SECTION B

AUTOMATIC CLIMATE CONTROL HEATER—AIR CONDITIONER SYSTEM

CONTENTS

DIVISION I SPECIFICATIONS AND ADJUSTMENTS

13-101 SPECIFICATIONS

a Vacuum Specifications

Piloted Vacuum Actuator (PVA)	Manifold side of PVA shall have manifold vacuum of 15-20" at idle with 0 vacuum on Pilot Side link shall be fully extended.
	Pilot Vacuum — shall be the same as TVR output, with varying this vacuum 0-7" with 15-20" Hg. on manifold side shall cause A.C.C. System to program (actuate) from Max. Htr. to Max. A/C respectively.
Thermostatic Vacuum Regulator (TVR)	With TVR output (regulated vacuum) hose disconnected and gage on TVR gage port — apply 20" to TVR input, gage — shall read 2.5 to 3.5" Hg. vacuum.
Master Switch	Switch must be closed at 10" Hg. vacuum and remain closed until 3-4" vacuum. Switch must be open at 1.0" vacuum.

Program Vacuum Disc Switch	With PVA regulator set to align gage holes in program vacuum switch, vacuum program is set at mode shift.

b. Piloted Vacuum Actuator (PVA) Specifications

Travel of PVA stem from fully extended position to full retracted position by *applying 0 and 7"* vacuum to pilot side and engine running (manifold vacuum) shall be 13/16" + or – 1/64".

Time of PVA stem travel from max. A/C position (Recirc. Air) to max. heat position or max. heat position to max. A/C position by applying 0-7" Hg. vacuum shall be 15 + or – 5 seconds.

c. Thermomechanical Specifications

Thermostatic Vacuum Regulator (TVR) with TVR temperature constant, apply 15-20" vacuum at input. Output to be per chart below:

Temperature °F	PVA Vacuum
60	0.7"
70	2.7"
75	3.7"
80	4.7"
90	6.7"
100	8.7"

PVA Vacuum is + or – 0.5"

Compressor Ambient Switch	On (Rising Ambient) 45° maximum Off (Dropping Ambient) 25° minimum
Thermostatic Vacuum Valve	Starts to open at engine coolant temperature of 100° - 125°.

d. Electrical Specifications

Blower motor voltages with engine running (SELECTOR in "HIGH" or "DEFOG" or "LOW").

		"HIGH" & "DEFOG"	"LOW"
High Speed	(Hi)	12.5 Htr. 13.5 A/C	7.7 Htr. Only
Medium High Speed	(M3)	10.5	7.3
Medium Speed	(M2)	9.1	6.7
Medium Low Speed	(M1)	7.4	5.6
Low Speed	(Lo)	6.0	5.1

e. Mechanical Specifications

PVA Linkage	Set temperature door in maximum heat and 0 pilot vacuum.

f. Miscellaneous Specifications:

Blower Switch	Switch must provide High Blower at each end of program with continuous stepping voltages in between and allow temperature door seal at each end.
Program Switch (Vacuum) for Mode Shift	90-100° A/C discharge temperature at time of shift to heater. 85-95° Htr. discharge temperature at time of shift to A/C.

g. Glossary of Abbreviations

ACC	Automatic Climate Control	OSA	Outside Air
A/C	Air Condition	PBA	Plenum Blower Assembly
A.I.	Air Inlet	PVA	Piloted Vacuum Actuator
EBA	Evaporator–Blower Assembly	RVR	Regulated Vacuum Relay
HTR	Heater	TVR	Thermostatic Vacuum Regulator
MS	Master Switch	TVV	Thermostatic Vacuum Valve

13-102 ADJUSTMENT OF PILOTED VACUUM ACTUATOR (PVA) TO TEMPERATURE DOOR LINKAGE

NOTE: *Do not operate engine during initial steps of this adjustment.*

1. a. (45-46-48000 Series) Remove instrument panel cover. See Figure 13-201.

b. (49000 Series) Remove control protection cover. See Figure 13-202.

2. (45-46-48000 Series Only) Remove right defroster hose. See Figure 13-203.

3. Disconnect brown vacuum hose from regulated vacuum port of TVR and plug end of hose. Disconnect source (black) hose from power side of PVA. See Figure 13-204 for 45-46-48000 Series. See Figure 13-205 for 49000 Series.

4. Disconnect linkage return spring. See Figure 13-206 for 45-46-48000 Series. See Figure 13-207 for 49000 Series.

5. Loosen temperature door linkage adjusting screw. See Figure 13-206 for 45-46-48000 Series. See Figure 13-207 for 49000 Series.

6. Push temperature door linkage in maximum heat position. Tighten linkage adjusting screw.

7. Reconnect linkage return spring.

8. Reconnect source (black) hose to power side of PVA and start engine so that vacuum is applied to power (Manifold) side of PVA. Check temperature door for seal in maximum heat position by feeling temperature door shaft and lever for tightness. If tight, temperature door is properly sealed.

9. CONNECT BROWN VACUUM HOSE REMOVED FROM TVR in Step 3, to regulated vacuum port of Vacuum Regulator J-22860. Connect TVR source (black) hose, to source port of J-22860. Install a vacuum gage to third port of J-22860. With engine operating to supply vacuum to power (Manifold) side of PVA, adjust regulator valve on Tool J-22860 to have a regulated vacuum of 8" Hg on the pilot side of the PVA.

NOTE: *Regulator valve must be open when connecting Vacuum Regulator J-22860 to PVA.*

10. Check for temperature door seal in maximum A/C by feeling temperature door shaft and lever for tightness. If tight, temperature door is properly sealed.

11. If temperature door does not seal in Step 8 or 9, readjust, free-up, or repair as necessary to obtain door seal.

13-103 ADJUSTMENT OF PROGRAM VACUUM DISC SWITCH

1. a. (45-46-48000 Series) Remove instrument panel cover. See Figure 13-201.

b. (49000 Series) Remove control protection cover. See Figure 13-202.

2. (45-46-48000 Series Only) Remove right defroster hose. See Figure 13-203.

3. Start engine so that vacuum is applied to power (Manifold) side of PVA. With system in maximum A/C, such as obtained in paragraph 13-102, step 9, slowly reduce vacuum to pilot side of PVA to 3.0". Adjust program link on temperature door linkage, to pin on program vacuum disc switch, for A/C to heater mode shift. See Figure 13-208 for 45-46-48000 Series. See Figure 13-209 for 49000 Series.

4. Increase regulated vacuum to pilot side of PVA to 8". Check for maximum A/C including recirculated air.

5. Slowly reduce vacuum to pilot side of PVA and check for change to outside air, and vacuum to water valve before movement of temperature door from maximum A/C.

6. If A.I. door does not change from recirculated air to outside air, and no vacuum is applied to water valve before movement of temperature door in Step 5, readjust, free-up, or repair as necessary to obtain proper operation and sequence.

13-104 ADJUSTMENT OF BLOWER SWITCH

1. a. (45-46-48000 Series) Remove instrument panel cover. See Figure 13-201.

b. (49000 Series) Remove control protection cover. See Figure 13-202.

2. (45-46-48000 Series Only) Remove right defroster hose. See Figure 13-203.

3. Position SELECTOR Switch in "HIGH" blower range.

4. Start engine so that vacuum is applied to power side of PVA. With Tool J-22860 installed as in paragraph 13-102, step 9, reduce vacuum to pilot side of PVA to 0", check for high blower (12.5 volts) in maximum heater.

5. Increase regulated vacuum on pilot side of PVA, to 8", check for high blower (13.5 volts) in maximum A/C.

6. Position blower switch as necessary to obtain high blower in both maximum heater (12.5 volts) and maximum A/C (13.5 volts). See Figure 13-210 for 45- 46-48000 Series. See Figure 13-211 for 49000 Series.

NOTE: *Be sure that at 0 pilot side PVA vacuum (maximum heat) and 8' pilot side PVA vacuum (maximum A/C) that the blower switch does not bottom out preventing proper tempera ture door seal.*

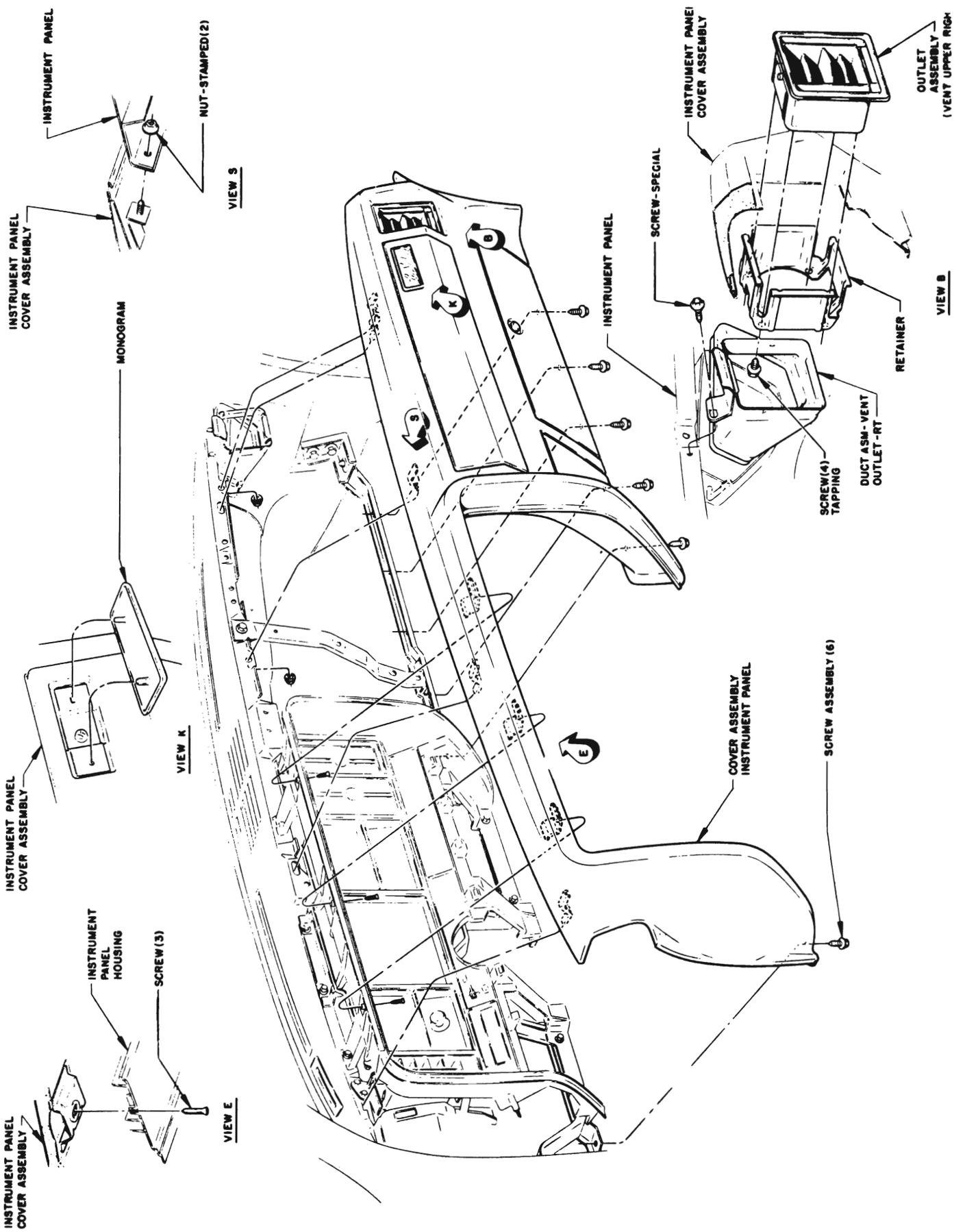


Figure 13-201 - 45-46-48000 Series Instrument Panel Cover

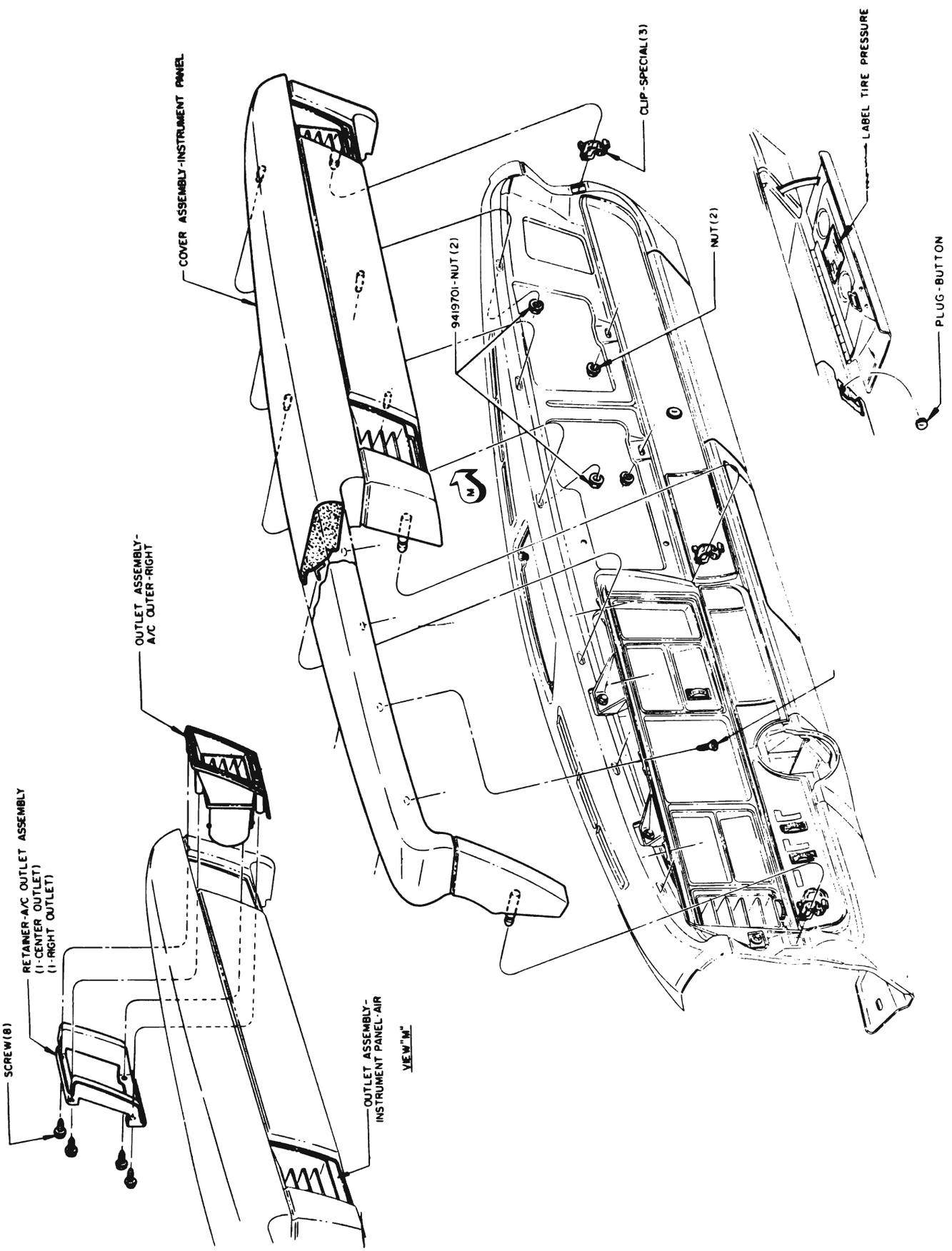


Figure 13-202 - 49000 Series Instrument Panel Cover

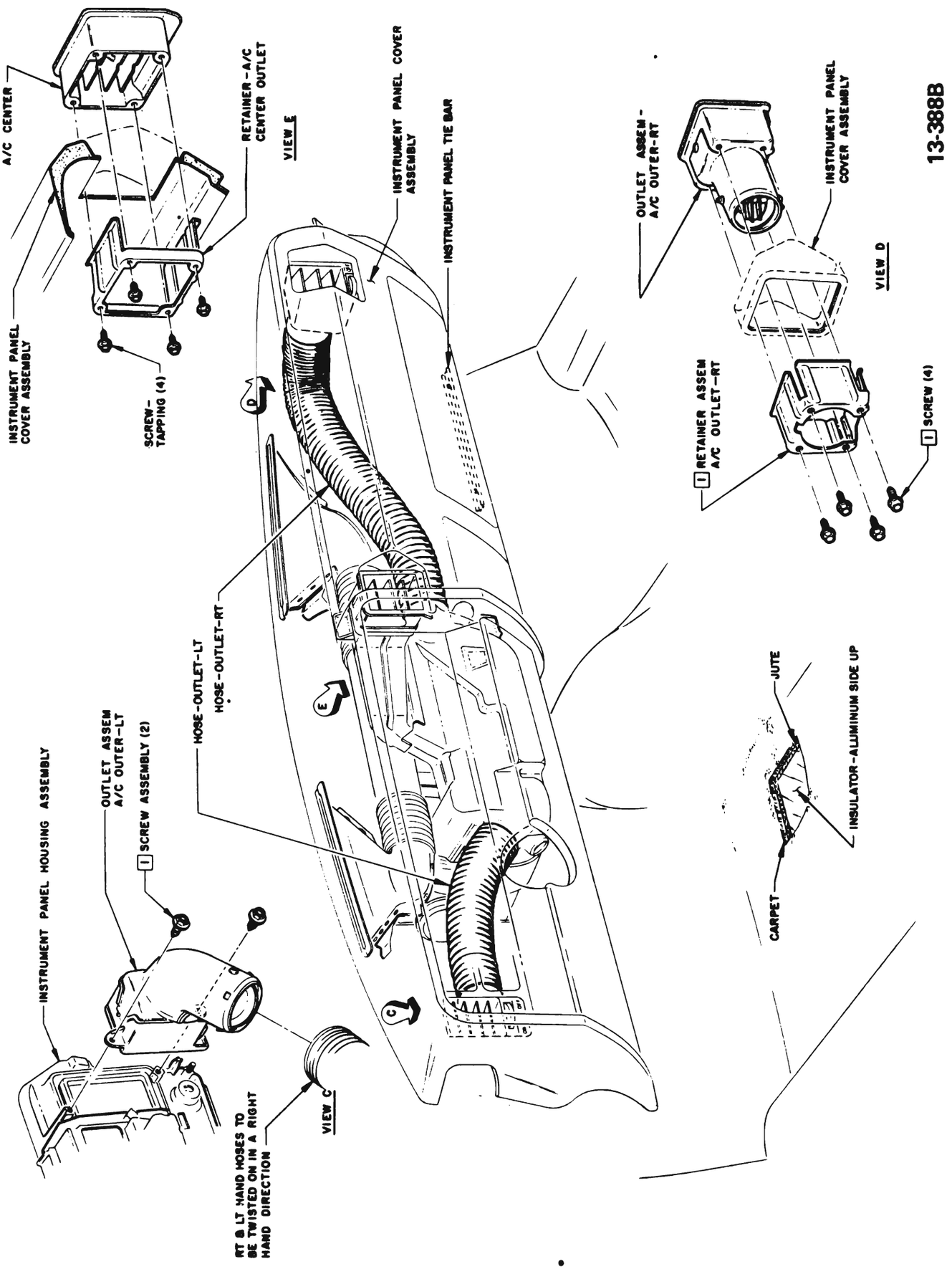


Figure 13-203 - 45-46-48000 Series Defroster Hose Installation

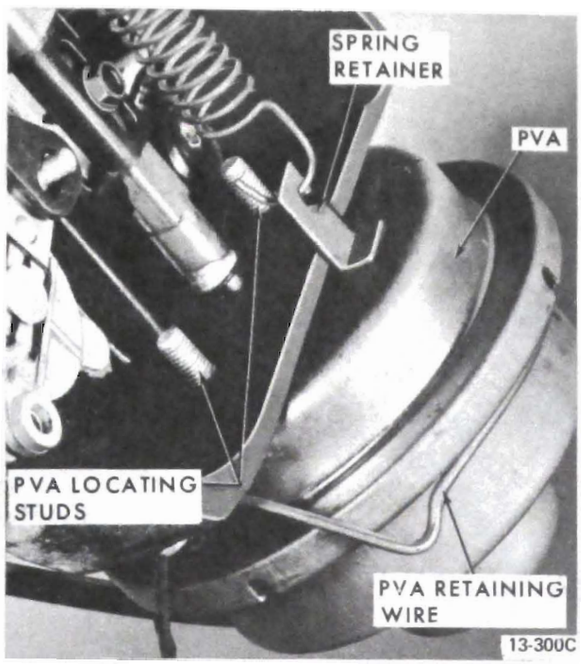


Figure 13-204 - 45-46-48-000 Series PVA Installation

13-105 ADJUSTMENT OF THERMOSTATIC VACUUM REGULATOR (TVR)

VACUUM RELAY

1. If vacuum to pilot side of PVA drops off more than 0.5" and will not hold at this point when smaller diameter black hose in removed from TVR, the TVR is defective and must be replaced.

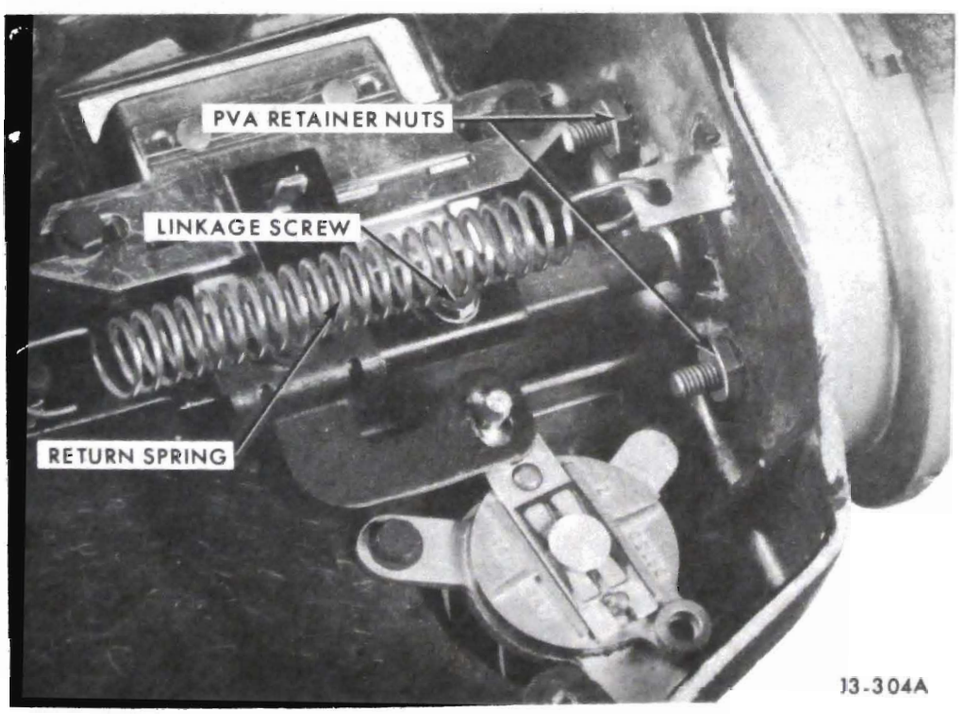


Figure 13-205 - 49000 Series PVA Installation

VACUUM REGULATOR

2. If the system remains in maximum heater after hot soak (in-car temperature over 65° and higher than mabient temperature), a malfunction of the TVR is possible. Check for source vacuum to TVR (smaller black hose), then check TVR regulated vacuum output (brown hose). If there is source vacuum to TVR but no regulated output vacuum to PVA with the in-car temperature over 70 F., a TVR replacement is required.

3. Check to see if range adjustment will correct this condition, if not, a TVR replacement is required.

RANGE

NOTE: *Vacuum relay must be checked before any range adjustment is attempted.*

The following chart lists approximate garage temperature and corresponding PVA pilot side vacuum approximately one minute after start-up with ambient drive hose removed from TVR.

Temperature	PVA Vacuum		
100°	8.7"	70°	2.7"
90°	6.7"	60°	0.7"
80°	4.7"		

PVA Vacuum is + or - O.5".

4. With TEMPERATURE Lever in middle of range, operate the system until the in-car temperature stabilizer (such as running for 20 minutes with windows and doors closed).

5. The in-car temperature, as measured at drivers' breath level, should be 72° to 78° F. with TEMPERATURE lever in middle of range. If the in-car temperature is not in the 72° to 78°F. range, a Bowden cable or range adjustment is required.

a. Bowden Cable Adjustment

1. Sub-assemble control wire to instrument panel controls.

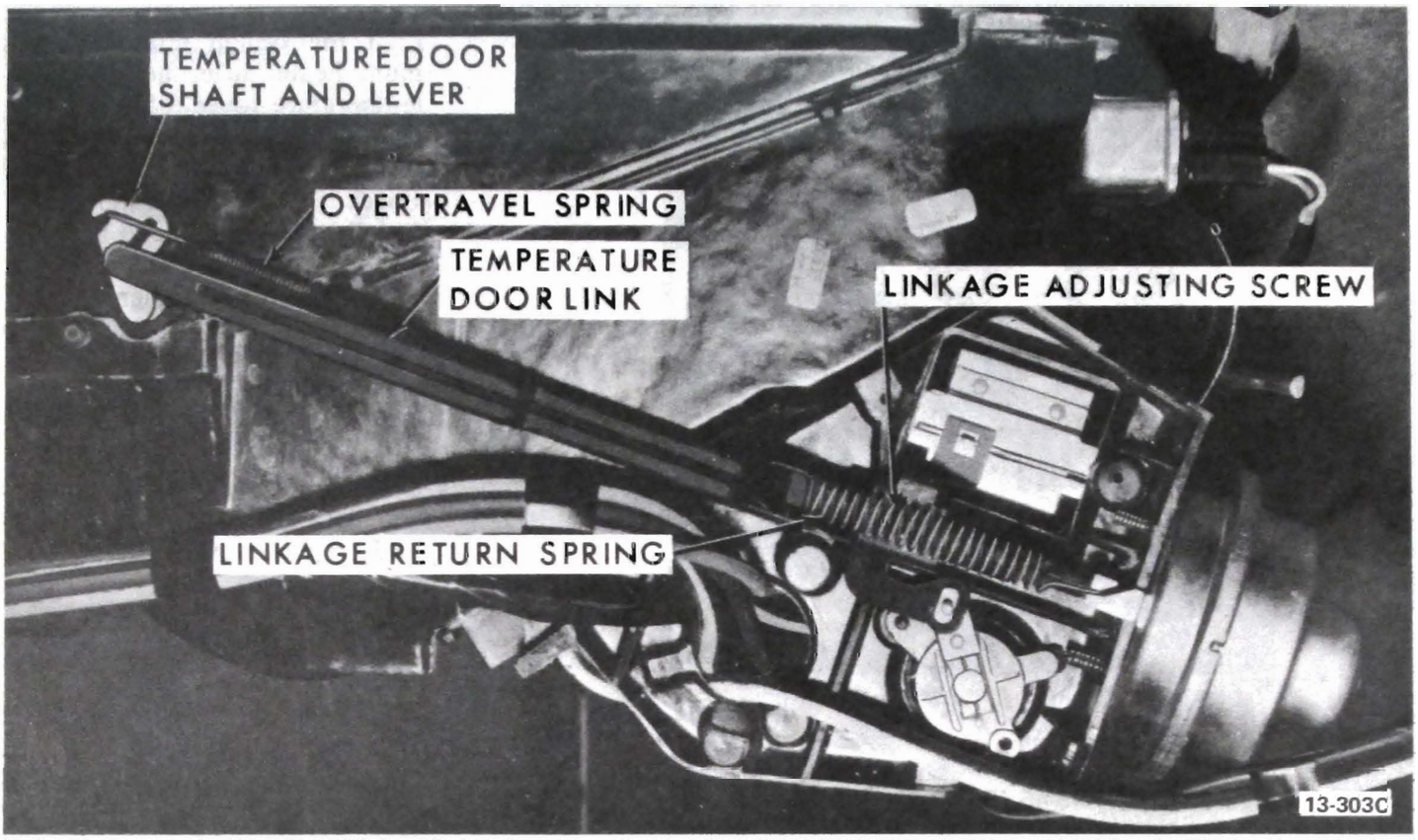


Figure 13-206 · 45-46-48000 Series PVA Linkage

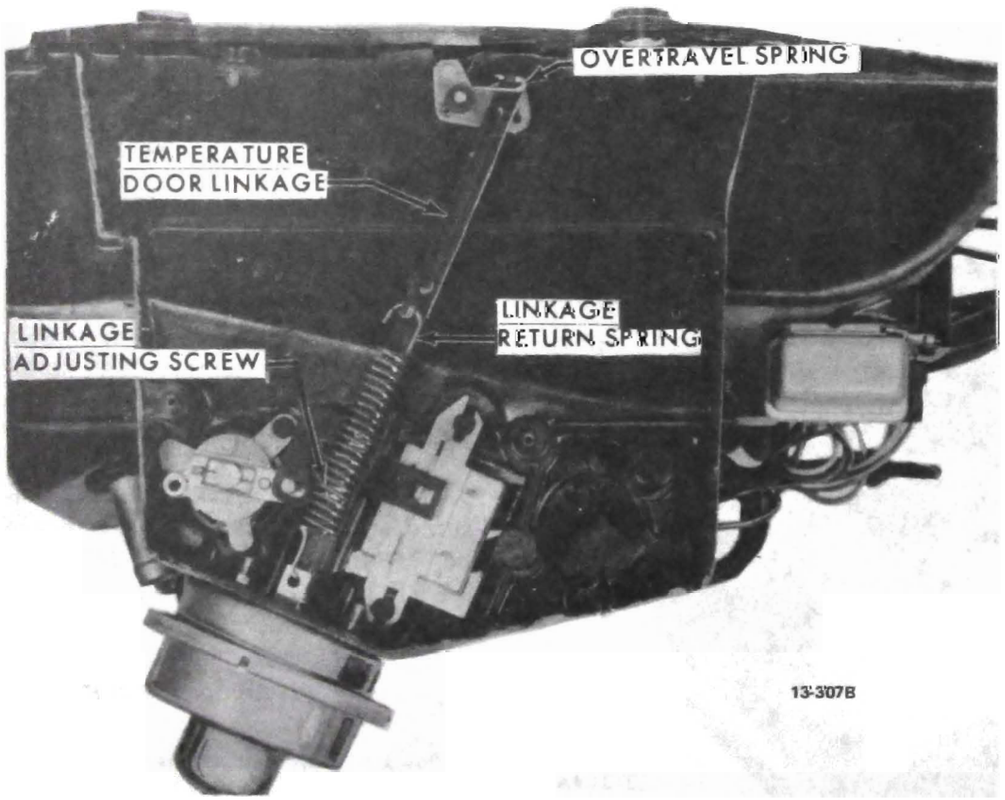


Figure 13-207 · 49000 Series PVA Linkage

2. Temperature wire (red).

a. Remove spring retainer from temperature control lever on thermostatic vacuum regulator.

b. Secure temperature wire to temperature control lever.

c. Adjust temperature wire so that 1/8" spring back is obtained in cool position.

b. Range Adjustment

With TVR vacuum relay checked and Bowden cable adjusted, and improper breath temperature continues, adjust the TVR range screw in to lower temperature range, or out to raise temperature range. A change of approximately 5° will be obtained by turning the range screw 1/8 turn. See Figure 13-214 view A. The range screw is properly adjusted when the in-car temperature, as measured at the drivers' breath level, is 72° to 78° F.

