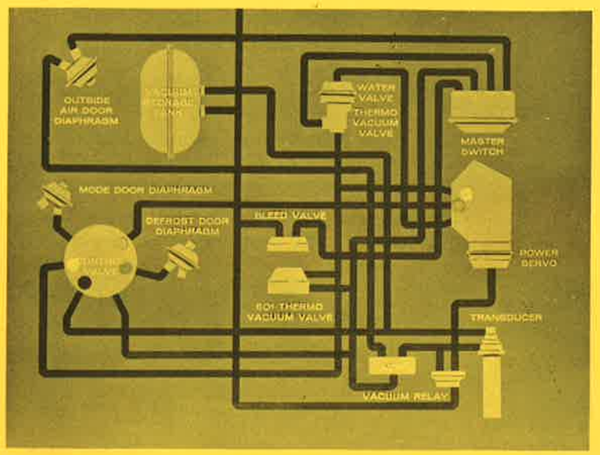
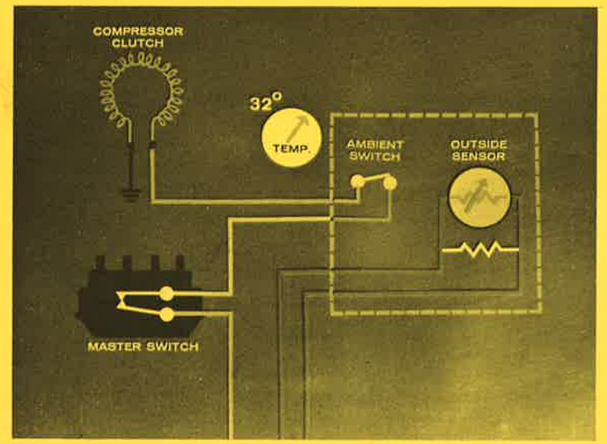
VALVES AND THEIR FUNCTION:



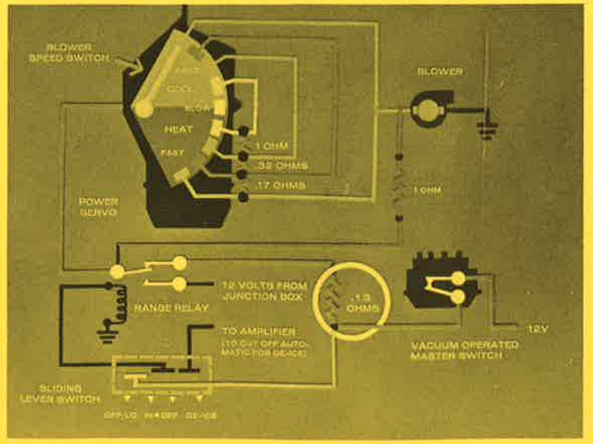
The water valve—Its purpose is to shut off the water flow to the heater core when the system is in maximum cooling. It is controlled by full vacuum from the vacuum valve operated by the power servo. When the power servo has the temperature door positioned for maximum cooling, it also has the vacuum valve positioned to supply full vacuum to close the water valve. This shuts off water to the heater.

The vacuum bleed valve—When the engine is turned off, the bleed valve opens and allows vacuum on the master switch to bleed off. This opens the blower switch and allows the outside air door to close and prevents blower operation the next time the car is started until blower operation is called for. Without this valve, you could get a blast of cold air in the morning when you started your car. Not too desirable, especially on a frosty morning.

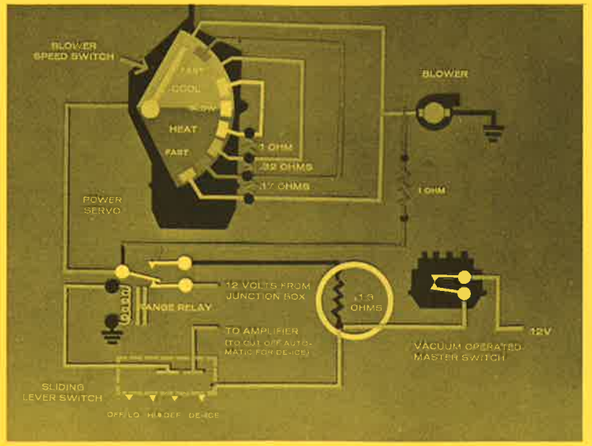
The vacuum operated valve (VOV)—Its purpose is to prevent the outside air door from opening until vacuum reaches the master switch. Vacuum from 3 sources can operate this valve. First, from the master switch. Second, from the thermostatic vacuum valve on the control panel. Third, from the control panel when the lever is on "de-ice." Vacuum to the VOV allows regulated vacuum from the transducer to be applied to the outside air door, and opens it further as regulated vacuum increases. This allows more outside air to enter the system. The door will be wide open at approximately 4″ of regulated vacuum.



