HEATING AND AIR CONDITIONING

SECTION 1B
AIR CONDITIONING

Caution:
When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used.

Fasteners that are not reused, and those requiring thread locking compound, will be called out. The correct torque values must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

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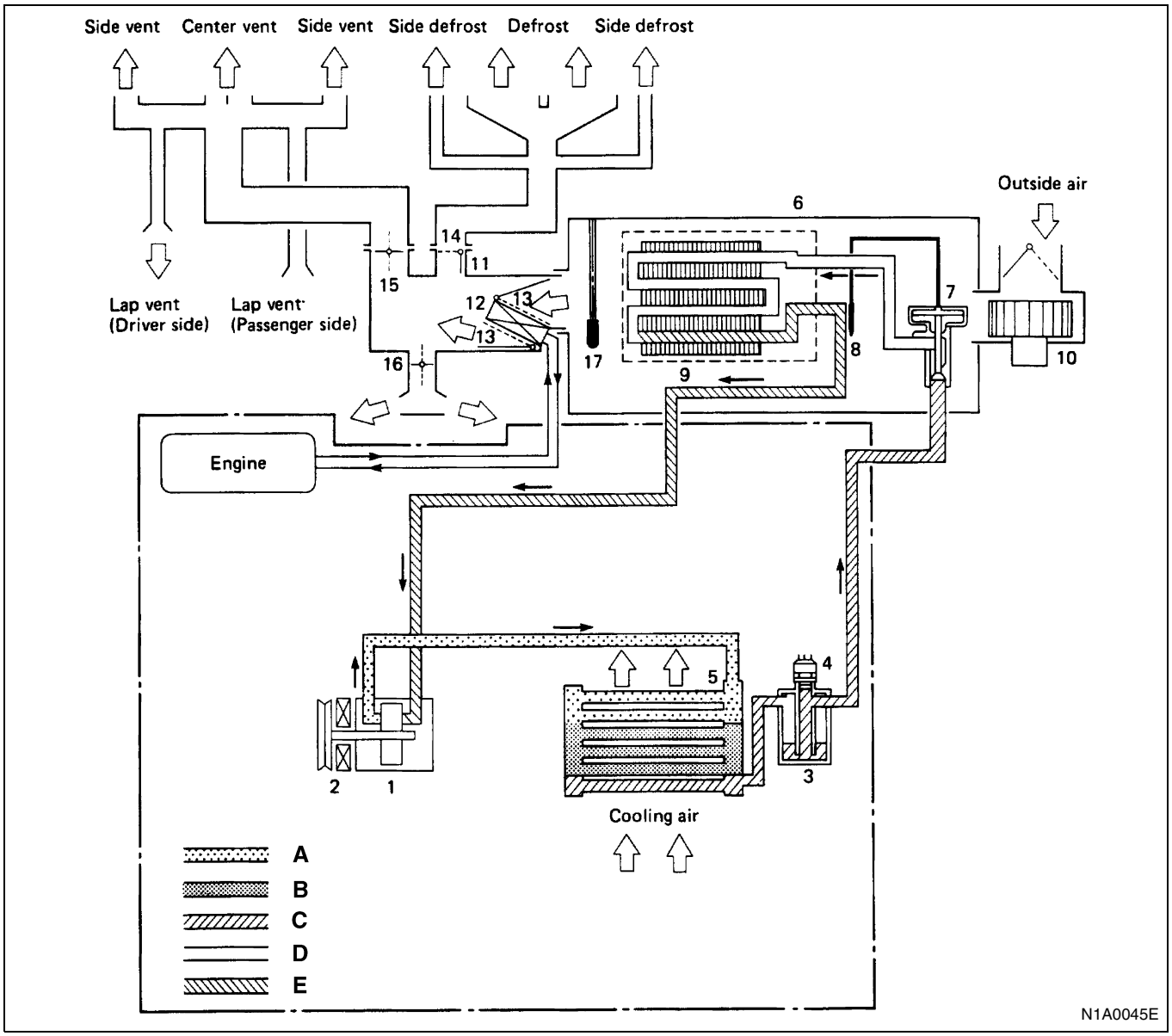
GENERAL DESCRIPTION

Caution:
This Vehicle is equipped with Refrigerant-134a (R-134a) air conditioning system.

R-134a and A-12 systems require different types of lubricating oil. Components designed solely for use with one refrigerant and oil type must never be interchanged with components designed solely for use with another refrigerant and oil type. Refer to “ON-VEHICLE SERVICE” for Precautions for R-134a Air Conditioning system in this section.

Air Conditioning Refrigerant Cycle Construction



Legend

A. High pressure, high temperature gas
B. High pressure, high temperature mixture of gas and liquid
C. High pressure, medium temperature liquid
D. Low pressure, low temperature mixture of liquid and gas
E. Low pressure, low temperature gas
1. Compressor
2. Magnetic clutch
3. Receiver / Drier
4. Pressure switch
5. Condenser
6. Evaporator assembly
7. Expansion valve
8. Temperature sensor
9. Evaporator core
10. Blower motor
11. Heater unit
12. Heater core
13. Temp. control door (Air mix door)
14. MODE (DEF) control door
15. MODE (VENT) control door
16. MODE (HEAT) control door
17. Electronic thermostat

The refrigeration cycle includes the following four processes as the refrigerant changes repeatedly from liquid to gas and back to liquid while circulating.

Evaporation

The refrigerant is changed from a liquid to a gas inside the evaporator. The refrigerant mist that enters the evaporator vaporizes readily. The liquid refrigerant removes the required quantity of heat (latent heat of vaporization) from the air around the evaporator core cooling fins and rapidly vaporizes.
Removing the heat cools the air, which is then radiated from the fins and lowers the temperature of the air inside the vehicle.
The refrigerant liquid sent from the expansion valve and the vaporized refrigerant gas are both present inside the evaporator and the liquid is converted to gas.
With this change from liquid to gas, the pressure inside the evaporator must be kept low enough for vaporization to occur at a lower temperature.
Because of that, the vaporized refrigerant is sucked into the compressor.

Compression

The refrigerant is compressed by the compressor until it is easily liquefied at normal temperature.
The vaporized refrigerant in the evaporator is sucked into the compressor. This action maintains the refrigerant inside the evaporator at a low pressure so that it can easily vaporize, even at low temperatures close to 0°C (32°F).
Also, the refrigerant sucked into the compressor is compressed inside the cylinder to increase the pressure and temperature to values such that the refrigerant can easily liquefy at normal ambient temperatures.

Condensation

The refrigerant inside the condenser is cooled by the outside air and changes from gas to liquid.
The high temperature, high pressure gas coming from the compressor is cooled and liquefied by the condenser with outside air and accumulated in the receiver/drier. The heat radiated to the outside air by the high temperature, high pressure gas in the compressor is called heat of condensation. This is the total quantity of heat (heat of vaporization) the refrigerant removes from the vehicle interior via the evaporator and the work (calculated as the quantity of heat) performed for compression.

Expansion

The expansion valve lowers the pressure of the refrigerant liquid so that it can easily vaporize.
The process of lowering the pressure to encourage vaporization before the liquefied refrigerant is sent to the evaporator is called expansion. In addition, the expansion valve controls the flow rate of the refrigerant liquid while decreasing the pressure.
That is, the quantity of refrigerant liquid vaporized inside the evaporator is determined by the quantity of heat which must be removed at a prescribed vaporization temperature. It is important that the quantity of refrigerant be controlled to exactly the right value.

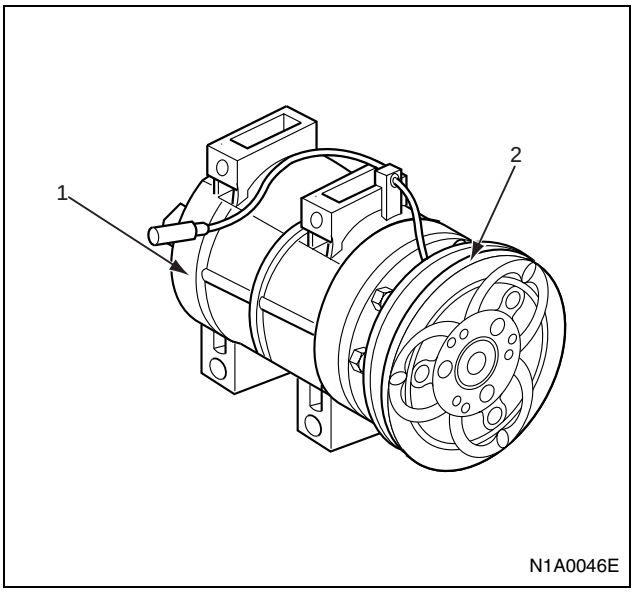
Compressor

The compressor performs two main functions:
It compresses low-pressure and low-temperature refrigerant vapor from the evaporator into high-pressure and high-temperature refrigerant vapor to the condenser. And it pumps refrigerant and refrigerant oil through the A/C system.
This vehicle is equipped with a swash plate type compressor (DKS-15 D Type, DKS-13 CH Type for Taiwan only).
Swash plate compressors have a swash (slanted) plate mounted on the shaft. When the shaft turns, the rotation of the swash plate is converted to reciprocating piston motion which sucks in and compresses the refrigerant gas.
Shaft seal (Lip type) is installed between the valve plate and shaft a cylinder head to prevent refrigerant gas leaks. A specified amount of compressor oil is contained in the oil pan.

This oil is supplied to the cylinders, bearings, etc., by an oil pump which is connected to the swash plate shaft.
With some compressors the differential between the intake pressure and discharge pressure generated while the compressor is operating is used for lubrication instead of an oil pump.
The specified amount of compressor oil is 180cc (5.0 Imp fl oz).
The oil used in the R-134a system compressor differs from that used in R-12 systems.
Also, compressor oil to be used varies according to the compressor model. Be sure to avoid mixing two or more different types of oil.
If the wrong oil is used, lubrication will be poor and the compressor will seize or malfunction.
(Refer to "ON-VEHICLE SERVICE" for Precautions for R-134a Air Conditioning System in this section)
The magnetic clutch connector is a waterproof type.

Magnetic Clutch

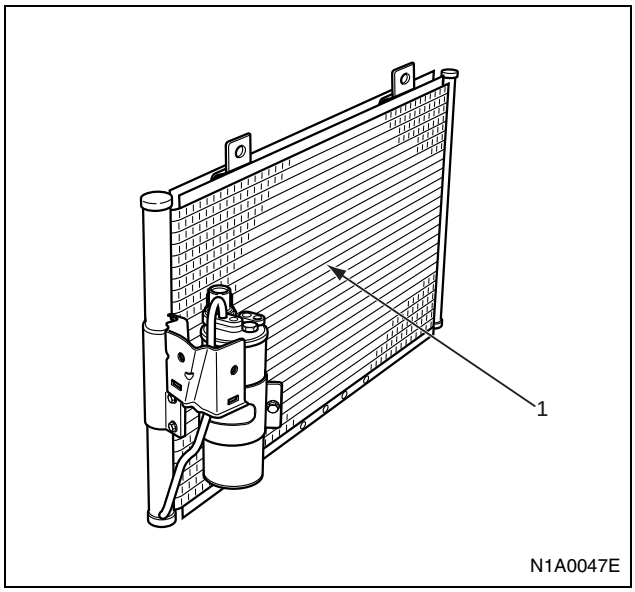
The compressor (1) is driven by the drive belt from the crank pulley of the engine. If the compressor is activated each time the engine is started, this causes too much load to the engine. The magnetic clutch (2) transmits the power from the engine to the compressor and activates it when the air conditioning is "ON". Also, it cuts off the power from the engine to the compressor when the air conditioning is "OFF". (Magnetic clutch repair procedure can be found in Section 1D)



Condenser

The condenser assembly in front of the radiator, which carry the refrigerant and cooling fins to provide rapid transfer of heat.
Also, it functions to cool and liquefy the high-pressure and high-temperature vapor sent from the compressor by the radiator fan or outside air.

A condenser (1) may malfunction in two ways: it may leak, or it may be restricted. A condenser restriction will result in excessive compressor discharge pressure. If a partial restriction is present, the refrigerant expands after passing through the restriction.
Thus, ice or frost may from immediately after the restriction. If air flow through the condenser or radiator is blocked, high discharge pressures will result. During normal condenser operation, the refrigerant outlet line will be slightly cooler than the inlet line.
The vehicle is equipped with the condenser of the parallel flow type condenser. A larger thermal transmission area on the inner surface of the tube allows the radiant heat to increase and the ventilation resistance to decrease.



Receiver/Drier

The receiver/drier performs four functions;

- As the quantity of refrigerant circulated varies depending on the refrigeration cycle conditions, sufficient refrigerant is stored for the refrigeration cycle to operate smoothly in accordance with fluctuations in the quantity circulated.
- The liquefied refrigerant from the condenser is mixed with refrigerant gas containing air bubbles. If refrigerant containing air bubbles is sent to the expansion valve, the cooling capacity will decrease considerably. Therefore, the liquid and air bubbles are separated and only the liquid is sent to the expansion valve.
- The receiver/drier utilizes a filter and dryer to remove the dirt and water mixed in the cycling refrigerant.

A receiver/drier may fail due to a restriction inside the body of the unit. A restriction at the inlet to the receiver/drier will cause high pressures.
Outlet restrictions will be indicated by low pressure and little or no cooling. An excessively cold receiver/drier outlet may indicate a restriction.

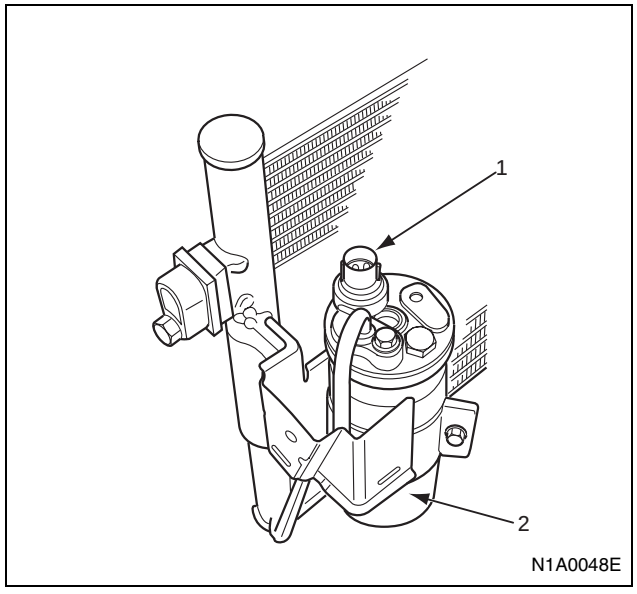
The receiver/drier of this vehicle is made of aluminum with a smaller tank. It has 250cc (7.1 Imp fl oz) refrigerant capacity.

Dual Pressure Switch (for GCC and Taiwan)

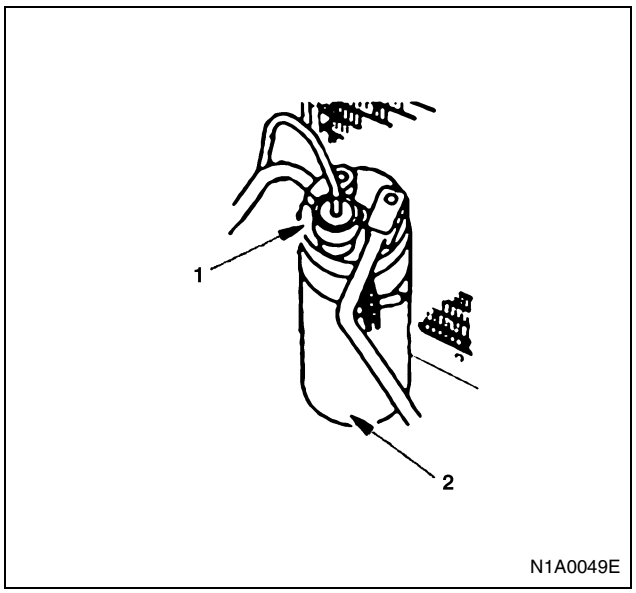
The dual pressure switch (1) is installed on the upper part the receiver/drier (2), to defect excessively high pressure (high pressure switch) and prevent compressor seizure due to the refrigerant leaking (low pressure switch), switching the compressor “ON” or “OFF” as required.
The pressure switch connector is water proof type.
R-134a refrigerant pressure characteristics differ from those of R-12. Thus, the dual pressure switch operation for R-134a systems has been changed from R-12.

- Low-pressure control (for GCC) kPa (kg/cm^2 / PSI)
  Compressor
  – ON: 206±30 (2.1±0.3 / 30±4)
  – OFF: 177±25 (1.8±0.2 / 26±3)
- High-pressure control (for GCC)
  Compressor
  – ON: 2,350±200 (24.0±2.0 / 341±29)
  – OFF: 2,940±200 (30.0±2.0 / 426±29)
- Low-pressure control (for Taiwan)
  Compressor
  – ON: 221±20 (2.25±0.2 / 32±3)
  – OFF: 196±20 (2.0±0.2 / 28±3)
- High-pressure control (for Taiwan)
  Compressor
  – ON: 2,350±200 (24.0±2.0 / 341±29)
  – OFF: 2,940±200 (30.0±2.0 / 426±29)

For GCC



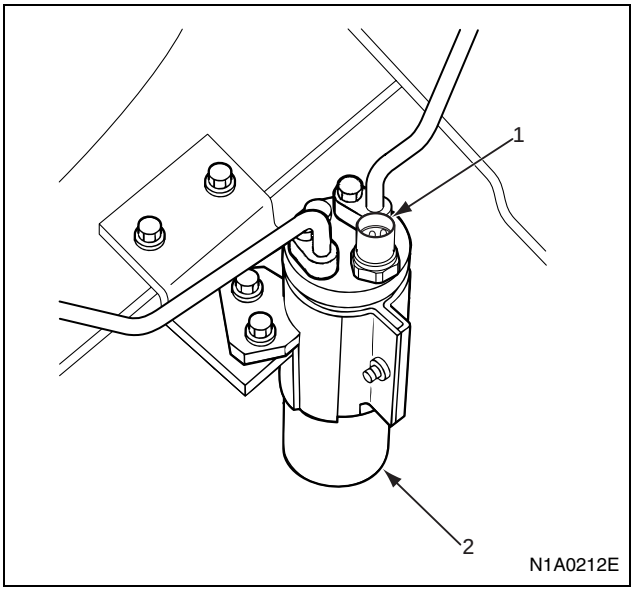
For Taiwan



Triple Pressure Switch (for Australia)

The triple pressure switch (1) is installed on the upper part of the receiver/drier (2). This switch is constructed with a unitized type of two switches. One of them is a low and high pressure switch (Dual pressure switch) to switch “ON” or “OFF” the magnetic clutch as a result of irregularly high-pressure or low-pressure of the refrigerant. The other one is a medium pressure switch (Cycling switch) to switch “ON” or “OFF” the condenser fan by sensing the condenser high side pressure.

