

## SECTION **HA**

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**MANUAL AND AUTO**

**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" and "HOW TO PERFORM EFFICIENT DIAGNOSIS FOR AN ELECTRICAL INCIDENT".**

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## Supplemental Restraint System (SRS) "AIR BAG"

The Supplemental Restraint System "Air Bag", used along with a seat belt, helps 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 bag modules (located in the center of the steering wheel and on the instrument panel on the passenger side), a diagnosis sensor unit, warning lamp, wiring harness and spiral cable. Information necessary to service the system safely is included in the **RS** section of this Service Manual.

### WARNING:

- To avoid rendering the SRS inoperative, which could increase the risk of personal injury or death in the event of a collision which would result in air bag inflation, all maintenance must be performed by an authorized NISSAN dealer.
- Improper maintenance, including incorrect removal and installation of the SRS, can lead to personal injury caused by unintentional activation of the system.
- Do not use electrical test equipment on any circuit related to the SRS unless instructed to in this Service Manual. SRS wiring harnesses are covered with yellow insulation either just before the harness connectors or for the complete harness, for easy identification.

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

### WARNING:

- CFC-12 (R-12) refrigerant and HFC-134a (R-134a) refrigerant are not compatible. These refrigerants must never be mixed, even in the smallest amounts. If the refrigerants are mixed, compressor failure is likely to occur.
- Use only specified lubricant for the HFC-134a (R-134a) A/C system and HFC-134a (R-134a) components. If lubricant other than that specified is used, compressor failure is likely to occur.
- The specified HFC-134a (R-134a) lubricant rapidly absorbs moisture from the atmosphere. 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. Connect all refrigerant loop components as quickly as possible to minimize the entry of moisture into system.
  - c: Only use the specified lubricant from a sealed container. Immediately reseal containers of lubricant. Without proper sealing, lubricant will become moisture saturated and should not be used.
  - d: Avoid breathing A/C refrigerant and lubricant vapor or mist. Exposure may irritate eyes, nose and throat. Remove R-134a from the A/C system, using certified service equipment meeting requirements of SAE J2210 (R-134a recycling equipment), or J2209 (R-134a recovery equipment). If accidental system discharge occurs, ventilate work area before resuming service. Additional health and safety information may be obtained from refrigerant and lubricant manufacturers.
  - e: Do not allow lubricant (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.

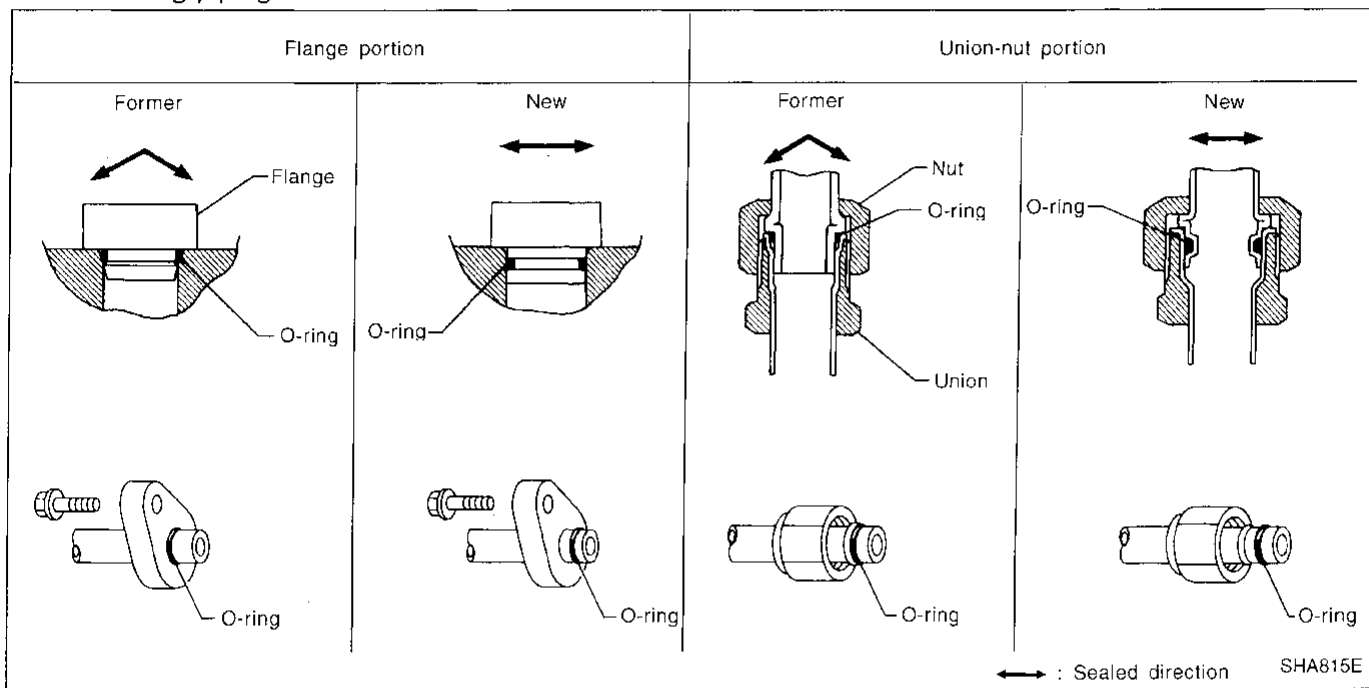
### Precautions for Refrigerant Connection

A new type refrigerant connection has been introduced to all refrigerant lines except the following portion.

- Expansion valve to cooling unit

#### FEATURES OF NEW TYPE REFRIGERANT CONNECTION

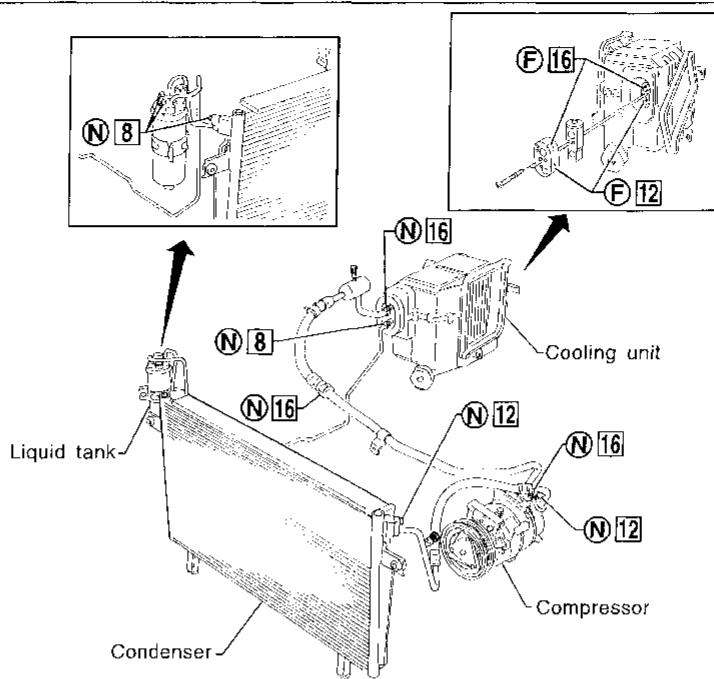
- The O-ring has been relocated. It has also been provided with a groove for proper installation. This eliminates the chance of the O-ring being caught in, or damaged by, the mating part. The sealing direction of the O-ring is now set vertically in relation to the contacting surface of the mating part to improve sealing characteristics.
- The reaction force of the O-ring will not occur in the direction that causes the joint to pull out, thereby facilitating piping connections.



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Precautions for Refrigerant Connection  
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O-RING AND REFRIGERANT CONNECTION

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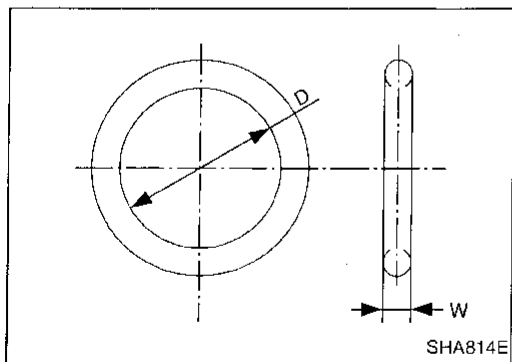


- ⓕ : Former type refrigerant connection
- Ⓝ : New type refrigerant connection
- : O-ring size

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**CAUTION:**

The new and former refrigerant connections use different O-ring configurations. Do not confuse O-rings since they are not interchangeable. If a wrong O-ring is installed, refrigerant will leak at, or around, the connection.



**O-ring part numbers and specifications**

Connection type	O-ring size	Part number	D mm (in)	W mm (in)
New	8	92471 N8210	6.8 (0.268)	1.85 (0.0728)
Former		92470 N8200	6.07 (0.2390)	1.78 (0.0701)
New	12	92472 N8210	10.9 (0.429)	2.43 (0.0957)
Former		92475 71L00	11.0 (0.433)	2.4 (0.0945)
New	16	92473 N8210	13.6 (0.535)	2.43 (0.0957)
Former		92475 72L00	14.3 (0.563)	2.3 (0.0906)

A refrigerant connection has been added to the union nut portion of the low pressure flexible hose on 1997 vehicle models. The following parts are not interchangeable between the 1996 and 1997 vehicle models.

- Low-pressure flexible hose
- Low-pressure pipe

Precautions for Refrigerant Connection  
(Cont'd)

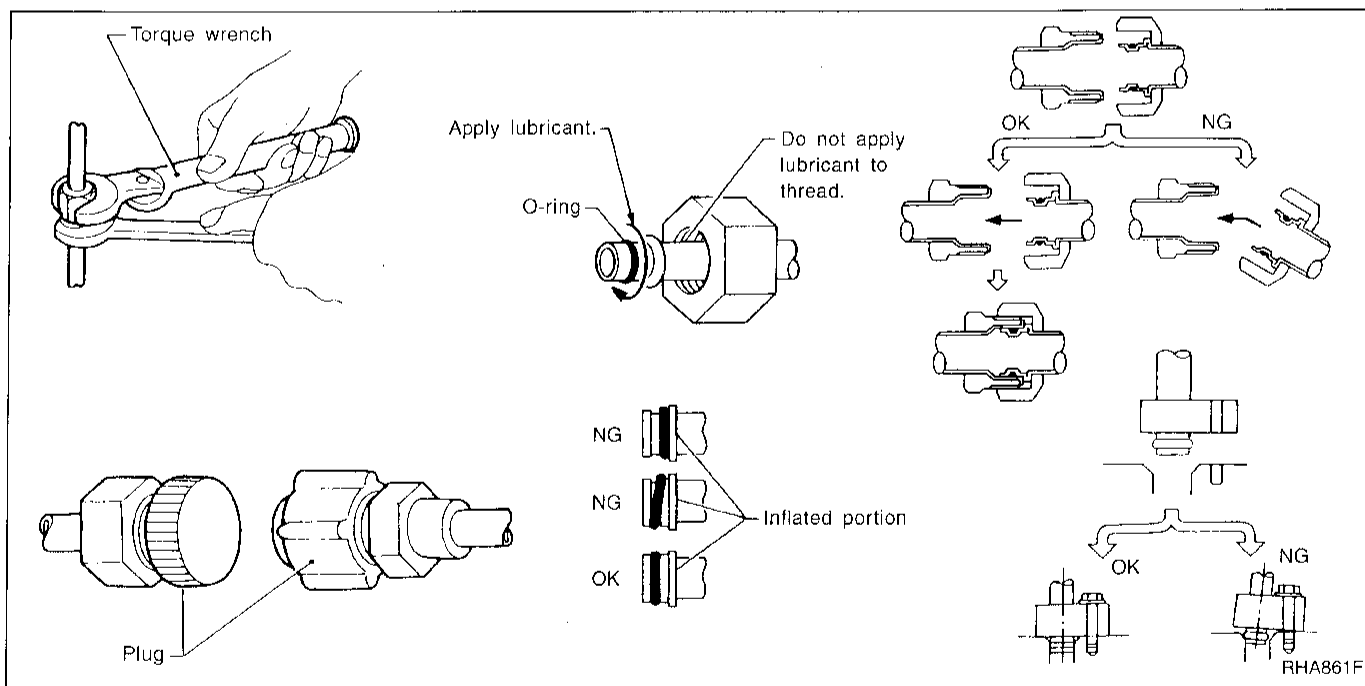
**WARNING:**

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

**CAUTION:**

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

- When the compressor is removed, store it in the same position as it is when mounted on the car. Failure to do so will cause lubricant to enter the low pressure chamber.
  - When connecting tubes, always use a torque wrench and a back-up wrench.
  - After disconnecting tubes, immediately plug all openings to prevent entry of dirt and moisture.
  - When installing an air conditioner in the vehicle, connect the pipes as the final stage of the operation. Do not remove the seal caps of pipes and other components until just before required for connection.
  - Allow components stored in cool areas to warm to working area temperature before removing seal caps. This prevents condensation from forming inside A/C components.
  - Thoroughly remove moisture from the refrigeration system before charging the refrigerant.
  - Always replace used O-rings.
  - When connecting tube, apply lubricant to circle of the O-rings shown in illustration. Be careful not to apply lubricant to threaded portion.
- Lubricant name: Nissan A/C System Oil Type S  
Part number: KLH00-PAGS0
- O-ring must be closely attached to dented portion of tube.
  - When replacing the O-ring, be careful not to damage O-ring and tube.
  - Connect tube until you hear it click, then tighten the nut or bolt by hand until snug. Make sure that the O-ring is installed to tube correctly.
  - 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.



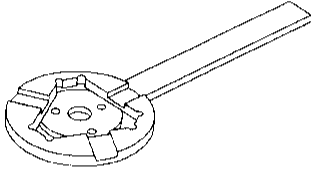
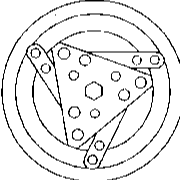

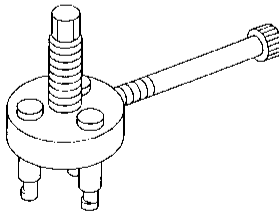
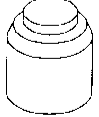
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### Precautions for Servicing Compressor

- Plug all openings to prevent moisture and foreign matter from entering.
- When the compressor is removed, store it in the same position as it is when mounted on the car.
- When replacing or repairing compressor, follow "Maintenance of Lubricant Quantity in Compressor" exactly. Refer to HA-102.
- Keep friction surfaces between clutch and pulley clean. If the surface is contaminated, with lubricant, wipe it off by using a clean waste cloth moistened with thinner.
- After compressor service operation, turn the compressor shaft by hand more than five turns in both directions. This will equally distribute lubricant inside the compressor. After the compressor is installed, let the engine idle and operate the compressor for one hour.
- After replacing the compressor magnet clutch, apply voltage to the new one and check for normal operation.

### Special Service Tools

The actual shapes of Kent-Moore tools may differ from those of special service tools illustrated here.

Tool number (Kent-Moore No.) Tool name	Description
KV99106100 (J-41260) Clutch disc wrench	<div style="text-align: right;">Removing center bolt</div>  <p>NT232</p>  <p>When replacing the magnet clutch in the above compressor, use a clutch disc wrench with the pin side on the clutch disc to remove it.</p>  <p>NT378</p>
KV99232340 (J-38874) or KV992T0001 ( — ) Clutch disc puller	<div style="text-align: right;">Removing clutch disc</div>  <p>NT376</p>
KV99106200 (J-41261) Pulley installer	<div style="text-align: right;">Installing pulley</div>  <p>NT235</p>

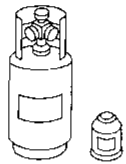

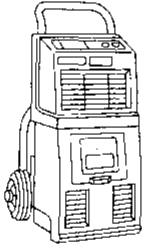
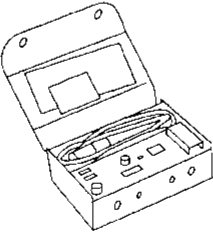
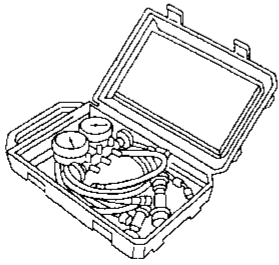
### HFC-134a (R-134a) Service Tools and Equipment

Never mix HFC-134a refrigerant and/or its specified lubricant with CFC-12 (R-12) refrigerant and/or its lubricant.

Separate and non-interchangeable service equipment must be used for handling each type of refrigerant/lubricant.

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). This is to avoid mixed use of the refrigerants/lubricant.

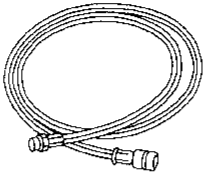
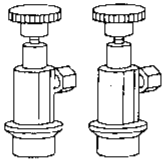

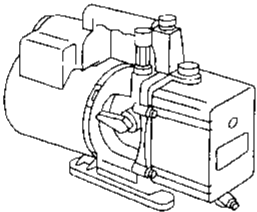
Adapters that convert one size fitting to another must never be used: refrigerant/lubricant contamination will occur and compressor failure will result.

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 <ul style="list-style-type: none"> <li>• large container 1/2"-16 ACME</li> </ul>
KLH00-PAGS0 ( — ) Nissan A/C System Oil Type S	 NT197	Type: Poly alkylene 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-NI) Recovery/Recycling Recharging equipment (ACR4)	 NT195	Function: Refrigerant Recovery and Recycling and Recharging
(J-39400) Electrical leak detector	 NT198	Power supply: <ul style="list-style-type: none"> <li>• DC 12 V (Cigarette lighter)</li> </ul>
(J-39183) Manifold gauge set (with hoses and couplers)	 NT199	Identification: <ul style="list-style-type: none"> <li>• The gauge face indicates R-134a.</li> <li>• Fitting size: Thread size</li> <li>• 1/2"-16 ACME</li> </ul>

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

Tool number (Kent-Moore No.) Tool name	Description	Note
Service hoses <ul style="list-style-type: none"> <li>● High side hose (J-39501-72)</li> <li>● Low side hose (J-39502-72)</li> <li>● Utility hose (J-39476-72)</li> </ul>	 <p style="text-align: center;">NT201</p>	Hose color: <ul style="list-style-type: none"> <li>● Low hose: Blue with black stripe</li> <li>● High hose: Red with black stripe</li> <li>● Utility hose: Yellow with black stripe or green with black stripe</li> </ul> Hose fitting to gauge: <ul style="list-style-type: none"> <li>● 1/2"-16 ACME</li> </ul>
Service couplers <ul style="list-style-type: none"> <li>● High side coupler (J-39500-20)</li> <li>● Low side coupler (J-39500-24)</li> </ul>	 <p style="text-align: center;">NT202</p>	Hose fitting to service hose: <ul style="list-style-type: none"> <li>● M14 x 1.5 fitting is optional or permanently attached.</li> </ul>
(J-39650) Refrigerant weight scale	 <p style="text-align: center;">NT200</p>	For measuring of refrigerant Fitting size: Thread size <ul style="list-style-type: none"> <li>● 1/2"-16 ACME</li> </ul>
(J-39649) Vacuum pump (Including the isolator valve)	 <p style="text-align: center;">NT203</p>	Capacity: <ul style="list-style-type: none"> <li>● Air displacement: 4 CFM</li> <li>● Micron rating: 20 microns</li> <li>● Oil capacity: 482 g (17 oz)</li> </ul> Fitting size: Thread size <ul style="list-style-type: none"> <li>● 1/2"-16 ACME</li> </ul>

**Precautions for Service Equipment**

**RECOVERY/RECYCLING EQUIPMENT**

Follow the manufacturer's instructions for machine operation and machine maintenance. Never introduce any refrigerant other than that specified into the machine.

**ELECTRONIC LEAK DETECTOR**

Follow the manufacture's instructions for tester operation and tester maintenance.

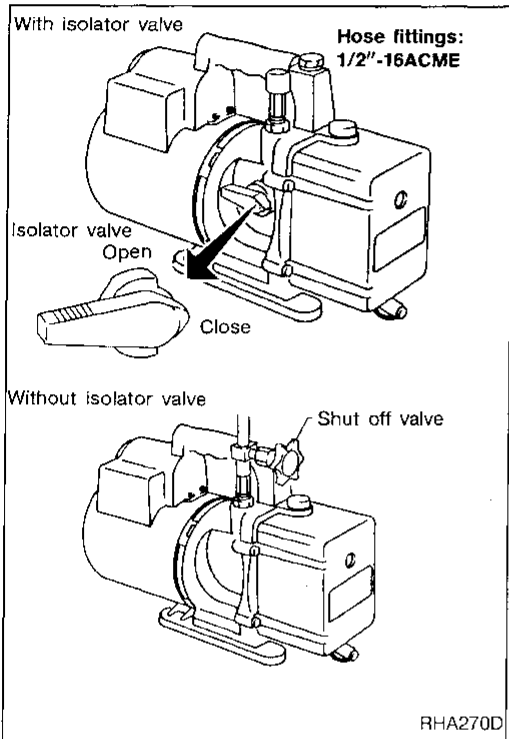
**VACUUM PUMP**

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

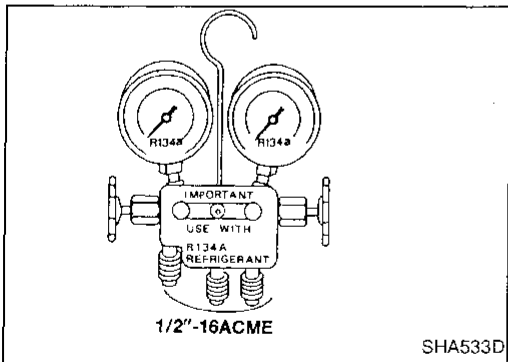
To prevent this migration, use a manual valve situated near the hose-to-pump connection, as follows.

- Usually vacuum pumps have a manual isolator valve as part of the pump. Close this valve to isolate the service hose from the pump.
- For pumps without an isolator, use a hose equipped with a manual shut-off valve near the pump end. Close the valve to isolate the hose from the pump.
- If the hose has an automatic shut off valve, disconnect the hose from the pump: as long as the hose is connected, the valve is open and lubricating oil may migrate.

Some one-way valves open when vacuum is applied and close under a no vacuum condition. Such valves may restrict the pump's ability to pull a deep vacuum and are not recommended.



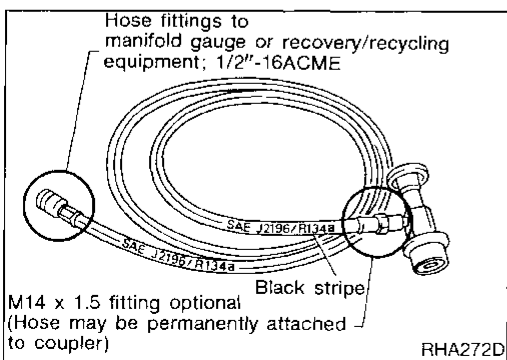
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**MANIFOLD GAUGE SET**

Be certain that the gauge face indicates R-134a or 134a. Make sure the gauge set has 1/2"-16 ACME threaded connections for service hoses. Confirm the set has been used only with refrigerant HFC-134a (R-134a) along with specified lubricant.



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**SERVICE HOSES**

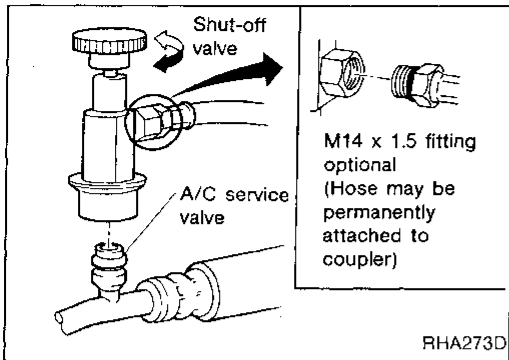
Be certain that the service hoses display the markings described (colored hose with black stripe). All hoses must include positive shut off devices (either manual or automatic) near the end of the hoses opposite the manifold gauge.

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**Precautions for Service Equipment (Cont'd)**

**SERVICE COUPLERS**

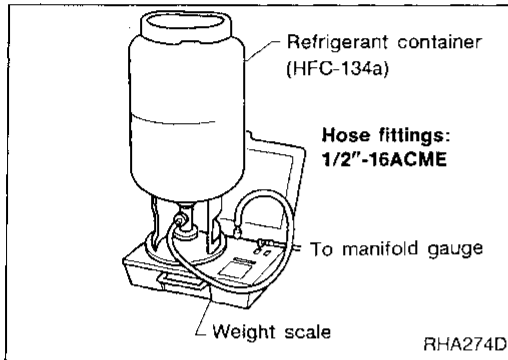
Never attempt to connect HFC-134a (R-134a) service couplers to an CFC-12 (R-12) A/C system. The HFC-134a (R-134a) couplers will not properly connect to the CFC-12 (R-12) system. However, if an improper connection is attempted, discharging and contamination may occur.



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

**REFRIGERANT WEIGHT SCALE**

Verify that no refrigerant other than HFC-134a (R-134a) and specified lubricants have been used with the scale. If the scale controls refrigerant flow electronically, the hose fitting must be 1/2"-16 ACME.



**CHARGING CYLINDER**

Using a charging cylinder is not recommended. Refrigerant may be vented into air from cylinder's top valve when filling the cylinder with refrigerant. Also, the accuracy of the cylinder is generally less than that of an electronic scale or of quality recycle/recharge equipment.

## 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 A/C 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.

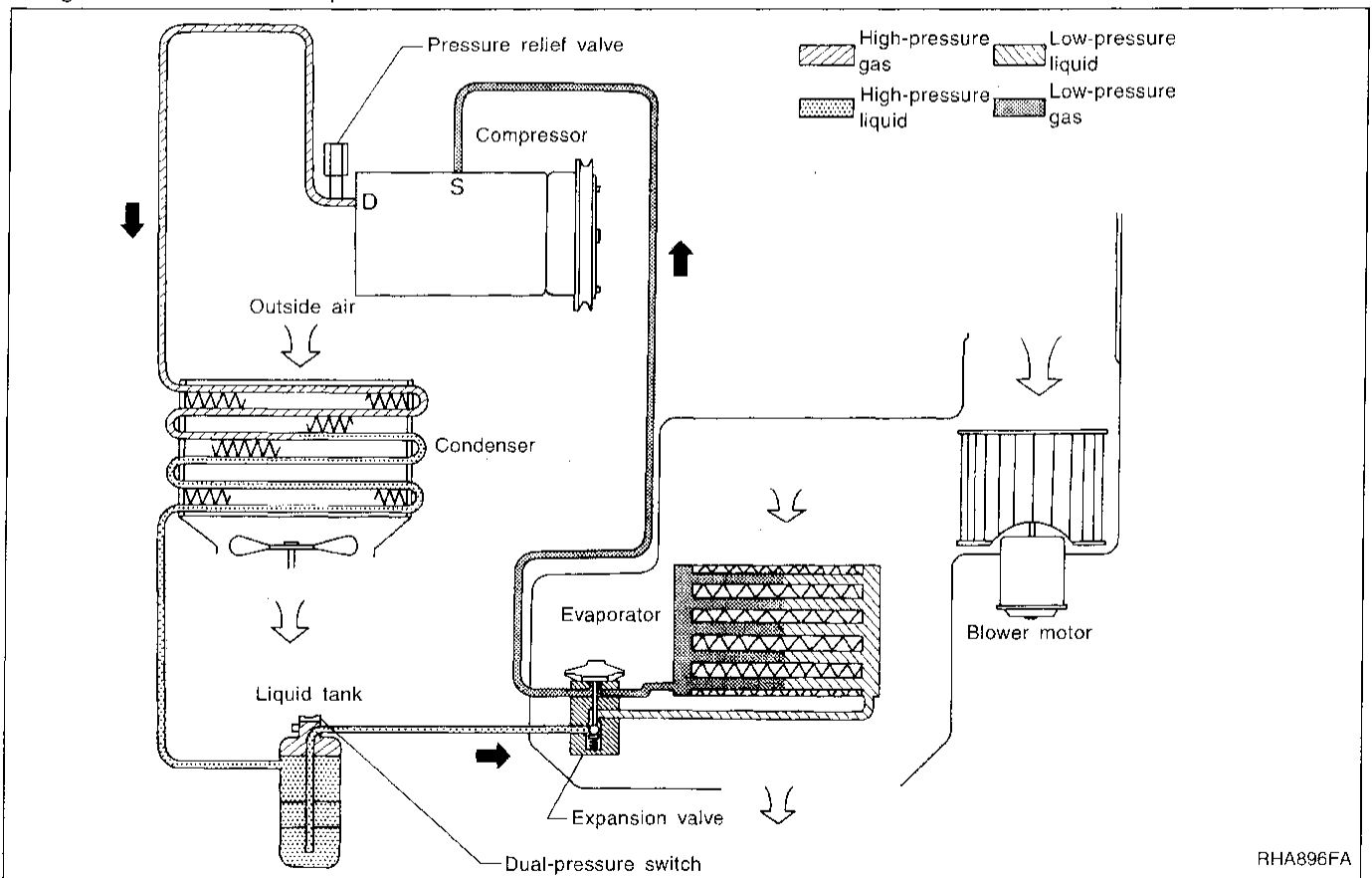
### REFRIGERANT SYSTEM PROTECTION

#### 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<sup>2</sup>, 540 psi)], the release port on the pressure relief valve automatically opens and releases refrigerant into the atmosphere.



## V-6 Variable Displacement Compressor

### GENERAL INFORMATION

1. The V-6 variable compressor differs from previous units. The vent temperatures of the V-6 variable compressor do not drop too far below 5°C (41°F) when:
  - evaporator intake air temperature is less than 20°C (68°F)
  - 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 cold winters, it may not produce high refrigerant pressure discharge (compared to previous units) when used with 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. For air conditioning systems 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<sup>2</sup>, 21 to 26 psi) under varying conditions. In previous compressors, however, suction pressure was reduced with increases in engine speed.

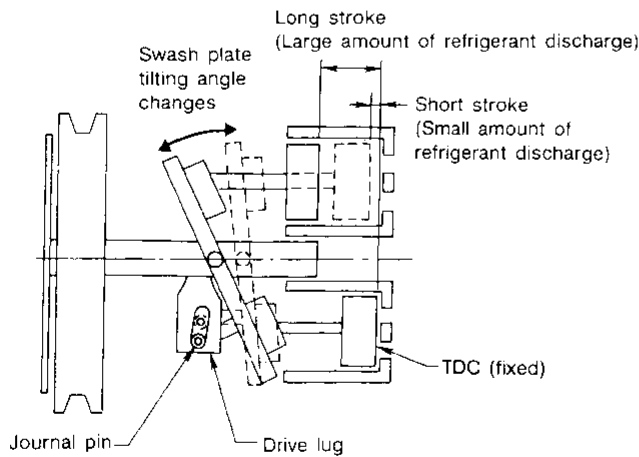
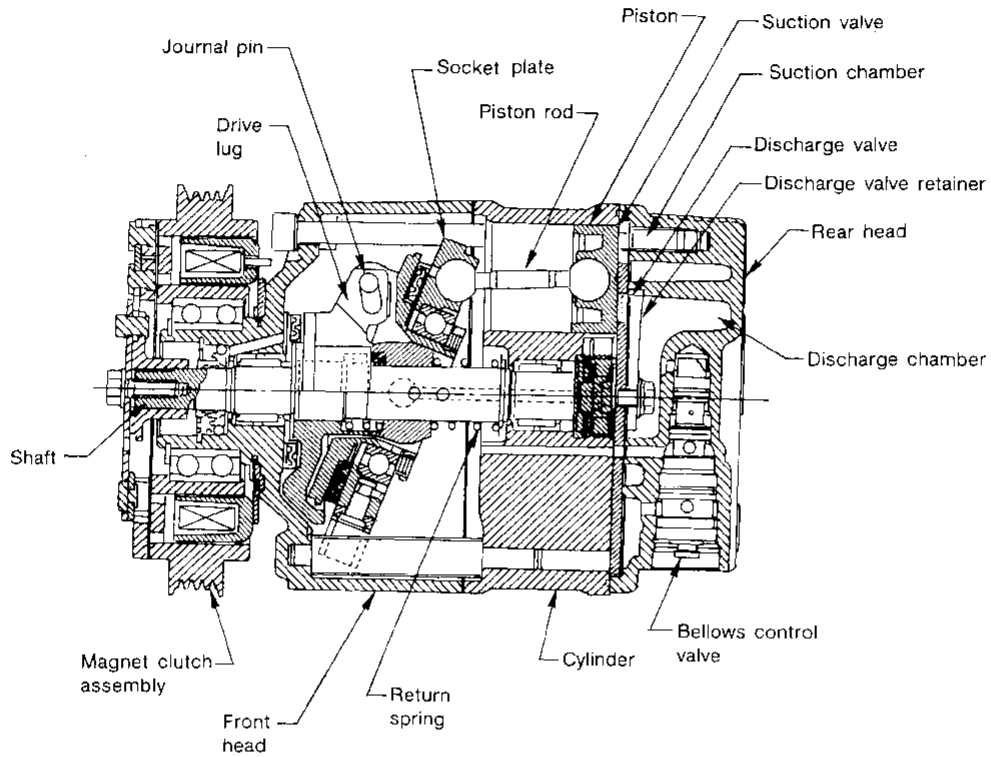
V-6 Variable Displacement Compressor (Cont'd)

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 14.5 to 184 cm<sup>3</sup> (0.885 to 11.228 cu in).



Discharge control	Discharge capacity cm <sup>3</sup> (cu in)/rev.	Piston stroke length mm (in)
Minimum	14.5 (0.885)	2.3 (0.091)
Maximum	184 (11.228)	28.6 (1.126)

RHA037DB

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## 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

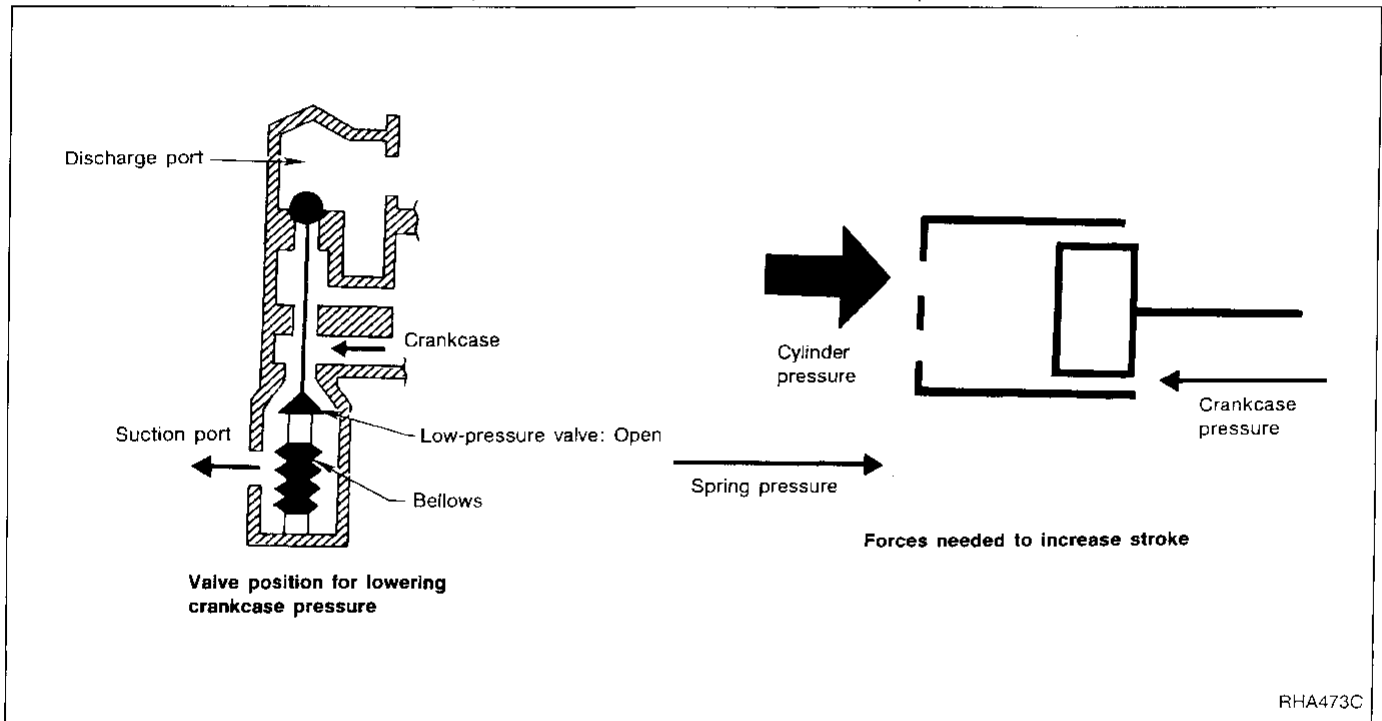
Refrigerant pressure on the low-pressure side increases with an increase in heat loads.

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 following pressure changes:

- the crankcase's internal pressure to equal the pressure on the low-pressure side;
- 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)

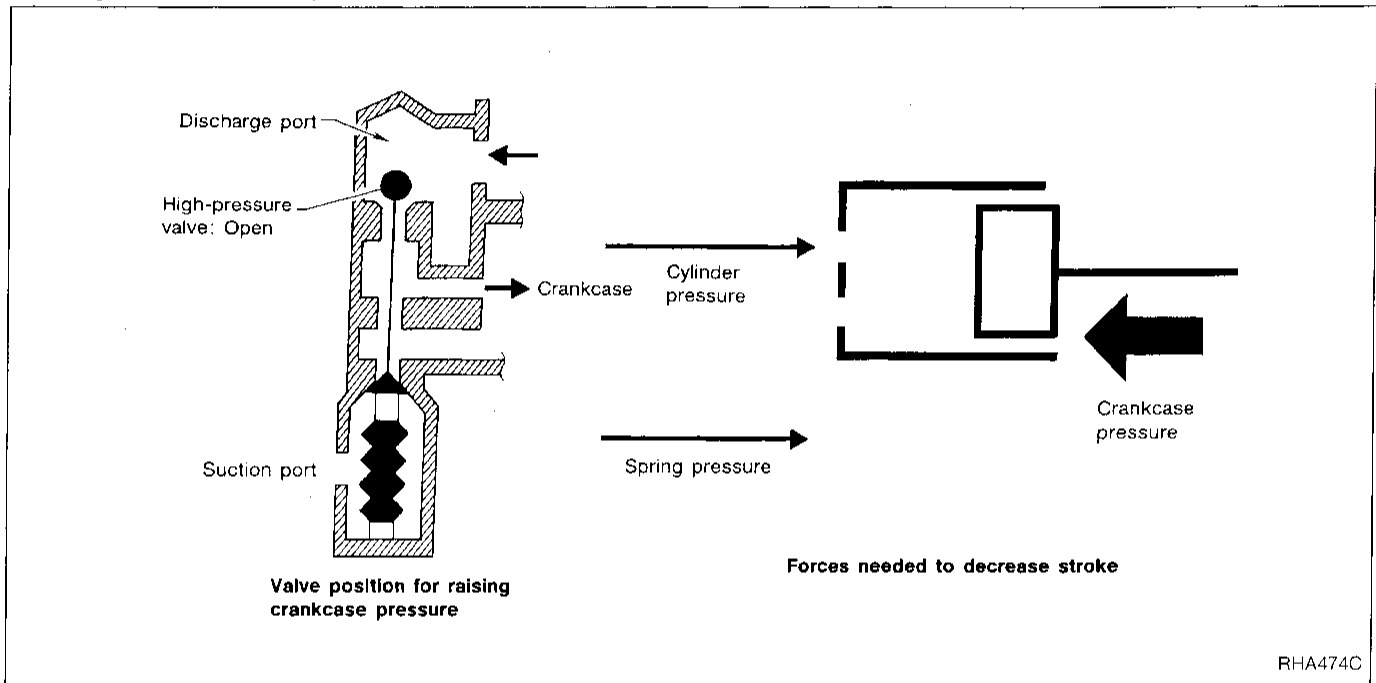
## 3. Capacity control

- 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<sup>2</sup>, 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  $P_s$  and discharge pressure  $P_d$ , which is near suction pressure  $P_s$ . If crankcase pressure  $P_c$  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, crankcase pressure increase triggers pressure difference between the piston and the crankcase. The pressure difference changes the angle of the swash plate.



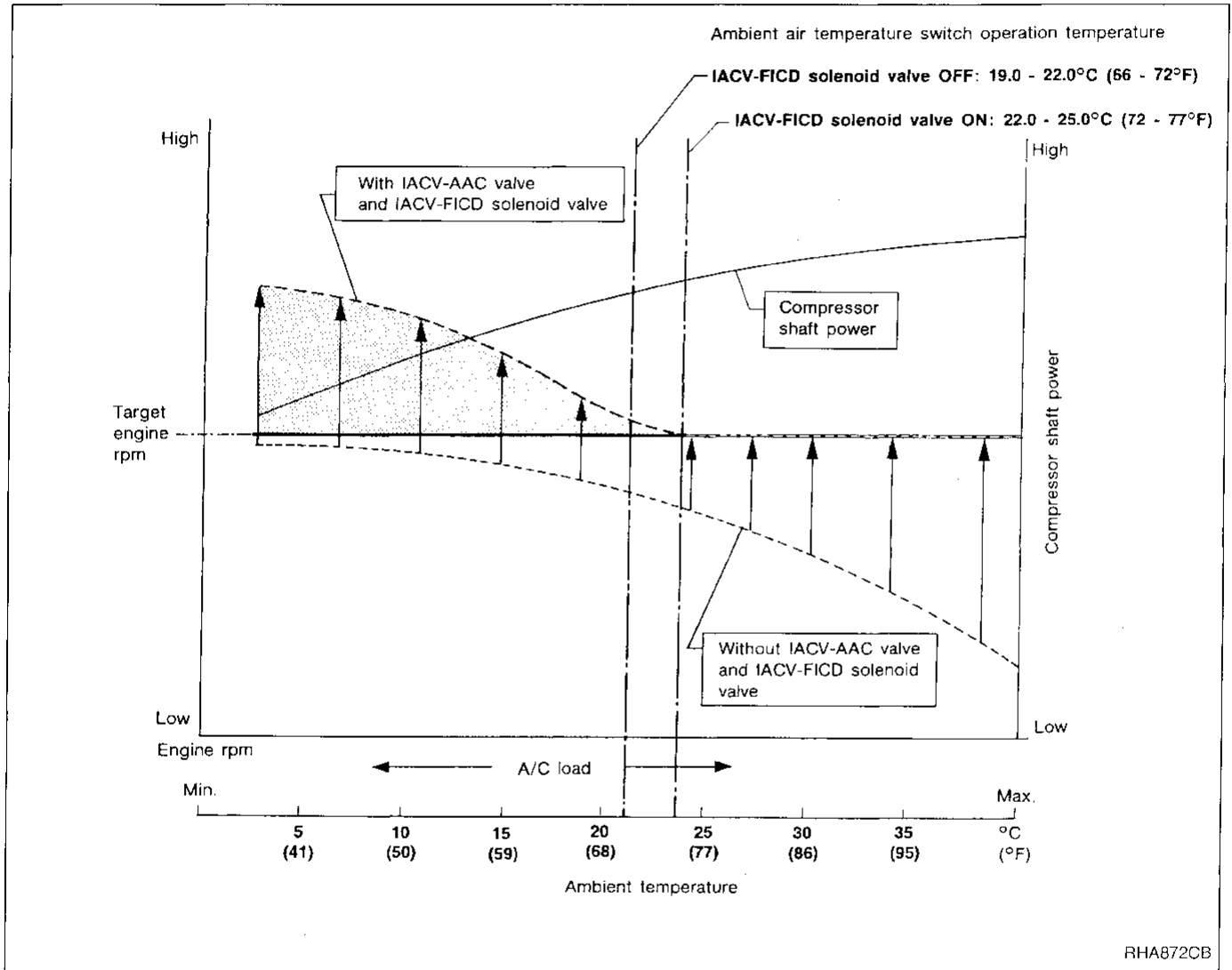


V-6 Variable Displacement Compressor (Cont'd)

FICD CONTROL SYSTEM

General

With the variable displacement compressor, the compressor power requirements differ from when the ambient temperature is high and maximum cooling effect is required (i.e., when refrigerating load is large and the tilt angle of the compressor swash plate is large) to when the ambient temperature is low and less cooling effect is required (i.e., when refrigerating load is small and the tilt angle of the swash plate is small). To correspond correctly to this change in compressor power requirements, it is also necessary to control the operation of the IACV-FICD according to the refrigerating load. Thus, an ambient air temperature switch is provided on the front face of the condenser so that the IACV-FICD can be controlled depending on the ambient temperature.



V-6 Variable Displacement Compressor (Cont'd)

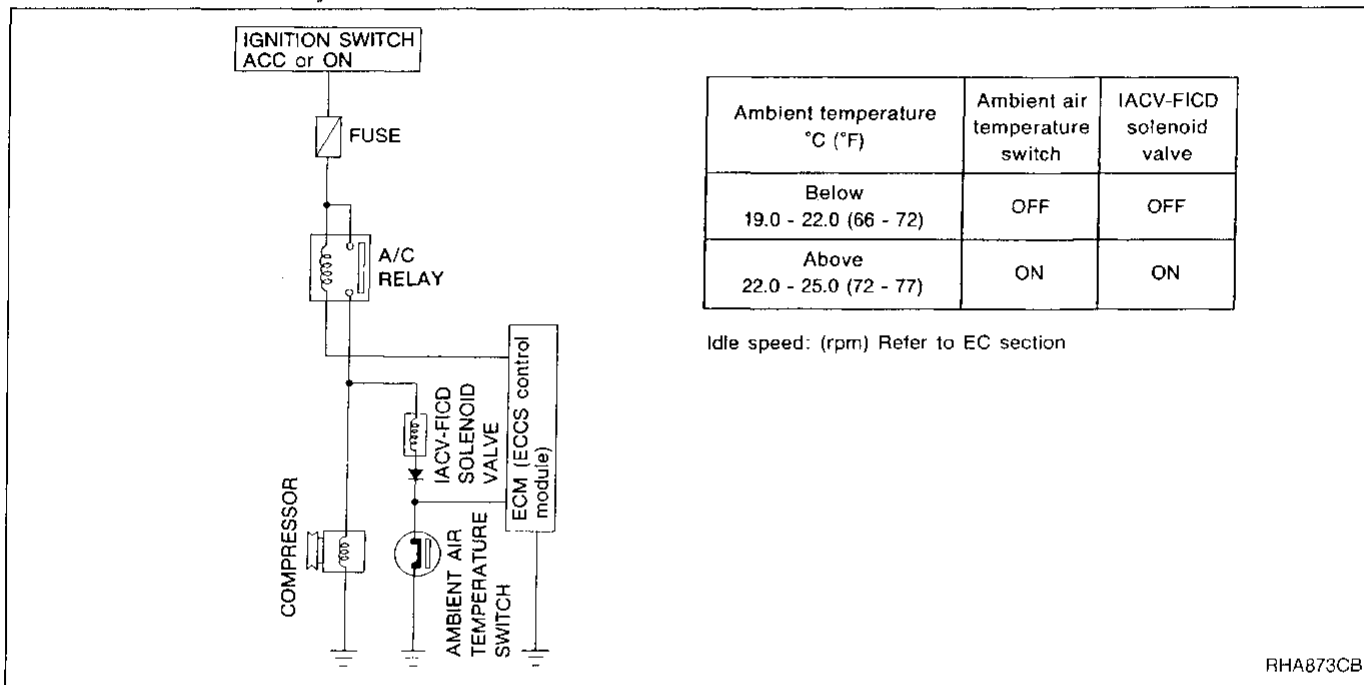
Operation

When the air conditioner is OFF, the ECM (ECCS control module) detects the load applied to the engine, and controls the IACV-AAC valve to adjust the engine idling speed to the appropriate rpm by supplying additional air from the IACV-AAC valve.

