

AIR CONDITIONING SYSTEM

	Page
GENERAL INFORMATION	AC-2
DESCRIPTION	AC-4
PREPARATION	AC-7
TROUBLESHOOTING	AC-8
REFRIGERATION SYSTEM	AC-10
DRIVE BELT	AC-14
REFRIGERATION LINES	AC-15
COMPRESSOR	AC-16
RECEIVER	AC-29
CONDENSER	AC-30
COOLING UNIT	AC-32
EVAPORATOR	AC-36
EXPANSION VALVE	AC-36
THERMISTOR	AC-37
A/C CONTROL ASSEMBLY	AC-38
PRESSURE SWITCH	AC-42
WATER TEMPERATURE SENSOR	AC-42
SERVOMOTORS	AC-43
BLOWER MOTOR	AC-43
CONDENSER FAN MOTOR	AC-44
BLOWER RESISTOR	AC-44
HEATER MAIN RELAY	AC-44
MAGNETIC CLUTCH RELAY	AC-44
FAN MAIN RELAY	AC-45
FAN RELAY NO. 1	AC-45
FAN RELAY NO. 2	AC-45
FAN RELAY NO. 3	AC-45
VACUUM HOSE CIRCUIT	AC-45
VACUUM SWITCHING VALVE (VSV)	AC-46
A/C AMPLIFIER	AC-47

GENERAL INFORMATION

ELECTRICAL PARTS

Before removing and inspecting the electrical parts, set the ignition switch to the LOCK position and disconnect the negative (–) terminal cable from the battery.

CAUTION: Work must not be started until after at least 20 seconds or longer from the time the negative (–) terminal cable is disconnected.

SRS AIRBAG SYSTEM

Failure to carry out service operation in the correct sequence could cause the airbag system to deploy, possibly leading to a serious accident.

When removal or installation of the parts and the yellow wire harness and connector for the airbag is necessary, refer to the precautionary notices in the AB section before performing the operation.

REFRIGERATION SYSTEM

1. WHEN HANDLING REFRIGERANT (R-12), FOLLOWING PRECAUTIONS MUST BE OBSERVED;

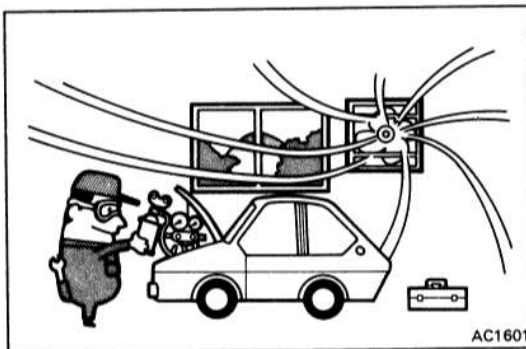
- (a) Do not handle refrigerant in an enclosed area or near an open flame.
- (b) Always wear eye protection.
- (c) Be careful that liquid refrigerant does not get in your eyes or on your skin.

If liquid refrigerant gets in your eyes or on your skin;

- Do not rub.
- Wash the area with lots of cool water.
- Apply clean petroleum jelly to the skin.
- Go immediately to a physician or hospital for professional treatment.
- Do not attempt to treat yourself.

2. WHEN REPLACING PARTS IN REFRIGERANT LINE;

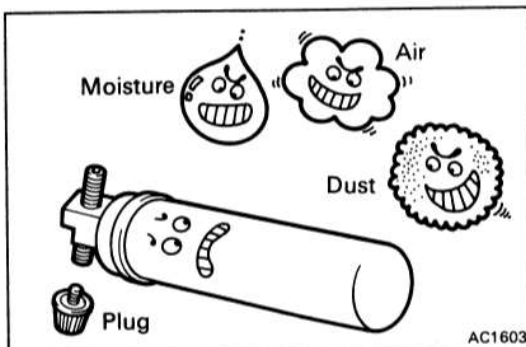
- (a) Discharge the refrigerant in the line slowly before replacement.
- (b) Insert a plug immediately in disconnected parts to prevent the entry of moisture and dust.
- (c) Do not leave a new condenser or receiver, etc., lying around with the plug removed.



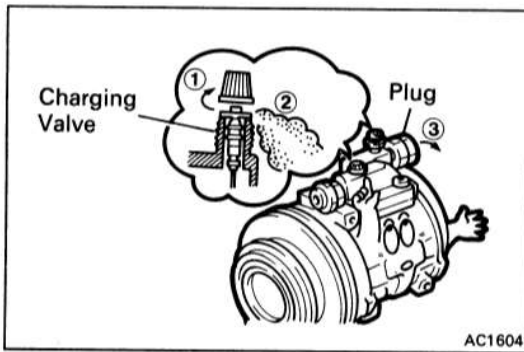
AC1601



AC1602



AC1603

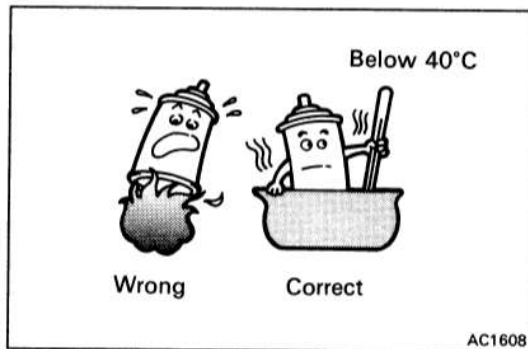


- (d) Discharge the refrigerant from the charging valve before installing a new compressor.

If the refrigerant is not discharged first, compressor oil will spray out with the refrigerant gas when the plug is removed.

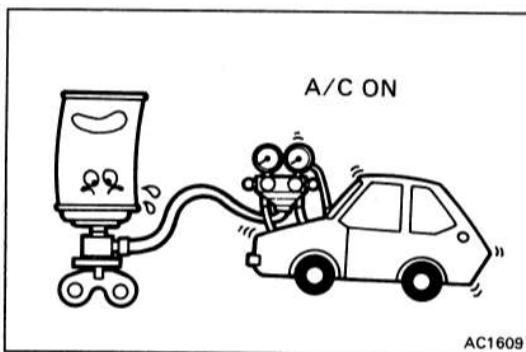
- (e) Do not use a torch for tube bending or lengthening operations.

If tubes are heated with a torch, a layer of oxidation forms inside the tube, causing the same kind of trouble as an accumulation of dust.



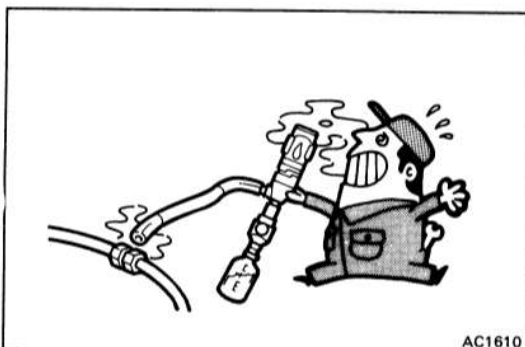
3. WHEN HANDLING REFRIGERANT CONTAINER (SERVICE CAN);

- (a) The container must never be heated.
- (b) Containers must be kept below 40°C (104°F)
- (c) If warming a service can with hot water, be careful that the valve on top of the service can is never immersed in the water, as the water may permeate the refrigerant cycle.
- (d) Empty service cans must never be re-used.



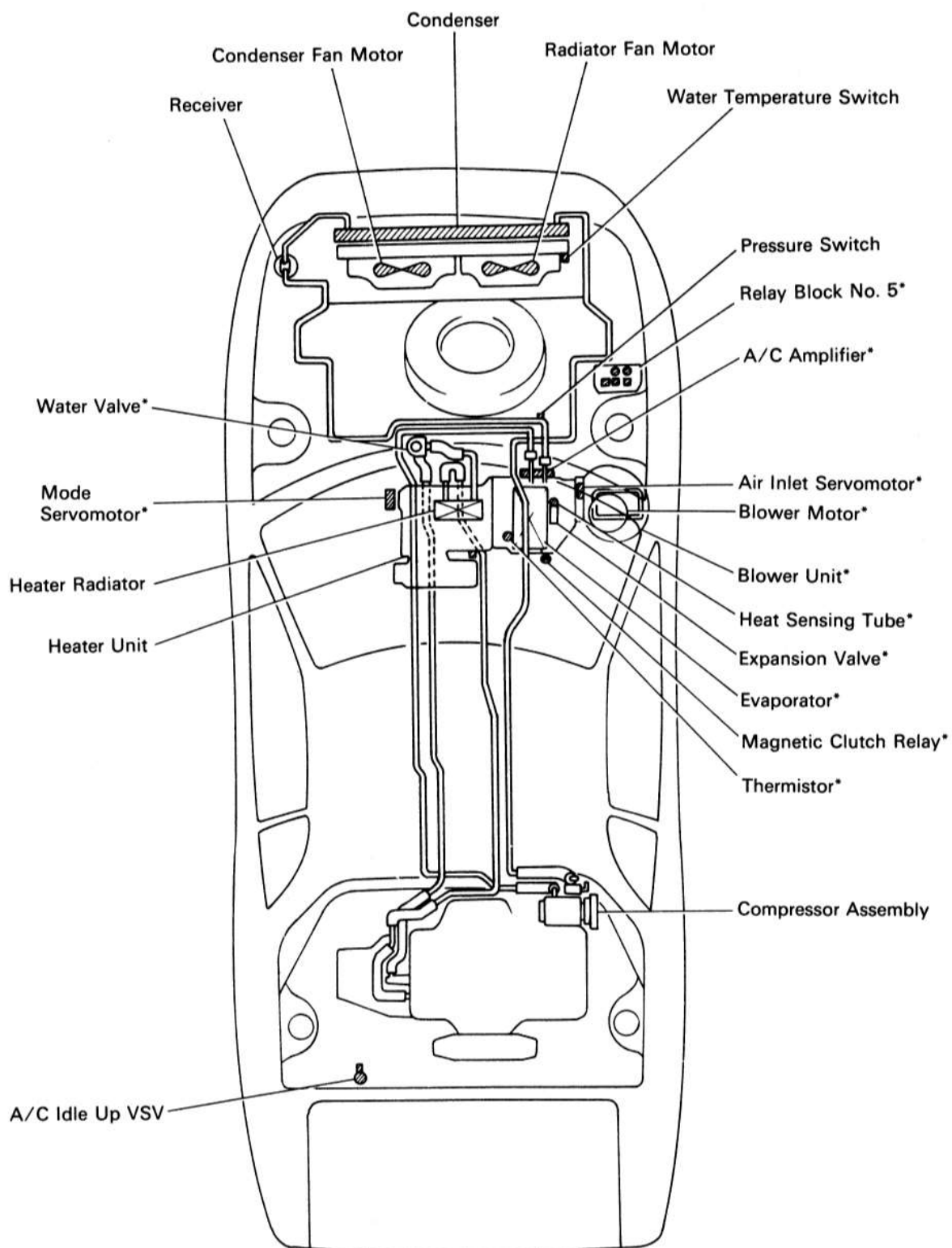
4. WHEN A/C IS ON AND REFRIGERANT GAS IS BEING REPLENISHED;

- (a) If there is not enough refrigerant gas in the refrigerant cycle, oil lubrication will be insufficient and compressor burnout may occur, so take care to avoid this.
- (b) If the valve on the high pressure side is opened, refrigerant flows in the reverse direction and could cause the service can to rupture, so open and close the valve on the low pressure side only.
- (c) If the service can is inverted and refrigerant is loaded in a liquid state, the liquid is compressed and causes the compressor to break down, so the refrigerant must be in a gaseous state.
- (d) Be careful not to load too much refrigerant gas, as this cause trouble such as inadequate cooling, poor fuel economy, engine overheating, etc.



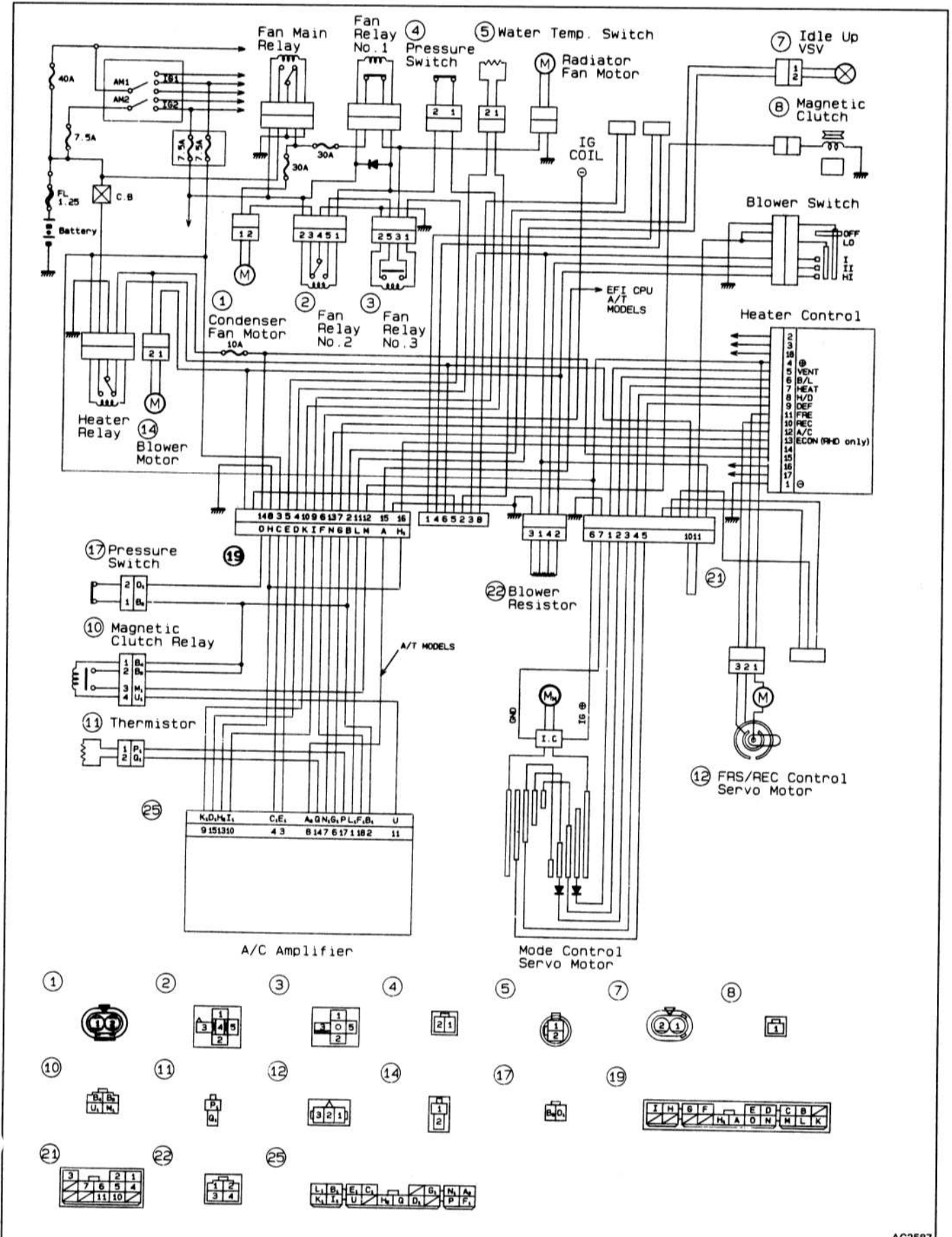
5. WHEN USING GAS-CYLINDER TYPE GAS LEAK TESTER;

- (a) As a naked flame is used, first make sure that there are no flammable substances nearby before using it.
- (b) Be careful, as a poisonous gas is produced when refrigerant gas comes in contact with heated parts.

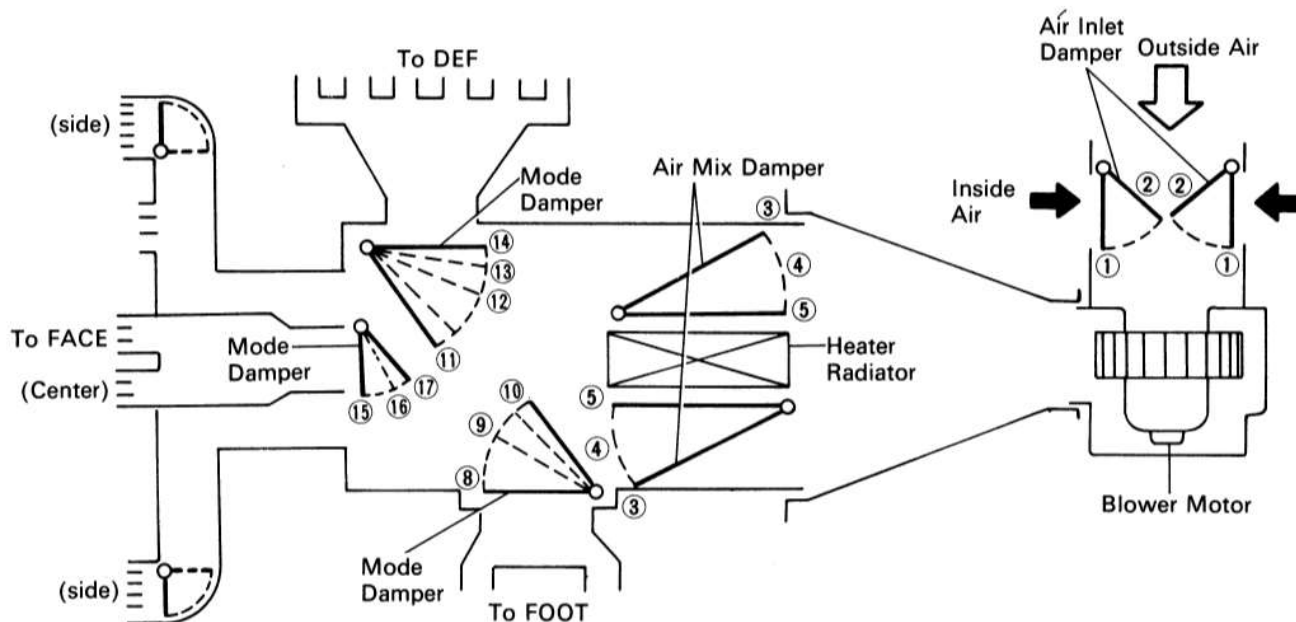
DESCRIPTION**LOCATIONS OF A/C SYSTEM**

RHD vehicles, for parts marked (*), are in always symmetrically opposite to LHD vehicles.

