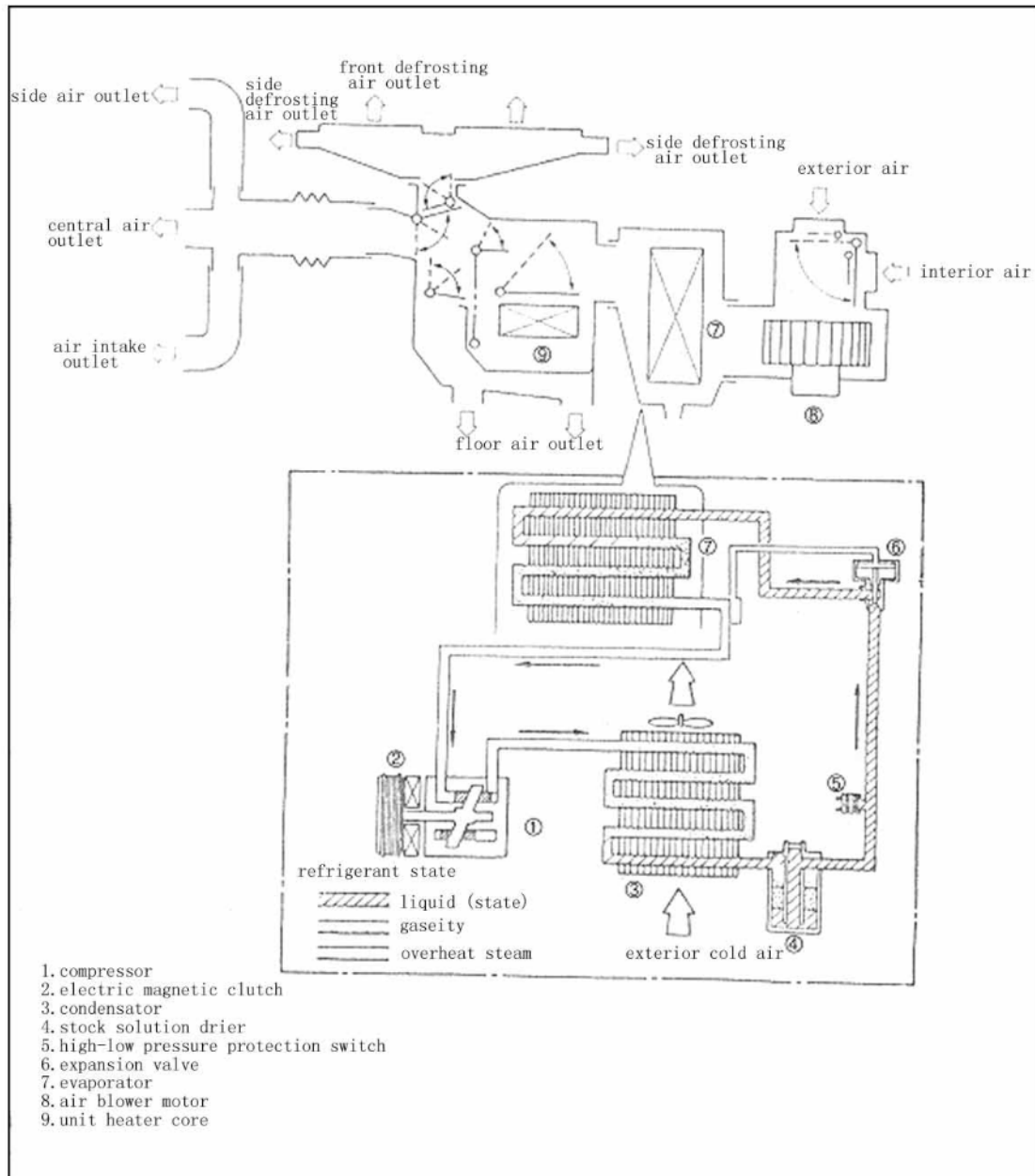


Chapter7 Air-conditioning

Section 1 General

I. Major parts of the air-conditioning and refrigerant flow chart.



II. Function descriptions of each part

1. Compressor

The compressor serves to compress the refrigerant that is evaporated as gaseous one in evaporator, so the compressed gaseous refrigerant is fed by force into condenser in which it is changed to liquid form, heat resulted from vaporization of liquid refrigerant can be reused. Compressor used in auto air conditioning can be classified as reciprocating, rotating blade and oblique disk style. This car adopts oblique disk style compressor that is characterized by little vibration and good durability. As the pictures show:



Assembly drawing for the compressor



Inside structure of the compressor1



Inside structure of the compressor 2



Inside structure of the compressor3

2. Electric magnetic clutch

In case of engine operating, when starting up air conditioning, the electric magnetic clutch engages, compressor runs. Otherwise, the electric magnetic clutch disengages,

compressor does not run. .

It is recommended to use high power electric magnetic clutches.



Diagram for the clutch fitted on the compressor

3. Condensator

A condensator serves to change the high temperature and high pressure refrigerant in gaseity to liquid one by taking away the heat of the refrigerant in gaseity by force.

With similar structure as radiator, the condensator is installed at the most front of the car so as to upgrade heat dissipation rate and is forcedly cooled by cooling fan.



4. Receiver drier

Stock solution drier has 3 following functions:

A)A liquid reservoir is equal to a temporary buffer for liquefacient refrigerant in condensator, it used to provide evaporator with liquefacient refrigerant as per the need of cooling load.

B)The drier serves to remove moisture and contamination in the refrigerant with the filter and desiccant sealed in itself.



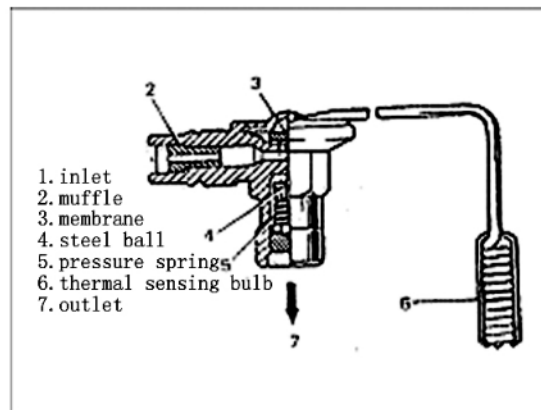
dryer

5. High-low pressure protection switch

The high-low pressure protection switch is used for control. When there is abnormal pressure variation occurring in circular refrigerant, the switch will cut off the circuit of the electric magnetic clutch and the condensator's fan to stop the compressor.

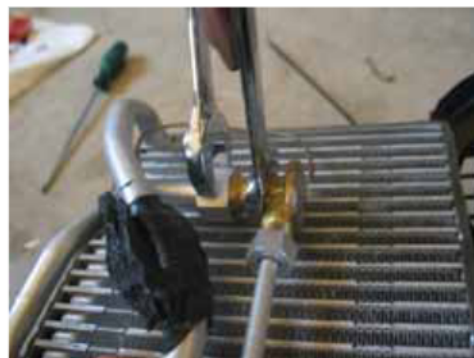
6. Expansion valve

The expansion valve ejects the liquid refrigerant from a slim hole that pass through stock solution drier to expand it suddenly and produces low temperature and low pressure pulverization refrigerant.



7. Evaporator

The cooled pulverization refrigerant makes the temperature inside car lower through evaporator. Meanwhile the refrigerant turns to the thermal gaseous refrigerant and is supplied into the compressor. As far as function is concerned, evaporator is directly contrary to that of condensator (when refrigerant enters evaporator it is liquid. While it is in gaseity when exit.)



III. Function of each control element

1. Relay (condensator' fan/electric magnetic clutch)

The relay is used to control condensator fan motor and electric magnetic clutch respectively. As far as the air conditioning (compressor) is running, the condensator fan will work continuously.

2. Electric magnetic clutch

The electric magnetic clutch engages so as to start up the compressor only when air conditioning is turned on. The electric magnetic clutch is controlled by ECU.

3. Thermistor of the evaporator

When the evaporating temperature falls to 1℃(34° F) or below, the radiator fin of the evaporator will frost or freeze, which then results in air flow volume decreasing and ineffective refrigerating. Thermistor is a kind of sensor for avoiding frosting and icing. The thermistor fitted in the evaporator converts the evaporating temperature into resistance value which then is sent to amplifier of the air conditioner.

4. Cooling liquid (water) temperature sensor

When the temperature of the cooling water is too low, the ECU will stop the compressor by disconnecting the relay of the compressor clutch.

The high-low pressure protection switch is used for control. When the pressure of the circular refrigerant becomes too low or too high due to leakage or insufficient, the switch will turn off the compressor.