When the air conditioner is ON (A/C relay is ON), and when the ambient air temperature switch is ON (this switch turns ON automatically when the ambient temperature rises to approx. 25.0°C (77°F) or higher), the IACV-FICD solenoid valve is energized and additional air is supplied to the engine.

If the appropriate engine speed is not reached, the IACV-AAC valve supplies the additional air required to increase the engine rpm.

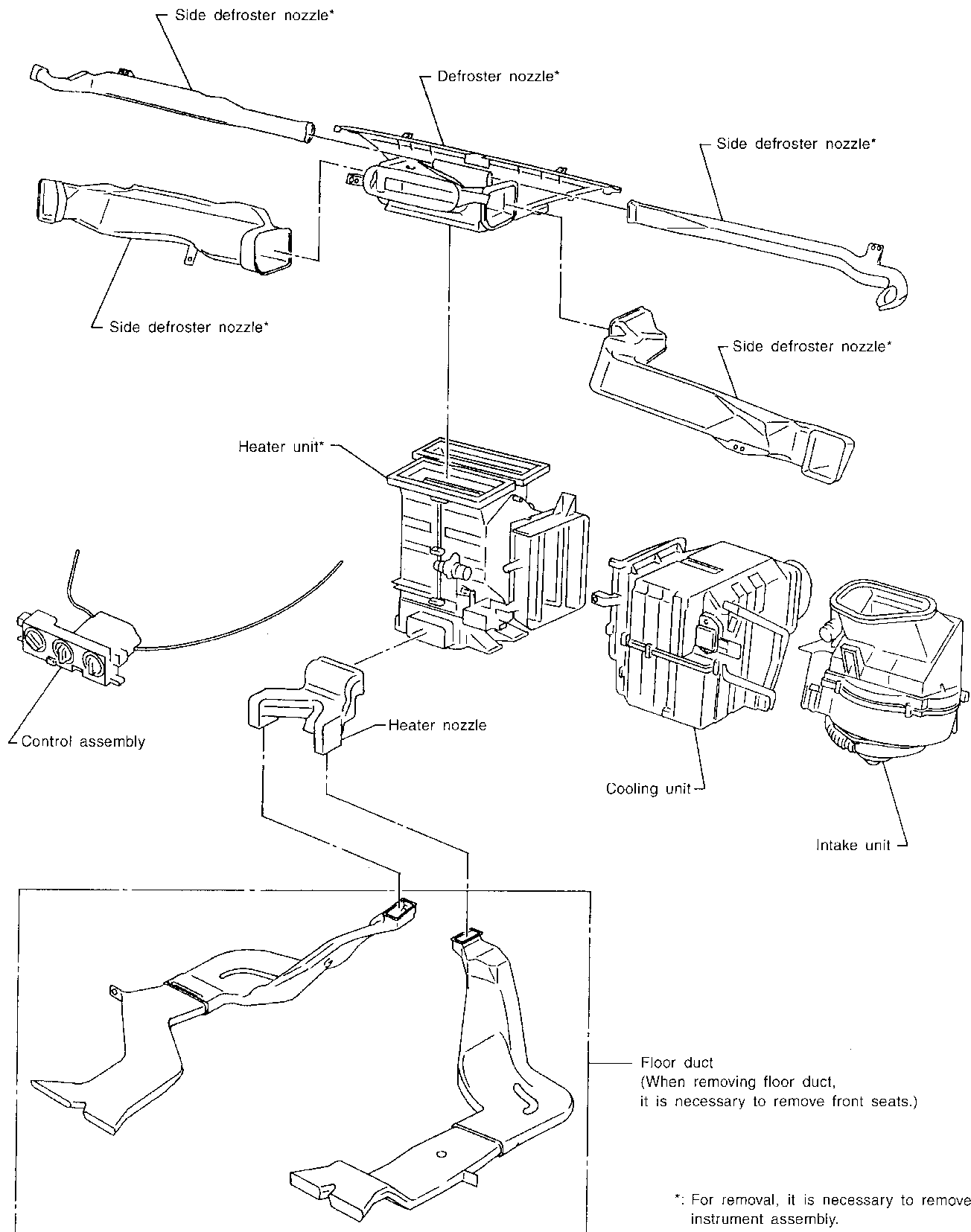
If the ambient air temperature switch is OFF (this switch turns OFF when the ambient temperature is below 19.0°C (66°F) even when the air conditioner is ON (A/C relay is ON), the IACV-FICD solenoid valve is deenergized, and the idling speed is controlled so that the appropriate rpm can be achieved by operation of the IACV-AAC valve only.



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### Component Layout

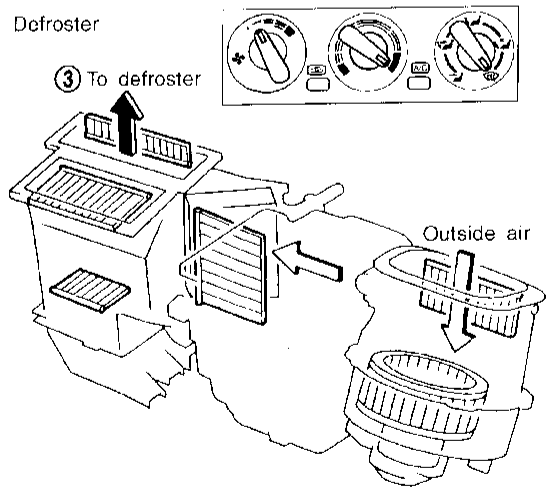
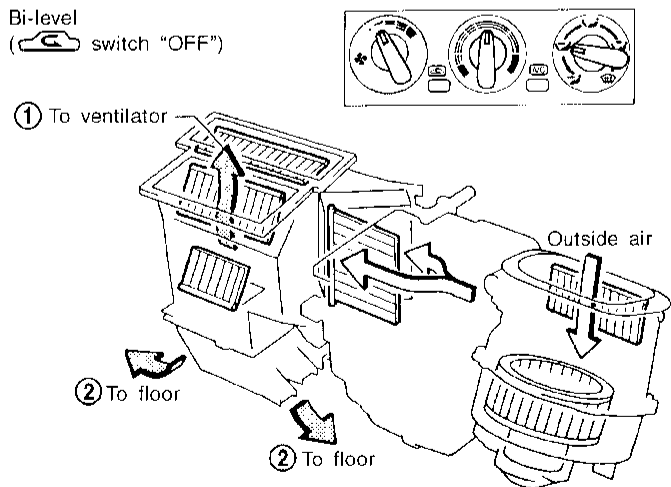
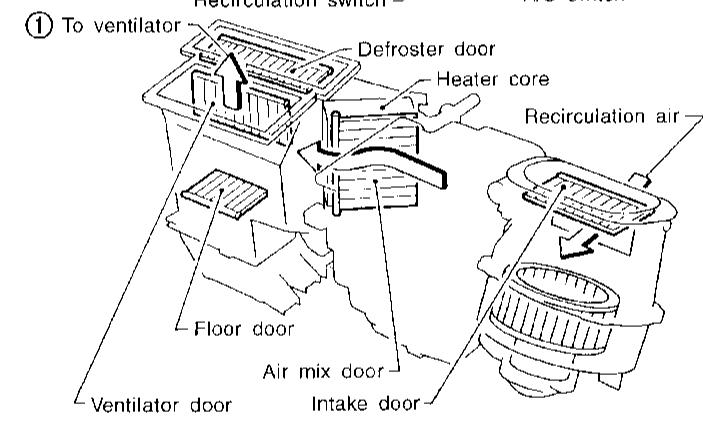
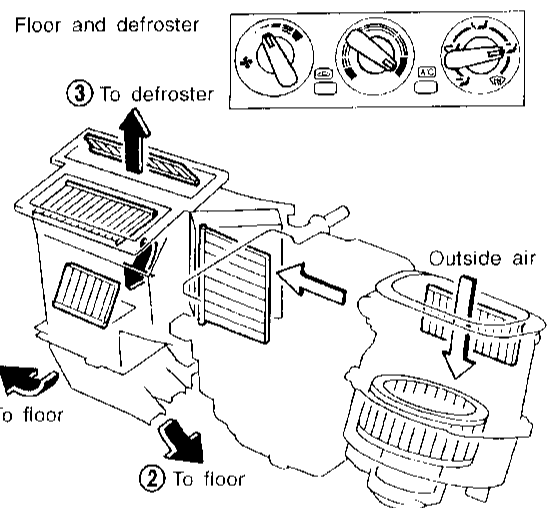
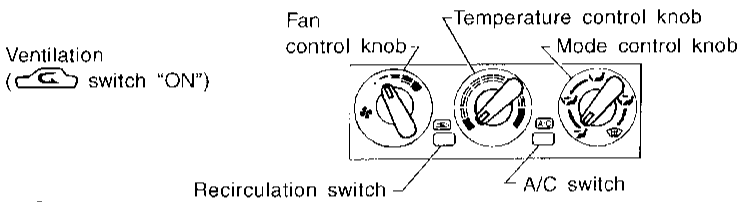
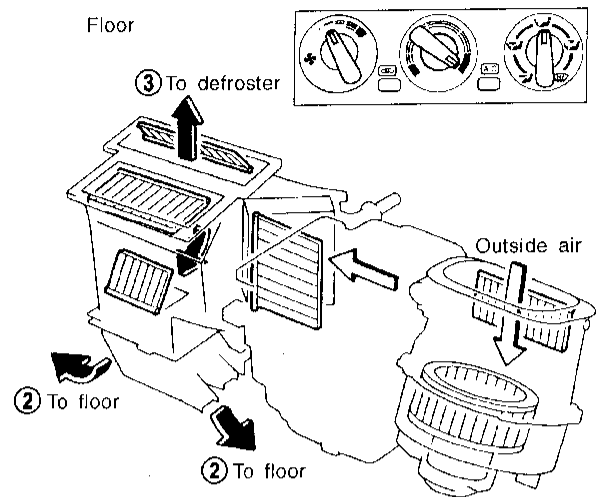
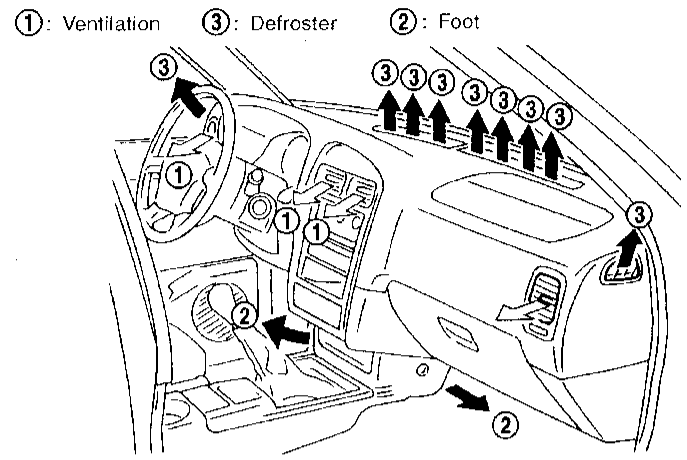
SEC. 270•271•272•273



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

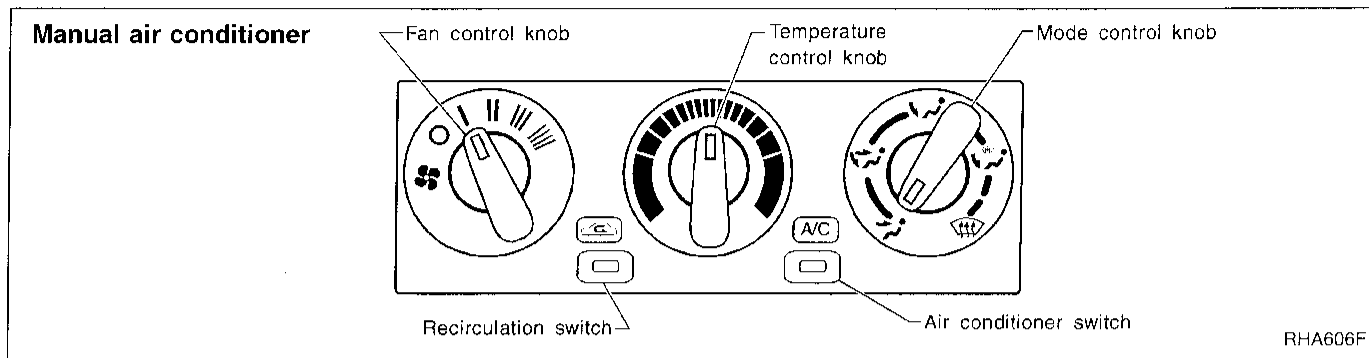
Discharge Air Flow

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← : Air passed through heater core  
 ← + ← : Mixed air  
 ← : Air not passed through heater core

## Control Operation

**FAN CONTROL KNOB**

This knob turns the fan ON and OFF, and controls fan speed.

**MODE CONTROL KNOB**

This knob controls the outlet air flow.

In "DEF" or "D/F" mode, the intake door is set to "FRESH".

**TEMPERATURE CONTROL KNOB**

This knob allows adjustment of the temperature of the outlet air.

**RECIRCULATION (REC) SWITCH**

OFF position: Outside air is drawn into the passenger compartment.

ON position: Interior air is recirculated inside the vehicle. The indicator lamp will also light.

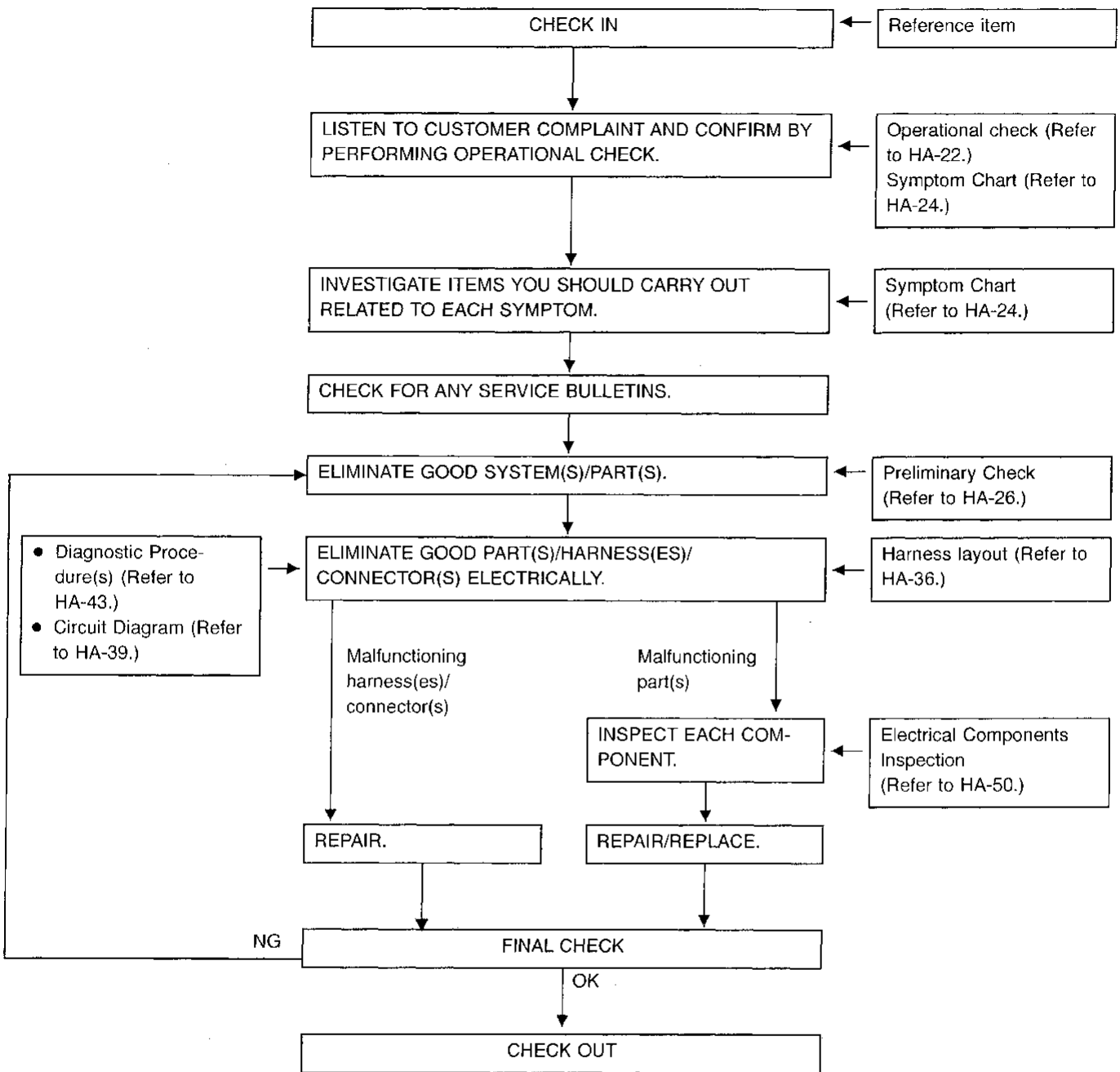
**AIR CONDITIONER SWITCH**

The air conditioner switch controls the A/C system. When the switch is depressed with the fan ON, the compressor will turn ON. The indicator lamp will also light.

**The air conditioner cooling function operates only when the engine is running.**

How to Perform Trouble Diagnoses for Quick and Accurate Repair

WORK FLOW



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**Operational Check**

The purpose of the operational check is to confirm that the system operates as it should. The systems which are checked are the blower, mode (discharge air), intake air, temperature decrease, temperature increase.

**CONDITIONS:**

Engine running at normal operating temperature.

**PROCEDURE:**

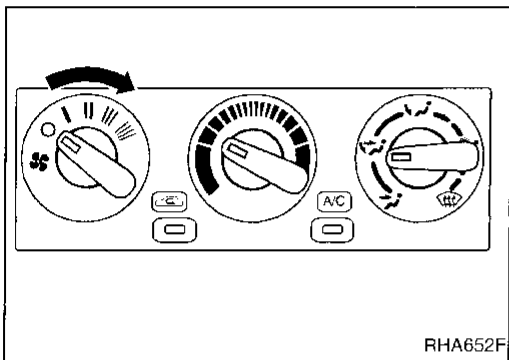
**1. Check blower**

- 1) Turn fan control knob to 1-speed. Blower should operate on 1-speed.
- 2) Then turn fan control knob to 2-speed.
- 3) Continue checking blower speed until all four speeds are checked.
- 4) Leave blower on 4-speed.

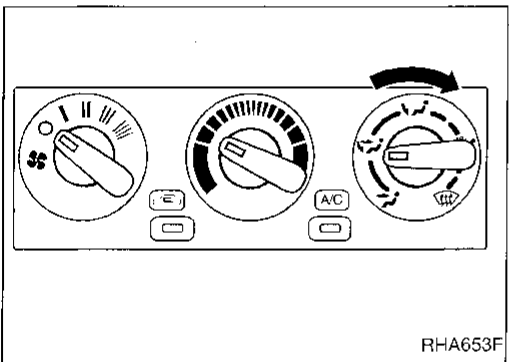
**2. Check discharge air.**

- 1) Turn mode control knob.

- 2) Confirm that discharge air comes out according to the air distribution table at left. Refer to "Discharge Air Flow" in "DESCRIPTION" (HA-19).



RHA652F



RHA653F

**Discharge air flow**

Mode control knob	Air outlet/distribution		
	Face	Foot	Defroster
	100%	-	-
	60%	40%	-
	-	80%	20%
	-	60%	40%
	-	-	100%

RHA654F

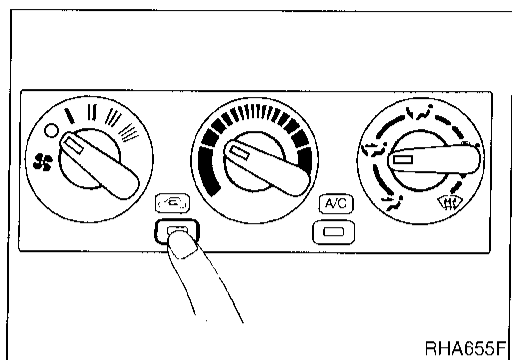
**Operational Check (Cont'd)**

**3. Check recirculation**

- 1) Press recirculation switch. Recirculation indicator should light.
- 2) Listen for intake door position change (you should hear blower sound change slightly).

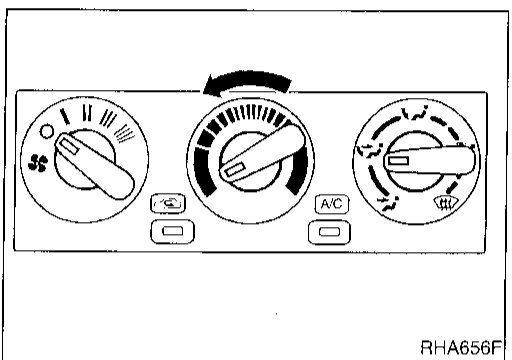
**NOTE:**

Confirm that the RECIRCULATION (REC) switch is canceled in the DEF (  ) and D/F (  ) mode.



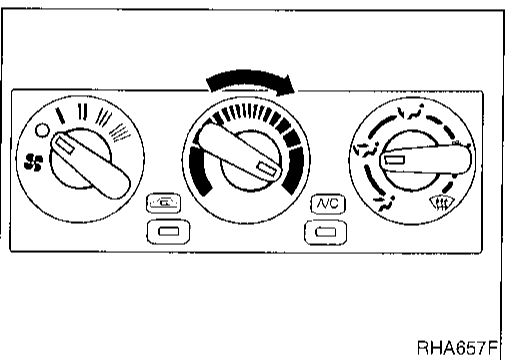
**4. Check temperature decrease**

- 1) Turn temperature control knob to full cold.
- 2) Check for cold air at discharge air outlets.



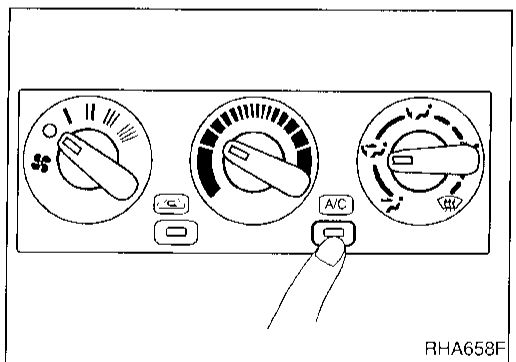
**5. Check temperature increase**

- 1) Turn temperature control knob to full hot.
- 2) Check for hot air at discharge air outlets.



**6. Check air conditioner switch**

Turn fan control knob to the desired (1 to 4-speed) position and push the air conditioner switch to turn ON the air conditioner. The indicator light should come on when air conditioner is ON.



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Symptom Chart

DIAGNOSTIC TABLE

PROCEDURE	Preliminary Check				Diagnostic Procedure		
	HA-26	HA-27	HA-28	HA-29	HA-43	HA-45	HA-47
REFERENCE PAGE							
SYMPTOM	Preliminary check 1	Preliminary check 2	Preliminary check 3	Preliminary check 4	Diagnostic procedure 1	Diagnostic procedure 2	Diagnostic procedure 3
A/C does not blow cold air.	①				○		○
Blower motor does not rotate.	①				②		
Insufficient heating				①	○		
Air outlet does not change.		①					
Intake door does not change.						①	
Magnet clutch does not operate when A/C switch and fan switch are ON.	①						②
Noise			①				

①, ② : The number means checking order.  
 ○ : As for checking order, refer to each flow chart. (It depends on malfunctioning portion.)

# TROUBLE DIAGNOSES

## Symptom Chart (Cont'd)

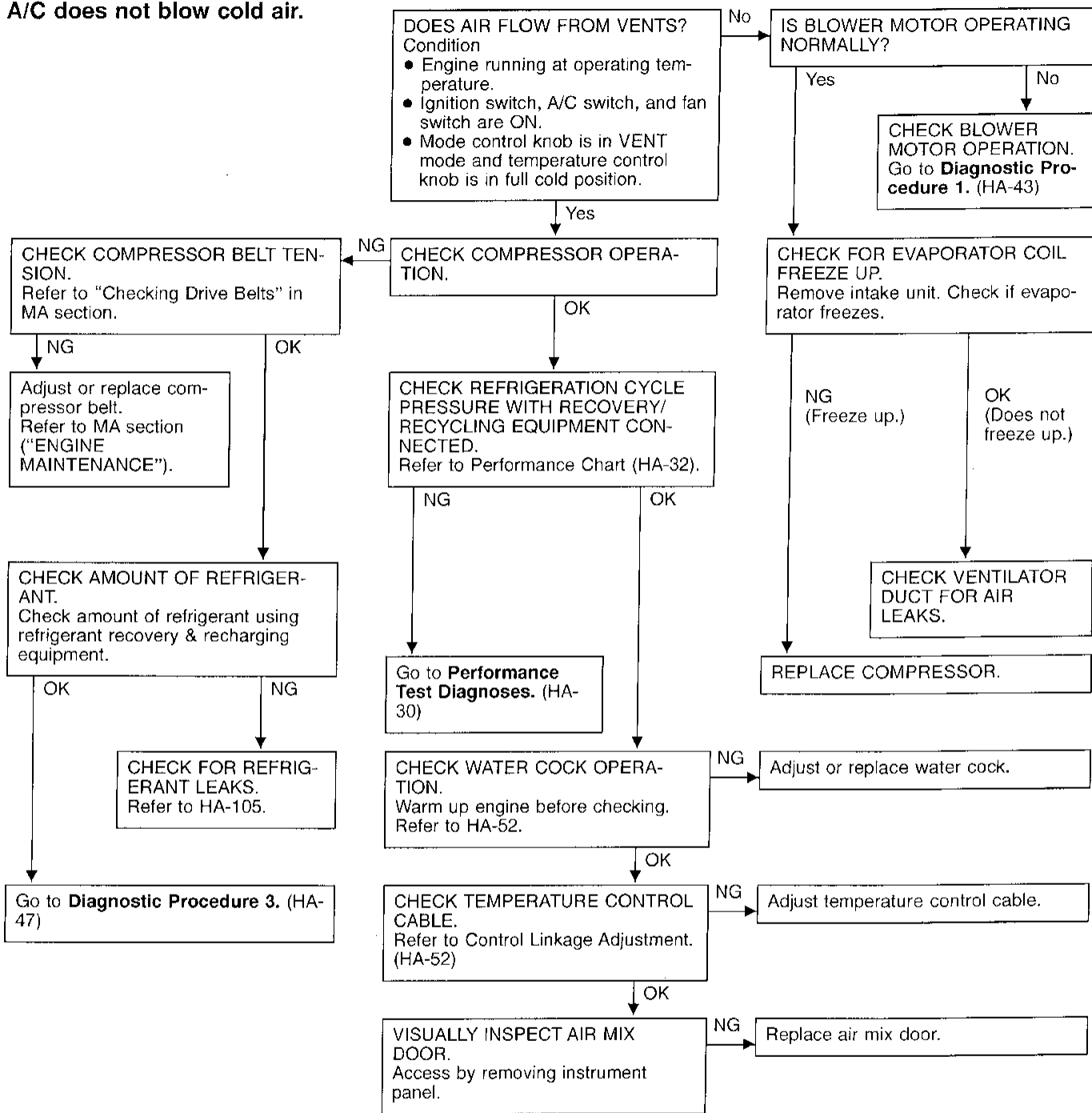
Electrical Components Inspection

	HA-50	HA-50	HA-50	HA-51	HA-51	HA-50	HA-51	HA-51	Refer to EC section	Refer to EL section	
Blower motor											
Blower resistor											
A/C switch											
Recirculation switch											
Mode switch											
Fan switch											
A/C relay											
Dual-pressure switch											
ECM (ECCS control module), ECM (Engine control module)											
Illumination system											
Harness											
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>
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Preliminary Check

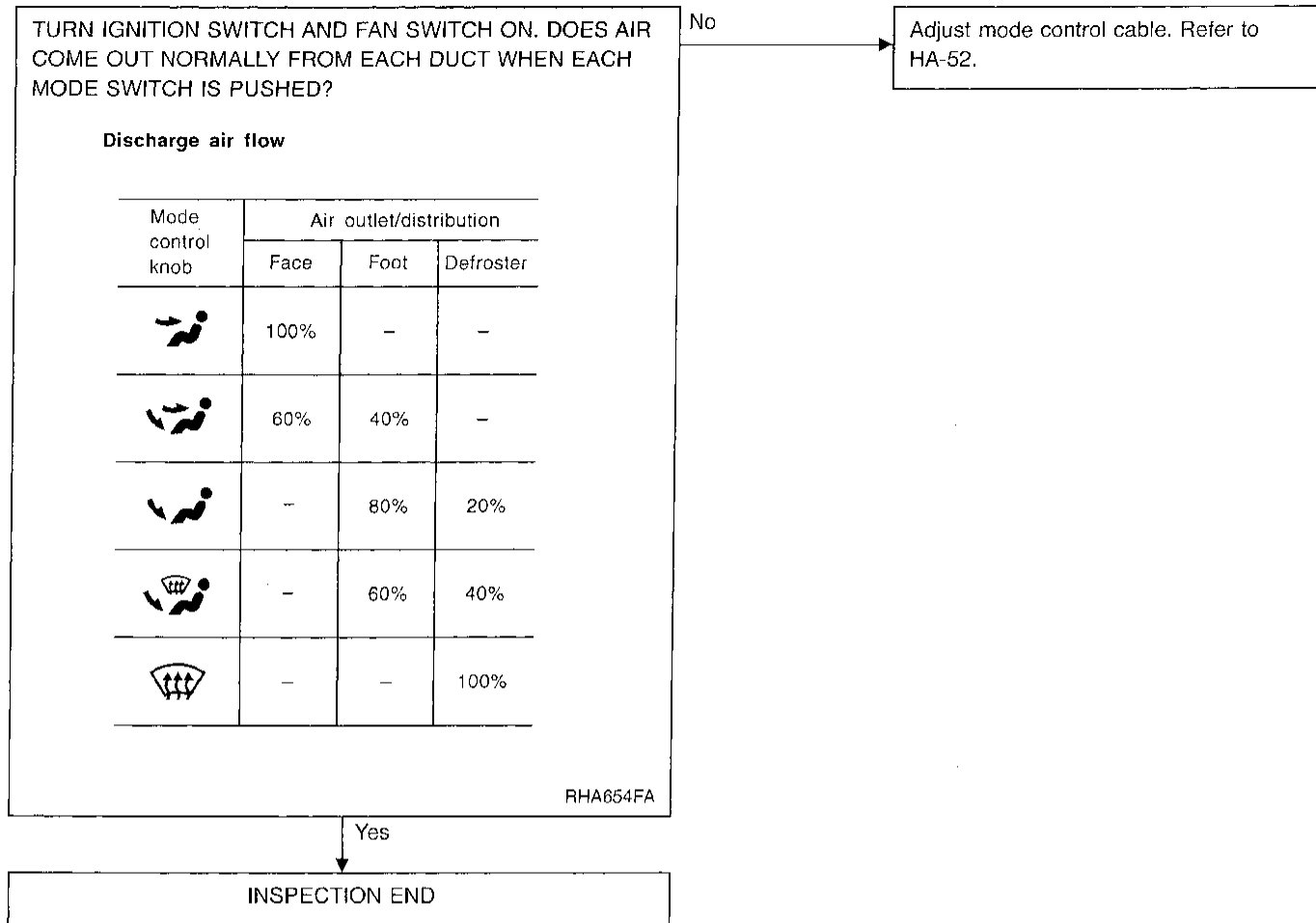
**PRELIMINARY CHECK 1**  
A/C does not blow cold air.



Preliminary Check (Cont'd)

PRELIMINARY CHECK 2

Air outlet does not change.

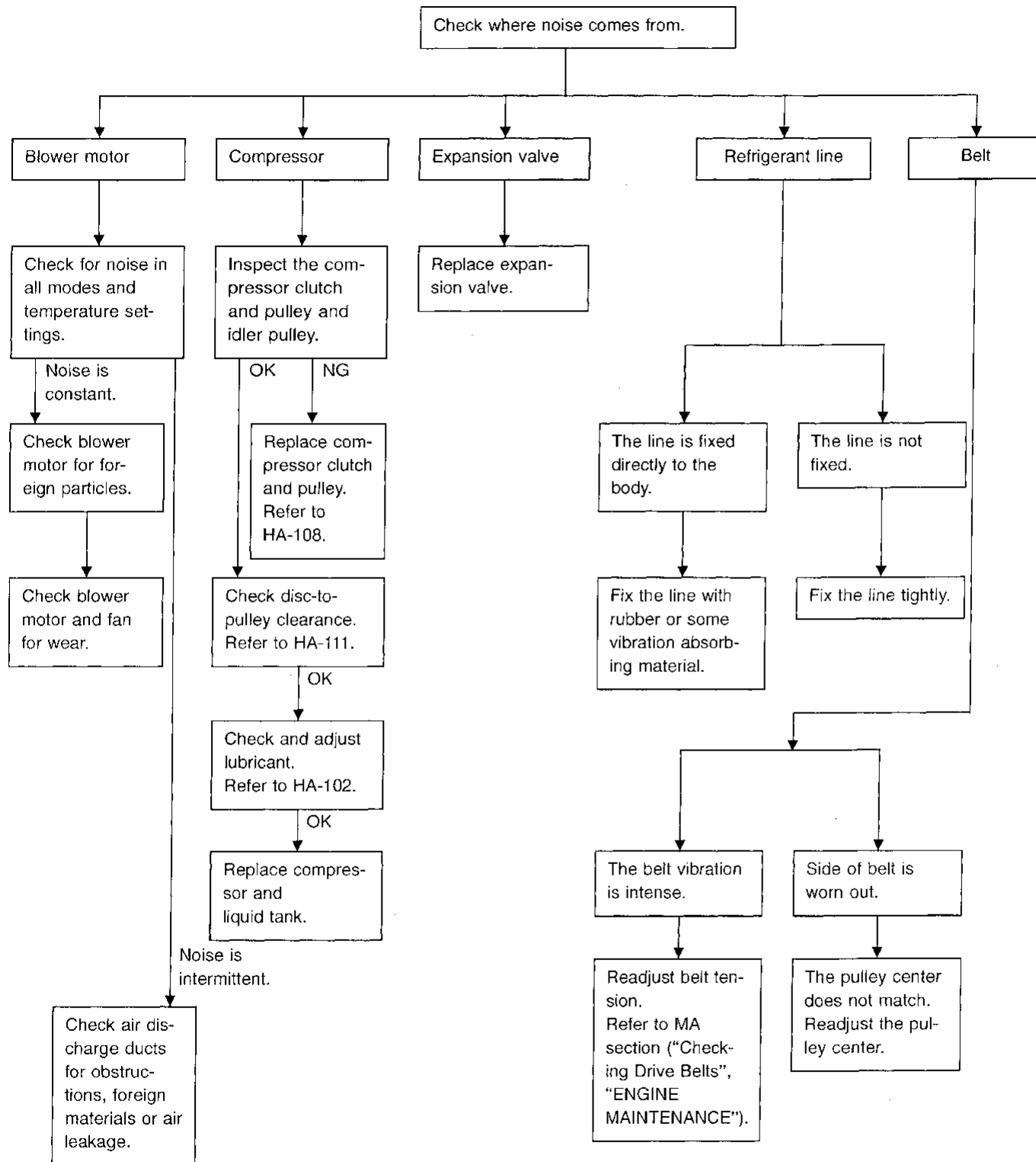


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- HA**
- EL
- DX

Preliminary Check (Cont'd)

PRELIMINARY CHECK 3

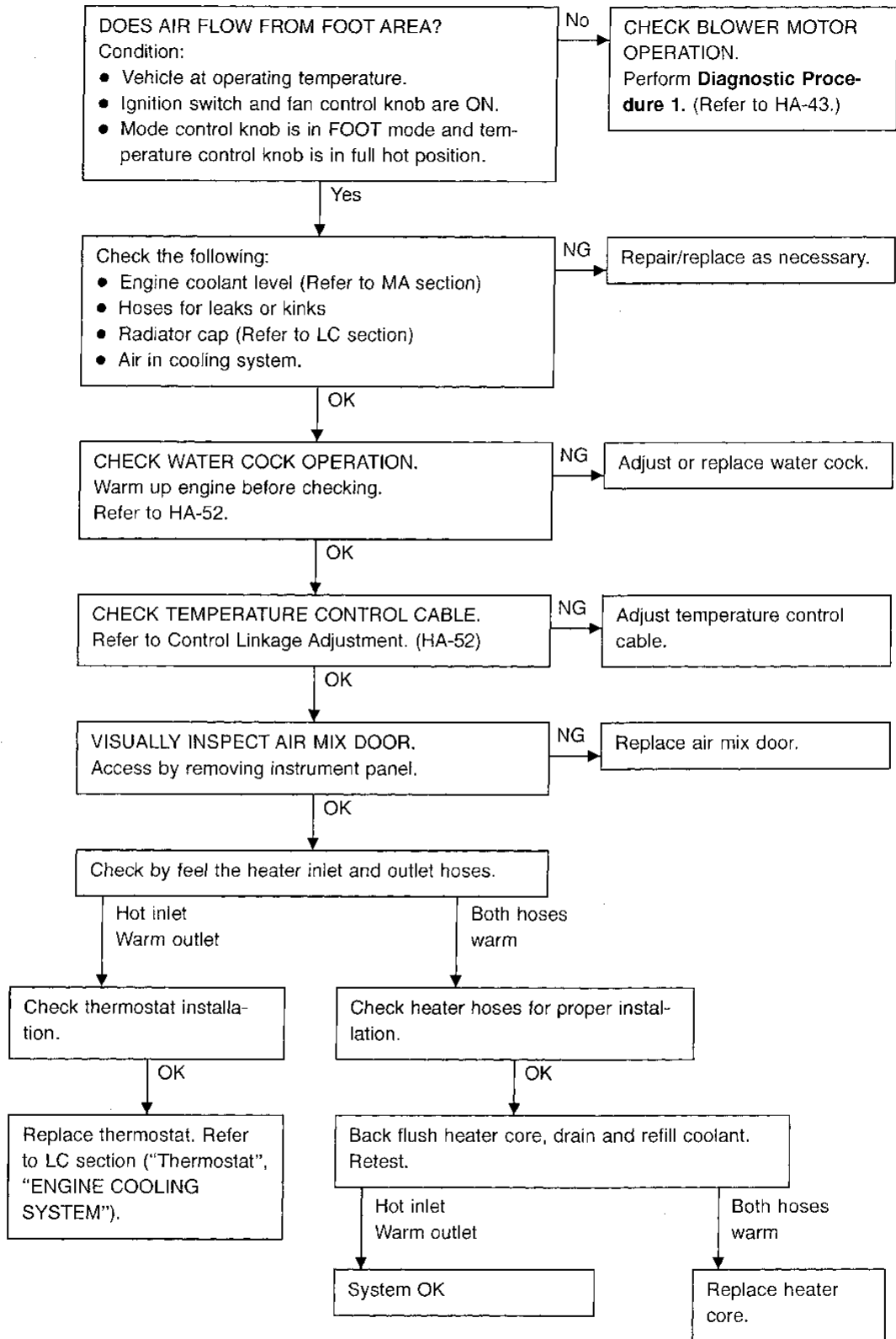
Noise



Preliminary Check (Cont'd)

PRELIMINARY CHECK 4

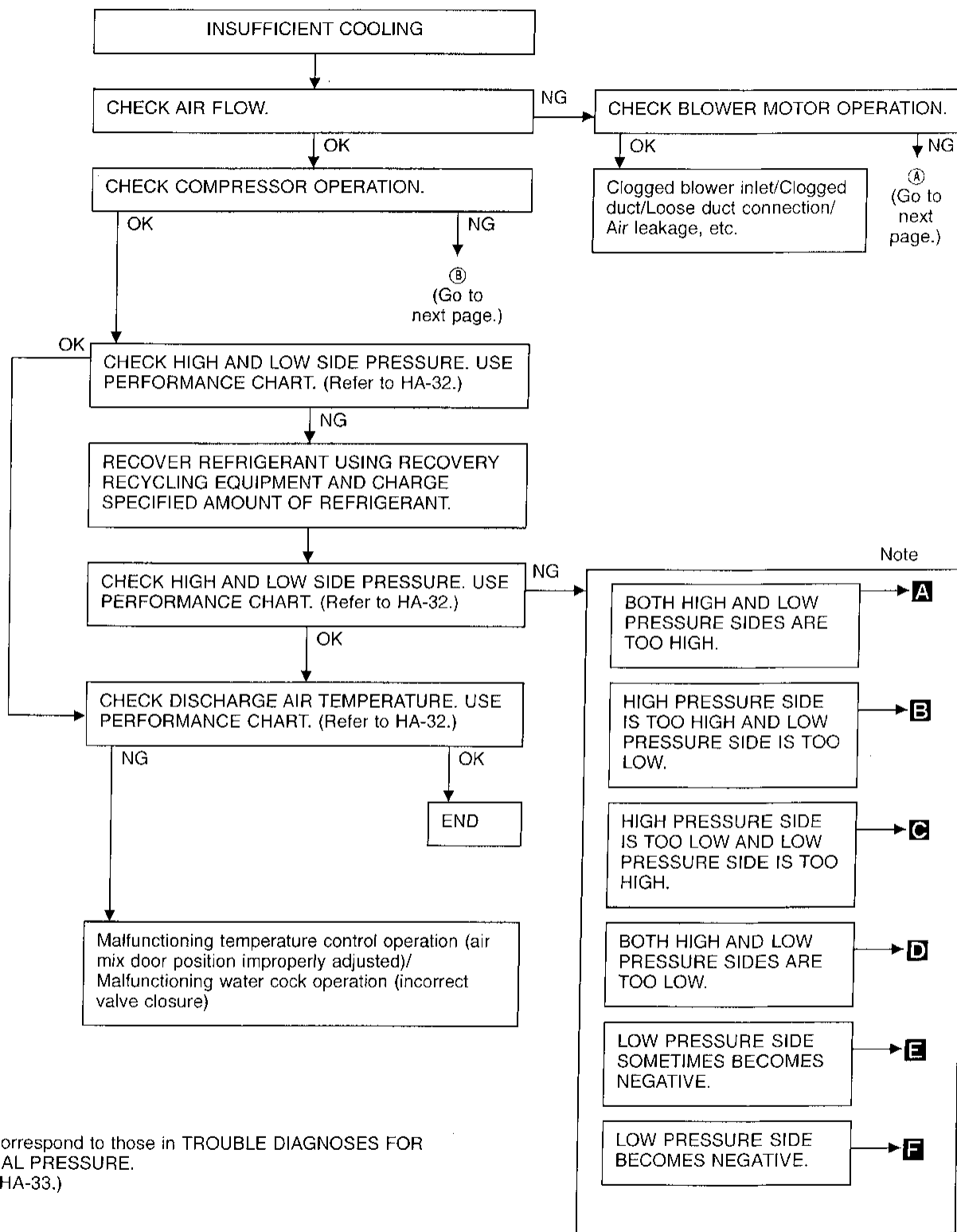
Insufficient heating



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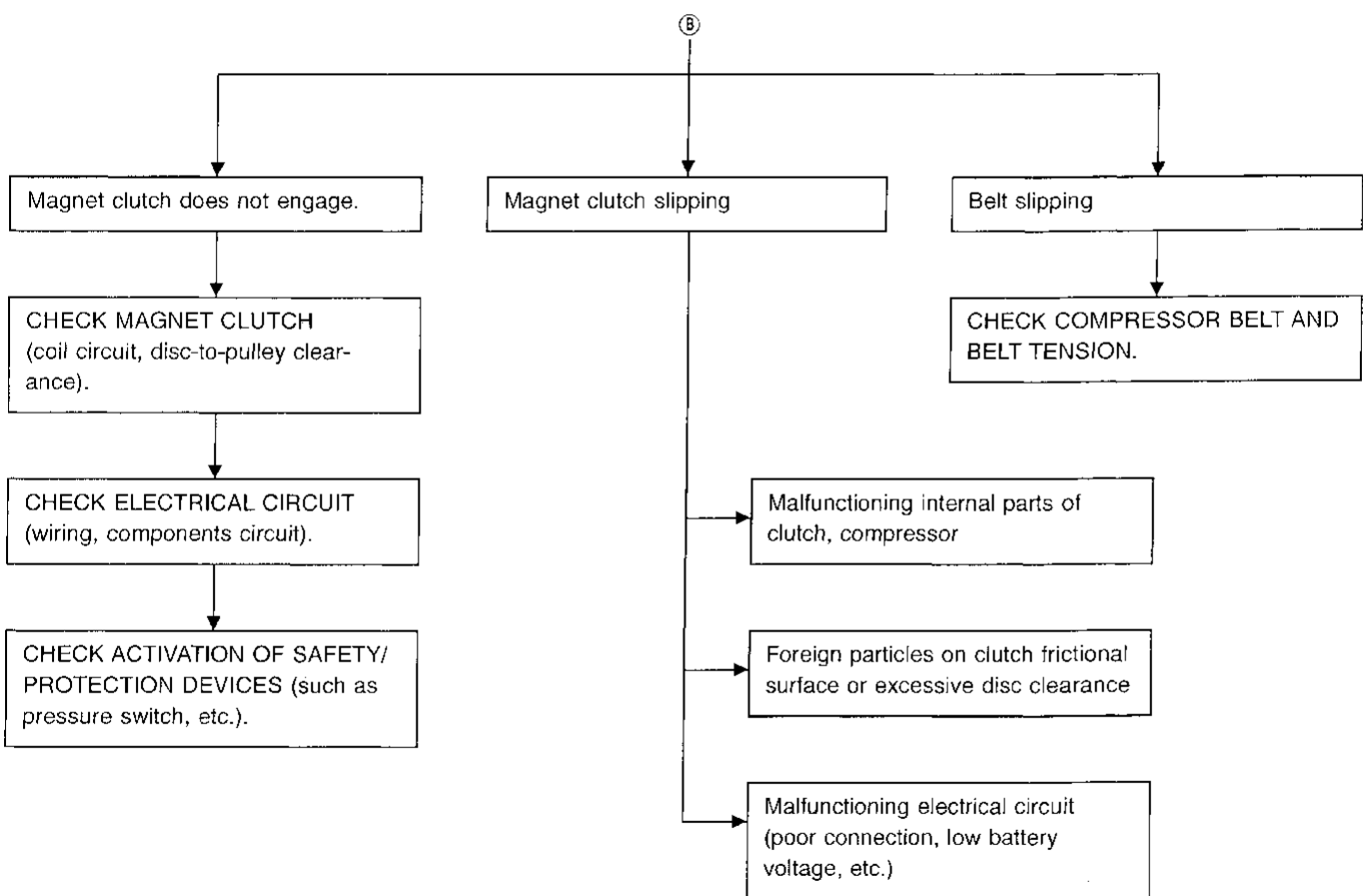
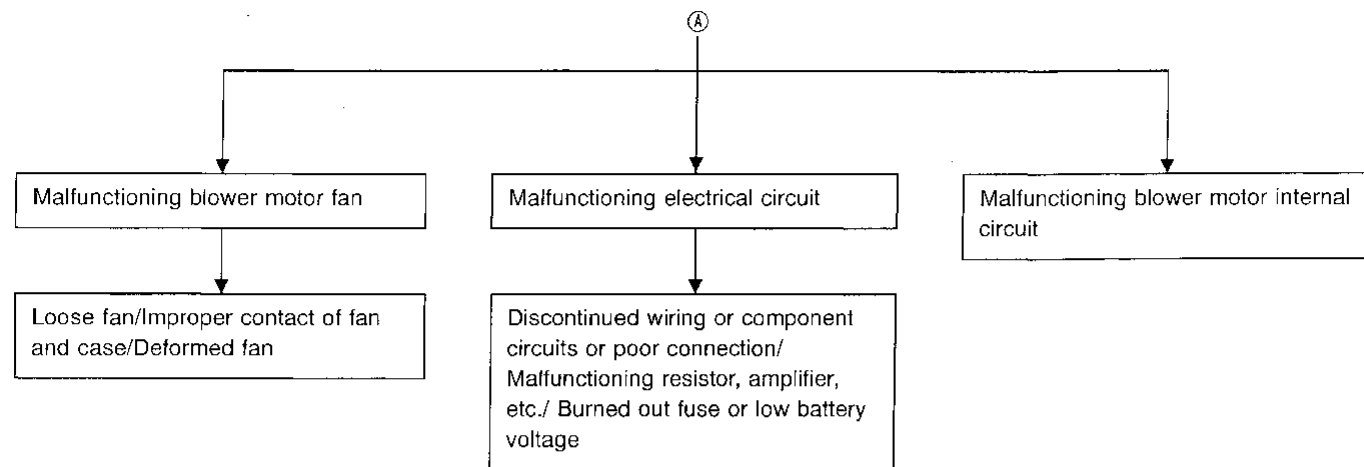
Performance Test Diagnoses

INSUFFICIENT COOLING



Note: **A-F** correspond to those in TROUBLE DIAGNOSES FOR ABNORMAL PRESSURE. (Refer to HA-33.)