- Low-pressure control kPa (kg/cm^2 / PSI)
  Compressor
  – ON: 206±30 (2.1±0.3 / 30±4)
  – OFF: 177±25 (1.8±0.2 / 26±3)
- Medium-pressure control
  Condenser fan
  – ON: 1,470±100 (15±1.0 / 213±14)
  – OFF: 1,079±120 (11±1.2 / 156±17)
- High-pressure control
  Compressor
  – ON: 2,350±200 (24.0±2.0 / 341±29)
  – OFF: 2,940±200 (30.0±2.0 / 426±29)



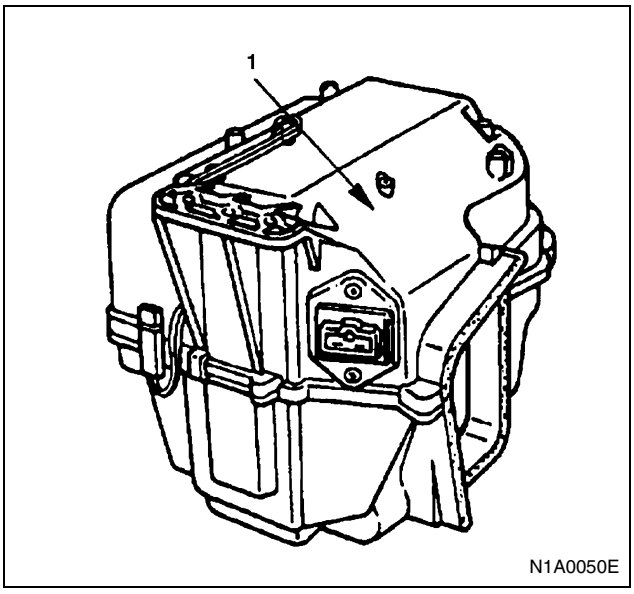
Evaporator

The evaporator (1) cools and dehumidifies the air before the air enters the vehicle. High-pressure liquid refrigerant flows through the expansion valve into the low-pressure area of the evaporator.The heat in the air passing through the evaporator core is lost to the cooler surface of the core, thereby cooling the air.

As heat is lost between the air and the evaporator core surface, moisture in the vehicle condenses on the outside surface of the evaporator core and is drained off as water.

When the evaporator malfunctions, the trouble will show up as inadequate supply of cool air. The causes is typically a partially plugged core due to dirt, or a malfunctioning blower motor.

The evaporator core with a laminate louver fin is a single-sided tank type where only one tank is provided under the core.



Expansion Valve

This expansion valve is external pressure type and it is installed at the evaporator intake port.

The expansion valve converts the high pressure liquid refrigerant sent from the receiver/drier to a low pressure liquid refrigerant by forcing it through a tiny port before sending it to the evaporator.

This type of expansion valve consists of a temperature sensor, diaphragm, ball valve, ball seat, spring adjustment screw, etc.

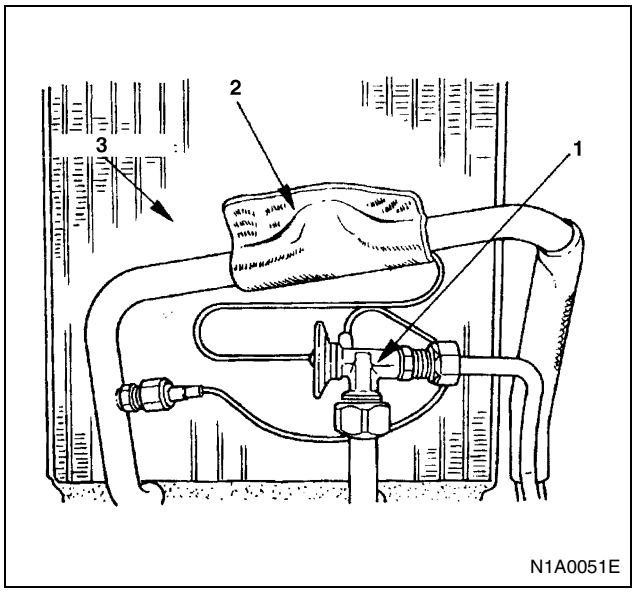
The temperature sensor contacts the evaporator outlet pipe, and converts changes in temperature to pressure. It then transmits these to the top chamber of the diaphragm.

The refrigerant pressure is transmitted to the diaphragms bottom chamber through the external equalizing pressure tube.

The ball valve is connected to the diaphragm. The opening angle of the expansion valve is determined by the force acting on the diaphragm and the spring pressure.

The expansion valve regulates the flow rate of the refrigerant. Accordingly, when a malfunction occurs to this expansion valve, both discharge and suction pressures get low, resulting in insufficient cooling capacity of the evaporator.

For R-134a air conditioning, the expansion valve calibration has been changed from R-12 to match the R-134a characteristics.

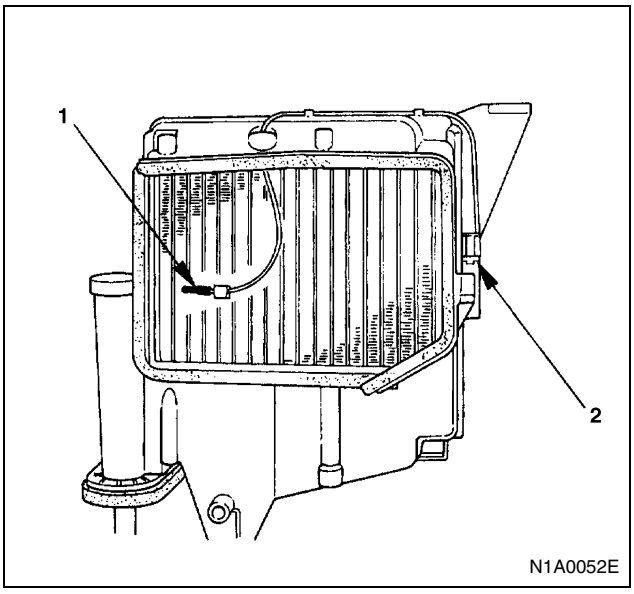


Legend

1. Expansion valve
2. Insulator
3. Evaporator core

Electronic Thermostat

The thermostat consists of the thermosensor (1) and thermostat unit (2) which functions electrically to reduce the noises being generated while the system is in operation.
The electronic thermosensor is mounted at the evaporator core outlet and senses the temperature of the cool air from the evaporator, Temperature signals are input to the thermostat unit. This information is compared by the thermo unit and the results in output to operate the A/C thermo relay and turn the magnetic clutch “ON” or “OFF” to prevent evaporator freeze-up.
A characteristic of the sensor is that the resistance decreases as the temperature increases and the resistance increases as the temperature decreases.

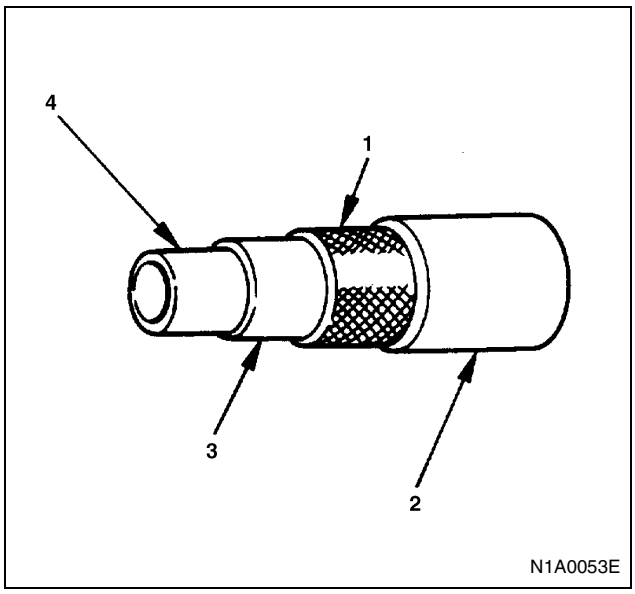


Refrigerant Line

Restrictions in the refrigerant line will be indicated by:

1. Suction line; A restricted suction line will cause low suction pressure at the compressor, low discharge pressure and little or not cooling.
2. Discharge line; A restriction in the discharge line generally will cause the discharge line to leak.
3. Liquid line; A liquid line restriction will be evidenced by low discharge and suction pressure and insufficient cooling.

Refrigerant flexible hoses that have a low permeability to refrigerant and moisture are used.
These low permeability hoses have a special nylon layer on the inside.

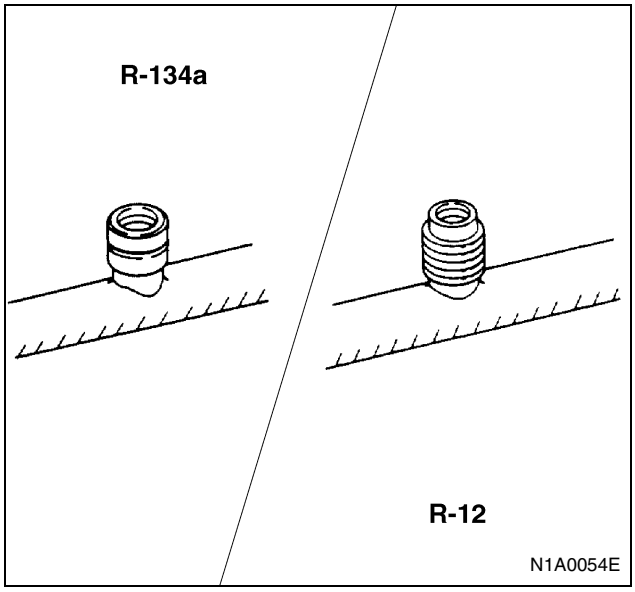


Legend

1. Reinforcement layer (Polyester)
2. External rubber layer
3. Internal rubber layer
4. Resin layer (Nylon)

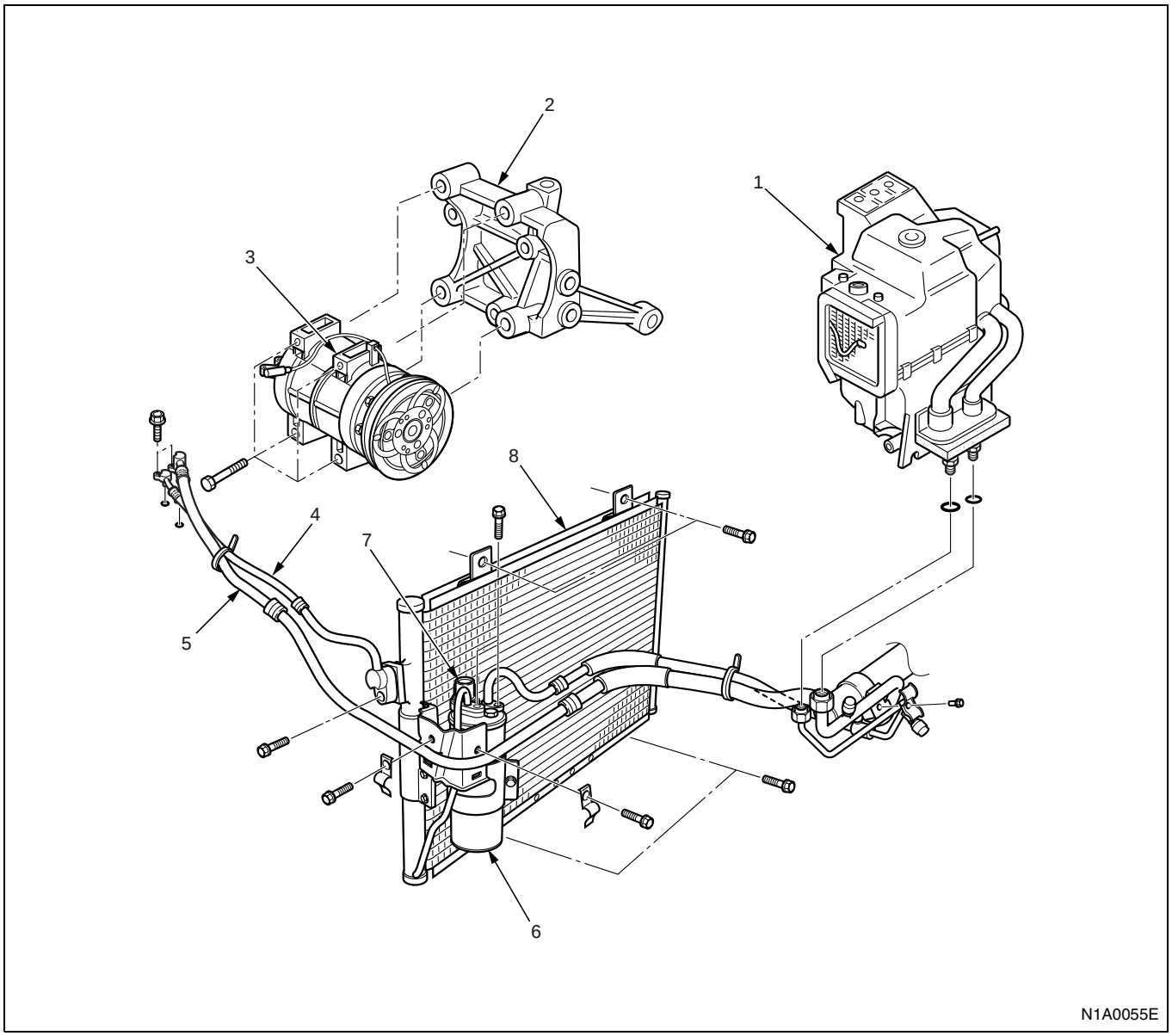
Service Charge Valves

R-134a service charge valve shapes is different from the charge valves used in the R-12 system. The charging hoses have a quick-joint type fitting, to reduce refrigerant loss during removal and installation. This type of valve also eliminates the possibility of cross charging R-12 and R-134a systems when using approved service equipment.



Air Conditioning Parts

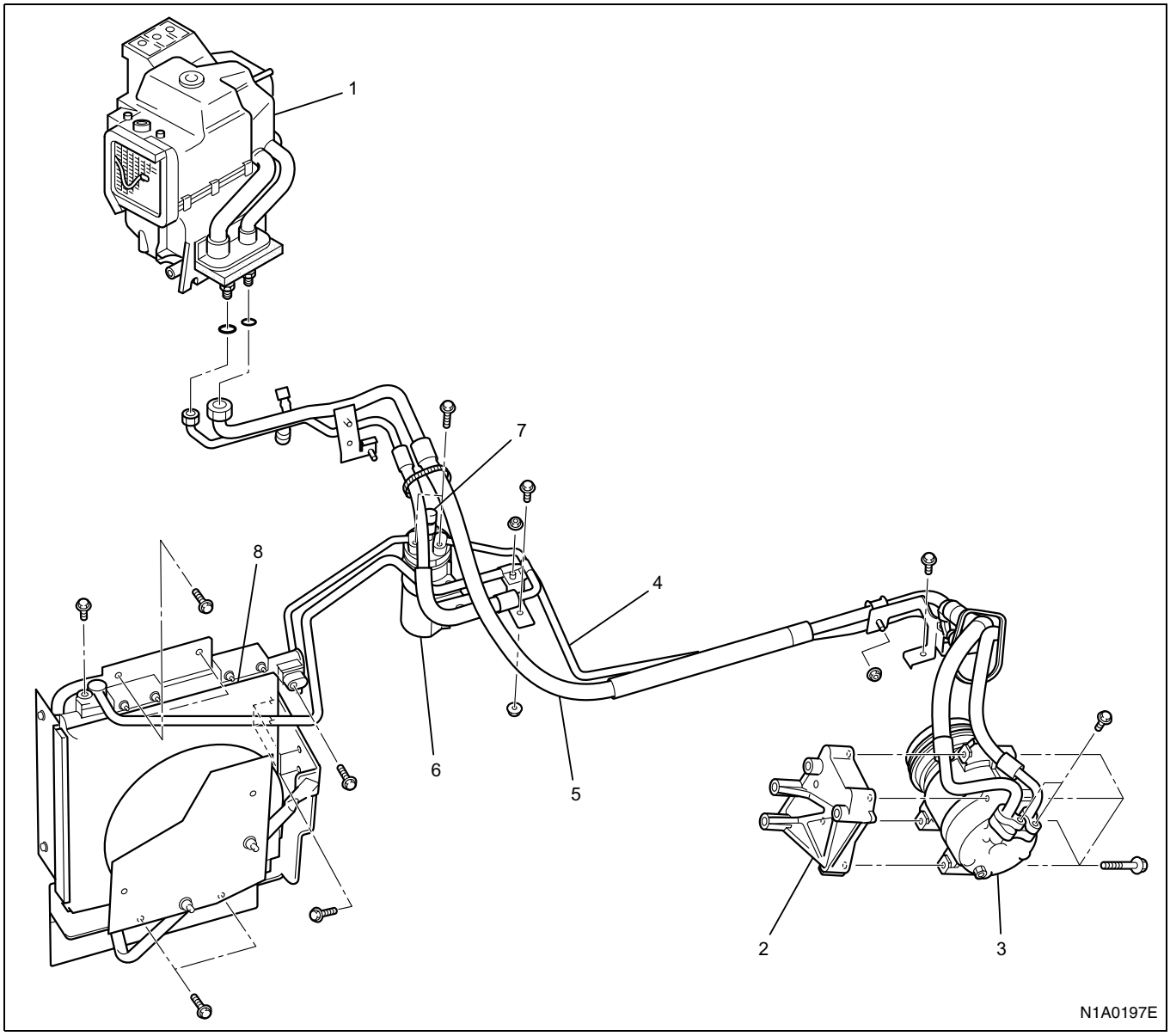
Except 4HK1-TC Engine Model For Australia



Legend

1. Evaporator
2. Compressor bracket
3. Compressor
4. Refrigerant liquid line
5. Refrigerant suction line
6. Receiver / drier
7. Pressure switch
8. Condenser

4HK1-TC Engine Model For Australia



Legend

1. Evaporator
2. Compressor bracket
3. Compressor
4. Refrigerant liquid line
5. Refrigerant suction line
6. Receiver / drier
7. Pressure switch
8. Condenser

ON-VEHICLE SERVICE

Precautions for Refrigerant -134a (R-134a) Air Conditioning System

This vehicle is equipped with Refrigerant-134a (R-134a) air conditioning system.
R-134a and R-12 systems require different types of lubricating oil. Components designed solely for use with one refrigerant and oil type must never be interchanged with components designed solely for use with another refrigerant and oil type.