This high-low pressure protection switch is fitted in the high pressure pipe behind the stock solution drier.

5. Air conditioner on/off control

Refrigerant high pressure:

Over 3140kpa

(32kg/cm², 455 psi).....off

Below 2250kpa

(26kg/cm², 370psi)...on

refrigerant lower than:

below 196kpa

(2.0 kg/cm²,28.4psi)...off

over 226kpa

(2.3kg/cm²,32.7psi)...on

Engine cooling water temperature

Over 110(230℃)...off

Below 103(230℃)...on

When starting engine makes the engine start...off

Evaporator temperature:

When the air conditioner's switch on

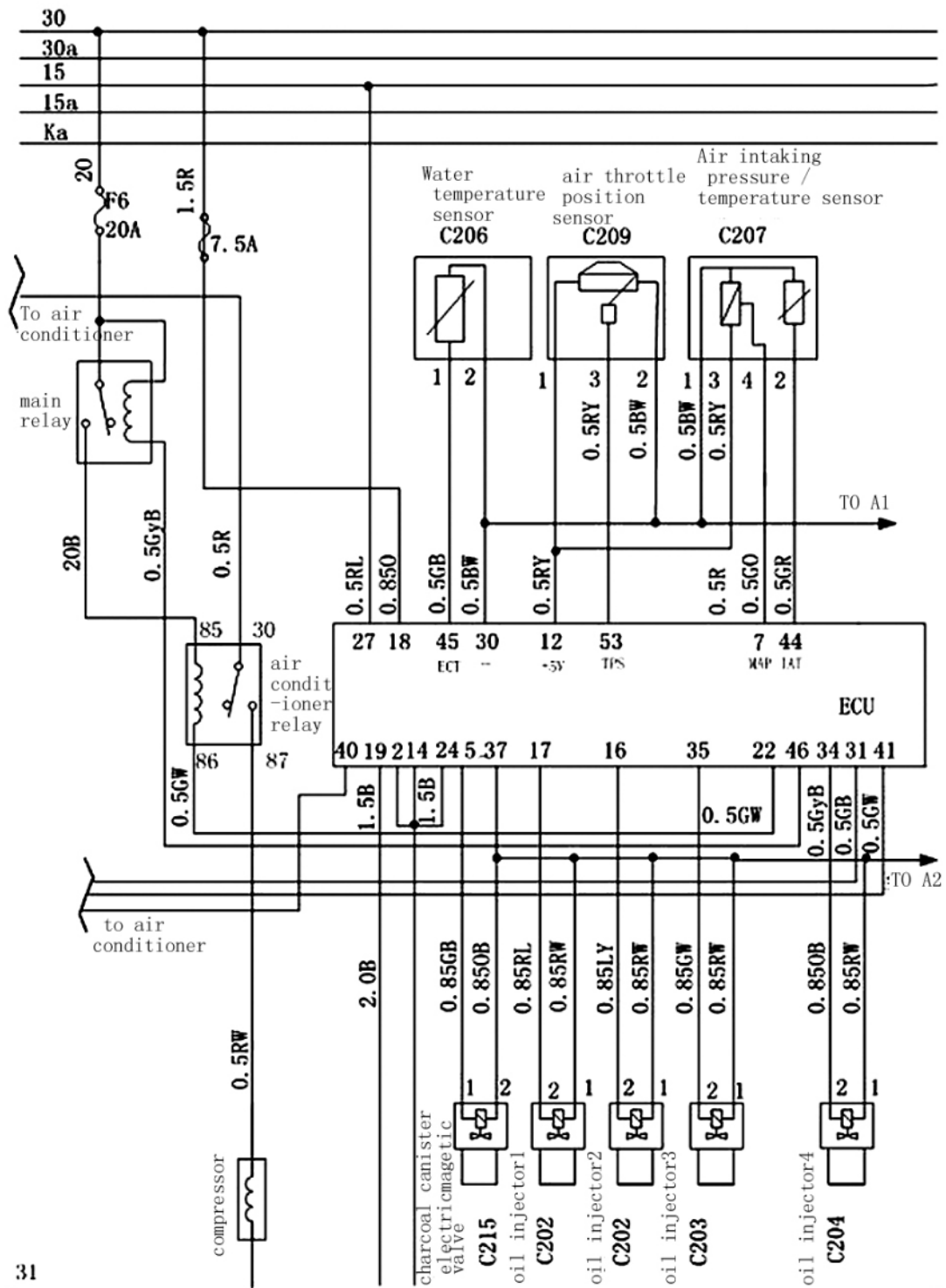
Over 2.5(36.5°F)...off

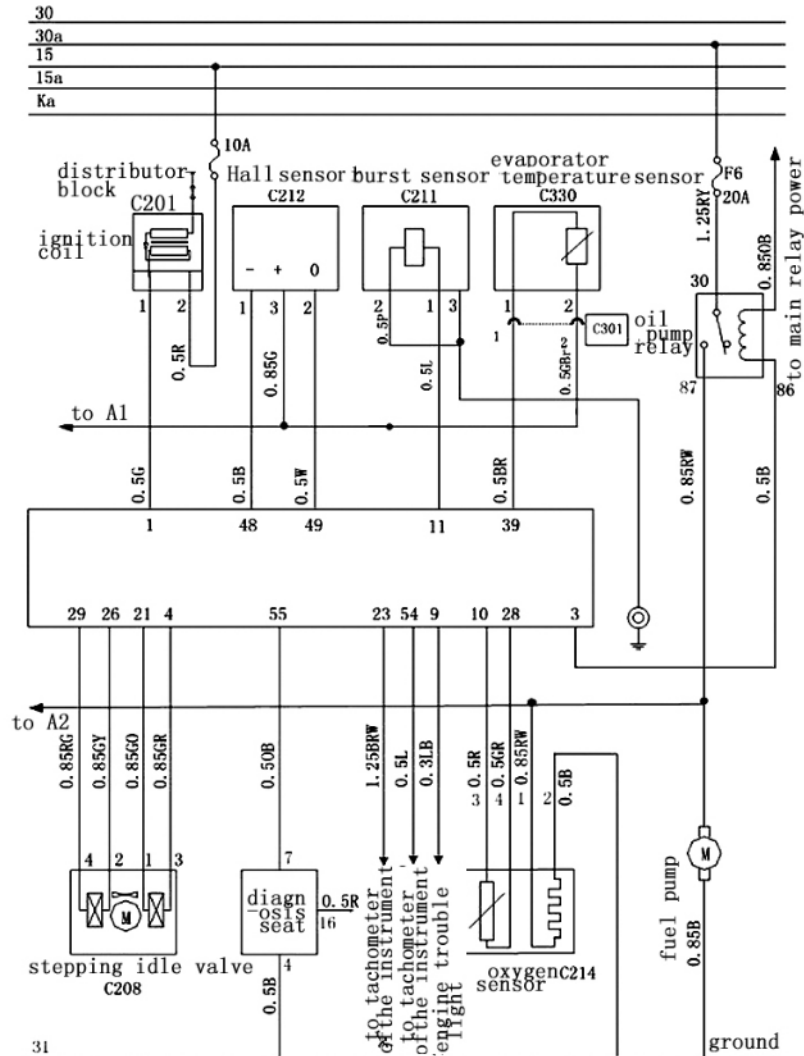
Below 4.0(39.2°F)...on

When accelerating quickly

(air throttle opening is up to 90% within 10 s)

IV. Engine computer air conditioning circuit diagram





1、 principle of operation:

When startup a car, the ignition cell (+)12V will supply power to ECU, duty relay and the main relay coil respectively, the duty relay closes and ECU makes the main relay close after receiving the ignition signal.

+12V from the duty relay switch is divided into two lines. One line supplies power to defroster via F15(15A) to the back defrosting switch and grounds by connecting the back defrosting switch indicator. When the defrosting switch is on the back defroster will work normally. Connects the switch of the air blower and select different gear, the air blower will work at that gear. When close the air blower switch and the A/C switch signal will be sent to ECU, then the air conditioner relay operates after the ECU receiving the signal and now the compressor works normally.

The ECU makes the low speed relay operating after receiving the A/C switch closed signal, then the fan begins to work. When the water temperature is higher than certain degree, ECU will make the fan's high speed relay operating automatically, then the high speed fan works.

The pressure switch in this circuit is fitted on the side of the high pressure loop (i.e. drying bottle mouth) of the air conditioning cooling midum loop, its function is to protect refrigeration loop when abnormal pressures occurs due to over-charged refrigerant or gas leakage. Pressure switch signals are sent to the ECU that will stop the compressor by disconnecting the air conditioner relay when the pressure switch disconnects for some reasons.

