HEATER & AIR CONDITIONER

SECTION HA

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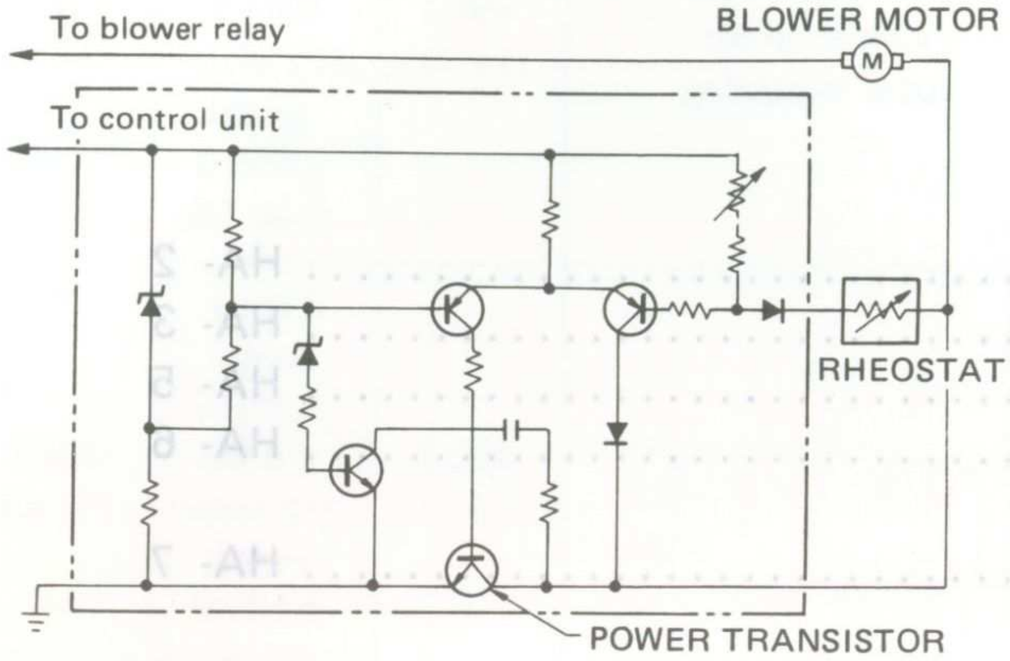
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GENERAL DESCRIPTION

Continuously Variable Air Flow Control

The fan control amplifier, which utilizes transistor circuits, continuously controls the air flow blown out by the blower, allowing for selection of the desired air flowrate. The fan control amplifier is housed in the blower motor unit. The heat-radiating plate of the amplifier is placed in the stream of the air flow to effectively cool the transistors.

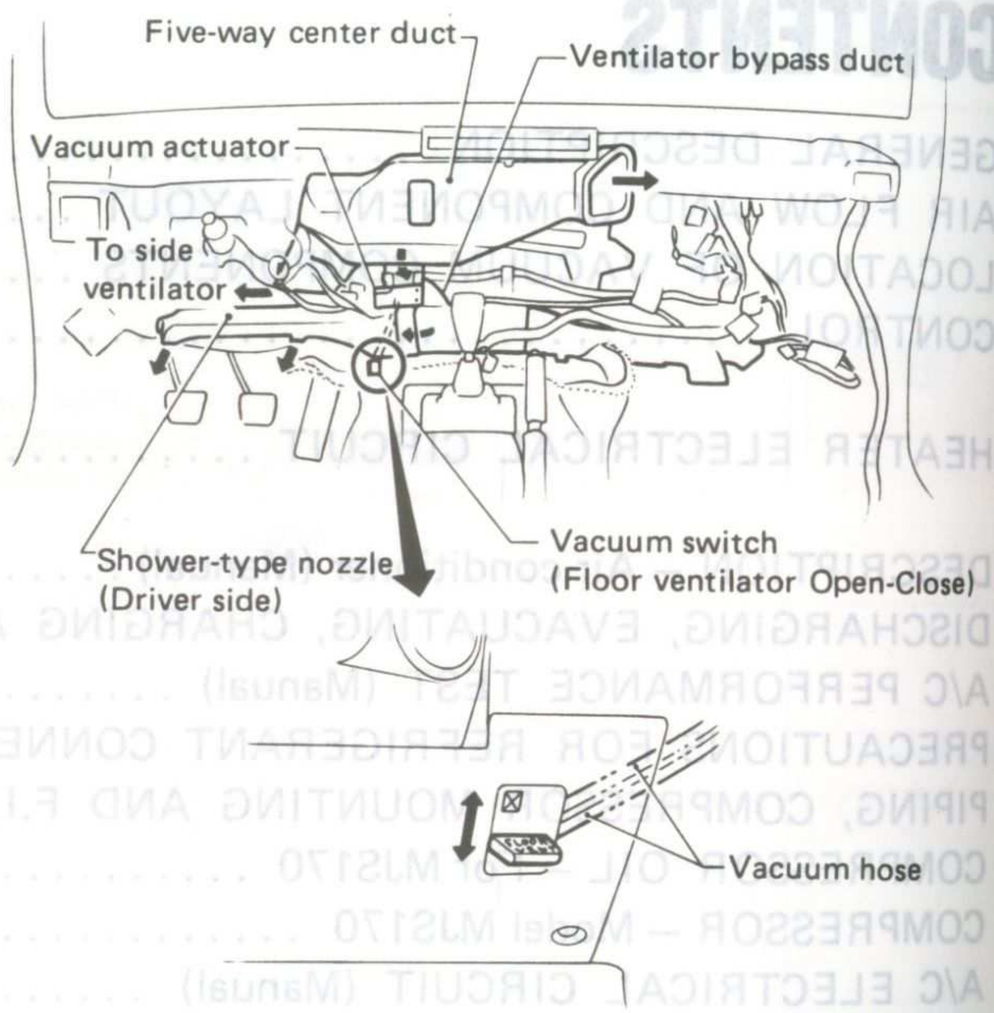


FAN CONTROL AMPLIFIER

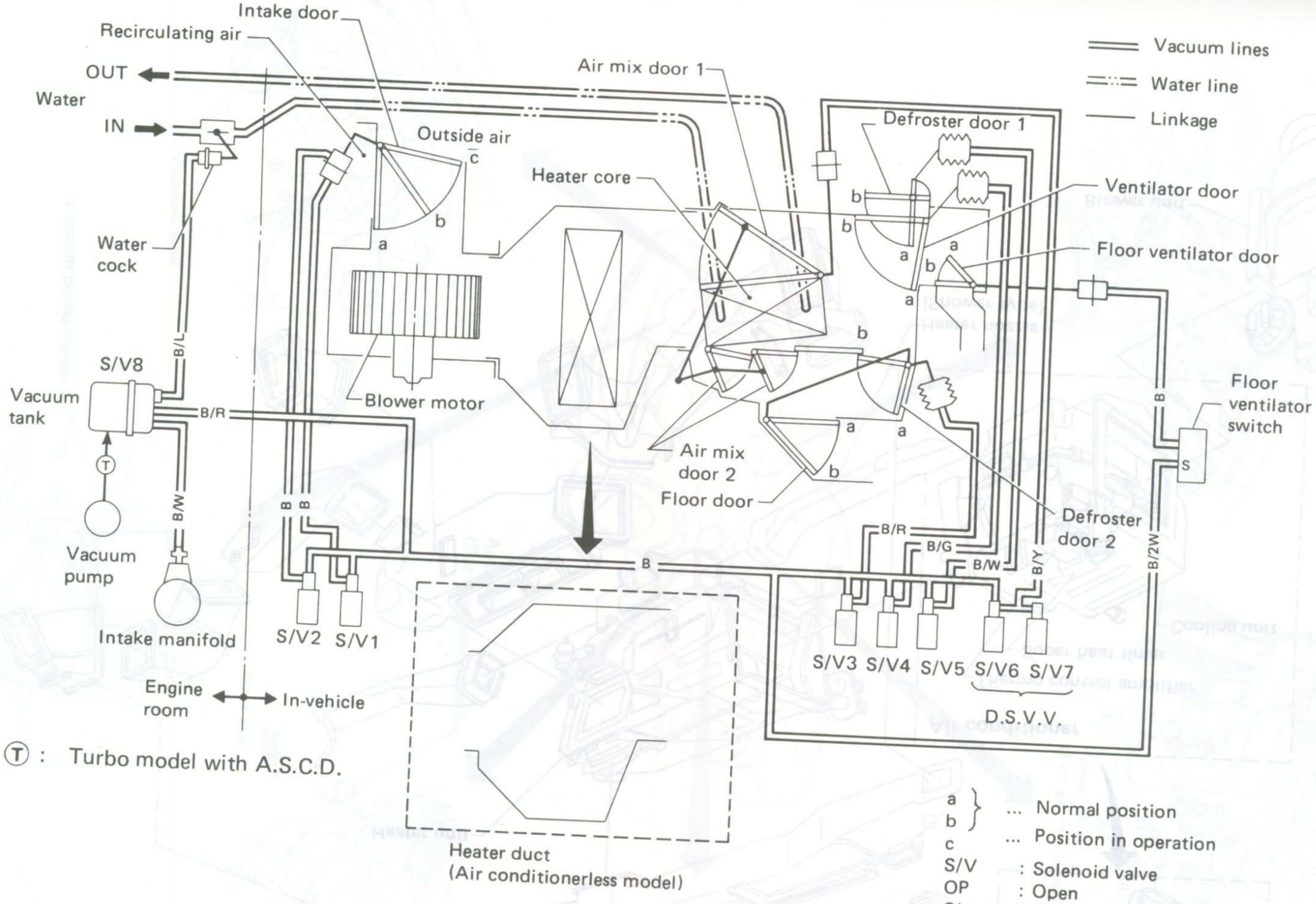
SHA255B

Device for Distributing Cool Air to the Feet during "FACE MODE"

A vacuum actuator is used in the cool-air distribution device to remove the hot air directed to the floor area and distribute the optimum air temperature to the driver's compartment. When the vacuum switch is turned "ON", part of the outside air (or: part of the cool air on models equipped with air conditioning systems) taken in the vehicle is bypassed to the shower duct on the driver's side through the operation of the actuator.



SHA230B



Ⓣ : Turbo model with A.S.C.D.

a, b ... Normal position
c ... Position in operation
S/V : Solenoid valve
OP : Open
CL : Closed
B/2W : Black with two white stripes

OUTLET CONTROL						
MODE		FACE	B/L	FOOT	DEMIST	DEF
DOOR POSITION	DEF. DOOR 1	b	b	b	a	a
	VENT. DOOR	b	b	a	a	a
	FLOOR. DOOR	a	b	b	b	a
	DEF. DOOR 2	a	b	b	b	a
OPERATION OF SOLENOID VALVE	S/V 3	CL.	OP.	OP.	OP.	CL.
	S/V 4	OP.	OP.	CL.	CL.	CL.
	S/V 5	OP.	OP.	OP.	CL.	CL.

AIR MIX DOOR CONTROL					
			HOT side	HOLD	COLD side
Air mix door 1, 2	OPERATION OF SOLENOID VALVE	S/V 6	CL.	CL.	OP.
		S/V 7	OP.	CL.	CL.

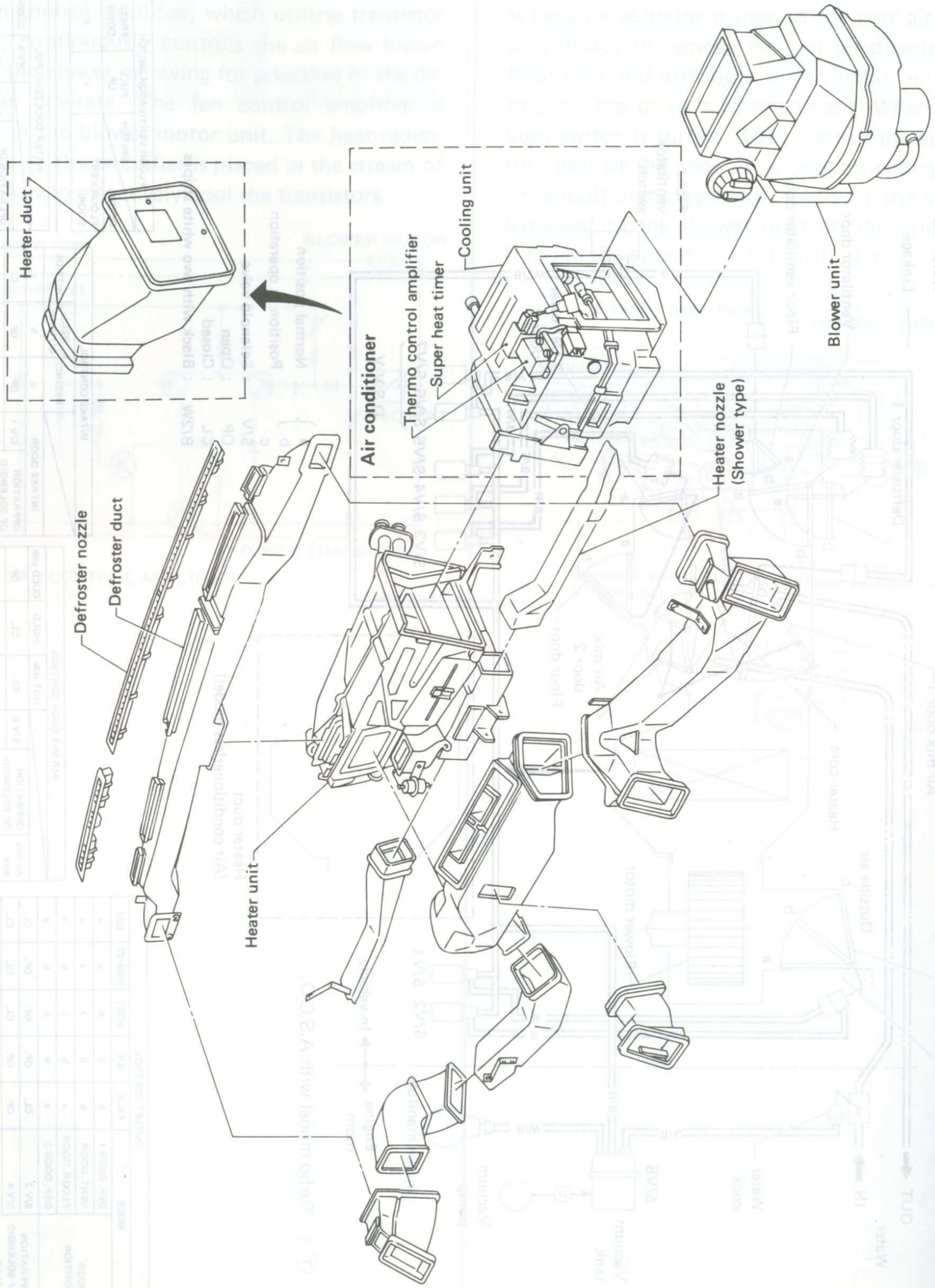
INTAKE CONTROL				
		RECIRC.	REC/ OUTSIDE	OUTSIDE
INTAKE DOOR		c	b	a
OPERATION OF SOLENOID VALVE	S/V 1	OP.	OP.	CL.
	S/V 2	OP.	CL.	CL.

FLOOR VENTILATOR SWITCH		
SWITCH / DOOR	PULL UP	PRESS DOWN
FLOOR VENT. DOOR	a	b

WATER COCK CONTROL			
		OPEN	CLOSE
OPERATION OF SOLENOID VALVE	S/V 8	CL.	OP.

AIR FLOW AND COMPONENT LAYOUT

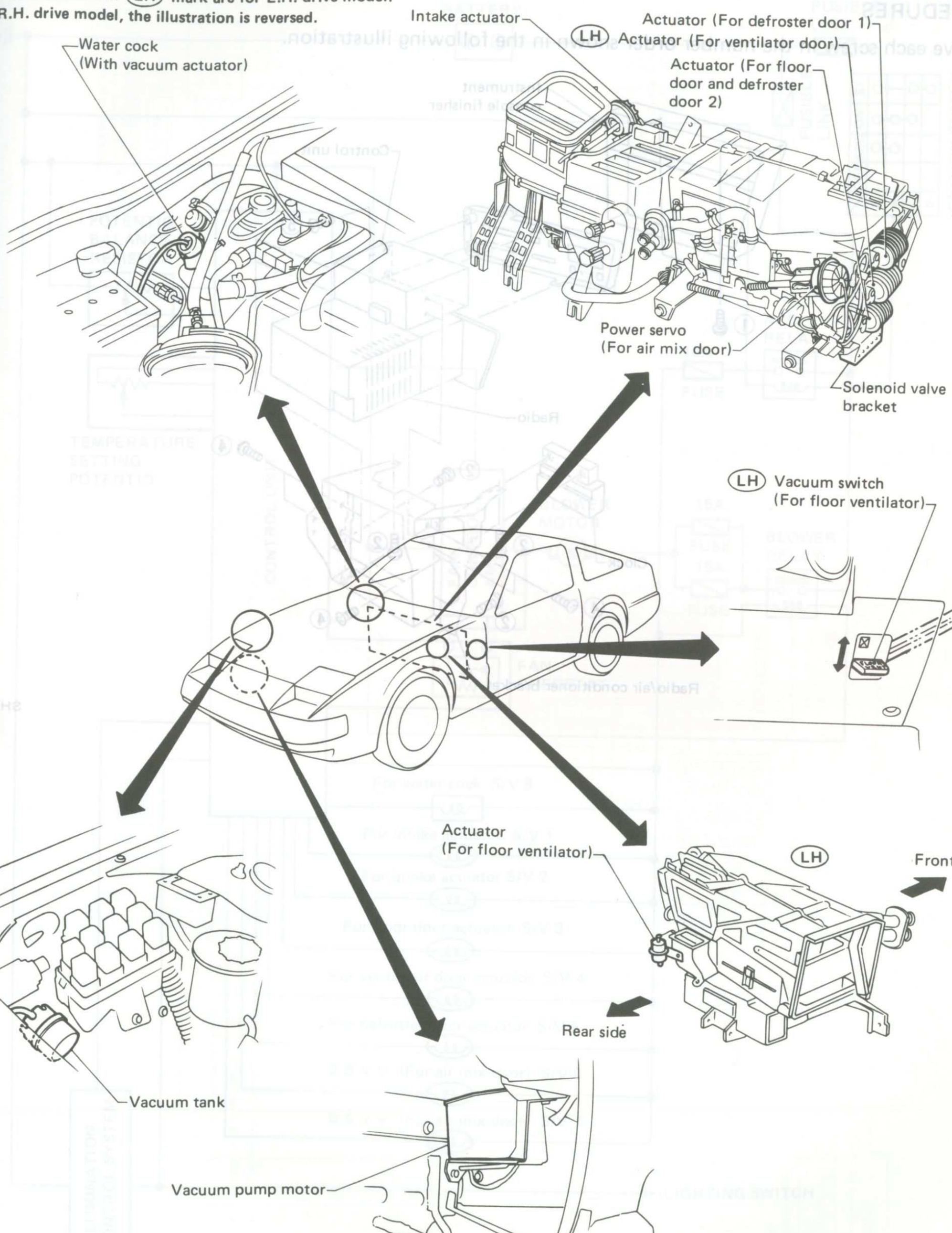
Component Layout



SHA232B

LOCATION OF VACUUM COMPONENTS

The illustrations with (LH) mark are for L.H. drive model.
For R.H. drive model, the illustration is reversed.



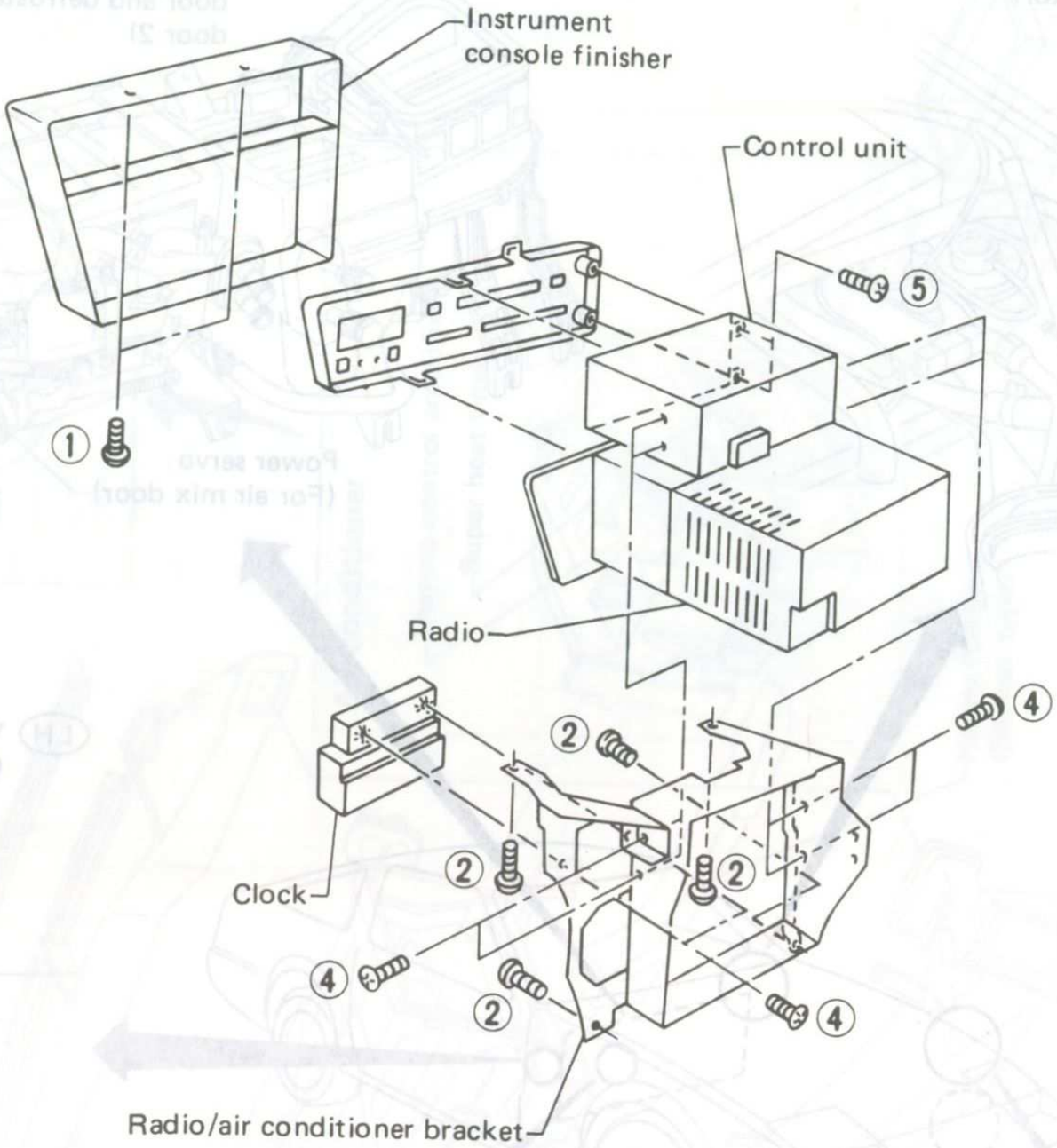
SHA233B

CONTROL

Heater and Air Conditioner Control Removal

PROCEDURES

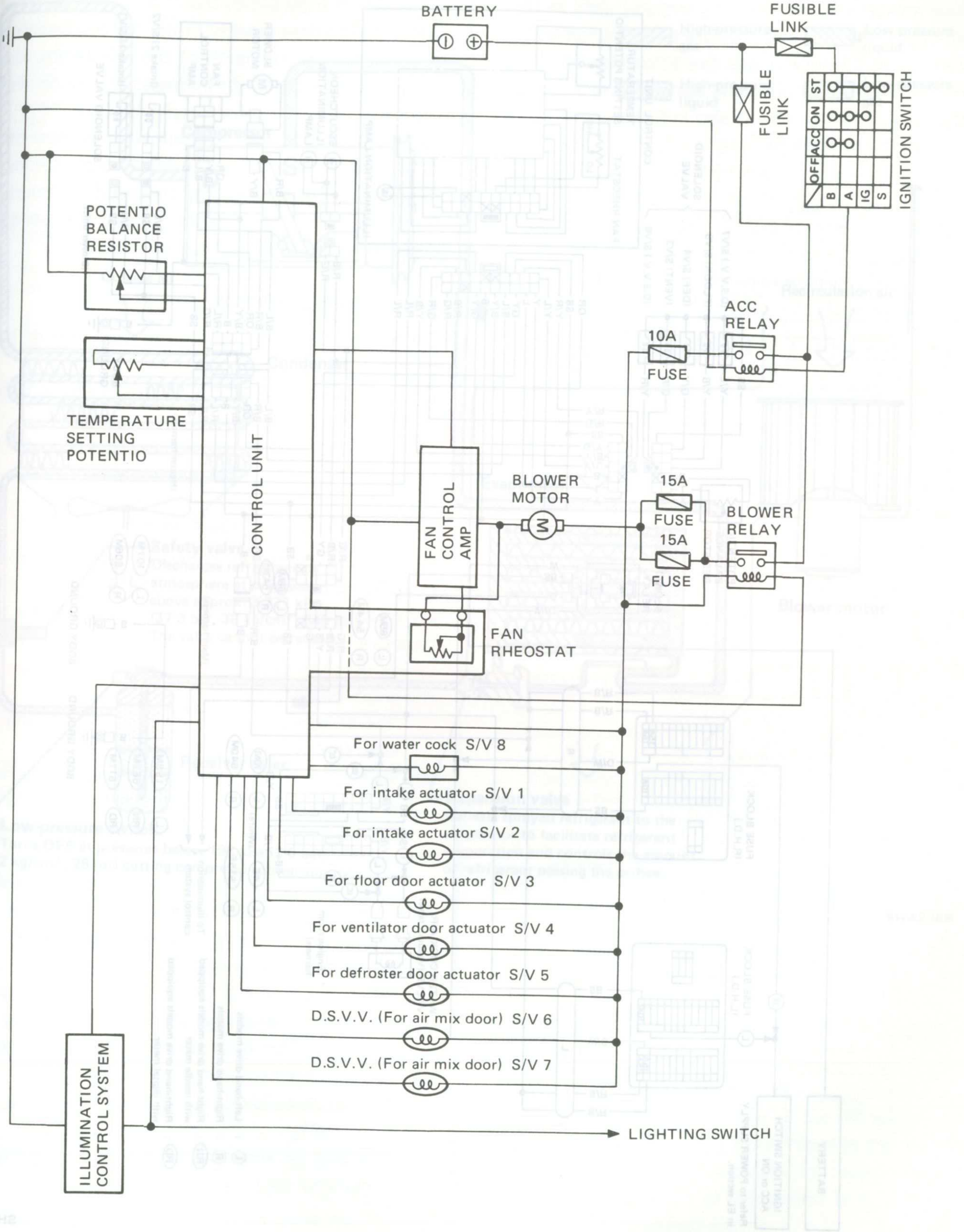
Remove each screw in the number order shown in the following illustration.



SHA234B

HEATER ELECTRICAL CIRCUIT

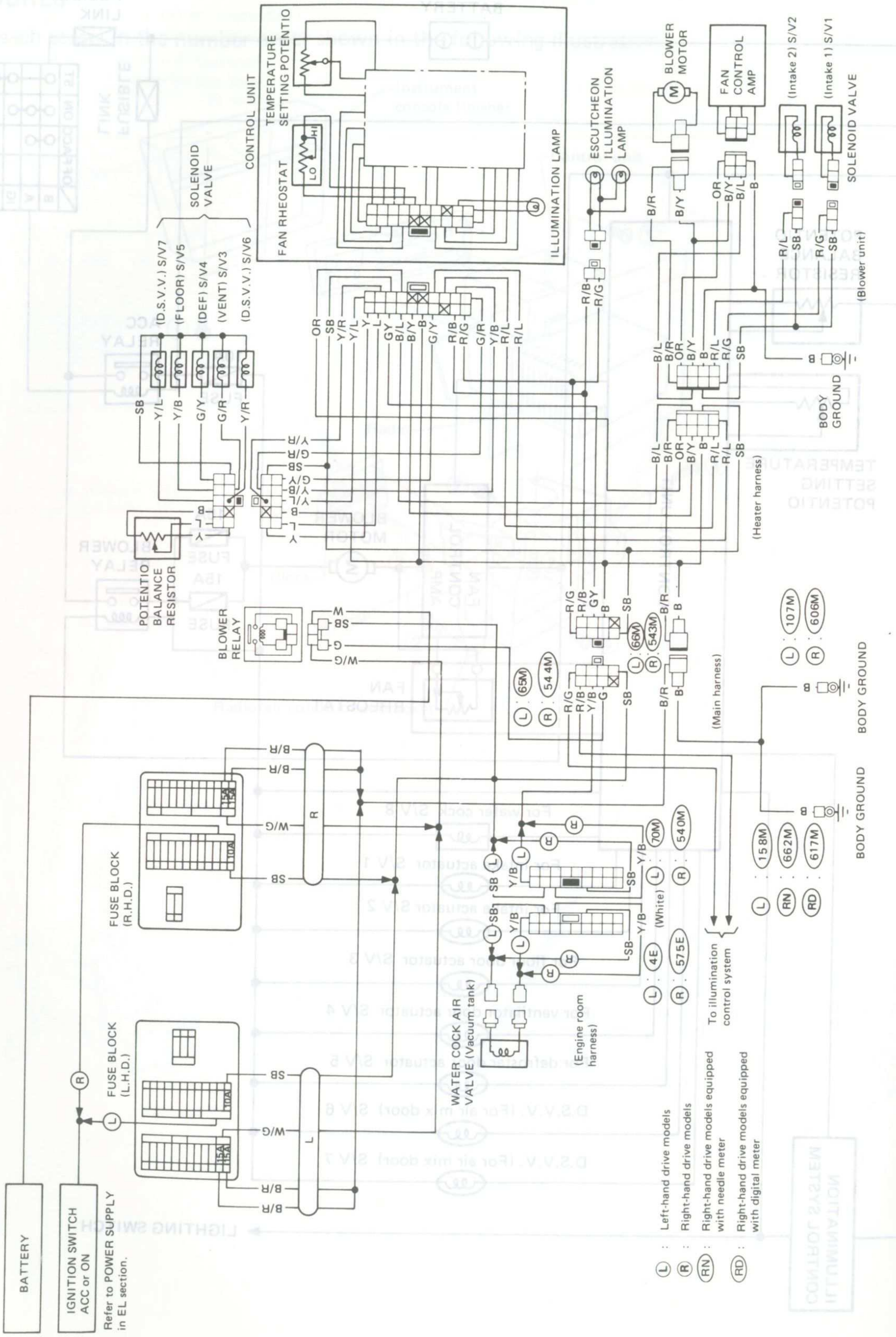
Schematic



SHA417B

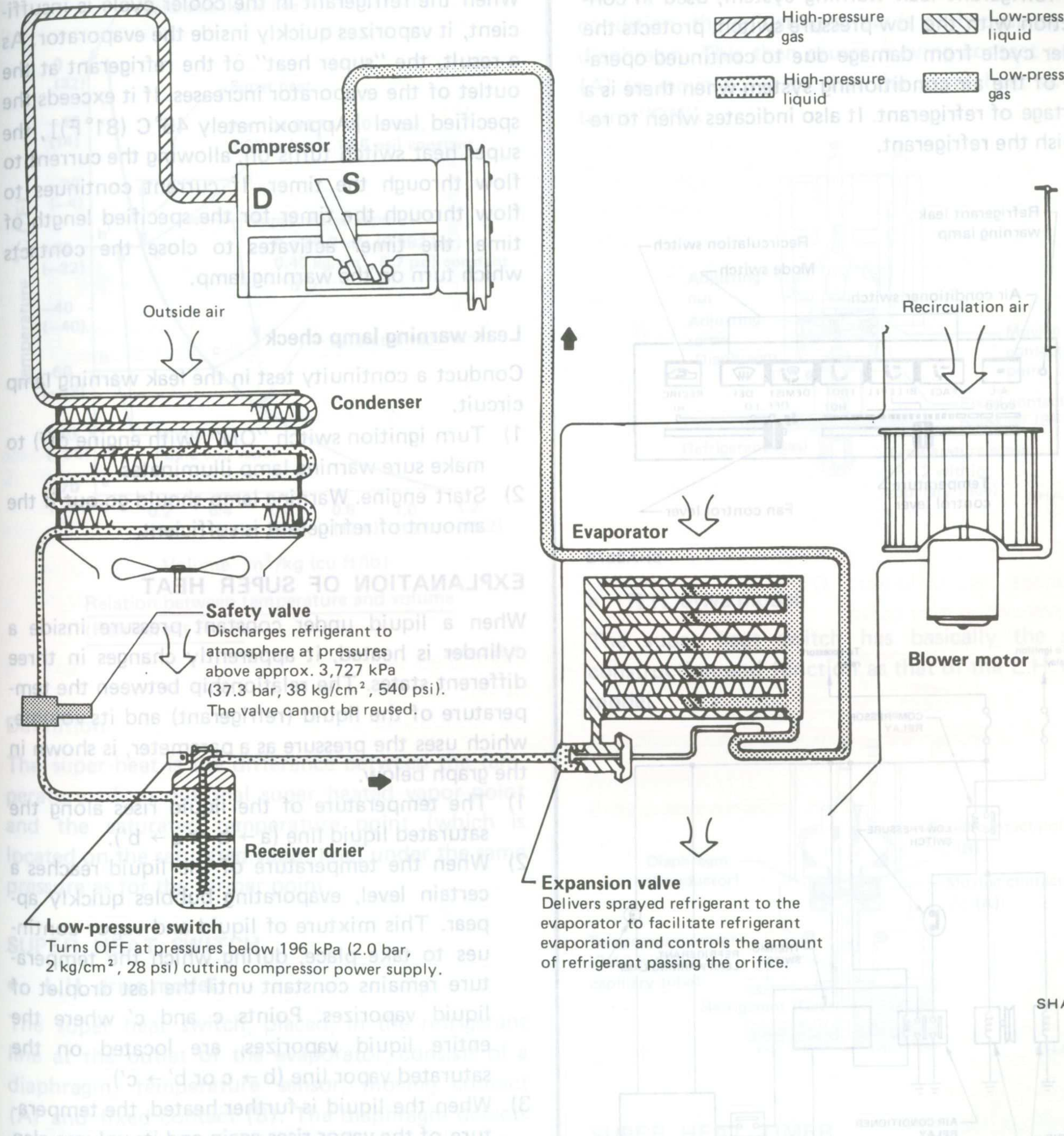
HEATER ELECTRICAL CIRCUIT

Wiring Diagram



DESCRIPTION—Air Conditioner (Manual)

Refrigeration Cycle

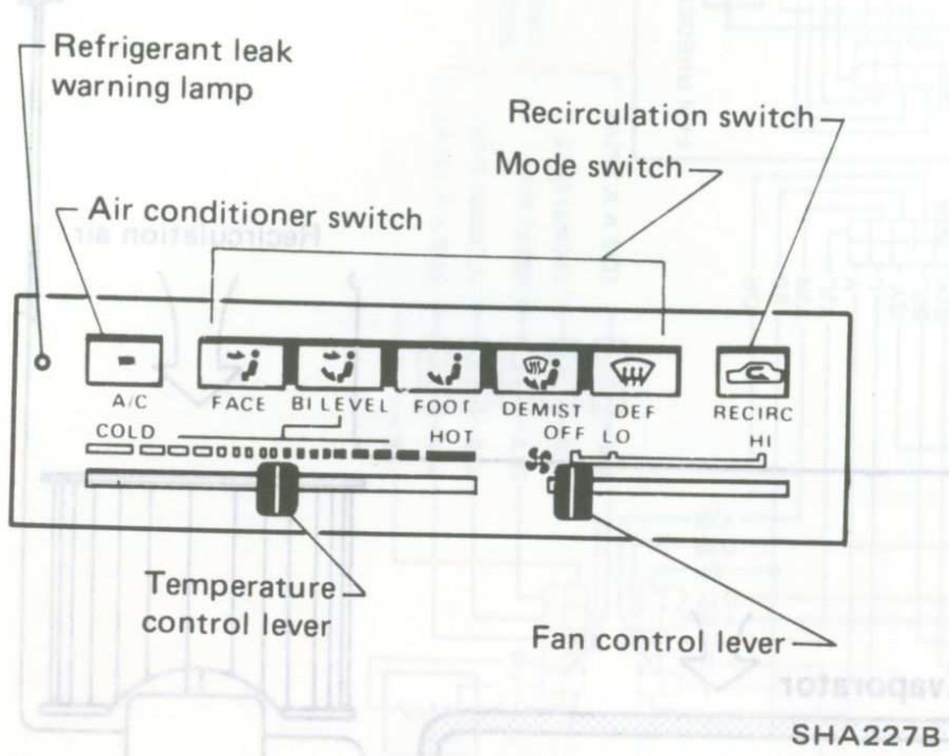


SHA238B

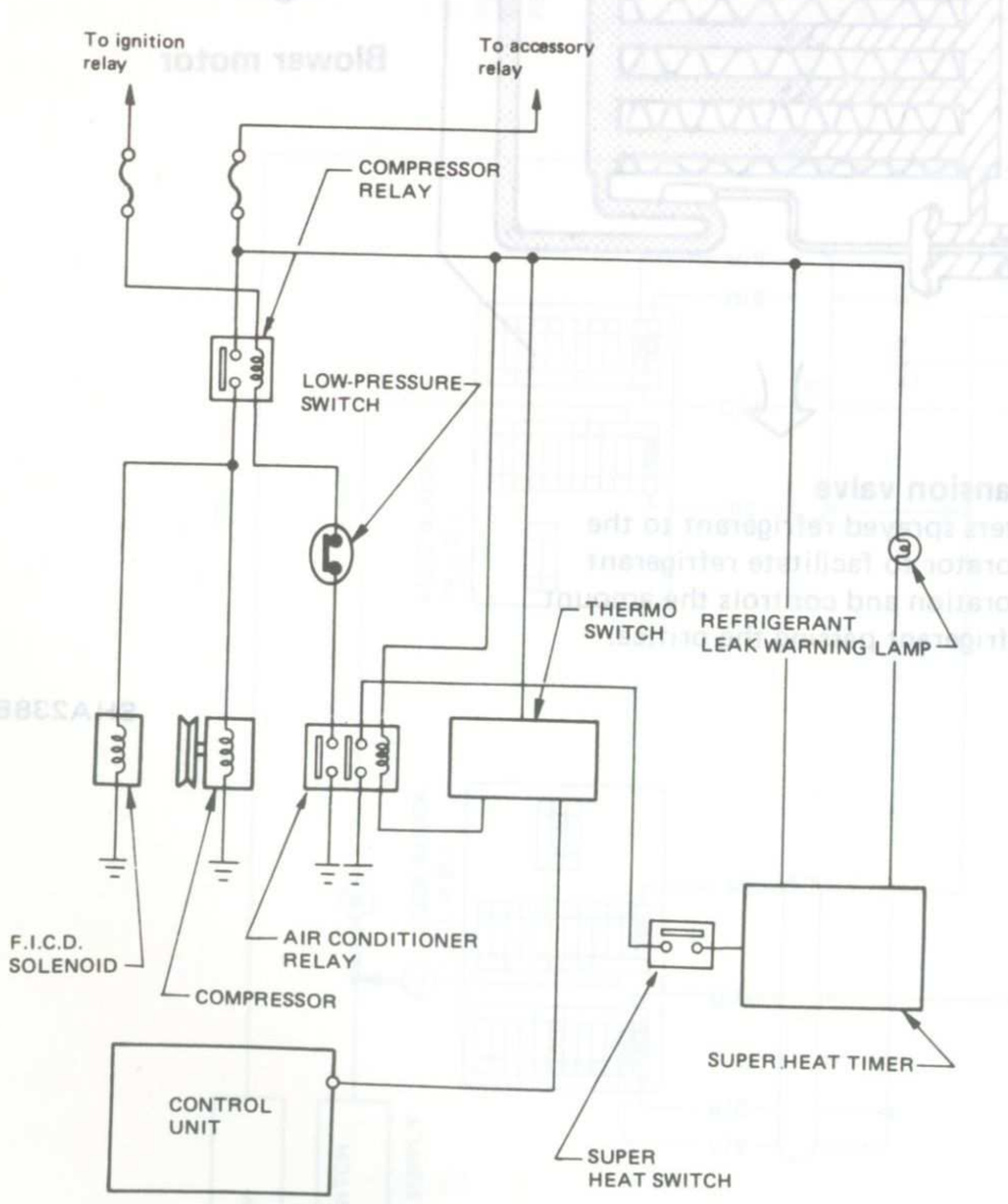
DESCRIPTION—Air Conditioner (Manual)

Refrigerant Leak Warning System

The refrigerant leak warning system, used in conjunction with the low-pressure switch, protects the cooler cycle from damage due to continued operation of the air conditioning system when there is a shortage of refrigerant. It also indicates when to replenish the refrigerant.



SHA227B



SHA228B

When the refrigerant in the cooler cycle is insufficient, it vaporizes quickly inside the evaporator. As a result, the "super heat" of the refrigerant at the outlet of the evaporator increases. If it exceeds the specified level [Approximately 45°C (81°F)], the super heat switch turns on, allowing the current to flow through the timer. If current continues to flow through the timer for the specified length of time, the timer activates to close the contacts which turn on the warning lamp.

Leak warning lamp check

Conduct a continuity test in the leak warning lamp circuit.

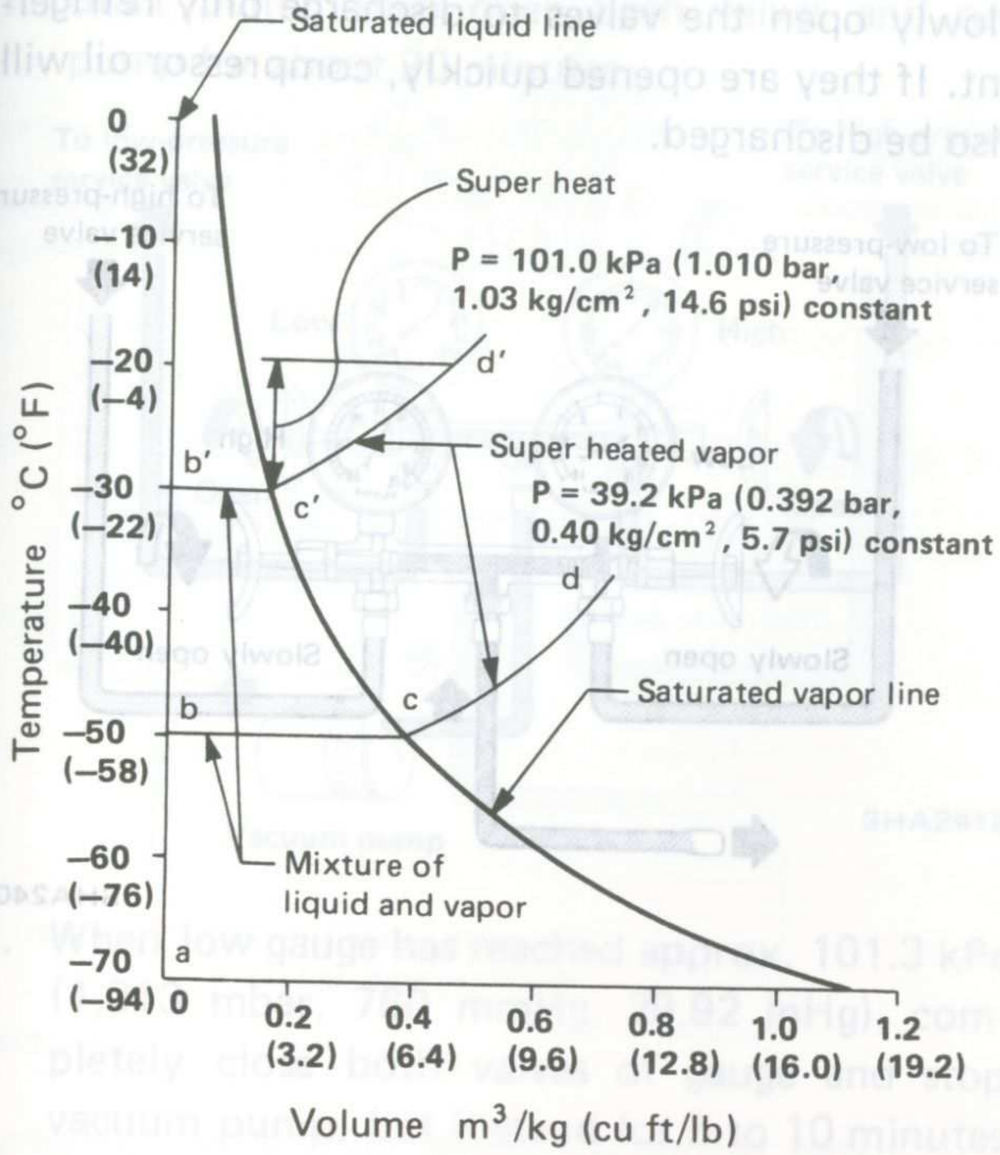
1) Turn ignition switch "ON" (with engine off) to make sure warning lamp illuminates.
2) Start engine. Warning lamp should go out if the amount of refrigerant is sufficient.

EXPLANATION OF SUPER HEAT

When a liquid under constant pressure inside a cylinder is heated, it apparently changes in three different states. The relationship between the temperature of the liquid (refrigerant) and its volume, which uses the pressure as a parameter, is shown in the graph below.

1) The temperature of the liquid rises along the saturated liquid line (a → b or a → b').
2) When the temperature of the liquid reaches a certain level, evaporating bubbles quickly appear. This mixture of liquid and vapor continues to take place, during which the temperature remains constant until the last droplet of liquid vaporizes. Points c and c' where the entire liquid vaporizes, are located on the saturated vapor line (b → c or b' → c').
3) When the liquid is further heated, the temperature of the vapor rises again and its volume also increases. The volume will continue to increase as the temperature is increased.
   We call this vapor "super heated vapor" (c → d or c' → d').
   The line between points c and c' is called the "saturated vapor line."

Refrigerant Leak Warning System (Cont'd)



Relation between temperature and volume (Refrigerant R-12)

SHA239B

Definition

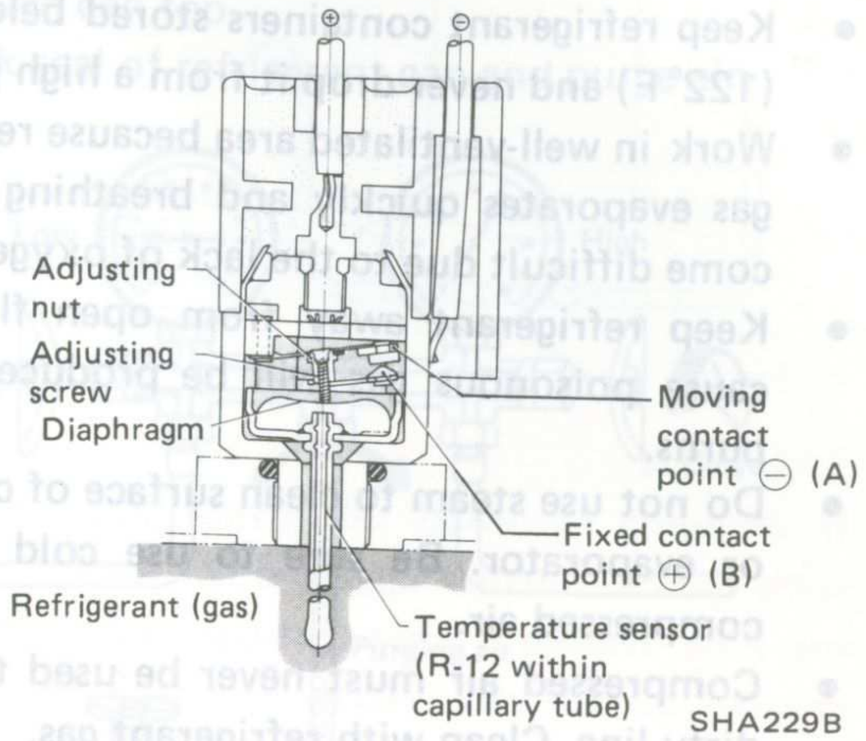
The super heat is the difference between the temperature of an optional super heated vapor point and the saturated temperature point (which is located on the saturated vapor line) under the same pressure as for the former point.

SUPER HEAT SWITCH

- **L.H. drive model**

The super heat switch, placed, in the refrigerant line at the outlet of the evaporator, consists of a diaphragm, temperature sensor, moving contact (A) and fixed contact (B). The diaphragm detects the refrigerant line pressure and the temperature sensor senses the refrigerant line temperature.

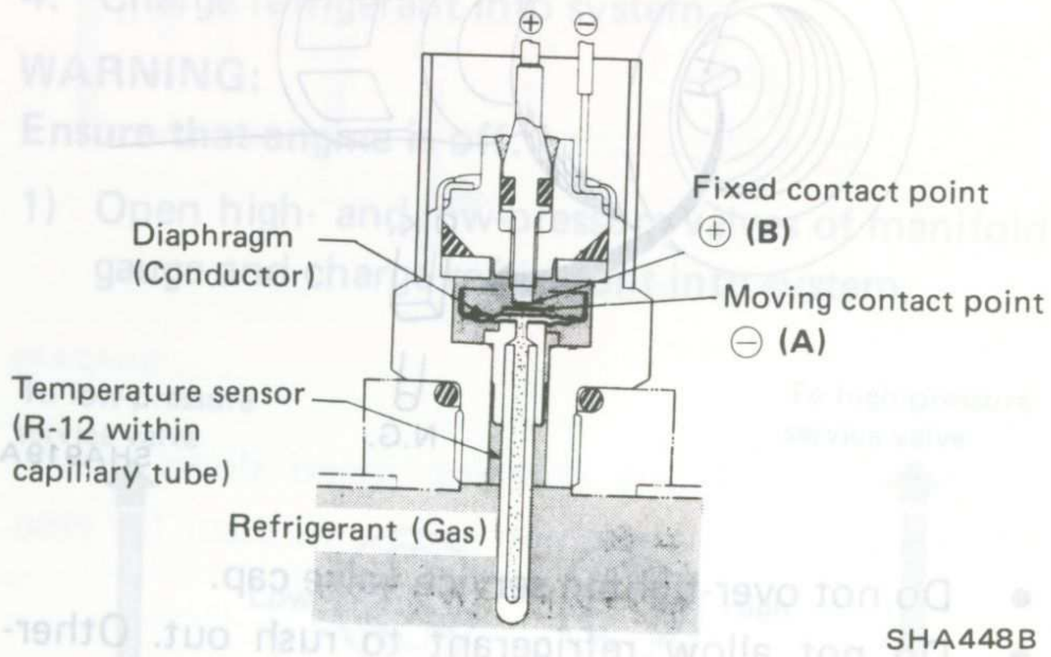
When the temperature in the refrigerant line increases, the gas charged inside the temperature sensor expands. This causes a force to move the diaphragm upward against the refrigerant line pressure. When the difference between the saturated temperature and the detected temperature in relation to the detected pressure reaches a specified condition, the adjusting screw is pushed up by the diaphragm. This then causes moving contact point (A) to move down so that the super heat switch turns "ON".



SHA229B

- **R.H. drive model**

The super heat switch has basically the same construction and function as that of the L.H. drive model.



SHA448B

SUPER HEAT TIMER

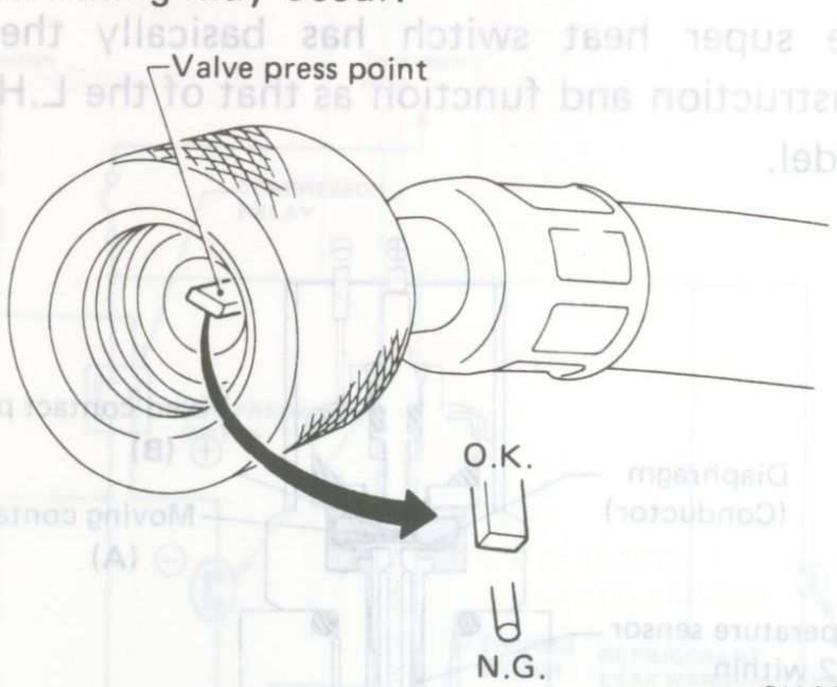
During rapid acceleration, the "super heat" increases momentarily and returns to its original level quickly even when the amount of the refrigerant is normal. Because of this, a timer, used in the warning system, detects an increase in "super heat" only when the amount of refrigerant is low, thereby preventing erroneous alarms.

DISCHARGING, EVACUATING, CHARGING AND CHECKING

Precautions

WARNING:

- **Always be careful that refrigerant does not come in contact with your skin.**
- **Always wear eye protection when working around the system.**
- **Keep refrigerant containers stored below 50°C (122°F) and never drop it from a high place.**
- **Work in well-ventilated area because refrigerant gas evaporates quickly and breathing may become difficult due to the lack of oxygen.**
- **Keep refrigerant away from open flames because poisonous gas will be produced if it is burns.**
- **Do not use steam to clean surface of condenser or evaporator. Be sure to use cold water or compressed air.**
- **Compressed air must never be used to clean a dirty line. Clean with refrigerant gas.**
- Do not use manifold gauge whose press point shape is different. Otherwise, insufficient evacuating may occur.

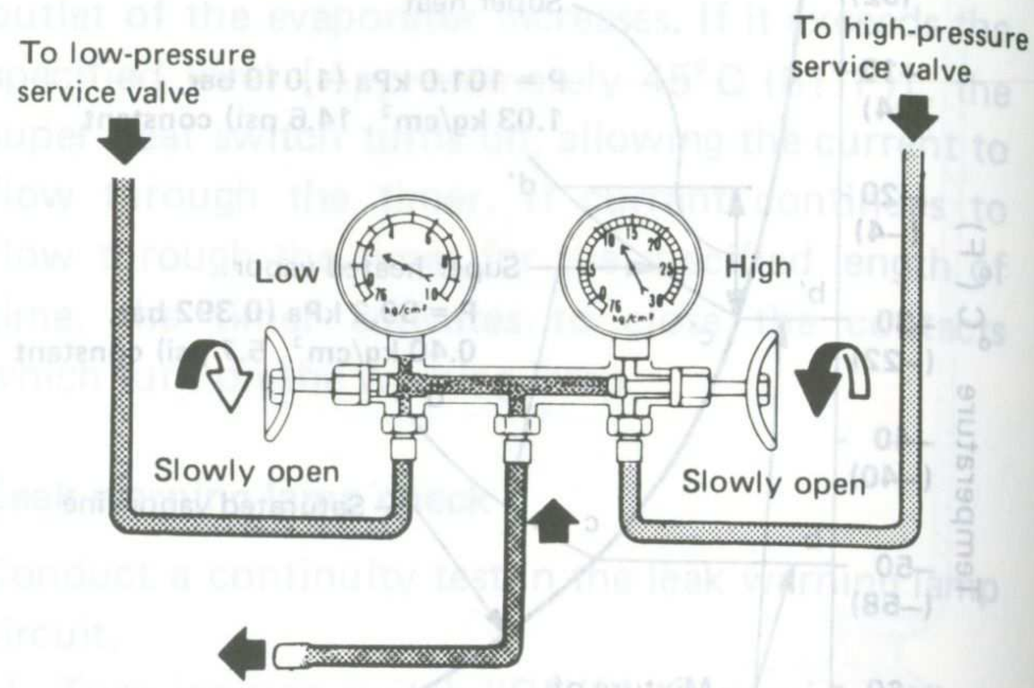


SHA919A

- Do not over-tighten service valve cap.
- Do not allow refrigerant to rush out. Otherwise, compressor oil will be discharged along with refrigerant.

Discharging

Slowly open the valves to discharge only refrigerant. If they are opened quickly, compressor oil will also be discharged.

