

HEATER & AIR CONDITIONER

SECTION **HA**

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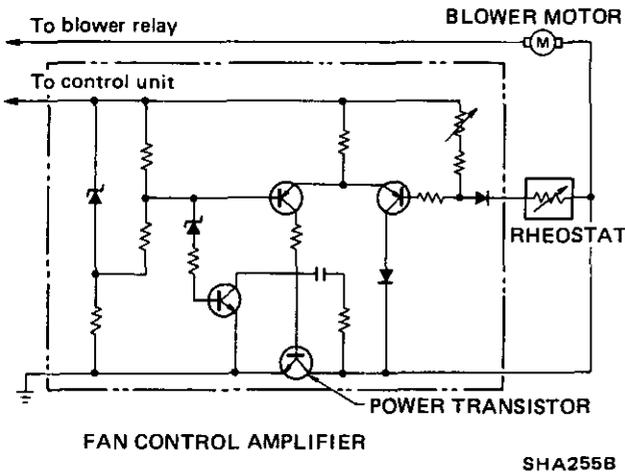
A black triangular graphic pointing downwards, containing the white text "HA".

HA

GENERAL DESCRIPTION

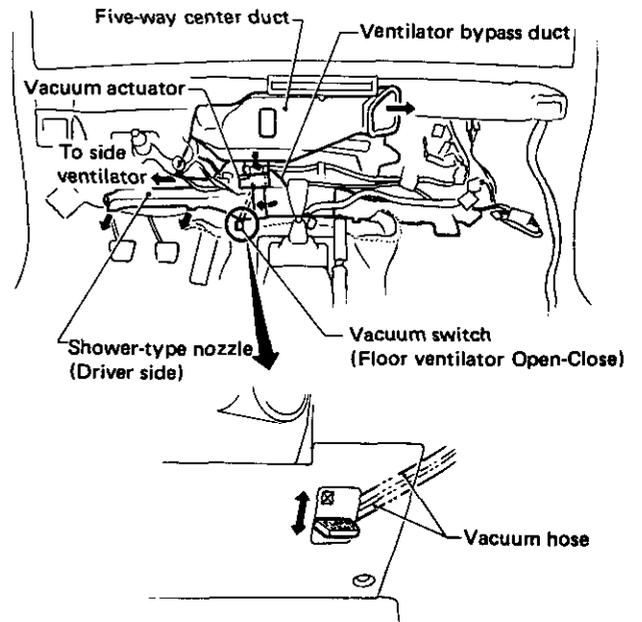
Continuously Variable Air Flow Control

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.



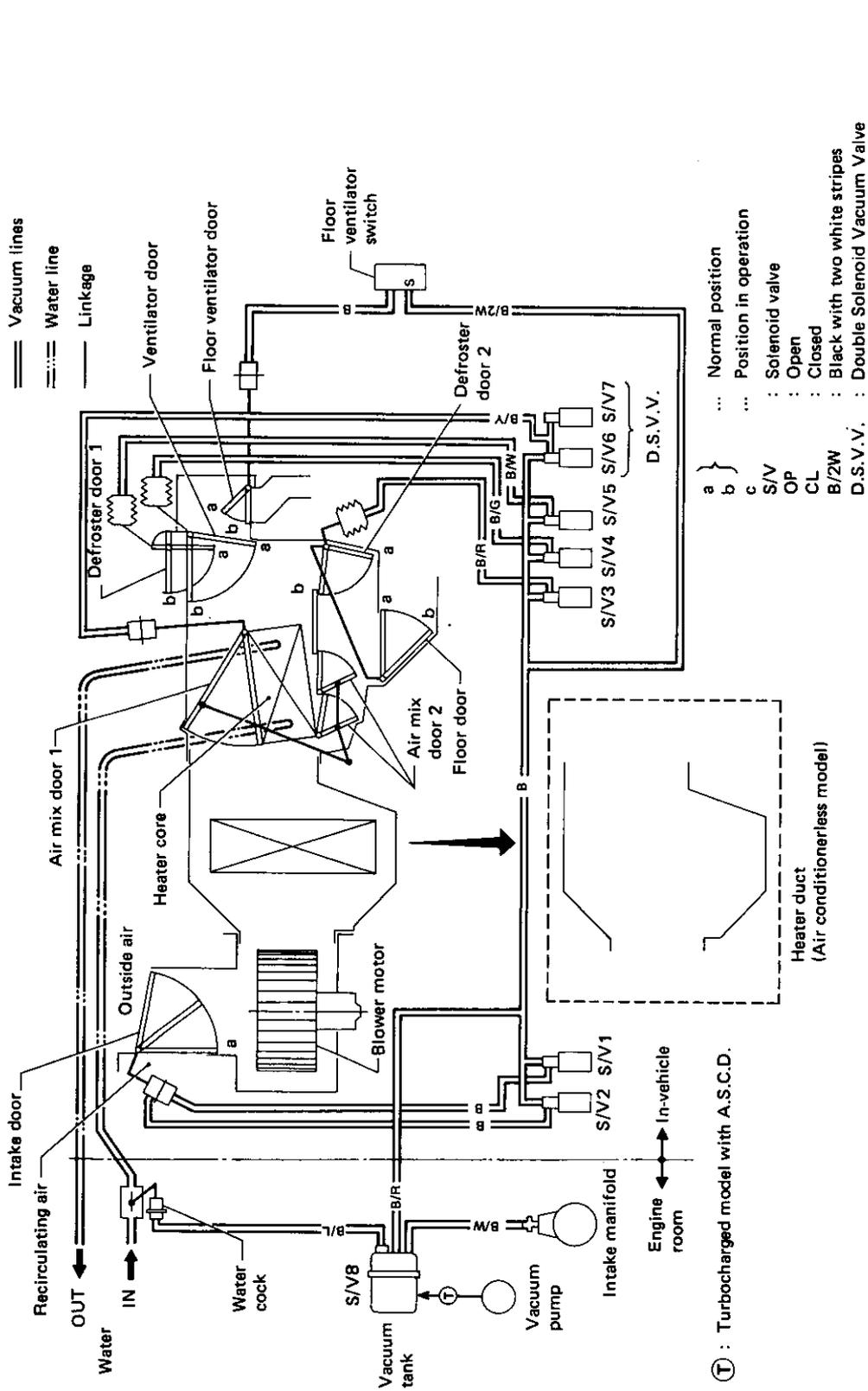
Device for Distributing Cool Air to the Feet during "FACE MODE"

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.



AIR FLOW AND COMPONENT LAYOUT (Manual)

Air Flow



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

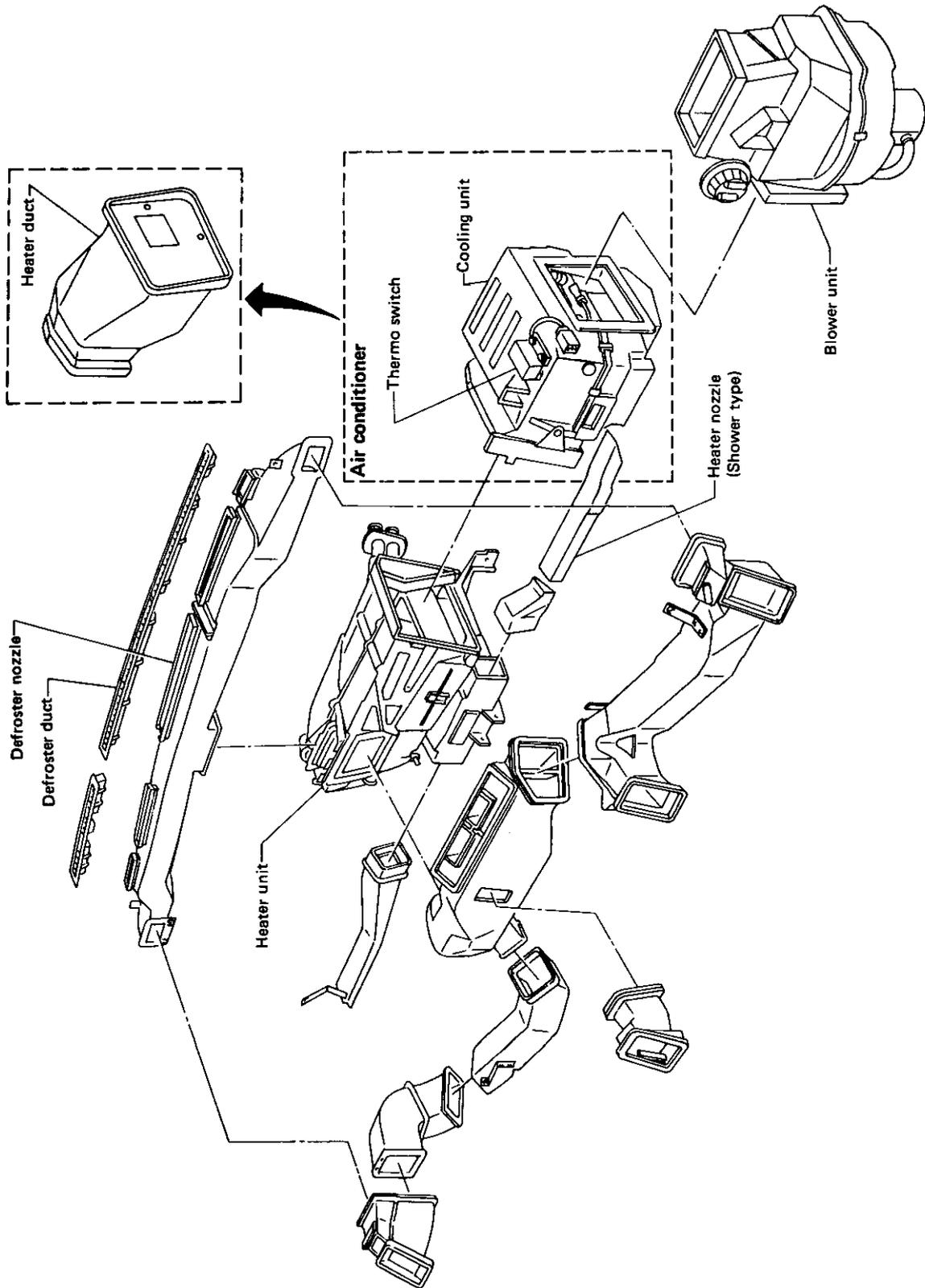
INTAKE CONTROL	RECIRC.	c	b	a
	OUTSIDE			
OPERATION OF SOLENOID VALVE	INTAKE DOOR	S/V 1	OP.	CL.
	SOLENOID VALVE	S/V 2	OP.	CL.

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

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

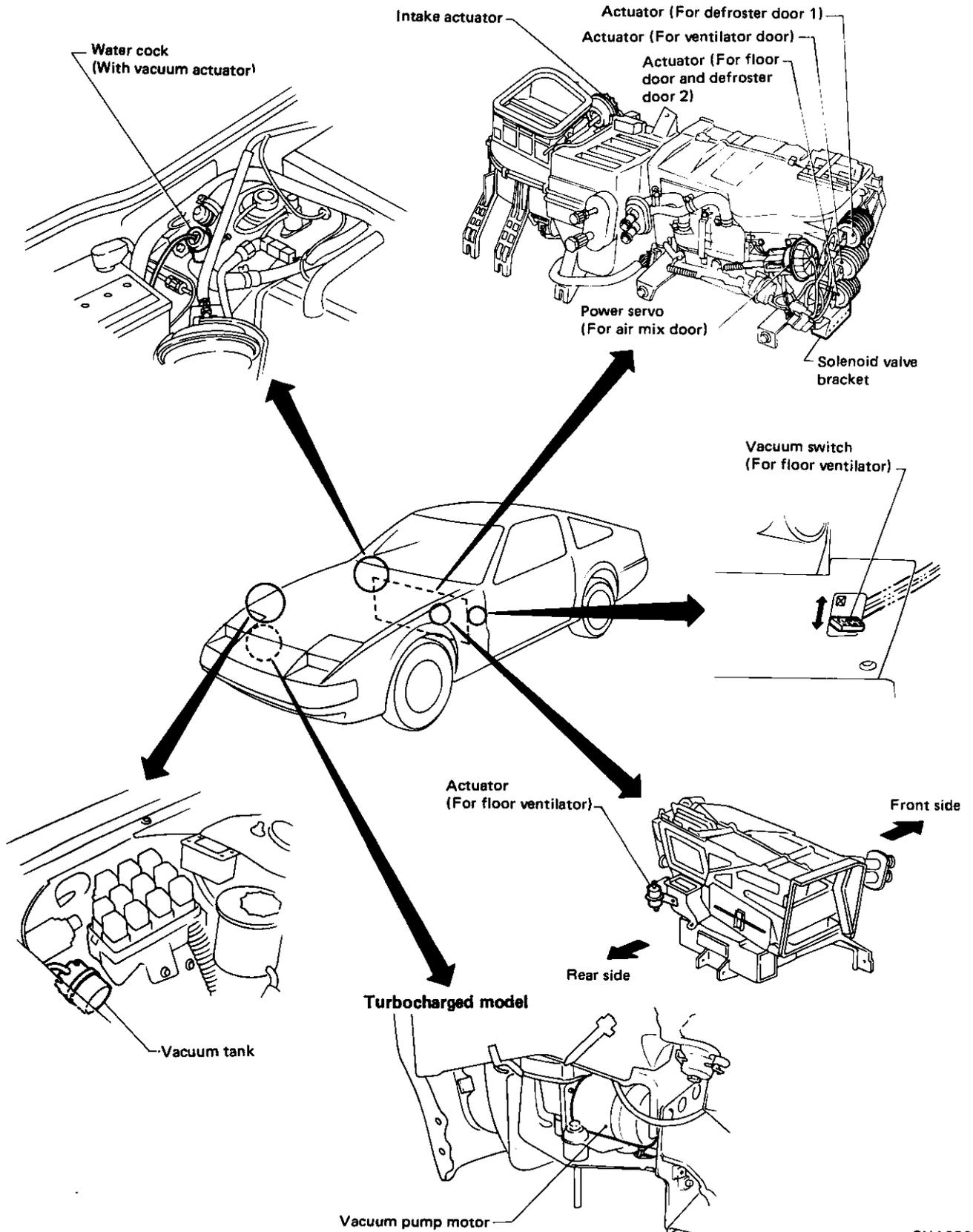
AIR FLOW AND COMPONENT LAYOUT (Manual)

Component Layout



SHA790B

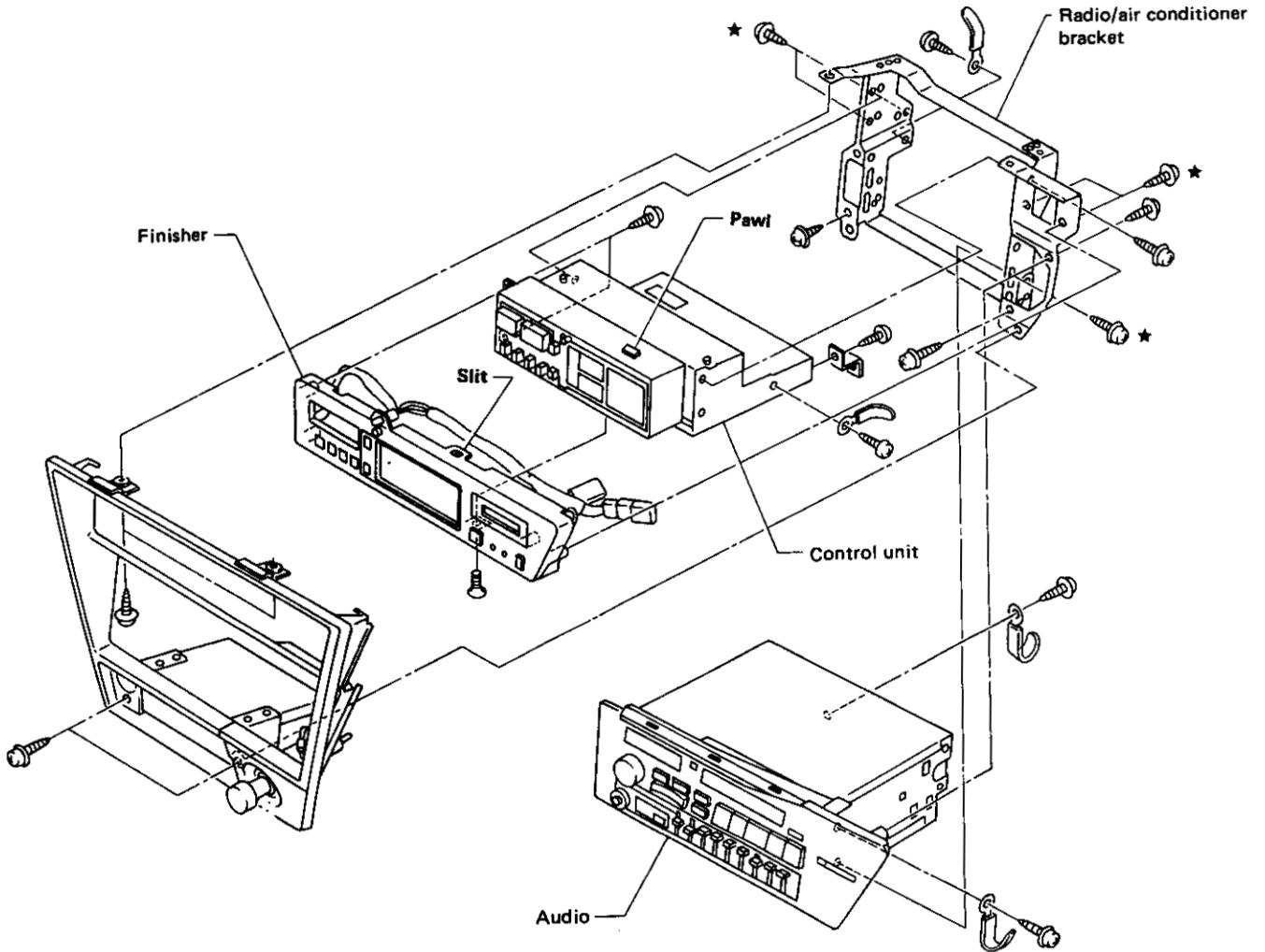
LOCATION OF VACUUM COMPONENTS (Manual)



SHA980B

CONTROL

Heater and Air Conditioner Control Removal

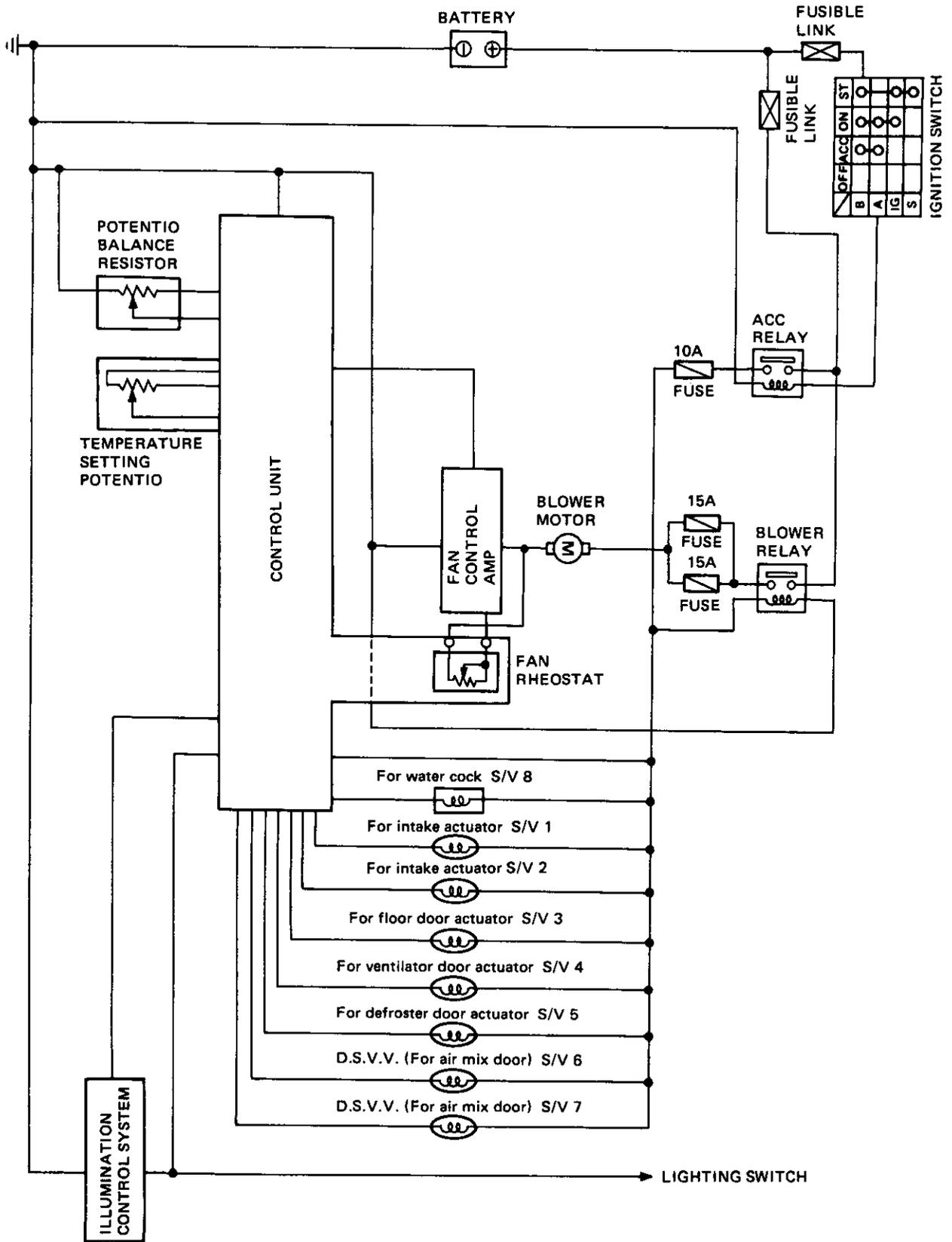


★: Heater and air conditioner control assembly mounting bolts

SHA981B

HEATER ELECTRICAL CIRCUIT

Schematic



SHA417B

DESCRIPTION—Air Conditioner (Manual)

Refrigeration Cycle

REFRIGERANT FLOW

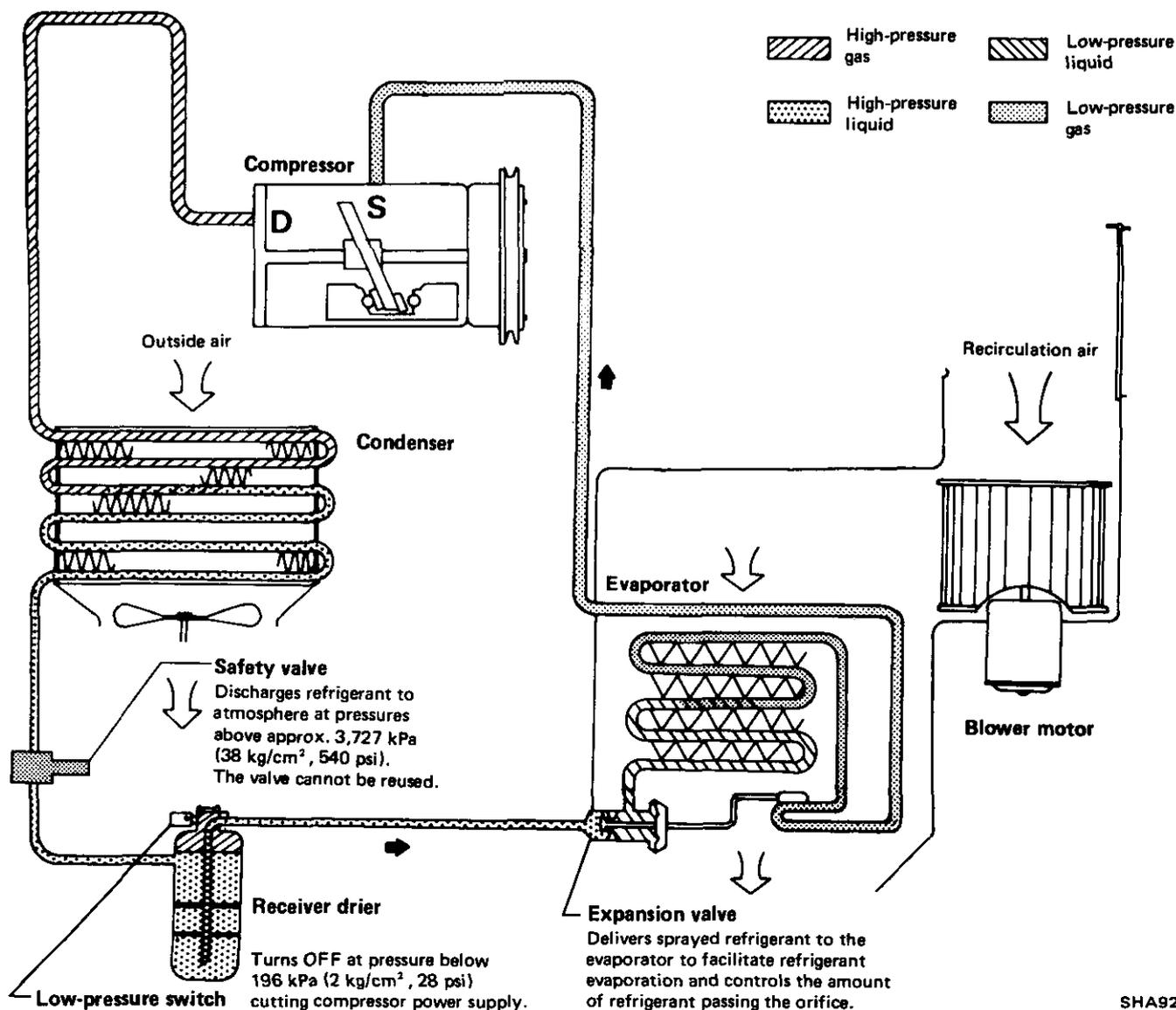
The refrigerant flows in the standard pattern, that is, through the compressor, the condenser, the receiver drier, through the evaporator, and back to the compressor.

The refrigerant evaporation through the evaporator coil is controlled by an externally equalized expansion valve, located inside the evaporator case.

FREEZE PROTECTION — Compressor control

The compressor cycles on and off to maintain the evaporator temperature within a specified range. When the evaporator coil temperature falls below a specified point, the thermo control amplifier interrupts the compressor operation. When the evaporator coil temperature rises above the specification, the thermo control amplifier allows compressor operation.

The refrigerant system is protected against excessively high pressure by a pressure relief valve located between the receiver drier and the condenser. Protection against excessively low pressure (interruption of compressor operation) is provided by a low pressure switch, located on the receiver drier.



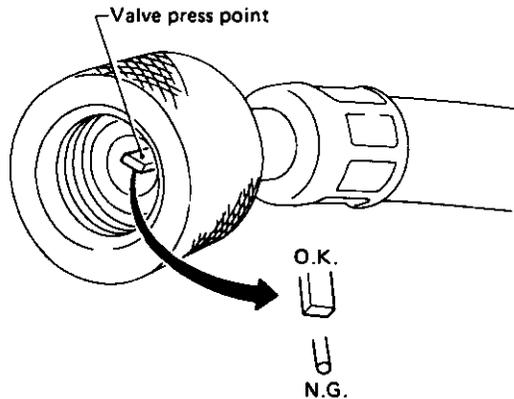
SHA926B

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 from high places.
- 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 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.

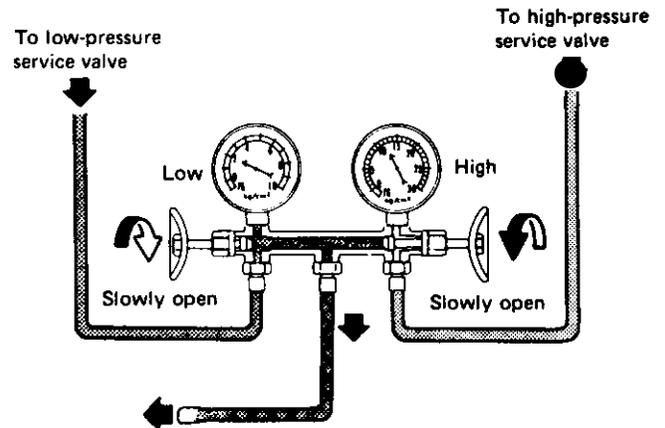


SHA919A

- 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.

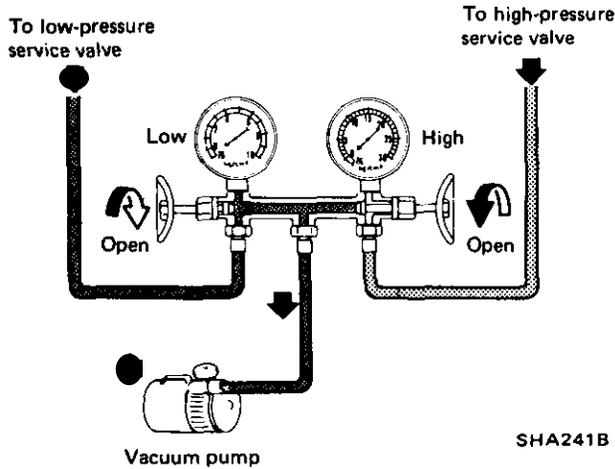


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DISCHARGING, EVACUATING, CHARGING AND CHECKING

—Evacuating the System—Step one

1. Start pump, then open both valves and run pump for about 5 minutes.



2. When low gauge has reached approx. 101.3 kPa (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 (25 mmHg, 0.98 inHg) per 300 m (1,000 ft) elevation. Perform evacuation according to the following table.

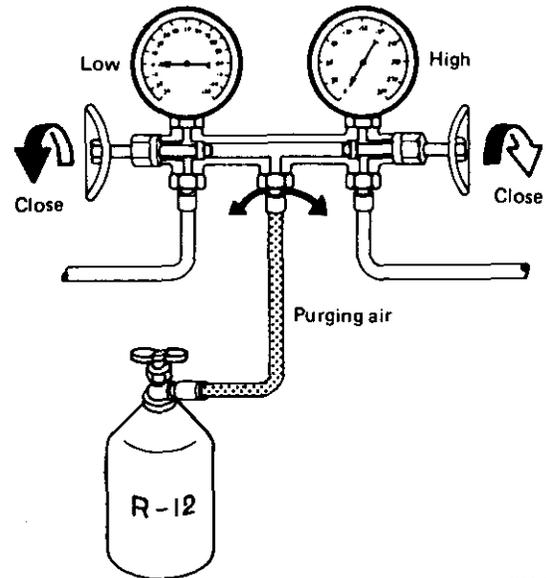
Elevation m (ft)	Vacuum of system* kPa (mmHg, inHg)
0 (0)	101.3 (760, 29.92)
300 (1,000)	98.0 (735, 28.94)
600 (2,000)	94.6 (710, 27.95)
900 (3,000)	91.3 (685, 26.97)

*: 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 (25 mmHg, 0.98 inHg) in five minutes.

—Charging—Step one

1. Evacuate refrigerant system.
Refer to "Evacuating the System-Step One".
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.

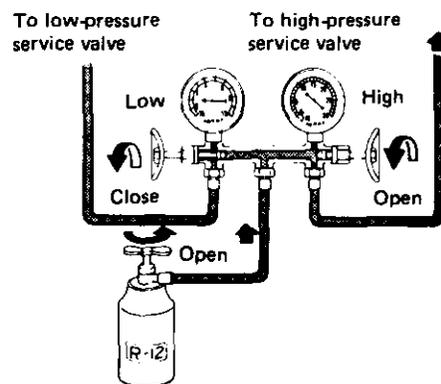


4. Charge refrigerant into system.

WARNING:

Ensure that engine is off.

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

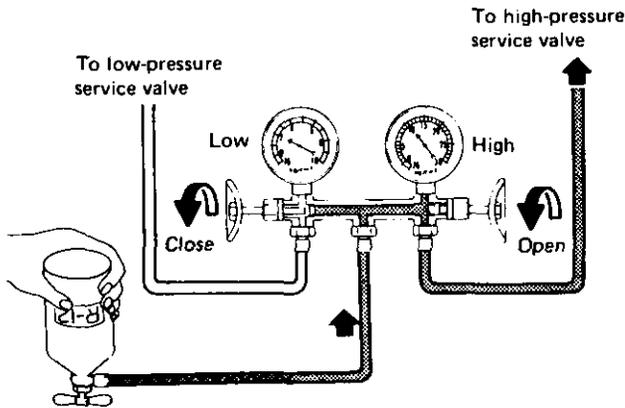


DISCHARGING, EVACUATING, CHARGING AND CHECKING

Charging—Step one (Cont'd)

CAUTION:

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

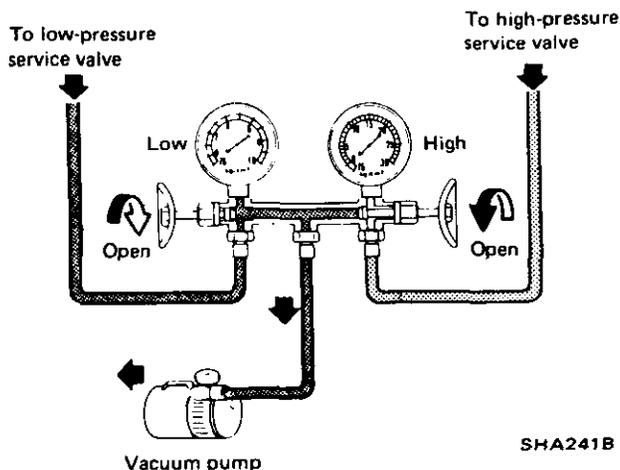


SHA244B

- 2) When low-pressure gauge reading is 98 kPa (1.0 kg/cm², 14 psi), completely close high-pressure valve of manifold gauge and stop charging.

Evacuating the System—Step two -

1. Close manifold gauge valve securely and disconnect charging hose from refrigerant can.
2. Connect center charging hose to vacuum pump.
3. Start pump, then open both valves and run pump for about 20 minutes.

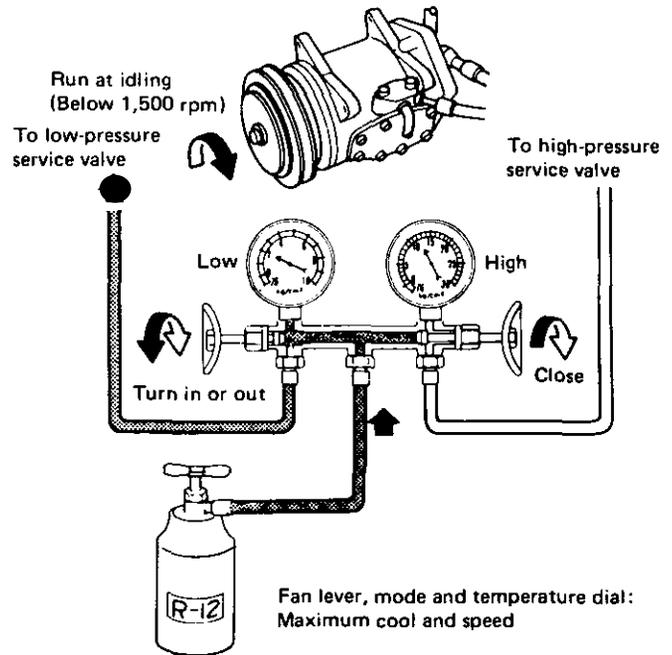


SHA241B

Charging—Step two

Refer to "Charging step one" of Nos. 2 through 4.

4. When refrigerant charging speed slows down, close high-pressure valve of manifold gauge and open low-pressure valve of manifold gauge and charge it while running the compressor for ease of charging.



SHA245B

5. Start Engine — Air conditioning system ON, maximum temperature set, maximum blower speed. Open low-pressure valve on gauge set, with can in upright position, and monitor sight glass. Charge is complete when sight glass is clear.

Cycling clutch systems will produce bubbles in sight glass when clutch engages. Therefore, allow 5 seconds after clutch engages to determine if bubbles continue, and, if so, add refrigerant to clear sight glass.

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.

DISCHARGING, EVACUATING, CHARGING AND CHECKING

Charging—Step two (Cont'd)

6. Charge refrigerant while controlling low-pressure gauge reading at 275 kPa (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.

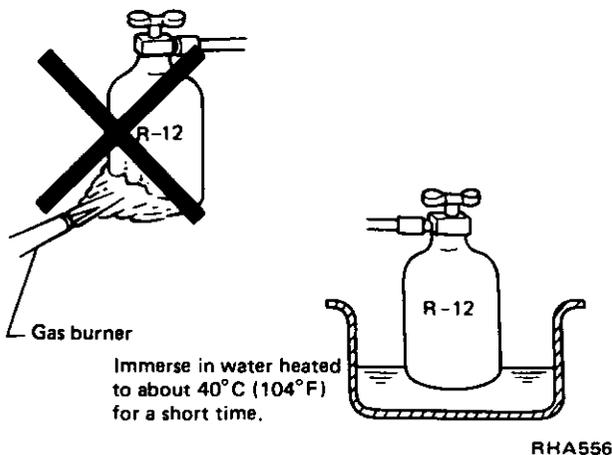
In low ambient conditions in order to reduce charging time, warming of the refrigerant can will increase internal pressure.

CAUTION:

Do not increase can temperature beyond 40°C (104°F).

WARNING:

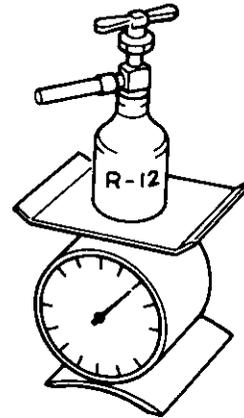
Do not heat can directly. There is danger of it exploding.



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

Refrigerant amount:

0.9 - 1.1 kg (2.0 - 2.4 lb)



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.
- When refrigerant charging is performed with a charging cylinder, charging station, or automatic charging equipment, engine off, charge only through high side, after specified refrigerant amount has entered the system, close high pressure valve on gauge set. Start engine return to idle speed, operate A/C at maximum temperature setting, high blower. Observe sight glass to confirm complete charge.

Overcharging will result in increased high pressures, and reduced performance.

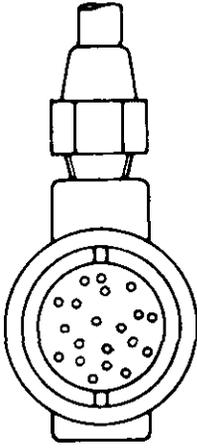
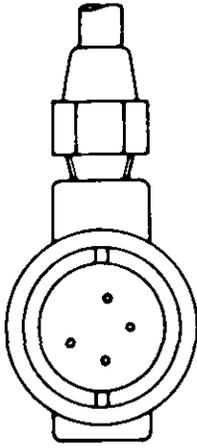
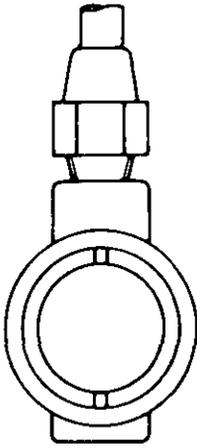
DISCHARGING, EVACUATING, CHARGING AND CHECKING

Checking Refrigerant Level

CONDITION

- Door window: Open
- A/C switch: ON

- TEMP. lever position: Max. COLD
- FAN lever position: 4
- Check sight glass after a lapse of about five minutes.

Amount of refrigerant	Almost no refrigerant	Insufficient	Suitable	Too much refrigerant
Check item				
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

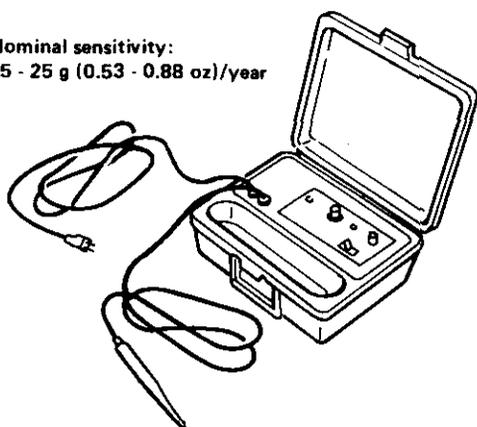
Checking Refrigerant Leaks

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 manufacturer's manuals 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

Place the probe on connection fitting and wait for 5 seconds or more.

As to check cooling unit, wait for 10 seconds or more.

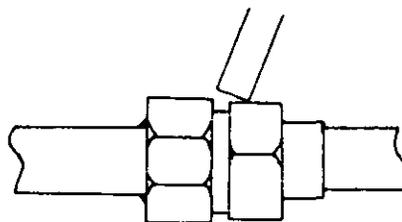
WARNING:

As detector's meter moves even slightly, keep the probe as still as possible for one more minute.

NOTICE:

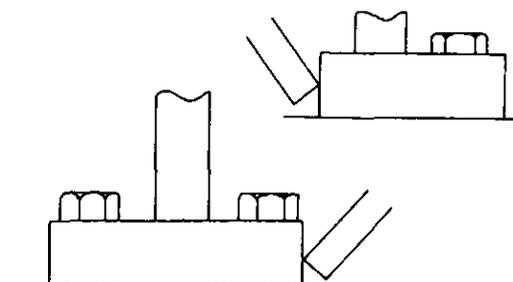
When fixing single bolt flange, place the probe on opposite side of the fitting.

UNION TYPE



RHA279

PLATE TYPE



RHA280

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 found leaking must be repaired.

- The nominal sensitivity of the detector is determined under the assumption that all the leaking gas is collected by the detector. Accordingly, the quantity of gas actually leaking can amount to five to ten times the indicated value. Generally speaking, leakage of 150 to 200 g (5.29 to 7.05 oz) of refrigerant can cause insufficient cooling.
- Oil deposited during assembling must be wiped off before inspection. Refrigerant easily dissolves in oil, and the presence of oil can cause an error in measurement. This precaution is important when checking a used vehicle for refrigerant leakage.
- If any trace of oil is noted at and around connection fittings, it is a sure indication that refrigerant is leaking.

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 (kg/cm ² , psi)	Low pressure (Suction side) kPa (kg/cm ² , psi)
Relative humidity %	Air temperature °C (°F)		
50 - 70	20 (68)	853 - 1,049 (8.7 - 10.7, 124 - 152)	59 - 78 (0.6 - 0.8, 9 - 11)
	25 (77)	1,040 - 1,275 (10.6 - 13.0, 151 - 185)	88 - 108 (0.9 - 1.1, 13 - 16)
	30 (86)	1,216 - 1,491 (12.4 - 15.2, 176 - 216)	108 - 137 (1.1 - 1.4, 16 - 20)
	35 (95)	1,393 - 1,706 (14.2 - 17.4, 202 - 247)	137 - 167 (1.4 - 1.7, 20 - 24)
	40 (104)	1,579 - 1,932 (16.1 - 19.7, 229 - 280)	157 - 196 (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.

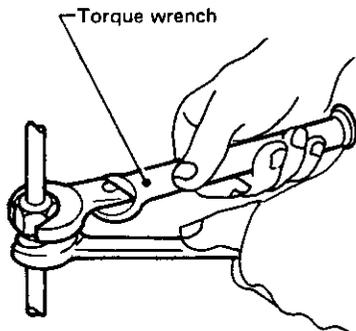
PRECAUTIONS FOR REFRIGERANT CONNECTION

WARNING:

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

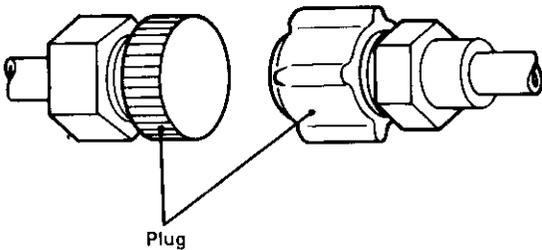
When replacing or cleaning refrigerant cycle components, observe the following.

- 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.



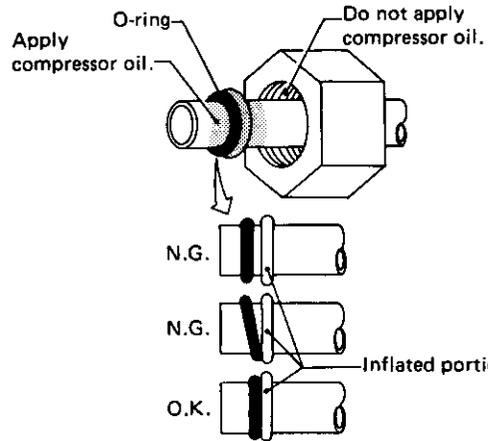
SHA896A

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



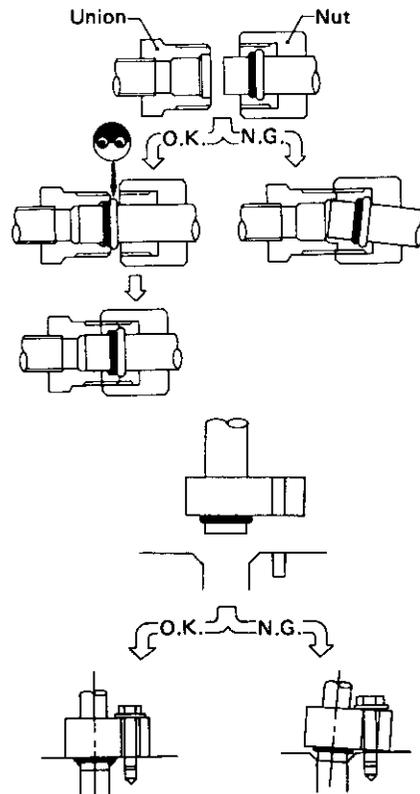
SHA058

- 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.

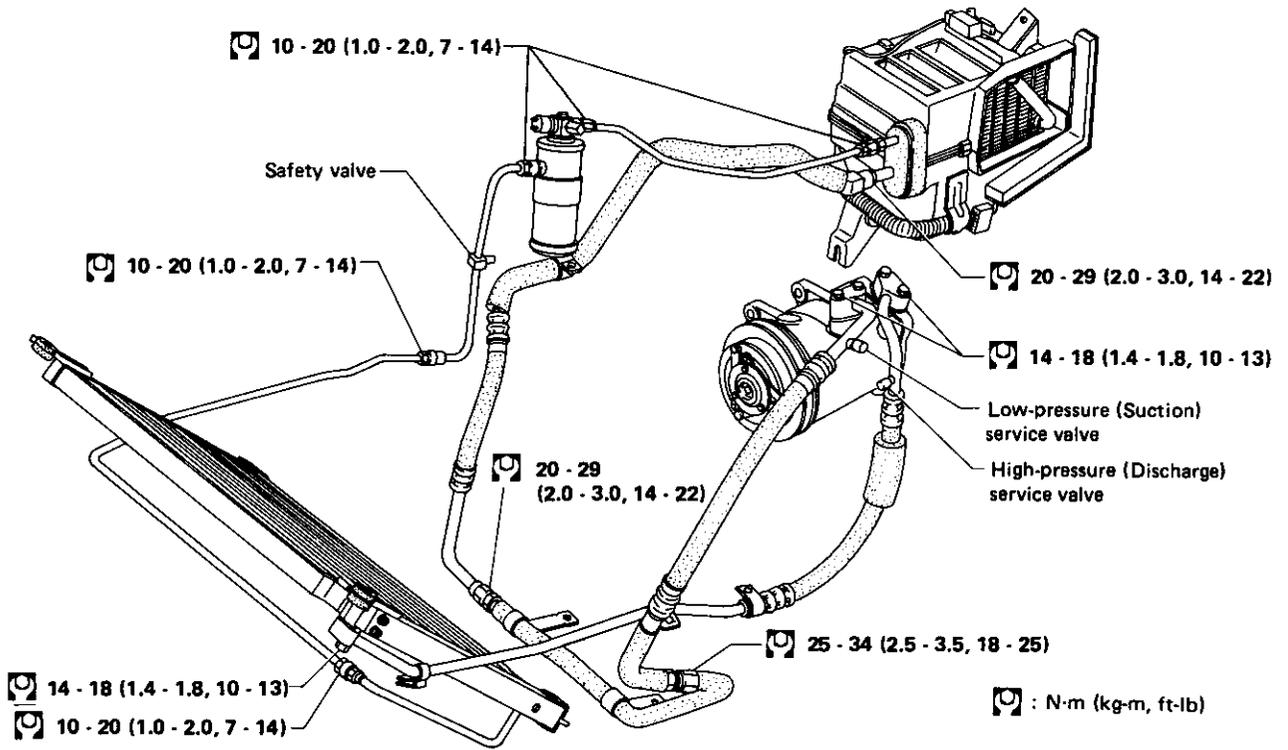


SHA898A

- 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.

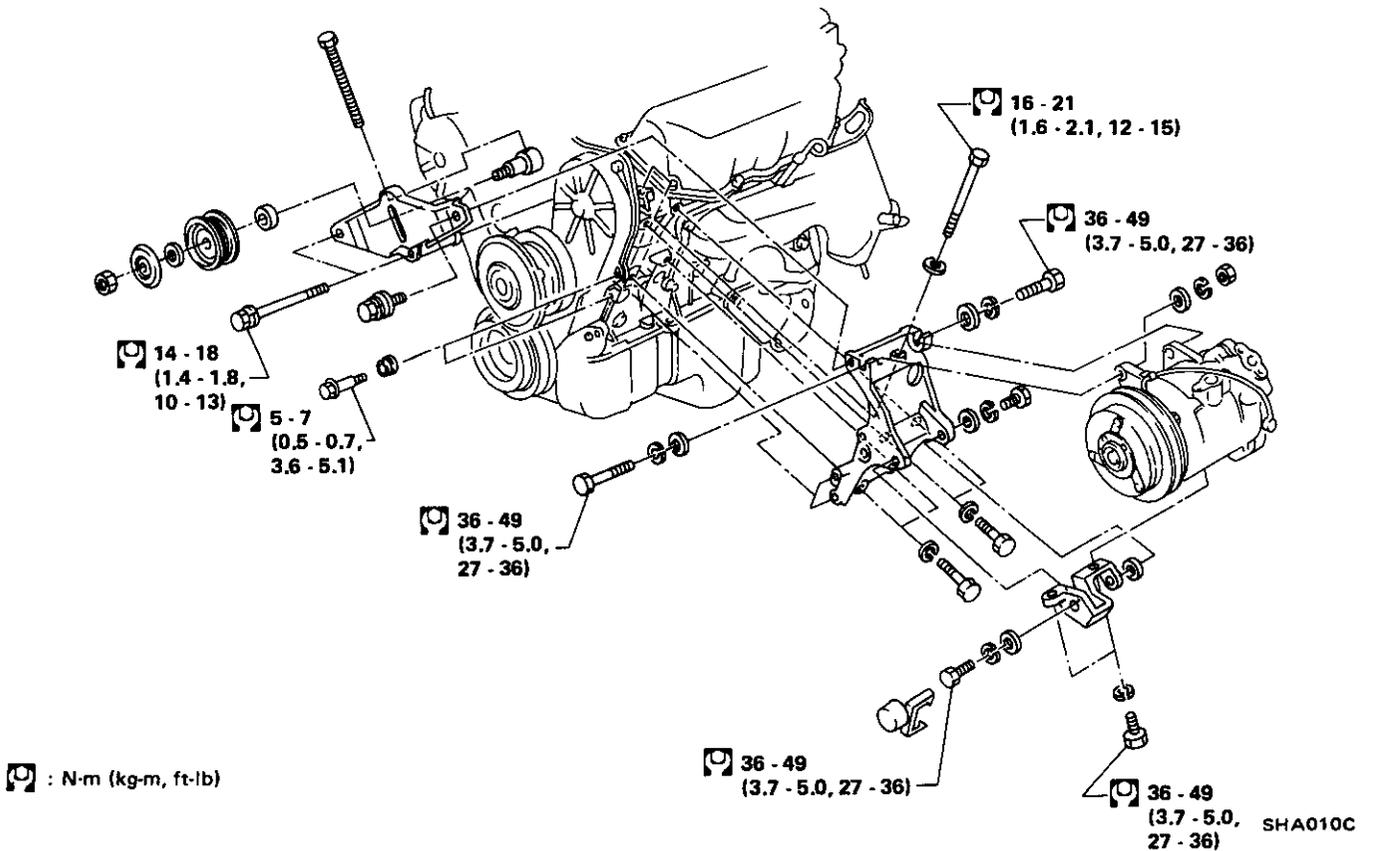
PIPING, COMPRESSOR MOUNTING AND F.I.C.D.

