

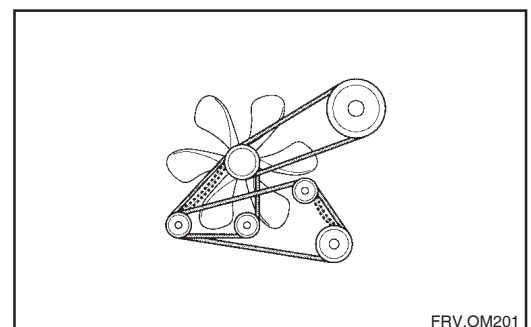
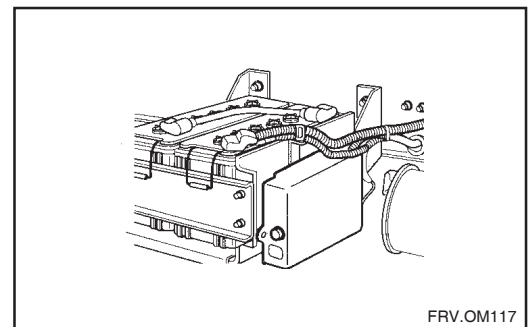
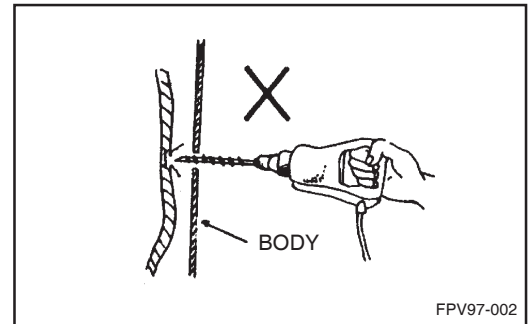
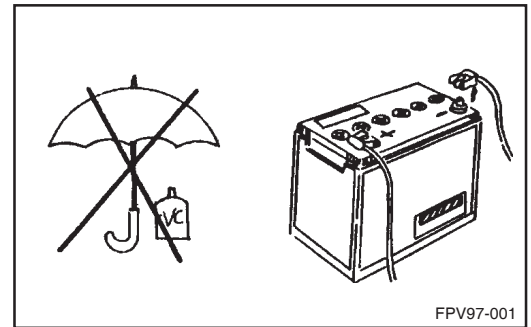
HEATER AND AIR CONDITIONER

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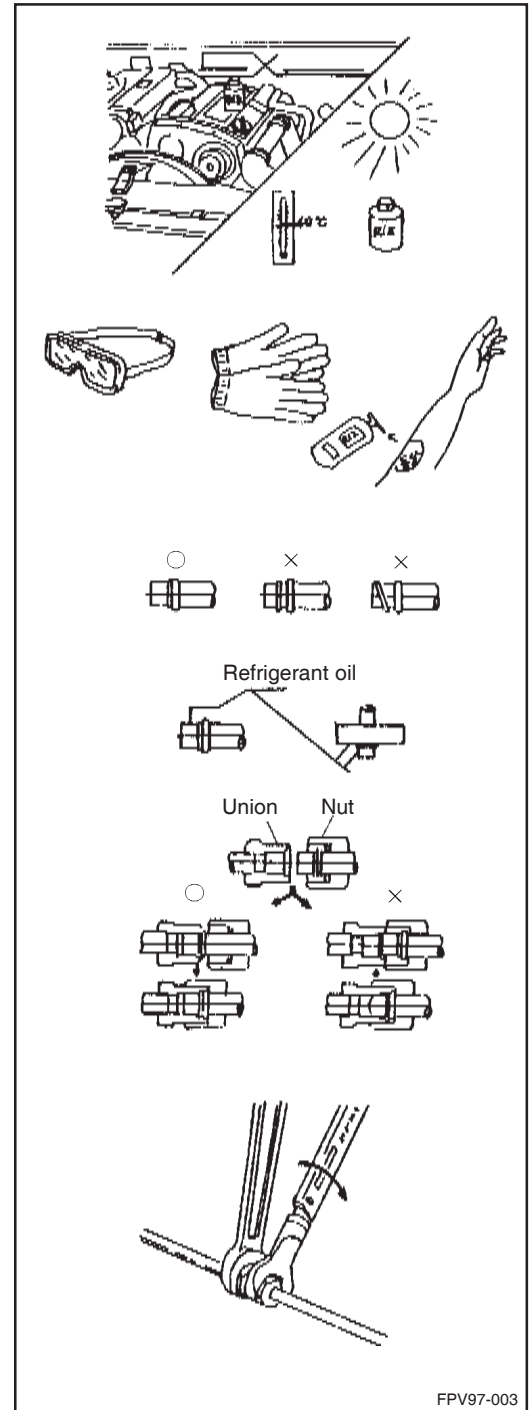
**GENERAL
CAUTIONS IN HANDLING AIR-CONDITIONER AND
HEATER.**

- Handle these items indoors where ventilates well and are no combustibile substances.
- Since moisture does harm to air-conditioner, refrain from working in a rainy day.
- While working on these items, do not touch the parts of brake system, fuel system, and power steering system.
- Put the protection cover on the body so that the body is not scratched or damaged.
- When you have to work underneath the vehicle, be sure to put the safety support.
- Be sure to remove the earth (-) wire before the work to prevent electric damage.
- Put the key switch at "off" position or key off while working on the vehicle.
- Put the gearshift in neutral position, and apply the parking brake.
- When engine is on, do not work close to rotating part like fan, belts etc.
- While working, do not touch the heated parts like radiator, exhaust manifold, exhaust pipe, muffler and catalytic converter.
- Smoking is prohibited while working.



PRECAUTIONS IN HANDLING REFRIGERANT.

- Refrigerant, having low freezing point, is highly volatile. A drop on the skin of your hand may result in localized frostbite. Therefore, be sure to wear protection goggles and gloves when handling refrigerant.
- Since refrigerant is stored in high-pressure vessel, keep it away from the engine or light.
- Do not remove refrigerant pipe before draining the refrigerant fully.
- Air-con parts are sealed with protection cap to prevent the inflow of dirt, dust and moisture. Be sure to remove this cap just before the work and close it immediately after the work.
- Especially 'O' ring parts of hose and pipe should be free from dirt and deformation. Check these parts before assembly and replace it in case of defective.
- Never reuse the "O" ring and apply refrigerant oil on to "O" ring before assembly.
- As for the bolting, assemble them with bare hands first and tighten it with 2 spanners.
- When replacing evaporator, compressor, or refrigerant pipes, make sure to replace receiver drier too.
- When tightening connector, bolts and nuts, tighten them with the tightening torques shown in the table below.



TIGHTENING TORQUE

Unit : kg/cm²G

Diameter	Pitch	Bolt, Nut		Flange bolt/ Nut	
		4T	7T	4T	7T
M6	1.0	0.4~0.6	0.7~1.1	0.5~0.7	0.8~1.2
M8	1.25	0.9~1.4	1.7~2.6	1.0~1.5	1.8~2.8
M10	1.25	1.9~2.8	3.5~5.5	2.1~3.1	3.9~6.0

TIGHTENING TORQUE

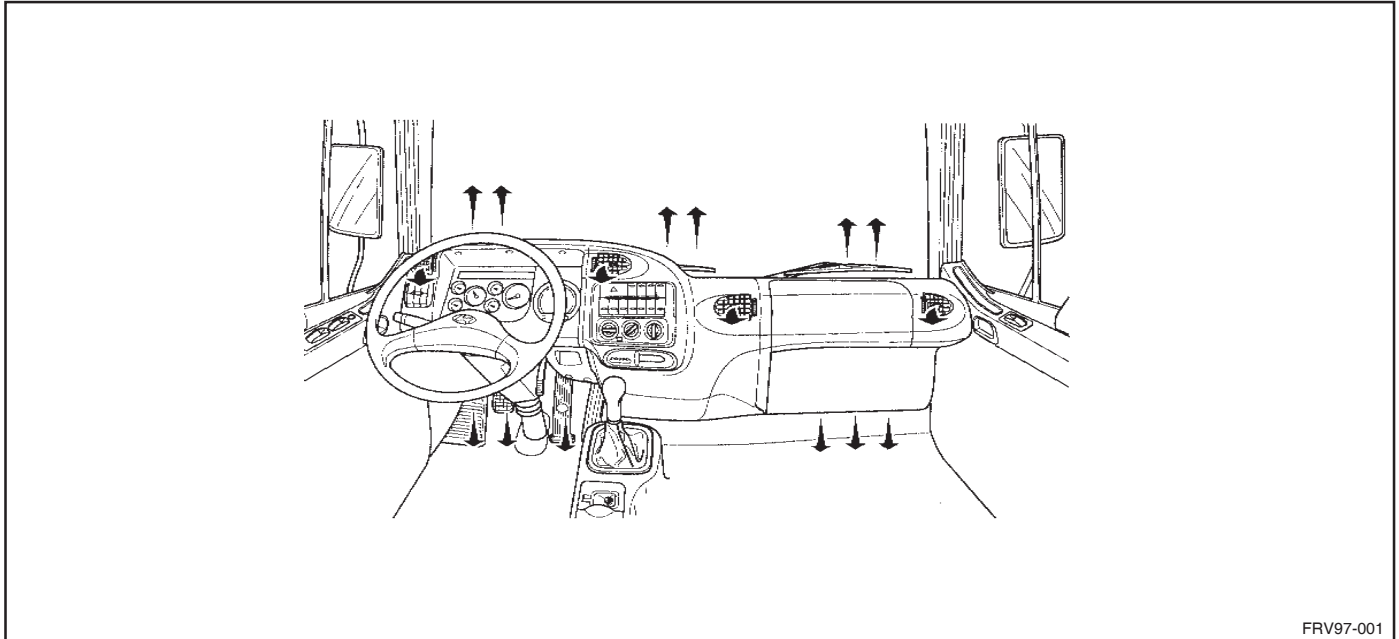
Unit : kg/cm²G

Type	Items	Diameter	5/16(0)	3/8	1/2(12)	5/8(16)	3/4(19)
Swival nut	Torque		1.2~1.5		2.0~2.5	3.0~3.5	3.5~4.0
Joint	Body side	Torque	0.4~0.6		1.0~1.5		
Flange	Engine side	Torque			2.0~3.0		
		Bolt	M6		M8		

HEATER AND VENTILATION SYSTEM

OPERATION OVERVIEW

Ventilation outlets are defroster, heating floor and cooling vents on the whole as shown in the figure. In case of bi-level and mix mode, blower and temperature are controlled properly and blown through these ventilation outlets for amicable climate control.



VENT

1. This mode is mainly used in air-con operation and interior air ventilation.
2. Blower is coming from vent register grille and it can be directed anywhere easily by adjusting the louver angle.
3. Fresh outside air, recirculation of inside air, temperature, airflow can be controlled arbitrarily. However, recirculation of inside air mode is used for the quick cooling and fresh outside air mode is chosen otherwise.

FLOOR

1. This mode is mainly used in heating.
2. Blower is directed outside the seat through the floor duct inside the car, and a small quantity of air is directed toward the windshield glass.
3. Fresh outside air, recirculation of interior air, temperature, airflow can be controlled arbitrarily. However, fresh outside air is used mainly.

BI-LEVEL (IT IS DISTINGUISHED INTO COOLING RANGE AND HEATING RANGE)

1. This mode is mainly used for the combined use of cooling and heating in spring or fall.
2. Blower is directed through floor duct, vent register grille and defroster (in case of heating range).
3. Though air intake, temperature and blower are arbitrarily chosen, as for the temperature, middle range is usually selected.

MIX

1. This mode is mainly used to do heating and defrosting the front windshield at the same time.
2. Air is blown from floor duct and front windshield glass (defroster) outlet at the same time.
3. Fresh outside air mode is selected and temperature and blower is arbitrarily controlled. As for the temperature warming (red zone) is usually selected.

DEFROSTER

1. This mode mainly used to defrost front windshield glass.
2. Air is blown from front windshield glass outlet.
3. Fresh outside air mode is selected and temperature and blower is arbitrarily controlled.

RECIRCULATION / FRESH

1. When recirculation is selected, air inside the vehicle recirculates. This mode is mainly used for quick cooling.
2. When fresh outside air mode is selected, fresh outside air is flown inside to ventilate.

TEMPERATURE CONTROL

As for the temperature control of the air from each outlet, temperature switches and buttons are properly selected to control the temperature. Temperature control switch is dial type, and dial is distinguished into heating (red color) and cooling (blue color). If the temperature control dial is set blue color range, air-mix door shuts airflow to heater core and cold air passing evaporator is directly blown. If it is set at the red color range, air-mix door opens and heated air is blown passing heater core. If the dial is set at in-between of red and blue, air mix door is located at the center of the passage to control and mix the cold air and hot air.

BLOWER CONTROL

Blower control is selected by controlling blower button in the control.

STRUCTURE AND OPERATION OF AIR-CON AND HEATER.

Air passed the evaporator is divided into the air to heater core and the air to elsewhere.

So this different air is mixed right before the outlet and sent to the outlet. Temperature is controlled by the air quantity by the air mix damper. In other words, warm air and cold air are mixed properly. So temperature can be controlled continuously from cooling to heating along with demohisturization. Since this is mixing control of warm and cold air, it is called air-mixing type.

AIR-CON OPERATION.

When air-con switch is turned on, compressor operates cycling by repeating on and off by the evaporator pin temperature sensor, which is to prevent evaporator core freezing. Air-con operates only when blower operates first.

SPECIFICATIONS

Items		Specifications	Remarks	
Heater	Heating capacity	5000±10% kcal/h		
	Flow capacity	500±10% m ³ /h		
	Power consumption	240±10% W		
	Blower rev.	3100±10% rpm		
	Blower control step	4step(REISTER)		
Air Conditioner	Cooling capacity	4700±10% kcal/h		
	Flow capacity	500±10% m ³ /h		
	Power consumption	240±10% W		
	Blower rev.	3100±10% rpm		
	Blower control step	4step(REISTER)		
Compo- nents	Heater care	Copper and Brass		
	Blower motor	O.D. Ø76		
	Compressor	HS-17 1700cc DC24V		
	Evaporator	Laminated tank		
	Condenser	Super compact condenser		
	Condenser fan	2000±10% m ³ /h, 24V		
	Safety system	High/Low pressure switch, Fuse		
		Coolant temperature switch		
	Refrigerant	(R-12) about 650g		
		(R134a) about 650g		
Receiver drier	Aeperated Drier and Sight glass			
	Capacity : 250 cc			

MAIN COMPONENTS

HEATER UNIT ASSEMBLY

It is assembled at the center of vehicle inside instrument panel, whose housing is made of plastic case. And it consists of heater core, in which engine coolant flows through the fascia, and mode door, which controls airflow, and temperature door, which controls temperature. Heater coolant temperature sensor is installed at the lower side of heater core, which senses engine coolant temperature flowing inside heater core.

EVAPORATOR UNIT

Evaporator unit is installed at the right side of heater assembly, whose housing is made of plastic case. It consists of evaporator core and thermal expansion valve. Evaporator core evaporates refrigerant flown into case and thermal expansion valve expands liquid refrigerant. And evaporator core pin sensor is inserted between core pins to prevent the evaporator core freezing.