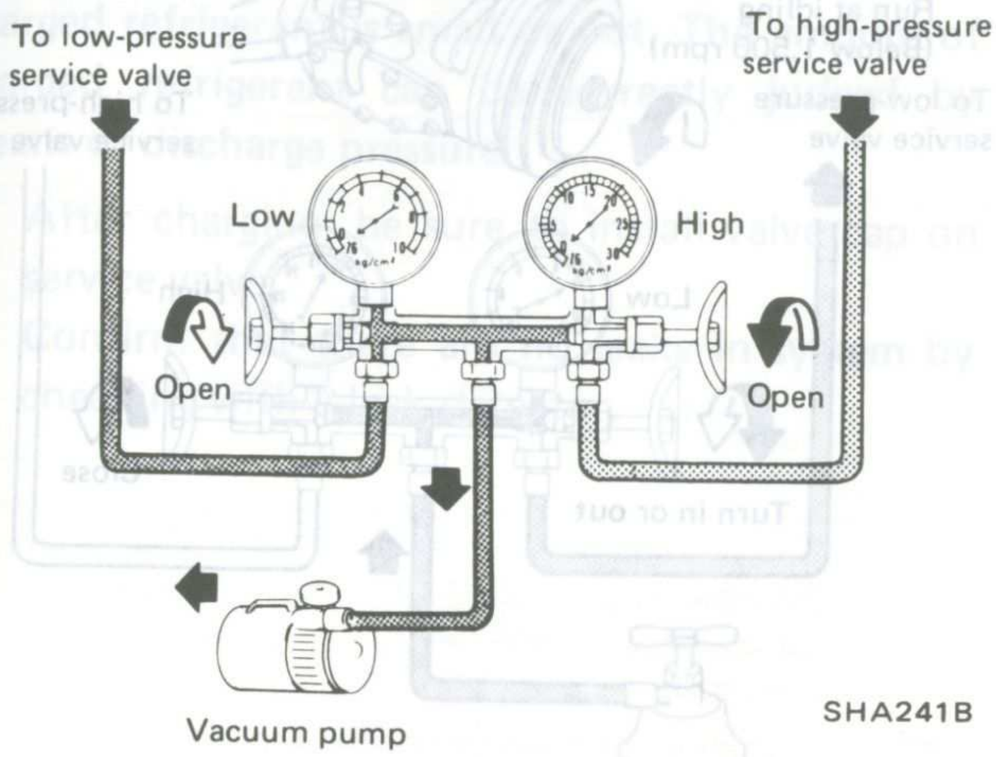


SHA240B

DISCHARGING, EVACUATING, CHARGING AND CHECKING

Evacuating The System

1. Start pump, then open both valves and run pump for about 20 minutes.



SHA241B

2. When low gauge has reached approx. 101.3 kPa (1,013 mbar, 760 mmHg, 29.92 inHg), completely close both valves of gauge and stop vacuum pump. Let it stand for 5 to 10 minutes in this state and confirm that the reading does not rise.

a. The low-pressure gauge reads lower by 3.3 kPa (33 mbar, 25 mmHg, 0.98 inHg) per 300 m (1,000 ft) elevation. Perform evacuation according to the following table.

Elevation m (ft)	Vacuum of system * kPa (mbar, mmHg, inHg)
0 (0)	101.3 (1,013, 760, 29.92)
300 (1,000)	98.0 (980, 735, 28.94)
600 (2,000)	94.6 (946, 710, 27.95)
900 (3,000)	91.3 (913, 685, 26.97)

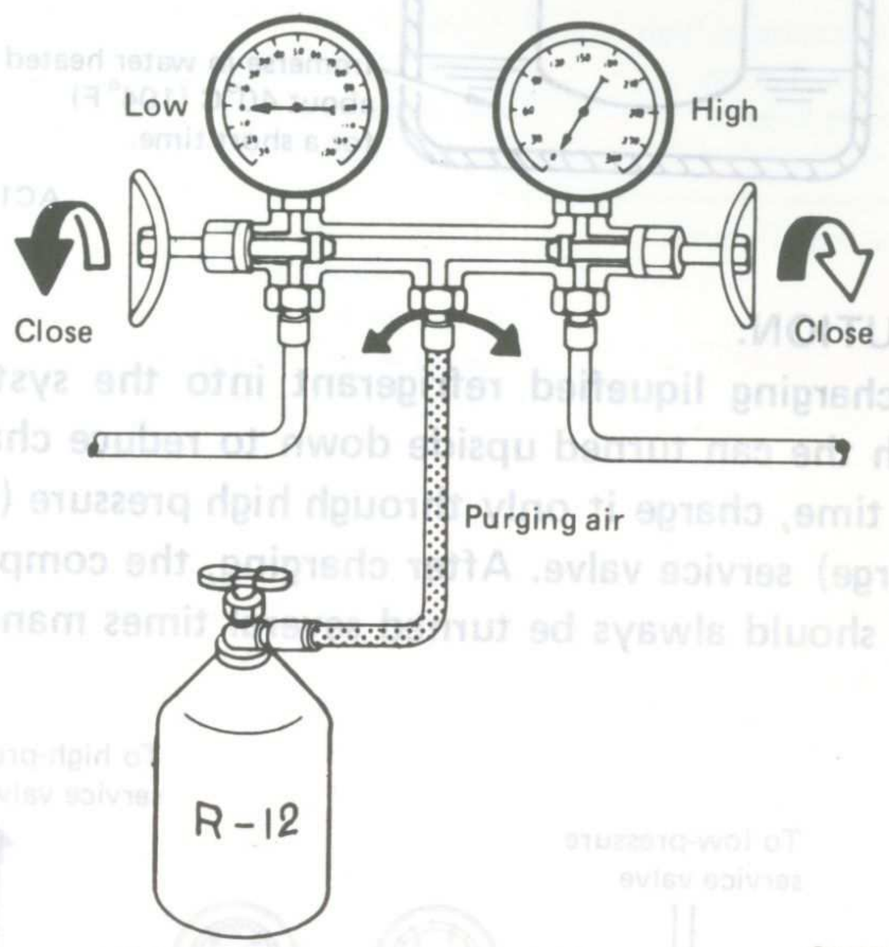
*: Values show reading of the low-pressure gauge.

b. The rate of ascension of the low-pressure gauge should be less than 3.3 kPa (33 mbar, 25 mmHg, 0.98 inHg) in five minutes.

Charging

1. Evacuate refrigerant system.
2. Close manifold gauge valves securely and disconnect charging hose from vacuum pump.
3. Purge air from center charging hose.

1) Connect center charging hose to refrigerant can through can top.
2) Break seal of refrigerant can and purge air.

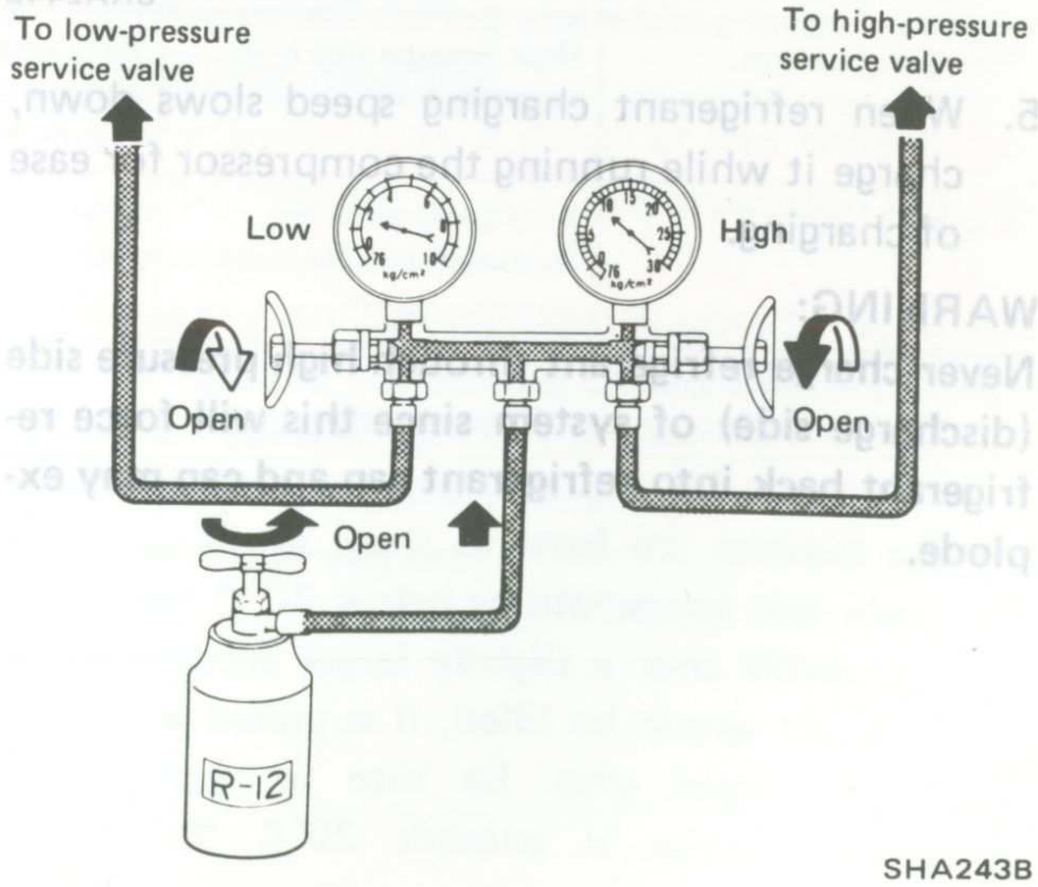


SHA242B

4. Charge refrigerant into system.

WARNING:
Ensure that engine is off.

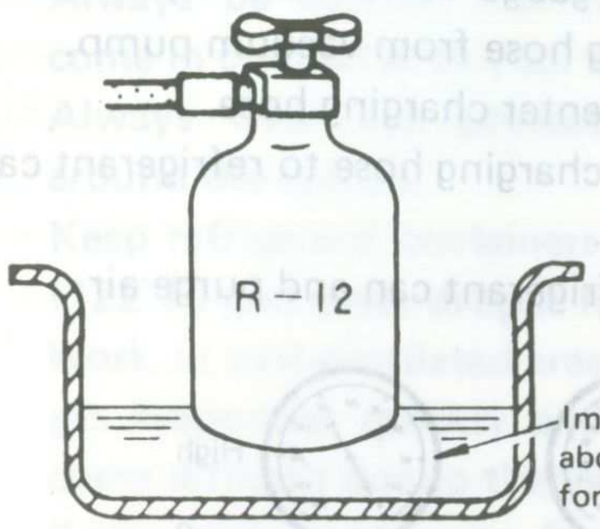
1) Open high- and low-pressure valves of manifold gauge and charge refrigerant into system.



SHA243B

Charging (Cont'd)

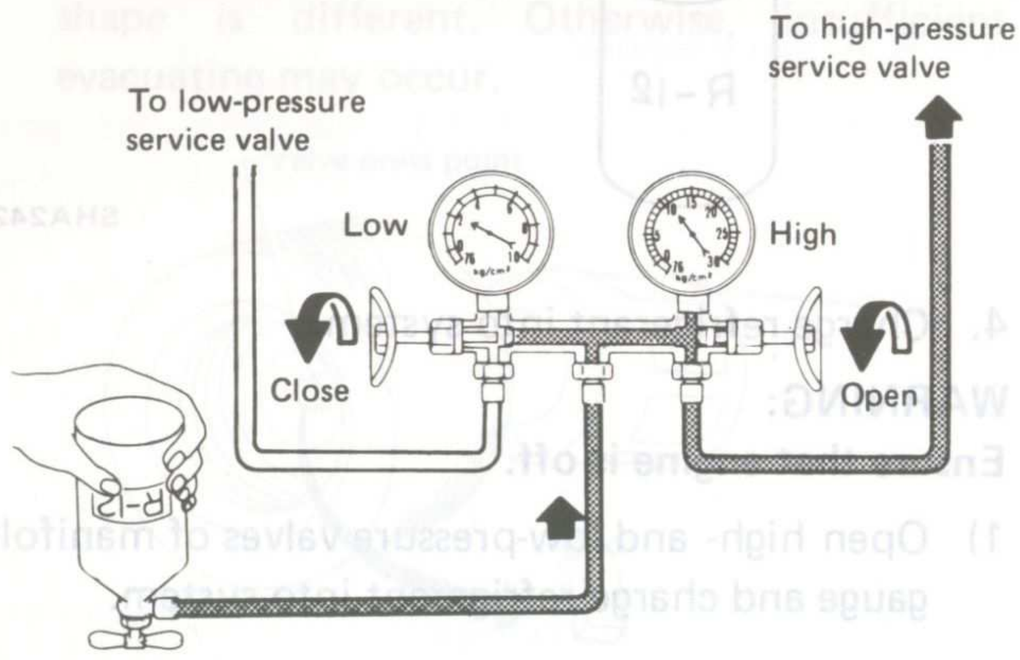
2) Quick charging



AC184A

CAUTION:

If charging liquefied refrigerant into the system with the can turned upside down to reduce charging time, charge it only through high pressure (discharge) service valve. After charging, the compressor should always be turned several times manually.

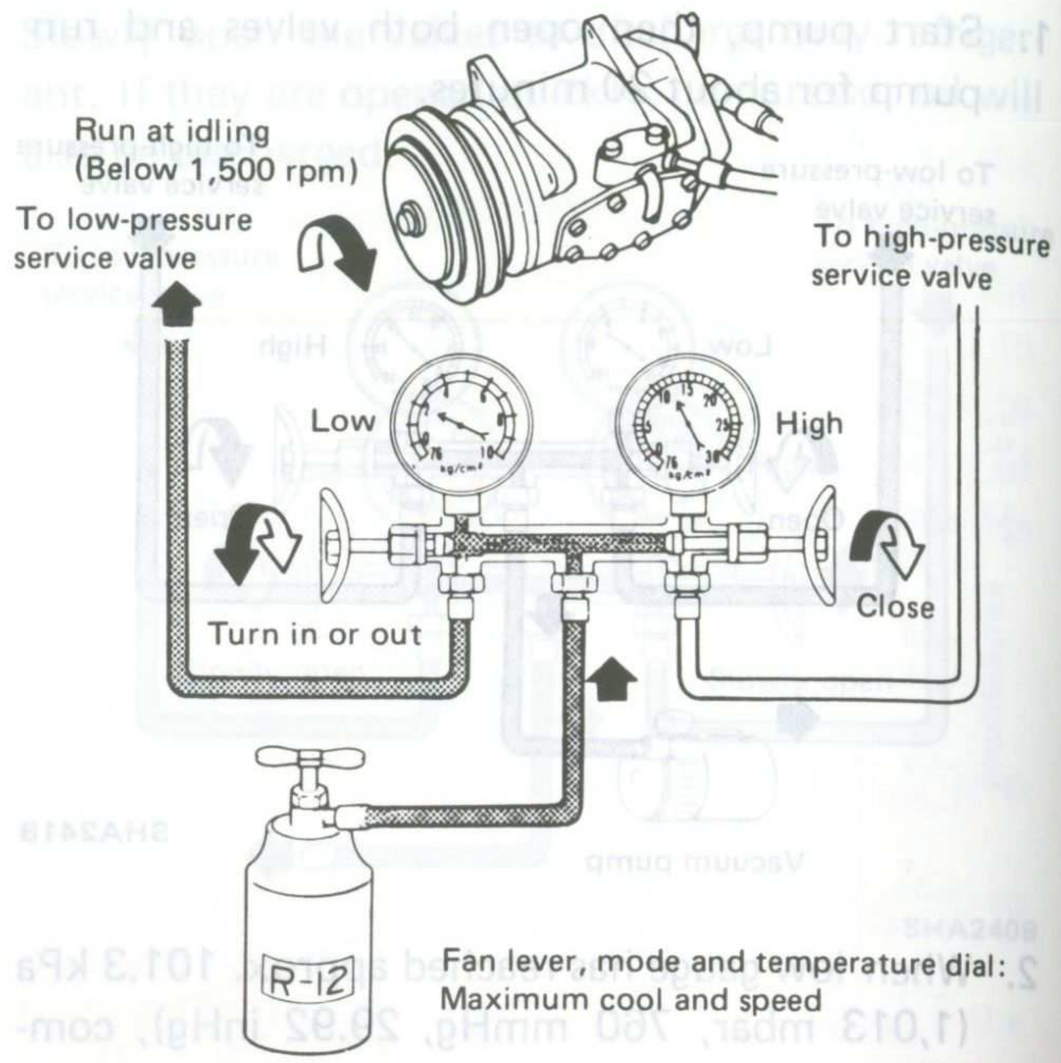


SHA244B

5. When refrigerant charging speed slows down, charge it while running the compressor for ease of charging.

WARNING:

Never charge refrigerant through high pressure side (discharge side) of system since this will force refrigerant back into refrigerant can and can may explode.



SHA245B

6. Charge refrigerant while controlling low-pressure gauge reading at 275 kPa (2.75 bar, 2.8 kg/cm², 40 psi) or less by turning in or out low-pressure valve of manifold gauge.

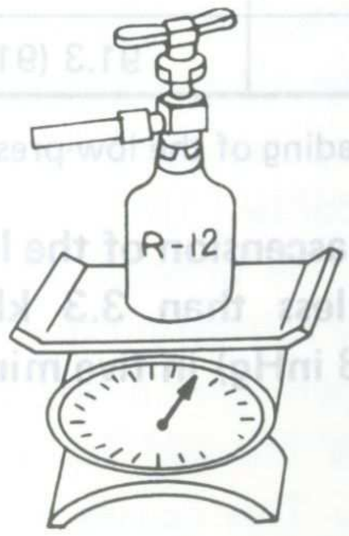
- **Be sure to purge air from charging hose when replacing can with a new one.**

7. Charge the specified amount of refrigerant into system by weighing charged refrigerant with scale. Overcharging will cause discharge pressure to rise.

Refrigerant amount:

MJS170

0.9 - 1.1 kg (2.0 - 2.4 lb)



SHA900A

Charging (Cont'd)

The state of the bubbles in sight glass should only be used for checking whether the amount of charged refrigerant is small or not. The amount of charged refrigerant can be correctly judged by means of discharge pressure.

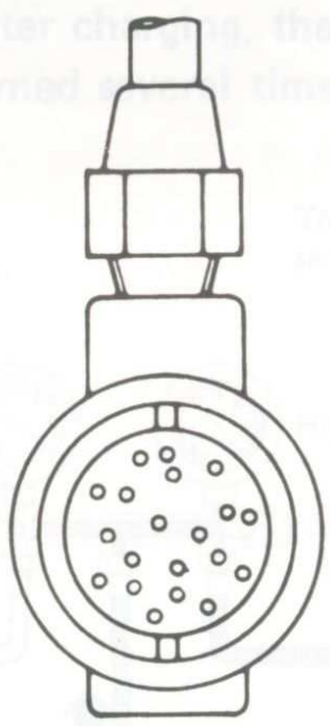
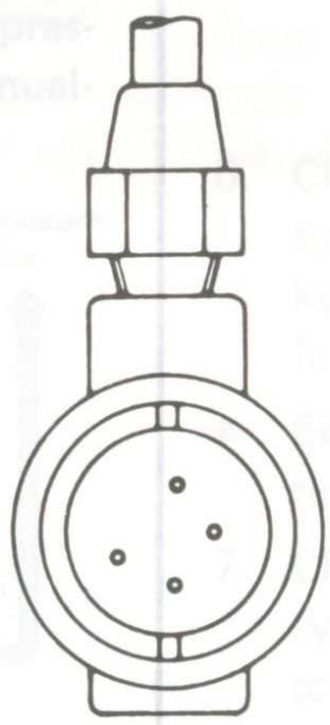
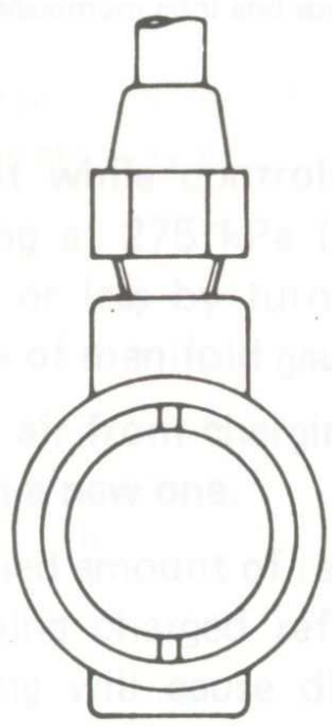
8. After charging, be sure to install valve cap on service valve.
9. Confirm that there are no leaks in system by checking with a leak detector.

DISCHARGING, EVACUATING, CHARGING AND CHECKING

Checking Refrigerant Level

CONDITION

- Door window: Open
- A/C switch: ON
- TEMP. lever position: Max. COLD
- FAN lever position: Maximum speed
- Check sight glass after a lapse of about five minutes.

Check item \ Amount of refrigerant	Almost no refrigerant	Insufficient	Suitable	Too much refrigerant
Temperature of high pressure and low pressure lines.	Almost no difference between high pressure and low pressure side temperature.	High pressure side is warm and low pressure side is fairly cold.	High pressure side is hot and low pressure side is cold.	High pressure side is abnormally hot.
State in sight glass.	Bubbles flow continuously. **Bubbles will disappear and something like mist will flow when refrigerant is nearly gone.**	The bubbles are seen at intervals of 1 - 2 seconds.	Almost transparent. Bubbles may appear when engine speed is raised and lowered. **No clear difference exists between these two conditions.**	No bubbles can be seen.
	 AC256	 AC257	 AC258	
Pressure of system.	High pressure side is abnormally low.	Both pressure on high and low pressure sides are slightly low.	Both pressures on high and low pressure sides are normal.	Both pressures on high and low pressure sides are abnormally high.
Repair.	**Stop compressor immediately** and conduct an overall check.	Check for gas leakage, repair as required, replenish and charge system.		Discharge refrigerant from service valve of low pressure side.

a. The bubbles seen through the sight glass are influenced by the ambient temperature. Since the bubbles are hard to show up in comparatively low temperatures below 20°C (68°F), it is possible that a slightly larger amount of refrigerant would be filled, if supplied according to the sight glass. Be sure to recheck the amount when it exceeds 20°C (68°F). In higher temperature the bubbles are easy to show up.

b. When the screen in the receiver drier is clogged, the bubbles will appear even if the amount of refrigerant is normal. In this case, the outlet side pipe of the receiver drier becomes considerably cold.

DISCHARGING, EVACUATING, CHARGING AND CHECKING

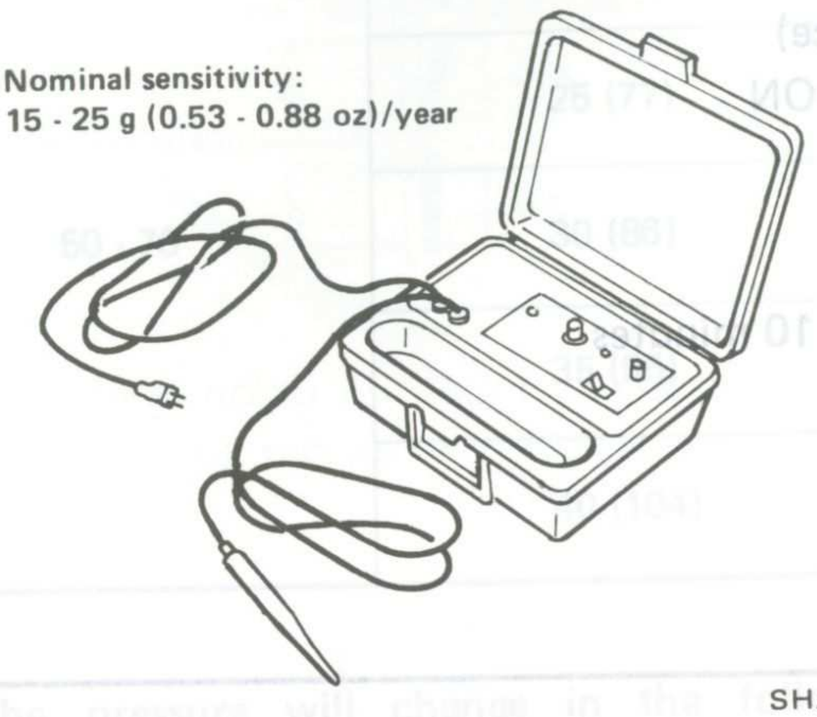
Checking Refrigerant Leaks

ELECTRIC LEAK-DETECTOR

The leak detector is a delicate device that detects small amounts of halogen.

In order to use the device properly, read the manuals put out by each maker and perform the specified maintenance and inspections.

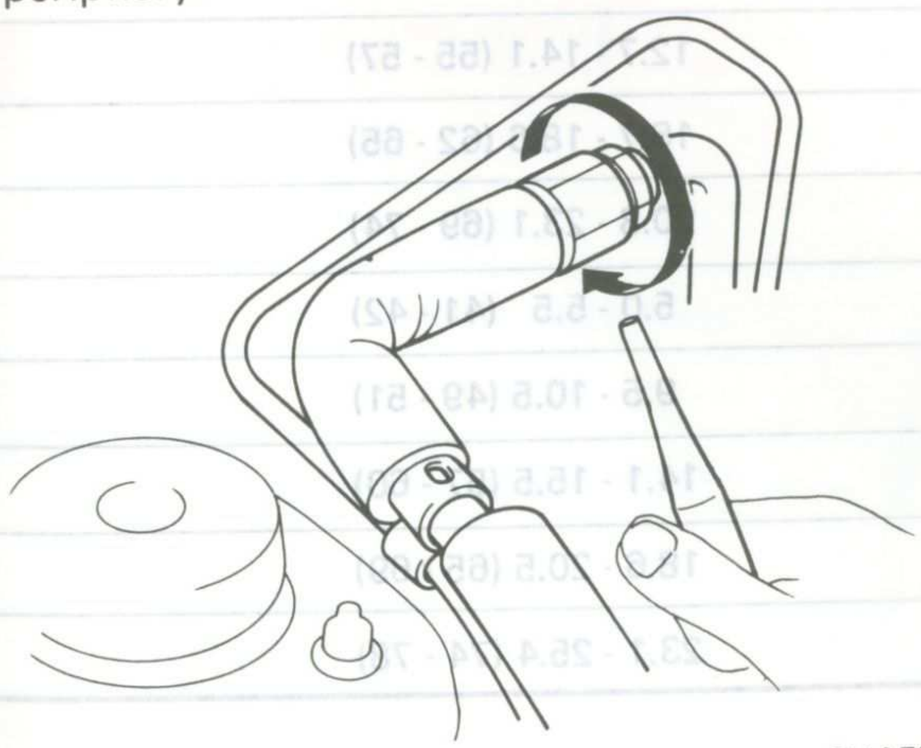
Nominal sensitivity:
15 - 25 g (0.53 - 0.88 oz)/year



SHA733A

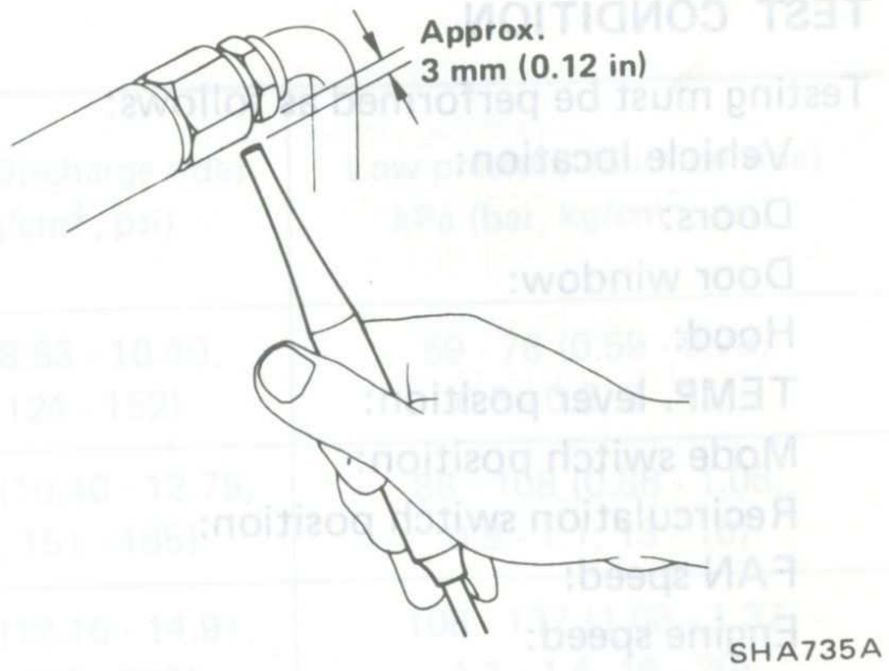
GENERAL PRECAUTIONS FOR HANDLING LEAK DETECTOR

1. Each fitting must be checked around its entire periphery.



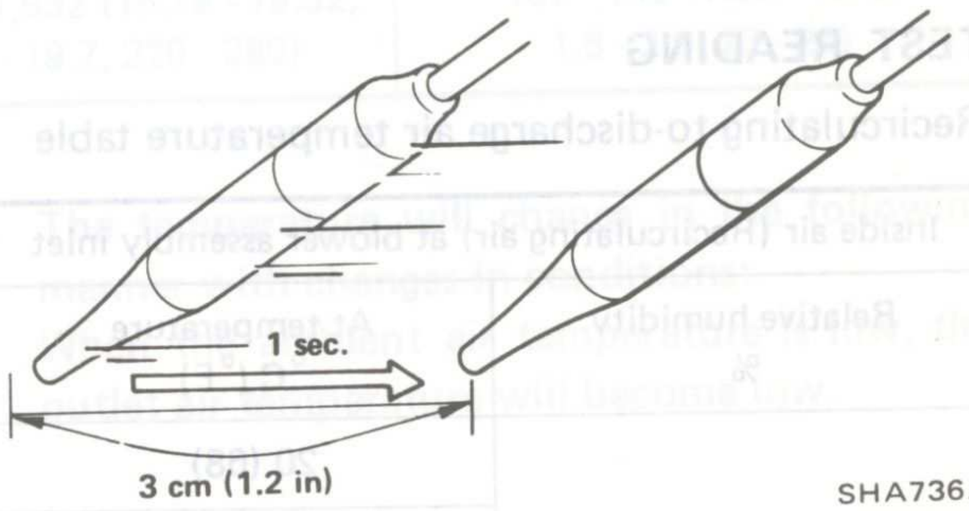
SHA734A

2. Move probe close to and 3 mm (0.12 in) away from the point to be checked.



SHA735A

3. The moving speed of the probe must be maintained at less than 3 cm (1.2 in)/sec.



SHA736A

MEASUREMENT STANDARD

If any reaction is noted using a detector having a nominal sensitivity of 15 to 25 g (0.53 to 0.88 oz)/year, that portion checked be found as leaking, and therefore must be repaired.

- Oil deposited during assembling must be wiped off before inspection.
- If any trace of oil is noted at and around connection fittings, it is a sure indication that refrigerant is leaking.
- **When the gas leaking point is found, disconnect that line and replace the O-ring. Check seal seat for fit for further use and then tighten connections to the specified torque.**
- **Do not overtighten.**

A/C PERFORMANCE TEST (Manual)

Performance Chart

TEST CONDITION

Testing must be performed as follows:

Vehicle location:	Indoors or in the shade (in a well ventilated place)
Doors:	Closed
Door window:	Open
Hood:	Open
TEMP. lever position:	Max. COLD
Mode switch position:	(Face)
Recirculation switch position:	RECIRC. ON
FAN speed:	MAX. HI
Engine speed:	1,500 rpm
Time required before starting testing after air conditioner starts operating:	More than 10 minutes

TEST READING

Recirculating-to-discharge air temperature table

Inside air (Recirculating air) at blower assembly inlet		Discharge air temperature at center ventilator °C (°F)
Relative humidity %	At temperature °C (°F)	
50 - 60	20 (68)	4.5 - 5.0 (40 - 41)
	25 (77)	8.6 - 9.5 (47 - 49)
	30 (86)	12.7 - 14.1 (55 - 57)
	35 (95)	16.7 - 18.6 (62 - 65)
	40 (104)	20.8 - 23.1 (69 - 74)
60 - 70	20 (68)	5.0 - 5.5 (41 - 42)
	25 (77)	9.5 - 10.5 (49 - 51)
	30 (86)	14.1 - 15.5 (57 - 60)
	35 (95)	18.6 - 20.5 (65 - 69)
	40 (104)	23.1 - 25.4 (74 - 78)

A/C PERFORMANCE TEST (Manual)

Performance Chart (Cont'd)

Ambient air temperature to compressor pressure table

Ambient air		High pressure (Discharge side) kPa (bar, kg/cm^2, psi)	Low pressure (Suction side) kPa (bar, kg/cm^2, psi)
Relative humidity %	Air temperature °C (°F)		
50 - 70	20 (68)	853 - 1,049 (8.53 - 10.49, 8.7 - 10.7, 124 - 152)	59 - 78 (0.59 - 0.78, 0.6 - 0.8, 9 - 11)
	25 (77)	1,040 - 1,275 (10.40 - 12.75, 10.6 - 13.0, 151 - 185)	88 - 108 (0.88 - 1.08, 0.9 - 1.1, 13 - 16)
	30 (86)	1,216 - 1,491 (12.16 - 14.91, 12.4 - 15.2, 176 - 216)	108 - 137 (1.08 - 1.37, 1.1 - 1.4, 16 - 20)
	35 (95)	1,393 - 1,706 (13.93 - 17.06, 14.2 - 17.4, 202 - 247)	137 - 167 (1.37 - 1.67, 1.4 - 1.7, 20 - 24)
	40 (104)	1,579 - 1,932 (15.79 - 19.32, 16.1 - 19.7, 229 - 280)	157 - 196 (1.57 - 1.96, 1.6 - 2.0, 23 - 28)

a. The pressure will change in the following manner with changes in conditions:

- When blower speed is low, discharge pressure will drop.
- When the relative humidity of intake air is low, discharge pressure will drop.

b. The temperature will change in the following manner with changes in conditions:
When the ambient air temperature is low, the outlet air temperature will become low.

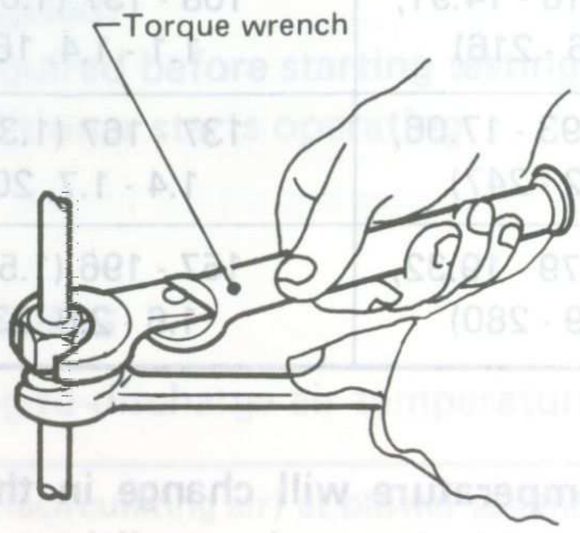
PRECAUTIONS FOR REFRIGERANT CONNECTION

WARNING:

Gradually loosen discharge side hose fitting, and remove it after remaining pressure has been released.

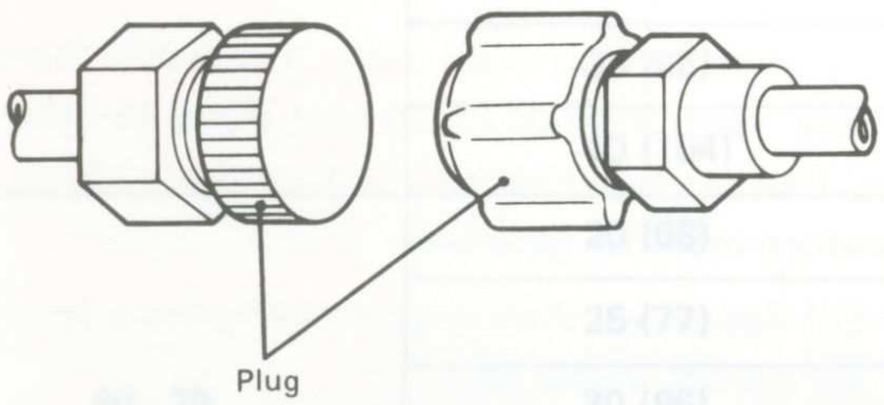
When replacing or cleaning refrigerant cycle components, observe the following.

- Do not leave compressor on its side or upside down for more than 10 minutes, as compressor oil will enter low pressure chamber.
- When connecting tubes, be sure to use a torque wrench.



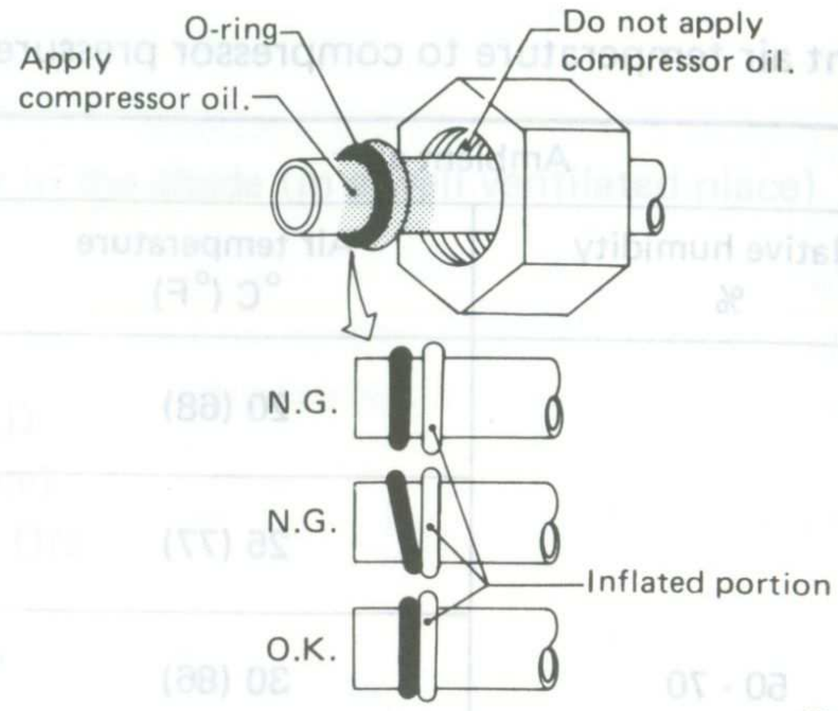
SHA896A

- After disconnecting tubes, plug all openings immediately to prevent entrance of dirt and moisture.



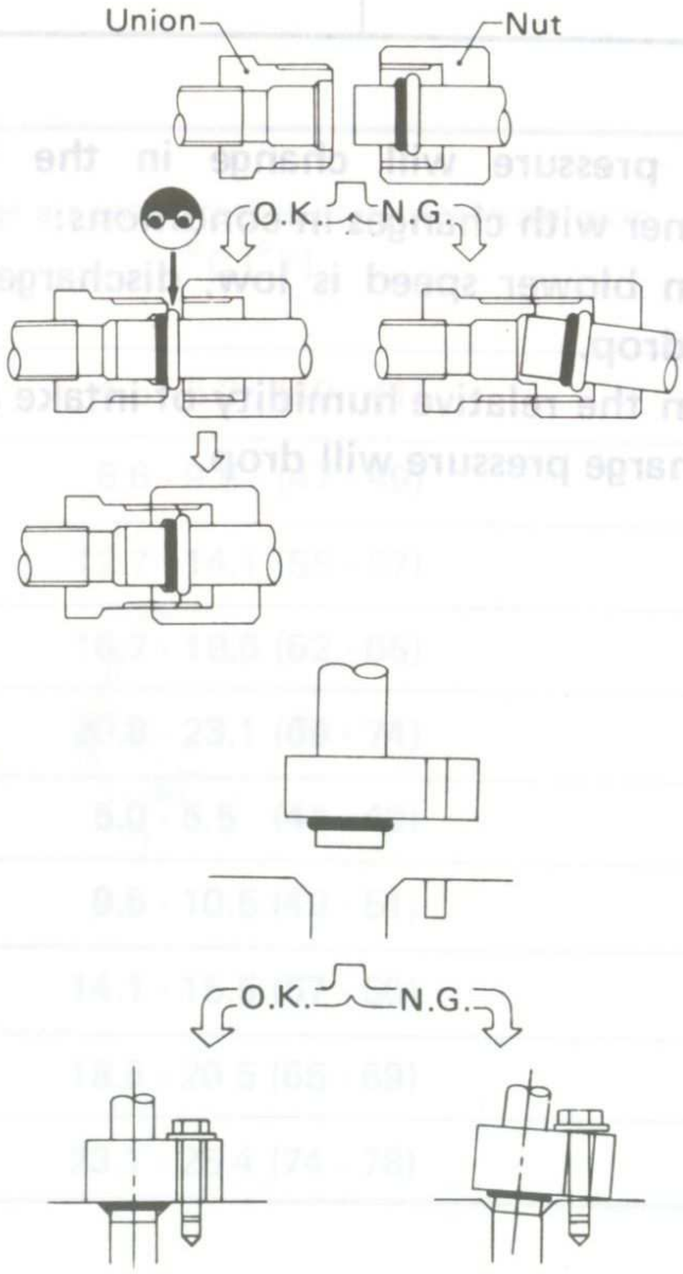
SHA058

- Do not reuse used O-ring.
- When connecting tube, apply compressor oil to portions shown in illustration. Be careful not to apply oil to threaded portion.
- O-ring must be closely attached to inflated portion of tube.



SHA897A

- After inserting tube into union until O-ring is no more visible, tighten nut to specified torque.

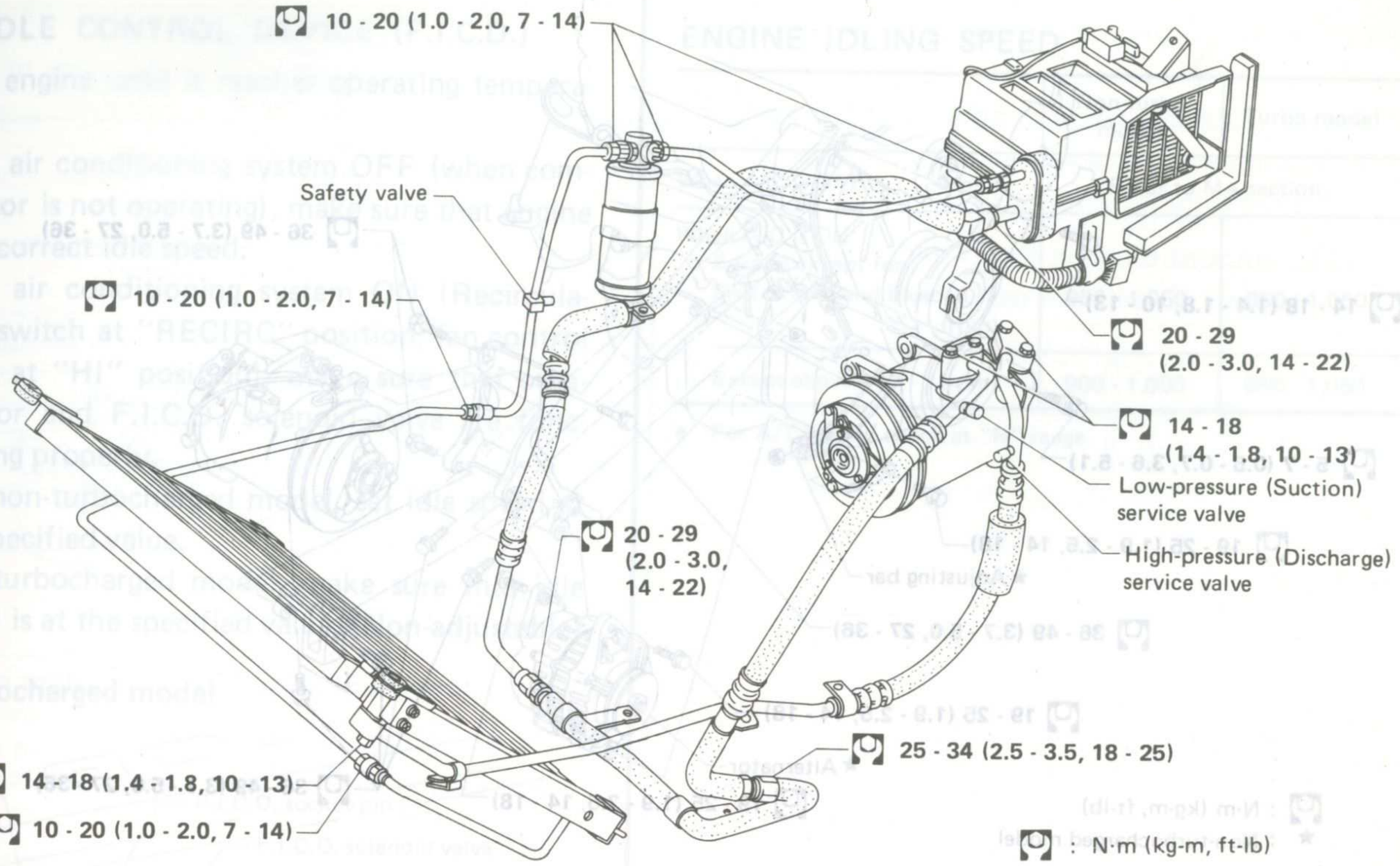


SHA898A

- After connecting line, conduct leak test and make sure that there is no leak from connections. When the gas leaking point is found, disconnect that line and replace the O-ring. Check fit for further use and then tighten connections to seal seat for the specified torque.

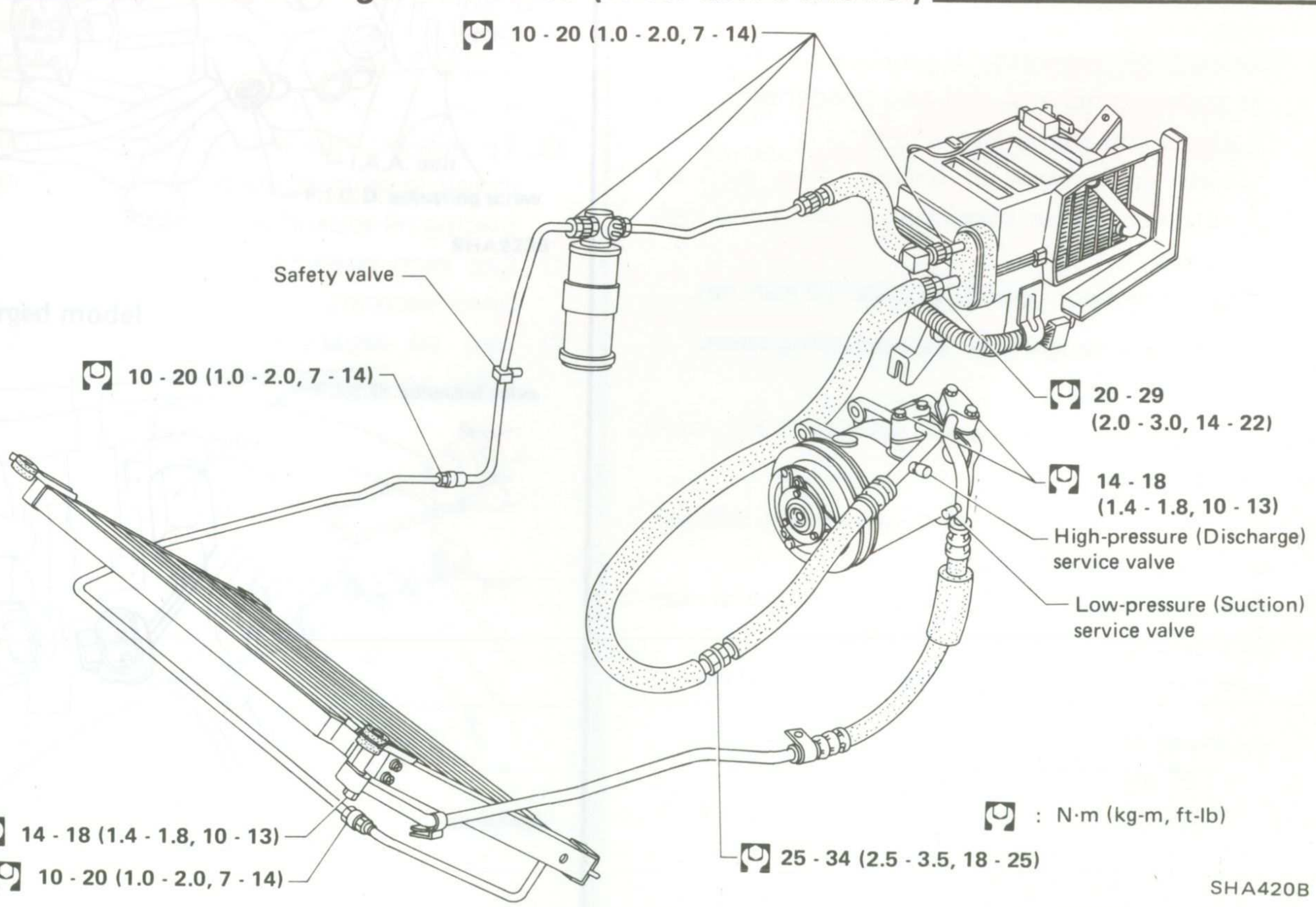
PIPING, COMPRESSOR MOUNTING AND F.I.C.D.

Refrigerant Lines (L.H. drive model)



SHA419B

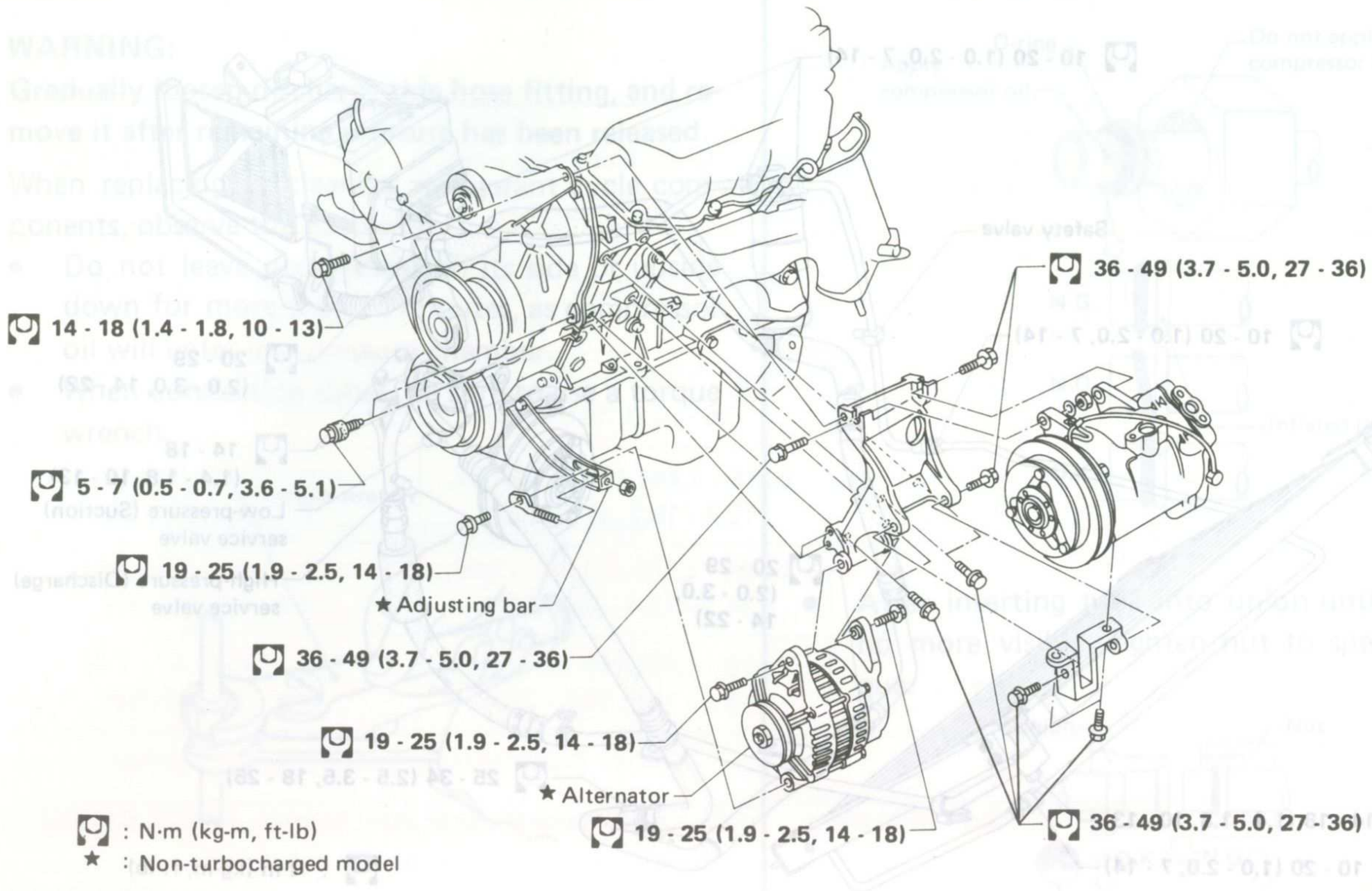
Refrigerant Lines (R.H. drive model)



SHA420B

PIPING, COMPRESSOR MOUNTING AND F.I.C.D.

Compressor Mounting



: N·m (kg-m, ft-lb)
★ : Non-turbocharged model

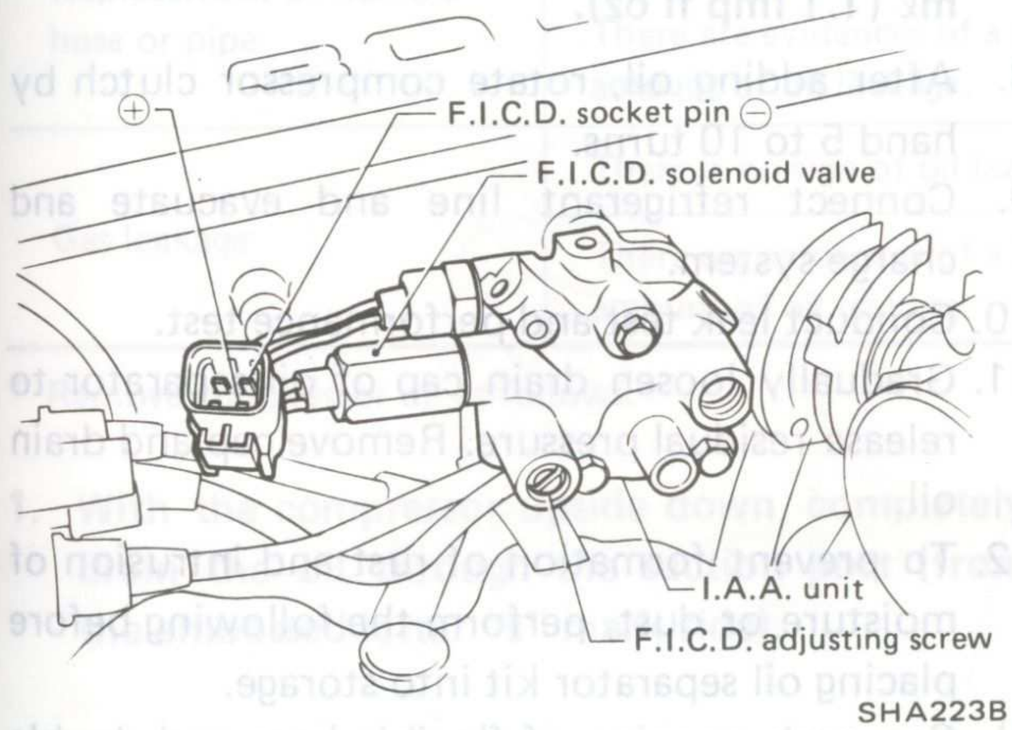
SHA247B

Idle Speed Adjusting and Checking

FAST IDLE CONTROL DEVICE (F.I.C.D.)

