HEATER & AIR CONDITIONER

SECTION HA

CONTENTS

When you read wiring diagrams:
- **Read GI section, "HOW TO READ WIRING DIAGRAMS".**
- **See EL section, "POWER SUPPLY ROUTING" for power distribution circuit.**

When you perform trouble diagnoses, read GI section, "HOW TO FOLLOW FLOW CHART IN TROUBLE DIAGNOSES".

Supplemental Restraint System "AIR BAG" and "SEAT BELT PRE-TENSIONER"

The Supplemental Restraint System "Air Bag" and "Seat Belt Pre-tensioner" help to reduce the risk or severity of injury to the driver and front passenger in a frontal collision. The Supplemental Restraint System consists of air bags (located in the center of the steering wheel and on the instrument panel on the passenger side), seat belt pre-tensioners, sensors, a control unit, warning lamp, wiring harness and spiral cable. Information necessary to service the system safely is included in the **BF section** of this Service Manual.

WARNING:

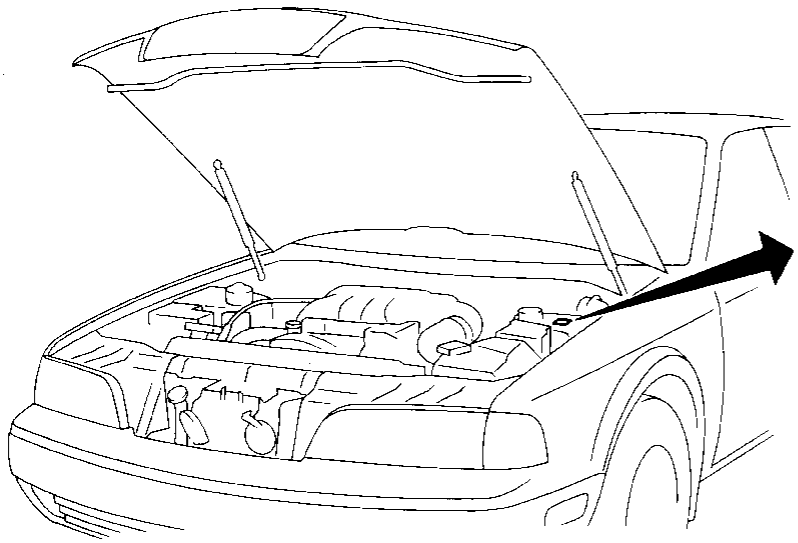
- **To avoid rendering the SRS inoperative, which could lead to personal injury or death in the event of a severe frontal collision, all maintenance must be performed by an authorized INFINITI dealer.**
- **Improper maintenance, including incorrect removal and installation of the SRS, can lead to personal injury caused by unintentional activation of the system.**
- **All SRS air bag electrical wiring harnesses and connectors are covered with yellow outer insulation. Do not use electrical test equipment on any circuit related to the SRS SYSTEM.**

Introduction

To prevent the ozone layer from being destroyed, the HFC-134a (R-134a) refrigerant has replaced the previously used CFC-12 (R-12).
The new and previous service tools, refrigerant, lubricant, etc. are not interchangeable due to differences in their physical properties and characteristics.
Always service the HFC-134a (R-134a) air conditioning system using the specified tools, lubricant and refrigerant, observing the following precautions:

Identification

IDENTIFICATION LABEL FOR VEHICLE



AIR CONDITIONER NISSAN

	REFRIGERANT	COMPRESSOR LUBRICANT
TYPE (PART NO.)	R134a	⚠1
AMOUNT	⚠3	⚠2

CAUTION PRÉCAUTION

- REFRIGERANT UNDER HIGH PRESSURE.
- SYSTEM TO BE SERVICED BY QUALIFIED PERSONNEL
- IMPROPER SERVICE METHODS MAY CAUSE PERSONAL INJURY.
- CONSULT SERVICE MANUAL.
- THIS AIR CONDITIONER SYSTEM COMPLIES WITH SAE J-639.

NISSAN MOTOR CO., LTD., Tokyo, Japan

⚠1 : Lubricant type and service part number

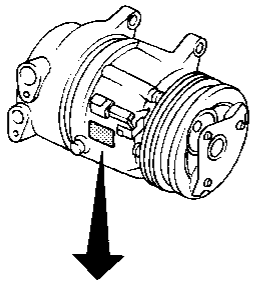
⚠2 : Amount of lubricant

⚠3 : Amount of refrigerant

SHA194E

PARTS IDENTIFICATION

1. Compressor label



CALSONIC

PART NO. ○○○○○ ○○○○○ ○○○○○ ○○○○○

SER. NO

TYPE V6-16 REFRIG. R134a
OIL DH-PS: 200 cm³ (7 fl oz)
(NISSAN PART NO. KLH00-PAGSO)
LEAK TEST HIGH SIDE : 30kg/cm² G (430P S.I.G)
LOW SIDE : 15kg/cm² G (215P S.I.G)
R134a用 USA FOR R134a
MFD. CALSONIC CORP. MADE IN JAPAN

2. Other component parts label

R134a label

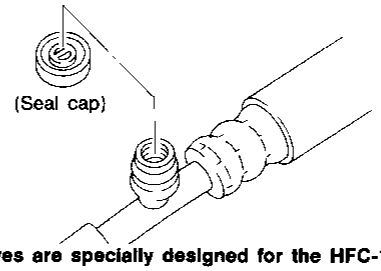
R134a用
USE FOR R134a

Base color: Light blue

R134a用
USE FOR
R134a

Part name	Identification
1. Compressor	Compressor label
2. Cooling unit	R134a label
3. Expansion valve	Stamp
4. Condenser	R134a label
5. Liquid tank	R134a label
6. Hose or pipe	R134a label

3. Service valves (suction/discharge)



The service valves are specially designed for the HFC-134a (R-134a) system. Those for the CFC-12 (R-12) system are different in size and configuration. Refer to "PREPARATION".

RHA968D

Precautions for Working with HFC-134a (R-134a)

WARNING:

- **CFC-12 (R-12) refrigerant and HFC-134a (R-134a) refrigerant must never be mixed, even in the smallest amounts, as they are incompatible with each other. If the refrigerants are mixed, compressor failure is likely to occur.**
- **Use only specified lubrication oil for the HFC-134a (R-134a) A/C system and HFC-134a (R-134a) components. If lubrication oil other than that specified is used, compressor failure is likely to occur.**
- **The specified HFC-134a (R-134a) lubrication oil absorbs moisture from the atmosphere at a rapid rate, therefore the following handling precautions must be observed:**
  - **a: When removing refrigerant components from a vehicle, immediately cap (seal) the component to minimize the entry of moisture from the atmosphere.**
  - **b: When installing refrigerant components to a vehicle, do not remove the caps (unseal) until just before connecting the components. Also, complete the connection of all refrigerant loop components as quickly as possible to minimize the entry of moisture into the system.**
  - **c: Use the specified lubrication oil from a sealed container only. Containers must be re-sealed immediately after dispensing the lubrication oil. Lubrication oil in containers which are not properly sealed will become moisture saturated, and such lubrication oil is no longer suitable for use and should be properly disposed of.**
  - **d: Avoid breathing A/C refrigerant and lubrication oil vapor or mist. Exposure may irritate eyes, nose and throat. Use only approved recovery/recycling equipment to discharge HFC-134a (R-134a) systems. If accidental system discharge occurs, ventilate work area before resuming work.**
  - **e: Do not allow lubrication oil (Nissan A/C System Oil Type S) to come in contact with styrofoam parts. Damage may result.**

General Refrigerant Precautions

WARNING:

- **Do not release refrigerant into the air. Use approved recovery/recycling equipment to capture the refrigerant every time an air conditioning system is discharged.**
- **Always wear eye and hand protection (goggles and gloves) when working with any refrigerant or air conditioning system.**
- **Do not store or heat refrigerant containers above 52°C (125°F).**
- **Do not heat a refrigerant container with an open flame; if container warming is required, place the bottom of the container in a warm pail of water.**
- **Do not intentionally drop, puncture, or incinerate refrigerant containers.**
- **Keep refrigerant away from open flames: poisonous gas will be produced if refrigerant burns.**
- **Refrigerant will displace oxygen, therefore be certain to work in well ventilated areas to prevent suffocation.**
- **Do not introduce compressed air to any refrigerant container or refrigerant component.**

Precautions for Refrigerant Connection

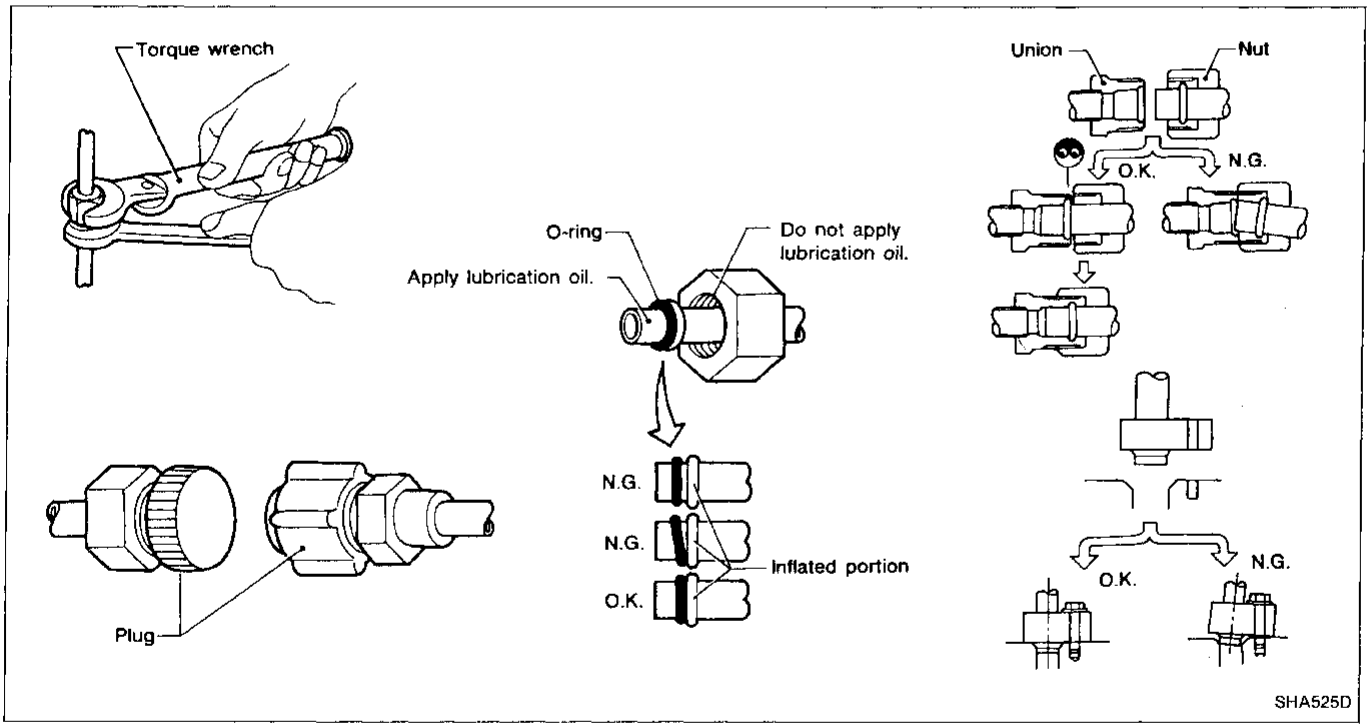
WARNING:

Make sure all refrigerant is discharged into the recycling equipment and the pressure in the system is less than atmospheric. Then gradually loosen the discharge side hose fitting and remove it.

CAUTION:

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, always use a torque wrench and a back-up wrench.**
- **After disconnecting tubes, plug all openings immediately to prevent entrance of dirt and moisture.**
- **When installing an air conditioner in the vehicle, the pipes must be connected as the final stage of the operation. The seal caps of the pipes and other components must not be removed until their removal is required for connection.**
- **To prevent the condensation of moisture inside A/C components, components stored in cool areas should be allowed to warm to the working area temperature before removing the seal caps.**
- **Thoroughly remove moisture from the refrigeration system before charging the refrigerant.**
- **Always replace used O-rings.**
- **When connecting tube, apply lubrication oil to portions shown in illustration. Be careful not to apply oil to threaded portion.**
  Lubrication oil name: Nissan A/C System Oil Type S
  Part number: KLH00-PAGS0
- **O-ring must be closely attached to inflated portion of tube.**
- **After inserting tube into union until O-ring is no longer visible, tighten nut to specified torque.**
- **After connecting line, conduct leak test and make sure that there is no leakage from connections. When the gas leaking point is found, disconnect that line and replace the O-ring. Then tighten connections of seal seat to the specified torque.**



Precautions for Servicing Compressor

- Attach a blind plug to the suction port (low pressure) and discharge port (high pressure) of the compressor to prevent oil from leaking out and dust from getting inside.
- When the compressor is removed, store it under the same condition as it is when mounted on the car.
- When replacing the compressor, be sure to remove oil from the compressor and check the oil quantity extracted.
- When replacing with a new compressor, be sure to remove oil from the new compressor so that the quantity of oil remaining in the new compressor is equal to the quantity collected from the removed compressor. See the section "LUBRICATION OIL".
- Pay attention so as not to allow dirt and oil to attach on the friction surfaces between clutch and pulley. If the surface is contaminated with oil, wipe it off by using a clean waste cloth moistened with thinner.
- After completing the compressor service operation, be sure to rotate the compressor shaft more than five turns in both directions by hand to equalize oil distribution inside the compressor, then run the compressor for about one hour by idling the engine.

Introduction

The Automatic Temperature Control (ATC) system provides automatic regulation of the vehicles interior temperature based on the operator selected "set temperature", regardless of the outside temperature changes. This is done by utilizing a microcomputer, also referred to as the automatic amplifier, which receives input signals from several sensors. The automatic amplifier uses these input signals (including the set temperature) to automatically control the ATC system's outlet air volume, air temperature, and air distribution.

Features

Air mix door control

The air mix door is automatically controlled so that in-vehicle temperature will reach, and be maintained at the operator selected "set temperature". For a given set temperature, the mix door position will depend on: Ambient temperature, in-vehicle temperature, amount of sunload, and intake air temperature.

Fan speed control

The blower speed is automatically controlled, with the actual speed (for a given set temperature) depending on: Ambient temperature, in-vehicle temperature, amount of sunload, intake air temperature, and mix door position. Additionally, when the system is turned on, the blower will start slowly and then increase speed (over a period of approximately 5 seconds) until the objective speed is reached. When cold starting in cold ambient temperatures, the blower operation will be delayed to prevent blowing cold air on the occupants feet.

Intake door control

The intake door position will be determined by: Ambient temperature, in-vehicle temperature, and whether the compressor is on or off.

Outlet door control

The outlet door position will be determined by: Ambient temperature, in-vehicle temperature, intake air temperature, and amount of sunload.

Compressor clutch control

The compressor operation (ON-OFF) is automatically controlled by the ambient sensor to prevent compressor damage in very cold ambient temperatures.

Recirculation switch

When RECIRC switch is pressed, intake door is fixed at RECIRC position.

Self-diagnostic system

The self-diagnostic system consists of five steps. Each step can be accessed by pushing the switches on the automatic amplifier.
STEP 1: Checks L.E.D.s and segments of the display.
STEP 2: Checks each sensor circuit for open or short circuit.
STEP 3: Checks mode door position.
STEP 4: Checks operation of each actuator.
STEP 5: Checks temperature detected by each sensor.
AUXILIARY TRIMMER MECHANISM: Set temperature trimmer.

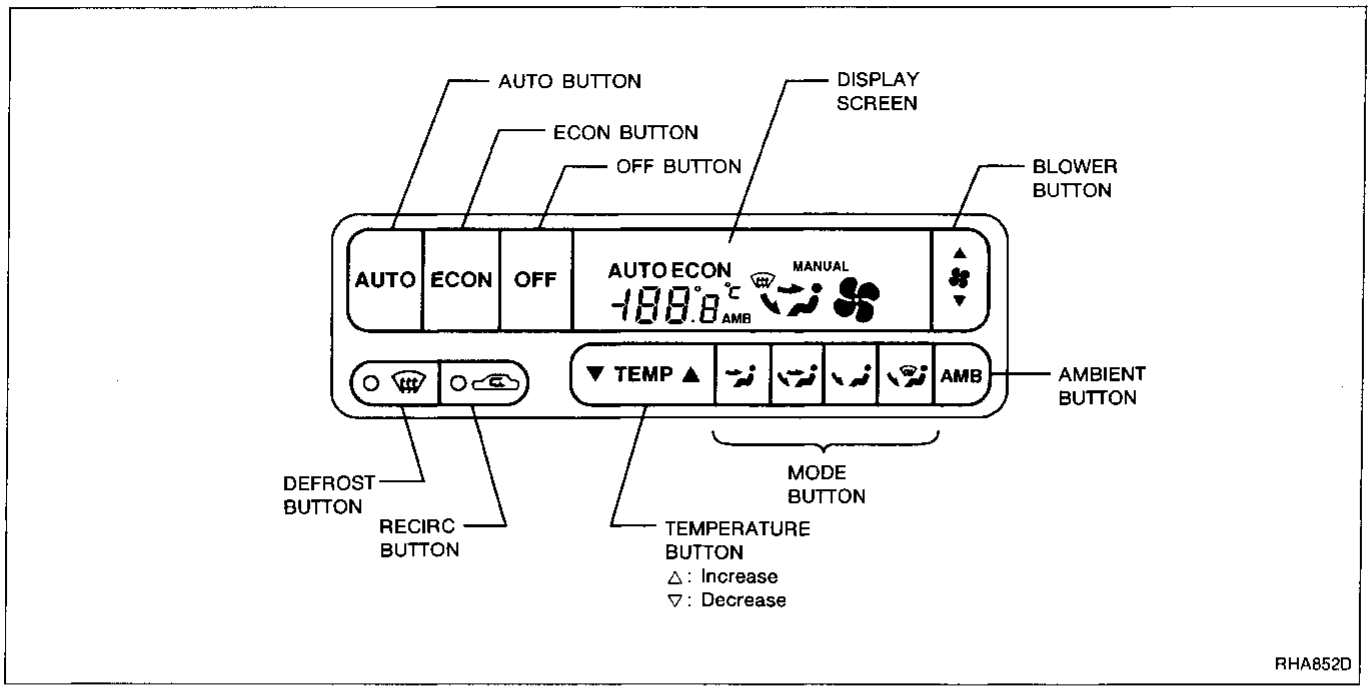
Memory function

When the ignition switch is turned from "ON" to "OFF", the auto amplifier stores the set temperature and inputs of various switches in its memory. When the ignition switch is turned from "OFF" to "ON", the system begins operation with the information stored in the memory, then immediately compensates for the actual operating conditions.

Refrigeration cycle

Refer to page HA-12 for the description of the refrigeration cycle.

Control Operation



DISPLAY SCREEN
Displays the operational status of the system.

AUTO BUTTON
The compressor, air inlet door, air mix door, outlet doors, and blower speed are automatically controlled so that the in-vehicle temperature will reach, and be maintained at the set temperature selected by the operator.

ECON BUTTON
Fully automatic control with the compressor off. With the compressor off, the system will not remove heat (cool) or de-humidify. The system will maintain the in-vehicle temperature at the set temperature when the set temperature is above the ambient (outside) temperature.

TEMPERATURE INCREASE/DECREASE BUTTON
Increases or decreases the set temperature.

OFF BUTTON
The compressor and blower are off, the air inlet door is set to the outside air position, and the air outlet doors are set to the foot (70% foot and 30% defrost) position. In the off position the ATC system uses the vehicle's "flow through" ventilation to try to maintain the interior temperature based on the temperature set when the system was last operating.

BLOWER BUTTON
Manual control of the blower speed. Four speeds are available for manual control (as shown on the display screen):
low , medium low , medium high , high

MODE BUTTON
Manual control of the air discharge outlets. There selections are available (as shown on the display screen):
face , bi-level , foot , foot/defroster

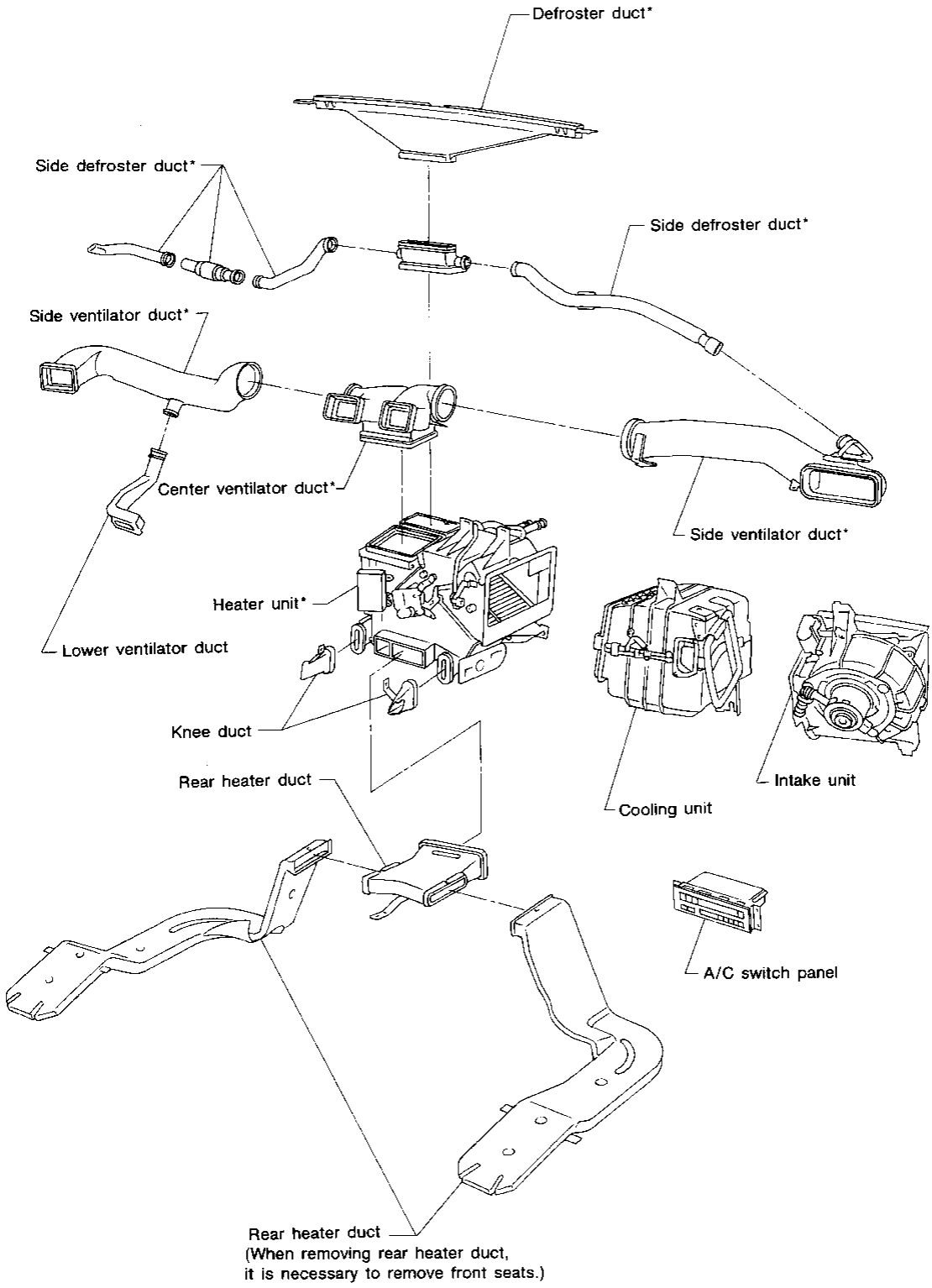
Control Operation (Cont'd)

AMBIENT BUTTON
Shows the ambient (outside) air temperature on the display screen for 5 seconds.

RECIRC BUTTON
Positions the air inlet door to the recirculation position.

DEFROST BUTTON
Positions the air discharge doors to the defrost position. Also positions the air inlet door to the outside air position. The compressor operates at ambient temperature approx. 6°C (43°F) or above.

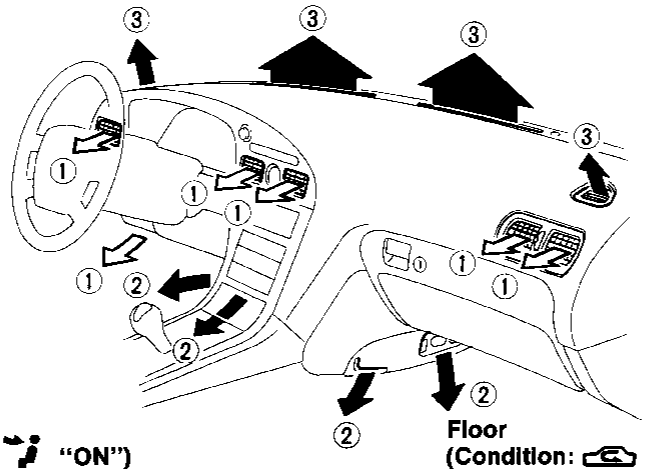
Component Layout



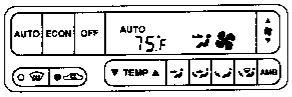
*: For removal, it is necessary to remove instrument assembly.

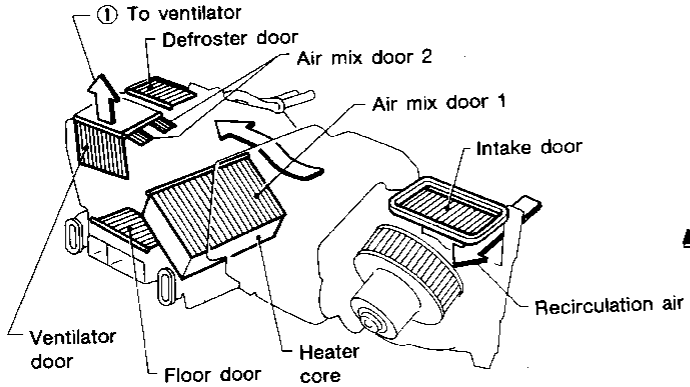
RHA853D

Air Flow

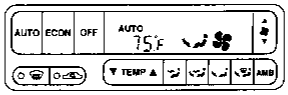


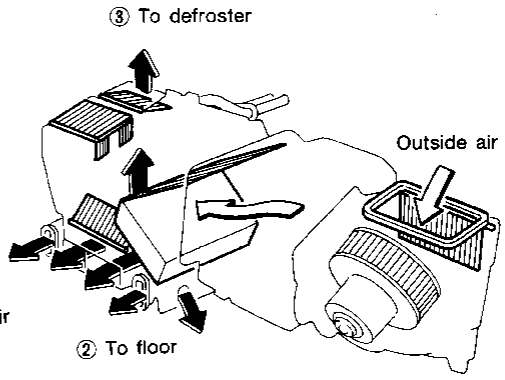
Ventilation
(Condition: and "ON")



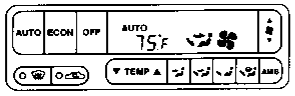


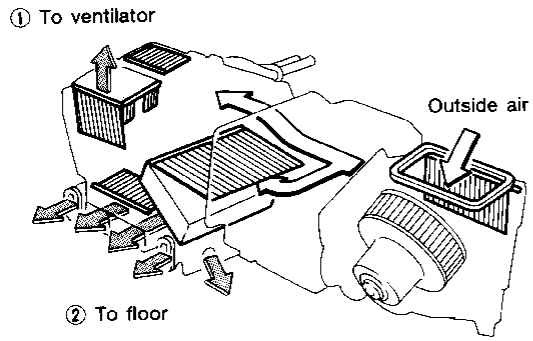
Floor
(Condition: "OFF" and "ON")



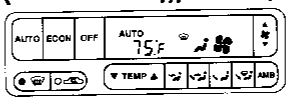


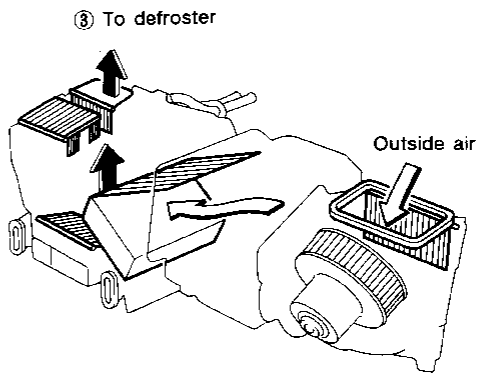
Bi-level
(Condition: "OFF" and "ON")





Defroster
(Condition: "ON")





: Air passed through heater core

: Mixed air (+)

: Air not passed through heater core

RHA854D

Refrigeration Cycle

REFRIGERANT FLOW

The refrigerant flows in the standard pattern, that is, through the compressor, the condenser, the liquid tank, through the evaporator, and back to the compressor.
The refrigerant evaporation through the evaporator coil is controlled by an externally equalized expansion valve, located inside the evaporator case.

FREEZE PROTECTION

Under normal operating conditions, when the AUTO is switched on, the compressor runs continuously, and the evaporator pressure, and therefore temperature, is controlled by the V-6 variable displacement compressor to prevent freeze up.

REFRIGERANT SYSTEM PROTECTION

Dual-pressure switch

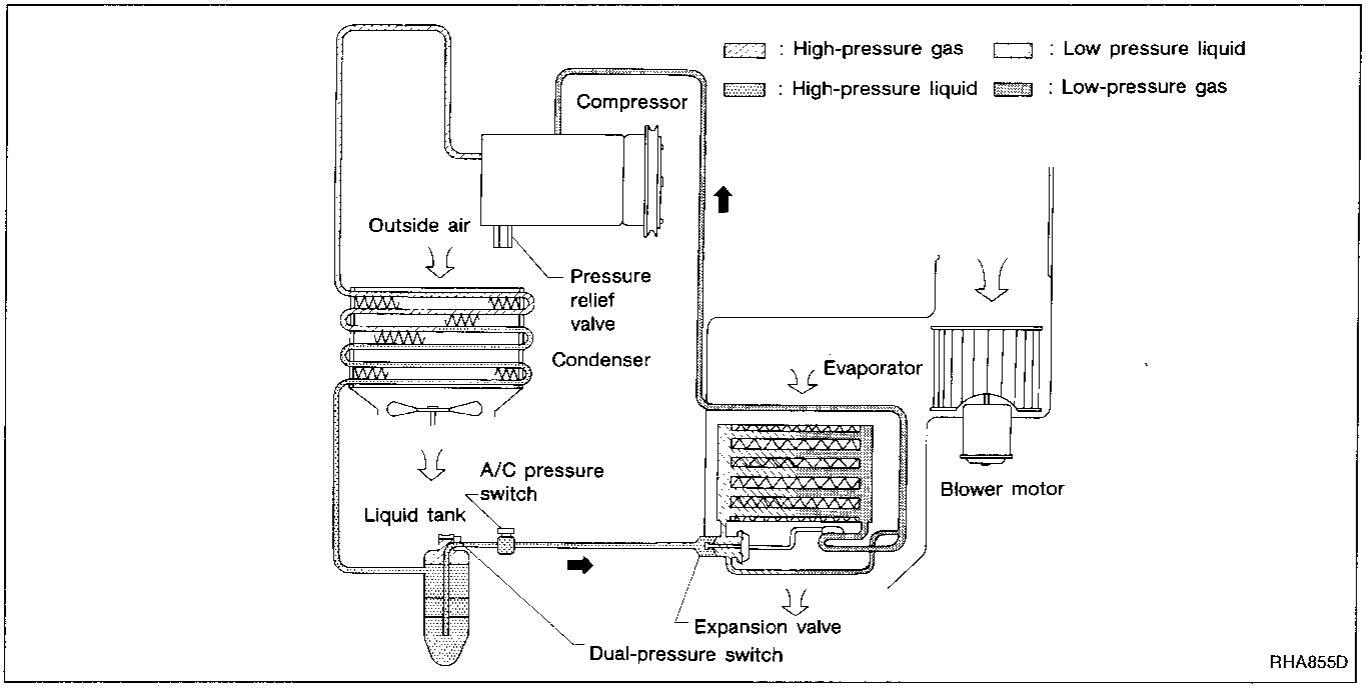
The refrigerant system is protected against excessively high or low pressures by the dual-pressure switch, located on the liquid tank. If the system pressure rises above, or falls below the specifications, the dual-pressure switch opens to interrupt the compressor operation.

Pressure relief valve

The refrigerant system is also protected by a pressure relief valve, located on the end of high flexible hose near compressor. When the pressure of refrigerant in the system increases to an abnormal level [more than 3,727 kPa (38 kg/cm^2, 540 psi)], the release port on the pressure relief valve automatically opens and releases refrigerant into the atmosphere.

A/C pressure switch

The refrigerant system is protected against excessively high pressure by the A/C pressure switch located in the high-pressure side line. If the system pressure rises above specifications the A/C pressure switch closes to operate the condenser fan motor. The condenser fan motor operates at "LOW" as controlled by condenser fan relay-1.



V-6 Variable Displacement Compressor

GENERAL INFORMATION

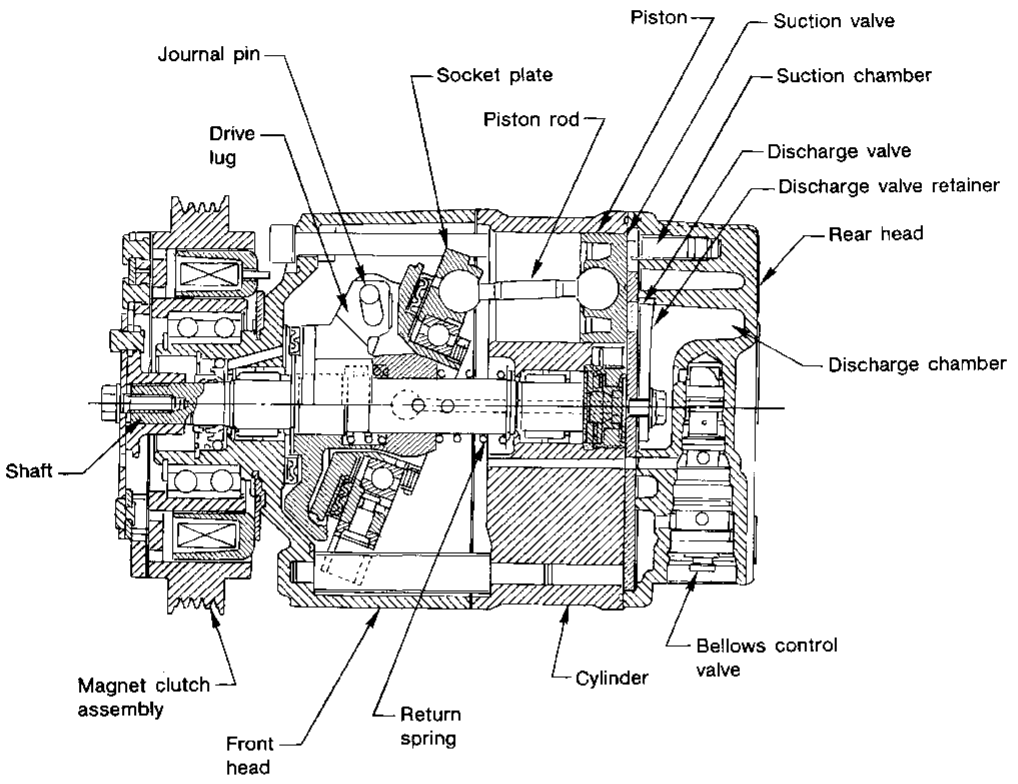
1. The V-6 variable compressor differs from previous units in that the vent temperatures do not drop too far below 5°C (41°F) at an evaporator intake air temperature of less than 20°C (68°F) while the engine is running at speeds less than 1,500 rpm. This is because the V-6 compressor provides a means of "capacity" control.
2. The V-6 variable compressor provides refrigerant control under varying conditions. During the winter season when ambient temperatures are low, it sometimes does not produce high refrigerant pressure discharge (compared to previous units) when used with automobile air conditioning systems.
3. A "clanking" sound may occasionally be heard during refrigerant charge. The sound indicates that the tilt angle of the swash plate has changed and is not a problem.
4. In air conditioning systems which are equipped with the V-6 compressor, the clutch remains engaged unless the system main switch, fan switch or ignition switch is turned OFF. When ambient (outside) temperatures are low or when the amount of refrigerant is insufficient, the clutch is disengaged to protect the compressor.
5. A constant range of suction pressure is maintained when engine speed is greater than a certain value. It normally ranges from 147 to 177 kPa (1.5 to 1.8 kg/cm^2, 21 to 26 psi) under varying conditions.
   In previous compressors, however, suction pressure was reduced with increases in engine speed.

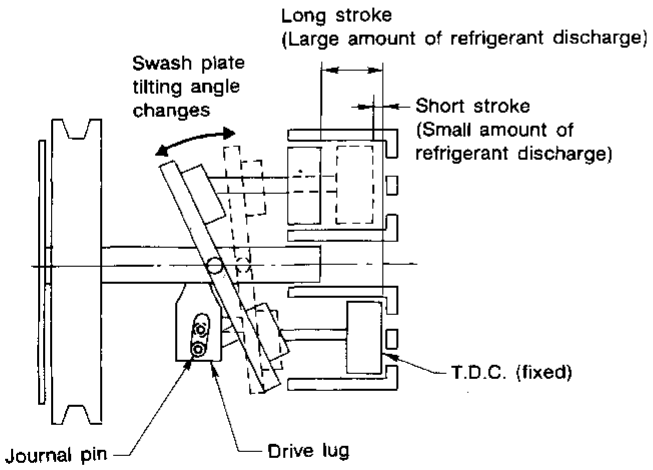
V-6 Variable Displacement Compressor (Cont'd)

DESCRIPTION

General

The variable compressor is basically a swash plate type that changes piston stroke in response to the required cooling capacity.
The tilt of the swash plate allows the piston's stroke to change so that refrigerant discharge can be continuously changed from 10.5 to 165 cm^3 (0.641 to 10.068 cu in).





Discharge control	Discharge capacity cm^3 (cu in)/rev.	Piston stroke length mm (in)
Minimum	10.5 (0.641)	1.6 (0.063)
Maximum	165 (10.068)	25.6 (1.008)

RHA969D

V-6 Variable Displacement Compressor (Cont'd)

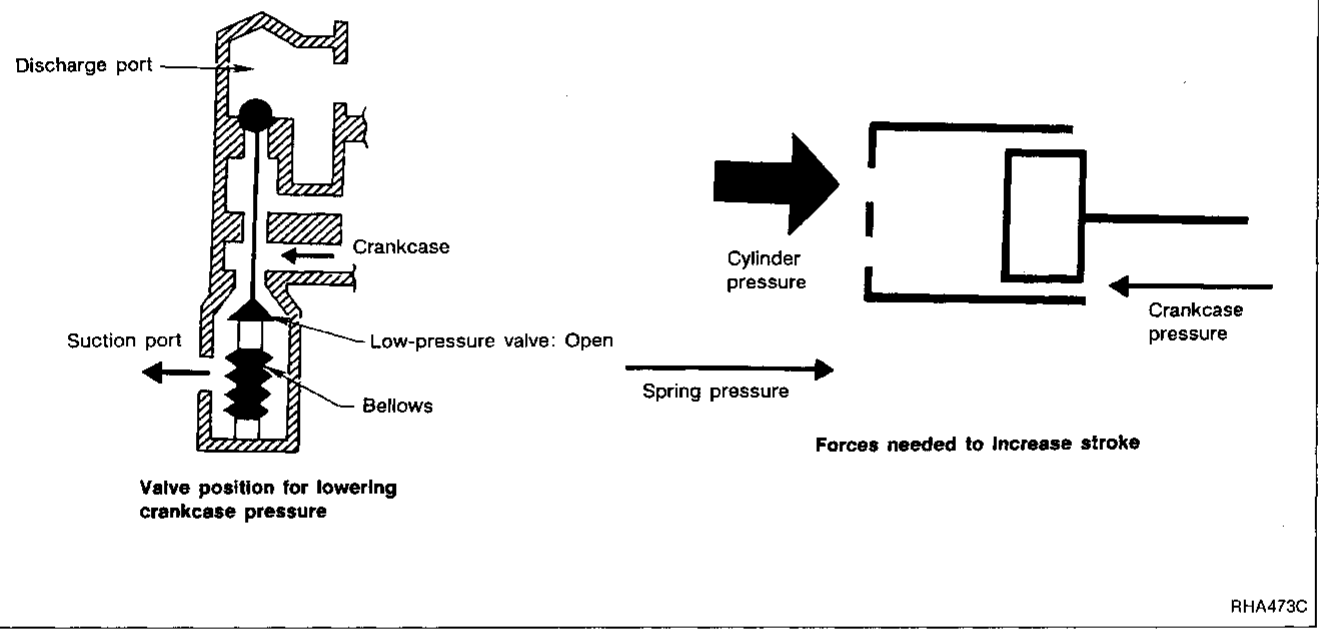
Operation

1. Operation control valve

Operation control valve is located in the suction port (low-pressure) side, and opens or closes in response to changes in refrigerant suction pressure.
Operation of the valve controls the internal pressure of the crankcase.
The angle of the swash plate is controlled between the crankcase's internal pressure and the piston cylinder pressure.

2. Maximum cooling

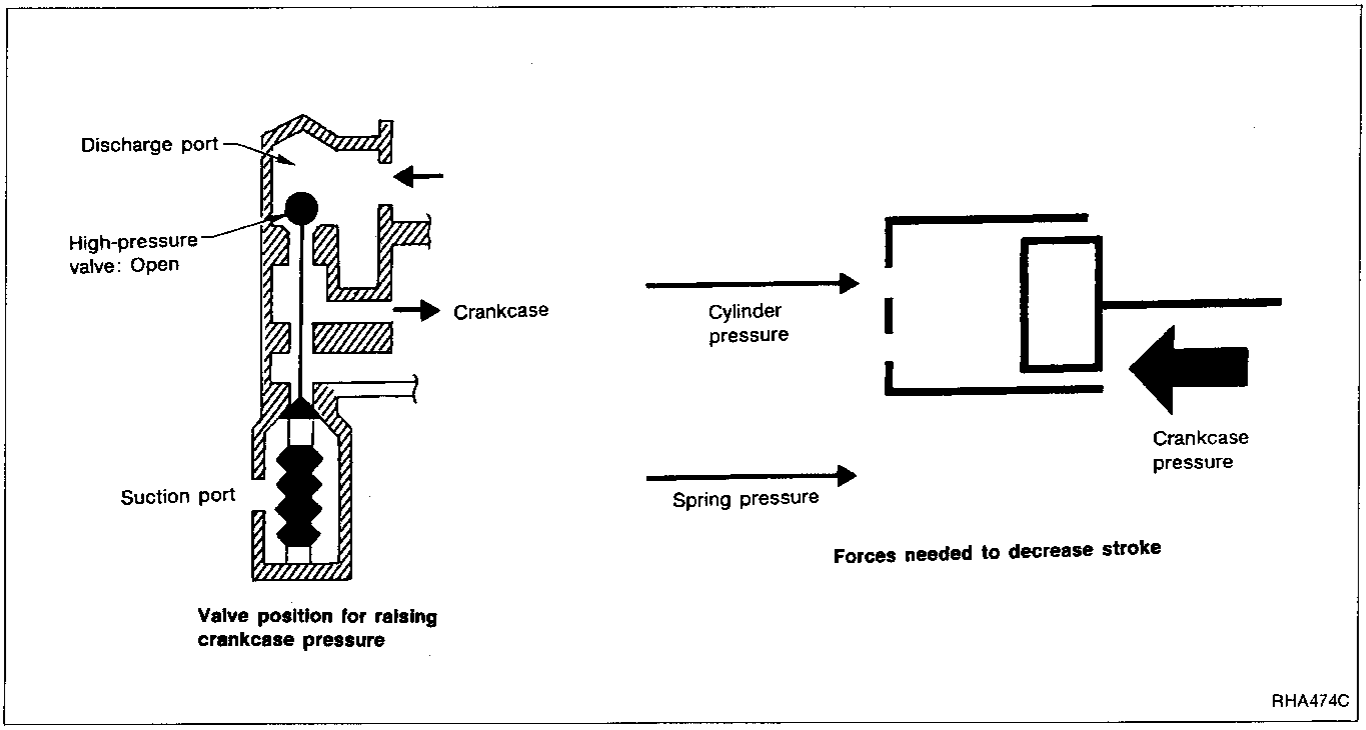
Refrigerant pressure on the low-pressure side increases with an increase in heat loads.
When this occurs, the control valve's bellows compress to open the low-pressure side valve and close the high-pressure side valve.
This causes the crankcase's internal pressure to equal the pressure on the low-pressure side and the cylinder's internal pressure to be greater than the crankcase's internal pressure. Under this condition, the swash plate is set to the maximum stroke position.



