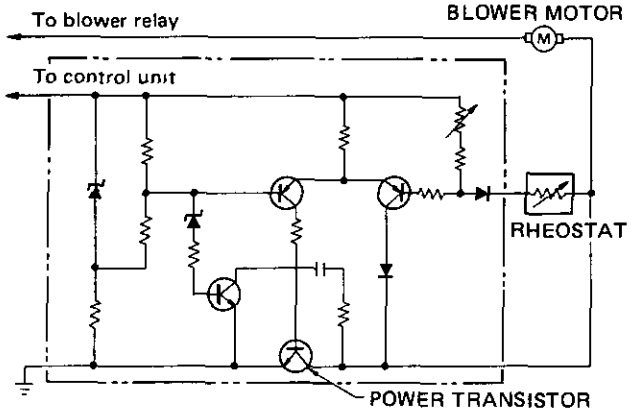
HEATER & AIR CONDITIONER

SECTION HA

CONTENTS

Continuously Variable Air Flow Control

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

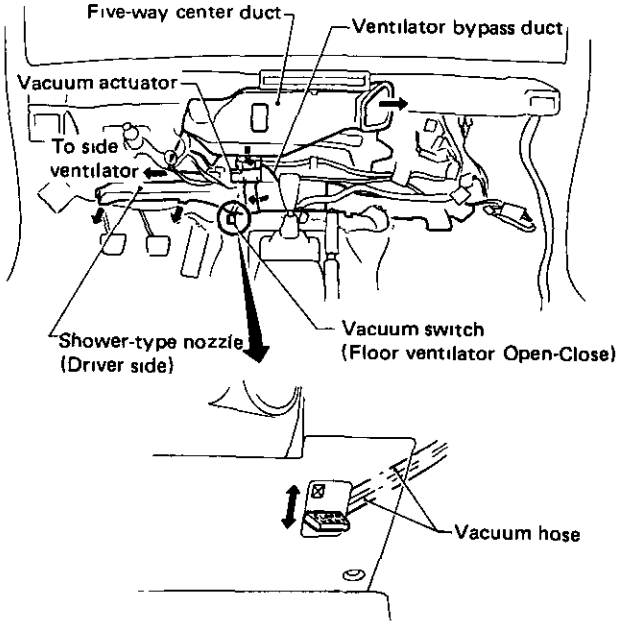


FAN CONTROL AMPLIFIER

SHA255B

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

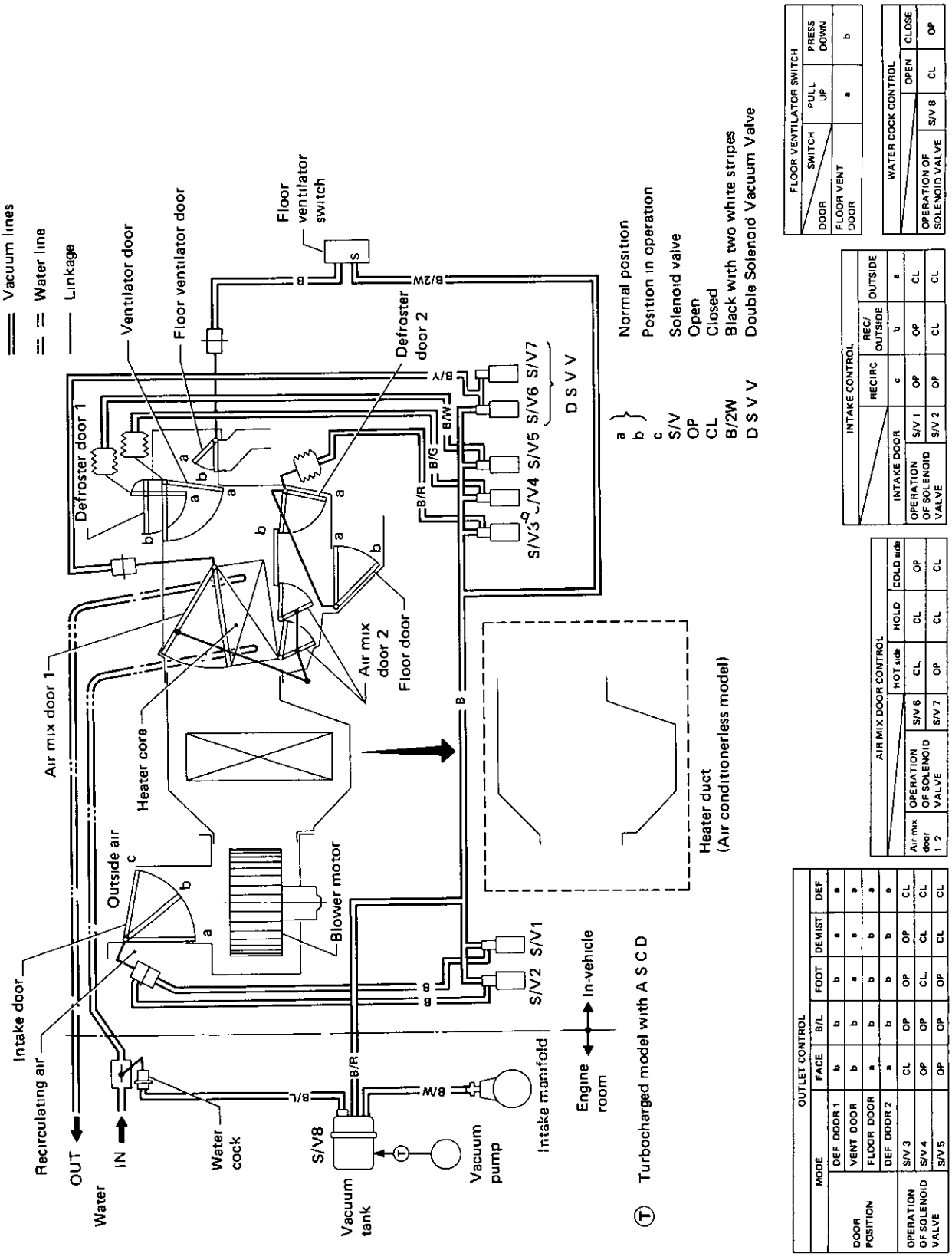
A vacuum actuator is used in the cool-air distribution device to remove the hot air directed to the floor area and distribute the optimum air temperature to the driver's compartment. When the vacuum switch is turned "ON", part of the outside air (or part of the cool air on models equipped with air conditioning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



SHA230B

AIR FLOW AND COMPONENT LAYOUT (Manual)

Air Flow



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

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

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

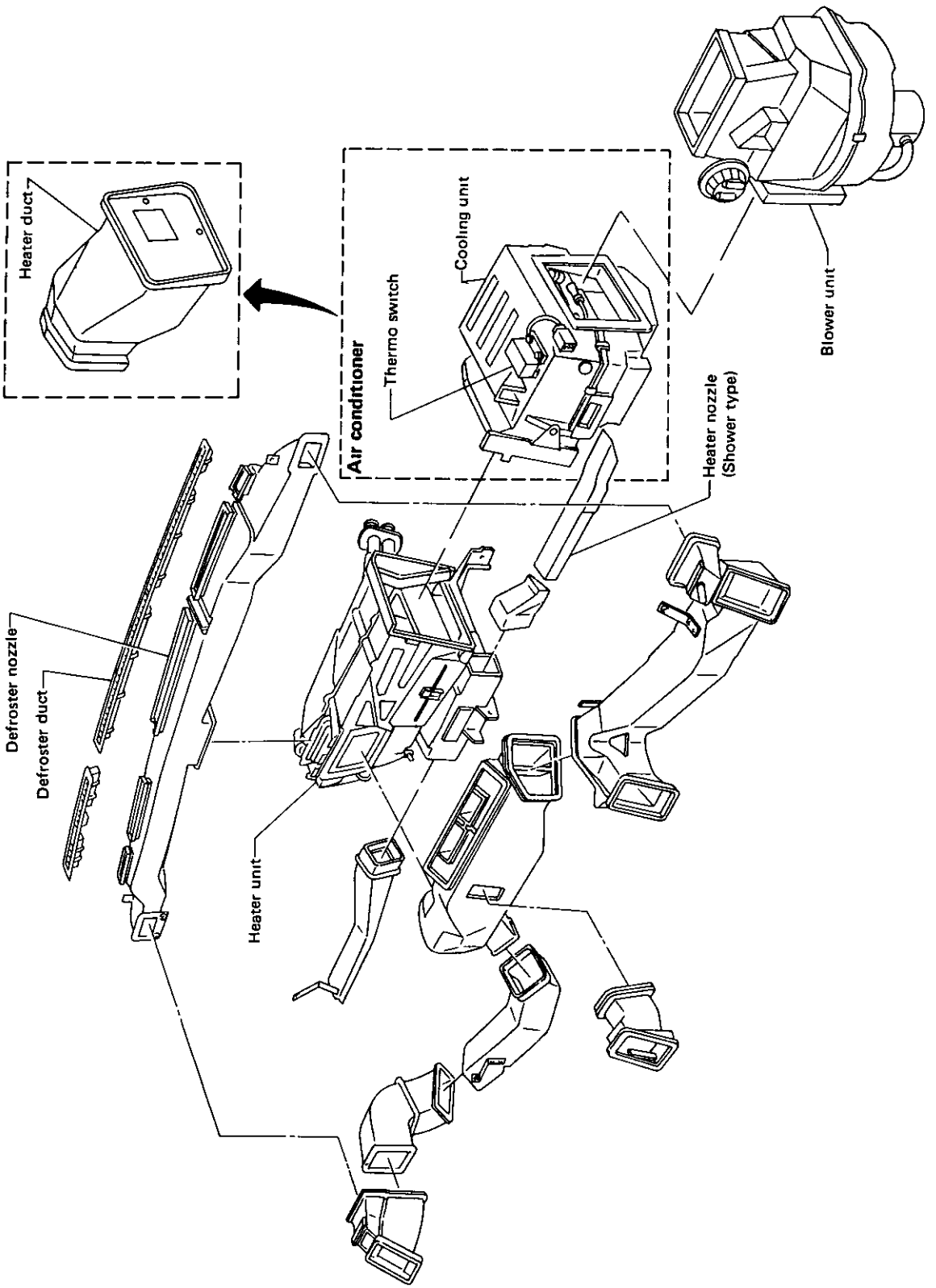
FLOOR VENTILATOR SWITCH			
DOOR	SWITCH	PULL UP	PRESS DOWN
FLOOR VENT DOOR		a	b

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

SHA231B

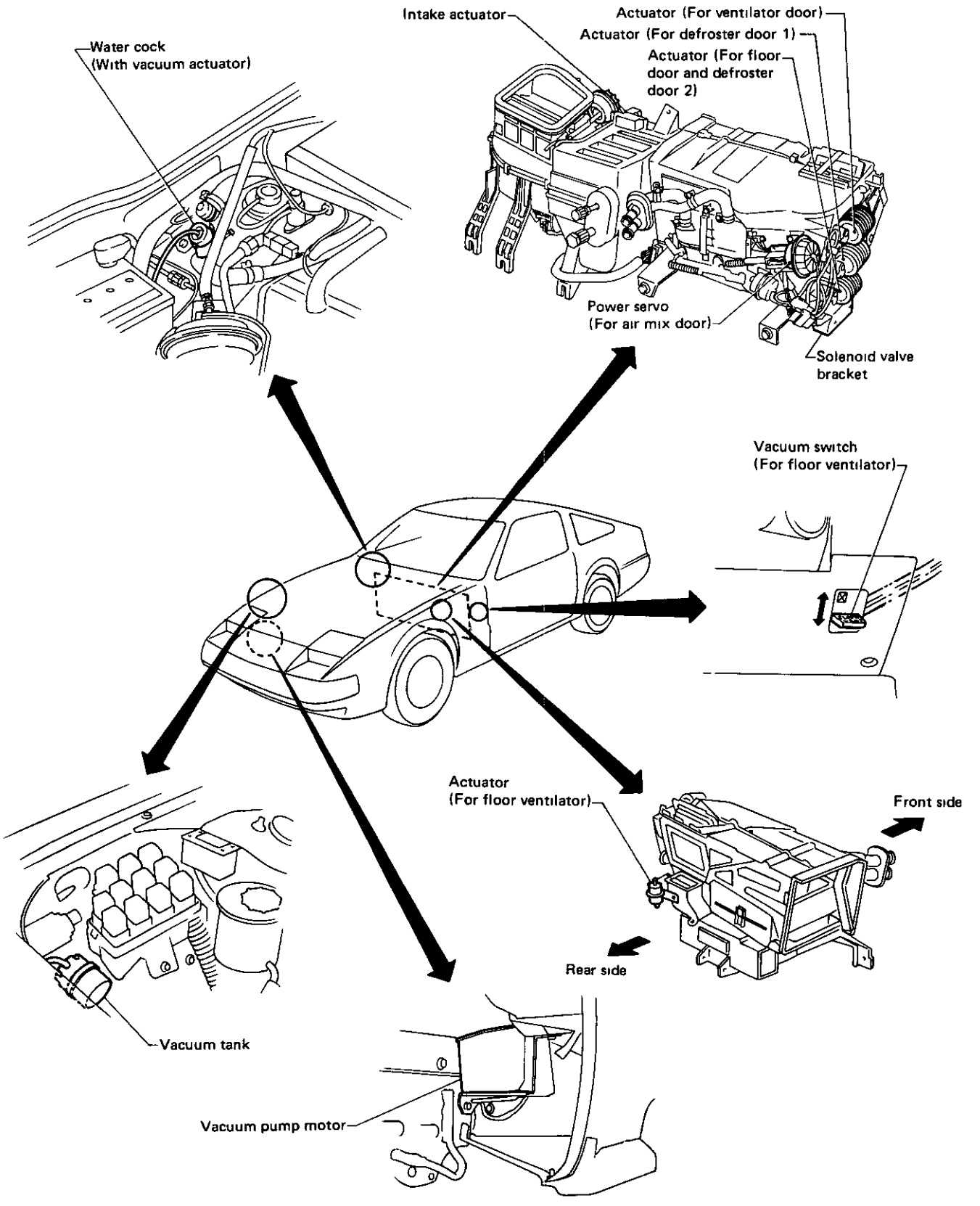
AIR FLOW AND COMPONENT LAYOUT (Manual)

Component Layout



SHA790B

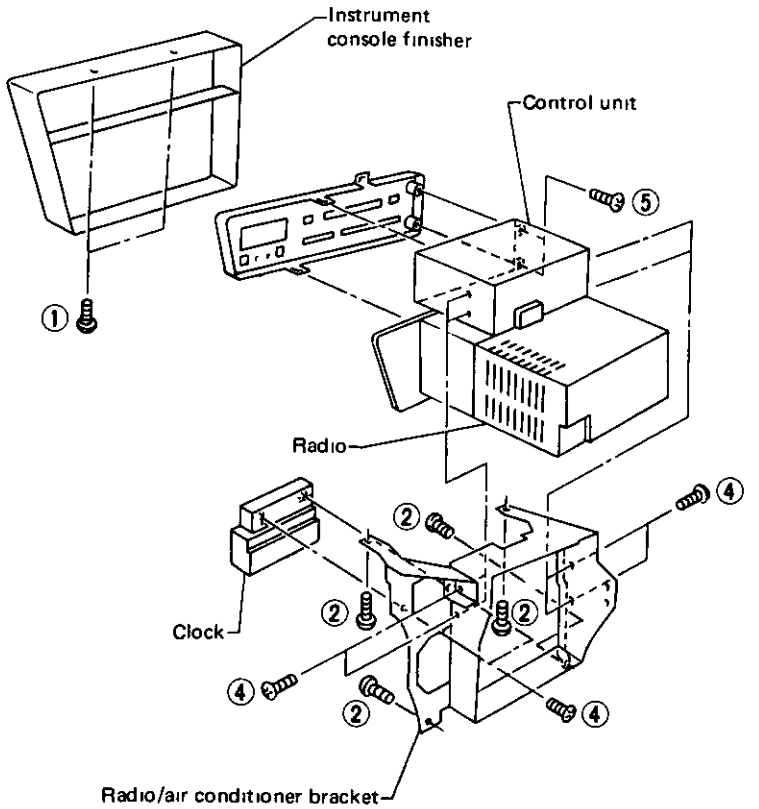
LOCATION OF VACUUM COMPONENTS



Heater and Air Conditioner Control Removal

PROCEDURES

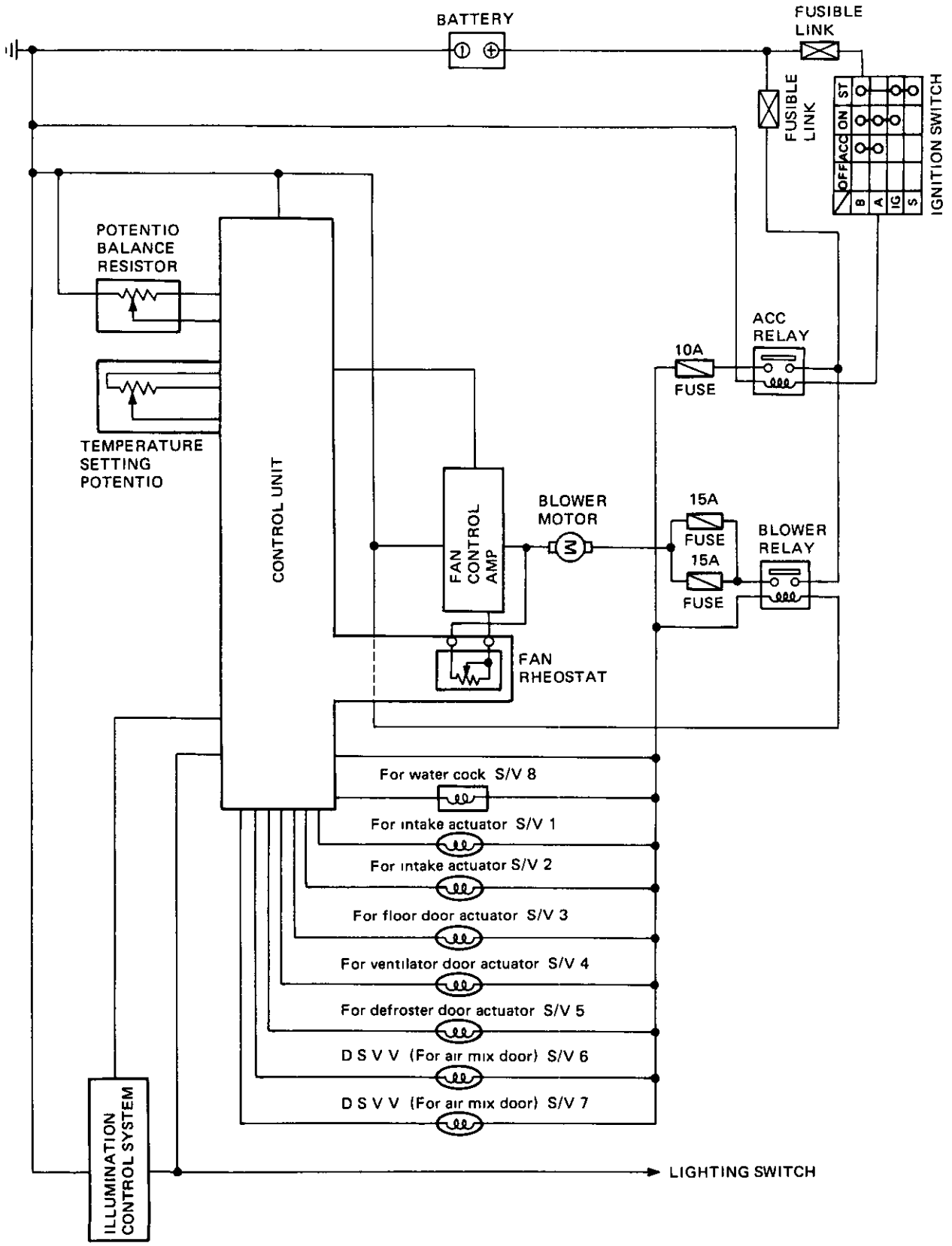
Remove each screw in the number order shown in the following illustration.



SHA234B

HEATER ELECTRICAL CIRCUIT

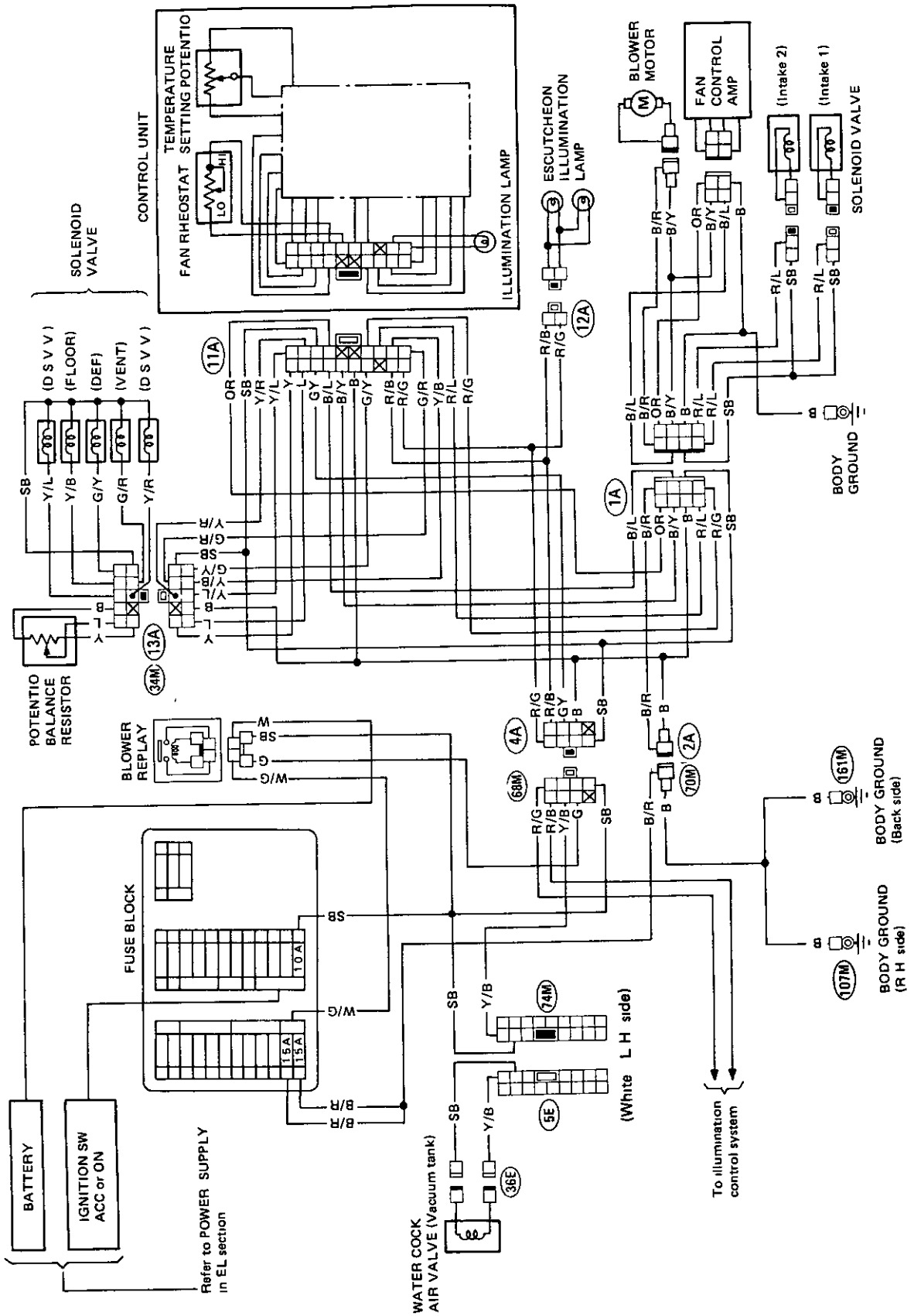
Schematic



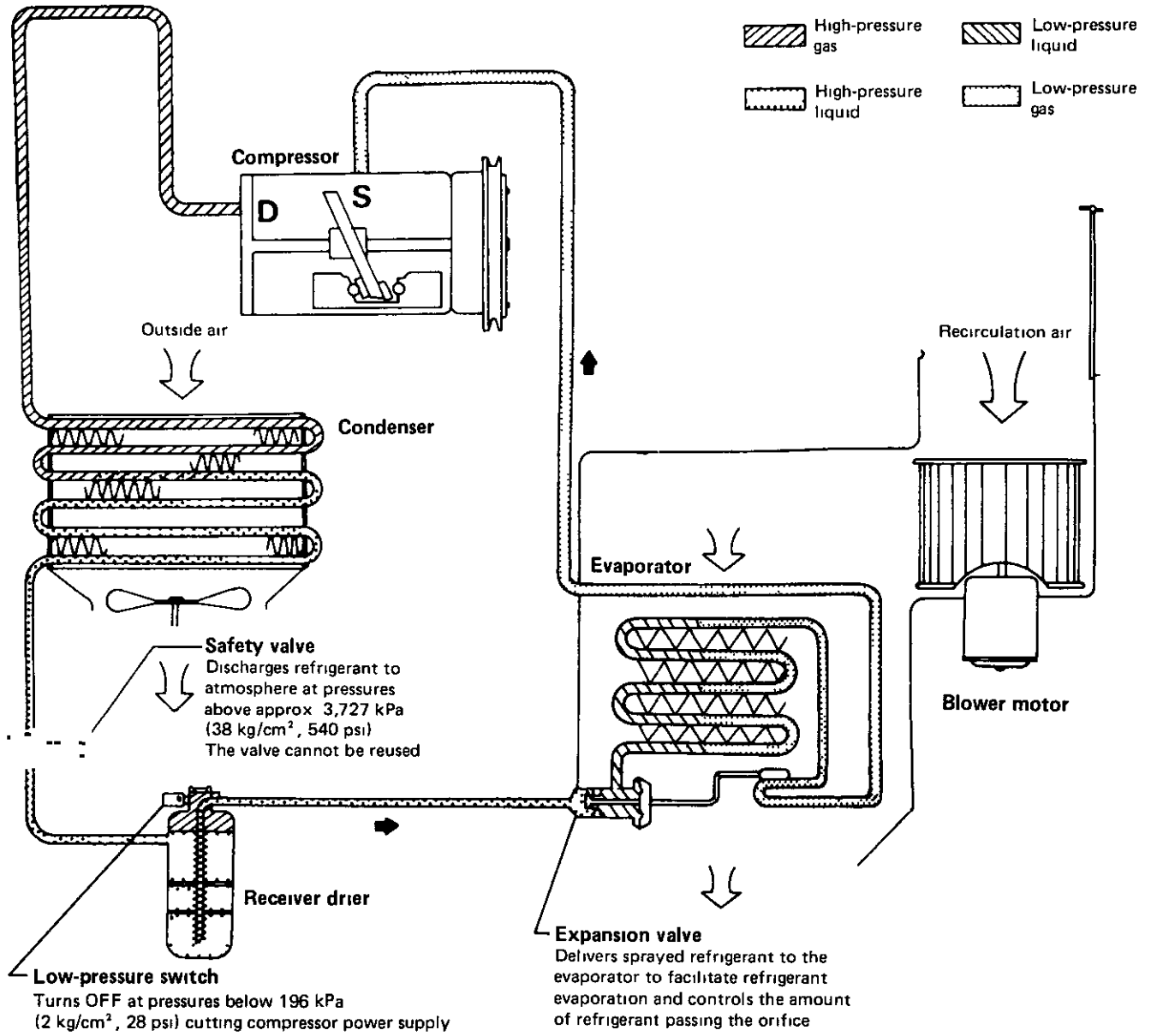
SHA417B

HEATER ELECTRICAL CIRCUIT

Wiring Diagram



Refrigeration Cycle

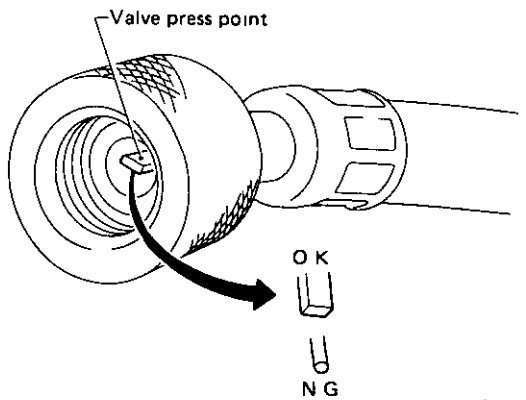


SHA606B

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

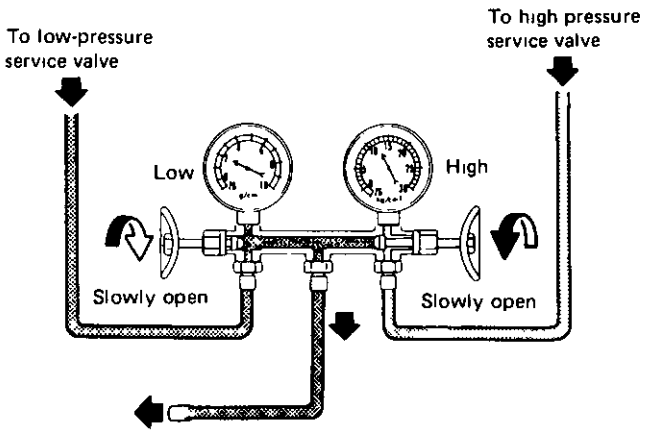


SHA919A

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

Discharging

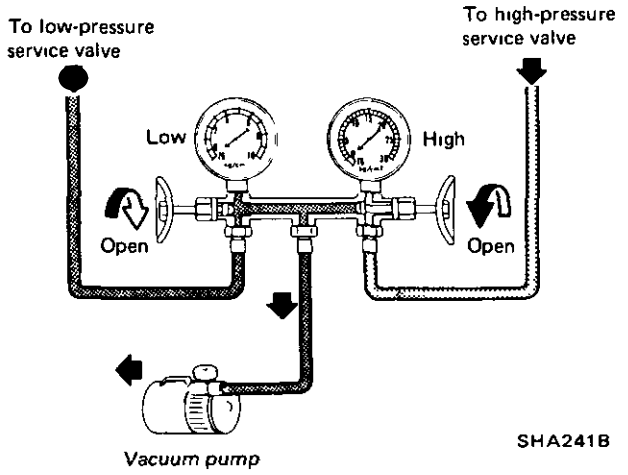
Slowly open the valves to discharge only refrigerant If they are opened quickly, compressor oil will also be discharged



SHA240B

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

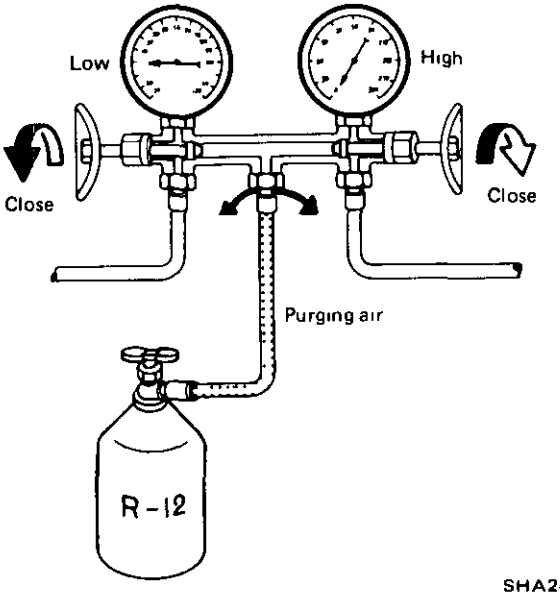
Refer to "Evacuating the System-Step One".

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

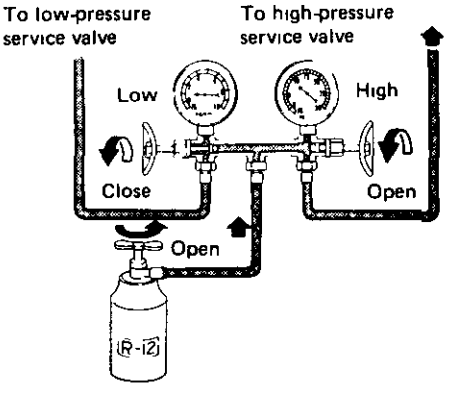


4 Charge refrigerant into system

WARNING:

Ensure that engine is off.

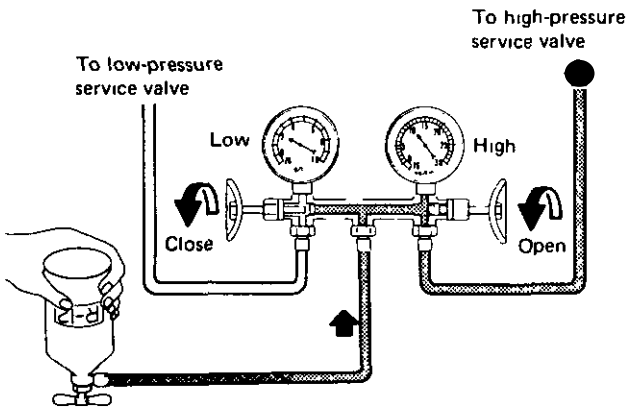
1) Open high-pressure valve of manifold gauge and charge refrigerant into system.



Charging—Step one (Cont'd)

CAUTION:

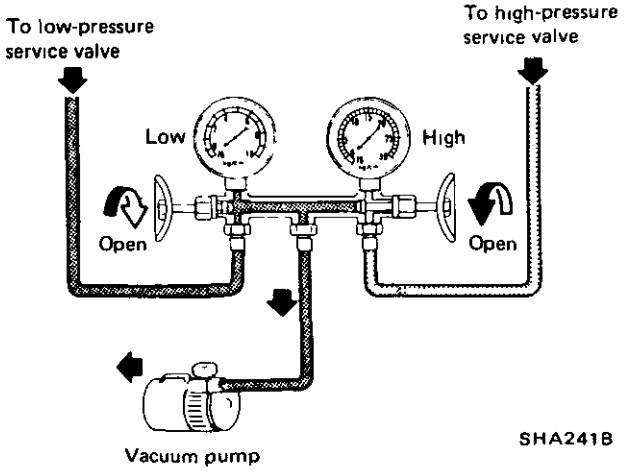
If charging liquefied refrigerant into the system with the can turned upside down to reduce charging time, charge refrigerant only through high-pressure (discharge) service valve. After charging, the compressor should always be turned several times manually.



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

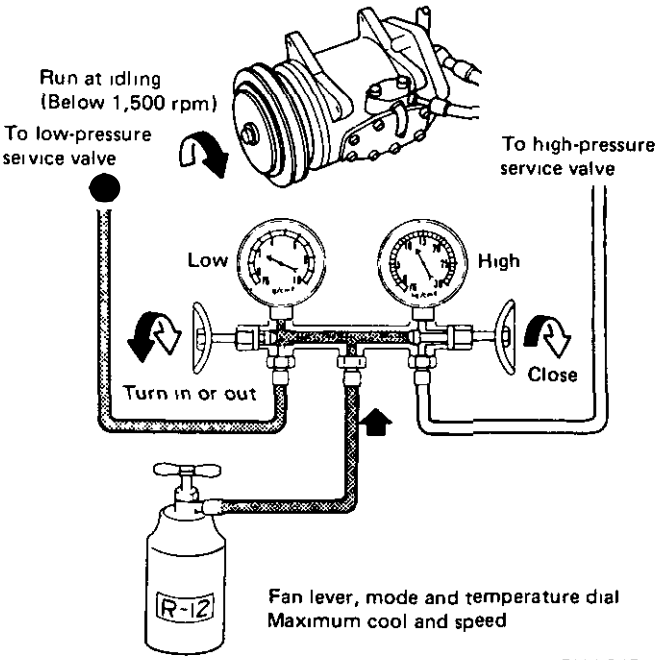
1 Close manifold gauge valve securely and disconnect charging hose from refrigerant can
2 Connect center charging hose to vacuum pump
3. Start pump, then open both valves and run pump for about 20 minutes



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



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.

Charging—Step two (Cont'd)

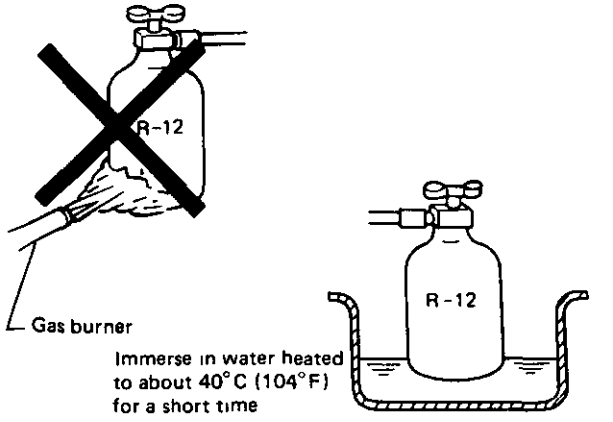
6 Charge refrigerant while controlling low-pressure gauge reading at 275 kPa (2 8 kg/cm², 40 psi) or less by turning in or out low-pressure valve of manifold gauge

- **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).

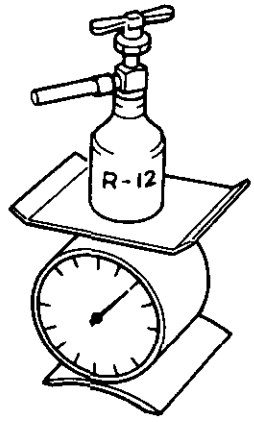
WARNING:
Do not heat can directly. There is danger of it exploding.



RHA556

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)



RHA504

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.

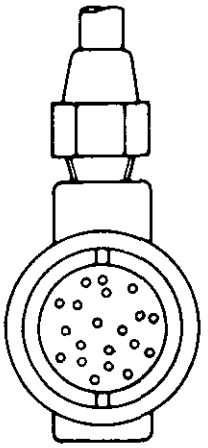
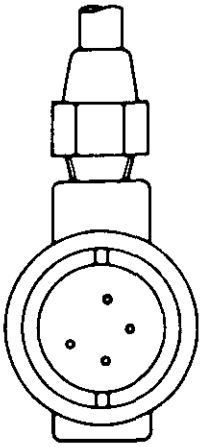
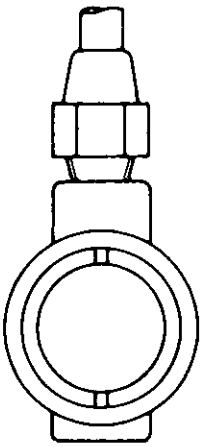
***Overcharging will result in increased high pressures,* and reduced performance**

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

Check item \ Amount of refrigerant	Almost no refrigerant	Insufficient	Suitable	Too much refrigerant
Temperature of high pressure and low pressure lines	Almost no difference between high pressure and low pressure side temperature	High pressure side is warm and low pressure side is fairly cold	High pressure side is hot and low pressure side is cold	High pressure side is ab normally hot
State in sight glass	Bubbles flow continu ously **Bubbles will disappear and something like mist will flow when refrigerant is nearly gone**  AC256	The bubbles are seen at intervals of 1 2 seconds  AC257	Almost transparent Bubbles may appear when engine speed is raised and lowered **No clear difference exists between these two conditions**  AC258	No bubbles can be seen
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**

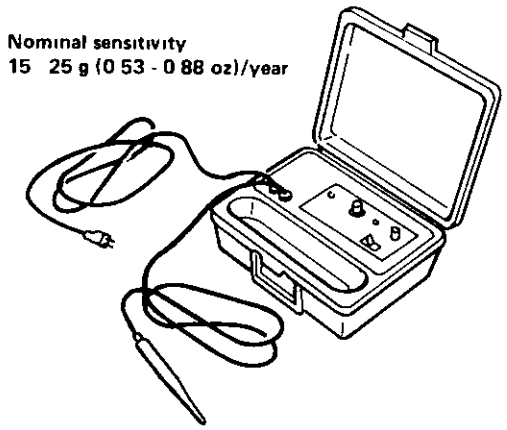
b. **When the screen in the receiver drier is clogged, the bubbles will appear even if the amount of refrigerant is normal In this case, the outlet side pipe of the receiver drier becomes considerably cold**

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



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

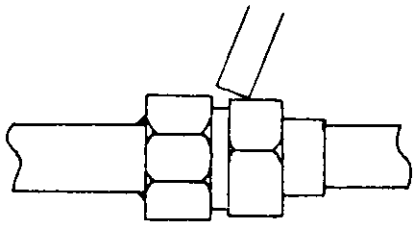
WARNING:

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

NOTICE·

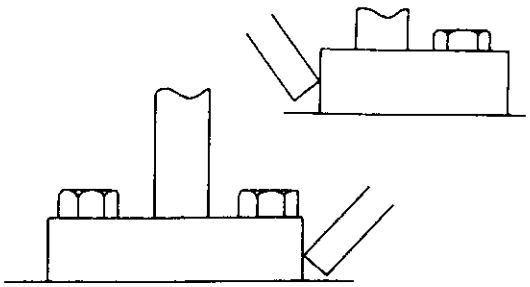
When fixing single bolt flange, place the probe on opposite side of the fitting

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)

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.

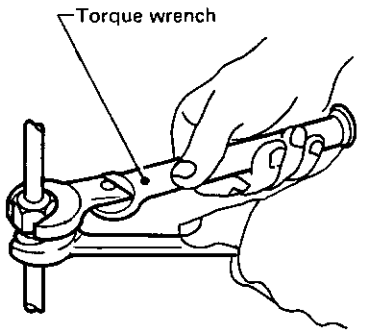
PRECAUTIONS FOR REFRIGERANT CONNECTION

WARNING:

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

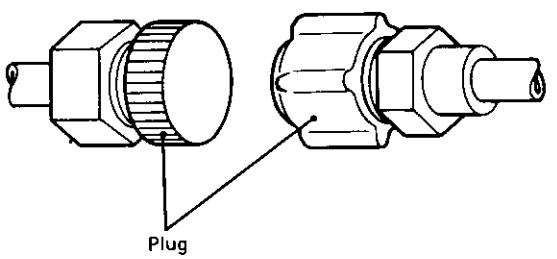
When replacing or cleaning refrigerant cycle components, observe the following

- 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



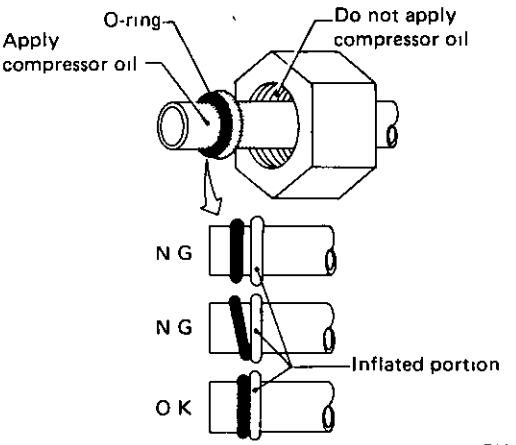
SHA896A

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



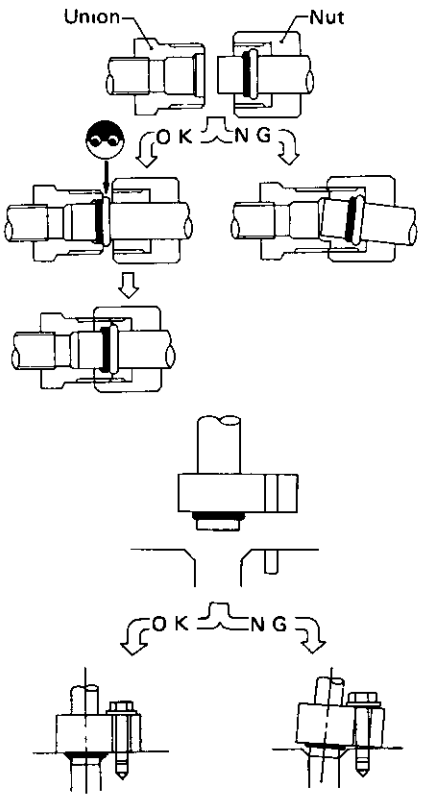
SHA058

- 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

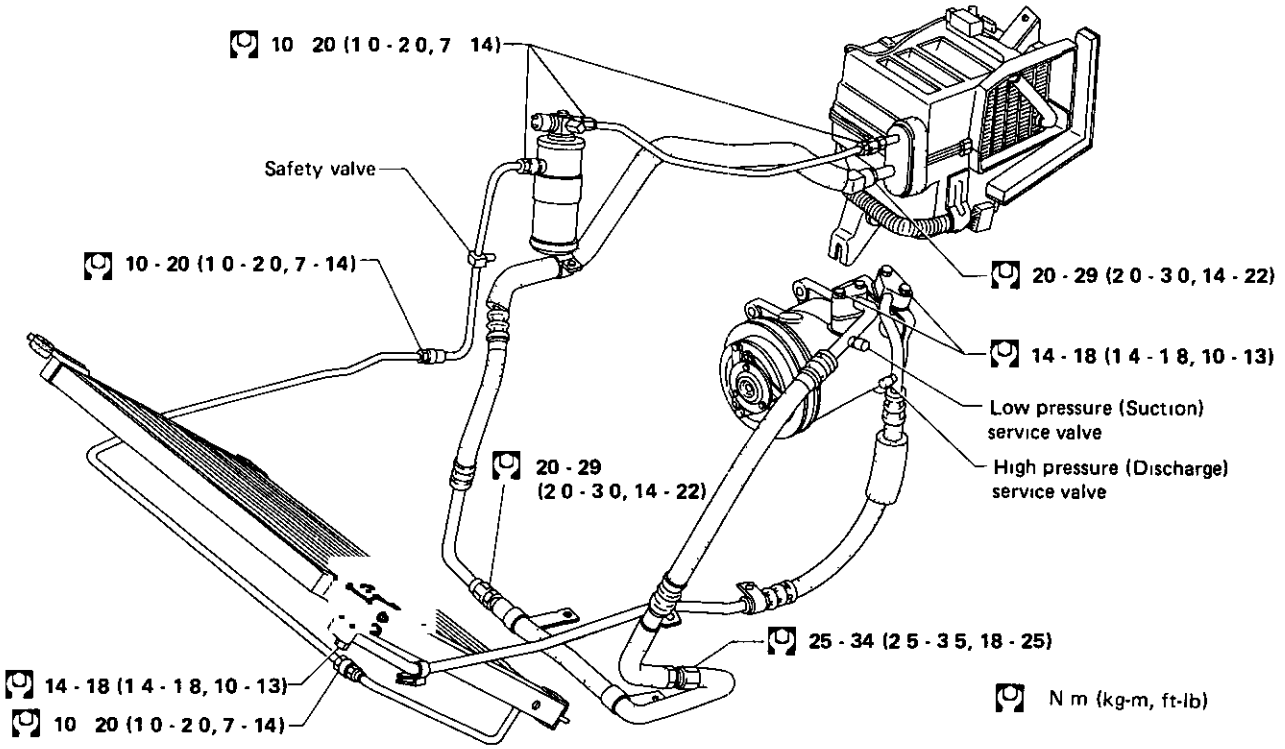


SHA898A

- 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

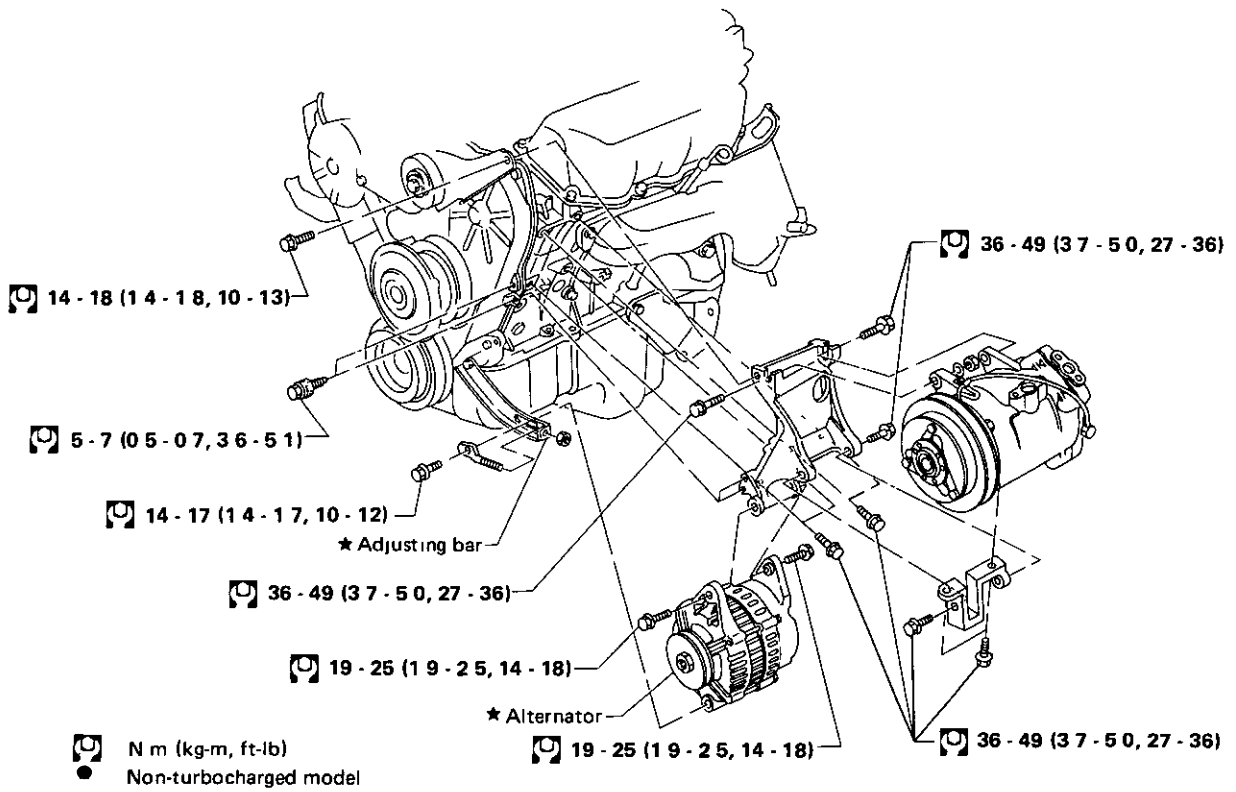
PIPING, COMPRESSOR MOUNTING AND F.I.C.D.