Refrigerant Lines



SHA246B

Compressor Mounting



SHA010C

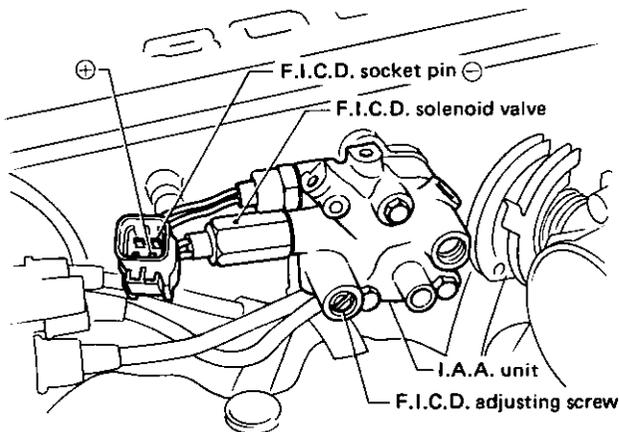
PIPING, COMPRESSOR MOUNTING AND F.I.C.D.

Idle Speed Adjusting and Checking

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

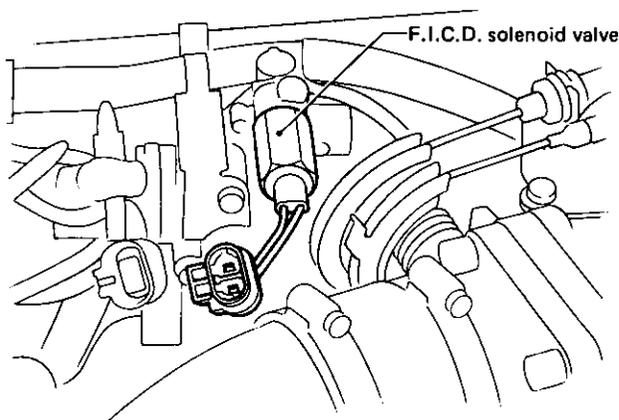
1. Run engine until it reaches operating temperature.
2. With air conditioning system OFF (when compressor is not operating), make sure that engine is at correct idle speed.
3. With air conditioning system ON (Recirculation switch at "RECIRC" position, fan control lever at "HI" position), make sure that 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

Transmission		Non-turbocharged model	Turbocharged model
When A/C is OFF			
Refer to MA section.			
When A/C is ON			
M/T	rpm	750 - 850	750 - 850
A/T	rpm	750 - 850 at "D" range	750 - 850 at "D" range

COMPRESSOR OIL—For MJS170

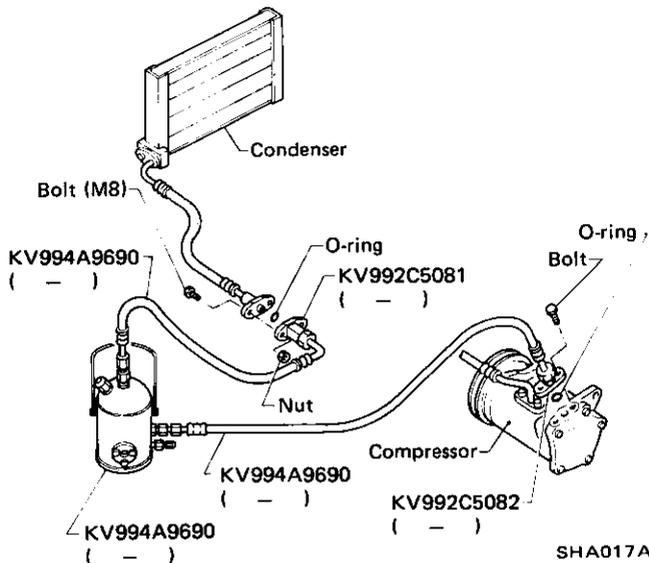
Checking and Adjusting

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 (5.1 US fl oz, 5.3 Imp fl oz)



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.

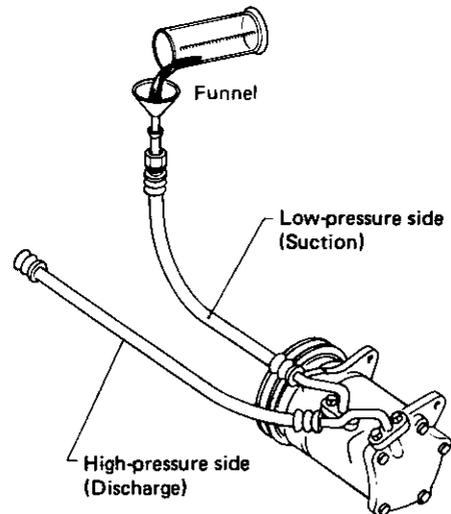
CAUTION:

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 (4.1 US fl oz, 4.2 Imp fl oz)



- **Oil remains unremoved in the system about 30 ml (1.0 US fl oz, 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 (US fl oz, 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 (2.7, 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 (2.0, 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 (2.4, 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 (2.4, 2.5)

* Remove compressor oil as follows.

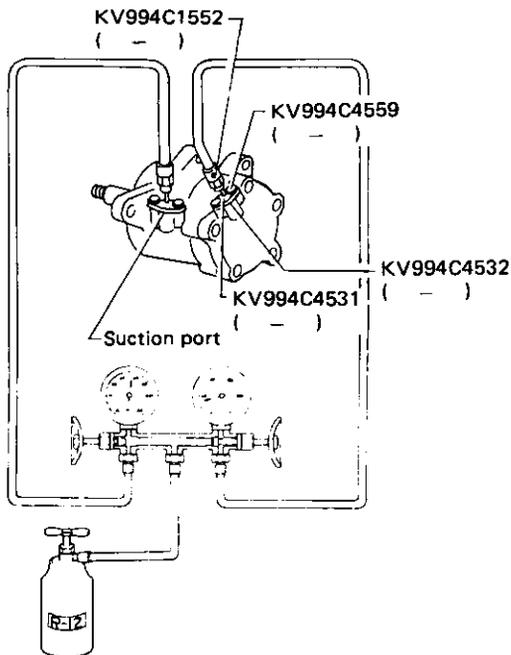
1. With the compressor upside down, completely drain the oil through the suction port (from the embossed letter "s" mark side).

2. When the oil stops flowing out, rotate the clutch hub two or three times to completely drain the oil.

COMPRESSOR—Model MJS170

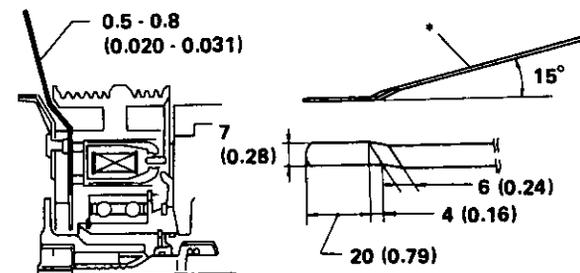
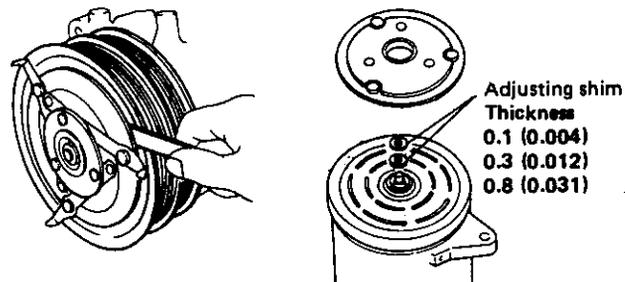
Leak Test

EVACUATE AND CONDUCT LEAK TEST



SHA907A

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



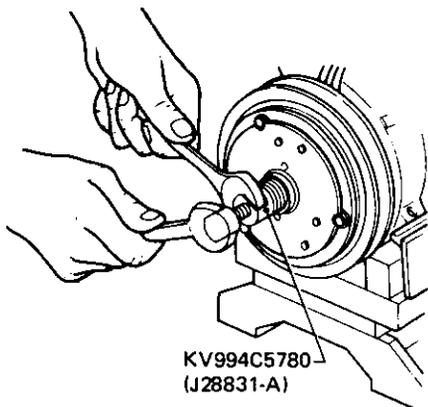
* Use thickness gauge by machining it as shown.

Unit: mm (in)

RHA839

Clutch Replacement

- When removing shaft nut, hold clutch hub with Tool.
- Tool No.: KV99412302 (J24878-1)
- Using Tool, clutch hub can be removed easily.



KV994C5780-
(J28831-A)

SHA268A

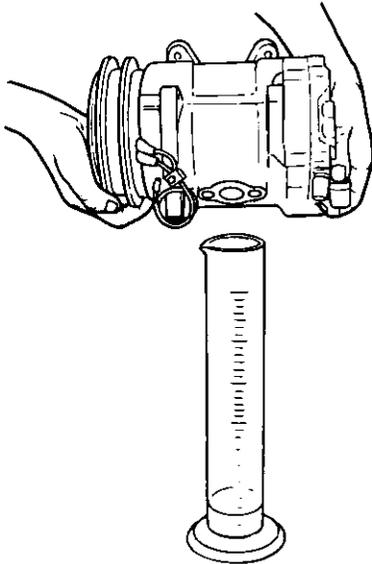
BREAK-IN OPERATION

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.

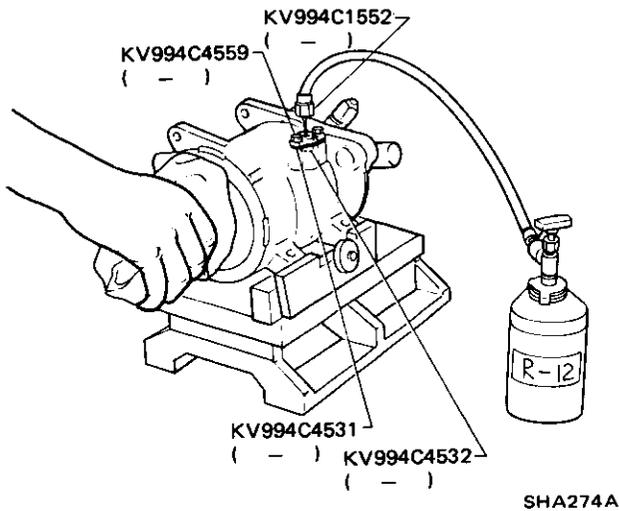
COMPRESSOR—Model MJS170

Shaft Seal Replacement

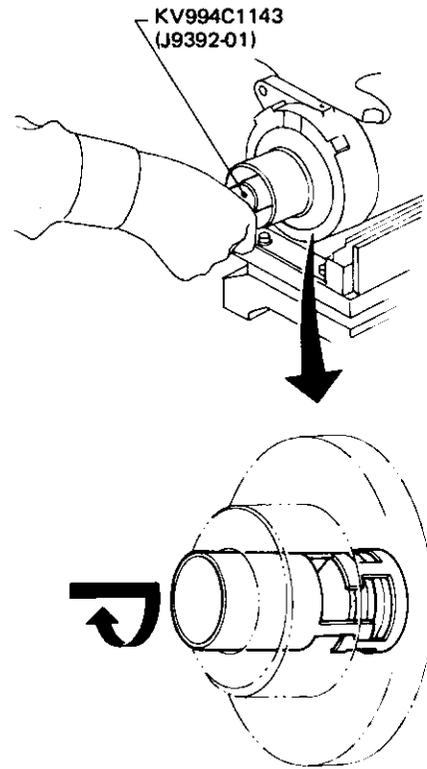
- Before disassembling, be sure to measure the amount of oil.
After assembling, charge with the same amount of new oil.



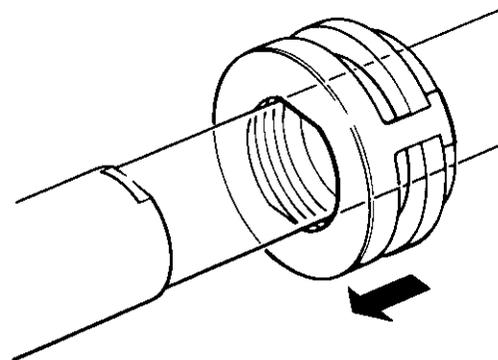
- When removing seal seat
Apply pressure with refrigerant.



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



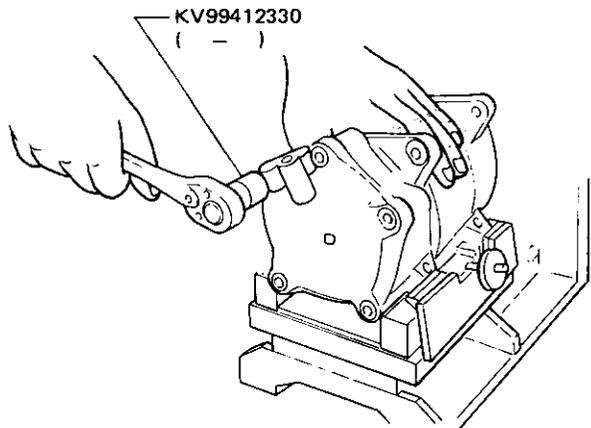
- When installing shaft seal
 - 1) Cap Tool to the top end of compressor shaft.
Tool number: KV994C5784 (J33212)
 - 2) Using Tool, insert shaft seal with shaft seal case and shaft cutout aligned.
Apply force to turn the seal somewhat to the left and right. Insure that shaft seal seats properly in the shaft cutout.
Tool number: KV994C1143 (J9392-01)



COMPRESSOR—Model MJS170

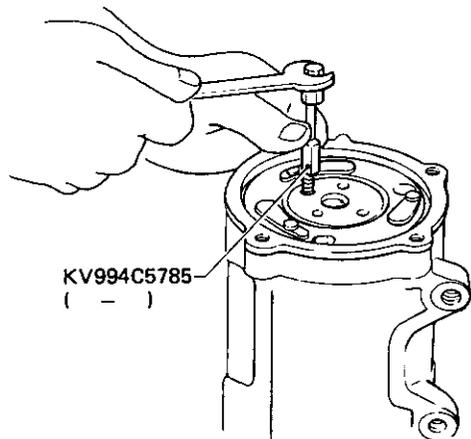
Valve Replacement

- Using Tool, remove rear cover.



SHA038A

- Using Tool, remove rear cylinder head.

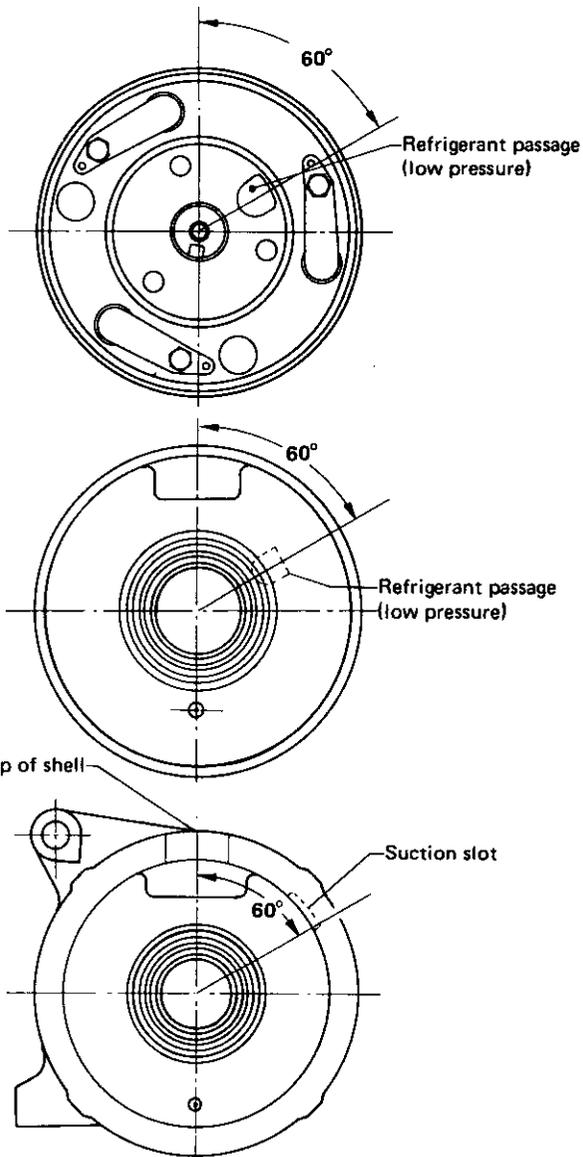


SHA909A

- 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°.

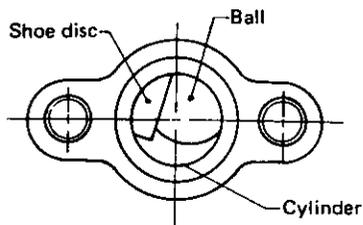
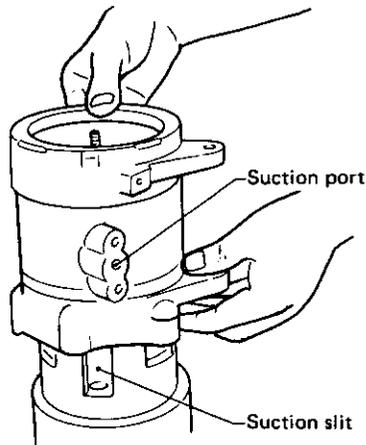
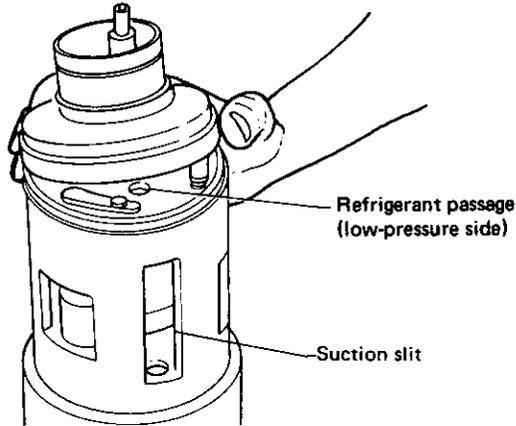


SHA276A

COMPRESSOR—Model MJS170

Valve Replacement (Cont'd)

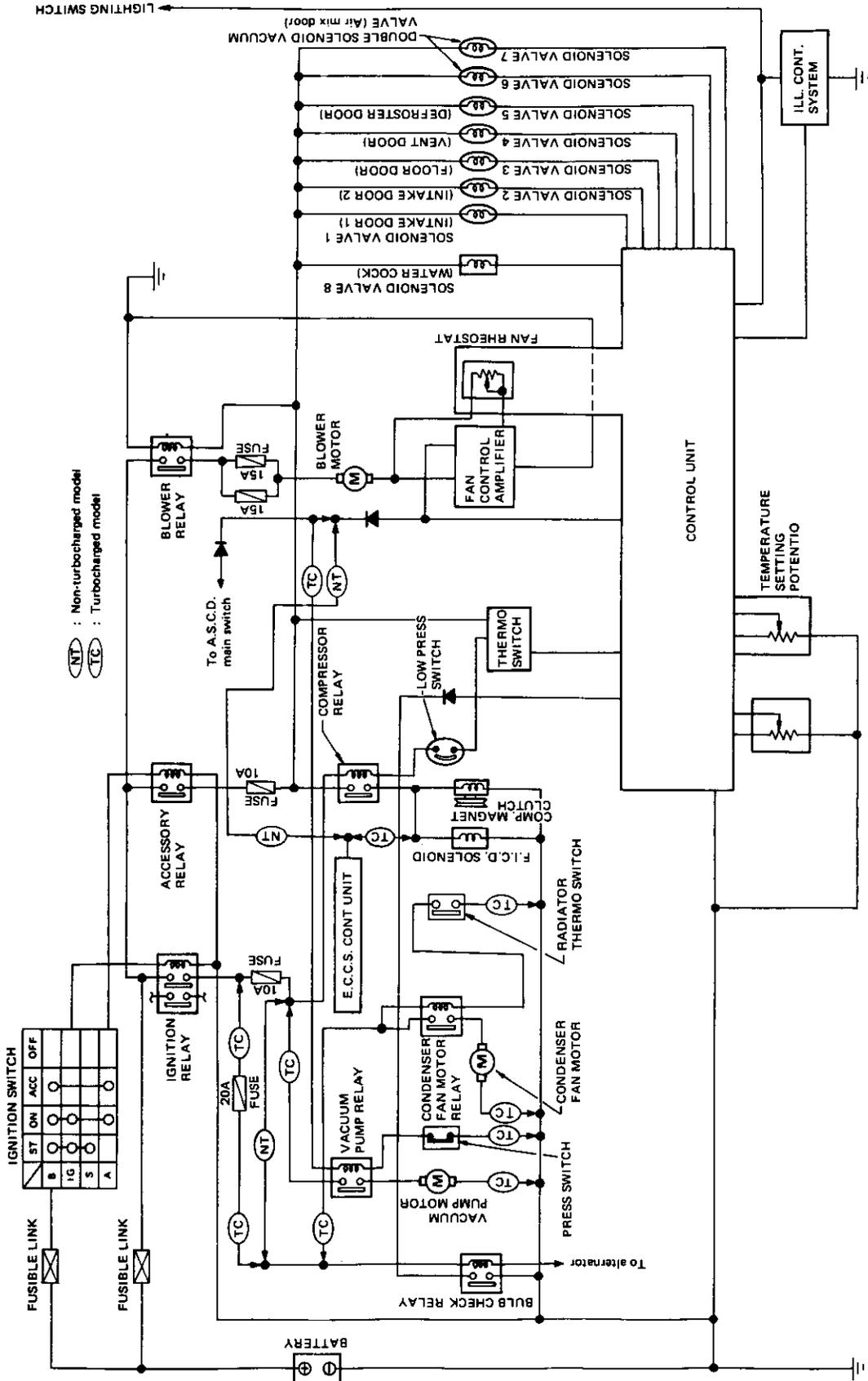
- 2) When installing shell on cylinder, adjust position of shell so that suction inlet of shell opens in the same direction as suction slot of cylinder assembly. Then, make sure swash plate is visible in suction inlet by removing suction valve.



SHA277A

A/C ELECTRICAL CIRCUIT (Manual)

Schematic

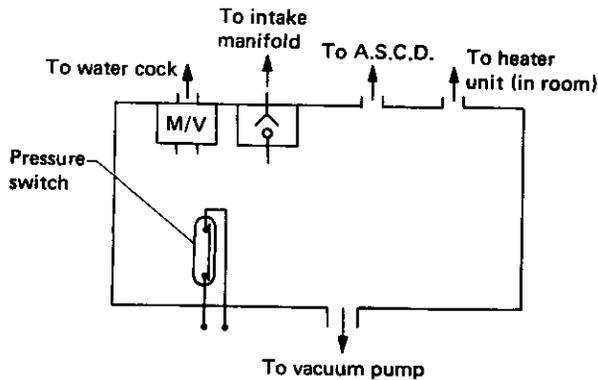


SHA9918

A/C ELECTRICAL COMPONENTS (Manual)

Inspection

VACUUM TANK



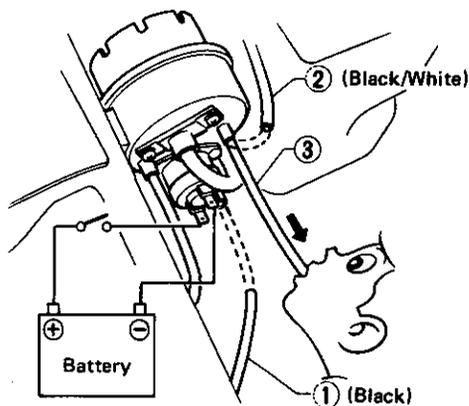
 : Magnet valve
 : Check valve (One way ↓)

SHA253B

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.

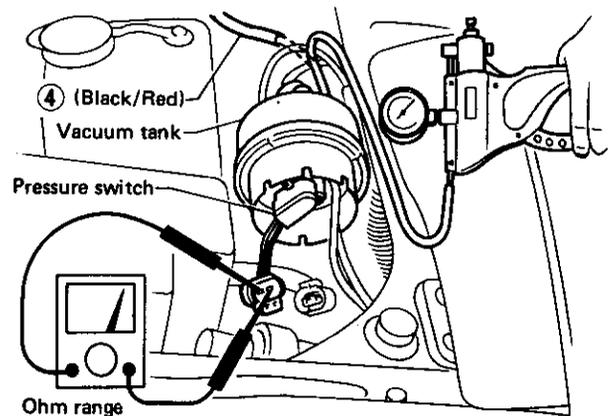
Applied voltage to solenoid (V)	Operation of solenoid valve
0	Close
12	Open

Solenoid valve check for water cock



SHA254B

Pressure switch check for turbocharged model



Pressure	Resistance (Ω)
Atmospheric pressure	0
Vacuum pressure more than 46.7 kPa (350 mmHg, 13.78 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.

A/C ELECTRICAL COMPONENTS (Manual)

Inspection (Cont'd)

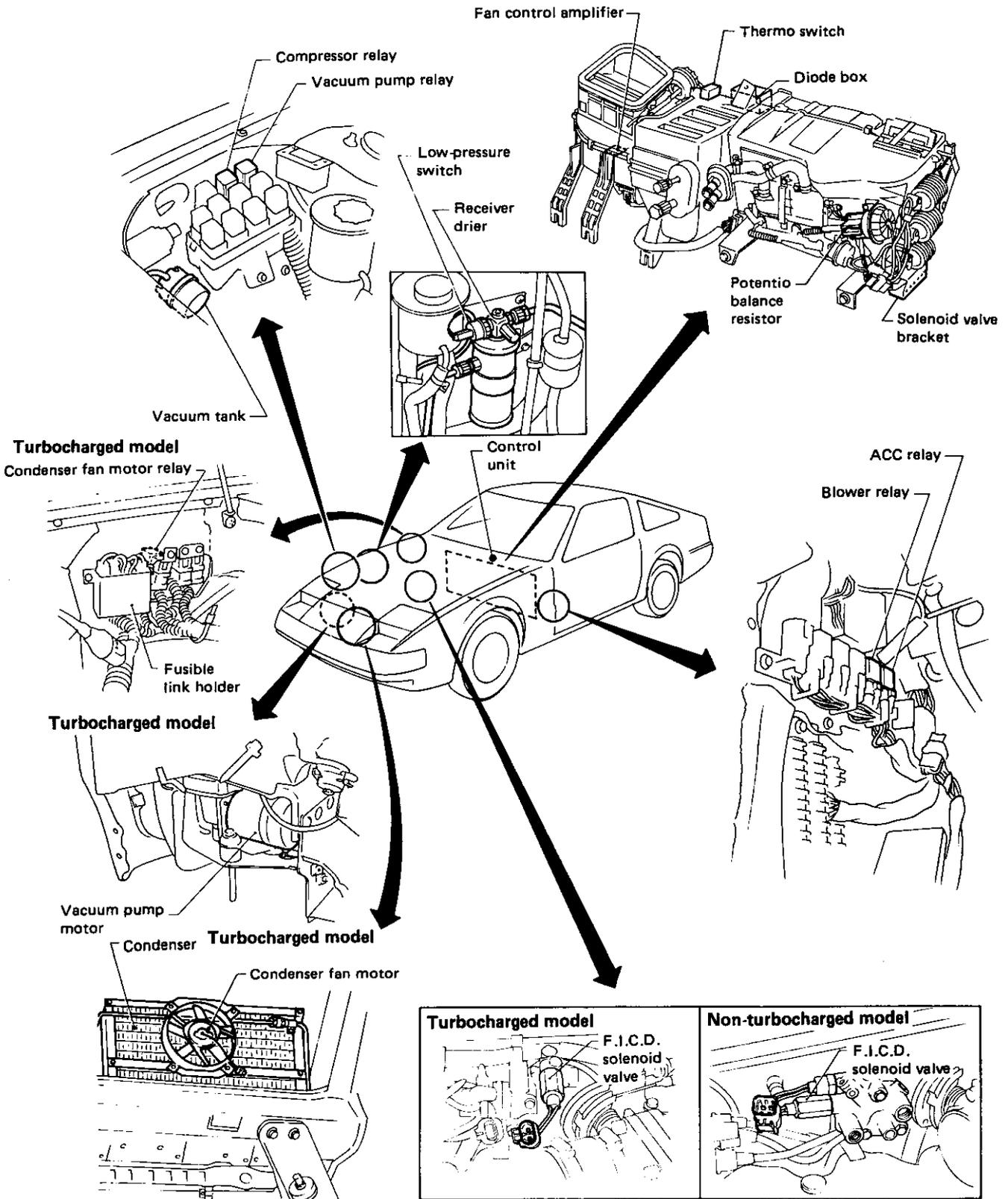
VACUUM PUMP MOTOR

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-29).

LOCATION OF A/C ELECTRICAL COMPONENTS (Manual)



SHA997B

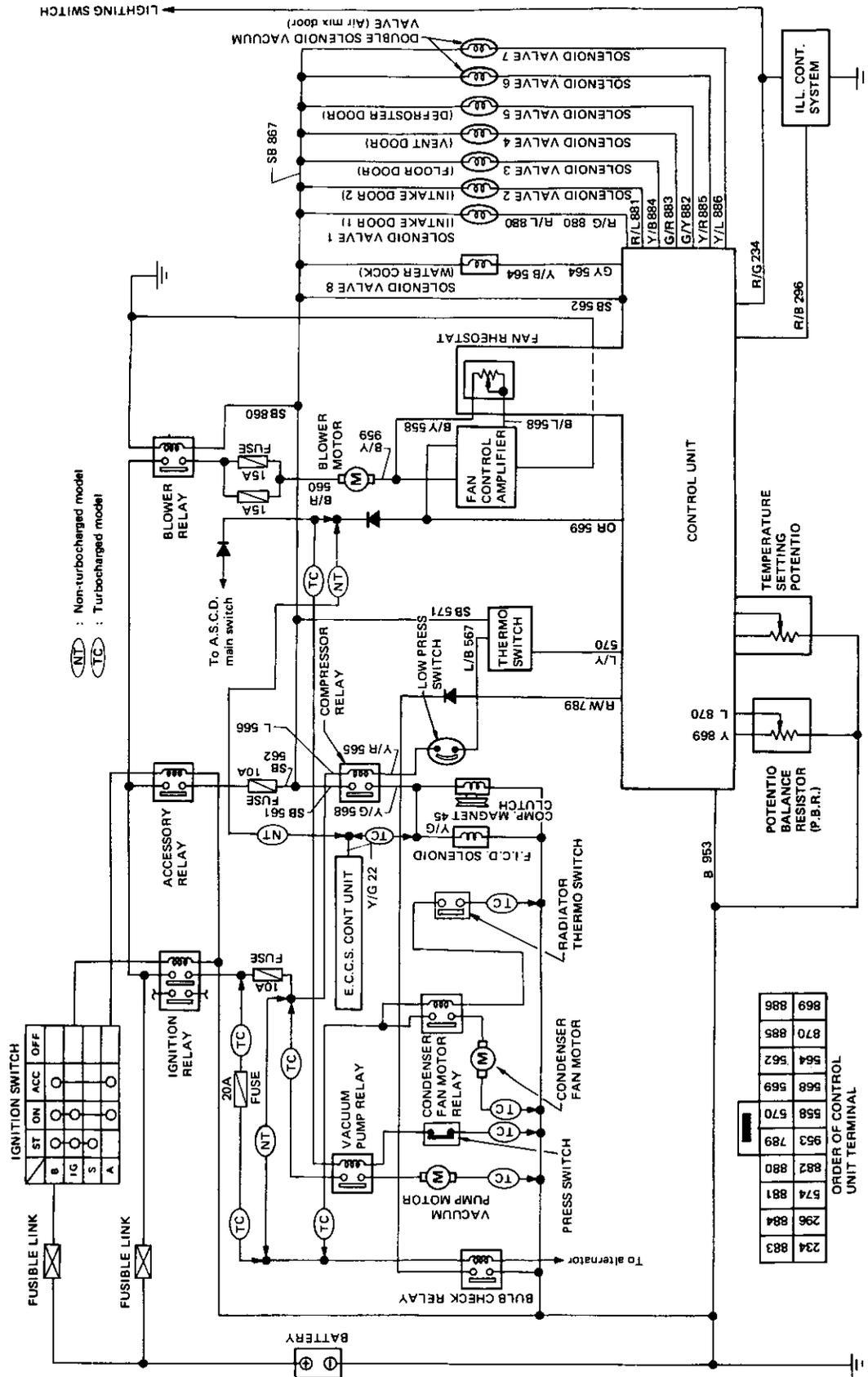
TROUBLE DIAGNOSES (Manual)

CONTENTS

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(R) Malfunction of F.I.C.D.	HA-63
(S) Blower motor rotates intermittently.	HA-64

TROUBLE DIAGNOSES (Manual)

Circuit for Trouble Diagnoses



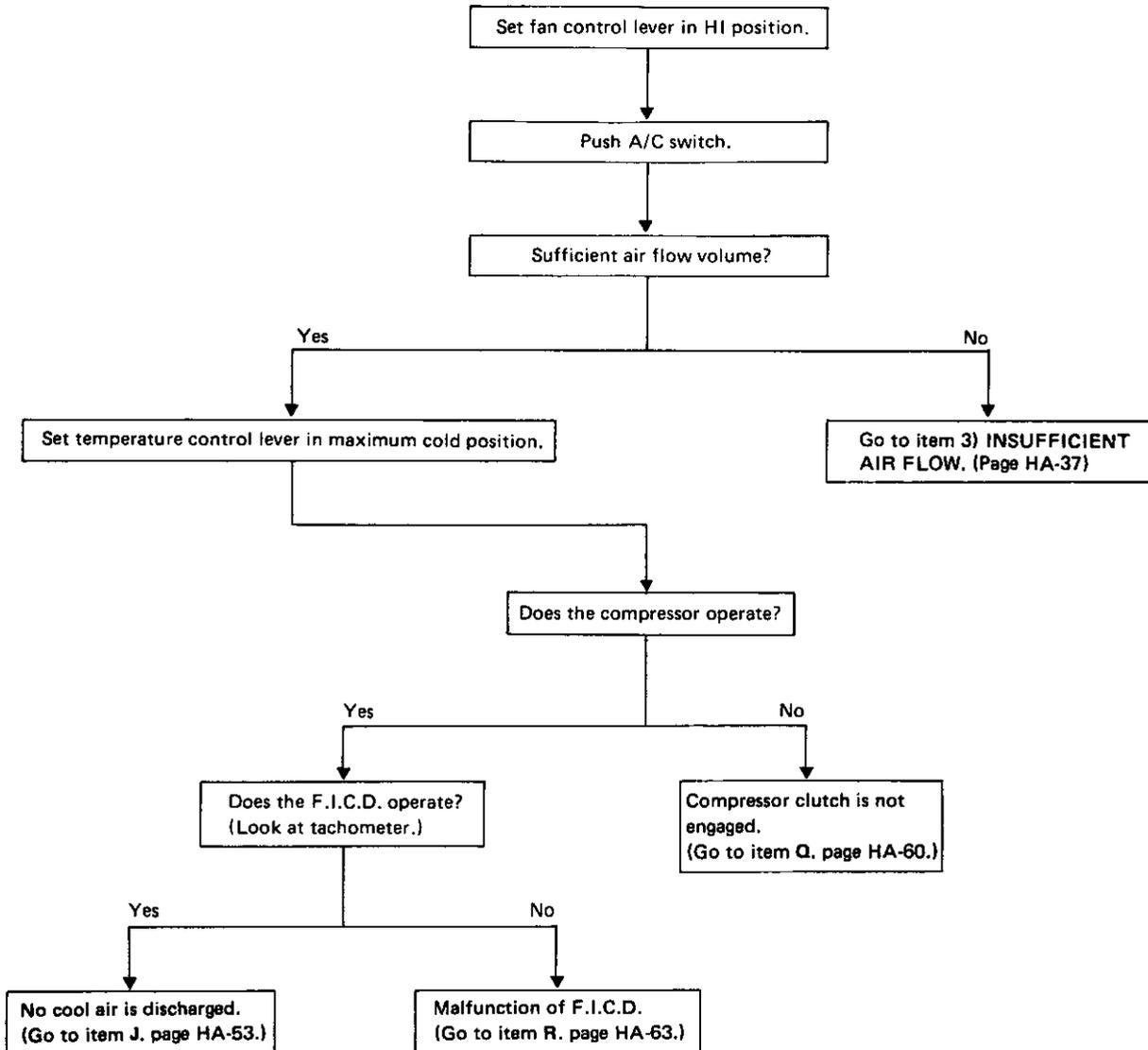
SHA995B

TROUBLE DIAGNOSES (Manual)

Preliminary Check

Before starting to diagnose the trouble, check the items below in order to completely understand the trouble symptom.

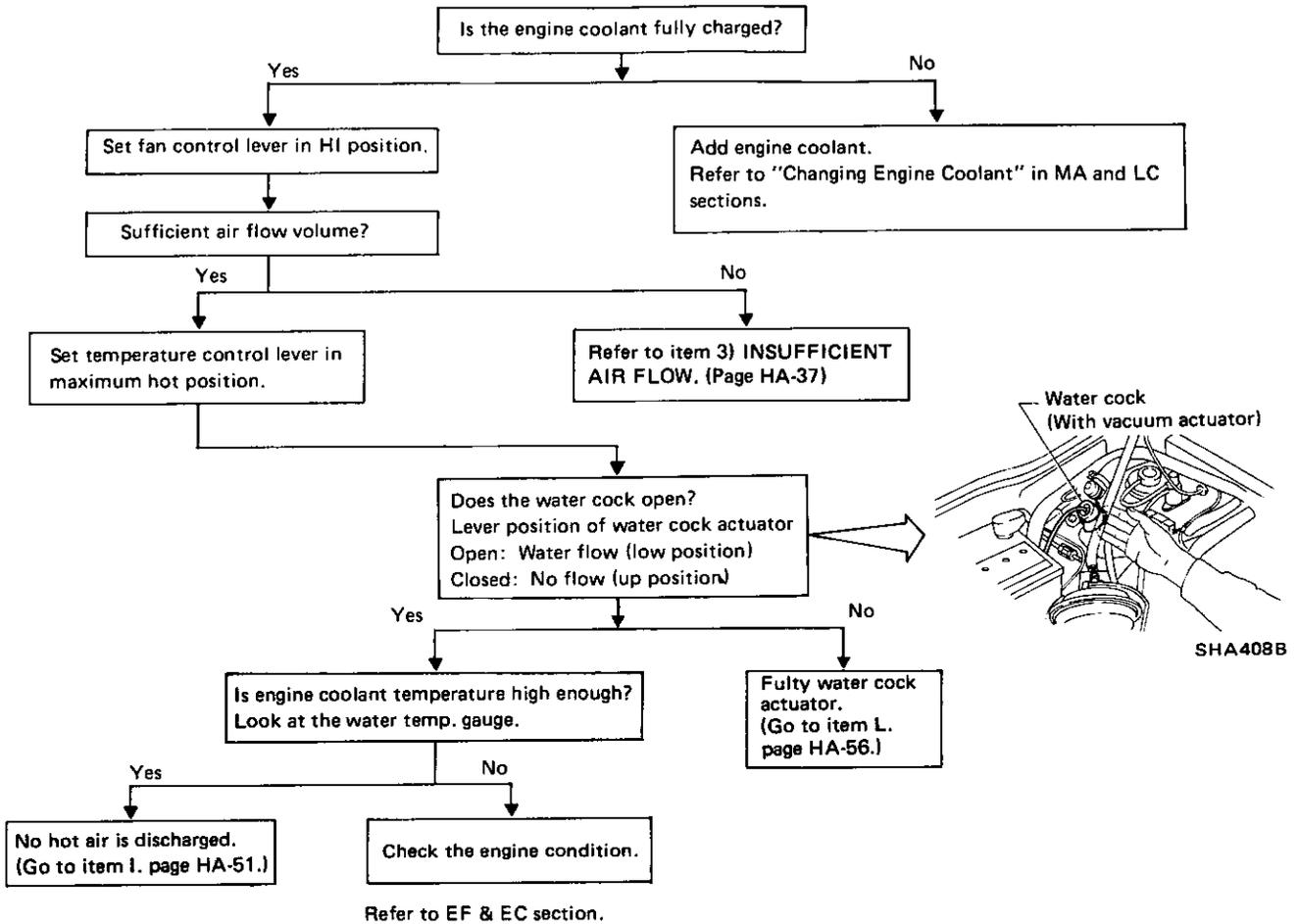
1) INSUFFICIENT COOLING (Mode switch position: "FACE")



TROUBLE DIAGNOSES (Manual)

Preliminary Check (Cont'd)

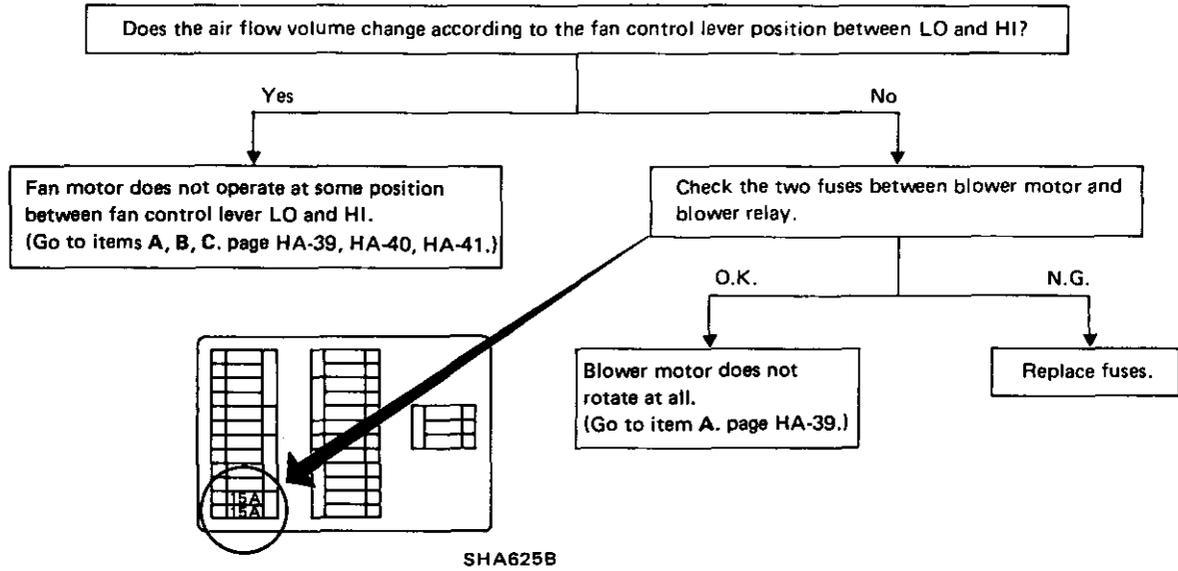
2) INSUFFICIENT HEATING



TROUBLE DIAGNOSES (Manual)

Preliminary Check (Cont'd)

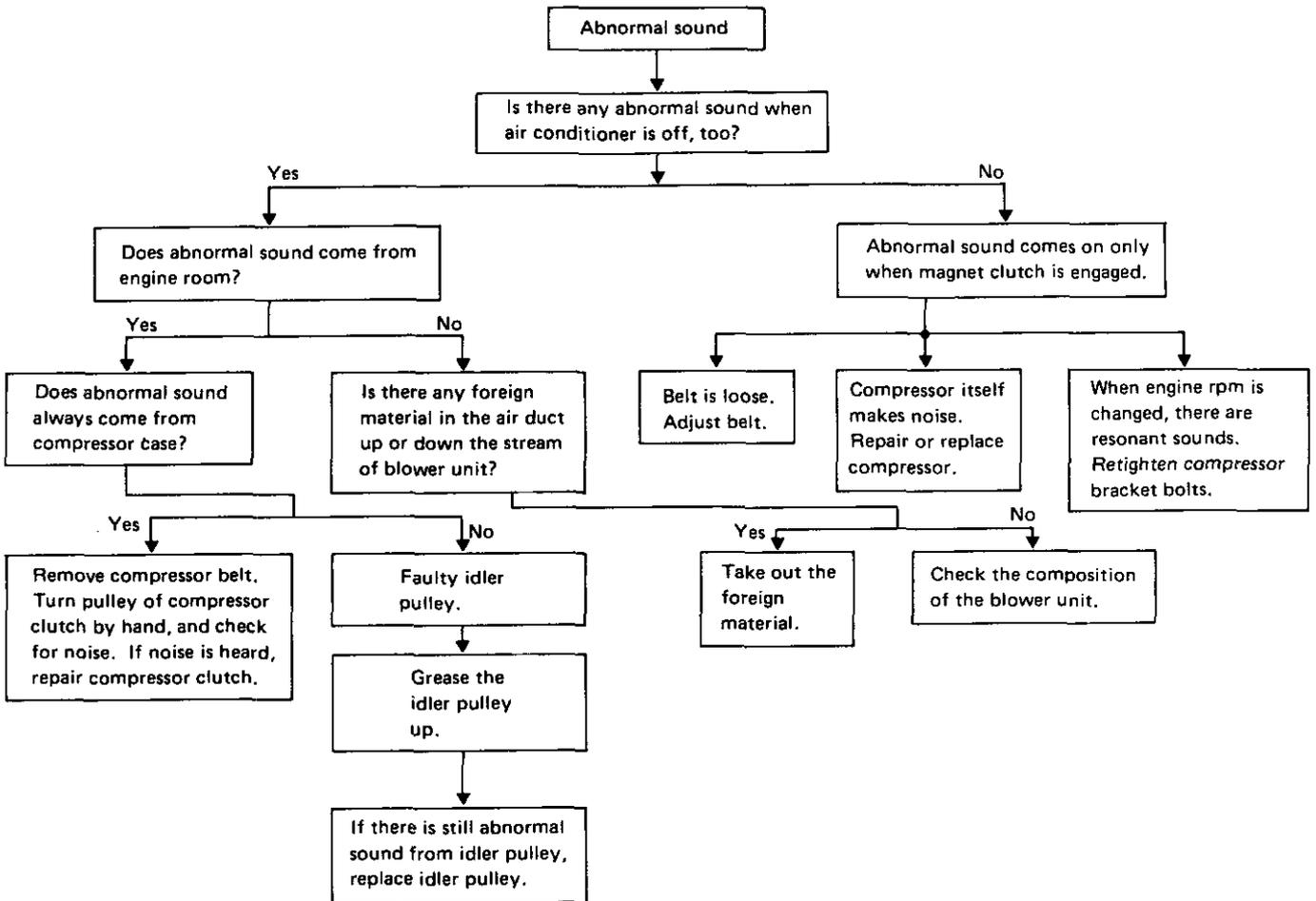
3) INSUFFICIENT AIR FLOW (Blower motor does not rotate.)



TROUBLE DIAGNOSES (Manual)

Preliminary Check (Cont'd)

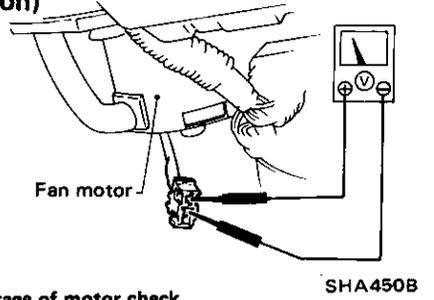
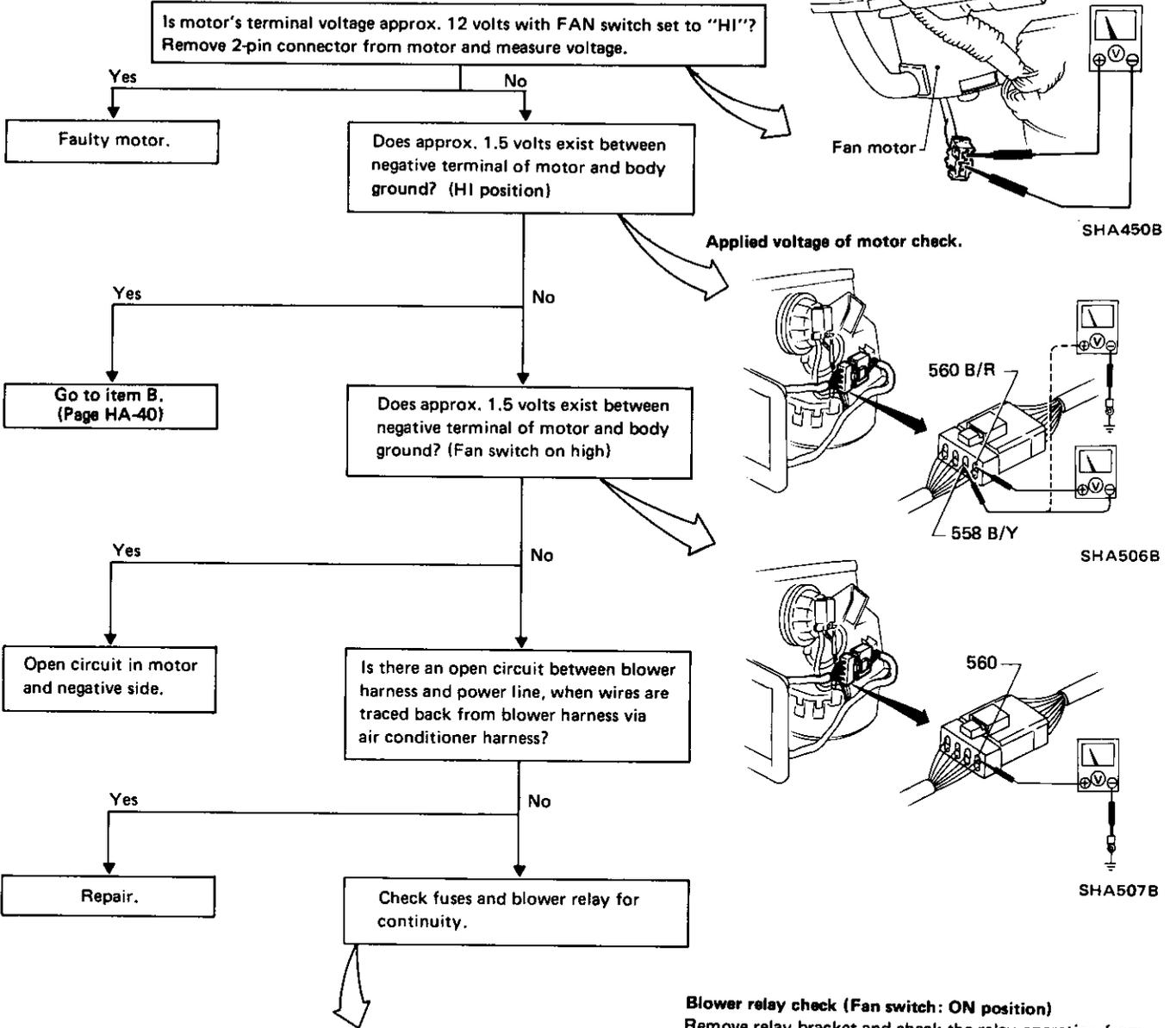
4) ABNORMAL SOUND



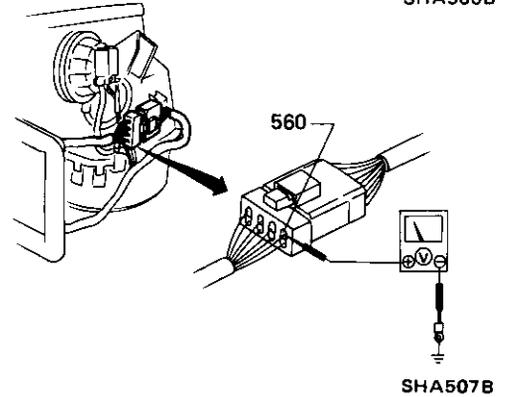
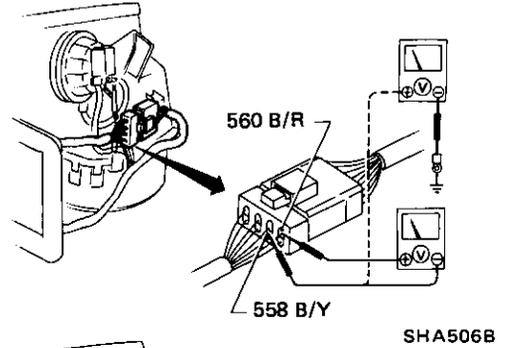
TROUBLE DIAGNOSES (Manual)

Trouble Diagnoses from Abnormal Conditions

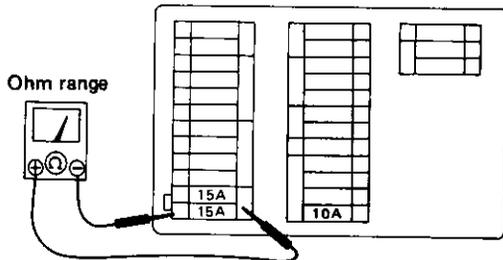
(A) BLOWER MOTOR DOES NOT ROTATE. (Ignition switch on position)



Applied voltage of motor check.