V-6 Variable Displacement Compressor (Cont'd)

3. Capacity control

- Refrigerant pressure on suction side is low during high speed driving or when ambient or interior temperature is low.
- The bellows expands when refrigerant pressure on the suction pressure side drops below approximately 177 kPa (1.8 kg/cm^2, 26 psi).
  Since suction pressure is low, it makes the suction port close and the discharge port open. Thus, crankcase pressure becomes high as high pressure enters the crankcase.
- The force acts around the journal pin near the swash plate, and is generated by the pressure difference before and behind the piston.
  The drive lug and journal pin are located where the piston generates the highest pressure. Piston pressure is between suction pressure Ps and discharge pressure Pd, which is near suction pressure Ps. If crankcase pressure Pc rises due to capacity control, the force around the journal pin makes the swash plate angle decrease and also the piston stroke decrease. In other words, the pressure difference between the piston and the crankcase according to crankcase pressure increase changes the angle of the swash plate.

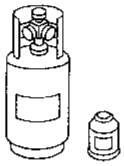
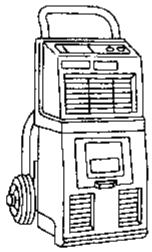
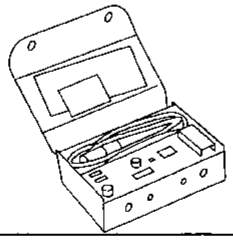
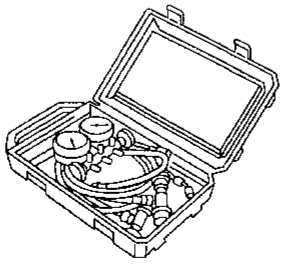


Valve position for raising crankcase pressure

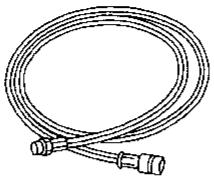
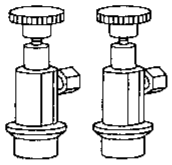
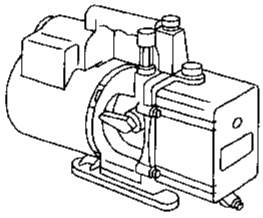
Forces needed to decrease stroke

HFC-134a (R-134a) Service Tools and Equipment

It is important to understand that HFC-134a (R-134a) refrigerant, and the specified lubricant which must be used with HFC-134a (R-134a), must never be mixed with CFC-12 (R-12) refrigerant and/or the CFC-12 (R-12) lubricant.
This means that separate and non-interchangeable service equipment must be used for handling each type of refrigerant/lubricant.
To prevent the mixing of refrigerants/lubricants, refrigerant container fittings, service hose fittings, and service equipment fittings (equipment which handles refrigerant and/or lubricant) are different between CFC-12 (R-12) and HFC-134a (R-134a).
Adaptors to convert from one size fitting to the other must never be used: refrigerant/lubricant contamination will occur and compressor failure will result.

Tool number (Kent-Moore No.) Tool name	Description	Note
HFC-134a (R-134a) refrigerant	 NT196	Container color: Light blue Container marking: HFC-134a (R-134a) Fitting size: Thread size • large container 1/2"-16 ACME
KLH00-PAGS0 (—) Nissan A/C System Oil Type S	 NT197	Type: Poly alkyline glycol oil (PAG), type S Application: HFC-134a (R-134a) swash plate (piston) compressors (Nissan only) Lubricity: 40 mℓ (1.4 US fl oz, 1.4 Imp fl oz)
(J-39500-INF) Recovery/Recycling equipment (ACR4)	 NT195	Function: Refrigerant Recovery and Recycling and Recharging
(J-39400) Electrical leak detector	 NT198	Power supply: • DC 12 V (Cigarette lighter)
(J-39183) Manifold gauge set (with hoses and couplers)	 NT199	Identification: • The gauge face indicates R-134a. Fitting size: Thread size • 1/2"-16 ACME

HFC-134a (R-134a) Service Tools and Equipment (Cont'd)

Tool number (Kent-Moore No.) Tool name	Description	Note
Service hoses • High side hose (J-39501-72) • Low side hose (J-39502-72) • Utility hose (J-39476-72)	 NT201	Hose color: • Low hose: Blue with black stripe • High hose: Red with black stripe • Utility hose: Yellow with black stripe or green with black stripe Fitting size: Thread size • 1/2"-16 ACME
Service couplers • High side coupler (J-39500-20) • Low side coupler (J-39500-24)	 NT202	Fitting size: • M14 x 1.5 fitting is optional
(J-39650) Refrigerant weight scale	 NT200	For measuring of refrigerant Fitting size: Thread size • 1/2"-16 ACME
(J-39649) Vacuum pump (Including the isolator valve)	 NT203	Capacity: • Air displacement: 4 CFM • Micron rating: 20 microns • Oil capacity: 482 g (17 oz) Fitting size: Thread size • 1/2"-16 ACME

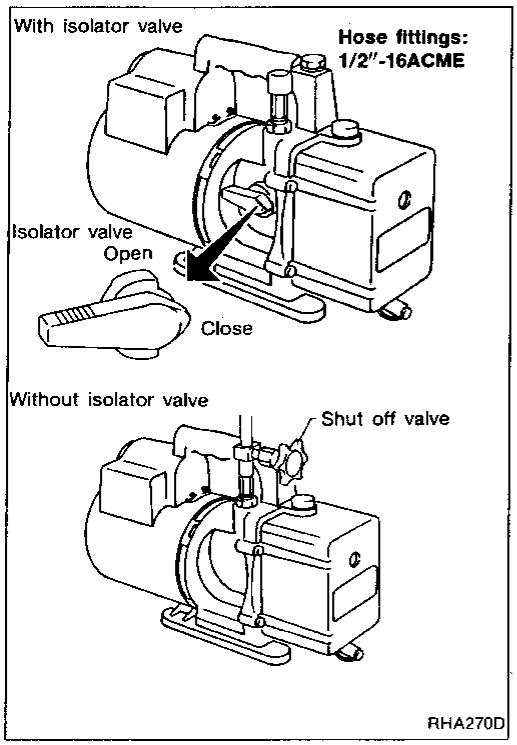
Precautions for Service Equipment

RECOVERY/RECYCLING EQUIPMENT

Be certain to follow the manufacturers instructions for machine operation and machine maintenance. Never introduce any refrigerant other than that specified into the machine.

ELECTRICAL LEAK DETECTOR

Be certain to follow the manufactures instructions for tester operation and tester maintenance.



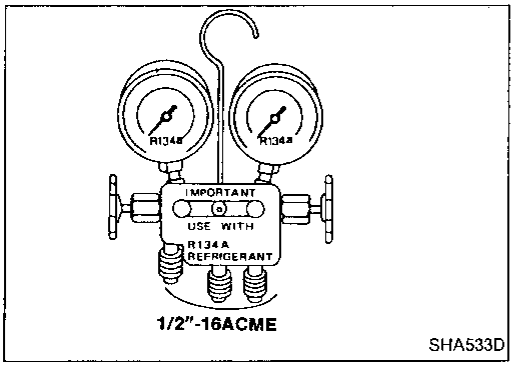
VACUUM PUMP

The lubricant contained inside the vacuum pump is not compatible with the specified lubricant for HFC-134a (R-134a) A/C systems. Since the vent side of the vacuum pump is exposed to atmospheric pressure, it is possible for the vacuum pump lubricant to migrate out of the pump into the service hose if the pump is switched off after evacuation (vacuuming) and the service hose is not isolated from the vacuum pump.

To prevent the migration of vacuum pump lubricant into service hoses, it is necessary to use a valve (which can be manually opened or closed) near the connection of the service hose to the pump.

- On a vacuum pump which is equipped with an isolator valve (usually part of the vacuum pump), closing this valve will isolate the service hose from the pump.
- For pumps without an isolator valve, be certain that the service hose is equipped with a manual shut off valve near the pump end of the hose.
- Hoses which contain an automatic shut off valve at the end of the service hose must be disconnected from the vacuum pump to prevent the migration of lubricant: as long as the hose is connected, the valve is open and lubricant may migrate.

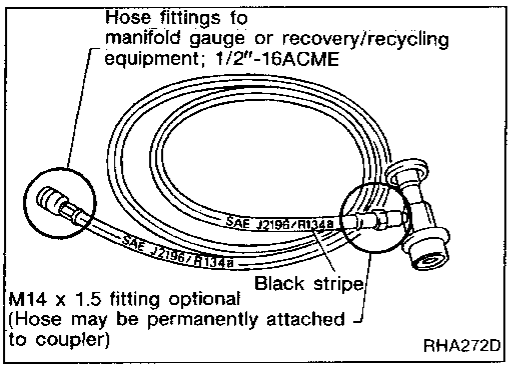
One-way valves which open when vacuum is applied and close under a no vacuum condition are not recommended, because this valve may restrict the pump's ability to pull a deep vacuum.



MANIFOLD GAUGE SET

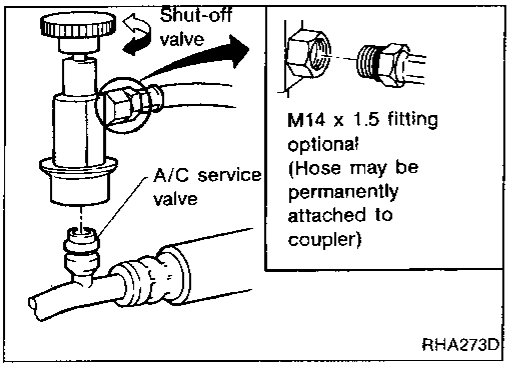
Be certain that the gauge face indicates R-134a or 134a. Be certain that the manifold gauge set has the 1/2"-16 ACME threaded connections for service hoses, and that no refrigerants other than HFC-134a (R-134a) (along with only specified lubricants) have been used with the manifold gauge set.

Precautions for Service Equipment (Cont'd)



SERVICE HOSES

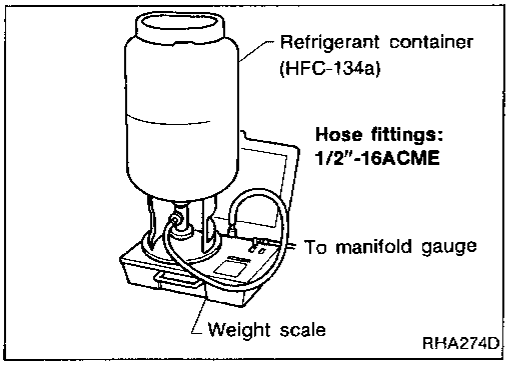
Be certain that the service hoses display the markings described (colored hose with black stripe). Be certain that all hoses include positive shut off devices (either manual or automatic) near the end of the hoses opposite the manifold gauge.



SERVICE COUPLERS

Never attempt to connect HFC-134a (R-134a) service couplers to an CFC-12 (R-12) A/C system. Although the HFC-134a (R-134a) couplers will not secure on to the CFC-12 (R-12) system, CFC-12 (R-12) refrigerant and lubricant will be discharged into the HFC-134a (R-134a) coupler, causing contamination.

Shut off valve rotation	A/C service valve
Clockwise	Open
Counterclockwise	Close



REFRIGERANT WEIGHT SCALE

If the scale allows electronic control of the flow of refrigerant through the scale, be certain that the hose fitting size is 1/2"-16 ACME, and that no refrigerant other than HFC-134a (R-134a) (along with only specified lubricant) has been used with the scale.

CHARGING CYLINDER

The charging cylinder is not recommended because refrigerant may be vented into the air from the top valve of the cylinder when filling the cylinder with refrigerant. Additionally, the accuracy of the cylinder is generally less than that of an electronic scale or of quality recycle/recharge equipment.

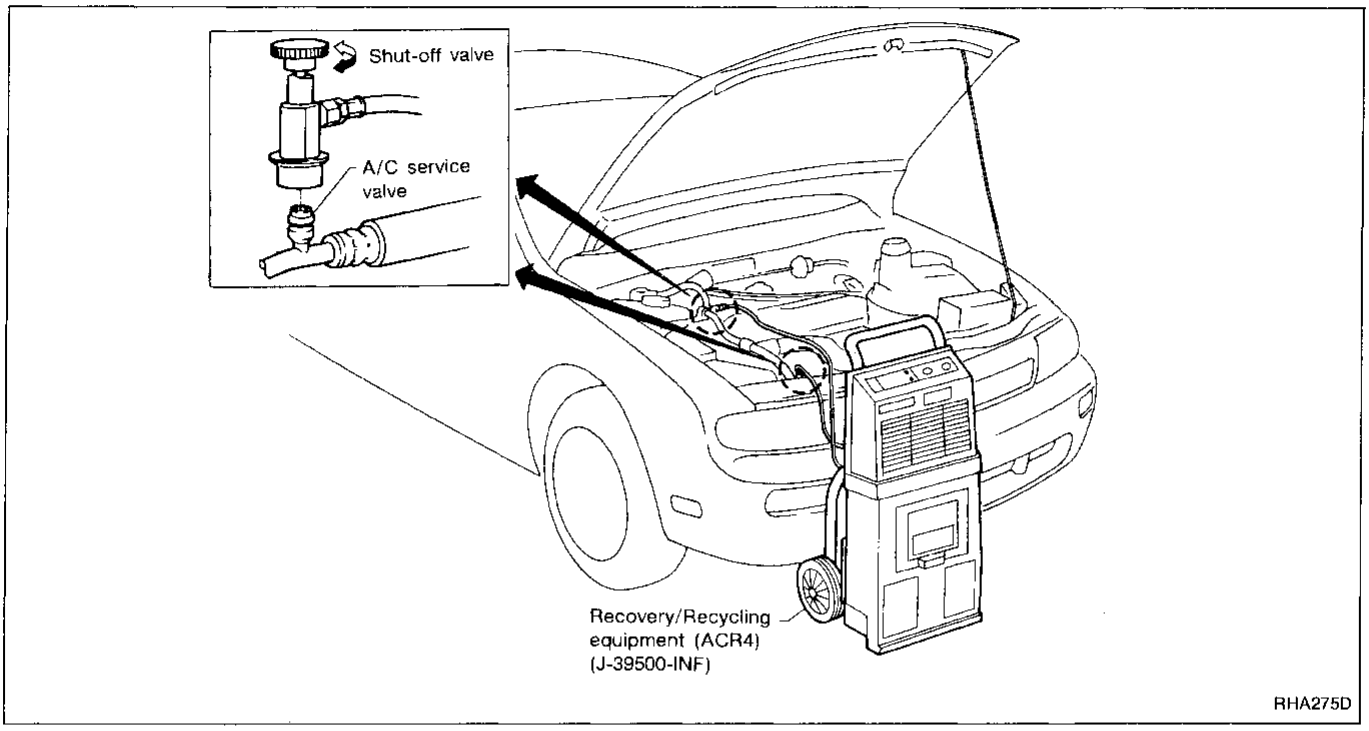
HFC-134a (R-134a) Service Procedure

SETTING OF SERVICE TOOLS AND EQUIPMENT

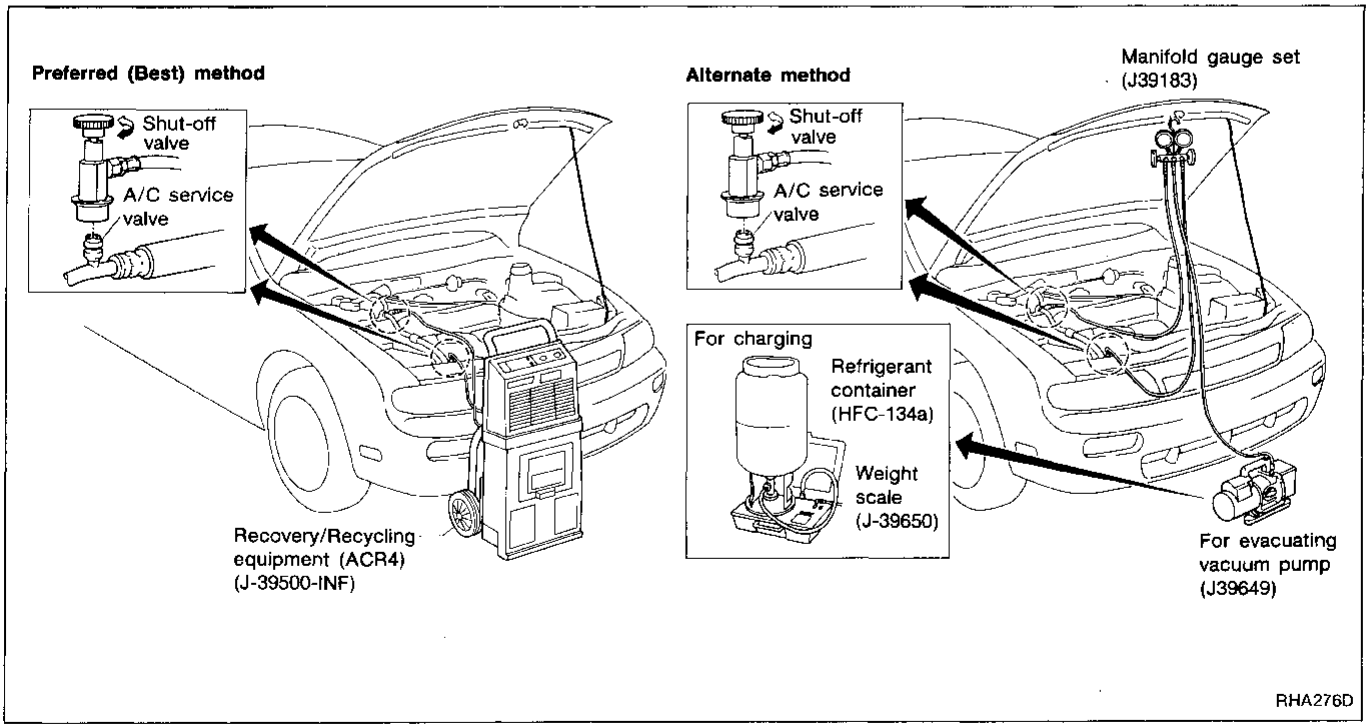
DISCHARGING REFRIGERANT

WARNING:

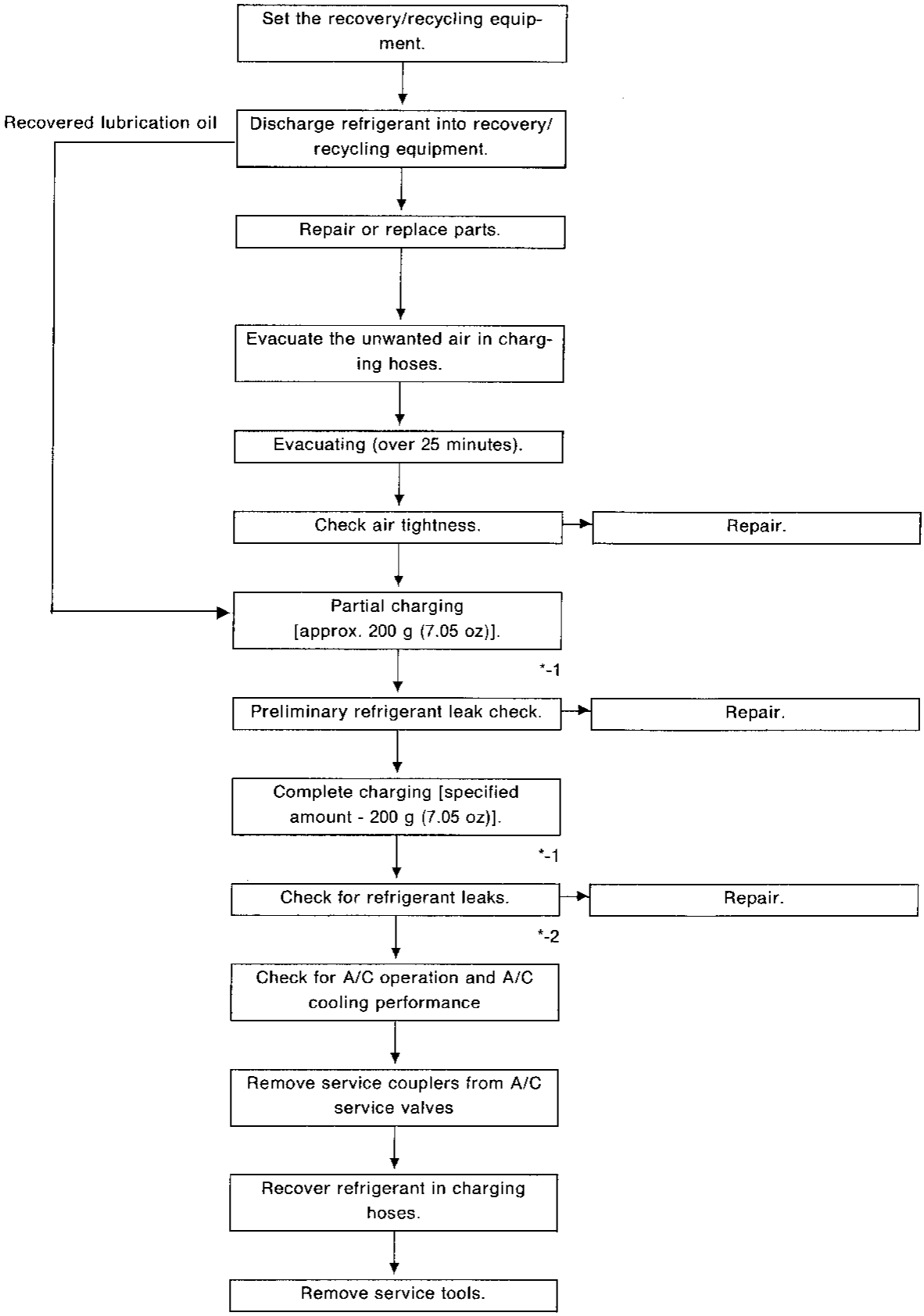
Avoid breathing A/C refrigerant and lubrication oil vapor or mist. Exposure may irritate eyes, nose and throat. Use only approved recovery/recycling equipment to discharge HFC-134a (R-134a) systems. If accidental system discharge occurs, ventilate work area before resuming work.



EVACUATING SYSTEM AND CHARGING REFRIGERANT



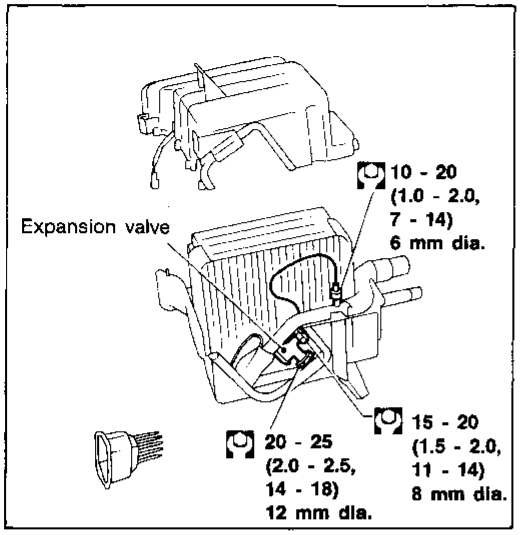
HFC-134a (R-134a) Service Procedure (Cont'd)



Note: *-1 Before charging refrigerant, ensure engine is off.
*-2 Before checking for leaks, start engine to activate air conditioning system then turn in off. Service valve caps must be attached to valves (to prevent leakage).

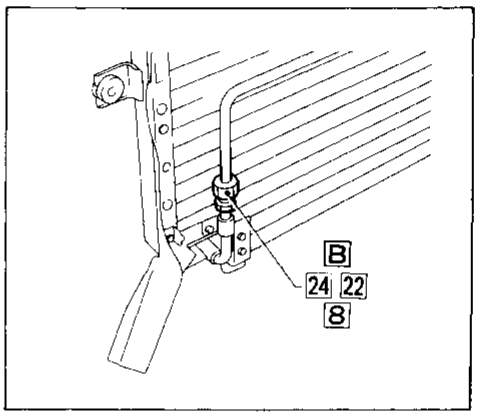
Refrigerant Lines

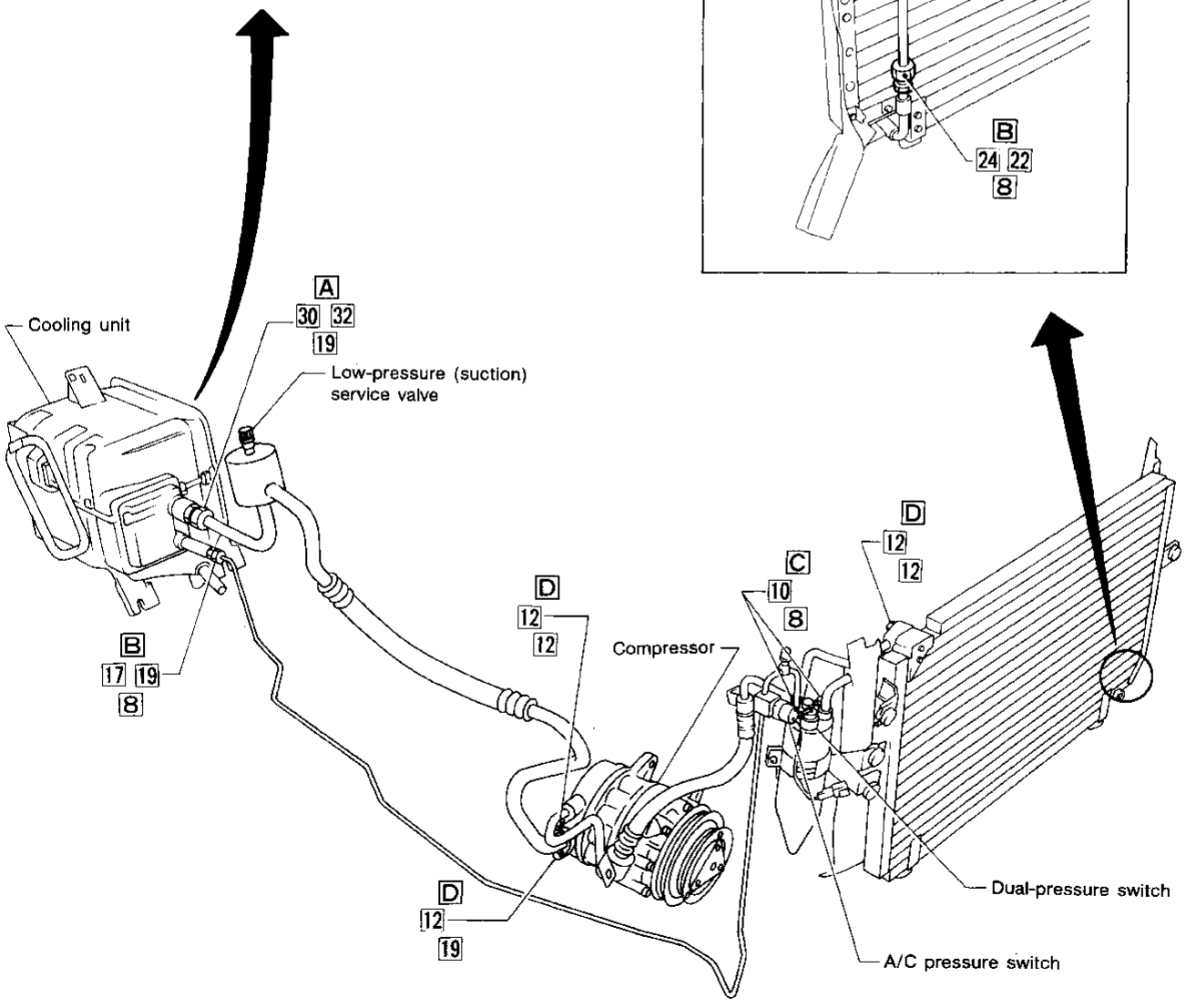
- **Refer to page HA-5 regarding "Precautions for Refrigerant Connection".**



(Tightening torque)
(Wrench size)
(O-ring size)

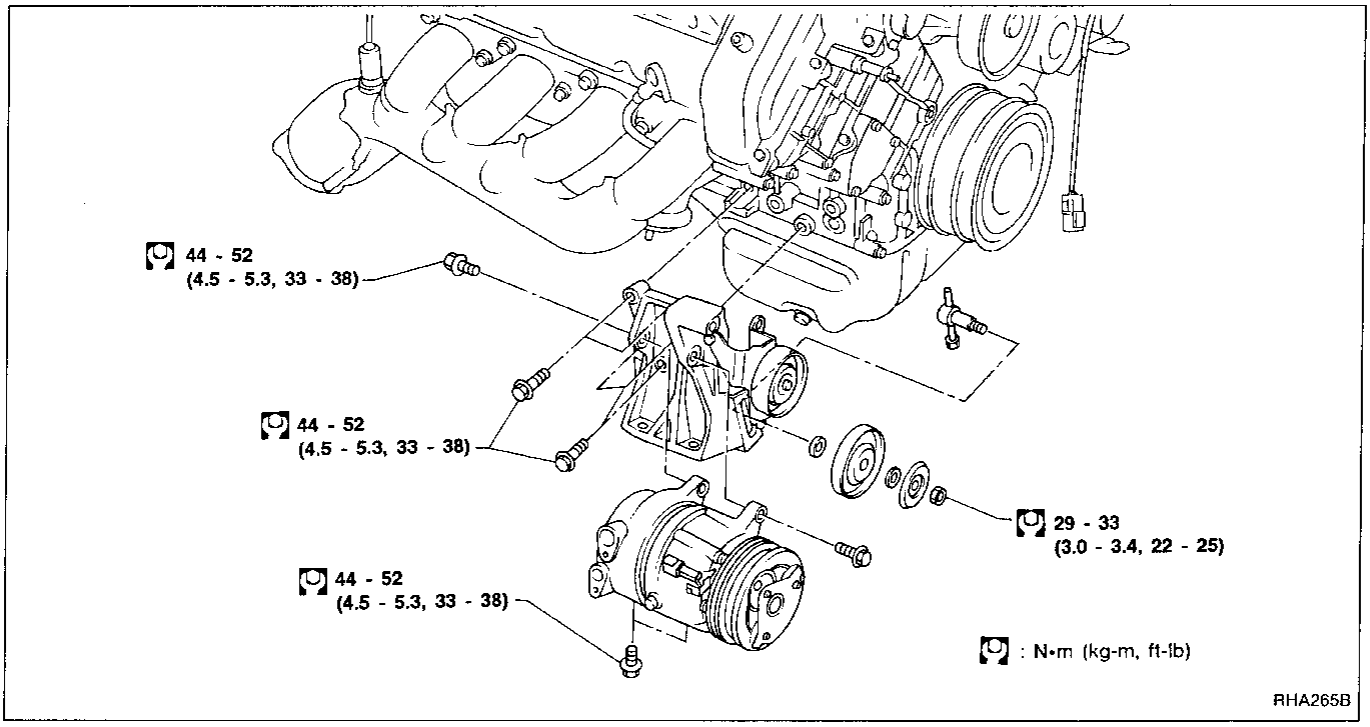
A : 25 - 34 (2.5 - 3.5, 18 - 25)
B : 10 - 20 (1.0 - 2.0, 7 - 14)
C : 3 - 4 (0.3 - 0.4, 2.2 - 2.9)
D : 8 - 11 (0.8 - 1.1, 5.8 - 8.0)
E : 10 - 12 (1.0 - 1.2, 7 - 9)
: N•m (kg-m, ft-lb)





RHA856D

Compressor Mounting



Belt Tension

- Refer to MA section.

Engine Idling Speed (When A/C is ON)

- Refer to EF & EC section.

Lubrication Oil

Name: Nissan A/C System Oil Type S
Part number: KLH00-PAGS0

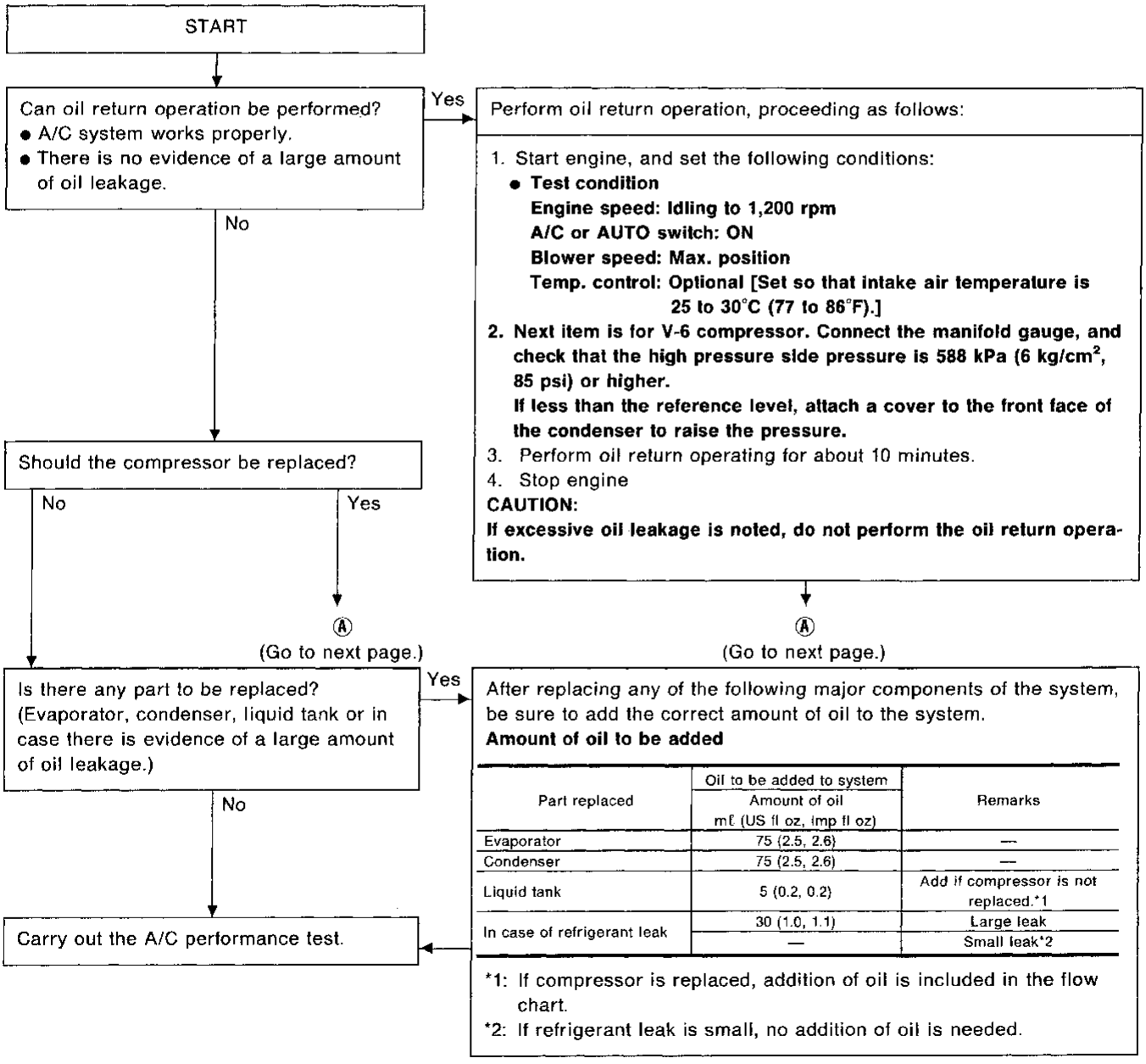
Maintenance of Oil Quantity in Compressor

The oil used to lubricate the compressor circulates through the system with the refrigerant. Whenever any component of the system is replaced or a large amount of gas leakage occurs, add oil to the compressor to maintain the specified amount.
If oil quantity is not maintained properly, the following malfunctions may result:

- Lack of oil: May lead to a seized compressor
- Excessive oil: Inadequate cooling (thermal exchange impeded)

Checking and Adjusting

Adjust the oil quantity according to the flowchart shown below.



Part replaced	Oil to be added to system: Amount of oil mℓ (US fl oz, Imp fl oz)	Remarks
Evaporator	75 (2.5, 2.6)	—
Condenser	75 (2.5, 2.6)	—
Liquid tank	5 (0.2, 0.2)	Add if compressor is not replaced.*1
In case of refrigerant leak	30 (1.0, 1.1)	Large leak
	—	Small leak*2

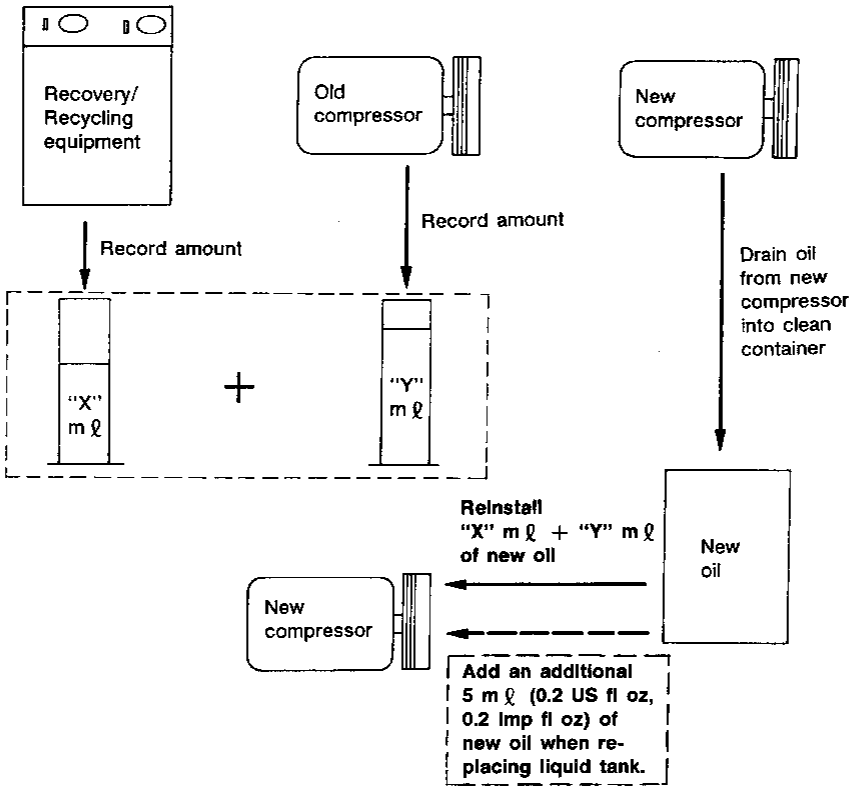
*1: If compressor is replaced, addition of oil is included in the flow chart.
*2: If refrigerant leak is small, no addition of oil is needed.

Checking and Adjusting (Cont'd)

Ⓐ

1. Discharge refrigerant into the refrigerant recovery/recycling equipment. Measure oil discharged into the recovery/recycling equipment.
2. Remove the drain plug (for V-6 and DKS-16H compressor) and drain the oil from the "old" (removed) compressor into a graduated container, and record the amount of oil drained.
3. Remove the drain plug and drain the oil from the "new" compressor into a separate, clean container.
4. Measure an amount of the new oil equivalent to that drained from the "old" compressor, and add this oil to the "new" compressor through the drain plug or suction port opening.
5. Measure an amount of the "new" oil equivalent to that recovered during discharging, and add this oil to the "new" compressor through the drain plug or suction port opening.
6. Torque the drain plug.
   V-6 compressor: 18 - 19 N·m (1.8 - 1.9 kg-m, 13 - 14 ft-lb)
   DKS-16H compressor: 14 - 16 N·m (1.4 - 1.6 kg-m, 10 - 12 ft-lb)
7. If the liquid tank also needs to be replaced, add an additional 5 mℓ (0.2 US fl oz, 0.2 Imp fl oz) of oil at this time.
   Do not add this 5 mℓ (0.2 US fl oz, 0.2 Imp fl oz) of oil if only replacing the compressor.

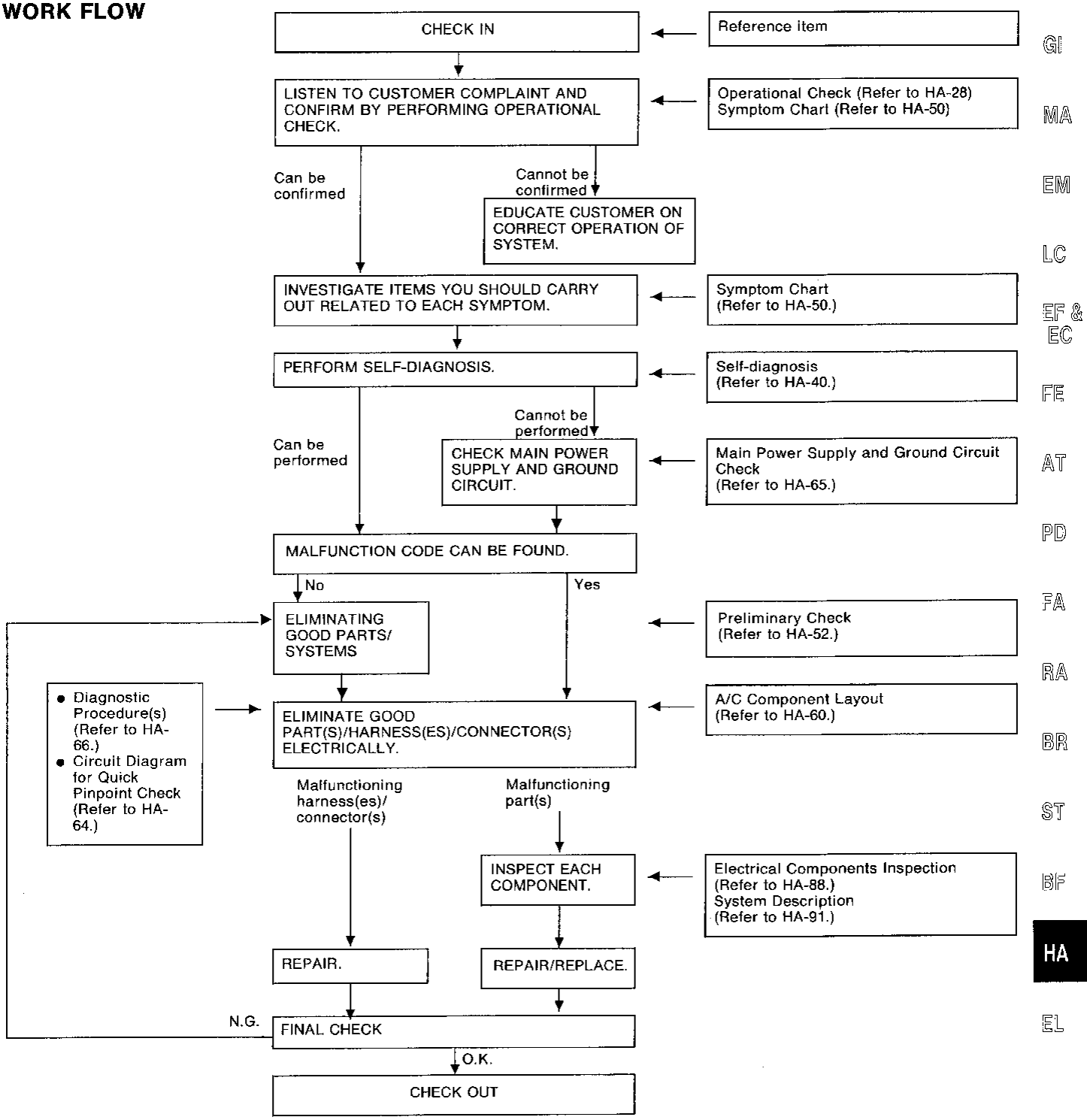
Oil adjusting procedure for compressor replacement



RHA065D

How to Perform Trouble Diagnoses for Quick and Accurate Repair

WORK FLOW

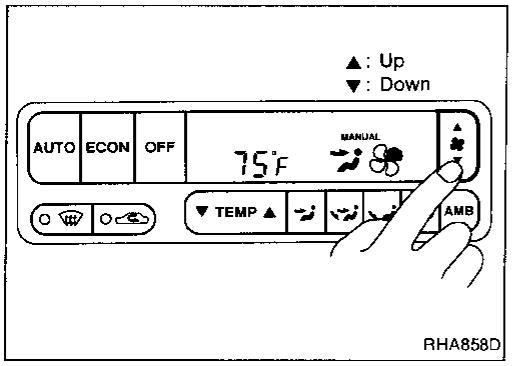


Operational Check

The purpose of the operational check is to confirm that the system operates as it should. The systems which will be checked are the blower, mode (discharge air), ambient display, intake air, defrost, econ, auto, temperature decrease, temperature increase, and the memory function.