Refrigerant Lines



SHA246B

Compressor Mounting



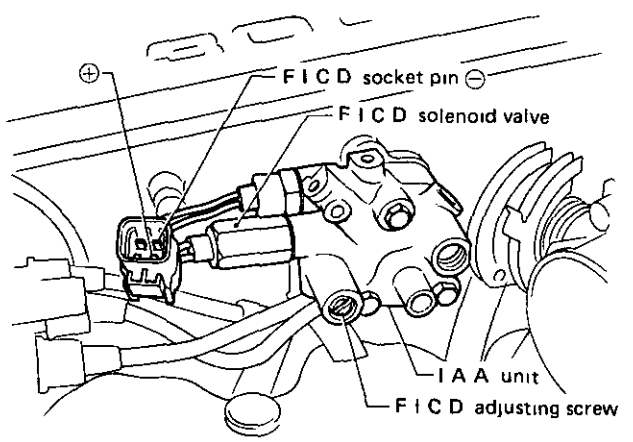
SHA247B

Idle Speed Adjusting and Checking

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

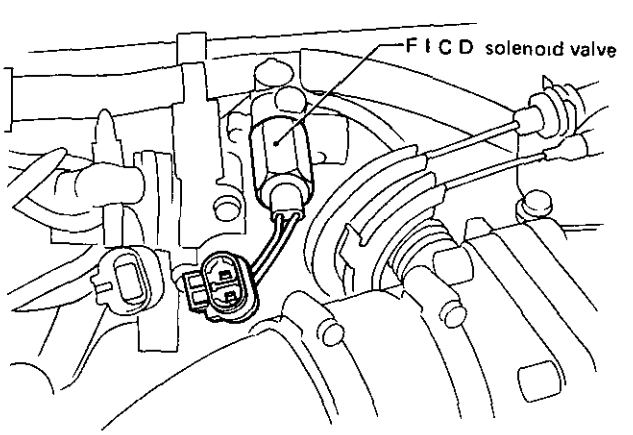
1 Run engine until it reaches operating temperature.
2. With air conditioning system OFF (when compressor is not operating), make sure that engine is at correct idle speed
3 With air conditioning system ON (Recirculation switch at "RECIRC" position, fan control lever at "HI" position), make sure that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

Non-turbocharged model



SHA223B

Turbocharged model



SHA248B

ENGINE IDLING SPEED

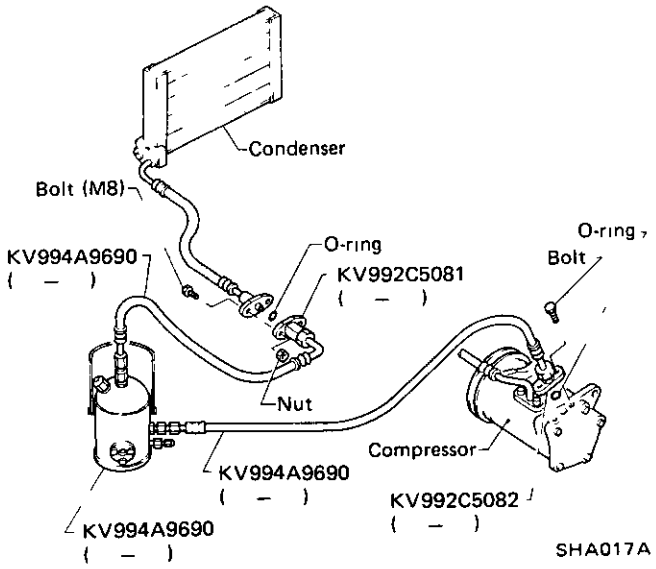
Transmission			Non-turbocharged model	Turbocharged *model*
When A/C is OFF			Refer to MA section	
When A/C is ON	M/T	rpm	750 - 850	750 - 850
	A/T	rpm	750 - 850 at "N" range	750 - 850 at "N" range

COMPRESSOR OIL—For MJS170

Checking and Adjusting

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

Total amount of oil in the system:
150 mℓ (5 1 US fl oz, 5.3 Imp fl oz)



SHA017A

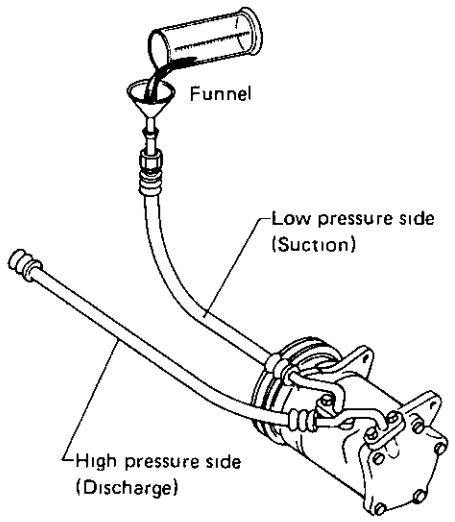
1 Connect oil separator KV994A9690 between compressor discharge side and condenser
2 Evacuate and charge the system
3 Operate compressor at engine idling with air conditioner set for maximum cooling and high fan speed
4 Stop compressor operation after 10 minutes

Never allow engine speed to exceed idling speed.

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

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

Amount of oil to be added:
120 mℓ (4.1 US fl oz, 4.2 Imp fl oz)



SHA702

- **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)

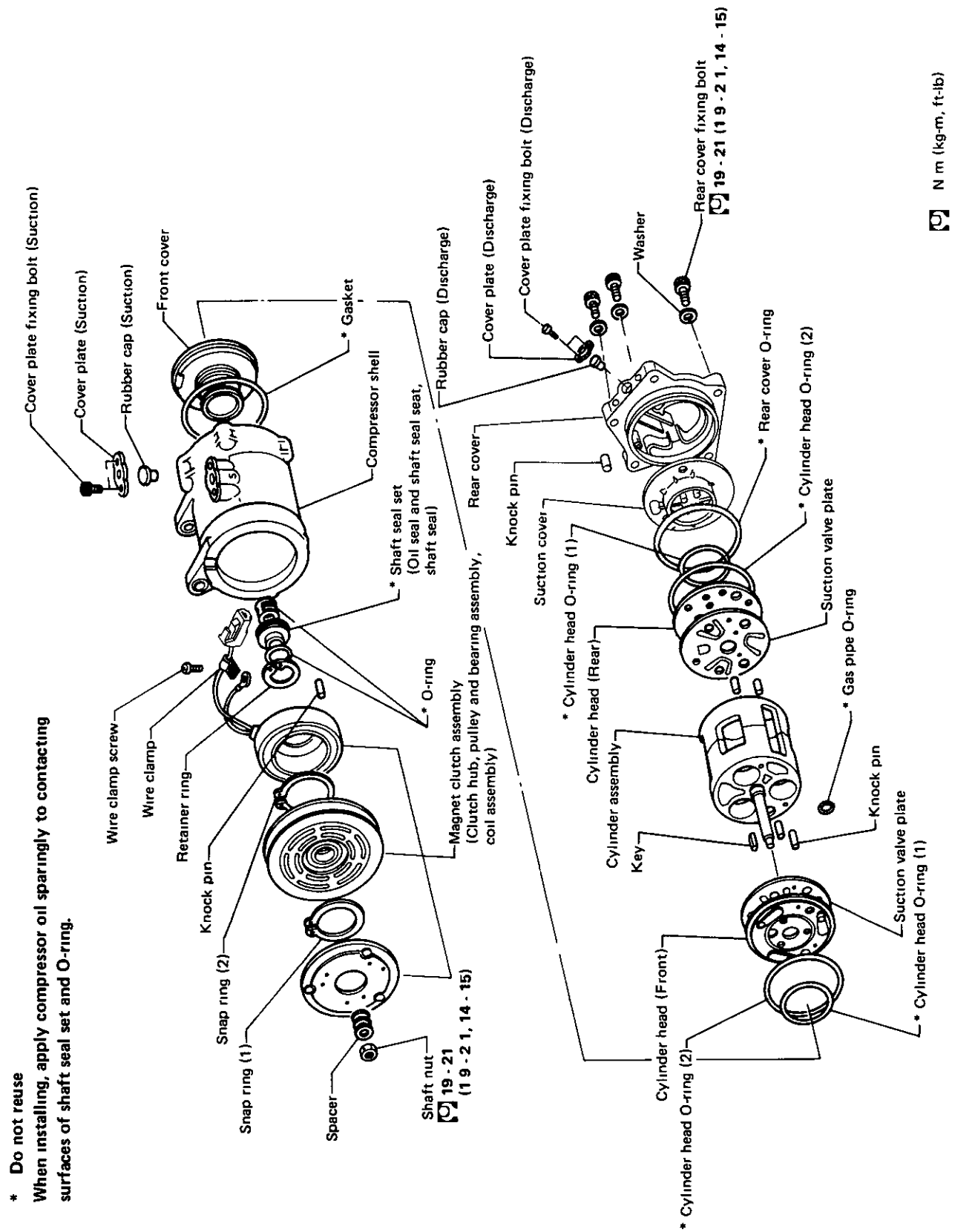
IF OIL SEPARATOR IS NOT AVAILABLE

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**

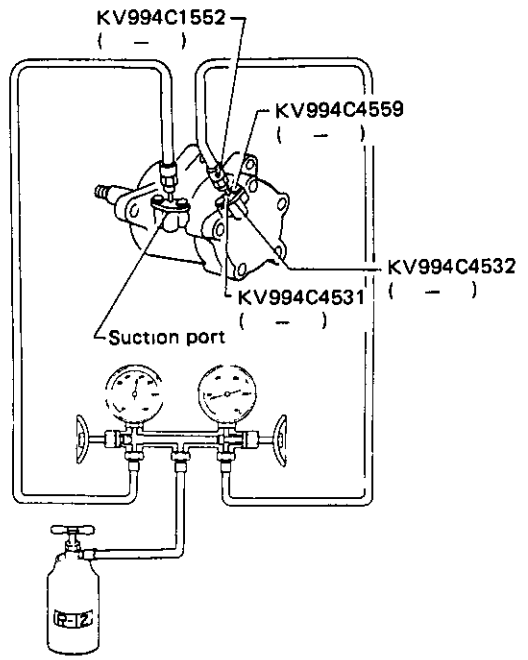


* Do not reuse
When installing, apply compressor oil sparingly to contacting surfaces of shaft seal set and O-ring.

SHA906A

Leak Test

EVACUATE AND CONDUCT LEAK TEST



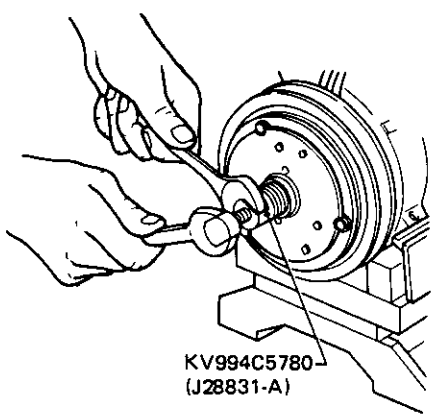
SHA907A

Clutch Replacement

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

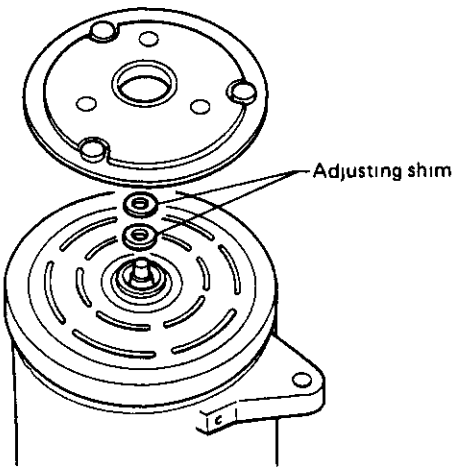
  Tool No.: KV99412302 (J24878-1)

- Using Tool, clutch hub can be removed easily.

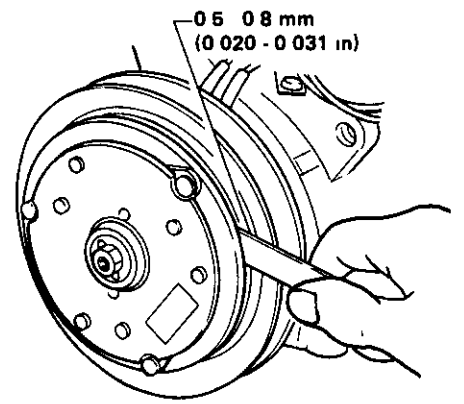


SHA268A

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



SHA272A



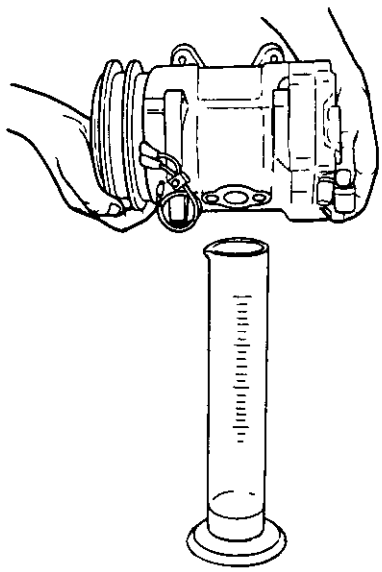
SHA908A

BREAK-IN OPERATION

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

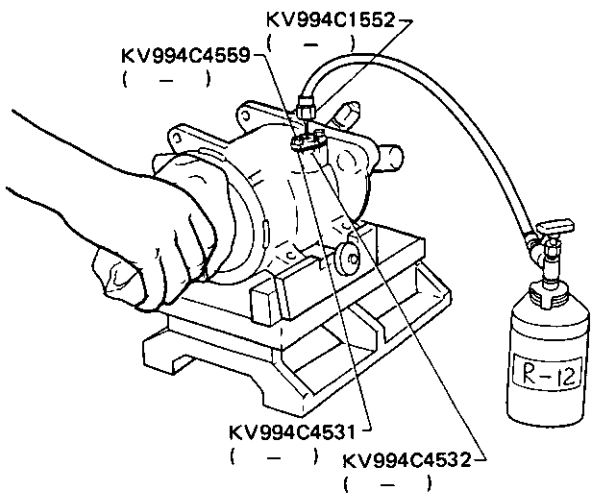
Shaft Seal Replacement

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



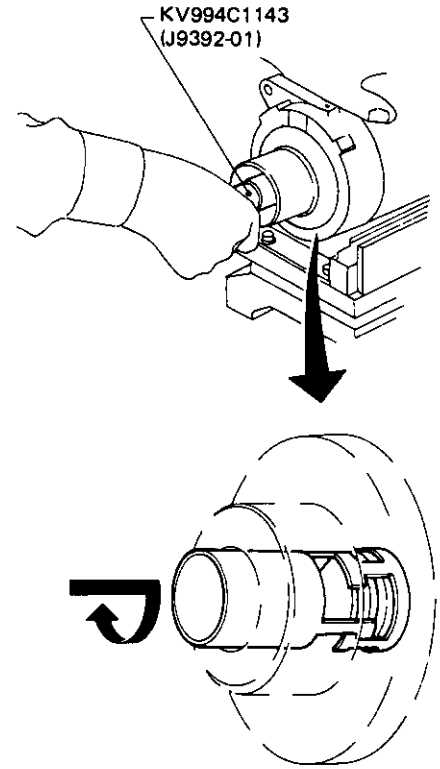
SHA033A

- When removing seal seat
  Apply pressure with refrigerant.



SHA274A

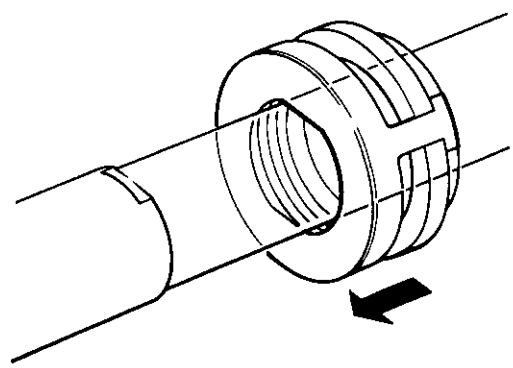
- With Tool, depress carbon seal and hook the case of shaft seal.



SHA275A

- When installing shaft seal

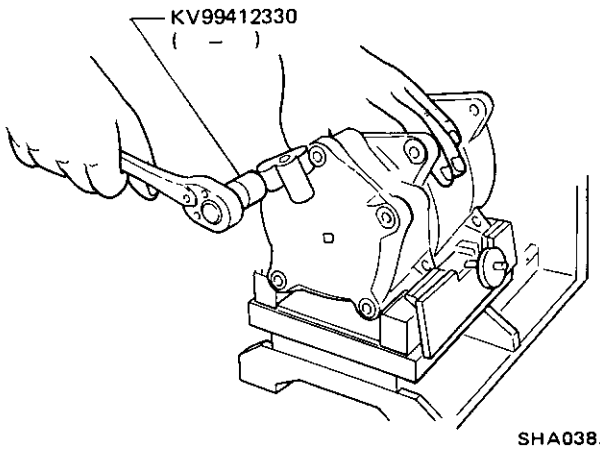
1) Cap Tool to the top end of compressor shaft
   Tool number: KV994C5784 (J33212)
2) Using Tool, insert shaft seal with shaft seal case and shaft cutout aligned
   Apply force to turn the seal somewhat to the left and right Insure that shaft seal seats properly in the shaft cutout.
   Tool number: KV994C1143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



AC037

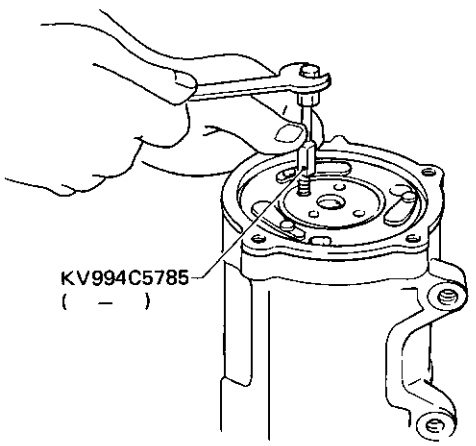
Valve Replacement

- Using Tool, remove rear cover



SHA038A

- Using Tool, remove rear cylinder head

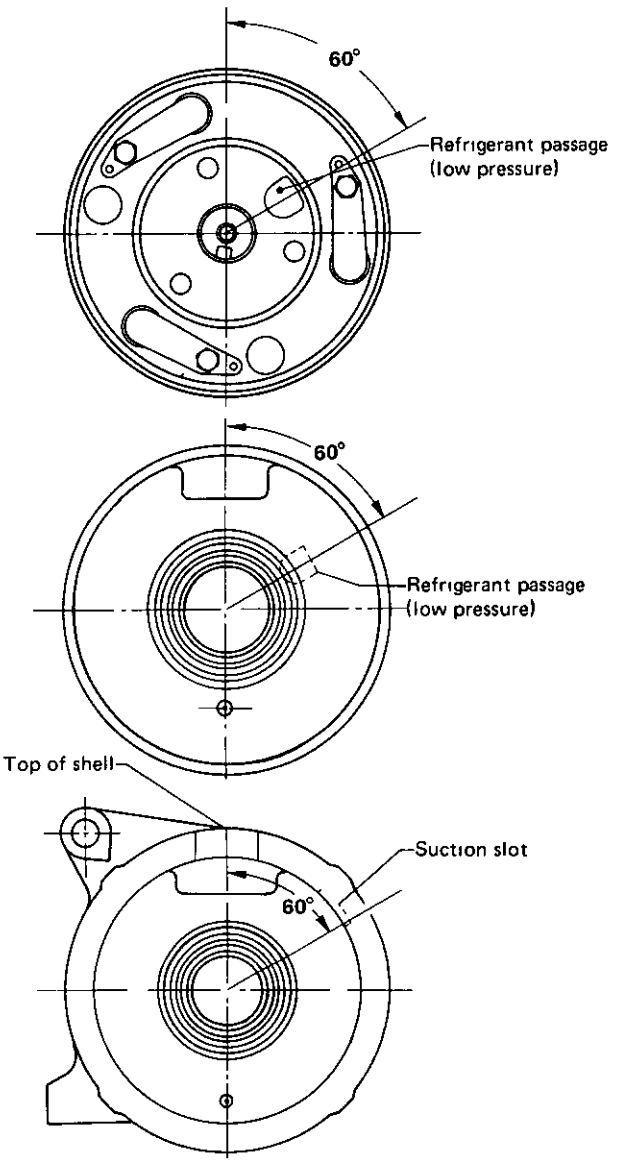


SHA909A

- When assembling

1) Front cover must be installed so that the cut-out portions of front cover and shell are aligned

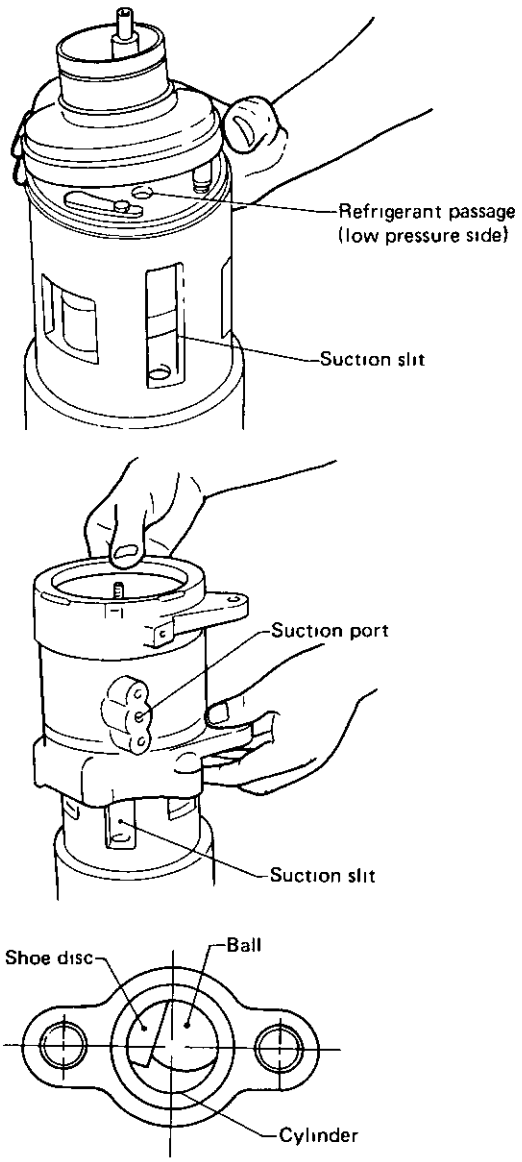
   For this purpose, install front cover on cylinder head so that angle between threaded hole in front cover and low pressure side refrigerant passage in cylinder head is about 60°



SHA276A

Valve Replacement (Cont'd)

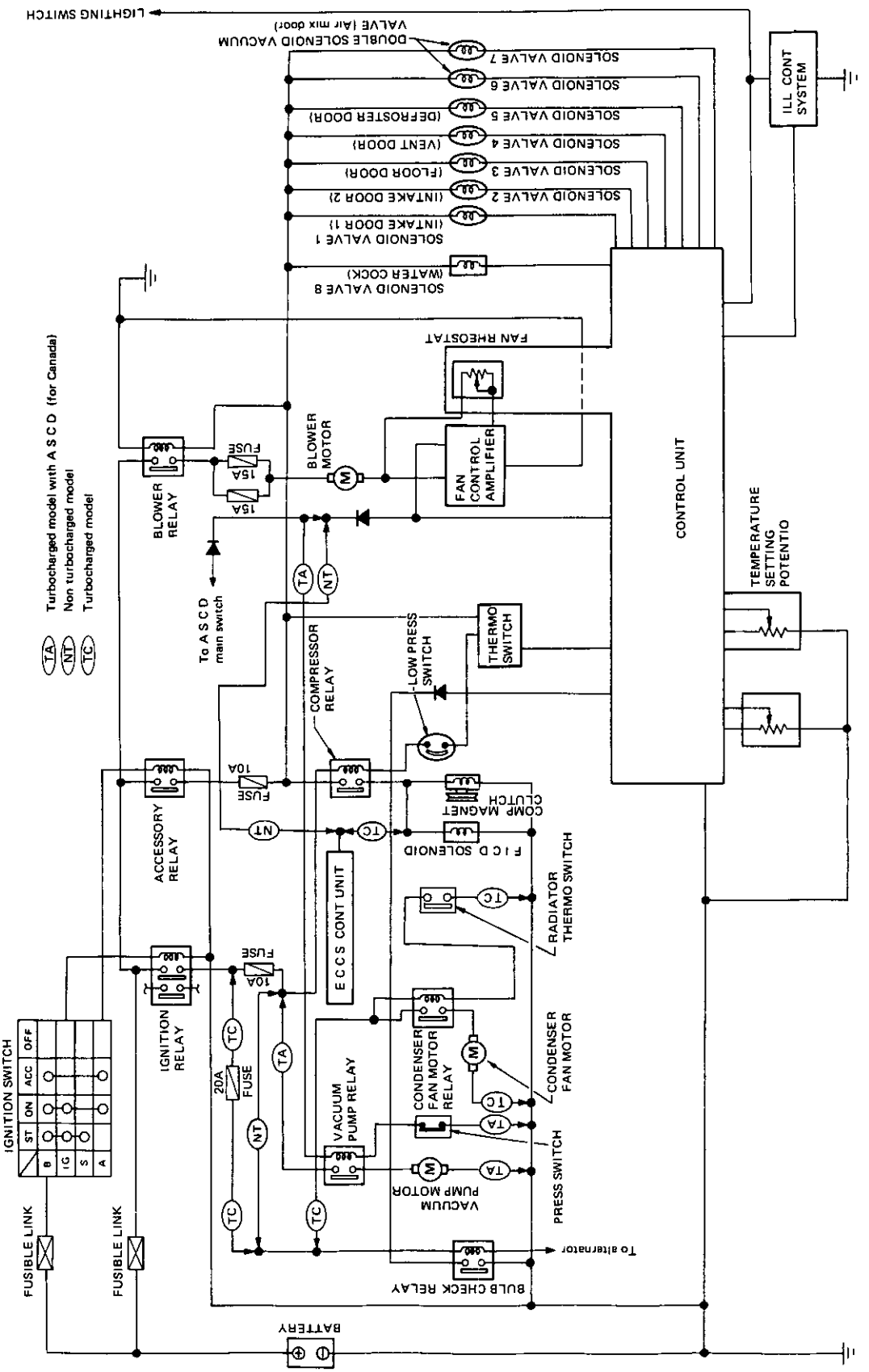
2) When installing shell on cylinder, adjust position of shell so that suction inlet of shell opens in the same direction as suction slot of cylinder assembly. Then, make sure swash plate is visible in suction inlet by removing suction valve



SHA277A

A/C ELECTRICAL CIRCUIT (Manual)

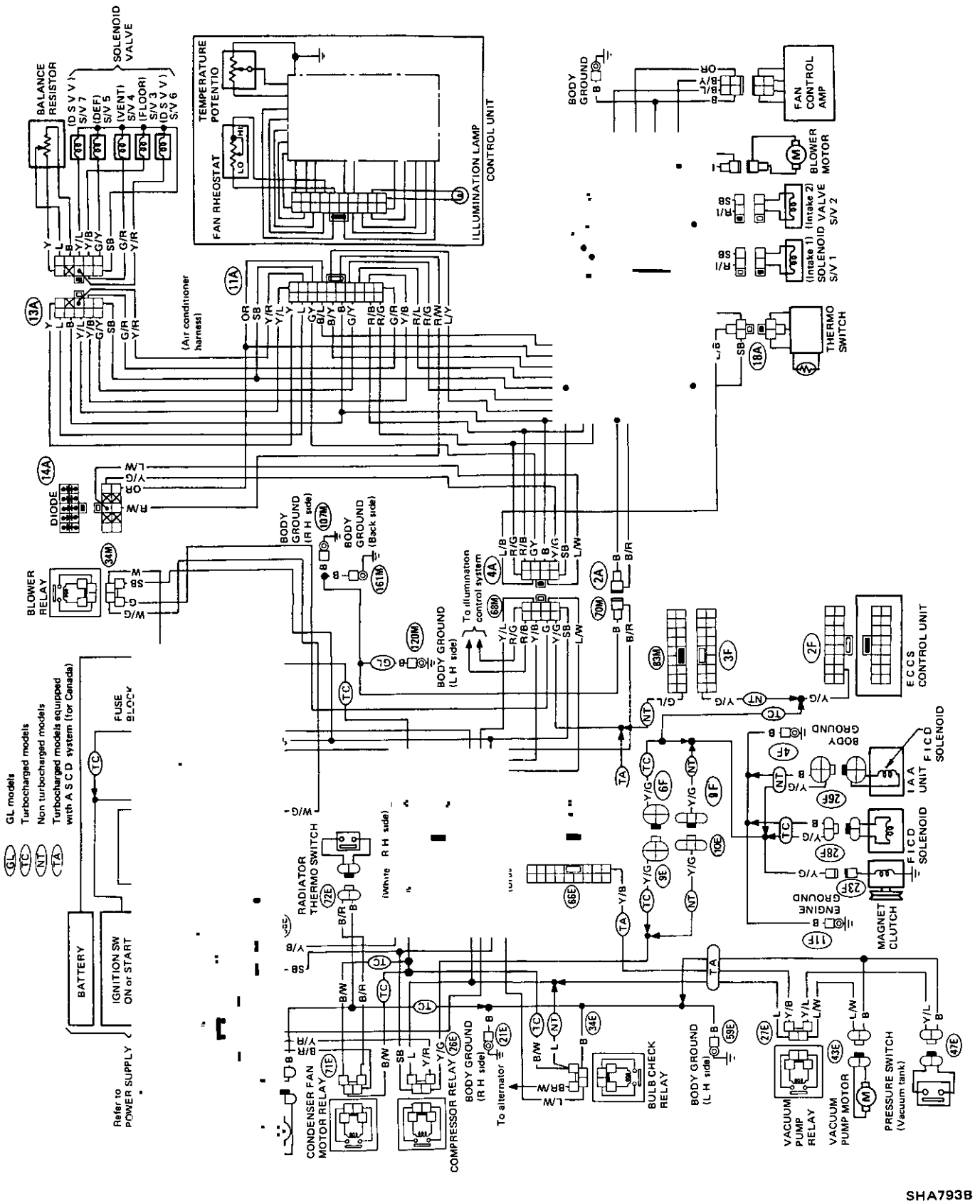
Schematic



SHA792B

A/C ELECTRICAL CIRCUIT (Manual)

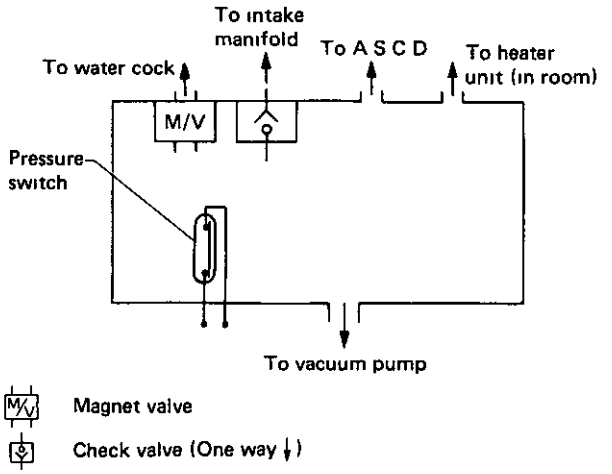
Wiring Diagram



SHA793B

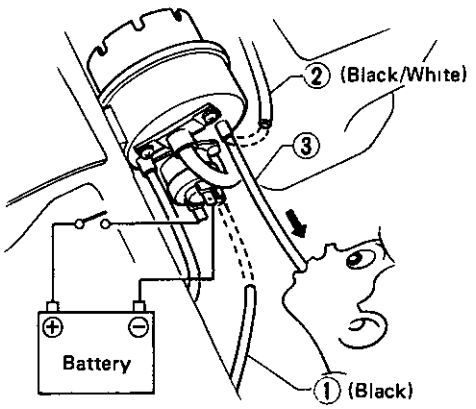
Inspection

VACUUM TANK



SHA253B

Solenoid valve check for water cock

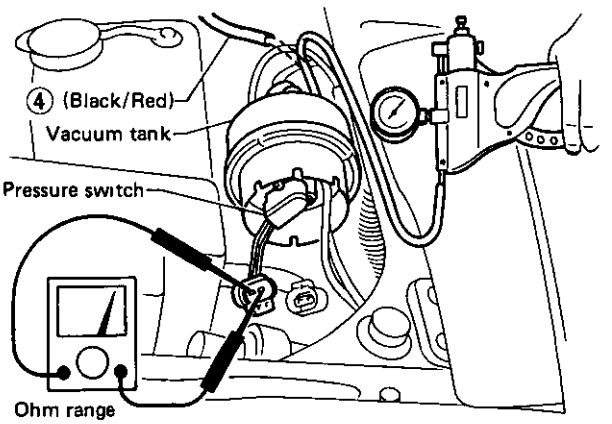


SHA254B

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

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

Pressure switch check for 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

Inspection (Cont'd)

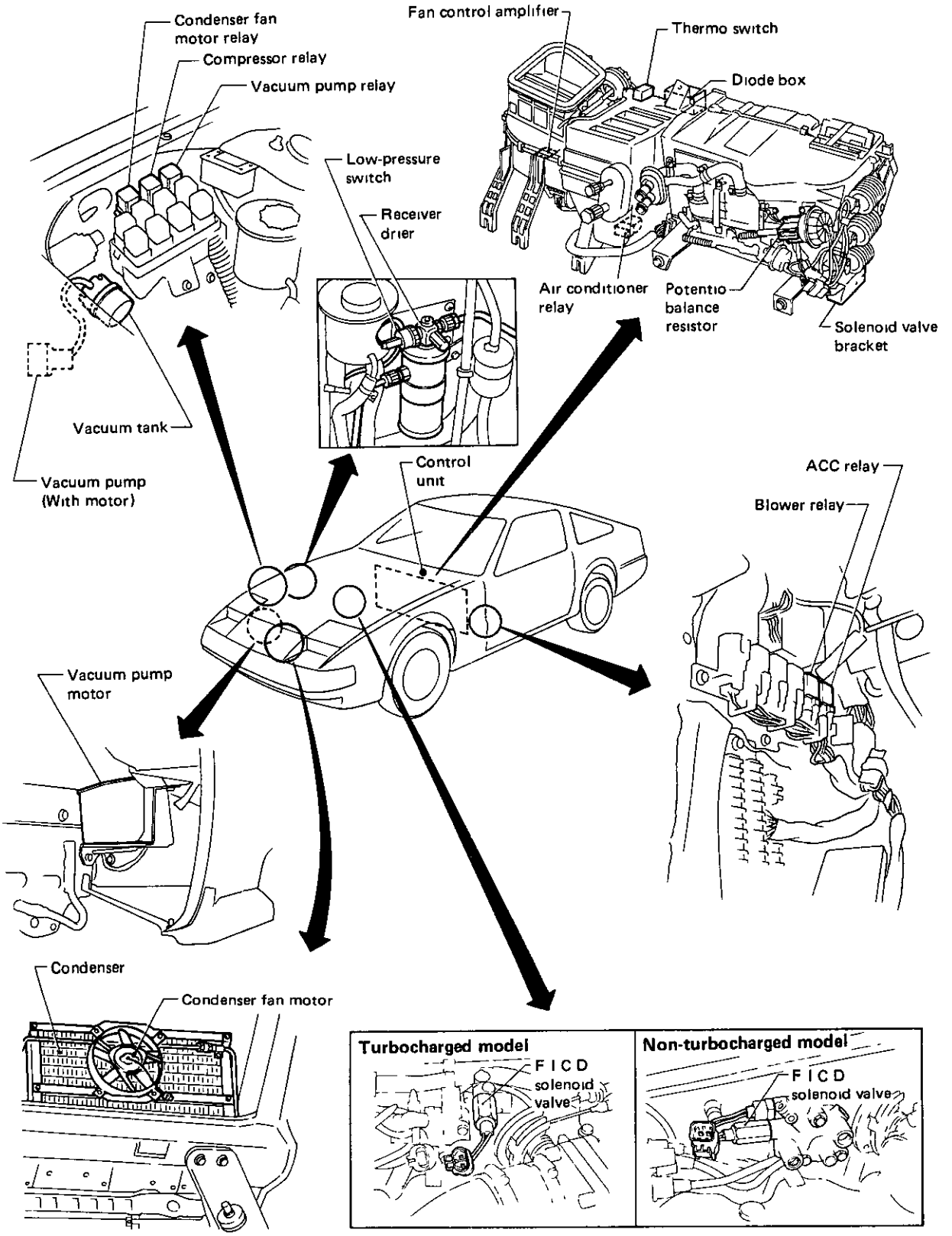
VACUUM PUMP MOTOR

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).

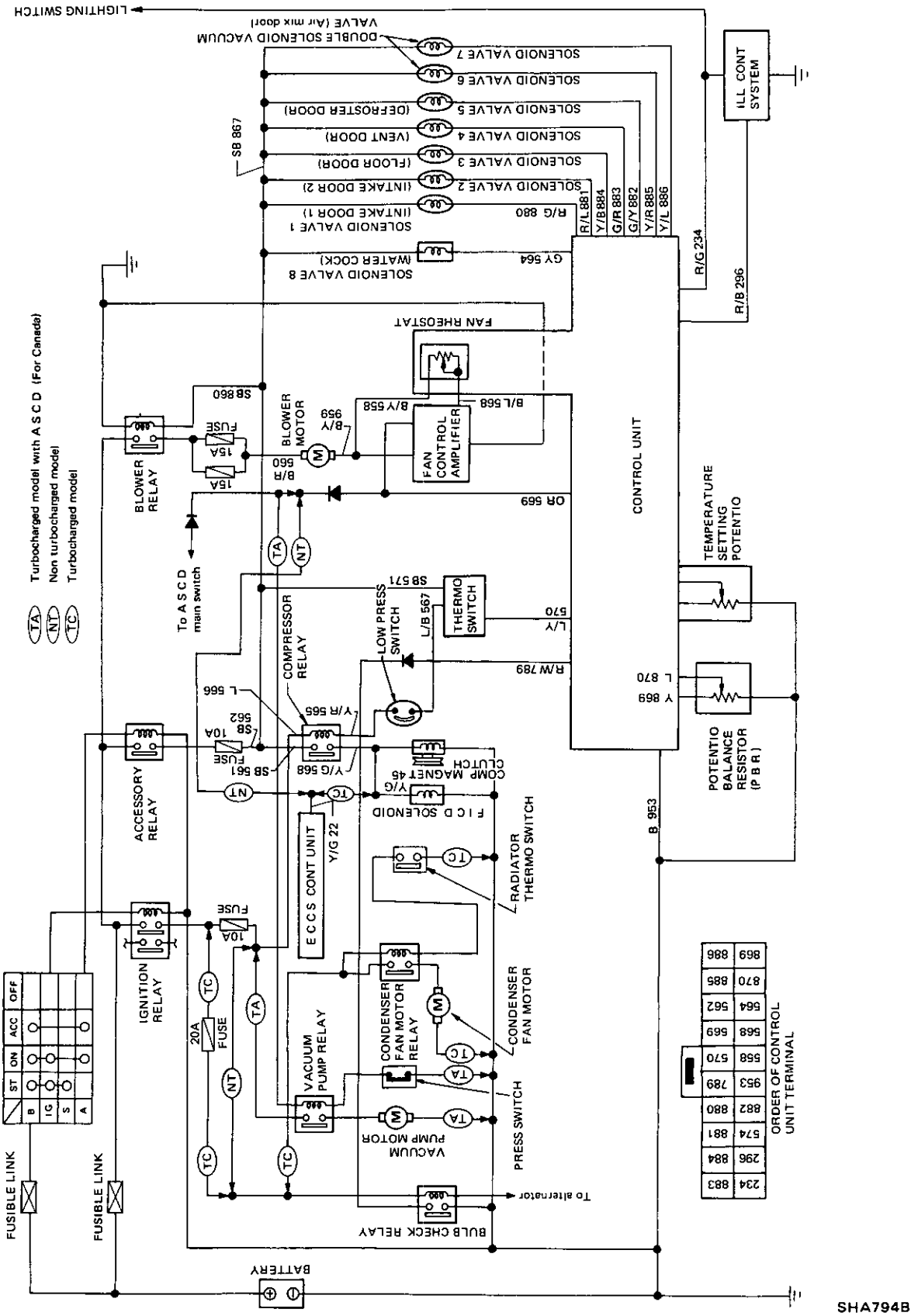
LOCATION OF A/C ELECTRICAL COMPONENTS (Manual)



SHA791B

CONTENTS

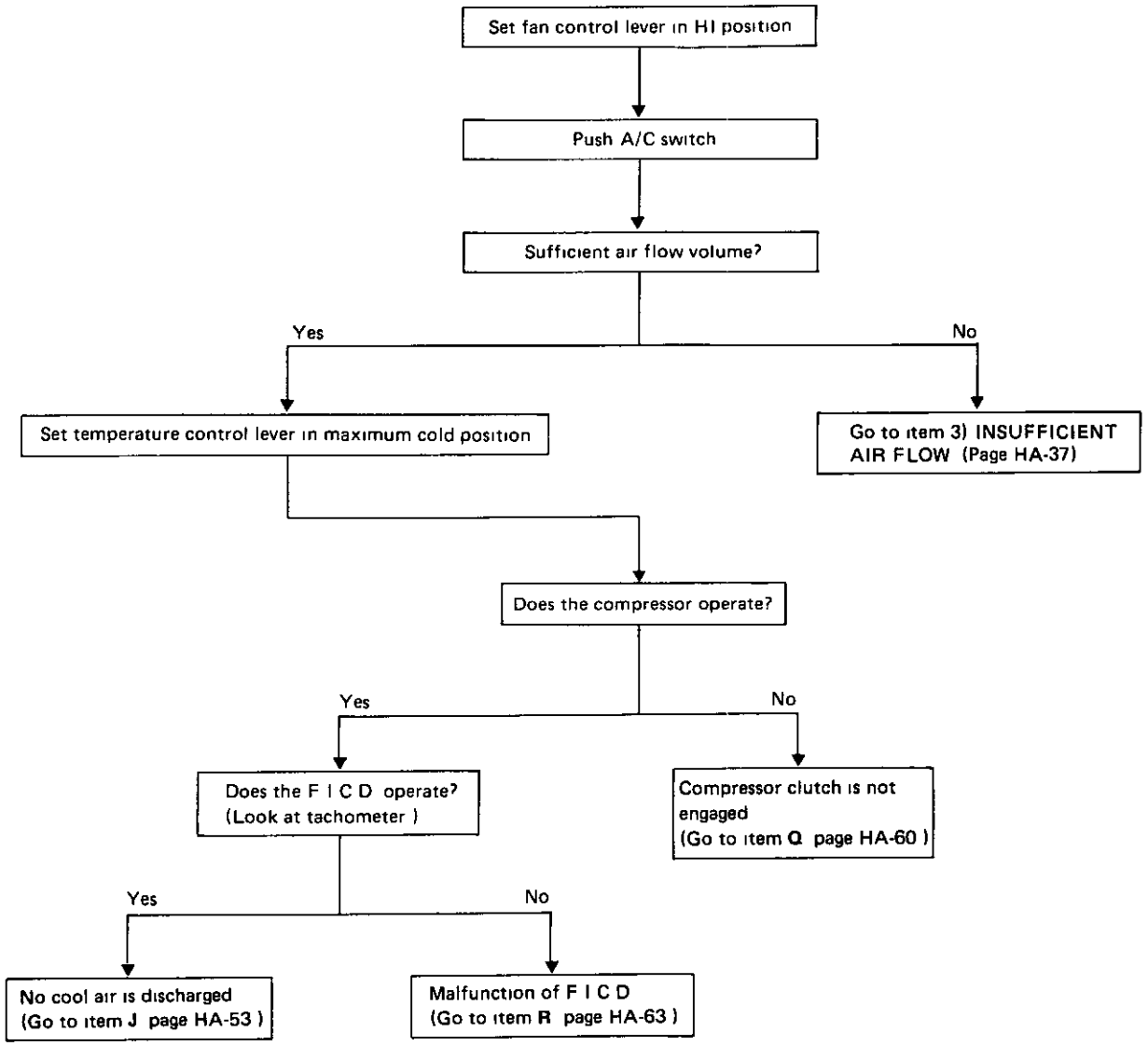
Circuit for Trouble Diagnoses



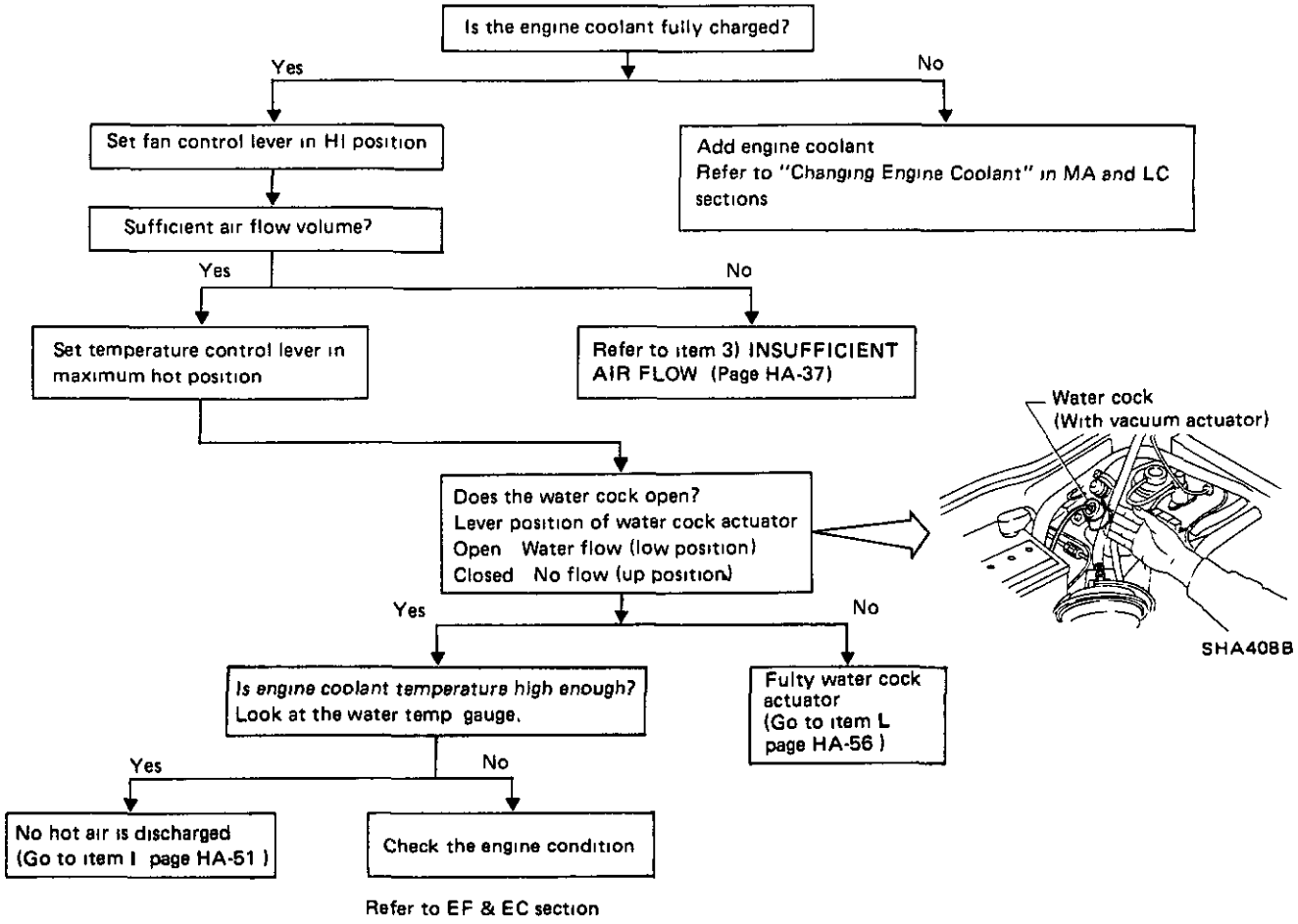
Preliminary Check

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")