Now, there are two electrical units to discuss. First, is the ambient switch — a temperature-sensitive electric switch similar in operation to a thermostat. It is located adjacent to the outside "sensor" and is operated by ambient temperature. Its purpose is to turn the air-conditioning compressor on when the ignition switch is on and ambient temperature is above approximately 32 degrees.

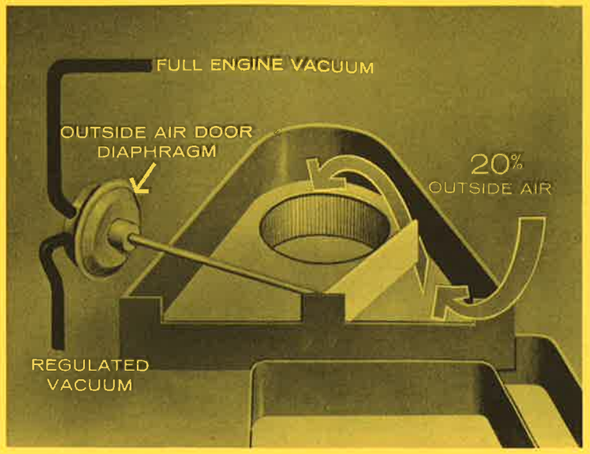


The second electrical unit to discuss is the blower-speed range relay. This relay changes the current flow to the blower when the lever is moved from low to high. In low, all current must pass through the resistor, which reduces the amount of voltage to the blower and it operates in one of the five speeds in the low range.



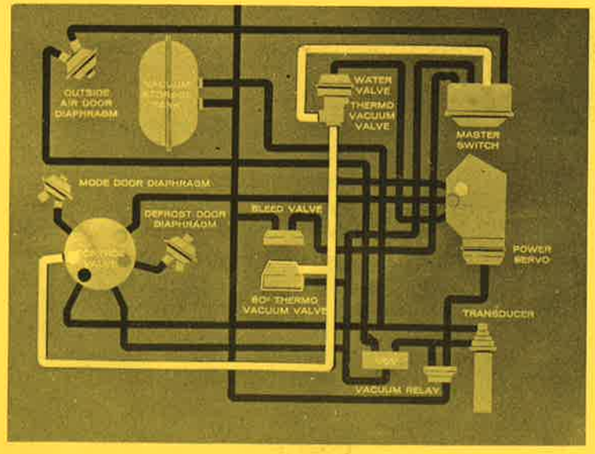
When the lever is moved to high, a switch on the control is closed which energizes the range relay. The voltage from the junction block is then directed through the points to the blower without going through that resistor. This allows the blower to operate in one of the five high-range speeds.

Correct operation of the Comfortron system is dependent upon each component. To properly diagnose the system, you must have a thorough knowledge of the complete operating cycle — from heat to air conditioning and back to heat.



So, let's start by looking down into the air-inlet and blower portion of the Comfortron's air distribution system. Here you see the outside air door. It is operated by full engine vacuum and by regulated vacuum.

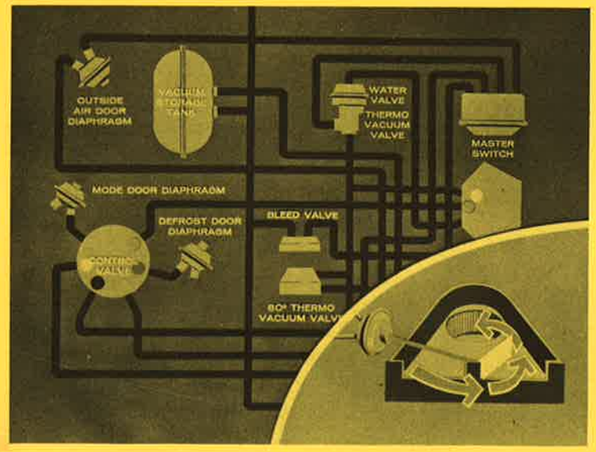
Full engine vacuum operates the recirculate diaphragm, opening the door, allowing approximately 20% outside air to enter the system. Regulated vacuum also operates the outside air door diaphragm. As regulated vacuum increases, the door opening increases. Let's look behind the scenes and see what happens.



When the control lever is moved to the right, the vacuum valve on the control panel directs engine vacuum to the thermostatic vacuum valve on the control panel and to the thermostatic vacuum valve mounted on the water valve.

