

## SECTION 11-C

### AIR CONDITIONER

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## 11-12 SPECIFICATIONS

### a. Tightening Specifications

Part	Location	Torque Ft. Lbs.
Nut	Drive Plate Nut to Compressor Shaft . . . . .	14-16
Nut	Compressor Rear Head to Shell . . . . .	19-23
Cap	Schrader Service Valve . . . . .	4-5

For Compressor mounting bracket bolts see Figures 11-90 and 11-91.

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 11-42—Pipe and Hose Connection Torque Chart

### b. Compressor Specifications

Type . . . . .	Six Cylinder Axial
Make . . . . .	Frigidaire
Displacement - (cu. in.) . . . . .	12.6

**b. Compressor Specifications (Cont'd.)**

Oil . . . . .	Frigidaire 525 Viscosity
Oil Content (New) . . . . .	10-1/2 oz. Fluid
Internal Clearances . . . . .	See Figure 11-59
Air Gap Between Clutch Drive Plate and Pulley . . . . .	.022" to .057"
Clutch Type . . . . .	Magnetic
Belt Tension . . . . .	See Figure 2-40

**c. Miscellaneous**

Refrigerant . . . . .	Freon 12, Ucon 12, Genetron 12, Isotron 12
System Capacity (Fully Charged) . . . . .	4400-4600-4800 4 lbs. 4700 . . . . . 3 1/2 lbs.
Blower Motor Fuse . . . . .	30 Amp. Located on Fuse Block
Type of Temperature Control . . . . .	Suction Throttle Valve

**11-13 DESCRIPTION AND OPERATION OF AIR CONDITIONER SYSTEM**

The air conditioner is optional on all series.

The Air Conditioner is dash mounted with all the components located in or ahead of the dash. The compressor is mounted over the right cylinder head and is connected to the evaporator and condenser by flexible synthetic rubber hoses. The condenser is mounted forward of the radiator core and the receiver-dehydrator vertically to the right of the condenser. The evaporator on the 4400, 4600 and 4800 is located near the center of the cowl in the engine compartment. The evaporator on the 4700 is located under the right side of the instrument panel. The blower and air inlet assembly is located on the right side at cowl on all series.

The air conditioner uses an air distribution system entirely separate from the heater and defroster, however, the same blower is used to force air through the air conditioner ducts or the heater ducts or both systems simultaneously on the 4700.

A larger capacity radiator and fan to increase cooling system efficiently are included on all factory equipped cars with air conditioner. Also a fan clutch is used.

Air condition equipped cars have the fuel vapor by-pass system. This consists of a special fuel filter and fuel return lines which allows a constant flow of fuel from gas tank to filter and back to tank. This reduces the possibility of vapor lock when operating in extreme hot weather.

Any service work that requires loosening a refrigerant line connection should be performed only by qualified service personnel who have attended either Buick or other automotive air conditioner training schools. Whenever a hose or pipe is disconnected from any unit, refrigerant will escape. Any work involving the handling of refrigerants require special equipment and a knowledge of its proper use.

The air conditioner uses Schrader valve fittings instead of shut-off service valves; therefore, whenever a part is removed that is in the refrigeration circuit or a line disconnected, the refrigerant must be discharged from system as described in paragraph 11-17.

**a. Description of Components**

NOTE: See paragraph 11-14 for description of compressor.

1. Hoses. The connecting elements are made from a high temperature, high pressure synthetic rubber hose with double cord reinforcements. The hose ends are fitted with "O" ring fittings.

2. Schrader Service Valves. Two Schrader service valves are used on the air conditioner for evacuating and charging the system. The valve located on the compressor discharge line at rear of compressor, also is used for checking compressor head or discharge pressures. The low pressure valve located on the suction throttle valve is also used for checking evaporator pressure when functional testing system or adjusting suction throttle valve.

3. Condenser. The condenser is similar to the ordinary car radiator but is designed to withstand much higher pressures. The condenser used on all series is of aluminum construction. The condenser is mounted in front of the radiator so that it receives a high volume of air. Air passing over the condenser cools the hot high pressure refrigerant gas, causing it to condense into high pressure liquid refrigerant.

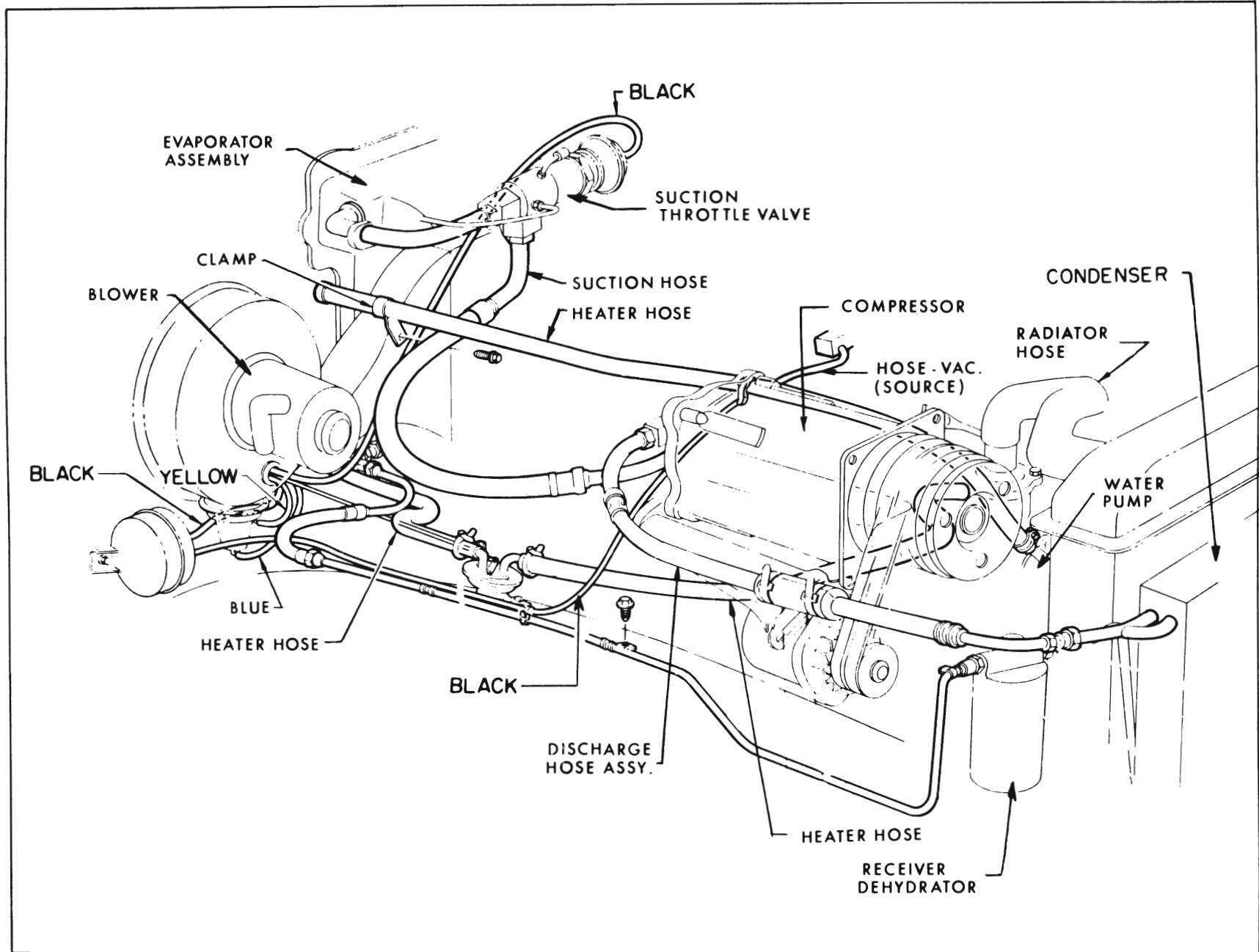


Figure 11-43—Air Conditioner Installation—4400-4600-4800 Series

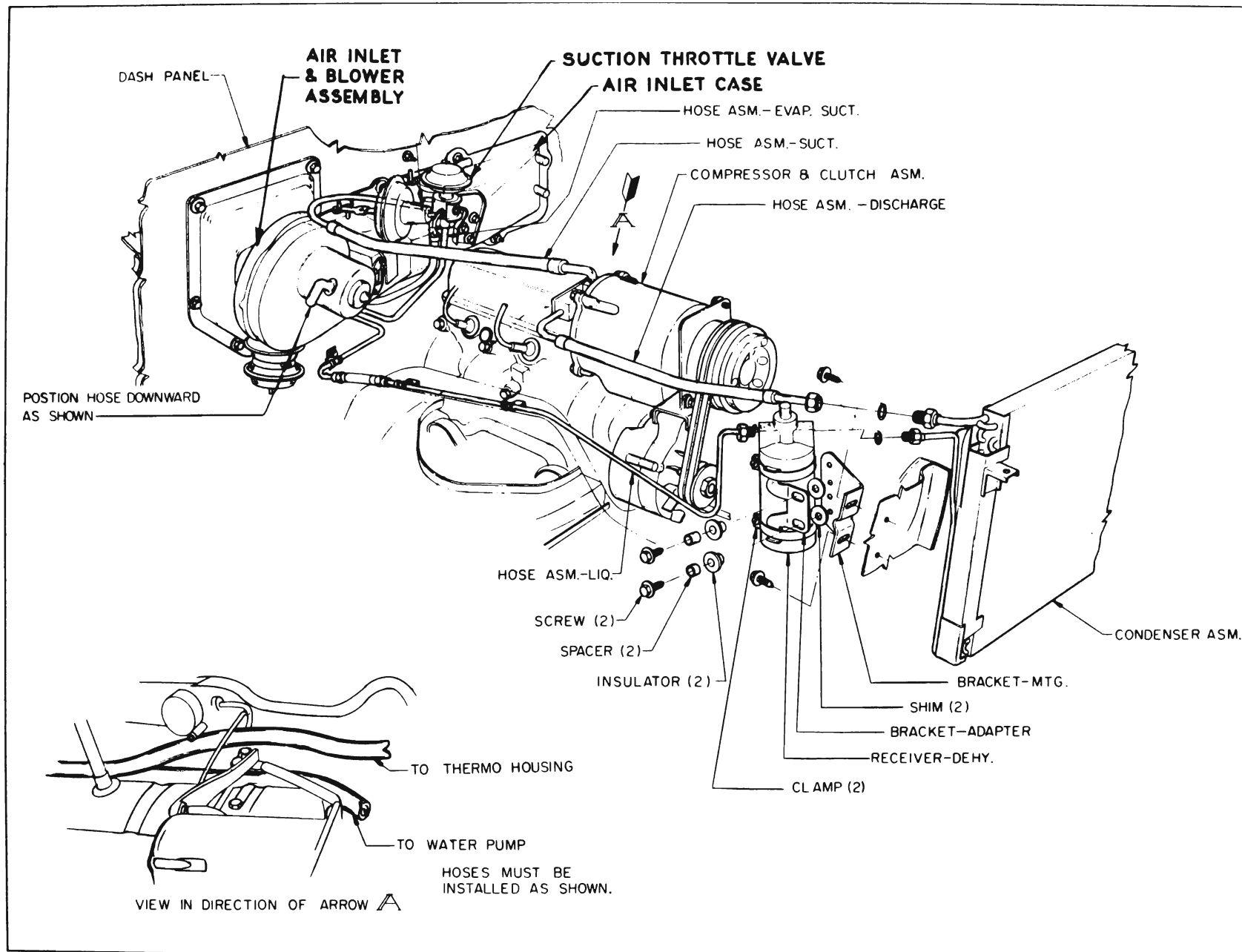


Figure 11-44—Air Conditioner Installation—4700 Series

**4. Receiver-Dehydrator.** The receiver-dehydrator is located at the right front of engine compartment. A liquid indicator or sight glass is an integral part of the outlet pipe of the receiver-dehydrator. The sight glass serves as an aid to diagnosis. The appearance of bubbles or foam beneath the sight glass when ambient temperature is higher than 70°F indicates air or a shortage of refrigerant in the system.

**CAUTION:** Continuous bubbles may appear in a properly charged system on a cool day. This may be considered normal if temperature of surrounding air is low.

The purpose of the receiver part of 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 dehydrator part of assembly is to absorb any moisture that might be present in system after assembly. Also, it traps foreign material which may have entered system during assembly.

**NOTE:** IN and OUT are stamped on receiver. IN attaches to condenser and OUT to liquid line.

**5. Thermostatic Expansion Valve.** The thermostatic expansion valve is located at the inlet to the evaporator core.

The thermostatic expansion valve 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 with the suction throttling valve outlet pressure. See Figure 11-46.

The valve contains three operating pins, 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

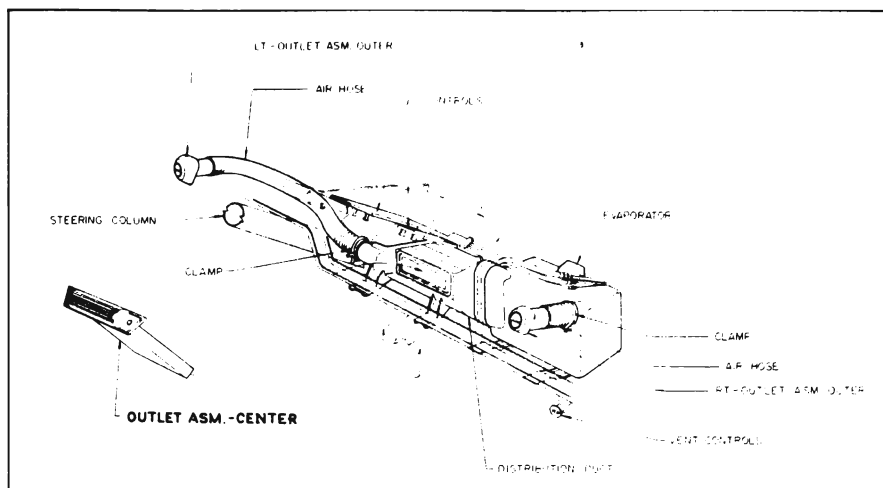


Figure 11-45—Air Conditioner Outlets—4700 Series

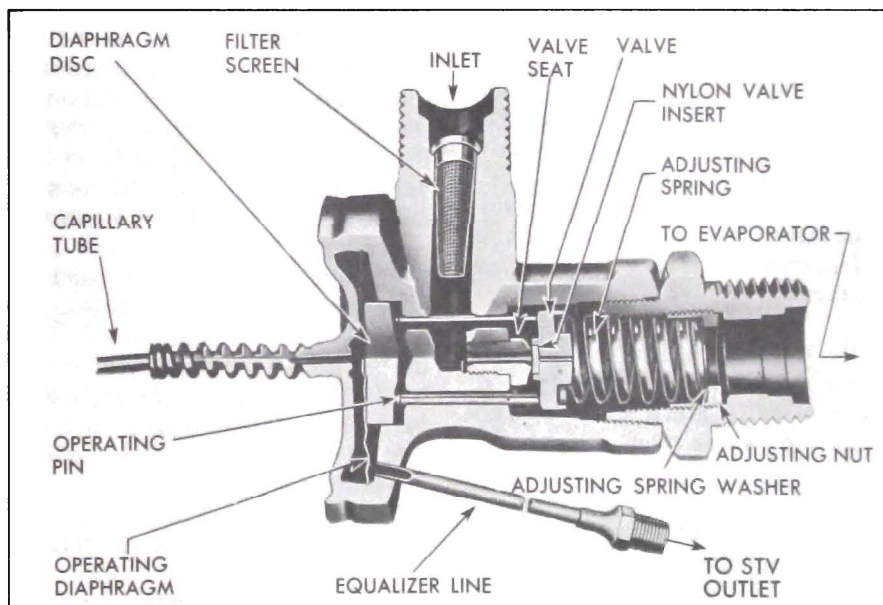


Figure 11-46—Thermostatic Expansion Valve

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, the thermo bulb is attached to the evaporator outlet pipe.

The equalizer line joins the expansion valve to the suction throttling valve outlet so that this pressure will register in the expansion valve.

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 vaporized.

NOTE: The superheat setting on the 4700 expansion valve is 10°F. For explanation purposes, the 6°F setting of the 4400, 4600 and 4800 will be used.

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 temperature differential between the inlet and outlet decreases below 6°F., the expansion valve will automatically reduce the amount of refrigerant entering the evaporator.

If the temperature differential increases, the expansion valve will automatically allow more refrigerant to enter the evaporator.

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; when turned, moves the spring seat to increase or decrease the tension on the needle valve carriage spring. By varying the tension on this spring, it is possible to regulate the point at which the needle 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.

When the air conditioning system has not been operating, all pressure 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. (Pressure under the diaphragm is evaporator pressure. It reaches this area by means of clearance around the operating pins 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 needle will hold the needle valve over to close the needle valve orifice.

When the air conditioning system first begins to operate, the compressor will immediately begin to draw refrigerant from 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 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.

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 needle valve towards its seat closing off the flow of refrigerant past the needle 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 needle valve further, admitting more refrigerant to the evaporator.

The equalizer line permits the STV outlet pressure to be imposed on the expansion valve diaphragm, thus, over-riding its normal control of liquid refrigerant. As the compressor capacity becomes greater than the evaporator load, the drop in compressor suction line pressure forces the expansion valve to flood liquid through the evaporator and STV, thus preventing the suction pressure from dropping below a predetermined pressure.

The equalizer line is used primarily to prevent prolonged and constant operation of the compressor in vacuum conditions. This operation is considered undesirable both from a noise angle and from possibility of subjecting the compressor to reduced oil return. Second considerations for having the external equalized expansion valve is to maintain a full evaporator during throttling, and also guard against non-condensibles entering the system especially through loosened fittings.

**6. Evaporator.** The evaporator core on the 4400, 4600 and 4800 Series is of plate type design and is located near the center of the cowl in the engine compartment. The 4700 Series evaporator is of the tube and fin (Series) design and is located under the right side of the instrument panel.

The purpose of the evaporator core is to cool and dehumidify the air that is flowing through it when the system air conditioner is in operation. High pressure liquid refrigerant flows through the 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 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. As the process of heat loss from the air to the evaporator core surface is taking place, moisture in the air condenses on the outside surface of the evaporator core and is drained off.

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 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 107.5 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
-20	2.4	60	57.7
-10	4.5	70	63.7
-5	6.8	75	70.1
0	9.2	80	76.9
5	11.8	85	84.1
10	14.7	90	91.7
15	17.7	95	99.6
20	21.1	100	108.1
25	24.6	105	116.9
30	28.5	110	126.2
32	30.1	115	136.0
35	32.6	120	146.5
40	37.0	125	157.5
45	41.7	130	169.0
50	46.7	140	204.5

Figure 11-47—Pressure—Temperature Relationship of Refrigerant—12

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 suction throttling valve is used to provide this necessary refrigerant volume control.

The 4400, 4600 and 4800 evaporator has an oil bleed line connected from its bottom tank to the outlet side of the suction throttle valve (compressor suction). This bleed line is connected to a check valve on the suction throttle valve. The check valve is a special low force spring valve core and may be identified by the black color of the gasket cup and head of the center pin. Only this valve should be used at this location.

The bleed line is in the system

as an insurance measure to provide increased compressor life during times of low refrigerant charge. During normal-charge conditions this line is of no particular benefit as the compressor runs on an adequate oil supply. With partially depleted F-12 charge any excess oil and refrigerant mixture will flow from the bottom tank of the evaporator through the oil bleed line to the compressor. This oil flow helps to prevent oil deficiencies in the compressor that could arise under these conditions. During times of zero-charge no refrigerant will be available to carry oil back to the compressor. It is therefore important that completely discharged systems be kept to a minimum of operation, thus preventing seizure.

**NOTE:** The 4700 series evaporator does not have an oil bleed line as it is of series design and oil does not tend to settle in the bottom like the 4400, 4600 and 4800 plate evaporator.

The bleed line's check valve opens at 5 psi differential pressure between the evaporator inlet pressure and STV outlet pressure. This check valve is fully open when these two pressures exceed 12 psi differential. Below the 5 psi differential, the check valve will be closed to prevent capacity loss. This feature prevents bypassing the evaporator at traffic conditions when cooling demands are greatest.

At all times when the compressor capacity (evaporator inlet pressure) exceeds the evaporator load demands by 5 psi or greater, this valve starts to open. It then permits refrigerant and oil to flow from the evaporator bottom tank to the inlet of the compressor.

**7. Suction Throttle Valve.** Two different suction throttle valves are used. One for the 4400, 4600 and 4800 air conditioner and one for the 4700 air conditioner. The



difference between these two valves is the method of controlling the setting of the valve for less cooling.

The 4400, 4600 and 4800 has a two position suction throttle valve which obtains the maximum cooling setting by applying vacuum to its vacuum diaphragm. For setting this valve for less cooling, the vacuum is exhausted from the diaphragm.

The 4700 suction throttle valve has a vacuum diaphragm of different construction and maximum cooling is obtained when vacuum is not applied to the diaphragm. A vacuum modulation is used with the 4700 suction throttle valve to vary the vacuum to the diaphragm from 0 to 6 1/2 inches and set it at a higher setting (less cooling). The greater the vacuum present in the diaphragm (up to 6 1/2

inches) the higher the air conditioner outlet temperature.

The suction throttle valve (STV) controls the evaporator pressure and in turn the evaporator air outlet temperature. Also the STV prevents freezing of the condensation on the evaporator core surface. The STV consists of a valve body, piston, piston diaphragm, control spring, diaphragm cover, diaphragm cap and vacuum diaphragm. See Figure 11-48 and Figure 11-49.

The inside of the piston is hollow and is open to the piston diaphragm by small holes in the end of the piston. Located in the lower extremity of the piston is a fine mesh screen, held in place by a retainer. The purpose of this screen is to prevent any foreign particle of any substance entering

the piston and lodging in the holes drilled in the piston wall and possibly scoring the surface of the body, thus interfering with its proper operation.

The piston diaphragm retains the piston to it by a tab on the front side and has the cup held against it by the spring on the rear side. The vacuum diaphragms actuating pin fits in the end of the cup. The body of the vacuum diaphragm threads into the valve's cover and determines the amount of spring tension on the cup. The vacuum diaphragm is locked to the cover after it has been set by a locknut.

On the 4700 STV, the vacuum diaphragm is connected to the vacuum modulator on the instrument panel by a small hose. When vacuum is present on the diaphragm, it is pulled toward the piston and its pin adds to the

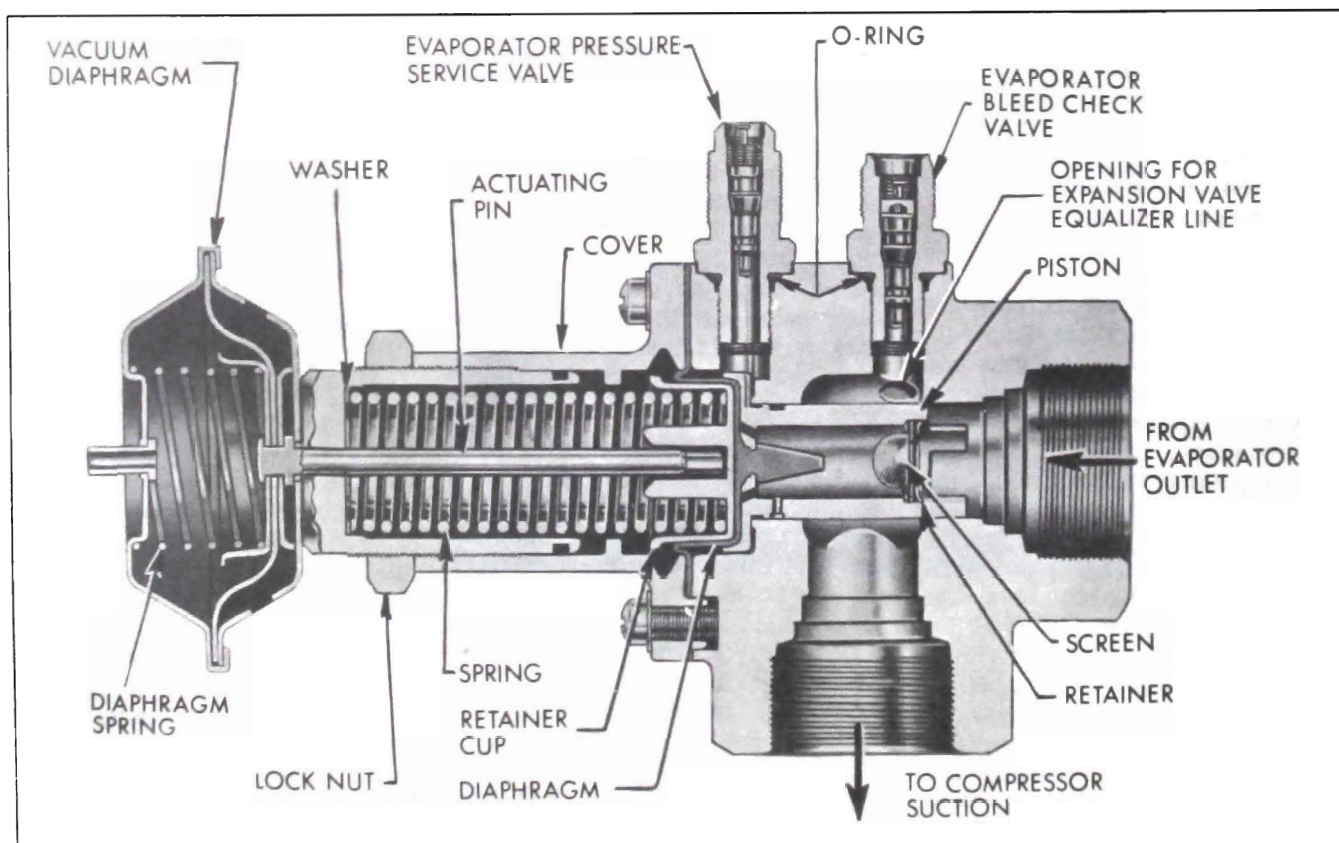


Figure 11-48—Suction Throttle Valve—4400, 4600 and 4800 Series



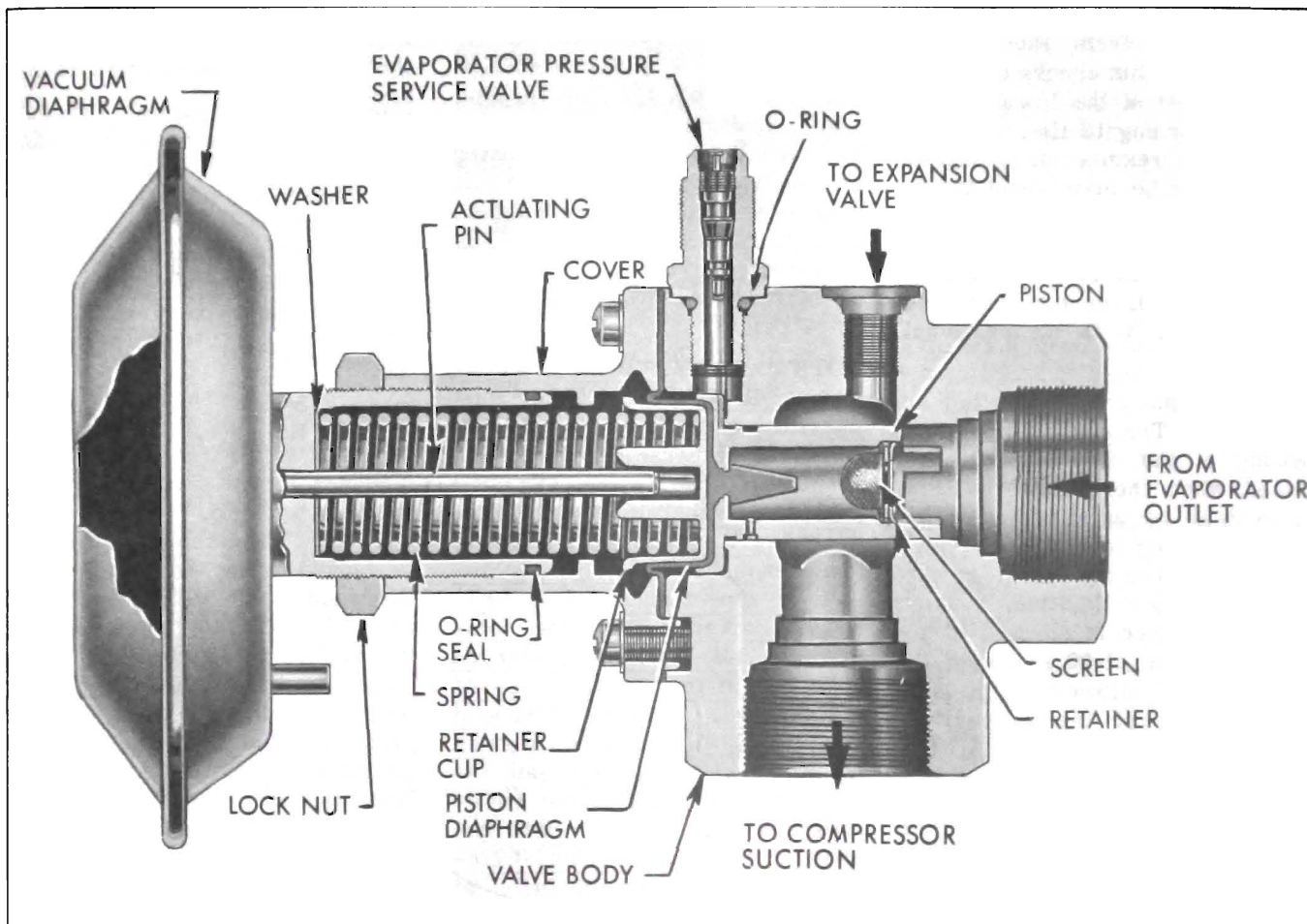


Figure 11-49—Suction Throttle Valve—4700 Series

spring pressure on the piston diaphragm.

The vacuum diaphragm on the 4400, 4600 and 4800 suction throttle valve is connected to a vacuum switch which is operated by the "TEMP" lever. The vacuum diaphragm has a spring inside of it. See Figure 11-48. This spring adds to the pressure of the large spring located in the cover when vacuum is not present in diaphragm. When vacuum is applied, the vacuum diaphragm compresses the spring inside it and the spring tension is reduced on the piston diaphragm.

The STV inlet is connected to the evaporator outlet and its outlet is connected to the compressor suction port. See Figure 11-48.

The flow of the low pressure vapor from the evaporator to the compressor is determined and controlled by the position of the piston in the valve body of the STV. See Figure 11-48. The position of the piston in the body is determined by the balance of the forces that are applied to the piston diaphragm. These forces consist of the refrigerant vapor pressure returning from the evaporator on one side and the spring tension, plus the force of the actuating pin on the other side. (The actuating pin adds or subtracts to the spring pressure.) Movement of the piston permits vapor to pass by scallops in the piston skirt and then on to the compressor inlet.

During the time that maximum

cooling is being produced, the STV vacuum diaphragm on the 4700 does not have vacuum applied to it, while the 4400, 4600 and 4800 vacuum diaphragm has at least 4 1/2 inches of vacuum applied to it. The full flow of low pressure refrigerant vapor is being returned to the compressor to permit it to exert its full capacity on the evaporator and produce maximum cooling. Under most all operating conditions, STV inlet and outlet pressures will not be the same as there will be some throttling to prevent evaporator icing.

When the operator desires to raise the temperature within the car, the controls are changed to apply engine vacuum to the 4700 STV vacuum diaphragm. On the

4400, 4600 and 4800, the vacuum is exhausted from the vacuum diaphragm. This checks or throttles the flow of the low pressure vapor returning to the compressor. This results in a higher pressure to be maintained in the evaporator assembly. The STV outlet pressure will also increase, but the differential between inlet and outlet will be much greater than when STV is at maximum cooling.

(1) Maximum cooling setting of 4700 STV -- The maximum cooling setting of the 4700 STV is obtained when there is no vacuum present at its vacuum diaphragm and the spring tension is the only controlling factor. When at the maximum cool position, evaporating pressure is allowed to go to a minimum of 20 to 22 psi. If pressure is allowed to go any lower, icing of the evaporator core will occur.

(2) Minimum cooling setting of 4700 STV -- The minimum cooling setting of the 4700 STV is obtained when 6 1/2" ( $\pm 1/2$ ") of vacuum is applied to STV vacuum diaphragm. To move the piston in the STV, the evaporator pressure must overcome spring tension plus the force applied by the actuating pin to the piston diaphragm. This force on the piston's diaphragm maintains an evaporator pressure of approximately 50 psi minimum.

(3) Maximum cooling setting of the 4400, 4600 and 4800 STV. The maximum cooling setting of the 4400, 4600 and 4800 STV is obtained when 4 1/2 inches of vacuum is applied to the STV vacuum diaphragm. The internal spring in the diaphragm is compressed, thus the spring in the cover is the only controlling factor. When at the maximum cooling position, evaporator pressure is allowed to go to a minimum of 29-31 psi. If pressure is allowed to go lower, icing of the evaporator will occur.

(4) Minimum cooling setting of

the 4400, 4600 and 4800 STV. The minimum cooling setting is obtained when vacuum is not applied to the vacuum diaphragm. The diaphragm spring tension is added to the tension of the spring in the cover. The evaporator pressure then must overcome both springs to move the piston. The evaporator pressure will be maintained at approximately 32 to 34 psi.

**NOTE:** At 60 MPH it will not be unusual for the compressor inlet pressure to be from 10 to 15 psi, while the evaporator is controlled at 30 psi. By consulting the pressure-temperature chart (Figure 11-47) it will be noted that compressor inlet conditions result in approximately 5 to 10°F. Frost accumulates on the compressor inlet line after prolonged operation at these conditions. At minimum, or further reduced-load conditions, when the throttling demands on the STV are again increased, the compressor inlet pressure may drop to zero psi or even 6"-8" of vacuum. Compressor inlet temperatures at these reduced load conditions may approach minus 30°F, so that even frosting of the compressor rear head is probable.

8. Vacuum Modulator - 4700. The vacuum modulator which controls the amount of vacuum to the 4700 suction throttle valve's vacuum diaphragm, is mounted on the air conditioner control lever assembly

on the instrument panel. It is activated by the "Cool" and "Air" control levers. See Figure 11-84.

Engine intake manifold vacuum is present at the vacuum modulator when the air conditioner control system is energized. (The vacuum modulator vacuum source hose is tapped into the #2 and #4 vacuum diaphragm's hose which is located on the blower and valve housing and explained in paragraph 11-16.) The vacuum modulator controls output vacuum to the STV from 6-7 inches Hg. at minimum cooling ("cool" lever just on) to 0 inches Hg. at maximum cooling ("cool" and "air" control lever full on). When the "cool" lever is moved from the off position, the vacuum modulator is set to allow 6-7 inches of vacuum to the suction throttle valve. As the "cool" lever is moved further on, the vacuum is gradually decreased from 6-7 inches to a minimum of 2-1 1/2 inches when lever is full on. Movement of the "air" lever from off to the first two detents has no effect on the setting of the vacuum modulator. When "cool" lever is full on and the "air" lever is moved to the full on position, the modulator shuts off the vacuum supply to the suction throttle valve.

9. Air Outlets. The air conditioner air outlets are entirely separate from the heater outlets and are located as shown in Figures 11-45 and 11-50.

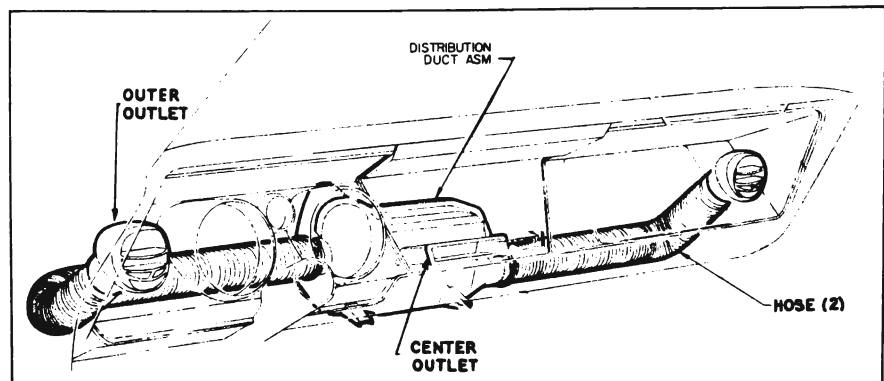


Figure 11-50—Air Conditioner Outlets—4400-4600-4800 Series

Air is introduced into the car through three outlets, two at each end of the instrument panel and one at the upper center of the instrument panel. The center outlet vanes may be tilted to change air flow direction. The disc may be turned fully "up" to shut off air flow from the center outlet.

The outer outlets have a rotating ball to control air flow direction. See Figure 11-51. The ball may be set in any desired position to direct air flow for maximum comfort. A shut-off valve is provided in each of the outer outlets which is controlled by a knob on lower edge of outlet.

#### b. Air Conditioner Controls—4700 Series

NOTE: See paragraph 11-15 for 4400, 4600 and 4800 controls.

The air conditioner control levers for the 4700 are located to the right of the heater levers, replacing the vent levers on non-air conditioner cars. See Figure 11-52.

The "Cool" and "Air" levers provide full control of the air conditioner and also allow for use of the air conditioner air distribution system for outside air ventilation, without cooling, if desired.