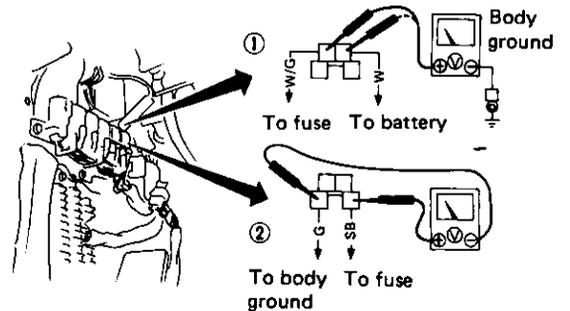
Fuse check
(Ignition switch: OFF position)



Blower relay check (Fan switch: ON position)

Remove relay bracket and check the relay operation from the back side of the electrical connector.

- ① Terminal voltage check (Correct voltage: Approx. 12V)
- ② If item ① is N.G., check applied voltage of relay coil. (Correct voltage: Approx. 12V)

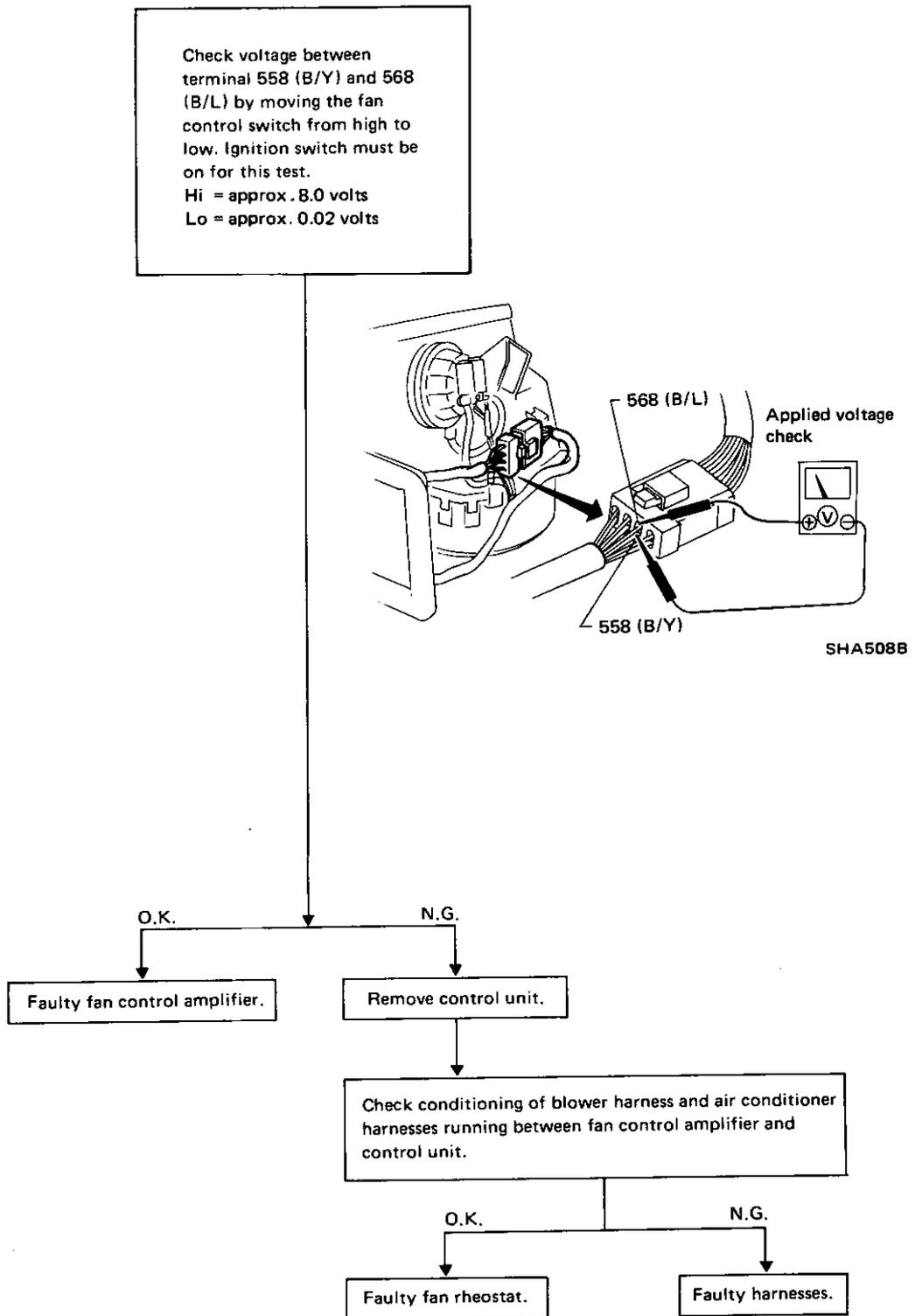


SHA396B

TROUBLE DIAGNOSES (Manual)

Trouble Diagnoses from Abnormal Conditions (Cont'd)

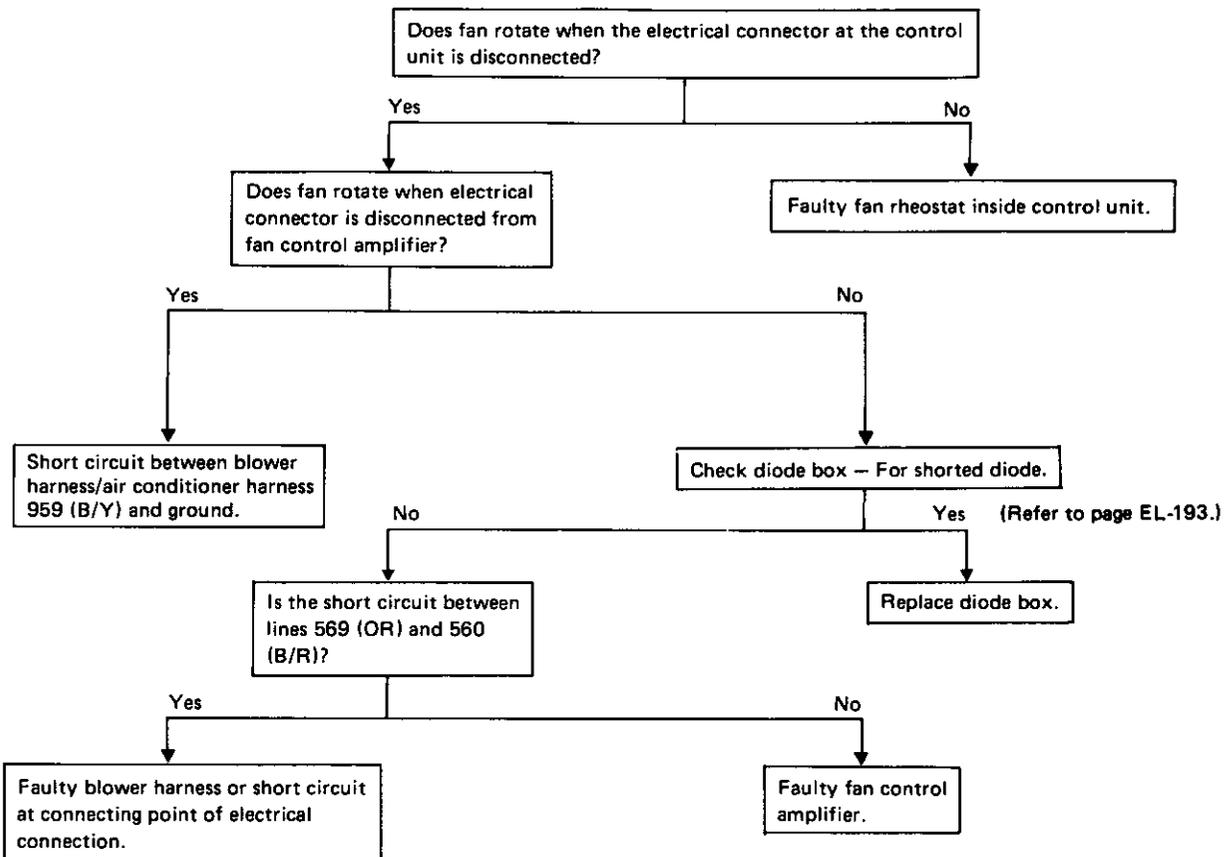
(B) AIR FLOW CANNOT BE CHANGED BETWEEN HI AND LO.



TROUBLE DIAGNOSES (Manual)

Trouble Diagnoses from Abnormal Conditions (Cont'd)

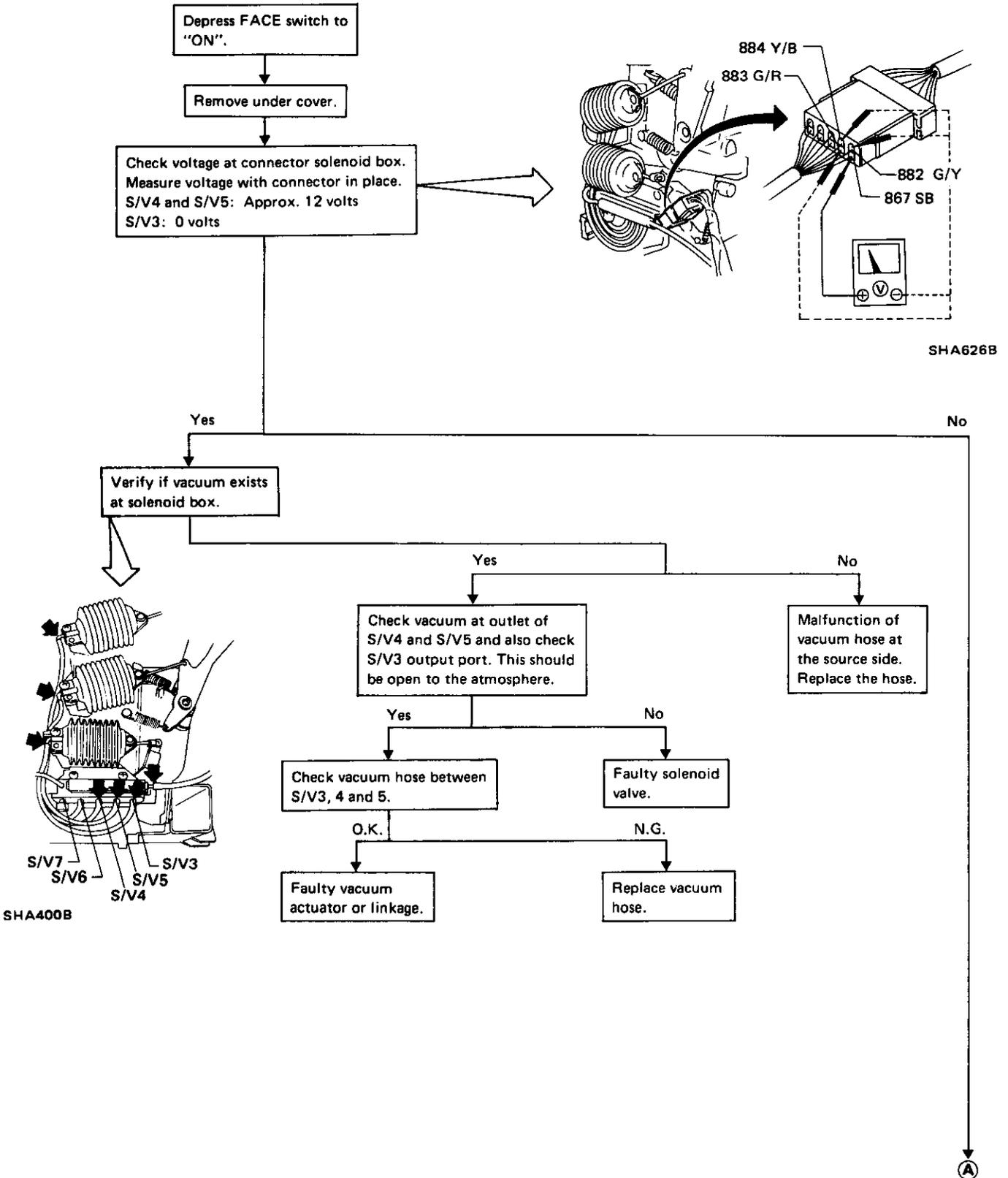
(C) BLOWER MOTOR CONTINUES TO ROTATE WHEN FAN SWITCH IS TURNED OFF.



TROUBLE DIAGNOSES (Manual)

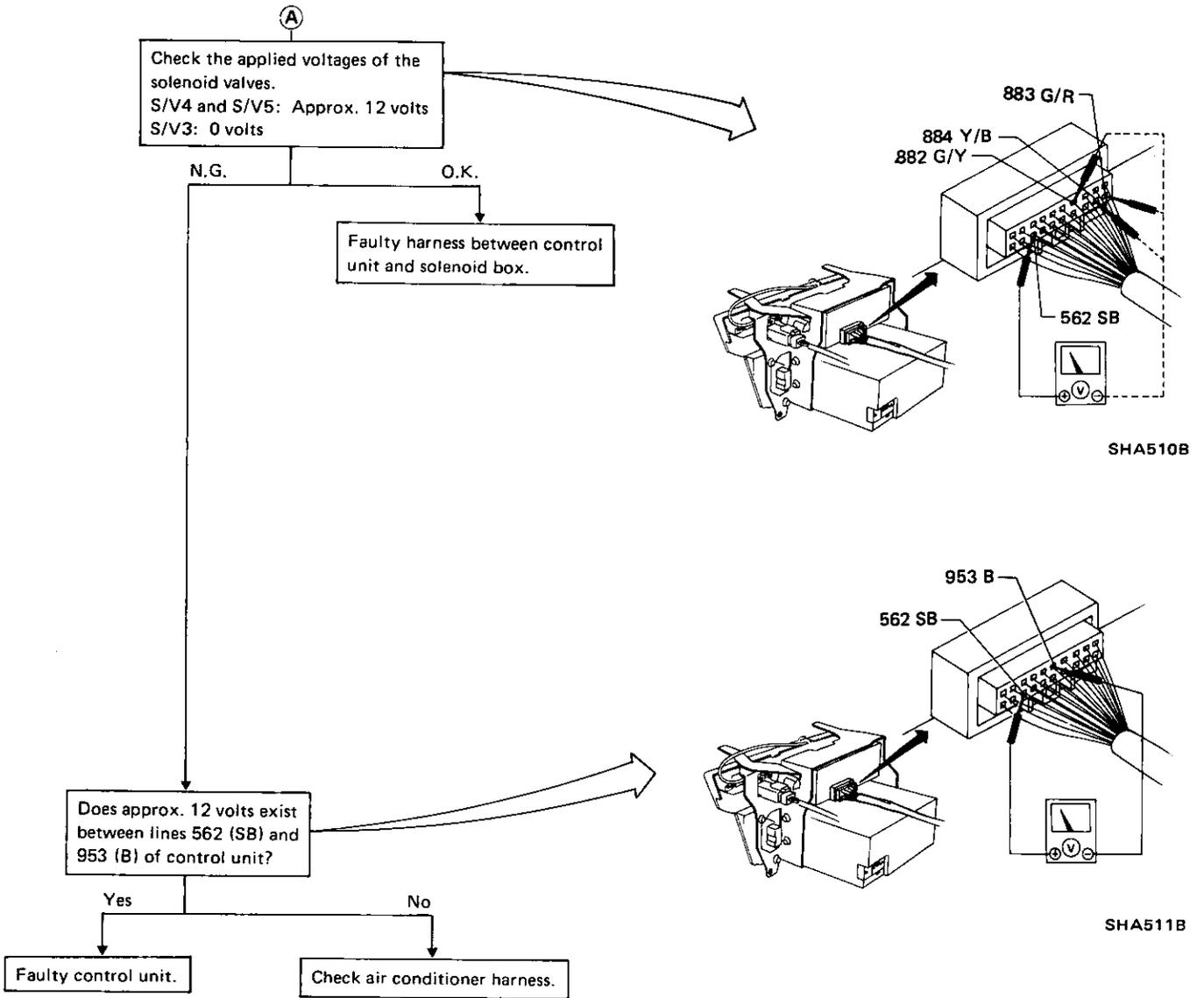
Trouble Diagnoses from Abnormal Conditions (Cont'd)

(D) "FACE" MODE CANNOT BE SET.



TROUBLE DIAGNOSES (Manual)

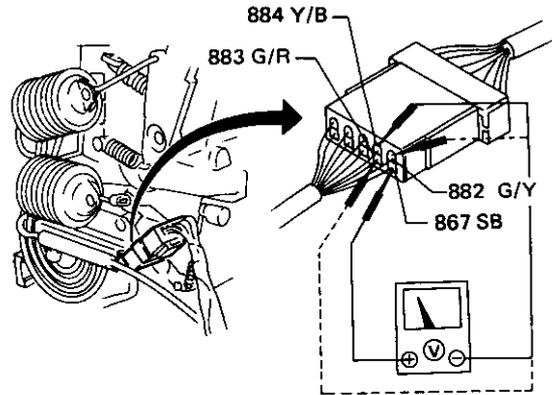
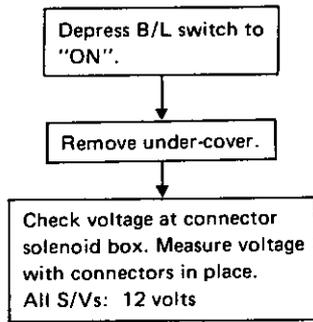
Trouble Diagnoses from Abnormal Conditions (Cont'd)



TROUBLE DIAGNOSES (Manual)

Trouble Diagnoses from Abnormal Conditions (Cont'd)

(E) "B/L" MODE CANNOT BE SET.



SHA509B

Yes

No

Verify that vacuum exists at solenoid box.

Yes

No

Check vacuum at outlet of S/V3, S/V4 and S/V5.

Malfunction of vacuum hose at source side.

Yes

No

Check vacuum hose between S/V3, 4 and 5.

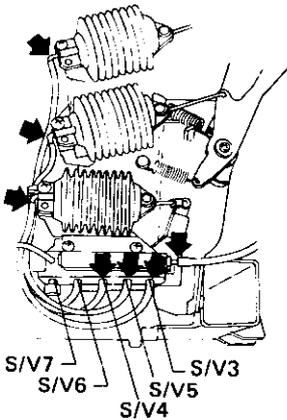
Faulty solenoid valve.

O.K.

N.G.

Faulty vacuum actuator or linkage.

Replace vacuum hose.

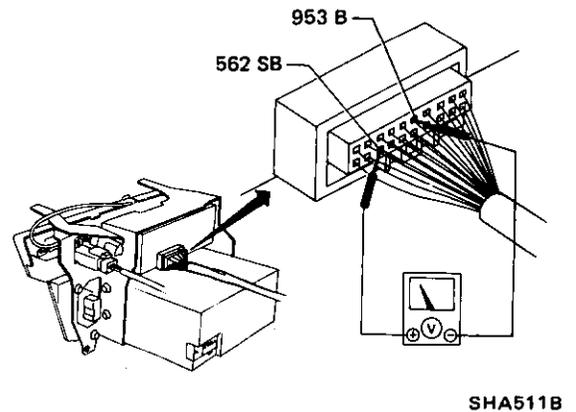
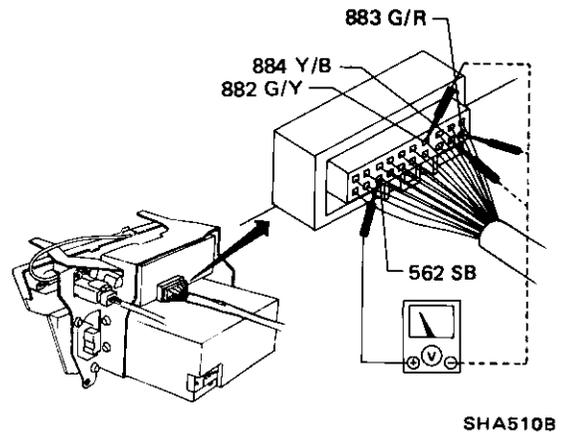
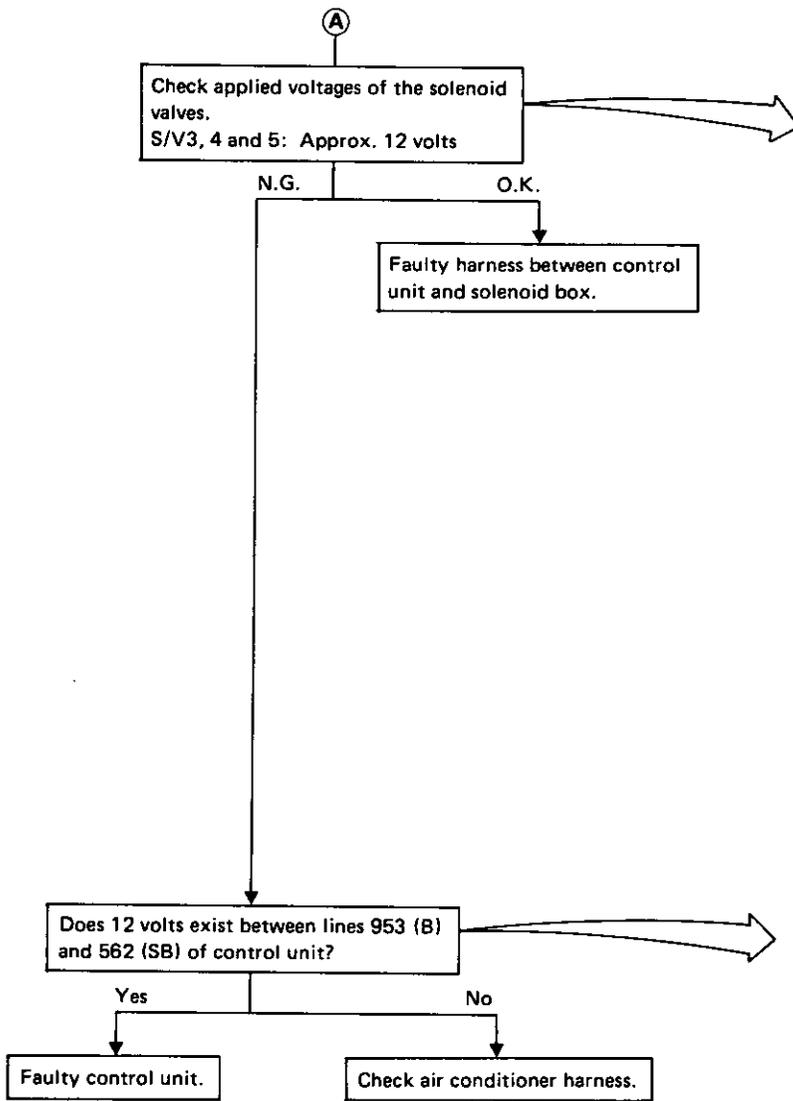


SHA400B

(A)

TROUBLE DIAGNOSES (Manual)

Trouble Diagnoses from Abnormal Conditions (Cont'd)



TROUBLE DIAGNOSES (Manual)

Trouble Diagnoses from Abnormal Conditions (Cont'd)

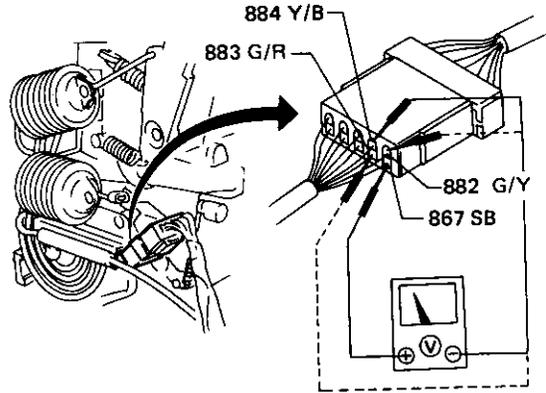
(F) "FOOT" MODE CANNOT BE SET.

Depress FOOT switch to "ON".

Remove under-cover.

Check voltage at connector solenoid box. Measure voltage with connector in place.

- S/V3 and S/V5: Approx. 12 volts
- S/V4: Approx. 0 volts

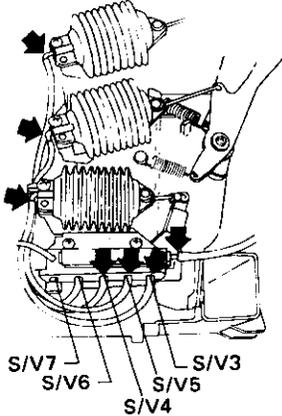


SHA509B

Yes

No

Check vacuum at the inlet of the solenoid box.



SHA400B

Yes

No

Check vacuum at the outlets of S/V3 and 5. Check S/V4—this should be opened to atmosphere.

Faulty vacuum hose at source side.

Yes

No

Check vacuum hose between solenoid valves and vacuum actuator.

Faulty solenoid valve.

O.K.

N.G.

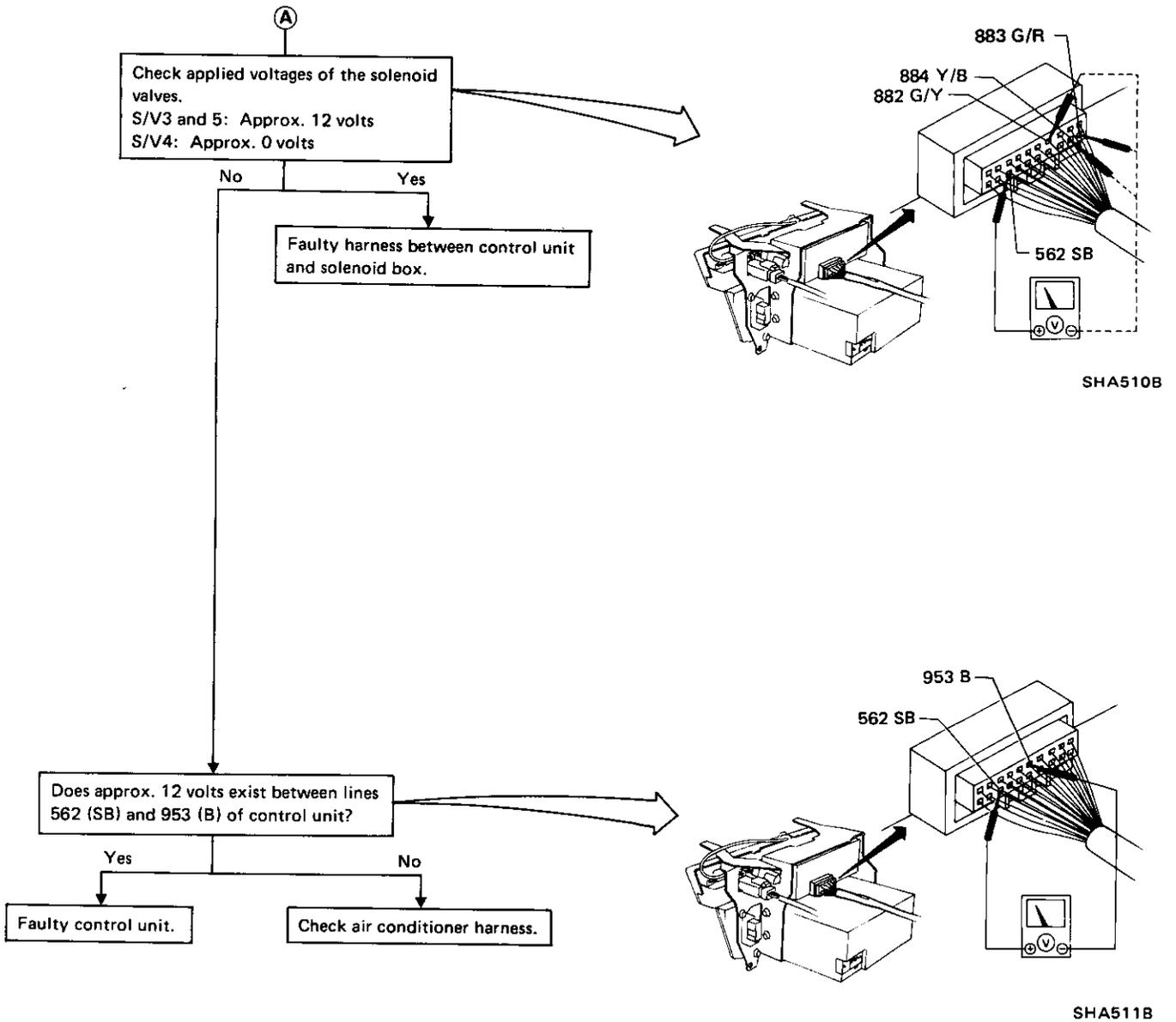
Faulty vacuum actuator or linkage.

Replace vacuum hose.

A

TROUBLE DIAGNOSES (Manual)

Trouble Diagnoses from Abnormal Conditions (Cont'd)



TROUBLE DIAGNOSES (Manual)

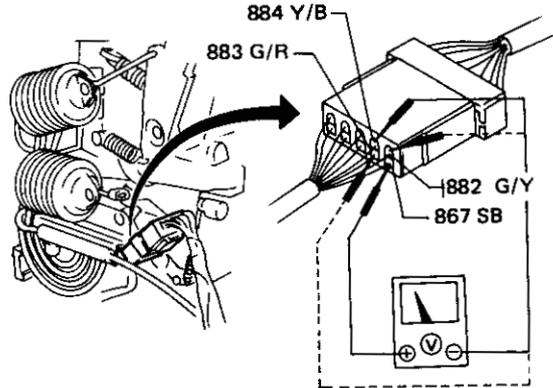
Trouble Diagnoses from Abnormal Conditions (Cont'd)

(G) "DEMIST" MODE CANNOT BE SET.

Depress DEMIST switch to "ON".

Remove under-cover from driver's side.

Check voltage at connector solenoid box.
Measure voltage with connector in place.
S/V4 and 5: Approx. 0 volts
S/V3: Approx. 12 volts

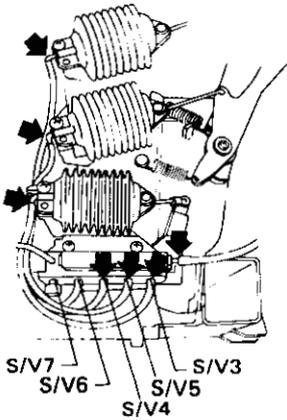


SHA509B

Yes

No

Check vacuum at the inlet of the solenoid box.



SHA400B

Yes

No

Check vacuum at outlets S/V3.
Check outlet at S/V4 and 5; this should be opened to the atmosphere.

Faulty vacuum hose at source side.

Yes

No

Check vacuum hose between solenoid valve and vacuum actuator.

Faulty solenoid valve.

O.K.

N.G.

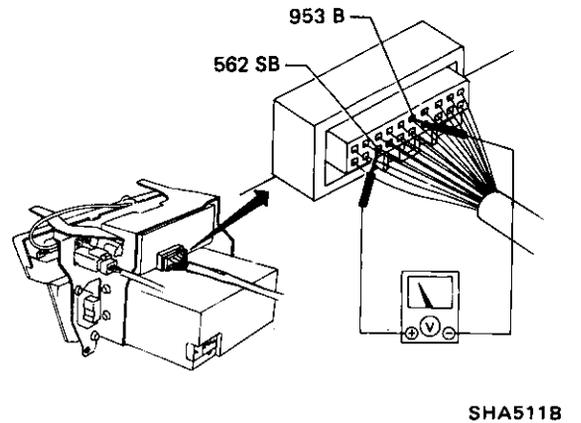
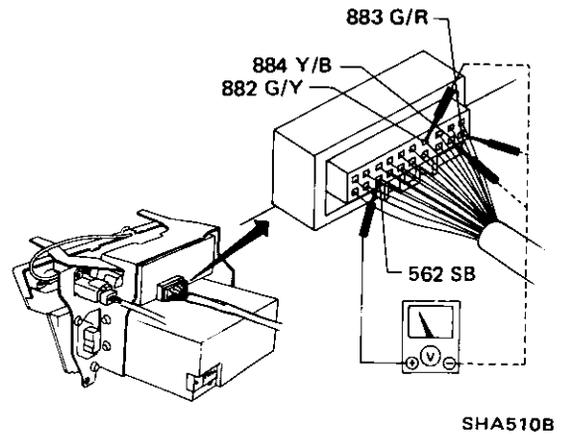
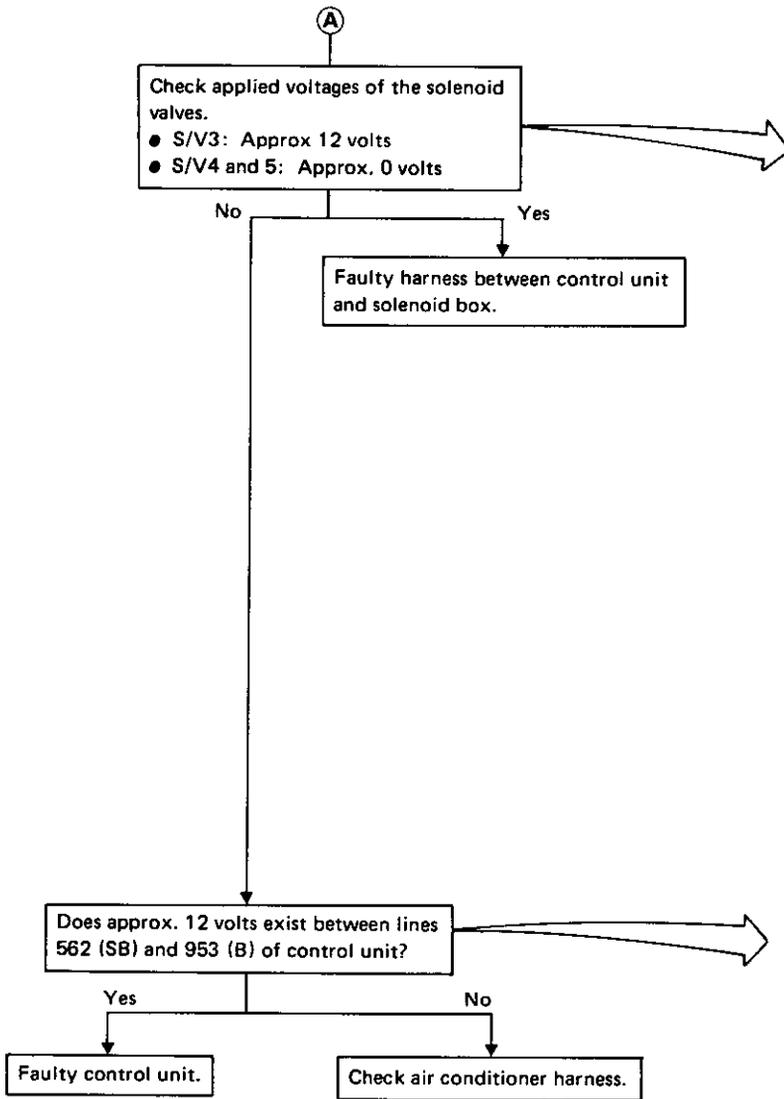
Faulty vacuum actuator or linkage.

Replace vacuum hose.

(A)

TROUBLE DIAGNOSES (Manual)

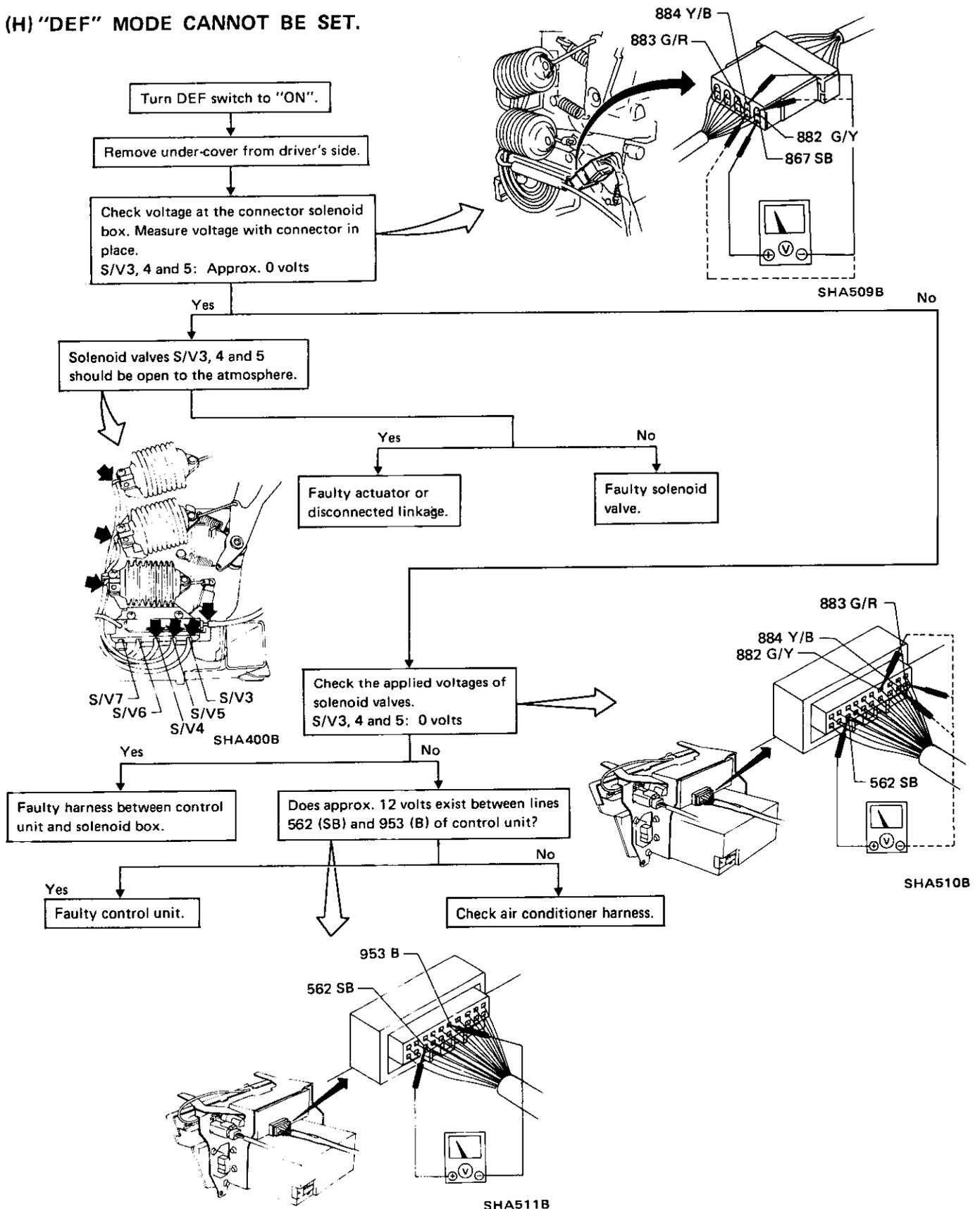
Trouble Diagnoses from Abnormal Conditions (Cont'd)



TROUBLE DIAGNOSES (Manual)

Trouble Diagnoses from Abnormal Conditions (Cont'd)

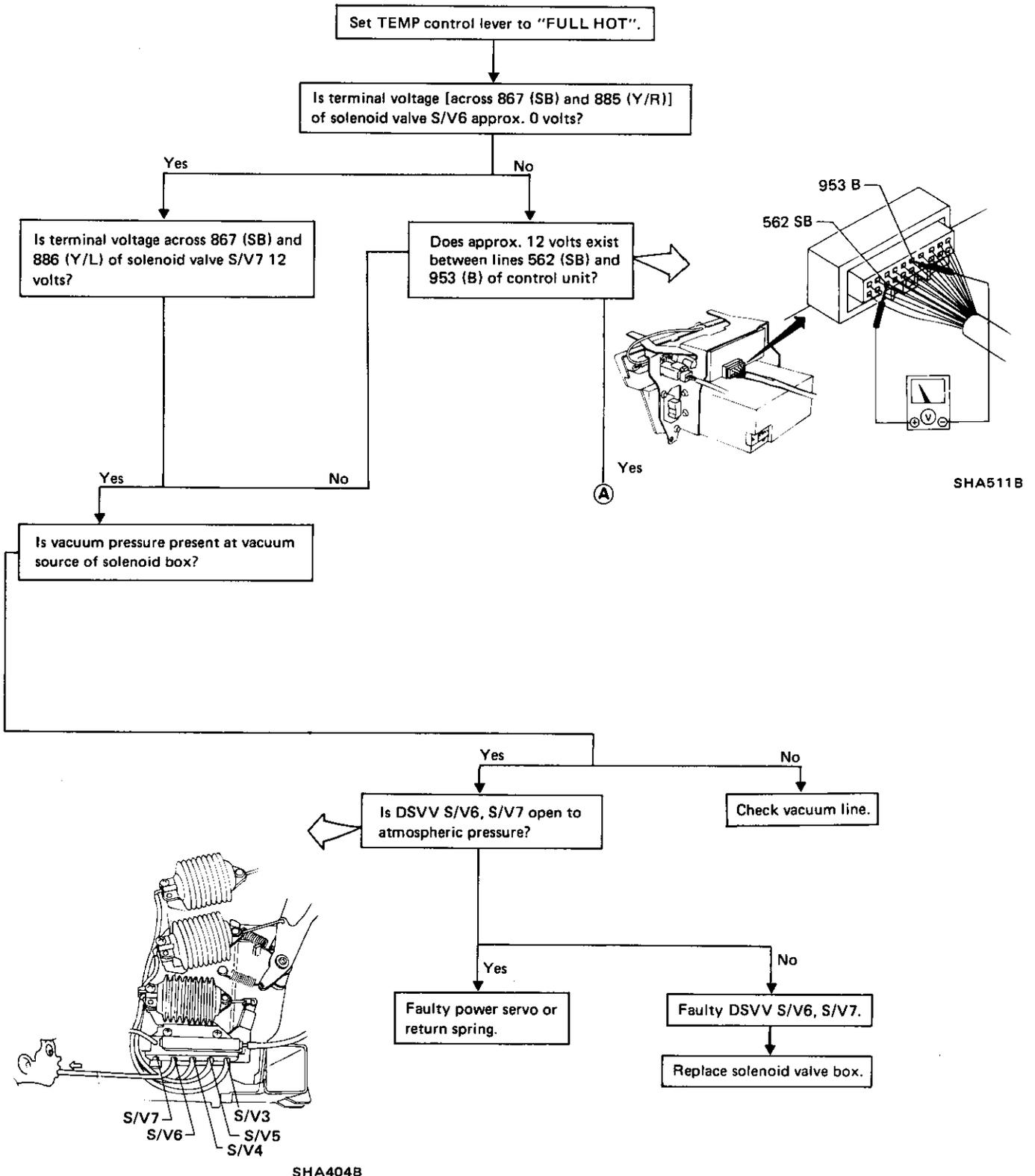
(H) "DEF" MODE CANNOT BE SET.



TROUBLE DIAGNOSES (Manual)

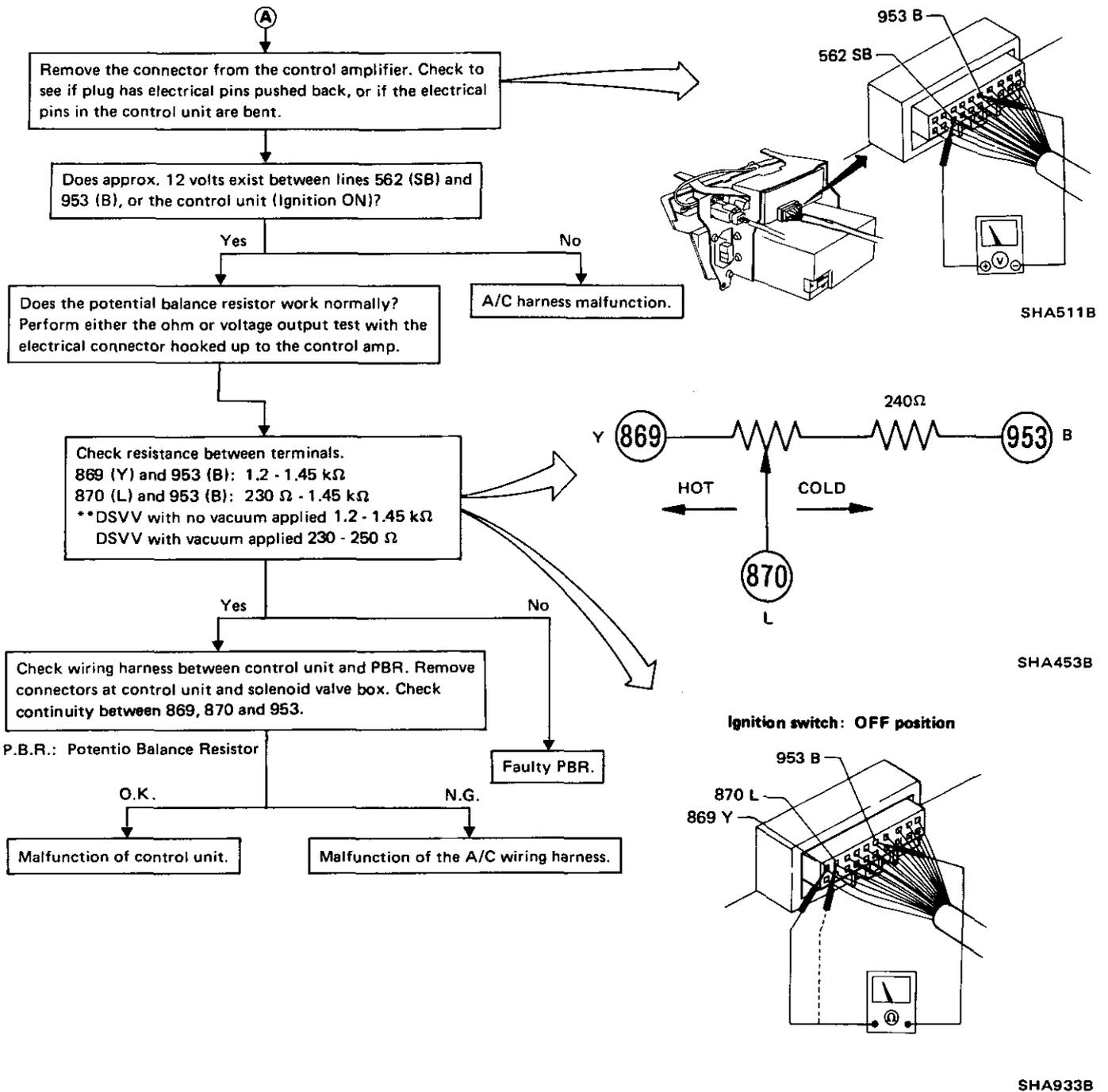
Trouble Diagnoses from Abnormal Conditions (Cont'd)

(I) OUTLET AIR WILL NOT BECOME WARM.



TROUBLE DIAGNOSES (Manual)

Trouble Diagnoses from Abnormal Conditions (Cont'd)



TROUBLE DIAGNOSES (Manual)

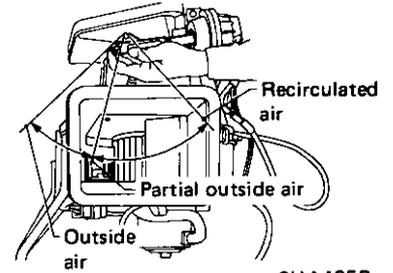
Trouble Diagnoses from Abnormal Conditions (Cont'd)

(J) OUTLET AIR WILL NOT BECOME COOL.

Set TEMP control lever to "FULL COOL" and press A/C switch and "Face" switch to "ON".

Make sure intake door is set to "partial outside air" position.*

* Intake door position is always in partial outside air position with A/C switch "ON".

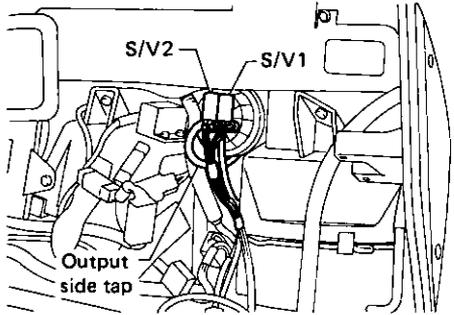


SHA405B

Does approx. 12 volts exist between lines 867 (SB) and 886 (Y/L) of solenoid valve S/V7?

Check the operation of the solenoid valve 1 by turning A/C switch to "ON" and "OFF". Is vacuum pressure present at outlet port or solenoid valve S/V2?

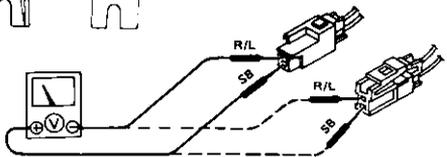
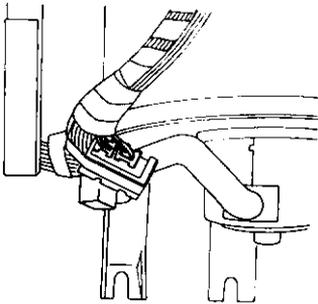
Check vacuum hoses between solenoid valve and actuator.



SHA406B

Check voltage at solenoid valves 1 and 2 when the recirculation switch is "OFF". The voltage should be at zero volts. When the recirculation switch is on, the voltage should be 12V at both solenoids.

Faulty linkage actuator or linkage.