The temperature sensor in this circuit is an electric one (thermistor), the resistance value of which changes as temperature changes. So the thermistor connects or disconnects the electric magnetic clutch, drive or stop the compressor by sensing air temperature blew by air conditioner. Therefore it can control the interior temperature and avoid frosting to make a constant temperature.

The ECU controls the compressor's electric magnetic clutch and condensator fan motor on basis of detecting the running condition for engine and signals from sensors. ECU will connect air conditioner and condensator fan only when the following conditions are met:

Engine rotate speed: 600-6000r/min

Engine cooling temperature:below 110°C

Evaporator temperature:over 4°C

Refrigerant pressure switch:on

AC switch and the air blower switch:on

Section 2 Safety Cautions for Air conditioning System

1. Do not deal with the refrigerant in closed place or colse to fire.
2. Be sure to take safety goggles.
3. Take good care of the refrigerant. Avoid the liquid refrigerant to splash into your

eyes and skin. If it occurs, wash with cooled water.

Warning: (a) Do not wipe your eyes or skin.

(b) Clean the oil on your skin properly

(c) Go to hospital for professional treatment at once

4. Do not heat container or put it close to fire.

5. Put the reservoir carefully and avoid it to be impacted with sharp object.

6. Refrigerating system used outdoor must have enough refrigerant, otherwise the compressor will burn due to thus insufficient lubricant oil. So you should take care of such case.

7. Do not turn on the pressure combined vaccum valve when compressor is running.

If the high-pressure valve is turned on the refrigerant will flow at inverse direction and result in breakdown of the charging cylinder body, therefore only the low pressure valve can be switched.

8. Do not make system with refrigerant overloaded.

If the refrigerating unit is overloaded, then a series of problems will take place.

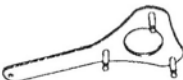
For example, insufficient refrigeration, reduction of fuel efficiency, overheating of engine and etc.

9. Spare control system

This model of car is equipped with spare control system, such as air bag in drive cab and fore carriage.

In maintenance, in case of operation not in order, the spare system will unfold, thus resulting in series of accidents. So maintenance workers should read carefully precautions of the air bag before operating (including movement, installation, check and removal for air bag).

Section 3 Items of Tools and Devices

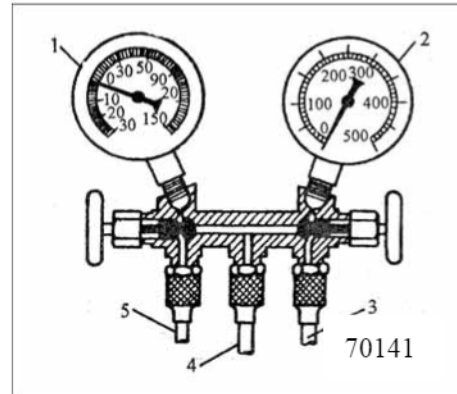
Maintenance kit for air conditioner		
Spare valve for discharging refrigerant		
Refrigerant charge meter		
Refrigerant charge hose		green
Refrigerant charge hose		blue
Refrigerant charge hose		orange
Disconnecting valve		
Set of charge hoses with disconnecting valve		if disconnecting valves are needed, please order (in set)
Disassembly tool for magnetic clutch		
Retainer for magnetic clutch		
Spring clasp clamp		
Spring clasp clamp		
Lip sealing protection		

Section 4 Operating Method for the Manifold Pressure Meter

As shown in the figure, the manifold pressure meter is the most common meter used for air conditioning unit maintenance. The low-pressure meter can show both pressure

and vacuum. The vacuum range is $0-5 \times 10^5 \text{pa}$ ($0-760 \text{mmHg}$), the pressure scale starts from 0 and range is over $4.2 \times 10^5 \text{pa}$ (approximate 4.2kgf/cm^2). The high-pressure meter scale starts from 0 and range is over $21.1 \times 10^5 \text{pa}$ (approximate 21.1kgf/cm^2). These two meters are fitted on the same seat, each end of which has a manual valve and under which there are three path joint.

Joint of low-pressure meter, that connects to low pressure pipe connector through a hose.



Manifold pressure meter

1- Lowe-pressure meter(blue) 2-high-pressure meter(red) 3- hose at high pressure side (red) 4- hose for maintainance (yellow) 5- hose at low pressure side (blue)

Joint for high-pressure meter connects to the high pressure pipe with a hose. The middle joint connects to the vaccum pump or refrigerant tank with a hose. Two manual valves combined with three hoses make the manifold pressure meter have four functions(as shown in below diagram)

Functions of the manifold pressure meter

positions of the high and low pressure valves	functions
high and low pressure valves off	Fault diagonosis for the refrigeration system
Low pressure valve on, high pressure valve off	Filling refrigerant or refrigerant oil in refrigeration system
Low pressure valve off, high pressure valve on	Check leakage of the refrigeration system and charge liquid quickly
high and low pressure valves on	Evacuate the refrigeration system

Note: high and low pressure valves are on, which means that the two meters are connect ed to refrigeration system and middle pipe respectively; high and low pressure valves are off, which means that the two meters are disconnected to the middle pipe but connected to refrigeration system.

Secion 5 Operating Method of the Recovery Device for Refrigerant

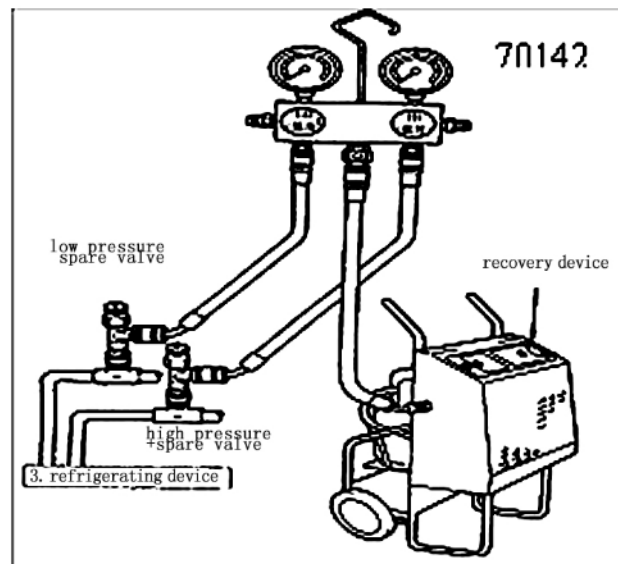
I. Recovery refrigerant from the refrigerating device

When refrigerant is discharged from the refrigerating device at following cases, a recovery device should be used to recovery refrigerant:

Before changing parts on refrigerant pipe.

When water vapor or air enter refrigerant pipe.

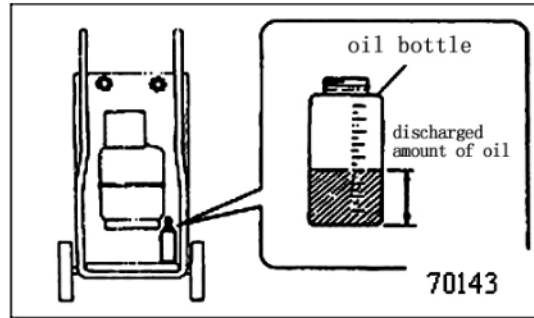
When refrigerant is overcharged.



Note:

(1) when using recovery device, you must follow the requirement in the specification.

(2) after recovery is finished, the discharged oil from compressor must be measured in order to charge the same amount of oil to refrigerating device later.



II. Operating method for recovery device

1. The manifold pressure meter set is installed on the spare valve.
2. Refrigerant is recovered from the refrigerating device.
 - (1) The middle hose is connected to recovery device.
 - (2) To operate recovery device.
 - (3) To open the manual high pressure and low pressure valves on the manifold pressure meter set.
3. Stop recovery device after recovery is finished.
4. The manifold pressure meter set is disassembled from the spare valve.

Section 6 Installation of Air-conditioning System

I. Preparation before installation

The following items should be checked and adjusted before installation:

- (1) engine ignition timing
- (2) engine cooling system
- (3) accumulator electrolyte and charging system
- (4) carriage seal
- (5) fuel system
- (6) general conditions of vehicle

II. Preparation for parts of air conditioner

Parts should be put according to the installation order after the package box for parts is open. At the same time, you must make sure that no part is missed or bad. When installing air conditioner, you must protect the fenders and seats with supplementary mats.