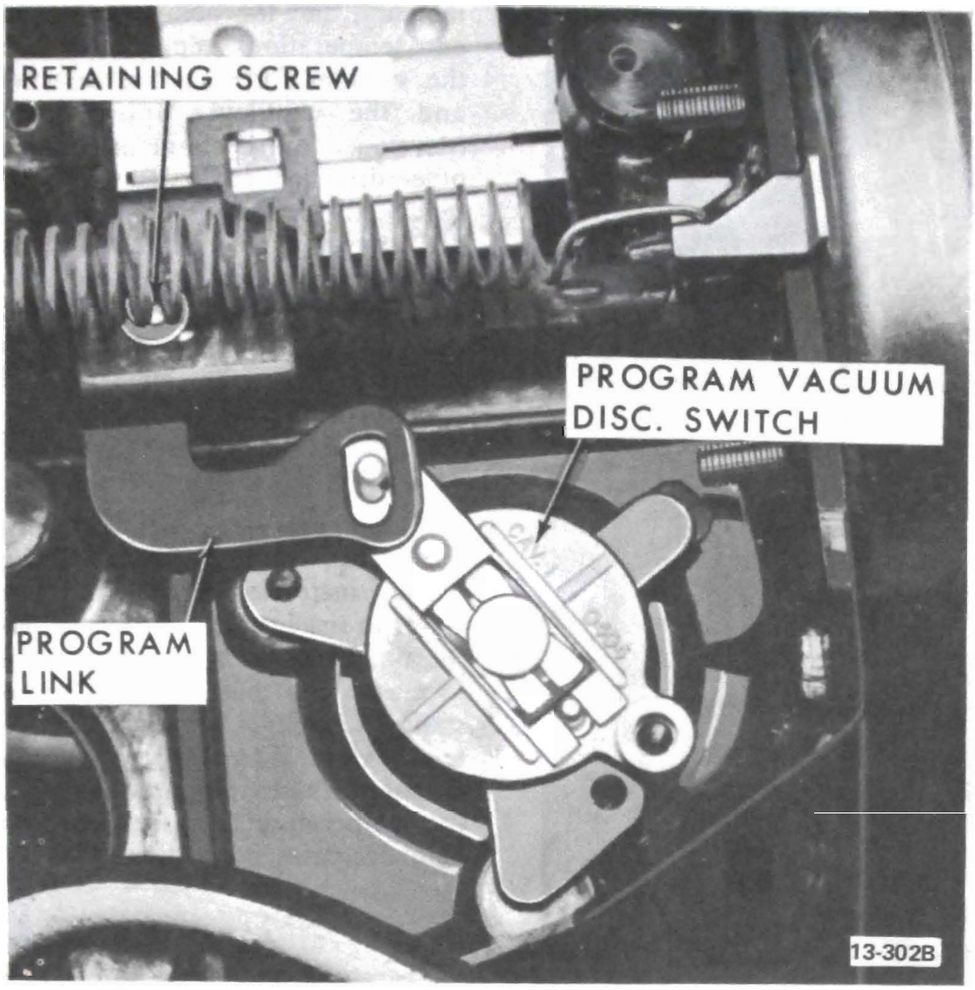


Figure 13-208 - 45-46-48000 Series Adjust Program Vacuum Disc Switch

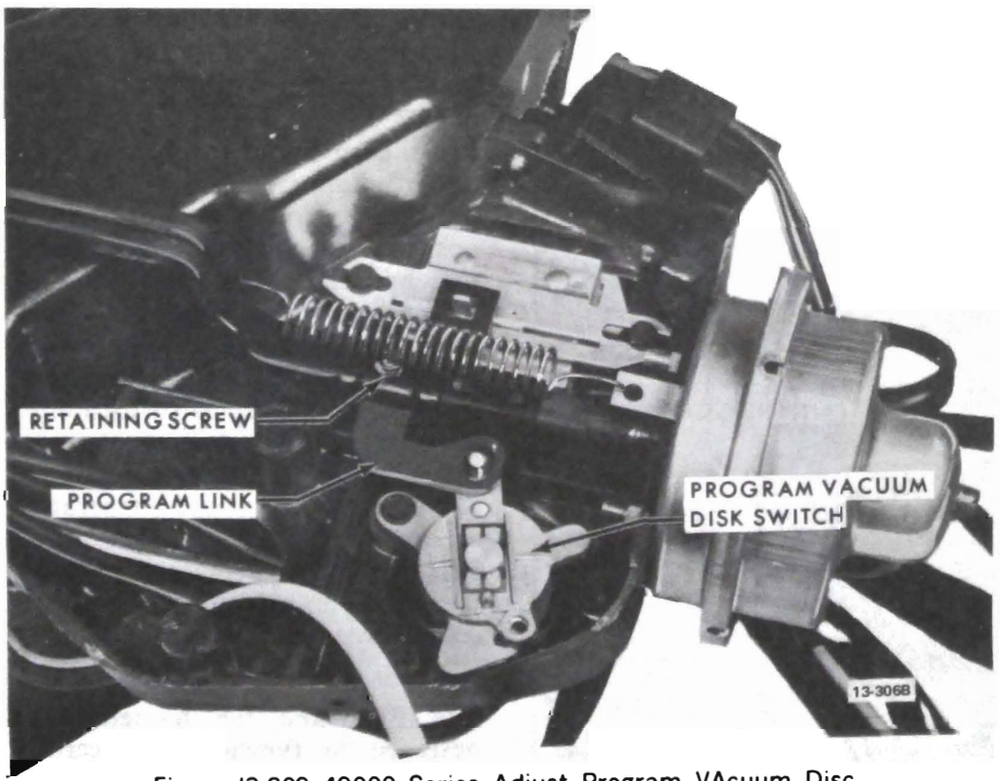


Figure 13-209 49000 Series Adjust Program VAcuum Disc Switch

DIVISION II

DESCRIPTION AND OPERATION

13-108 GENERAL DESCRIPTION

The Buick Automatic Climate Control (ACC) is a thermo-mechanical system utilizing two bi-metal sensors, one sensing breath (in-car) air temperature and the other sensing ambient (outside) air temperature. The bi-metalic Thermostatic Vacuum Regulator (TVR) provides a vacuum output that is proportioned to the breath and ambient air temperatures. The vacuum output operates the Piloted Vacuum Actuator (PVA) which in turn regulates the blower motor speed, positioning of the temperature door, heater-air conditioner (Mode) door and the outside-recirculated air (Air Intake-A.I.) door. The systems for the 45-46-48000 Series and 49000 Series use basically the same components, however, they are located in different areas due to variations in design of the dash and instrument panels. See Figure 13-221 for 45-46-48000 Series. See Figure 13-222 for 49000 Series.

PURPOSE OF THE THERMOSTATIC VACUUM REGULATOR (TVR) AND HOW IT WORKS

The two sensors are located in the TVR which is mounted behind the instrument panel cover and above the glove compartment. The TVR is the "brain" or prime component of the ACC system. See Figure 13- 214 view A. Ambient air is blown through a tube attached to the Plenum Blower Assembly (PBA) on 45-46-48000 Series or Evaporator Blower Assembly (EBA) on 49000 Series. Breath air is aspirated to the TVR by the action of the ambient air passing through a nozzle in the TVR. See Figure 13-214 view B. The response of the bi-metals, as ambient and breath air pass over them, is converted into a mechanical action to regulate vacuum to the PVA.

Figure 13-210 - 45-46-48000 Series Adjust Blower Switch

As shown in Figure 13-223, two bi-metals connected by a push-pin are arranged as a cantilever spring, pulling on a ball valve. Regulated vacuum pulls on the other side of the ball.

If the spring tension is set for a particular vacuum, say 5 inches of mercury, and the breath and ambient temperatures remain constant, the vacuum force in one direction and the cantilever spring force (developed by the bi-metals) in the other direction are balanced. If the regulated vacuum should start to drift upwards, the increased vacuum force pulls the ball open and more air bleeds past the ball to maintain the original 5 inches regulated vacuum. Thus, the regulator will maintain constant output as the manifold vacuum changes.

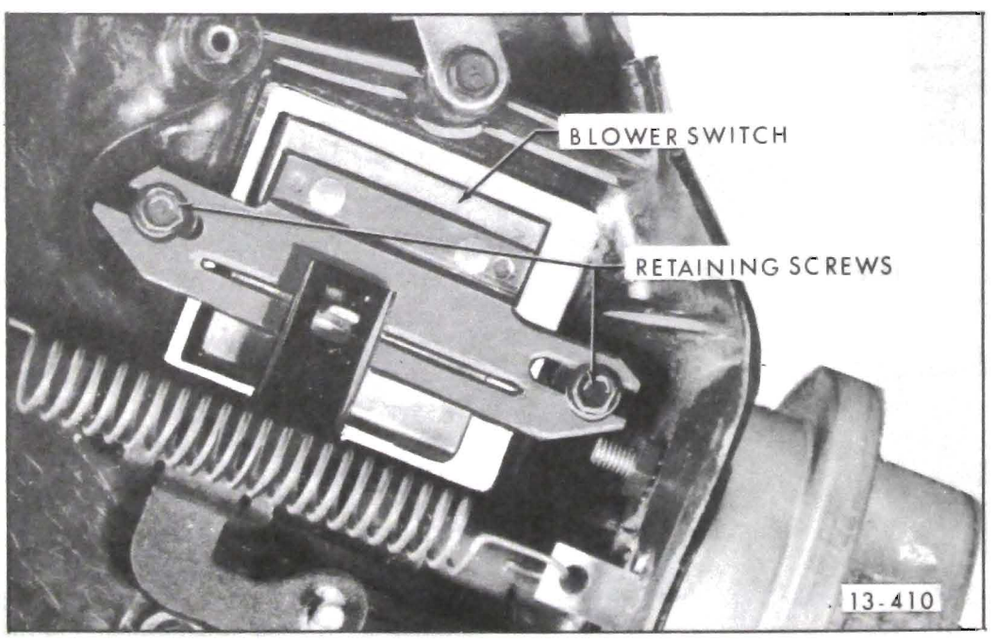


Figure 13-211 - 49000 Series Adjust Blower Switch

If the breath or ambient temperature rises, the bi- metal spring tension increases, the ball is pulled closer to the seat, less air bleeds past the ball, and the regulated vacuum increases. We thus have a Thermostatic VAcuum Regulator--as the temperature increases the vacuum output increases proportionately; as the temperature decreases, the vacuum decreases proportionately.

In order to control discharge air temperature, and hence in-car temperature, the thermostatically regulated vacuum is applied to a spring-loaded vacuum actuator which moves the temperature door. As shown in Figure 13-224, as the regulated vacuum increases, it pulls harder against the PVA spring, and the linkage return spring causes the power diaphragm to follow and move the temperature door to a new position toward air-conditioning, thereby delivering colder air. Thus, the temperature door angle and hence, the discharge air temperature, is proportional to the regulated vacuum. As the regulated vacuum is proportional to ambient and in-car temperature, the TVR/PVA system will cause the discharge temperature to become cooler in warmer ambients and in-car temperatures. This design is called a "proportional" control system.

The PVA and the bi-metals are designed to function over certain temperature and vacuum ranges. These are called bandwidths.

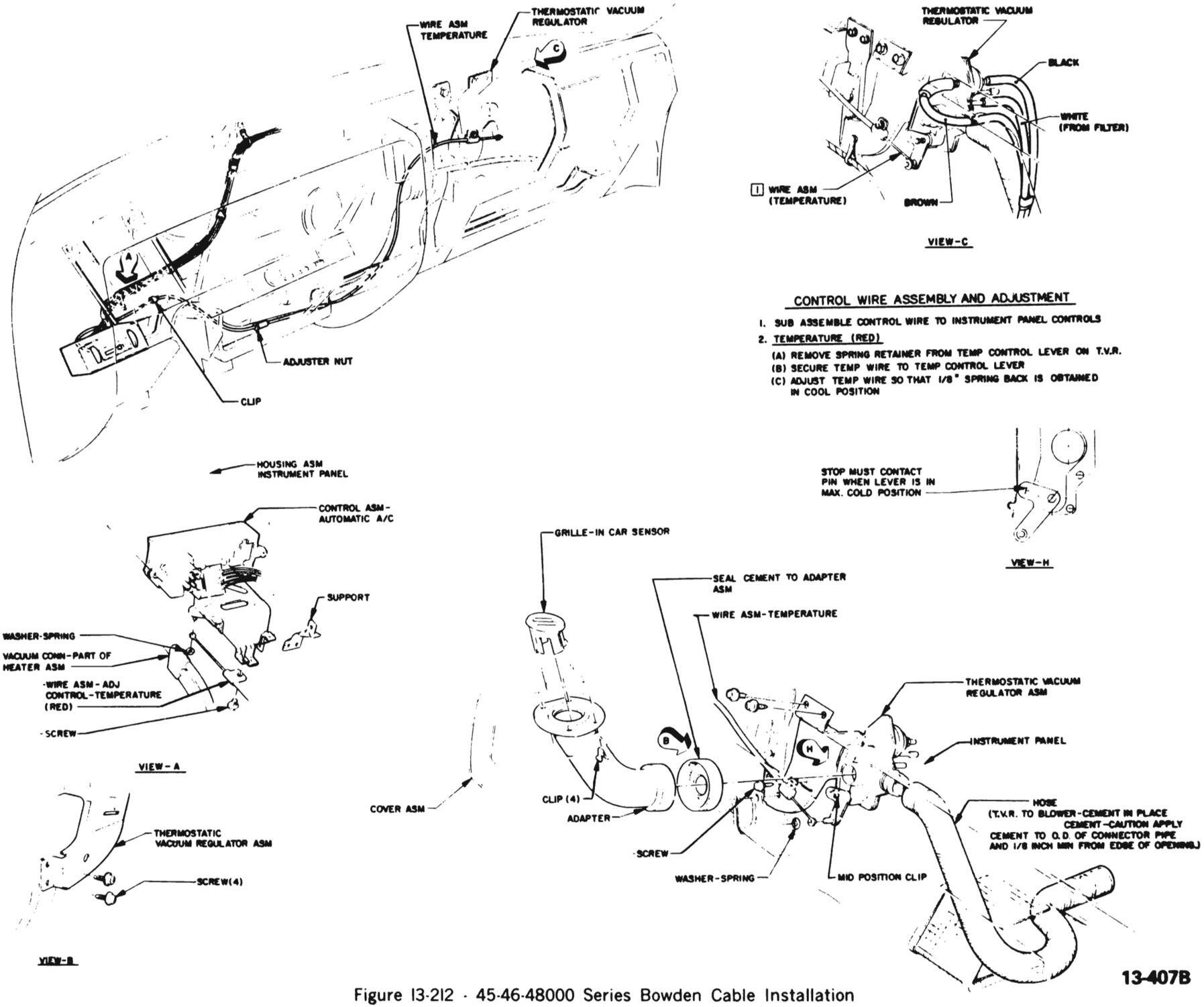


Figure 13-212 - 45-46-48000 Series Bowden Cable Installation

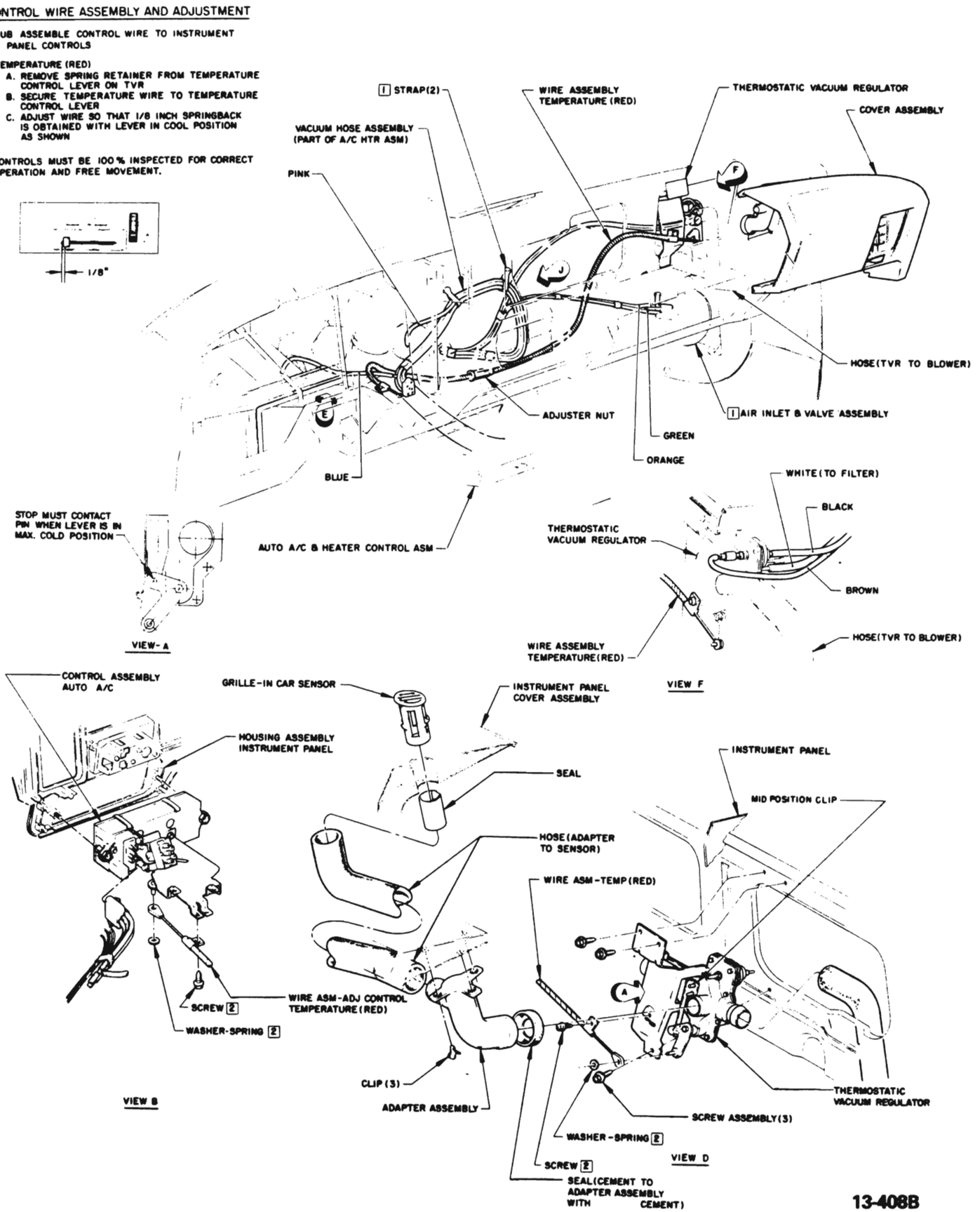


Figure 13-213 - 49000 Series Bowden Cable Installation

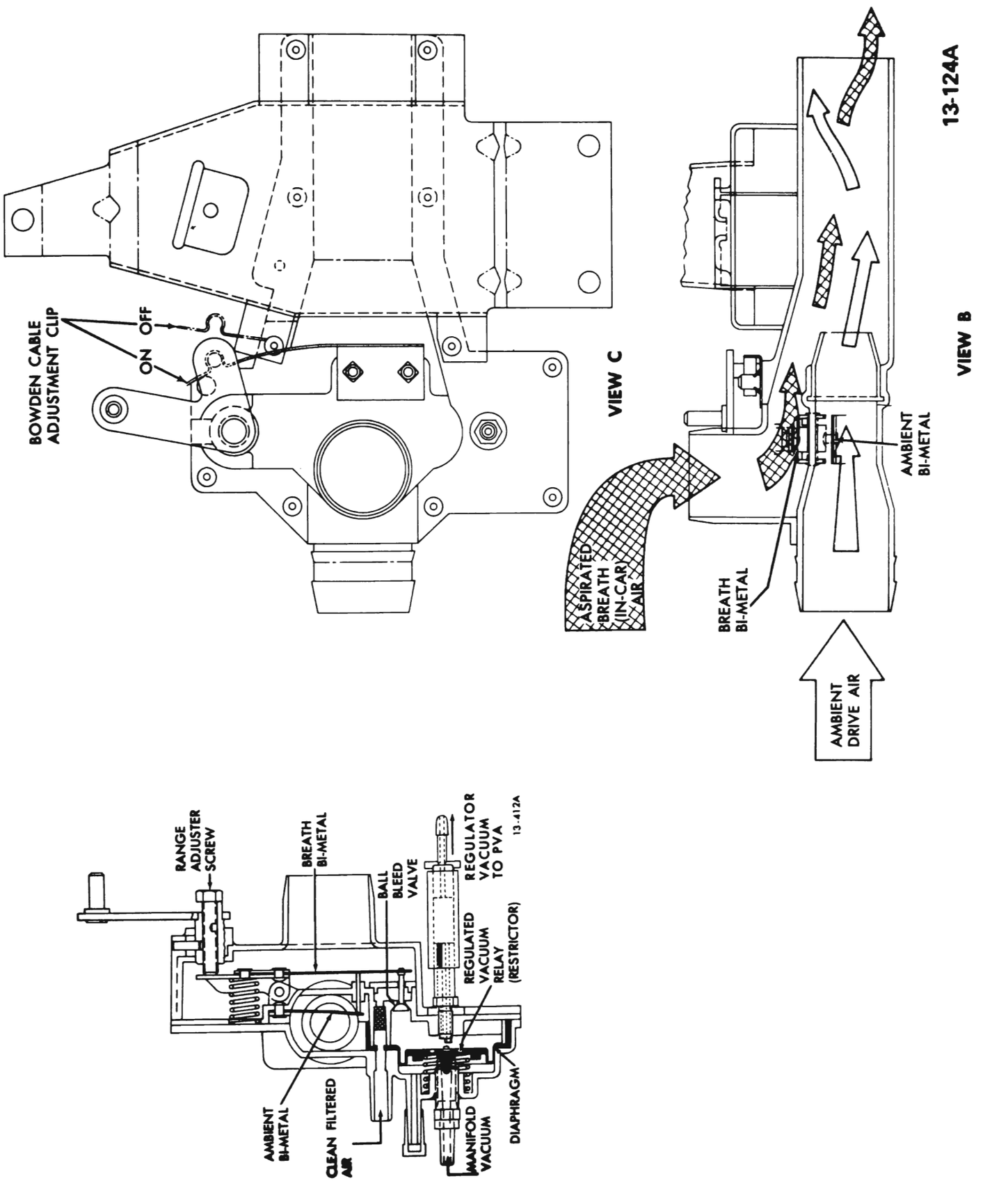


Figure 13-214 Thermostatic Vacuum Regulator

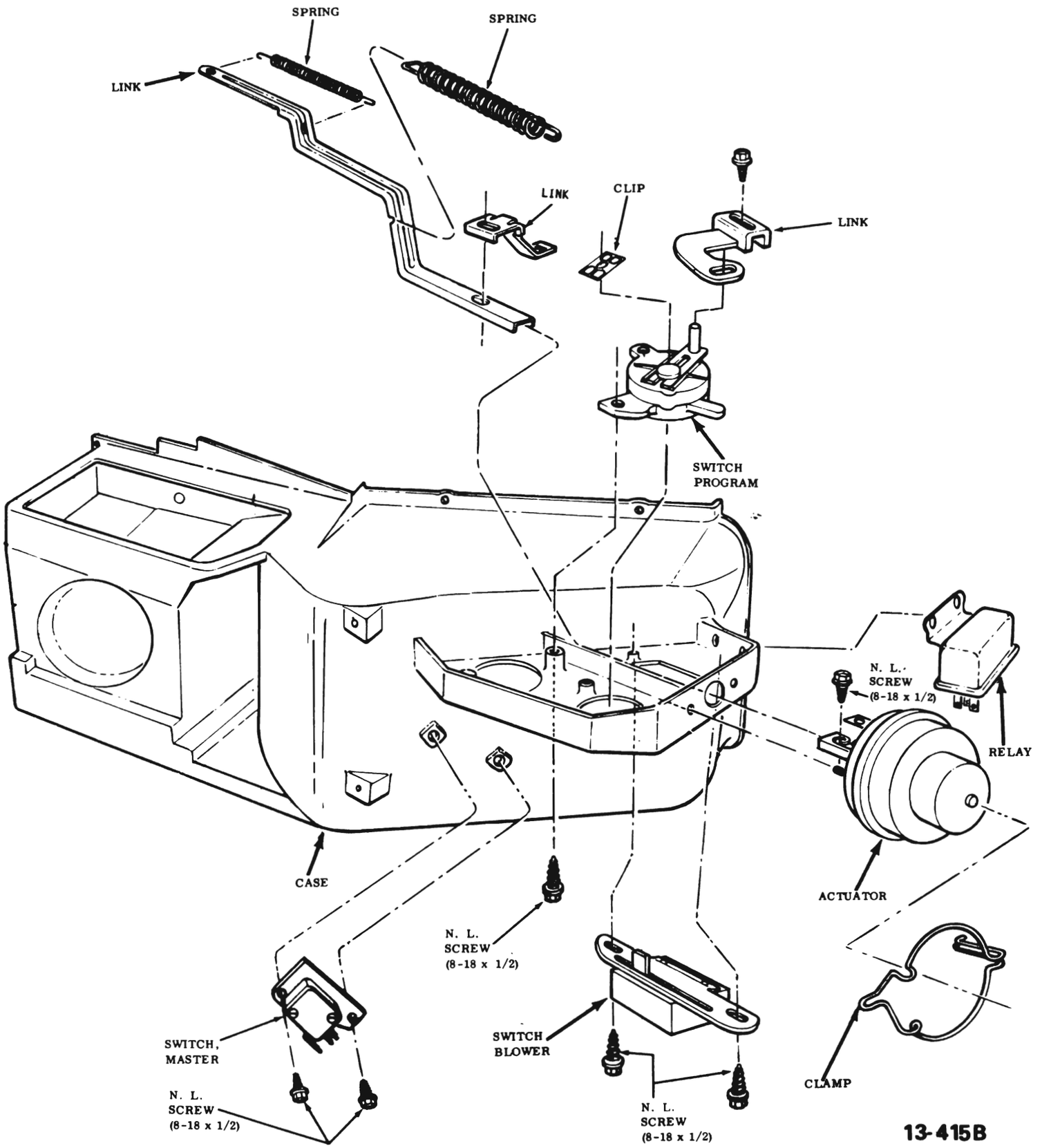


Figure 13-221 - 45-46-48000 Series Heater-Air Conditioner Case Assembly

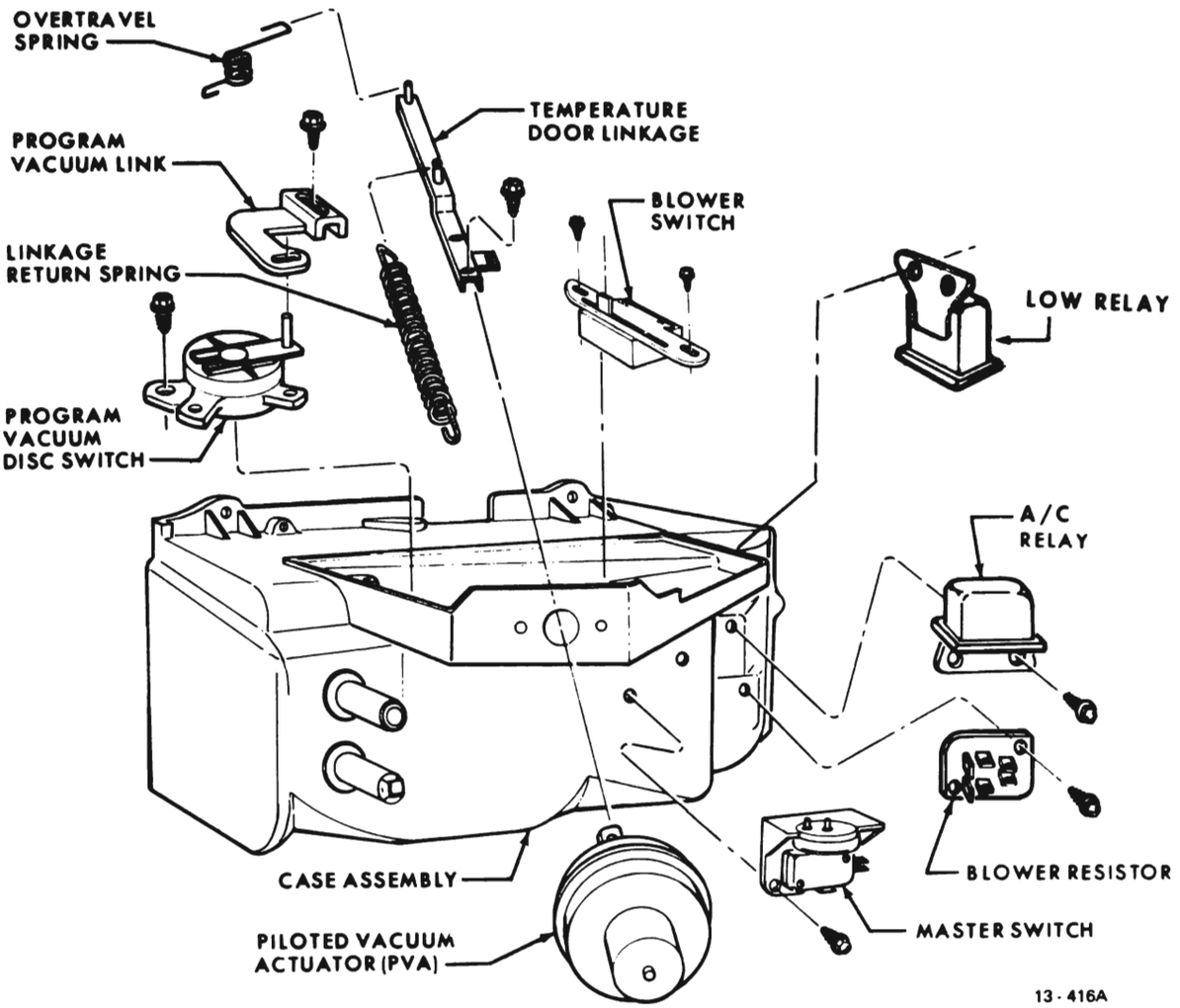


Figure 13-222 - 49000
Series Heater-Air Conditioner Case Assembly

As shown in Figure 13-225, if the breath air temperature is such that the temperature door is in midposition, breath air temperature must INCREASE to move the door to provide a cooler discharge temperature.

The number of °F. change in breath air temperature required to move the PVA through full stroke is the proportional bandwidth. The breath bi-metal is designed to provide full PVA stroke over 28°F. EXAMPLE: In constant ambient, for a breath bandwidth of 28°F. (

or - 14° from mid-position) and the PVA starts in mid-position at 75°F., then the PVA reaches maximum A/C at 89°F. breath temperature and maximum heater at 61°F. breath temperature. Intermediate positions are proportional to breath temperatures.

As mentioned earlier, the TVR maintains a constant regulated vacuum output as the manifold vacuum varies. This statement is correct as long as the manifold vacuum remains above the regulated output level. However, as the engine approaches wide open throttle, as during heavy accelerations and on long grades, the manifold vacuum will decrease to nearly 0" Hg.

Again looking at Figure 13-214, view A shows a Regulated VAcuum Relay (RVR) with a diaphragm blanced between manifold and regulated vacuum. As the manifold vacuum drops near the level of the regulated vacuum, the diaphragm blocks off the vacuum supply to the PVA. This holds the temperature door stationary until the manifold vacuum rises. Thus, during heavy throttle operation, the temperature door locks into position until the throttle is released.

In addition to the lock-out feature, the RVR is also designed to provide a regulated vacuum to the ball valve, thereby eliminating any variations caused by fluxuations in source vacuum. The small hole in the diaphragm and regulator spring are calibrated to maintain a minimum of 3" Hg. vacuum differential between regulator source and output vacuums.

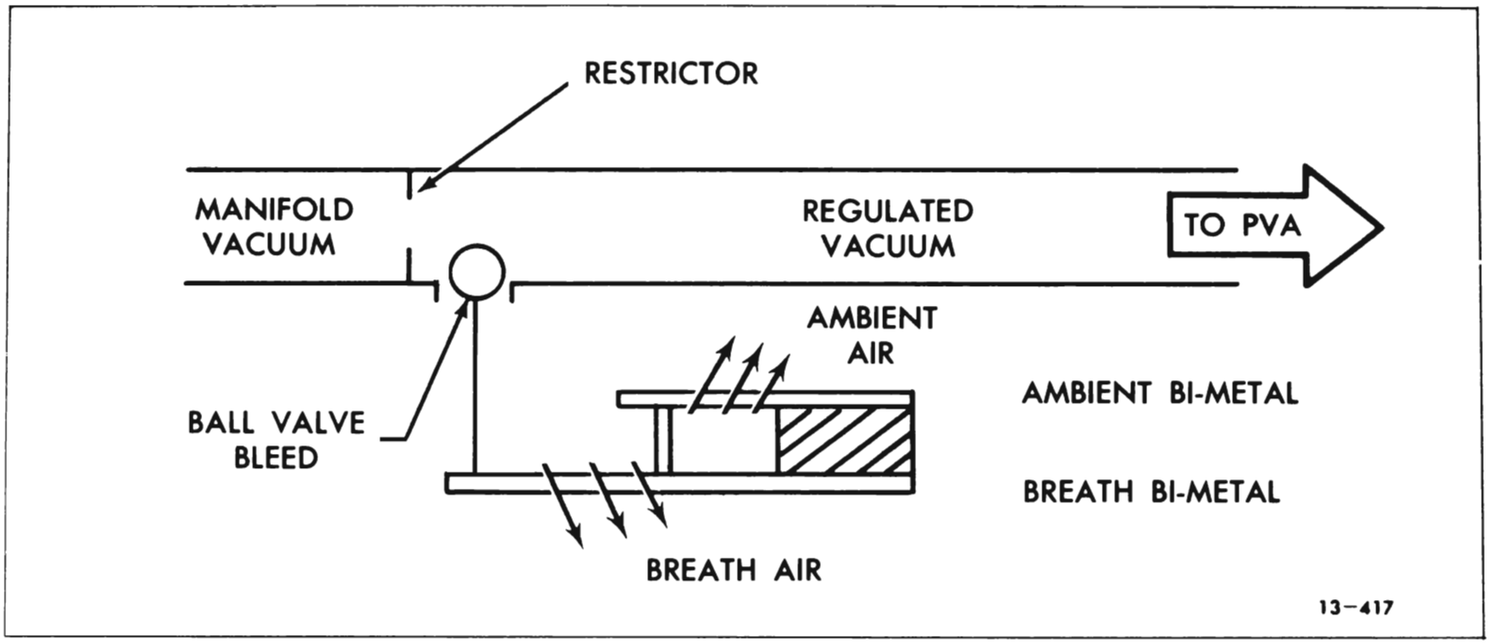


Figure 13-223 Thermostatic Vacuum REGULATOR Schematic

It may be noted at this point that clean (filtered) air is supplied to the TVR so that the ball valve and seat will not become contaminated and cause the ball to stick to the seat.

