

# Delanair Mark II

## Automatic Climate Control System

### Service Manual

As fitted to: 74-87 Jaguar XJ6, XJ12, and VDP  
76-87 Jaguar XJS

(Reprinted from original BL Service Training Literature)

## INTRODUCTION

The air conditioning heating system fitted to Mark II models is a climatic control type using two manual controls. One selects the desired temperature; the other selects mode of operation.

The system can automatically maintain any temperature selected at the temperature selector (65°F - 85°F) by comparing the car's interior temperature with that selected at the manual selector. The difference in temperature at these two points produces an electronic signal which, through an amplifier to a motor driven camshaft, operates various relays, microswitches, vacuum switches, linkage and flaps programming the unit to automatically cause hot or cold air to flow to the car's interior, depending upon the temperature selector setting. The camshaft servo motor can be driven in either direction. The air temperature entering the interior may be hot or cold or an infinitely variable mixture of the two. The air is introduced into the interior by two four-speed fans and fed through a series of blending flaps which direct it to the evaporator and/or heater cores and then into the car interior. If quick or slow air distribution of heating or cooling is desired, the automatic fan speed functions can be overridden to provide high or low fan speed. The low speed fan operates in Auto and LO positions automatically; however, if high or low speed fan is selected, all other functions still remain automatic.

Air into the car's interior is available at both front and rear footwells - center dash face level outlets - end of dash face level outlets and screen outlets, depending upon mode of operation selected. The dash panel outlets are controllable for quantity and direction of air distribution.

Defrost may also be selected in which case the automatic sensing system is overridden and all air is emitted at high fan speed at the screen outlets with a small bleed to the footwells. Manual operation of the end of dash panel outlets for side window demisting is optional.

#### ADVANTAGES

As temperature output is controlled by mixing air of differing temperatures rather than controlling the flow of Freon through the evaporator, some difference in temperature is possible between upper and lower outlets, depending upon the position of the flaps. This air blending gives a more rapid response to manual control changes and finer selected temperature control. All air, whether heating or cooling is selected, is passed through the evaporator and dehumidified.

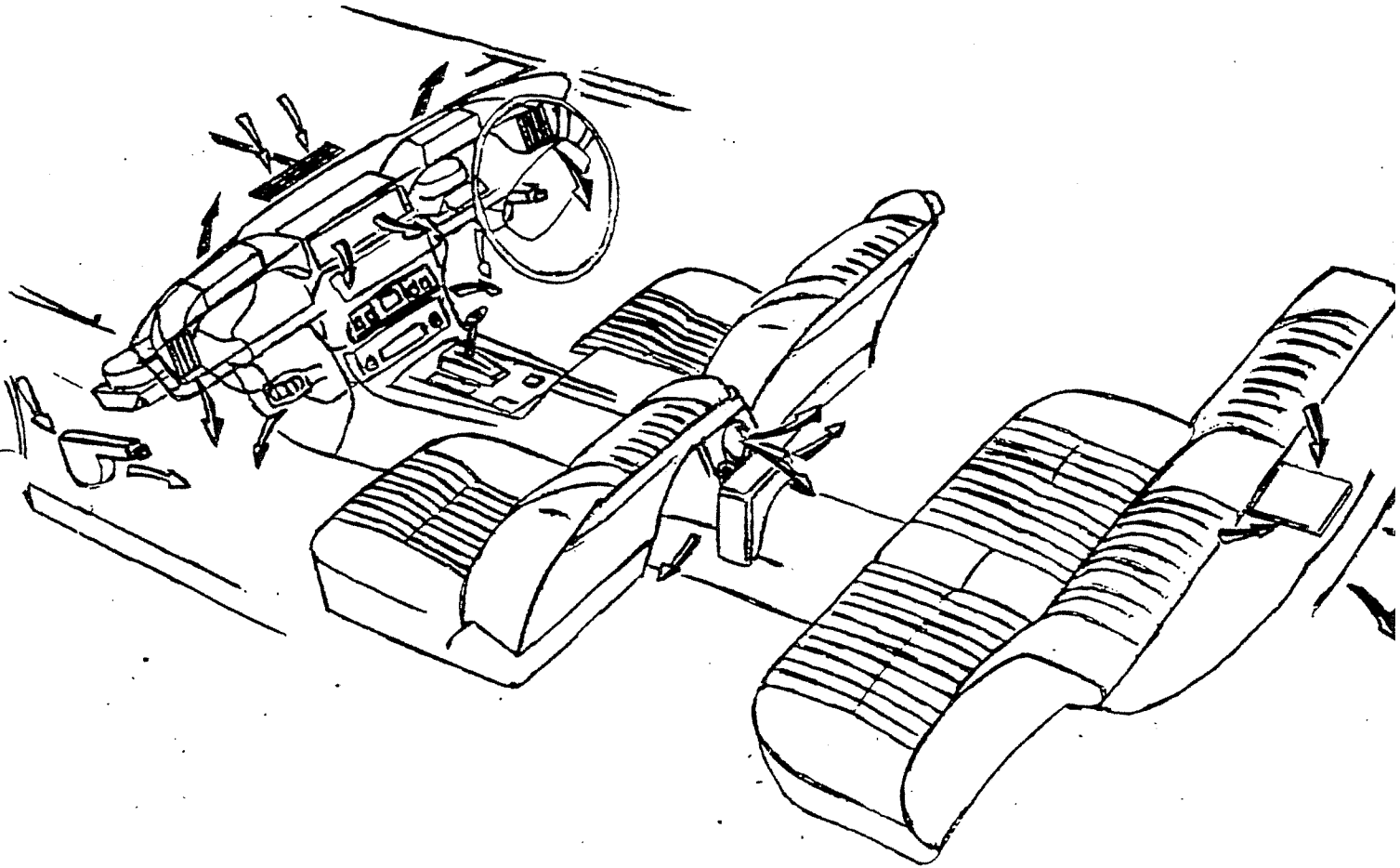
#### MAXIMUM AIR FLOW

The air flow from the unit is 230 cu.ft./min. on heating, 300 cu.ft./min. on cooling. By comparison, the Jaguar Mark I air flow was 200 cu.ft./min for both cooling and heating.

#### COOLING AND HEATING CAPACITY

Cooling capacity of the Mark II is 27300 BthUs/hour, heating 13500 BthUs/hour; whereas the Mark I was 17900 BthUs/hour cooling, 11700 BthUs/hour heating.

PASSENGER COMPARTMENT AIR DISTRIBUTION



Fresh Air

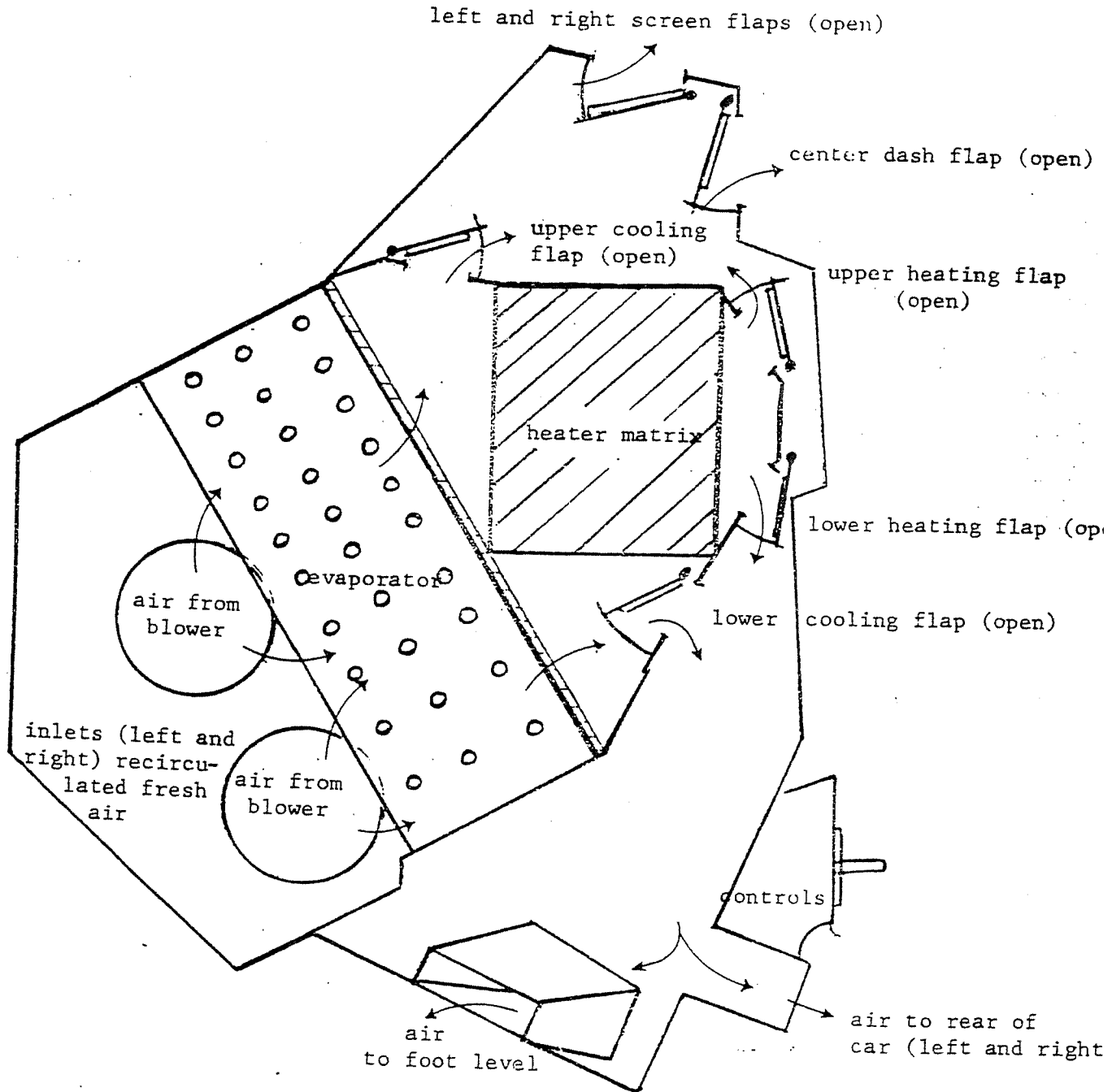


Cold and Regulated Air

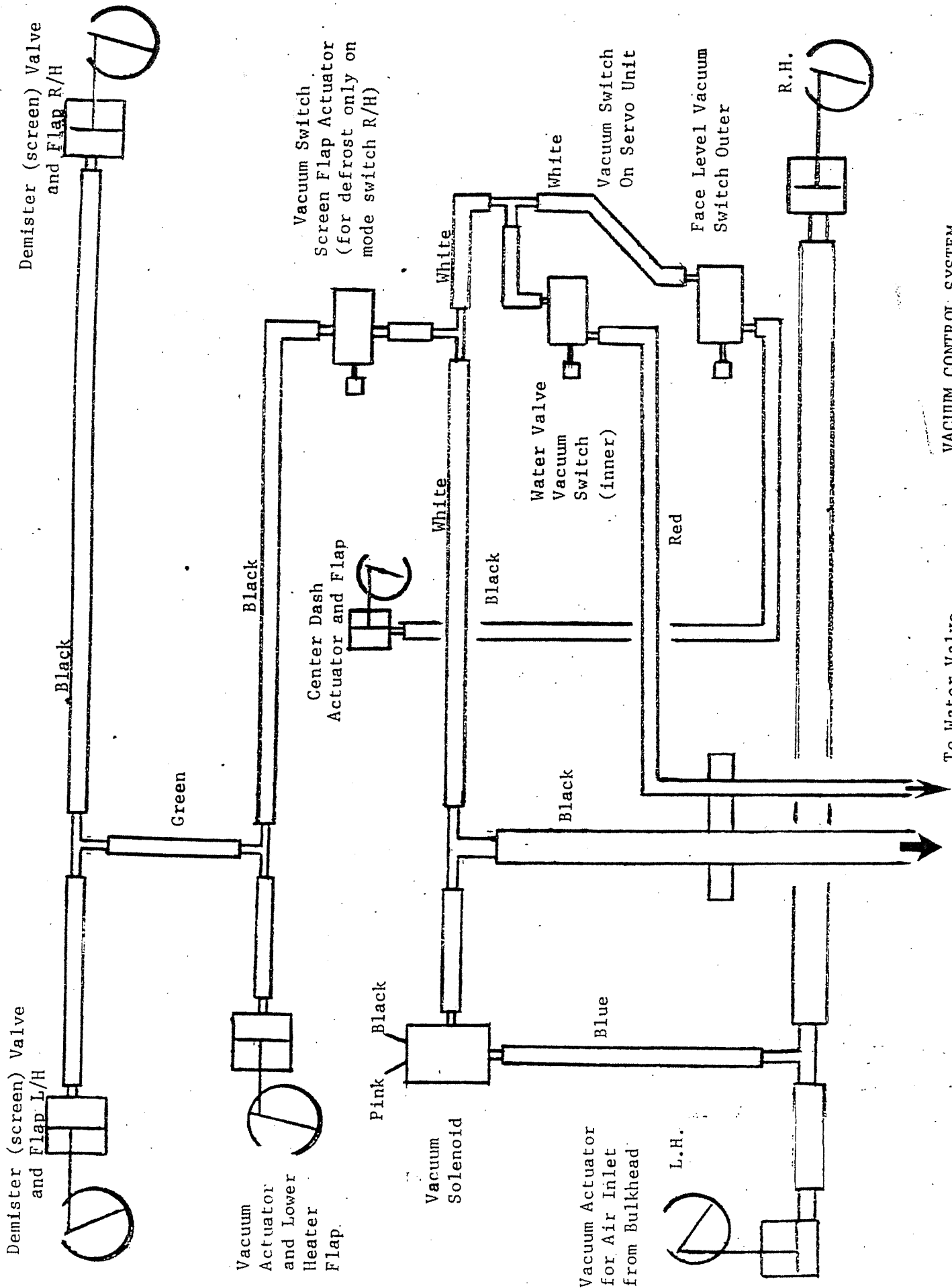


Hot Air

BULKHEAD AIR DISTRIBUTION

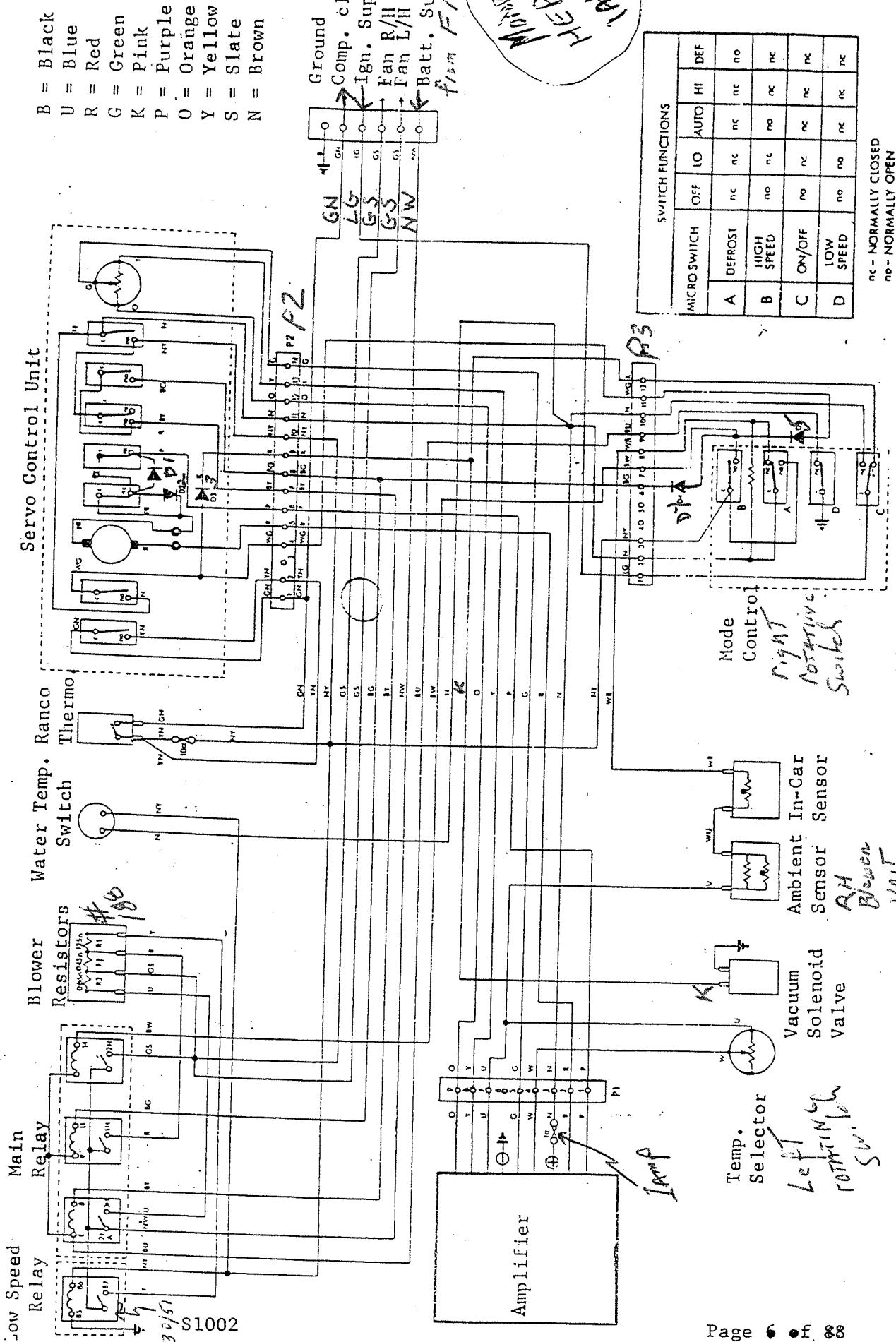


Upper and Lower heating flaps and Lower Cooling flap on common linkage -  
Lower heater flap can be overridden by vacuum actuator - Upper Cooling flap  
is controlled by arm.



VACUUM CONTROL SYSTEM

# AIR CONDITIONING WIRING DIAGRAM



- B = Black
- U = Blue
- R = Red
- G = Green
- K = Pink
- P = Purple
- O = Orange
- Y = Yellow
- S = Slate
- N = Brown

Ground  
 Comp. clutch From  
 Ign. Supp. Elec.  
 Fan R/H  
 Fan L/H  
 Batt. Supp. H8  
 from FIB

MINIMUM  
 30 VOLTS  
 AMP 15A

MICRO SWITCH		SWITCH FUNCTIONS				
		OFF	LO	AUTO	HI	DEF
A	DEFROST	nc	nc	nc	nc	no
B	HIGH SPEED	no	nc	nc	nc	nc
C	ON/OFF	no	nc	nc	nc	nc
D	LOW SPEED	no	no	nc	nc	nc

nc - NORMALLY CLOSED  
 no - NORMALLY OPEN

Low Speed Relay

Main Relay

Blower Resistors

Water Temp. Switch

Servo Control Unit

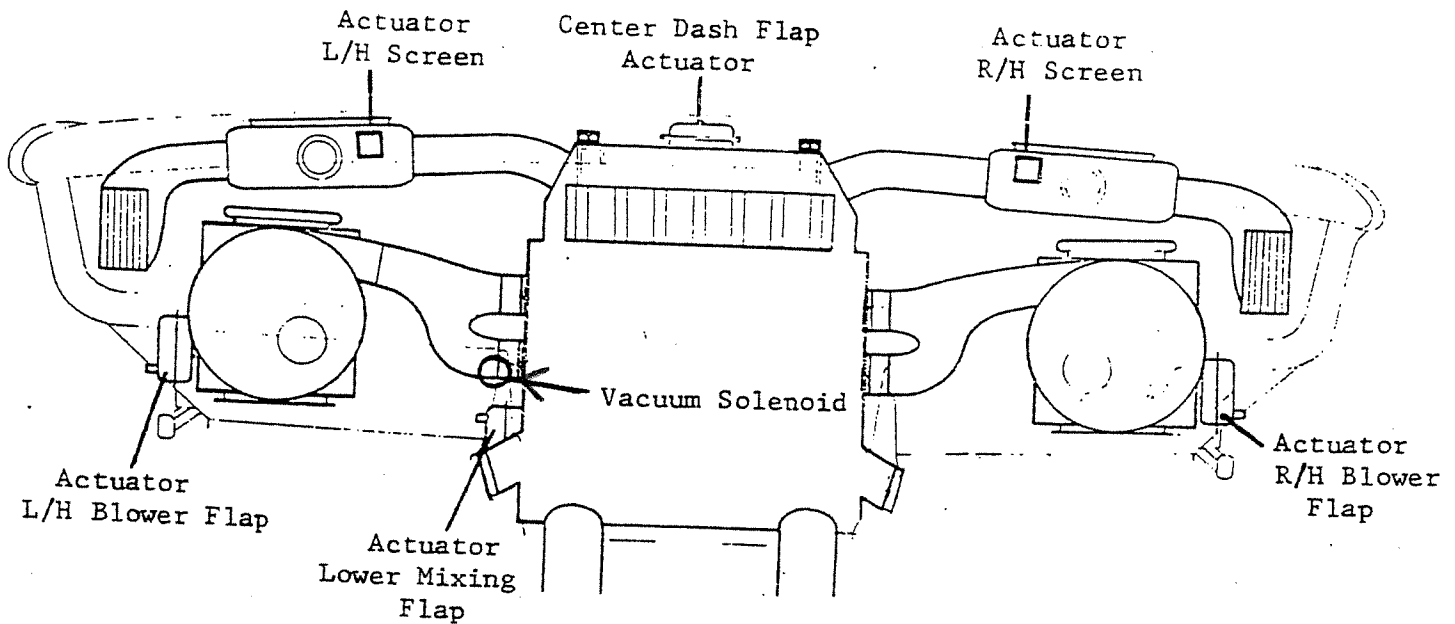
Amplifier

Temp. Selector  
 Left Rotational Switch

Vacuum Solenoid Valve  
 Ambient In-Car Sensor  
 Sensor Sensor  
 AH Blower Unit

Mode Control  
 Right Rotational Switch

## VACUUM ACTUATOR AND SWITCH LOCATIONS



### VACUUM SOLENOID

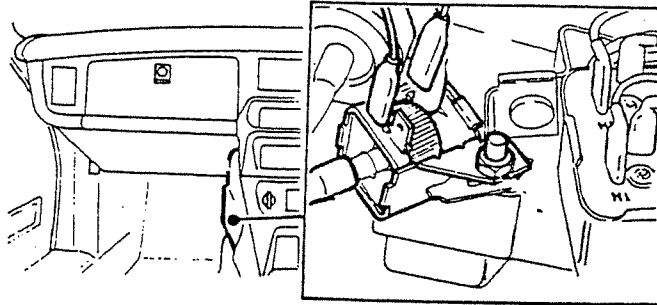
Function: Controls vacuum to blower motor flap actuators. Switch energized in recirculation mode - Switch de-energized in fresh air mode.

The solenoid is energized in only two conditions:

- (a) With air conditioning system off (ign. on)
- (b) Full cooling mode



Location: Behind L/H console kick panel and in front of main air conditioning relay.

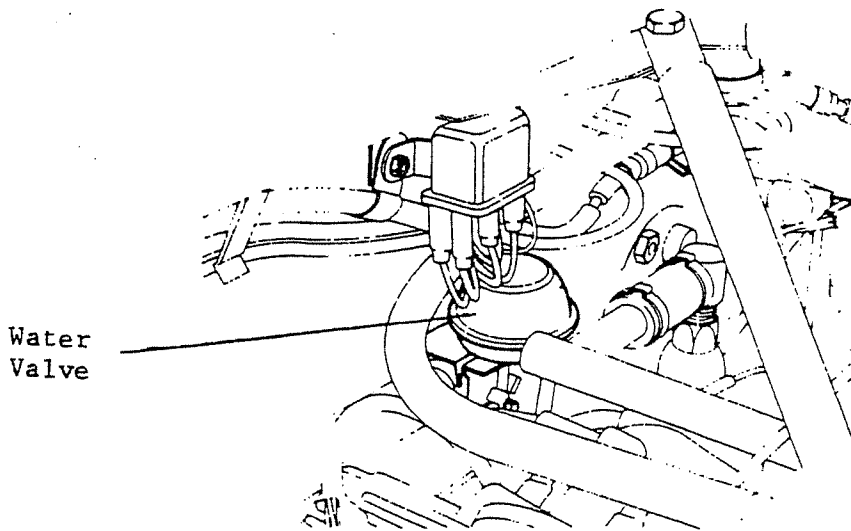


- Testing:
- (a) With mode switch 'OFF', a supply of 12 volts to solenoid pink lead connection should be present. If so, and the solenoid still fails to operate, replace solenoid.
  - (b) If solenoid functions correctly with mode control 'OFF' but does not function when the servo camshaft is in the full cooling mode, the high speed/recirculation switch is suspected. If this component functions correctly, check Diode (D3) and associated wiring for continuity.

## VACUUM CONTROLLED WATER VALVE

Function: To allow water to flow through the heater core in the heating mode. To prevent water flow through the heater core in the full cooling mode. A vacuum is applied during the last 35° of camshaft rotation in full cooling mode preventing water flow through heater core.