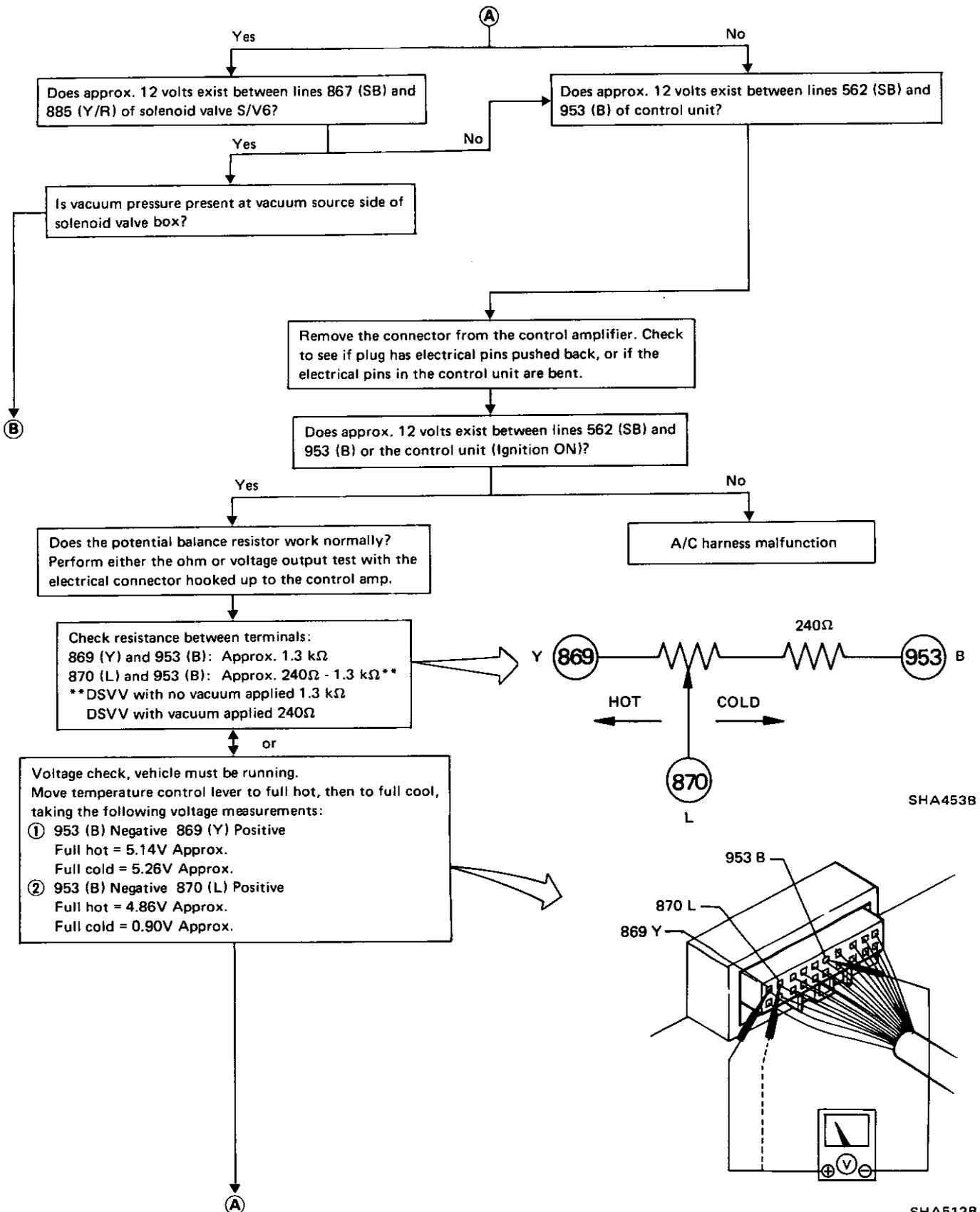


SHA934B

A

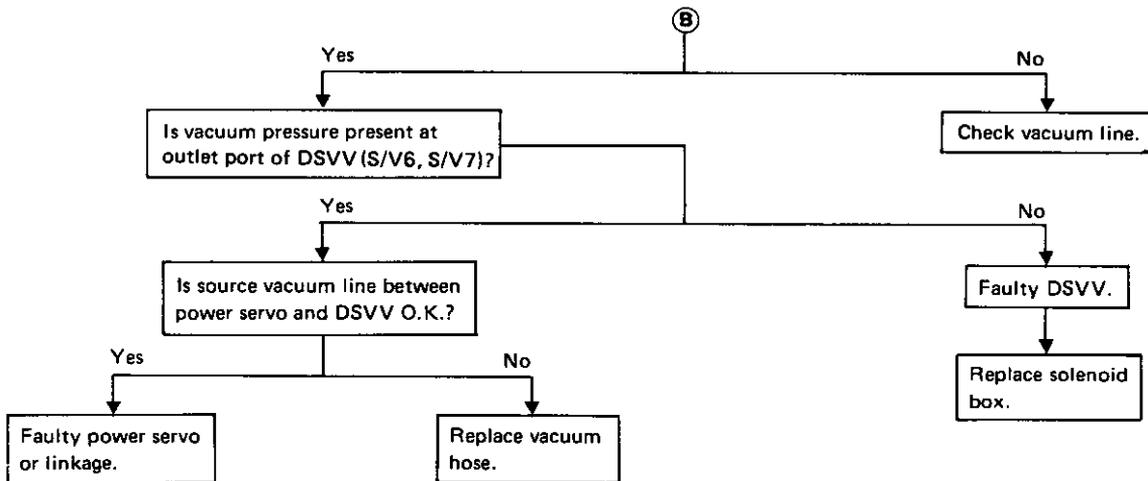
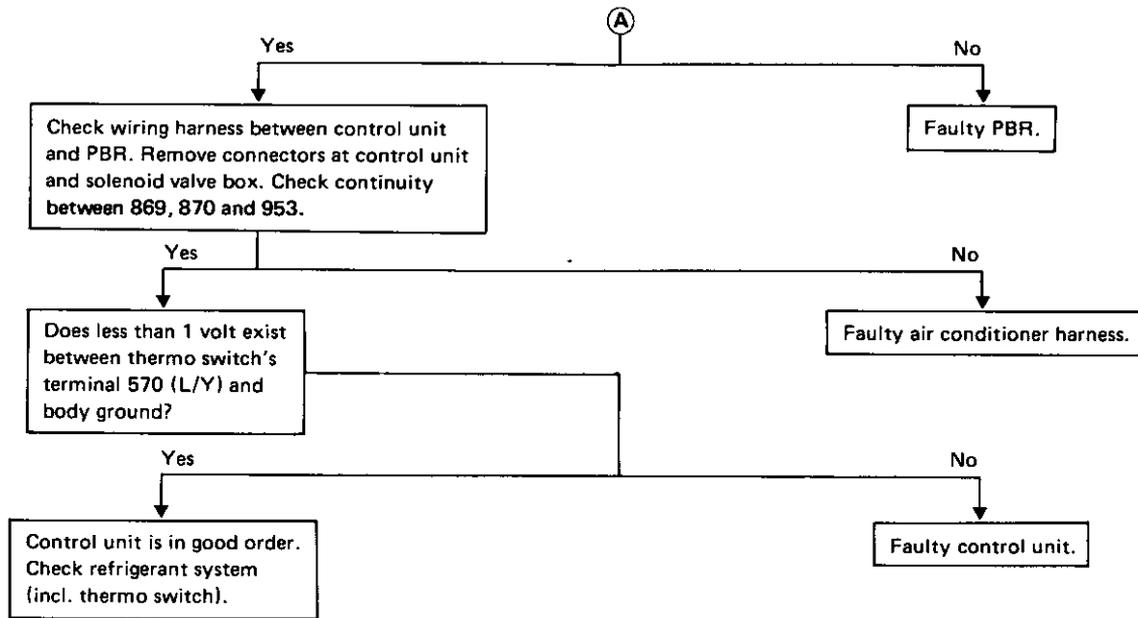
TROUBLE DIAGNOSES (Manual)

Trouble Diagnoses from Abnormal Conditions (Cont'd)



TROUBLE DIAGNOSES (Manual)

Trouble Diagnoses from Abnormal Conditions (Cont'd)



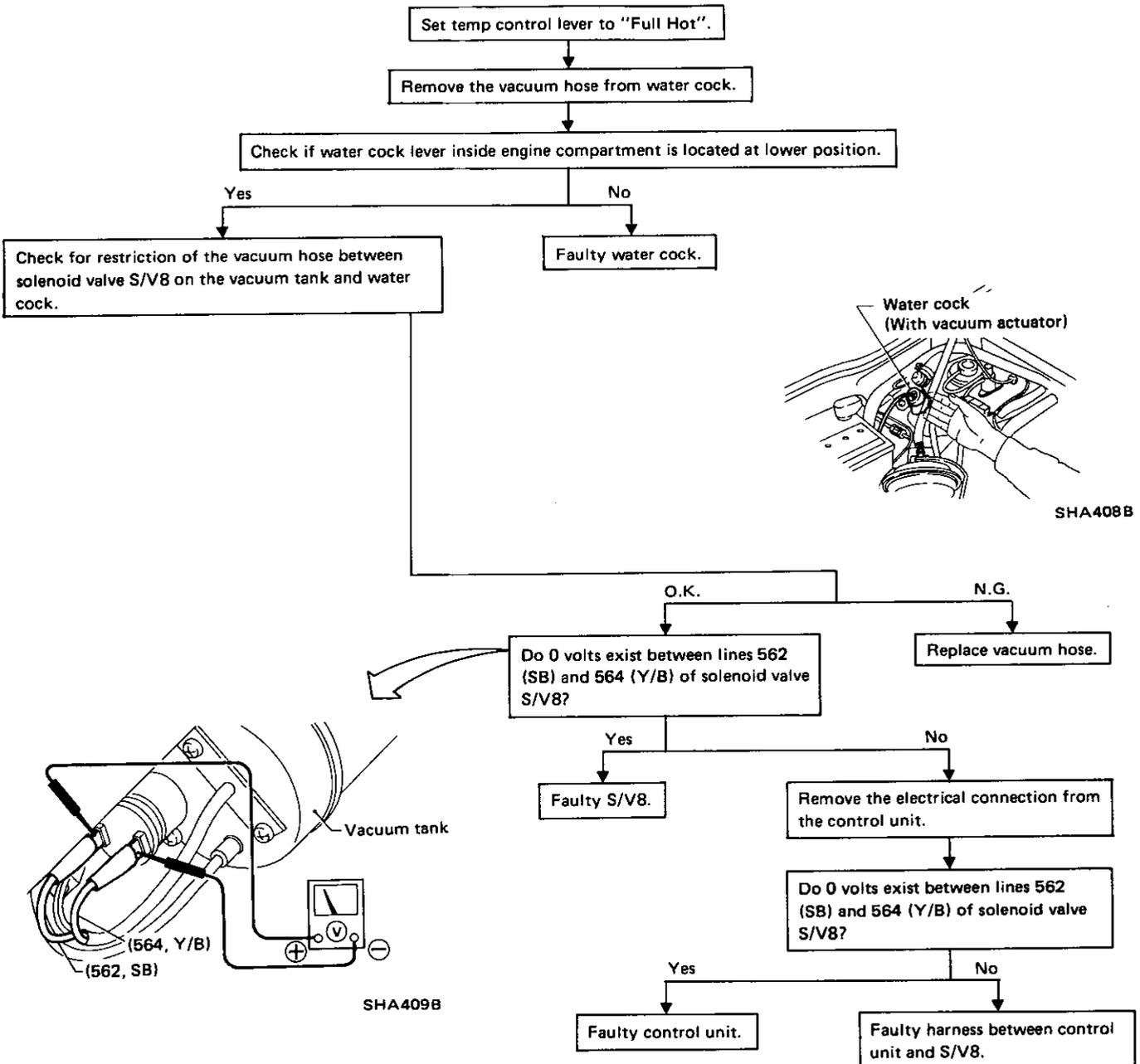
TROUBLE DIAGNOSES (Manual)

Trouble Diagnoses from Abnormal Conditions (Cont'd)

(K) OUTLET AIR TEMPERATURE CANNOT BE CHANGED WITH TEMP. CONTROL LEVER.

Refer to item (I) or (J) above to check and correct.

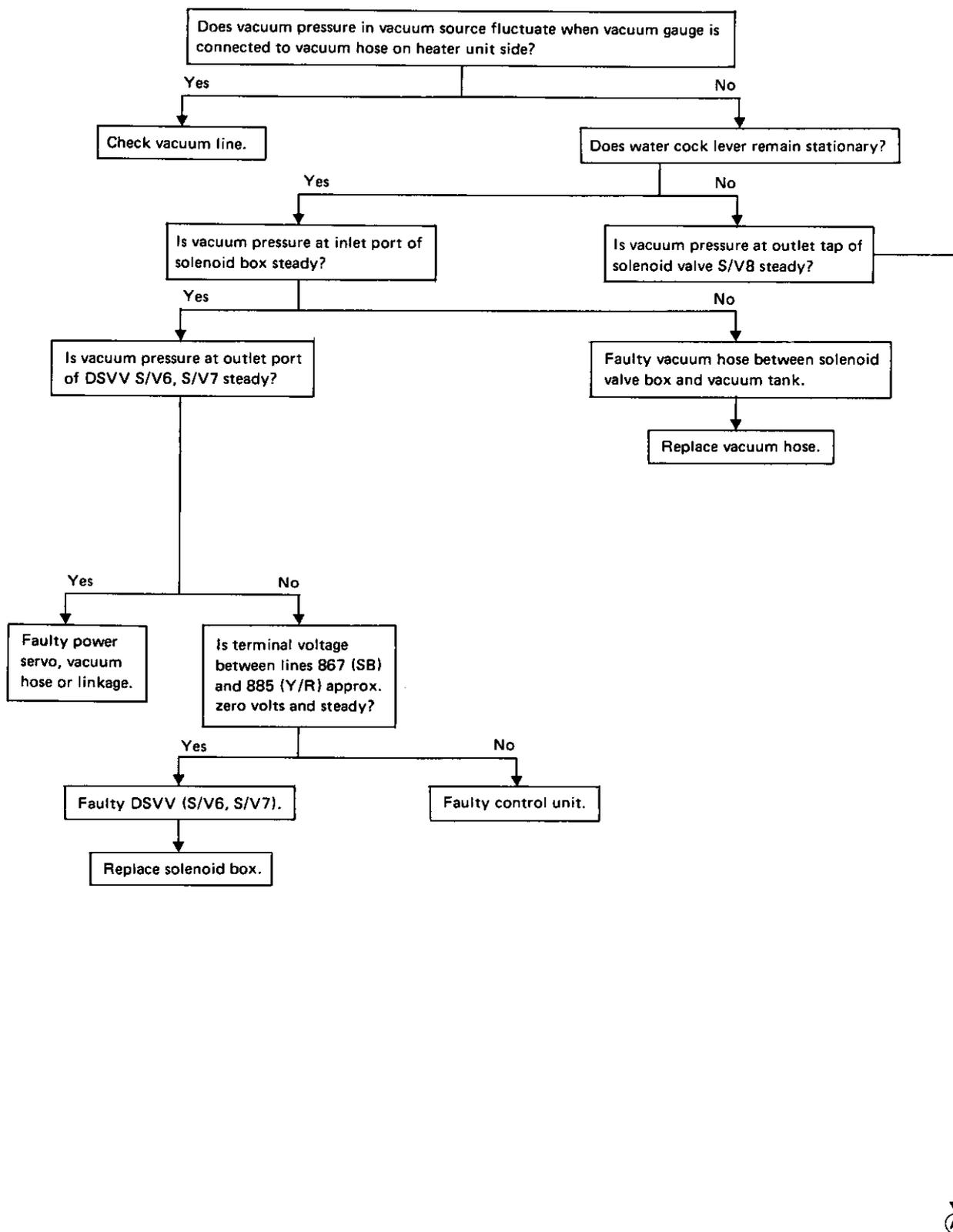
(L) MALFUNCTION OF WATER COCK OPERATION.



TROUBLE DIAGNOSES (Manual)

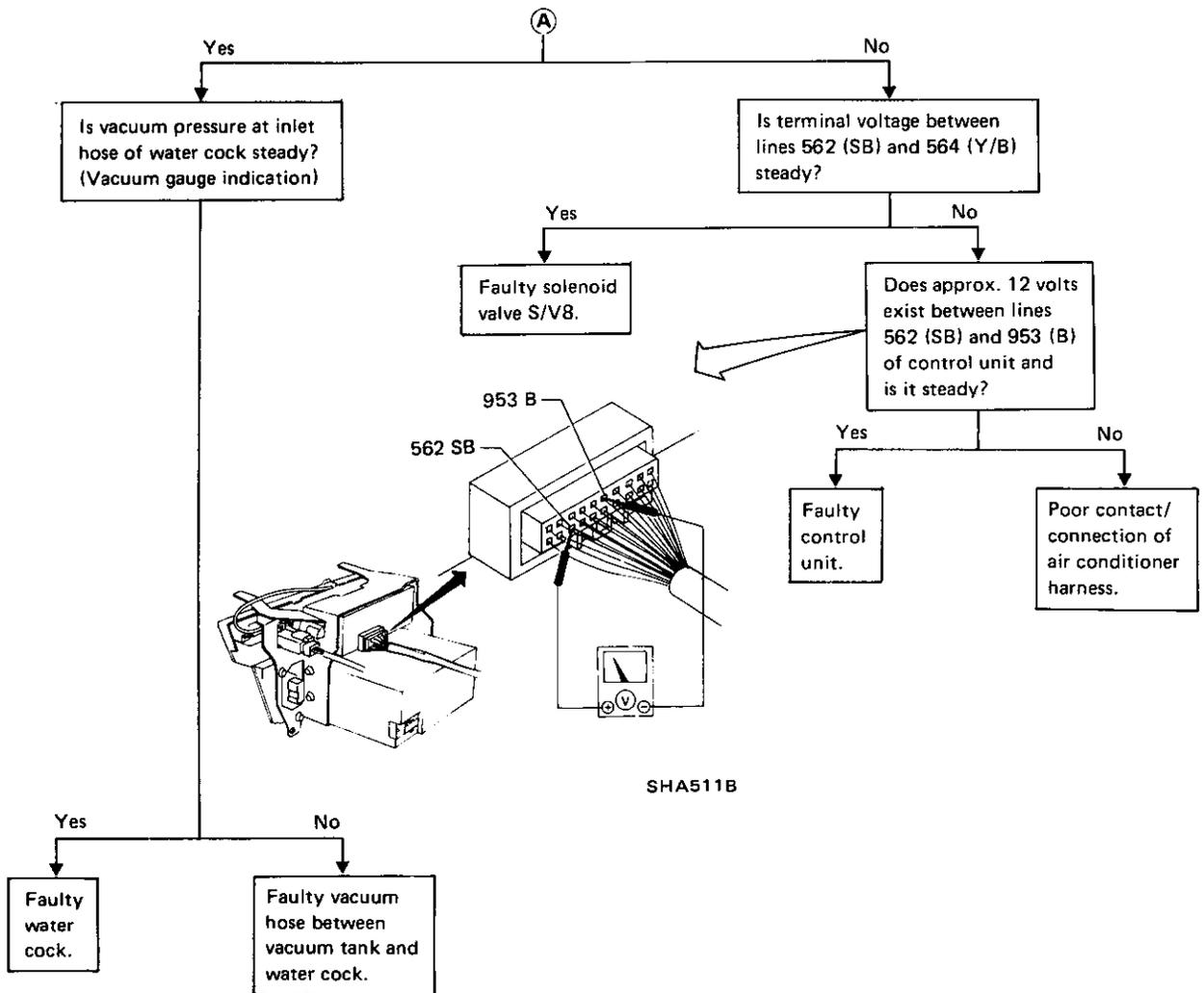
Trouble Diagnoses from Abnormal Conditions (Cont'd)

(M) OUTLET AIR TEMPERATURE FLUCTUATES.



TROUBLE DIAGNOSES (Manual)

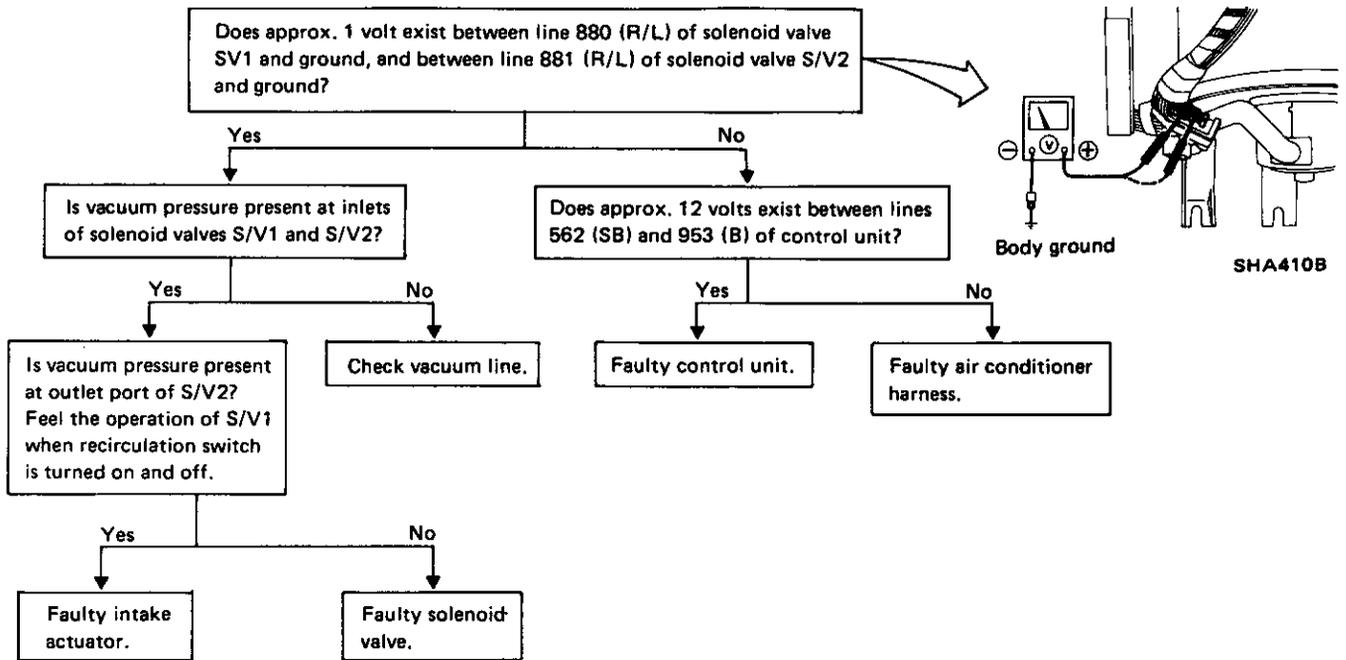
Trouble Diagnoses from Abnormal Conditions (Cont'd)



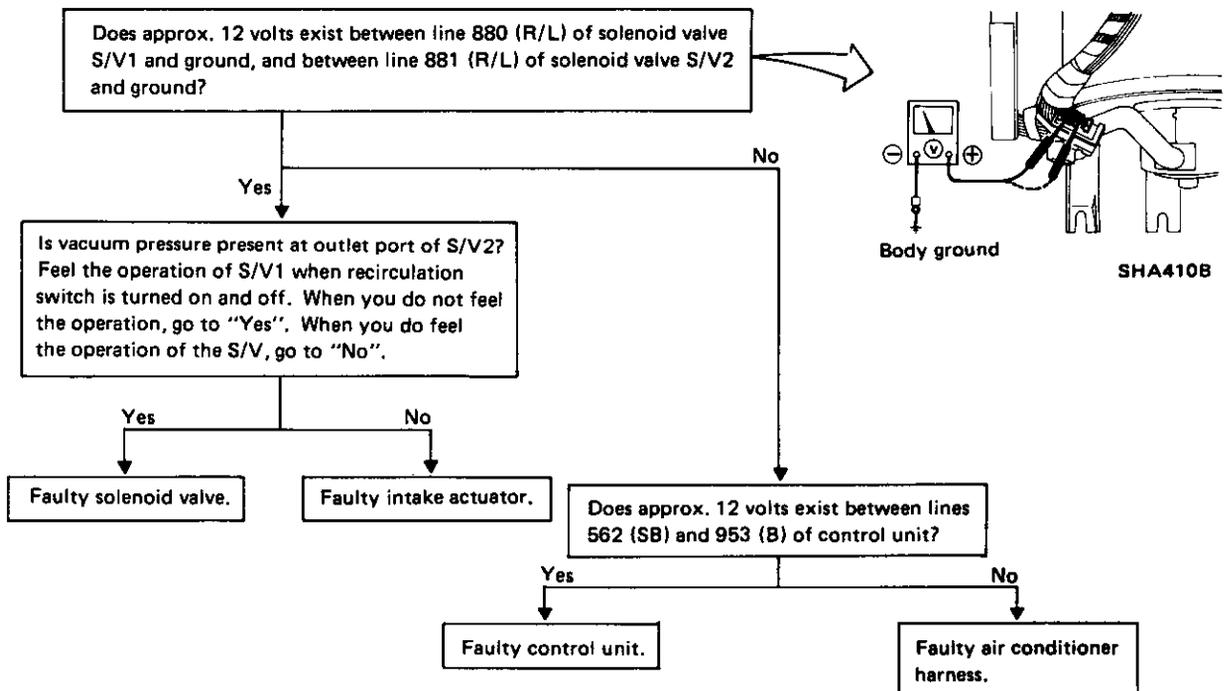
TROUBLE DIAGNOSES (Manual)

Trouble Diagnoses from Abnormal Conditions (Cont'd)

(N) RECIRCULATION MODE CANNOT BE SET WHEN "REC" SWITCH IS PRESSED.



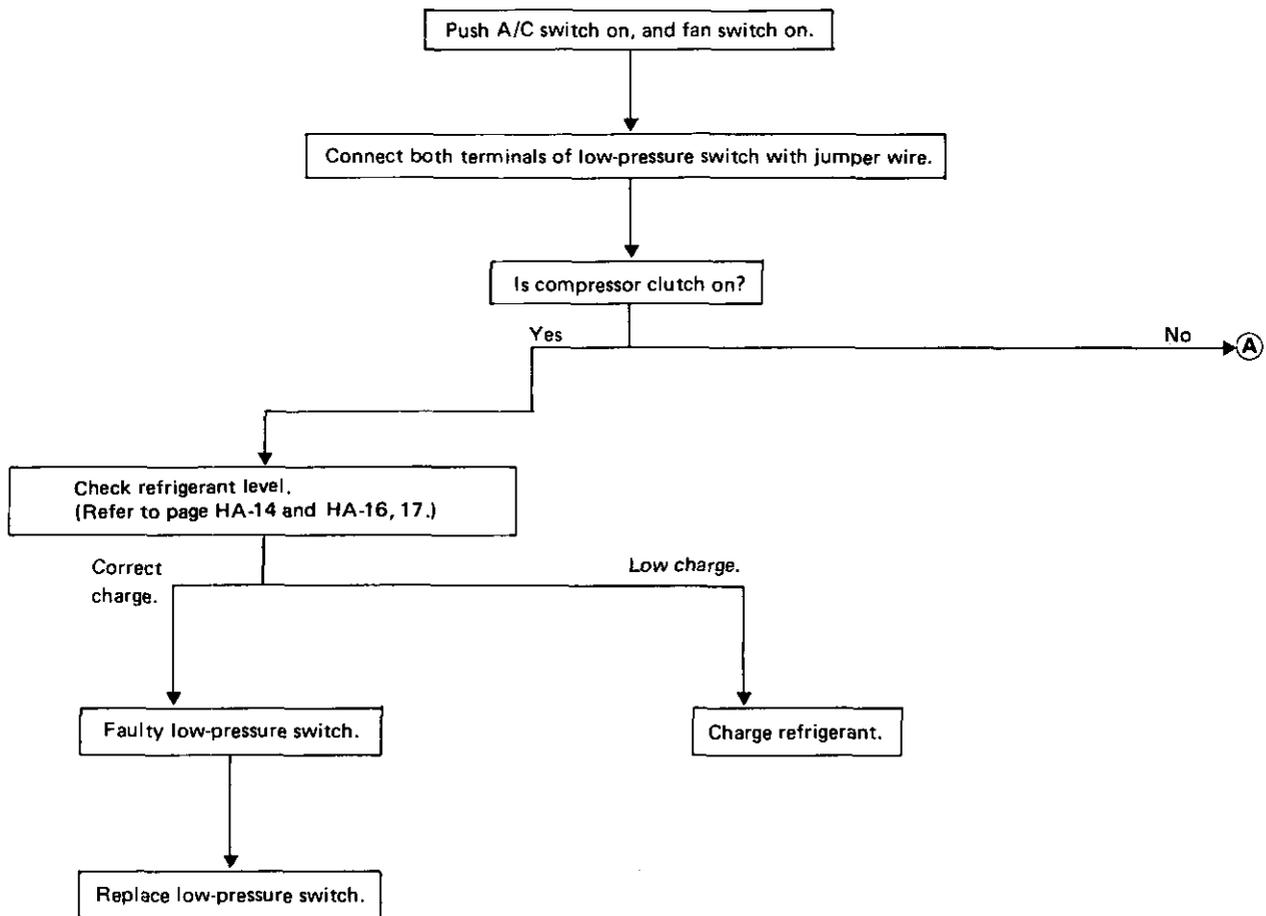
(P) OUTSIDE AIR IS NOT DRAWN INTO COMPARTMENT WHEN "REC" SWITCH IS TURNED OFF.



TROUBLE DIAGNOSES (Manual)

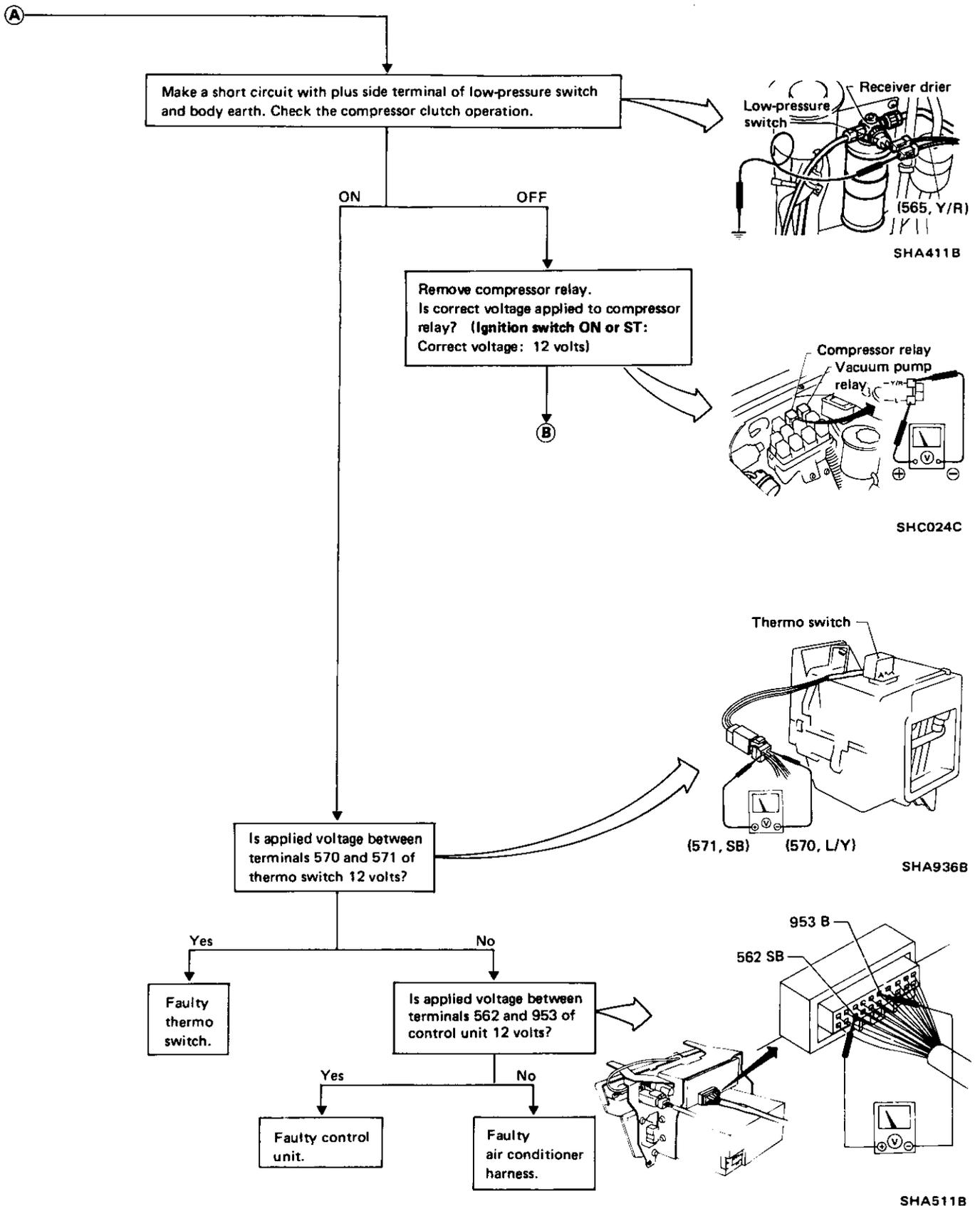
Trouble Diagnoses from Abnormal Conditions (Cont'd)

(Q) COMPRESSOR CLUTCH IS NOT ENGAGED.



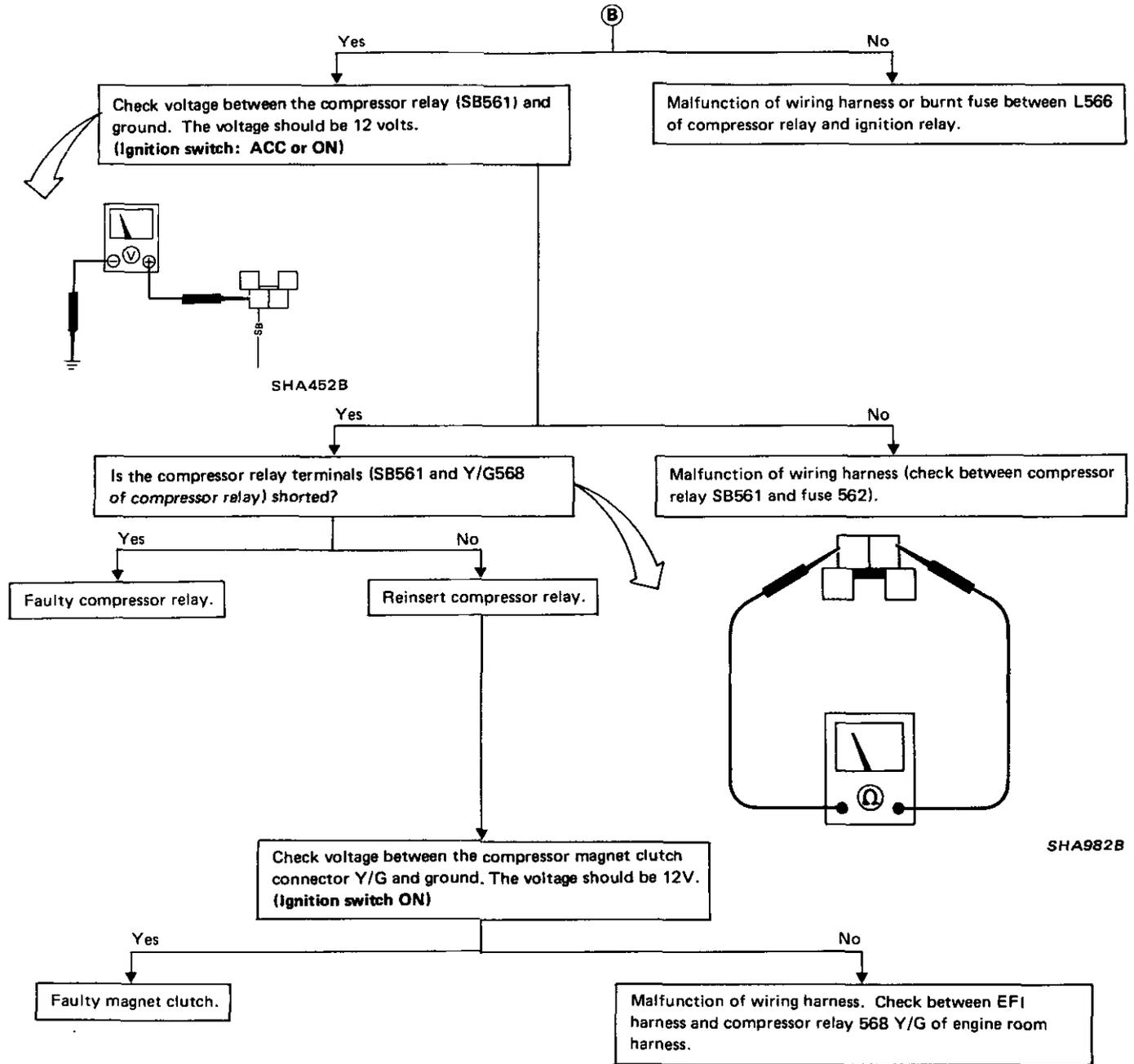
TROUBLE DIAGNOSES (Manual)

Trouble Diagnoses from Abnormal Conditions (Cont'd)



TROUBLE DIAGNOSES (Manual)

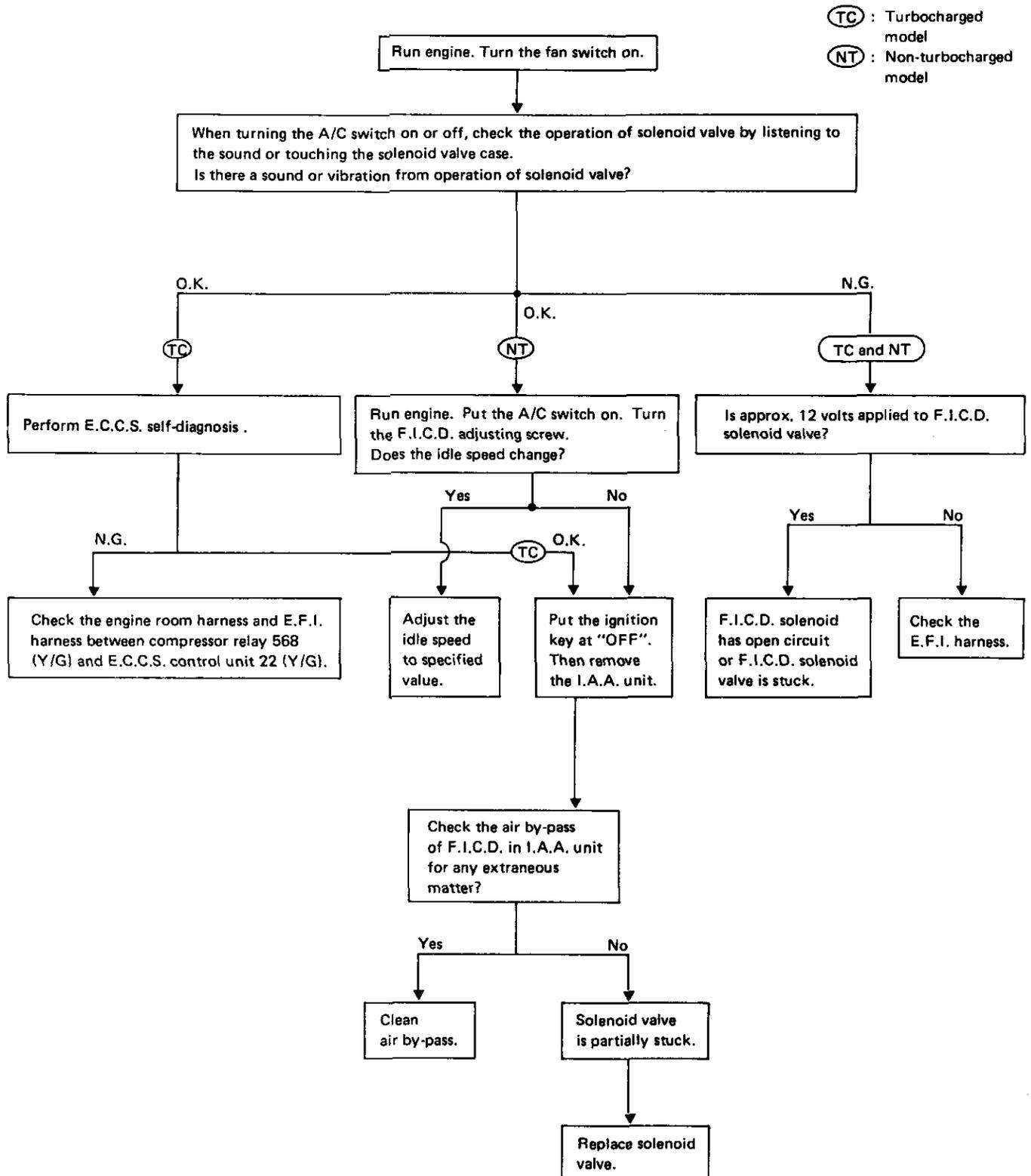
Trouble Diagnoses from Abnormal Conditions (Cont'd)



TROUBLE DIAGNOSES (Manual)

Trouble Diagnoses from Abnormal Conditions (Cont'd)

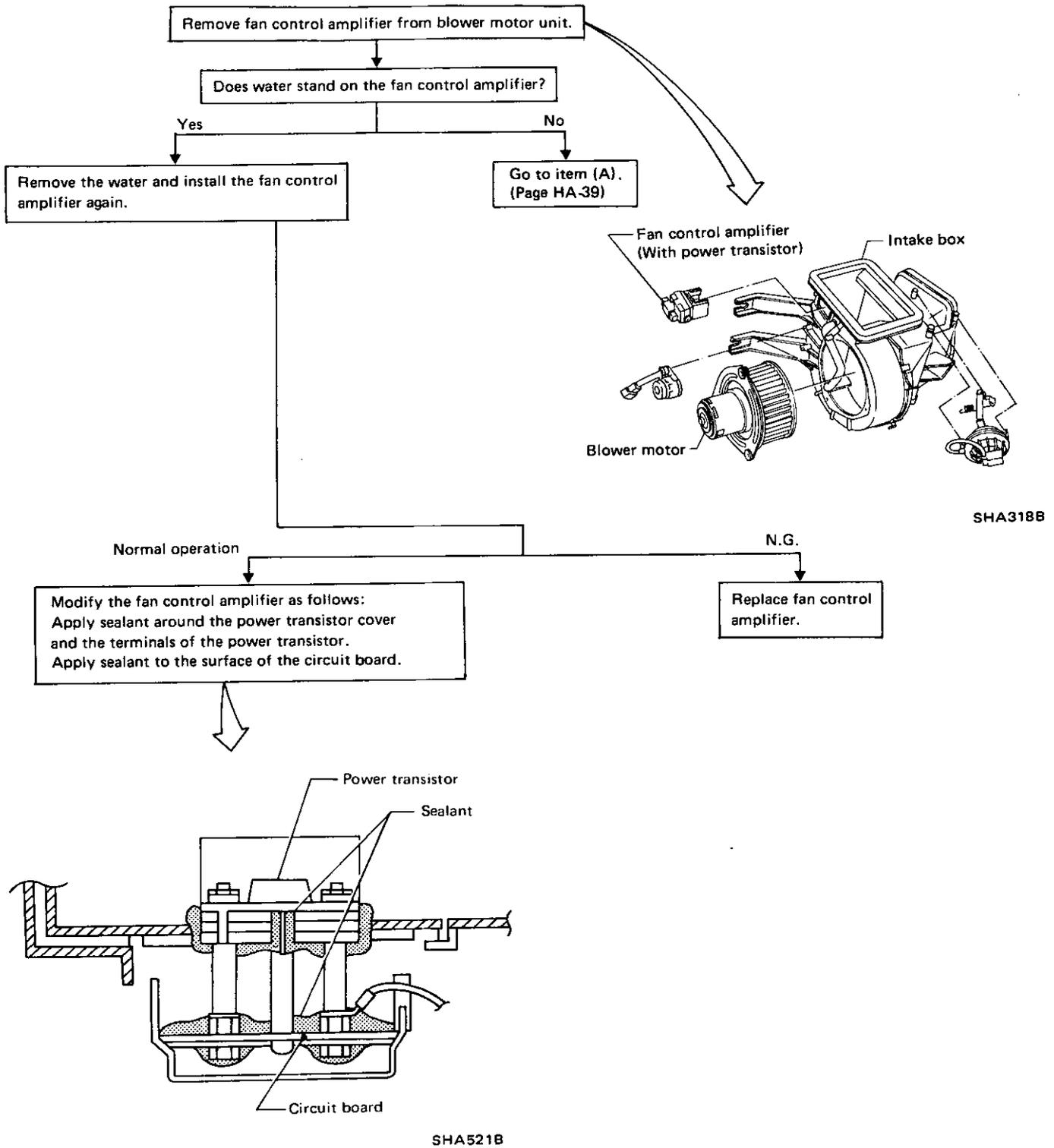
(R) MALFUNCTION OF F.I.C.D.



TROUBLE DIAGNOSES (Manual)

Trouble Diagnoses from Abnormal Conditions (Cont'd)

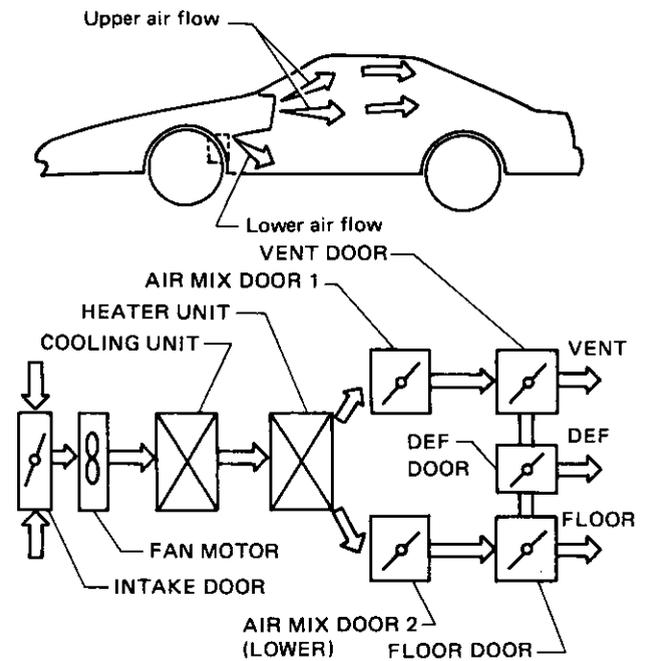
(S) BLOWER MOTOR ROTATES INTERMITTENTLY.



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 weather, the system immediately operates in the defroster mode until the coolant temperature rises, thereby preventing fogging of 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 $\pm 2^{\circ}\text{C}$ ($\pm 3.6^{\circ}\text{F}$).
- 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.



SHA336B

DESCRIPTION — Air Conditioner (Auto)

Refrigeration Cycle

REFRIGERANT FLOW

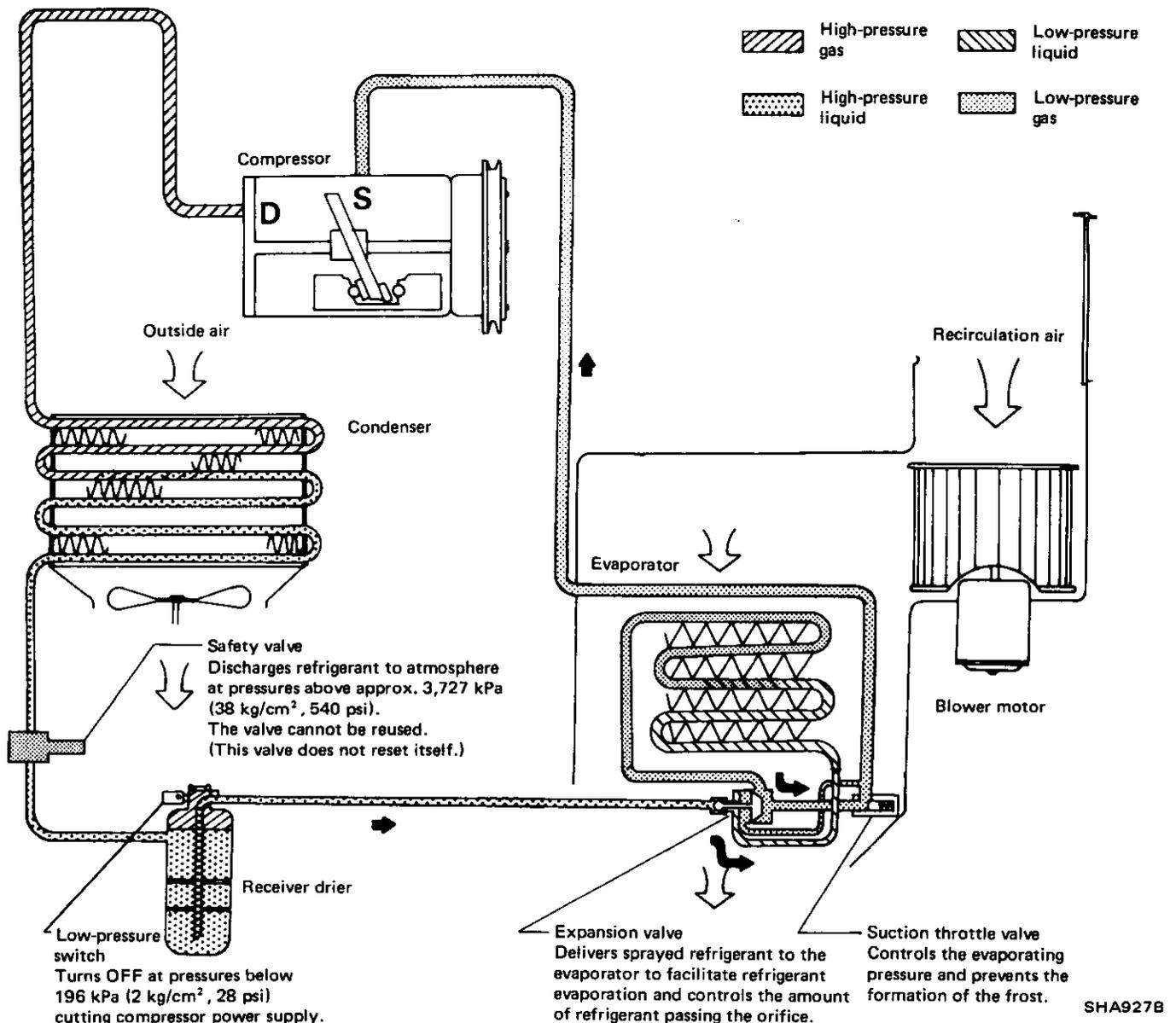
The refrigerant flows in the standard pattern, that is, through the compressor, the condenser, the receiver drier, through the evaporator, and back to the compressor.

The refrigerant evaporation through the evaporator coil is controlled by an externally equalized expansion valve, located inside the evaporator case.

FREEZE PROTECTION — Compressor control

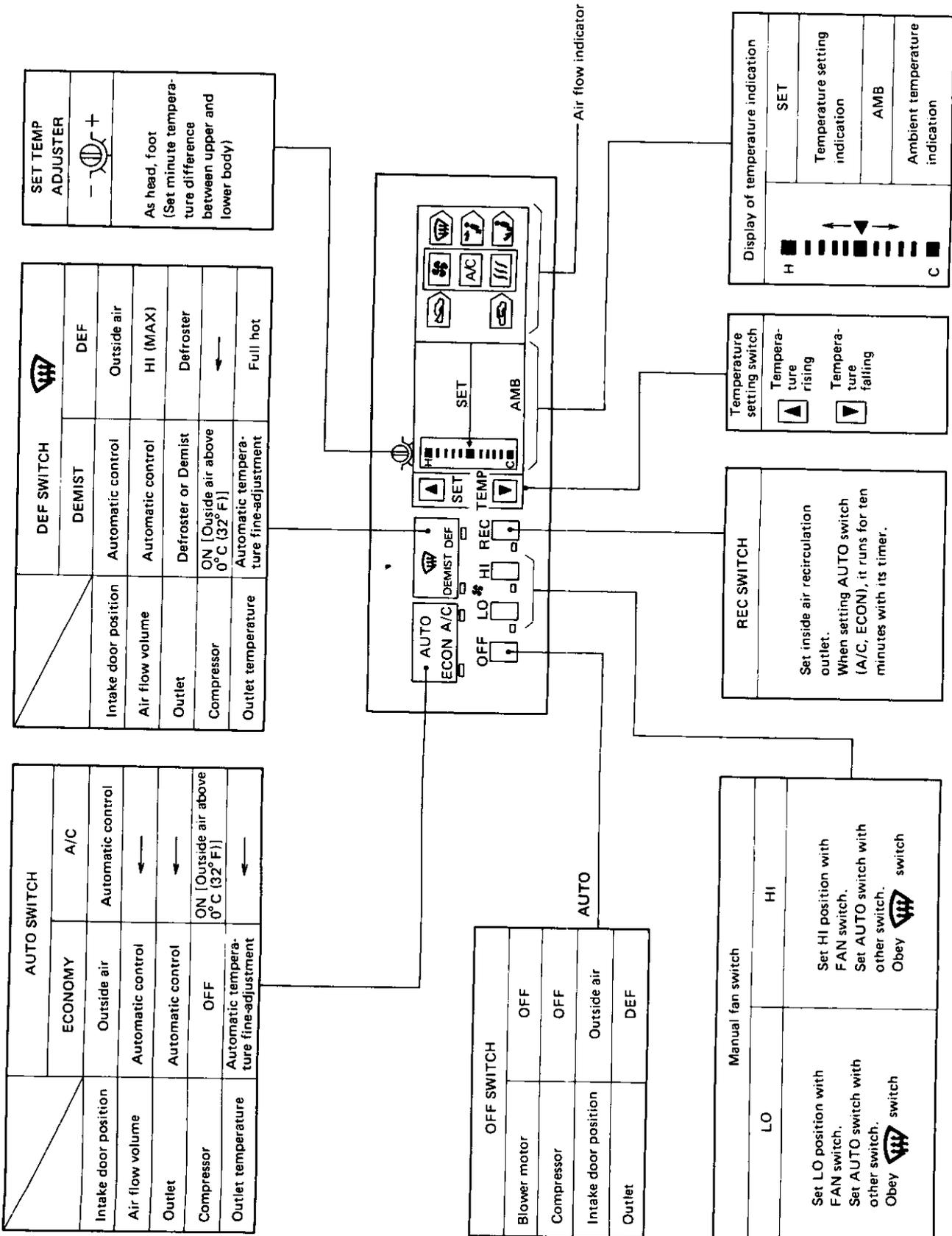
When the A/C is switched on, the compressor runs continuously, and the evaporator pressure is controlled by a suction throttling valve (S.T.V.) to prevent freeze up.