Cautions during installation:

- (1) the negative lead of the accumulator should be removed.
- (2) the air conditioner parts are fixed on engine with the supplied bolts according to required torque.
- (3) when pipes and wire bundle for air conditioner are installed, pipe and wire arrangement should be right in order to avoid to be interfered with surrounding parts.
- (4) when pipes and hoses are connected, 2-3 drops of refrigerant should be dropped on the pipe socket nut.
- (5) two wrenches should be used when pipe joints are fixed or unscrewed to make the pipe line be supported during fixing or unscrewing.
- (6) the pipe socket nut should be fixed according to the required torque.
- (7) plugs at connected places should not be removed before all parts are not installed properly.

Note: The compressor is charged with a small amount of refrigerant before delivering to avoid the seal corruption. So it is necessary to remove the plug of the compressor carefully to let the refrigerant flow slowly.

- (8) when using HFC-134a (R-134a) refrigerant, you must take the safety goggles and work carefully to avoid it to splash to your skin.
- (9) HFC-134a (R-134a) can be put in hot water and keep it about 40°C (100°F).
- (10) The air conditioning system should be installed according to the specification delivered with the spares.

Section 7 Recovery, Evacuation and Charge

I. Recovery of refrigerant

Refrigerant recovery unit must be used when the refrigerant for air conditioning is discharged. Directly discharging refrigerant into atmosphere will bring harmful effects on environment.

Note: when using recovery unit, you must follow the operating instruction of the device.

II. Evacuation

(1) air conditioning system must be evacuated with the vacuum pump whenever its joints are disconnected (exposed to air). The air conditioning system should be connected to manifold pressure meter and it will take about 15 mins to evacuate air.

Note: Do not evacuate air conditioning before refrigerant is recovered.

(2) connect the high/low pressure charge hoses for manifold pressure meter respectively as described in the following.

High pressure charge hose—discharging hose of the compressor

Low pressure charge hose—intaking hose of the compressor

(3) center charge hose of the manifold pressure meter is connected to vacuum pump.

(4) start the vacuum pump, then switch on the manual valve at the intaking side of manifold pressure meter (Lo) .

If the system is not blocked, there is indication on high-pressure meter.

When the indicator lights, switch on the manual valve at the other side (Hi) .

(5) if there is no leakage for about 10 mins, the low-pressure meter will indicate the vacuum pressure is lower than 760mmHg.

Note:

If vacuum is higher than 760mmHg, the manual valves should be turned off, the vacuum pump is stopped and the pointer swaying of low-pressure meter should be

observed.

If reading becomes greater, it indicates there is leakage. So the system must be repaired before evacuation operation continues.

If the reading keeps unchanged, it indicates there is no leakage. You can continue evacuation.

(6) the total evacuation time should be over 15 mins.

(7) continue evacuation untill the reading of low-pressure meter is lower than 760mmHg, then turn off the manual valves at both sides.

(8) stop vacuum pump, remove the center charge hose from the vacuum pump inlet, then refrigerant can be charged into the system.

III. Refrigerant charge

The air conditioning system is charged with HFC-134a (R-134a)

The part describes how to charge refrigerant into air conditioning system from the refrigerant tank.

When charging refrigerant which is recovered by the recovery and regenerative unit, you should follow the methods described in the instruction of device manufactory.

Warning:

Avoid liquid refrigerant to splash into eyes.

Occasionally some liquid refrigerant will exit, which means it's temperature is lower than the freezing point. If liquid HFC-134a (R-134a) splashes into eyes, dangerous hurt will be caused. So you must take safety goggles to avoid these kinds of accidents. if the HFC-134a (R-134a) splashes into eyes, you should go to hospital for treatment at once.

Do not wipe your injured eyes by hand, but should wash the splashed part with large amount of cleaned cold water to increase temperature of the part up to freezing point.

Accept treatment from doctors or ophthalmology professors as soon as possible.

If HFC-134a (R-134a) splashes on skins, treatment for frostbite should be adopted.

It is not allowed to deal with refrigerant at places where welding is being taken or there has vapor.

The refrigerant should be stored at cool and dark places. Do not put it at places of high temperature, such as the place directly under sunshine or close to fire or in the car (including trunk).

Avoid to breath in smoke from the burning HFC-134a (R-134a) which is harmful for health. The refrigerant must be charged at low pressure side, but absolutely not allowed at high pressure side.

Charge is not allowed when the compressor is heated. Follow related specification in operation instruction from manufactory when you fit the charge valve to the refrigerant tank and make a small hole in it.

Pressure meters must be used before and during charge.

The refrigerant tank should be emptied before it is abandoned.

It is not allowed to heat the refrigerant to over 40°C and put the refrigerant tank upside down during charge, otherwise the refrigerant will enter the compressor and result in troubles, such as compressing liquid refrigerant, etc..

IV. Refrigerant Charging Procedure

(1) make sure that the hoses are fitted properly after the system is evacuated (see the left diagram).

(2) connect the manifold pressure meter, then turn on the charge valve of refrigerant tank, wash the charge pipe and turn on the manual valve at low pressure side.

Warning: make sure that the manual valve at high-pressure side is turned off fixedly.

(3) start engine and keep the rotate speed 1000r/min, then turn on air conditioner.

(4) charge the gas refrigerant into air conditioning system. At this time the refrigerant tank should be kept straight.

(5) after refrigerant tank is emptied, change a new one as described in the following steps:

a. Switch the manual valve off at the low pressure side.

b. Replace the empty refrigerant tank with the newly charged one. When charge valve

of the refrigerant tank is used, replacement should be done according to method as described in the following.

- ① unscrew the plate nut, return the hole forming pin back and remove the charge valve of the refrigerant tank.
- ② install the removed charge valve on the new refrigerant tank.
- ③ as long as the refrigerant leaks from the gap between the refrigerant tank and the charge valve with sizzling noise, you should promptly fix the plate nut and the manual valve at low-pressure side of the manifold pressure meter.
- ④ turn the handle of the charge valve clockwise, screw the hole forming pin into the new refrigerant tank and perforate a pinhole to make the refrigerant flow.
- ⑤ you should turn off the manual valve at the low side of the manifold pressure meter after the system is charged with the specified amount of refrigerant(650g or when the high/low pressure meters indicate the following specified values respectively.

When the specified amount of refrigerant is charged, the low-pressure meter indicates:
Approximately 245kPa (2.5kg/cm², 35.5psi)

When the specified amount of refrigerant is charged, the high-pressure meter indicates:

Approximately 1470kPa (15kg/cm², 213psi)

V. Remove **manifold pressure meter**

When the air conditioning system has been charged with the specified amount of the refrigerant, you could remove the manifold pressure meter as per the following steps.

- (1) turn off the manual valve at the low side of the manifold pressure meter (the manual valve at the high side should not be turned off during refrigerant charge)
- (2) turn off the charge valve of the refrigerant tank.
- (3) stop the engine.
- (4) wrap the charge hoses with cloth and remove it from the service pipe, which should be performed quickly.

Warning: the high side is naturally under high pressure, so you should take care of

your eyes and skin.

- (5) fit the maintenance valve cover.

Section 8 Troubleshooting

I. Trouble-shooting Chart

Fault	Possible reasons	Action
No cold or heat air	Electric magnetic clutch operating fault a.fuse blowout or relay fault b.electric magnetic clutch fault c.air conditioning system switch fault d.thermistor fault e.high-low pressure protection switch fault f.wiring or grounding fault g.no refrigerant h.ECU fault Compressor runs abnormally a.drive belt slacks or has cracking b.compressor fault Air blower fault Expansion valve fault System leakage Fusible plug of the stock solution drier melts or is blocked	Replace the fuse and check if short circuit occurs Check the clutch Check the switch Check thermistor Check the switch Repair if necessary Check the air conditioning pipe line Replace ECU Fasten or replace the belt Check the compressor Check the air blower Check expansion valve Check leakage in system Check the stock solution drier
Discontinuous cold air	Electric magnetic clutch slides ECU fault Expansion valve fault	Check the electric magnetic clutch Replace ECU

	Improperly wiring in the circuit Over damp system	Check the expansion valve Repair if necessary evacuate and charge the system
cold air exists only at high speed	Condensator is blocked Drive belt trackslip Compressor fault Insufficient or over-charged refrigerant Air exists in the system	Check the condensator Check or replace the drive belt Check the compressor Check the refrigerant charge Evacuate and charge the system with refrigerant