Location: Under hood on bulkhead behind engine.



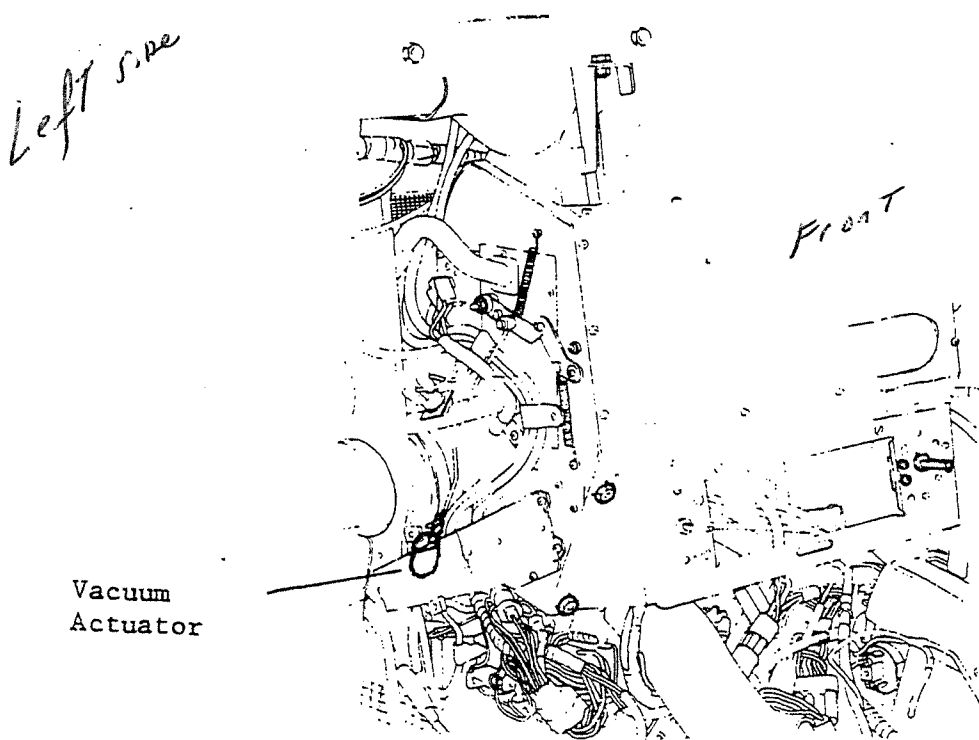
Testing: Apply a vacuum to valve. Observe movement of linkage - Should maintain vacuum until released. In full heating mode feel both inlet and outlet hoses for equal temperature. Supply pipe color code = Red from inner vacuum switch on camshaft - Fails in fully open position.

## LOWER HEATER FLAP VACUUM ACTUATOR

Function: To hold lower heater flap open except in Defrost.

In defrost, vacuum supply cut off at mode control vacuum switch, flap held closed by return spring - Other modes vacuum actuator overridden as necessary by cam and peg on linkage.

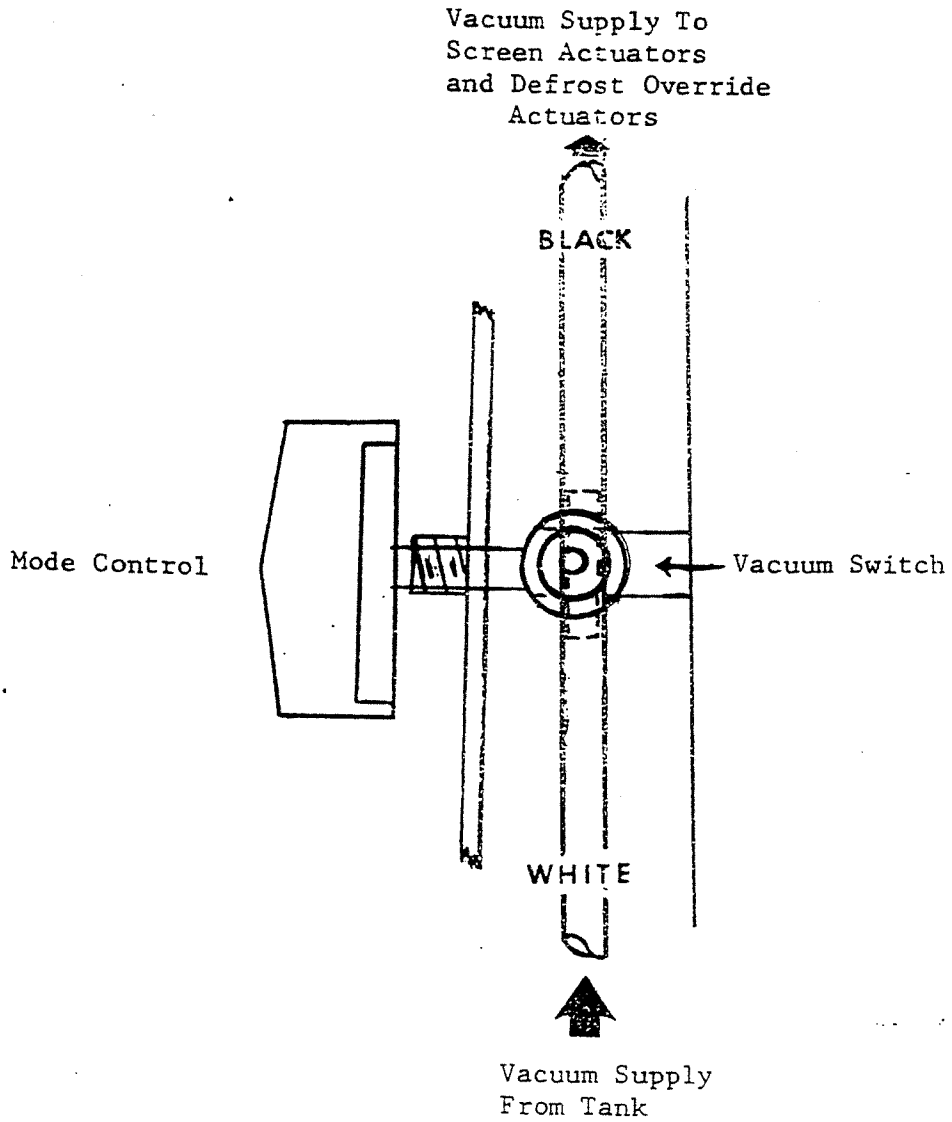
Location: Behind L/H console kick panel and above main air conditioning relay.



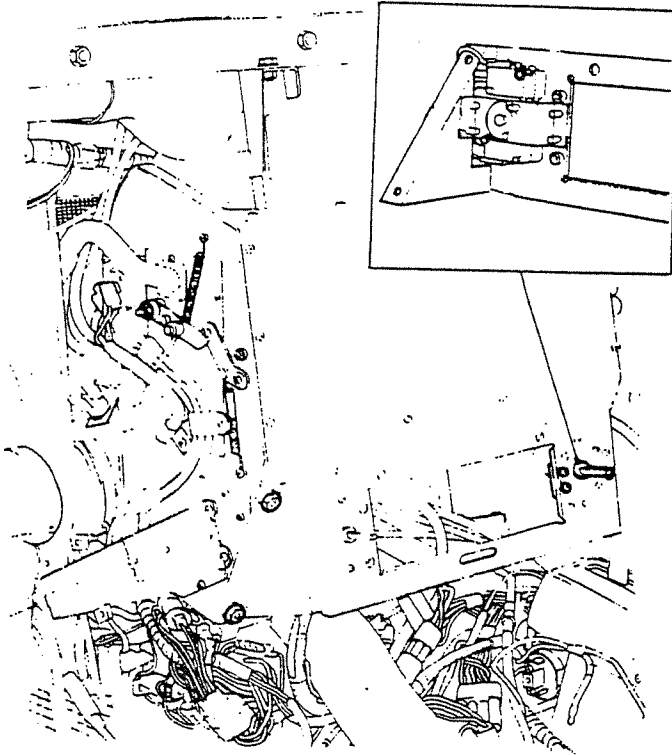
Testing: With mode control at Defrost, ensure vacuum supply is cut off. All other modes, ensure vacuum supply available and that actuator operates.

VACUUM SWITCH MODE CONTROL

Function: Activates screen outlet actuators (flaps open) in defrost mode, also closes lower heater flap by overriding linkage.



Location: On right-hand side and behind console panel mode control switch.

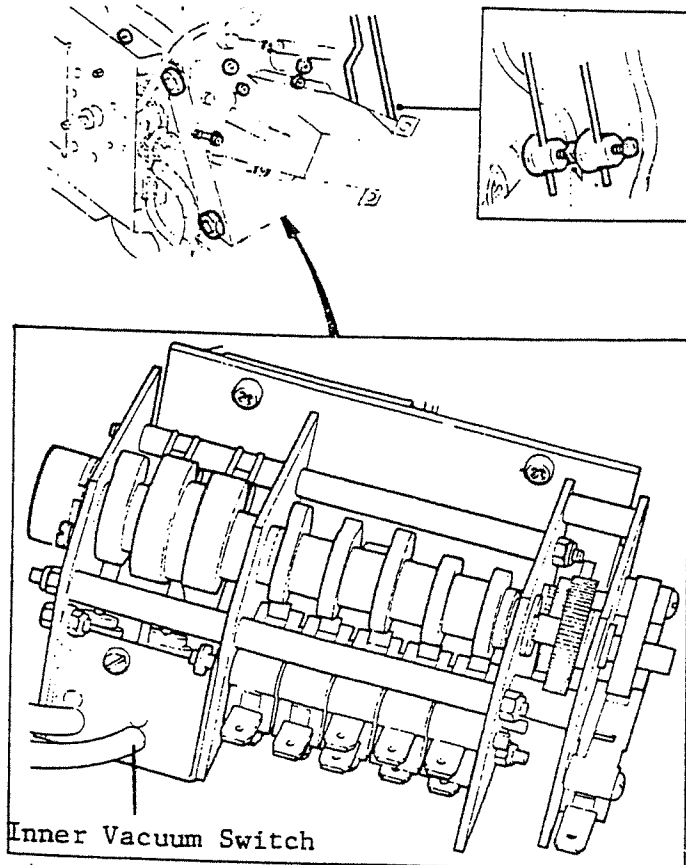


Testing: Check for vacuum supply from vacuum source. If available, bypass switch and observe operation of screen outlet flaps. These should open - lower heater flap should close. Supply pipe color code = White - Green to screen flaps.

VACUUM SWITCH (Inner) SERVO CONTROL UNIT

Function: Closes water valve when in full cooling mode.

Location: Behind R/H dash kick panel and center console in servo control unit.

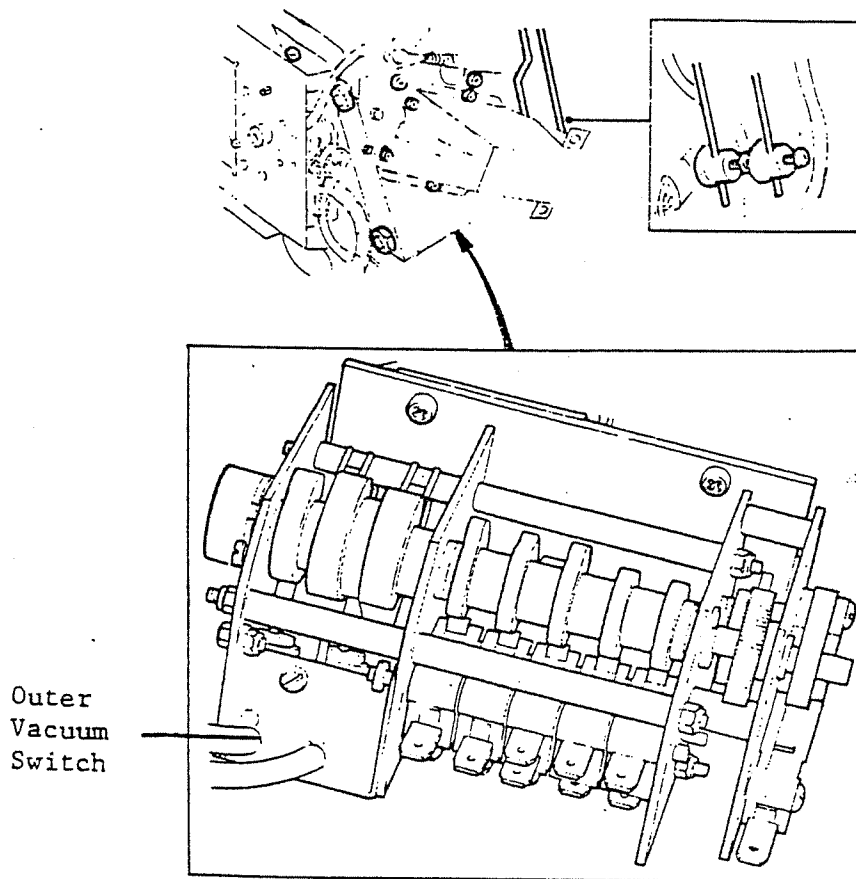


Testing: In full cooling mode check vacuum supply to water valve. If none available, check at (inner) vacuum switch on camshaft. Supply pipe color code = White-- Red pipe to water valve.

VACUUM SWITCH (Outer) SERVO CONTROL UNIT

Function: Opens center dash flap in cooling mode.

Location: Behind R/H dash kick panel and center console in servo control unit.



Testing: In full cooling mode check vacuum supply to (outer) switch on camshaft. Bypass switch and observe that center dash flap opens. Supply pipe color = White -- Pipe to center dash flap = Black.

## BASIC ELECTRICAL COMPONENT DESCRIPTION

### THERMISTOR (Sensor)

A thermistor is a device whose resistance depends on its temperature. The lower the temperature, the higher the resistance - The higher its temperature, the lower its resistance, i.e. In-car sensor, ambient sensor.

### POTENTIOMETER

A potentiometer is a device whose resistance varies when one of its two elements is rotated either way, manually or mechanically, i.e. Temperature selector, feedback potentiometer.

### RANCO THERMOSTAT

Is an electrical switch which passes current at all times except when its sensing probe, attached to the evaporator, drops to 2°C (36°F). When this occurs, the Ranco Thermostat becomes non-conductive and the circuit to the compressor clutch is disengaged closing down the refrigeration system to prevent evaporator freeze-up.

### DIODE

Is an electrical device which will allow current flow in one direction only.

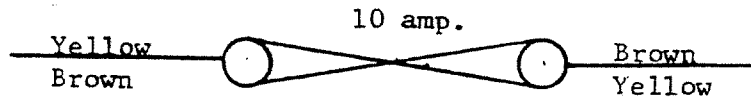


ELECTRICAL COMPONENT FUNCTION, LOCATION AND TESTING

IN-LINE-FUSE RANCO THERMOSTAT, COMPRESSOR CLUTCH

Function: Protects feed to compressor clutch.

Location: Next to Ranco Thermostat on right side of evaporator case behind dash underpanel.

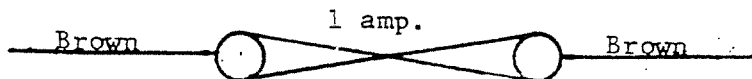


IN-LINE-DELAY-FUSE, AMPLIFIER

Function: \*Protects servo motor, circuit wiring and amplifier from current su

Location: Behind L/H console kick panel.

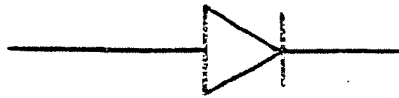
\*NOTE: Replacing this fuse with one of higher value can result in damage to the amplifier.



## DIODES

Function: To allow current flow in one direction only.

Location: D1, D2, D3 In servo motor control unit. D5 In harness  
between mode control and harness plug.

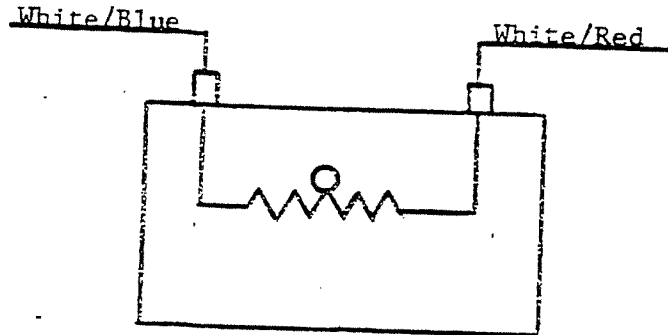


Testing: Check that current flows in direction of arrowhead. None  
in reverse direction

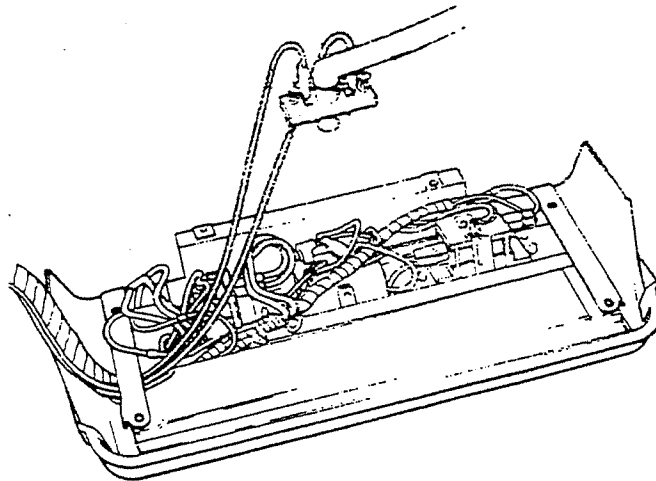
IN-CAR TEMPERATURE SENSOR (Thermistor)

Function: Measures air temperature of vehicle interior.

Electrical Diagram:



Location: Behind dash center oddment tray in center of tray.



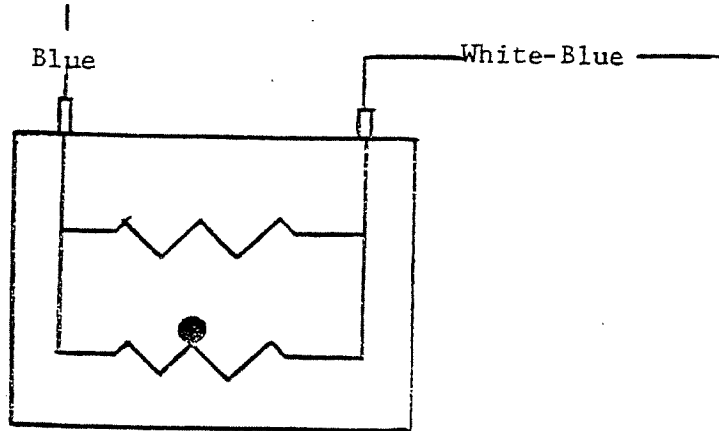
Testing: Suggest best method of testing is by substitution. Resistance varies between 70K ohms to 1.75K ohms for temperature range of -20°C (-4°F) to 70°C (157°F)

5/12/19  
OK

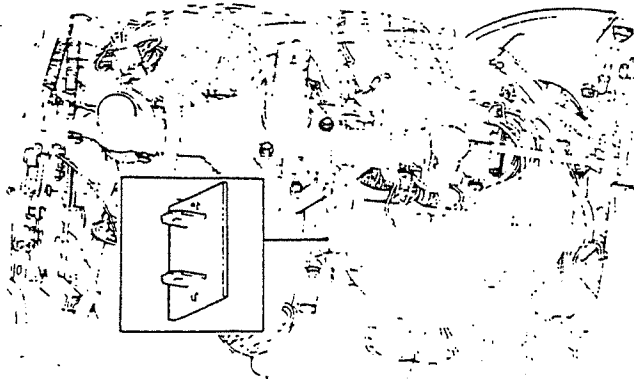
AMBIENT TEMPERATURE SENSOR (Thermistor)

Function: As its name suggests, it registers ambient air temperature at R/H blower inlet.

Electrical Diagram:



Location: In left-hand side of right-hand blower casing.



Testing: Suggest best method of testing is by substitution. Resistance should be no greater than 3.9K ohms.

THERMISTOR TEMPERATURE/RESISTANCE CHARACTERISTICS

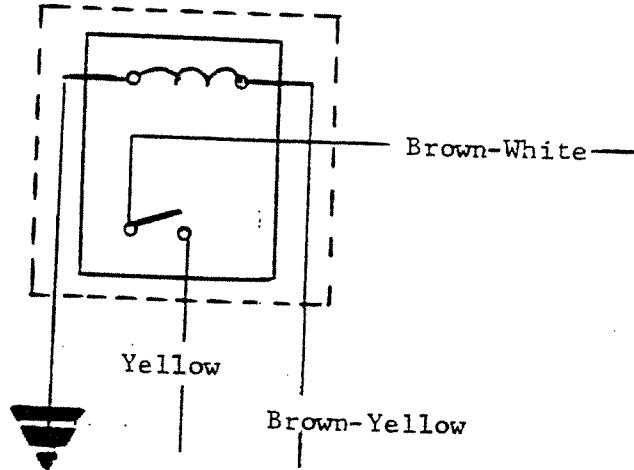
<u>TEMPERATURE</u>		<u>EFFECTIVE RESISTANCE VALUES</u>	
<u>Deg. C</u>	<u>Deg. F</u>	<u>PAGE 18</u> <u>In-Car Sensor</u>	<u>PAGE 19</u> <u>Ambient Sensor</u>
-20°C	-4°F	70K	4.0K
-15°C	5°F	52K	3.9K
-10°C	14°F	40K	3.8K
-5°C	24°F	31K	3.7K
0°C	32°F	24K	3.6K
5°C	42°F	19K	3.5K
10°C	48°F	15K	3.4K
15°C	59°F	12.5K	3.3K
20°C	69°F	10K	3.1K
25°C	76°F	8.3K	2.9K
30°C	85°F	6.8K	2.75K
35°C	94°F	5.6K	2.55K
40°C	103°F	4.7K	2.35K
45°C	112°F	3.8K	2.1K
50°C	120°F	3.3K	1.8K
55°C	131°F	2.8K	1.65K
60°C	140°F	2.4K	1.5K
65°C	148°F	2.0K	1.35K
70°C	157°F	1.75K	1.2K

*Handwritten note:* ← 1/14/19  
OK

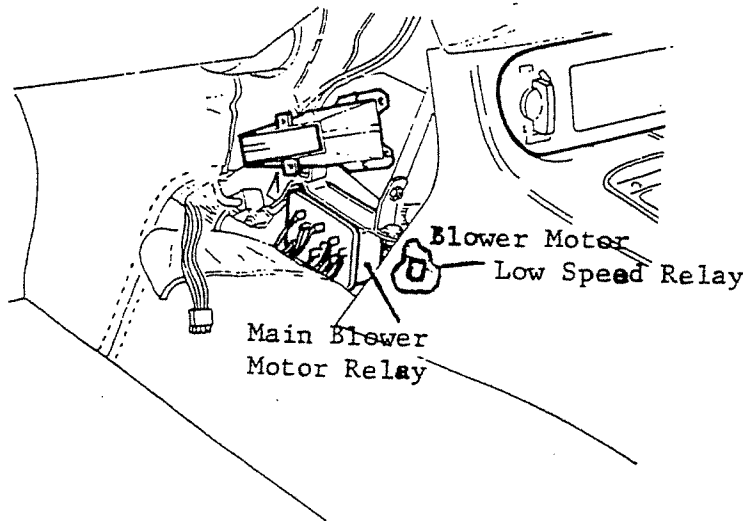
BLOWER MOTOR LOW SPEED RELAY

Function: Supplies power to fans via resistors at all times when auto or low is selected.

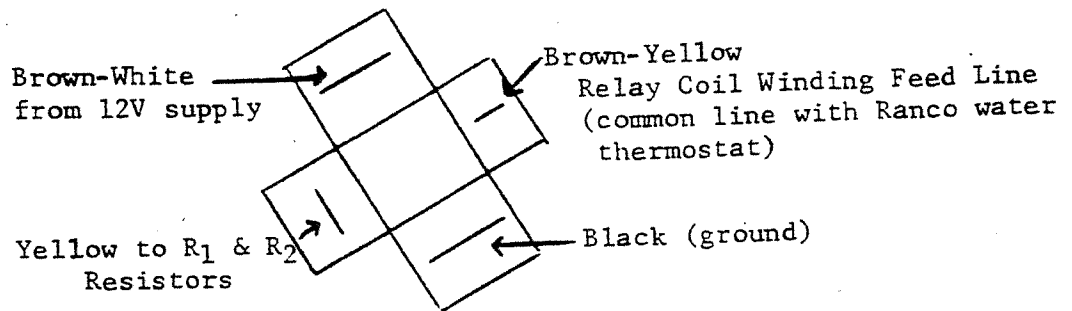
Electrical Diagram:



Location: Behind L/H console kick panel to rear of main blower motor relay.