CONDITIONS:

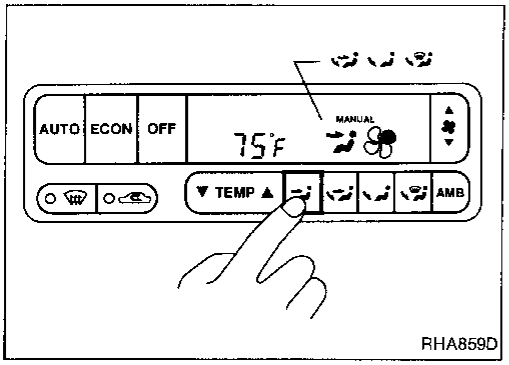
Engine running at normal operating temperature.



PROCEDURE:

1. Check blower

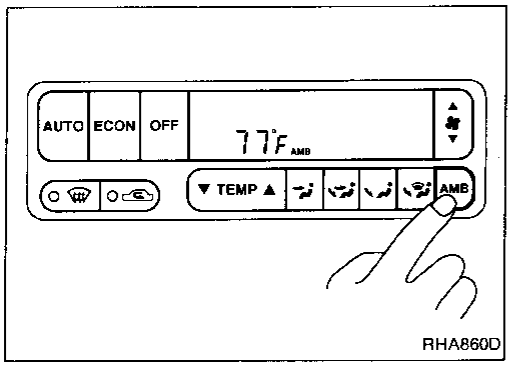
1) Press FAN switch (▲: Up) one time.
   MANUAL should appear on the display.
   Blower should operate on low speed, and the fan symbol should have one blade lit ( ).
2) Press FAN switch one more time.
3) Continue checking blower speed and fan symbol until all four speeds have been checked.
4) Leave blower on high speed.
5) Press FAN switch (▼: Down) one time. Blower should operate in third speed.
6) Continue checking blower speed and fan symbol until all three speeds have been checked.



2. Check discharge air

1) Press the switch.
   Display should show air to the face.
2) Confirm that all discharge air comes out the face vents.
3) Press switch.
   Display should show air to face and foot (bi-level).
4) Confirm that discharge air comes out the face and foot vents.
5) Press switch.
   Display should show air to foot.
6) Confirm that discharge air comes mostly from the foot outlets, with some air from the defroster outlets.
7) Press switch.
   Display should show air to foot and defrost.
8) Confirm that discharge air comes mostly from the defrost vents, with some air from the foot outlets.

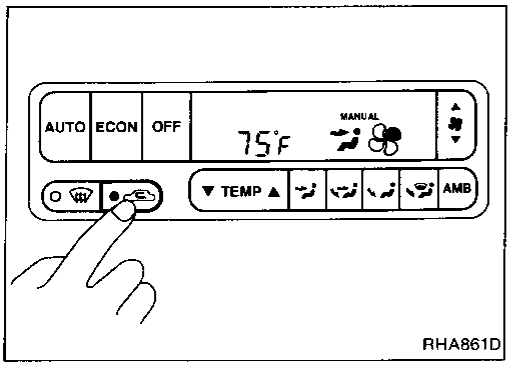
Operational Check (Cont'd)



RHA860D

3. Check ambient display

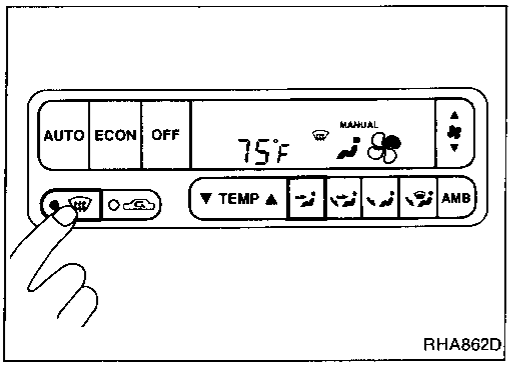
Press the AMB button.
Display should show the outside (ambient) temperature for approximately 5 seconds.



RHA861D

4. Check recirc

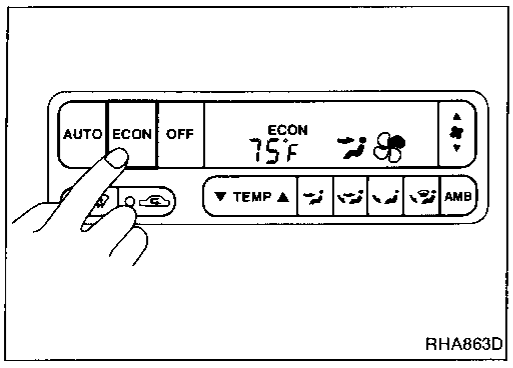
1) Press RECIRC button.
RECIRC indicator should illuminate.
2) Listen for intake door position change (you should hear blower sound change slightly).



RHA862D

5. Check defrost

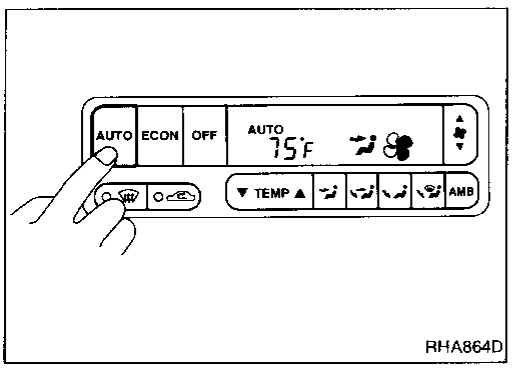
1) Press defrost button.
2) Check that RECIRC is canceled.
The discharge air should be coming only from the defrost vents.
3) Confirm that the compressor clutch is engaged (visual inspection).
The display should indicate AUTO, MANUAL, and defrost ( ).



RHA863D

6. Check ECON mode

1) Press ECON button.
Defrost should be canceled.
Discharge air outlet will depend on ambient, in-vehicle, and set temperatures.
Display should indicate ECON (no AUTO, no MANUAL).
2) Confirm that the compressor clutch is not engaged (visual inspection).

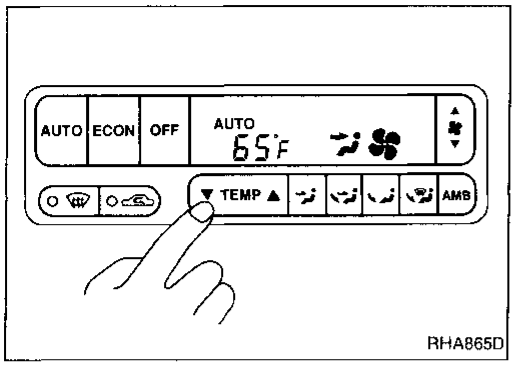


RHA864D

7. Check AUTO mode

1) Press AUTO button.
2) Confirm that the compressor clutch engages (audio or visual inspection).
Display should indicate AUTO (no ECON, no MANUAL).
(Discharge air will depend on ambient, in-vehicle, and set temperatures).

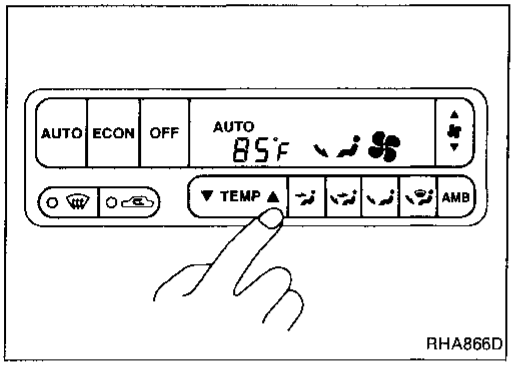
Operational Check (Cont'd)



RHA865D

8. Check temperature decrease

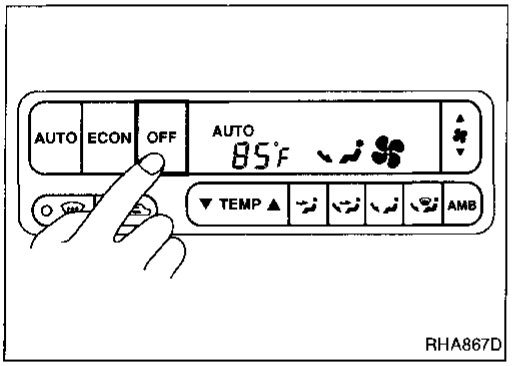
1) Press the temperature decrease button until 18°C (65°F) is displayed.
2) Check for cold air at discharge air outlets.



RHA866D

9. Check temperature increase

1) Press the temperature increase button until 32°C (85°F) is displayed.
2) Listen for changes in blower speed as set temperature changes.
3) Check for hot air at discharge air outlets.



RHA867D

10. Check memory function

1) Press off button.
2) Turn the ignition off.
3) Wait 15 seconds.
4) Turn the ignition on.
5) Press the AUTO button.
6) Confirm that the set temperature remained at 32°C (85°F).

Performance Chart

TEST CONDITION

Before conducting performance test, disconnect ambient sensor harness connector and make short circuit using jumper cable.

Testing must be performed as follows:

- Vehicle location: Indoors or in the shade (in a well-ventilated place)
- Doors: Closed
- Door window: Open (Front driver side only)
- Hood: Open
- (AUTO) switch: ON
- Temperature switch (P.T.C.): Max. COLD set
- Mode switch: (Ventilation) set
- (REC) switch: (Recirculation) set
- (fan) switch: Max. speed set
- 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

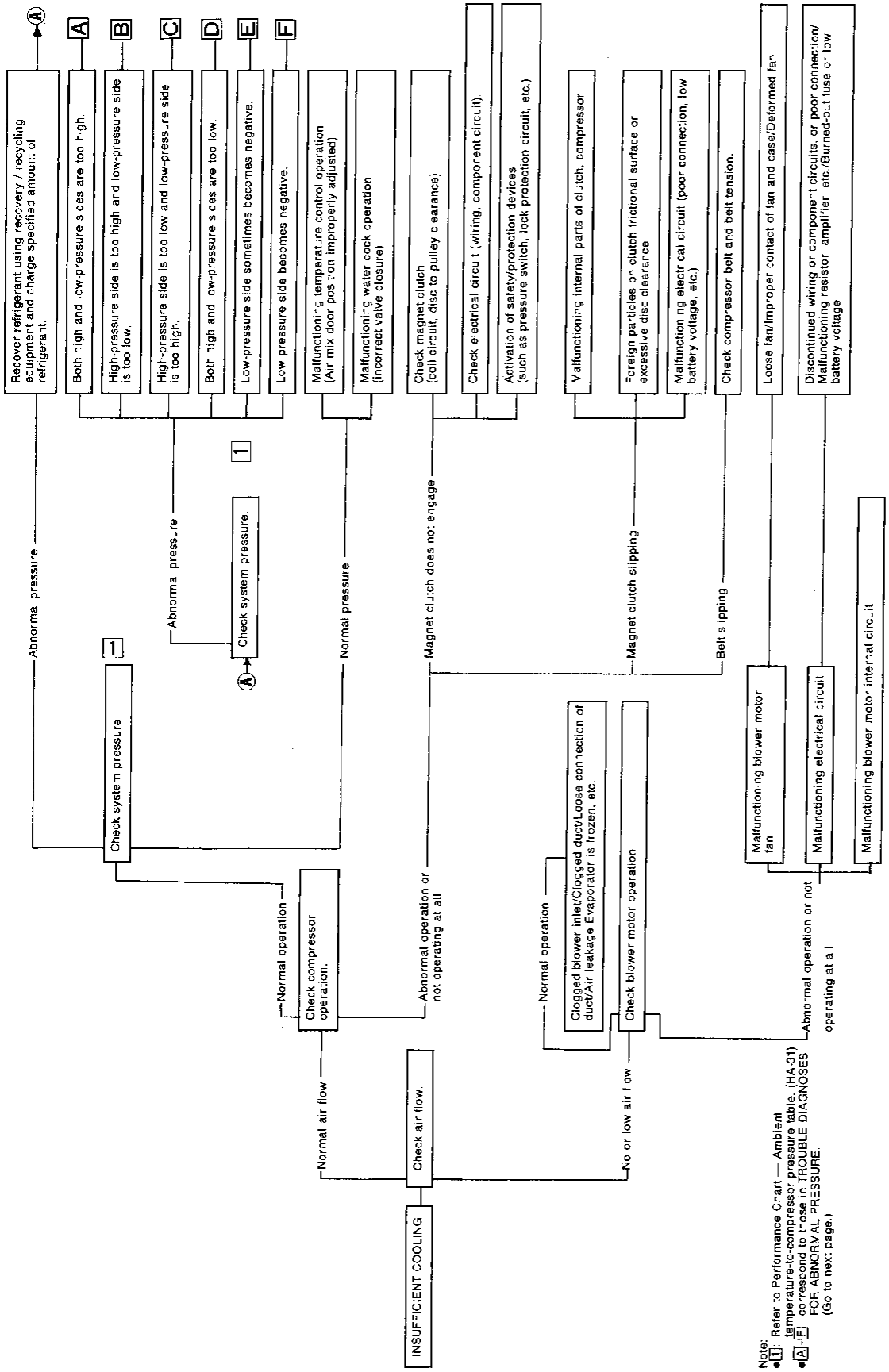
Inside air (Recirculating air) at blower assembly inlet		Discharge air temperature at center ventilator °C (°F)
Relative humidity %	Air temperature °C (°F)	
50 - 60	25 (77)	9.0 - 11.1 (48 - 52)
	30 (86)	13.1 - 15.2 (56 - 59)
	35 (95)	17.1 - 19.3 (63 - 67)
60 - 70	25 (77)	11.1 - 13.2 (52 - 56)
	30 (86)	15.2 - 17.4 (59 - 63)
	35 (95)	19.3 - 21.5 (67 - 71)

Ambient air temperature-to-compressor pressure table

Ambient air		High-pressure (Discharge side) kPa (kg/cm², psi)	Low-pressure (Suction side) kPa (kg/cm², psi)
Relative humidity %	Air temperature °C (°F)		
50 - 70	25 (77)	1,226 - 1,432 (12.5 - 14.6, 178 - 208)	190.3 - 213.8 (1.94 - 2.18, 27.6 - 31.0)
	30 (86)	1,324 - 1,599 (13.5 - 16.3, 192 - 232)	193.2 - 217.7 (1.97 - 2.22, 28.0 - 31.6)
	35 (95)	1,520 - 1,844 (15.5 - 18.8, 220 - 267)	201.0 - 229.5 (2.05 - 2.34, 29.2 - 33.3)
	40 (104)	1,755 - 2,118 (17.9 - 21.6, 255 - 307)	213.8 - 246.2 (2.18 - 2.51, 31.0 - 35.7)

Performance Test Diagnoses

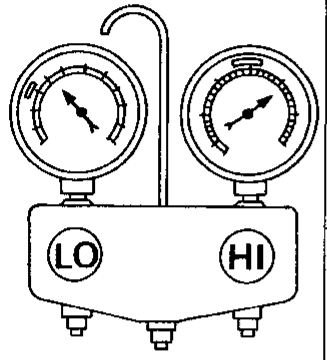
INSUFFICIENT COOLING



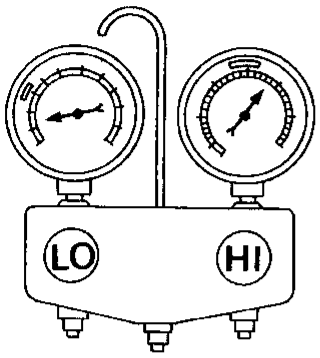
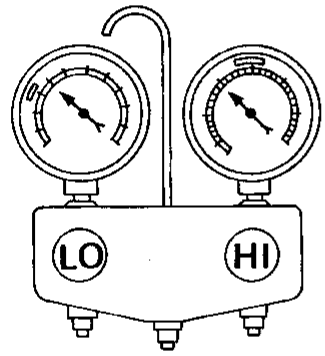
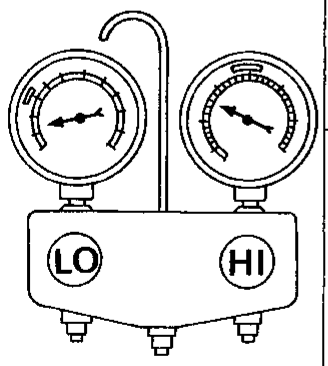
Performance Test Diagnoses (Cont'd)

TROUBLE DIAGNOSES FOR ABNORMAL PRESSURE

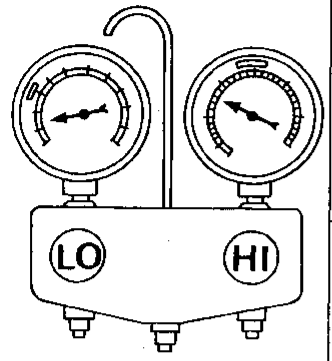
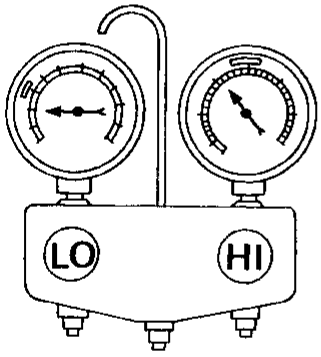
Whenever abnormal pressure of high and/or low sides of the system is noted, diagnosis must be conducted by using a manifold gauge. The large-line zone on the gauge scale (see illustrations.) shown in the following table refers to the standard (normal) pressure range for the corresponding pressure side (high or low). Since the standard (normal) pressure, however, differs from vehicle to vehicle, refer to the "Ambient Temperature-Pressure Characteristics" chart.

Gauge indication	Refrigerant cycle	Probable cause	Corrective action
Both high and low-pressure sides are too high. A  AC359A	• Pressure is reduced soon after water is splashed on condenser.	Excessive refrigerant charge in refrigeration cycle	Reduce refrigerant until specified pressure is obtained.
	Air suction by radiator or condenser fan is insufficient.	Insufficient condenser cooling performance ↓ ① Condenser fan are clogged. ② Improper rotation of radiator fan or condenser fan	• Clean condenser. • Check and repair radiator or condenser fan as necessary.
	• Low-pressure pipe is not cold. • When compressor is stopped high-pressure value quickly drops by approximately 196 kPa (2 kg/cm^2, 28 psi). It then decreases gradually thereafter.	Poor heat exchange in condenser (After compressor operation stops, high pressure decreases too slowly.) ↓ Air in refrigeration cycle	Evacuate repeatedly and recharge system.
	Engine tends to overheat.	Engine cooling systems malfunction.	Check and repair each engine cooling system.
	• Areas near low-pressure pipe connection and service valves are considerably cold compared with areas near expansion valve outlet or evaporator. • Plates are sometimes covered with frost.	• Excessive liquid refrigerant on low-pressure side • Excessive refrigerant discharge flow • Expansion valve is open a little compared with the specification. ↓ ① Improper thermal valve installation ② Improper expansion valve adjustment	Replace expansion valve.

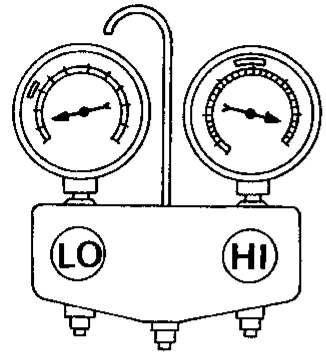
Performance Test Diagnoses (Cont'd)

Gauge indication	Refrigerant cycle	Probable cause	Corrective action
High-pressure side is too high and low-pressure side is too low. B  AC360A	Upper side of condenser and high-pressure side are hot, however, liquid tank is not so hot.	High-pressure tube or parts located between compressor and condenser are clogged or crushed.	• Check and repair or replace malfunctioning parts. • Check compressor oil for contamination.
High-pressure side is too low and low-pressure side is too high. C  AC356A	High and low-pressure sides become equal soon after compressor operation stops.	Compressor pressure operation is improper. ↓ Damaged inside compressor packings	Replace compressor.
	No temperature difference between high and low-pressure sides	Compressor discharge capacity does not change. (Compressor stroke is set at maximum.)	Replace compressor.
Both high-and low-pressure sides are too low. D  AC353A	• There is a big temperature difference between liquid tank outlet and inlet. Outlet temperature is extremely low. • Liquid tank inlet and expansion valve are frosted.	Liquid tank inside is clogged a little.	• Replace liquid tank • Check compressor oil for contamination.
	• Temperature of expansion valve inlet is extremely low as compared with areas near liquid tank. • Expansion valve inlet may be frosted. • Temperature difference occurs somewhere in high-pressure side	High-pressure pipe located between liquid tank and expansion valve is clogged.	• Check and repair malfunctioning parts. • Check compressor oil for contamination.

Performance Test Diagnoses (Cont'd)

Gauge indication	Refrigerant cycle	Probable cause	Corrective action
Both high and low-pressure sides are too low. D  AC353A	There is a big temperature difference between expansion valve inlet and outlet while the valve itself is frosted.	Expansion valve closes a little compared with the specification. ↓ ① Improper expansion valve adjustment ② Malfunctioning thermal valve ③ Outlet and inlet may be clogged.	• Remove foreign particles by using compressed air. • Check compressor oil for contamination.
	Areas near low-pressure pipe connection and service valve are extremely cold as compared with areas near expansion valve outlet and evaporator.	Low-pressure pipe is clogged or crushed.	• Check and repair malfunctioning parts. • Check compressor oil for contamination.
	Air flow volume is not enough or is too low.	Evaporator is frozen. ↓ Compressor discharge capacity does not change. (Compressor stroke is set at maximum length.)	Replace compressor.
Low-pressure side sometimes becomes negative. E  AC354A	• Air conditioning system does not function and does not cyclically cool the compartment air. • The system constantly functions for a certain period of time after compressor is stopped and restarted.	Refrigerant does not discharge cyclically. ↓ Moisture is frozen at expansion valve outlet and inlet. ↓ Water is mixed with refrigerant.	• Drain water from refrigerant or replace refrigerant. • Replace liquid tank.

Performance Test Diagnoses (Cont'd)

Gauge indication	Refrigerant cycle	Probable cause	Corrective action
Low-pressure side becomes negative. F  AC362A	Liquid tank or front/rear side of expansion valve's pipe is frosted or dewed.	High-pressure side is closed and refrigerant does not flow. ↓ Expansion valve or liquid tank is frosted.	After the system is left at rest, start it again in order to confirm whether or not problem is caused by water or foreign particles. • If the problem is due to water, drain water from refrigerant or replace refrigerant. • If it is due to foreign particles, remove expansion valve and remove them with dry and compressed air. • If either of the above methods cannot correct the problem, replace expansion valve. • Replace liquid tank. • Check compressor oil for contamination.

NOTE

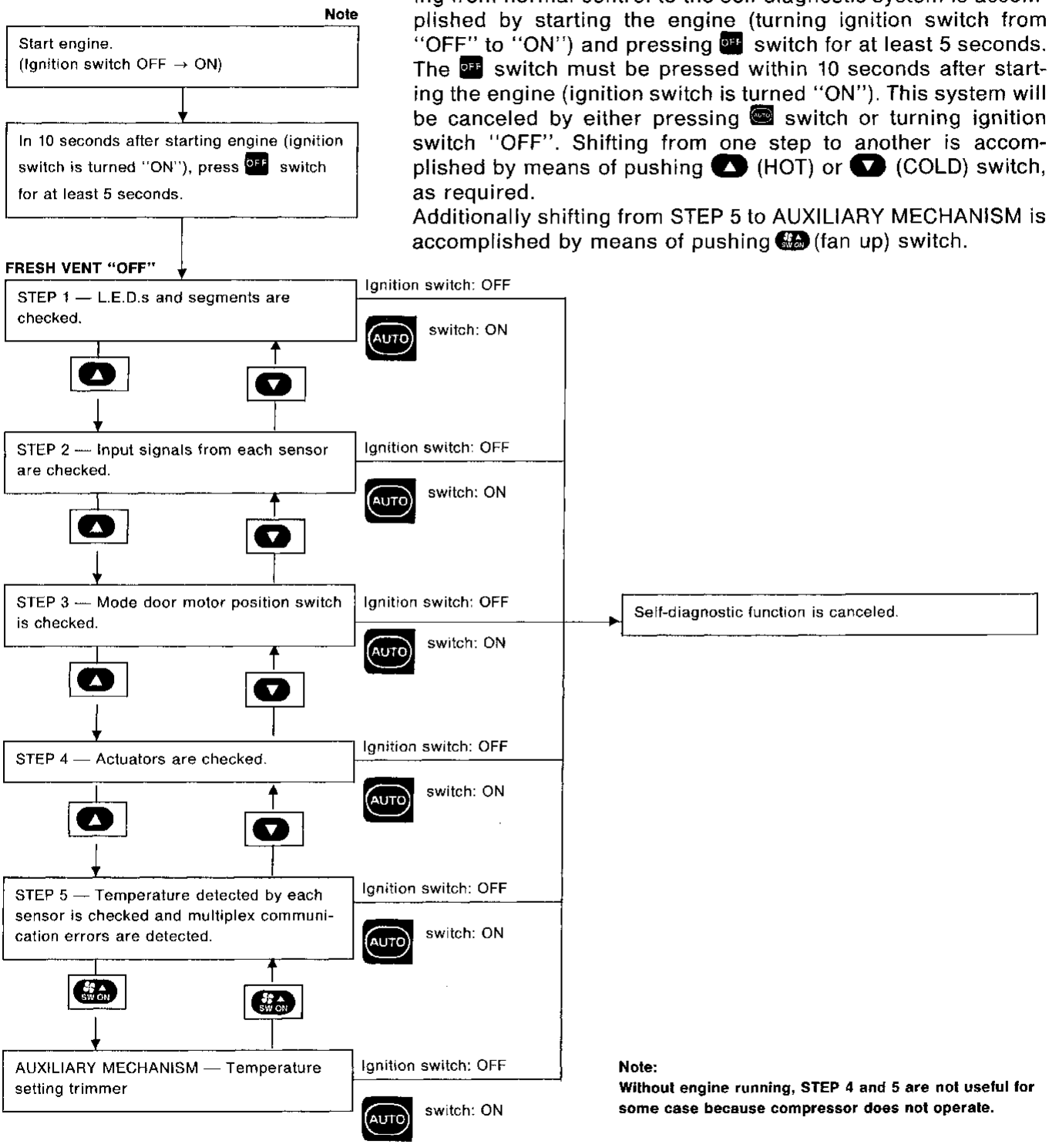
Contents

Contents (Cont'd)

Self-diagnosis

INTRODUCTION AND GENERAL DESCRIPTION

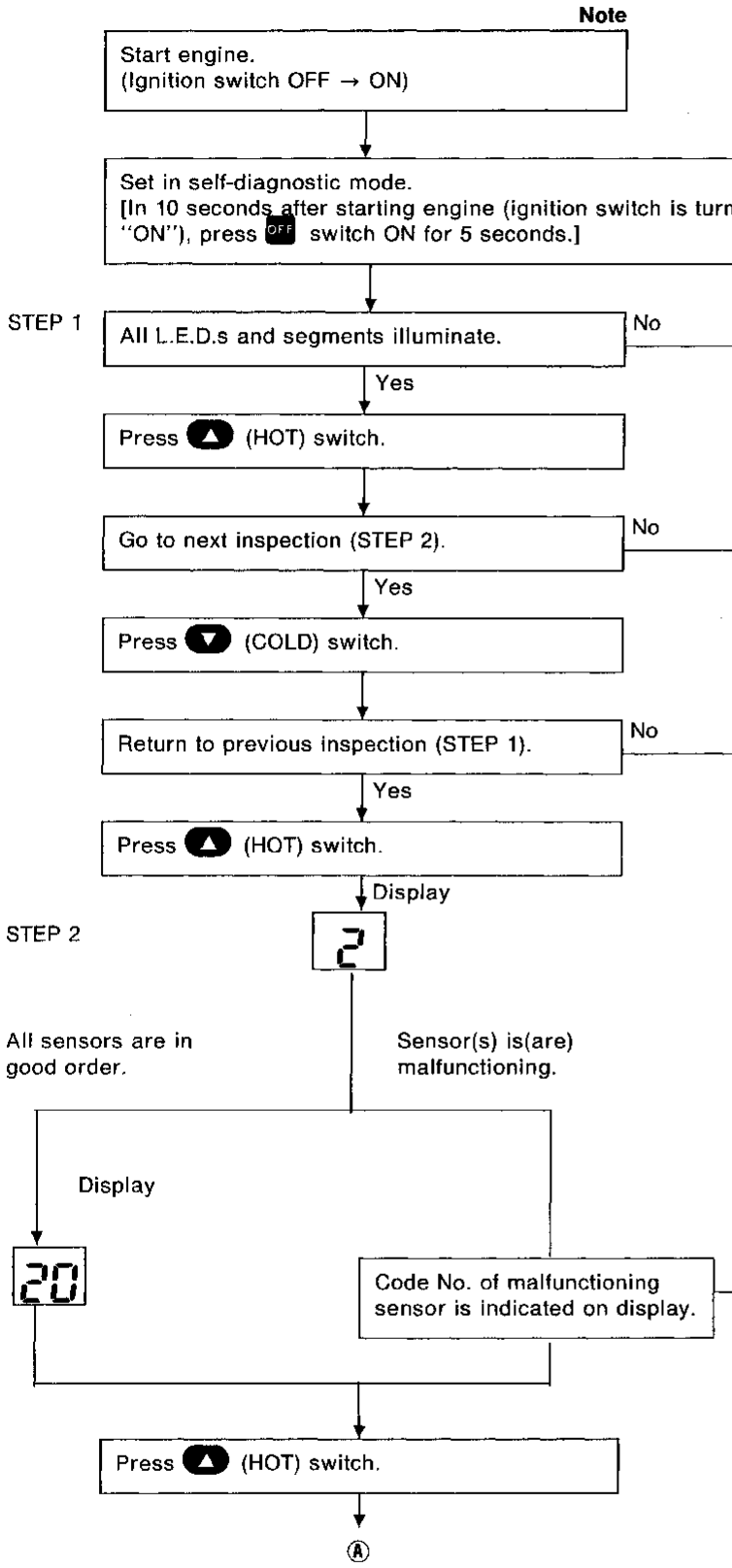
The self-diagnostic system diagnoses sensors, door motors, blower motor and multiplex communication errors, etc. by system line. Refer to applicable sections (items) for details. Shifting from normal control to the self-diagnostic system is accomplished by starting the engine (turning ignition switch from "OFF" to "ON") and pressing OFF switch for at least 5 seconds. The OFF switch must be pressed within 10 seconds after starting the engine (ignition switch is turned "ON"). This system will be canceled by either pressing AUTO switch or turning ignition switch "OFF". Shifting from one step to another is accomplished by means of pushing ▲ (HOT) or ▼ (COLD) switch, as required.
Additionally shifting from STEP 5 to AUXILIARY MECHANISM is accomplished by means of pushing SW ON (fan up) switch.



Note:
Without engine running, STEP 4 and 5 are not useful for some case because compressor does not operate.

Self-diagnosis (Cont'd)

STEP BY STEP PROCEDURE

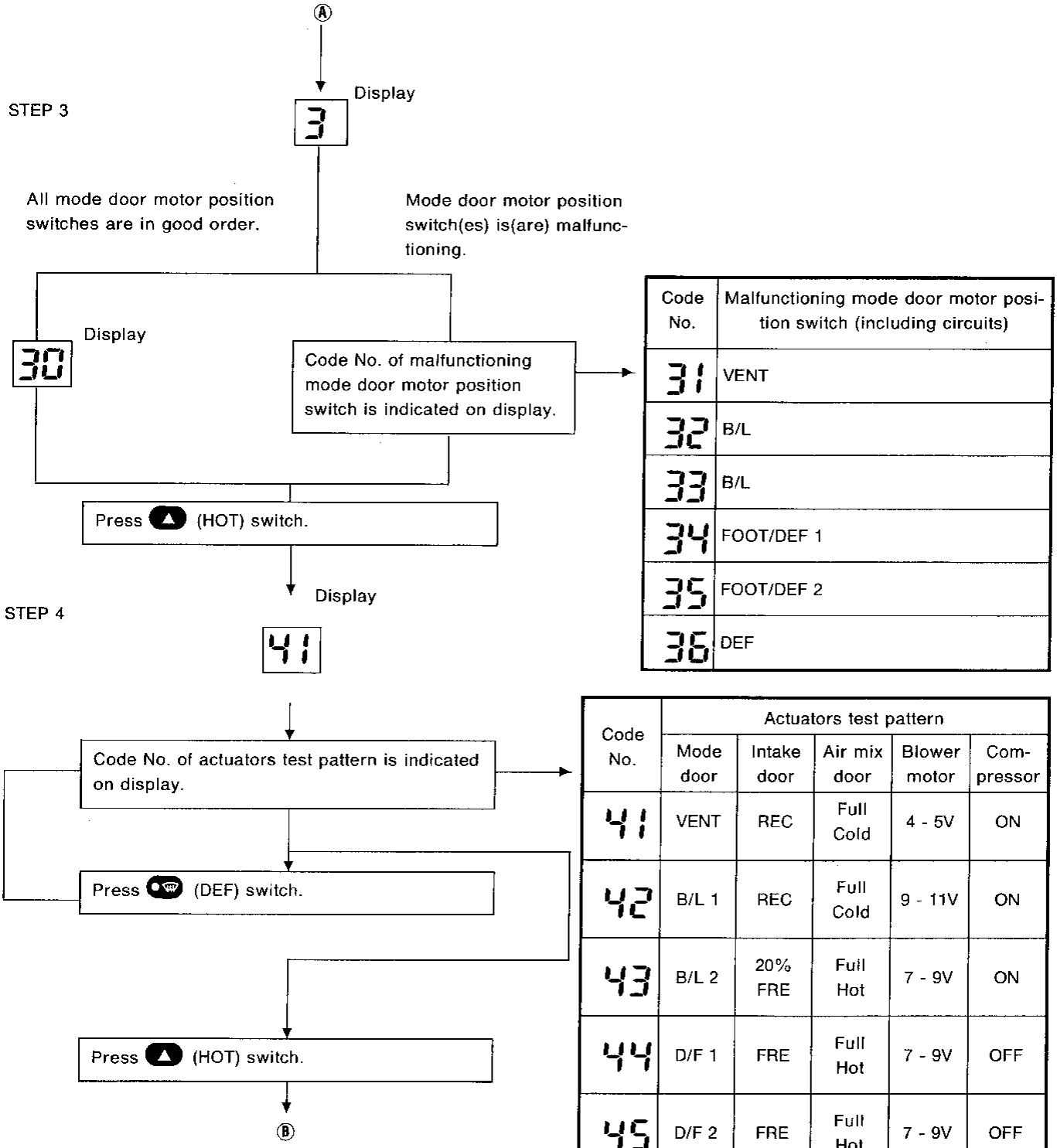


***1: Conduct self-diagnosis STEP 2 under sunshine.**
When conducting indoors, direct light (more than 60W) at sunload sensor or Code No. 25 will indicate despite that sunload sensor is functioning properly.

Code No.	Malfunctioning sensor (including circuits)
21	Ambient sensor
22	In-vehicle sensor
23	Water temperature sensor (Thermistor)
24	Intake sensor
25	Sunload sensor*1
26	P.B.R.
27	Thermal transmitter

Note:
Without engine running, STEP 4 and 5 are not useful for some case because compressor does not operate.

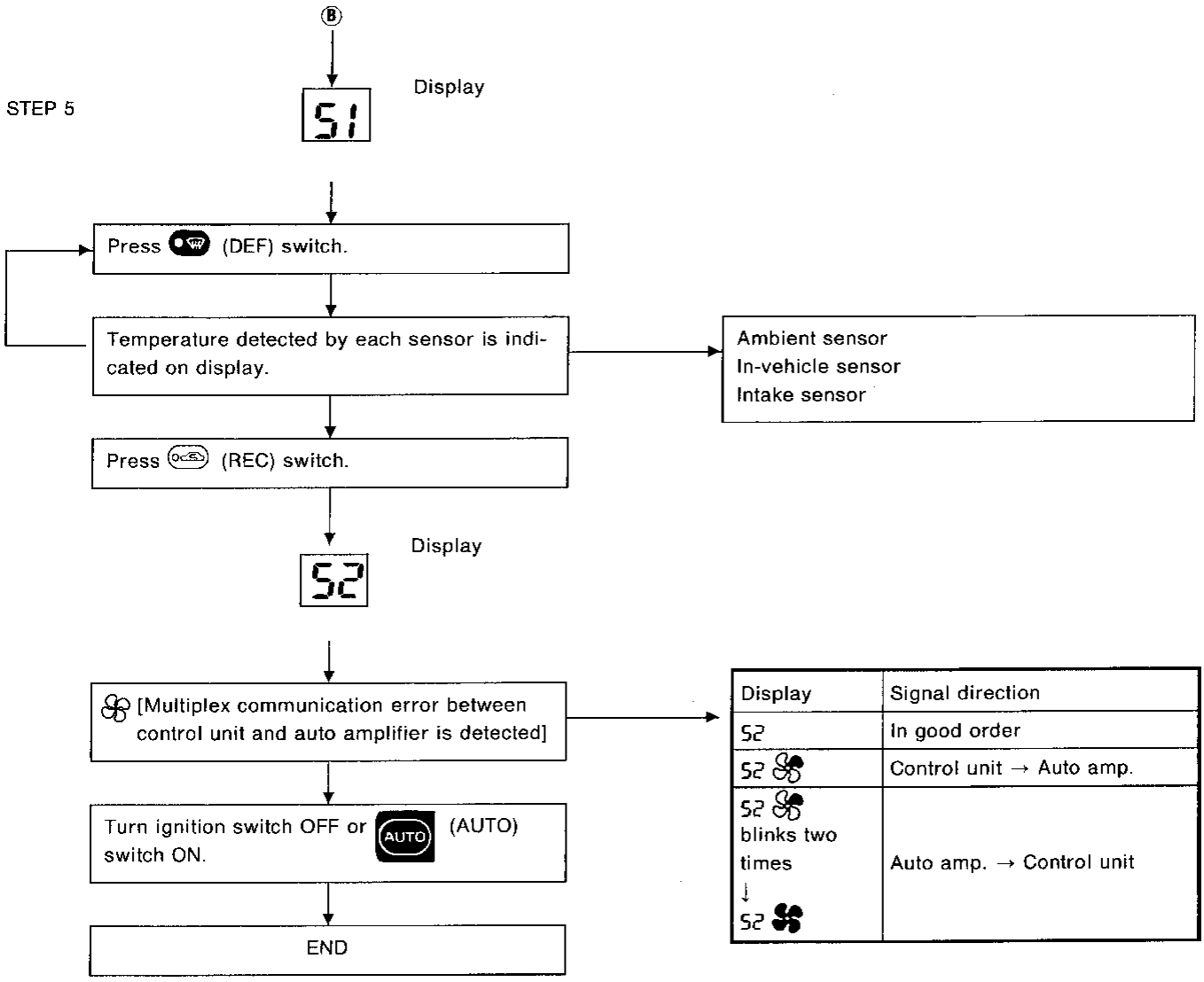
Self-diagnosis (Cont'd)



Code No.	Malfunctioning mode door motor position switch (including circuits)
31	VENT
32	B/L
33	B/L
34	FOOT/DEF 1
35	FOOT/DEF 2
36	DEF

Code No.	Actuators test pattern				
	Mode door	Intake door	Air mix door	Blower motor	Compressor
41	VENT	REC	Full Cold	4 - 5V	ON
42	B/L 1	REC	Full Cold	9 - 11V	ON
43	B/L 2	20% FRE	Full Hot	7 - 9V	ON
44	D/F 1	FRE	Full Hot	7 - 9V	OFF
45	D/F 2	FRE	Full Hot	7 - 9V	OFF
46	DEF	FRE	Full Hot	10 - 12V	ON

Self-diagnosis (Cont'd)



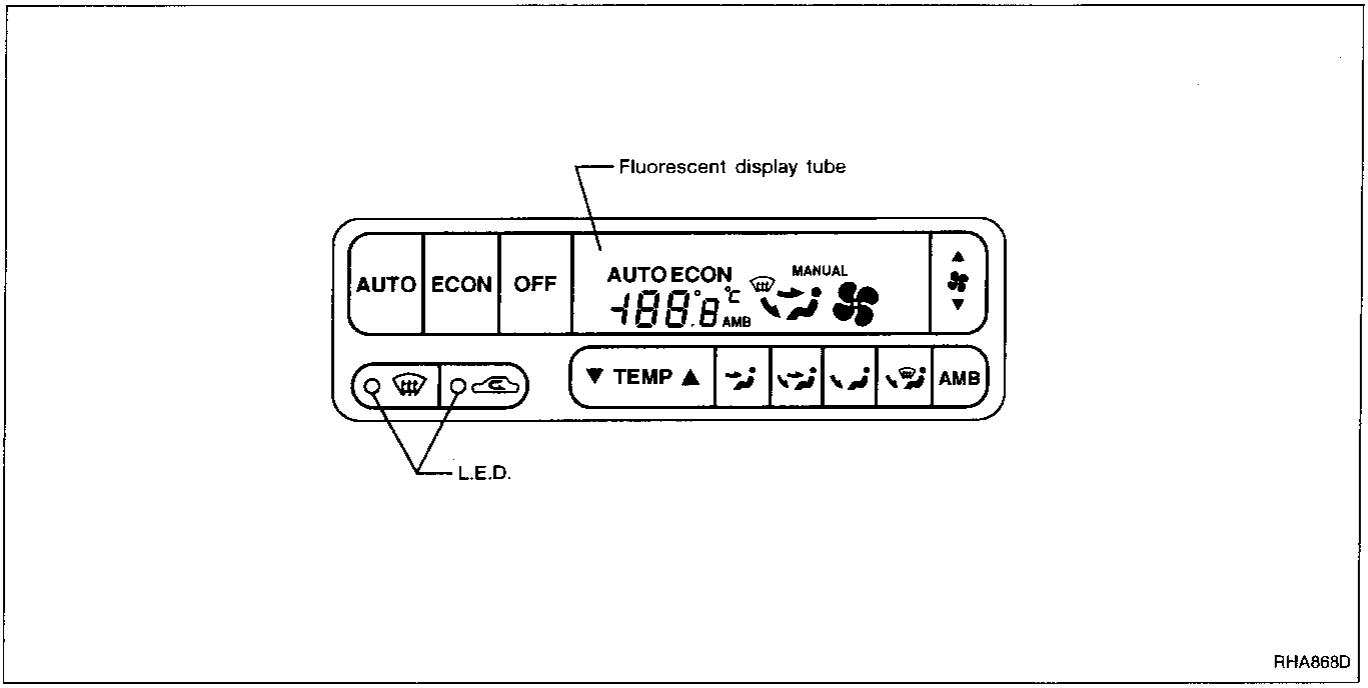
Display	Signal direction
52	In good order
52	Control unit → Auto amp.
52 blinks two times ↓ 52	Auto amp. → Control unit

Self-diagnosis (Cont'd)

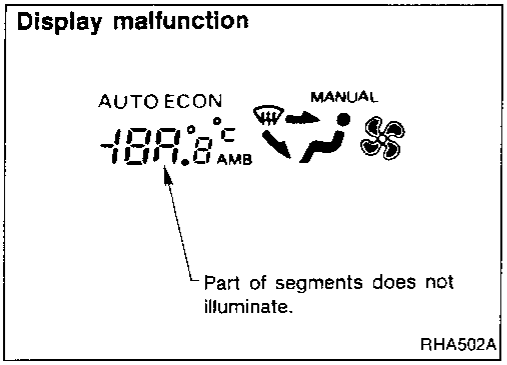
HOW TO INTERPRET THE RESULTS

STEP 1: Checks L.E.D.s and segments

When switch's L.E.D. and segments are in good order in STEP 1 mode, the corresponding L.E.D. and fluorescent display tube will illuminate.

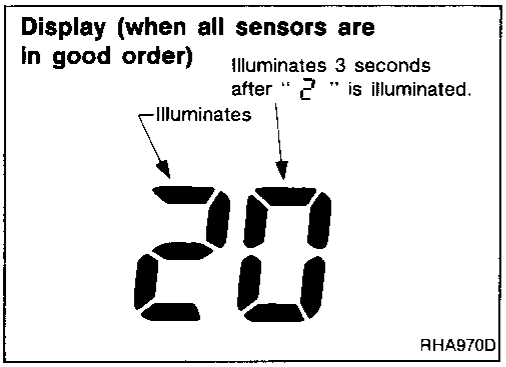


Display malfunction



If L.E.D.s or segments malfunction, L.E.D. does not come on or display shows incomplete segment.