NOTE

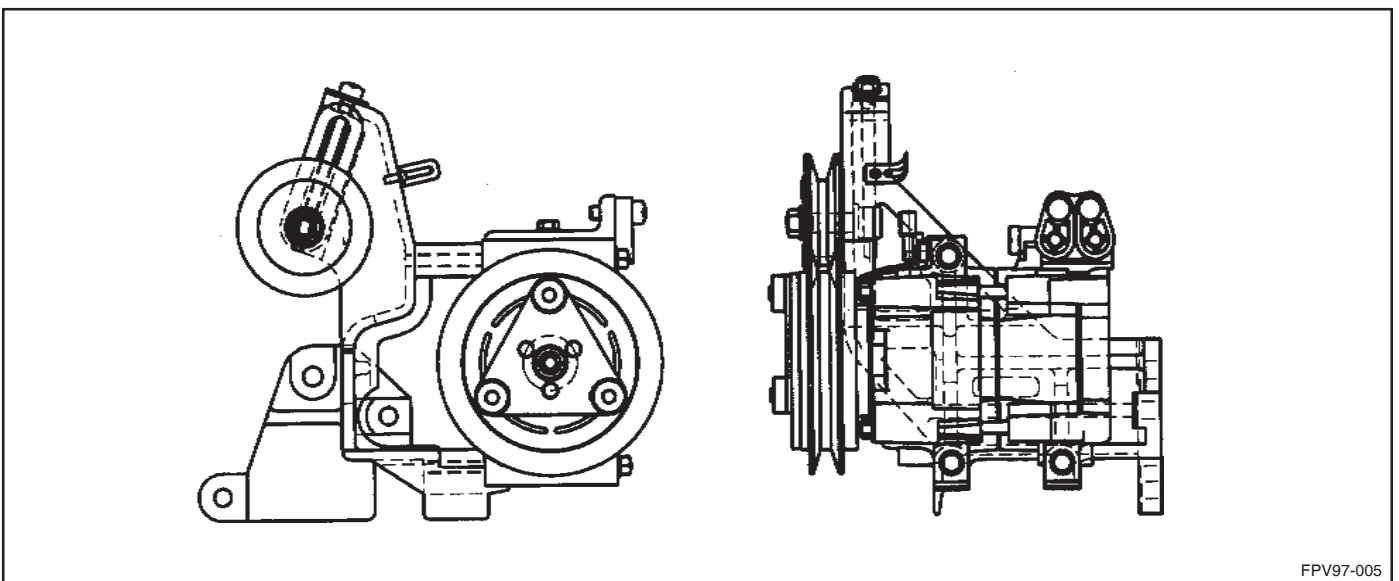
- **Do not adjust the thermal expansion valve since it is set to optimal performance when delivered. It may cause a deterioration of cooling performance.**
- **Do not change the insertion point of evaporator core pin. It may cause the bad influence on the air-con system.**

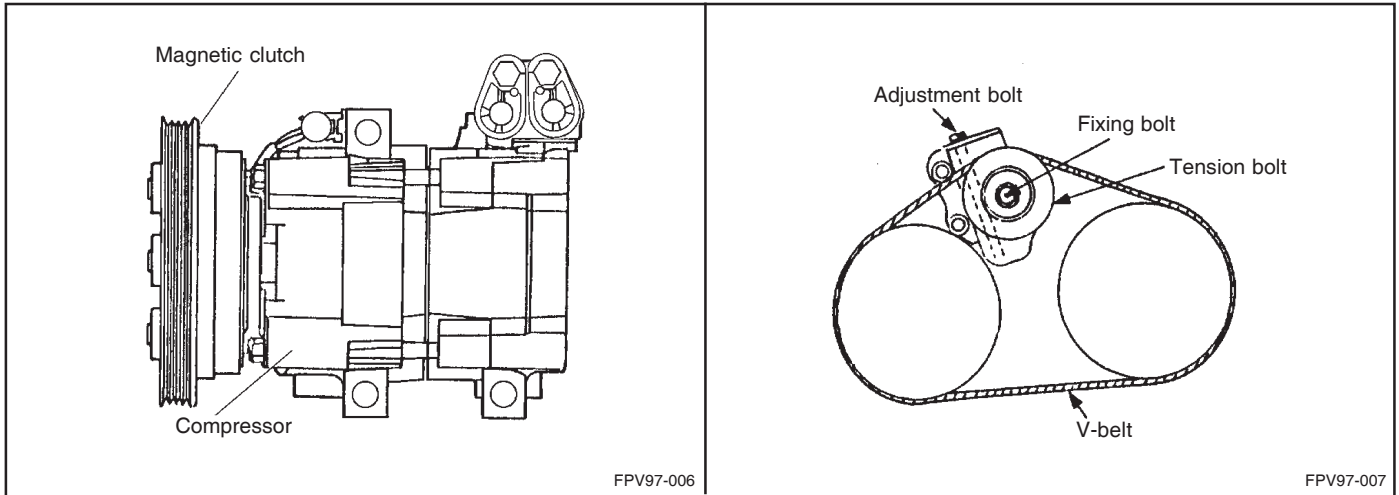
BLOWER UNIT

Its housing is made of plastic case. It consists of blower motor and wheels. Besides, there are conversion door between circulation and fresh air inside modes, which is operated by electrically driven motor, and outside air temperature sensor, which senses outside air temperature. Besides, HI blower relay is installed for air-con.

COMPRESSOR

Air-con is installed onto the engine, which intakes and compresses air-con refrigerant to recirculate the refrigerant. Magnetic clutch operates and connected to engine pulley and belts by air-con switch operation



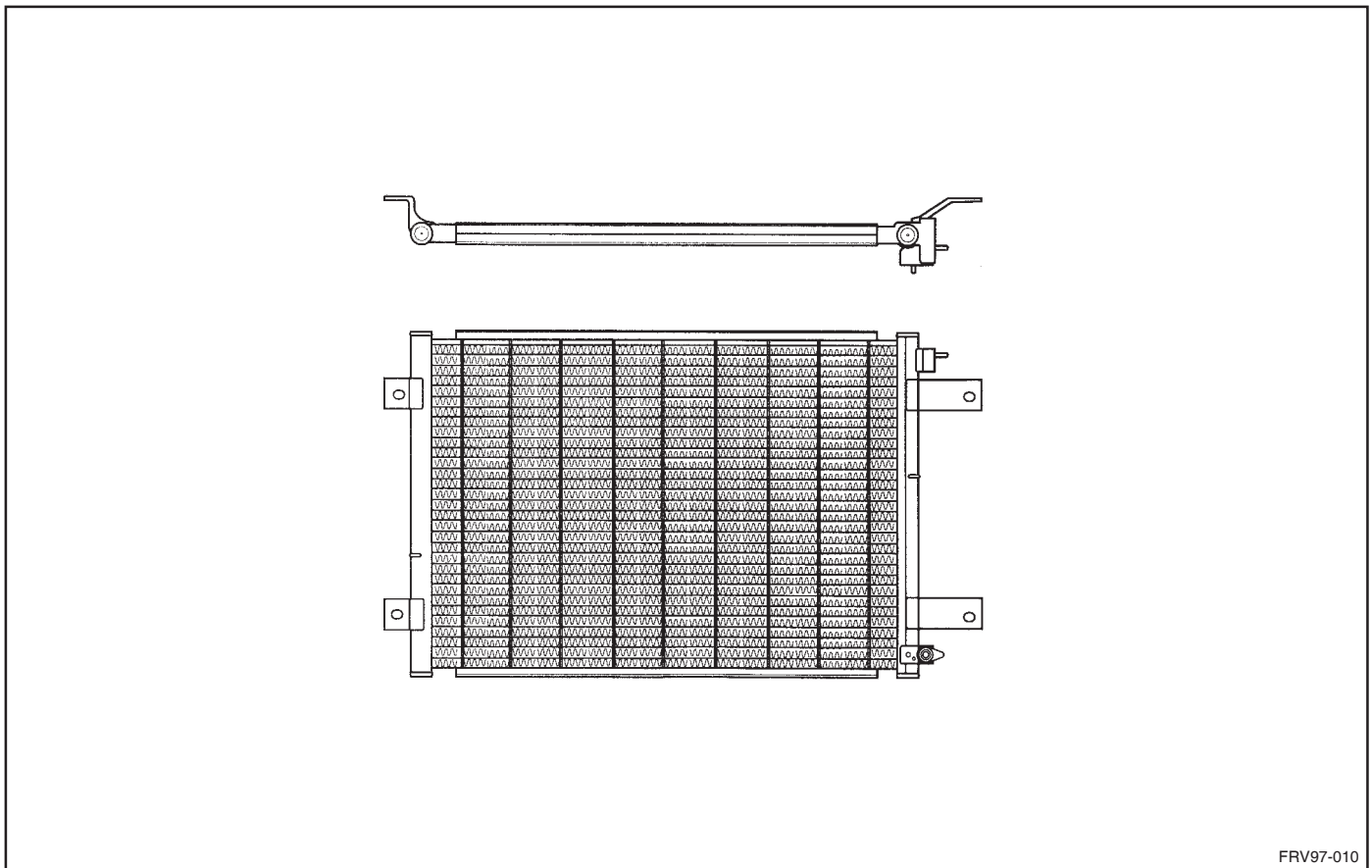


CONDENSER

It is installed at the front of radiator, whose function is to compress the refrigerant after receiving from compressor. And it is made of aluminum for the efficiency improvement and weight reduction.

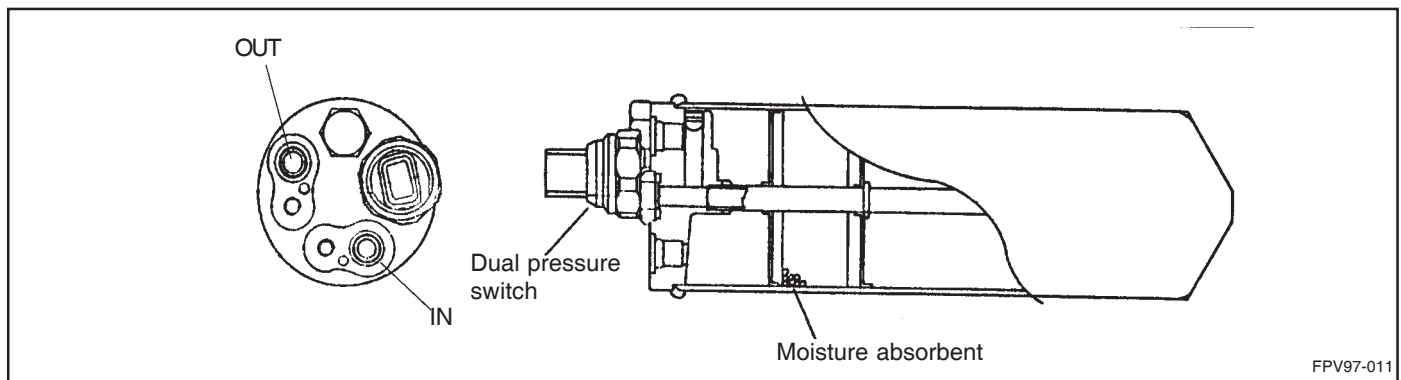
NOTE

- Since it is made of aluminum, be careful not to damage and tear fins in handling.



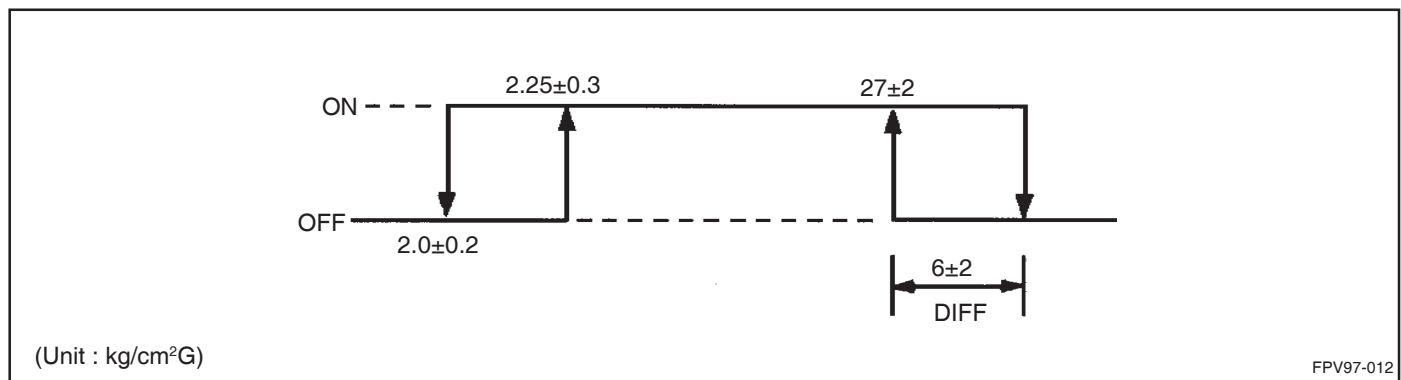
RECEIVER DRIER

It filters dirt and moisture in the refrigerant, which recirculating air-con system, stores refrigerant temporarily before refrigerant flows into evaporator. It is installed between condenser and expansion valve. Besides, receiver tank consists of Hi-low pressure switch, which shuts the system automatically in abnormally high or low pressure, and sight glasses, in which we can check refrigerant filling and pressure outlet, which prevents high pressure in temperature increase.



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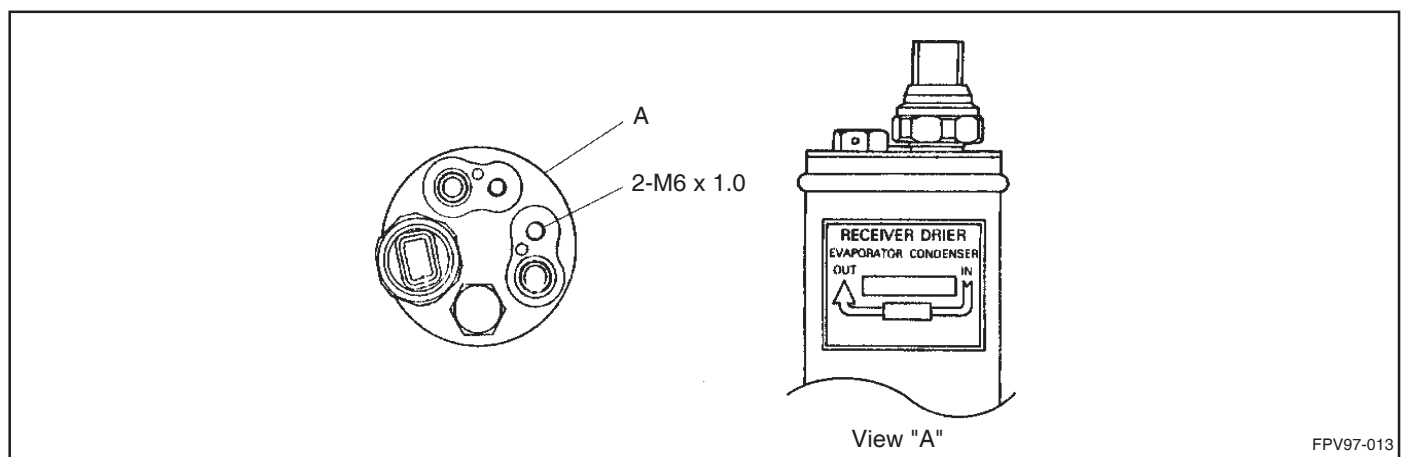
High-pressure switch operation diagram



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NOTE

- Since receiver tank inlet and outlet are distinguished, assemble it between tube and liquid by checking in and out marked on the label.



FPV97-013

RELAY

Blower off relay, Hi

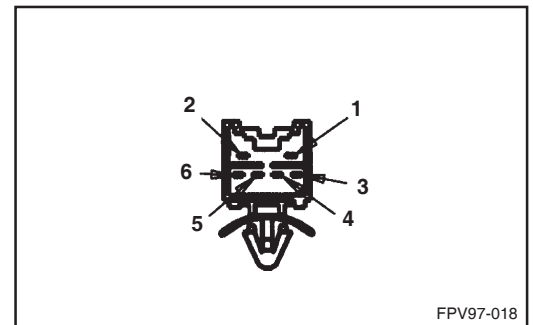
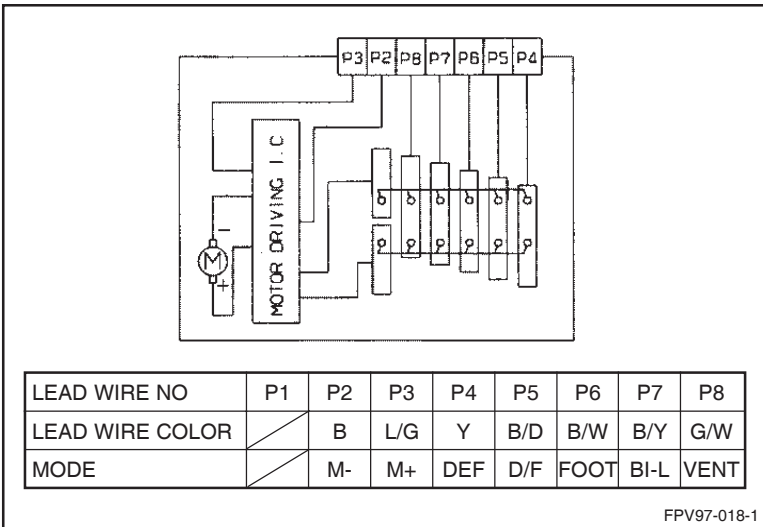
- Blower off relay
As a relay to supply power to blower fan motor, it is installed to blower unit case.

Compressor relay, condenser fan relay

- Compressor relay

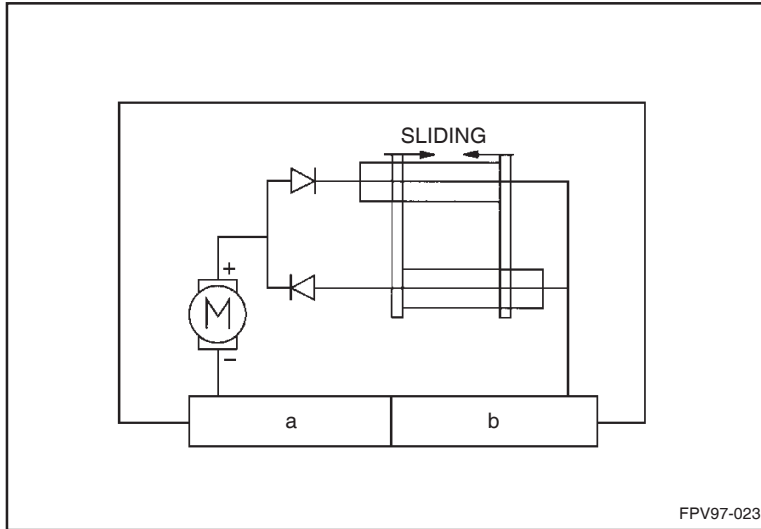
Mode actuator

Installed to the front heater unit, it controls 5th mode control from vent to defroster by selecting mode switch.

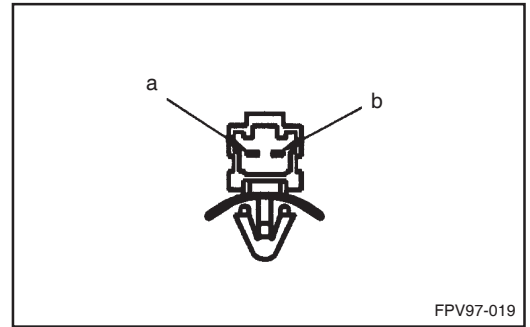


Fresh air and recirculation actuator

Installed to the right side of blower unit, it operates damper to select air intake (Fresh air, recirculation) by operating heater control push button.