Performance Test Diagnoses (Cont'd)



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## Performance Chart

### TEST CONDITION

Testing must be performed as follows:

Vehicle location: Indoors or in the shade (in a well-ventilated place)

Doors: Closed

Door window: Open

Hood: Open

TEMP.: Max. COLD

Discharge Air: Face Vent

REC switch: (Recirculation) set

FAN speed: High speed

Engine speed: Idle speed

Operate the air conditioning system for 10 minutes before taking measurements.

### TEST READING

#### Recirculating-to-discharge air temperature table

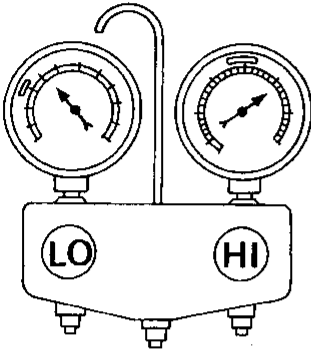
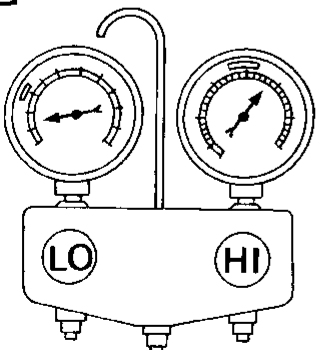
Inside air (Recirculating air) at blower assembly inlet		Discharge air temperature at center ventilator °C (°F)
Relative humidity %	Air temperature °C (°F)	
50 - 60	25 (77)	6.0 - 9.0 (43 - 48)
	30 (86)	10.0 - 13.6 (50 - 56)
	35 (95)	15.2 - 19.5 (59 - 67)
	40 (104)	22.5 - 27.1 (73 - 81)
60 - 70	25 (77)	9.0 - 12.2 (48 - 54)
	30 (86)	13.6 - 17.2 (56 - 63)
	35 (95)	19.5 - 23.7 (67 - 75)
	40 (104)	27.1 - 32.3 (81 - 90)

#### Ambient air temperature-to-operating pressure table

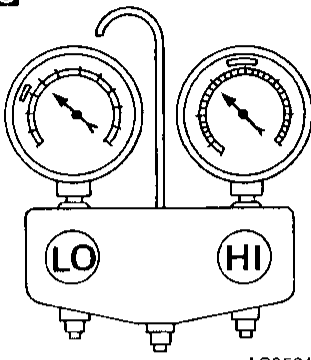
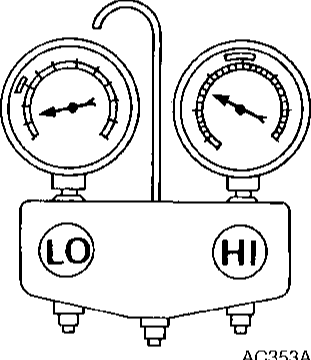
Ambient air		High-pressure (Discharge side) kPa (kg/cm <sup>2</sup> , psi)	Low-pressure (Suction side) kPa (kg/cm <sup>2</sup> , psi)
Relative humidity %	Air temperature °C (°F)		
50 - 70	25 (77)	1,226 - 1,638 (12.5 - 16.7, 178 - 237)	172 - 250 (1.75 - 2.55, 25 - 36)
	30 (86)	1,422 - 1,883 (14.5 - 19.2, 206 - 273)	196 - 275 (2.0 - 2.8, 28 - 40)
	35 (95)	1,657 - 2,187 (16.9 - 22.3, 240 - 317)	231 - 309 (2.35 - 3.15, 33 - 45)
	40 (104)	1,922 - 2,501 (19.6 - 25.5, 279 - 363)	280 - 373 (2.85 - 3.8, 41 - 54)

Trouble Diagnoses for Abnormal Pressure

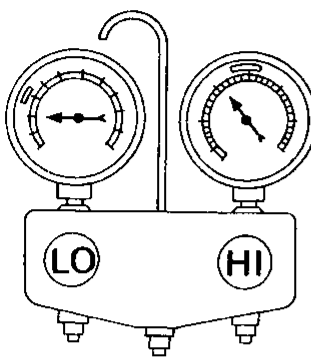
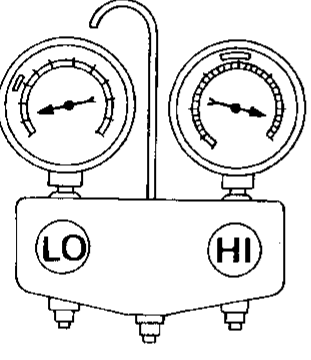
Whenever system's high and/or low side pressure is abnormal, diagnose using a manifold gauge. The marker above the gauge scale in the following tables indicates the standard (normal) pressure range. Since the standard (normal) pressure, however, differs from vehicle to vehicle, refer to HA-32 ("Ambient air temperature-to-operating pressure table").

Gauge indication	Refrigerant cycle	Probable cause	Corrective action
<p>Both high and low-pressure sides are too high.</p> <p><b>A</b></p>  <p>AC359A</p>	<ul style="list-style-type: none"> <li>Pressure is reduced soon after water is splashed on condenser.</li> </ul>	<p>Excessive refrigerant charge in refrigeration cycle</p>	<p>Reduce refrigerant until specified pressure is obtained.</p>
	<p>Air suction by cooling fan is insufficient.</p>	<p>Insufficient condenser cooling performance</p> <p>↓</p> <p>① Condenser fins are clogged. ② Improper fan rotation of cooling fan</p>	<ul style="list-style-type: none"> <li>Clean condenser.</li> <li>Check and repair cooling fan as necessary.</li> </ul>
	<ul style="list-style-type: none"> <li>Low-pressure pipe is not cold.</li> <li>When compressor is stopped high-pressure value quickly drops by approximately 196 kPa (2 kg/cm<sup>2</sup>, 28 psi). It then decreases gradually thereafter.</li> </ul>	<p>Poor heat exchange in condenser (After compressor operation stops, high pressure decreases too slowly.)</p> <p>↓</p> <p>Air in refrigeration cycle</p>	<p>Evacuate repeatedly and recharge system.</p>
	<p>Engine tends to overheat.</p>	<p>Engine cooling systems malfunction.</p>	<p>Check and repair each engine cooling system.</p>
	<ul style="list-style-type: none"> <li>An area of the low-pressure pipe is colder than areas near the evaporator outlet.</li> <li>Plates are sometimes covered with frost.</li> </ul>	<ul style="list-style-type: none"> <li>Excessive liquid refrigerant on low-pressure side</li> <li>Excessive refrigerant discharge flow</li> <li>Expansion valve is open a little compared with the specification.</li> </ul> <p>↓</p> <p>① Improper thermal valve installation ② Improper expansion valve adjustment</p>	<p>Replace expansion valve.</p>
<p>High-pressure side is too high and low-pressure side is too low.</p> <p><b>B</b></p>  <p>AC360A</p>	<p>Upper side of condenser and high-pressure side are hot, however, liquid tank is not so hot.</p>	<p>High-pressure tube or parts located between compressor and condenser are clogged or crushed.</p>	<ul style="list-style-type: none"> <li>Check and repair or replace malfunctioning parts.</li> <li>Check lubricant for contamination.</li> </ul>

Trouble Diagnoses for Abnormal Pressure (Cont'd)

Gauge indication	Refrigerant cycle	Probable cause	Corrective action
High-pressure side is too low and low-pressure side is too high. <b>C</b>  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 pressure operation is improper. ↓ Damaged inside compressor packings.	Replace compressor.
Both high- and low-pressure sides are too low. <b>D</b>  AC353A	<ul style="list-style-type: none"> <li>• There is a big temperature difference between receiver drier outlet and inlet. Outlet temperature is extremely low.</li> <li>• Liquid tank inlet and expansion valve are frosted.</li> </ul>	Compressor discharge capacity does not change. (Compressor stroke is set at maximum.)	<ul style="list-style-type: none"> <li>• Replace liquid tank.</li> <li>• Check lubricant for contamination.</li> </ul>
	<ul style="list-style-type: none"> <li>• Temperature of expansion valve inlet is extremely low as compared with areas near liquid tank.</li> <li>• Expansion valve inlet may be frosted.</li> <li>• Temperature difference occurs somewhere in high-pressure side</li> </ul>	High-pressure pipe located between receiver drier and expansion valve is clogged.	<ul style="list-style-type: none"> <li>• Check and repair malfunctioning parts.</li> <li>• Check lubricant for contamination.</li> </ul>
	<ul style="list-style-type: none"> <li>• Expansion valve and liquid tank are warm or only cool when touched.</li> </ul>	Low refrigerant charge ↓ Leaking fittings or components	Check refrigerant for leaks. Refer to "Checking Refrigerant Leaks", HA-105.
	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.	<ul style="list-style-type: none"> <li>• Remove foreign particles by using compressed air.</li> <li>• Check lubricant for contamination.</li> </ul>
	An area of the low-pressure pipe is colder than areas near the evaporator outlet.	Low-pressure pipe is clogged or crushed.	<ul style="list-style-type: none"> <li>• Check and repair malfunctioning parts.</li> <li>• Check lubricant for contamination.</li> </ul>
	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.

Trouble Diagnoses for Abnormal Pressure (Cont'd)

Gauge indication	Refrigerant cycle	Probable cause	Corrective action
<p>Low-pressure side sometimes becomes negative.</p> <p><b>E</b></p>  <p>AC354A</p>	<ul style="list-style-type: none"> <li>• Air conditioning system does not function and does not cyclically cool the compartment air.</li> <li>• The system constantly functions for a certain period of time after compressor is stopped and restarted.</li> </ul>	<p>Refrigerant does not discharge cyclically.</p> <p style="text-align: center;">↓</p> <p>Moisture is frozen at expansion valve outlet and inlet.</p> <p style="text-align: center;">↓</p> <p>Water is mixed with refrigerant.</p>	<ul style="list-style-type: none"> <li>• Drain water from refrigerant or replace refrigerant.</li> <li>• Replace liquid tank.</li> </ul>
<p>Low-pressure side becomes negative.</p> <p><b>F</b></p>  <p>AC362A</p>	<p>Liquid tank or front/rear side of expansion valve's pipe is frosted or dewed.</p>	<p>High-pressure side is closed and refrigerant does not flow.</p> <p style="text-align: center;">↓</p> <p>Expansion valve or liquid tank is frosted.</p>	<p>Leave the system at rest until no frost is present. Start it again to check whether or not the problem is caused by water or foreign particles.</p> <ul style="list-style-type: none"> <li>• If water is the cause, initially cooling is okay. Then the water freezes, causing a blockage. Drain water from refrigerant or replace refrigerant.</li> <li>• If due to foreign particles, remove expansion valve and remove the particles with dry and compressed air (not shop air).</li> <li>• If either of the above methods cannot correct the problem, replace expansion valve.</li> <li>• Replace liquid tank.</li> <li>• Check lubricant for contamination.</li> </ul>

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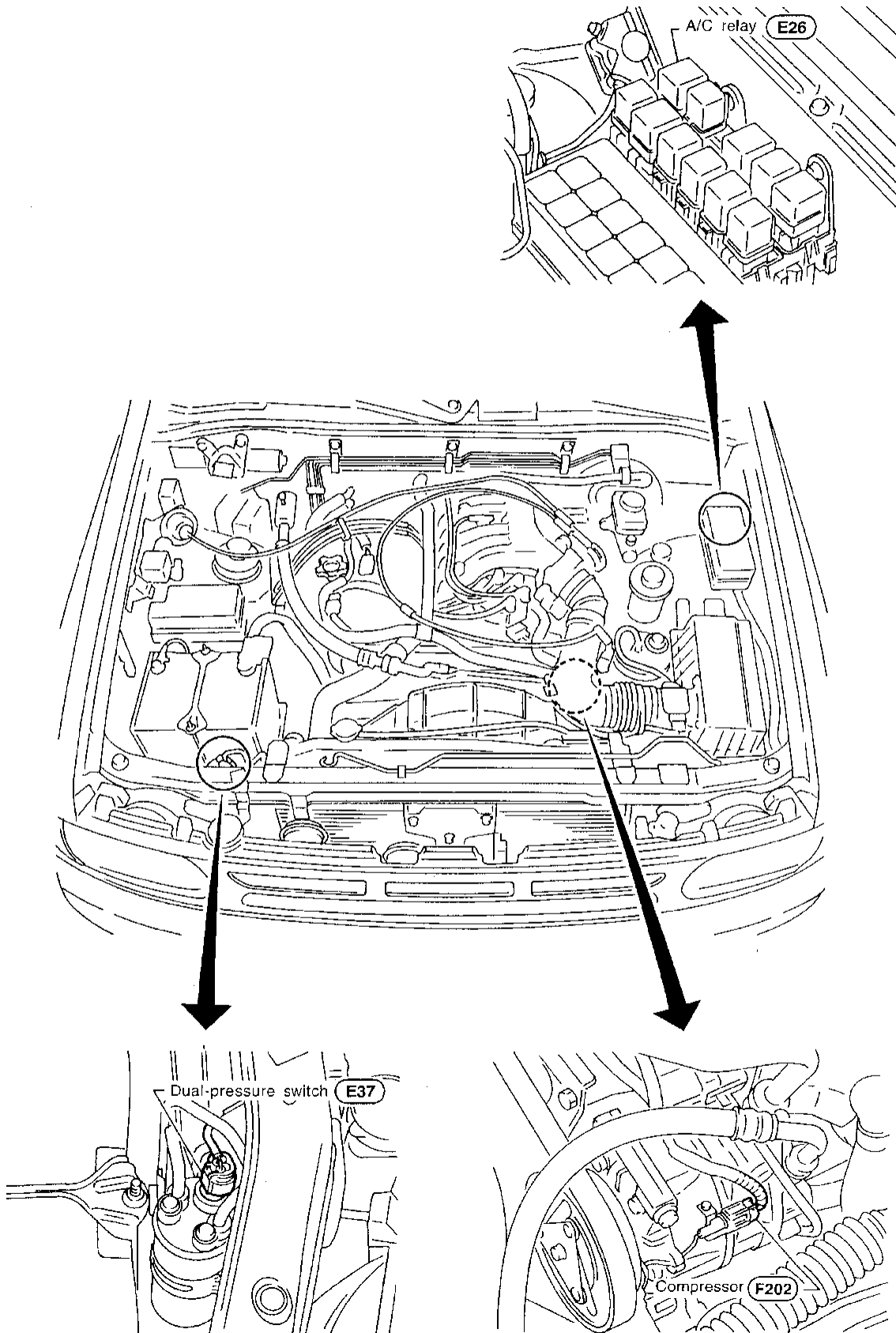
**HA**

EL

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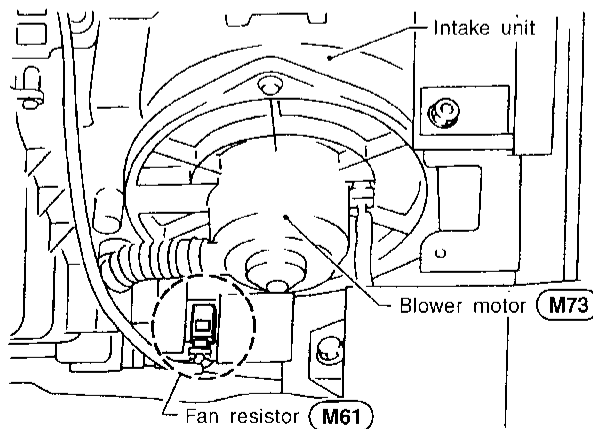
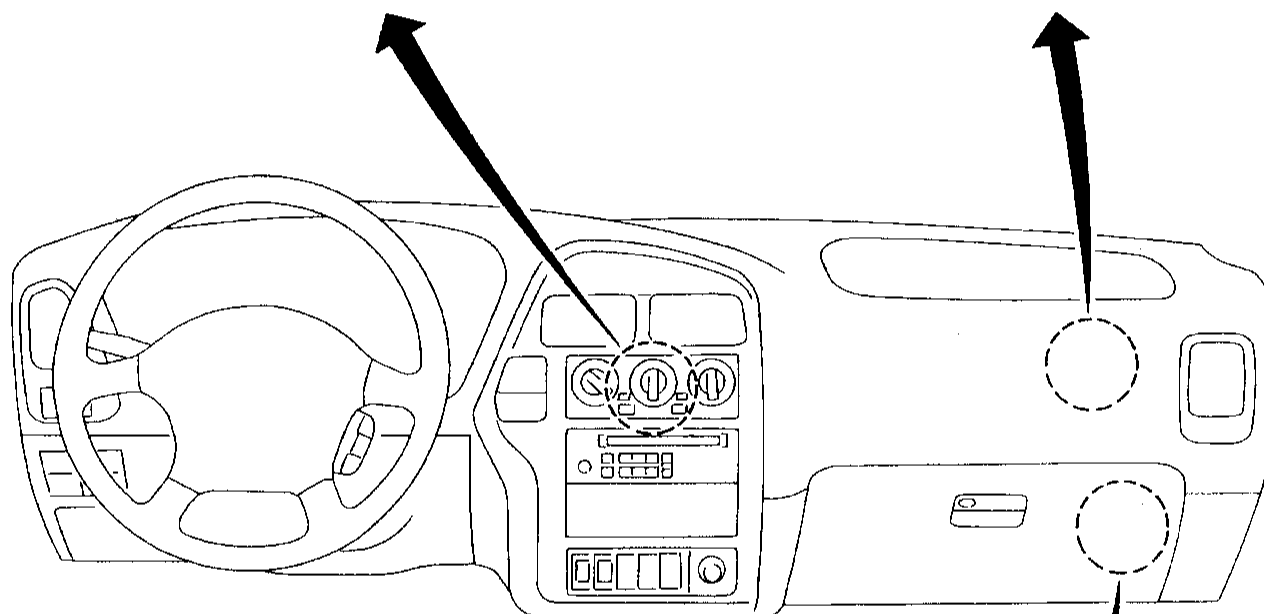
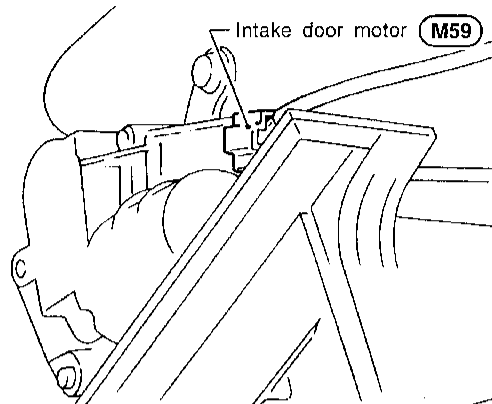
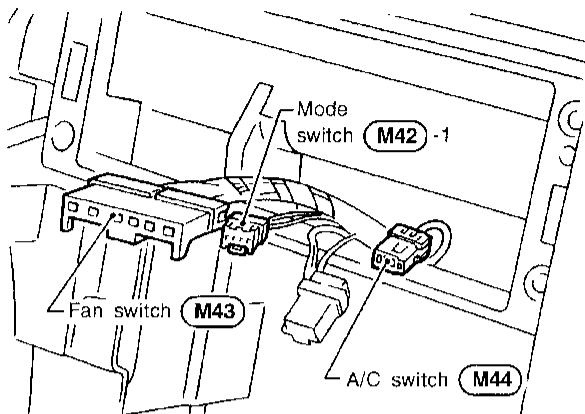
Harness Layout

ENGINE COMPARTMENT



Harness Layout (Cont'd)

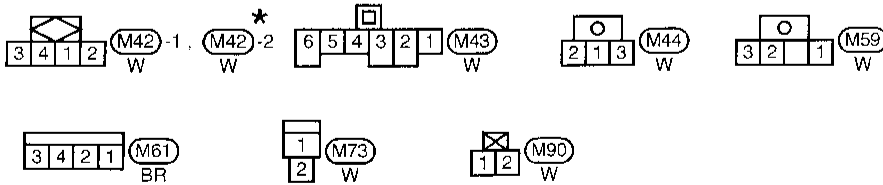
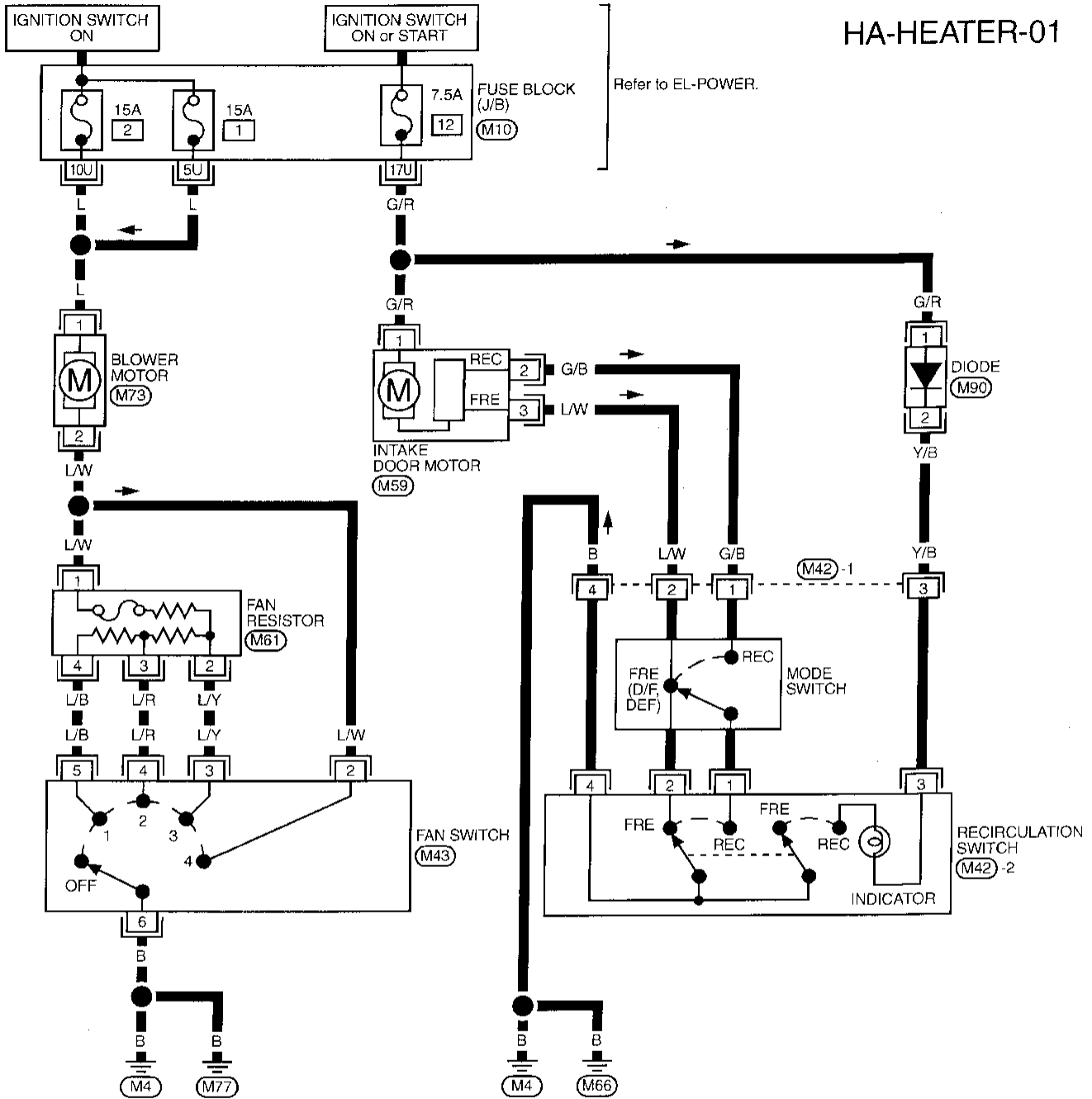
PASSENGER COMPARTMENT



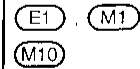
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- BT
- HA**
- EL
- IDX

Wiring Diagram — HEATER —

HA-HEATER-01

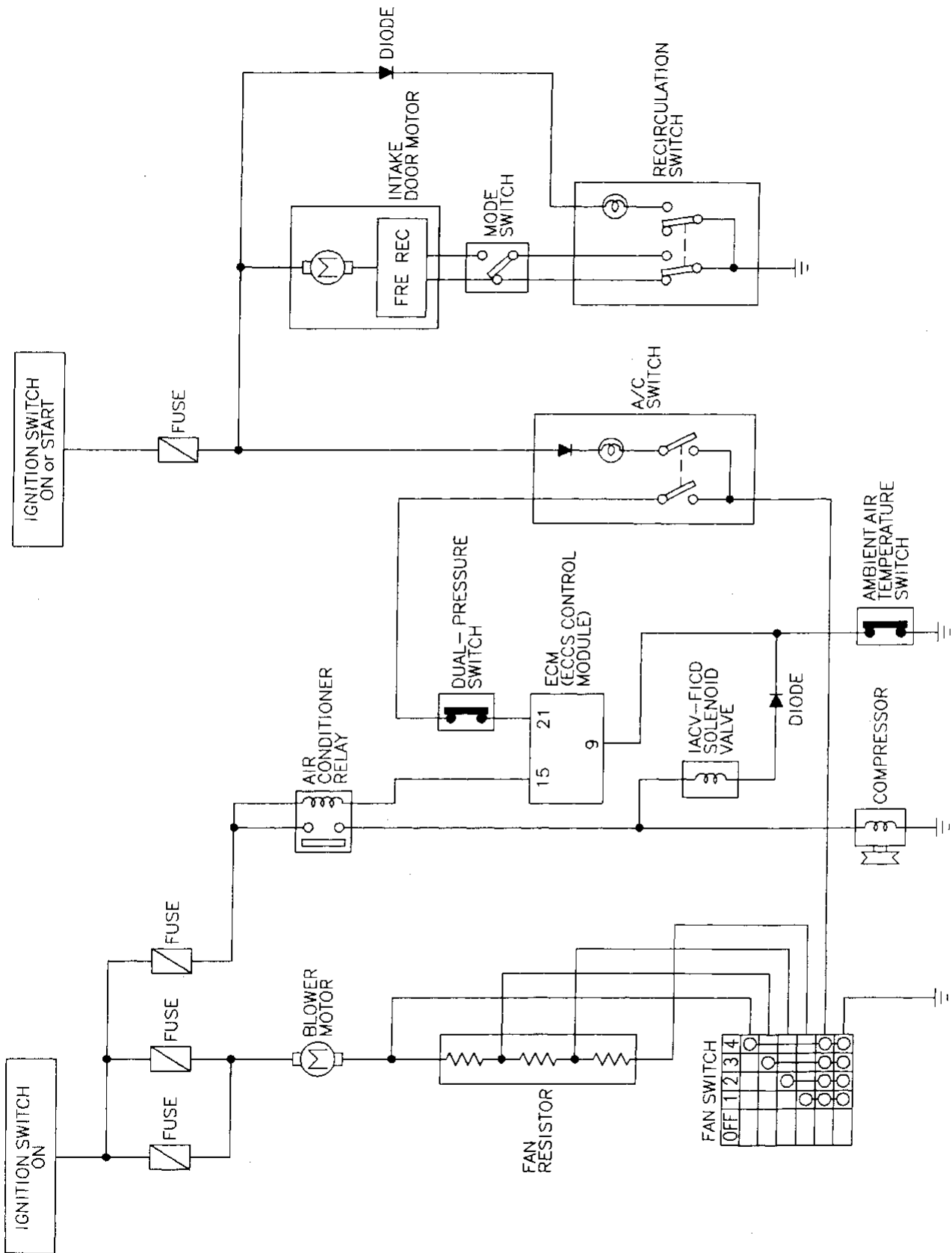


Refer to last page (Foldout page).



\* : This connector is not shown in "HARNESS LAYOUT" of EL section.

Circuit Diagram — Air Conditioner

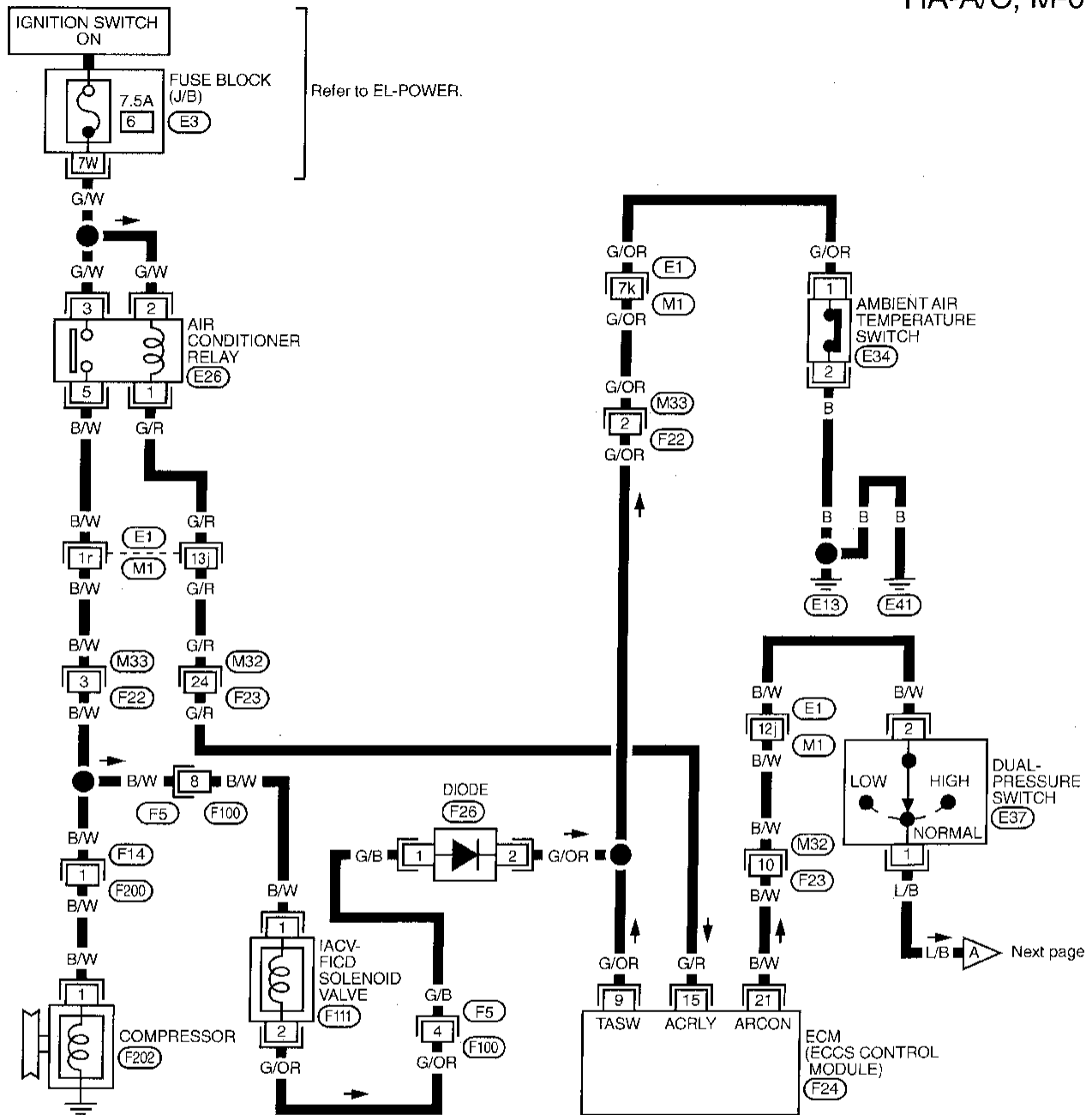


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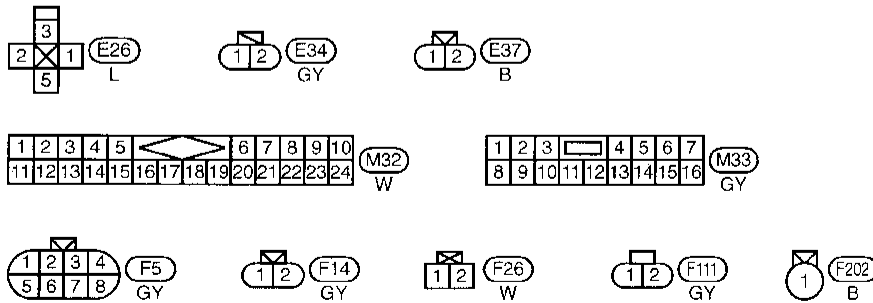


Wiring Diagram — A/C, M —

HA-A/C, M-01



Next page



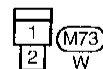
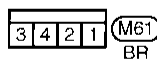
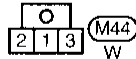
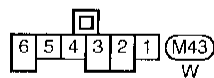
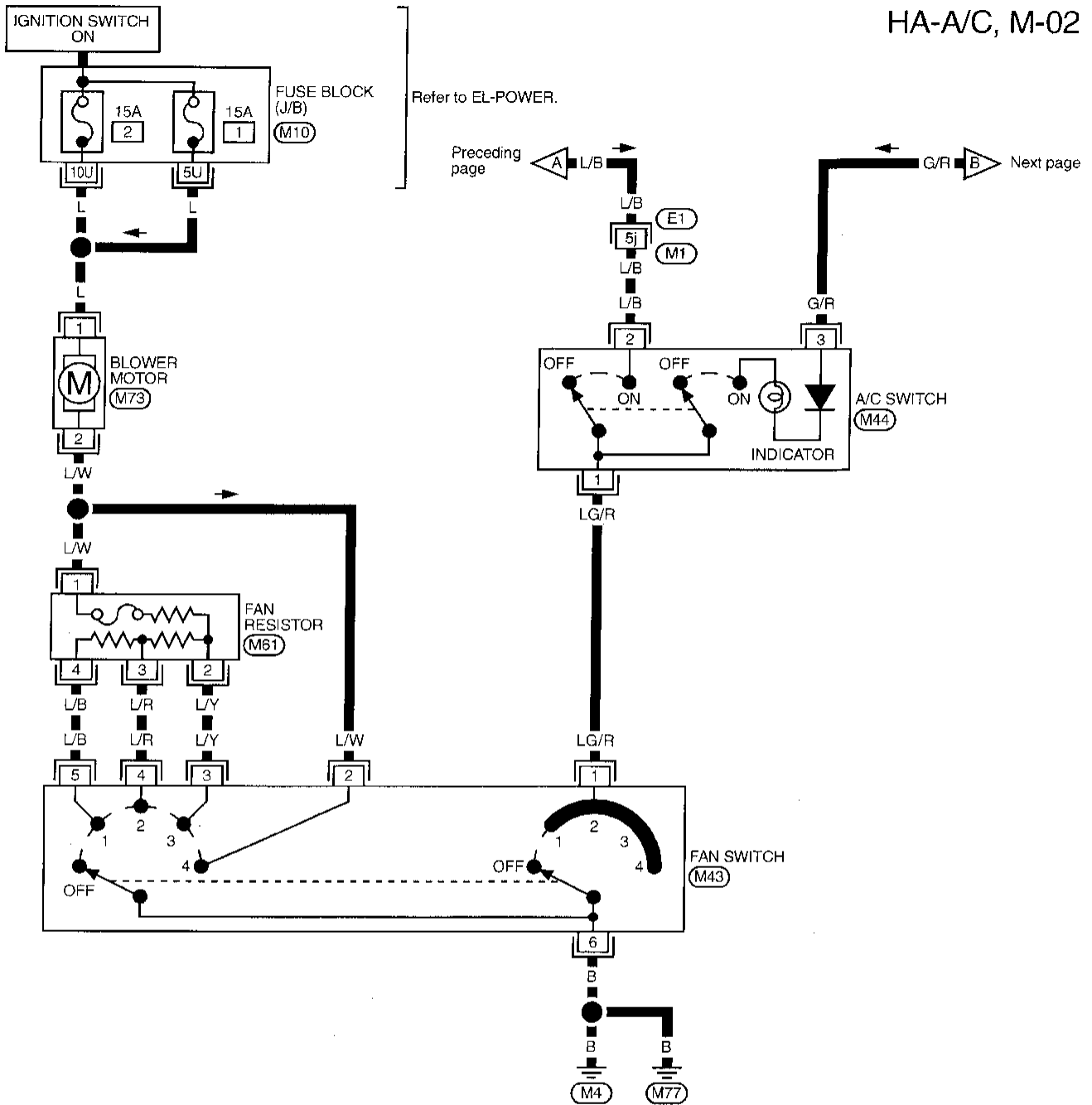
Refer to last page (Foldout page).

- (E3)
- (E1) (M1)
- (F24)

Wiring Diagram — A/C, M — (Cont'd)

HA-A/C, M-02

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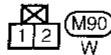
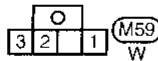
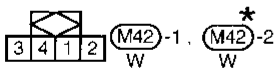
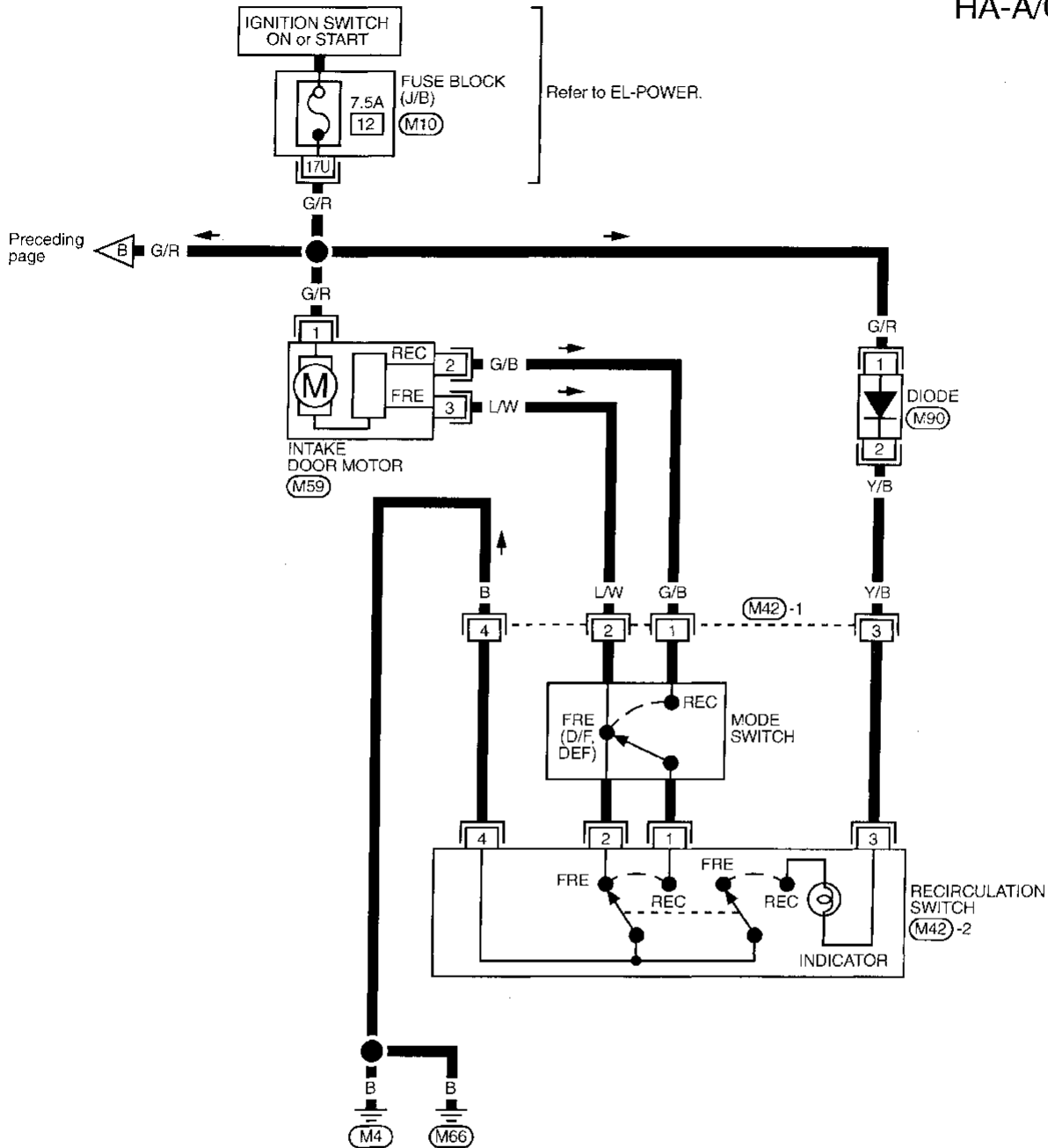
Refer to last page (Foldout page).

(E1) (M1)

(M10)

Wiring Diagram — A/C, M — (Cont'd)

HA-A/C, M-03



Refer to last page (Foldout page).  
M10

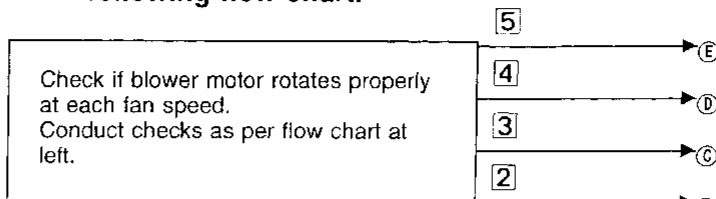
\* : This connector is not shown in "HARNESS LAYOUT" of EL section.

	INCIDENT	Flow chart No.
1	Fan fails to rotate.	1
2	Fan does not rotate at 1-speed.	2
3	Fan does not rotate at 2-speed.	3
4	Fan does not rotate at 3-speed.	4
5	Fan does not rotate at 4-speed.	5

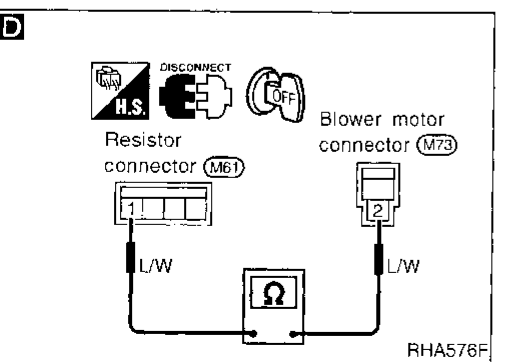
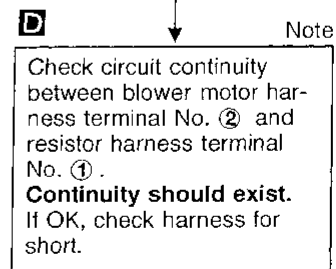
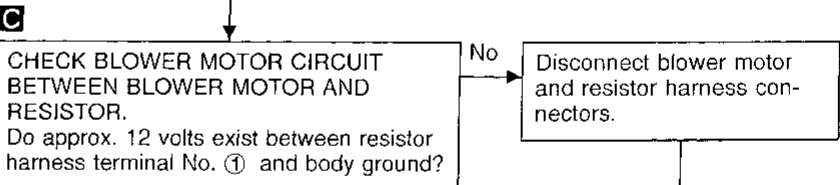
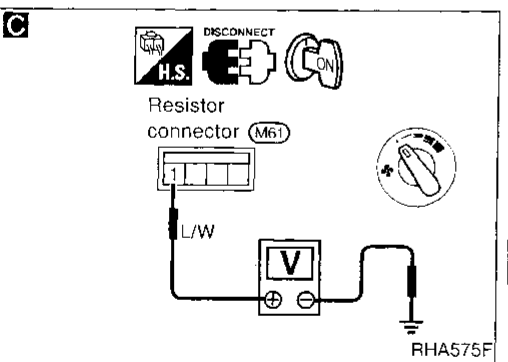
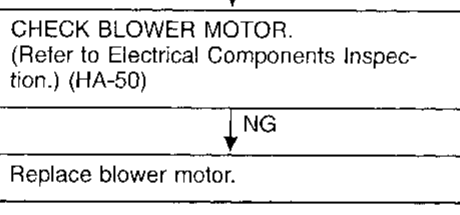
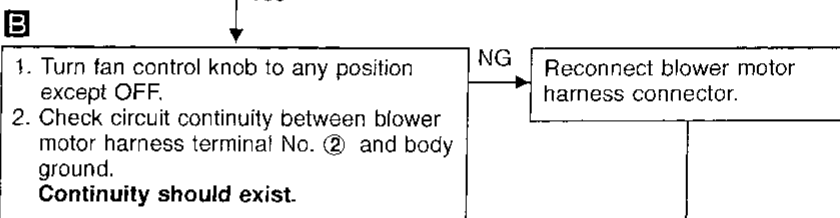
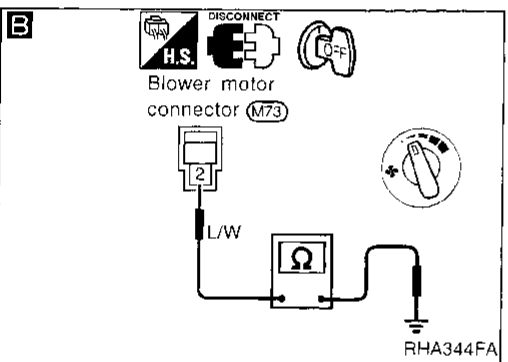
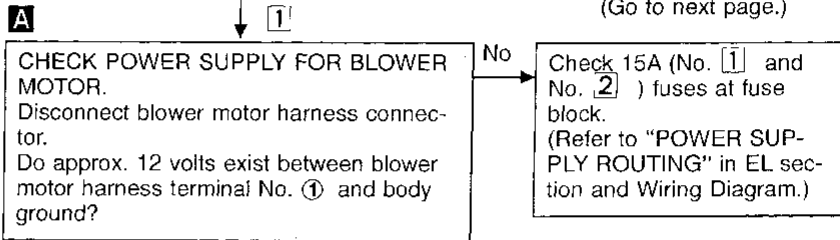
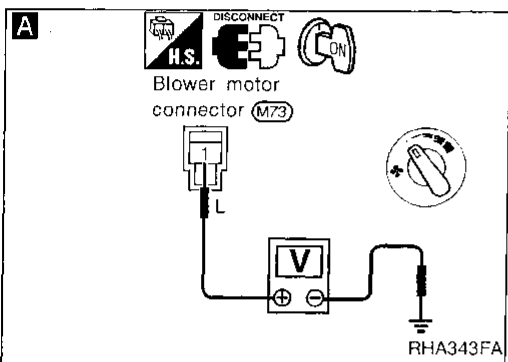
### Diagnostic Procedure 1

**SYMPTOM: Blower motor does not rotate.**

- Perform **PRELIMINARY CHECK 1** before referring to the following flow chart.