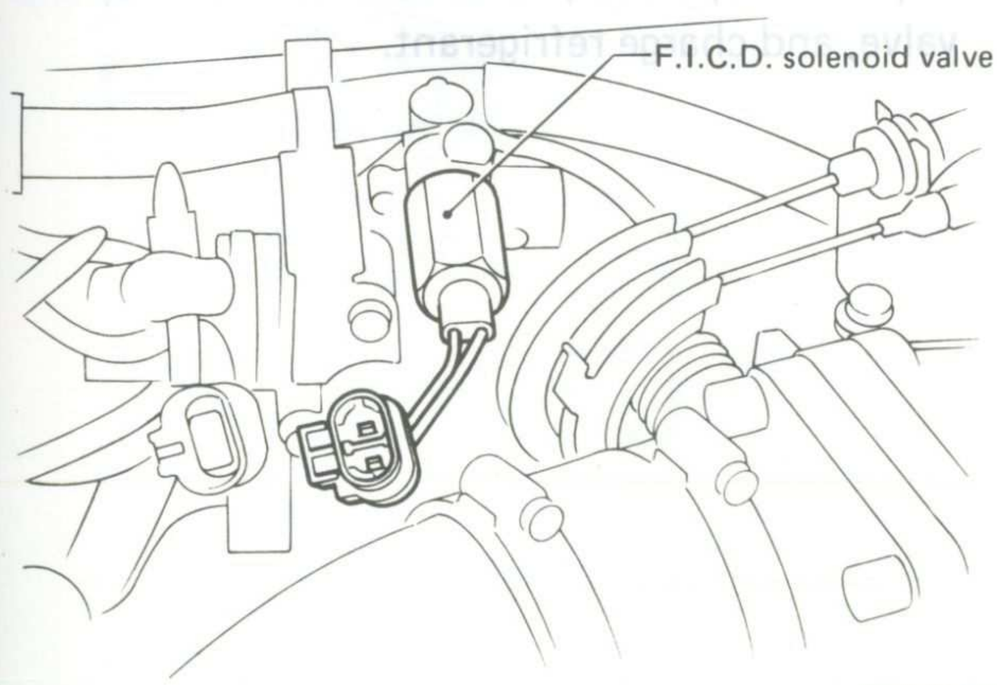
1. Run engine until it reaches operating temperature.
2. With air conditioning system OFF (when compressor is not operating), make sure that engine is at correct idle speed.
3. With air conditioning system ON (Recirculation switch at "RECIRC" position, fan control lever at "HI" position), make sure that compressor and F.I.C.D. solenoid valve are functioning properly.
4. For non-turbocharged model, set idle speed at the specified value.
   For turbocharged model, make sure that idle speed is at the specified value. **(Non-adjustable)**

Non-turbocharged model



SHA223B

Turbocharged model



SHA248B

ENGINE IDLING SPEED

		Non-turbo model	Turbo model
When A/C is OFF	(rpm)	Refer to MA section.	
When A/C is ON Europe except for Switzerland and Sweden	(rpm)	950 - 1,050	950 - 1,050
Except above	(rpm)	900 - 1,000	950 - 1,050

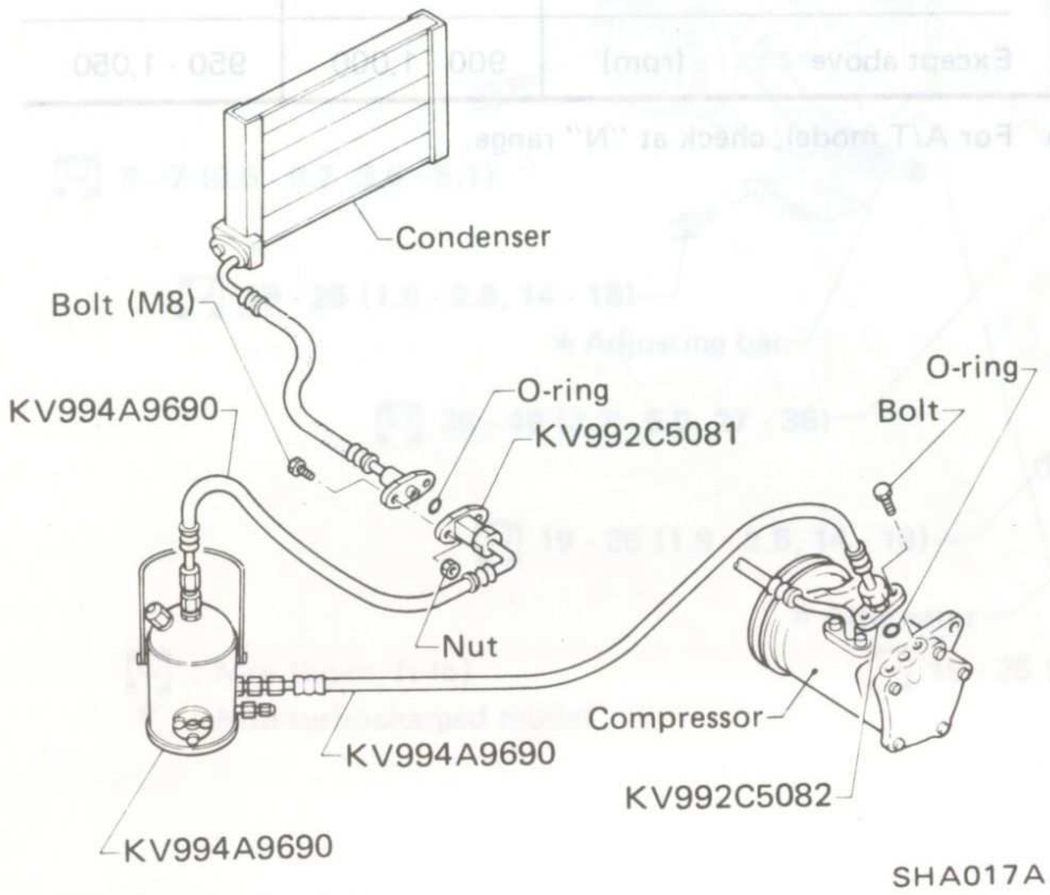
- For A/T model, check at "N" range.

COMPRESSOR OIL—For MJS170

Checking and Adjusting

The oil used to lubricate the compressor is circulating with the refrigerant.
Whenever replacing any component of the system of a large amount of gas leakage occurs, add oil to maintain the original amount of oil.

Total amount of oil in the system:
150 mℓ (5.3 Imp fl oz)



SHA017A

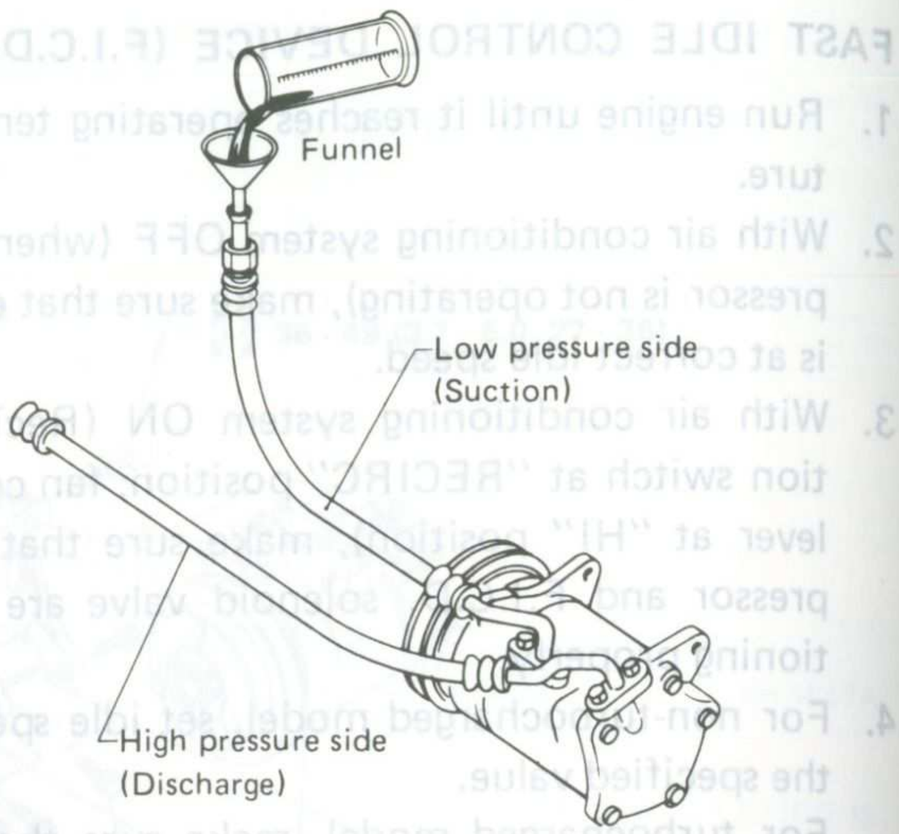
1. Connect oil separator KV994A9690 between compressor discharge side and condenser.
2. Evacuate and charge the system.
3. Operate compressor at engine idling with air conditioner set for maximum cooling and high fan speed.
4. Stop compressor operation after 10 minutes.

Never allow engine speed to exceed idling speed.

CAUTION:
Do not continue compressor operation for more than 10 minutes.

5. Disconnect oil separator and connect refrigerant line to original positions.
6. Disconnect low flexible hose from compressor suction valve.
7. Add new oil from compressor suction port.

Amount of oil to be added:
120 mℓ (4.2 Imp fl oz)



SHA702

- **Oil remains unremoved in the system about 30 mℓ (1.1 Imp fl oz).**

8. After adding oil, rotate compressor clutch by hand 5 to 10 turns.
9. Connect refrigerant line and evacuate and charge system.
10. Conduct leak test and performance test.
11. Gradually loosen drain cap of oil separator to release residual pressure. Remove cap and drain oil.
12. To prevent formation of rust and intrusion of moisture or dust, perform the following before placing oil separator kit into storage.

1) Cap each opening of flexible hose and double union securely.
2) Cap oil separator, evacuate it from service valve, and charge refrigerant.

COMPRESSOR OIL—For MJS170

Checking and Adjusting (Cont'd)

IF OIL SEPARATOR IS NOT AVAILABLE

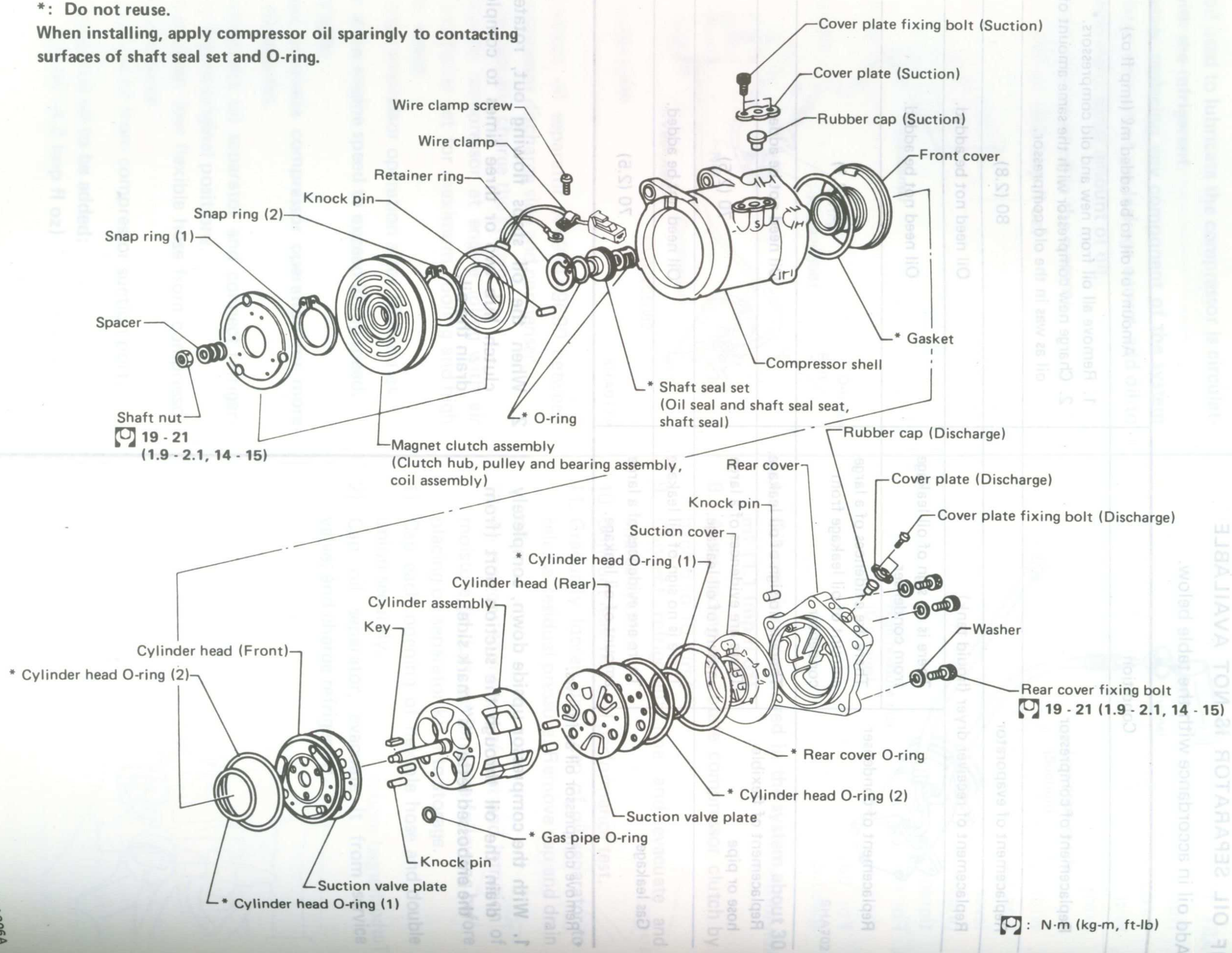
Add oil in accordance with the table below.

Condition		Amount of oil to be added mℓ (Imp fl oz)
Replacement of compressor		1. Remove all oil from new and old compressors.* 2. Charge new compressor with the same amount of oil as was in the old compressor.
Replacement of evaporator		80 (2.8)
Replacement of receiver dryer (liquid tank)		Oil need not be added.
Replacement of condenser	There is no sign of oil leakage from condenser.	Oil need not be added.
	There are evidences of a large amount of oil leakage from condenser.	60 (2.1)
Replacement of flexible hose or pipe	There is no sign of oil leakage.	Oil need not be added.
	There are evidences of a large amount of oil leakage.	70 (2.5)
Gas leakage	There is no sign of oil leakage.	Oil need not be added.
	There are evidences of a large amount of oil leakage.	70 (2.5)

* Remove compressor oil as follows.

1. **With the compressor upside down, completely drain the oil through the suction port (from the embossed letter "s" mark side).**
2. **When the oil stops flowing out, rotate the clutch hub two or three times to completely drain the oil.**

***: Do not reuse.**
When installing, apply compressor oil sparingly to contacting surfaces of shaft seal set and O-ring.

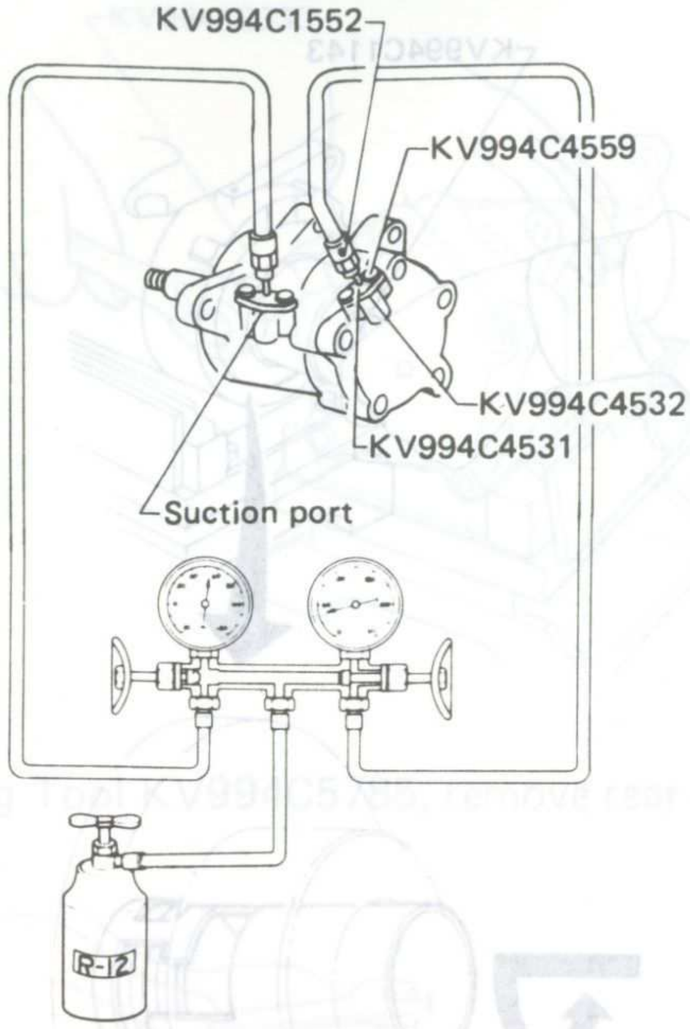


: N·m (kg-m, ft-lb)

COMPRESSOR—Model MJS170

Leak Test

EVACUATE AND CONDUCT LEAK TEST



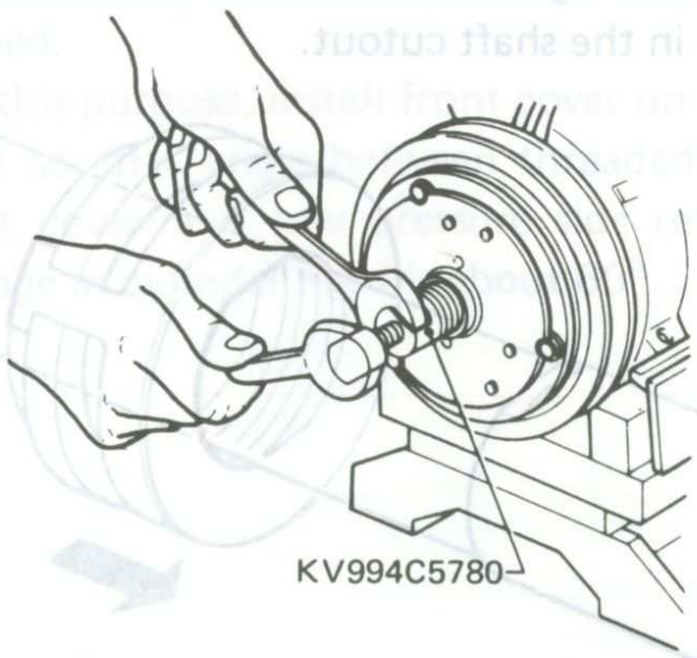
SHA907A

Clutch Replacement

- When removing shaft nut, hold clutch hub with Tool.

  Tool No.: KV99412302

- Using Tool KV994C5780, clutch hub can be removed easily.

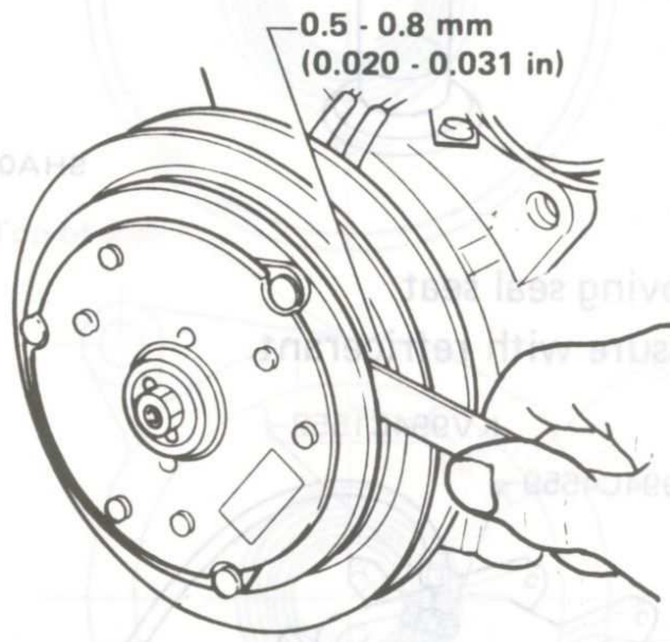


SHA268A

- When assembling clutch hub, adjust hub-to-pulley clearance with shims.



SHA272A



SHA908A

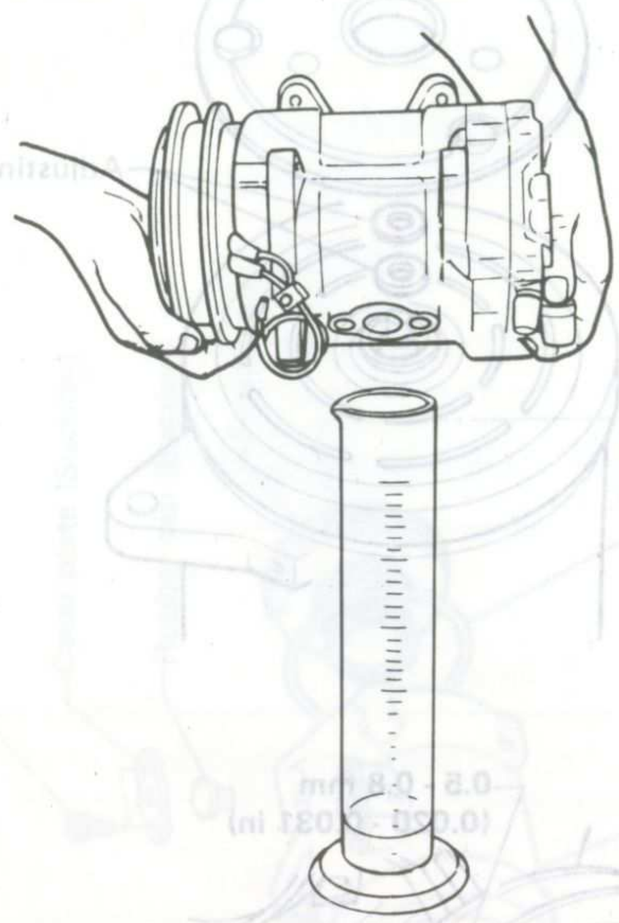
BREAK-IN OPERATION

When replacing compressor clutch assembly, do not forget break-in operation, accomplished by engaging and disengaging the clutch about thirty times. Break-in operation raises the level of transmitted torque.

COMPRESSOR—Model MJS170

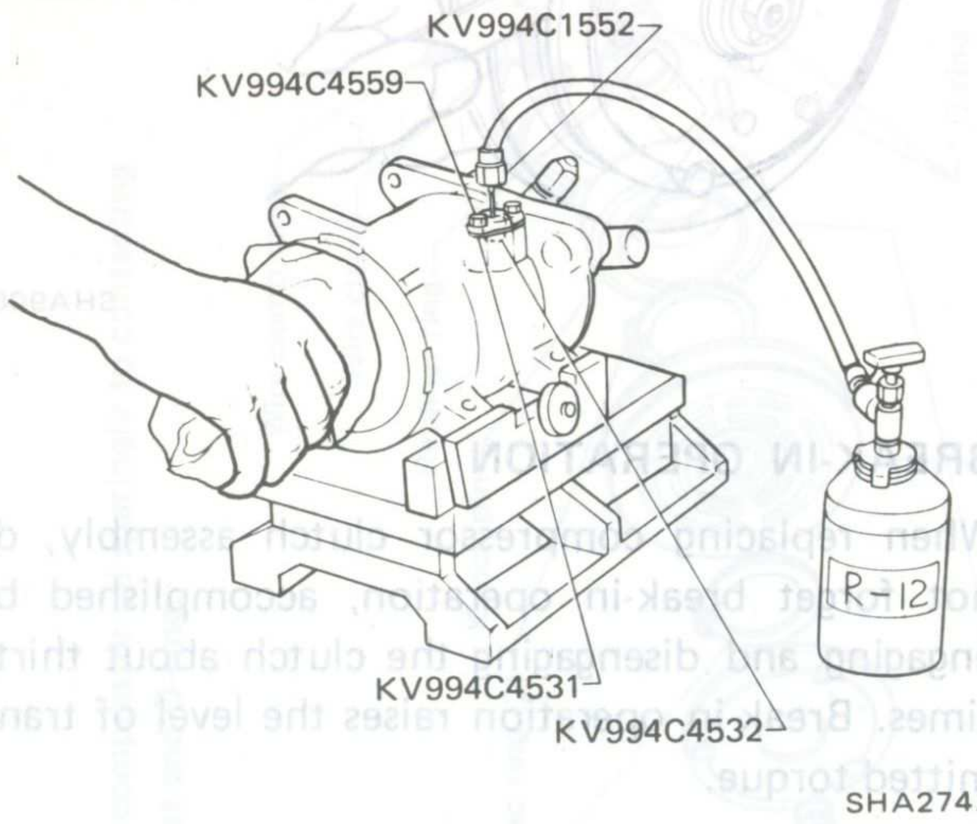
Shaft Seal Replacement

- Before disassembling, be sure to measure the amount of oil.
  After assembling, charge with the same amount of new oil.



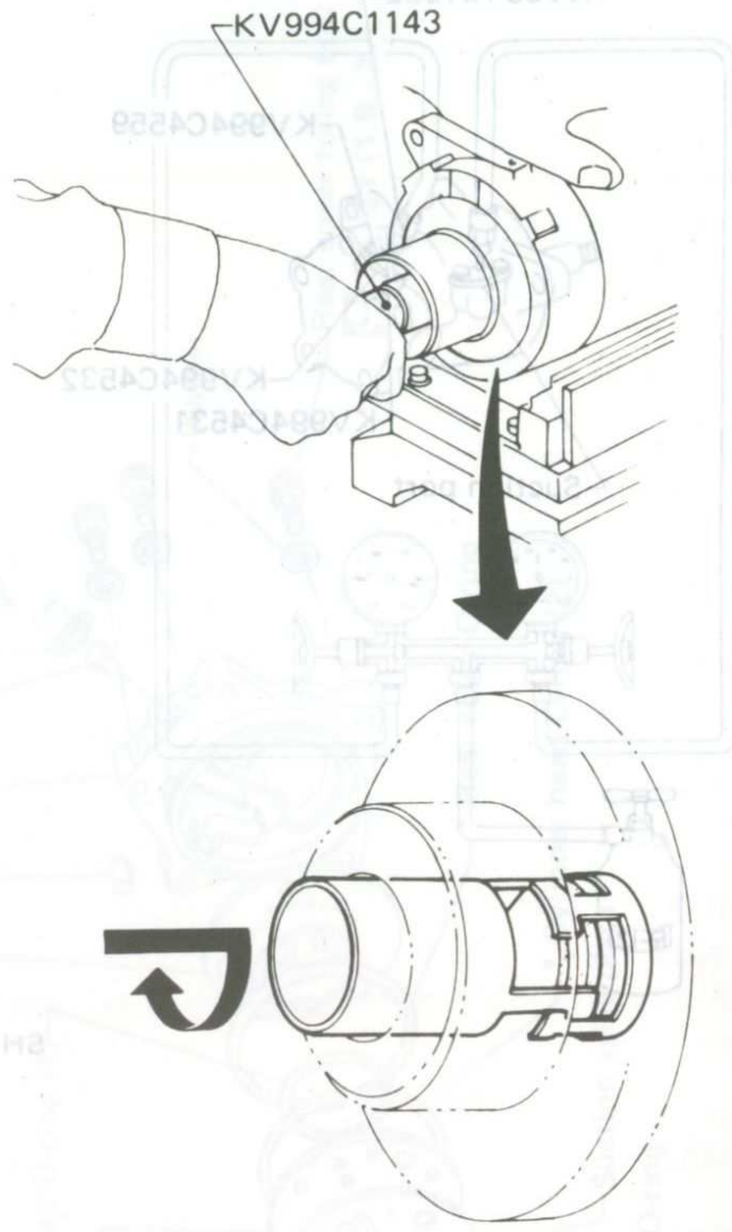
SHA033A

- When removing seal seat
  Apply pressure with refrigerant.



SHA274A

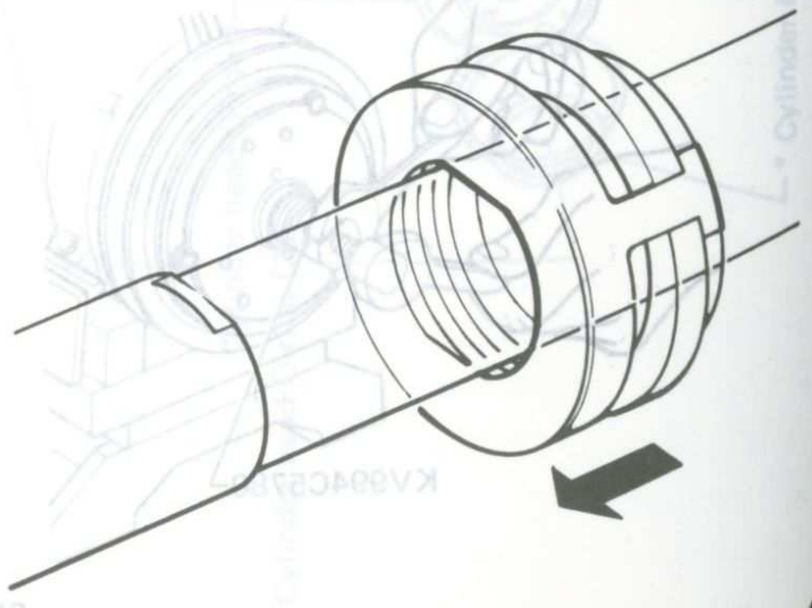
- With Tool KV994C1143, depress carbon seal and hook the case of shaft seal.



SHA275A

- When installing shaft seal

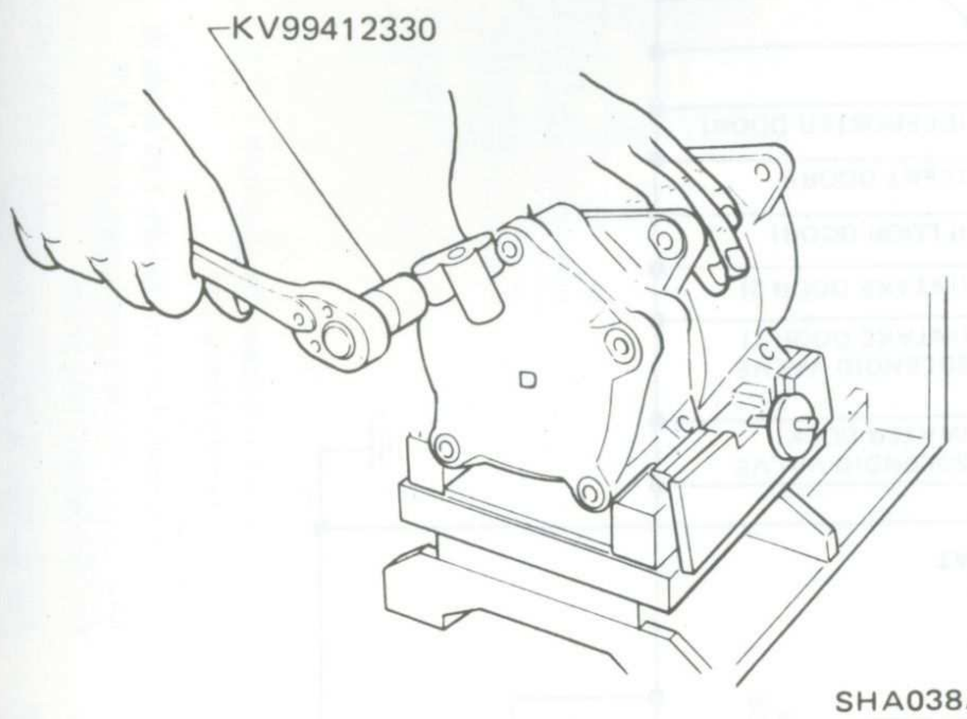
1) Cap Tool KV994C5784 to the top end of compressor shaft.
2) Using Tool KV994C1143, insert shaft seal with shaft seal case and shaft cutout aligned.
   Apply force to turn the seal somewhat to the left and right. Insure that shaft seal seats properly in the shaft cutout.



AC037

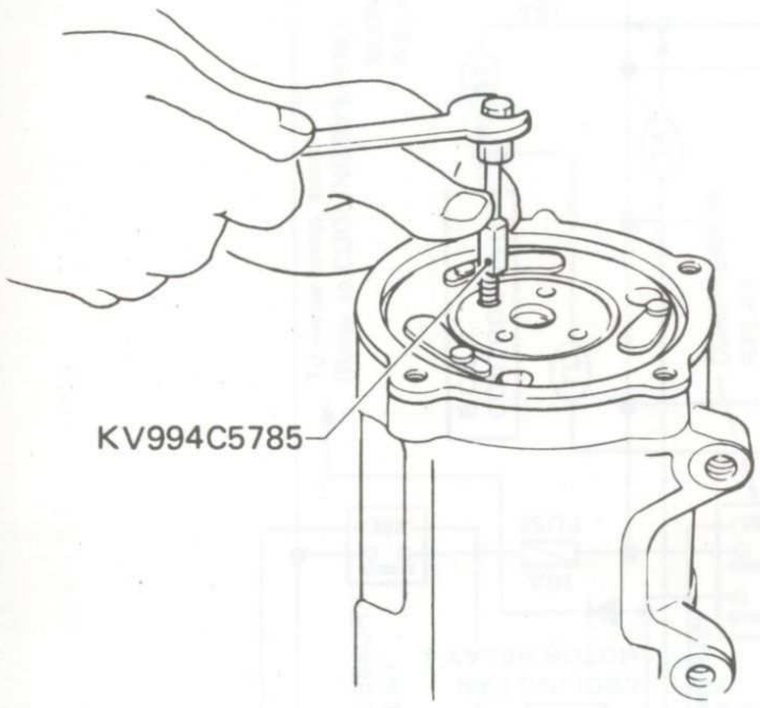
Valve Replacement

- Using Tool KV99412330, remove rear cover.



SHA038A

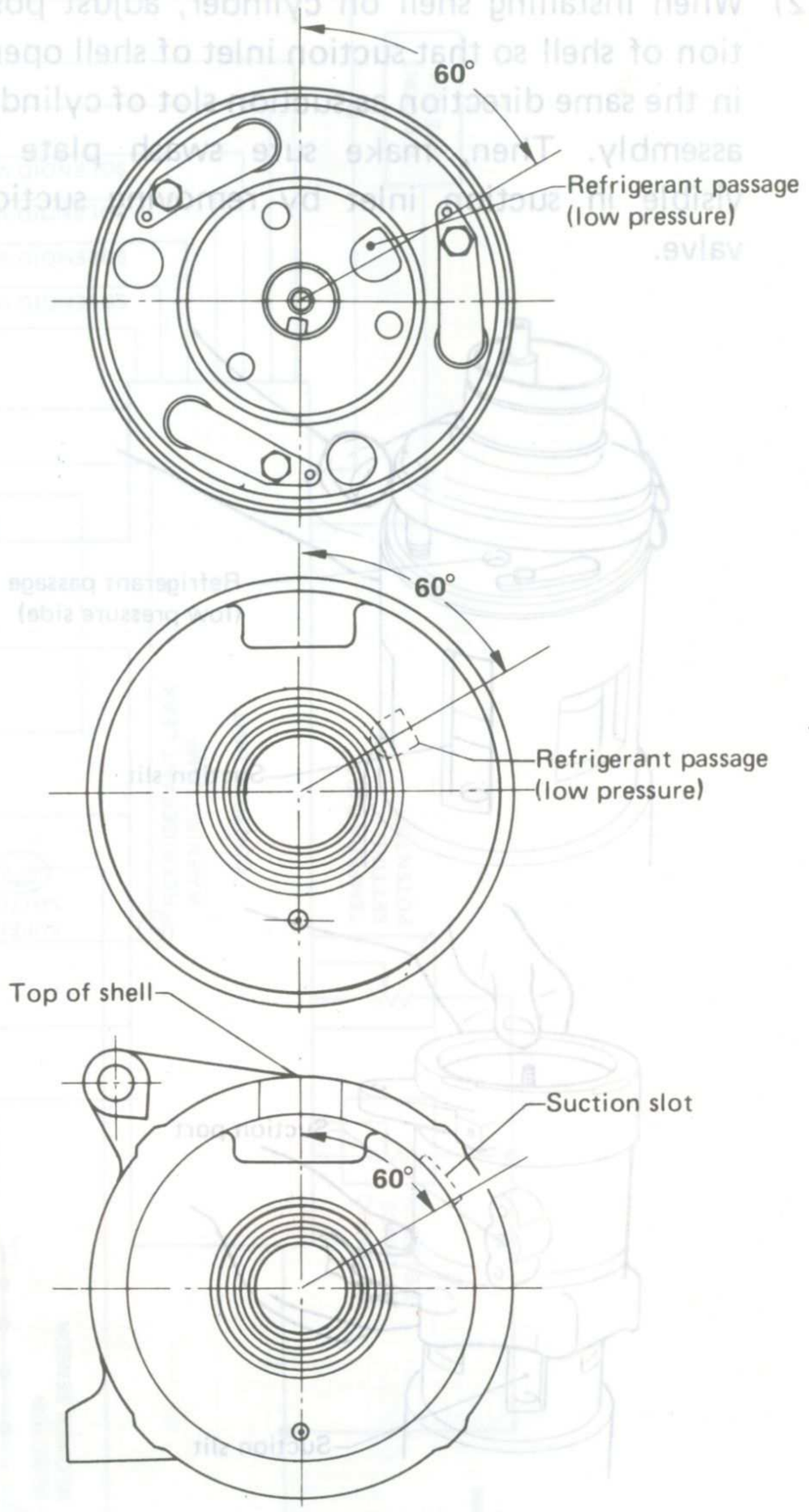
- Using Tool KV994C5785, remove rear cylinder head.



SHA909A

- When assembling

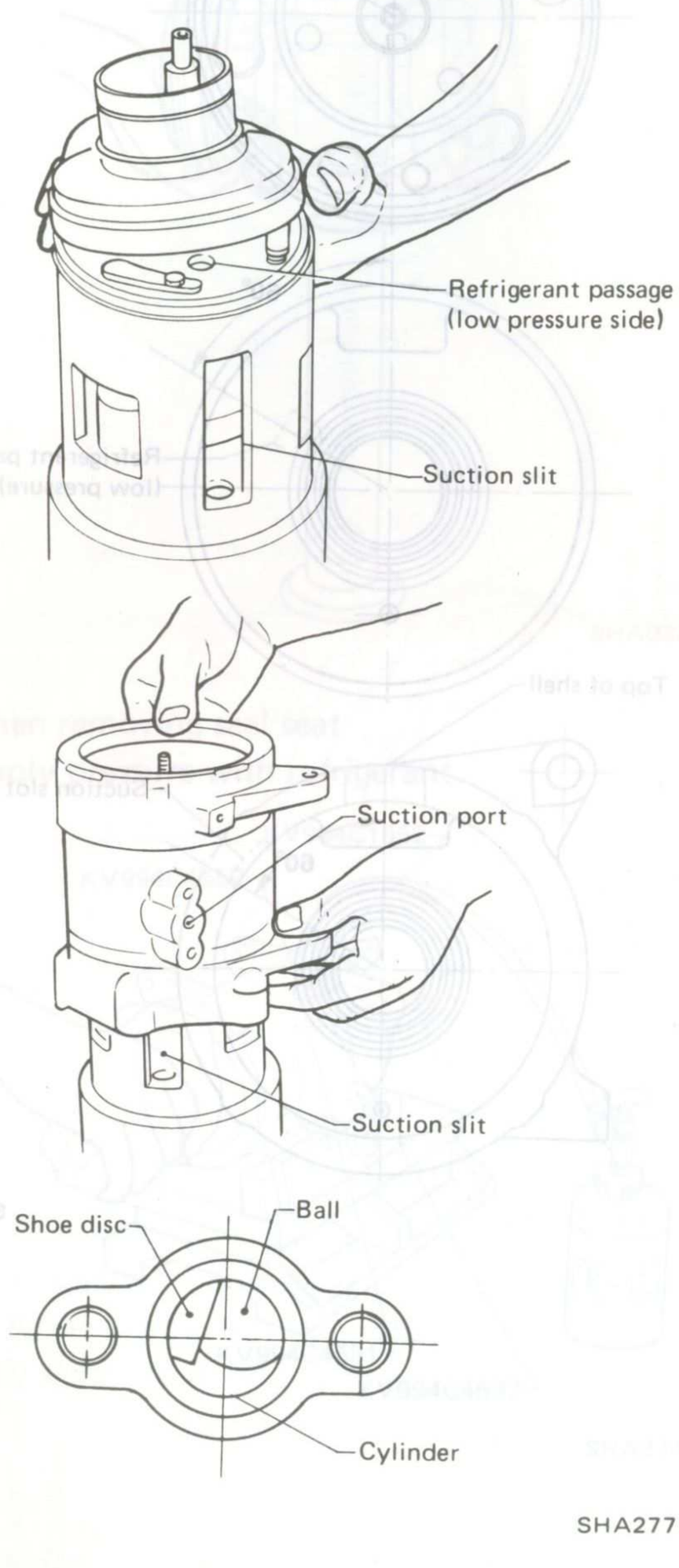
1) Front cover must be installed so that the cut-out portions of front cover and shell are aligned.
   For this purpose, install front cover on cylinder head so that angle between threaded hole in front cover and low pressure side refrigerant passage in cylinder head is about 60°.



SHA276A

Valve Replacement (Cont'd)

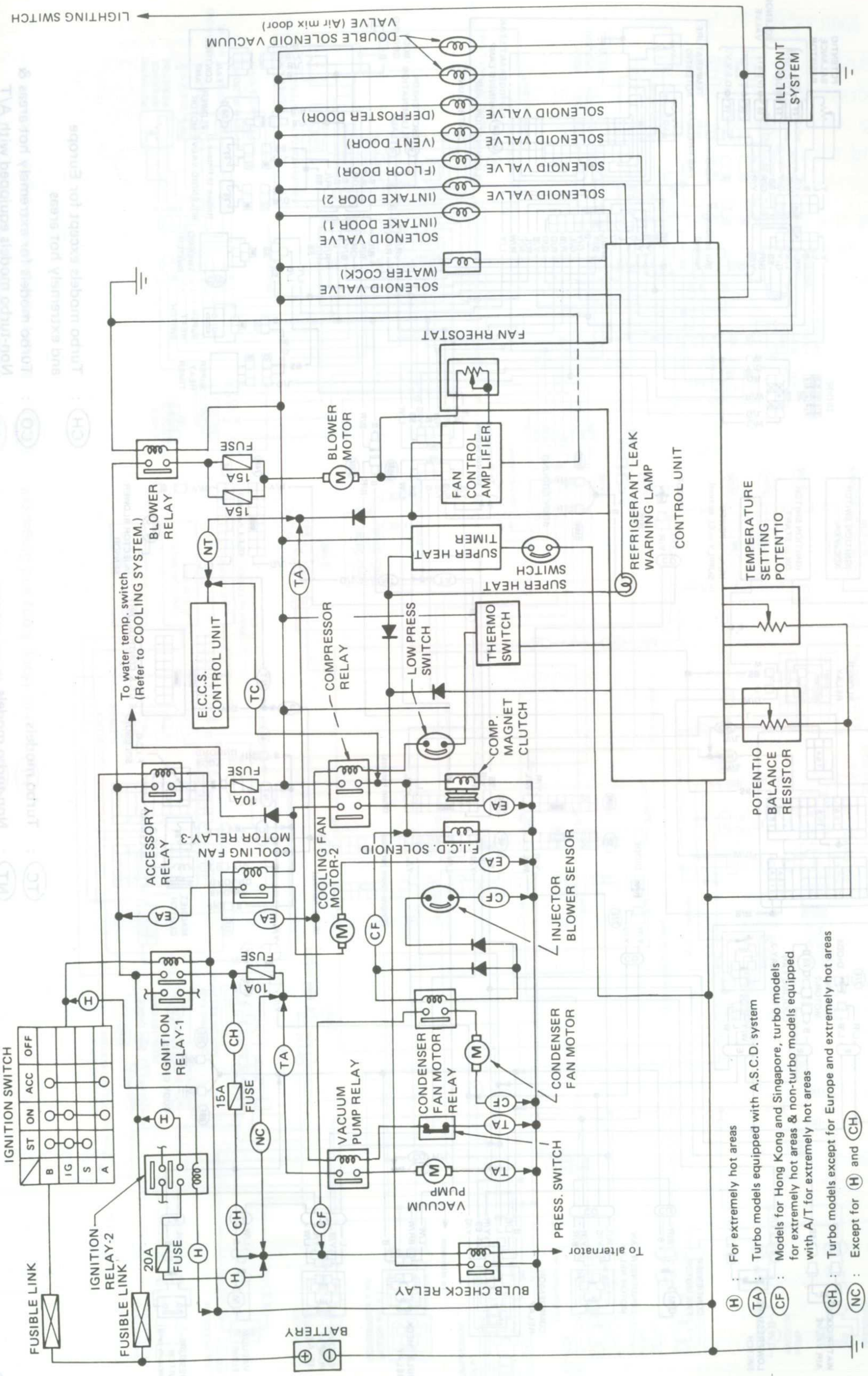
2) When installing shell on cylinder, adjust position of shell so that suction inlet of shell opens in the same direction as suction slot of cylinder assembly. Then, make sure swash plate is visible in suction inlet by removing suction valve.



SHA277A

A/C ELECTRICAL CIRCUIT (Manual)

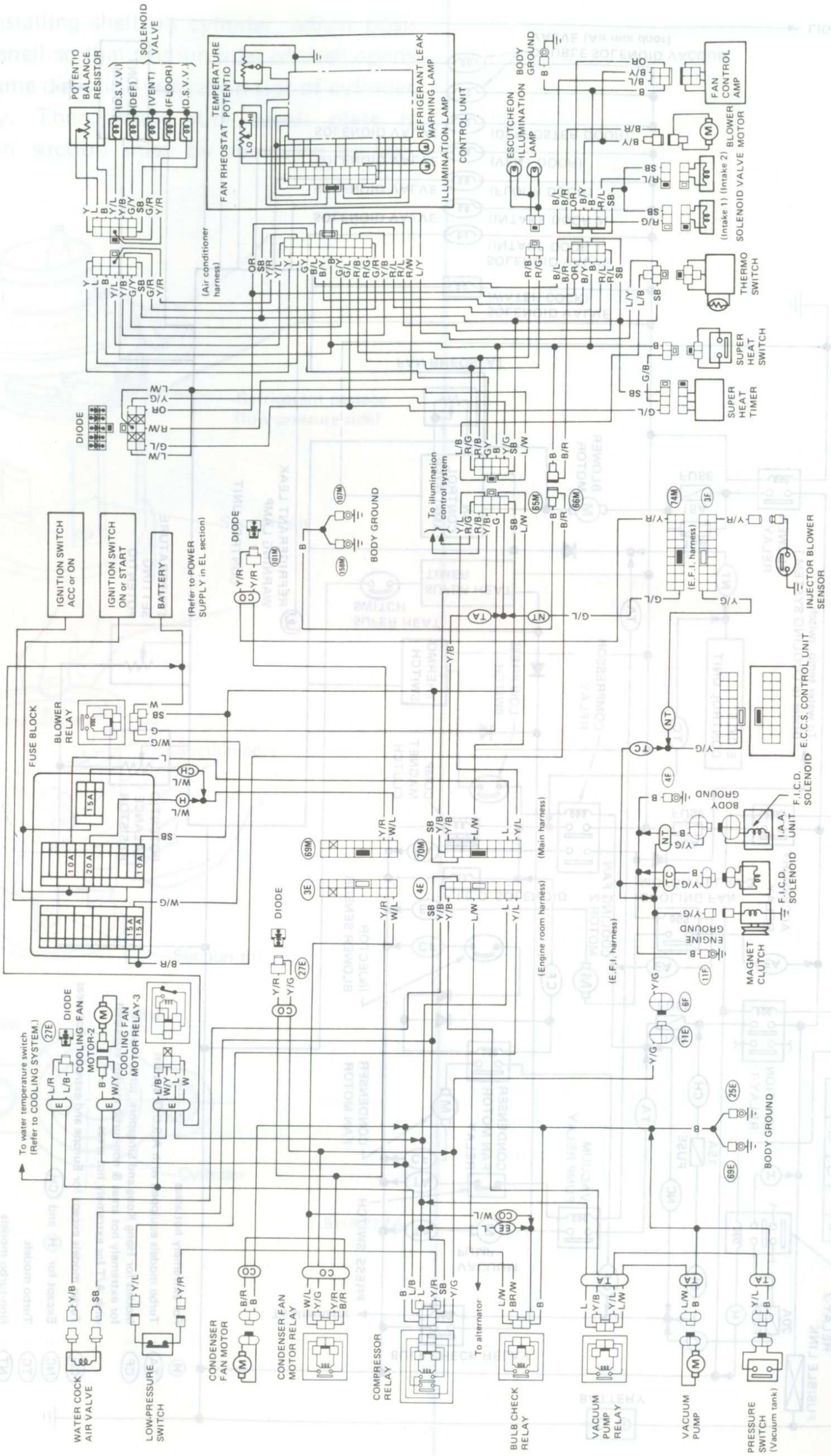
Schematic



SHA421B

A/C ELECTRICAL CIRCUIT (Manual)

Wiring Diagram (L.H. drive model)



SHA422B

(CH) : Turbo models except for Europe and extremely hot areas

(CO) : Turbo models for extremely hot areas & Non-turbo models equipped with A/T for extremely hot areas

(EE) : For Europe & Except for (CO)

(TA) : *Turbo models equipped with A.S.C.D. system*

(TC) : Turbo models

(NT) : Non-turbo models

(E) : For Europe

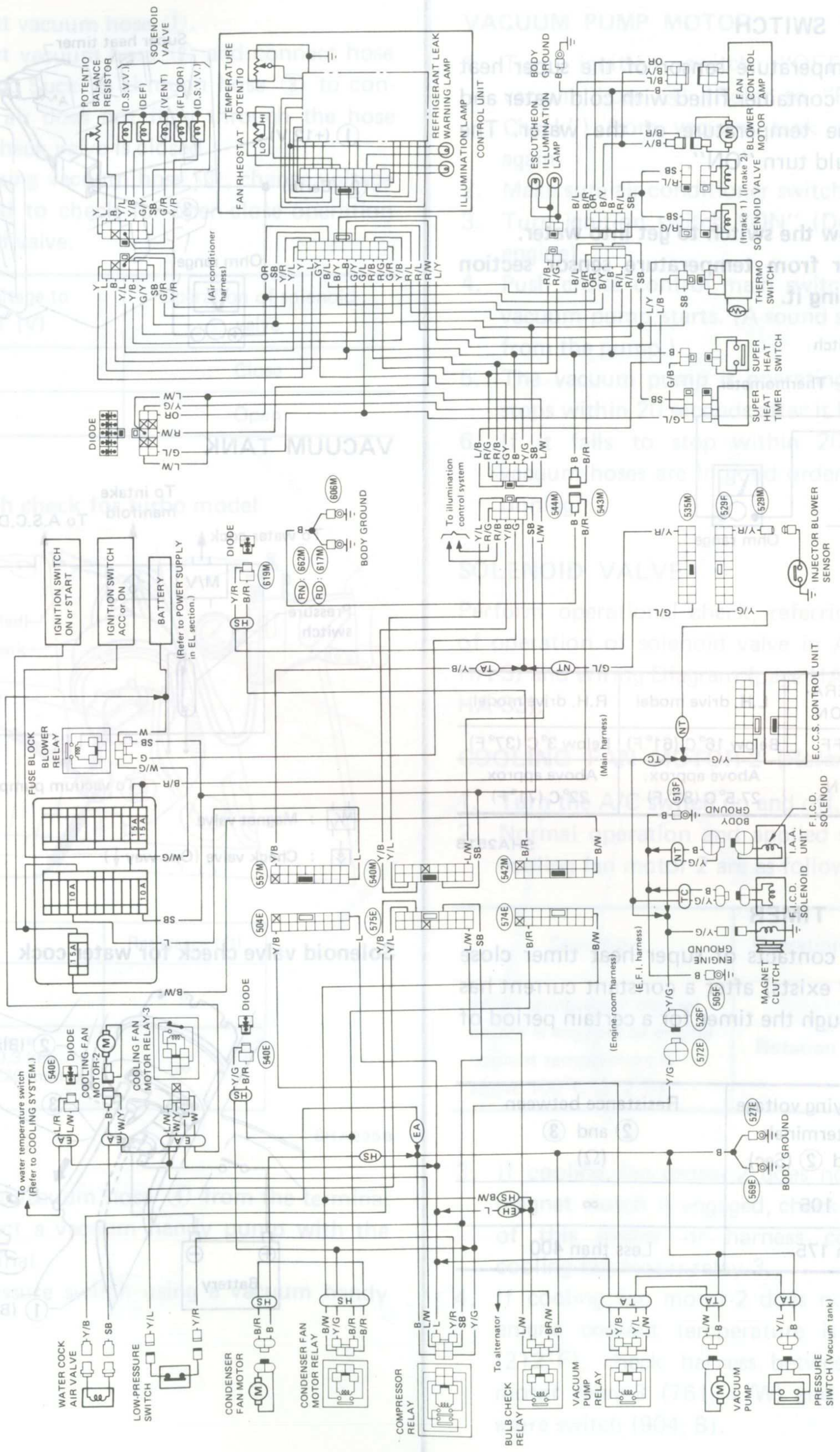
(H) : For extremely hot areas

A/C ELECTRICAL CIRCUIT (Manual)

Wiring Diagram (R.H. drive model)

(EH) : Except for Hong Kong and Singapore
(TA) : Turbo models equipped with A.S.C.D. system
(RN) : Models equipped with needle meter
(RD) : Models equipped with digital meter

(EA) : For Europe and Australia
(TC) : Turbo models
(NT) : Non-turbo models
(HS) : For Hong Kong and Singapore



SHA423B

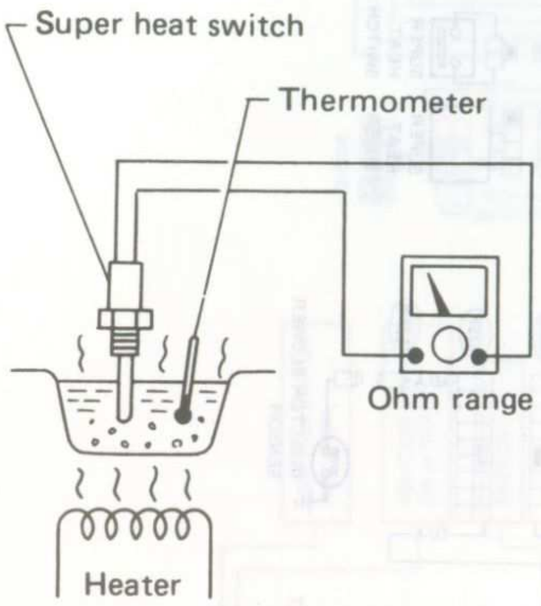
Inspection

SUPER HEAT SWITCH

- Dip the temperature sensor of the super heat switch in a container filled with cold water and increase the temperature of the water. The switch should turn "ON".

NOTICE

- **Do not allow the switch to get into water.**
- **Wipe water from temperature sensor section after checking it.**



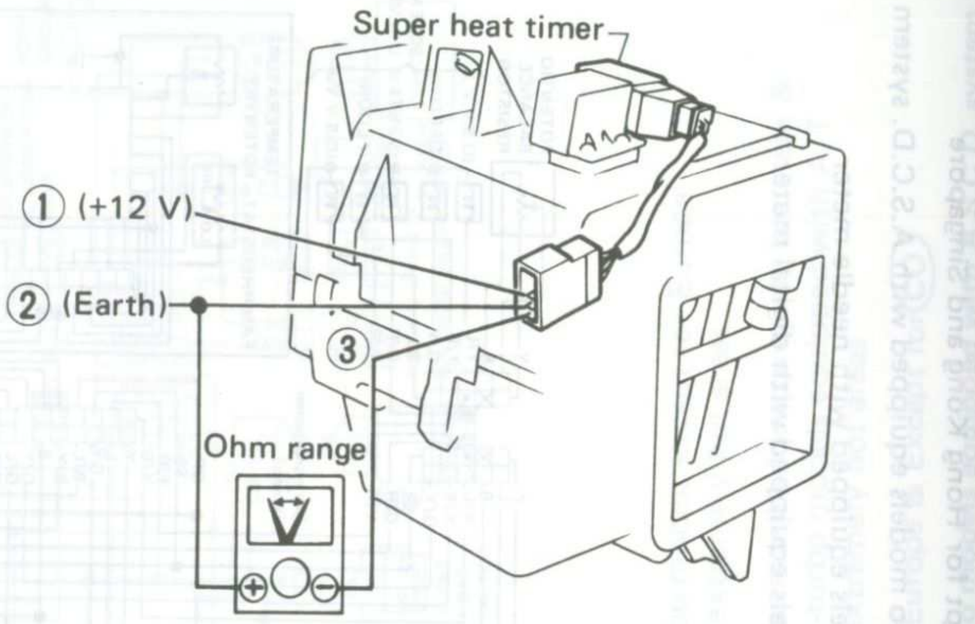
OPERATION	L.H. drive model	R.H. drive model
OFF	Below 16°C (61°F)	Below 3°C (37°F)
ON	Above approx. 27.5°C (82°F)	Above approx. 22°C (71°F)

SHA251B

SUPER HEAT TIMER

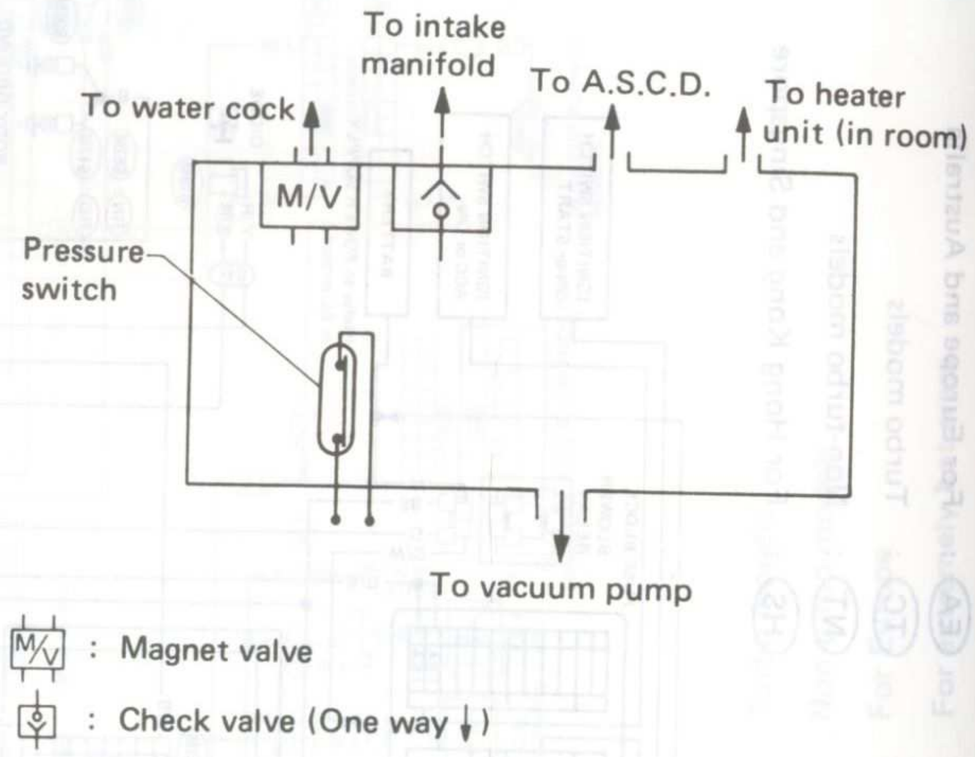
- Make sure contacts of super heat timer close (continuity exists) after a constant current has passed through the timer for a certain period of time.