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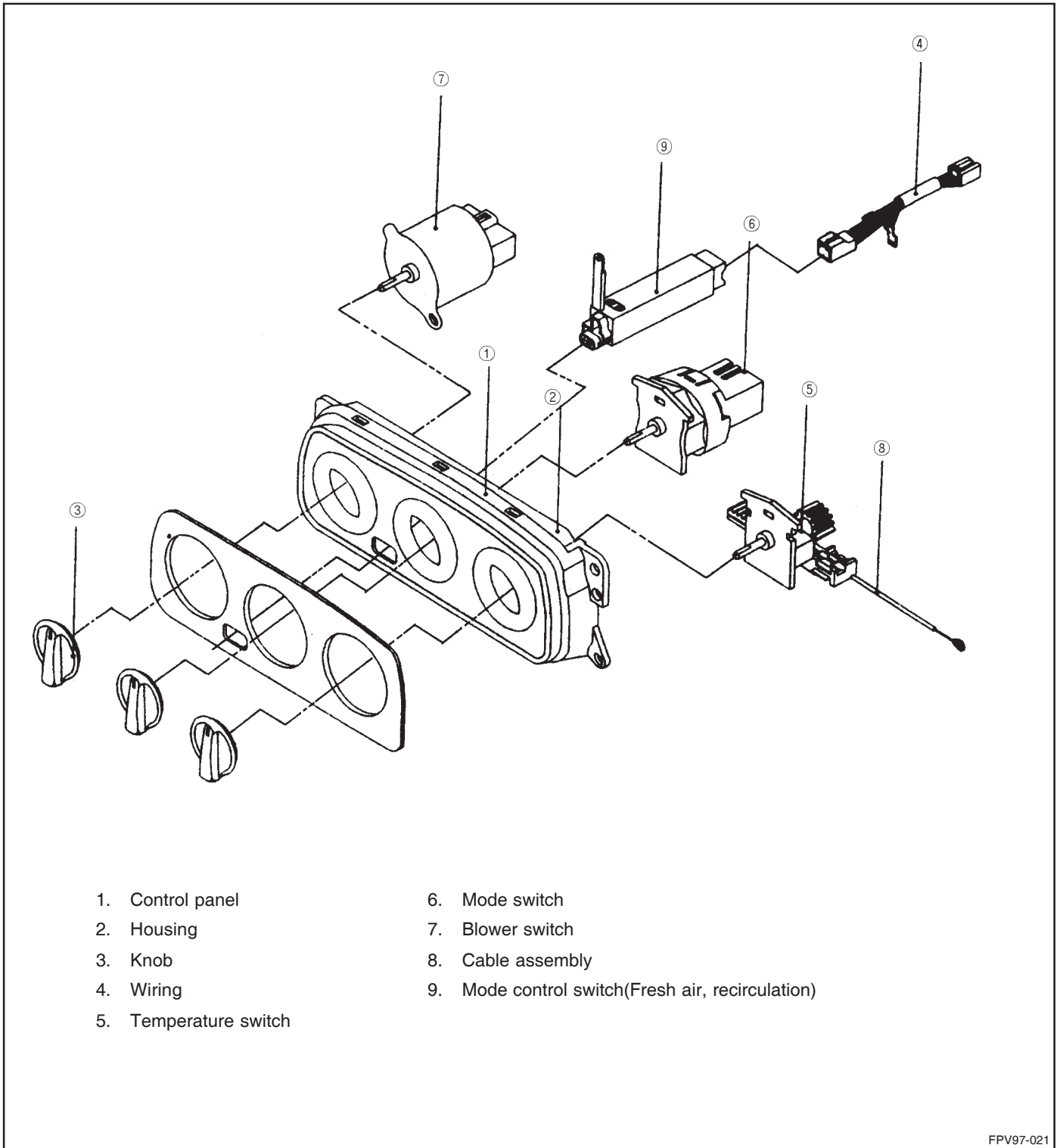
INPUT		OUTPUT
a	b	POSITION
+	-	FRESH
-	+	RECIRCULATION

HEATER CONTROLLER (MANUAL)

Rotary and push button type.

Vent mode selection and switching between fresh outside air and recirculation are decided by damper motor operation, and temperature is controlled by operating air-mix damper by the cable movement with rotary operation, which is installed to the heater unit.

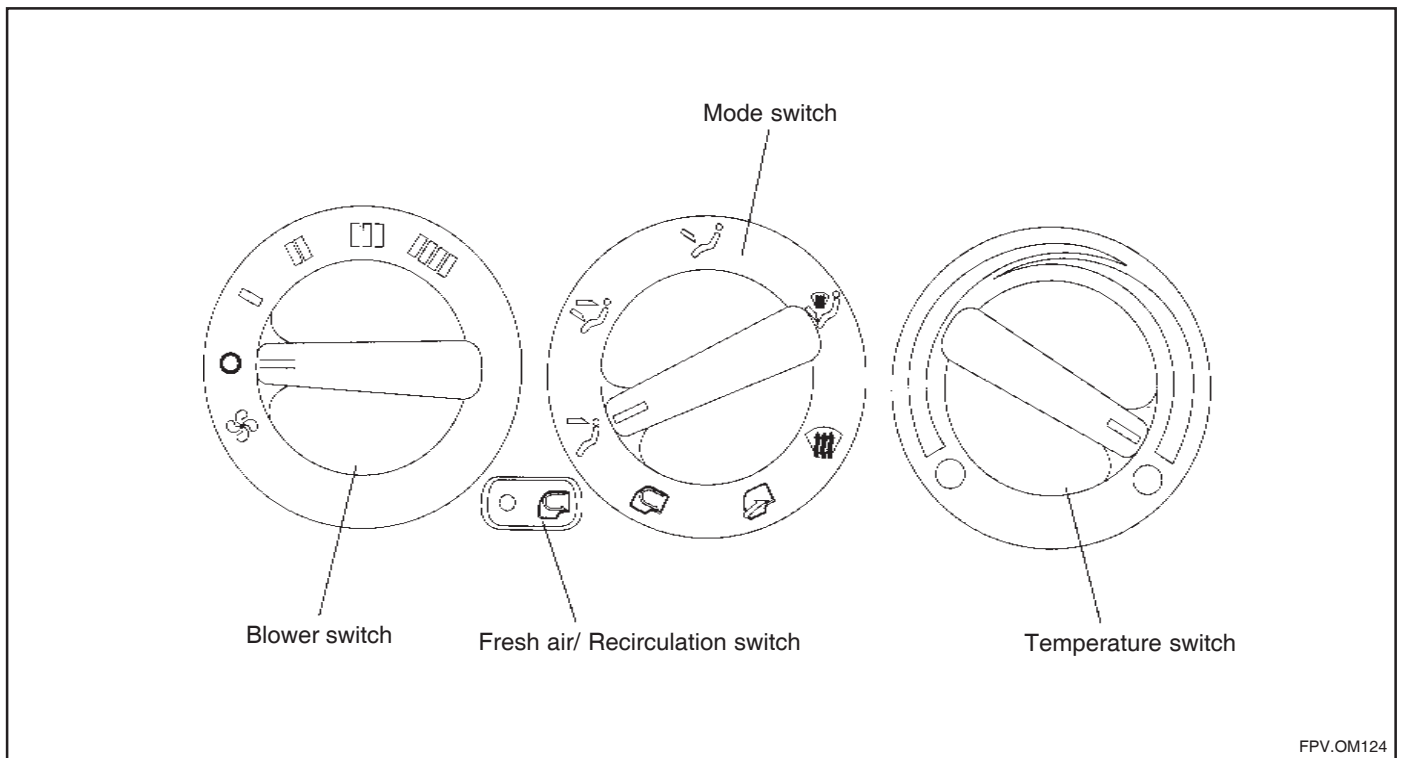
Control structure diagram



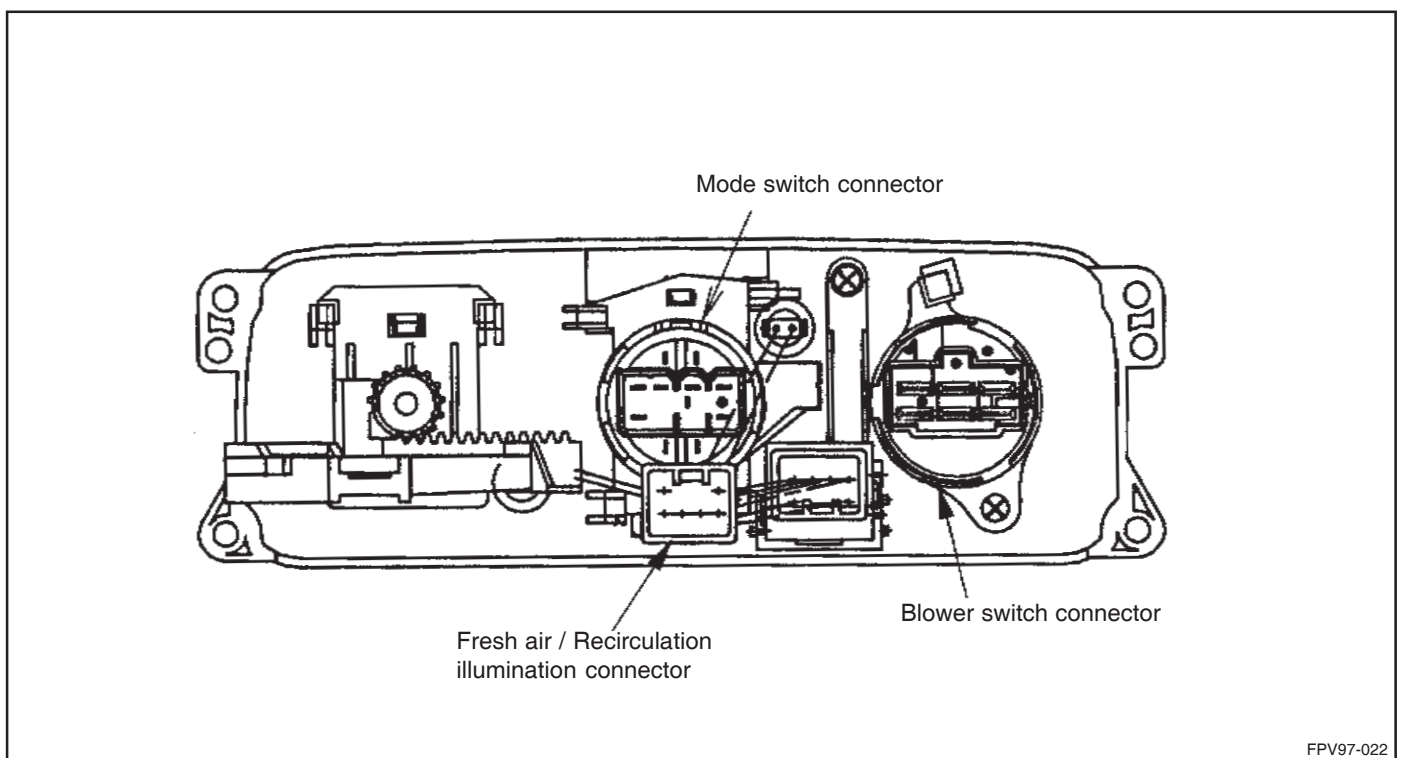
- | | |
|-----------------------|--|
| 1. Control panel | 6. Mode switch |
| 2. Housing | 7. Blower switch |
| 3. Knob | 8. Cable assembly |
| 4. Wiring | 9. Mode control switch(Fresh air, recirculation) |
| 5. Temperature switch | |

SWITCHES

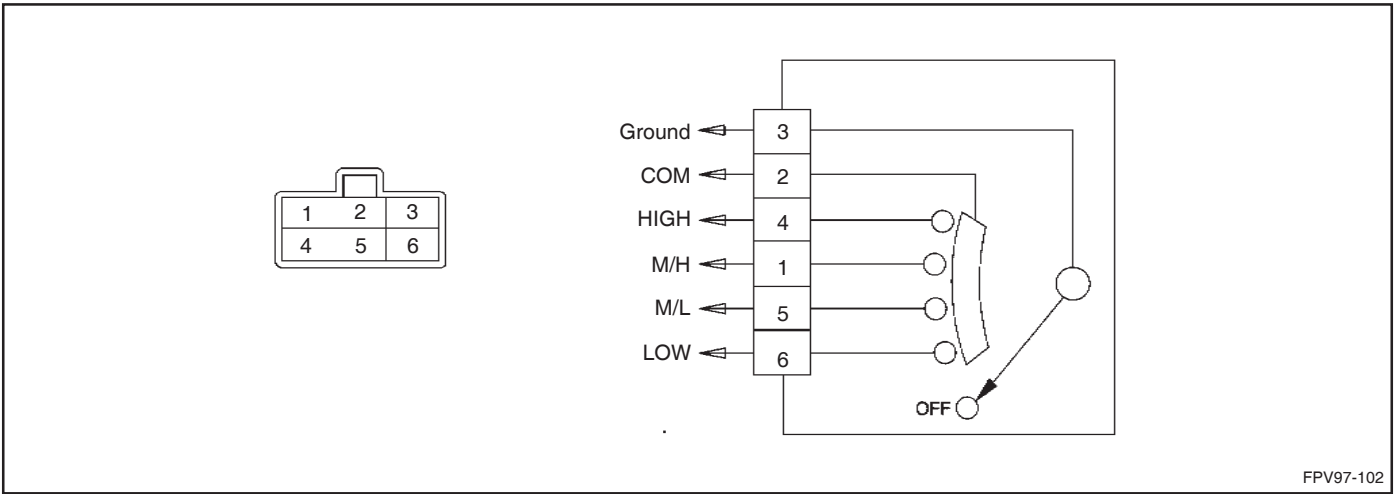
1. Control panel(Front)



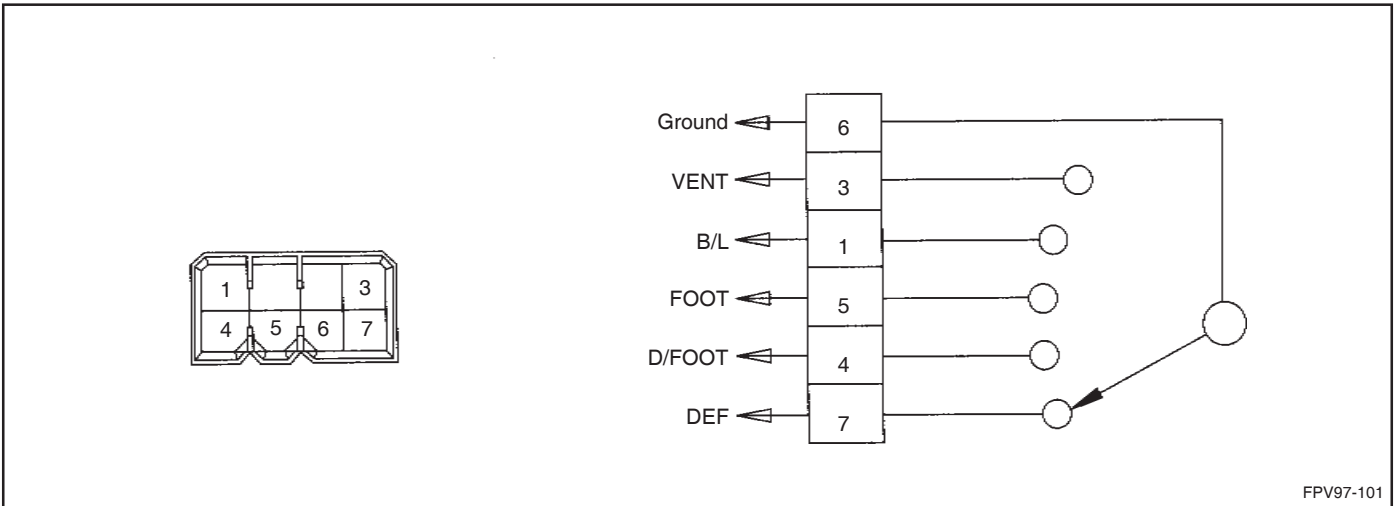
2. Control panel(Back)



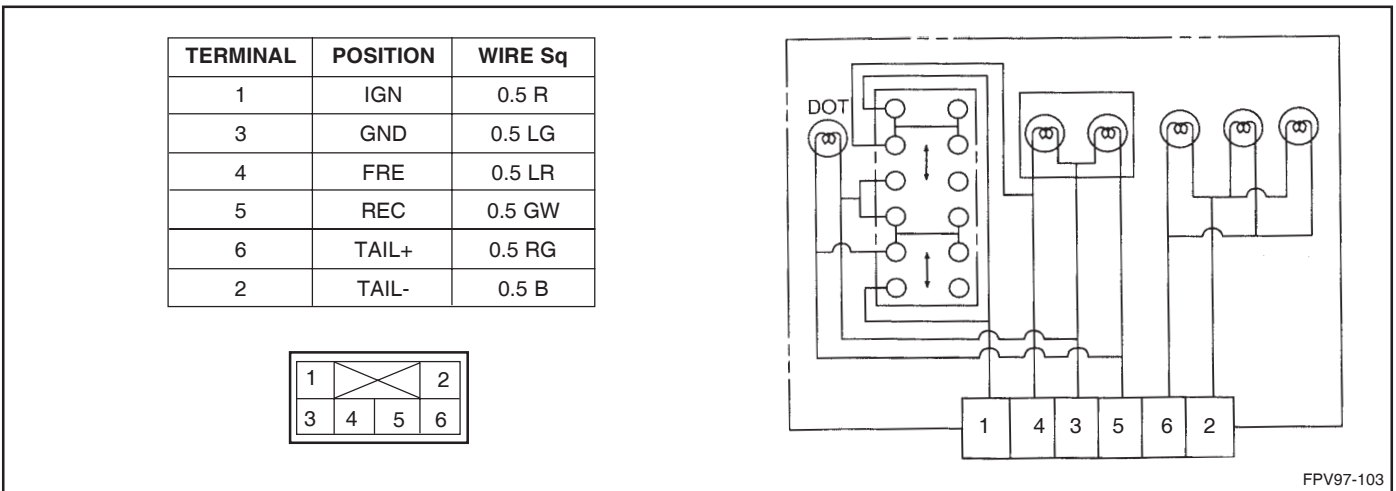
3. Blower switch terminal



4. Mode select switch



5. Fresh, recirculation switch



TROUBLE SHOOTING

MANUAL TYPE

Check points	Symptoms				
	Air-con is not working when ignition switch is on.	Temperature does not drop when air-con is working	Blower fan and motor is not rotating	Vent mode selection is impossible.	Air intake mode is not controlled
Fuse	1		1	1	1
Connector	2		2	2	2
Refrigerant volume	3	1			
Compressor relay	4	4			
Magnetic clutch	5	5			
Dual pressure switch	6	2			
Air-con switch	7				
Blower relay			3		
Blower motor			4		
Switch	8		5		
Blower resistance			6		
Air intake control mode damper motor	10				3
Mode selection damper motor	11			3	

Number means the checking points by sequence.