ELECTRICAL WIRING DIAGRAMS



DAMPERS POSITION



A/C control switch	A/C control lever position	Dampers position	Air flow vents			
			FACE		FOOT	DEF
			Center	Side		
Air Inlet Control Lever	Fresh	①	/	/	/	/
	Recirc	②				
Temperature Control Lever	Warm ↕ Cool	③ ↕ ④ ↕ ⑤				
Mode Control Lever	Def.	⑧ ⑪ ⑮		○		○
	Foot/Def.	⑨ ⑫ ⑮		○	○	○
	Foot	⑩ ⑬ ⑮		○	○	○
	Bi-Level	⑨ ⑭ ⑯	○	○	○	
	Face	⑧ ⑭ ⑰	○	○		

The size of circle (○) indicates the proportion of the air flow volume.

PREPARATION

SPECIAL TOOLS AND EQUIPMENT

Tool	SST No.	Use
Air conditioner service tool set	07110-58011	To evacuate and charge system
Ohmmeter	–	To perform electrical diagnosis
Voltage meter	–	To perform electrical diagnosis
Ammeter	–	To perform electrical diagnosis
Magnetic clutch tool set	07110-77011	General set for magnetic clutch
Magnetic clutch remover	07112-71010	To remove pressure plate
Snap ring pliers (External type)	07114-84020	To remove and install rotor and stator
Key remover	07112-45021	To remove key
Seal plate remover	07112-15010	To remove seal plate
Seal plate presser	07114-15010	To remove and install shaft seal
Hexagon wrench set	07110-61050	To remove and install service valve and front housing
Shaft seal remover	07112-25010	To install seal plate
Key replacer	07114-45010	To install key

SSM (SPECIAL SERVICE MATERIALS)

Part Name	Part No.	Use etc.
DENSO OIL 6, SUNISO No. 5GS or equivalent	07117-68040 –	Compressor

TROUBLESHOOTING

You will find the cause of trouble more easily by properly using the table shown below. In this table, the numbers indicate the order of priority of the causes of trouble. Check each part in the order shown. If necessary, replace the part.

See page	AC-12	AC-10	AC-14	AC-5	AC-5	AC-5	AC-42	AC-37	CO-42	AC-44	AC-44	CO-45	AC-44	AC-43
Parts Name	Inspect Volume of Refrigerant	Inspect Refrigeration System with Manifold Gauge Set	Inspect Drive Belt Tension	Fusible Link (ALT)	Circuit Breaker (HEATER)	Fuse (A/C)	Pressure Switch	Thermistor	Water Temp. Sensor	Heater Main Relay	Magnetic Clutch Relay	Engine Main Relay and Fan Relay No. 1, 2, 3	Blower Resistor	Air Inlet Servomotor
Trouble														
No blower operation				1	2					3			6	
No blower control														
No air flow mode control														
No air inlet control														2
Insufficient flow of cool air										1			3	
Insufficient flow of warm air										1			3	
No cool air comes out	3	4	5			1	6	12			2			
Cool air comes out intermittently	1	2	3					5						
Cool air comes out only at high engine speed	2	3	1											
Insufficient cooling	1	2	3					13	7			6		
No warm air comes out														
Air temp. control not functioning														
No engine idle up when A/C switch on														

[illegible]

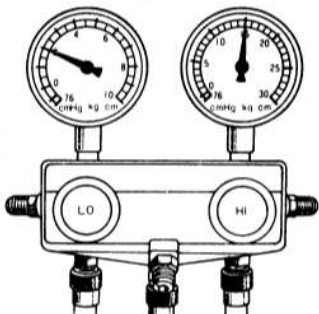
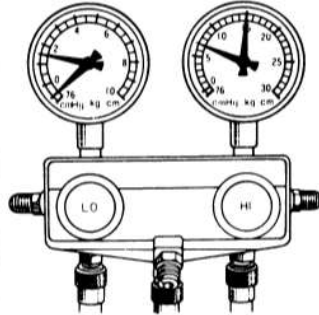
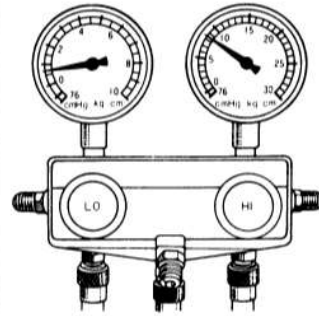
REFRIGERATION SYSTEM

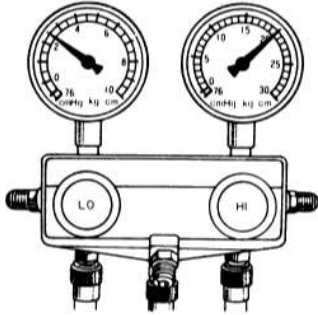
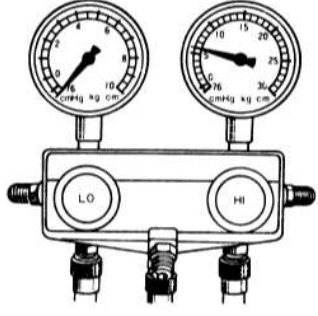
INSPECTION OF REFRIGERATION SYSTEM WITH MANIFOLD GAUGE SET

This is a method in which the trouble is located by using a manifold gauge set. (See "Installation of Manifold Set" on page AC-13.) Read the manifold gauge pressure when the following conditions are established:

- Temperature at the air inlet with the switch set at RECIRC is 30 – 35°C (86 – 95°F)
- Engine running at 2,000 rpm
- Blower fan speed control switch set at high speed
- Temperature control switch set at max cool side

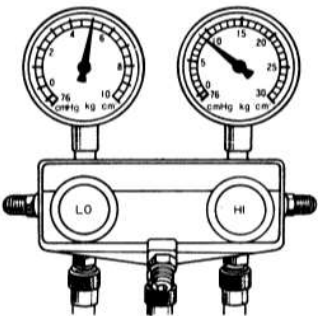
HINT: It should be noted that the gauge indications may vary slightly due to ambient temperature conditions.

No.	Gauge reading kg/cm ² (psi, kPa)	Condition	Probable	Remedy
1	LO: 1.5 – 2.0 (21 – 28, 147 – 196) HI: 14.5 – 15.0 (206 – 213, 1,422 – 1,471) 	Normal cooling	Normally functioning system	
2	During operation, pressure at low pressure side sometimes becomes a vacuum and sometimes normal 	Periodically cools and then fails to cool	Moisture present in refrigeration system	(1) Replace receiver (2) Remove moisture in system through repeatedly evacuating air (3) Charge with refrigerant to proper amount
3	Pressure low at both low and high pressure sides 	- Insufficient cooling - bubbles seen in sight glass	Insufficient refrigerant	(1) Using gas leak tester, check for leakage (2) Charge refrigerant to proper amount
		- Insufficient cooling - Frost on tubes from receiver to unit	Refrigerant flow obstructed by dirt in receiver	Replace receiver

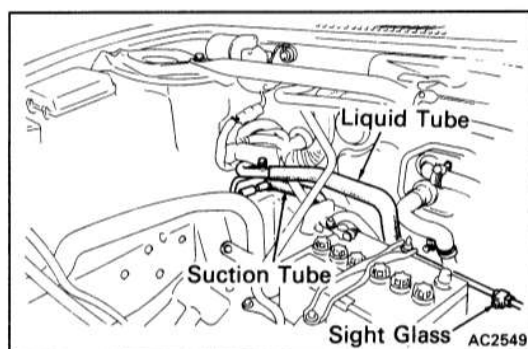
No.	Gauge reading kg/cm ² (psi, kPa)	Condition	Probable cause	Remedy
4	Pressure too high at both low and high pressure side 	Insufficient cooling	Insufficient cooling of condenser	(1) Clean condenser (2) Check fan motor operation
5			Refrigerant over charged	Check amount of refrigerant HINT: Vent out refrigerant through gauge manifold low pressure side by gradually opening valve
6			Air present in system	(1) Replace receiver (2) Check compressor oil to see if dirty or insufficient (3) Evacuate air and charge with new refrigerant
7		- Insufficient cooling - Frost or large amount of dew on piping at low pressure side	Expansion valve improperly mounted, heat sensing tube defective (Opens too wide)	(1) Check heat sensing tube installation condition (2) If (1) is normal, check expansion valve (3) Replace if defective
8	Vacuum indicated at low pressure side, very low pressure indicated at high pressure 	- Does not cool (Cools from time to time in some cases) - Frost or dew seen on piping before and after receiver or expansion valve	Refrigerant does not circulate	Allow to stand for some time and then restart operation to determine if trouble is caused by moisture or dirt If caused by moisture refer to procedures step 2 on page AC-10 If caused by dirt, remove expansion valve and clean off dirt by blowing with air. If not able to remove dirt, replace valve Evacuate air and charge with new refrigerant to proper amount For gas leakage from heat sensing tube, replace expansion valve

HINT at No. 6

These gauge indications are shown when the refrigeration system has been opened and the refrigerant charged without evacuating air.

No.	Gauge reading kg/cm ² (psi, kPa)	Condition	Probable cause	Remedy
9	Pressure too high at low pressure side, pressure too low at high pressure side. 	Does not cool	Insufficient compression	Repair or replace compressor

AC0157



INSPECTION OF REFRIGERANT VOLUME

1. RUN ENGINE AT APPROX. 1,500 RPM
2. OPERATE A/C AT MAXIMUM COOLING FOR A FEW MINUTES
3. INSPECT AMOUNT OF REFRIGERANT
Observe the sight glass on the liquid tube.

Item	Symptom	Amount of refrigerant	Remedy
1	Bubbles present in sight glass	Insufficient*	Check for gas leakage with gas leak tester
2	No bubbles present in sight glass	None, sufficient or too much	Refer to items 3 and 4
3	No temperature difference between compressor inlet and outlet	Empty or nearly empty	Evacuate and charge system. Then check for gas leakage with gas leak tester
4	Temperature between compressor inlet and outlet is noticeably different	Proper or too much	Refer to items 5 and 6
5	Immediately after air conditioner is turned off, refrigerant in sight glass stays clear	Too much	Discharge excess refrigerant to specified amount
6	When air conditioner is turned off, refrigerant foams and then stays clear	Proper	Refer to items 3 and 4

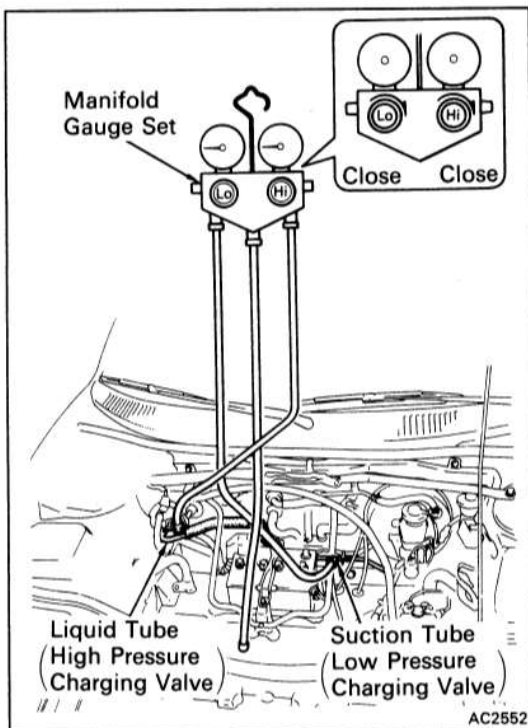
*: Bubbles in the sight glass with ambient temperatures higher can be considered normal if cooling is sufficient.

DISCHARGING OF REFRIGERANT IN REFRIGERATION SYSTEM

(See Air Conditioning Fundamentals and Repairs Pub. No. 36950E)

EVACUATING OF AIR IN REFRIGERATION SYSTEM AND CHARGING WITH REFRIGERANT.

(See Air Conditioning Fundamentals and Repairs Pub. No. 36950E)

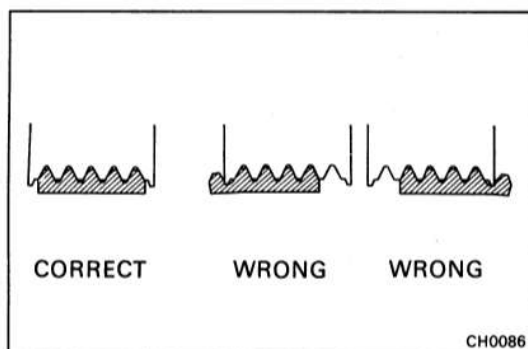


INSTALLATION OF MANIFOLD GAUGE SET

1. CLOSE BOTH HIGH AND LOW HAND VALVES
2. CONNECT CHARGING HOSES TO CHARGING VALVES

- (a) Connect the low pressure hose to the low pressure charging valve and the high pressure hose to the high pressure charging valve.
- (b) Tighten the hose nuts by hand.

NOTICE: Do not apply compressor oil to the seats of the connection.

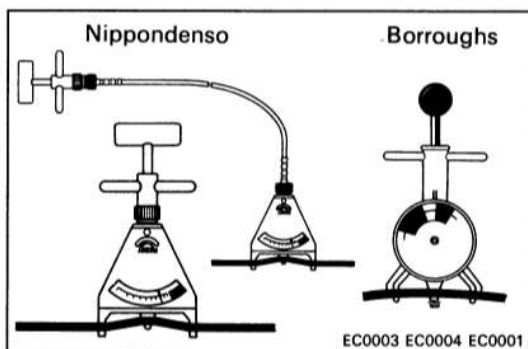


DRIVE BELT

INSPECTION OF DRIVE BELT TENSION

1. MAKE SURE THAT DRIVE BELT IS INSTALLED CORRECTLY

Check that the drive belt fits properly in the ribbed grooves.



2. INSPECT DRIVE BELT TENSION

Using a belt tension gauge, check the drive belt tension.

Belt tension gauge:

Nippondenso BTG-20 (95506-00020) or
Borroughs No. BT-33-73F

Drive belt tension:

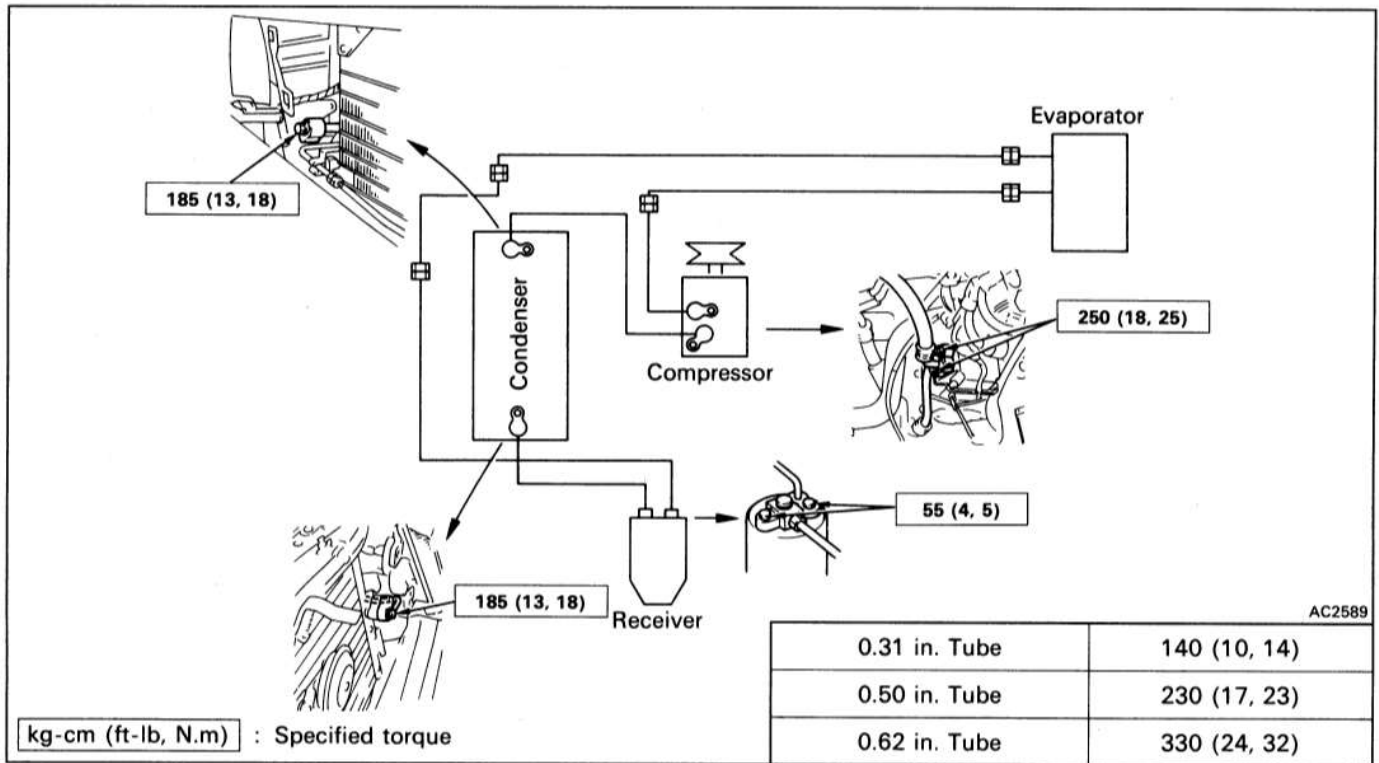
New belt 160 ± 25 lb

Used belt 100 ± 20 lb

HINT:

- "New belt" refers to a belt which has been used less than 5 minutes on a running engine.
- "Used belt" refers to a belt which has been used on a running engine for 5 minutes or more.
- After installing the drive belt, check that it fits properly in the ribbed grooves.