R-134a Refrigerant:

- R-134a differs entirely from R-12 in its composition and, therefore, the two should never be mixed. Always charge the specified amount of R-134a.
- The pressure characteristics of R-134a differ from those of R-12. The low pressure is lower, and the high pressure is higher.

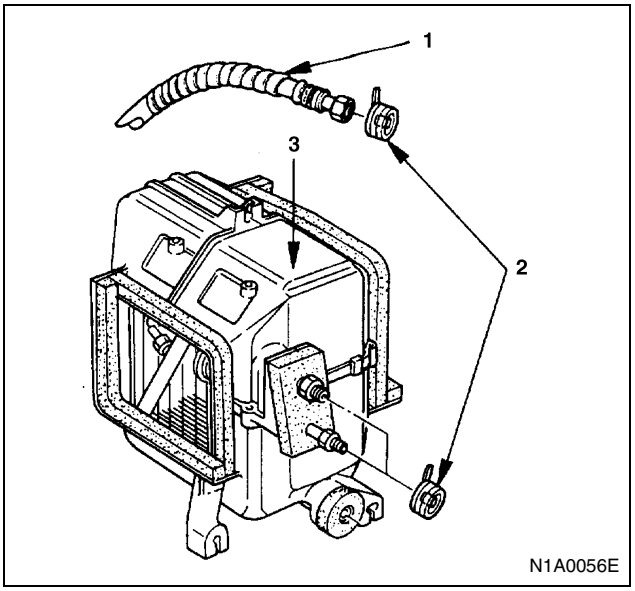
R-134a Compressor oil:

- The R-134a system requires a synthetic (PAG) compressor oil whereas the R-12 system requires a mineral compressor oil. The two oils must never be mixed.
- Compressor (PAG) oil varies according to compressor model. Be sure to use oil specified for the model of compressor.

Oil Specification

ZXL-100PG (ISUZU PART No. 8-97101-338-0)

- The PAG compressor oil for the R-134a system tends to absorb moisture more quickly than mineral oil. When air conditioning parts are removed for servicing, all the open ends of parts and components must be sealed with caps to keep out contaminants.
- The PAG compressor oil must be stored in metal containers, not in plastic containers.

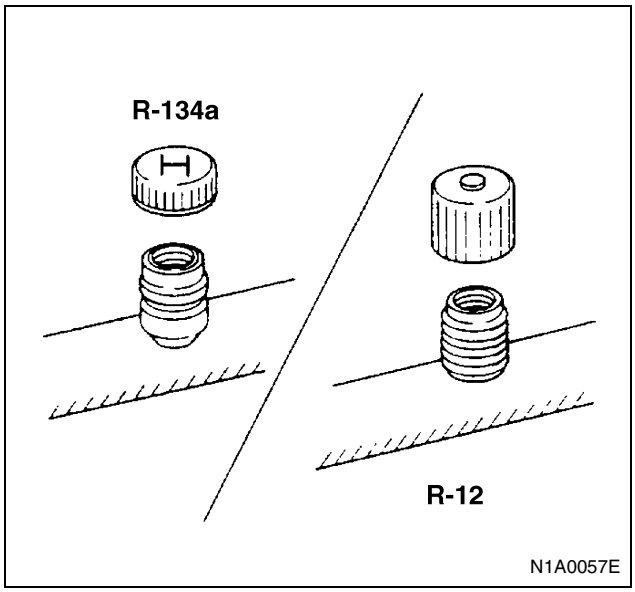


Legend

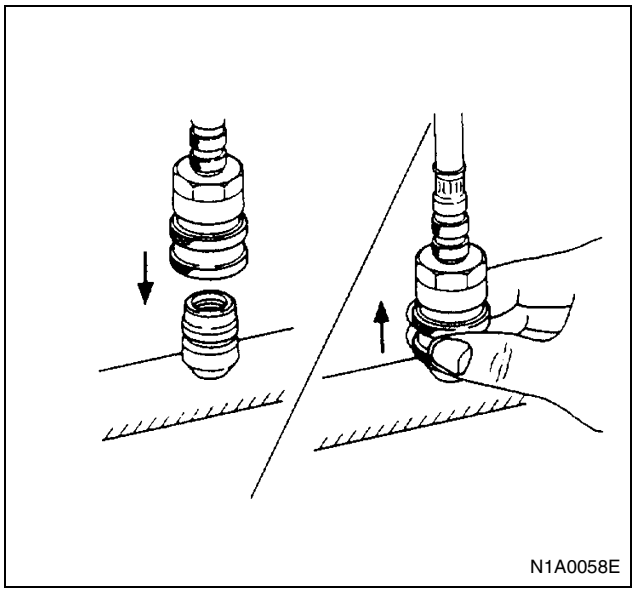
1. Refrigerant line
2. Cap
3. Evaporator

Service charge valve:

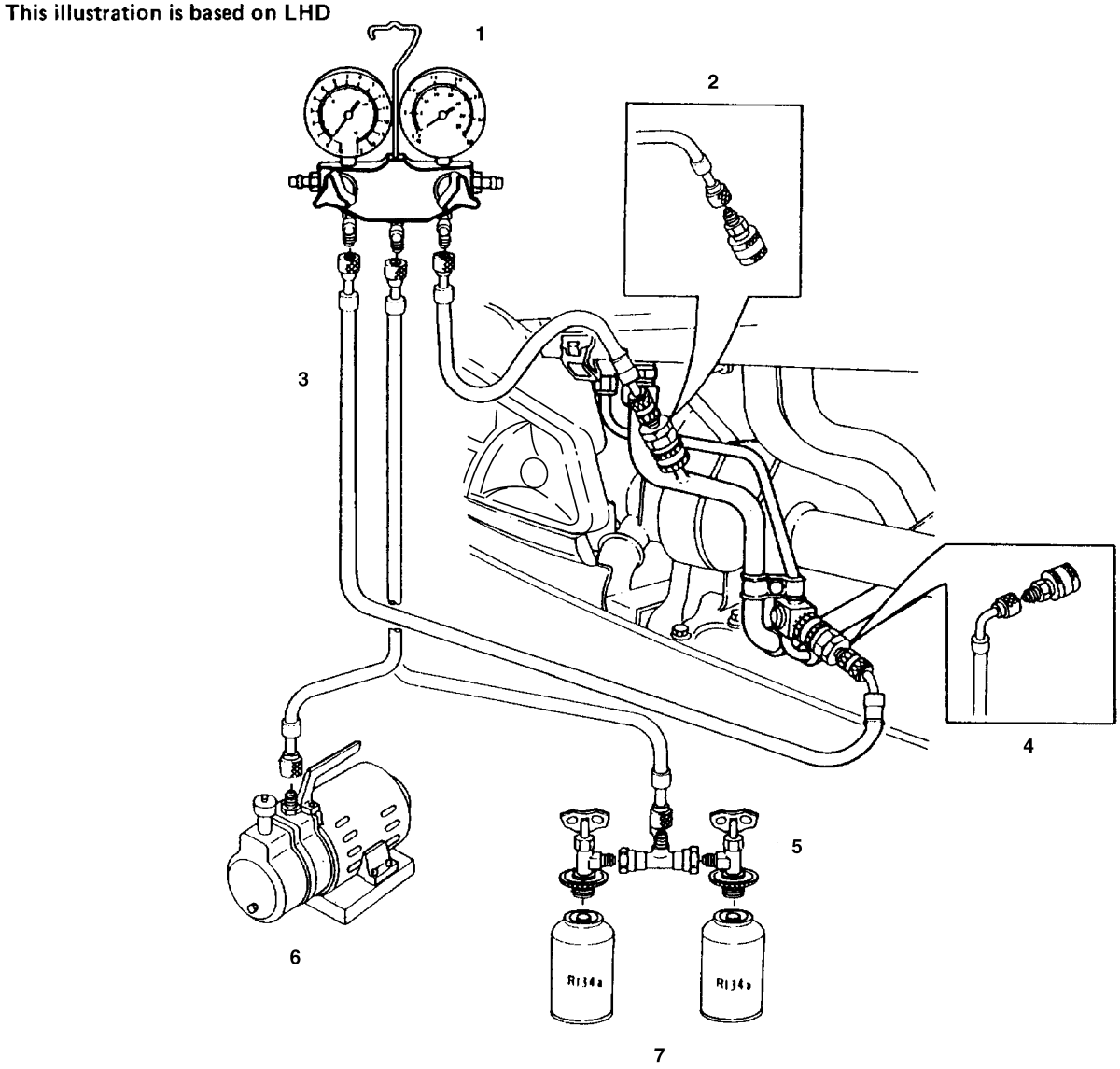
- The diameter of the service charge valve for the R-134a system is made larger than that for the R-12 system to prevent cross-contamination. In addition, the screw-in type joint of the R-12 system is replaced with a quick joint type in the R-134a system.



- To prevent refrigerant from escaping during installation and removal of charging hoses from the service charge valves, quick-joint type fittings are used.
  Connection: Push on firmly until locked (a “click” will be heard).
  Removal: Hold the grip-ring and pull to remove.



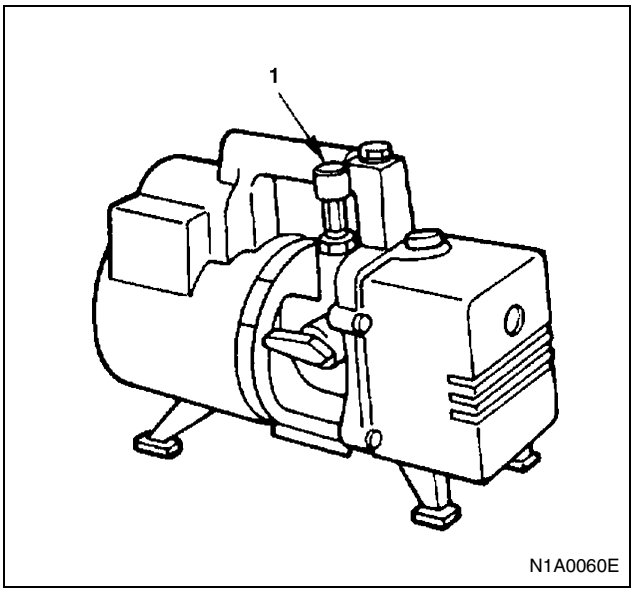
- Air conditioning manifold gauges, charging hoses and other service tools designed exclusively for the R-134a system must be used with this vehicle.



Legend

1. Manifold gauge
2. Quick joint (Low side)
3. Charging hose
4. Quick joint (High side)
5. Charge valve handle
6. Vacuum pump
7. Service container

- Do not use the same vacuum pump for evacuating the R-134a and R-12 systems interchangeably (The vacuum pump hose fitting is a M10X1.5).
- R-134a vacuum pumps must have a positive shut-off valve.

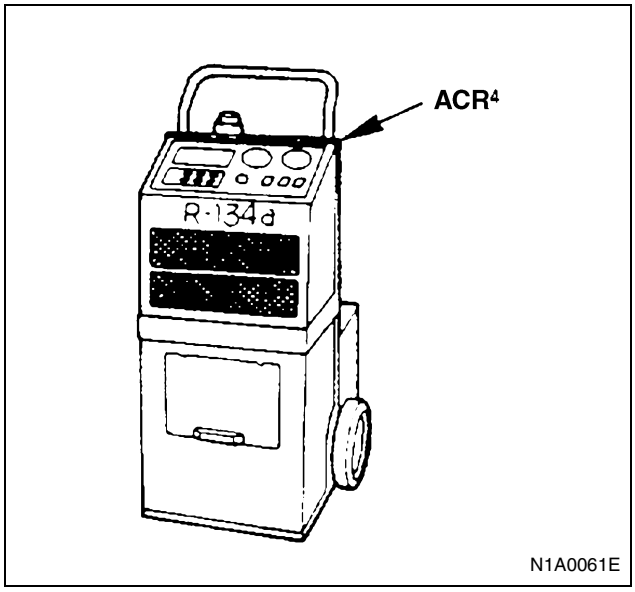


Legend
1. M10 × 1.5 (Hose fitting)

Caution:
Never use the same vacuum pump for both R-134a and R-12 systems, as cross contamination of compressor oil may occur.

Refrigerant Recovery, Recycling and Charging

- Avoid releasing the R-134a into the atmosphere. Use the ACR^4 (R-134a Refrigerant Recovery/ Recycling/ Recharging/ System) or equivalent to recover and recycle R-134a. Note that the ACR^4 (or equivalent) is not interchangeable between the R 134a and R-12 systems.
  ACR^4 (115V 60Hz): 5-8840-0629-0 (J-39500-A)
  ACR^4 (220-240V 50/60Hz): 5-8840-0630-0 (J-39500-220A)
  ACR^4 (220-240V 50/60Hz Australian model): 5-8840-0631-0 (J-39500-220ANZ)



Refrigerant Leak Inspection

- The flame type gas leak detector for the R-12 system cannot be used with the R-134a system.
- The electric leak detector for the R-12 cannot be used with the R-134a system as the R-134a particles are far smaller than the R-12 molecules and, therefore, may not be always detected. Use leak detectors designed exclusively for the R-134a system.

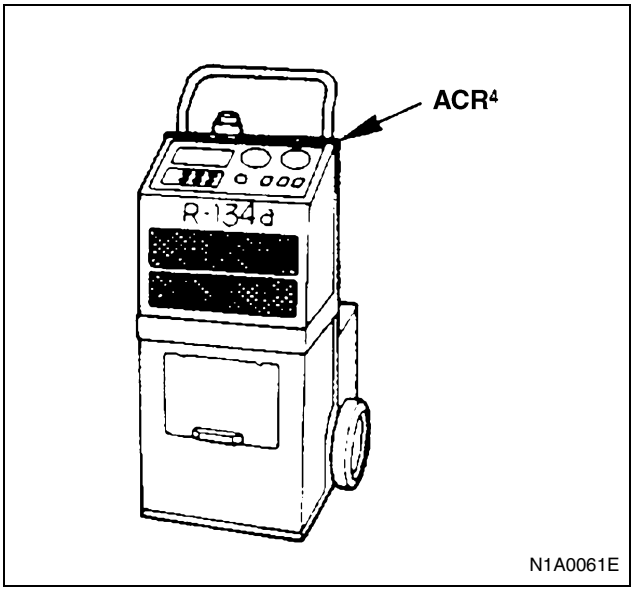
Precautions for Replacement or Repair of R-134a Air Conditioning Parts

There are certain procedure, practices and precautions that should be followed when servicing air conditioning systems:

- Keep your work area clean.
- Always wear safety goggle and protective gloves when working on refrigerant systems.
- Beware of the danger of carbon monoxide fumes caused by running the engine.
- Beware of discharged refrigerant in enclosed or improperly ventilated garages.
- Always disconnect the negative battery cable and discharge and recover the refrigerant whenever repairing the air conditioning system.
- When discharging and recovering the refrigerant, do not allow refrigerant to discharge too fast; it will draw compressor oil out of the system.
- Keep moisture and contaminants out of the system. When disconnecting or removing any lines or parts, use plugs or caps to close the fittings immediately.
  Never remove the caps or plugs until the lines or parts are reconnected or installed.
- When disconnecting or reconnecting the lines, use two wrenches to support the line fitting, to prevent from twisting or other damage.

- Always install new O-rings whenever a connection is disassembled.
- Before connecting any hoses or lines, apply new specified compressor oil to the O-rings.
- When removing and replacing any parts which require discharging the refrigerant circuit, the operations described in this Section must be performed in the following sequence:

1. Using the ACR^4 (R-134a Refrigerant Recovery/ Recycling/ Recharging/ System) or equivalent to thoroughly discharge and recover the refrigerant.
   ACR^4 (115V 60Hz): 5-8840-0629-0 (J-39500-A)
   ACR^4 (220-240V 50/60Hz): 5-8840-0630-0 (J-39500-220A)
   ACR^4 (220-240V 50/60Hz Australian model): 5-8840-06311-0 (J-39500-220ANZ)

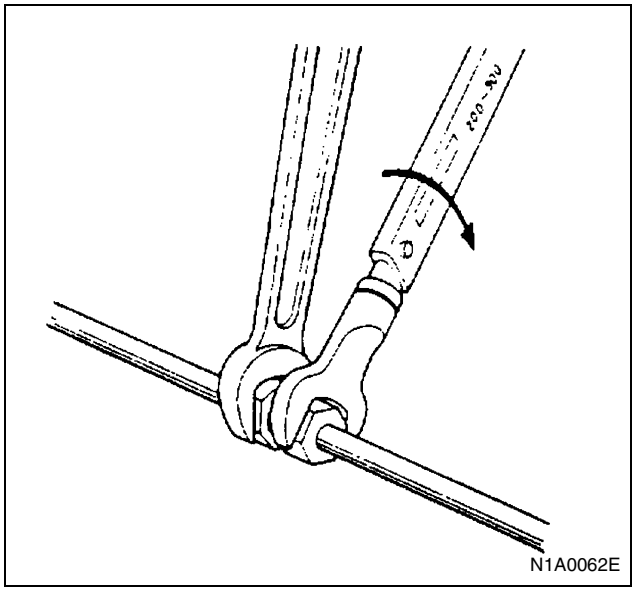


2. Remove and replace the defective part.
3. After evacuation, charge the air conditioning system and check for leaks.

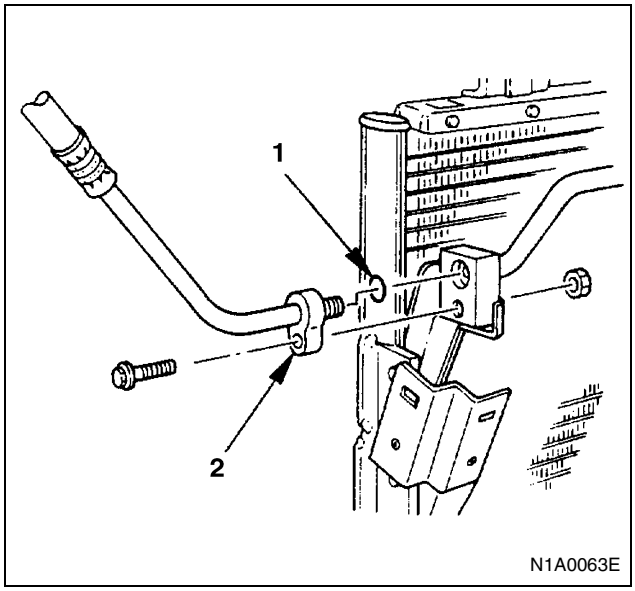
Repair of Refrigerant Leaks

Refrigerant Line Connections

Install new O-rings, if required. When disconnecting or connecting lines, use two wrenches to prevent the connecting portion from twisting or becoming damaged.