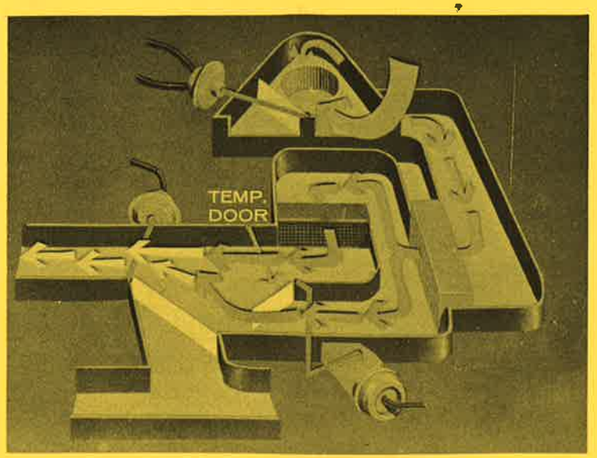
Either of these two valves can make the decision to allow the outside air door to open.

If the engine water temperature is above 120°, the thermostatic vacuum valve mounted on the end of the water valve will be open and directing vacuum to the master switch. Vacuum is directed through the switch and to the outside air door diaphragm and the door opens part way to allow 20% outside air to enter. But, if the water temperature is below 120°, vacuum would have been shut off at the thermostatic vacuum valve.



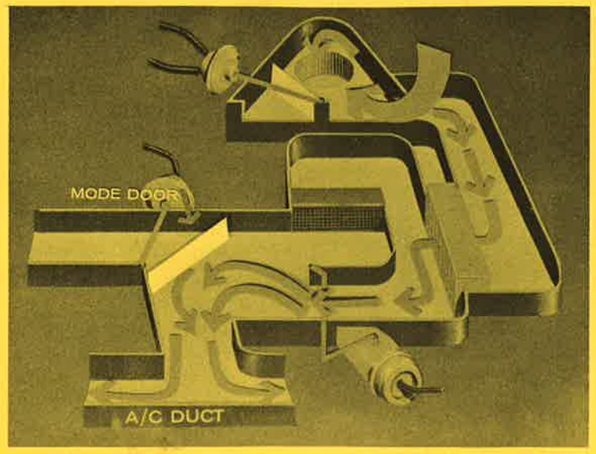
The thermostatic vacuum valve on the control panel can also allow the outside air inlet door to open. This valve is located inside the car and is sensitive to in-car temperature. If the in-car temperature is above 80 degrees, vacuum will be directed through the valve to the master switch and to the outside door diaphragm—and again, the door opens part way to allow 20% outside air to enter.

Remember, when diagnosing the system, the outside door will not open unless the engine water temperature is above 120 degrees, the in-car temperature is above 80 degrees, or the control lever is on "de-ice."

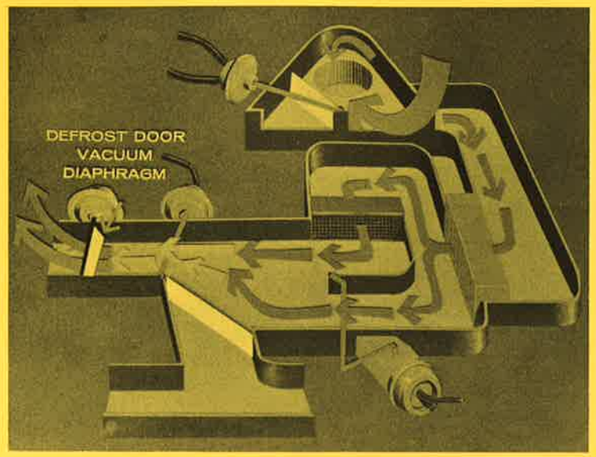


This is the temperature door. It is operated by linkage from the power servo. Remember, high vacuum on the power servo means "make it warmer." High vacuum pulls the door linkage and the door moves to direct more air through the heater core. Low vacuum on the power servo permits the internal spring to move the linkage out, and the temperature door moves to direct less air through the heater core.

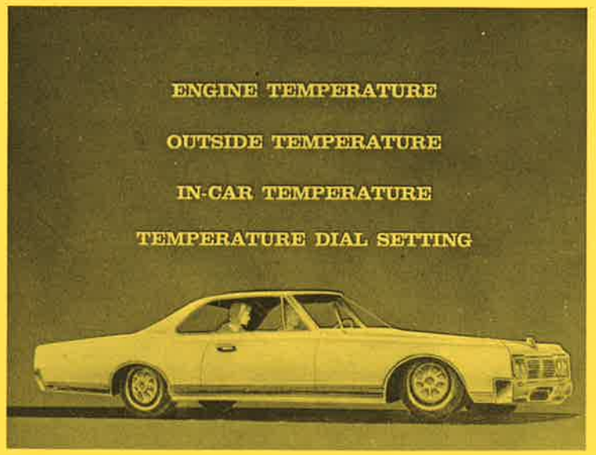
The distance the door moves depends on the amount of regulated vacuum on the power servo.