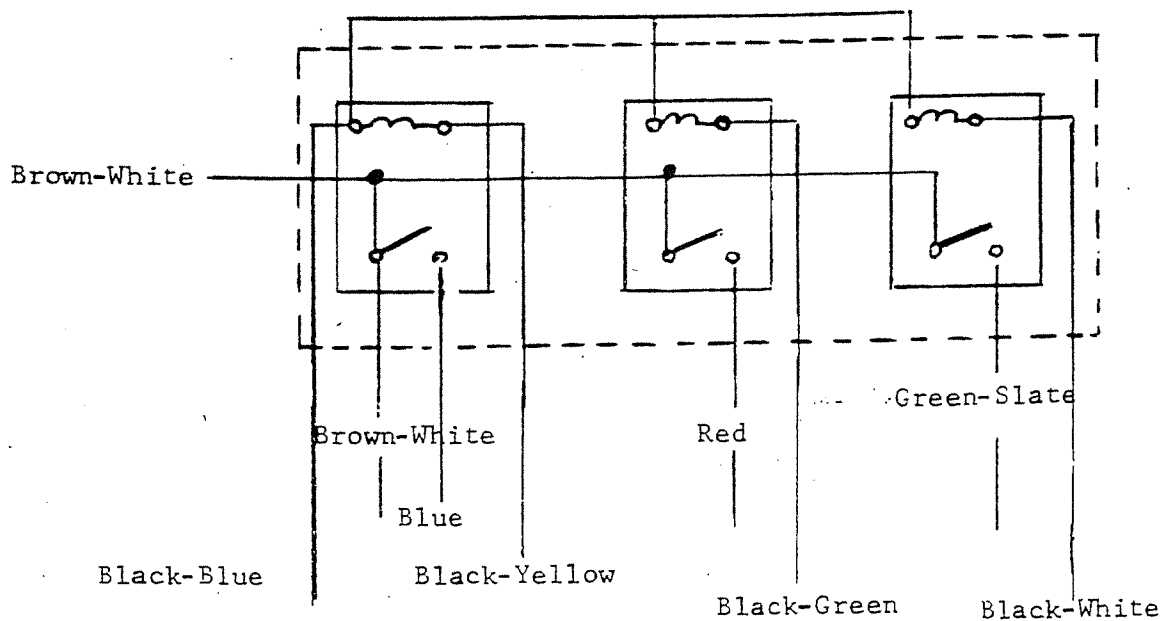
Testing: If fans fail to operate in auto, low speed or low manual selection with engine water temperature above 40°C (103°F), check for 12 volts at N/Y lead and check ground lead for good connection. If as stated, there should be 12 volts at the N/W and Y leads. NOTE: There should be 12 volts at N/W white wire at all times because it is battery supply from fuse F10.



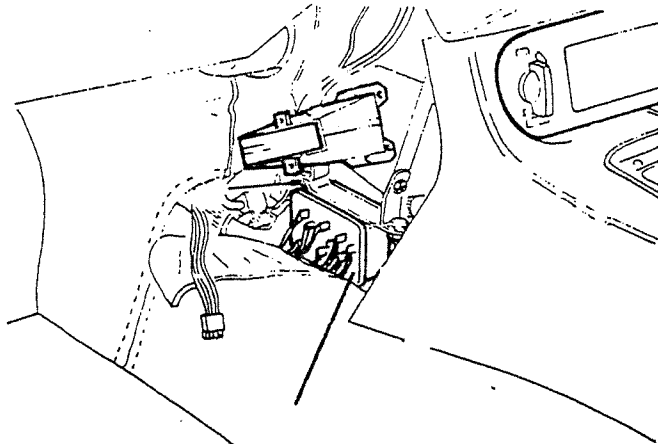
MAIN BLOWER MOTOR RELAY

Function: Supplies 12 volts to blower resistors providing different fan speeds depending upon which resistor is selected.

Electrical Diagram:



Location: Behind L/H console kick panel.



MAIN BLOWER MOTOR RELAY

Testing: One rivet supports each relay - 3H is MED 1 (2nd) speed relay, 1H is MED 2 (3rd) speed relay, 2H (4th) is high speed relay.

With HIGH speed selected, a continuity check between terminals E and 9 should show zero resistance. If not, check low speed switch for (a) correct cam operation (b) good ground.

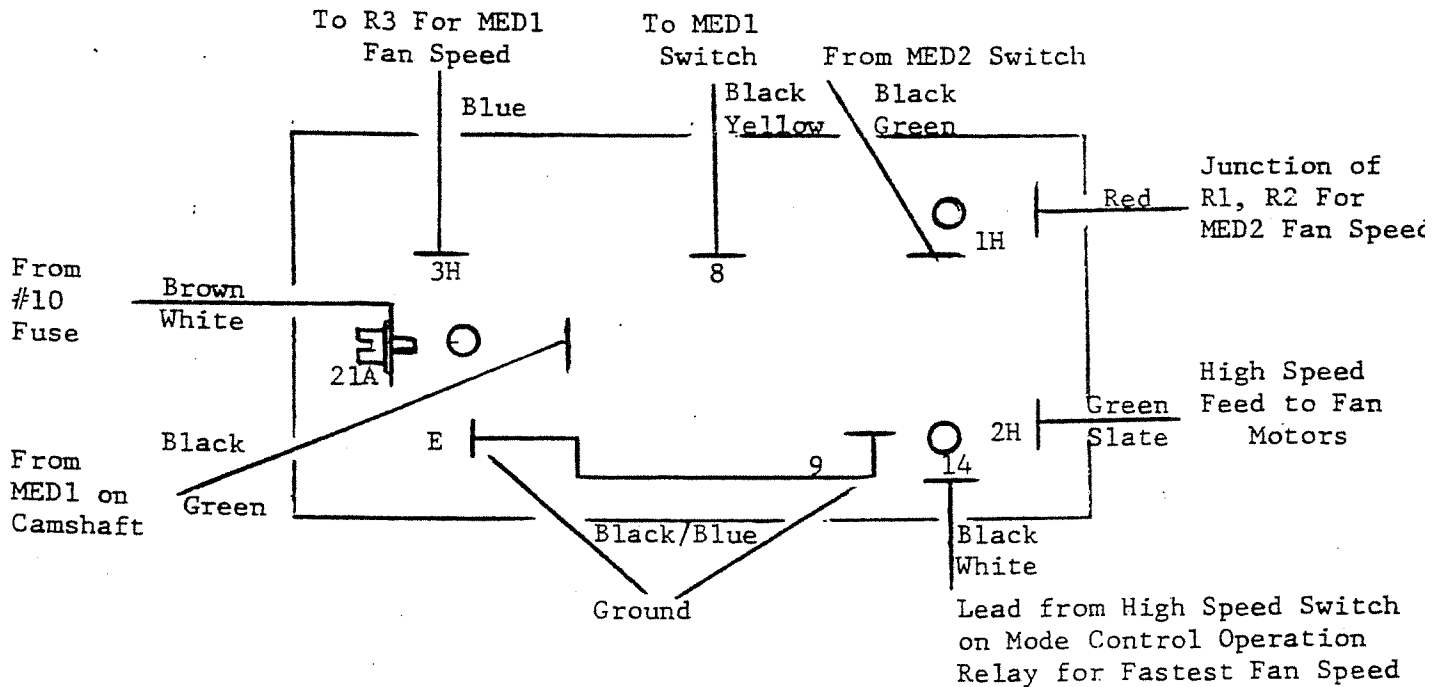
To check operation of the relays, select 85 on temperature control for several minutes, then select 65 causing the servo camshaft to travel to the full cooling position depending upon ambient temperature.



The relays will activate as follows:

- (a) 12 Volts Will Be Switched To Terminal 8 By MED 1 Switch
- (b) " " " " " " " 3H By Relay 2
- (c) " " " " " " " 11 By MED 2 Switch
- (d) " " " " " " " 1H By Relay 3
- (e) " " " " " " " 14 By High Speed Recir.
- (f) " " " " " " " 2H By Relay 4

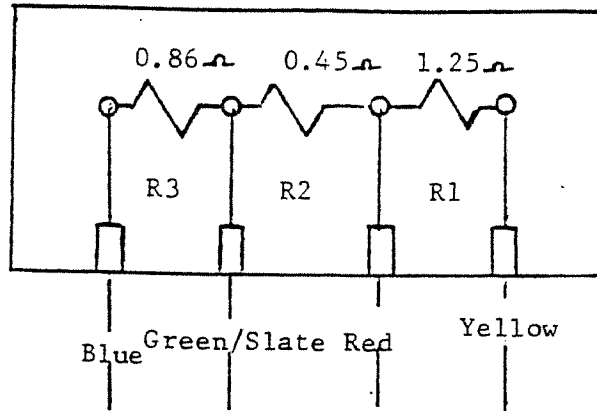
12 volts will appear at 1H at the same time it appears at terminal 8.



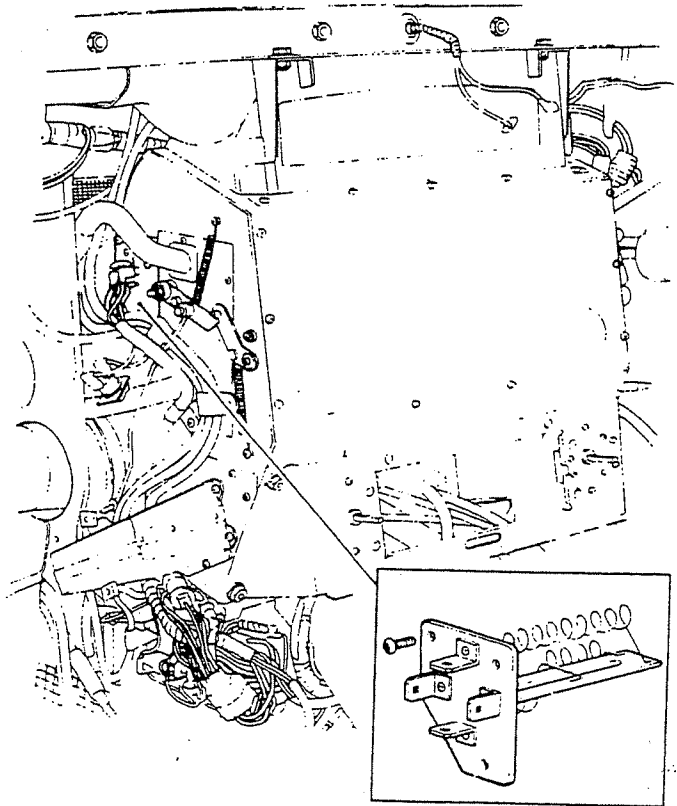
BLOWER MOTOR RESISTANCE UNIT

Function: To vary the resistance in the blower motor circuit thereby changing blower speed.

Electrical Diagram:



Location: Behind L/H console kick panel and dash underpanel.



Testing: Input leads should reflect 12 volts (yellow, red and blue) at the terminal board. Output lead is green/slate lead. From the camshaft switch sequence, the following should occur at the resistance terminal:

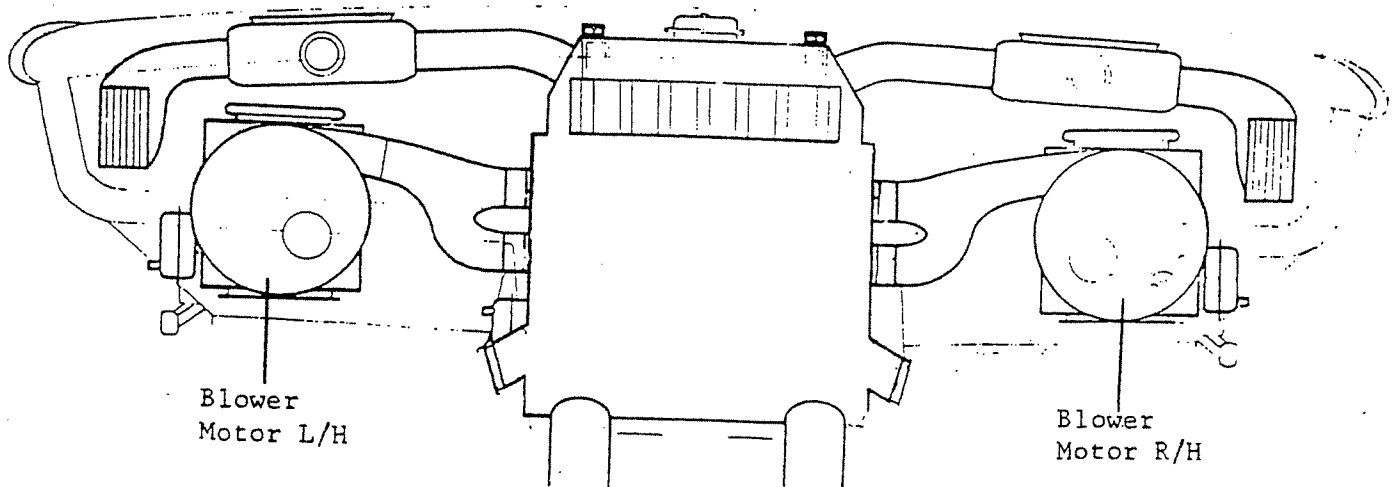
1. 12 volts occur at yellow terminal - Low speed fans
2. " " " " red " - MED 1 (2nd speed) fans
3. " " " " blue " - MED 2 (3rd speed) fans
4. " " " " green/slate " - High (4th speed) fans

In all but (4) above, the resistance will cause a voltage drop at the green/slate output terminal to give the various fan speeds.

#### BLOWER MOTORS

Function: To deliver air, either fresh or recirculated, to the heater/air conditioning unit. Fans are four speed - First speed is on automatically in AUTO and LO. Other speeds are MED 1 (2nd speed) MED 2 (3rd speed) Recirculation/High speed (4th speed)

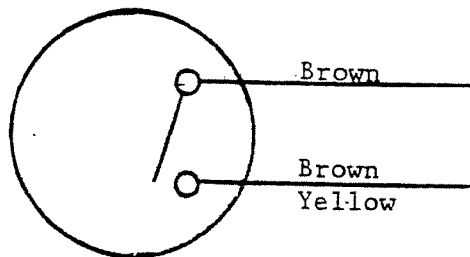
Location: Either side of the car above the dash underpanel.



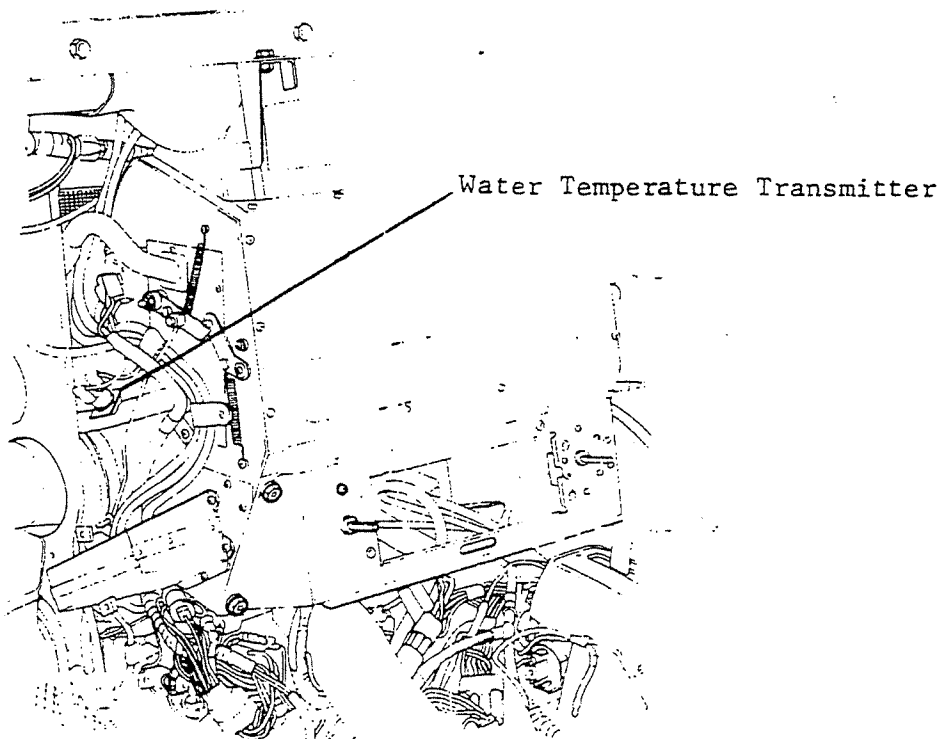
Testing: Apply 12 volts to motor and check ground condition.  
If motor fails to operate, change motor.

WATER TEMPERATURE TRANSMITTER

Function: Prevents system from operating heating mode until water temperature is 40°C (103°F) - Overridden by water temperature override switch in cooling and defrost modes.



Location: On heater core inlet water pipe located above L/H floor vent outlet behind L/H console kick panel.

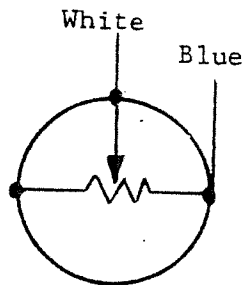


- Testing:
- (a) In heating mode check that system does not operate until engine water temperature reaches 40°C (103°F).
  - (b) Check for continuity when engine temperature is above 40°C (103°F).

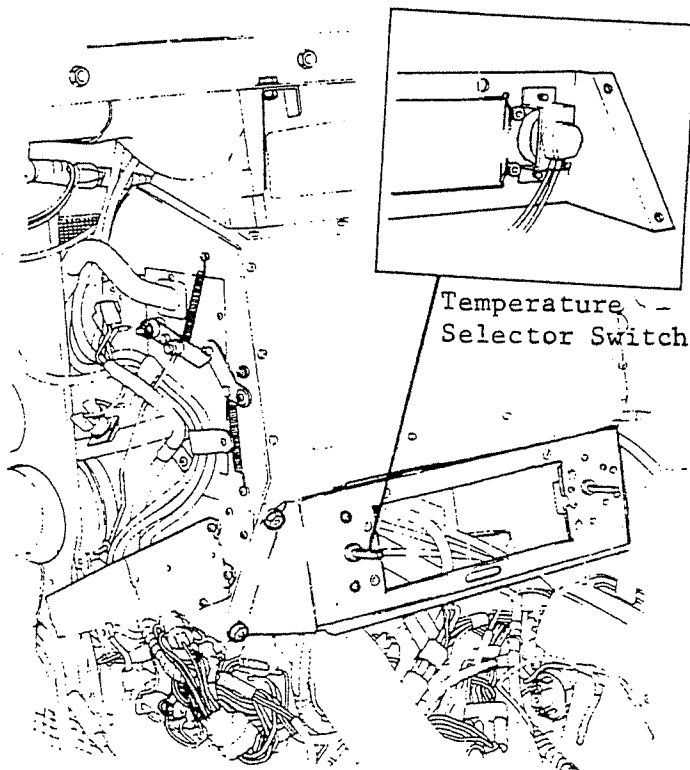
TEMPERATURE SELECTOR SWITCH (Manually Operated Potentiometer)

Function: To allow operator to select desired in-car temperature. Track resistance value is 15K ohms, however, rotation limited to 180° or 10K ohms.

Electrical Diagram:



Location: On left-hand side of console control panel.



Testing: Failure of this component will be apparent by lack of system response. Check connections to switch. Using ohmmeter, check track resistance - should be 15K ohms linear. Check between wiper connection and track with ohmmeter for continuity and variable resistance.

#### MODE CONTROL

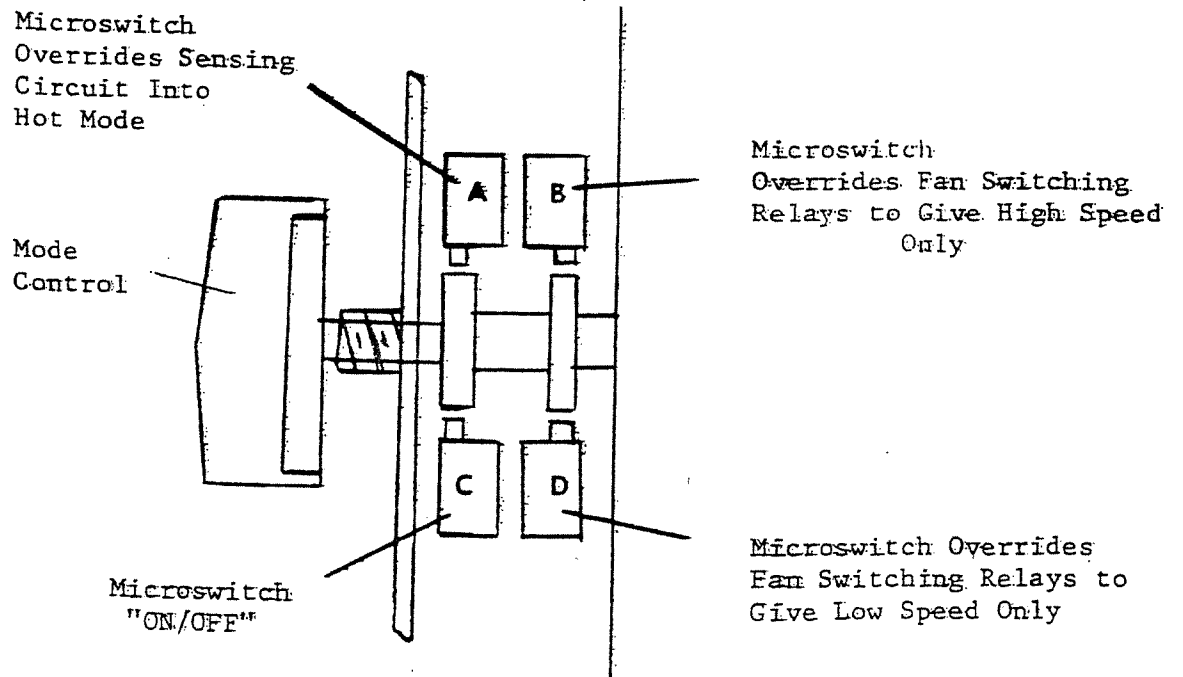
Function: To select desired mode of operation. Four microswitches and one vacuum switch are operated by a small camshaft. On Auto or Low setting the lowest fan speed is 'ON' automatically.

#### Mode Control 'OFF'

1. There is no heating or cooling taking place.
2. Vacuum solenoid is energized placing input flaps in recirculation mode.
3. Feeds to both blower fans are disconnected.
4. Feed to compressor clutch is disconnected.
5. Vacuum feed to vacuum system is off allowing hot water to flow through heater core.
6. Screen flaps in closed position (natural position).
7. Center dash flap closed.
8. No output to front or rear footwells.

#### Mode Control 'ON' Lo or Auto

1. Microswitch 'C' moves to closed position - allows a feed to amplifier via 1 amp. delay fuse also to water temperature transmitter, and through resistance to in-car sensor, ambient sensor, temperature selector and amplifier terminal 7.



MICROSWITCH FUNCTIONS

## MICROSWITCH FUNCTIONS

### Mode Control 'LO'

Microswitch 'D' energizes R1 section of main blower relay which through resistor R1 allows current from fuse #10 to MED 1 (2nd) speed microswitch on servo control unit camshaft.

### Mode Control 'HI'

Microswitch 'B' moves to closed position. Allows feed to High/Recirculation microswitch - feeds to main blower motor relay overriding fan relays to give High Speed continuously - water temperature switch, water temperature bypass microswitch, Ranco Thermostat low speed relay.

### Mode Control 'DEF'

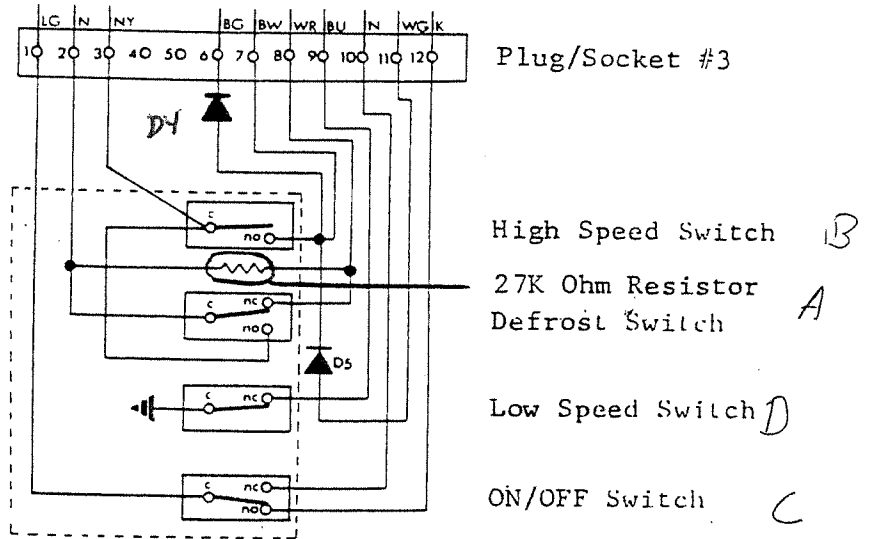
Microswitch 'A' moves to closed position - allows feed to Recirculation/High speed microswitch. Main blower relay overriding sensing circuit into hot mode.

Testing: Using ohmmeter and circuit diagram, check microswitch continuity.