When connecting the refrigerant line at the block joint, securely insert the projecting portion of the joint portion into the connecting hole on the unit side and secure with a bolt.

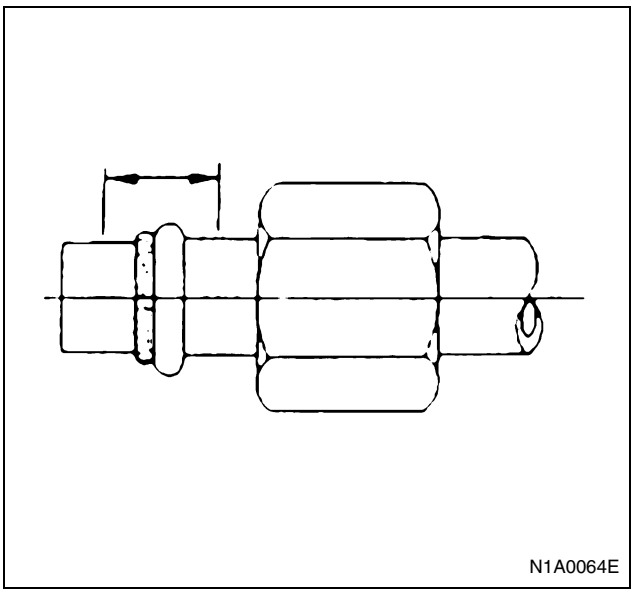


Legend

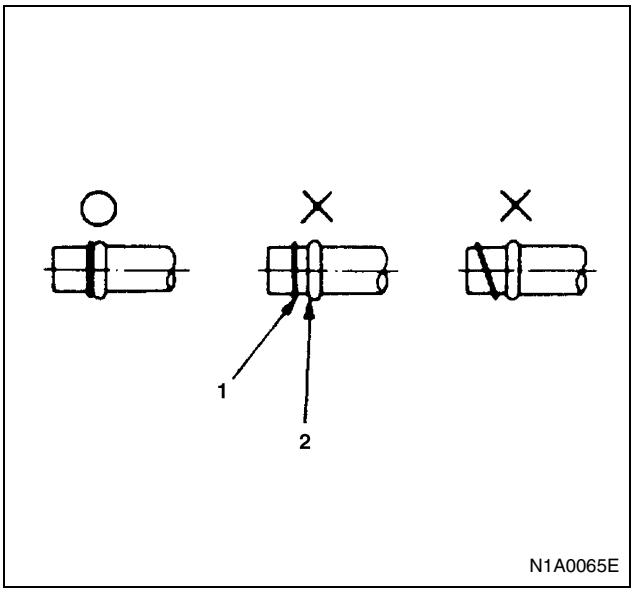
1. O-ring
2. Block joint

Apply specified compressor oil to the O-rings prior to connecting.

Caution:
Compressor (PAG) oil to be used varies according to compressor model. Be sure to apply specified oil for the model of compressor.


N1A0064E

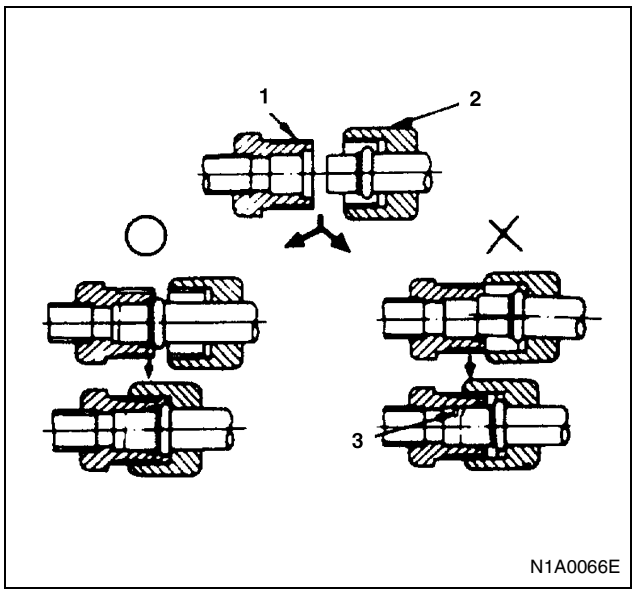
O-rings must be closely aligned with raised portion of refrigerant line.



N1A0065E

Legend
1. O-ring
2. Raised portion

Insert nut into union. First tighten nut by hand as much as possible. Then, tighten nut to specified torque. (Refer to “SERVICE INFORMATION” for Fixing Torque in section 00)



N1A0066E

Legend
1. Union
2. Nut
3. Damage

Leak at Refrigerant Line Connections

1. Check the torque on the refrigerant line fitting and, if too loose, tighten to the specified torque.
   - Use two wrenches to prevent twisting and damage to the Line.
   - Do not over tighten.
2. Perform a leak test on the refrigerant line fitting.
3. If the leak is still present, discharge and recover the refrigerant from the system.
4. Replace the O-rings.
   - O-rings cannot be reused. Always replace with new ones.
   - Be sure to apply specified compressor oil to the new O-rings.
5. Retighten the refrigerant line fitting to the specified torque.
   - Use two wrenches to prevent twisting and damage to the line.
6. Evacuate, charge and retest the system.

Leak in The Hose

If the compressor inlet or outlet hose is leaking, the entire hose must be replaced. Refrigerant hose must not be cut or spliced for repair.

1. Locate the leak.
2. Discharge and recover the refrigerant.
3. Remove the hose assembly.
   - Cap the open connections at once.
4. Connect the new hose assembly.
   - Use two wrenches to prevent twisting or damage to the hose fitting.

- Tighten the hose fitting to the specified torque.

5. Evacuate, charge and test the system.

Compression Leaks

If leaks are located around the compressor shaft seal or shell, replace or repair the compressor.

Recovery, Recycling, Evacuation and Charging

Handling Refrigerant-134a
Air conditioning systems contain R-134a.
This is a chemical mixture which requires special handling procedures to avoid personal injury.

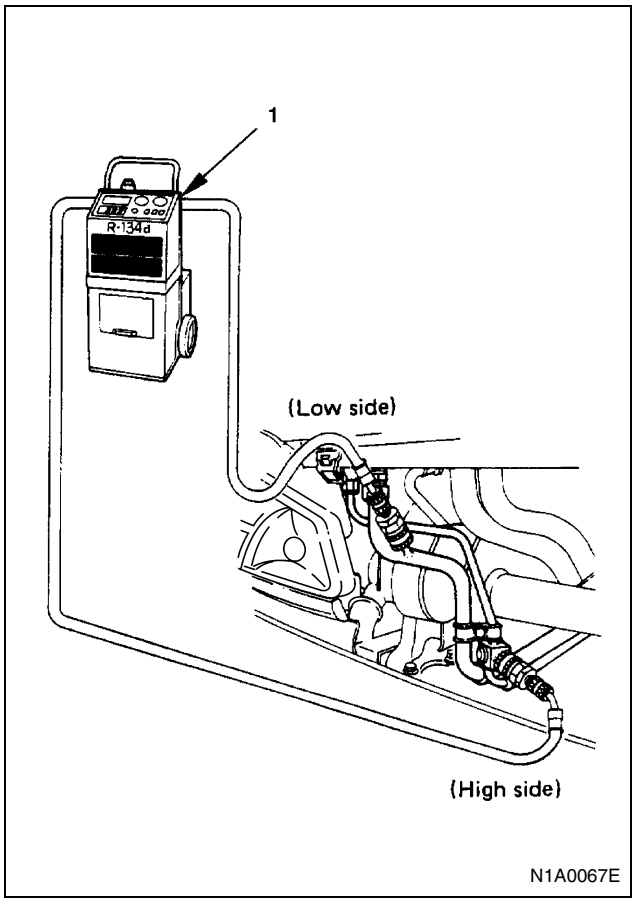
- Always wear safety goggles and protective gloves.
- Always work in a well-ventilated area. Do not weld or steam clean on or near any vehicle-installed air conditioning lines or components.
- If R-134a should come in contact with any part of the body, flush the exposed area with cold water and immediately seek medical help.
- If it is necessary to transport or carry any container of R-134a in a vehicle, do not carry it in the passenger compartment.
- If it is necessary to fill a small R-134a container from a large one, never fill the container completely. Space should always be allowed above the liquid for expansion.
- R-134a and R-12 should never be mixed as their compositions are not the same.
- R-134a PAG oil tends to absorb moisture more quickly than R-12 mineral oil and, therefore, should be handled more carefully.
- Keep R-134a containers stored below 40°C (100°F).

WARNING:

- **SHOULD R-134a CONTACT YOUR EYE(S), CONSULT A DOCTOR IMMEDIATELY.**
- **DO NOT RUB THE AFFECTED EYE(S). INSTEAD, SPLASH QUANTITIES OF FRESH COLD WATER OVER THE AFFECTED AREA TO GRADUALLY RAISE THE TEMPERATURE OF THE REFRIGERANT ABOVE THE FREEZING POINT.**
- **OBTAIN PROPER MEDICAL TREATMENT AS SOON AS POSSIBLE. SHOULD THE R-134a TOUCH THE SKIN, THE INJURY MUST BE TREATED THE SAME AS SKIN WHICH HAS BEEN FROSTBITTEN OR FROZEN.**

Refrigerant Recovery

The refrigerant must be discharged and recovered by using ACR^4 (R-134a Refrigerant Recovery/ Recycling/ Recharging/ System) (1) or equivalent before removing or mounting air conditioning parts.
ACR^4 (115V 60Hz): 5-8840-0629-0 (J-39500-A)
ACR^4 (220-240V 50/60Hz): 5-8840-0630-0 (J-39500-220A)
ACR^4 (220-240V 50/60Hz Australian model): 5-88410-0631-0 (J-39500-220ANZ)



1. Connect the high and low charging hoses of the ACR^4 (or equivalent) as shown.
2. Recover the refrigerant by following the ACR^4 Manufacture's Instructions.
3. When a part is removed, put a cap or a plug on the connecting portion so that dust, dirt or moisture cannot get into it.

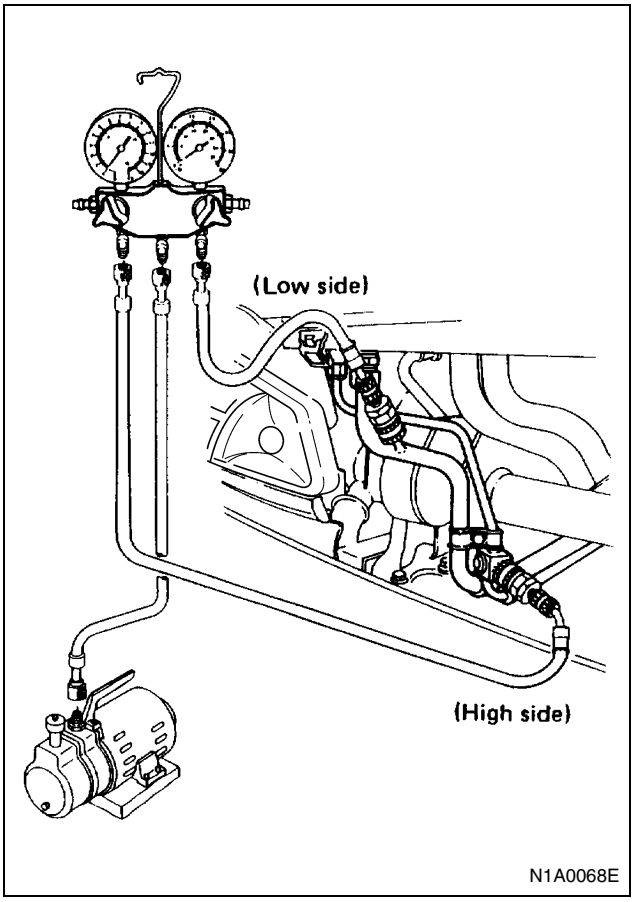
Refrigerant Recycling

Recycle the refrigerant recovered by ACR^4 or equivalent.
For the details of the actual operation, follow the steps in the ACR^4 Manufacture's Instructions.
ACR^4 (115V 60Hz): 5-8840-0629-0 (J-39500-A)
ACR^4 (220-240V 50/60Hz): 5-8840-0630-0 (J-39500-220A)
ACR^4 (220-240V 50/60Hz Australian model): 5-8840-0631-0 (J-39500-220ANZ)

Evacuation of The Refrigerant System

Notice:
Explained below is a method using a vacuum pump. Refer to ACR^4 (or equivalent) manufacture's instructions when evacuating the system with ACR^4 (or equivalent).

Air and moisture in the refrigerant will cause problems in the air conditioning system.
Therefore, before charging the refrigerant, be sure to evacuate air and moisture thoroughly from the system.



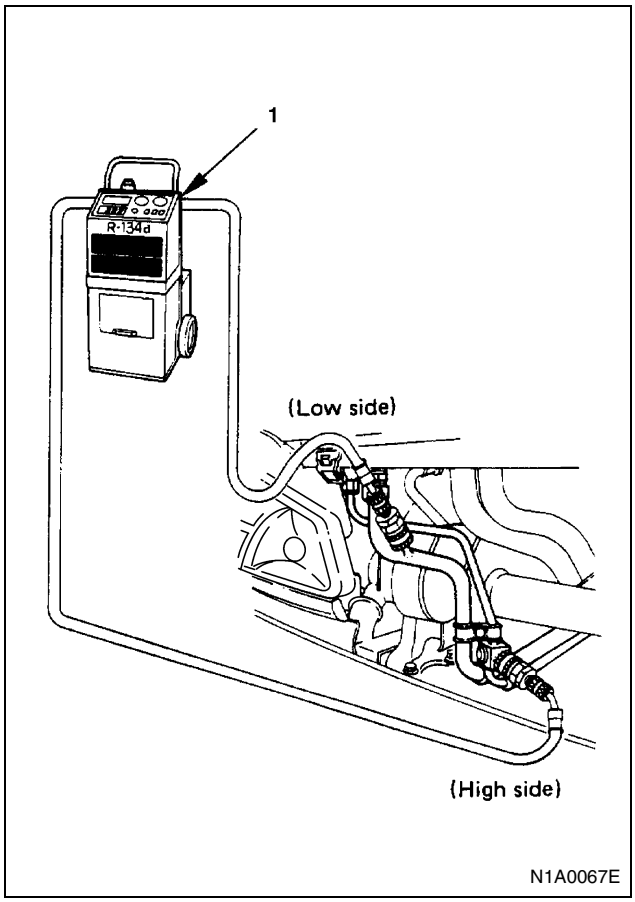
1. Connect the gauge manifold.
   - High-pressure valve (HI) — Discharge-side
   - Low-pressure valve (LOW) — Suction-side
2. Discharge and recover the refrigerant.
3. Connect the center hose of the gauge manifold set to the vacuum pump inlet.
4. Operate the vacuum pump, open shutoff valve and then open both hand valves.
5. When the low-pressure gauge indicates approx. 750 mmHg (30 inHg), continue the evacuation for 5 minutes or more.
6. Close both hand valves and stop the vacuum pump.
7. Check to ensure that the pressure does not change after 10 minutes or more.
   - If the pressure changes, check the system for leaks.
   - If leaks occur, retighten the refrigerant line connections and repeat the evacuation steps.
8. If no leaks are found, again operate the vacuum pump for 20 minutes or more. After confirming that the gauge manifold pressure is at 750 mmHg(30 inHg), close both hand valves.
9. Close positive shutoff valve.
   Stop the vacuum pump and disconnect the center hose from the vacuum pump.

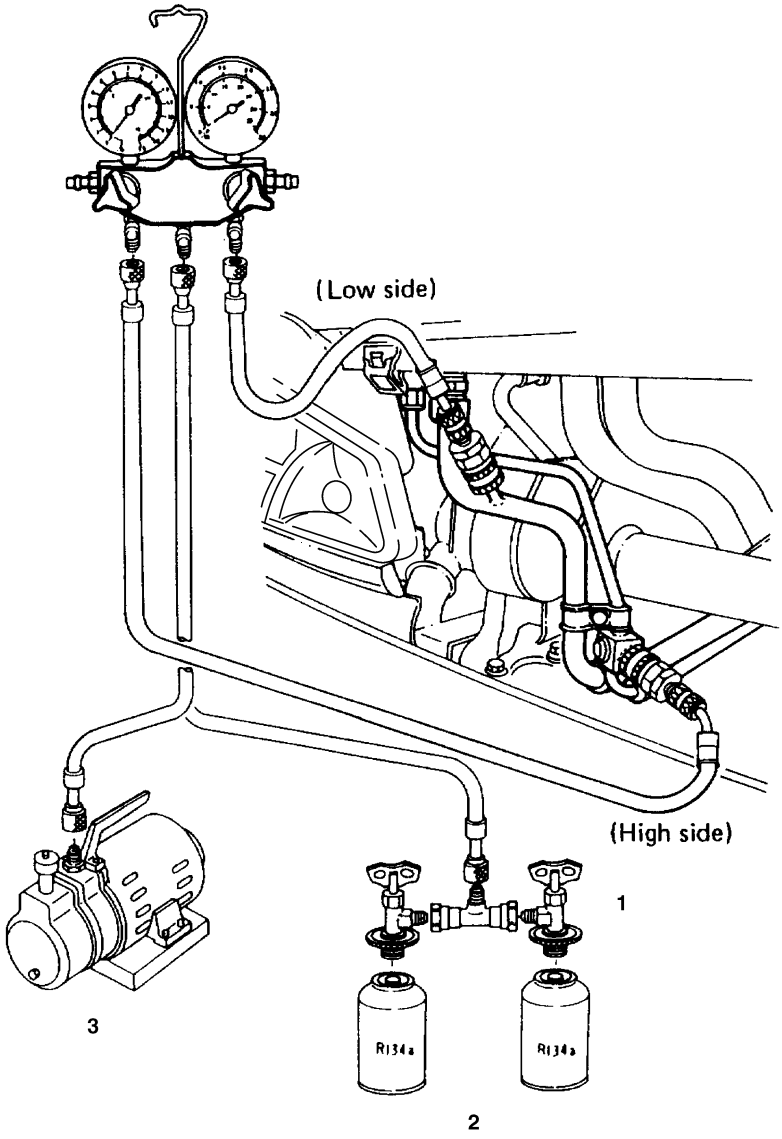
Charging The Refrigerant System

There are various methods of charging refrigerant into the air conditioning system.
These include using ACR^4 (R-134a Refrigerant Recovery/ Recycling/ Recharging/ System) or equivalent and direct charging with a manifold gauge charging station.
ACR^4 (115V 60Hz): 5-8840-0629-0 (J-39500-A)
ACR^4 (220-240V 50/60Hz): 5-8840-0630-0 (J-39500-220A)
ACR^4 (220-240V 50/60Hz Australian model): 5-8840-0631-0 (J-39500-220ANZ)

Charging procedure

- ACR^4 (or equivalent) method
  For the charging of refrigerant recovery by ACR^4 (1), follow the manufacture's instruction.