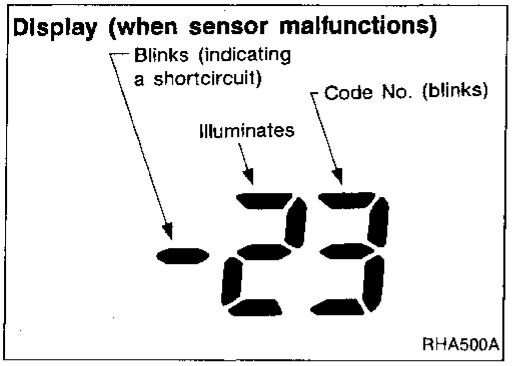
Display (when all sensors are in good order)



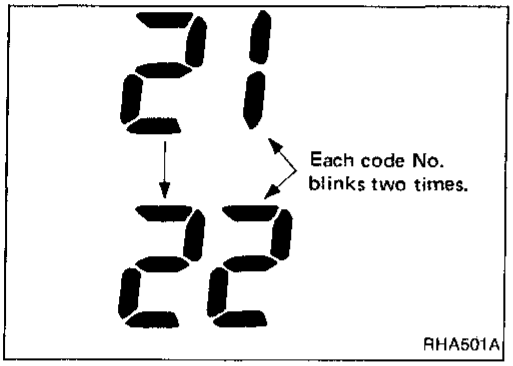
STEP 2: Checks each sensor circuit for open or short circuit

Display shows "2 " in STEP 2 mode.
When all sensors are in good order, display shows "20".
It takes approximately 3 seconds to check all sensors.

Self-diagnosis (Cont'd)



If a sensor is malfunctioning, the corresponding code No. blinks on display. A short circuit is identified by a blinking "– " mark preceding mode number.



If two or more sensors malfunction, corresponding code Nos. respectively blink two times.

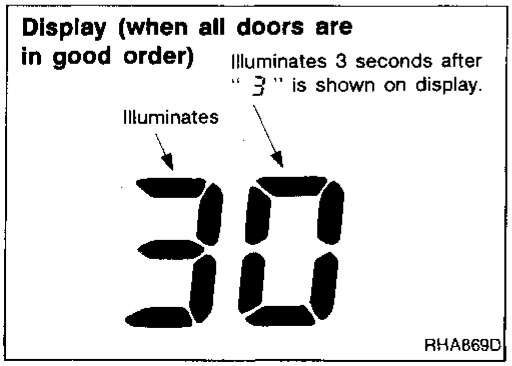
Sensors and abnormalities

If a circuit is opened or shorted, display shows its code No. when input corresponds with any of following conditions.

Code No.	Sensor	Open circuit	Short circuit
21	Ambient sensor	Less than –41.9°C (–43°F)	Greater than 100°C (212°F)
22	In-vehicle sensor	Less than –41.9°C (–43°F)	Greater than 100°C (212°F)
23	Water temperature sensor	Less than –25.6°C (–14°F)	Greater than 150°C (302°F)
24	Intake sensor	Less than –41.9°C (–43°F)	Greater than 100°C (212°F)
25	Sunload sensor*2	Less than 0.0152 mA	Greater than 0.545 mA
26	P.B.R.*1	Greater than 50%	Less than 30%
27	Thermal transmitter	Greater than 11.5V	Less than 2.2V

*1: "50%" and "30%" refer to percentage with respect to full stroke of air mix door. (Full cold: 0%, Full hot: 100%)

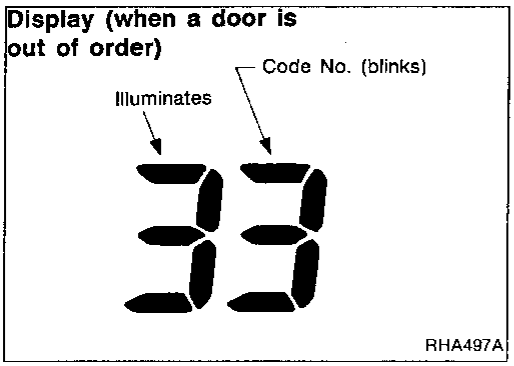
*2: **Conduct self-diagnosis STEP 2 under sunshine.**
When conducting indoors, direct light (more than 60W) at sunload sensor.



STEP 3: Checks mode door position

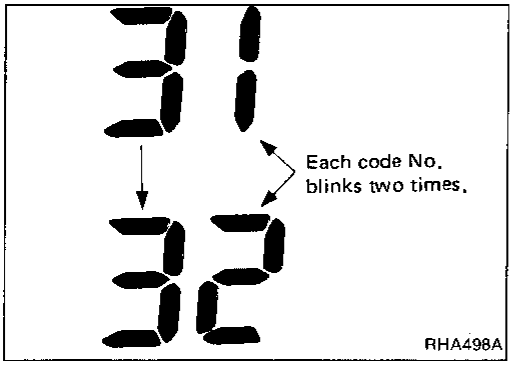
Display shows " 3 " in STEP 3 mode.
When all doors are in good order, display will then show "30".
It takes approximately 3 seconds to check all mode doors.

Self-diagnosis (Cont'd)



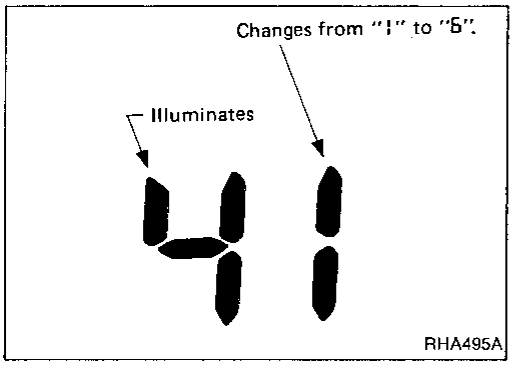
When abnormalities are detected, display shows a code No. corresponding with malfunctioning part.

Code No.	31	32	33	34	35	36
Malfunctioning part	VENT	B/L 1	B/L 2	F/D 1	F/D 2	DEF



If two or more mode doors are out of order, corresponding code numbers respectively blink two times.

If any mode door motor position switch is malfunctioning, mode door motor will also malfunction.



STEP 4: Checks operation of each actuator

Display shows "41" in STEP 4 mode.
When (DEF) switch is pressed one time, display shows "42". Thereafter, each time the switch is pressed, display advances one number at a time, up to "46", then returns to "41".

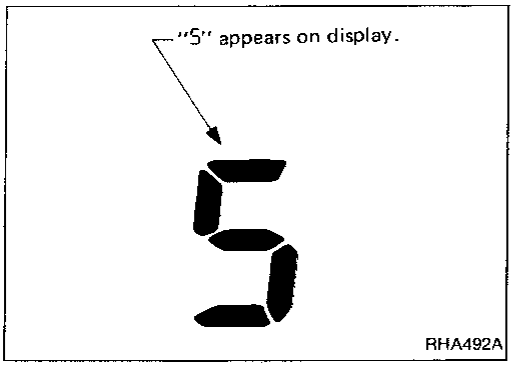
During inspection in STEP 4 mode, auto amplifier will forcefully transmit an output to the affected actuators in response to code No. shown on display, as indicated in table below.

Checks must be made visually, by listening to any noise, or by touching air outlets with your hand, etc. for improper operation.

Code No. / Actuator	41	42	43	44	45	46
Mode door	VENT	B/L 1	B/L 2	F/D 1	F/D 2	DEF
Intake door	REC	REC	20% FRE	FRE	FRE	FRE
Air mix door	Full Cold	Full Cold	Full Hot	Full Hot	Full Hot	Full Hot
Blower motor	4 - 5 V	9 -11 V	7 - 9 V	7 - 9 V	7 - 9 V	10 - 12 V
Compressor	ON	ON	ON	OFF	OFF	ON

Operating condition of each actuator cannot be checked by indicators.

Self-diagnosis (Cont'd)

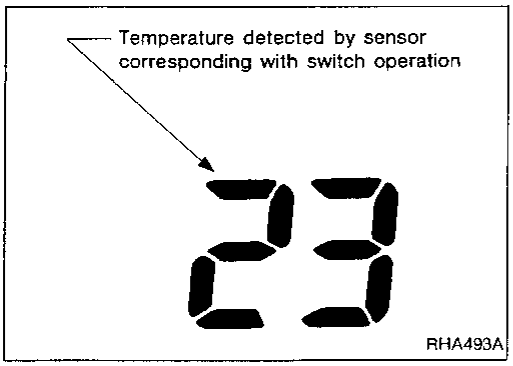


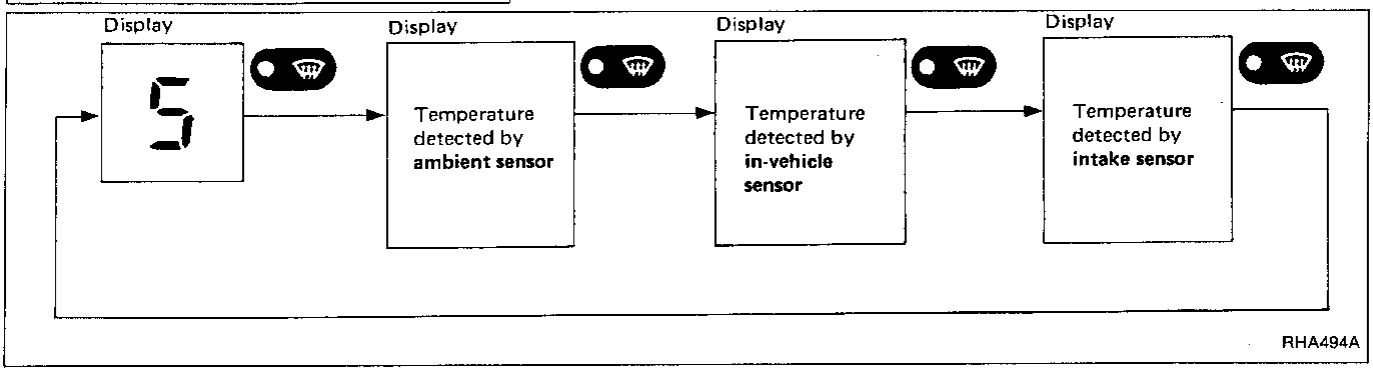
STEP 5: Checks temperature detected by sensors, and detects multiplex communication error

Checks temperature detected by sensors.

Display shows "5 " in STEP 5 mode.

- When (DEF) switch is pressed one time, display shows temperature detected by ambient sensor.
- When (DEF) switch is pressed second time, display shows temperature detected by in-vehicle sensor.
- When (DEF) switch is pressed third time, display shows temperature detected by intake sensor.
- When (DEF) switch is pressed fourth time, display returns to original presentation "5 ".

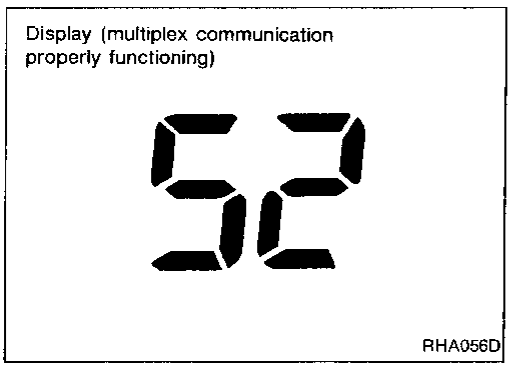




If temperature shown on display greatly differs from actual temperature, check sensor circuit at first then inspect sensor itself according to the procedures described in **Electrical Components Inspection**.

Self-diagnosis (Cont'd)

Display (multiplex communication properly functioning)



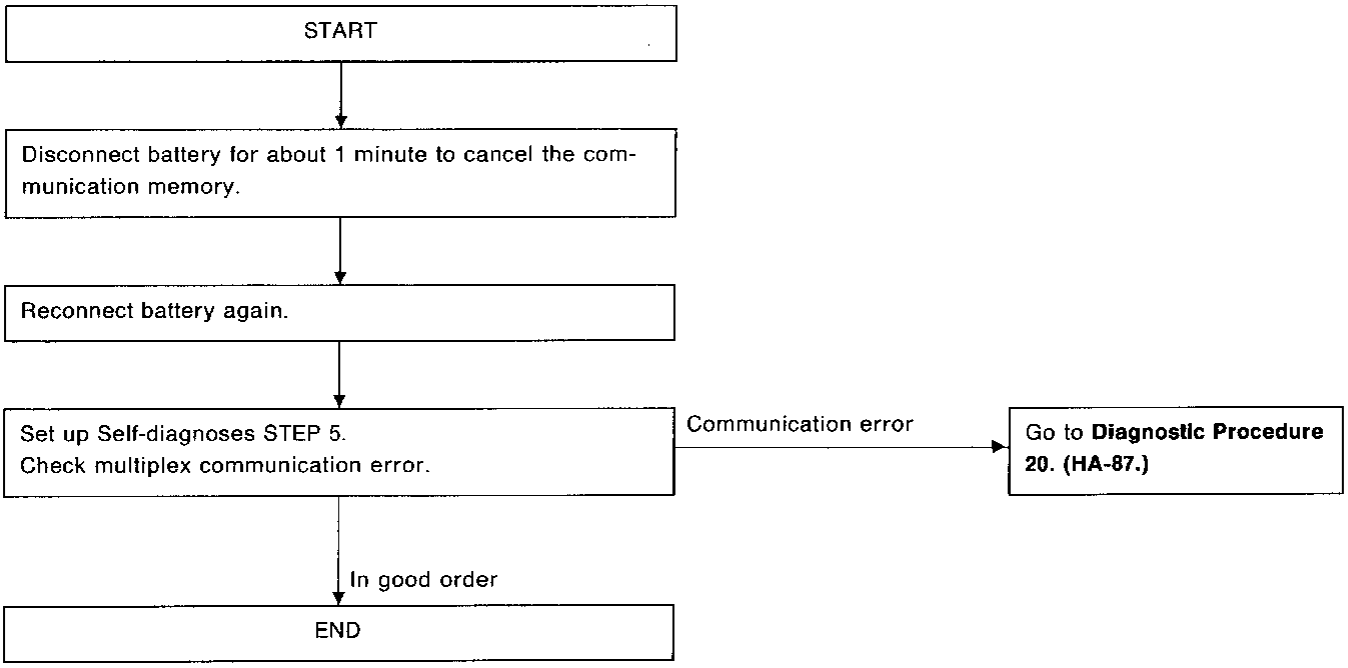
Detects multiplex communication error

Display shows "52" in STEP 5 mode.
[Multiplex communication error between control unit and auto amplifier is detected]

Display	Signal direction
52	In good order
52	Control unit → auto amplifier
52 blinks two times ↓ 52	Auto amplifier → control unit

CAUTION:
The auto amplifier memorizes any communication error in the system in a normal control with battery connected.
When there is an error, display will be as shown above.
When plural errors occur, the display of each error will blink two times for 0.5 second intervals.

If a communication error is displayed, follow the flow chart below to judge if the error occurred in the past or is currently happening.



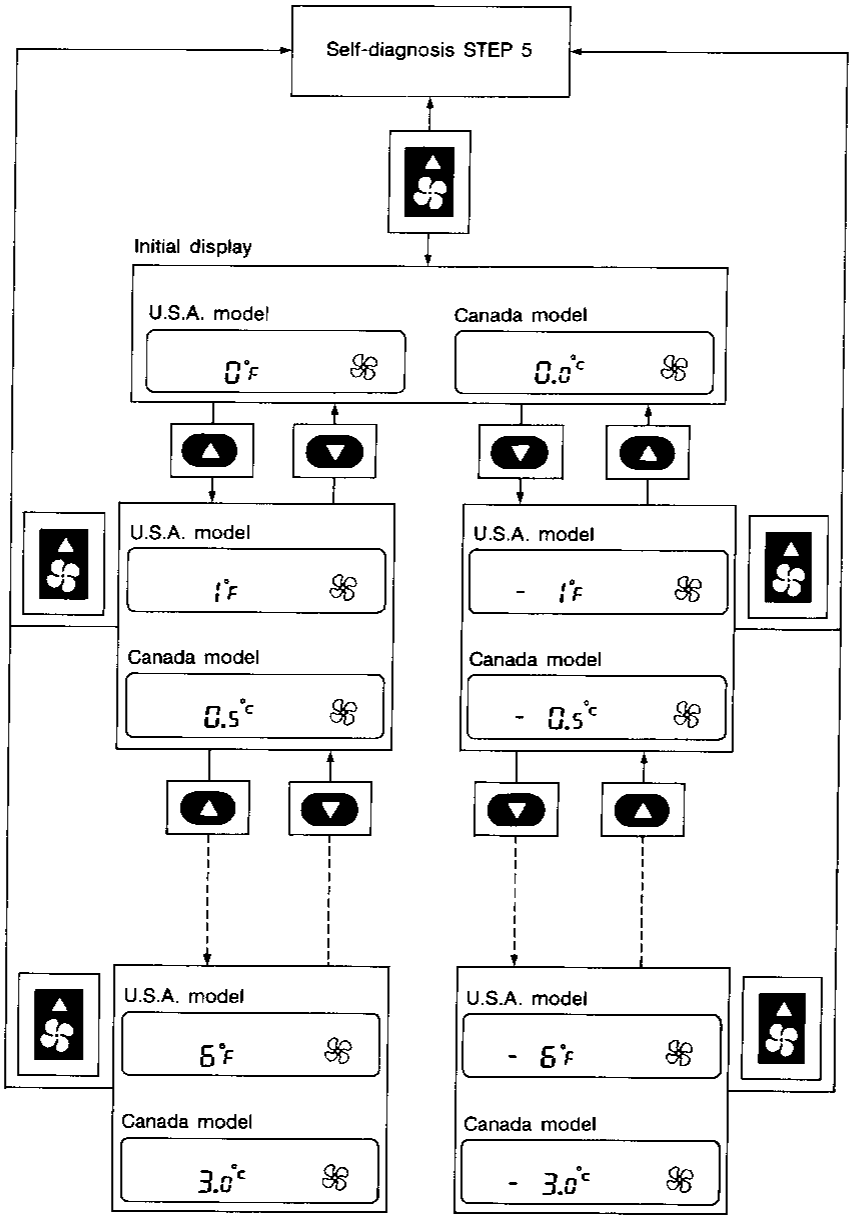
Self-diagnosis (Cont'd)

AUXILIARY MECHANISM: Temperature setting trimmer

This trimmer compensates for differences between temperature setting (displayed digitally) and temperature felt by driver in a range of ±3°C (±6°F).

Operating procedures for this trimmer are as follows:

Starting with STEP 5 under "Self-diagnostic mode", press (fan up) switch to set air conditioning system in auxiliary mode. Then, press either (HOT) or (COLD) switch as desired. Temperature will change at a rate of 0.5°C (1°F) each time a switch is pressed.



SHA197E

When battery cable is disconnected, trimmer operation is canceled and temperature set becomes that of initial condition, i.e. 0°C (0°F).

Symptom Chart

DIAGNOSTIC TABLE

PROCEDURE			Self-diagnosis						Preliminary Check								Diagnostic Procedure												
SYMPTOM	DIAGNOSTIC ITEM AND REFERENCE PAGE		STEP 1 (HA-40, 44)	STEP 2 (HA-40, 44)	STEP 3 (HA-40, 45)	STEP 4 (HA-40, 46)	STEP 5 (HA-40, 47)	AUXILIARY MECHANISM (HA-49)	Preliminary Check 1 (HA-52)	Preliminary Check 2 (HA-53)	Preliminary Check 3 (HA-54)	Preliminary Check 4 (HA-55)	Preliminary Check 5 (HA-56)	Preliminary Check 6 (HA-57)	Preliminary Check 7 (HA-58)	Preliminary Check 8 (HA-59)	Diagnostic Procedure 1 (HA-78)	Diagnostic Procedure 2 (HA-67)	Diagnostic Procedure 3 (HA-68)	Diagnostic Procedure 4 (HA-69)	Diagnostic Procedure 5 (HA-70)	Diagnostic Procedure 6 (HA-71)	Diagnostic Procedure 7 (HA-72)	Diagnostic Procedure 8 (HA-73)	Diagnostic Procedure 9 (HA-73)	Diagnostic Procedure 10 (HA-74)	Diagnostic Procedure 11 (HA-74)	Diagnostic Procedure 12 (HA-75)	Diagnostic Procedure 13 (HA-76)
Air outlet does not change.			❶	❷	○	○	○		❸								○	○		○	○	○		○	○		○	○	○
Intake door does not change.			❶	❷		○	○			❸							○	○		○	○	○		○	○		○	○	○
Insufficient cooling			○	○	○	○	○	○	○	○	❶		○	○	○		○	○		○	○	○		○	○		○	○	○
Insufficient heating			○	○	○	○	○	○	○	○		❶	○		○		○	○		○	○	○		○	○		○	○	○
Blower motor operation is malfunctioning.			❶	❷		○	○						❸				○	○	○	○	○	○		○	○	○	○	○	○
Magnet clutch does not engage.			❶	❷		○	○							❸			○	○		○	○	○		○	○		○	○	○
Discharged air temperature does not change.			❶	❷		○	○								❸		○	○		○	○	○		○	○		○	○	○
Noise																❶													
Result of self-diagnosis STEP 2	21	Ambient sensor circuit is open.	❶	❷			❸										❹												
	22	In-vehicle sensor circuit is open.	❶	❷			❸											❹											
	23	Water temperature circuit is open.	❶	❷															❸										
	24	Intake sensor circuit is open.	❶	❷			❸													❹									
	25	Sunload sensor circuit is open.	❶	❷																	❸								
	26	P.B.R. circuit is open.	❶	❷																		❸							
	27	Thermal transmitter circuit is open.	❶	❷																			❸						
	-21	Ambient sensor circuit is shorted.	❶	❷			❸																	❹					
	-22	In-vehicle sensor circuit is shorted.	❶	❷			❸																		❹				
	-23	Water temperature sensor circuit is shorted.	❶	❷																						❸			
	-24	Intake sensor circuit is shorted.	❶	❷			❸																				❹		
	-25	Sunload sensor circuit is shorted.	❶	❷																								❸	
	-26	P.B.R. circuit is shorted.	❶	❷																									❸
	-27	Thermal transmitter circuit is shorted.	❶	❷																									
Mode door motor does not operate normally.			❶	❷	❸	❹	○										○	○		○	○	○		○	○		○	○	○
Intake door motor does not operate normally.			❶	❷		❸	○										○	○		○	○	○		○	○		○	○	○
Air mix door motor does not operate normally.			❶	❷		❸	○										○	○		○	○	○		○	○		○	○	○
Blower motor operation is malfunctioning under out of Starting Fan Speed Control.			❶	❷		○	○						❸				○	○	○	○	○	○		○	○	○	○	○	○
Magnet clutch does not operate after performing Preliminary Check 6.			❶	❷		○	○							❸			○			○									
Self-diagnosis cannot be performed.																													

❶, ❷: The number means checking order.
○: As for checking order, refer to each flow chart. (It depends on malfunctioning portion.)

Symptom Chart (Cont'd)

Diagnostic Procedure							Main Power Supply and Ground Circuit Check						Electrical Components Inspection																				
Diagnostic Procedure 14 (HA-77)	Diagnostic Procedure 15 (HA-78)	Diagnostic Procedure 16 (HA-80)	Diagnostic Procedure 17 (HA-82)	Diagnostic Procedure 18 (HA-83)	Diagnostic Procedure 19 (HA-85)	Diagnostic Procedure 20 (HA-87)	Auto amp. (HA-65)	Control unit (HA-65)	10A Fuse #23 (HA-65)	15A Fuses #4 and #5 (HA-65)	10A Fuse #10 (HA-65)	10A Fuse #20 (HA-65)	Ambient sensor (HA-93)	In-vehicle sensor (HA-92)	Water temperature sensor (HA-95)	Intake sensor (HA-94)	Sunload sensor (HA-94)	P.B.R. (HA-100)	Air mix door motor (HA-100)	Mode door motor (HA-102)	Intake door motor (HA-98)	Blower motor (HA-88)	Fan control amp. (HA-106)	Blower high relay (HA-88)	A/C relay (HA-88)	Dual-pressure switch (HA-88)	Magnet clutch (Compressor) (HA-107)	Control unit (HA-91)	Auto amp. (HA-96)	ECM (ECCS control module) (EF & EC)	Cooling fan motor (EF & EC)	Cooling fan relay (EF & EC)	A/C pressure switch (HA-88)	Harness
	○						○	○	○	○		○	○	○		○	○	○		○		○							○	○				○
		○					○	○	○	○		○	○	○		○	○	○	○	○	○	○	○						○	○				○
	○	○			○		○	○	○	○	○		○	○		○	○	○	○	○	○	○	○	○	○			○	○	○	○	○	○	○
					○		○	○	○	○	○		○	○	○	○	○	○	○				○	○	○				○	○	○				○
						○	○	○	○	○	○	○	○			○	○	○	○				○	○	○	○	○	○	○	○	○				○
				○			○	○	○	○	○	○	○	○		○	○	○	○	○									○	○				○
													○																	○				○
														○																○				○
															○															○				○
																	○													○				○
																		○												○				○
																			○											○				○
													○																	○				○
														○																○				○
															○															○				○
																○														○				○
																	○													○				○
																		○												○				○
																			○											○				○
																				○										○				○
																					○									○				○
																						○								○				○
																							○							○				○
																								○						○				○
																									○					○				○
																										○				○				○
																											○			○				○
																												○		○				○
❸																																		
	❺						○	○	○	○		○	○	○		○	○	○		○								○	○				○
		❹					○	○	○	○		○	○	○		○	○	○			○							○	○				○
			❹				○	○	○	○		○	○	○		○	○	○	○									○	○				○
				❹			○	○	○	○		○	○	○	○	○	○	○				○	○	○				○	○	○				○
					❹		○	○	○	○	○	○	○			○									○	○	○	○	○	○	○				○
						❶	❷	❸																					○	○				○

Preliminary Check

PRELIMINARY CHECK 1

Air outlet does not change.

- **Perform Self-diagnosis STEP 1 before referring to the flow chart.**

CHECK SENSOR CIRCUIT.
Set up Self-diagnosis STEP 2.
Is each sensor circuit normal?
Code No. 20 should be indicated on the display after approx. 3 seconds.

N.G. → CHECK SENSOR CIRCUIT IN DETAIL ACCORDING TO THE DIAGNOSTIC PROCEDURE BELOW CORRESPONDING TO EACH CODE NO.

Code No.	How to repair	Reference page
21	Go to Diagnostic Procedure 1.	HA-66
22	Go to Diagnostic Procedure 2.	HA-67
23	Go to Diagnostic Procedure 3.	HA-68
24	Go to Diagnostic Procedure 4.	HA-69
25	Go to Diagnostic Procedure 5.	HA-70
26	Go to Diagnostic Procedure 6.	HA-71
27	Go to Diagnostic Procedure 7.	HA-72
-21	Go to Diagnostic Procedure 8.	HA-73
-22	Go to Diagnostic Procedure 9.	HA-73
-23	Go to Diagnostic Procedure 10.	HA-74
-24	Go to Diagnostic Procedure 11.	HA-74
-25	Go to Diagnostic Procedure 12.	HA-75
-26	Go to Diagnostic Procedure 13.	HA-76
-27	Go to Diagnostic Procedure 14.	HA-77

When malfunctioning sensor circuits for ambient sensor, in-vehicle sensor and intake sensor are suspected, it is useful to check temperature detected by each sensor with Self-diagnosis STEP 5 to confirm the temperature is within normal range before performing Diagnostic Procedures.

O.K.

CHECK MODE DOOR MOTOR.
Set up Self-diagnosis STEP 3.
Is mode door motor operating normally?
Code No. 30 should be indicated on the display after approx. 3 seconds.

N.G. → Go to **Diagnostic Procedure 15.** (HA-78)

O.K.

CHECK MODE DOOR OPERATION.
Set up Self-diagnosis STEP 4.
Does air outlet change according to each code No.?

41	42	43	44	45	46
VENT	B/L 1	B/L 2	F/D1	F/D2	DEF

Refer to Air Flow. (HA-11)

N.G. → CHECK SIDE LINK MECHANISM.
Refer to DOOR CONTROL. (HA-89)

N.G. → Repair or adjust.

O.K. → Go to **Diagnostic Procedure 15.** (HA-78)

O.K.

Air outlet control system is normal. Refer to **Outlet door control specification.** (HA-102)

PRELIMINARY CHECK 2

Intake door does not change.

- **Perform Self-diagnosis STEP 1 before referring to the following flow chart.**

CHECK SENSOR CIRCUIT.
Set up Self-diagnosis STEP 2.
Is each sensor circuit normal?
Code No. 20 should be indicated on the display after approx. 3 seconds later.

N.G. → CHECK SENSOR CIRCUIT IN DETAIL ACCORDING TO THE DIAGNOSTIC PROCEDURE BELOW CORRESPONDED TO EACH CODE NO.

Code No.	How to repair	Reference page
21	Go to Diagnostic Procedure 1.	HA-66
22	Go to Diagnostic Procedure 2.	HA-67
23	Go to Diagnostic Procedure 3.	HA-68
24	Go to Diagnostic Procedure 4.	HA-69
25	Go to Diagnostic Procedure 5.	HA-70
26	Go to Diagnostic Procedure 6.	HA-71
27	Go to Diagnostic Procedure 7.	HA-72
-21	Go to Diagnostic Procedure 8.	HA-73
-22	Go to Diagnostic Procedure 9.	HA-73
-23	Go to Diagnostic Procedure 10.	HA-74
-24	Go to Diagnostic Procedure 11.	HA-74
-25	Go to Diagnostic Procedure 12.	HA-75
-26	Go to Diagnostic Procedure 13.	HA-76
-27	Go to Diagnostic Procedure 14.	HA-77

When malfunctioning sensor circuits for ambient sensor, in-vehicle sensor and intake sensor are suspected, it is useful to check temperature detected by each sensor with Self-diagnosis STEP 5 to confirm the temperature is within normal range before performing Diagnostic Procedures.

O.K.

CHECK INTAKE DOOR MOTOR OPERATION.
Set up Self-diagnosis STEP 4.
Does intake air change according to each code No.?

41	42	43	44	45	46
REC	REC	20% FRE	FRE	FRE	FRE

N.G. → CHECK INTAKE DOOR ROD or LEVER MECHANISM.
Refer to DOOR CONTROL. (HA-90)

N.G. → Repair or adjust.

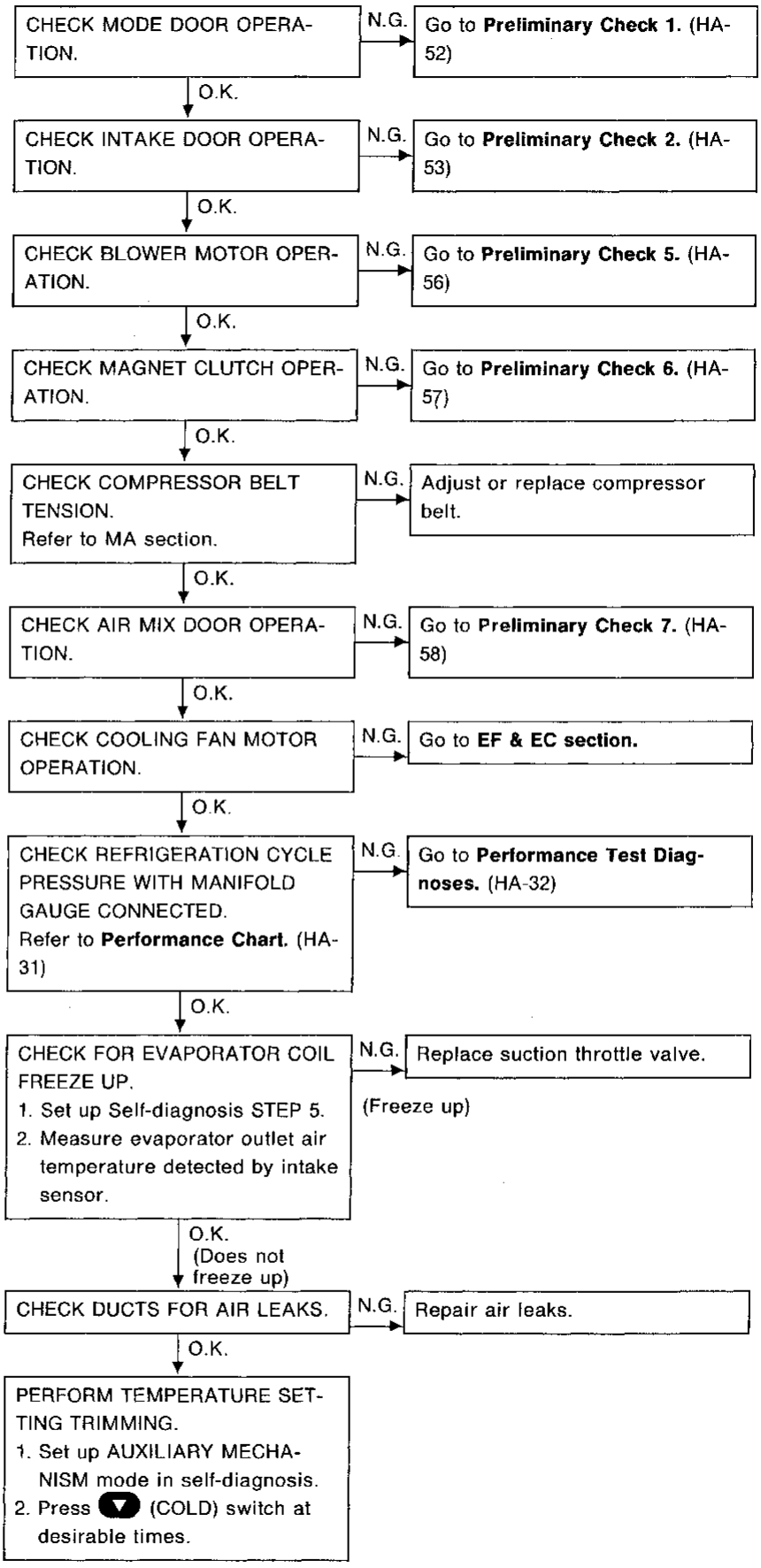
O.K. → Go to **Diagnostic Procedure 16.** (HA-80)

O.K. → Intake door control system is normal.
Refer to **Intake door control specification.** (HA-98)

Preliminary Check (Cont'd)

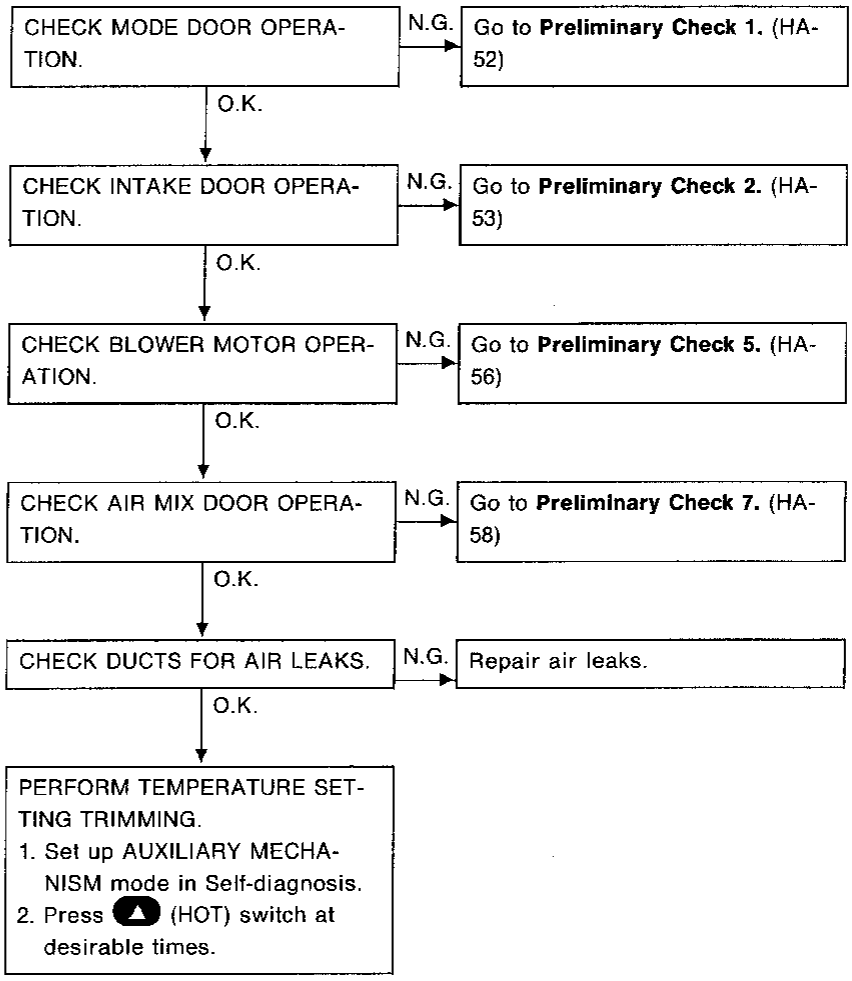
PRELIMINARY CHECK 3

Insufficient cooling



PRELIMINARY CHECK 4

Insufficient heating



Preliminary Check (Cont'd)

PRELIMINARY CHECK 5

Blower motor operation is malfunctioning.

- **Perform Self-diagnosis STEP 1 before referring to the following flow chart.**

CHECK SENSOR CIRCUIT.
Set up Self-diagnosis STEP 2.
Is each sensor circuit normal?
Code No. 20 should be indicated on the display after approx. 3 seconds.

N.G. → CHECK SENSOR CIRCUIT IN DETAIL ACCORDING TO THE DIAGNOSTIC PROCEDURE BELOW CORRESPONDING TO EACH CODE NO.

Code No.	How to repair	Reference page
21	Go to Diagnostic Procedure 1.	HA-66
22	Go to Diagnostic Procedure 2.	HA-67
23	Go to Diagnostic Procedure 3.	HA-68
24	Go to Diagnostic Procedure 4.	HA-69
25	Go to Diagnostic Procedure 5.	HA-70
26	Go to Diagnostic Procedure 6.	HA-71
27	Go to Diagnostic Procedure 7.	HA-72
-21	Go to Diagnostic Procedure 8.	HA-73
-22	Go to Diagnostic Procedure 9.	HA-73
-23	Go to Diagnostic Procedure 10.	HA-74
-24	Go to Diagnostic Procedure 11.	HA-74
-25	Go to Diagnostic Procedure 12.	HA-75
-26	Go to Diagnostic Procedure 13.	HA-76
-27	Go to Diagnostic Procedure 14.	HA-77

When malfunctioning sensor circuits for ambient sensor, in-vehicle sensor and intake sensor are suspected, it is useful to check temperature detected by each sensor with Self-diagnosis STEP 5 to confirm the temperature is within normal range before performing Diagnostic Procedures.

O.K.

CHECK BLOWER MOTOR OPERATION.
Set up Self-diagnosis STEP 4.
Does blower speed change according to each code No.?

Code No.	41	42	43	44	45	46
Blower motor speed	Low	Middle high	Middle low			High

N.G. → Go to **Diagnostic Procedure 18.** (HA-83)

O.K.

Is engine coolant temperature below 50°C (122°F) and ambient temperature below 15°C (59°F)?

No → Blower motor operation is normal.
Refer to **Fan speed control specification.** (HA-106)

Yes

IS BLOWER MOTOR CONTROLLED UNDER STARTING FAN SPEED CONTROL?
Refer to **Starting fan speed control specification.** (HA-105)

No → Check engine coolant temperature sensor control circuit.
Refer to EF & EC section.

Yes

Blower motor operation is normal.

PRELIMINARY CHECK 6

Magnet clutch does not engage.
Perform Self-diagnosis STEP 1 before referring to the following flow chart.

CHECK SENSOR CIRCUIT.
Set up Self-diagnosis STEP 2.
Is each sensor circuit normal?
Code No. 20 should be indicated on the display after approx. 3 seconds.

N.G. → CHECK SENSOR CIRCUIT IN DETAIL ACCORDING TO THE DIAGNOSTIC PROCEDURE BELOW CORRESPONDED TO EACH CODE NO.

Code No.	How to repair	Reference page
21	Go to Diagnostic Procedure 1.	HA-66
22	Go to Diagnostic Procedure 2.	HA-67
23	Go to Diagnostic Procedure 3.	HA-68
24	Go to Diagnostic Procedure 4.	HA-69
25	Go to Diagnostic Procedure 5.	HA-70
26	Go to Diagnostic Procedure 6.	HA-71
27	Go to Diagnostic Procedure 7.	HA-72
-21	Go to Diagnostic Procedure 8.	HA-73
-22	Go to Diagnostic Procedure 9.	HA-73
-23	Go to Diagnostic Procedure 10.	HA-74
-24	Go to Diagnostic Procedure 11.	HA-74
-25	Go to Diagnostic Procedure 12.	HA-75
-26	Go to Diagnostic Procedure 13.	HA-76
-27	Go to Diagnostic Procedure 14.	HA-77

When malfunctioning sensor circuits for ambient sensor, in-vehicle sensor and intake sensor are suspected, it is useful to check temperature detected by each sensor with Self-diagnosis STEP 5 to confirm the temperature is within normal range before performing Diagnostic Procedures.

O.K. ↓

CHECK MAGNET CLUTCH OPERATION.
Set up Self-diagnosis STEP 4.
Does magnet clutch operate according to each code No.?

Code No. / Actuator	41	42	43	44	45	46
Compressor	ON	ON	ON	OFF	OFF	ON

N.G. → CHECK REFRIGERANT.
Connect manifold gauge, then check system pressure.

N.G. → Check refrigerant leaks.

O.K. ↓

Go to **Diagnostic Procedure 19.** (HA-85)

O.K. ↓

Magnet clutch control system is normal.
Refer to MAGNET CLUTCH CONTROL. (HA-107)

Preliminary Check (Cont'd)

PRELIMINARY CHECK 7

Discharged air temperature does not change.
Perform Self-diagnosis STEP 1 before referring to the following flow chart.

CHECK SENSOR CIRCUIT.
Set up Self-diagnosis STEP 2.
Is each sensor circuit normal?
Code No. 20 should be indicated on the display after approx. 3 seconds later.

N.G. → CHECK SENSOR CIRCUIT IN DETAIL ACCORDING TO THE DIAGNOSTIC PROCEDURE BELOW CORRESPONDING TO EACH CODE NO.

Code No.	How to repair	Reference page
21	Go to Diagnostic Procedure 1.	HA-66
22	Go to Diagnostic Procedure 2.	HA-67
23	Go to Diagnostic Procedure 3.	HA-68
24	Go to Diagnostic Procedure 4.	HA-69
25	Go to Diagnostic Procedure 5.	HA-70
26	Go to Diagnostic Procedure 6.	HA-71
27	Go to Diagnostic Procedure 7.	HA-72
-21	Go to Diagnostic Procedure 8.	HA-73
-22	Go to Diagnostic Procedure 9.	HA-73
-23	Go to Diagnostic Procedure 10.	HA-74
-24	Go to Diagnostic Procedure 11.	HA-74
-25	Go to Diagnostic Procedure 12.	HA-75
-26	Go to Diagnostic Procedure 13.	HA-76
-27	Go to Diagnostic Procedure 14.	HA-77

When malfunctioning sensor circuits for ambient sensor, in-vehicle sensor and intake sensor are suspected, it is useful to check temperature detected by each sensor with Self-diagnosis STEP 5 to confirm the temperature is within normal range before performing Diagnostic Procedures.

O.K. ↓

CHECK AIR MIX DOOR OPERATION.
Set up Self-diagnosis STEP 4.
Does discharged air temperature change according to each code No.?