REFRIGERATION LINES



ON-VEHICLE INSPECTION

1. **INSPECT HOSE AND TUBE CONNECTIONS FOR LOOSENESS**
2. **INSPECT HOSES AND TUBES FOR LEAKAGE**
Using a gas leak tester, check for leakage of refrigerant.

REPLACEMENT OF REFRIGERANT LINES

1. **DISCHARGE REFRIGERANT IN REFRIGERATION SYSTEM**
2. **REPLACE FAULTY TUBE OR HOSE**
HINT: Cap the open fittings immediately to keep moisture or dirt out of the system.
3. **TORQUE CONNECTIONS TO SPECIFIED TORQUE**
NOTICE: Connections should not be torqued tighter than the specified torque.
4. **EVACUATE AIR IN REFRIGERATION SYSTEM AND CHARGE WITH REFRIGERANT**
Specified amount: 850 ± 50 g (29.98 ± 1.76 oz)
5. **INSPECT FOR LEAKAGE OF REFRIGERANT**
Using a gas leak tester, check for leakage of refrigerant.
6. **INSPECT AIR CONDITIONER OPERATION**

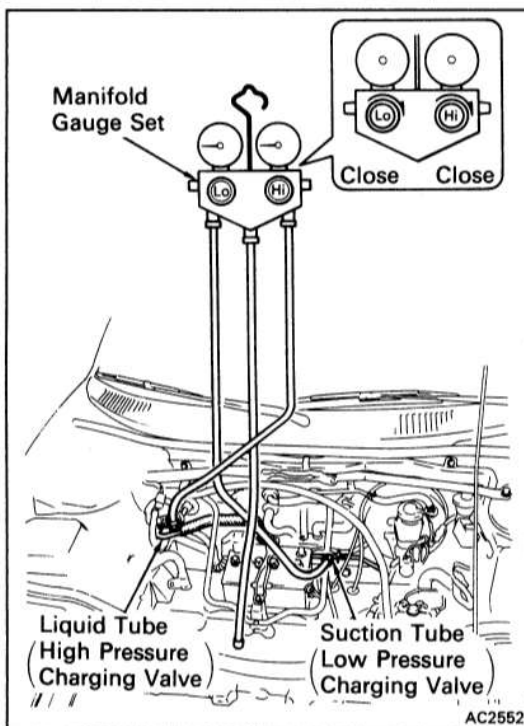
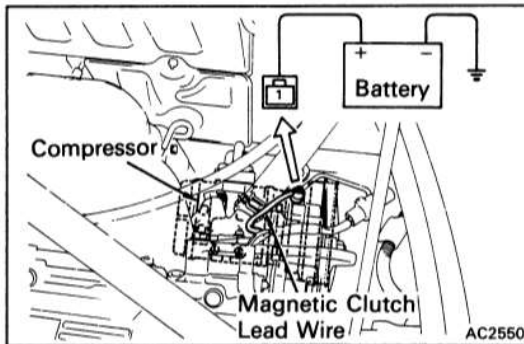
COMPRESSOR

ON-VEHICLE INSPECTION (Magnetic Clutch)

INSPECT MAGNETIC CLUTCH FOR FOLLOWING

- Inspect the pressure plate and the rotor for signs of oil.
- Check the clutch bearings for noise and grease leakage.
- Connect the positive (+) lead from the battery to the terminal on the magnetic clutch connector and the negative (-) lead to the body ground.
- Check that the magnetic clutch is energized.

If the magnetic clutch is not energized, replace the magnetic clutch.



(Compressor)

- INSTALL MANIFOLD GAUGE SET**
See page AC-13

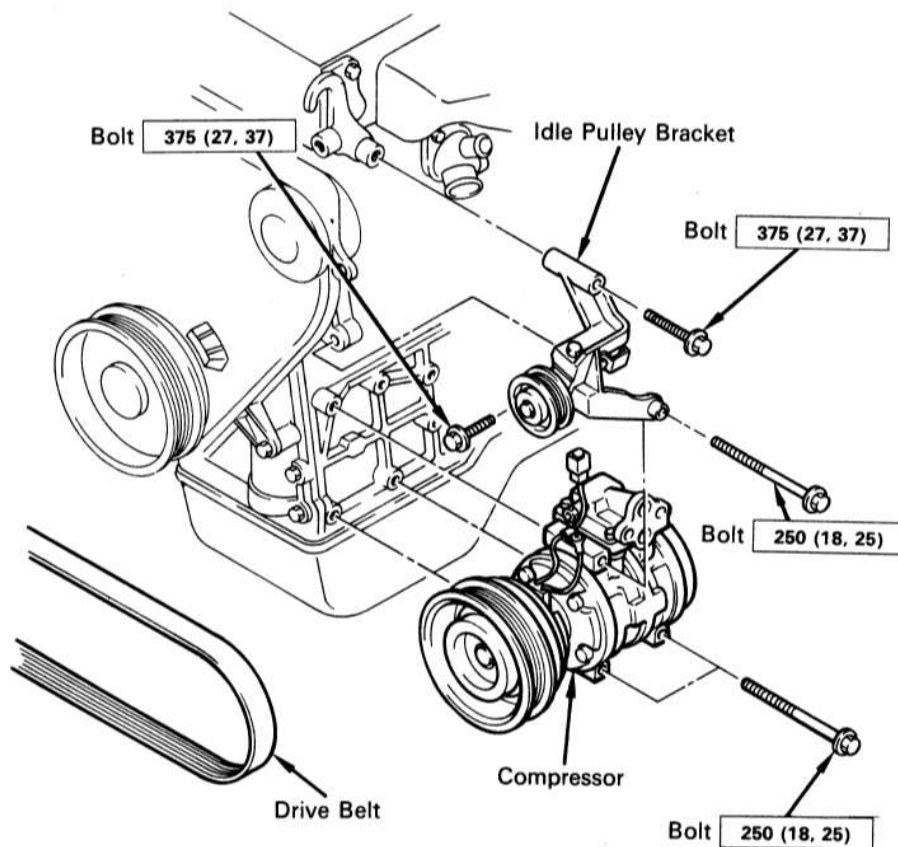
- RUN ENGINE AT APPROX. 2,000 RPM**

- INSPECT COMPRESSOR FOR FOLLOWING**

- High pressure gauge reading is not lower and low pressure gauge reading is not higher than normal.
- Check that the metallic sound.
- Check that the leakage from shaft seal.

If defects are found, replace the compressor.

Removal of Compressor

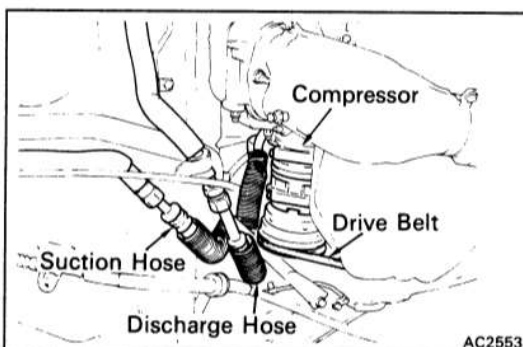


kg-cm (ft-lb, N·m) : Specified torque

AC2565

1. RUN ENGINE AT IDLE SPEED WITH A/C ON FOR TEN MINUTES
2. STOP ENGINE
3. DISCONNECT NEGATIVE CABLE TO BATTERY
4. REMOVE UNDER COVER.
5. DISCONNECT CONNECTOR FROM MAGNETIC CLUTCH
6. DISCHARGE REFRIGERANT FROM REFRIGERATION SYSTEM
7. DISCONNECT TWO HOSES FROM COMPRESSOR SERVICE VALVES

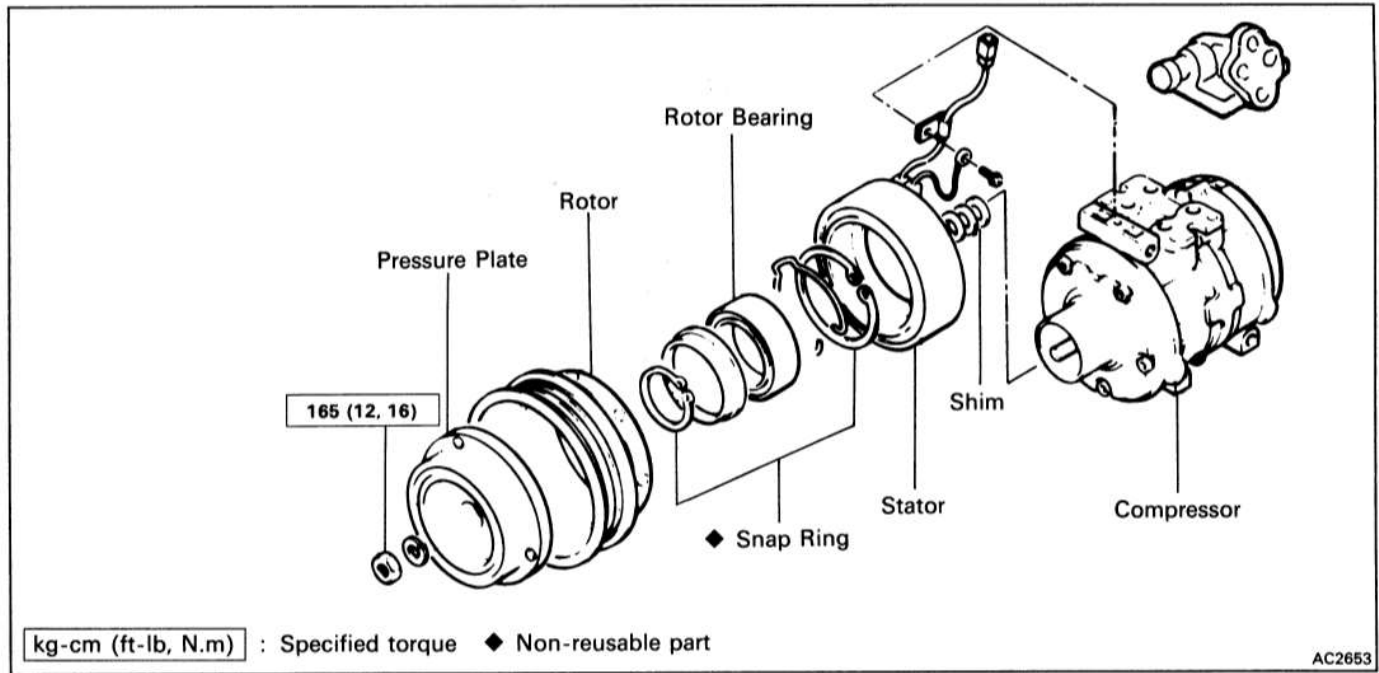
HINT: Cap the open fitting immediately to keep moisture and dust out of the system.



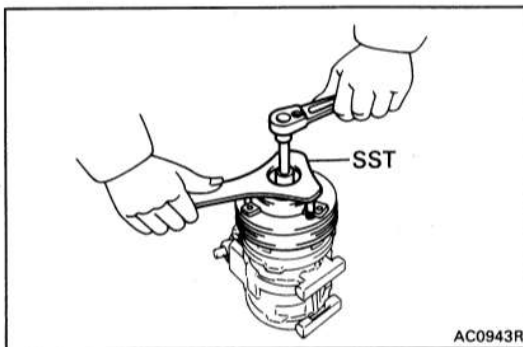
AC2553

8. REMOVE COMPRESSOR

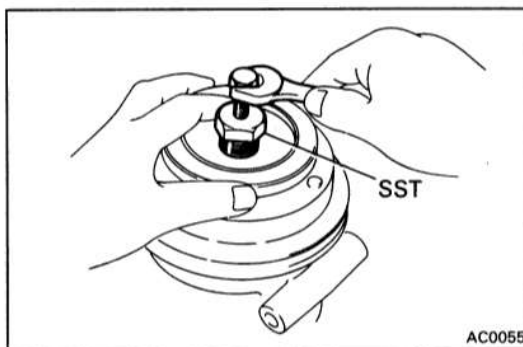
- (a) Loosen the drive belt.
- (b) Remove the idle pulley bracket.
- (c) Remove the compressor.

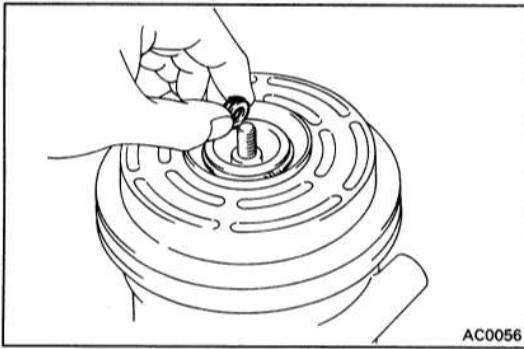
DISASSEMBLY OF MAGNETIC CLUTCH**1. REMOVE PRESSURE PLATE**

- (a) Using SST and a socket, remove the shaft nut.
SST 07112-76040

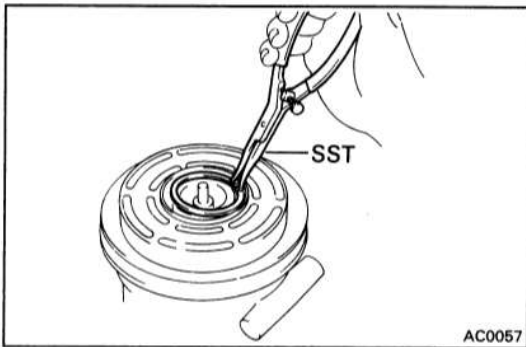


- (b) Using SST and a socket, remove the pressure plate.
SST 07112-71010



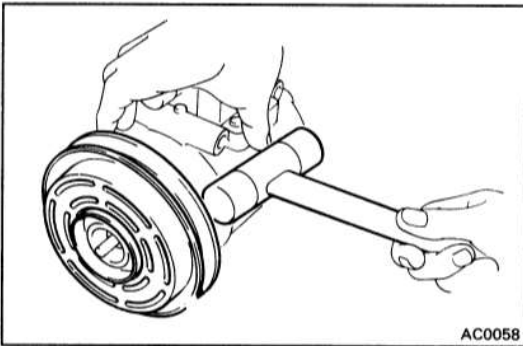


(c) Remove the shims from the shaft.

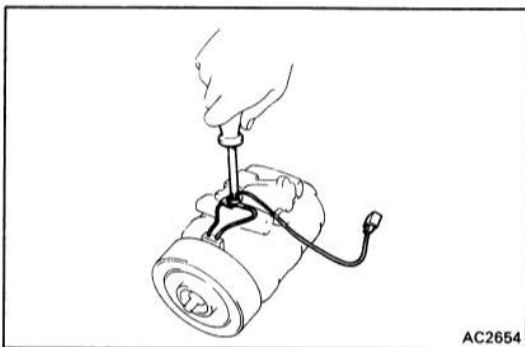


2. REMOVE ROTOR

(a) Using SST, remove the snap ring.
SST 07114-84020

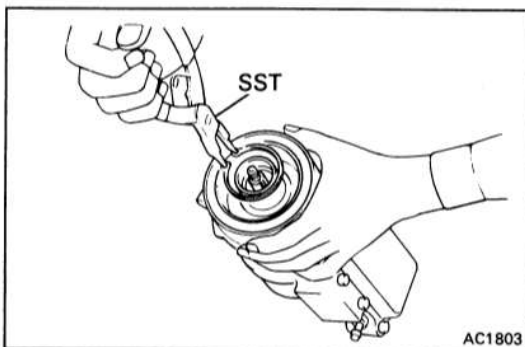


(b) Using a plastic hammer, tap the rotor off the shaft.
NOTICE: Be careful not to damage the pulley when tapping on the rotor.

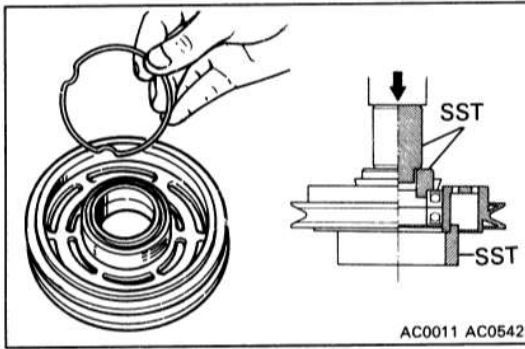


3. REMOVE STATOR

(a) Disconnect the stator lead wires from the compressor housing.



(b) Usint SST, remove the snap ring. Remove the stator.
SST 07114-84020



4. REMOVE ROTOR BEARINGS

HINT: Press out the bearings only if they are to be replaced.