Symptoms	Possible causes	Repair
Air-con is not working when ignition switch is on.	- Fuse blown	Fuse replacement
	- Harness or connector defective	Repair harness or connector
	- Refrigerant leakage or over charging	Refrigerant refill or repair or leakage or discharge
	- Compressor relay defective	Replacement
	- Magnetic relay defective	Amateur plate, rotor or clutch oil replacement
	- Dual pressure switch defective	Replacement
	- Front air-con switch defective	Replacement
	- Front blower switch defective	Replacement
Temperature does not drop when air-con is working	- Refrigerant leakage	Refrigerant refill or repair leakage points
	- Dual pressure switch defective	Replacement
	- Compressor relay defective	Replacement
	- Magnetic clutch defective	Replacement
Blower fan and motor is not rotating	- Fuse blown	Replacement
	- Harness or connector defective	Replacement
	- Blower motor relay defective	Replacement
	- Front blower motor defective	Replacement
	- Front blower switch defective	Replacement
	- Blower resistance defective	Replacement
Vent mode selection is impossible.	- Fuse blown	Replacement
	- Harness or connector defective	Replacement
	- Mode selection damper motor defective	Replacement
Air intake mode is not controlled (Fresh air and recirculation)	- Fuse blown	Replacement
	- Harness or connector defective	Replacement
	- Air intake mode switch damper motor defective	Replacement

FAULT DIAGNOSTIC TABLE

Check points	Fuse	Air-con control unit	Wiring	Heater link	Blower relay	Register	Blower motor	Compressor relay	Magnetic clutch	Air intake damper actuator (Fresh air outside, recirculation)	Vent mode damper actuator	Dual pressure switch	Condenser fan motor	Refrigerant volume
Symptoms														
Air-con is not working when ignition switch is on.	①	②	③					④	⑤			⑥		⑦
Inside temperature is not going up (Warm air is not coming)		①	③	②										
Inside temperature does not drop (Cold air is not coming)		⑤	⑥					②	③				④	①
Blower motor is not rotating	①	⑥	⑤		④	③	②							
Blower motor does not stop.		③	②			①								
Air intake mode is not controlled		③	②							①				
Vent mode damper is not working		③	②								①			
Condenser fan is not working	①	④	③										②	

※ "O" represents the parts which needs repair, and the number means the priority number.

TROUBLE SHOOTING

No	Symptoms	Possible causes	Repair
1	Air-con is not working when ignition switch is on.	Wire short or disconnection	Wire repair
		Air-con control unit is damage	Air-con control unit replacement
2	Inside temperature is not going up (Warm air is not coming)	Temp damper stuck	Temp damper repair and replacement
		Wire short or disconnection	Wire repair
		Air-con control unit is damage	Air-con control unit replacement
3	Inside temperature does not drop (Cold air is not coming)	Damage of temp damper operation lever and damper connector	Connector repair
		Temp damper stuck	Temp damper repair and replacement
		Wire short or disconnection	Wire repair
		Compressor relay damage	Relay replacement
		Refrigerant leakage	Refrigerant refill or leakage repair
		Magnetic clutch damage	Replacement
		Air-con control unit is damage	Air-con control unit replacement
4	Blower motor is not rotating	Blower moter damage	Blower motor replacement
		Blower relay damage	Relay replacement
		Wire short or disconnection	Wire repair
		Air-con control unit is damage	Air-con control unit replacement
5	Blower motor does not stop.	Blower moter damage	Power transistor replacement
		Wire short or disconnection	Wire repair
		Air-con control unit is damage	Air-con control unit replacement
6	Air intake mode is not controlled (Fresh air and recirculation)	Air intake mode actuator damage	Air intake mode actuator replacement
		Linkage or damper damage	Connector repair
		Wire short or disconnection	Wire repair
		Air-con control unit is damage	Air-con control unit replacement
7	Vent mode damper is not working	Vent mode damper actuator damage	Vent mode damper actuator replacement
		Vent mode actuator linkage damage	Connector repair
		Air-con control unit is damage	Air-con control unit replacement
8	Condenser fan is not working while air-con operating	Condenser fan motor relay damage	Relay replacement
		Condenser fan motor damage	Condenser fan motor replacement

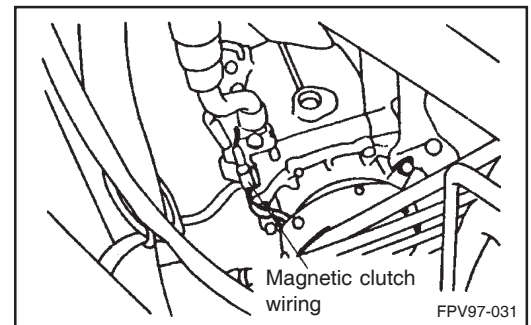
Maintenance procedures

1. Test procedures

- 1) Refrigerant charging level test of sight glass is done with the refrigerant level indicator. To check the refrigerant charging level, start the engine after cleaning sight glass. Operate the compressor by pressing air-con button. Put the blower switch at the high position put and temperature level at the coldest position and check the sight glass.
 - a. When sight glass is cleaned, operate magnetic clutch. If the compressor discharge line is warm and compressor inlet is cold, it means that system is fully charged.
 - b. When sight glass is cleaned, operate magnetic clutch. If there is no temperature difference between compressor inlet and discharge line, it means that system lacks refrigerant.
 - c. When a bubble is seen at the sight glass, charge the system again.

2) Magnetic clutch

- a. Remove the wiring from magnetic clutch.
- b. Connect positive voltage of battery directly to magnetic clutch wiring.
- c. When magnetic clutch is normal, it will display "click". If the pulley or amateur is not connected to "click", system is in malfunction.

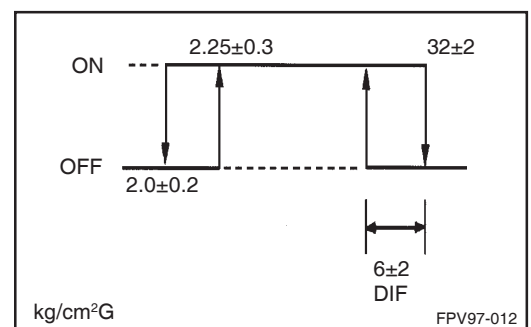


3) Receiver drier

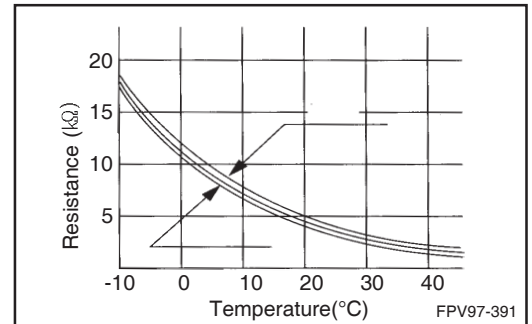
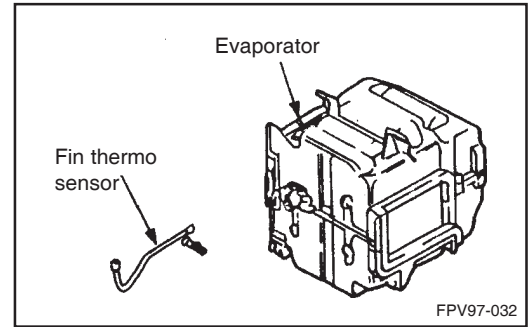
- a. Receiver drier test
- b. Hold receiver drier outlet and inlet, and check the pipe temperature after operating the unit.
- c. If there is temperature difference, check the receiver drier and replace it, if needed.

4) Dual pressure switch (low pressure switch)

- a. Close the valve by rotating the adaptor valve handle fully, and install it to the low-pressure service valve.
- b. Close the gauge manifold low-pressure maintenance valve, and connect gauge manifold high-pressure side charging hose to adaptor valve.
- c. Tighten the adaptor valve handle and open the service valve.
- d. When the side pressure of low-pressure is "on" level of dual pressure switch, and if there is continuity between dual pressure switch terminals, switch is normal. Replace the switch otherwise.



- 1) Fin thermo sensor
 - a. Remove the sensor connector from evaporator case and then measure the resistance using resistance tester. If the sensor value lies within plus minus 10 % range, sensor is in normal operation.
 - b. Even if the sensor is normal, replace it when the air-con control unit is in malfunction.

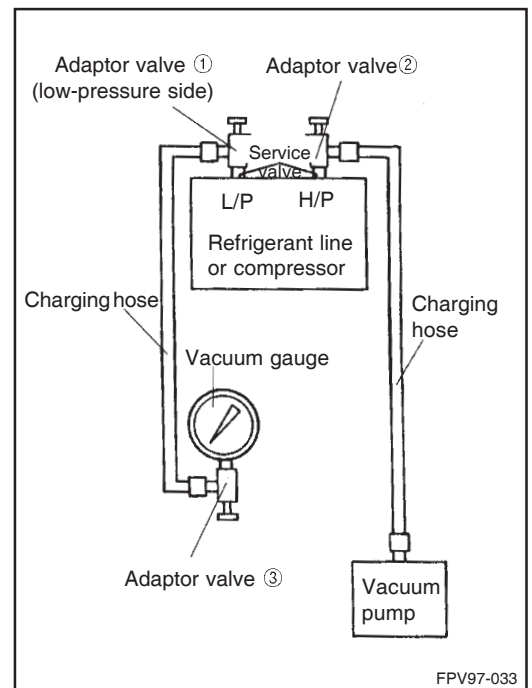


2. Charging procedures

- 1) Installation of charging equipments
 - ① When using vacuum gauge.
 - a. Rotate the handle of adaptor valve ① and ② fully, and then install adaptor valve ① and ② to low pressure valve and high pressure valve respectively.
 - b. Tighten the adaptor valve ① and ② fully (valve open), and then open low-pressure valve and high pressure valve.
 - c. Connect charging hoses to adaptor valve ① and ② .
 - d. Tighten the adaptor valve ③ fully (valve open), and then install it to the low pressure charging hose.
 - e. Install the vacuum gauge to adaptor valve ①.
 - f. Install vacuum pump to high-pressure charging hose.

NOTE

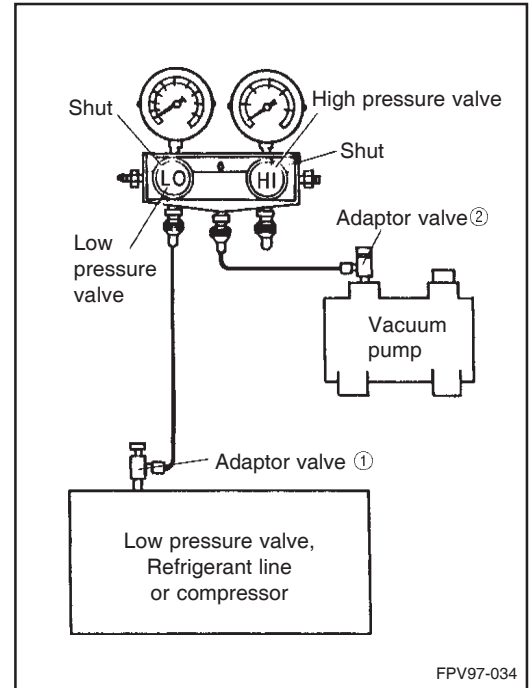
- **Be careful not to be confused in connecting low-pressure and high-pressure. (Connect the high pressure to condenser and then connect the low-pressure to evaporator)**
- **“DIS” and “SUC” of compressor stands for high pressure and low pressure respectively.**



- ② When using gauge manifold.
 - a. Turn adaptor valve handle counterclockwise, and then install adaptor valve ① and ② to low-pressure maintenance valve and vacuum valve.
 - b. Install gauge manifold to low pressure and high pressure.
 - c. Connect charging hoses to each adaptor.
 - d. Open maintenance valve and vacuum pump by rotating handle of adaptor ① and ② clockwise.

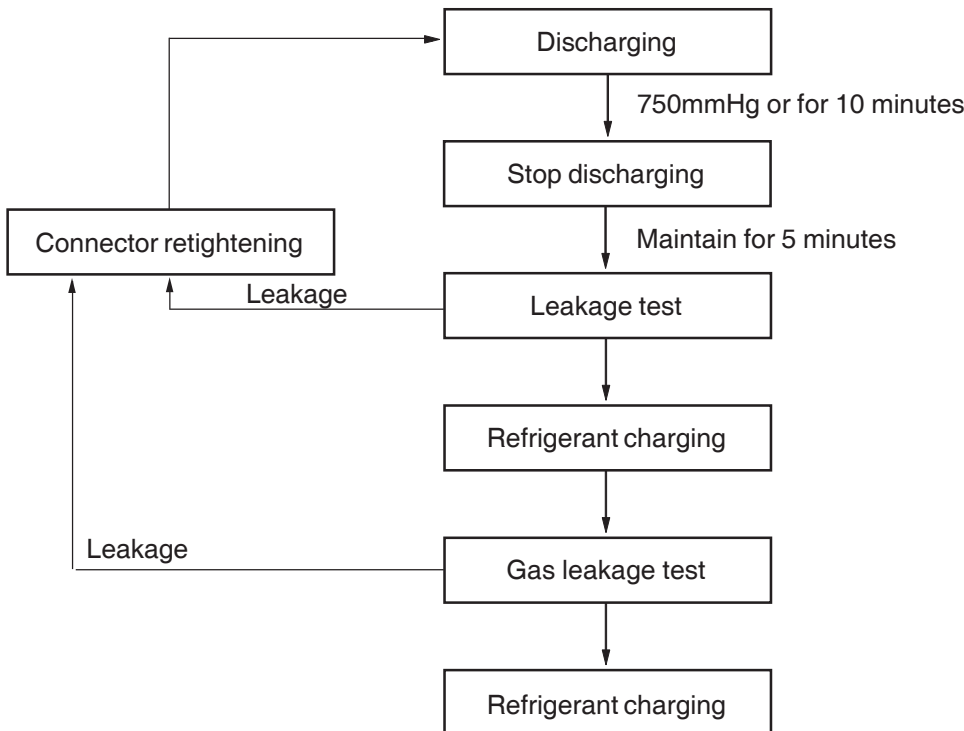
[REFERENCE]

- **Be careful not to be confused in connecting low-pressure and high-pressure. (Connect the high pressure to condenser and then connect the low-pressure to evaporator)**
- **“DIS” and “SUC” of compressor stands for high pressure and low pressure respectively.**



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2) Charging unit



Refrigerant is discharged through outlet.

Charge with only R-134a.

R-134a can be used in a bulk tank and small can as well.

Please follow the preventive safety measures when handling substances like R-134a.

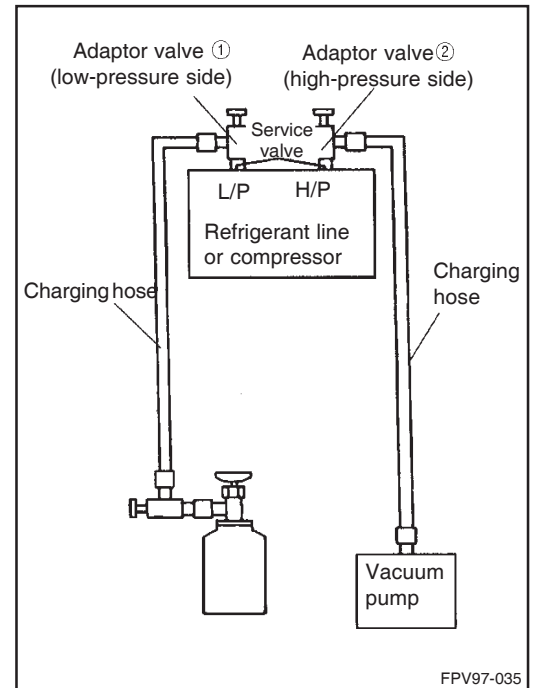
3. Refrigerant charging

1) Charging a small can.