The refrigerant system is protected against excessively high pressure by a pressure relief valve located between the receiver drier and the condenser. Protection against excessively low pressure (interruption of compressor operation) is provided by a low pressure switch, located on the receiver drier.



DESCRIPTION — Air Conditioner (Auto)

Function of the Switches on Control Unit



SHA983B

DESCRIPTION — Air Conditioner (Auto)

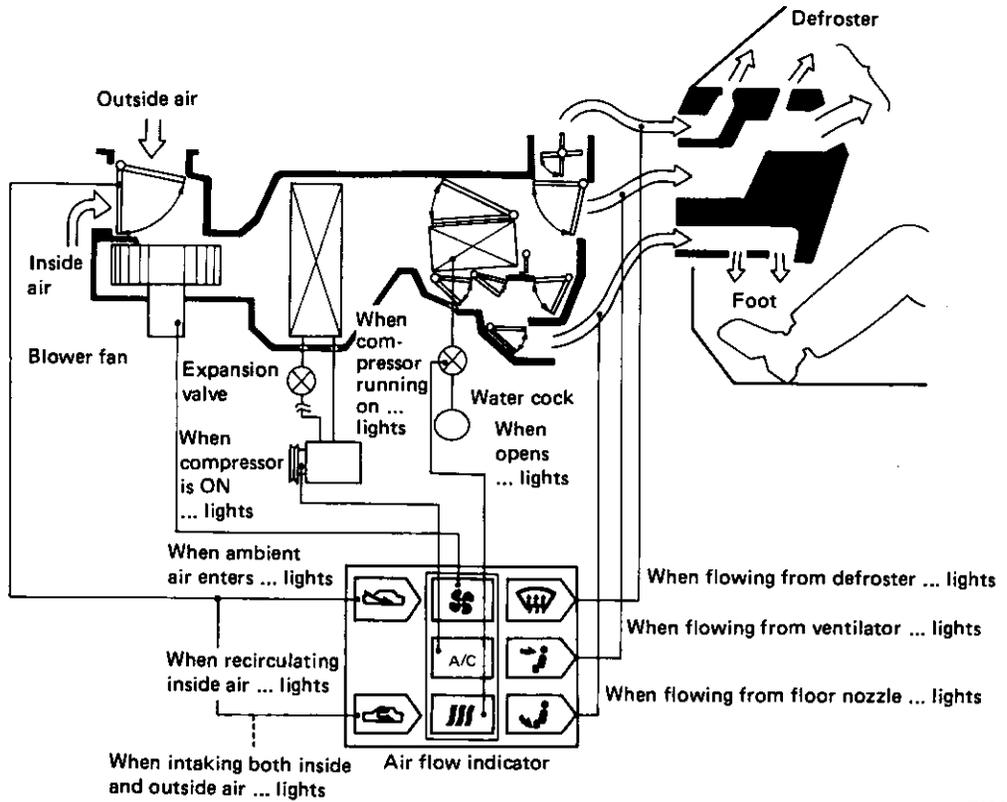
Basic Control Function and Control Switches

(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	Auto		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 "  " 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 "  " switches. When manual switch is pushed again, control function is cancelled.
REC		—	—	—	—	Inside air recirculation	—		REC function is activated by AUTO switch (A/C position) and OFF. REC switch is provided with timer which cancels REC function 10 minutes after it has turned on.
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.

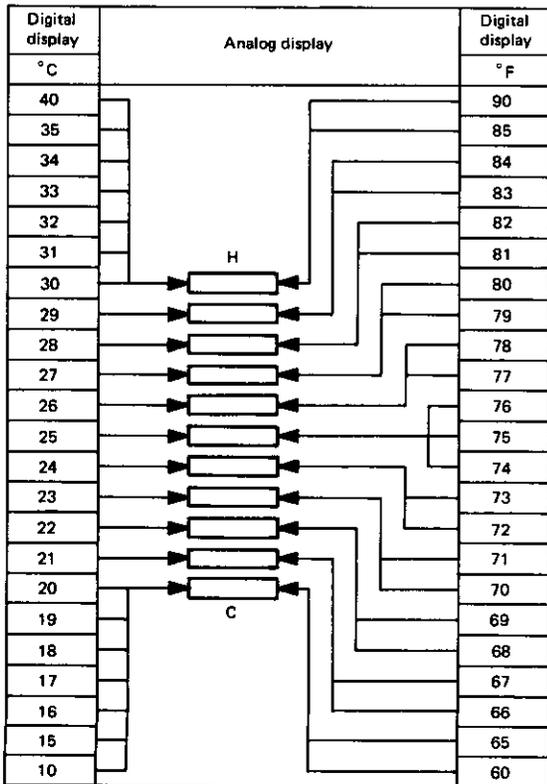
DESCRIPTION — Air Conditioner (Auto)

Display of the Air Flow Indicator



SHA797B

Display of Temperature Setting

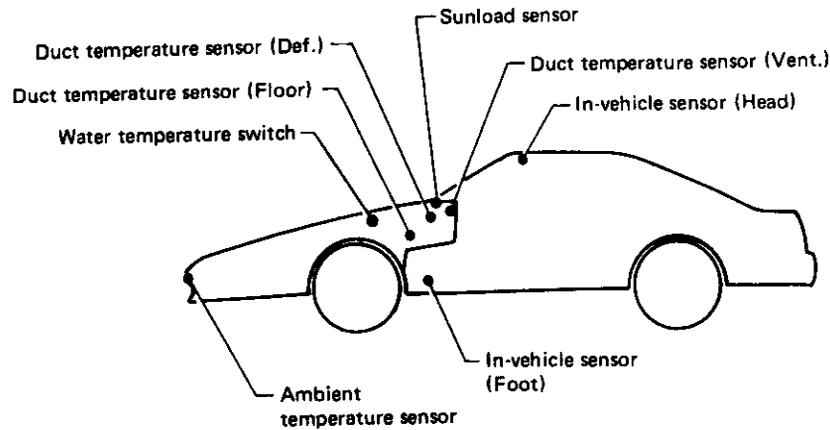


SHA523B

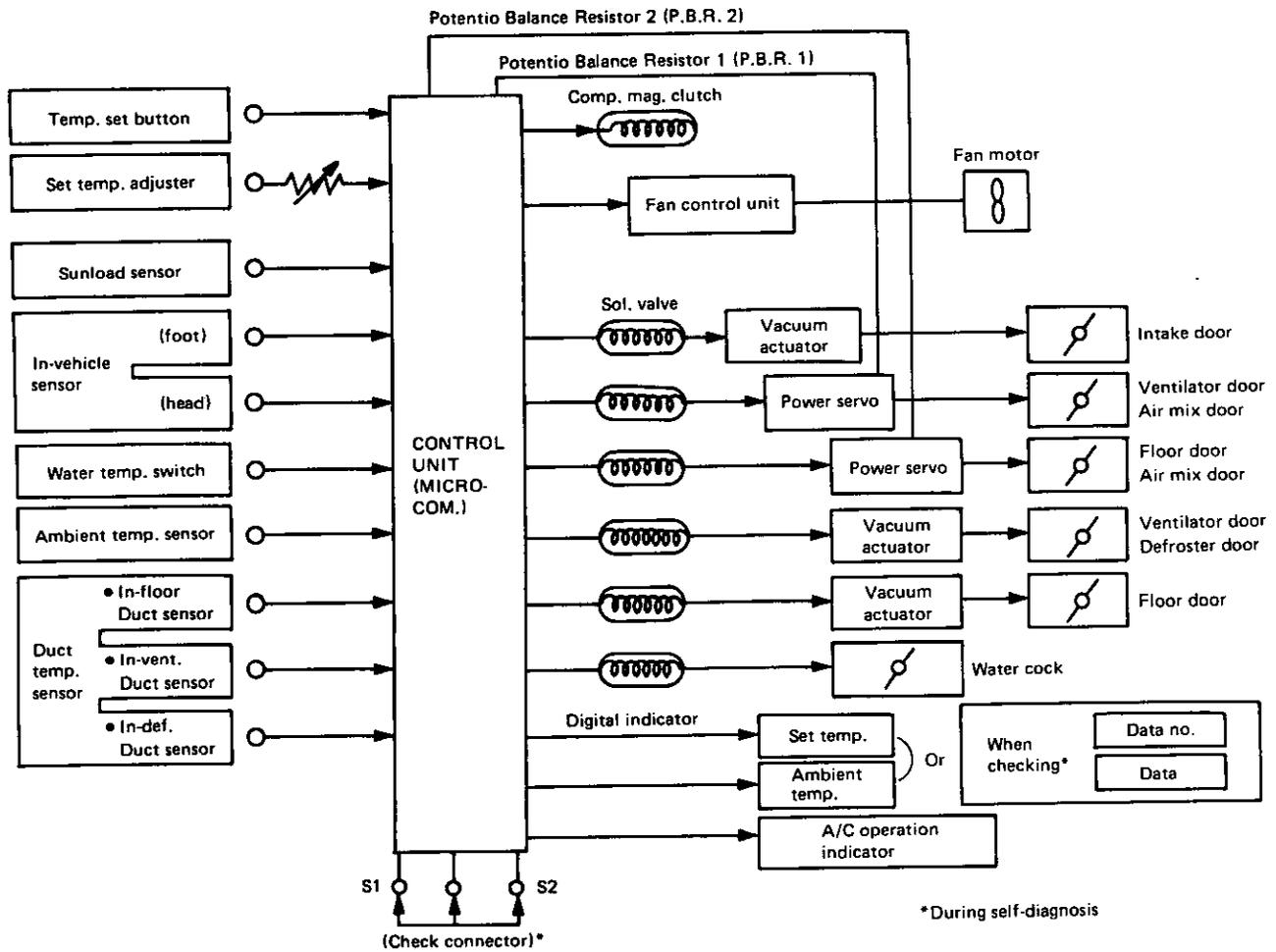
DESCRIPTION — Air Conditioner (Auto)

Control System

SENSOR & SWITCH LOCATION



SHA925B



SHA799B

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.

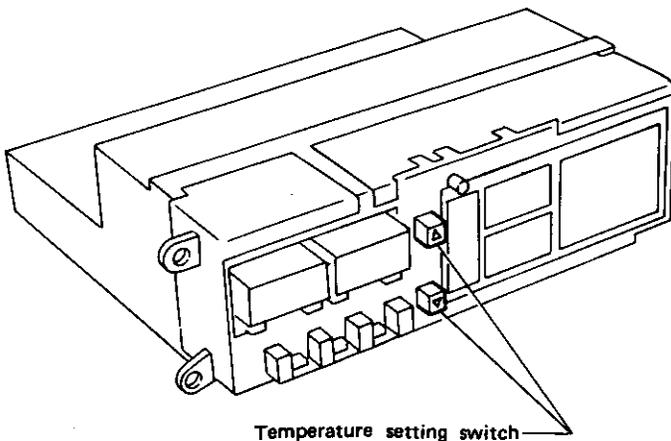
- 1) Automatic amplifier (with microcomputer)
- 2) Temperature setting switch
- 3) Two in vehicle sensors (head/foot)
- 4) Ambient temperature sensor
- 5) Three duct temperature sensors (defroster duct, ventilator duct, floor duct)
- 6) Sunload sensor
- 7) Power servo 1 and Power servo 2
- 8) PBR1 and 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 a self-diagnosis mode program.

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

● Temperature setting switch

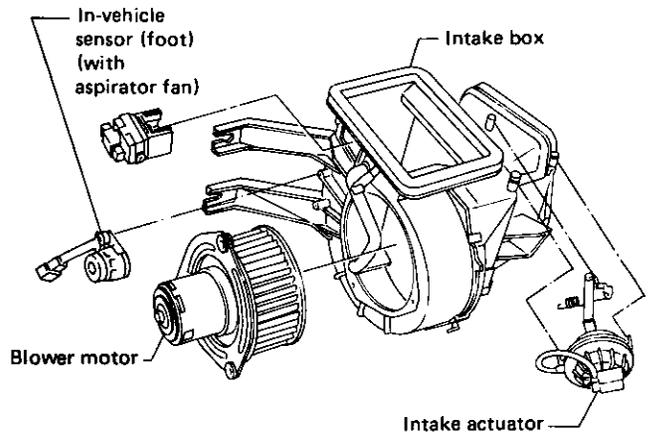


SHA984B

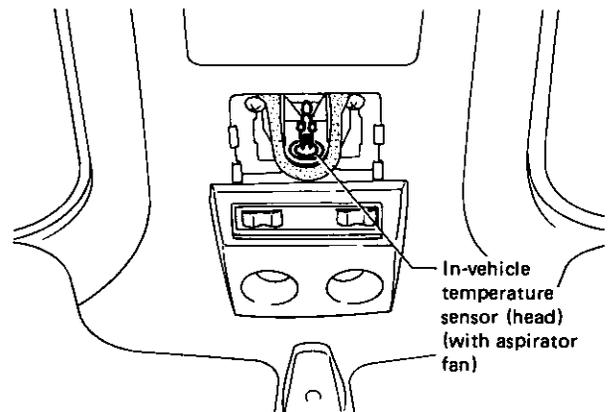
This switch is used for setting the in-vehicle temperature. Temperature set by the temperature setting switch is electrically memorized by the microcomputer in the automatic amplifier.

● 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 a 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.



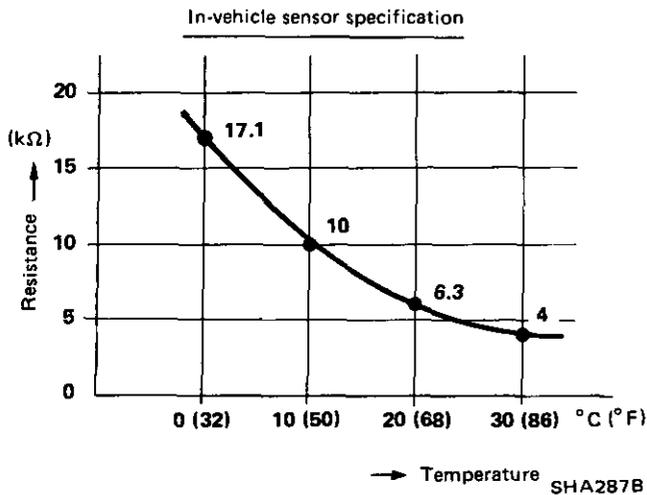
SHA318B



SHA609B

DESCRIPTION — Air Conditioner (Auto)

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 the automatic amplifier.

(The specification of this sensor is the same as for the in-vehicle sensor.)

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

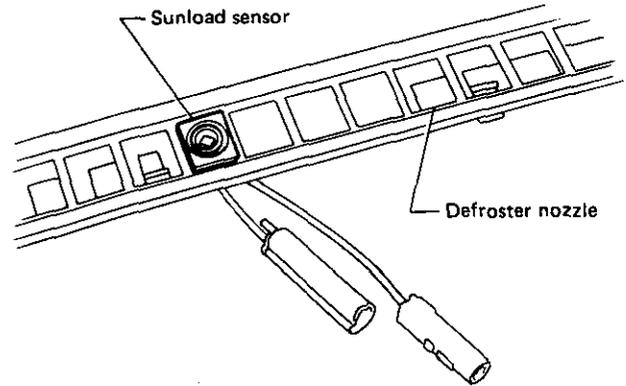
Each sensor transforms the value of outlet air temperature from each duct into a resistance value, which is put into automatic amplifier.

(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)**

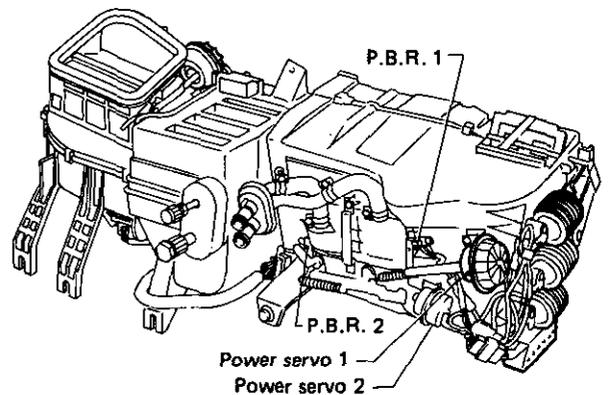
This sensor transforms sunload into current value, which is put into the automatic amplifier. This sensor is located in the defroster grille.



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 the 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.

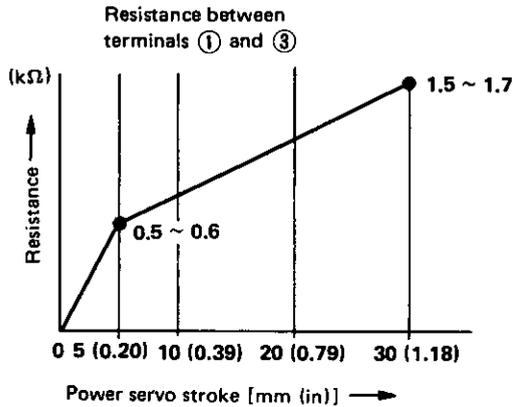


SHA319B

DESCRIPTION — Air Conditioner (Auto)

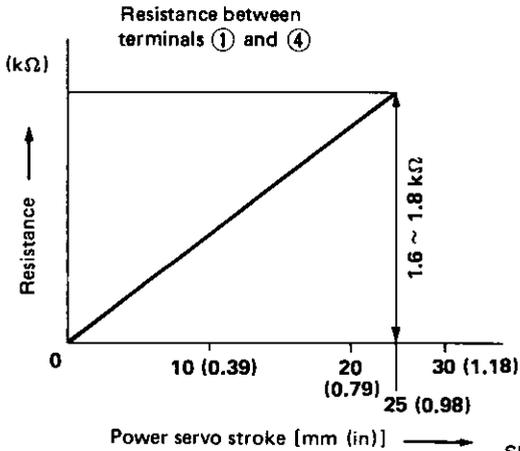
System Operation (Air mix door control) (Cont'd)

P.B.R. 1

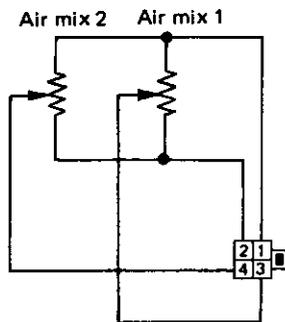


SHA610B

P.B.R. 2

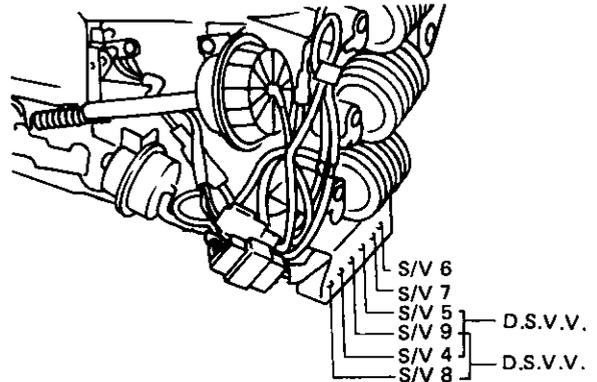


SHA301B



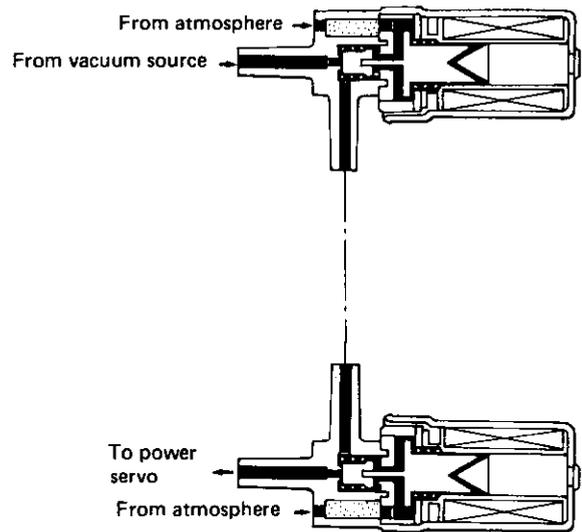
SHA611B

- **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.



SHA985B

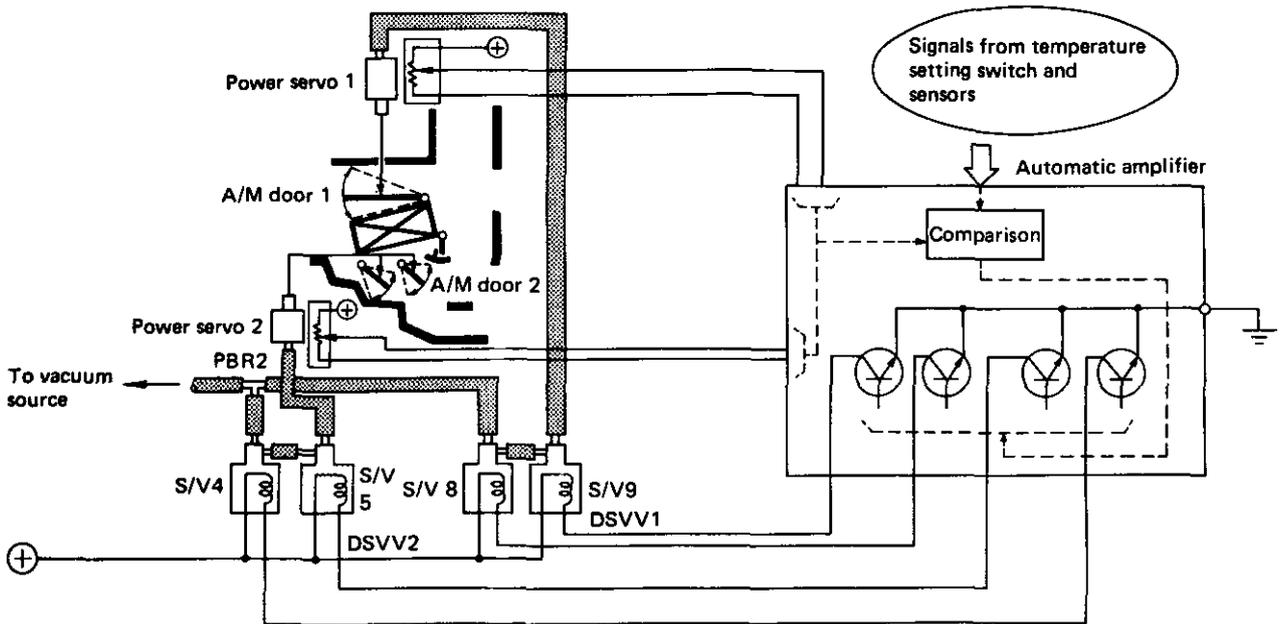
Inner structure of D.S.V.V.



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

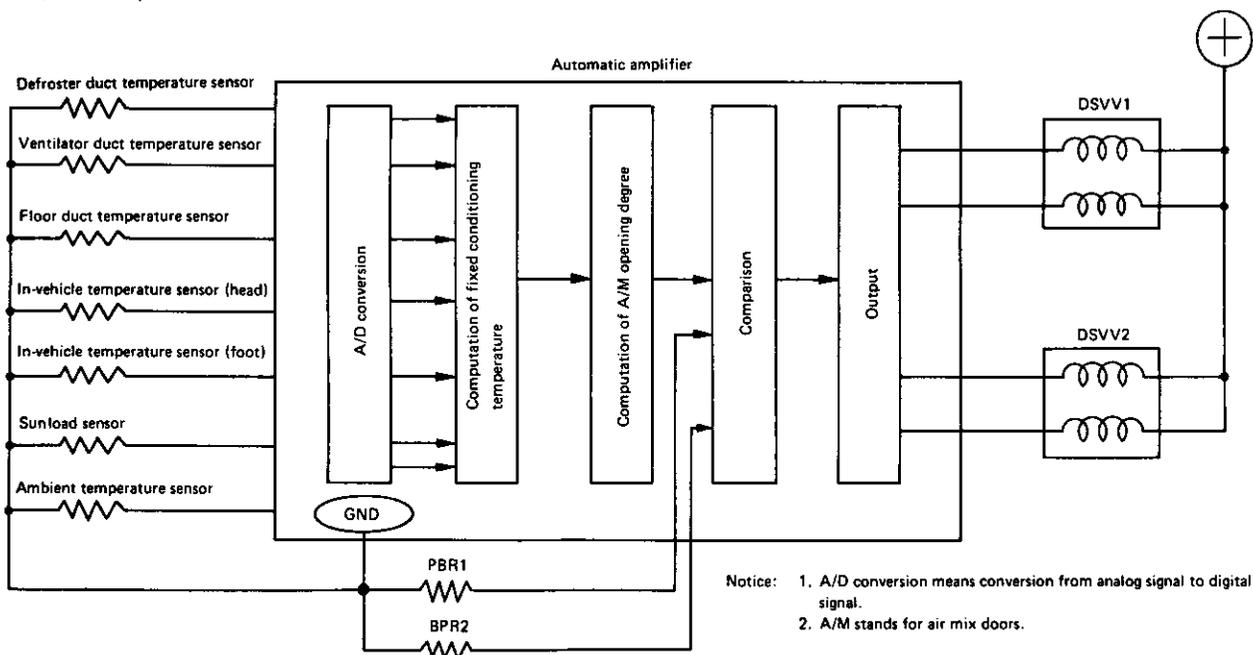
AIR MIX DOOR CONTROL

			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	Operation of solenoid valve	S/V4	CL	CL	OP
		S/V5	OP	CL	OP

DESCRIPTION — Air Conditioner (Auto)

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

2. System operation of air mix door control



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.

DESCRIPTION — Air Conditioner (Auto)

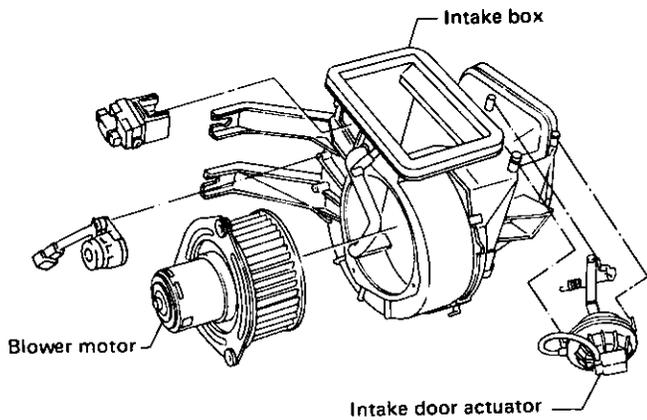
System Operation (Intake door control)

INTAKE DOOR CONTROL

1. Component parts

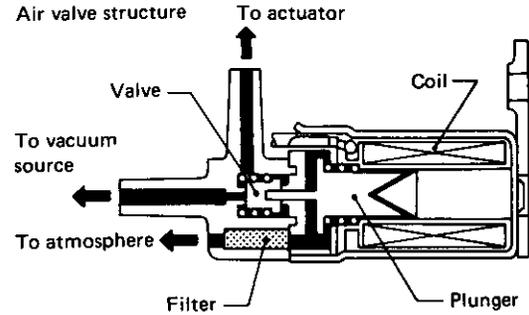
The next parts are added to the component parts of air mix door control system.

- Intake door actuator



SHA318B

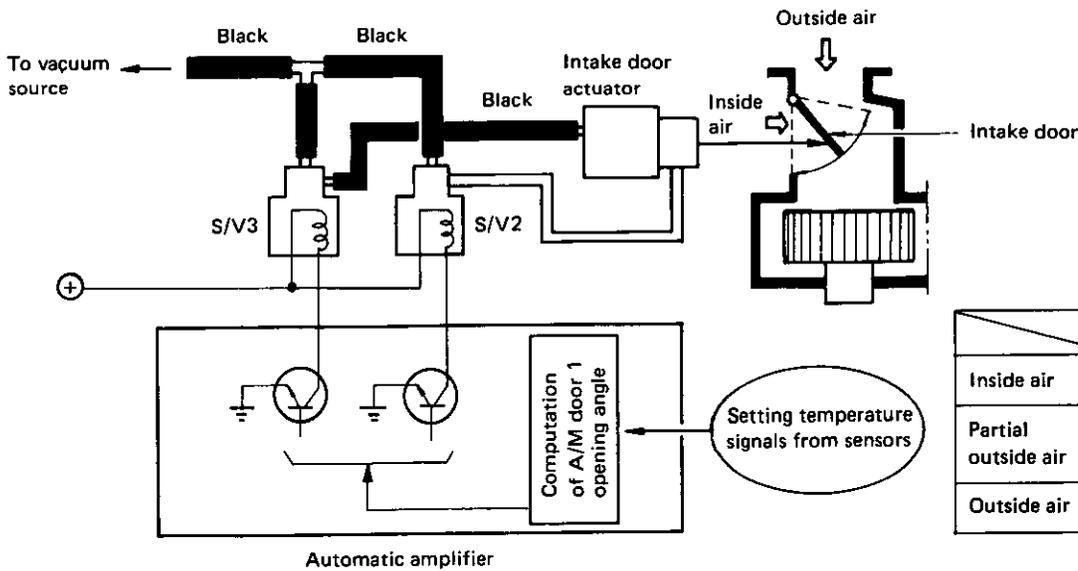
- Solenoid valve (Air valve type)



SW	Vacuum source	Actuator side	Atmosphere side
ON	○	○	
OFF		○	○

SHA302B

2. System operation of intake door control



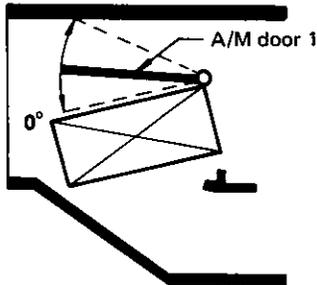
	S/V3	S/V2
Inside air	OPEN	OPEN
Partial outside air	OPEN	CLOSED
Outside air	CLOSED	CLOSED

SHA303B

DESCRIPTION — Air Conditioner (Auto)

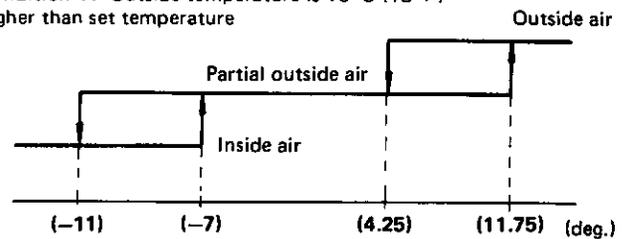
System Operation (Intake door control) (Cont'd)

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.



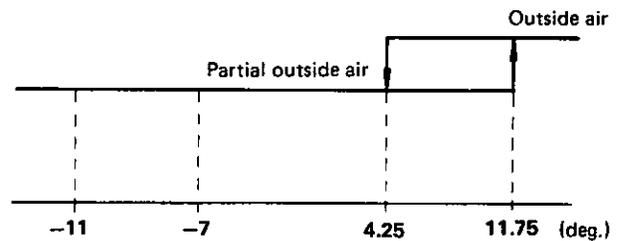
SHA304B

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)

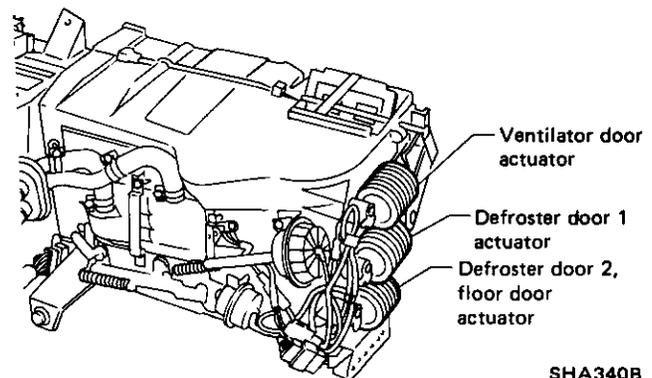
OUTLET DOOR CONTROL

1. Component parts

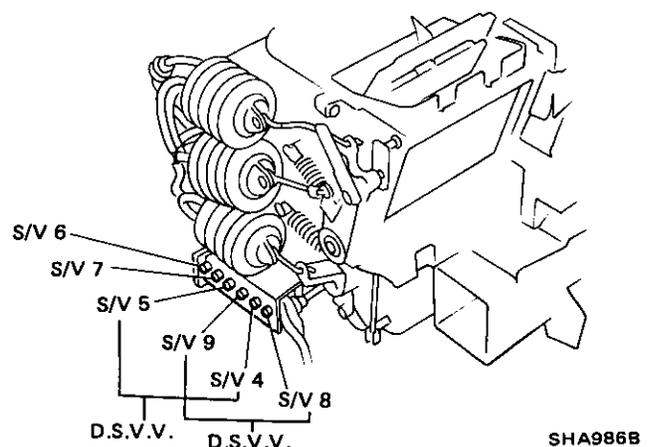
Outlet door control system consists of the parts shown below.

- 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



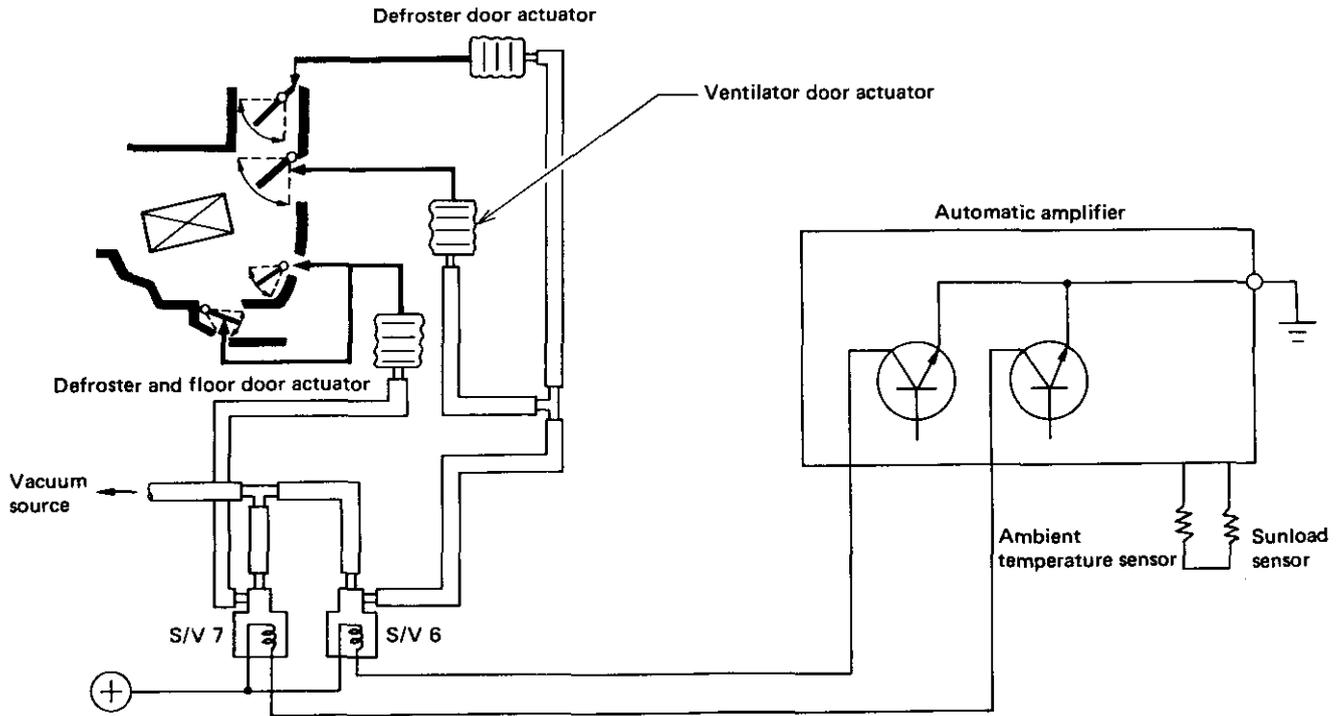
• Solenoid valve 6, 7



DESCRIPTION — Air Conditioner (Auto)

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

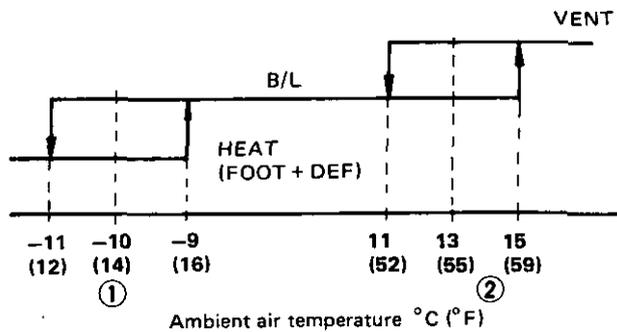
2. System operation of outlet door control



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])

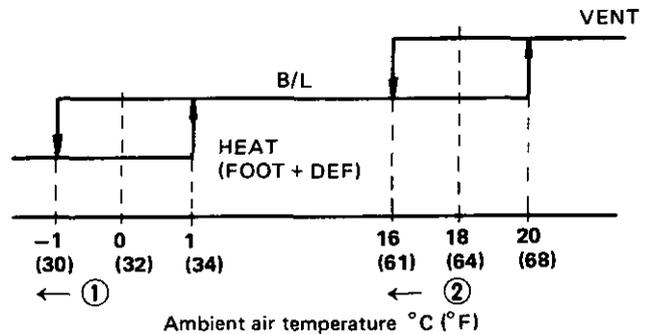


SHA800B

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



SHA801B

DESCRIPTION — Air Conditioner (Auto)

System Operation (Air flow volume control)

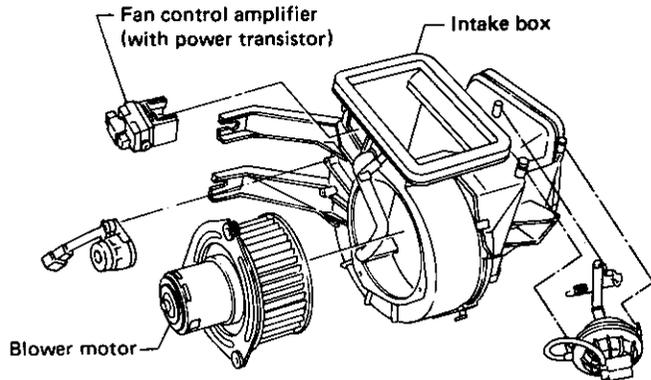
AIR FLOW VOLUME CONTROL

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.

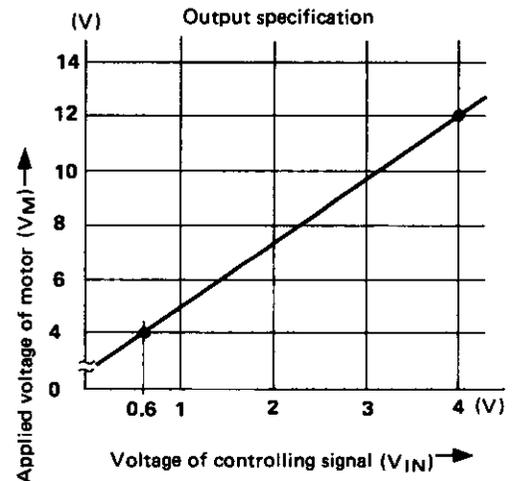
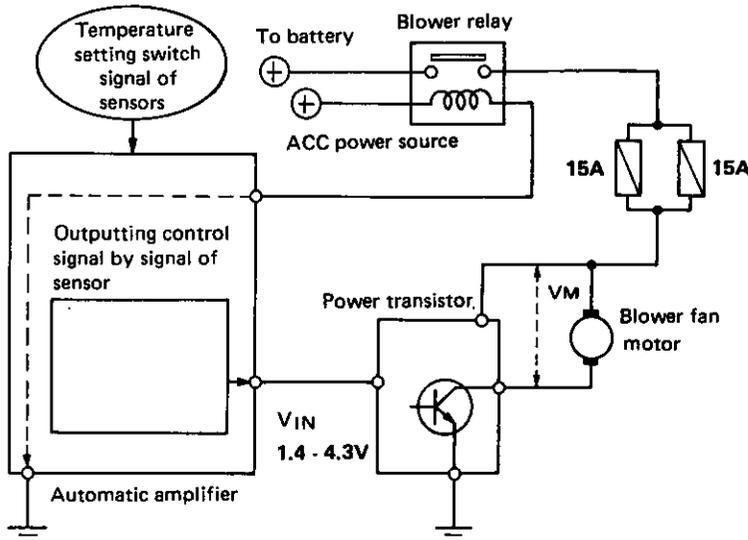


SHA318B

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 5.0V (VENT) or 5.5V (Except for VENT) for LO, and at 12V for HI position.



SHA802B

DESCRIPTION — Air Conditioner (Auto)

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

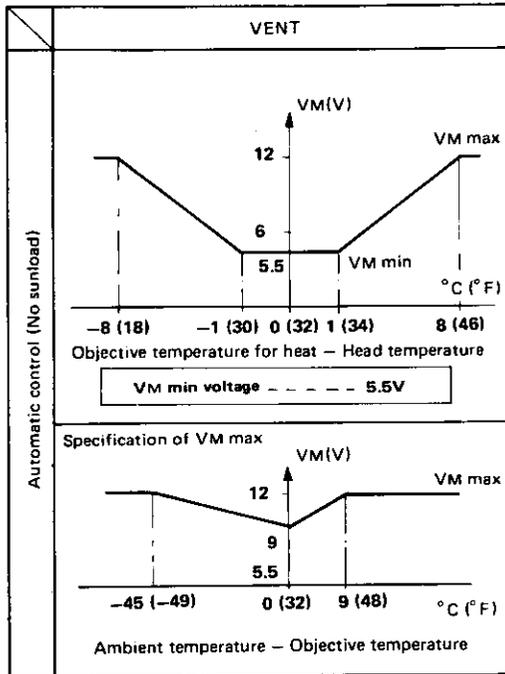
3. Specification of air flow volume control (Automatic control)

- 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.

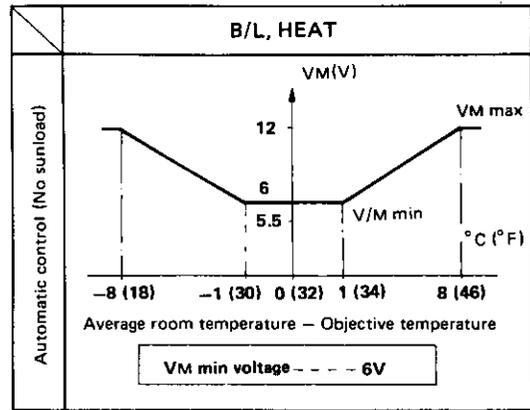


SHA310B

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

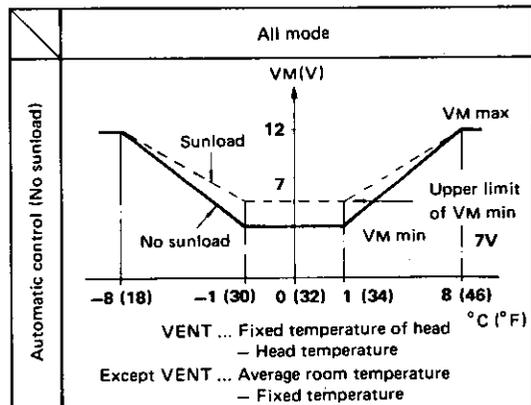
4. Compensation of air flow volume when sunload exists

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

DESCRIPTION — Air Conditioner (Auto)

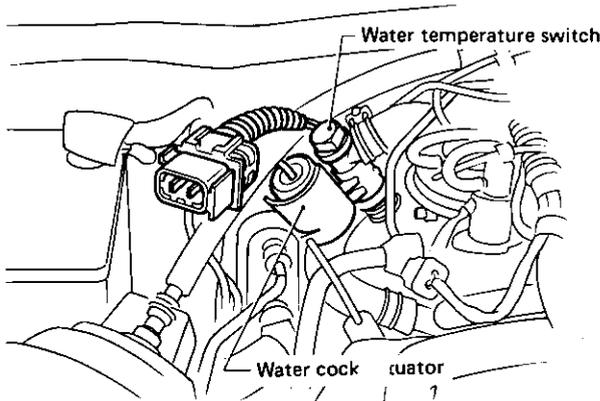
System Operation (Control at starting)

CONTROL AT STARTING

1. Component parts

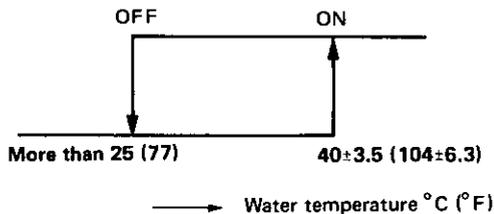
Water temperature switch is added to the component parts of air mix door control system.

- Water temperature switch



SHA312B

Specification

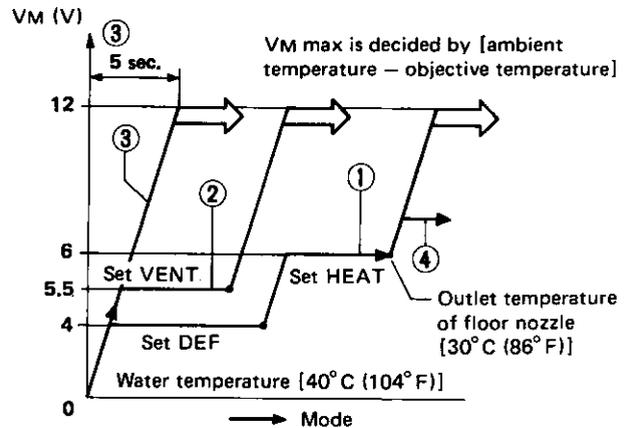


SHA293B

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

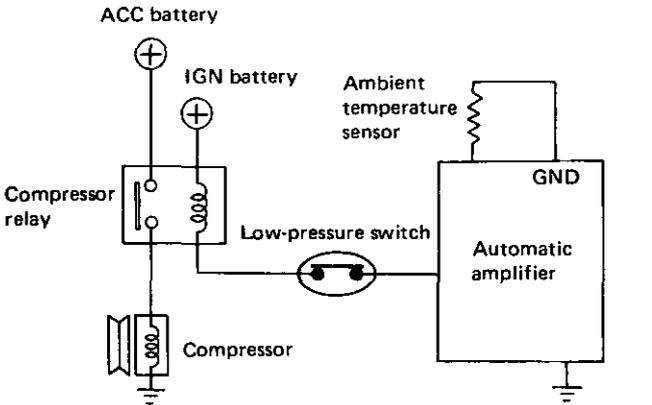
DESCRIPTION — Air Conditioner (Auto)

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

COMPRESSOR CONTROL

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

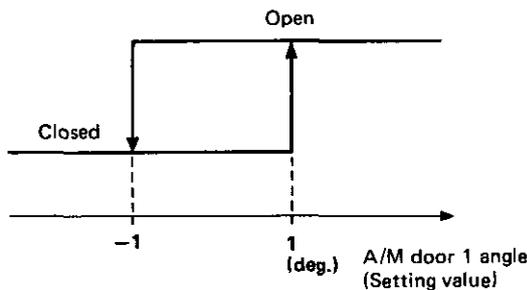
Ambient temperature	Control
More than 0°C (32°F)	ON
Less than 0°C (32°F)	OFF



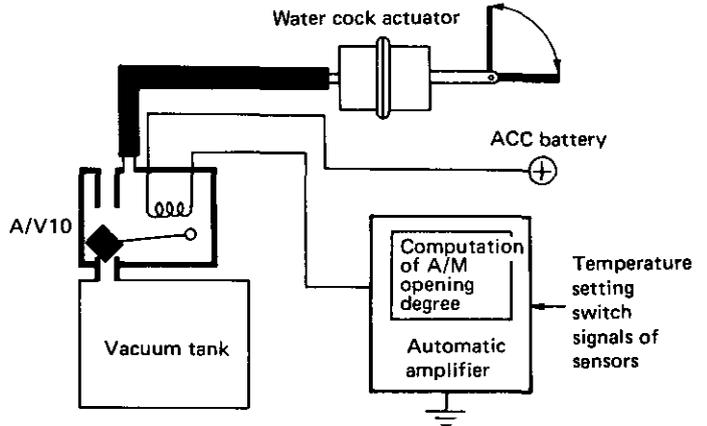
SHA294B

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



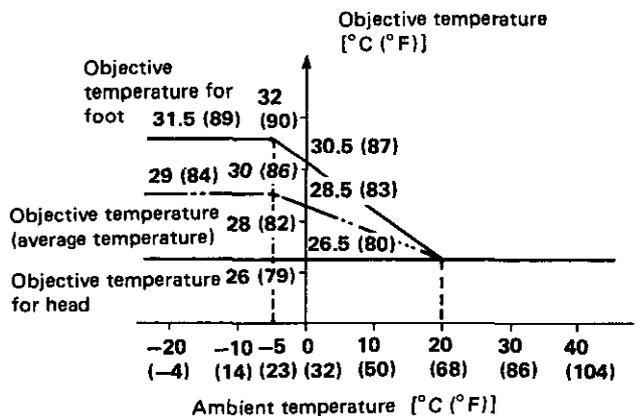
SHA295B

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)]



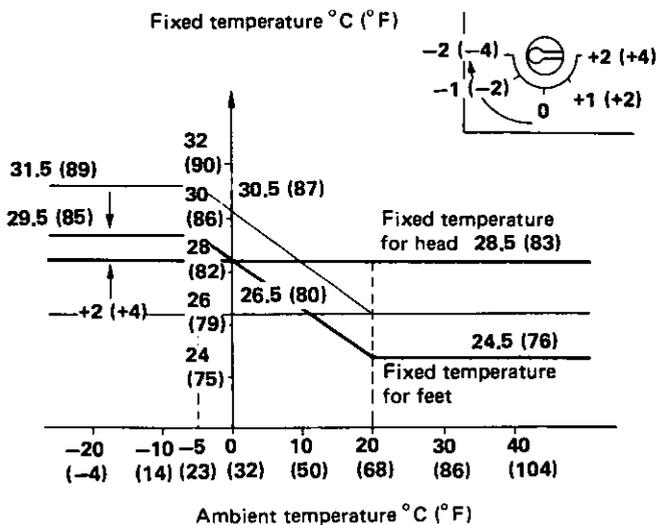
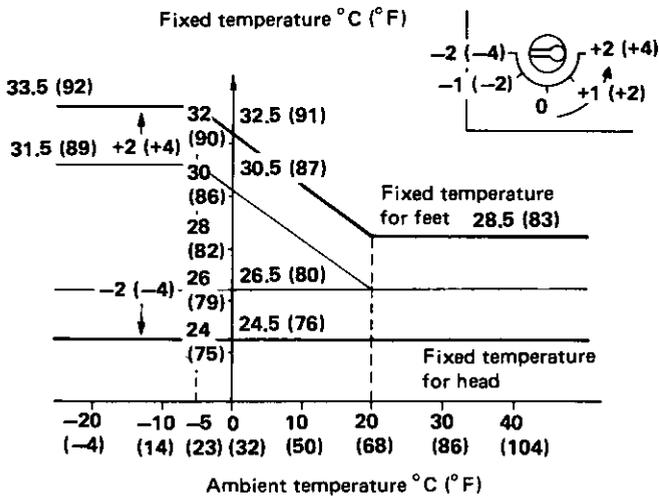
SHA803B

DESCRIPTION — Air Conditioner (Auto)

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.