41	42	43	44	45	46
Full cold		Full hot			

O.K. ↓

Air mix door control system is normal.
Refer to **Air mix door control specification.** (HA-99)

N.G. ↓

CHECK AIR MIX DOOR MECHANISM.
Repair to DOOR CONTROL. (HA-89)

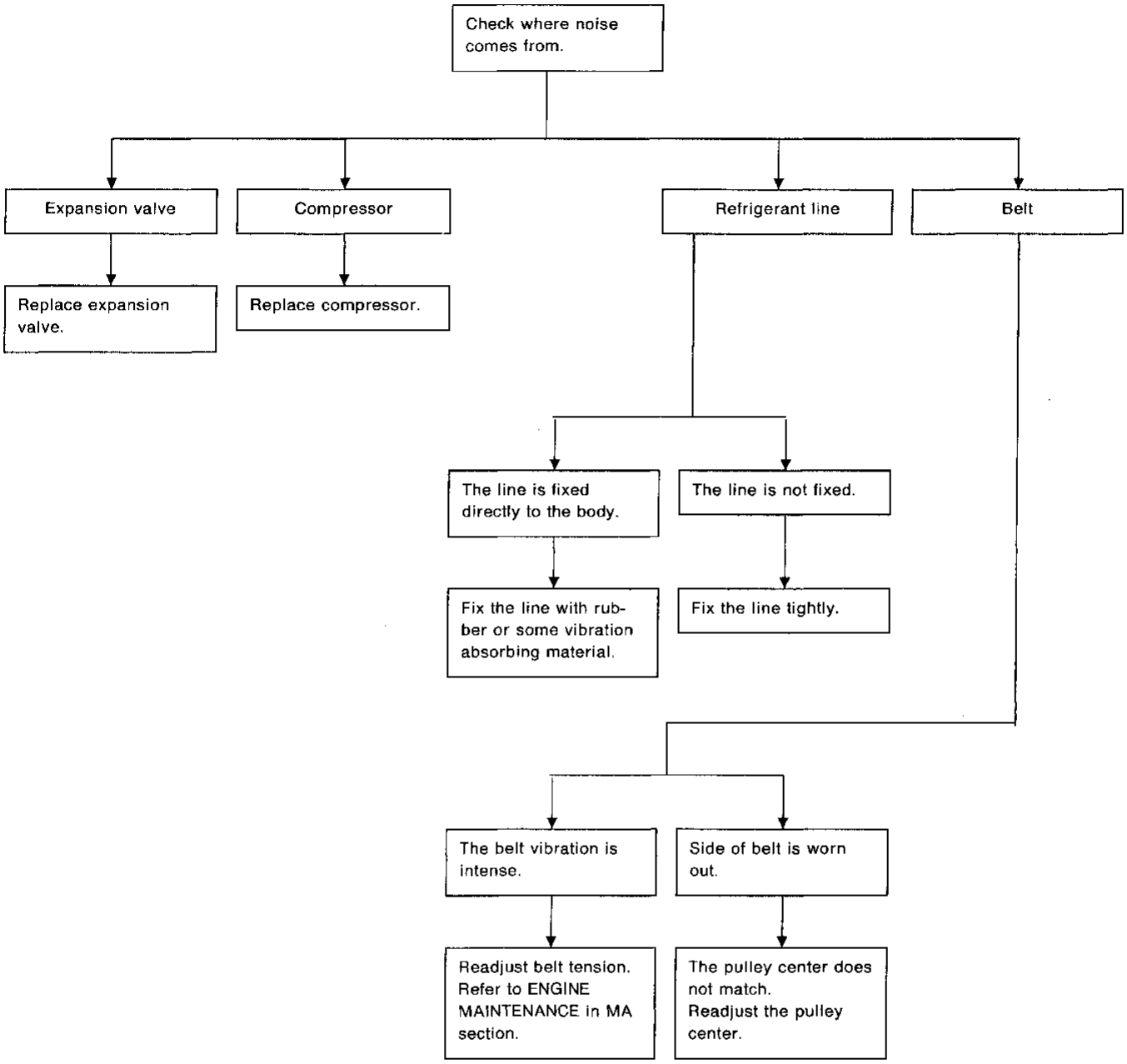
N.G. → Repair or adjust.

O.K. ↓

Go to **Diagnostic Procedure 17.** (HA-82)

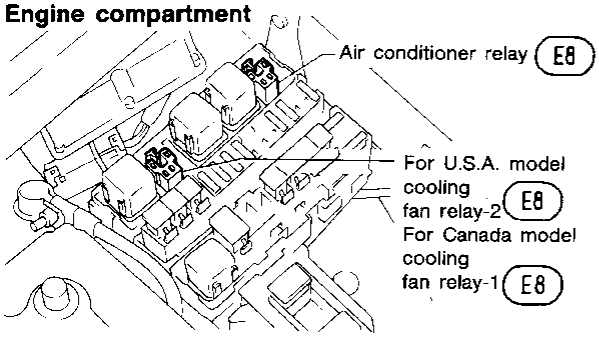
PRELIMINARY CHECK 8

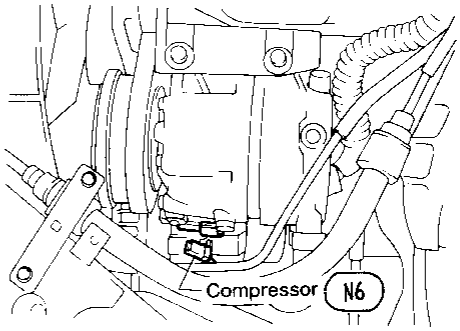
Noise

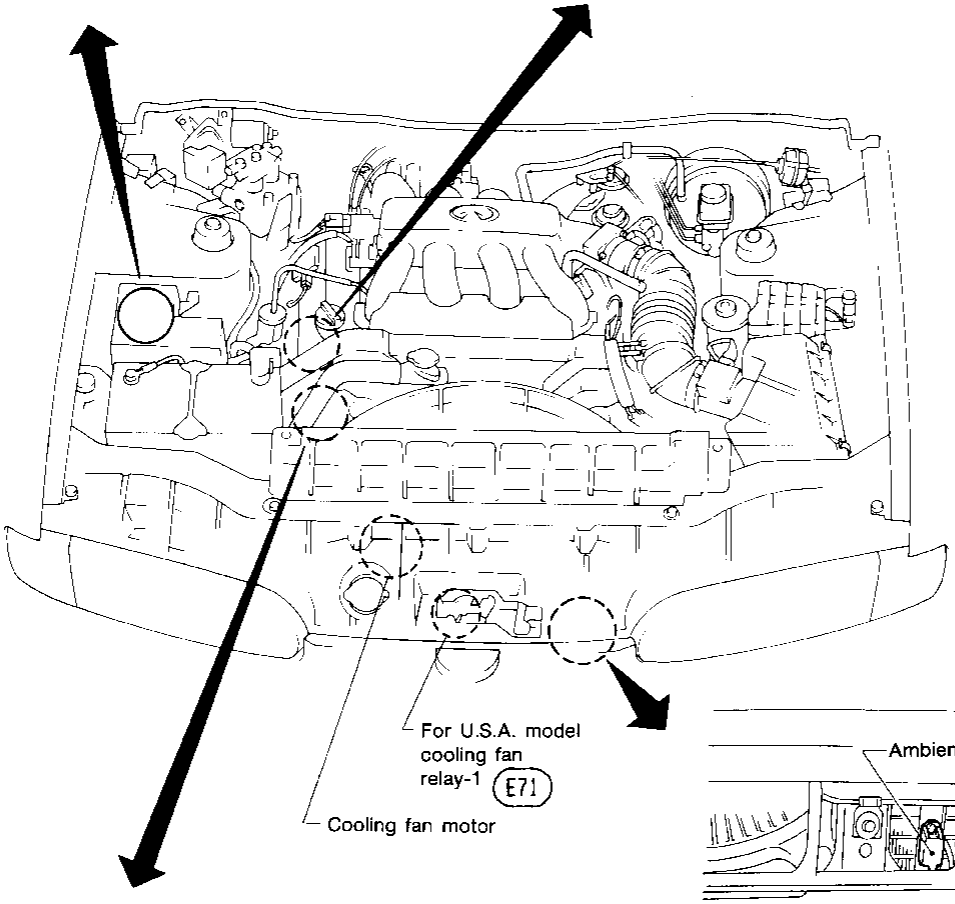


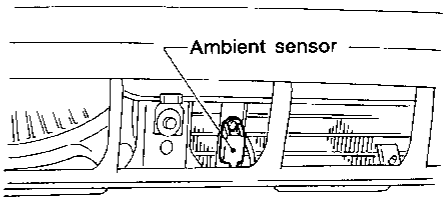
A/C Component Layout

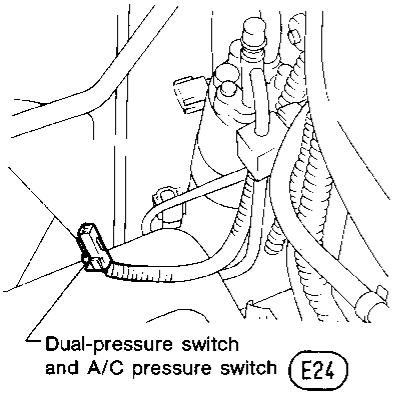
Engine compartment

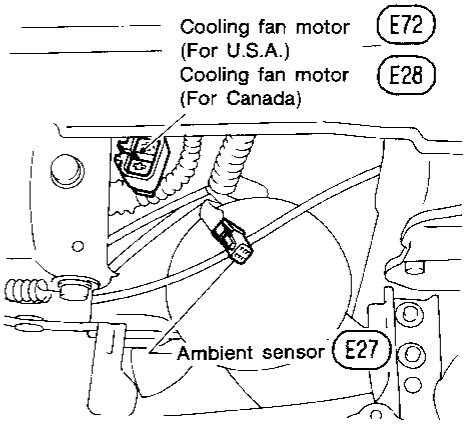








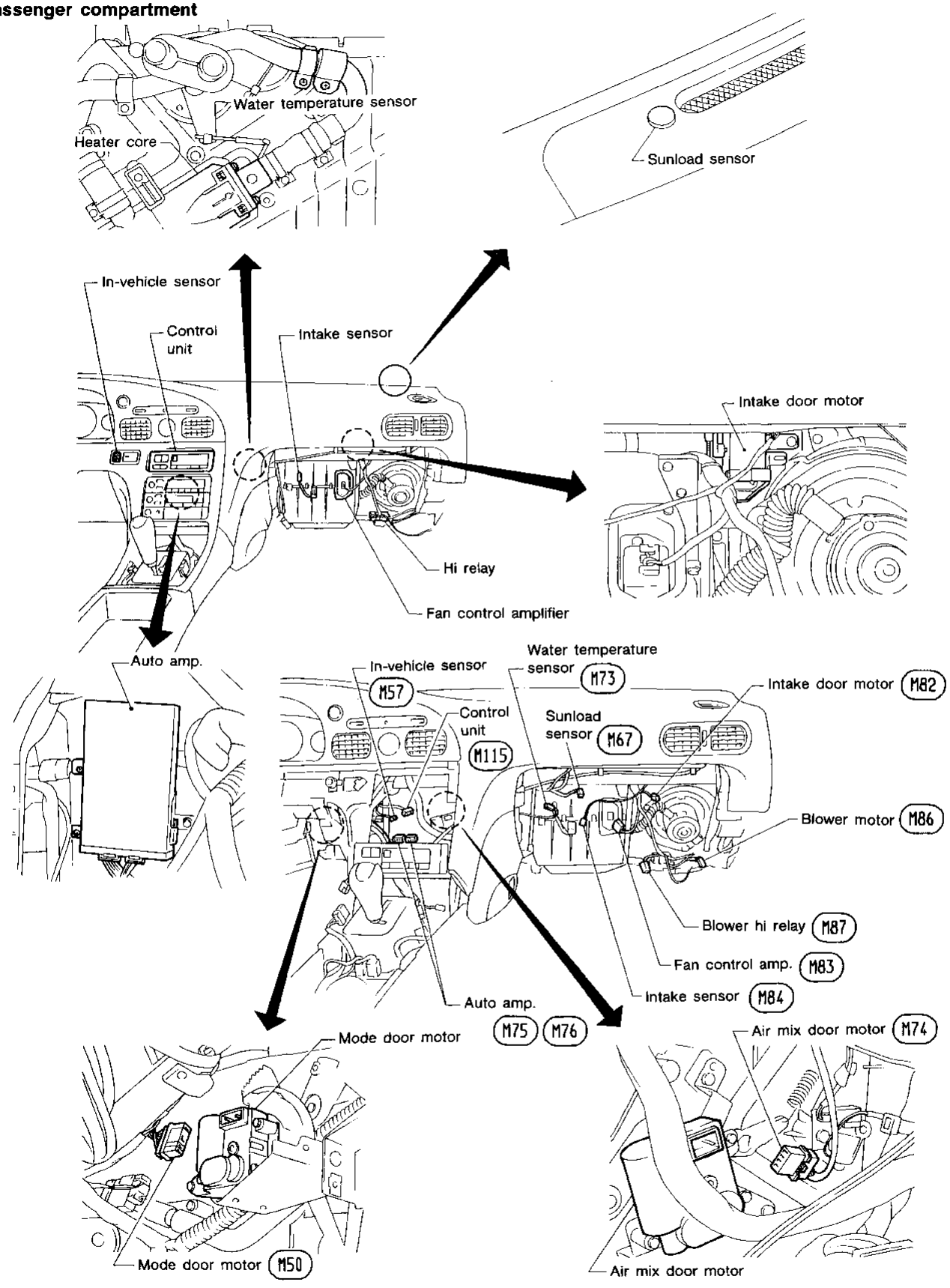




SHA196E

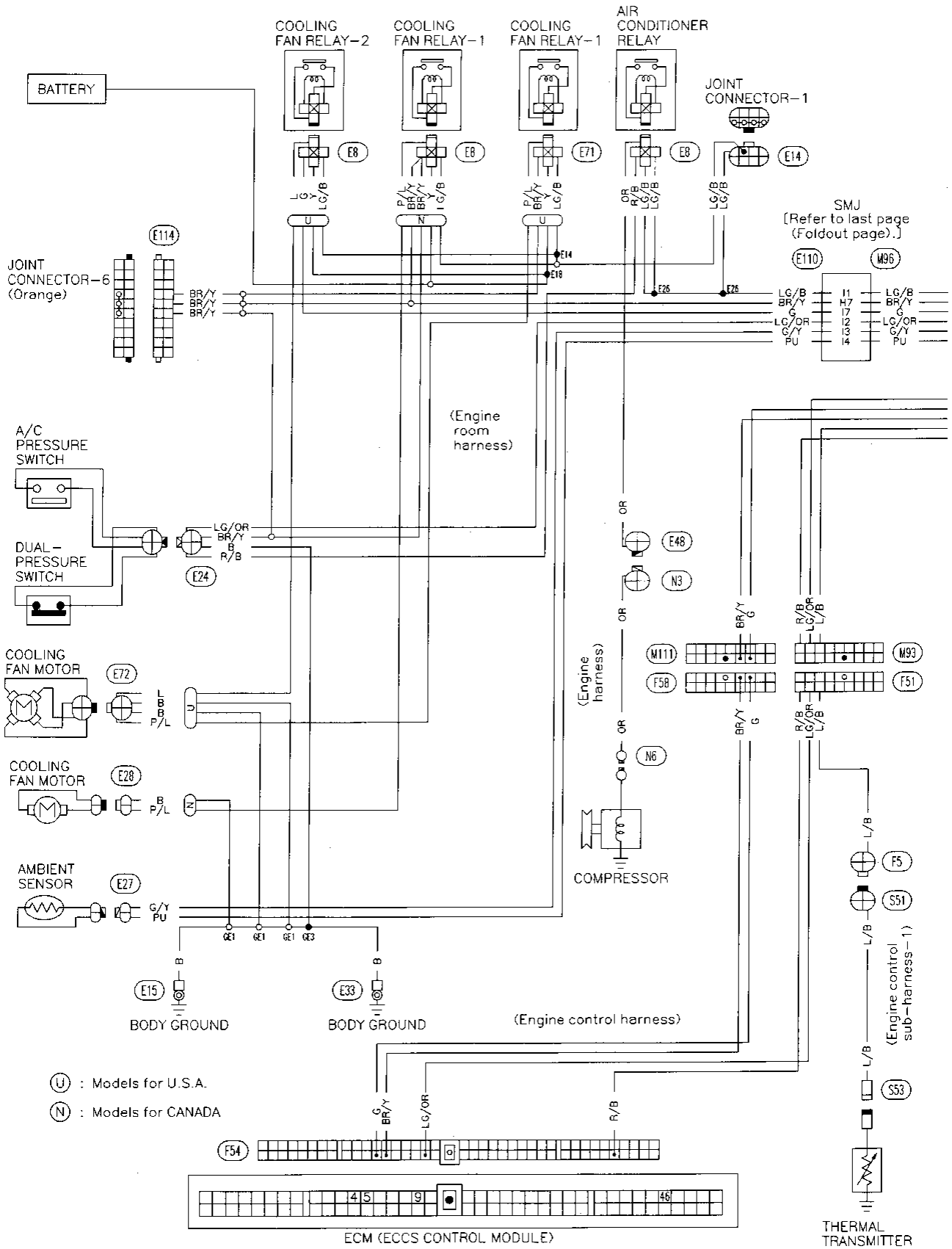
A/C Component Layout (Cont'd)

Passenger compartment

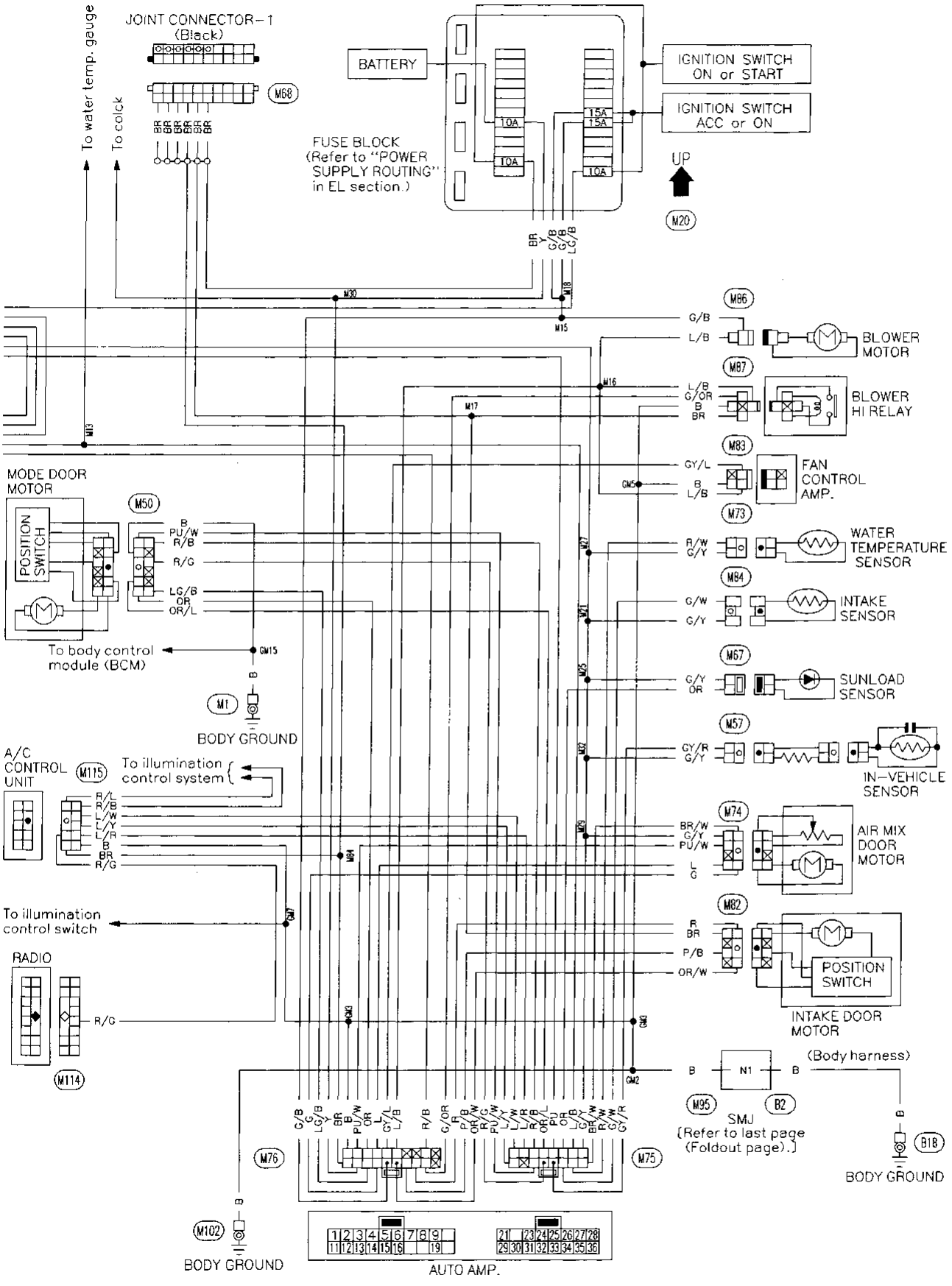


RHA870D

Wiring Diagram

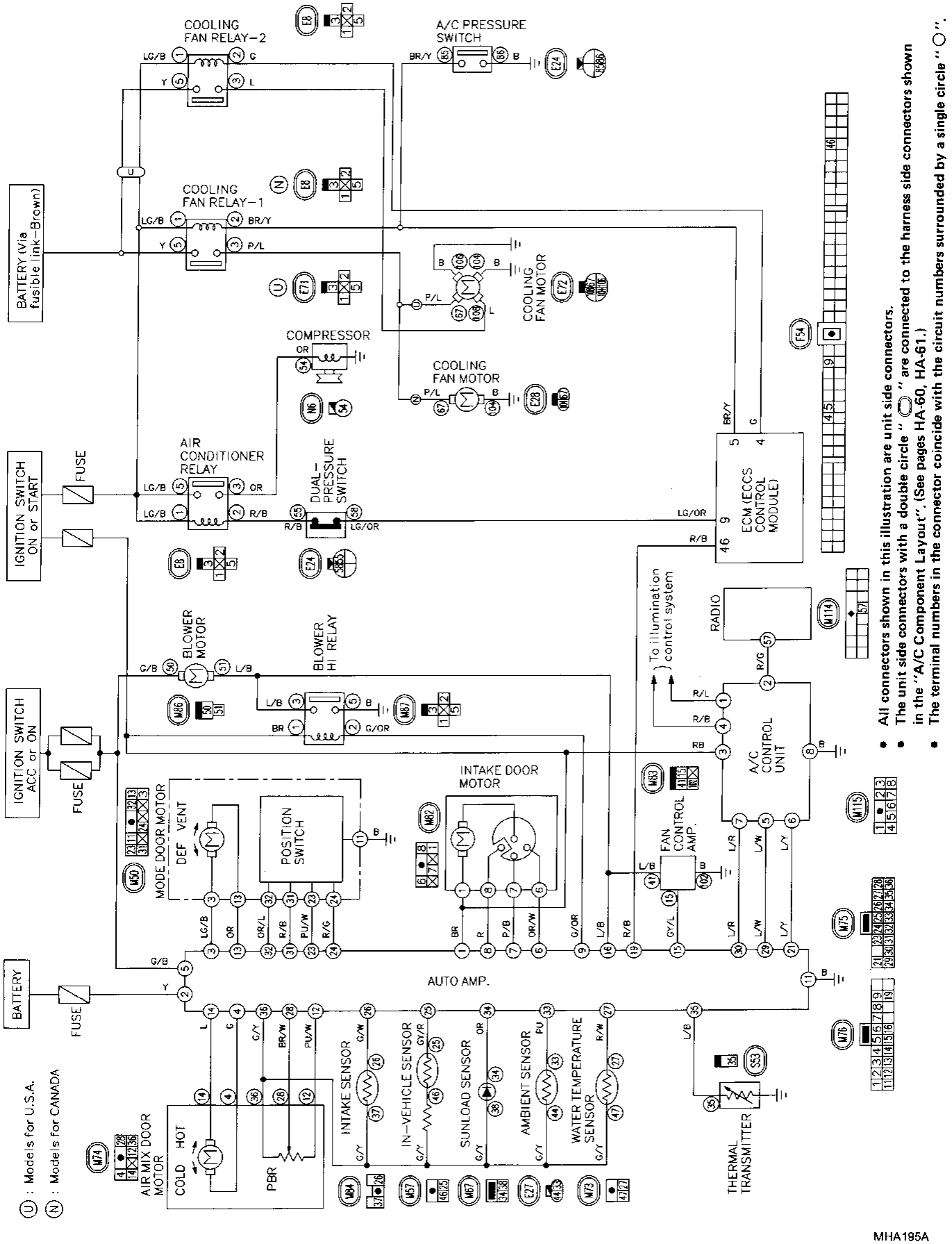


Wiring Diagram (Cont'd)



MHA194A

Circuit Diagram for Quick Pinpoint Check



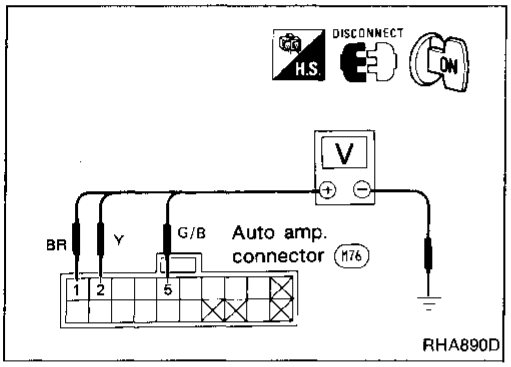
- All connectors shown in this illustration are unit side connectors.
- The unit side connectors with a double circle " ◎ " are connected to the harness side connectors shown in the "A/C Component Layout". (See pages HA-60, HA-61.)
- The terminal numbers in the connector coincide with the circuit numbers surrounded by a single circle " ○ ".

MHA195A

Main Power Supply and Ground Circuit Check

POWER SUPPLY CIRCUIT CHECK FOR AUTO A/C SYSTEM

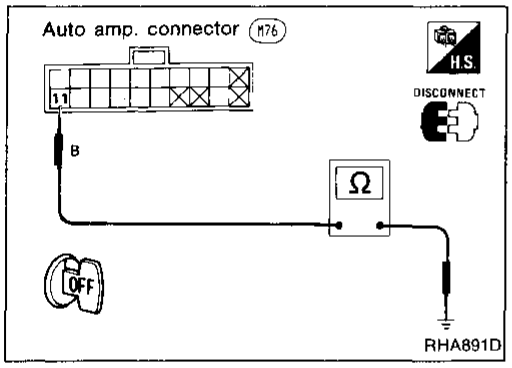
Check power supply circuit for auto air conditioning system.
Refer to "POWER SUPPLY ROUTING" in EL section and Wiring Diagram.



AUTO AMP. CHECK

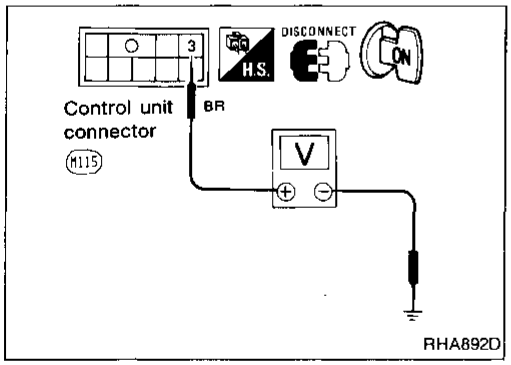
Check power supply circuit for auto amp. with ignition switch ON.
Measure voltage across terminal Nos. ①, ②, ⑤ and body ground.

Voltmeter terminal		Voltage
⊕	⊖	
② ⑤ ①	Body ground	Approx. 12V



Check body ground circuit for auto amp. with ignition switch OFF.
Check for continuity between terminal No. ⑪ and body ground.

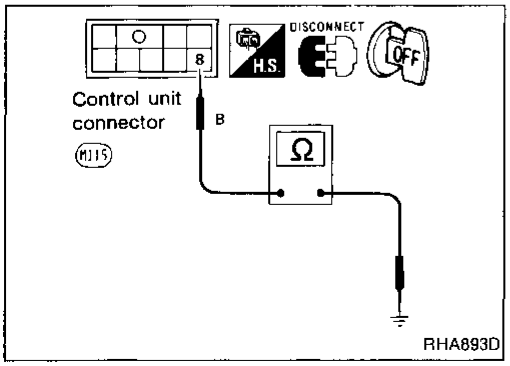
Ohmmeter terminal		Continuity
⊕	⊖	
⑪	Body ground	Yes



CONTROL UNIT CHECK

Check power supply circuit for control unit with ignition switch ON.
Measure voltage across terminal No. ③ and body ground.

Voltmeter terminal		Voltage
⊕	⊖	
③	Body ground	Approx. 12V

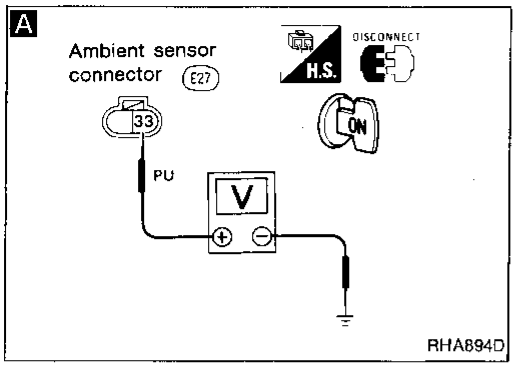


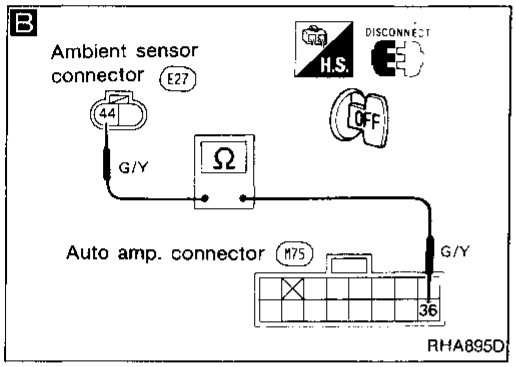
Check body ground circuit for control unit with ignition switch OFF.
Check for continuity between terminal No. ⑧ and body ground.

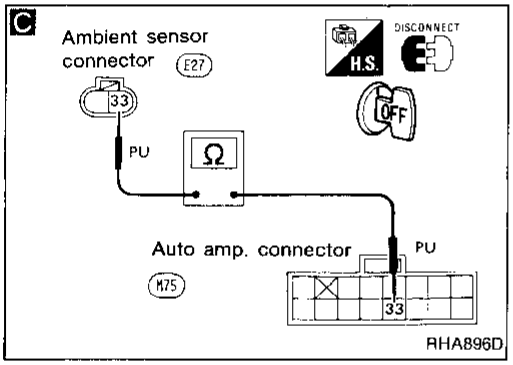
Ohmmeter terminal		Continuity
⊕	⊖	
⑧	Body ground	Yes

Diagnostic Procedure 1

SYMPTOM: Ambient sensor circuit is open. (21 is indicated on auto amp. as a result of conducting Self-diagnosis STEP 2.)







A

CHECK AMBIENT SENSOR CIRCUIT BETWEEN AMBIENT SENSOR AND AUTO AMP.
Disconnect ambient sensor harness connector.
Do approx. 5 volts exist between ambient sensor harness terminal No. 33 and body ground?

N.G. → Disconnect auto amp. harness connector.

C Note
Check circuit continuity between ambient sensor harness terminal No. 33 and auto amp. harness terminal No. 33.

O.K. → Replace auto amp.

O.K. → Disconnect auto amp. harness connector.

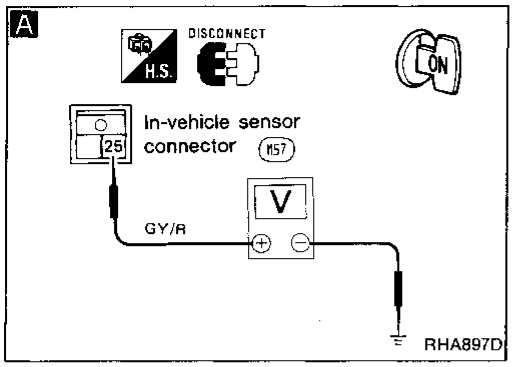
B Note
Check circuit continuity between ambient sensor harness terminal No. 44 and auto amp. harness terminal No. 36.

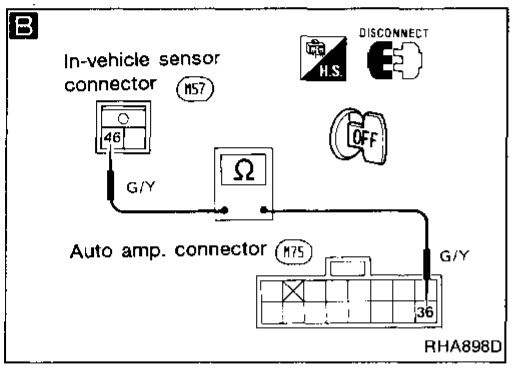
O.K. → CHECK AMBIENT SENSOR.
(Refer to Control System Input Components.) (HA-93)

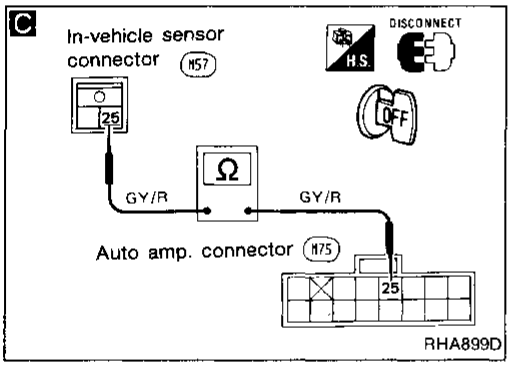
N.G. → Replace ambient sensor.

O.K. → Replace auto amp.

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.







Diagnostic Procedure 2

SYMPTOM: In-vehicle sensor circuit is open. (22 is indicated on auto amp. as a result of conducting Self-diagnosis STEP 2.)

A

CHECK IN-VEHICLE SENSOR CIRCUIT BETWEEN IN-VEHICLE SENSOR AND AUTO AMP.
Disconnect in-vehicle sensor harness connector.
Do approx. 5 volts exist between in-vehicle sensor harness terminal No. 25 and body ground?

N.G. → Disconnect auto amp. harness connector.

C Note
Check circuit continuity between in-vehicle sensor harness terminal No. 25 and auto amp. harness terminal No. 25.

O.K. → Replace auto amp.

O.K. → Disconnect auto amp. harness connector.

B Note
Check circuit continuity between in-vehicle sensor harness terminal No. 46 and auto amp. harness terminal No. 36.

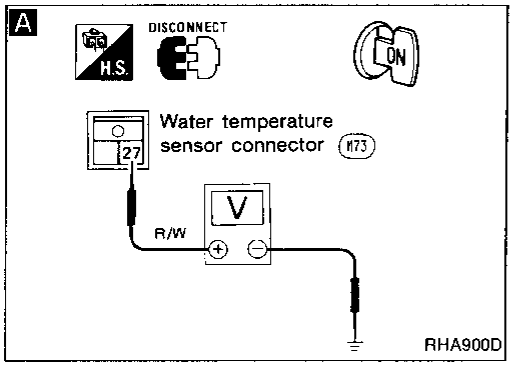
O.K. → CHECK IN-VEHICLE SENSOR. (Refer to Control System Input Components.) (HA-92)

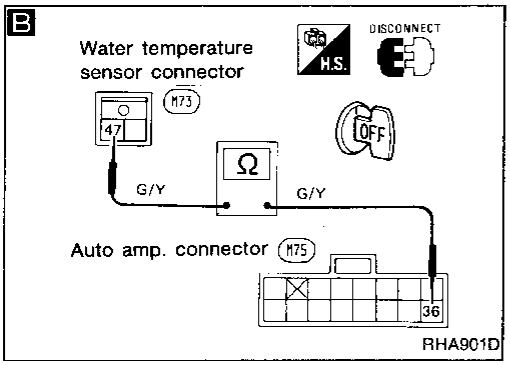
N.G. → Replace in-vehicle sensor.

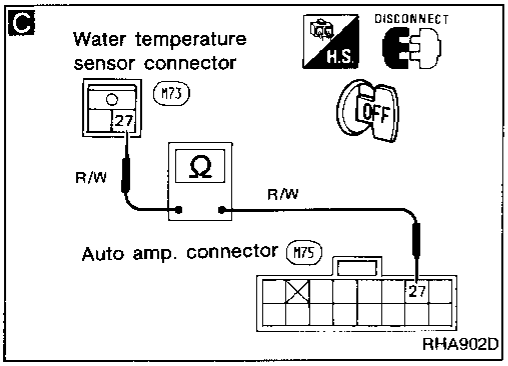
O.K. → Replace auto amp.

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.

GI MA EM LC EF & EC FE AT PD FA RA BR ST BF HA EL







Diagnostic Procedure 3

SYMPTOM: Water temperature sensor circuit is open. (23 is indicated on auto amp. as a result of conducting Self-diagnosis STEP 2.)

A

CHECK WATER TEMPERATURE SENSOR CIRCUIT BETWEEN WATER TEMPERATURE SENSOR AND AUTO AMP.
Disconnect water temperature sensor harness connector.
Do approx. 5 volts exist between water temperature sensor harness terminal No. 27 and body ground?

N.G. → Disconnect auto amp. harness connector.

C

Note

Check circuit continuity between water temperature sensor harness terminal No. 27 and auto amp. harness terminal No. 27.

O.K. → Replace auto amp.

O.K. → Disconnect auto amp. harness connector.

B

Note

Check circuit continuity between water temperature sensor harness terminal No. 47 and auto amp. harness terminal No. 36.

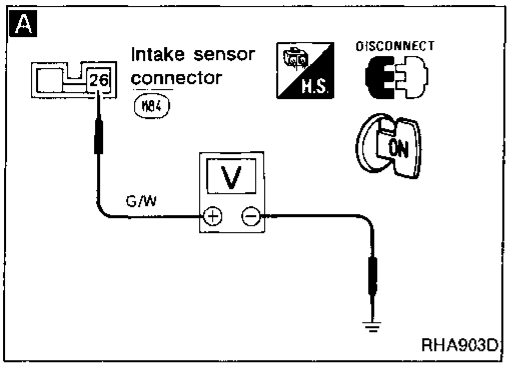
O.K. →

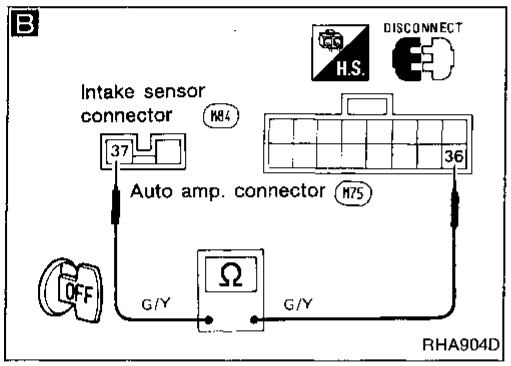
CHECK WATER TEMPERATURE SENSOR.
(Refer to Control System Input Components.) (HA-95)

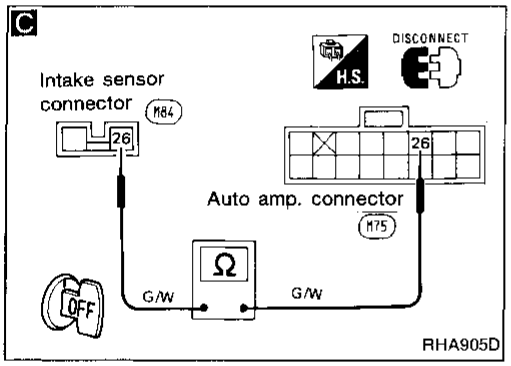
N.G. → Replace water temperature sensor.

O.K. → Replace auto amp.

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.







Diagnostic Procedure 4

SYMPTOM: Intake sensor circuit is open. (24 is indicated on auto amp. as a result of conducting Self-diagnosis STEP 2.)

A

CHECK INTAKE SENSOR CIRCUIT BETWEEN INTAKE SENSOR AND AUTO AMP.
Disconnect intake sensor harness connector.
Do approx. 5 volts exist between intake sensor harness terminal No. 26 and body ground?

N.G. → Disconnect auto amp. harness connector.

C

Note: Check circuit continuity between intake sensor harness terminal No. 26 and auto amp. harness terminal No. 26.

O.K. → Replace auto amp.

O.K. → Disconnect auto amp. harness connector.

B

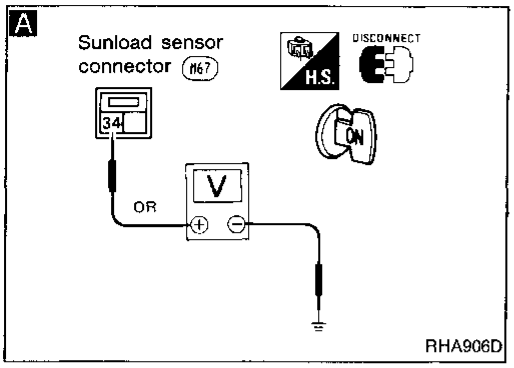
Note: Check circuit continuity between intake sensor harness terminal No. 37 and auto amp. harness terminal No. 36.

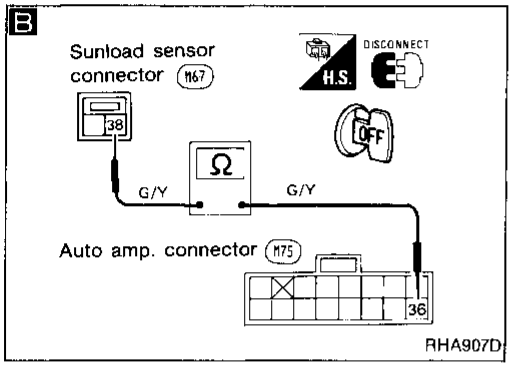
O.K. → CHECK INTAKE SENSOR. (Refer to Control System Input Components.) (HA-94)

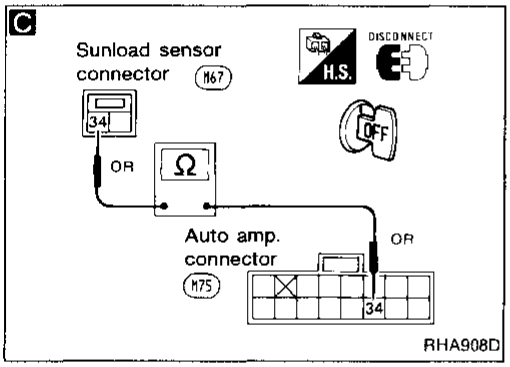
N.G. → Replace intake sensor.

O.K. → Replace auto amp.

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.







Diagnostic Procedure 5

SYMPTOM: Sunload sensor circuit is open. (25 is indicated on auto amp. as a result of conducting Self-diagnosis STEP 2.)

A

CHECK SUNLOAD SENSOR CIRCUIT BETWEEN SUNLOAD SENSOR AND AUTO AMP.
Disconnect sunload sensor harness connector.
Do approx. 5 volts exist between sunload sensor harness terminal No. ㉞ and body ground?

N.G. → Disconnect auto amp. harness connector.

C

Note

Check circuit continuity between sunload sensor harness terminal No. ㉞ and auto amp. harness terminal No. ㉞.

O.K. → Replace auto amp.

O.K. → Disconnect auto amp. harness connector.

B

Note

Check circuit continuity between sunload sensor harness terminal No. ㊳ and auto amp. harness terminal No. ㊱

O.K. → CHECK SUNLOAD SENSOR.
(Refer to Control System Input Components.) (HA-94)

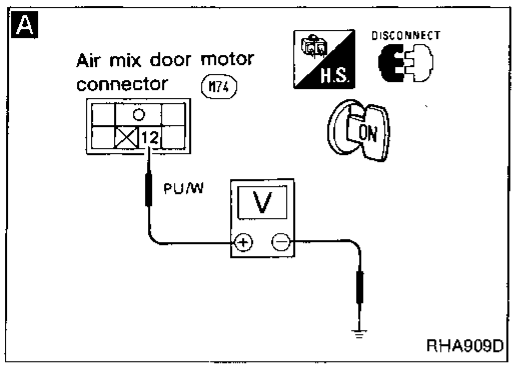
N.G. → Replace sunload sensor.

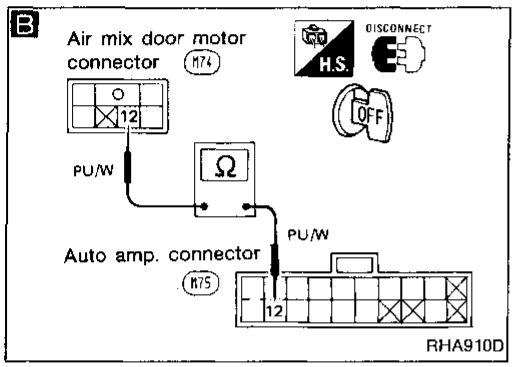
O.K. → Replace auto amp.

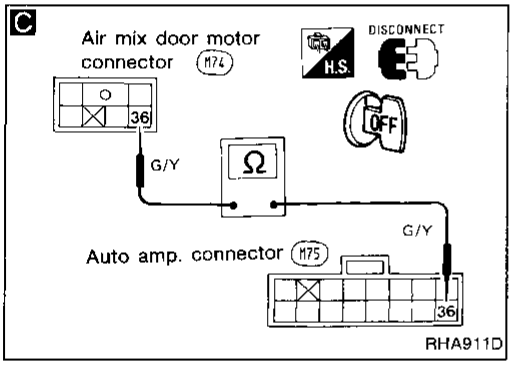
Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.