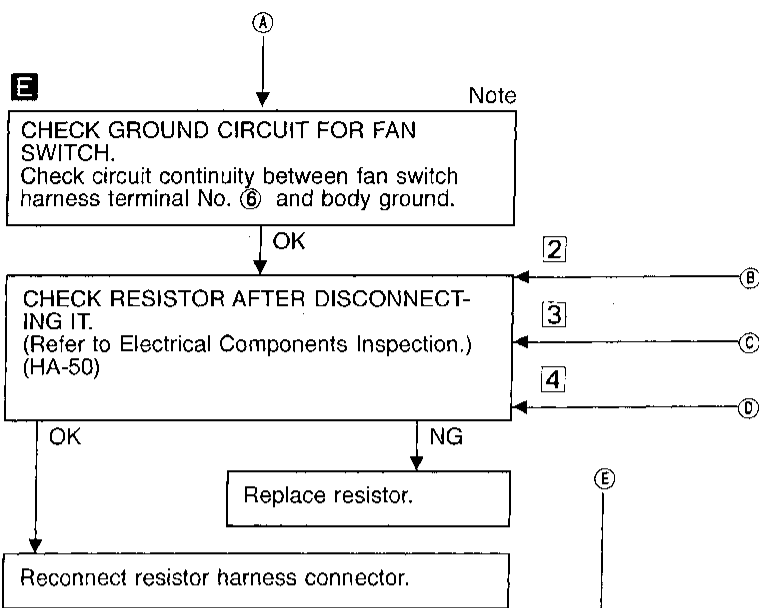
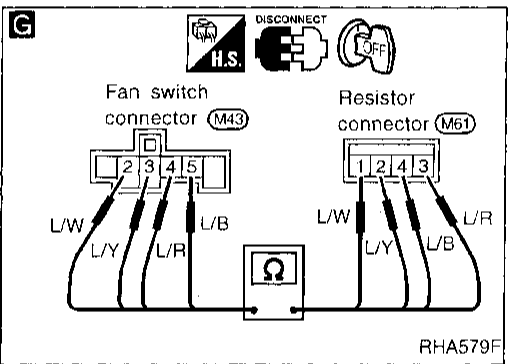
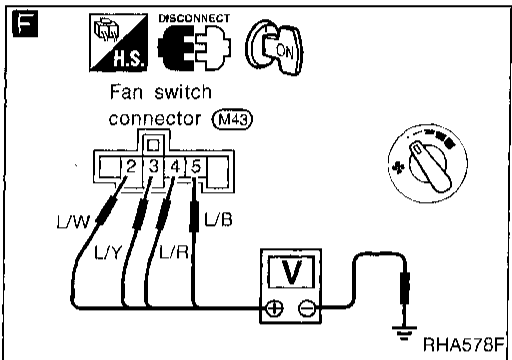
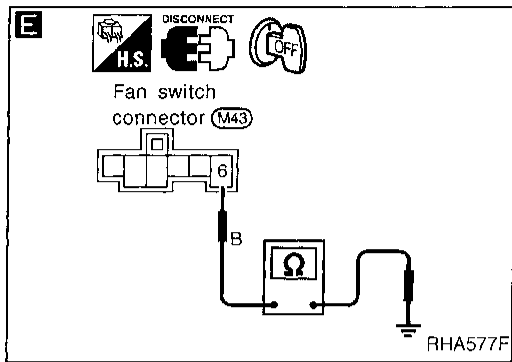
(Go to next page.)



(Go to next page.)

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

Diagnostic Procedure 1 (Cont'd)



**F**

CHECK FAN SWITCH CIRCUIT.  
Do approx. 12 volts exist between each fan switch harness terminal and body ground?

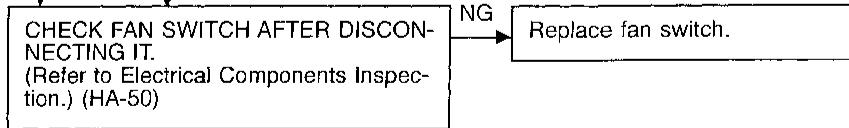
Flow chart No.	Terminal No.		Voltage
	⊕	⊖	
2	5	Body ground	Approx. 12V
3	4		
4	3		
5	2		

**G** Note

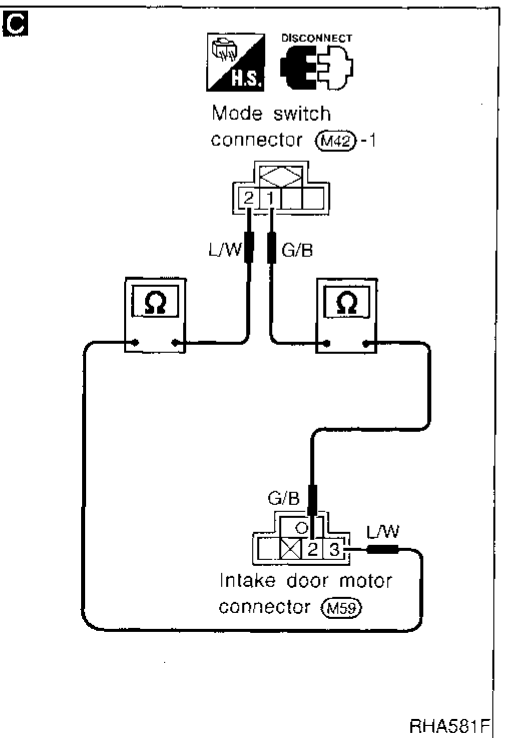
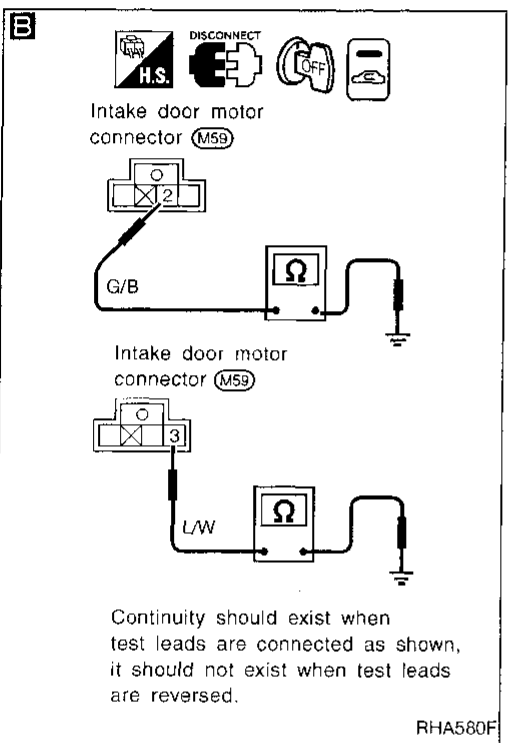
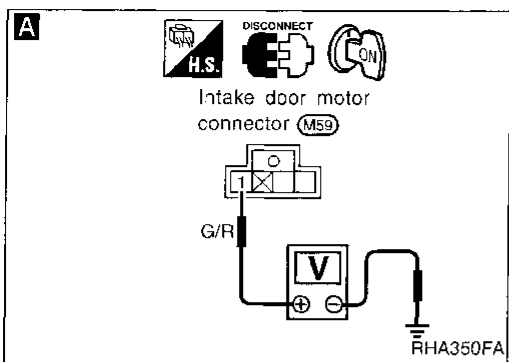
Check circuit continuity between fan switch harness terminal and resistor harness terminal.

Terminal No.		Continuity
Fan switch	Resistor	
2	1	Yes
3	2	
4	3	
5	4	

If OK, check harness for short.



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



### Diagnostic Procedure 2

**SYMPTOM:** Intake door does not change in VENT, B/L or FOOT mode.

**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?

No → Check 7.5A (No. 12) fuse at fuse block. (Refer to "POWER SUPPLY ROUTING" in EL section and Wiring Diagram.)

**B**

**CHECK GROUND CIRCUIT FOR INTAKE DOOR MOTOR.**  
 Check continuity between intake door motor harness terminals and body ground.

Recirculation switch condition	Terminal No.		Continuity
	⊕	⊖	
REC	②	Body ground	Yes
	③		No
FRE	②		No
	③		Yes

NG → Disconnect mode switch harness connector.

**C**

**Note**  
 Check continuity between mode switch harness terminal No. ① (②) and intake door motor harness terminal No. ② (③).  
**Continuity should exist.**  
 If OK, check harness for short.

OK → **CHECK INTAKE DOOR LINKAGE.**  
 Refer to Control Linkage Adjustment. (HA-52)

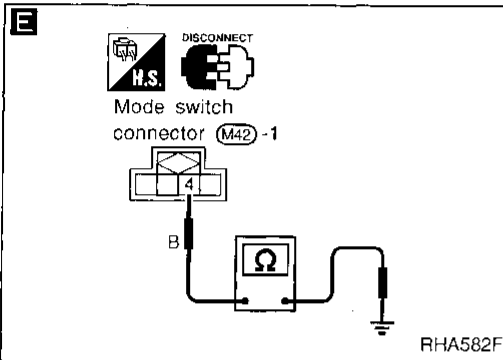
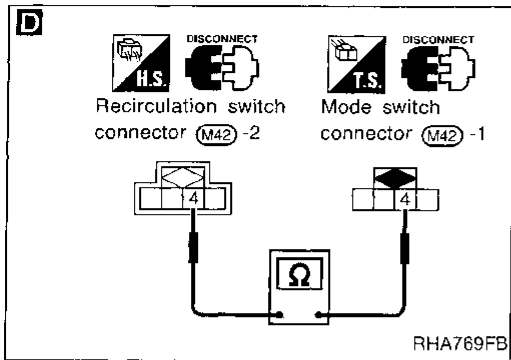
OK → **Replace intake door motor.**

OK → (Go to next page.)

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

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Diagnostic Procedure 2 (Cont'd)



Ⓐ

**CHECK MODE SWITCH.**  
(Refer to Electrical Components Inspection.) (HA-51)

NG → Replace mode switch.

**D**

Check circuit continuity between mode switch harness terminal No. ④ and recirculation switch harness terminal No. ④.  
**Continuity should exist.**  
If OK, check harness for short.

NG → Replace mode switch.

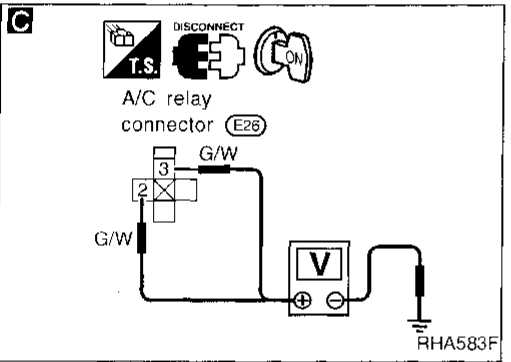
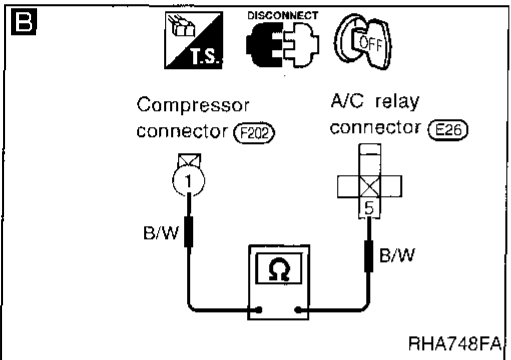
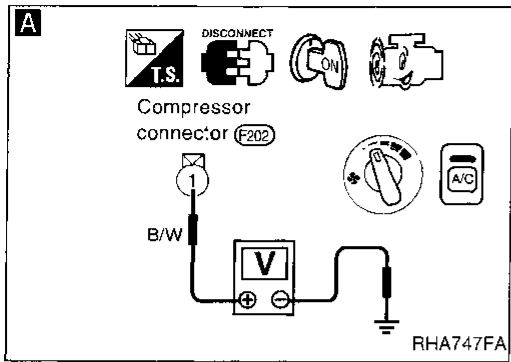
**E** Note

**CHECK GROUND CIRCUIT FOR MODE SWITCH.**  
Check circuit continuity between mode switch harness terminal No. ④ and body ground.  
**Continuity should exist.**  
If OK, check harness for short.

**CHECK RECIRCULATION SWITCH.**  
(Refer to Electrical Components Inspection.) (HA-51)

NG → Replace recirculation switch.

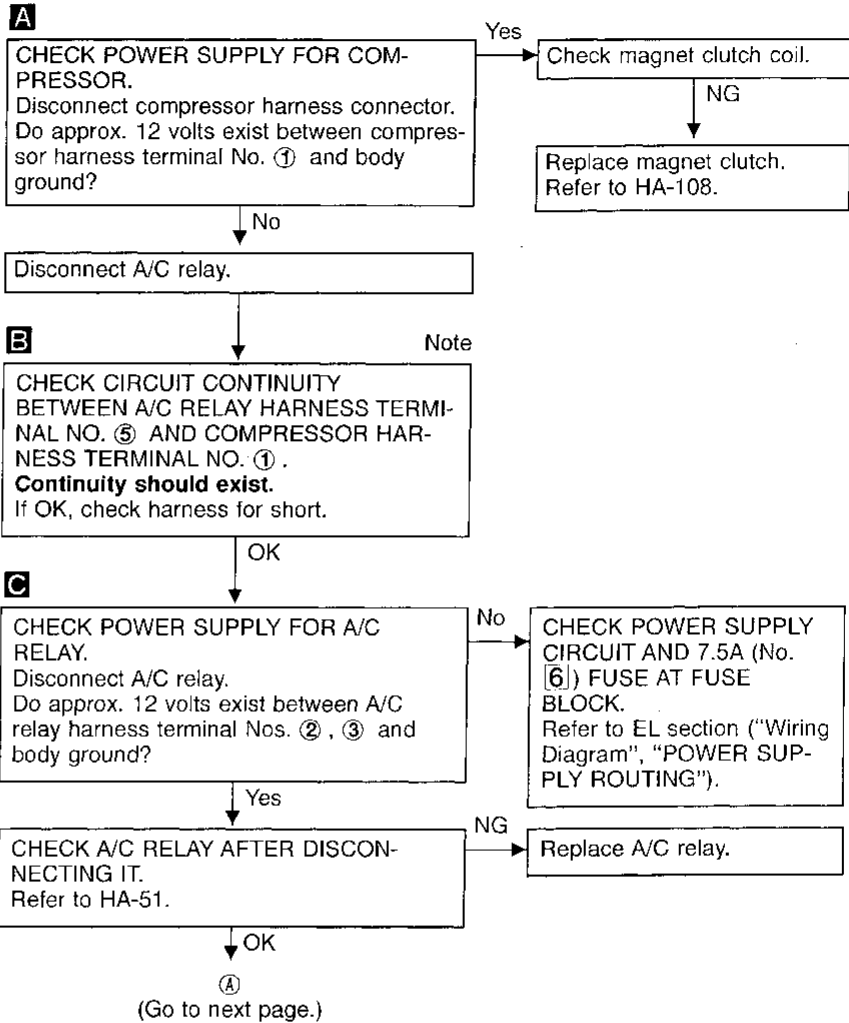
**Note:**  
If the result is NG after checking circuit continuity, repair harness or connector.



**Diagnostic Procedure 3**

**SYMPTOM:** Magnet clutch does not engage when A/C switch and fan switch are ON.

- Perform **PRELIMINARY CHECK 1** before referring to the following flow chart.

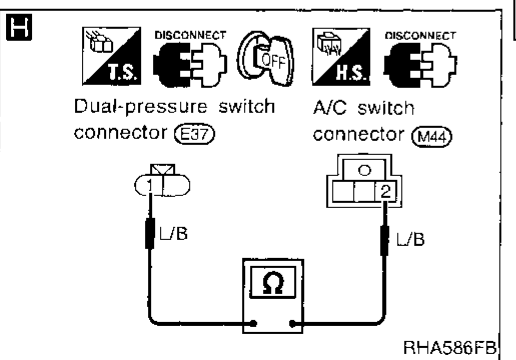
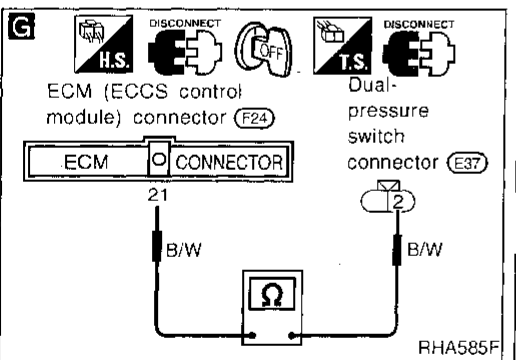
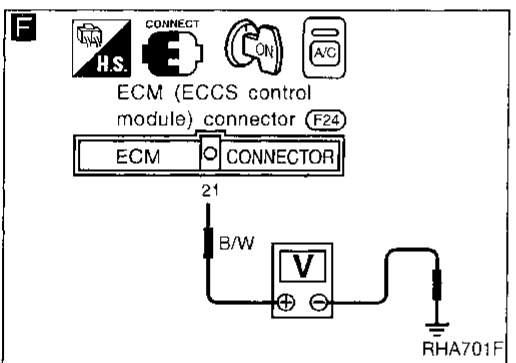
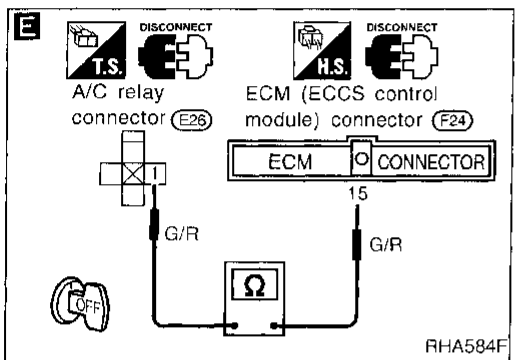
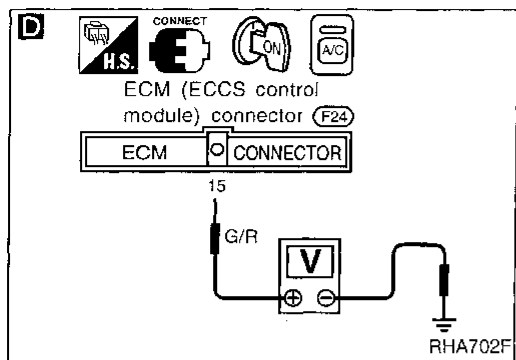


**Note:**  
If the result is NG after checking circuit continuity, repair harness or connector.

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Diagnostic Procedure 3 (Cont'd)



Ⓐ

Reconnect A/C relay.

**D** CHECK COIL SIDE CIRCUIT OF A/C RELAY.  
Do approx. 12 volts exist between ECM (ECCS control module) harness terminal No. ⑮ and body ground?  
No → Disconnect A/C relay. Disconnect ECM (ECCS control module) harness connector.  
Yes →

**E** Note  
CHECK CIRCUIT CONTINUITY BETWEEN A/C RELAY HARNESS TERMINAL NO. ① AND ECM (ECCS CONTROL MODULE) HARNESS TERMINAL NO. ⑮.  
**Continuity should exist.** If OK, check harness for short.

**F** CHECK VOLTAGE FOR ECM (ECCS control module).  
Do approx. 12 volts exist between ECM (ECCS control module) harness terminal No. ② and body ground?  
No → CHECK ECM (ECCS control module). Refer to EC section.  
Yes →

Disconnect ECM (ECCS control module) harness connector.  
Disconnect dual-pressure switch harness connector.

**G** Note  
CHECK CIRCUIT CONTINUITY BETWEEN ECM (ECCS CONTROL MODULE) HARNESS TERMINAL NO. ② AND DUAL-PRESSURE SWITCH HARNESS TERMINAL NO. ②.  
**Continuity should exist.** If OK, check harness for short.  
OK →

CHECK DUAL-PRESSURE SWITCH. Refer to HA-51.  
NG → Replace dual-pressure switch.  
OK →

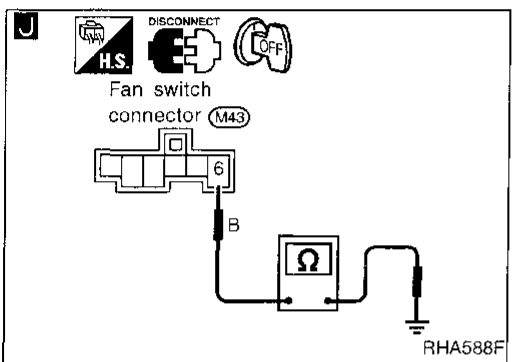
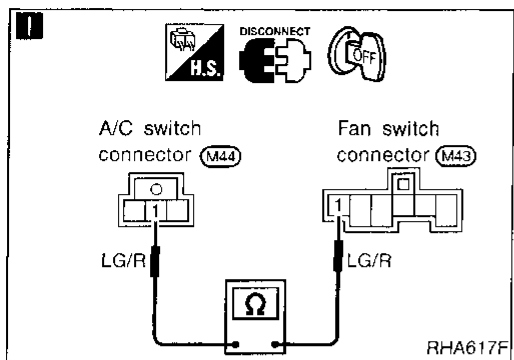
Disconnect A/C switch harness connector.

**H** Note  
CHECK CIRCUIT CONTINUITY BETWEEN DUAL-PRESSURE SWITCH HARNESS TERMINAL NO. ① AND A/C SWITCH HARNESS TERMINAL NO. ②.  
**Continuity should exist.** If OK, check harness for short.  
OK →

Ⓑ

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

Diagnostic Procedure 3 (Cont'd)



ⓑ

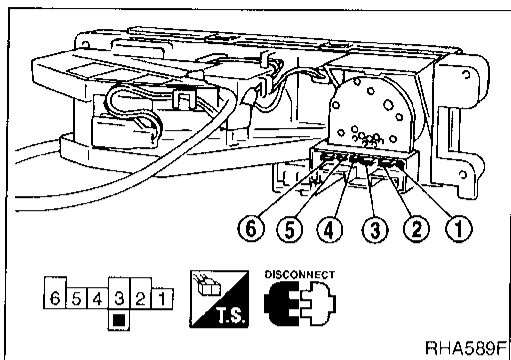
```

    graph TD
      B((B)) --> I1[CHECK A/C SWITCH.  
Refer to HA-50.]
      I1 -- NG --> I1_NG[Replace A/C switch.]
      I1 -- OK --> I2[Disconnect fan switch harness connector.]
      I2 --> I3[CHECK CIRCUIT CONTINUITY  
BETWEEN A/C SWITCH HARNESS  
TERMINAL NO. ① AND FAN SWITCH  
HARNESS TERMINAL NO. ①.  
If OK, check harness for short.]
      I3 --> I4[CHECK BODY GROUND CIRCUIT FOR  
FAN SWITCH.  
Does continuity exist between fan switch  
harness terminal No. ⑥ and body  
ground?]
      I4 -- Yes --> I5[CHECK FAN SWITCH.  
Refer to HA-50.]
      I4 -- NG --> I5_NG[Replace fan switch.]
      I5 -- NG --> I5_NG
  
```

**Note:**

If the result is NG or No after checking circuit continuity, repair harness or connector.

- GI
- MA
- EM
- LC
- EC
- HE
- CL
- MT
- AT
- TF
- PD
- FA
- RA
- BR
- ST
- RS
- BT
- HA**
- EL
- IDX



### Electrical Components Inspection

#### FAN SWITCH

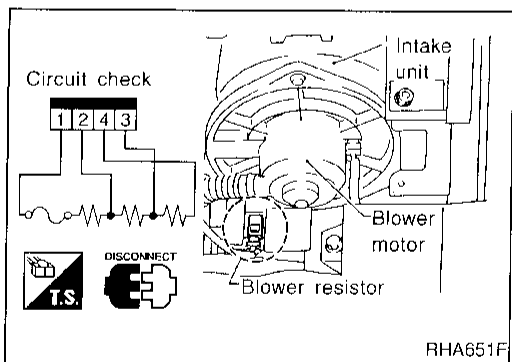
Check continuity between terminals at each switch position.

KNOB POSITION	Continuity between terminals
OFF	
1	⑤ — ① — ⑥
2	④ — ① — ⑥
3	③ — ① — ⑥
4	② — ① — ⑥

#### BLOWER MOTOR

Confirm smooth rotation of the blower motor.

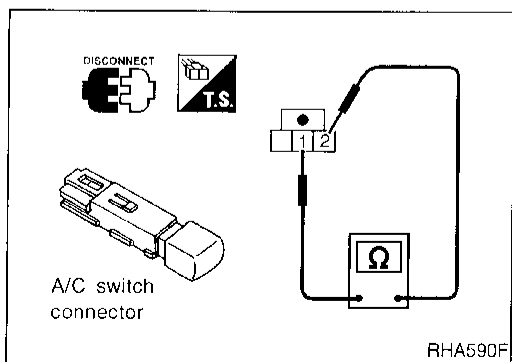
- Ensure that there are no foreign particles inside the intake unit.



#### BLOWER RESISTOR

Check resistance between terminals.

Terminal No.		Resistance
⊕	⊖	
③	①	Approx. 1.4 - 1.6Ω
④		Approx. 2.5 - 2.8Ω
②		Approx. 0.5 - 0.6Ω



#### A/C SWITCH

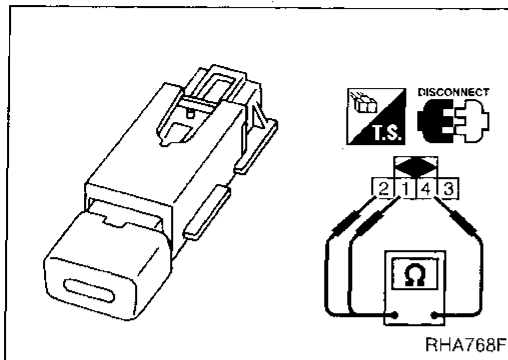
Check continuity between terminals at each switch position.

Switch condition	Terminal No.		Continuity
	⊕	⊖	
A/C	②	①	Yes
ON			
OFF			No

Electrical Components Inspection (Cont'd)

RECIRCULATION SWITCH

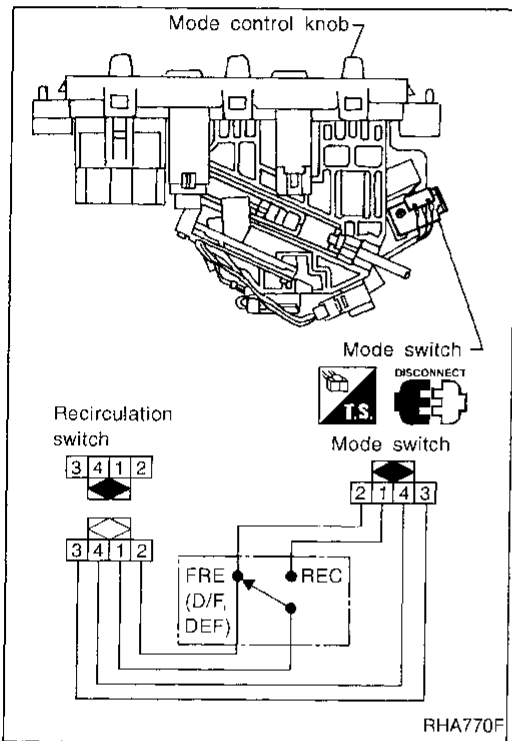
Check continuity between terminals at each switch position.



Terminal No.		Recirculation switch condition	Continuity
⊕	⊖		
①	④	REC	Yes
		FRE	No
②	④	REC	No
		FRE	Yes

MODE SWITCH

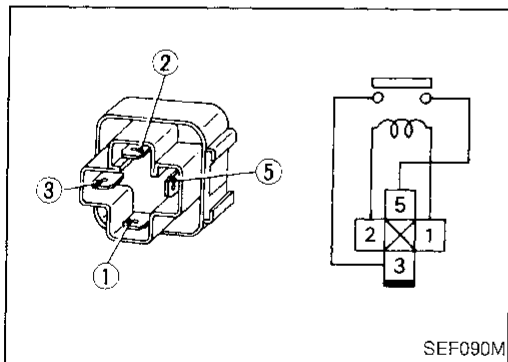
Check continuity between terminals at each switch position.



Terminal No.		Mode control knob condition	Continuity
Mode switch ⊕	Recirculation switch connector ⊖		
①	①	VENT, B/L, FOOT	Yes
		D/F, DEF	No
②	①	VENT, B/L, FOOT	No
		D/F, DEF	Yes
②	②	All	Yes
③	③	All	Yes
④	④	All	Yes

A/C RELAY

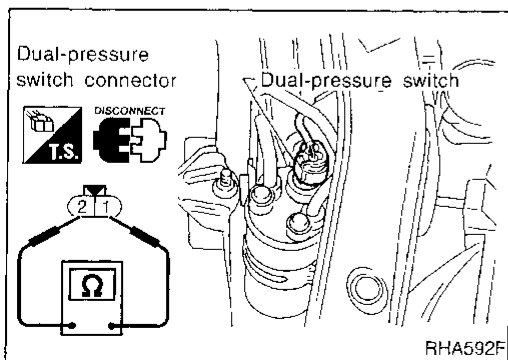
Check continuity between terminal Nos. ③ and ⑤.



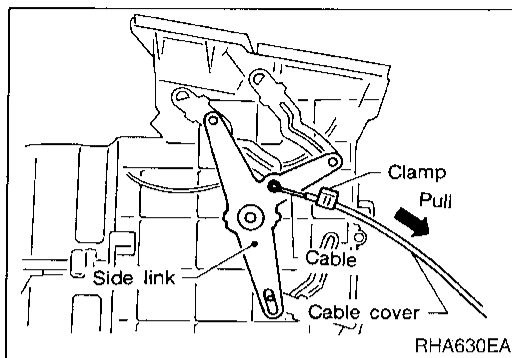
Conditions	Continuity
12V direct current supply between terminal Nos. ① and ②	Yes
No current supply	No

If NG, replace relay.

DUAL-PRESSURE SWITCH



	ON kPa (kg/cm <sup>2</sup> , psi)	OFF kPa (kg/cm <sup>2</sup> , psi)
Low-pressure side	Increasing to 157 - 216 (1.6 - 2.2, 23 - 31)	Decreasing to 157 - 196 (1.6 - 2.0, 23 - 28)
High-pressure side	Decreasing to 1,863 - 2,256 (19 - 23, 270 - 327)	Increasing to 2,452 - 2,844 (25 - 29, 356 - 412)

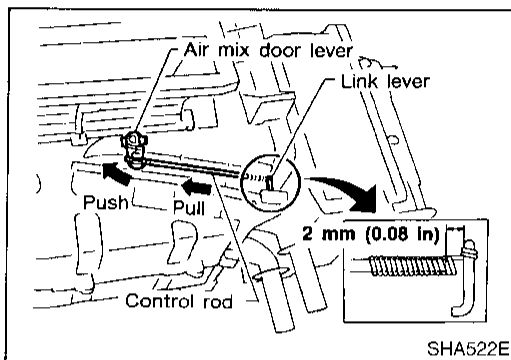


## Control Linkage Adjustment

### MODE CONTROL CABLE

1. Turn the mode control knob to the DEF position.
2. Set the side link in the DEF position by hand.
3. Pull on the cable cover in the direction of the arrow, then clamp it.

After positioning control cable, check that it operates properly.

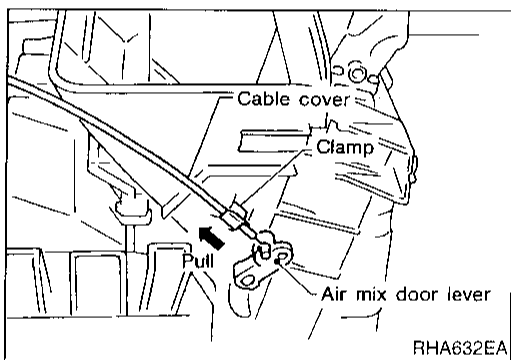


### WATER COCK CONTROL ROD

- When adjusting water cock control rod, first disconnect temperature control cable from air mix door lever and then adjust control rod. Reconnect temperature control cable and readjust it. (Refer to TEMPERATURE CONTROL CABLE.)

1. Push air mix door lever in direction of arrow.
2. Pull control rod of water cock in direction of arrow so as to make clearance of about 2 mm (0.08 in) between ends of rod and link lever and connect the rod to door lever.

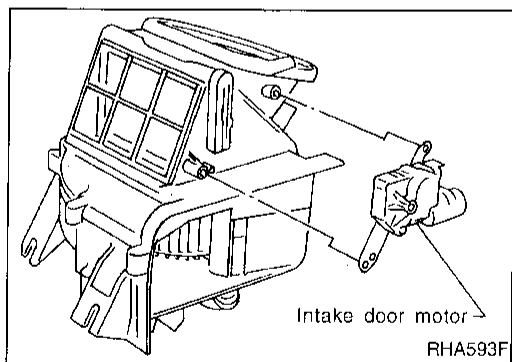
After connecting control rod, check it operates properly.



### TEMPERATURE CONTROL CABLE

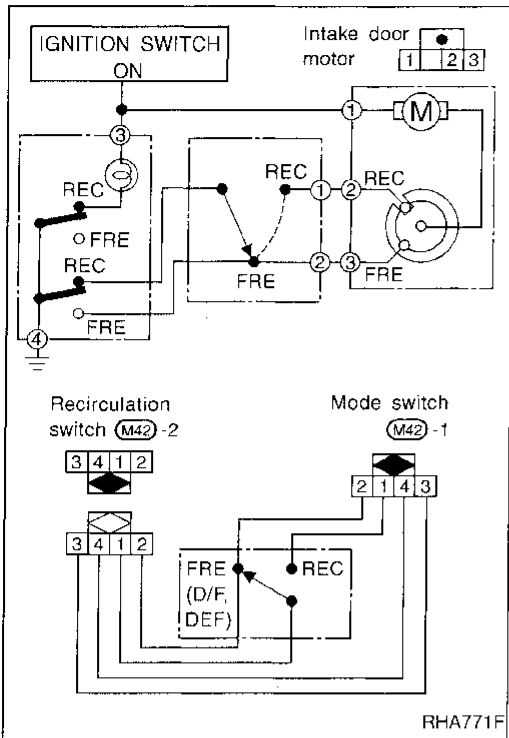
1. Move the temperature control knob to the full hot position.
2. Set the air mix door lever in the full hot position.
3. Pull on the cable cover in the direction of the arrow, then clamp it.

After positioning control cable, check that it operates properly.



### INTAKE DOOR MOTOR

1. Install intake door motor on intake unit.  
Ensure that the intake door motor lever is fitted into the slit portion of intake door link.
2. Connect the intake door motor harness connector.
3. Turn ignition switch to ON.
4. Check that intake door operates properly when RECIRCULATION switch is turned ON and OFF.



**System Description**

**INTAKE DOOR MOTOR**

The intake door motor is installed on the intake unit. Using a link it opens and closes the intake door.

When RECIRCULATION switch is at REC (except DEF and D/F modes), the ground line of the motor is switched from intake door motor terminal ③ to ②. This starts the motor because the position switch contacts built into it make current flow. When RECIRCULATION switch is at FRE (except DEF and D/F modes), the ground line is switched from intake door motor terminal ② to ③. The contacts turn along with the motor. When they reach the non-current flow position, the motor will stop. The motor always turns in the same direction.

RECIRCULATION switch is canceled by MODE switch in DEF and D/F modes.

**SWITCHES AND THEIR CONTROL FUNCTIONS**

Knob/Switch	Knob/Switch position							Air outlet	Intake air	Compressor
	A/C									
A/C	○							—	—	ON*1
Mode		○						VENT	—	—
			○					B/L	—	—
				○				FOOT	—	—
					○			D/F	FRE	—
						○		DEF	FRE	ON*1
						○	—	REC*2	—	

\*1: Compressor is operated by dual-pressure switch.

\*2: In DEF and D/F modes, REC switch is canceled.

GI  
MA  
EM  
LC  
EC  
FE  
CL  
MT  
AT  
TF  
PD  
FA  
HA  
BR  
ST  
RS  
BT  
HA  
EL  
IDX

NOTE

## Introduction

The automatic temperature control (ATC) system provides automatic regulation of the discharged air temperature and the discharged air volume (Blower speed).

The air outlet door, intake door and compressor magnet clutch are controlled by the manual operation of each switch.

## Features

### Air mix door control (Automatic temperature 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 air mix door position will depend on: Ambient temperature, in-vehicle temperature, amount of sunload, set temperature and A/C switch signals.

### Fan speed control

When the fan control knob is in the Auto position, the blower speed is automatically controlled, depending on: Ambient temperature, in-vehicle temperature, amount of sunload, set temperature, and A/C switch signals. It is also controlled by the manual operation of the fan control knob.

### Starting fan speed control

When engine coolant temperature is low, the air outlet door position is detected by the microswitch and if this is set in B/L, FOOT or DEF/FOOT blower speed is controlled to prevent a large amount of cold air from being discharged into the floor area.

### Outlet door control

This can be selected by operation of the mode knob.

### Intake door control

This can be selected by changing the REC switch position.

### Compressor magnet clutch control

Under normal operating conditions, when the A/C 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.

GI

MA

EM

LC

EC

FE

CL

MT

AT

TF

PD

FA

RA

BR

ST

RS

BT

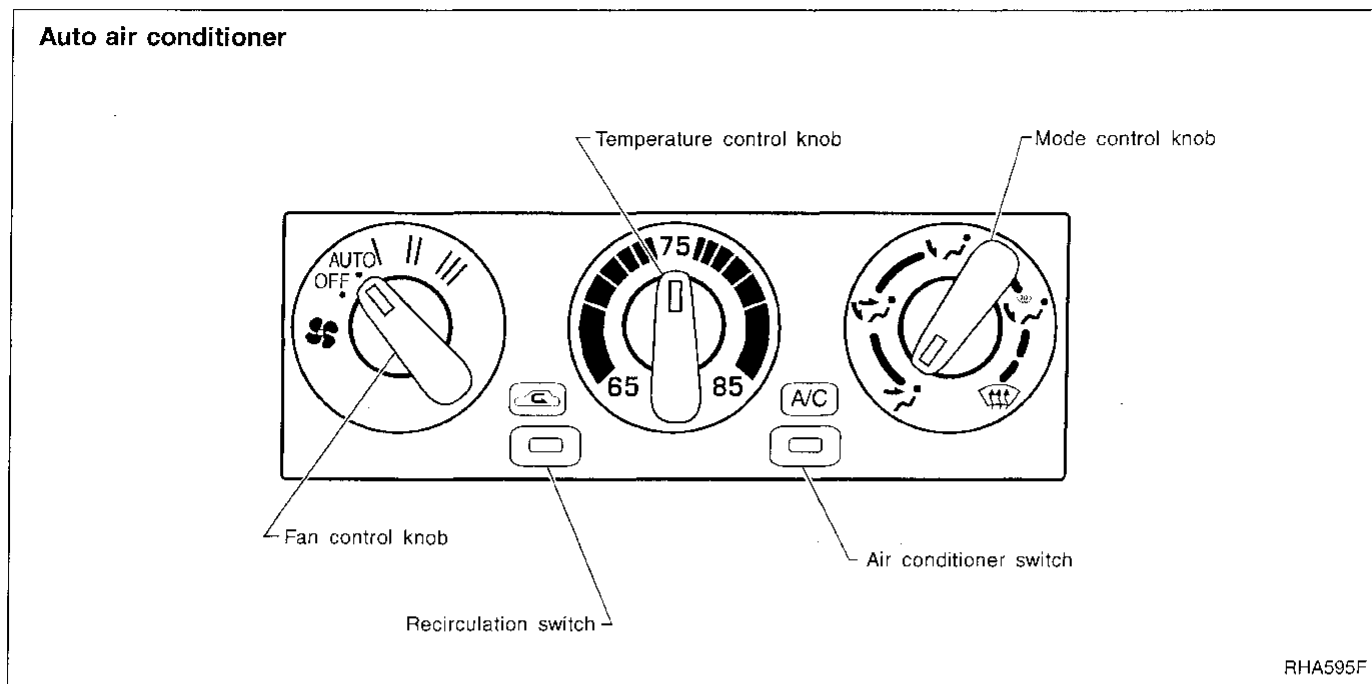
HA

EL

IDX



## Control Operation

**FAN CONTROL KNOB**

This knob controls fan speed. (The fan turns ON when the fan control knob is set in all but the OFF position.) When AUTO position is selected, fan speed and air mix door position are automatically controlled.

**MODE CONTROL KNOB**

This knob controls the outlet air flow. In "DEF" or "D/F" mode, the intake door is set to "FRESH".

**TEMPERATURE CONTROL KNOB**

This knob allows the temperature of the outlet air to be adjusted.

**RECIRCULATION SWITCH**

OFF position: Outside air is drawn into the passenger compartment.  
ON position: Interior air is recirculated inside the vehicle. The indicator lamp will also light.

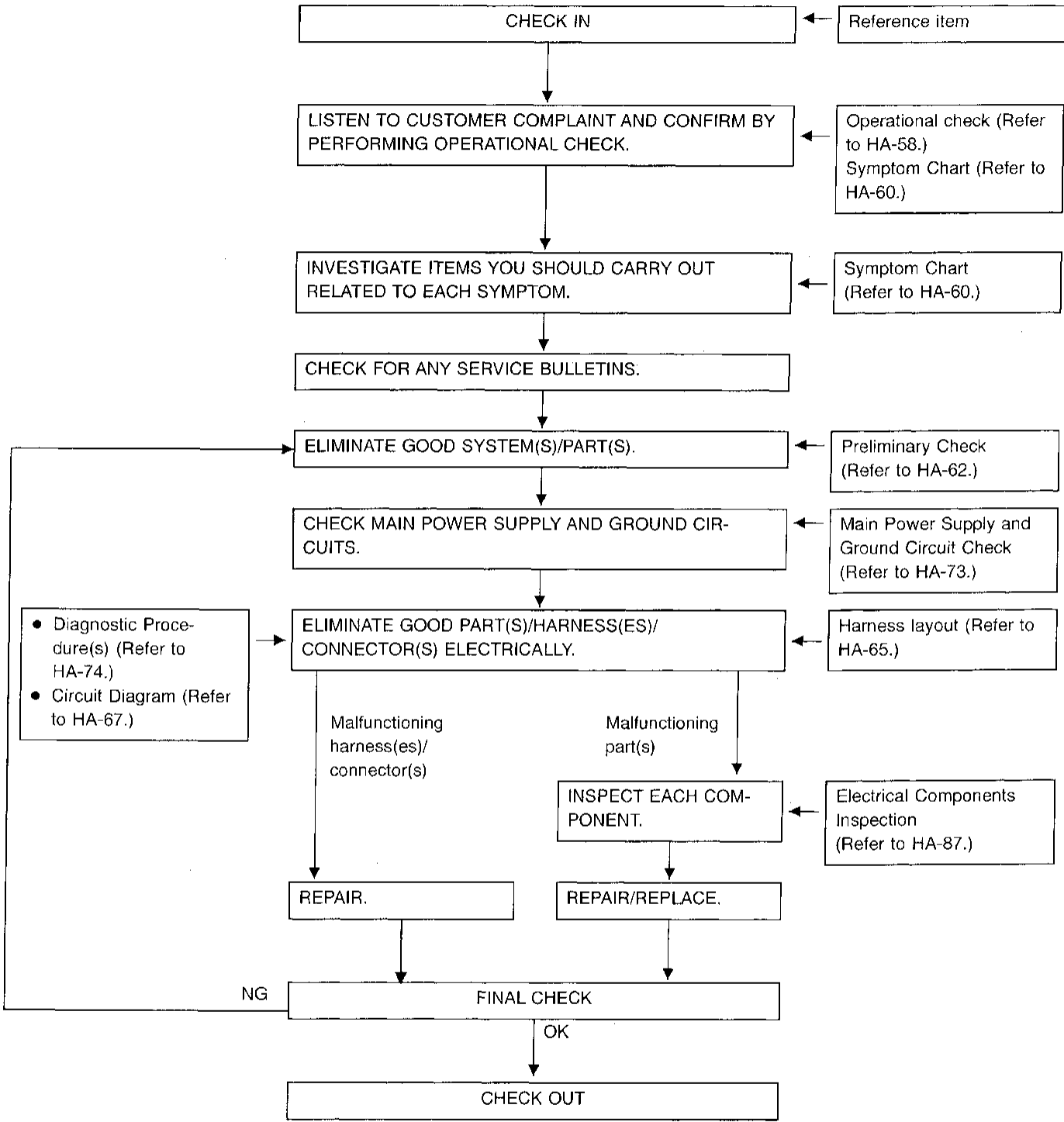
**AIR CONDITIONER SWITCH**

The air conditioner switch controls the A/C system. When the switch is depressed with the fan ON, the compressor will turn ON. The indicator lamp also illuminates.

**The air conditioner cooling function operates only when the engine is running.**

How to Perform Trouble Diagnoses for Quick and Accurate Repair

WORK FLOW



GI

MA

EM

LC

EC

FE

CL

MT

AT

TF

PD

FA

RA

BR

ST

RS

BT

**HA**

EL

DX

**Operational Check**

The purpose of the operational check is to confirm that the system is as it should be. The systems which will be checked are the blower, mode (discharge air), intake air, temperature decrease, temperature increase and A/C switch systems.

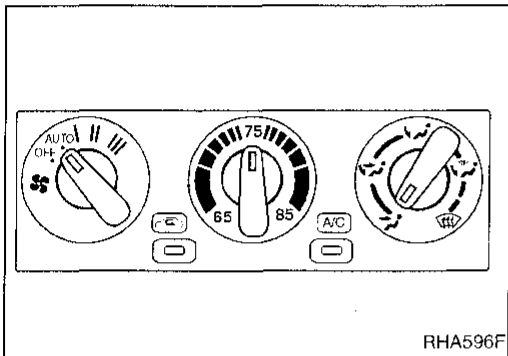
**CONDITIONS:**

Engine running and at normal operating temperature.

**PROCEDURE:**

**1. Check blower**

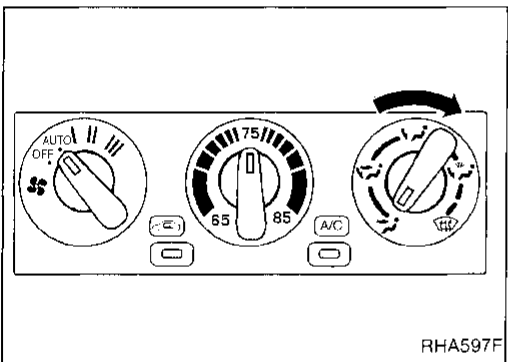
- 1) Turn fan control knob to AUTO. Blower should operate at speed AUTO.
- 2) Then turn knob to speed 1.
- 3) Continue checking blower speed until all speeds are checked.



RHA596F

**2. Check discharge air**

- 1) Turn mode control knob.



RHA597F

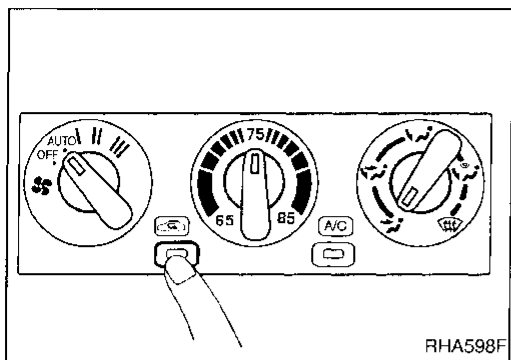
- 2) Confirm that discharge air comes out according to the air distribution table at left. Refer to "Discharge Air Flow" in "DESCRIPTION" (HA-19).

**Discharge air flow**

Mode control knob	Air outlet/distribution		
	Face	Foot	Defroster
	100%	-	-
	60%	40%	-
	-	80%	20%
	-	60%	40%
	-	-	100%

RHA654F

Operational Check (Cont'd)

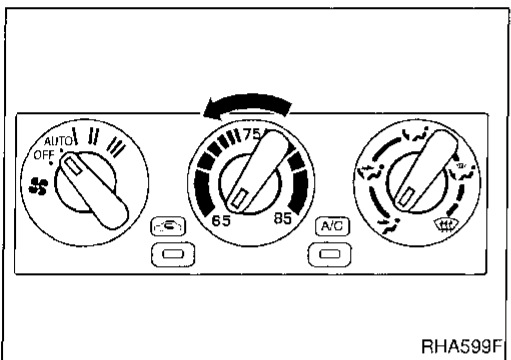


3. Check recirculation

- 1) Press recirculation switch. RECIRCULATION (REC) indicator should illuminate.
- 2) Listen for intake door position change (you should hear sound change slightly).