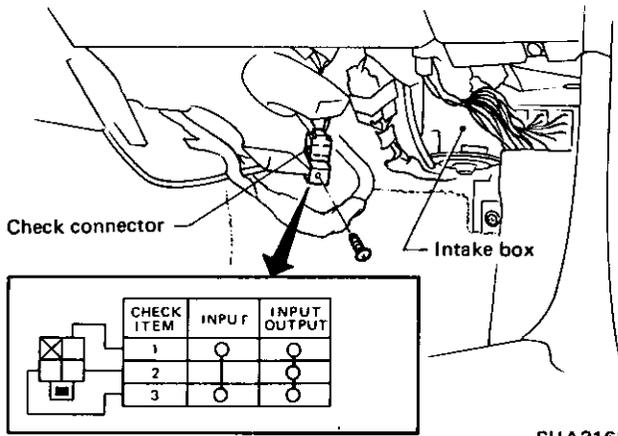
DESCRIPTION — Air Conditioner (Auto)

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

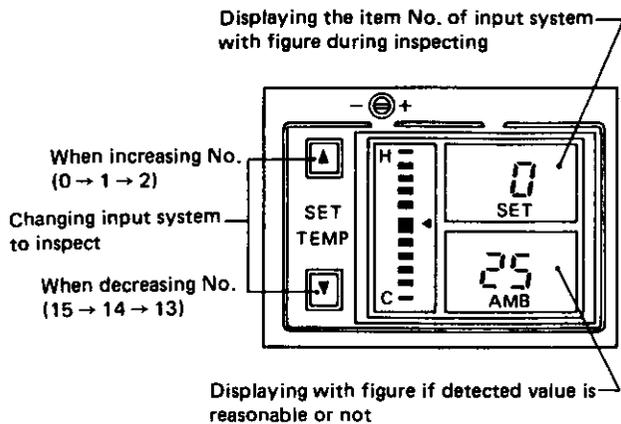
Diagnosing check connector
To change the system to the diagnosis mode, short the check terminal located at the lower portion of the cooling unit.



SHA316B

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.



SHA998B

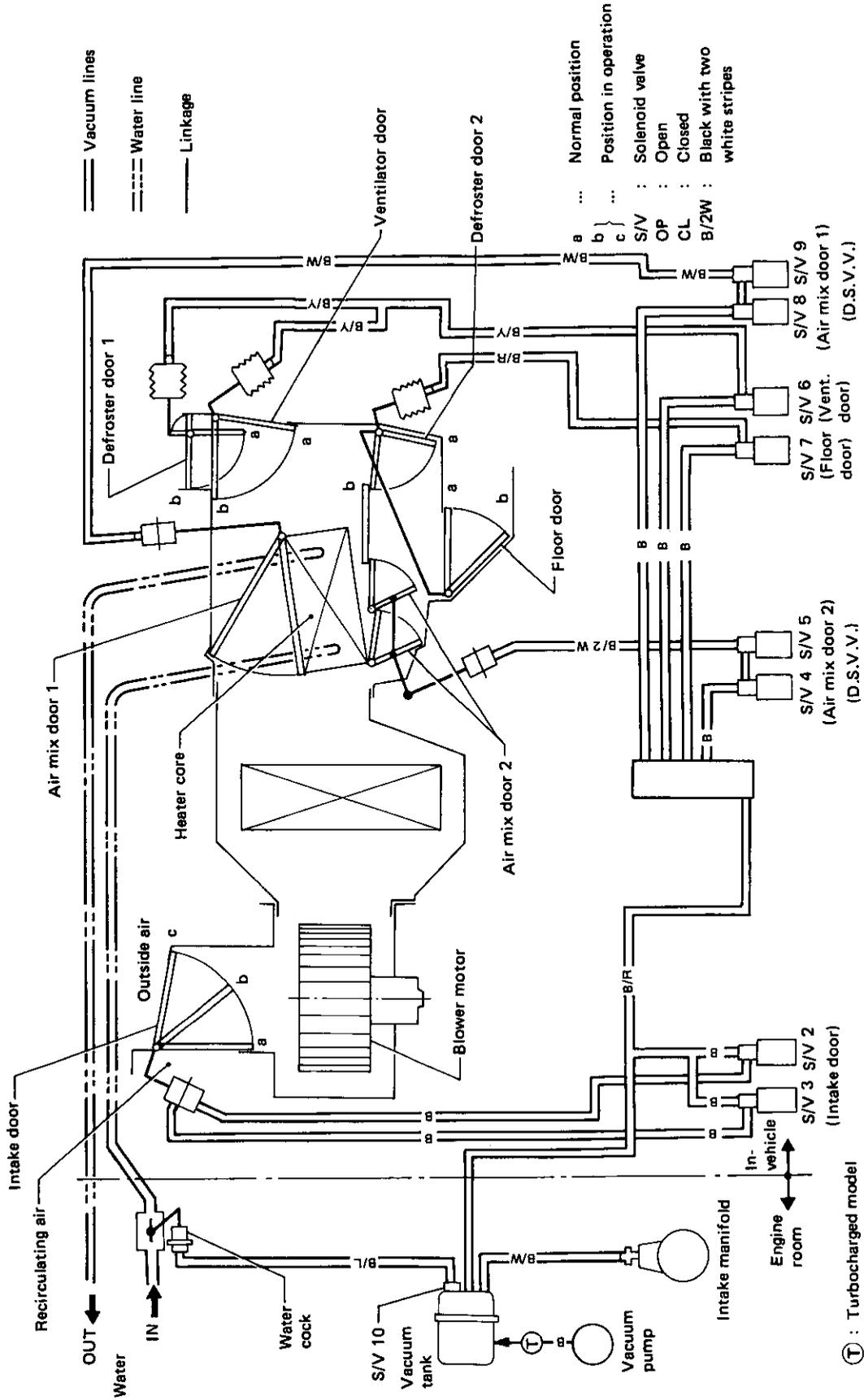
Display No.	Item of input signal	Parts to be checked
0	Temperature of inside air temperature sensor (foot)	In-vehicle sensor (foot)
1	Temperature of in-vehicle sensor (head)	In-vehicle sensor (head)
2	Temperature of floor outlet	Floor duct temperature sensor
3	Temperature of ventilator outlet	Ventilator 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



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

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

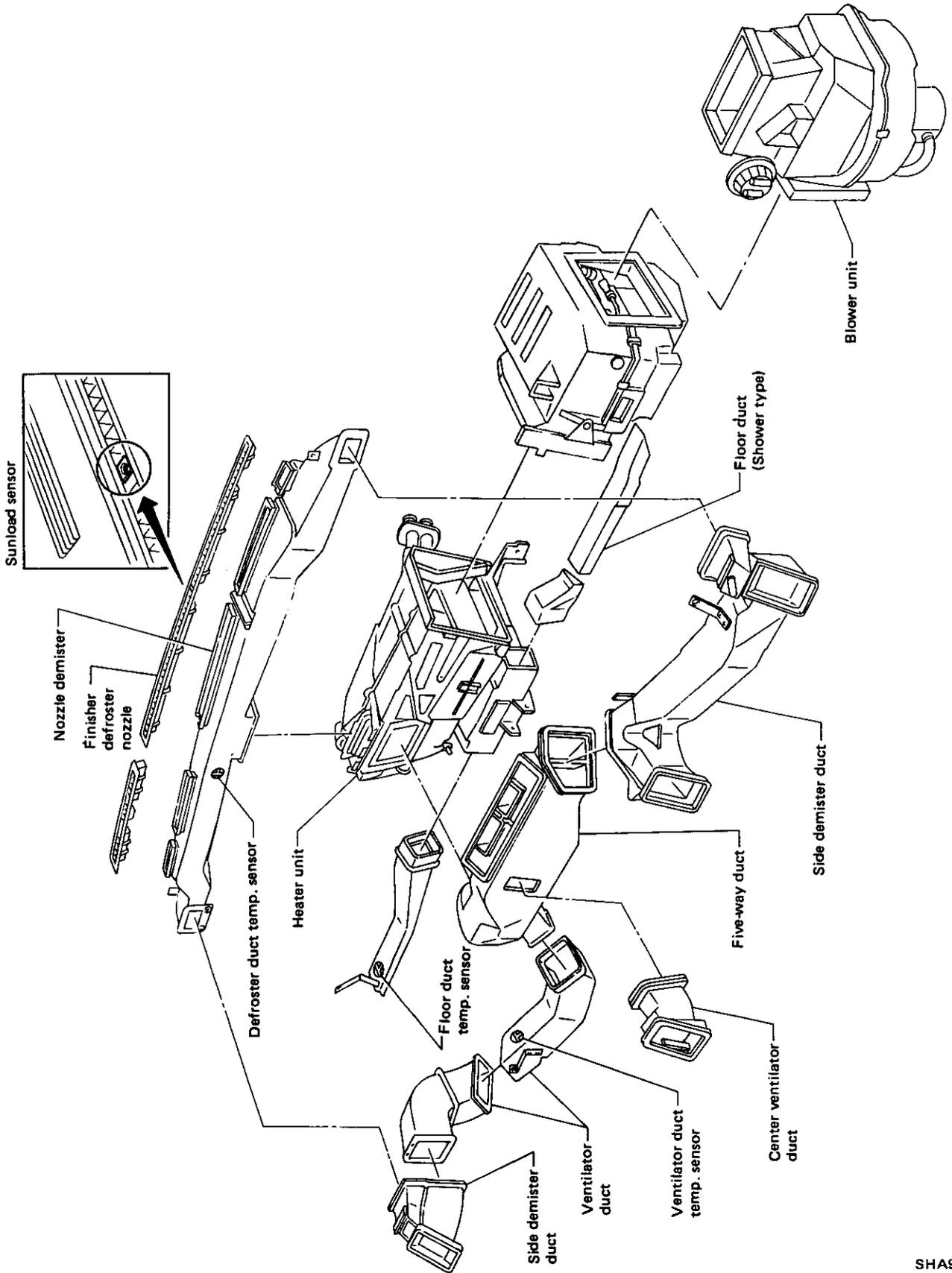
WATER COCK CONTROL		OPEN	CLOSED
OPERATION OF SOLENOID VALVE	S/V10	CL	OP

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

Ⓣ : Turbocharged model

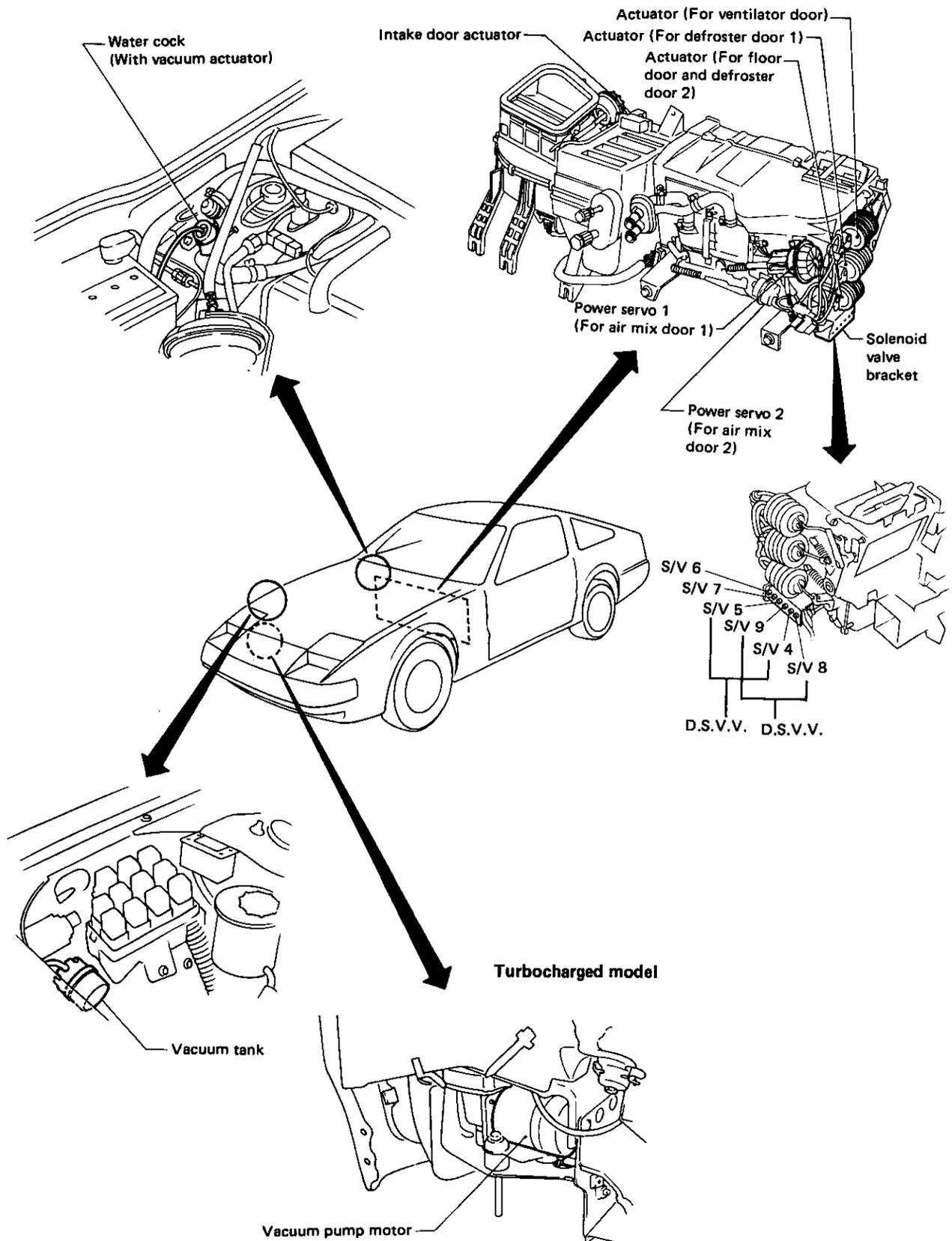
AIR FLOW AND COMPONENT LAYOUT (Auto)

Component Layout



SHA988B

LOCATION OF VACUUM COMPONENTS (Auto)



SHA989B

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

*Connect 895 (L/B) and 866 (BR/W) terminals of check connector with jumper wire.

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)/PIPING (Auto)

Performance Chart

Ambient air temperature to compressor pressure table

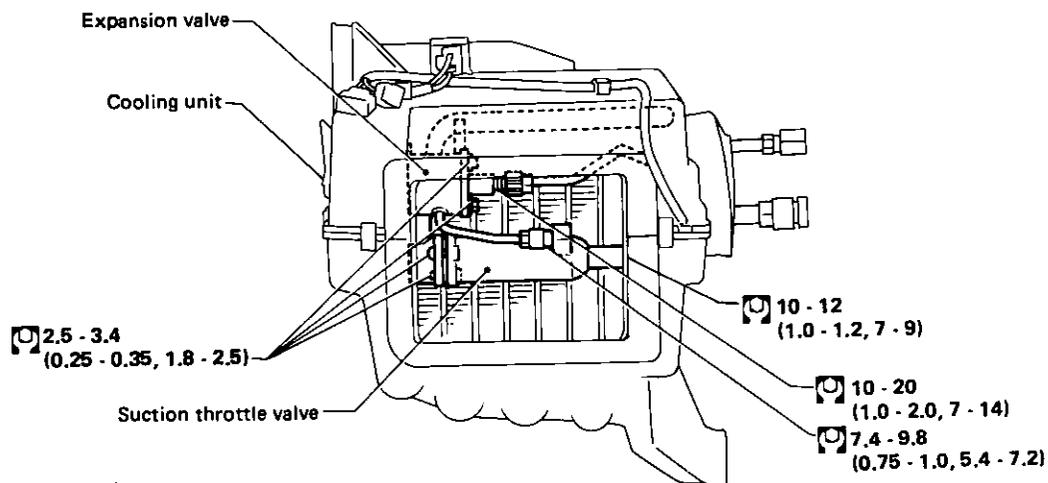
Ambient air		Low pressure (Suction side) kPa (kg/cm ² , psi)	High pressure (Discharge side) kPa (kg/cm ² , psi)
Relative humidity %	Air temperature °C (°F)		
50 - 70	20 (68)	59 - 98 (0.6 - 1.0, 9 - 14)	755 - 892 (7.7 - 9.1, 109 - 129)
	25 (77)	78 - 127 (0.8 - 1.3, 11 - 18)	883 - 1,030 (9.0 - 10.5, 128 - 149)
	30 (86)	98 - 157 (1.0 - 1.6, 14 - 23)	1,010 - 1,187 (10.3 - 12.1, 146 - 172)
	35 (95)	118 - 186 (1.2 - 1.9, 17 - 27)	1,138 - 1,334 (11.6 - 13.6, 165 - 193)
	40 (104)	137 - 216 (1.4 - 2.2, 20 - 31)	1,295 - 1,510 (13.2 - 15.4, 188 - 219)
70 - 90	20 (68)	98 - 137 (1.0 - 1.4, 14 - 20)	883 - 1,020 (9.0 - 10.4, 128 - 148)
	25 (77)	127 - 177 (1.3 - 1.8, 18 - 26)	1,030 - 1,177 (10.5 - 12.0, 149 - 171)
	30 (86)	157 - 216 (1.6 - 2.2, 23 - 31)	1,187 - 1,344 (12.1 - 13.7, 172 - 195)
	35 (95)	186 - 255 (1.9 - 2.6, 27 - 37)	1,334 - 1,530 (13.6 - 15.6, 193 - 222)
	40 (104)	216 - 304 (2.2 - 3.1, 31 - 44)	1,510 - 1,736 (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.

Refrigerant Lines—Cooling Unit

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

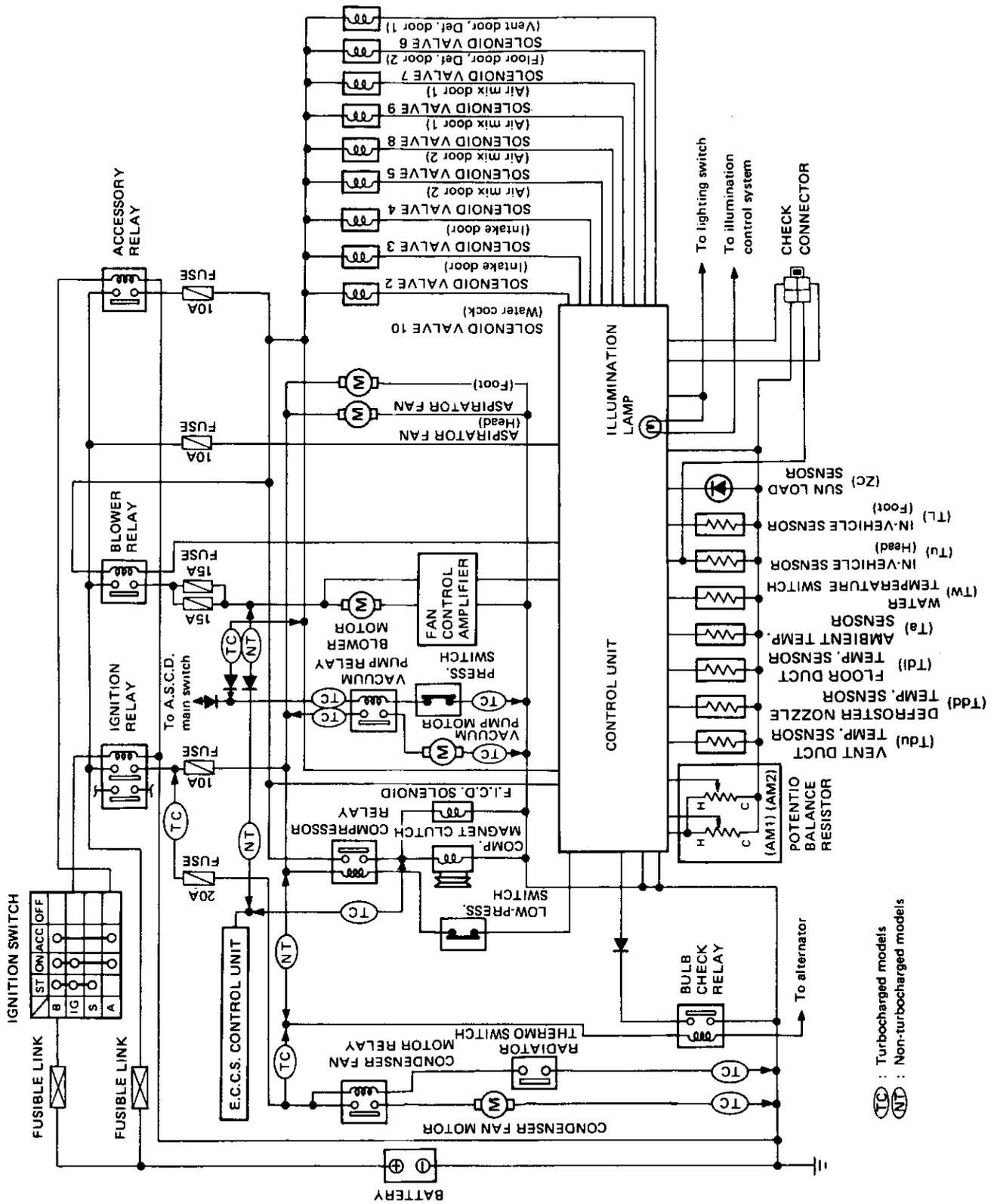


: N-m (kg-m, ft-lb)

SHA807B

A/C ELECTRICAL CIRCUIT (Auto)

Schematic



SHA9938

A/C ELECTRICAL CIRCUIT (Auto)

Notes:

A/C ELECTRICAL COMPONENTS (Auto)

Inspection

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

- For aspirator fan, check the air flow when applying 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)].

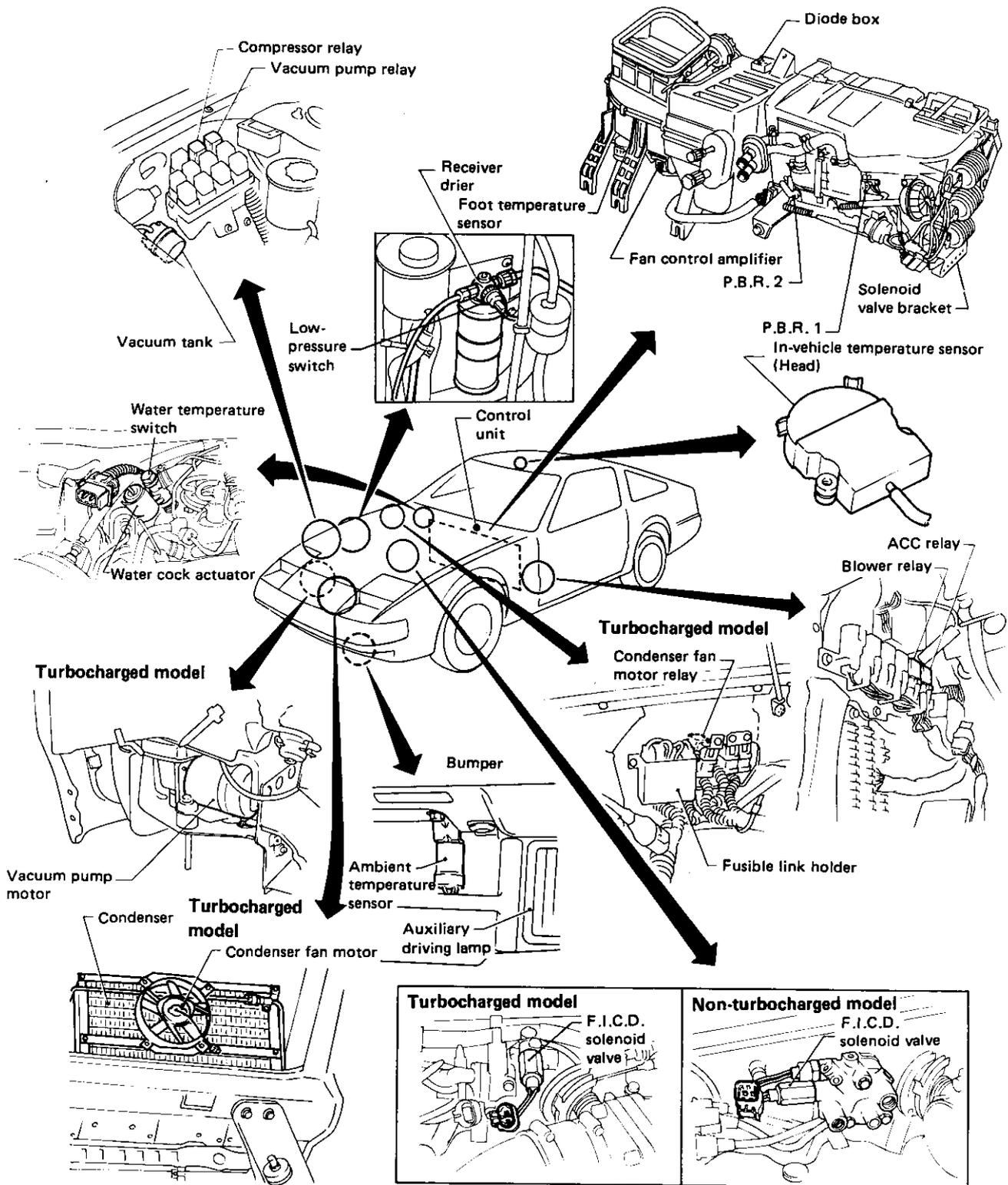
NOTICE

- 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)



SHA996B

LOCATION OF A/C ELECTRICAL COMPONENTS (Auto)

Diagnostic Procedure

Listen carefully to the customer's complaint to correctly understand the problem. Then start the engine, sit in the seat, and operate the control panel to check system operation on the following items (A) to (D). In this case, check whether the air outlet grille is oriented correctly; if necessary, correct its orientation before starting inspection.

A.T.C. normal operating condition	Trouble diagnosis
<p>(A) Ignition key ON</p> <p>(a) SET and AMB temperatures are indicated on digital meters. (Air flow indicator is not lighted.)</p> <p>(b) With blower OFF, automatic temperature control operates in ram pressure temperature control mode.</p>	<p>(1) Check if the power supply is connected to the control amplifier.</p> <p>(2) Check if the body ground terminal of the control amplifier is connected to ground.</p> <p>If items (1) and (2) above are all normal but item (a) at left is not normal, the control unit is faulty.</p> <p>When the ram pressure temperature control or mode control is faulty with A/C switch OFF, use the self-diagnosis program.</p>
<p>(B) Mode SW (AUTO, DEF) ON</p> <p>(a) The outlet mode is determined according to the ambient air temperature and sunload.</p> <ul style="list-style-type: none"> • If the engine cooling water temperature is low when starting the engine, the system is set temporarily in the start control mode. <p>Example</p> <ul style="list-style-type: none"> ○ Low Tu and Low Tw → Start in DEF mode ○ High Tu, Low T_L and Low Tw → Start in VENT mode <p>Tu Head level temperature T_L Foot level temperature Tw Engine cooling water temperature</p> <p>(b) If ambient air temperature is above 0°C (32°F) in A/C mode, COMP is ON.</p> <p>(1) In economy mode, comp is OFF.</p> <p>(2) DEF SW ON</p> <p>(a) In DEMIST mode, air comes out of FLOOR and DEF. Lo: 8V Automatic temperature control and REC switch are refused.</p> <p>(b) In DEF mode, air comes out only from DEF. Manual Lo is operable.</p>	<p>(1) Items to be checked when mode control is abnormal.</p> <ul style="list-style-type: none"> (a) Ambient temperature sensor (b) Sunload sensor ... Perform self-diagnosis of input system. (c) Air valve, actuator ... Perform self-diagnosis of input & output system. (d) Check harness connectors. <p>(2) Checking procedure when start control is faulty</p> <ul style="list-style-type: none"> (a) Water temperature sensor (b) TdL sensor (c) Tu, T_L sensors <p>Perform self-diagnosis of input system.</p> <ul style="list-style-type: none"> (d) Air valve, actuator ... Perform self-diagnosis of input & output system. (e) Check wiring and harness connectors <ul style="list-style-type: none"> (a) Ambient temperature sensor ... Perform self-diagnosis of AMB temperature indication and input & output system. (b) Harness wiring and connectors <ul style="list-style-type: none"> (a) Air valve and actuator (b) COMP Magnet clutch <p>Perform self-diagnosis of input & output system.</p> <ul style="list-style-type: none"> (a) Air valve, actuator (b) Blower speed <p>Perform self-diagnosis of input & output system.</p> <ul style="list-style-type: none"> (a) Perform self-diagnosis of input & output system.

LOCATION OF A/C ELECTRICAL COMPONENTS (Auto)

Diagnostic Procedure (Cont'd)

A.T.C. normal operating condition	Trouble diagnosis
<p>(C) TEMP SW change</p> <p>(1) Air outlet temperature varies with a change in set temperature.</p> <p>(2) Blower speed varies with the set temperature.</p> <p>(3) W/C operation and intake mode vary with the set temperature.</p>	<p>(a) T_L, T_u, T_{dL}, T_{du}, T_{dd}, T_w, Z_c, T_a ... Self-diagnosis of input system</p> <p>(b) P_L, P_u ... Self-diagnosis of input & output system</p> <p>(c) Air valve, actuator ... Self-diagnosis of input & output system</p> <p>(d) Check wiring and connectors.</p> <p>(a) T_L, T_u</p> <p>(b) Fan control system Perform self-diagnosis of input & output system.</p> <p>(a) Air valve and actuator (For control of intake door) (For control of water cock) Perform self-diagnosis of output system.</p>
<p>(D) manual SW operation</p> <p>(1) Blower speed is set at Hi or Lo by blower Hi-Lo switch.</p> <p>(2) Air intake mode is changed to REC mode by REC SW.</p>	<p>(1) Fan control system Perform self-diagnosis of input & output system.</p> <p>(2) Air valve and actuator (For control of intake door) Perform self-diagnosis of input & output system.</p>

Note: T_{dL} Floor duct temperature
 T_{du} Vent duct temperature
 T_{dd} Def. duct temperature

Z_c Sun load
 T_a Ambient temperature
 P_L Position of Feedback potentiometer (floor side)
 P_u Position of Feedback potentiometer (vent side)

(1) Diagnosing functions

The diagnostic program facilitates detection of failed points, and permits diagnosis in the following two modes:

- (a) Input system inspection Inspection of sensor and potentiometer (Step 1)
- (b) Input-output system inspection Inspection of actuator, W/C, COMP, and blower motor simultaneously with inspection of item (a) (Step 2)

Shown below are examples of efficient use of this diagnostic function.

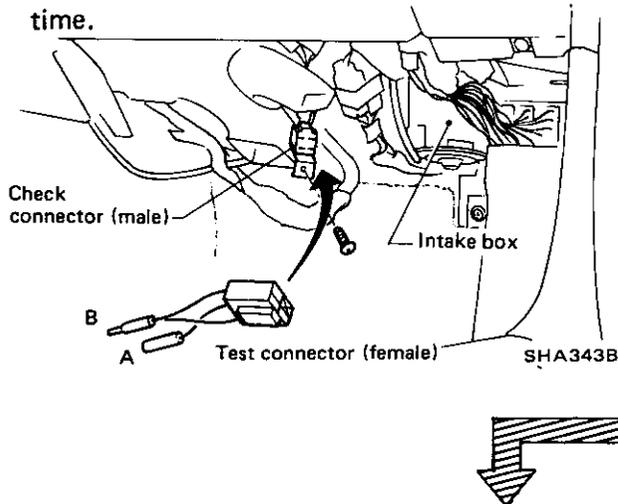
- "Input system inspection" permits inspection of the temperature of all sensors, power servo stroke and other functions while operating the A.T.C. system normally. Hence, this can be utilized to determine whether or not a device is normal according to the data obtained.
- In "Input & output system inspection", the specified control voltage is applied from the control unit to the blower control amplifier to control the blower motor speed when inspecting blower speed. Accordingly, whether the control unit and the blower control amplifier are normal or not can be determined by checking whether the control voltage is normal.
- In the simultaneous inspection of the input & output system in item (b) above, the air-mix door is forcibly actuated by the specified stroke during inspection of the output system. By reading the potentiometer during inspection of the input system as mentioned in (a), it is possible to determine whether the temperature control system is operating normally.

SELF-DIAGNOSING SYSTEM OF TROUBLE (Auto)

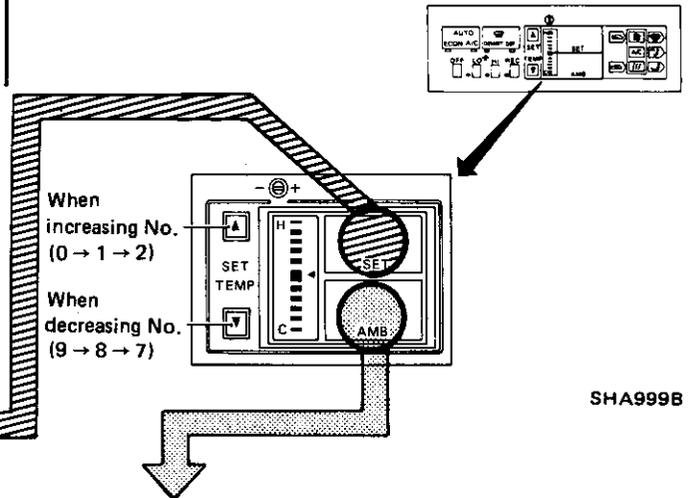
Inspection of Input System

CHECKING PROCEDURES FOR INPUT SIGNALS

1. For Input Test Step No. 0 through No. 9, plug the test connector into the check connector. Do not connect the wire leads (A and B) at this time.



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



SHA999B

Step No.	Unit to be checked	"Set"	Results (Ambient section)	
			Correct	Incorrect
0	In-vehicle sensor (foot level) (TL)	0	Indicates the approximate temperature at the location of the sensor.	All other figures: -17 (2) indicates open circuit. 83 (181) indicates short circuit. Proceed to Step (B2), Page HA-108.
1	In-vehicle sensor (head level) (Tu)	1		
2	Floor duct sensor (Tdl)	2		
3	Vent duct sensor (Tdu)	3		
4	Defrost duct sensor (Tdd)	4		
5	Water temperature switch (Tu)	5	Water temp. under 40°C (104°F) = -17 (2) Water temp. over 40°C (104°F) = 83 (181)	All others: Refer to Step (B3), Page HA-108.
6	Sunload sensor (Tc)	6	0 (32) no sunload 40 (104) high sunload (Note 1)	No change: Refer to Step (B4), Page HA-108.
7	Objective temperature adjusting switch	7	Set temperature adjuster setting equal to approx. temp. difference	Varies from actual temp. difference. Refer to Step No. 4, Page HA-120.
8	Potential balance resistor (Air mix door No. 2)	8	Varies in the range of approx. 40 to approx. 20 (approx. 104 to approx. 68). (Must perform output system diagnosis to read variation)	No variation: Improper variation: Refer to Step (C0), Page HA-110.
9	Potential balance resistor (Air mix door No. 1)	9		

NOTE 1: Values change gradually while simulating sensor with incandescent lamp.

NOTE 2: Values in () indicate °F.

0 (32) - + 64 (147)
0 - 64 (32 - 147) 32 (90)

Set Temp. Adjuster

SELF-DIAGNOSING SYSTEM OF TROUBLE (Auto)

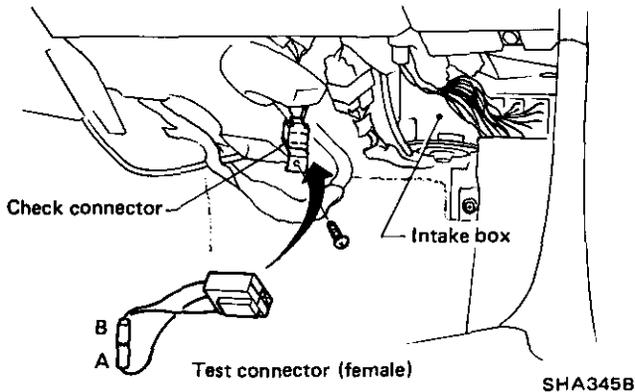
Inspection of Ambient Temperature Sensor

1. Turn the ignition to "ACC" position.
2. Read figures indicated on "AMB" indicator.
3. How to judge
Terminal No. 864 (L/W)
The letter in () indicates lead color.
OK – Reasonable ambient temperature
–49 [–56] * : Open sensor
83 [181] : Shorted sensor
*Figures in [] indicate degrees Fahrenheit.
(U.S.A. model)

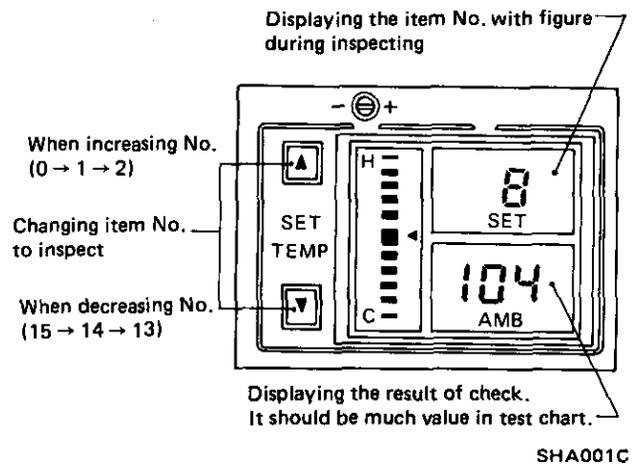
Inspection of Output System

CHECKING PROCEDURES FOR OPERATION OF ACTUATORS

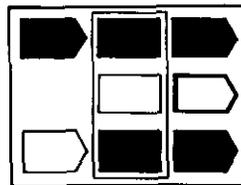
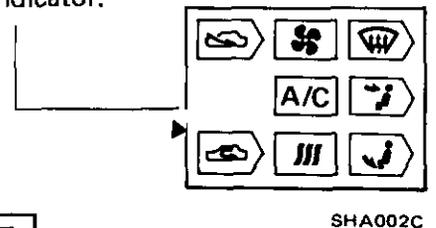
1. For Input/Output System Test 1 to 4, connect leads A and B, and plug the test connector into check connector.



2. Start the engine and press the "ECON/AC" button.
3. Check that output parts operate smoothly using the following chart. (Refer to pages HA-100, 101.)
 - The way to make sure of the operation of actuators.
 - 1) By digital indicator
When checking air mix door, set indicated number at 8 or 9 in SET section by pushing SET TEMP. button as shown below and read the displayed value in AMB section.



- 2) By air flow indicator.



Checking items are displayed in the indicator during inspecting.

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

SELF-DIAGNOSING SYSTEM OF TROUBLE (Auto)

Inspection of Output System (Cont'd)

The following 4 steps can be selected by pushing the OFF Switch.

Step number increases by pushing the switch. Each single push advances to next Step.

(1st push → 2, 2nd push → 3, 3rd push → 4, 4th push → 1)

Checking item	Procedures of confirming operation	Step No.				Terminal No
		1	2	3	4	
O-1 Air mix door 1 (Upper) P.B.R. 1	<ul style="list-style-type: none"> Position of air mix door 1 	Full Hot				882 (W/R), 883 (W/Y)
	<ul style="list-style-type: none"> Item No. 9 Objective display value 		approx. 104* (40)	104* (40)	86* (30)	
O-1 Air mix door 2 (Lower) P.B.R. 2	<ul style="list-style-type: none"> Position of air mix door 2 	Full Hot				884 (W/B), 885 (W/L)
	<ul style="list-style-type: none"> Item No. 8 Objective display value 		approx. 104* (40)	104* (40)	86* (30)	
O-2 Outlet	<ul style="list-style-type: none"> Air flow indicator Check each outlet by hand. 	DEF. VENT. B/L DEMIST				DEF/VENT Changeover 887 (R/Y) FOOT Opens/ Closes 886 (R)
O-3 Intake door	<ul style="list-style-type: none"> Air flow indicator Look at the intake door spring 	REC. Partial REC. Fresh air				880 (R/L), 881 (R/G)
O-4 Water cock	<ul style="list-style-type: none"> Air flow indicator Look at the water cock position and check temperature by hand. 	ON OFF				564 (GY)
O-5 Compressor clutch	<ul style="list-style-type: none"> Air flow indicator Check operation of the magnet clutch. 	ON OFF				567 (Y/L)
Display						

Note: ● Value marked * is for U.S.A. model.

● The letter in () indicates lead wire color.

● If approx. ±7 difference exists between indicated value and the value in test chart, this is normal.

● Location of components is shown on page HA-87, HA-95.

SHA003C

SELF-DIAGNOSING SYSTEM OF TROUBLE (Auto)

Inspection of Output System (Cont'd)

Blower motor can be checked by the following procedure.

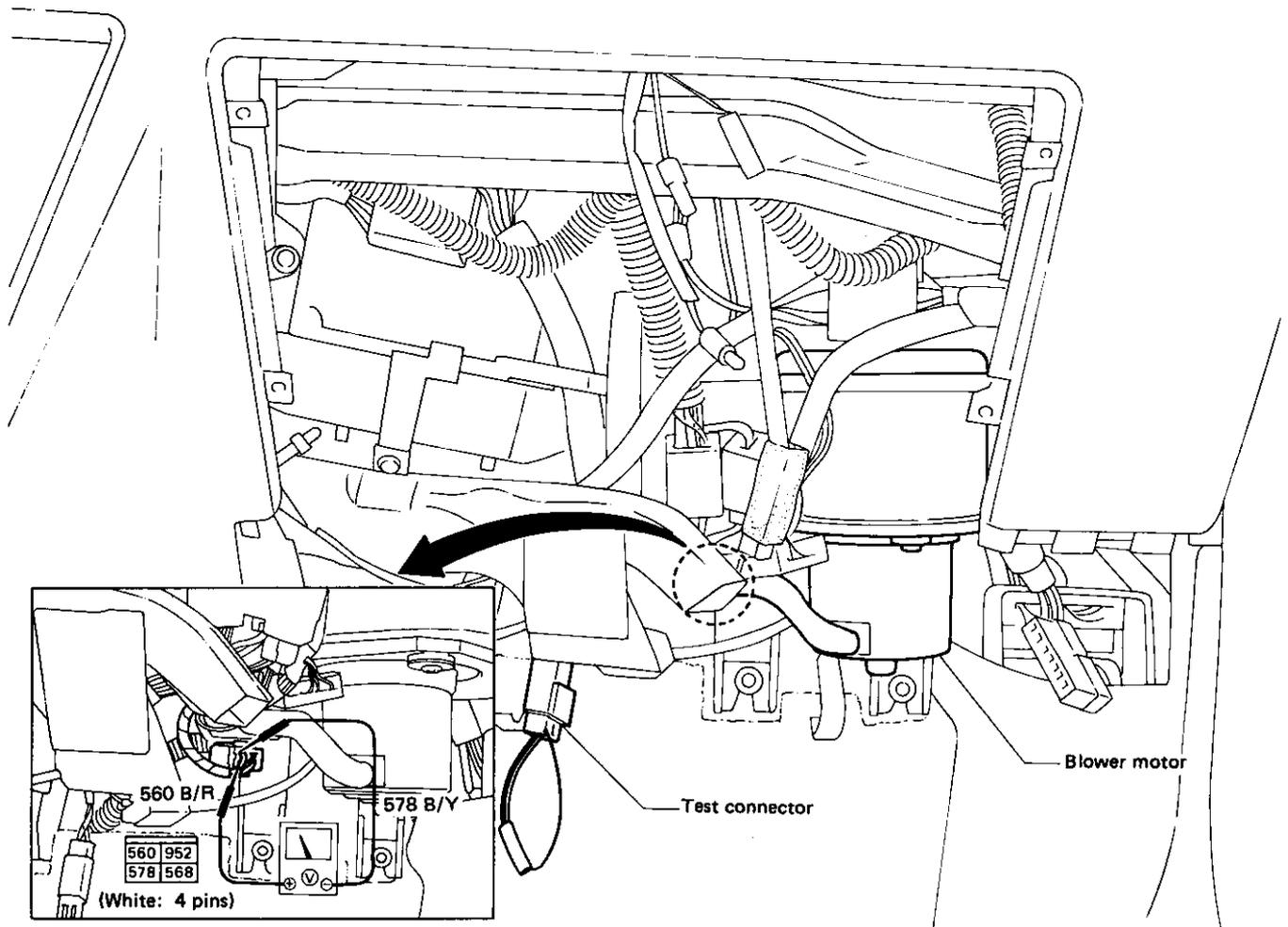
4 steps can be selected by pushing the Lo Switch. Step No. increases by pushing the switch.

Checking item	Procedures of confirming operation	Step No.				Terminal No.
		1	2	3	4	
O-6 Blower motor	<ul style="list-style-type: none"> ● Air conditioner operation indicator ● Touch with each outlet by hand. ● Measure the applied voltage of motor. 	12 (V) 8.5 6 4				Blower relay 571 (G) Signal for amount of air 568 (G/W)

Note: The letter in () indicates lead wire color.

SHA820B

Measurement of blower motor applied voltage



SHA004C

TROUBLE DIAGNOSES (Auto)

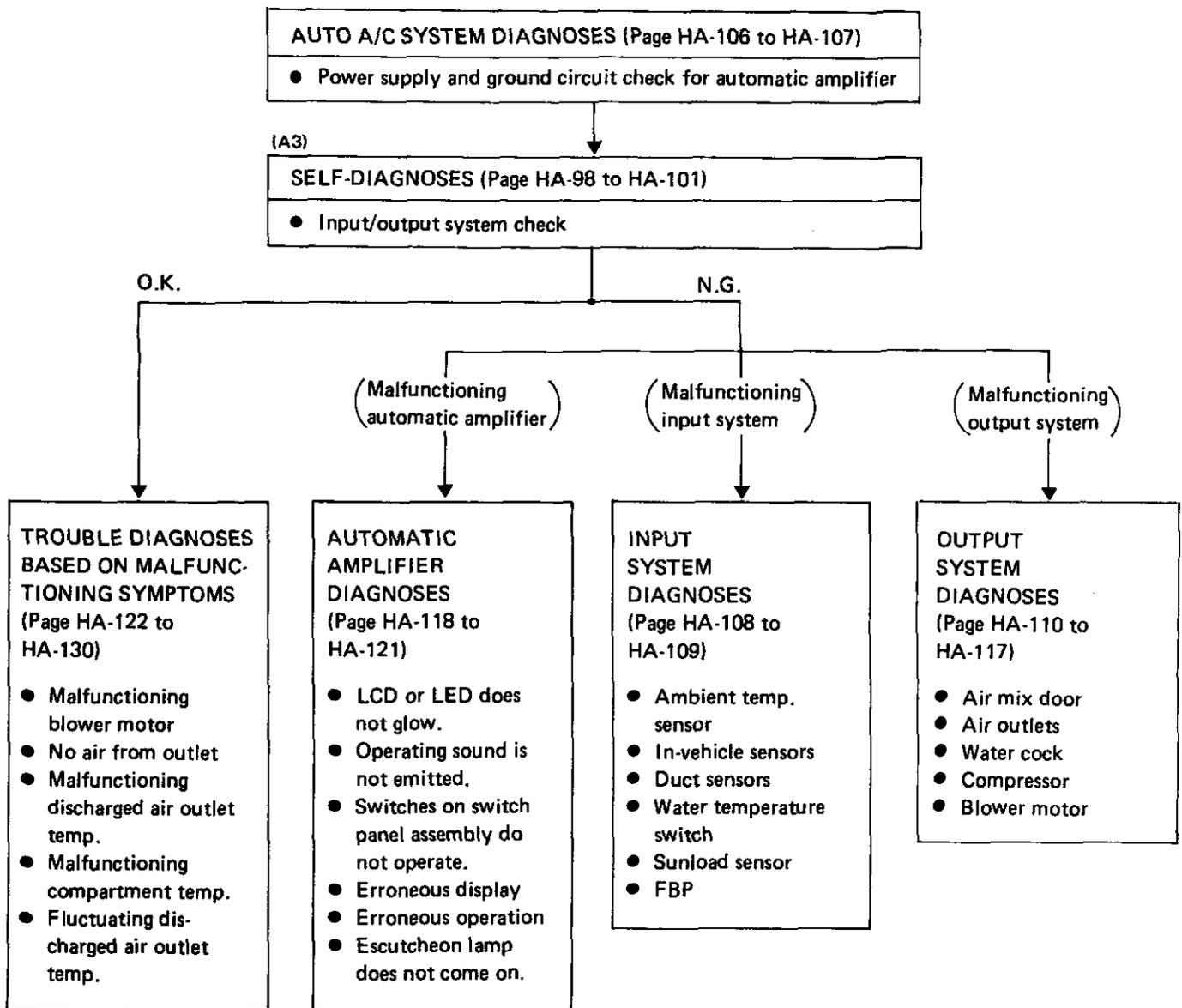
CONTENTS

Circuit for trouble diagnoses	HA-104
Auto A/C system diagnosis	HA-106
(A0) Check to see if SET AMB. temperature is displayed when ignition switch is set to ACC, or when engine is running	HA-106
Input system diagnosis	HA-108
(B0) Inoperative input system	HA-108
Output system diagnosis	HA-110
1) Inoperative air mix door	HA-110
(C0) Input & output system: Check O-1 for proper operation	HA-110
2) Doors, water cock and compressor diagnosis	HA-112
(D0) Check if 12 volts are present at terminal 867 (SB) with connector ⑨ in place ...	HA-112
(E0) Check if 12 volts are present at terminal 561 (SB) when connector ⑮ is connected	HA-113
(F0) Check if 12 volts are present at lead wire (OR) of air valve located on vacuum tank	HA-114
(G0) Check if 12 volts are present at lead wire (L side) of air conditioner relay located in engine compartment	HA-115
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(I0) Do LCD's or LED's glow?	HA-118
2) Operating (Buzzing) sound is not emitted.	HA-119
(J0) Disconnect buzzer connector from control subassembly and apply 12 volts across buzzer terminals (red ⊕ and black ⊖) to see if buzzer sounds	HA-119
3) Switches on switch panel assembly do not operate.	HA-119
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Blower rotates only in LO mode	HA-122
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Cool air at foot level will not stop or is discharged intermittently	HA-127
Outside air is not drawn into compartment	HA-127
Discharged air is too cool	HA-128
Discharged air is not cool	HA-128
Compartment is too hot	HA-129

TROUBLE DIAGNOSES (Auto)

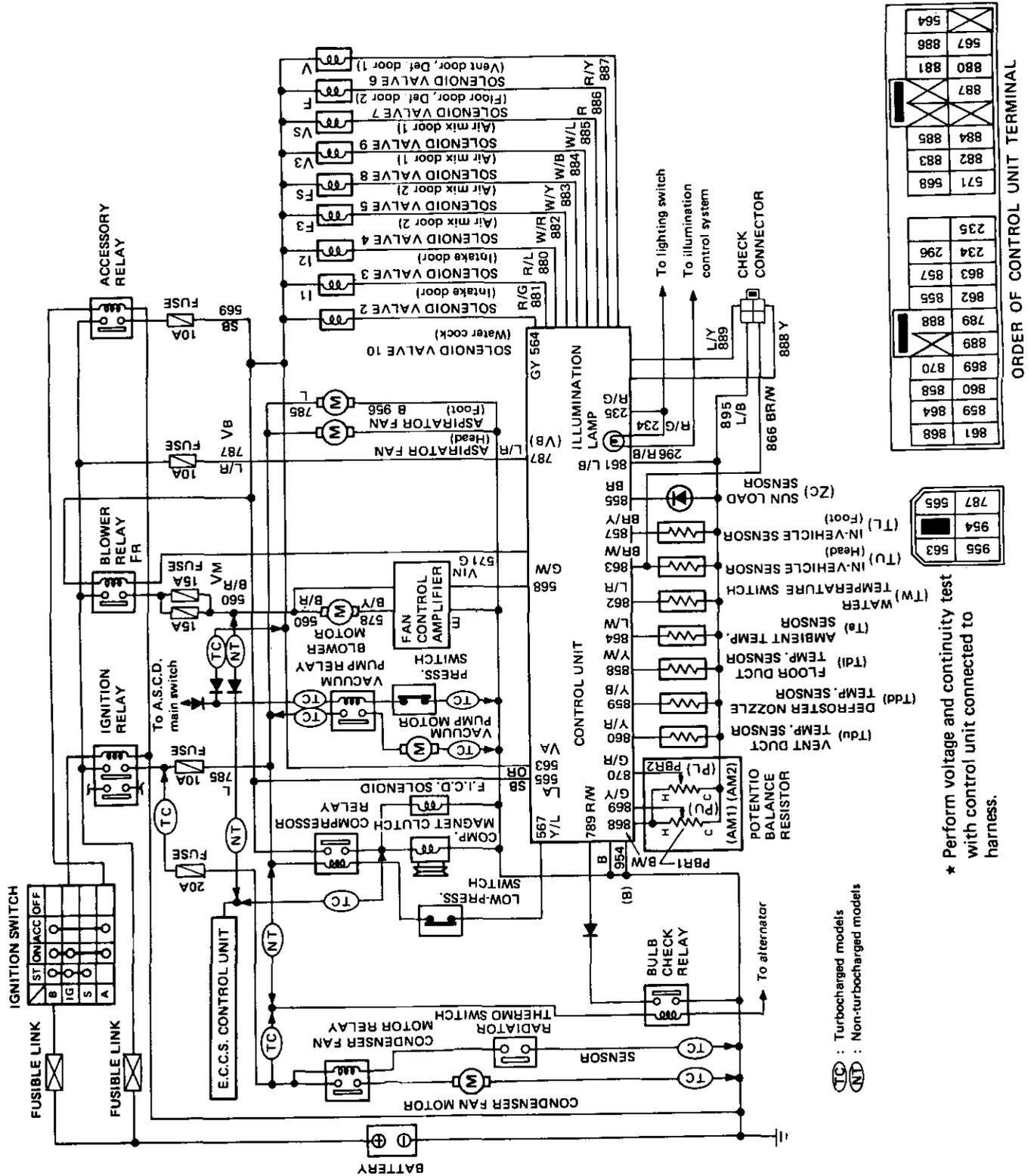
- Compartment will not become warm HA-129
- Temperature of air discharged from floor outlets fluctuates HA-130
- In-vehicle temperature fluctuates HA-130
- Temperature of air discharged from def. outlets on instrument panel fluctuates HA-130

TROUBLE DIAGNOSES GUIDE



TROUBLE DIAGNOSES (Auto)

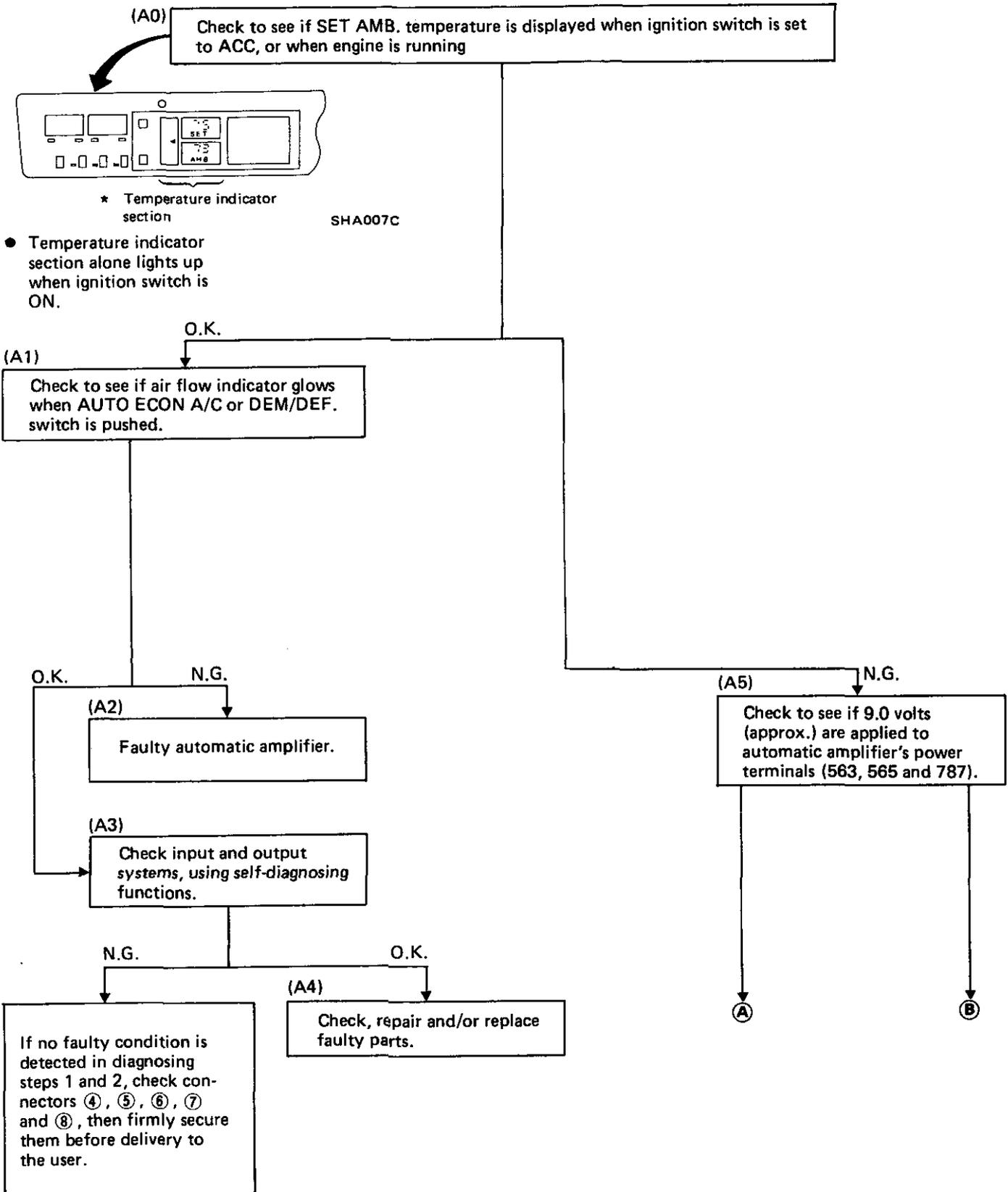
Circuit for Trouble Diagnoses



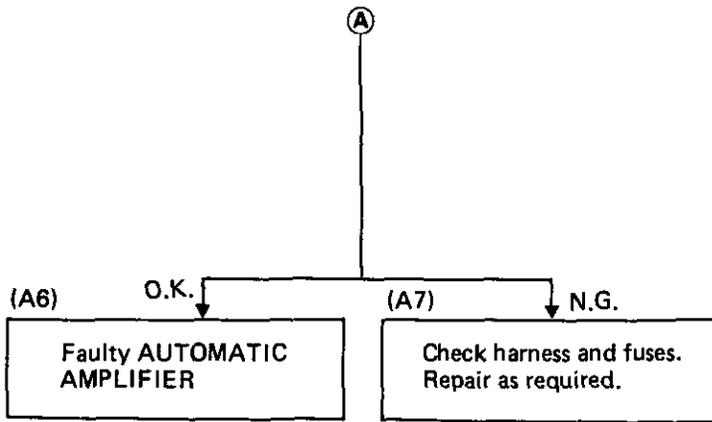
SHA005C

TROUBLE DIAGNOSES (Auto)

AUTO A/C SYSTEM DIAGNOSIS



TROUBLE DIAGNOSES (Auto)



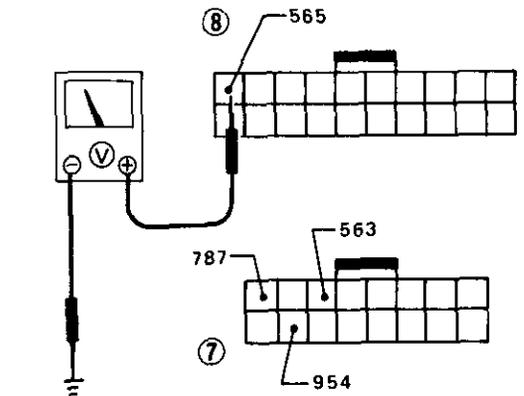
ⓑ

Inspection procedure:

Refer to Connector arrangement diagrams ① to ⑳ shown in HA-105.