Time while applying voltage (12V) to the terminals between ① and ② (Sec)	Resistance between ② and ③ (Ω)
Less than 105	∞
More than 175	Less than 400



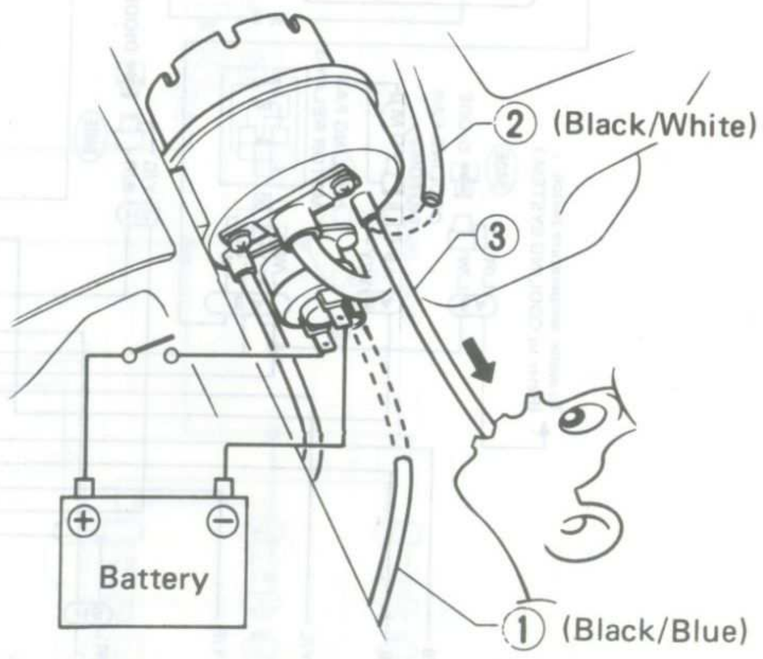
SHA252B

VACUUM TANK



SHA253B

Solenoid valve check for water cock



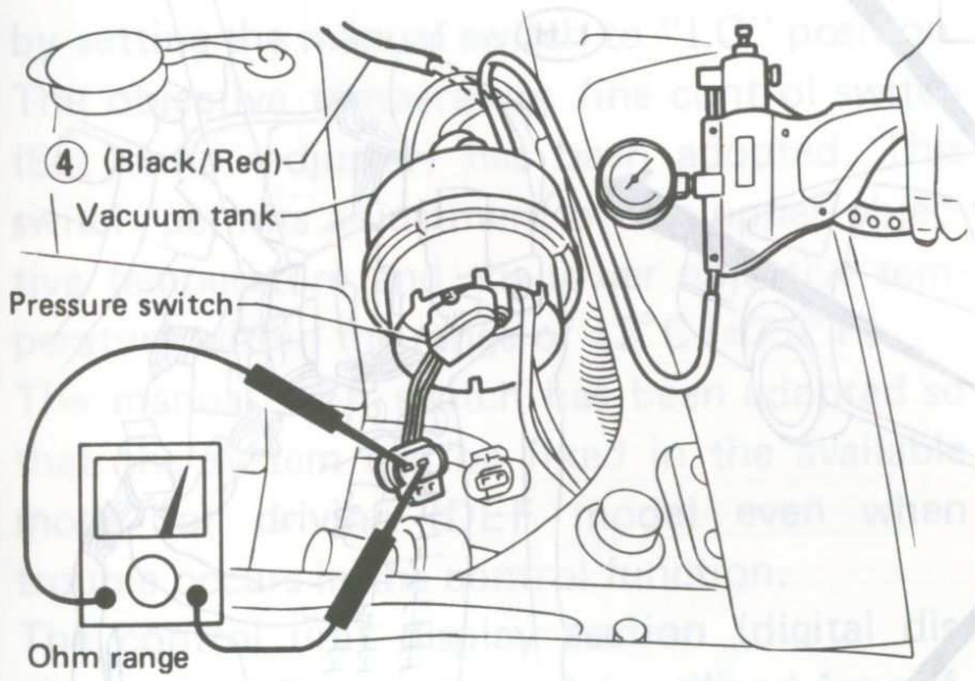
SHA254B

Inspection (Cont'd)

1. Disconnect vacuum hose ①.
2. Disconnect vacuum hose ② and connect hose ③ instead. Suck in through hose ③ to confirm that air does not flow through the hose and that check valve is closed.
3. While sucking vacuum hose ③, change voltage to solenoid to check for open-close operation of solenoid valve.

Applied voltage to solenoid (V)	Operation of solenoid valve
0	Close
12	Open

Pressure switch check for turbo model



Pressure	Resistance (Ω)
Atmospheric pressure	0
Vacuum pressure more than 29.3 kPa (293 mbar, 220 mmHg, 8.66 inHg)	∞

SHA255B

1. Disconnect vacuum hose ④ from the terminal and connect a vacuum handy pump with the same terminal.
2. Check pressure switch using a vacuum handy pump.

VACUUM PUMP MOTOR

1. Turn ignition switch "OFF". Disconnect vacuum hose ④ (Refer to "Pressure Switch Check") from vacuum tank and connect it again.
2. Make sure air conditioner switch is "OFF".
3. Turn ignition switch "ON" (Do not start the engine).
4. Push cruise control main switch to make sure vacuum pump starts. (A sound should be heard from the pump.)
5. The vacuum pump is operating properly if it stops within 20 seconds after it has started.
6. If it fails to stop within 20 seconds, and vacuum hoses are in good order, it is malfunctioning.

SOLENOID VALVE

Perform operational check, referring to the table of operation of solenoid valve in Air Flow (page HA-3) and Wiring Diagram (page HA-8 or HA-32 or HA-33).

COOLING FAN MOTOR-2 (Refer to HA-36.)

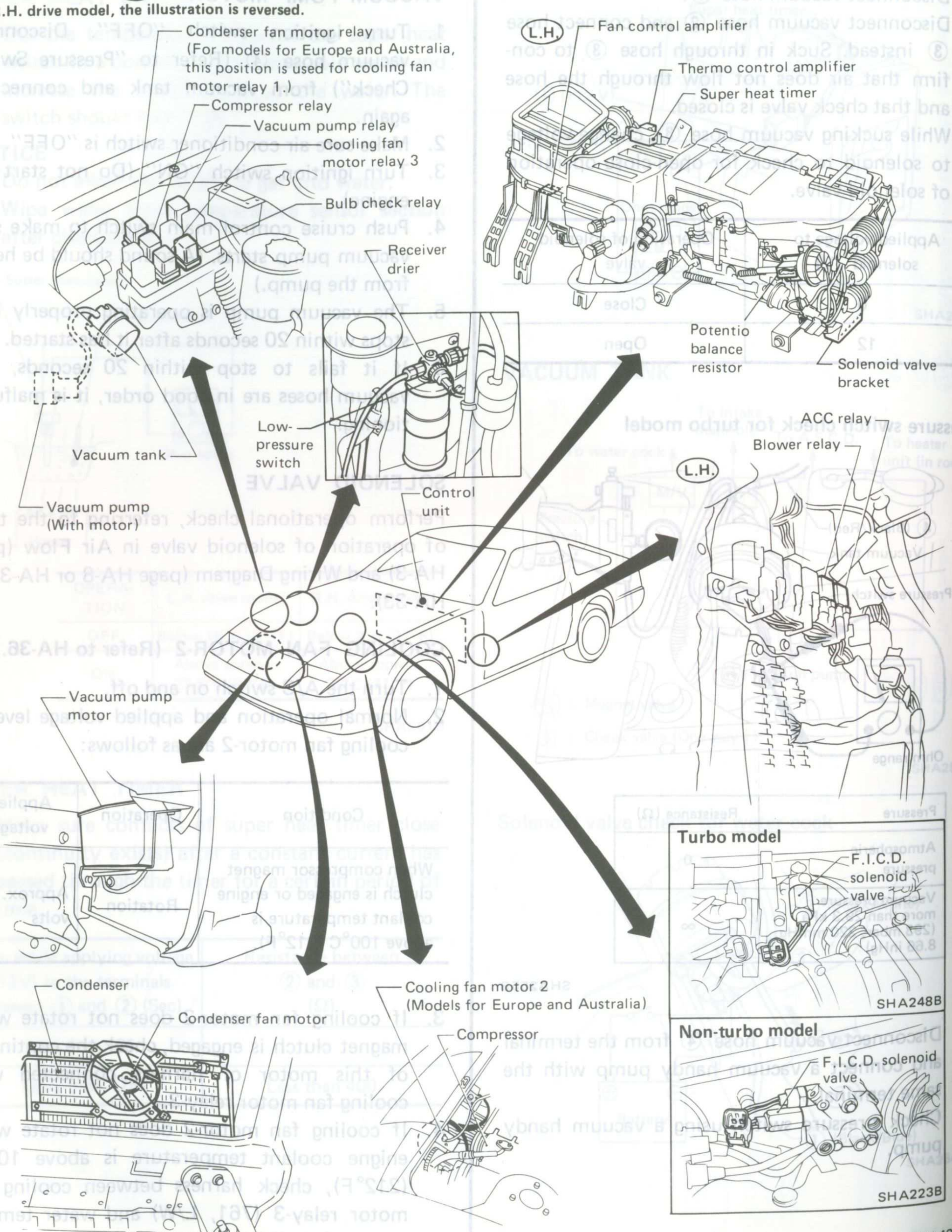
1. Turn the A/C switch on and off.
2. Normal operation and applied voltage level of cooling fan motor-2 are as follows:

Condition	Operation	Applied voltage
When compressor magnet clutch is engaged or engine coolant temperature is above 100°C (212°F).	Rotation	Approx. 12 volts

3. If cooling fan motor-2 does not rotate when magnet clutch is engaged, check the continuity of this motor or harness connected with cooling fan motor relay-3.
4. If cooling fan motor-2 does not rotate when enigne coolant temperature is above 100°C (212°F), check harness between cooling fan motor relay-3 (761, L/W) and water temperature switch (904, B).

LOCATION OF A/C ELECTRICAL COMPONENTS (Manual)

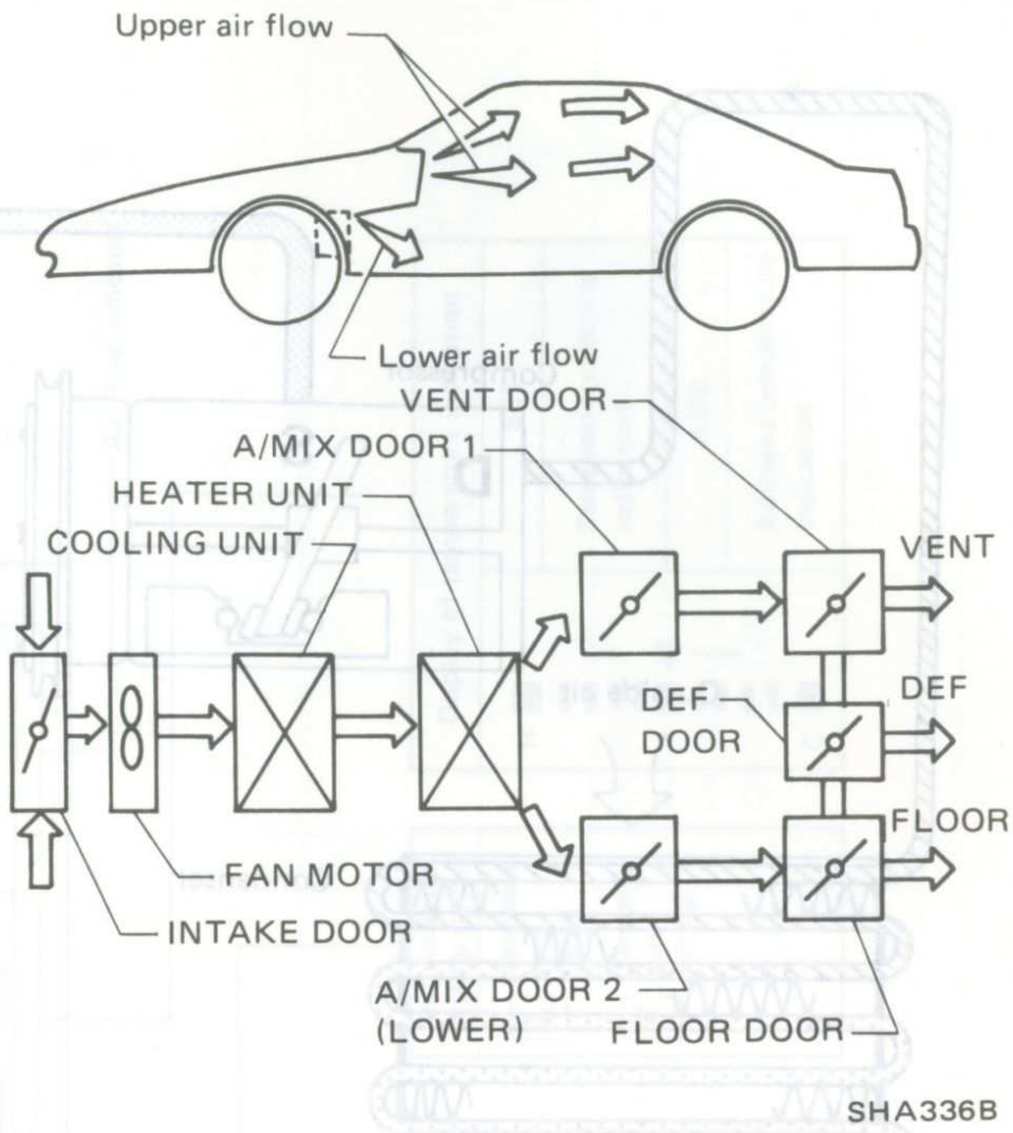
The illustrations with (LH) mark are for L.H. drive model.
For R.H. drive model, the illustration is reversed.



DESCRIPTION — Air Conditioner (Auto)

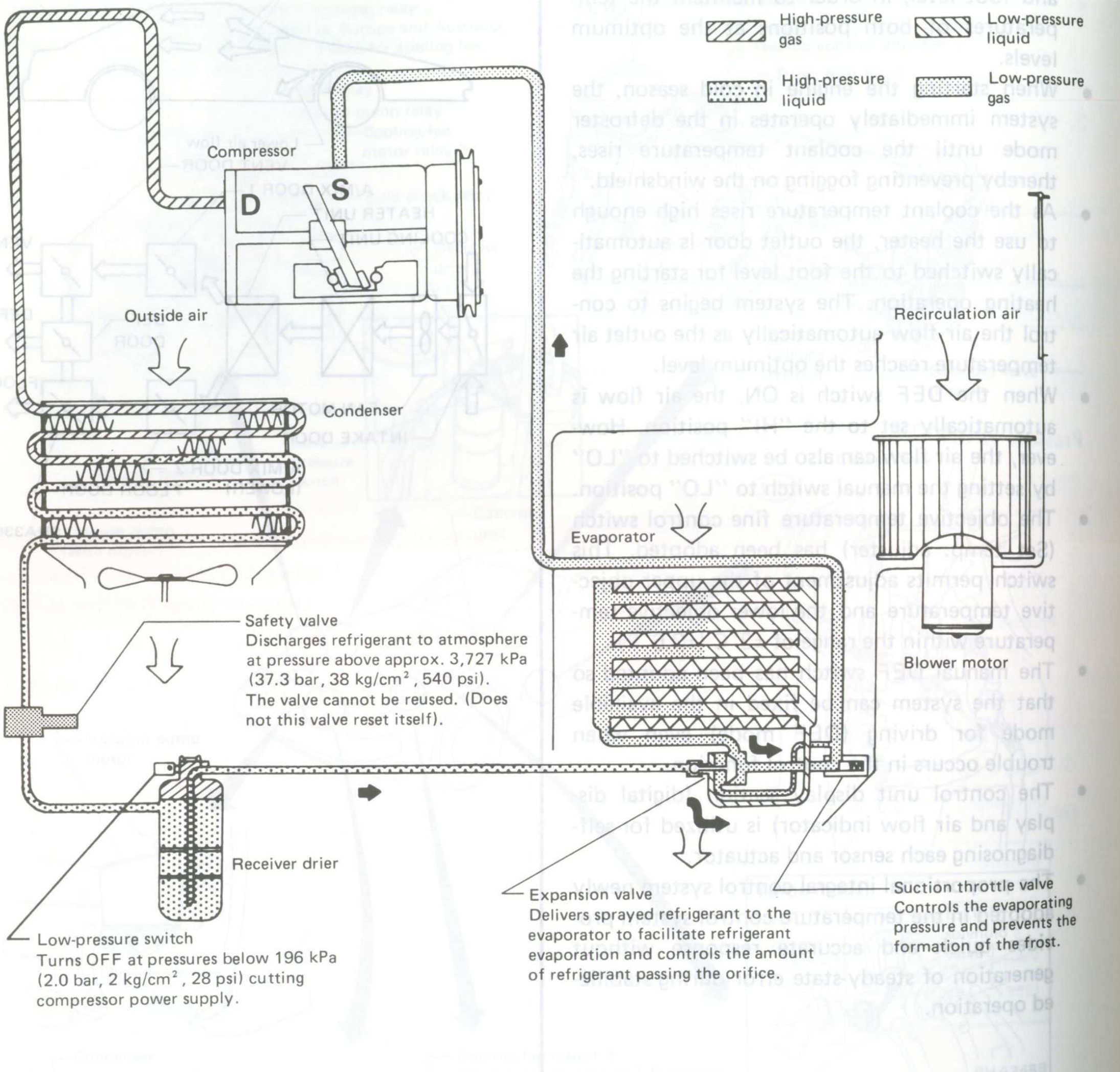
Features

- The vehicle sensors are installed at head level and foot level, in order to maintain the temperatures of both positions at the optimum levels.
- When starting the engine in cold season, the system immediately operates in the defroster mode until the coolant temperature rises, thereby preventing fogging on the windshield.
- As the coolant temperature rises high enough to use the heater, the outlet door is automatically switched to the foot level for starting the heating operation. The system begins to control the air flow automatically as the outlet air temperature reaches the optimum level.
- When the DEF switch is ON, the air flow is automatically set to the "HI" position. However, the air flow can also be switched to "LO" by setting the manual switch to "LO" position.
- The objective temperature fine control switch (Set temp. adjuster) has been adopted. This switch permits adjustment of the upper objective temperature and the lower objective temperature within the range of ±2°C (±3.6°F).
- The manual DEF switch has been adopted so that the system can be fixed in the available mode for driving (DEF mode) even when trouble occurs in the control function.
- The control unit display section (digital display and air flow indicator) is utilized for self-diagnosing each sensor and actuator.
- The proportional integral control system newly adopted in the temperature control system provides quick and accurate response without generation of steady-state error during stabilized operation.



DESCRIPTION — Air Conditioner (Auto)

Refrigeration Cycle

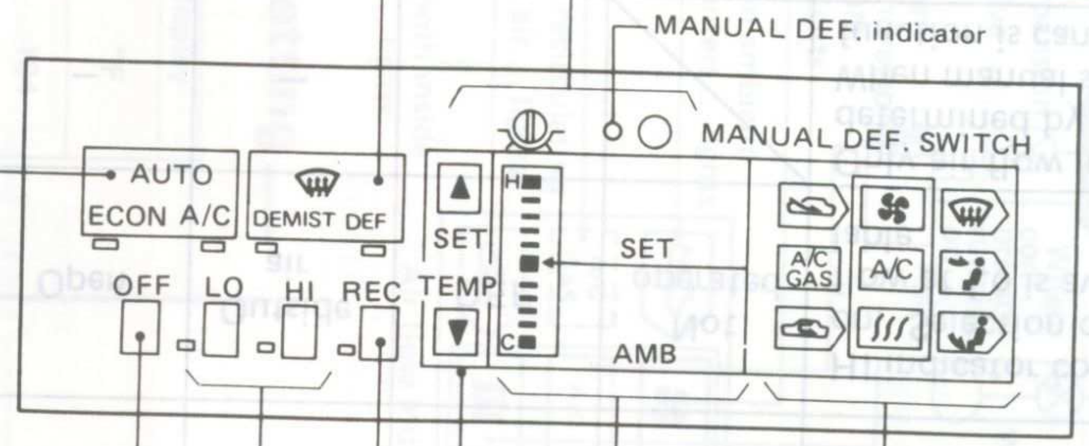


SHA276B

	AUTO SWITCH	
	ECONOMY	A/C
Intake door position	Outside air	Automatic control
Air flow volume	Automatic control	←
Outlet	Automatic control	←
Compressor	OFF	ON [Outside air above 0°C (32°F)]
Outlet temperature	Automatic temperature fine-adjustment	←

	DEF SWITCH	
	DEMIST	DEF
Intake door position	Automatic control	Outside air
Air flow volume	Automatic control	HI (MAX)
Outlet	DEF. and foot	Defroster
Compressor	ON [Ouside air above 0°C (32°F)]	←
Outlet temperature	Automatic temperature fine-adjustment	Full hot

SET TEMP ADJUSTER	MANUAL DEF
− +	○
As head, foot (Set minute temperature difference between upper and lower body)	PUSH ... DEF Mode (Lock) Compressor off When pushed again ... return Press to override automatic operation in case of system malfunction.



OFF SWITCH	
Blower motor	OFF
Compressor	OFF
Intake door position	Outside air
Outlet	DEF

Manual fan switch	
LO	HI
Set LO position with FAN switch. Set AUTO switch with other switch. Obey switch	Set HI position with FAN switch. Set AUTO switch with other switch. Obey switch

REC SWITCH
Set inside air recirculation outlet. When setting AUTO switch (A/C, ECON), it runs for ten minutes with its timer.

Temperature setting switch	
▲	Temperature rising
▼	Temperature falling

Display of temperature indication	
H ■	SET
■	Temperature setting indication
■	AMB
C ■	Ambient temperature indication

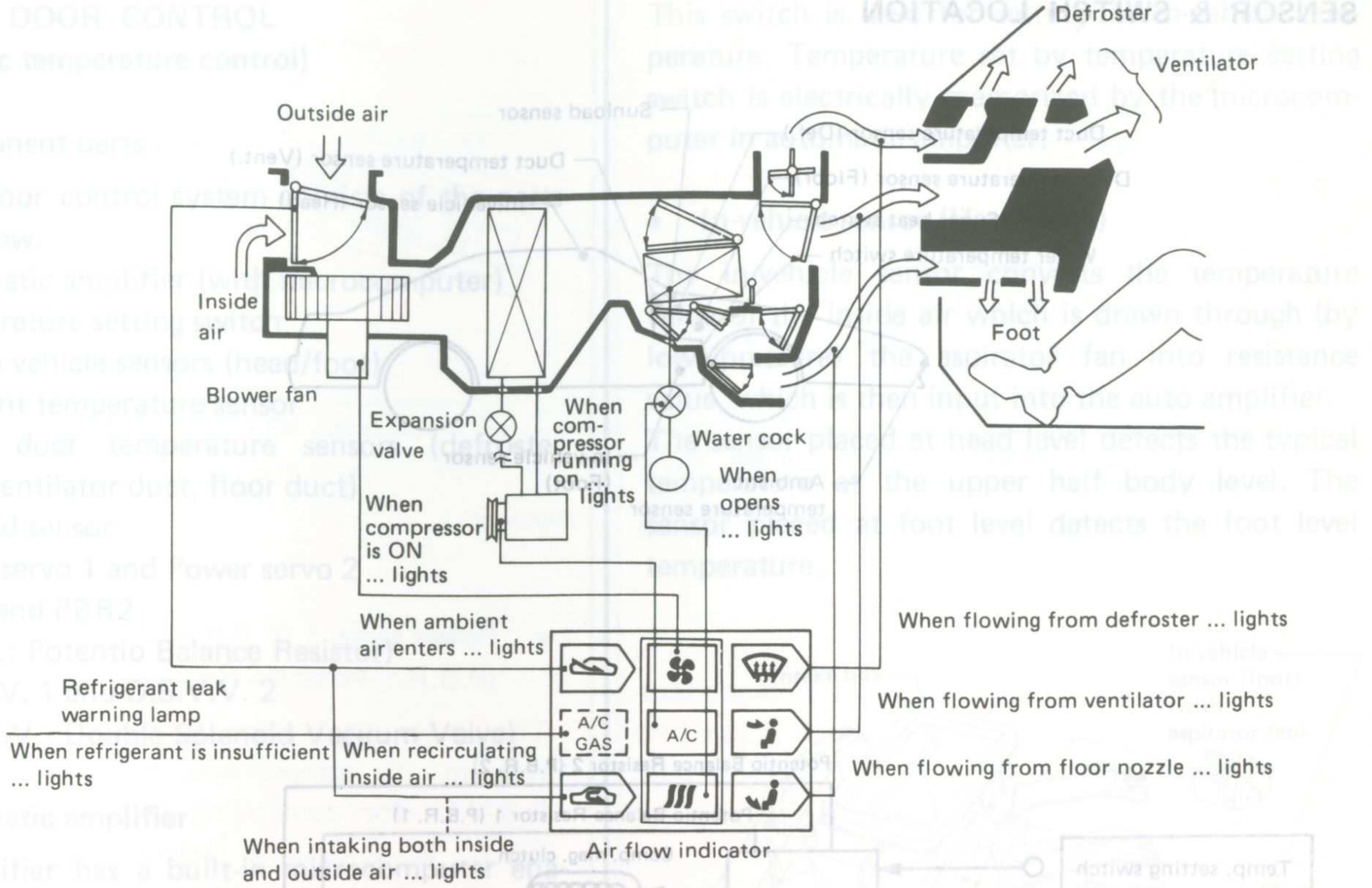
SHA282B

(3) SWITCHES AND THEIR CONTROL FUNCTIONS

Switch \ Item to be controlled		Air flow	A/M door	Compressor	Water cock (W/C)	Intake air	Air outlet	Control When starting	Remarks
OFF		OFF	Auto	OFF	Auto	Outside air	DEF		Display (SET)/(AMB) is ON with ignition switch set to ACC. A/M door and W/C control air temperature obtained by ram pressure.
AUTO SW	A/C	Auto	Auto	ON [OFF below 0°C (32°F) amb. temp.]	Auto	Auto	Auto	Operated	A/C – ECON momentary switch (A/C has priority over ECON.)
	ECON	Auto	Auto	OFF	Auto	Outside air	Auto	Operated	
SW	DEMIST	Auto	Auto	ON [OFF below 0°C (32°F) amb. temp.]	Auto	Auto	DEF and foot	Operated	DEF – DEMIST momentary switch (DEF has priority over DEMIST.)
	DEF	HI	Full-Hot	ON [OFF below 0°C (32°F) amb. temp.]	Open	Outside air	DEF	Not operated	HI indicator comes on. Selection of air flow at Lo is available.
Manual fan SW	Lo	Lo	–	–	–	–	–		Only air flow in Lo mode. All others are as determined by AUTO and "SW" switches. When manual switch is pushed again, control function is cancelled.
	HI	HI	–	–	–	–	–		Only air flow in HI mode. All others are as determined by AUTO and "SW" switches. When manual switch is pushed again, control function is cancelled.
REC		–	–	–	–	Inside air recirculation	–		REC function is activated only by AUTO switch (A/C or ECON). REC switch is provided with timer which cancels REC function 10 minutes after it has turned on.
MANUAL DEF		HI	Full-Hot	OFF	Open	Outside air	DEF		Pushing this switch again returns to previous condition.
SET TEMP ADJUSTER		–	–	–	–	–	–	–	Air temperatures at head and foot levels are adjustable to ±2°C (±3.6°F), regardless of operation of any other switch.

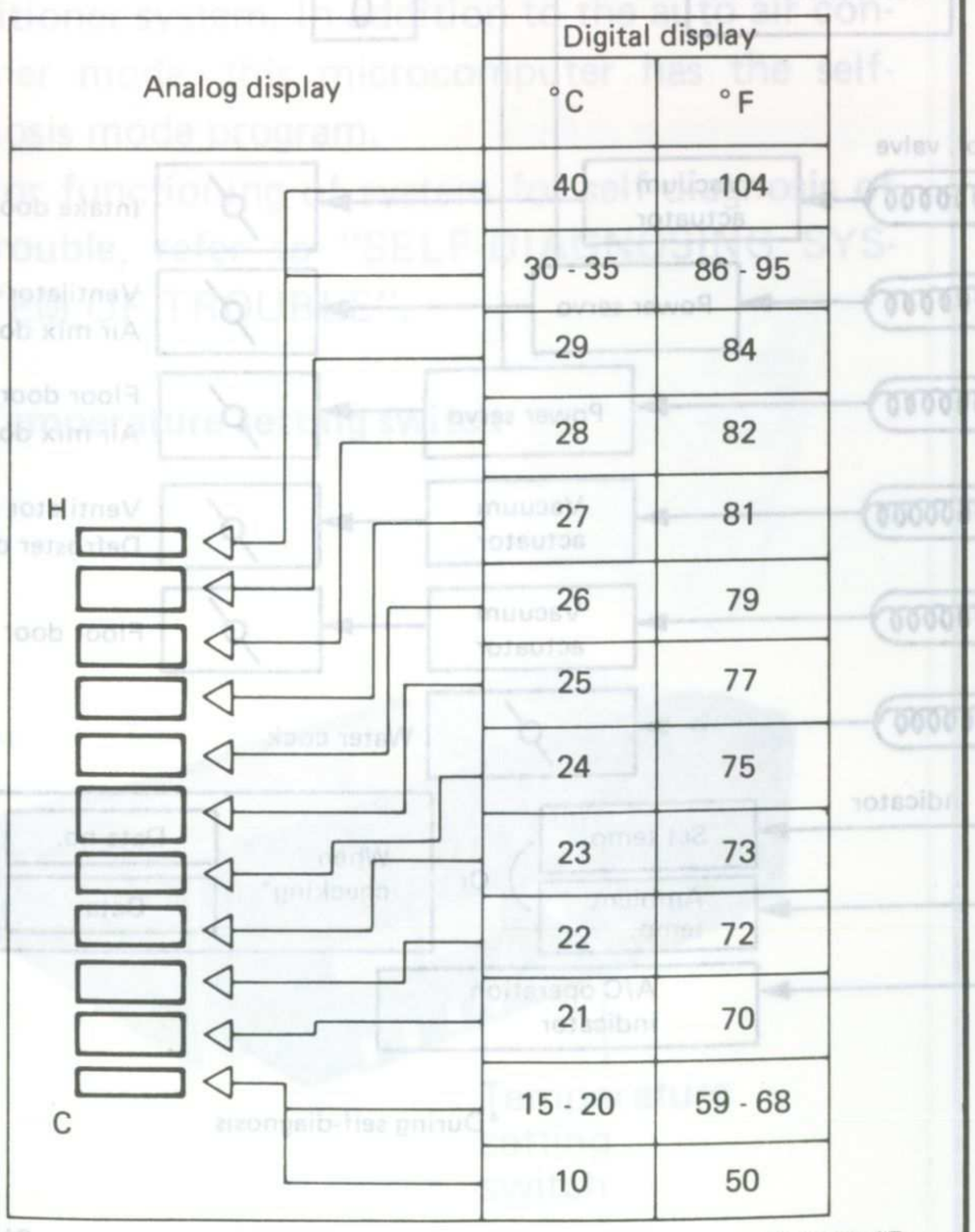
DESCRIPTION — Air Conditioner (Auto)

Display of the Air Flow Indicator



SHA283B

Display of Temperature Setting

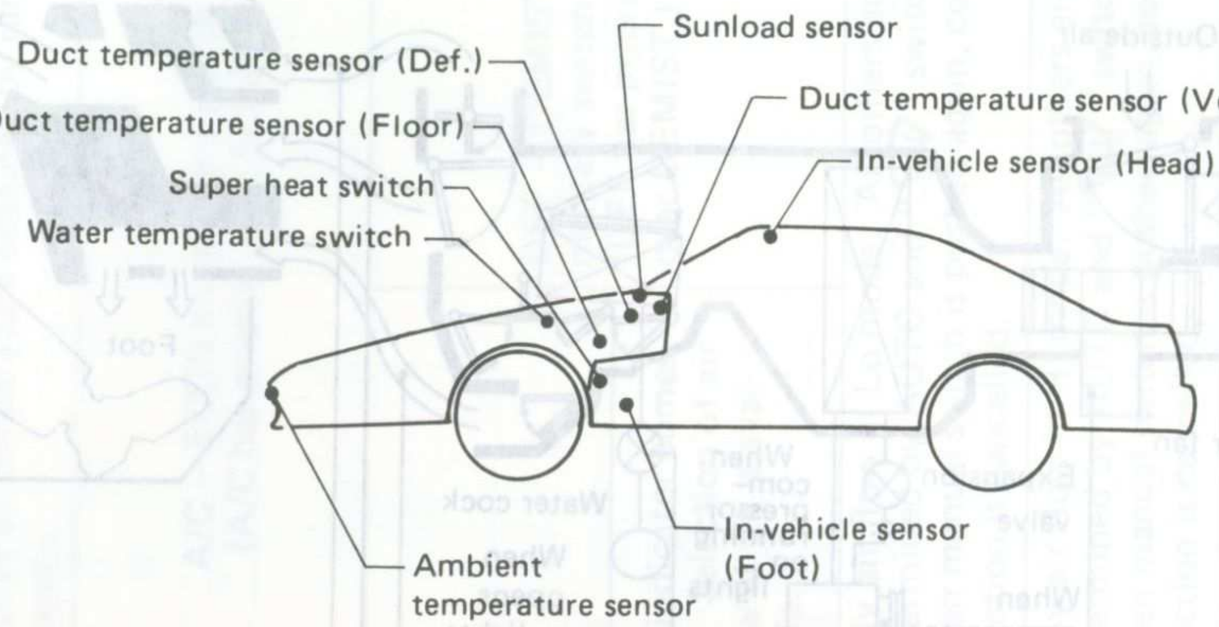


SHA284B

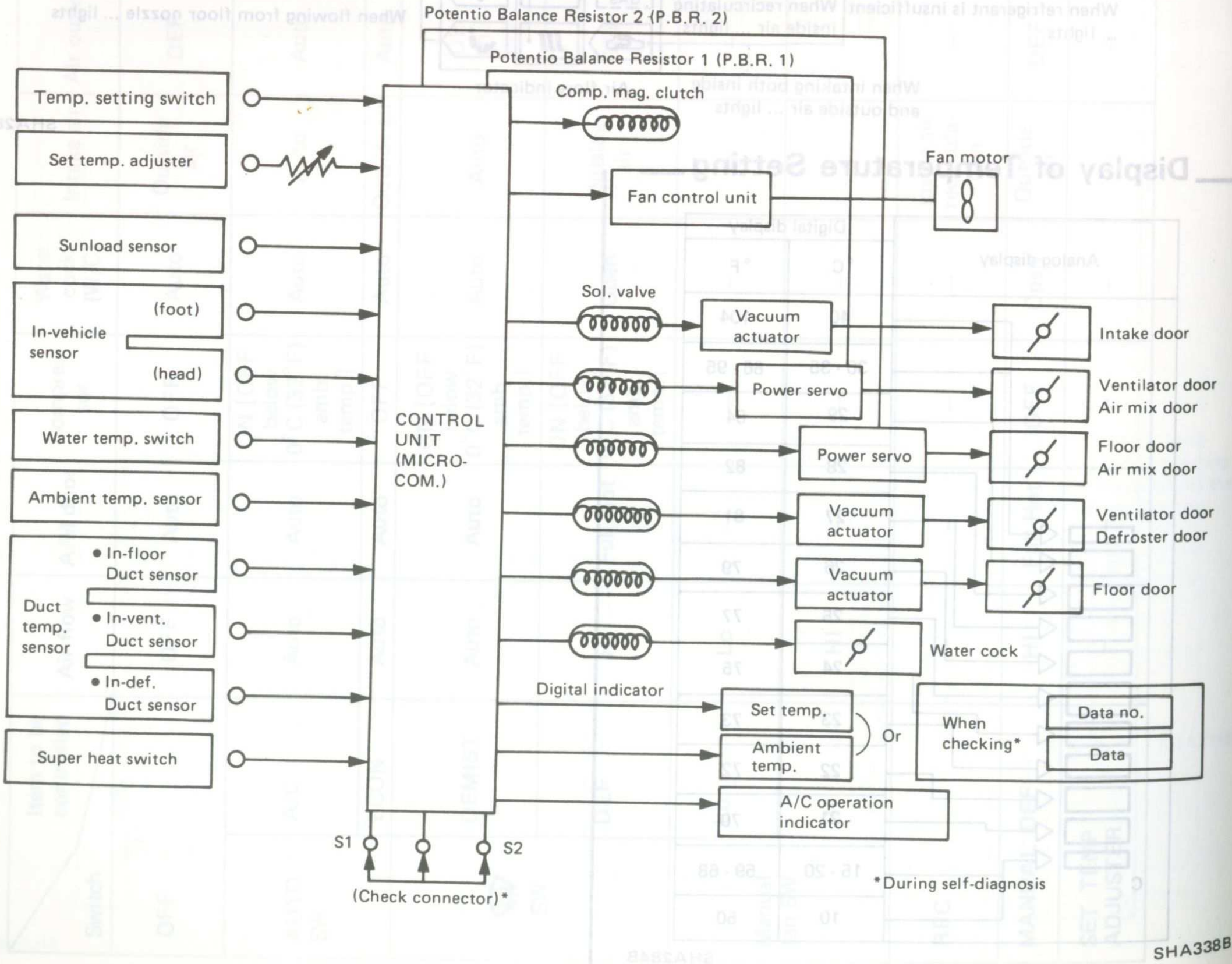
DESCRIPTION — Air Conditioner (Auto)

Control System

SENSOR & SWITCH LOCATION



SHA337B



SHA338B

DESCRIPTION — Air Conditioner (Auto)

System Operation (Air mix door control)

AIR MIX DOOR CONTROL (Automatic temperature control)

1. Component parts

Air mix door control system consists of the parts shown below.

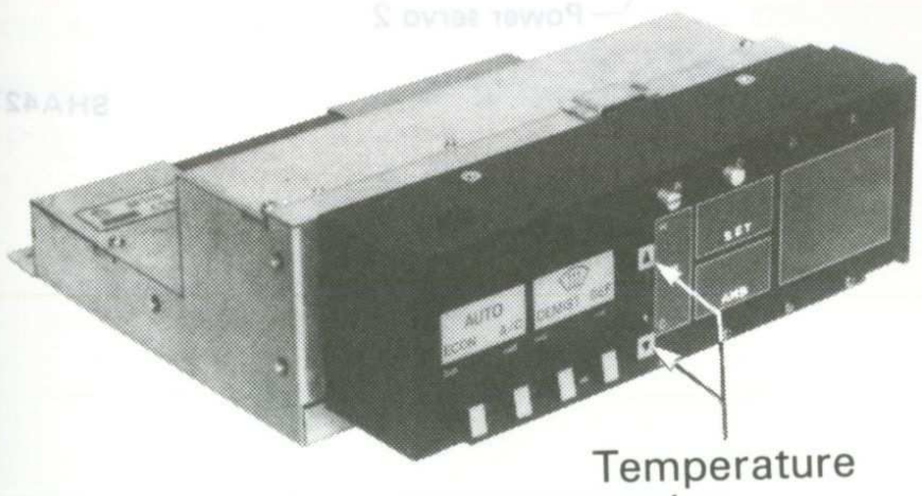
1) Automatic amplifier (with microcomputer)
2) Temperature setting switch
3) Two in vehicle sensors (head/foot)
4) Ambient temperature sensor
5) Three duct temperature sensors (defroster duct, ventilator duct, floor duct)
6) Sunload sensor
7) Power servo 1 and Power servo 2
8) PBR1 and PBR2
   (P.B.R.: Potentio Balance Resistor)
9) D.S.V.V. 1 and D.S.V.V. 2
   (D.S.V.V.: Double Solenoid Vacuum Valve)

- **Automatic amplifier**

This amplifier has a built-in microcomputer enabling it to deal with data and to provide precise control, which is necessary for driving the auto air conditioner system. In addition to the auto air conditioner mode, this microcomputer has the self-diagnosis mode program.

* For functioning of system for self-diagnosis of trouble, refer to "SELF-DIAGNOSING SYSTEM OF TROUBLE".

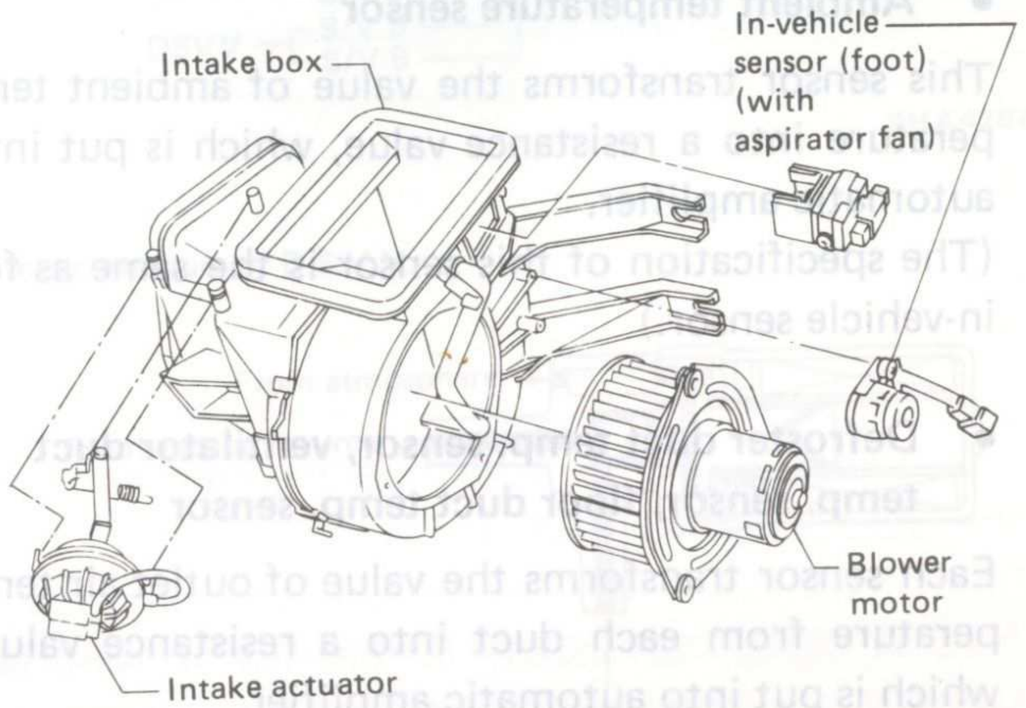
- **Temperature setting switch**



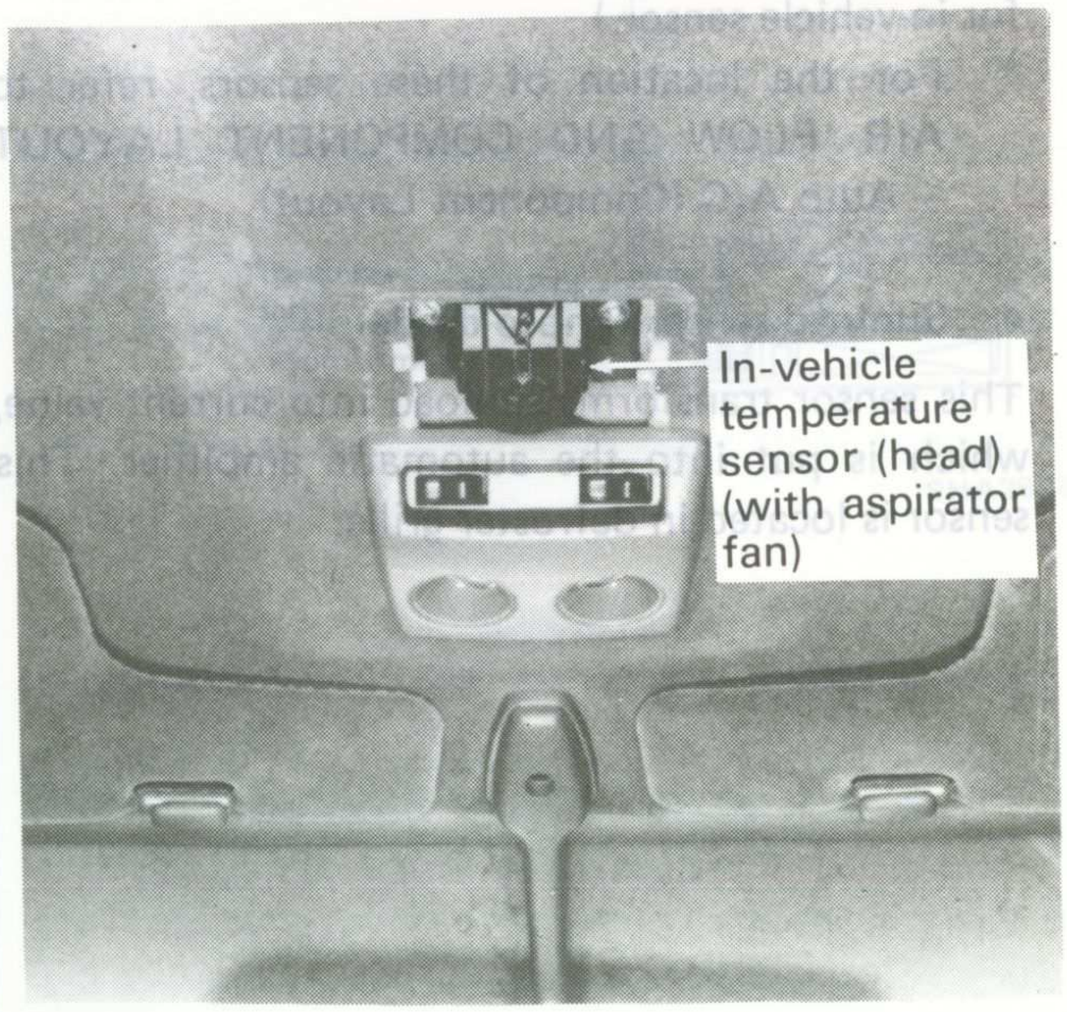
This switch is used for setting the in-vehicle temperature. Temperature set by temperature setting switch is electrically memorized by the microcomputer in automatic amplifier.

- **In-vehicle sensor (Head, foot)**

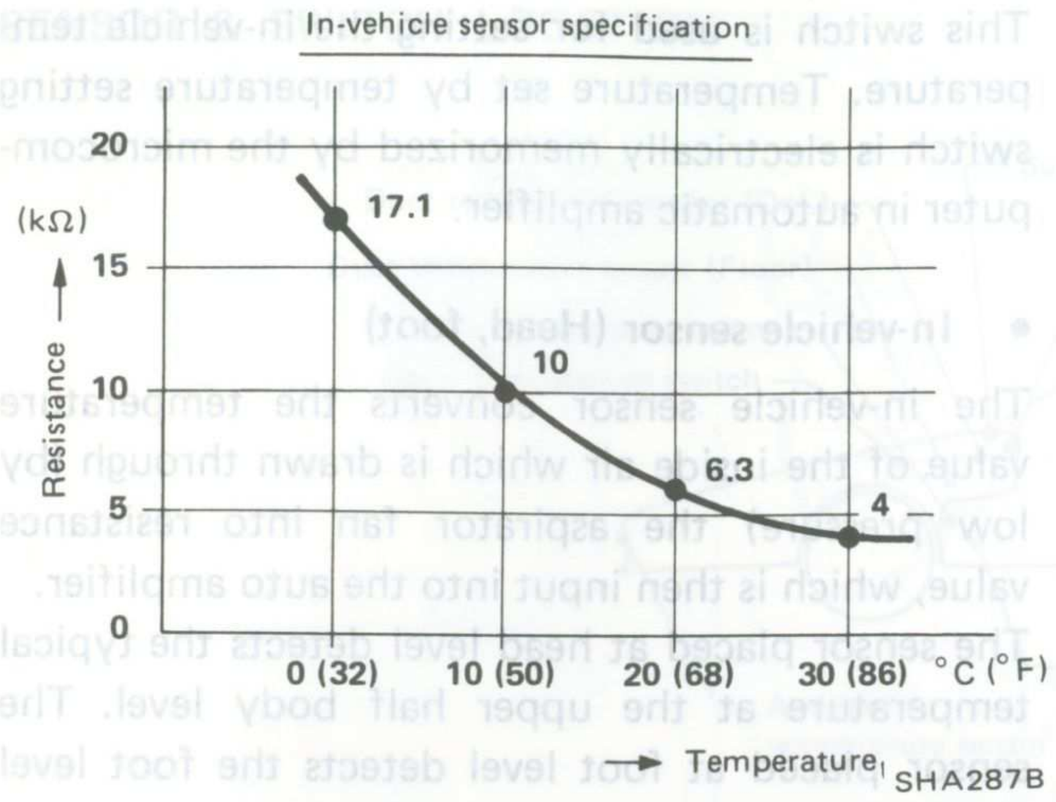
The in-vehicle sensor converts the temperature value of the inside air which is drawn through (by low pressure) the aspirator fan into resistance value, which is then input into the auto amplifier. The sensor placed at head level detects the typical temperature at the upper half body level. The sensor placed at foot level detects the foot level temperature.



SHA426B



System Operation (Air mix door control) (Cont'd)



- **Ambient temperature sensor**

This sensor transforms the value of ambient temperature into a resistance value, which is put into automatic amplifier.
(The specification of this sensor is the same as for in-vehicle sensor.)

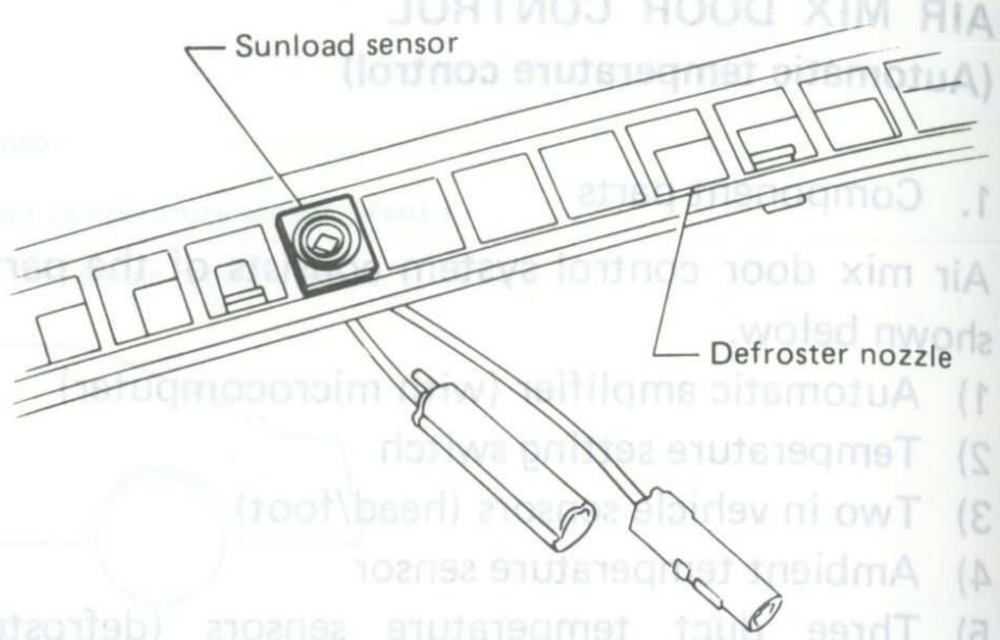
- **Defroster duct temp. sensor, ventilator duct temp. sensor, floor duct temp. sensor**

Each sensor transforms the value of outlet air temperature from each duct into a resistance value, which is put into automatic amplifier.
(The specification of these sensors is the same as for in-vehicle sensor.)

* For the location of these sensors, refer to AIR FLOW AND COMPONENT LAYOUT — Auto A/C (Component Layout).

- **Sunload sensor (Photo diode)**

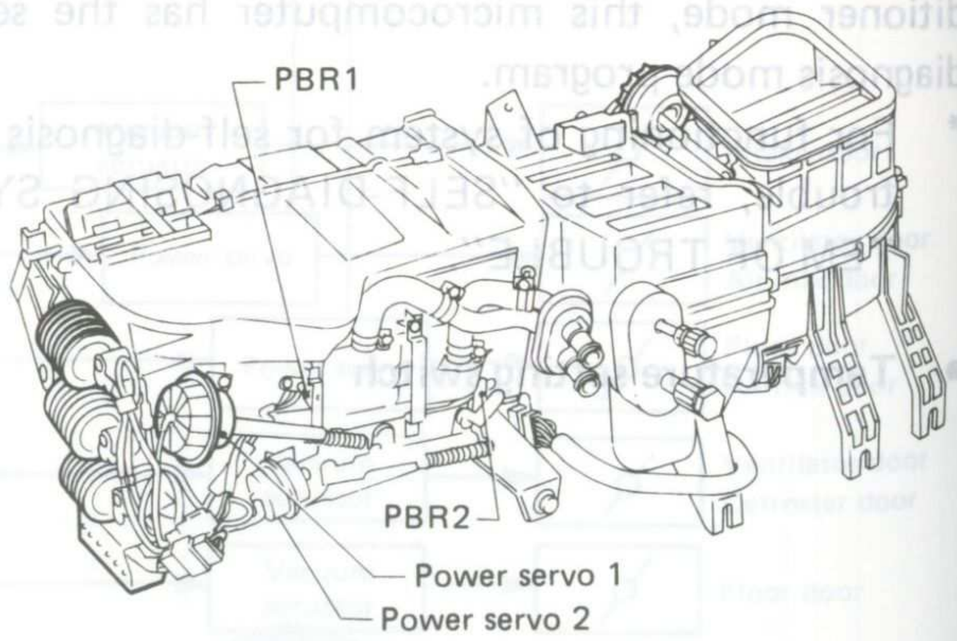
This sensor transforms sunload into current value, which is put into the automatic amplifier. This sensor is located in defroster grille.



SHA299B

- **Power servo 1, 2 P.B.R. 1, 2 (P.B.R.: Potentio Balance Resistor)**

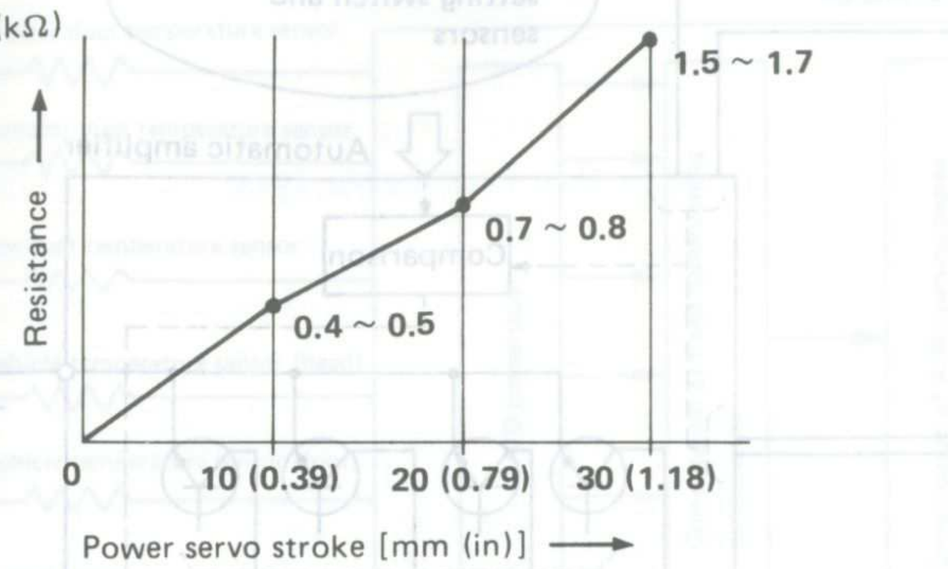
The power servo varies its stroke depending on the vacuum or atmospheric pressure led through D.S.V.V. for controlling the air mix door. The P.B.R. is a variable resistor interlinked to the power servo, and the air mix door position (opening) information is input into the auto amplifier in terms of resistance value.