Insufficient refrigeration	Condensator is blocked Drive belt trackslip Electric magnetic clutch fault Compressor fault Expansion valve fault Thermistor fault Insufficient or over-charged refrigerant Air exists in the system or excessive oil in the compressor Stock solution drier is blocked	Check the condensator Check or replace the drive belt Check the electric magnetic clutch Check the compressor Check the expansion valve Check the thermistor Check refrigerant charge Evacuate and charge the system Check the stock solution drier
Insufficient flow speed of cold air	Evaporator is blocked or frosts Air leakage in the cooling device or air ducts Air inlet is blocked Air blower motor fault	Check the evaporator Repair if necessary Repair if necessary Replace the air blower motor

II Trouble-shooting Chart (electron temperature control system)

Phenomenon	Possible position of the fault	Diagnosis and measurement	Result	Reason
The compressor does not work when the air conditioner switch is turned on	power source is out of condition	F6 (20A) fuse voltage 12V	F6 is out of condition	Without air conditioner relay power source
	air conditioner relay is out of condition	No. 30, 87 pin voltates for relay operation are 12V	Relay is out of condition	Contacts is out of condition
	Air blower switch	Air blower switch disconnects the no.2 pin ground strap connection	Air blower switch is out of condition or no.1 pin does not ground	Without ground strap connection signal output
	A/C switch	A/C switch on no.1 pin	A/C switch or compression is out of condition	Without ground strap connection signal output
	pressure switch is out of condition	Remove the joint, direct cross connection	Switch is out of condition or insufficient pressure	Pressure switch can not be turned on
	temperature sensor for evaporator is out of condition	Resistance value is over 2KΩ	Sensor is out of condition or improper installation	Detection temperature is too low
	water temperature for engine is too low	Check the engine values	water temperature sensor is out of condition	water temperature is too low , compressor does not work
	The engine is accelerating	Gasoline throttle position sensor	normal	normal operation conditions
	ECU is out of condition	Measure the ECU no.41, 22 pins	ECU or wiring	ECU cannot deal with the A/C switch signals

Air blower does not	duty relay is out of condition	No.85, 86, 30, 87 pins of the relay	Wiring is out of condition	Without +12V supplied to air blower
---------------------	--------------------------------	-------------------------------------	----------------------------	-------------------------------------

work	resistance of air blower is out of condition	Measuring resistance is over 0Ω	Resistance is short circuit	Without speed governing signal
	Switch of air blower is out of condition	Measuring switch conduction	Switch is out of condition	Without control signal
	air blower is out of condition	Remove plug , power supply 12V	Air blower breaks down	replace
Fan does not work (high speed)	F2 fuse	+12V	Break down	replace
	High speed fan relay	measure the relay and the wiring	replace	Without +12V supplied to heat emission fan
	fan wiring is out of condition	pin measurement	repair	connection of the pins or wiring is out of condition
	air blower is out of condition	Remove the plug and test with power	replace	Air blower burns out
	water temperature sensor is out of condition	Check water temperature for engine	replace	Low water temperature for engine
	Pressure switch	Remove the plug, cross connection	insufficient pressure of the pressure switch or pressure	Without switch signals
	ECU	ECU no.31pin ground strap connection	ECU is out of condition	replace
insufficient refrigeration (clutch unmovable)	Refer to the diagnosis tables metioned above (reasons out of the electron temperature control system)			

Section 9 Maintenance On-board

Note: you should comply with the following rules when maintaining air conditioning system.

1. Wiring

- (1) remove the accumulator's negative wire to avoid short circuit.
- (2) the lead connector should be plugged fixedly.
- (3) the gum cover should be fitted in panel holes before wiring arrangement to protect the wiring bundle.
- (4) connect the wiring bundle of air conditioner to main wiring bundle with pdythene belt or original binding terminal block.
- (5) if original wiring bundle is removed or stripped when maintaining, you should put it back to the place where it was.
- (6) original binding terminal block and wiring bundle of the air conditioner should not be pressed during installation.
- (7) when the leads are welded to the wiring bundle, the two leads should have the same diameters and the connection should be wrapped with insulated belt.
- (8) the wiring bundle should keep away from the moving elements or high temperature places.
- (9) it is not allowed that the connection parts is close to the fuel pipe.
- (10) check the wiring bundle if it contacts with sharp edges and corners.

2. Refrigerating return pipe

- (1) heating elbow bend pipe is absolutely impermissible.
The degree of bending should be as small as possible.
- (2) parts in air conditioner should be kept dry and free of dirt.
When removing any pipe of the system, you should fit a cap on the joint of this pipe as soon as possible.
- (3) when the hose and the metal pipe are interconnected, drops of refrigerating oil

should be dropped on the seat surface of the connecting nut and the O-shape of seal ring.

(4) when the joint is screwed or unscrewed, two wrenches should be used, one is for tightening, the other for supporting.

(5) inlet connecting pipe of the stock solution drier should be connected with the outlet connecting pipe of the condensator.

(6) tighten the pipe socket nut according to the following required tightening torque.

Tightening torque for connecting nut: 8 mm pipe: 12-15N·m

(1.2-1.5kg-m.8.6-11.0lb-ft) 1/2 inch pipe: 20-25N·m

(2.0-2.5kg-m.14.5-18.0lb-ft) 5/8 inch pipe: 30-35N·m

(3.0-3.5kg-m.22.0-25.3lb-ft)

(7) water drain hoses should be arranged in the way that the drained water should not drop on the parts of the car.

3. Recovery of the refrigerant

Refrigerant recovery and regenerative unit must be used when refrigerant is discharged from air conditioning system. Directly discharging refrigerant HFC-134a (R-134a) into atmosphere will bring serious effects on environment.

Note: when using recovery and regenerative unit, you must follow the operating instruction of the device.

4. Management of refrigerant

(1) when dealing with refrigerant, you must take the safety goggles to protect your eyes.

(2) avoid to touch liquid refrigerant directly.

(3) the refrigerant tank should not be heated over to 40°C.

(4) it is not allowed to discharge the refrigerant to the atmosphere.

(5) it is not allowed to splash the refrigerant to the polishing metal surface because the corrosive combination of refrigerant and water can make the polishing metal surface dislustered (including chromium-coated part).

(6) after refrigerant of the system is recovered, lost oil in compressor must be

determined and make-up the same amount of oil.

Warning: if refrigerant HFC-134a (R-134a) splashes into eyes, you should go to hospital for treatment quickly.

It is not permissible to wipe your hurted eyes, but to wash them with a large amount of clean cold water to make the temperature of your hurted parts rise to the freezing point.

Must go to see doctors or ophthalmology professors for treatment. If HFC-134a (R-134a) liquid splashes on skin, the hurt should be treated in the same way as the frostbite treatment.

Section 10 Check Refrigerant System with Manifold Measurement Unit

I. This method serves to confirm the fault position with manifold measurement unit

Read the manifold pressure meter when the system reaches the following status:

- (1) set the switch on the circular position , the supplying air temperature is 30-35 °C
- (2) the engine runs in 1500r/min.
- (3) set the rotate speed control switch of supply fan at high speed.
- (4) set the temperature control switch at the position where the cold air is most sufficient.

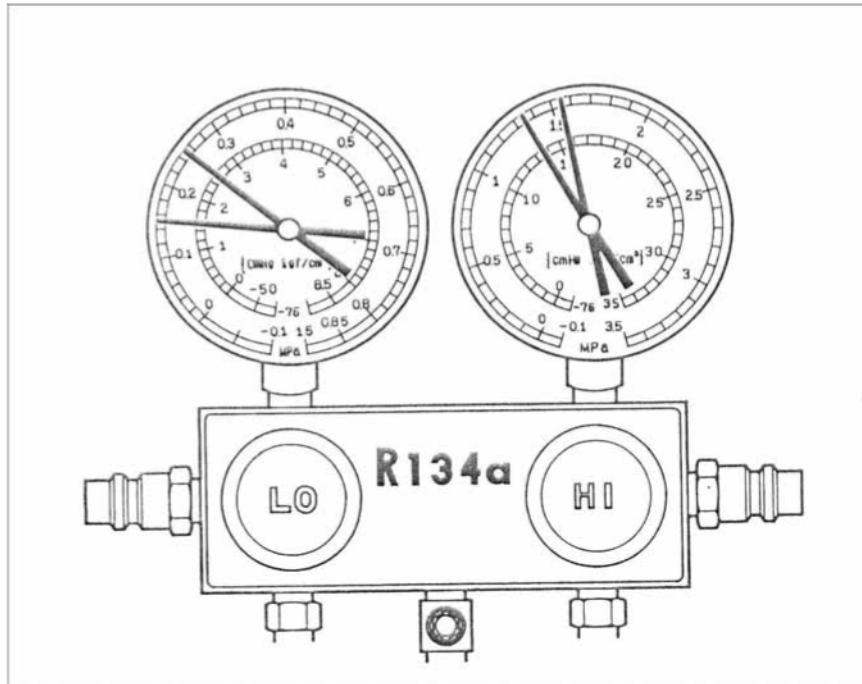
Note: It should be indicated that the readings of the meter will change slightly depending on the environment temperature.