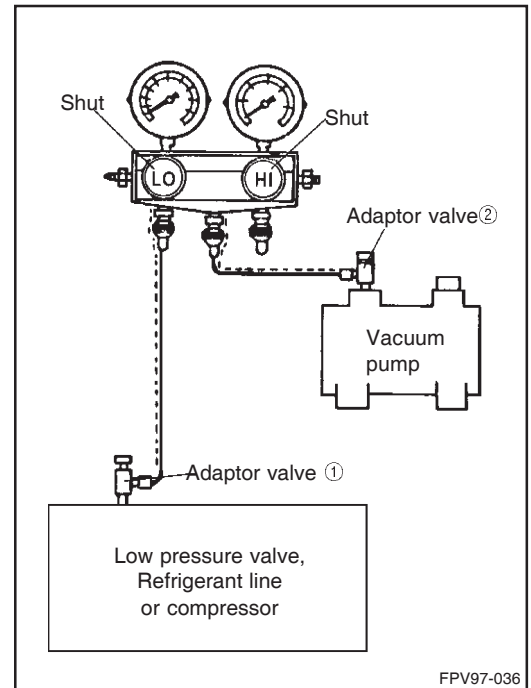
- ① When using a vacuum gauge.
 - a. Operate vacuum pump.
 - b. Keep the vacuum pressure more than 750 mmHg (discharging for more than 10 minutes)
 - c. Turn clockwise the handle of high pressure adaptor valve ② (valve closed)
 - d. Maintain the vacuum state for 5 minutes while vacuum pump operation is stopped.
 - e. Check the leakage. (Good condition if vacuum state is kept)
 - f. Turn the handle of charging valve ④ backward (valve open) and install it to charging can
 - g. Turn the handle of charging valve ③ fully backward (valve closed) and install charging can after removing vacuum meter.
 - h. Tighten the charging valve handle ④ to pierce a hole.
 - i. Turn the charging valve handle ④ backward (valve open), and tighten adaptor valve handle ③ completely (valve open) and then charge the refrigerant.
 - j. When refrigerant is not circulating, turn the handle of adaptor valve ① counterclockwise. (Valve closed)
 - k. Check the gas leakage using leak tester.
 - l. Start the engine
 - m. Turn the air-con on and put the switch at max cool position.
 - n. Fix the engine speed at 1,500 rpm
 - o. Charge the refrigerant as needed by turning the handle of adaptor valve ① completely clockwise (valve open)

NOTE

- **If the maintenance can is put upside down, liquid refrigerant may flow down and damage the compressor with the liquid compression. Put the maintenance can upright so that the refrigerant can be filled as a gas.**
- p. After charging, turn the adaptor valve handle ① fully counterclockwise (valve closed)



- ① When using gauge manifold
 - a. Operate vacuum pump
 - b. Keep the vacuum pressure more than 750 mmHg (discharging for more than 10 minutes)
 - c. Turn the handle of adaptor valve "è fully clockwise (valve closed).
 - d. Stop vacuum pump operation and keep the vacuum state for more than 5 minutes.
 - e. Check the leakage.

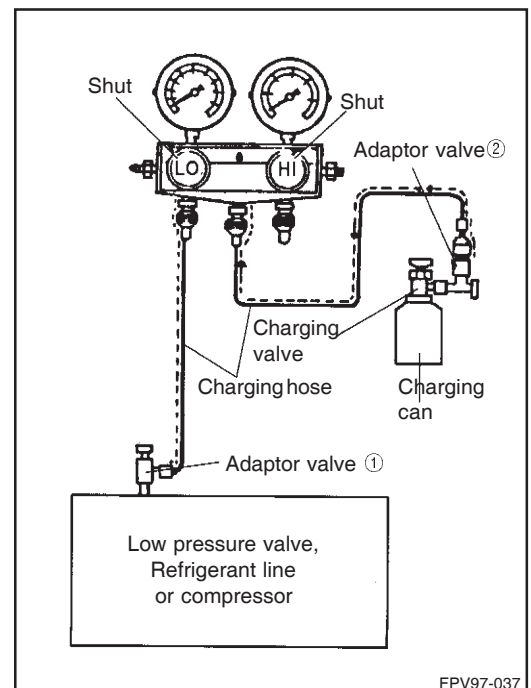


- f. Tighten the handle of charging valve ③ to the maintenance can.
- g. Tighten the handle of adaptor valve ② fully and open the charging valve.
- h. Charge the refrigerant to the low-pressure valve of manifold gauge through charging hose.

NOTE

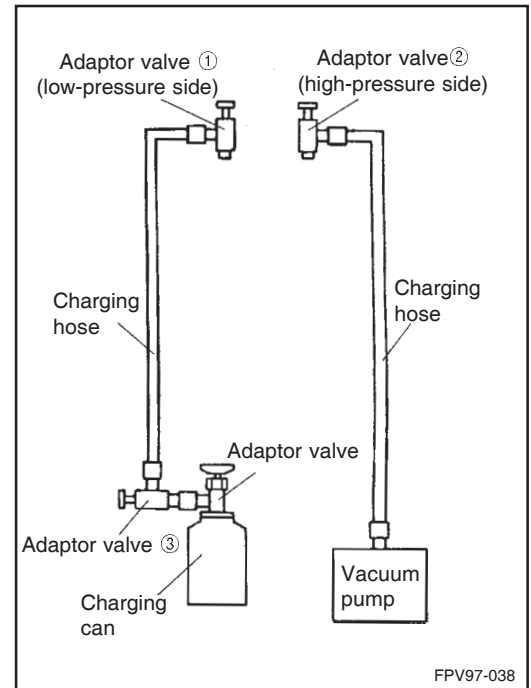
- **If the maintenance can is put upside down, liquid refrigerant may flow down and damage the compressor with the liquid compression. Put the maintenance can upright so that the refrigerant can be filled as a gas.**

- i. When the refrigerant is not charging, turn the handle of adaptor valve ① counterclockwise. (Valve closed)
- j. Check the gas leakage using gas leakage tester.
- k. Start the engine.
- l. Turn the air-con on and put the switch at max cool position.
- m. Fix the engine speed at 1,500 rpm
- n. Charge the refrigerant as needed by turning the handle of adaptor valve completely clockwise (valve open)
- o. After charging, turn the adaptor valve handle ① fully backward (valve closed)



2) Removal of charging equipments

- ① Close the charging valve ④ (valve closed)
- ② Remove adaptor valve ① and ② from each service valve.
- ③ Remove maintenance valve
- ④ Remove charging valve ④.
- ⑤ Remove adaptor ③
- ⑥ Remove adaptor ①
- ⑦ Remove adaptor ②
- ⑧ Remove vacuum pump.

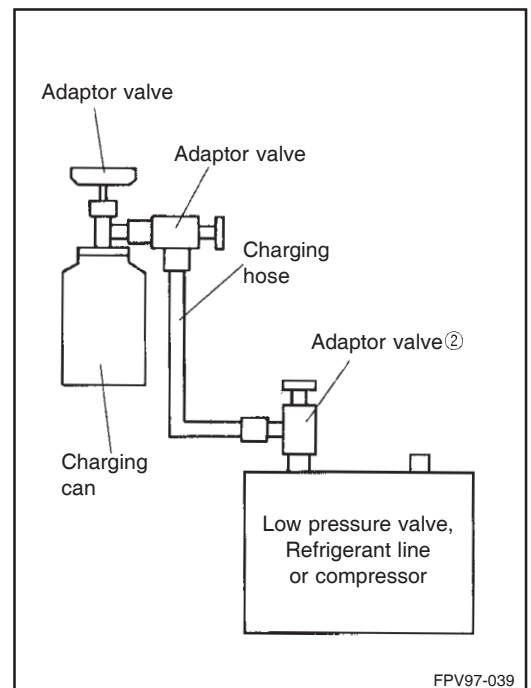


2) Refill of low refrigerant level.

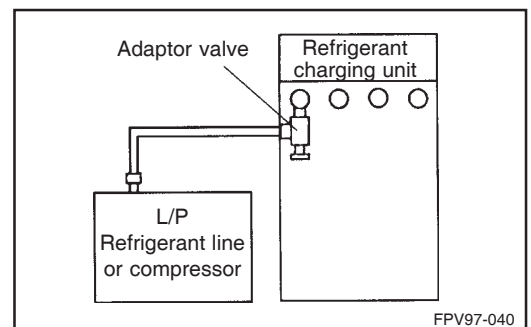
- ① Turn the charging valve handle backward (valve open) and install it to the maintenance can.
- ② Tighten the handle and install the adaptor valve ① to charging valve. (Valve open)
- ③ Install the charging hose to adaptor valve ①
- ④ Turn the adaptor valve "è backward (valve closed) and install the charging hose.
- ⑤ Turn the charging valve handle and pierce a hole in a can.
- ⑥ Turn the handle of charging valve ③ backward (valve open), and operate it as the air should not leak from adaptor valve.

(Operation)

- **Do not use high-pressure side. There is a risk of refrigerant backward flow and subsequent damage on charging can and hoses.**



- ⑦ Install adaptor valve ② to low pressure maintenance valve.
- ⑧ Start the engine
- ⑨ Turn the air-con on and put the switch at max cool position.
- ⑩ Fix the engine speed at 1,500 rpm
- ⑪ After tightening handle of adaptor valve ② (valve open), charge the refrigerant as checking refrigerant charging level with sight glass.
- ⑫ After charging, turn the adaptor valve handle ② fully backward (valve closed)
- ⑬ Remove the adaptor valve "è from maintenance valve.



4) Charging equipment

Please refer to the unit operation manual for the use of refrigerant recovery unit equipment and recycling unit equipment.

5) Proper refrigerant quantity of air-con system.

In charging, do not overcharge nor undercharge.

NOTE

- **Charge properly, since overcharging or undercharging may cause air-con performance deterioration or system malfunction.**

Air-con specification	Refrigerant quantity(g)
Manual	650±20g

6) Refill of refrigerant oil in air-con system.

When refrigerant oil is insufficient, compressor lubrication is not proper and causes malfunction accordingly. On the contrary, if there is too much refrigerant oil, discharging temperature goes up and weaken the air-con performance. When assembled in factory, 200 cc of refrigerant oil is charged. While air-con is in operation, refrigerant oil flows throughout the system with the refrigerant. Since the refrigerant oil remains in many places, refill the system with the proper quantity of refrigerant oil when the system components are replaced.

Refill quantity of refrigerant oil when replacing air-con system components

Items	Quantity (cc)
Condenser	8
Evaporator	72
Receiver drier	6.4

4. Performance test

- 1) Park the vehicle to be tested in the shaded place.
- 2) Connect the tachometer
- 3) Turn the adaptor valve handle backward and then install the adaptor valve to high-pressure and low-pressure maintenance valve respectively.
- 4) Connect the gauge manifold to adaptor valve.
- 5) Tighten adaptor valve handle and then open the service valve.
- 6) Start the engine.

7) Put the control at the following positions.

Items	Position
Air-con switch	Air-con on position
Mode selection	Vent position
Temperature control	Max cooling (max, cool position)
Air mode	Recirculation position
Blower switch	Hi position

8) Set the engine speed at 1,000 rpm so that air-con compressor turns on and off.

9) Warm up the engine after closing door and windows.

10) Install the thermometer at the center of air-con outlet (center of center vent grille) and start the engine for about 20 minutes.

11) Measure the discharging temperature

<Temperature table>

Ambient temperature(°C)	21	26.7	32.2	37.8	43.3
Discharging temperature(°C)	0.0~3.0	0.0~3.3	0.0~4.0	0.0~4.0	0.0~4.0
Compressor discharge pressure(kg/cm ² G)	6.5~7.0	7.4~7.9	9.8~10.2	11.5~12.0	13.2~13.7
Compressor suction pressure(kg/cm ² G)	1.3~1.9	1.3~1.9	1.3~1.9	1.3~1.9	1.3~1.9

5. Repairing procedures of refrigerant leakage

1) Refrigerant leakage

When all refrigerant leaked away

- ① Vacuum the system. (Refer to the vacuuming procedures)
- ② Charge the system with about 1 pound of refrigerant
- ③ Check the leakage
- ④ Discharge the refrigerant
- ⑤ Repair the leaking point
- ⑥ Replace the receiver drier.

NOTE

- **Receiver drier should be sealed when stored. Receiver drier, which is used in air-con system, absorbs water quickly when exposed to the air. When installing the receiver drier, reassemble it as quickly as possible without leaving it open for a long while.**

- ⑦ Vacuum the system and charge it with refrigerant.

2) Insufficient charging

Repair the leakage if refrigerant charging is impossible. Since only small quantity of refrigerant is left in the system, charge the refrigerant to increase the system pressure.

When repairing the leakage without discharging the remaining refrigerant in the system, follow the repair procedures of low refrigerant charging level.

6. Tubing and fittings procedures

Refrigerant tubing or sharp bending in the refrigerant hose lines will greatly reduce the overall system performance. System pressure becomes high, while operating. Make sure that all connections are tightened with proper torque. Be careful so that any dirt and moisture contaminate the system when it is open for repair or replacement of lines or components. Discharge the fitting completely before connecting it to the refrigerant system. The following precautions must be observed. The system must be completely discharged before opening any fitting or connection in the refrigeration system. Open fittings with caution even after the system has been discharged. If any pressure is detected when disconnecting a fitting, allow trapped pressure to bleed off very slowly.

Never attempt to rebend formed lines to fit. Use the correct line for the installation you are servicing. A good rule for the flexible hose lines is keeping the radius of all bends at least 10 times of the hose outer diameter.

Sharper bends will reduce the flow of refrigerant.

The flexible hose lines should be routed so that they are at least 80 mm from the exhaust manifold. It is good practice to inspect all flexible hose lines at least once a year to make sure they are in good condition and properly routed.

O-rings used on connections are not reusable.

7. Compressor noise check

You must first know the conditions when the noise occurs. These conditions are: weather, vehicle speed, in gear or neutral, engine temperature or any other special conditions. Noises that develop during A/C operation can often be misleading. For example: what sounds like a failed front bearing or connecting rod, may be caused by loose bolts, nuts, mounting brackets or a loose clutch assembly. Verify accessory drive belt tension (power steering or alternator).

Improper accessory drive belt tension can cause a misleading noise when the compressor is engaged and little or no noise when the compressor is disengaged.

Drive belts are speed-sensitive. In other words, at different engine speeds, and depending upon belt tension, belts can develop unusual noises that are often mistaken for mechanical problems within the compressor.

a. Adjustment

- 1) Select a quiet area for testing. Duplicate conditions as much as possible. Turn compressor on and off several times to clearly identify compressor noise. To duplicate high ambient conditions (high head pressure), restrict airflow through condenser. Install manifold gauge set to make sure discharge pressure doesn't exceed 21.4 kg/cm².
- 2) Tighten all compressor mounting bolts, clutch mounting bolt, and compressor drive belt. Check to assure clutch coil is tight (no rotation or wobble).
- 3) Check refrigerant hoses for rubbing or interference that can cause unusual noises.
- 4) Check refrigerant charge.
- 5) Recheck compressor noise as in Step 1.
- 6) If noise still exists, loosen compressor mounting bolts and re-torque. Repeat Step 1.
- 7) If noise continues, replace compressor and repeat Step 1.

SERVICE PROCEDURE

UNIT ASSEMBLY

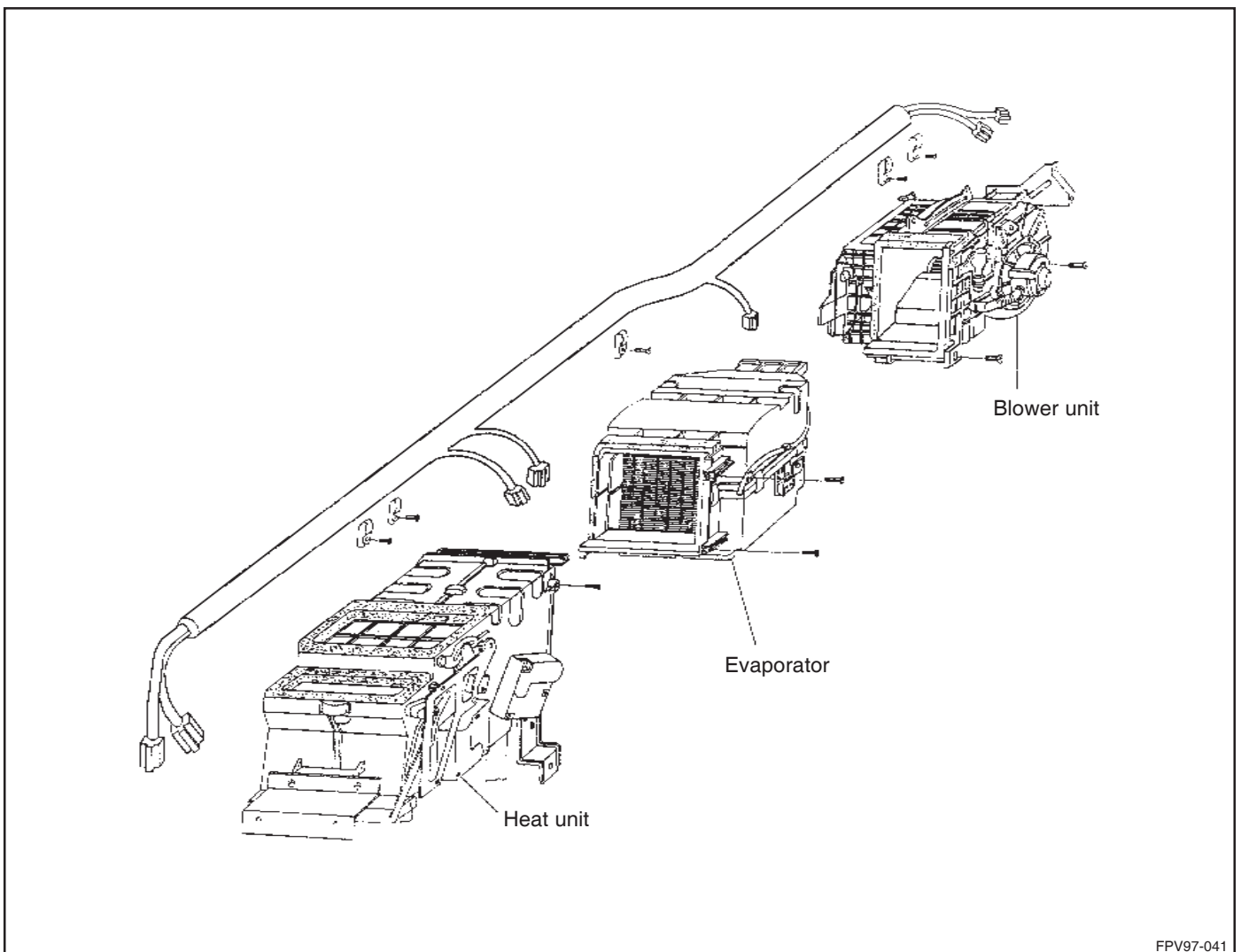
Removal

1. Heater hose
2. In-outlet refrigerant pipe
3. Mounting nut
4. Control assembly
5. Audio assembly
6. Control panel
7. Passenger side under cover
8. Instrument assembly
9. Mounting bracket

Installation

Installation is the reverse of removal.