N1A0070E

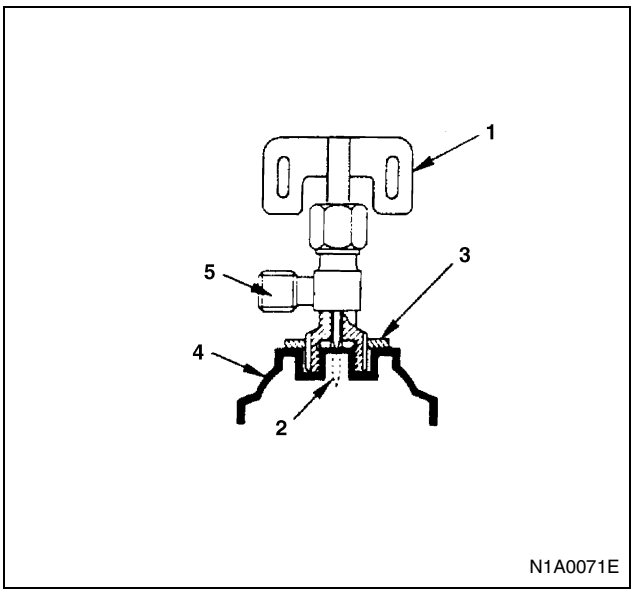
Legend

1. Charge valve handle
2. Service container
3. Vacuum pump

- Direct charging with a manifold gauge charging station method
  Handling the charging valve handle when installing refrigerant container.

1. Before attaching the charge valve to the refrigerant container, turn the charge valve handle (1) counterclockwise until the needle (2) is fully retracted.
2. Turn the plate nut (3) counterclockwise until it reaches its highest position relative to the charge valve.
3. Install the charge valve onto the refrigerant container (4).
4. Turn the plate nut clockwise and connect the center hose of the manifold gauge to the charge valve (5).
5. Tighten the plate nut sufficiently by hand. Then turn the charge valve handle clockwise to lower the needle and bore a hole in the refrigerant container.
6. Turn the charge valve handle counterclockwise to raise the needle. The refrigerant in the refrigerant container is charged into the air conditioning system by the operation of the manifold gauge.

- Be absolutely sure not to reuse the emptied refrigerant container.



1. Make sure the evacuation process is correctly completed.
2. Connect the center-hose of the manifold gauge to the refrigerant container.
   - Turn the charge valve handle counterclockwise to purge the charging line and purge any air existing in the center-hose of the manifold gauge.
3. Open the low-pressure hand valve and charge the refrigerant about 200 g (0.44 lbs.).
   - Make sure the high-pressure hand valve is closed.
   - Avoid charging the refrigerant by turning the refrigerant container upside down.
4. Close the low-pressure hand valve of the manifold gauge.
   - Check to ensure that the degree of pressure does not charge.
5. Check the refrigerant leaks by using a R-134a leak detector.
   - If a leak occurs, repair the leak connection, and start all over again from the first step of evacuation.
6. If no leaks are found, open the low-pressure hand valve of the manifold gauge. Then continue charging refrigerant to the system.
   - When charging the system becomes difficult:
     1) Run the engine at 1,300 — 1,500 rpm and open the all vehicle doors.
     2) A/C switch is “ON”.
     3) Set the fan control knob (fan switch) to its highest position.

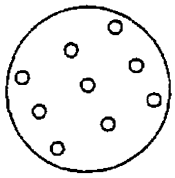
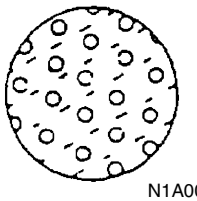
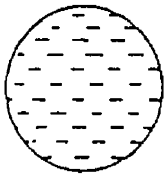
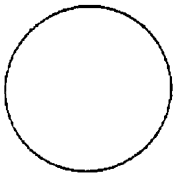
WARNING:
BE ABSOLUTELY SURE NOT TO OPEN THE HIGH-PRESSURE HAND VALVE. SHOULD THE HIGH-PRESSURE HAND VALVE BE OPENED, THE HIGH-PRESSURE REFRIGERANT GAS WOULD FLOW BACKWARD, AND THIS MAY CAUSE THE REFRIGERANT CONTAINER TO BURST.

7. When the refrigerant container is emptied, use the following procedure to replace it with a new refrigerant container.
   1) Close the low pressure hand valve.
   2) Raise the needle upward and remove the charge valve.
   3) Reinstall the charge valve to the new refrigerant container.
   4) Purge any air existing in the center hose of the manifold gauge.
8. Charge the system to the specified amount and then close the low-pressure hand valve.

Refrigerant Amount	g (lbs.)
450 (0.99) GCC, 600 (1.32) Australia & Taiwan	

   - A fully charged system is indicated by the sight glass on the receiver/drier being free of any bubbles (Refer to “Reading Sight Glass”).
   - Check the high and low pressure value of the manifold gauge.
   - Check for refrigerant leaks by using a R-134a leak detector.
     Immediately after charging refrigerant, both high and low pressures are slightly high and to the left of the gauge, but they settle down to the guide pressure valves as shown below:
   - Ambient temperature; 30 — 35°C (86 — 95°F)
   - Guide pressure
     High-pressure side;
     Approx. 1373 — 1667 kPa (14 — 17 kg/cm^2 / 199 — 242 PSI)
     Low-pressure side;
     Approx. 127 — 245 kPa (1.3 — 2.5 kg/cm^2 / 18 — 36 PSI)
9. Close the low pressure hand valve and charge valve of the refrigerant container.
10. Stop the air conditioning and the engine.
11. Disconnect the high and low pressure hoses from the manifold gauge fittings.

Reading Sight Glass

High and low pressure pipe temperature	The high pressure pipe is hot and the low pressure pipe is cold. There is a distinct difference in temperature between them.	The high pressure pipe is warm and the low pressure pipe is cool. There is no great difference in temperature between them.	There is little difference in temperature between the high pressure pipe and the low pressure pipe.	The high pressure pipe is hot and the low pressure pipe is slightly warm. There is a difference in temperature between them.
Sight glass condition	Almost transparent. A flow of bubbles can be seen, but they disappear when the throttle is opened.  N1A0072E	A flow of bubbles always can be seen. It appears sometimes transparent, and sometimes frothy.  N1A0073E	Something like fog faintly can be seen.  N1A0074E	Even at idle with the fan at “HI” (with the window fully open), the bubbles cannot be seen.  N1A0075E
Air conditioner cycle condition	OK	NG (Not enough refrigerant)	NG (Almost no refrigerant)	NG (Too much refrigerant)

The sight glass provides accurate diagnosis only under the following conditions.
If the vehicle can be tested under these conditions, check the sight glass appearance and compare to the chart.

- Engine speed 1,500 RPM
- A/C switch “ON”
- Blower fan operating at highest speed
- Air source selector lever at “RECIRC”
- Temperature control knob at coldest position
- Ambient temperature below 35°C (95°F) and humidity below 70%

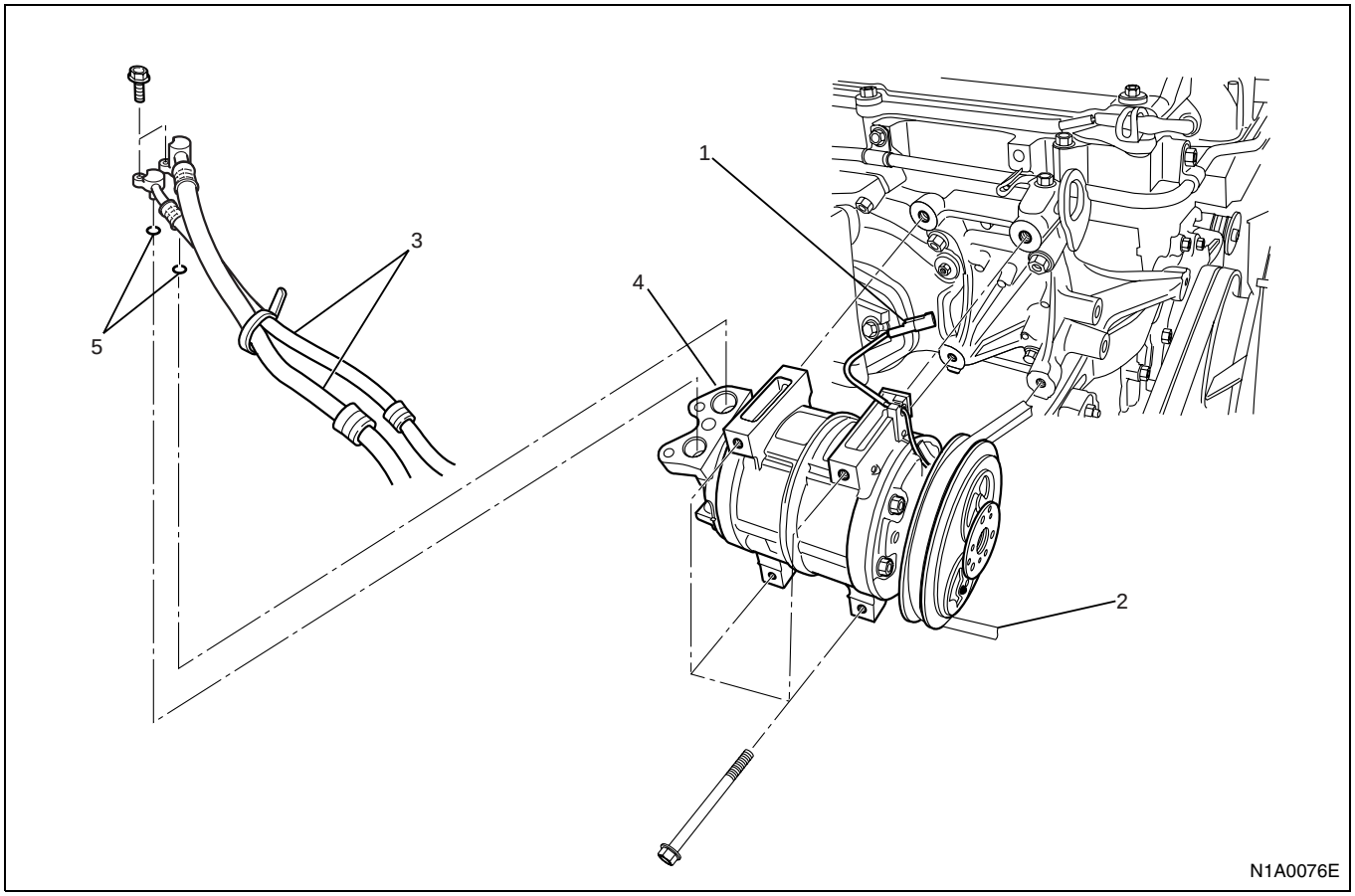
Notice:
If the vehicle cannot be moved to a testing location that meets these specifications, then the sight glass cannot be used for diagnosis. You must discharge and recover the refrigerant, then recharge the system with the specified amount of refrigerant. Then continue checking the system performance.

- High side pressure less than 1667 kPa (17 kg·cm^2 / 242 PSI)

Notice:
If the high side pressure is greater than stated, the sight glass cannot be used for diagnosis. You must discharge and recover the refrigerant, then recharge the system with the specified amount of refrigerant.

Then continue checking system performance.

Compressor



Legend

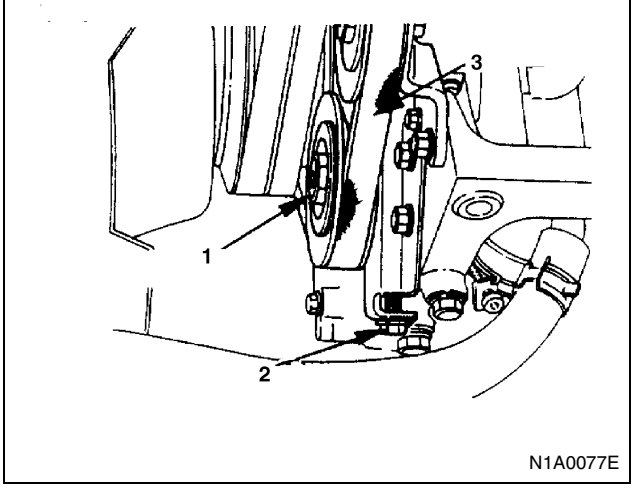
1. Magnetic clutch harness connector
2. Drive belt
3. Refrigerant line
4. Compressor
5. O-ring

Removal

Preparation:
Disconnect the battery ground cable.
Discharge and recover refrigerant.

1. Magnetic clutch harness connector
2. Drive Belt
   Loosen the tension pulley center nut (1) and tension adjustment bolt (2), then remove the drive belt (3).

This illustration is based in 4HF1 engine



3. Refrigerant line
   When removing the line connector, the connecting part should immediately be plugged or capped to prevent foreign matter from being mixed into the line.
4. Compressor

Installation

1. Compressor
   Tighten the compressor fixing bolts to the specified torque.

Tighten:
Compressor Bolt to 19 N·m (1.9 kg·m/14 lb·ft).

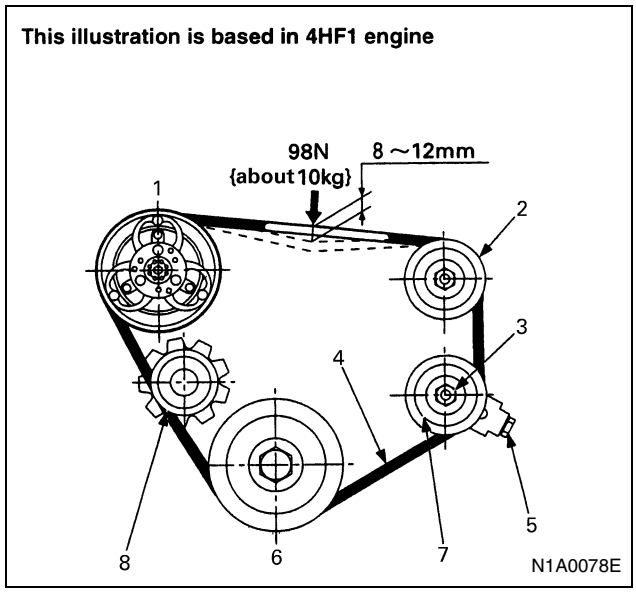
2. Refrigerant Line
   - Tighten the refrigerant line fixing bolt to the specified torque.

Tighten:
Refrigerant Line Bolt to 27 N·m (2.8 kg·m/20 lb·ft).

- O-ring cannot be reused. Always replace with new ones.
- Be sure to apply new specified compressor oil to the O-rings when connecting refrigerant lines.

3. Drive Belt
   Push the drive belt with the force of 10 kg (22 lbs) and adjust the drive belt tension by tightening idle pulley tension adjustment bolt, until the 8 — 12 mm (0.31 — 0.47 in) deflection of the belt is obtained. Then tighten the pulley center nut.

Tighten:
Idle Pulley Center nut to 39 N·m (4.0 kg·m/29 lb·ft).



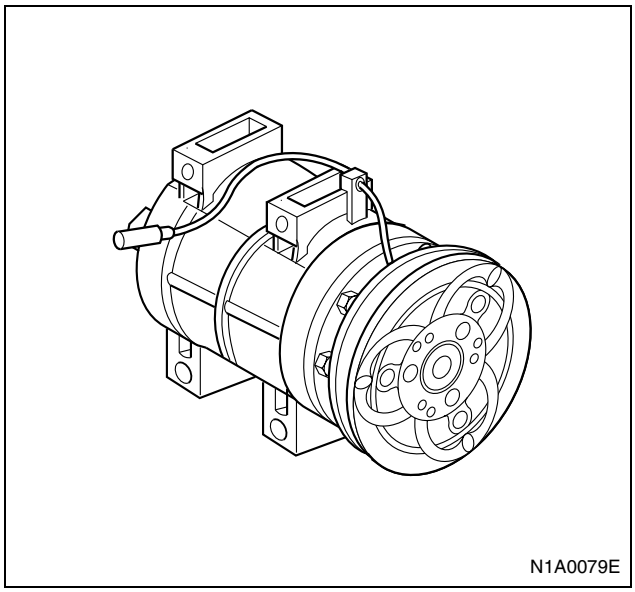
Legend

1. A/C compressor
2. Pulley
3. Center nut
4. Drive belt
5. Adjustment bolt
6. Crank pulley
7. Tension pulley
8. Generator

4. Magnetic Clutch Harness Connector

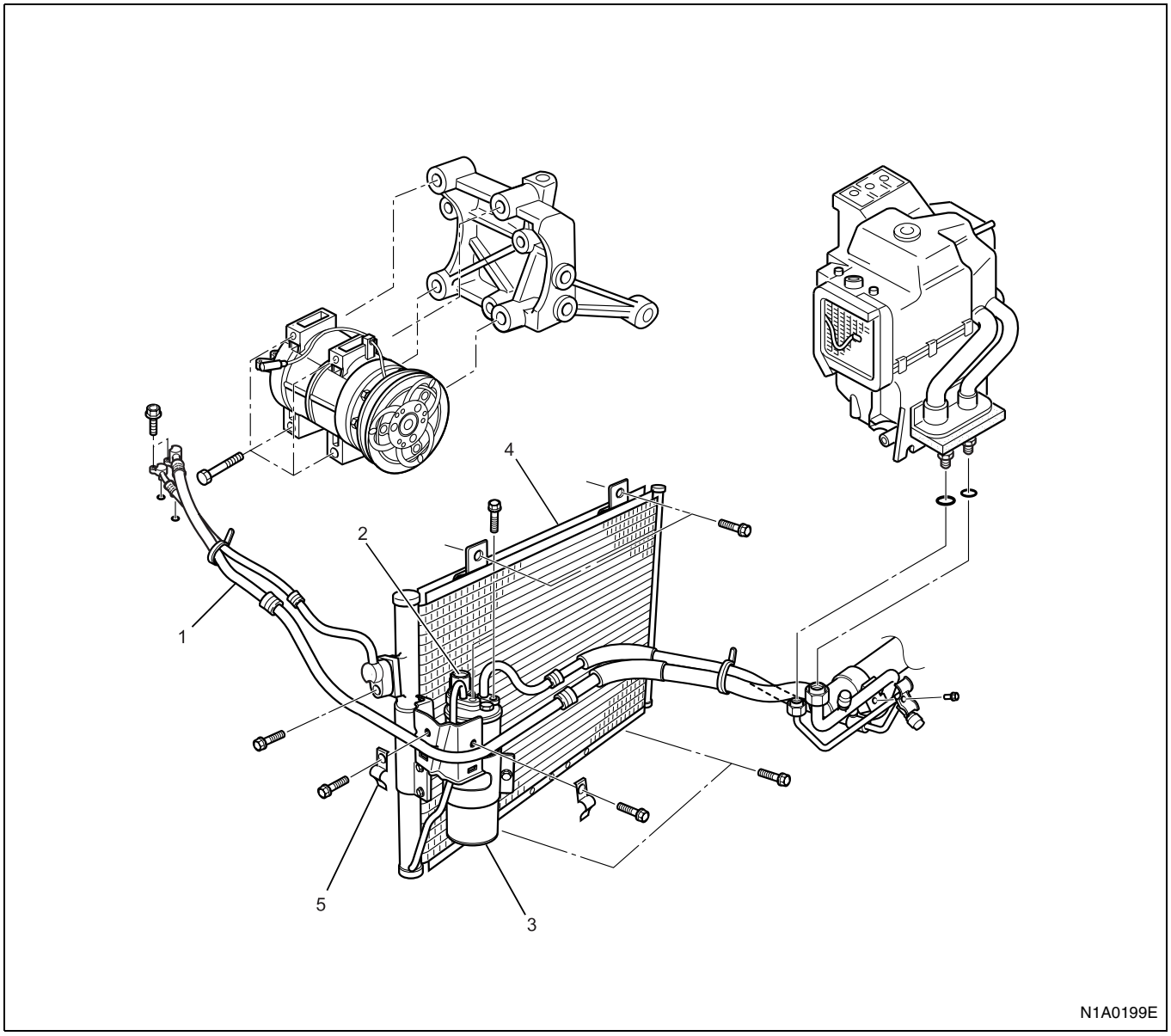
New Compressor Installation

The new compressor is filled with 180cc (5.0 Imp fl oz) of compressor oil and nitrogen gas. When mounting the compressor on the vehicle, perform the following steps;



1. Gently release nitrogen gas from the rear head of the new compressor.
   - Take care not to let the compressor oil flow out.
   - Inspect O-rings and replace if necessary.
2. Turn the compressor several times by hand and release the compressor oil in the cylinder.
3. When installing on a new system, the compressor should be installed as it is. When installing on a used system, the compressor should be installed after adjusting the amount of compressor oil. (Refer to Section 1D “COMPRESSOR OVERHAUL” for General Information.)