This is the mode door. It's purpose is to direct air through the air conditioning outlets, or the heater outlets. The mode door is operated by a vacuum diaphragm and has two positions. The mode door *never* stops in between. When it has *full* engine vacuum, it directs air out the heater outlets. When it has *no* vacuum, it directs air out the air-conditioning outlets.

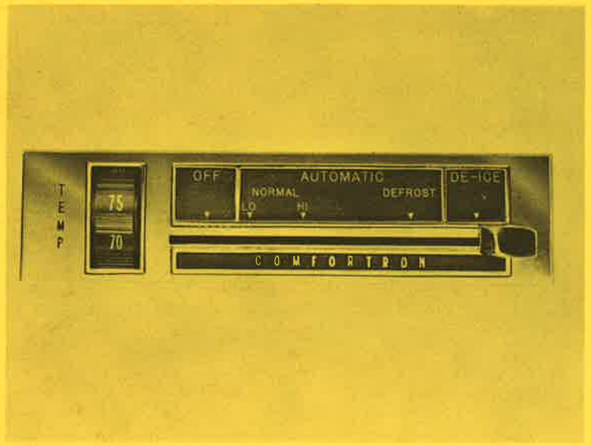


This is the defroster door. Its purpose is to direct air up to the windshield. With the lever in the "defrost" position, the defroster door opens to direct air out of the defroster outlets.
Air temperature from the defroster outlets can be warm or cold because the system is on automatic. But, warm or cold, a portion of the air comes out the heater outlets, never the air-conditioning outlets, because, when the lever is on "defrost" the mode door closes the air conditioning outlets. So, air temperature from the defroster depends upon what the driver asks for with the temperature dial. If the lever is in the "defrost" position and the dial is set for low temperature, cold air comes out the defroster and heater outlets.

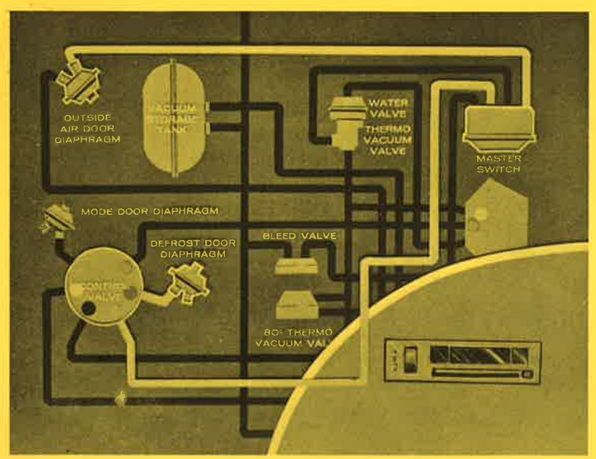


Up until now, every operation of the system has been automatically controlled, depending upon:

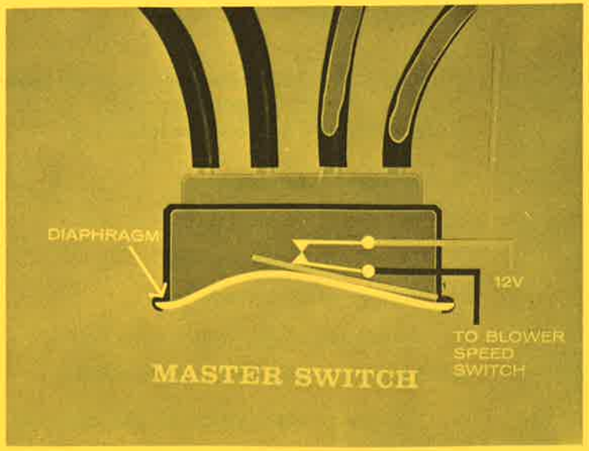
- Engine Temperature
- Outside Temperature
- In-Car Temperature
- Temperature Dial Setting



But, automatic control of the system is not true when the driver puts the lever in the de-ice position.