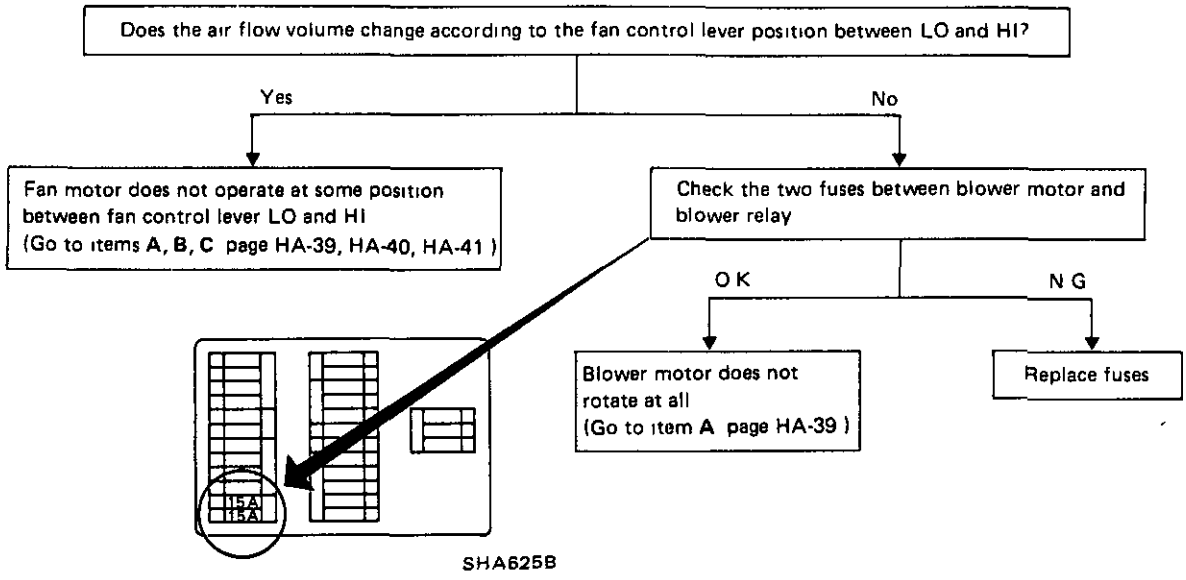


2) INSUFFICIENT HEATING

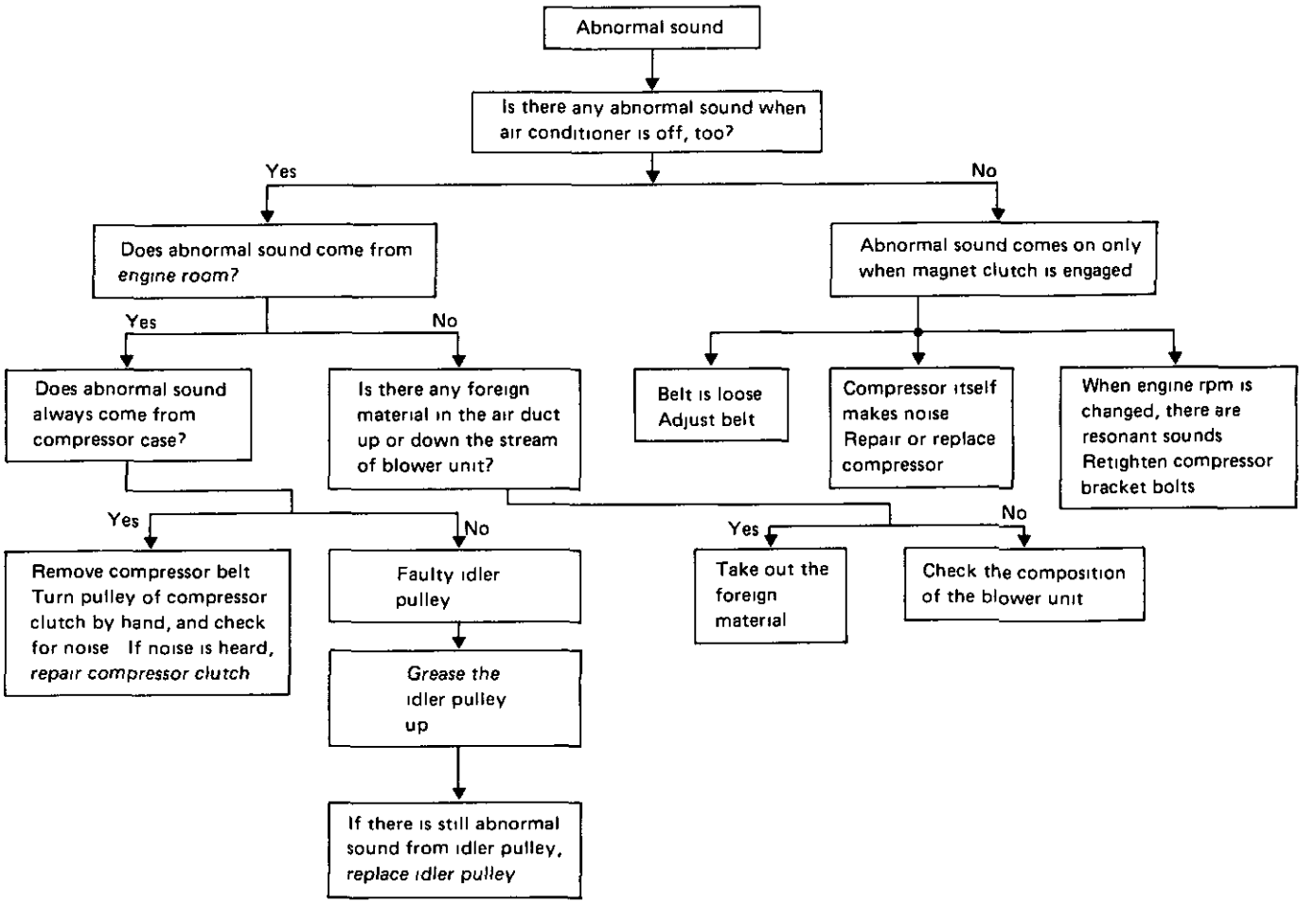


Preliminary Check (Cont'd)

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



4) ABNORMAL SOUND



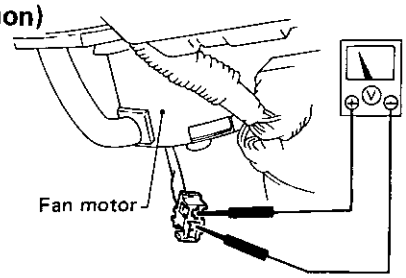
Trouble Diagnoses from Abnormal Conditions

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

Is motor's terminal voltage approx 12 volts with FAN switch set to "HI"?
Remove 2-pin connector from motor and measure voltage

Yes → Faulty motor

No → Does approx 1.5 volts exist between negative terminal of motor and body ground? (HI position)

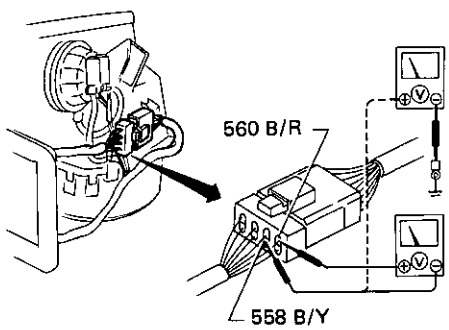


SHA450B

Applied voltage of motor check

Yes → Go to item B (Page HA-40)

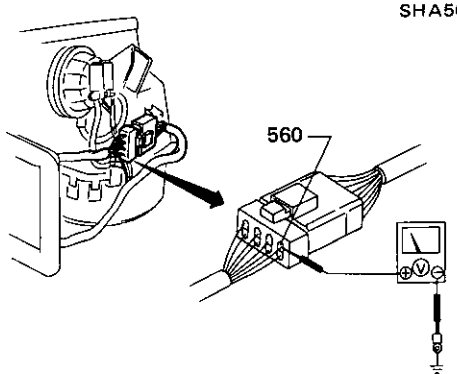
No → Does approx 1.5 volts exist between negative terminal of motor and body ground? (Fan switch on high)



SHA506B

Yes → Open circuit in motor and negative side

No → Is there an open circuit between blower harness and power line, when wires are traced back from blower harness via air conditioner harness?

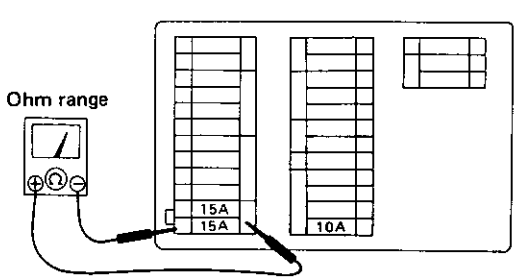


SHA507B

Yes → Repair

No → Check fuses and blower relay for continuity

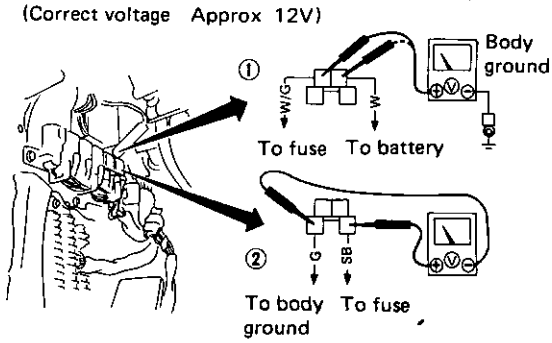
Fuse check
(Ignition switch OFF position)



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)

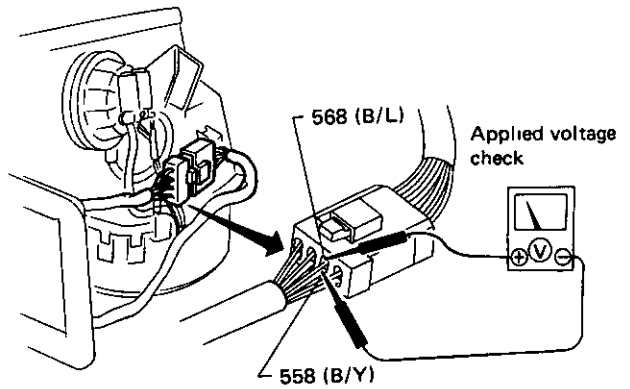


SHA396B

Trouble Diagnoses from Abnormal Conditions (Cont'd)

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

Check voltage between terminal 558 (B/Y) and 568 (B/L) by moving the fan control switch from high to low Ignition switch must be on for this test
Hi = approx. 8 0 volts
Lo = approx 0 02 volts



SHA508B

O K → Faulty fan control amplifier

N G → Remove control unit

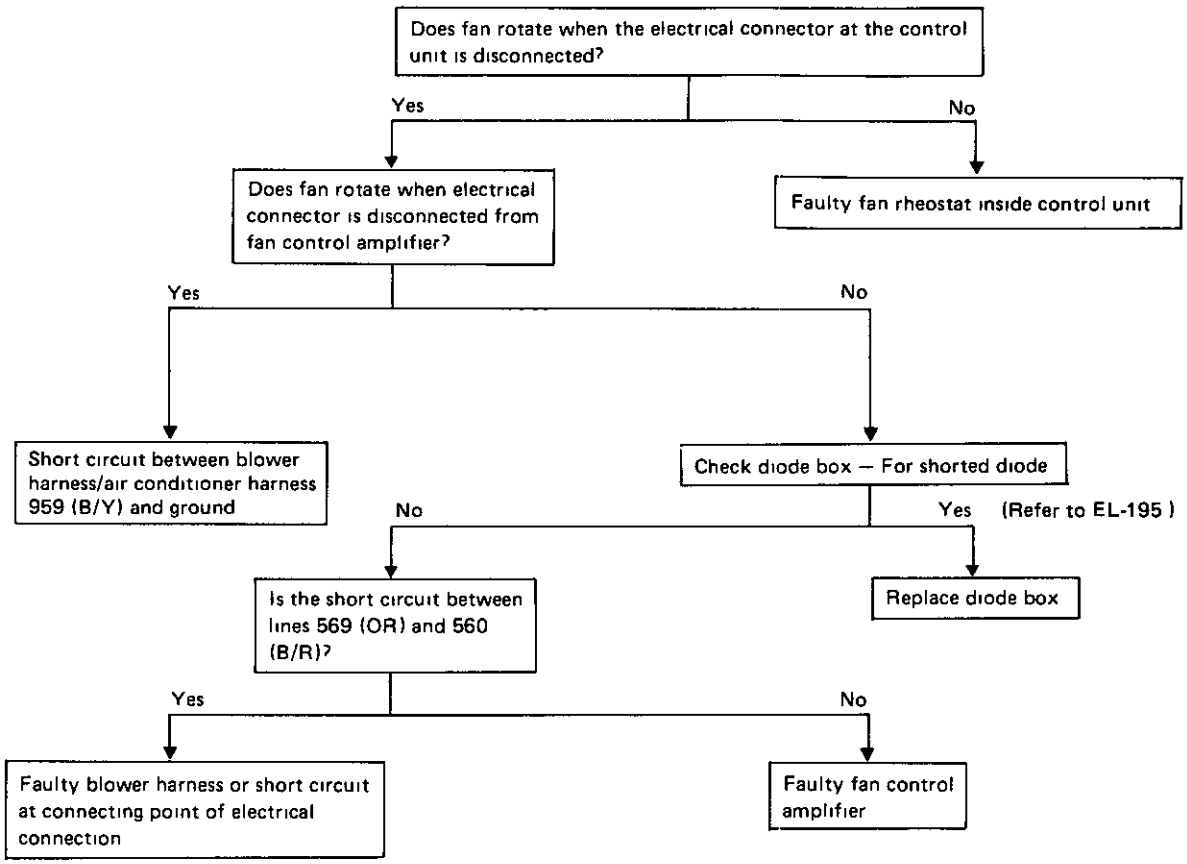
Check conditioning of blower harness and air conditioner harnesses running between fan control amplifier and control unit

O K → Faulty fan rheostat

N G → Faulty harnesses

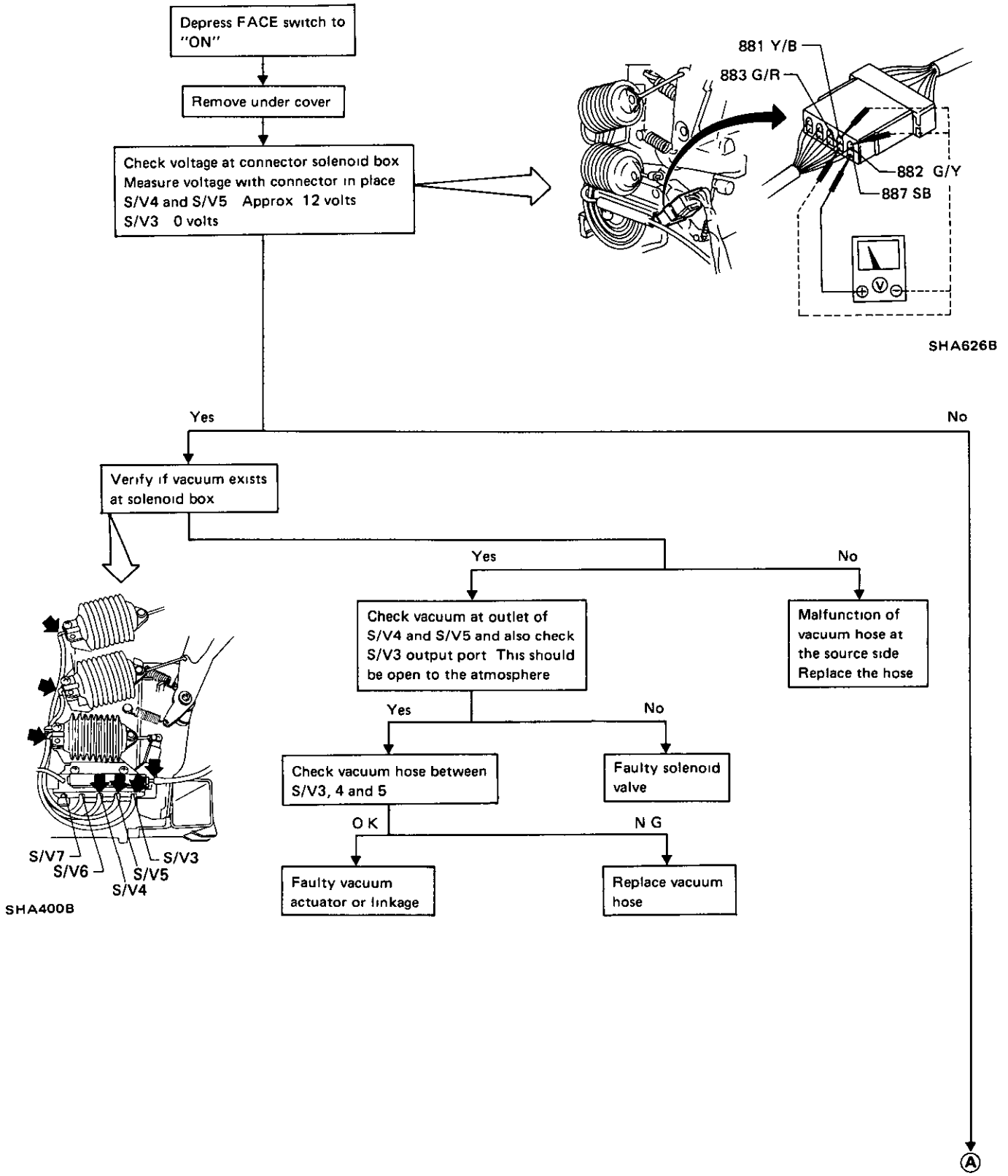
Trouble Diagnoses from Abnormal Conditions (Cont'd)

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

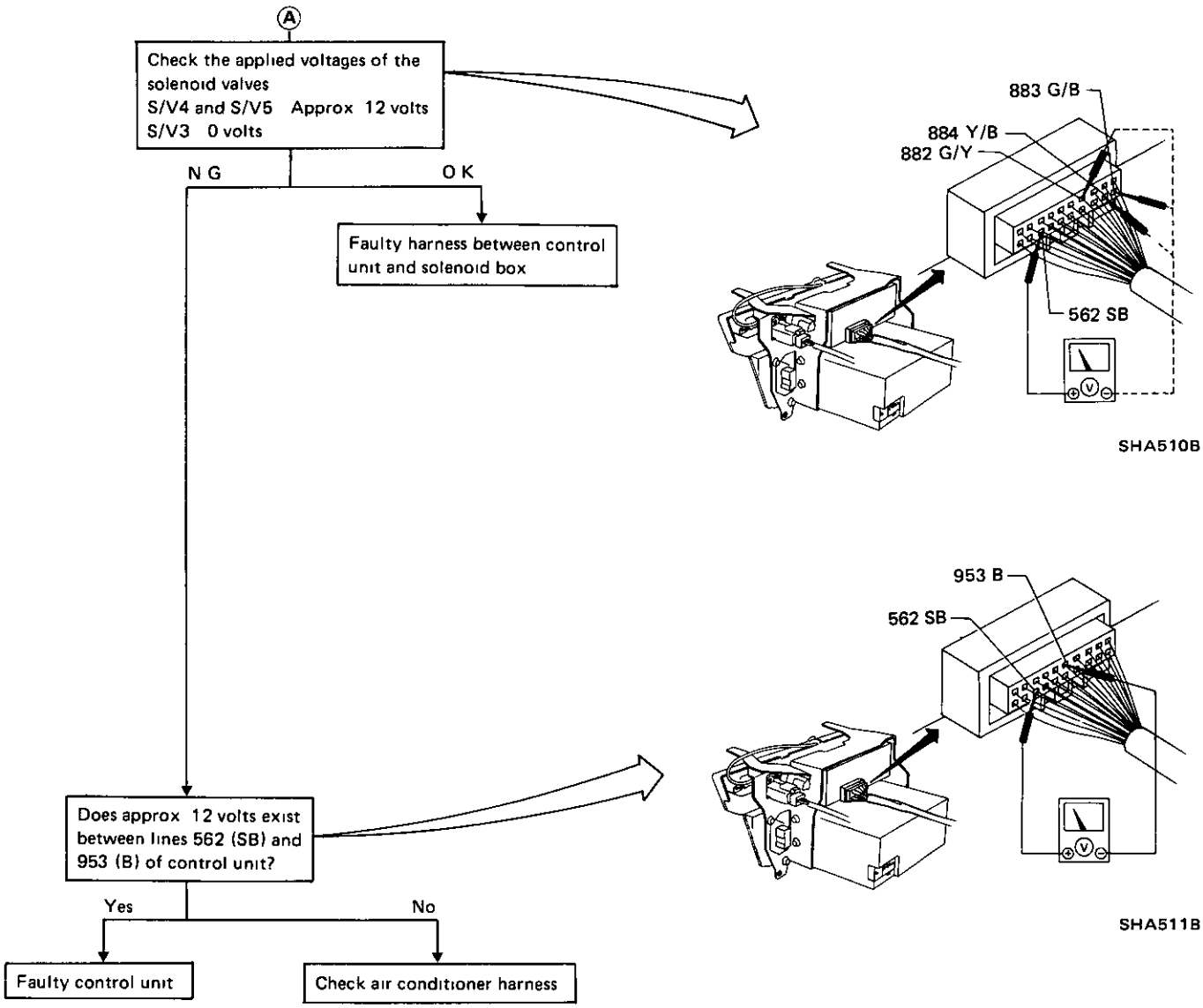


Trouble Diagnoses from Abnormal Conditions (Cont'd)

(D) "FACE" MODE CANNOT BE SET.



Trouble Diagnoses from Abnormal Conditions (Cont'd)

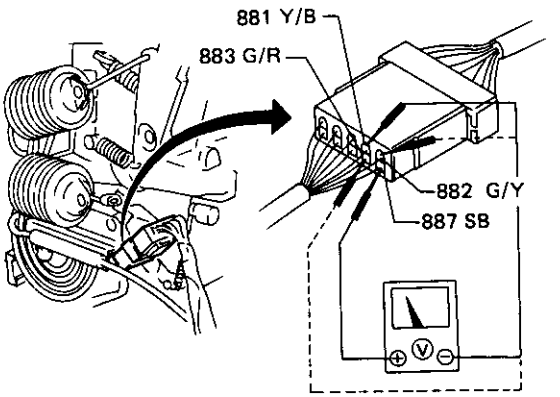


(E) "B/L" MODE CANNOT BE SET.

Depress B/L switch to "ON"

Remove under-cover

Check voltage at connector solenoid box. Measure voltage with connectors in place. All S/Vs 12 volts

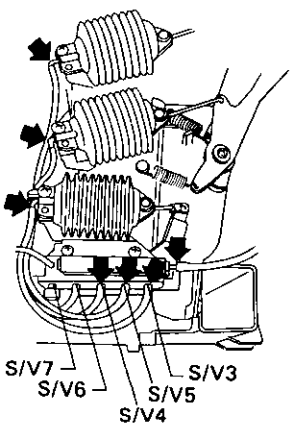


SHA509B

Yes

No

Verify that vacuum exists at solenoid box



SHA400B

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

Ⓐ

Trouble Diagnoses from Abnormal Conditions (Cont'd)

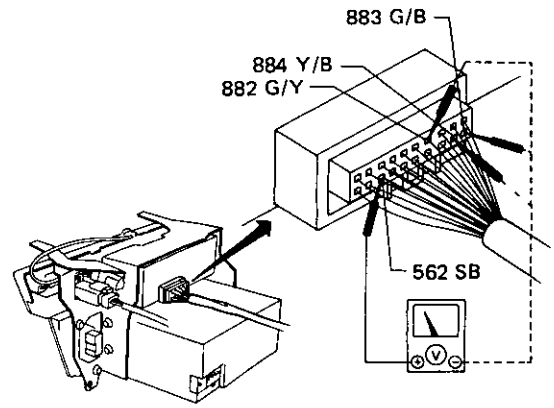
Ⓐ

Check applied voltages of the solenoid valves
S/V3, 4 and 5 ·Approx 12 volts

NG

OK

Faulty harness between control unit and solenoid box



SHA510B

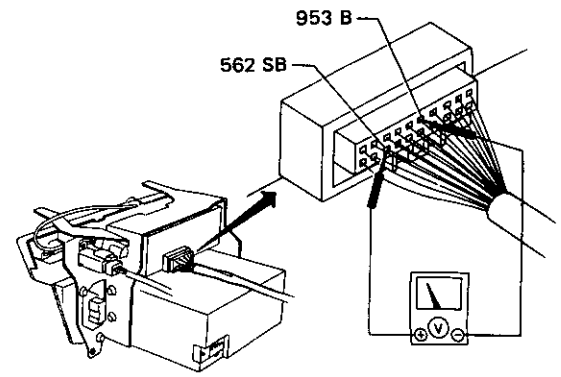
Does 12 volts exist between lines 953 (B) and 562 (SB) of control unit?

Yes

No

Faulty control unit

Check air conditioner harness



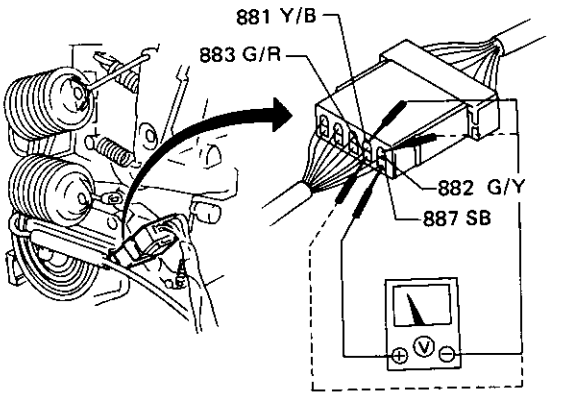
SHA511B

(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

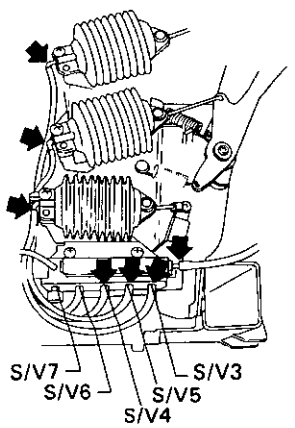


SHA509B

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

Ⓐ

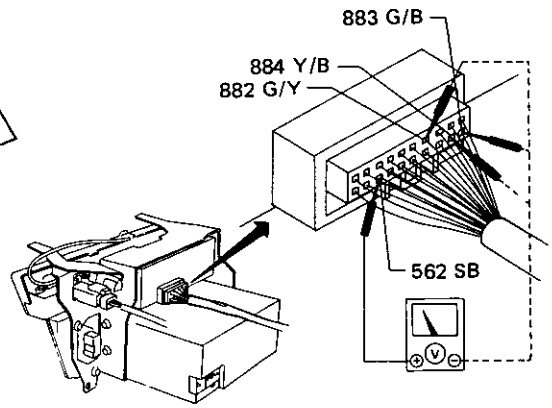
Trouble Diagnoses from Abnormal Conditions (Cont'd)

Ⓐ

Check applied voltages of the solenoid valves
S/V3 and 5 Approx 12 volts
S/V4 Approx 0 volts

No — Yes

Faulty harness between control unit and solenoid box



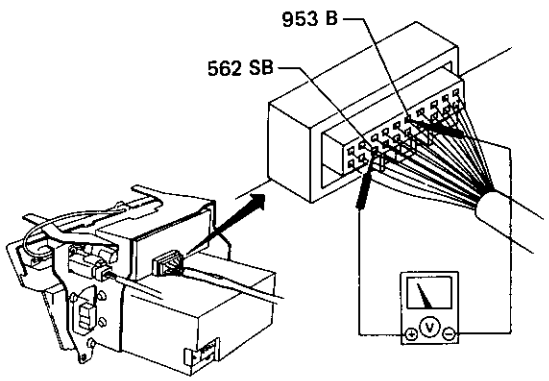
SHA510B

Does approx 12 volts exist between lines 562 (SB) and 953 (B) of control unit?

Yes — No

Faulty control unit

Check air conditioner harness



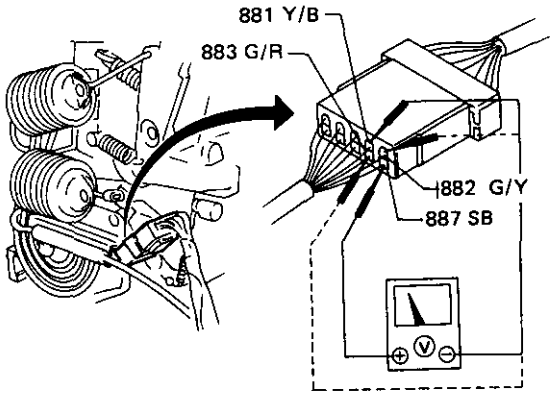
SHA511B

(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

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

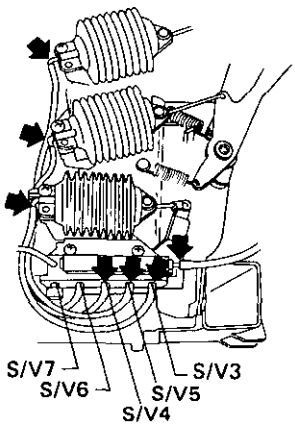
Faulty solenoid valve

O K

N G

Faulty vacuum actuator or linkage

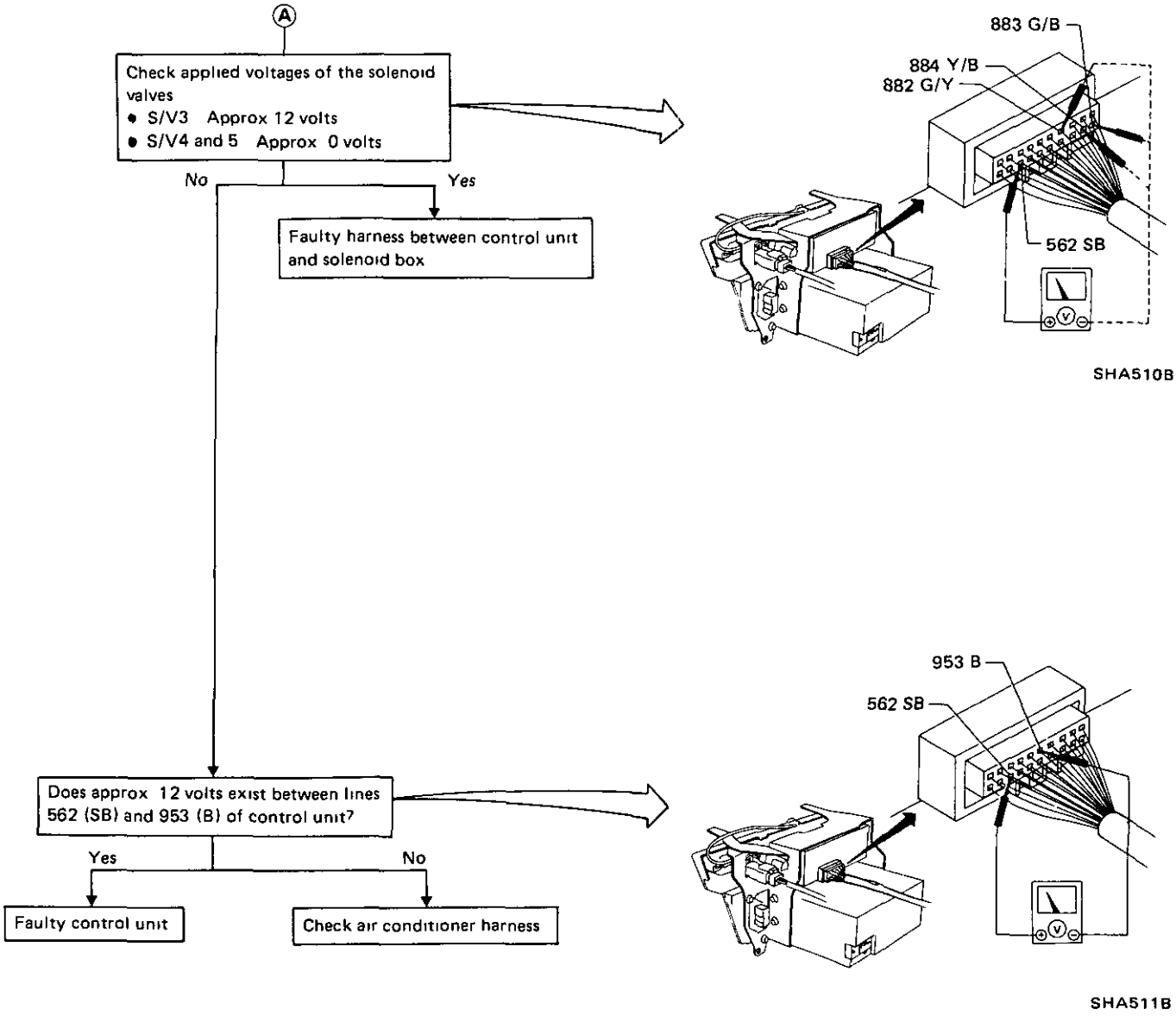
Replace vacuum hose



SHA400B

Ⓐ

Trouble Diagnoses from Abnormal Conditions (Cont'd)

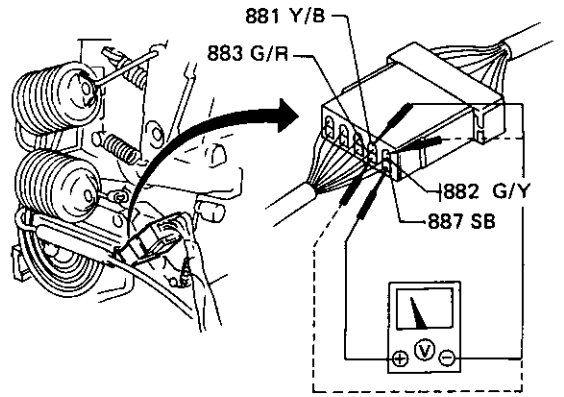


(H) "DEF" MODE CANNOT BE SET.

Turn DEF switch to "ON"

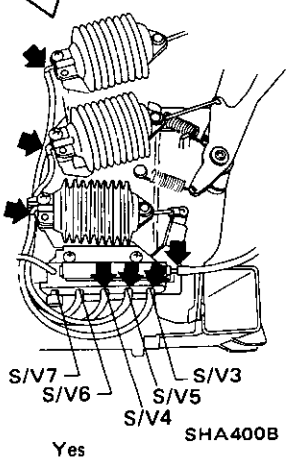
Remove under-cover from driver's side

Check voltage at the connector solenoid box Measure voltage with connector in place
S/V3, 4 and 5 Approx 0 volts



Yes

Solenoid valves S/V3, 4 and 5 should be open to the atmosphere



Yes

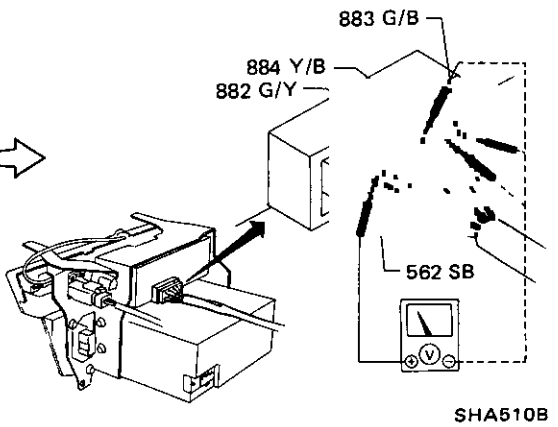
Faulty actuator or disconnected linkage

No

Faulty solenoid valve

No

Check the applied voltages of solenoid valves
S/V3, 4 and 5 0 volts



Yes

Faulty harness between control unit and solenoid box

No

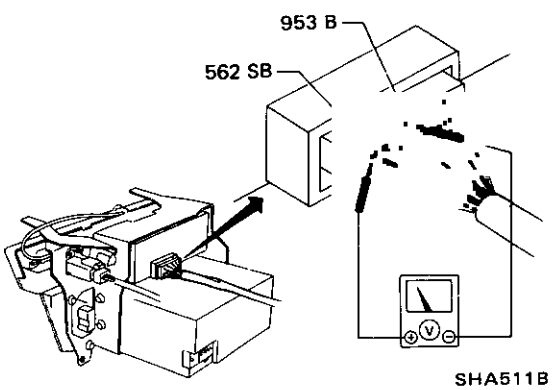
Does approx 12 volts exist between lines 562 (SB) and 953 (B) of control unit?

Yes

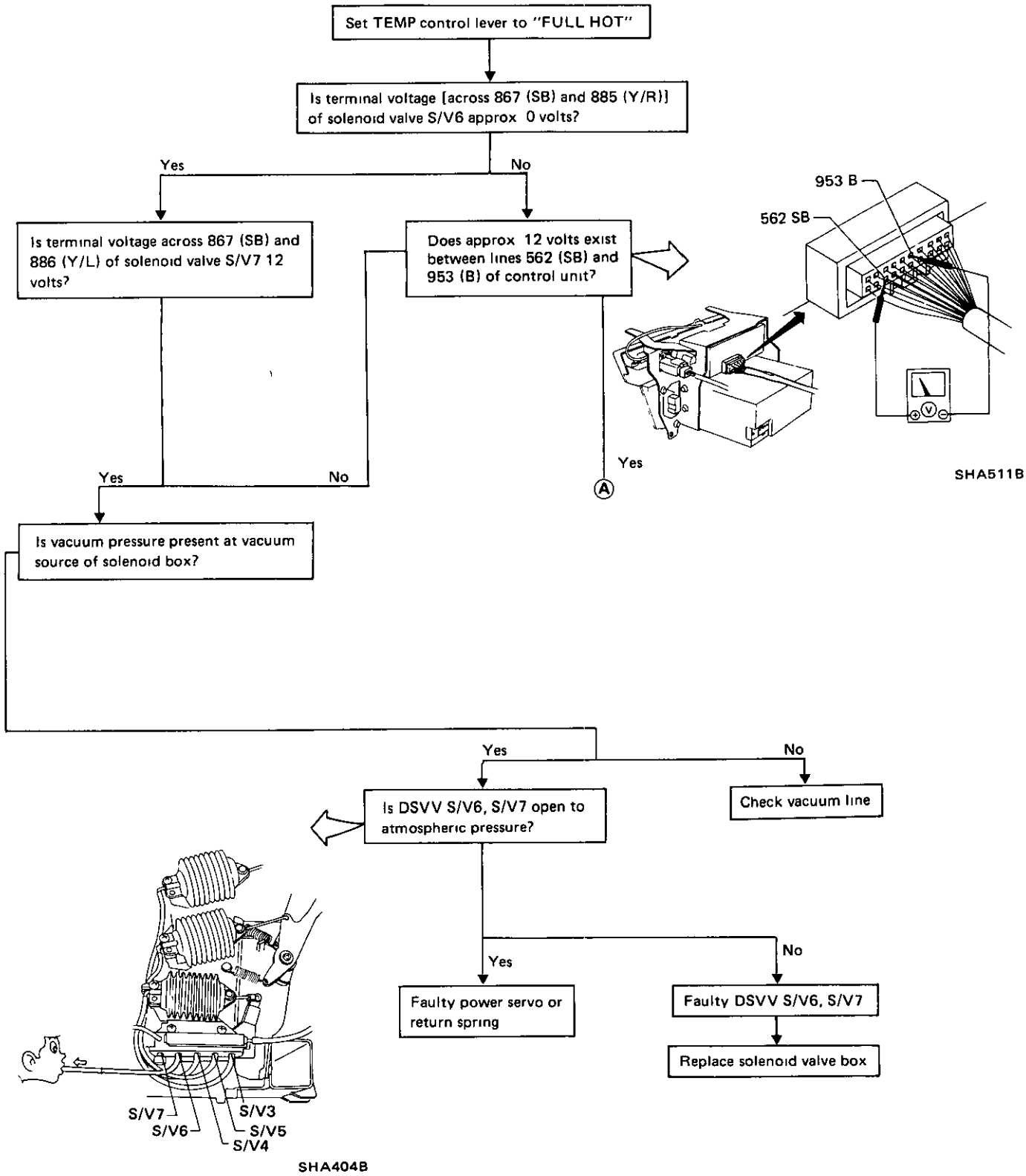
Faulty control unit

No

Check air conditioner harness



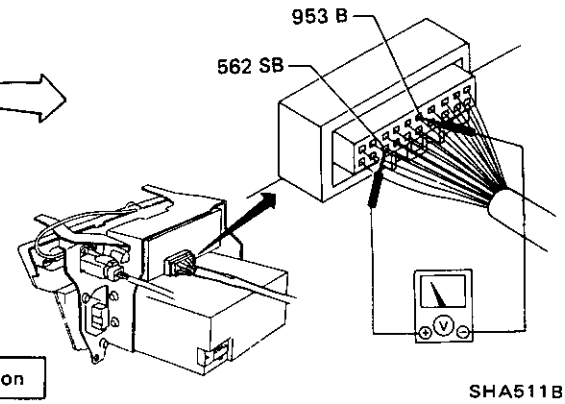
(I) OUTLET AIR WILL NOT BECOME WARM.



Trouble Diagnoses from Abnormal Conditions (Cont'd)

Ⓐ

Remove the connector from the control amplifier Check to see if plug has electrical pins pushed back, or if the electrical pins in the control unit are bent



SHA511B

Does approx 12 volts exist between lines 562 (SB) and 953 (B), or the control unit (Ignition ON)?

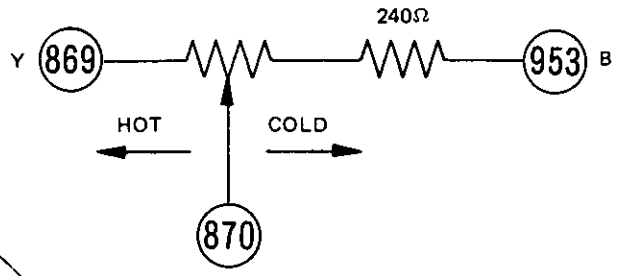
Yes

No

A/C harness malfunction

Does the potential balance resistor work normally? Perform either the ohm or voltage output test with the electrical connector hooked up to the control amp

Check resistance between terminals
869 (Y) and 953 (B) 1 2 - 1 45 kΩ
870 (L) and 953 (B) 230 Ω - 1 45 kΩ
**DSVV with no vacuum applied 1 2 - 1 45 kΩ
DSVV with vacuum applied 230 - 250 Ω



SHA453B

Yes

No

Check wiring harness between control unit and PBR Remove connectors at control unit and solenoid valve box Check continuity between 869, 870 and 954

P B R Potentio Balance Resistor

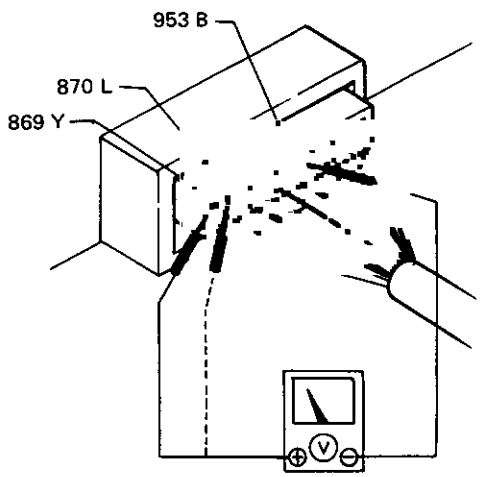
Faulty PBR

O K

N G

Malfunction of control unit

Malfunction of the A/C wiring harness



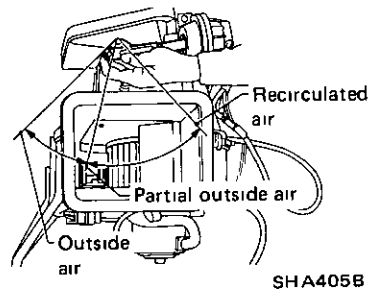
SHA512B

(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

Yes

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

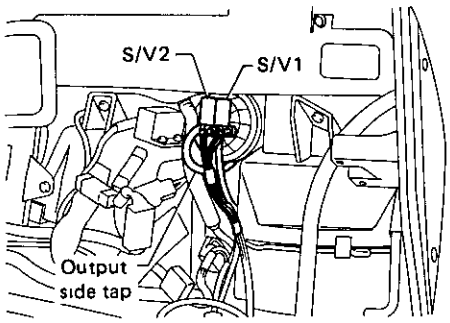
No

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?

Yes

Check vacuum hoses between solenoid valve and actuator

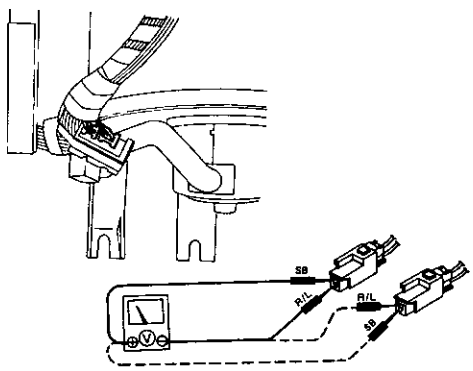
No



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



SHA514B

Ⓐ

Ⓐ

Yes

Does approx 12 volts exist between lines 867 (SB) and 885 (Y/R) of solenoid valve S/V6?

Yes

Is vacuum pressure present at vacuum source side of solenoid valve box?

Ⓑ

No

Does approx 12 volts exist between lines 562 (SB) and 953 (B) of control unit?

No

Remove the connector from the control amplifier Check to see if plug has electrical pins pushed back, or if the electrical pins in the control unit are bent

Does approx 12 volts exist between lines 562 (SB) and 953 (B) or the control unit (Ignition ON)?