SHA427B

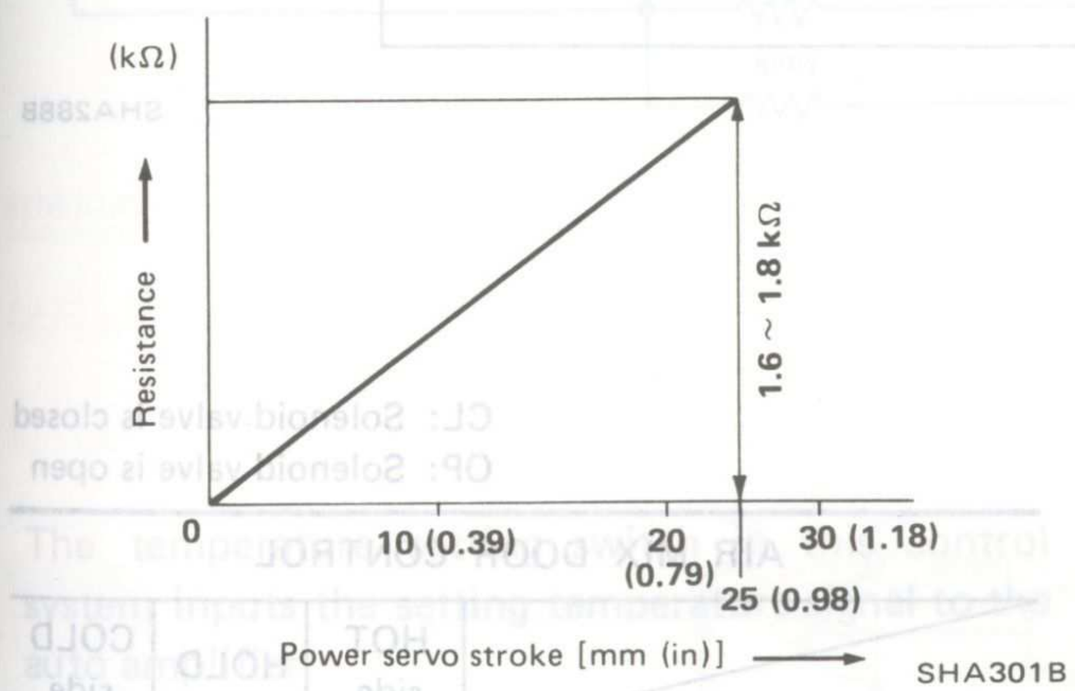
System Operation (Air mix door control) (Cont'd)

P.B.R. 1



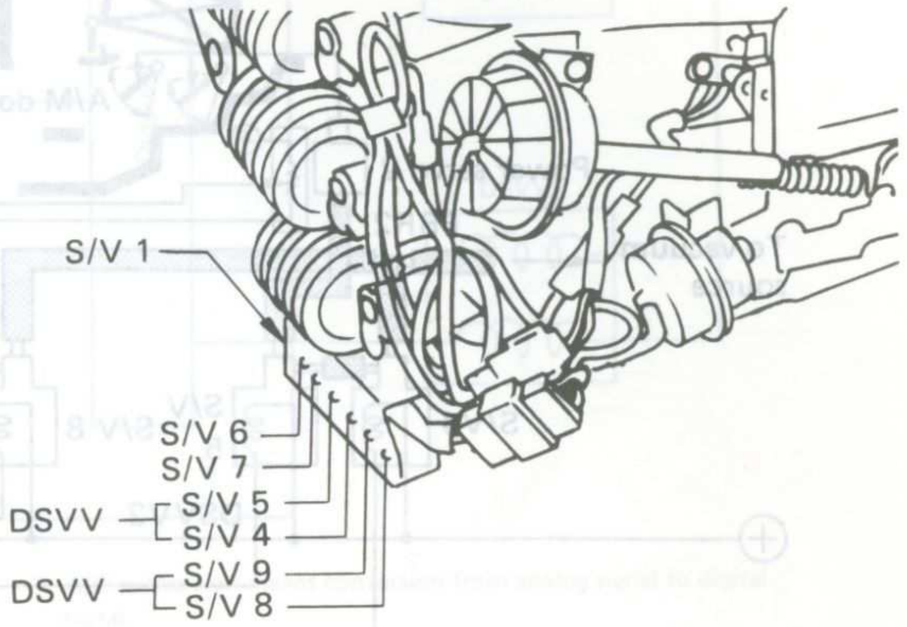
SHA300B

P.B.R. 2



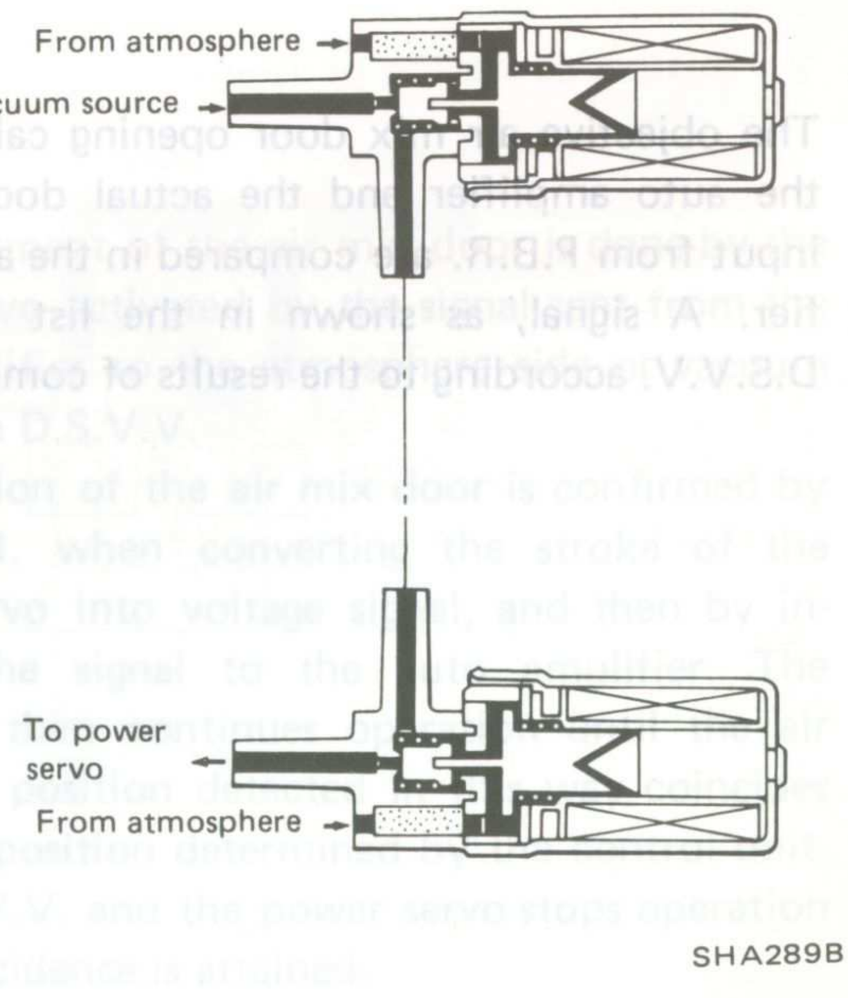
SHA301B

- **D.S.V.V. (Double Solenoid Vacuum Valve)**
  D.S.V.V. can drive the power servo, because it transforms the electric signal from automatic amplifier into vacuum pressure or atmospheric pressure.



SHA428B

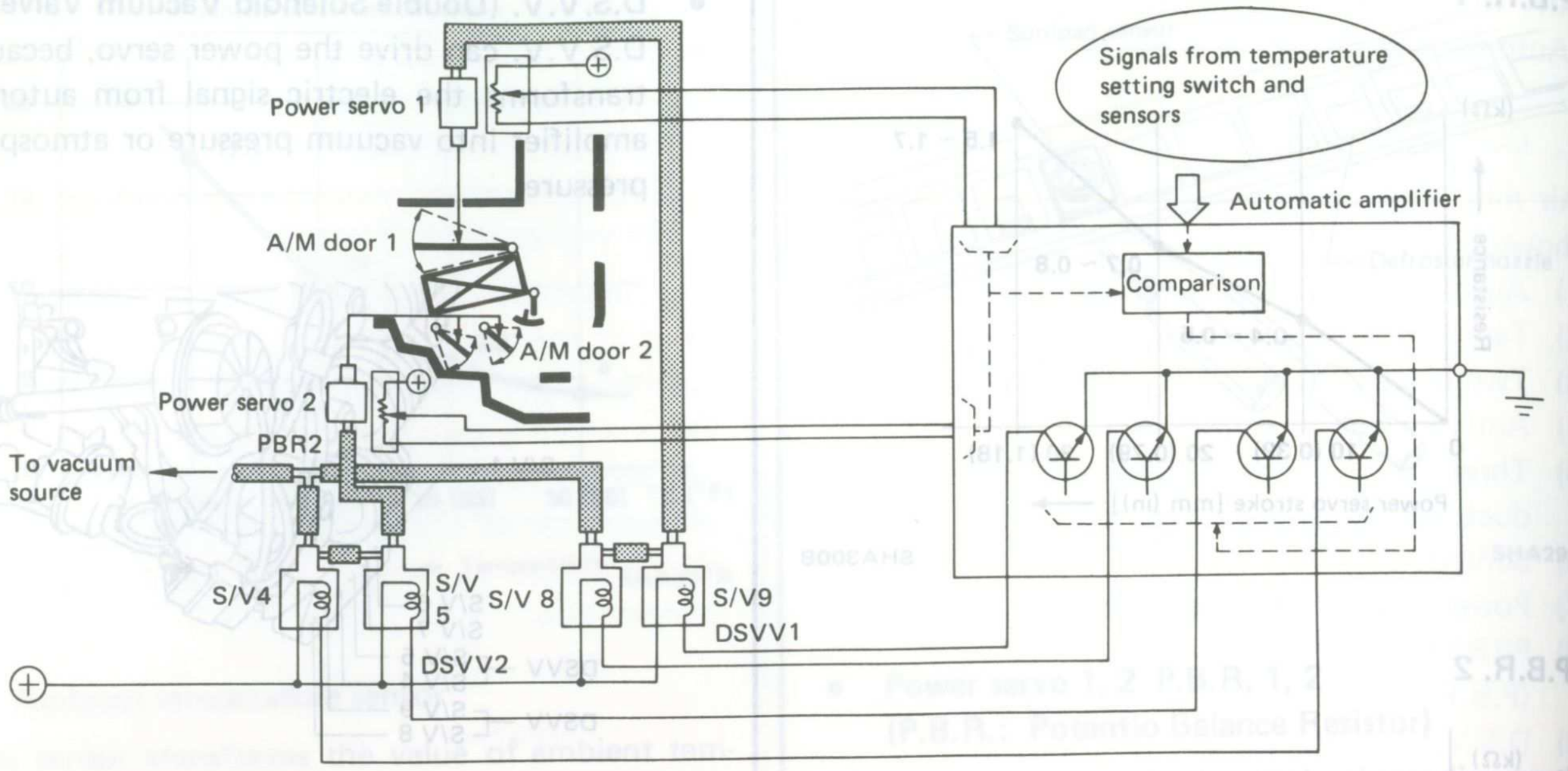
Inner structure of D.S.V.V.



SHA289B

DESCRIPTION — Air Conditioner (Auto)

System Operation (Air mix door control) (Cont'd)



SHA288B

The objective air mix door opening calculated in the auto amplifier and the actual door opening input from P.B.R. are compared in the auto amplifier. A signal, as shown in the list is sent to D.S.V.V. according to the results of comparison.

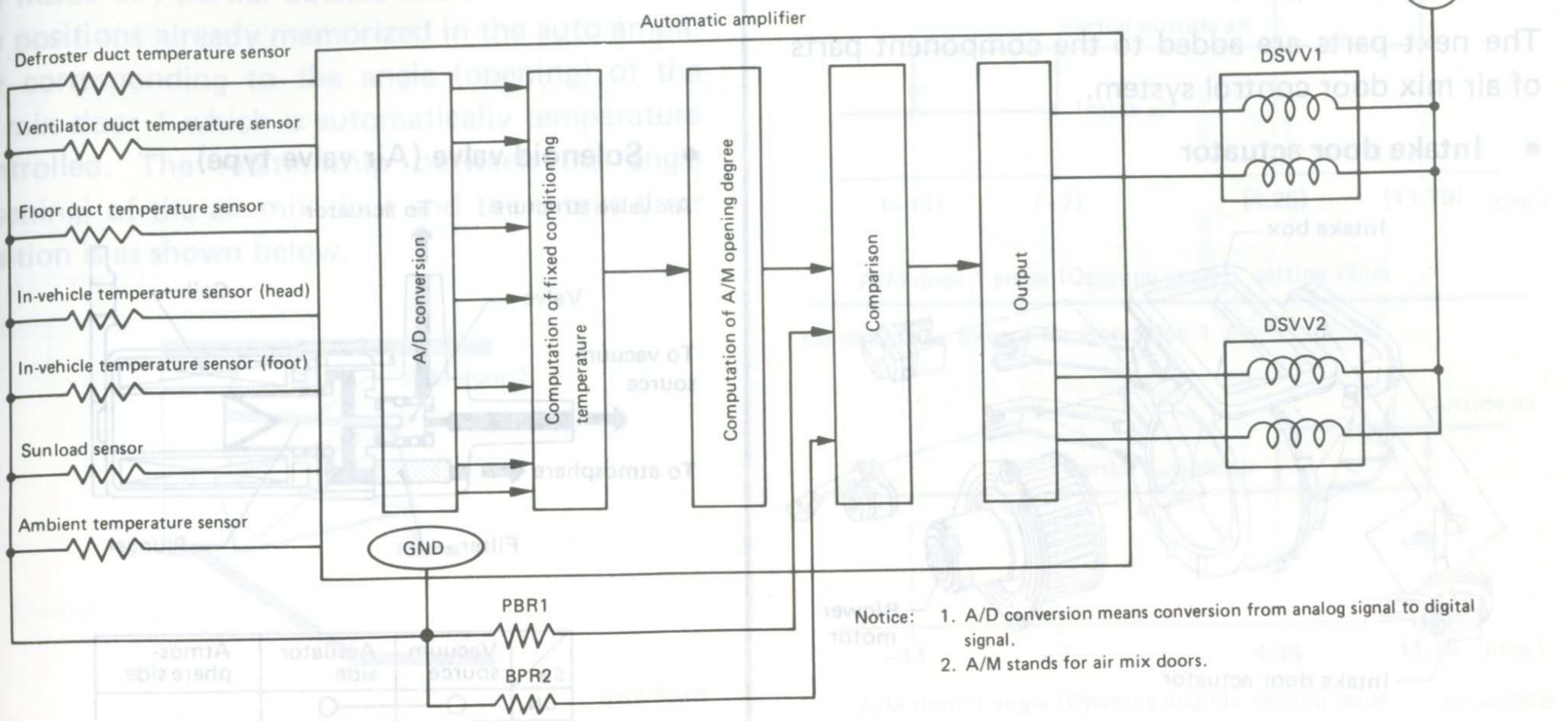
CL: Solenoid valve is closed
OP: Solenoid valve is open

AIR MIX DOOR CONTROL

			HOT side	HOLD	COLD side
Air mix door 1	Operation of solenoid valve	S/V8	CL	CL	OP
		S/V9	OP	CL	OP
Air mix door 2		S/V4	CL	CL	OP
		S/V5	OP	CL	OP

System Operation (Air mix door control) (Cont'd)

2. System operation of air mix door control



Notice: 1. A/D conversion means conversion from analog signal to digital signal.
2. A/M stands for air mix doors.

SHA290B

The temperature setting switch in this control system inputs the setting temperature signal to the auto amplifier.
The in-vehicle sensor, sunload sensor, ambient air temperature sensor, and duct temperature sensor also input the resistance value signals respectively to the auto amplifier corresponding to their conditions.
Receiving these input signals, the auto amplifier calculates the desirable air mix door position and causes the air mix door to move to the calculated position from its actual position detected by P.B.R. 1.

This movement of the air mix door is done by the power servo activated by the signal sent from the auto amplifier to the atmosphere side or vacuum side of the D.S.V.V.
The position of the air mix door is confirmed by the P.B.R. when converting the stroke of the power servo into voltage signal, and then by inputting the signal to the auto amplifier. The D.S.V.V. then continues operation until the air mix door position detected in this way coincides with the position determined by the control unit. The D.S.V.V. and the power servo stops operation once coincidence is attained.

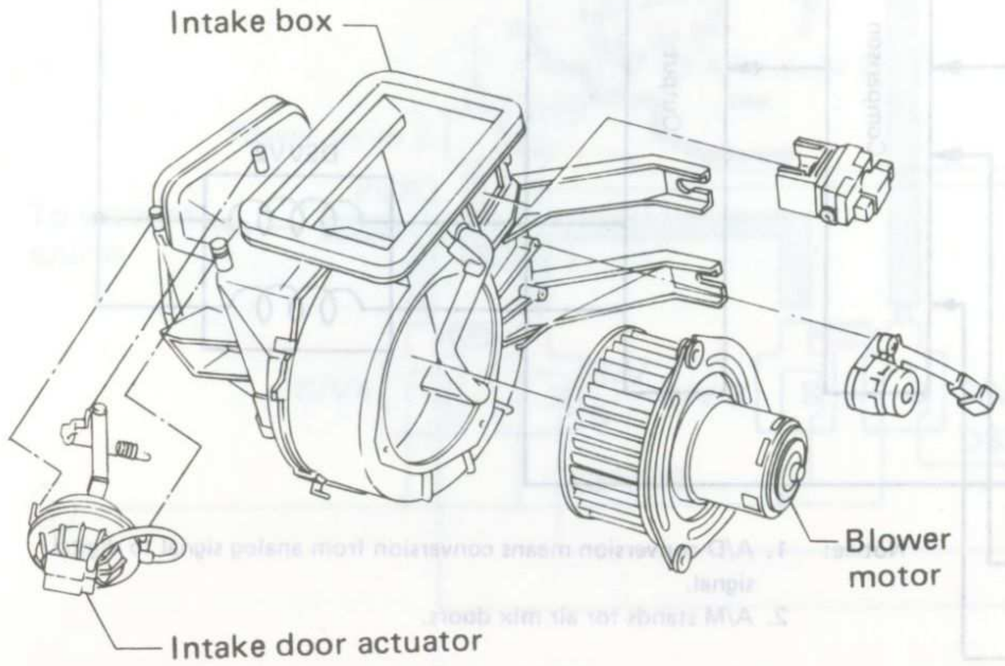
System Operation (Intake door control)

INTAKE DOOR CONTROL

1. Component parts

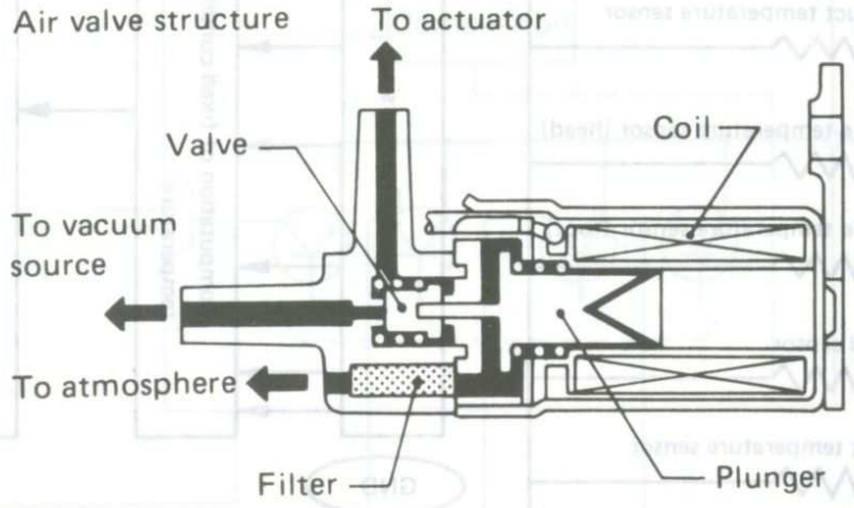
The next parts are added to the component parts of air mix door control system.

- **Intake door actuator**



SHA429B

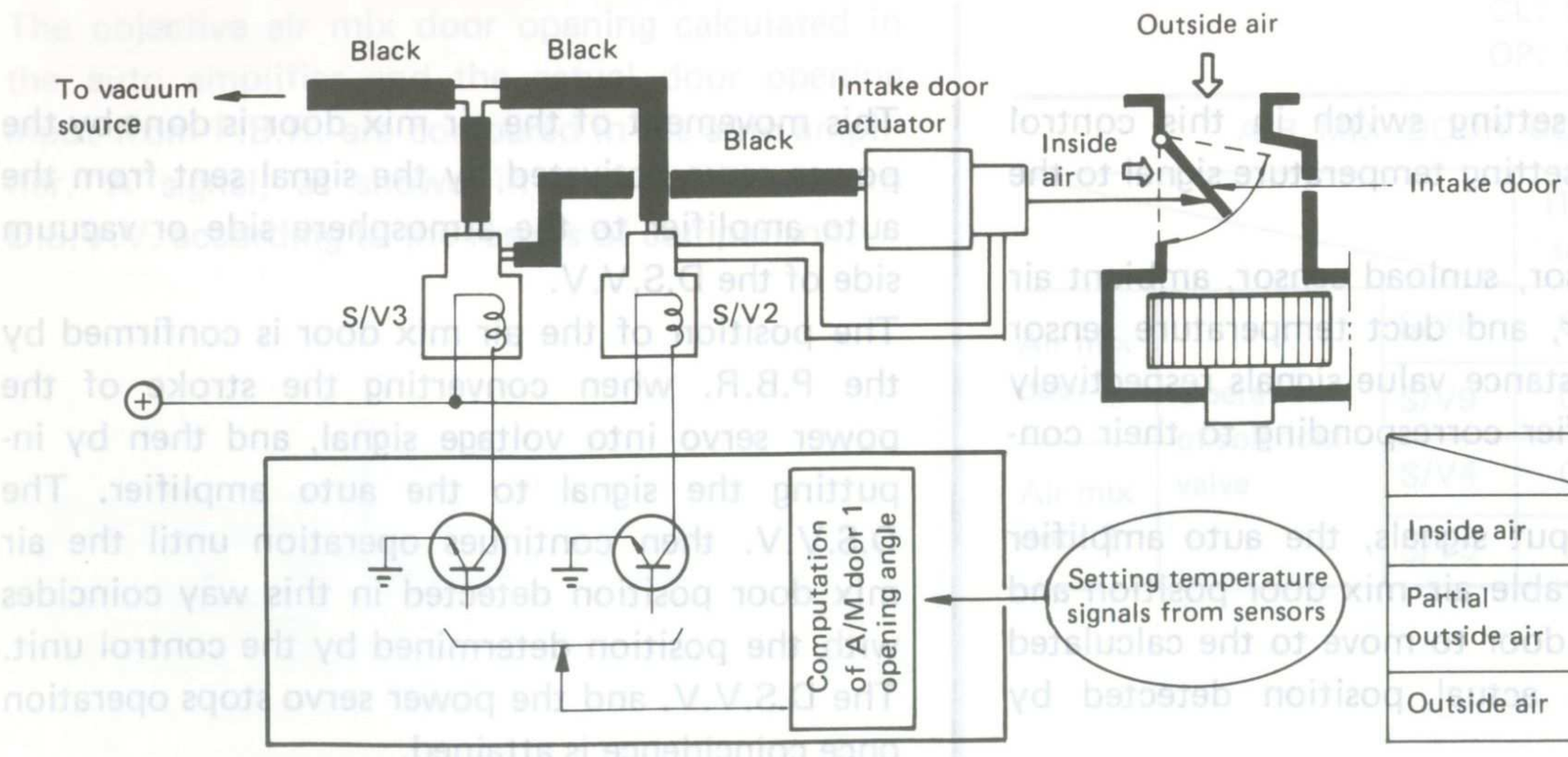
- **Solenoid valve (Air valve type)**



SW	Vacuum source	Actuator side	Atmos-phere side
ON	○	○	
OFF		○	○

SHA302B

2. System operation of intake door control



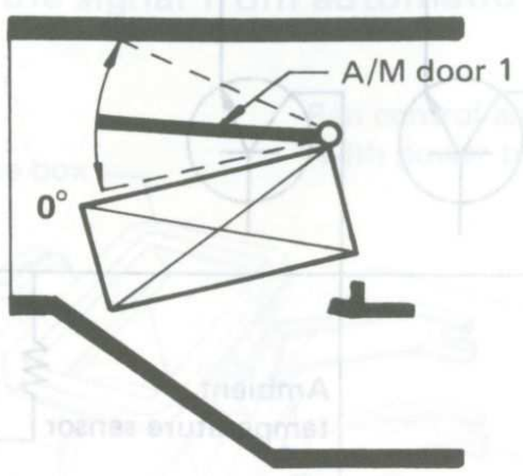
	S/V3	S/V2
Inside air	OPEN	OPEN
Partial outside air	CLOSED	CLOSED
Outside air	CLOSED	CLOSED

SHA303B

DESCRIPTION — Air Conditioner (Auto)

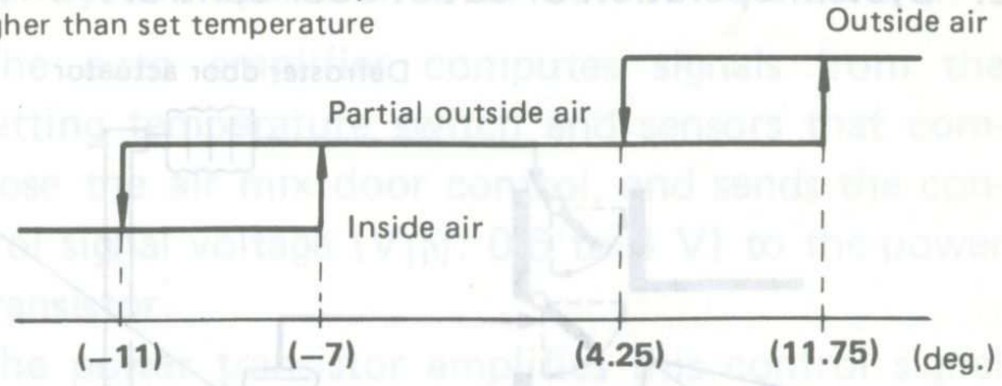
System Operation (Intake door control) (Cont'd)

The intake door is switched in order to introduce the inside air, partial outside air, or outside air at the positions already memorized in the auto amplifier corresponding to the angle (opening) of the air mix door 1 which is automatically temperature controlled. The relationship between the angle (opening) of the air mix door and the intake door position is as shown below.



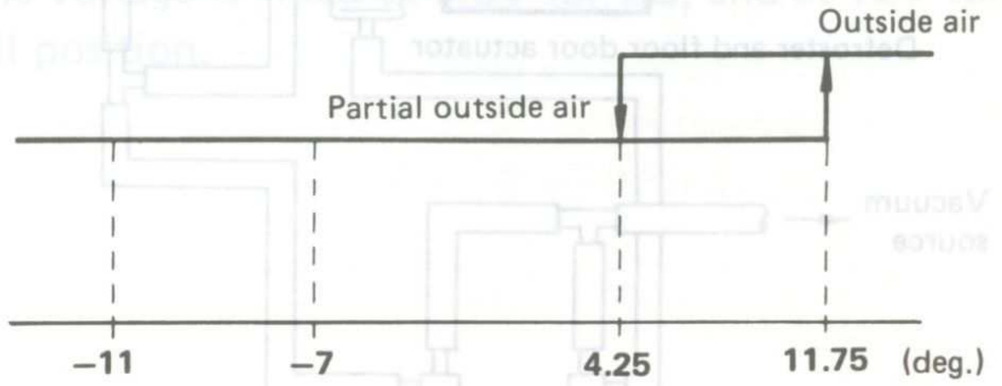
SHA304B

Condition 1: Outside temperature is 10°C (18°F) higher than set temperature



A/M door 1 angle (Opening angle): setting value

Condition 2: Except for Condition 1



A/M door 1 angle (Opening angle): setting value.

SHA305B

System Operation (Outlet door control)

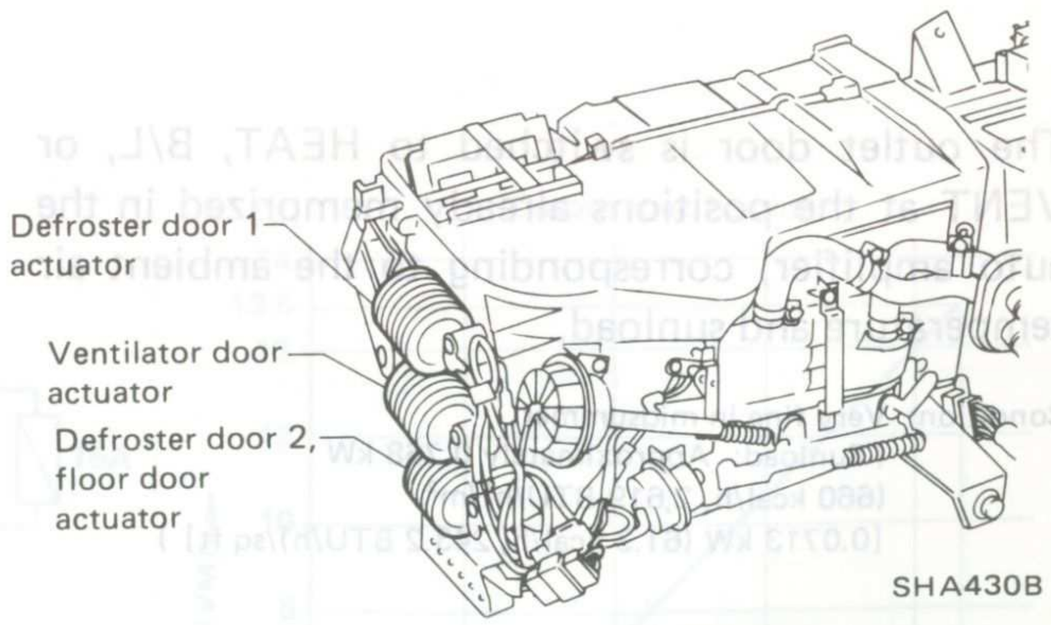
OUTLET DOOR CONTROL

1. Component parts

Outlet door control system consists of the parts shown below.

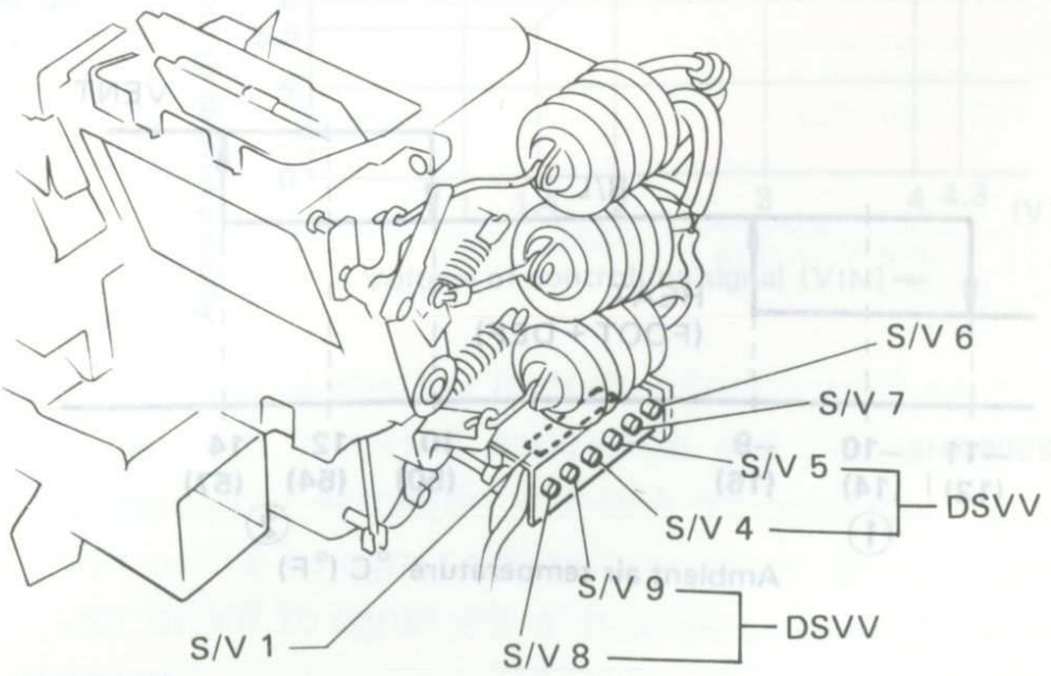
1) Defroster door actuator
2) Ventilator door actuator
3) Defroster and floor door actuator
4) Solenoid valve 6, 7
5) Sunload sensor
6) Ambient temperature sensor
7) Automatic amplifier

- **Actuators**



SHA430B

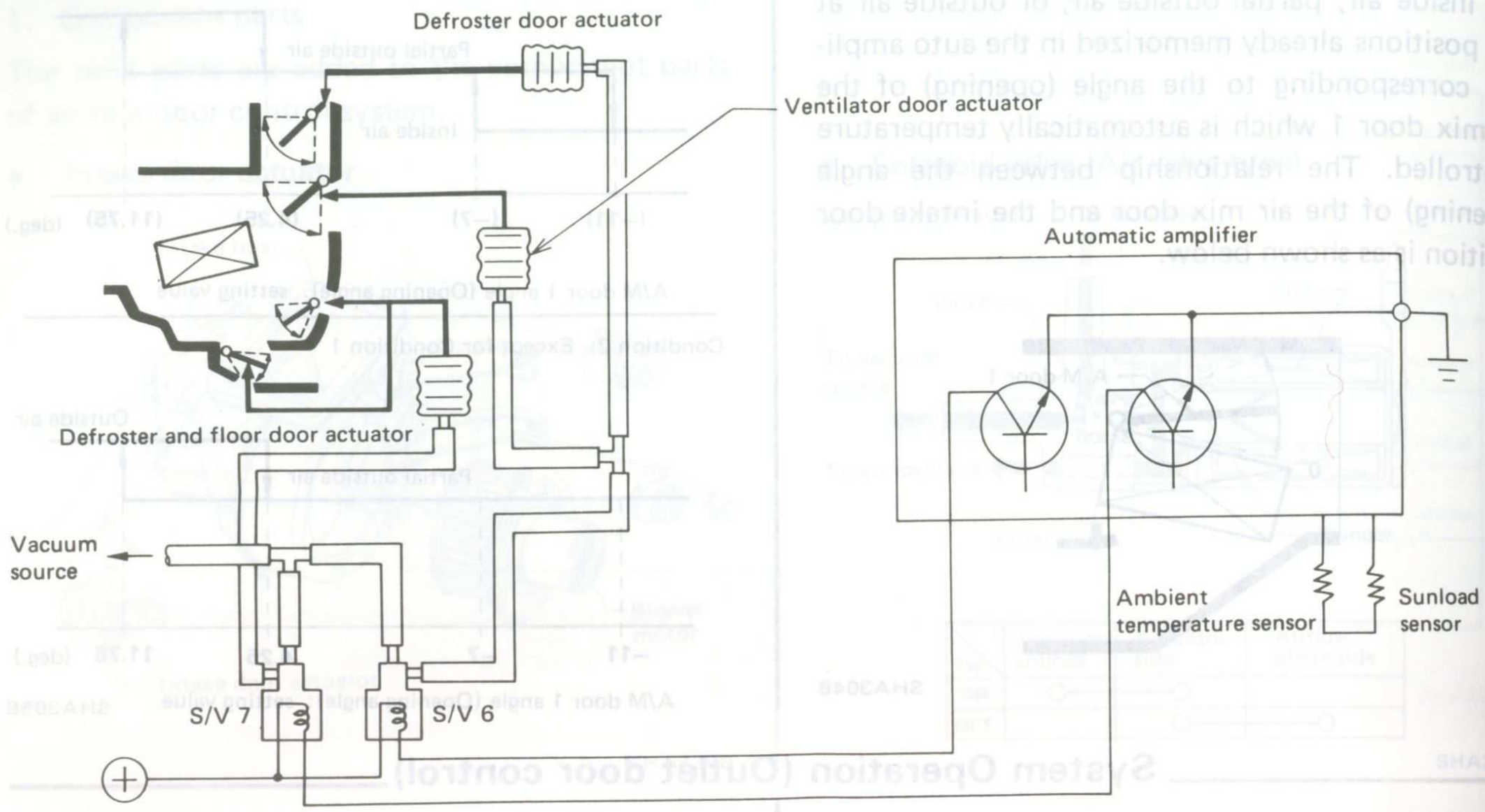
- **Solenoid valve 6, 7**



SHA431B

System Operation (Outlet door control) (Cont'd)

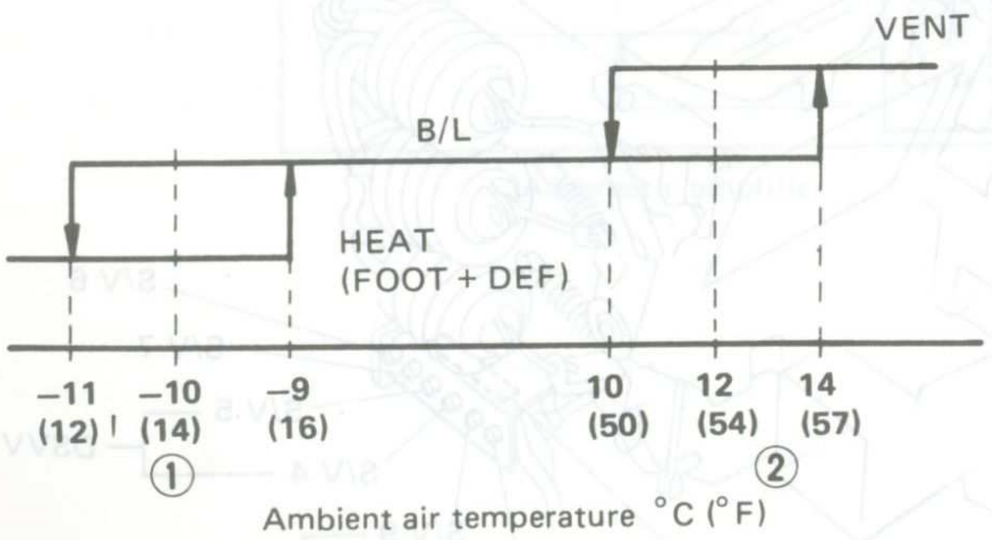
2. System operation of outlet door control



SHA291B

The outlet door is switched to HEAT, B/L, or VENT at the positions already memorized in the auto amplifier, corresponding to the ambient air temperature and sunload.

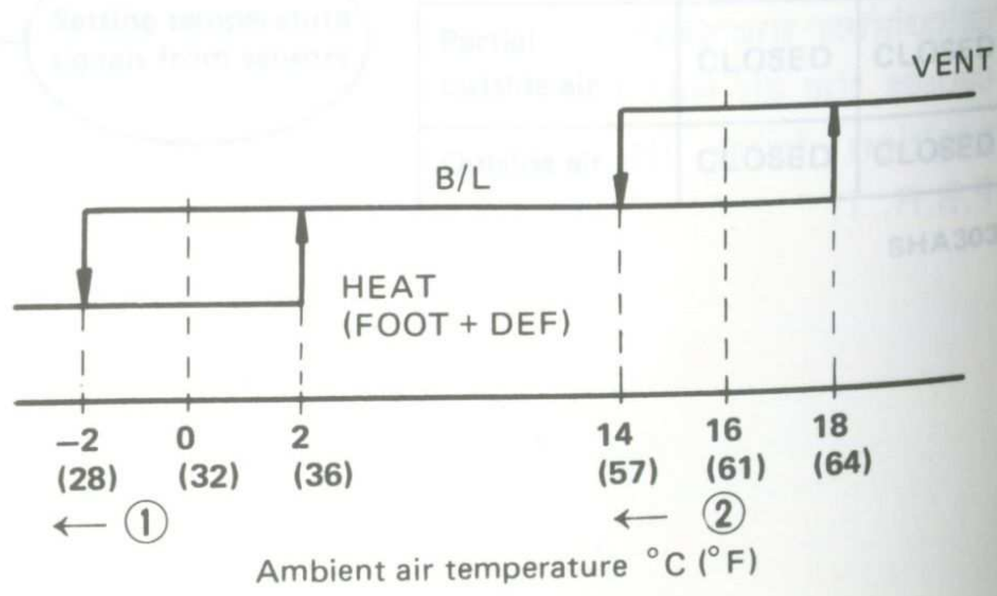
Condition: Very fine in midsummer
(Sunload: Approximately 0.768 kW
(660 kcal/h, 2,619 BTU/h)/m²
[0.0713 kW (61.3 kcal/h, 243.2 BTU/h)/sq ft])



SHA307B

The relationship between the ambient air temperature and outlet door is as shown below.
If the sunload increases, points ① and ② are moved in parallel direction to the arrow by the distance corresponding to the increase in sunload.

Condition: No sunload



SHA308B

DESCRIPTION — Air Conditioner (Auto)

System Operation (Air flow volume control)

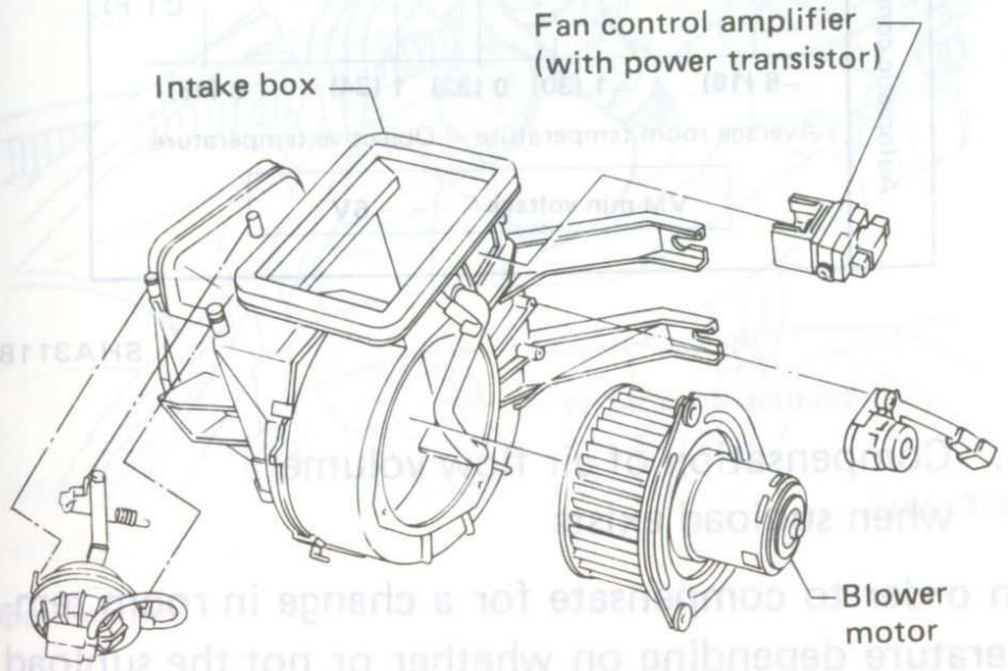
AIR FLOW VOLUME CONTROL

1. Component parts

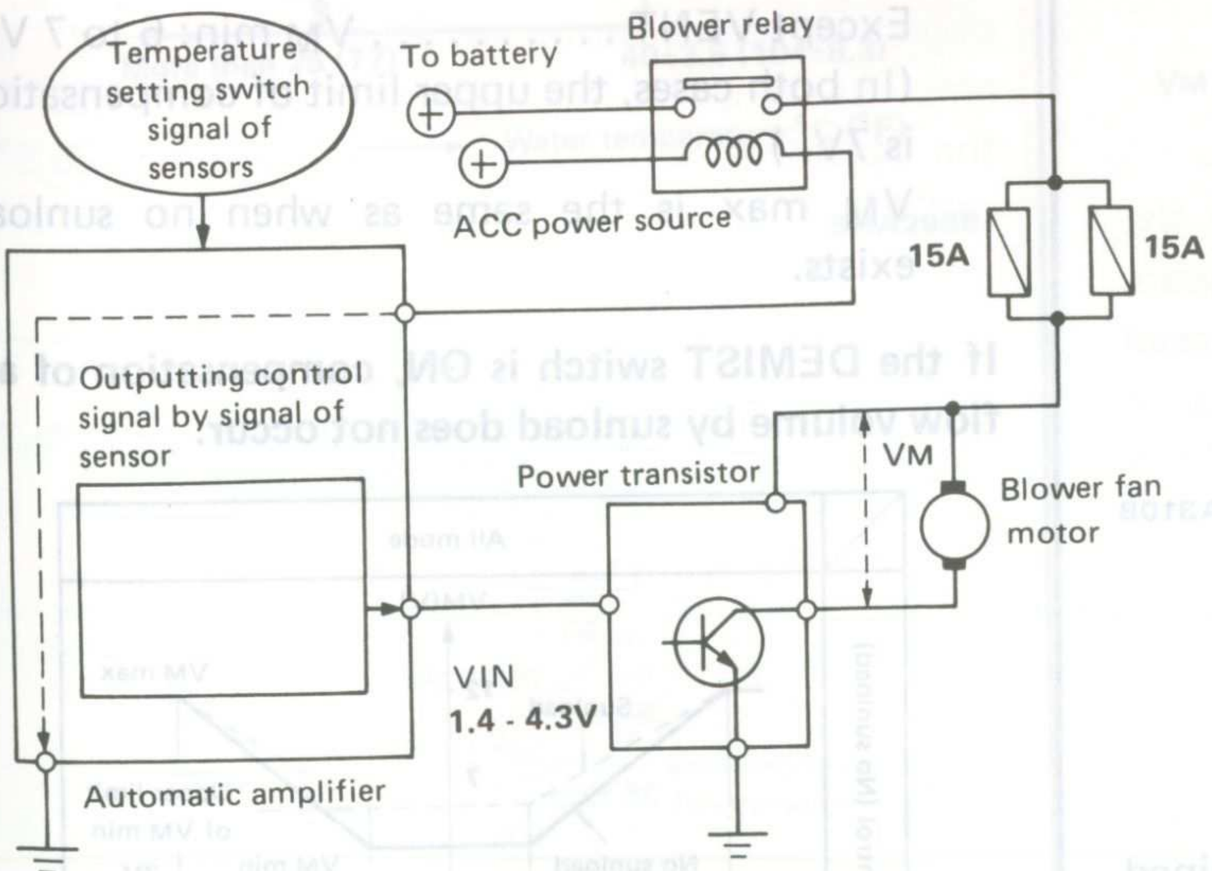
Power transistor is added to the component parts of air mix door control system.

- **Power transistor**

Power transistor varies blower speed automatically according to the signal from automatic amplifier.

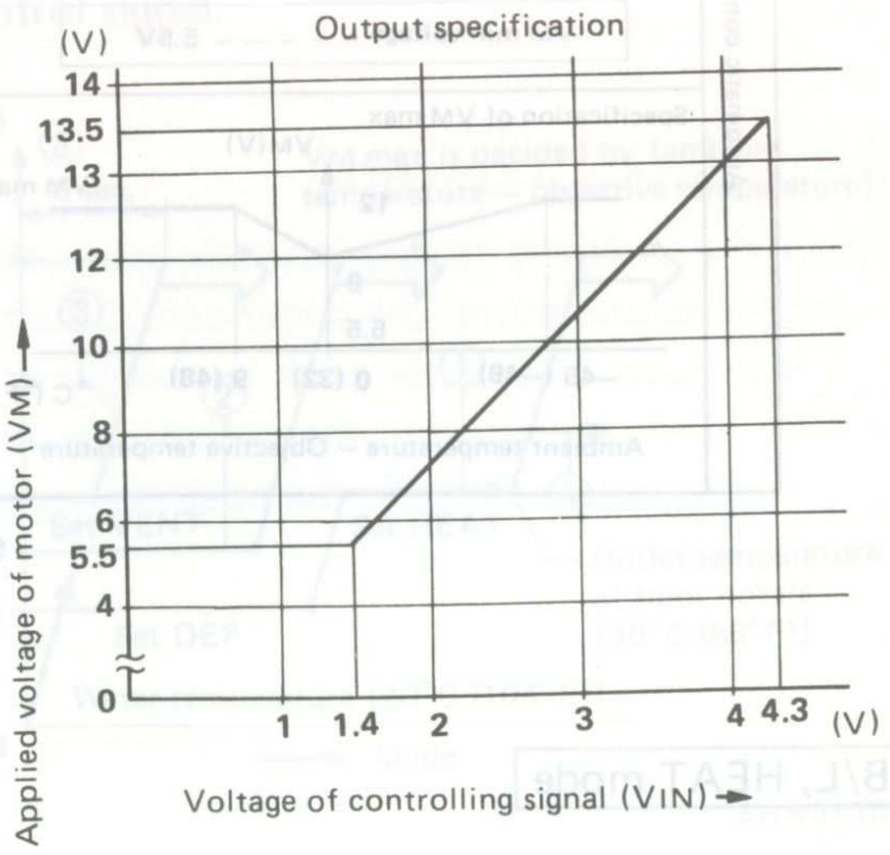


SHA432B



2. System operation of air flow volume control

The auto amplifier computes signals from the setting temperature switch and sensors that compose the air mix door control, and sends the control signal voltage (V_{IN}: 0.6 to 4 V) to the power transistor.
The power transistor amplifies this control signal voltage to change the voltage (V_M) fed to the motor terminals. Accordingly, the air flow is controlled automatically. With the manual fan switch, the voltage is fixed at 5.5V for LO, and at 12V for HI position.



SHA309B

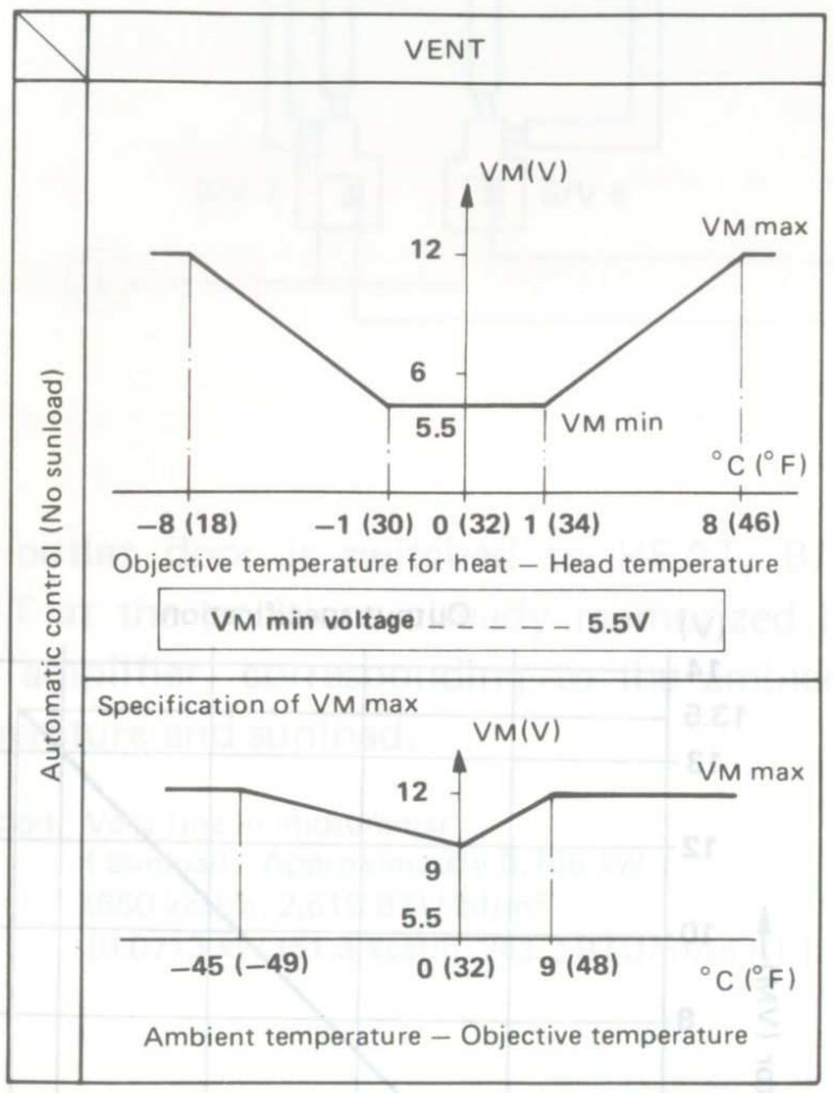
System Operation (Air flow volume control) (Cont'd)

3. Specification of air flow volume control (Automatic control)

- When "AUTO" switch is ON:

VENT mode

The air flow volume control voltage is determined according to the difference between the objective temperature at head level and the actual room temperature at head level. This voltage varies within the range of 5.5V to 12V.
The V_M max is determined according to the difference between the ambient temperature and objective temperature, and this voltage varies within the range of from 9V to 12V.

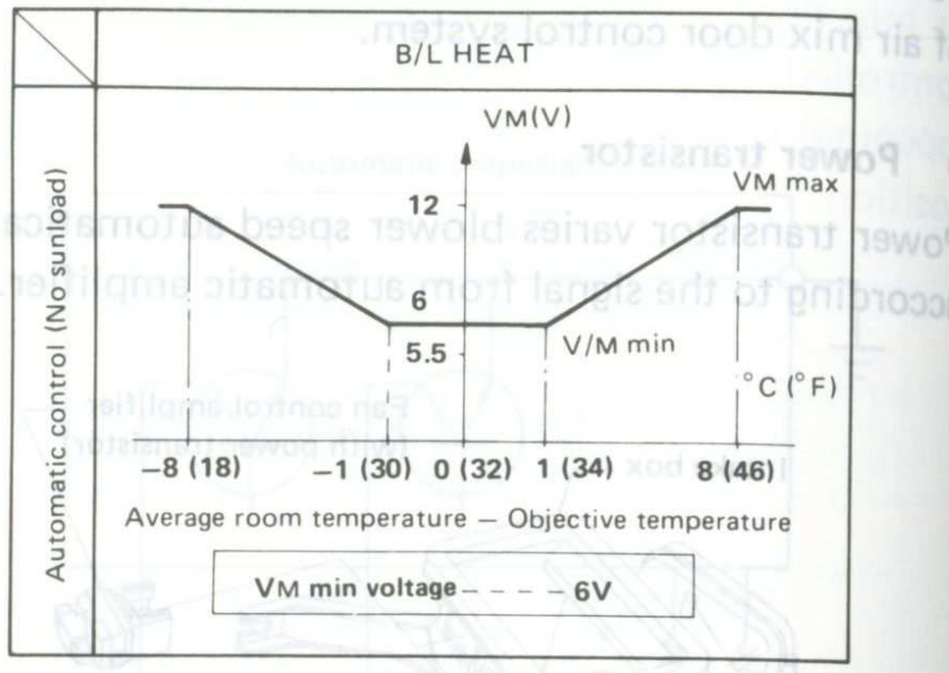


SHA310B

B/L, HEAT mode

The air flow volume control voltage is determined according to the difference between the average room temperature and the objective temperature. This voltage varies within the range of 6V to 12V. The V_M max varies within the range of 9V to 12V, just like in the case of VENT.

When the DEMIST switch on the DEF switch is ON, the V_M min voltage is fixed at 8V. Accordingly, the control voltage varies within the range of 8V to 12V.