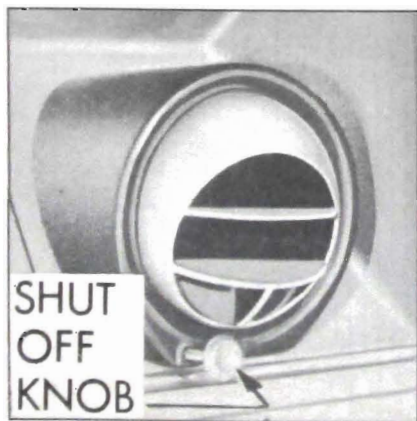


Figure 11-51—Air Conditioner Outer Outlet

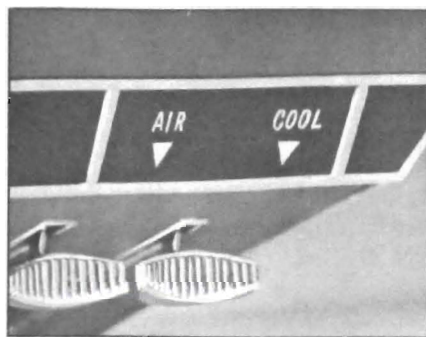


Figure 11-52—Air Conditioner Control Levers—4700 Series

When the "Cool" lever is moved from the off position, the compressor clutch is energized and blower is turned on low-low speed. See Figure 11-155 for electrical circuit for controlling air conditioner. The suction throttle valve is set, the air valve in the plenum and blower assembly, and the air valve in the selector valve and case assembly are set for proper air distribution of all outside air. The air valves are positioned by a sequence of opening and closing vacuum switches on the control plate assembly. Further movement of the "Cool" lever sets the STV to a cooler position. The last portion of travel repositions the air valves for recirculated air. Low blower speed only is obtained by this lever. When the heater "Air" lever is on, recirculated air for air conditioner is not available.

The "Air" lever controls blower speed for low, medium and high. Each speed has a detent feel. When the air conditioner system is to be used for outside air ventilation (no cooling) the "Cool" lever is left off, and the complete control is through the "Air" lever. When outside air ventilation is desired, movement to the first detent sets the air valves and turns on the low blower speed. Further movement increases blower speed through medium and high.

The complete mechanism for controlling heater and air conditioner

is located in the engine compartment and is mounted on the right fender skirt. The control mechanism is protected from dust, dirt and splash by a plastic protective cover.

NOTE: The complete description of the 4700 air distribution system is covered in paragraph 11-16.

To obtain maximum cooling, both the "air" and "cool" levers must be full on.

To place the 4700 air conditioner in operation;

- (a) Make sure heater and ventilator are off.
- (b) Move "Cool" lever to full on position.
- (c) Move "Air" lever to full on position.
- (d) Start engine. See note below.
- (e) When desired car interior temperature has been reached, reposition "Cool" lever to maintain car interior temperature at a satisfactory level. It may also be desirable to lower blower speed by repositioning "Air" lever. Maximum air conditioner performance is achieved with all windows and ventilators closed.

NOTE: The wiring to the compressor clutch coil is so arranged that during cranking the compressor clutch is disengaged, thus eliminating the necessity of turning the air conditioner off while starting the engine.

#### c. Operation of Air Conditioner Refrigeration Circuit

Cool refrigerant gas is drawn into the compressor from the evaporator and pumped from the compressor to the condenser under high pressure. See Figure 11-53 and Figure 11-54. This high pressure gas will also have a high temperature as a result of being subjected to compression. As this

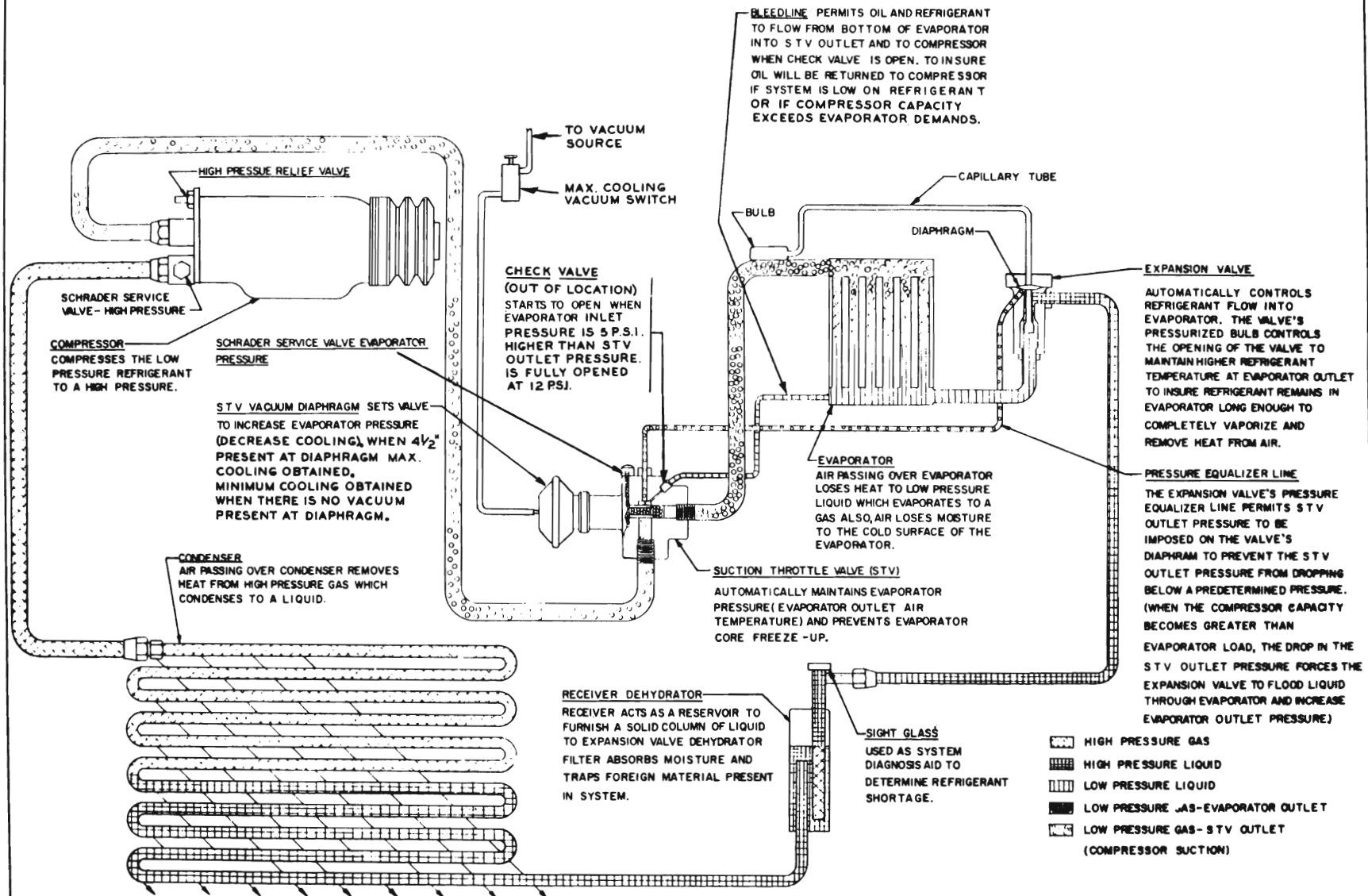


Figure 11-53—Air Conditioner Refrigeration Circuit—4400-4600-4800 Series



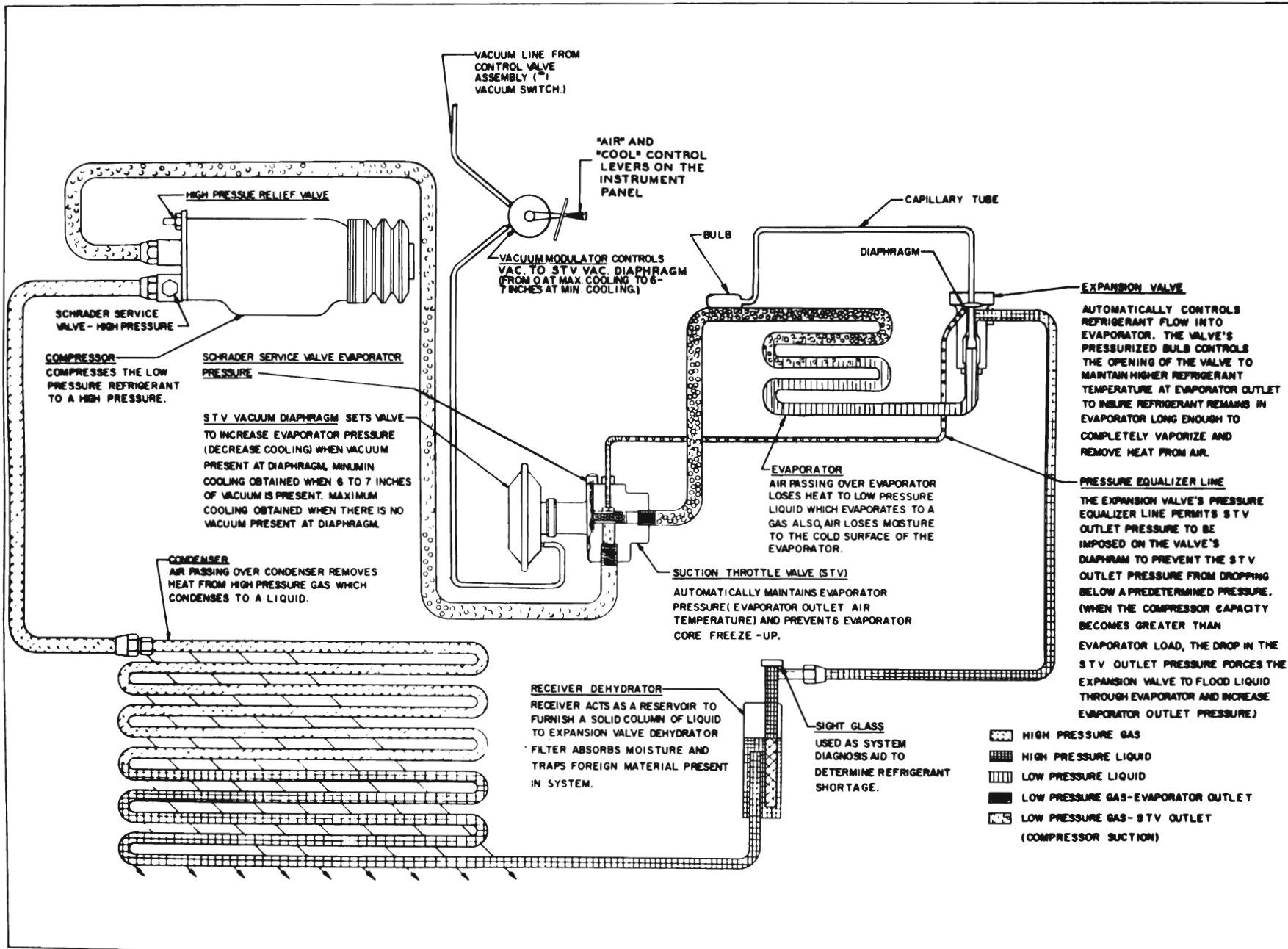


Figure 11-54—Air Conditioner Refrigeration Circuit—4700 Series

gas passes through the condenser, the high pressure, high temperature gas rejects its heat to the outside air as the air passes over the surfaces of the condenser. The cooling of the surfaces of the condenser. The cooling of the gas causes it to condense into liquid refrigerant. The liquid refrigerant, still under high pressure passes from the bottom of the condenser into the receiver-dehydrator. The receiver acts as a reservoir for the liquid.

The liquid refrigerant flows from receiver-dehydrator to the thermostatic expansion valve meters the high pressure 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 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 surface of the core, resulting in cool dehydrated air entering inside the car. By the time the gas leaves the evaporator, it has completely vaporized and is slightly superheated. Superheat is an increase in temperature of the gaseous refrigerant above the temperature at which the refrigerant vaporized.

The pressure in the evaporator is controlled by the suction throttle valve as described in subparagraph a, item 7.

Refrigerant vapor passing through the evaporator, flows through the suction throttle valve and is returned to the compressor where the refrigeration cycle is repeated.

## **11-14 DESCRIPTION AND OPERATION OF AIR CONDITIONER COMPRESSOR**

The compressor is mounted on the right-front of the engine over the generator.

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 1-1/2" bore, have a 1-1/8" stroke and are actuated by a swash plate pressed on the compressor shaft. See Figure 11-55.

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

### **a. Suction Reed Valves and Discharge Valve Plates**

A three-reed suction valve disc is assembled to both the front and rear cylinder heads. See Figure 11-56. 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 valves close against their seats to prevent the high pressure vapor being forced back into the low side of the system.

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.

### **b. Cylinder Heads**

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 sealed with "O" rings and spacers.)

### **c. Oil Pump**

An oil pump mounted at the rear of the compressor picks up oil from the bottom of the compressor and pumps it to the internal parts. The inner gear has a "D" shaped hole in the center which fits over a matching "D" flat on the rear of the main shaft. The outer driven gear has internal gear teeth which mesh with the external teeth on the inner (drive) gear.



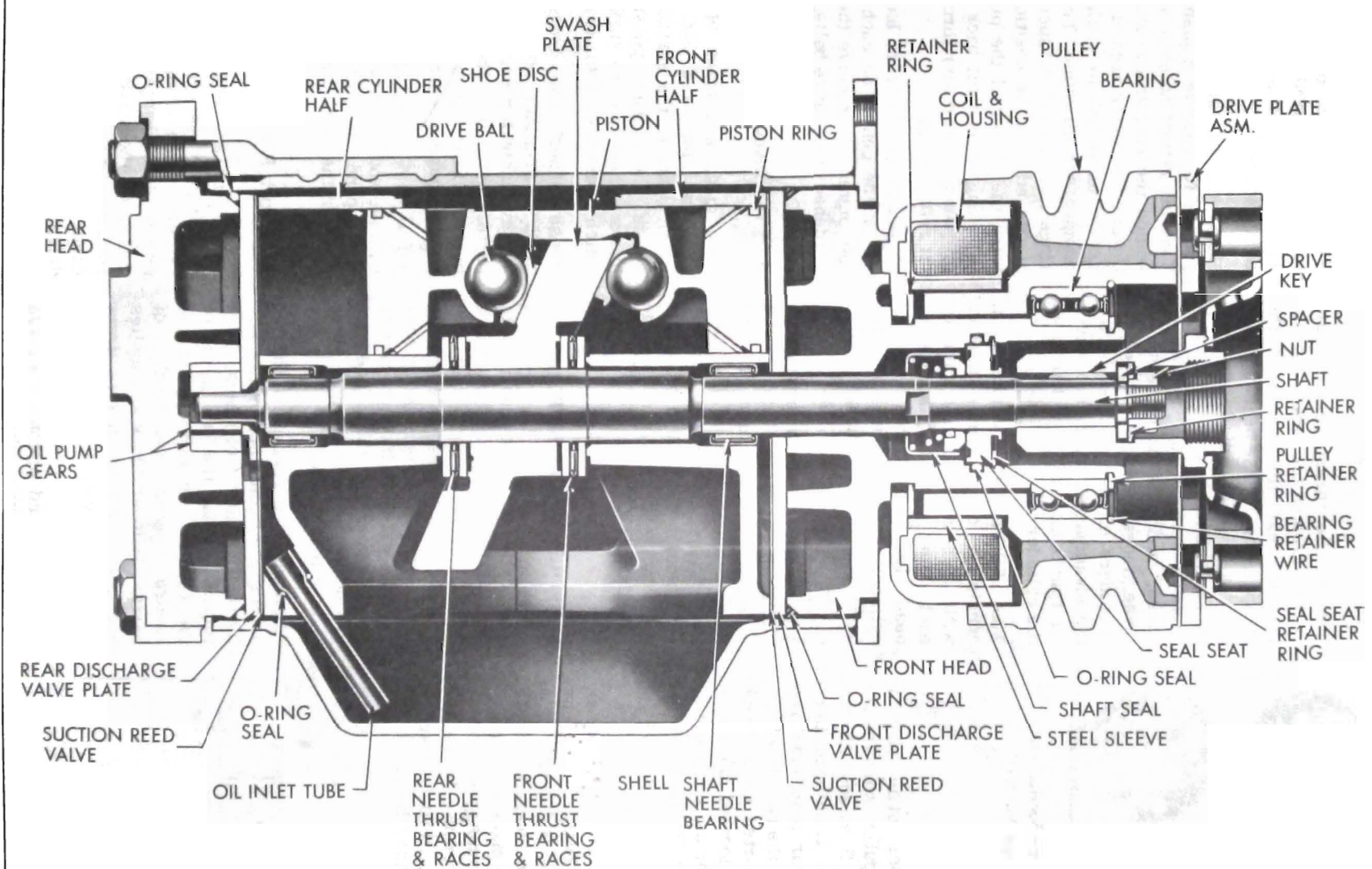


Figure 11-55—Sectional View of Compressor

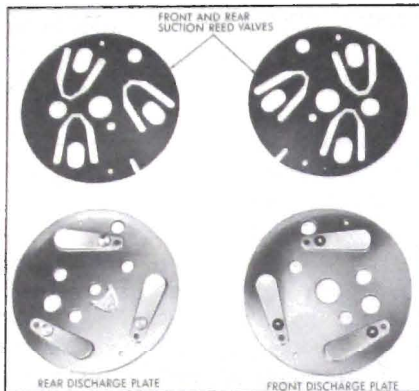


Figure 11-56—Suction and Discharge Valves

#### d. Main Shaft

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

A 3/16" diameter oil passage extends from the rear oil pump cavity to the shaft seal cavity. Four 5/64" diameter holes are drilled at 90° to the main oil passage. These drilled passages direct oil under pump pressure to the shaft seal surfaces, thrust bearings, and shaft cylinder bearings. See Figure 11-57.

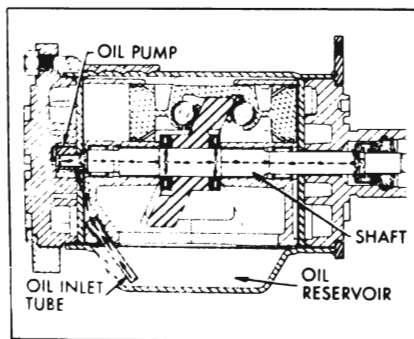


Figure 11-57—Oil Flow in Compressor

#### e. Thrust Bearings and Races

Two needle thrust bearings are seated around the shaft and are located near the center of the compressor. These bearings have rollers placed radially in their housing. 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 selected thrust race on each side, provides the proper head clearance below the top of cylinder and the underside of the suction and discharge valve plates. See Figure 11-59.

The REAR end combination, consisting of a needle bearing with a selected thrust race on each side, obtains a .0005 to .0015 running clearance between the hub surfaces of the swash plate and the front and rear hubs of the cylinder. See Figure 11-59.

#### f. Cylinder Block and Piston

The cylinder block consists of two halves, front and rear. Three piston bores in each half are line bored as one assembly during ment and parallelism. After boring, the cylinder block is parted at the center and these faces are ground parallel to the two outer ends of the cylinder.

Alignment and register of the two halves are maintained by two cylindrical locator (roll) pins. It is important that the two halves of the cylinder be kept together to assure correct relationship of parts. Cylinder block assemblies are only serviced in sets (front and rear halves).

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 to be 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 allow oil to drain to the compressor oil sump. The piston rings have an oil scraper groove at one edge (to be positioned 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 piston hardened steel drive balls.

#### g. 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 drive ball.

These shoes are provided in .0005" 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 part number.

#### h. 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

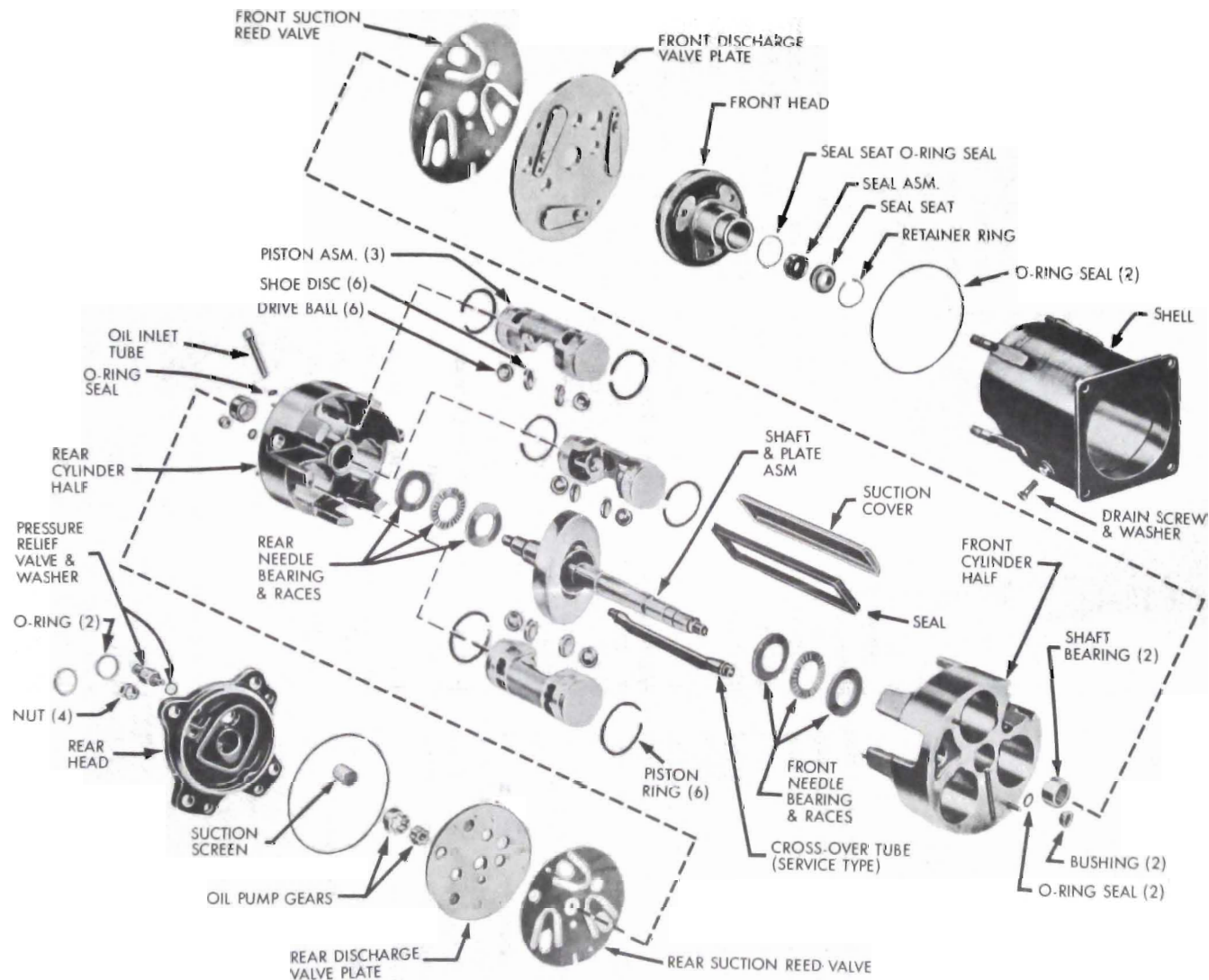


Figure 11-58—Exploded View of Compressor (Less Clutch and Coil)



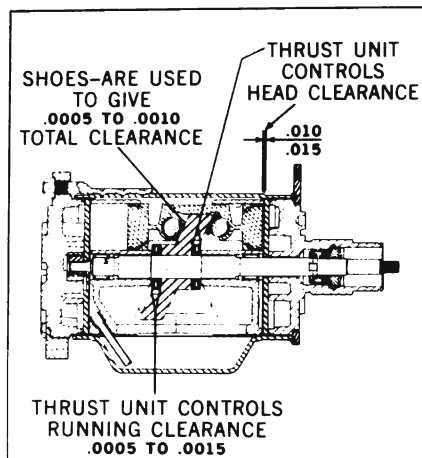


Figure 11-59—Compressor Internal Clearances

pistons. The swash plate has two angular faces ground smooth and parallel to permit smooth sliding of the shoe discs.

The plate is a press fit on to the drive shaft and is positioned by a Woodruff key located in the shaft. The swash plate and shaft are serviced only as an assembly.

#### i. Suction Cross-Over Cover

Since the pistons are double-acting, low pressure vapor from the suction throttle valve 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 suction throttle valve. 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 could damage the compressor mechanism. See Figure 11-60.

A flat rectangular cavity is cast into the outer face of the front and rear cylinders. The edges of this cavity are machined into a "dove-tail" shape to retain a rectangular suction cross-over cover with a neoprene seal around its edges. This cover and seal form

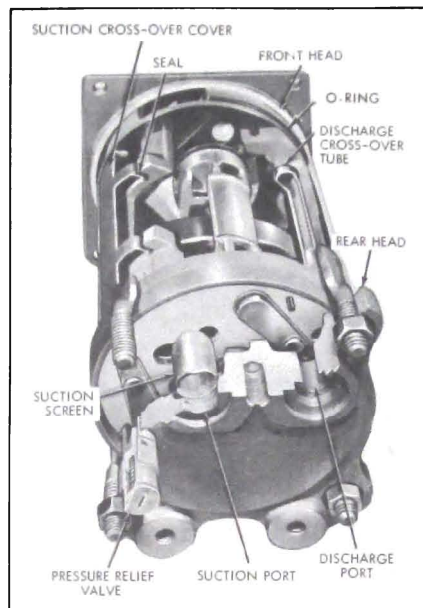


Figure 11-60—Cutaway Compressor Rear View

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.

#### j. Production Type Discharge Cross-Over Tube

The double-acting pistons 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. See Figure 11-60.

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 a hole in the front and rear cylinder head casting 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 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.

#### k. Service Type Discharge Cross-Over Tube

The function and design of the service discharge tube are the same as that for the production type tube with the exception of shouldered sleeves located in both ends of the service tube. See Figure 11-61. 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 operation 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.

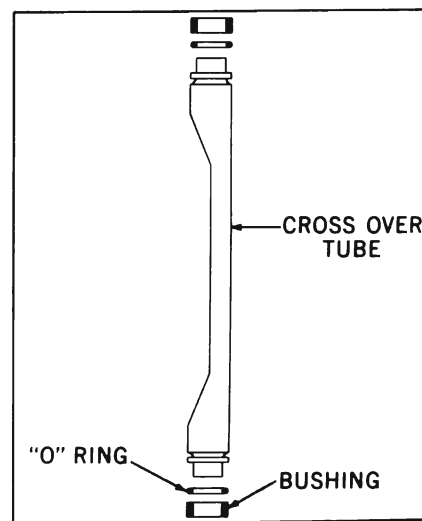


Figure 11-61—Service Type Discharge Crossover Tube

### l. Pressure Relief Valve

The compressor is fitted with a high pressure relief valve. See Figure 11-60. 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.

### m. Oil Drain Screw

An oil drain screw is located on the under side of the compressor shell. This screw is used just for draining and adding oil. It is not an oil test outlet as the oil level cannot be checked while the compressor is installed on the engine due to the design of the compressor. It is not necessary to check compressor oil unless a large amount of oil has been lost. This could happen only with a sudden breaking of a line or some other serious break in system. If there has been a major loss of

oil, the compressor should be removed and drained and oil added as outlined under Checking Compressor Oil and Adding Oil, paragraph 11-17, subparagraph k.

### n. 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. The oil drain screw and gasket are 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.

### o. Clutch and Pulley Assembly

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

When the compressor clutch is not engaged, the compressor shaft

does not turn, although the pulley is still being turned by the compressor belts.

The clutch armature plate, which is the movable member of the drive plate assembly, is attached to the drive hub through driver springs and is riveted to both members. The hub of this assembly is pressed over 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 lock nut. See Figure 11-62.

The pulley assembly consists of three parts: (1) pulley rim, (2) power element ring, and (3) pulley hub. These three parts form a final assembly by molding a frictional material between the hub and the rim. A power element rim 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 wire. This pulley and bearing assembly is pressed over the front head of the compressor and held in place by a retainer ring.

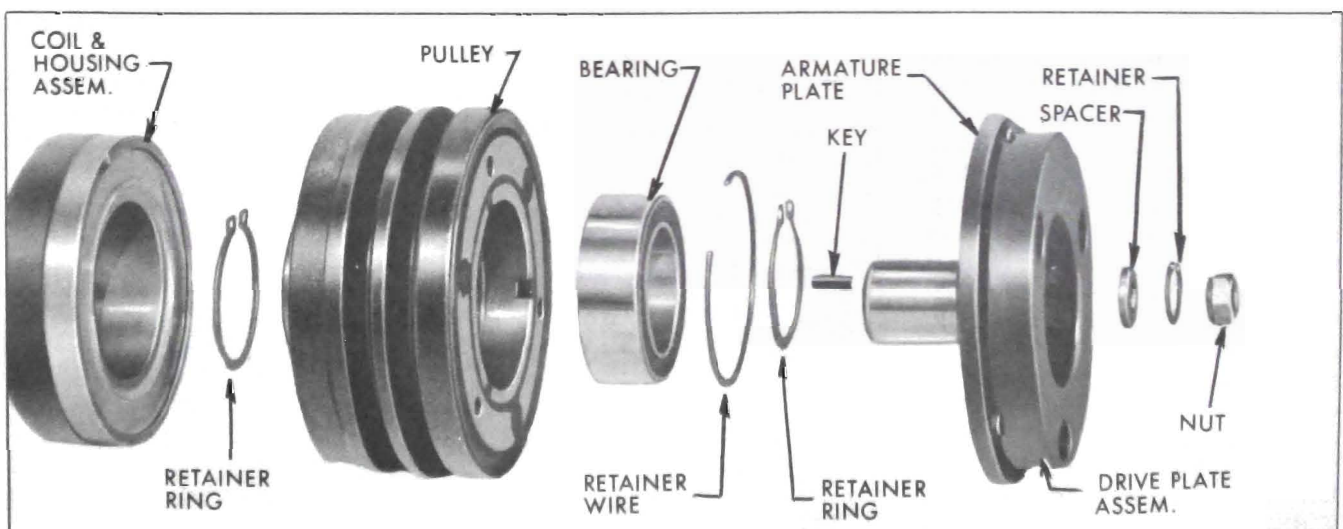


Figure 11-62—Compressor Clutch Assembly

The clutch actuating coil is molded into the coil housing with a filled epoxy resin; therefore, the coil and housing are 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 12 volts 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. If removed, it is important that the coil and housing be reassembled in their original position so that the wiring harness connector may be plugged on the coil terminals.

When the air conditioner controls are set for cooling, current flowing through the coil creates a magnetic force which flows through the pulley to draw the armature plate (forward of the pulley assembly) rearward toward the pulley. As the armature plate moves toward the pulley, it contacts the pulley face (which rotates freely on the hub of the front head).

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 armature plate hub is pressed on, and keyed to, the compressor shaft will then turn with the pulley.

When the air conditioner controls are turned "off" the electric circuit to the compressor clutch is opened and the magnetic pull on the clutch no longer exists. The armature plate to armature plate hub 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.

#### p. 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 are the retaining ring, the small "O" ring, the compressor spring-loaded shaft seal, the cast iron seal seat and the large "O" ring. See Figure 11-63. 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.

Because of the constant pressures inside the compressor, this surface must be protected against

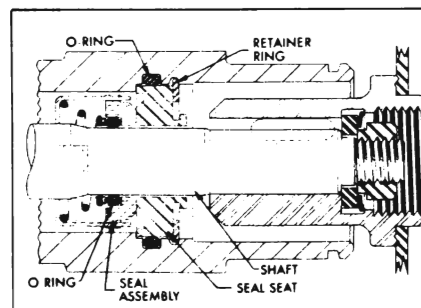


Figure 11-63—Shaft Seal Assembly

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 the area between the seal seat and the compressor front head.

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

### 11-15 AIR CONDITIONER—HEATER CONTROLS AND AIR DISTRIBUTION SYSTEM—4400, 4600 and 4800 Series

#### a. Air Conditioner—Heater Controls—4400, 4600 and 4800 Series

The controls for the 4400, 4600 and 4800 air conditioner heater consists of a four position "CLIMATE" control and four slide levers. See Figure 11-64.

To operate the system, it is only necessary to select one of the four positions on the Climate Control: HEAT, VENT, AIR COND NORMAL or AIR COND RECIR. The operation of the selected condition is then controlled by first moving the "AIR" lever, then moving one or all of the other three slide levers: TEMP, DEFR and REAR.



Figure 11-64—Air Conditioner—Heater Controls—4400-4600-4800 Series



The operation of each system starts by moving the "AIR" lever and is stopped when the lever is returned to the "Off" position.

The "Climate" control is a four position rotary control vacuum selector valve and a combination blower and compressor clutch control switch. The vacuum selector valve controls vacuum supply to two vacuum diaphragms located on the heater case and blower and air inlet assembly.

The electrical switch is operated by the rotation of the selector valve through the four positions. The clutch and blower switch contacts are held open in the "Heat" and "Vent" positions and are closed in both air conditioner positions to turn compressor on and set blower at low-low speed. See Figure 11-65.

The settings of the "CLIMATE" control are used as follows:

**HEAT** - The HEAT position gives low level air discharge for cold weather driving.

**VENT** - This setting gives upper level ventilation or warming as selected by operation of controls. The compressor does not operate as this position is primarily to be used in 30 to 50 degree outside air temperature when the upper level of car requires cooling due to the high sun and dehumidification is not desired.

**AIR COND NORMAL** - This position is for comfort under all weather conditions above 50 degree outside temperatures.

**AIR COND RECIR** - This setting is used when maximum refrigeration is desired for quick cool down of car interior after car has been parked in the sun.

The "AIR" lever control wire is attached to a circuit control assembly located on the heater

case. See Figure 11-66. Included in the circuit control assembly is an electrical circuit switch, blower switch and the main vacuum switch. The "Air" lever wire operates the blower switch through five detent positions. For air conditioner operation the five positions are, OFF, LOW-LOW, LOW, MEDIUM and HIGH. For heater and ventilation operations, the positions become off, Ram air (blower off and car moving), Low-Low, Low and Medium.

When the "AIR" lever is at the off position the circuit switch opens the air conditioner - heater electrical circuit, and the main vacuum switch shuts off the vacuum supply to the climate control and to the vacuum diaphragm located on the air inlet case. When the "Air" lever is moved from the off position, besides operating the blower switch, the circuit switch is closed and the vacuum switch is opened.

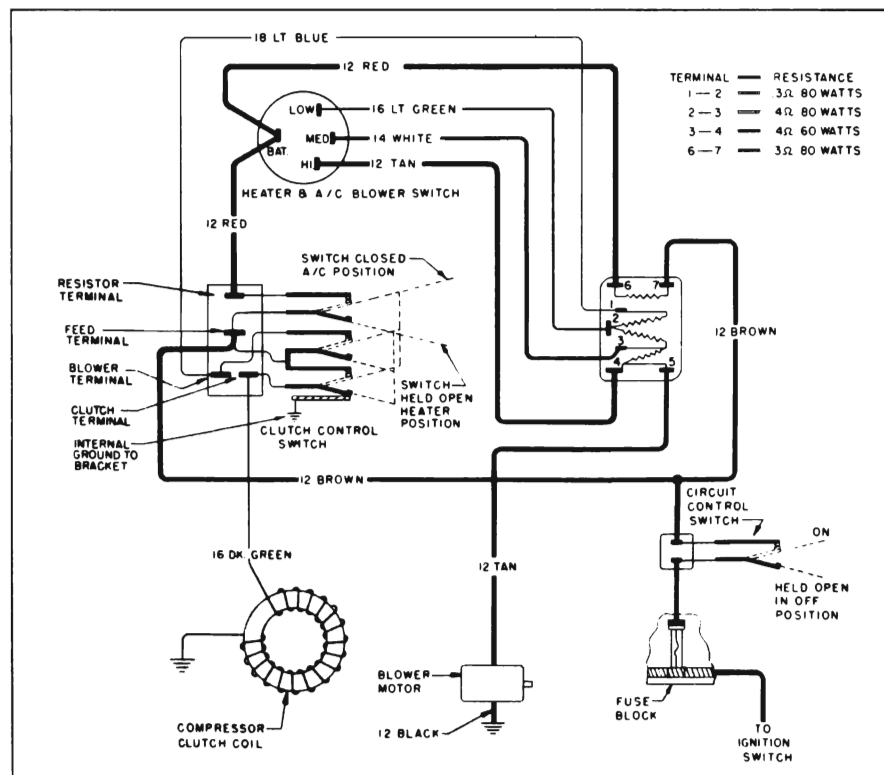


Figure 11-65—Air Conditioner—Heater Wiring Schematic—  
4400, 4600 and 4800 Series

The Temp lever wire attaches to the temperature valve. See Figure 11-66. Located at the temperature valve is the max. cooling vacuum switch which controls the vacuum to the suction throttle valve. Also, a second wire connects from the temperature valve to the manual water valve. First movement of the "Temp" lever from off, opens the water valve to allow water flow through the heater core, positions the temperature valve to allow some air to pass through heater core and closes the vacuum switch to set the suction throttle valve at its minimum cooling position. Further movement of the lever only positions the temperature valve to allow more air to pass through the heater core.

The "Defr" lever wire connects to the defroster valve in the heater. Movement of this lever from Off, directs air through the center outlet to the windshield. The "Rear" lever opens and

closes the valve in the rear floor duct adapter to allow air to be directed to the rear floor of car.

### b. Air Distribution Valves and Vacuum Diaphragms

The 4400, 4600 and 4800 Air Conditioner-heater system has five (5) air distribution valves.

1. A combination outside-recirculated air valve is located on blower and air inlet assembly. See Figure 11-66 and 11-67. This air valve is operated by dual control #3 and #4 vacuum diaphragm.
2. A heater-air conditioner air valve is located in the heater assembly and is operated by the #1 vacuum diaphragm. See Figure 11-67.
3. A temperature valve, located in the heater assembly is operated by the "TEMP" lever control wire.
4. A defroster valve is located in the heater assembly and is operated by the "DEFR" control wire.
5. A rear heat valve is located in the rear floor duct adapter assembly and is controlled by the "REAR" lever.

The outside-recirculated air valve is normally held closed by a spring. When vacuum is applied to the #4 section of the dual vacuum diaphragm it is positioned at the recirculated or one quarter open position. See Figure 11-70. When vacuum is applied to both the #3 and #4 sections of the dual diaphragm the air valve is pulled to the full open or outside air position. See Figure 11-68.

The heater-air conditioner air valve is normally held in the air conditioner position by a spring attached to its operating lever. See Figure 11-67. When the valve is in this position all air entering the system is directed through the air conditioner outlets. When

vacuum is applied to the #1 vacuum diaphragm, the air valve is pulled to the heater position and all air entering the system is directed to the heater outlets.

When vacuum is exhausted from the diaphragms, the air valves return to their closed position.