PURPOSE OF THE PILOTED VACUUM ACTUATOR (PVA) AND HOW IT WORKS

In the previous illustrations, we referred to the PVA as a simple spring-loaded vacuum actuator. This, however, is not actually the case as can be seen in Figure 13-226 and the following information.

The PVA has two diaphragms, a pilot diaphragm and a power diaphragm. Thermostatically regulated vacuum is applied to the pilot diaphragm which takes a position proportional to the amount of vacuum applied. Air then bleeds in, between the two diaphragms from the external vent holes and flows through the hole in the center of the power diaphragm. This bleed flow

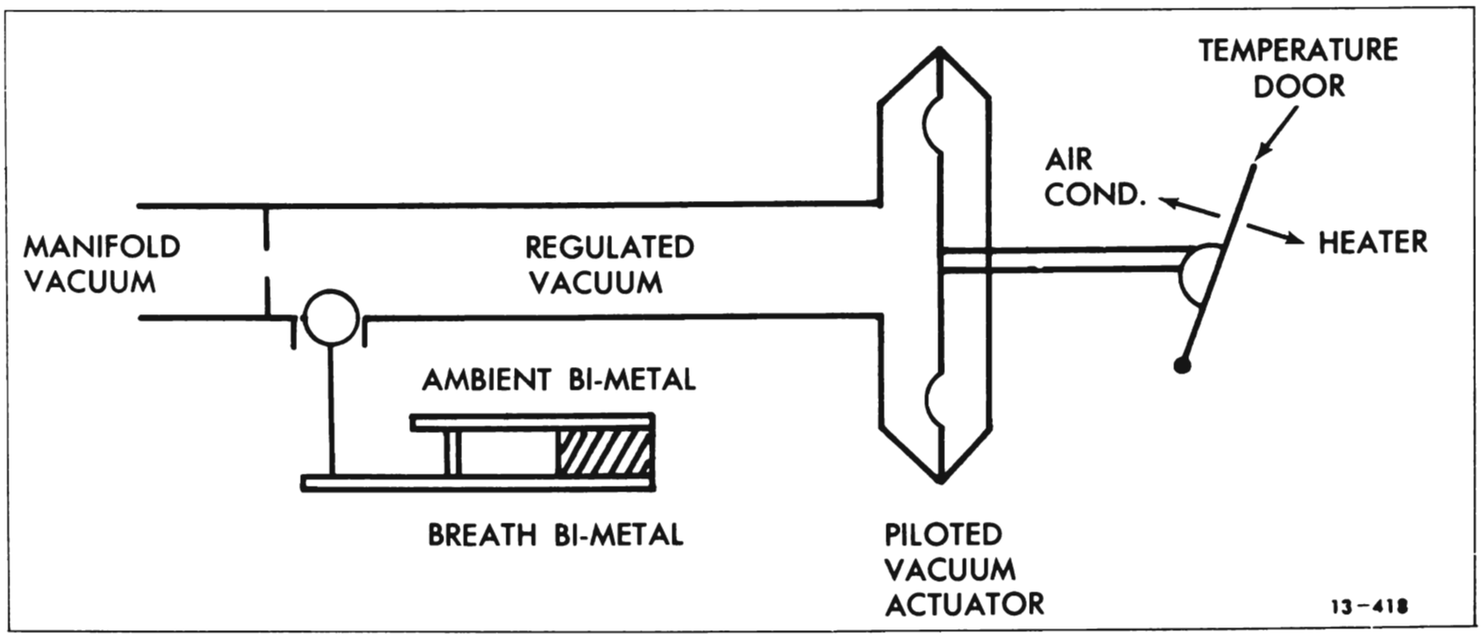


Figure 13-224 Operation of Thermostatic VAcuum Regulator and Piloted VAcuum Actuator

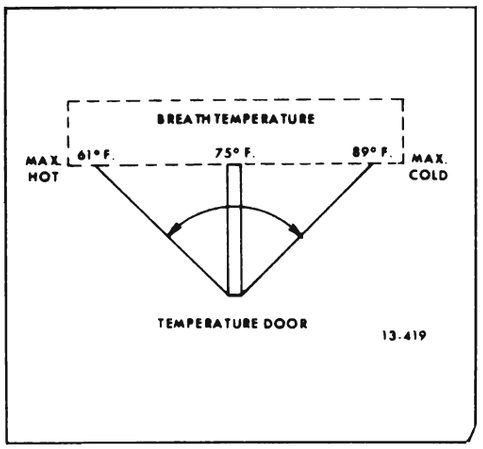


Figure 13-225 Temperature Door Angle

overcomes the manifold vacuum so that the vacuum under the power diaphragm decreases. As the PVA linkage return spring is connected to the power side of the PVA, its force then pushes the power diaphragm toward the pilot diaphragm. As the power and pilot diaphragms approach each other, the bleed hole in the power diaphragm is throttled. When the bleed flow equals the manifold flow, the power diaphragm stabilizes.

If the TVR regulated vacuum varies slightly, the pilot diaphragm is free to move with no system resistance. If it moves towards the power diaphragm, it seals the bleed hole so that manifold vacuum pulls the power diaphragm back to a stabilized position; if it moves away, it opens the bleed hole so that excess bleed flow overcomes the manifold vacuum capacity and the return spring drives the power diaphragm back to a stabilized position.

The system will react to a change as small as 0.5 inch of regulated vacuum.

FUNCTIONS OF TEMPERATURE PROGRAM

The basic functions are programmed on discharge temperature (or temperature door angle) and are divided into vacuum functions and electrical functions as follows:

a. Vacuum Functions

1. Heater vs. A/C air distribution (mode).

2. Recirculated air vs. outside air source.

3. Water valve on vs. off.

These functions are obtained by a rotary vacuum disc switch driven by the PVA linkage. This switch is called the program vacuum disc switch.

b. Electrical Functions

The only electrical function programmed on temperature door angle is blower speed. The 1970 system uses a linear slide electric switch driven by the PVA linkage and will provide a five speed blower program in both heater and A/C when in "HIGH" selector position. In "LOW" selector position, the electrical circuit is arranged to obtain five speeds for heater and four speeds for air conditioning.

FUNCTIONS OF SELECTOR VACUUM AND ELECTRIC SWITCHES

The selector vacuum and electric switches are both of the linear design and are mounted "piggyback" on the instrument panel control assembly.

Figure 13-227 shows the SELECTOR switch position vs. selector vacuum and electrical functions.

AUXILIARY FUNCTIONS

a. Heater Warm-Up Delay

In cold ambients, the system must remain off until the engine coolant

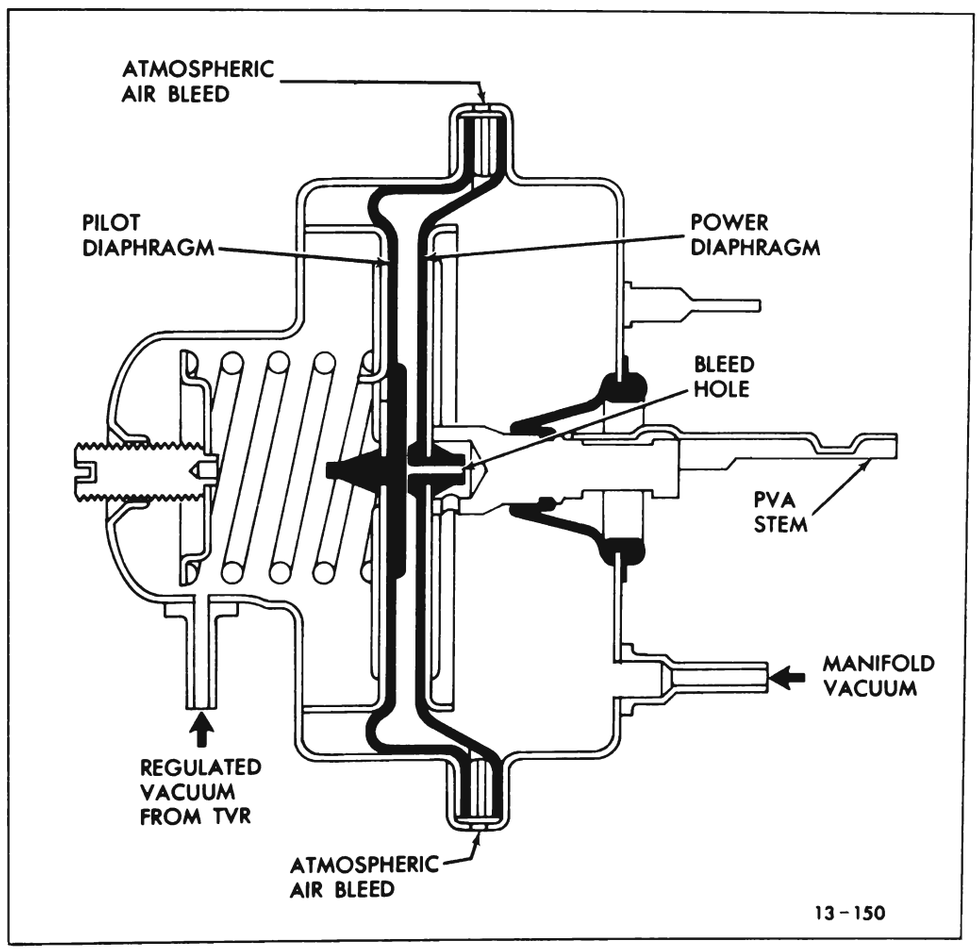


Figure 13-226 Piloted VAcuum Actuator - Cross Section

	OFF	LOW	HIGH	DEFOG	DEICE
AIR	NONE	SEE NOTE 1 OSA REC. AT MAX. A/C	SEE NOTE 1 OSA REC. AT MAX. A/C	SEE NOTE 1 OSA	OSA
DEFROSTER VALVE	1/8 OPEN	1/8 OPEN	1/8 OPEN	7/8 OPEN	7/8 OPEN
AIR DELIVERY (MODE)	NONE	A/C - HTR. PVA	A/C - HTR. PVA	HTR.	HTR.
BLOWER SPEED	NONE	SEE NOTE 2 RANGE 5.1 - 7.3 V.	SEE NOTE 2 RANGE 6.0 - 13.5 V.	SEE NOTE 2 RANGE 6.0 - 13.5 V.	FIXED 13.5 V.
TEMPERATURE VALVE	CONTROLED BY PVA	CONTROLED BY PVA	CONTROLED BY PVA	CONTROLED BY PVA	CONTROLED BY PVA
WATER	NO FLOW	CONTROLED BY PVA	CONTROLED BY PVA	CONTROLED BY PVA	CONTROLED BY PVA
COMPRESSOR	INOPERATIVE	CONTROLED BY AMBIENT SWITCH NO DELAYS	CONTROLED BY AMBIENT SWITCH NO DELAYS	CONTROLED BY AMBIENT SWITCH NO DELAYS	CONTROLED BY AMBIENT SWITCH NO DELAYS
WARM UP DELAY	INOPERATIVE	IN HEATER MODE	IN HEATER MODE	IN HEATER MODE	NONE
MASTER SWITCH	IMMEDIATE ELECTRICAL OFF	HTR. T.V.V. OR 15 SEC. DELAY A/C-15 SEC. DELAY	HTR. T.V.V. OR 15 SEC. DELAY A/C-15 SEC. DELAY MAX. A/C IMMEDIATE OVER-RIDE	SAME AS HI	IMMEDIATE OVER-RIDE BY SELECTOR SWT.

NOTES:

1. SUBJECT TO T.V.V. DELAY IN HEATER MODE.
2. NO HI BLOWER RELAY IN MAX. HEATER, HI BLOWER IS IGNITION VOLTAGE SPEED RANGE - LOW 5.1 - 5.6 - 6.7 - 7.3 (7.7 HEATER ONLY) HI 6.0 - 7.4 - 9.1 - 10.5 - 12.5 (13.5 A/C ONLY)

13-420A

Figure 13-227 SELECTOR Switch Position vs. Selector VACUUM AND Electrical Switch Functions

warms up to some minimum temperature level. A wax power element Thermostatic VACUUM Valve (TVV) mounted on the water valve is used. When the engine coolant temperature reaches 120°F., the vacuum valve will open, thereby supplying vacuum to the Air Inlet (A.I.) door diaphragm and a vacuum-electric master switch mounted on the case.

b. Heater Warm-Up Delay Bypass

In warm ambients, it is necessary to bypass the heater warm-up delay to start cooling the car immediately. In the 1970 system, the TVV is bypassed in the vacuum circuitry of the program vacuum disc switch when the sensors require an A/C mode start-up. The program vacuum disc switch is designed to provide this functions when the program is in A/C mode.

c. Blower Delay for Air Door Positioning

Because the volume of the vacuum circuits feeding the A.I. door diaphragm the PVA are greater than that supplying the master switch, it would be possible, on start-up to turn on the blower before the A.I. door and temperature door are properly positioned. To eliminate the possibliity of the blower being turned on before all system components are properly positioned as directed by the TVR, there is a delay restrictor (15-30 seconds) in the vacuum hose feeding the master switch. This delay will occur at all times except at "DEICE" or when the TVR/PVA program is calling for maximum air conditioning.

d. System Bleed Down When Engine is Stopped

When the engine is stopped and the engine coolant cools down, it is necessary to bleed the vacuum down to avoid immediate start-up when the engine is re- started. A sintered metal rivet is used to bleed down the vacuum circuit in 12-35 minutes after the engine is stopped. This bleed rivet has a low bleed rate (in order of 0.5 cubic foot per hour).

e. Compressor On/Off

The system has a bi-metallic compressor ambient switch mounted in the blower discharge of the PBA or EBA. The compressor is on at ambient temperatures above 45°.

THE PRINCIPLE OF BALANCED TEMPERATURES AND HOW APPLIED TO SYSTEM

The principle on which the system was engineered involves the maintaining of a balance of two temperature points: (1) the actual temperature of the car and (2) the temperature point at which the system was set to operate. When the actual temperature in the car is the same as the temperature at which the system was set to maintain, the system becomes balanced and stabilizes at the set temperature. The way in which the balance of the two temperatures is attained involves the method of moving the ball valve in the TVR which in turn controls the position of the PVA stem. When both temperatures (actual in-car temperature and the set temperature) are equal, the ball valve will assume a neutral position (floating just off the seat).

Whenever the actual and set temperatures differ, the ball valve will seat tightly on the seat or raise higher off the seat to control regulated vacuum to the PVA. When this occurs, the system will be out of balance and will begin developing heat and cold until these temperatures are equal again. The set temperature is obtained by the positioning of the lever on the TVR to increase or decrease tension on the end of the bi-metals opposite that of the ball valve.

HOW THE COMPONENTS OF THE SYSTEM WORK TOGETHER TO PRODUCE HEAT OR COLD

The way in which the system develops heat or cold when the ball valve in the TVR is unseated or seated is an follows. When the ball valve is unseated (for heat) or seated (for cold), regulated vacuum will be applied to pilot side of the PVA. Depending on the amount of vacuum applied to pilot side of PVA the stem of the PVA will be extended to drive the system toward a warmer setting or retracted to drive the system toward a cooler setting. As shown in Figure 13-228 the temperature door, blower switch and program vacuum disc switch are mechanically linked to the stem and are thereby affected by its movement. The blower switch controls the speed of the blower motor. Teh program vacuum disc switch affects the application of vacuum to the outsiderecirculated air door, the heater-air conditioner (mode) door, the master switch vacuum diaphragm and the water valve vacuum diaphragm. Therefore, as the PVA stem moves through its length of travel, the components directly affected by its extent of travel (the air doors, the blower motor and the vacuum diaphragms) will function in a predetermined sequence. Figure 13-229 diagrammatically shows the relationship between the extent of travel of the PVA stem and the sequence in which the affected components are acted on. As the stem of te PVA drives to one extreme or the other, the factors are programmed to cumulatively add or subtract from the cooling or heating of the system.

DETAILED DESCRIPTION OF TYPICAL SEQUENCE OF COMPONENT OPERATION

The following description explains in actual sequence of events, how the components of the system will react to (l) a temperature setting change and (2) an air temperature change.

Assume the system is operating under a condition wherein the temperature in the car coincides with the set temperature. When this situation exists, what has happened is that the sensors have positioned the ball valve at some point off its' seat so that the PVA is receiving a steady amount of regulated vacuum. Since the PVA is receiving a steady regulated vacuum to the pilot side, the pilot diaphragm is stationary. With the pilot diaphragm stationary, manifold vacuum has pulled the power diaphragm away from the pilot diaphragm far enough to allow a constant atmospheric air bleed between the two diaphragms and through the hole in the power diaphragm to offset manifold vacuum and the output temperature of the system is being held steady.

(l) System Reaction to Temperature Setting Change

If for instance, the instrument panel TEMPERATURE lever is moved to a If for instance, the instrument panel TEMPERATURE lever is moved to a warmer setting, the tension on the bi-metals is reduced thereby allowing the ball valve to float farther off the seat. This allows the pilot diaphragm in the PVA to move up to the power diaphragm throttling the atmospheric air bleed and allowing manifold vacuum in effect to pull both diaphragms.

The PVA begins to extend its stem thereby causing those components affected by it to reposition and produce more heat. As the PVA stem extends increasing the heat output, the in-car (breath) sensor immediately begins to respond to this increase in temperature and start to cause the ball valve to move back toward the seat. When the temperature in the car (actual temperature) reaches and coincides with the new set temperature, the ball valve is then floating at some point farther above the seat so that a steady but lower vacuum is applied to the pilot side of the PVA. The PVA stops moving and will hold the output temperature at this temperature point (set temperature point). Normally the system will drive hot and cold once or twice until the exact temperature setting is achieved. This hunting is caused by a slight overshooting of the temperature in the car as it adjusts to match the set temperature point.

(2) System Reaction to Air TEMPERATURE Change

When the temperature in the car varies due to normal leakage of air from the car, the door or window being opened momentarily, or a change in ambient temperature or sun load, the sensor will react to this temperature change and cause the ball valve to seat or unseat, automatically driving the system hot or cold until it re-establishes the car temperature at the level for which the TEMPERATURE lever was set. If the actual breath air temperature drops below the set temperature, the sensor will allow the ball valve to move farther off the seat and the system will start deliverying more heat. As the in-car temperature increases, the ball valve will change direction of travel (due to the difference in rate of expansion of the metals in the bi-metal sensor), gradually shutting off air bleed as the temperatures become equal again. Conversely, if the actual temperature rises above the set temperature, the sensor will force the ball valve to move closer to the seat causing the system to deliver more cool air. As the in-car temperature decreases, the ball valve will move farther off the seat until it again reaches a floating position.

13-109 DESCRIPTION OF SYSTEM COMPONENTS

The following description of each component will apply to all series cars. The description of the components is divided into two groups: the thermomechanical components and the program components. The thermomechanical components are those which respond to temperature changes and regulate the application of vacuum to the PVA, while the

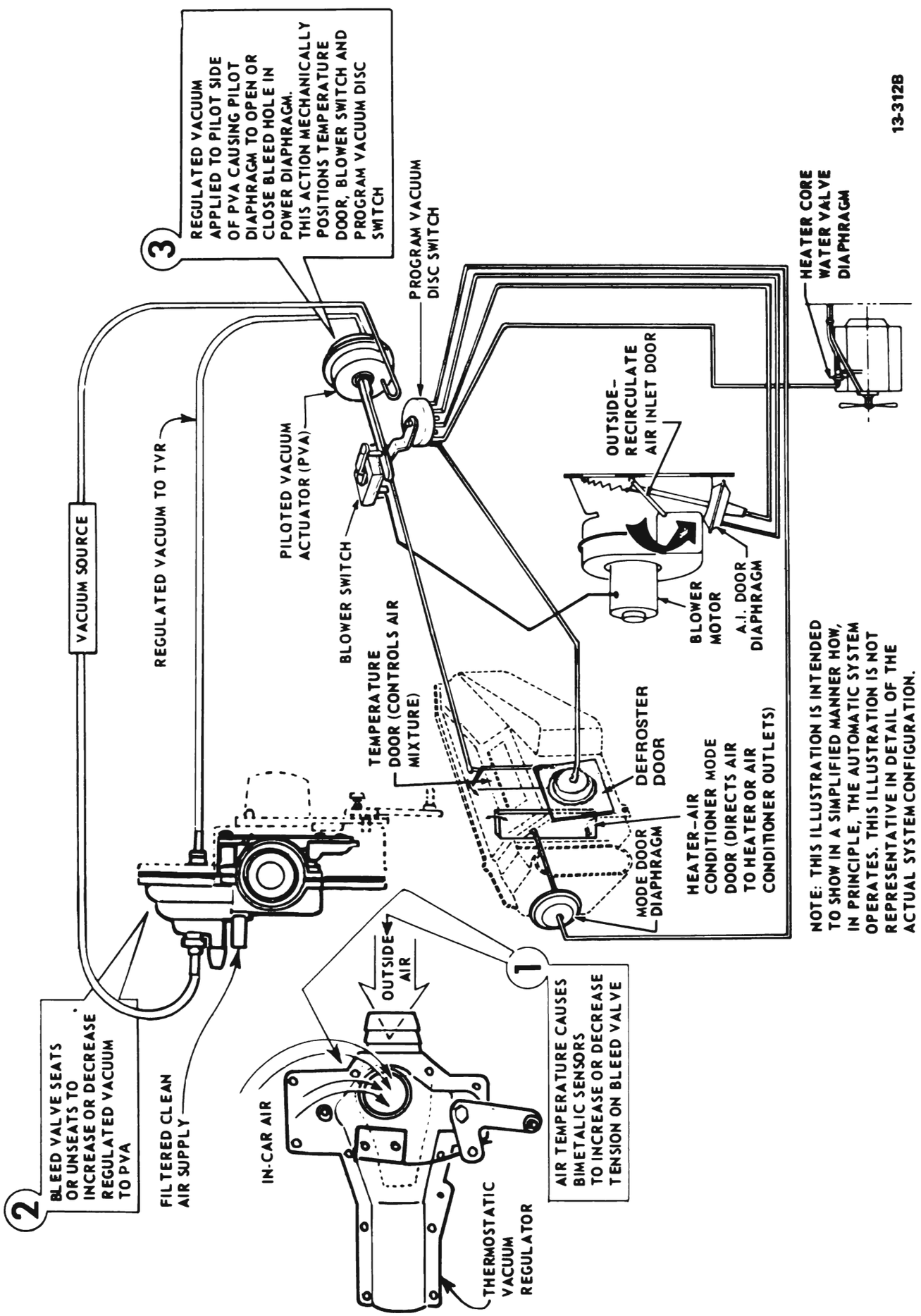


Figure 13-228 Simplified Diagram of Automatic Climate Control System

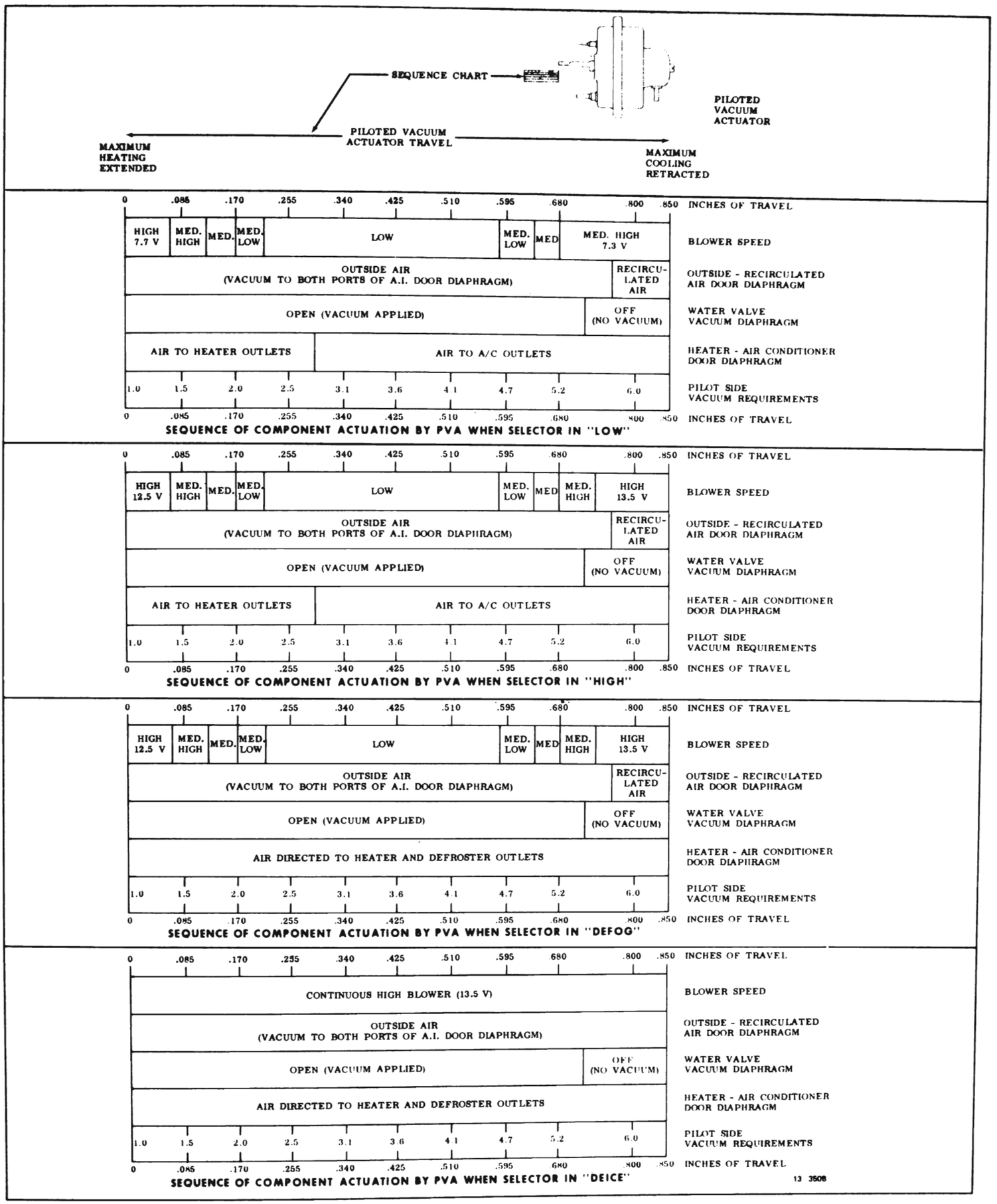


Figure 13-229 Automatic Climate Control Component Sequence Charts

components in the program are those which establish the mode of air delivery (heater or A/C outlets), quantity of air delivered (blower speed), type of air delivered (outside or recirculated air), ratio of air mixtures (temperature door position) and water valve and thermostatic vacuum valve function (on or off).

THERMOMECHANICAL COMPONENTS

a. The Sensors

The sensors work on a principle similar to that of a household thermostat. Each sensor consists of two strips of different metal bonded together to form one strip. The different rate of expansion or contraction of each metal of the sensor causes the sensor to bend varying amounts depending on the temperature of the air passing over the sensor. Depending on the expansion or contraction of the bi- metals, the ball valve is unseated or seated a specific amount. One sensor is situated in the TVR so that ambient air from the PBA or EBA will pass over it. The other sensor is situated in the TVR so that aspirated breath (in-car) air will pass over it. Both sensors are linked by a push pin so that the action of one sensor is transmitted to the other. See Figure 13-230.

b. TVR Ball Valve and Regulated VACUUM Relay (RVR)

The ball valve which is connected to one end of the breath sensor bi-metal regulates the amount of vacuum that exists in the regulated vacuum chamber. Vacuum is supplied to the chamber through a small hole in the TVR diaphragm plate which is called the Regulated Vacuum Relay (RVR).

Regulated vacuum from this chamber then passes through a hose to the pilot side of the PVA. With the ball valve at a steady position, a steady and specific vacuum is applied to the pilot side of the PVA. When the ball valve moves farther away from or closer to the seat, vacuum to the PVA is reduced or increased.

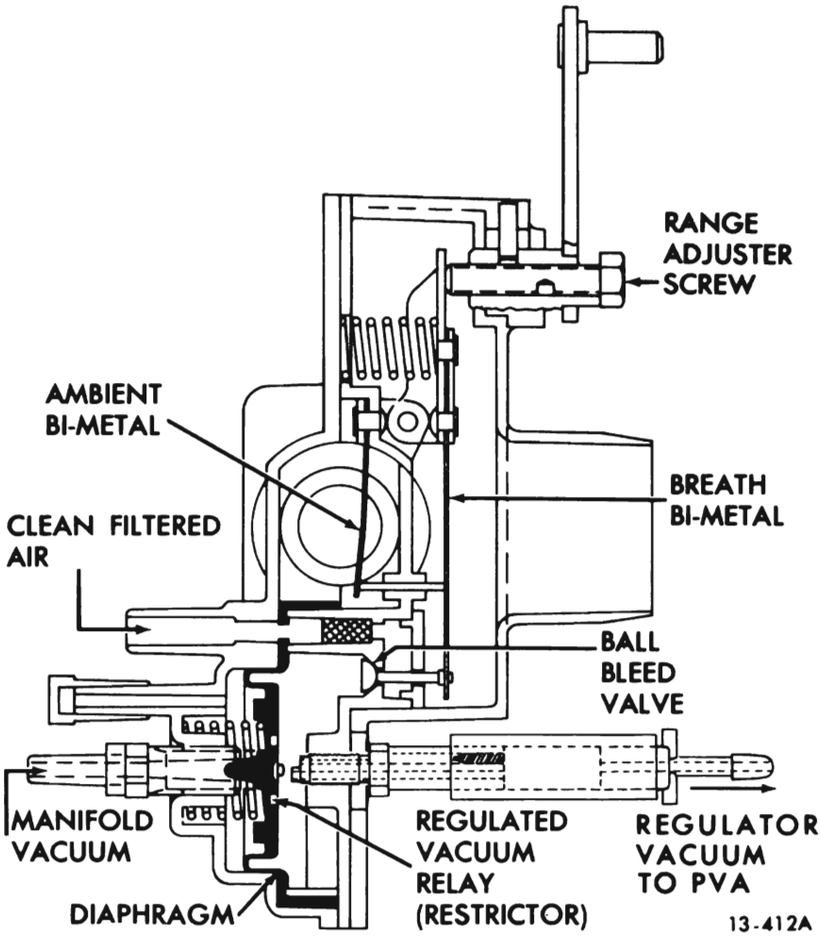


Figure 13-230 Thermostatic VACUUM Regulator

PROGRAM COMPONENTS

c. Piloted VAcuum Acutator (PVA)

The Piloted Vacuum Actuator (PVA) is a two diaphragm, sincle unit which has a regulated amount of vacuum applied to a pilot diaphragm and manifold vacuum applied to a power diaphragm. The power diaphragm has a small air bleed hole in the center so that manifold vacuum acting on the power diaphragm can be controlled. A stem attached to the power diaphragm is mechanically connected to the temperature door and moves the door whenever the power diaphragm changes position as determined by the pilot diaphragm. See Figure 13-226.

d. Temperature Door

The temperature door (See Figure 13-228) functions to regulate the air mixture. The duct air temperature is determined by the position of this door. Movement of the temperature door is in direct relation to movement of the PVA stem. The adjustment of the temperature door adjustable link to the temperature door shaft and lever assembly (See Figure 13-206 and 13-207) determines the maximum temperature of the air out of the A/C outlets before the air flow shifts to the floor outlets. This adjustment is sometimes referred to as the "mode shift point."

e. SELECTOR Switch, (Selector Vacuum Switch and Selector Electrical Switch)

These switches are located on the instrument panel control assembly.

These switches provide for manual setting of the selector vacuum and electrical switches. These two switches in turn control the application of vacuum and electrical power to the system. The selector vacuum switch, and the thermostatic vacuum valve (TVV), (See Figure 13-231).

The selector electrical switch is a linear switch and feeds power to the blower switch, compressor ambient switch, resistor block and A/C relay (See Figure 13-232 or 13-233). Placement of the SELECTOR switch in the "LOW", "HIGH", "DEFOG" or "DEICE" position provides different variations of control (See Figure 13-234). When the SELECTOR switch is in the "LOW" position, the selector electrical switch feeds power through an additional resistor giving variable blower speeds but at a voltage reduced from the voltage used in "HIGH". The temperature of the car under this condition is still under automatic control. When the SELECTOR switch is in "DEICE" position the blower motor operates only at high blower speed. The blower motor will turn on immediately when "DEICE" is selected or when the program vacuum disc switch is in the maximum air condition position. In all other positions there is a 15 to 30 second delay built into the system.

f. Power Vacuum Disc Switch and Blower Switch

On 45-46-48000 Series cars, the program vacuum disc and blower switches are located on the platform that is an intergral part of the air conditioner heater case assembly under the instrument panel (See Figure 13-208). On 49000 Series cars, these two switches are located on the air conditioner heater case assembly, however, the assembly is situated on the engine side of the dash panel (See Figure 13-209). These switches are directly linked to the PVA to temperature door linkage and provide for the application and automatic control of vacuum and electrical power as the PVA stem moves (See Figure 13-229). Figure 13-230 graphically shows the functional sequence in which the vacuum and electrical power are fed to the vacuum diaphragms, and the blower motor as the PVA stem moves through its length of travel.

g. Instrument Panel Control Assembly

The instrument panel control assembly (See Figure 13-212 and 13-213), has one lever and one switch. The TEMPERATURE lever sets the temperature at which the system is to operate. A temperature control Bowden cable connects the instrument panel TEMPERATURE lever to the temperature range lever on the TVR.