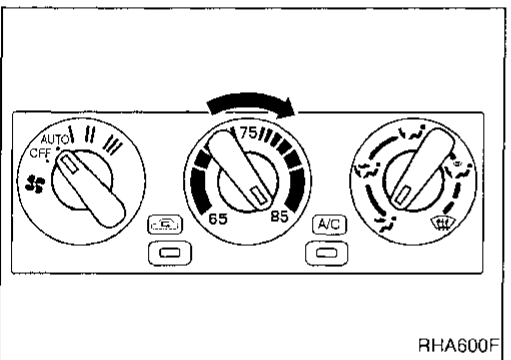
NOTE:

Confirm that the RECIRCULATION (REC) switch is canceled in the DEF (☀) and D/F (☀) mode.



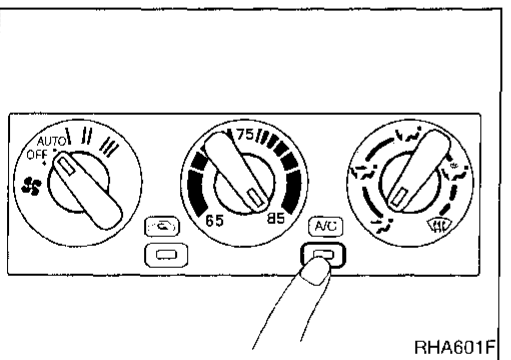
4. Check temperature decrease

- 1) Turn temperature control knob to full cold [18°C (65°F)].
- 2) Check for cold air at discharge air outlets.



5. Check temperature increase

- 1) Turn temperature control knob to full hot [30°C (85°F)].
- 2) Check for hot air at discharge air outlets.



6. Check A/C switch

Move fan control knob to the desired position (AUTO to 3) and press air conditioner switch to turn ON air conditioner. Indicator light will come on when air conditioner is ON.

GI  
MA  
EM  
LC  
EC  
FE  
CL  
MT  
AT  
TF  
PD  
FA  
RA  
BR  
ST  
RS  
BT  
HA  
EL  
DX

Symptom Chart

DIAGNOSTIC TABLE

PROCEDURE	Preliminary Check			Diagnostic Procedure									Main Power Supply and Ground Circuit Check			
	HA-62	HA-63	HA-64	HA-74	HA-76	HA-77	HA-78	HA-79	HA-81	HA-84	HA-85	HA-86	HA-73	HA-73	HA-73	HA-73
REFERENCE PAGE																
SYMPTOM	Preliminary check 1	Preliminary check 2	Preliminary check 3	Diagnostic Procedure 1	Diagnostic Procedure 2	Diagnostic Procedure 3	Diagnostic Procedure 4	Diagnostic Procedure 5	Diagnostic Procedure 6	Diagnostic Procedure 7	Diagnostic Procedure 8	Diagnostic Procedure 9	15A fuses #1 and #2	7.5A fuse #6	7.5A fuse #12	Auto amp.
A/C does not blow cold air.		①		○					○				○	○	○	○
Blower motor does not rotate at all. (Fan switch [AUTO] [1] [2] [3])		①		②									○		○	
Blower motor does not rotate at all when the fan speed is in AUTO. (It operates in 1, 2, or 3-speed only)													○		○	○
Starting fan speed control does not operate.					①										○	○
There is too much difference between setting temp. on PTC and in-vehicle temp.		①				②								○	○	○
Air mix door motor does not operate normally.		①					②								○	○
Intake door does not change in VENT, B/L or FOOT mode.								①						○		
Intake door is not set at "FRESH" in DEF or D/F mode.	①							○						○		
Magnet clutch does not engage when A/C switch and fan switch are ON.		①							②					○	○	
Ambient sensor circuit is open or shorted.										①					○	○
In-vehicle sensor circuit is open or shorted.											①				○	○
Sunload sensor circuit is open or shorted.												①			○	○
Noise			①													

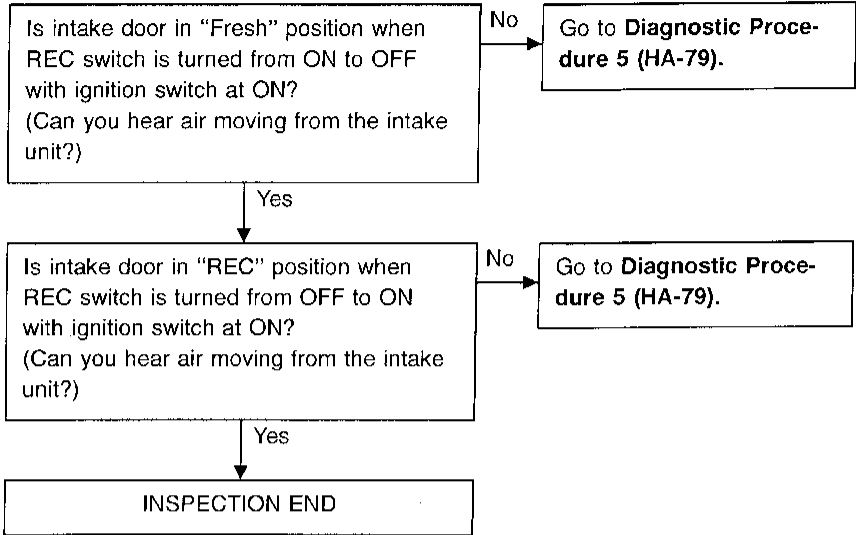
①, ② : The number means checking order.

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



Preliminary Check

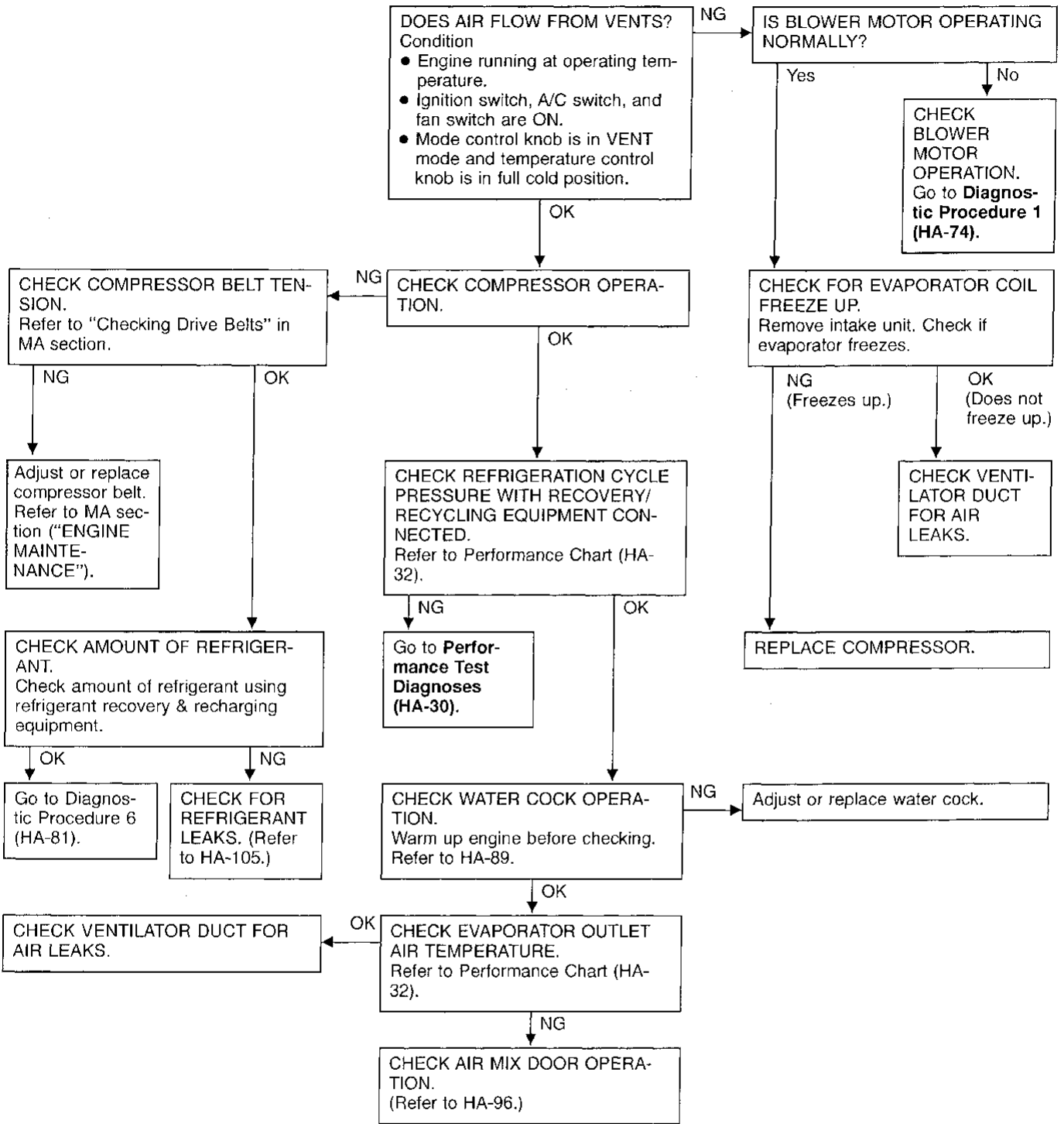
**PRELIMINARY CHECK 1**  
Intake door is not set at "FRESH".



Preliminary Check (Cont'd)

PRELIMINARY CHECK 2

A/C does not blow cold air.



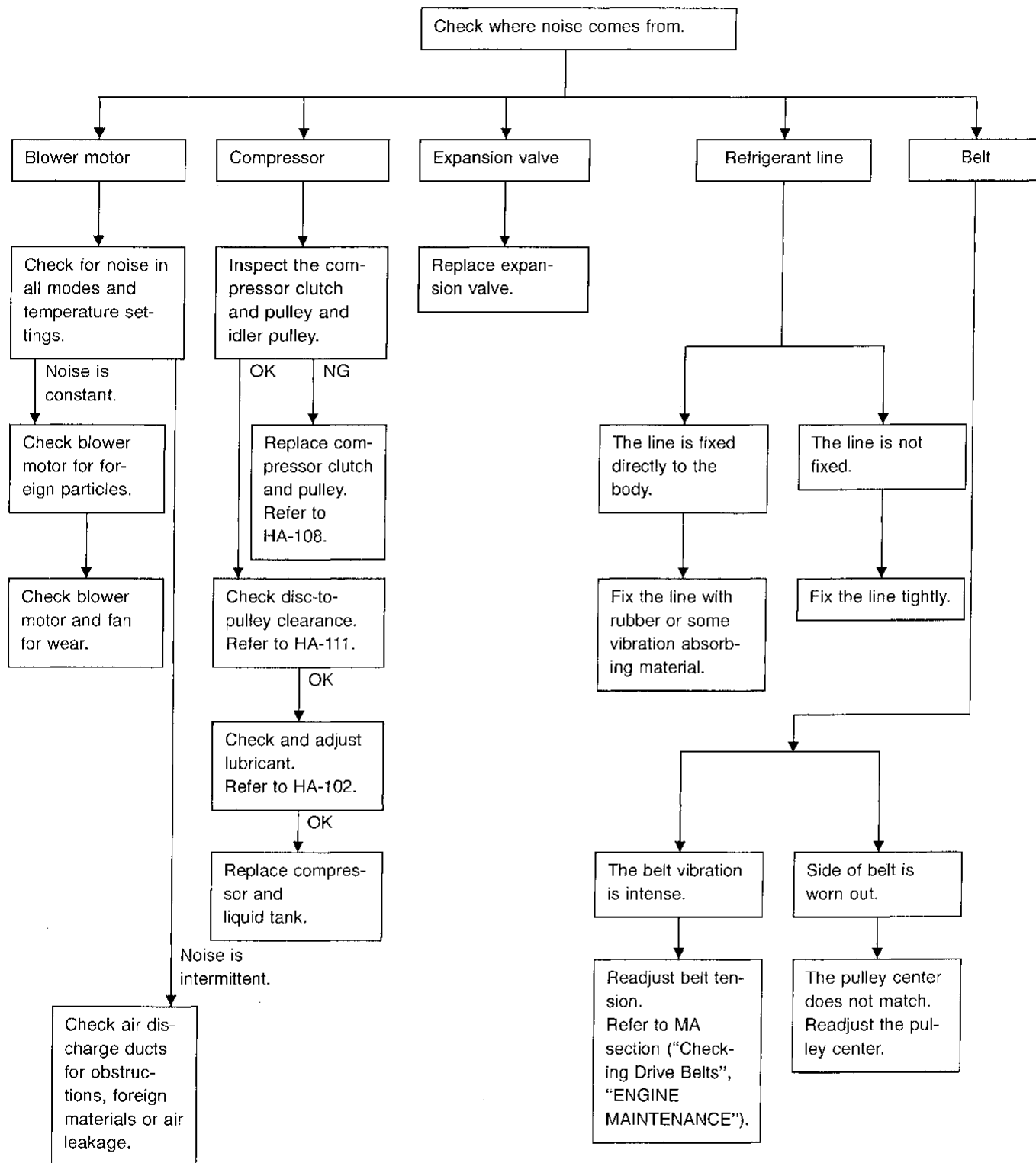
GF  
VA  
EM  
LC  
EC  
FE  
CL  
MT  
AT  
TF  
PD  
EA  
RA  
BR  
ST  
RS  
BT  
HA  
EL  
IDX



Preliminary Check (Cont'd)

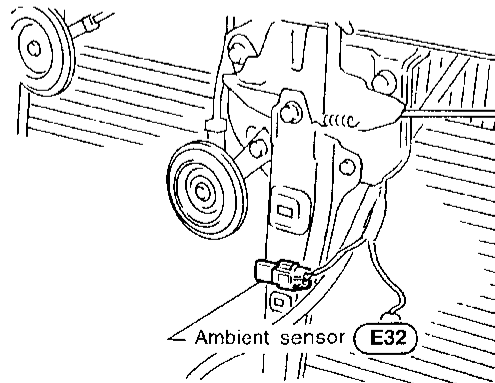
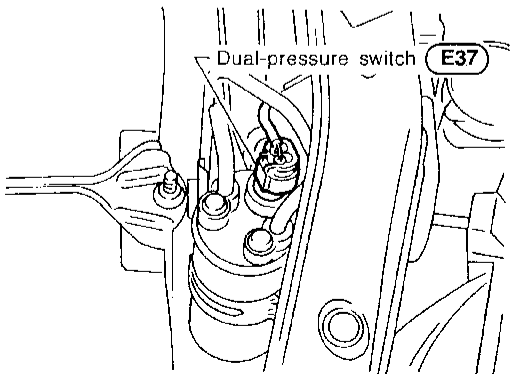
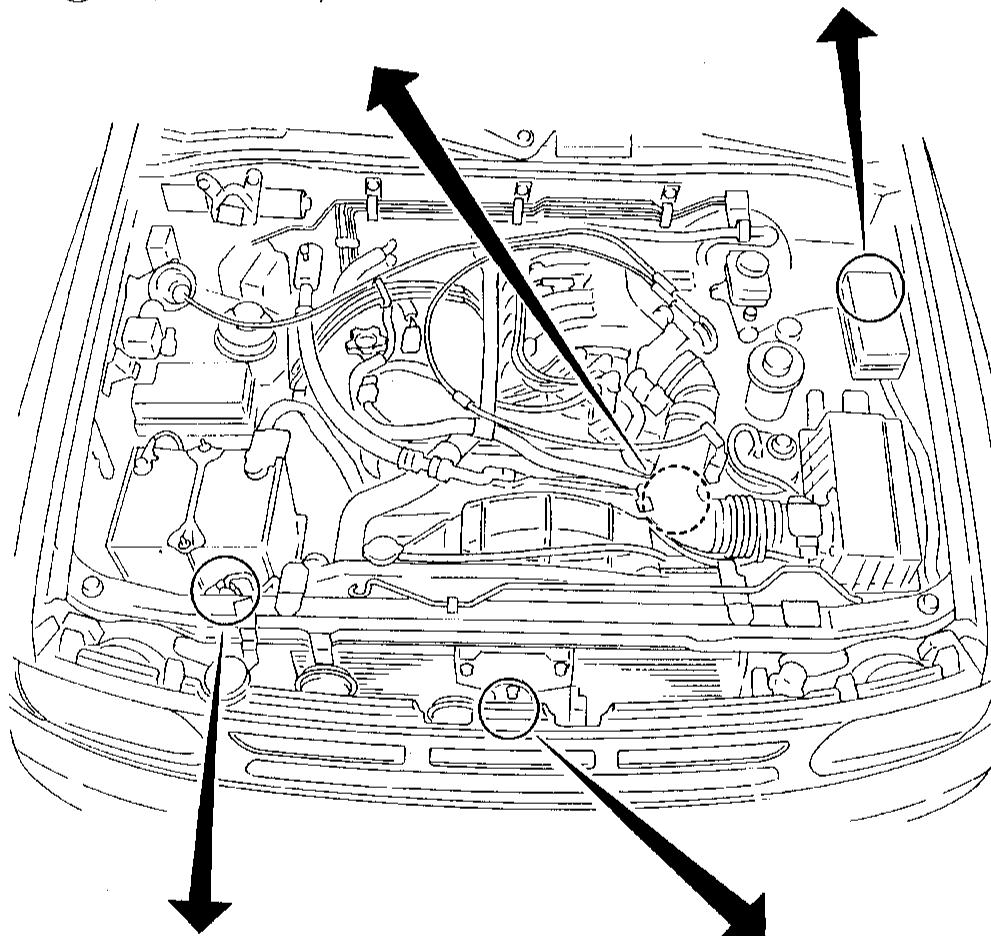
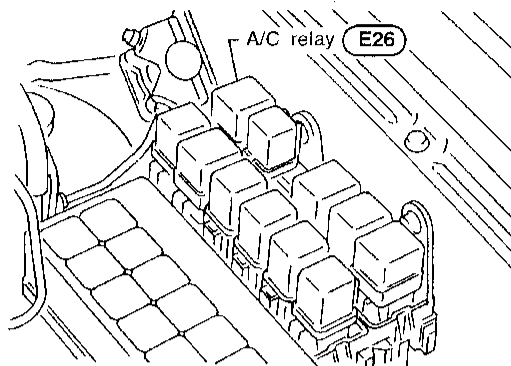
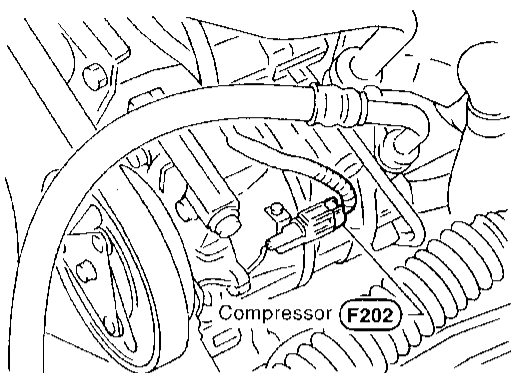
PRELIMINARY CHECK 3

Noise



Harness Layout

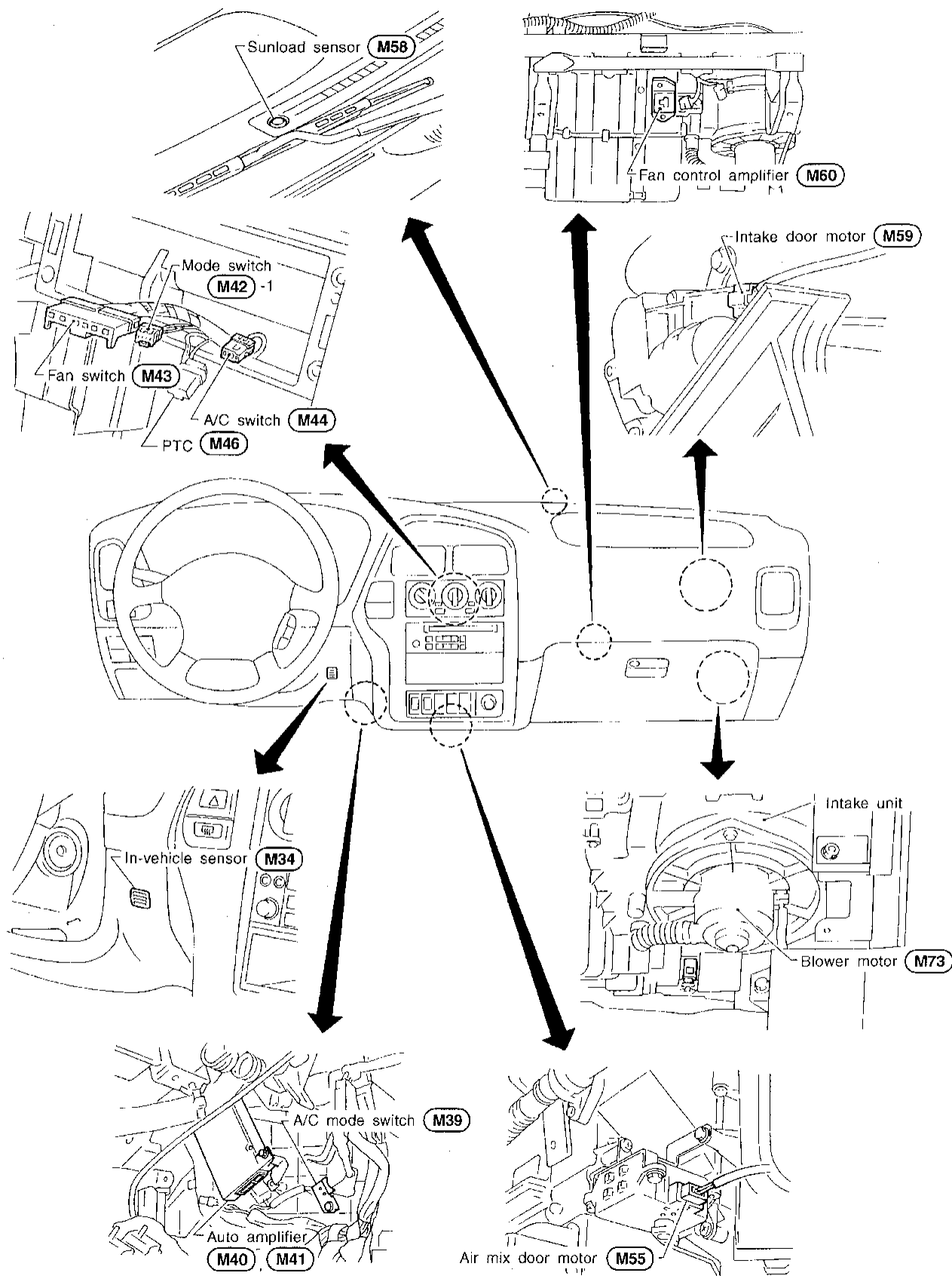
ENGINE COMPARTMENT



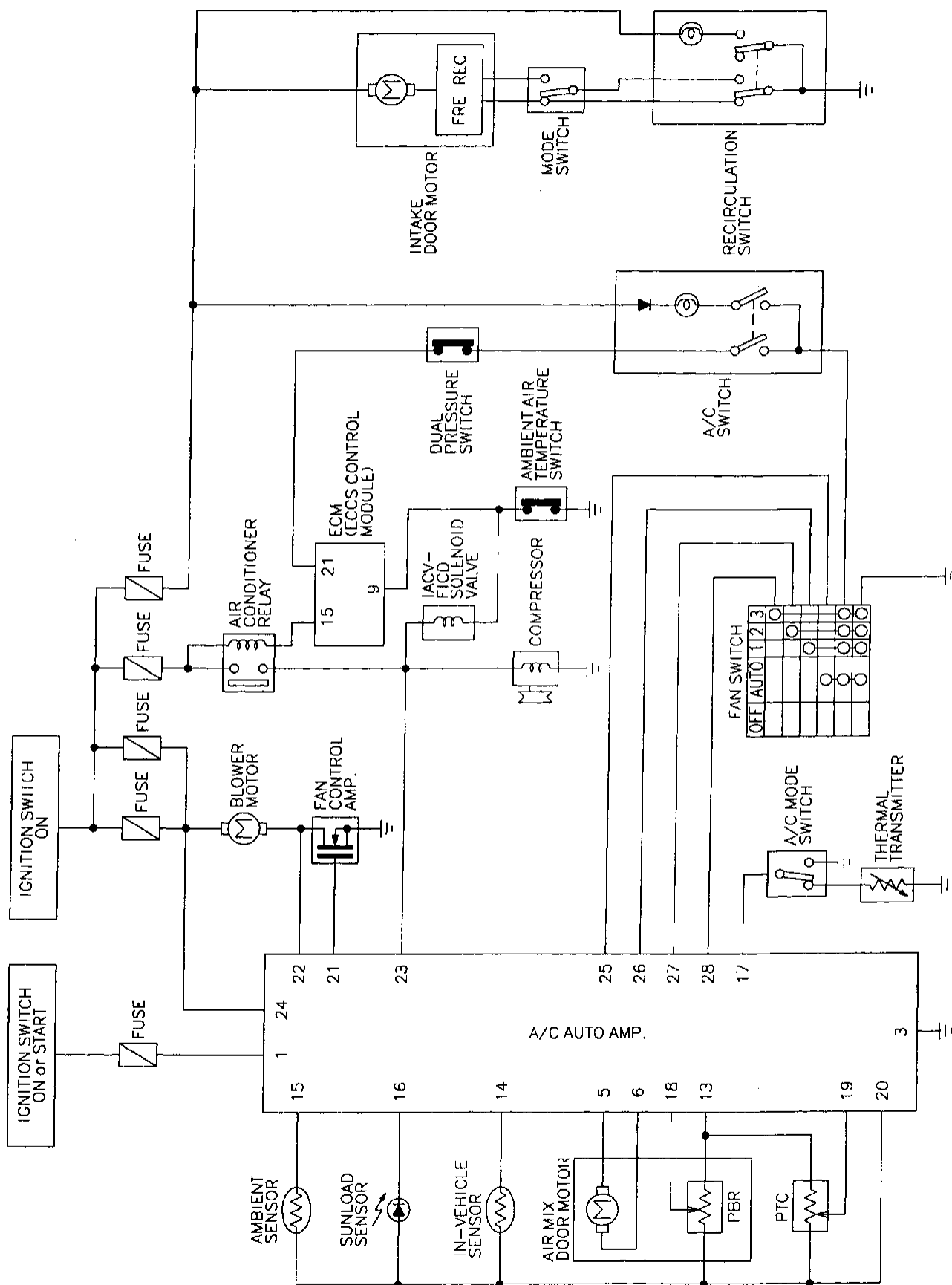
- GI
- MA
- EM
- LC
- EC
- FE
- CL
- MT
- AT
- TF
- PD
- FA
- RA
- BR
- ST
- RS
- BT
- HA**
- EL
- IDX

Harness Layout (Cont'd)

PASSENGER COMPARTMENT



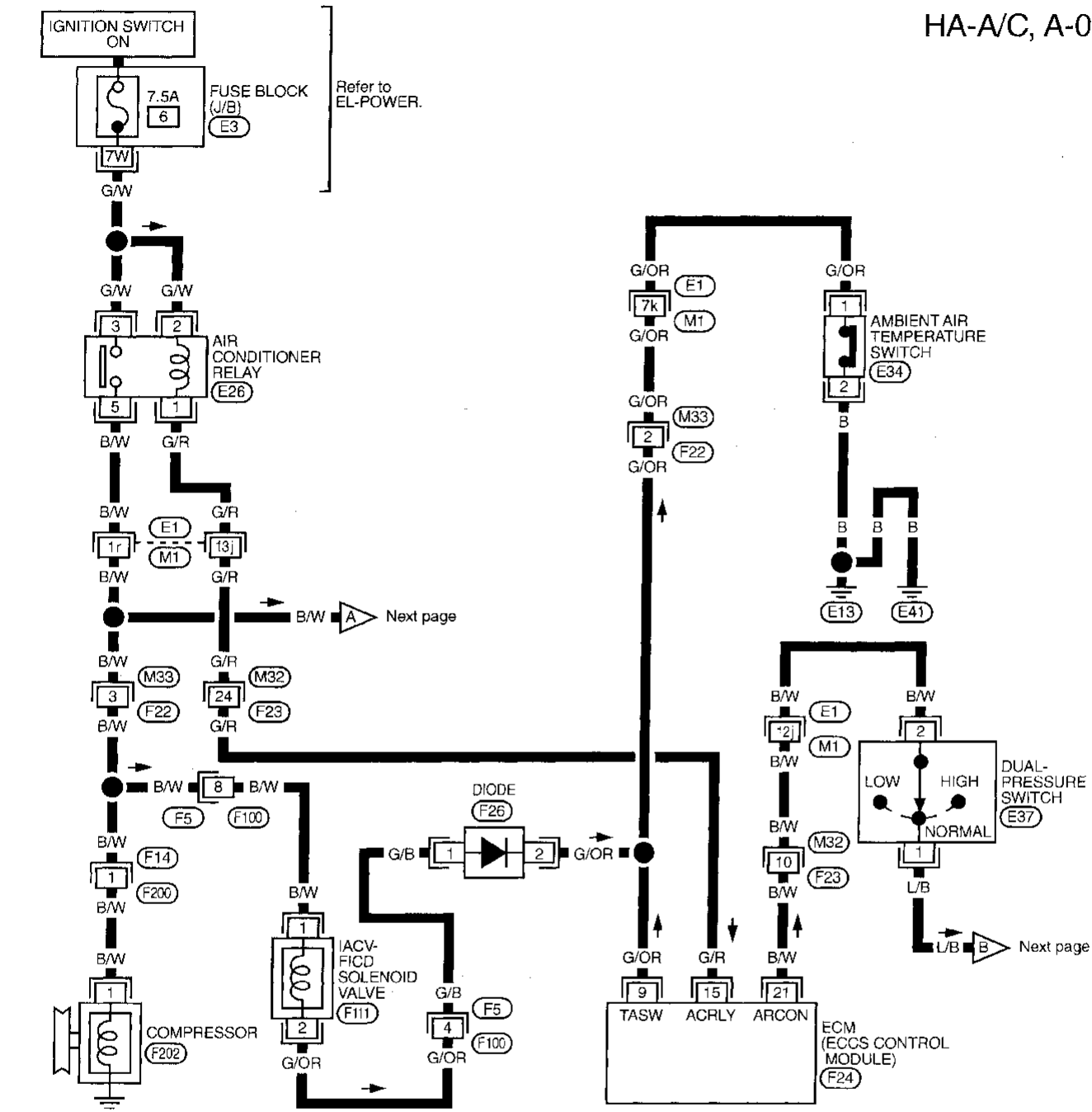
Circuit Diagram — Auto Air Conditioner



GI  
MA  
EM  
LC  
EC  
FE  
CL  
MT  
AT  
TF  
PD  
FA  
PA  
BR  
ST  
BS  
BT  
HA  
EL  
IDX

Wiring Diagram — A/C, A —

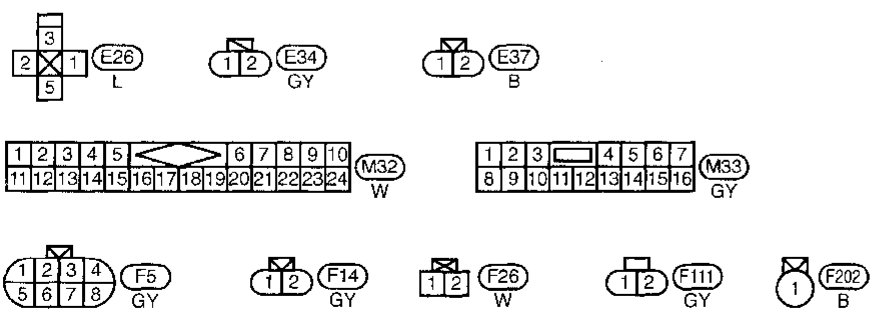
HA-A/C, A-01



Refer to EL-POWER.

Next page

Next page

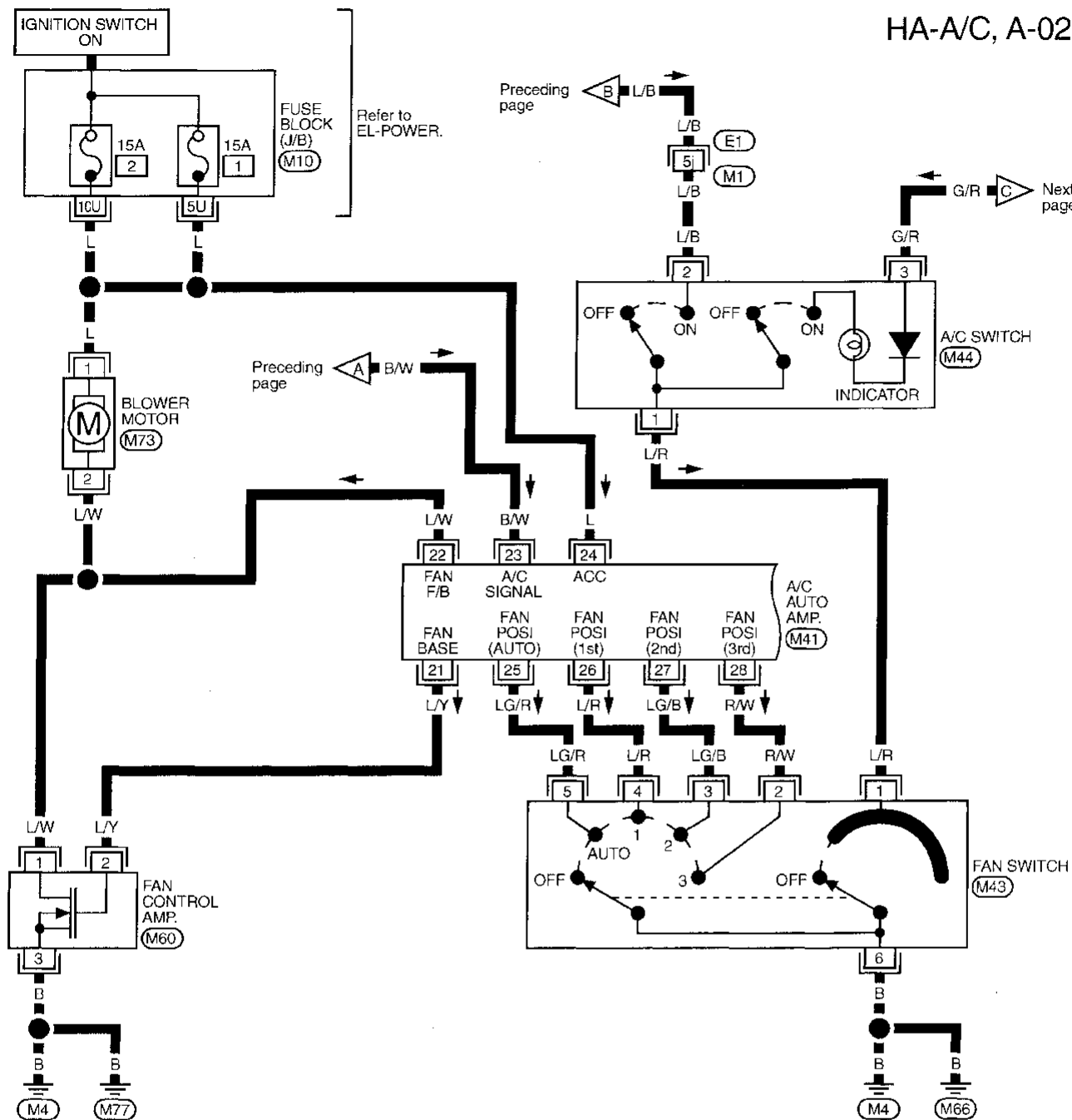


Refer to last page (Foldout page).

- (E1) (M1)
- (E3)
- (F24)

Wiring Diagram — A/C, A — (Cont'd)

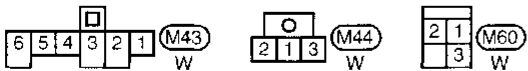
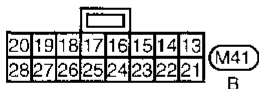
HA-A/C, A-02



GI  
MA  
EM  
LC  
EC  
FE  
CL  
MT  
AT  
TF  
PD  
FA  
RA  
BR  
ST  
RS  
BT  
HA  
EL  
IDX

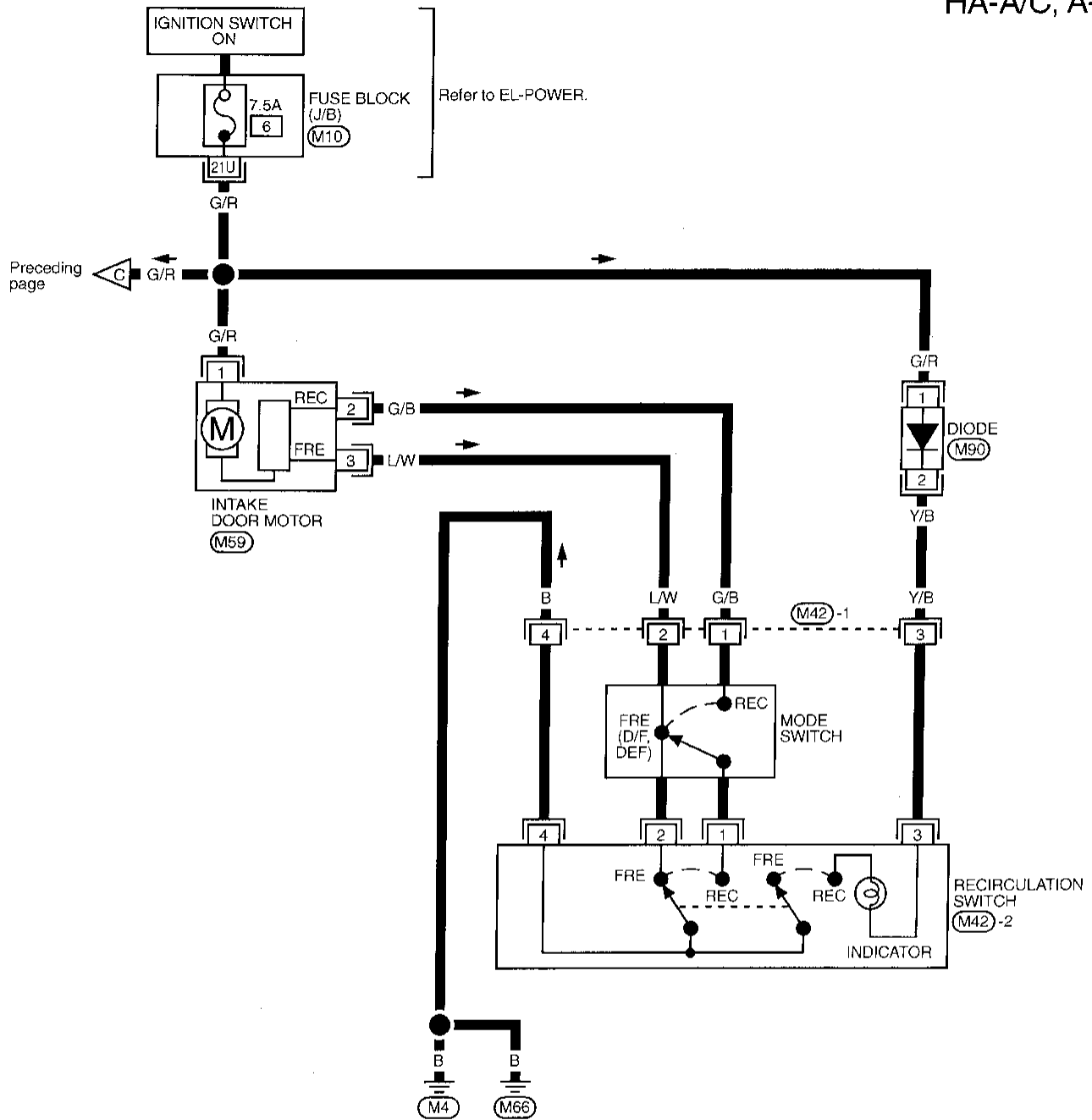
Refer to last page (Foldout page).

(E1) (M1)  
(M10)



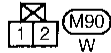
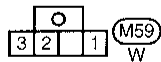
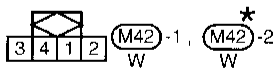
Wiring Diagram — A/C, A — (Cont'd)

HA-A/C, A-03



Refer to last page (Foldout page).

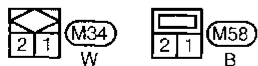
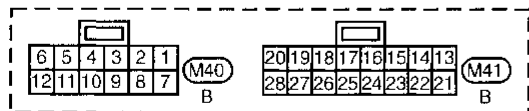
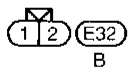
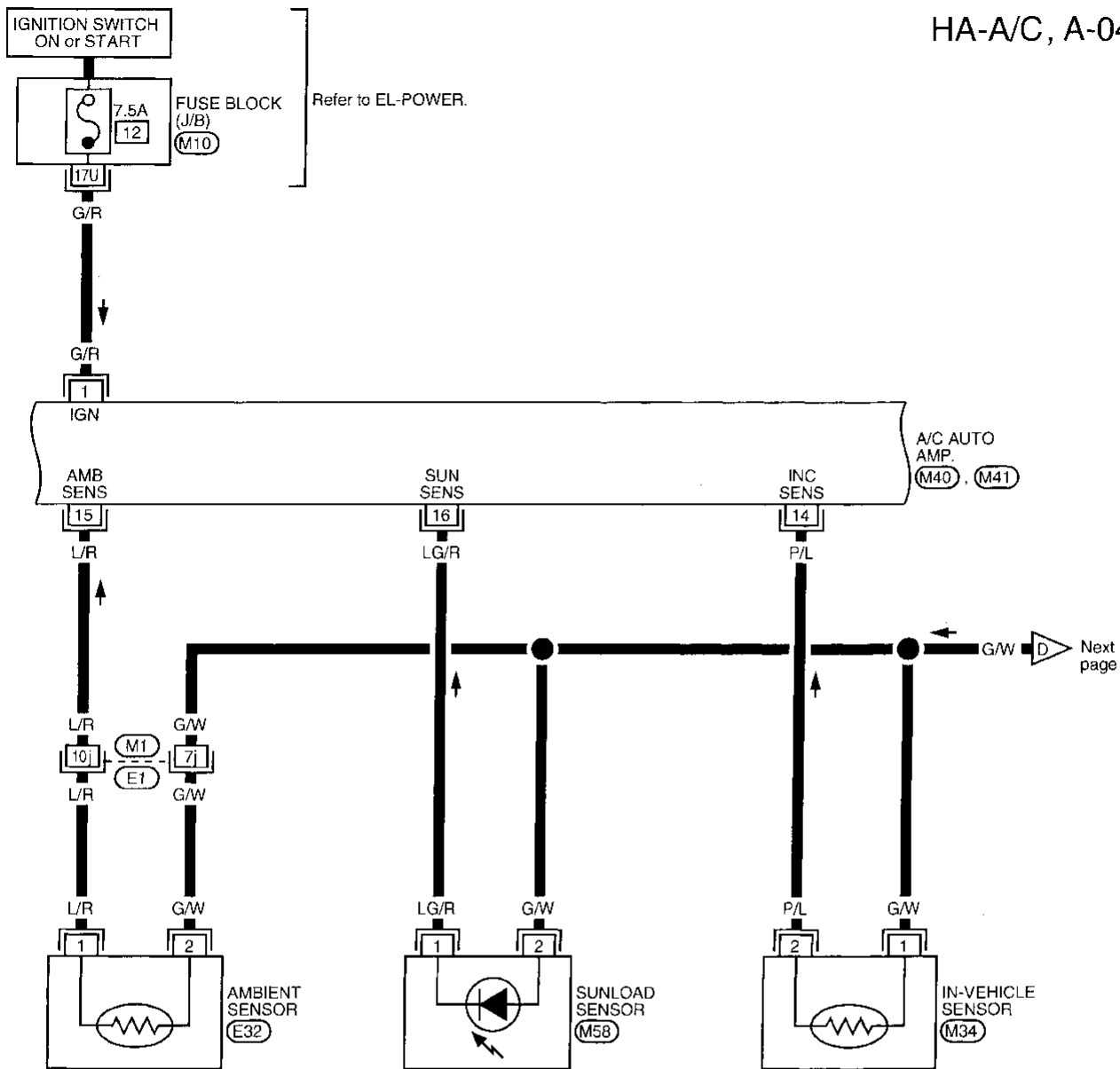
(M10)



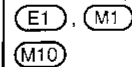
\* : This connector is not shown in "HARNESS LAYOUT" of EL section.

Wiring Diagram — A/C, A — (Cont'd)

HA-A/C, A-04



Refer to last page (Foldout page).



GI

MA

EM

LC

EC

FE

GL

MT

AT

TF

PD

FA

RA

BR

ST

RS

BT

**HA**

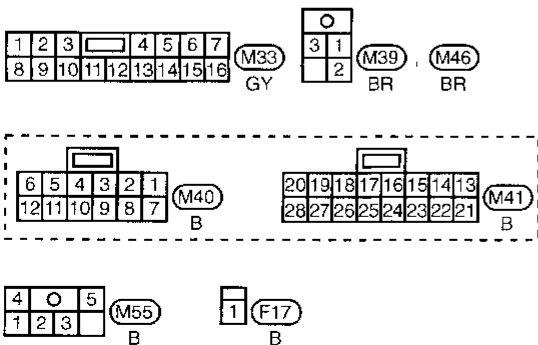
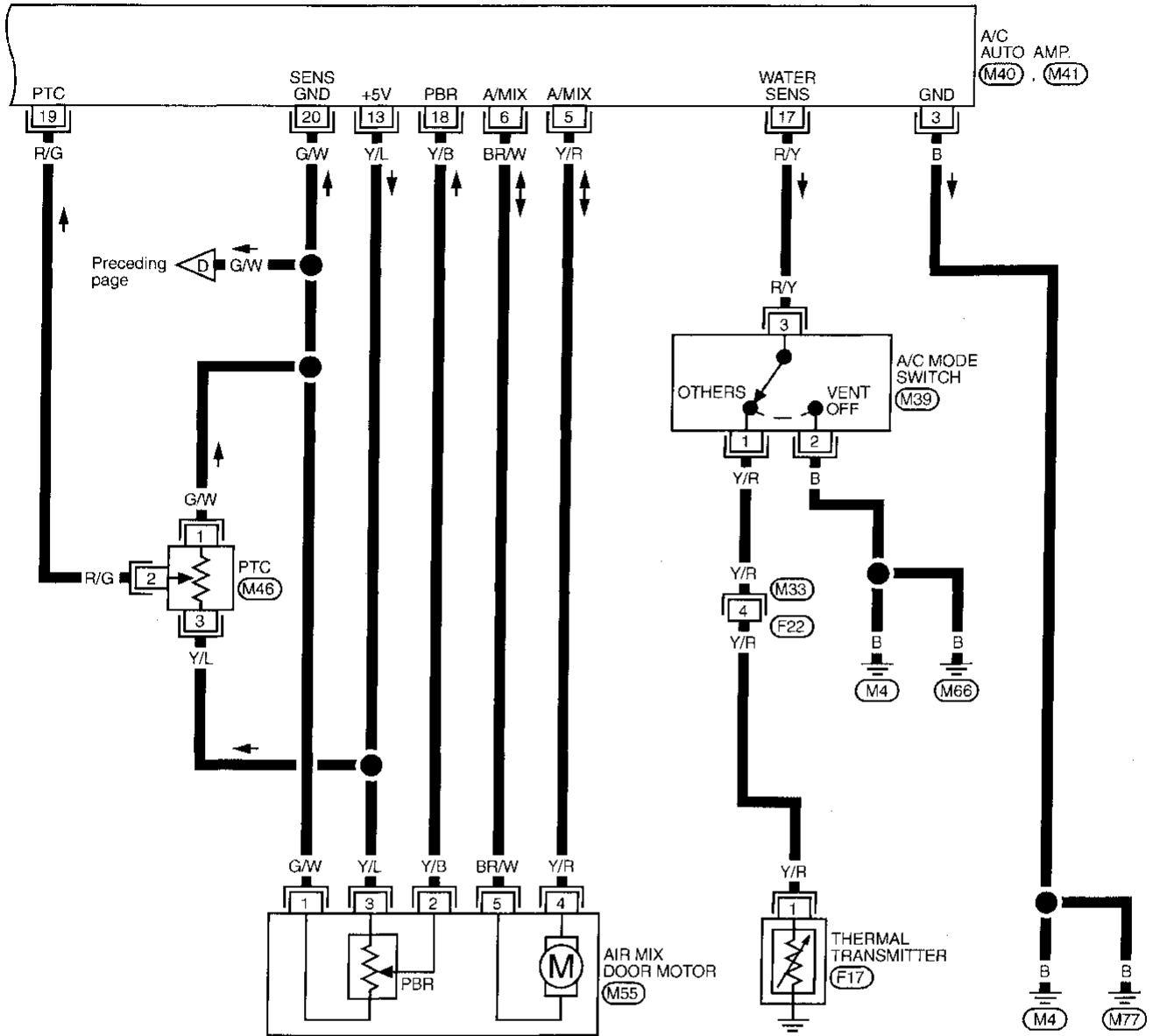
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Wiring Diagram — A/C, A — (Cont'd)

HA-A/C, A-05



**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.

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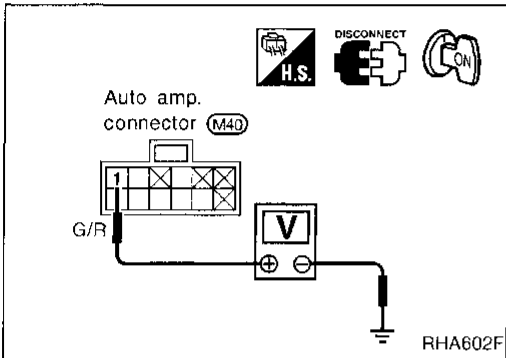
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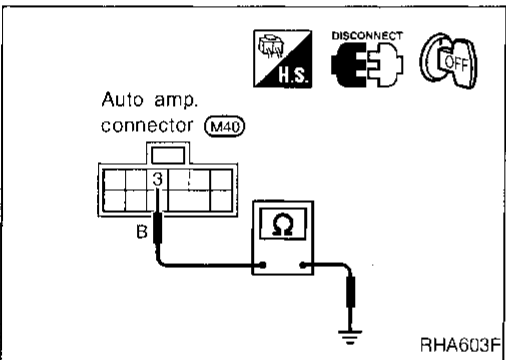


**AUTO AMP. CHECK**

Check power supply circuit for auto amp. with ignition switch ON.