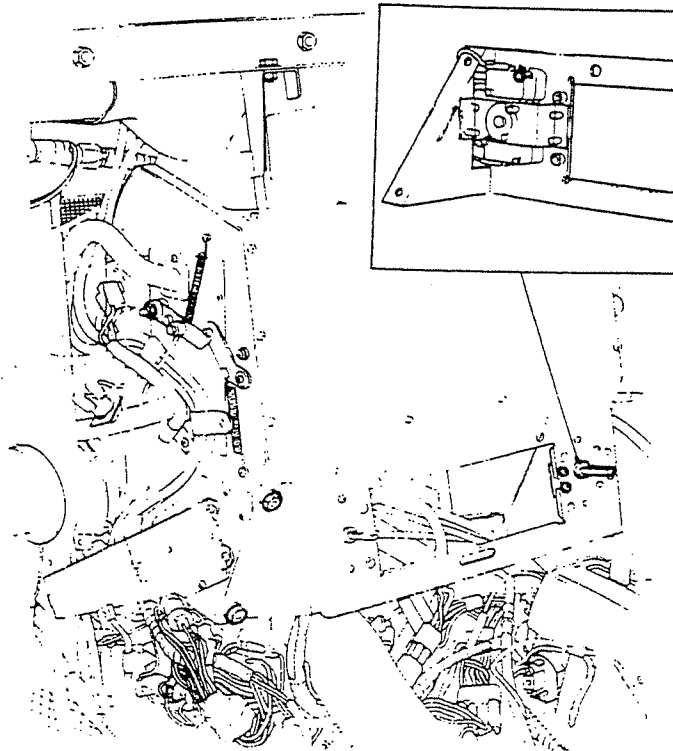


Electrical Diagram:

*Mode Control Switches*



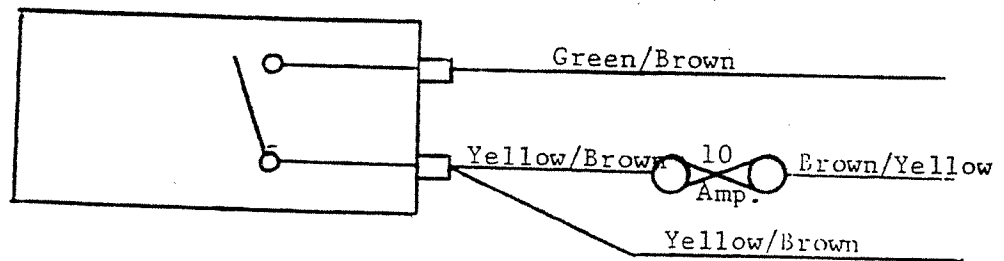
Location:



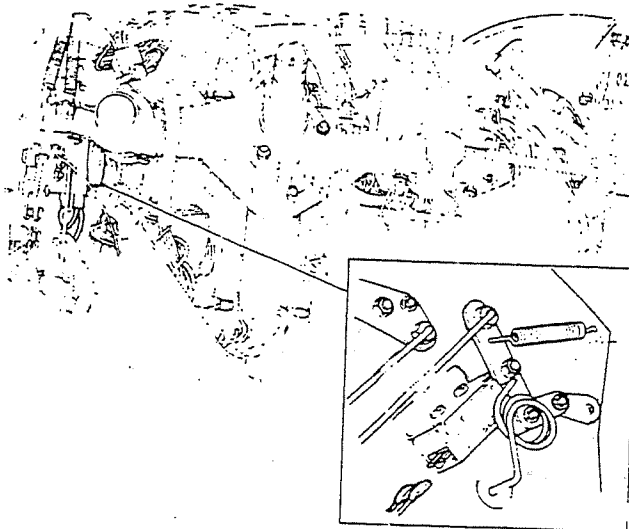
## RANCO THERMOSTAT

Function: To sense temperature of the system at the evaporator preventing evaporator freeze-up. The thermostat is conductive in all modes and functions except when evaporator temperature falls below 2°C (36°F) or when overridden by Ranco override switch in high ambient situations. When this occurs, the electrical feed is disconnected to the compressor clutch eliminating the refrigeration cycle until the evaporator warms to above 2°C - then the refrigeration cycle will restart.

### Electrical Diagram:



Location: Behind R/H console kick panel and dash underpanel.



Testing: Check continuity with ohmmeter - Will pass current providing evaporator is not below 2°C (36°F).

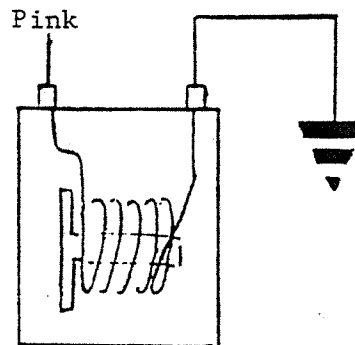
### VACUUM SOLENOID

Function: Controls vacuum to blower motor flap actuators. Switch energized in recirculation mode - Switch de-energized in fresh air mode.

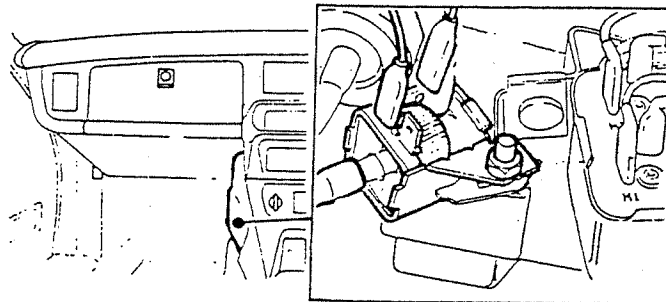
The solenoid is energized in only two conditions:

- (a) With air conditioning system off (ign. on)
- (b) Full cooling mode

Electrical Diagram:



Location: Behind L/H console kick panel and in front of main air conditioning relay.

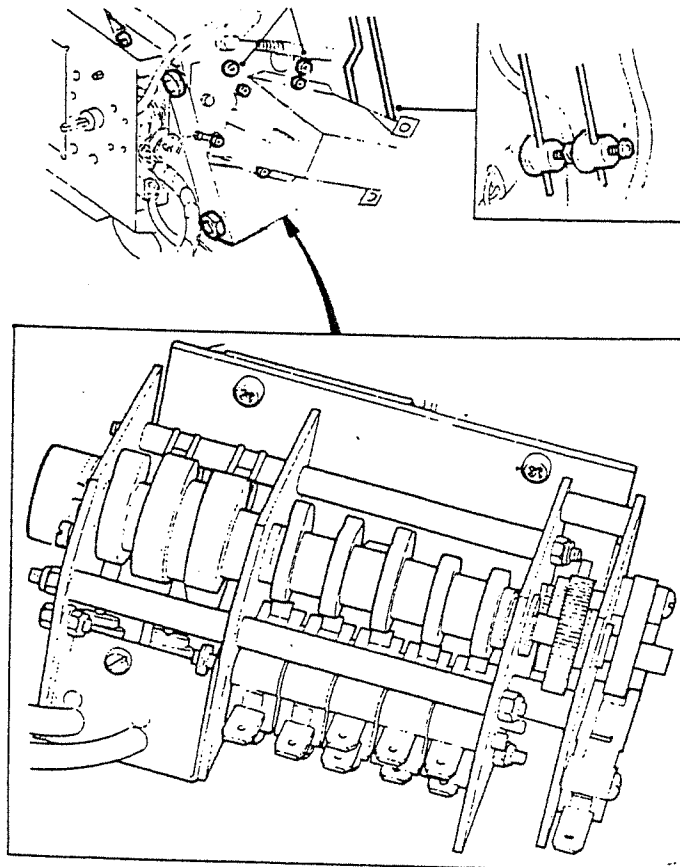


Testing: (Same as that described in Vacuum Section)

### SERVO CONTROL UNIT

Function: To operate various microswitches, vacuum switches and air distribution flap linkage by means of a camshaft, on signal from the in-car and ambient sensor, temperature selector and feedback potentiometer.

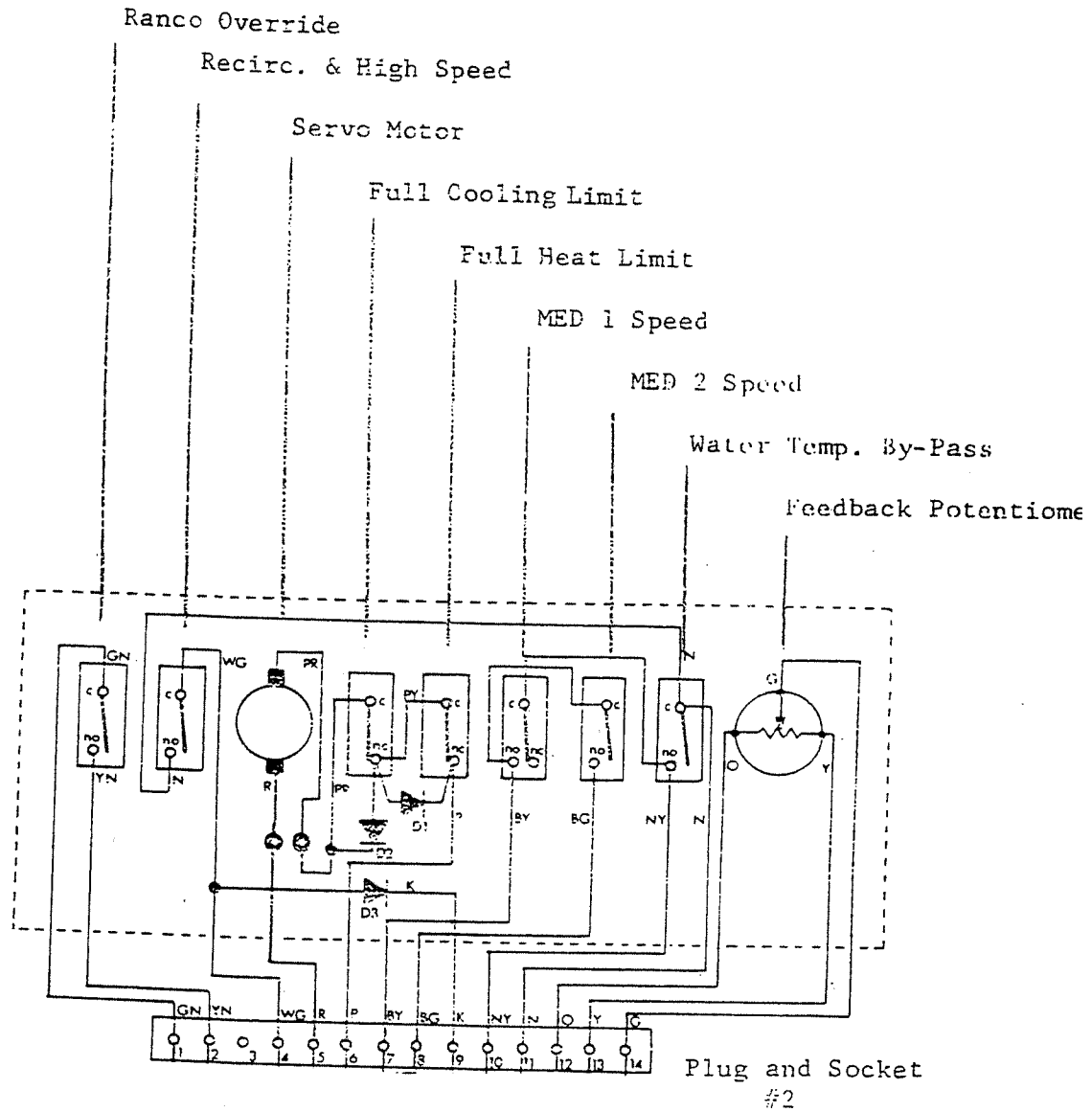
Location: Behind R/H console kick panel and center console.



### OPERATION

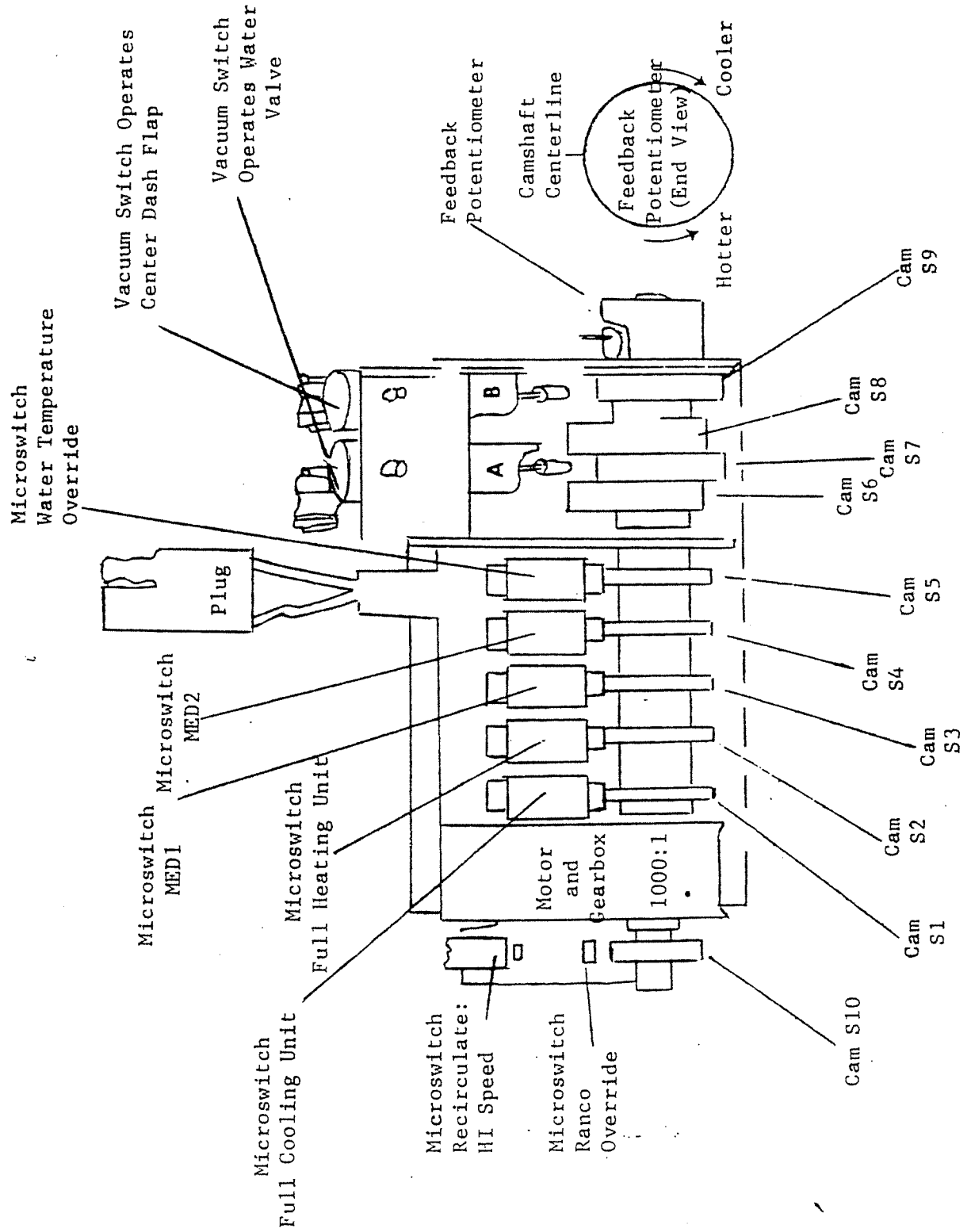
Depending upon the position of the temperature selector and temperature of the in-car sensor, the camshaft will rotate in either direction.

Electrical Diagram:



Testing: Check continuity of microswitches. Refer to vacuum section and linkage adjustment section for testing of these items. Do not apply 12 volts to servo motor. Feedback potentiometer, check continuity resistance.

SERVO COMPONENT OPERATION



SERVO MOTOR

Function: To drive camshaft in either direction upon signal from amplifier.

RECIRCULATION/HIGH SPEED MICROSWITCH

Function: To allow high (4th) speed fan in full cooling mode when camshaft has moved to full cooling limit switch - operated by camshaft Cam S10.

RANCO OVERRIDE MICROSWITCH

Function: To override Ranco thermostat in full cooling mode to allow minimum cool down time - operated by camshaft Cam S10.

FULL COOLING LIMIT MICROSWITCH

Function: To limit maximum camshaft movement in full cooling mode - operated by camshaft Cam S1.

FULL HEATING LIMIT MICROSWITCH

Function: To limit maximum camshaft movement in full heating mode - operated by camshaft Cam S2.

FAN SPEED MED 1 MICROSWITCH

Function: MED 1 is 2nd fan speed - Signals through resistors to increase or decrease fan speed in cooling mode. Decrease fan speed in heating mode depending upon rotational direction of camshaft (heating mode limited to Low and MED 1 speeds) - operated by camshaft Cam S3.

FAN SPEED MED 2 MICROSWITCH

Function: MED 2 is 3rd fan speed, signals through resistors to increase or decrease fan speed in cooling mode - operated by camshaft Cam S4.

#### WATER TEMPERATURE OVERRIDE MICROSWITCH

Function: Overrides water temperature transmitter when cooling mode is selected and engine water temperature is below 40°C (103°F). In cooling mode this allows the fans and compressor to operate immediately - operated by camshaft Cam S5. Does not allow air distribution to vehicle interior until water temperature is 40°C (103°F) - heating mode selected.

#### LINKAGE MOVEMENT

Function: To place air distribution flaps in position depending upon selection at mode control and temperature selector.

Operation: Upper heating, lower heating, lower cooling - operated by camshaft Cam S6.

#### VACUUM SWITCH A (Inner)

Function: Closes heater water valve in full cooling mode - operated by camshaft Cam S7.

#### LINKAGE MOVEMENT

Function: To place air distribution flaps in position depending upon selection at mode switch.

Operation: Upper cooling flap - operated by camshaft Cam S8.

#### VACUUM SWITCH B (Outer)

Function: Opens center dash flap in full cooling mode - operated by camshaft Cam S9.

#### FEEDBACK POTENTIOMETER

Function: One member rotates with camshaft varying resistance. Provides a modified response to bias circuit to prevent hunting between heating and cooling. Maintains a balanced electrical condition.



## CAMSHAFT OPERATIONAL SEQUENCE

### MODE CONTROL

- OFF
1. Vacuum solenoid energized - recirculation mode for fans
  2. No blower feeds
  3. Clutch disconnected
  4. No vacuum feeds so that:
    - (a) hot water flows to heater matrix
    - (b) defrost flaps open (rest position)
    - (c) face grill closed
    - (d) no front or rear output (no air circulation)

### AUTO

If 65 is selected from 85 then camshaft will rotate to the full cooling position so that from the central position the following functions will occur.

Initially however:

- (a) water valve will be open
- (b) hot water will flow to heater
- (c) fresh air mode
- (d) Ranco conductive

### CAMSHAFT STARTS TO REVOLVE

1. Fans low
2. Fans MED 1
3. Fans MED 2
4. Face level flaps open (Vac. switch outer on camshaft)
5. Heat flaps close, cool flaps open
6. Water temperature switch by-passed
7. Water valve switched off (Vac. switch inner on camshaft)
8. Ranco overridden

9. Hi speed/recirculation switch switches on maximum fan speeds and recirculation flaps

10. Full cool limit switch.

If 85 from 65 is now selected, the reverse of the above sequence will occur. Assuming that the camshaft has reached the central position again then the following will occur.

If temperature is above  $40^{\circ}\text{C}$  ( $103^{\circ}\text{F}$ ) then the procedure is shown below: Depends on ambient influence.

1. Center flap closes
2. LO fan speed
3. MED 1 fan speed
4. Full heat limit switch

#### DEGREE OF ROTATION

Depending on which position the temperature control is in initially and what temperature is selected determines how far the camshaft will rotate.

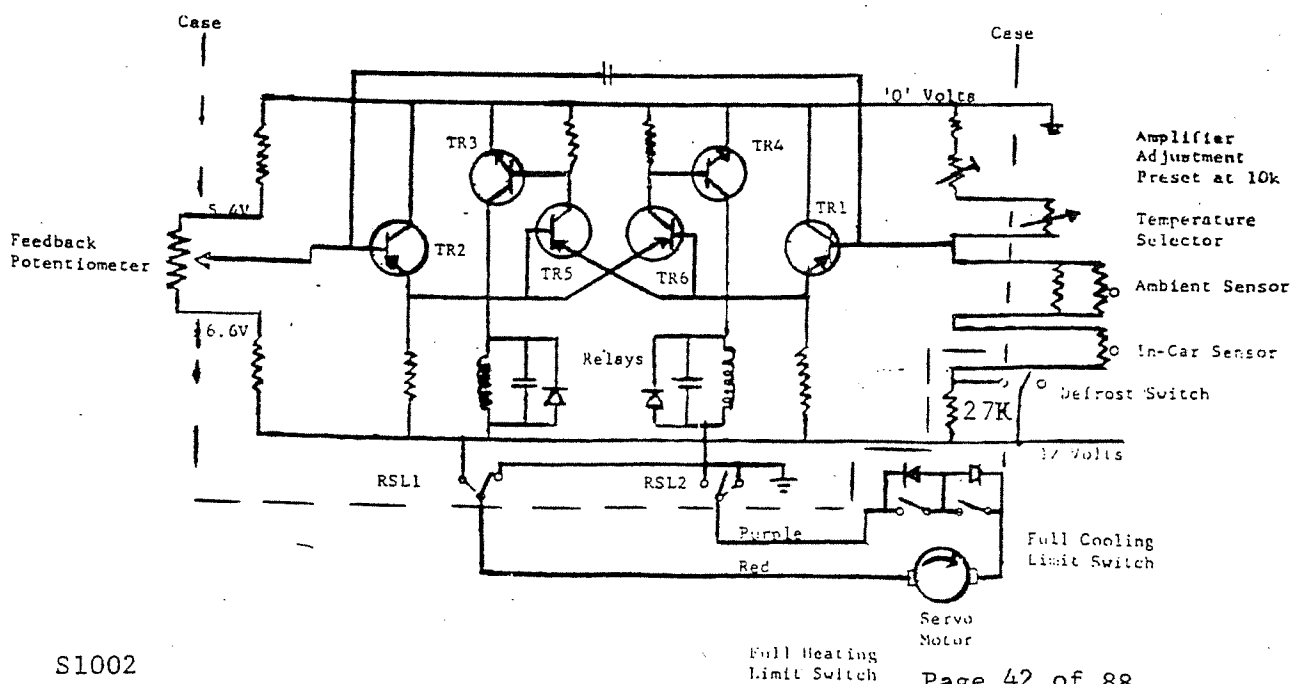
Small temperature change = Small camshaft rotation

## AMPLIFIER (Switching Unit)

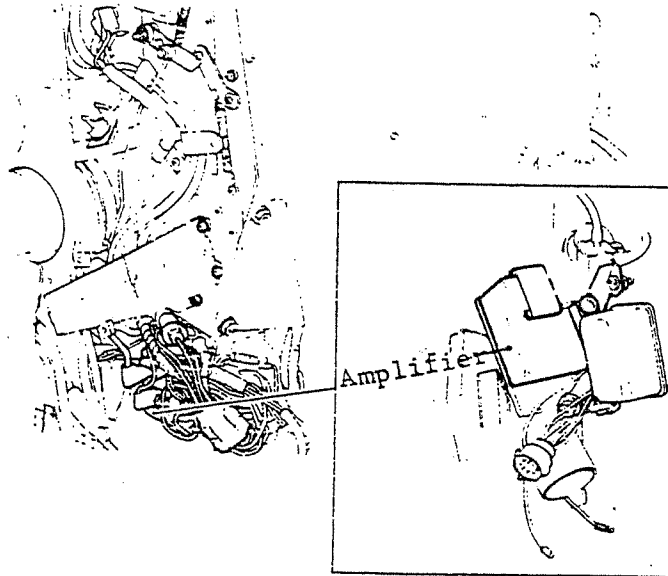
Function: Automatic temperature control is achieved by comparing the in-car temperature at the sensor with that set at the manual temperature selector. Any difference in these two settings causes an IMBALANCE voltage situation in the amplifier which in turn signals the servo control motor through a relay to rotate the camshaft to either the heating or cooling mode.

When the camshaft rotates, a feedback potentiometer also rotates and as the system starts to heat or cool the interior, the feedback potentiometer commences to return the camshaft back to the balance position. Any sudden change in ambient temperature is sensed by the ambient sensor and through the in-car sensor can modify the camshaft position calling for more heating or cooling before the in-car sensor could reflect the ambient change itself.

### Electrical Diagram:



Location: Behind L/H console kick panel and then behind the main air conditioning relay.



Testing: Select 85 at the temperature selector switch. This will cause the relay in the amplifier unit to switch purple lead of the motor circuit to 12 volts. Red lead should reflect 0 volts.

After a few minutes, select 65 at temperature selector switch. This will cause the other amplifier relay to reflect 12 volts at the red lead and 0 volts at the purple lead.

If camshaft does not rotate in either test, check wiring continuity.

FULL HEATING and FULL COOLING limit switches for continuity.