The SELECTOR switch controls the blower speed range in which the system will operate. It also controls operation of the vacuum operated defroster door.

h. Thermostatic VAcuum VAlve (TVV)

The Thermostatic Vacuum Valve (TVV) is a temperature sensititve vacuum valve which is mounted on the water valve (See Figures 13-235 and 13-236). Mechanically the switch consists of a power element cylinder containing a temperature sensitive compound and a piston. When the engine is cold and the coolant has not yet warmed up, vacuum passage through the TVV (See Figure 13-237) is blocked. When the engine coolant temperature reaches a specific range (100° to 125°F.) the compound in the cylinder of the TVV expands and pushes the piston to a point where it opens the vacuum ports permitting flow of vacuum from the selector vacuum switch to the master switch vacuum diaphragm and outside-recirculated air door diaphragm. The TVV serves to delay the start-up of the system until sufficient heat is available. This is accomplished by blocking vacuum to the vacuum actuated electrical master switch thereby preventing the switch from closing and operating the blower motor. The TVV also blocks vacuum to the outside-recirculated air door diaphragm on cold days keeping the door closed so that no air enters the system. When the SELECTOR switch is in "DEICE" position, the TVV is bypassed allowing the blower to operate immediately without waiting for the engine coolant to warm-up.

i. Compressor Ambient Switch

This switch is a bi-metal unit that mounts in the PBA/EBA. See Figures 13-238 and 13-239. This switch senses the temperature of the outside air and will close (permitting compressor to operate) at 45°F. maximum or opens (Breaking circuit of compressor) at 25°F. minimum. This switch is in series with the compressor clutch and functions to eliminate the unnecessary operation of the compressor on cold days.

j. Master Switch and VAcuum Diaphragm

The master switch (See Figures 13-240 and 13- 222) is a vacuum actuated single stage, single pole micro swtich which closes to complete the electrical circuit to the blower motro (See Figures 13-232 or 13-233). The vacuum to actuate this switch is fed from the selector vacuum switch to the TVV and then to the master switch vacuum diaphragm. See Figure 13-231. This arrangement provides that the master switch will hold the blower motor circuit open until the engine coolant temperature warms. When the engine coolant warms sufficiently, the TVV opens and applies vacuum to close the master switch. See Figures 13-250 through 13-273.

13-110 OPERATION OF SYSTEM CONTROLS

The purpose of the Automatic Climate Control system is to relieve the operator of the necessity of continuously adjusting the instrument panel controls as is required with themanual heater-air conditioner system. The usefulness of the

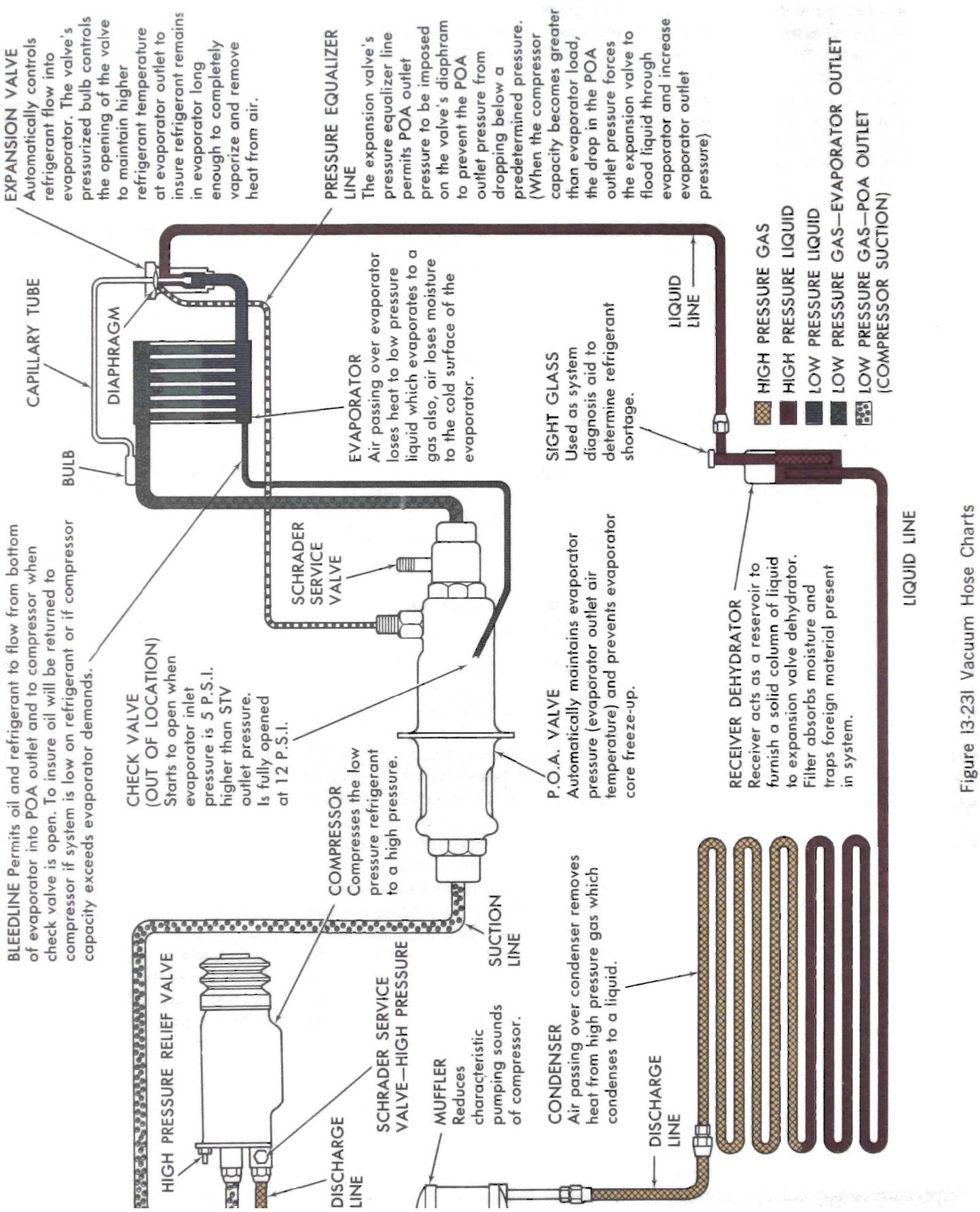


Figure 13-231 Vacuum Hose Charts

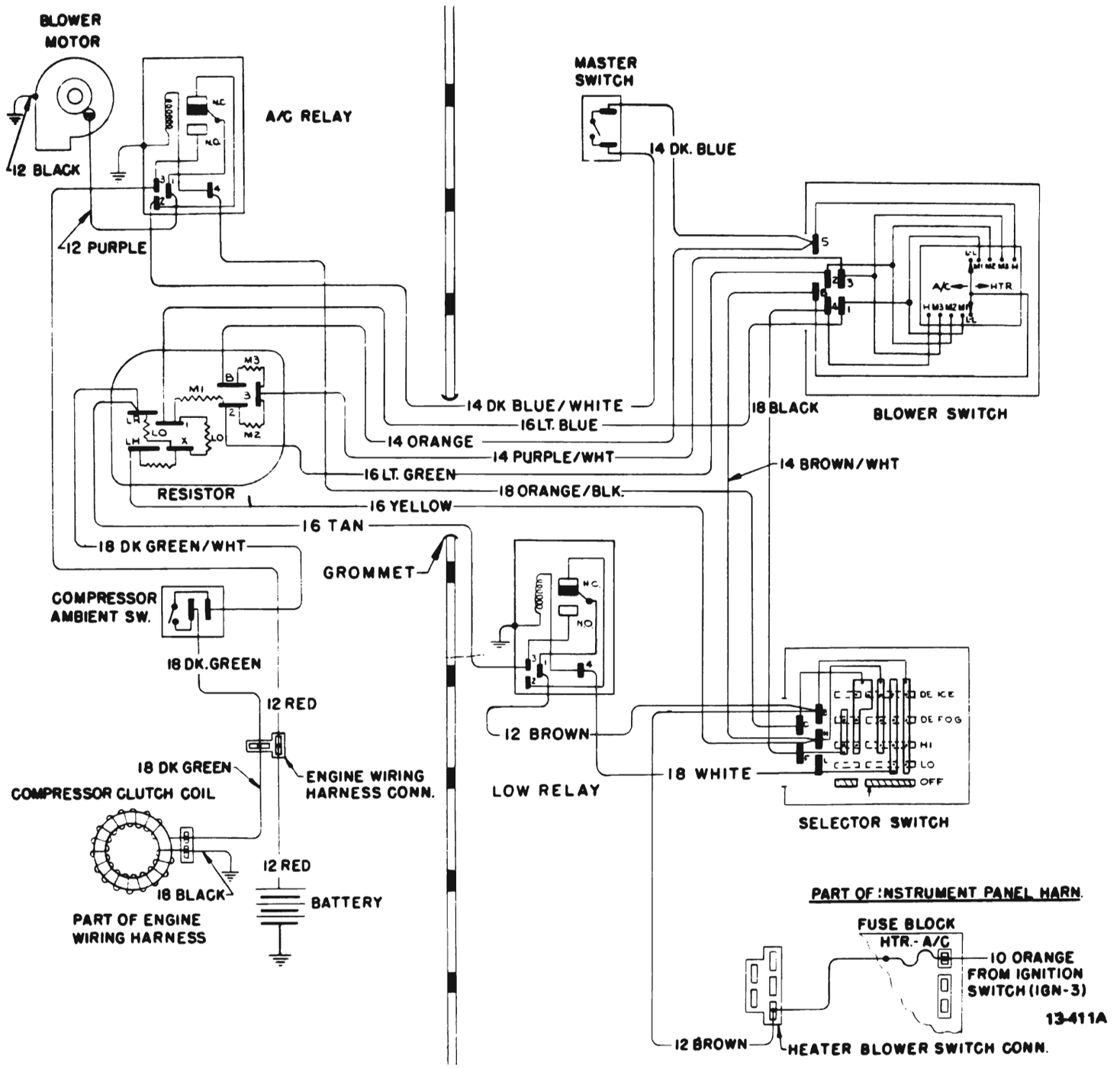


Figure 13-232 - 45-46-48000 Series Wiring Circuit Diagram

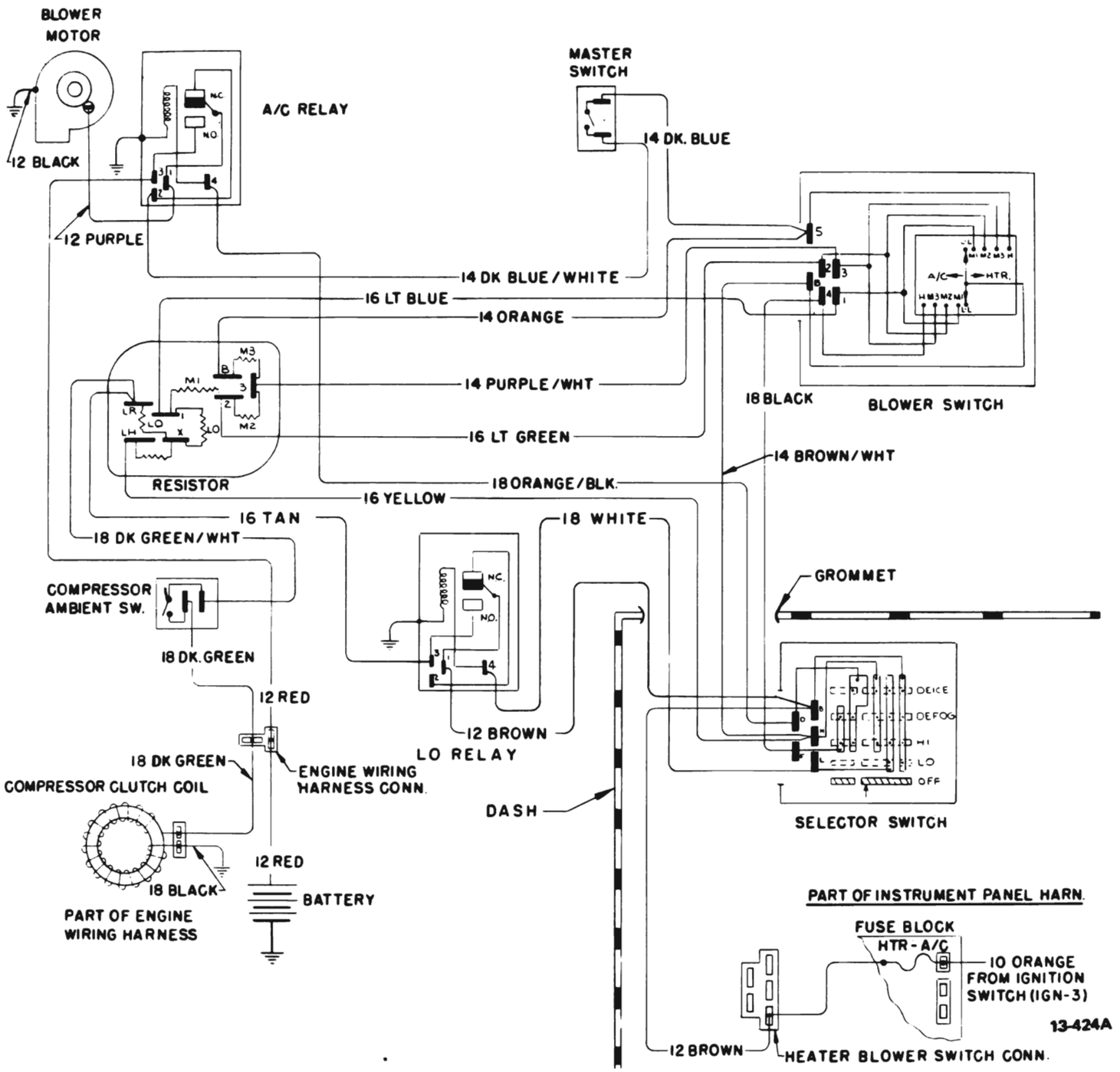


Figure 13-233 49000 Series Wiring Circuit Diagram

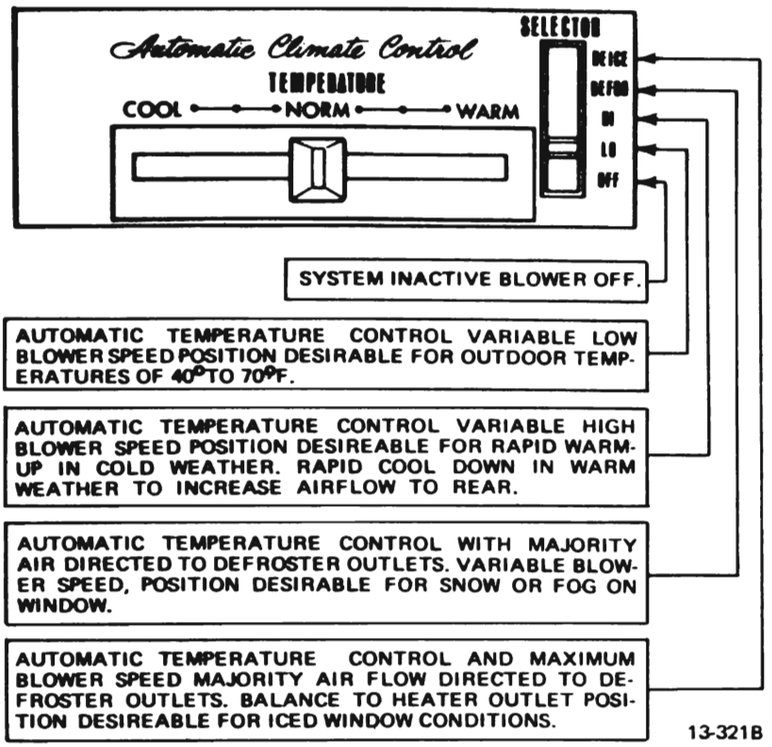


Figure 13-234 SELECTOR Switch Programming sequence

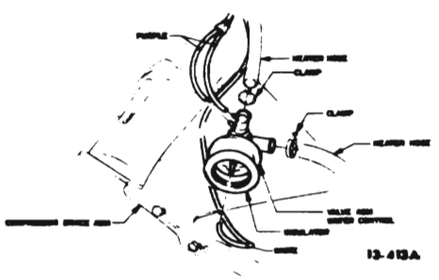


Figure 13-235 - 45-46-48000 Series Thermostatic Vacuum Valve Installation

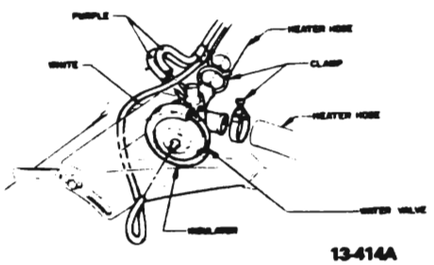


Figure 13-236 -49000 Series Thermostatic Vacuum Valve Installation

system can be reduced by the operator if, in attempting to speed up system performance, the controls are overly adjusted. Positioning of temperature selector wheel to one extreme or the other does not speed up warm-up or cool-down time but can overdrive system to a temperature not desired. It is suggested that the TEMPERATURE lever be moved only a small amount to readjust the in-car temperature.

The purpose of the SELECTOR switch is to provide control over mode of system operation. The recommended selector switch positions for various driving conditions are as follows:

"LOW" position - This setting is used during moderate weather or approximately 30° to 70°F., outside temperature. The system will be on automatic temperature and blower speed control. However, in this position the car will take longer to reach a stabilized condition, however, the system will operate in a lowr blower speed range and will not have a high blower speed in maximum A/C.

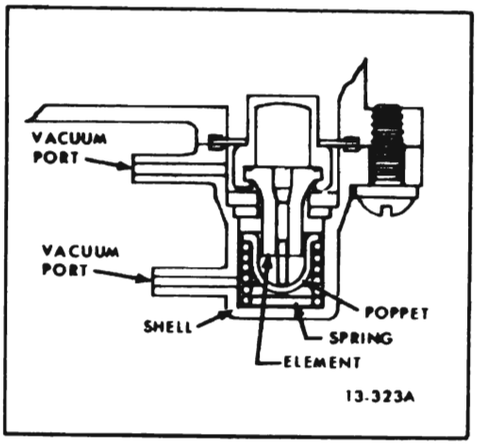


Figure 13-237 Thermostatic Vacuum Valve

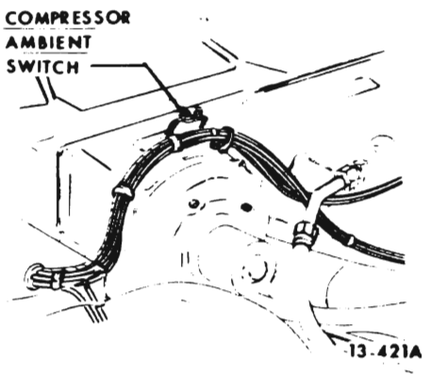


Figure 13-238 45-46-48000 Series Compressor Ambient Switch

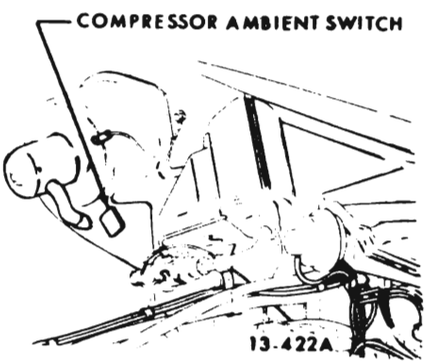


Figure 13-239 49000 Series Compressor Ambient Switch

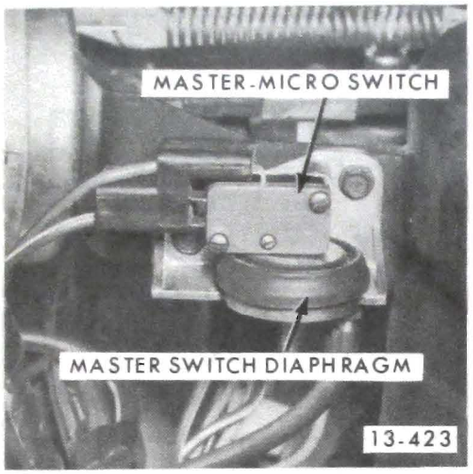


Figure 13-240 45-46-48000 Series Master Switch Installation

"HIGH" position - This setting provides fast warm- up or cool-down. The system is on automatic temperature control and may vary volume of air flow between five blower speeds. "HIGH" position may also be used to provide added heating or cooling to the rear seat during some weather conditions.

"DEFOG" position - This position causes the air flow to be directed only to the heater and defroster outlets. The system remains on automatic temperature control and may vary the volume of air flow between five blower speeds.

"DEICE" position - When the selector wheel is in "DEICE", approximately 85

of the air flow will be deflected to the defroster outlets. The system is automatically controlling the temperature, however, the blower motor remains on high speed.

DIVISION III

SERVICE PROCEDURES

13-111 GENERAL INFORMATION

Cleanliness is extremely important when performing any service procedures on the automatic system components. If dirt particles enter the vacuum circuit, it is possibel to cause partial loss of vacuum and inasmuch as certain vacuum circuits (i.e. the PVA circuit) operate within specific vacuum tolerances, the system operational sequence could be disrupted.

13-112 REMOVAL AND INSTALLATION OF THERMOSTATIC VACUUM REGULATOR (TVR)

a. Removal

1. Remove instrument panel cover assembly.

2. Carefully remove ambient air tube from TVR. Tube is cemented to TVR.

3. Disconnect temperature control (red) Bowden cable from TVR.

4. Disconnect three hoses from TVR.

5. Remove screws securing TVR and bracket assembly to instrument panel.

b. Installation

1. Attach TVR and bracket assembly to instrument panel.

2. Connect three hoses to TVR.

NOTE: *The hoses and TVR hose fittings are color coded to assist in installing hoses in correct locations.*

3. Reglue ambient air tube to TVR.

4. Position TEMPERATURE lever to "Cool" range.

NOTE: *See Control Wire Assembly and Adjustment drawing, Figure 13-213, for proper adjustment of Bowden Calbe.*

5. Install instrument panel cover assembly.

13-113 REMOVAL AND INSTALLATION OF SELECTOR ELECTRICAL SWITCH AND/OR VACUUM SWITCH

a. Removal

(45-46-48000 Series)

1. Disconnect energizer ground cable.

2. Disconnect parking brake release handle rod retaining clip from parking brake assembly.

3. Remove lower instrument panel filler panel.

4. REACH UNDER INSTRUMENT PANEL AND DISCONNECT COMPRESSOR LEAD WIRE (manual air conditioner equipped cars only).

5. On manual air conditioner equipped cars, remove two (2) switch-tocontrol housing attaching screws and remove switch.

6. On Automatic Climate Control cars, remove two (2) switch-to-control attaching screws. Remove two (2) control housing to instrument panel nuts. Remove control housing to support bracket attahcing screw. Remove rear control assembly support bracket. Remove temperature control bowden cable retainer (red in color). DO NOT REMOVE CONTROL ASSEMBLY, but reposition so switch can be removed. Disconnect blower wire connector from blower switch.

7. Install switch reversing removal procedure.

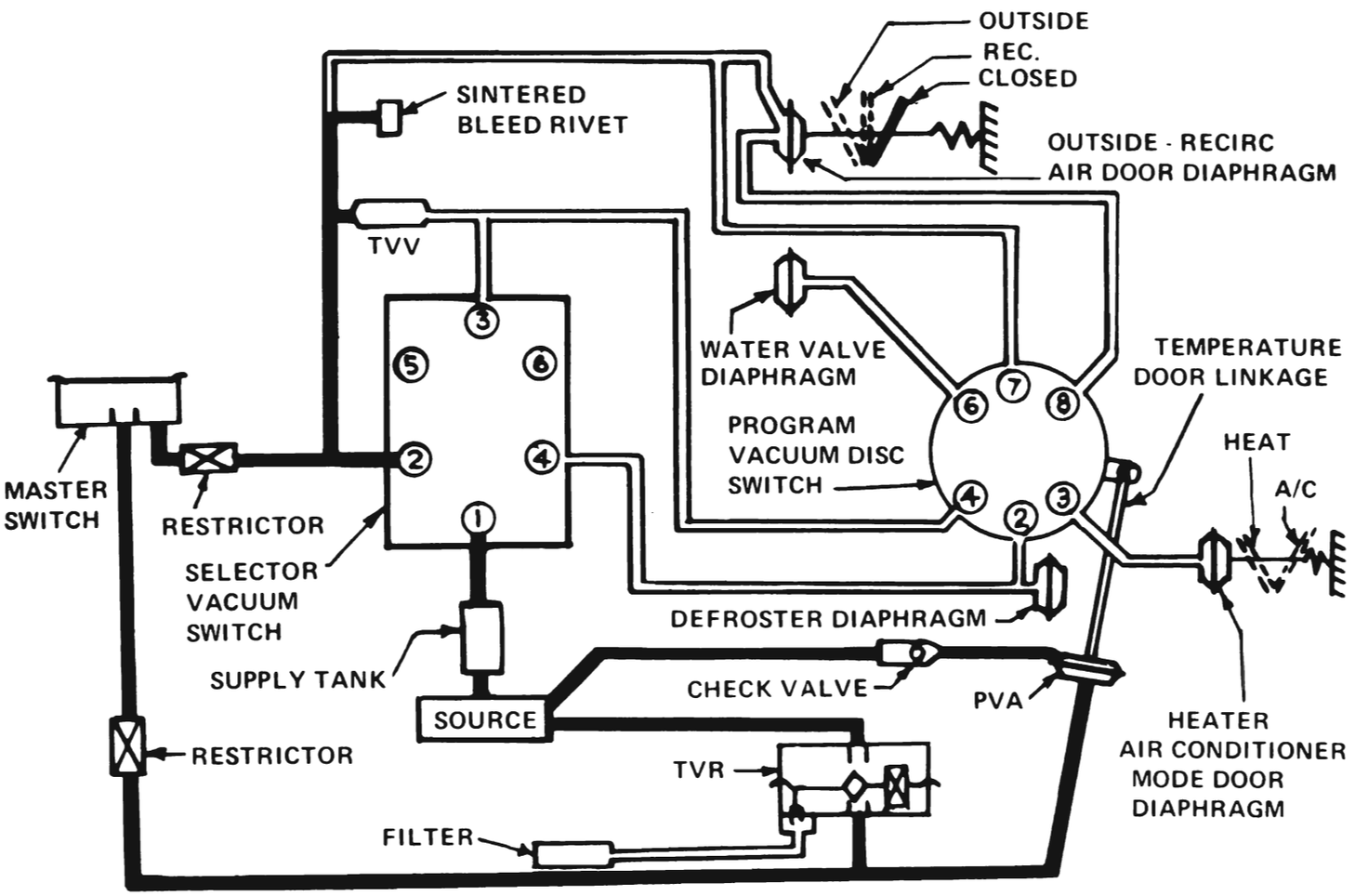
8. Connect energizer cable.

(49000 Series)

1. Remove ash tray assembly.

2. Remove radio.

3. Loosen self-contained nuts on back of control assembly.



NOTE: HEAVY BLACK LINES INDICATE VACUUM APPLIED

NOTE: PORTING OF PROGRAM VACUUM SWITCH IS ARBITRARILY SHOWN. ACTUAL PORTING WOULD BE DEPENDENT ON WHERE P.V.A. HAPPENS TO STOP DRIVING.

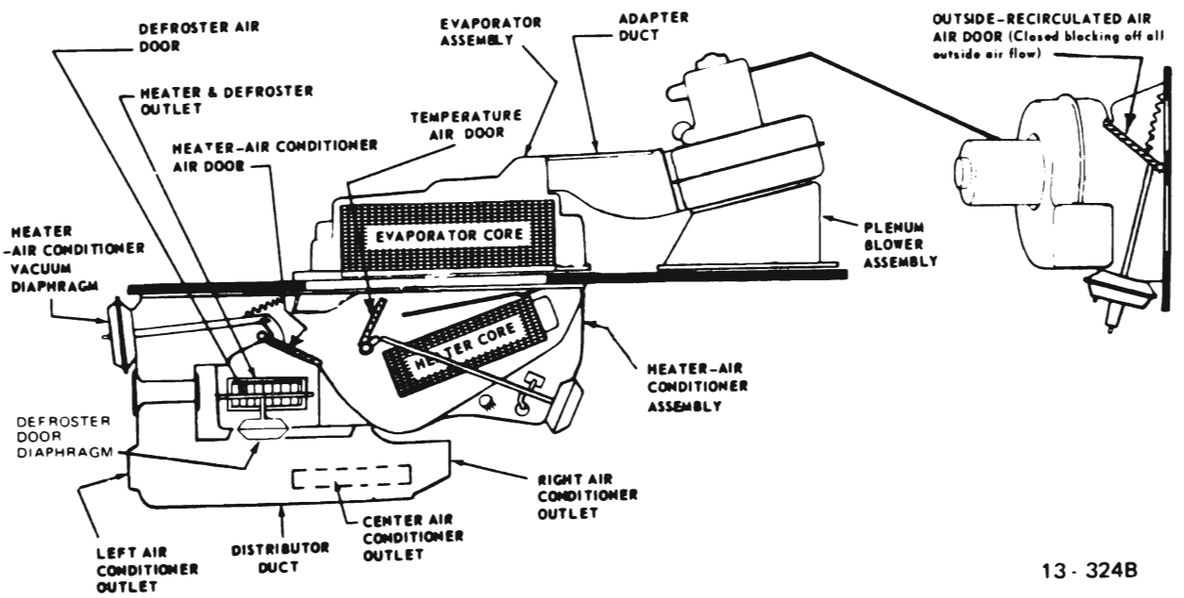
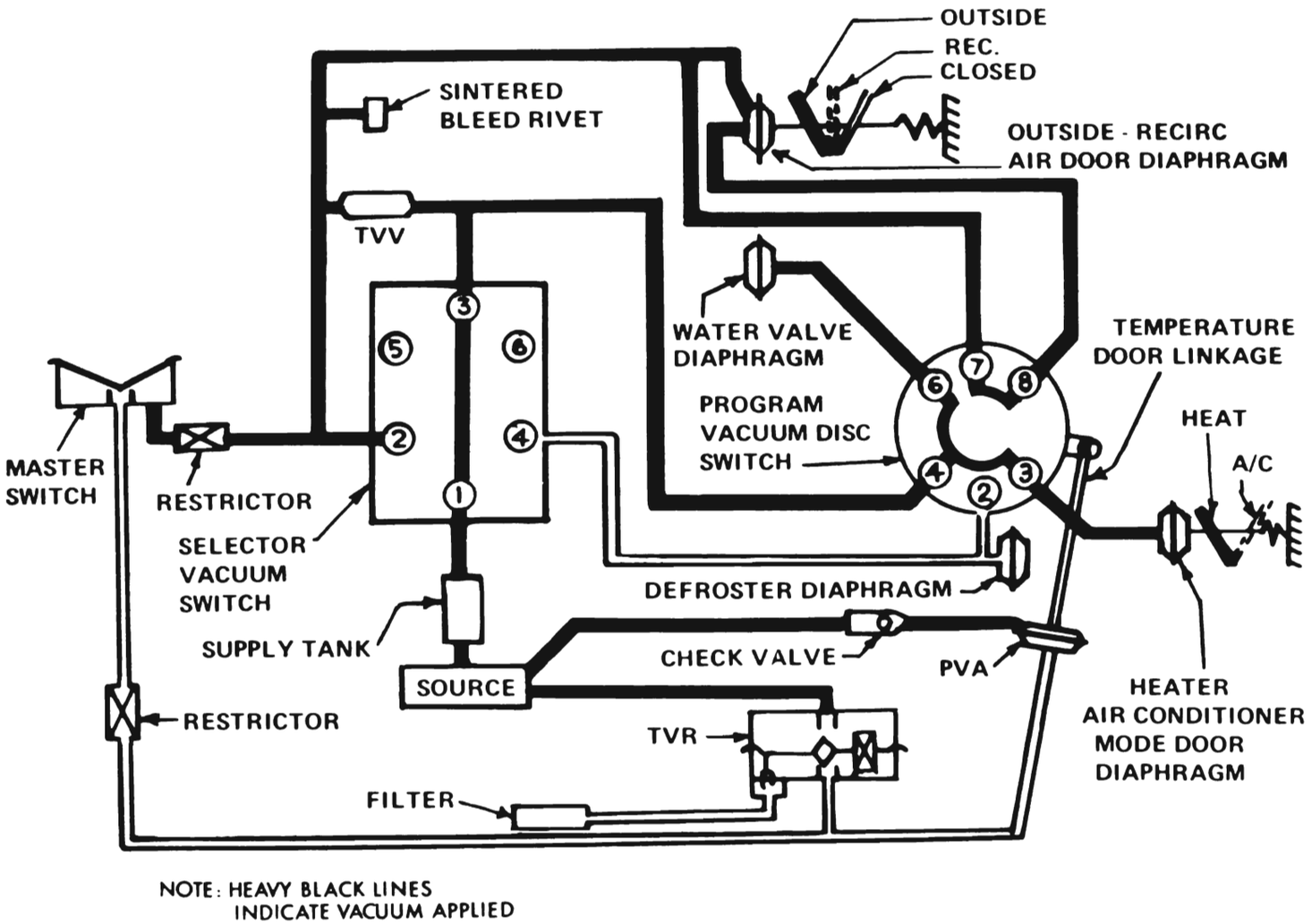