1. Disconnect auto amp. harness connector.
2. Connect voltmeter from harness side.
3. Measure voltage across terminal No. ① and body ground.

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



Check body ground circuit for auto amp. with ignition switch OFF.

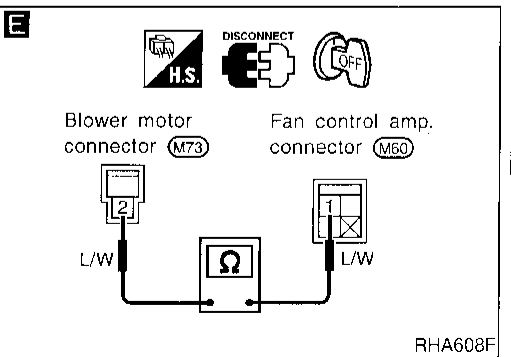
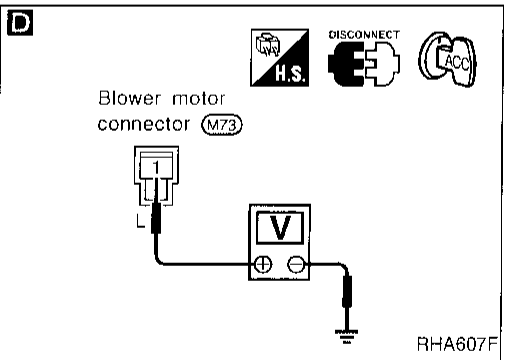
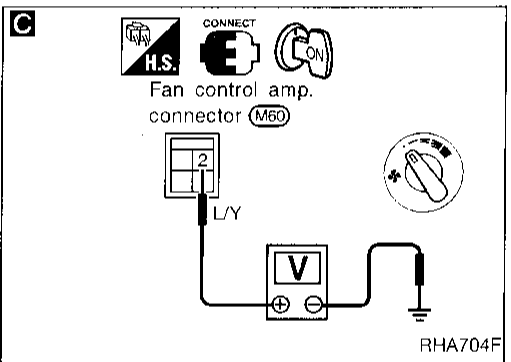
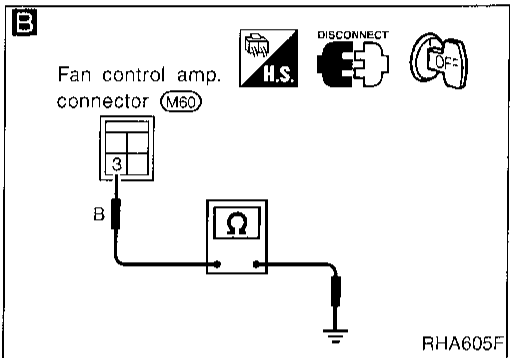
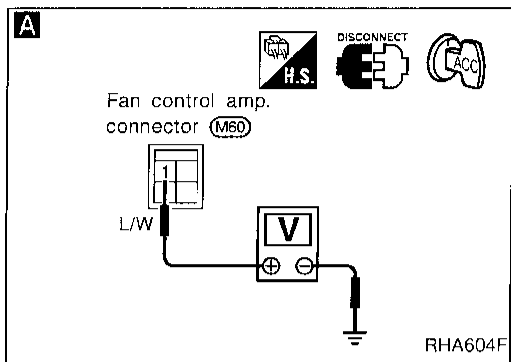
1. Disconnect auto amp. harness connector.
2. Connect ohmmeter from harness side.
3. Check for continuity between terminal No. ③ and body ground.

Ohmmeter terminal		Continuity
⊕	⊖	
③	Body ground	Yes

### Diagnostic Procedure 1

**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. ① and body ground?

**B** CHECK BODY GROUND CIRCUIT FOR FAN CONTROL AMP.  
Does continuity exist between fan control amp. harness terminal No. ③ and body ground?

Reconnect fan control amp. harness connector.

**C** CHECK FOR OUTPUT OF AUTO AMP.  
Measure voltage across fan control amp. harness terminal No. ② and body ground.

Fan control knob condition	Terminal No.		Voltage
	⊕	⊖	
Speed 1	②	Body ground	Approx. 2.5 - 3.0V
Speed 3		Body ground	Approx. 8.5 - 9.0V

Replace fan control amp.

**D** CHECK POWER SUPPLY FOR BLOWER MOTOR.  
Disconnect blower motor harness connector.  
Do approx. 12 volts exist between blower motor harness terminal No. ① and body ground?

Check 15A (No. ①, ②) fuses at fuse block. (Refer to "POWER SUPPLY ROUTING" in EL section and Wiring Diagram.)

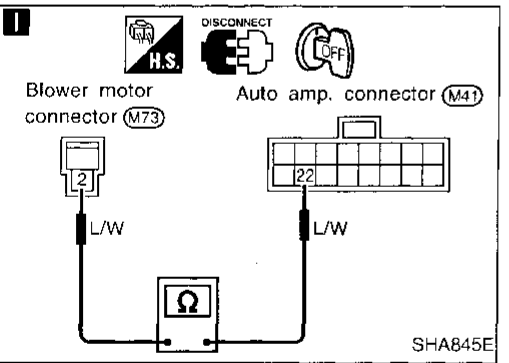
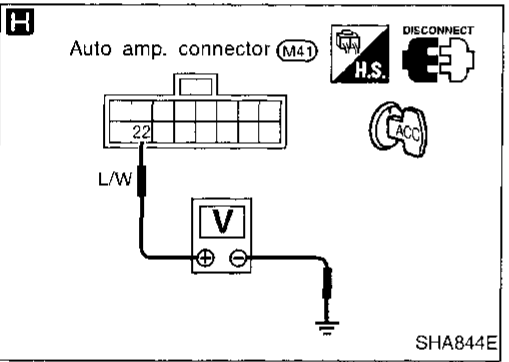
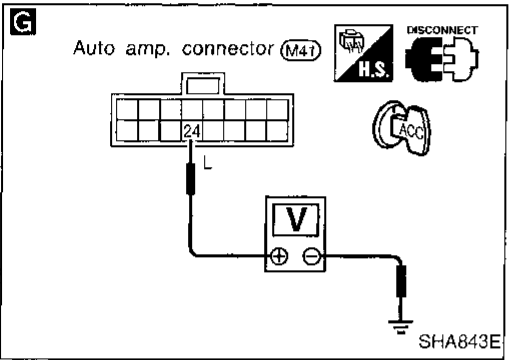
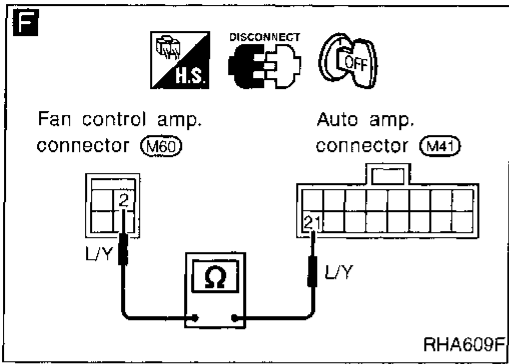
**E** Check circuit continuity between blower motor harness terminal No. ② and fan control amp. harness terminal No. ①.  
**Continuity should exist.** If OK, check harness for short.

CHECK BLOWER MOTOR. (Refer to Electrical Components Inspection.) (HA-87)

Replace blower motor.

**Note:** If the result is NG or No after checking circuit continuity, repair harness or connector.

Diagnostic Procedure 1 (Cont'd)



**A**

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

**F**      Note

Does continuity exist between auto amp. harness terminal No. ① and fan control amp. harness terminal No. ② ?

**Continuity should exist.**

If OK, check harness for short.

**G**

CHECK FAN FEED BACK CIRCUIT.

Do approx. 12 volts exist between auto amp. harness terminal No. ④ and body ground?

No

Check power supply circuit and 15A fuses (No. ① and ②, located in the fuse block).

Refer to EL section ("Wiring Diagram", "POWER SUPPLY ROUTING").

**H**

Do approx. 12 volts exist between auto amp. harness terminal No. ② and body ground?

No

**I**      Note

Check circuit continuity between blower motor harness terminal No. ② and auto amp. harness terminal No. ②.

**Continuity should exist.**

If OK, check harness for short.

Replace auto amp.

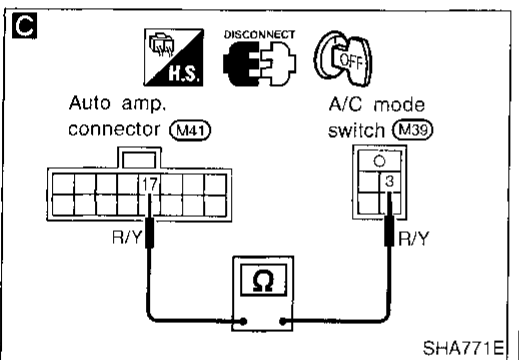
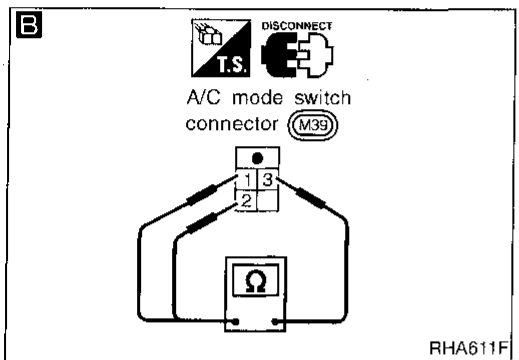
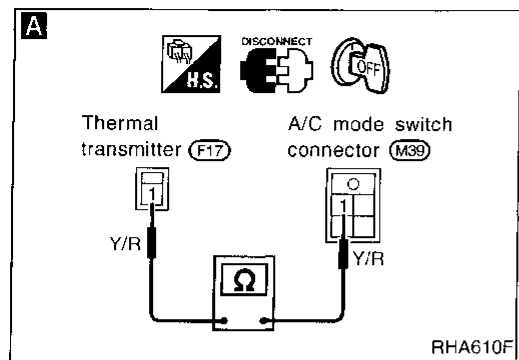
**Note:**

If the result is NG or No after checking circuit continuity, repair harness or connector.

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### Diagnostic Procedure 2

**SYMPTOM:** Starting fan speed control does not operate.



**A** Note

**CHECK THERMAL TRANSMITTER CIRCUIT BETWEEN THERMAL TRANSMITTER AND A/C MODE SWITCH.**  
 Disconnect thermal transmitter harness connector and A/C mode switch harness connector.  
 Check circuit continuity between thermal transmitter harness terminal No. ① and A/C mode switch harness terminal No. ①.  
**Continuity should exist.**  
 If OK, check harness for short.

**B**

**CHECK A/C MODE SWITCH.**  
 Check circuit continuity between each terminal on mode switch.

Mode switch position	Terminal No.	Continuity
VENT DEF	② and ③	Yes
Others	① and ③	Yes

**C**

**CHECK THERMAL TRANSMITTER.**  
 Refer to EL section.

**C** Note

Disconnect A/C auto amp. harness connector and A/C mode switch connector.  
 Check circuit continuity between A/C auto amp. connector harness terminal No. ① and A/C mode switch harness terminal No. ③.  
**Continuity should exist.**  
 If OK, check harness for short.

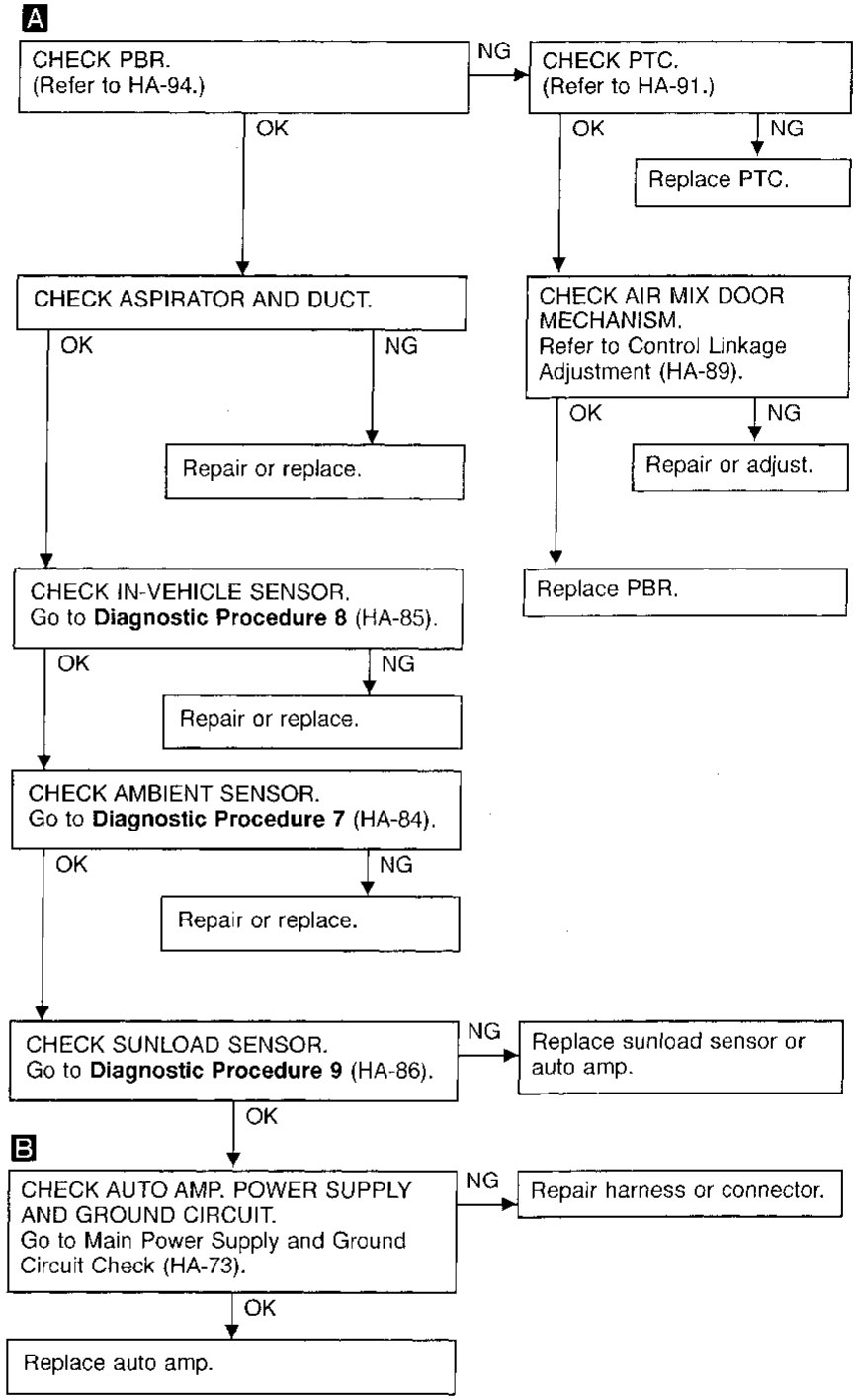
Replace auto amp.

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

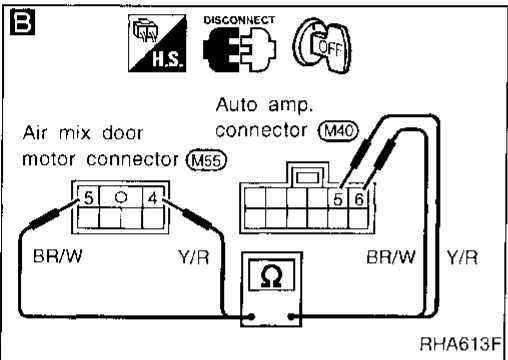
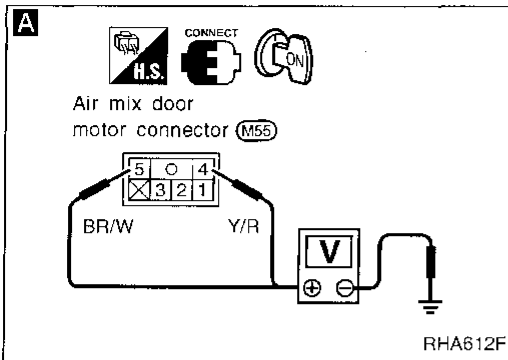
**Diagnostic Procedure 3**

**SYMPTOM:** There is too much difference between setting temp. on PTC and in-vehicle temp.

- Perform PRELIMINARY CHECK 2 before referring to the following flow chart.



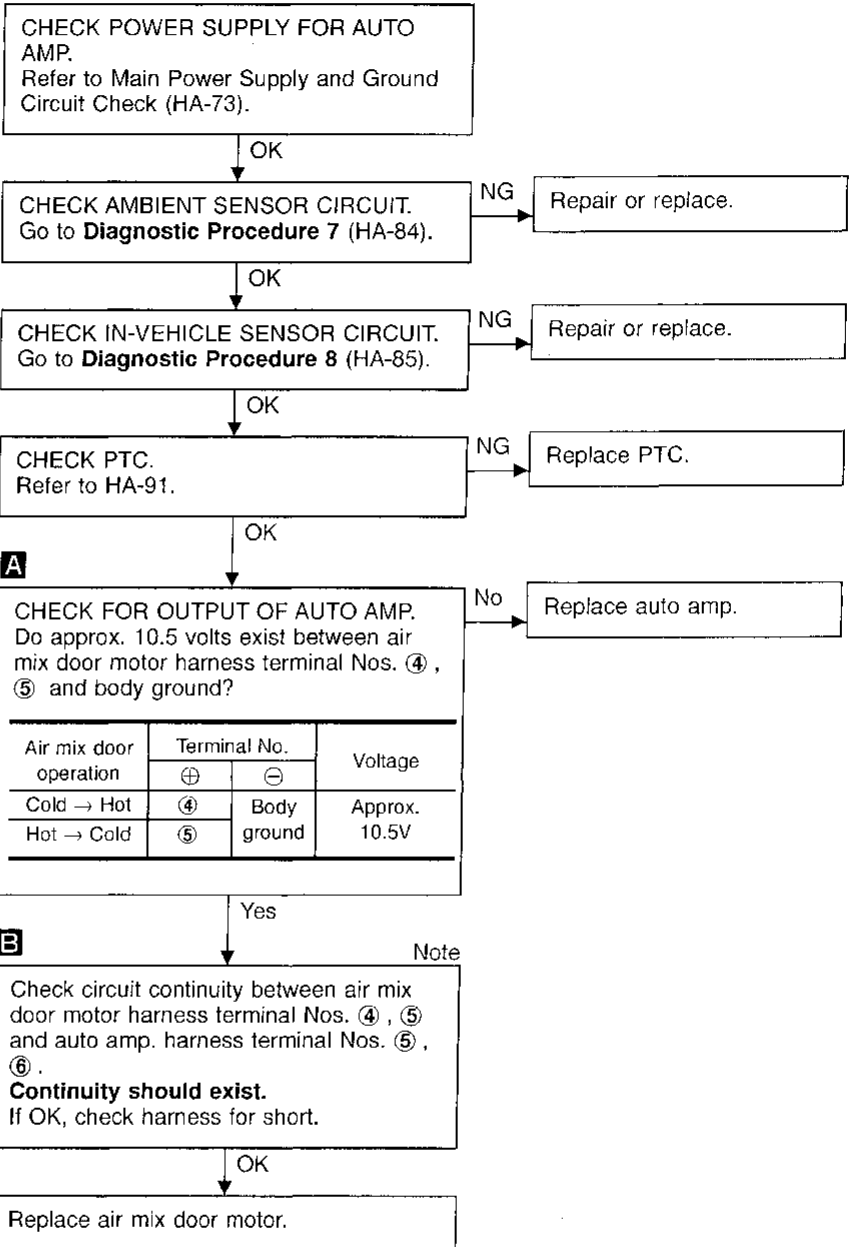
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### Diagnostic Procedure 4

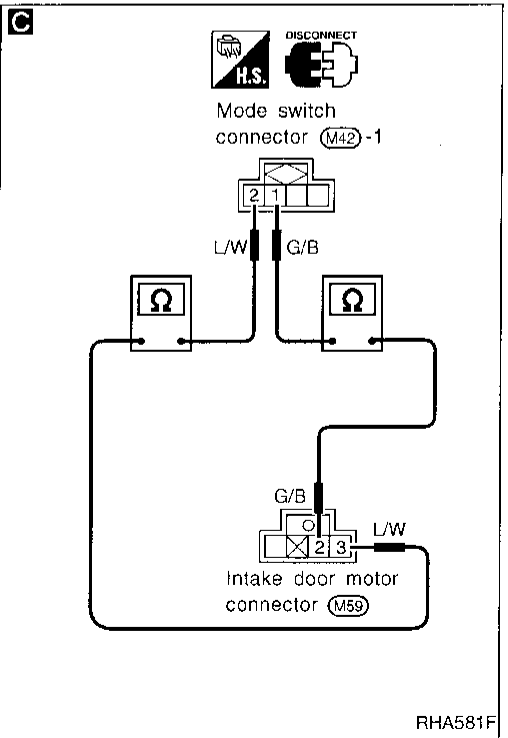
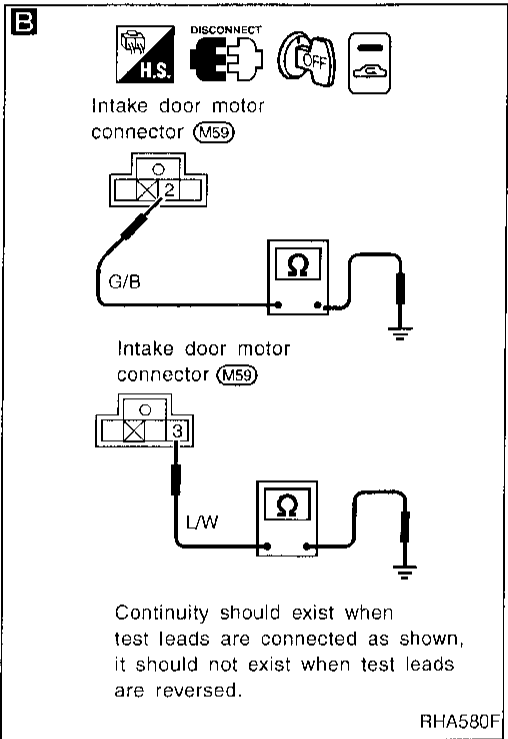
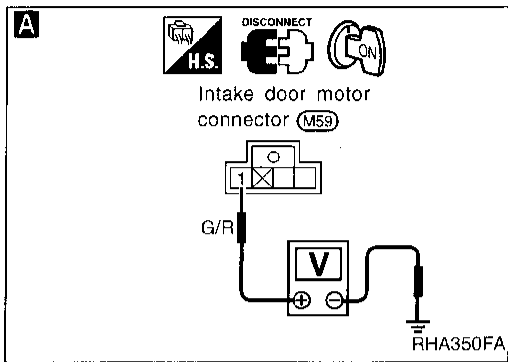
**SYMPTOM:** Air mix door motor does not operate normally.

- Perform **PRELIMINARY CHECK 2** before referring to the following flow chart.



**Note:**

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



**Diagnostic Procedure 5**

**SYMPTOM:** Intake door does not change in VENT, B/L or FOOT mode.

**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?

No

Check 7.5A (No. 6) fuse at fuse block.  
 (Refer to "POWER SUPPLY ROUTING" in EL section and Wiring Diagram.)

**B**

**CHECK GROUND CIRCUIT FOR INTAKE DOOR MOTOR.**  
 Check continuity between intake door motor harness terminals and body ground.

Recirculation switch condition	Terminal No.		Continuity
	⊕	⊖	
REC	②	Body ground	Yes
	③		No
FRE	②		No
	③		Yes

NG

Disconnect mode switch harness connector.

**C**

Note

Check continuity between mode switch harness terminal No. ① (②) and intake door motor harness terminal No. ② (③).  
**Continuity should exist.**  
 If OK, check harness for short.

OK

**CHECK INTAKE DOOR LINKAGE.**  
 Refer to Control Linkage Adjustment. (HA-89)

OK

Replace intake door motor.

OK

Ⓐ

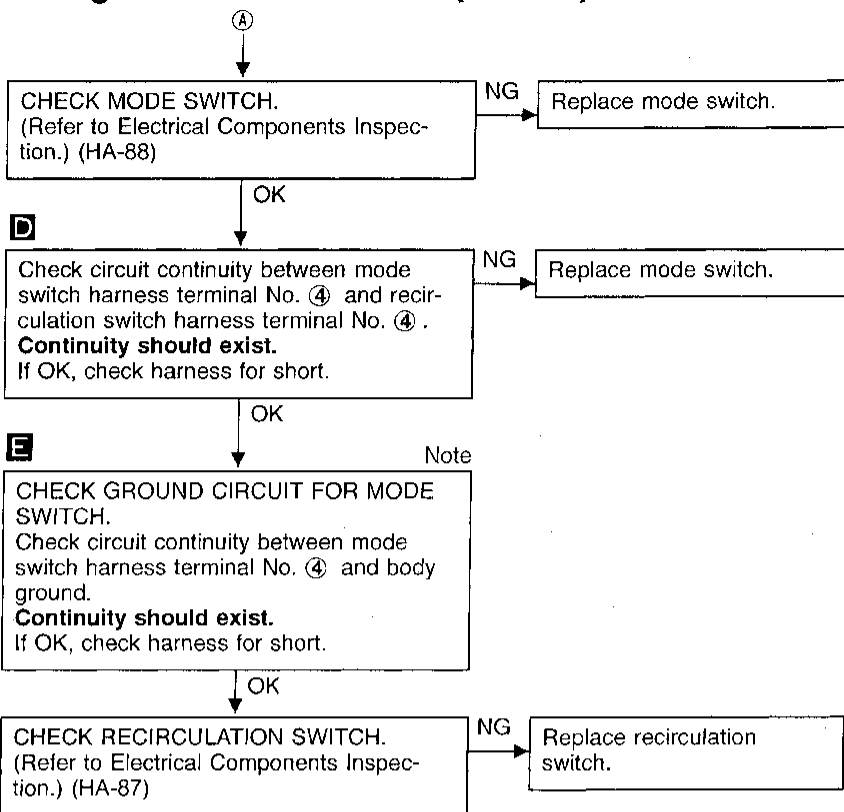
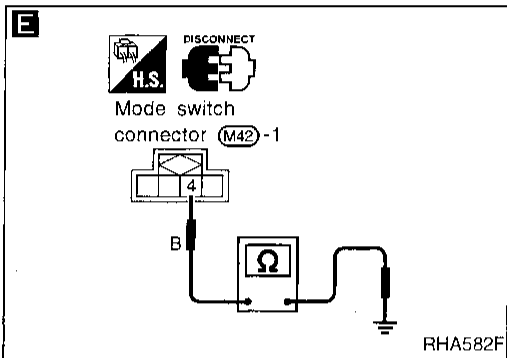
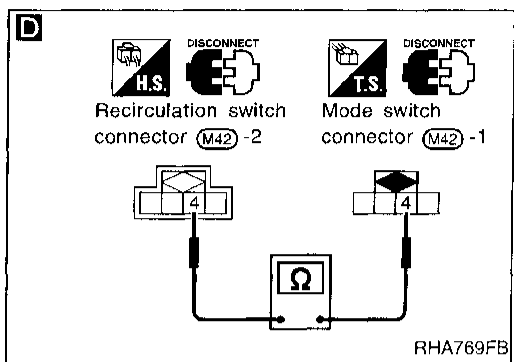
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**Note:**  
 If the result is NG after checking circuit continuity, repair harness or connector.

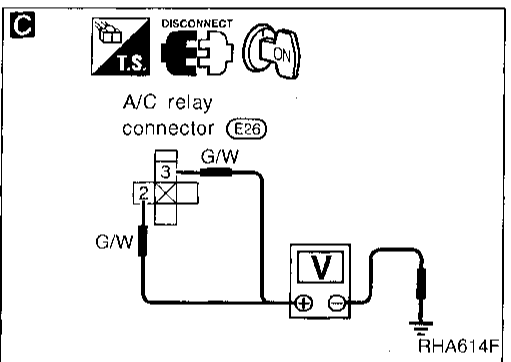
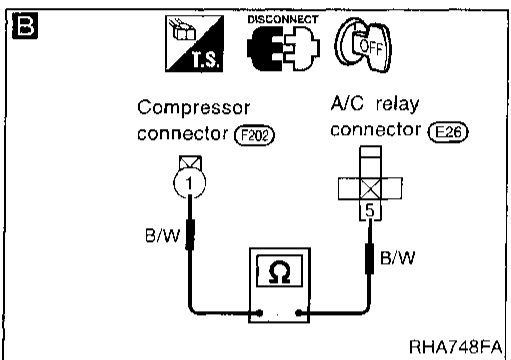
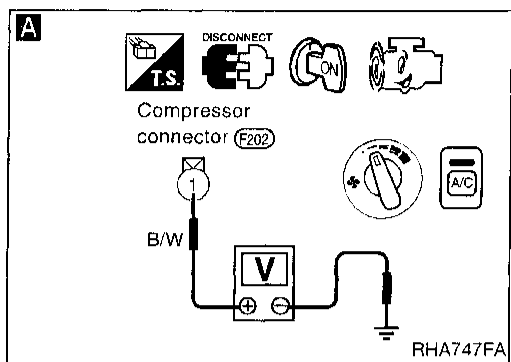
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Diagnostic Procedure 5 (Cont'd)



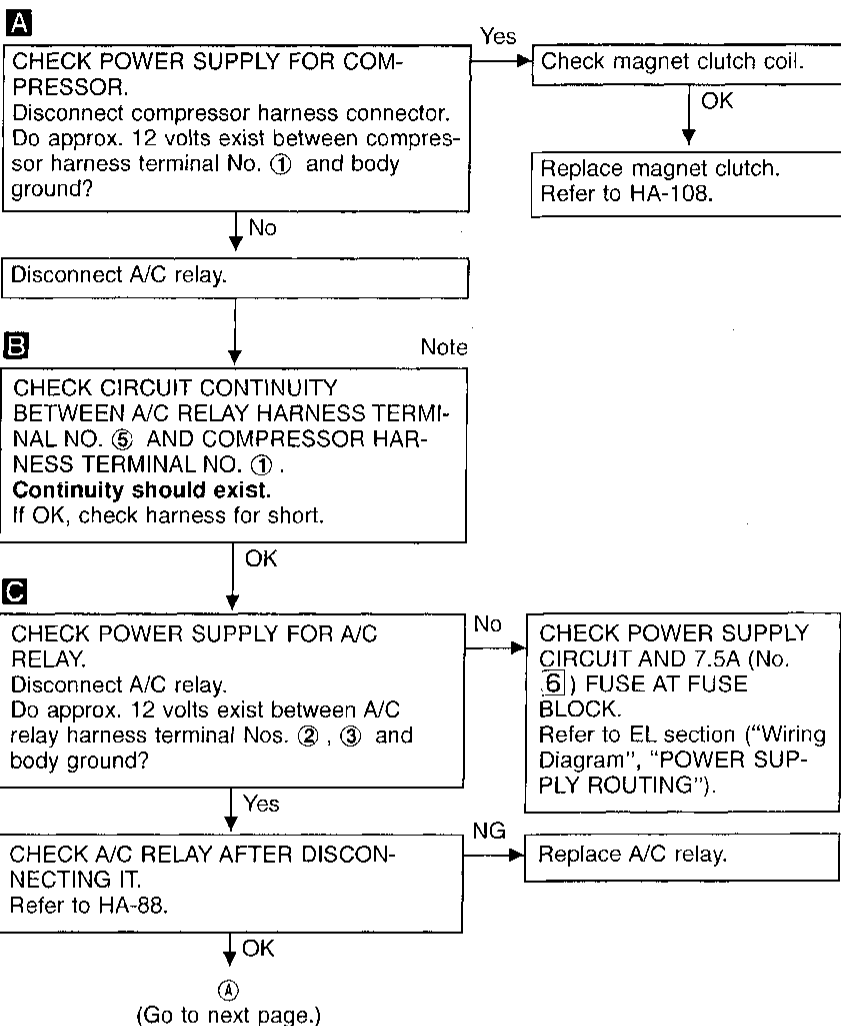
**Note:**  
If the result is NG after checking circuit continuity, repair harness or connector.



**Diagnostic Procedure 6**

**SYMPTOM:** Magnet clutch does not engage when A/C switch and fan switch are ON.

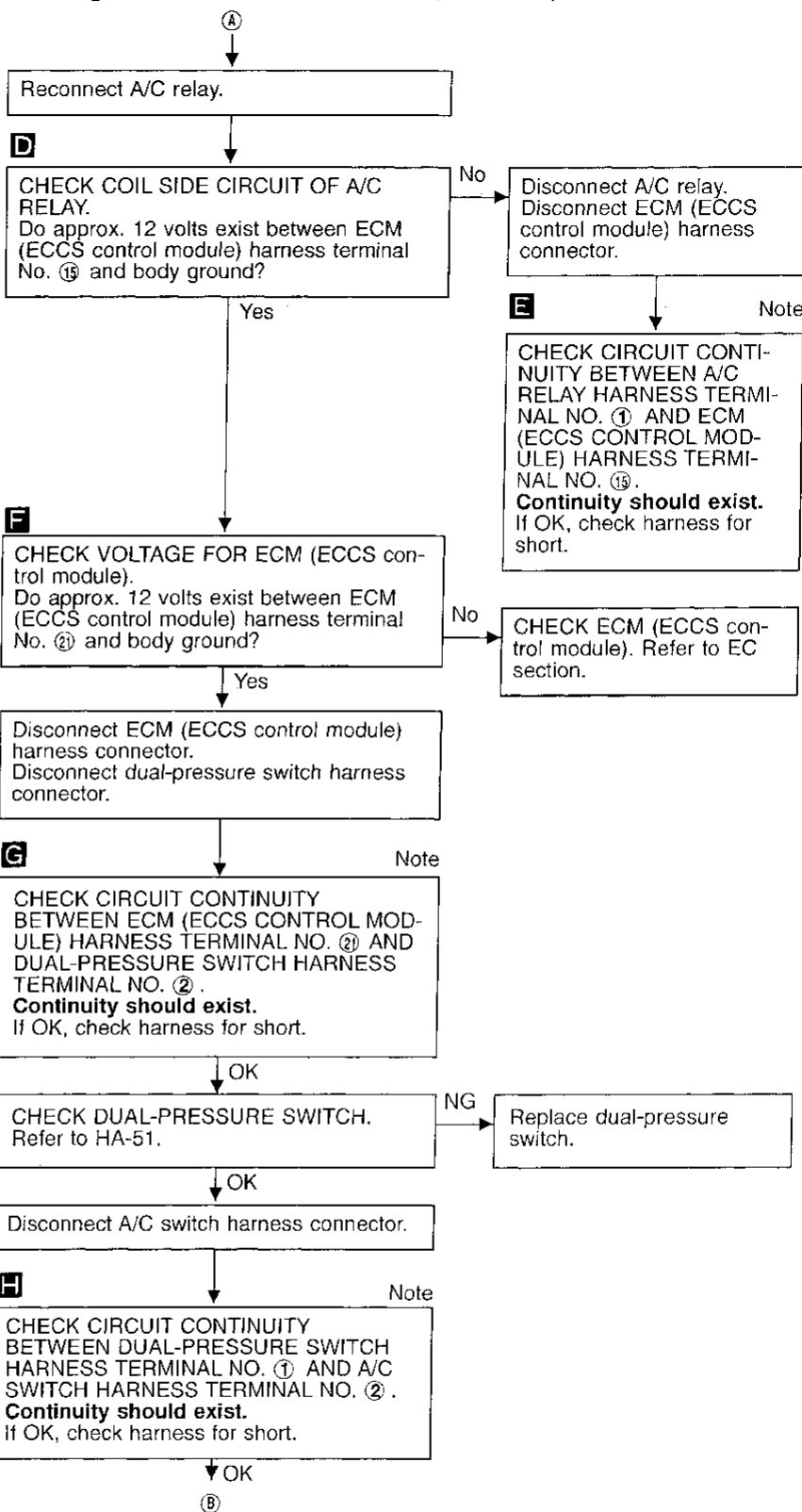
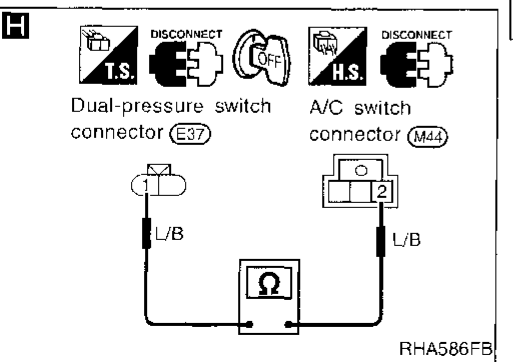
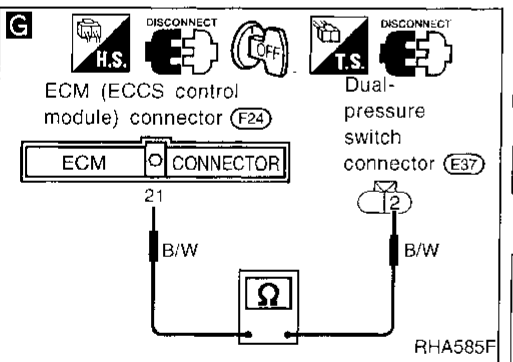
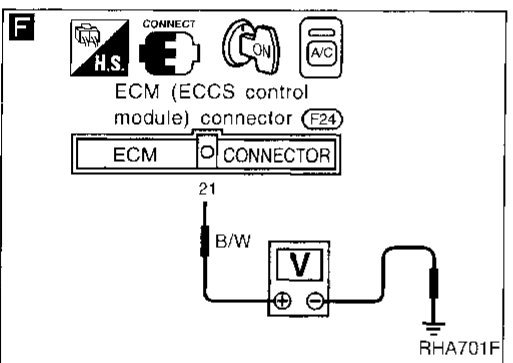
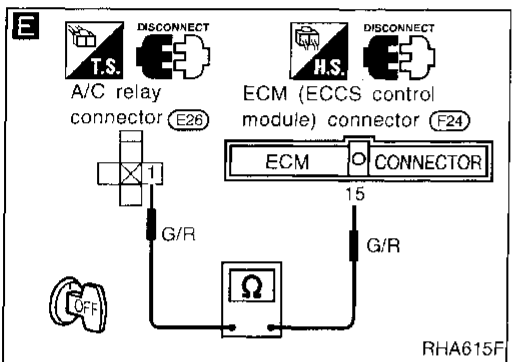
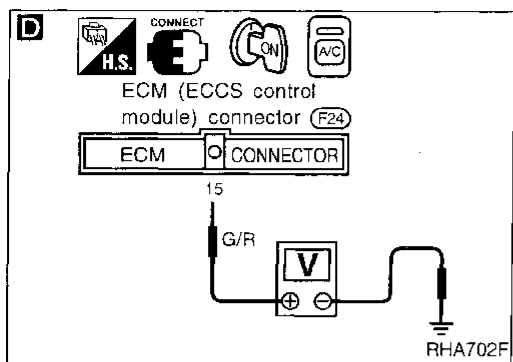
- Perform **PRELIMINARY CHECK 1** before referring to the following flow chart.



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

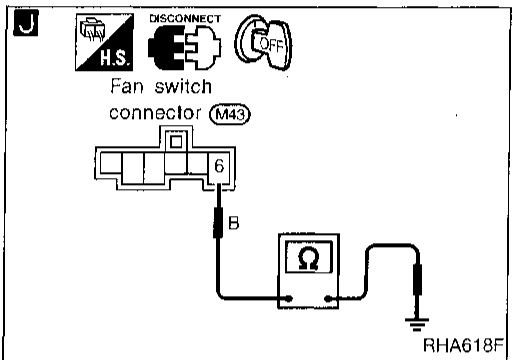
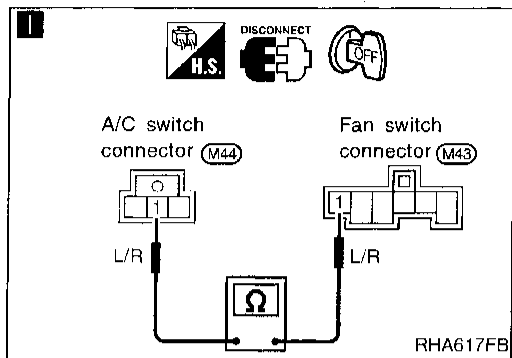
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Diagnostic Procedure 6 (Cont'd)



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

Diagnostic Procedure 6 (Cont'd)



ⓑ

CHECK A/C SWITCH.  
Refer to HA-87.

NG → Replace A/C switch.

OK

Disconnect fan switch harness connector.

ⓐ Note

Check circuit continuity between A/C switch harness terminal No. ① and fan switch harness terminal No. ①.  
**Continuity should exist.**  
If OK, check harness for short.

OK

ⓐ Note

CHECK BODY GROUND CIRCUIT FOR FAN SWITCH.  
Does continuity exist between fan switch harness terminal No. ⑥ and body ground?  
**Continuity should exist.**  
If OK, check harness for short.

Yes

CHECK FAN SWITCH.  
Refer to HA-87.

NG → Replace fan switch.

**Note:**  
If the result is NG or No after checking circuit continuity, repair harness or connector.

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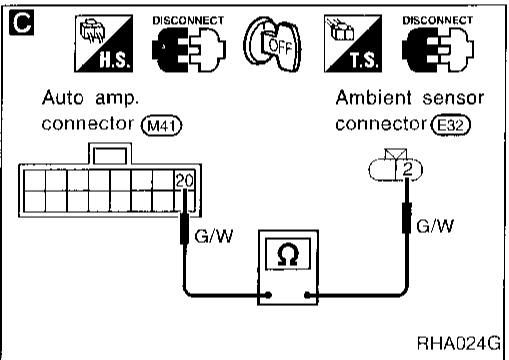
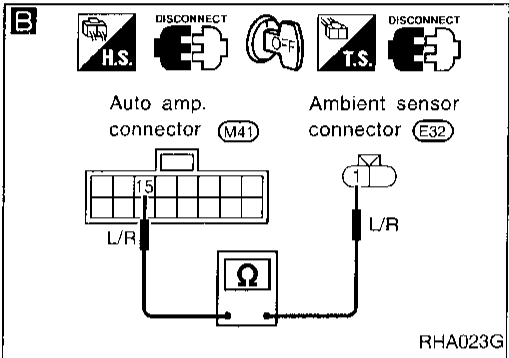
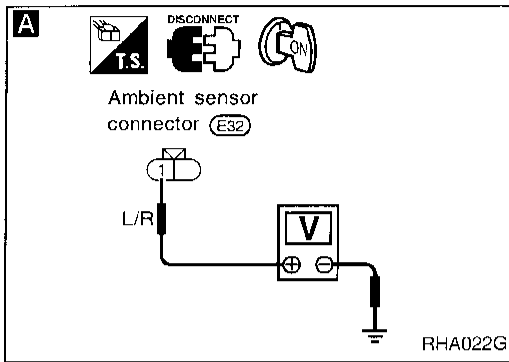
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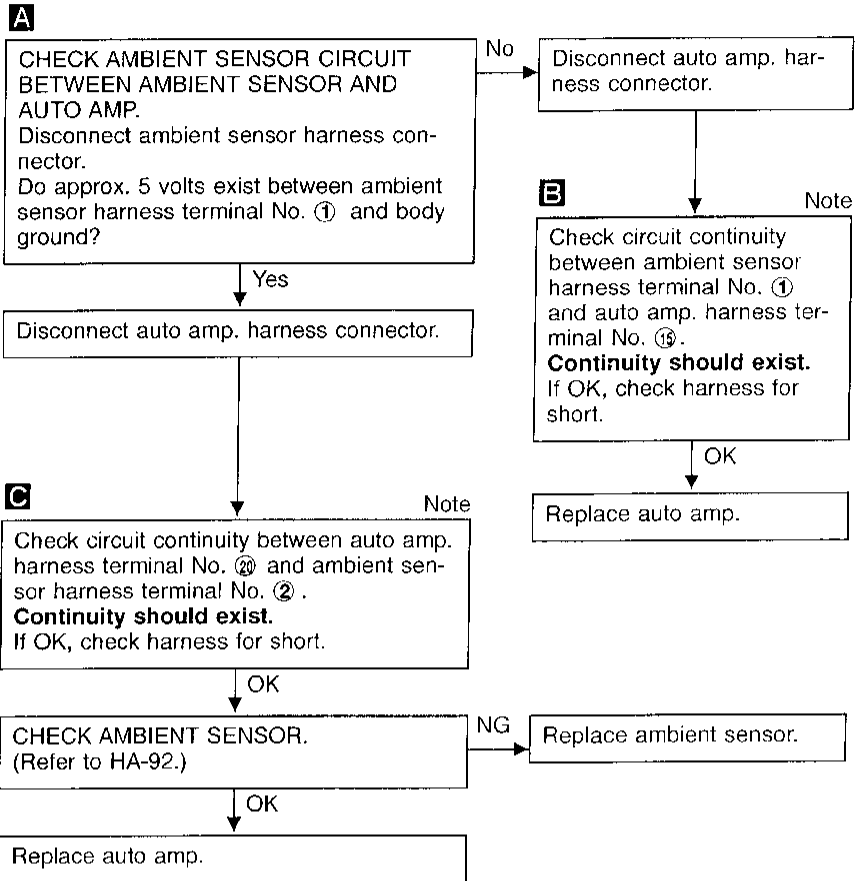
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### Diagnostic Procedure 7

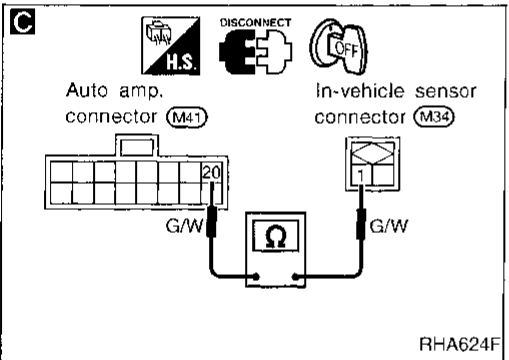
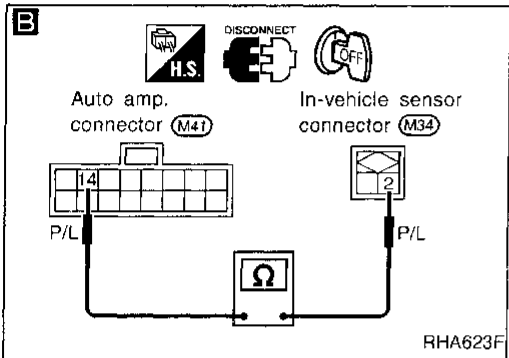
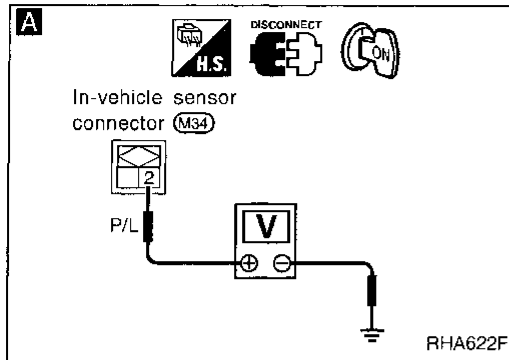
**SYMPTOM: Ambient sensor circuit is open or shorted.**



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

**Diagnostic Procedure 8**

**SYMPTOM: In-vehicle sensor circuit is open or shorted.**



**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. ② and body ground?

No → Disconnect auto amp. harness connector.