Condenser Assembly (Except 4HK1-TC Engine Model For Australia)



Legend

1. Refrigerant line
2. Pressure switch
3. Receiver / drier
4. Condenser assembly
5. Refrigerant line fixing clamp

Removal

Preparation:
Disconnect the battery ground cable.
Discharge and recover refrigerant.

1. Pressure switch connector
2. Refrigerant line fixing clamp
3. Refrigerant Line
   - Use a back up wrench when disconnecting and re-connecting the refrigerant lines.
   - When removing the line, the connecting part should immediately be plugged or capped to prevent foreign matter from being mixed into the line.
4. Condenser assembly
   - Remove the radiator stay before condenser (GCC).

Installation

1. Condenser Assembly
   - If installing a new condenser, be sure to add 30cc (0.8 Imp fl oz) of new specified compressor oil to a new one.
   - Tighten the condenser bolt to the specified torque.
2. Refrigerant Line
   - Tighten the inlet line to the specified torque.

Tighten:
Inlet line to 15 N·m (1.5 kg·m/11 lb·ft)

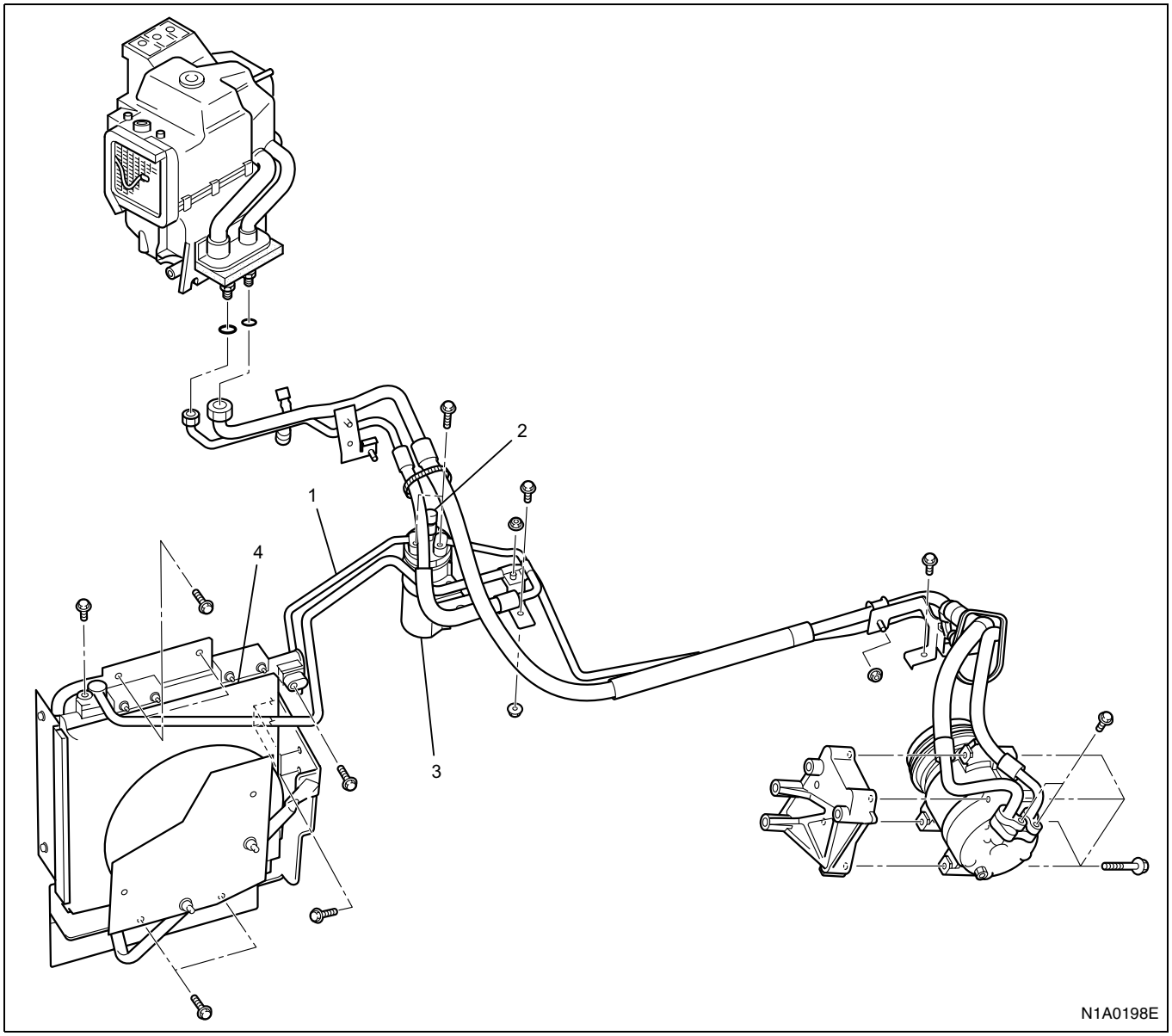
- Tighten the outlet line to the specified torque.

Tighten:
Outlet line to 6 N·m (0.6 kg·m/4 lb·ft)

- O-rings cannot be reused. Always replace with new ones.
- Be sure to apply new specified compressor oil to the O-rings when connecting refrigerant line.

3. Refrigerant Line Fixing Clamp
4. Pressure Switch Connector

Condenser Assembly (4HK1-TC Engine Model For Australia)



Legend

1. Refrigerant line
2. Pressure switch
3. Receiver / drier
4. Condenser assembly

Removal

Preparation:
Disconnect the battery ground cable.
Discharge and recover refrigerant.

1. Refrigerant Line
   - Use a back up wrench when disconnecting and re-connecting the refrigerant lines.
   - When removing the line, the connecting part should immediately be plugged or capped to prevent foreign matter from being mixed into the line.
2. Condenser assembly

Installation

1. Condenser Assembly
   - If installing a new condenser, be sure to add 30cc (0.8 Imp fl oz) of new specified compressor oil to a new one.
   - Tighten the condenser bolt to the specified torque.
2. Refrigerant Line
   - Tighten the inlet line to the specified torque.

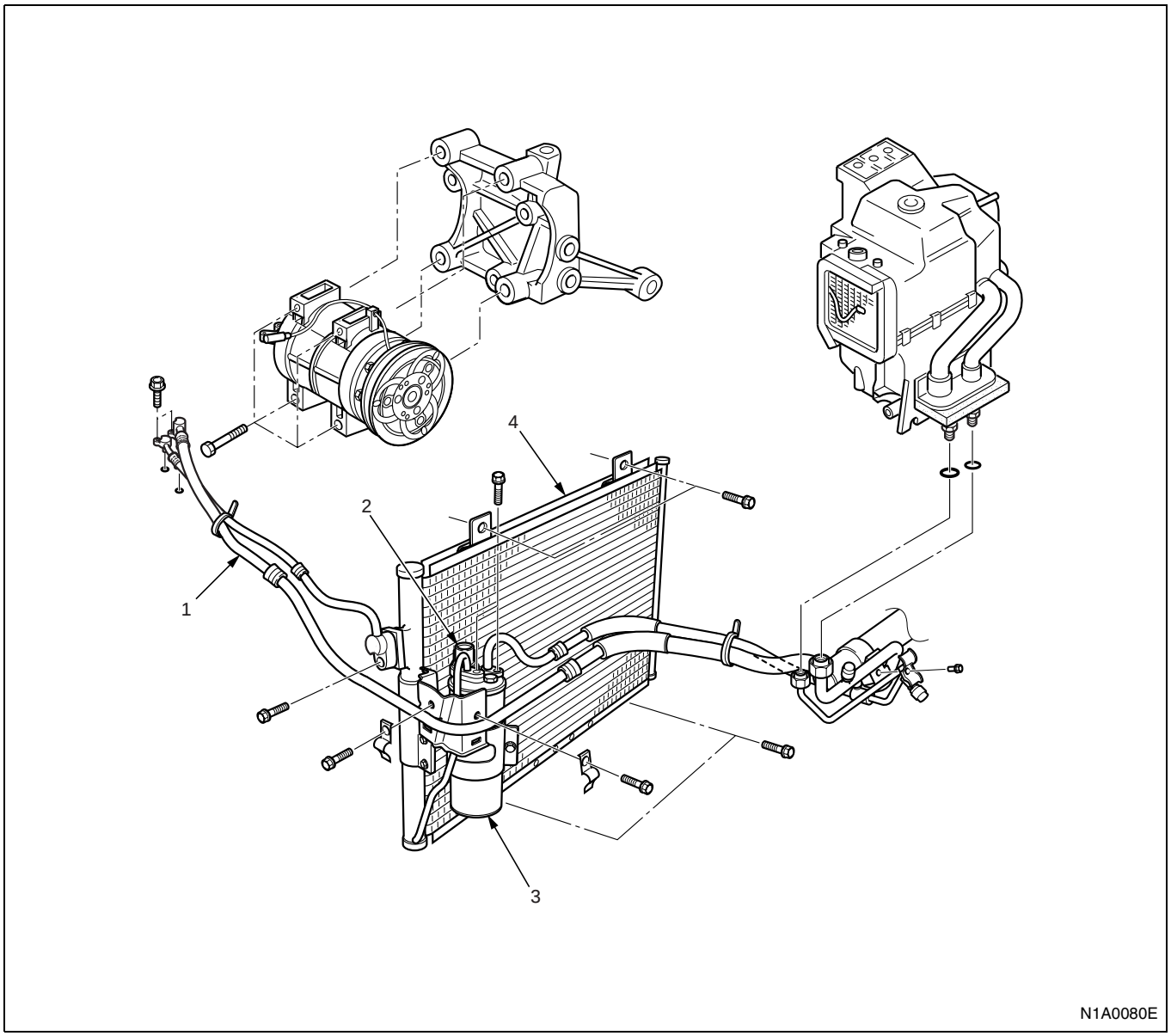
Tighten:
Inlet line to 15 N·m (1.5 kg·m/11 lb·ft)

- Tighten the outlet line to the specified torque.

Tighten:
Outlet line to 6 N·m (0.6 kg·m/4 lb·ft)

- O-rings cannot be reused. Always replace with new ones.
- Be sure to apply new specified compressor oil to the O-rings when connecting refrigerant line.

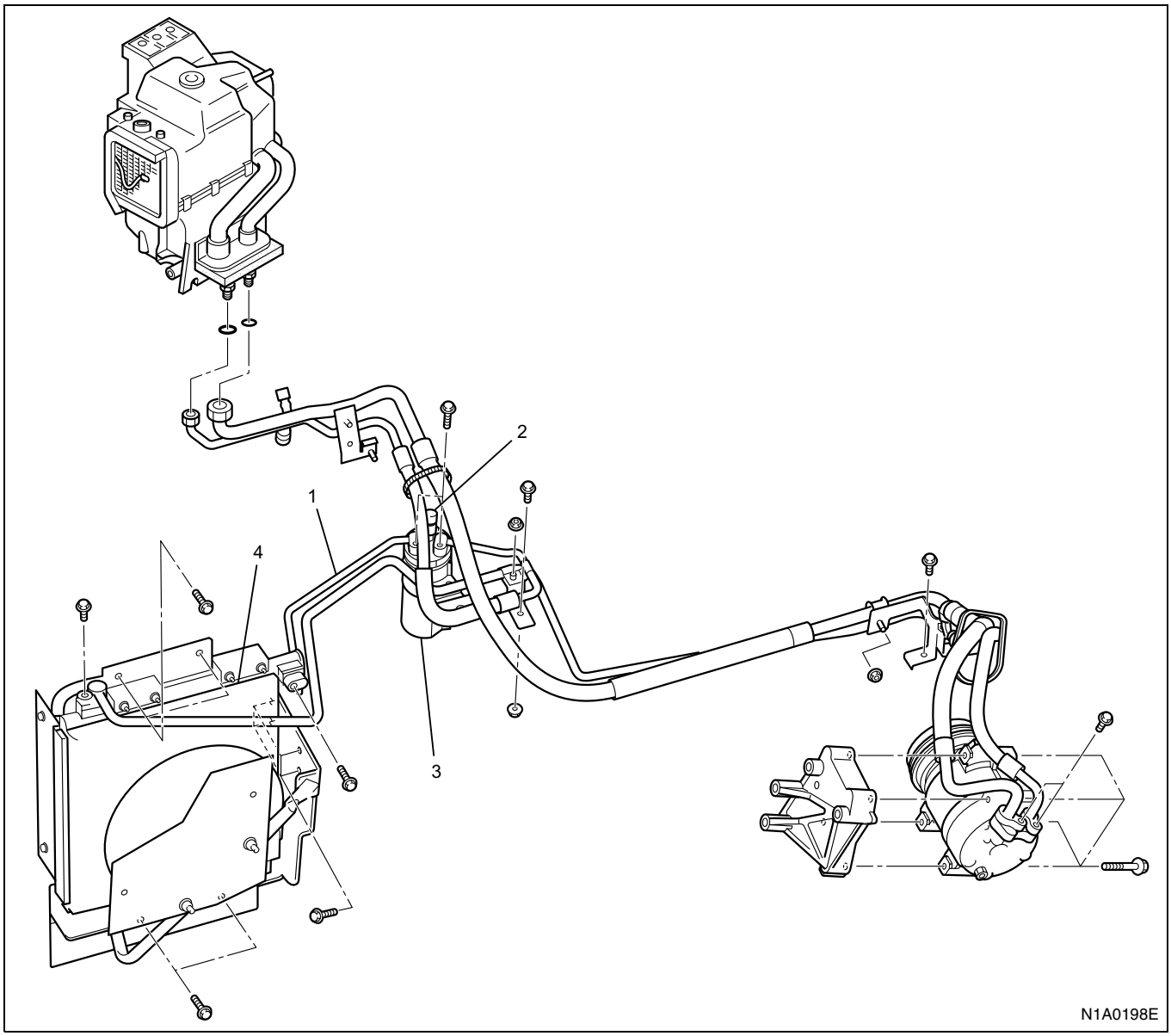
Receiver / Drier (Except 4HK1-TC Engine Model For Australia)



Legend

1. Refrigerant line
2. Pressure switch
3. Receiver / drier
4. Condenser assembly

Receiver / Drier (4HK1-TC Engine Model For Australia)



Legend

1. Refrigerant line
2. Pressure switch
3. Receiver / drier
4. Condenser assembly

Removal

Preparation:
Disconnect the battery ground cable.
Discharge and recover refrigerant.