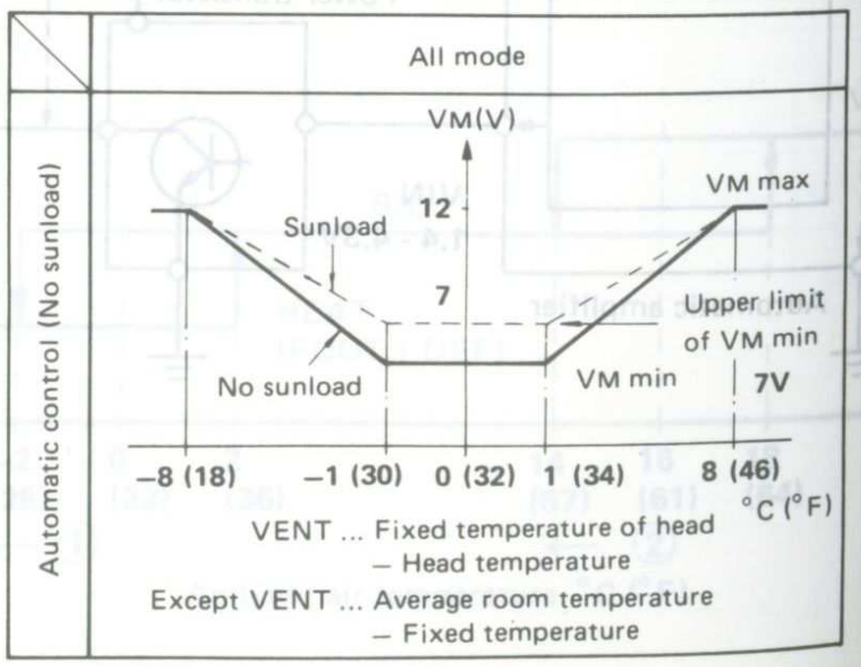
SHA311B

4. Compensation of air flow volume when sunload exists

In order to compensate for a change in room temperature depending on whether or not the sunload exists, the air flow volume is corrected according to the following diagram.

In VENT . . . . . V_M min: 5.5 to 7 V
Except VENT . . . . . V_M min: 6 to 7 V
(In both cases, the upper limit of compensation is 7V.)
V_M max is the same as when no sunload exists.

If the DEMIST switch is ON, compensation of air flow volume by sunload does not occur.



SHA292B

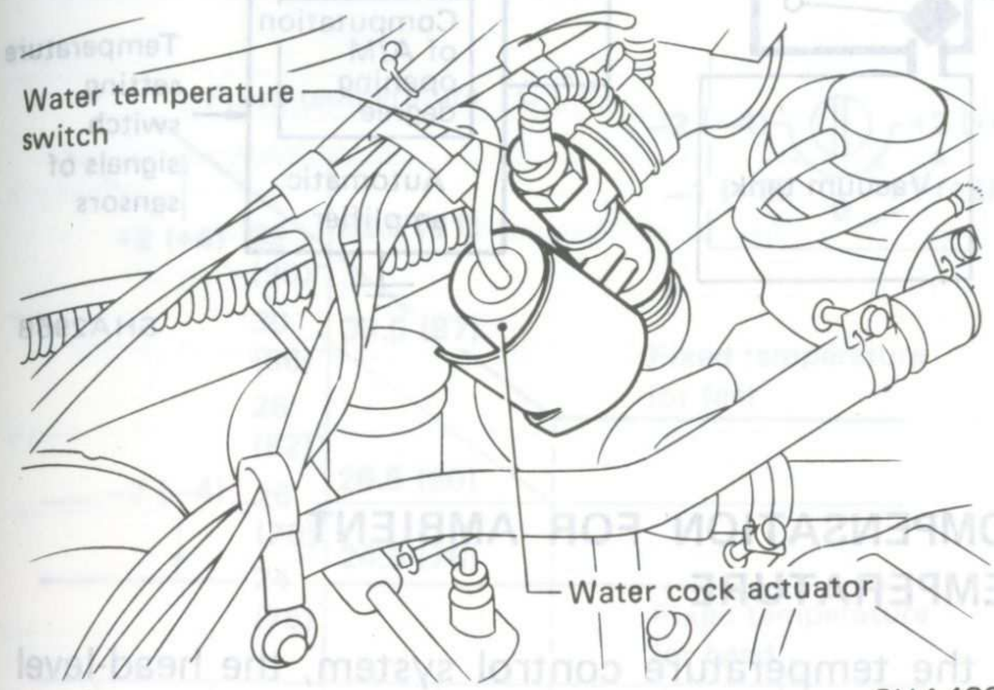
System Operation (Control at starting)

CONTROL AT STARTING

1. Component parts

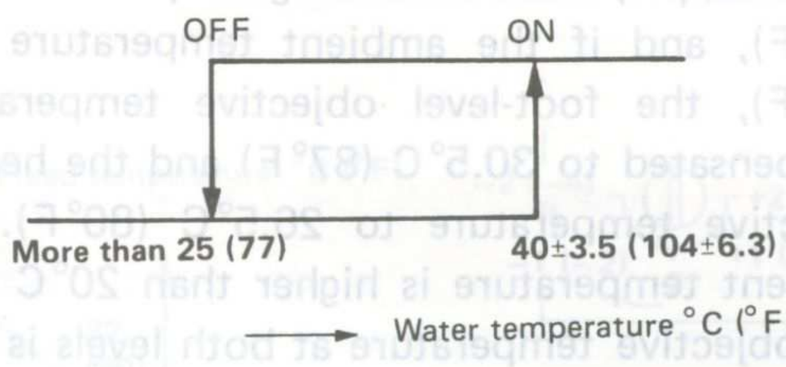
Water temperature switch is added to the component parts of air mix door control system.

- **Water temperature switch**



SHA433B

Specification

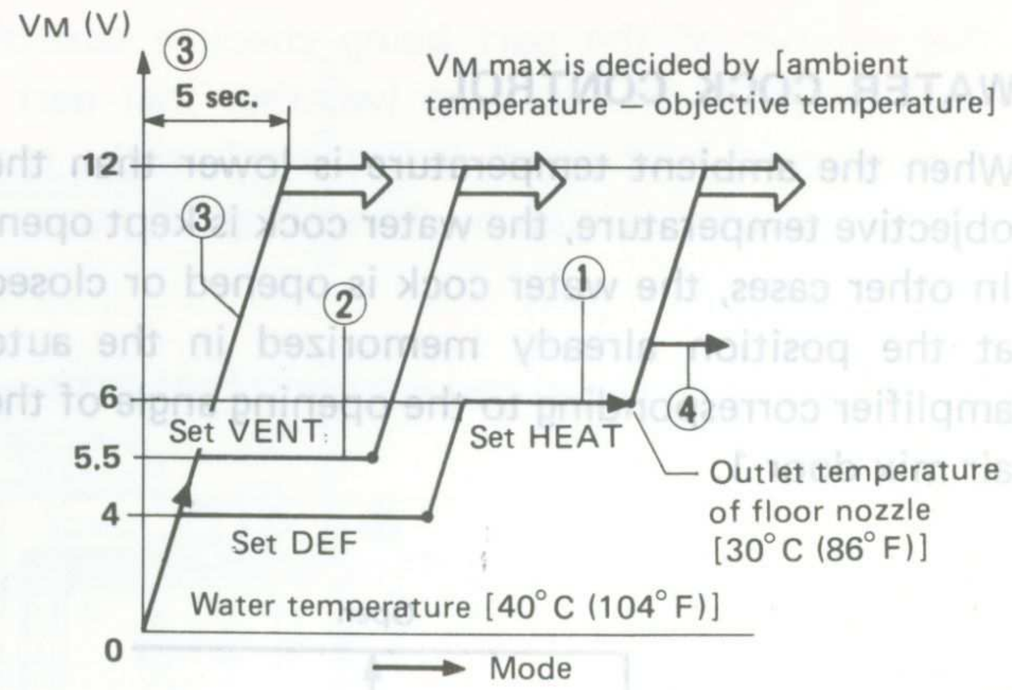


SHA293B

2. System operation of control at starting

- Curve ① means that the coolant temperature is below 40°C (104°F) and the room temperature at head level is lower than the objective temperature by more than 5°C (9°F).
  (Example: When sunload does not exist in winter)
- Curve ② means that the coolant temperature is below 40°C (104°F) and the room temperature at foot level is only lower than the objective temperature.
  (Example: When sunload exists in winter)
- Curve ③ means that the room temperature at head level is higher than the objective temperature by more than 5°C (9°F) and the room temperature at foot level is also higher than the objective temperature.
  (The outlet door is controlled by the outlet door control signal.)
- Curve ④ means that the difference between the objective temperature and actual room temperature is less than 8°C (14°F).

In cases ① and ② when the voltage is higher than 6V, the outlet door is determined by the outlet door control signal.



SHA313B

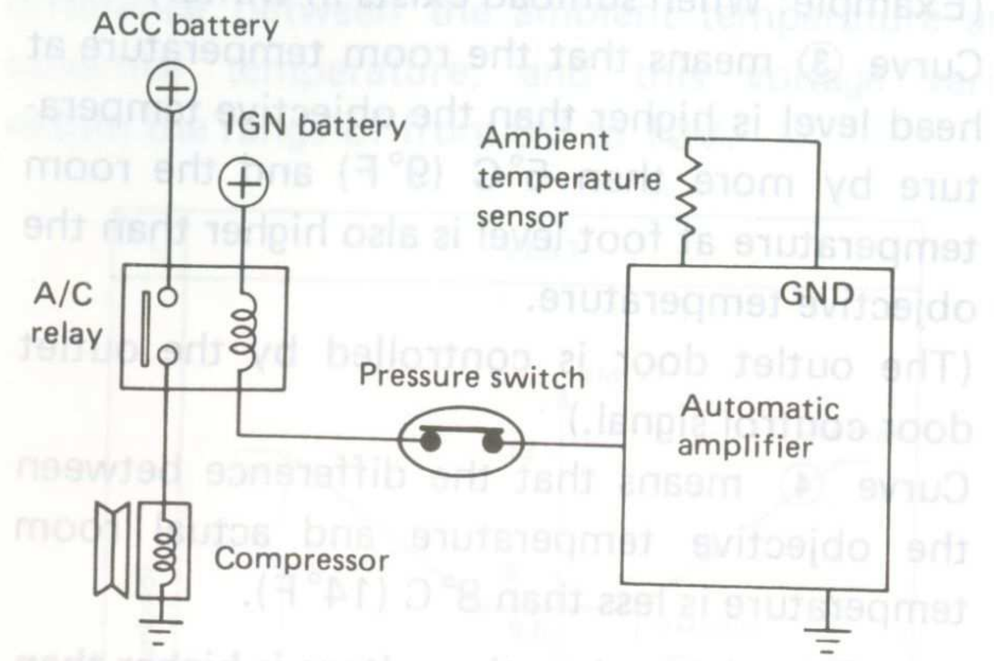
DESCRIPTION — Air Conditioner (Auto)

System Operation (Compressor, water cock control and compensation for ambient temperature)

COMPRESSOR CONTROL

- "ECON" mode: OFF
- Except for "ECON" mode:

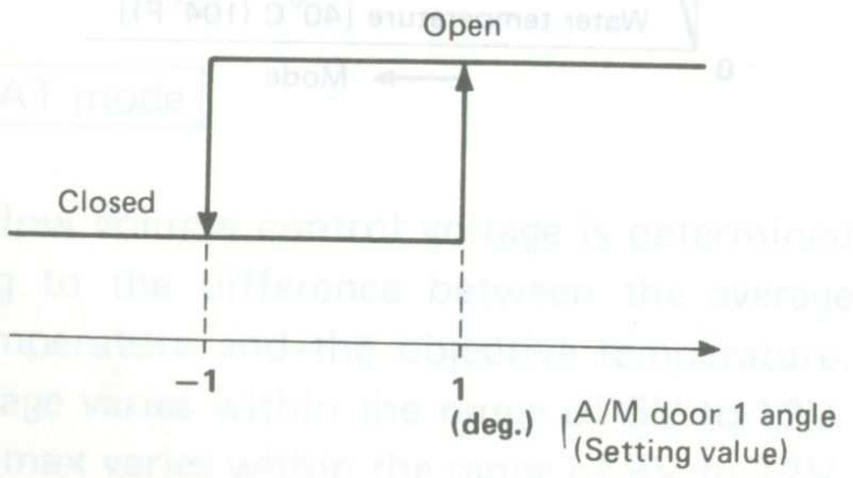
Ambient temperature	Control
More than 0°C (32°F)	ON
Less than 0°C (32°F)	OFF



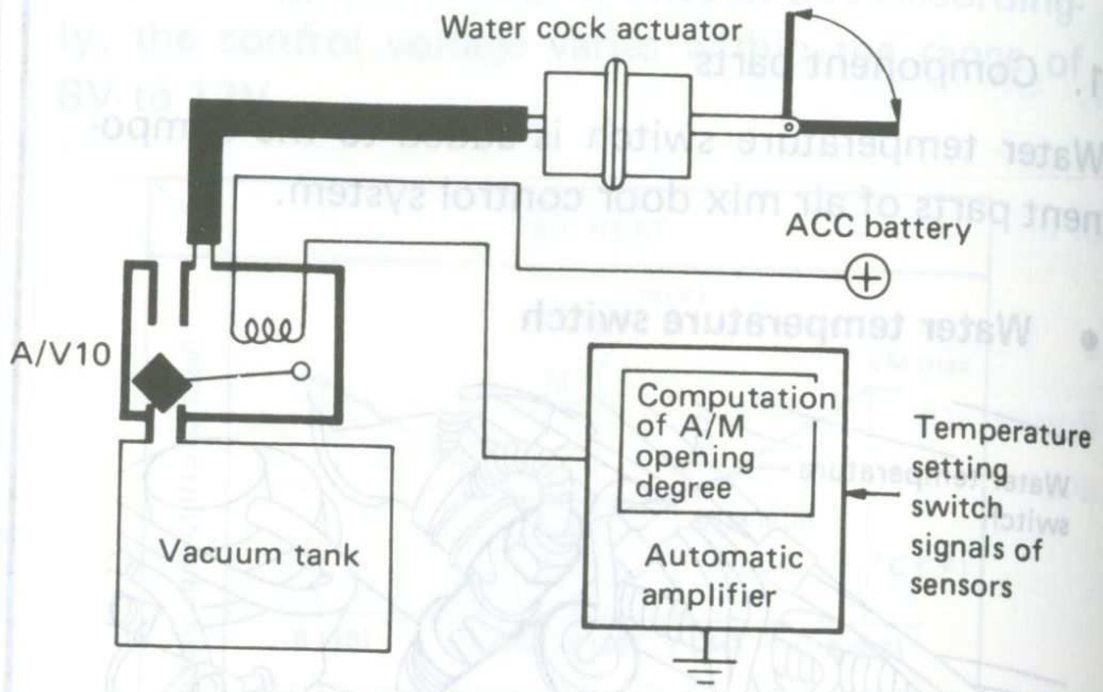
SHA294B

WATER COCK CONTROL

When the ambient temperature is lower than the objective temperature, the water cock is kept open. In other cases, the water cock is opened or closed at the position already memorized in the auto amplifier corresponding to the opening angle of the air mix door 1.



SHA314B

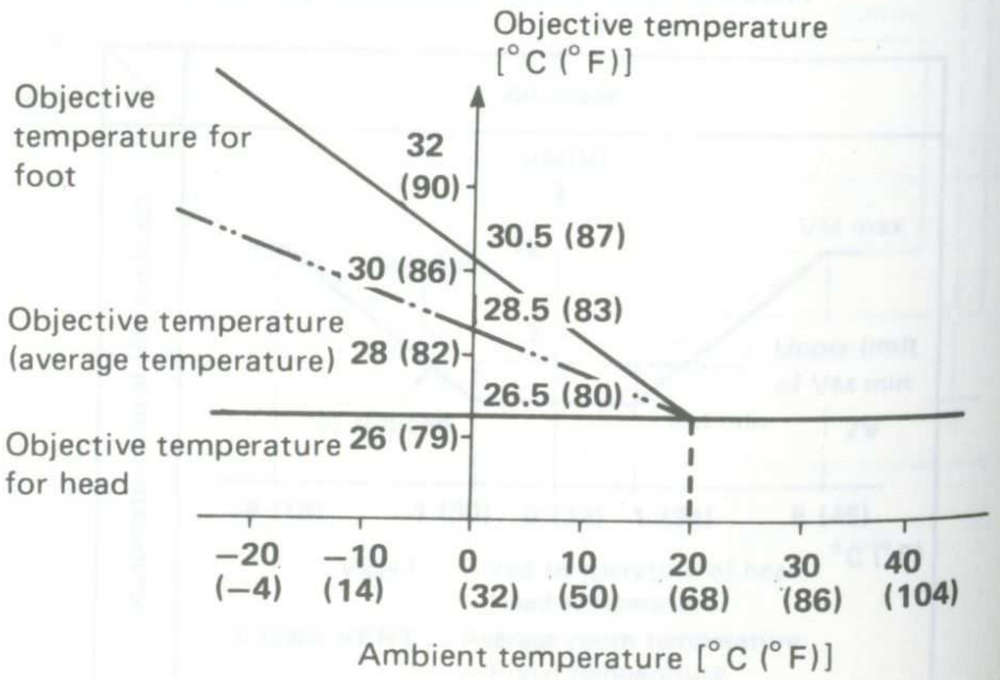


SHA295B

COMPENSATION FOR AMBIENT TEMPERATURE

In the temperature control system, the head-level and foot-level objective temperatures are compensated for a change in the ambient temperature.
For example, when the setting temperature is 25°C (77°F), and if the ambient temperature is 0°C (32°F), the foot-level objective temperature is compensated to 30.5°C (87°F) and the head-level objective temperature to 26.5°C (80°F). If the ambient temperature is higher than 20°C (68°F), the objective temperature at both levels is 26.5°C (80°F).

Specification of objective temperature
[When the setting temperature is 25°C (77°F)]

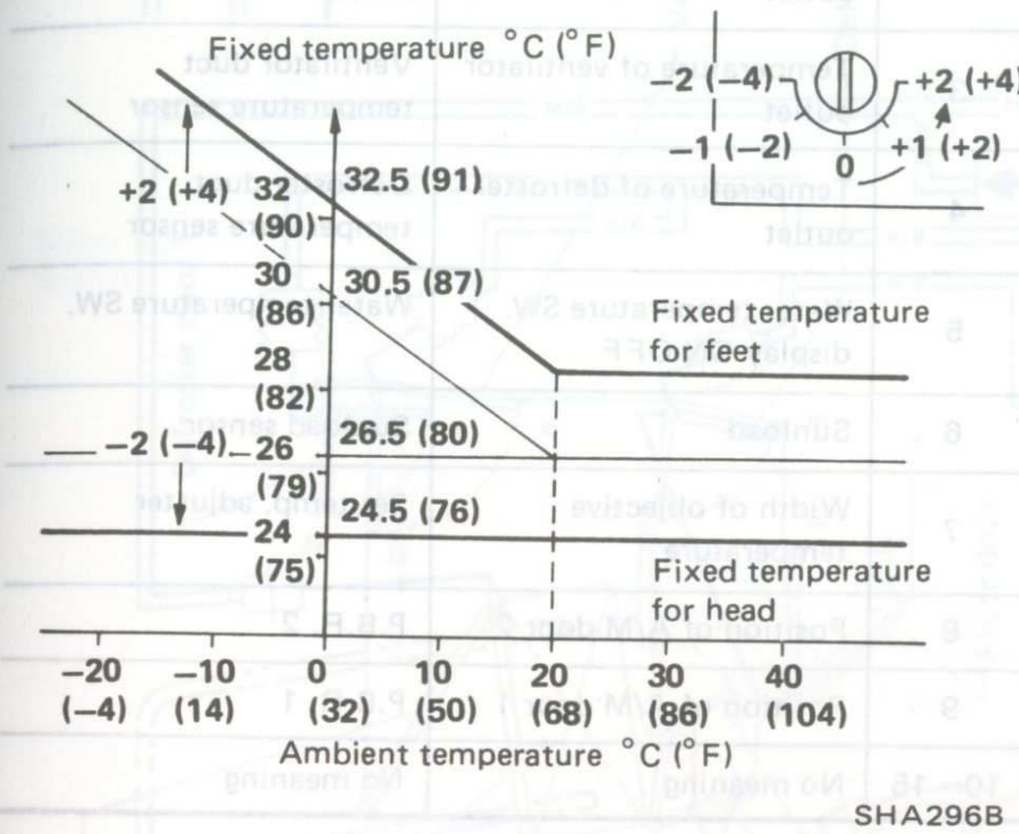


SHA315B

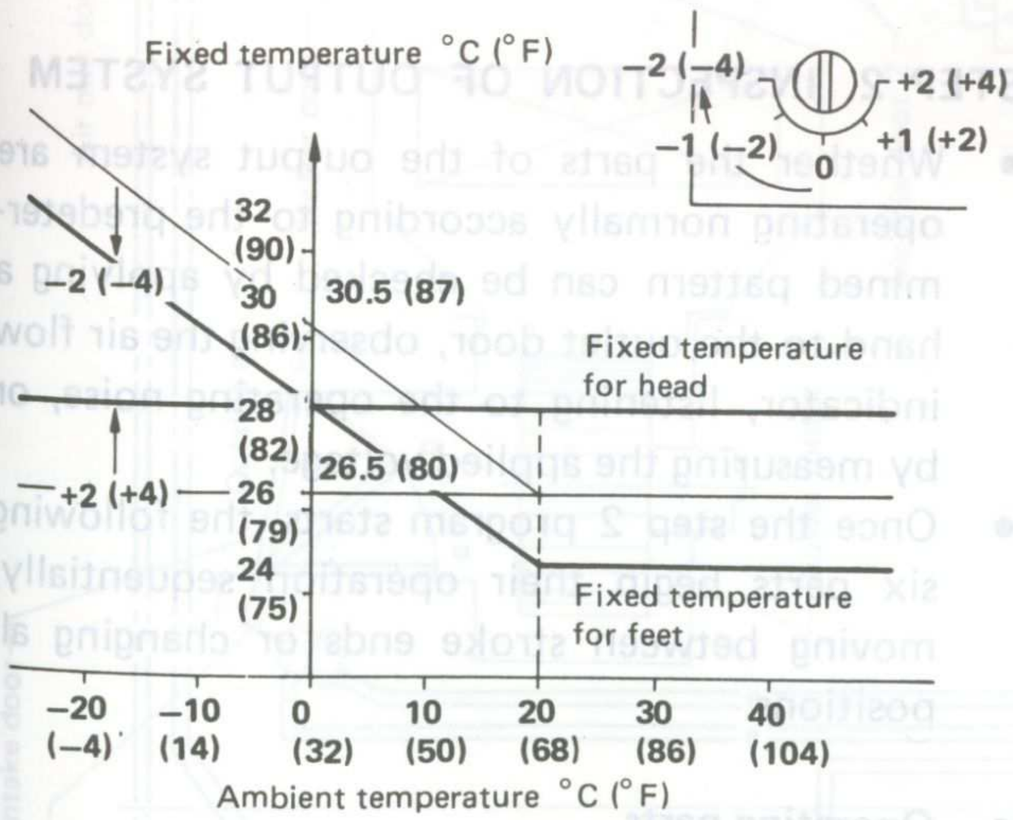
System Operation (Function of set TEMP. adjuster)

FUNCTION OF SET TEMP. ADJUSTER

TEMP. SET ADJUSTER changes the value of the objective controlling temperature shown above, according to the ambient temperature, to the next value shown below.



SHA296B



SHA297B

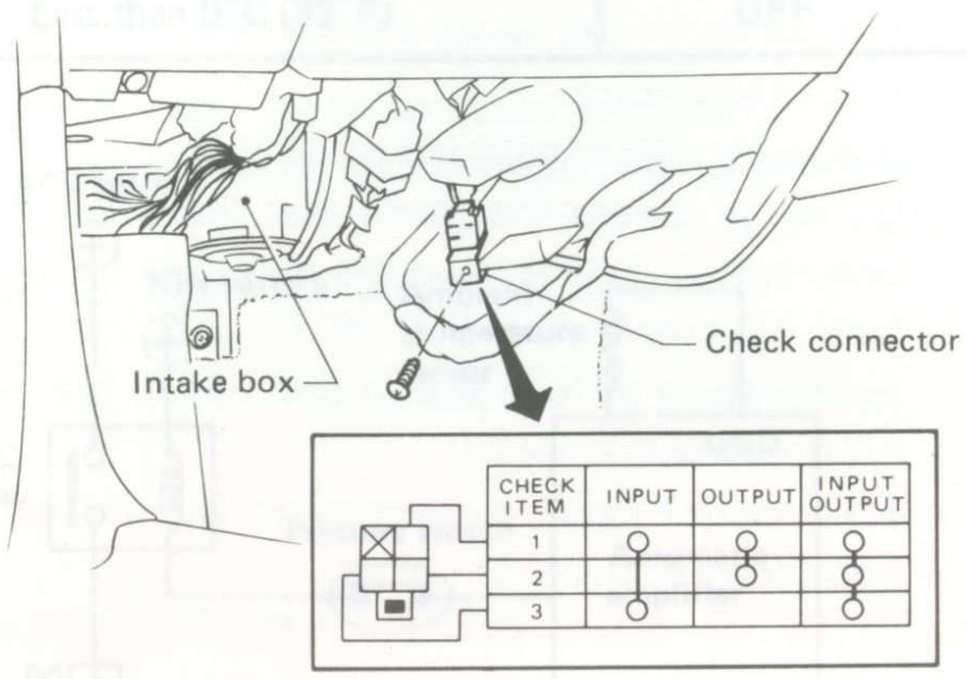
DESCRIPTION — Air Conditioner (Auto)

Function of Self-Diagnosis of Trouble

The self-diagnosis program is used to locate trouble and is composed of the following two steps:

Step 1 . . . . . Inspection of input system
Step 2 . . . . . Inspection of output system

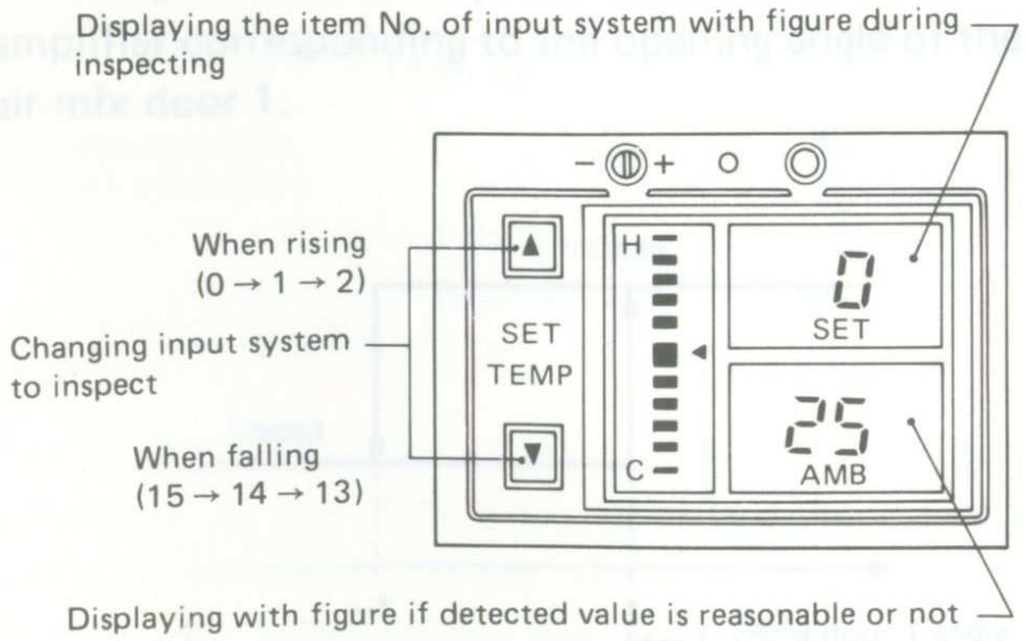
- Diagnosing check terminal
  To change the system to the diagnosis mode, short the check terminal located at the lower portion of the cooling unit.



SHA434B

STEP 1 INSPECTION OF INPUT SYSTEM

The number of the part being checked and the value detected by that part (whether that part is disconnected or shorted) is displayed on the temperature display section by the setting temperature switch.



SHA317B

Display No.	Item of input signal	Parts name
0	Temperature of inside air temperature sensor (foot)	In-vehicle sensor (foot)
1	Temperature of in-vehicle sensor (head)	In-vehicle sensor (head)
2	Temperature of floor outlet	Floor duct temperature sensor
3	Temperature of ventilator outlet	Ventilator duct temperature sensor
4	Temperature of defroster outlet	Defroster duct temperature sensor
5	Water temperature SW. display ON-OFF	Water temperature SW.
6	Sunload	Sunload sensor
7	Width of objective temperature	Set temp. adjuster
8	Position of A/M door 2	P.B.R. 2
9	Position of A/M door 1	P.B.R. 1
10~ 15	No meaning	No meaning

STEP 2 INSPECTION OF OUTPUT SYSTEM

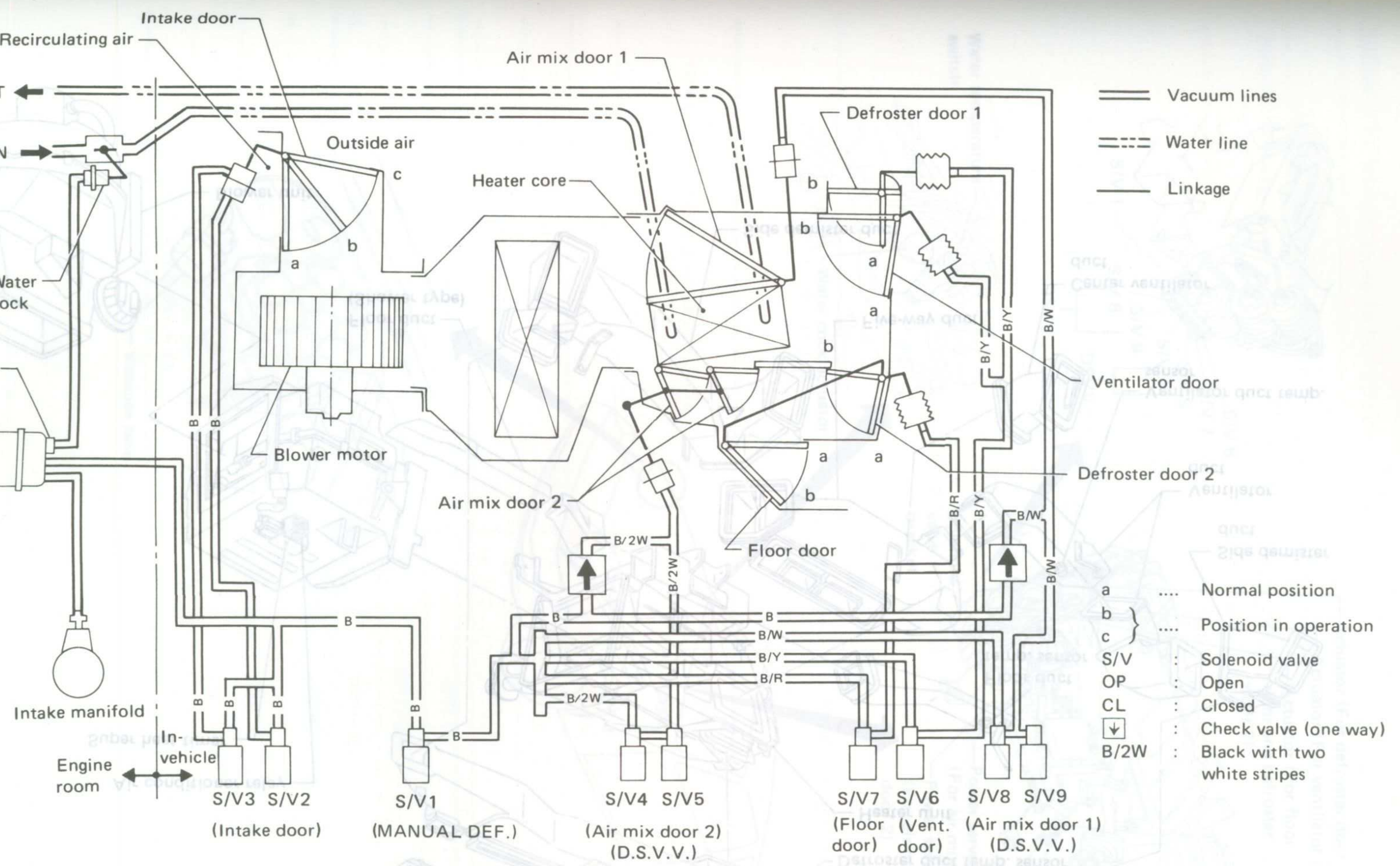
- Whether the parts of the output system are operating normally according to the predetermined pattern can be checked by applying a hand to the outlet door, observing the air flow indicator, listening to the operating noise, or by measuring the applied voltage.
- Once the step 2 program starts, the following six parts begin their operation sequentially, moving between stroke ends or changing all positions.

- **Operating parts**

1. Air mix door 1 and air mix door 2 (same motion)
2. Outlet doors (All mode)
3. Intake door
4. Water cock
5. Compressor magnet clutch
6. Blower motor

AIR FLOW AND COMPONENT LAYOUT (Auto)

Air Flow



OUTLET CONTROL					
MODE		VENT	B/L	HEAT/ DEMIST	DEF
DOOR POSITION	DEF, DOOR 1	b	b	a	a
	VENT, DOOR	b	b	a	a
	FLOOR, DOOR	a	b	b	a
	DEF, DOOR 2	a	b	b	a
OPERATION OF SOLENOID VALVE	S/V6	OP	OP	CL	CL
	S/V7	CL	OP	OP	CL

AIR MIX DOOR CONTROL					
			HOT side	HOLD	COLD side
Air mix door 1	OPERATION OF SOLENOID VALVE	S/V8	CL	CL	OP
		S/V9	OP	CL	OP
Air mix door 2		S/V4	CL	CL	OP
		S/V5	OP	CL	OP

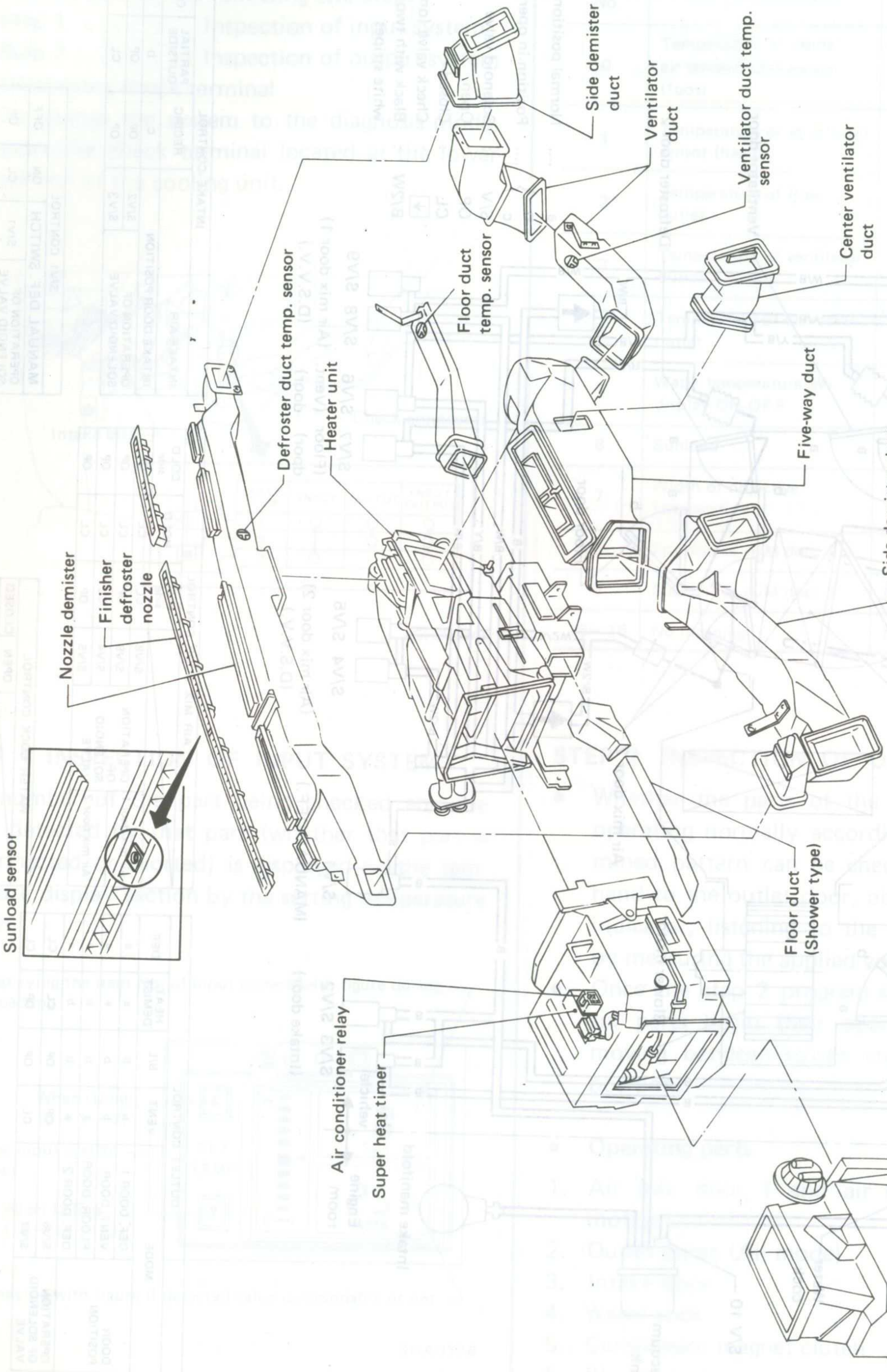
INTAKE CONTROL				
INTAKE AIR		RECIRC	PARTIAL OUTSIDE	OUTSIDE
INTAKE DOOR POSITION		c	b	a
OPERATION OF SOLENOID VALVE	S/V2	OP	OP	CL
	S/V3	OP	CL	CL

WATER COCK CONTROL			
		OPEN	CLOSED
OPERATION OF SOLENOID VALVE	S/V10	CL	OP

S/V1 CONTROL			
MANUAL DEF. SWITCH		ON	OFF
OPERATION OF SOLENOID VALVE	S/V1	CL	OP

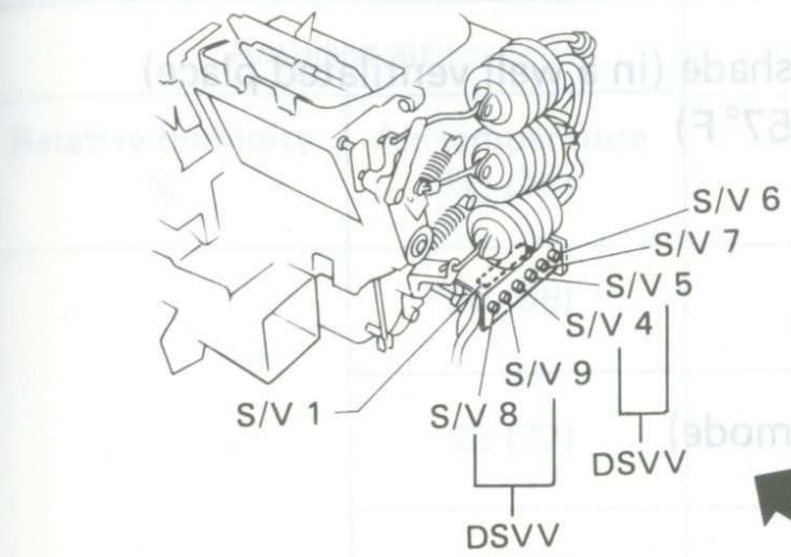
AIR FLOW AND COMPONENT LAYOUT (Auto)

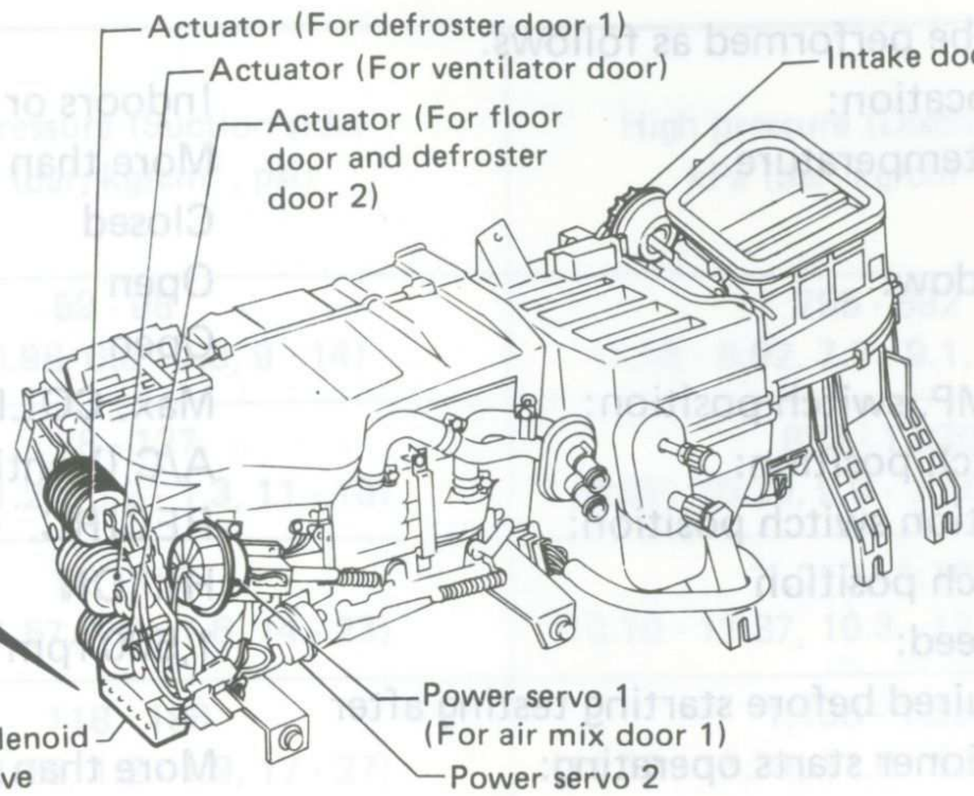
Component Layout

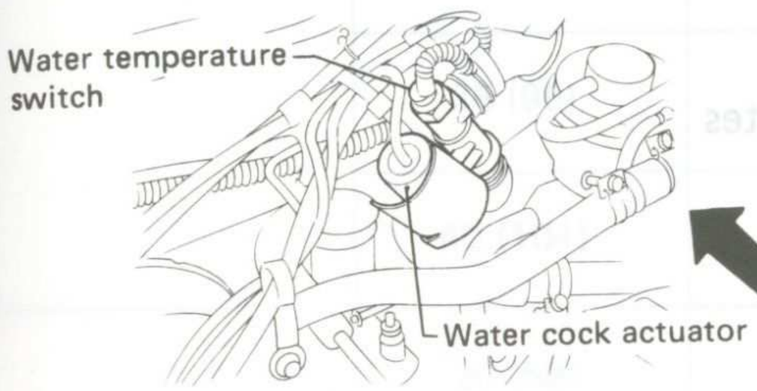


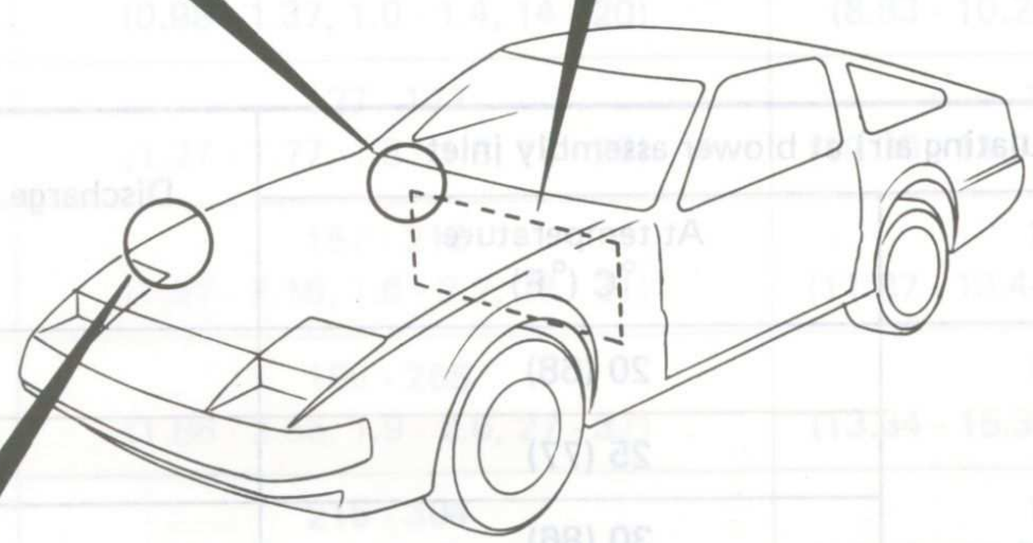
SHA435B

LOCATION OF VACUUM COMPONENTS (Auto)











SHA436B

A/C PERFORMANCE TEST (Auto)

Performance Chart

TEST CONDITION

Testing must be performed as follows:

Vehicle location:	Indoors or in the shade (in a well ventilated place)
Ambient temperature	More than 14°C (57°F)
Doors:	Closed
Door window:	Open
Hood:	Open
SET TEMP. switch position:	Max. COLD
Auto switch position:	A/C (Ventilation mode)
Recirculation switch position:	RECIRC. ON
FAN switch position	HI. ON
Engine speed:	1,500 rpm
Time required before starting testing after air conditioner starts operating:	More than 10 minutes

TEST READING

Recirculating-to-discharge air temperature table

Inside air (Recirculating air) at blower assembly inlet		Discharge air temperature at center ventilator °C (°F)
Relative humidity %	At temperature °C (°F)	
50 - 70	20 (68)	3.0 - 5.0 (37 - 41)
	25 (77)	5.5 - 8.5 (42 - 47)
	30 (86)	10.0 - 13.5 (50 - 56)
	35 (95)	14.7 - 18.4 (58 - 65)
	40 (104)	19.5 - 23.2 (67 - 74)
70 - 90	20 (68)	5.0 - 7.0 (41 - 45)
	25 (77)	8.5 - 11.5 (47 - 53)
	30 (86)	13.5 - 17.0 (56 - 63)
	35 (95)	18.4 - 21.8 (65 - 71)
	40 (104)	23.2 - 26.8 (74 - 80)

A/C PERFORMANCE TEST (Auto)

Performance Chart

Ambient air temperature to compressor pressure table

Ambient air		Low pressure (Suction side) kPa (bar, kg/cm^2, psi)	High pressure (Discharge side) kPa (bar, kg/cm^2, psi)
Relative humidity %	Air temperature °C (°F)		
50 - 70	20 (68)	59 - 98 (0.59 - 0.98, 0.6 - 1.0, 9 - 14)	755 - 892 (7.55 - 8.92, 7.7 - 9.1, 109 - 129)
	25 (77)	78 - 127 (0.78 - 1.27, 0.8 - 1.3, 11 - 18)	883 - 1,030 (8.83 - 10.30, 9.0 - 10.5, 128 - 149)
	30 (86)	98 - 157 (0.98 - 1.57, 1.0 - 1.6, 14 - 23)	1,010 - 1,187 (10.10 - 11.87, 10.3 - 12.1, 146 - 172)
	35 (95)	118 - 186 (1.18 - 1.86, 1.2 - 1.9, 17 - 27)	1,138 - 1,334 (11.38 - 13.34, 11.6 - 13.6, 165 - 193)
	40 (104)	137 - 216 (1.37 - 2.16, 1.4 - 2.2, 20 - 31)	1,295 - 1,510 (12.95 - 15.10, 13.2 - 15.4, 188 - 219)
70 - 90	20 (68)	98 - 137 (0.98 - 1.37, 1.0 - 1.4, 14 - 20)	883 - 1,020 (8.83 - 10.20, 9.0 - 10.4, 128 - 148)
	25 (77)	127 - 177 (1.27 - 1.77, 1.3 - 1.8, 18 - 26)	1,030 - 1,177 (10.30 - 11.77, 10.5 - 12.0, 149 - 171)
	30 (86)	157 - 216 (1.57 - 2.16, 1.6 - 2.2, 23 - 31)	1,187 - 1,344 (11.87 - 13.44, 12.1 - 13.7, 172 - 195)
	35 (95)	186 - 255 (1.86 - 2.55, 1.9 - 2.6, 27 - 37)	1,334 - 1,530 (13.34 - 15.30, 13.6 - 15.6, 193 - 222)
	40 (104)	216 - 304 (2.16 - 3.04, 2.2 - 3.1, 31 - 44)	1,510 - 1,736 (15.10 - 17.36, 15.4 - 17.7, 219 - 252)

a. The pressure will change in the following manner with changes in conditions:

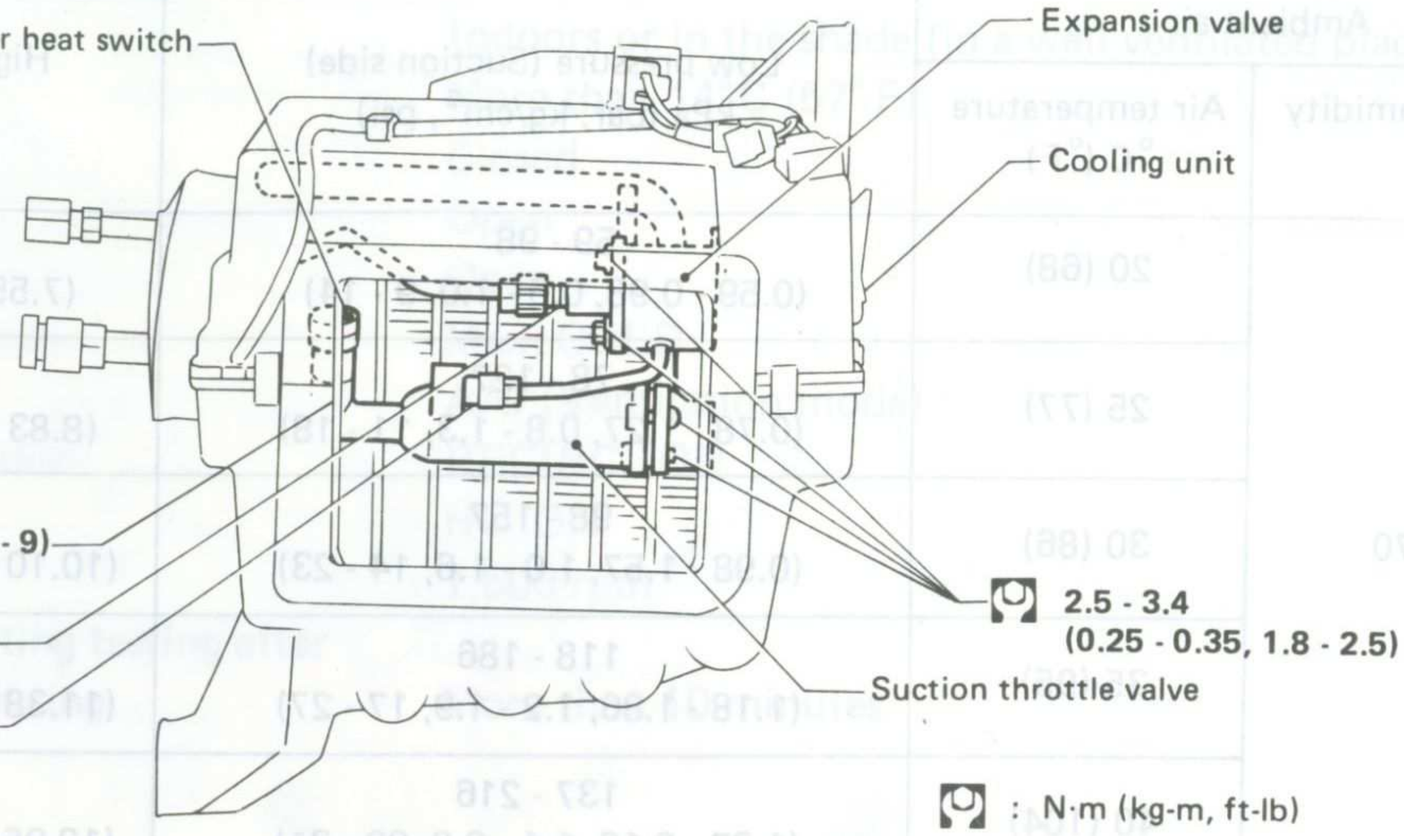
- When blower speed is low, discharge pressure will drop.
- When the relative humidity of intake air is low, discharge pressure will drop.

b. The temperature will change in the following manner with changes in conditions:
When the ambient air temperature is low, the outlet air temperature will become low.

PIPING (Auto)

Refrigerant Lines—Cooling Unit

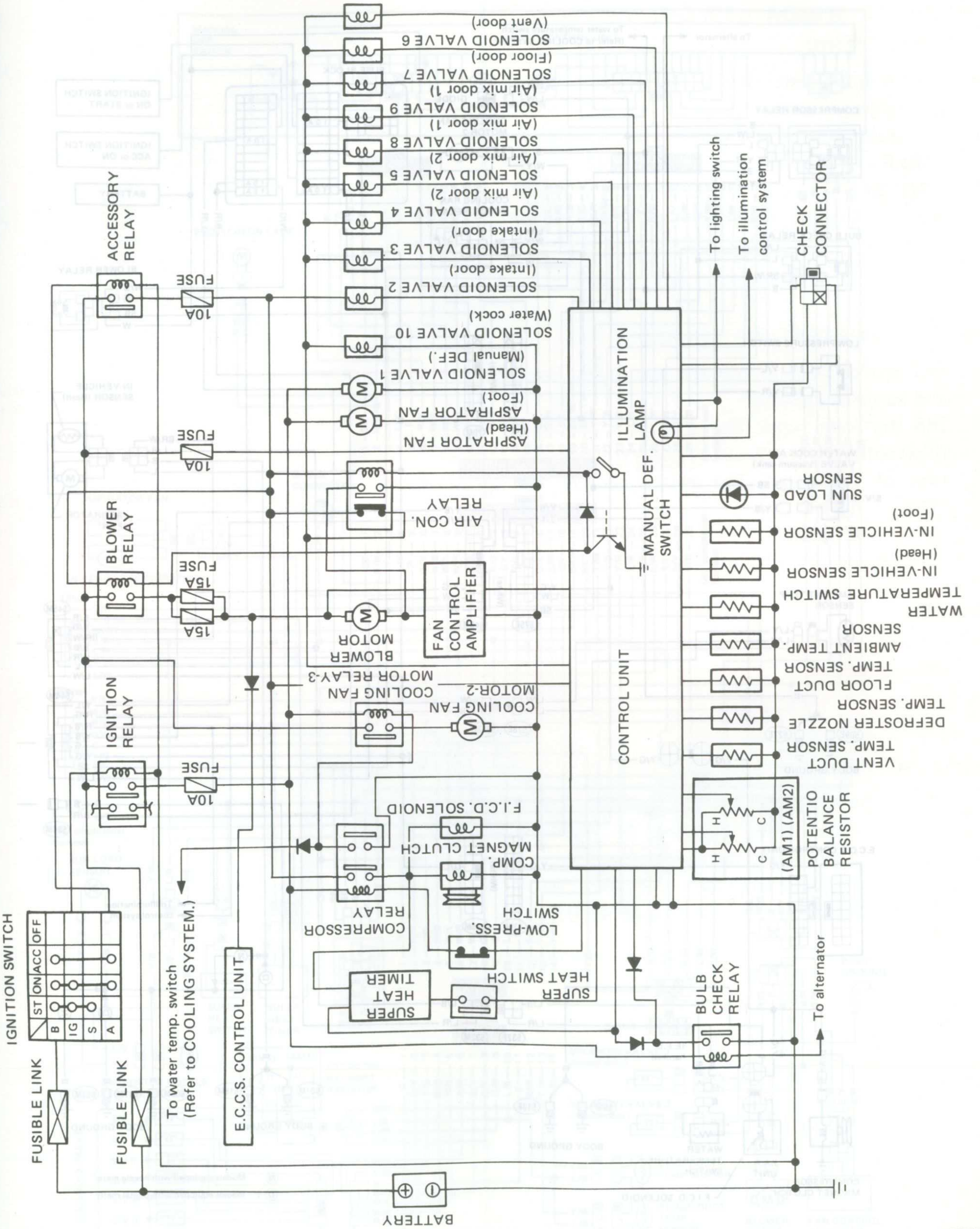
- Refrigerant lines for auto A/C are the same as for manual A/C.