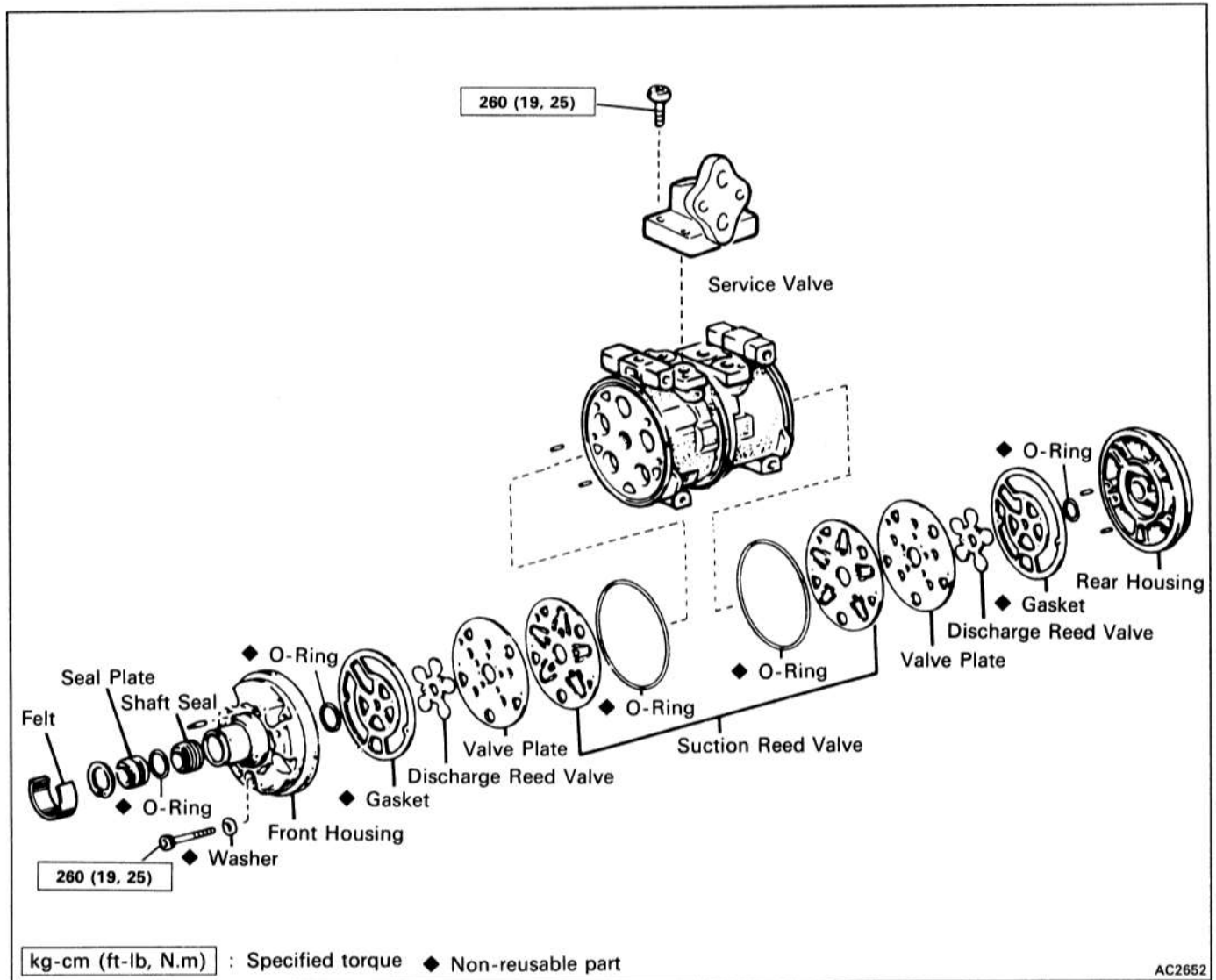
- Remove the bearing snap ring from the rotor.
- Using SST, press out the two bearings.

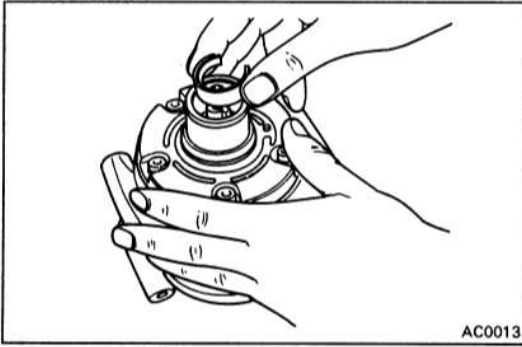
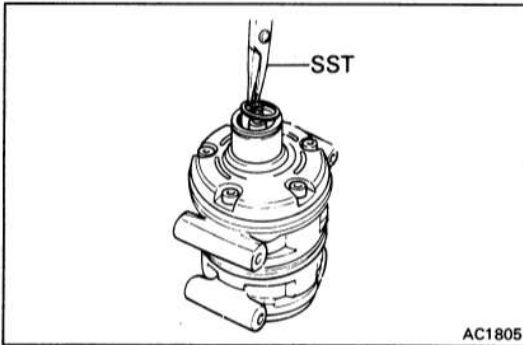
SST 07110-77011

5. INSPECT PRESSURE PLATE AND ROTOR

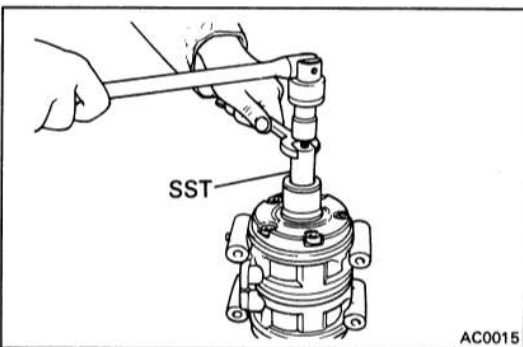
- Inspect the pressure plate and rotor surfaces for wear and scoring. Replace if necessary.
- Check the rotor bearings for wear and leakage of grease. Replace if necessary.

DISASSEMBLY OF COMPRESSOR

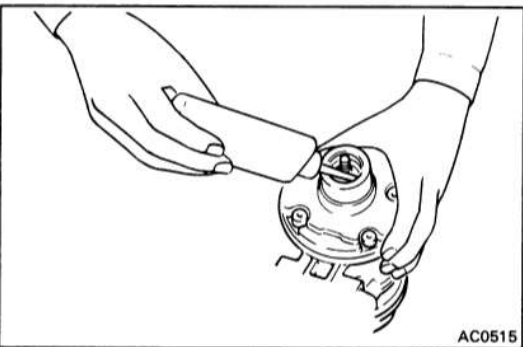


**1. REMOVE FELT****2. REMOVE SNAP RING**

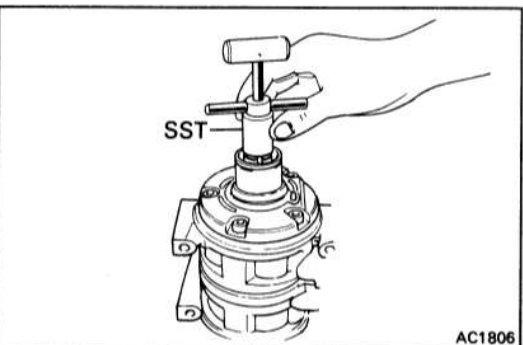
Using SST, remove the snap ring.
SST 07114-84020

**3. REMOVE KEY**

Remove the key from the shaft.
SST 07112-45021

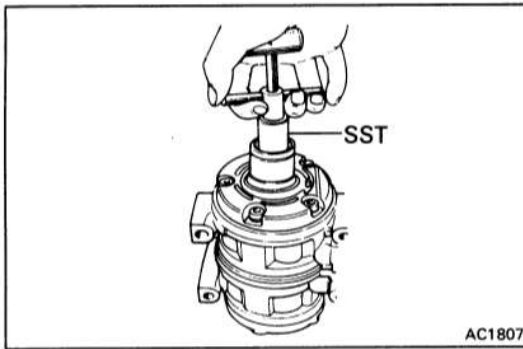
**4. APPLY COMPRESSOR OIL TO INNER BORE**

Apply compressor oil to the inner bore of the compressor.

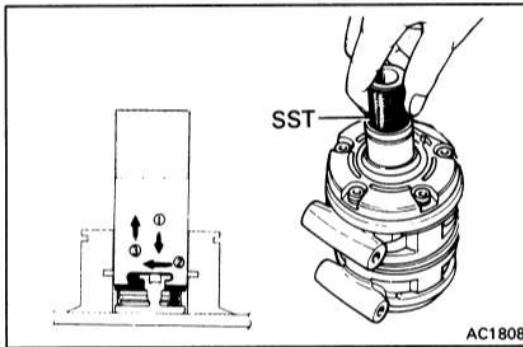
**5. REMOVE SEAL PLATE**

(a) Insert SST against the shaft. Then push the holder ring downward.

SST 07112-15010



(b) Pull up the remover bar, and remove the seal plate.

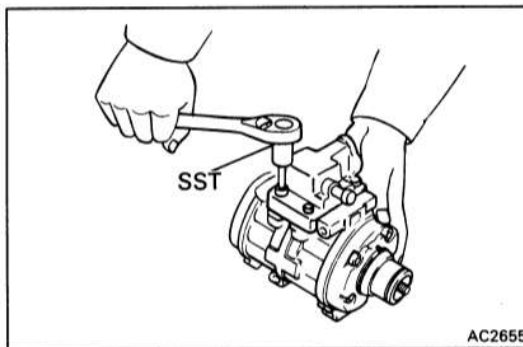


6. REMOVE SHAFT SEAL

Insert SST against the shaft, and turn it to the right while pressing on the remover.

Then remove the shaft seal.

SST 07114-15010

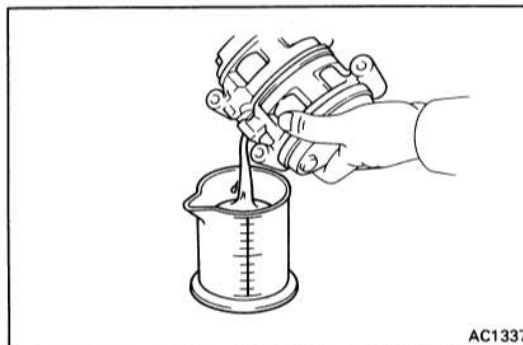


7. REMOVE SERVICE VALVE

(a) Using SST, remove the bolts holding the service valve.

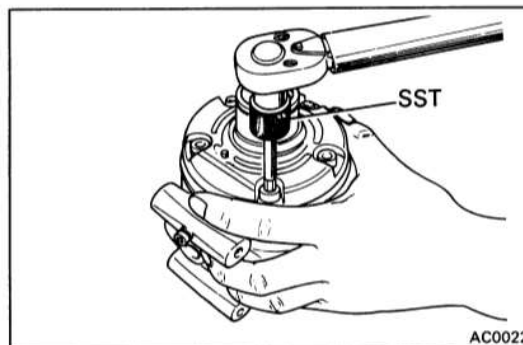
SST 07110-61050

(b) Remove the O-ring from the service valve and discard them.



8. DRAIN COMPRESSOR OIL INTO MEASURING FLASK

Measure the quantity of drained oil because the same amount should be replaced later.

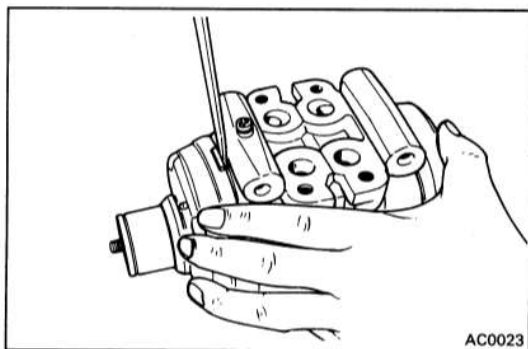


9. REMOVE FRONT HOUSING

(a) Using SST, remove the five through bolts.

HINT: Do not reuse the five washers.

SST 07110-61050



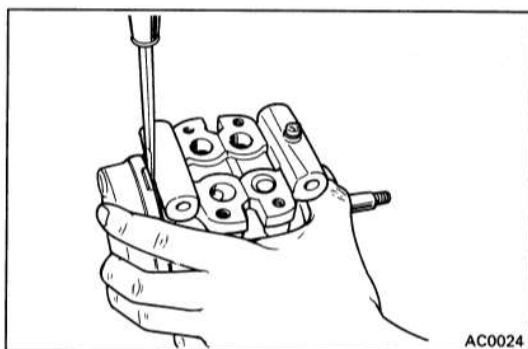
(b) Using a screwdriver, remove the front housing.

NOTICE: Be careful not to scratch the sealing surface of the front housing.



10. REMOVE FRONT VALVE PLATE

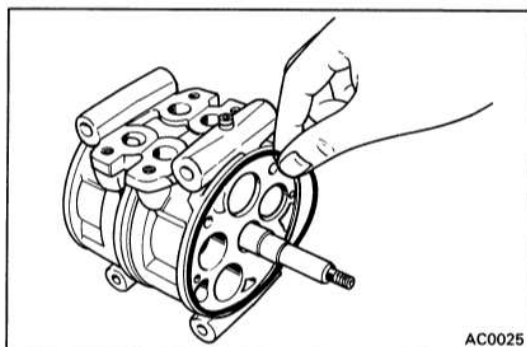
Remove the two pins from the front housing. Discard the pins.



11. REMOVE REAR HOUSING

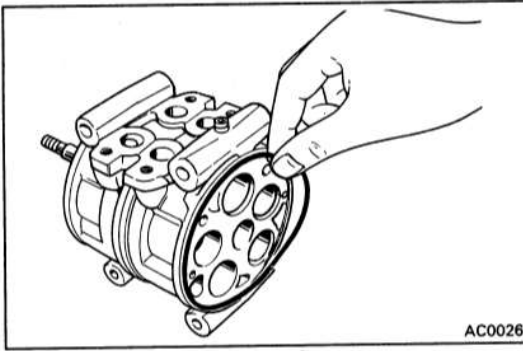
Using a screwdriver, remove the rear housing.

NOTICE: Be careful not to scratch the sealing surface of the rear housing.

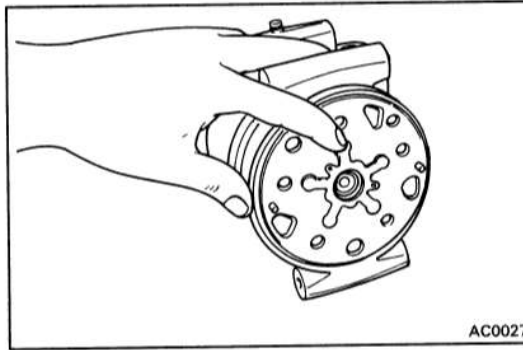


12. REMOVE FRONT AND REAR O-RINGS FROM CYLINDER BLOCK

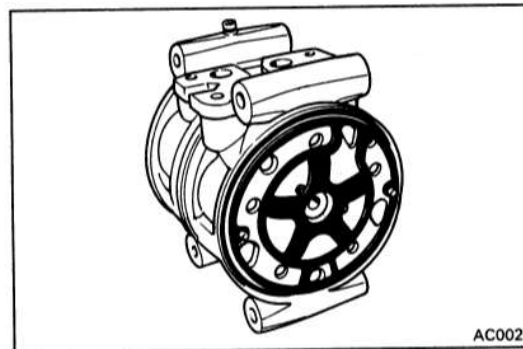
Discard the O-rings.



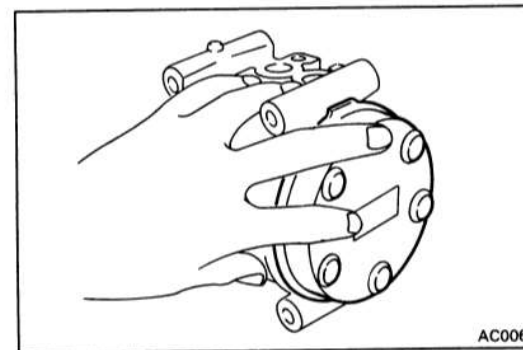
AC0026



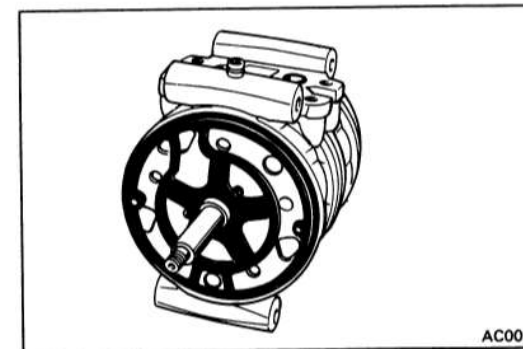
AC0027



AC0028



AC0065



AC0029

ASSEMBLY OF COMPRESSOR

(See page AC-20)

1. INSTALL REAR VALVE PLATE ON REAR CYLINDER

- Install two pins in the rear cylinder.
- Lubricate a new O-ring with compressor oil. Install the O-ring in the rear cylinder.

- Install the rear suction valve over the pins on the rear cylinder.

HINT: The front and rear suction valves are identical.

- Install the rear valve plate together with the discharge valve over the pins on the rear cylinder.

HINT: The rear valve plate is marked with an "R".

- Lubricate the new gasket with compressor oil. Install the gasket on the valve plate.

2. INSTALL REAR HOUSING ON REAR CYLINDER

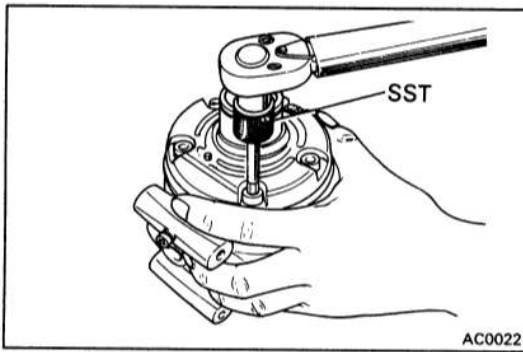
3. INSTALL FRONT VALVE PLATE ON FRONT CYLINDER

- Install the two pins in the front cylinder.
- Lubricate a new O-ring with compressor oil. Install the O-ring in the front housing.
- Install the front suction valve over the pins on the front cylinder.

- Install the front valve plate together with the discharge valve over the pins on the front cylinder.

HINT: The front valve plate is marked with an "F".

- Lubricate the new gasket with compressor oil. Install the gasket on the valve plate.

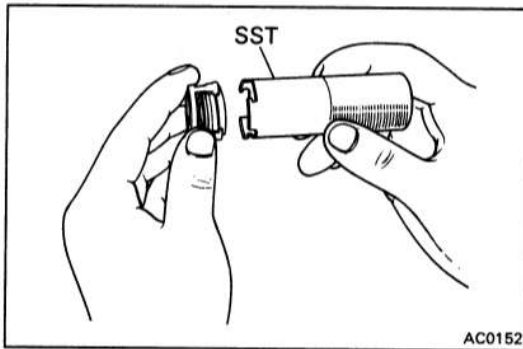


4. INSTALL FRONT HOUSING ON FRONT CYLINDER AND TIGHTEN FIVE THROUGH BOLTS

Using SST and torque wrench, gradually tighten the five through bolts in two or three passes.