1. Pressure Switch Connector
2. Refrigerant line
   - Use a back up wrench when disconnecting and reconnecting the refrigerant line.
   - When removing the line connected part, the connecting part should immediately be plugged or capped to prevent foreign matter from being mixed into the line.
3. Receiver / Drier
   - Loosen the fixing bolt and carefully pull out the receiver/drier.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

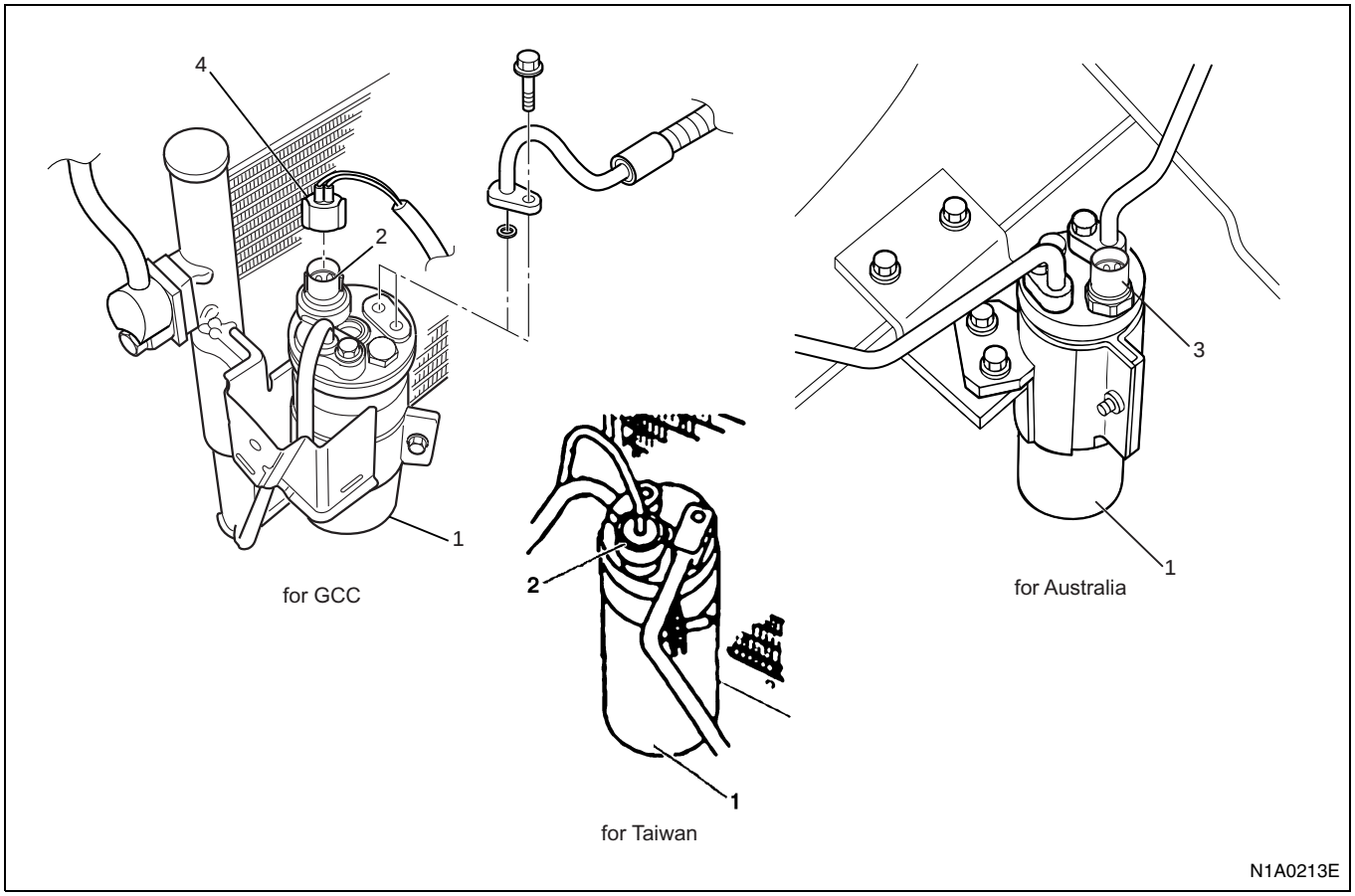
1. If installing a new receiver/drier, be sure to add 30 cc (0.8 Imp fl oz) of new specified compressor oil to a new one.
2. Put the receiver/drier in the bracket, and connect with the refrigerant line. Check that no excessive force is imposed on the line. Fasten the fixing bolt to the receiver/drier.

3. Tighten the line to the specified torque.

Tighten:
Refrigerant Line to 6 N·m (0.6 kg·m/4 lb·ft)

4. O-rings cannot be reused. Always replace with new ones.
5. Be sure to apply new specified compressor oil to the O-rings when connecting refrigerant line.

Pressure Switch



Legend

1. Receiver / drier
2. Dual pressure switch
3. Triple pressure switch
4. Pressure switch connector

Removal

Preparation:
Disconnect the battery ground cable.
Discharge and recover refrigerant.

1. Pressure Switch Connector
2. Pressure Switch
   - Turn the pressure switch counterlockwise to remove it.
   - When removing the switch connected part, the connecting part should immediately be plugged or capped to prevent foreign matter from being mixed into the line.

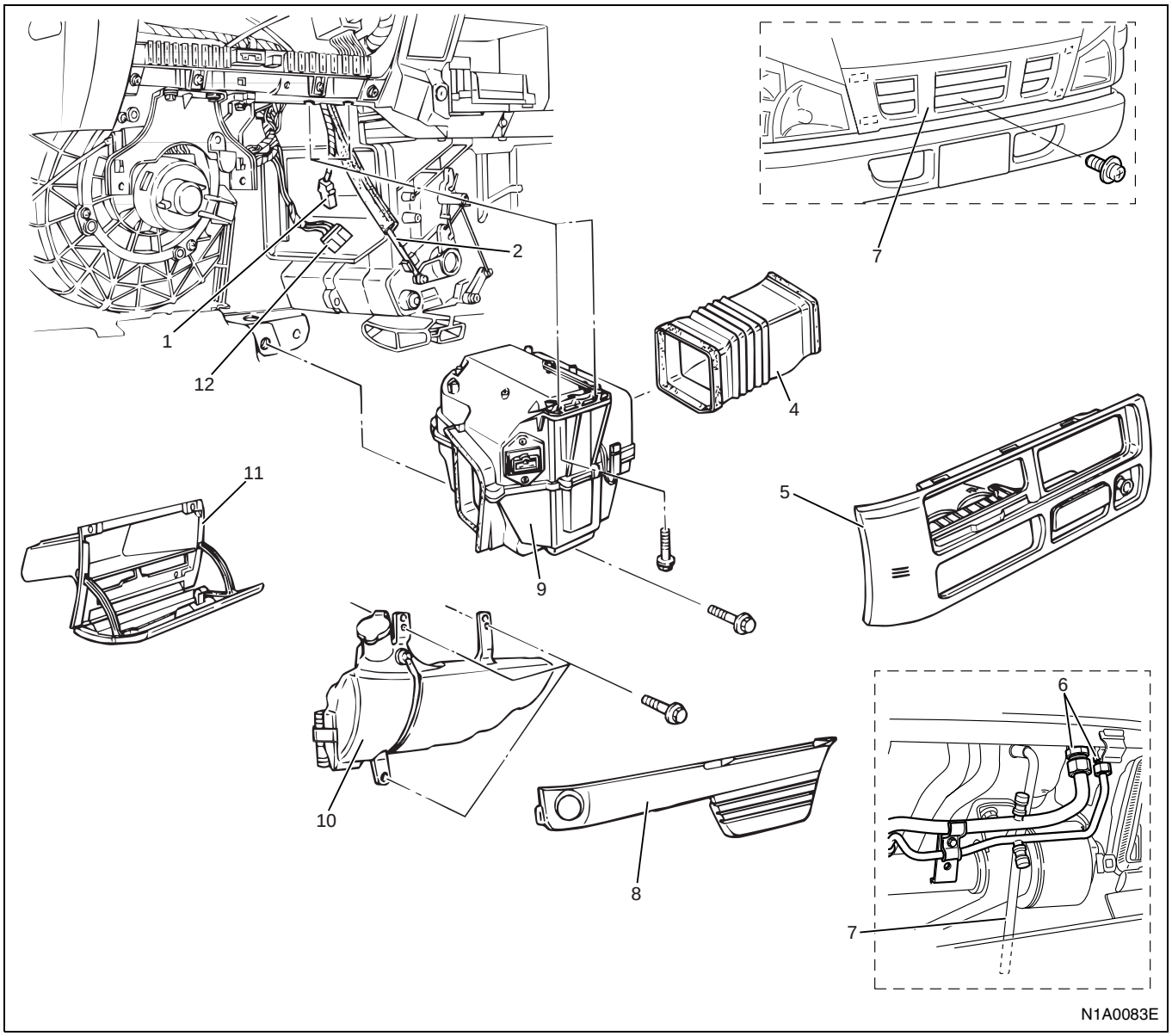
Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. O-ring cannot be reused. Always replace with a new one.
2. Be sure to apply new specified compressor oil to the O-ring when connecting pressure switch.
3. Tighten the pressure switch to the specified torque.

Tighten:
Pressure switch to 10 N·m (1.0 kg·m/7.4 lb·ft)

Evaporator Assembly



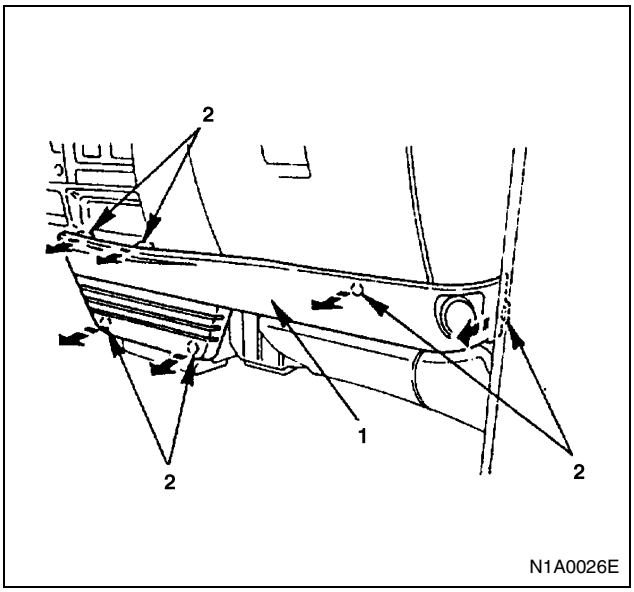
Legend

1. Electronic thermostat connector
2. Temperature control cable
3. Front grille
4. Duct (NPR only)
5. Center cluster
6. Refrigerant line
7. Drain hose
8. Under cover
9. Evaporator assembly
10. Washer tank
11. Glove box
12. Resistor connector

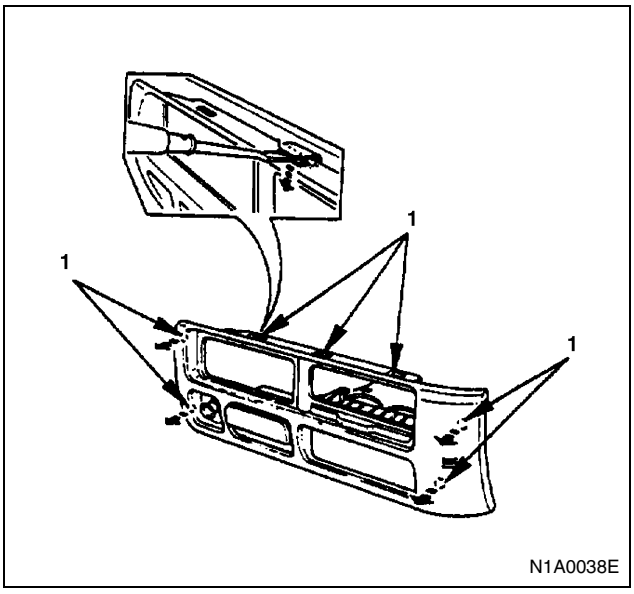
Removal

Preparation:
Disconnect the battery ground cable.
Discharge and recover refrigerant.

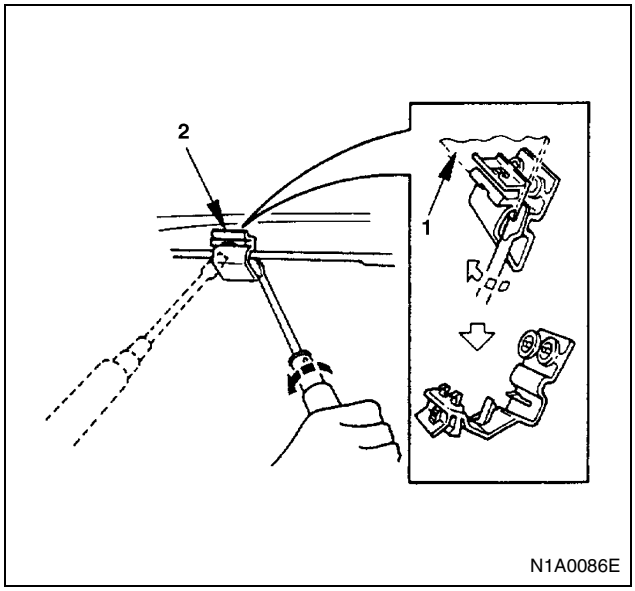
1. Glove Box
   Open the glove box and remove the fixing screws.
2. Under Cover
   While pulling the under cover (1) with care, remove the clips (2) on the back side of the cover.



3. Washer Tank
   - Remove the washer tank fixing three bolts (Upper: two, Lower: one) and disconnect the connector.
   - Do not disconnect the washer tank tube.
4. Center Cluster
   - While pulling the cluster with care, remove the upper and back side clips (1) of the cluster.
   - Disconnect the cigar lighter and illumination connectors.

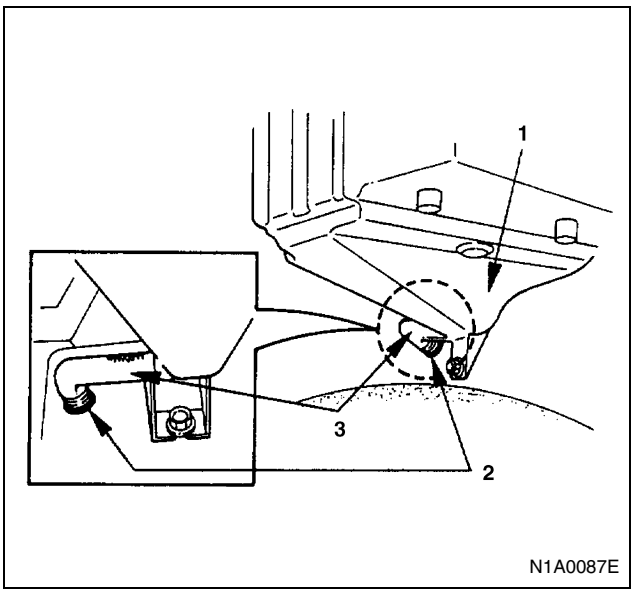


5. Temperature Control Cable
   Disconnect the temperature control cable of the control lever assembly from the heater unit.
6. Duct (NPR only)
7. Front Grille
   After removing the grille, remove the grille fixing clip (RH).



Legend
1. Panel
2. Clip

8. Refrigerant Line
   - Use a back up wrench when disconnecting and reconnecting the refrigerant line.
   - When removing the refrigerant line connected part, the connecting part should immediately be plugged or capped to prevent foreign matter from being mixed into the line.
9. Evaporator Assembly
   - Disconnect the resistor and thermostat connectors.
   - Disconnect the drain hose.



Legend

1. Evaporator
2. Grommet
3. Drain hose

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. To install a new evaporator assembly, add 50cc (1.4 lmp fl oz) of new specified compressor oil to a new core.
2. Tighten the refrigerant outlet line to the specified torque.

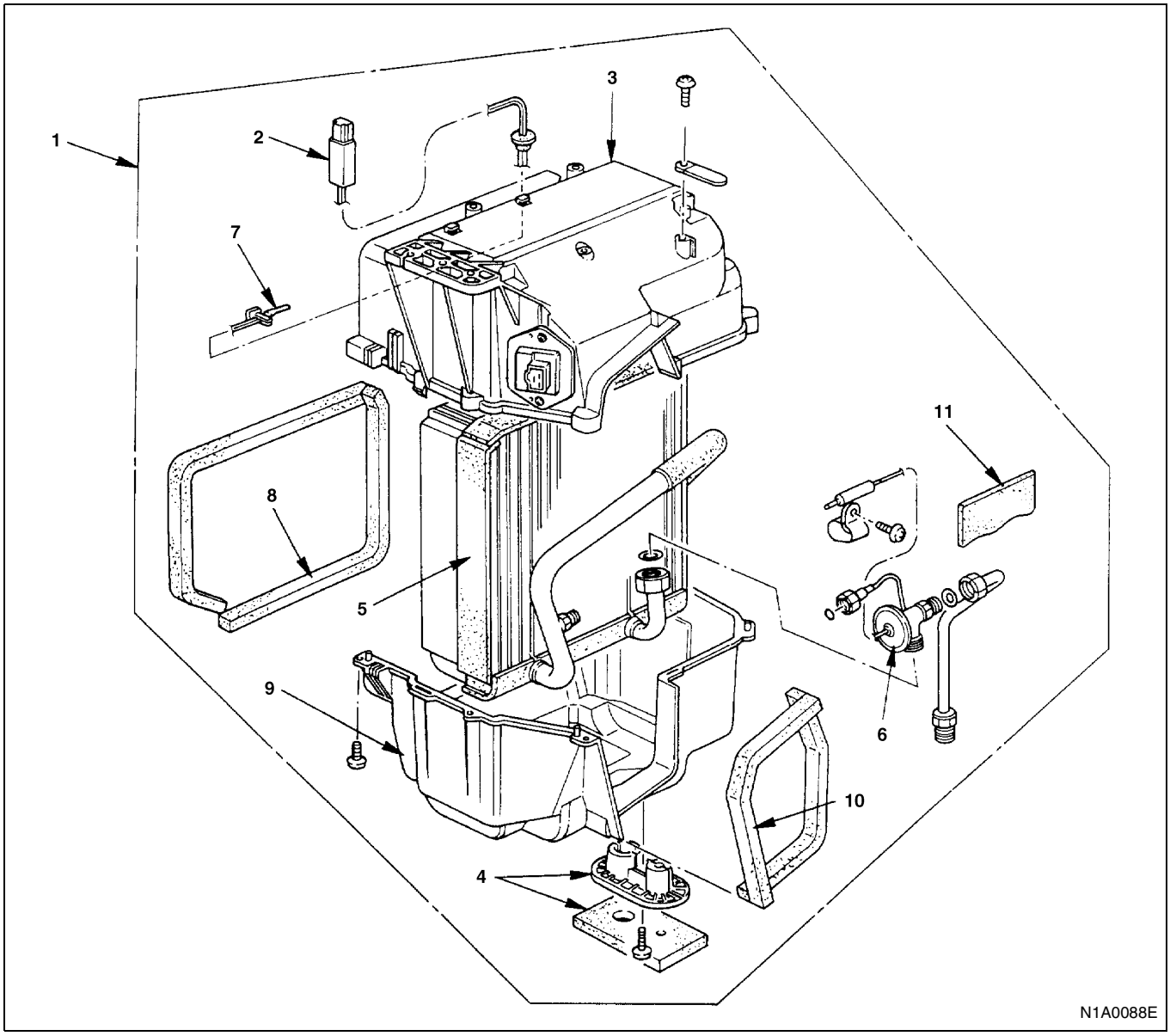
Tighten:
Outlet line to 28 N·m (2.8 kg·m/21 lb·ft)

3. Tighten the refrigerant inlet line to the specified torque.

Tighten:
Inlet line to 15 N·m (1.5 kg·m/11 lb·ft)

4. O-rings cannot be reused. Always replace with new ones.
5. Be sure to apply new specified compressor oil to the O-rings when connecting lines.