Yes

Does the potential balance resistor work normally? Perform either the ohm or voltage output test with the electrical connector hooked up to the control amp

Check resistance between terminals
869 (Y) and 953 (B) Approx 1 3 kΩ
870 (L) and 953 (B) Approx 240Ω 1 3 kΩ**
**DSVV with no vacuum applied 1 3 kΩ
DSVV with vacuum applied 240Ω

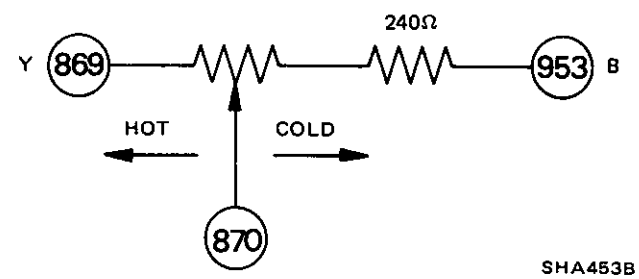
or

Voltage check, vehicle must be running
Move temperature control lever to full hot, then to full cool, taking the following voltage measurements
① 953 (B) Negative 869 (Y) Positive
Full hot = 5 14V Approx
Full cold = 5 26V Approx
② 953 (B) Negative 870 (L) Positive
Full hot = 4 86V Approx
Full cold = 0 90V Approx

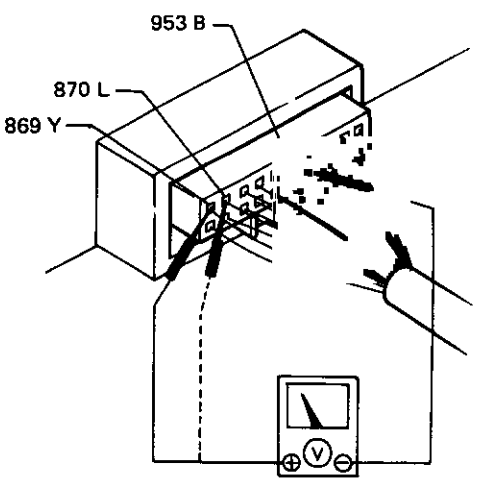
Ⓐ

No

A/C harness malfunction

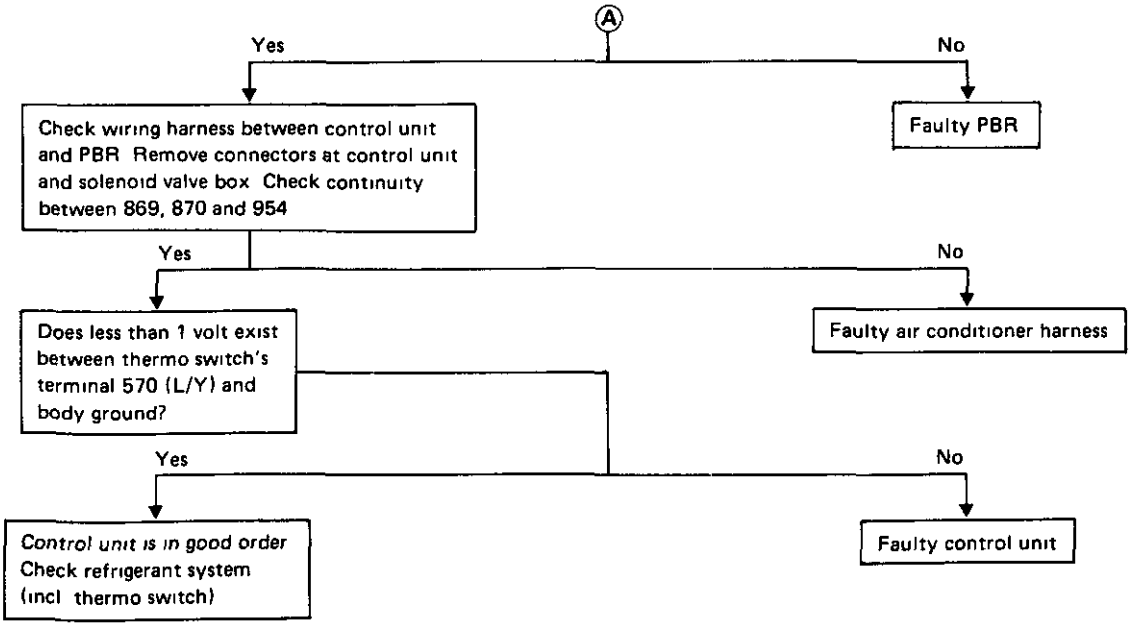


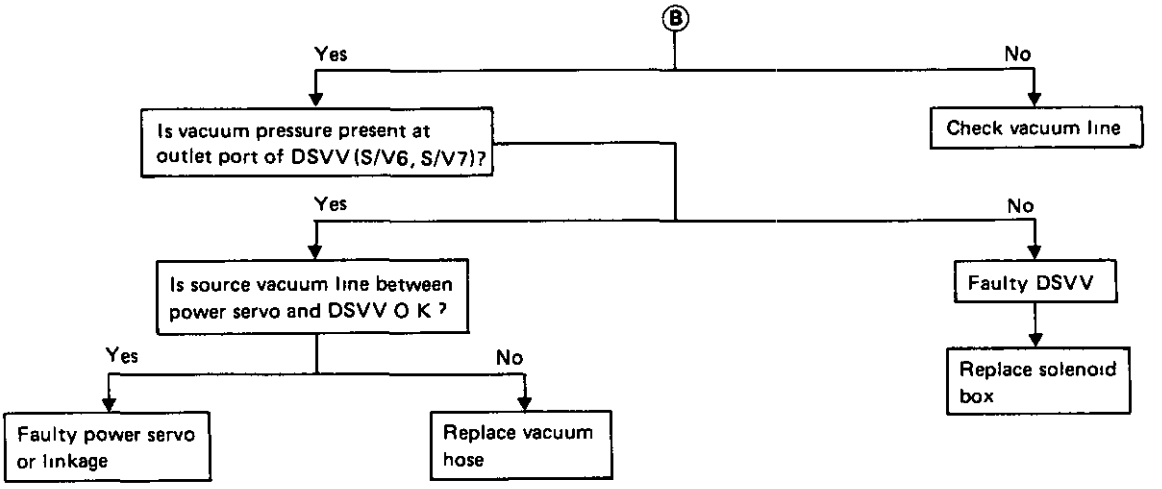
SHA453B



SHA512B

Trouble Diagnoses from Abnormal Conditions (Cont'd)

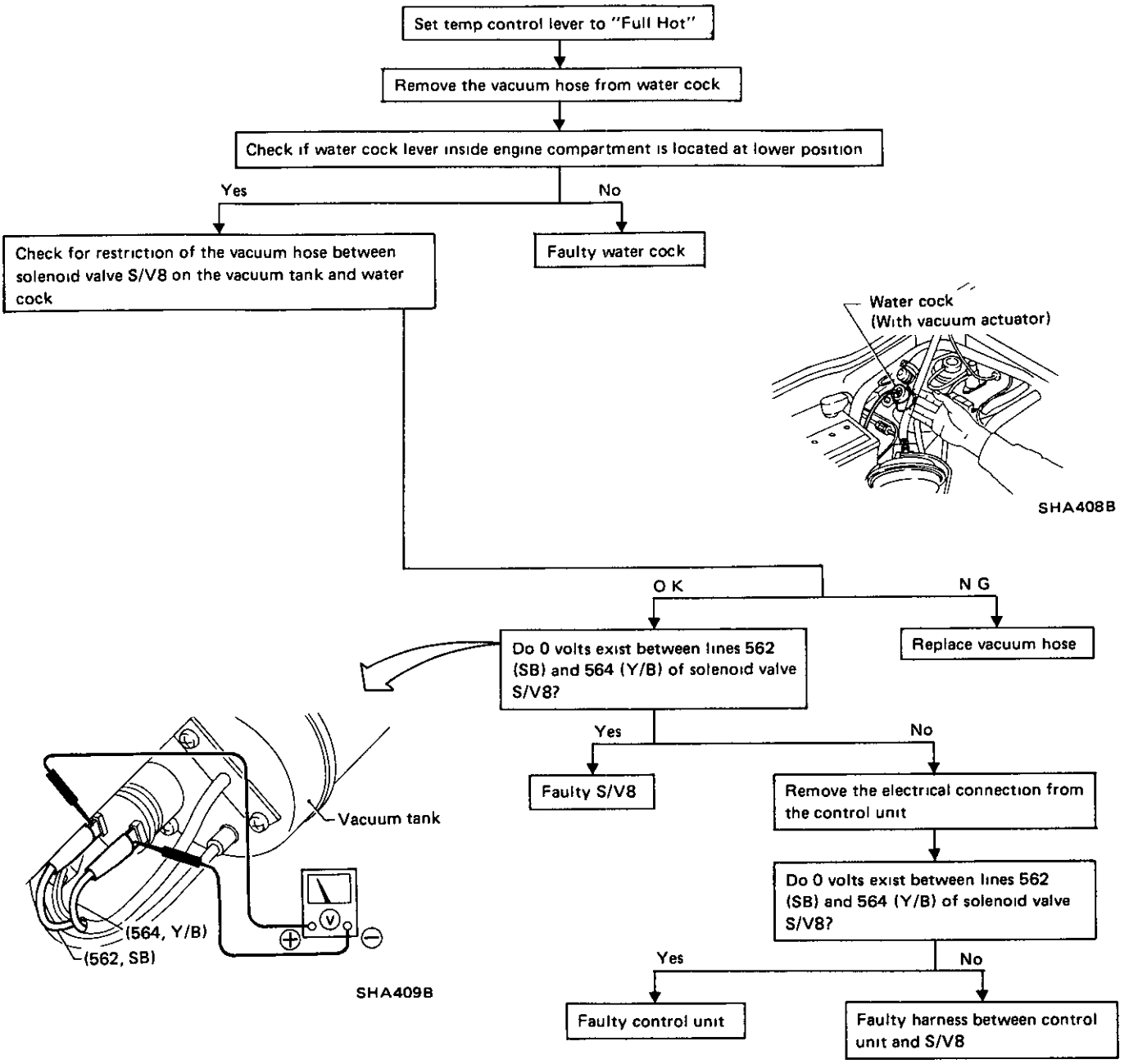




(K) OUTLET AIR TEMPERATURE CANNOT BE CHANGED WITH TEMP. CONTROL LEVER.

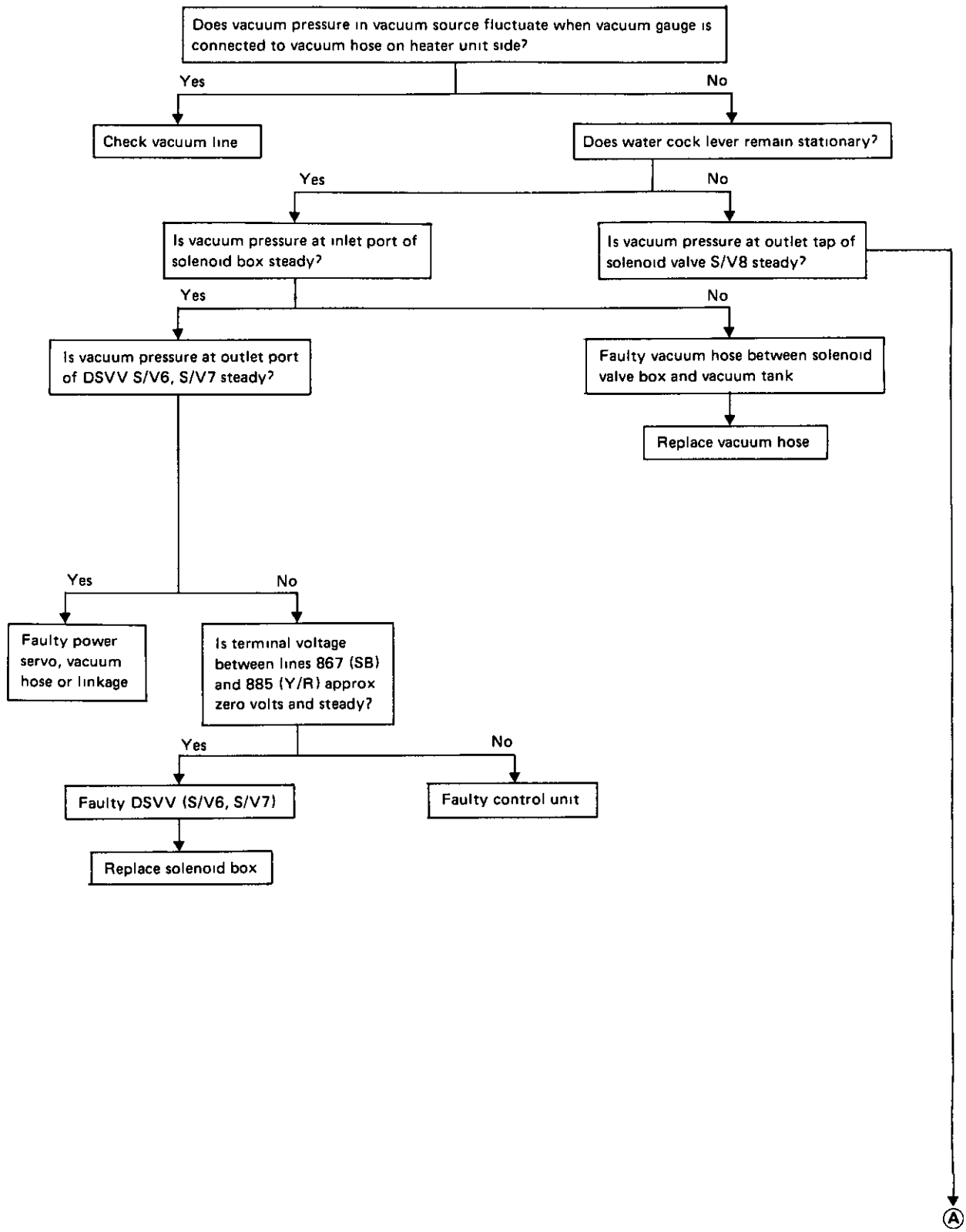
Refer to item (I) or (J) above to check and correct.

(L) MALFUNCTION OF WATER COCK OPERATION.

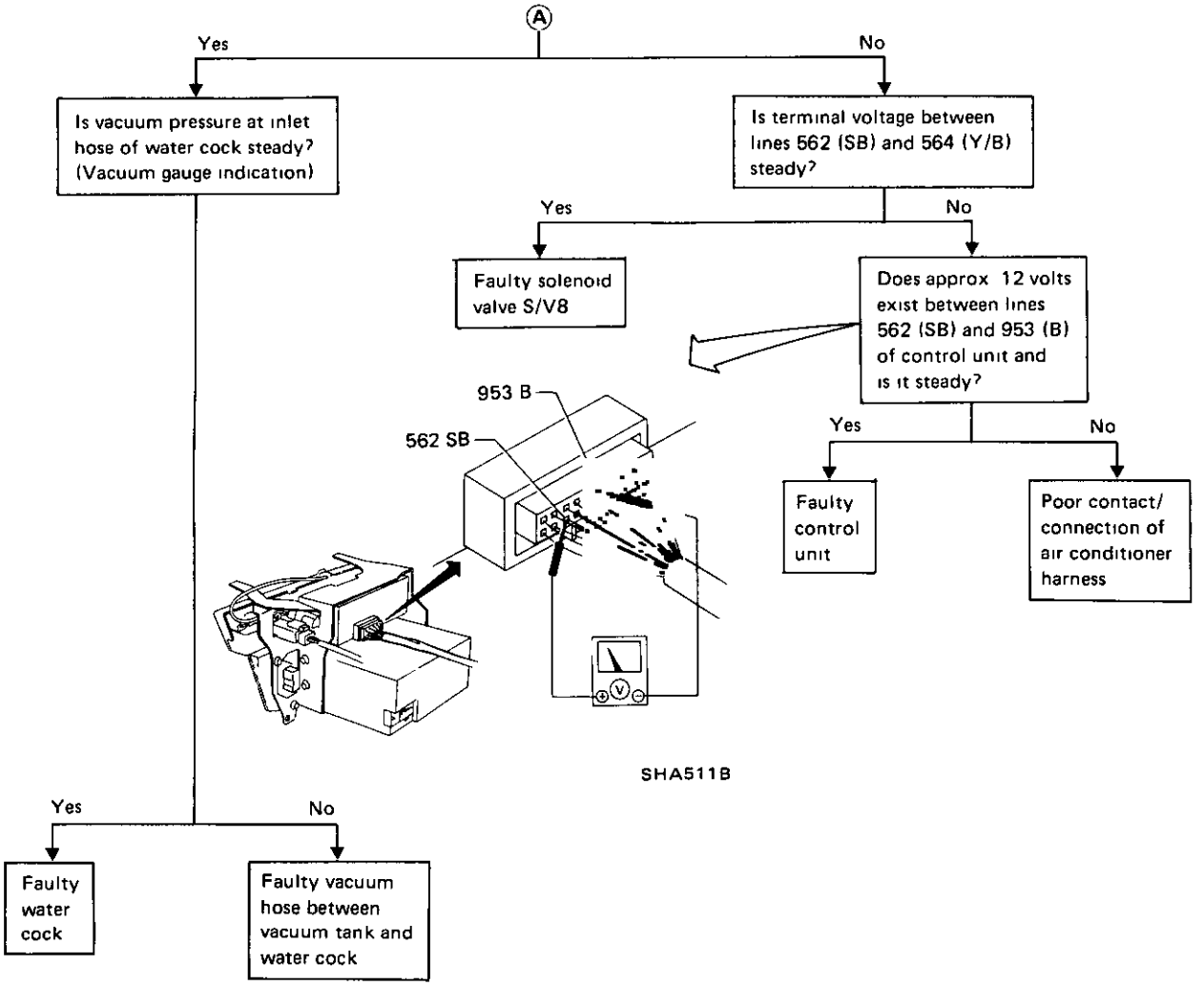


Trouble Diagnoses from Abnormal Conditions (Cont'd)

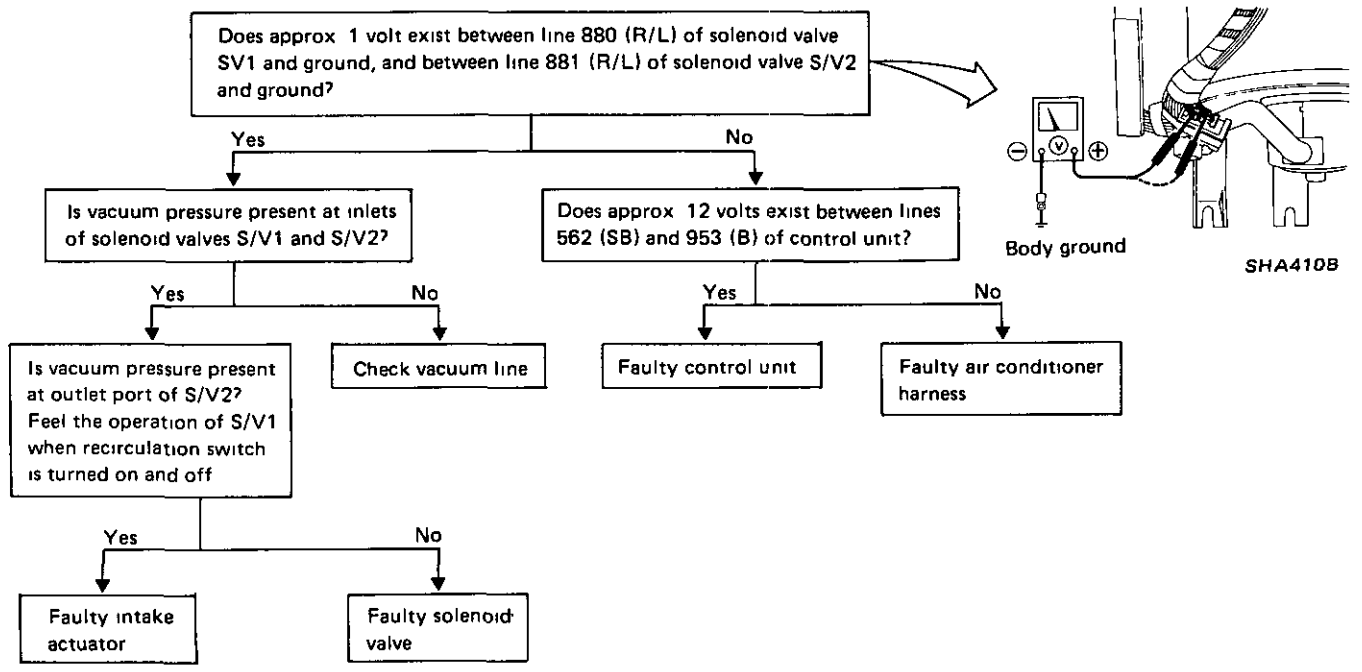
(M) OUTLET AIR TEMPERATURE FLUCTUATES.



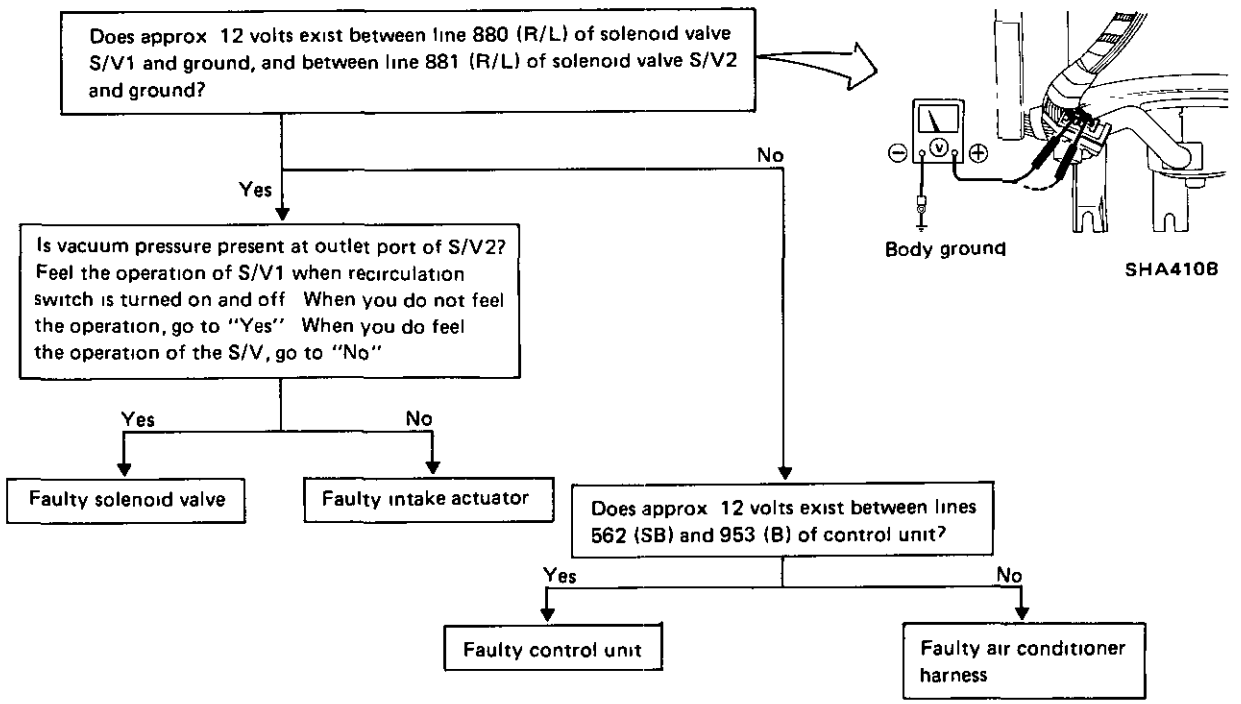
Trouble Diagnoses from Abnormal Conditions (Cont'd)



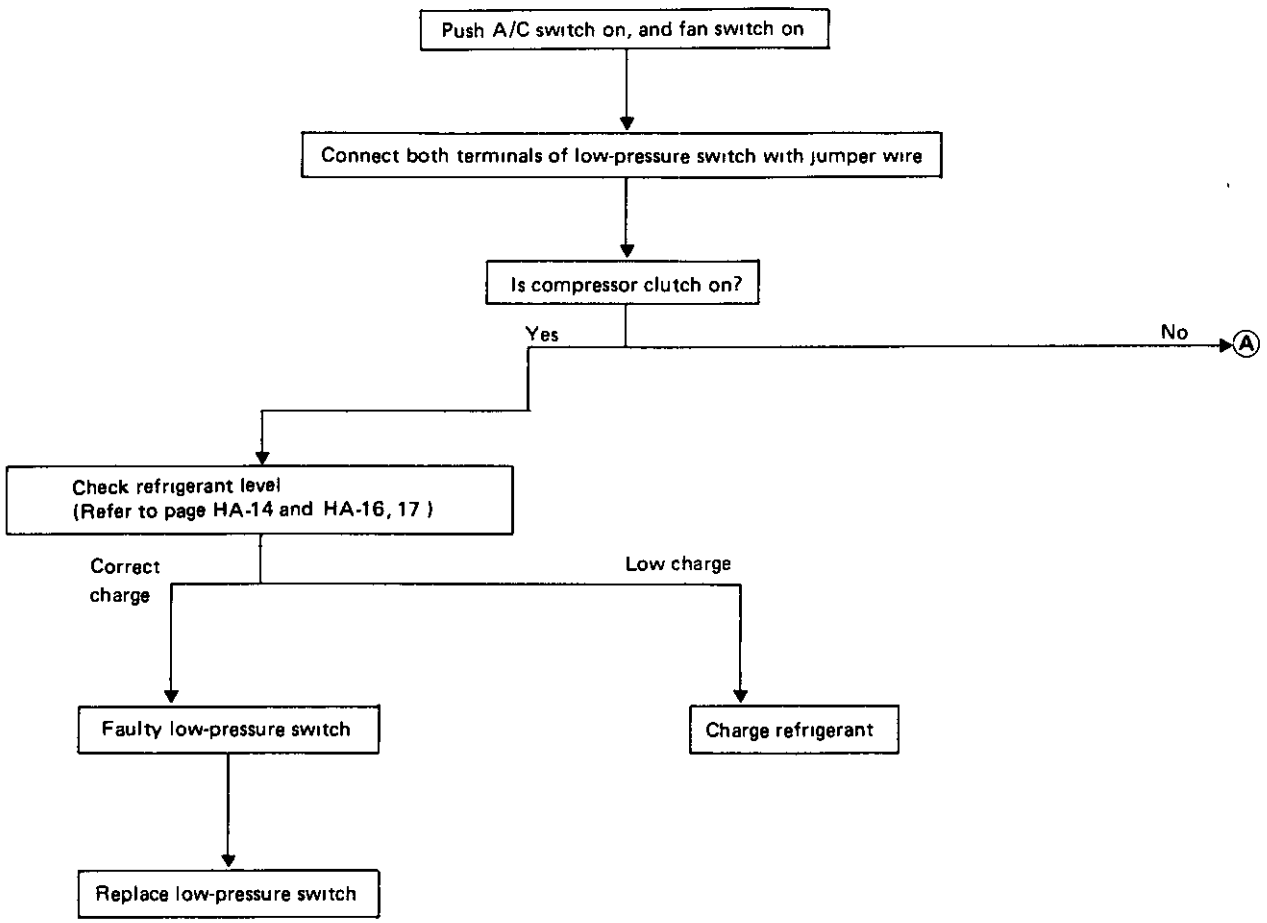
(N) RECIRCULATION MODE CANNOT BE SET WHEN "REC" SWITCH IS PRESSED.

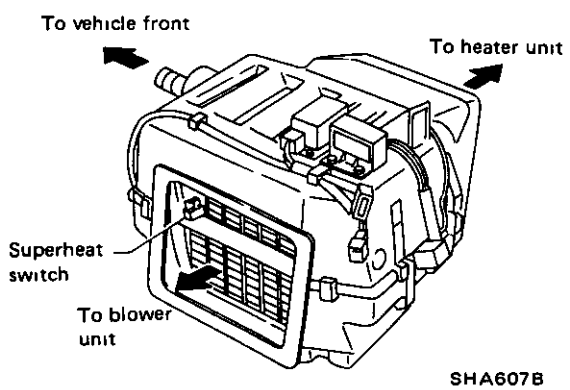


(P) OUTSIDE AIR IS NOT DRAWN INTO COMPARTMENT WHEN "REC" SWITCH IS TURNED OFF.



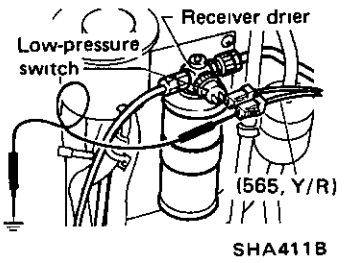
(Q) COMPRESSOR CLUTCH IS NOT ENGAGED.





Ⓐ

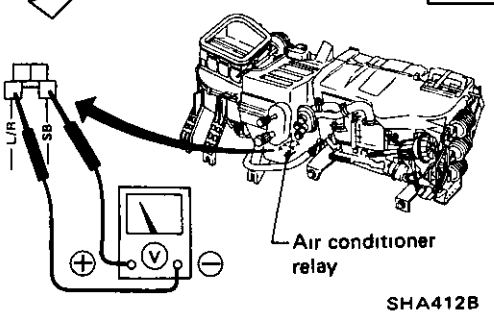
Make a short circuit with plus side terminal of low-pressure switch and body earth. Check the compressor clutch operation



SHA411B

ON / OFF

Is correct voltage applied to air con relay coil? (Correct voltage 12 volts)



SHA412B

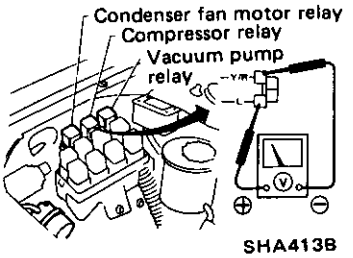
Yes / No

Faulty relay

Replace

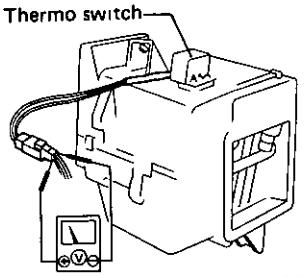
Remove compressor relay
Is correct voltage applied to compressor relay? (Correct voltage 12 volts)

Ⓑ



SHA413B

Is applied voltage between terminals 570 and 571 of thermo switch 12 volts?

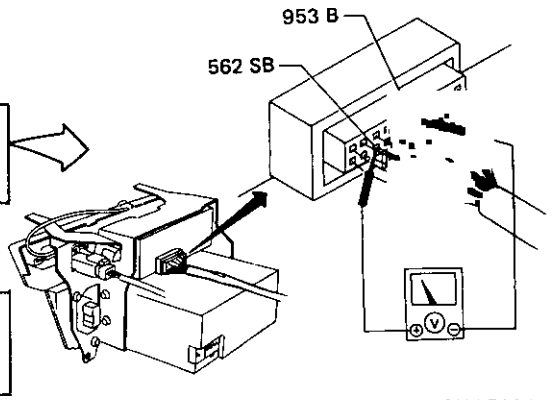


SHA795B

Yes / No

Faulty thermo switch

Is applied voltage between terminals 562 and 953 of control unit 12 volts?



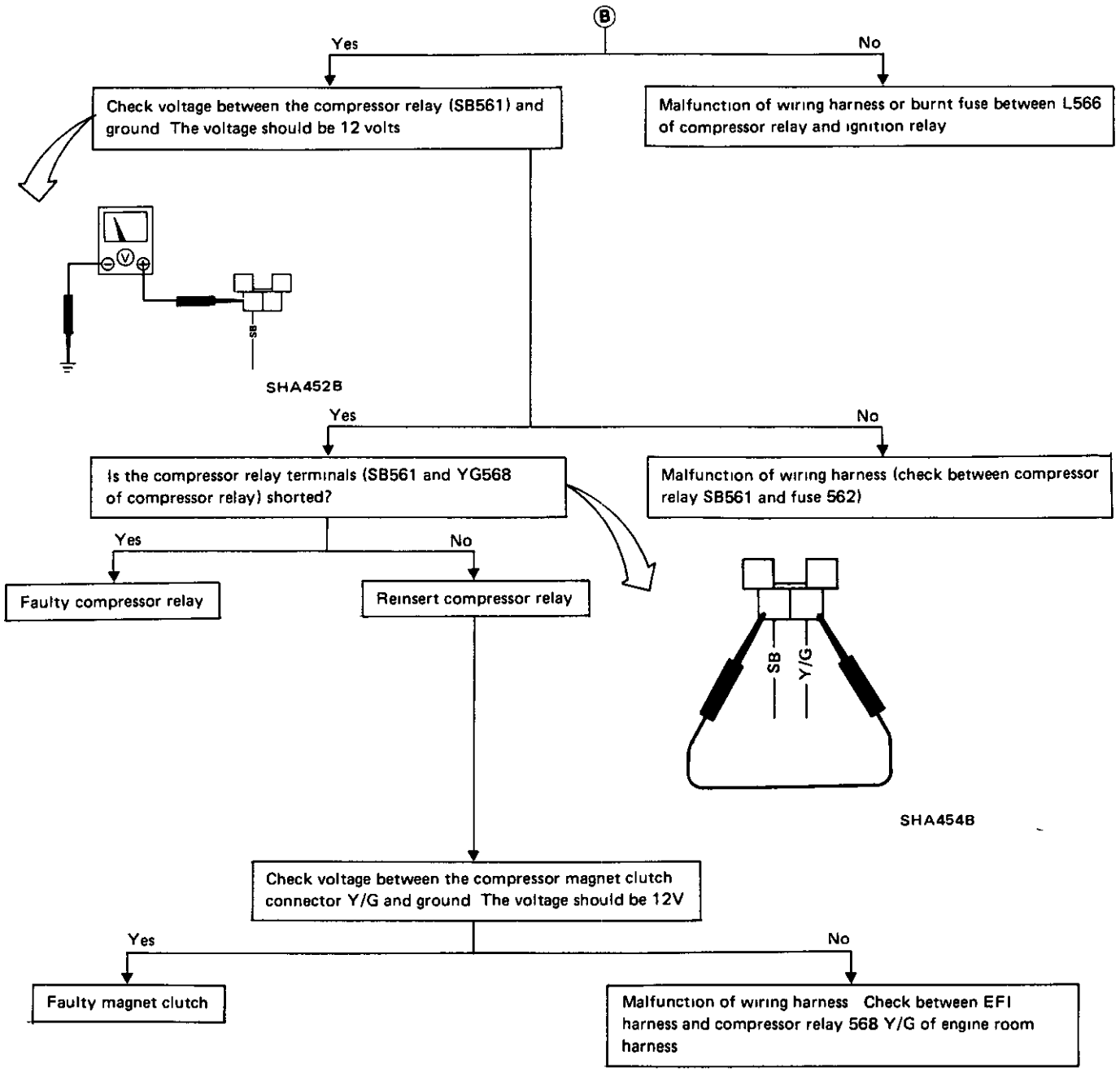
SHA511B

Yes / No

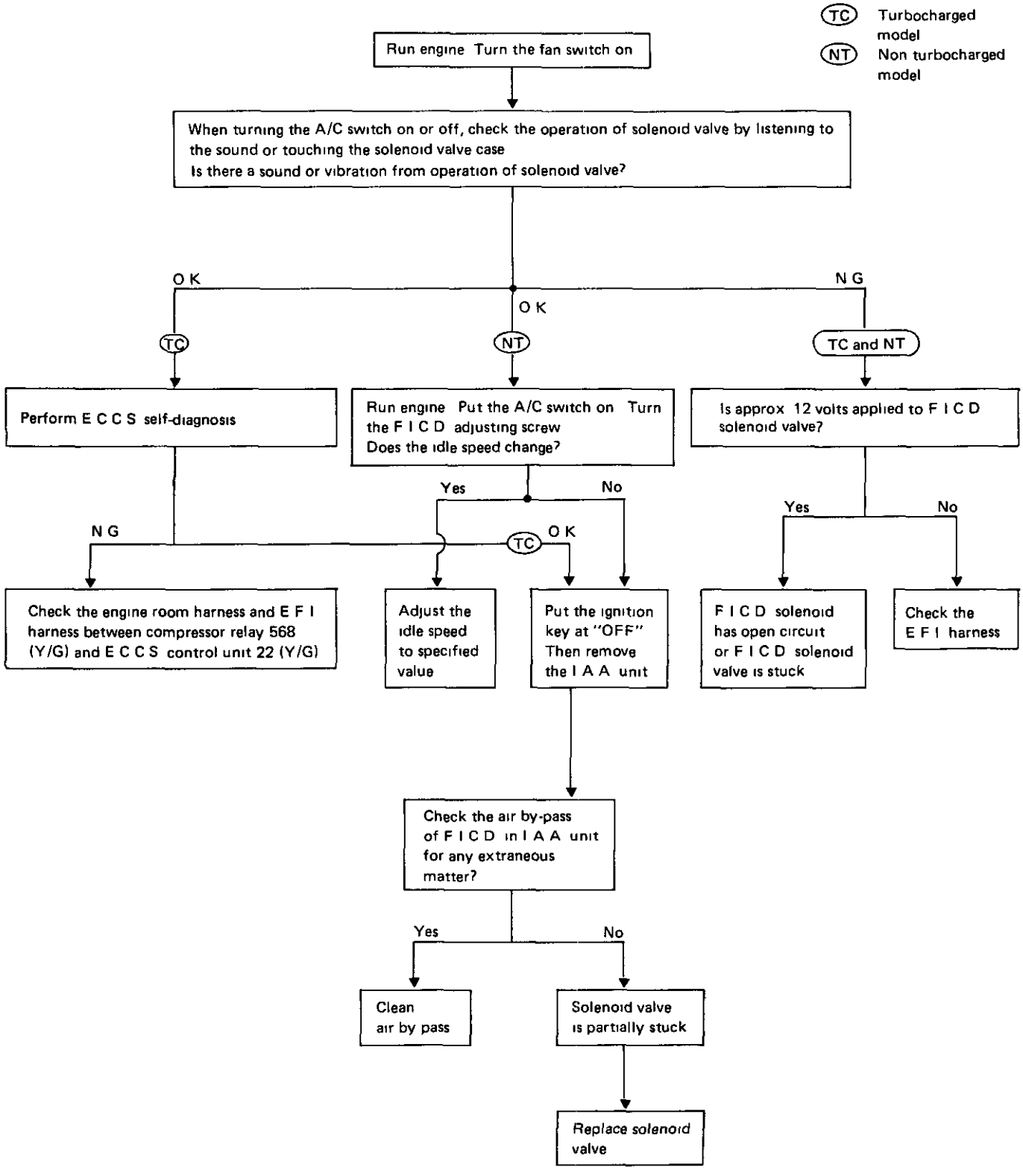
Faulty control unit

Faulty air conditioner harness

Trouble Diagnoses from Abnormal Conditions (Cont'd)



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



(S) BLOWER MOTOR ROTATES INTERMITTENTLY.

Remove fan control amplifier from blower motor unit

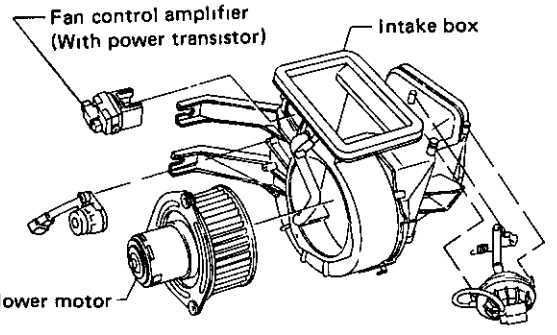
Does water stand on the fan control amplifier?

Yes

Remove the water and install the fan control amplifier again

No

Go to item (A) (Page HA-39)



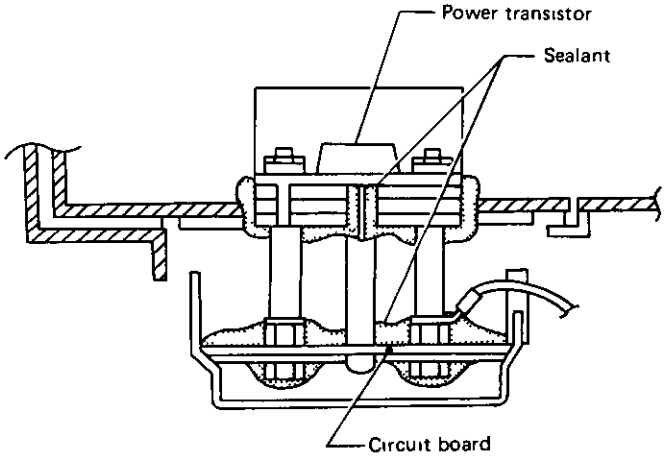
SHA318B

Normal operation

Modify the fan control amplifier as follows
Apply sealant around the power transistor cover and the terminals of the power transistor
Apply sealant to the surface of the circuit board

N G

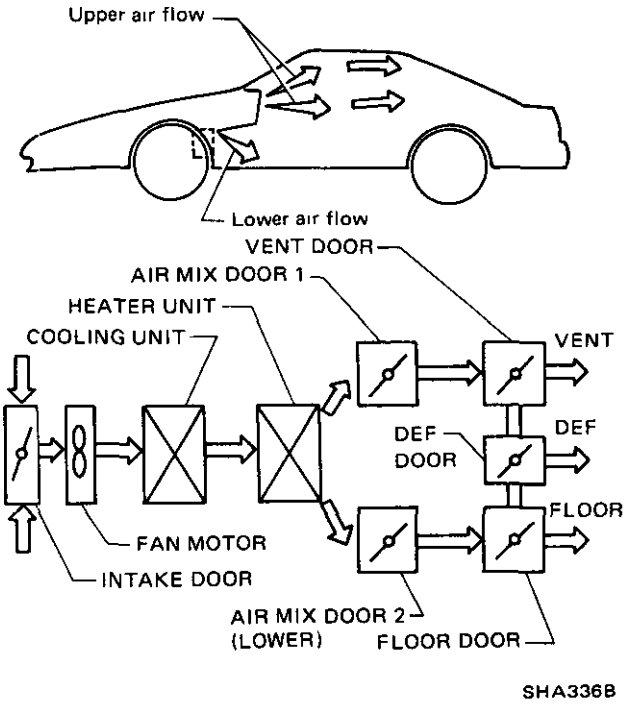
Replace fan control amplifier



SHA521B

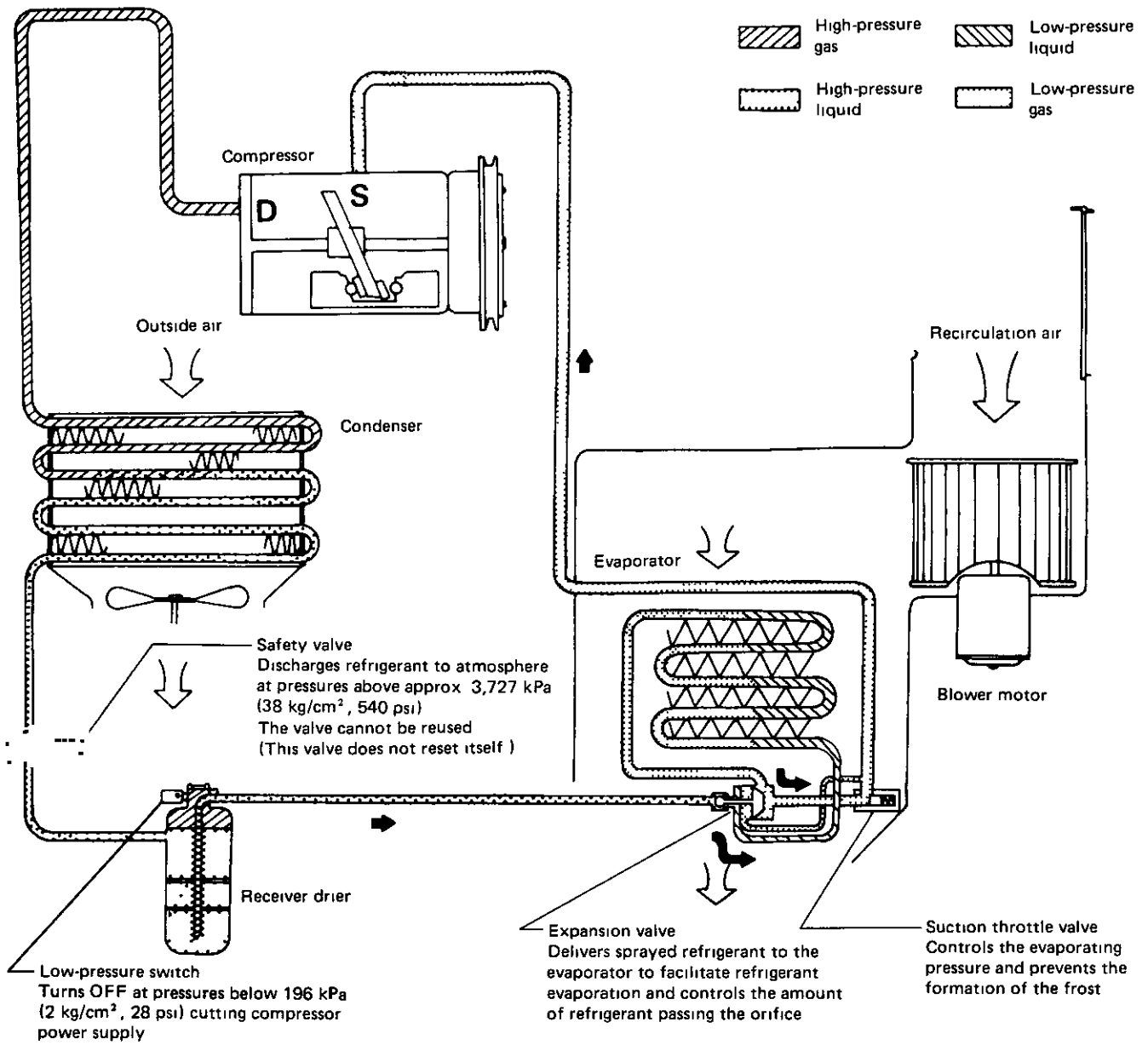
Features

- 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 ±2°C (±3.6°F)
- The manual DEF switch has been adopted so that the system can be fixed in the DEF mode for driving even when trouble occurs in the control function
- The control unit display section (digital display and air flow indicator) is utilized for self-diagnosing each sensor and actuator.
- The proportional integral control system newly adopted in the temperature control system provides quick and accurate response without generation of steady-state error during stabilized operation



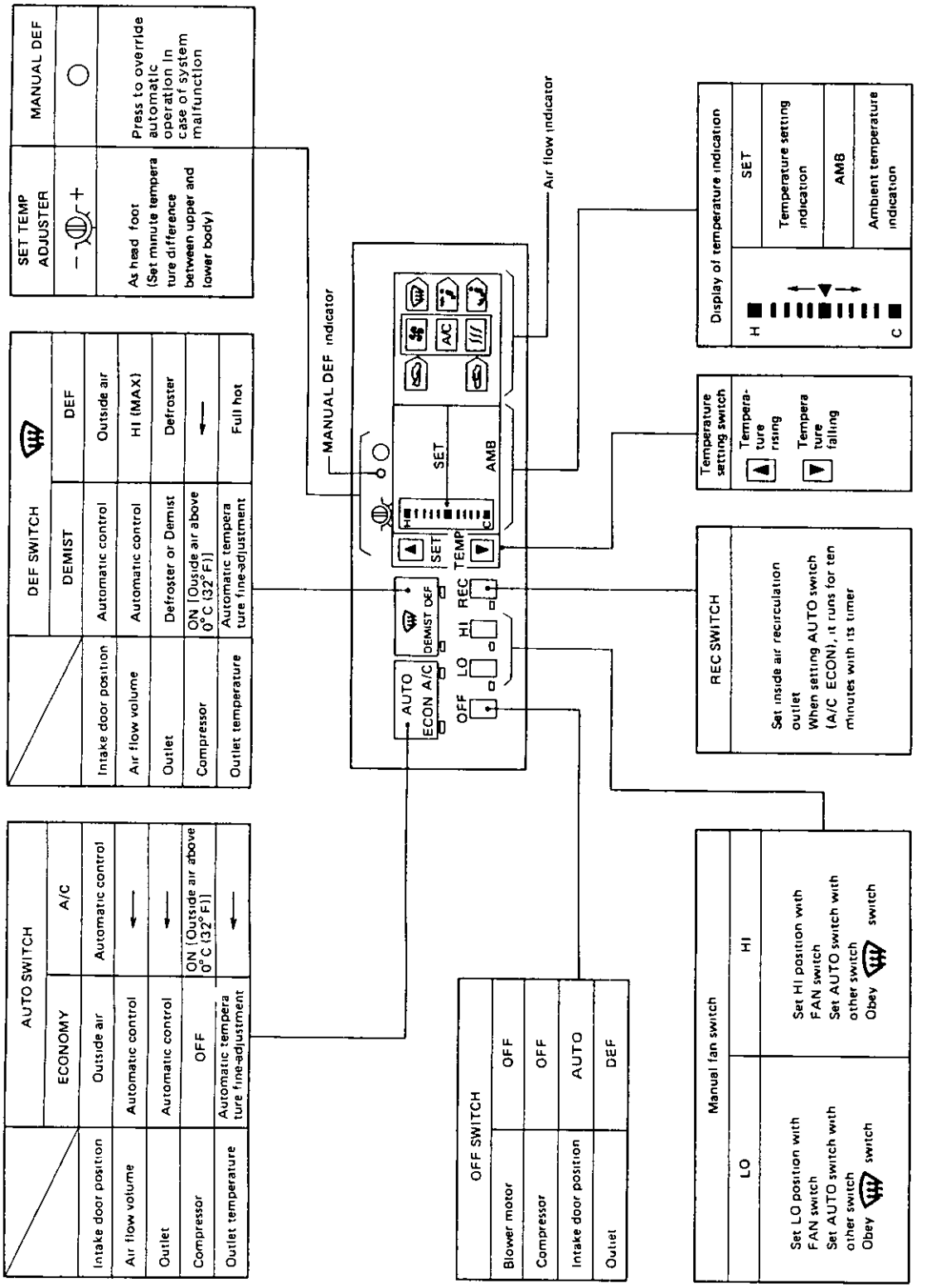
SHA336B

Refrigeration Cycle



SHA276B

Function of the Switches on Control Unit

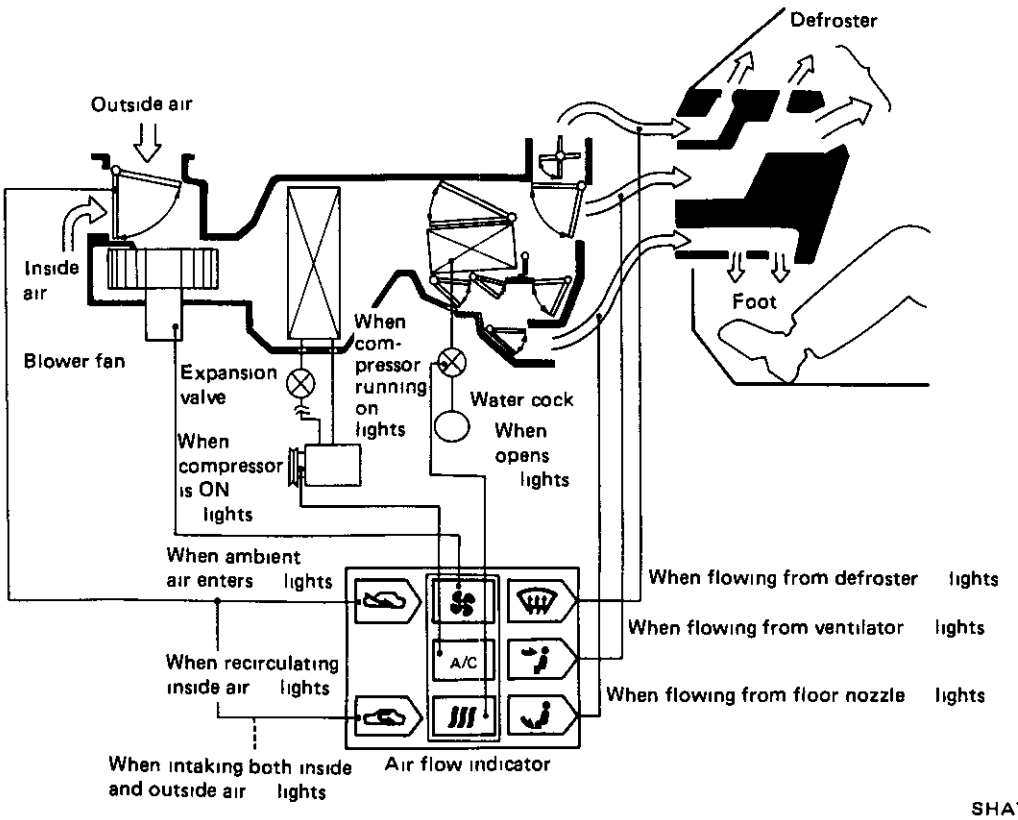


SHA796B

(3) SWITCHES AND THEIR CONTROL FUNCTIONS

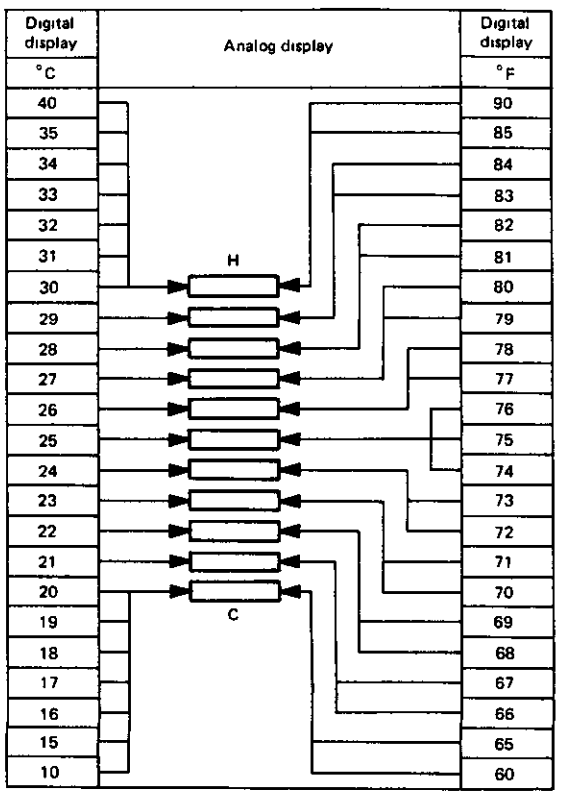
Switch \ Item to be controlled		Air flow	A/M door	Compressor	Water cock (W/C)	Intake air	Air outlet	Control When starting	Remarks
OFF		OFF	Auto	OFF	Auto	Outside air	Auto		Display (SET)/(AMB) is ON with ignition switch set to ACC A/M door and W/C control air temperature obtained by ram pressure
AUTO SW	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)
SW	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
Manual fan SW	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
MANUAL DEF		HI	Full-Hot	OFF	Open	Outside air	DEF		Pushing this switch again returns to previous condition
SET TEMP ADJUSTER		–	–	–	–	–	–	–	Air temperatures at head and foot levels are adjustable to ±2°C (±3 6°F), regardless of operation of any other switch