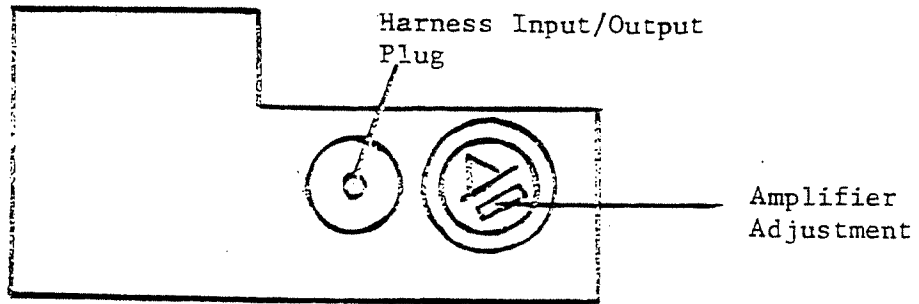
If correct, check Diodes (D1, D2 and D3) for continuity in forward and reverse bias modes.

If Correct:

1. Check that there are 12 volts at the brown lead and ground potential at the black lead.
2. Select Def. - Amplifier relay should show 12 volts at purple lead.
3. Check fuse in brown supply lead.
4. Replace amplifier.

#### AMPLIFIER ADJUSTMENT

1. Set the temperature selector at 75 and run vehicle at 1500 rpm.
2. Ensure engine temperature is normal and ambient temperature is fairly stable.
3. Measure the air temperature in the region of the in-car sensor using a Mercury thermometer.
4. When the temperature on the Mercury thermometer has stabilized and the camshaft ceases to move, note the difference in temperature between the 75 selected at the temperature selector and that registered by the Mercury thermometer.
5. Every 5°F between the two items equals 45° angular rotation of the temperature control.
6. If the temperature is higher at the Mercury thermometer than that selected at the temperature selector, rotate the amplifier potentiometer adjusting screw anti-clockwise by the same angular amount as that estimated at the temperature selector.
7. Similarly, if temperature is lower at the Mercury thermometer, adjust in a clockwise direction.

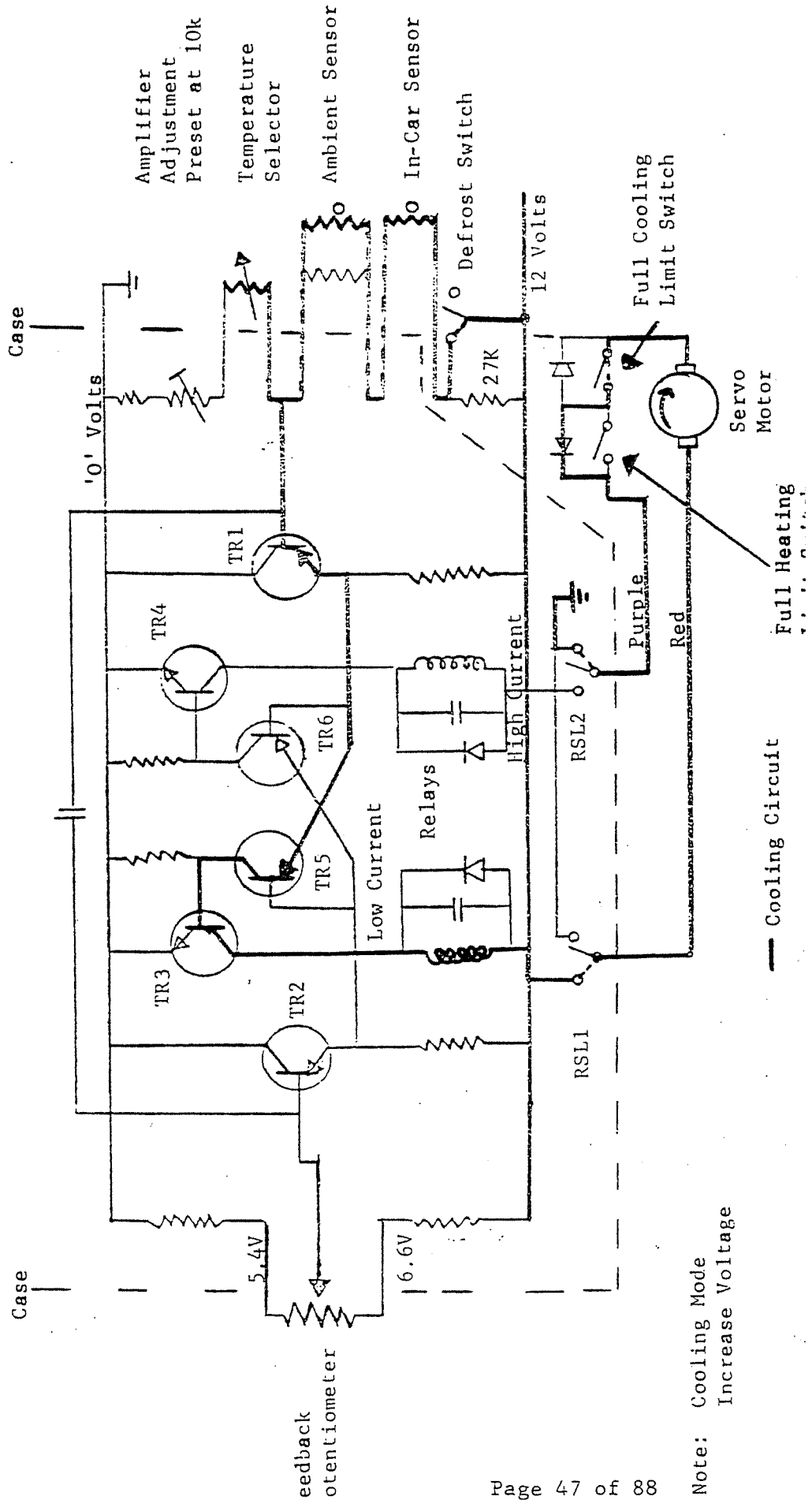


### FULL COOLING

When full cooling is selected, the temperature selector is placed at 65. This introduces a resistance into the circuit which lowers the current and increases the voltage. Sensing the higher voltage, the amplifier allows the current flow through TR1, TR5 and TR3 which energizes relay RSL1 which in turn allows current flow through the red lead and return to ground through the purple lead, rotating the motor and hence the camshaft into the cooling mode. Under high ambient conditions, the Ranco thermostat is also overridden by the Ranco override switch.

When the selected temperature is reached, the in-car sensor's resistance changes cancelling the IMBALANCE and allows the feedback potentiometer to return the camshaft to the balance position. Camshaft travel is limited by the full cooling limit switch - Depends on Ambient influence.

AMPLIFIER CIRCUIT  
FULL COOLING



Note: Cooling Mode  
Increase Voltage

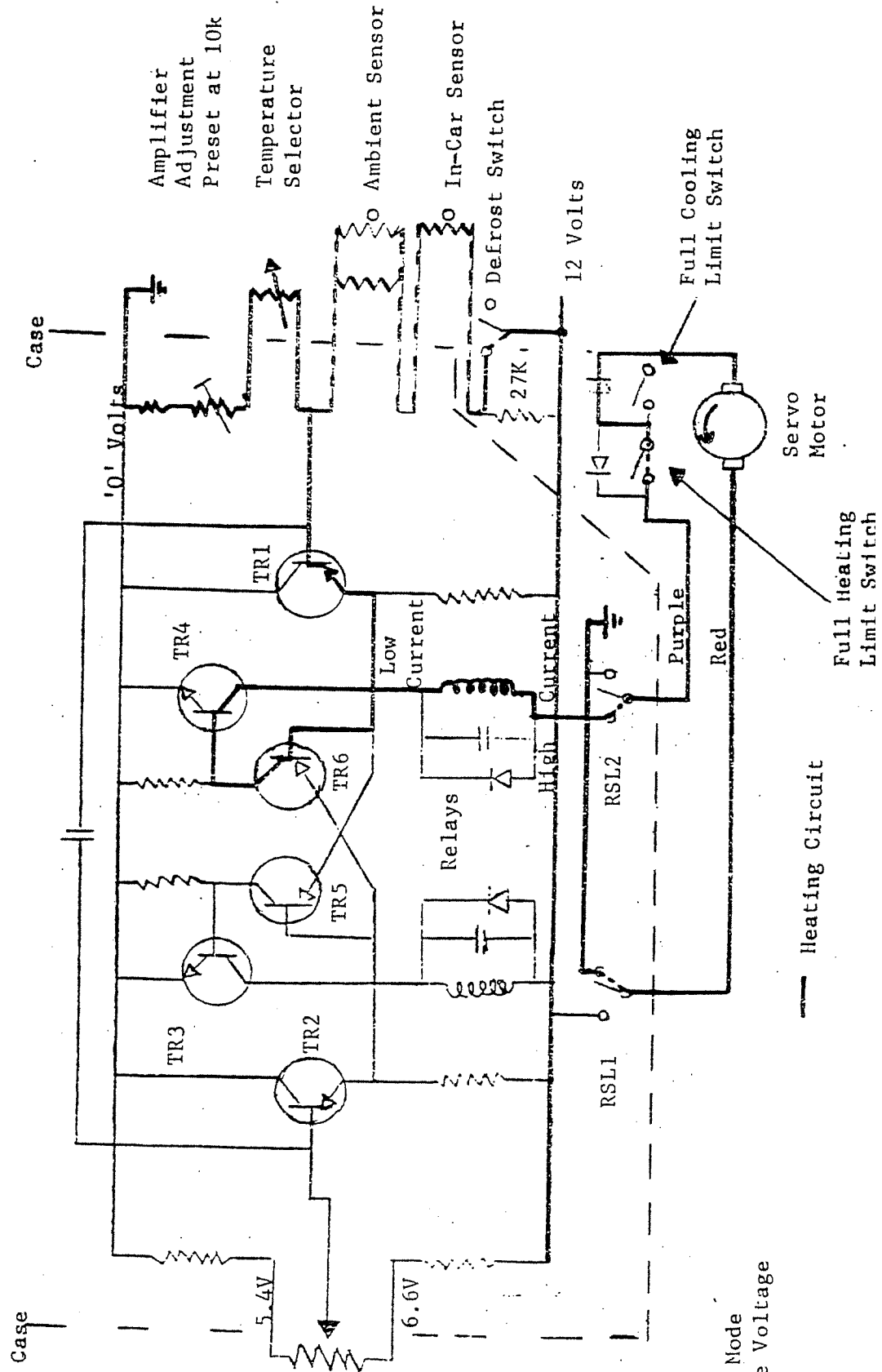


FULL HEATING

When full heating is selected, the temperature selector is placed at 85. This introduces a resistance into the circuit which raises the current and reduces the voltage. Sensing the lower voltage, the amplifier allows current flow through TR1, TR6 and TR4 which energizes RSL2 which in turn allows current flow through the purple lead and return to ground through the red lead, rotating the motor and hence the camshaft into the heating mode. When the selected temperature is reached, the in-car sensor's resistance changes cancelling the IMBALANCE and allows the feedback potentiometer to return the camshaft to the central position. In full heating, fan speeds are limited to Low and MED 1 (2nd speed) - Depends on Ambient influence.

To bypass amplifier hook into purple wire  
& red (fused) wire - to ~~ground~~ <sup>NEGATIVE</sup> &/or positive

AMPLIFIER CIRCUIT  
FULL HEATING

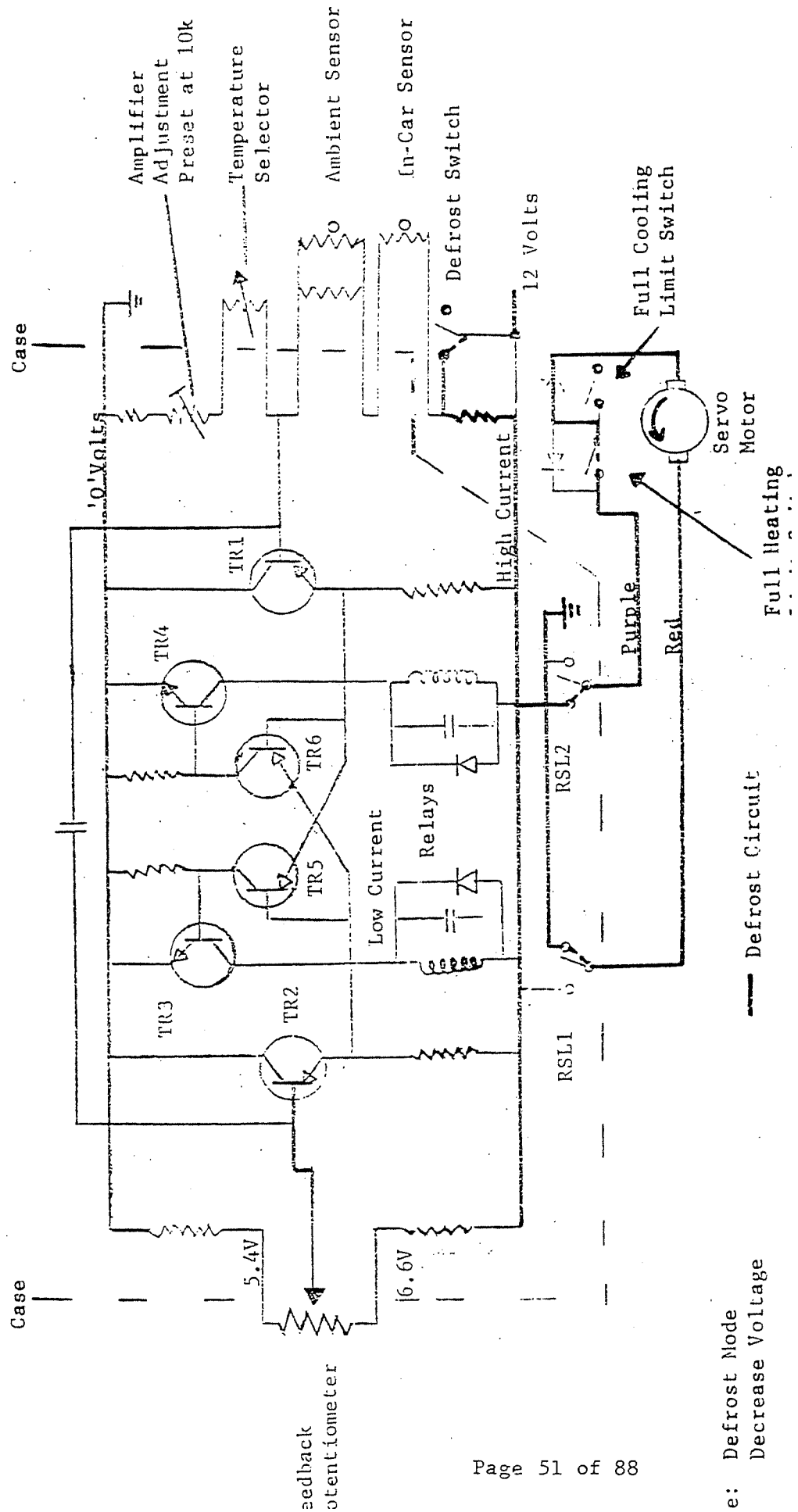


Note: Heating Mode  
Decrease Voltage

DEFROST MODE MAXIMUM

When defrost is selected, the temperature selector is placed at 85. This introduces a 27K resistance into the circuit which raises the current and reduces the voltage bypassing the amplifier bias circuit and causes the camshaft to rotate to the full heating mode. The fans will operate at the highest speed.

AMPLIFIER CIRCUIT  
DEFROST MODE



## OPERATION OF VACUUM AND FLAP COMPONENTS

### FULL HEATING MODE - AUTO

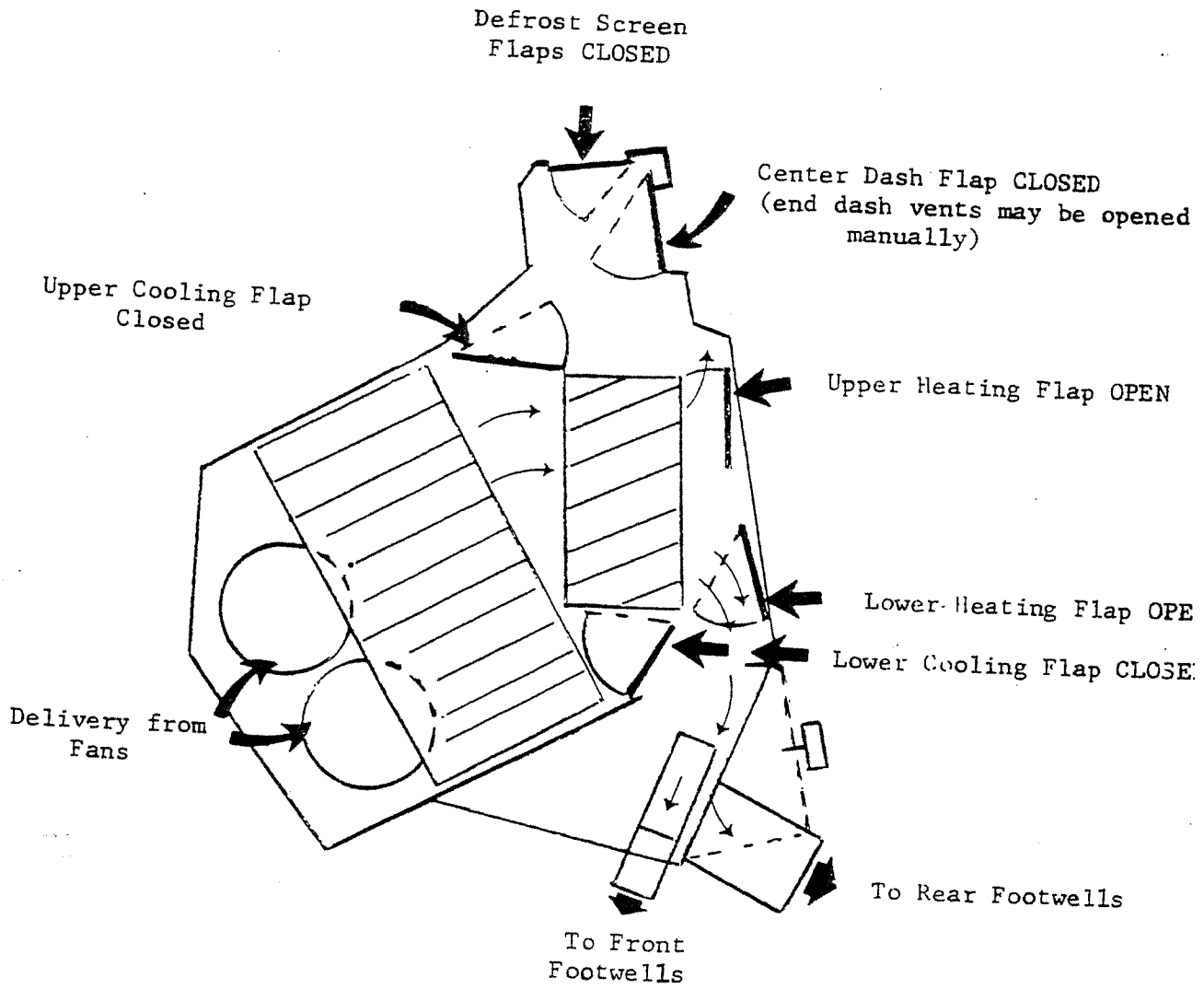
There is no vacuum feed to center dash flap, therefore, it is closed - heater flaps are fully opened - cooler flaps closed by camshaft. System will not operate until engine water temperature reaches 40°C (103°F). Fans will automatically be on LO speed (1st) and switch to MED 1 (2nd) speed by camshaft. Only the two lowest fan speeds are available in the heating mode.

Camshaft turns until stopped by full heat limit switch.

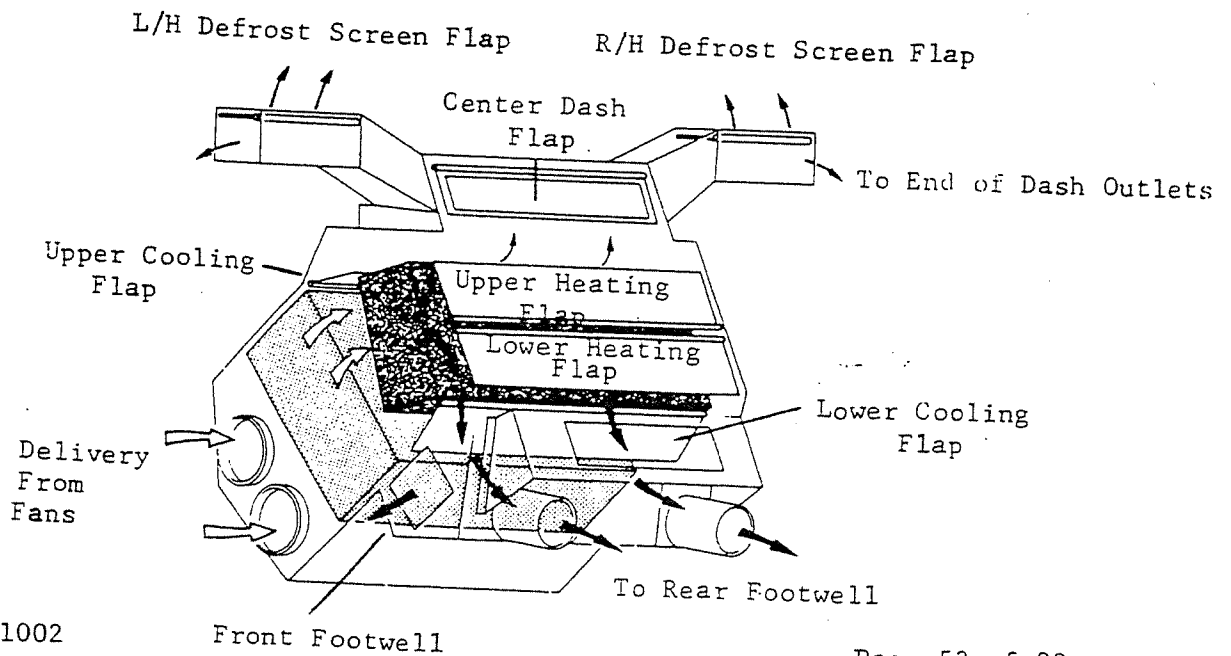
Camshaft movement depends on ambient and desired temperature set at temperature selector. Therefore, depending on conditions, flap positions will vary to meet in-car temperature requirements. All air is passed through evaporator to be dehumidified.

### HIGH & LO FAN SELECTION

Except for maintaining the given fan speed selected, the system's operation still remains automatic.



BULKHEAD FLOW AT FULL HEATING



LH Screen Flap Closed  
by Applied Vacuum

RH Screen Flap Closed  
by Applied Vacuum

S1002

Lower Heater Flap  
Open

Center Dash Flap  
Closed

Vacuum Switch  
Manual Control  
'ON'

Vacuum  
Solenoid  
'OFF'

Both Switches  
on Camshaft  
CLOSED

L/H Blower Flap  
Open

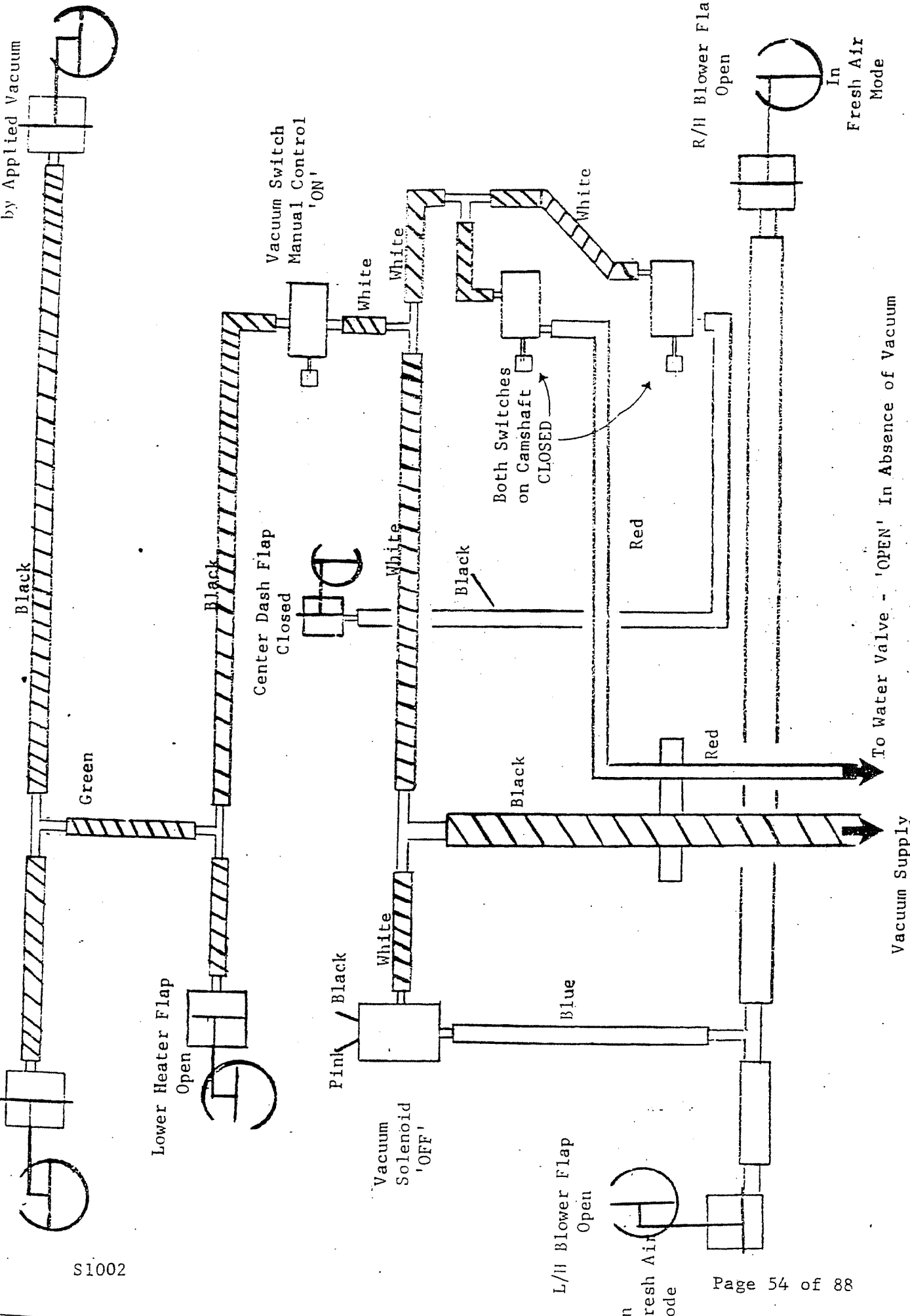
In  
Fresh Air  
Mode

R/H Blower Flap  
Open

In  
Fresh Air  
Mode

To Water Valve - 'OPEN' In Absence of Vacuum

Vacuum Supply



FULL COOLING MODE - AUTO

Approximately 75% of the air after passing through the evaporator is fed to the dash outlets, the remaining 25% to the footwells.