Yes → Disconnect auto amp. harness connector.

**B** Note

Check circuit continuity between in-vehicle sensor harness terminal No. ② and auto amp. harness terminal No. ⑭.  
**Continuity should exist.**  
If OK, check harness for short.

OK → Replace auto amp.

**C** Note

Check circuit continuity between auto amp. harness terminal No. ⑳ and in-vehicle sensor harness terminal No. ①.  
**Continuity should exist.**  
If OK, check harness for short.

OK → CHECK IN-VEHICLE SENSOR. (Refer to HA-91.)

NG → Replace in-vehicle sensor.

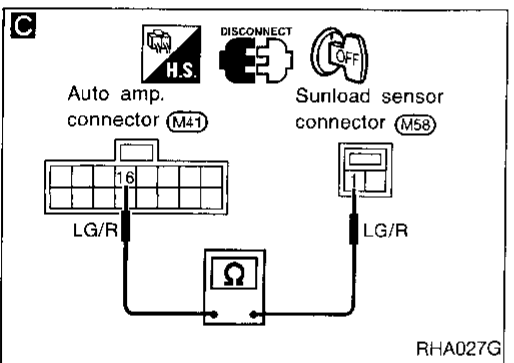
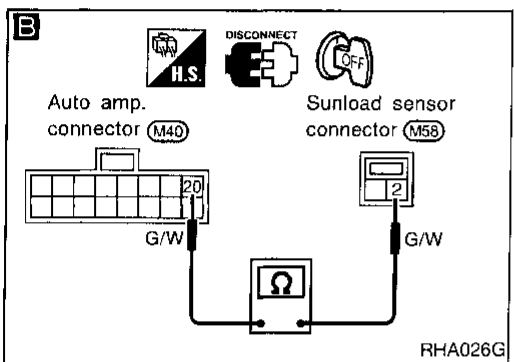
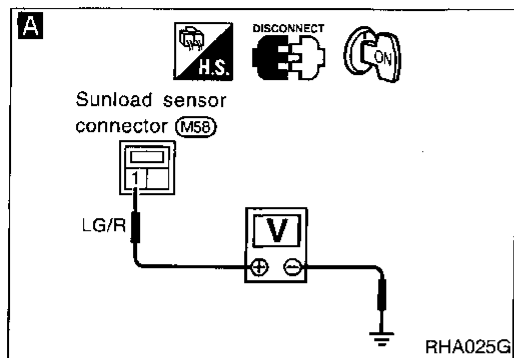
OK → Replace auto amp.

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

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### Diagnostic Procedure 9

**SYMPTOM: Sunload sensor circuit is open or shorted.**

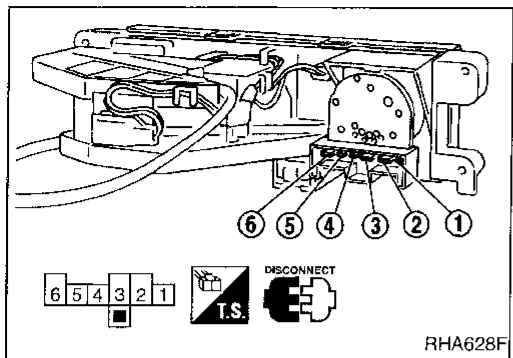


```

    graph TD
        A["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. ① and body  
ground?"]
        B["B  
Check circuit continuity between sunload  
sensor harness terminal No. ② and auto  
amp. harness terminal No. ②①.  
Continuity should exist.  
If OK, check harness for short."]
        C["C  
Check circuit continuity  
between auto amp. harness  
terminal No. ①⑥ and sun-  
load sensor harness termi-  
nal No. ①.  
Continuity should exist.  
If OK, check harness for  
short."]
        D["Disconnect auto amp. harness  
connector."]
        E["Disconnect auto amp. harness  
connector."]
        F["CHECK SUNLOAD SENSOR.  
(Refer to HA-93.)"]
        G["Replace auto amp."]
        H["Replace sunload sensor."]
        I["Replace auto amp."]

        A -- No --> E
        A -- Yes --> D
        E --> C
        C -- OK --> I
        C -- NG --> H
        D --> B
        B -- OK --> I
        B -- NG --> F
        F -- OK --> I
        F -- NG --> H
    
```

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



**Electrical Components Inspection**

**FAN SWITCH**

Check continuity between terminals at each switch position.

KNOB POSITION	Continuity between terminals
OFF	
AUTO	⑤ — ① — ⑥
1	④ — ① — ⑥
2	③ — ① — ⑥
3	② — ① — ⑥

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**BLOWER MOTOR**

Confirm smooth rotation of the blower motor.

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

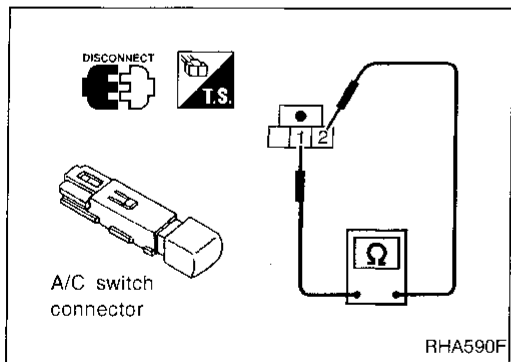
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**A/C SWITCH**

Check continuity between terminals at each switch position.

Switch condition	Terminal No.		Continuity
	⊕	⊖	
A/C ON	②	①	Yes
A/C OFF			No

AT  
TF  
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FA



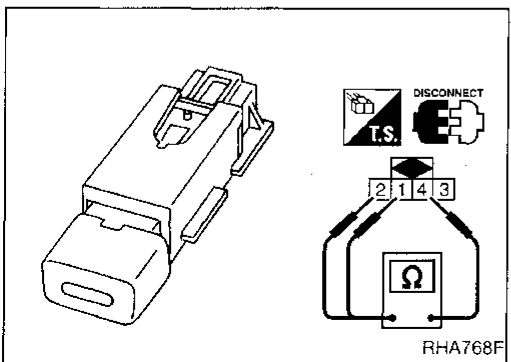
RA  
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**RECIRCULATION SWITCH**

Check continuity between terminals at each switch position.

Terminal No.		Recirculation switch condition	Continuity
⊕	⊖		
①	④	REC	Yes
		FRE	No
②	④	REC	No
		FRE	Yes

BT  
HA



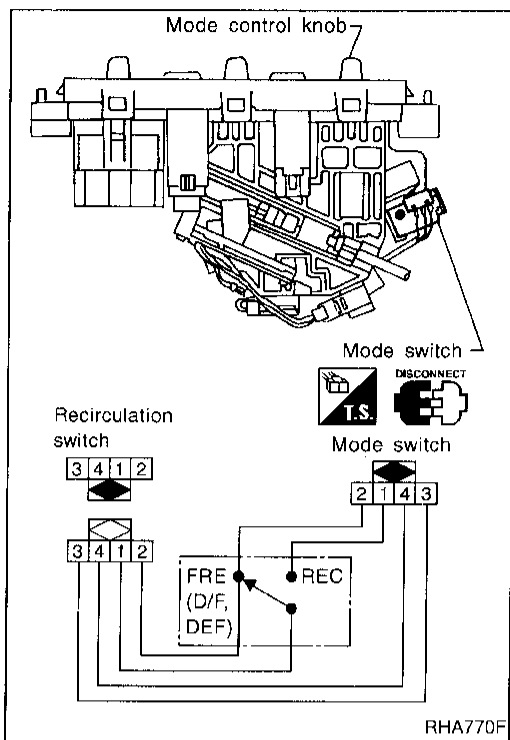
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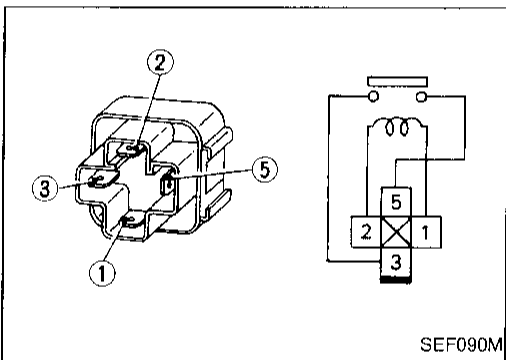
**Electrical Components Inspection (Cont'd)**

**MODE SWITCH**

Check continuity between terminals at each switch position.



Terminal No.		Mode control knob condition	Continuity
Mode switch ⊕	Recirculation switch connector ⊖		
①	①	VENT, B/L, FOOT	Yes
		D/F, DEF	No
②	①	VENT, B/L, FOOT	No
		D/F, DEF	Yes
②	②	All	Yes
③	③	All	Yes
④	④	All	Yes

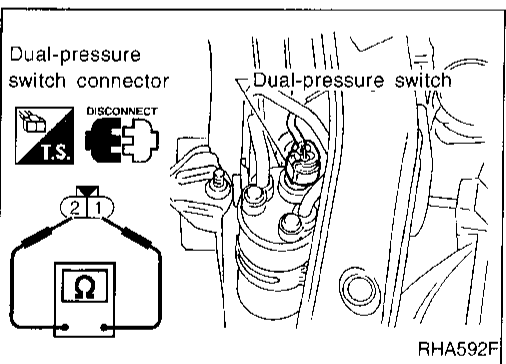


**A/C RELAY**

Check continuity between terminal Nos. ③ and ⑤.

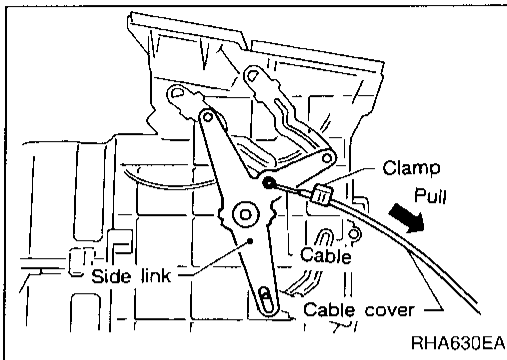
Conditions	Continuity
12V direct current supply between terminal Nos. ① and ②	Yes
No current supply	No

If NG, replace relay.



**DUAL-PRESSURE SWITCH**

	ON kPa (kg/cm <sup>2</sup> , psi)	OFF kPa (kg/cm <sup>2</sup> , psi)
Low-pressure side	Increasing to 157 - 216 (1.6 - 2.2, 23 - 31)	Decreasing to 157 - 196 (1.6 - 2.0, 23 - 28)
High-pressure side	Decreasing to 1,863 - 2,256 (19 - 23, 270 - 327)	Increasing to 2,452 - 2,844 (25 - 29, 356 - 412)



**Control Linkage Adjustment**

**MODE CONTROL CABLE**

1. Turn the mode control knob to the DEF position.
2. Set the side link in the DEF position by hand.
3. Pull on the cable cover in the direction of the arrow, then clamp it.

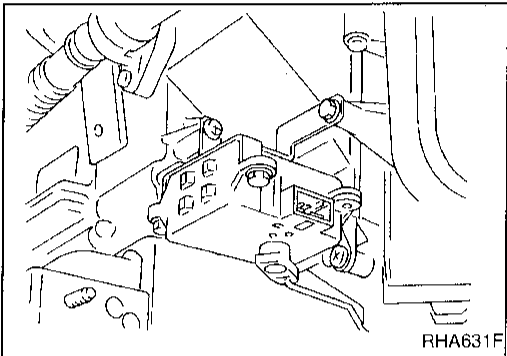
**After positioning control cable, check that it operates properly.**

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**AIR MIX DOOR**

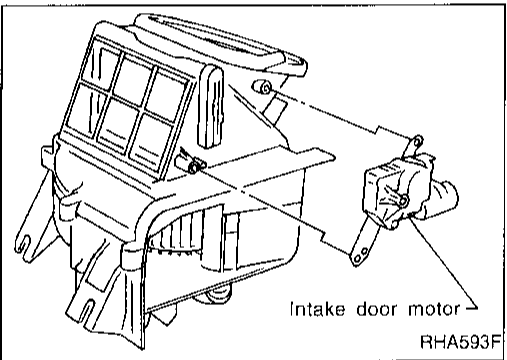
1. Install air mix door motor on heater unit and connect it to the air mix door motor harness.
2. Set PTC at 18°C (65°F) and air mix door motor at "full cold".
3. Move air mix door lever by hand and hold it at the full-cold position.
4. Attach air mix door lever to rod holder.
5. Check that air mix door operates properly when PTC is moved from 20 to 30°C (65 to 85°F).

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**INTAKE DOOR**

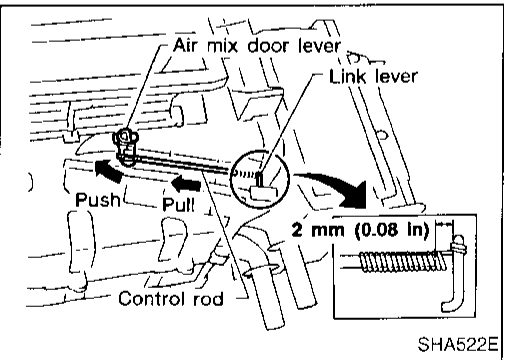
1. Install intake door motor onto intake unit and connect it to intake door motor harness.
2. Turn ignition switch to ACC.
3. Push REC switch OFF.
4. Set intake door switch in FRE.
5. Check that intake door operates properly when REC switch is turned ON and OFF.

AT

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**WATER COCK CONTROL ROD**

● **Reinstall the air mix door motor from side link before adjusting water cock control rod.**

1. Push air mix door lever in direction of arrow.
2. Pull control rod of water cock in direction of arrow so as to make clearance of about 2 mm (0.08 in) between ends of rod and link lever and connect the rod to door lever.

**After connecting control rod, check it operates properly.**

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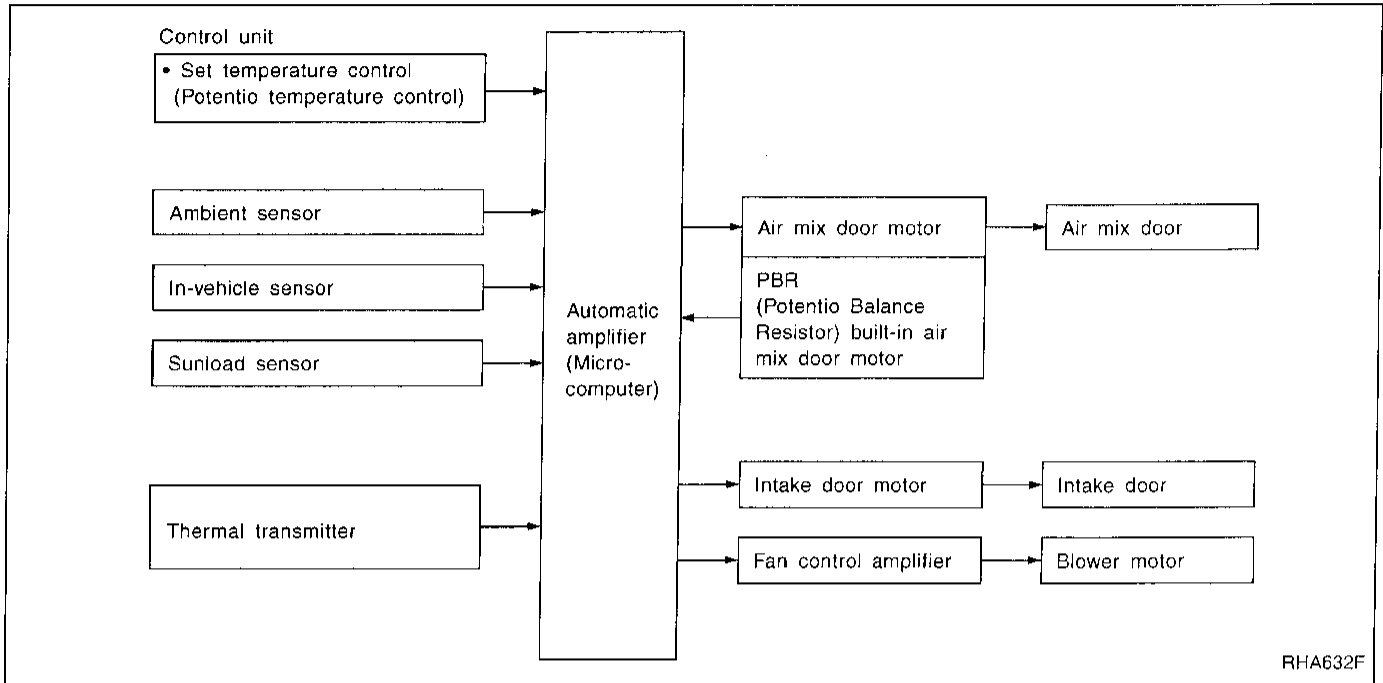
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### Overview of Control System

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.



### SWITCHES AND THEIR CONTROL FUNCTIONS

Knob/Switch	Knob/Switch position							Air outlet	Intake air	Compressor
	A/C									
A/C	○							—	—	ON*1
Mode			○					VENT	—	—
				○				B/L	—	—
					○			FOOT	—	—
						○		D/F	FRE	—
							○	DEF	FRE	ON*1
							○	—	REC*2	—

\*1: Compressor is operated by dual-pressure switch.  
 \*2: In DEF and D/F modes, REC switch is canceled.

### Control System Input Components

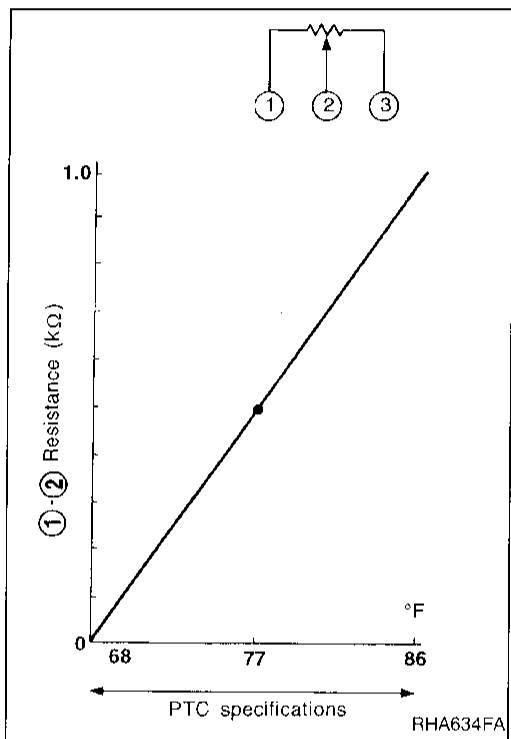
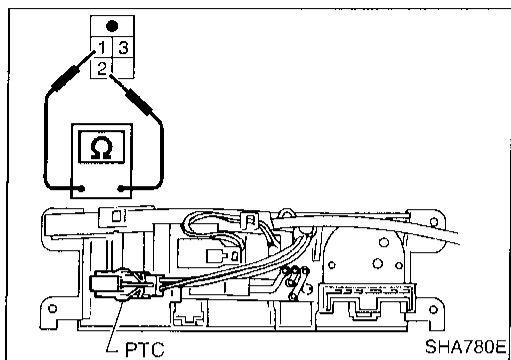
#### POTENTIO TEMPERATURE CONTROL (PTC)

The PTC is built into the control unit. It has a variable resistance which changes according to the set temperature. This resistance is connected to the temperature knob.

Control System Input Components (Cont'd)

PTC

After disconnecting PTC harness connector, measure resistance between terminals ① and ② at PTC harness side.



IN-VEHICLE SENSOR

The in-vehicle sensor is attached to the instrument lower cover. It converts variations in the temperature of the compartment air drawn in by the aspirator into a resistance value, which is then input into the auto amplifier.

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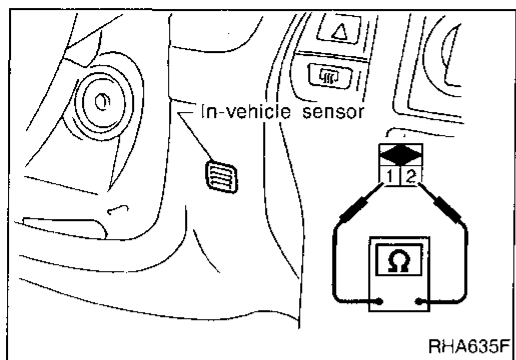
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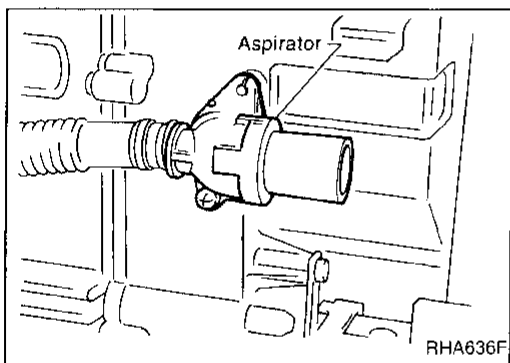
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**Control System Input Components (Cont'd)**

After disconnecting in-vehicle sensor harness connector, measure resistance between terminals ① and ② at sensor harness side, using the table below.

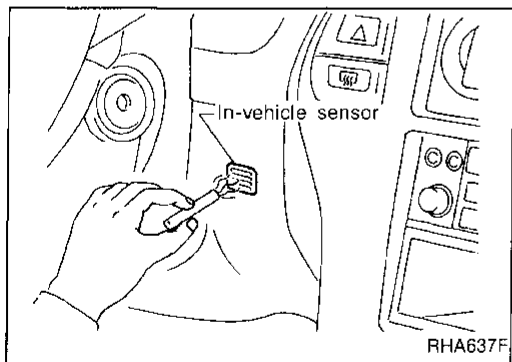


Temperature °C (°F)	Resistance kΩ
-15 (5)	12.73
-10 (14)	9.92
-5 (23)	7.80
0 (32)	6.19
5 (41)	4.95
10 (50)	3.99
15 (59)	3.24
20 (68)	2.65
25 (77)	2.19
30 (86)	1.81
35 (95)	1.51
40 (104)	1.27
45 (113)	1.07



**ASPIRATOR**

The aspirator is located in front of the heater unit. The aspirator continuously draws compartment air into the in-vehicle sensor while the ignition switch is ON.

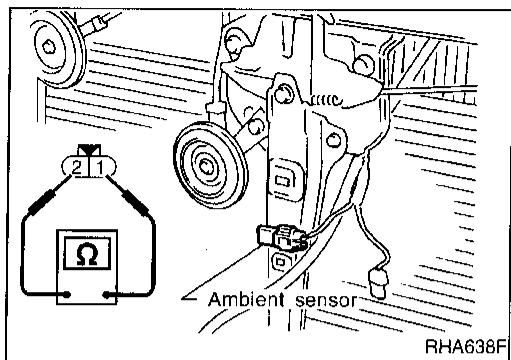


Check that smoke is properly sucked into in-vehicle sensor when a lighted cigarette is moved close to the sensor.

**AMBIENT SENSOR**

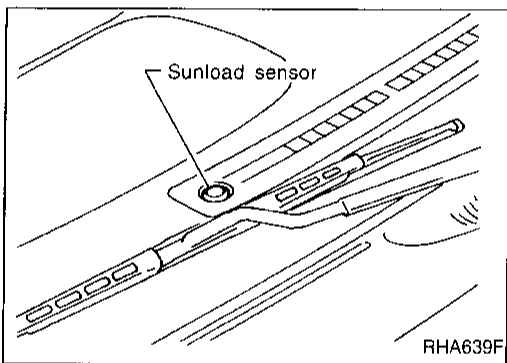
The ambient sensor is located on the hood lock stay. It detects the ambient temperature and converts it into a resistance value, which is then input into the auto amplifier.

**Control System Input Components (Cont'd)**



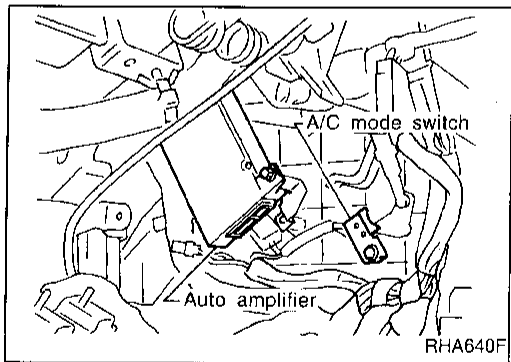
After disconnecting ambient sensor harness connector, measure resistance between terminals ① and ② at sensor harness side, using the table below.

Temperature °C (°F)	Resistance kΩ
-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



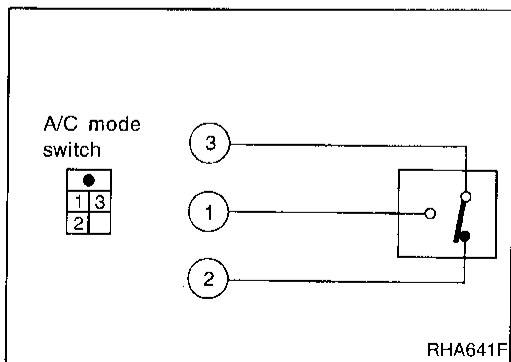
**SUNLOAD SENSOR**

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



**A/C MODE SWITCH**

The microswitch is installed around the side link of the heater unit and operates the link in response to the position of the mode switch. The operation of this microswitch is as shown below:



**A/C mode switch operation**

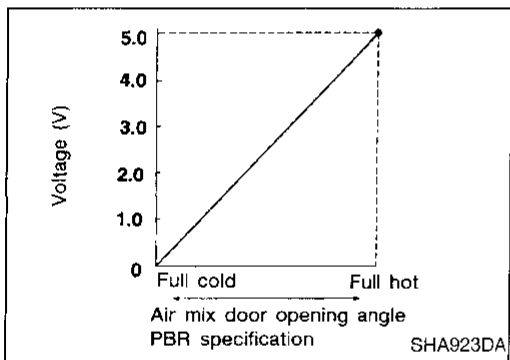
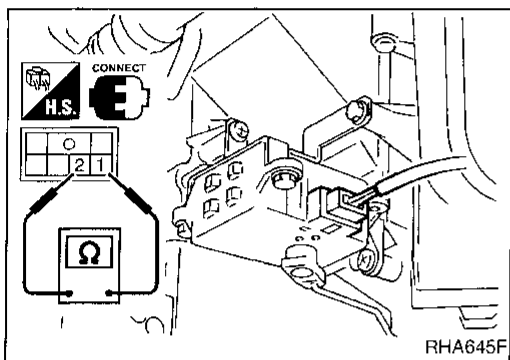
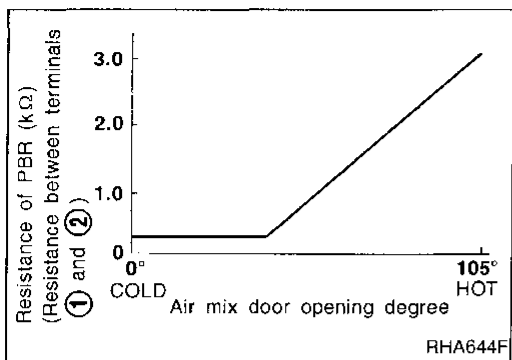
MODE	VENT	B/L	FOOT	DEF/FOOT	DEF
Terminal ③	○	○	○	○	○
Terminal ①	○	○	○	○	○
Terminal ②		○	○	○	

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**Control System Input Components (Cont'd)**

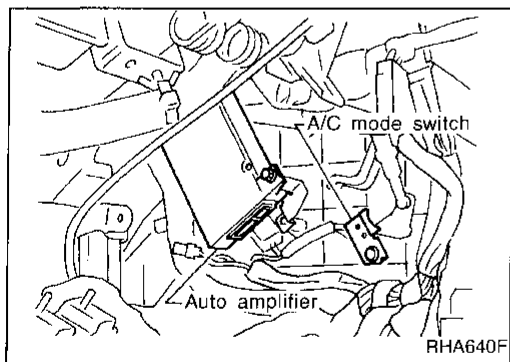
**PBR**

Measure resistance between terminals ① and ② at vehicle harness side.



**Ignition switch: ON**

- Ensure tester pointer deflects smoothly when PTC is moved from 20°C (65°F) to 30°C (85°F) and vice versa.



**Control System Auto Amplifier (Auto amp.)**

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

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

**AMBIENT TEMPERATURE INPUT PROCESS**

The auto amp. includes a "processing circuit" for the ambient sensor input. When the ambient temperature increases quickly, the processing circuit controls the input from the ambient sensor. It allows the auto amp. to recognize the increase of temperature only 0.2°C (0.4°F) per 100 seconds.

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

**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 ATC 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. As a result, the effect the above mentioned does not cause any change in the ATC 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**

**AIR MIX DOOR CONTROL (Automatic temperature control)**

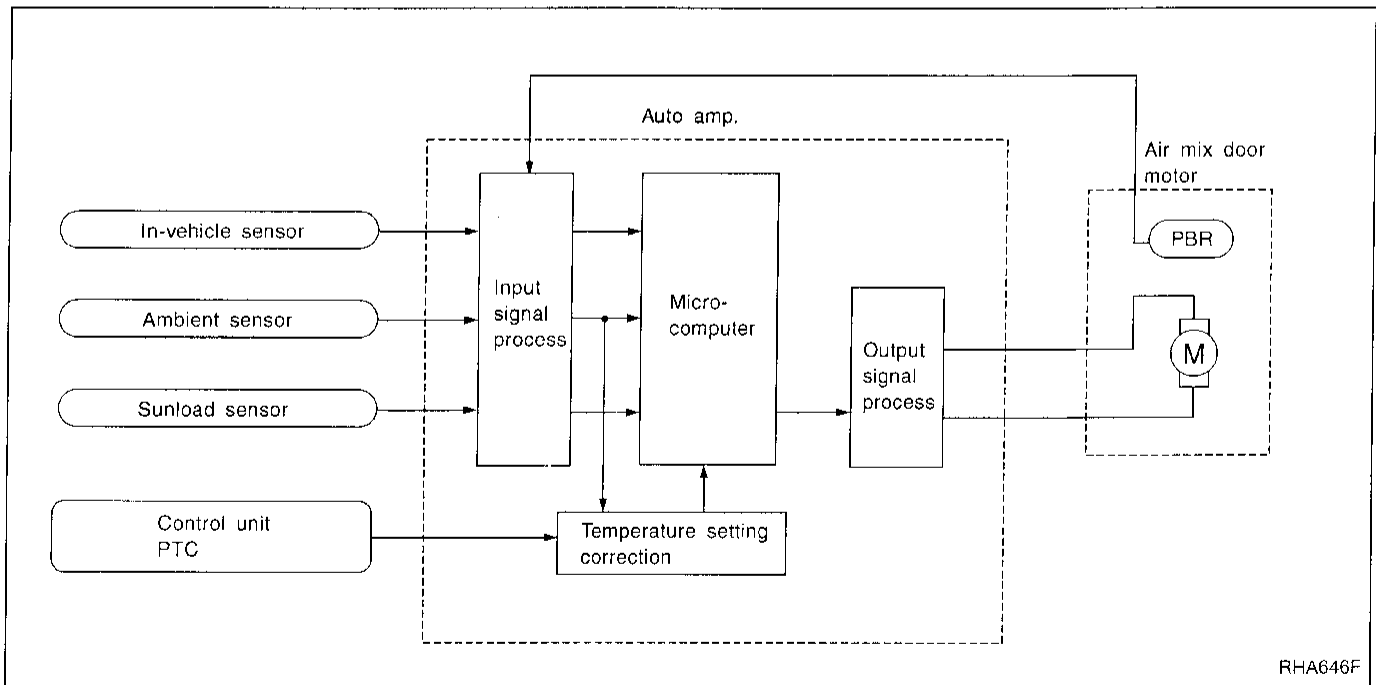
**Component parts**

Air mix door control system components are:

- 1) Auto amp.
- 2) Air mix door motor (PBR)
- 3) In-vehicle sensor
- 4) Ambient sensor
- 5) Sunload sensor

**System operation**

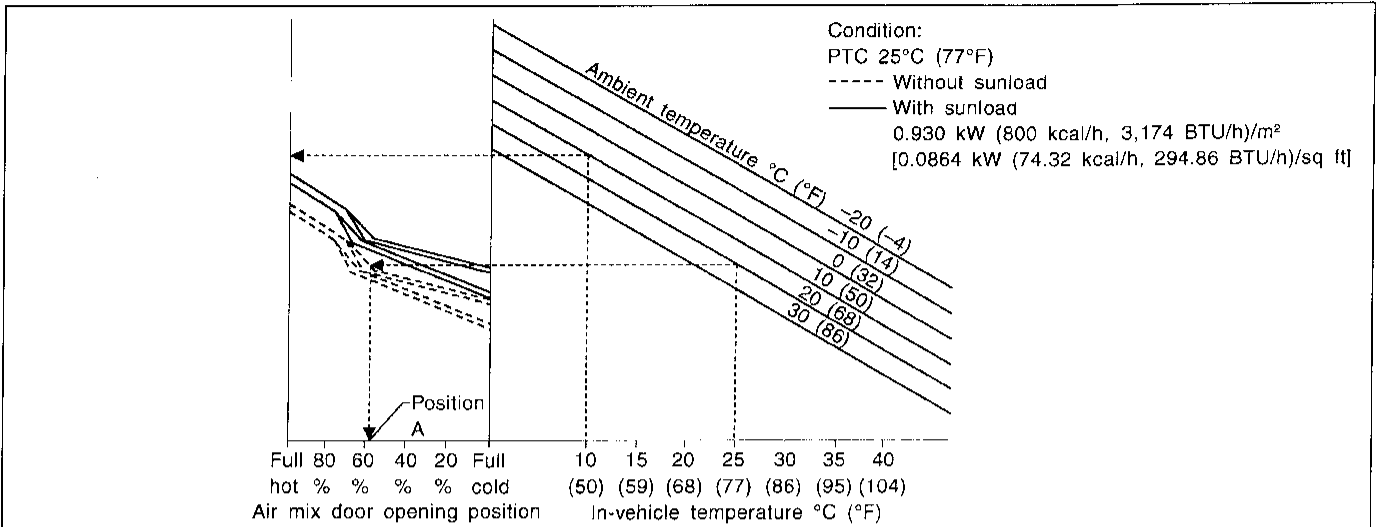
Temperature set by Potentio Temperature Control (PTC) is compensated through setting temperature correction circuit to determine target temperature. Auto amp. will operate air mix door motor to set air conditioning system in HOT or COLD position, depending upon relationship between conditions (target temperature, sunload, in-vehicle temperature and ambient temperature) and conditions (air mix door position and compressor operation).



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Control System Output Components (Cont'd)  
Air mix door control specification

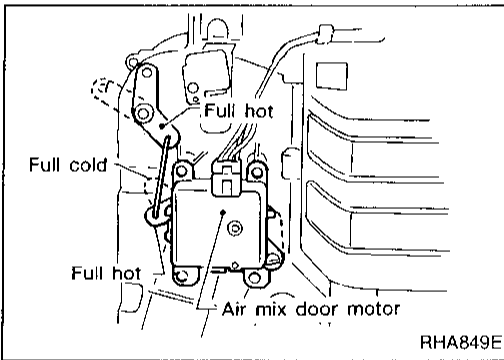


Example:

- If temperature setting is set at 25°C (77°F) under no sunload condition when ambient and in-vehicle temperature are 10°C (50°F), air mix door is initially automatically set in full hot position.
- Within some period, in-vehicle temperature will lower towards the objective temperature, and the air mix door position will shift gradually towards the cold side and finally stay in this position (A).

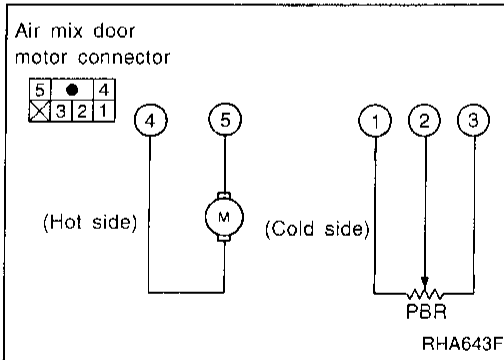
Air mix door opening position is always fed back to auto amp. by PBR built-in air mix door motor.

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AIR MIX DOOR MOTOR

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

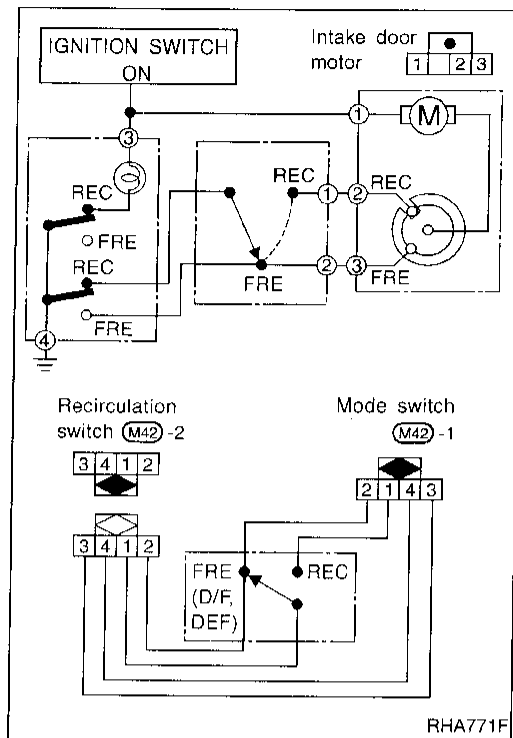


4	5	Air mix door operation	Direction of lever movement
⊕	⊖	COLD → HOT	Clockwise (Toward passenger compartment)
—	—	STOP	STOP
⊖	⊕	HOT → COLD	Counterclockwise (Toward engine compartment)

Control System Output Components (Cont'd)

INTAKE DOOR MOTOR

The intake door motor is installed on the intake unit. Using a link it opens and closes the intake door.  
 When RECIRCULATION switch is at REC (except DEF and D/F modes), the ground line of the motor is switched from intake door motor terminal ③ to ②. This starts the motor because the position switch contacts built into it make current flow. When RECIRCULATION switch is at FRE (except DEF and D/F modes), the ground line is switched from intake door motor terminal ② to ③. The contacts turn along with the motor. When they reach the non-current flow position, the motor will stop. The motor always turns in the same direction.  
 RECIRCULATION switch is canceled by MODE switch in DEF and D/F modes.



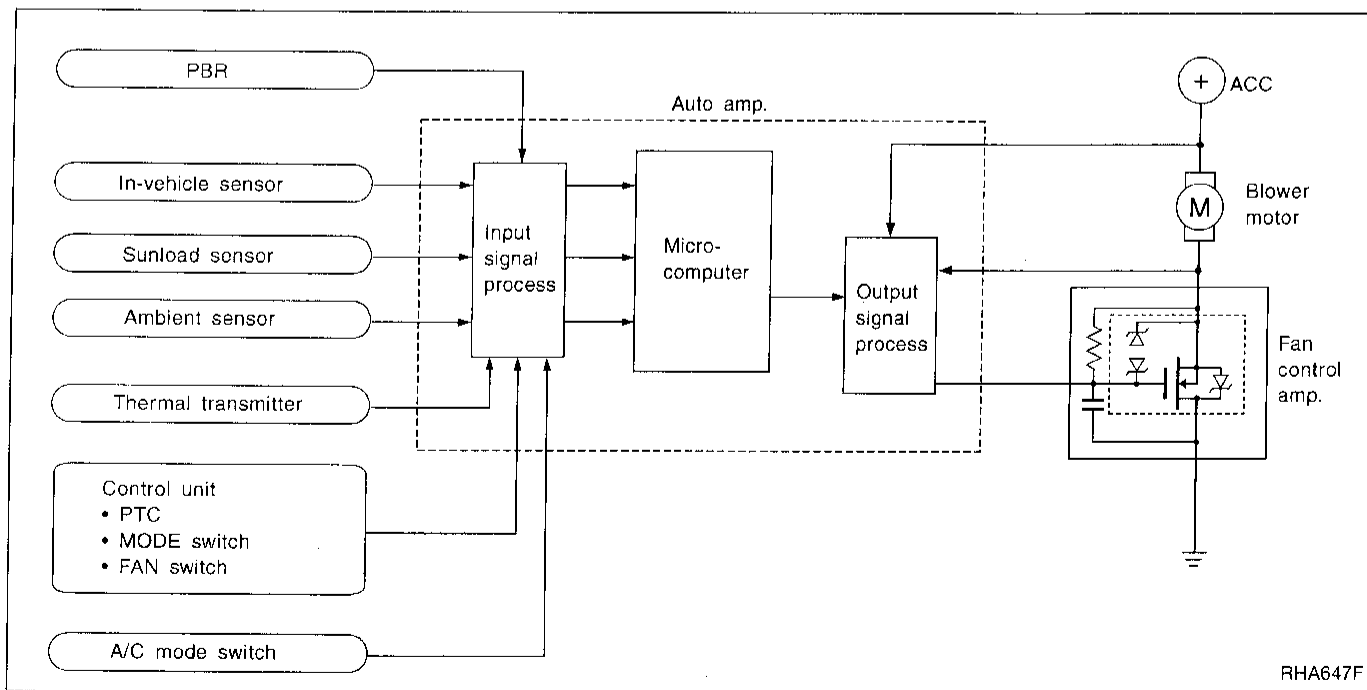
FAN SPEED CONTROL

Component parts

Fan speed control system components are:

- 1) Auto amp.
- 2) Fan control amplifier
- 3) PBR
- 4) In-vehicle sensor
- 5) Ambient sensor
- 6) Sunload sensor
- 7) Thermal transmitter
- 8) A/C mode switch

System operation



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 EL  
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Control System Output Components (Cont'd)

**AUTOMATIC MODE**

In the automatic mode, the blower motor speed is calculated by the auto amp. based on inputs from the PBR, in-vehicle sensor, sunload sensor, and ambient sensor. The blower motor applied voltage ranges from approximately 5.0 volts (lowest speed) to 12 volts (highest speed).

To control blower speed (in the range of 5V to 12V), the auto amp. 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.

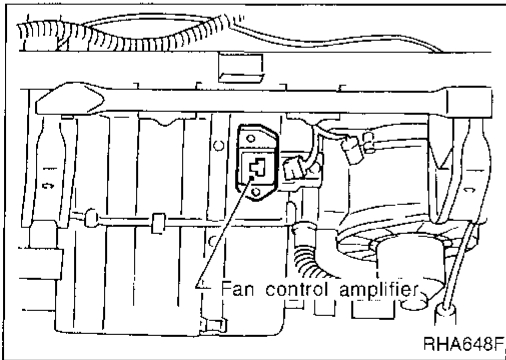
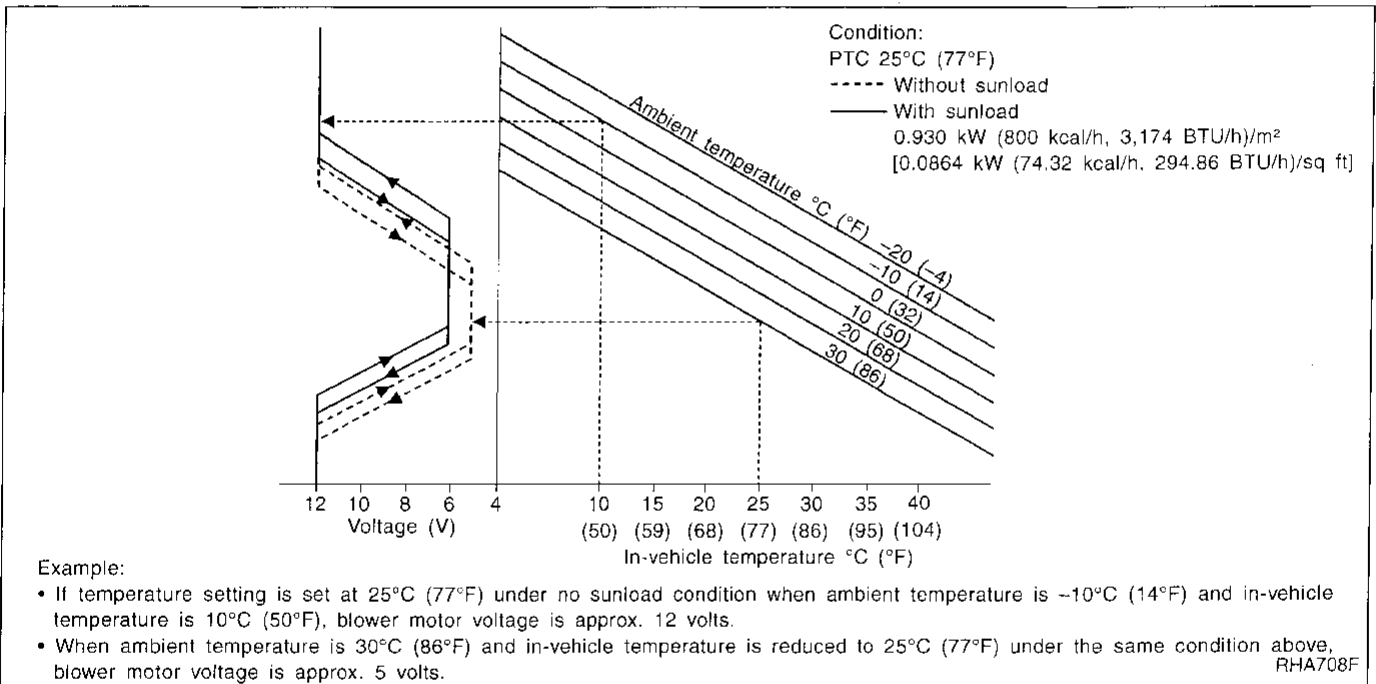
**STARTING FAN SPEED CONTROL**

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

In a cold start up condition where the engine coolant temperature is below 50°C (122°F) (except VENT and DEF modes), the blower will not operate for a short period of time (up to 126 seconds). 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 126 seconds. After this delay, the blower will operate at low speed until the engine coolant temperature rises above 55°C (131°F). Then the blower speed will increase to the objective speed.

**Fan speed control specification**



**FAN CONTROL AMPLIFIER**

The fan control amplifier is located on the cooling unit. It amplifies a 12-step base current flowing from the auto amp. to change the blower speed within the range of 5V to 12V.

**MAGNET CLUTCH CONTROL**

Under normal operating conditions, when the A/C 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.