SST 07110-61050

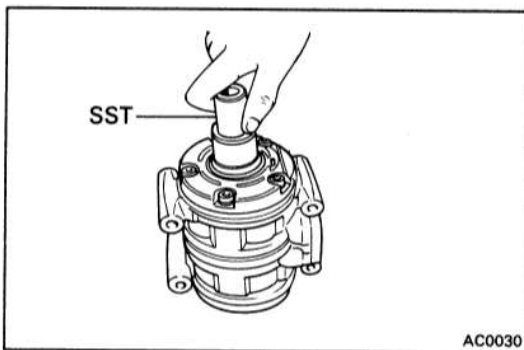
Torque: 260 kg-cm (19 ft-lb, 25 N.m)



5. INSTALL SHAFT SEAL

(a) Fit the shaft seal onto SST.

SST 07114-15010

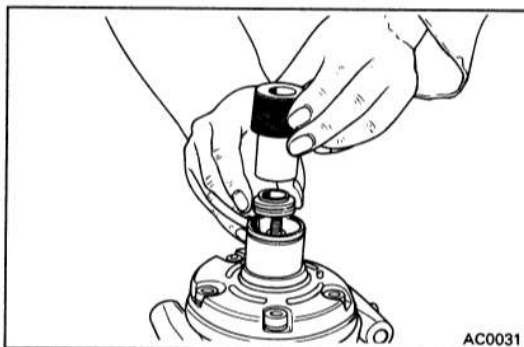


(b) Apply oil to the bore.

(c) Insert SST, and turn it counterclockwise while lightly pressing in.

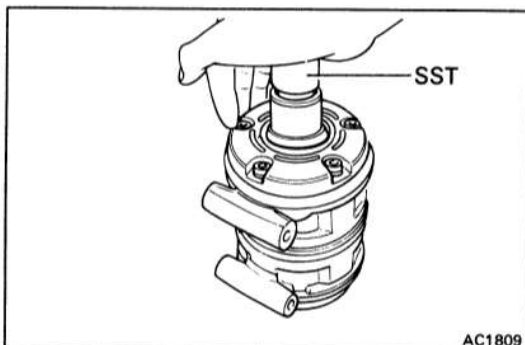
(d) Then pull up the SST.

SST 07114-15010



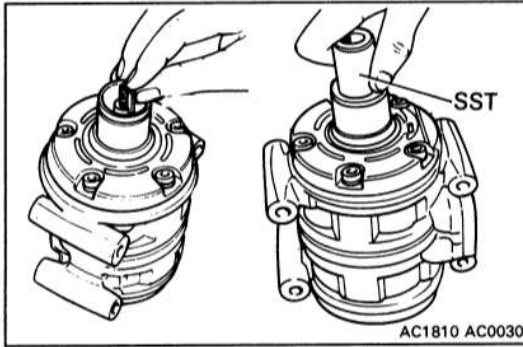
6. INSTALL SEAL PLATE

(a) Put in the seal plate.



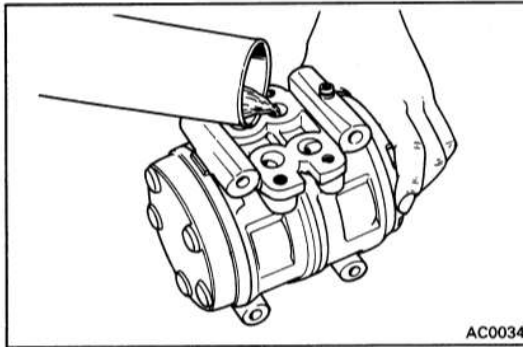
(b) Press in SST.

SST 07112-25010

**7. INSTALL KEY IN SHAFT GROOVE**

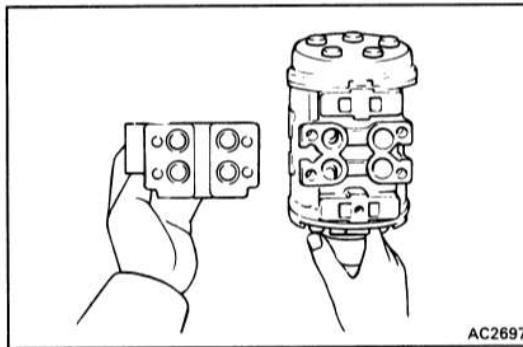
Using SST and plastic hammer, tap the key lightly.
SST 07114-45010

Place the felt inside the bore.
(Refer to page AC-21)

**8. POUR COMPRESSOR OIL INTO COMPRESSOR**

Add the same quantity of oil as was removed, plus 20 cc, into the compressor.

Compressor oil: **DENSOIL 6, SUNISO No.5GS or equivalent**

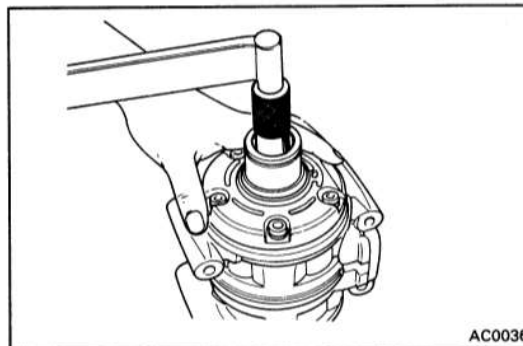
**9. INSTALL SERVICE VALVE**

(a) Lubricate new O-rings with compressor oil. Install the O-rings in the service valve.

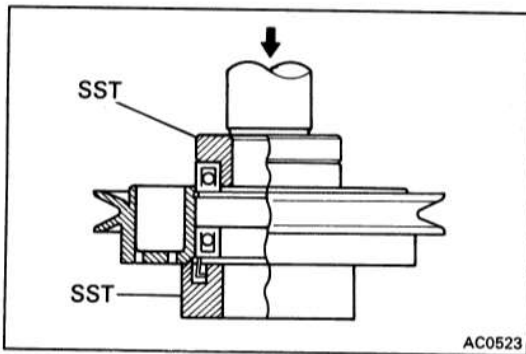
(b) Install the service valve on the compressor. Using SST and torque wrench, tighten the bolts.

SST 07110-61050

Torque: **260 kg-cm (19 ft-lb, 25 N.m)**

**10. CHECK SHAFT STARTING TORQUE**

Torque: **50 kg-cm (43 in.-lb, 4.9 N.m) or less**



ASSEMBLY OF MAGNETIC CLUTCH

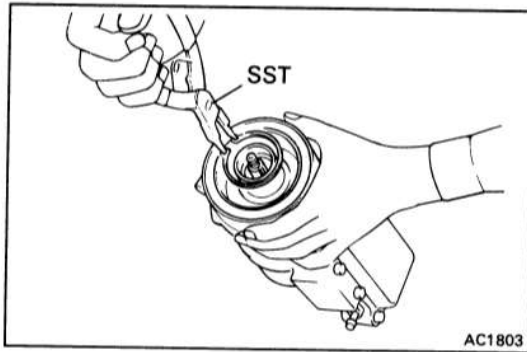
(See page AC-18)

1. INSTALL TWO BEARINGS IN ROTOR

- (a) Using SST, press a shield ring and two new bearings into the rotor boss until fully seated.

SST 07110-77011

- (b) Install the bearing snap ring into the rotor groove.



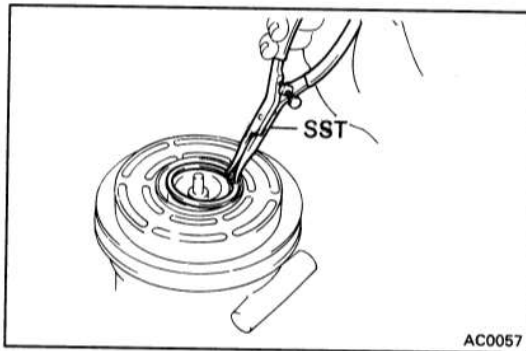
2. INSTALL STATOR

- (a) Install the stator on the compressor.

- (b) Using SST, install the new snap ring.

SST 07114-84020

- (c) Connect the stator lead wires to the compressor housing.

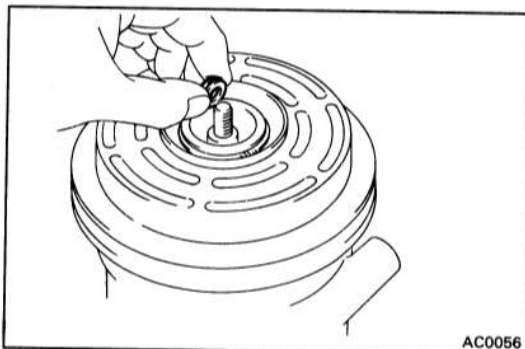


3. INSTALL ROTOR

- (a) Install the rotor on the compressor shaft.

- (b) Using SST, install the new snap ring.

SST 07114-84020

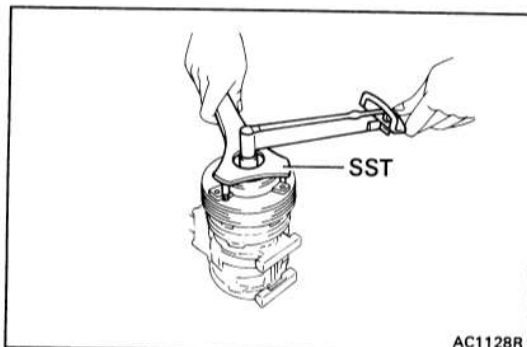


4. INSTALL PRESSURE PLATE

- (a) Adjust the clearance between the pressure plate and rotor by installing shims on the compressor shaft.

Standard clearance: 0.8 ± 0.2 mm (0.32 ± 0.08 in.)

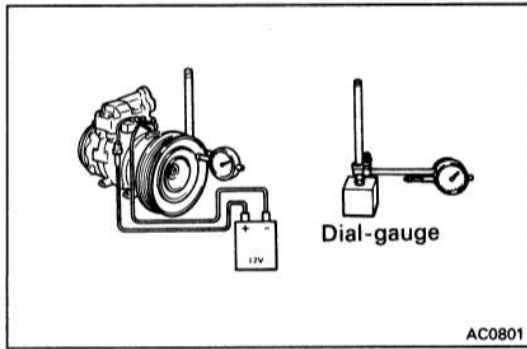
If the clearance is not within tolerance, change the number of shims to obtain the standard clearance.



- (b) Using SST and torque wrench, install the shaft nut.

SST 07112-76040

Torque: 200 kg-cm (14 ft-lb, 20 N.m)

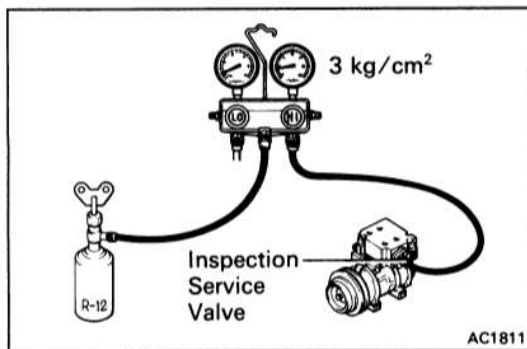


5. INSPECT CLEARANCE OF MAGNETIC CLUTCH

- Set the dial-gauge to the pressure plate of the magnetic clutch.
- Connect the magnetic clutch lead wire to the positive (+) terminal of the battery.
- Check the clearance between the pressure plate and rotor, when connect the negative (-) terminal of the battery.

Standard Clearance: 0.8 ± 0.2 mm (0.32 ± 0.08 in.)

If the clearance is not within standard clearance, adjust the clearance using shims to obtain the standard clearance.



PERFORMANCE TEST OF COMPRESSOR

1. PERFORM GAS LEAKAGE TEST

- Install the inspection service valve on the service valve.

HINT: Use only a TOYOTA supplied inspection service valve to perform the gas leakage test.

Part No. Suction side 88376-17020
Discharge side 88376-22020

- Charge the compressor with refrigerant through the charge valve until the pressure is 3 kg/cm^2 (43 psi, 294 kPa).
- Using a gas leak detector, check the compressor for leaks.

If leaks are found, check and replace the compressor.

2. EVACUATE COMPRESSOR AND CHARGE WITH REFRIGERANT

Make sure the caps are tight and compressor is free from moisture and contamination.

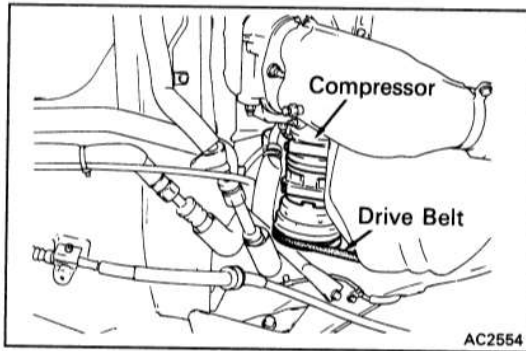
HINT: When storing a compressor for an extended period, charge the compressor with refrigerant or dry nitrogen gas to prevent corrosion.

INSTALLATION OF COMPRESSOR

(See page AC-17)

1. **INSTALL COMPRESSOR AND IDLE PULLEY BRACKET WITH FIVE BOLTS**

Torque:



2. **INSTALL DRIVE BELT**

See page AC-14

3. **CONNECT TWO HOSES TO COMPRESSOR**

Torque:

Discharge line	250 kg-cm (18 ft-lb, 25 N·m)
Suction line	250 kg-cm (18 ft-lb, 25 N·m)

4. **CONNECT CLUTCH LEAD WIRE TO WIRING HARNESS**

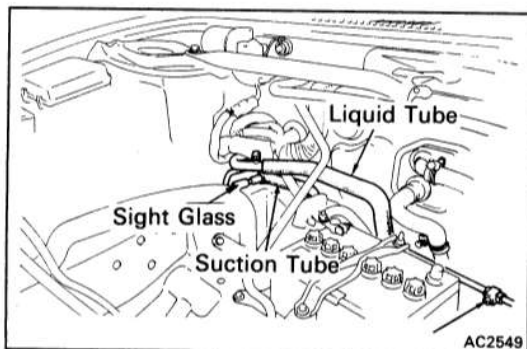
5.

6. **CONNECT CABLES TO BATTERY**

7. **EVACUATE AIR FROM AIR CONDITIONING SYSTEM**

8. **CHARGE AIR CONDITIONING SYSTEM WITH REFRIGERANT AND CHECK FOR GAS LEAKAGE**

Specified amount: 850 ± 50 g (29.98 ± 1.76 oz)



RECEIVER

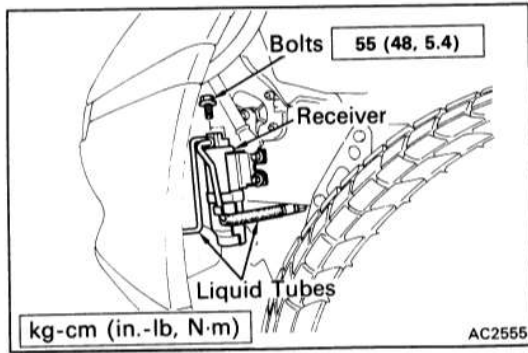
ON-VEHICLE INSPECTION

INSPECT SIGHT GLASS, FUSIBLE PLUG AND FITTINGS FOR LEAKAGE

Use a gas leak tester. Repair as necessary.

REMOVAL OF RECEIVER

1. **DISCHARGE REFRIGERANT FROM REFRIGERATION SYSTEM**
2. **REMOVE LEFT SIDE FRONT FENDER LINER AND UNDER COVER**
3. **DISCONNECT TWO LIQUID TUBES FROM RECEIVER**
HINT: Cap the open fittings immediately to keep moisture out of the system.
4. **REMOVE RECEIVER FROM RECEIVER HOLDER**



INSTALLATION OF RECEIVER

1. INSTALL RECEIVER IN RECEIVER HOLDER

HINT: Do not remove the blind plugs until ready for connection.

2. CONNECT TWO LIQUID TUBES TO RECEIVER

Torque: 55 kg-cm (48 in.-lb, 5.4 N·m)

3. REINSTALL FENDER LINER AND UNDER COVER.

4. IF RECEIVER WAS REPLACED, ADD COMPRESSOR OIL TO COMPRESSOR

Add 20 cc (0.7 fl.oz.)

Compressor oil: DENSO OIL 6,
SUNISO NO.5GS or equivalent

5. EVACUATE AIR FROM REFRIGERATION SYSTEM

6. CHARGE SYSTEM WITH REFRIGERANT AND INSPECT FOR LEAKAGE OF REFRIGERANT

Specified amount: 850 ± 50 g (29.98 ± 1.76 oz)

CONDENSER

ON-VEHICLE INSPECTION

1. INSPECT CONDENSER FINS FOR BLOCKAGE OR DAMAGE

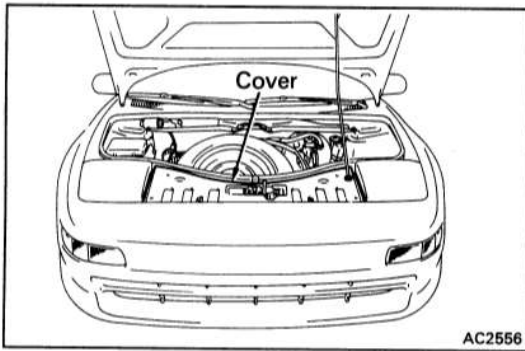
If the fins are clogged, wash them with water and dry with compressed air.

NOTICE: Be careful not to damage the fins.

If the fins are bent, straighten them with a screwdriver or pliers.

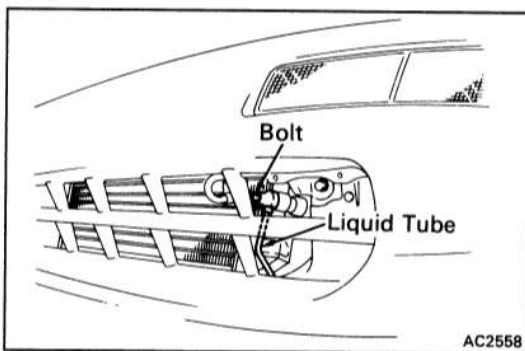
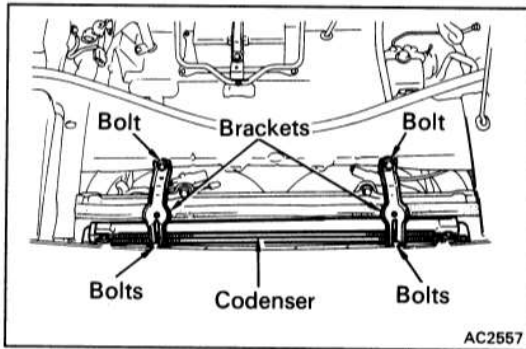
2. INSPECT CONDENSER FITTINGS FOR LEAKAGE

Repair as necessary.