Display of the Air Flow Indicator



SHA797B

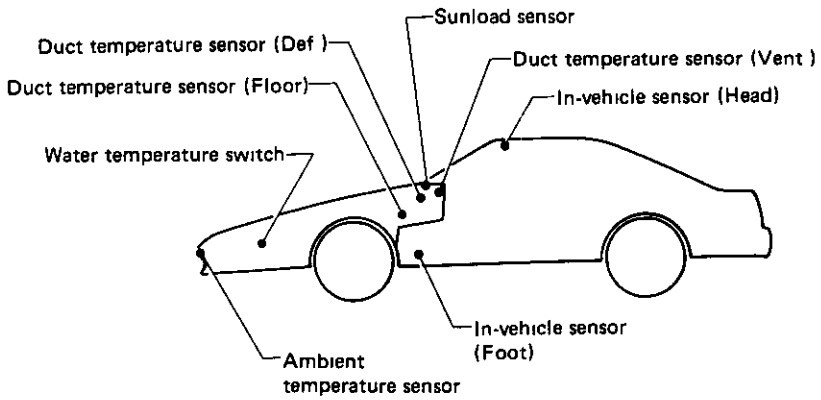
Display of Temperature Setting



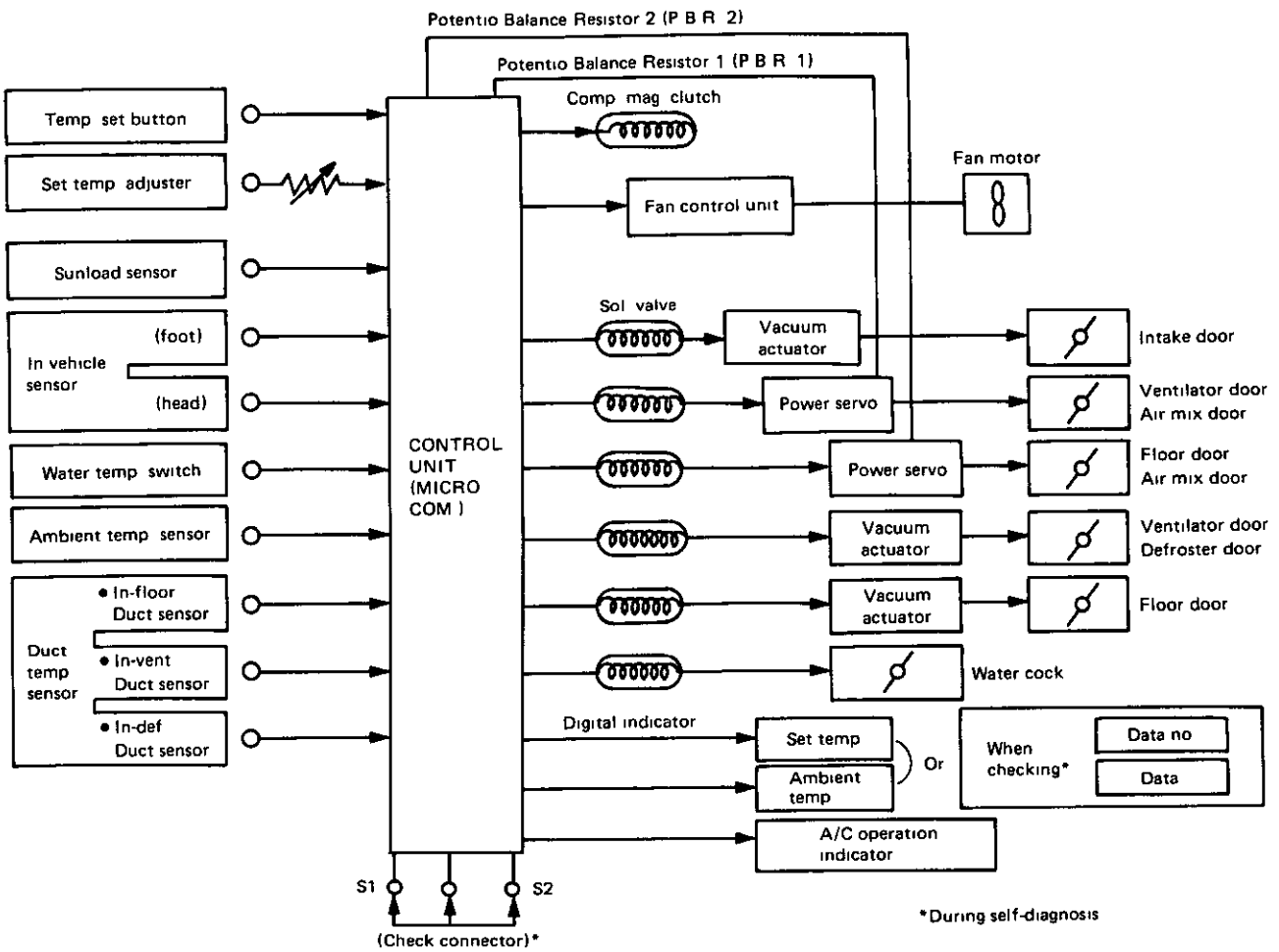
SHA523B

Control System

SENSOR & SWITCH LOCATION



SHA798B



SHA799B

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

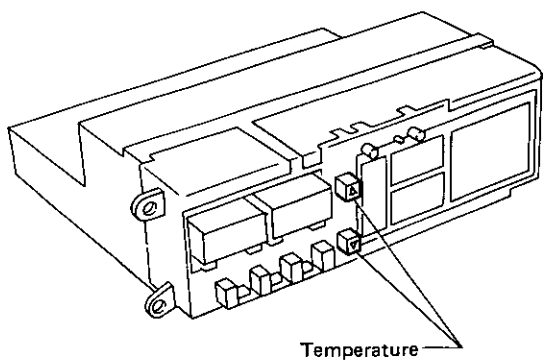
1) Automatic amplifier (with microcomputer)
2) Temperature setting switch
3) Two in vehicle sensors (head/foot)
4) Ambient temperature sensor
5) Three duct temperature sensors (defroster duct, ventilator duct, floor duct)
6) Sunload sensor
7) Power servo 1 and Power servo 2
8) PBR1 and PBR2
   (P B R · 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**

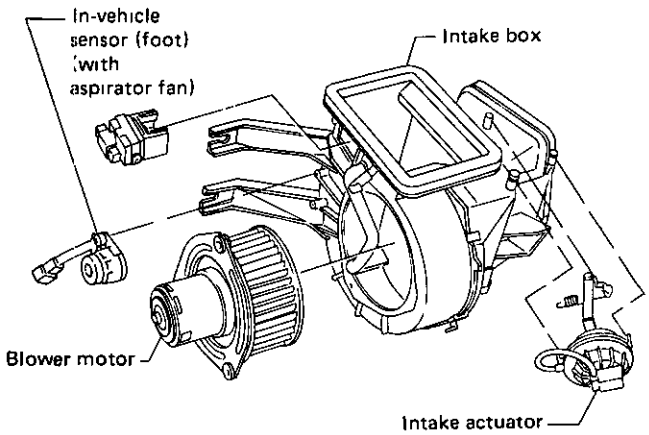


SHA608B

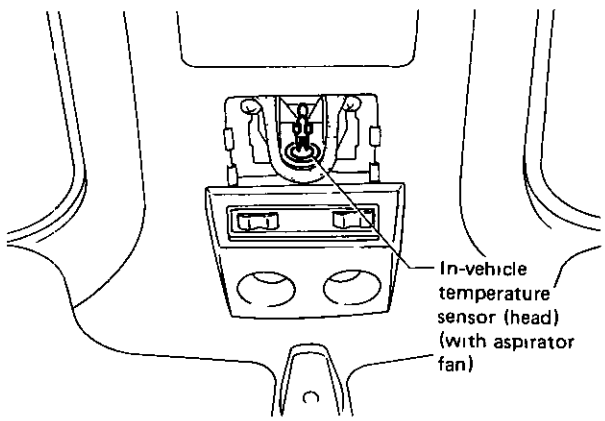
This switch is used for setting the in-vehicle temperature. Temperature set by the temperature setting switch is electrically memorized by the microcomputer in the automatic amplifier

- **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

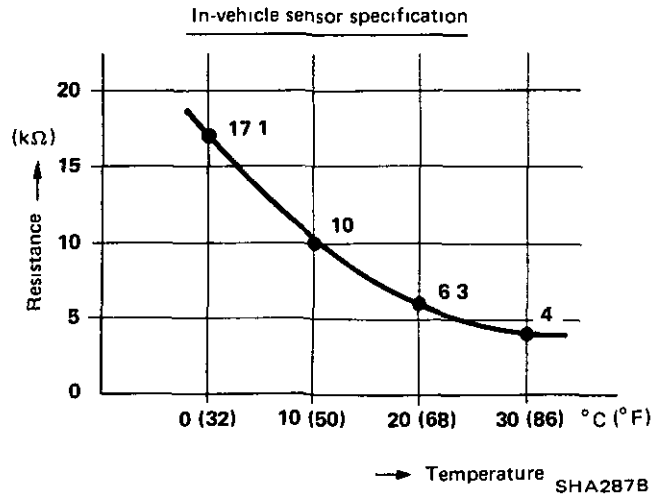


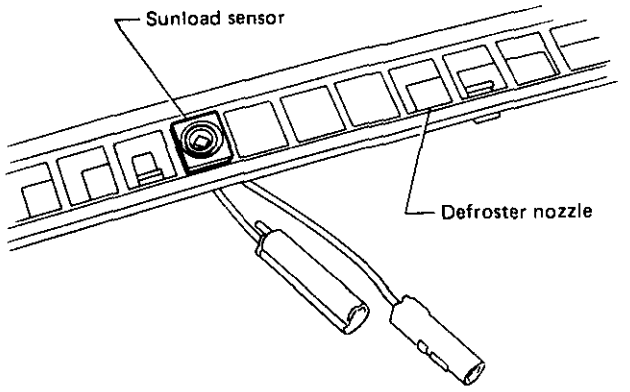
SHA318B



SHA609B

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)

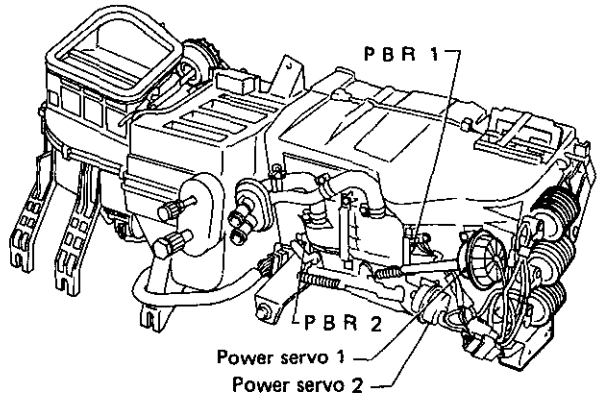
* For the location of these sensors, refer to AIR FLOW AND COMPONENT LAYOUT — Auto A/C (Component Layout).

- **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.

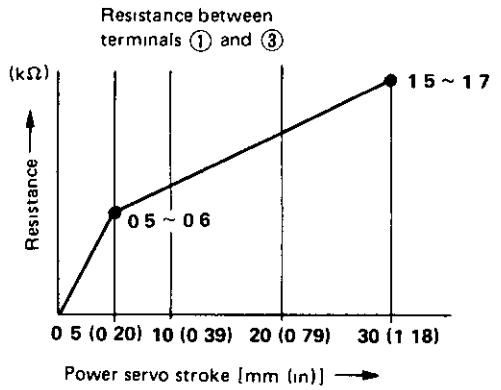
- **Power servo 1 & 2, P.B.R. 1 & 2 (P.B.R.. Potentio Balance Resistor)**

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



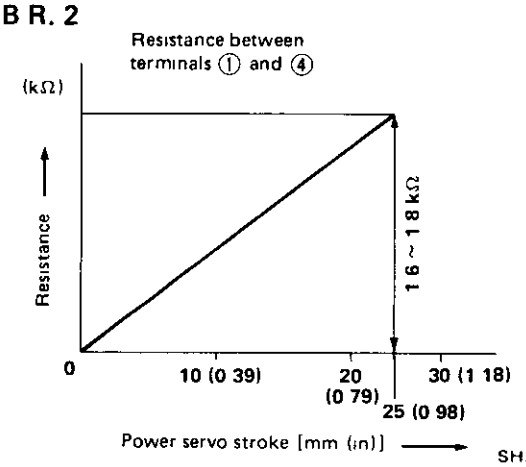
System Operation (Air mix door control) (Cont'd)

P.B R 1

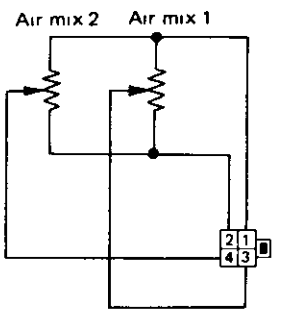


SHA610B

P.B R. 2

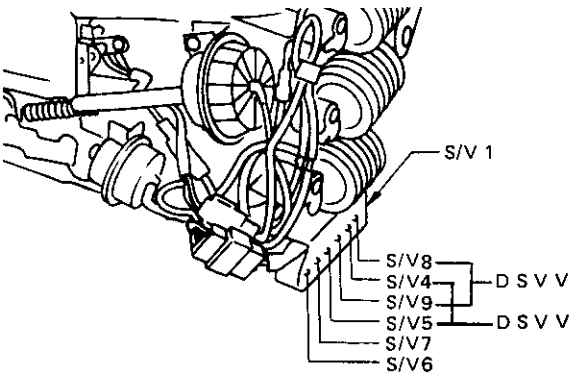


SHA301B



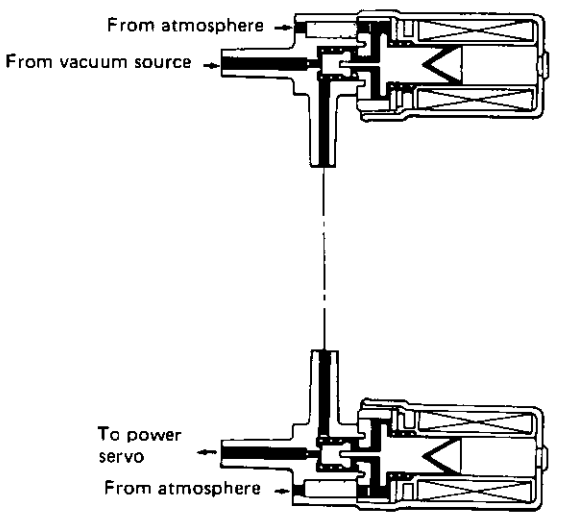
SHA611B

- **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



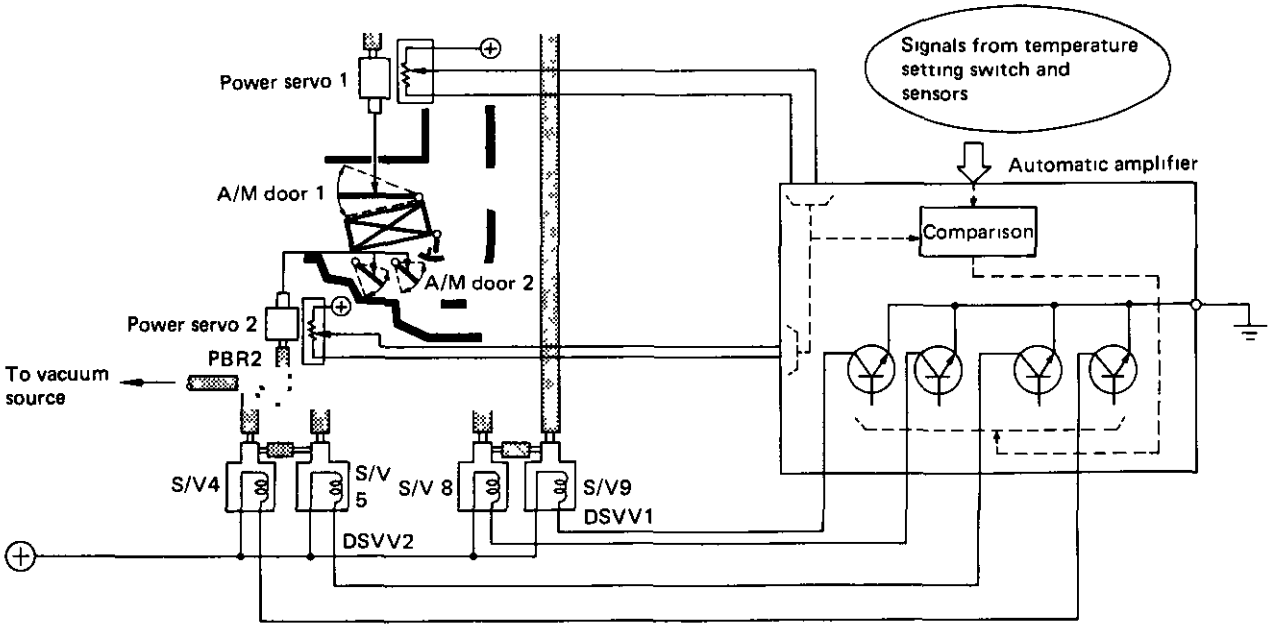
SHA339B

Inner structure of D S V V



SHA289B

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



SHA288B

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

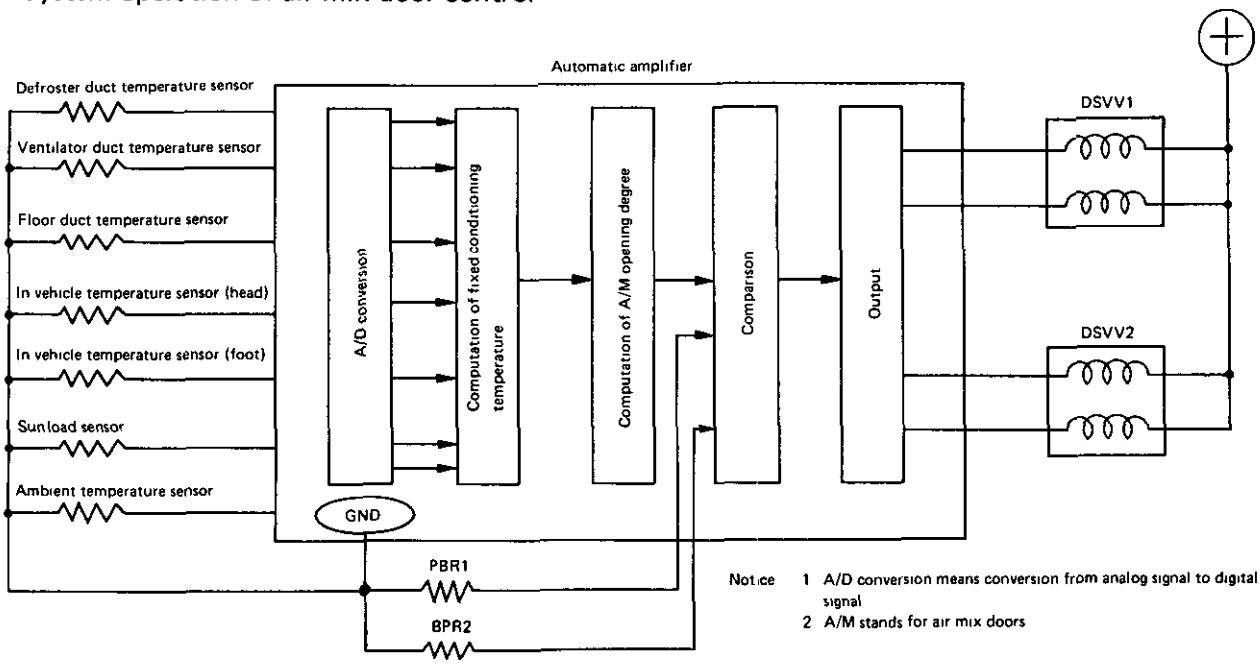
CL Solenoid valve is closed
OP Solenoid valve is open

AIR MIX DOOR CONTROL

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

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

2 System operation of air mix door control



SHA290B

The temperature setting switch in this control system inputs the setting temperature signal to the auto amplifier

The in-vehicle sensor, sunload sensor, ambient air temperature sensor, and duct temperature sensor also input the resistance value signals respectively to the auto amplifier corresponding to their conditions

Receiving these input signals, the auto amplifier calculates the desirable air mix door position and causes the air mix door to move to the calculated position from its actual position detected by P B R. 1.

This movement of the air mix door is done by the power servo activated by the signal sent from the auto amplifier to the atmosphere side or vacuum side of the D.S.V V.

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

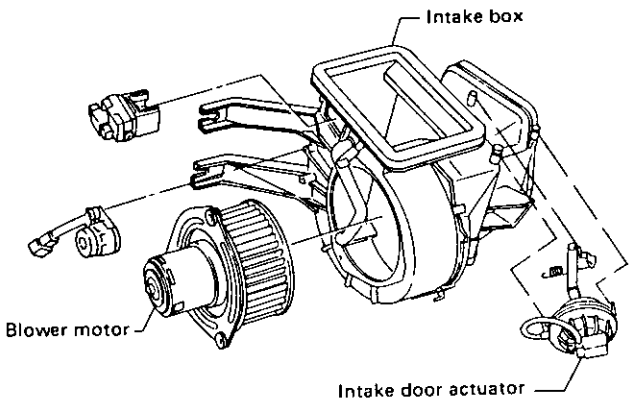
System Operation (Intake door control)

INTAKE DOOR CONTROL

1 Component parts

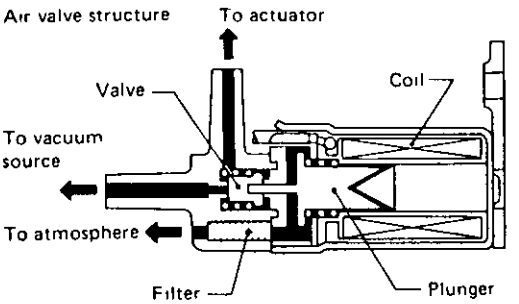
The next parts are added to the component parts of air mix door control system

- **Intake door actuator**



SHA318B

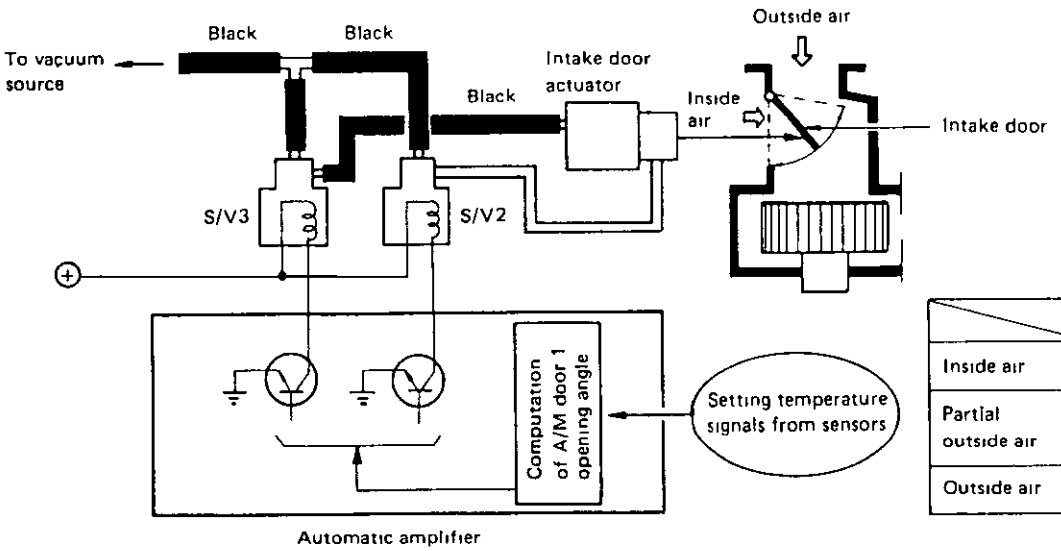
- **Solenoid valve (Air valve type)**



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

SHA302B

2 System operation of intake door control

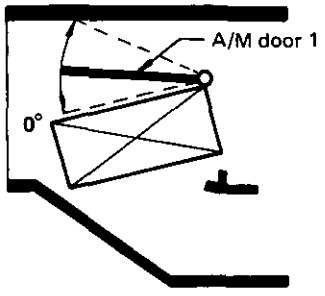


	S/V3	S/V2
Inside air	OPEN	OPEN
Partial outside air	OPEN	CLOSED
Outside air	CLOSED	CLOSED

SHA303B

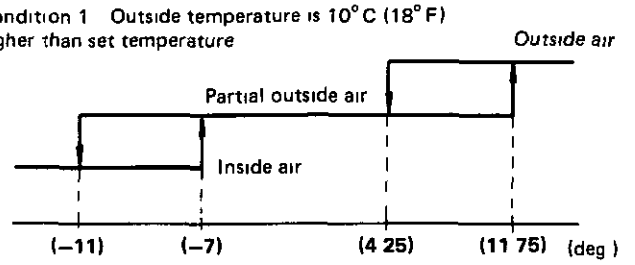
System Operation (Intake door control) (Cont'd)

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



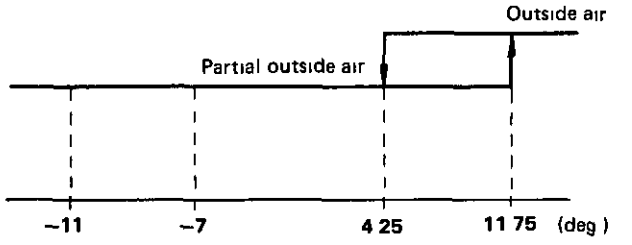
SHA304B

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)

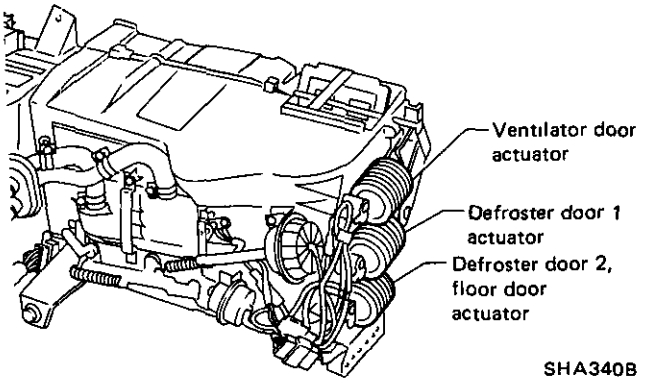
OUTLET DOOR CONTROL

1. Component parts

Outlet door control system consists of the parts shown below.

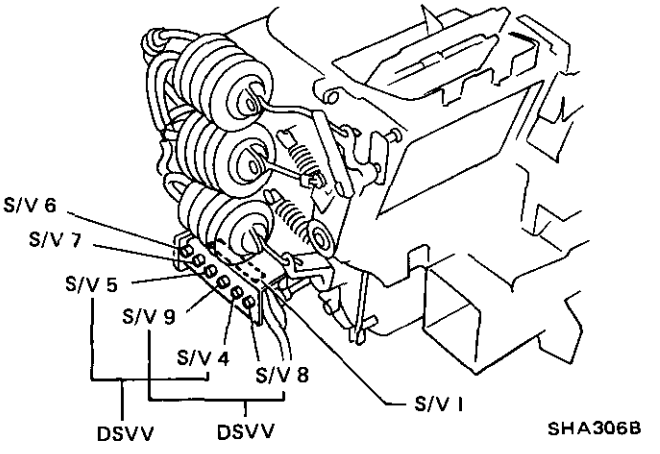
1) Defroster door actuator
2) Ventilator door actuator
3) Defroster and floor door actuator
4) Solenoid valve 6, 7
5) Sunload sensor
6) Ambient temperature sensor
7) Automatic amplifier

- **Actuators**



SHA340B

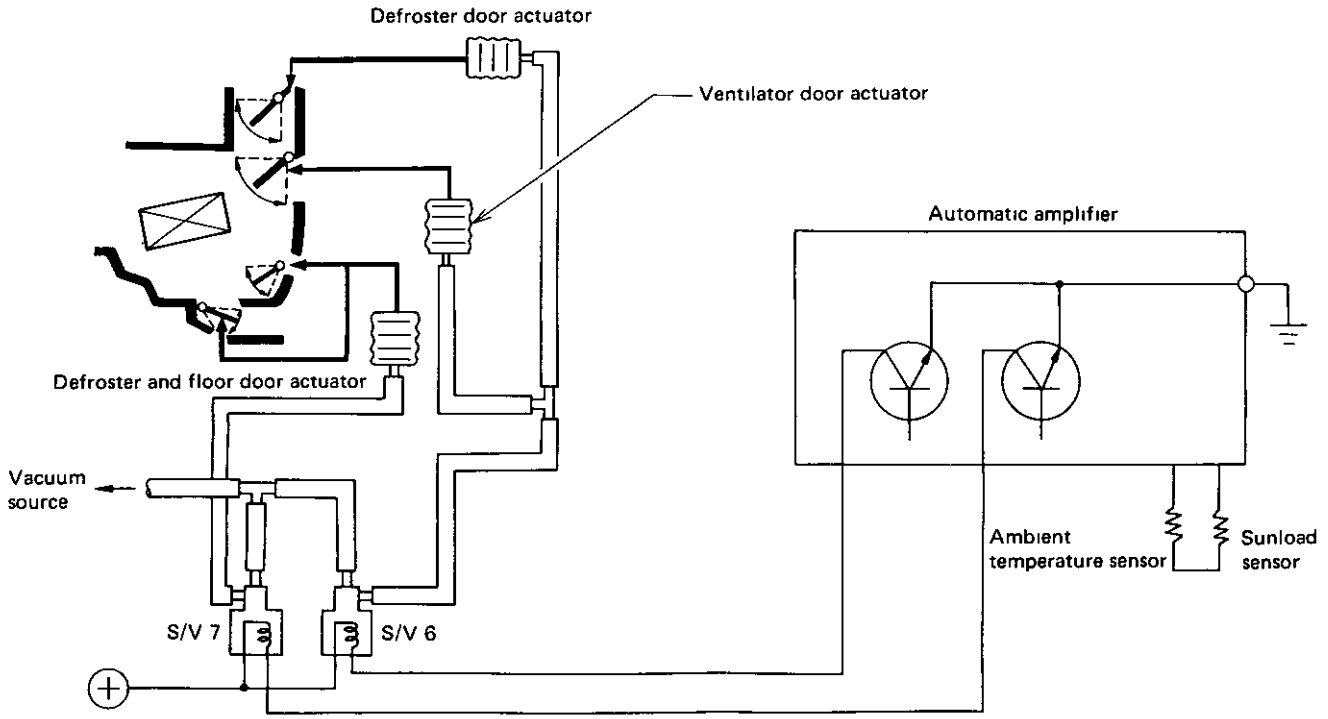
- **Solenoid valve 6, 7**



SHA306B

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

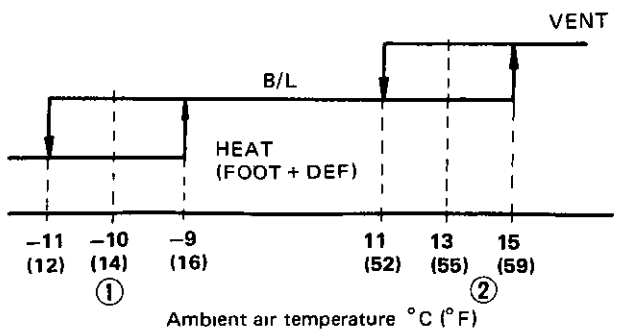
2 System operation of outlet door control



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

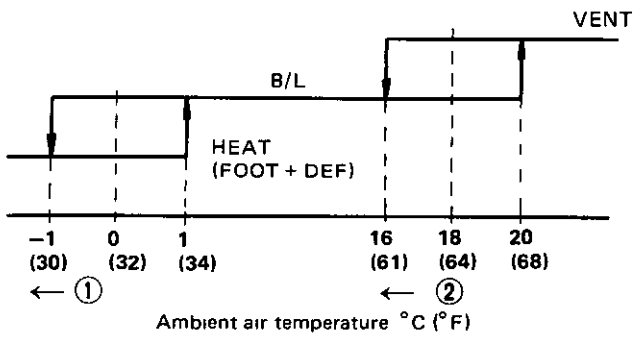
Condition Very fine in midsummer
(Sunload Approximately 0 768 kW
(660 kcal/h, 2,619 BTU/h)/m^2
[0 0713 kW (61 3 kcal/h, 243 2 BTU/h)/sq ft])



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

System Operation (Air flow volume control)

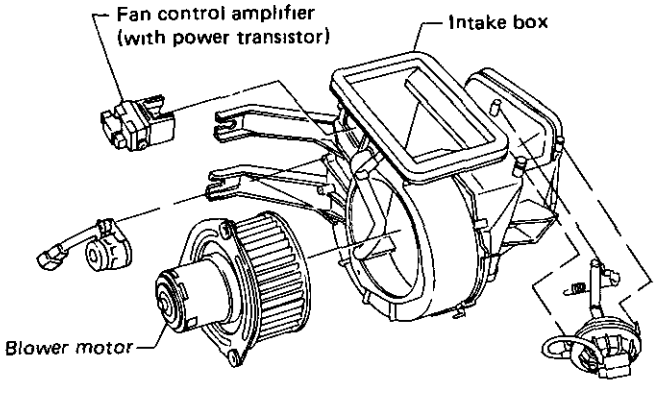
AIR FLOW VOLUME CONTROL

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

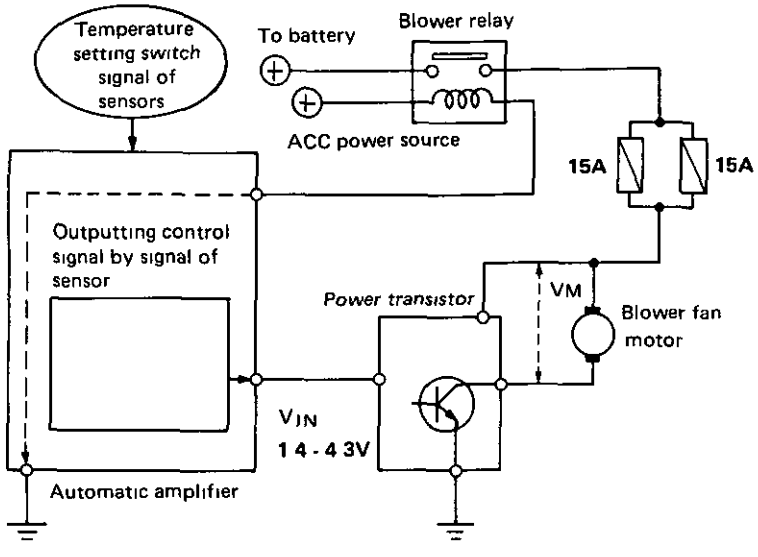


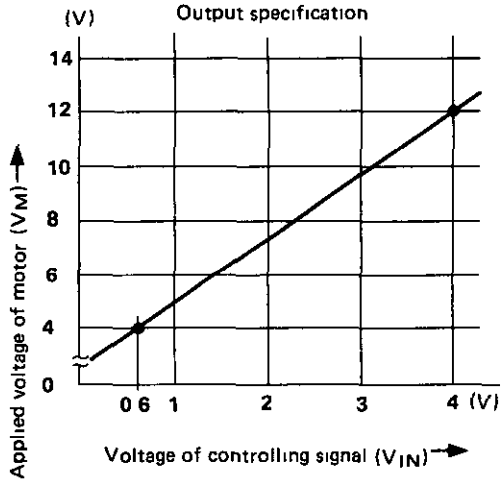
SHA318B

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

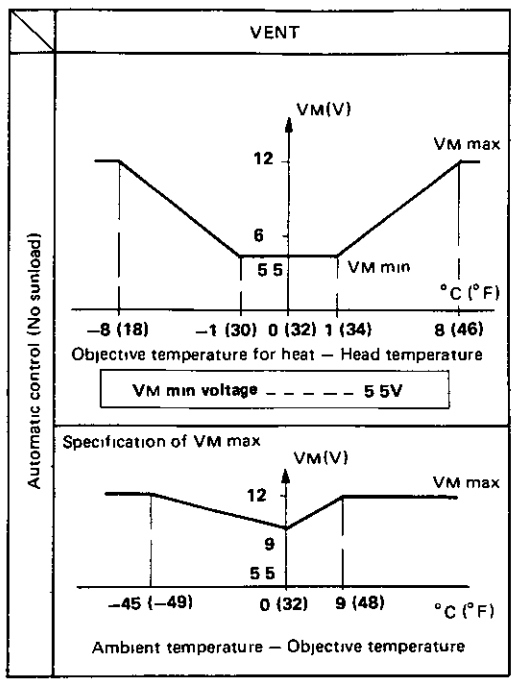
System Operation (Air flow volume control) (Cont'd)

3 Specification of air flow volume control (Automatic control)

- When "AUTO" switch is ON:

VENT mode

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

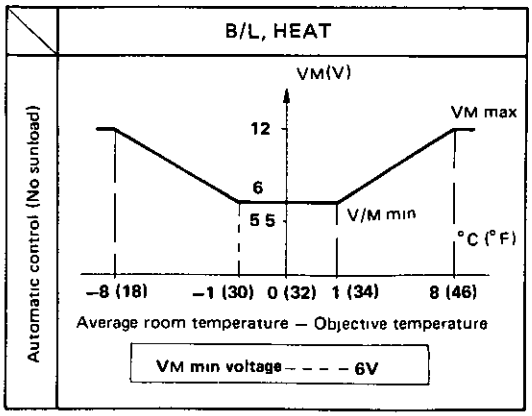


SHA310B

B/L, HEAT mode

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

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



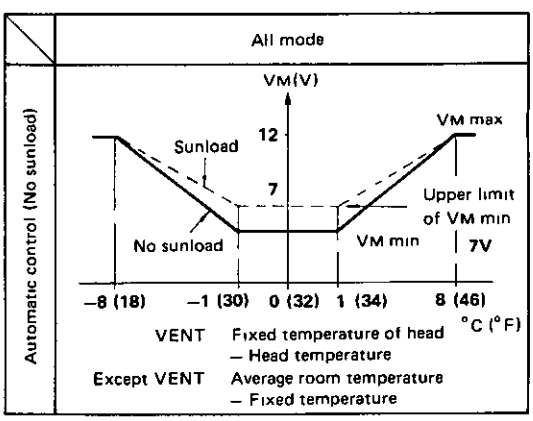
SHA311B

4 Compensation of air flow volume when sunload exists

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

In VENT . . . V_M min. 5 5 to 7 V
Except VENT . . V_M min· 6 to 7 V
(In both cases, the upper limit of compensation is 7V)
V_M max is the same as when no sunload exists

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



SHA292B

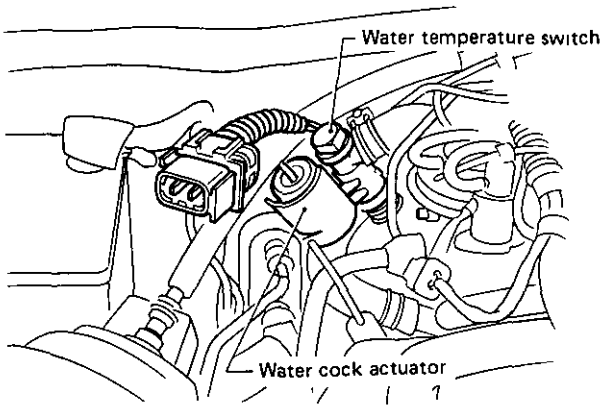
System Operation (Control at starting)

CONTROL AT STARTING

1. Component parts

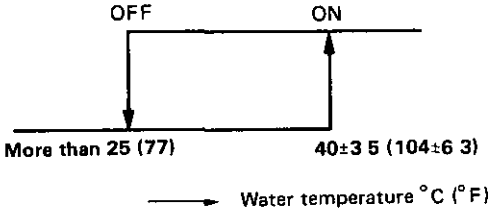
Water temperature switch is added to the component parts of air mix door control system

- **Water temperature switch**



SHA312B

Specification

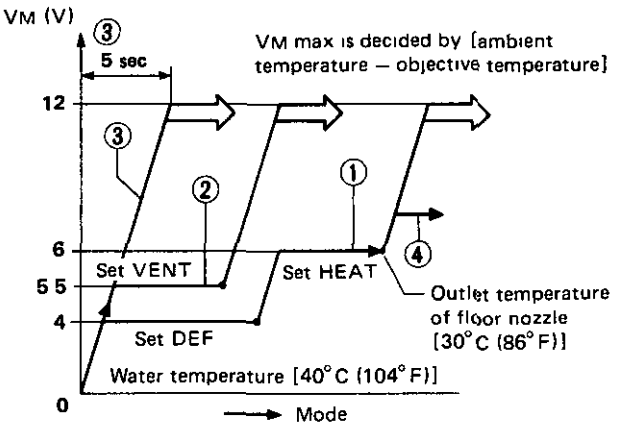


SHA293B

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.