1. Inspection of connectors ⑦ and ⑧, located near the cooling unit, to heater unit connecting section.

(1) Disconnect the connector and check the voltage at terminals 563, 565 and 787 on the cooling unit side. (Voltage must be greater than 9 volts.)



(Body ground)

SHA013C

(2) Check the voltage of terminal 954. (Voltage must be 0 volt.)

2.

(1) If the result of inspection 1 above is no good, check the fuse of 10A (ACC) and 10A (VB) in the fuse box.

(2) If the result of inspection 1 above is O.K., connect connectors ⑦ and ⑧ and disconnect connector ④ on the rear side of the control unit.

565	□	563
787	954	955

Check the voltage of terminals 563 (OR), 565 (SB), 787 (L/B), 954 (B) and 955 (B).

If it is difficult to check with connectors ⑦

and ⑧ connected, this inspection may be substituted with the continuity check between connectors ⑦ and ⑧ and connector ④.

3.

(1) If the result of inspection 2 above is no good, continuity of the harness between connectors ⑦ and ⑧ and connector ④ is faulty.

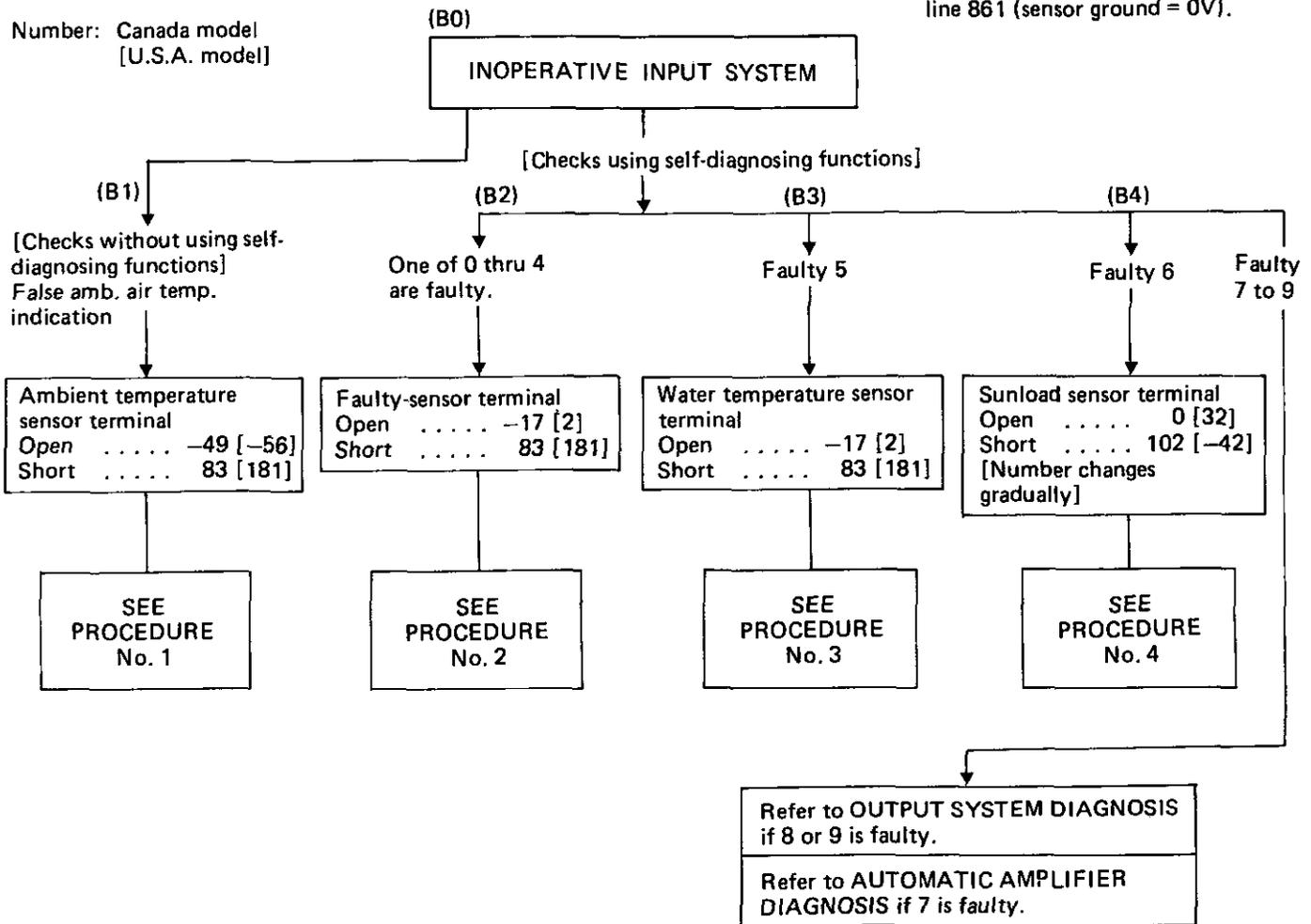
(2) If the result of inspection is O.K., the control unit is faulty.

TROUBLE DIAGNOSES (Auto)

INPUT SYSTEM DIAGNOSIS (Page HA-98)

● Numbers displayed on indicators.
When the indicator at Step No. 0 thru 4 shows only -17 [2], check line 861 (sensor ground = 0V).

Number: Canada model
[U.S.A. model]



INSPECTION PROCEDURE

Conduct inspection referring to connector arrangement diagram on page HA-105.

Procedure 1

- (1) If ambient display on the control panel is faulty, disconnect the ambient sensor connector at the front bumper. If the display is -49°C (-56°F) when disconnected and 83°C (181°F) when the voltage side is shorted to ground, the auto amplifier and harness are O.K. Check the ambient sensor for temperature-resistance characteristics. (See page HA-72.)
- (2) If the display does not change from -49°C (-56°F) even when shorted, check terminal 864 for approx. 5.0 volts with the sensor disconnected. No = faulty auto amplifier. Yes = proceed to step 3.
- (3) Check circuit 864 through to sensor.

TROUBLE DIAGNOSES (Auto)

Procedure 2

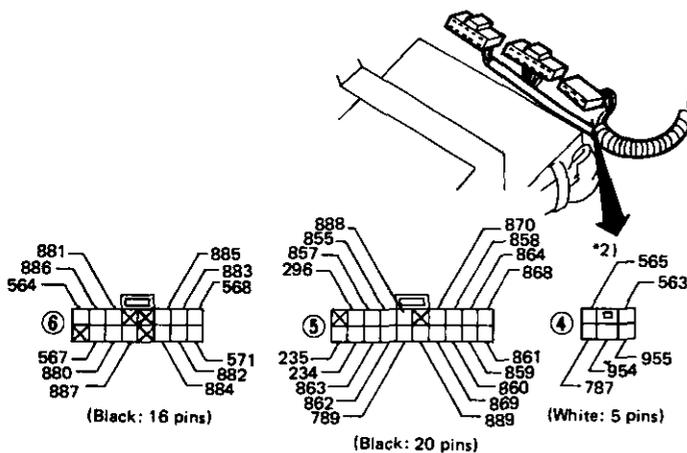
- (A) If display Nos. 0, 1, 2, 3, or 4 are faulty, disconnect harness connector at the sensor location. If the display is -17°C (2°F) with the connector disconnected, and 83°C (181°F) when the voltage side is shorted to ground, the auto amplifier and harness are O.K. Check the sensor temperature-resistance characteristics.
- (B) If the display does not change from -17°C (2°F) even when shorted, check for approx. 5.0 volts at the appropriate terminal of the auto amplifier harness.
- No = Faulty auto amplifier Yes = Proceed to (C).
- (C) Check faulty circuit from auto amplifier through to sensor.

Procedure 3

- (A) Disconnect harness connector at the sensor. If the display is -17°C (2°F) with the harness disconnected, and 83°C (181°F) when the voltage side is shorted to ground, replace water temperature switch.
- (B) If the display does not change from -17°C (2°F) even when shorted, check for approx. 5.0 volts at terminal 862 (L/R) of auto amplifier harness.
- No = Faulty auto amplifier Yes = Proceed to (C).
- (C) Check circuit from connector No. 5 through to connector **34F**.

Procedure 4

- (A) If 0 (32) is displayed with connector No. 17 removed, move vehicle into the sun and check for a change in current value between male terminals 855 (BR) and 890 (L/B). No change = Replace sensor.
- Under high sunload condition: If the output is on the order of 0.05 to 2.0 mA and it drops to 0 mA when the sunload sensor is covered, the display is normal.



*2) Check connectors ④, ⑤ and ⑥ with the control unit pulled out as far as the gear shift lever.

STEP NO.	SENSOR	TERMINAL
0	TL	857 (BR/Y)
1	Tu	863 (BR/W)
2	TdL	858 (Y/W)
3	Tdu	860 (Y/R)
4	Tdd	859 (Y/B)

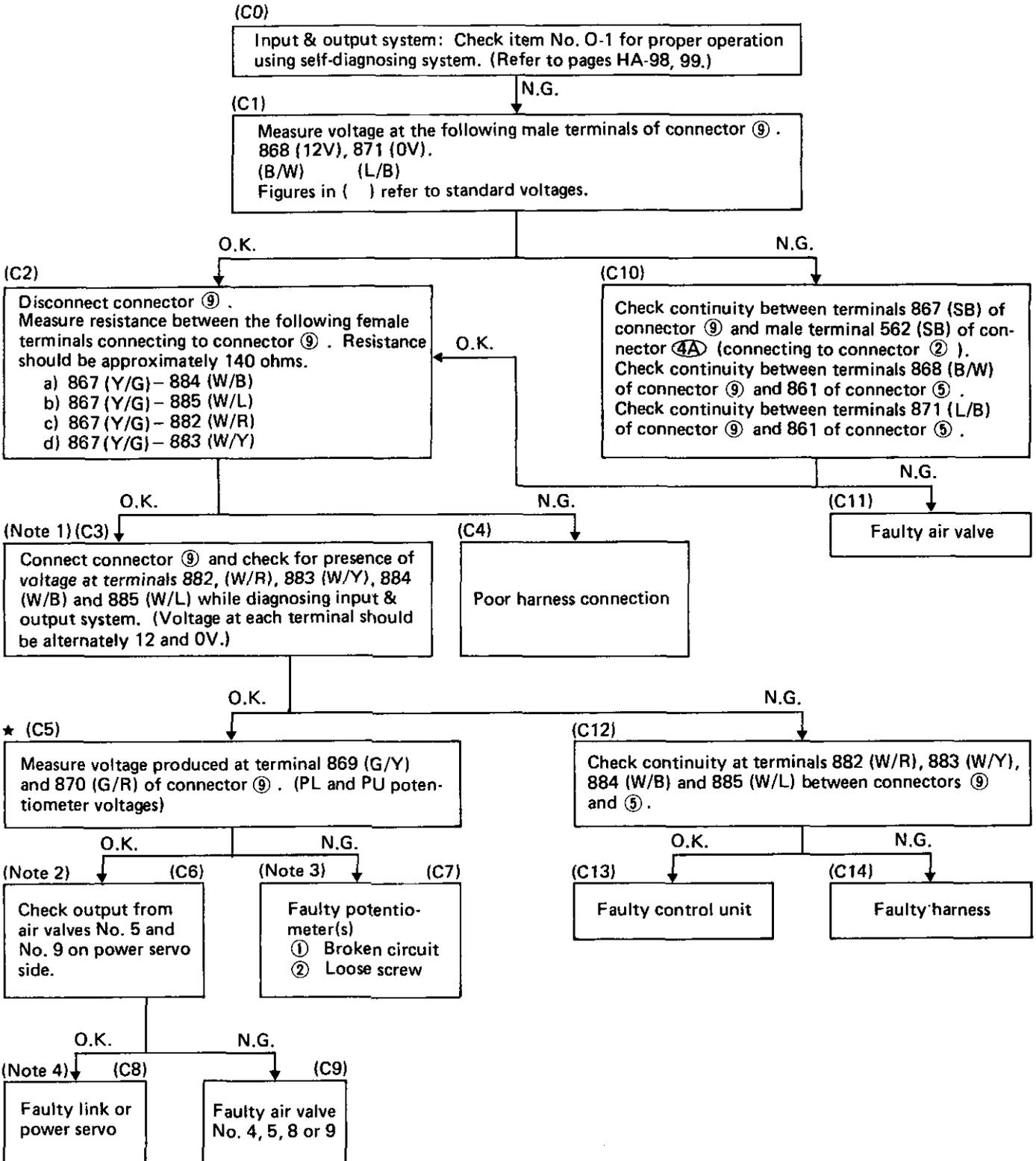
SHA008C

TROUBLE DIAGNOSES (Auto)

OUTPUT SYSTEM DIAGNOSIS (Page HA-99 to HA-101)

1) Inoperative air mix door

INSPECTION PROCEDURE – Air Mix Door



TROUBLE DIAGNOSES (Auto)

INSPECTION PROCEDURE

Use layout of connectors ① through ⑳ on page HA-105 as an inspection guide.

(Note 1) Check with engine running while diagnosing input and output system.

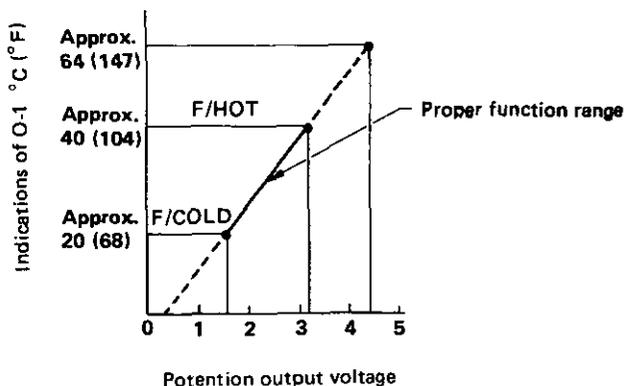
(Note 2) Same as Note 1 above. Faulty input vacuum line can be determined by fixed DEF mode.

(Note 3) After disconnecting vacuum hose from air valve No. 5 or No. 9, connect vacuum hose (on hand) to the hose. Suck air from and blow air into hose orally or by using a vacuum pump and check if potentiometer reading varies with changes in air temperature. If potentiometer reading does not change, link may be jammed, power servo may not be installed properly (loose screws, etc.) or power servo may be faulty.

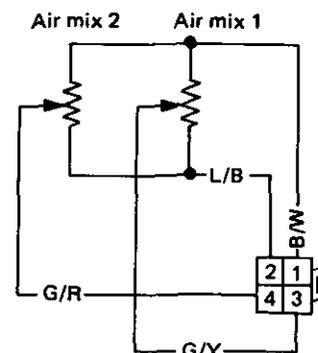
(Note 4) In a manner similar to Note 3 above, disconnect vacuum hose from air valve No. 5 or No. 9 and connect vacuum hose (on hand) to the hose. Suck air from and blow air into hose orally or by using a vacuum pump. If air temperature does not change regardless of control operation of photo amplifier for power servo, link may be jammed, power servo may be installed improperly (loose screws, etc.) or power servo is not functioning.

Other If air valves constantly repeat ON-OFF operation when ATC and input & output system function properly, air valve(s) may be leaking.

- Performance characteristics of PL and PU-potentiometer voltages and input indications (#8 and 9)



SHA618B



SHA009C

POTENTIOMETER ADJUSTMENT PROCEDURE

With the heater assembly removed from the vehicle, check to be sure that there is no binding of either the air mix doors or linkage. With both air mix doors in the full heat position, (no vacuum applied), adjust the resistance between terminals No. 1 (B/W) and No. 3 (G/Y) of the P.B.R. harness to 2.8k. Adjust the resistance between terminal No. 1 (B/W) and No. 4 (G/R) to 3.0k.

TROUBLE DIAGNOSES (Auto)

2) Doors, water cock and compressor diagnosis

While checking input, 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)

INSPECTION PROCEDURE – Doors, Water Cock and Compressor

Check operation of air valves and relays while operating input and output system SELF DIAGNOSIS FUNCTION.

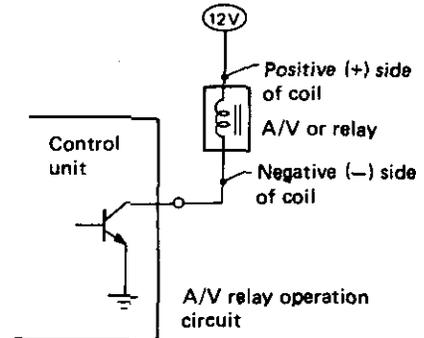
Air valves and relays

Positive (+) side: Approximately 12 volts (constant)

Negative (-) side: Approximately 0 volts (OFF)

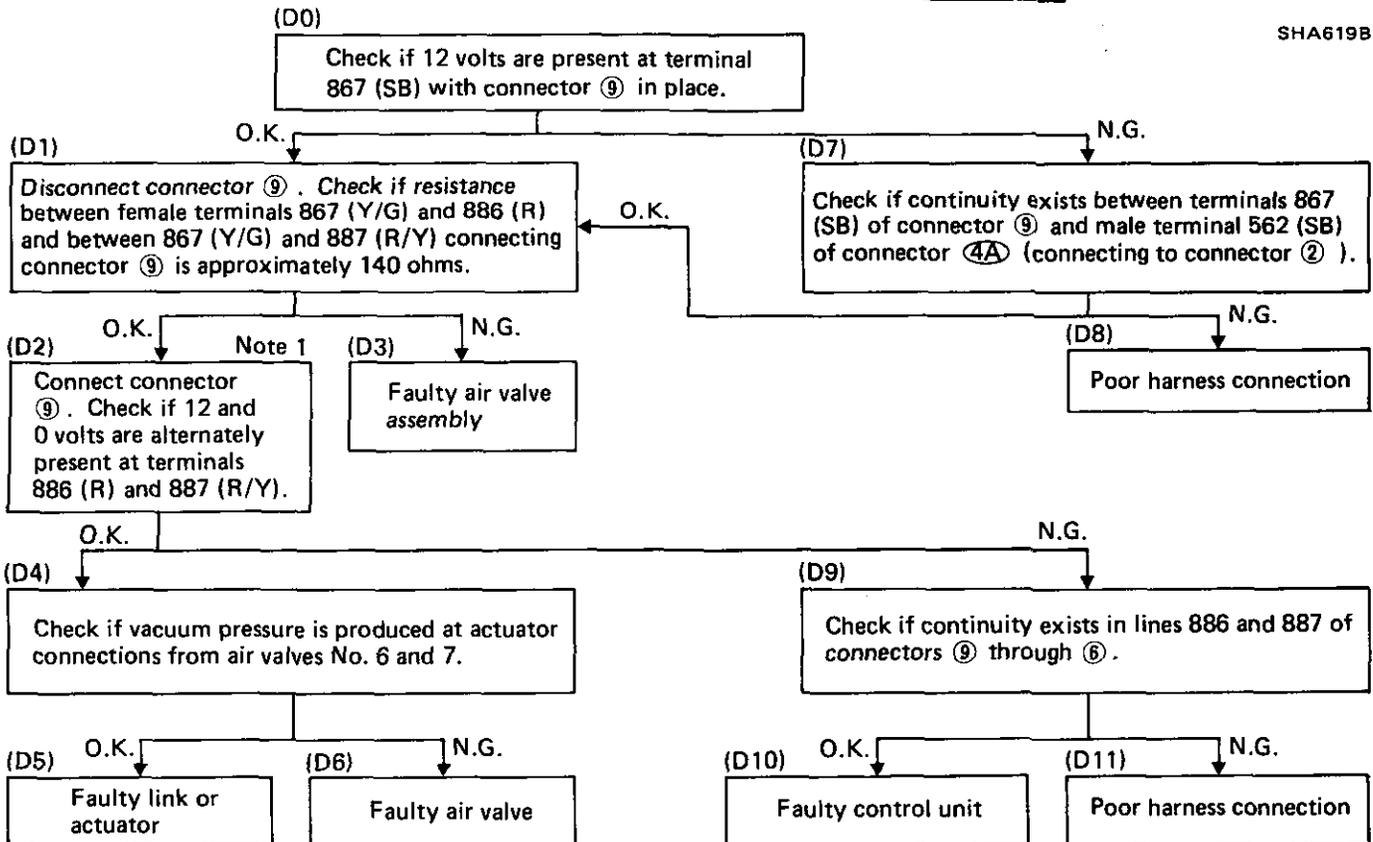
(Downstream of coil): Approximately 0 volts (ON)

- Be careful not to short-circuit positive and negative sides of coil. Otherwise, transistor(s) inside control unit may be damaged.



2-1 Inspection Procedure – Air Outlets

SHA619B



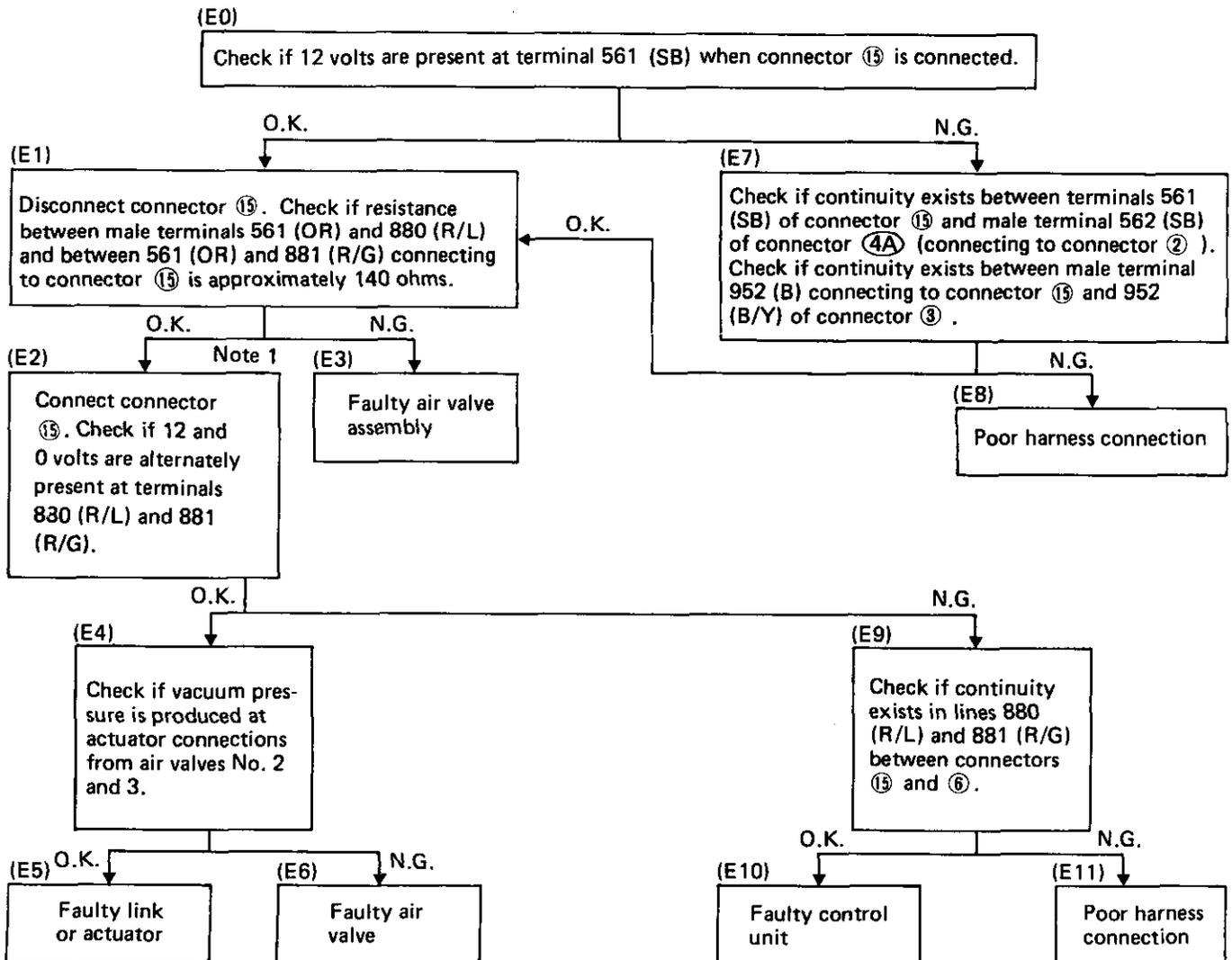
NOTE 1: Check with engine running while operating Input and Output System Test.

TROUBLE DIAGNOSES (Auto)

Mode Door Operation

Air valve actuator		Air valve		Actuator		
		No. 6	No. 7	DEF door	VENT door	FLOOR door
Mode Air outlet	DEF	OFF	OFF	Atmospheric pressure		
	VENT	ON	OFF	Vacuum pressure		Atmospheric pressure
	B/L	ON	ON	Vacuum pressure		
	HEAT	OFF	ON	Atmospheric pressure		Vacuum pressure

2-2 Inspection Procedure – Intake Doors



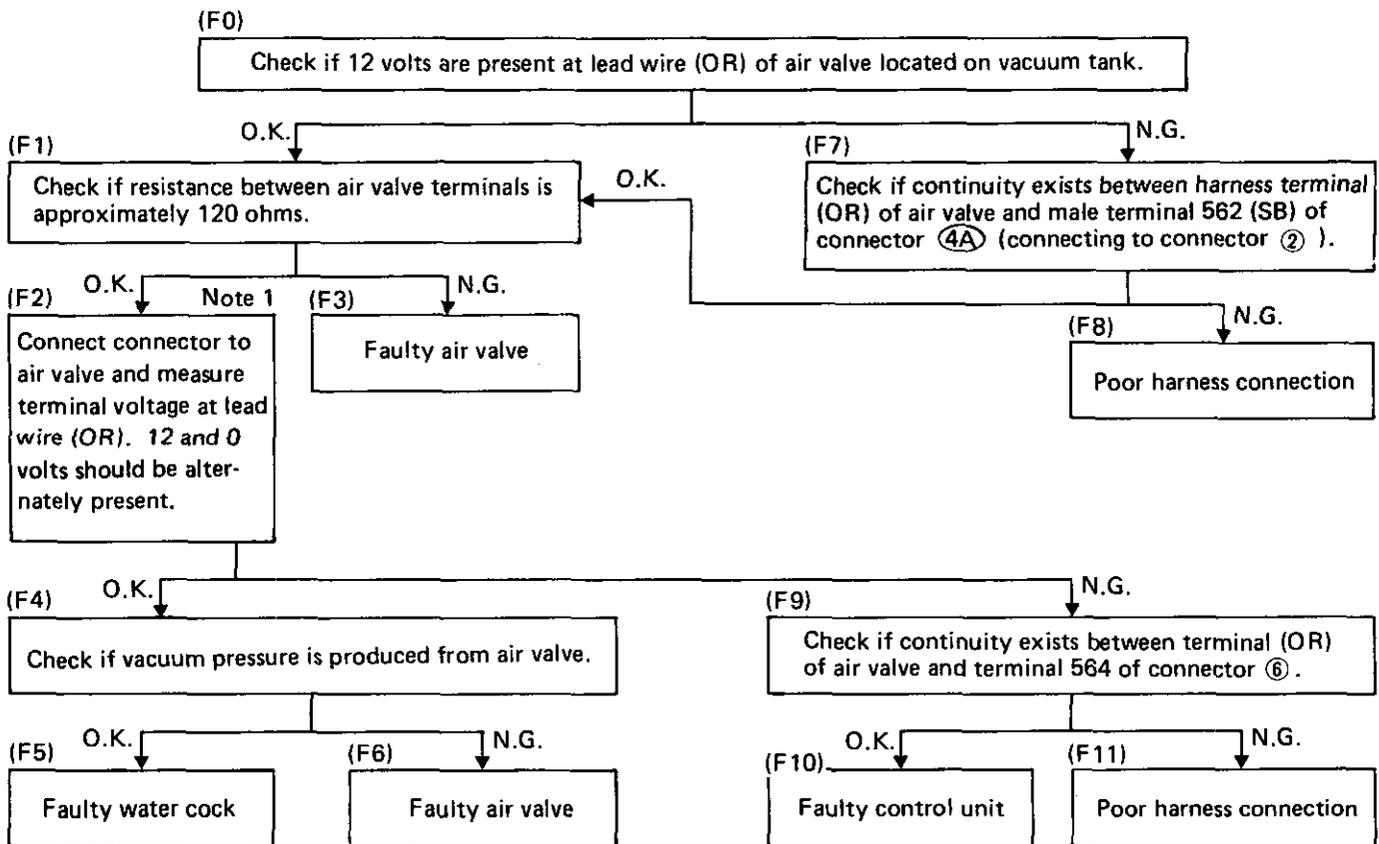
NOTE 1: Check with engine running while operating Input and Output System Test.

TROUBLE DIAGNOSES (Auto)

Intake Door Operation

Air valve actuator		Air valve No. 3	Air valve No. 2	Double-action actuator (intake door closed)
Air inlet	Inside air	ON	ON	Vacuum pressure (at 1st and 2nd positions)
	Inside-outside air	ON	OFF	Vacuum pressure (at 1st position)
	Outside air	OFF	OFF	Atmospheric pressure

2-3 Inspection Procedure – Water Cock



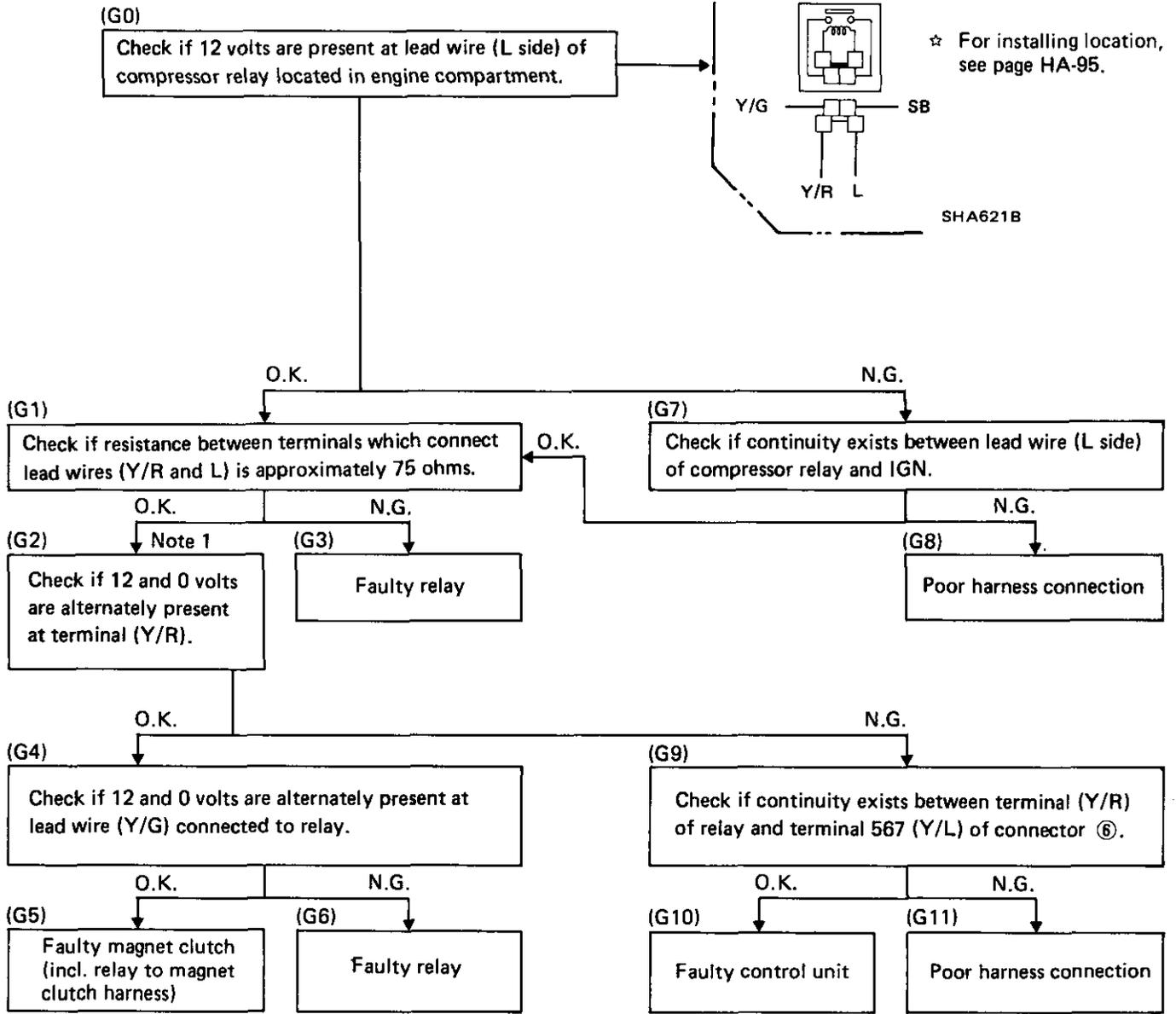
NOTE 1: Check with engine running while operating Input and Output System Test.

Water cock operation

Water cock	Air valve actuator	
	Air valve	Water cock actuator
Open	OFF	Atmospheric pressure
Close	ON	Vacuum pressure

TROUBLE DIAGNOSES (Auto)

2-4 Inspection Procedure – Compressor



Compressor operation

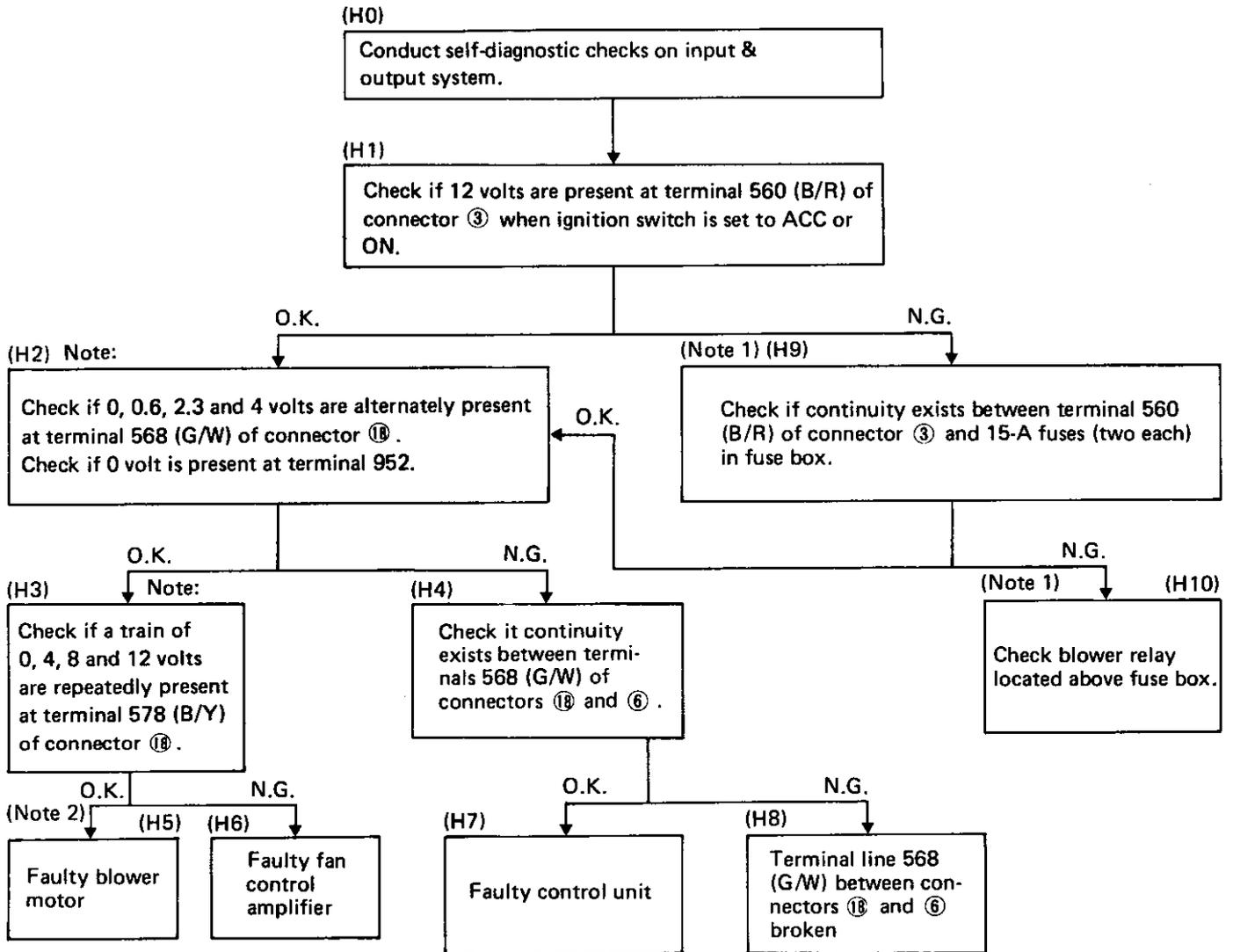
	Relay
Compressor ON	ON
Compressor OFF	OFF

NOTE 1: Check with engine running while operating Input and Output System Test.

TROUBLE DIAGNOSES (Auto)

3) Blower motor diagnosis

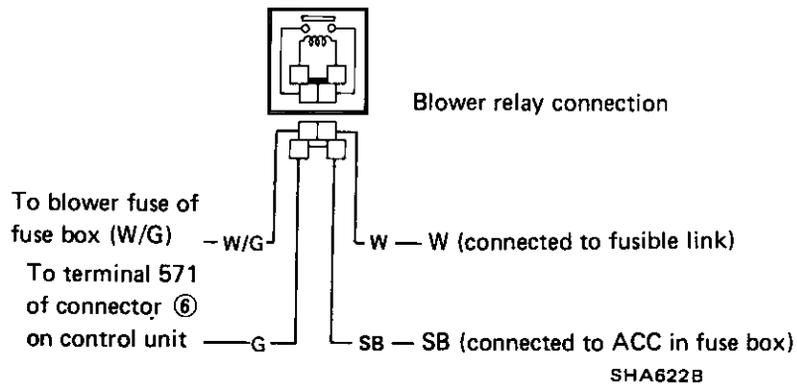
INSPECTION PROCEDURE – Blower & Motor



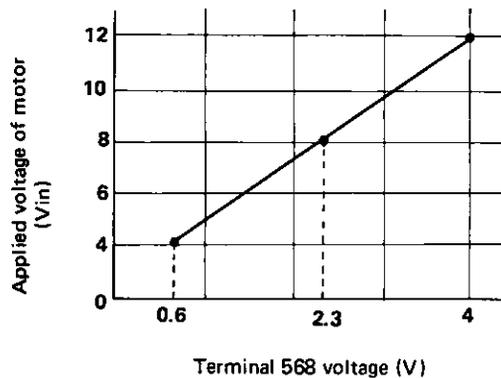
NOTE: Check with engine running while performing Input and Output System Test.

TROUBLE DIAGNOSES (Auto)

- (Note 1) When ignition switch is set to ACC, current flows through blower relay coil. With ignition switch held there, activating switches "AUTO" and "DEF" on control unit causes downstream side of relay coil to be grounded so that blower relay activates. If blower motor does not activate due to problems in its power supply, it will be due to one of the following causes:
- (a) Lead wire (W) between fusible link and relay is broken,
 - (b) The line between lead wire (W/G) of relay and terminal 560 of connector (3) (including two 15-A fuses) is broken,
 - (c) The line between lead wire (S/B) of relay and fuse (ACC) is broken, or
 - (d) The line between lead wire (G) of relay and terminal 571 of connector (6) is broken.



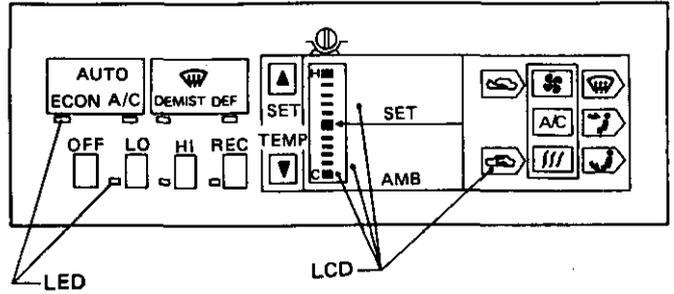
- (Note 2) Output performance characteristics of fan control is shown below.



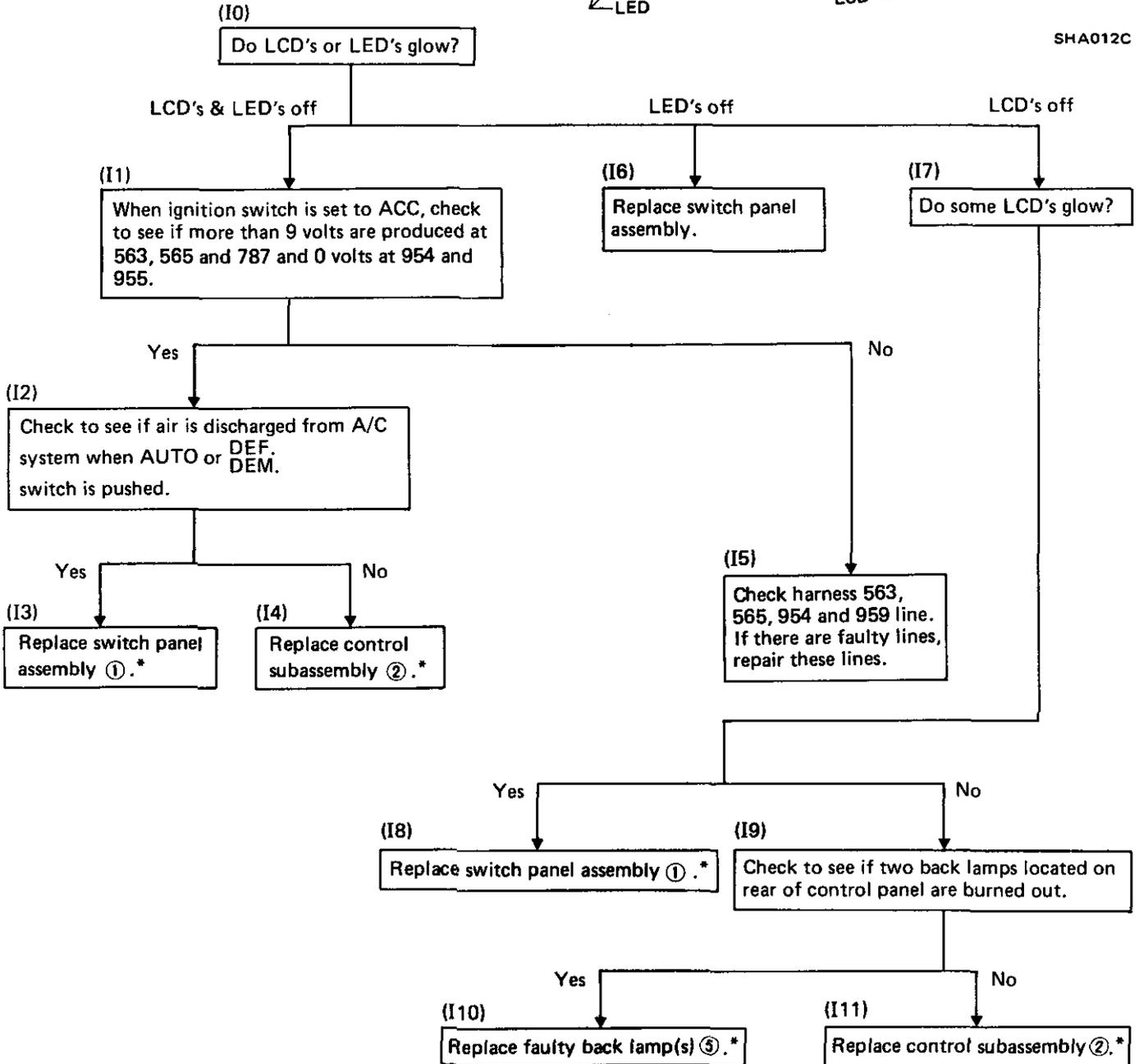
TROUBLE DIAGNOSES (Auto)

AUTOMATIC AMPLIFIER DIAGNOSIS

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



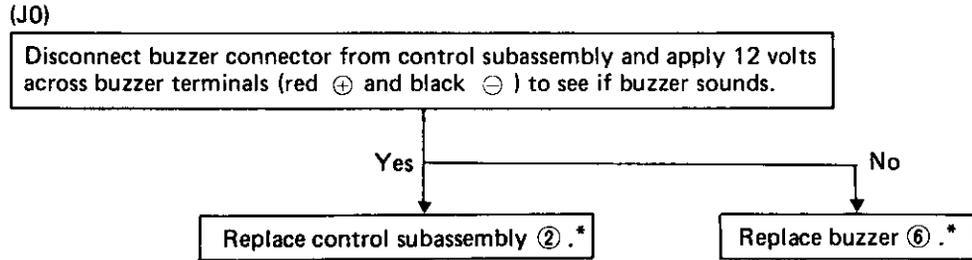
SHA012C



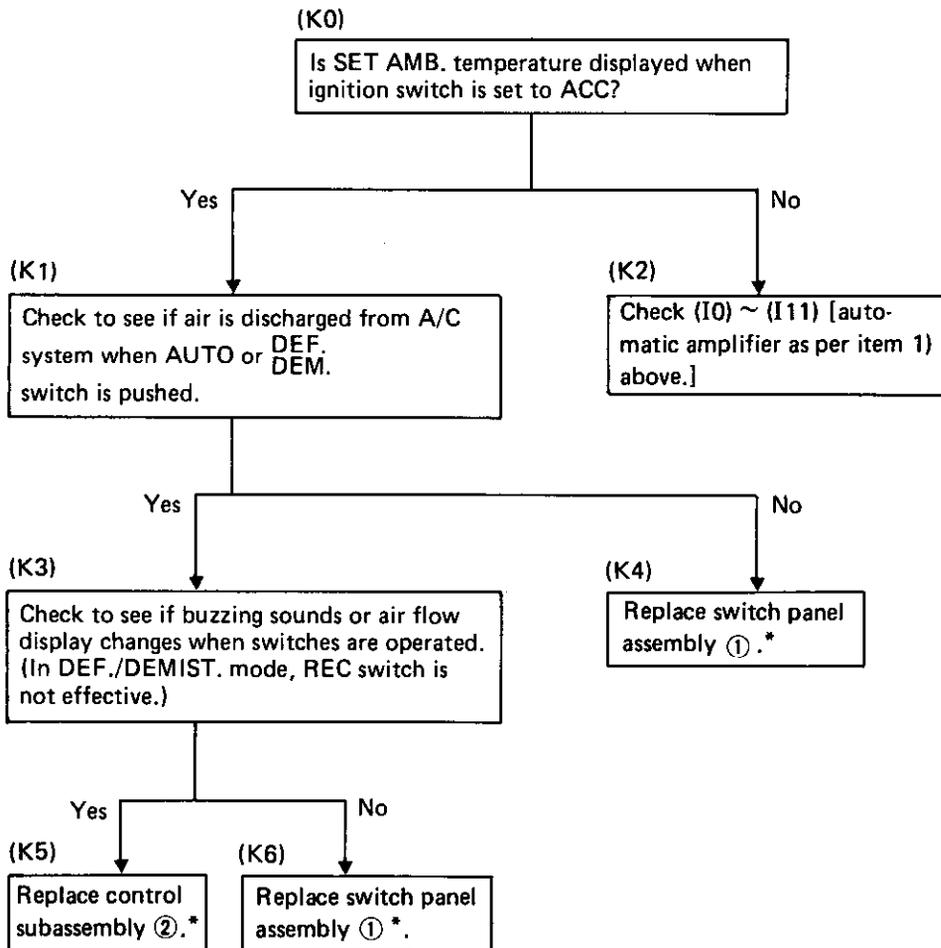
*: Refer to REPLACEMENT OF CONTROL SUBASSEMBLY AND SWITCH PANEL ASSEMBLY. (Page HA-121)

TROUBLE DIAGNOSES (Auto)

2) Operating (Buzzing) Sound is not Emitted.