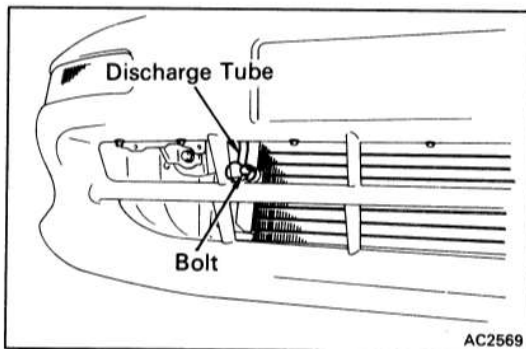
REMOVAL OF CONDENSOR

1. **DISCHARGE REFRIGERANT FROM REFRIGERATION SYSTEM**
2. **REMOVE COVER AND TWO BRACKETS WITH FOUR BOLTS**



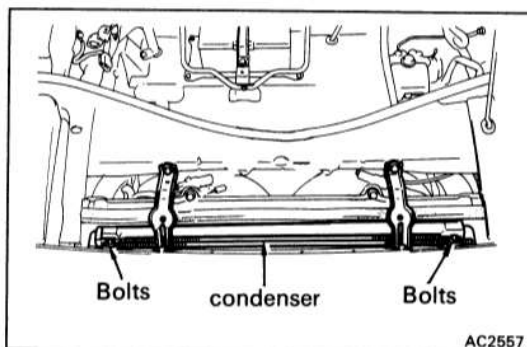
3. **DISCONNECT LIQUID TUBE AND DISCHARGE TUBE FROM CONDENSER FITTINGS**

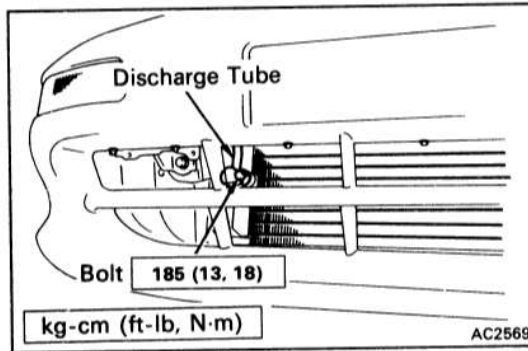
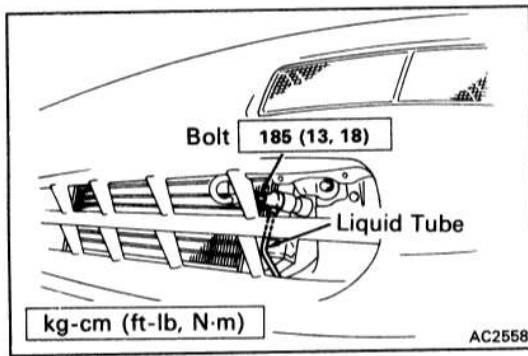
HINT: Cap the open fittings immediately to keep moisture out of the system.



4. **REMOVE CONDENSER**

- (a) Remove the two bolts.
- (b) Pull out the condenser between the radiator and the body.





INSTALLATION OF CONDENSER

1. INSTALL CONDENSER

Install the brackets and bolts, making sure the rubber cushions fit on the mounting flanges correctly.

2. CONNECT LIQUID TUBE AND DISCHARGE TUBE TO CONDENSER

Torque: 185 kg-cm (13 ft-lb, 18 N·m)

3. REINSTALL TWO BRACKETS WITH FOUR BOLTS AND COVER

4. IF CONDENSER WAS REPLACED, ADD COMPRESSOR OIL TO COMPRESSOR

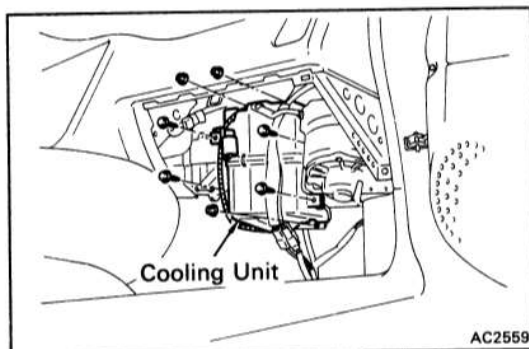
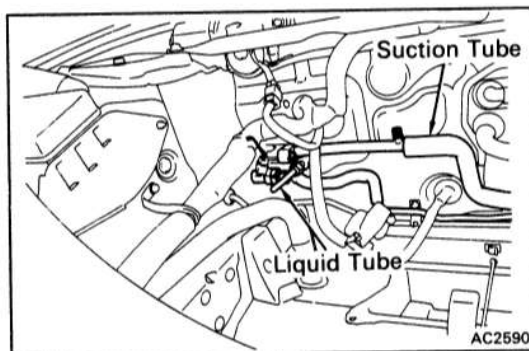
Add 40 – 50 cc (1.4 – 1.8 fl.oz.)

Compressor oil: DENSO OIL 6,
SUNISO NO.5GS or equivalent

5. EVACUATE AIR FROM AIR CONDITIONING SYSTEM

6. CHARGE SYSTEM WITH REFRIGERANT AND INSPECT FOR LEAKAGE OF REFRIGERANT

Specified amount: 850 ± 50 g (29.98 ± 1.76 oz)



COOLING UNIT

REMOVAL OF COOLING UNIT

1. DISCONNECT NEGATIVE CABLE FROM BATTERY

2. DISCHARGE REFRIGERANT FROM REFRIGERATION SYSTEM

3. DISCONNECT SUCTION TUBE FROM COOLING UNIT OUTLET FITTING

4. DISCONNECT LIQUID TUBE FROM COOLING UNIT INLET FITTING

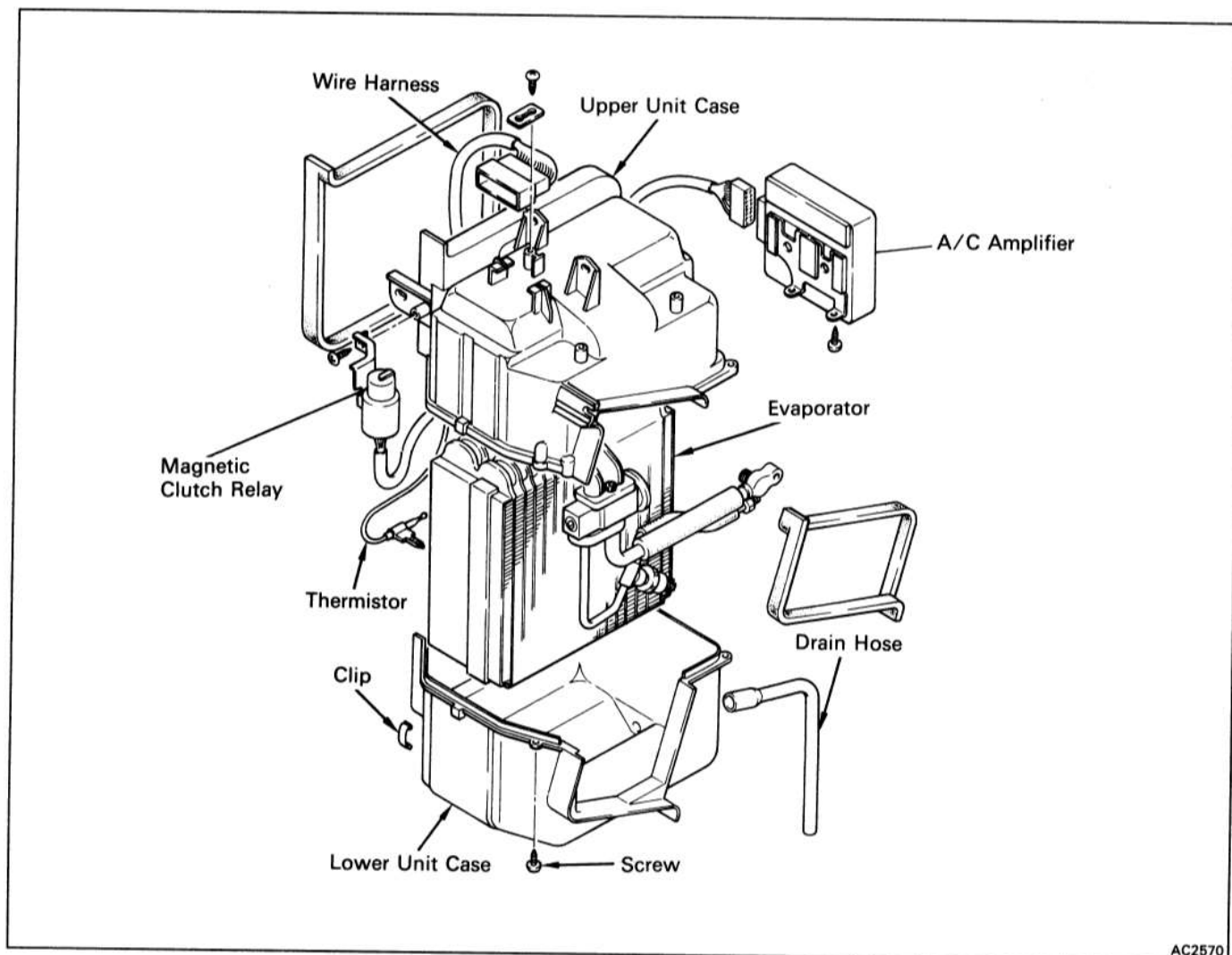
HINT: Cap the open fittings immediately to keep moisture out of the system.

5. REMOVE GLOVE BOX

6. DISCONNECT CONNECTORS

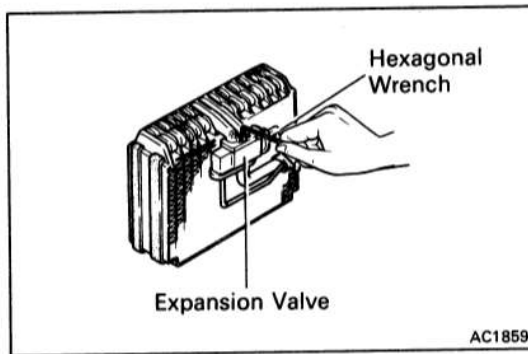
7. REMOVE COOLING UNIT

Remove the three nuts and four bolts and the cooling unit.

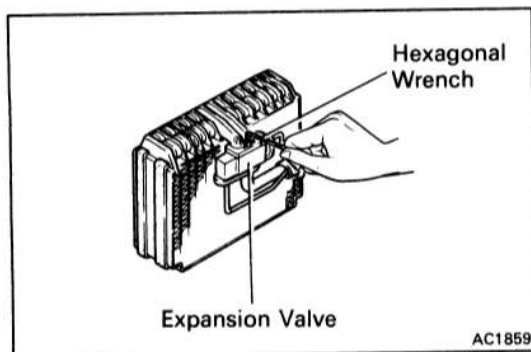
DISASSEMBLY OF COOLING UNIT

- 1. REMOVE MAGNETIC CLUTCH RERAY**
- 2. REMOVE A/C AMPLIFIER**
- 3. REMOVE UPPER UNIT CASE**
 - (a) Disconnect the connectors.
 - (b) Remove the wire harness.
 - (c) Remove the two clips.
 - (d) Remove the four screws.
 - (e) Remove the upper unit case.
- 4. REMOVE EVAPORATOR FROM LOWER UNIT CASE**
- 5. REMOVE THERMISTOR FROM EVAPORATOR**

Remove the thermistor with the thermistor holder.

**6. REMOVE EXPANSION VALVE FROM EVAPORATOR**

- (a) Remove the packing and heat sensing tube from suction and liquid tubes.
- (b) Remove the expansion valve from the evaporator.

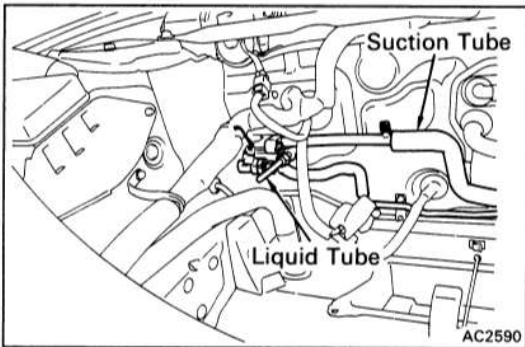
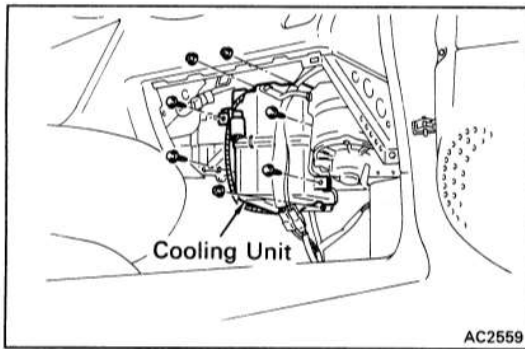
**ASSEMBLY OF COOLING UNIT****INSTALL COMPONENTS ON EVAPORATOR**

- (a) Connect the expansion valve, suction and liquid tubes to the evaporator. Torque the bolt.

Torque: 55 kg-cm (48 in.-lb, 5.4 N·m)

HINT: Be sure that the O-rings are positioned on the tube fitting.

- (b) Install the holder to the suction and liquid tubes with heat sensing tube.
- (c) Install the lower unit case to the evaporator.
- (d) Install the thermistor to the evaporator.
- (e) Install the upper unit case.
- (f) Install the four screws.
- (g) Install three clips.
- (h) Install the connector of thermistor.



INSTALLATION OF COOLING UNIT

1. INSTALL COOLING UNIT

Install the cooling unit with the three nuts and four bolts.

2. CONNECT CONNECTORS

3. INSTALL GLOVE BOX REINFORCEMENT

4. CONNECT LIQUID TUBE TO COOLING UNIT INLET FITTING

Torque the nut.

Torque: 140 kg-cm (10 ft-lb, 14 N·m)

5. CONNECT SUCTION TUBE TO COOLING UNIT OUTLET FITTING

Torque the nut.

Torque: 330 kg-cm (24 ft-lb, 32 N·m)

6. IF EVAPORATOR WAS REPLACED, ADD COMPRESSOR OIL TO COMPRESSOR

Add 40 – 50 cc (1.4 – 1.7 fl.oz.)

Compressor oil: **DENSOIL 6,**
SUNISO NO.5GS OR equivalent

7. CONNECT NEGATIVE CABLE TO BATTERY

8. EVACUATE AIR FROM REFRIGERATION SYSTEM

9. CHARGE SYSTEM WITH REFRIGERANT AND INSPECT FOR LEAKAGE OF REFRIGERANT

Specified amount: 850 ± 50 g (29.98 ± 1.76 oz)

EVAPORATOR

REMOVAL OF EVAPORATOR

See Disassembly of Cooling Unit on page AC-30.

INSPECTION OF EVAPORATOR

1. INSPECT EVAPORATOR FINS FOR BLOCKAGE

If the fins are clogged, clean them with compressed air.

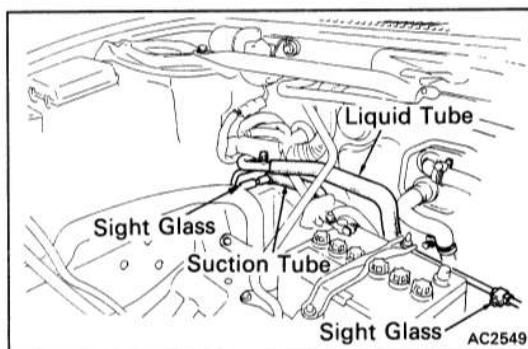
NOTICE: Never use water to clean the evaporator.

2. INSPECT FITTINGS FOR CRACKS OR SCRATCHES

Repair as necessary.

INSTALLATION OF EVAPORATOR

See Assembly of Cooling Unit on page AC-32.



EXPANSION VALVE

ON-VEHICLE INSPECTION

1. INSPECT REFRIGERANT VOLUME

See page AC-12.

2. INSTALL MANIFOLD GAUGE SET

See page AC-13.

3. A/C SWITCH ON AND BLOWER SWITCH TO HI

4. RUN ENGINE AT APPROX, 2,000 RPM

Run the engine at 2,000 rpm for at least 5 minutes.

5. INSPECT EXPANSION VALVE

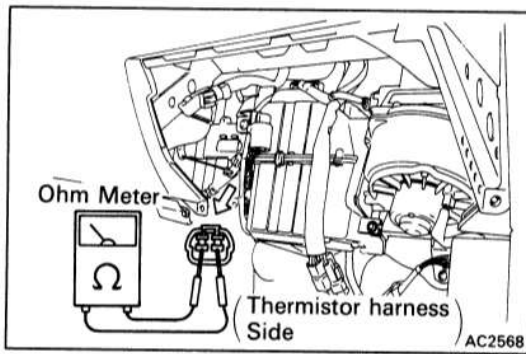
If the expansion valve is clogged, the low pressure reading will drop to 0 kg-cm² (0psi, 0kpa), otherwise it is OK.

REMOVAL OF EXPANSION VALVE

See Disassembly of Cooling Unit on page AC-30.

INSTALLATION OF EXPANSION VALVE

See Assembly of Cooling Unit on page AC-32.