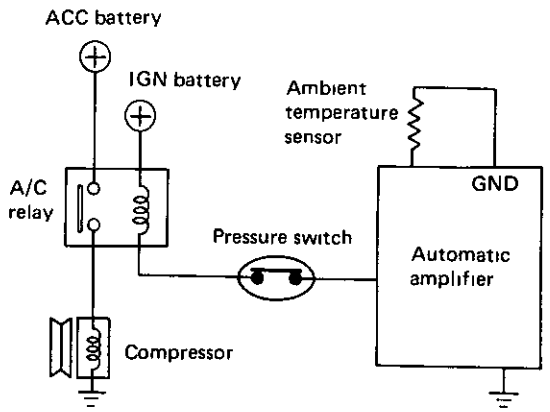
SHA313B

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

COMPRESSOR CONTROL

- "ECON" mode. OFF
- Except for "ECON" mode

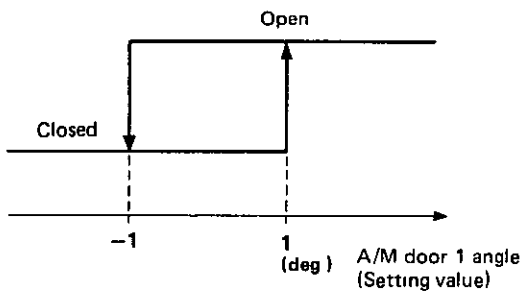
Ambient temperature	Control
More than 0°C (32°F)	ON
Less than 0°C (32°F)	OFF



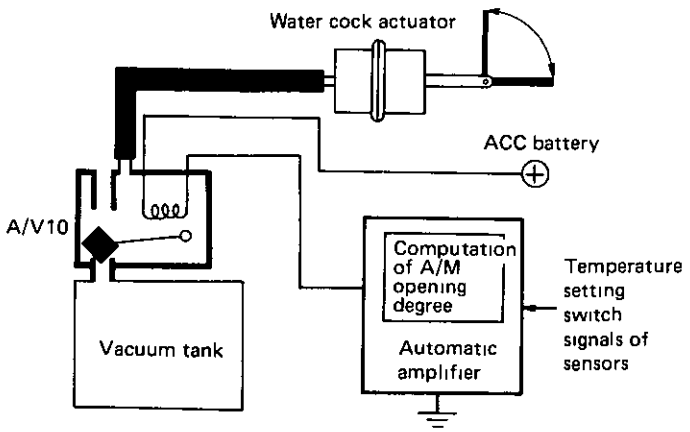
SHA294B

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

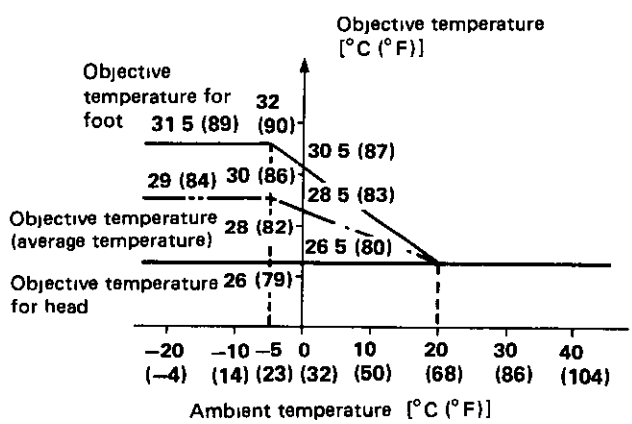


SHA295B

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)]

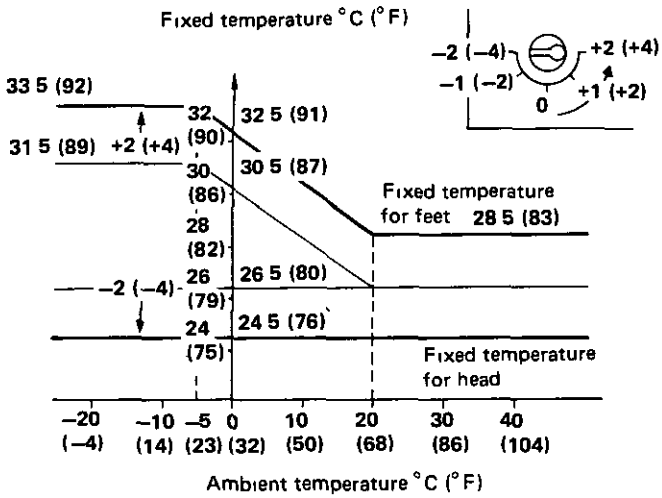


SHA803B

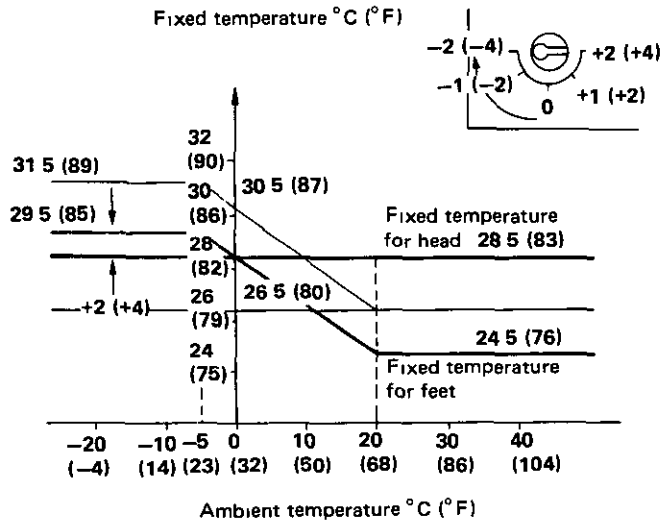
System Operation (Function of set TEMP. adjuster)

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



SHA804B



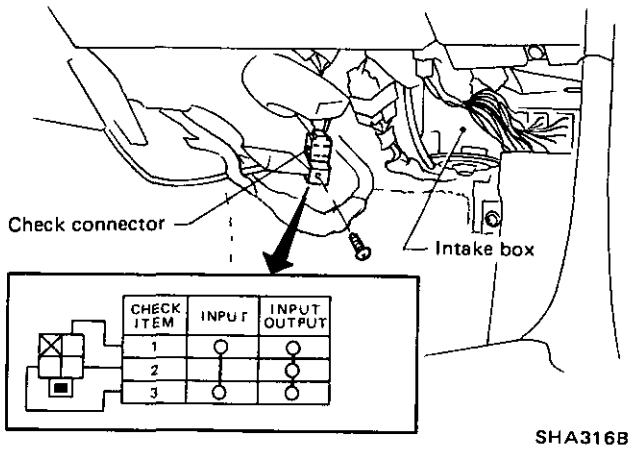
SHA805B

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

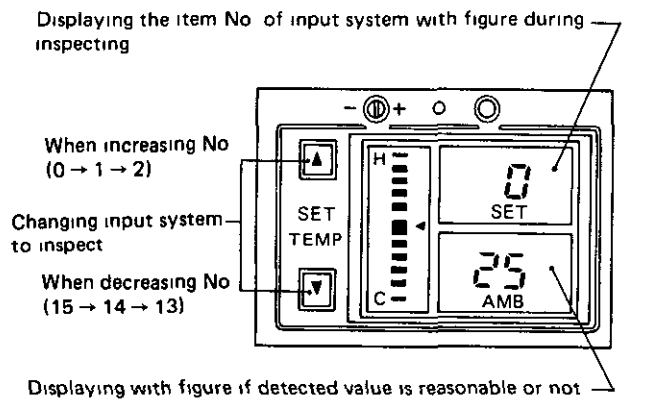


SHA316B

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 1 INSPECTION OF INPUT SYSTEM

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



SHA317B

STEP 2 INSPECTION OF OUTPUT SYSTEM

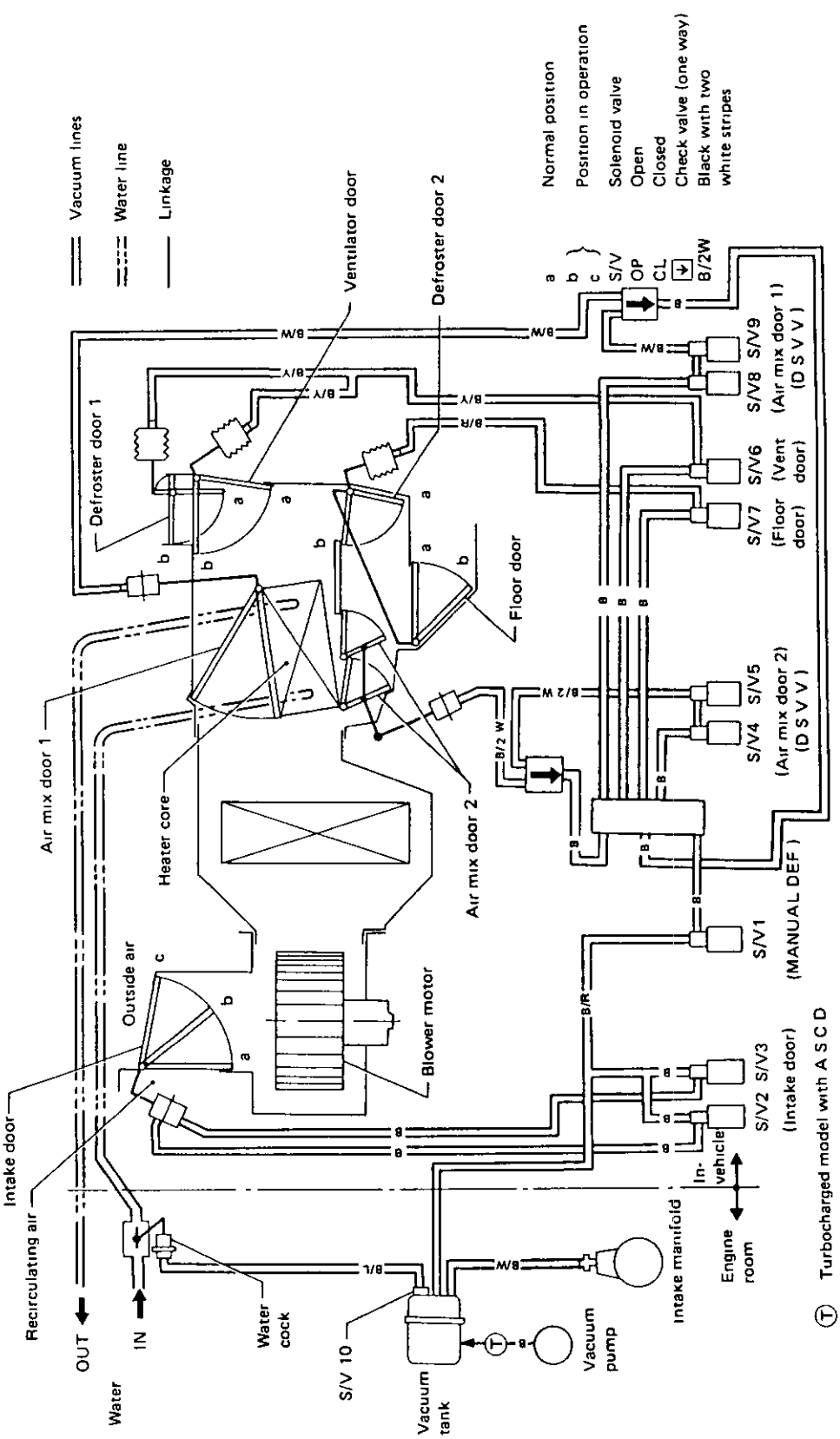
- Whether the parts of the output system are operating normally according to the predetermined pattern can be checked by applying a hand to the outlet door, observing the air flow indicator, listening to the operating noise, or by measuring the applied voltage.
- Once the step 2 program starts, the following 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				
INTAKE AIR		RECIRC	PARTIAL OUTSIDE	OUTSIDE
INTAKE DOOR POSITION		c	b	a
OPERATION OF SOLENOID VALVE	S/V2	OP	CL	CL
	S/V3	OP	OP	CL

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

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

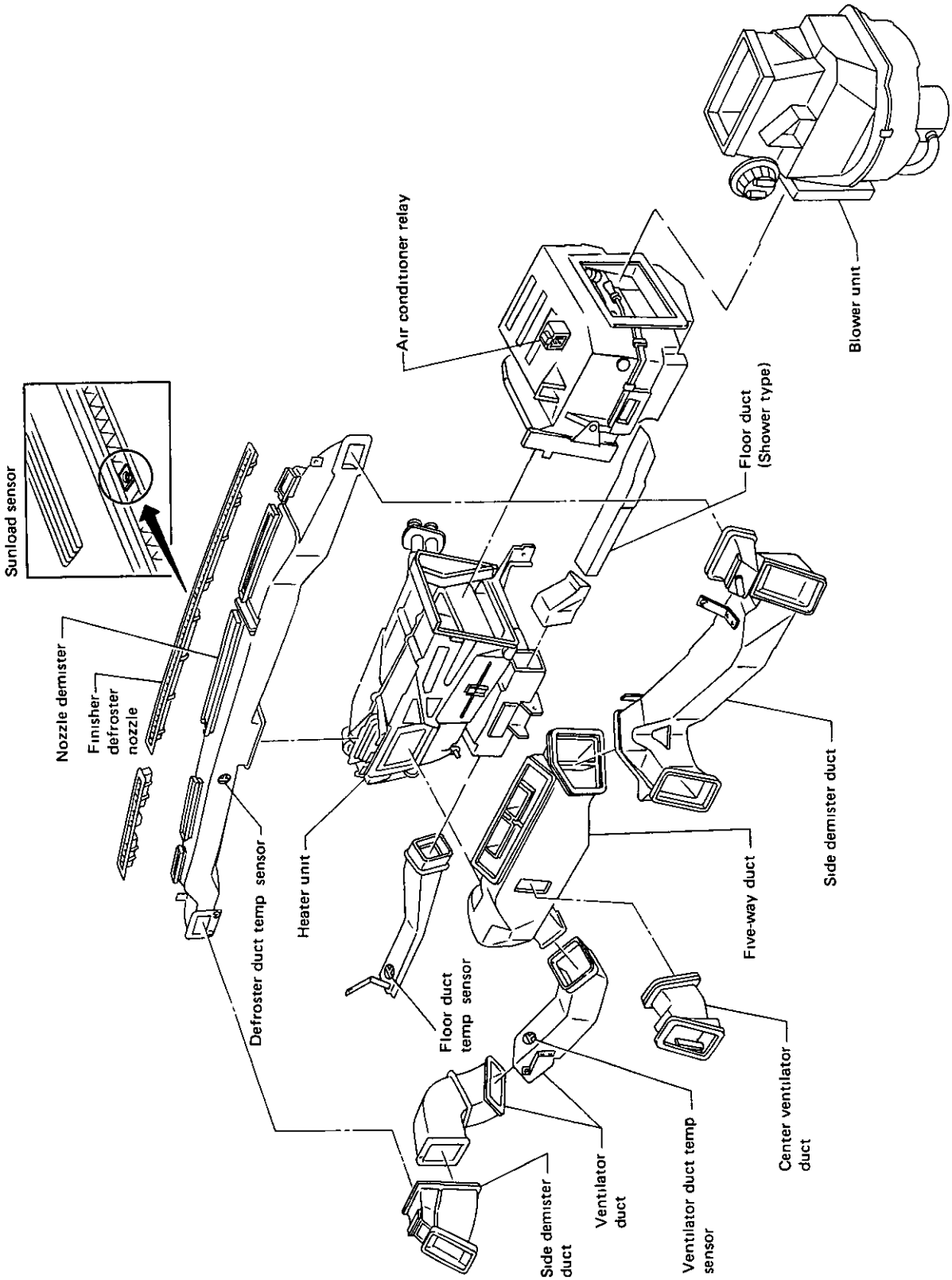
WATER COCK CONTROL			
		OPEN	CLOSED
OPERATION OF SOLENOID VALVE	S/V10	CL	OP

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

SHA612B

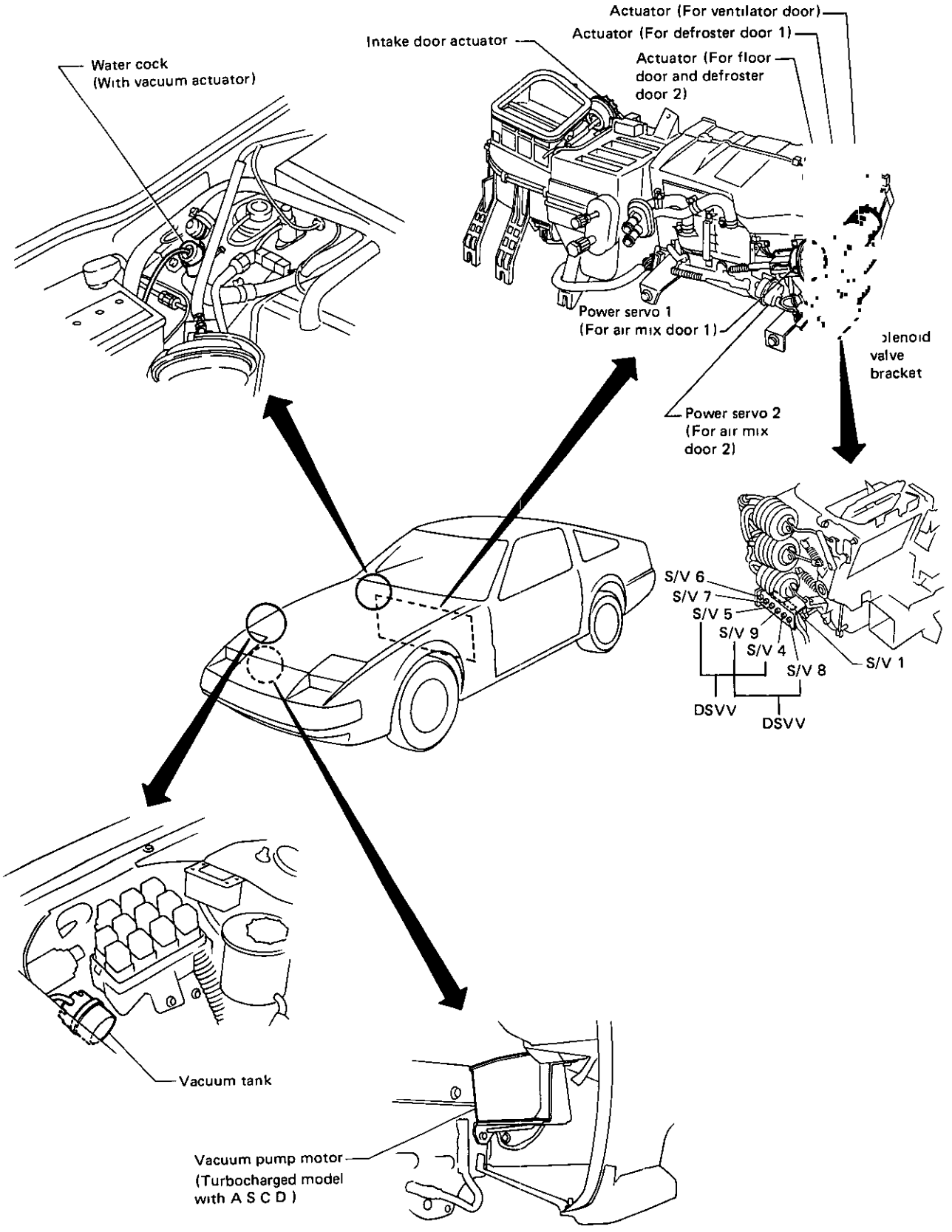
AIR FLOW AND COMPONENT LAYOUT (Auto)

Component Layout



SHA806B

LOCATION OF VACUUM COMPONENTS (Auto)



SHA341B

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)

Performance Chart

Ambient air temperature to compressor pressure table

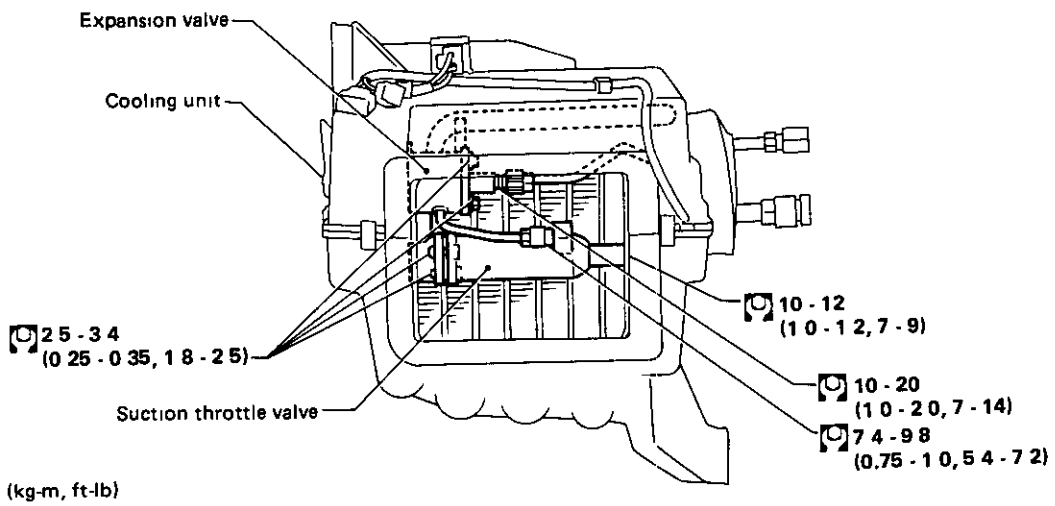
Ambient air		Low pressure (Suction side) kPa (kg/cm^2, psi)	High pressure (Discharge side) kPa (kg/cm^2, psi)
Relative humidity %	Air temperature °C (°F)		
50 - 70	20 (68)	59 - 98 (0 6 - 1.0, 9 - 14)	755 - 892 (7 7 - 9 1, 109 - 129)
	25 (77)	78 - 127 (0 8 - 1.3, 11 - 18)	883 - 1,030 (9 0 - 10 5, 128 - 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

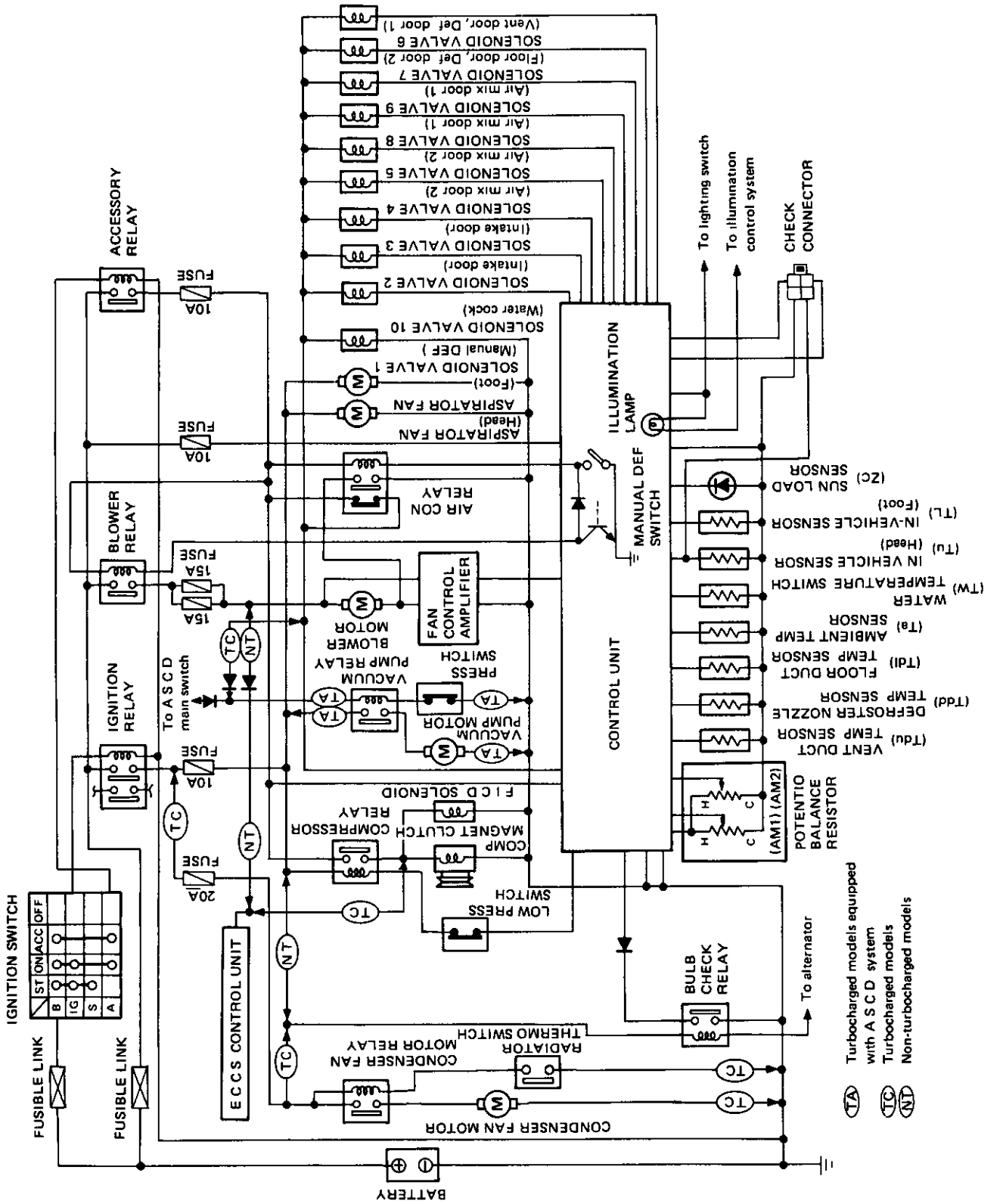
Refrigerant Lines—Cooling Unit

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



A/C ELECTRICAL CIRCUIT (Auto)

Schematic

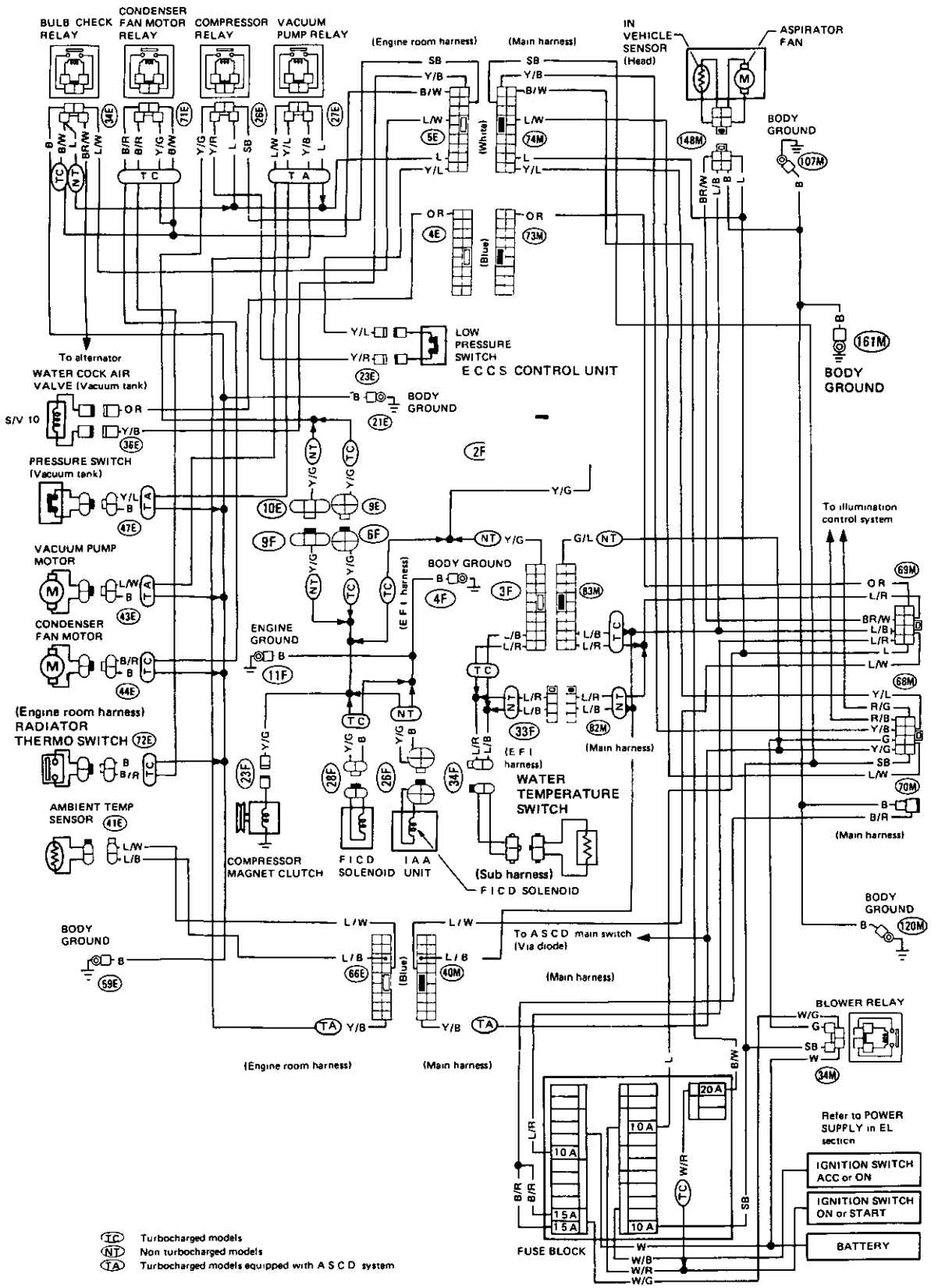


SHA808B

Notes

A/C ELECTRICAL CIRCUIT (Auto)

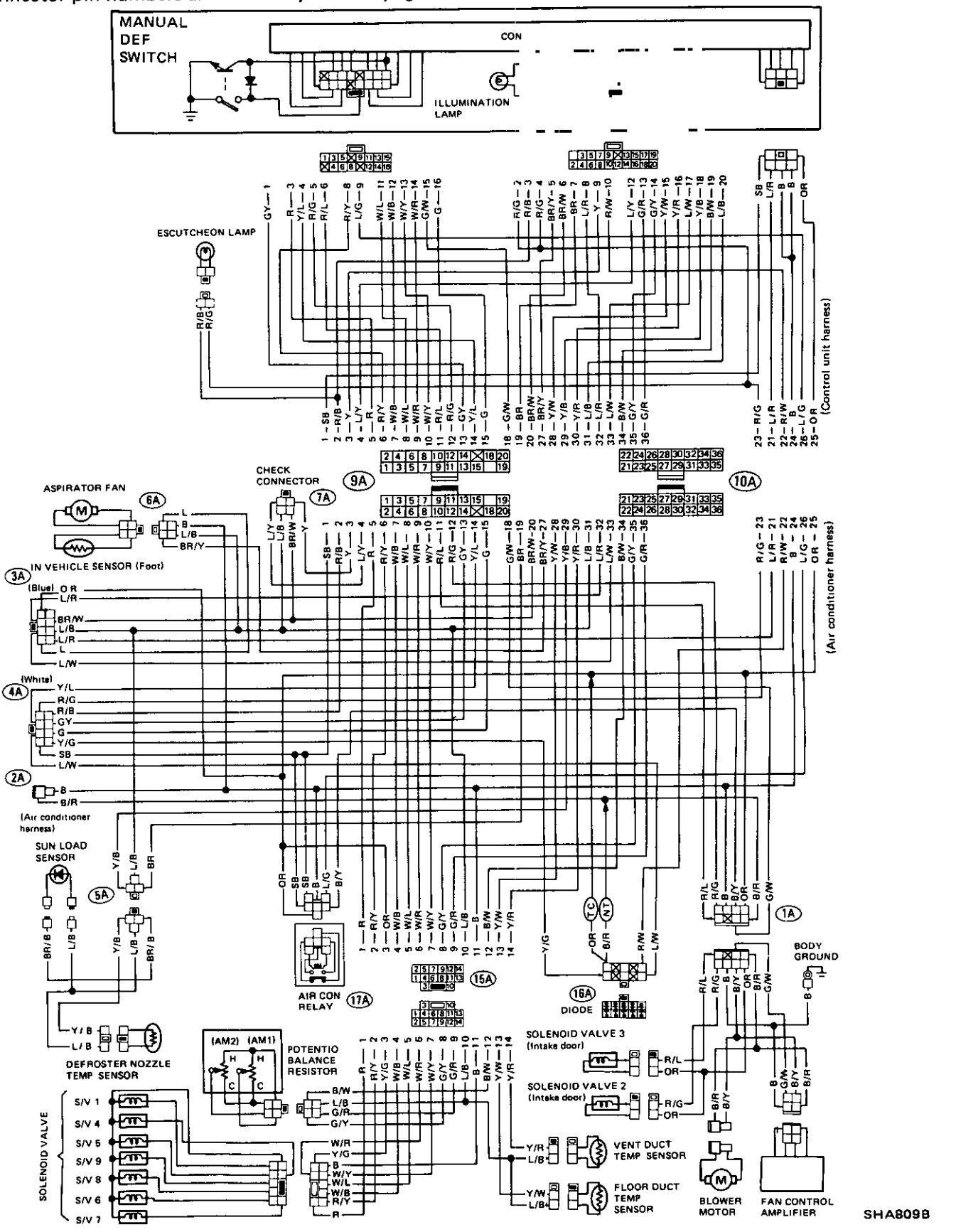
Wiring Diagram



A/C ELECTRICAL CIRCUIT (Auto)

Wiring Diagram (Cont'd)

*Connector pin numbers are valid only for this page



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)]

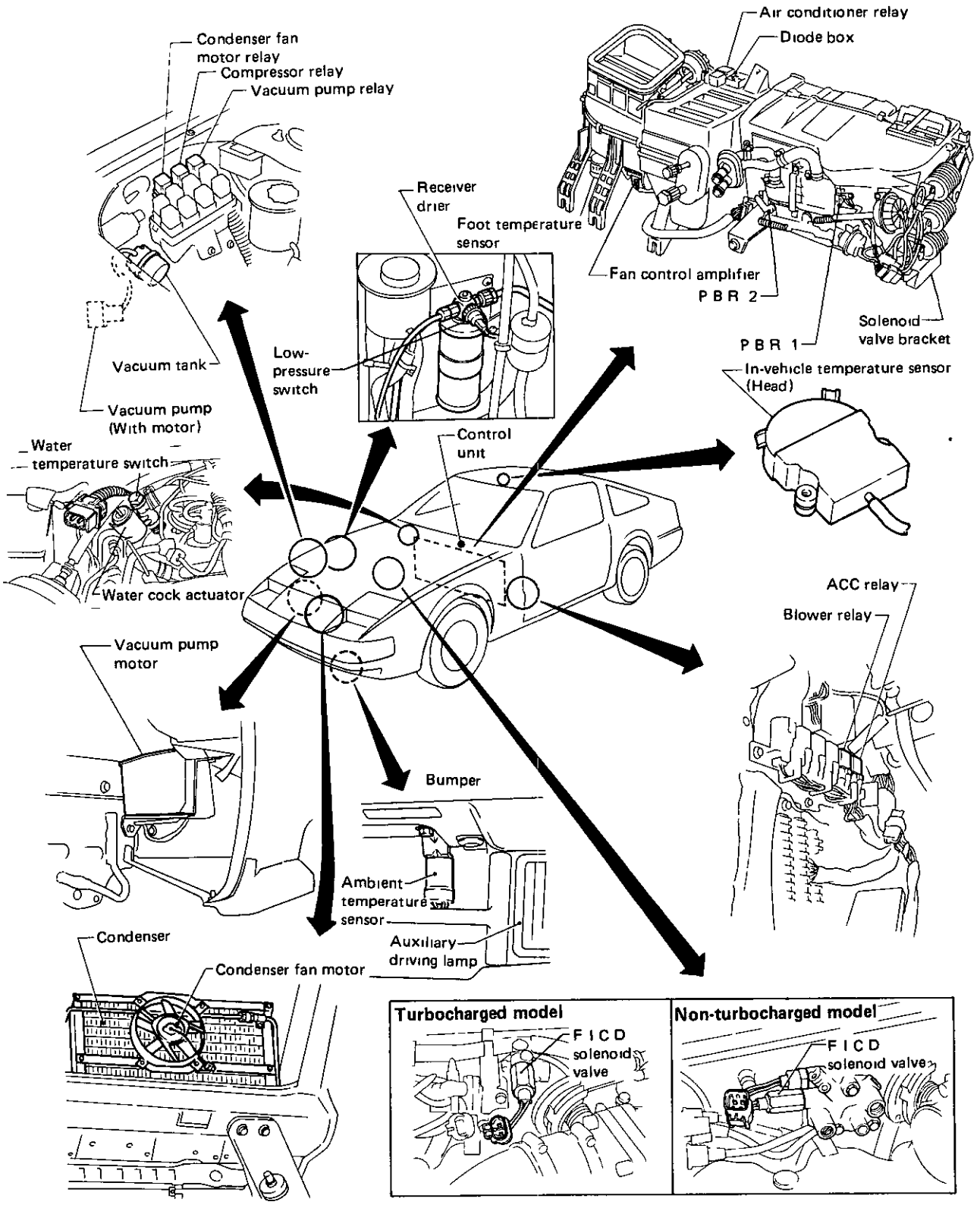
NOTICE

- **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)



SHA810B

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 is orientation before starting inspection

A T C normal operating condition	Trouble diagnosis
(A) Ignition key ON (a) SET and AMB temperatures are indicated on digital meters (Air flow indicator is not lighted) (b) With blower OFF, automatic temperature control operates in ram pressure temperature control mode (This system is adopted on the '85 models For '84 models, the air outlet is fixed at DEF)	(1) Check if MANUAL DEF SW is depressed (when all indicator lamps are off and blower is set at Hi) (2) Check if the power supply is connected to the control amplifier (3) Check if the body ground terminal of the control amplifier is connected to ground If items (1), (2) and (3) above are all normal but item (a) at left is not normal, the control unit is faulty When the ram pressure temperature control or mode control is faulty with A/C switch OFF, use the self-diagnosis program.
(B) Mode SW (AUTO, DEF) ON (a) The outlet mode is determined according to the ambient air temperature and sunload * If the engine cooling water temperature is low when starting the engine, the system is set temporarily in the start control mode Example ○ Low Tu and Low Tw → Start in DEF mode ○ High Tu, Low TL and Low Tw → Start in VENT mode Tu Head level temperature TL Foot level temperature Tw Engine cooling water temperature	(1) Items to be checked when mode control is abnormal (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 (2) Checking procedure when start control is faulty (a) Water temperature sensor (b) TdL sensor (c) Tu, TL sensors Perform self-diagnosis of input system (d) Air valve, actuator Perform self-diagnosis of input & output system (e) Check wiring and harness connectors
(b) If ambient air temperature is above 0°C (32°F) in A/C mode, COMP is ON	(a) Ambient temperature sensor Perform self-diagnosis of AMB temperature indication and input & output system (b) Harness wiring and connectors
(1) In economy mode, comp is OFF	(a) Air valve and actuator (b) COMP Magnet clutch Perform self-diagnosis of input & output system
(2) DEF SW ON (a) In DEMIST mode, air comes out of FLOOR and DEF Lo 8V Automatic temperature control and REC switch are refused	(a) Air valve, actuator (b) Blower speed Perform self-diagnosis of input & output system
(b) In DEF mode, air comes out only from DEF Manual Lo is operable	(a) Perform self-diagnosis of input & output system

Diagnostic Procedure (Cont'd)

A T C normal operating condition	Trouble diagnosis
(C) TEMP SW change (1) Air outlet temperature varies with a change in set temperature	(a) T_L, Tu, TdL, Tdu, Tdd, Tw, Zc, Ta Self-diagnosis of input system (b) P_L, Pu Self-diagnosis of input & output system (c) Air valve, actuator Self-diagnosis of input & output system (d) Check wiring and connectors
(2) Blower speed varies with the set temperature	(a) T_L, Tu (b) *Fan control system* Perform self-diagnosis of input & output system
(3) W/C operation and intake mode vary with the set temperature	(a) Air valve and actuator (For control of intake door) (For control of water cock) Perform self-diagnosis of output system
(D) manual SW operation (1) Blower speed is set at Hi or Lo by blower Hi-Lo switch	(1) Fan control system Perform self-diagnosis of input & output system
(2) Air intake mode is changed to REC mode by REC SW	(2) Air valve and actuator (For control of intake door) Perform self-diagnosis of input & output system

Note
- TdL: Floor duct temperature
- Tdu: Vent duct temperature
- Tdd: Def duct temperature
- Zc: Sun load
- Ta: Ambient temperature
- P_L: Position of Feedback potentiometer (floor side)
- Pu: 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)

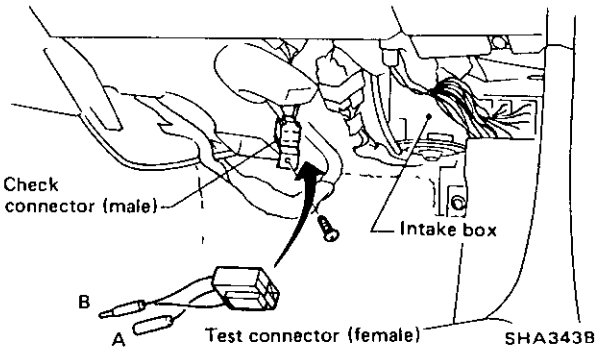
Shown below are examples of efficient use of this diagnostic function

- "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

Inspection of Input System

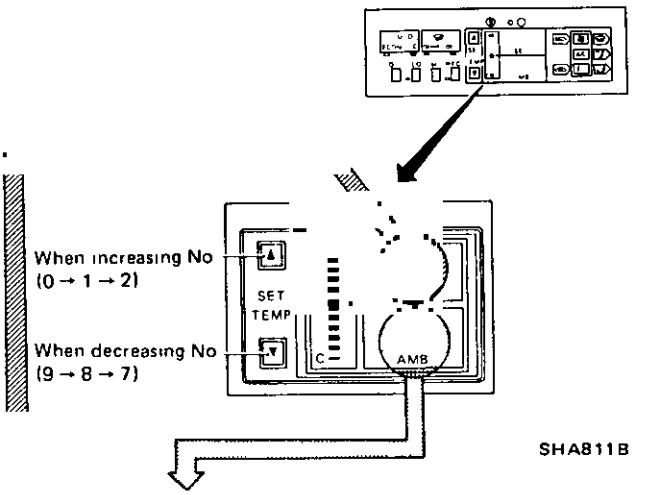
CHECKING PROCEDURES FOR INPUT SIGNALS

1 For Input Test I-0 through I-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

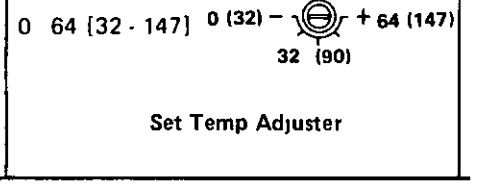
3 Set data number by pushing set temp button Read figures indicated on "AMB" indicator



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 (T_W)	5	Water Temp under 40°(104°) = −17 (2) Water Temp over 40° (104°) = 83 (181)	All others Refer to Step (B3) Page HA-108
6	Sunload sensor (Tc)		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	Equal to set temperature adjuster setting (see below)	Unable to adjust Refer to Step No 4, Page HA 120
8	Potentio balance resistor (Air mix door No 2)	8	Varies in the range of approx 40 to approx 20 (approx 104 to 68) (Must perform output system diagnosis to read variation)	No variation Improper variation Refer to Step (C0) Page HA-110
9	Potentio balance resistor (Air mix door No 1)	9		

NOTE 1 Values change gradually while simulating sensor with incandesent lamp

NOTE 2 Values in ( ) indicate F°



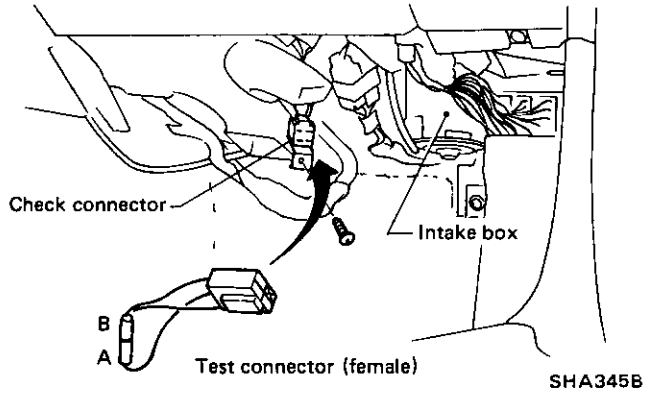
Inspection of Ambient Temperature Sensor

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.

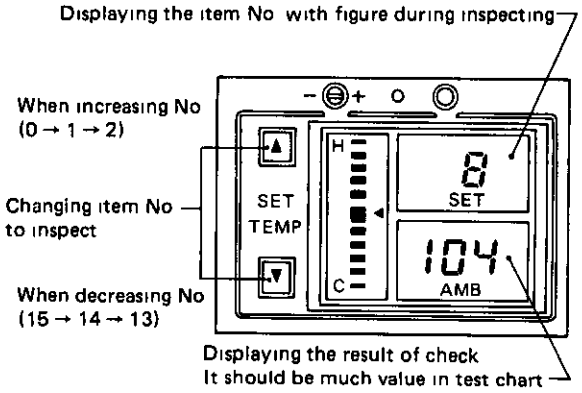


SHA345B

2 Start the engine and press the "ECON/AC" button.
3. Check that output parts operate smoothly using the following chart. (Refer to page HA-100, 101.)

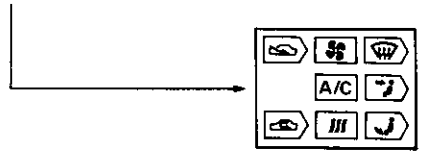
- The way to make sure of the operation of actuators.

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.

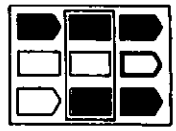


SHA816B

2) By air flow indicator



SHA812B



Checking items are displayed in the indicator during inspecting

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

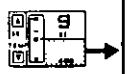
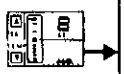
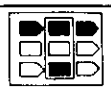
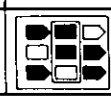
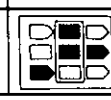
SELF-DIAGNOSING SYSTEM OF TROUBLE (Auto)

Inspection of Output System (Cont'd)

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

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)

SET BUTTON ↓

Checking item		Procedures of confirming operation	Step No					Terminal No
				1	2	3	4	
1	Air mix door 1 (Upper) P B R 1	• Position of air mix door 1	Full Hot … Full Cool					882 (W/R), 883 (W/Y)
		Item No 9 Objective display value 		approx [104] 40	[104] 40	[86] 30	[68] 20	
	Air mix door 2 (Lower) P B R 2	• Position of air mix door 2	Full Hot … Full Cool					884 (W) 885 (W/L)
		Item No 8 Objective display value 		approx [104] 40	[104] 40	[86] 30	[68] 20	
2	Outlet	• Air flow indicator • Check each outlet by hand	DEF … VENT … B/L … DEMIST					DEF/VENT Changeover 887 (R/Y) FOOT Opens/ Closes 886 (R)
3	Intake door	• Air flow indicator • Look at the intake door spring	REC … Partial REC … Fresh air					880 (R/L), 881 (R/G)
4	Water cock	• Air flow indicator • Look at the water cock position and check temperature by hand	ON … OFF					564 (G/)
5	Compressor clutch	• Air flow indicator • Check operation of the magnet clutch	ON … OFF					567 (Y/L)
Display								

Note
- Value in [ ] indicates F°
- The letter in ( ) indicates lead wire color
- If approx ±7 deference exists between indicated value and the value in test chart, this is normal
- Location of components is shown on page HA 87, HA 95

SHA819B

SELF-DIAGNOSING SYSTEM OF TROUBLE (Auto)

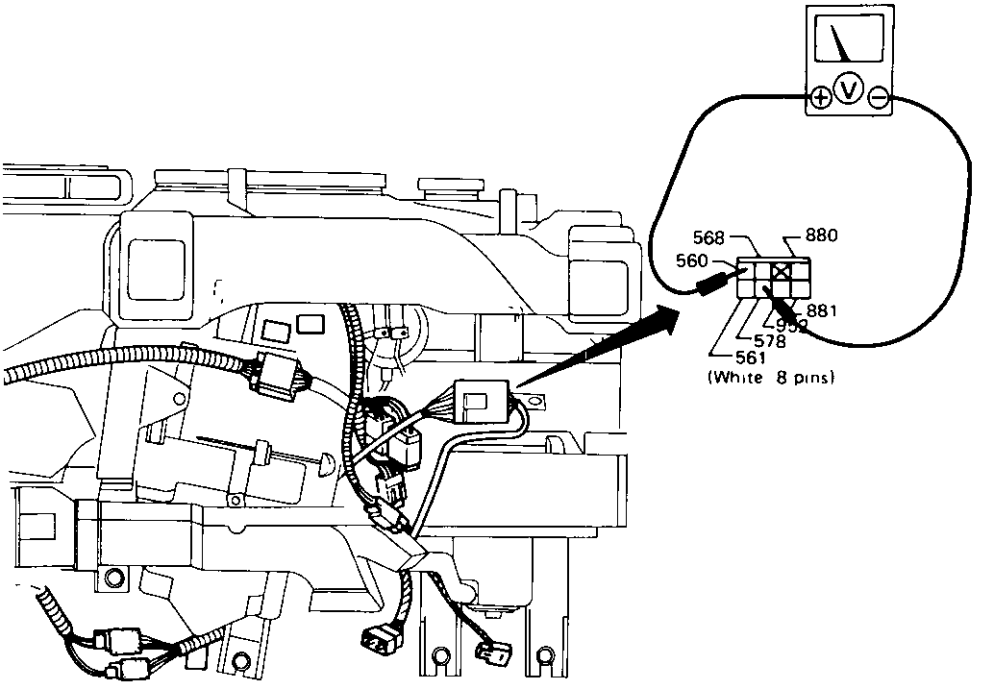
Inspection of Output System (Cont'd)

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	
6	Blower motor	• 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 Signal for amount of air 568 (G/W)