Disassembly and assembly



HEATER UNIT

Removal

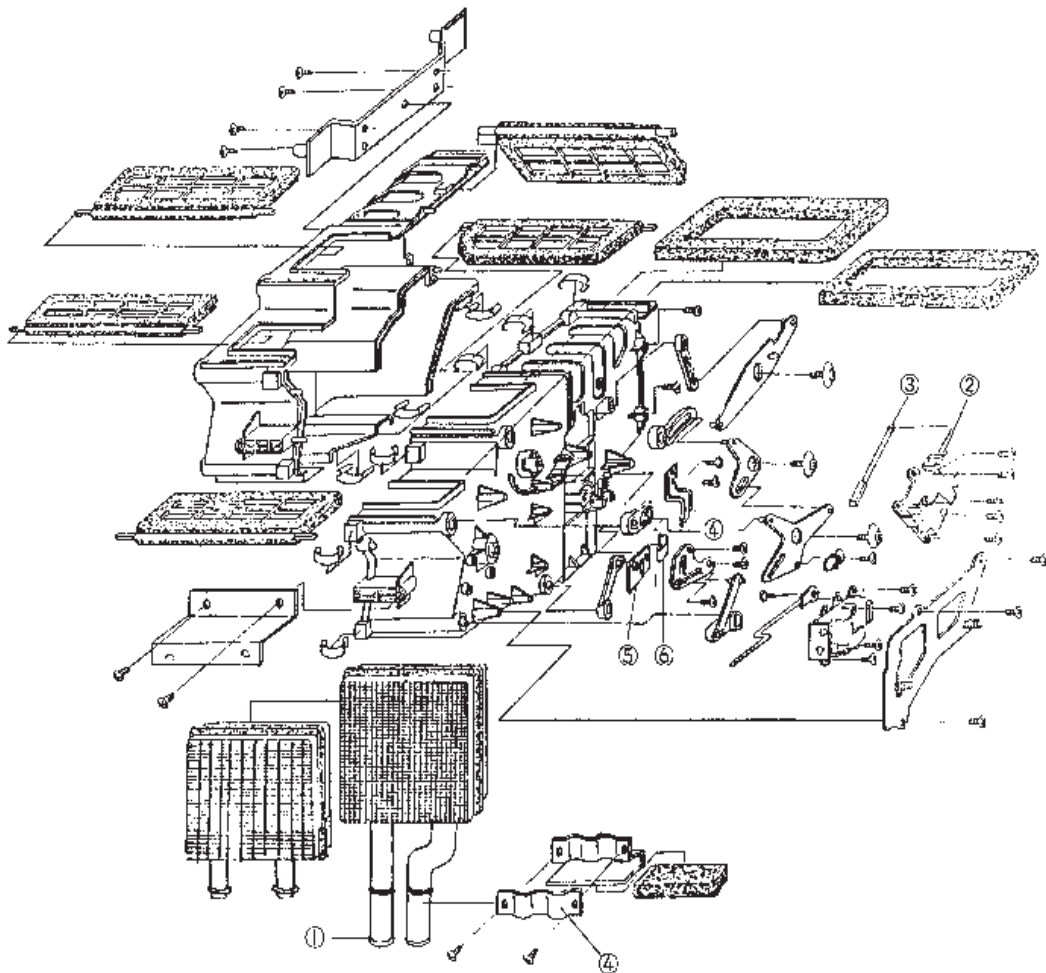
Disassemble after that heater unit removal

Installation

Installation is the reverse of removal.

Disassembly and assembly

1. Disassemble as below illumination.
2. Assembly is the reverse of disassembly.



- ①④ Heater core and mounting bracket
- ②③ Temperature actuator and coolant temperature sensor
- ⑤⑥ Wire clamp and bracket

EVAPORATOR UNIT

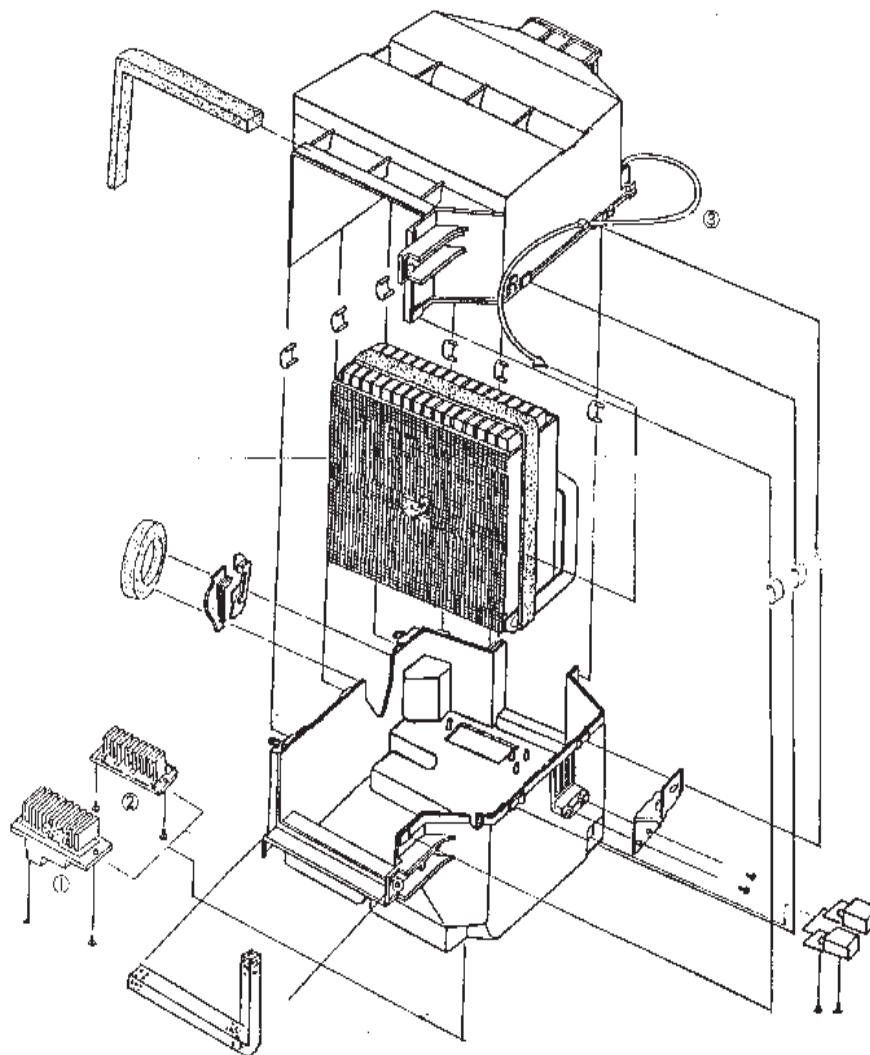
Removal

Disassemble after that evaporator unit removal

Installation

Installation is the reverse of removal.

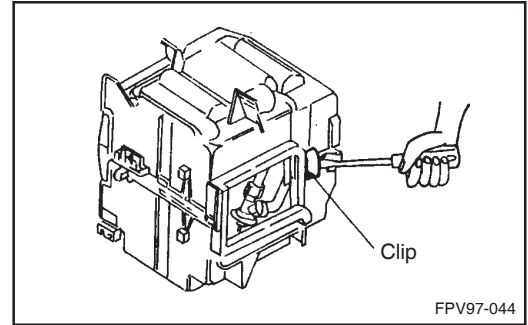
Disassembly and assembly



- ① Power transistor(for Automatic Air-con)
- ② Resistor (for Manual A-con)
- ③ Thermist (for Automatic), Resistor(for Manual)

1. Removal of case clip

To remove the case clip, insert the “-“ type screwdriver inside the clip and pull it slowly not to damage the case.

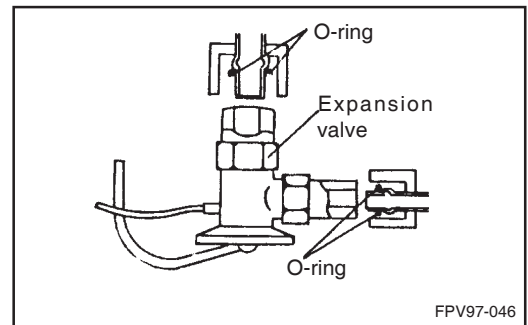
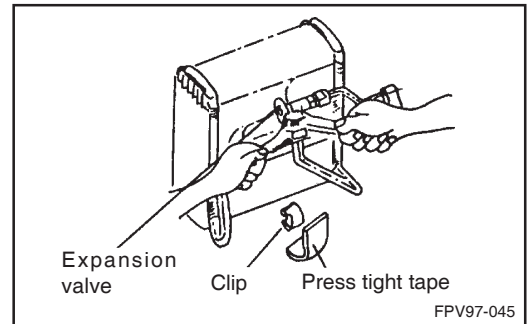


2. Removal of expansion valve

Loosen the swivel nut using 2 wrenches.

NOTE

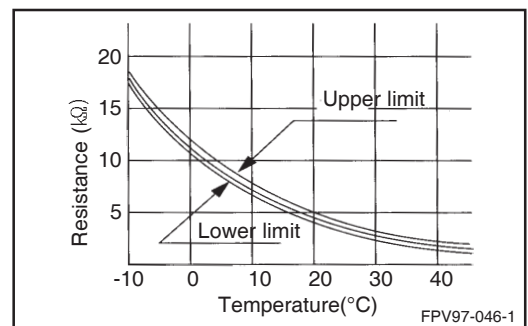
- When installing an expansion valve, be careful with the temperature sensor.
- Wrap it thoroughly with press-tight tape after fastening the clips.



3. Check any damage of O-ring and apply the refrigerant oil before connecting hose and pipes to the inlet and outlet of evaporator.

NOTE

- Check of evaporator pin thermo sensor.
Measure the resistance values of terminals more than 2 times at a different temperatures. If the value lies within the specification, sensor is normally operating.



※ When measuring resistance values, temperature condition should not exceeds the temperature range of the graph.

BLOWER UNIT

Removal

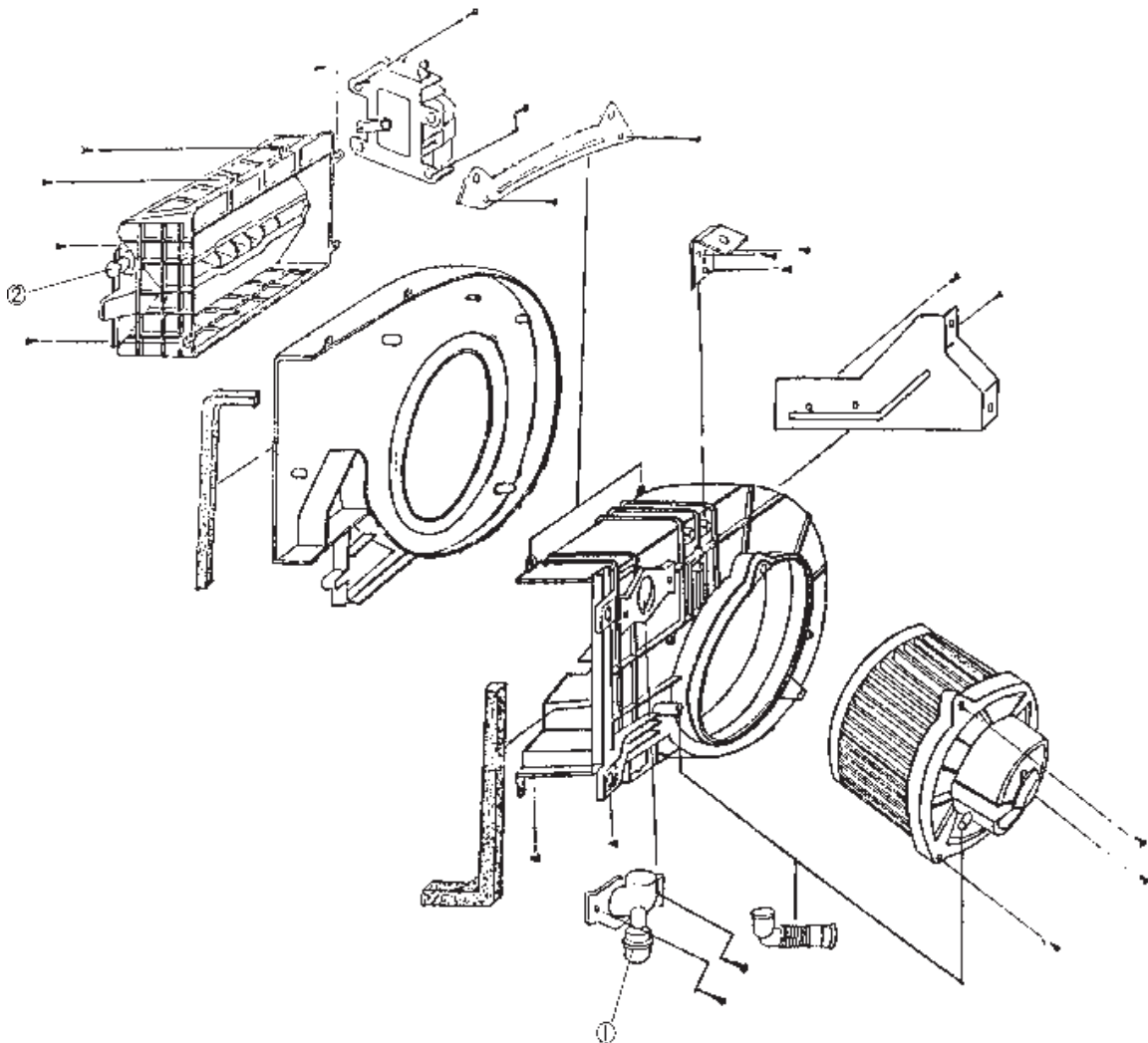
Disassemble after that blowr unit removal

Installation

Installstion is the reverse of removal.

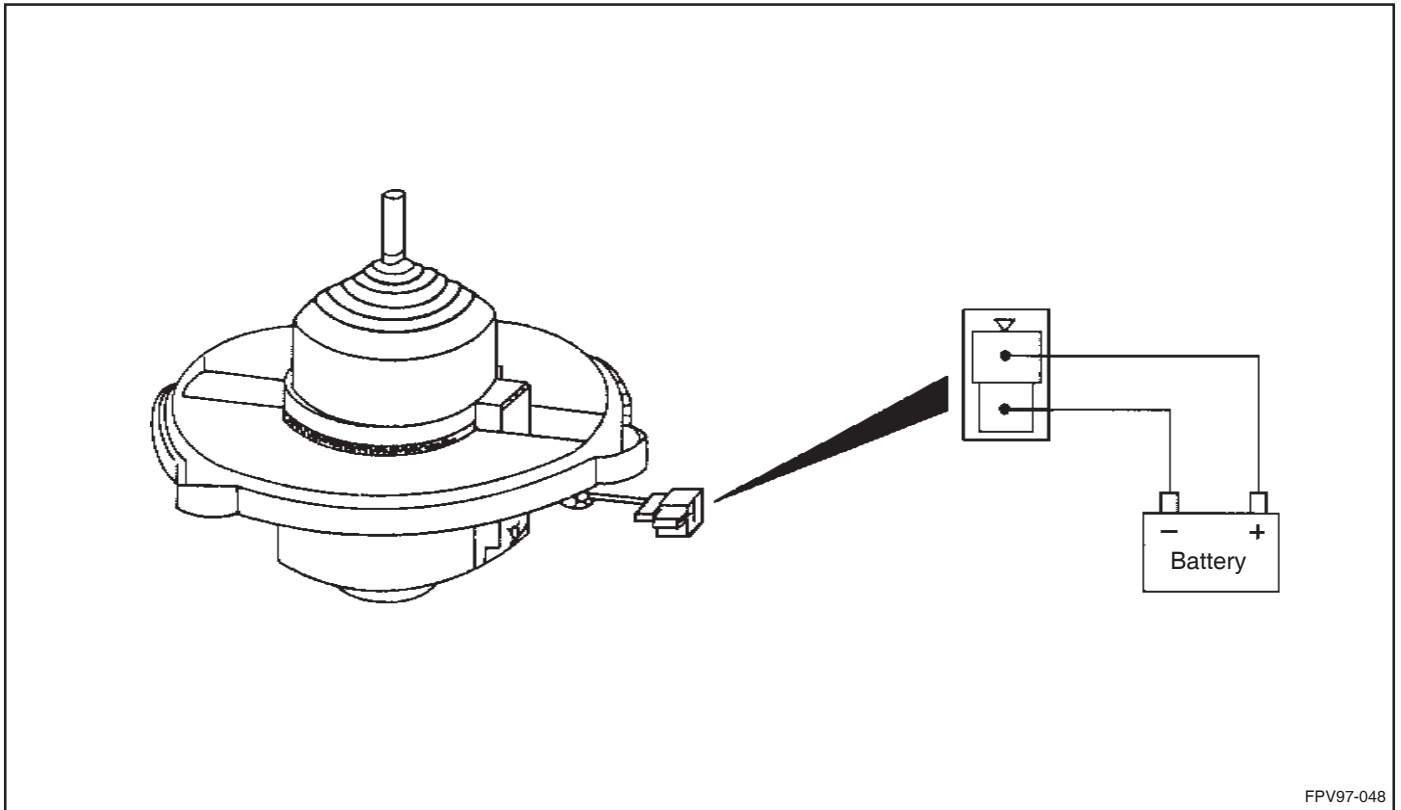
Disassembly and assembly

1. Disassemble as below illumination.
2. Assembly is the reverse of disassembly.



- ① Aspiration (for Automatic Air-con)
- ② Ambient sensor (for automatic A-con)