SHA437B

A/C ELECTRICAL CIRCUIT (Auto)

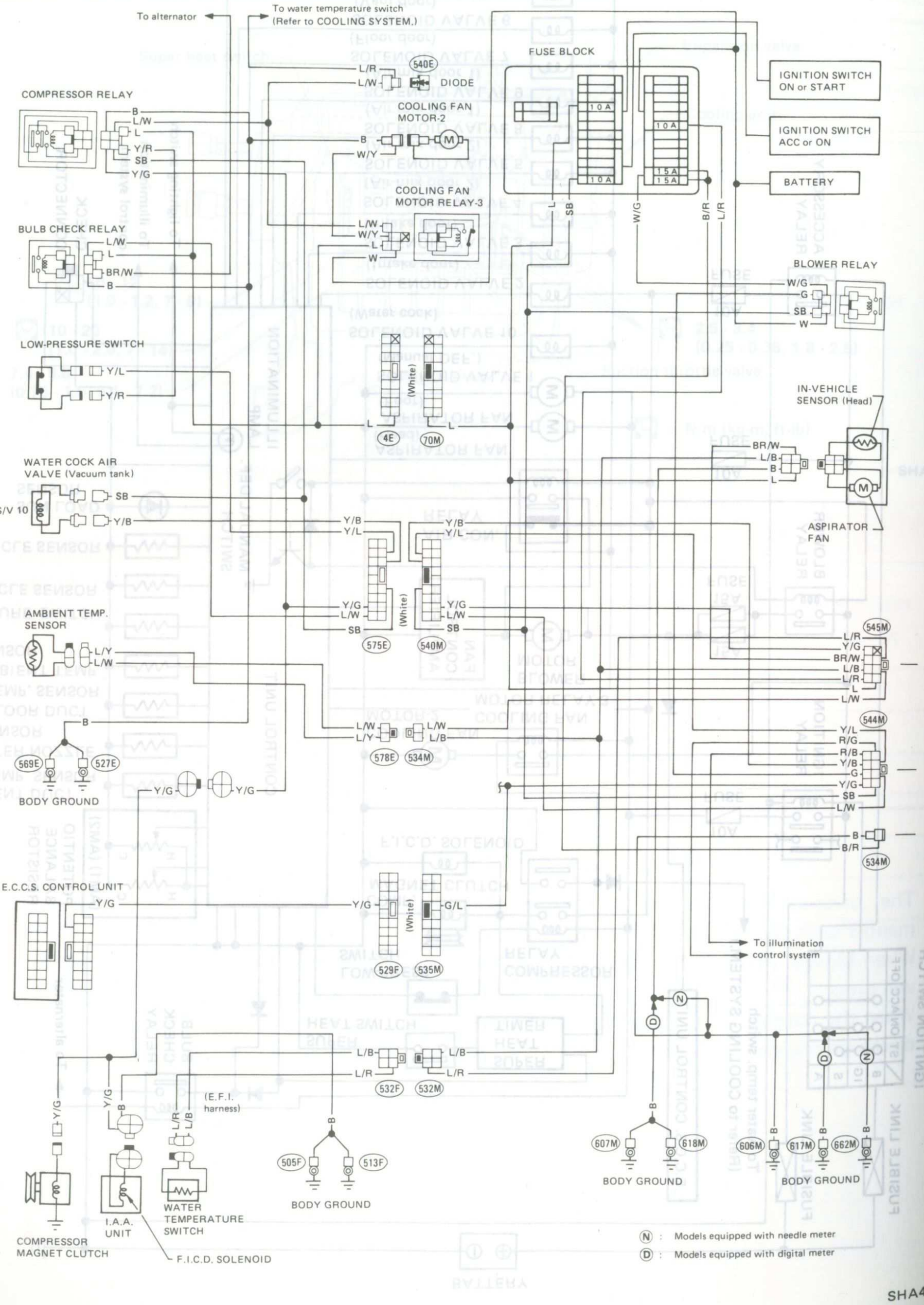
Schematic



SHA438B

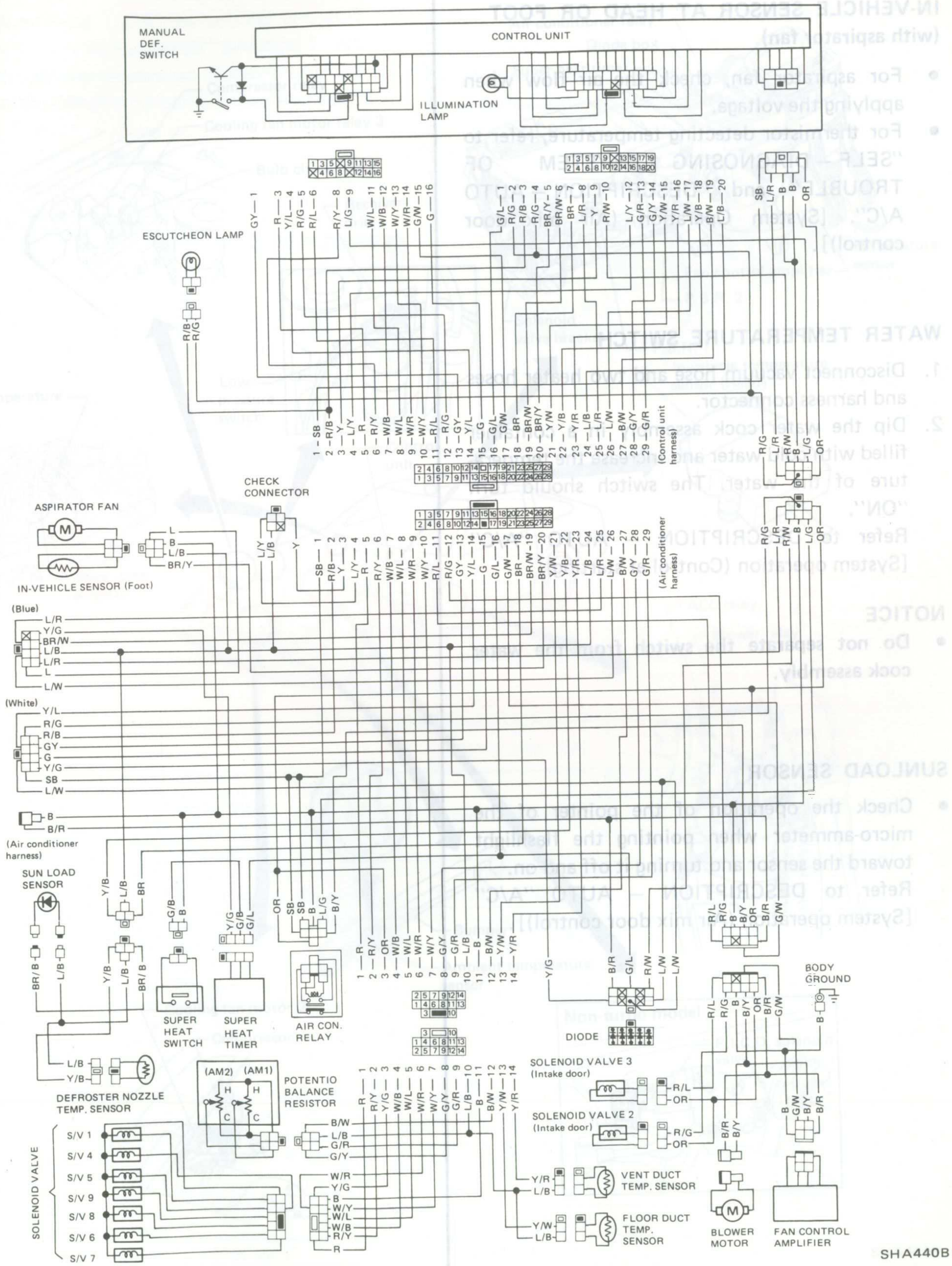
A/C ELECTRICAL CIRCUIT (Auto)

Wiring Diagram



A/C ELECTRICAL CIRCUIT (Auto)

Wiring Diagram (Cont'd)



Inspection

IN-VEHICLE SENSOR AT HEAD OR FOOT (with aspirator fan)

- For aspirator fan, check the air flow when applying the voltage.
- For thermistor detecting temperature, refer to "SELF – DIAGNOSING SYSTEM OF TROUBLE" and "DESCRIPTION – AUTO A/C". [System Operation (Air mix door control)].

WATER TEMPERATURE SWITCH

1. Disconnect vacuum hose and two heater hoses and harness connector.
2. Dip the water cock assembly in a container filled with cold water and increase the temperature of the water. The switch should turn "ON".
   Refer to DESCRIPTION – AUTO "A/C" [System operation (Control at starting)].

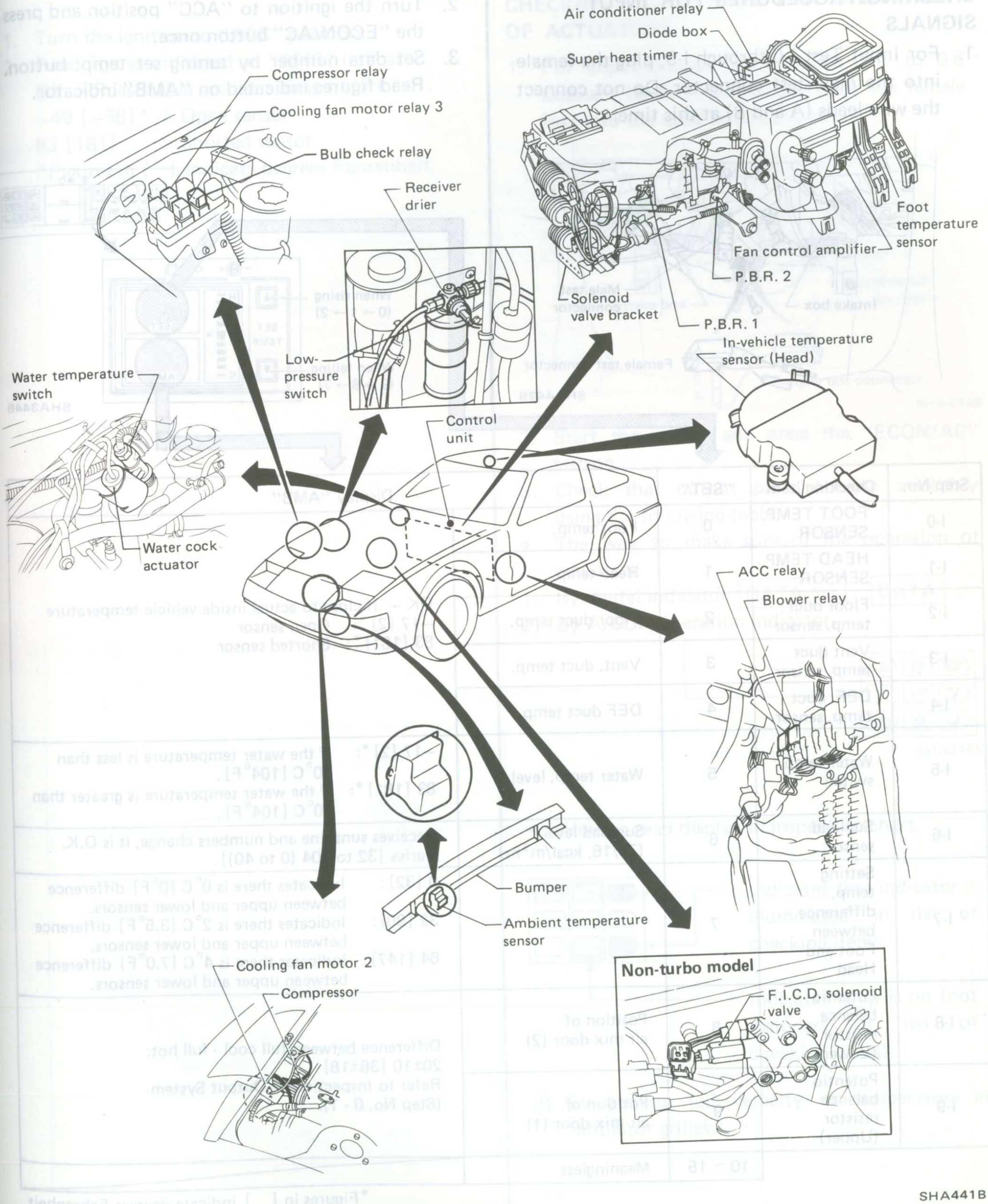
NOTICE

- **Do not separate the switch from the water cock assembly.**

SUNLOAD SENSOR

- Check the operation of the pointer of the micro-ammeter when pointing the flashlight toward the sensor and turning it off and on.
  Refer to DESCRIPTION – AUTO "A/C" [System operation (Air mix door control)].

LOCATION OF A/C ELECTRICAL COMPONENTS (Auto)

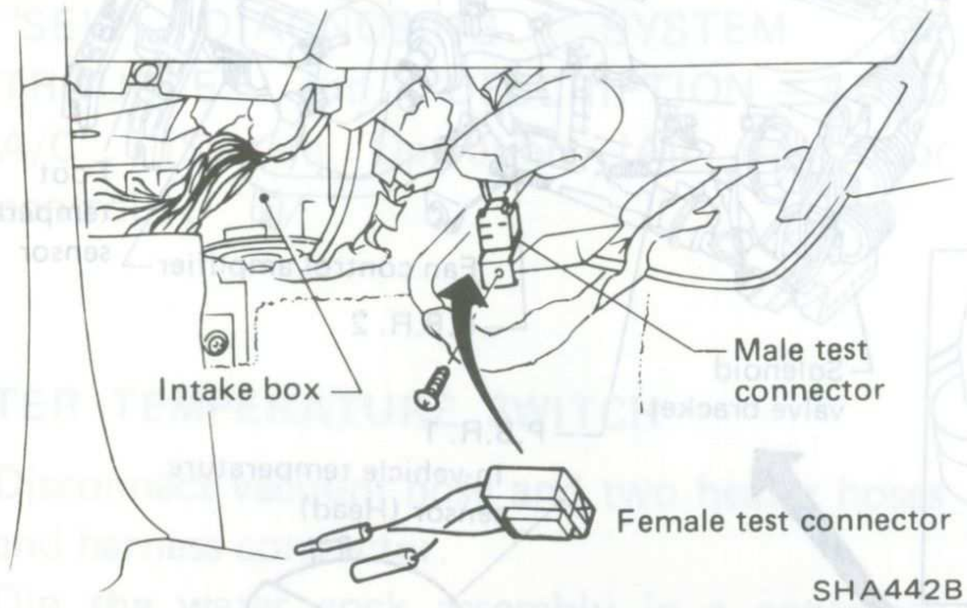


SHA441B

Inspection of Input System

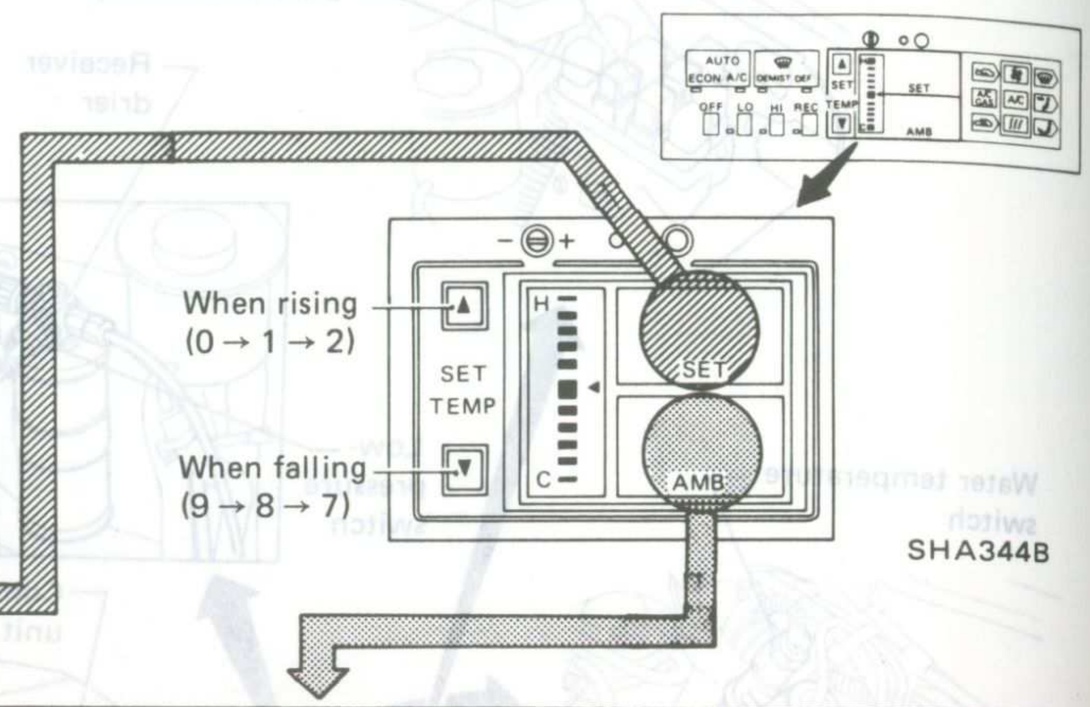
CHECKING PROCEDURES FOR INPUT SIGNALS

1. For Input Test I-0 through I-9, plug the female into the male test connector. Do not connect the wire leads (A and B) at this time.



SHA442B

2. Turn the ignition to "ACC" position and press the "ECON/AC" button once.
3. Set data number by tuning set temp. button. Read figures indicated on "AMB" indicator.



SHA344B

Step No.	Checking item	"SET"	Display "AMB"
I-0	FOOT TEMP. SENSOR	0	Foot temp.
I-1	HEAD TEMP. SENSOR	1	Head temp.
I-2	Floor duct temp. sensor	2	Floor duct temp.
I-3	Vent duct temp. sensor	3	Vent. duct temp.
I-4	DEF. duct temp. sensor	4	DEF duct temp.
I-5	Water temp. switch	5	Water temp. level
I-6	Sunload sensor	6	Sunload level (Zc/16, kcal/m^2hr)
I-7	Setting temp. difference between Foot and Head	7	—
I-8	Potentio balance resistor (Lower)	8	Position of air mix door (2)
I-9	Potentio balance resistor (Upper)	9	Position of air mix door (1)
		10 ~ 15	Meaningless

OK — If close to actual inside vehicle temperature
−17 [2] *: Open sensor
83 [181] *: Shorted sensor

−17 [2] *: If the water temperature is less than 40°C [104°F].
83 [181] *: If the water temperature is greater than 40°C [104°F].

Receives sunshine and numbers change, it is O.K.
Varies [32 to 104 (0 to 40)].

0 [32]: Indicates there is 0°C [0°F] difference between upper and lower sensors.
32 [90]: Indicates there is 2°C [3.5°F] difference between upper and lower sensors.
64 [147]: Indicates there is 4°C [7.0°F] difference between upper and lower sensors.

Difference between full cool - full hot:
20±10 [36±18]
Refer to Inspection of Output System (Step No. 0 - 1).

*Figures in [ ] indicate degrees Fahrenheit.

SELF-DIAGNOSING SYSTEM OF TROUBLE (Auto)

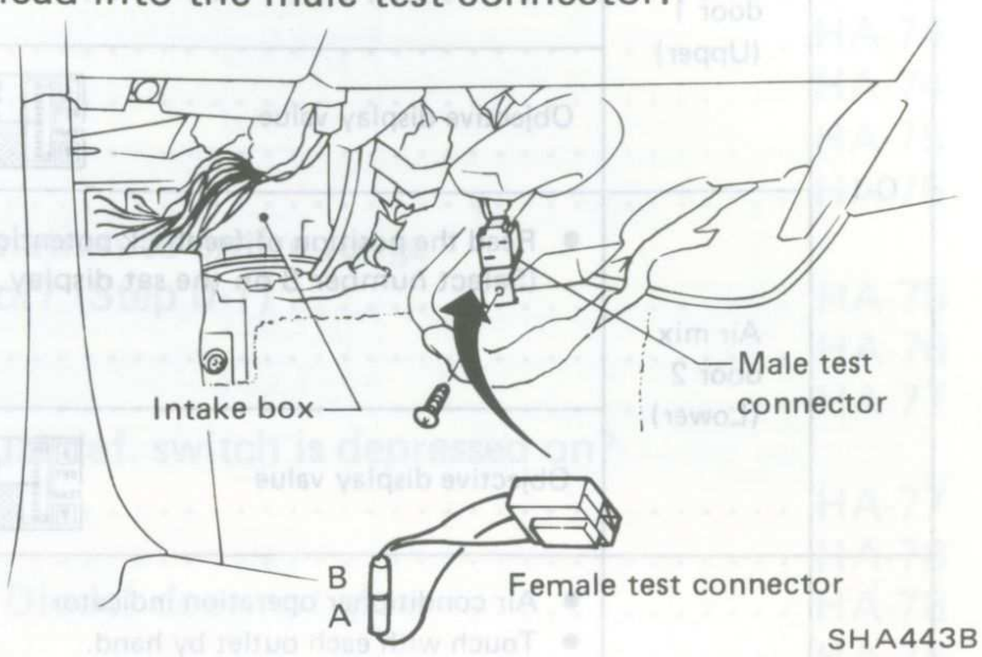
Inspection of Ambient Temperature Sensor

1. Turn the ignition to "ACC" position.
2. Read figures indicated on "AMB" indicator.
   OK — Reasonable ambient temperature
   –49 [–56] * : Open sensor
   83 [181] : Shorted sensor
   *Figures in [ ] indicate degrees Fahrenheit.

Inspection of Output System

CHECKING PROCEDURES FOR OPERATION OF ACTUATORS

1. For Input/Output System Test 0-1 to 0-6
   Connect leads A and B, and plug the female lead into the male test connector.

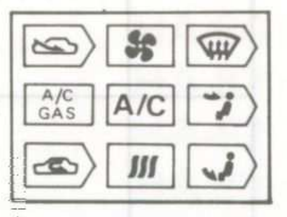


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2. Start the engine and press the "ECON/AC" button.
3. Check that output parts operate smoothly using the following table.

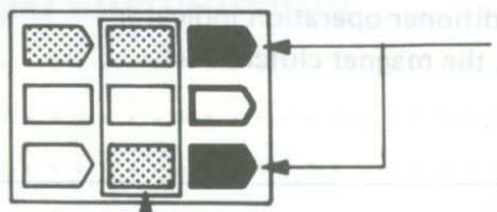
- The way to make sure of the operation of actuators.

1) By digital indicator DATA No. DATA .
2) By A/CON operation indicator.



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- How to read display in inspection chart.



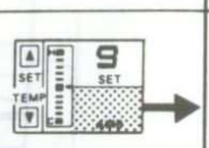
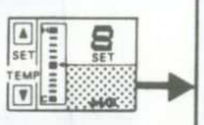
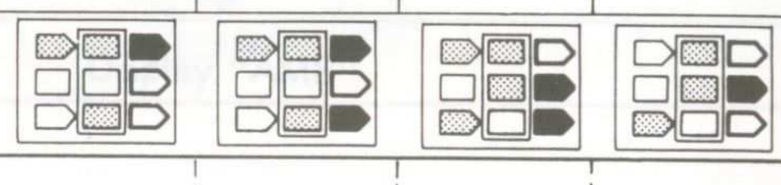
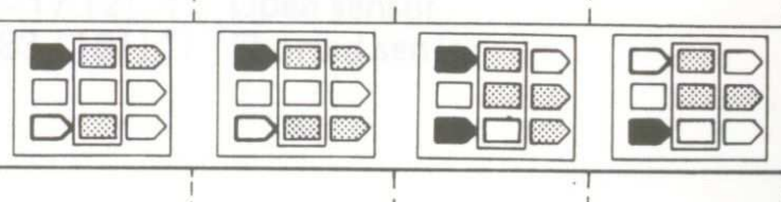
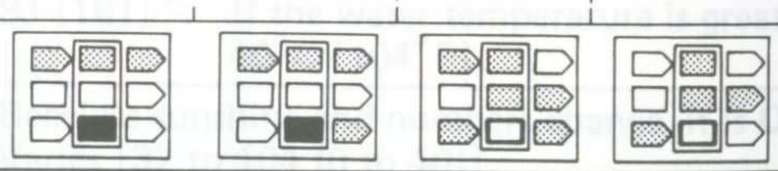
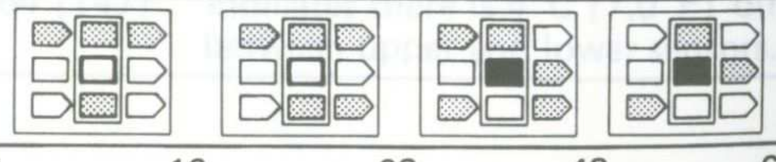
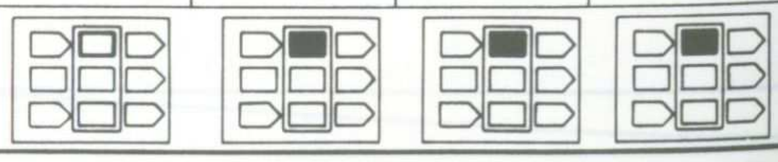
Indicates that indicator is illuminated in list of checking items.

Indicates lamp is on (not included in list of checking items).

3) By feeling. (air velocity or temperature at ventilator grilles.)

SELF-DIAGNOSING SYSTEM OF TROUBLE (Auto)

Inspection of Output System (Cont'd)

Step No.	Checking item	Procedures of confirming operation	
O-1	Air mix door 1 (Upper)	• Read the position of feedback potentio (Select number 9 on the set display.)	Time (SEC) 0 4 8 12 16 Full Hot Full Cool
		Objective display value 	40 [104] * 30 [86] * 20 [68] *
	Air mix door 2 (Lower)	• Read the position of feedback potentio (Select number 8 on the set display.)	Full Hot Full Cool
		Objective display value 	40 [104] * 30 [86] * 20 [68] *
O-2	Outlet	• Air conditioner operation indicator • Touch with each outlet by hand.	(SEC) DEF. VENT. B/L DEMIST
		Display	
O-3	Intake door	• Air conditioner operation indicator • Look at the intake door spring	REC. Partial REC. Fresh air
		Display	
O-4	Water cock	• Air conditioner operation indicator • Look at the water cock and touch with the diaphragm of cock.	ON OFF
		Display	
O-5	Compressor clutch	• Air conditioner operation indicator • Look at the magnet clutch.	ON OFF
		Display ("REC" "DEF")	
O-6	Blower motor	• Air conditioner operation indicator • Touch with each outlet by hand. • Measure the applied voltage of motor.	0 16 32 48 64 12 (V) 8 4 OFF
		Display	

*Figures in [ ] indicate degrees Fahrenheit

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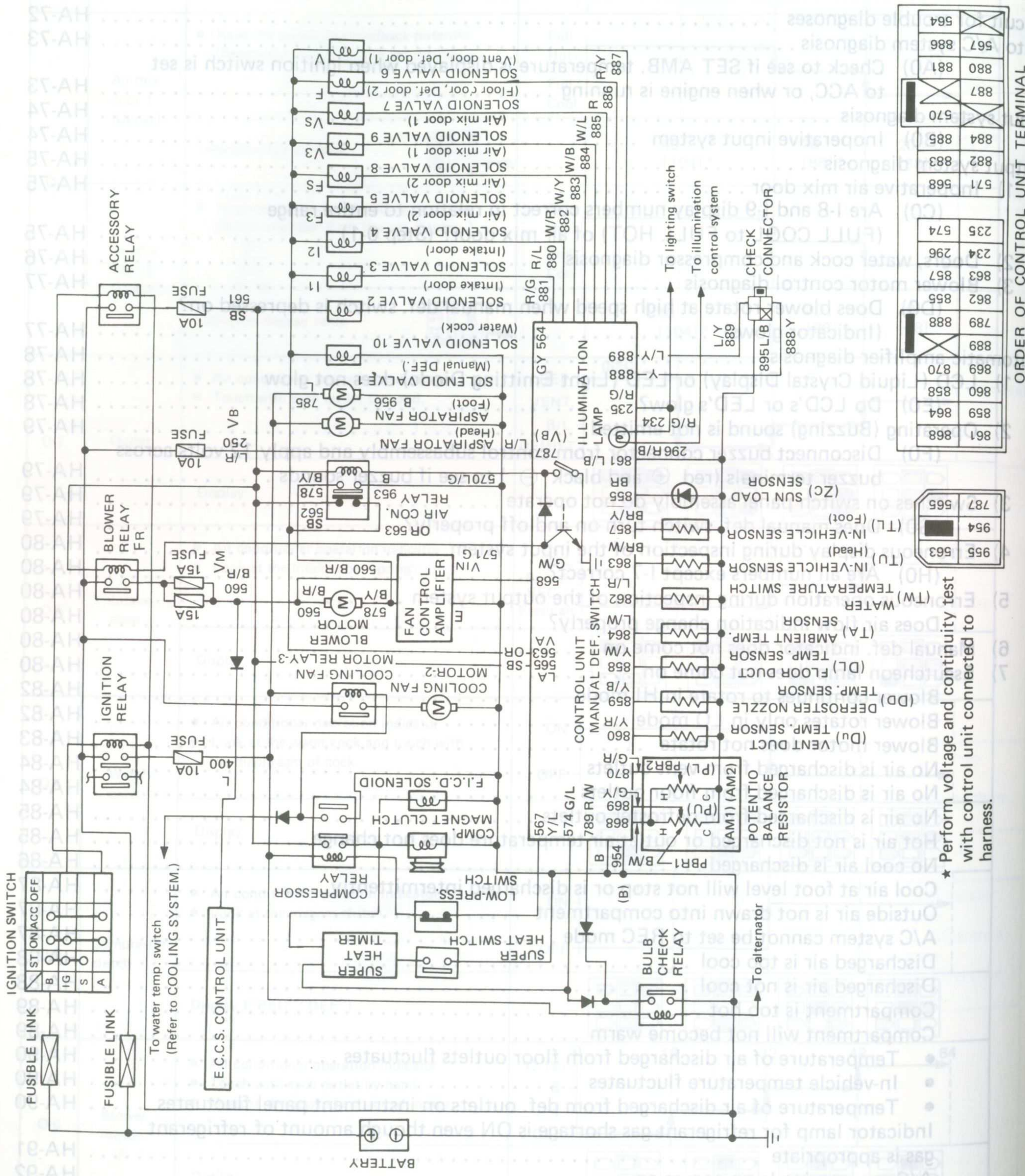
TROUBLE DIAGNOSES (Auto)

CONTENTS

Circuit for trouble diagnoses HA-72
Auto A/C system diagnosis HA-73
(A0) Check to see if SET AMB. temperature is displayed when ignition switch is set to ACC, or when engine is running HA-73
Input system diagnosis HA-74
(B0) Inoperative input system HA-74
Output system diagnosis HA-75
1) Inoperative air mix door HA-75
(C0) Are I-8 and I-9 display numbers correct in relation to entire range (FULL COOL to FULL HOT) of air mix door? (Step 0-1) HA-75
2) Doors, water cock and compressor diagnosis HA-76
3) Blower motor control diagnosis HA-77
(D0) Does blower rotate at high speed when manual def. switch is depressed on? (Indicator glows) HA-77
Automatic amplifier diagnosis HA-78
1) LCD (Liquid Crystal Display) or LED (Light Emitting Diode) does not glow HA-78
(E0) Do LCD's or LED's glow? HA-78
2) Operating (Buzzing) sound is not emitted HA-79
(F0) Disconnect buzzer connector from control subassembly and apply 12 volts across buzzer terminals (red ⊕ and black ⊖) to see if buzzer sounds HA-79
3) Switches on switch panel assembly do not operate HA-79
(G0) Does manual def. switch turn on and off properly? HA-79
4) Erroneous display during inspection of the input system HA-80
(H0) Are all numbers except I-7 correct? HA-80
5) Erroneous operation during inspection of the output system HA-80
Does air flow indication change properly? HA-80
6) Manual def. indicator does not come on HA-80
7) Escutcheon lamp does not come on HA-80
Blower continues to rotate in HI mode HA-82
Blower rotates only in LO mode HA-82
Blower motor does not rotate HA-83
No air is discharged from vent outlets HA-84
No air is discharged from floor outlets HA-84
No air is discharged from defroster outlets HA-85
Hot air is not discharged or outlet air temperature does not change HA-85
No cool air is discharged HA-86
Cool air at foot level will not stop or is discharged intermittently HA-87
Outside air is not drawn into compartment HA-87
A/C system cannot be set to REC mode HA-87
Discharged air is too cool HA-88
Discharged air is not cool HA-88
Compartment is too hot HA-89
Compartment will not become warm HA-89
- Temperature of air discharged from floor outlets fluctuates HA-90
- In-vehicle temperature fluctuates HA-90
- Temperature of air discharged from def. outlets on instrument panel fluctuates HA-90

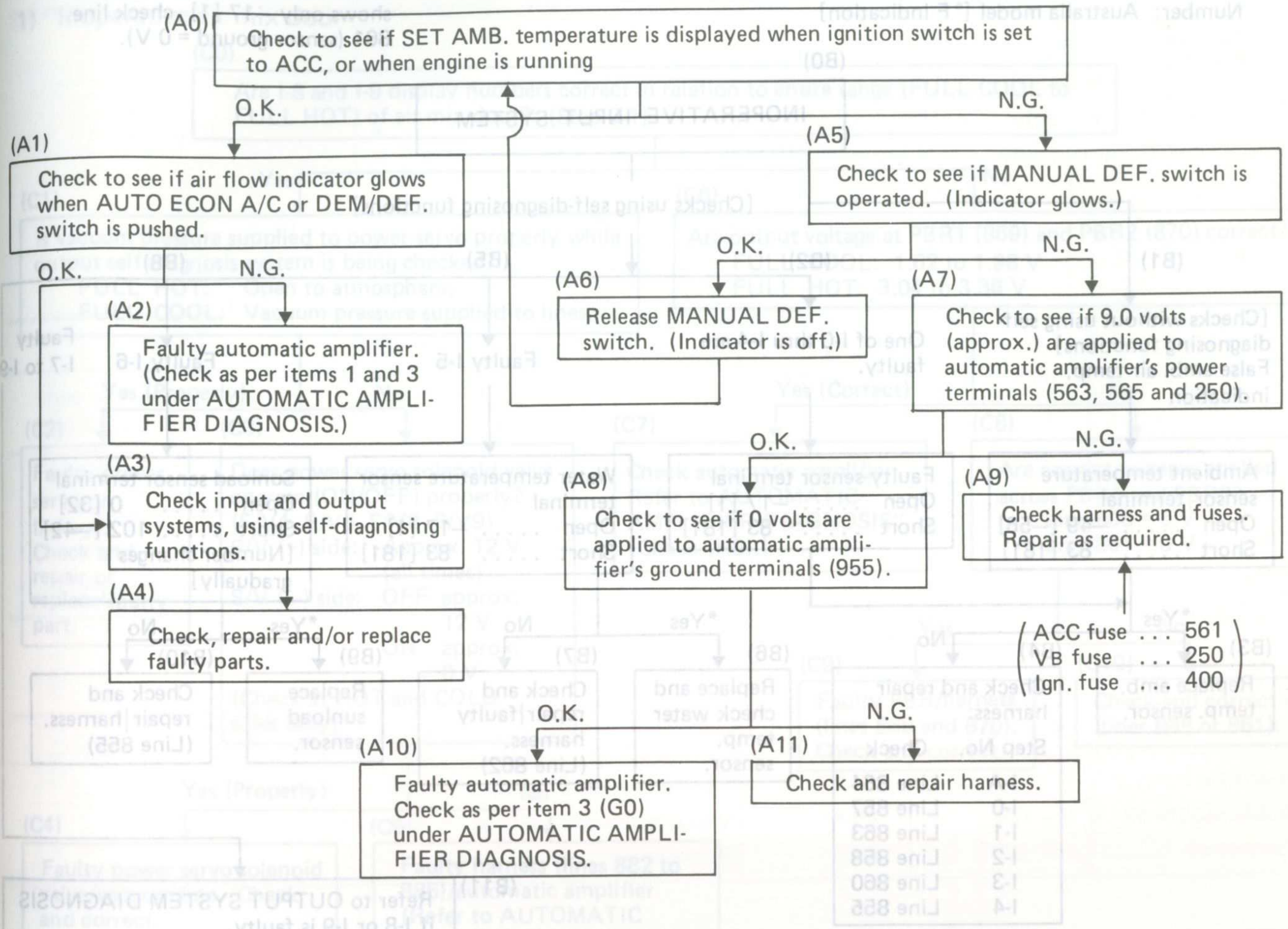
Indicator lamp for refrigerant gas shortage is ON even though amount of refrigerant gas is appropriate HA-91
A/C gas warning lamp comes on HA-92

Circuit for Trouble Diagnoses



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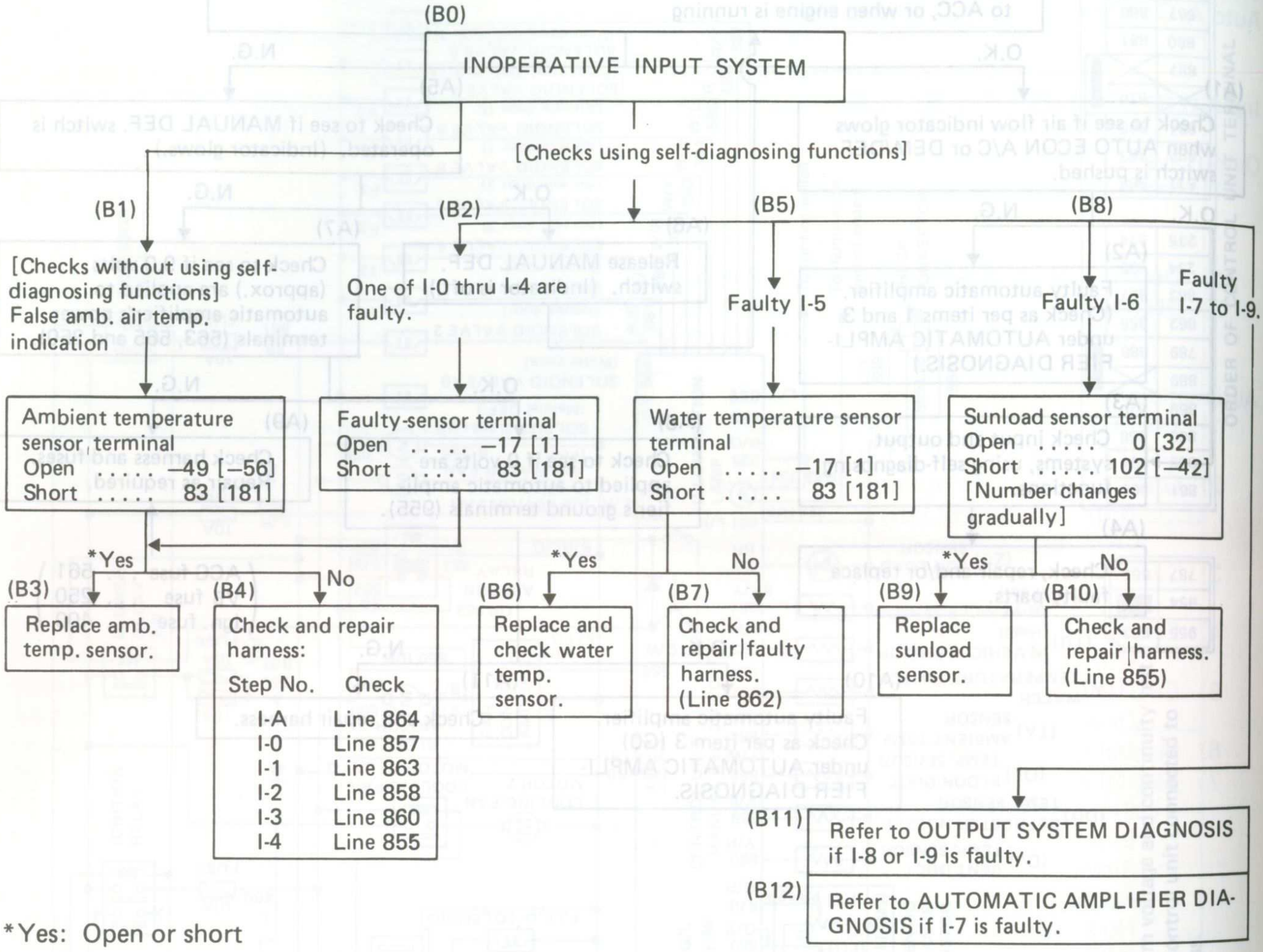
AUTO A/C SYSTEM DIAGNOSIS



INPUT SYSTEM DIAGNOSIS

Number: Australia model [°F indication]

★Numbers displayed on indicators.
When the indicator at I-0 thru I-4 shows only –17 [1], check line 861 (sensor ground = 0 V).



*Yes: Open or short

OUTPUT SYSTEM DIAGNOSIS

1) Inoperative air mix door

(C0)

Are I-8 and I-9 display numbers correct in relation to entire range (FULL COOL to FULL HOT) of air mix door? (Step 0-1)

Yes

(C1)

Is vacuum pressure supplied to power servo properly while output self-diagnosis system is being checked?
FULL HOT: Open to atmosphere.
FULL COOL: Vacuum pressure supplied to lines.

Yes (Properly)

(C2)

Faulty power servo or linkage. Check and repair or replace faulty part.

No

(C3)

Does power servo solenoid valve operate (ON/OFF) properly? (S/V4, S/V5, S/V8, S/V9)
S/V (+) side: Approx. 12 V (all times)
S/V (−) side: OFF approx. 12 V
ON approx. 0 V
(Check at HOT and COLD sides only)

Yes (Properly)

(C4)

Faulty power servo solenoid valve/vacuum line. Check and correct.

No

(C5)

Faulty harness (lines 882 to 885)/automatic amplifier (Refer to AUTOMATIC AMPLIFIER DIAGNOSIS.). Check and correct.

No

(C6)

Are output voltage at PBR1 (869) and PBR2 (870) correct?
FULL COOL: 1.62 to 1.98 V
FULL HOT: 3.04 to 3.36 V

Yes (Correct)

(C7)

Check automatic amplifier. Refer to AUTOMATIC AMPLIFIER DIAGNOSIS". [Check (H0).]

No

(C8)

Are correct voltages applied across PBR1 and PBR2?
Line 808 = 5 V
Line 861 = 0 V

Yes

(C9)

Faulty PBR/harness (lines 869 and 870). Check and correct.

No

(C10)

Check and correct (lines 868 or 861).

2) Doors, water cock and compressor diagnosis

While checking output system, check solenoid valves, relays, vacuum pressure, etc., using the following tables as a guide.

Normal solenoid valve and relay operation

Positive (+) side: Approx. 12 V (Constant)

Negative (−) side: OFF (approx. 12 V)

ON (0 volts)

(K1)

Outlet	S/V6 (887)	S/V7 (886)	Actuator		
			DEF. door (Ad)	VENT. door (Av)	Floor door and DEF. door 2 (Af)
DEF.	OFF	OFF	Atmosphere	←	←
VENT.	ON	OFF	Vacuum pressure	←	Atmosphere
B/L	ON	ON	Vacuum pressure	←	Vacuum pressure
HEAT	OFF	ON	Atmosphere	←	Vacuum pressure

(K2)

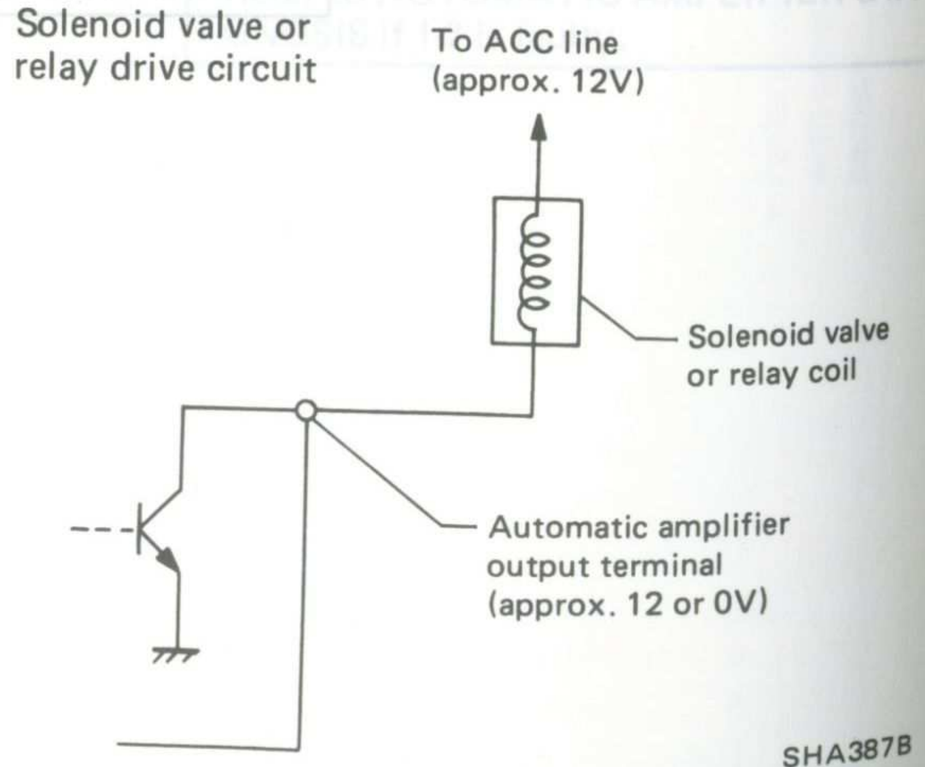
Inlet	S/V3 (881)	S/V2 (880)	Double action actuator (AI)
Inside air	ON	ON	Vacuum pressure (at both 1st and 2nd position)
Inside-outside air	ON	OFF	Vacuum pressure (only at 1st position)
Outside air	OFF	OFF	Atmosphere

(K3)

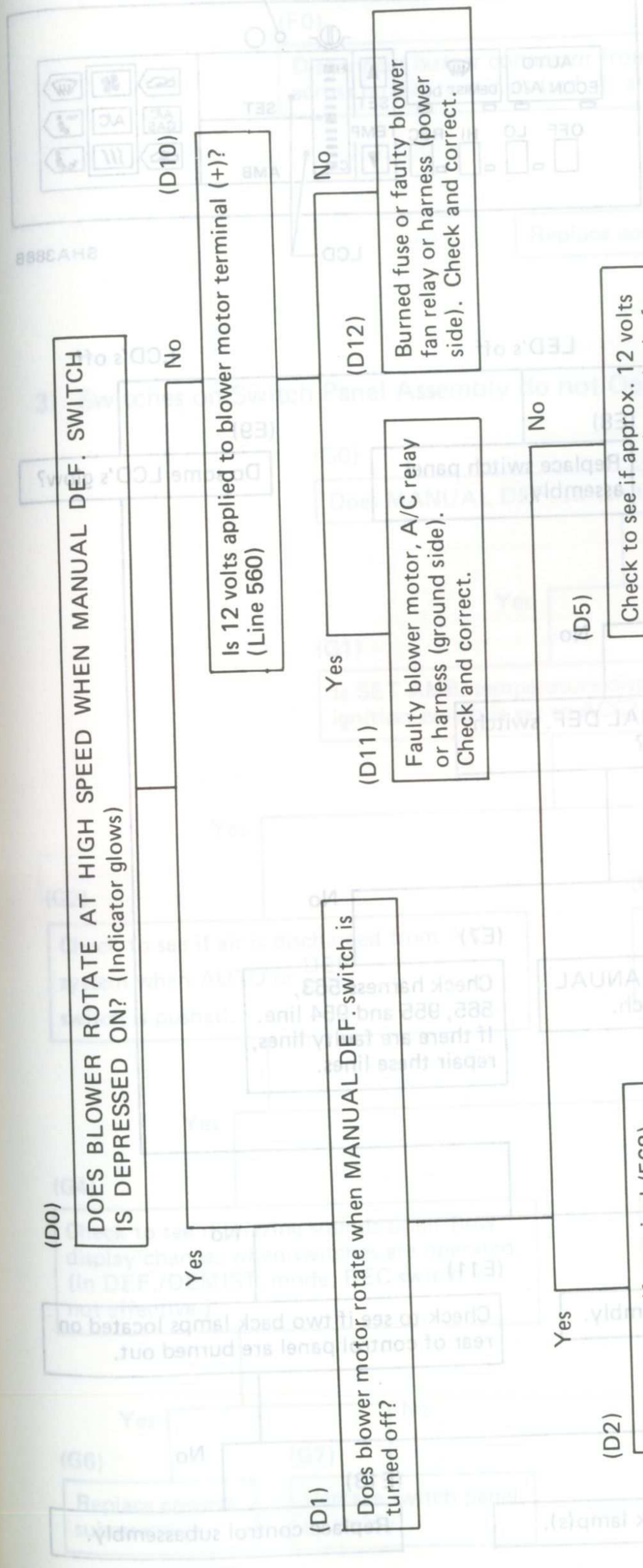
	S/V10 (564)	W/C (AW) actuator
Hot water closed	OFF	Atmosphere
Hot water opened	ON	Vacuum pressure

(K4)

	Compressor relay (567)
Compressor ON	ON
Compressor OFF	OFF

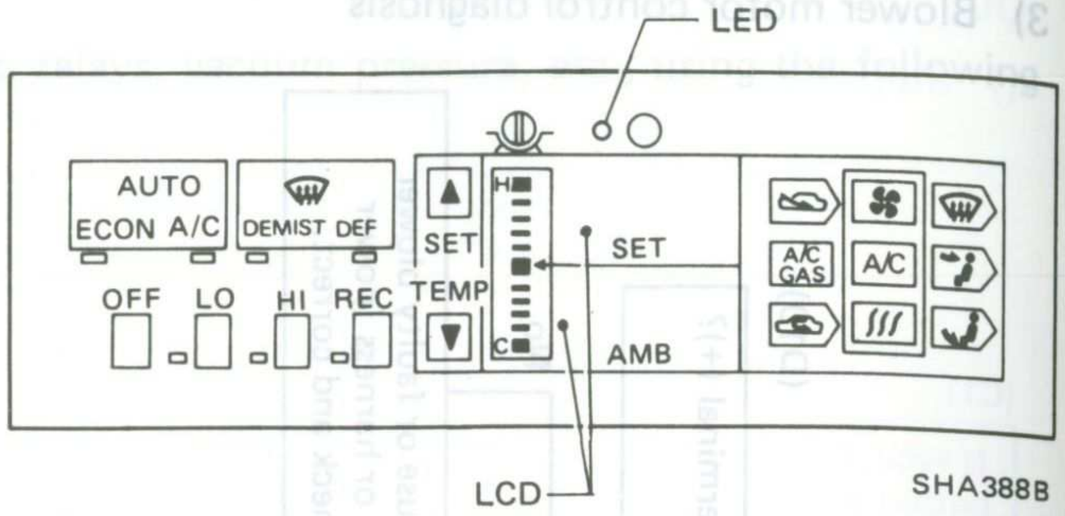


3) Blower motor control diagnosis



AUTOMATIC AMPLIFIER DIAGNOSIS

1) LCD (Liquid Crystal Display) or LED (Light Emitting Diode) does not glow.



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(E0)

Do LCD's or LED's glow?

LCD's & LED's off

(E1)

When ignition switch is set to ACC, check to see if more than 9 volts are produced at 563, 565 and 250 and 0 volts at 955.

Yes

(E2)

Check to see if air is discharged from A/C system when AUTO or DEF. DEM. switch is pushed.

Yes

(E4)

Replace switch panel assembly.

No

(E5)

Replace control subassembly.

No

(E3)

Is MANUAL DEF. switch activated?

Yes

(E6)

Release MANUAL DEF. switch.

No

(E7)

Check harness 563, 565, 955 and 954 line. If there are faulty lines, repair these lines.

LED's off

(E8)

Replace switch panel assembly.

LCD's off

(E9)

Do some LCD's glow?

Yes

(E10)

Replace switch panel assembly.

No

(E11)

Check to see if two back lamps located on rear of control panel are burned out.

Yes

(E12)

Replace faulty back lamp(s).

No

(E13)

Replace control subassembly.

2) Operating (Buzzing) Sound is not Emitted.

(F0)

Disconnect buzzer connector from control subassembly and apply 12 volts across buzzer terminals (red ⊕ and black ⊖) to see if buzzer sounds.

Replace control subassembly.

3) Switches on Switch Panel Assembly do not Operate.

(G0)

Does MANUAL DEF. switch turn on and off properly?

Yes

(G1)

Is SET AMB. temperature displayed when ignition switch is set to ACC?

Yes

(G2)

Check to see if air is discharged from A/C system when AUTO or DEF. DEM. switch is pushed.

Yes

(G4)

Check to see if buzzing sounds or air flow display changes when switches are operated. (In DEF./DEMIST. mode, REC switch is not effective.)

Yes

(G6)

Replace control subassembly.

No

(G7)

Replace switch panel assembly.

No

(G3)

Check (E0) ~ (E13) [automatic amplifier as per item 1) above.]

No

(G5)

Replace switch panel assembly.

No

(G8)

Disconnect MANUAL DEF. switch connector. Check to see if resistance between terminals is 0 ohm when switch is on and infinity when switch is off.

Yes

(G9)

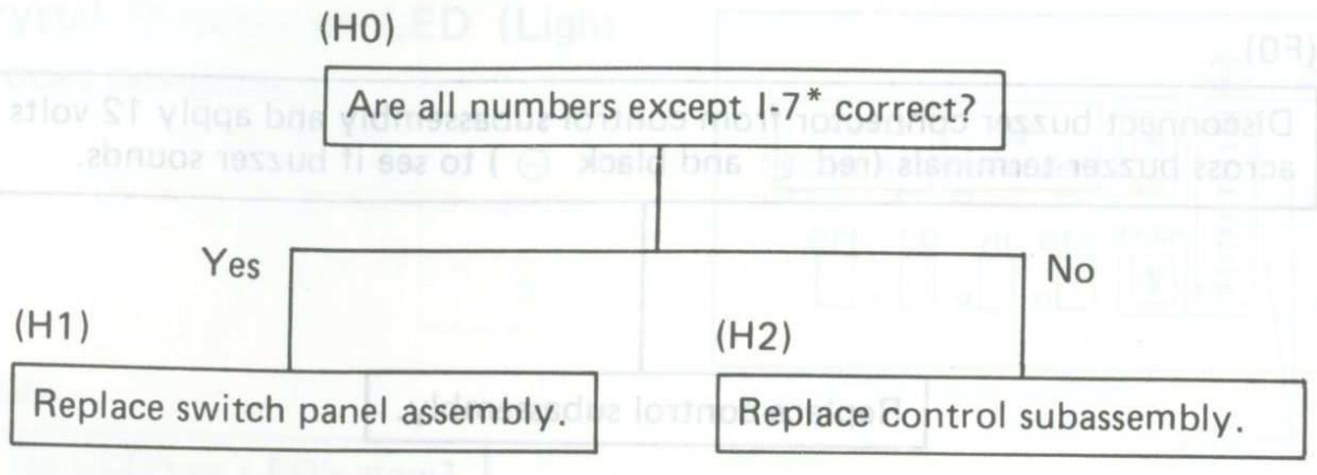
Replace control subassembly.

No

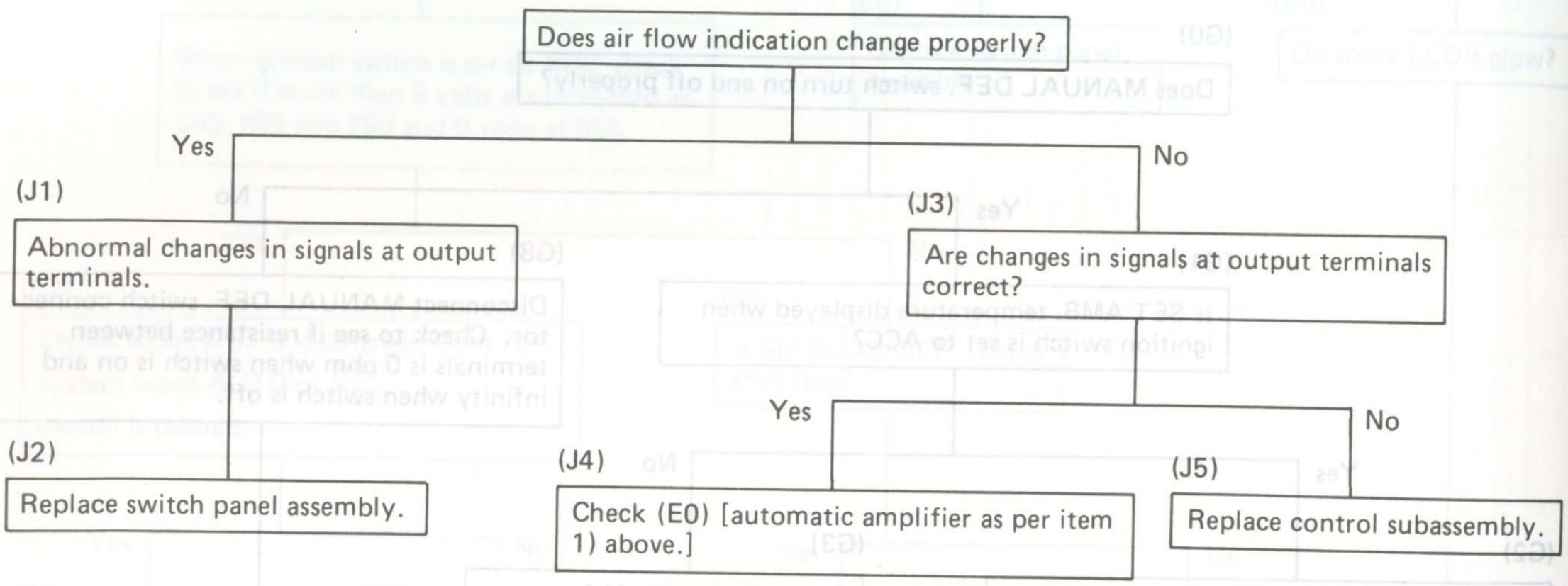
(G10)

Replace switch panel assembly.

4) Erroneous Display during Inspection of the Input System



5) Erroneous Operation during Inspection of the Output System



6) MANUAL DEF. indicator does not come on.
   Replace switch panel assembly.
7) Escutcheon lamp does not come on.
   Check for burned-out lamp located at rear of switch panel assembly.