Note The letter in ( ) indicates lead wire color

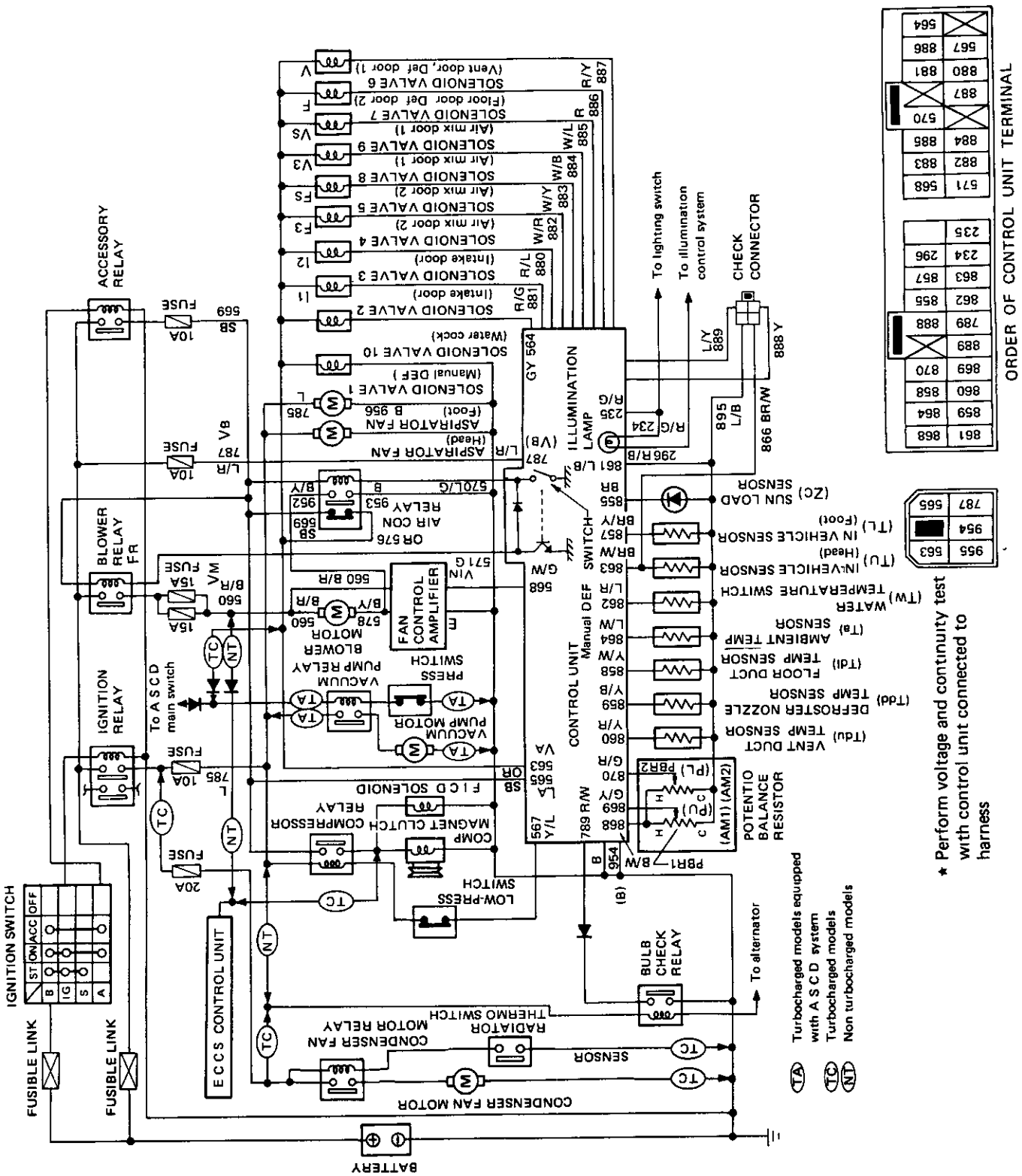
SHA820B



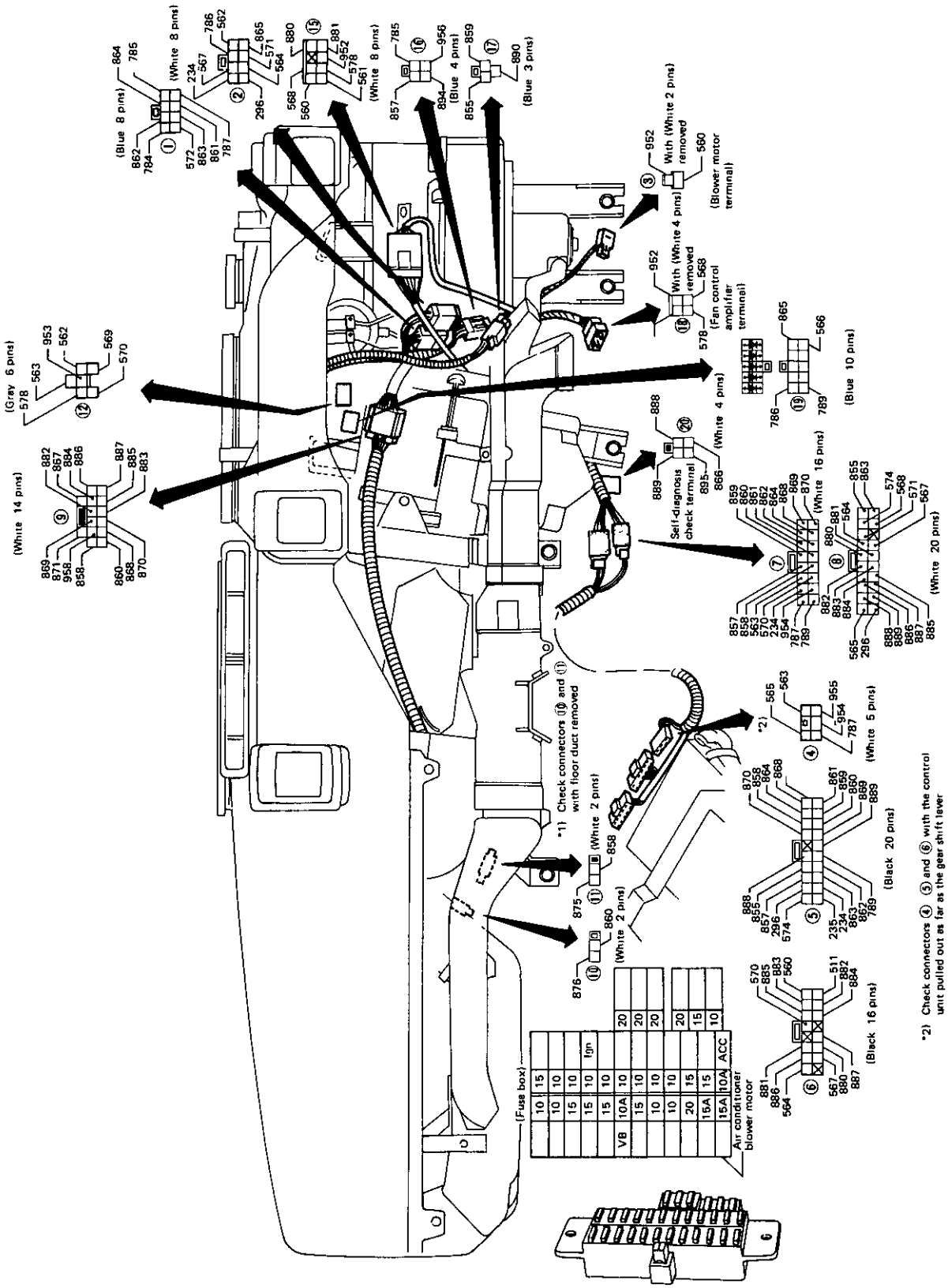
Applied Voltage Test

CONTENTS

Circuit for Trouble Diagnoses

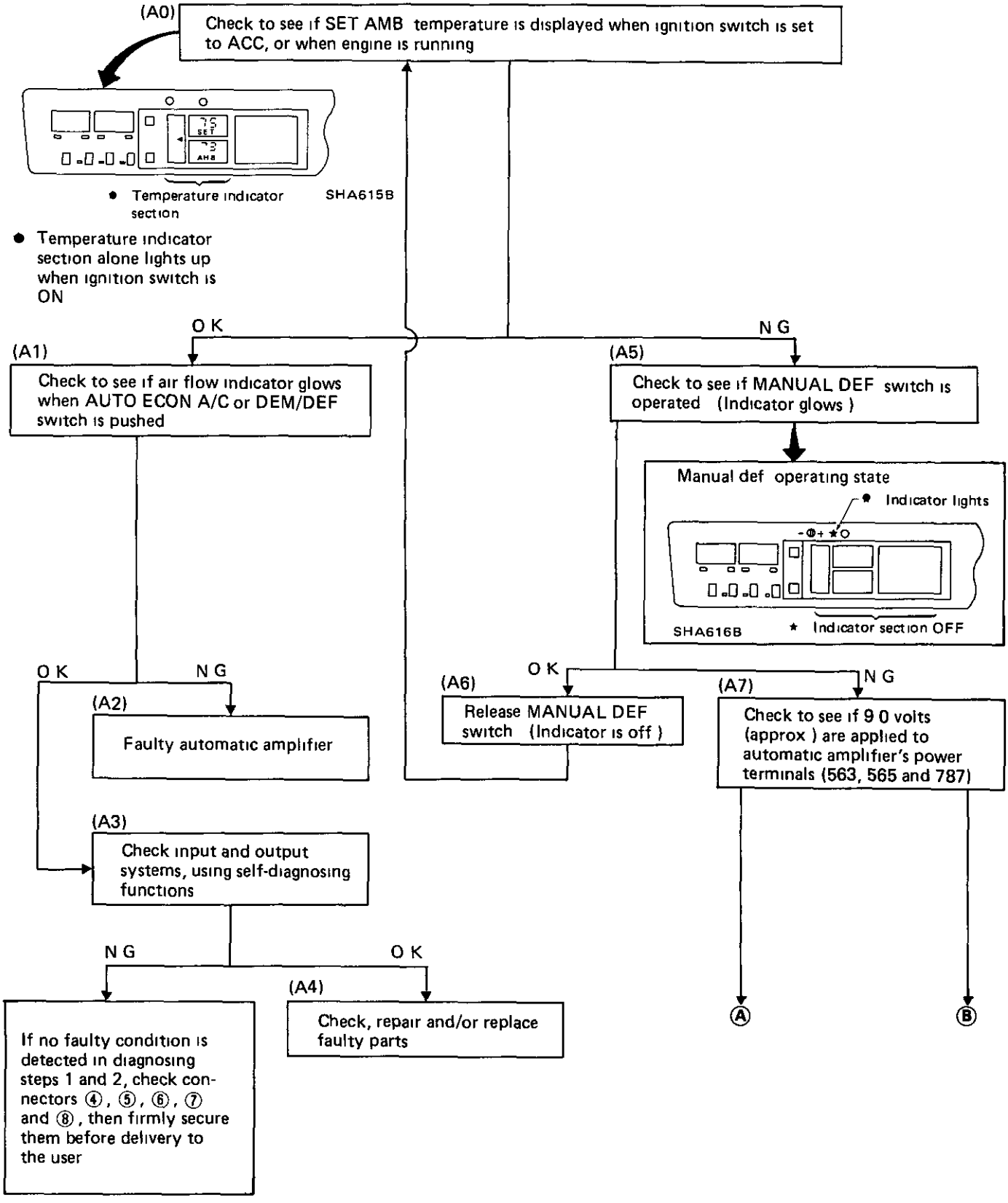


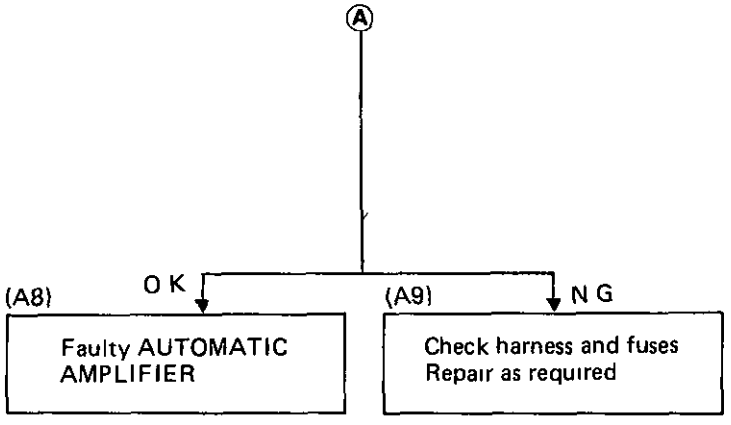
SHA813B


(Blue 8 pins)
(White 8 pins)
(Blue 4 pins)
(Blue 3 pins)
(Gray 6 pins)
(White 14 pins)
(White 4 pins)
(White 16 pins)
(Blue 10 pins)
(White 20 pins)
(White 2 pins)
(White 5 pins)
(Black 20 pins)
(Black 16 pins)
With (White 2 pins) removed
(Blower motor terminal)
With (White 4 pins) removed
(Fan control amplifier terminal)
Self-diagnosis check terminal
*1) Check connectors ⑪ and ⑪ with floor duct removed
*2) Check connectors ④ ⑤ and ⑥ with the control unit pulled out as far as the gear shift lever
(Fuse box)
Air conditioner blower motor
Ign
ACC
VB

SHA814B

AUTO A/C SYSTEM DIAGNOSIS





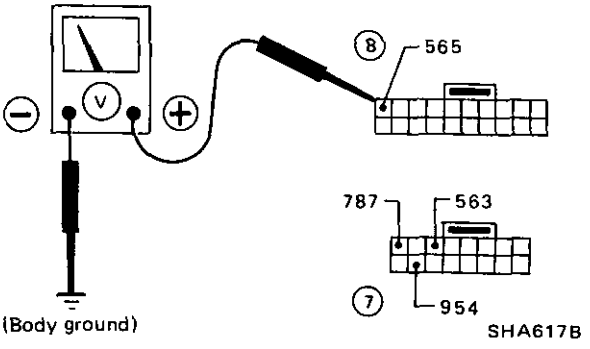
Ⓑ

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)



(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 ACC 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

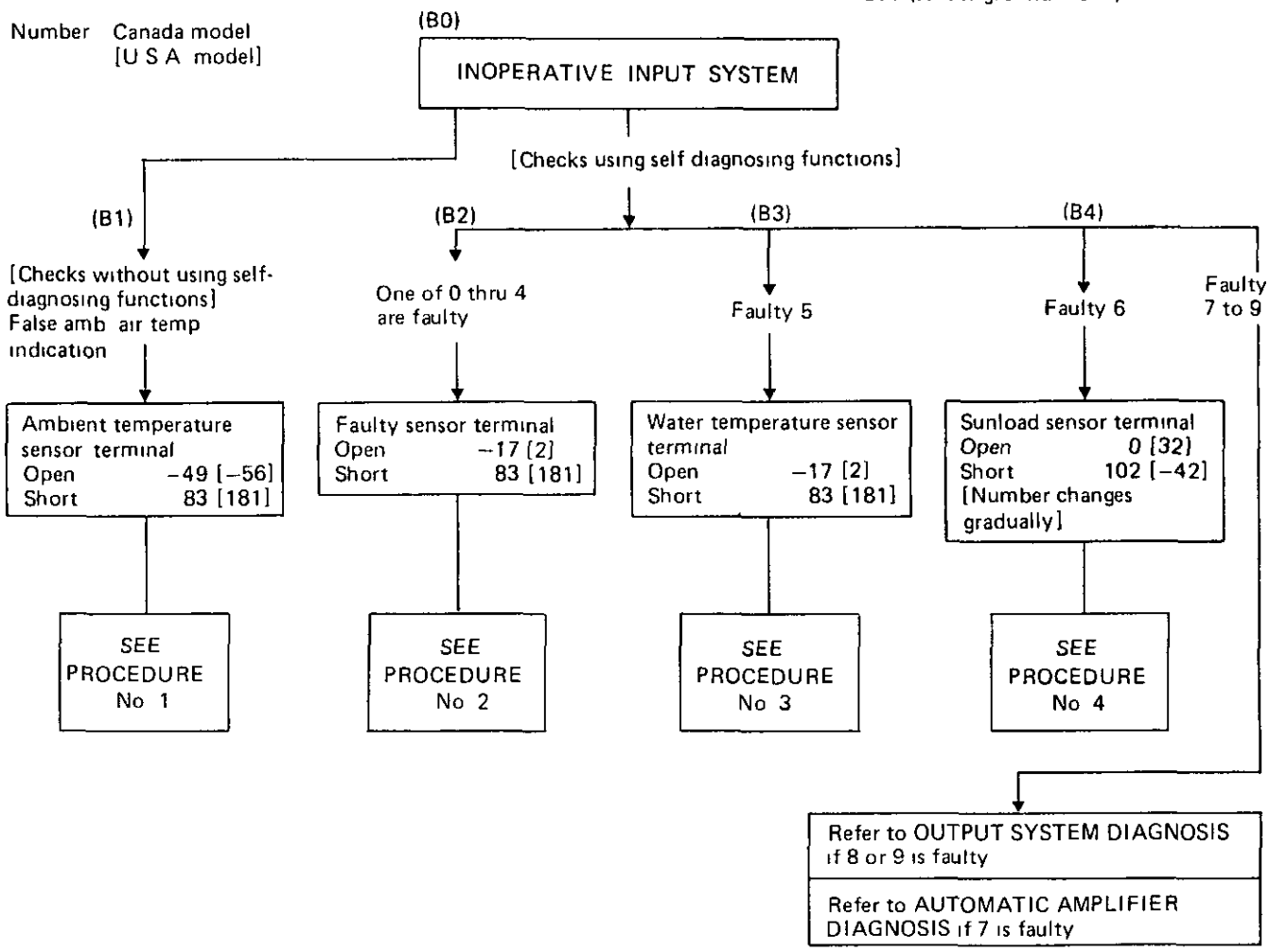
3

(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

INPUT SYSTEM DIAGNOSIS (Page HA-98)

★Numbers displayed on indicators
When the indicator at 10 thru 14 shows only --17 [2], check line 861 (sensor ground = 0 V)



INSPECTION PROCEDURE

Conduct inspection referring to connector arrangement diagram on page HA-107

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-74)

(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

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

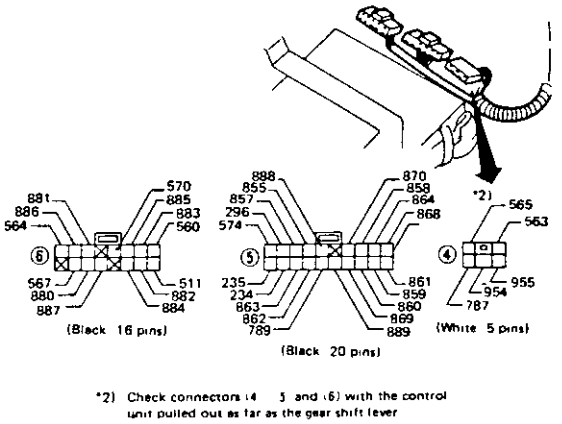
No = Faulty auto amplifier Yes = Proceed to (C)

(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 05 to 2 0 mA and it drops to 0 mA when the sunload sensor is covered, the display is normal



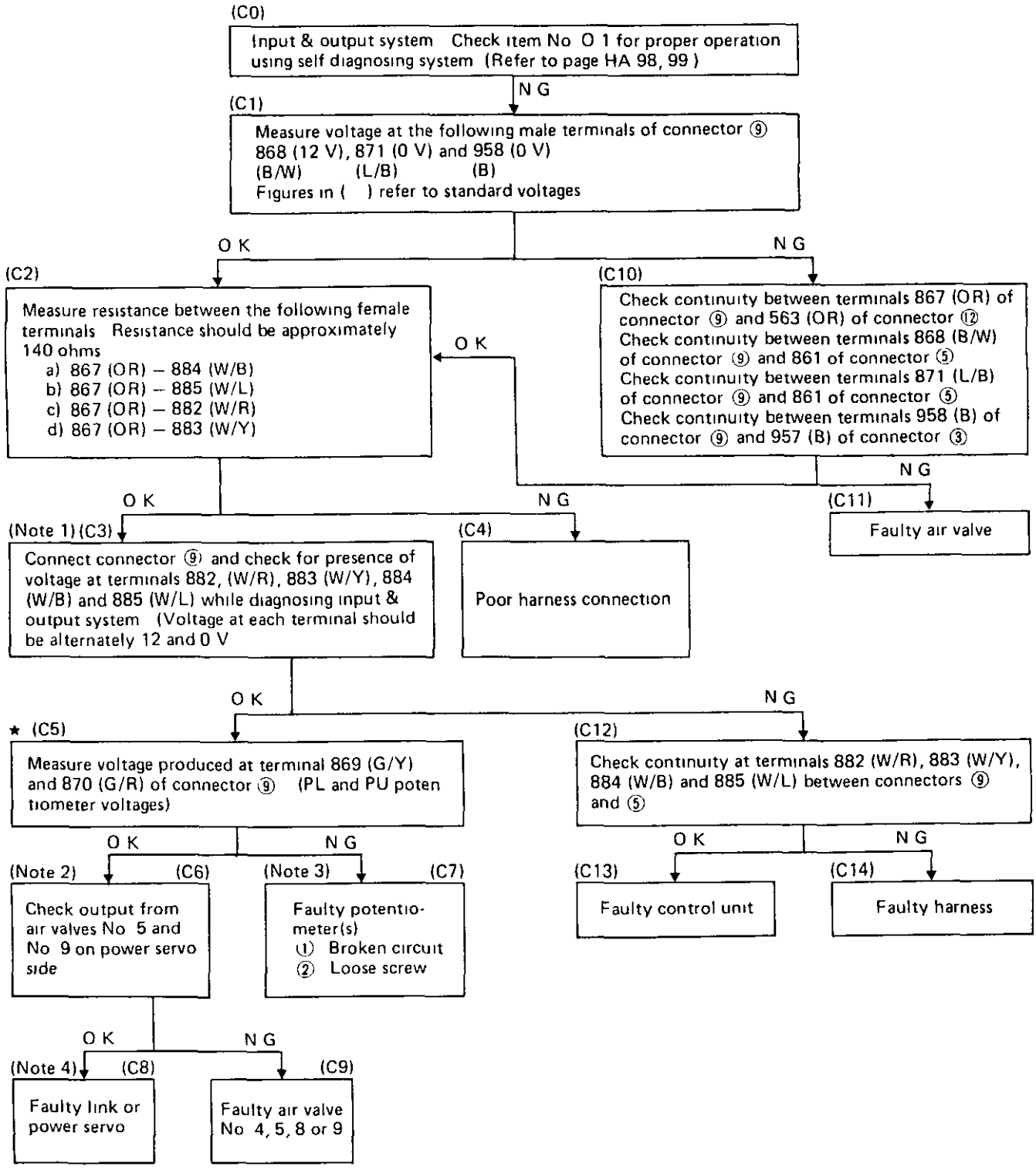
*2) Check connectors (4 5 and (6) with the control unit pulled out as far as the gear shift lever

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)

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

1) Inoperative air mix door

INSPECTION PROCEDURE – Air Mix Door



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

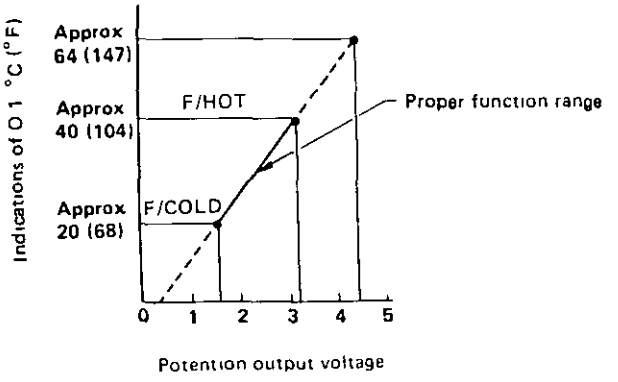
(Note 2) Same as Note 1 above Faulty input vacuum line can be determined by fixed DEF mode

(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

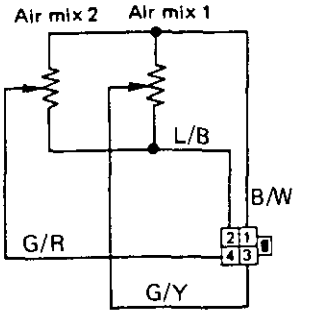
(Note 4) In a manner similar to Note 3 above, disconnect vacuum hose from air valve No 5 or No 9 and connect vacuum hose (on hand) to the hose Suck air from and blow air into hose orally or by using a vacuum pump If air temperature does not change regardless of control operation of photo amplifier for 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



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 PBR harness to 2 8k Adjust the resistance between terminal No 1 (B/W) and No 4 (G/R) to 3 0k

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)

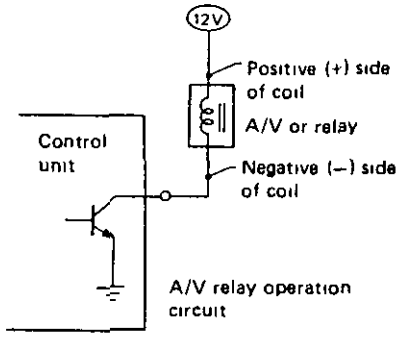
INSPECTION PROCEDURE – Doors, Water Cock and Compressor

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

Air valves and relays

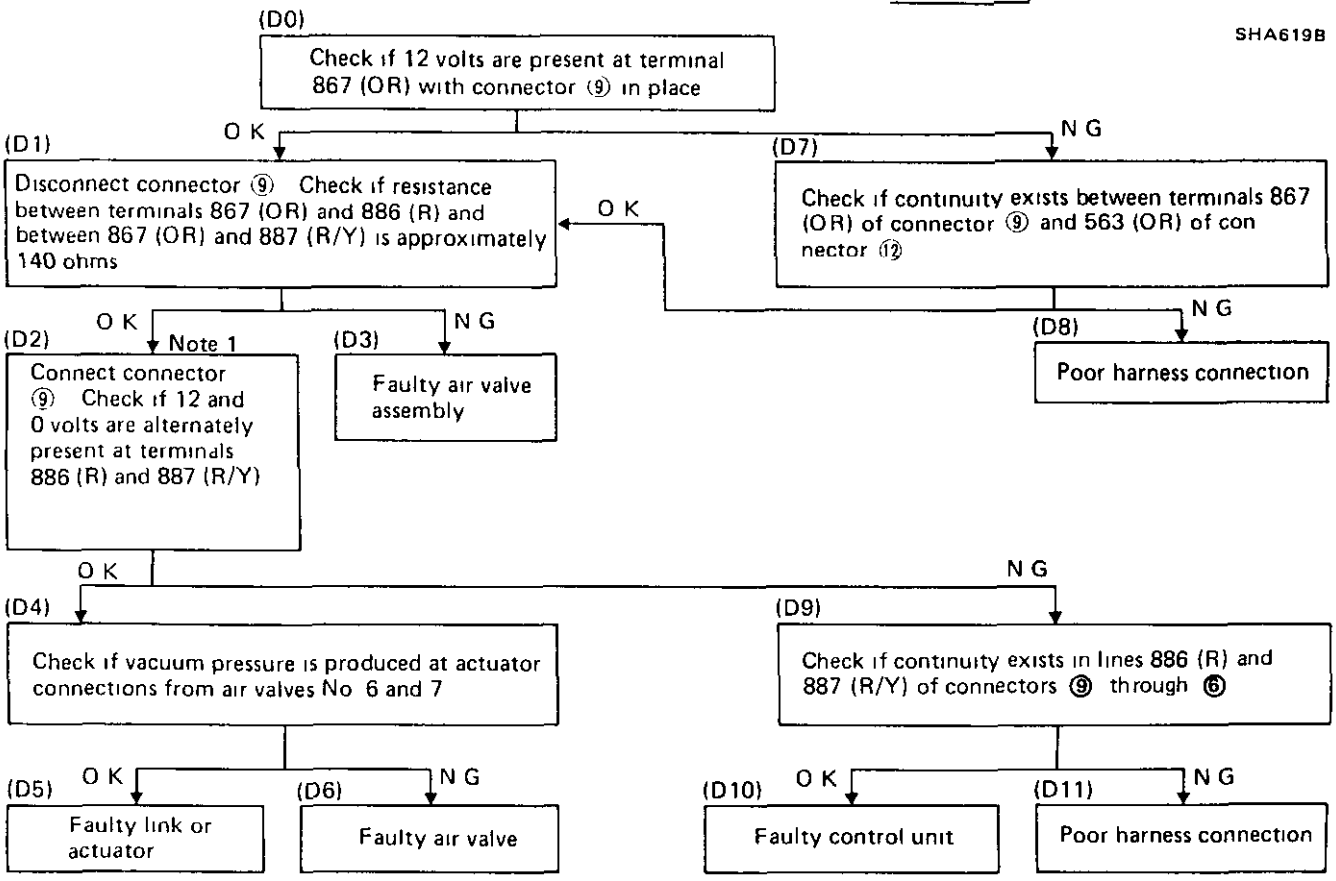
Positive (+) side	Approximately 12 volts (constant)
Negative (−) side	Approximately 0 volts (OFF)
(Downstream of coil)	Approximately 0 volts (ON)

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



SHA619B

2-1 Inspection Procedure – Air Outlets

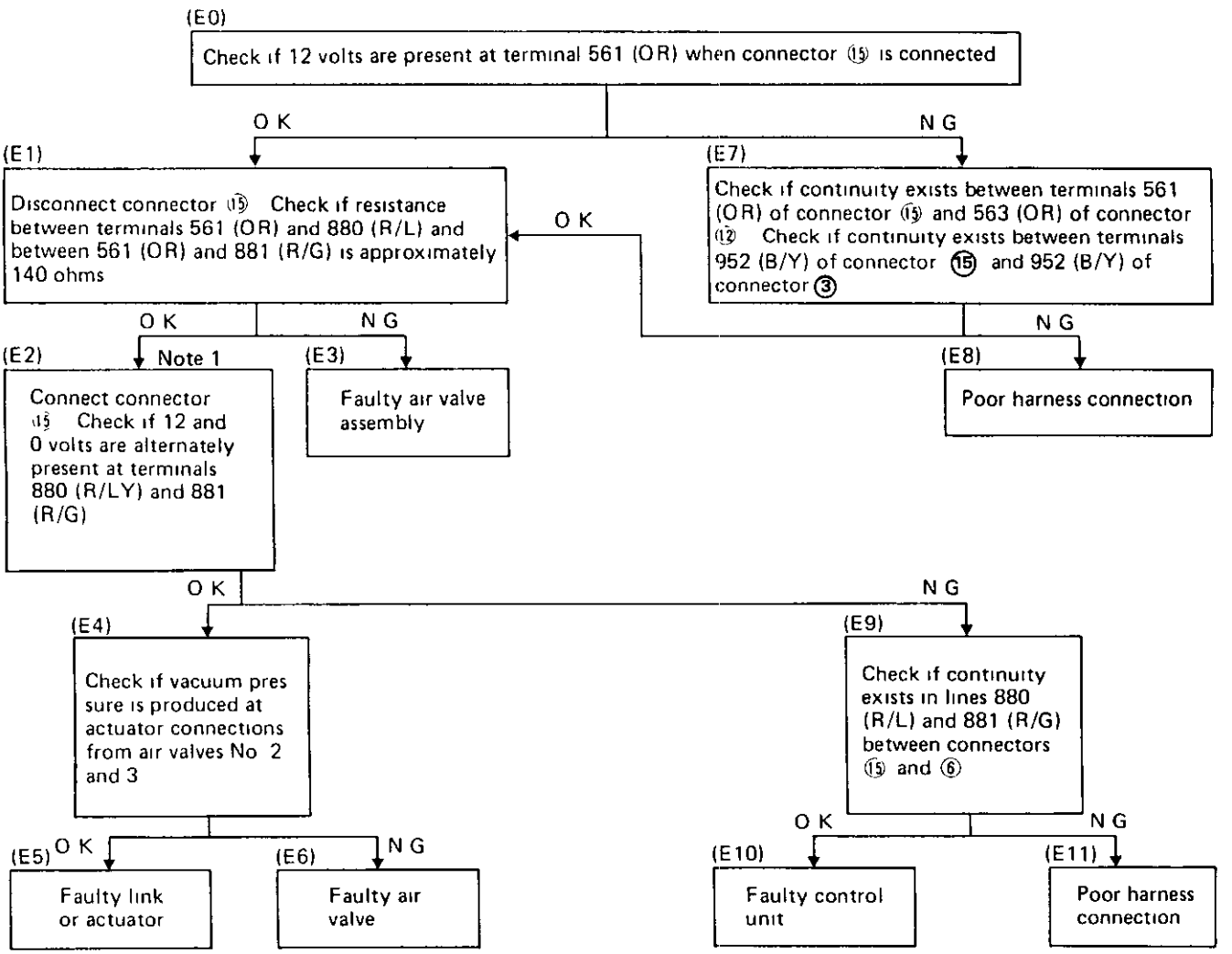


NOTE 1 Check with engine running while operating Input and Output System Test

Mode Door Operation

Mode \ Air valve actuator		Air valve		Actuator		
		No 6	No 7	DEF door	VENT door	FLOOR door
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



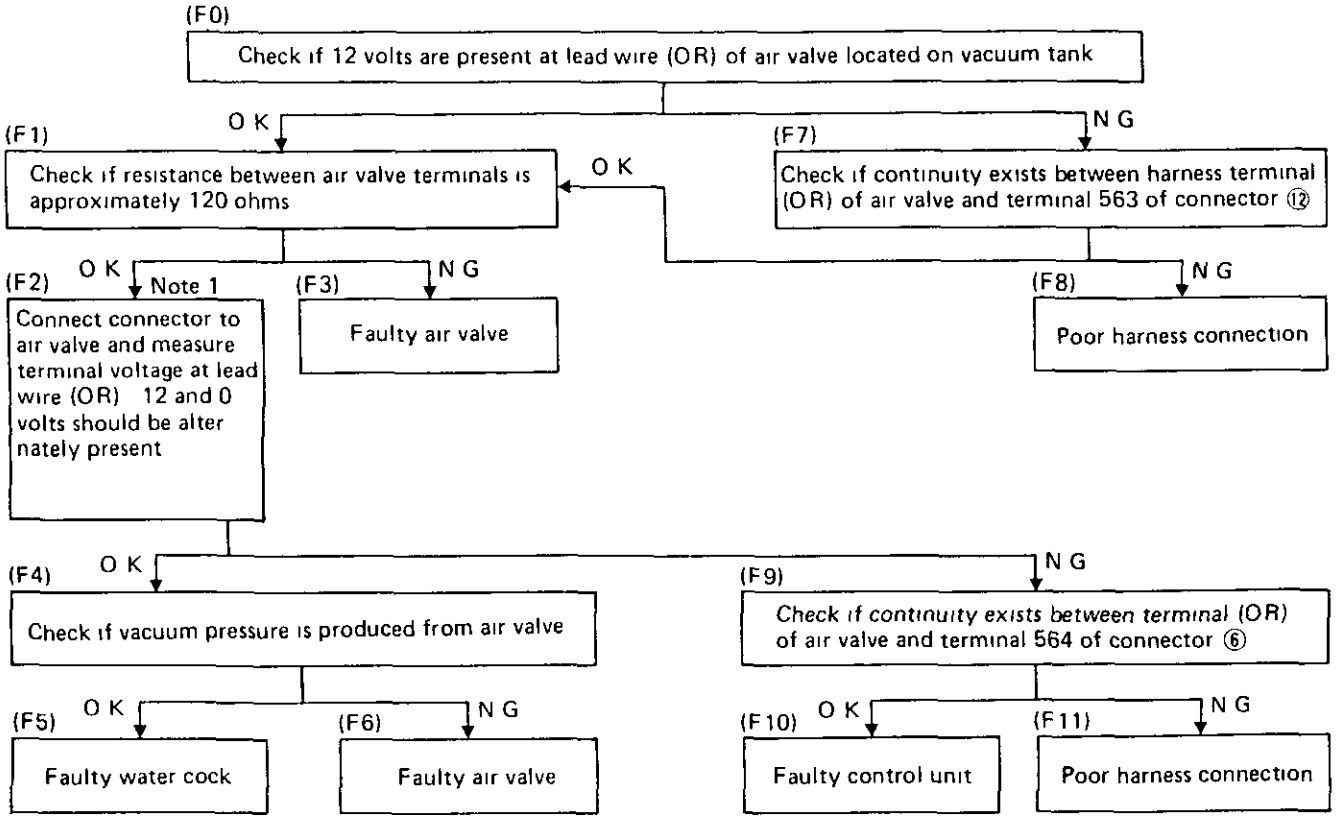
NOTE 1 Check with engine running while performing Input and Output System Test.

1987 300ZX Service Manual
HA87-013 (TS87-119)
Revised July 1987

Intake Door Operation

Mode	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

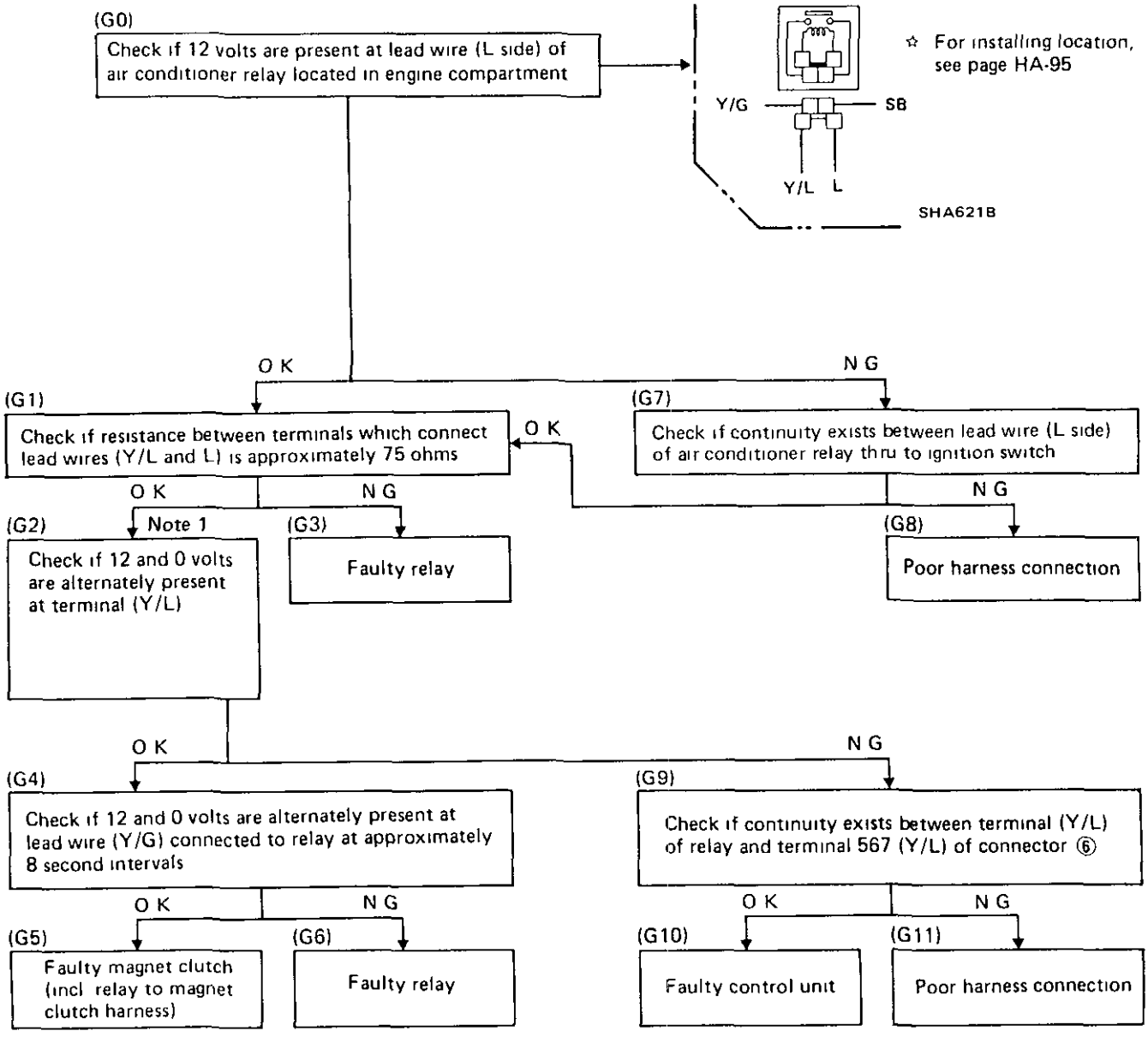


NOTE 1 Check with engine running while performing Input and Output System Test

Water cock operation

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

2 4 Inspection Procedure – Compressor



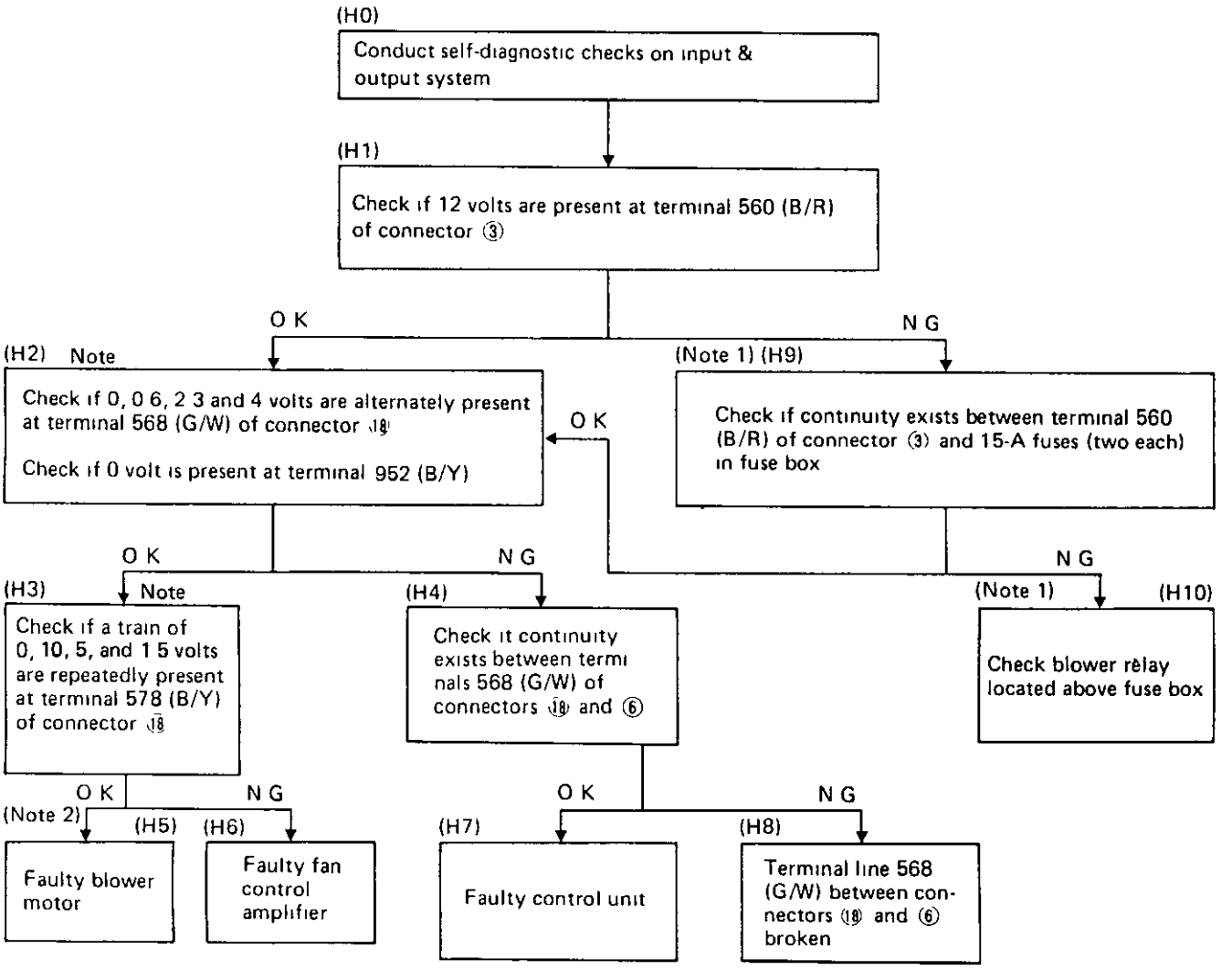
Compressor operation

	Relay
Compressor ON	ON
Compressor OFF	OFF

NOTE 1 Check with engine running while performing Input and Output System Test

3) Blower motor diagnosis

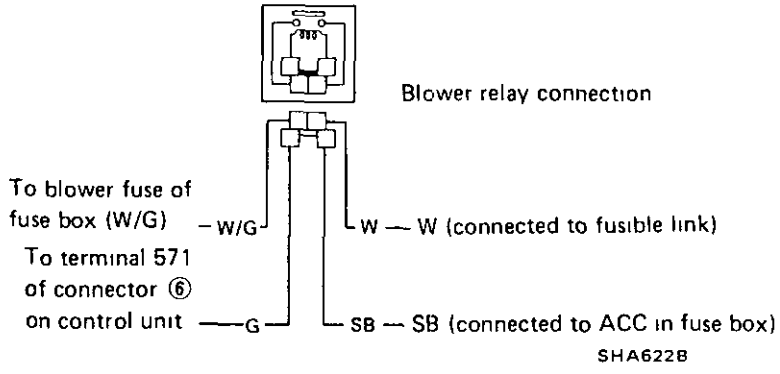
INSPECTION PROCEDURE – Blower & Motor



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

(Note 1) When ignition switch is set to ACC, current flows through blower relay coil With ignition switch held there, activating switches "AUTO", " " and "SW" 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

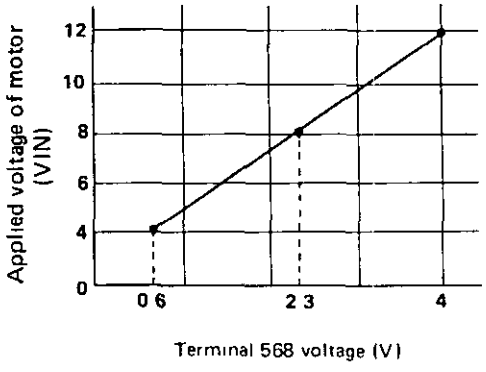
(a) Lead wire (W) between fusible link and relay is broken,
(b) The line between lead wire (W/G) of relay and terminal 560 of connector ③ (including two 15-A fuses) is broken,
(c) The line between lead wire (S/B) of relay and fuse (ACC) is broken, or
(d) The line between lead wire (G) of relay and terminal 571 of connector ⑥ is broken



SHA622B

(Note 2) If blower starts when manual DEF switch is activated, problem is due to poor body ground of fan control amplifier

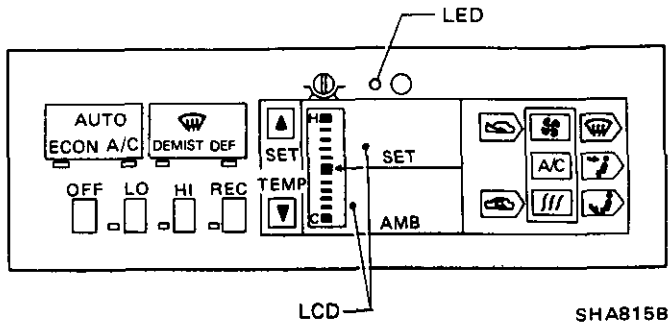
(Note 3) Output performance characteristics of fan control is shown below



SHA620B

AUTOMATIC AMPLIFIER DIAGNOSIS

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



(I0) Do LCD's or LED's glow?

- LCD's & LED's off
- LED's off
- LCD's off

(I1) When ignition switch is set to ACC, check to see if more than 9 volts are produced at 563, 565 and 787 and 0 volts at 954 and 955

- Yes
- No

(I2) Check to see if air is discharged from A/C system when AUTO or DEF DEM switch is pushed

- Yes
- No

(I4) Replace switch panel assembly

(I5) Replace control subassembly

(I3) Is MANUAL DEF switch activated?

- Yes
- No

(I6) Release MANUAL DEF switch

(I7) Check harness 563, 565, 954 and 959 line. If there are faulty lines, repair these lines.

(I8) Replace switch panel assembly

(I9) Do some LCD's glow?

- Yes
- No

(I10) Replace switch panel assembly

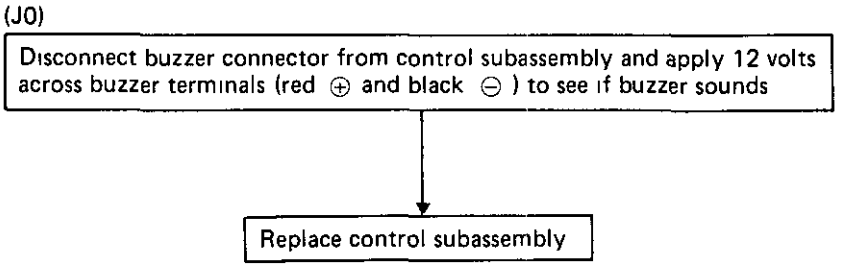
(I11) Check to see if two back lamps located on rear of control panel are burned out

- Yes
- No

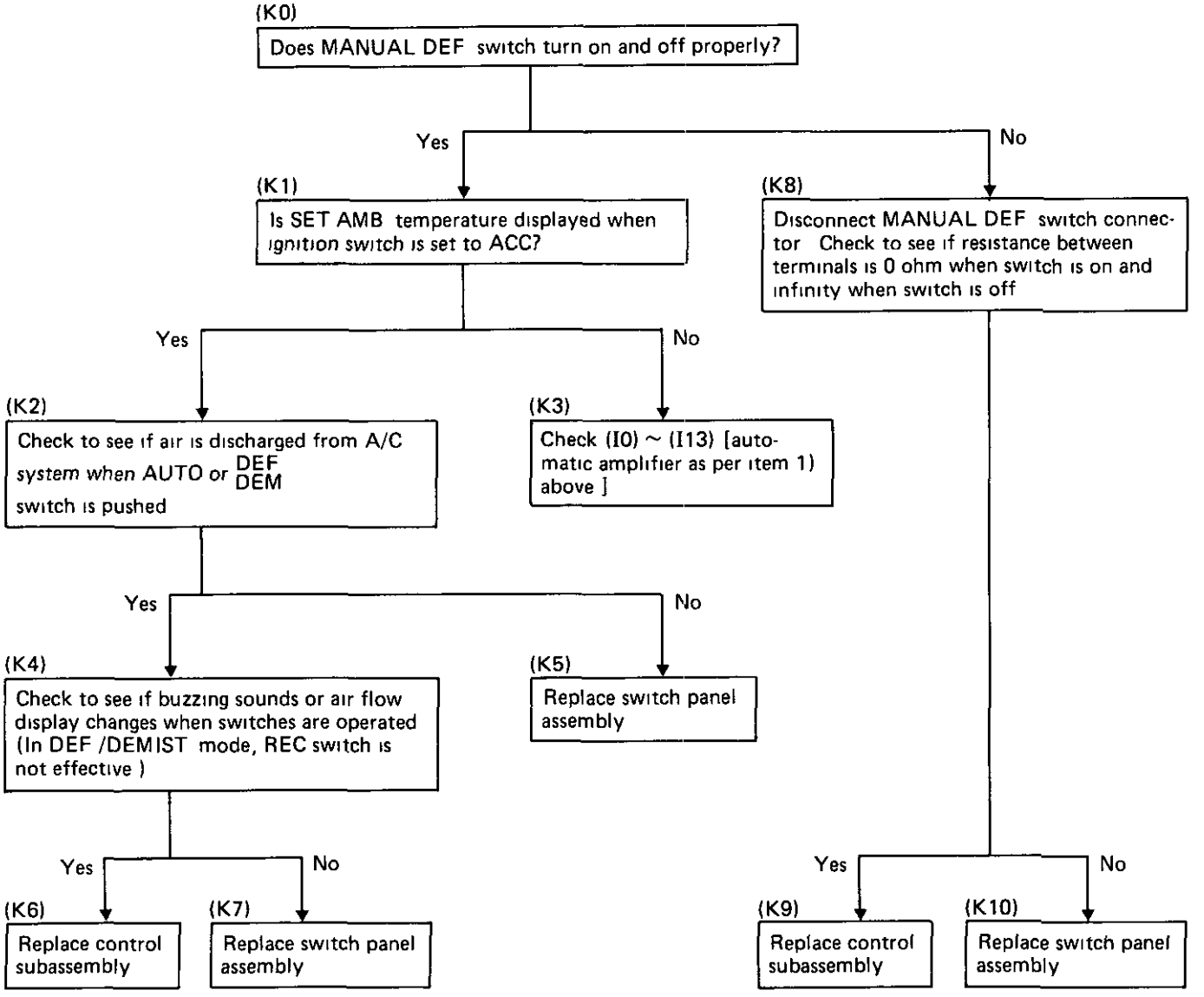
(I12) Replace faulty back lamp(s)

(I13) Replace control subassembly

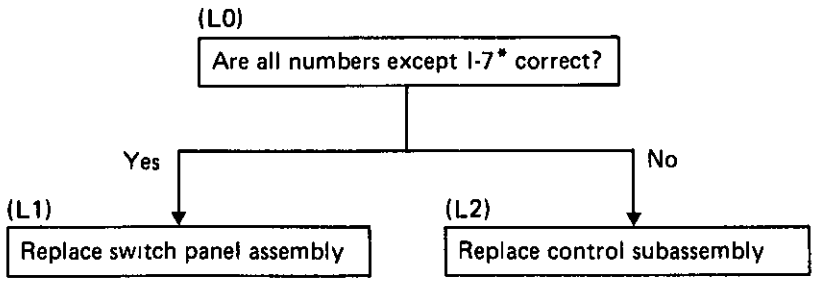
2) Operating (Buzzing) Sound is not Emitted



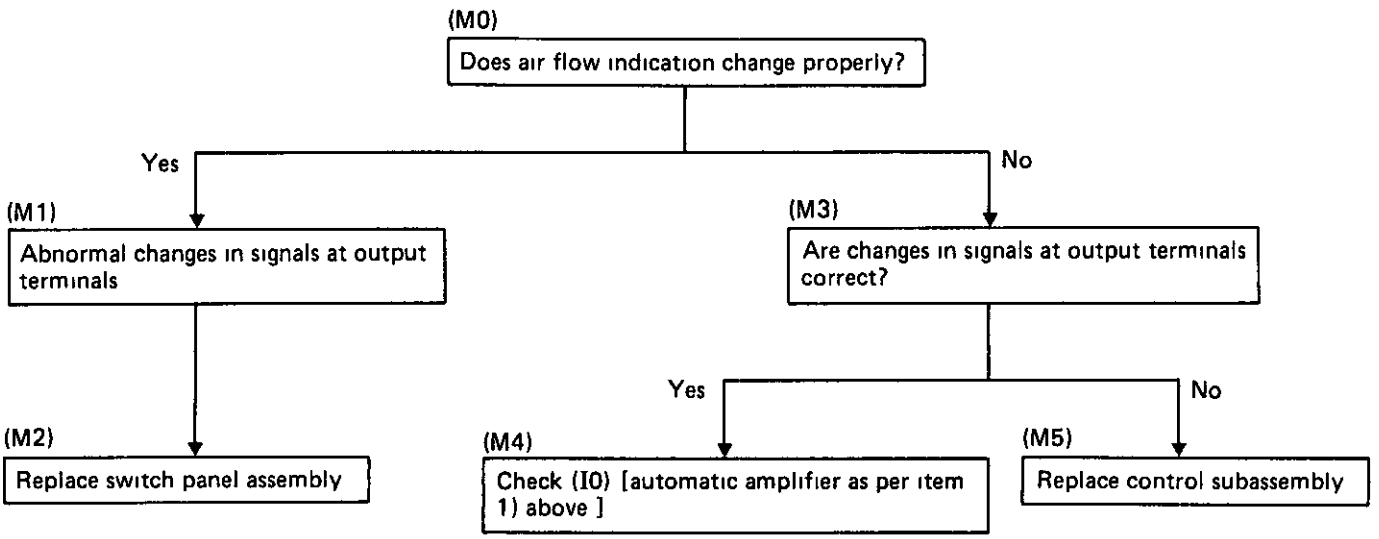
3) Switches on Switch Panel Assembly do not Operate



4) Erroneous Display during Inspection of the Input System



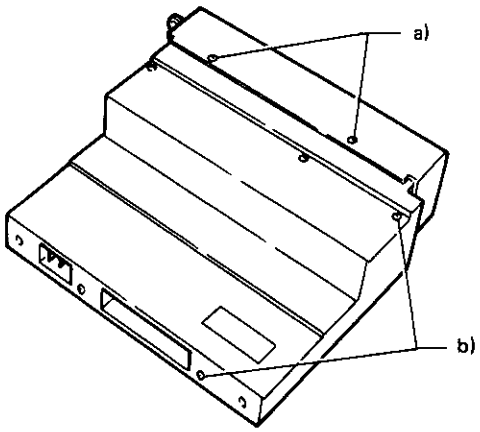
5) Erroneous Operation during Inspection of the Output System



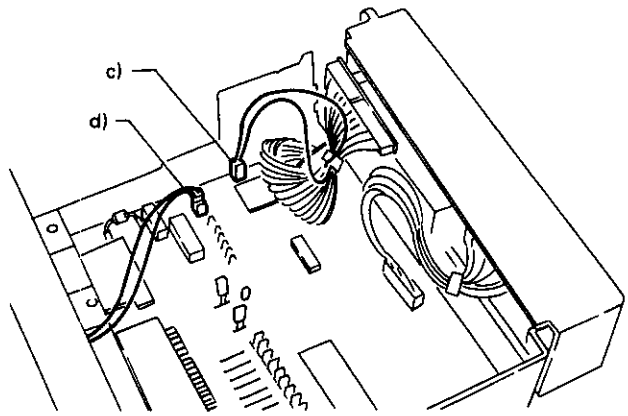
6) MANUAL DEF indicator does not come on.
   Replace switch panel assembly.
7) Escutcheon lamp does not come on.
   Check for burned-out lamp located at rear of switch panel assembly

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, MANUAL DEF switch connector and buzzer connector are secure and tight and are free from damage.