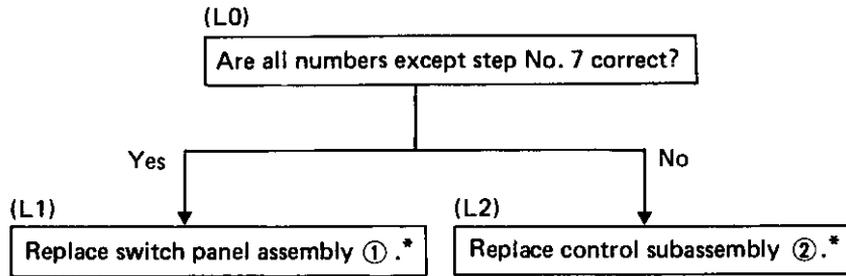
3) Switches on Switch Panel Assembly do not Operate.



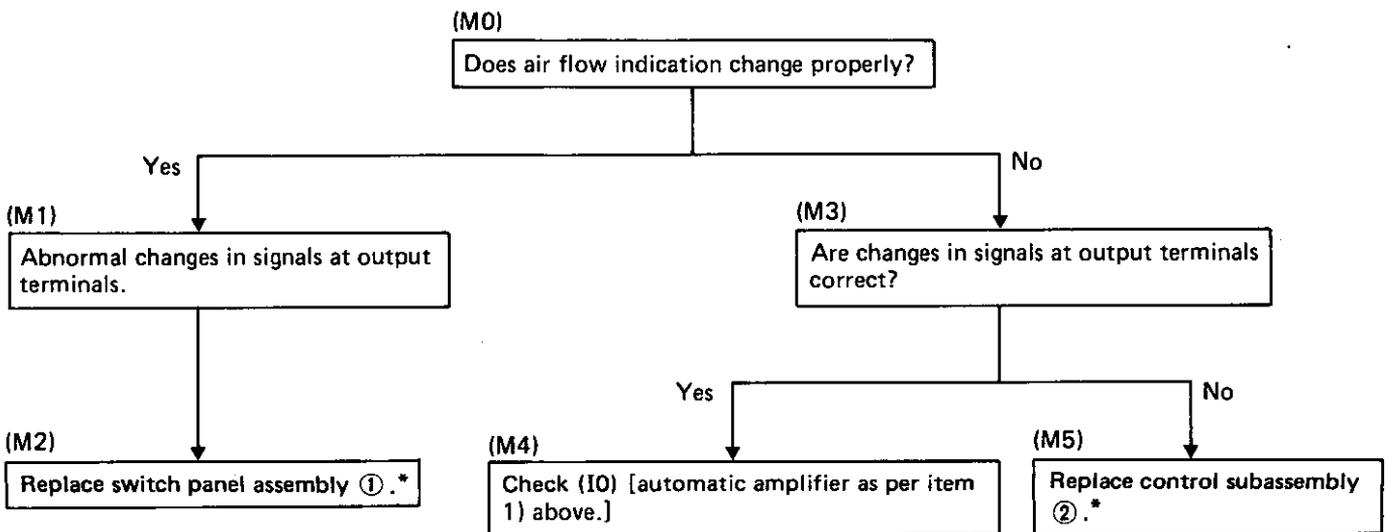
*: Refer to REPLACEMENT OF CONTROL SUBASSEMBLY AND SWITCH PANEL ASSEMBLY. (Page HA-121)

TROUBLE DIAGNOSES (Auto)

4) Erroneous Display during Inspection of the Input System



5) Erroneous Operation during Inspection of the Output System



6) Escutcheon lamp does not come on.

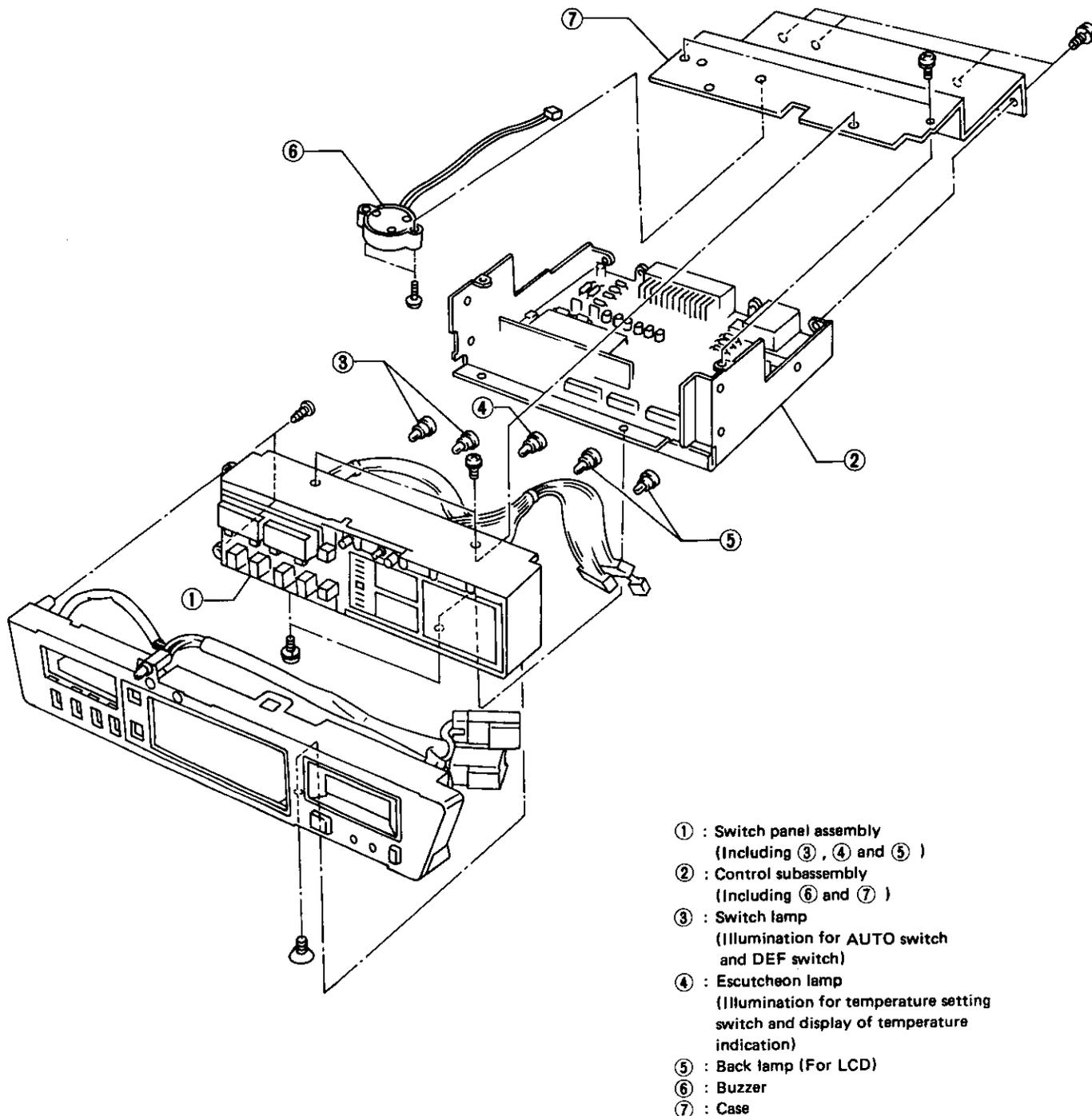
Check for burned-out lamp located at rear of switch panel assembly ④.*

*: Refer to REPLACEMENT OF CONTROL SUBASSEMBLY AND SWITCH PANEL ASSEMBLY. (Page HA-121)

TROUBLE DIAGNOSES (Auto)

REPLACEMENT OF CONTROL SUBASSEMBLY AND SWITCH PANEL ASSEMBLY

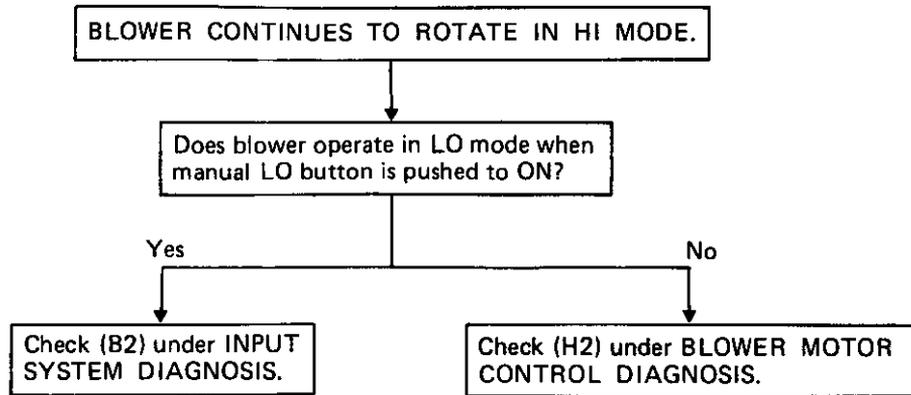
- Before performing various operational checks of the automatic amplifier, check to make sure the four switch panel assembly-to-control subassembly connectors and buzzer connector are secure and tight and are free from damage.
- On the rear of the control panel assembly are five light bulbs that can be serviced as required.



- ① : Switch panel assembly
(Including ③ , ④ and ⑤)
- ② : Control subassembly
(Including ⑥ and ⑦)
- ③ : Switch lamp
(Illumination for AUTO switch
and DEF switch)
- ④ : Escutcheon lamp
(Illumination for temperature setting
switch and display of temperature
indication)
- ⑤ : Back lamp (For LCD)
- ⑥ : Buzzer
- ⑦ : Case

SHA011C

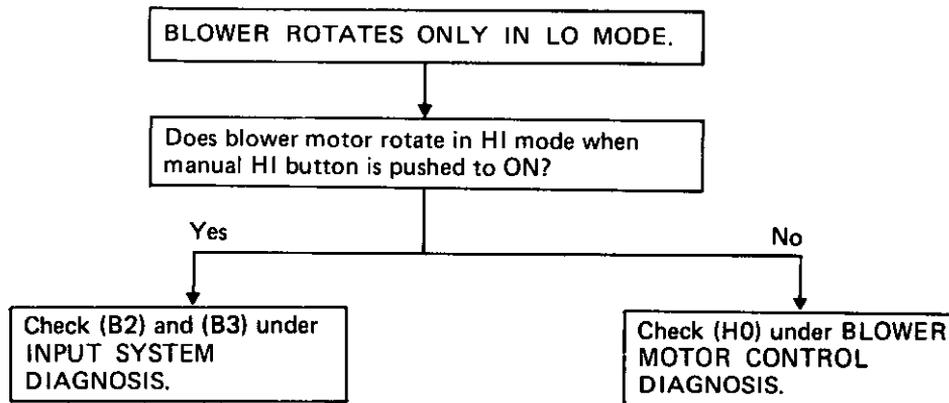
TROUBLE DIAGNOSES (Auto)



[CHECK POINTS]

- (1) Open or shorted sensor (Tu, Tdu, or Tdd)
- (2) Aspirator motor does not rotate and "Tu" value is close to "TA" value.

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

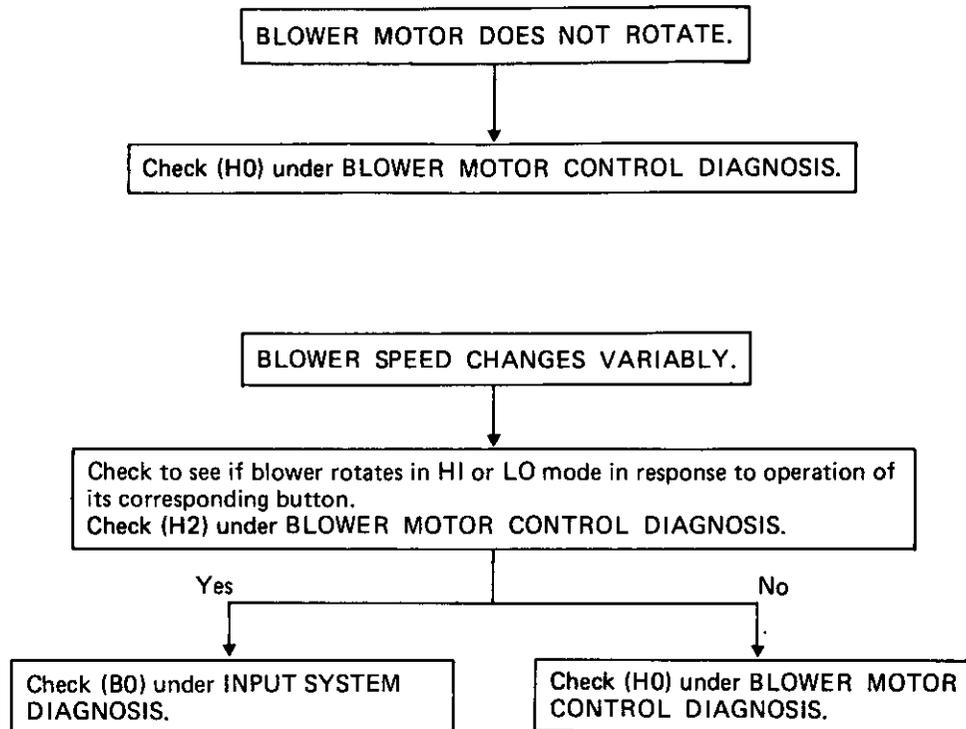


[CHECK POINTS]

Harnesses, connectors and sensors in relation to TL, Tu, TdL, Tdu, Tdd

TL: In-vehicle sensor (Foot)
Tu: In-vehicle sensor (Head)
TdL: Floor duct temp. sensor
Tdu: Vent duct temp. sensor
Tdd: Defroster nozzle temp. sensor

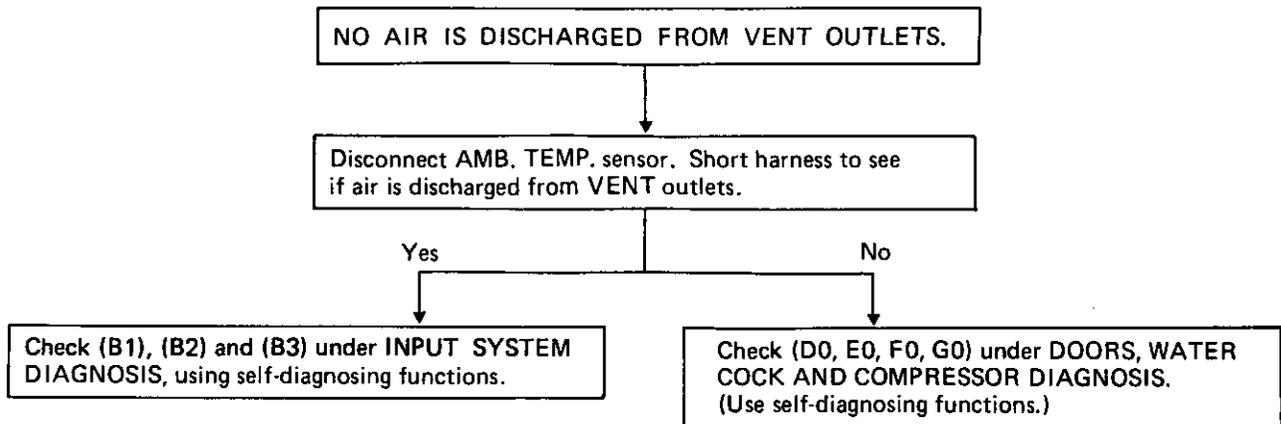
TROUBLE DIAGNOSES (Auto)



[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 (AM1), Potentio Balance Resistor (AM2).
- (2) Start-stop operation of aspirator motor and voltage measurements at sensors (Remove sensor assembly to gain access to sensors.)

TROUBLE DIAGNOSES (Auto)



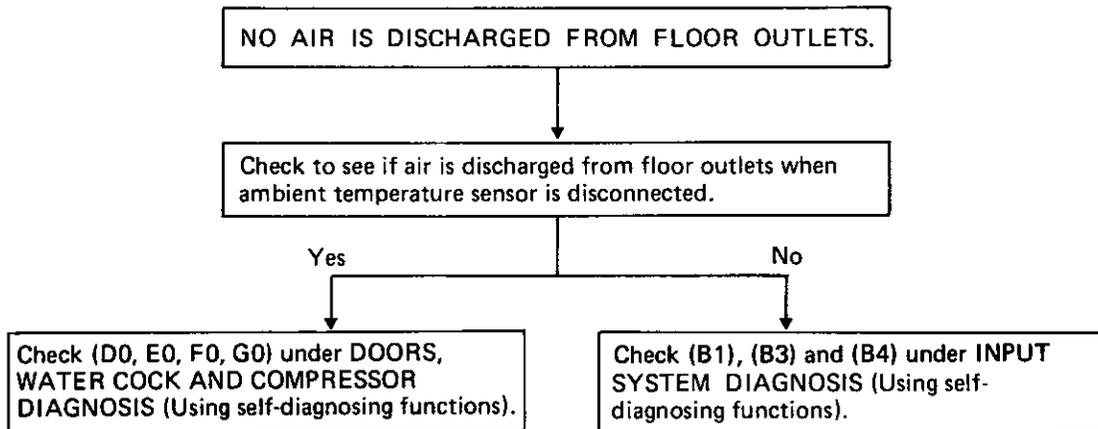
[CHECK POINTS]

(1) Open circuit in TA, TL, Tu and DL sensors.

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

[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.



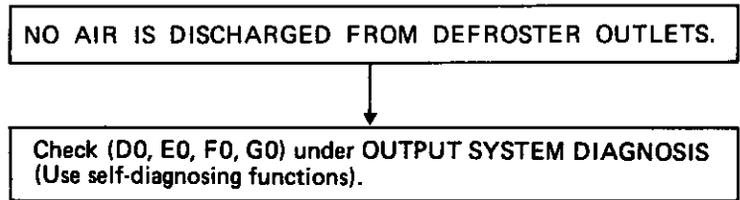
[CHECK POINTS]

Short circuit in ambient temp. sensor and unload sensor

[CHECK POINTS]

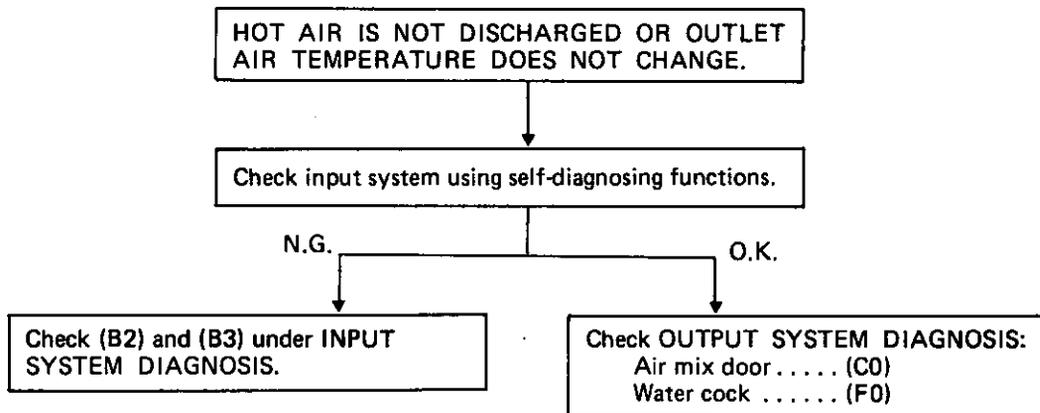
(1) Harness (line 886) and solenoid valve (7)
(2) Damage to hose between solenoid valve (7) and floor actuator Af, and condition of link system affected

TROUBLE DIAGNOSES (Auto)

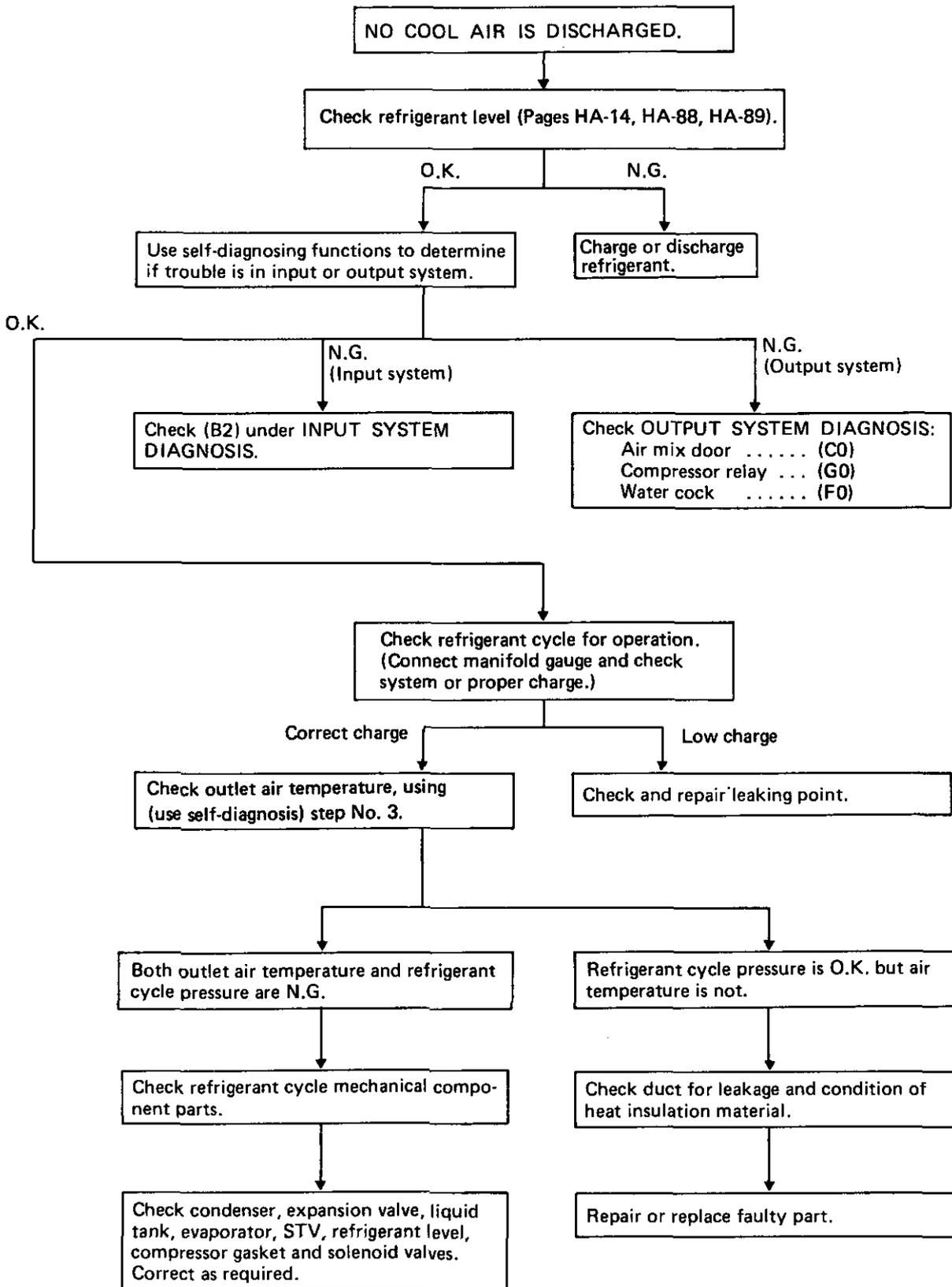


[CHECK POINTS]

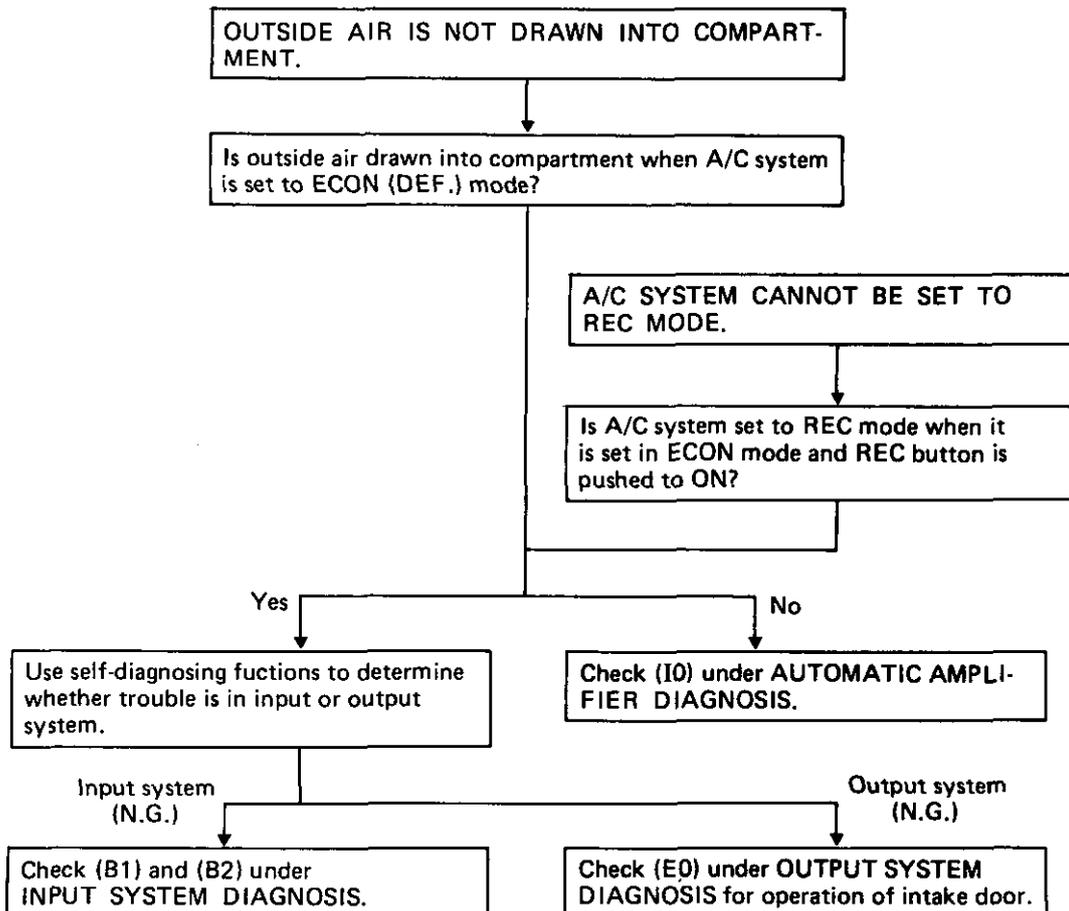
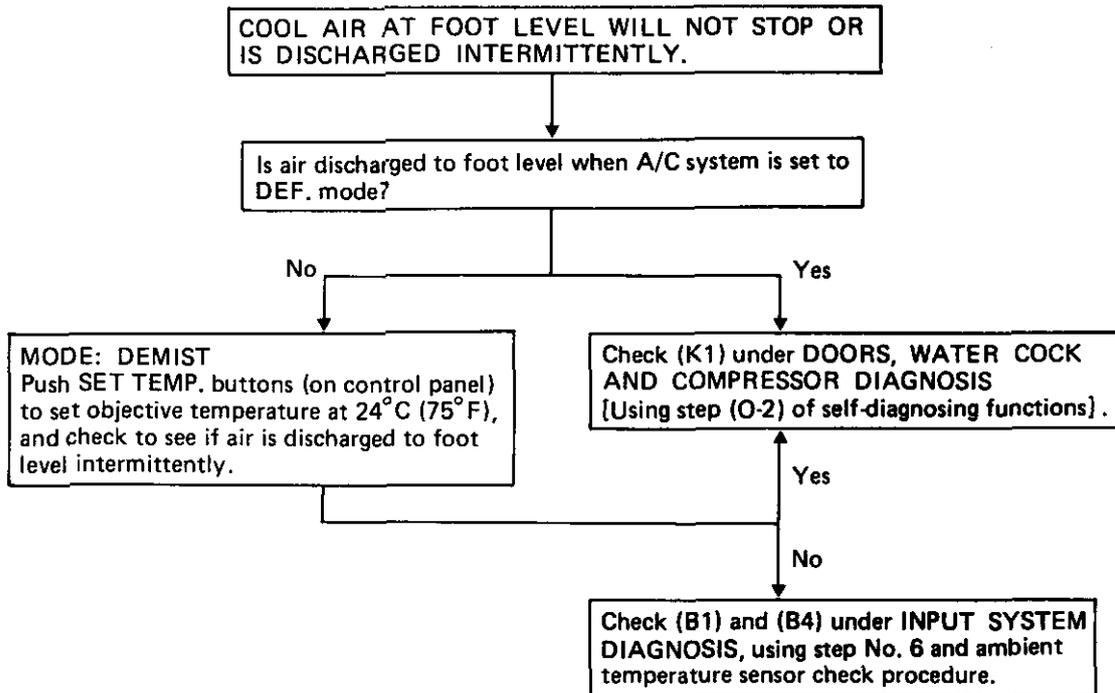
- (1) Harness (line 887) and solenoid valve 6
- (2) Damaged hose/link between solenoid valve 6 and actuator Ad (DEF. door Actuator)



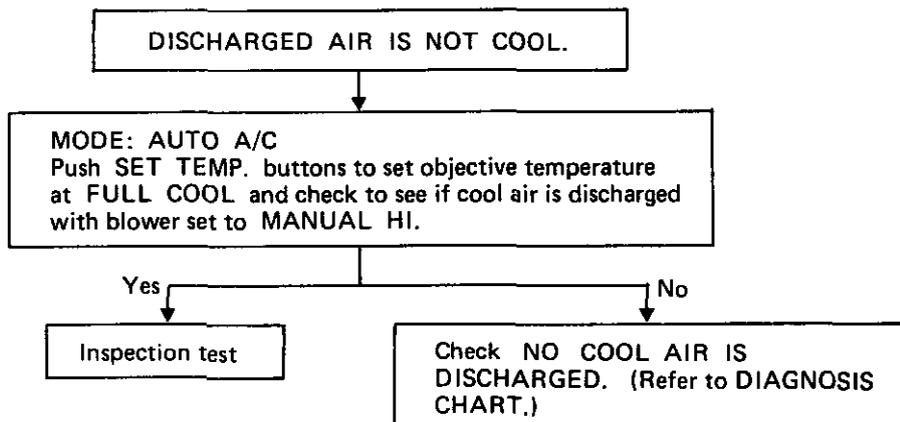
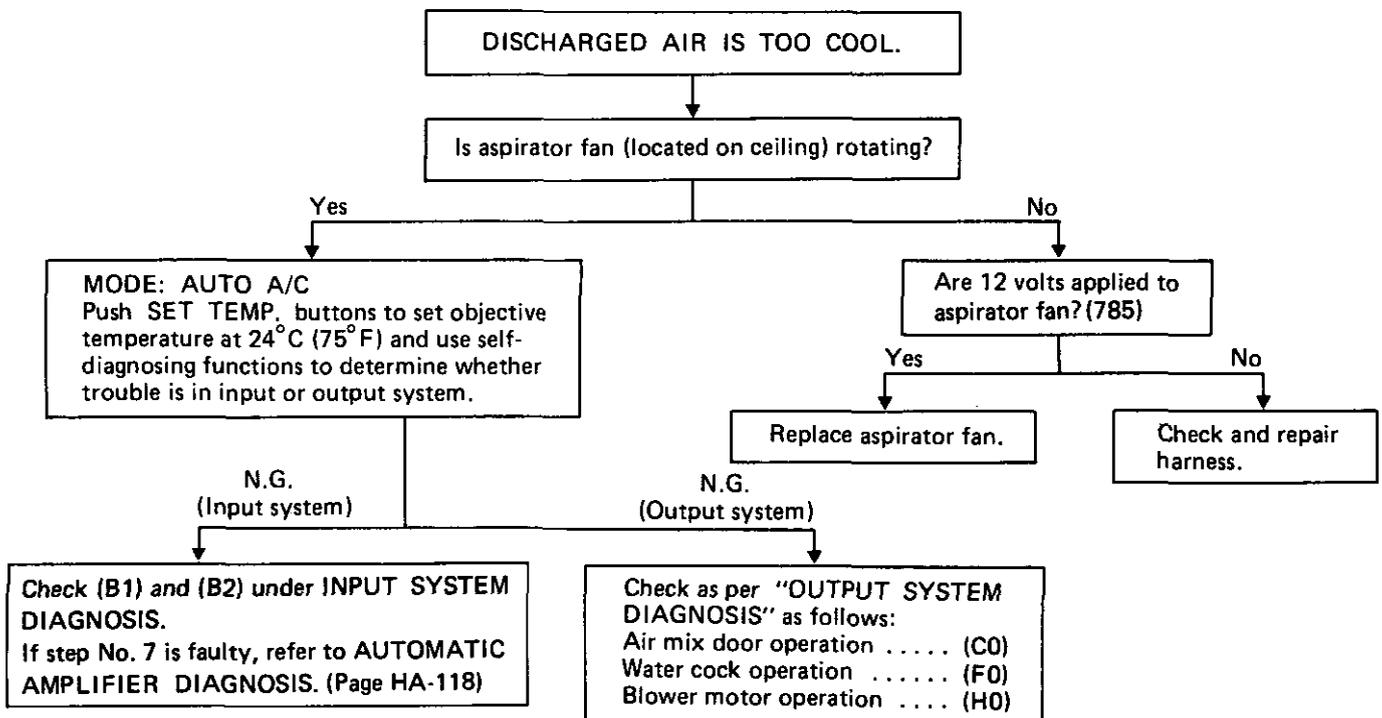
TROUBLE DIAGNOSES (Auto)



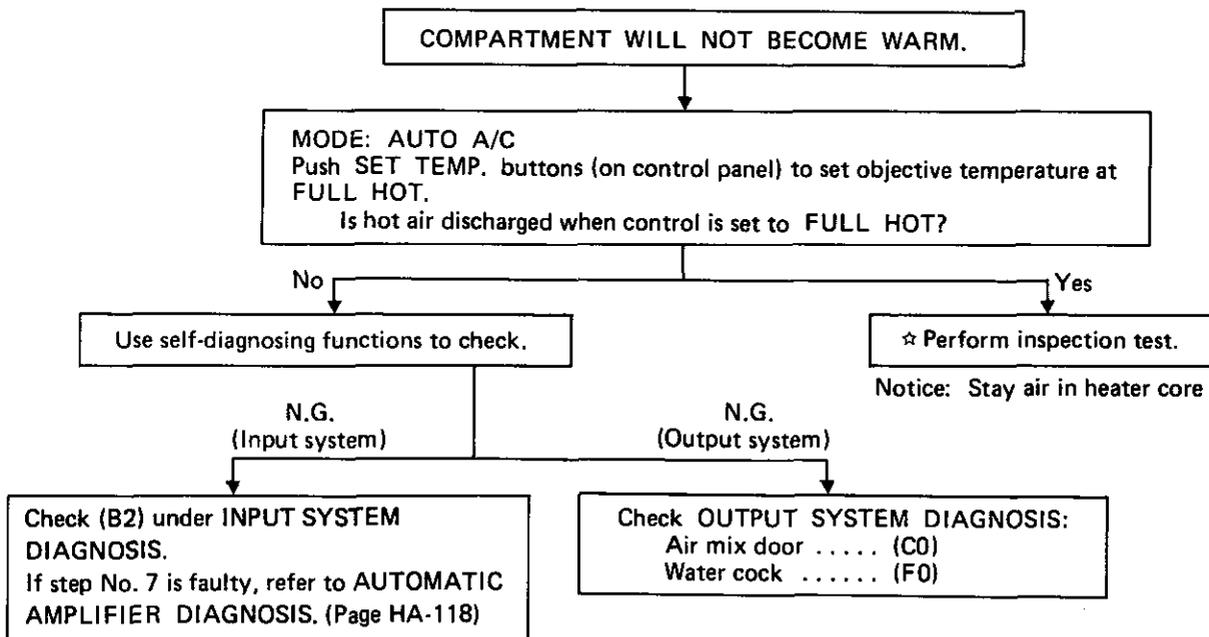
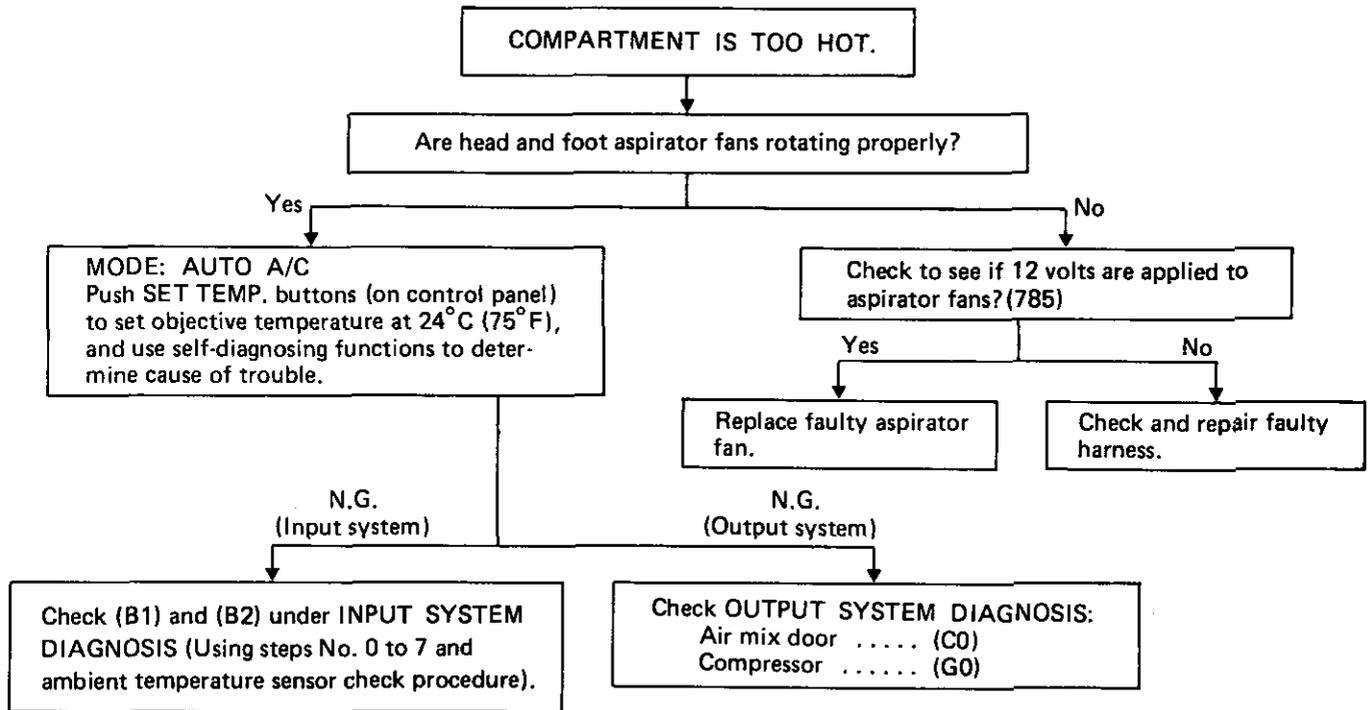
TROUBLE DIAGNOSES (Auto)



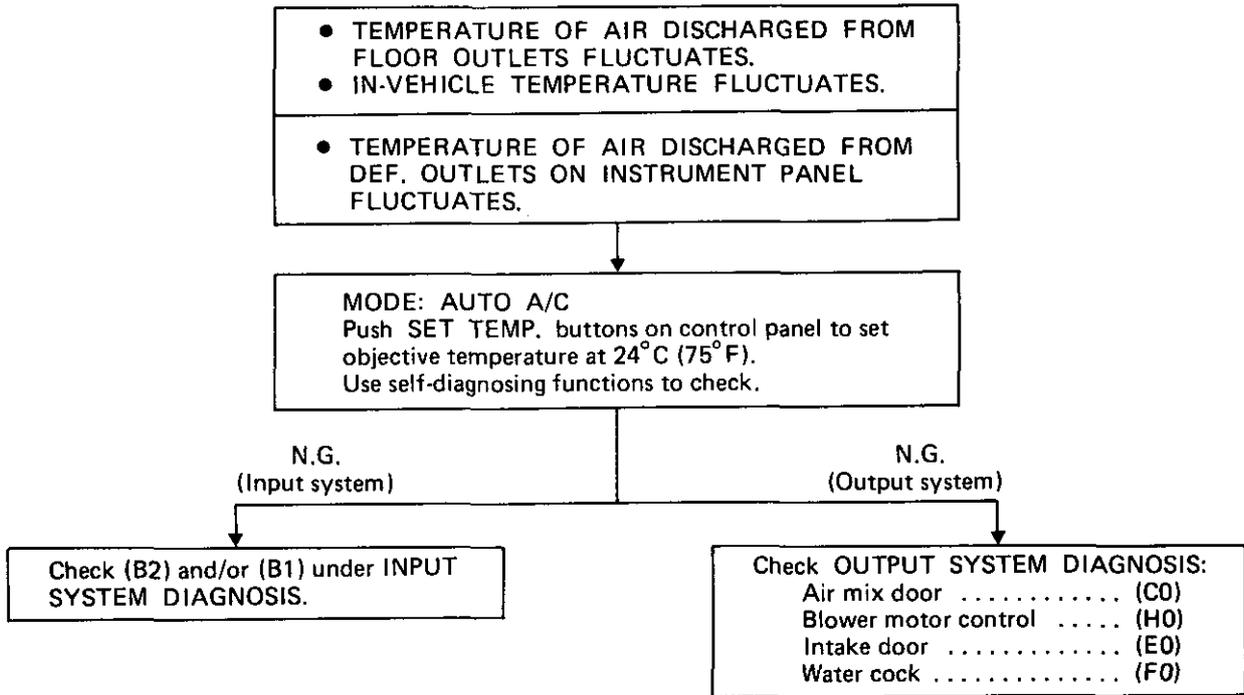
TROUBLE DIAGNOSES (Auto)



TROUBLE DIAGNOSES (Auto)



TROUBLE DIAGNOSES (Auto)



[CHECK POINTS]

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

If outlet discharged air temperature fluctuates (sometimes becomes warm), check continuity between terminals corresponding to each symptom using following table.

Terminal (harness line) No. See HA-104 & 105.	Portions to be inspected		Outlet from which discharged air temperature is fluctuating			Remarks
	Connector No. See HA-105.	Circuit connection	VENT	FLOOR	DEF.	
864 (L/W)	① ⑤ ⑦	AMBIENT TEMP. SENSOR		⊙	⊙	Refer to step (B1) Page HA-108.
857 (BR/Y)	⑤ ⑦ ⑩	IN-VEHICLE SENSOR (FOOT)		⊙		Refer to step (B2) Page HA-108.
863 (BR/W)	① ⑤ ⑧	IN-VEHICLE SENSOR (HEAD)	⊙		○	
858 (Y/W)	⑤ ⑦ ⑨ ⑪	FLOOR DUCT TEMP. SENSOR		⊙		
860 (Y/R)	⑤ ⑦ ⑨ ⑩	VENT DUCT TEMP. SENSOR	⊙			
859 (Y/B)	⑤ ⑦ ⑰	DEFROSTER DUCT TEMP. SENSOR			⊙	
868 (B/W)	⑤ ⑦ ⑨	P, B, R, 1 & 2	⊙	⊙	○	—
882 (W/R)	⑥ ⑧ ⑨	S/V 4		⊙		For air mix door 2
883 (W/Y)	⑥ ⑧ ⑨	S/V 5		⊙		
884 (W/B)	⑥ ⑧ ⑨	S/V 8	⊙		○	For air mix door 1
885 (W/L)	⑥ ⑧ ⑨	S/V 9	⊙		○	
567 (Y/L)	② ⑥ ⑧	COMPRESSOR RELAY	⊙	⊙		—

- This table indicates the portions to be inspected for each type of symptom. It is necessary for each symptom to check circuit connections marked "⊙" or "○".
- Prior to portions marked "○", check portions marked "⊙".

SERVICE DATA AND SPECIFICATIONS (S.D.S.)

General Specifications

Inspection and Adjustment

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 (1.575 x 0.890)
Direction of rotation	Clockwise (viewed from drive end)
Type of driving belt	Poly V

LUBRICATING OIL

Model	MJS170
Type	SUNISO 5GS
Capacity mℓ (US fl oz, Imp fl oz)	
Amount of oil in the system	150 (5.1, 5.3)
Residual oil level in the system (After oil return operation and draining oil)	120 (4.1, 4.2)

REFRIGERANT

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

ENGINE IDLING SPEED

Transmission		Non-turbocharged model	Turbocharged model
When A/C is OFF			
Refer to MA section.			
When A/C is ON			
M/T	rpm	750 - 850	750 - 850
A/T	rpm	750 - 850 at "D" range	750 - 850 at "D" range

COMPRESSOR

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

SERVICE DATA AND SPECIFICATIONS (S.D.S.)

Tightening Torque

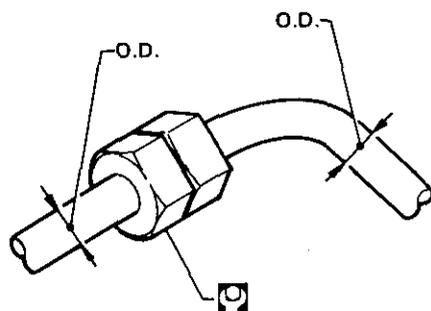
COMPRESSOR INSTALLATION

	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.

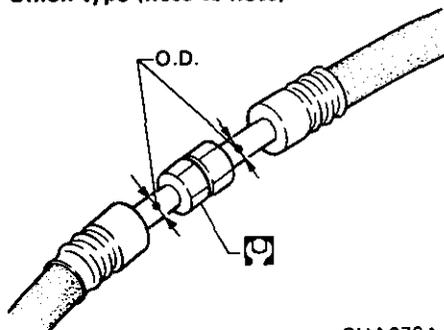
Union type (pipe to pipe)



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)



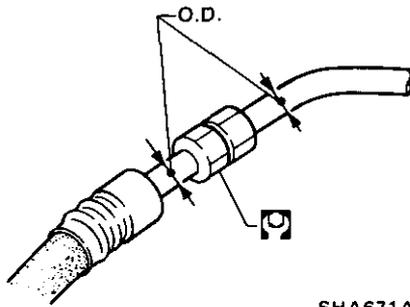
SHA670A

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

SERVICE DATA AND SPECIFICATIONS (S.D.S.)

Tightening Torque (Cont'd)

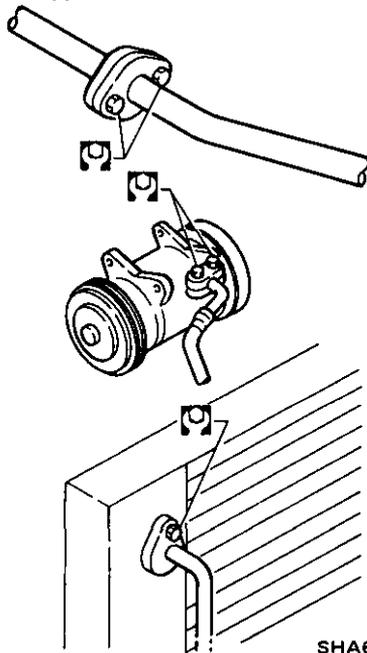
Union type (hose to pipe)



SHA671A

- Use tightening torque for flexible hose.

Plate type

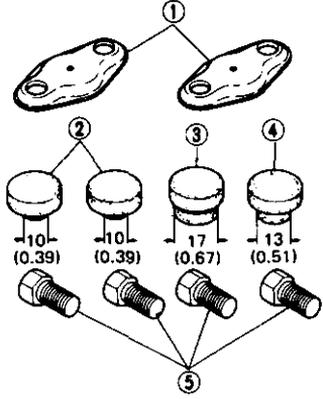
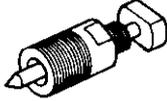
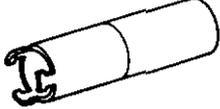
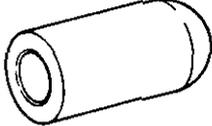
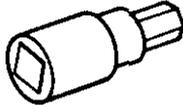
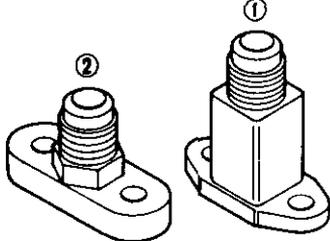


SHA672A

Grade	Nominal size	Bolt type		Tightening torque		
		Bolt diameter mm	Pitch mm	N·m	kg·m	ft·lb
	M6	6.0	1.0	3 - 4	0.3 - 0.4	2.2 - 2.9
4T	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

In case of 7T Bolt has been installed in vehicle,
Tightening torque is as same as 4T bolt.

SPECIAL SERVICE TOOLS

Tool number (Kent-Moore No.) Tool name	Tool	Tool number (Kent-Moore No.) Tool name	Tool
KV99412302 (J24878-1) Clutch hub wrench		KV994C4548 (J33902) Blind cover set ① KV994C4531 (-) Blind cover ② KV994C4532 (-) Gasket ③ KV994C4533 (-) Gasket (Useless) ④ KV994C4534 (-) Gasket (Useless) ⑤ KV994C4559 (-) Bolt	 <p>Unit: mm (in)</p>
KV994C5780 (J28831-A) Clutch hub puller			
KV994C1143 (J9392-01) Shaft seal remover and installer			
KV994C5784 (J33212) 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	