### c. Vacuum Switches

Two vacuum switches are used. See Figure 11-66. The main vacuum switch which is operated by the "Air" lever and located on the circuit control assembly is open (allows vacuum to pass through) when its plunger is fully released. The max. cooling vacuum switch which is operated by the "Temp" wire is open when its plunger is fully depressed. The two vacuum switches must not be interchanged. When the vacuum switches are off or closed, they allow the vacuum in the diaphragm to be exhausted or vented through them so that the air valve will return to the off position.

### d. Operation

To insure proper vacuum control operation, a vacuum supply tank and check valve assembly is used with the air conditioner vacuum control system. The check valve closes when intake manifold vacuum drops below a predetermined amount so that vacuum will remain in the system and operation of the air valves will not be affected.

The position of the air valves in the housing, the setting of the climate control and the position of the vacuum switch with heater or air conditioner on is described below:

**1. Air Conditioner and Heater Off** - When the "air" lever is in the "off" position, both the air conditioner and heater are off. The outside-circulated air valve is held closed by its spring and the blower will not be operating.

The main vacuum switch is closed. See Figure 11-67. The maximum cooling vacuum switch is open if the "Temp" lever is also in the "off" position. This allows vacuum to be present at the suction throttle valves vacuum diaphragm even though the air conditioner is not operating.

**2. Air Conditioner Off, Heat On** - The climate control is set at "HEAT", the "AIR" and "TEMP" lever moved forward from the "off" position for heater operation. The main vacuum switch is opened which allows vacuum to be present at the #4 diaphragm and climate control. The climate control allows vacuum at the #1 and #3 vacuum diaphragms. Thus, the outside - recirculated air valve is full open and the heater-air conditioner air valve is positioned to direct air through the heater outlets. See Figure 11-68. The first movement of the "Temp" lever wire opens the manual water valve to allow water to flow through heater core, positions the temperature valve to direct some air through the heater core and closes the maximum cooling switch (which has no effect on operation of heater). Full movement of the "TEMP" lever provides maximum heat by positioning the temperature valve for all air to pass through the heater core.

**3. Ventilation through Air Conditioner Outlets** - To use the air conditioner outlets for outside air ventilation without cooling set "Climate" control at "Vent" and push "Air" lever on. If heat is desired through air conditioner outlets, push "Temp" lever on.

The air lever opens the main vacuum switch so that vacuum is present at the #4 diaphragm and climate control. The climate control allows vacuum to be present at the #3 diaphragm. The outside air-recirculated air valve is positioned full open allowing 100% outside air for ventilation. The

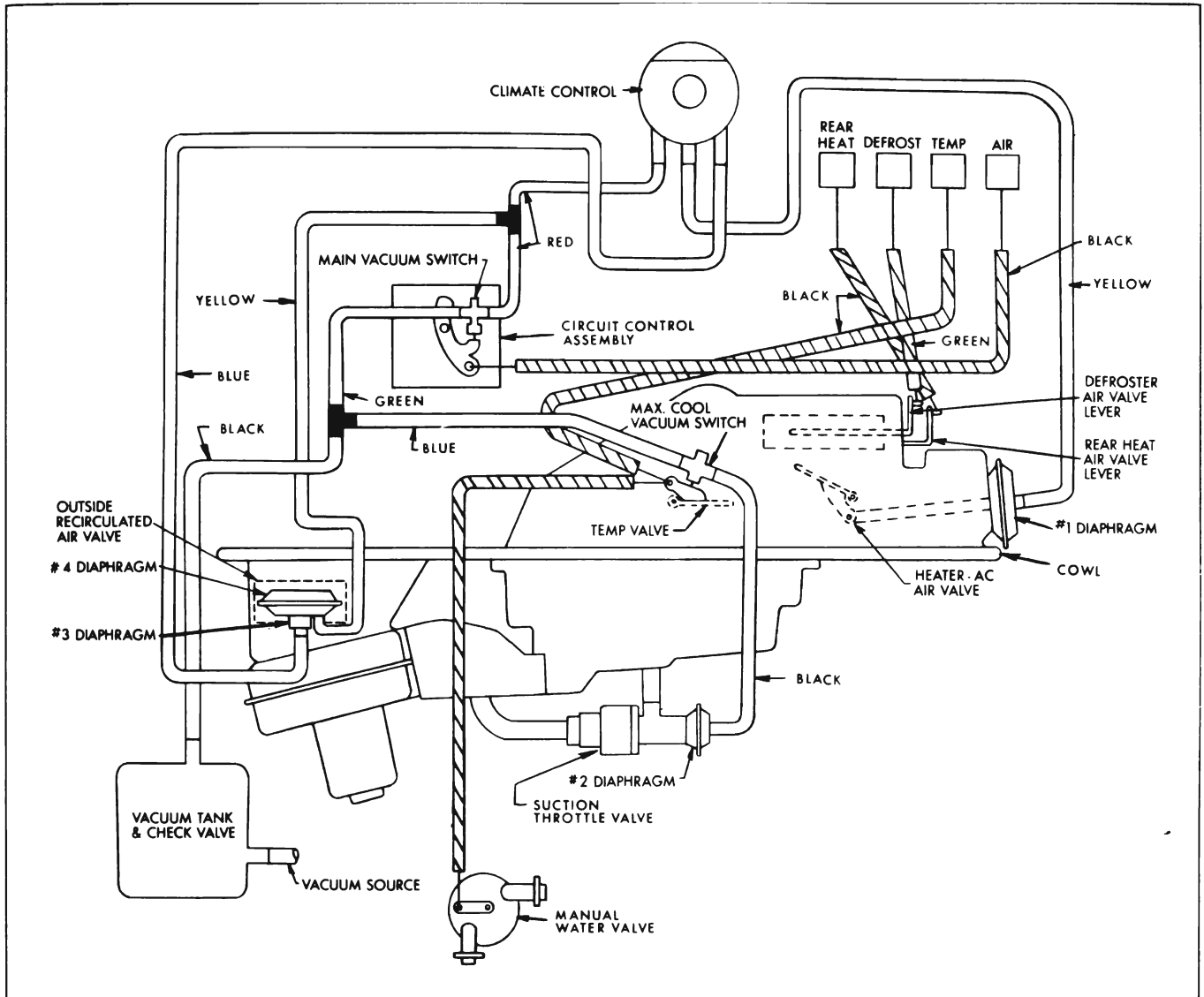


Figure 11-66—Schematic of 4400, 4600 and 4800 Controls

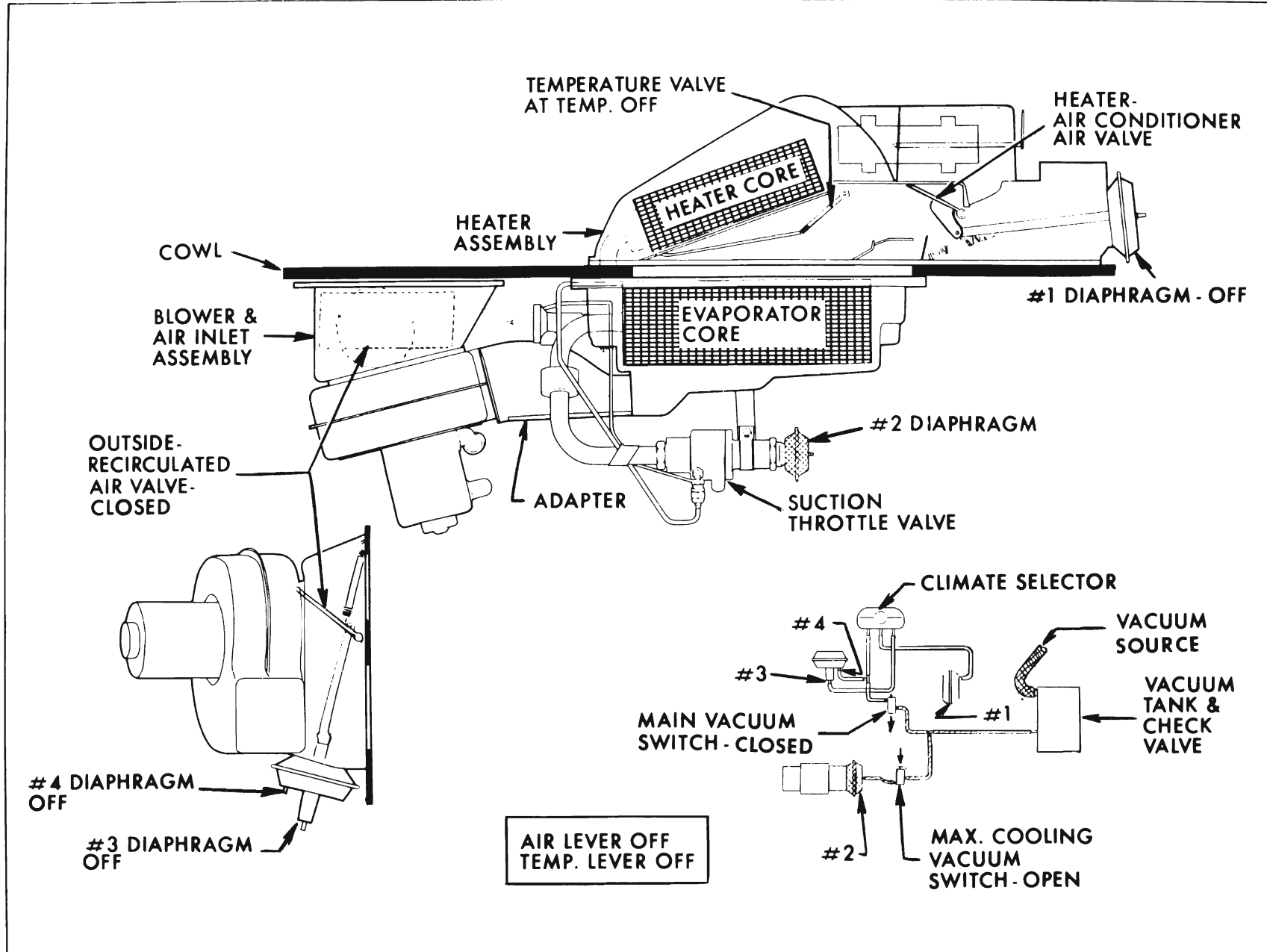


Figure 11-67—Air Conditioner and Heater Off—4400-4600-4800 Series

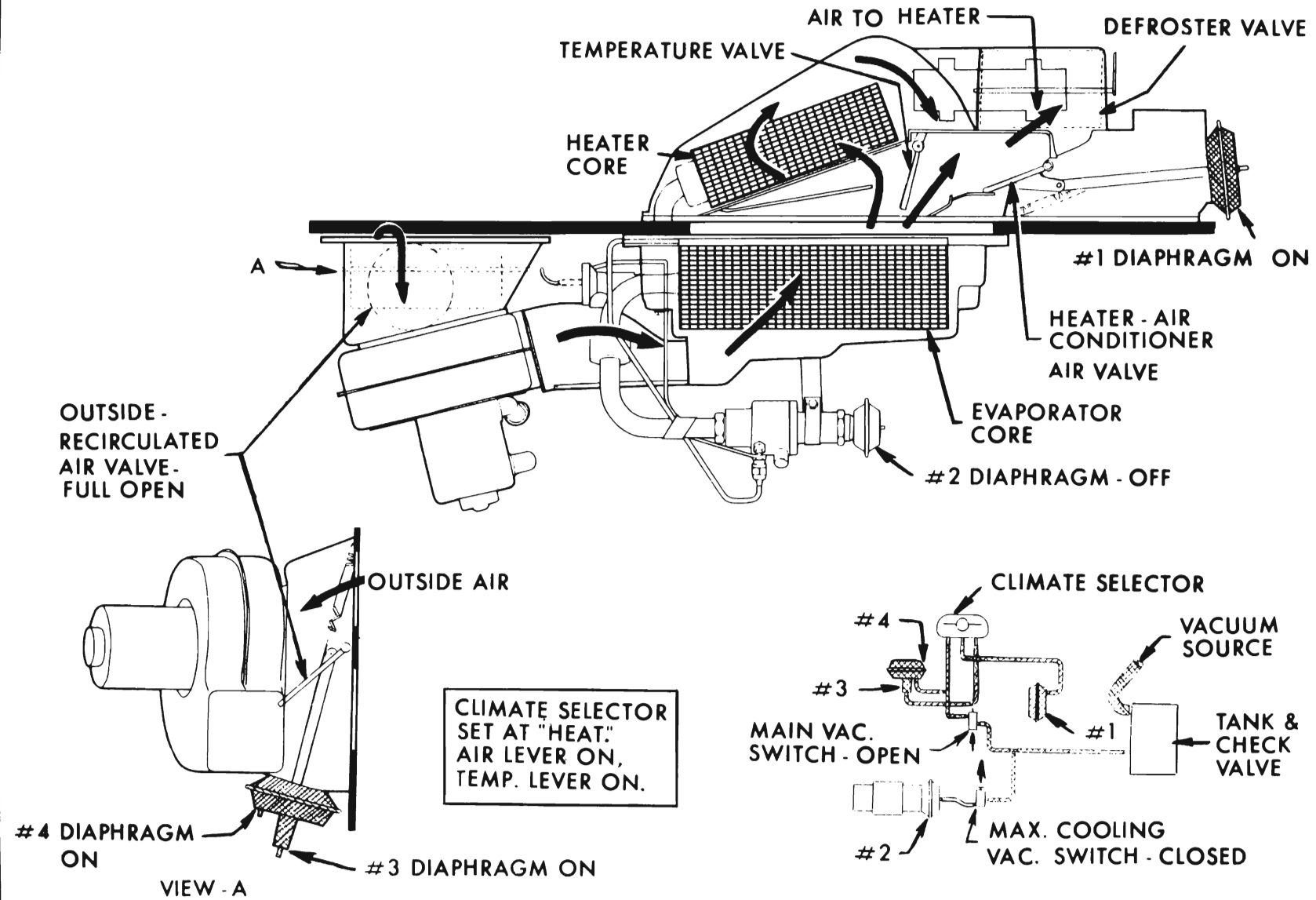


Figure 11-68—Air Conditioner Off, Heat On—4400-4600-4800 Series

#1 diaphragm does not have vacuum applied to it so the heater-air conditioner air valve directs air to air conditioner outlets. See Figure 11-69.

**4. Air Conditioner Normal, Heat Off or On -** The climate control is set at "Air Cond Normal" and the "Air" lever is pushed on.

The outside-recirculated air valve is full open as vacuum is present at #3 and #4 diaphragm. See Figure 11-70. The compressor clutch is engaged and the blower is set on low-low blower speed when the "air" lever is in the first detent from off. Further movement of the "Air" lever increases blower speed to Low, Medium and High. The suction throttle valve is set at maximum cooling as vacuum is present at its vacuum diaphragm.

If warm-dry air is desired out of air conditioner outlets, leave climate control at "AIR COND NORMAL" and push "TEMP" lever on. This opens manual water valve, closes max. cooling vacuum switch and positions temperature valve to direct some air as it leaves evaporator to go through heater core. The further forward TEMP lever is positioned, the more air routed through the heater core and the warmer the air leaving air conditioner outlets. When "TEMP" lever is full on, some air will still by-pass heater core through the by-pass at left side of evaporator. This is allowed so that the air outlet temperature when using air conditioner with heat will not be as hot as when using just heater. In extreme cold weather, to obtain sufficient heating, the heater then will have to be used. This prevents needlessly running the air conditioner compressor.

**5. Air Conditioner Maximum, Heat Off.** The Climate Control is set at "Air Cond Recir." Air lever full on and the "Temp" lever off. The outside-recirculated air valve is set at the one-quarter open position by having vacuum applied only to the #4 section of the dual diaphragm. See Figure 11-70. This allows 1/4 outside air and 3/4 recirculated air to mix and be directed to the evaporator. With Temp lever off, the suction throttle valve is set at maximum cooling and no air is directed through the heater core.

#### **e. Air Distribution Chart— 4400-4600-4800 Series**

Listed in the chart below are the positions of the Climate Control, Temp Lever, and Air Lever, Diaphragm in Operation, Vacuum Switch that is Open and the Air Distribution.

"Climate" Control Setting	"Air" Lever	"Temp" Lever	Diaphragm Applied	Main Vacuum Switch	Max. Cooling Vacuum Switch	Air Distribution
Any Position	Off	Off	#2	Closed	Open	None
Heat	On	On	#1, 3, 4	Open	Closed	Heater Outlets
Vent or Air Cond Normal	On	Off	#2, 3, 4	Open	Open	Air Conditioner Outlets
Vent or Air Cond Normal	On	On	#3, 4	Open	Closed	Air Conditioner Outlets
Air Cond Recir	On	Off	#2, 4	Open	Open	Air Conditioner Outlets

#### **f. Trouble Diagnosis— 4400-4600-4800 Series**

If the air conditioner-heater air distribution system does not function properly, first check the

vacuum hose connections and control wire adjustments. See Figure 11-71. If this does not correct, check for vacuum at air valve diaphragms for proper operation

of vacuum switches and climate control. See Figures 11-67 through 11-70. Refer to following chart for other possible causes.



CONDITION	COMPLAINT	POSSIBLE CAUSE
Note: If the vacuum hoses are properly attached (Figure 11-66 and 11-71) and lever control wires properly adjusted (Par. 11-17 Subpar. d) complaint maybe caused by the items listed on this chart.		
Air Lever off	Air out of Air conditioner outlets or heater outlets	Check main vacuum switch.
Climate Control Set at any Position. Air lever on.	*No air through air conditioner or heater outlets (blower operates)	Main vacuum switch defective. Climate control defective. #3 and #4 dual diaphragm defective.
	*Blower does not operate	Control circuit switch defective. Blower switch defective. 30 amp fuse on fuse block blown. Blower motor defective.
*When climate control is at Vent or Heat, air lever must be in third, fourth or fifth position for blower to operate.		
Climate Control set at any position, air lever on	Air flow changes or shuts off when car is accelerated	Defective check valve in vacuum tank or vacuum leak.
Climate Control set at "heat", air lever on	Air out of air conditioner outlets	#1 Vacuum diaphragm defective. Climate control defective.
Climate Control set at "Air Cond Normal" or "Air Cond Recir", Air lever on	Compressor fails to operate	Clutch switch defective
Climate Control set at "Air Cond Recir", Air lever on	No recirculated air	Climate Control defective #4 diaphragm defective

## 11-16 AIR DISTRIBUTION SYSTEM OPERATION AND TROUBLE DIAGNOSIS—4700 Series

### a. Vacuum Valve Diaphragms

Three vacuum switches control the four diaphragms which are located on the Plenum, blower and air inlet assembly and the

selector valve and case assembly. See Figure 11-73.

These diaphragms are connected to two air valves. These valves are the outside-recirculated valve and the heater-evaporator valve. Two diaphragms are used in operating each air valve to provide three valve positions. The #1 and #2 diaphragms are enclosed in a dual diaphragm assembly.

The #3 and #4 are separate diaphragms. Figure 11-73 is a schematic of these valves with both air conditioner and heater in the Off position.

The heater and evaporator valve vacuum diaphragm assembly which attaches to the selector valve case, consists of the number 1 and 2 diaphragms. See Figure 11-73. When vacuum is not present at either of these

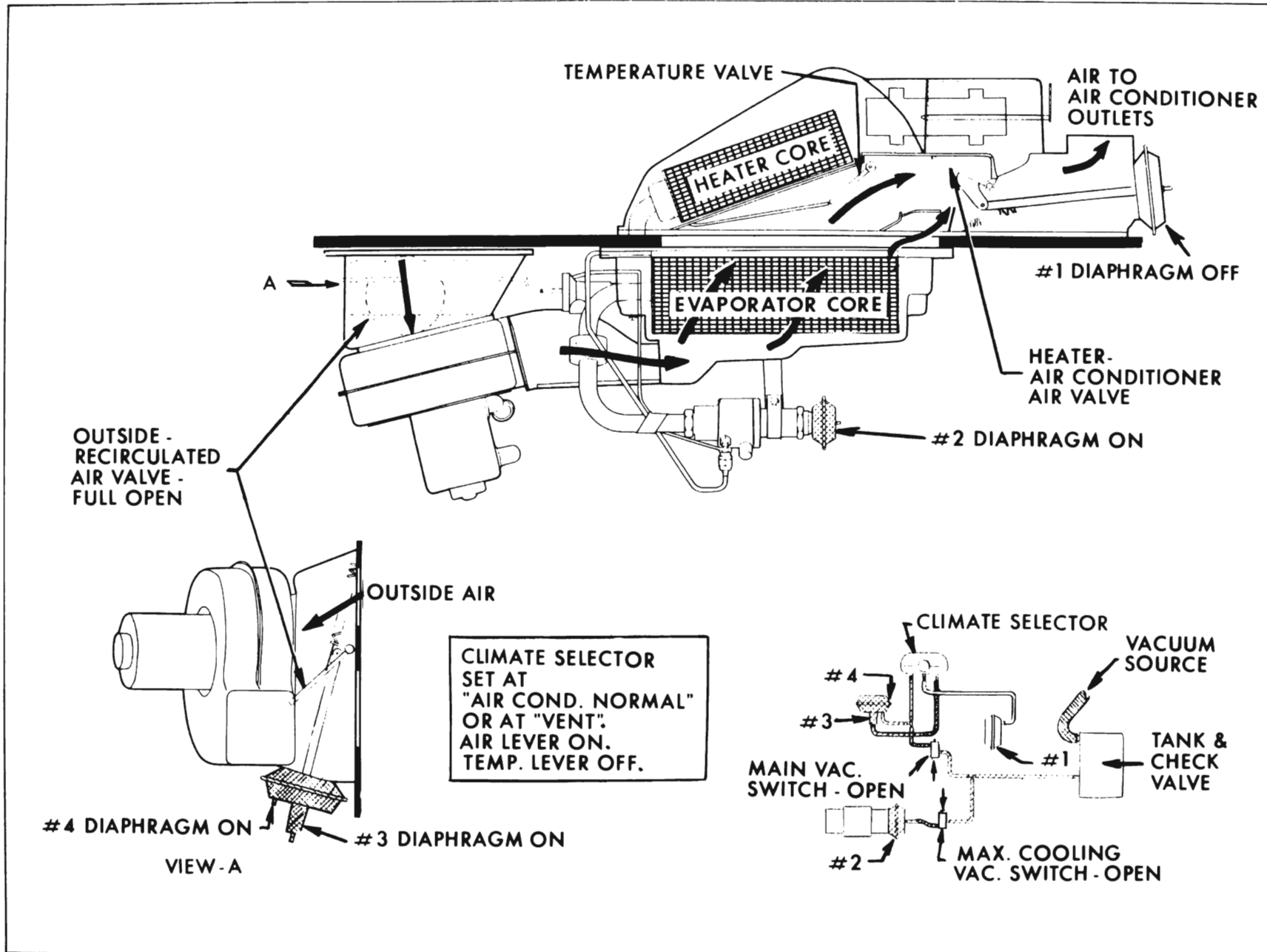


Figure 11-69—Air Conditioner Normal or Ventilation Through A/C Outlets, Heat Off—4400-4600-4800 Series

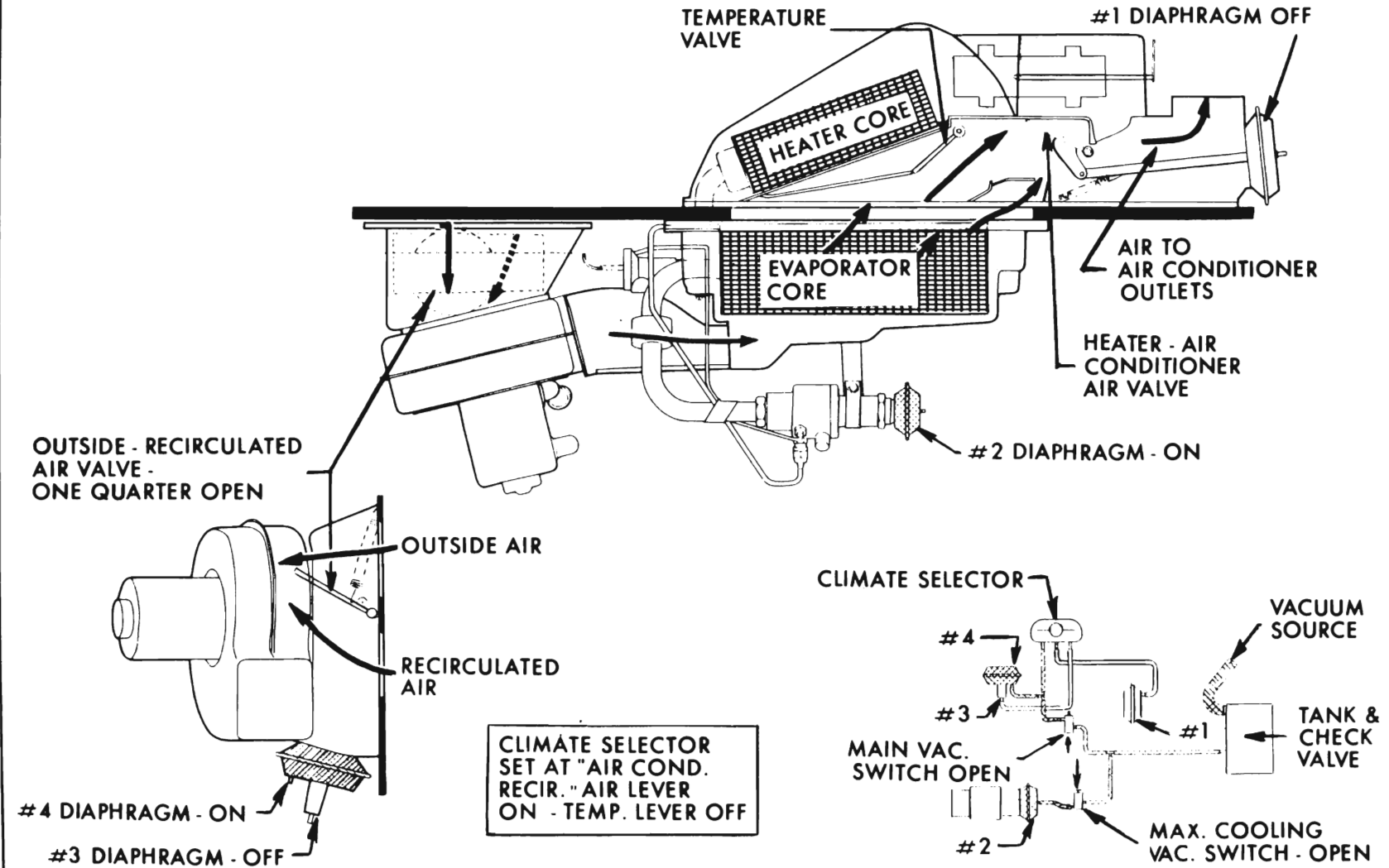


Figure 11-70—Air Conditioner Maximum, Heat Off—4400-4600-4800 Series

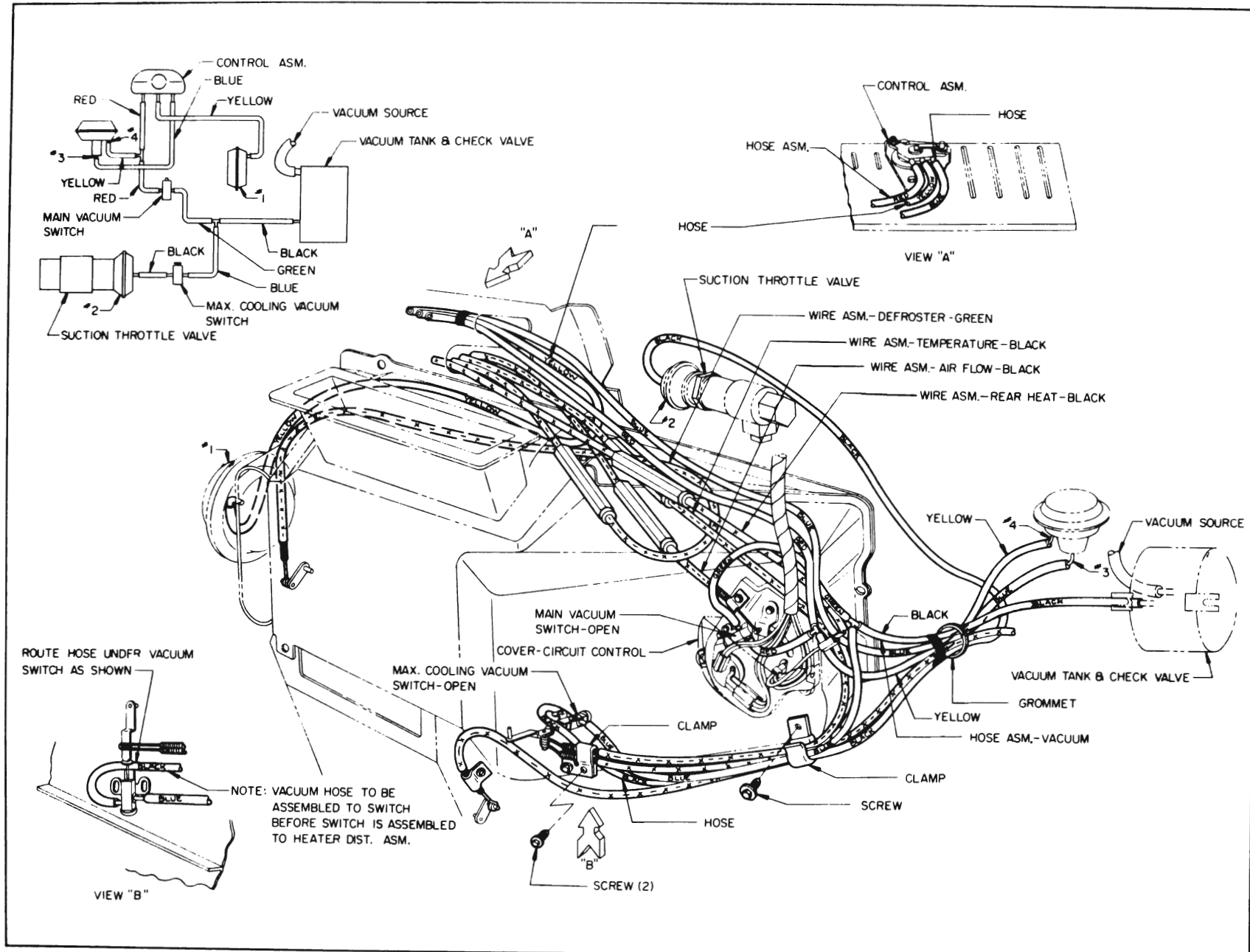


Figure 11-71—Vacuum Hose Installation—4400-4600-4800 Series

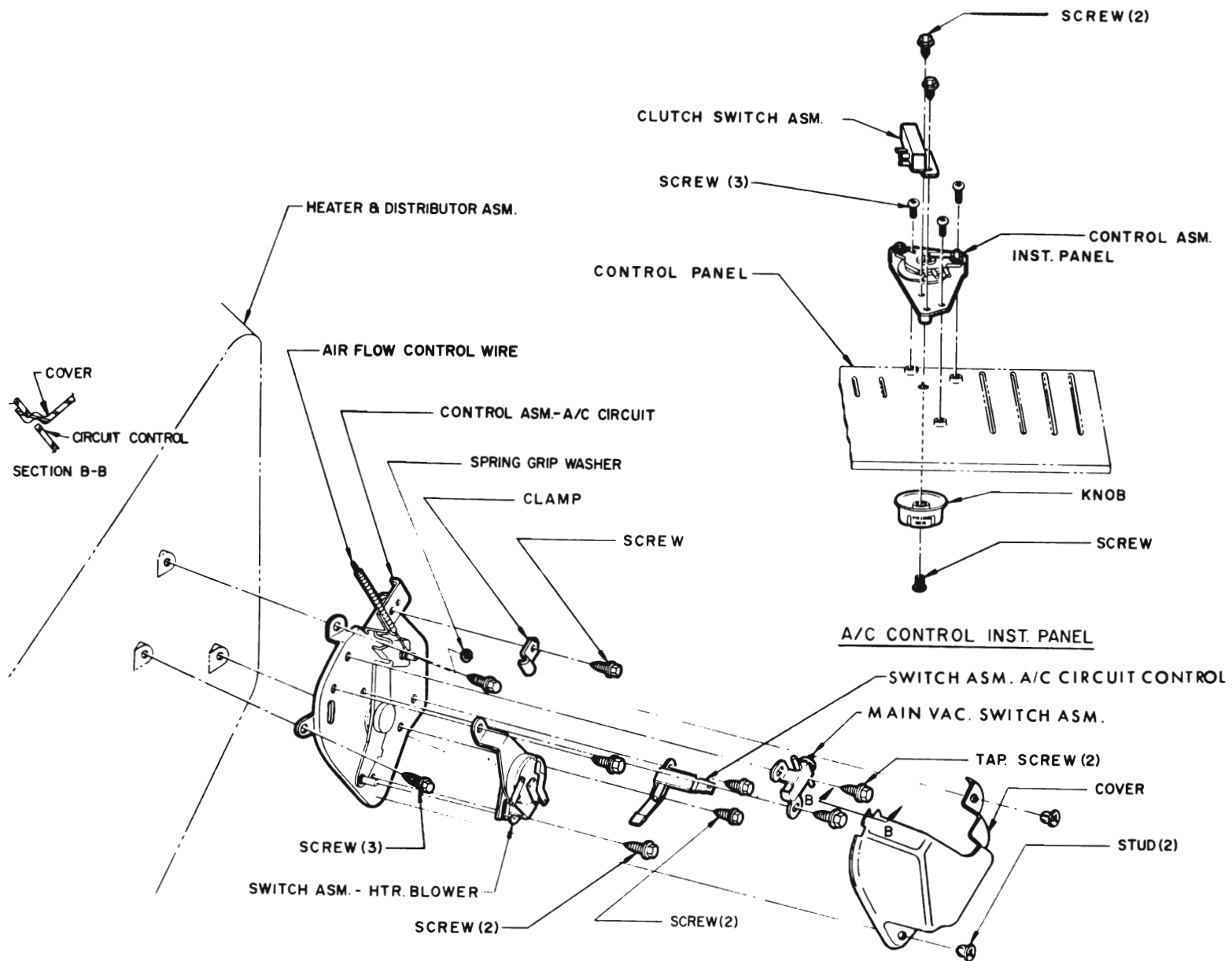


Figure 11-72—Air Conditioner—Heater Circuit and Climate Control Installation—4400-4600-4800 Series

diaphragms, the heater and evaporator valve is held at closed position by a spring. See Figure 11-73. When vacuum is applied to both the #1 and #2 diaphragms, the heater and evaporator valve is positioned at the full open position. See Figure 11-75. When vacuum is applied only to the #2 diaphragm, the heater and evaporator valve is positioned at the half open position. See Figure 11-77.

The number 3 and 4 outside recirculated air valve vacuum diaphragms, which are two separate diaphragms, are located at the bottom of the plenum, blower and air valve assembly. See Figure 11-73. When vacuum is not applied to the 3 and 4 diaphragms, the outside and recirculated air valve is held at the closed position by its spring. See Figure 11-73. When vacuum is applied to the #3 diaphragm the air valve is positioned at the full open position. See Figure 11-74. When vacuum is applied to the #4 diaphragm the air valve is positioned at quarter open position. See Figure 11-76. In cases where vacuum is applied to both the #3 and #4 diaphragms, the air valve will be positioned at the full open position as the full open #3 diaphragm will be the controlling diaphragm.

The diaphragms are vented through the vacuum switches after each operation.

### b. Vacuum Switches

The air conditioner control valve assembly has three vacuum switches. The #1 vacuum switch is open (allows vacuum to pass through) when its plunger is fully released and the #2 and #3 vacuum switches are open when their plungers are fully depressed.

The vacuum source (intake manifold) is connected to the #1 and #2 vacuum switches. The #1 vacuum switch allows vacuum to be

present at the #2 and #4 valve diaphragms, at the #3 vacuum switch and at the vacuum modulator when it is open.

The #2 vacuum switch allows vacuum to be present at the #3 valve diaphragm when open. When #1 and #3 vacuum switches are open, vacuum is present at the #1 valve diaphragm.

### c. Vacuum Hose Connections

Figure 11-78 and 11-79 shows the correct vacuum hose connections to the air valve vacuum diaphragms and vacuum switches. The hoses must be routed and connected as shown for the air distribution system to operate correctly.

### d. Operation

A check valve located at the intake manifold, allows vacuum to be present at the air conditioner control valve assembly. When manifold vacuum drops below a predetermined amount the check valve closes so that vacuum will be maintained at the vacuum diaphragms and the operation of the air valves will not be affected.

The position of the air valves and the vacuum switches that are open to allow vacuum to the vacuum diaphragms with heater and/or air conditioner on is described below.

#### 1. Air Conditioner and Heater Off

When both the heater and air conditioner controls are off, the heater-evaporator and the outside-recirculated air valves are held in their respective closed positions by spring tension. Outside air will be closed off and the blower will not be operating. By the position of the valves, no air will be circulated through either of them. See Figure 11-73. The #1 and #2 vacuum switches are closed, thus, there is no vacuum to valve diaphragms.

#### 2. Air Conditioner Off, Heater On

With the heater "Air" control on, the heater-evaporator air valve remains in its closed position (being fully open to heater core) and the outside-recirculated air valve will fully open bringing in all outside air which will circulate into the heater. See Figure 11-74. The #2 vacuum switch is open, thus, there is vacuum to the #3 diaphragm.

#### 3. Air Conditioner Normal, Heater Off

With the air conditioner "Cool" control on, but not fully on and/or the "Air" control on, the outside-recirculated air valve will be fully open allowing 100% outside air for normal cooling or ventilation. Under this condition, the heater-evaporator air valve will fully open allowing all air to be directed into the evaporator. See Figure 11-75. All three vacuum switches are open, thus, vacuum is to all four valve diaphragms and vacuum modulator.

#### 4. Air Conditioning Maximum, Heater Off

The heater-evaporator air valve is fully open to the evaporator and closed to the heater core with the air conditioning "Cool" control in the maximum on position. The outside-recirculated air valve will be 1/4 open. This will allow approximately 25% outside air and 75% recirculated air to mix and be directed to the evaporator. See Figure 11-76. The #1 and #3 vacuum switches are open, thus, there is vacuum to #1, #2 and #4 valve diaphragms and vacuum modulator.