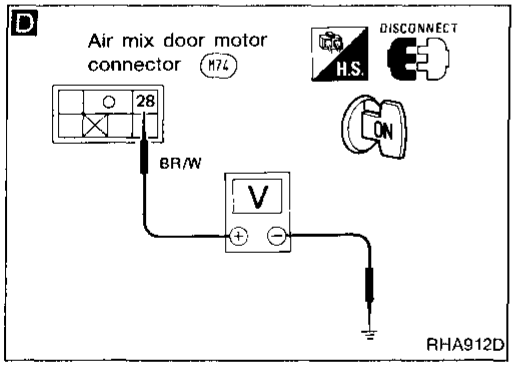
Diagnostic Procedure 6

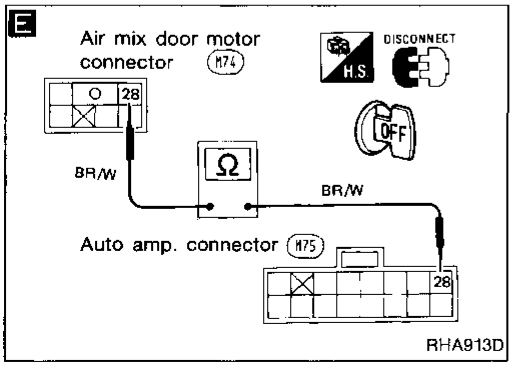
SYMPTOM: P.B.R. circuit is open. (26 is indicated on auto amp. as a result of conducting Self-diagnosis STEP 2.)











A

CHECK P.B.R. CIRCUIT BETWEEN P.B.R. AND AUTO AMP.
Disconnect air mix door motor harness connector.
Do approx. 5 volts exist between air mix door motor harness terminal No. ⑫ and body ground?

N.G. → Disconnect auto amp. harness connector.

O.K. ↓

Disconnect auto amp. harness connector.

C

Note: Check circuit continuity between air mix door motor harness terminal No. ㊱ and auto amp. harness terminal No. ㊱ .

O.K. ↓

D

CHECK P.B.R. CIRCUIT BETWEEN P.B.R. AND AUTO AMP.
Reconnect auto amp. harness connector.
Do approx. 5 volts exist between air mix door motor harness terminal No. ㉘ and body ground?

N.G. → Disconnect auto amp. harness connector.

O.K. ↓

CHECK P.B.R.
(Refer to Control System Output Components.) (HA-100)

N.G. → Replace air mix door motor (P.B.R.).

O.K. ↓

Replace auto amp.

B

Note: Check circuit continuity between air mix door motor harness terminal No. ⑫ and auto amp. harness terminal No. ⑫ .

O.K. ↓

Replace auto amp.

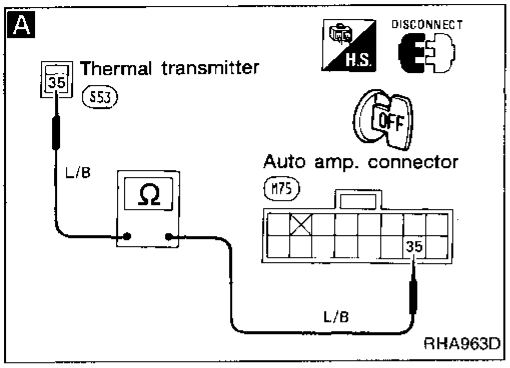
E

Note: Check circuit continuity between air mix door motor harness terminal No. ㉘ and auto amp. harness terminal No. ㉘ .

O.K. ↓

Replace auto amp.

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.



Diagnostic Procedure 7

SYMPTOM: Thermal transmitter circuit is open. (27 is indicated on auto amp. as a result of conducting Self-diagnosis STEP 2.)

A

Note

CHECK THERMAL TRANSMITTER CIRCUIT BETWEEN THERMAL TRANSMITTER AND AUTO AMP.
Disconnect thermal transmitter harness connector and auto amp. harness connector.
Check circuit continuity between thermal transmitter harness terminal No. 35 and auto amp. harness terminal No. 35.

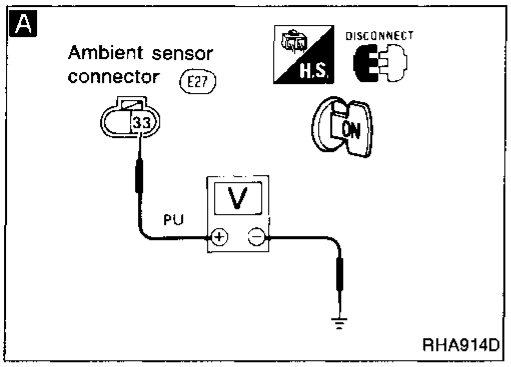
↓ O.K.

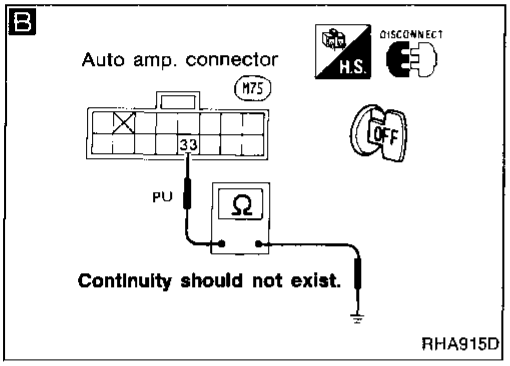
CHECK THERMAL TRANSMITTER.
Refer to EL section.

↓ O.K.

Replace auto amp.

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.





Diagnostic Procedure 8

SYMPTOM: Ambient sensor circuit is shorted. (-21 is indicated on auto amp. as a result of conducting Self-diagnosis STEP 2.)

A

CHECK AMBIENT SENSOR CIRCUIT BETWEEN AMBIENT SENSOR AND AUTO AMP.
Disconnect ambient sensor harness connector.
Do approx. 5 volts exist between ambient sensor harness terminal No. 33 and body ground?

N.G. → Disconnect auto amp. harness connector.

B

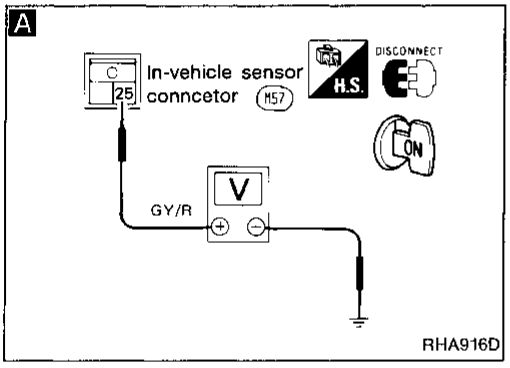
Note: Check circuit continuity between auto amp. harness terminal No. 33 and body ground.

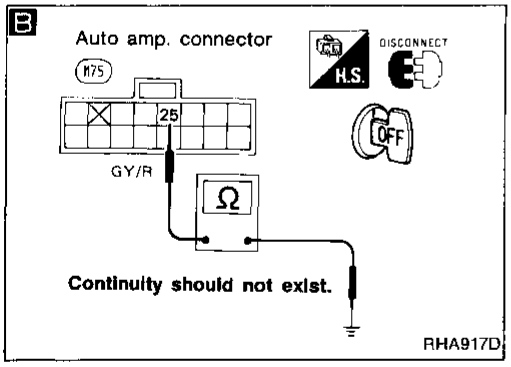
O.K. → Replace auto amp.

O.K. → CHECK AMBIENT SENSOR. (Refer to Control System Input Components.) (HA-93)

N.G. → Replace ambient sensor.

O.K. → Replace auto amp.





Diagnostic Procedure 9

SYMPTOM: In-vehicle sensor circuit is shorted. (-22 is indicated on auto amp. as a result of conducting Self-diagnosis STEP 2.)

A

CHECK IN-VEHICLE SENSOR CIRCUIT BETWEEN IN-VEHICLE SENSOR AND AUTO AMP.
Disconnect in-vehicle sensor harness connector.
Do approx. 5 volts exist between in-vehicle sensor harness terminal No. 25 and body ground?

N.G. → Disconnect auto amp. harness connector.

B

Note: Check circuit continuity between auto amp. harness terminal No. 25 and body ground.

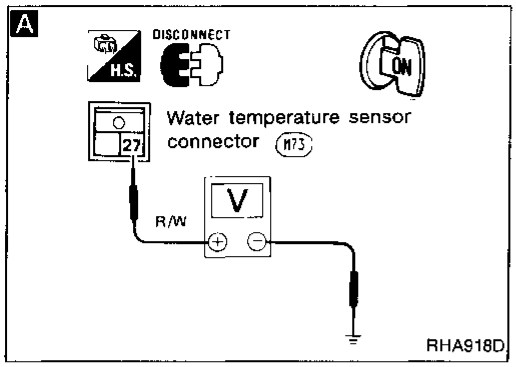
O.K. → Replace auto amp.

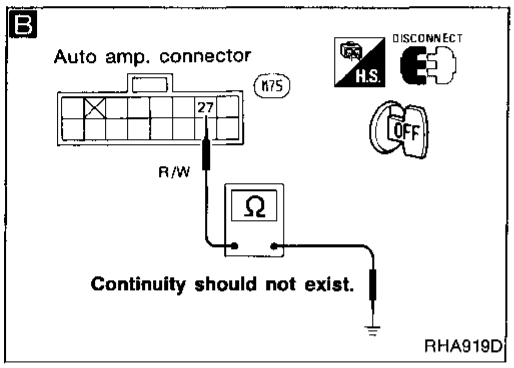
O.K. → CHECK IN-VEHICLE SENSOR. (Refer to Control System Input Components.) (HA-92)

N.G. → Replace in-vehicle sensor.

O.K. → Replace auto amp.

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector short.





Diagnostic Procedure 10

SYMPTOM: Water temperature sensor circuit is shorted. (-23 is indicated on auto amp. as a result of conducting Self-diagnosis STEP 2.)

A

CHECK WATER TEMPERATURE SENSOR CIRCUIT BETWEEN WATER TEMPERATURE SENSOR AND AUTO AMP.
Disconnect water temperature sensor harness connector.
Do approx. 5 volts exist between water temperature sensor harness terminal No. 27 and body ground?

N.G. → Disconnect auto amp. harness connector.

B

Check circuit continuity between auto amp. harness terminal No. 27 and body ground.

Note

O.K. → Replace auto amp.

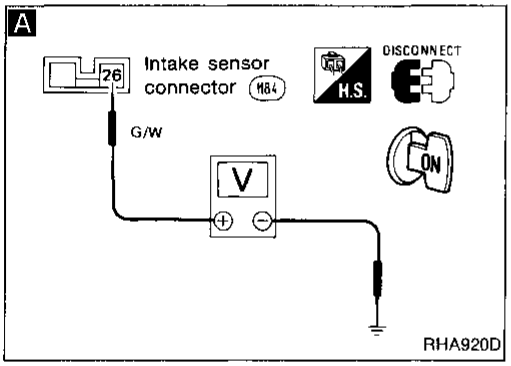
O.K. →

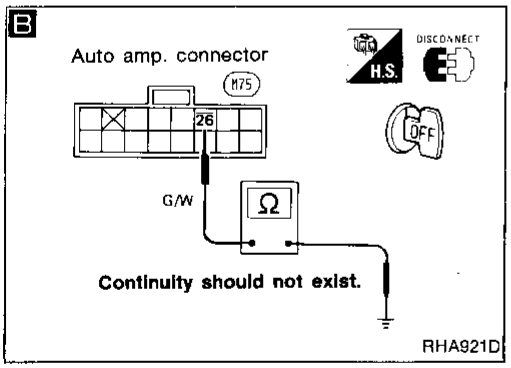
CHECK WATER TEMPERATURE SENSOR. (Refer to Control System Input Components.) (HA-95)

N.G. → Replace water temperature sensor.

O.K. →

Replace auto amp.





Diagnostic Procedure 11

SYMPTOM: Intake sensor circuit is shorted. (-24 is indicated on auto amp. as a result of conducting Self-diagnosis STEP 2.)

A

CHECK INTAKE SENSOR CIRCUIT BETWEEN INTAKE SENSOR AND AUTO AMP.
Disconnect intake sensor harness connector.
Do approx. 5 volts exist between intake sensor harness terminal No. 26 and body ground?

N.G. → Disconnect auto amp. harness connector.

B

Check circuit continuity between auto amp. harness terminal No. 26 and body ground.

Note

O.K. → Replace auto amp.

O.K. →

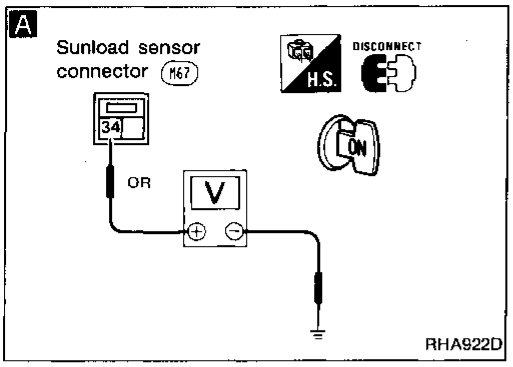
CHECK INTAKE SENSOR. (Refer to Control System Input Components.) (HA-94)

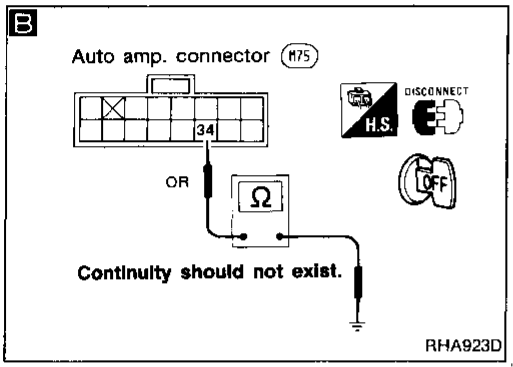
N.G. → Replace intake sensor.

O.K. →

Replace auto amp.

Note: If the result is N.G. after checking circuit continuity, repair harness or connector short.





Diagnostic Procedure 12

SYMPTOM: Sunload sensor circuit is shorted. (-25 is indicated on auto amp. as a result of conducting Self-diagnosis STEP 2.)

A

CHECK SUNLOAD SENSOR CIRCUIT BETWEEN SUNLOAD SENSOR AND AUTO AMP.
Disconnect sunload sensor harness connector.
Do approx. 5 volts exist between sunload sensor harness terminal No. 34 and body ground?

N.G. → Disconnect auto amp. harness connector.

B

Check circuit continuity between auto amp. harness terminal No. 34 and body ground.

Note

O.K. → Replace auto amp.

O.K.

CHECK SUNLOAD SENSOR.
(Refer to Control System Input Components.) (HA-94)

N.G. → Replace sunload sensor.

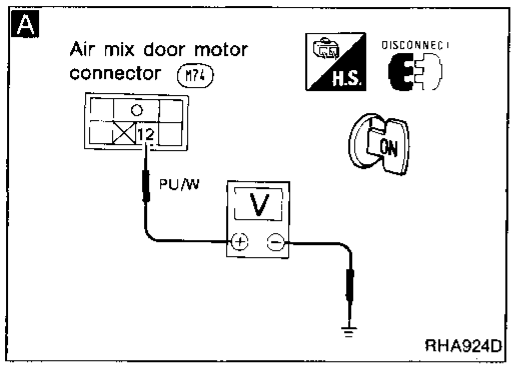
O.K.

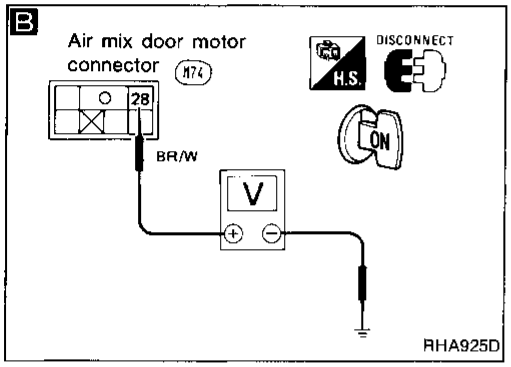
Replace auto amp.

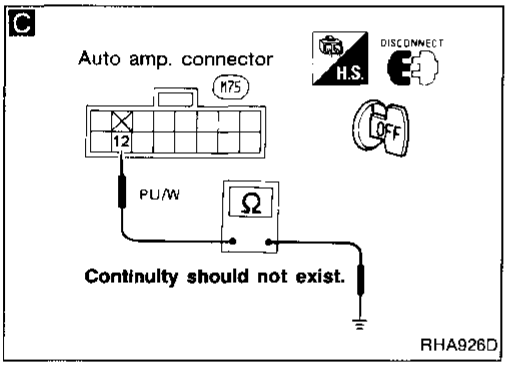
Note:
If the result is N.G. after checking circuit continuity, repair harness or connector short.

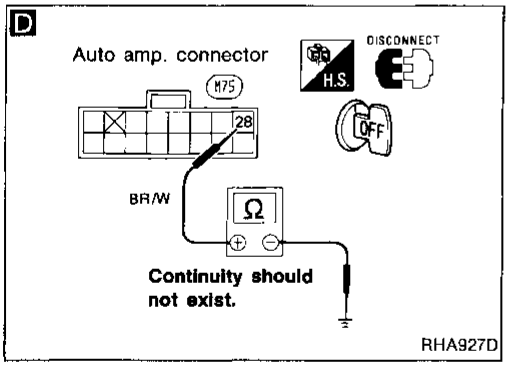
Diagnostic Procedure 13

SYMPTOM: P.B.R. circuit is shorted. (-26 is indicated on auto amp. as a result of conducting Self-diagnosis STEP 2.)









A

CHECK P.B.R. CIRCUIT BETWEEN P.B.R. AND AUTO AMP.
Disconnect air mix door motor harness connector.
Do approx. 5 volts exist between air mix door motor harness terminal No. ⑫ and body ground?

N.G. → Disconnect auto amp. harness connector.

C

Check circuit continuity between auto amp. harness terminal No. ⑫ and body ground. (Note)

O.K. → Replace auto amp.

O.K. →

B

CHECK P.B.R. CIRCUIT BETWEEN P.B.R. AND AUTO AMP.
Do approx. 5 volts exist between air mix door motor harness terminal No. ㉘ and body ground?

N.G. → Disconnect auto amp. harness connector.

D

Check circuit continuity between auto amp. harness terminal No. ㉘ and body ground. (Note)

O.K. → Replace auto amp.

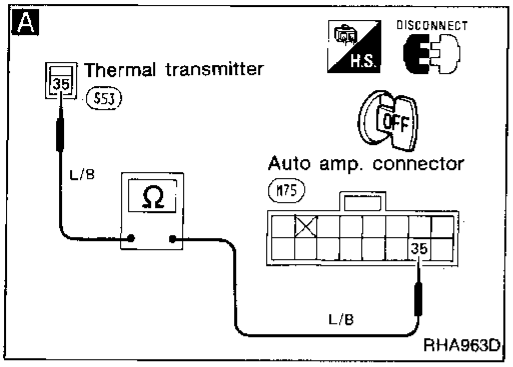
O.K. →

CHECK P.B.R.
(Refer to Control System Output Components.) (HA-100)

O.K. → INSPECTION END

N.G. → Replace air mix door motor.

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector short.



Diagnostic Procedure 14

SYMPTOM: Thermal transmitter circuit is shorted. (-27 is indicated on auto amp. as a result of conducting Self-diagnosis STEP 2.)

A

Note

CHECK THERMAL TRANSMITTER CIRCUIT BETWEEN THERMAL TRANSMITTER AND AUTO AMP.
Disconnect thermal transmitter harness connector and auto amp. harness connector.
Check circuit continuity between thermal transmitter harness terminal No. 35 and auto amp. harness terminal No. 35.

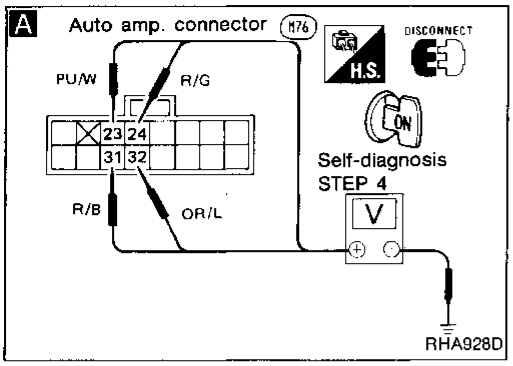
↓ O.K.

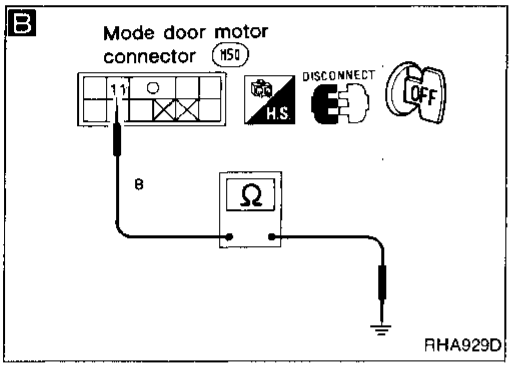
CHECK THERMAL TRANSMITTER.
Refer to EL section.

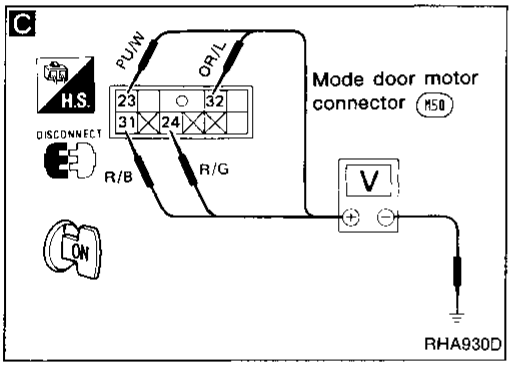
↓ O.K.

Replace auto amp.

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector short.







Diagnostic Procedure 15

SYMPTOM: Mode door motor does not operate normally.

- **Perform Self-diagnosis STEPS 1 to 4 before referring to the following flow chart.**

A

CHECK MODE DOOR MOTOR POSITION SWITCH.

1. Set up code No. 41 in Self-diagnosis STEP 4.
2. Disconnect auto amp. harness connector after turning ignition switch OFF.
3. Check if continuity exists between terminal No. (23) or (24) of auto amp. harness connector and body ground.
4. Using above procedure, check for continuity in any other mode, as indicated in chart.

Code No.	Condition	Terminal No. ⊕	Terminal No. ⊖	Continuity
41	VENT	(32)	Body ground	Yes
42 or 43	B/L	(24)		
44	F/D 1	(31)		
45	F/D 2	(23) or (24) or (32)		
46	DEF	(23) or (31) or (24)		

N.G. → Disconnect mode door motor harness connector.

O.K. ↓

INSPECTION END

B Note

CHECK BODY GROUND CIRCUIT FOR MODE DOOR MOTOR.
Does continuity exist between mode door motor harness terminal No. (11) and body ground?

O.K. ↓

Reconnect auto amp. harness connector.

C

CHECK POWER SUPPLY FOR MODE DOOR MOTOR CONTROL CIRCUIT.
Do approx. 5 volts exist between mode door motor harness terminals and body ground?

Terminal No. ⊕	Terminal No. ⊖	Voltage
(24)	Body ground	Approx. 5V
(23)		
(31)		
(32)		

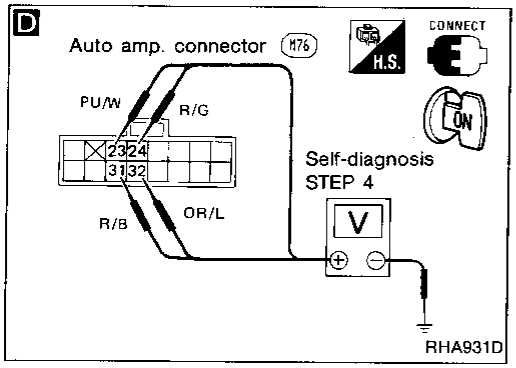
O.K. → Reconnect mode door motor harness connector. → Ⓐ (Go to next page.)

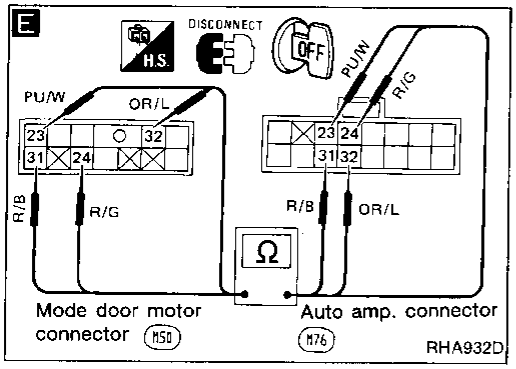
N.G. → Ⓑ (Go to next page.)

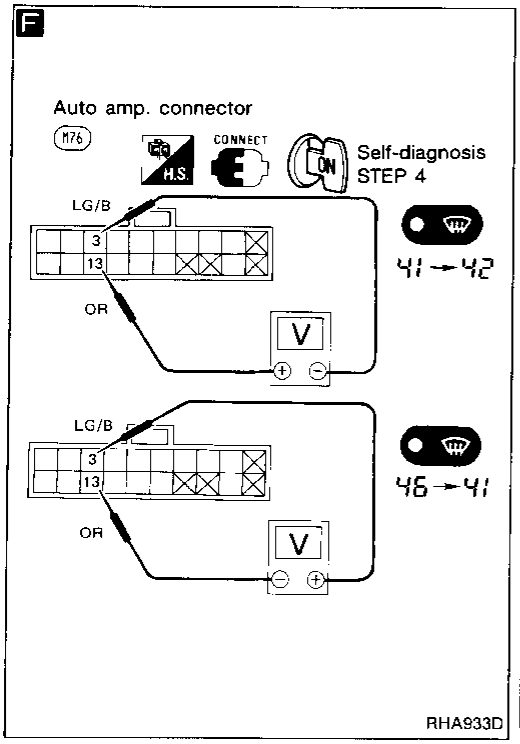
Note:

If the result is N.G. after checking circuit continuity, repair harness or connector.

Diagnostic Procedure 15 (Cont'd)







Ⓐ

D

CHECK MODE DOOR MOTOR POSITION SWITCH.
Set up Self-diagnosis STEP 4.
Measure voltage across auto amp. harness terminals and body ground.

Code No.	Condition	Terminal No. ⊕ ㉔	㉓	㉛	㉜	Terminal No. ⊖
41	VENT	5V	5V	5V	0V	Body ground
42	B/L1	0V	5V	5V	5V	
43	B/L2	5V	5V	0V	5V	
44	D/F 1	5V	0V	5V	5V	
45	D/F 2	0V	0V	5V	0V	
46	DEF	0V	0V	0V	5V	

0V: Approx. 0V
5V: Approx. 5V

O.K. → **F**

N.G. → Replace mode door motor.

Ⓑ

E Note

Check circuit continuity between each terminal on auto amp. and on mode door motor.

Terminal No. ⊕ Auto amp.	Terminal No. ⊖ Mode door motor	Continuity
㉜	㉜	Yes
㉛	㉛	
㉓	㉓	
㉔	㉔	

O.K. → Replace auto amp.

F

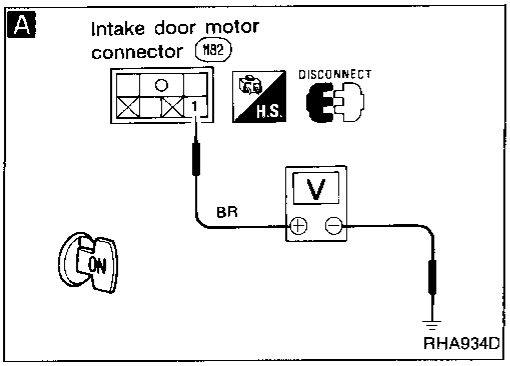
CHECK FOR OUTPUT OF AUTO AMP.
Do approx. 10.5 volts exist between auto amp. harness terminals No. ⑬ and ③ when code No. is switched from "41" to "42" or when code No. is switched from "46" to "41"?

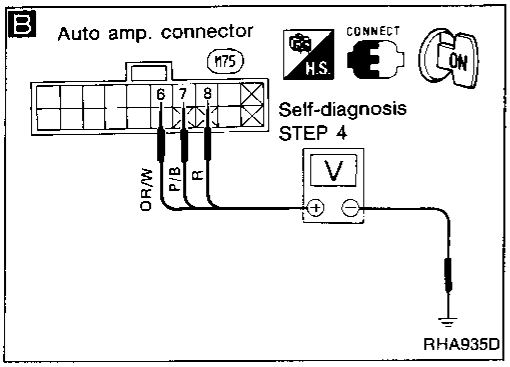
N.G. → Replace auto amp.

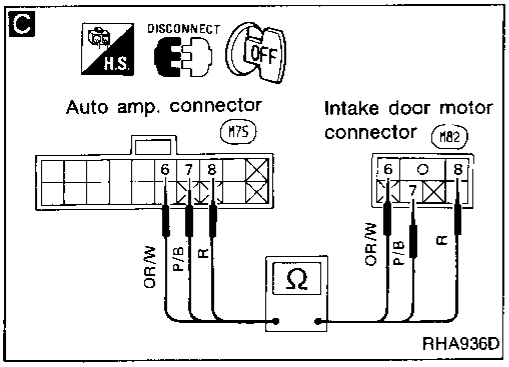
Code No.	Mode door motor operation	Terminal No. ⑬	Terminal No. ③	Voltage V
41→42	VENT → B/L	⊕	⊖	Approx. 10.5
46→41	DEF → VENT	⊖	⊕	
–	Stop	–	–	0

O.K. → Replace mode door motor.

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.







Diagnostic Procedure 16

SYMPTOM: Intake door motor does not operate normally.

- **Perform Self-diagnosis STEPS 1, 2 and 4 before referring to the following flow chart.**

A

CHECK POWER SUPPLY FOR INTAKE DOOR MOTOR.
Disconnect intake door motor harness connector.
Do approx. 12 volts exist between intake door motor harness terminal No. ① and body ground?

N.G. → Check 10A fuse at fuse block.
(Refer to "POWER SUPPLY ROUTING" in EL section and Wiring Diagram.)

O.K. ↓

Reconnect intake door motor harness connector.

B

CHECK FOR OUTPUT OF AUTO AMP.
Set up Self-diagnosis STEP 4.
Measure voltage across auto amp. harness terminals and body ground.

Code No.	Terminal No. ⊕	Terminal No. ⊖	Condition	Voltage V
41, 42	⑧	Body ground	REC	0
Other				12
43	⑦		20% FRE	0
Other				12
44, 45, 46	⑥		FRE	0
Other				12

0V: Approx. 0V
12V: Approx. 12V

N.G. → Disconnect auto amp. and intake door motor harness connectors.

C Note

Check circuit continuity between each terminal on auto amp. and on intake door motor.

Terminal No. ⊕ (Auto amp.)	Terminal No. ⊖ (Intake door motor)	Continuity
⑧	⑧	Yes
⑦	⑦	
⑥	⑥	

O.K. ↓

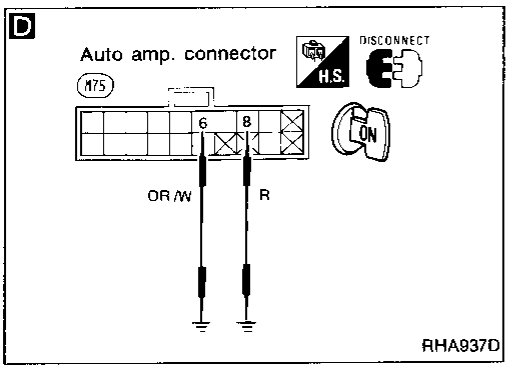
Ⓐ
(Go to next page.)

O.K. ↓

INSPECTION END

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.

Diagnostic Procedure 16 (Cont'd)



Ⓐ

Reconnect intake door motor harness connector.

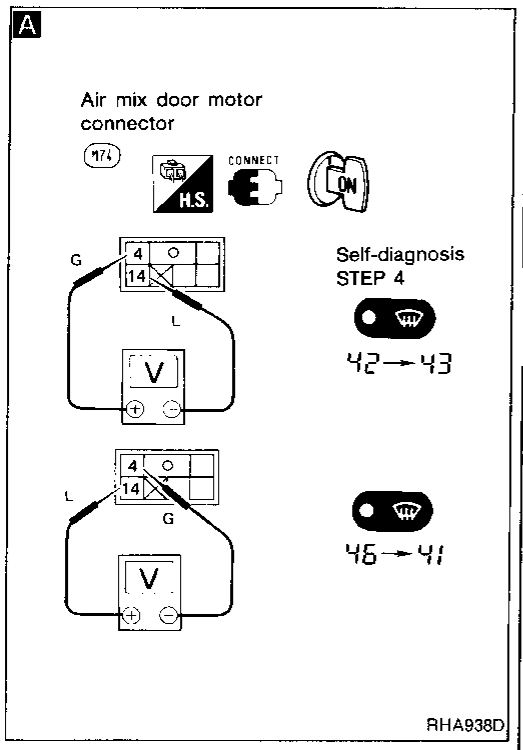
D

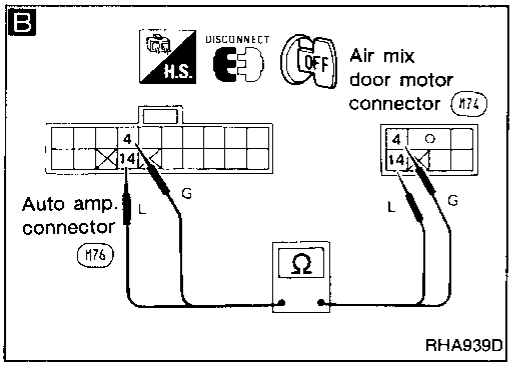
CHECK INTAKE DOOR MOTOR.
Does intake door move to "REC" position after connecting auto amp. harness terminal No. ⑥ and body ground with a jumper cable?
Then, does intake door move to "FRE" position after connecting auto amp. harness terminal No. ⑧ and body ground with a jumper cable?

N.G. → Replace intake door motor.

O.K. ↓

Replace auto amp.





Diagnostic Procedure 17

SYMPTOM: Air mix door motor does not operate normally.

- **Perform Self-diagnosis STEPS 1, 2 and 4 before referring to the following flow chart.**

IS P.B.R. OPERATING NORMALLY?
Refer to Self-diagnoses STEP 2.

N.G. → CHECK P.B.R. CIRCUIT. Go to Diagnostic Procedure 6 or 13.

O.K. ↓

A

CHECK FOR OUTPUT OF AUTO AMP.
Set up Self-diagnosis STEP 4.
Do approx. 10.5 volt exist between air mix door motor harness terminals No. ④ and ⑭ when code No. is switched from "42" to "43" or when code No. is switched from "46" to "41"?

N.G. → Disconnect auto amp. and air mix door motor harness connectors.

Code No.	Air mix door operation	Terminal No. ④	Terminal No. ⑭	Voltage V
42 → 43	Cold → Hot	⊕	⊖	Approx. 10.5
46 → 41	Hot → Cold	⊖	⊕	
–	Stop	–	–	0

B

Note: Check circuit continuity between auto amp. harness terminal No. ④ (⑭) and air mix door motor harness terminal No. ④ (⑭).

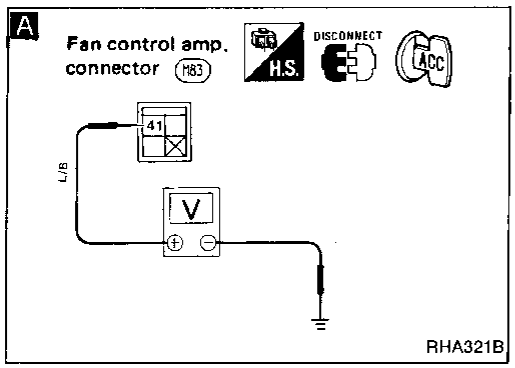
O.K. ↓

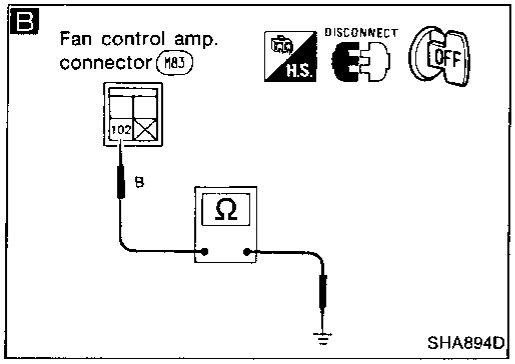
Replace auto amp.

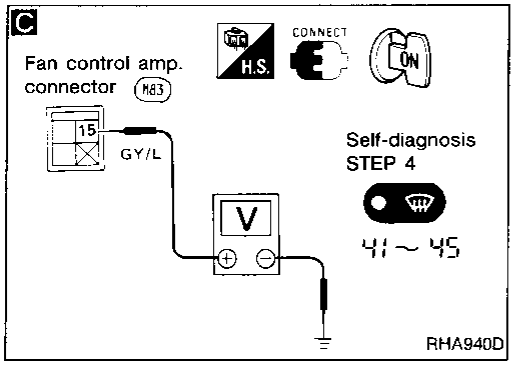
O.K. ↓

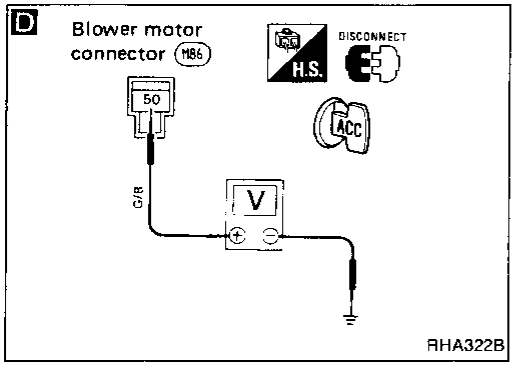
Replace air mix door motor.

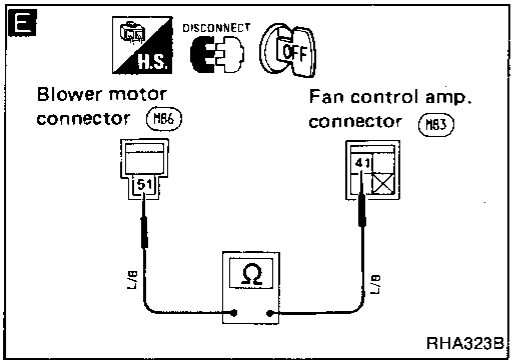
Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.











Diagnostic Procedure 18

SYMPTOM: Blower motor operation is malfunctioning under out of Starting Fan Speed Control.

- **Perform Preliminary Check 5 before referring to the following flow chart.**

A

CHECK POWER SUPPLY FOR FAN CONTROL AMP.
Disconnect fan control amp. harness connector.
Do approx. 12 volts exist between fan control amp. harness terminal No. 41 and body ground?

N.G. → **D**

CHECK POWER SUPPLY FOR BLOWER MOTOR.
Disconnect blower motor harness connector.
Do approx. 12 volts exist between blower motor harness terminal No. 50 and body ground?

O.K. ↓

N.G. → Check 15A fuses at fuse block. (Refer to "POWER SUPPLY ROUTING" in EL section and Wiring Diagram.)

B Note

CHECK BODY GROUND CIRCUIT FOR FAN CONTROL AMP.
Does continuity exist between fan control amp. harness terminal No. 102 and body ground?

O.K. ↓

Reconnect fan control amp. harness connector.

E Note

Check circuit continuity between blower motor harness terminal No. 51 and fan control amp. harness terminal No. 41.

O.K. ↓

C

CHECK FOR OUTPUT OF AUTO AMP.
Set up Self-diagnosis STEP 4.
Measure voltage across fan control amp. harness terminal No. 15 and body ground.

Code No.	Terminal No. ⊕	Terminal No. ⊖	Voltage
41 → 45	15	Body ground	Approx. 1 - 3V

N.G. → Ⓐ (Go to next page.)

O.K. ↓

Replace fan control amp.

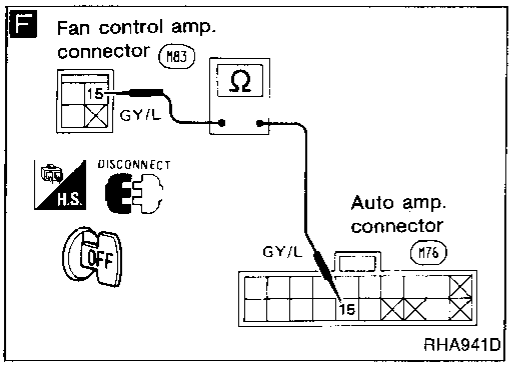
CHECK BLOWER MOTOR. (Refer to Electrical Components Inspection.) (HA-88)

N.G. ↓

Replace blower motor.

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.

Diagnostic Procedure 18 (Cont'd)



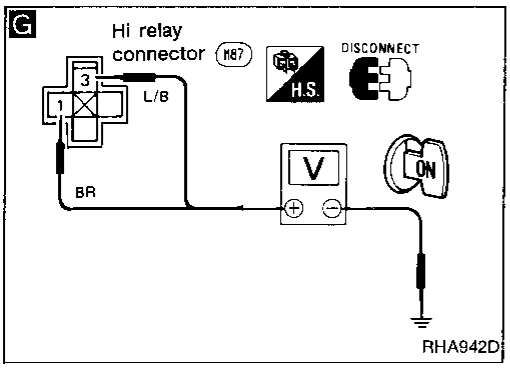
Ⓐ

Disconnect auto amp. and fan control amp. harness connector.

F Note

Does continuity exist between auto amp. harness terminal No. ⑮ and fan control amp. harness terminal No. ⑮ ?

O.K.



G

CHECK POWER SUPPLY FOR HI RELAY.
Do approx. 12 volts exist between Hi relay harness terminals No. ① , ③ and body ground?

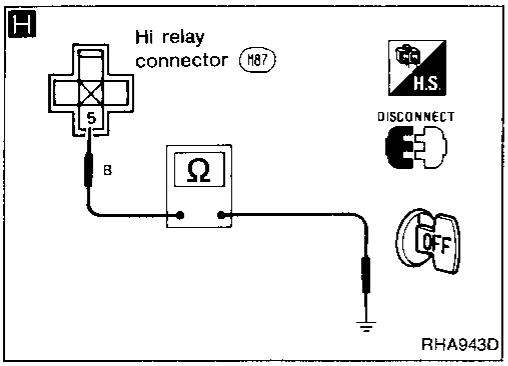
N.G. → Check 10A or 15A fuses at fuse block.
(Refer to "POWER SUPPLY ROUTING" in EL section and Wiring Diagram.)

O.K.

H Note

CHECK BODY GROUND CIRCUIT FOR HI RELAY.
Does continuity exist between Hi relay harness terminal No. ⑤ and body ground?

O.K.

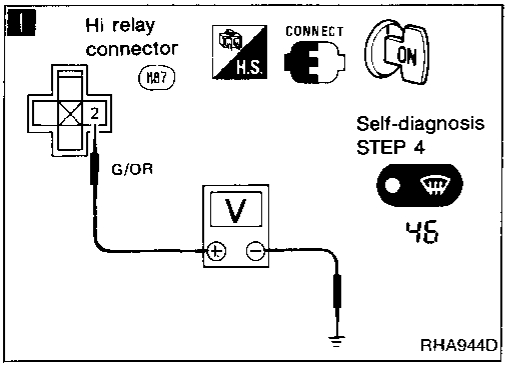


CHECK HI RELAY AFTER DISCONNECTING IT.
(Refer to Electrical Components Inspection.) (HA-88)

N.G. → Replace Hi relay.

O.K.

Reconnect Hi relay.



I

CHECK FOR OUTLET OF AUTO AMP.
Set up Self-diagnosis STEP 4.
Measure voltage across Hi relay harness terminal No. ② and body ground.

Code No.	Terminal No. ⊕	Terminal No. ⊖	Voltage
46	②	Body ground	Less than approx. 1.5V

N.G. → Disconnect Hi relay and auto amp. harness connectors.

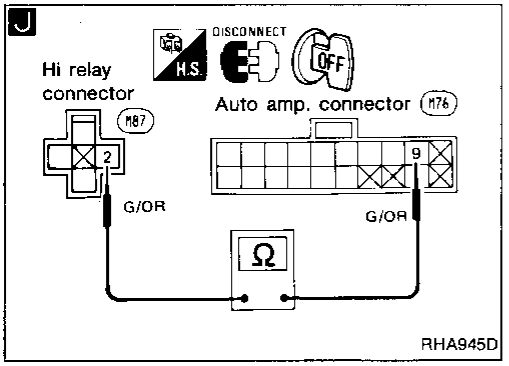
J Note

Does continuity exist between Hi relay harness terminal No. ② and auto amp. harness terminal No. ⑨ ?