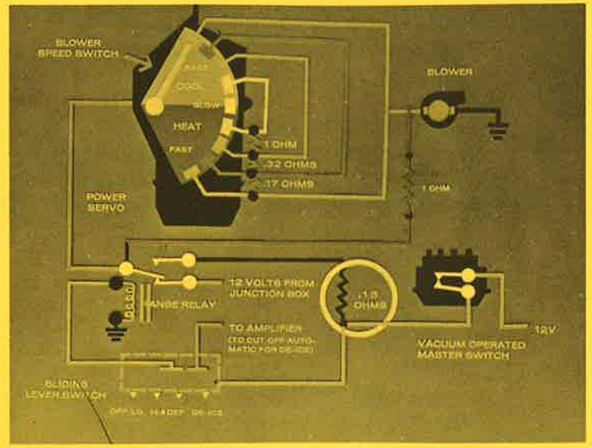


Movement of the lever to "de-ice" moves the vacuum valve on the control and full vacuum is directed to the master switch. The two thermostatic vacuum valves, on the control and on the water valve, are *bypassed* and the outside air door opens, regardless of engine or in-car temperature. Also, movement of the temperature dial has no effect on the system. So, the defroster door opens just as it did when the lever was in the "defrost" position. When the driver moves the lever to "de-ice," he wants maximum heat from the defroster. But, remember, the thermostatic vacuum valve is bypassed. Therefore, de-ice air will not be hot until engine temperature rises.



BLOWER OPERATION:

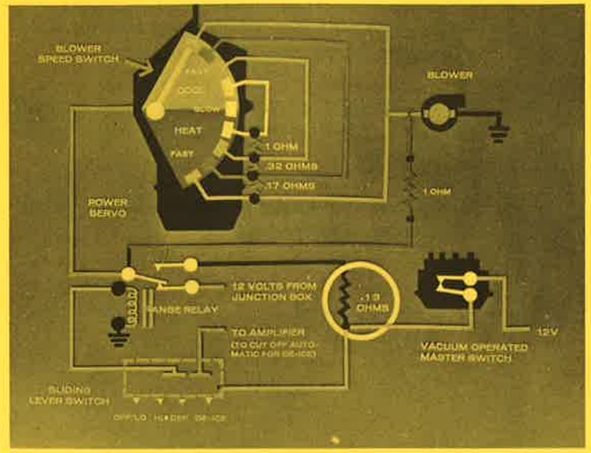
The blower cannot operate until vacuum is supplied to the master switch to close the switch and turn the blower on. So, the blower will not operate until the engine water temperature is above 120 degrees, or the in-car temperature is above 80 degrees, or the selector lever is in the de-ice position. Satisfying any *one* or more of these conditions will allow the blower to operate.



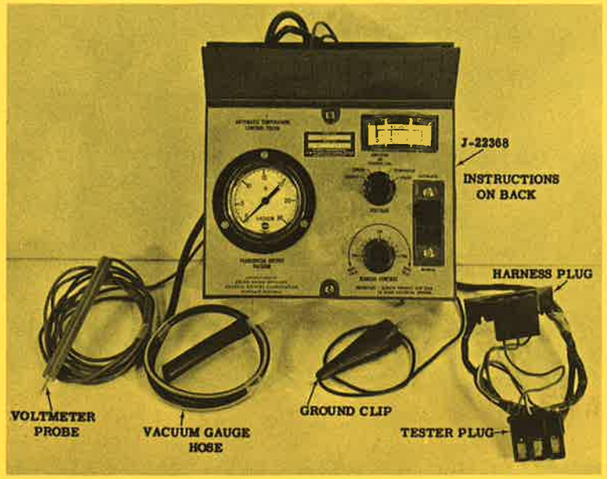
This is the blower speed selector switch. It is operated by the power servo. The switch is constructed so that the same speed combinations are available for heating or air conditioning.

There are five different blower speeds in the low-range position, five more different blower speeds in high-range and these same five speeds in the defroster range. When the lever is in the de-ice range, the blower remains on maximum speed.

As the power servo linkage moves to operate the temperature door to blend just the right amount of heated air and cooled air, it also selects the proper blower speed.



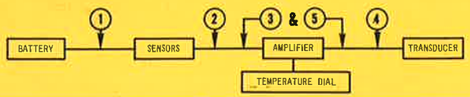
The power servo selects the faster blower speeds when it has the temperature door in either of two positions: maximum heat or maximum cool. Slower blower speeds are selected as the door moves toward the center. The slowest speed occurs when the temperature door is in the mid-way position.
Although variation in blower speed is slight, you can hear the difference in motor sound and it will help you in diagnosis.
Also remember, when the lever is in either "high" or "defrost" position, a resistor is bypassed. This resistance is eliminated from the blower circuit, causing higher blower speeds. Again, blower speed does not affect temperature, only air velocity for desired comfort.