Figure 13-250 45-46-48000 Series Air Flow and Vacuum Circuits, System in 'OFF' Position



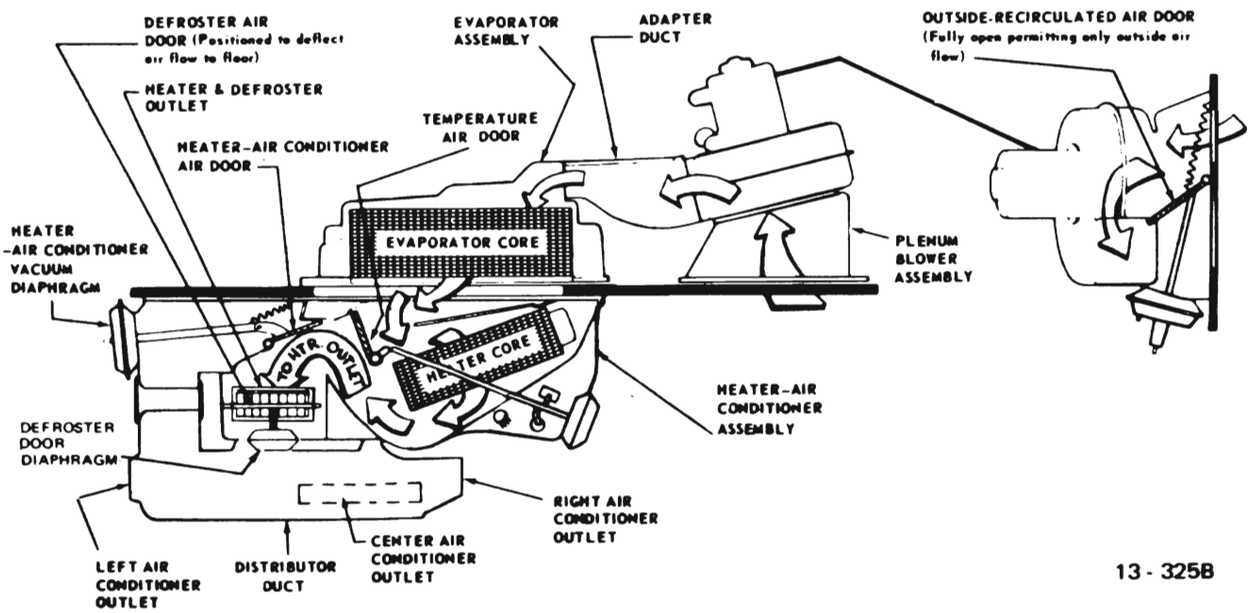
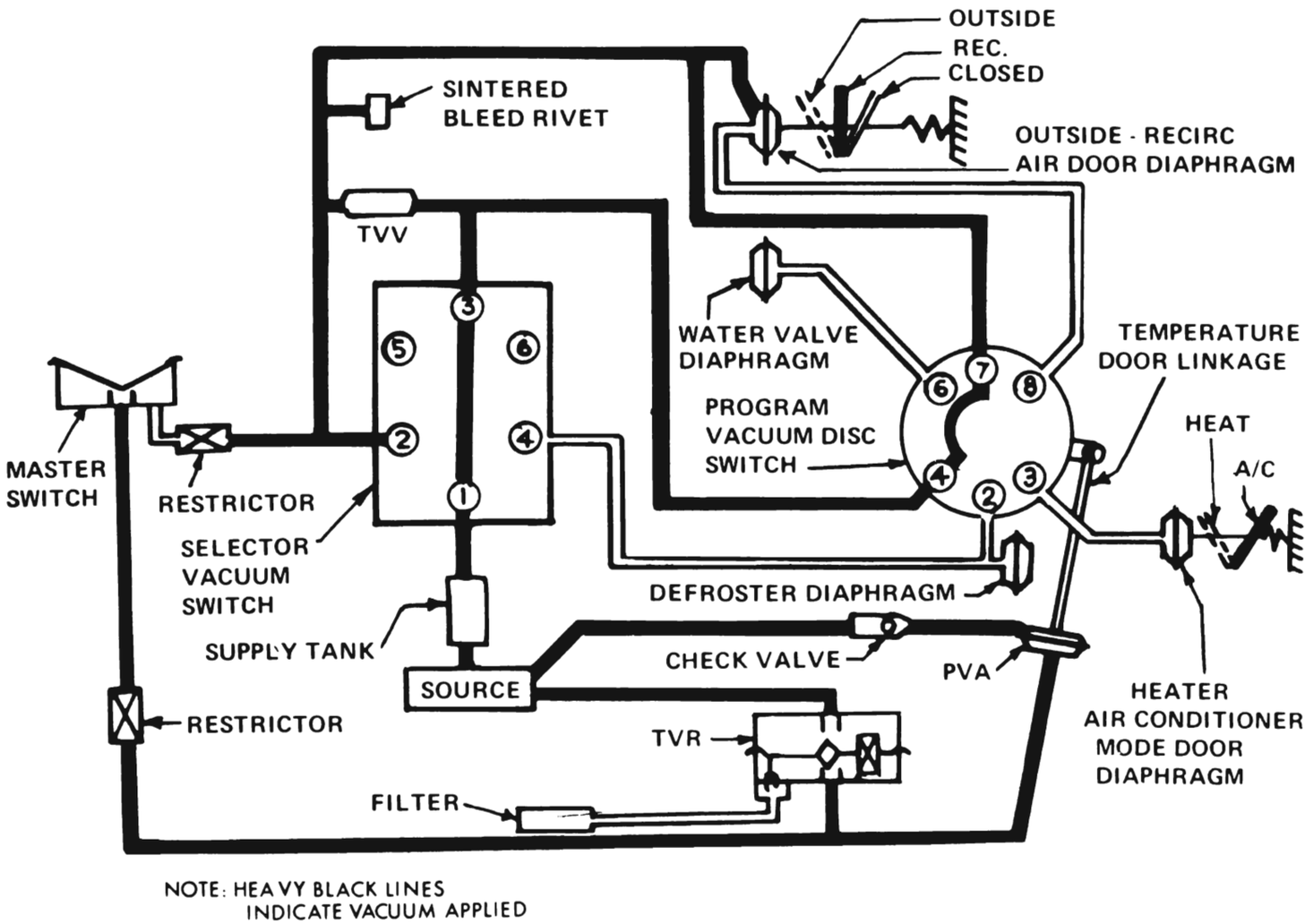


Figure 13-25I 45-46-48000 Series Air Flow and Vacuum Circuits, System in 'LOW' or 'HIGH' and PVA Driving to Maximum Heat Position



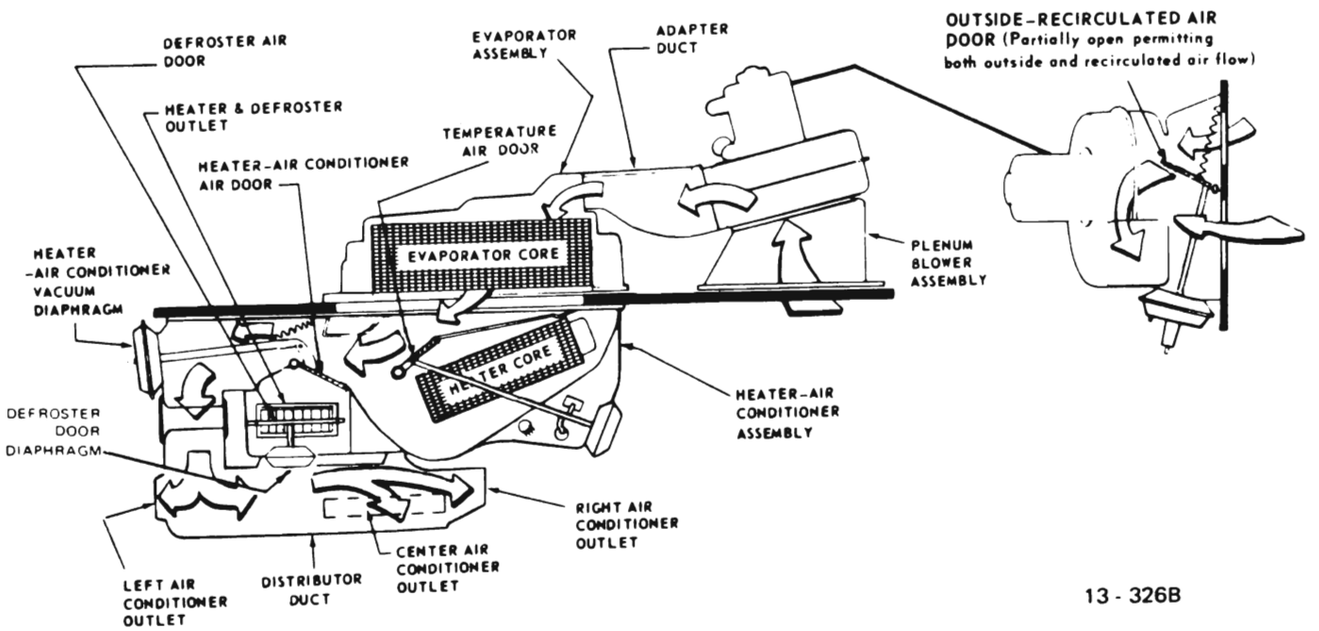
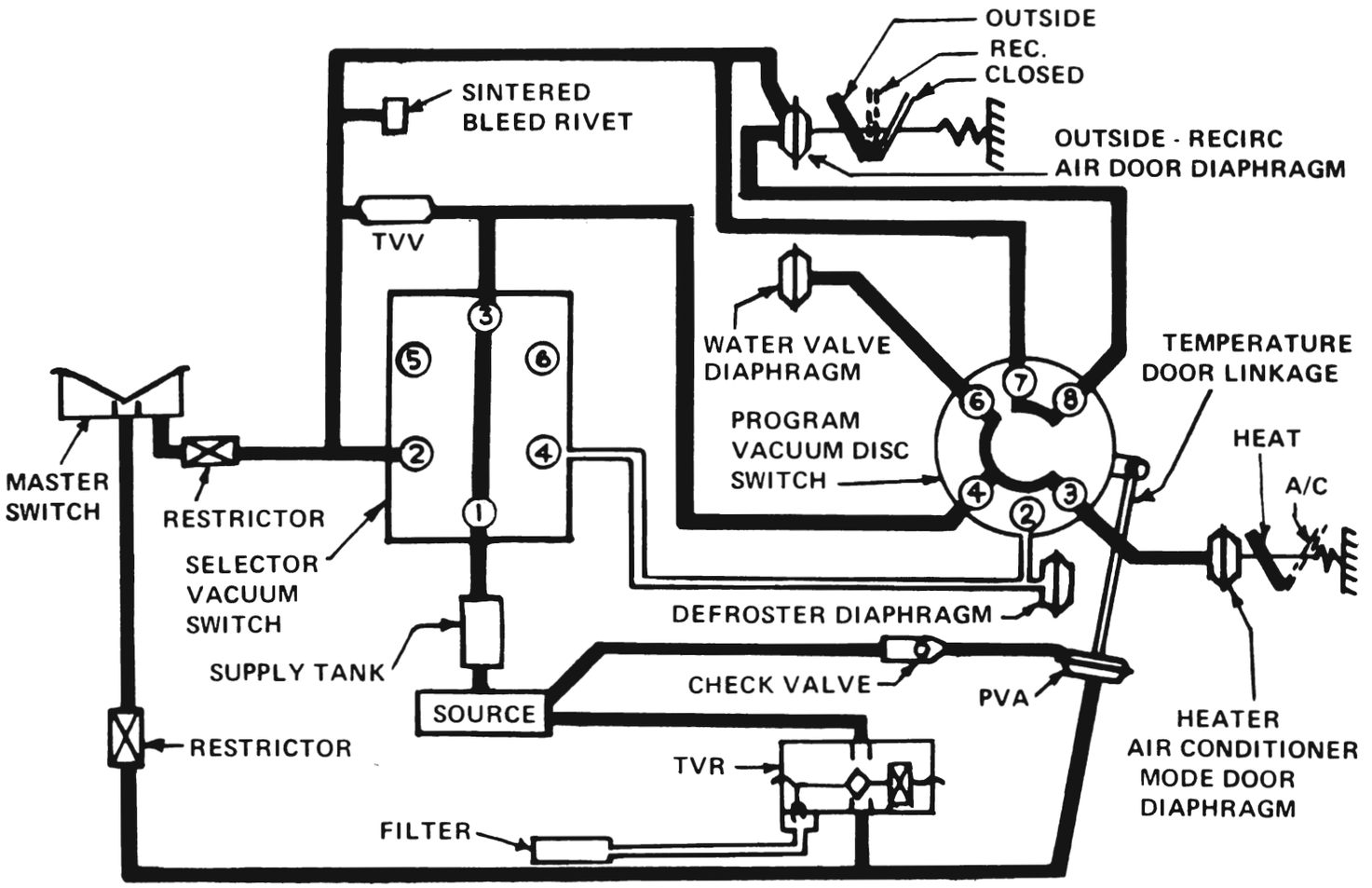


Figure 13-252 45-46-48000 Series Air Flow and Vacuum Circuits, System in 'LOW or 'HIGH' and PVA Driving to Maximum A/C Position



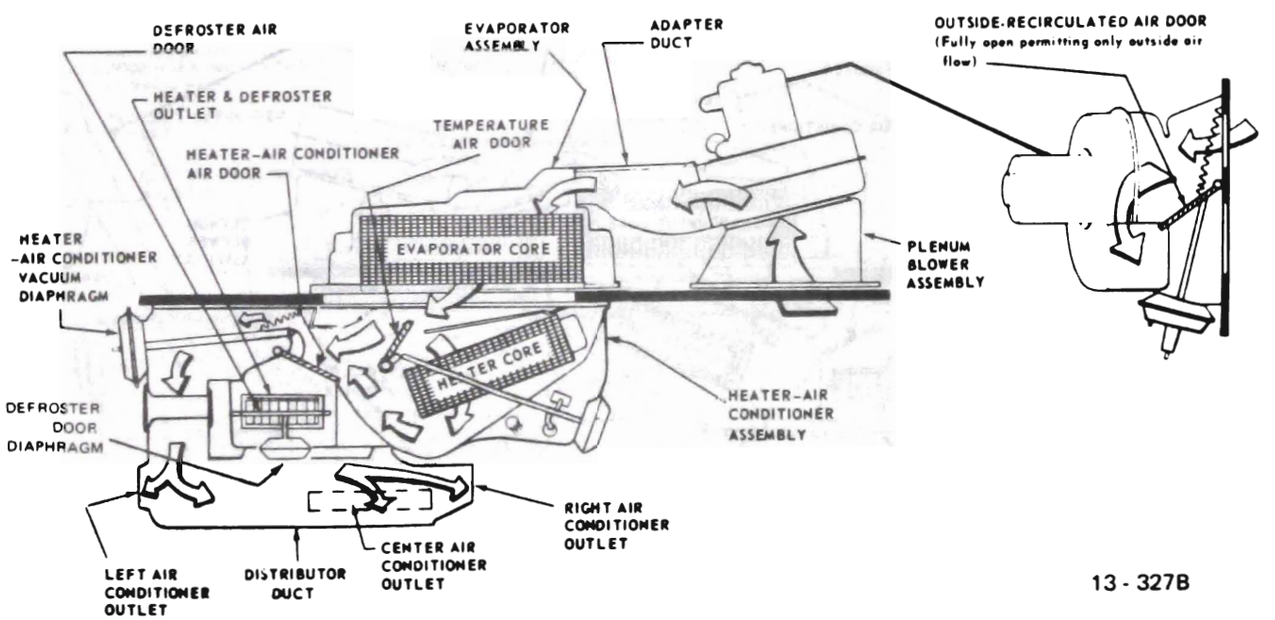
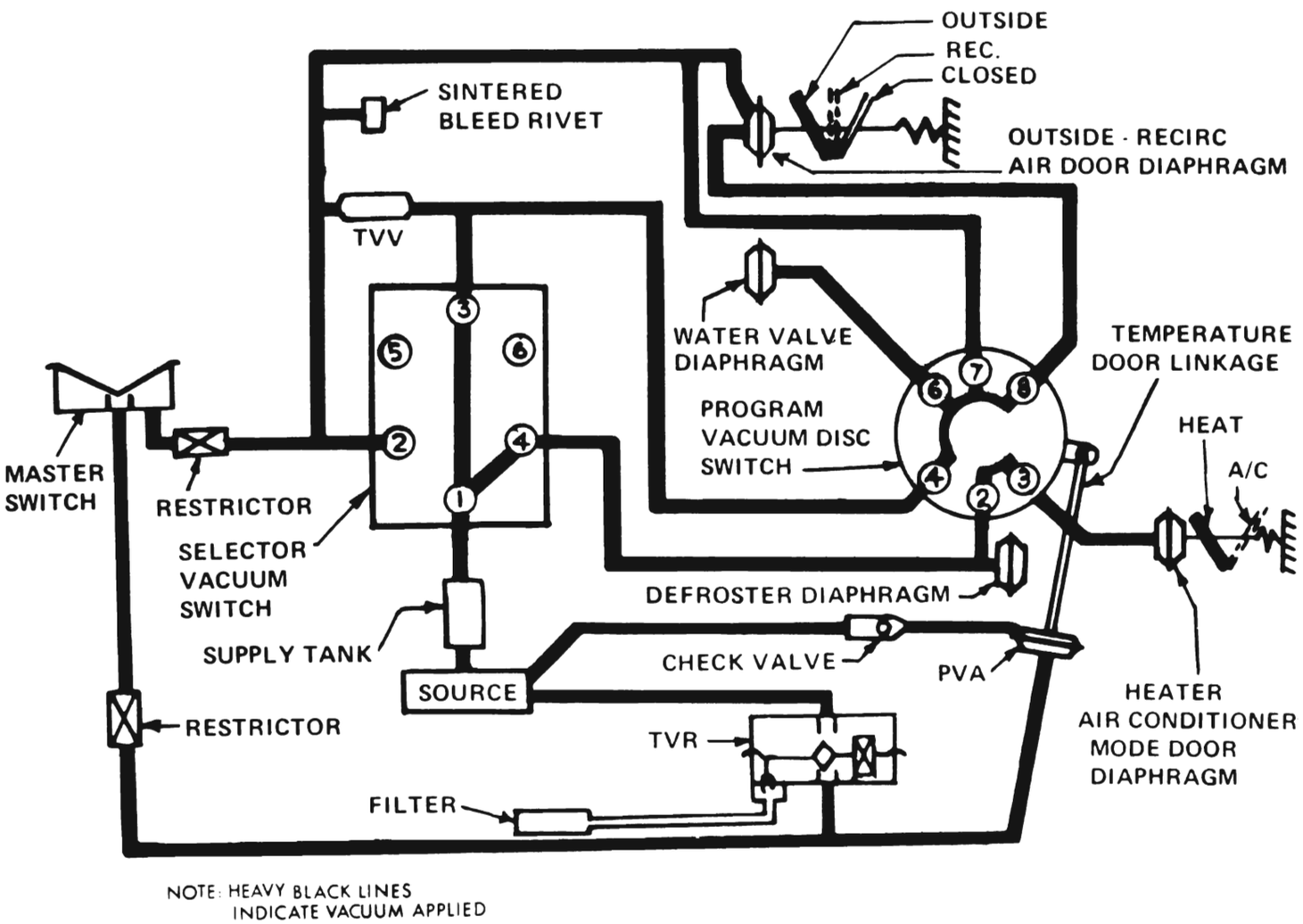


Figure 13-253 45-46-48000 Series Air Flow and Vacuum Circuits, System in 'LOW' or 'HIGH' and PVA Stabilized (55°F. Ambient)



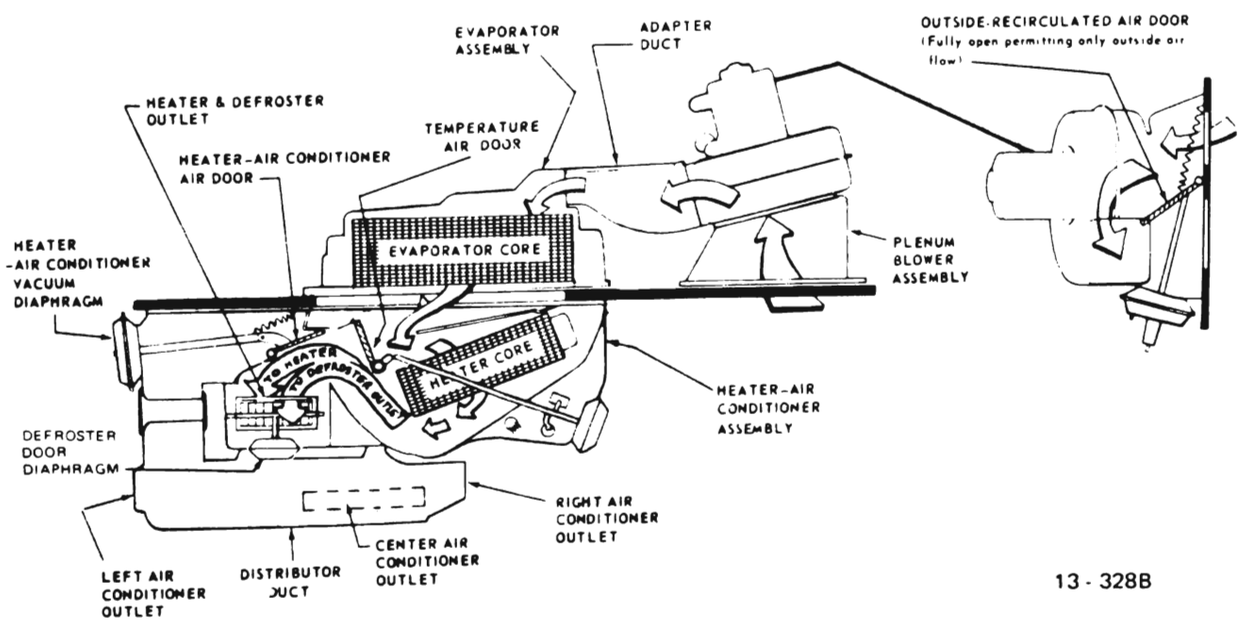
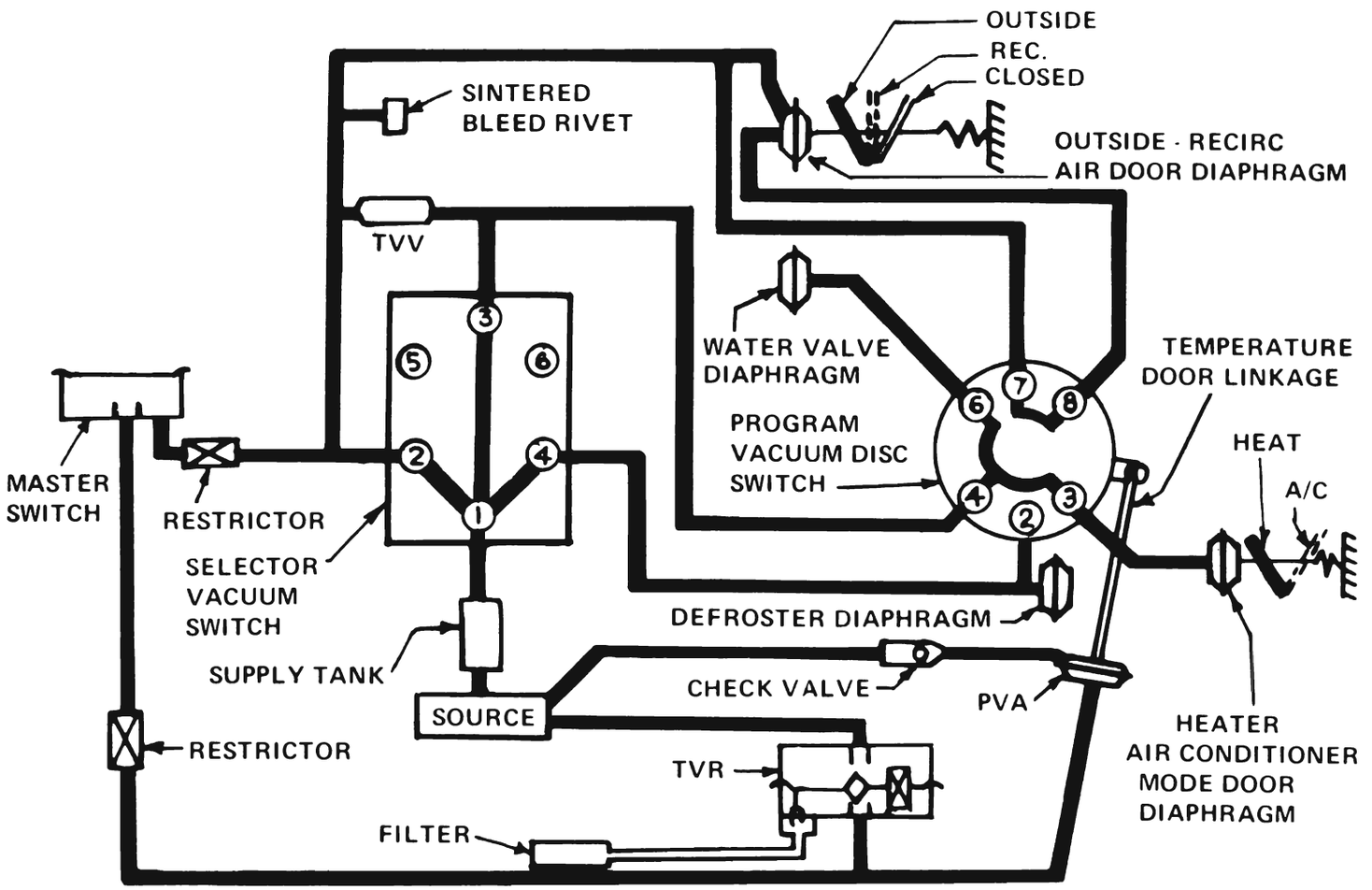


Figure 13-254 45-46-48000 Series Air Flow and VAcuum Circuits, System in 'DEFOG' and PVa Stabilized



NOTE: HEAVY BLACK LINES INDICATE VACUUM APPLIED

NOTE: TVV BYPASSED THRU NO. 2 PORT OF SELECTOR VACUUM SWITCH ALLOWING IMMEDIATE START - UP DURING COLD WEATHER OPERATION.

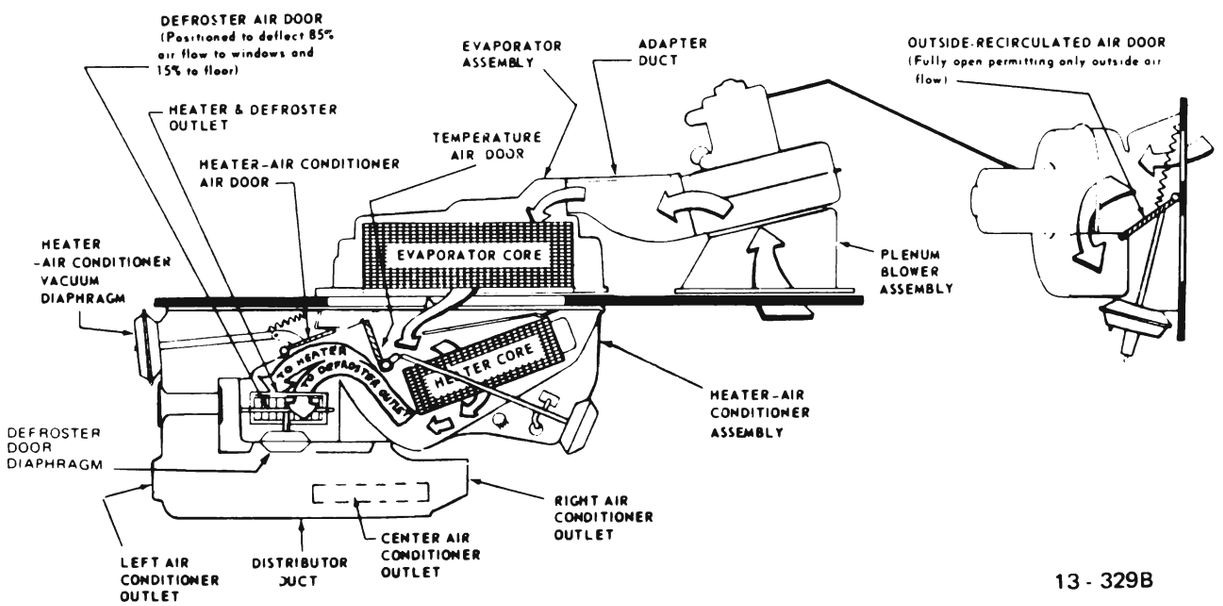
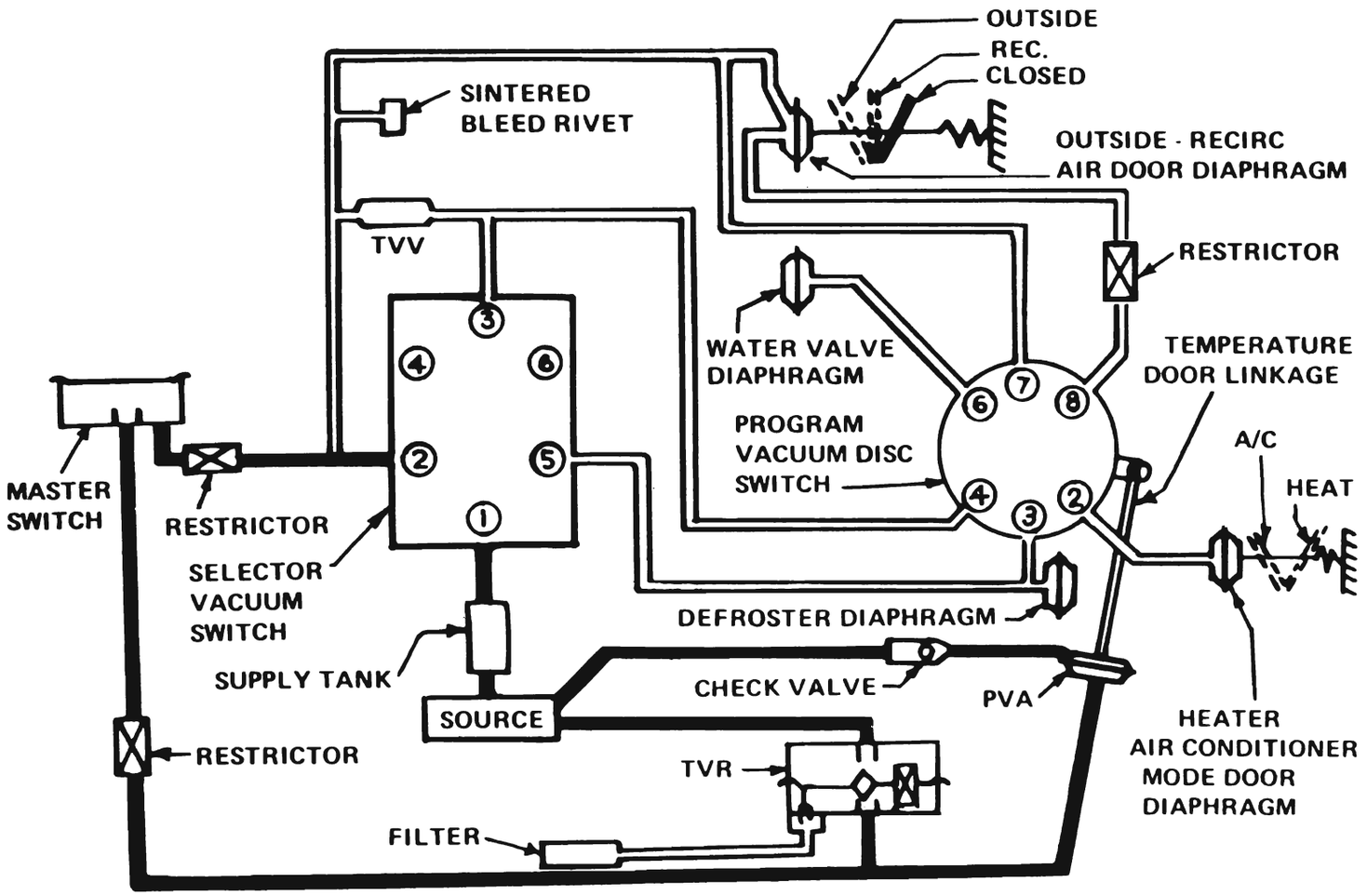


Figure 13-255 45-46-48000 Series Air Flow and Vacuum Circuits, System in 'DEICE' and PVA Stabilized Toward Maximum Heat Position