1. Refrigeration system works normally

Reading on meter:

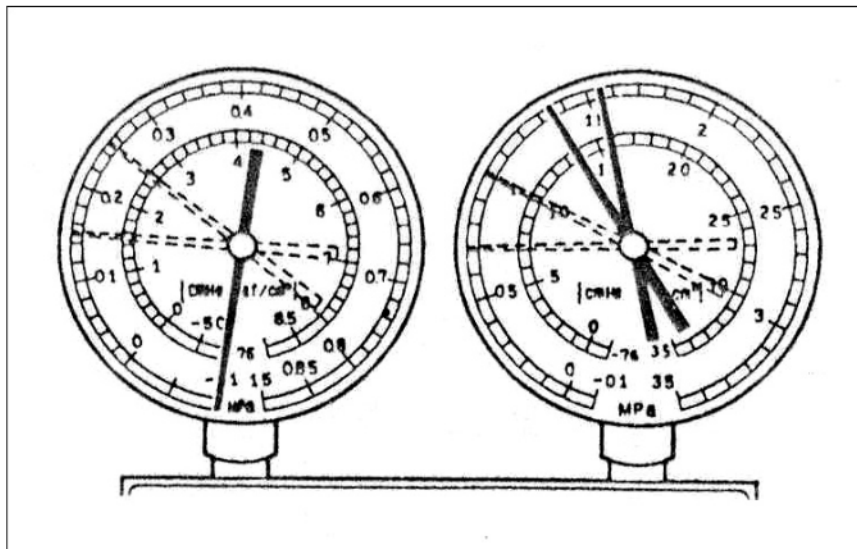
Low pressure side: 0.15-0.25 MPa (1.5-2.5kg/cm²)

High pressure side: 1.37-1.57 MPa (14-16kg/cm²)



2. Water vapor exists in the refrigeration system.

Symptom: discontinuous cold air to no cold air.

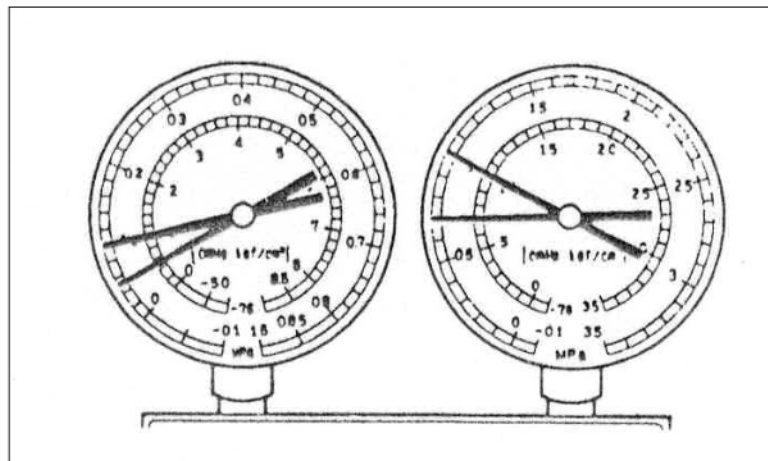


Fault symptom of refrigeration system	Possible reasons	Fault diagnosis	Troubleshooting action
When running, pressure	The vapor entering	Drier is in	(1) replace the stock

at low pressure side sometimes is normal, but sometimes vacuum.	the refrigeration system ices in the spraying hole of the expansion valve to make the circulation stop temporarily, but after the ice melts, it can work normally.	oversaturation ↓ Water vapor ices at the spraying hole of the expansion valve to block circulation of refrigerant.	solution drier (2) evacuate air repeatedly to eliminate the vapor in the circulation. (3) charge appropriate amount of new refrigerant.
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3. Insufficient refrigerant

Symptom: insufficient cold air

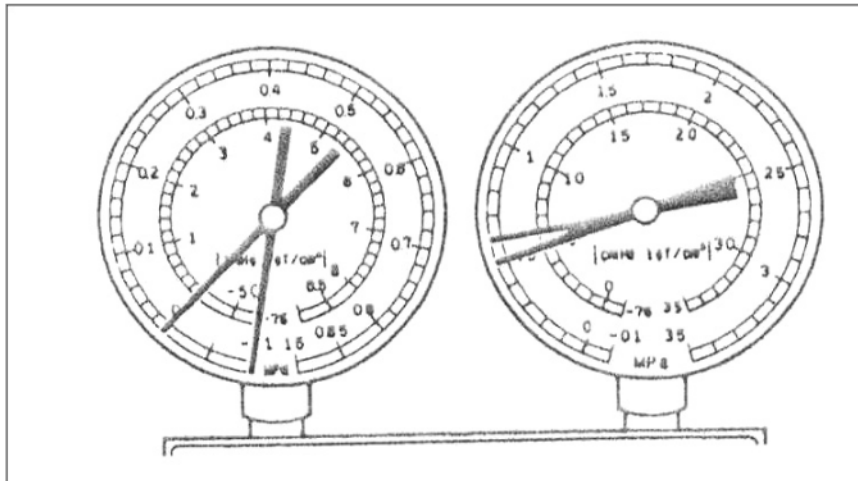


Fault symptom of refrigeration system	Possible reasons	Fault diagnosis	Trouble-shooting action
Low pressure at both low pressure side and high side bad cooling Performance	air leakage at somewhere in refrigeration system	Insufficient refrigerant in system ↓ Refrigerant leakage	(1) using air leakage detector to check where there is leakage. If necessary, repair it. (2) charge appropriate amount of refrigerant. (3) if the reading is about 0 after connecting the meter, the leakage positions should be

			found and repaired, then air in system is evacuated.
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4. Refrigerant circulation is out of condition

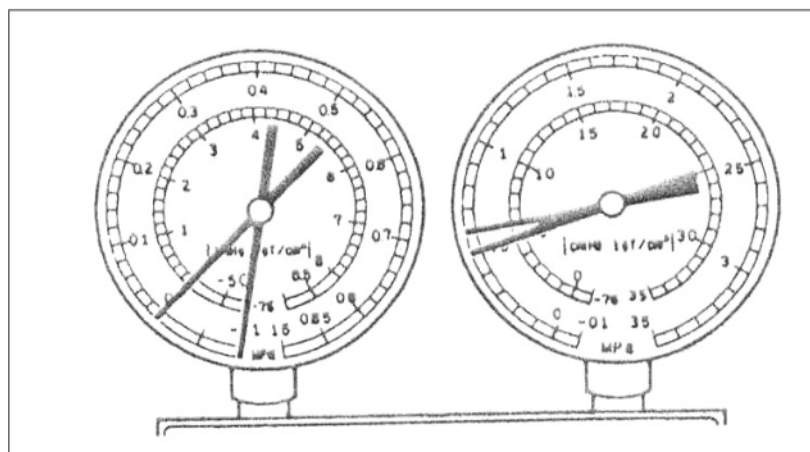
Symptom: insufficient cold air



Fault symptom of refrigeration system	Possible reasons	Fault diagnosis	Troubleshooting action
Low pressure at both low pressure side and high side There is frost between the reservoir and the assembly pipe.	Refrigerant can not flow due to the reservoir is blocked by dirt.	Reservoir is blocked.	replace the reservoir.