Vacuum solenoid is de-energized placing inlet flaps in fresh air mode. Ranco thermostat is conductive and refrigeration cycle operates. Fans are initially on LO speed (always in this mode when Auto is selected).

As camshaft revolves, it trips MED 1 (2nd speed) fan switch then MED 2 (3rd speed).

Center dash flap opens when cam operates outer vacuum switch. Upper and lower heater flaps are closed preventing air passing over heater core. Cooling flaps are open - All flaps being operated by camshaft through external linkage.

Water temperature bypass switch activated by camshaft - Water valve closed to prevent water circulation through heater core - Cam closes vacuum feed from inner vacuum switch. Ranco thermostat overridden by Ranco override switch.

High speed (4th)/Recirculation switch activated by camshaft - Positive voltage via Diode #D3 energizes vacuum solenoid and allows vacuum feed to inlet flaps placing them in recirculation mode.

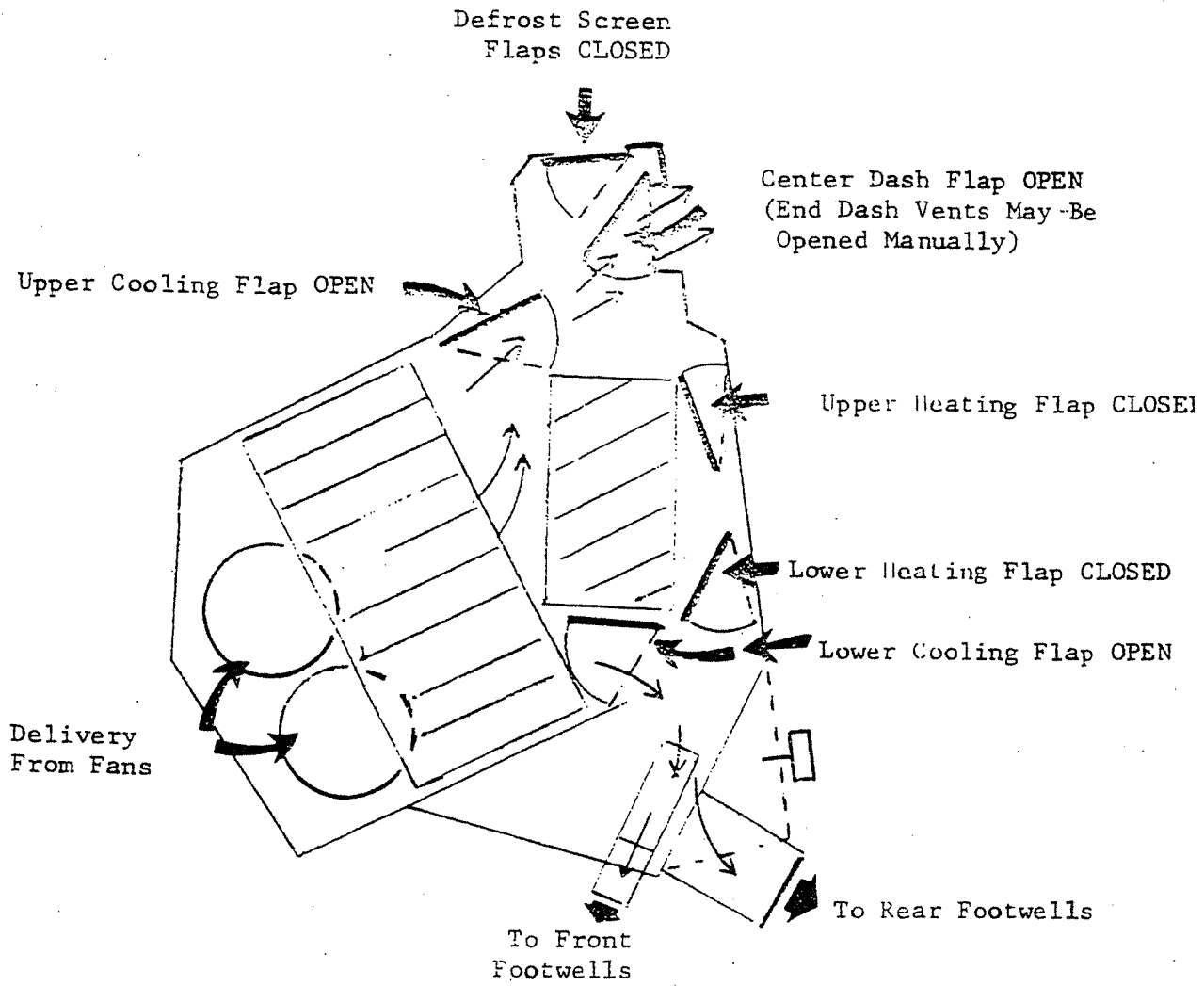
Camshaft trips full cooling limit switch inhibiting further camshaft travel.

As selected temperature is reached, the feedback potentiometer, via the amplifier, signals the camshaft to reverse this sequence until camshaft revolves back to central position.

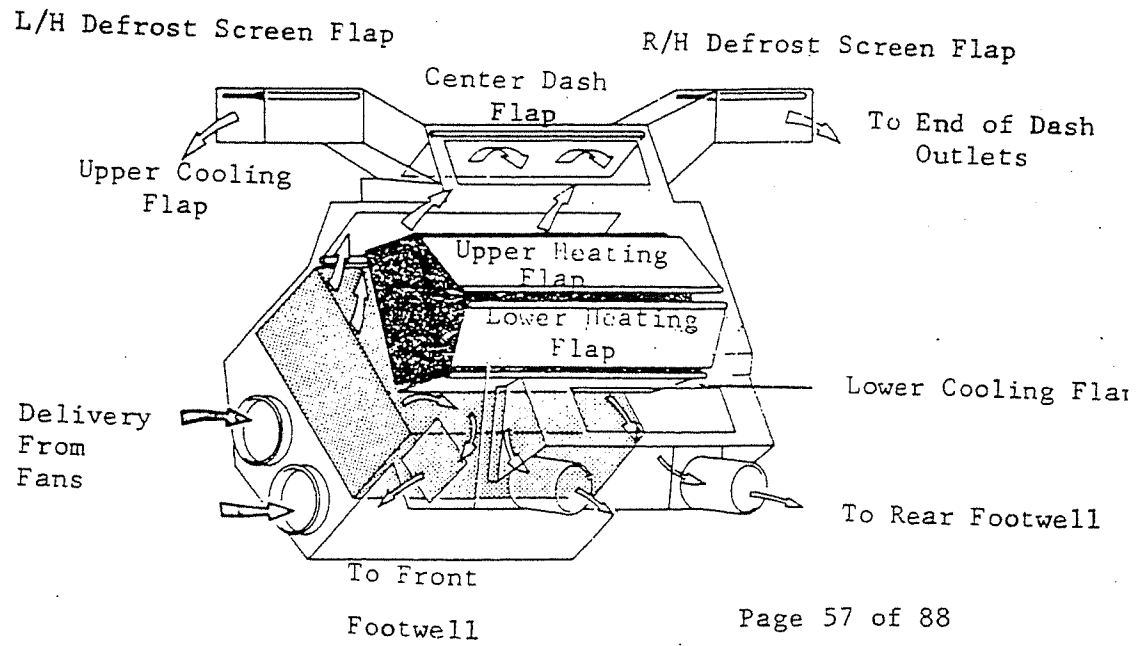


HIGH & LO FAN SELECTION

In cooling mode, HIGH or LO may be selected either to maintain a high or low air velocity into the vehicle interior; however, all other functions remain automatic.



BULKHEAD FLOW AT FULL COOLING



RH Screen Flap Closed  
by Applied Vacuum

LH Screen Flap Closed  
by Applied Vacuum

S1002

Lower Heater Flap  
Opened by Vacuum  
But Overridden  
by Flap Arm  
X on Camshaft

Center Dash Flap Open  
by Applied Vacuum From  
Camshaft Switch 'A'

Vacuum Switch  
Manual Control  
'ON'

Vacuum Solenoid  
Energized by  
R3 and Hi/Speed  
Recirc. Switch

Both Switches  
on Camshaft  
OPEN

LH Blower Flap  
Closed

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In Recirc. Mode

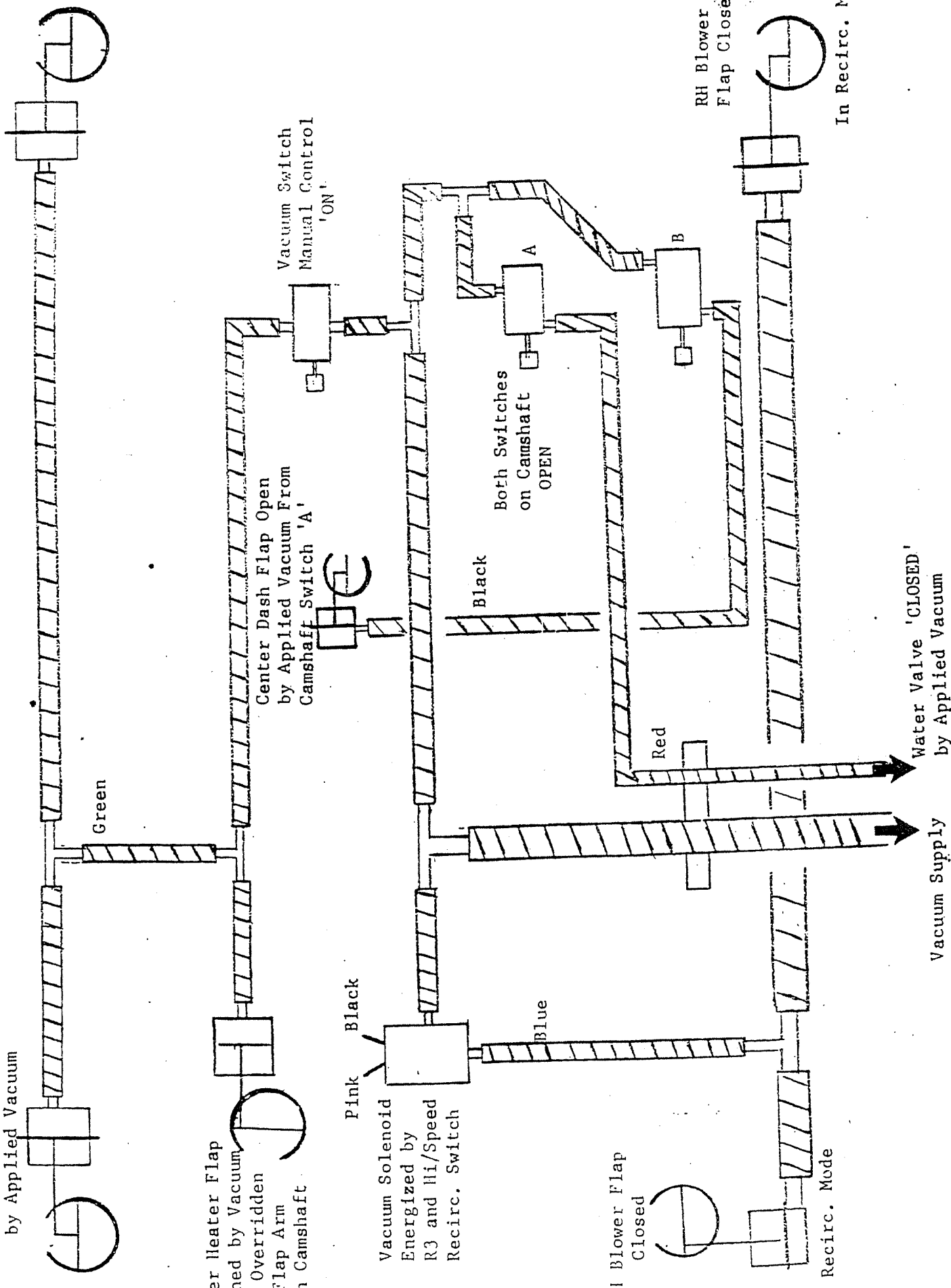
RH Blower  
Flap Closed

In Recirc. Mode

Water Valve 'CLOSED'  
by Applied Vacuum

Vacuum Supply

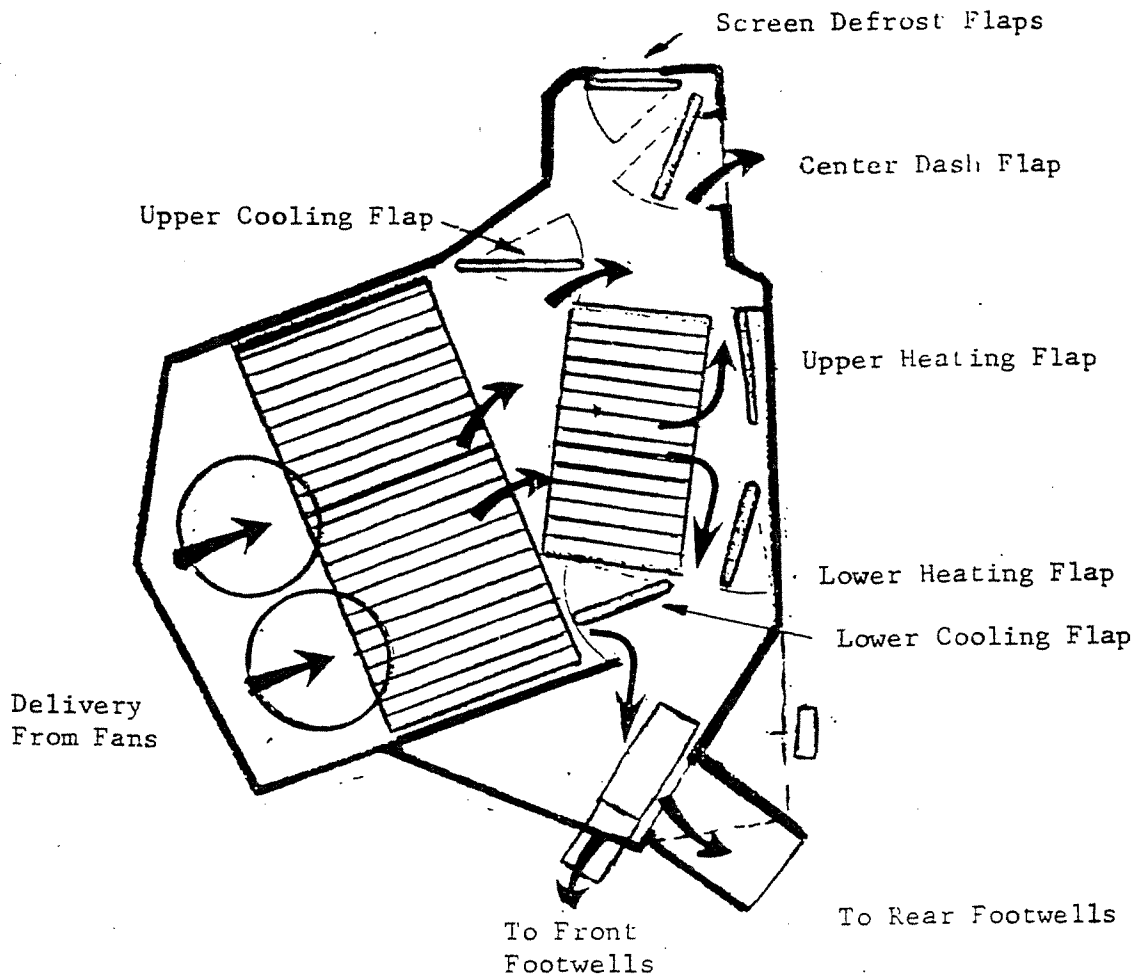
MAINTENANCE SYSTEM FURTHER COOLING MODE

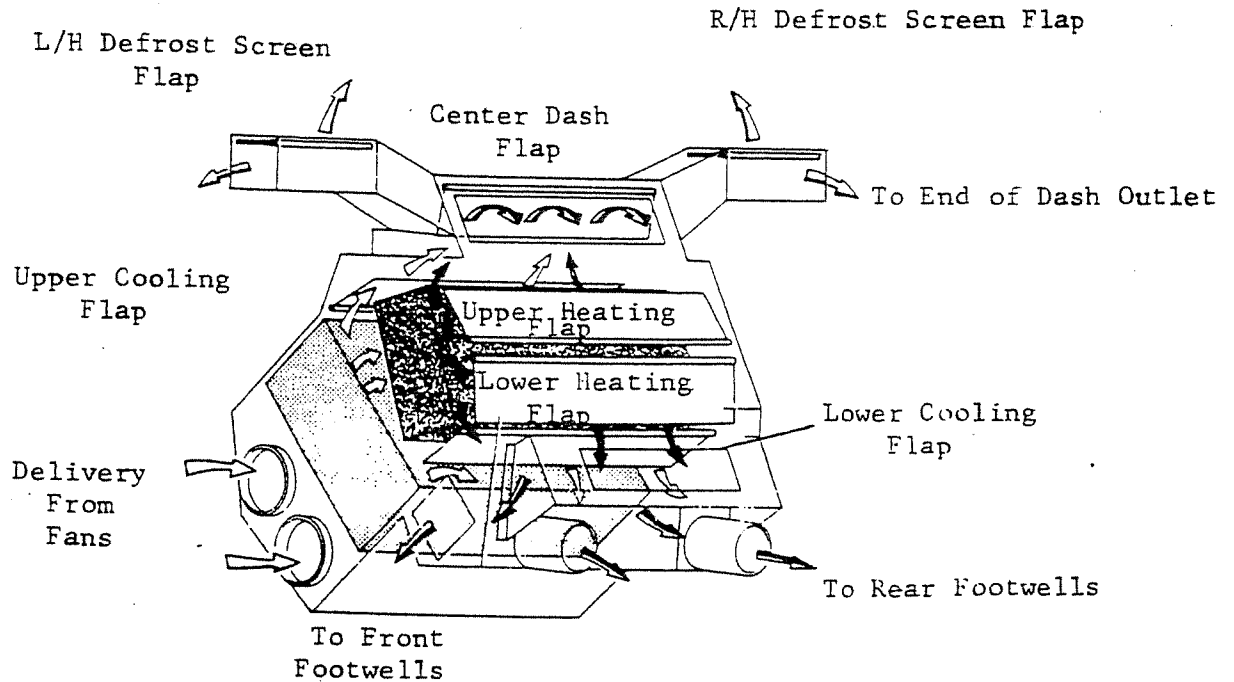


INTERMEDIATE SETTINGS

Depending on ambient temperature and temperature at the in-car sensor as compared to that selected at the temperature selector control, an infinite number of settings between full heating and full cooling are possible. Therefore, flaps, vacuum and electronic control signals are governed by the camshaft position necessary to maintain the selected temperature.

BULKHEAD FLAP POSSIBLE INTERMEDIATE POSITIONS



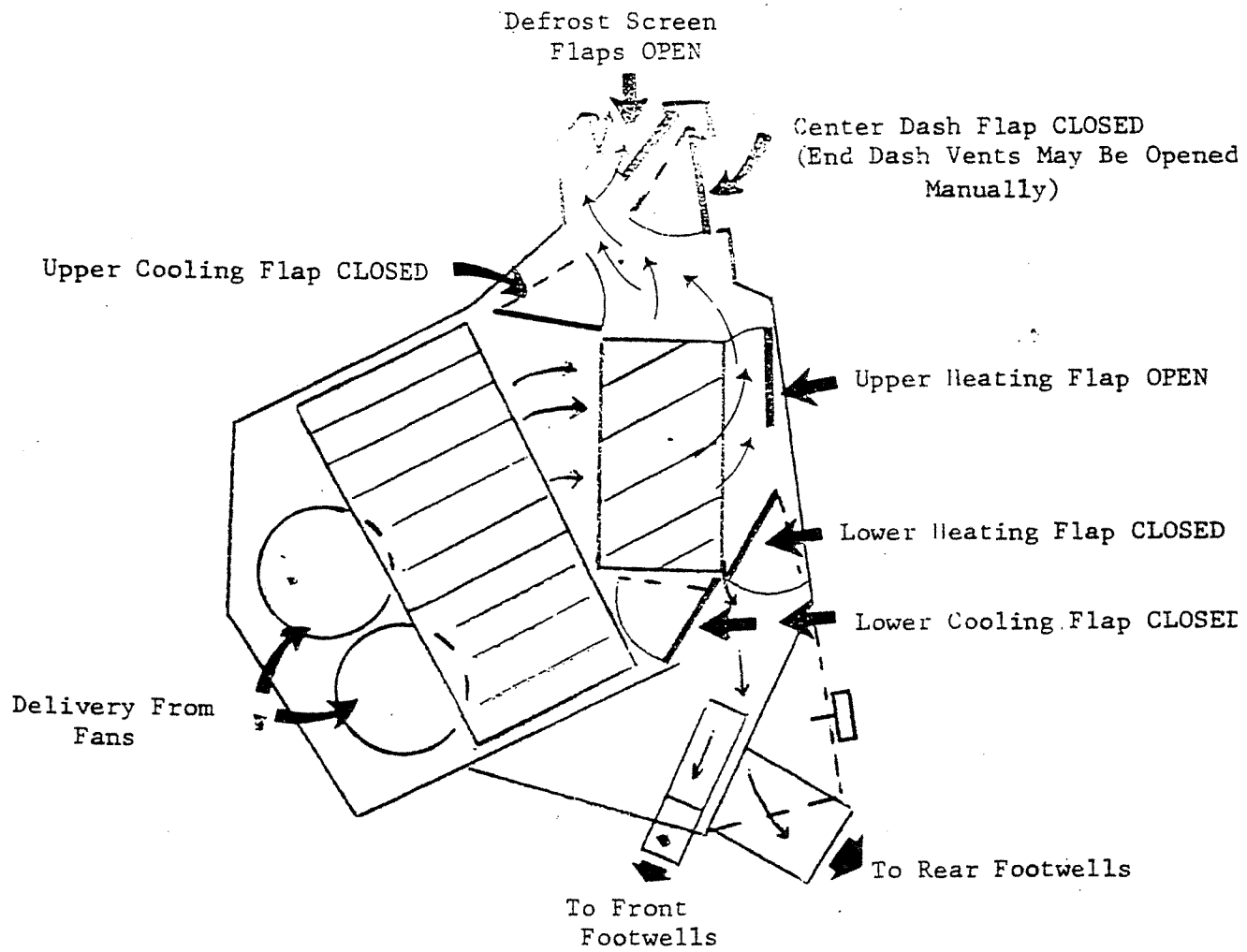


### DEFROST

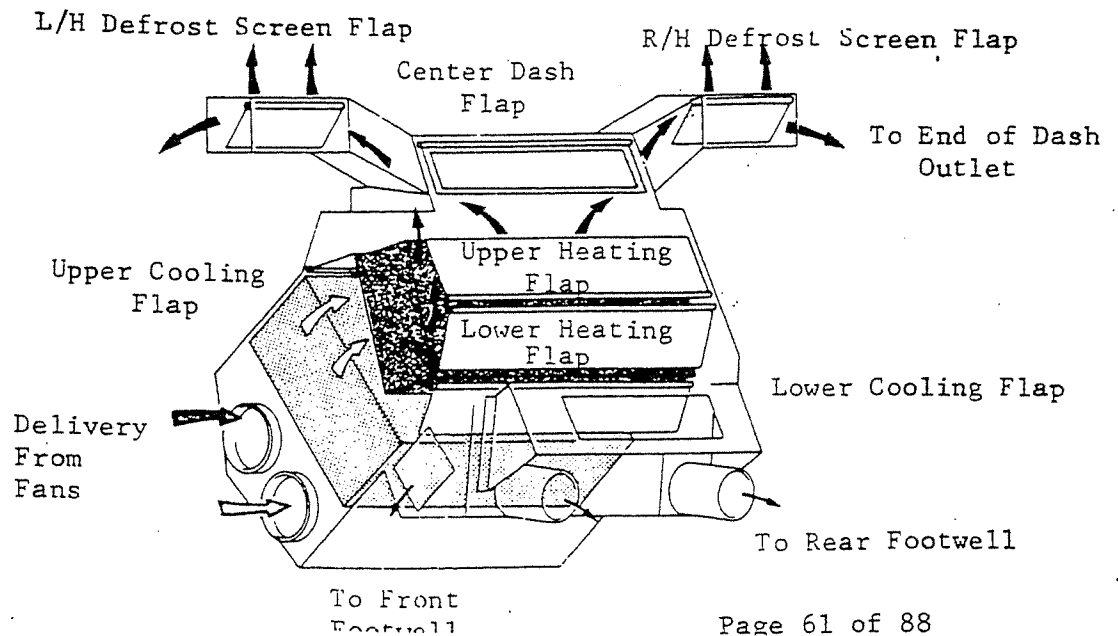
Selecting defrost at the manual control introduces a high value resistance (27K) which completely overrides the amplifier bias circuits. The camshaft moves to the full heat position closing the upper and lower cooling flaps and opening the heater flaps. However, the lower heating flap which normally is held open by a vacuum actuator, does not have a vacuum feed, therefore, is held closed by the return spring. All heated air is directed to the screen outlets. Manual operation of the dash end outlets is optional for side window defogging.