AUTOMATIC TEMPERATURE CONTROL TESTER
OPERATING INSTRUCTIONS
J – 22368

I. BEFORE MAKING TESTS:
1. DISCONNECT "3 WAY" ELECTRICAL PLUG FROM CONTROL AMPLIFIER, PLUG TESTER PLUG WITH YELLOW WIRE INTO CONTROL AMPLIFIER, PLUG CAR HARNESS INTO TESTER, CONNECT BLACK GROUND CLIP TO GOOD GROUND.
2. DISCONNECT LARGE VACUUM HOSE FROM TRANSDUCER AND INSERT TESTER TEE IN VACUUM LINE.
3. SET DASH CONTROL TO NORMAL HIGH, TEMPERATURE DIAL TO 75°, AND ENGINE ON FAST IDLE.

II. FOLLOW CHART TO DIAGNOSE DEFECT. FOR DETAILS REFER TO SERVICE MANUAL.



STEP	TESTER SETTINGS: ROCKER SWITCH	VOLTAGE KNOB	MANUAL CONTROL	TESTER SHOULD INDICATE	TO CORRECT ABNORMAL INDICATION
1	MANUAL	SOURCE	150	BATTERY VOLTAGE	CHECK FUSE AND WIRING
2	MANUAL	SENSOR	150	BATTERY VOLTAGE	CHECK FOR OPEN IN SENSOR CIRCUIT
3	MANUAL	AMPLIFIER OR CONTROL CAL.	A. MAX. HEAT*	0 – 4 VOLTS	SEE SERVICE MANUAL: MALFUNCTIONING AMPLIFIER OR TEMPERATURE DIAL
			B. MAX. COLD*	8 VOLTS MIN.	
4	MANUAL	TRANSDUCER	A. MAX. COLD*	8 VOLTS MIN. 0 – 3 IN. VAC.	CHECK FOR OPEN OR BAD GROUND IN TRANSDUCER CIRCUIT OR REPLACE TRANSDUCER
			B. MAX. HEAT*	0 – 4 VOLTS 9 IN. MIN. VAC.	
5	A. MANUAL	AMPLIFIER OR CONTROL CAL.	REFER TO SERVICE MANUAL FOR CAL. SETTING	6.5 VOLTS	ROTATE CAR TEMPERATURE DIAL UNTIL METER READS 6.5 VOLTS. CAR TEMPERATURE DIAL SHOULD INDICATE 75°. (IF NOT, SEE SERVICE MANUAL)
	B. AUTOMATIC	AMPLIFIER OR CONTROL CAL.	SAME AS 5A ALLOW 5 MIN. FOR SYSTEM TO STABILIZE WITH DOORS & WINDOWS CLOSED	5.5 – 7.5 VOLTS	AFTER 5 MINUTES OF OPERATION, CHECK FOR DEFECTIVE SENSOR. SEE SERVICE MANUAL

*BLOWER MOTOR SHOULD OBTAIN HIGH SPEED. SEE SERVICE MANUAL.

III. REFER TO SERVICE MANUAL FOR FURTHER OPERATIONAL CHECKS.

7796977

AUTOMATIC TEMPERATURE CONTROL TESTER
OPERATING INSTRUCTIONS
J – 22368

DIAGNOSIS:

This tester J-22368 is available from the tool supplier. It was designed especially for the Comfortron and will test the following:

1. Voltage to the sensors
2. Voltage to the amplifier
3. Operation of the amplifier
4. Voltage to the transducer
5. Calibration of the temperature dial
6. Vacuum in any part of the system
7. Voltage at any location in the electrical system

When the voltage knob is in the "probe" position and the tester black wire grounded, the tester is used as a Voltmeter.
Use the tester red lead to check voltage at various locations.

IMPORTANT: *WHEN CHECKING FOR AN OPEN CIRCUIT IN THE SENSOR STRING, YOU MUST PULL THE PLUG FROM THE BACK OF THE AMPLIFIER.*

This is the instruction card on the back of the tester.

The numbered steps in the left column are in the sequence you must use to diagnose the system. *DO NOT* proceed to the next step until you obtain a satisfactory tester indication and do not skip a step.

The numbers in the circles on the block diagram show you what you are testing in each step.

Example: In step 1 you are checking for battery voltage to the sensors.

The chart on the next page can be used in diagnosis. It shows you the electrical and vacuum source for each unit.