5. Refrigerant doesn't circulate

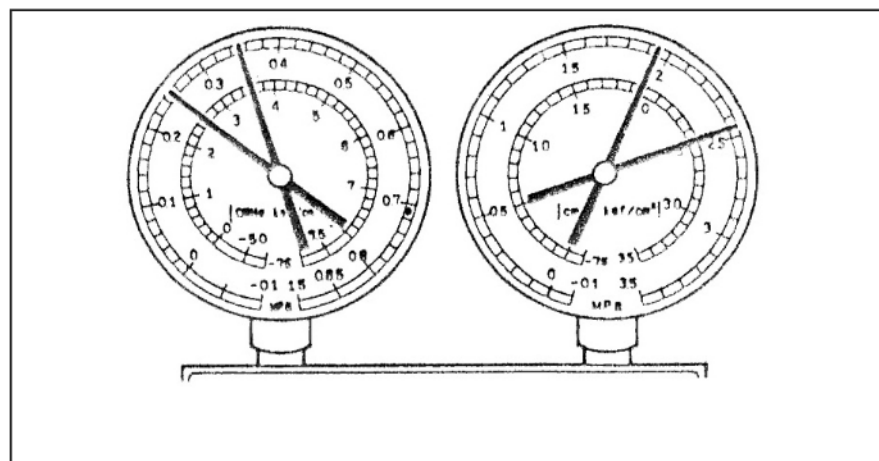
Symptom: without cold air (sometimes there has cold air)



Fault symptom of refrigeration system	Possible reasons	Fault diagnosis	Troubleshooting action
Low pressure side indicates vacuum and high pressure side indicates too low pressure. Frost or dew appears on the pipes before and behind the reservoir, drier and expansion valve.	Refrigerant can not flow because the water vapor or dirt block the refrigeration system Refrigerant can not flow because the thermal sensitive pipe of the expansion valve leaks air or is blocked.	Refrigerant doesn't circulate	(1) check the thermal sensitive pipe, expansion valve and pressure regulator of the evaporator. (2) blow out the dirt in the expansion valve with air (3) if the dirt can not be removed, expansion valve should be replaced. (4) evacuate air from system and charge appropriate amount of new refrigerant. If thermal sensitive pipe leaks air, the expansion valve should be replaced.

6. Excessive charge of refrigerant or insufficient refrigerating of condensator

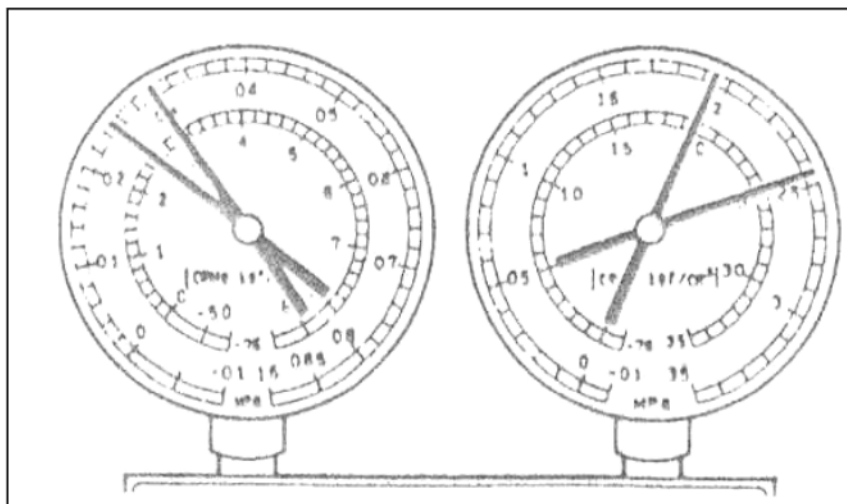
symptom: insufficient cold air



Fault symptom of refrigeration system	Possible reasons	Fault diagnosis	Troubleshooting action
High pressure at both the low and high pressure sides even if the engine runs at a very low rotation speed.	Good performance cannot be played due to excessive refrigerant in the system Insufficient refrigerating of condensator	Excessive refrigerant in circulation Excessive charge of refrigerant Insufficient refrigerating of condensator Radiator rib of condensator is blocked or the motor of fan has fault.	(1) clean the condensator (2) check the working conditions of fan's motor (3) if (1) and (2) is normal, check the amount of refrigerant and charge appropriate amount of refrigerant.

7. Air exists in refrigeration system

Symptom: inadequate temperature reduction



Note:

when

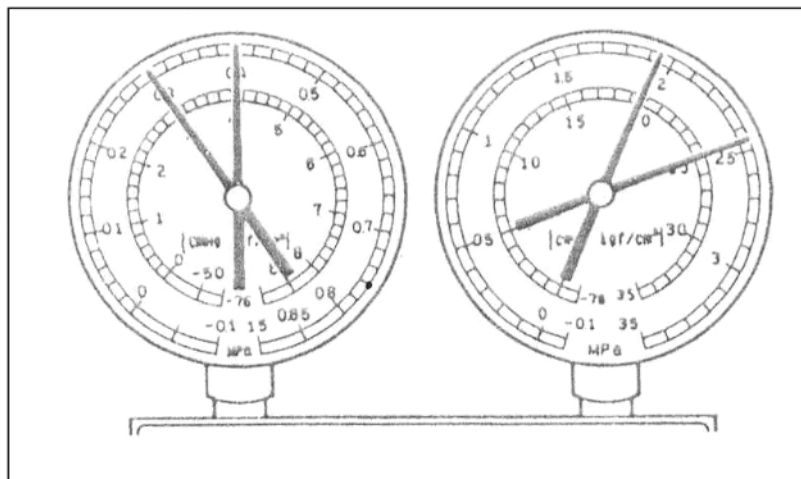
refrigeration system is open to charge refrigerant without evacuating, the meter will show reading.

Fault symptom of refrigeration system	Possible reasons	Fault diagnosis	Troubleshooting action

High pressure at both the low and high pressure sides Low pressure pipe is too hot to be touched	Air enters refrigeration system	Air exists in the refrigeration system ↓ Inadequate vacuum	(1) check if the compressor oil is polluted or insufficient. (2) evacuate air in the system and charge new refrigerant.
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8. Improper installation of expansion valve /breakdown of the thermal sensitive pipe (open too much)。

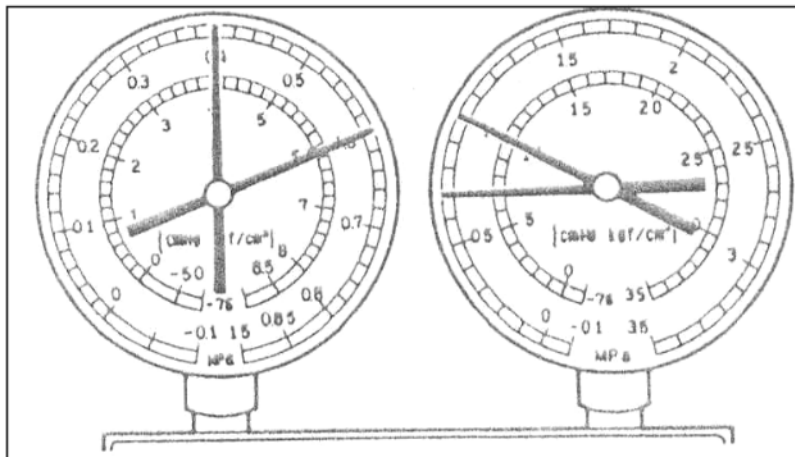
Symptom: inadequate cold air



Fault symptom of refrigeration system	Possible reasons	Fault diagnosis	Troubleshooting action
High pressure at both the low and high pressure side Frost or a large amount of dew at the low pressure pipe side.	Expansion valve has fault or improper installation of the thermal sensitive pipe	Excessive refrigerant in the low pressure pipe ↓ Expansion valve opens too much	(1) check the installation status of thermal sensitive pipe (2) if (1) is normal, check the expansion valve. If it is broken, replace it.

9. Compression of the compressor is out of condition

Symptom: without cold air



Fault symptom of refrigeration system	Possible reasons	Fault diagnosis	Troubleshooting action
Too high pressure at the low pressure side	Leakage exists in the compressor	Compression is out of condition ↓	Repair or replace compressor.
Too low pressure at the high pressure side		Air valve leaks air or gets out order, part slides	

Section 11 Check and Maintenance for Refrigeration System

1. Condensator

Check

- (1) whether the radiator rib of the condensator is blocked.

(2) whether leakage exists at joints of condensator.

(3) whether the radiator rib of the condensator is damaged. If the radiator rib is blocked you should wash it with water and dry it with compressed air.

Note:

Be careful not to damage the radiator rib of the condensator. If it becomes curved, a screwdriver or joint pliers should be used.

If leakage is found in joints or refrigerating pipes the condensator should be repaired or replaced.

2. Receiver drier

Check:

Check whether the gas refrigerant leaks with leakage detector.

Remove

(1) When refrigerant is recovered with the recovery and regenerative unit, you should follow the instruction of the device. You must measure the lost oil in compressor and make-up the same amount of oil.

(2) remove the liquid refrigerant pipe.

(3) remove the stock solution drier from the bracket

Installation

(1) when refrigerant is recovered with recovery and regenerative unit, you must follow the operating instruction of the device. The lost oil in compressor must be measured and make-up the same amount of oil.

(2) remove the liquid refrigerant pipe.

(3) remove the stock solution drier from the bracket.

Installation

(1) install the stock solution drier in the order contrary to removing.

Note:

Supply refrigerant oil of 10cc into the inlet of the compressor when replacing the stock solution drier.

It is not allowed to remove the cap before installing the stock solution drier.