THERMISTOR

ON-VEHICLE INSPECTION

1. DISCONNECT NEGATIVE BATTERY CABLE
2. REMOVE GLOVE BOX
3. CHECK RESISTANCE OF THERMISTOR

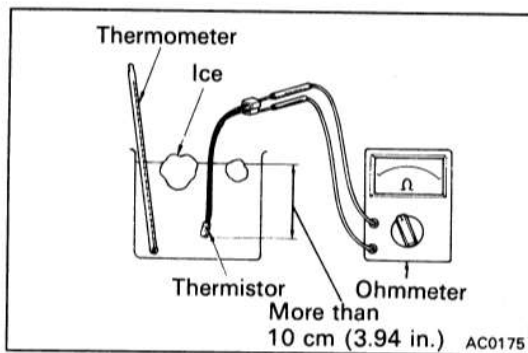
Measure the resistance between terminals.

Standard resistance: 1,500 Ω at 25°C (77°F)

If resistance value is not as specified, replace the thermistor.

REMOVAL OF THERMISTOR

See Disassembly of Cooling Unit on page AC-30.

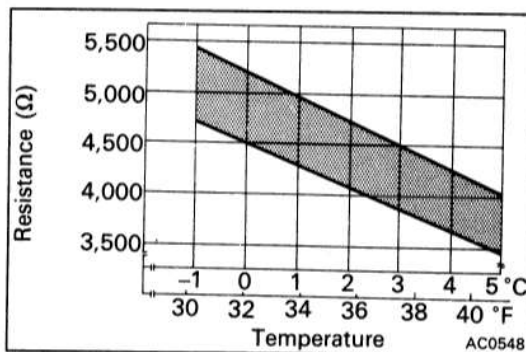


INSPECTION OF THERMISTOR

INSPECT THERMISTOR OPERATION

- (a) Place the thermistor in cold water. While varying the temperature of the water, measure the resistance at the connector and at the same time, measure the temperature of the water with a thermometer.
- (b) Compare the two readings on the chart.

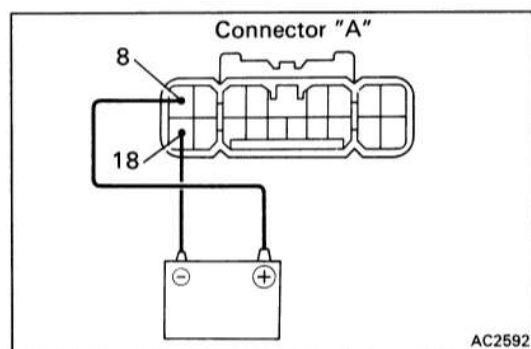
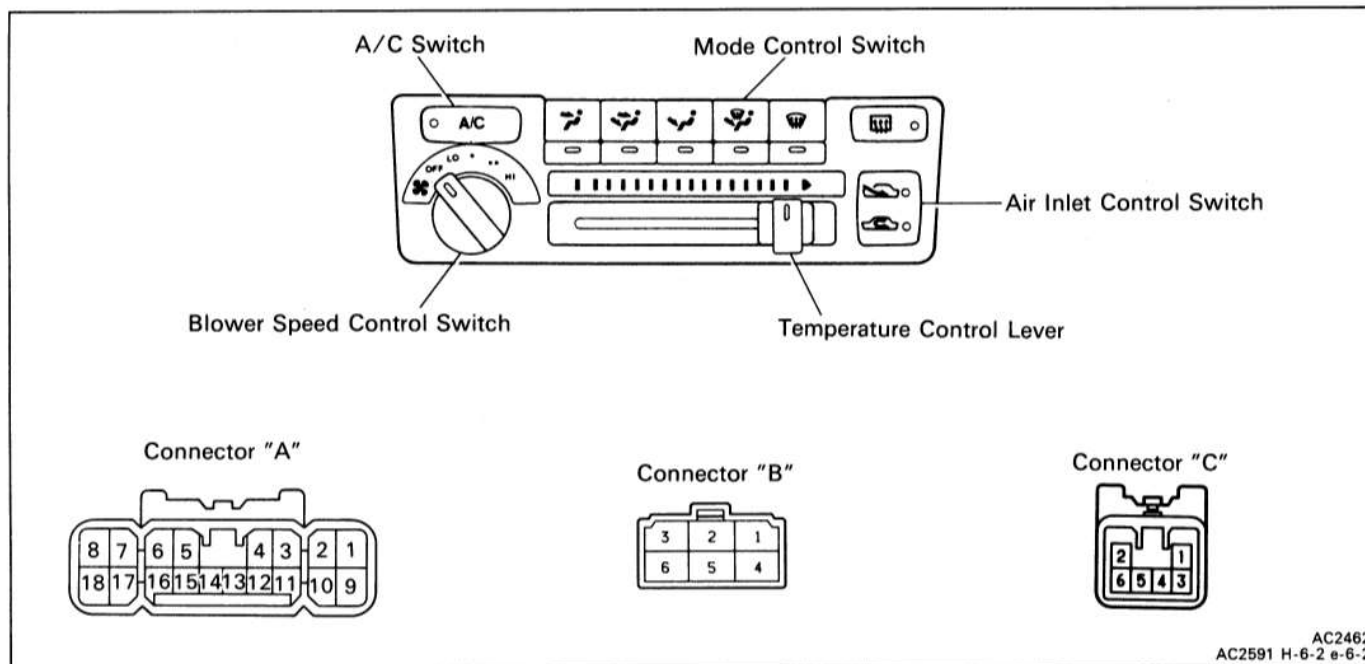
If the intersection is not between the two lines, replace the thermistor.



INSTALLATION OF THERMISTOR

See Assembly of Cooling Unit on page AC-32.

A/C CONTROL ASSEMBLY



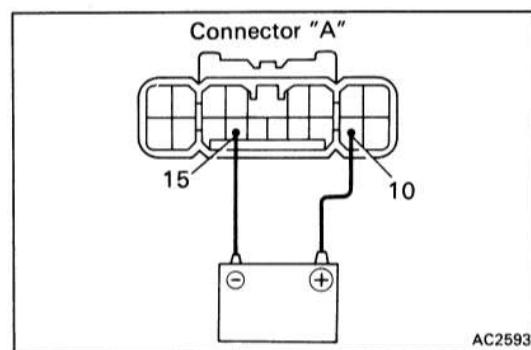
Illuminations (Except A/C Switch)

INSPECTION OF ILLUMINATION

1. INSPECT ILLUMINATION

Connect the positive (+) lead from the battery to terminal A-18 and the negative (-) lead to terminal A-8, then check that the illuminations light up.

If illuminations do not light up, test the bulb.



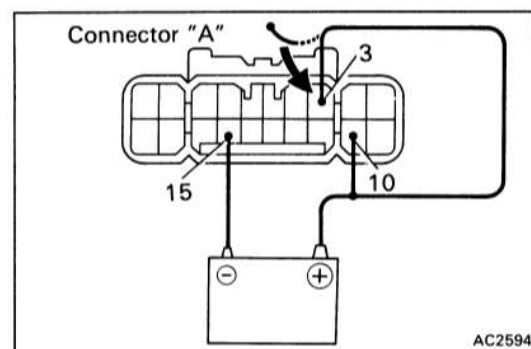
Air Inlet Control Switch

INSPECTION OF AIR INLET CONTROL SWITCH

1. INSPECT INDICATOR

- Connect the positive (+) lead from the battery to terminal A-10 and the negative (-) lead to terminal A-15.
- Check that the FRESH and RECIRC indicators light up alternately each time the air inlet control switch button is pressed.
- Then, connect the positive (+) lead from the battery to terminal A-3 and check that the indicator dims.

If indicators operation is not as specified, replace the A/C control assembly.

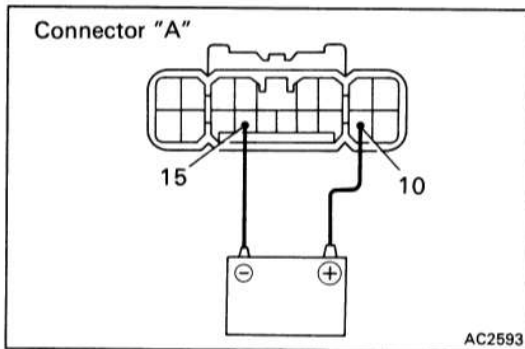


2. INSPECT SWITCH CONTINUITY

Connector "A"	Terminal		
	Switch position		
	A-1	A-9	A-15
	FRESH (Free)	○ —▶— ○	○ —▶— ○
	RECIRC (Pushed in)		○ —▶— ○

AC2591

If continuity is not as specified, replace the A/C control assembly.



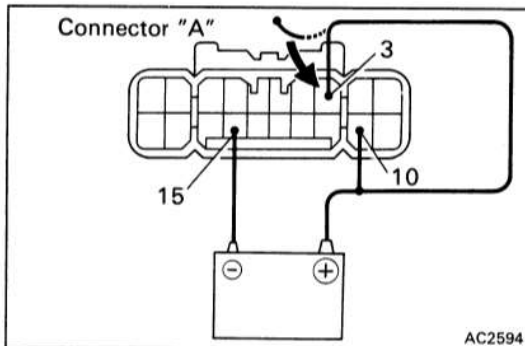
AC2593

Mode Control Switch**INSPECTION OF MODE CONTROL SWITCH****1. INSPECT INDICATOR**

- Connect the positive (+) lead from the battery to terminal A-10 and the negative (-) lead to terminal A-15.
- Push each of the mode control switch buttons in and check that their indicators light up.

- Then, connect the positive (+) lead from the battery to terminal A-3 and check that the indicator dims.

If indicators operation is not as specified, replace the A/C control assembly.



AC2594

2. INSPECT SWITCH CONTINUITY

Connector "A"	Terminal					
	Switch position					
	A-4	A-5	A-12	A-13	A-14	A-15
	FACE			○ —▶—		○
	B/L				○ —▶—	○
	FOOT	○ —▶—				○
	FOOT/DEF		○ —▶—			○
	DEF				○ —▶—	○

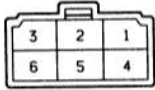
AC2591

If continuity is not as specified, replace the A/C control assembly.

Blower Speed Control Switch

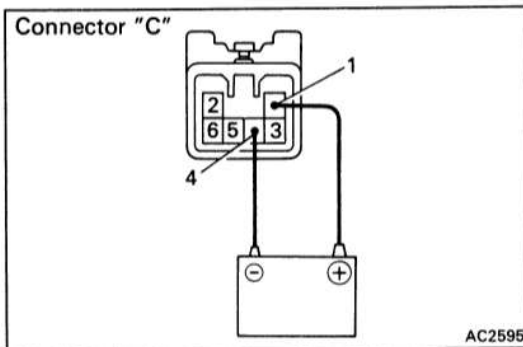
INSPECTION OF BLOWER SPEED CONTROL SWITCH

INSPECT SWITCH CONTINUITY

Connector "B"	Terminal Switch position	B-1	B-2	B-3	B-4	B-6
	OFF					
	LO				○ — ○	
	■	○ —			○ —	○ —
	■ ■		○ —		○ —	○ —
	HI			○ —	○ —	○ —

H-6-2

If continuity is not as specified, replace the blower speed control switch.



A/C Switch

INSPECTION OF A/C SWITCH

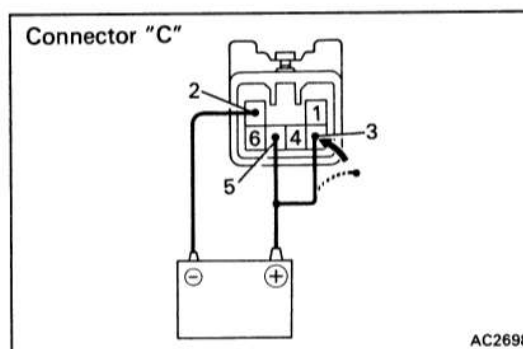
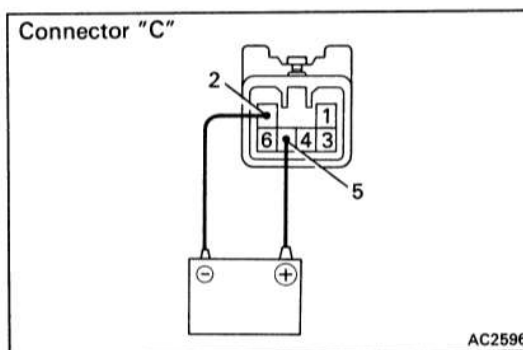
1. INSPECT ILLUMINATION

Connect the positive (+) lead from the battery to terminal C-1 and the negative (–) lead to terminal C-4, then check that the illumination lights up.

If illumination does not light up, test the bulb.

2. INSPECT INDICATOR

- Connect the positive (+) lead from the battery to terminal C-5 and the negative (–) lead to terminal C-2.
- Push the A/C switch button in and check that the indicator lights up.



- Then, connect the positive (+) lead from the battery to terminal C-3 and check that the indicator dims.

If indicators operation is not as specified, replace the A/C switch.

3. INSPECT SWITCH CONTINUITY

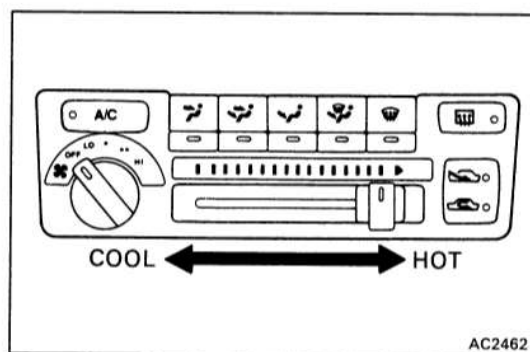
Connector "C" 	Terminal	C-3	C-5	C-6
	Switch position			
	OFF			
	A/C			

e-6-2

If continuity is not as specified, replace the A/C switch.

Temperature Control Lever**INSPECTION OF TEMPERATURE CONTROL LEVER****INSPECT LEVER OPERATION**

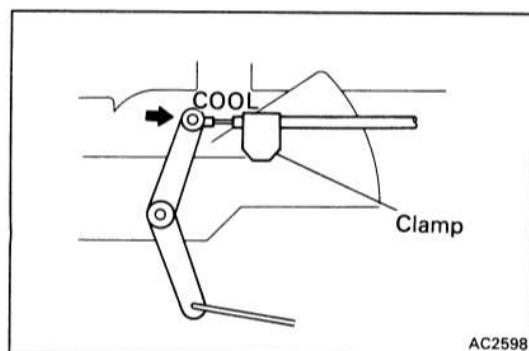
Move the control lever left and right, and check for stiffness and bindings through the full range of the levers.



AC2462

ADJUSTMENT OF CONTROL CABLES**1. ADJUST AIR MIX DAMPER CONTROL CABLE**

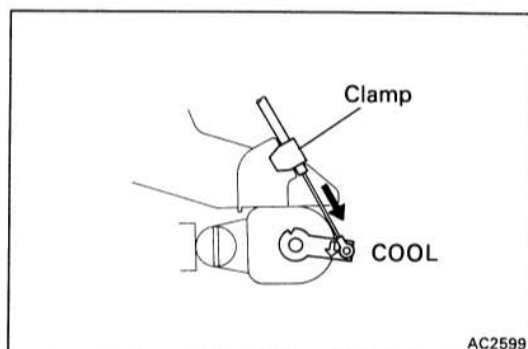
Set the air mix damper and the control lever to "COOL", then install the control cable and lock the clamp.



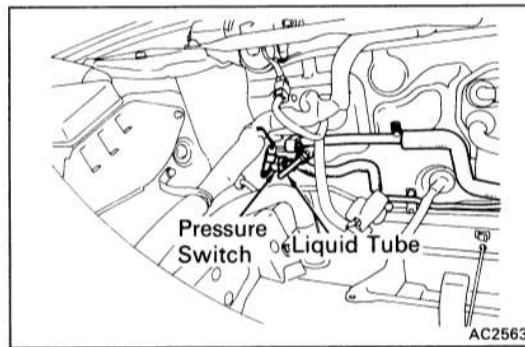
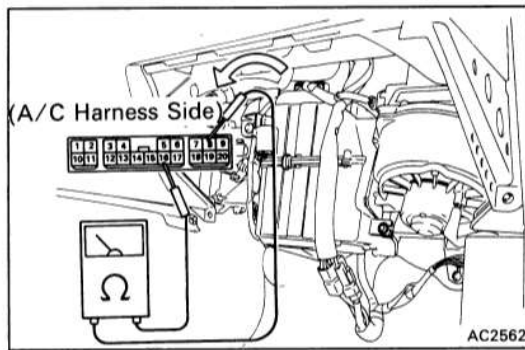
AC2598

2. ADJUST WATER VALVE CONTROL CABLES

Set the water valve and the control lever to "COOL", then install the control cable and lock the clamp.



AC2599

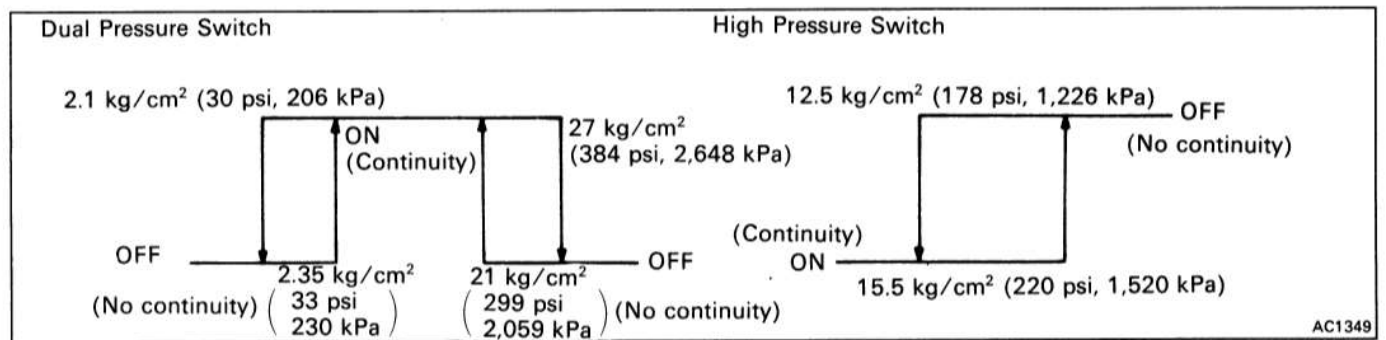


PRESSURE SWITCH

(See page AC-4)

ON-VEHICLE INSPECTION

1. **DISCONNECT CONNECTOR OF PRESSURE SWITCH**
2. **INSPECT PRESSURE SWITCH**
 - (a) Install the manifold gauge set.
 - (b) Observe the gauge reading.
 - (c) Check the continuity between the two terminals of the pressure switch shown in the below.