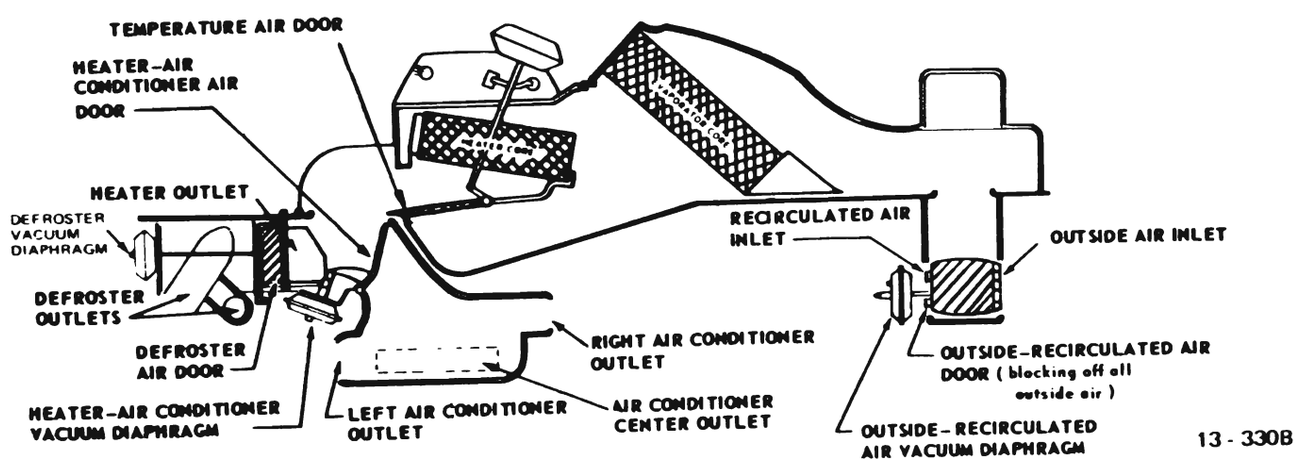
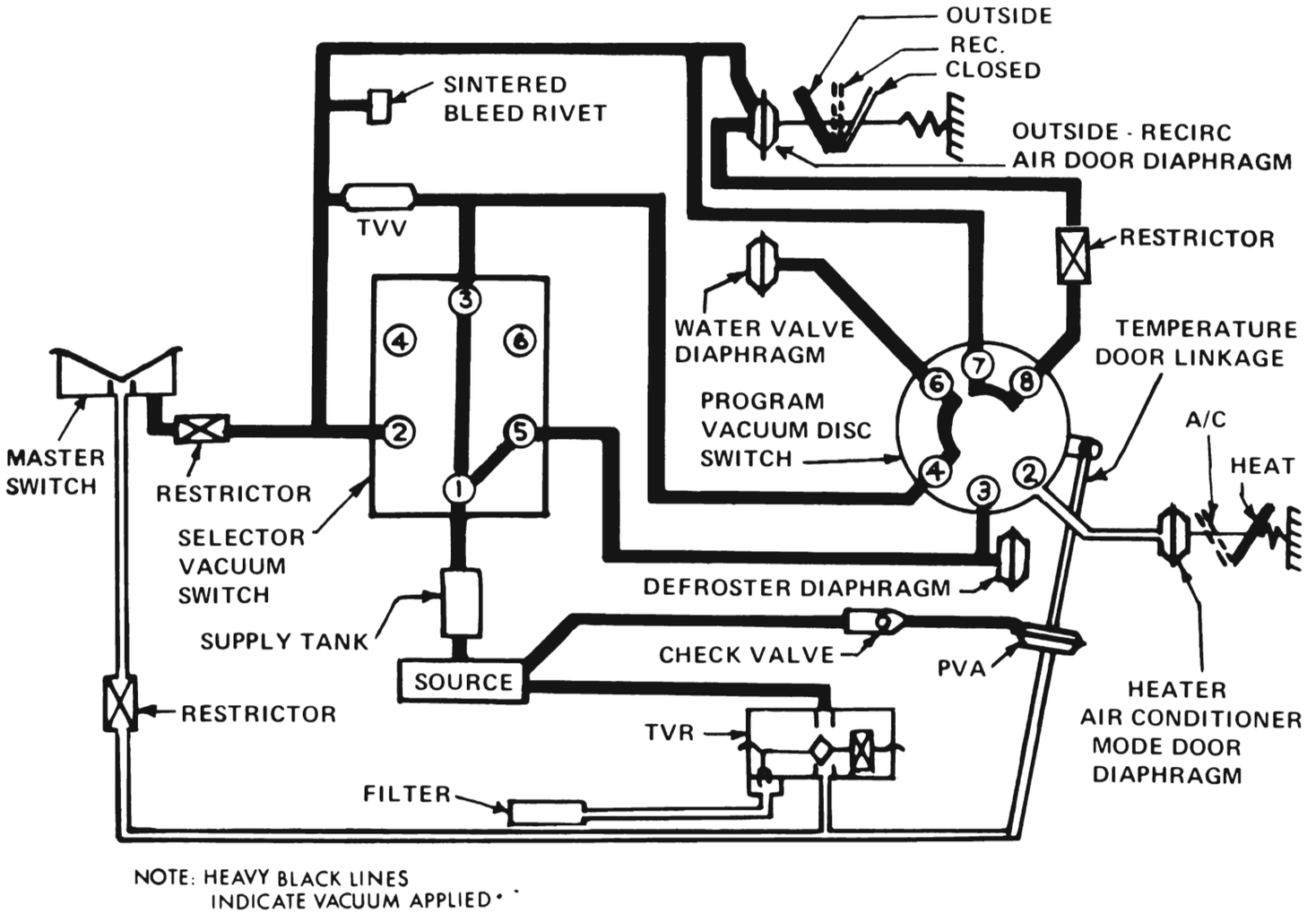


Figure 13-256 49000 Series Air Flow and Vacuum Circuits, System in 'OFF' Position



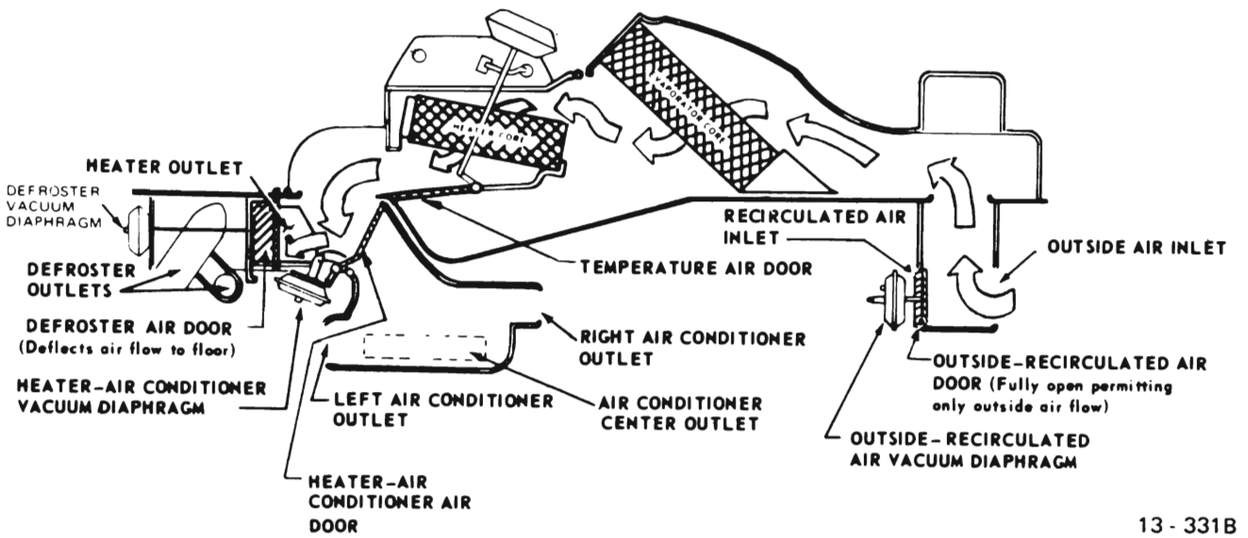
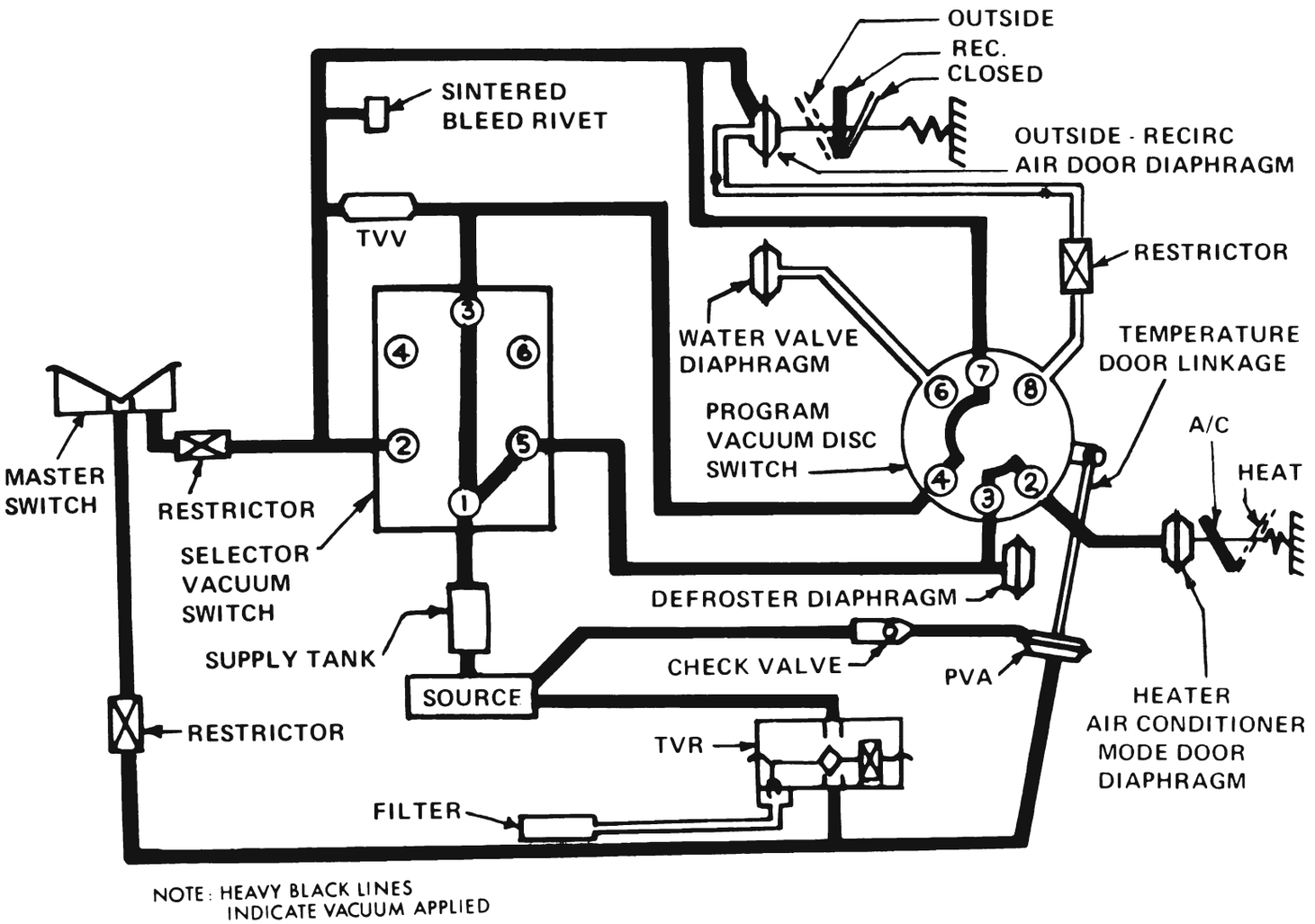


Figure 13-257 49000 Series Air Flow and VACUUM Circuits,
System in 'LOW' or 'HIGH' and PVA Driving to Maximum Heat Position



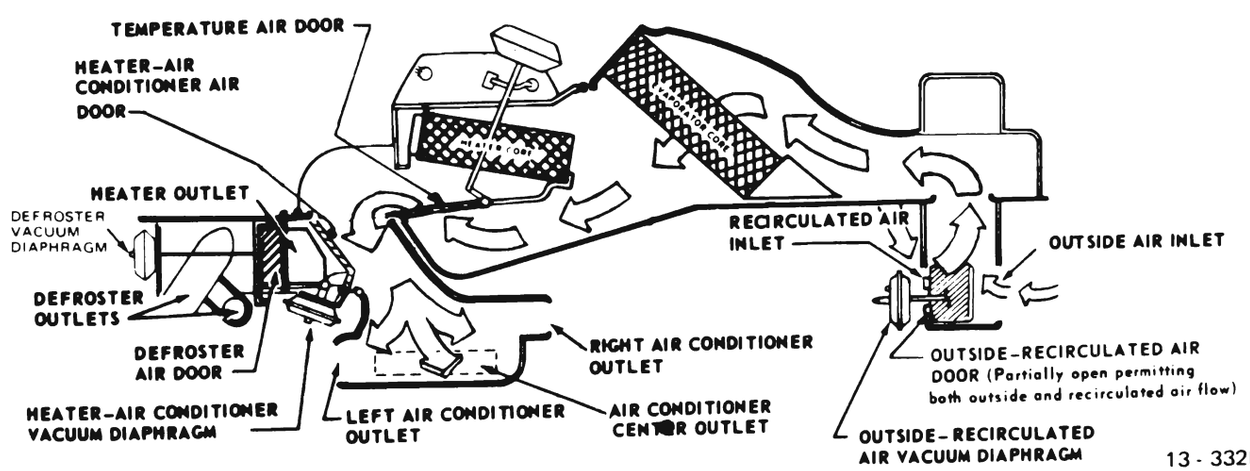
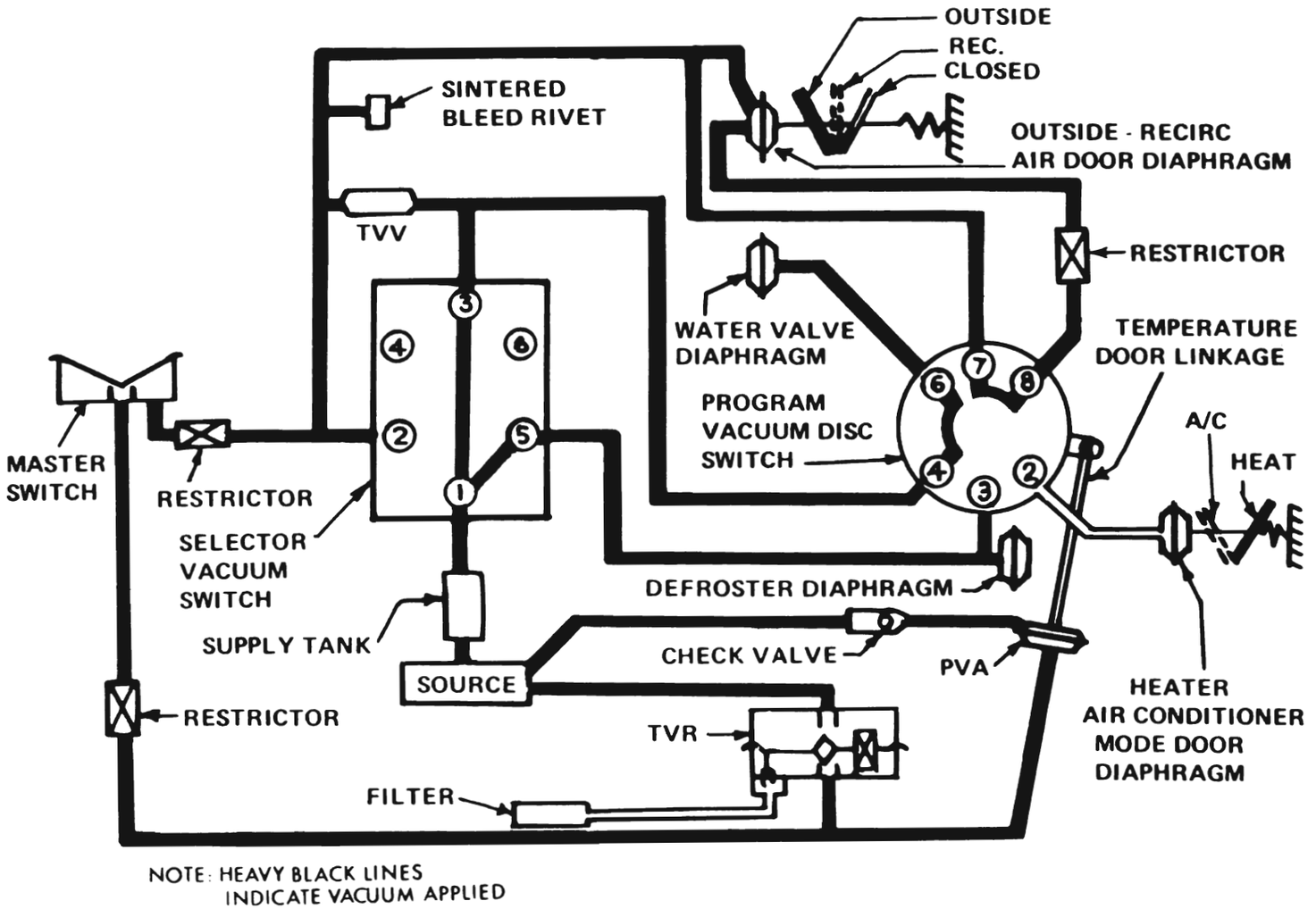


Figure 13-258 49000 Series Air Flow and Vacuum Circuits, System In 'LOW' or 'HIGH' and PVA Driving to Maximum A/C Position



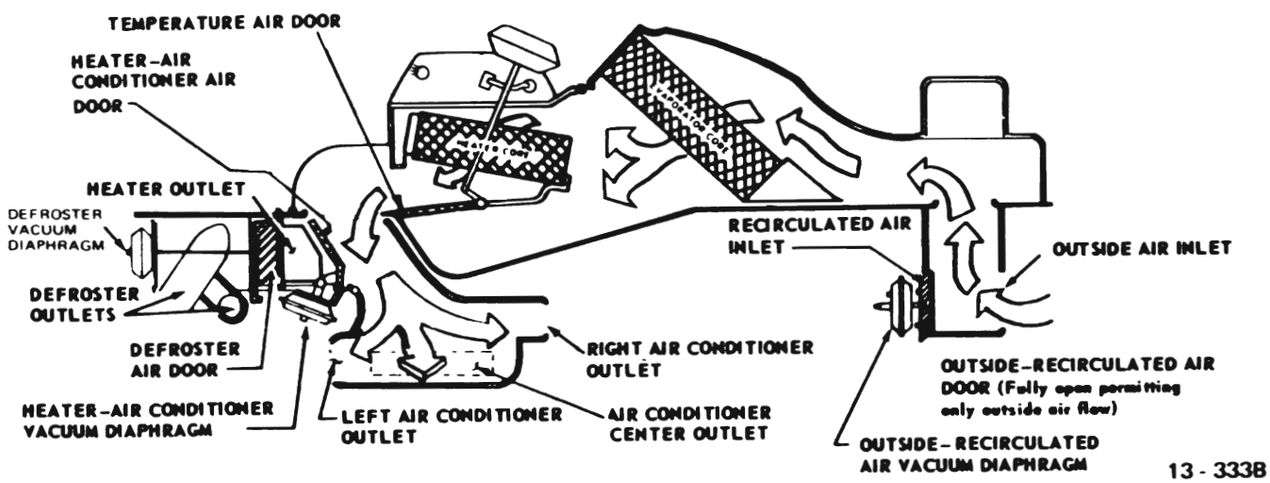
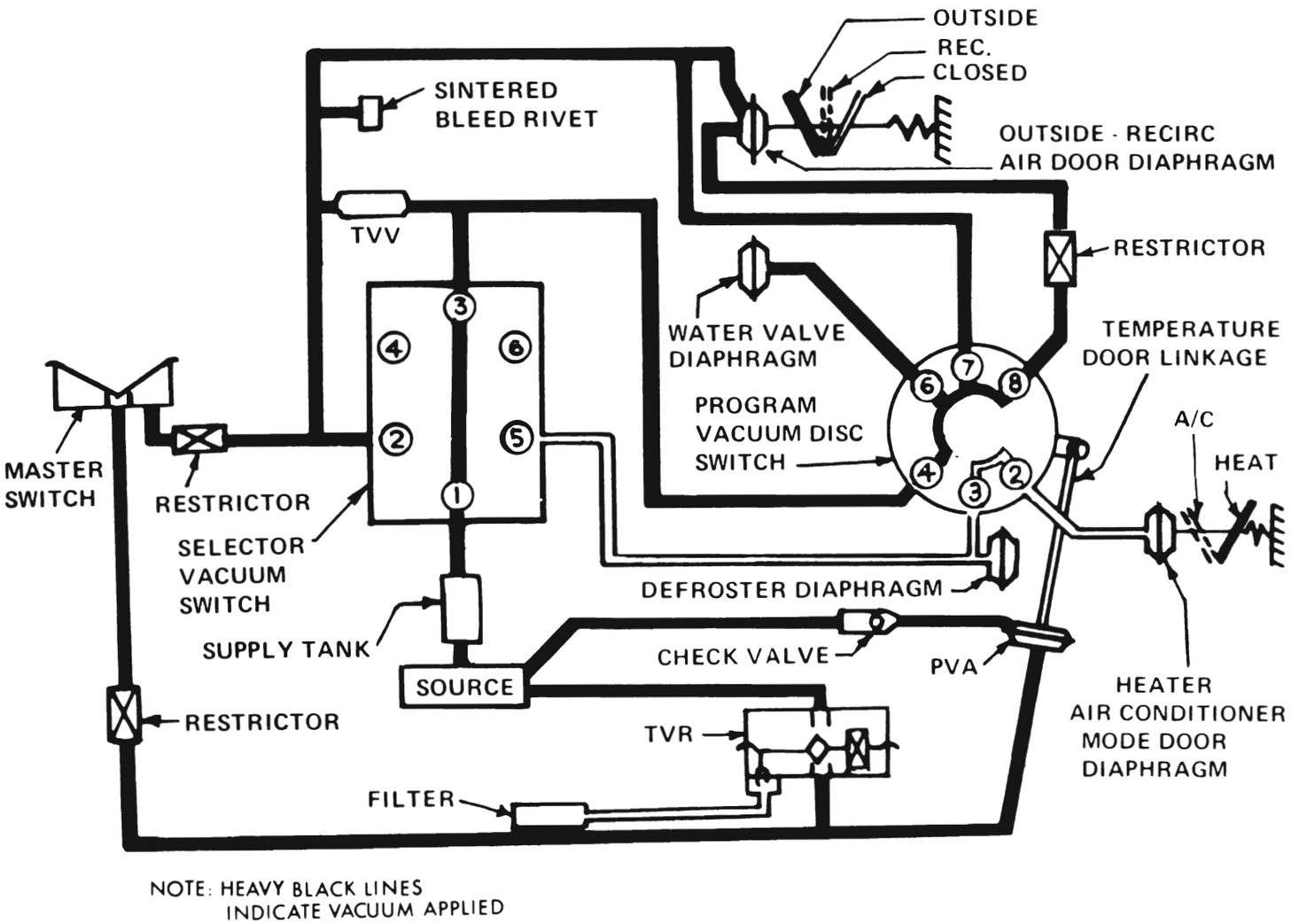


Figure 13-259 49000 Series Air Flow and VAcuum Cirucits, Systm in 'LOW' or 'HIGH' and PVA Stabilized (55°F. Ambient)



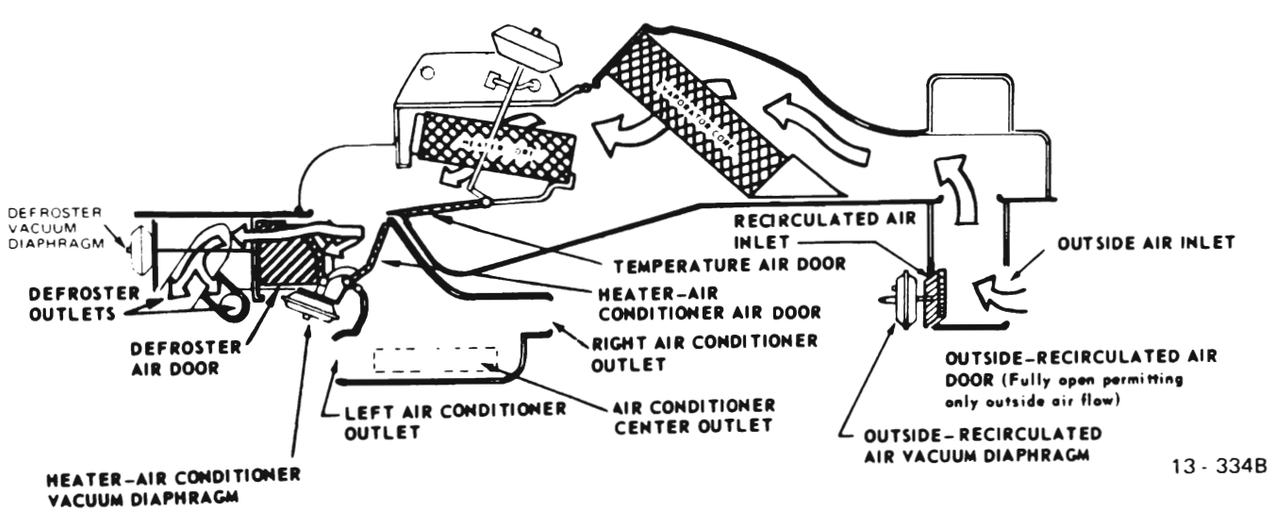
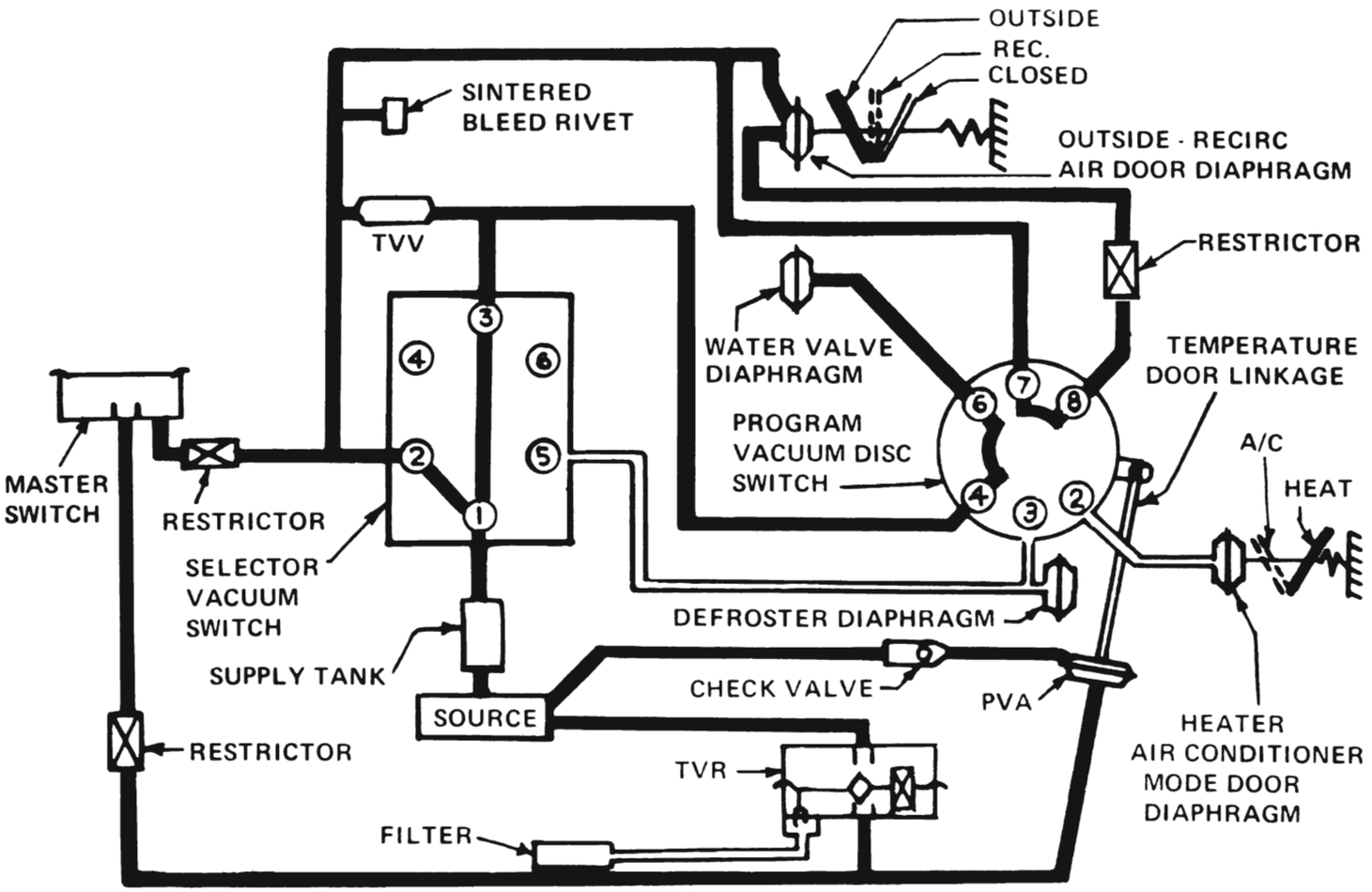


Figure 13-260 49000 Series Air Flow and Vacuum Circuits, System in 'DEFOG' and PVA Stabilized



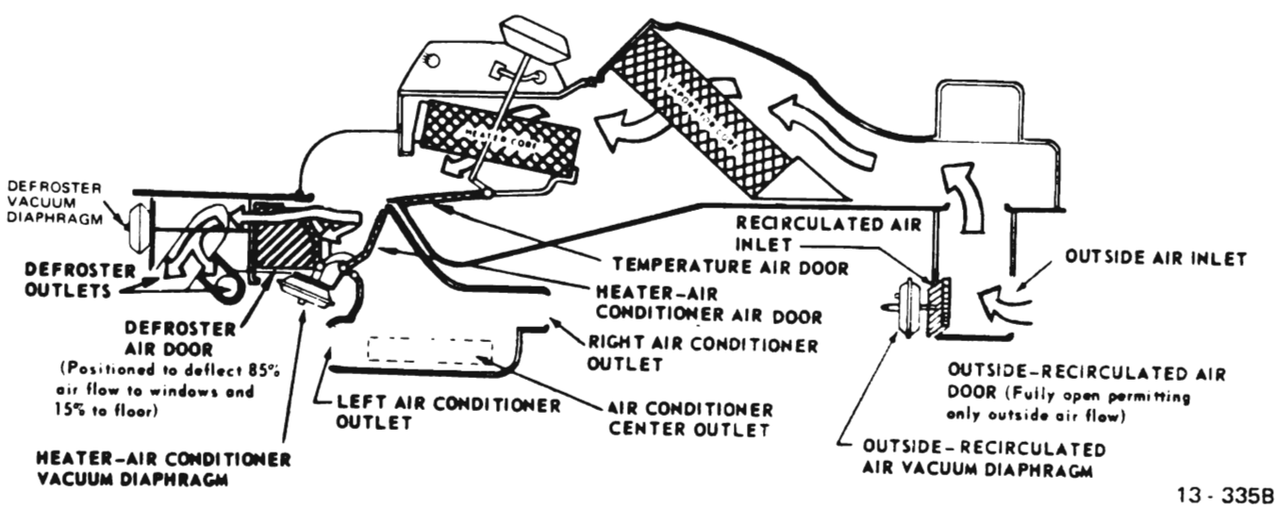


Figure 13-26 49000 Series Air Flow and VACUUM Circuits, System in 'DEICE' and PVA Stabilized Toward Maximum Heat Position