(2) evacuate and charge the system in accordance with the above methods.

3. Evaporator (thermantidote)。

Remove

- (1) remove the negative wire of the accumulator.
- (2) prohibit the air bag system function.
- (3) when regrigerant is recovered with recovery and regenerative unit , you must follow the operating instruction of the device. The lost oil in compressor must be measured and make-up the same amount of oil.
- (4) remove the air blower motor and connector of the resistance lead.
- (5) remove fresh air zipper from the air blower motor.
- (6) remove the air blower motor after removing the tool kit
- (7) remove the lead connector of the thermistor.
- (8) remove the intaking tube of the compressor, the outlet pipe the stock solution drier and the discharging hose from the evaporator (thermantidote) .

Note:

As long as the hoses and metal pipes mentioned above are removed, the joints must be pluggedd with caps.

- (9) remove the evaporator and the its enclosure.

Disassemble

- (1) remove the fixing catch and separate the upper box from the lower one of the evaporator.
- (2) remove the upper box and take the evaporator out.
- (3) remove the following parts from the evaporator.

△expansion valve

△thermistor

Check

(1) whether the radiator rib of the evaporator is blocked. If obstruction occurs, radiator rib should be cleaned with compressed air.

Note:

It is not allowed to wash the evaporator with water.

(2) check whether cracks or scratches exists at joints of the inlet and outlet. If necessary, please repair it.

4. Expansion valve

Check before removal

- (1) connect the manifold pressure meter to the service valve.
- (2) make the engine run in a speed of 1000r/min and turn on the air conditioner.
- (3) check whether the low pressure meter shows 0.5g (5.0kg/cm²) .

If reading is too low (lower than 0.5kg/cm²), the expansion valve and/or stock solution drier should be checked. If necessary, please replace it.

If reading is too high (higher than 0.5kg/cm²), the thermal sensitive bulb bracket should be fastened or the expansion valve should be replaced.

Removal

See “remove and disassemble” in the previous section of evaporator (thermantidote) for details.

Installation

- (1) install the expansion valve in the contrary order of removing it.
- (2) restore the function of the air bag.
- (3) evacuate and charge the system in accordance with the above methods.

5. Thermistor of the evaporator

Thermistor, a kind of temperature sensors, serves to sense the temperature of air discharged from the evaporator. Its electrical characteristics are as follows.

When the temperature is lower than the specified temperature, the ECU will make the electric magnetic clutch disconnect to avoid the evaporator frosting.

Temperature °C	Resistance kΩ
0°C	6.65±5%
25°C	2.0+10%

Remove

See “remove and disassemble” in the evaporator section for details.

Installation

- (1) install the thermistor in the order contrary to removing it.
- (2) evacuate and charge the system according to the above described methods.

6. Refrigeration pipe

Check

- (1) check whether the hoses and the metal tubes leak air with leakage detector.
- (2) check whether each hose clamp or metal tube clamp is fastened. If not, please fasten them or replace the slack.

Remove

- (1) when refrigerant is recovered with recovery and regenerative unit , you must follow the operating instruction of the device. The lost oil in compressor must be measured and make-up the same amount of oil.
- (2) change the faulty hoses or metal tubes.

Note:

The above hoses and metal tubes should be covered with caps quickly when they are removed to avoid damp and dirt to enter.

Installation

- (1) install the refrigeration pipes in the order contrary to removing it.
- (2) evacuate and charge the system according to the above described methods.

7. Circuit elements

1) air conditioner switch

Check

- (1) remove the negative wire of the accumulator
- (2) remove the unit heater slider and the central decoration
- (3) Remove the air conditioner switch connector, take down the air conditioner switch.
- (4) check whether terminals' conduction of the air conditioner switch is correct with ohm gauge

Switch	1	2	3	4	5
OFF	● ——— ●		⊗		●
ON	X	● ——— ●			●

If the air conditioner switch does not conduct, please replace it.

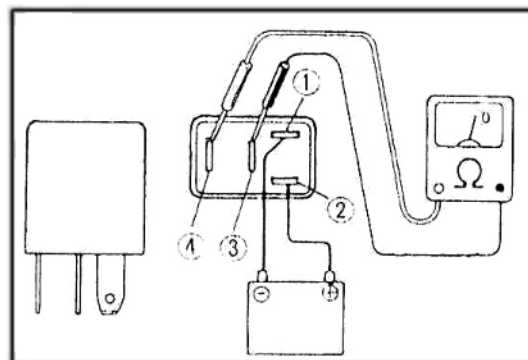
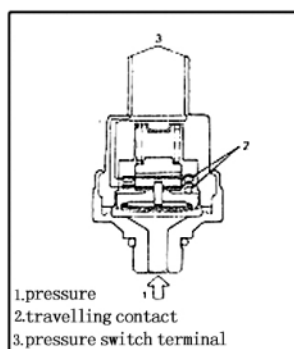
2) high-low pressure protection switch

This car is equipped with the high-low pressure protection switch check

(1) check whether switches conduct at normal temperature of about 25℃ when the air conditioning system is charged with refrigerant properly and the compressor works.

(2) the switches should not conduct under the following pressures

Pressure at the high pressure side	Switch
Below 196kPa(0.2kg/cm ²)	non-conducting
Over 3140kPa(32kPa/cm ²)	



3) relay for fan

The relay for air conditioner is located in the box of the fore cabin fuse relay.

Check

- (1) remove the negative wire of the accumulator.
- (2) remove the relay connector and then remove the relay.
- (3) wiring as shown in the diagram. Check whether the pins ③ and ① are conducting. If not, please replace the relay.

8. Compression system

Parts of the compressor must be free from dirt and foreign substance when the compressor is being maintained. For correct maintenance, the clean tools and work spots are the most important. The connections and surface of the compressor should be made clean before maintenance or removing the compressor on any car. Parts of the compressor should be kept clean at any time. Any resassembled parts must be washed with methane trioxide, crude gasoline, kerosene or other equivalent solution and then dried in dry air. Only napped cotton fabric can be used for wiping parts.

Without additional descriptions, removing the compressor from a car and overhauling it on the work table should follow the below operations. The parts should be prepared in the order of check. The remaining oil in the compressor should be drained out after the compressor is removed from a car for maintenance, then the compressor is charge with new refrigerant.

1) fault diagnosis

Item	Troubles	Possible reasons	Action
1	Compressor has noise	Piston, bearing, cylinder and/or crank shaft is out of condition	replace
2	Electric magnetic clutch has noise	Working face for bearing and/or clutch is out of condition	replace
3	Insufficient refrigeration	Gasket and/or reed valve is out of	replace

		condition	
4	No rotating	Due to item 1 locked	replace
5	Oil or air leakage	Seal is out of condition	replace

Light maintenance can be done onboard and the refrigerant needn't be discharged, while the refrigerant must be discharged in overhaul.

There are three main types of the compressor faults: air leakage, noise and underpressure. In most cases, air leakage always occurs at the shaft seal. Leakage detector must be used when leakage is checked. In case of a small amount of compressor oil leakage from the shaft seal, it is unnecessary to replace the shaft seal. A little bit of oil leakage from the shaft seal is designed to lubricate the system. So only when a large amount of oil leakage occurs or air leakage is found with leakage detector, you can replace the shaft seal. For noise and underpressure, repair should be done after the fault is confirmed.

2) check compressor

- (1) install manifold pressure meter;
- (2) run the engine with rapid idle speed.
- (3) check the following items for the compressor.
 - ① reading of the high pressure meter is not lower than the normal value and the reading of the low pressure meter is not higher than the normal value.
 - ② metal noise.
 - ③ leakage at the shaft seal.

The compressor should be repaired if any fault above occurs.

Remove

- (1) run the engine with idle speed, turn on the air conditioner for about 10 mins.
- (2) remove the negative wire of the accumulator.
- (3) when refrigerant is recovered with recovery and regenerative unit, you must

follow the operating instruction of the device. The lost oil in compressor must be measured and make-up the same amount of oil.

(4) remove the electric magnetic clutch lead from the wiring bundle of air conditioner.

(5) remove the intaking hose and discharging hose from the compressor.

(6) take down the o-shape of seal ring from hose.

Note: cap the removed joints rapidly to avoid the system damp.

(7) lift the car and take the lower cover (right) of the engine down.

(8) slack the drive belt of the compressor, then remove the fixing bolts from compressor.

(9) remove the compressor with the electric magnetic clutch assembly from the engine stand.

(10) discharge the compressor oil and measure the discharged amount of oil.

Note:

When the compressor is removed, care should be taken to avoid radiator rib of the condensator to be damaged.