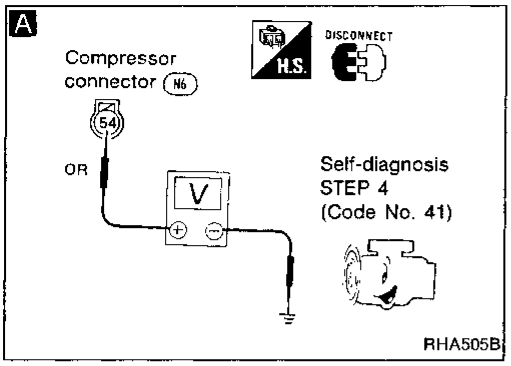
O.K. → Replace auto amp.

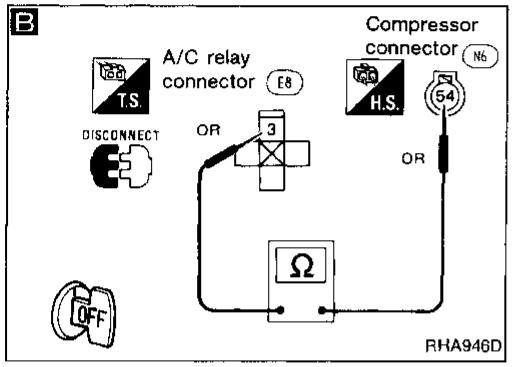
O.K.

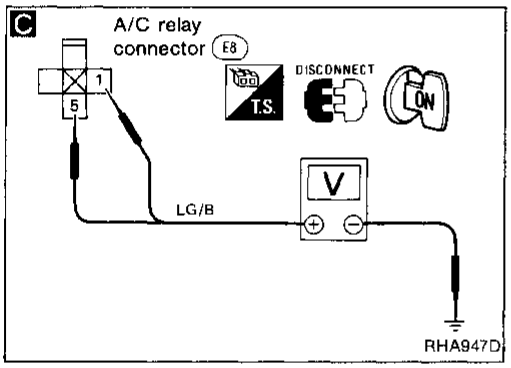
Replace blower motor.



Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.







Diagnostic Procedure 19

SYMPTOM: Magnet clutch does not engage after performing Preliminary Check 6.

- **Perform Preliminary Check 6 before referring to the flow chart.**

A

CHECK POWER SUPPLY FOR COMPRESSOR.
1. Disconnect compressor harness connector.
2. Set up code No.44 in Self-diagnosis STEP 4.
3. Do approx. 12 volts exist between compressor harness terminal No. 54 and body ground?

N.G. → Disconnect A/C relay harness connector.

B

Check circuit continuity between A/C relay harness terminal No. 3 and compressor harness terminal No. 54

Note

O.K. ↓

Check magnet clutch.

N.G. ↓

Replace magnet clutch.

O.K. → Turn ignition switch OFF to cancel Self-diagnosis STEP 4.

C

CHECK POWER SUPPLY FOR A/C RELAY.
Disconnect A/C relay.
Do approx. 12 volts exist between A/C relay harness terminal No. 1, 5 and body ground?

N.G. → CHECK POWER SUPPLY CIRCUIT AND 10A FUSE AT FUSE BLOCK. (Refer to "POWER SUPPLY ROUTING" in EL section and Wiring Diagram.)

O.K. ↓

CHECK A/C RELAY AFTER DISCONNECTING IT. (Refer to Electrical Components Inspection.) (HA-88)

N.G. → Replace A/C relay.

O.K. ↓

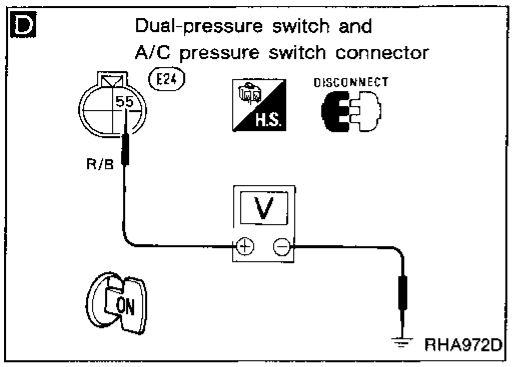
Reconnect A/C relay.

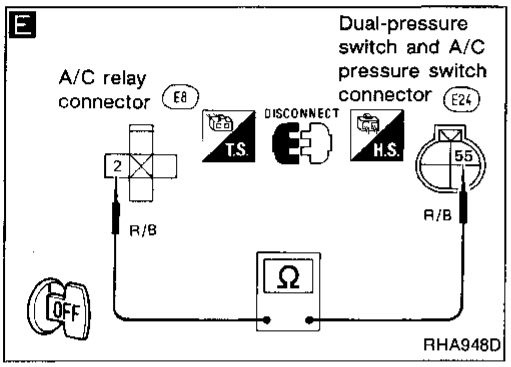
Ⓐ

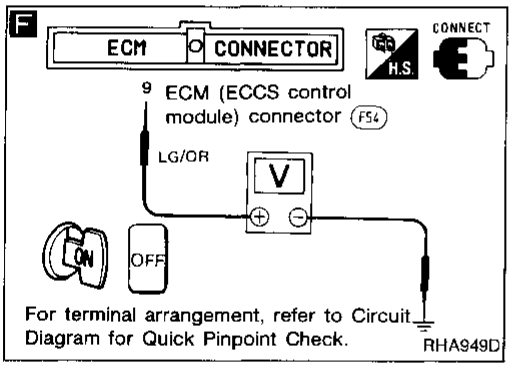
(Go to next page.)

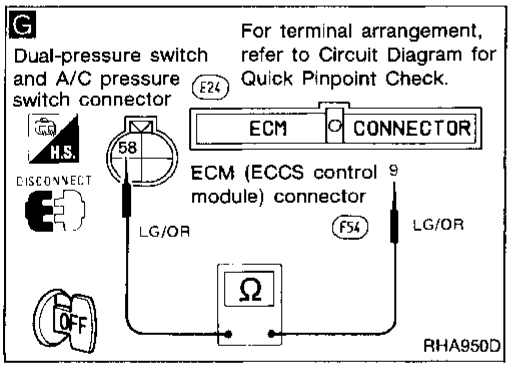
Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.

Diagnostic Procedure 19 (Cont'd)









Ⓐ

D

CHECK DUAL-PRESSURE SWITCH CIRCUIT BETWEEN DUAL-PRESSURE SWITCH AND A/C RELAY
Disconnect dual-pressure switch and A/C pressure switch harness connector.
Do approx. 12 volts exist between dual-pressure switch and A/C pressure switch harness terminal No. ⑤⑤ and body ground?

N.G. → Disconnect A/C relay harness connector.

E Note

Check circuit continuity between A/C relay harness terminal No. ② and dual-pressure switch and A/C pressure switch harness terminal No. ⑤⑤.

O.K. ↓

CHECK DUAL-PRESSURE SWITCH.
(Refer to Electrical Components Inspection.) (HA-88)

N.G. → Replace dual-pressure switch.

O.K. ↓

Reconnect dual-pressure switch and A/C pressure switch harness connector.

F

CHECK COIL SIDE CIRCUIT OF A/C RELAY.
Do approx. 12 volts exist between ECM (ECCS control module) harness terminal No. ⑨ and body ground?

N.G. → **G** Note

Check circuit continuity between dual-pressure switch and A/C pressure switch harness terminal No. ⑤⑧ and ECM (ECCS control module) harness terminal No. ⑨.

O.K. ↓

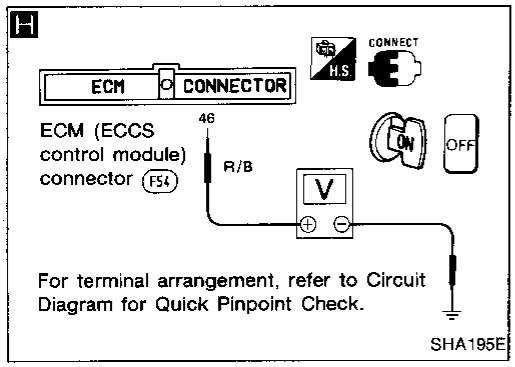
Reconnect ECM (ECCS control module) harness connector.

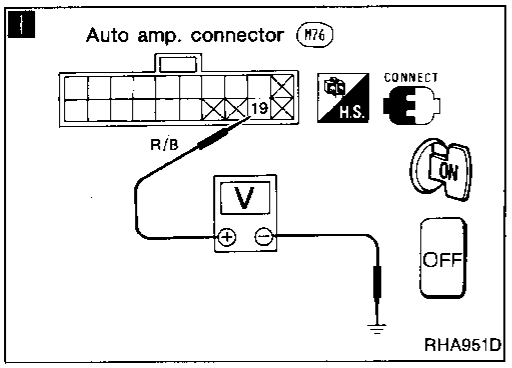
Ⓑ

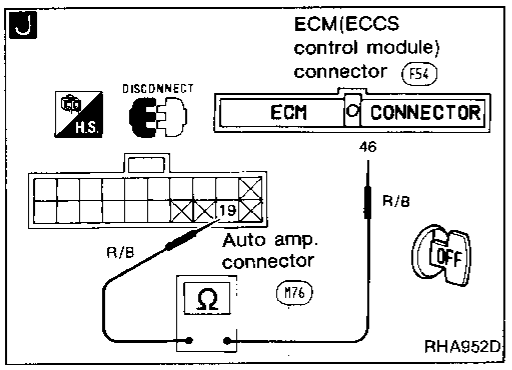
(Go to next page)

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.

Diagnostic Procedure 19 (Cont'd)







(B)

H

CHECK COIL SIDE CIRCUIT OF A/C RELAY CONTROLLED BY ECM (ECCS CONTROL MODULE). Do approx. 8 to 9 volts exist between ECM (ECCS control module) harness terminal No. 46 and body ground?

N.G. → CHECK ECM (ECCS CONTROL MODULE). (Refer to EF & EC section.)

O.K. ↓

Disconnect auto amp. harness connector.

I

CHECK AUTO AMP. CIRCUIT BETWEEN ECM (ECCS CONTROL MODULE) AND AUTO AMP. Do approx. 8 to 9 volts exist between auto amp. harness terminal No. 19 and body ground?

N.G. → J Note: Check circuit continuity between auto amp. harness terminal No. 19 and ECM (ECCS control module) harness terminal No. 46.

O.K. ↓

Replace auto amp.

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.

Diagnostic Procedure 20

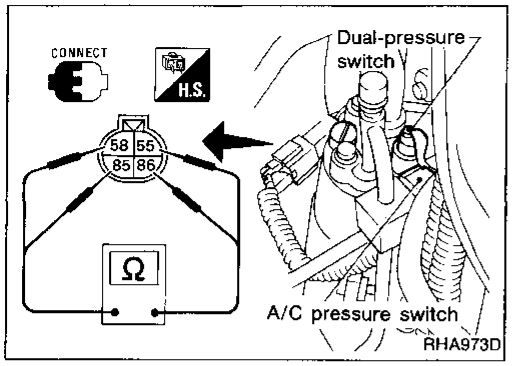
SYMPTOM: Self-diagnosis cannot be performed.

CHECK MAIN POWER SUPPLY AND GROUND CIRCUIT FOR AUTO AMP. (Refer to page HA-65.)

N.G. → Repair Main Power Supply and Ground Circuit.

O.K. ↓

Replace auto amp.



Electrical Components Inspection

DUAL-PRESSURE SWITCH

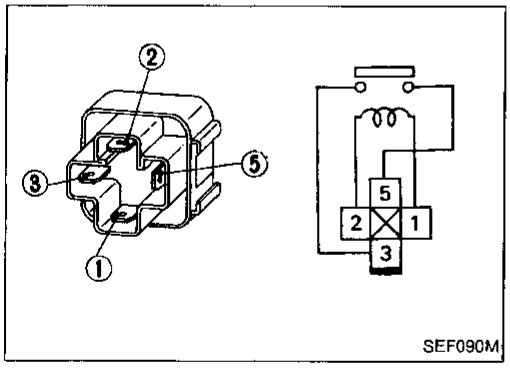
Check continuity between terminals ⑤⑤ and ⑤⑧.

High-pressure side line pressure kPa (kg/cm^2, psi)	Operation	Continuity
Decreasing to 177 - 216 (1.8 - 2.2, 26 - 31) Increasing to 2,452 - 2,844 (25 - 29, 356 - 412)	Turn OFF	Does not exist
Increasing to 177 - 235 (1.8 - 2.4, 26 - 34) Decreasing to 1,863 - 2,256 (19 - 23, 270 - 327)	Turn ON	Exists

A/C PRESSURE SWITCH

Check continuity between terminals ⑧⑤ and ⑧⑥.

High-pressure side line pressure kPa (kg/cm^2, psi)	Operation	Continuity
Decreasing to 1,226 - 1,324 (12.5 - 13.5, 178 - 192)	Turn OFF	Does not exist
Increasing to 1,422 - 1,520 (14.5 - 15.5, 206 - 220)	Turn ON	Exists

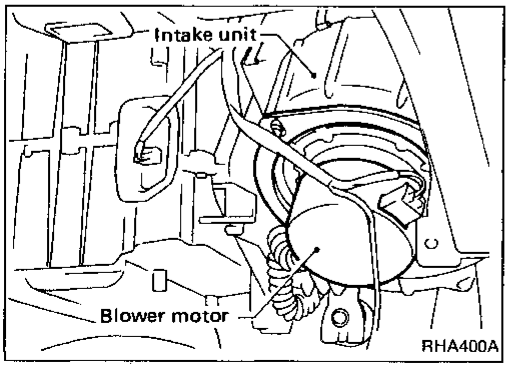


A/C RELAY, CONDENSER FAN RELAYS AND BLOWER HIGH RELAY

Check continuity between terminals ③ and ⑤.

Conditions	Continuity
12V direct current supply between terminals ① and ②.	Yes
No current supply	No

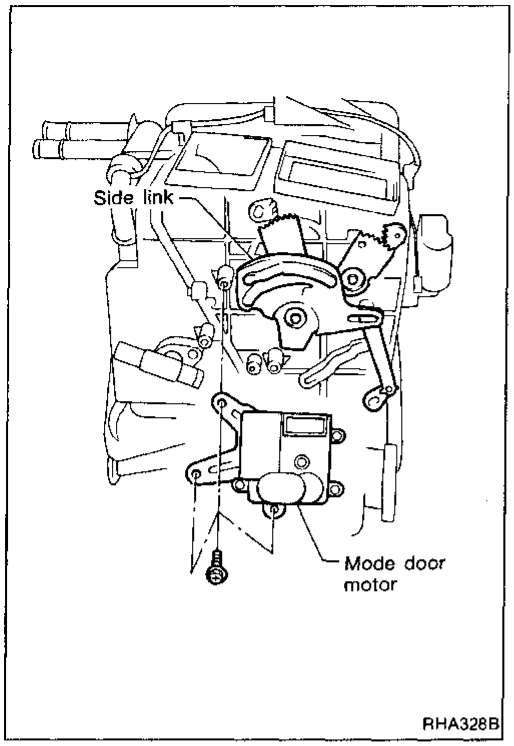
If N.G., replace relay.



BLOWER MOTOR

Confirm smooth rotation of the blower motor.

- Ensure that there are no foreign particles inside the intake unit.

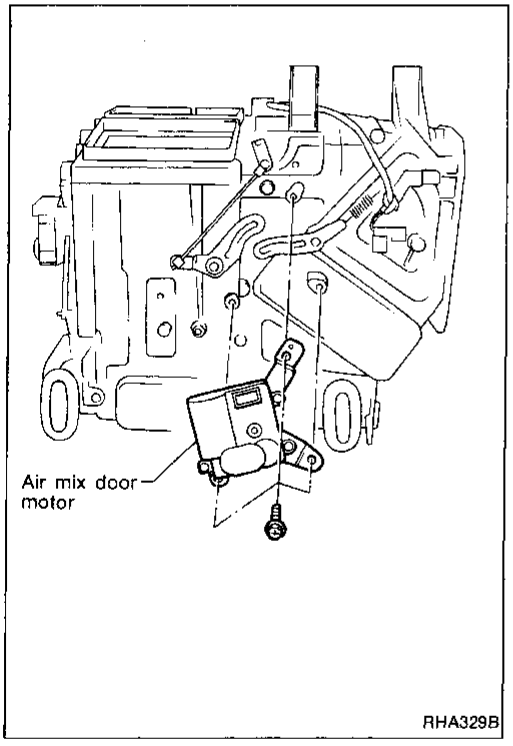


Control Linkage Adjustment

MODE DOOR

1. Install mode door motor on heater unit and connect it to body harness.
2. Set up code No. 41 in Self-diagnosis STEP 4.
3. Move side link by hand and hold mode door in VENT mode.
4. Attach mode door motor rod to side link rod holder.
5. Check mode door operates properly when changing code No. 41 to 46 by pushing (DEF) switch.

41	42	43	44	45	46
VENT	B/L	B/L	D/F1	D/F2	DEF

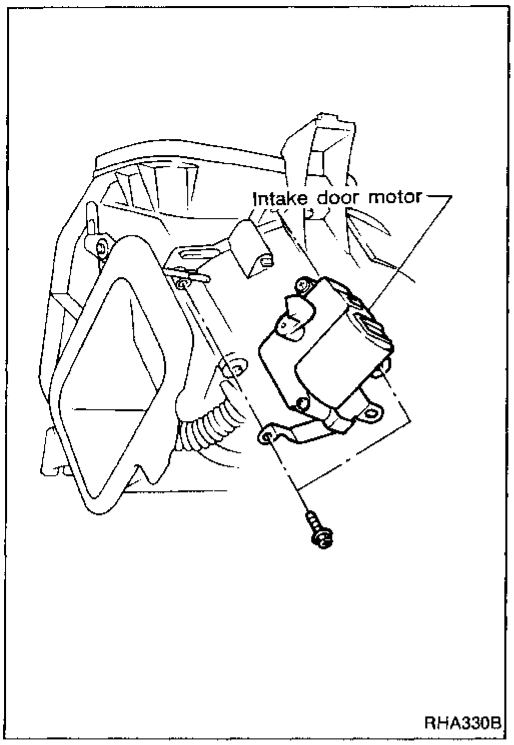


AIR MIX DOOR

1. Install air mix door motor on heater unit and connect it to body harness.
2. Set up code No. 41 in Self-diagnosis STEP 4.
3. Move air mix door lever by hand and hold it at full cold position.
4. Attach air mix door lever to rod holder.
5. Check air mix door operates properly when changing code No. 41 to 46 by pushing (DEF) switch.

41	42	43	44	45	46
Full Cold		Full Hot			

Control Linkage Adjustment (Cont'd)



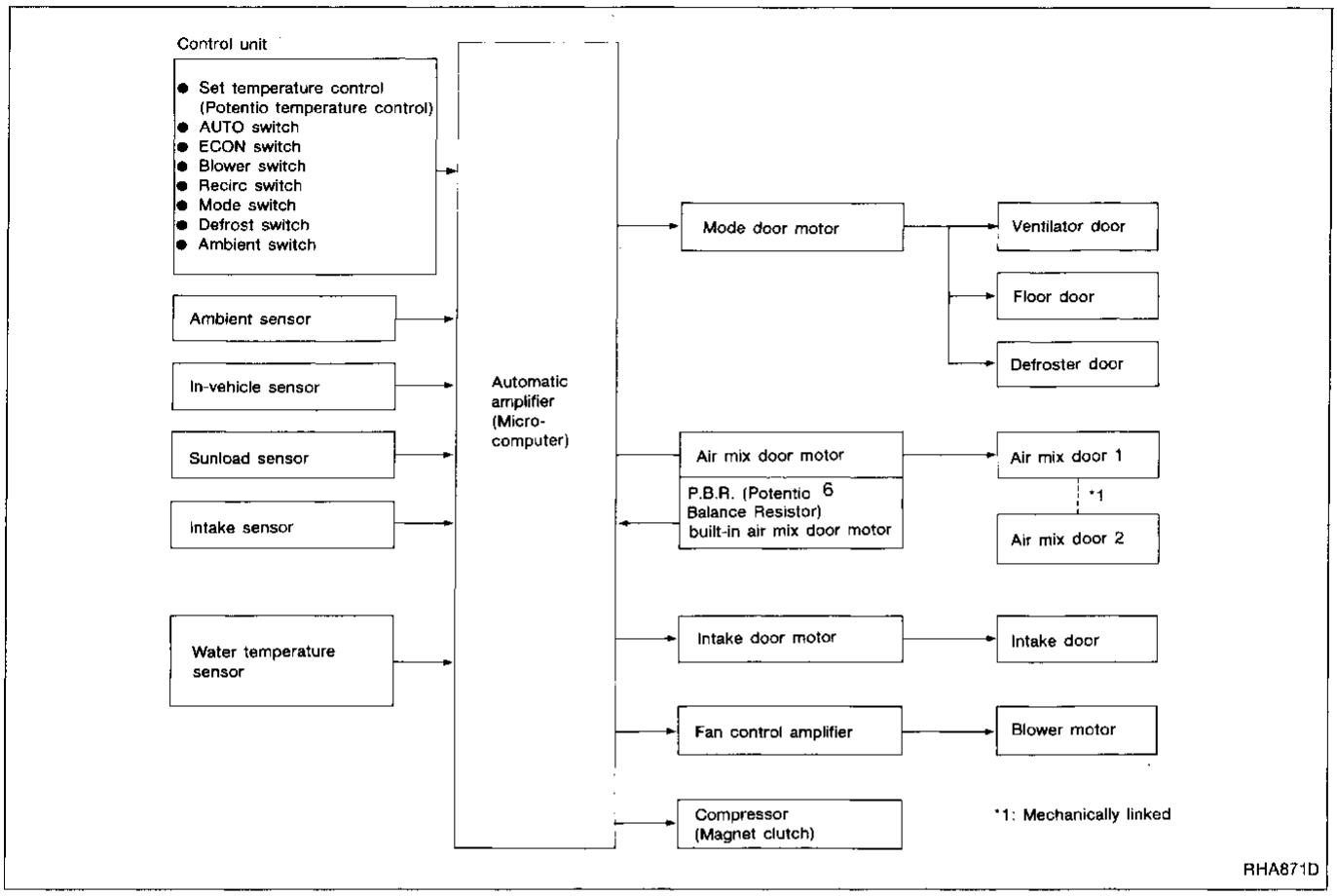
INTAKE DOOR

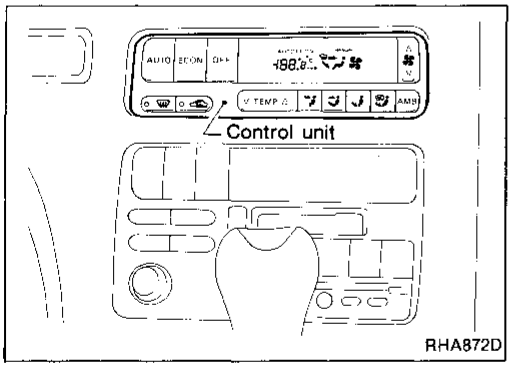
1. Install intake door motor on intake unit and connect it to body harness.
2. Set up code No. 41 in Self-diagnosis STEP 4.
3. Move intake door link by hand and hold it at REC position.
4. Attach intake door lever to rod holder.
5. Check intake door operates properly when changing code No. 41 to 46 by pushing (DEF) switch.

41	42	43	44	45	46
REC		20% FRE	FRE		

Overview of Control System

The control system consists of a) input sensors and switches, b) the automatic amplifier (microcomputer), and c) outputs. The relationship of these components is shown in the diagram below:

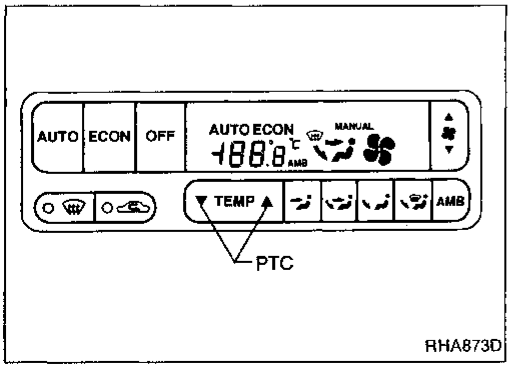




Control System Input Components

CONTROL UNIT

By means of multiplex communication, the control unit signals to the auto amp. the switch position and display mode.



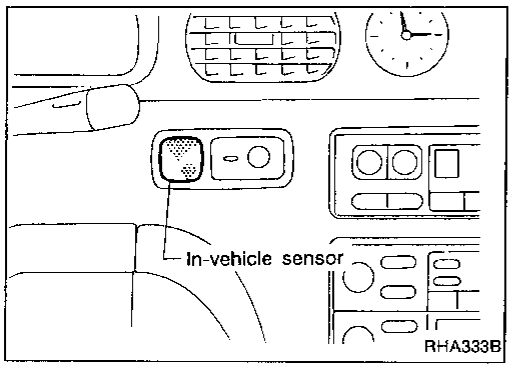
POTENTIO TEMPERATURE CONTROL (P.T.C.)

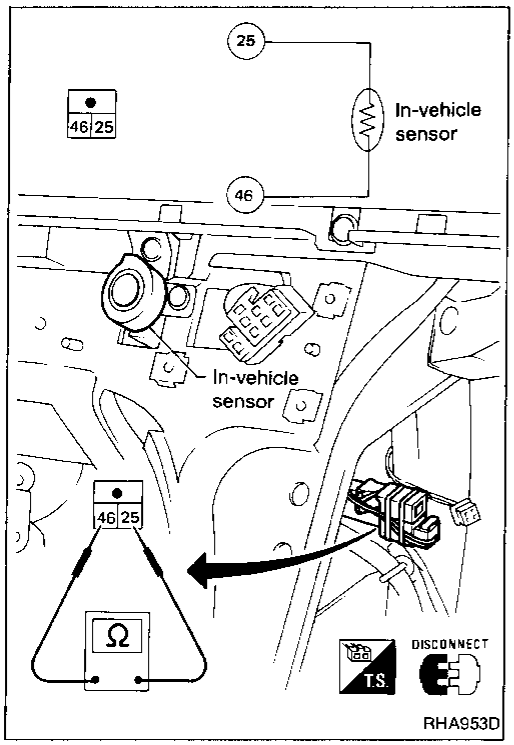
The P.T.C. is built into the auto amplifier. It can be set at an interval of 0.5°C (1.0°F) in the 18°C (65°F) to 32°C (85°F) temperature range by pushing the temperature switch [▲ (HOT) or ▼ (COLD)].

Control System Input Components (Cont'd)

IN-VEHICLE SENSOR

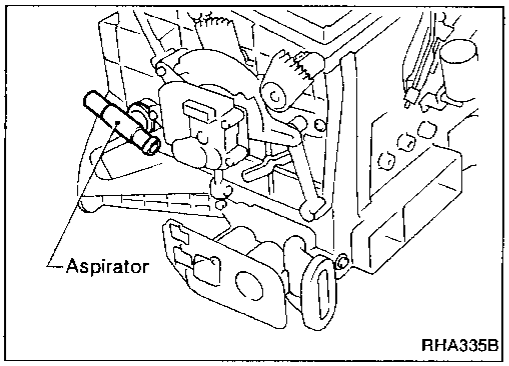
The in-vehicle sensor is attached to cluster lid C. It converts variations in temperature of compartment air drawn from the aspirator into a resistance value which is then input into the auto amplifier.





After disconnecting in-vehicle sensor harness connector, measure resistance between terminals ㉕ and ㊻ at sensor harness side, using the table below.

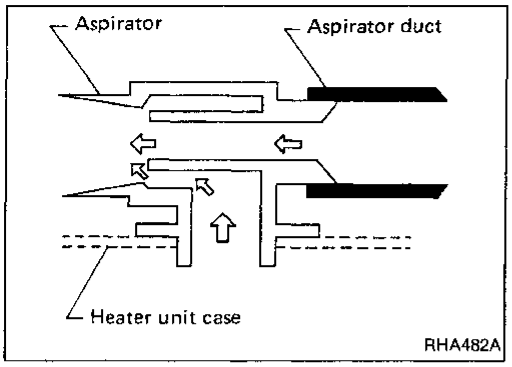
Temperature °C (°F)	Resistance kΩ
–35 (–31)	38.57
–30 (–22)	28.84
–25 (–13)	21.83
–20 (–4)	16.72
–15 (5)	12.95
–10 (14)	10.14
–5 (23)	8.02
0 (32)	6.41
5 (41)	5.17
10 (50)	4.21
15 (59)	3.46
20 (68)	2.87
25 (77)	2.41
30 (86)	2.03
35 (95)	1.73
40 (104)	1.49
45 (113)	1.29
50 (122)	1.13
55 (131)	0.99
60 (140)	0.88
65 (149)	0.79

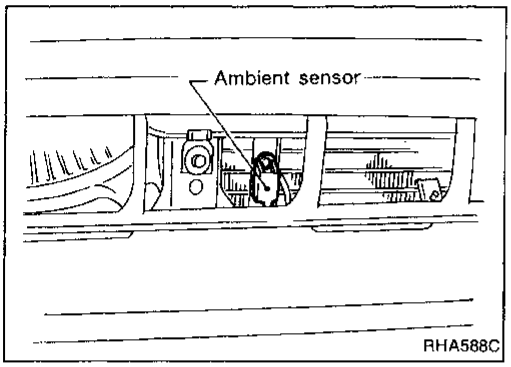


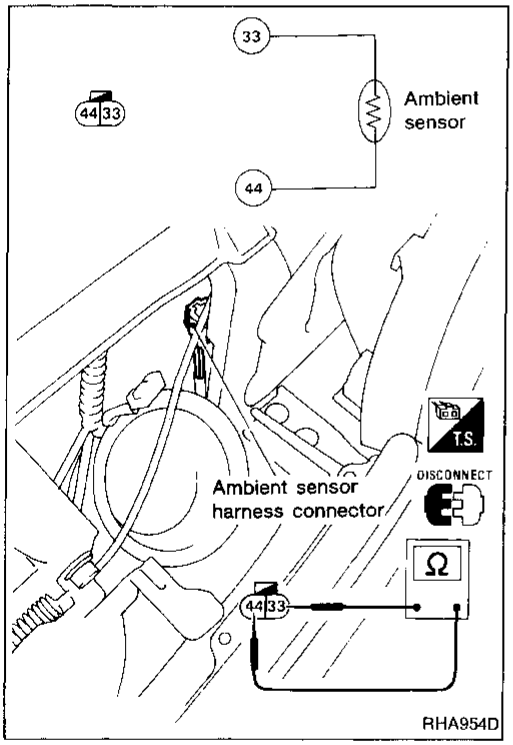
ASPIRATOR

The aspirator is located below the side link of heater unit. It produces vacuum pressure due to air discharged from the heater unit, continuously taking compartment air in the aspirator.

Control System Input Components (Cont'd)







AMBIENT SENSOR

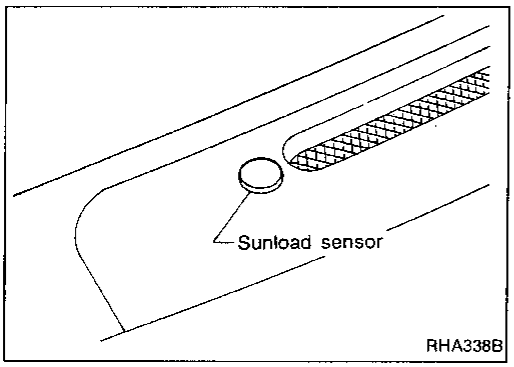
The ambient sensor is attached in front of the driver's side condenser. It detects ambient temperature and converts it into a resistance value which is then input to the auto amplifier.

After disconnecting ambient sensor harness connector, measure resistance between terminals ㉝ and ㊹ at sensor harness side, using the table below.

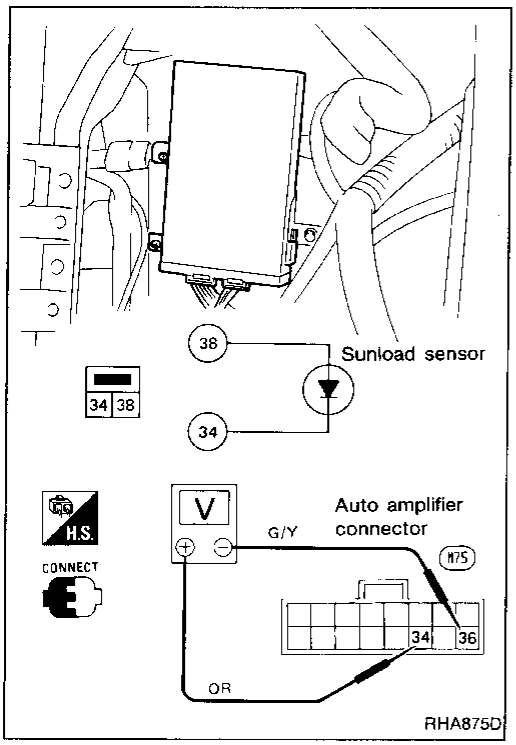
Temperature °C (°F)	Resistance kΩ
–35 (–31)	38.35
–30 (–22)	28.62
–25 (–13)	21.61
–20 (–4)	16.50
–15 (5)	12.73
–10 (14)	9.92
–5 (23)	7.80
0 (32)	6.19
5 (41)	4.95
10 (50)	3.99
15 (59)	3.24
20 (68)	2.65
25 (77)	2.19
30 (86)	1.81
35 (95)	1.51
40 (104)	1.27
45 (113)	1.07
50 (122)	0.91
55 (131)	0.77
60 (140)	0.66
65 (149)	0.57

Control System Input Components (Cont'd)

SUNLOAD SENSOR



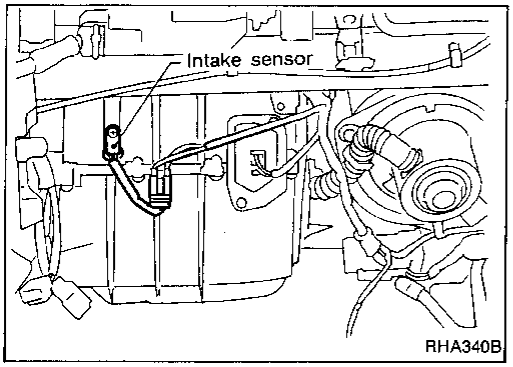
The sunload sensor is located on the right defroster grille. It detects sunload entering through windshield by means of a photo diode and converts it into a current value which is then input to the auto amplifier.



Measure voltage between terminals ㉞ and ㊳ at vehicle harness side, using the table below.

Input current mA	Output voltage V
0	5.0
0.1	4.1
0.2	3.1
0.3	2.2
0.4	1.3
0.5	0.4

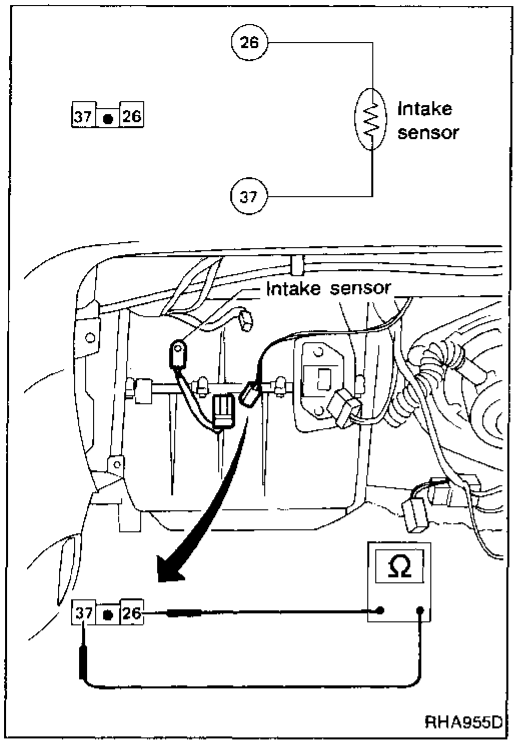
- **When checking sunload sensor, select a place where sun shines directly on it.**



INTAKE SENSOR

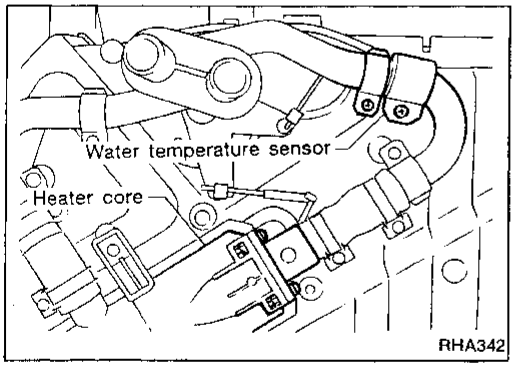
The intake sensor is located on the cooling unit. It converts temperature of air after it passes through the evaporator into a resistance value which is then input to the auto amplifier.

Control System Input Components (Cont'd)



After disconnecting intake sensor harness connector, measure resistance between terminals ㉖ and ㊲ at sensor harness side, using the table below.

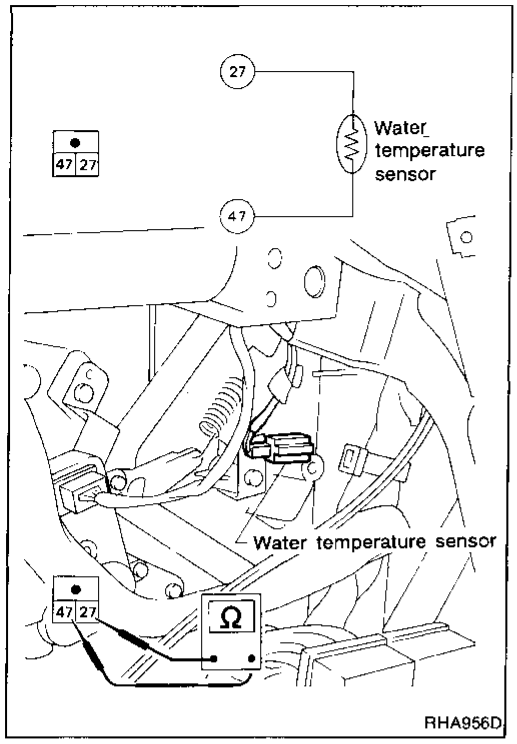
Temperature °C (°F)	Resistance kΩ
−35 (−31)	38.35
−30 (−22)	28.62
−25 (−13)	21.61
−20 (−4)	16.50
−15 (5)	12.73
−10 (14)	9.92
−5 (23)	7.80
0 (32)	6.19
5 (41)	4.95
10 (50)	3.99
15 (59)	3.24
20 (68)	2.65
25 (77)	2.19
30 (86)	1.81
35 (95)	1.51
40 (104)	1.27
45 (113)	1.07
50 (122)	0.91
55 (131)	0.77
60 (140)	0.66
65 (149)	0.57



WATER TEMPERATURE SENSOR

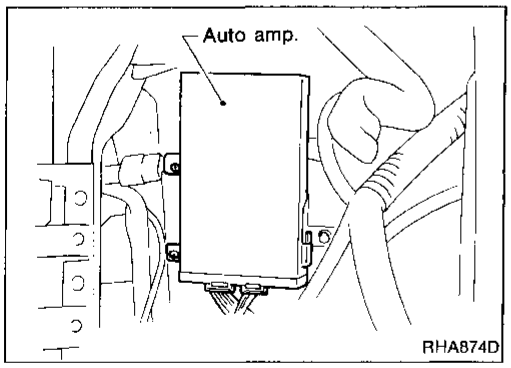
The water temperature sensor is attached to the heater unit. It converts the water temperature value at the heater core entrance into a resistance value. It inputs the voltage, that varies according to change in the resistance value, into the auto amp.

Control System Input Components (Cont'd)



After disconnecting water temperature sensor harness connector, measure resistance between terminals ㉗ and ㊼ at sensor harness side, using table below.

Temperature °C (°F)	Resistance kΩ
0 (32)	3.99
5 (41)	3.17
10 (50)	2.54
15 (59)	2.05
20 (68)	1.67
25 (77)	1.36
30 (86)	1.12
35 (95)	0.93
40 (104)	0.78
45 (113)	0.65
50 (122)	0.55
55 (131)	0.47
60 (140)	0.40
65 (149)	0.34
70 (158)	0.29
75 (167)	0.25
80 (176)	0.22



Control System Automatic Amplifier (Auto amp.)

The auto amplifier has a built-in microcomputer which processes information sent from various sensors needed for air conditioner operation. The air mix door motor, mode door motor, intake door motor, blower motor and compressor are then controlled.

The auto amplifier is unitized with control mechanisms. Signals from various switches and Potentio Temperature Control (P.T.C.) are directly entered into auto amplifier.

Self-diagnostic functions are also built into auto amplifier to provide quick check of malfunctions in the auto air conditioner system.

AMBIENT TEMPERATURE INPUT PROCESS

The automatic amplifier includes a "processing circuit" for the ambient sensor input. When the temperature detected by the ambient sensor increases quickly, the processing circuit allows the auto amp. to recognize an ambient temperature increase of only 0.33°C (0.6°F) per 100 seconds.

As an example, consider stopping for a cup of coffee after high speed driving. Even though the actual ambient temperature has not changed, the temperature detected by the ambient sensor will increase because heat radiated from the engine compartment can radiate to the front grille area (where the ambient sensor is located).

Control System Automatic Amplifier (Auto amp.) (Cont'd)

SUNLOAD INPUT PROCESS

The auto amp. also includes a processing circuit which "average" the variations in detected sunload over a period of time. This prevents drastic swings in the A.T.C. system operation due to small or quick variations in detected sunload.

For example, consider driving along a road bordered by an occasional group of large trees. The sunload detected by the sunload sensor will vary whenever the trees obstruct the sunlight. The processing circuit averages the detected sunload over a period of time, so that the (insignificant) effect of the trees momentarily obstructing the sunlight does not cause any change in the A.T.C. system operation. On the other hand, shortly after entering a long tunnel, the system will recognize the change in sunload, and the system will react accordingly.