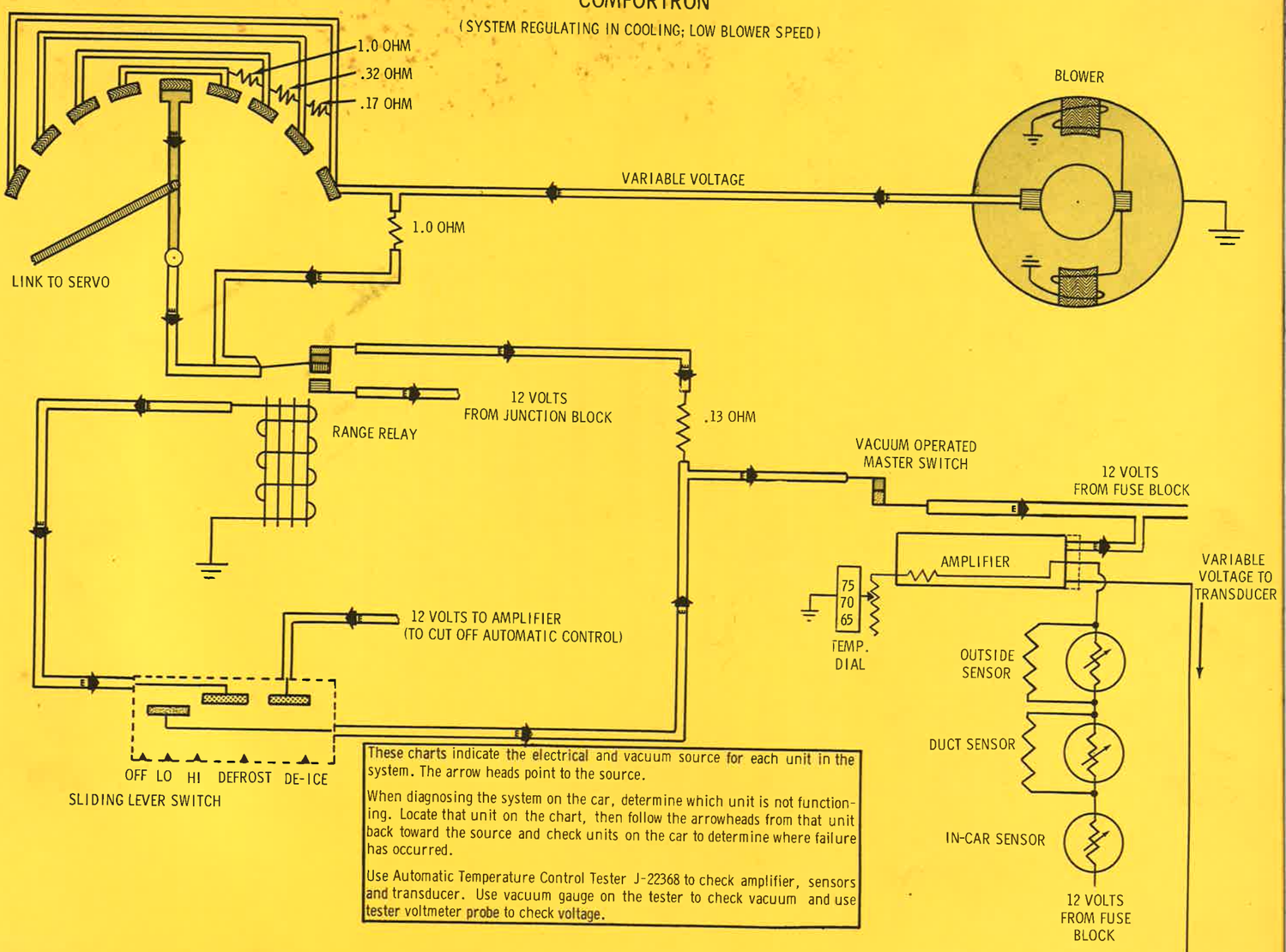
Inspect the system on the car and determine what is not functioning, then refer to the chart and locate the source of vacuum and/or voltage for that unit. Check on the car to determine where the failure has occurred.

EXAMPLE: SERVO DOES NOT OPERATE, UNIT STAYS ON HEAT.

1. Refer to chart, power servo diaphragm requires regulated vacuum to operate.
2. Connect tester vacuum gauge into the vacuum line to power servo.
3. If there is full vacuum and it does not change with rotation of the dial, refer to chart to locate source for regulated vacuum, which is the transducer.
4. Connect tester plug to amplifier and check operation of the transducer.