If defective, replace the pressure switch.

3. **CONNECT CONNECTOR OF PRESSURE SWITCH**

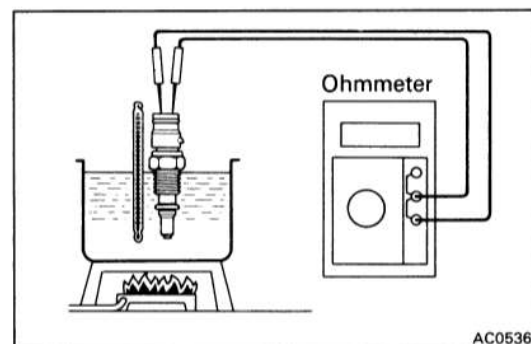
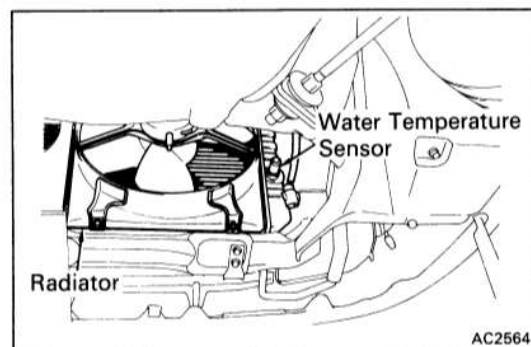
WATER TEMPERATURE SENSOR

(See page AC-4)

INSPECTION OF TEMPERATURE SENSOR

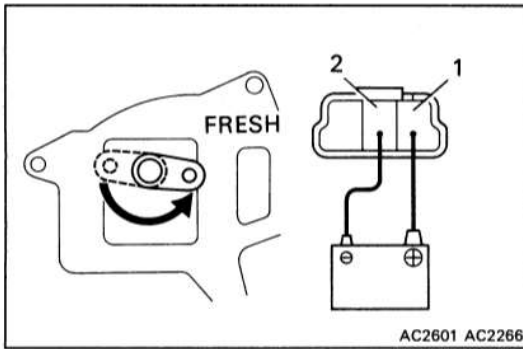
INSPECT WATER TEMPERATURE SENSOR

Using an ohmmeter, measure the resistance of the water temperature sensor.



Water temperature	Resistance
85°C (185°F)	approx. 1.35 kΩ
90°C (194°F)	approx. 1.19 kΩ
95°C (203°F)	approx. 1.05 kΩ

If resistance value is not as specified, replace the sensor.



SERVOMOTORS

(See page AC-4)

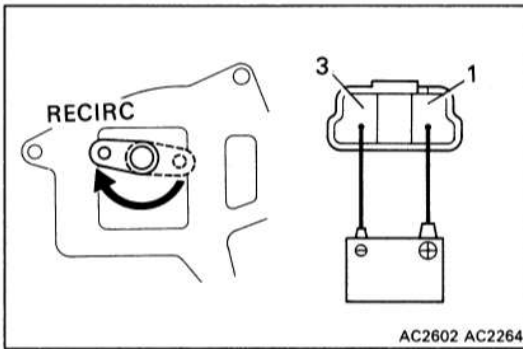
Air Inlet Servomotor

INSPECTION OF AIR INLET SERVOMOTOR

INSPECT SERVOMOTOR OPERATION

- Connect the positive (+) lead from the battery to terminal 1 and the negative (-) lead to terminal 2, check that the arm rotates to the "FRESH" side smoothly.
- Connect the positive (+) lead from the battery to terminal 1 and the negative (-) lead to terminal 3, check that the arm rotates to the "RECIRC" side smoothly.

If operation is not as specified, replace the servo motor.



Mode Servomotor

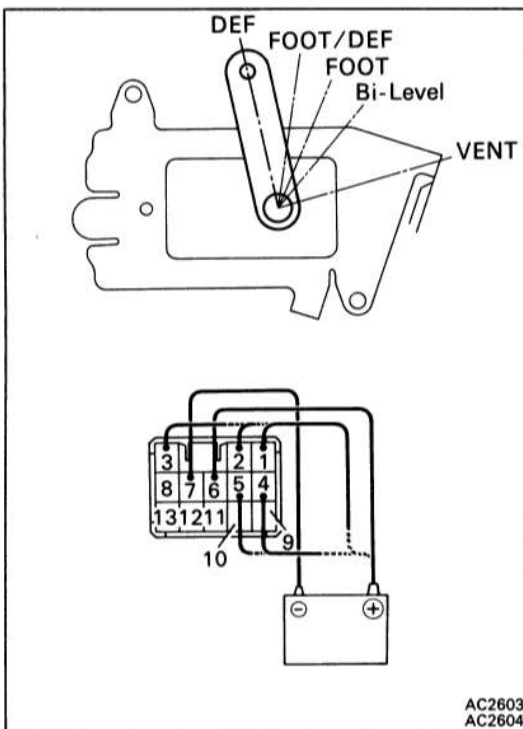
INSPECTION OF MODE SERVOMOTOR

INSPECT SERVOMOTOR OPERATION

- Connect the positive (+) lead from the battery to terminal 6 and the negative (-) lead to terminal 7.
- Connect the negative (-) lead from the battery to each terminal and check that the arm rotates to each position as shown.

Connected terminal	Position
1	VENT
2	Bi-Level
3	FOOT
4	FOOT/DEF
5	DEF

If operation is not as specified, replace the servomotor.



BLOWER MOTOR

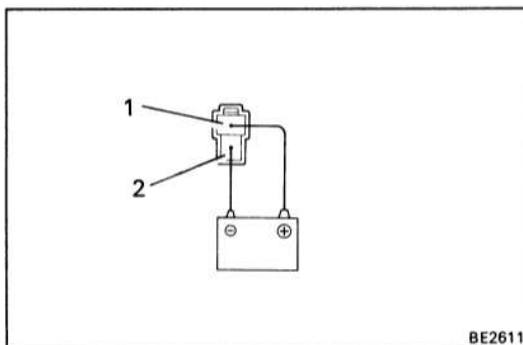
(See page AC-4)

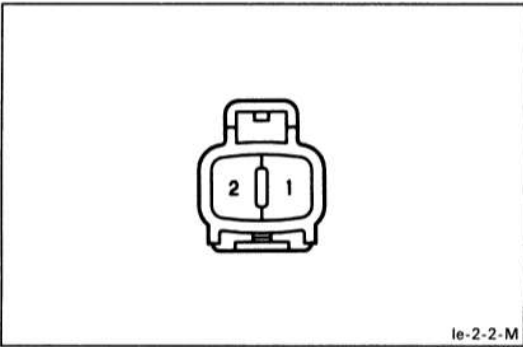
INSPECTION OF BLOWER MOTOR

INSPECT BLOWER MOTOR OPERATION

Connect the positive (+) lead from the battery to terminal 1 and the negative (-) lead to terminal 2, check that the motor operation is smooth.

If operation is not as specified, replace the motor.





CONDENSER FAN MOTOR

INSPECTION OF CONDENSER FAN MOTOR

INSPECT FAN MOTOR OPERATION

Connect the positive (+) lead from the battery to terminal 1 and the negative (-) lead to terminal 2, check that the motor operation is smooth.

If operation is not as specified, replace the motor.

BLOWER RESISTOR

INSPECTION OF BLOWER RESISTOR

INSPECT BLOWER RESISTOR CONTINUITY

Diagram of a blower resistor. It is a rectangular unit with four terminals labeled: '1' (top right), '2' (top left), '3' (bottom right), and '4' (bottom left). Below the diagram is the label 'H-4-2'.

Terminal	1	3	2	4
Condition				
Constant				

If continuity is not as specified, replace the blower resistor.

HEATER MAIN RELAY

INSPECTION OF HEATER MAIN RELAY

INSPECT RELAY CONTINUITY

Diagram of a heater main relay. It shows a cross-section of the relay with five terminals labeled: '1' (top left), '2' (bottom left), '3' (top right), '4' (bottom right), and '5' (middle right). A circuit diagram to the left shows a coil connected to terminals 1 and 2, and two switch contacts labeled 'NO' and 'NC' connected to terminals 3, 4, and 5. Below the diagram is the label 'AC2208'.

Terminal	1	2	3	4	5
Condition					
Constant					
Apply battery voltage to terminal 1 and 2					

If continuity is not as specified, replace the relay.

MAGNETIC CLUTCH RELAY

INSPECTION OF MAGNETIC CLUTCH RELAY

INSPECT RELAY CONTINUITY

Diagram of a magnetic clutch relay. It shows a cross-section of the relay with four terminals labeled: '1' (top right), '2' (top left), '3' (bottom right), and '4' (bottom left). A circuit diagram to the right shows a coil connected between terminals 1 and 3, and a switch contact connected between terminals 2 and 4. Below the diagram is the label 'BE1647 BE1841'.

Terminal	1	2	3	4
Condition				
Constant				
Apply battery voltage to terminals 1 and 3.				

If continuity is not as specified, replace the relay.

FAN MAIN RELAY

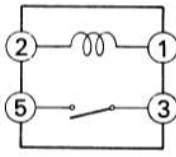
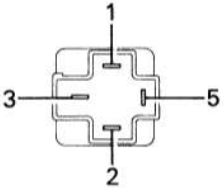
INSPECTION OF RELAY

Check the relay the same way as for the Heater Main Relay.

FAN RELAY NO.1

INSPECTION OF RELAY

INSPECT RELAY CONTINUITY



BE4049 BE1840

Terminal	1	2	3	5
Condition				
Constant				
Apply battery voltage to terminals 1 and 2.				

If continuity is not as specified, replace the relay.

FAN RELAY NO.2

INSPECTION OF RELAY

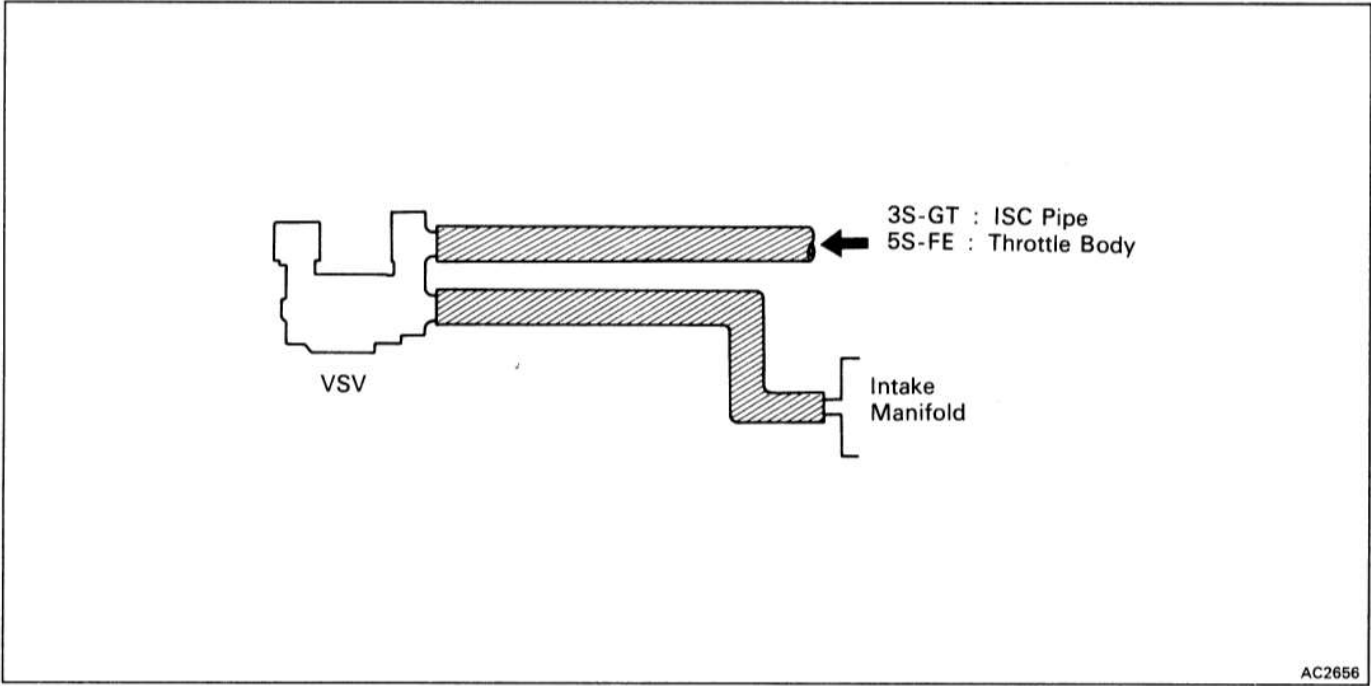
Check the relay the same way as for the Heater Main Relay.

FAN RELAY NO.3

INSPECTION OF RELAY

Check the relay the same way as for the Fan relay No.1 Relay.

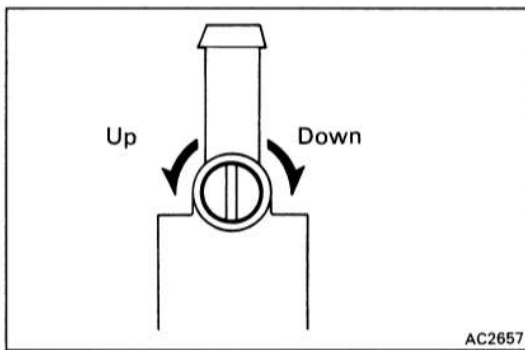
VACUUM HOSE CIRCUIT



VACUUM SWITCHING VALVE (VSV)

INSPECTION OF IDLE-UP SPEED

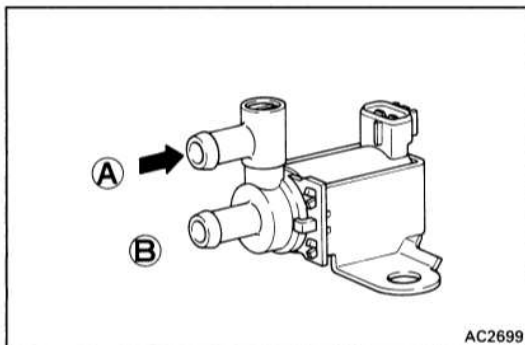
1. WARM UP ENGINE
2. SET VEHICLE IN FOLLOWING
 - Transmission position to Nutral
 - A/C switch ON and Magnetic clutch engaged
 - Blower speed control switch to HI
 - Door window fully opened
3. INSPECT IDLE-UP SPEED
Standard: 950 ± 50 rpm



ADJUSTMENT OF IDLE-UP SPEED

If idle-up speed is not as specified, adjust the idle-up speed turning the idle speed adjusting screw on the VSV.

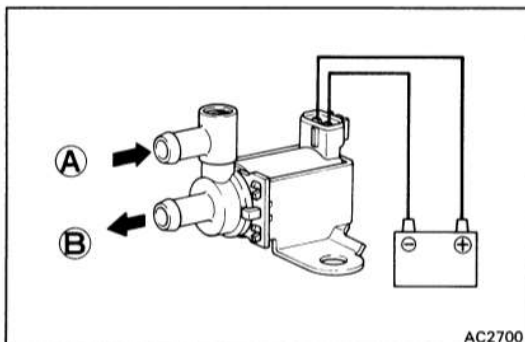
NOTICE: Do not use too much force when tightening the idle adjusting screw.



INSPECTION OF VSV OPERATION

INSPECT VSV OPERATION

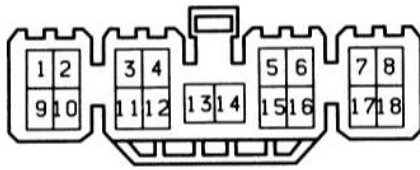
- (a) Blow into pipe "A" and check that air does not come out of pipe "B".



- (b) Apply battery voltage (12V) between the terminals 1 and 2.
- (c) Blow into pipe "A" and check that air comes out of pipe "B".

If a problem is found, replace the VSV.

Wire Harness Side



S-18-1

A/C AMPLIFIER**INSPECTION OF AMPLIFIER****INSPECT AMPLIFIER CIRCUIT**

Disconnect the amplifier and inspect the connector on the wire harness side as shown in the chart.

Test conditions:

- Temperature control lever: MAX COOL
- Blower fan speed control switch: HI

Check for	Tester connection	Condition		Specified value
Continuity	8 – Engine control ECU terminal A/C	Constant		Continuity
	13 – Ground	Constant		Continuity
Resistance	3 – Ground	Constant		Continuity
	9 – 15	Engine coolant condition	85°C (185°F)	Approx. 1.35 kΩ
			90°C (194°F)	Approx. 1.19 kΩ
			95°C (203°F)	Approx. 1.05 kΩ
	14 – 17	Ambient temperature at 25°C (77°F)		Approx. 1.5 kΩ
Voltage	1 – Ground	Ignition switch position switch ON	LOCK or ACC	No voltage
			ON	Battery voltage
	2 – Ground	Ignition switch position switch ON	LOCK or ACC	No voltage
			ON	Battery voltage
	4 – Ground	Ignition switch position switch ON	LOCK or ACC	No voltage
			ON	Battery voltage
	6 – Ground	A/C switch position with ignition switch ON	OFF	No voltage
			ON	Battery voltage
	7 – Ground (RHD models)	ECON switch position with ignition switch ON	OFF	No voltage
			ON	Battery voltage
	10 – Ground	Ignition switch position switch ON	LOCK or ACC	No voltage
			ON	Battery voltage
	11 – Ground	Ignition switch position switch ON	LOCK or ACC	No voltage
			ON	Battery voltage
	18 – Ground	Engine condition	Running	Approx. 10 to 14 v
			Stopped	No voltage