Check



FPV97-048

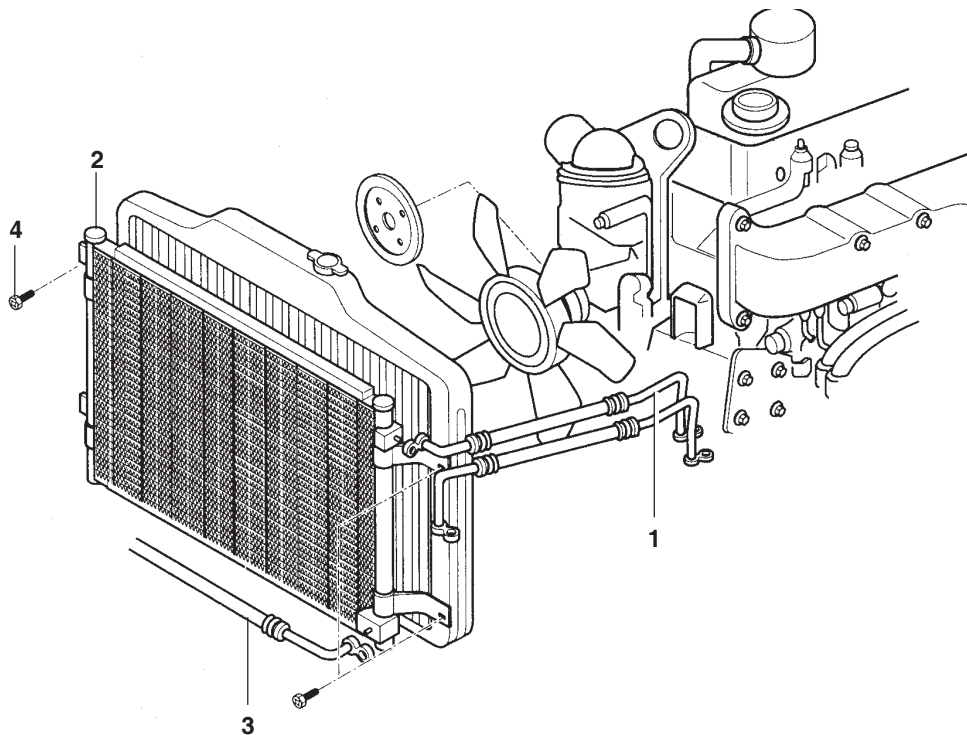
1. General check

- ① Any deformation or bending of blower motor shaft
- ② Any damage of wheel and blower case.
- ③ Operation state of air intake switch door motor.
- ④ Any malfunction of power relay

2. Blower motor assembly check

- ① Remove the connector of blower motor.
- ② Connect the connector to the blower motor directly and check whether blower motor turns smoothly.
- ③ Connect by changing the electrode and check whether the motor turns smoothly to the reverse direction.
- ④ Replace the motor if any fault is found.

CONDENSER



1. Exhaust hose assembly
2. Condenser assembly
3. Pipe assembly
4. Bolt

FPV97-050

Disassembling order.

1. Discharge hose and liquid tube (A)
2. Condenser bolts (4 ea)
3. Condenser

NOTE

- Discharge the refrigerant completely before disassembling condenser. Remove the radiator grille.

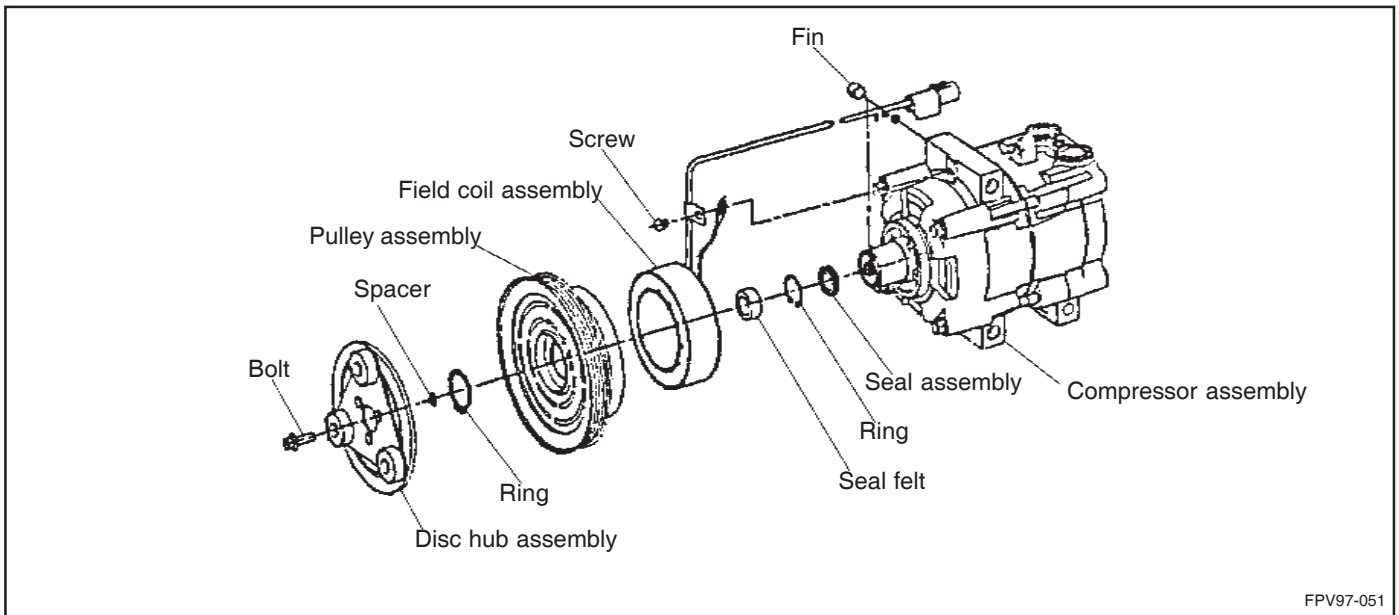
Assembly order

Assembly is done by the reverse order of disassembly.

NOTE

- Recharge the refrigerant to the specification after installing the condenser.

COMPRESSOR UNIT



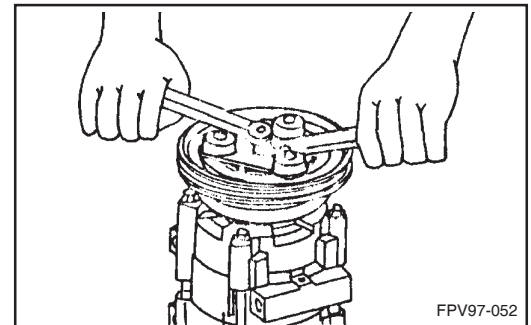
FPV97-051

Assembly and disassembly of compressor unit

1. Clutch and hub pulley

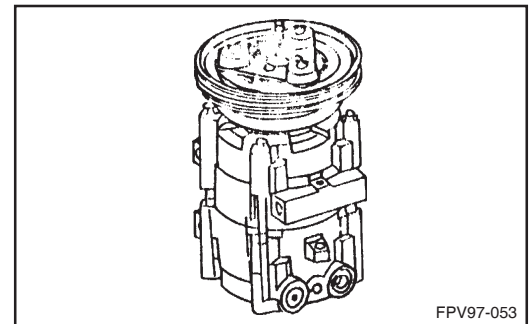
1) Removal

① Remove the clutch hub supporting bolts with the spanner wrench.



FPV97-052

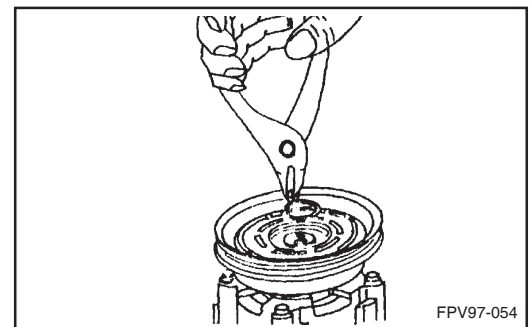
② Pull the clutch hub and shim from the compressor shaft. When the hub is not pulled from compressor shaft, insert the bolt of 8 mm into the hub shaft hole and remove the shaft.



FPV97-053

③ Remove the pulley supporting snap ring

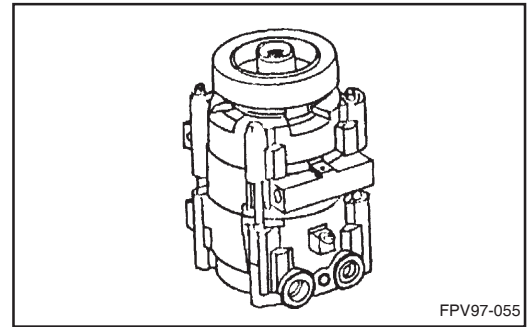
④ Remove compressor pulley and bearing assembly



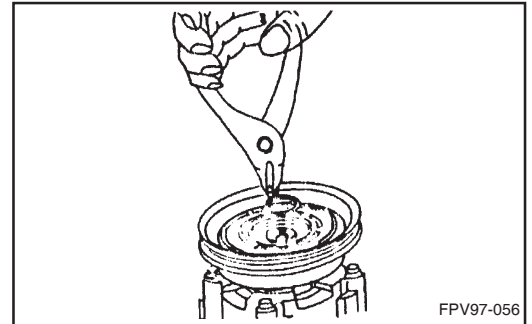
FPV97-054

2) Installation

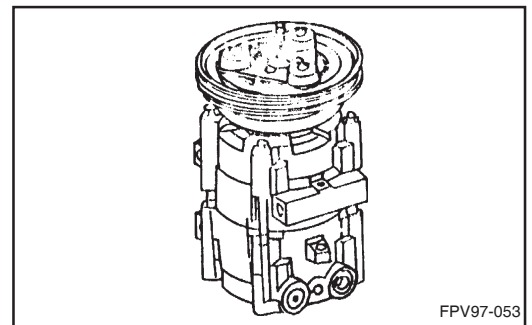
- ① Clean pulley bearing of compressor head to remove any dirt or rust.
- ② Install the compressor pulley and bearing



- ③ Install the pulley snap ring as the slanted part faces outer direction.



- ④ Put one spacer shim of specified thickness inside hub spool line opening, and slide down the hub to compressor shaft end

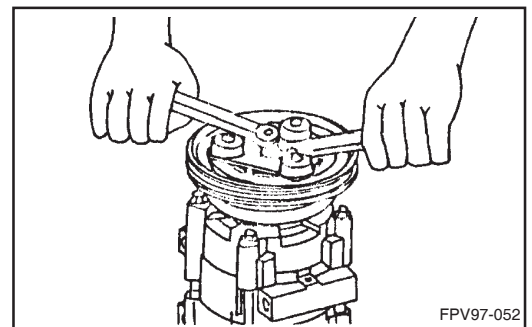


- ⑤ Put the new hub-supporting bolt on the compressor shaft end and tighten it with the specified torques.

Tightening torque	1.1~1.4kg·m
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NOTE

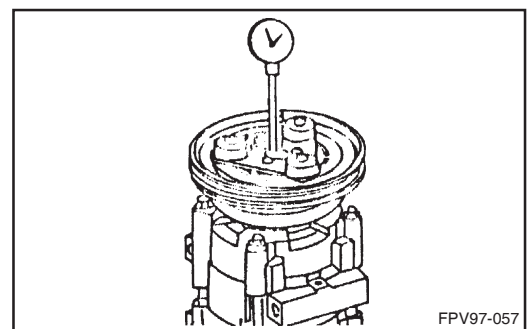
- **Do not turn on the air-con.**



- ⑥ Check the clutch air gap between clutch hub and pulley faces with dial gauge, and compare it with the specification. Check it 3 times around pulley.

Items	Standard
Clutch air clearance	0.4~0.7mm

- ⑦ If the clutch air gap exceeds the specification, adjust the air clearance to the specification by trying the different shims.



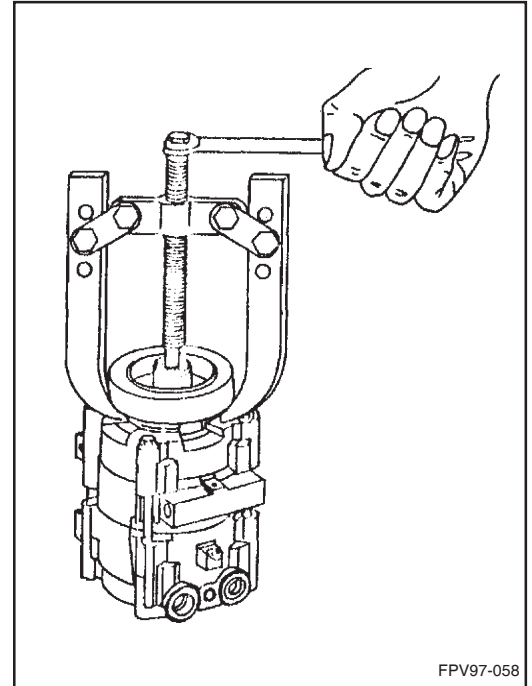
2. Clutch field coil

1) Removal

- ① Remove clutch hub and pulley
- ② Install the shaft protection tool at the compressor opening
- ③ Install the compressor pulley as shown in the figure. Position the puller screw end at the concave part of shaft protector and position the pulley jaw around the bottom of the field coil.
- ④ Remove the coil out of compressor rotating the screw with wrench.

NOTE

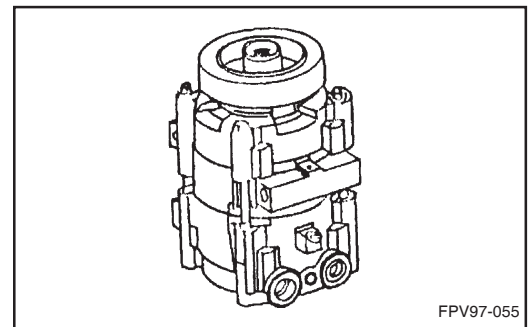
- Do not turn on the air-con.



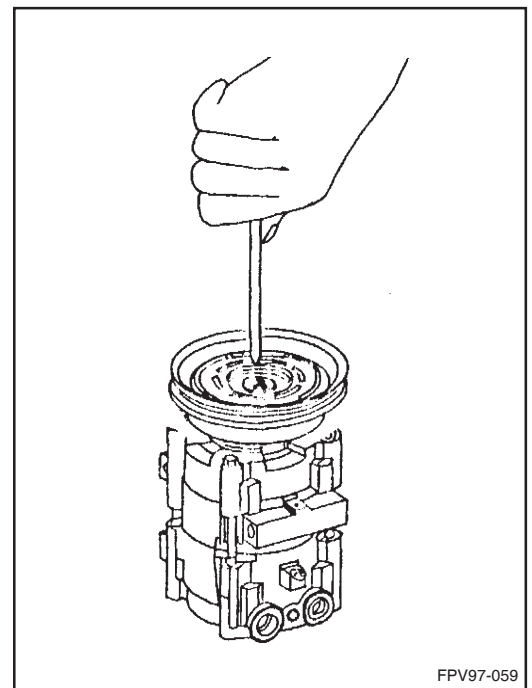
FPV97-058

2) Installation

- ① Clean the coil installation part of front head.
- ② Position the compressor upright and put the coil at the original position of the compressor front head. Check whether electric connector of clutch coil is positioned correctly.
- ③ Put the coil compression tools at the inner circle of compressor nose and field coil.
- ④ Put the 2 pullers of 8 inches at the compressor and compression tool respectively. Puller jaw should hold tight the back of the installation part of front compressor, and screw should be positioned at the center of compression tool.
- ⑤ Tighten the screw with wrench as installing the coil tight at the compressor front head.
- ⑥ Install clutch hub and pulley to the compressor.