#### 5. Air Conditioning Normal or Maximum, Heater On

With the air conditioner "Cool" control on, and the heater "Air"



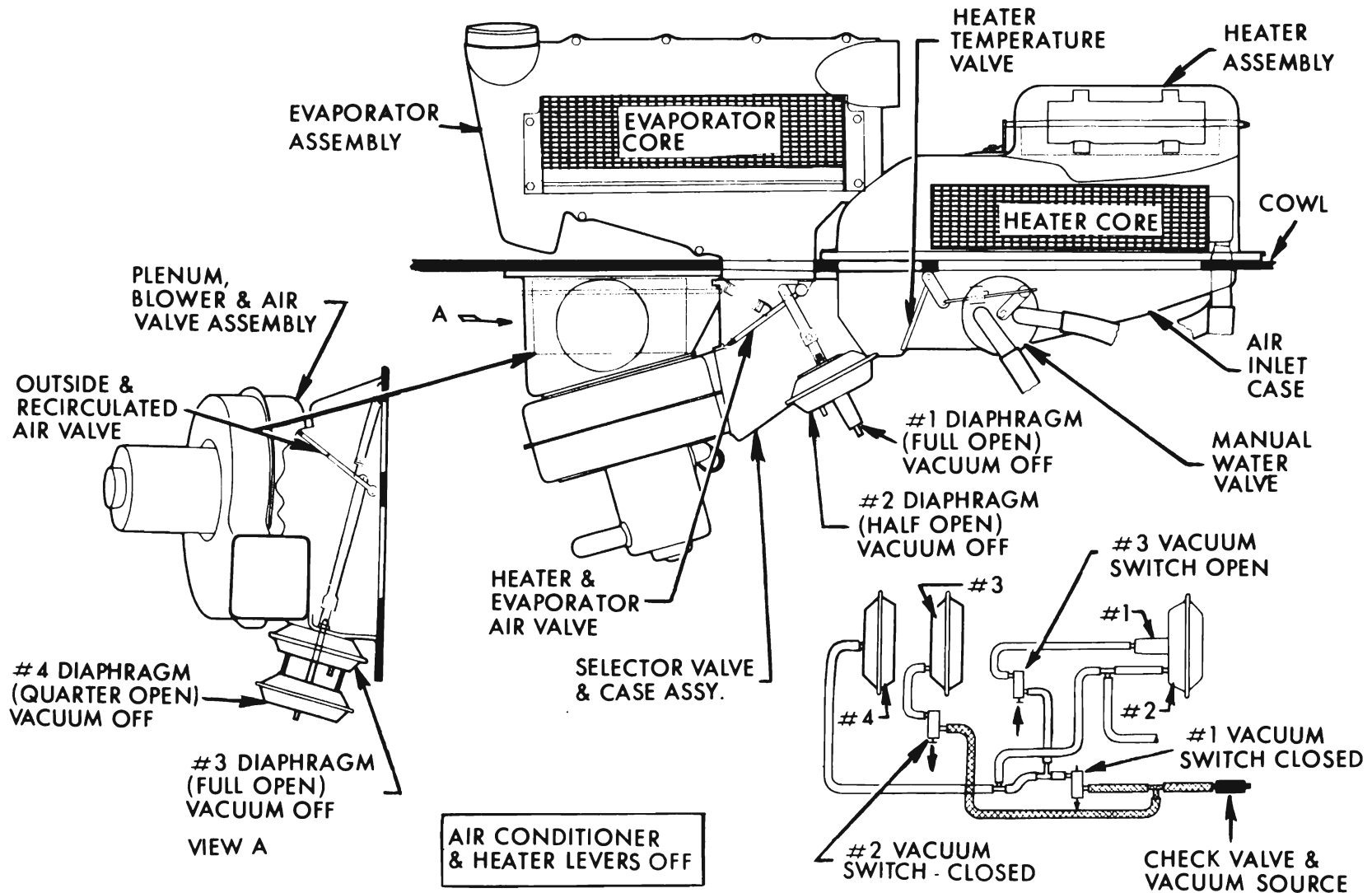


Figure 11-73—Air Conditioner and Heater Off—4700 Series

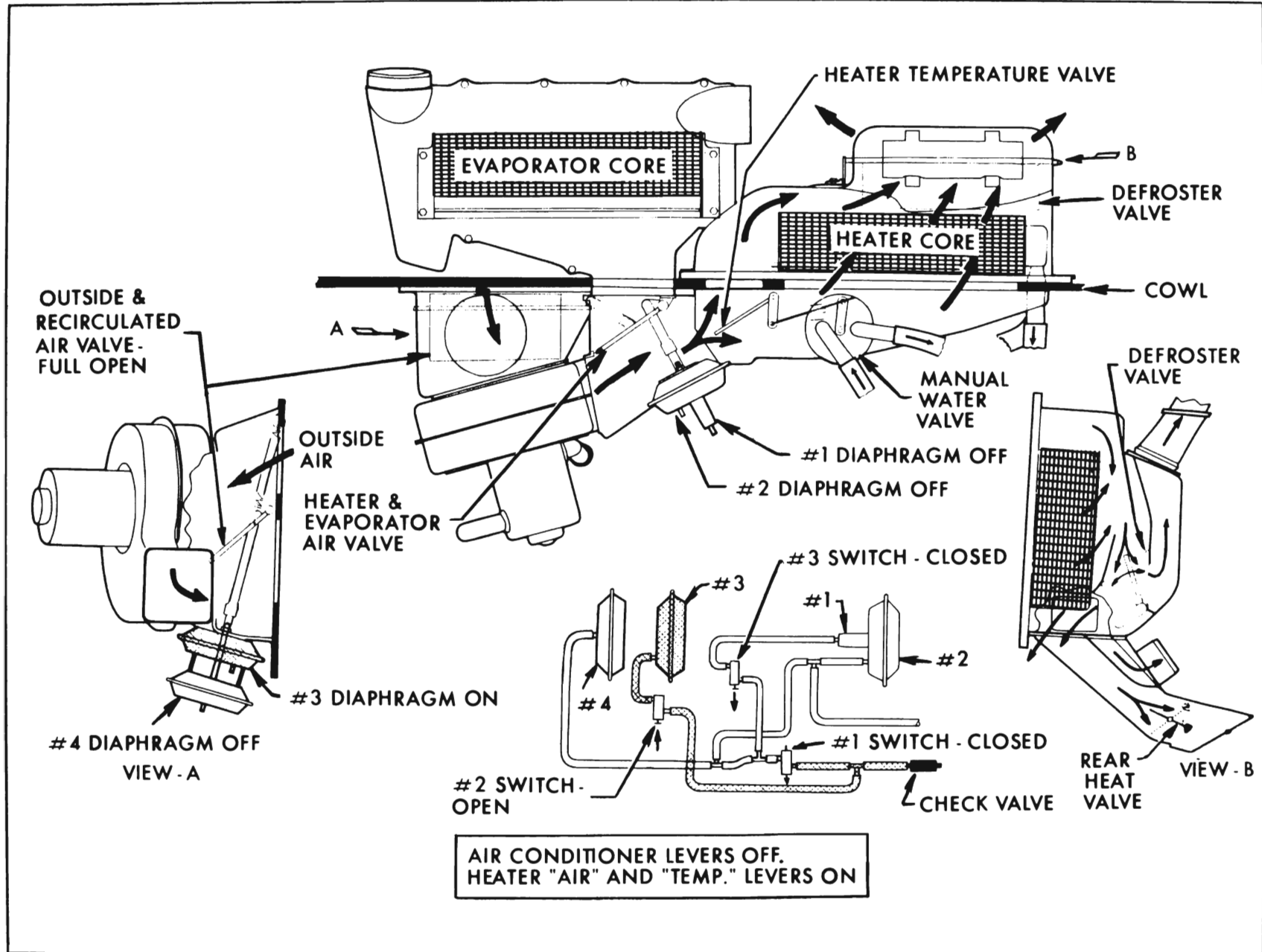


Figure 11-74—Air Conditioner Off, Heater On—4700 Series

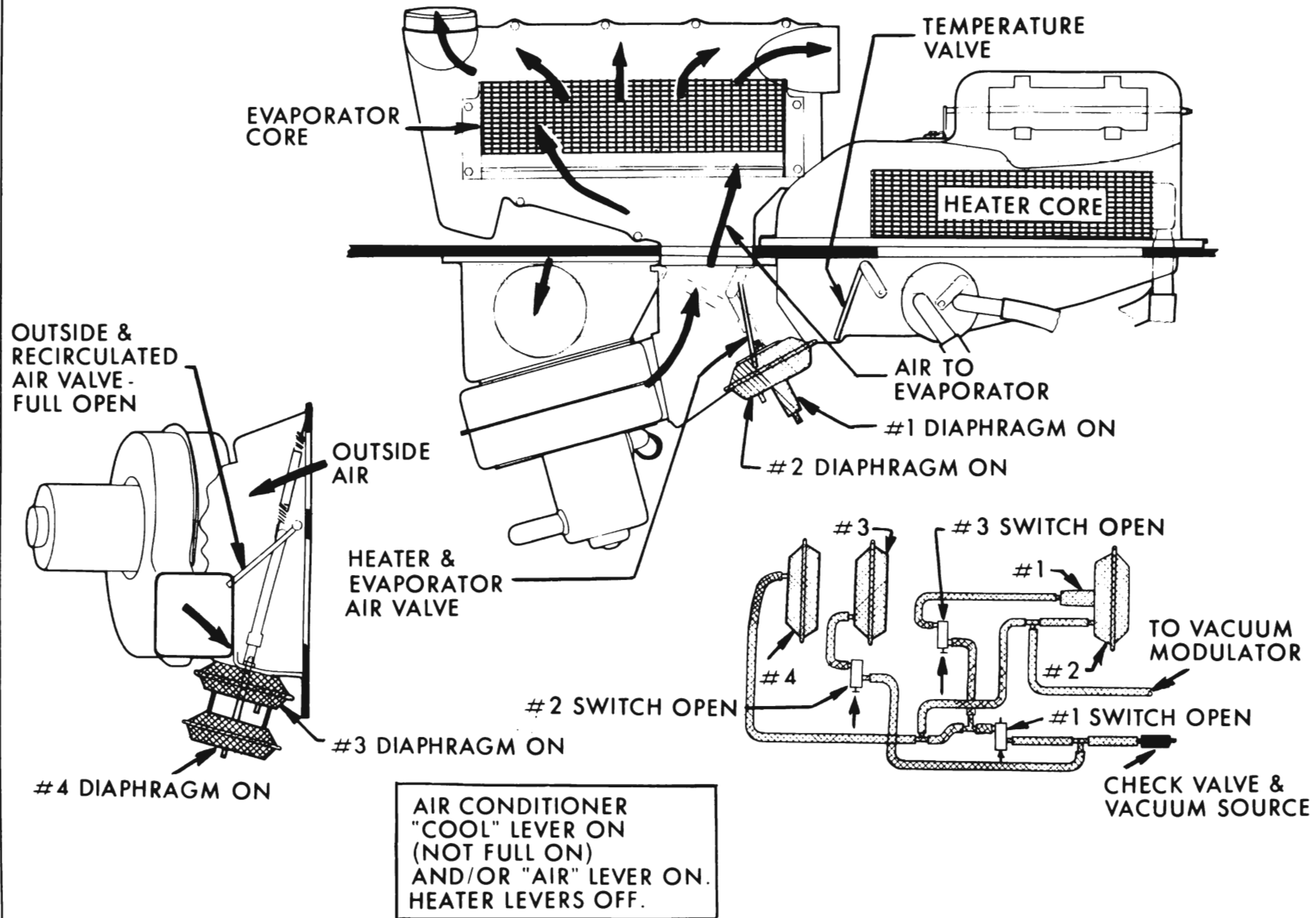


Figure 11-75—Air Conditioner Normal, Heater Off—4700 Series

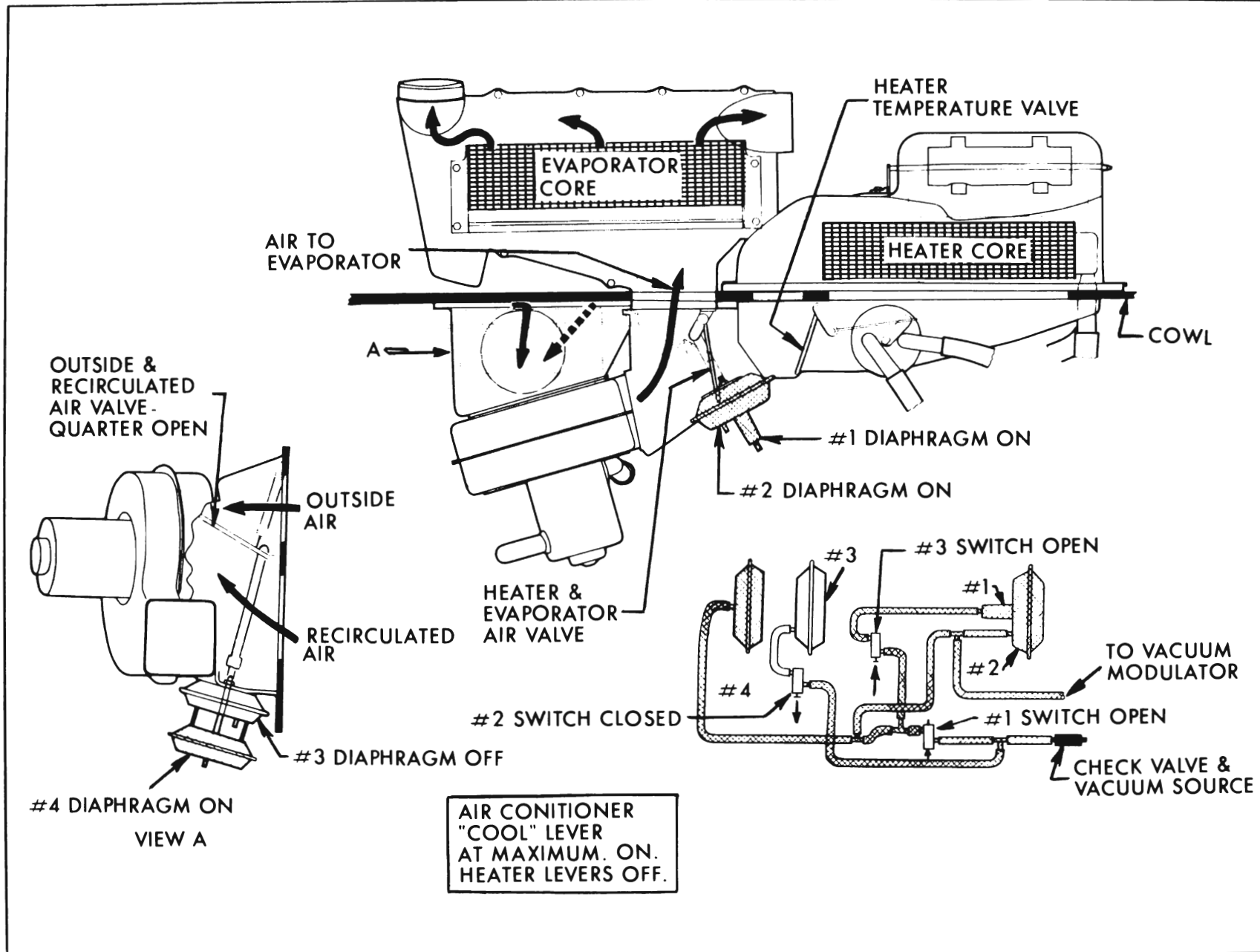


Figure 11-76—Air Conditioner Maximum, Heater Off—4700 Series

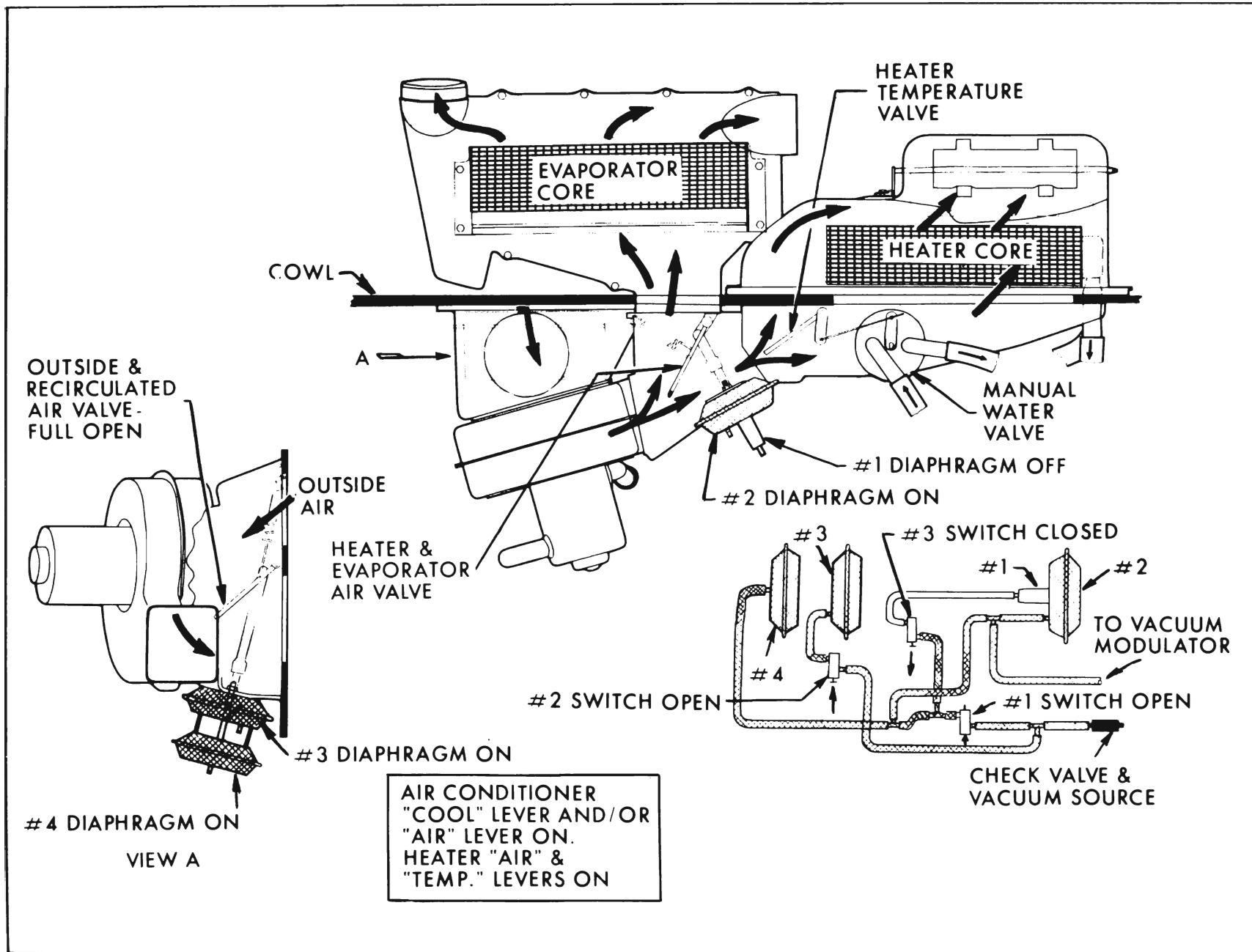


Figure 11-77—Air Conditioner Normal or Maximum, Heater On—4700 Series

lever on, the heater-evaporator air valve will half open allowing air to be directed to both the evaporator and the heater core. The outside recirculated air valve will fully open allowing all outside air to be distributed to the evaporator and heater core. See Figure 11-77. The #1 and #2 vacuum switches are open, thus, there is vacuum to #2, #3 and #4 valve diaphragms and vacuum modulator.

#### **e. Air Distribution Chart—4700 Series**

Listed in the chart below are the

positions of the control levers, diaphragms in operation, vacuum switch that is open and the air distribution.

**IMPORTANT:** Although applied diaphragms are diaphragms actually holding air valves in proper positions; vacuum may also be present to one or two other diaphragms. For example:

When #3 diaphragm (full open outside-recirculated air valve) is shown as applied, vacuum is also present at #4 diaphragm (quarter open outside and recirculated air valve). This in no way affects operation of #3 diaphragm. Likewise, when #1 diaphragm (full

open heater evaporator valve) is applied, vacuum is also present at #2 diaphragm (half open heater and evaporator valve). As the full open diaphragm overrides the half open diaphragm, vacuum applied to #2 has no effect on #1 diaphragm. On normal cooling with no heater operation, vacuum is applied to all four diaphragms. However, only #1 and #3 diaphragms (full open) are holding the valves in their proper positions.

When the plunger of the #1 vacuum switch is depressed it is closed, and when the plungers of the #2 and #3 vacuum switches are depressed they are open.

Heater Air Control	Air Conditioner Cool and Air Controls	Diaphragms Applied	#1 Vacuum Switch	#2 Vacuum Switch	#3 Vacuum Switch	Air Distribution
Off	Off	None	Closed	Closed	Open	No air
On	Off	#3	Closed	Open	Closed	Heater outlets only
Off	Cool control on, but not full on and/or Air control on	#1, #2, #3, #4	Open	Open	Open	A/C outlets only
Off	Cool control full on	#1, #2, #4	Open	Closed	Open	A/C outlets only
On	Cool control on and/or Air control on	#2, #3, #4	Open	Open	Closed	A/C and heater outlets

#### **f. Trouble Diagnosis— 4700 Series**

If the air conditioner air distribution system is not functioning properly, first check the vacuum hose connections, Figures 11-78 and 11-79, the control cable adjustments and the vacuum switch adjustment as instructed in para-

graph 11-17. If this does not correct complaint, check for vacuum at valve diaphragms, for proper functioning of vacuum switches and position of air valves as shown in Figures 11-73 through 11-74. Refer to trouble diagnosis chart for possible causes of complaint.

**IMPORTANT:** If complaint is

that air flow changes or shuts off when car is accelerated, check valve at intake manifold may be defective. Also, if there is no vacuum to suction throttle valve when "Cool" lever is on (not full on), check for the vacuum hoses being off vacuum modulator, hoses being kinked or modulator being defective.



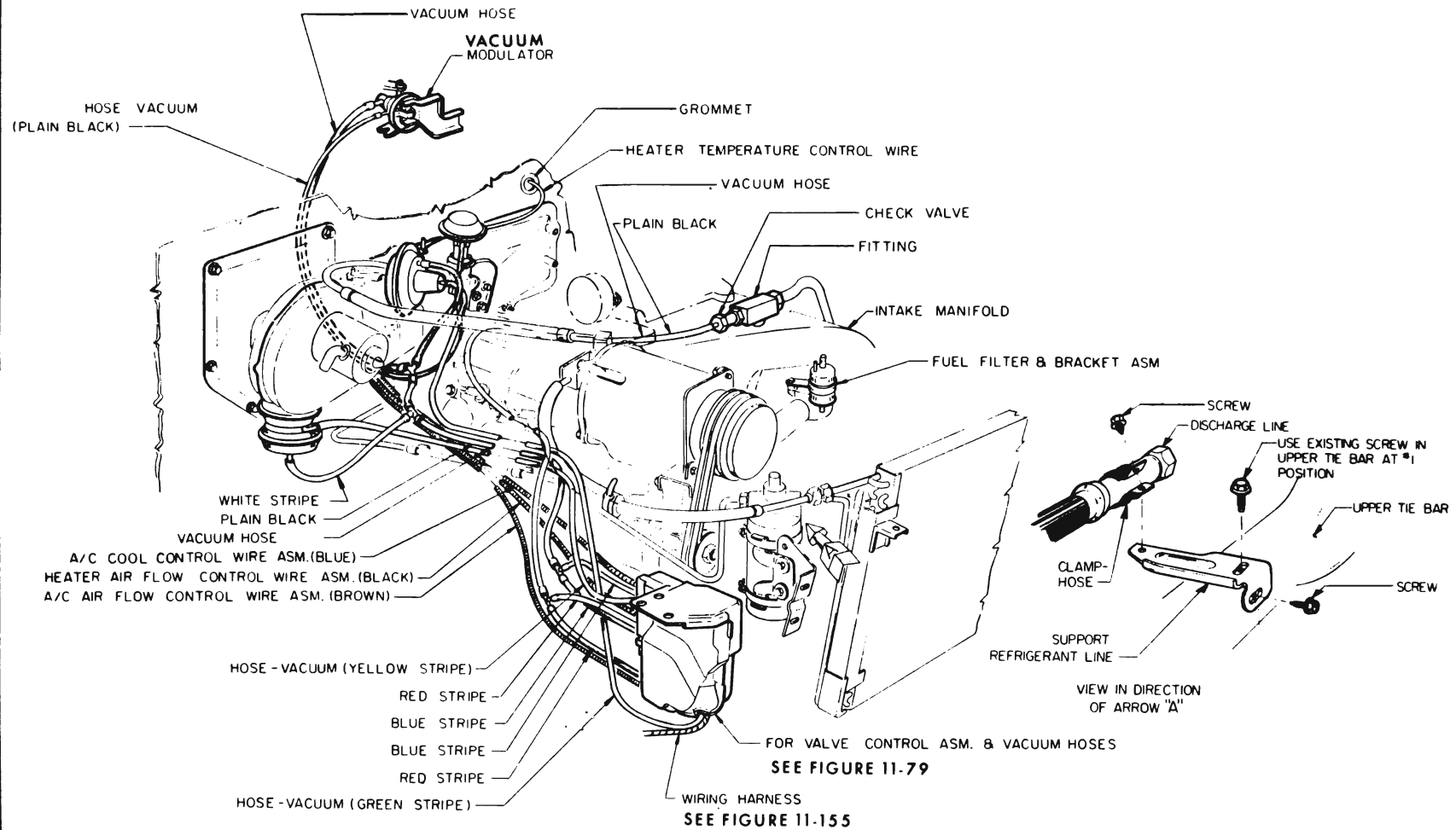


Figure 11-78—Vacuum Hose Installation on Diaphragms and Modulator—4700 Series

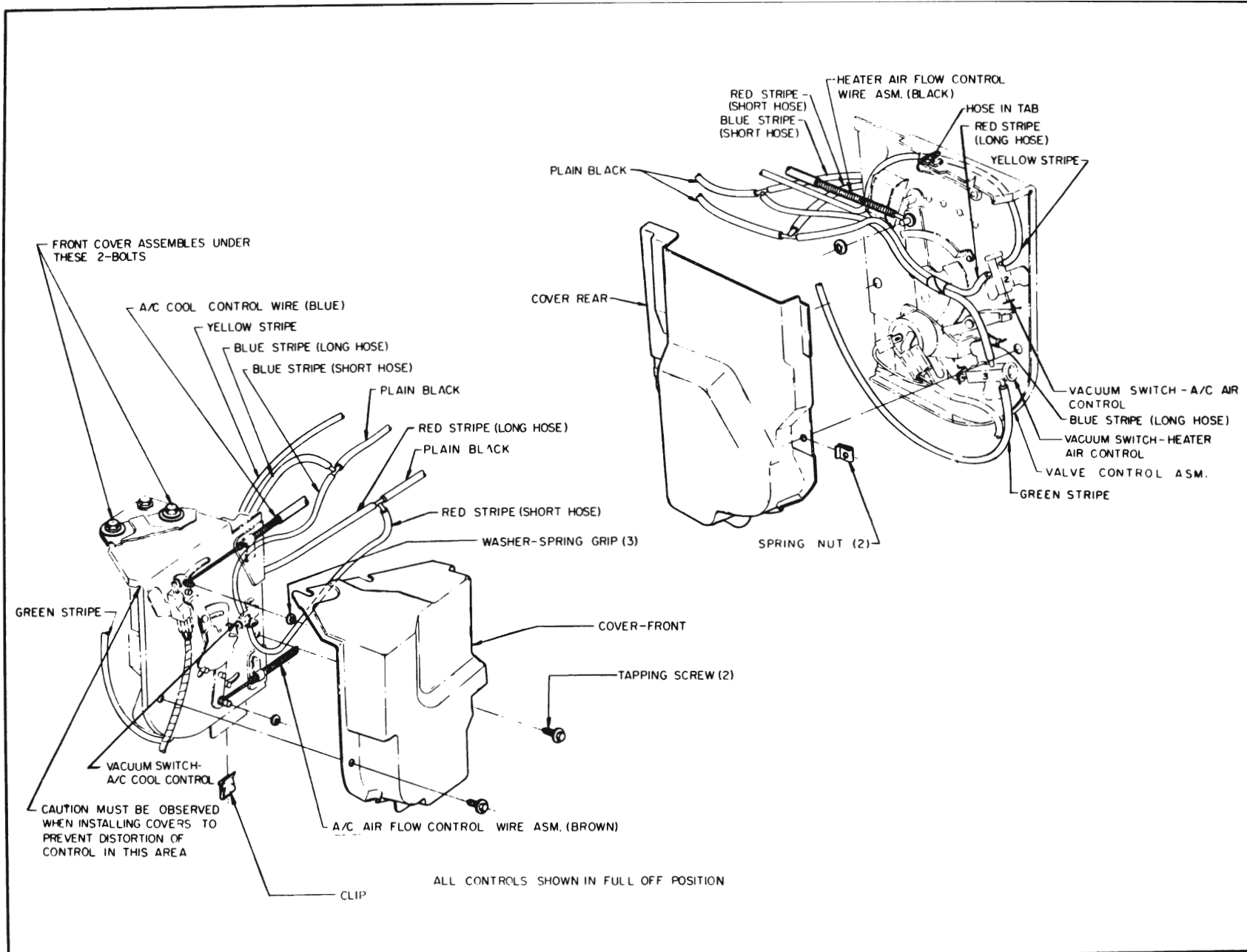


Figure 11-79—Vacuum Hose Installation on Vacuum Switches—4700 Series

**g. Vacuum Switch Trouble Diagnosis—4700 (Series)**

CONDITION	COMPLAINT	POSSIBLE CAUSE
All controls off.	Air out of A/C outlets.	#1 and 2 vacuum switches adjusted improperly or defective.
	Air out of heater.	#1 vacuum switch adjusted incorrectly allowing #2 to remain open. #2 vacuum switch adjusted incorrect or defective.
Heater "Air" on.	Recirculated air only - no outside air, windows steam up, air in car stale.	#2 vacuum switch adjusted incorrectly or defective, does not allow outside air valve to open.
	Air out of heater.	#1 vacuum switch adjusted incorrectly or defective, allowing vacuum to #2 valve diaphragm.
A/C "Cool" control on normal and/or A/C "Air" control on.	All air out of heater outlets.	#1 vacuum switch adjusted incorrect or defective.
	Recirculated air through heater.	#1 vacuum switch defective, #2 adjusted incorrectly or defective, no vacuum to any of the diaphragms.
	1/4 outside air only.	#2 not adjusted correctly or defective, no vacuum to diaphragm #3.
	Air out of A/C and heater outlets.	#3 vacuum switch adjusted incorrectly or defective, no vacuum to #1 diaphragm.
A/C "Cool" control on maximum.	No recirculated air	#2 vacuum switch incorrectly adjusted or defective, vacuum to #3 diaphragm.
A/C "Control" and/or "Air" control on and heater "Air" control on.	All air through heater outlets.	#1 vacuum switch defective <u>no</u> vacuum to #2 diaphragm.
	All air through A/C outlets.	#3 vacuum switch defective, vacuum to #1 diaphragm.
	1/4 outside air only.	#2 vacuum switch incorrectly adjusted or defective, no vacuum to #3 diaphragm.

## 11-17 SERVICE PROCEDURES

**IMPORTANT:** If a receiver-dehydrator is replaced, the IN must be attached to condenser outlet.

**NOTE:** See paragraphs 11-18 and 11-19 for service procedures on compressor assembly.

### a. Safety Precautions

The following safety precautions should always be used when servicing the air conditioner refrigeration system.

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 or directly into engine air intake.
7. Do not expose eyes to liquid refrigerant; always wear safety goggles.

### b. Installation Precautions

1. All subassemblies are shipped sealed and dehydrated. They are to remain sealed until just prior to making connections.
2. All subassemblies should be at room temperature before uncapping. This prevents condensation of moisture from air that enters the system.
3. All precautions should be taken to prevent damage to fittings or connections. Even minute damage to a connection could cause it to leak.
4. Any fittings with grease or dirt on them should be wiped clean with a cloth dipped in alcohol.

Do not clean fittings or hoses with chlorinated salts such as trichlorethylene as they are contaminants. If dirt, grease or moisture gets inside the pipes and cannot be removed, the pipe is to be replaced.

5. Use a small amount of refrigeration oil on all tube and hose joints and lubricate the "O" ring seal in this oil before assembling the joint as this oil will help in making a leakproof joint. When tightening joints use a second wrench to hold the stationary part of the connection to prevent twisting and to prevent hose kinking as kinked hoses are apt to transmit noise and vibration.

**CAUTION:** Tighten all connections in accordance with recommended torques. See pipe and hose connection chart. See Figure 11-42. Insufficient torque when tightening can result in loose joints and excessive torque, when over-tightening can result in distorted joint parts and either condition can result in refrigerant leakage.

6. Do not connect receiver dehydrator assembly until all other seals of assemblies have been connected. This is necessary to insure optimum dehydration and maximum moisture protection of the system.

### c. Discharging Refrigerant from Air Conditioner System

When a part is removed or disconnected that is in the Air Conditioner refrigeration circuit, the refrigerant must be discharged from system using the following procedure.

1. Remove protective caps from Schrader valve gauge fittings on suction throttle valve and discharge line located at rear of compressor.
2. Using Adapters J-5420, connect charging lines of pressure

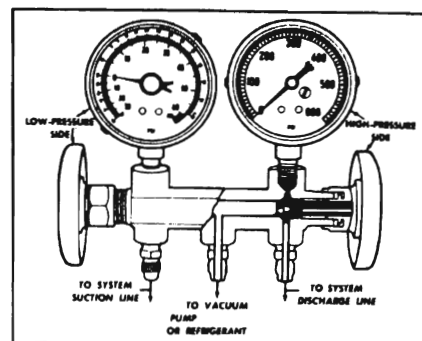


Figure 11-80-J-5725-01 Manifold and Gauge Set

gauge and set Manifold J-5415 to Schrader valves as shown in Figure 11-149 with both valves of manifold closed. See Figure 11-80.

3. Slowly open valves on Manifold and discharge all pressure from system.

**CAUTION:** Do not open valves too fast as excessive oil will be blown out of system. Place rag over end of discharge service line to prevent oil or liquid refrigerant from spraying on car or person.

### d. Adjustments—4400—4600—4800 Series

There is no service adjustment on the blower switch, the thermostatic expansion valve, the circuit switch or the climate control.

#### 1. Control Wire Adjustment

The air conditioner - heater wires are adjusted by rotating the adjusters which are part of the wire assembly.

To adjust any of the control wires, set control valves in the "off" position. Then rotate the adjuster so that the lever on instrument panel is 1/8" from full off position. See Figure 11-71 and 11-81.

**IMPORTANT:** Always recheck adjustment, by again placing valve or control in off position of control lever. Lever should be 1/8" from off position and lined up.

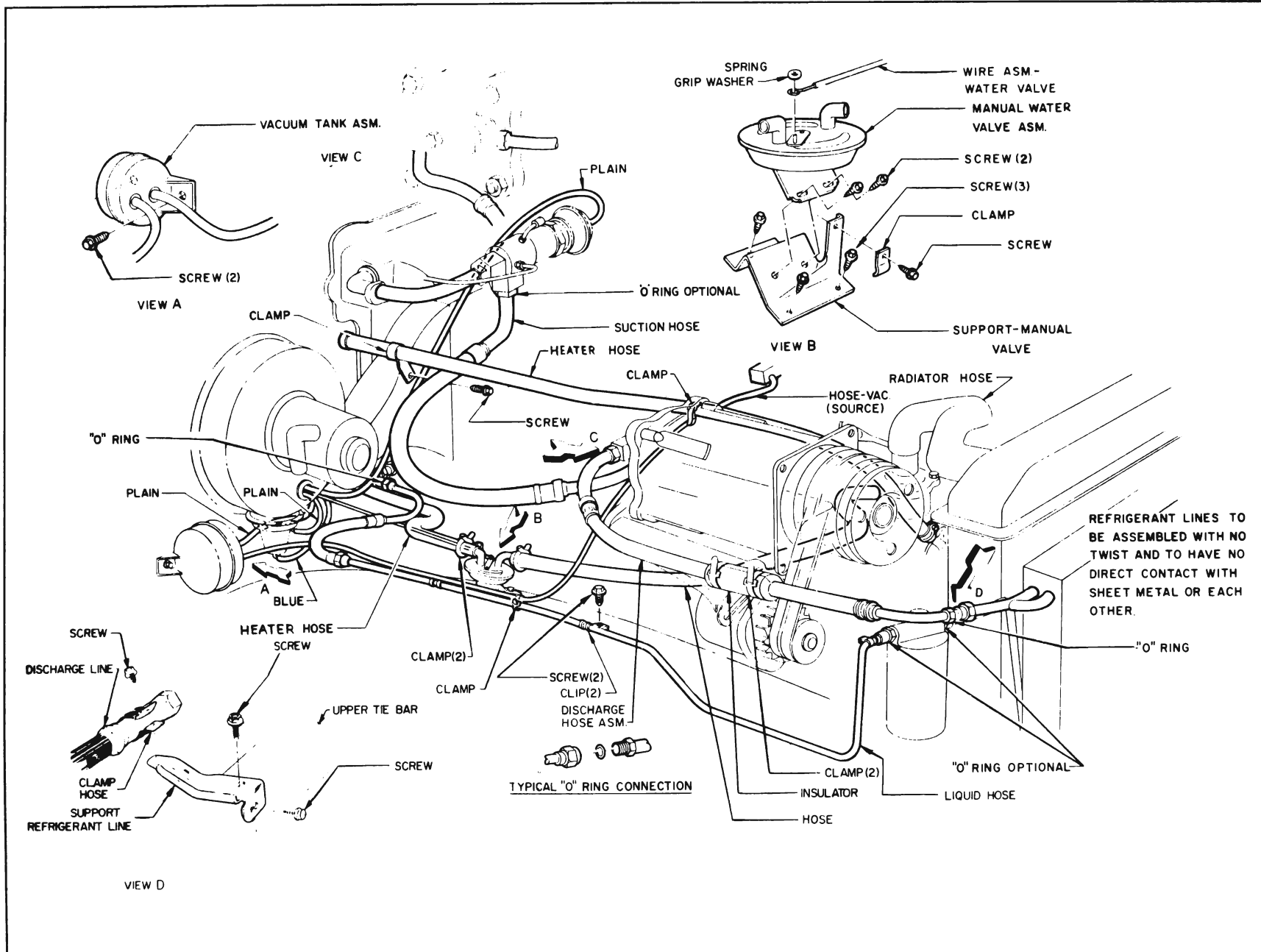


Figure 11-81—Manual Water Valve and Hose Installation—4400-4600-4800 Series

When adjusting "TEMP" wire be sure manual water valve is in the off position.