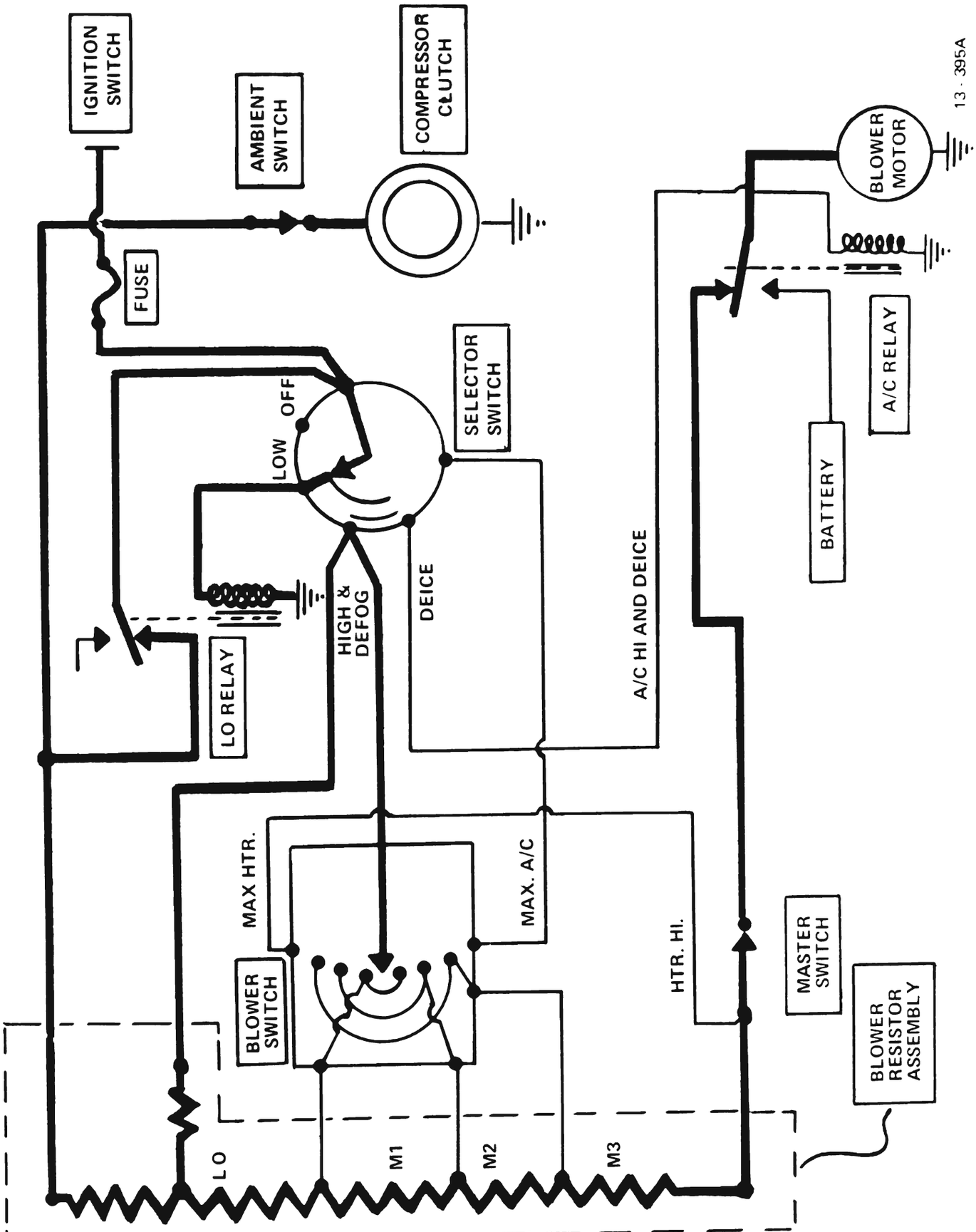


Figure 13-262 All Series Electrical Circuit, System in LOW, Compressor On and Low Blower Speed

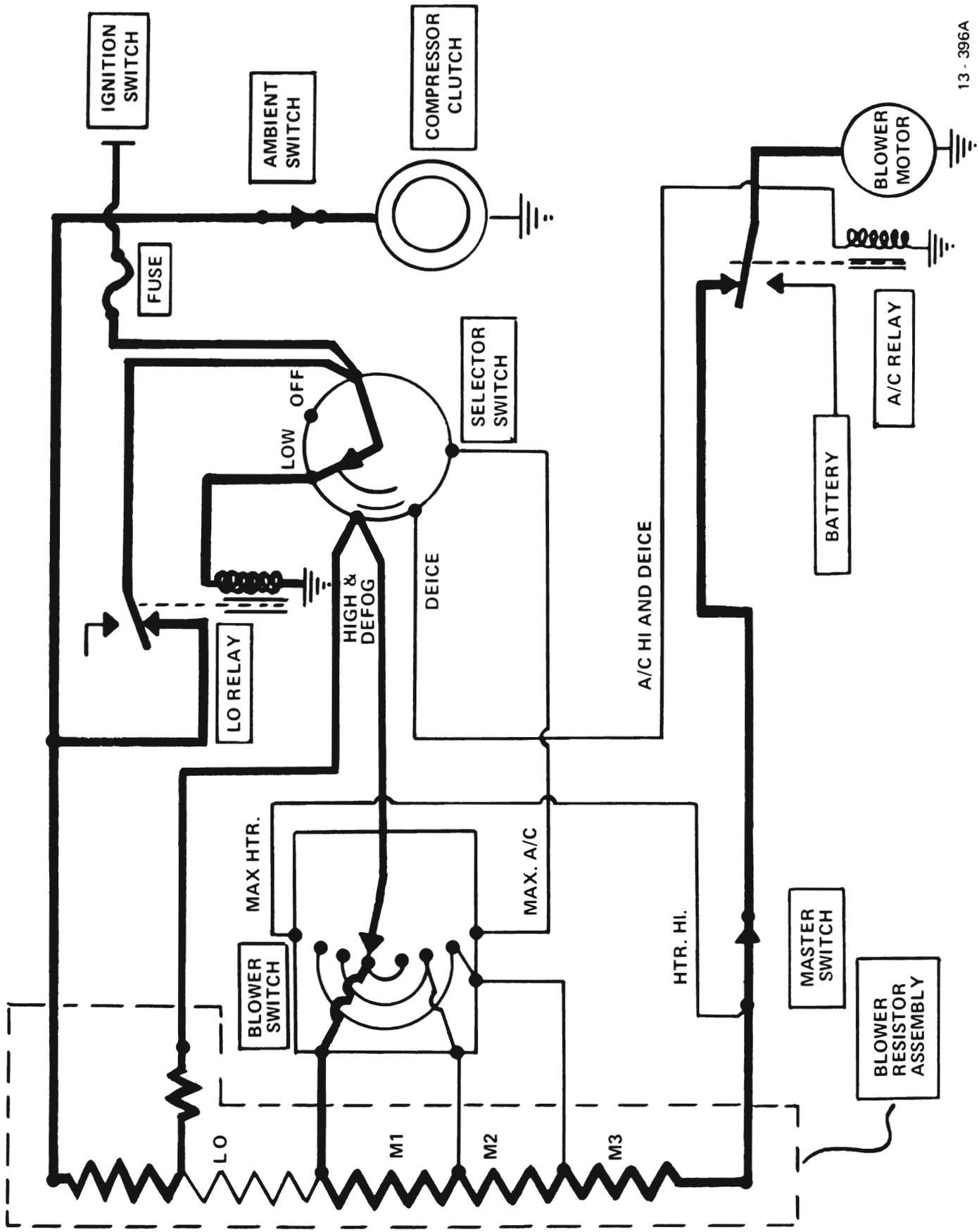


Figure 13-263 All Series - Electrical Circuit, System in 'LOW', Compressor On and Medium Low (MI) Blower Speed

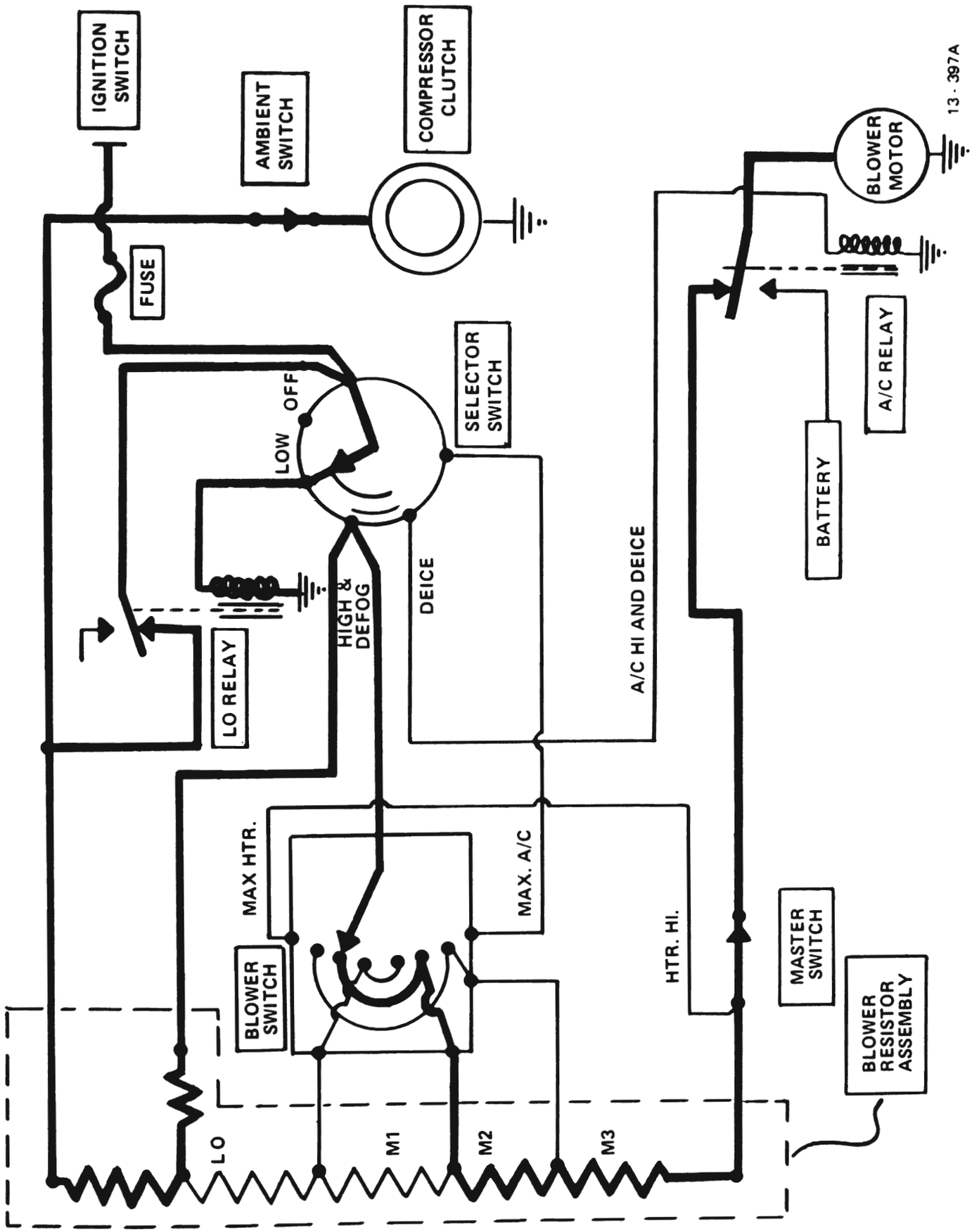


Figure 13-264 All Series - Electrical Circuit, System in 'LOW', Compressor On and Medium (M2) Blower Speed

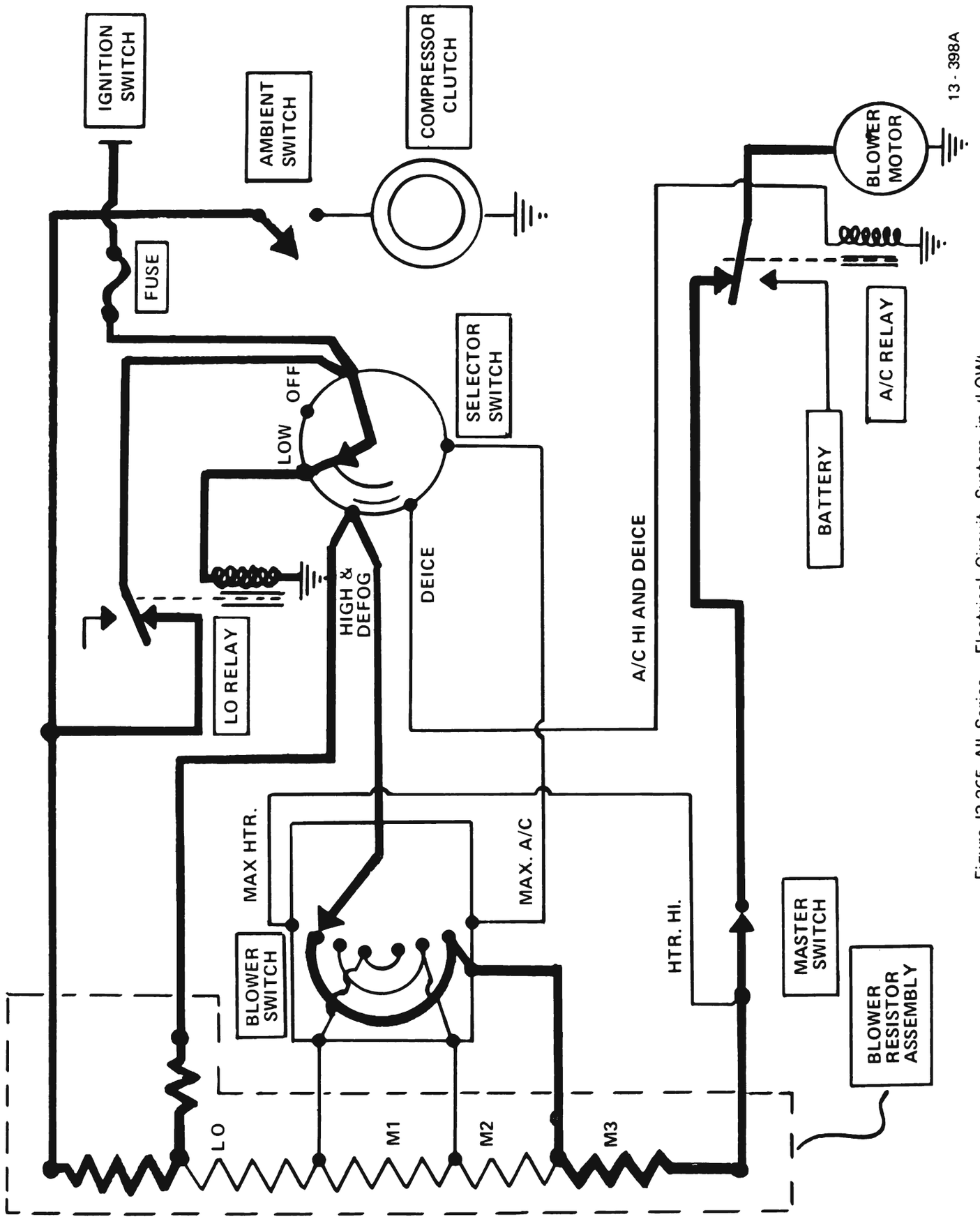


Figure 13-265 All Series - Electrical Circuit, System in 'LOW', Compressor Off and Medium High (M3) Blower Speed

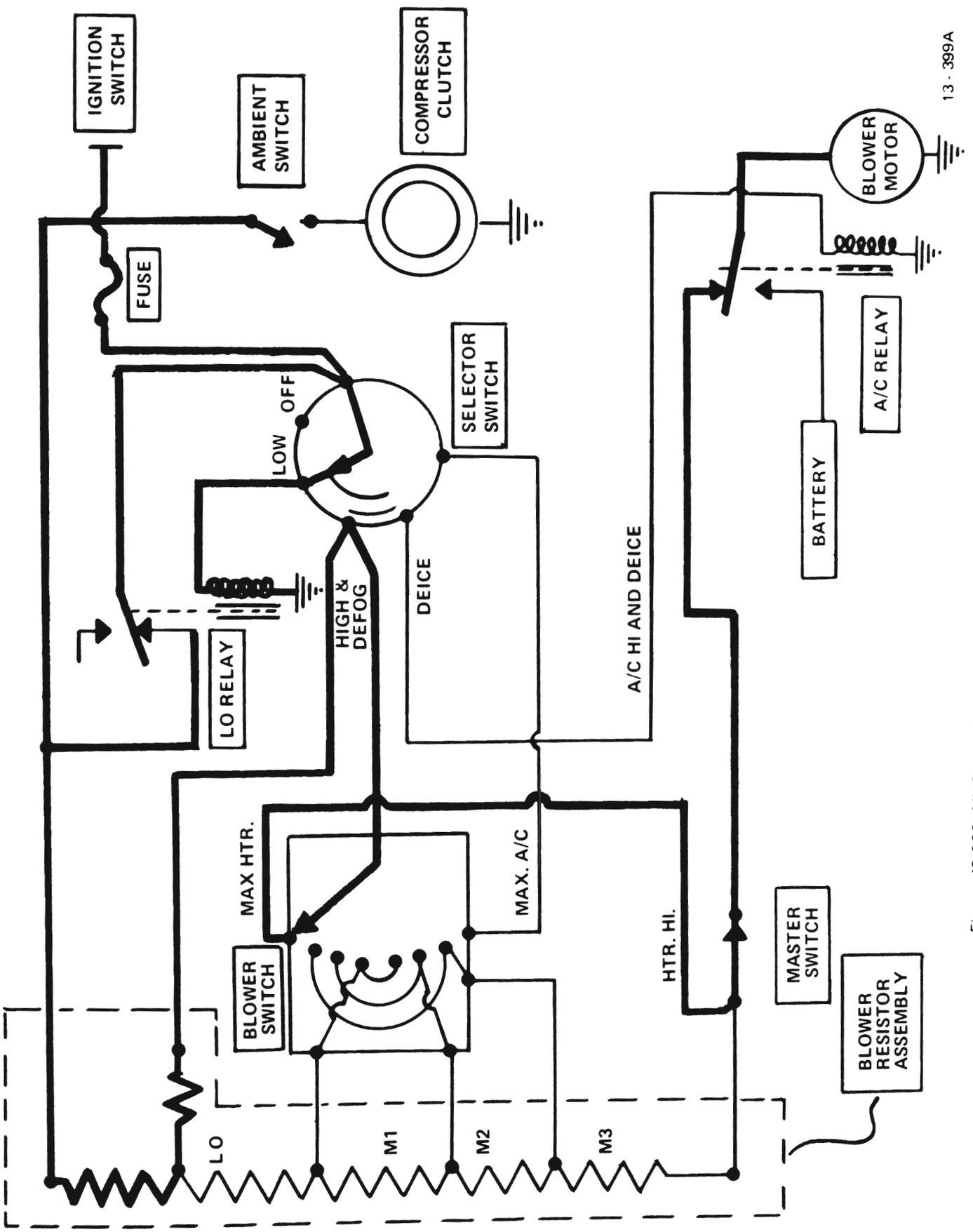


Figure 13-266 All Series Electrical Circuit, System in 'LOW', Compressor Off and High Blower Speed (Heater Only)

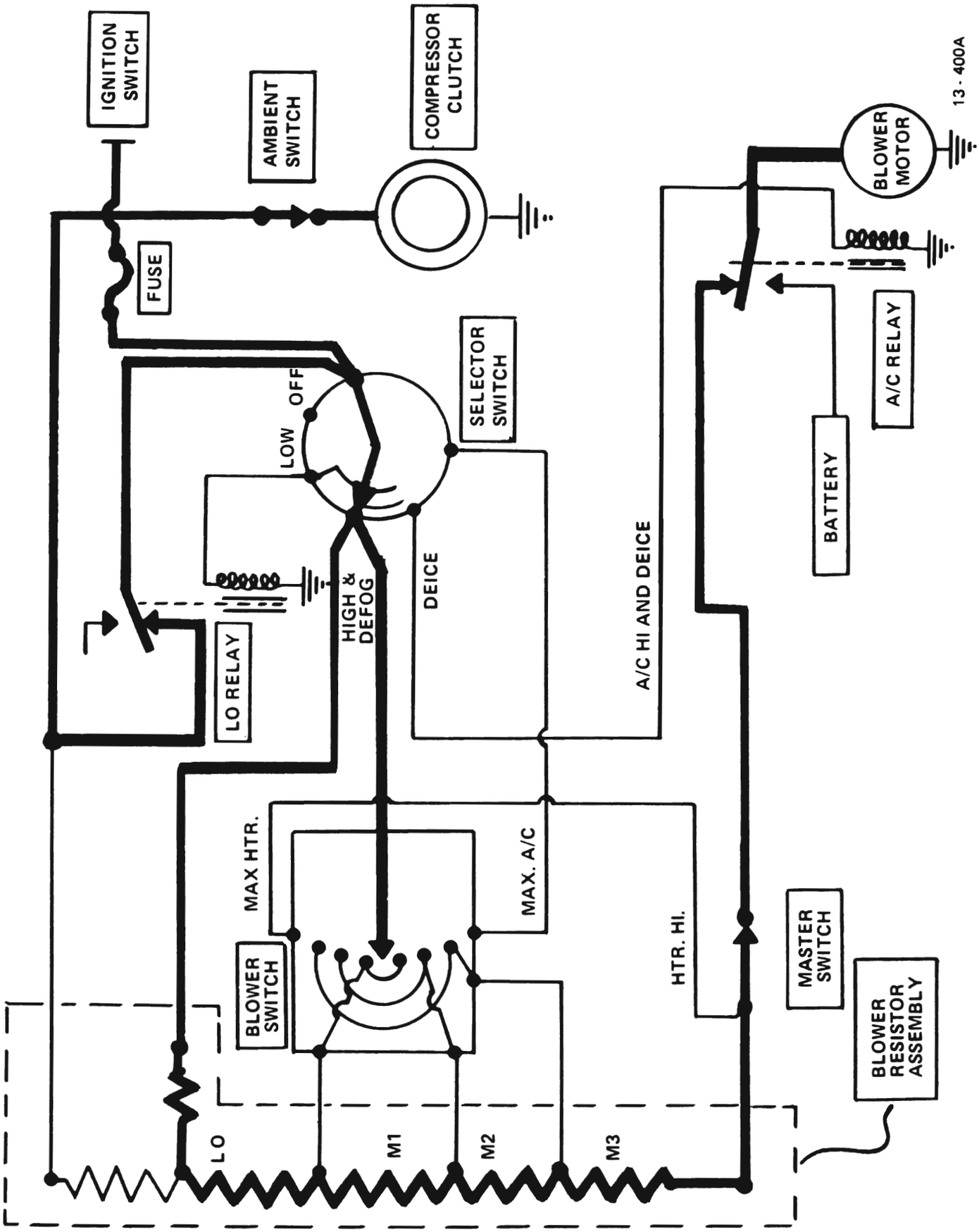


Figure 13-267 All Series - Electrical Circuit, System in 'HIGH' or 'DEFOG', Compressor On and Low Blower Speed

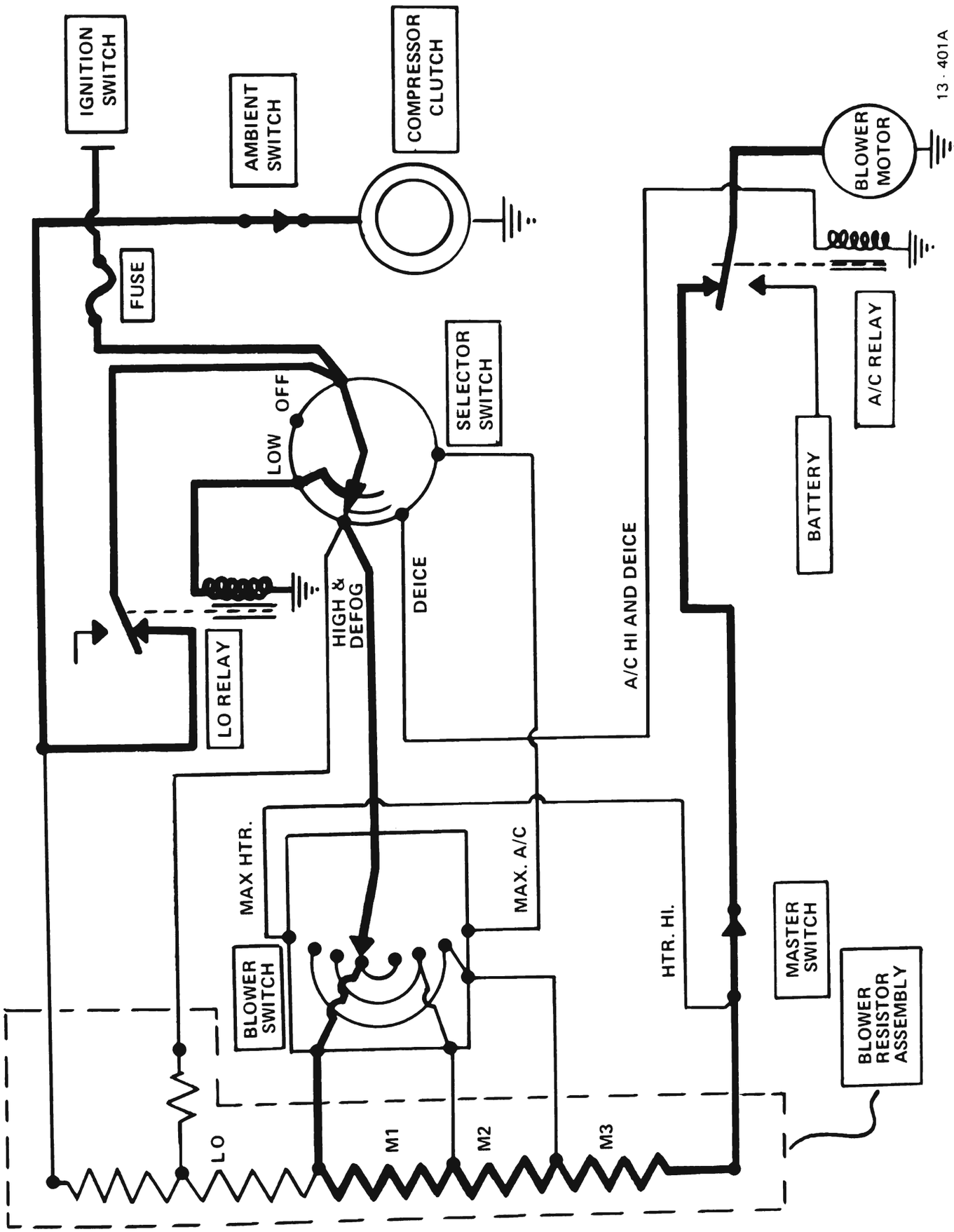


Figure 13-268 All Series - Electrical Circuit, System in 'HIGH' or 'DEFOG', Compressor ON the Medium Low (MI) Blower Speed

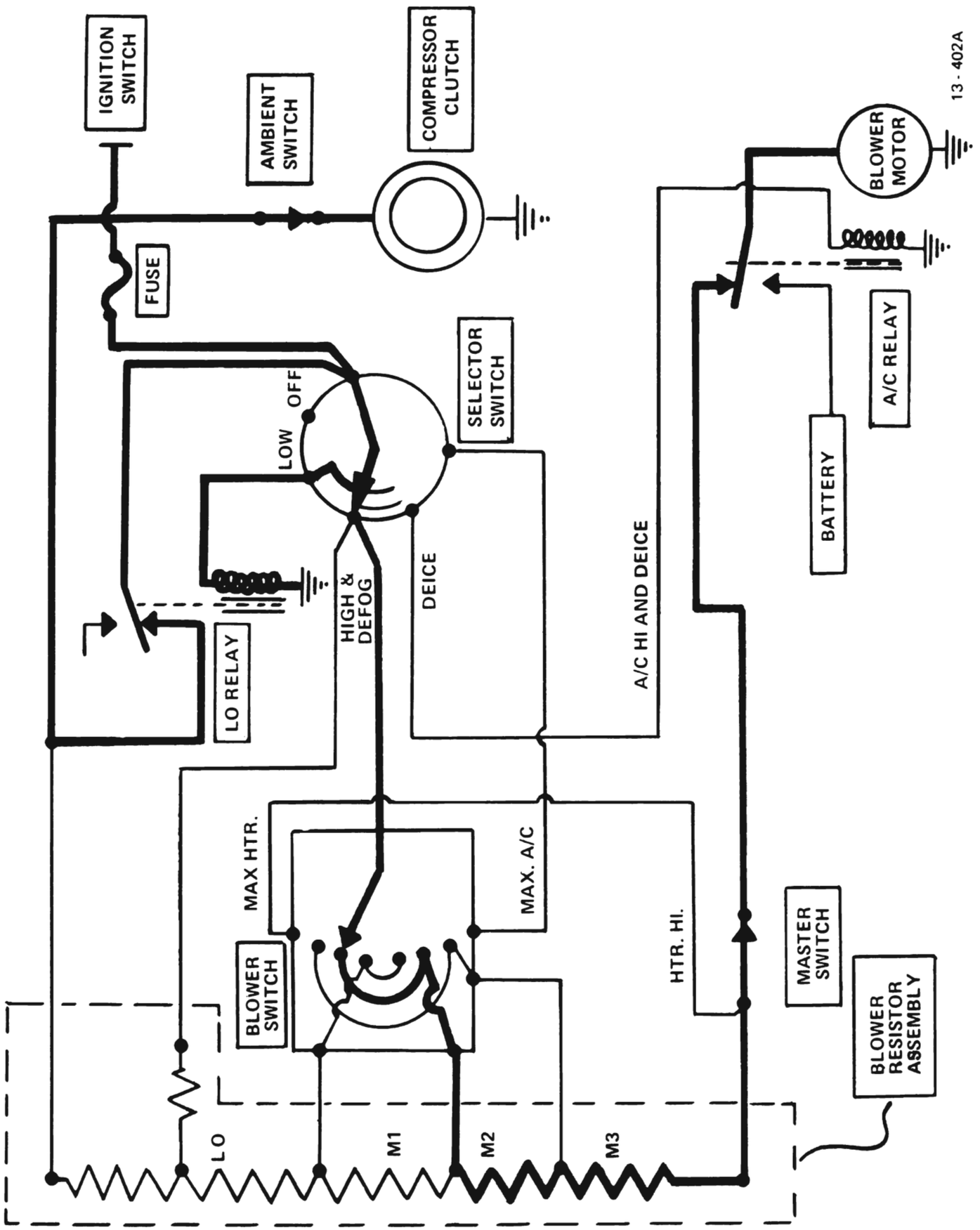


Figure 13-269 All Series - Electrical Circuit, System in 'HIGH' or 'DEFOG', Compressor On and Medium (M2) (Blower Speed)

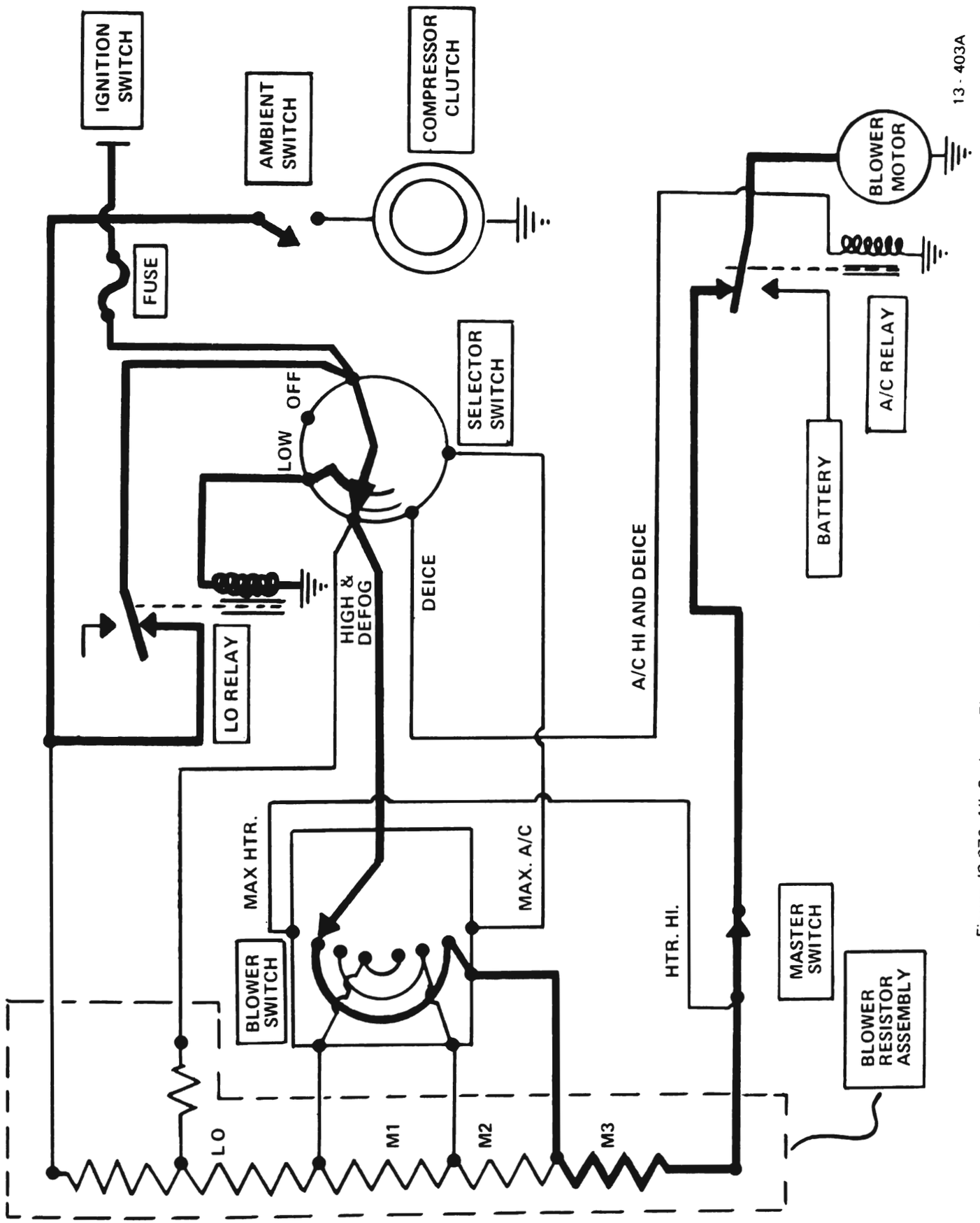


Figure 13-270 All Series - Electrical Circuit, System in 'HIGH' or 'DEFOG', Compressor Off and Medium High (M3) Blower Speed