FPV97-055



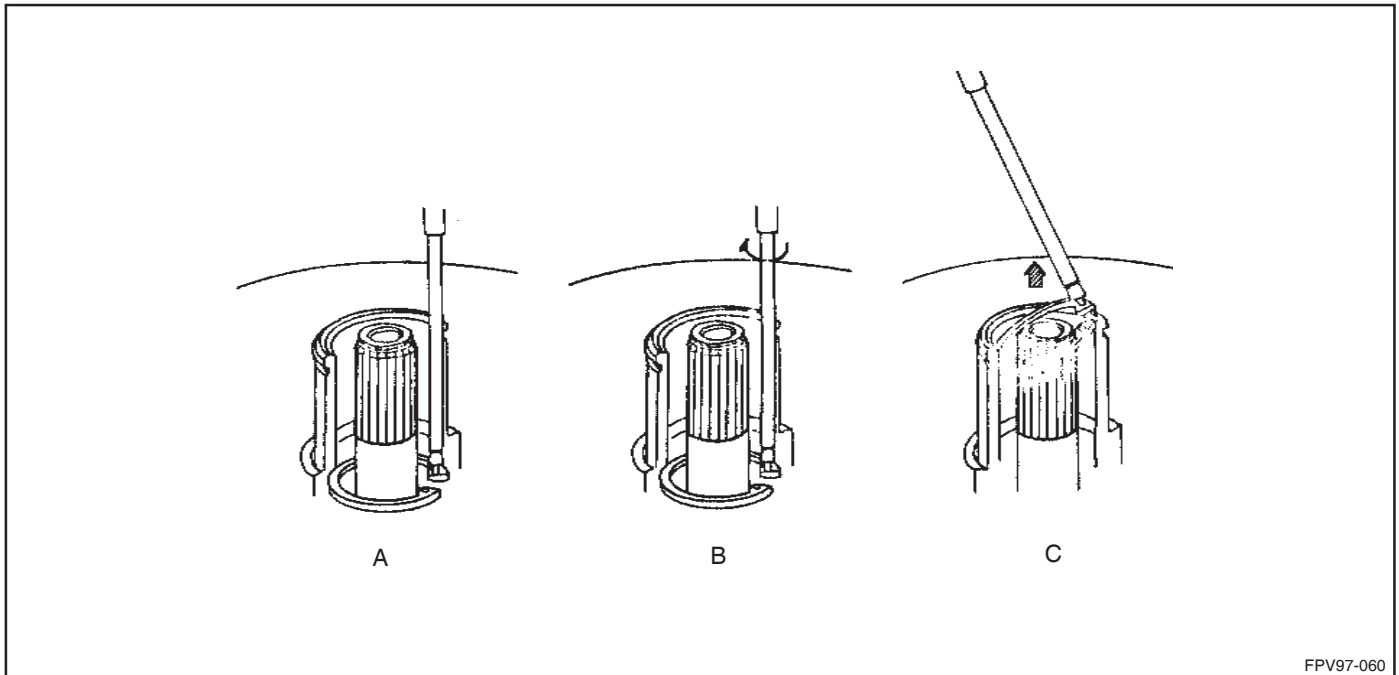
FPV97-059

3. Shaft seal

Before replacing the compressor seal, remove the compressor from the vehicle and then discharge the refrigerant.

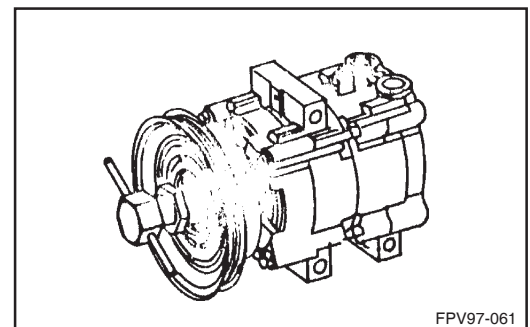
1) Removal

- ① Remove the clutch hub from the compressor
- ② Remove shaft seal felt from the compressor nose using proper equipment.
- ③ Blow out the dirt using the low-pressure compressed air, and wipe off the compressor nose in and out with no shaggy clothe.
- ④ Remove shaft seal supporting snap ring from inside of compressor nose with snap ring remover as shown below.



- a. Insert one end of the snap ring remover into a hole of the snap ring.(Figure A)
- b. Turn the ring remover as the tool end snap ring hole approach to the compressor shaft.(Figure B)
- c. Lift the snap ring remover quickly by leveraging the end onto the nose, and remove the snap ring. (Figure C)

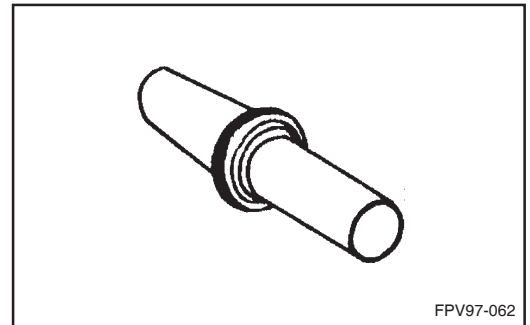
- ⑤ Put shaft seal remover at the compressor shaft and slide it into compressor nose and down to shaft seal. Grip the hexagonal part with bare hand and turn the tool handle clockwise and insert tool end into inside the seal. And then pull out the shaft seal form the compressor.



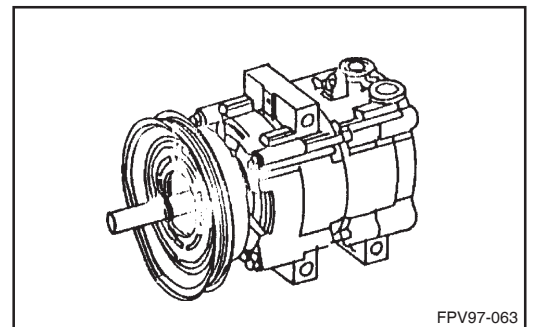
2) Installation

- ① Prepare the new shaft seal kit. Unpack it with care and check the plastic shaft seal protector whether machined parts are damaged or rough.
- ② Wipe off the shaft and seal pocket inside the compressor nose with no shaggy clothe.

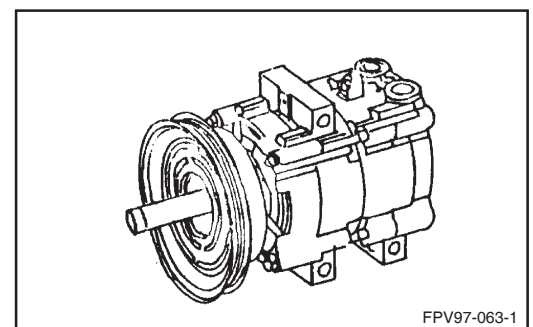
- ③ Dip the shaft seal protector and seal into the clean refrigerant oil, and then put the seal onto the protector as the seal rib faces bigger end of the protector.



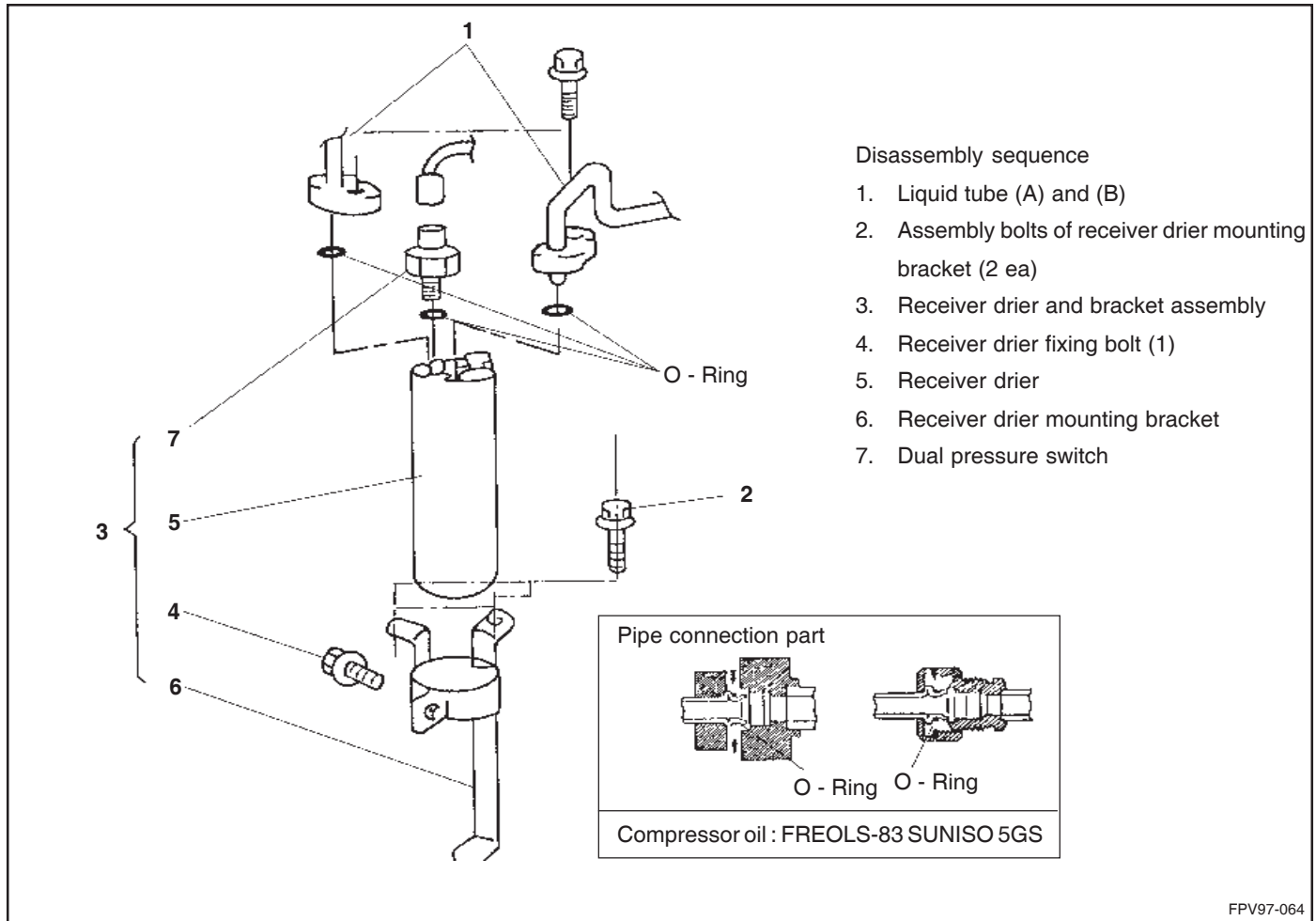
- ④ Install the seal protector installed with shaft seal at the compressor shaft end.



- ⑤ Install the shaft seal installer at the shaft seal protector end, and then slide the shaft seal slowly into compressor to be in a place.
- ⑥ Remove the seal installer and seal protector form the compressor
- ⑦ Put a new seal supporting snap ring on the compressor nose, and then insert the snap ring into the groove with the remover.
- ⑧ Turn the shaft about 10 revolutions with clutch hub, and perform leak test the seal installation part.
- ⑨ Install the new felt at the compressor nose.
- ⑩ Install the compressor clutch hub



RECEIVER DRIER ASSEMBLY



Disassembly sequence

1. Liquid tube (A) and (B)
2. Assembly bolts of receiver drier mounting bracket (2 ea)
3. Receiver drier and bracket assembly
4. Receiver drier fixing bolt (1)
5. Receiver drier
6. Receiver drier mounting bracket
7. Dual pressure switch

NOTE

- Discharge the refrigerant thoroughly, before the disassembly of receiver drier.

Check

Assembly order is the reverse of disassembly order

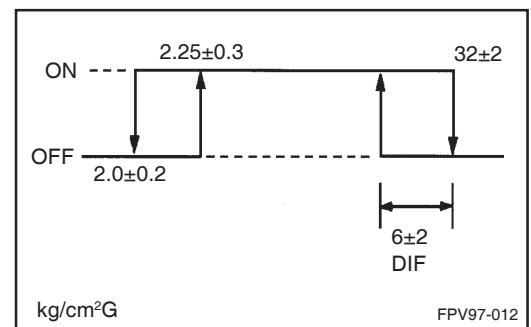
NOTE

- Recharge the refrigerant with the specified quantity after receiver drier installation.

Check

1. Dual pressure switch check

Measure the pressure at the high-pressure side. When dual pressure switch is "On" as shown in the figure, if there is continuity between pressure switch terminals, then the system is normal. If there is no continuity, replace the switch.



REFRIGERANT LINE

Removal and installation method

1. When removing, please refer to the cautions in removal below
2. When installing, please refer to the cautions in installation below.

(Cautions in removal)

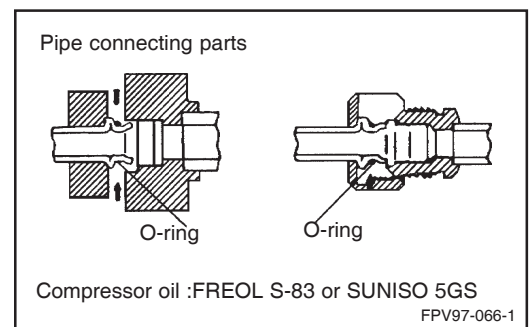
- Discharge the refrigerant thoroughly
- When removing the tubes and hoses, cover the hole so that no dust and dirt get into them.
- When removing, be careful not to damage the other parts like wiring and so on.

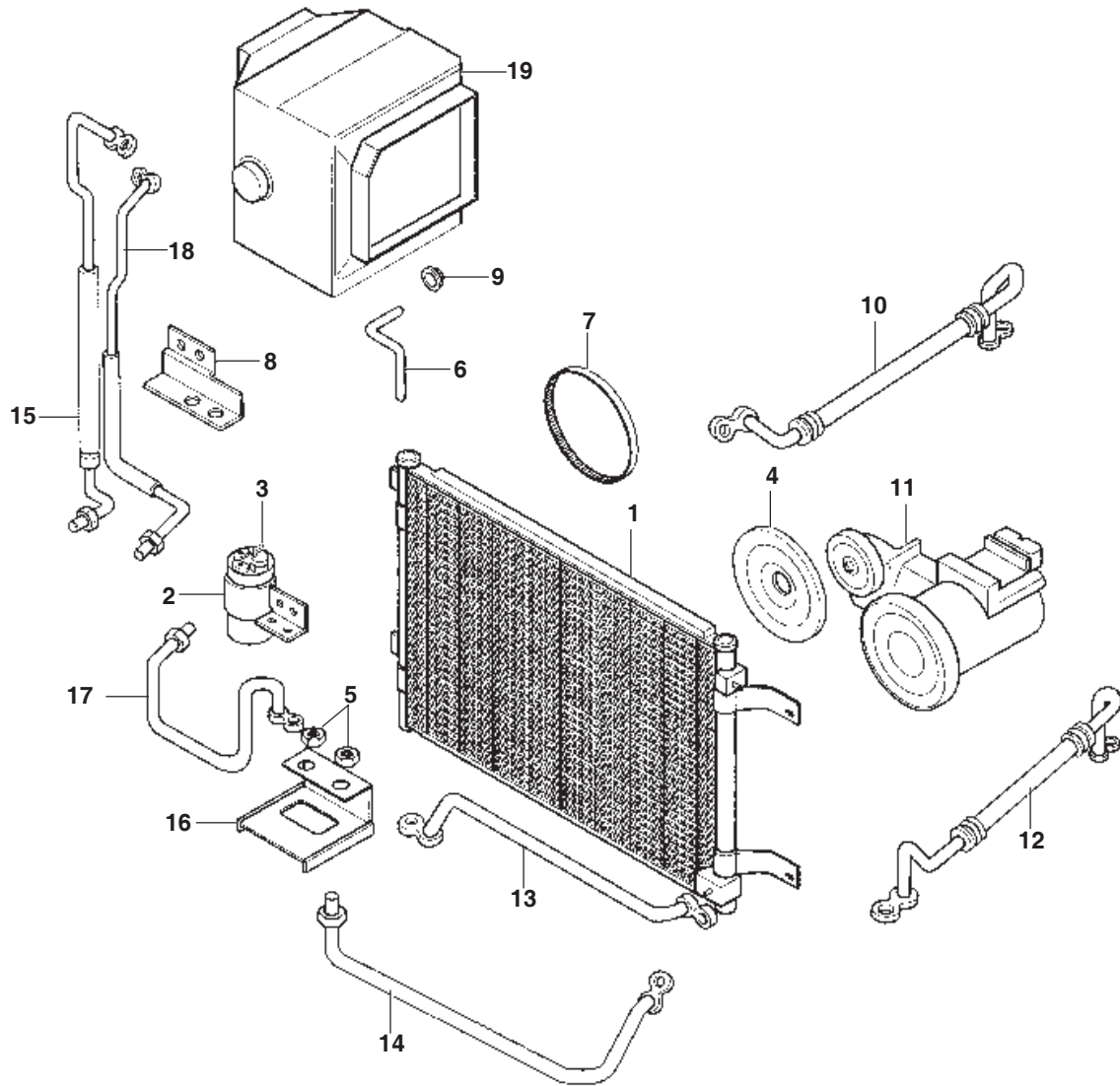
(Cautions in installation)

- Replace the O-ring at the connecting parts with new one, and apply the refrigerant oil.
- Check the O-ring whether it is at the right place and assemble.
- The designated torque on "P" must be applied.
- Swivel nut and joint flange type should be tightened tentatively with bare hands first, and then fastened tight with the tool.
- Tighten the connecting part first and then clamp it.
- Be careful not to cause any deformation, and check any interference with other parts after installation.
- Recharge the refrigerant with the specified quantity after installation.
- Check the air-con performance.

Removal order

1. Discharge hose
2. Liquid tube (A)
3. Suction hose
4. Liquid tube (B)
5. Liquid tube (C)
6. Receiver drier and bracket assembly
7. Receiver drier mounting bracket
8. Receiver drier
9. Dual pressure switch





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|---------------------------|--------------------------|---------------------------|
| 1. Condenser unit | 8. Pipe mounting bracket | 15. Suction pipe |
| 2. Receiver drier bracket | 9. Hose grommet | 16. Pipe mounting bracket |
| 3. Receiver drier | 10. Discharge hose | 17. Liquid hose |
| 4. Crank pulley | 11. Compressor | 18. Liquid pipe |
| 5. Nut | 12. Suction hose | 19. Evaporator unit |
| 6. Drain hose | 13. Liquid pipe | |
| 7. V-belt | 14. Suction hose | |