## 2. Main Vacuum Switch Adjustment

Place "AIR" lever in off position. Loosen main vacuum switch attaching screws and push switch against control lever on circuit control assembly to fully depress plunger. Tighten mounting screws. See Figure 11-82.

## 3. Max. Cooling Vacuum Switch Vacuum

Place temperature valve and "TEMP" lever in off position. Loosen Max. cooling vacuum switch retaining screws and push switch against temperature valve lever to fully depress switch plunger. Tighten mounting screws.

## e. Adjustments—4700 Series

There is no service adjustment on the blower switches, the thermostatic expansion valve or the vacuum modulator.

### 1. Air Conditioner "Air" and "Cool" and Heater Air Control Wires

With the control levers on the control valve assembly in the "Off" position as shown in Figure 11-85, rotate adjusters so that instrument panel contact levers are in line and 1/8" from "Off". See Figure 11-84.

### 2. Vacuum Switch Adjustment

Check operation of vacuum switches by referring to Figures 11-73 through 11-77. Place the control levers as indicated in each figure and check for vacuum

at each diaphragm by pulling the hose off the diaphragm fitting and holding finger over end of hose. If vacuum switches are functioning correctly, vacuum will be present only at each figure. The adjustment procedure for each vacuum switch is listed below and on Figure 11-85.

(a) Vacuum Switch #1. Loosen switch mounting screws. With air conditioner "Cool" lever in off position and "Air" lever in first detent, adjust vacuum #1 until plunger just lightly touches actuating tab lever mechanism. Tighten mounting screws. See Figure 11-86.

(b) Vacuum #2. Loosen switch mounting screws. With air conditioner "Air" lever in first detent from off position and "Cool" lever 1/4 to 1/3 on, place a .020 feeler gauge between vacuum

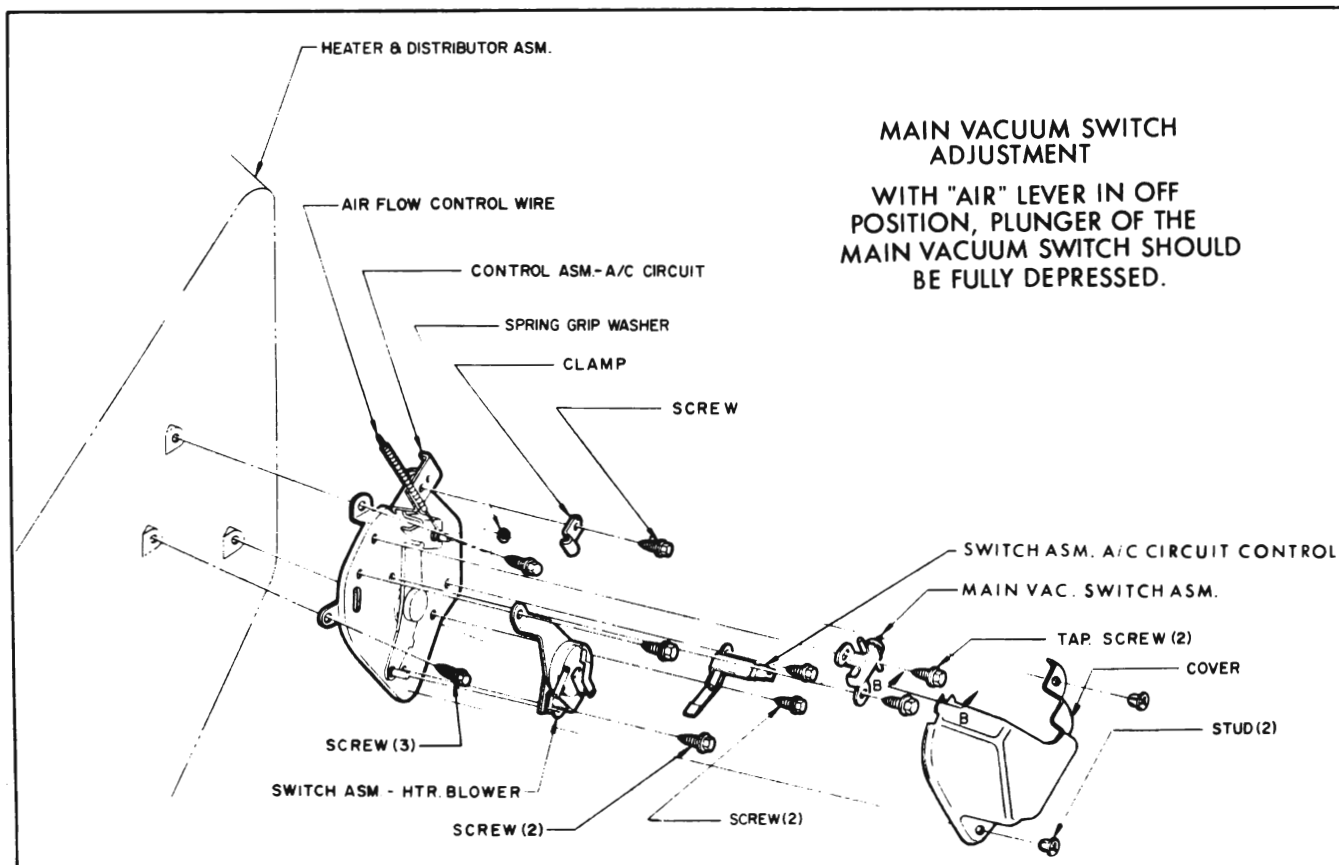


Figure 11-82—Main Vacuum Switch Adjustment—4400-4600-4800 Series



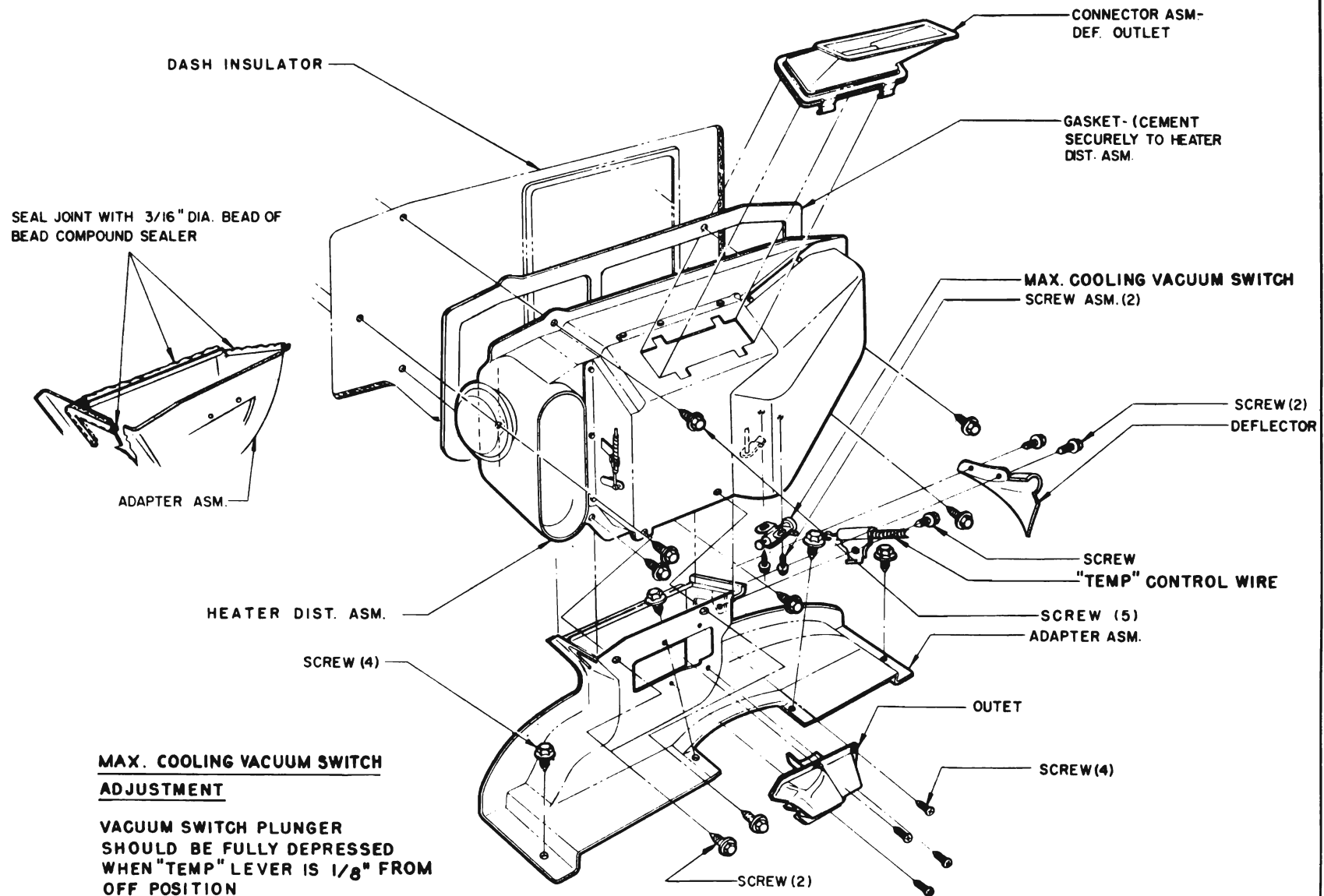


Figure 11-83—Max. Cooling Vacuum Switch Installation—4400-4600-4800 Series

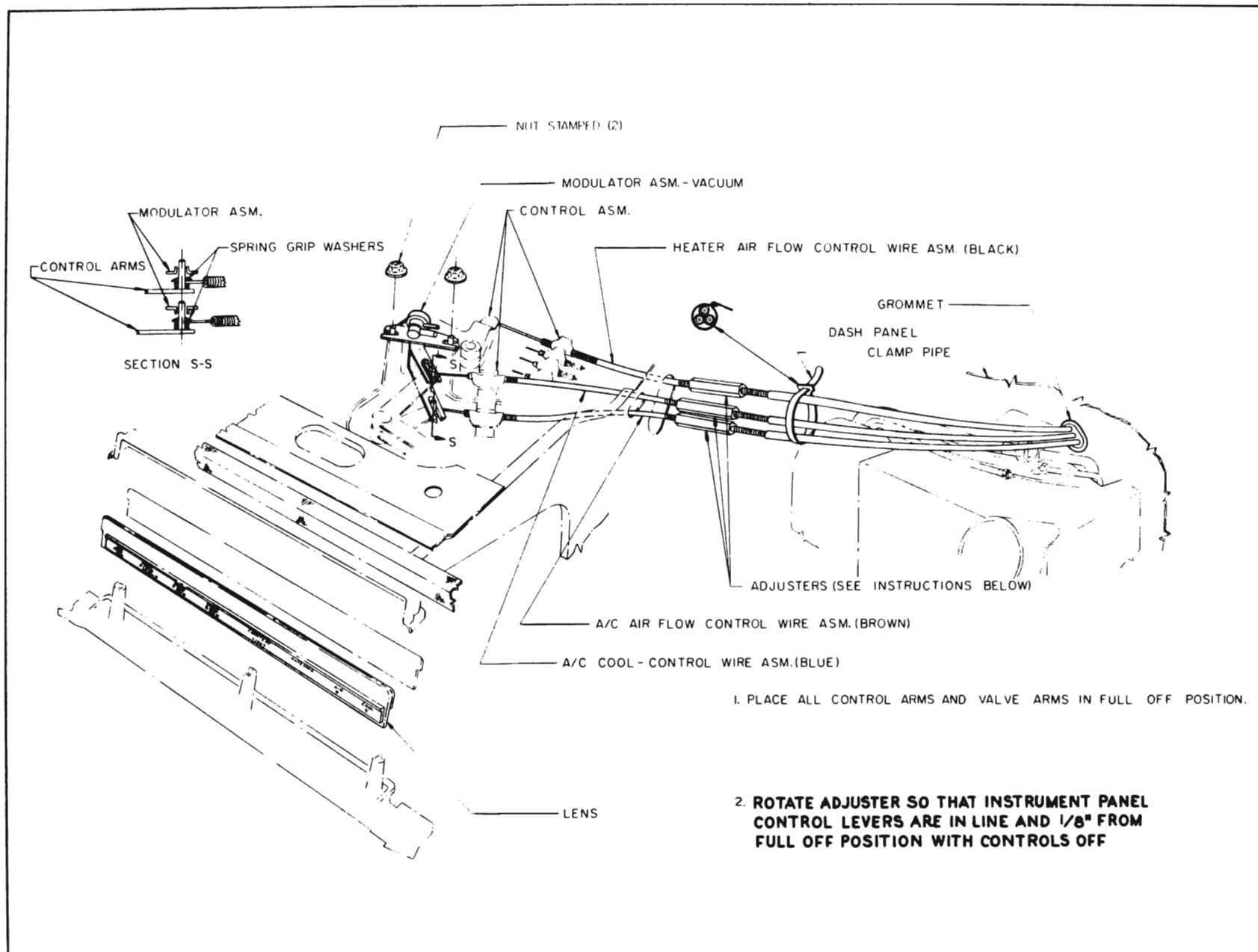


Figure 11-84—Vacuum Modulator Installation and Control Wire Adjustment—4700 Series

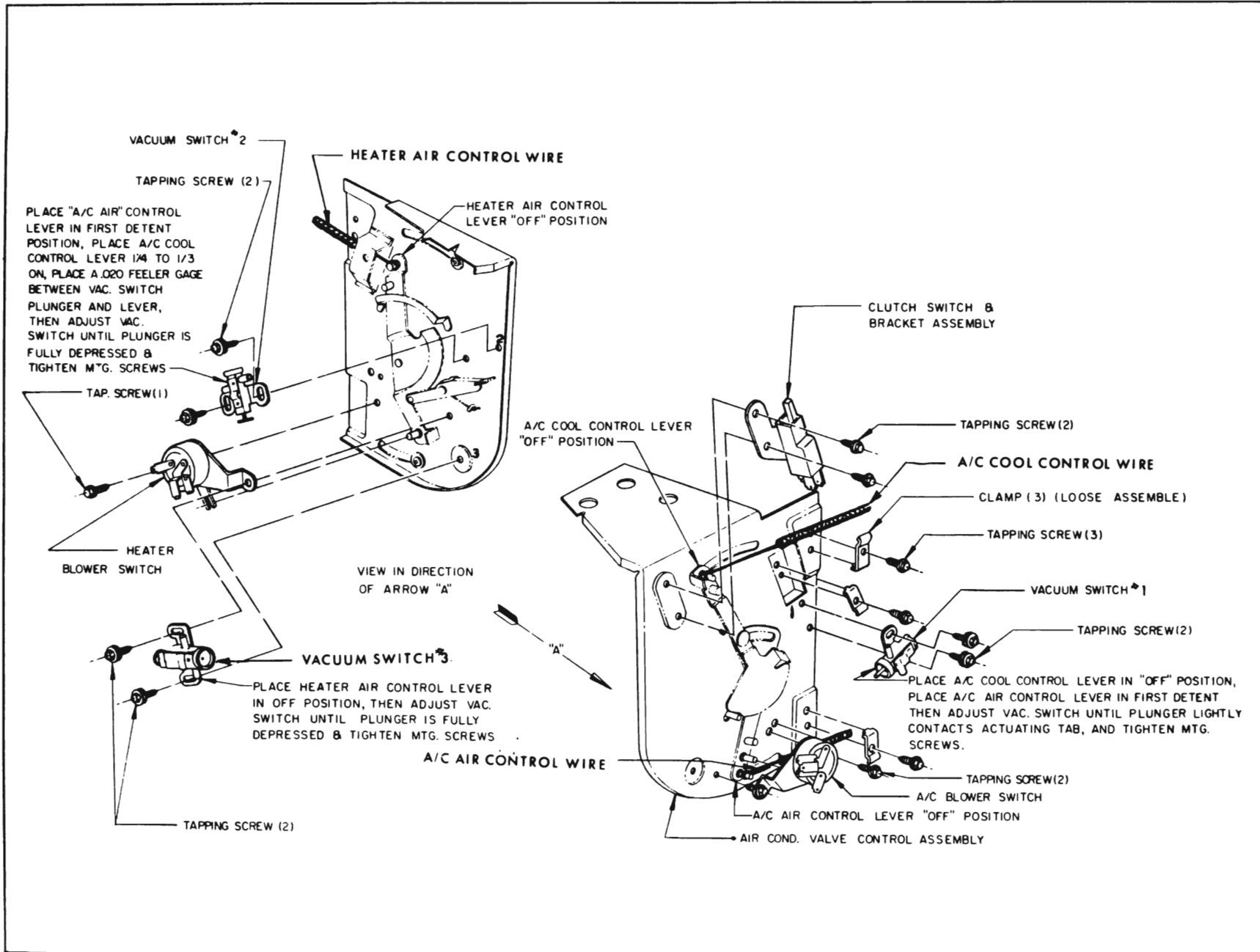


Figure 11-85—Vacuum Switch Adjustment and Installation—4700 Series

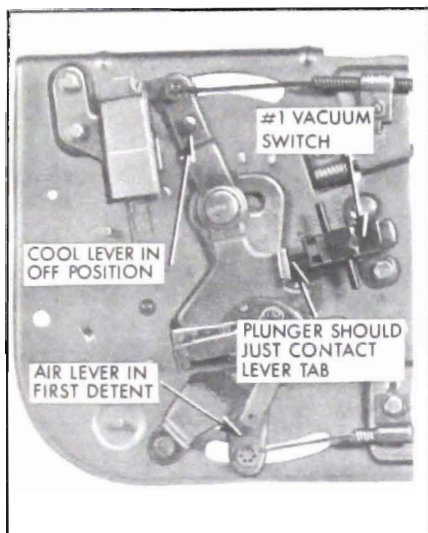


Figure 11-86—Number 1 Vacuum Switch Adjustment—4700 Series

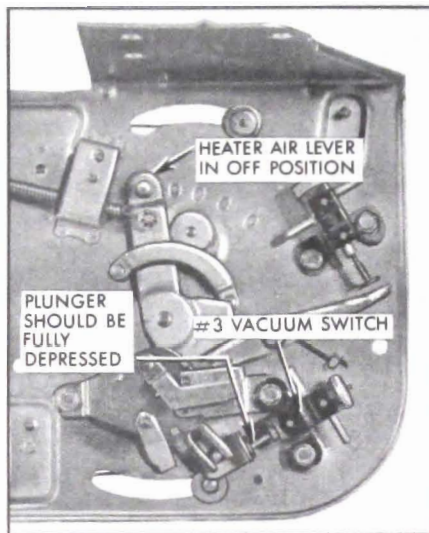


Figure 11-88—Number 3 Vacuum Switch Adjustment—4700 Series

switch plunger and lever, then adjust switch until plunger is fully depressed and tighten mounting screws. See Figure 11-87.

(c) Vacuum Switch #3. Loosen switch mounting screws. With heater "Air" lever in off position, adjust switch until plunger is fully depressed and tighten mounting screws. See Figure 11-88.

**NOTE:** If vacuum switches are adjusted, check adjustment of control wires.

### 3. Compressor Clutch Switch Adjustment

Bend switch operating tab (on lever that "cool" control wire is attached to) so that switch is in the extreme off position when "cool" lever is in the off position.

### f. Suction Throttle Valve Adjustments

**IMPORTANT:** The suction throttle valve adjustment is to be made only after the functional test

shows evaporator pressure significantly different from the chart.

1. Have service gauge set connected to Schrader valves as shown in Figure 11-149.

2. Set controls for maximum cooling, heater off, ventilators closed and all air conditioner outlets open.

(a) 4400-4600-4800 Series

Climate control set at Air Cond. Recir. and air lever full on. "Temp" lever must be off.

(b) 4700 Series

Air Conditioner Cool and Air Lever full on. Heater "Air" flow and "Temp" levers off.

3. Engine set at 2000 RPM.

4. Remove the vacuum hose from the 4700 suction throttle vacuum diaphragm. Do not remove hose from the 4400, 4600 or 4800 diaphragm.

5. Three (3) minutes after the valve has started to control, check the gauge readings and outlet temperature against the functional test chart.

6. If necessary to adjust valve, loosen the large lock nut on sleeve of suction throttle valve vacuum diaphragm.

7. To adjust valve, rotate diaphragm assembly clockwise to increase evaporate pressure and counterclockwise to decrease pressure.

8. After adjusting the valve, observe operation of the system for a few minutes to check readings.

9. Tighten lock nut on sleeve and reinstall the vacuum hose on the 4700 vacuum diaphragm.

10. Check operation of suction throttle valve.

(a) On 4400 - 4600 - 4800 series, move the "Temp" lever a short distance forward from the "Off"

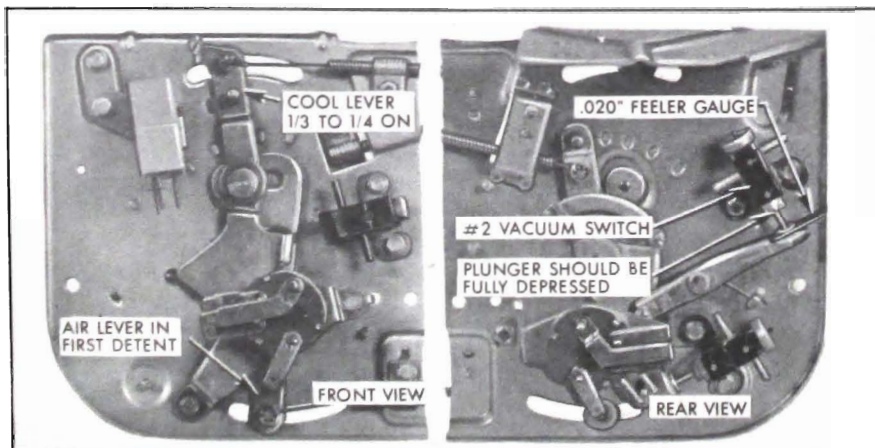


Figure 11-87—Number 2 Vacuum Switch Adjustment—4700 Series

position. There should be no vacuum to the valves vacuum diaphragm.

With the "Temp" lever in this position, the evaporator pressure should raise by approximately 3 psi.

If the evaporator pressure does not increase, check the adjustment of the "Temp" lever wire and Max. cooling vacuum switch at the temperature valve, improper vacuum hose connections or kinked vacuum hoses. If these are correct, the suction throttle valve is defective and should be repaired.

(b) On 4700 Series, move the Air Conditioner "Air" lever to off position and "Cool" lever to just On.

With the Cool lever in this position, the evaporator should raise to approximately 50 psi. Return the "Cool" and "Air" levers to full on and recheck setting of the suction throttle valve.

If the 4700 evaporator pressure does not increase when "cool" lever is at minimum cooling position, check operation of vacuum modulator by connecting a vacuum gauge to the hose that goes to the STV. The modulator should regulate manifold vacuum from 6 to 7 inches when the "cool" lever is moved just down from the off position. The vacuum should decrease to 0 inches when the "cool" and "air" levers are moved to the extreme down position. If modulator does not function properly, check vacuum hose connections, check for kinked hose or for defective modulator.

### **g. Removal and Installation of Suction Throttle Valve**

1. Discharge refrigerant from system as described in subparagraph c.
2. Disconnect lines from valve.

3. Remove valve mounting screws and remove valve. See Figure 11-93.

NOTE: All of the openings to the air conditioning system should be capped or plugged during the time the STV is removed.

4. Install valve by reversing procedure for removal, paying attention to the following:

(a) Install new "O" rings on line fittings.

(b) The valve piston must be lubricated with 525 compressor oil through line connections to prevent piston from sticking on initial operation.

(c) Evacuate and charge the system. Leak test valve and connections. Correct any leaks.

(d) After system has been charged, on 4700 move "Cool" control lever from one extreme to the other about 12 times with system operating to normalize the valve diaphragm.

(e) Check operation of the suction throttle valve, refer to subparagraph f.

### **h. Disassembly and Assembly of Suction Throttle Valve**

If test indicated suction throttle valve is defective, the valve should be overhauled as follows:

1. With valve removed from car, loosen lock nut on vacuum diaphragm and turn diaphragm assembly out of cover. On 4700 valve, discard "O" ring on sleeve of diaphragm. See Figure 11-89.

NOTE: Figure 11-89 shows the 4700 series suction throttle valve. The 4400, 4600 and 4800 suction throttle valve is basically the same except a different vacuum diaphragm is used and an "O" ring is not used on the vacuum diaphragm.

2. Remove spring from cover.
3. Remove the five screws that

retain cover to body of valve and remove cover.

4. Remove diaphragm and piston assembly.

5. Remove retainer cup from diaphragm.

The diaphragm should be handled with care to avoid damage by scuffing, cutting or abrading the rubber and fabric surfaces. The piston diaphragm or the screen and retainer in the lower portion of the piston should not be removed. The screen should, however, be examined for any foreign material or contamination. If necessary clean screen with a volatile solvent. All solvent should be removed from parts after cleaning.

In the event the exterior surface of the piston is damaged such as scored or scratched or nicked, in such a way as to cause it to bind in the bore, it should be replaced.

NOTE: It is recommended that no attempt be made to scrap, stone or crocus cloth these damaged areas due to the close tolerance that is required in the fitting of the parts for proper operation.

In the event the diaphragm is found to be damaged, the piston assembly should be replaced.

A very light application of powdered Molykote Type Z should be applied to the upper or fabric surface of the depressed section of the new diaphragm where the spring retainer cup will fit into it.

NOTE: The source for the material is: Alpha-Molykote Corporation Stamford, Connecticut.

No other material is recommended.

Examine the body bore surfaces for any surface imperfections, foreign material and any obvious damage that would cause the piston to not operate freely. The body should be replaced if the bore is damaged or if any cross



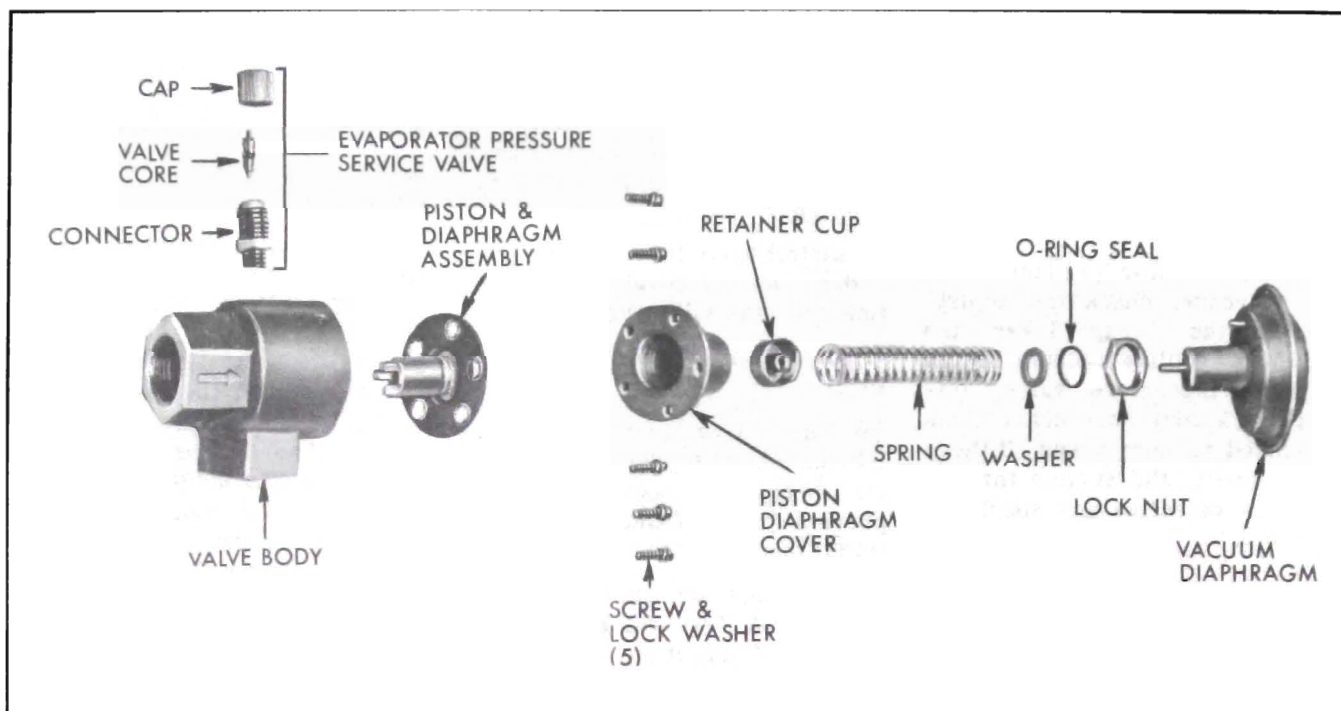


Figure 11-89—Exploded View of Suction Throttle Valve—4700 Series

threading or damage has been sustained around the connector ports.

6. Apply a light coat of 525 viscosity oil to the wall of the piston and insert it into the body of the valve.

7. Assemble the retainer cup to the diaphragm and place the cover in proper location over the diaphragm, being sure the diaphragm holes are in line with the locating protrusions under the cover flange. Start the five screws into the body, but **DO NOT TIGHTEN**.

8. With the cover and body held loosely in one hand, insert a clean smooth rod, approximately 3/8" in diameter, through the inlet opening so as to contact the screen retainer in the bottom of the piston.

Carefully push the piston into the cover so that the diaphragm positions properly into the cavity of the cover and does not become "pinched" under the flange.

Now remove the rod from the inlet opening and insert it through the upper portion of the cover. It should contact the center post of the cup. Press lightly downward so as to cause the piston to seat against the inner shoulder of the body. While the cup, diaphragm and piston are held down, tighten the five screws to 45 to 50 inch pounds torque.

9. Place lock nut on vacuum diaphragm and install a new "O" ring on diaphragm.

**NOTE:** 4400 - 4600 - 4800 valve diaphragm does not use an "O" ring.

10. Insert spring and thrust washer in vacuum diaphragm.

11. Install diaphragm assembly in cover approximately ten turns.

12. Install suction throttle valve as described in subparagraph g and adjust as described in subparagraph f.

#### i. Removal and Installation of Compressor

1. Discharge refrigerant from system as described in subparagraph c.

2. Remove bolt to remove valve retaining plate from rear end of compressor.

3. Cover the openings in lines and compressor with tape to exclude dirt.

4. Disconnect clutch coil wire connector, then loosen the belts and remove compressor from its mounting on engine. See Figures 11-90 and 11-91.

Do not place compressor in sun or near heat because it still contains some refrigerant.

**IMPORTANT:** Whenever a compressor replacement is being made the oil in the original compressor should be drained and

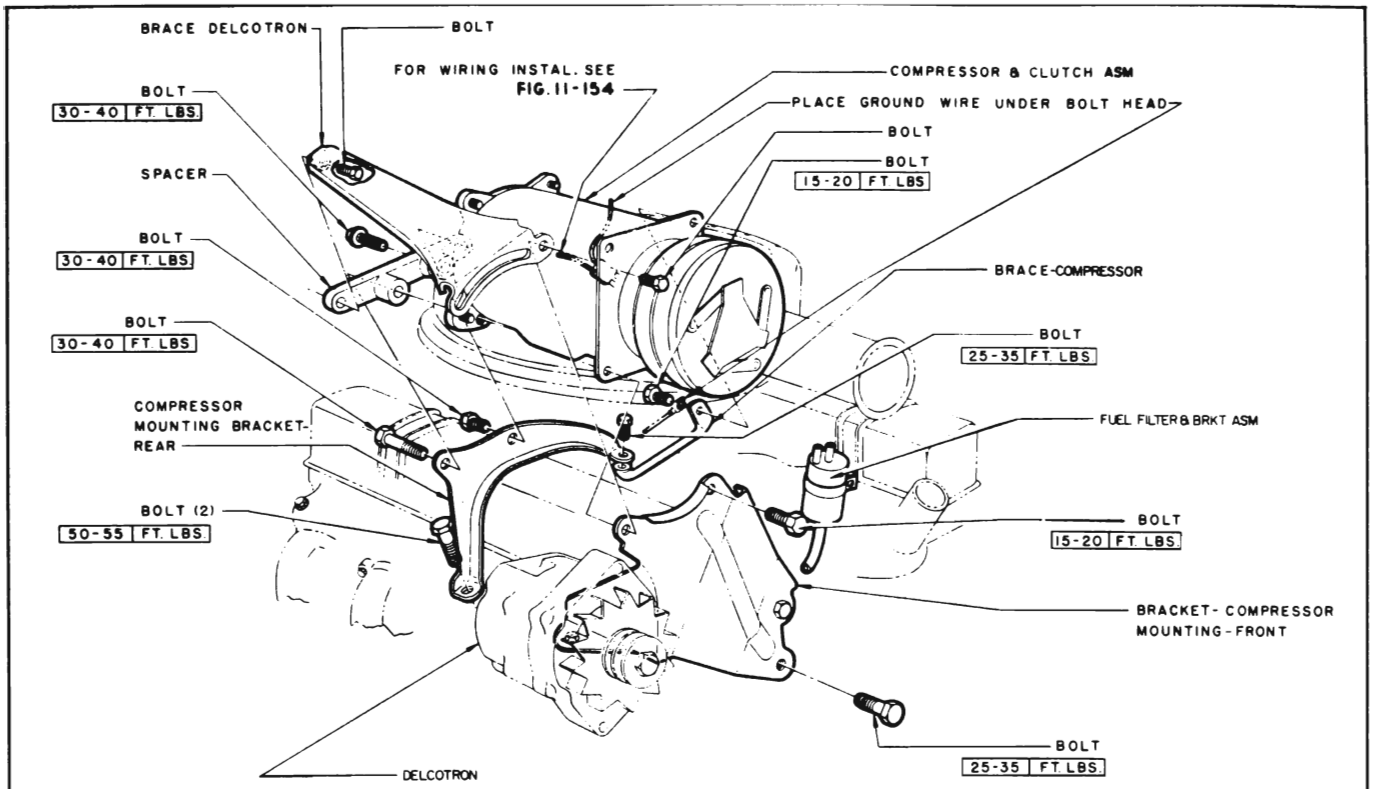


Figure 11-90—Compressor Installation—4400, 4600 and 4800 Series

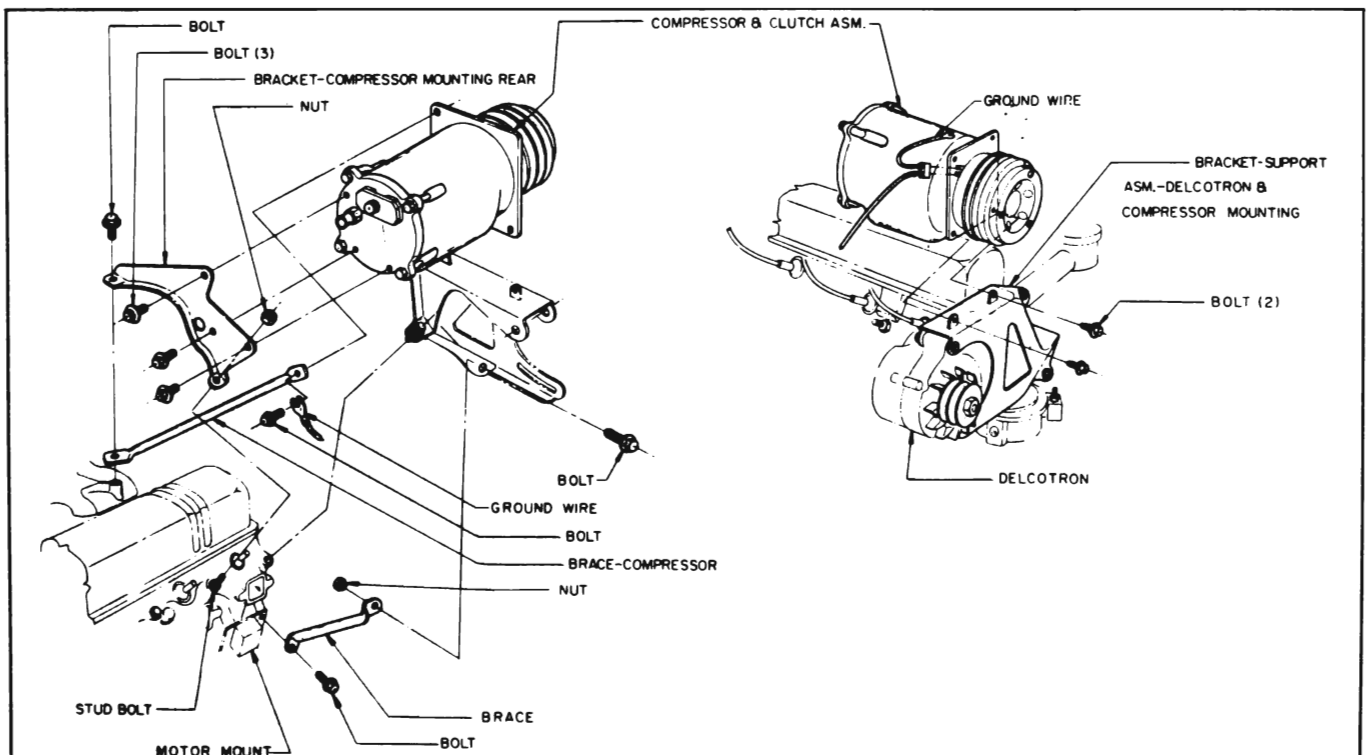


Figure 11-91—Compressor Installation—4700 Series

measured. The new compressor should contain the same amount of new 525 viscosity oil as was drained from the original compressor. This step is necessary as some of the oil from the original compressor remains in the system. The addition of a complete change of oil, in addition to the oil remaining in the system, would impair the cooling ability of the unit.