The vacuum switch on the manual control is closed preventing vacuum to the lower heating flap and screen outlet flaps (which allow screen flaps to open 90% of air flow). There is a small bleed-(10%) of hot air to the footwells. The fans are naturally on HIGH speed (4th) and will come on immediately.

The heating system will not function until the engine water temperature reaches 40°C (103°F).



BULKHEAD FLOW AT DEFROST



L/H Screen Flap (no vacuum applied)  
Open

R/H Screen Flap  
Open

Lower Heater Flap  
Closed

Center Dash Flap  
Closed

Vacuum Switch  
Manual Control  
'OFF'

Pink  
Black

No Feed  
To Vacuum  
Solenoid

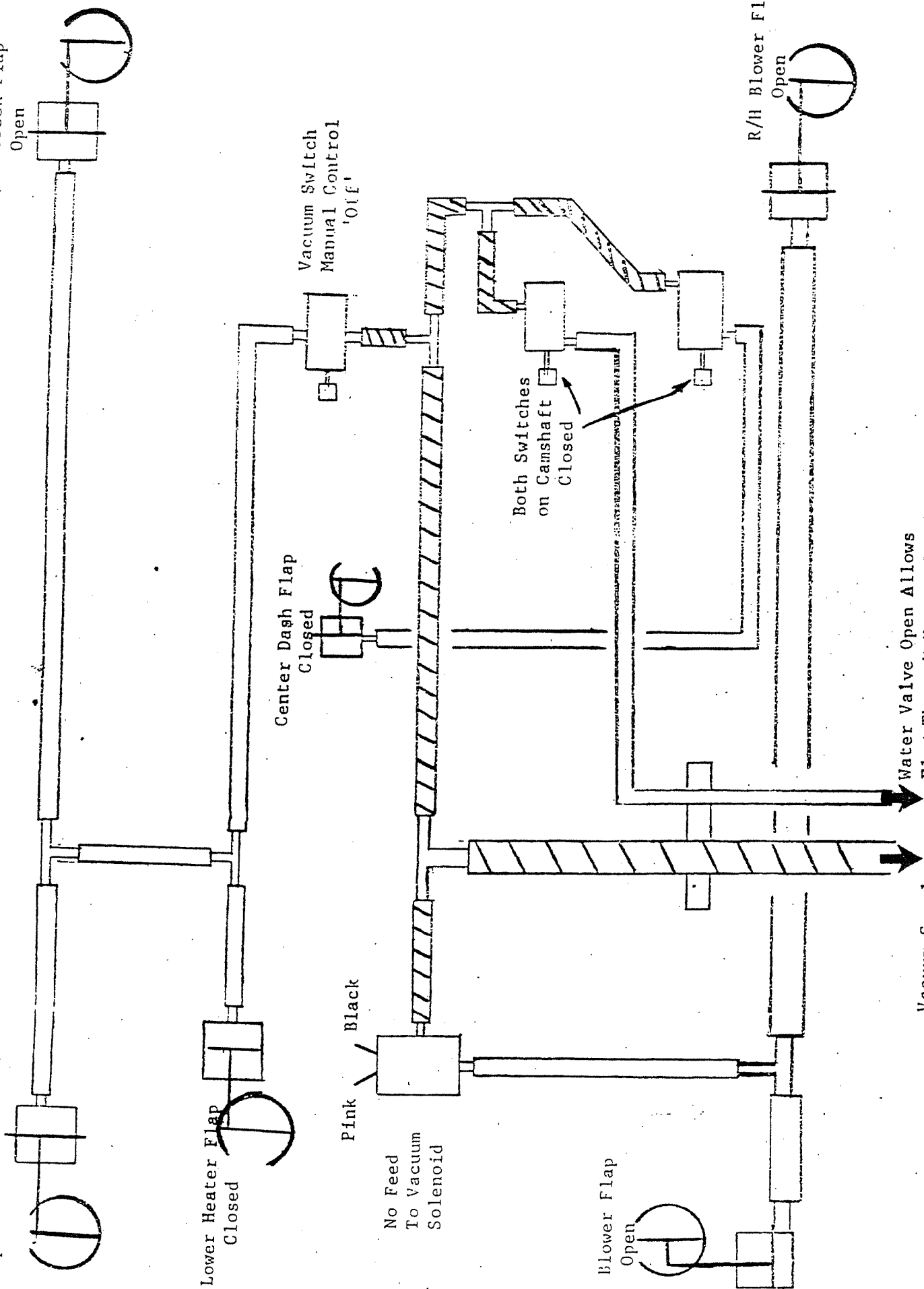
Both Switches  
on Camshaft  
Closed

L/H Blower Flap  
Open

R/H Blower Flap  
Open

Water Valve Open Allows  
Flow Through Heater Core

Vacuum Supply



### FLAP AND LINKAGE ADJUSTMENT

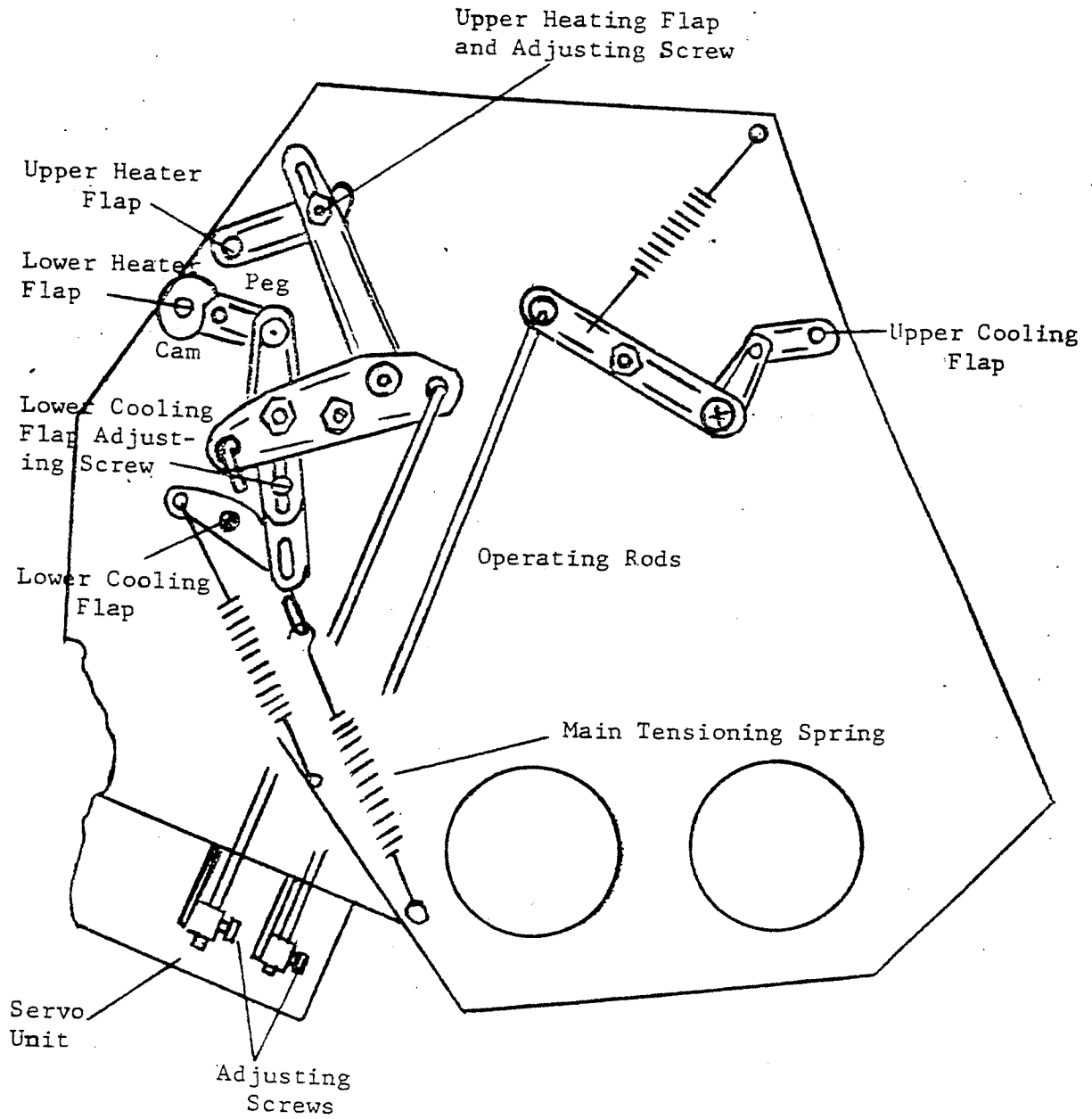
1. Remove main tension spring (leave lower cooling flap spring in situ.).
2. Check that all flaps are free to move.
3. Rotate camshaft into full cooling mode (clockwise - viewed from potentiometer end) by turning temperature selector to 65 with mode control at Auto.
4. Check that LOWER HEATING flap is closed by applying slight hand pressure - there should be no movement.
5. Check that UPPER HEATING flap is fully closed by rotating flap in a clockwise direction - adjust screw and locknut if necessary.
6. Check that both LOWER and UPPER HEATING flaps close fully by operating actuating rod.

NOTE: Peg on linkage operates on cam on the LOWER HEATING flap to override the lower heating flap vacuum actuator on the left side of the evaporator case. Peg closes lower heating flap in full cooling mode.

7. Place system into FULL HEATING mode by rotating camshaft anti-clockwise (viewed from potentiometer end).
8. Check that UPPER HEATING flap is fully OPEN (just touches casing).
9. Hold LOWER COOLING flap CLOSED and adjust actuating rods by set-screw on linkage.
10. Check that flaps close at opposite end of travel by operating rod.
11. Refit main tensioning spring.
12. Check that bottom cooler flap seats correctly.



EVAPORATOR CASE RIGHT-HAND SIDE



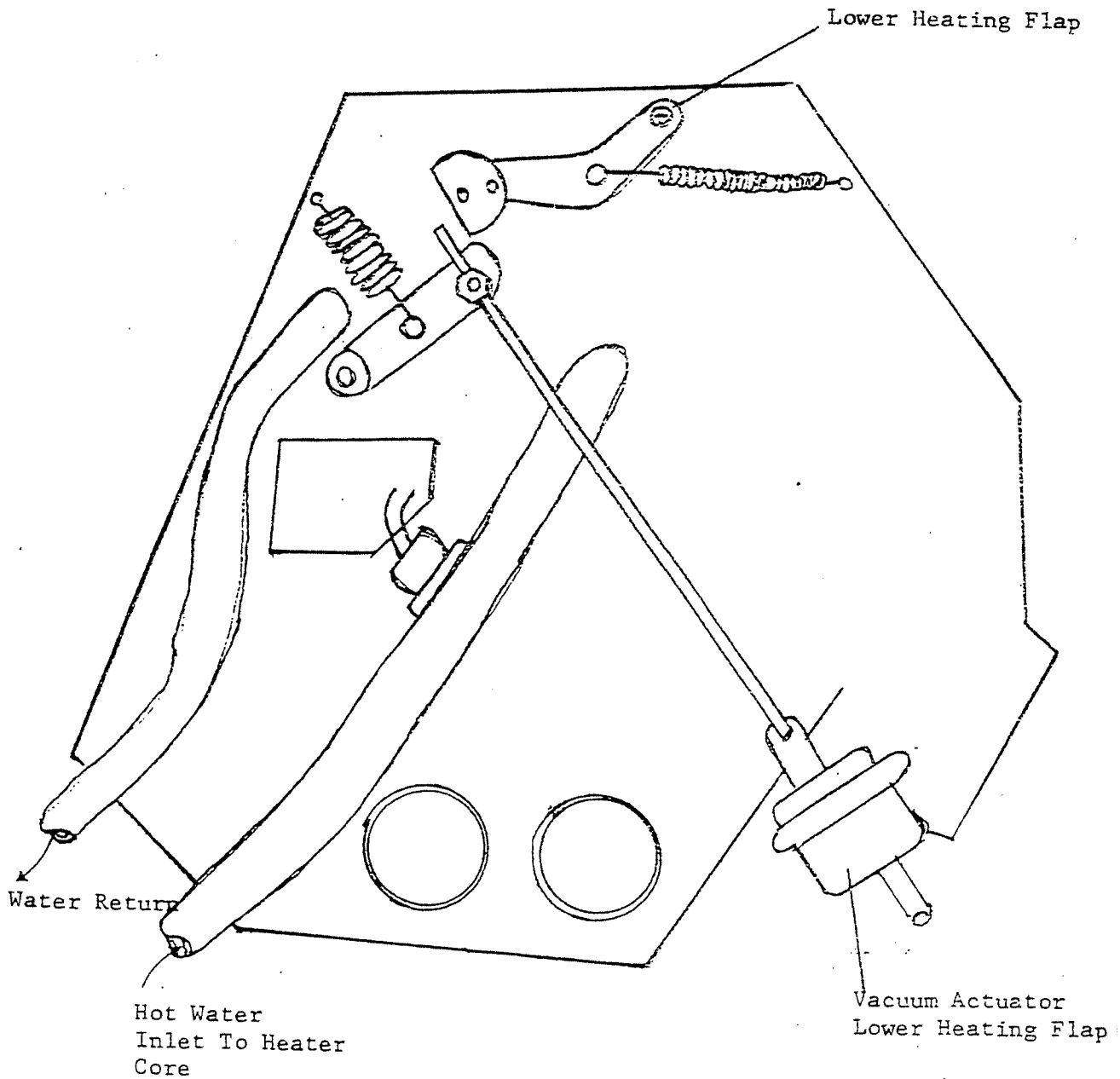
### LOWER HEATING FLAP ADJUSTMENT

1. Select FULL COOLING mode - loosen clamping setscrew - hold flap fully clockwise against heater box - retighten clamping setscrew. Check for free movement of flap.
2. Select FULL HEATING mode and check that flap opens fully (against casing).

The lower heating flap functions in all positions except defrost. The position of the lower heating flap is modified by the overriding action of the cam and peg on the upper heating/lower cooling flap operating linkage on the right side of the evaporator case. This linkage gives the correct air blend for all conditions.

In defrost there is no vacuum supply to the lower heating flap vacuum actuator. Therefore, no air flows to the front or rear footwells. In defrost mode, all air goes to screen outlets except for a slight bleed to the footwells or optional setting of the dash end outlets.

LOWER HEATING FLAP  
ACTUATING SYSTEM

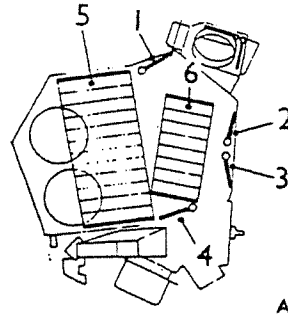


Evaporator Case  
Left-Hand Side

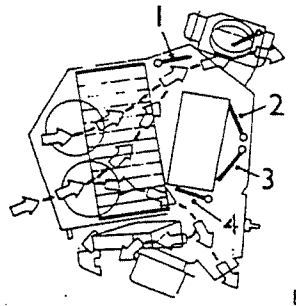
Check relative positions of flaps for FULL HEATING and FULL COOLING modes.

FLAP LOCATIONS

1. Upper Cooling Flap
2. Upper Heating Flap
3. Lower Heating Flap
4. Lower Cooling Flap
5. Evaporator
6. Heater Core

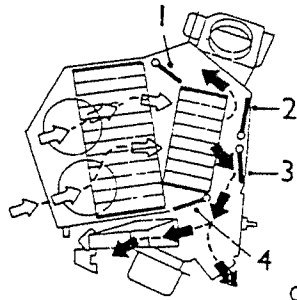


FULL COOLING MODE



1. Upper Cooling Flap Open
2. Upper Heating Flap Closed
3. Lower Heating Flap Closed
4. Lower Cooling Flap Open

FULL HEATING MODE



1. Upper Cooling Flap Closed
2. Upper Heating Flap Open
3. Lower Heating Flap Open
4. Lower Cooling Flap Closed

### CONTROL SYSTEM FUNCTIONAL TEST

1. With engine cold, turn TEMPERATURE SELECTOR to 85 and MODE CONTROL to AUTO.
2. Start engine - run at 1,000 rpm. Camshaft motor should be heard.
3. The fans should not operate until engine temperature reaches 40°C (103°F).
4. At 40°C (103°F) the fans should come on at MED 1 (2nd) speed. Check for correct speed by selecting LO at MODE CONTROL. Fans should drop to low (1st) speed. Place control back to AUTO. Compressor clutch should be energized.
5. Air from the outlets will gradually increase in temperature as the engine temperature increases.
6. With engine warm, turn TEMPERATURE SELECTOR to 65.  
The unit should go through the following sequence in about 20 seconds:
  - (7) Blower speed will drop to low.
  - (8) Incoming temperature will decrease, the upper temperature dropping more quickly than footwell temperature.
  - (9) After about 10 seconds, the center outlet flap will open.
  - (10) About 1 second later, the fan speed will shift to MED 1 (2nd speed).
  - (11) Another second later, the fan speed will shift to MED 2 (3rd speed).
  - (12) Another second later, the fan speed will shift to maximum (4th speed).At the same time, the fresh air vents will close and the recirculation flaps will open. A rush of air will be felt along the bottom edge of the lower trim panels.

(13) Turn MODE CONTROL to LO which should cause the fan speed to drop.

Return MODE CONTROL to AUTO.

NOTE: On some cars the change of the fan speeds may be hard to detect.

(14) Remove cigar lighter from vicinity of in-car sensor.

(15) Within ten minutes, depending upon ambient conditions, the unit should shift off recirculation and the blowers will drop to one of the intermediate speeds. (This test should be carried out on the road to get faster thermistor response.)

(16) Turn MODE CONTROL to DEFROST. The center dash flap should close and the screen outlets open. Air to the footwells should cut off leaving air supply to the upper outlets only.

(17) Fans should shift to maximum (4th) speed and hot air should flow from the upper outlets.

NOTE: Fan vibration should be assessed at this point.

(18) Check that air can be cut off at dash face level outer outlets.

(19) Set MODE CONTROL to AUTO. Set temperature selector to 75 and wait for unit to settle.

(20) The fans should now be on low speed - depending on Ambient temperature

(21) Turn MODE CONTROL to HIGH - Maximum (4th) speed should now engage.

DEFROST AND DEMIST TESTING

1. Set the TEMPERATURE SELECTOR to 85.
2. Set MODE CONTROL to DEFROST.
3. Close END OF DASH outlets.
4. Start engine and run at 1500 rpm for 7 minutes.
5. During the running period, measure air flow from screen outlets.  
The velocity should be 1550 f.p.m.
6. Also during running period turn MODE CONTROL to HIGH and open END DASH outlets. Using screen outlets and end of dash outlets, measure air velocity.
7. Should be 500 f.p.m. screen - 850 f.p.m. end of dash outlets minimum.
8. At the end of 7 minutes running period and the engine water temperature gauge is at normal, the following minimum screen outlet temperature should be obtained:

PLENUM INLET °C	SCREEN OUTLET °C
10	54
12	55
14	55.5
16	56.5
18	57
20	58
22	58.5
24	59.5

9. If the above minimum requirements are met, it can be assumed that:
  - (a) The thermostats are opening correctly.
  - (b) Water valve is opening fully.
  - (c) The flaps and linkage are correctly adjusted for the heating mode.
  - (d) The fans give adequate air flow at maximum speed.

10. If the above criteria are not met, check the following:
11. If water temperature will not reach normal in 7 minutes, check thermostat(s).
12. Water temperature is normal but the air outlet temperature remains low, check that vacuum to heater water valve is at least  $8\frac{1}{2}$  inches (Hg). If vacuum is sufficient, replace valve. However, if vacuum is low, check supply through water valve actuator, switch and supply pipe for a pinched condition.
13. If air velocity is low, check that appropriate flaps are fully closed adjust linkage if necessary. Excessive air flow may be caused by demist control flap sticking open.
14. If after checking flaps, air flow is still low, check blower motors for full voltage at maximum speed and that the motors are wired for correct rotation.



### VACUUM FUNCTIONAL SYSTEM TESTING

1. Engine at normal running temperature - Check that engine vacuum is at least  $8\frac{1}{2}$  (Hg) inches.
2. With engine running, select 65 on TEMPERATURE SELECTOR. Wait 1 minute then select Defrost: DEFROST SCREEN OUTLETS should open and provide maximum hot air flow to screen. Air should have equal velocity from each side.
3. There should be a small air bleed to the footwells. Heavy flow indicates a fault with lower heater flap linkage or flap actuator.
4. Select AUTO at MODE CONTROL 65 at TEMPERATURE SELECTOR. Wait 5 minutes for camshaft to travel to full cooling mode and observe the following:
  5. The center dash flap should open first and would indicate the vacuum system to this component is O.K. If it does not open, suspect mechanical seizure or vacuum supply fault.
  6. Secondly, the heater water valve should close (observe arm movement - should be drawn fully into the unit). If this occurs, it demonstrates the camshaft vacuum switch, water valve and piping is in working order.
7. When the camshaft reaches the end of its travel to the full cooling mode position, the HI speed/Recirculation microswitch puts the fans in HIGH speed. The vacuum solenoid is also energized allowing a vacuum feed to the vacuum actuator on the blower casings placing the air inlet flaps in the recirculation mode. Check that flaps drop down to the fullest extent which indicates vacuum system O.K.

Failure to do this indicates either mechanical seizure or vacuum failure.

NOTE: When the vacuum supply is disconnected from any component, the component should return rapidly to its rest position. Also, bear in mind that the vacuum pipes may be perished, split or pinched causing complete failure or intermittent operation.

## ELECTRICAL/ELECTRONIC FUNCTIONAL SYSTEM TESTING

A vacuum functional test should be performed prior to testing the Electrical/Electronic circuitry. Use the appropriate circuit diagrams and keep in mind that shorted, poorly grounded or open circuited wires may be the actual cause of component failure.

### ELECTRICAL FEED FUSE FAILURES

There are four fuses which protect the air conditioning unit:

1. If fan motors fail to function on all speeds, check the **35** amp. supply fuse #F10 at the main fuse box.
2. Ignition supply 35 amp. fuse #F11 controls all ignition auxiliary units, i.e. air conditioner, wipers, washers, etc. If this fuse fails, disconnect feed to air conditioner and replace fuse - Operate all auxiliary items to determine whether the fault lies in the auxiliary items or the air conditioner.
3. The third fuse is a delayed action fuse in the amplifier positive line. If, upon replacement, the fuse still fails, the amplifier, thermistors, Diodes, camshaft motor and associated wiring is suspected. If no fault is apparent, disconnect camshaft motor and thermistor. If fuse still fails, replace amplifier.
4. The fourth fuse is a 10 amp. fuse which protects the feed to the compressor clutch. If, on substitution, the fuse still fails, disconnect compressor clutch lead and try again. If it still fails, suspect Ranco thermostat or Ranco override switch. Test each item with an ohmmeter.

### FAN FAULTS

If fan faults exist, a voltage check must be taken at the input feed and fan supply leads.

1. The input feed should register 12 volts.
2. The other feeds are through the HIGH speed/Recirculation switch and Diode 5 (D5) for the high speed fan. This feed only occurs when the camshaft is in the full cooling mode and should reflect 12 volts. If, when full cooling is selected, the fans do not go into HIGH speed, the relay is O.K. and the fault lies with D5, the high speed/recirculation switch on the camshaft or the wiring.

Two additional feeds are between the 10 amp. clutch fuse and the water temperature thermostat.

## FAN SWITCH FAULTS

There are five switches which directly control the fans:

- (a) High/Recirculation fan switch on camshaft (described under fan faults).
- (b) High speed switch on MODE control.
- (c) Low speed switch on MODE control.
- (d) Med 1 (2nd speed) switch on camshaft.
- (e) Med 2 (3rd speed) switch on camshaft.