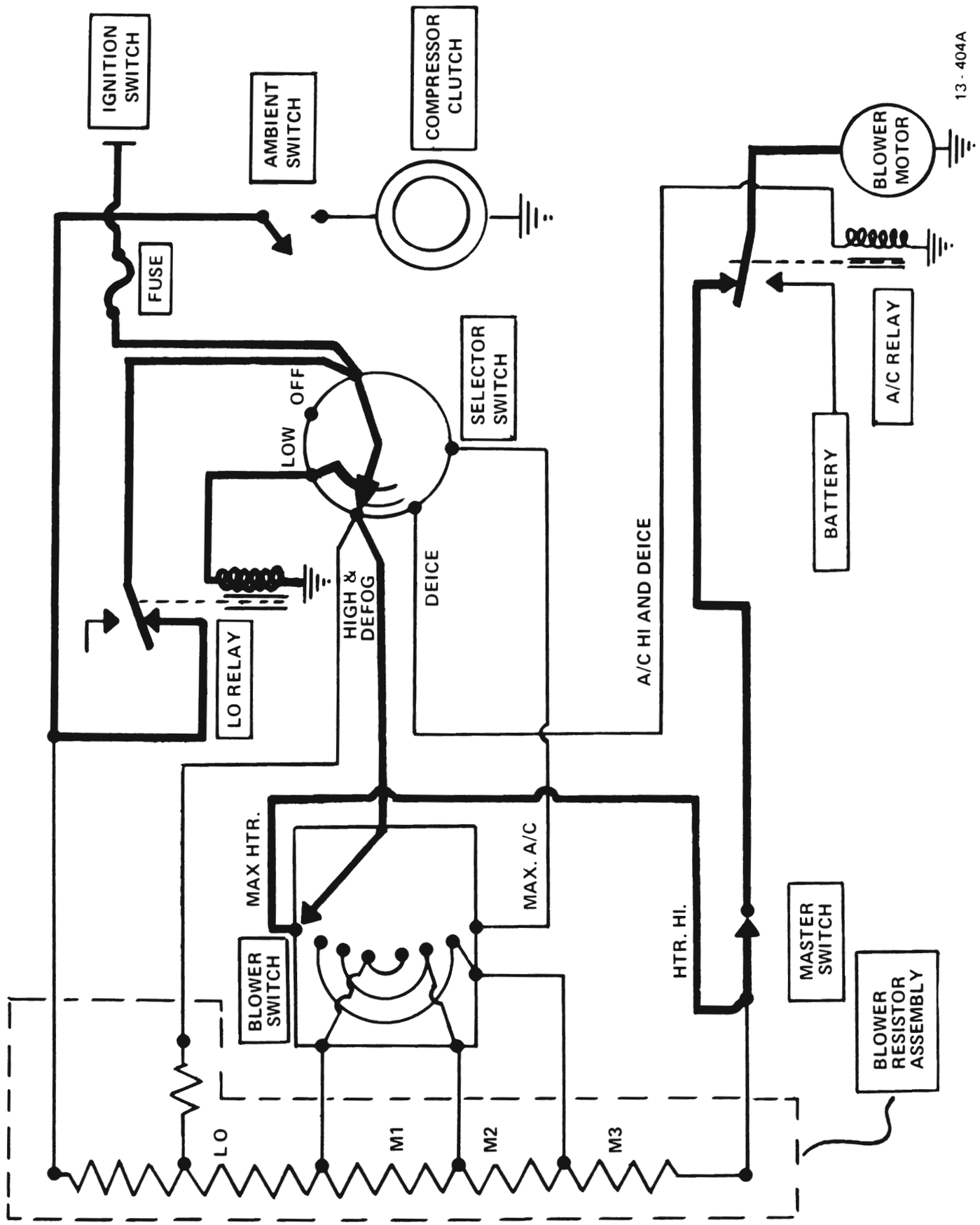


Figure 13-271 All Series - Electrical Circuit, System in 'HIGH' or 'DEFOG', Compressor Off and High Blower Speed (12.5 Volts Heater Only)

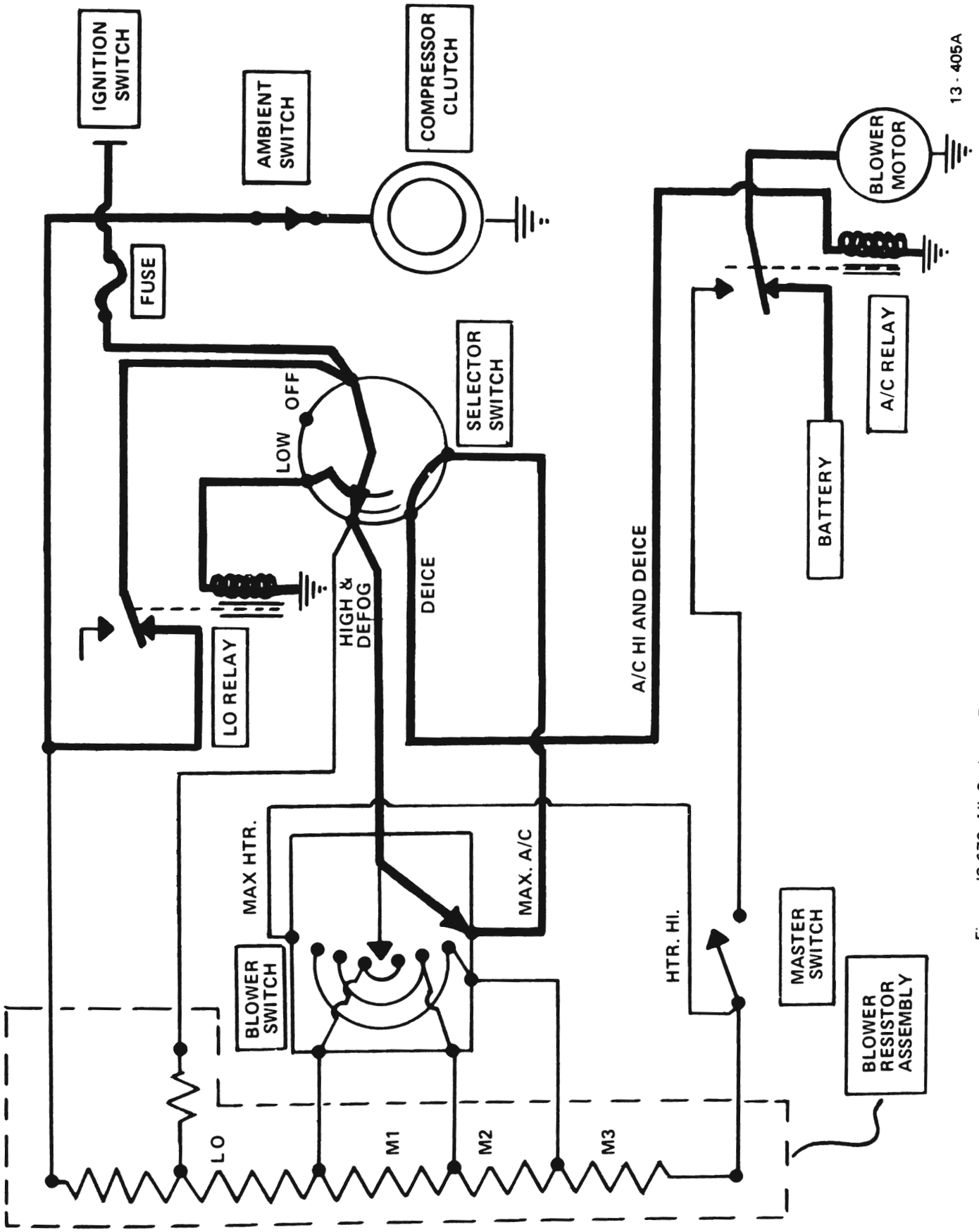


Figure 13-272 All Series - Electrical Circuit, System in 'HIGH' or 'DEFOG', Compressor On and High Blower Speed (13.5 Volts A/C Only)

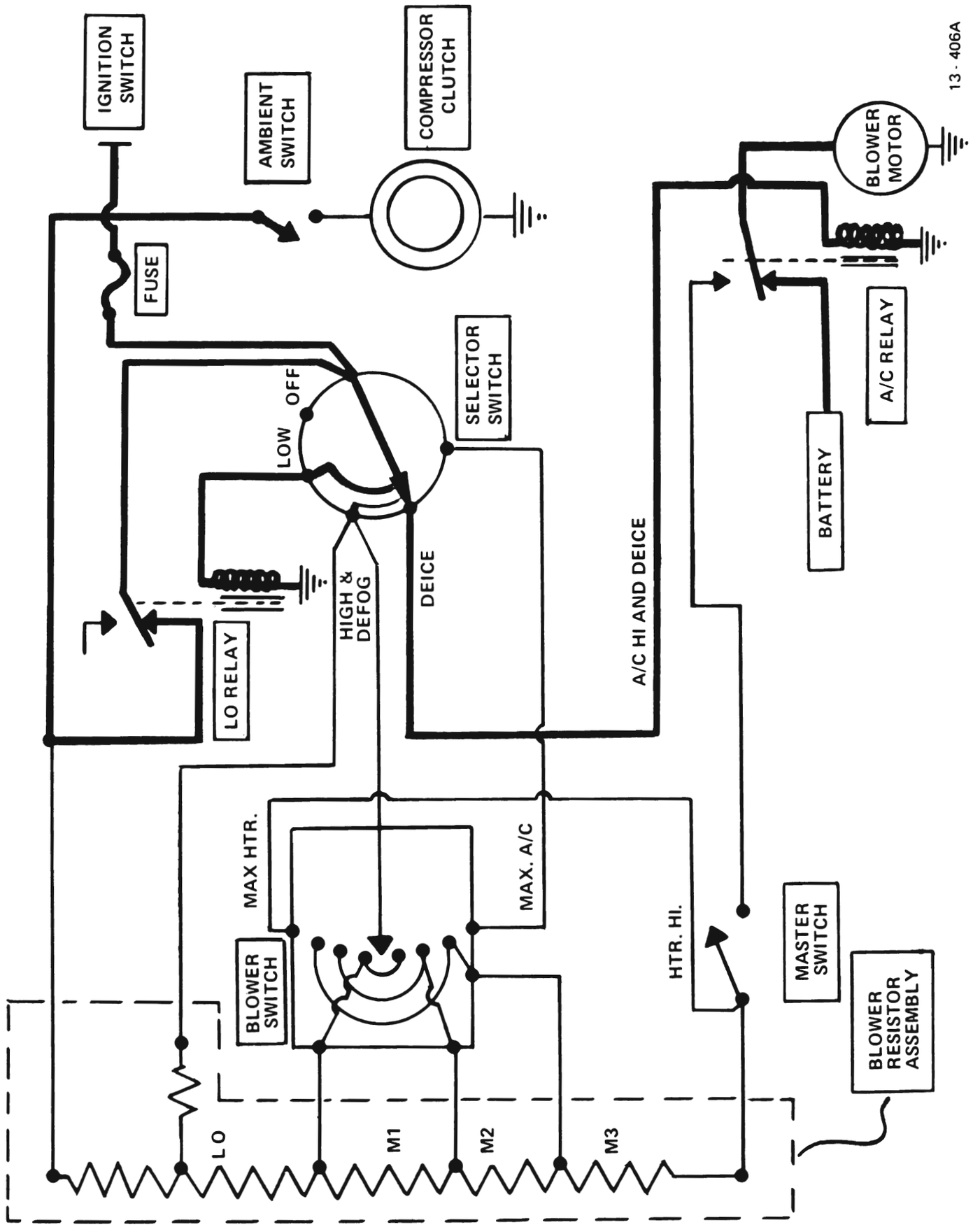


Figure 13-273 All Series - Electrical Circuit, System in 'DEICE', Compressor Off and High Blower Speed (13.5 Volts)

4. Move control assembly back and remove light sockets, electrical and vacuum connections, and bowden cable.

5. Remove control assembly through ash tray opening.

b. Installation

Install reverse of removal procedure.

13-114 REMOVAL AND INSTALLATION OF PROGRAM VACUUM DISC SWITCH

a. Removal

1. a. (45-46-48000 Series) Remove instrument panel cover assembly.

b. (49000 Series) Remove control protection cover.

2. (45-46-48000 Series Only) Remove right defroster hose and outlet.

3. Disconnect six hoses from bottom of switch.

4. Remove screw securing program vacuum disc switch link to PVA linkage and remove link.

5. Remove screw securing program vacuum disc switch to case platform and remove switch.

B. Installation

1. Install reverse of removal procedures.

NOTE: *The hoses and connections on the program vacuum disc switch are color coded to assist in installing hoses to correct locations.*

2. Adjust program vacuum disc switch (refer to Paragraph 13-103).

13-115 REMOVAL AND INSTALLATION OF BLOWER SWITCH

a. Removal

1. a. (45-46-48000 Series) Remove instrument panel cover assembly.

b. (49000 Series) Remove control protection cover.

2. (45-46-48000 Series Only) Remove right defroster hose and outlet.

3. Disconnect electrical connectors from bottom of switch.

4. Remove two screws securing blower switch to case platform and remove switch.

b. Installation

1. Install reverse of removal procedures.

2. Adjust PVA to temperature door linkage (refer to Paragraph 13-102).

3. Adjust blower switch (refer to paragraph 13-104).

13-116 REMOVAL AND INSTALLATION OF PILOTED VACUUM ACTUATOR (PVA)

a. Removal

1. a. (45-46-48000 Series) Remove instrument panel cover assembly.

b. (49000 Series) Remove control protection cover.

2. (45-46-48000 Series Only) Remove right defroster hose and outlet.

3. Disconnect chartreuse hose from pilot side of PVA and black hose from power side of PVA.

4. Disconnect linkage return spring.

5. Disconnect temperature door linkage from PVA stem.

6. Remove two nuts securing PVA to case platform and remove PVA.

b. Installation

1. Install reverse of removal procedure.

2. Adjust PVA to temperature door linkage (refer to paragraph 13-102).

13-117 REMOVAL AND INSTALLATION OF MASTER SWITCH ASSEMBLY

a. Removal

(45-46-48000 Series)

1. Remove instrument panel cover assembly.

2. Remove right defroster hose and outlet.

3. Disconnect electrical connector from master-micro switch.

4. Disconnect two vacuum hoses from master switch.

5. Remove two screws securing master switch to case.

(49000 Series)

1. Disconnect electrical connector from master-micro switch.

2. Disconnect two vacuum hoses from master switch.

3. Remove two screws securing master switch to case.

b. Installation

(All Series)

Install reverse of removal procedures.

NOTE: *The hoses and connections on the master switch assembly are color coded to assist in installing hoses to correct locations.*

13-118 REMOVAL AND INSTALLATION OF THERMOSTATIC VACUUM VALVE (TVV) - WATER VALVE ASSEMBLY

a. Removal

1. Drain radiator.

2. Disconnect two vacuum hoses from TVV and one vacuum hose from water valve diaphragm.

3. Remove TVV - water valve assembly.

b. Installation

Install reverse of removal procedures.

DIVISION IV

TROUBLE DIAGNOSIS

13-121 GENERAL INFORMATION

The following trouble diagnosis applies only to those components which make up the Automatic Climate Control System. Information on diagnosing and correcting components which are a part of the Heater-Air Conditioner System is contained in Section A.

13-122 AUTOMATIC CLIMATE CONTROL QUICK CHECK METHOD

The chart shown in Figure 13-280 is the recommended method for a dealer to determine if the Automatic Climate Control system is functioning correctly. It should be understood that this is a general check of performance and is not an inclusive analyzation of the total system.

13-123 TROUBLE DIAGNOSIS TABLE (ALL SERIES)

It is recommended that a serviceman, when diagnosing a complaint, begin by riding the car with the customer and having the customer point out his complainst. This procedure is recommended insofar as many times an owner explanation of a difficulty is somewhat misleading, or the owner does not understand how the system should operate.

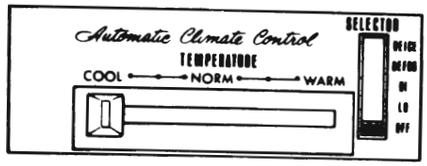
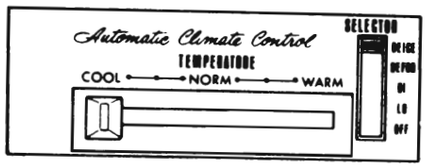
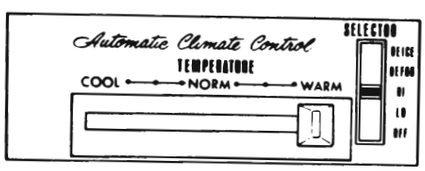
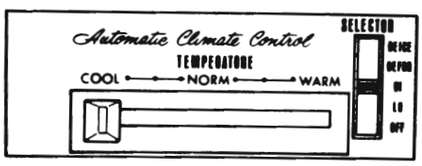
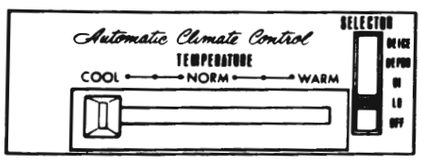
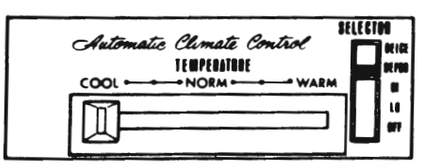
ACTION		OBSERVATION	
Note: Actions should be performed without excessive delay unless otherwise specified. This checking procedure should be performed inside a heated garage where the temperature is no less than 70° F. Close all car doors and windows during check.		Blower Operation	Air Flow
1 Position controls as shown and make observation		Off	None
2 Position controls as shown and maintain condition for 4-5 min. so that engine coolant warms thoroughly. Make observation.		High blower indicating power applied to high blower relay and relay operating properly.	Cold air from heater and defroster (mostly defroster) outlets indicating PVA is retracted toward the A/C position and compressor is operating.
3 Position controls as shown after in-car temperature reaches 70° F. or less. Make observation.		High blower speed indicating PVA has extended to maximum heat position.	Warm air from heater outlets.
4 Position controls as shown and make observation.		HIGH BLOWER SPEED RANGE (2) High (3) Medium - High (4) Medium (5) Low (6) Low - Low (8) Low (9) Medium (10) Medium - High (11) High (Blower reduces speed 4 times, and then increases back to high)	(1) Air flow from heater outlets becomes warm indicating water valve and TVV have opened. (7) Air switches to A/C outlets when blower is at low-low (6) speed. (12) Air flow switches from outside to recirculated air indicating system has automatically sequenced itself from maximum heat (PVA stem extended) to maximum cold (PVA stem retracted).
5 (a) Repeat Step 3 to have system driving for max. heat. (b) Position controls as shown and make observations.		LOW BLOWER SPEED RANGE (Same as in Step 4, but at lower blower speeds except, no high blower speed in A/C.)	(Same as in Step 4)
6 Position controls as shown and make observation.		HIGH BLOWER SPEED RANGE Blower speed will be determined by system requirements.	Heater and defroster outlets.
Note: Changing of system from outside to recirculate air flow can be detected by listening for an air flow sound pitch change.			13-345D

Figure 13-280 Automatic Climate Control (ACC) System Quick Check Chart (All Series)

SYMPTOM	POSSIBLE CAUSES	CHECKS AND CORRECTIONS
BLOWER SYMPTOMS Blower operates on "DEICE" setting only (Cold weather ambient below 55°F).	Not sufficient time allowed (approx. 3 minutes) for TVV to open.	Wait sufficient time for engine coolant to warm up and TVV to open. Instruct owner that system is designed to operate this way.
	Defective TVV (TVV stuck closed).	Refer to vacuum diagrams and check for vacuum at TVV. Replace TVV if necessary.
	Engine Thermostat stuck open delaying coolant warm up.	Replace thermostat.
	Master switch not closing due to defective master switch vacuum diaphragm or defective master switch or lack of vacuum to switch.	Check that there is vacuum to master switch vacuum diaphragm. Check that rubber diaphragm portion of vacuum diaphragm is not partially off and leaking vacuum. Check for voltage to and across master switch when vacuum applied.
	Plugged restrictor in vacuum hose to master switch.	Check for flow through restrictor.
	Defective selector or blower electrical switches, defective resistor assembly.	Replace as required.
Blower operates when SELECTOR "OFF" and ignition ON.	A/C relay stuck on high position.	Check relay and replace if necessary.
	Short circuit to external power source or incorrect wiring.	Refer circuit diagrams, check for shorts.
	Defective selector electrical switch.	Check switch and replace if necessary.
Blower operates when SELECTOR "OFF" and ignition OFF.	High blower relay stuck on high position.	Check relay and replace if necessary.
	Short circuit to external power source or incorrect wiring.	Refer circuit diagrams, check for shorts.
Blower operates at same speed in any SELECTOR position.	Defective SELECTOR electrical switch.	Repair or replace as necessary.

13-430A

SYMPTOM	POSSIBLE CAUSES	CHECKS AND CORRECTIONS
No blower in "DEICE" only. Blower operates on "LOW", "HIGH" or "DEFOG".	Orange/Black high blower relay wire not connected.	Check and correct.
	Water-proof connector connected together with prong missed.	Correct as required.
	Defective SELECTOR electrical switch or missed prong.	Repair or replace as required.
Blower speeds erratic and do not operate in proper sequence or give full range of speeds. or No change in blower speed when SELECTOR moved between "LOW" and "HIGH".	Defective resistor assembly due to resistor coils touching each other.	Check and repair.
	Connector blade of resistor assembly bent and not mating with harness connector.	Check and repair.
Blower does not reach high speed in maximum heating or cooling condition but does reach all other speeds.	System stabilizes preventing PVA from driving to extremes.	System operating normally. Automatic temperature control feature is reacting properly and controlling.
	Misadjusted blower switch.	Adjust blower switch.
	Insufficient PVA travel due to vacuum or mechanical restriction.	Check vacuum circuit, temperature door linkage, and program switch adjustment.
	Defective PVA	Replace PVA.
	Defective selector electrical switch or A/C relay. (A/C only).	Replace SELECTOR switch and or A/C relay.
Blower completely inoperative regardless of SELECTOR position.	Blown or defective fuse.	Refer circuit diagrams and check for short circuits.
	Loose terminal connections or incorrect wiring (i.e. check heater resistor connector) also jumper connector.	Check all terminal connectors and wiring.
	Defective selector switch.	Replace switch.
	Break in wiring or loose connections.	Refer circuit diagrams and check wire from ignition switch and wire to motor.

13-431A

SYMPTOM	POSSIBLE CAUSES	CHECKS AND CORRECTIONS
Blower completely inoperative regardless of SELECTOR position. (Cont'd.)	Defective blower switch.	Check and replace as necessary.
	Master switch defective.	Check and replace as necessary.
	Defective A/C relay. (maximum A/C only).	Replace relay.
	Motor not grounded.	Check motor ground.
	Defective motor.	Replace motor
Blower will not operate as soon as car is started during 73°F or higher ambient and 75°F or higher in-car temperatures. **NOTE:** This will depend upon TEMPERATURE lever position.	15 second delay inherent in system—longer delay indicates defective master switch, diaphragm, or plugged restrictor.	Repair or replace as necessary.
	Defective A/C relay. (maximum A/C).	Replace relay.
Blower operates as soon as car is started (SELECTOR in "LOW", "HIGH" or "DEFOG") during 55°F or lower ambient.	TVV sticking in open position.	Replace TVV.
	Master switch sticking in closed position.	Replace master switch.
Blower operates on high blower when SELECTOR in "LOW" or Blower operates only on high regardless of SELECTOR position.	Defective selector electrical switch.	Replace switch.
AIR FLOW SYMPTOMS Air flows only from heater outlets and does not alternate between heater and A/C outlets.	No vacuum to Htr. - A/C mode door diaphragm (49000 Series only).	Check vacuum circuits for pinched hose or restriction.
	Defective Htr. - A/C mode door diaphragm (49000 Series only).	Replace diaphragm.
	Vacuum bleed or vent to diaphragm plugged (45-46-48000 Series only) or Htr. - A/C mode door diaphragm mechanically obstructed.	Check and correct.
	Vacuum hoses crossed at program vacuum disc switch.	Check vacuum circuits.
	Broken or disconnected mode door spring (45-46-48000 Series only).	Repair or replace as necessary.

13-432A

SYMPTOM	POSSIBLE CAUSES	CHECKS AND CORRECTIONS
Air flows only from heater outlets and does not alternate between heater and A/C outlets or System will not shift air flow to A/C outlets when SELECTOR in "HIGH" but will shift when moved to "LOW".	SELECTOR, due to defect, appears to be "HIGH", however, is actually still in "DEFOG".	Replace SELECTOR switch.
	Pinched vacuum hoses.	Check and correct.
System remains fully on 100% recirculated air (outside-recirculated air door does not open) or switches only to recirculate air and not to outside air (air door fully opened). Inside of car develops a stale odor and windows tend to fog. **NOTE:** The movement of the outside recirculated air door may be observed on 49000 Series cars by removing the side kick panel and on 45-46-48000 Series cars by removing the glove box and the wire screen baffle.	Pinched vacuum hose(s) to outside-recirculated air vacuum diaphragm.	Check vacuum circuit for loose or pinched hoses.
	Defective vacuum diaphragm or on 49000 Series only the housing for the outside-recir. air door is warped.	Replace diaphragm or correct as necessary.
	Master switch vacuum hose disconnected.	Repair as required.
	Program vacuum disc switch defective.	Replace disc switch.
	Rubber diaphragm leaking at master switch.	Check and correct.
System will switch to outside air (outside-recirculated air door fully open) but will not switch to recirculated air (air door partially open).	Misadjusted program vacuum disc switch.	Adjust disc switch as required.
	TVR regulated vacuum low.	Check and correct.
	PVA linkage misadjusted.	Adjust linkage as required.
	PVA defective and not driving to fully retracted position.	Replace PVA
	Broken air door return spring.	Replace spring.
	Outside-recirculate air inlet door binding.	Correct condition as required.
Insufficient air flow from A/C outlets.	Air hoses leading to A/C outlets partially off.	Correct as required.
	Air leaks in ducting.	Correct as required.
	Frozen evaporator core.	Refer to trouble diagnosis in Chassis Service Manual. Section A.
	A/C side outlets partially closed.	Instruct owner how to adjust side outlets.

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SYMPTOM	POSSIBLE CAUSES	CHECKS AND CORRECTIONS
Air flows from A/C outlets even though SELECTOR wheel is in "DEFOG" or "DEICE".	45-46-48000 Series Only - Pinched or disconnected vacuum hose to Htr. – A/C mode door diaphragm.	Correct as required.
	Defective selector switch	Correct as required.
	49000 Series Only – Vacuum will not vent from Htr.–A/C mode door diaphragm.	Check for pinched or kinked hoses.
AIR TEMPERATURE SYMPTOMS (EXCESSIVE HEAT)		
Hot air only with air from heater outlets only or System drives to maximum heat and high blower speed and remains in this condition.	No vacuum passing to PVA even though TVR regulating vacuum for A/C	Check for vacuum leaks, blocked or pinched hose, ruptured PVA pilot side diaphragm, blocked air bleed hole in power diaphragm or defective vacuum disc switches.
	TVR not regulating vacuum to PVA pilot diaphragm.	Repair or replace TVR as required.
	Broken or disconnected temperature control Bowden cable.	Repair or replace as required.
	Range adjustment incorrect.	Adjust range cooler. **NOTE:** If this correction is not successful, reset range screw to original setting.
	PVA to temperature door linkage return spring broken or disconnected	Repair or replace as necessary.
Hot air from A/C outlets	Compressor inoperative.	Check compressor ambient bimetal switch and selector electrical switch for voltage. Check for wires from compressor to ambient switch and ambient switch to selector electrical switch for open circuit. Check clutch coil for continuity and for good ground condition. Check water-proof connector connected together with prong missed. Check for loose connector. Check for loose compressor belts.

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SYMPTOM	POSSIBLE CAUSES	CHECKS AND CORRECTIONS
Hot air from A/C outlets (Cont'd.)	Insufficient refrigerant.	Check for adequate refrigerant charge and correct as required.
	POA-STV sticking.	Check POA valve for operation. Repair or replace as required.
(INSUFFICIENT HEAT) Air from heater outlets cool or cold.	No vacuum being applied to water valve.	Check for pinched hose, restriction in hose, vacuum leak or defective selector or program vacuum disc switches.
	Defective water valve.	Replace valve.
	Insufficient coolant.	Correct as required.
	Loose water pump drive belt.	Adjust as required.
	Blockage in engine coolant circuit (i.e.—blocked heater core or kinked heater hoses or plugged water pump passages.)	Correct as required.
	Dirt in engine thermostat or defective thermostat.	Correct as required.
	Excessive vacuum to PVA pilot diaphragm.	Check for plugged vacuum line or vacuum leak.
	Defective PVA	Repair or replace.
	TVV not open	Check, repair or replace as required.
	Range adjustment incorrect.	Check and adjust as required. **NOTE:** If this does not correct situation—reset range to original setting.
	Misadjusted or binding PVA to temperature door linkage.	Check for free movement of linkage. Correct as required.
Heat buildup in car extremely slow.	Insufficient vacuum to PVA power diaphragm resulting in very slow drive of PVA.	Check for defective restrictor in vacuum source hose to power side of PVA. Check for plugged vacuum line or leaking hose.
	Excessive body air leaks.	Correct as required.

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SYMPTOM	POSSIBLE CAUSES	CHECKS AND CORRECTIONS
(EXCESSIVE COOLING)		
Cold air only, with air from A/C outlets or System drives to maximum cooling and high blower speed and remains in this condition.	Temperature control cable broken or disconnected.	Repair or replace as required.
	TVR not regulating vacuum to PVA pilot diaphragm. (Ball valve stuck to seat in TVR.)	Repair or replace as required.
	Defective PVA.	Replace PVA
	Range adjustment incorrect.	Adjust range warmer. **NOTE:** If this does not correct situation–reset range to original setting.
	PVA to temperature door linkage return spring broken or disconnected.	Repair or replace as required.
	Excessive vacuum passing to PVA pilot diaphragm.	Check for plugged clean air filter, blocked or pinched clean air hose, or defective vacuum disc switches.
Cold air from heater (floor) outlets.	No vacuum being applied to water valve.	Check for pinched hose, restriction in hose, vacuum leak, or defective selector or program vacuum disc switches.
	Defective water valve.	Replace water valve.
	Insufficient coolant.	Correct as required.
	Loose water pump drive belt.	Adjust as required.
	Blockage in engine coolant circuit (i.e.–blocked heater core or kinked heater hoses or plugged water pump passages.	Correct as required.
	Dirt in engine thermostat or defective thermostat.	Correct as required.
	Misadjusted or binding PVA to temperature door linkage.	Check for free movement of linkage. Correct as required.
	Excessive vacuum to PVA pilot diaphragm.	Check for plugged clean air filter, blocked or pinched clean air hose, or defective vacuum disc switches.
	Defective PVA.	Replace PVA.
	TVV not open.	Check, repair or replace as required.
	Range adjustment incorrect.	Check and adjust as required. **NOTE:** If this does not correct situation–reset range to original setting.

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SYMPTOM	POSSIBLE CAUSES	CHECKS AND CORRECTIONS
Cold air from heater (floor) outlets (Cont'd.)	Heater – A/C mode door not shifting position.	(45-46-48000 Series Only) Check for bleed or vent plugged on heater–A/C mode door diaphragm. Also check for binding condition at mode door. (49000 Series Only) Check for vacuum leak or pinched vacuum hose, defective vacuum diaphragm or binding condition at mode door.
(INSUFFICIENT COOLING) Car does not cool-down fast enough.	Loss of refrigerant.	Correct as required.
	Insufficient vacuum to PVA pilot diaphragm resulting in very slow drive of PVA.	Check for partially pinched or blocked vacuum hose or vacuum leak down due to loose or defective hose or component.
	Temperature door linkage binding, obstructed or misadjusted.	Correct as required.
	Outside-recirculated air door not in recirculated (partially closed) position.	Check for broken air door return spring and replace if necessary. Check for correct adjustment of of program vacuum disc switch and linkage.
	Flexible air hoses disconnected or air leakage in ducting.	Correct as required.
	A/C side outlets closed or partially closed.	Instruct owner how to adjust side outlets.
	Range adjustment incorrect.	Check and adjust range. **NOTE:** If this does not correct situation–reset range to original setting.
	Defective POA-STV valve.	Replace valve.
	PVA not completing its travel (one extreme to the other), or defective PVA.	Check and adjust travel or replace as necessary.
MISCELLANEOUS Compressor does not operate (ambient temperature above 48 °F).	Compressor ambient switch not connected.	Check and correct as required.
	Waterproof connector connected together with prong missed.	Check and correct as required.

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