**CAUTION:** If it is evident that the air conditioner has lost a large amount of oil, refer to subparagraph k for procedure for adding oil to compressor.

6. Install compressor by reversing procedure for removal, paying attention to the following points:

(a) Inspect drive belts and pulley grooves for conditions that might cause slippage. If a belt is cracked, frayed, or oil soaked, or is worn so that it bottoms in pulley grooves, replace both belts. Belts are furnished in matched sets only, to insure even tension.

(b) Use new "O" rings when attaching valve assemblies to compressor.

(c) Adjust compressor belt tension. See Figure 2-40.

(d) Evacuate, leak test and charge air conditioner system (par. 11-20).

#### **k. Checking Compressor Oil and Adding Oil**

The six cylinder air conditioner compressor is initially charged with 10 1/2 fluid ounces of 525 viscosity Frigidaire Refrigerant oil. After the air conditioner 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.

When the air conditioner is operated at around 1000 to 1500 engine RPM's, in the maximum cooling position and blower on high, approximately 4 ounces of oil remains in the compressor, while the rest is distributed in the various air conditioner components. At high engine RPM's, a lesser amount of oil will be retained in the compressor (as little as 2 ounces of oil which is adequate for lubrication of compressor).

The oil balance in the system has been carefully established. It is important in any servicing operations to neither add nor subtract oil which would cause the total oil change in the system to vary from 10 1/2 fluid ounces. If the total oil change is less, lubrication of the compressor may not be adequate; if too much oil is in the system this will reduce the refrigerating capacity of the system. The compressor oil cannot be checked while the compressor is installed on the car.

The oil level in the compressor should not be checked as a matter of course such as is done in the car engine crankcase. The compressor oil level should be questioned only in cases where there is evidence of a major loss of system oil such as:

1. Broken hose or severe hose fitting leak.
2. Oil sprayed in large amounts under the hood due to a very badly leaking compressor seal.

3. Collision damages to system components.

To check the oil and to determine amount to install in compressor, the compressor must be removed and drained. This same procedure is used to determine amount to install in a replacement compressor or in a compressor that has been disassembled for repair. To drain compressor, remove drain plug and place compressor in a horizontal position with drain plug opening downward. Allow all oil to drain into a container, measure total amount, then discard oil. To determine the amount of oil that should be installed in the compressor if there has been a major loss of oil, when replacing a compressor with a service compressor or when compressor has been disassembled and rebuilt use the following chart.

**IMPORTANT:** If oil drained from compressor contains any foreign materials such as chips or there is evidence of moisture in the system it will be necessary to replace receiver dehydrator and flush the other component parts with Refrigerant-12 (subpar. l). The full 10 1/2 oz. of oil should then be added to compressor.

**NOTE:** The service compressor will also contain 10 1/2 oz. of 525 oil. In most cases, it will be necessary to drain all of the oil from the service compressor, then install oil so that it will be the required amount determined by the chart.

During normal service operations where a condenser, receiver or evaporator is replaced with a new unit and where no major loss of oil is involved, add oil to the new unit per item 1 on chart. The oil can be poured directly into the part being replaced.

CONDITION	AMOUNT OF OIL DRAINED FROM COMPRESSOR	AMOUNT OF 525 OIL TO INSTALL IN COMPRESSOR
1. Major loss of oil and a component has to be replaced.	a. More than 4 oz.  b. Less than 4 oz.	a. Amount drained from compressor plus amount for component being replaced as follows: Evaporator - Add 3 oz. Condenser - Add 1 oz. Receiver Dehydrator - Add 1 oz.  b. Install 6 oz. plus amount for component being replaced as shown above.
2. Compressor being replaced with a service compressor and there wasn't a major loss of oil from the air conditioner system.	a. More than 1 1/2 oz. (See Note)  b. Less than 1-1/2 oz.	a. Same amount as drained from compressor being replaced.  b. Install 6 oz.
3. Same as step 2 except there has been a major loss of oil.	a. More than 4 oz.  b. Less than 4 oz.	a. Same amount as drained from compressor being replaced.  b. Install 6 oz.
4. Compressor has been inoperative and rebuilt and there wasn't a major loss of oil from air conditioner system.	a. More than 1 1/2 oz. (See Note)  b. Less than 1-1/2 oz.	a. Same amount as drained from compressor plus 1 oz. additional.  b. Install 7 oz.
5. Same as step 4 except there has been a major loss of oil.	a. More than 4 oz.  b. Less than 4 oz.	a. Same amount as drained from compressor plus 1 oz. additional.  b. Install 7 oz.
NOTE: If more than 1 1/2 oz. of clean oil was drained from compressor and there is little or no signs of oil being lost from system, install this amount of oil in replacement compressor (plus 1 oz. additional in repaired compressor).		

### I. Flushing Air Conditioner System

Flushing the air conditioner system 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 sup-

ported so that the refrigerant passing through it will be directed into an area where a temperature of -21.7°F. will do no damage. When a unit is not removed such as a condenser, disconnect the inlet and outlet lines before flushing it out.

**CAUTION:** 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 with refrigerant the expansion valve bulb must be detached from the evaporator outlet tube.

In all cases where it is necessary

to flush the air conditioner system, the receiver dehydrator should be replaced. Also, the thermostatic expansion valve inlet screen should be cleaned.

Dry nitrogen which is much cheaper than refrigerant if available, is preferred for flushing out the air conditioner system. Nitrogen will not cause the temperature to drop like refrigerant 12 does. The cold temperatures make it difficult to remove the contaminated oil from the unit being flushed. Also, the dry nitrogen will remove moisture from the system.

### **m. Removal of Evaporator Assembly and Air Distribution Parts**

Figure 11-92 shows the installation of the evaporator assembly on the 4400-4600-4800 Series.

Figure 11-93 and 11-94 show the installation of the 4700 series evaporator and air distribution system.

To remove the evaporator assembly on the 4700, remove the brackets that retain assembly to instrument panel. Then disconnect assembly from distribution duct and right outer outlet and lower assembly down from under instrument panel. Complete removal by disconnecting lines from evaporator assembly.

When reinstalling assembly be sure to properly install drain hoses and use new "O" rings on refrigerant lines. See Figure 11-94.

To remove distribution duct to service heater core on 4700, lower evaporator assembly from instrument panel. Then disconnect distribution duct and remove from right side of instrument panel.

## **11-18 COMPRESSOR CLUTCH COIL AND SHAFT SEAL REMOVAL AND INSTALLATION**

It is not necessary to remove compressor from refrigeration system to service clutch parts. It may be necessary to loosen it on its mounting to remove clutch pulley.

**CAUTION:** Never stand compressor on pulley end.

### **a. Clutch Drive Plate Removal**

1. Hold the clutch drive plate hub with J-9403 wrench and use J-9399 special thin wall 9/16" socket to remove shaft nut. See Figure 11-95.

2. Screw threaded hub puller J-9401 into the drive plate hub. Hold body of tool with a wrench and tighten the center screw to remove drive plate assembly. See Figure 11-96.

3. Remove drive plate key from compressor shaft or from drive plate hub.

4. Remove drive plate assembly retainer ring, using J-5403, No. 21 Truarc pliers. See Figure 11-97. Remove spacer from inside hub of drive plate.

### **b. Drive Plate Installation**

1. Insert square drive key into hub of drive plate so it projects approximately 3/16" out of end of keyway. See Figure 11-98.

2. Line up key in hub with keyway in shaft and position drive plate on shaft. See Figure 11-98.

3. Place "Free" spacer J-9480-2 on drive plate installer J-9480-1

and thread installer on end of compressor shaft. See Figure 11-99. Press the drive plate on shaft until there is approximately 3/32" (.093") space between the frictional faces of the drive plate and pulley as shown.

4. Remove installer and insert spacer around shaft and inside drive plate hub.

5. Install drive plate assembly retainer ring with flat side of ring facing spacer, using J-5403, No. 21 Truarc pliers.

6. Install a new shaft nut, using J-9399, special thin wall 9/16" socket. Tighten to 15 lb. ft. torque. The air gap between the frictional faces of the pulley and drive plate should now be between .022" to .057" (1/32" to 1/16") clearance. See Figure 11-100.

### **c. Pulley and Bearing Removal**

1. Remove clutch drive plate. Subparagraph a.

2. Remove pulley assembly retainer ring, using J-6435, No. 26 Truarc pliers. See Figure 11-101.

3. Place J-9395 puller pilot over compressor shaft and remove pulley assembly, using J-8433 puller. See Figure 11-102.

**IMPORTANT:** Puller pilot must be used or force will cause shaft to move in swash plate, resulting in damage to the cylinder mechanism.

**NOTE:** Do not remove pulley bearing unless it is going to be replaced.

4. Remove pulley bearing wire retainer with a small screwdriver. See Figure 11-103.

5. Remove bearing, using punch or a suitable socket.



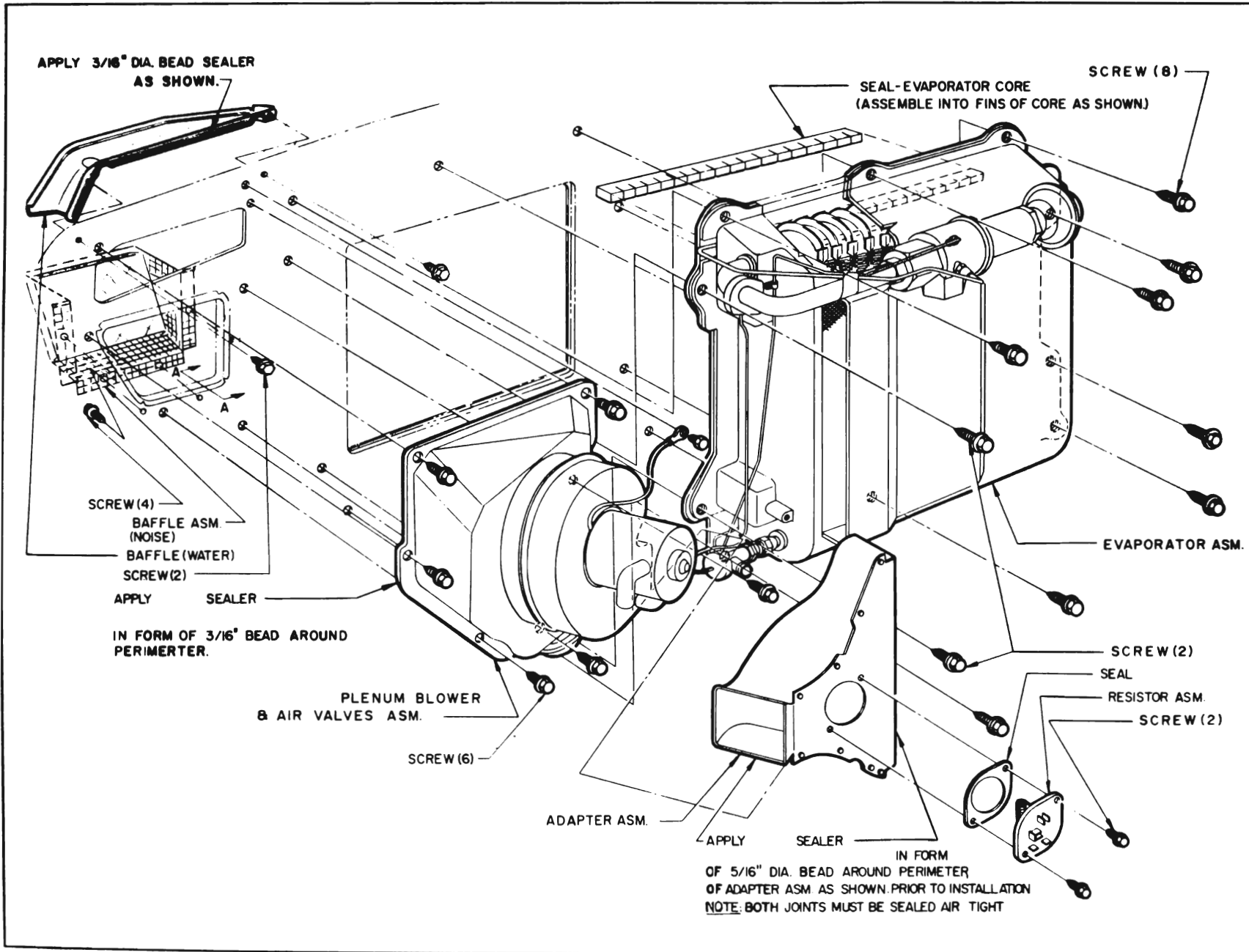


Figure 11-92—Installation of Evaporator Assembly and Plenum Blower and Air Valve Assembly—4400-4600-4800 Series

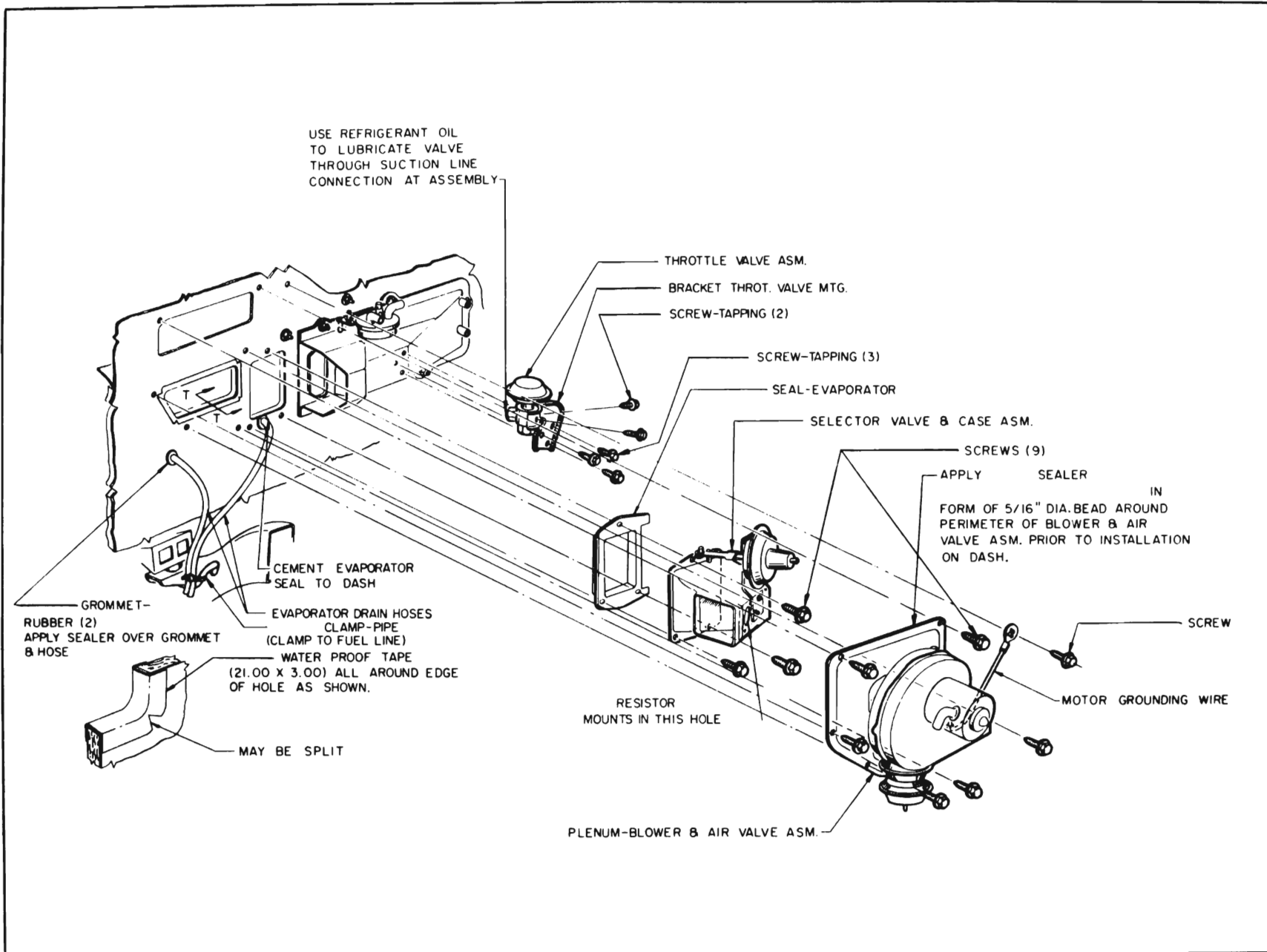


Figure 11-93—Suction Throttle Valve, Selector Valve Case and Plenum, Blower and Air Valve Installation—4700 Series

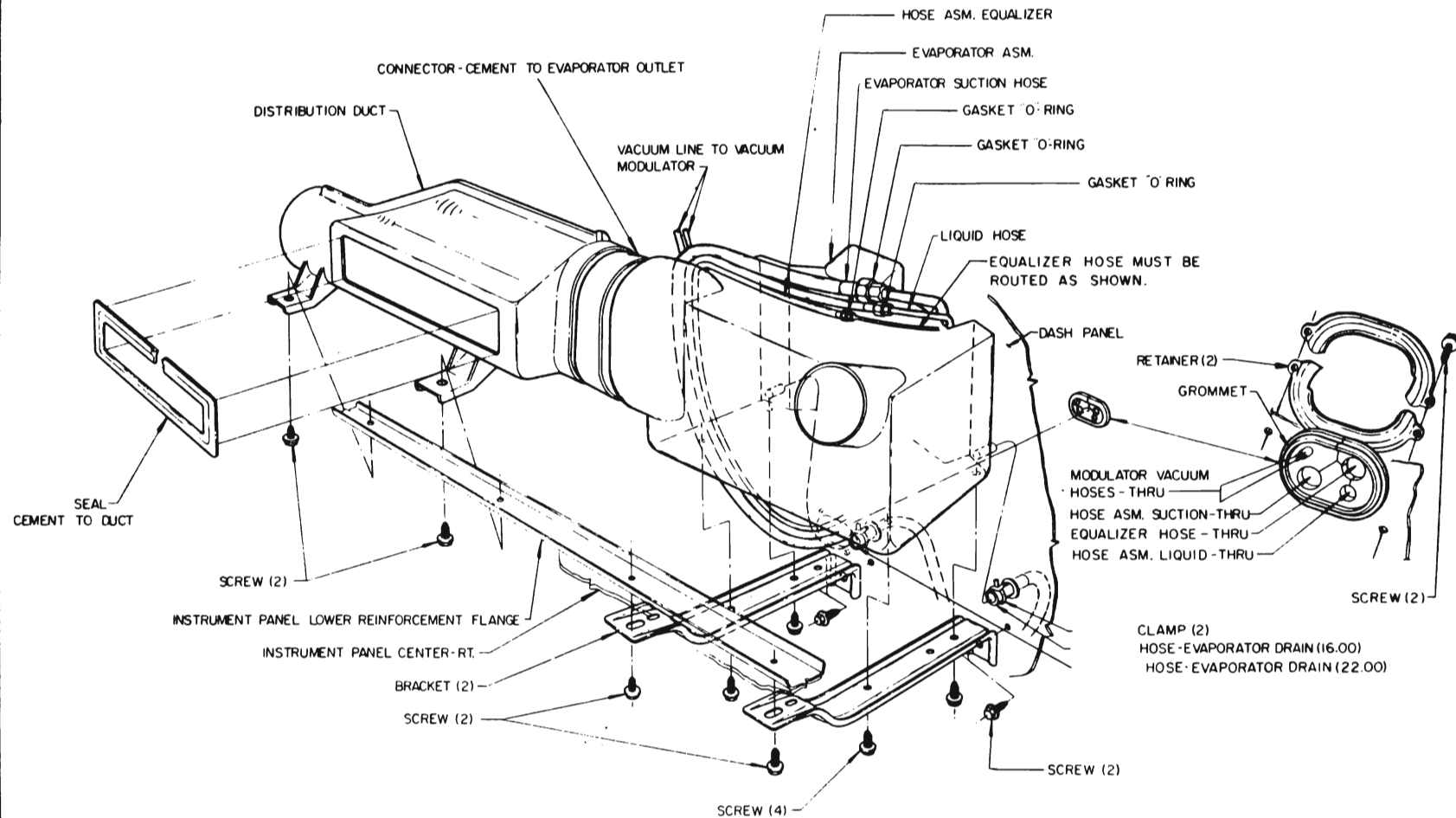


Figure 11-94—Evaporator and Distribution Duct—4700 Series

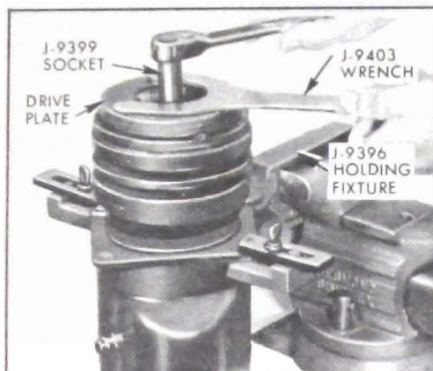


Figure 11-95—Removing Shaft Nut

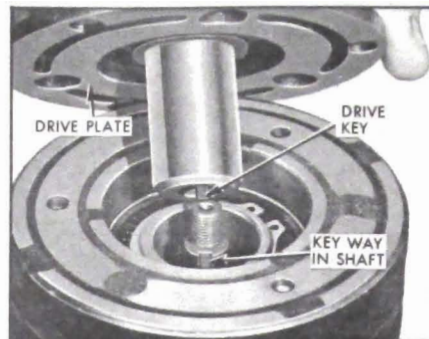


Figure 11-98—Positioning Drive Plate on Shaft

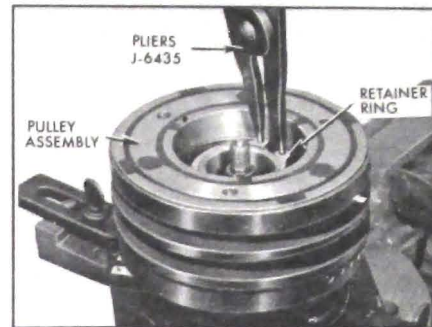


Figure 11-101—Removing Pulley Retainer Ring

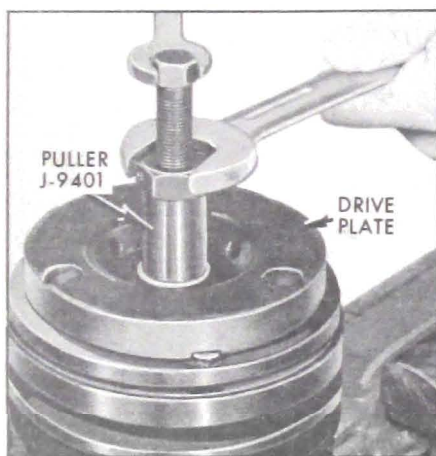


Figure 11-96—Removing Drive Plate Assembly

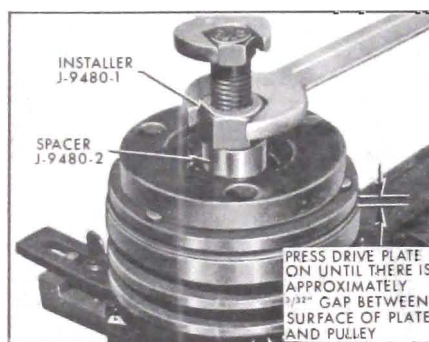


Figure 11-99—Installing Drive Plate Assembly

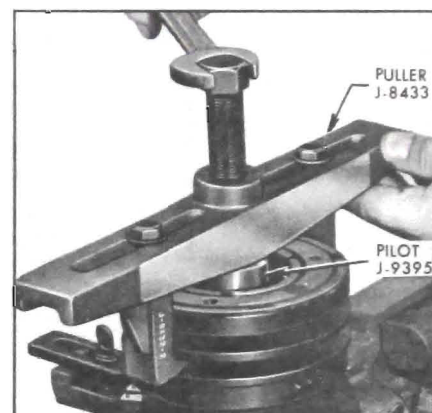


Figure 11-102—Removing Pulley Assembly

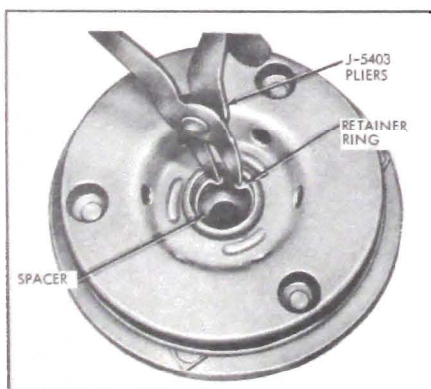


Figure 11-97—Removing Drive Plate Retainer Ring

#### d. Pulley and Bearing Installation

If the existing pulley and drive plate and hub assembly are to be

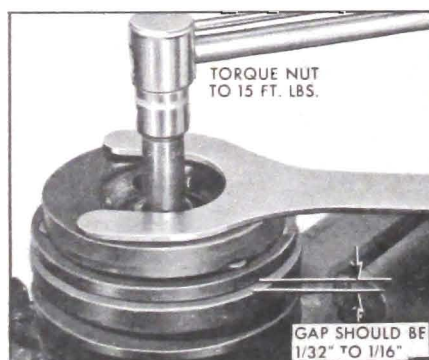


Figure 11-100—Torquing Shaft Nut

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 and drive handle J-8092 as shown. See Figure 11-104.

2. Replace the pulley assembly wire retainer ring in pulley, being sure it is properly seated in its groove.

3. Support bottom of compressor and press or tap the pulley and bearing assembly on the neck of the compressor, using J-9481 installed on J-8092 as shown. See Figure 11-105. Pulley should rotate freely.

4. Install pulley retainer with flat side of retainer toward bearing, using J-6435, No. 26 Truarc pliers.

5. Install drive plate assembly. Subparagraph b.



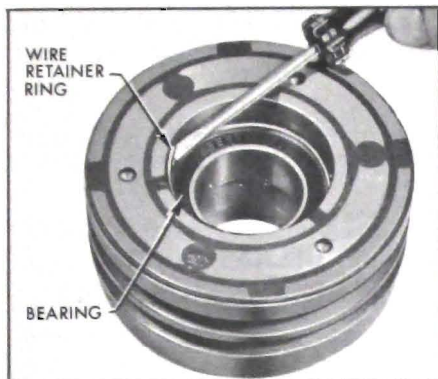


Figure 11-103—Removing Bearing Retainer Wire

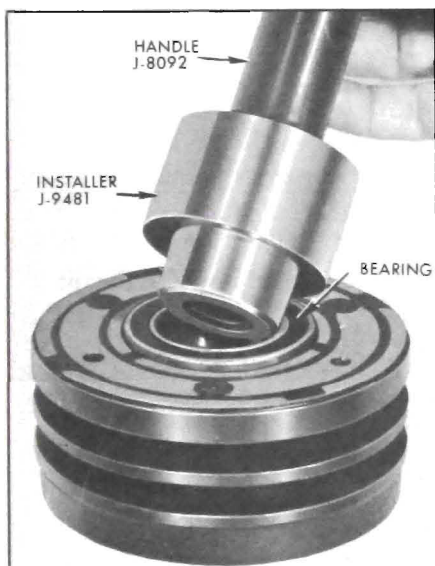


Figure 11-104—Installing Pulley Bearing

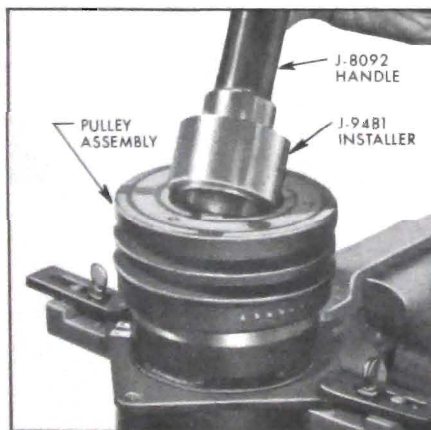


Figure 11-105—Installing Pulley Assembly

### e. Clutch Coil and Housing Removal

1. Remove drive plate assembly. Subparagraph a.
2. Remove pulley and bearing assembly. Subparagraph c.
3. Note position of electrical terminals and scribe location of coil housing terminals on compressor body to insure correct location of terminals when coil is reinstalled.
4. Use J-6435, No. 26 Truarc pliers and remove coil housing retaining ring, then remove coil assembly. See Figure 11-106.

### f. Clutch Coil and Housing Installation

1. Position clutch coil on compressor front head casting so electrical terminals are in their proper location as previously scribed on compressor body. 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. Install pulley and bearing assembly. Subparagraph d.
4. Install drive plate assembly. Subparagraph b.

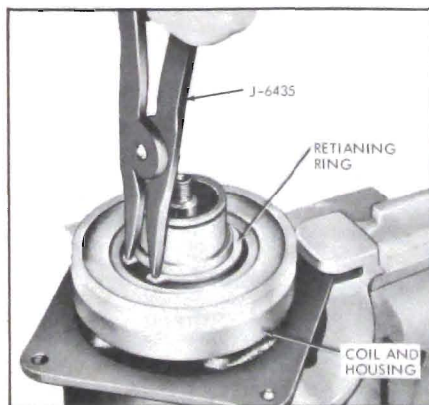


Figure 11-106—Removing Coil and Housing Retaining Ring

### g. Shaft Seal Removal

1. Remove drive plate assembly. Subparagraph a.
2. Remove shaft seal seat retaining ring from inside front head, using J-5403, No. 21 Truarc pliers. See Figure 11-107.
3. Remove shaft seal seat, using J-9393-1 and 2 to grasp flange on seal seat. See Figure 11-108. Pull straight out of end of tool to remove seal seat.
4. Engage tabs on compressor shaft seal assembly with locking tangs on J-9392 seal installer and

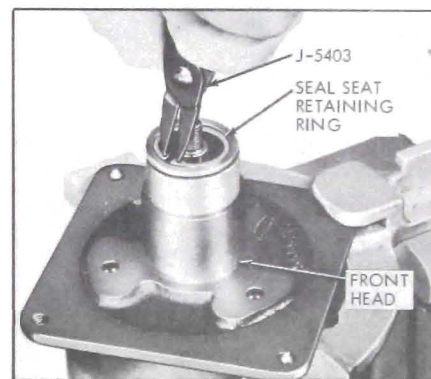


Figure 11-107—Removing Shaft Seal Seat Retaining Ring

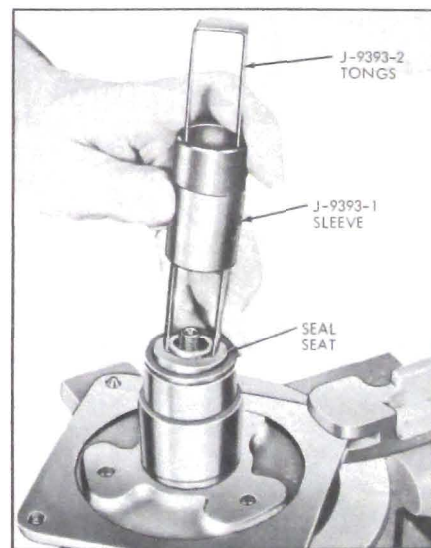


Figure 11-108—Removing Shaft Seal Seat

remover. Press down on tool and twist clockwise to engage seal. Remove seal assembly by pulling straight out from shaft. See Figure 11-109.

5. Remove "O" ring from interior of front head casting bore, using J-9553 remover. See Figure 11-110.

#### h. Shaft Seal Installation

**NOTE:** Apply 525 compressor oil to seal parts during assembly.

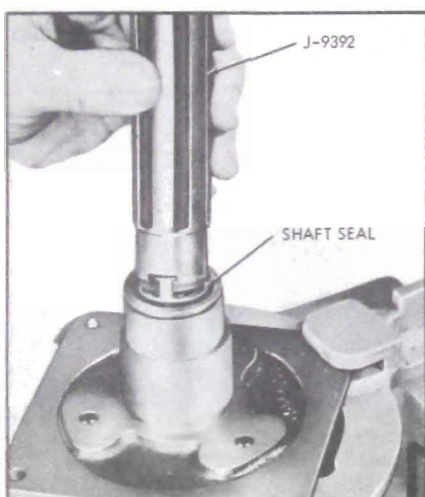


Figure 11-109—Removing Shaft Seal

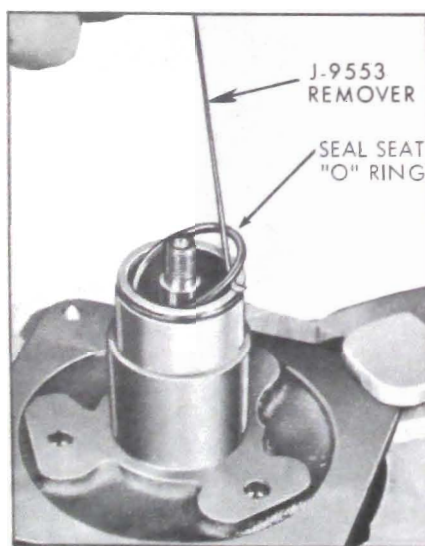


Figure 11-110—Removing Shaft Seal Seat "O"-Ring

1. Install a new seal seat "O" ring in its groove inside front head. Be sure it is not in retaining ring groove. See Figure 11-63.

2. Place shaft seal on J-9392 installer and insert seal on shaft inside front head. Be sure seal is properly seated on shaft. The shaft has two flats provided for the seal.

3. Position seal seat on shaft and use sleeve J-9393-1 to push seat down inside front head.

4. Install seat retaining ring with flat side of ring going toward seat, using J-5403, No. 21 Truarc pliers. If necessary, position sleeve J-9393-1 on retaining ring and push down on it to engage ring in its groove.

5. Attach charging line adapter plate, J-9527 on rear of compressor and pressurize suction side of compressor with Refrigerant-12 at pressure corresponding to room temperature. Rotate compressor shaft several times.

See Figure 11-111. Leak test with leak detector and correct any leaks.

6. Install drive plate assembly. Subparagraph b.

### 11-19 DISASSEMBLY, INSPECTION AND ASSEMBLY OF COMPRESSOR INTERNAL PARTS

**IMPORTANT:** A clean work bench, orderliness of the work area and a place for all parts being removed and replaced are of great importance. Any attempt to use makeshift or inadequate equipment may result in damage and/or improper operation of the compressor.

#### a. Rear Head and Oil Pump Removal

**CAUTION:** Under NO circumstances should compressor be placed on the pulley end.

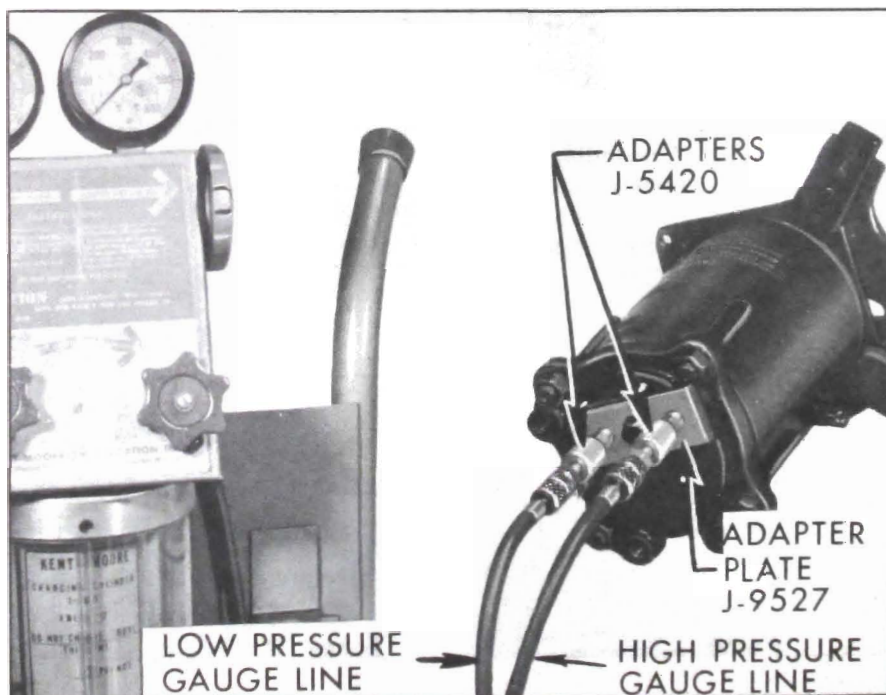


Figure 11-111—Charging Line Adapter Plate



1. Seal compressor fittings opening and openings in compressor rear head.

2. Thoroughly clean exterior of compressor assembly and blow dry with compressed air.

3. Place compressor assembly on clean, dry work bench.

**NOTE:** If compressor is not going to be disassembled any further than rear head or oil pump, omit Steps 4, 5, 6, 7 and 8.

4. Remove compressor oil drain 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.

5. Remove clutch drive plate assembly. Paragraph 11-18, subparagraph a.

6. Remove clutch pulley assembly. Paragraph 11-18, subparagraph c.

7. Remove clutch coil and housing. Paragraph 11-18, subparagraph e.

8. Remove shaft seal assembly. Paragraph 11-18, subparagraph g.

9. Attach J-9396 holding fixture to compressor and firmly mount assembly in vise. See Figure 11-112.

10. Remove compressor pressure relief valve and washer if head is going to be replaced.

11. Remove four locknuts from threaded studs welded to compressor shell and remove rear head by tapping lightly with plastic mallet.

12. Examine teflon surface on the rear head casting webs. If any damage is observed, the head should be replaced. See Figure 11-113.