Control System Output Components

INTAKE DOOR CONTROL

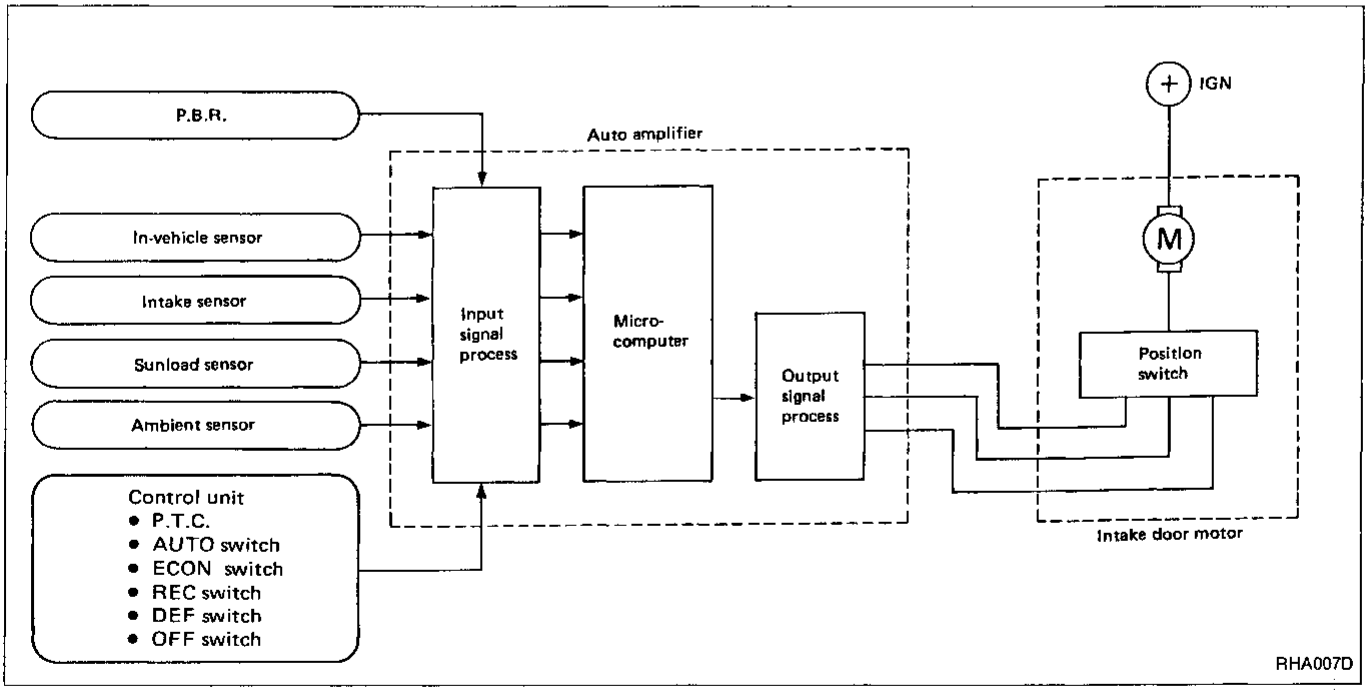
Components parts

Intake door control system components are:

1) Auto amplifier
2) Intake door motor
3) P.B.R.
4) In-vehicle sensor
5) Ambient sensor
6) Sunload sensor
7) Intake sensor
8) Control unit (P.T.C., AUTO, ECON, DEF, REC switches)

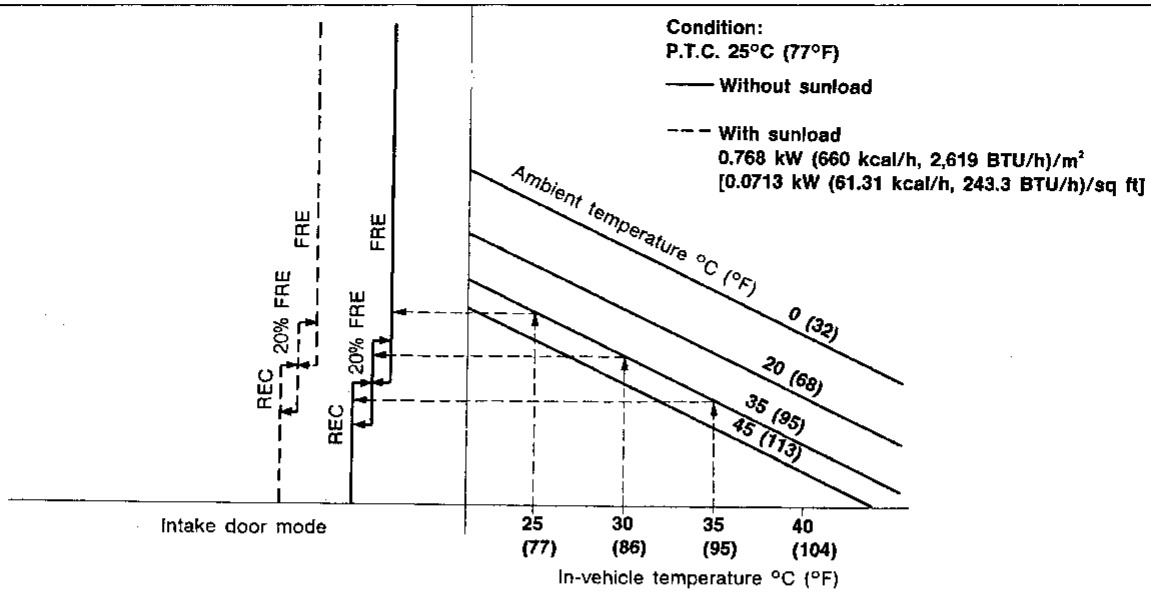
System operation

The intake door control determines intake door position based on the ambient temperature and the in-vehicle temperature. When the ECON, DEF, or OFF buttons are pushed, the auto amplifier sets the intake door at the "Fresh" position.



Control System Output Components (Cont'd)

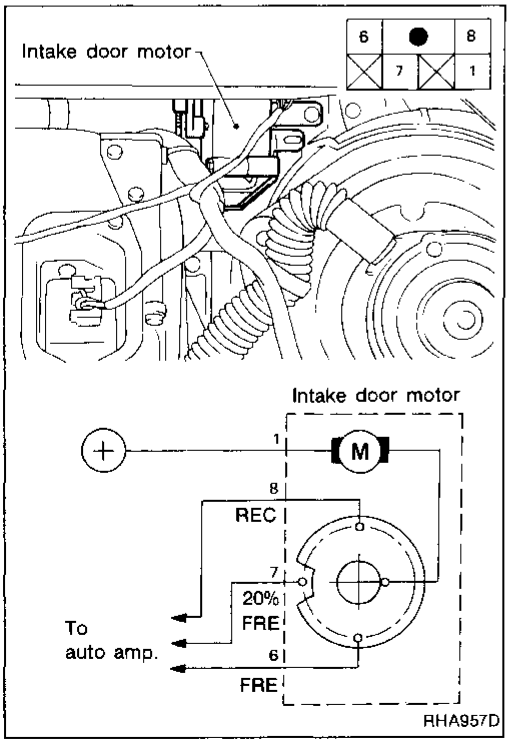
Intake door control specification



Example:

- If temperature setting is set at 25°C (77°F) under no sunload condition when ambient and in-vehicle temperature are 35°C (95°F), intake door is set automatically at REC position to make in-vehicle temperature cool down efficiently.
- In-vehicle temperature will lower and when 30°C (86°F) is reached, intake door will shift to 20% FRE position.
- In the state when in-vehicle temperature reaches the objective temperature 25°C (77°F), intake door is set at FRE position.

RHA473D



RHA957D

INTAKE DOOR MOTOR

The intake door motor is attached to the intake unit. It rotates so that air is drawn from inlets set by the auto amplifier. Motor rotation is conveyed to a lever which activates the intake door.

Intake door motor operation

Terminal No.			Intake door operation	Direction of lever rotation
① - ⑧ (⊕) (⊖)	① - ⑦ (⊕) (⊖)	① - ⑥ (⊕) (⊖)		
CL	OP	OP	REC	Counter clockwise
OP	CL	OP	20% FRE	
OP	OP	CL	FRE	

OP: Open circuit
CL: Closed circuit

Control System Output Components (Cont'd)

AIR MIX DOOR CONTROL (Automatic temperature control)

Component parts

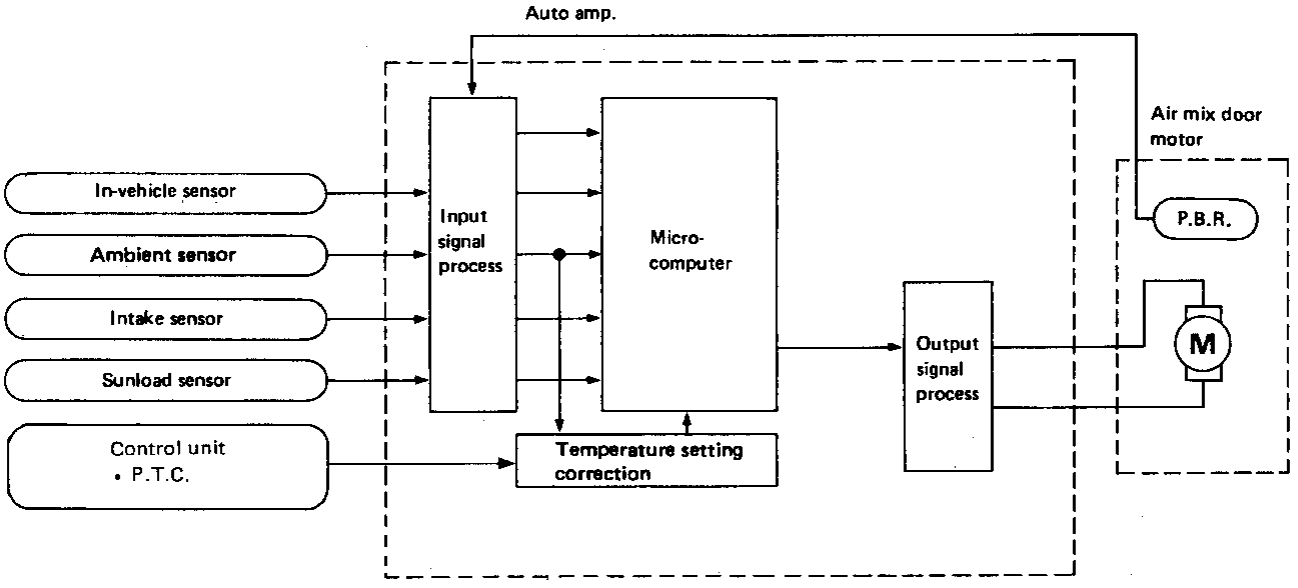
Air mix door control system components are:

1) Auto amplifier
2) Air mix door motor (P.B.R.)
3) In-vehicle sensor
4) Ambient sensor
5) Sunload sensor
6) Intake sensor
7) Control unit (P.T.C.)

System operation

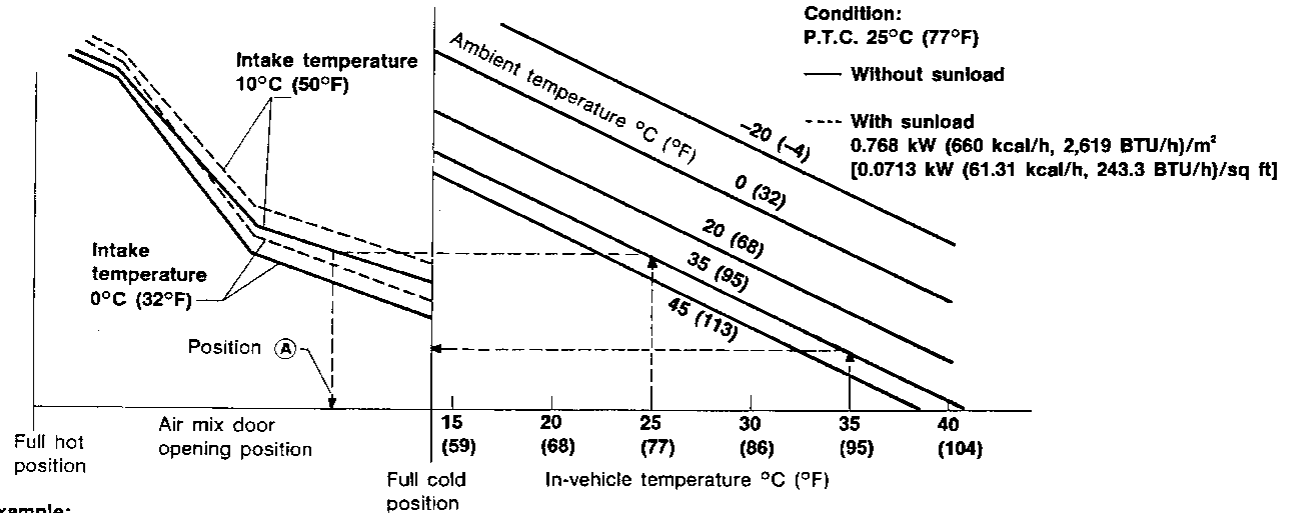
Temperature set by Potentio Temperature Control (P.T.C.) is compensated through setting temperature correction circuit to determine target temperature.

Auto amplifier will operate air mix door motor to set air conditioning system in HOT or COLD position, depending upon relationship between conditions (target temperature, sunload, in-vehicle temperature and ambient temperature) and conditions (air mix door position and intake air temperature).



RHA087D

Air mix door control specification



Example:

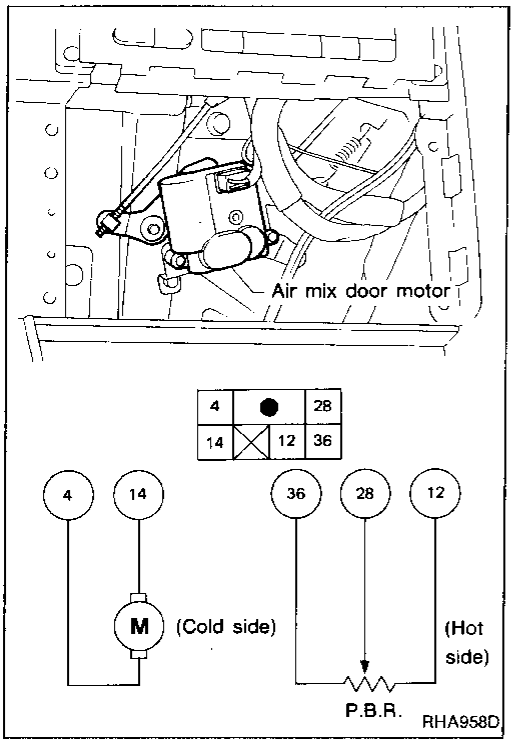
- If temperature setting is set at 25°C (77°F) under no sunload condition when ambient and in-vehicle temperature are 35°C (95°F), air mix door is initially automatically set in full cold position.
- Within some period, in-vehicle temperature will lower towards the objective temperature, and the air mix door position will shift incrementally towards the hot side and finally stay in this position Ⓐ if intake temperature is 10°C (50°F).
  Air mix door opening position is always fed back to auto amplifier by P.B.R. built-in air mix door motor.

RHA475D

Control System Output Components (Cont'd)

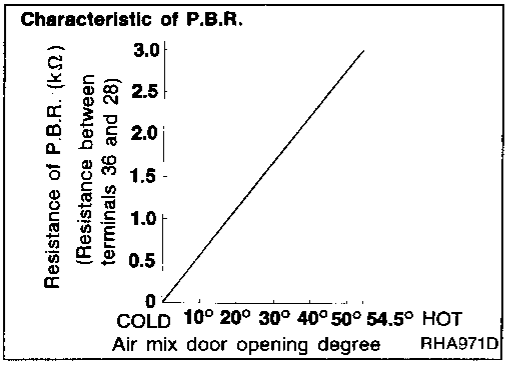
AIR MIX DOOR MOTOR

The air mix door motor is attached to the heater unit. It rotates so that the air mix door is opened to a position set by the auto amplifier. Motor rotation is then conveyed through a shaft and air mix door position is then fed back to the auto amplifier by P.B.R. built-in air mix door motor.



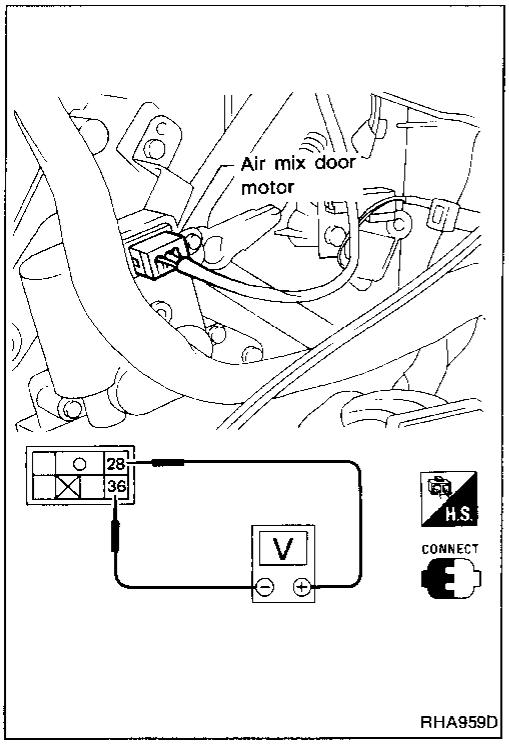
Air mix door motor operation

Terminal No.		Air mix door operation	Direction of lever movement
④	⑭		
⊕	⊖	COLD → HOT	Clockwise (Downward)
–	–	STOP	STOP
⊖	⊕	HOT → COLD	Counterclockwise (Upward)

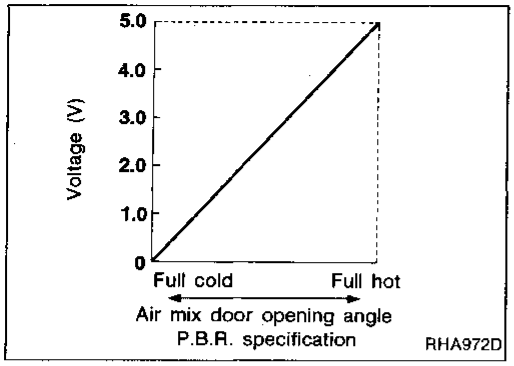


P.B.R.

Measure voltage between terminals ㉘ and ㊱ at vehicle harness side.



Control System Output Components (Cont'd)



Ignition switch: ON

- Ensure tester pointer deflects smoothly when P.T.C. is moved from 18°C (65°F) to 32°C (85°F) and vice versa.

OUTLET DOOR CONTROL

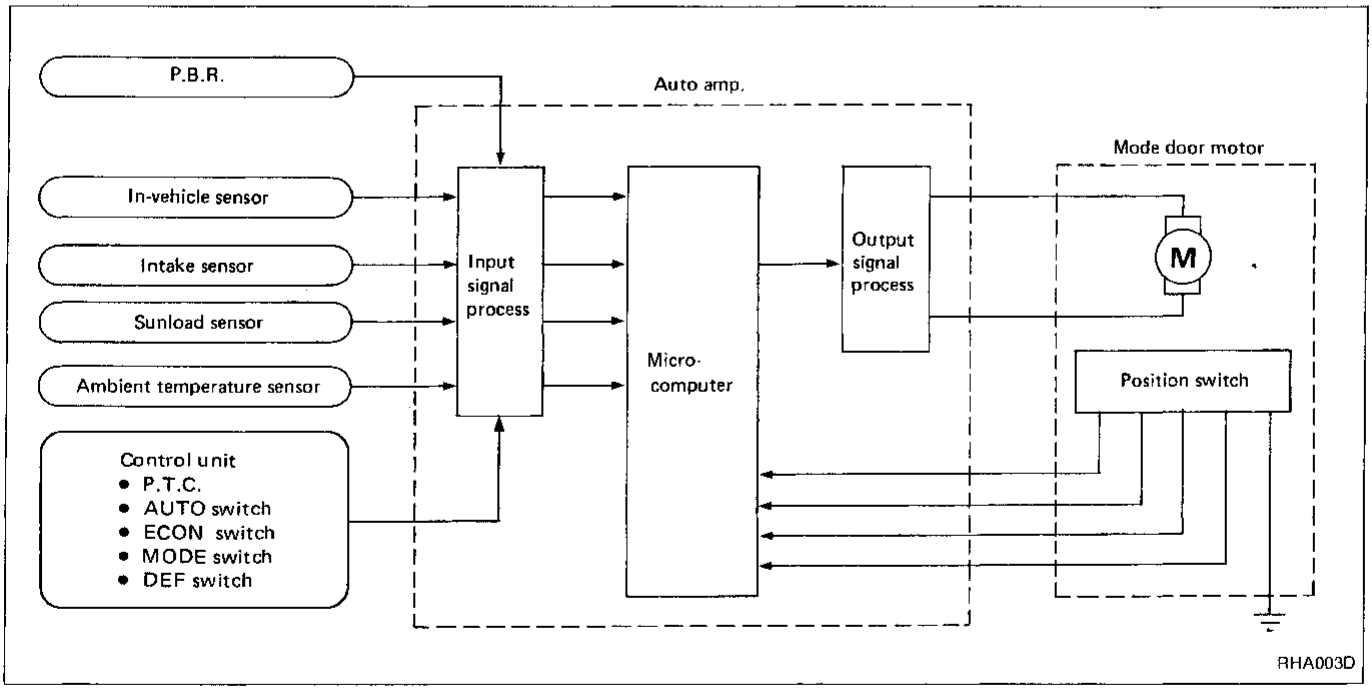
Component parts

Outlet door control system components are:

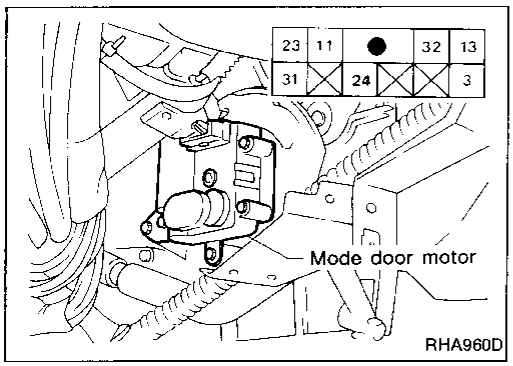
1) Auto amplifier
2) Mode door motor
3) P.B.R.
4) In-vehicle sensor
5) Ambient sensor
6) Sunload sensor
7) Intake sensor
8) Control unit
(P.T.C. and AUTO, ECON, MODE, DEF switches)

System operation

The auto amplifier computes the air outlet conditions according to the ambient temperature and the in-vehicle temperature. The computed outlet conditions are then corrected for sunload to determine air outlet through which air is discharged into the passenger compartment.
When the air outlet is automatically selected as FOOT/DEF, the actual outlet will be either F/D1 or F/D2 depending on the target temperature and the ambient temperature.



Control System Output Components (Cont'd)

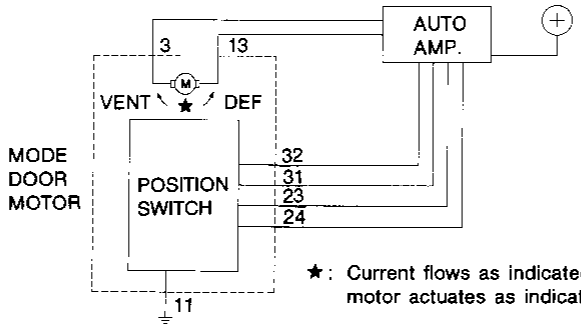


MODE DOOR MOTOR

The mode door motor is attached to the heater unit. It rotates so that air is discharged from outlet set by the auto amplifier. Motor rotation is conveyed to a link which activates the mode door.

Mode door motor operation

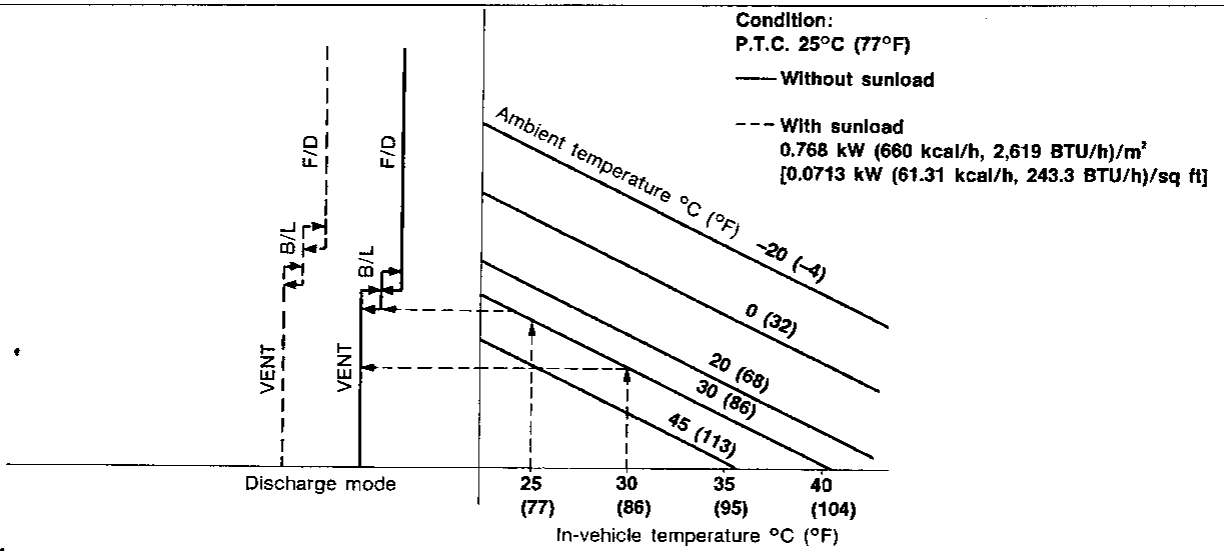
Terminal No.		Mode door operation	Direction of side link rotation
③	⑬		
⊕	⊖	VENT → DEF	Counterclockwise
–	–	STOP	STOP
⊖	⊕	DEF → VENT	Clockwise



★: Current flows as indicated by the arrow, motor actuates as indicated by the words.

RHA961D

Outlet door control specification

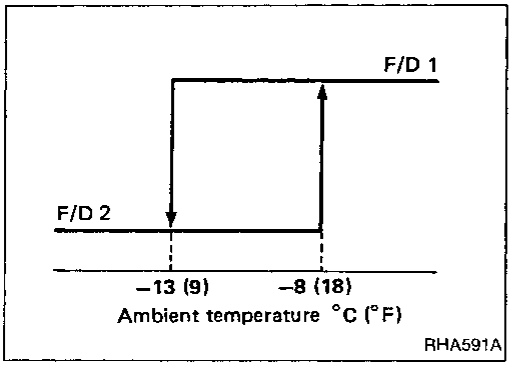


Example:

- If temperature setting is set at 25°C (77°F) under no sunload condition when ambient and in-vehicle temperature are 30°C (86°F), mode door is set automatically at VENT position.
- Then in-vehicle temperature will lower and when objective temperature 25°C (77°F) is reached mode door will shift from VENT position to B/L.

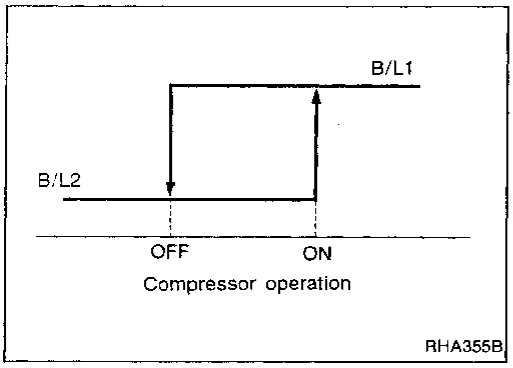
RHA480D

Control System Output Components (Cont'd)



FOOT/DEF mode specification

- When the air outlet is automatically selected as F/D, when target temperature is high, the air outlet is fixed at F/D 1.
- When the target temperature is low, the air outlet will be either F/D 1 or F/D 2 depending on the ambient temperature.
- When the ambient temperature decreases to –13°C (9°F), air outlet is changed from F/D1 to F/D2.
- When the ambient temperature increases to –8°C (18°F), air outlet is changed from F/D2 to F/D1.



B/L mode specification

- When compressor turn ON, air outlet is changed from B/L2 to B/L1.
- When compressor turns OFF, air outlet is changed from B/L1 to B/L2.

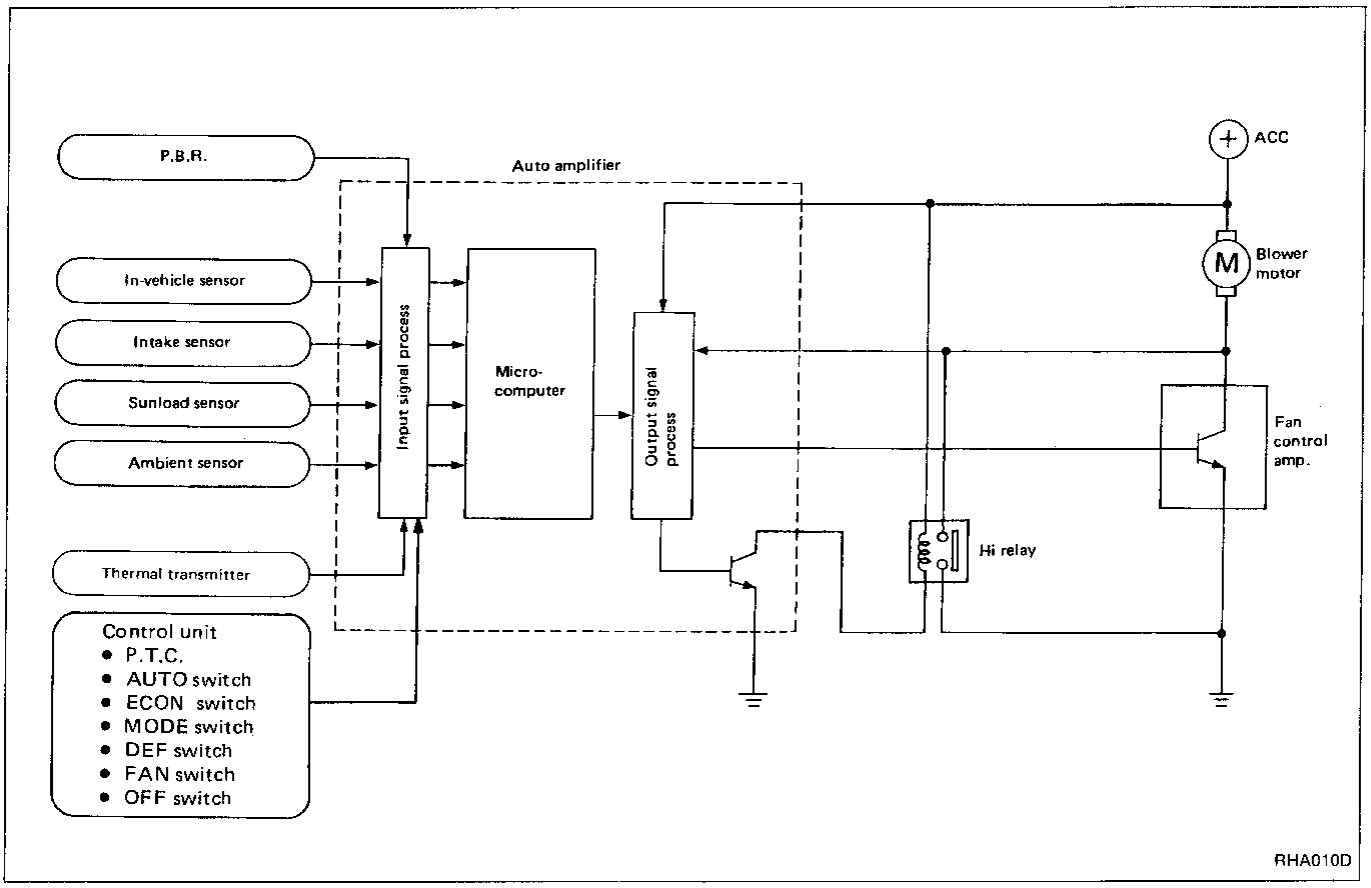
FAN SPEED CONTROL

Component parts

Fan speed control system components are:
1) Auto amplifier
2) Fan control amplifier
3) P.B.R.
4) In-vehicle sensor
5) Ambient sensor
6) Sunload sensor
7) Intake sensor
8) Hi relay
9) Water temperature sensor
10) Control unit (P.T.C., AUTO, ECON, MODE, DEF, FAN, OFF switches)

System operation

For description of system operation, see next page.



AUTOMATIC MODE

In the automatic mode, the blower motor speed is calculated by the automatic amplifier based on inputs from the P.B.R., in-vehicle sensor, sunload sensor, and ambient sensor. The blower motor applied voltage ranges from approximately 5 volts (lowest speed) to 12 volts (highest speed).
The control blower speed (in the range of 5 to 10.5V), the automatic amplifier supplies a signal to the fan control amplifier. Based on this signal, the fan control amplifier controls the current flow from the blower motor to ground. If the computed blower voltage (from automatic amplifier) is above 10.5 volts, the high blower relay is activated. The high blower relay provides a direct path to ground (bypassing the fan control amplifier), and the blower motor operates at high speed.

STARTING BLOWER SPEED CONTROL

Start up from "COLD SOAK" condition (Automatic mode)

In a cold start up condition where the engine coolant temperature is below 32°C (90°F) and the ambient temperature is below 15°C (59°F), the blower will not operate for a short period of time (up to 90 seconds). The exact start delay time varies depending on the ambient and engine coolant temperature.
When the engine coolant temperature is between 32°C (90°F) and 35°C (95°F), and the ambient temperature below 15°C (59°F), the blower speed will gradually rise to the objective speed over a time period of 18 minutes or less (actual time depends on the objective blower speed). The exact start delay time varies depending on the ambient and engine coolant temperature.
In the most extreme case (very low ambient) the blower starting delay will be 90 seconds as described above. After this delay, the blower will operate at low speed until the engine coolant temperature rises above 32°C (90°F), at which time the blower speed will increase to the objective speed.

Start up from normal or "HOT SOAK" condition (Automatic mode)

The blower will begin operation momentarily after the AUTO button is pushed. The blower speed will gradually rise to the objective speed over a time period of 5 seconds or less (actual time depends on the objective blower speed).

BLOWER SPEED COMPENSATION

Sunload

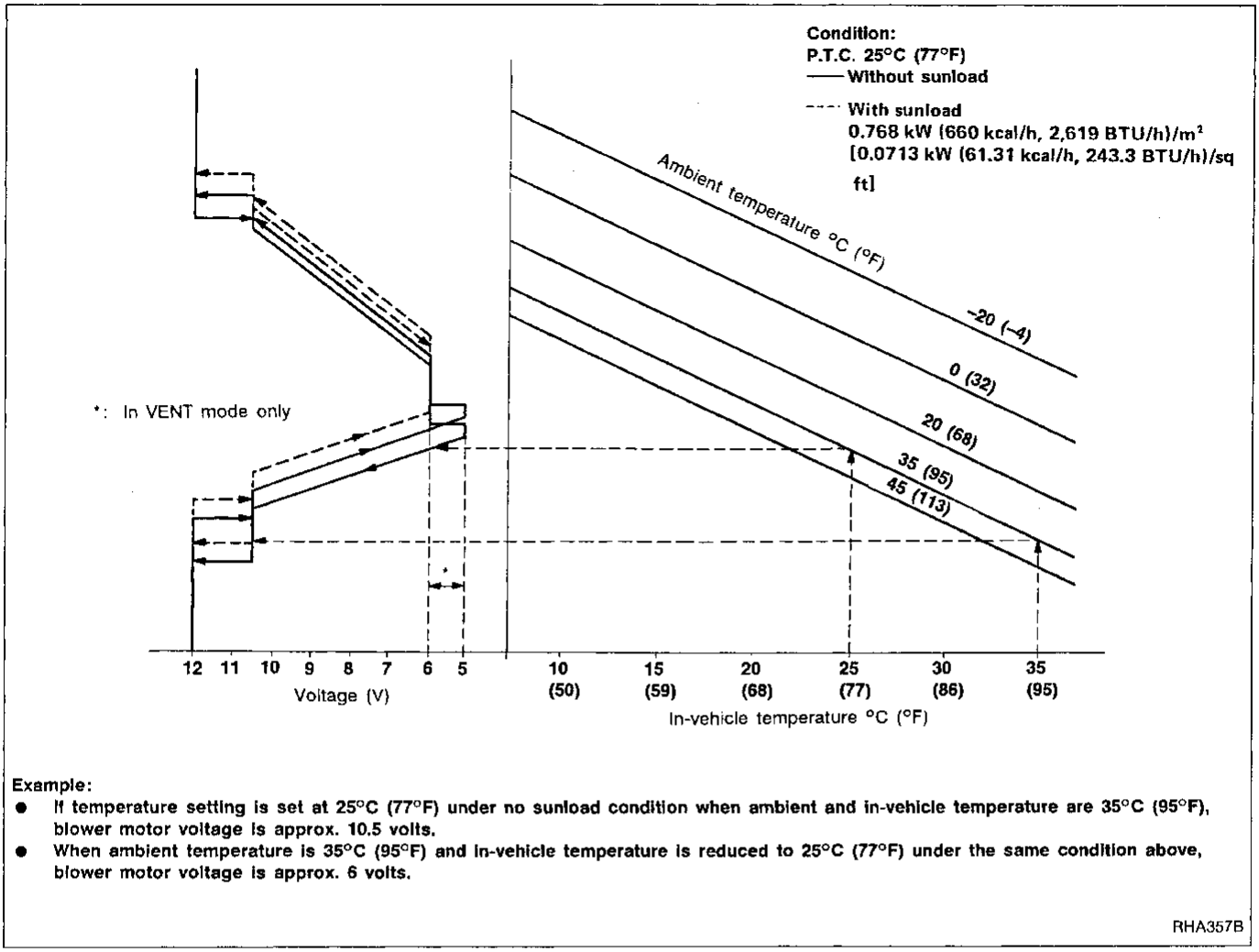
When the in-vehicle temperature and the set temperature are very close, the blower will be operating at low speed. The low speed will vary depending on the sunload. During conditions of high sunload, the blower low speed is "normal" low speed (approx. 6V). During low or no sunload conditions, the low speed will drop to "low" low speed (approx. 5V).

Ambient

When the ambient temperature is in the "moderate" range [10 – 15°C (50 - 59°F)], the computed blower voltage will be compensated (reduced) by up to 3.5V (depending on the blower speed). In the "extreme" ambient ranges [below 0°C (32°F) and above 20°C (68°F)] the computed objective blower voltage is not compensated at all. In the ambient temperature ranges between "moderate" and "extreme" [0 - 10°C (32 - 50°F) and 15 - 20°C (59 - 68°F)], the amount of compensation (for a given blower speed) varies depending on the ambient temperature.

Control System Output Components (Cont'd)

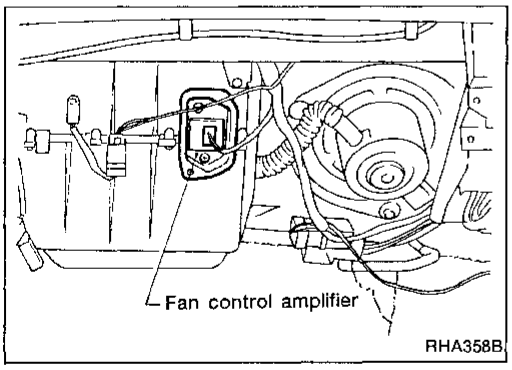
Fan speed control specification



Example:

- **If temperature setting is set at 25°C (77°F) under no sunload condition when ambient and in-vehicle temperature are 35°C (95°F), blower motor voltage is approx. 10.5 volts.**
- **When ambient temperature is 35°C (95°F) and in-vehicle temperature is reduced to 25°C (77°F) under the same condition above, blower motor voltage is approx. 6 volts.**

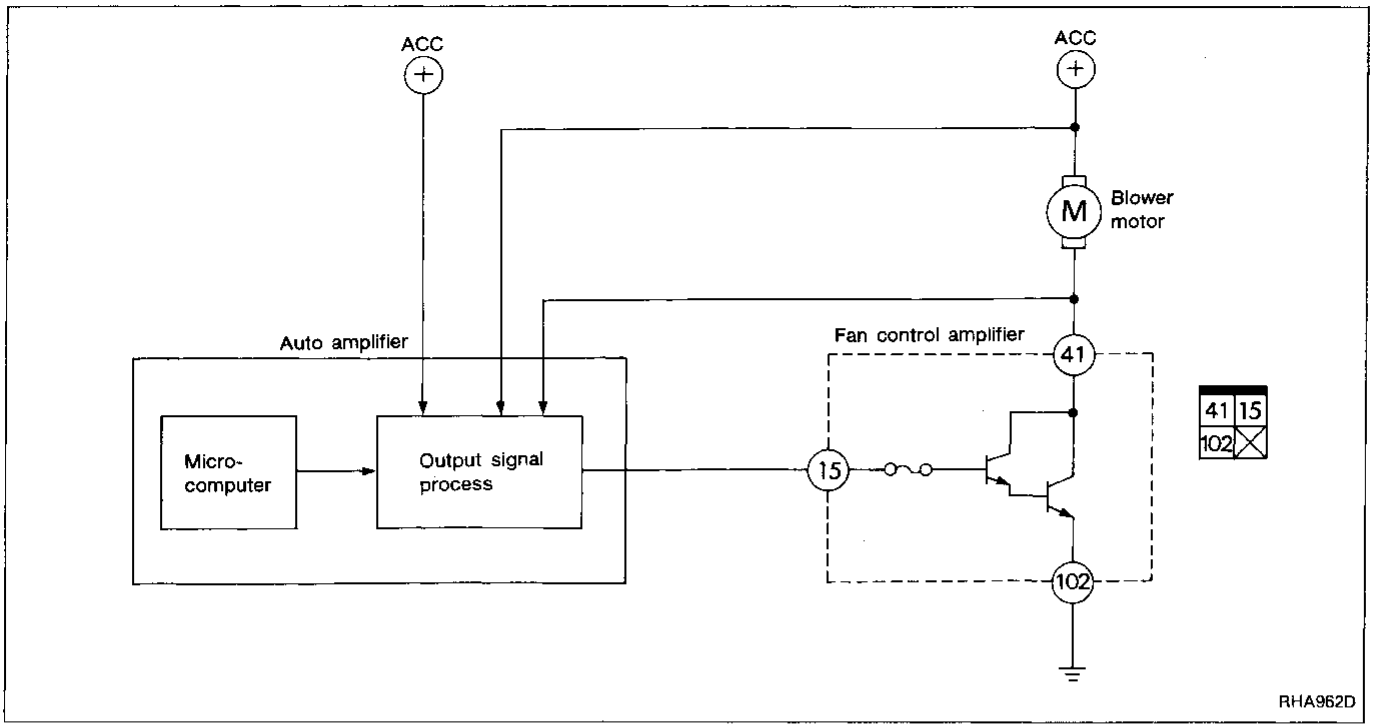
RHA357B

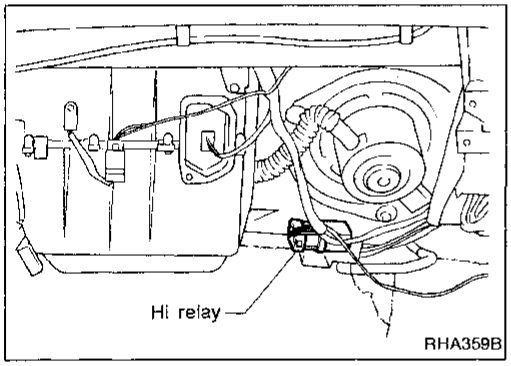


FAN CONTROL AMPLIFIER

The fan control amplifier is located on the cooling unit. It amplifies a 12-step base current flowing from the auto amplifier to change blower speed.

Control System Output Components (Cont'd)



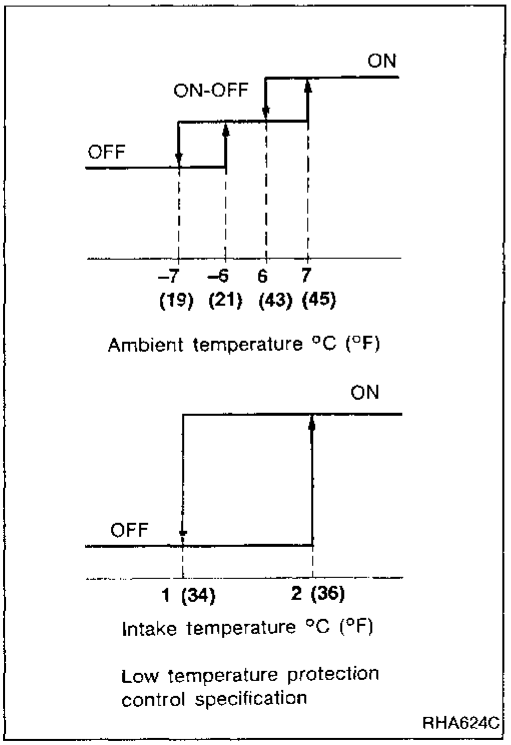


HI RELAY

The Hi relay is located on the intake unit. It receives a signal from the auto amplifier to operate the blower motor at high speed.

MAGNET CLUTCH CONTROL

Auto amplifier controls compressor operation by ambient temperature, intake temperature, and signal from ECM (ECCS control module).



Low temperature protection control

Auto amplifier will turn the compressor "ON" or "OFF" as determined by a signal detected by ambient temperature sensor and intake sensor.

When ambient temperatures are greater than 7°C (45°F), the compressor turns "ON". The compressor turns "OFF" when ambient temperatures are less than –7°C (19°F).

When ambient temperatures are between 7°C (45°F) and –7°C (19°F), the auto amplifier controls the ON-OFF operation of the compressor as determined by a signal detected by the intake sensor.

General Specifications

COMPRESSOR

Model	CALSONIC make V-6
Type	V-6 variable displacement
Displacement cm^3 (cu in)/rev.	
Max.	165 (10.068)
Min.	10.5 (0.641)
Cylinder bore x stroke mm (in)	37 (1.46) x [1.6 - 25.6 (0.063 - 1.008)]
Direction of rotation	Clockwise (viewed from drive end)
Drive belt	Poly V

LUBRICATION OIL

Model	CALSONIC make V-6
Name	Nissan A/C System Oil Type S
Part number	KLH00-PAGS0
Capacity mℓ (US fl oz, Imp fl oz)	
Total in system	200 (6.8, 7.0)
Compressor (Service part) charging amount	200 (6.8, 7.0)

REFRIGERANT

Type		HFC-134a (R-134a)
Capacity	kg (lb)	0.800 ± 0.025 (1.764 ± 0.055)

Inspection and Adjustment

ENGINE IDLING SPEED (When A/C is ON)

- Refer to EF & EC section.

BELT TENSION

- Refer to Checking Drive Belts (MA section).