BLOWER CONTINUES TO ROTATE IN HI MODE.

MODE: AUTO A/C
Does air flow decrease when SET TEMP. buttons (on control panel) are set to in-vehicle temperature?

Yes → Normal operation

No → Does blower operate in LO mode when manual LO button is pushed to ON?

Yes → Check (B2) under INPUT SYSTEM DIAGNOSIS.

[CHECK POINTS]
(1) Open or shorted sensor (Tu, Du, or Dd)
(2) Aspirator motor does not rotate and "Tu" value is close to "TA" value.

TU: In-vehicle sensor (Head)
TA: Ambient temp. sensor

No → Check (D2) under BLOWER MOTOR CONTROL DIAGNOSIS.

[CHECK POINTS]
Control unit VIN signal: 4.3 volts (HI)
1.4 volts (LO)

BLOWER ROTATES ONLY IN LO MODE.

MODE: AUTO A/C
Does air flow increase when SET TEMP. buttons (on control panel) are set to 40°C (90°F)?
[or set to 10°C (60°F)]

Yes → Normal operation

No → Does blower motor rotate in HI mode when manual HI button is pushed to ON?

Yes → Check (B2) and (B5) under INPUT SYSTEM DIAGNOSIS.

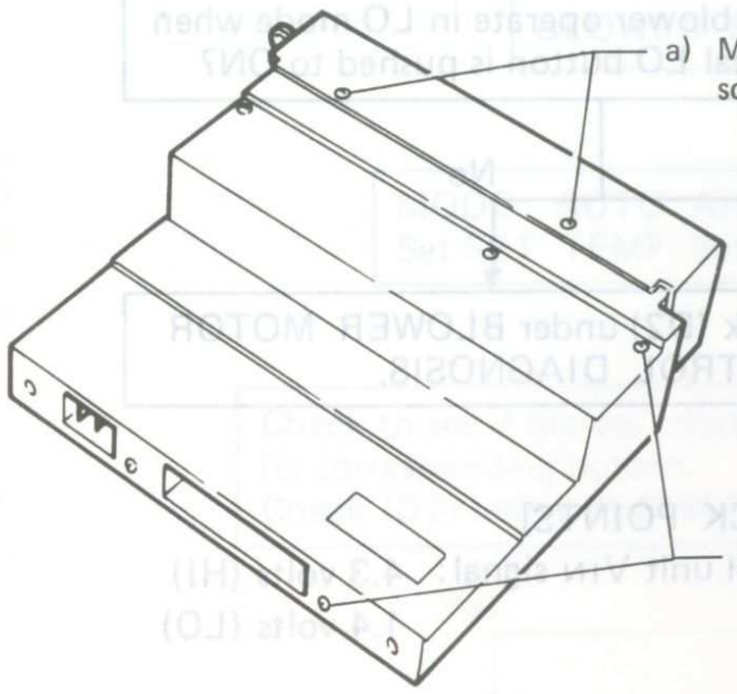
[CHECK POINTS]
Harnesses, connectors and sensors in relation to TL, Tu, DL, Du, DD

No → Check (D0) under BLOWER MOTOR CONTROL DIAGNOSIS.

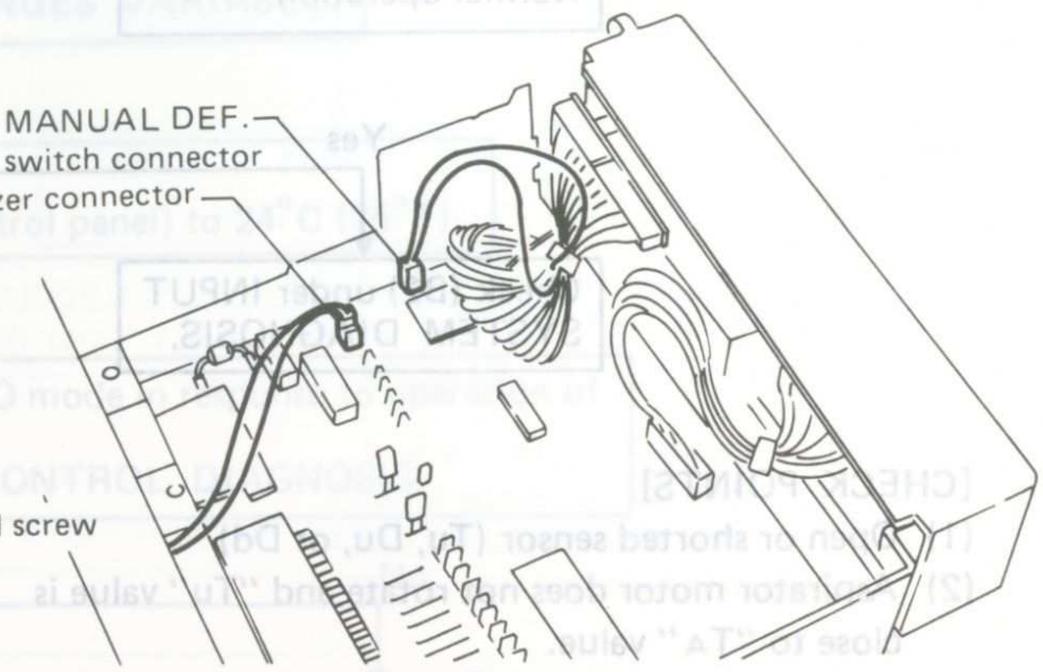
TL: In-vehicle sensor (Foot)
TU: In-vehicle sensor (Head)
DL: Floor duct temp. sensor
Du: Vent duct temp. sensor
DD: Defroster nozzle temp. sensor

Figure
a) M3 flat head screw, 2 places
b) M3 panhead screw, 4 places
c) MANUAL DEF. switch connector
d) Buzzer connector
e) Top view of the automatic amplifier PC board

* Before performing various operational checks of the automatic amplifier, check to make sure the four switch panel assembly-to-control subassembly connectors, MANUAL DEF. switch connector and buzzer connector are secure and tight and are free from damage.

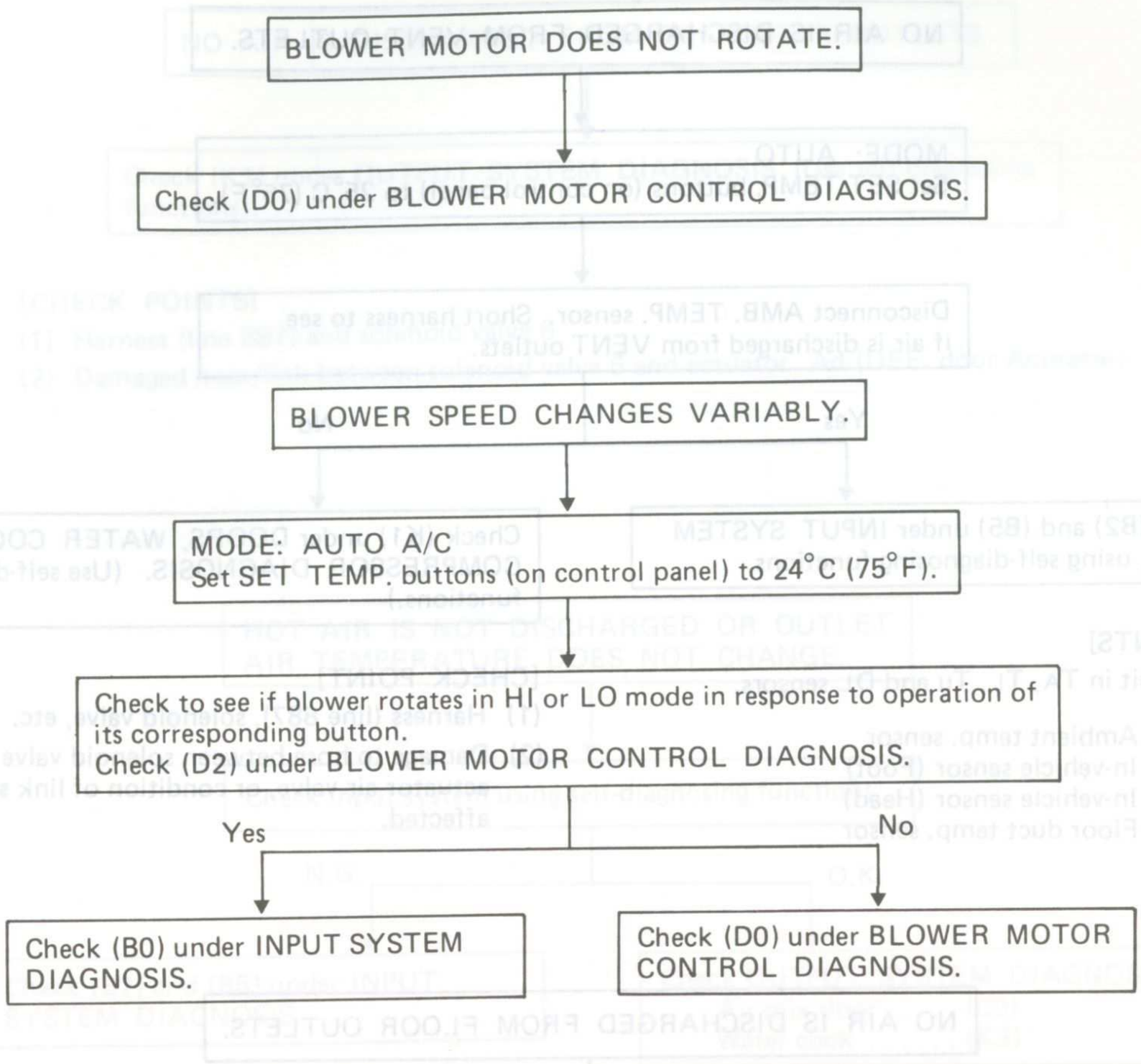


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e) Top view of the automatic amplifier PC board

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[CHECK POINTS]

(1) Poor or faulty connection of In-vehicle sensor (Foot), In-vehicle sensor (Head), Floor duct temp. sensor, Vent duct temp. sensor, Defroster nozzle duct temp. sensor, Ambient temp. sensor, Sunload sensor, Potentio Balance Resistor (AMI), Potentio Balance Resistor (AM2).

(2) Start-stop operation of aspirator motor and voltage measurements at sensors (Remove sensor assembly to gain access to sensors.)

NO AIR IS DISCHARGED FROM VENT OUTLETS.

↓

MODE: AUTO
Set SET TEMP. buttons (on control panel) to 25°C (75°F).

↓

Disconnect AMB. TEMP. sensor. Short harness to see if air is discharged from VENT outlets.

Yes → Check (B1), (B2) and (B5) under INPUT SYSTEM DIAGNOSIS, using self-diagnosing functions.

[CHECK POINTS]
(1) Open circuit in TA, TL, Tu and DL sensors.

- TA: Ambient temp. sensor
- TL: In-vehicle sensor (Foot)
- Tu: In-vehicle sensor (Head)
- DL: Floor duct temp. sensor

No → Check (K1) under DOORS, WATER COCK AND COMPRESSOR DIAGNOSIS. (Use self-diagnosing functions.)

[CHECK POINT]
(1) Harness (line 887), solenoid valve, etc.
(2) Damage to hose between solenoid valve (6) and actuator air valve, or condition of link system affected.

NO AIR IS DISCHARGED FROM FLOOR OUTLETS.

↓

MODE: AUTO A/C
Set SET TEMP. buttons (on control panel) to 25°C (75°F).

↓

Check to see if air is discharged from floor outlets when ambient temperature sensor is disconnected.

Yes → Check (K1) under DOORS, WATER COCK AND COMPRESSOR DIAGNOSIS (Using self-diagnosing functions).

[CHECK POINTS]
Short circuit in ambient temp. sensor and sunload sensor

No → Check (B1), (B5) and (B8) under INPUT SYSTEM DIAGNOSIS (Using self-diagnosing functions).

[CHECK POINTS]
(1) Harness (line 886) and solenoid valve (7)
(2) Damage to hose between solenoid valve (7) and floor actuator Af, and condition of link system affected

NO AIR IS DISCHARGED FROM DEFROSTER OUTLETS.

↓

Check (K1) under OUTPUT SYSTEM DIAGNOSIS (Use self-diagnosing functions).

[CHECK POINTS]
(1) Harness (line 887) and solenoid valve 6
(2) Damaged hose/link between solenoid valve 6 and actuator Ad (DEF. door Actuator)

HOT AIR IS NOT DISCHARGED OR OUTLET AIR TEMPERATURE DOES NOT CHANGE.

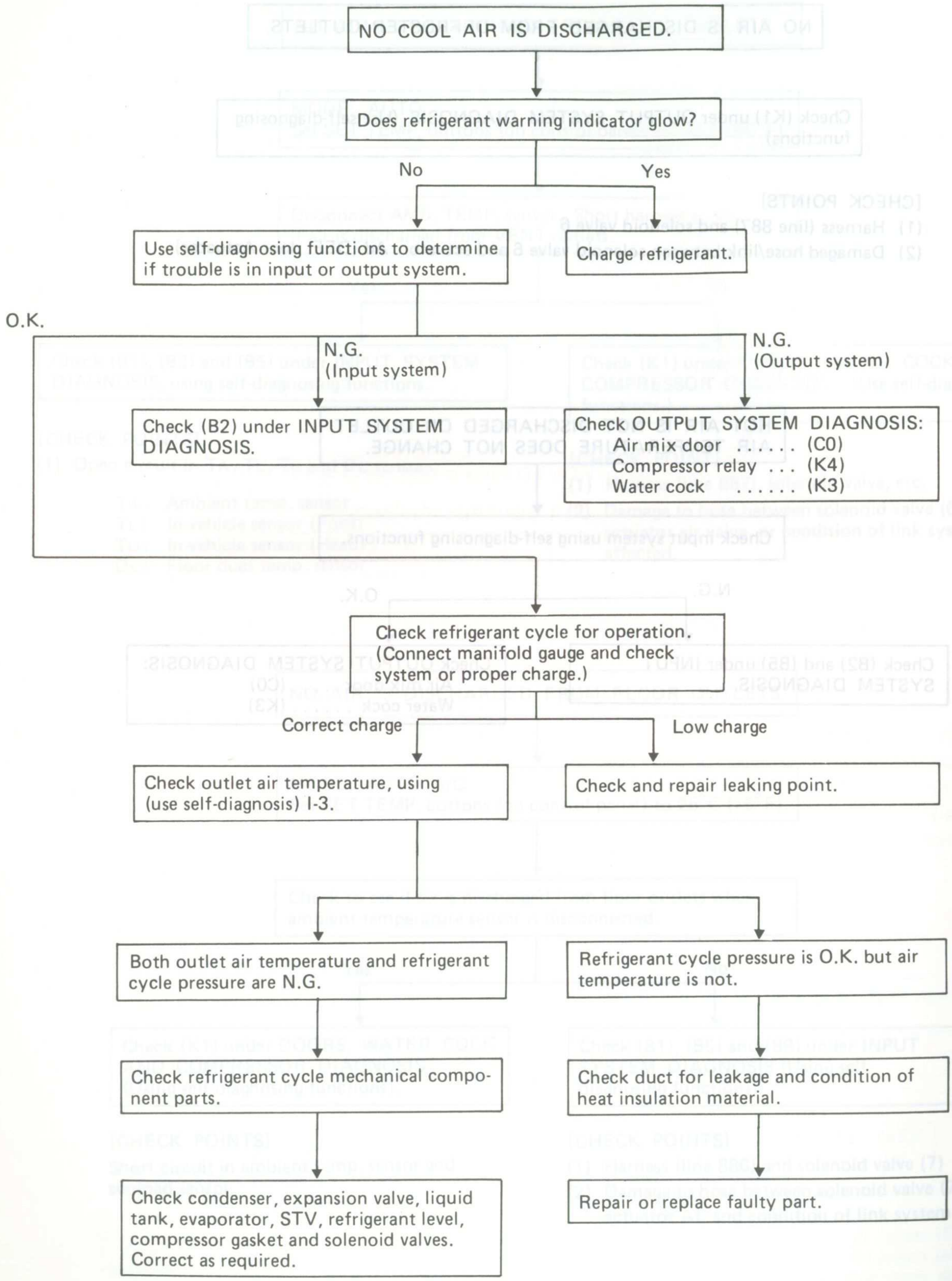
↓

Check input system using self-diagnosing functions.

N.G. ← → O.K.

Check (B2) and (B5) under INPUT SYSTEM DIAGNOSIS.

Check OUTPUT SYSTEM DIAGNOSIS:
Air mix door . . . . . (C0)
Water cock . . . . . (K3)


NO COOL AIR IS DISCHARGED.
Does refrigerant warning indicator glow?
No
Yes
Use self-diagnosing functions to determine if trouble is in input or output system.
Charge refrigerant.
O.K.
N.G. (Input system)
N.G. (Output system)
Check (B2) under INPUT SYSTEM DIAGNOSIS.
Check OUTPUT SYSTEM DIAGNOSIS:
Air mix door ..... (C0)
Compressor relay ... (K4)
Water cock ..... (K3)
Check refrigerant cycle for operation. (Connect manifold gauge and check system or proper charge.)
Correct charge
Low charge
Check outlet air temperature, using (use self-diagnosis) I-3.
Check and repair leaking point.
Both outlet air temperature and refrigerant cycle pressure are N.G.
Refrigerant cycle pressure is O.K. but air temperature is not.
Check refrigerant cycle mechanical component parts.
Check duct for leakage and condition of heat insulation material.
Check condenser, expansion valve, liquid tank, evaporator, STV, refrigerant level, compressor gasket and solenoid valves. Correct as required.
Repair or replace faulty part.

COOL AIR AT FOOT LEVEL WILL NOT STOP OR IS DISCHARGED INTERMITTENTLY.

Is air discharged to foot level when A/C system is set to DEF. mode?

No

MODE: DEMIST
Push SET TEMP. buttons (on control panel) to set objective temperature at 24°C (75°F), and check to see if air is discharged to foot level intermittently.

Yes

Check (K1) under DOORS, WATER COCK AND COMPRESSOR DIAGNOSIS [Using step (0-2) of self-diagnosing functions].

Yes

No

Check (B1) an (B8) under INPUT SYSTEM DIAGNOSIS, using step I-6 and ambient temperature sensor check procedure.

OUTSIDE AIR IS NOT DRAWN INTO COMPARTMENT.

Is outside air drawn into compartment when A/C system is set to ECON (DEF.) mode?

A/C SYSTEM CANNOT BE SET TO REC MODE.

Is A/C system set to REC mode when it is set in ECON mode and REC button is pushed to ON?

Yes

No

Use self-diagnosing fuctions to determine whether trouble is in input or output system.

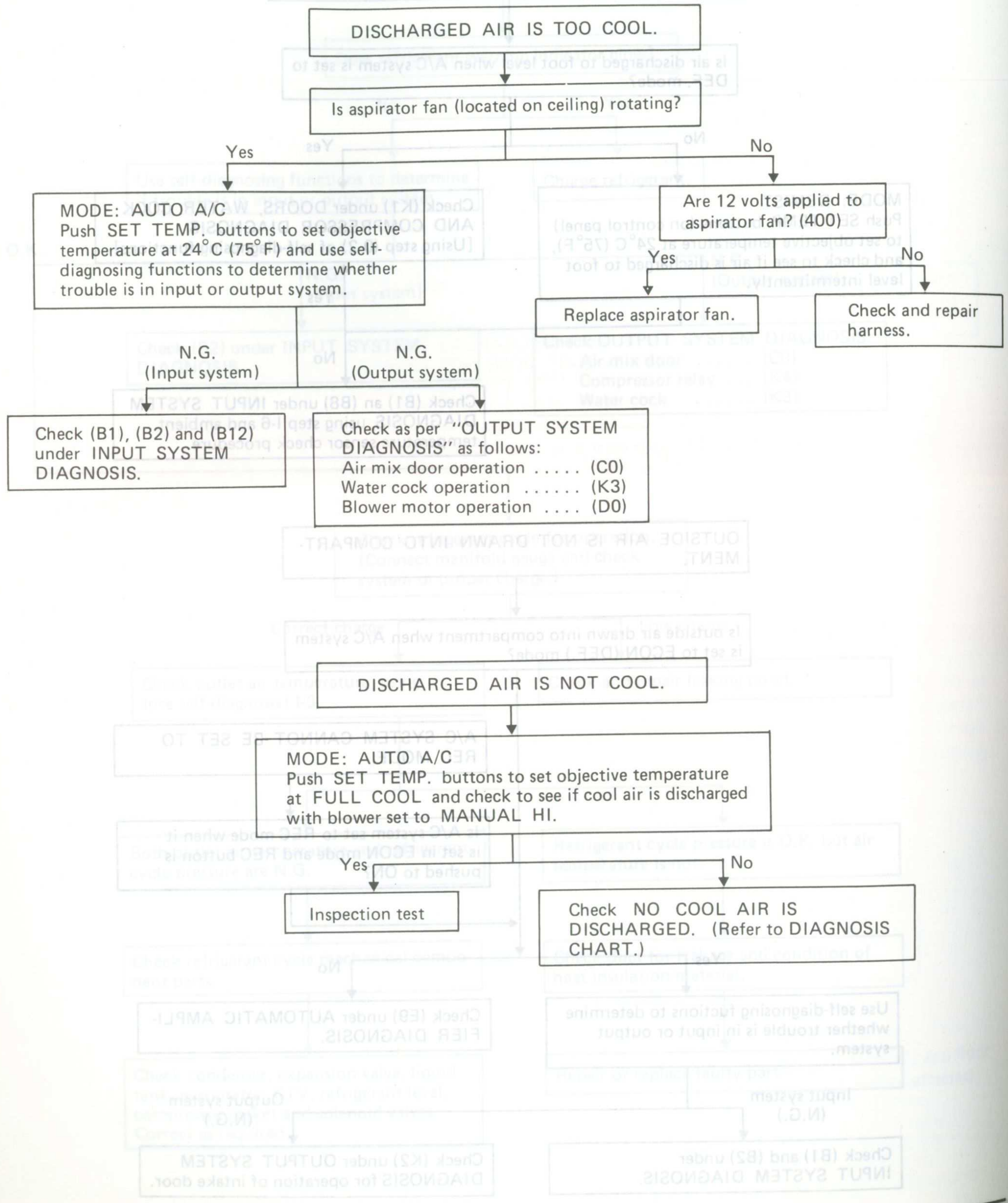
Check (E9) under AUTOMATIC AMPLIFIER DIAGNOSIS.

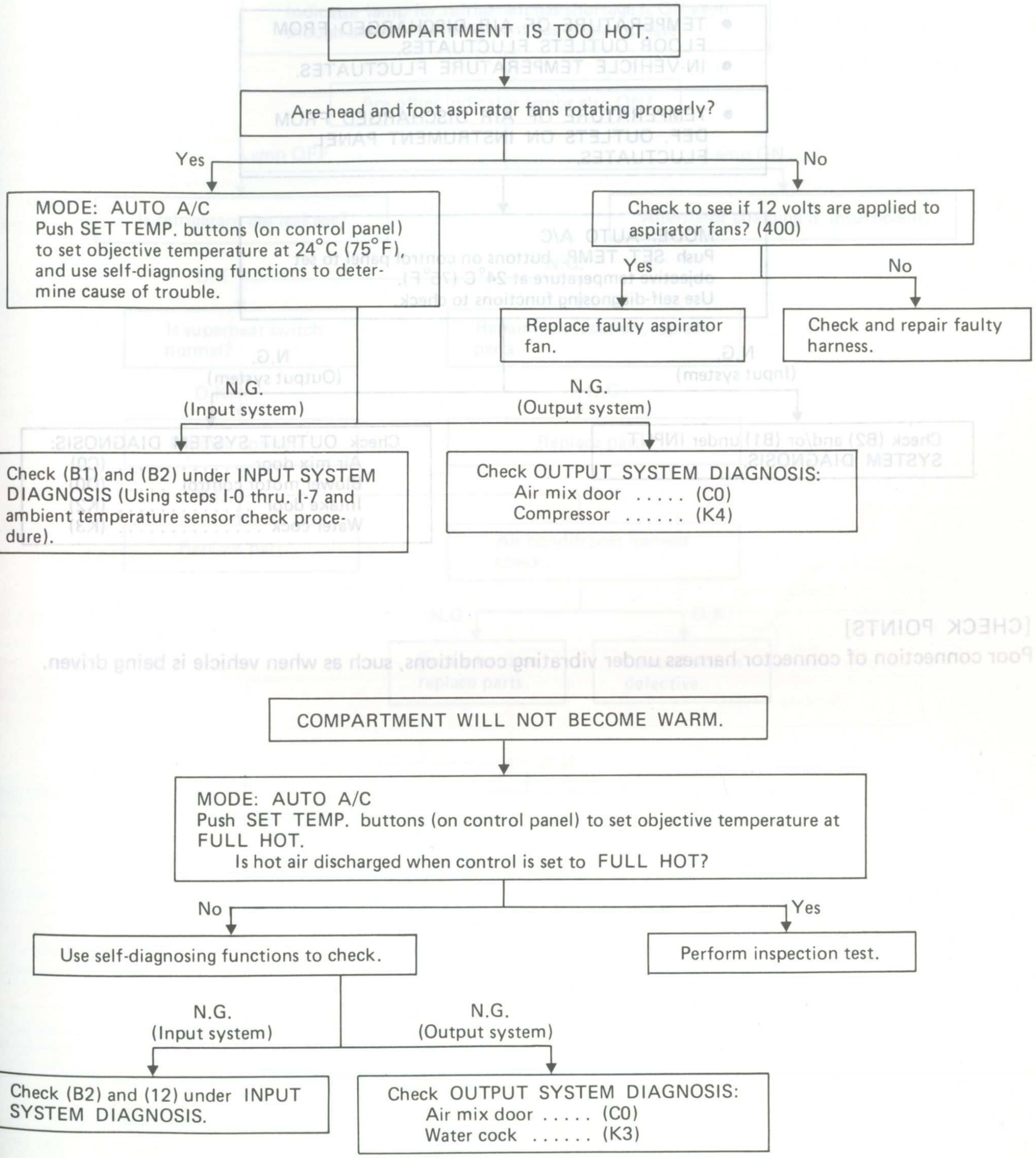
Input system (N.G.)

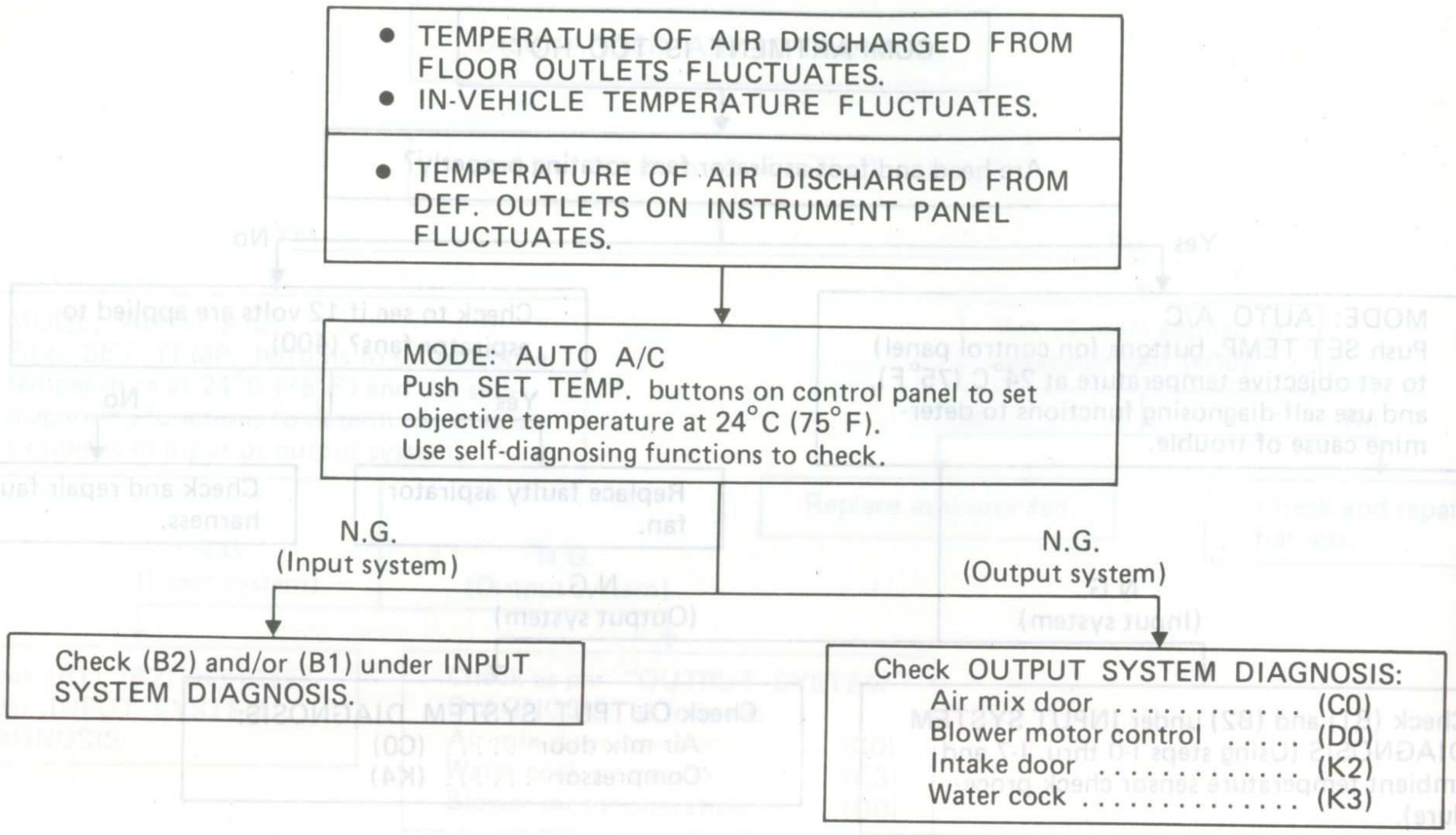
Output system (N.G.)

Check (B1) and (B2) under INPUT SYSTEM DIAGNOSIS.

Check (K2) under OUTPUT SYSTEM DIAGNOSIS for operation of intake door.

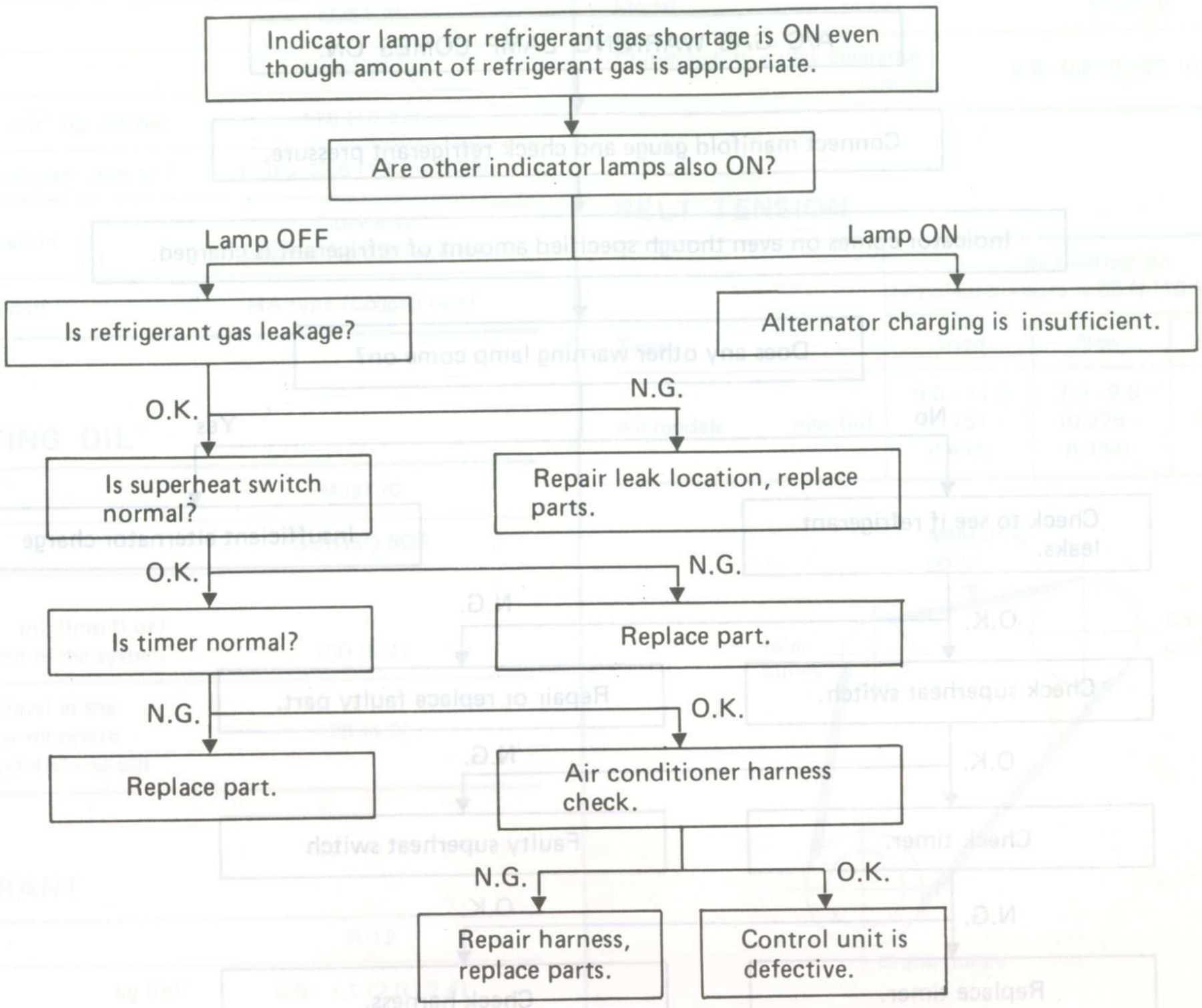

DISCHARGED AIR IS TOO COOL.
Is aspirator fan (located on ceiling) rotating?
Yes
No
MODE: AUTO A/C
Push SET TEMP. buttons to set objective temperature at 24°C (75°F) and use self-diagnosing functions to determine whether trouble is in input or output system.
Are 12 volts applied to aspirator fan? (400)
Yes
No
Replace aspirator fan.
Check and repair harness.
N.G. (Input system)
N.G. (Output system)
Check (B1), (B2) and (B12) under INPUT SYSTEM DIAGNOSIS.
Check as per "OUTPUT SYSTEM DIAGNOSIS" as follows:
Air mix door operation ..... (C0)
Water cock operation ..... (K3)
Blower motor operation .... (D0)
DISCHARGED AIR IS NOT COOL.
MODE: AUTO A/C
Push SET TEMP. buttons to set objective temperature at FULL COOL and check to see if cool air is discharged with blower set to MANUAL HI.
Yes
No
Inspection test
Check NO COOL AIR IS DISCHARGED. (Refer to DIAGNOSIS CHART.)

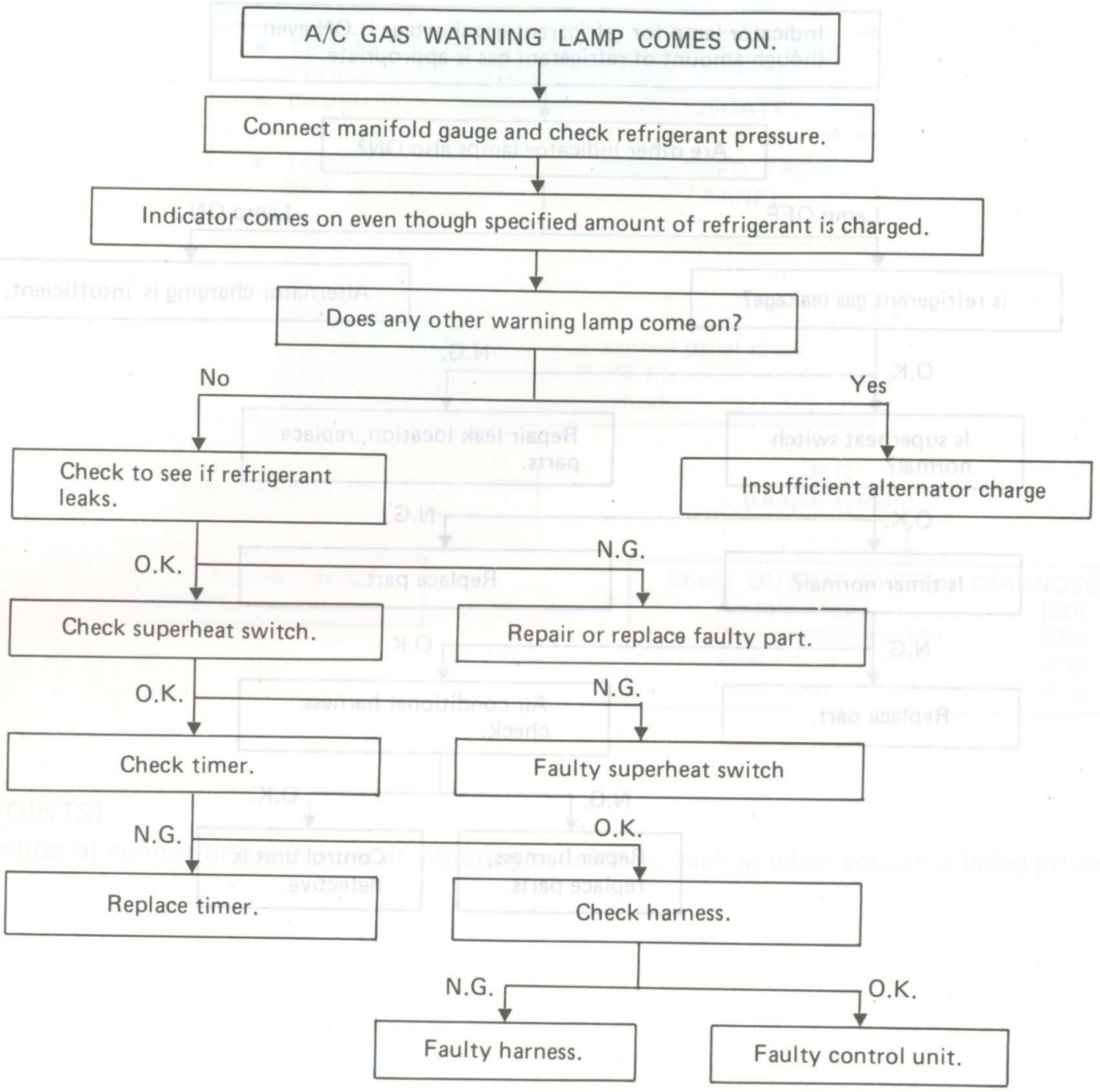

COMPARTMENT IS TOO HOT.
Are head and foot aspirator fans rotating properly?
Yes
No
MODE: AUTO A/C
Push SET TEMP. buttons (on control panel) to set objective temperature at 24°C (75°F), and use self-diagnosing functions to determine cause of trouble.
Check to see if 12 volts are applied to aspirator fans? (400)
Yes
No
Replace faulty aspirator fan.
Check and repair faulty harness.
N.G. (Input system)
N.G. (Output system)
Check (B1) and (B2) under INPUT SYSTEM DIAGNOSIS (Using steps I-0 thru. I-7 and ambient temperature sensor check procedure).
Check OUTPUT SYSTEM DIAGNOSIS:
Air mix door ..... (C0)
Compressor ..... (K4)
COMPARTMENT WILL NOT BECOME WARM.
MODE: AUTO A/C
Push SET TEMP. buttons (on control panel) to set objective temperature at FULL HOT.
Is hot air discharged when control is set to FULL HOT?
No
Yes
Use self-diagnosing functions to check.
Perform inspection test.
N.G. (Input system)
N.G. (Output system)
Check (B2) and (12) under INPUT SYSTEM DIAGNOSIS.
Check OUTPUT SYSTEM DIAGNOSIS:
Air mix door ..... (C0)
Water cock ..... (K3)



[CHECK POINTS]

Poor connection of connector harness under vibrating conditions, such as when vehicle is being driven.


Indicator lamp for refrigerant gas shortage is ON even though amount of refrigerant gas is appropriate.
Are other indicator lamps also ON?
Lamp OFF
Lamp ON
Is refrigerant gas leakage?
Alternator charging is insufficient.
O.K.
N.G.
Is superheat switch normal?
Repair leak location, replace parts.
O.K.
N.G.
Is timer normal?
Replace part.
N.G.
O.K.
Replace part.
Air conditioner harness check.
N.G.
O.K.
Repair harness, replace parts.
Control unit is defective.


A/C GAS WARNING LAMP COMES ON.
Connect manifold gauge and check refrigerant pressure.
Indicator comes on even though specified amount of refrigerant is charged.
Does any other warning lamp come on?
No
Yes
Check to see if refrigerant leaks.
Insufficient alternator charge
O.K.
N.G.
Check superheat switch.
Repair or replace faulty part.
O.K.
N.G.
Check timer.
Faulty superheat switch
N.G.
O.K.
Replace timer.
Check harness.
N.G.
O.K.
Faulty harness.
Faulty control unit.

SERVICE DATA AND SPECIFICATIONS

General Specifications

COMPRESSOR

Model	MJS170
Type	Swash plate
Displacement cm^3 (cu in)/rev.	170 (10.37)
Cylinder bore x stroke mm (in)	40.0 x 22.6 (1.57 x 0.89)
Direction of rotation	Clockwise (viewed from drive end)
Type of driving belt	HA type (Cogged belt)

LUBRICATING OIL

Model	MJS170
Type	SUNISO 5GS
Capacity mℓ (Imp fl oz)	
Amount of oil in the system	150 (5.3)
Residual oil level in the system (After oil return operation and draining oil)	120 (4.2)

REFRIGERANT

Type	R-12
Capacity kg (lb)	0.9 - 1.1 (2.0 - 2.4)

ENGINE IDLING SPEED

	Non-turbo model	Turbo model
When A/C is OFF (rpm)	Refer to MA section.	
When A/C is ON Europe except for Switzerland and Sweden (rpm)	950 - 1,050	950 - 1,050
Except above (rpm)	900 - 1,000	950 - 1,050

- For A/T model, check at "N" range.

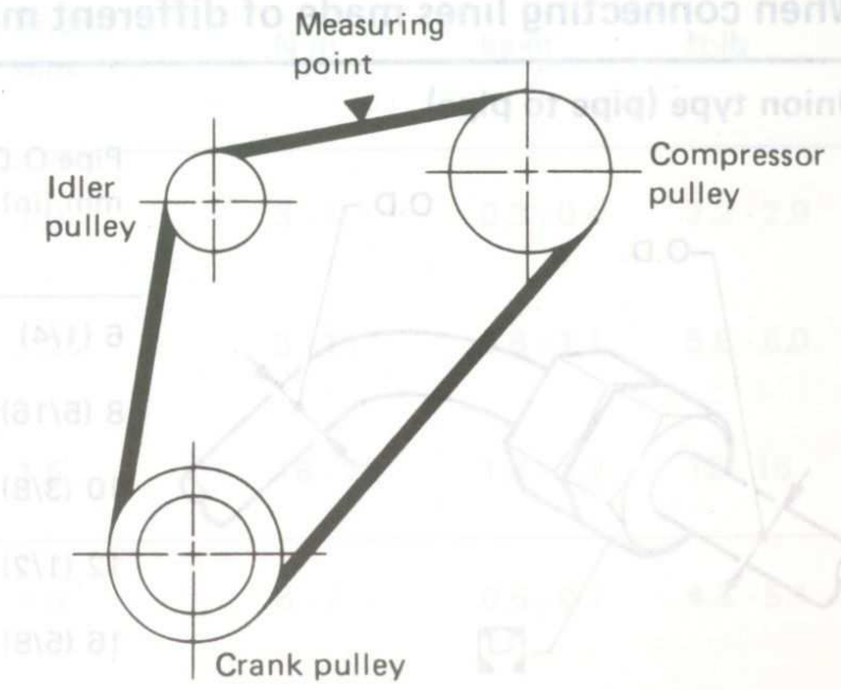
Inspection and Adjustment

COMPRESSOR

Model	MJS170
Clutch hub to pulley clearance mm (in)	0.5 - 0.8 (0.020 - 0.031)

BELT TENSION

Type		Belt deflection [Applied pressure is 98 N (10 kg, 22 lb)]		
		Used	New	Limit
All models	mm (in)	9.0 - 11.0 (0.354 - 0.433)	7.0 - 9.0 (0.276 - 0.354)	16 (0.63)



SHA252B

SERVICE DATA AND SPECIFICATIONS

Tightening Torque

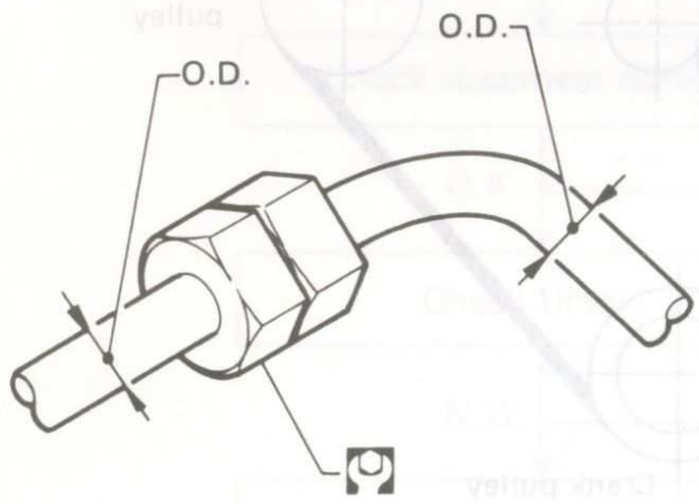
COMPRESSOR INSTALLATION

	N·m	kg-m	ft-lb
Compressor bracket to cylinder block	36 - 49	3.7 - 5.0	27 - 36
Compressor to compressor bracket	36 - 49	3.7 - 5.0	27 - 36
Compressor shaft nut	19 - 21	1.9 - 2.1	14 - 15
Compressor rear cover fixing bolt	19 - 21	1.9 - 2.1	14 - 15

REFRIGERANT LINE

When connecting lines made of different material, basically use the lower tightening torque of the two.

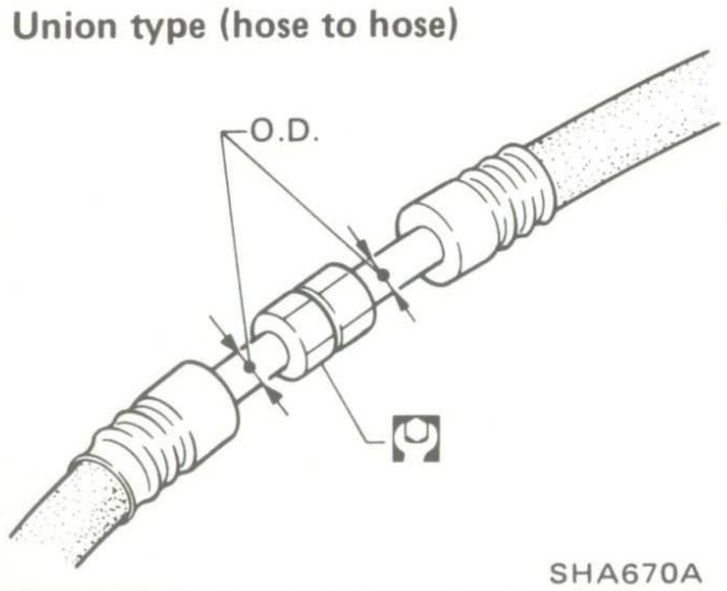
Union type (pipe to pipe)



SHA669A

Pipe O.D. mm (in)	Material					
	Steel or copper			Aluminum		
	N·m	kg-m	ft-lb	N·m	kg-m	ft-lb
6 (1/4)	10 - 20	1.0 - 2.0	7 - 14	—	—	—
8 (5/16)	15 - 25	1.5 - 2.5	11 - 18	10 - 20	1.0 - 2.0	7 - 14
10 (3/8)	15 - 25	1.5 - 2.5	11 - 18	10 - 20	1.0 - 2.0	7 - 14
12 (1/2)	20 - 29	2.0 - 3.0	14 - 22	15 - 25	1.5 - 2.5	11 - 18
16 (5/8)	25 - 34	2.5 - 3.5	18 - 25	20 - 29	2.0 - 3.0	14 - 22
19 (3/4)	25 - 34	2.5 - 3.5	18 - 25	20 - 29	2.0 - 3.0	14 - 22

Union type (hose to hose)

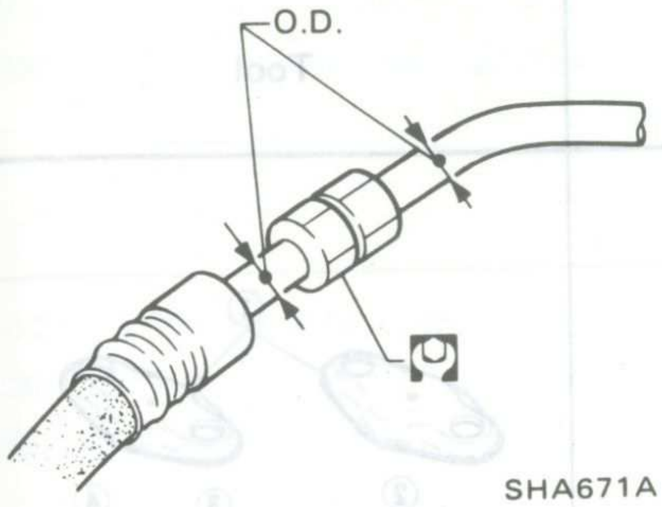


SHA670A

Pipe O.D. mm (in)	Material					
	Steel or copper			Aluminum		
	N·m	kg-m	ft-lb	N·m	kg-m	ft-lb
6 (1/4)	10 - 20	1.0 - 2.0	7 - 14	—	—	—
8 (5/16)	15 - 25	1.5 - 2.5	11 - 18	10 - 20	1.0 - 2.0	7 - 14
10 (3/8)	15 - 25	1.5 - 2.5	11 - 18	10 - 20	1.0 - 2.0	7 - 14
12 (1/2)	25 - 34	2.5- 3.5	18 - 25	20 - 29	2.0 - 3.0	14 - 22
16 (5/8)	25 - 34	2.5 - 3.5	18 - 25	20 - 29	2.0 - 3.0	14 - 22

Tightening Torque (Cont'd)

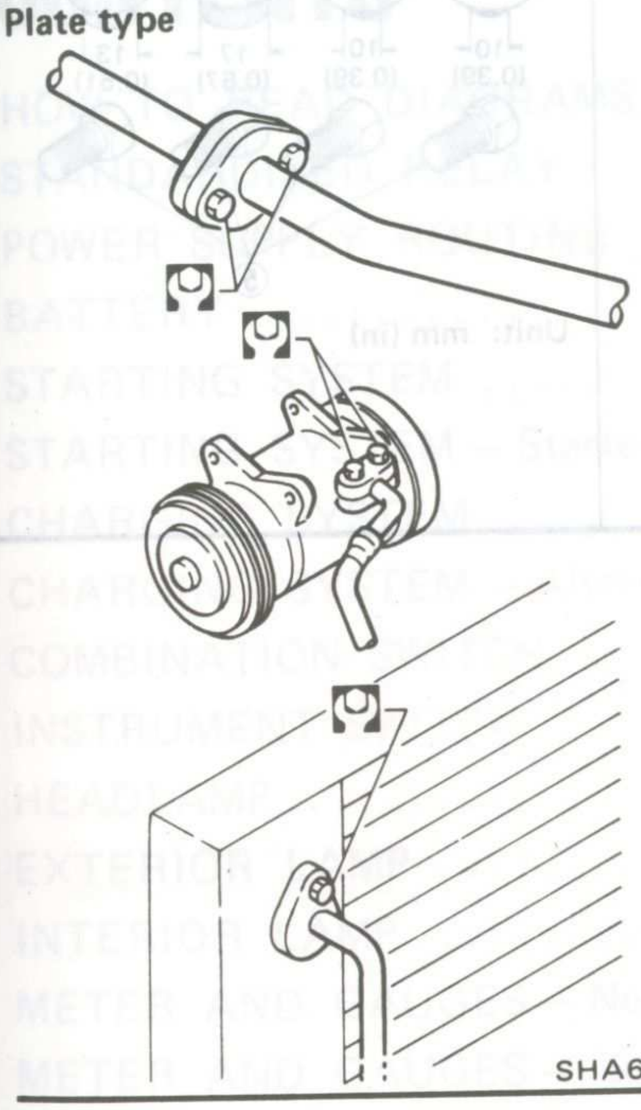
Union type (hose to pipe)



SHA671A

- Use tightening torque for flexible hose.

Plate type

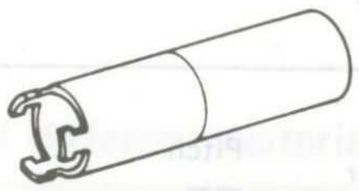
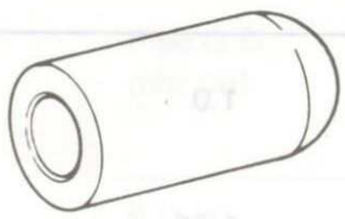
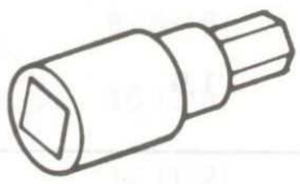
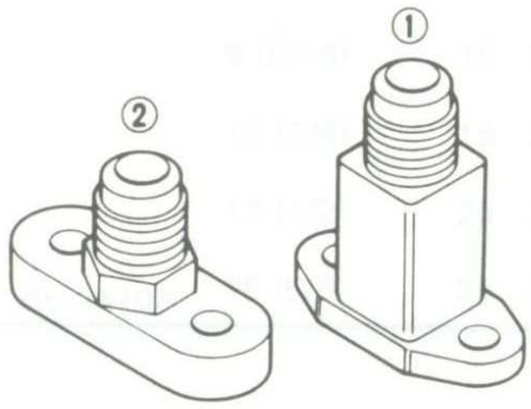
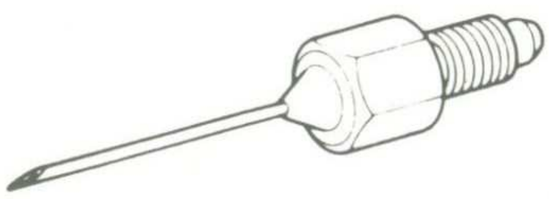


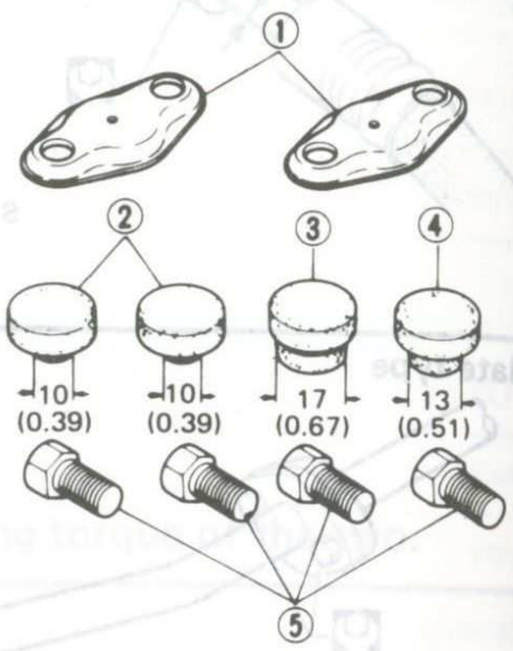
SHA672A

Bolt type				Tightening torque		
Grade	Nominal size	Bolt diameter mm	Pitch mm	N·m	kg-m	ft-lb
4T	M6	6.0	1.0	3 - 4	0.3 - 0.4	2.2 - 2.9
	M8	8.0	1.25	8 - 11	0.8 - 1.1	5.8 - 8.0
	M10	10.0	1.5	16 - 22	1.6 - 2.2	12 - 16
7T	M6	6.0	1.0	6 - 7	0.6 - 0.7	4.3 - 5.1
	M8	8.0	1.25	14 - 18	1.4 - 1.8	10 - 13
	M10	10.0	1.5	25 - 35	2.6 - 3.6	19 - 26

SPECIAL SERVICE TOOLS

*: Special tool or a commercial equivalent

Tool number Tool name	Tool
KV99412302 Clutch hub wrench	
KV994C5780 Clutch hub puller	
KV994C1143 Shaft seal remover and installer	
KV994C5784 Shaft seal pilot	
KV99412330 Allen socket	
KV994C5785 Cylinder head remover	
KV994A9690 Oil separator kit	
KV992C5079 ① KV992C5081 Adapter connector A ② KV992C5082 Adapter connector B	
KV994C1552 Charge nozzle	

Tool number Tool name	Tool
KV994C4548 Blind cover set ① KV994C4531 Blind cover ② KV994C4532 Gasket ③ KV994C4533 Gasket (Useless) ④ KV994C4534 Gasket (Useless) ⑤ KV994C4559 Bolt	 Unit: mm (in)