1. High Speed Switch - If cooling is selected by switching temperature selector setting from 85 to 65, the high speed fan should eventually be selected and the recirculation flaps should open. If not, the fault lies in the switch or an open circuit wire - depending on Ambient temperature.

2. Low Speed Switch - If only the highest fan speed is available and there is no output from the flaps in any position other than in high and full cooling, the fault lies in the low speed switch or wiring.

NOTE: Distortion of the MODE CONTROL carrier (sheet metal) can cause maladjustment of mode control microswitches.

3. MED 1 (2nd speed) Switch

Located on the camshaft - Failure of MED 1 switch will exhibit the following if faulty:

- (a) Very low air output when unit is in full heating mode.
- (b) Only three changes of fan speeds when selecting 65 from 85 at temperature selector. If so, check switch and/or wiring.

4. MED 2 (3rd speed) Switch

Located on the camshaft - Failure of MED 2 switch will be apparent by failure of the camshaft to select 3rd speed when going in or out of the full cooling mode. If so, check switch and/or wiring.

### COMPRESSOR CLUTCH FAULTS

1. If fans are functioning correctly there will be a 12 volt feed to the fuse protecting the field circuit.
2. If refrigeration is not occurring, then the clutch circuit must be tested.
3. Check 10 amp. fuse, if failed, disconnect wire from compressor clutch. If fuse still fails, the circuit should be checked for continuity as should the Ranco override switch and Ranco thermostat. If fuse fails when reconnecting clutch wire, then clutch winding is suspected.

### CAMSHAFT MOTOR FAULTS

1. Select 85 from 65 at the Temperature selector. This is full heating mode which causes the relay in the amplifier to switch the purple lead of the motor circuit to a 12 volt positive feed. A voltmeter check should then show 12 volts at the purple lead - 0 volts at the red lead.
2. After a few minutes, select 65 from 85 which causes the amplifier to energize a second relay which switches the positive 12 volt feed to the red lead and negative 0 volts to the purple lead.
3. If events listed in 1 and 2 occur, the amplifier control of the camshaft motor is correct. If the camshaft motor does not function, check continuity of the full heating and full cooling limit switches and wiring.
4. If all the foregoing proves correct, check diodes for forward and reverse bias modes.

5. Should all this prove to be correct, check continuity of motor windings and if faulty, replace camshaft assembly.

#### AMPLIFIER FAULTS

In addition to the amplifier checks performed under camshaft motor faults, the following two checks may also be performed:

- (a) There is a 12 volt positive input at the brown lead and a good ground at the black lead.
- (b) That when DEFROST is selected the relay inside the amplifier immediately connects the purple lead to 12 volt positive supply. There is a delayed action fuse in the brown positive input lead to protect the servo, wiring and amplifier.

#### CAMSHAFT MICROSWITCHES

It is recommended that if microswitch failure occurs that the complete servo unit be replaced, however, wires to switches should be checked for chafing, fraying and loose connections, etc. - Continuity checks may also be performed.

SENSING SYSTEM TESTING

Disconnect Amplifier plug from harness Socket. Perform following test at harness socket:

HARNESS SOCKET

Pin 7 (Blue wire) to Pin 4 (White wire). Temperature Selector should vary from 0 to 10K.

Pin 7 (Blue wire) to Pin 3 (Brown wire).

<u>AMBIENT TEMP.</u> <u>APPROXIMATELY</u>	<u>MODE CONTROL</u> <u>AT DEFROST</u>	<u>OTHER MODES</u>
60°	43K ohms	16K ohms
70°	40K	13K
75°	38K	11K
80°	37K	10K
85°	36.5K	2.5K

Pin 9 (Orange wire) to Pin 8 (Yellow wire).

Feedback Potentiometer = 2K

Pin 9 (Orange wire) to Pin 5 (Green wire).

Track to wiper arm of Feedback Potentiometer 0 - 2K ohms.

If Zero, servo in full heat position. If 2K, servo in full cool.

Pin 1 (Purple wire) to Pin 2 (Red wire).

30 ohms (servo motor resistance maximum acceptable 100 ohms).



JAGUAR MK II AIR CONDITIONER  
IN-CAR FAULT FINDING CHART

The procedure provides a check list of six tests on hand and automatic control. The sequence must be strictly followed as each check-out is based on the satisfactory result of previous tests. This method avoids undue repetition of tests and back referencing.

Before the fault finding sequence is started, the car engine must be run to ensure that the water is hot and that there is adequate vacuum in the system. For subjective and cooling tests the engine should be running for the refrigeration compressor to operate.

EQUIPMENT

The chart is based on the availability of the following test equipment:

- (i) VOLTMETER - to cover range 0-13V D.C.
- (ii) CONTINUITY TESTER - to check for harness breaks
- (iii) RESISTANCE METER - up to 20K ohms - to check sensors
- (iv) VACUUM GAUGE - (not essential) - to check vacuum level in vacuum tubes.

PROCEDURE

The following sequence must be followed to cover all foreseeable faults:

- HAND CONTROL
  - TEST 1 - 'OFF' POSITION
  - TEST 2 - 'DEFROST'
  - TEST 3 - AUTO - HIGH
  - TEST 4 - AUTO - LOW
- AUTOMATIC CONTROL
  - TEST 5 - AMPLIFIER/SERVO RESPONSE
  - TEST 6 - SERVO FUNCTION

JAGUAR MK II AIR CONDITIONER - IN-CAR FAULT FINDING CHART  
 TEST I - MODE CONTROL - 'OFF'; TEMPERATURE SELECTOR 75°F

1.1 BLOWERS OFF

Feel for air flow  
 at outlets

FLOW

Check single relay

NY terminal voltage

OV Relay fault - replace

Check Diodes And  
 Associated Wiring

12V

Switch fault - replace Switch C  
 at Mode Control

1.2 RECIRC. FLAPS OPEN  
 FRESH AIR FLAPS CLOSE  
 Feel position of  
 both recirc. flaps

BOTH SIDES

CLOSED

Disconnect vacuum  
 line at bottom of  
 solenoid valve

NO VACUUM - Blockage in vac. supply line  
 VACUUM

Disconnect vacuum  
 line at solenoid  
 valve outlet

NO VACUUM

Check voltage at  
 K. Terminal

12V - Solenoid valve  
 fault  
 OV - Electric fault -  
 trace to Switch C  
 at Mode Control

VACUUM

ONE SIDE

CLOSED

Pull open flap (s)  
 by hand

NOT POSSIBLE - Mechanical linkage fault

POSSIBLE

Check vacuum at  
 actuator inlet

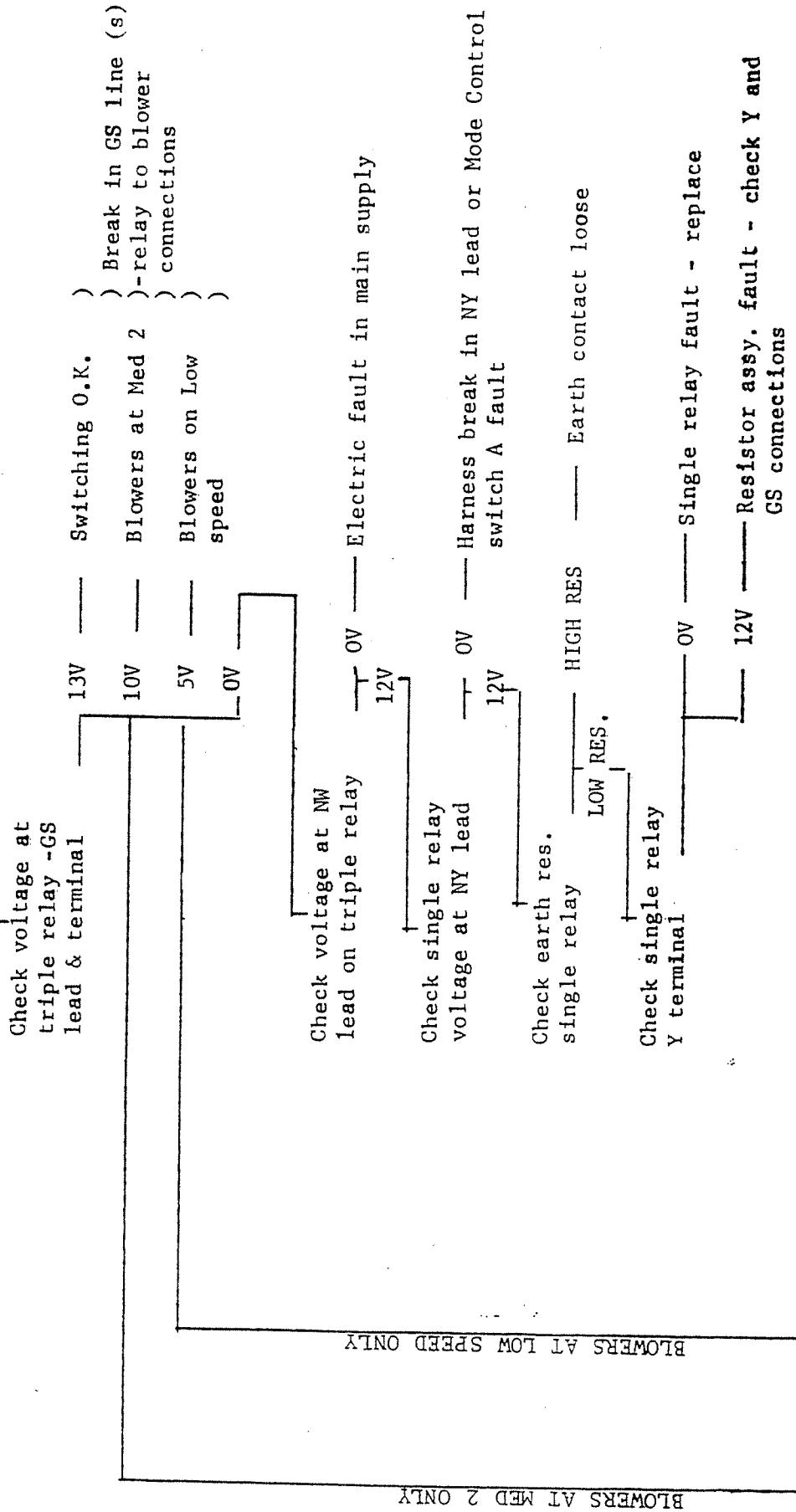
VACUUM Actuator fault

NO VACUUM - Blockage in line to  
 solenoid valve

TEST 2 - MODE CONTROL DEFROST; TEMPERATURE SELECTOR 75°F

2a BLOWERS TO HIGH SPEED

- Listen to both sides
- Check voltages at BLOWER (S) OFF — VOLTAGE NOT 0 — Blower electric fault connectors (each side)



TEST 2  
DEFROST  
(Cont.)

2a BLOWERS AT HIGH SPEED (cont.)

BLOWERS AT LOW SPEED

- Check earth res. at BU lead-triple relay  
HIGH RES. — harness break in BU lead or switch fault in Mode Control switch D or poor earth at D  
LOW RES. —

Check voltage in lead BG-triple relay  
OV — Harness break in lead BG to Mode Control Switch A  
12V —

Check voltage in relay Terminal R.  
OV — Relay fault - replace  
12V —

Fault in resistor assy. or connection to harness, lead R

BLOWERS AT MED 2 SPEED

(10V) - Check triple relay voltage at BW lead

OV — Harness break in BW line to Mode Control  
12V — Relay fault - replace

2b HOT AIR TO SCREEN

Feel outlets both sides

NO AIR TO SCREEN

AIR TO FOOT LEVEL — Check vacuum at T piece under crash padding (green line)

COLD AIR FOOT LEVEL  
COLD AIR SCREEN

VACUUM - Vac switch C fault on Mode Control  
NO VACUUM - actuator/mechanical flap fault  
Servo has not rotated - See Test 5

COLD AIR FOOT LEVEL  
OR COLD AIR SCREEN - Mechanical linkage system fault - see Test 6

TEST 3 - AUTO-HI; - 75°F

- .1 BLOWER SPEED HIGH
  - Listen to blowers ----- BLOWERS OFF ----- Water temperature switch faulty or harness break in N & NY lines
- .2 SCREEN FLAPS CLOSE AIR TO FOOT LEVEL -
  - Feel for air flow at screen outlets ----- HIGH FLOW AT SCREEN OR COLD AIR FOOT LEVEL
    - Check vacuum at T piece (green) below crash padding ----- VACUUM - Actuator fault or Flap mechanical failure
    - NO VACUUM - Faulty Vac. Mode Control Switch C or line blockage

TEST 4 - AUTO-LOW; @ 85°

- .1 BLOWERS TO LOW SPEED
  - Check voltage at triple relay GS lead ----- BLOWERS OFF ----- Check single relay voltage at NY lead 12V ----- OV ----- Harness break in NY lead
  - Check earth res. ----- HIGH RES, ----- Earth contact loose
  - LOW RES. -----
  - Check single relay ----- Single relay fault - replace
  - Y terminal ----- OV ----- Single relay fault - replace
  - 12V ----- Resistor assy. fault

BLOWERS AT MED I ----- Mode Control Switch D fault

TEST 5 - AMPLIFIER/SERVO RESPONSE

1. SERVO MOTOR ROTATION

- Move Temperature Selector both ways and listen for servo motor

S1002

NO MOVEMENT  
MOVEMENT  
Proceed to Test 6

Servo unit  
Check voltage at P & PR connector - move Temperature Selector

VOLTAGES CHANGES ± 12V

Servo motor fault - replace

BOTH VOLTAGES AT 12V

Amplifier fault - replace

BOTH LEADS AT EARTH POTENTIAL

Check amplifier supply at fuse (N line)

12V

Disconnect ambient sensor lead, U, and check res. of servo socket No7(U) to 4 (W)

0V - Harness break - N line

O/C-Temp. selector disconnected

ONE/BOTH LEADS OPEN CIRCUIT

Line break in R/P leads.

PR TERMINAL AT CONSTANT 12V (Cont. heating)

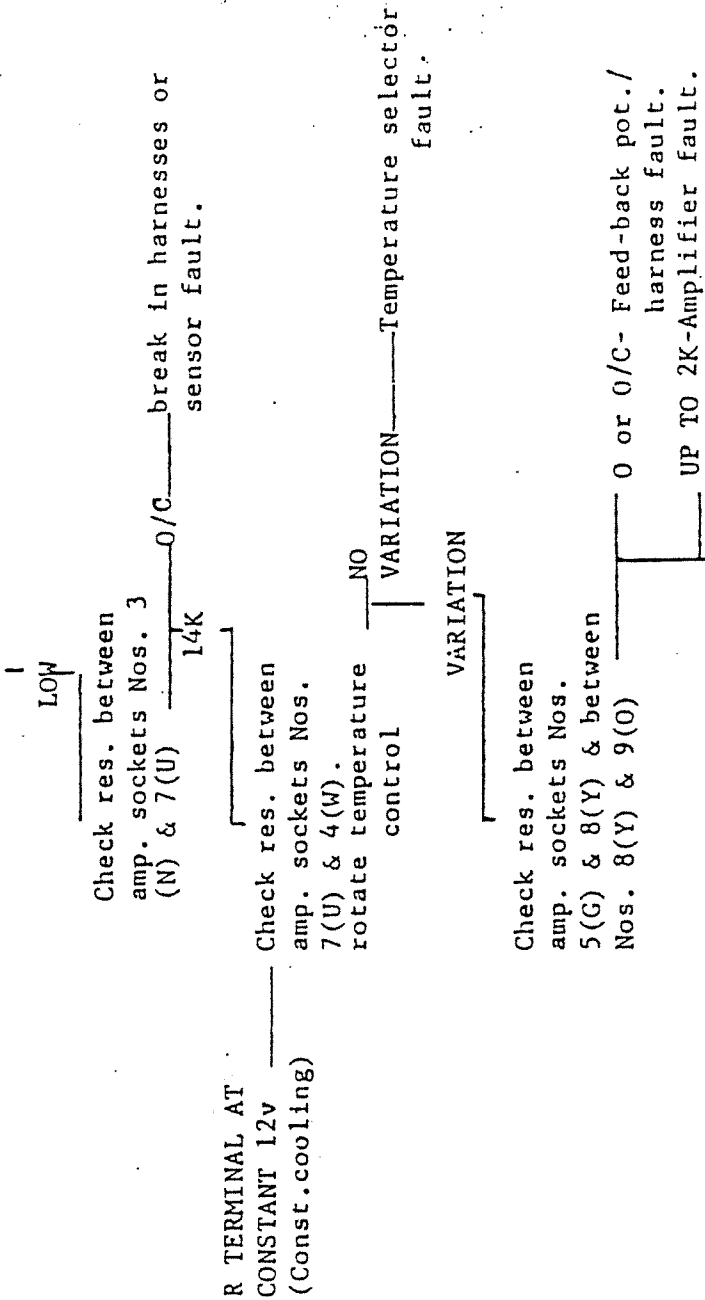
Switch off unit  
Check res. between amp. fuse and in-car sensor lead

WR HIGH RES

Mode Control Switch A fault

LOW

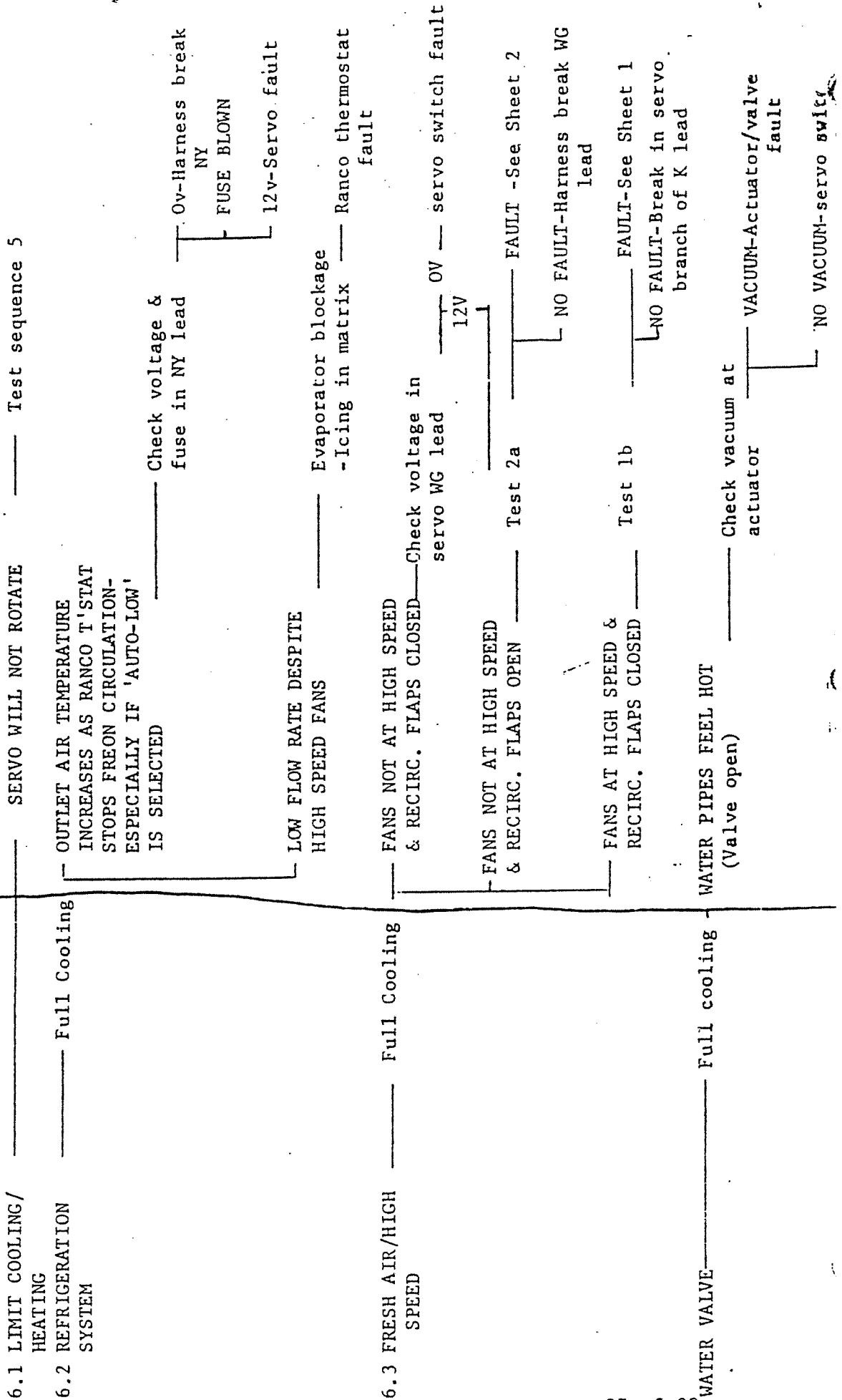
TEST 5 (Cont)  
SERVO MOTOR ROTATION  
(Cont)



*Correct*

TEST 6 - AUTOMATIC FUNCTIONS

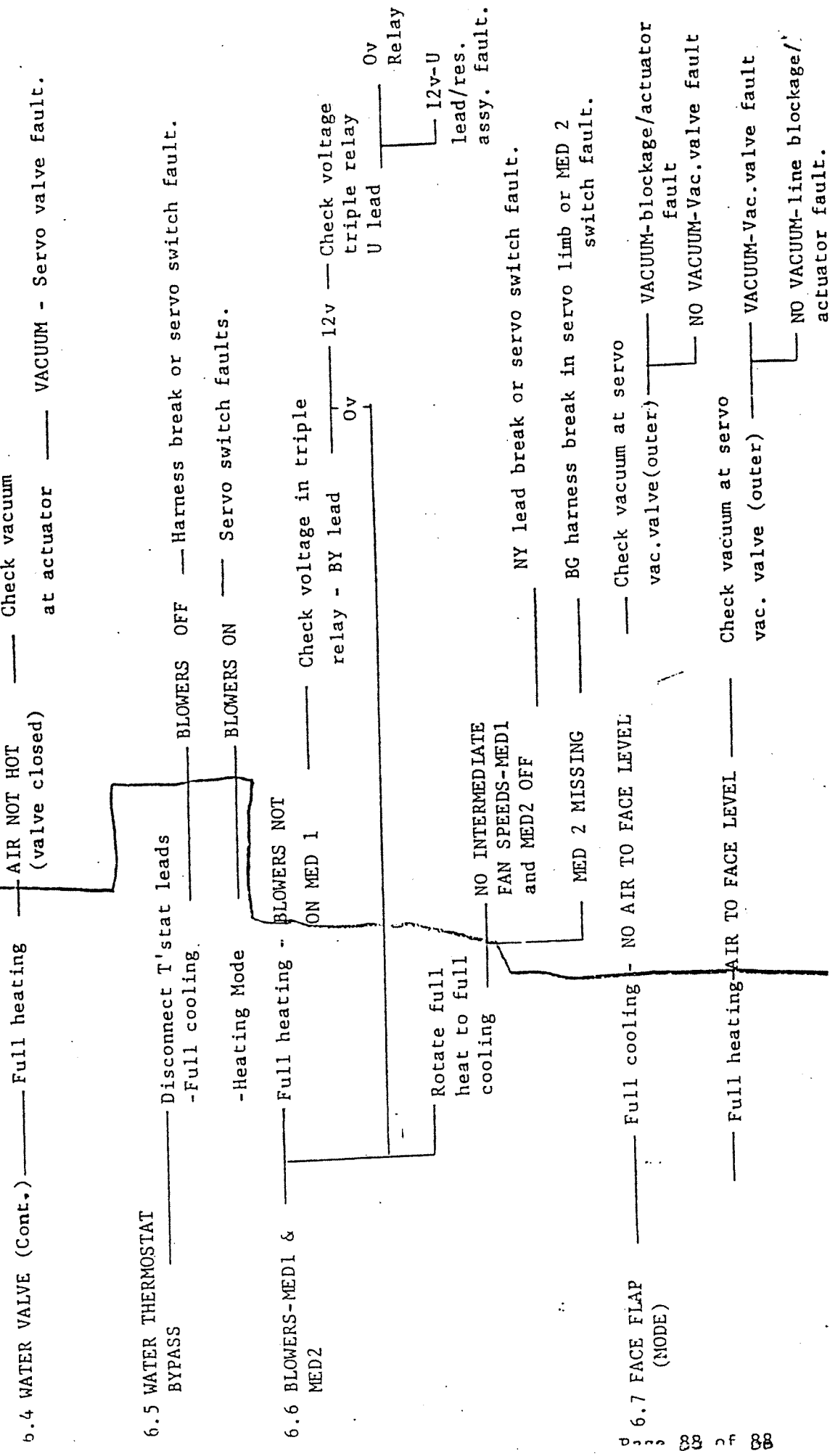
*fault*





*Correct*

*fault*



6.8 INCORRECT AIR TEMPERATURES AND AIR DIST. Blend flap fault if above tests are satisfactory. adjust linkage (R/H Front)

Full cooling-ensure that lower and upper cooling flaps are seated - adjust linkages (all)

.....NOTES.....