13. Remove suction screen and examine for damage or contamination. Clean or replace as necessary.

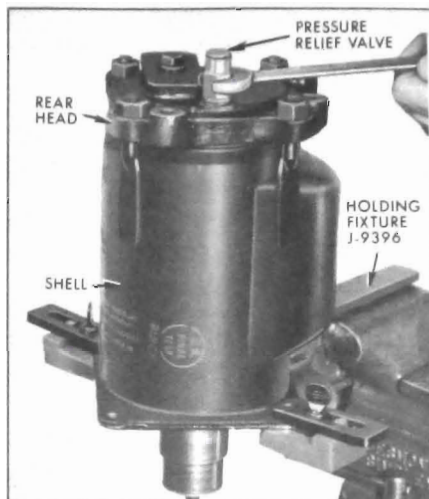


Figure 11-112—Removing Pressure Relief Valve

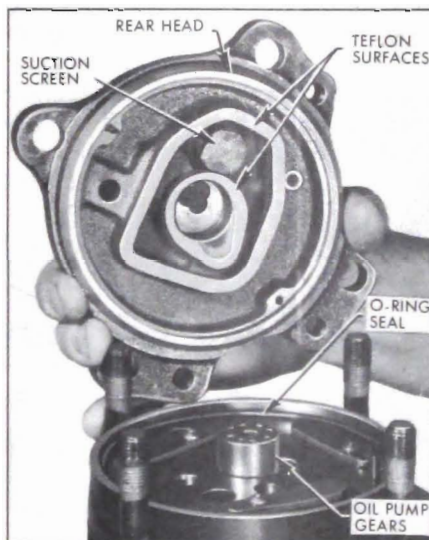


Figure 11-113—Rear Head Teflon Surface

14. Mark rear side of both oil pump gears with a pencil so that they can be reinstalled in same position. Remove gears and inspect for damage. Replace both gears if one or both show damage.

15. Remove and discard rear head to compressor shell "O" ring seal.

16. Carefully remove rear discharge valve plate assembly by prying up on assembly as shown with screwdrivers and examine

discharge valve reeds and seats. See Figure 11-114. Replace entire assembly if excessively scored or if any one of the three reeds are broken or seats are damaged.

17. If rear suction reed valve didn't come out with valve plate, carefully remove reed as shown with two small screwdrivers. See Figure 11-115. Replace reed valve if damaged.

**NOTE:** See subparagraph g for installation of rear head and oil pump.

### b. Compressor Cylinder Assembly and Front Head Removal

1. Remove oil inlet tube, using J-6586 Remover. See Figure 11-116. If tube "O" ring did not come out with tube, remove it from cylinder with small wire.

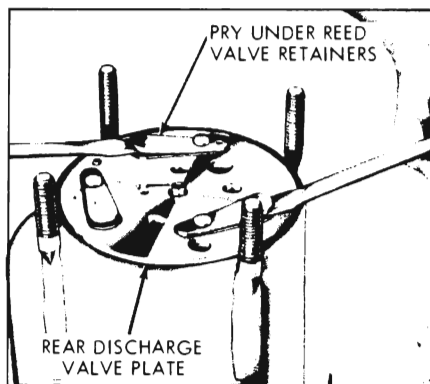


Figure 11-114—Removing Rear Discharge Valve Plate

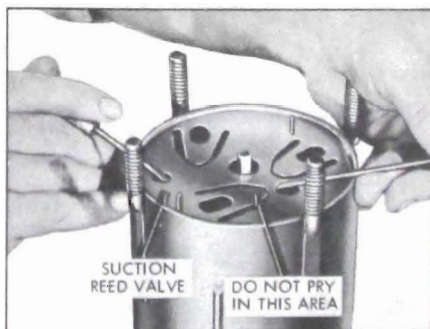


Figure 11-115—Removing Rear Suction Reed

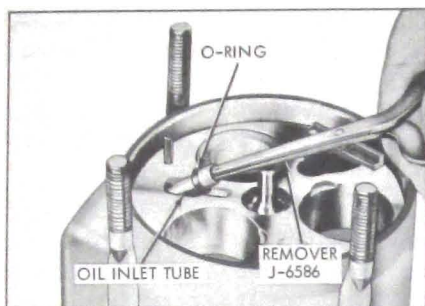


Figure 11-116—Removing Oil Inlet Tube

2. Push on front of compressor shaft to remove cylinder assembly from shell. See Figure 11-117. The cylinder assembly will slide out of shell when shell is inverted.

**CAUTION:** Do not hammer or use excessive force on end of shaft.

3. If the front discharge valve plate and suction reed valve were removed with cylinder mechanism, remove these parts from shaft before proceeding and examine for damage.

4. Examine cylinder mechanism for any obvious damage.

**NOTE:** If cylinder mechanism has sustained major damage, due possibly to loss of refrigerant and/or oil, it may be necessary to

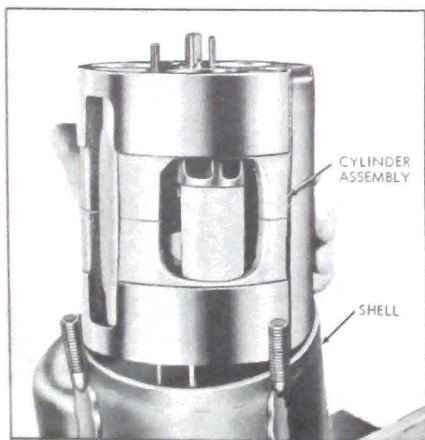


Figure 11-117—Removing Cylinder Assembly

use the service cylinder and shaft assembly rather than replace individual parts.

5. Remove compressor front head, using rubber mallet or wood block to unseat head from shell. See Figure 11-118. Care must be used to protect teflon surface on head from being damaged.

6. Remove and discard front head to shell "O" ring seal.

7. Examine teflon sealing surface on front head for damage and/or deep scratches. Replace if necessary. See Figure 11-119.

**NOTE:** If compressor cylinder assembly is going to be replaced, omit subparagraphs c, d and e.

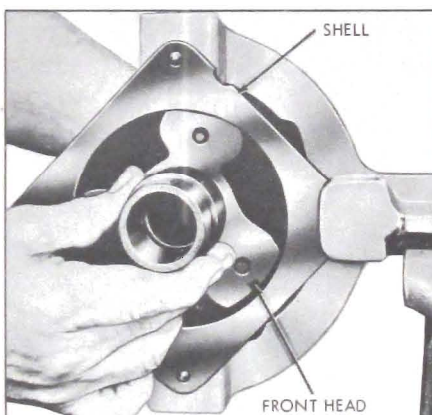


Figure 11-118—Removing Front Head



Figure 11-119—Front Head Teflon Sealing Surfaces

### c. Disassembly of Compressor Cylinder Assembly

1. Remove suction crossover cover as shown in Figure 11-120 and discard seal on cover.

2. Place cylinder assembly in fixture as shown.

3. Number pistons (1, 2 and 3) and their cylinder bores so parts can be replaced in their original locations.

4. Obtain clean J-9402 assembly parts tray to retain compressor parts during disassembly.

5. Separate front and rear cylinder halves, using a wood block or rubber mallet. See Figure 11-121. Rotate swash plate so that discharge tube does not contact it. A 9/16" open end wrench may be used on the shaft seal area of shaft to rotate swash plate.

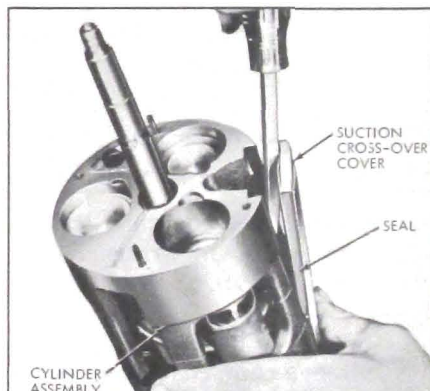


Figure 11-120—Removing Suction Crossover Cover

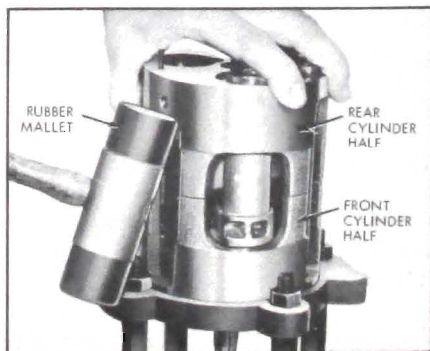


Figure 11-121—Separating Cylinder Halves



6. Remove rear cylinder half from pistons.

7. Rotate shaft until a piston is at its highest point. Push up on shaft and remove one piston assembly at a time. See Figure 11-122. Place parts in parts tray to keep them separated.

8. Remove piston rings, balls and shoe discs. Discard the shoe discs. Examine piston balls, if satisfactory for reuse, place in parts tray with proper end of piston. The front end of piston has identifying notch in casting web. See Figure 11-123.

9. Remove rear combination of thrust races and thrust bearing. Discard all three pieces.

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. Remove discharge crossover pipe from cylinder half by twisting it out with suitable pliers or

by holding on to it with pliers and tapping on pliers.

13. Examine swash plate surfaces for excessive scoring or damage. If satisfactory, reuse. If necessary, replace main shaft and swash plate assembly.

14. Wash compressor internal parts in a tank of clean trichloroethylene, alcohol or similar solvent. Blow dry all parts, using a source of clean, dry air. If drive balls show any signs of damage, replace.

15. Examine the front and rear cylinder halves and replace if cylinder bores are deeply scored or damaged.

16. Examine the shaft needle bearings. There is one in each cylinder half. If a bearing is damaged, remove bearing with a suitable socket or punch. Install new bearing with J-9432 so that lettering on bearing is toward outside of cylinder half. See Figure 11-125.

#### d. Adjusting Compressor Shaft End Play and Piston Shoe Disc Clearance

**IMPORTANT:** The following operations are required when it is practical to replace an internal part or parts of the cylinder assembly. If the complete assembly is replaced, gauging of the shaft end play and shoe disc clearance is not required.

1. Secure four ZERO thrust races, three ZERO shoe discs and two new thrust bearings.

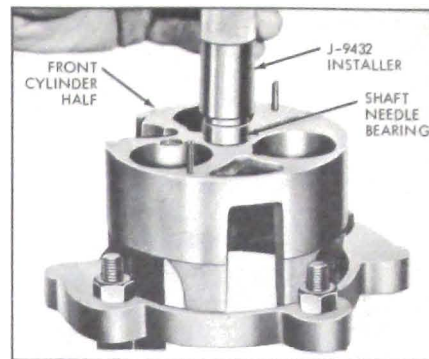


Figure 11-125—Installing Shaft Needle Bearing

2. Apply clean petroleum jelly to 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.

3. Place FRONT half of cylinder on J-9397 fixture. Insert threaded end of shaft (with front thrust bearing assembly) through front cylinder half and allow thrust race assembly to rest on hub of cylinder. See Figure 11-126.

4. Place a ZERO thrust race, a new thrust bearing and a second ZERO thrust washer on REAR of compressor main shaft so it rests on hub of swash plate.

5. Apply a light smear of clean petroleum jelly to ball pockets of each of three pistons.

6. Place balls in piston pockets.

7. Apply a light smear of clean petroleum jelly to cavity of three new ZERO shoe discs.

8. Place a ZERO shoe over each ball in FRONT end of piston. Do not place shoes on piston rear balls.

**NOTE:** Do not assemble any piston rings on pistons at this time.

9. Rotate shaft and swash plate until high point of swash plate is over piston cylinder bore, which has been identified as No. 1. Insert front end of No. 1 piston (notched end) in cylinder bore

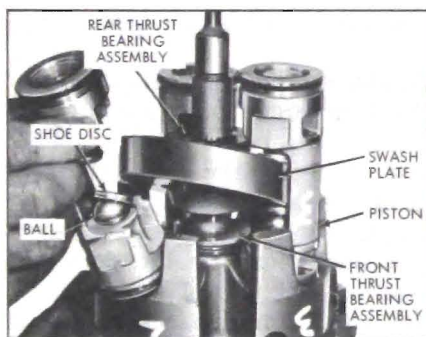


Figure 11-122—Removing Piston Assembly

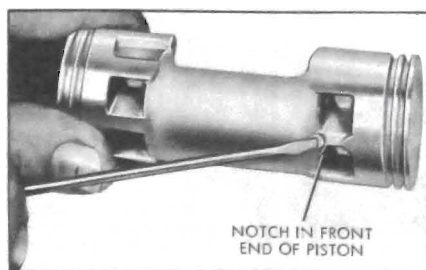


Figure 11-123—Piston Assembly

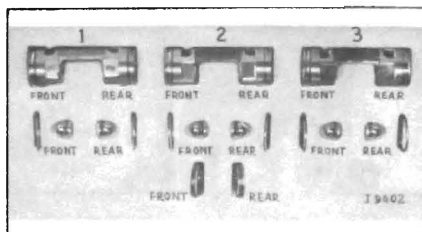


Figure 11-124—Parts Tray J-9402

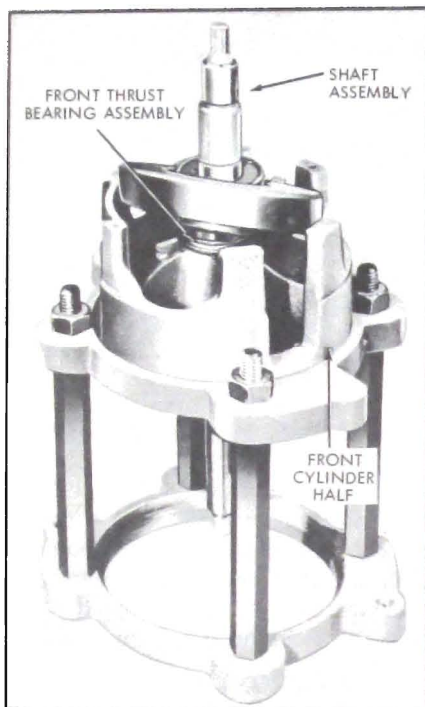


Figure 11-126—Shaft and Bearing Assembly In Front Cylinder Half

(toward the front of compressor) and at same time, place front ball and shoe and rear ball only over swash plate. See Figure 11-127.

**IMPORTANT:** It is necessary to lift shaft assembly when installing pistons. Hold front thrust bearing pack tightly against swash plate hub while lifting shaft.

10. Repeat this operation for No.

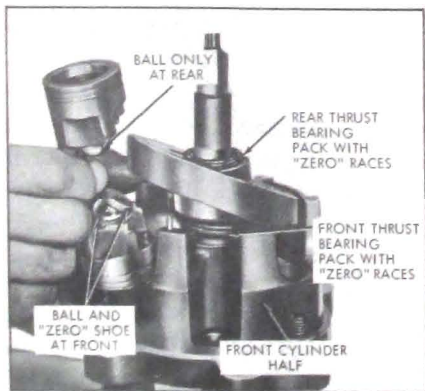


Figure 11-127—Installing Piston Assembly In Cylinder for Gauging

2 and No. 3 pistons. Balls and shoes must adhere to piston during this assembly.

11. Align rear cylinder half casting with bores, suction passage, discharge crossover holes, dowel pins, etc. Tap into place, using a wood block and mallet. See Figure 11-128.

12. Place cylinder assembly in J-9397 compressing fixture with front of compressor shaft pointing up, 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 15 lb. ft. torque.

13. Use a leaf-type feeler gauge to check clearance between REAR ball and swash plate for each piston.

(a) Use a suitable combination of feeler gauge leaves until the combination will result in a satisfactory 'feel' between ball and swash plate. See Figure 11-130.

(b) After a suitable combination of feeler gauge leaves have been selected for a satisfactory "feel" between the rear ball and swash plate as instructed in Step (a), attach a spring scale to end of feeler leaf. Spring scale must be calibrated in ounces, such as Generator brush tension scale

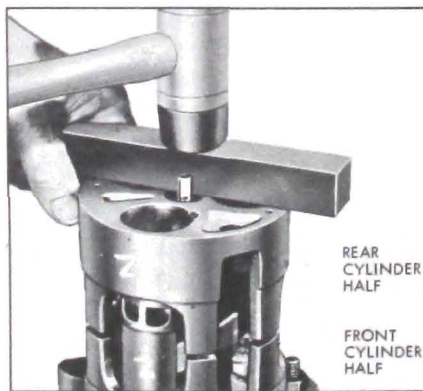


Figure 11-128—Assembling Rear Cylinder Half

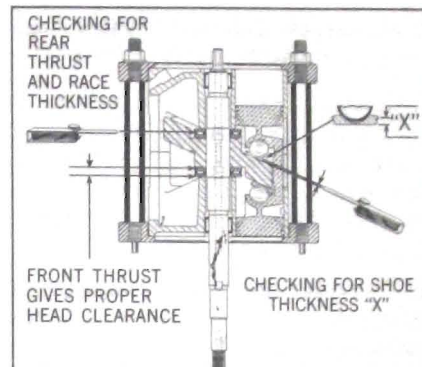


Figure 11-129—Checking Cylinder Clearances

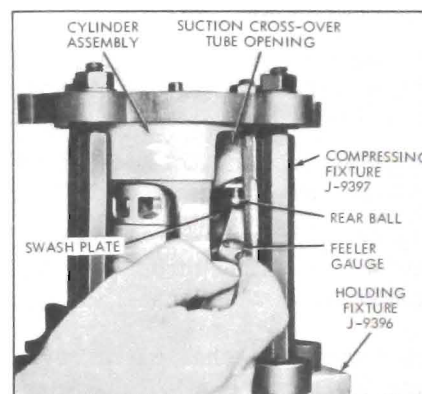


Figure 11-130—Gauging Clearance Between Rear Ball and Swash Plate

J-5184 or spring scale used for checking distributor point spring tension. Insert the selected feeler leaf between rear ball and swash plate, then pull straight out on spring scale with a steady, even pull being sure feeler does not bend or kink. See Figure 11-131. Record reading on scale. Spring

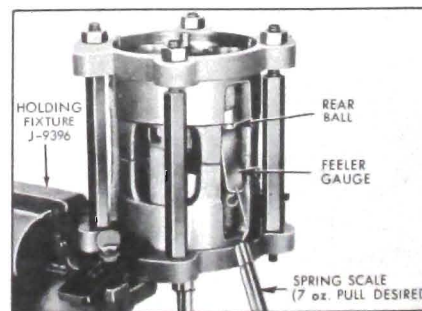


Figure 11-131—Checking Selected Feeler Gauge with Spring Scale



scale must be read while feeler is moving. If selected feeler is correct size, spring scale will read between 4 and 8 ounces (the higher reading is desired). If reading is not within limits, select the next .0005" smaller or larger feeler leaf and repeat spring scale check until proper reading is obtained. Then proceed with Steps (c), (d), (e), (f), and (g) checking selected feeler lead drag with spring scale at each location. The cylinder parts and feeler leaves must be very clean and coated with 525 viscosity compressor oil.

NOTE: By using the spring scale to check the selected feeler leafs, a standard may be set up as to the amount of feeler leaf drag required to properly rebuild the compressor. Also, the size of the numbered shoe discs and thrust bearing races for service has been determined by using the spring scale method of checking feeler leaf drag.

(c) Rotate the shaft approximately 120° and make a second check with feeler gauge between same ball and plate.

(d) Rotate shaft again approximately 120° and repeat check with feeler gauge between these same parts.

(e) From this total of three checks between the same ball and swash plate at 120° increments on swash plate, use the minimum feeler gauge reading to select a numbered shoe to correspond to this reading. See Example below.

Example:

	Position 1	Position 2	Position 3
Piston #1	.019	.020	.019
Select and use a No. 19 Shoe			
Piston #2	.020	.020	.020
Select and use a No. 20 Shoe			
Piston #3	.021	.020	.021
Select and use a No. 20 Shoe			

#### SHOE DISC CHART

Service Part Number	Identification No. Stamped on Shoe Disc
6557000	0
6556175	17-1/2
6556180	18
6556185	18-1/2
6556190	19
6556195	19-1/2
6556200	20
6556205	20-1/2
6556210	21
6556215	21-1/2
6556220	22

(f) Mark piston number (1, 2 or 3) on selected shoe package and place in corresponding position in parts tray.

(g) Repeat the above procedure on the other two pistons.

14. The next gauging operation is to determine space between REAR thrust bearing and rear outer thrust race.

(a) Use a suitable combination of feeler gauge leaves to get a satisfactory 'feel' between these two parts. See Figure 11-132.

(b) The spring scale method should also be used to check the drag of the feeler leaf that has been selected for clearance between rear thrust bearing and rear outer race. See Figure 11-133. The reading on the spring scale when pulling feeler leaf between these parts also should be between 4 and 8 ounces (the higher reading is desired). If reading is not within limits, select the next smaller or larger feeler leaf and repeat spring scale drag check until proper reading is obtained.

(c) Select from stock a numbered thrust race that corresponds to feeler gauge reading. For example, if feeler gauge reading is

.009", a race with a number 9 stamped on it should be selected and be installed in place of the rear outer race.

#### THRUST BEARING RACE CHART

Service Part Number	Identification No. Stamped on Race
6556000	0
6556060	6
6556065	6-1/2
6556070	7
6556075	7-1/2
6556080	8
6556085	8-1/2
6556090	9
6556095	9-1/2
6556100	10
6556105	10-1/2
6556110	11
6556115	11-1/2
6556120	12

(d) Mark the selected REAR thrust race or place it in the J-9402 assembly parts tray corresponding to its position.

15. Remove cylinder assembly from J-9397 compressing fixture.

16. Separate cylinder halves. It may be necessary to use a fiber block and mallet.

17. Remove rear half cylinder.

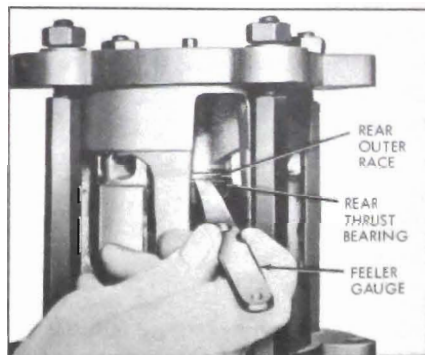


Figure 11-132—Gauging Clearance Between Rear Thrust Bearing and Rear Outer Race

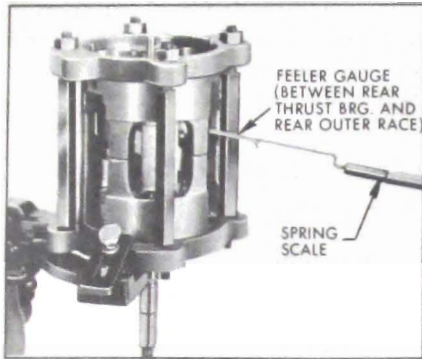


Figure 11-133—Checking Selected Feeler Gauge with Spring Scale

18. 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. Transfer each piston, balls and shoe assembly to their proper place in the J-9402 assembly tray.

19. Remove REAR outer ZERO thrust race from shaft and replace it with selected numbered thrust race, determined in Step No. 14. Apply a LIGHT smear of petroleum jelly 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.

#### e. Assembly of Compressor Cylinder Assembly

Be sure to install all new seals and "O" rings and to lubricate all the parts generously with 525 compressor oil during assembly.

1. Assemble a piston ring, scraper groove toward the center of piston, to each end of the three pistons.

2. Apply a light smear of petroleum jelly to selected numbered shoes and place them over correct ball in rear of piston.

3. With front and rear thrust bearing assemblies on shaft and

shaft installed in front cylinder half, rotate swash plate so high point is above cylinder bore No. 1. Carefully assemble No. 1 piston (complete with ball and ZERO shoe on FRONT end and ball and numbered shoe on REAR end) over swash plate. See Figure 11-134. Position piston rings so that the gap is toward center of cylinder.

Compress and enter piston ring into front half cylinder. Repeat this operation for pistons No. 2 and No. 3. See Figure 11-135.

4. Assemble one end of service discharge crossover tube into hole in front cylinder. See Figure 11-136.

5. Rotate shaft to position pistons in a "stair step" arrangement.

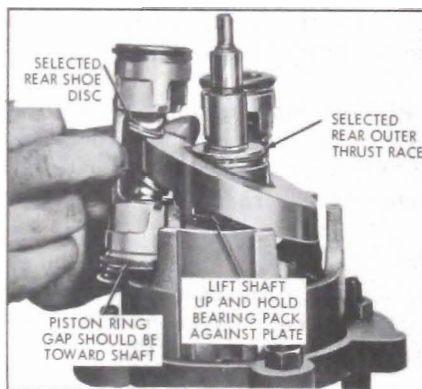


Figure 11-134—Installing Piston Assembly in Cylinder

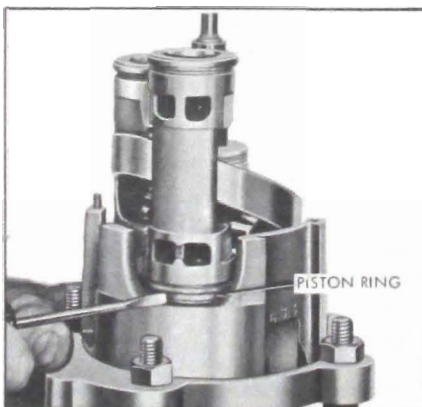


Figure 11-135—Compressing Front Piston Ring

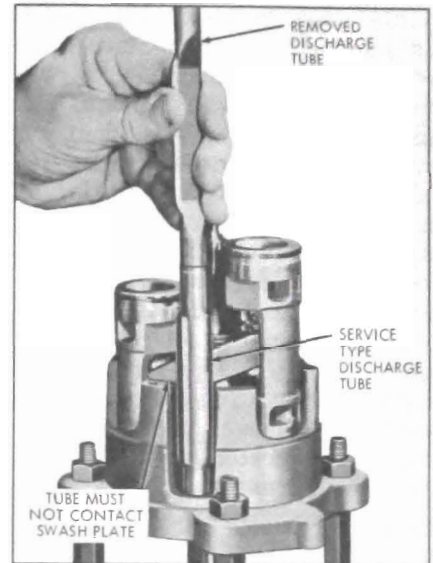


Figure 11-136—Installing Service Type Discharge Tube

See Figure 11-137. Position piston ring gaps toward center of cylinder. Place rear half cylinder over shaft and start pistons into cylinder bores.

(a) Compress piston ring on each piston so as to permit its entrance into cylinder. See Figure 11-138. If ring is not properly compressed when installing rear cylinder half, ring will be broken.

(b) When all three pistons and rings are in their respective cylinders, align end of the discharge crossover tube with hole in rear



Figure 11-137—Front Cylinder Half Assembly



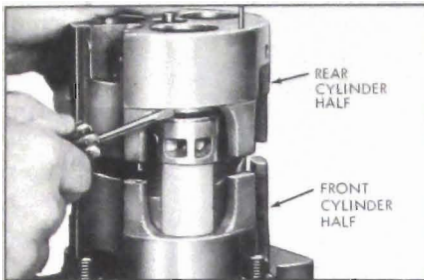


Figure 11-138—Compressing Rear Piston Ring

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. Assemble a new rectangular seal to suction crossover cover.

(a) Coat seal with clean 525 viscosity oil.

(b) Start one side of seal and cover into "dove tail" slot in the cylinder.

(c) Use J-9433 suction crossover cover seal installer as a "shoe horn", by placing it between the seal on opposite side and the "dove tail" slot. See Figure 11-139.

(d) Center cover and seal with ends of cylinder faces.

(e) Press down on cover to snap it into place.

(f) Remove J-9433 installer as shown in Figure 11-140.

(g) Examine cover and seal to be sure cover is properly seated and seal is not damaged.

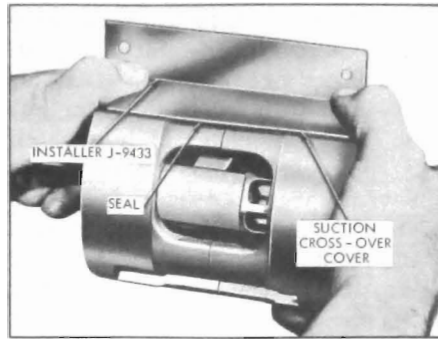


Figure 11-139—Installing Suction Crossover Cover and Seal

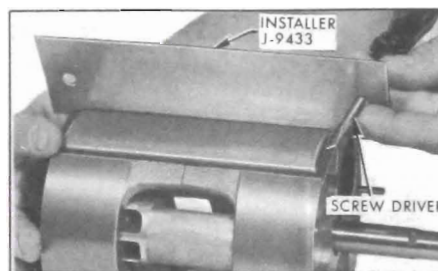


Figure 11-140—Removing Installer J-9433

8. If necessary to replace a locator pin, use suitable pliers to remove pin, using care not to damage surface of cylinder. See Figure 11-141. Install new pin, carefully tapping it into place.

#### f. Front Head and Cylinder Assembly Installation

1. Install discharge crossover tube front "O" ring and bushing. See Figure 11-142.

2. Assemble suction reed valve to front end of cylinder. Align dowel pin holes, suction ports and oil return slot. See Figure 11-143.

3. Assemble front discharge valve plate, aligning holes with dowel pins and proper openings in head. See Figure 11-144.

4. Coat teflon gasket surfaces on webs of compressor front head casting with clean 525 viscosity compressor oil.

5. Examine location of dowel pins and contour of webs and mark

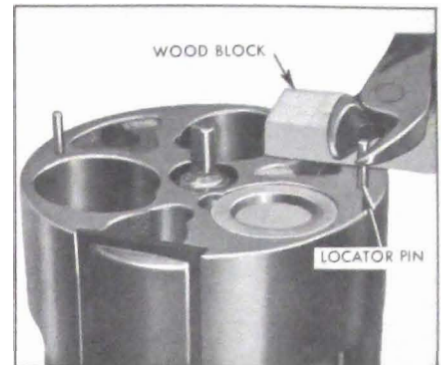


Figure 11-141—Removing Locator Pin



Figure 11-142—Installing Crossover Tube "O"-Ring

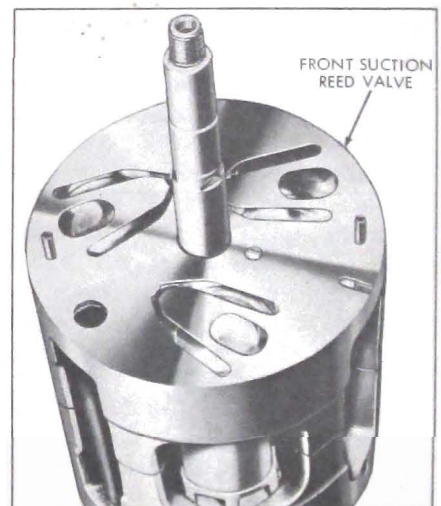


Figure 11-143—Front Suction Reed Valve Installed

dowel location on head with pencil as shown. Rotate so as to position it properly over discharge reed retainers. Use care



Figure 11-144—Placing Front Head On Cylinder Assembly

to avoid damaging teflon surfaces. See Figure 11-144. When in proper alignment, seat on front discharge plate with light mallet taps.

6. Place compressor shell with J-9396 holding fixture in vise so rear end of shell is up.

7. Install a new head to shell "O" ring on shoulder at rear of front head. See Figure 11-145.

8. Apply 525 viscosity oil on the "O" ring and surfaces of the front head.

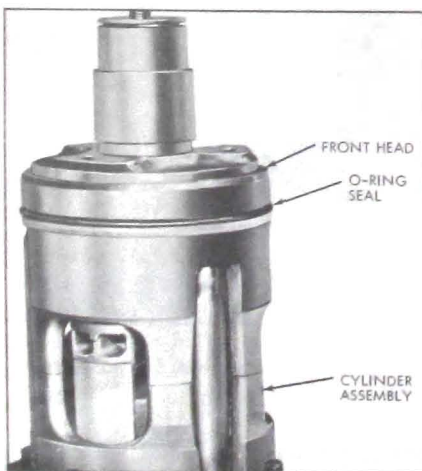


Figure 11-145—Cylinder and Front Head Assembly

9. Coat the inside machined surfaces of shell with clean 525 viscosity compressor oil. Line up oil sump with oil intake tube hole and lower mechanism into shell. Extreme care must be used to prevent large "O" ring seal from being damaged. Maintain this alignment when lowering mechanism into place. See Figure 11-146.

10. Place "O" ring on the oil intake tube; apply oil to cavity and "O" ring. Insert tube and "O" ring, rotating compressor mechanism as necessary and align tube with hole in the shell baffle. Be sure "O" ring and intake tube are properly seated.

11. Install discharge crossover tube rear "O" ring and bushing.

#### g. Oil Pump and Rear Head Installation

1. Position rear suction reed valve to align with dowel pins, reed tips, and ports in head.

2. Position rear discharge valve assembly to align with dowel pins and ports and slide it into place over locator pins.

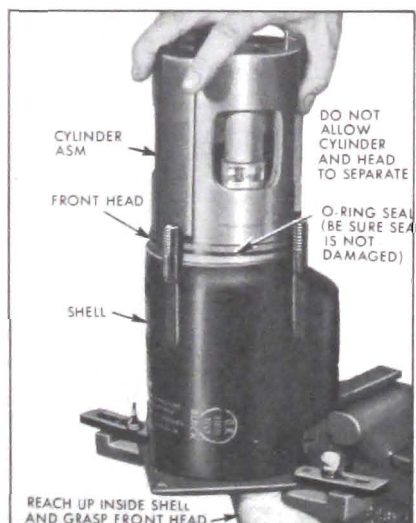


Figure 11-146—Inserting Cylinder Assembly in Shell

3. Assemble the inner oil pump gear over the "D" shaped flat on the shaft. Place outer oil pump gear over inner oil pump gear. If original gears are used, be sure gears are installed in their original positions.

4. 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.

5. Coat new head-to-shell "O" ring with oil and place it on valve plate in contact with shell.

6. Place suction screen in rear head if removed.

7. Position the oil pump outer gear as shown in Figure 11-147.

8. Assemble rear head to shell, using care not to damage the teflon sealing surfaces on head.

NOTE: If locator pins do not engage holes in rear head, grasp front head and slightly rotate cylinder assembly. See Figure 11-148.

9. Assemble new nuts to threaded shell studs and tighten to 20 lb. ft. torque.

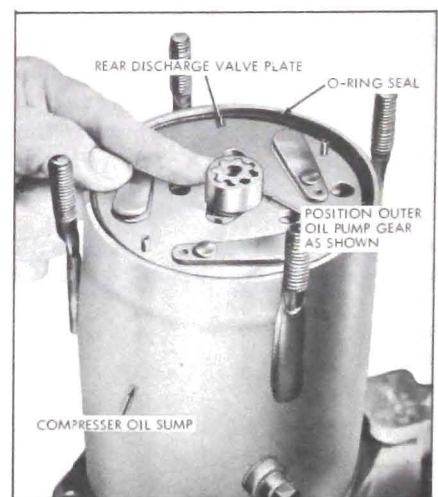


Figure 11-147—Positioning Oil Pump Outer Gear





Figure 11-148—Installing Rear Head

10. Replace pressure relief valve, if removed, using new copper washer.

11. Place new "O" rings on discharge and suction ports in compressor. Assemble charging line Adapter Plate J-9527 to compressor.

12. Invert compressor and compressor holding fixture in vise.

13. Install shaft seal assembly. Paragraph 11-18, subparagraph h.

**NOTE:** When checking compressor for leaks as instructed in seal installation, it is also recommended to check for internal leaks as follows:

With gauge set attached to compressor as shown, pressurize discharge side of compressor only. If the same pressure is immediately noted on the suction side gauge as on the discharge gauge, it indicates an internal leak such as head teflon sealing surface, discharge crossover tube, head to shell "O" ring seal or reed valves. Also observe the reading on the high pressure gauge with shut-off valves closed.

If gauge reading drops more than 10 pounds in 30 seconds, it indicates an internal leak in compressor.

14. Depressurize compressor and correct any leaks as necessary.

15. Remove charging line adapter plate from compressor and install end plate.

16. Refer to paragraph 11-17, subparagraph k for amount of 525 compressor oil to install in compressor. The oil is installed through oil drain screw opening.

17. Install compressor clutch coil and coil housing assembly. Paragraph 11-18, subparagraph f.

18. Install compressor pulley and bearing assembly. Paragraph 11-18, subparagraph d.

19. Install compressor clutch drive plate assembly. Paragraph 11-18, subparagraph b.

## 11-20 EVACUATION, LEAK TESTING AND CHARGING OF AIR CONDITIONER

Tool J-8393 Portable Air Conditioner Service Station is a Kent-Moore unit designed specifically for servicing automobile air conditioners. J-8393 provides a means of measuring refrigerant without the use of scales. The unit also makes it possible to charge a system without heating the refrigerant tank. As complete instructions are printed on the control panel of J-8393 and the instructions differ from those used with conventional equipment, only conventional equipment will be considered in this paragraph.

### a. Evaluation and Leak Testing of System

1. Attach gauge lines, adapters and vacuum pump set-up as shown

in Figure 11-149 and discharge any refrigerant that may be in system.

2. Start the vacuum pump, open both valves on gauge set, then slowly open the shut-off valve on the vacuum pump. **CAUTION:** If valve on the vacuum pump is opened too quickly, oil may be forced out of pump.

3. Operate vacuum pump until at least 28 inches vacuum (at sea level) is registered on the "Low" pressure gauge, then continue to run pump for at least ten minutes.

**NOTE:** Allowance should be made for elevation when obtaining a vacuum. A vacuum of 28 inches of mercury at or near sea level is required. For higher levels, the required vacuum may be reduced by 1 inch of mercury for each 1,000 feet of elevation.

4. If a 28 inch vacuum cannot be obtained, close pump shut-off valve and stop pump, then open the refrigerant-12 cylinder valve to charge the system at cylinder pressure. After closing the cylinder valve, leak test the complete system including gauge connections and correct any leaks found. Then re-evacuate system.

5. After 28 inches of vacuum has been maintained for ten minutes, close the vacuum pump shut-off valve and stop the pump. Observe gauge and if loss of vacuum is 2 inches or more in 5 minutes, there is a leak in the system and must be corrected.

6. If system checks out, charge the system with refrigerant-12 at cylinder pressure.

Then with refrigerant-12 cylinder valve closed, again evacuate the system with pump at 28 inches of vacuum for ten minutes. This charging and second evacuation is for the purpose of removing any air or moisture that may have entered the system.