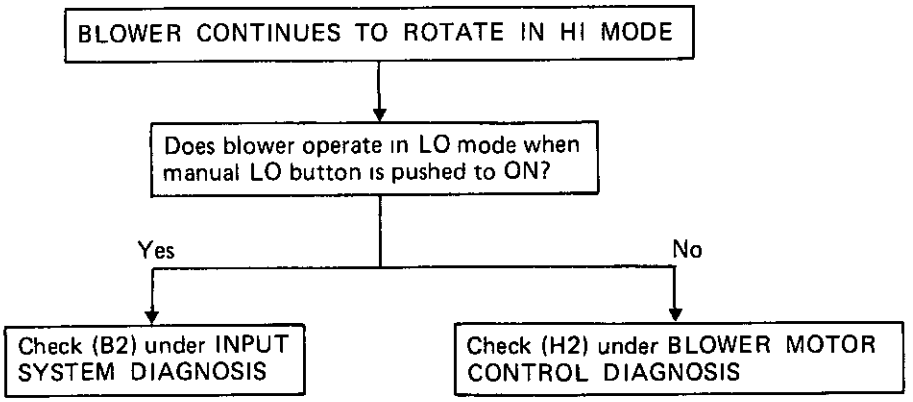
SHA385B



SHA386B

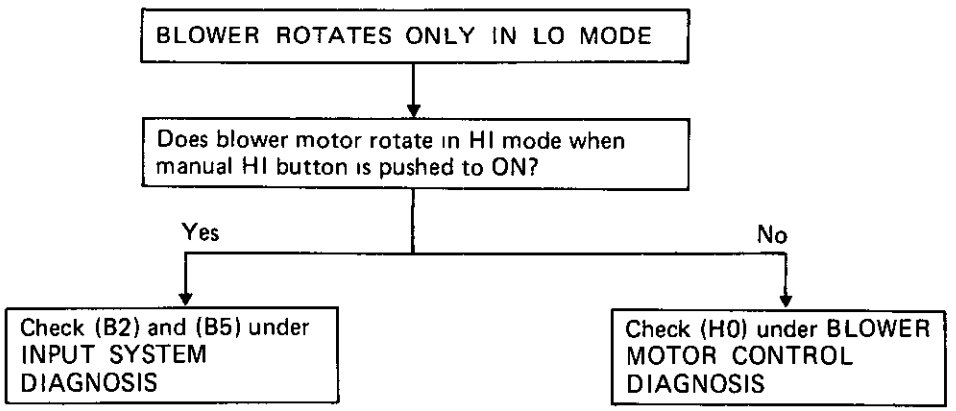
a) M3 flat head screw, 2 places
b) M3 panhead screw, 4 places
c) MANUAL DEF switch connector
d) Buzzer connector

1. Remove the four flat phillips head screws a) on the panel assembly. Then remove the four phillips pan head screws b).
2 Pull the panel assembly forward about an inch, then remove the top steel plate When removing the steel plate, caution should be observed A buzzer is connected to the plate with a lead wire running to a connector on the printed circuit board. Carefully disconnect the buzzer lead at the printed circuit board connector by prying the plastic lock retainer away from the wire's electrical connector
3. To separate the subassembly from the panel, unplug the five harness leads leading from the control panel at the printed circuit board connector Then replace assembly components as required.
4 On the rear of the control panel assembly are five light bulbs that can be serviced as required.



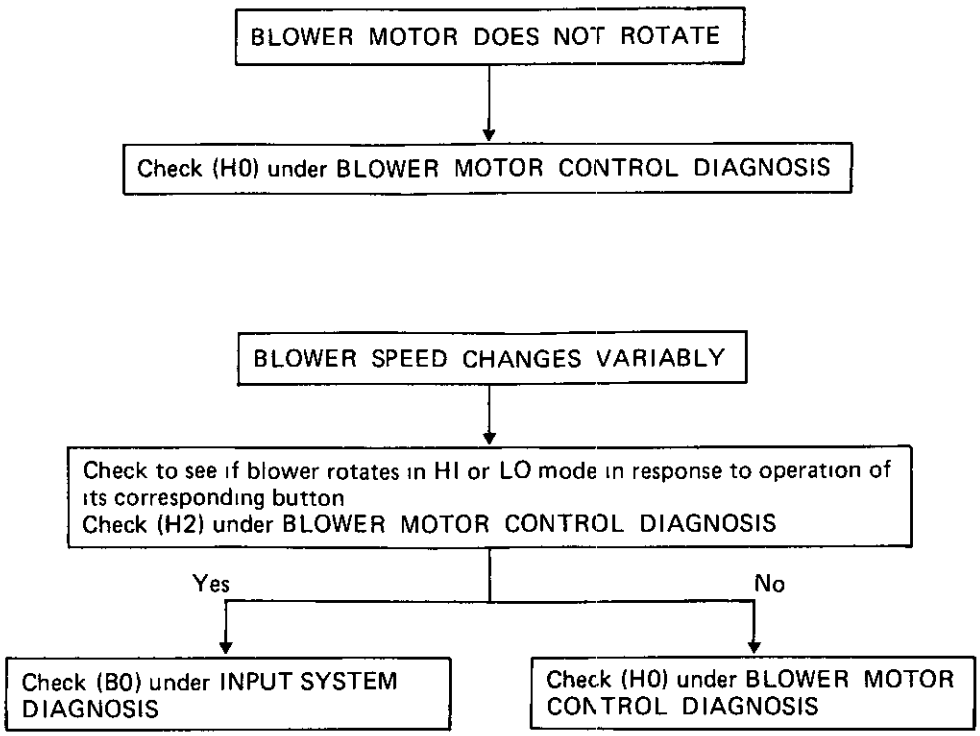
[CHECK POINTS]
(1) Open or shorted sensor (Tu, Tdu, or Tdd)
(2) Aspirator motor does not rotate and "Tu" value is close to "T_A" value

T_U In-vehicle sensor (Head)
T_A Ambient temp sensor



[CHECK POINTS]
Harnesses, connectors and sensors in relation to T_L, Tu, Td_L, Tdu, Tdd

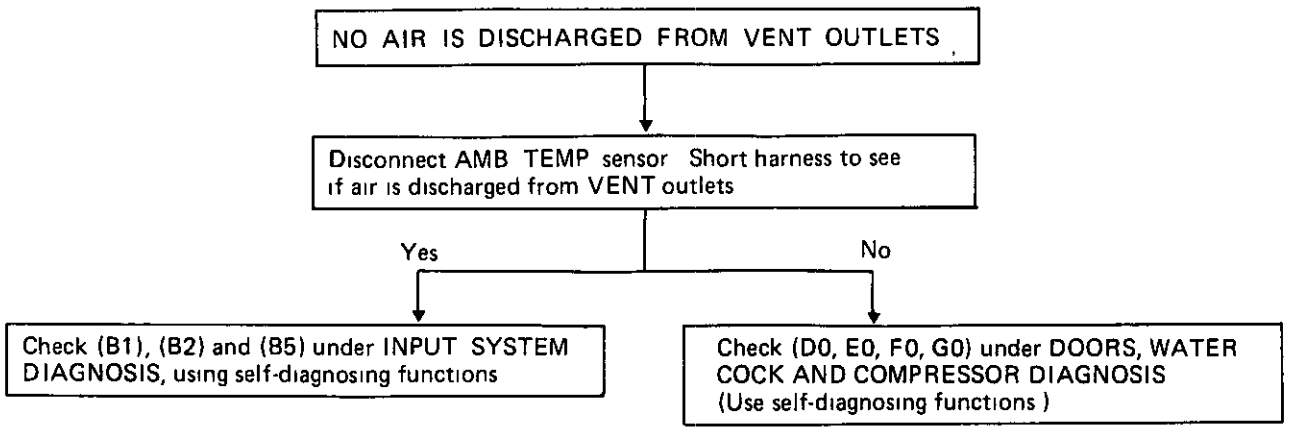
T_L In-vehicle sensor (Foot)
Tu In-vehicle sensor (Head)
Td_L Floor duct temp sensor
Tdu Vent duct temp sensor
Tdd Defroster nozzle temp sensor



[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)



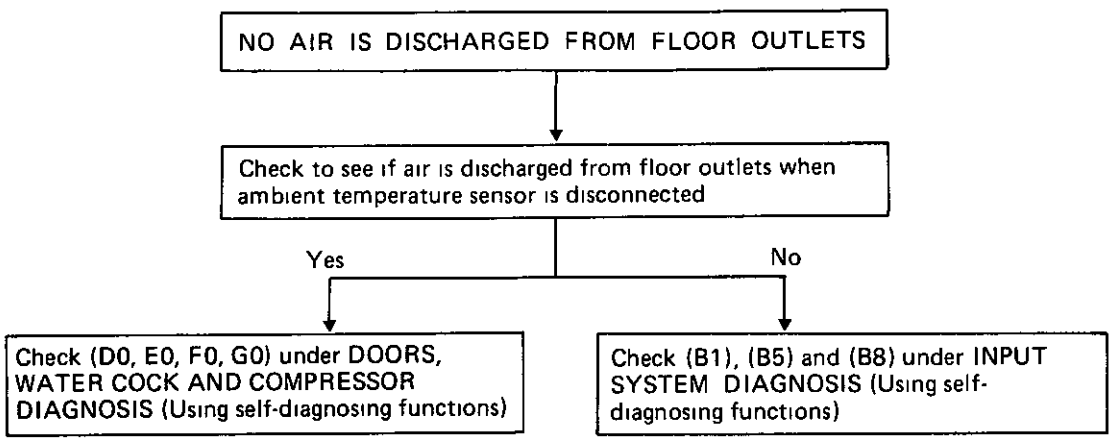
[CHECK POINTS]

(1) Open circuit in T_A, T_L, Tu and D_L sensors

T_A Ambient temp sensor
T_L In-vehicle sensor (Foot)
Tu In-vehicle sensor (Head)
T_{dL} 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

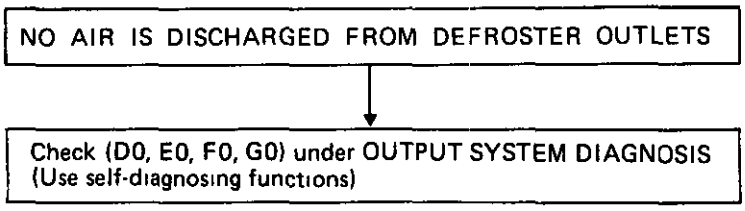


[CHECK POINTS]

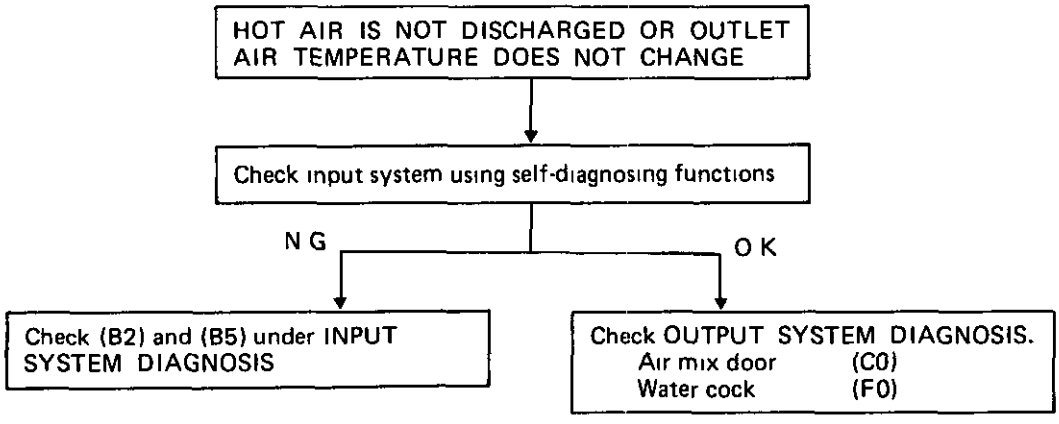
Short circuit in ambient temp sensor and sunload sensor

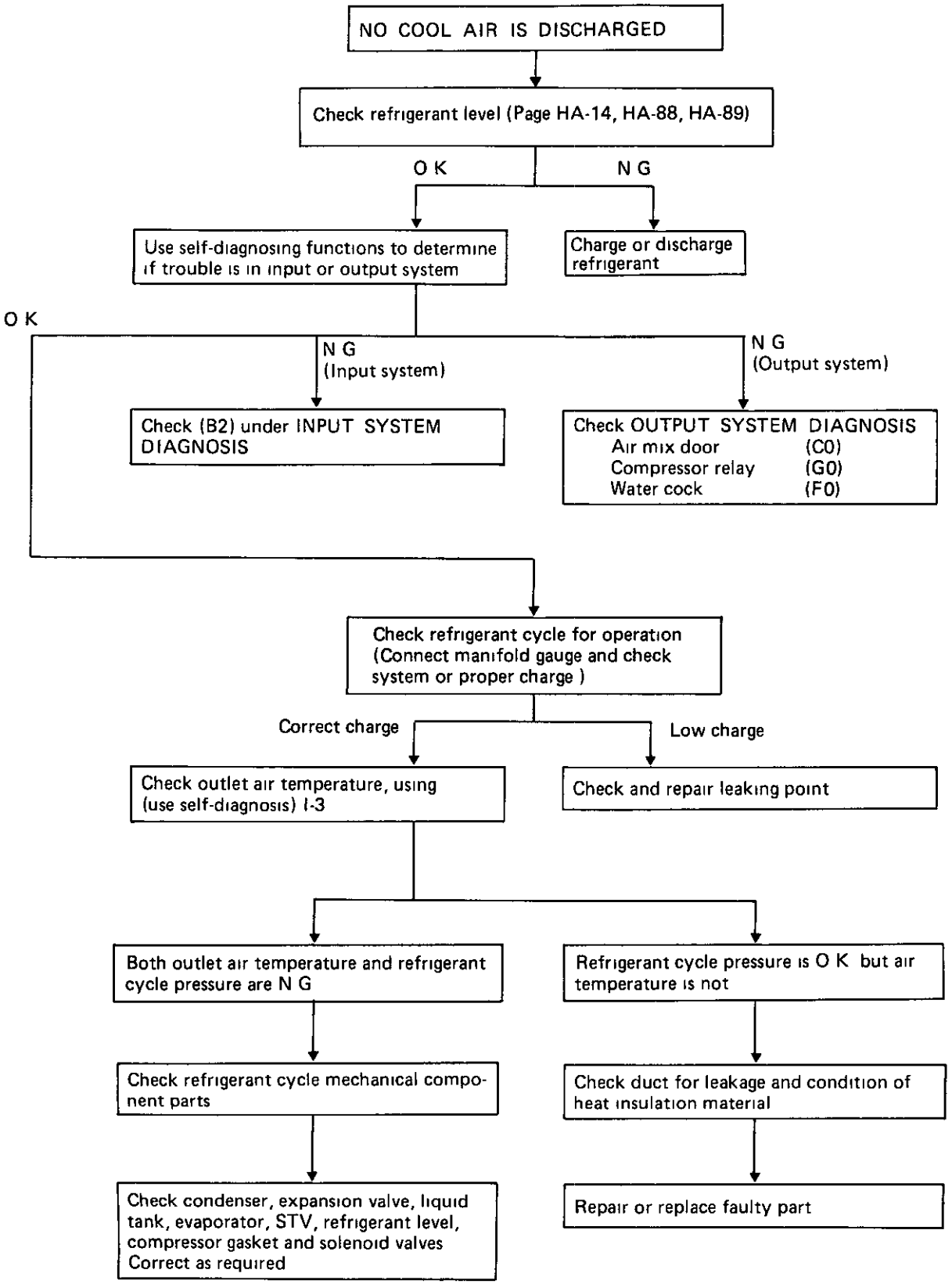
[CHECK POINTS]

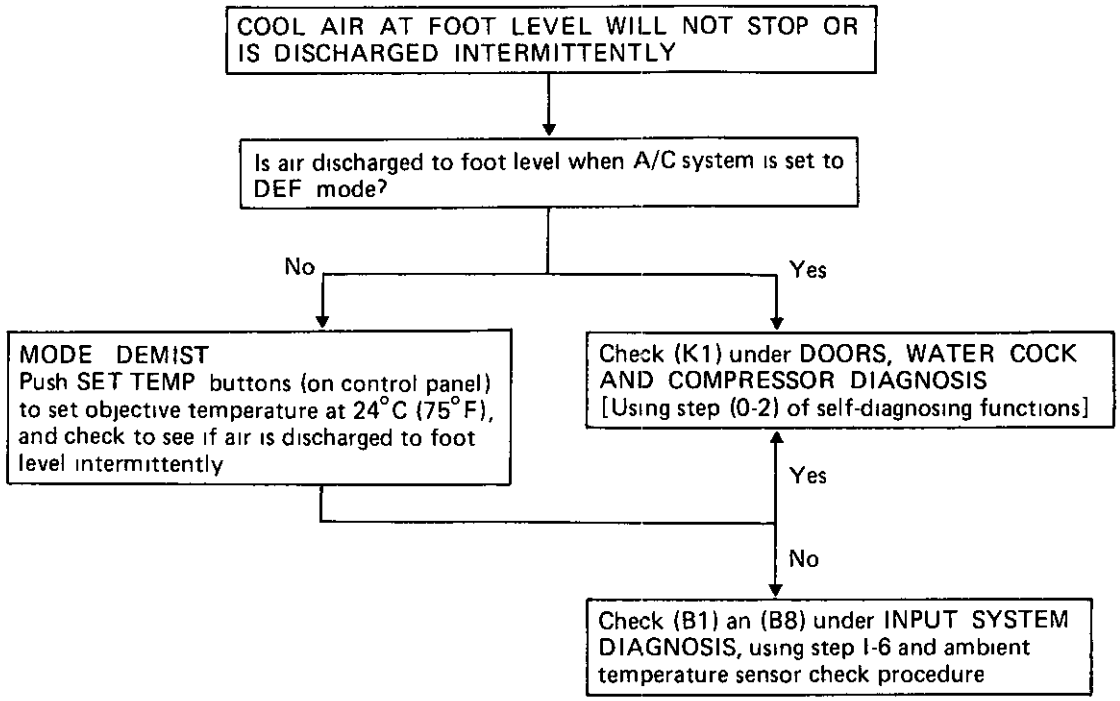
(1) Harness (line 886) and solenoid valve (7)
(2) Damage to hose between solenoid valve (7) and floor actuator Af, and condition of link system affected

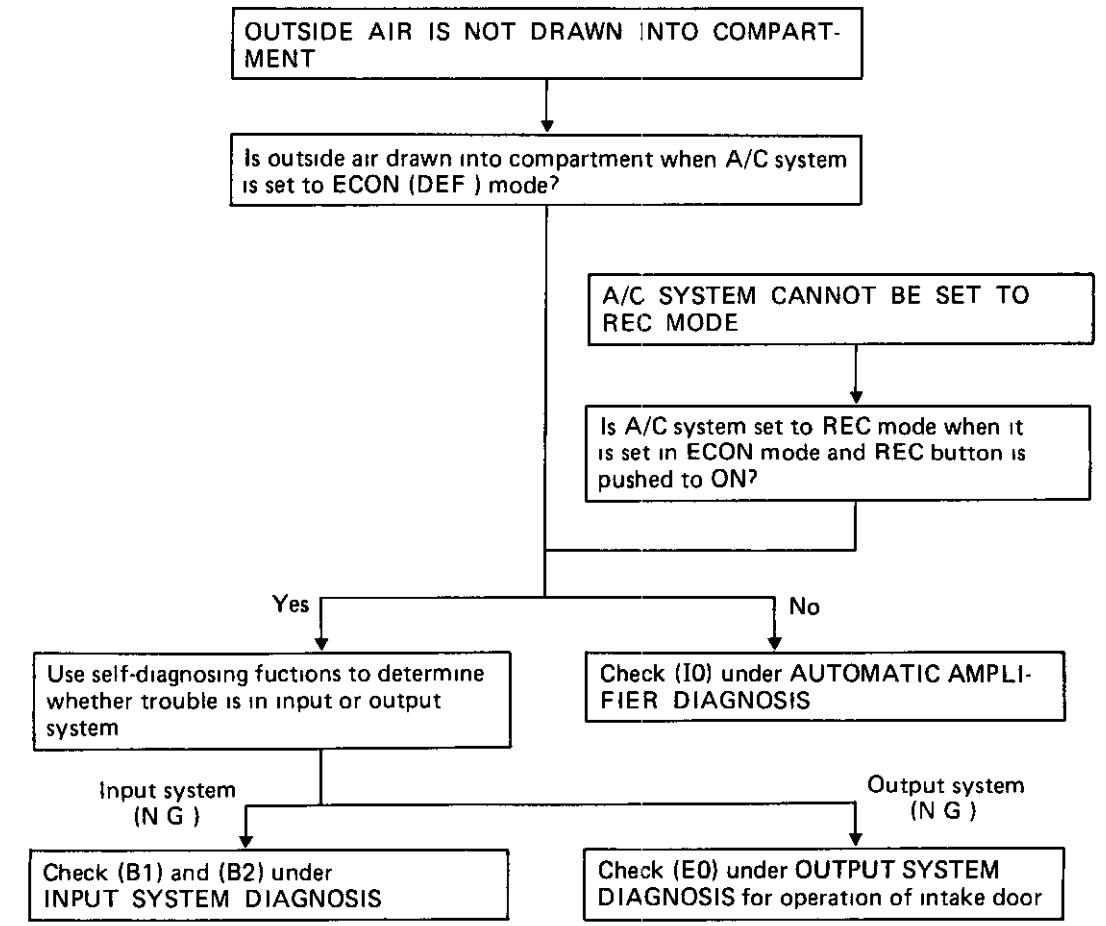


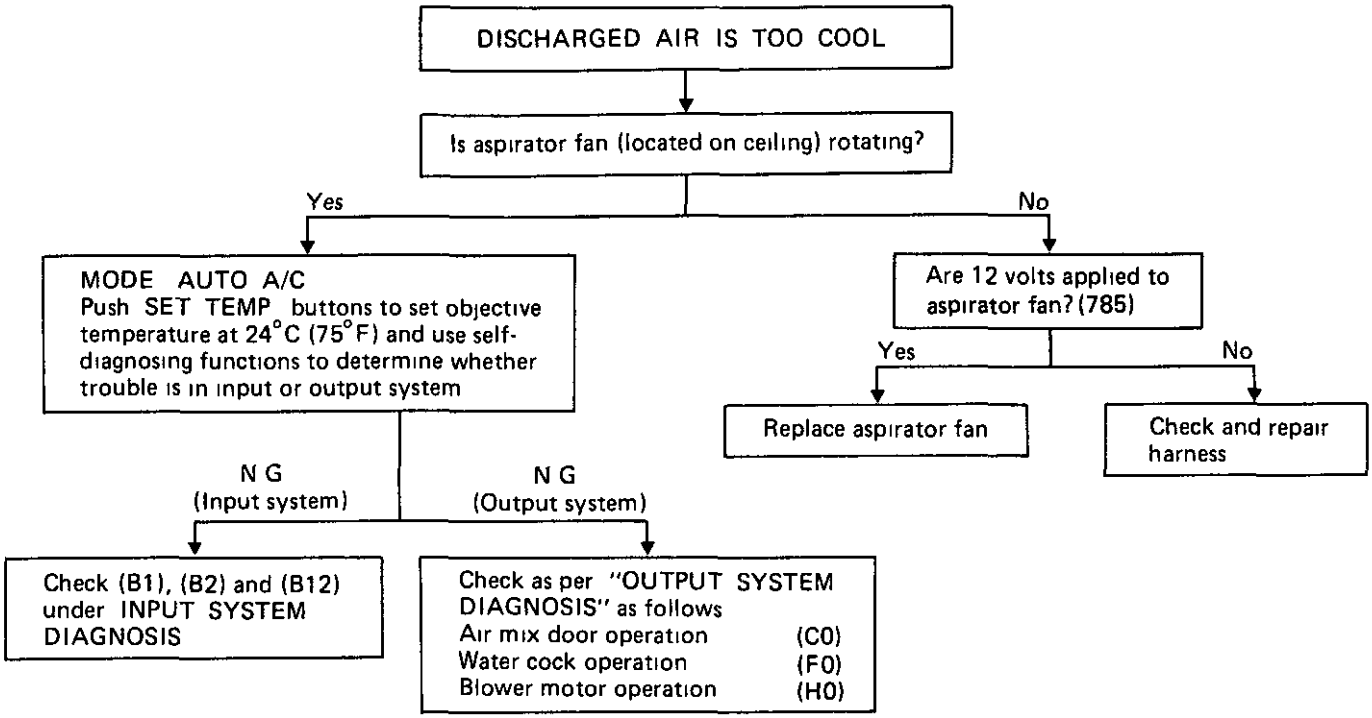
[CHECK POINTS]
(1) Harness (line 887) and solenoid valve 6
(2) Damaged hose/link between solenoid valve 6 and actuator Ad (DEF door Actuator)

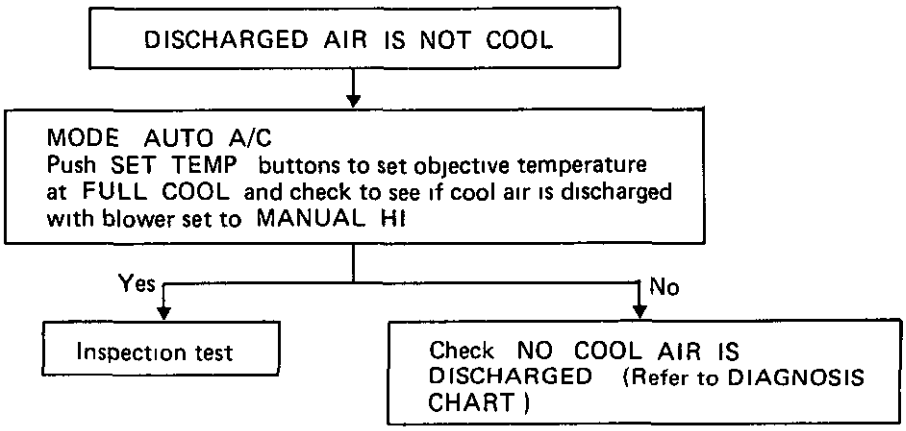


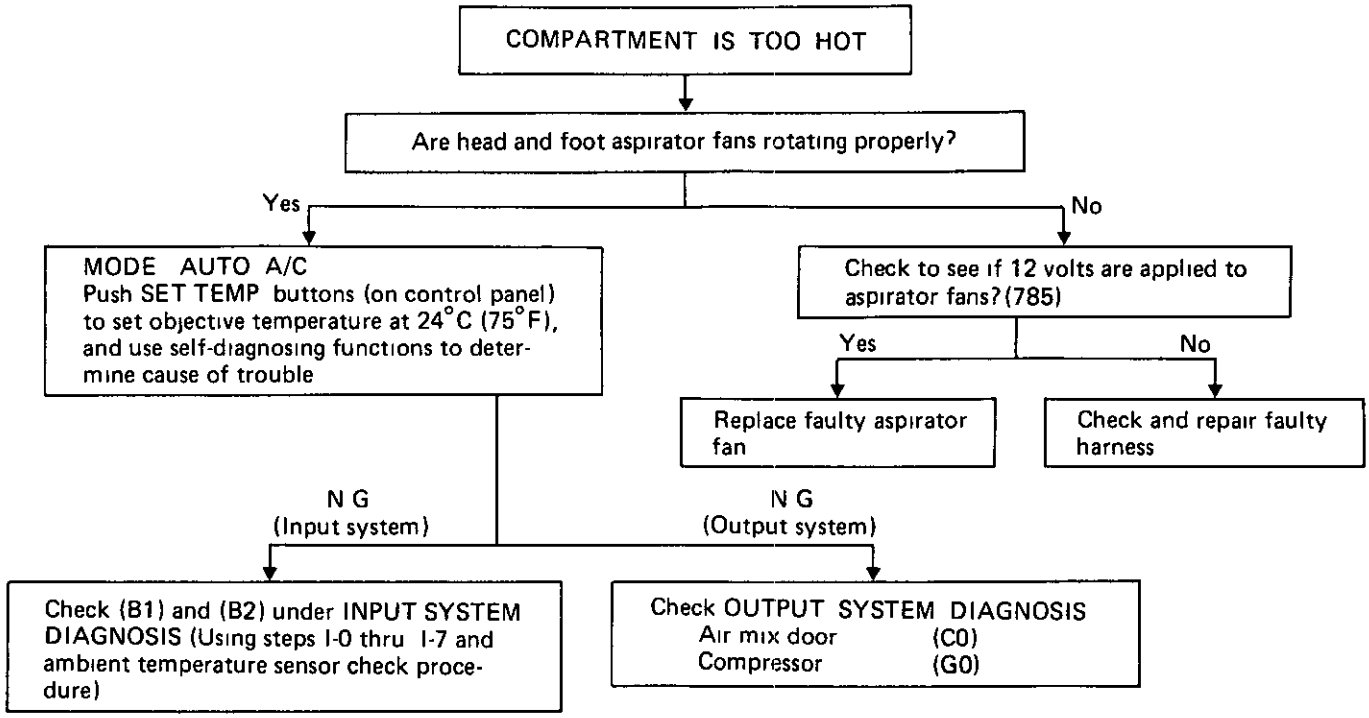

NO COOL AIR IS DISCHARGED
Check refrigerant level (Page HA-14, HA-88, HA-89)
O K
N G
Use self-diagnosing functions to determine if trouble is in input or output system
Charge or discharge refrigerant
O K
N G
(Input system)
N G
(Output system)
Check (B2) under INPUT SYSTEM DIAGNOSIS
Check OUTPUT SYSTEM DIAGNOSIS
Air mix door (C0)
Compressor relay (G0)
Water cock (F0)
Check refrigerant cycle for operation (Connect manifold gauge and check system or proper charge)
Correct charge
Low charge
Check outlet air temperature, using (use self-diagnosis) I-3
Check and repair leaking point
Both outlet air temperature and refrigerant cycle pressure are N G
Refrigerant cycle pressure is O K but air temperature is not
Check refrigerant cycle mechanical component parts
Check duct for leakage and condition of heat insulation material
Check condenser, expansion valve, liquid tank, evaporator, STV, refrigerant level, compressor gasket and solenoid valves Correct as required
Repair or replace faulty part

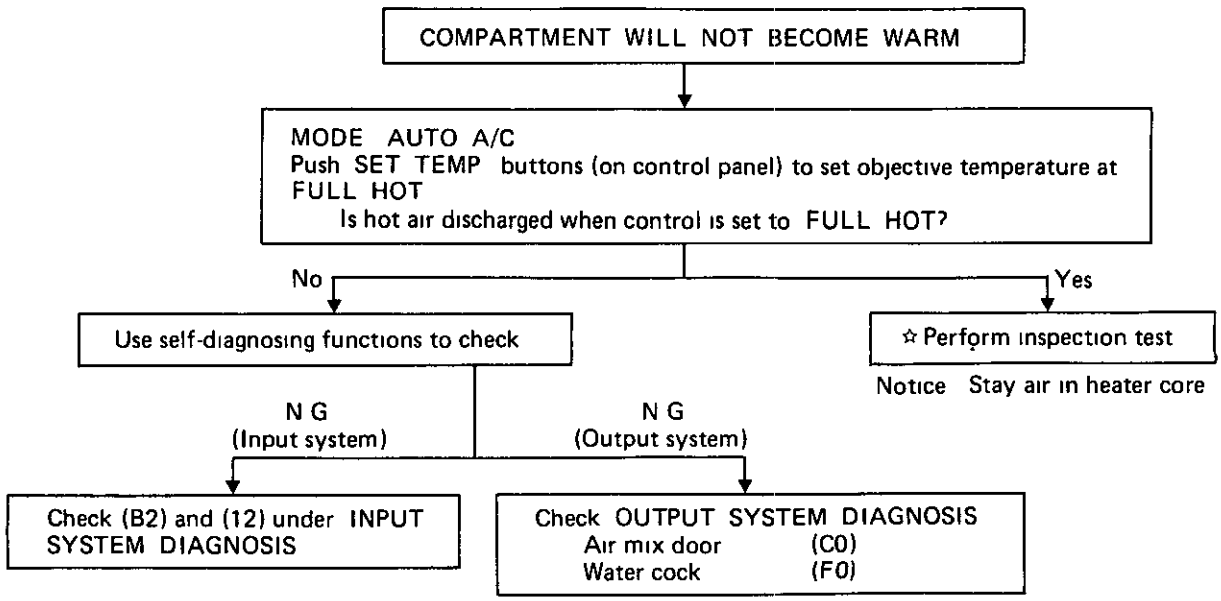

COOL AIR AT FOOT LEVEL WILL NOT STOP OR IS DISCHARGED INTERMITTENTLY
Is air discharged to foot level when A/C system is set to DEF mode?
No
Yes
MODE DEMIST
Push SET TEMP buttons (on control panel) to set objective temperature at 24°C (75°F), and check to see if air is discharged to foot level intermittently
Check (K1) under DOORS, WATER COCK AND COMPRESSOR DIAGNOSIS [Using step (0-2) of self-diagnosing functions]
Yes
No
Check (B1) an (B8) under INPUT SYSTEM DIAGNOSIS, using step I-6 and ambient temperature sensor check procedure

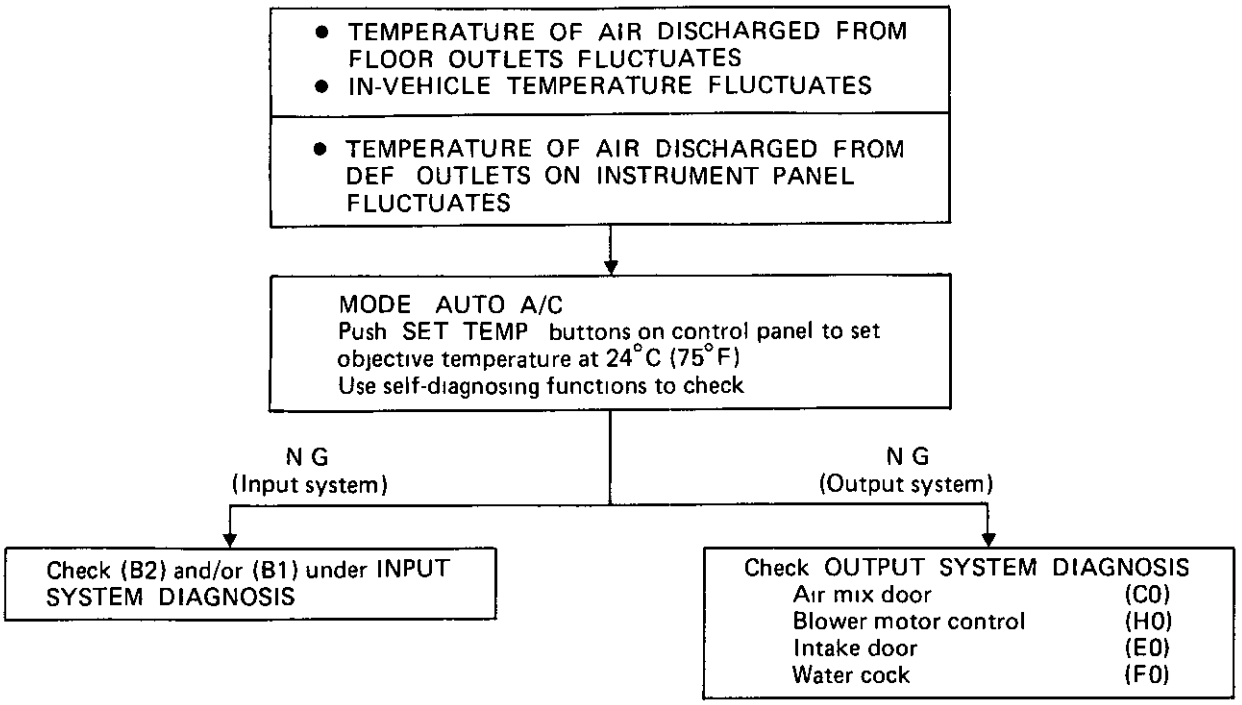

OUTSIDE AIR IS NOT DRAWN INTO COMPARTMENT
Is outside air drawn into compartment when A/C system is set to ECON (DEF) mode?
A/C SYSTEM CANNOT BE SET TO REC MODE
Is A/C system set to REC mode when it is set in ECON mode and REC button is pushed to ON?
Yes
No
Use self-diagnosing fuctions to determine whether trouble is in input or output system
Check (I0) under AUTOMATIC AMPLIFIER DIAGNOSIS
Input system (N G)
Output system (N G)
Check (B1) and (B2) under INPUT SYSTEM DIAGNOSIS
Check (E0) under OUTPUT SYSTEM DIAGNOSIS for operation of intake door


DISCHARGED AIR IS TOO COOL
Is aspirator fan (located on ceiling) rotating?
Yes
No
MODE AUTO A/C
Push SET TEMP buttons to set objective temperature at 24°C (75°F) and use self-diagnosing functions to determine whether trouble is in input or output system
Are 12 volts applied to aspirator fan? (785)
Yes
No
Replace aspirator fan
Check and repair harness
N G
(Input system)
N G
(Output system)
Check (B1), (B2) and (B12) under INPUT SYSTEM DIAGNOSIS
Check as per "OUTPUT SYSTEM DIAGNOSIS" as follows
Air mix door operation (C0)
Water cock operation (F0)
Blower motor operation (H0)


DISCHARGED AIR IS NOT COOL
MODE AUTO A/C
Push SET TEMP buttons to set objective temperature at FULL COOL and check to see if cool air is discharged with blower set to MANUAL HI
Yes
No
Inspection test
Check NO COOL AIR IS DISCHARGED (Refer to DIAGNOSIS CHART)


COMPARTMENT IS TOO HOT
Are head and foot aspirator fans rotating properly?
Yes
No
MODE AUTO A/C
Push SET TEMP buttons (on control panel) to set objective temperature at 24°C (75°F), and use self-diagnosing functions to determine cause of trouble
Check to see if 12 volts are applied to aspirator fans? (785)
Yes
No
Replace faulty aspirator fan
Check and repair faulty harness
N G
(Input system)
N G
(Output system)
Check (B1) and (B2) under INPUT SYSTEM DIAGNOSIS (Using steps I-0 thru I-7 and ambient temperature sensor check procedure)
Check OUTPUT SYSTEM DIAGNOSIS
Air mix door (C0)
Compressor (G0)


COMPARTMENT WILL NOT BECOME WARM
MODE AUTO A/C
Push SET TEMP buttons (on control panel) to set objective temperature at FULL HOT
Is hot air discharged when control is set to FULL HOT?
No
Yes
Use self-diagnosing functions to check
☆ Perform inspection test
Notice Stay air in heater core
N G
(Input system)
N G
(Output system)
Check (B2) and (12) under INPUT SYSTEM DIAGNOSIS
Check OUTPUT SYSTEM DIAGNOSIS
Air mix door (C0)
Water cock (F0)



[CHECK POINTS]

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

General Specifications

COMPRESSOR

Model	MJS170
Type	Swash plate
Displacement cm^3 (cu in)/rev	170 (10 37)
Cylinder bore x stroke mm (in)	40 0 x 22 6 (1 57 x 0 89)
Direction of rotation	Clockwise (viewed from drive end)
Type of driving belt	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 "N" range	750 - 850 at "N" range

Inspection and Adjustment

COMPRESSOR

Model	MJS170
Clutch hub to pulley clearance mm (in)	0 5 - 0 8 (0 020 - 0 031)

Tightening Torque

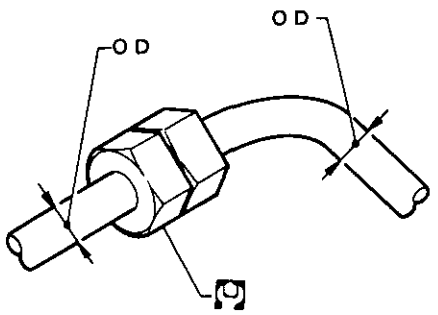
COMPRESSOR INSTALLATION

	N m	kg-m	ft-lb
Compressor bracket to cylinder block	36 - 49	3 7 - 5 0	27 - 36
Compressor to compressor bracket	36 - 49	3 7 - 5 0	27 - 36
Compressor shaft nut	19 21	1 9 - 2 1	14 - 15
Compressor rear cover fixing bolt	19 21	1 9 - 2 1	14 15

REFRIGERANT LINE

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

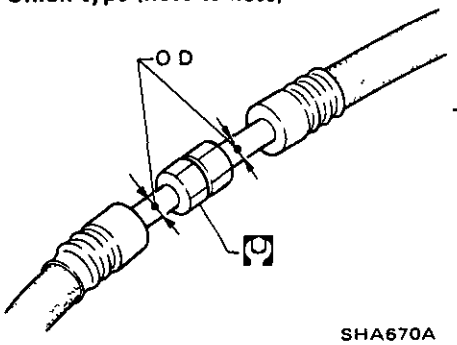
Union type (pipe to pipe)



SHA669A

Pipe O D mm (in)	Material					
	Steel or copper			*Aluminum*		
	N m	kg-m	ft-lb	N m	kg-m	ft-lb
6 (1/4)	10 - 20	1 0 - 2 0	7 14	–	–	–
8 (5/16)	15 - 25	1 5 - 2 5	11 - 18	10 20	1 0 2 0	7 - 14
10 (3/8)	15 - 25	1 5 - 2 5	11 - 18	10 - 20	1 0 - 2 0	7 - 14
12 (1/2)	20 - 29	2 0 - 3 0	14 22	15 - 25	1 5 - 2 5	11 - 18
16 (5/8)	25 34	2 5 3 5	18 - 25	20 - 29	2 0 - 3 0	14 - 22
19 (3/4)	25 - 34	2 5 3 5	18 - 25	20 - 29	2 0 3 0	14 22

Union type (hose to hose)

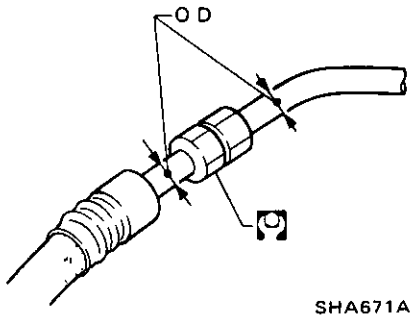


SHA670A

Pipe O D mm (in)	Material					
	Steel or copper			Aluminum		
	N m	kg-m	ft-lb	N m	kg-m	ft-lb
6 (1/4)	10 - 20	1 0 - 2 0	7 - 14	–	–	–
8 (5/16)	15 - 25	1 5 - 2 5	11 - 18	10 - 20	1 0 - 2 0	7 14
10 (3/8)	15 - 25	1 5 - 2 5	11 - 18	10 - 20	1 0 - 2 0	7 14
12 (1/2)	25 - 34	2 5- 3 5	18 - 25	20 - 29	2 0 3 0	14 22
16 (5/8)	25 - 34	2 5 - 3 5	18 - 25	20 - 29	2 0 3 0	14 - 22

Tightening Torque (Cont'd)

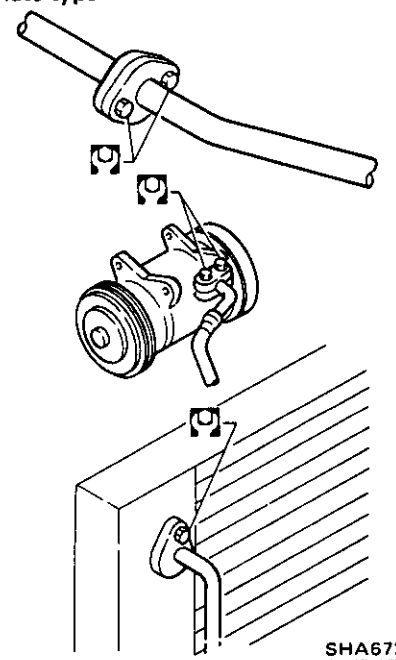
Union type (hose to pipe)



SHA671A

- Use tightening torque for flexible hose

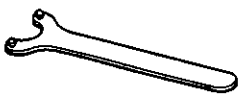
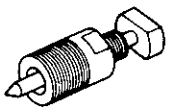
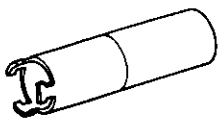
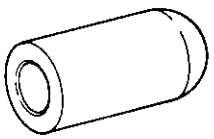
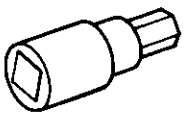
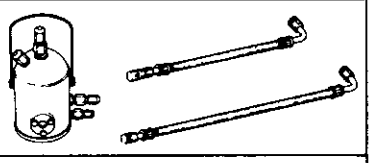
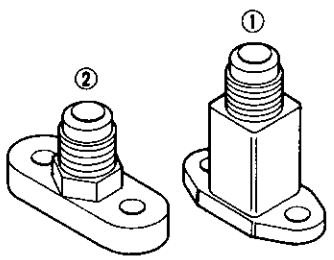
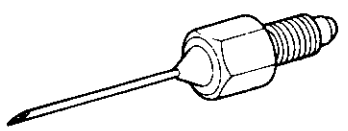
Plate type

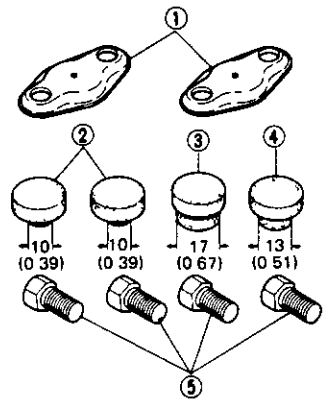

SHA672A

Bolt type				Tightening torque		
Grade	Nominal size	Bolt diameter mm	Pitch mm	N m	kg-m	ft-lb
4T	M6	6 0	1 0	3 - 4	0 3 0 4	2 2 - 2 9
	M8	8 0	1 25	8 - 11	0.8 - 1 1	5.8 - 8 0
	M10	10 0	1 5	16 - 22	1 6 2 2	12 - 16

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
KV99412302 (J24878-1) Clutch hub wrench	
KV994C5780 (J28831-A) Clutch hub puller	
KV994C1143 (J9392-01) Shaft seal remover and installer	
KV994C5784 (J33212) Shaft seal pilot	
KV99412330 (–) Hen socket	
KV994C5785 (–) Cylinder head remover	
KV994A9690 (–) Oil separator kit	
KV992C5079 (–) ① KV992C5081 (–) Adapter connector A ② KV992C5082 (–) Adapter connector B	
KV994C1552 (–) Charge nozzle	

Tool number (Kent-Moore No) Tool name	Tool
KV994C4548 (J33902) Blind cover set ① KV994C4531 (–) Blind cover ② KV994C4532 (–) Gasket ③ KV994C4533 (–) Gasket (Useless) ④ KV994C4534 (–) Gasket (Useless) ⑤ KV994C4559 (–) Bolt	 Unit mm (in)

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(800)527-1909

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