COMFORTRON

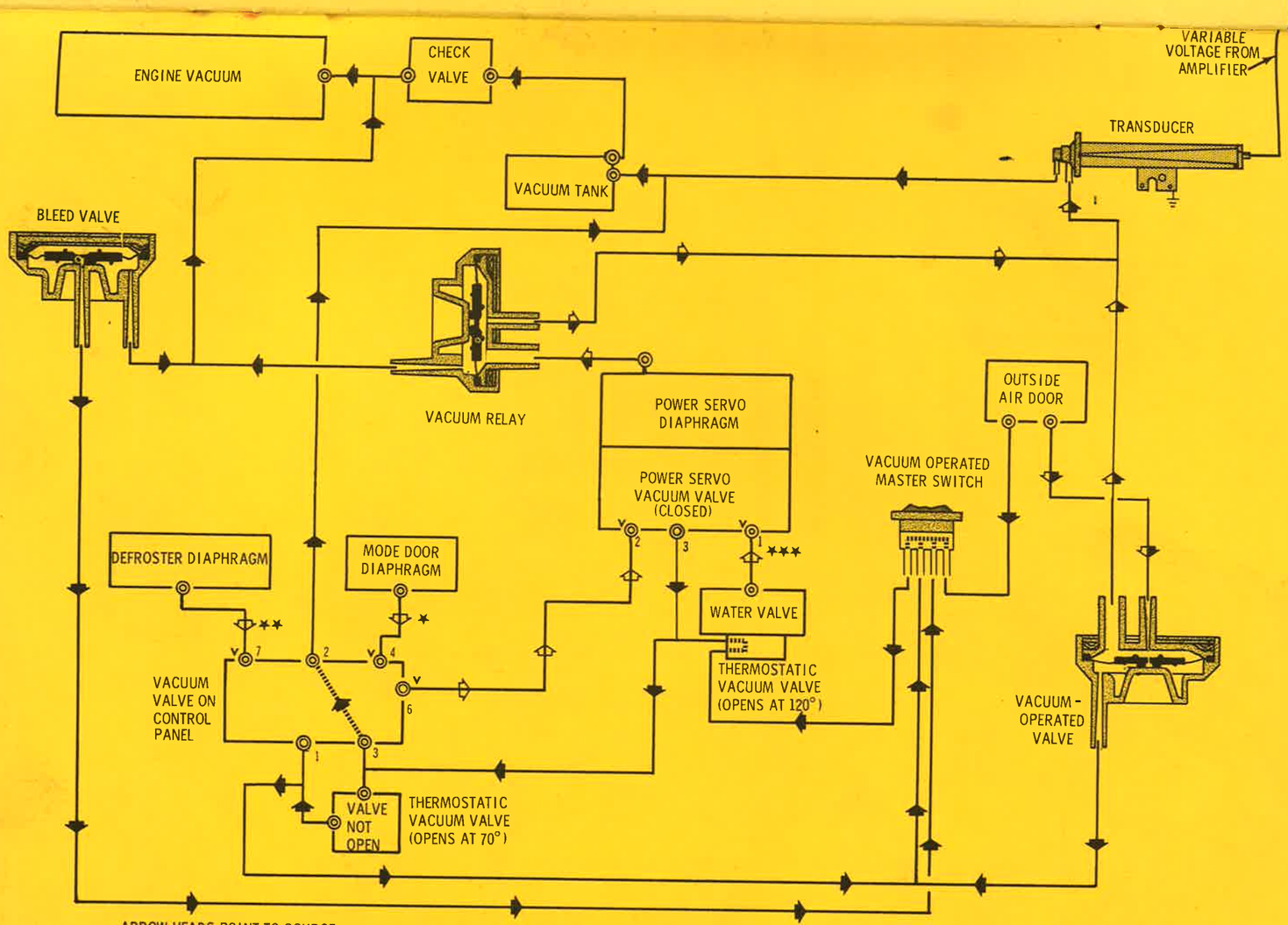
(SYSTEM REGULATING IN COOLING; LOW BLOWER SPEED)



These charts indicate the electrical and vacuum source for each unit in the system. The arrow heads point to the source.

When diagnosing the system on the car, determine which unit is not functioning. Locate that unit on the chart, then follow the arrowheads from that unit back toward the source and check units on the car to determine where failure has occurred.

Use Automatic Temperature Control Tester J-22368 to check amplifier, sensors and transducer. Use vacuum gauge on the tester to check vacuum and use tester voltmeter probe to check voltage.



ARROW HEADS POINT TO SOURCE
- FULL VACUUM
- E ELECTRIC CIRCUIT
- REGULATED VACUUM (SHOULD CHANGE WHEN TEMPERATURE DIAL IS ROTATED)
- NO VACUUM AT THIS TIME
- V VENTED AT THIS TIME
- * TORONADO SERIES - FULL VACUUM ON A/C, NO VACUUM ON HEAT
  ALL OTHER SERIES - FULL VACUUM ON HEAT, NO VACUUM ON A/C
- ** TORONADO SERIES - FULL VACUUM
- *** FULL VACUUM WHEN SYSTEM IS ON MAXIMUM A/C

SYSTEM REGULATING IN COOLING; LOW BLOWER SPEED