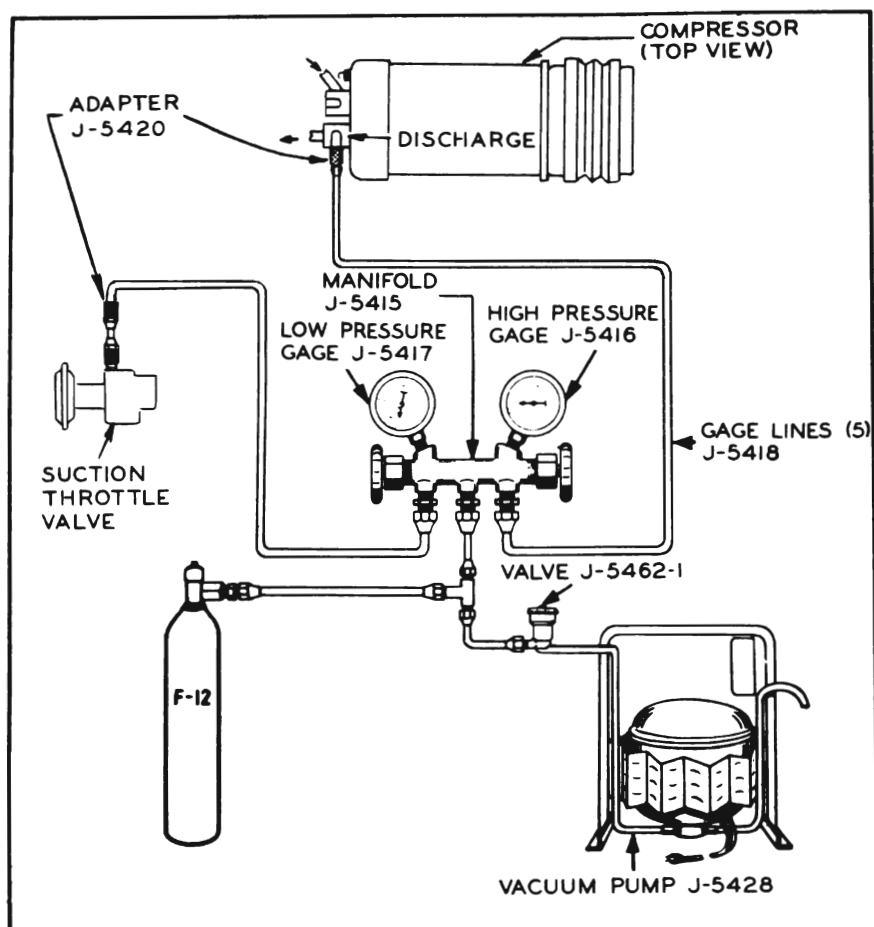


Figure 11-149—Service Gauge Hook-Up

7. After maintaining the 28 inches of vacuum for ten minutes, close the vacuum pump shut-off valve and stop the pump. The refrigeration system is now ready for charging.

#### b. Charging the System

1. With the vacuum pump, refrigerant-12 cylinder and gauge set connected to the compressor as shown in Figure 11-149, place the cylinder in a bucket of hot water which does not exceed 125°F.

**CAUTION:** Never heat refrigerant cylinder above 125°F. as tremendous hydrostatic pressures will develop, capable of rupturing cylinder. When there is a possibility of overheating cylinder, the cylinder must be opened

to a suitable pressure relief mechanism at all times.

2. Place cylinder and bucket on a suitable scale and record the total weight.

3. Open the low pressure valve on the gauge set. (High pressure valve on gauge set closed.)

4. Wearing goggles to protect eyes, fully open the refrigerant-12 cylinder valve and allow refrigerant-12 vapor to flow into the refrigerating system.

5. Operate engine and compressor at slow idling speed until a total of 4 pounds of refrigerant-12 have been charged into the 4400, 4600 and 4800 Series system or 3-1/2 pounds of refrigerant-12 in the 4700 Series system. It may

be necessary to reheat the water in bucket to maintain required pressure.

6. Close both valves on gauge set, close valve on refrigerant-12 cylinder, and remove cylinder from bucket of water.

**IMPORTANT:** Whenever the refrigeration system is discharged and recharged, it is necessary to cycle the suction throttle valve several times to normalize the piston diaphragm in the valve. This is done on the 4700 by moving "cool" and "air" levers from one extreme to the other. On the 4400-4600-4800, operate "Temp" lever several times.

7. Perform functional test, paragraph 11-21.

8. After test is completed, remove gauge lines and replace protective caps over Schrader valve fittings and tighten securely.

### 11-21 AIR CONDITIONER FUNCTIONAL TEST

In order to determine if the air conditioner system is operating properly and efficiently, it should be functional tested. Functional testing the air conditioner is determining if the discharge air temperature at the air outlet located at right side of the instrument panel, suction pressure and discharge pressure are within the specifications at a particular ambient condition. See Figure 11-150 and 11-151.

### 11-22 AIR CONDITIONER TROUBLE DIAGNOSIS

**NOTE:** If a case is encountered on a 4700 Series where the air conditioner has a refrigerant leak and there has been difficulty detecting it, there is a possibility that the piston diaphragm in the

Test Conditions -4400 - 4600 - 4800

1. Car doors and hood open.
2. "CLIMATE" control set at "AIR COND RECIR" and "Air" lever full on (blower on high).
3. "TEMP" lever in off position. Vent knobs in off position.
4. All air conditioner outlets open.
5. Gage set connected to Schrader valve fittings as shown in Figure 11-149.
6. Test should be conducted in area with above 70°F. ambient temperature.
7. Ambient air temperature should be measured in immediate test area toward front of car.
8. A fan should be used in front of radiator grille to insure minimum differential between temperature of air passing over condenser through radiator grille and evaporator through body cowl screen.

Test No. 1: - 4400 - 4600 - 4800

Set engine speed at 2000 rpm.

The following table lists ambient temperature, evaporator and head pressures and right air outlet temperatures that can be expected from a normally-functioning unit.

NOTE: If evaporator pressure is not correct for indicated ambient temperature, adjust suction throttle valve following procedure in par. 11-17, sub-par. f.

NOTE: The lower outlet temperature can be achieved on dry days, and the higher on humid days.

<u>Ambient Temperature °F</u>	<u>Evaporator Pressure PSIG</u>	<u>Compressor Head Pressure PSIG</u>	<u>Rt. Outlet Temperature °F</u>
70.	29-31	160-190	40-45
80	29-31	180-225	40-45
90	29-31	200-380	40-45
100	29-31	320-310	42-48
110	29-31	260-325	46-53

Test No. 2: - 4400 - 4600 - 4800

This should be run on cars which will pass Test No. 1, but do not perform satisfactorily on the road. In this test the engine speed should be adjusted to the ambient temperature and humidity.

<u>Ambient Temperature °F</u>	<u>Humidity</u>	<u>Engine R.P.M.</u>	<u>Evaporator Pressure PSIG</u>	<u>Compressor Head Pressure PSIG</u>	<u>Right Outlet °F</u>
70	Humid	425-450	35	140	47
80	Dry	475-510	35	164	47
80	Humid	525-550	35	169	50
90	Dry	500-525	35	185	49
90	Humid	750-775	35	204	53
100	Dry	525-575	35	210	52
100	Humid	750-800	35	230	56
110	Dry	650-800	35	252	56
110	Humid	350-900	35	268	61

The pressures and outlet temperature should be equal to or lower than those tabulated above.

Figure 11-150—Air Conditioner Functional Test—4400-4600-4800 Series

suction throttling valve may be the cause of the leak. If the piston diaphragm is leaking, the refrigerant will be drawn into the engine intake manifold through the vacuum hose and there will be no

indication that the suction throttle valve has an external leak. Thus, when checking the air conditioner system for leaks, remove the vacuum hose from the suction throttle valve vacuum diaphragm,

wait several seconds to allow refrigerant to collect in the diaphragm and leak test at the vacuum hose connection on the diaphragm. If leak detector indicates a leak, it will be necessary

Test Conditions - 4700 Series

1. Car doors and hood open.
2. Air Conditioner "Cool" and "Air" levers set at maximum cooling position.
3. All Air Conditioner outlets open.
4. Gage set connected to Schrader valve fittings as shown in Figure 11-149.
5. Heater defroster and ventilator controls in "Off" position.
6. Test should be conducted in area with above 70°F. ambient temperature.
7. Ambient air temperature should be measured in immediate test area toward front of car.
8. A fan should be used in front of radiator grille to insure minimum differential between temperature of air passing over condenser through radiator grille and evaporator through body cowl screen.

Test No. 1: - 4700 Series

Set engine speed at 2000 rpm.

The following table lists ambient temperature, evaporator and head pressures and right air outlet temperatures that can be expected from a normally-functioning unit.

NOTE: If evaporator pressure is not correct for indicated ambient temperature, adjust suction throttle valve following procedure in par. 11-17, sub-par. f.

NOTE: The lower outlet temperature can be achieved on dry days, and the higher on humid days.

Ambient Temperature °F	Evaporator Pressure PSIG	Compressor Head Pressure PSIG	Rt. Outlet Temperature °F
70	20-22	160-190	37-41
80	20-22	190-210	39-43
90	20-22	220-240	43-46
100	20-22	250-270	47-50
110	22-25	280-300	51-54

Test No. 2: - 4700 Series

This should be run on cars which will pass Test No. 1, but do not perform satisfactorily on the road. In this test the engine speed should be adjusted to the ambient temperature and humidity.

Ambient Temperature °F	Humidity	Engine R.P.M.	Evaporator Pressure PSIG	Compressor Head Pressure PSIG	Right Outlet °F
70	Dry	500-525	26	122	36
70	Humid	500-525	26	138	38
80	Dry	525-550	26	155	41
80	Humid	675-700	26	190	45
90	Dry	725-750	26	200	44
90	Humid	975-1000	26	220	48
100	Dry	1000-1025	26	230	46
100	Humid	1100-1125	26	245	49
110	Dry	1200-1225	26	260	49
110	Humid	1675-1700	26	285	54

Figure 11-151—Air Conditioner Functional Test—4700 Series



to remove suction throttle valve and replace the piston diaphragm in the valve.

#### **a. Inspection of Air Conditioner System**

1. Check compressor belt tension. See Figure 2-40.
2. 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.
3. Check air outlet hoses for leaks or restrictions.
4. Check outer surface of condenser 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. Check to insure that evaporator drains are open.
6. Check sight glass as instructed in subparagraph c.
7. Check ambient air temperature and air temperature at right air outlet following instructions on functional test charts. See Figure 11-150 and 11-151. Temperature should correspond with those listed on chart. If temperatures do not compare, attach gauge set (Figure 11-149) and functional test air conditioner.

#### **b. Diagnosis of Components**

Listed below are the air conditioner components and the possible conditions that could be encountered with each unit if defective.

1. **COMPRESSOR** - Compressor malfunction will appear in one of four ways: noise, seizure, leakage, or low discharge pressures. Even resonant compressor noises are not cause for excessive alarm; however, irregular noises

or rattles are likely to indicate broken parts.

Seizure will be indicated by the failure of the compressor to operate, if the clutch is in good operating condition and there is no break in the electrical continuity of the system. Continued operation of a seized or partially seized compressor will result in damage to the clutch. To check for seizure, de-energize the clutch and attempt to rotate the compressor shaft. If the shaft will not turn, the compressor is seized. Leakage of compressor refrigerant may be detected through routine leak detection.

Low discharge pressures may also be caused by insufficient refrigerant or a restriction elsewhere in the system. These should be checked out prior to compressor servicing.

2. **COMPRESSOR CLUTCH** - If the compressor is inoperative, the electrical lead to the clutch should first be checked. If there is current to the clutch and the compressor is not seized, the clutch is defective and should be repaired.

3. **CONDENSER** - There are two types of possible condenser malfunction. The condenser may leak, resulting in loss of refrigeration and low system pressures, or the condenser may have a restriction, resulting in excessive compressor discharge pressures and inadequate cooling. If a restriction occurs and some refrigerant passes the restriction, icing or frost may occur on the external surface of the condenser in the area of the restriction. Also if the air flow through the condenser is restricted or blocked, high discharge pressures will result. It is important that the external fins of the condenser and radiator core are not plugged with bugs, dirt, etc.

4. **THERMOSTATIC EXPANSION VALVE** - If malfunction of the

valve is suspected, make sure the power element bulb is in proper position, tightly attached, and well insulated from outside air temperatures.

If this valve fails, it usually fails in the power element and thus the valve remains closed. This will be indicated by low suction and discharge pressures. Also the inlet screen could be plugged. The screen may be cleaned with liquid refrigerant.

5. **EVAPORATOR** - Dirt or other foreign matter on the core surface or in the evaporator case will restrict air flow. A cracked or broken case can result in leakage of cold air and can result in insufficient air or warm air delivered to the passenger compartment. The condensation drains should be unrestricted.

6. **RECEIVER DEHYDRATOR** - Leakage of refrigerant indicates a defective unit. The desiccant cannot easily be checked, but if it, or the system has been exposed to outside air for a considerable length of time, the unit should be replaced.

Restrictions in the receiver-dehydrator can also cause system malfunction. If the inlet tube is blocked, it is likely to result in high head pressure. If the outlet tube is blocked, head pressure is likely to be low and there will be little or no cooling.

**IMPORTANT:** The IN stamped on receiver must be connected to the condenser.

7. **SUCTION THROTTLE VALVE (STV)** - If the STV is defective it may cause evaporator pressure to be too high (air outlet temperature too warm) or it could cause the evaporator pressure to be too low (air outlet temperature too low which may cause icing of the evaporator core). Also if the vacuum diaphragm of the STV is defective, there would be no means of setting the STV to change the air outlet temperature.

Refrigerant leakage of STV may be detected through routine leak detection.

Before servicing the suction throttle, it should be determined that the STV is actually the cause of the complaint by following adjustment procedure in paragraph 11-17, subparagraph f.

If tests indicate STV is defective, it should be removed, disassembled and repaired following procedure in paragraph 11-17, subparagraph g and h.

#### **c. Use of Receiver Sight Glass for Diagnosis**

At temperatures higher than

70°F., the sight glass may indicate whether the refrigerant charge is sufficient. A shortage of liquid refrigerant is indicated after about five minutes of compressor operation by the appearance of slow-moving bubbles (vapor) or a broken column of refrigerant under the glass. Continuous bubbles may appear in a properly charged system on a cool day. This is a normal situation. If the sight glass is generally clear and performance is satisfactory, occasional bubbles do not indicate refrigerant shortage.

If the sight glass consistently shows foaming or a broken liquid

column, it should be observed after partially blocking the air to the condenser. If under this condition the sight glass clears and the performance is otherwise satisfactory, the charge shall be considered adequate.

In all instances where the indications of refrigerant shortage continues, additional refrigerant should be added in 1/4 lb. increments until the sight glass is clear. An additional charge of 1/2 lb. should be added as a reserve.

In no case should the system be overcharged.

#### **d. Trouble Diagnosis Chart**

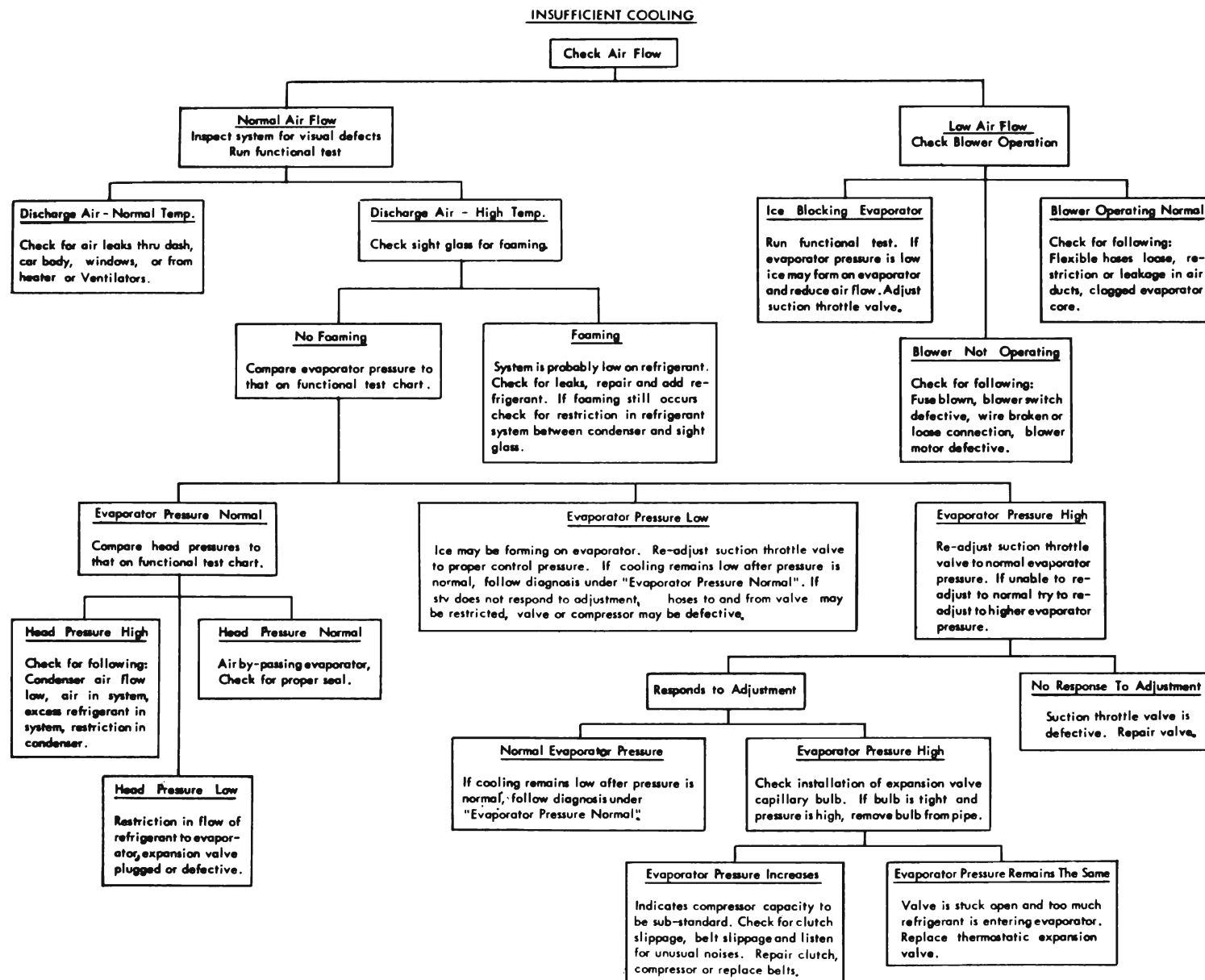
COMPLAINT AND CAUSE	CORRECTION
<p>1. Insufficient Cooling</p> <p>(a) Low air Flow</p> <p>(b) Defective heater core manual heater valve</p> <p>(c) Heater controls or ventilator control not in the "off" position</p> <p>NOTE: If none of the above items are cause of complaint of insufficient cooling, perform functional test on car. If car does not pass test see items 2, 3, 4 and 5 on this chart.</p>	<p>(a) Check blower operation. Check for obstructions in air distribution system. Check for clogged evaporator. If iced, deice core and check adjustment and operation of suction throttle valve. Paragraph 11-17, subparagraph f.</p> <p>(b) Check operation of valve. Adjust or replace as necessary.</p> <p>(c) Advise operator of correct operation of controls.</p>
<p>2. Compressor Discharge Pressure Too High</p> <p>(a) Engine overheated</p> <p>(b) Overcharge of refrigerant or air in system.</p>	<p>(a) See Paragraph 2-13 for possible cause.</p> <p>(b) Systems with excess discharge pressures should be slowly depressurized. (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 FUNCTIONAL TEST CHART,</p>

**d. Trouble Diagnosis Chart (Cont'd.)**

COMPLAINT AND CAUSE	CORRECTION
<p><b>2. Compressor Discharge Pressure Too High (Cont'd.)</b></p> <p>(c) Restriction in condenser or receiver liquid indicator.</p> <p>(d) Condenser air flow blocked.</p> <p>(e) Evaporator pressure too high.</p>	<p>slowly bleed system until bubbles appear in the sight glass and stop. Add refrigerant until bubbles clear, then add one-half pound of refrigerant. Recheck operational pressures. If system pressures still remain above specifications, and the evaporator pressure is slightly above normal, then a restriction exists in the high pressure side of the system. (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.</p> <p>(3) If discharge pressure remains high after depressurizing the system, continue depressurizing until bubbles appear in the sight glass. If evaporator pressures also remain high, there is a possibility of a restriction in the high pressure side of the refrigeration system or the STV may require adjustment. See EVAPORATOR PRESSURE TOO HIGH.</p> <p>(c) Remove parts, inspect, and clean or replace.</p> <p>(d) Clean condenser and radiator core surfaces as well as the space between the condenser and radiator.</p> <p>(e) See EVAPORATOR PRESSURE TOO HIGH.</p>
<p><b>3. Compressor Discharge Pressure Too Low</b></p> <p>(a) Insufficient refrigerant</p> <p>(b) Low suction pressure.</p> <p>(c) Defective compressor and/or broken compressor reed valves.</p>	<p>(a) Check for presence of bubbles or foam in liquid indicator. If bubbles or foam are noted (after five minutes of operation), check system for leaks, if no leaks found refrigerant should be added until sight glass clears, then add an additional 1/2 lb.</p> <p>(b) See EVAPORATOR PRESSURE TOO LOW.</p> <p>(c) Repair compressor.</p>

**d. Trouble Diagnosis Chart (Cont'd.)**

COMPLAINT AND CAUSE	CORRECTION
<p><b>4. Evaporator Pressure Too High</b> (This will be accompanied by air outlet temperature at outlet too high.)</p> <p>(a) Thermostatic expansion valve capillary tube bulb not tight to evaporator outlet tube.</p> <p>(b) Thermostatic expansion valve improperly adjusted or inoperative.</p> <p>(c) Suction throttle valve adjusted improperly or defective.</p> <p>(d) Vacuum modulator defective (4700).</p> <p>NOTE: If compressor suction line from STV is extremely colder than STV inlet line from evaporator, this indicates that STV outlet pressure is much lower than inlet pressure and STV may be defective.</p>	<p>(a) Check for tightness.</p> <p>(b) Replace valve.</p> <p>(c) Check operation of STV, Paragraph 11-17, subparagraph f. Repair valve, if necessary.</p> <p>(d) There should be no vacuum to STV when "Cool" lever on instrument panel is at maximum on position. Replace vacuum modulator if defective.</p>
<p><b>5. Evaporator Pressure Too Low</b></p> <p>(a) Thermostatic expansion valve capillary tube broken, inlet screen plugged or valve otherwise failed.</p> <p>(b) Restriction in system tubes or hoses.</p> <p>(c) Suction throttle valve adjusted improperly or defective.</p>	<p>(a) Replace valve or clean inlet screen of valve.</p> <p>(b) Replace kinked tube or restricted hose.</p> <p>(c) Check operation of STV, Paragraph 11-17, subparagraph f. Repair if necessary.</p>



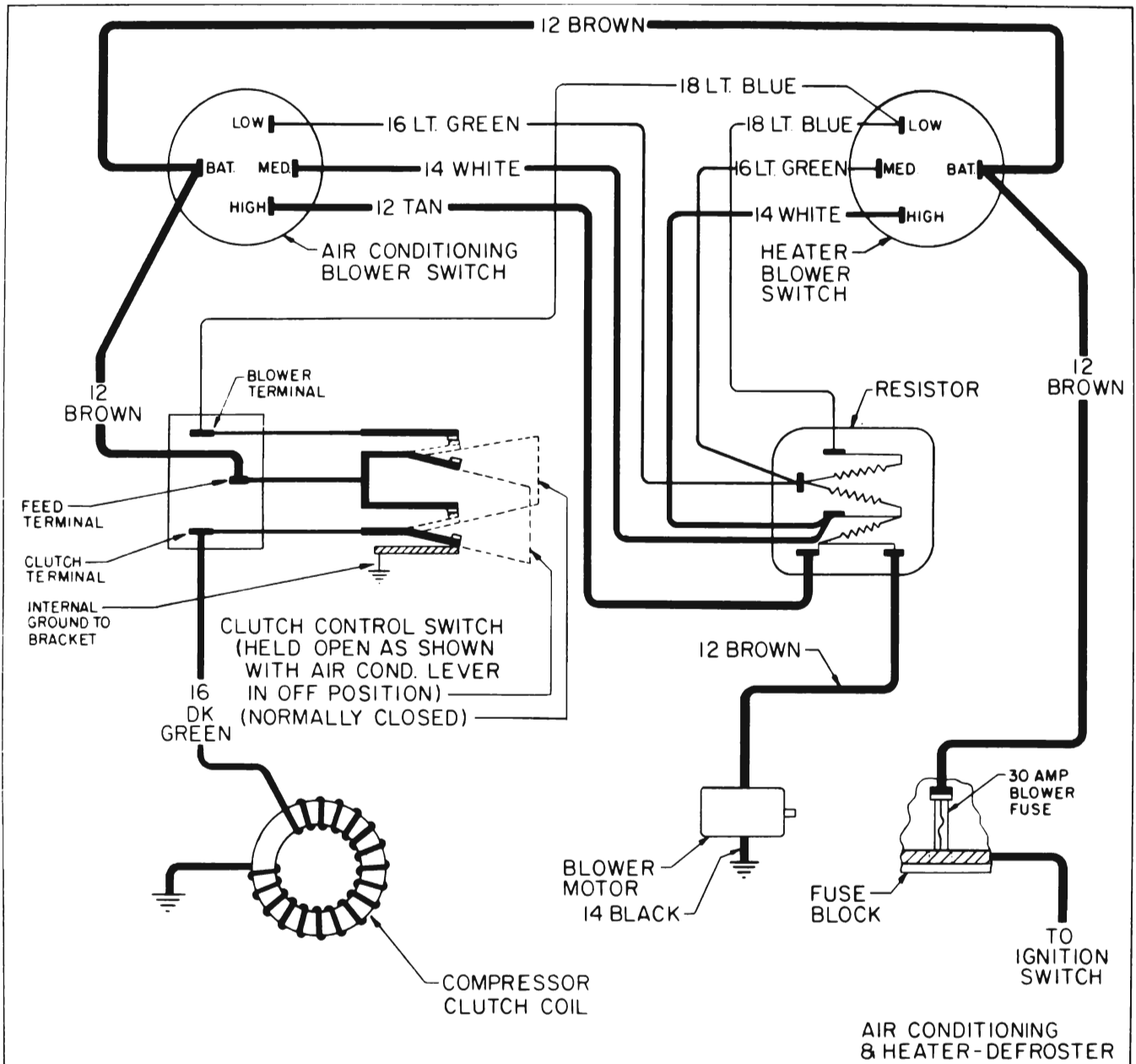


Figure 11-153—Wiring Schematic—Air Conditioner and Heater—4700 Series





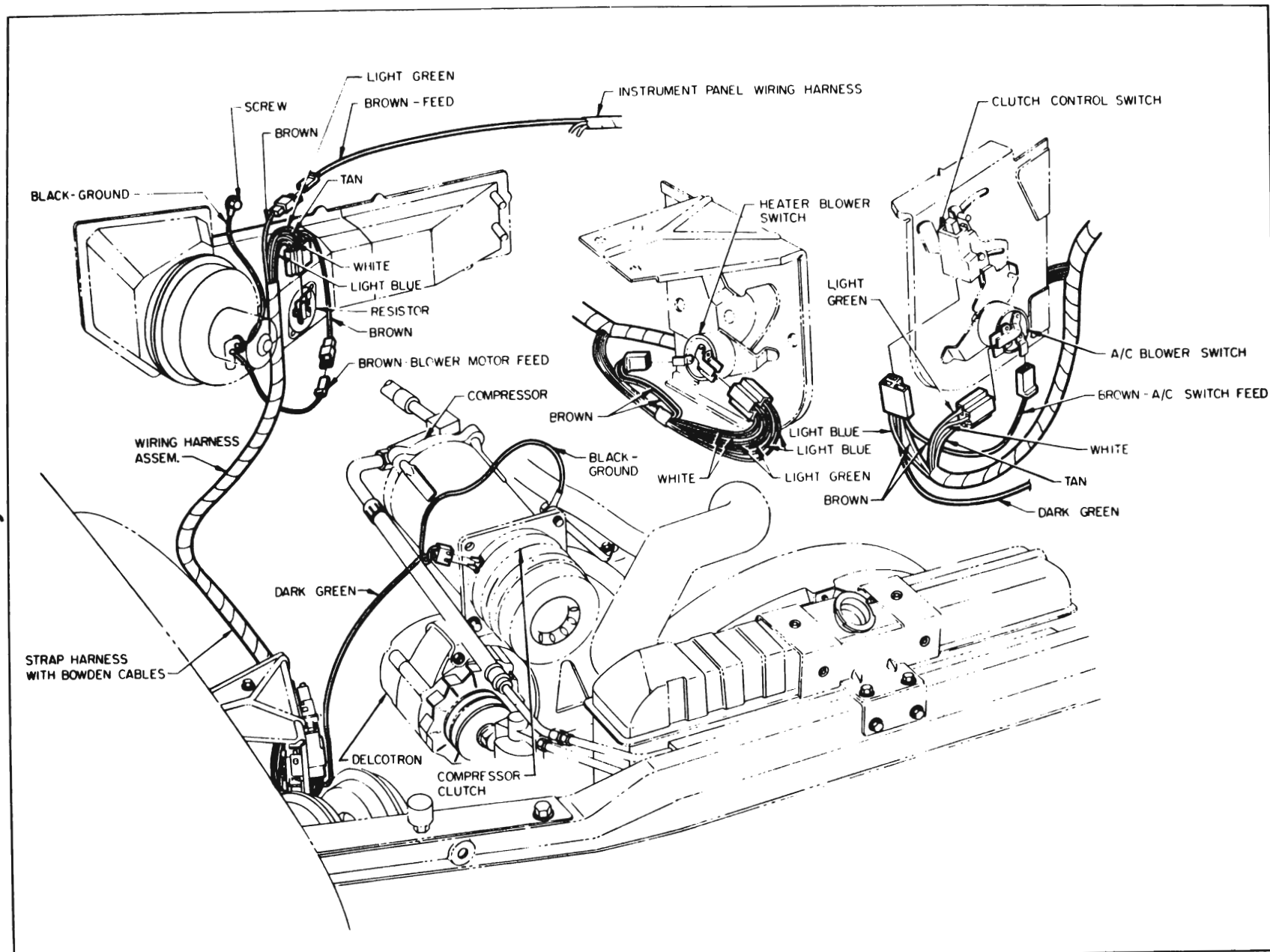


Figure 11-155 Air Conditioner Wiring Installation—4700 Series

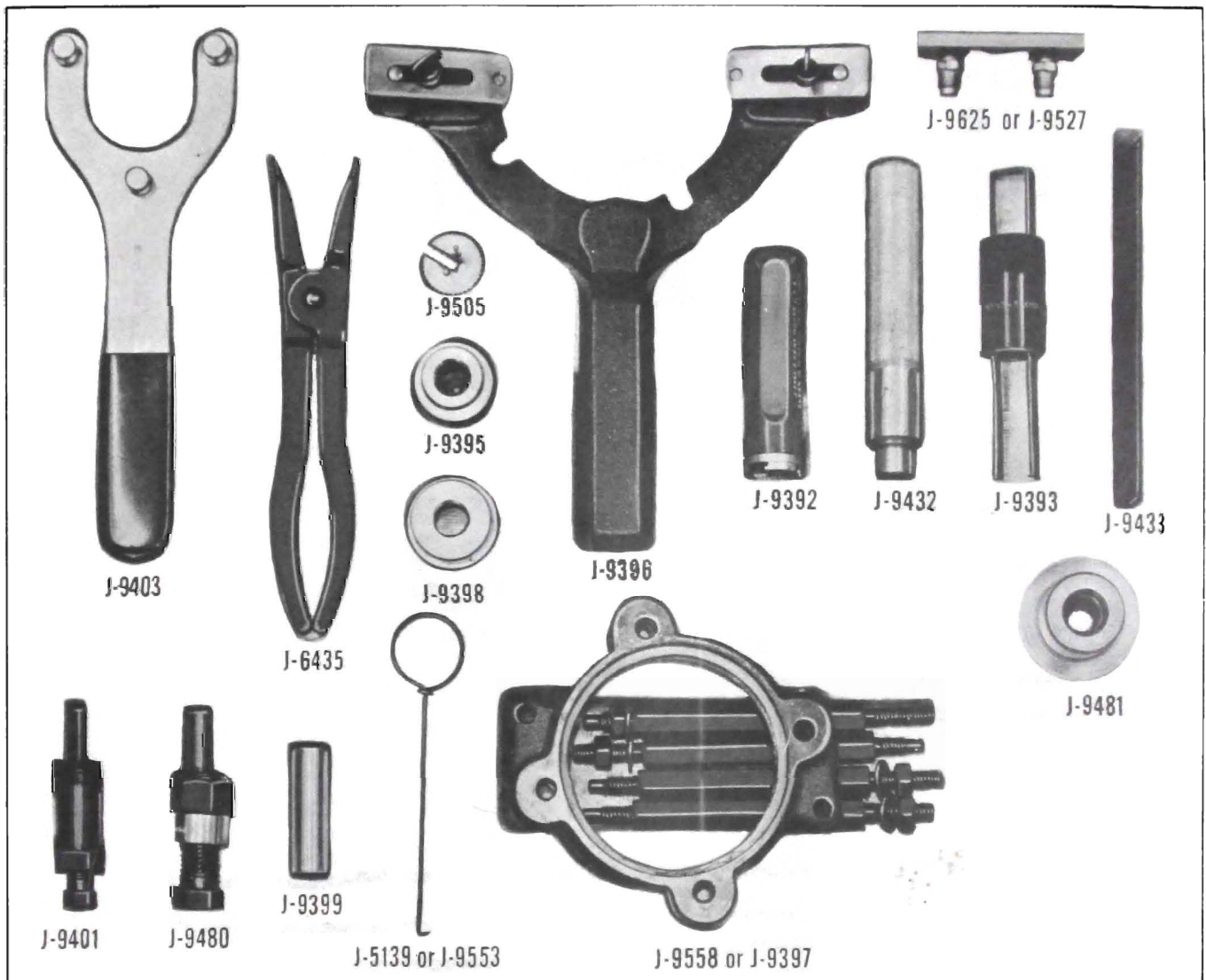
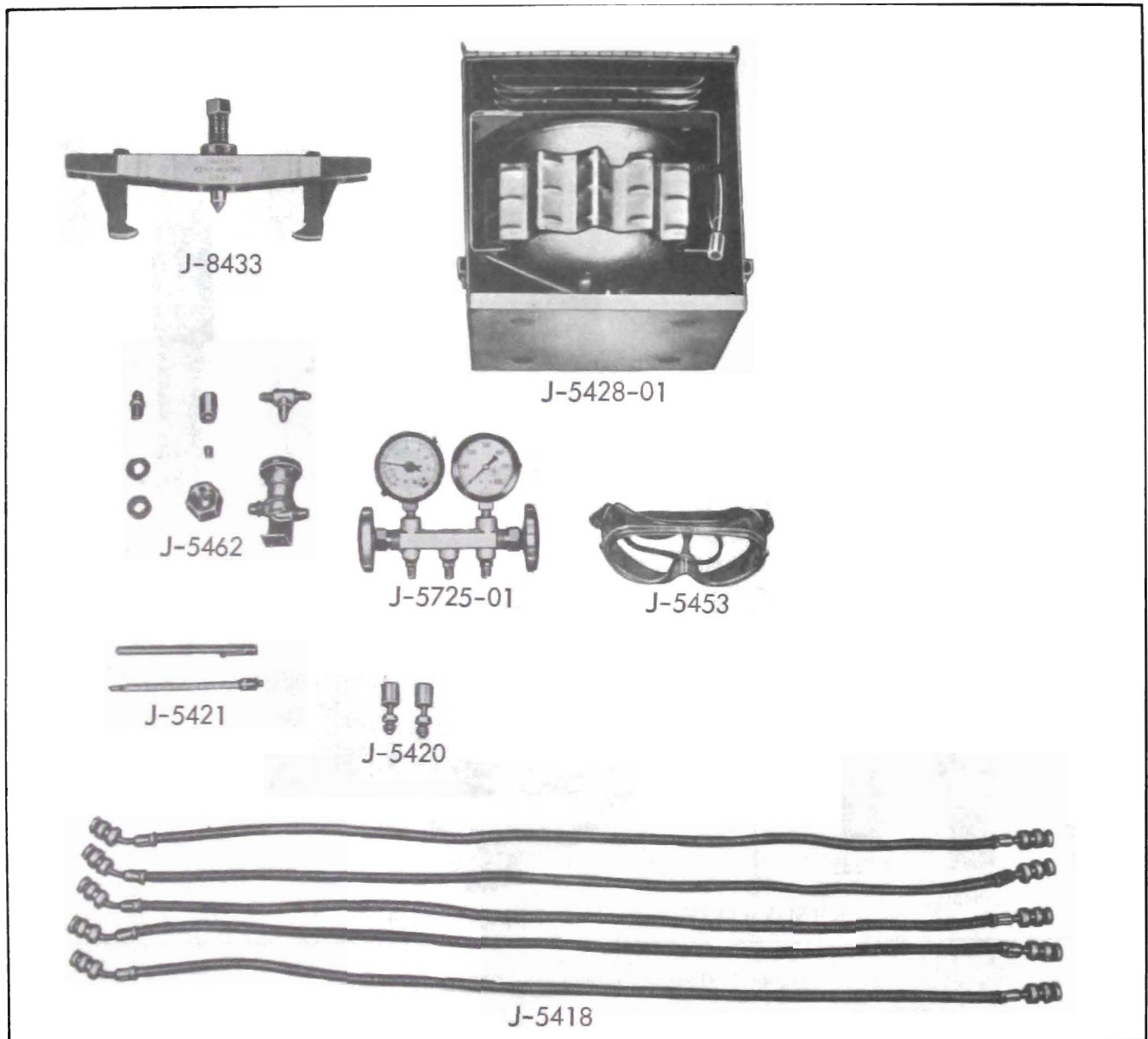


Figure 11-156—Air Conditioner Compressor Tools



J-5418	Gauge Charging Line (5 Required)
J-5420	Gauge Adapter (2 Required)
J-5421	Pocket Thermometer (0° to 220° F.) (Glass)
J-5428-01	Vacuum Pump in Metal Carrying Case
J-5453	Goggles
J-5462	Gauge Hook-Up Set
J-5725-01	Manifold and Gauge Set
J-8433	Compressor Pulley Remover

Figure 11-157—Air Conditioner Tools