Control System Output Components (Cont'd)

Acceleration cut control

The ECM (ECCS control module) will turn the compressor "ON" or "OFF" based on the signal from the throttle position sensor.

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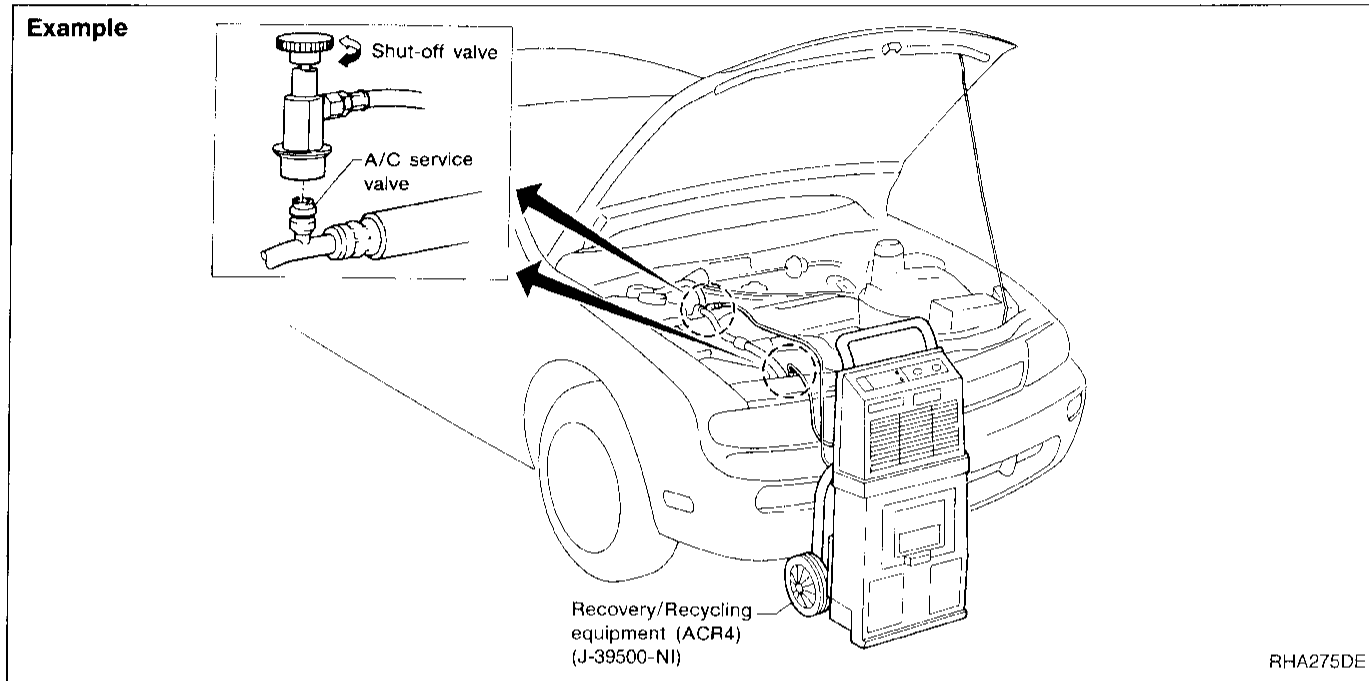
## HFC-134a (R-134a) Service Procedure

### SETTING OF SERVICE TOOLS AND EQUIPMENT

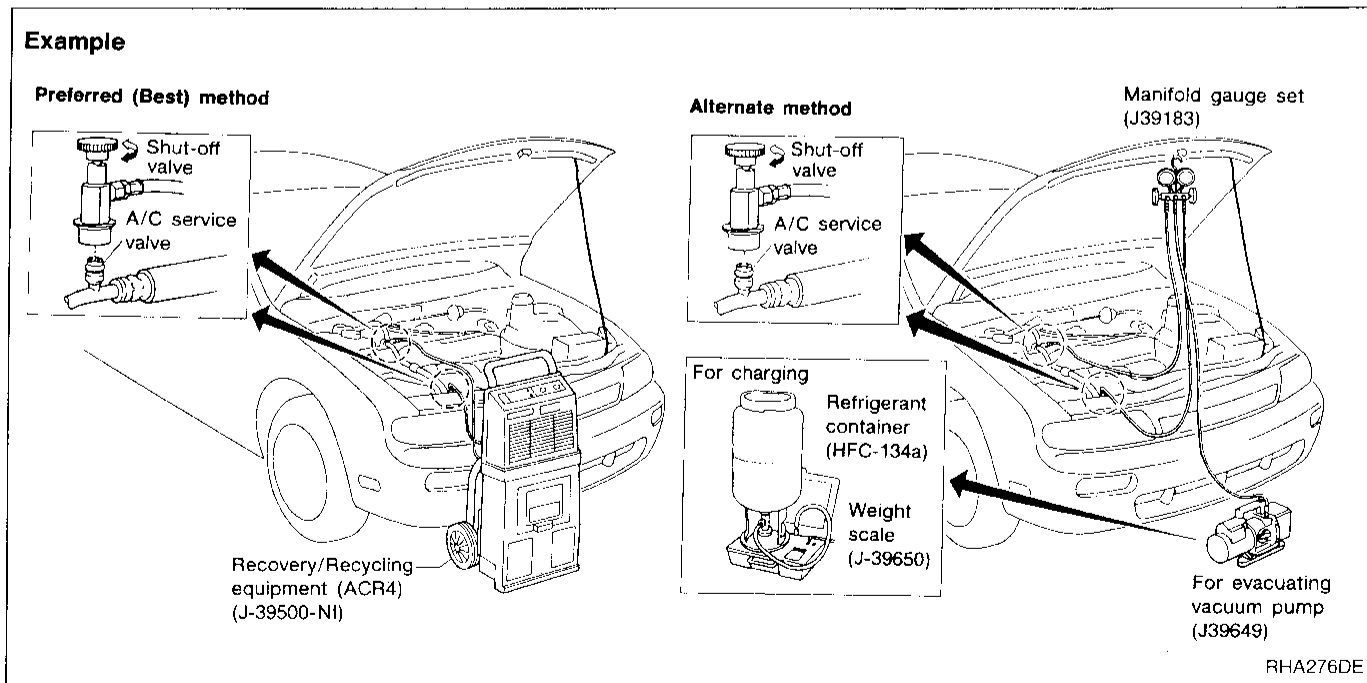
#### DISCHARGING REFRIGERANT

**WARNING:**

Avoid breathing A/C refrigerant and lubricant vapor or mist. Exposure may irritate eyes, nose and throat. Remove HFC-134a (R-134a) from A/C system using certified service equipment meeting requirements of SAE J2210 (R-134a recycling equipment) or J2209 (R-134a recovery equipment). If accidental system discharge occurs, ventilate work area before resuming service. Additional health and safety information may be obtained from refrigerant and lubricant manufacturers.

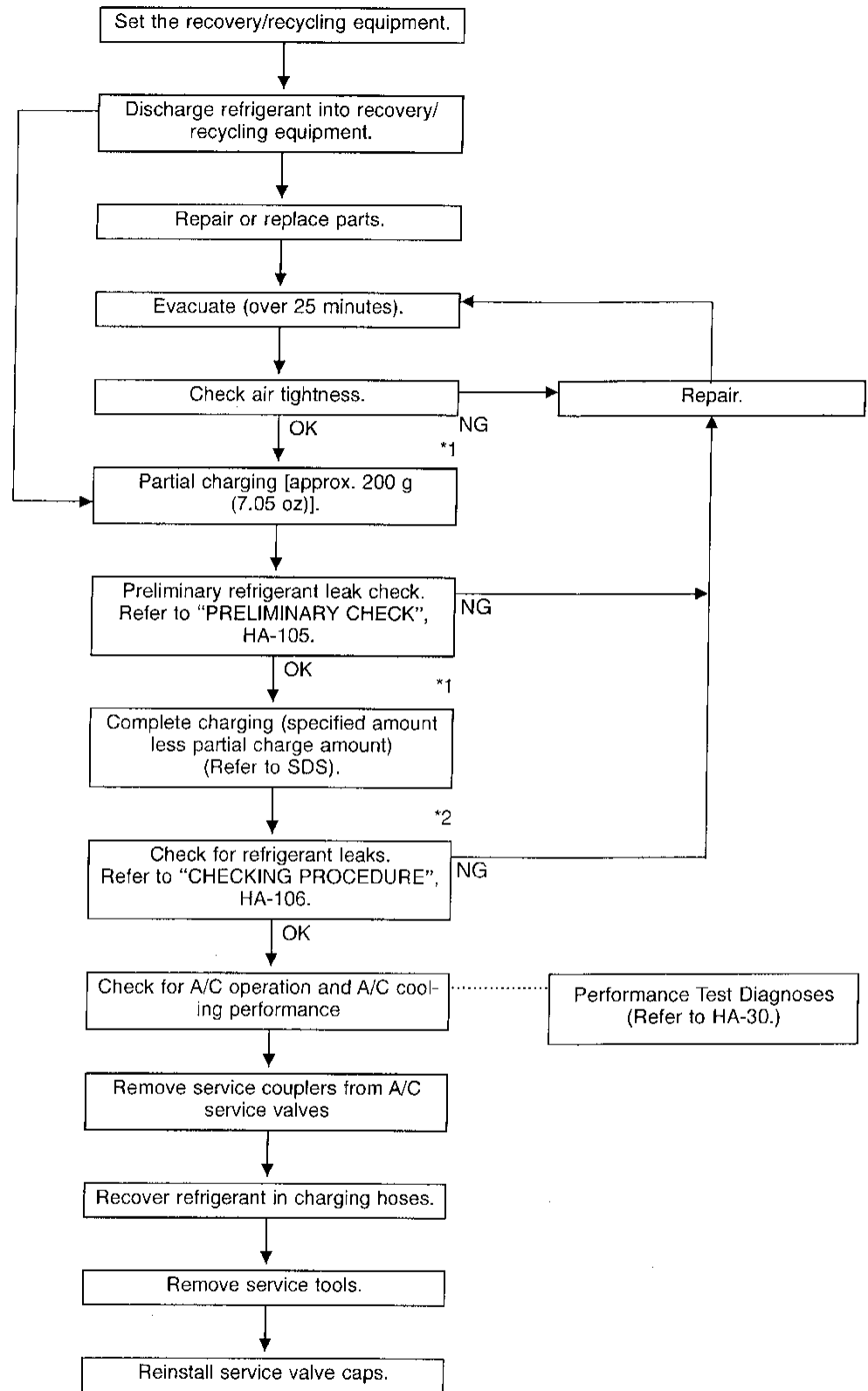


#### EVACUATING SYSTEM AND CHARGING REFRIGERANT



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

Recovered lubricant. Refer to CHECKING AND ADJUSTING (HA-102).



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

### Maintenance of Lubricant Quantity in Compressor

The lubricant in the compressor circulates through the system with the refrigerant. Add lubricant to compressor when replacing any component or after a large gas leakage occurred. It is important to maintain the specified amount.

If lubricant quantity is not maintained properly, the following malfunctions may result:

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

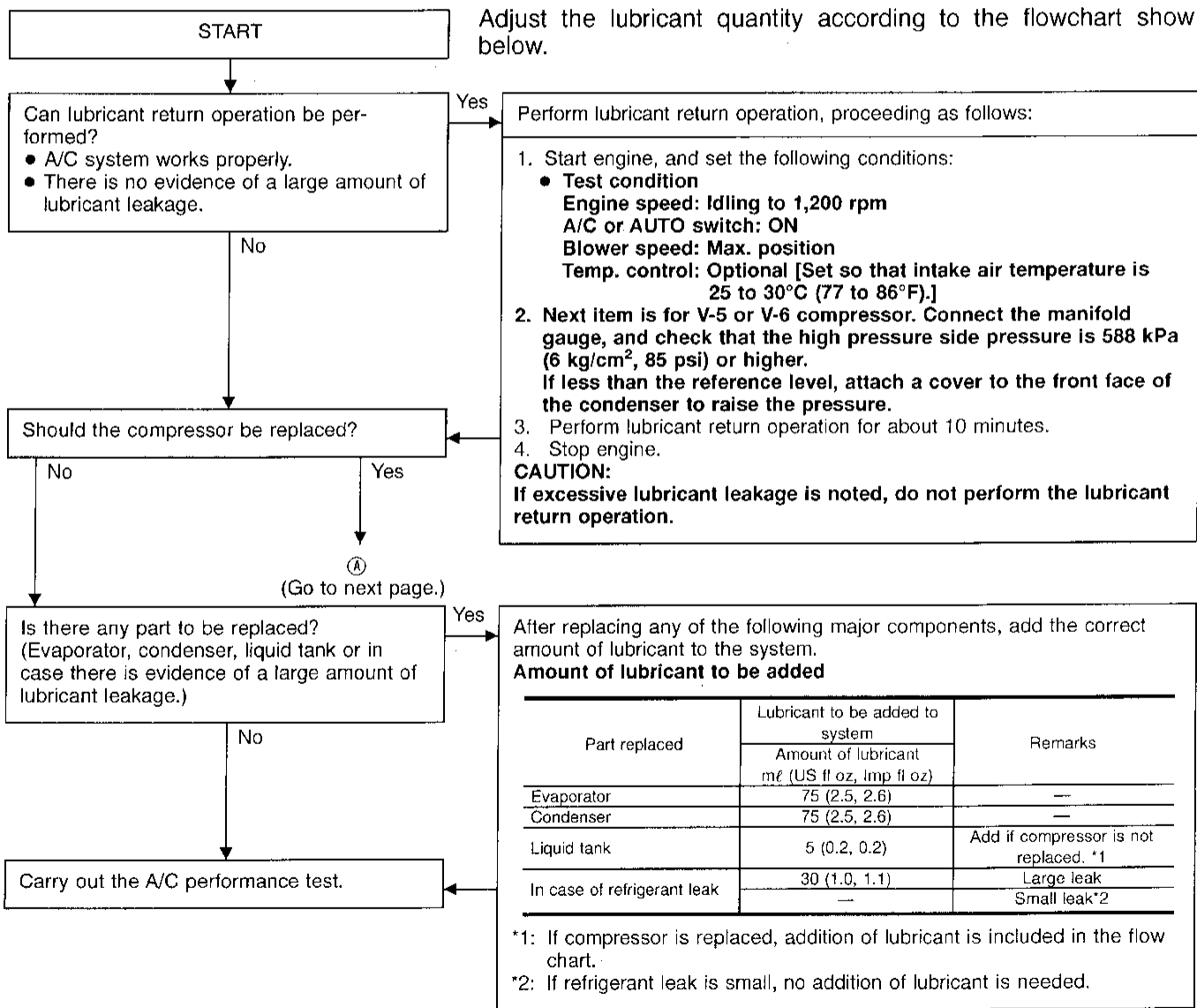
### LUBRICANT

Name: Nissan A/C System Oil Type S

Part number: KLH00-PAGS0

### CHECKING AND ADJUSTING

Adjust the lubricant quantity according to the flowchart shown below.



Maintenance of Lubricant Quantity in Compressor (Cont'd)



1. Discharge refrigerant into the refrigerant recovery/recycling equipment. Measure lubricant discharged into the recovery/recycling equipment.
2. Remove the drain plug of the "old" (removed) compressor (applicable only to V-5, V-6 or DKS-16H compressor). Drain the lubricant into a graduated container and record the amount of drained lubricant.
3. Remove the drain plug and drain the lubricant from the "new" compressor into a separate, clean container.
4. Measure an amount of new lubricant installed equal to amount drained from "old" compressor. Add this lubricant to "new" compressor through the suction port opening.
5. Measure an amount of new lubricant equal to the amount recovered during discharging. Add this lubricant to "new" compressor through the suction port opening.
6. Torque the drain plug.

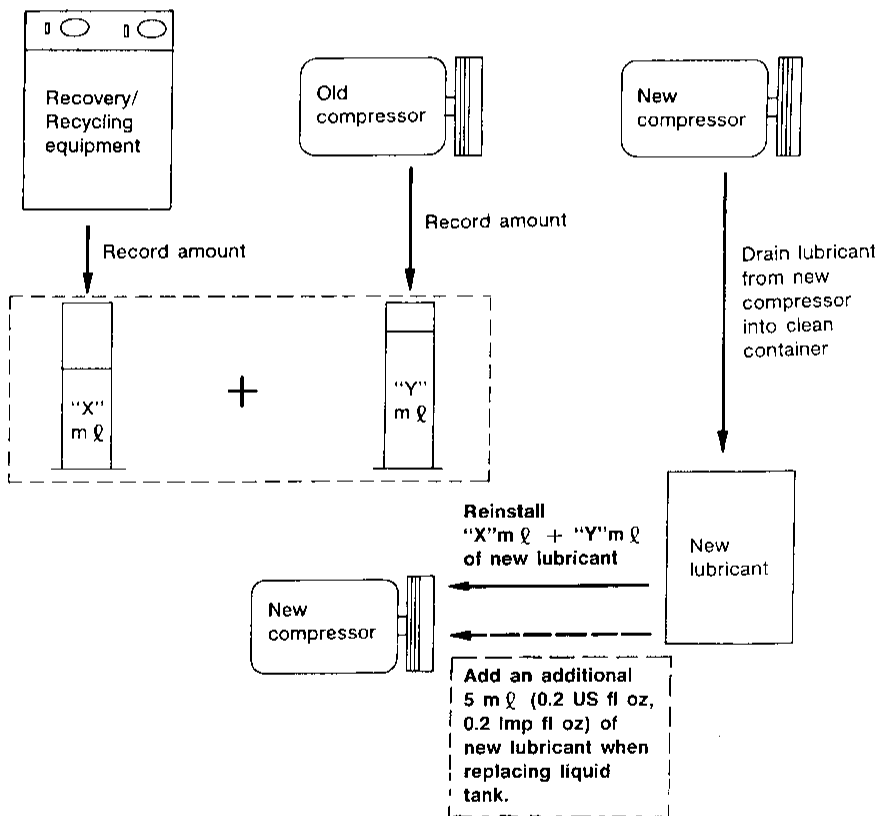
**V-5 or V-6 compressor: 18 - 19 N·m (1.8 - 1.9 kg·m, 13 - 14 ft·lb)**

**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 lubricant at this time.

**Do not add this 5 mℓ (0.2 US fl oz, 0.2 Imp fl oz) of lubricant if only replacing the compressor.**

**Lubricant adjusting procedure for compressor replacement**



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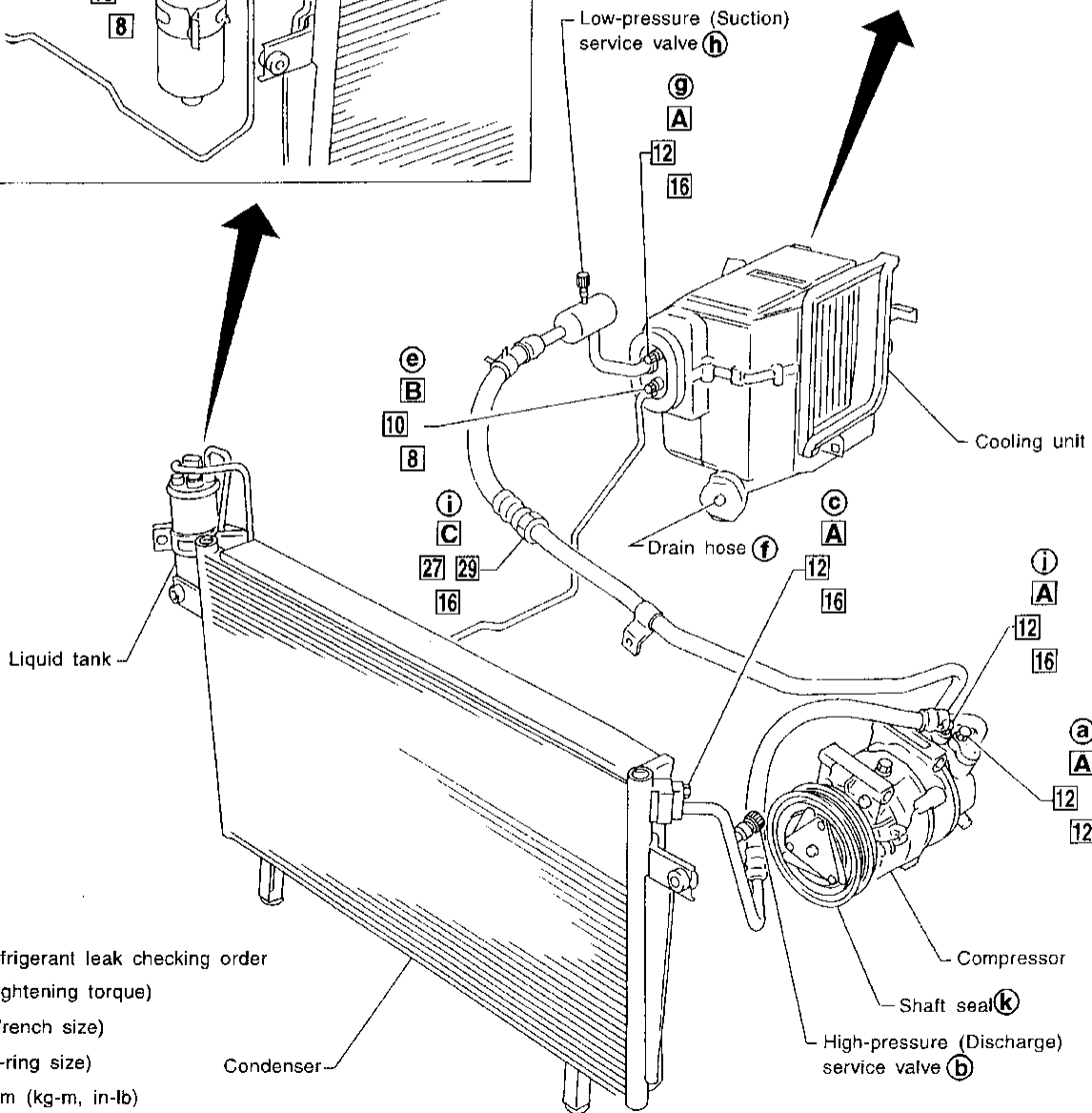
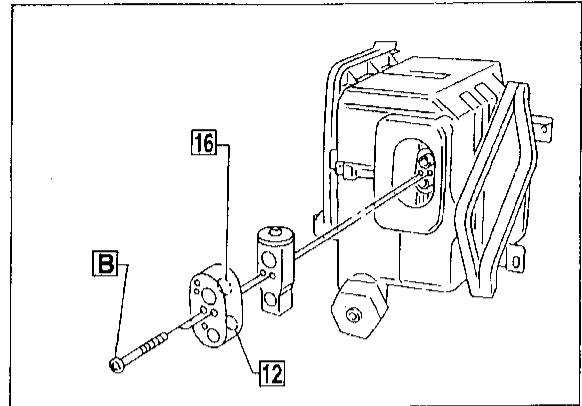
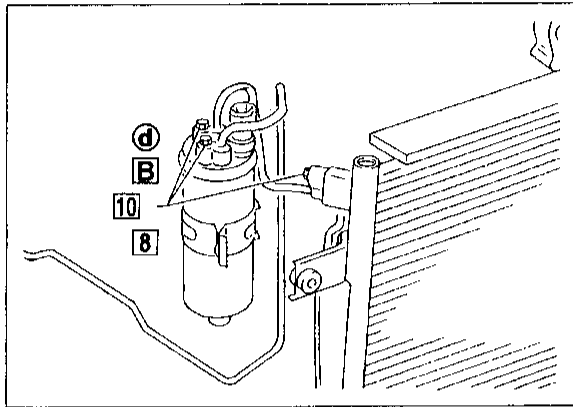
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Refrigerant Lines

- Refer to page HA-3 regarding "Precautions for Refrigerant Connection".

SEC. 271•274•276



- : Refrigerant leak checking order
- : (Tightening torque)
- □ : (Wrench size)
- : (O-ring size)
- Ⓜ : N·m (kg-m, in-lb)
- Ⓜ A : 8 - 20 (0.8 - 2.0, 69 - 174)
- Ⓜ B : 3 - 5 (0.3 - 0.5, 26 - 43)
- Ⓜ C : 20 - 29 (2 - 3, 14 - 22)

### Checking Refrigerant Leaks

#### PRELIMINARY CHECK

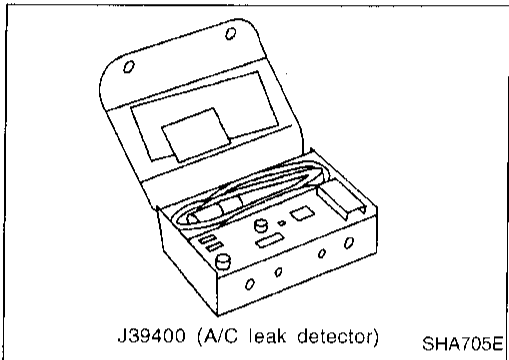
Perform a visual inspection of all refrigeration parts, fittings, hoses, and components for signs of A/C lubricant leakage, damage and corrosion.

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J39400 (A/C leak detector) SHA705E

#### PRECAUTIONS FOR HANDLING LEAK DETECTOR

When performing a refrigerant leak check, use a J39400 A/C leak detector or equivalent. Ensure that the instrument is calibrated and set properly per the operating instructions.

EC

The leak detector is a delicate device. In order to use the leak detector properly, read the operating instructions and perform any specified maintenance.

EE

**Other gases in the work area or substances on the A/C components, for example, anti-freeze, windshield washer fluid, solvents and cleaners, may falsely trigger the leak detector. Make sure the surfaces to be checked are clean. Do not allow the sensor tip of the detector to come into contact with any substance. This can also cause false readings and may damage the detector.**

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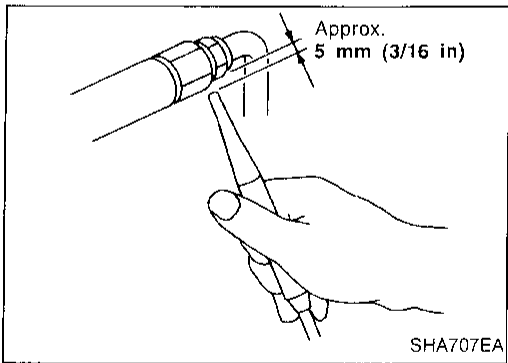
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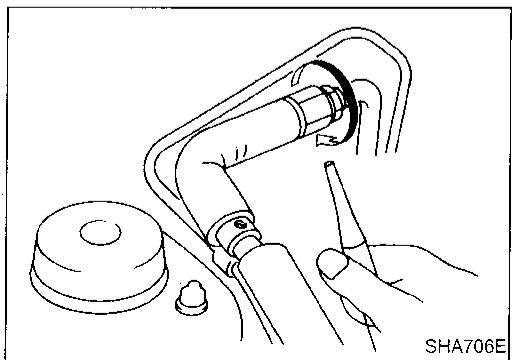
1. Position probe approximately 5 mm (3/16 in) away from point to be checked.

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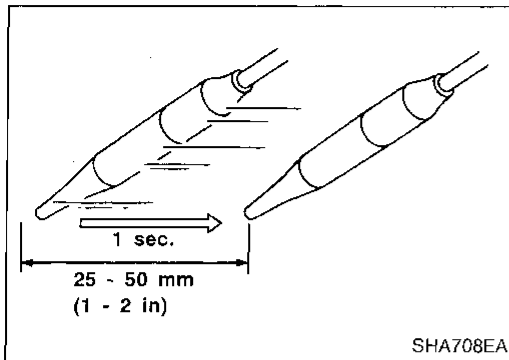
2. When testing, circle each fitting completely with probe.

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**Checking Refrigerant Leaks (Cont'd)**

3. Move probe along component approximately 25 to 50 mm (1 to 2 in)/sec.

**CHECKING PROCEDURE**

To prevent inaccurate or false readings, make sure there is no refrigerant vapor or tobacco smoke in the vicinity of the vehicle. Perform the leak test in calm area (low air/wind movement) so that the leaking refrigerant is not dispersed.

1. Turn engine off.
2. Connect a suitable A/C manifold gauge set to the A/C service ports.
3. Check if the A/C refrigerant pressure is at least 345 kPa (3.52 kg/cm<sup>2</sup>, 50 psi) above 16°C (61°F). If less than specification, evacuate and recharge the system with the specified amount of refrigerant.

NOTE: At temperatures below 16°C (61°F), leaks may not be detected since the system may not reach 345 kPa (3.52 kg/cm<sup>2</sup>, 50 psi).

4. Conduct the leak test from the high side to the low side at points Ⓐ through Ⓚ. Refer to HA-104. Perform a leak check for the following areas carefully. Clean the component to be checked and move the leak detector probe completely around the connection/component.

- **Compressor**

Check the fitting of high and low pressure hoses, relief valve and shaft seal.

- **Liquid tank**

Check the pressure switch, tube fitting, weld seams and the fusible plug mounts.

- **Service valves**

Check all around the service valves. Ensure service valve caps are secured on the service valves (to prevent leaks).

NOTE: After removing A/C manifold gauge set from service valves, wipe any residue from valves to prevent any false readings by leak detector.

- **Cooling unit (Evaporator)**

Turn blower fan on "High" for at least 15 seconds to dissipate any refrigerant trace in the cooling unit. Insert the leak detector probe into the drain hose immediately after stopping the engine. (Keep the probe inserted for at least ten seconds.)

5. If a leak detector detects a leak, verify at least once by blowing compressed air into area of suspected leak, then repeat check.
6. Do not stop when one leak is found. Continue to check for additional leaks at all system components.
7. Start engine.
8. Set the heater A/C control as follows:
  - a. A/C switch ON
  - b. Face mode
  - c. Recirculation switch ON

Checking Refrigerant Leaks (Cont'd)

- d. Max cold temperature
- e. Fan speed high
- 9. Run engine at 1,500 rpm for at least 2 minutes.
- 10. Turn engine off and perform leak check again following steps 4 through 6 above.

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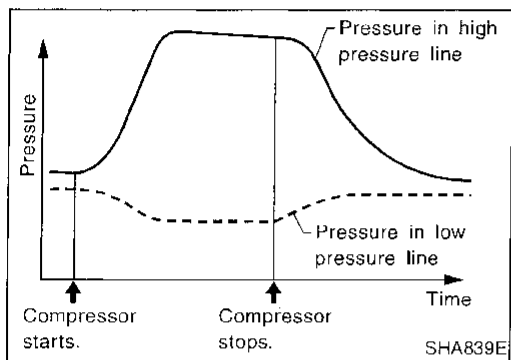
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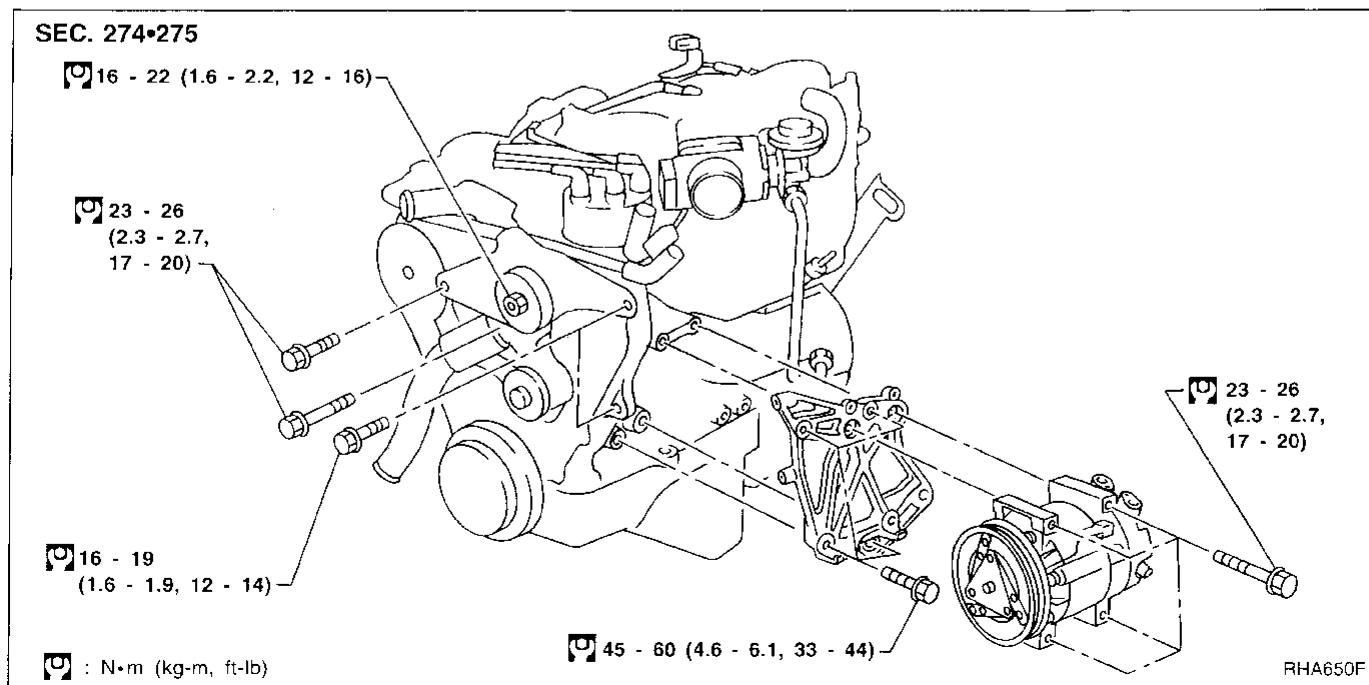
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Refrigerant leaks should be checked immediately after stopping the engine. Begin with the leak detector on the high pressure line. The pressure in the high pressure line will gradually drop after refrigerant circulation stops and pressure in the low pressure line will gradually rise, as shown in the graph. Leaks are more easily detected when pressure is high.

- 11. Discharge A/C system using approved refrigerant recovery equipment. Repair the leaking fitting or component as necessary.
- 12. Evacuate and recharge A/C system and perform the leak test to confirm no refrigerant leaks.
- 13. Conduct A/C performance test to ensure system works properly.

Compressor Mounting



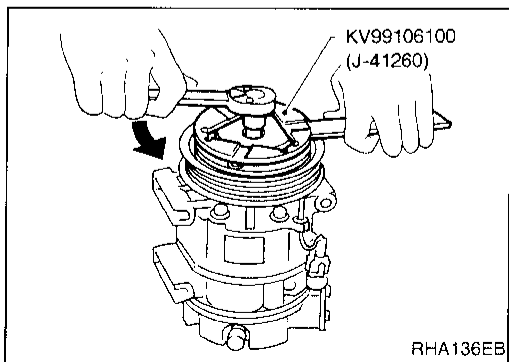
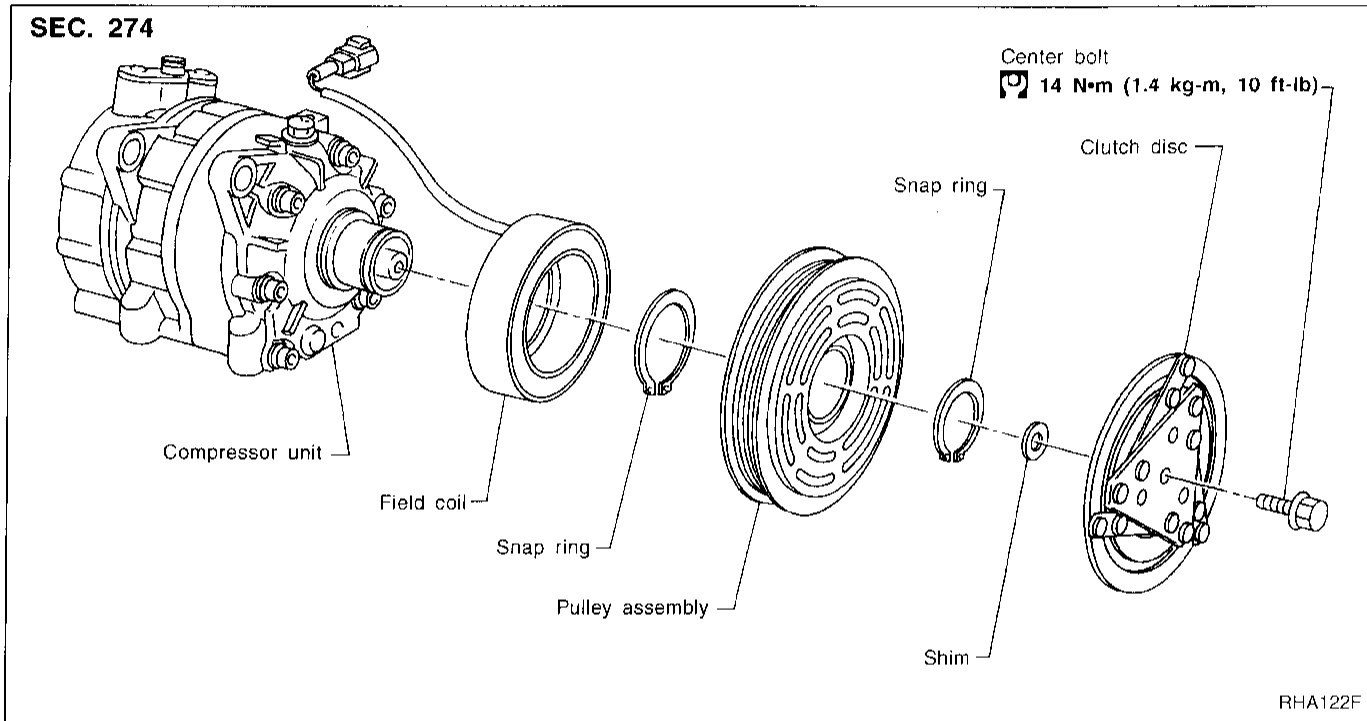
**Belt Tension**

- Refer to MA section.

**Fast Idle Control Device (FICD)**

- Refer to EC section.

**Compressor**

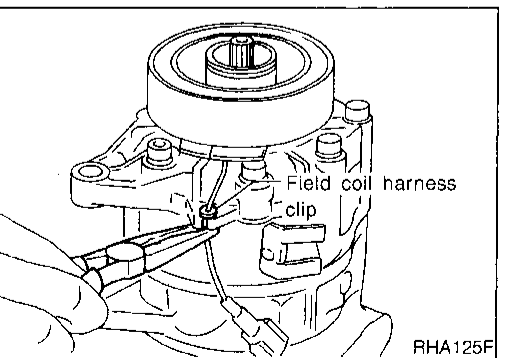
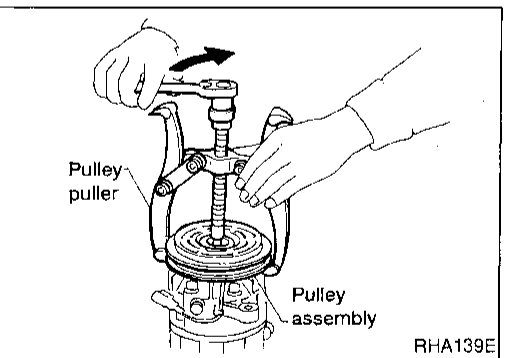
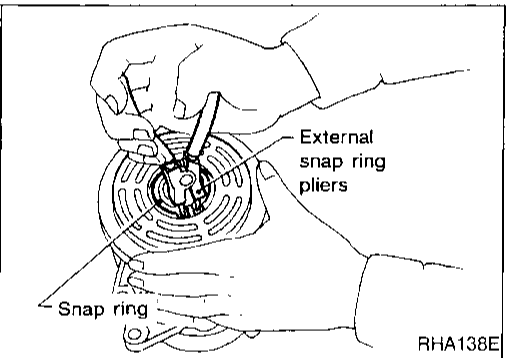
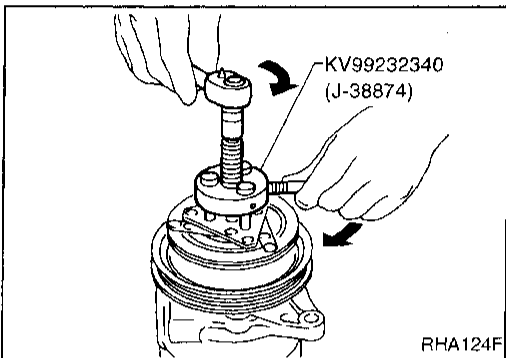
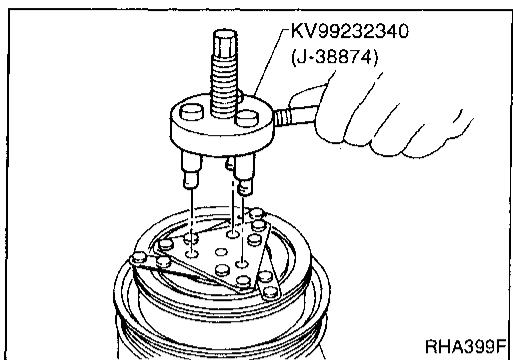


**Compressor Clutch**

**REMOVAL**

- When removing center bolt, hold clutch disc with clutch disc wrench.

Compressor Clutch (Cont'd)



- Remove the clutch disc using the clutch disc puller. Insert the holder's three pins into the holes in the clutch disc. Rotate the holder clockwise to hook it onto the plate. Then, tighten the center bolt to remove the clutch disc. After removing the clutch disc, remove the shims from either the drive shaft or the clutch disc.

- Remove the snap ring using external snap ring pliers.

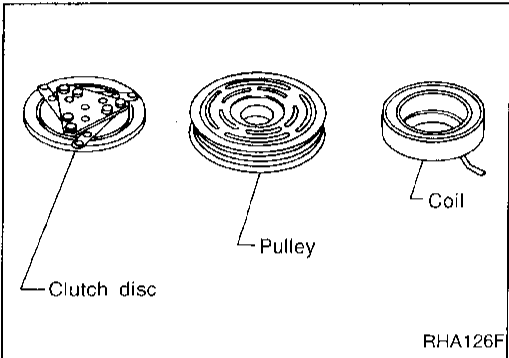
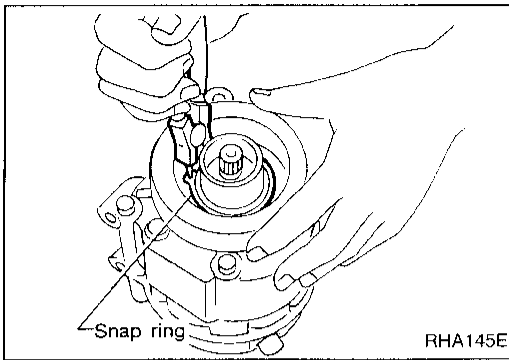
- Pulley removal  
Position the center pulley puller on the end of the drive shaft, and remove the pulley assembly using any commercially available pulley puller. **To prevent the pulley groove from being deformed, the puller claws should be positioned onto the edge of the pulley assembly.**

- Remove the field coil harness clip using a pair of pliers.

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**Compressor Clutch (Cont'd)**

- Remove the snap ring using external snap ring pliers.



**INSPECTION**

**Clutch disc**

If the contact surface shows signs of damage due to excessive heat, replace clutch disc and pulley.

**Pulley**

Check the appearance of the pulley assembly. If the contact surface of pulley shows signs of excessive grooving, replace clutch disc and pulley. The contact surfaces of the pulley assembly should be cleaned with a suitable solvent before reinstallation.

**Coil**

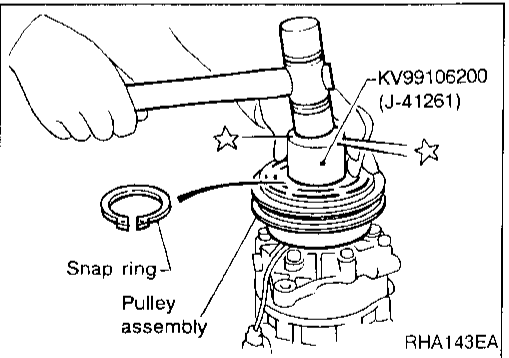
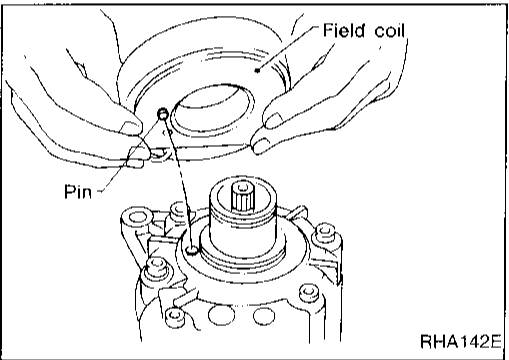
Check coil for loose connection or cracked insulation.

**INSTALLATION**

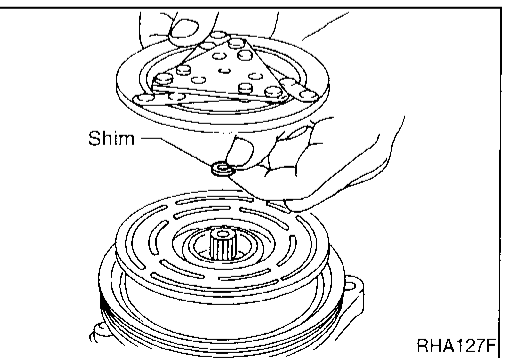
- Install the field coil.

**Be sure to align the coil's pin with the hole in the compressor's front head.**

- Install the field coil harness clip using a screwdriver.

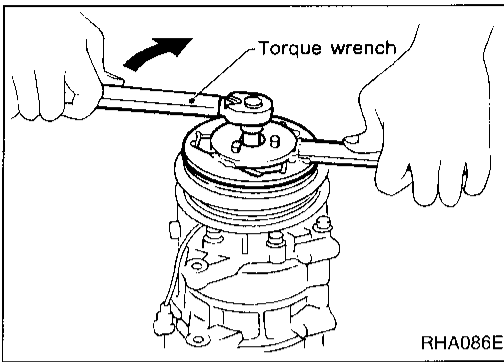


- Install the pulley assembly using the installer and a hand press, and then install the snap ring using snap ring pliers.



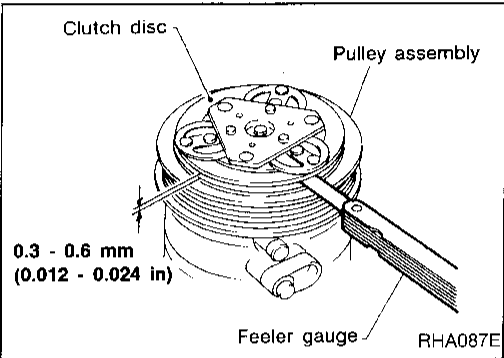
- Install the clutch disc on the drive shaft, together with the original shim(s). Press the clutch disc down by hand.

**Compressor Clutch (Cont'd)**



- Using the holder to prevent clutch disc rotation, tighten the bolt to 14 N·m (1.4 kg-m, 10 ft-lb) torque.

After tightening the bolt, check that the pulley rotates smoothly.



- Check clearance around the entire periphery of clutch disc.

**Disc-to-pulley clearance:**

**0.3 - 0.6 mm (0.012 - 0.024 in)**

If the specified clearance is not obtained, replace adjusting spacer and readjust.

**BREAK-IN OPERATION**

When replacing compressor clutch assembly, always carry out the break-in operation. This is done by engaging and disengaging the clutch about thirty times. Break-in operation raises the level of transmitted torque.

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**General Specifications**

**COMPRESSOR**

Model	CALSONIC make V-6	
Type	V-6 variable displacement	
Displacement	cm <sup>3</sup> (cu in)/rev.	
Max.		184 (11.228)
Min.		14.5 (0.885)
Cylinder bore x stroke	mm (in)	37 (1.46) x [2.3 - 28.6 (0.091 - 1.126)]
Direction of rotation	Clockwise (viewed from drive end)	
Drive belt	Poly V	

**LUBRICANT**

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)	0.60 - 0.70 (1.32 - 1.54)

**Inspection and Adjustment**

**ENGINE IDLING SPEED (When A/C is ON)**

- Refer to EC section.

**BELT TENSION**

- Refer to Checking Drive Belts (MA section).