Evaporator Core / Expansion Valve (LHD Model)



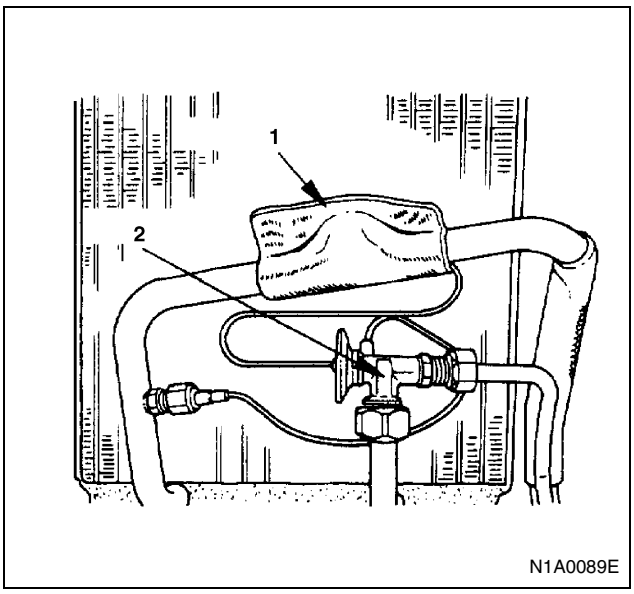
Legend

1. Evaporator assembly
2. Electronic thermostat
3. Upper case
4. Insulator and under cover
5. Evaporator core
6. Expansion valve
7. Thermo sensor
8. Lining
9. Lower case
10. Lining
11. Insulator

Removal

Preparation:
Disconnect the battery ground cable.
Discharge and recover refrigerant.

1. Evaporator Assembly
   Refer to “EVAPORATOR ASSEMBLY” removal procedure in this section.
2. Electronic Thermostat
   - Remove the sensor fixing clip.
   - Pull out the grommet from the upper case to remove the thermostat.
3. Upper Case
   - Separate the upper and lower case.
   - Slit the case parting face with a knife since the lining is separated.
4. Insulator and Under Cover
5. Evaporator Core
   Pull up the core from the lower case.
6. Expansion Valve
   - Tear off the insulator (1) carefully.
   - Remove the sensor fixing clip.
   - Use a back up wrench when disconnecting all refrigerant pipes, and remove the expansion valve (2).

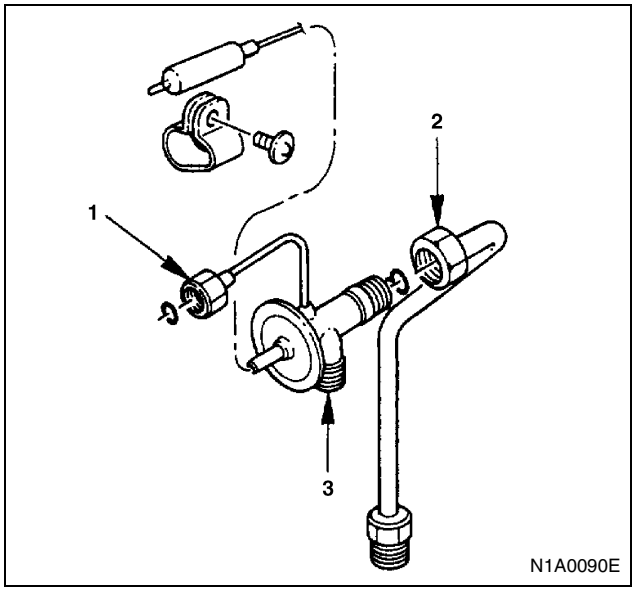


Installation

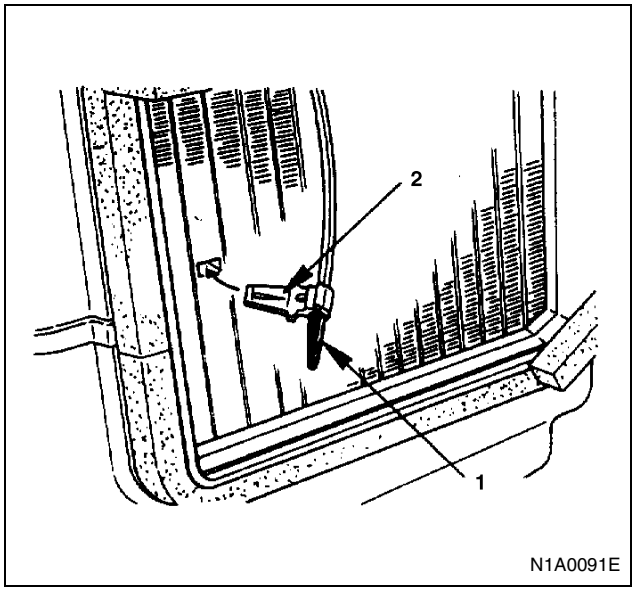
To install, follow the removal steps in the reverse order, noting the following points:

1. O-rings cannot be reused. Always replace new ones.
2. Be sure to apply new specified compressor oil to the O-rings when connecting lines.
3. Be sure to install the expansion valve sensor and the insulator on the place where it was before.
4. To install a new evaporator core, add 50cc (1.4 Imp. fl oz) of new specified compressor oil to a new core and install the thermostat sensor to the evaporator core specified position with the clip where it was before.
5. Tighten the refrigerant lines to the specified torque.

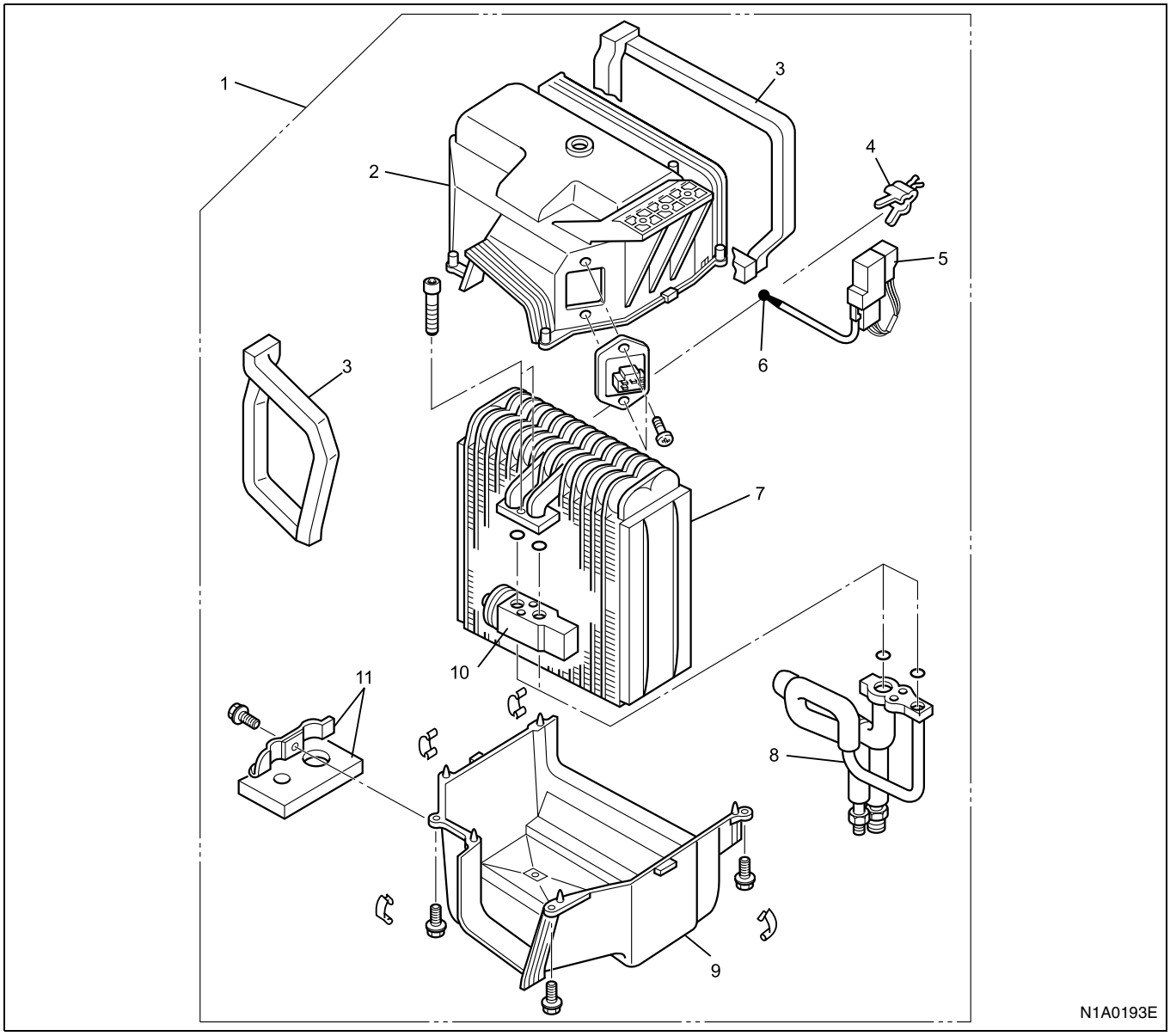
Tighten:
- Refrigerant line 1 to 10 N·m (1.0 kg·m/7 lb·ft)
- Refrigerant line 2 to 15 N·m (1.5 kg·m/11 lb·ft)
- Refrigerant line 3 to 20 N·m (2.0 kg·m/14 lb·ft)



6. Apply an adhesive to parting face of lining when assembling evaporator assembly.
7. The thermostat sensor (1) is installed on the core with the clip (2) and it must not interfere with the core.



Evaporator Core / Expansion Valve (RHD Model)



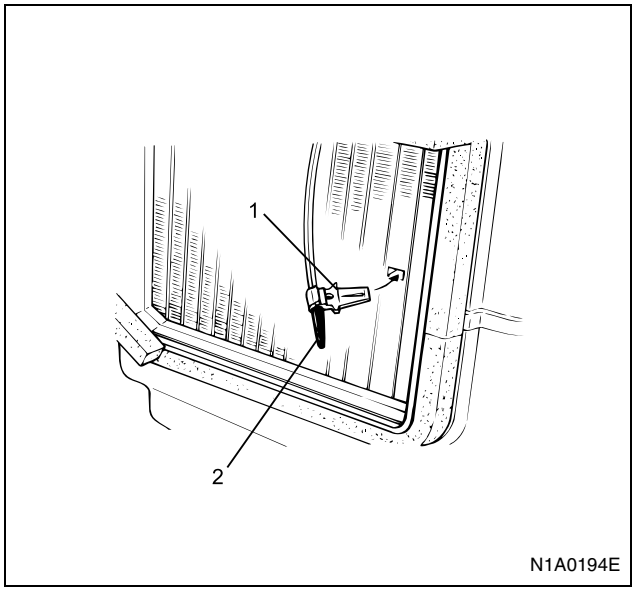
Legend

1. Evaporator assembly
2. Upper case
3. Lining
4. Clip
5. Amplifier & Thermistor
6. Thermo sensor
7. Evaporator core
8. Pipe assembly
9. Lower case
10. Expansion valve
11. Insulator and cover

Removal

Preparation:
Disconnect the battery ground cable.
Discharge and recover refrigerant.

1. Evaporator Assembly
   Refer to “EVAPORATOR ASSEMBLY” removal procedure in this section.
2. Amplifier & Thermistor
   - Remove the sensor fixing clip.
   - Pull out the grommet from the upper case to remove the thermostat.
3. Upper Case
   - Separate the upper and lower case.
   - Slit the case parting face with a knife since the lining is separated.
4. Insulator and Cover
5. Evaporator Core
   Pull up the core from the lower case.
6. Expansion Valve
   Take off two installation bolts and subsequently remove pipe assembly and expansion valve sequentially.



Installation

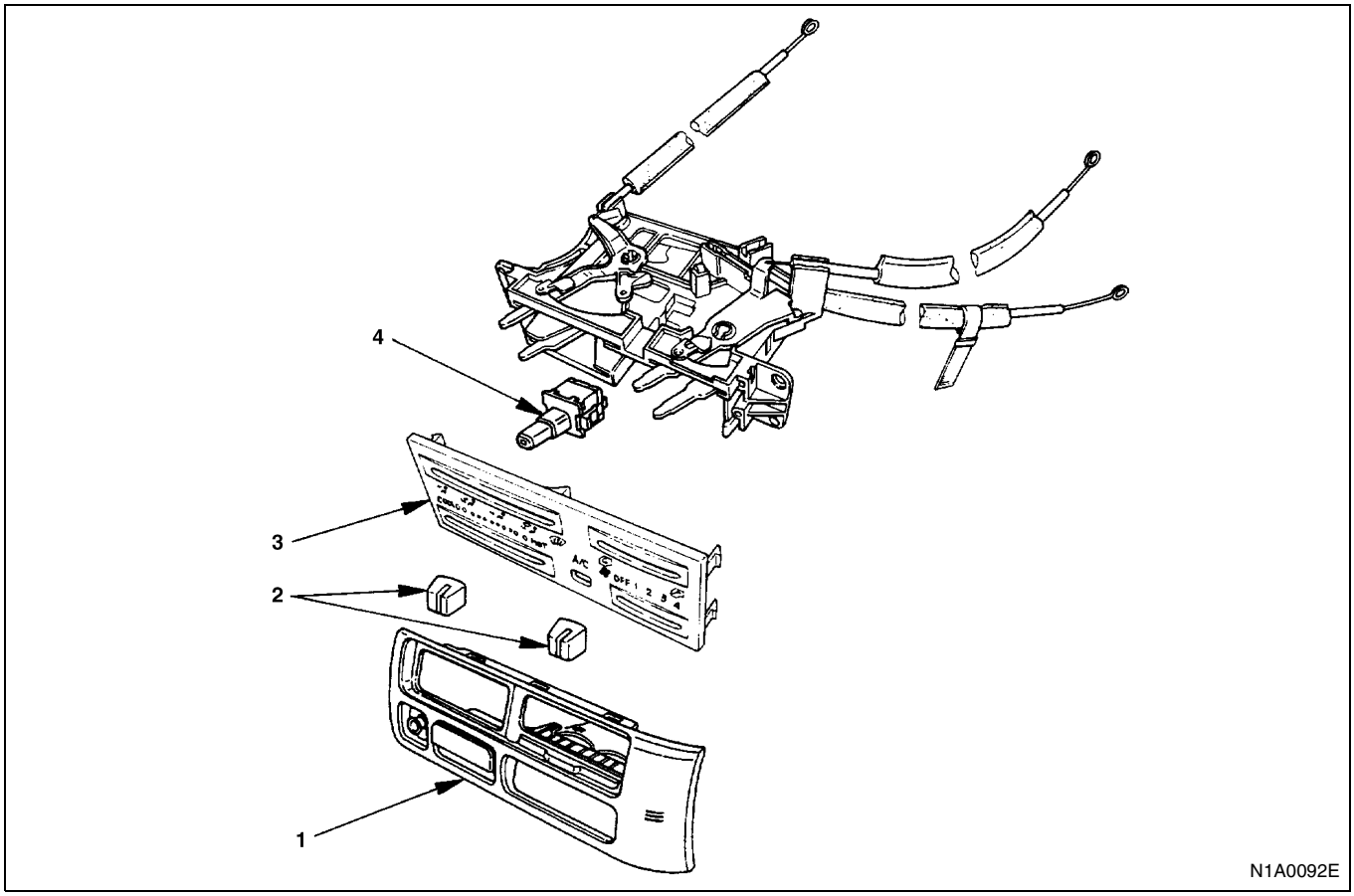
To install, follow the removal steps in the reverse order, noting the following points:

1. Tighten the expansion valve to the specified torque.

Tighten:
Installation bolts to 5 N·m (0.5 kg·m/3.7 lb·ft)

2. O-rings cannot be reused. Always replace new ones.
3. Be sure to apply new specified compressor oil to the O-rings when connecting lines.
4. To install a new evaporator core, add 50cc (1.4 Imp. fl oz) of new specified compressor oil to a new core.
5. Apply an adhesive to parting face of lining when assembling evaporator assembly.
6. Install the amplifier & thermistor sensor (2) surely to the evaporator core specified position with the clip (1) where it was before.

A/C Switch



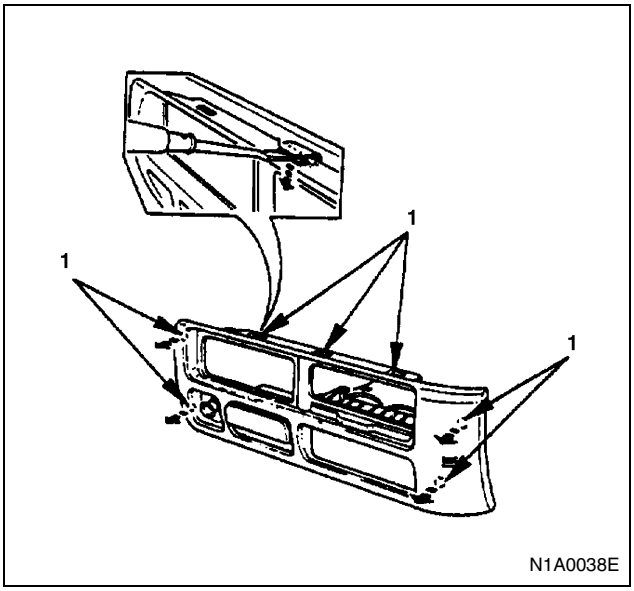
Legend

1. Center cluster
2. Knob
3. Control panel bezel
4. A/C switch

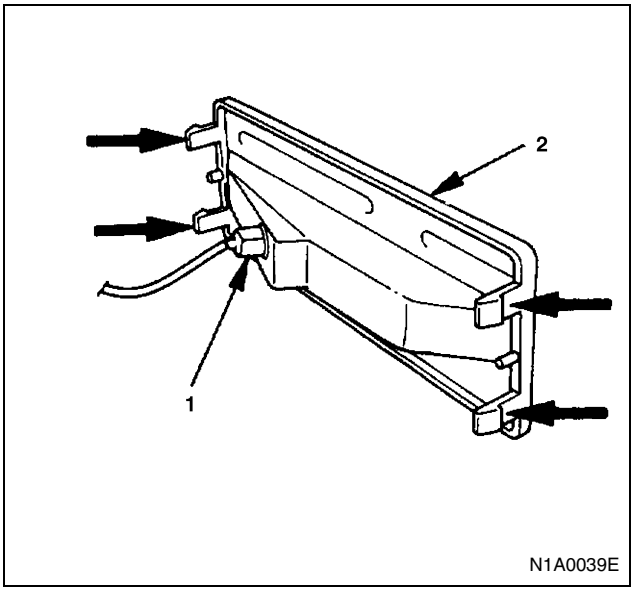
Removal

Preparation:
Disconnect the battery ground cable.

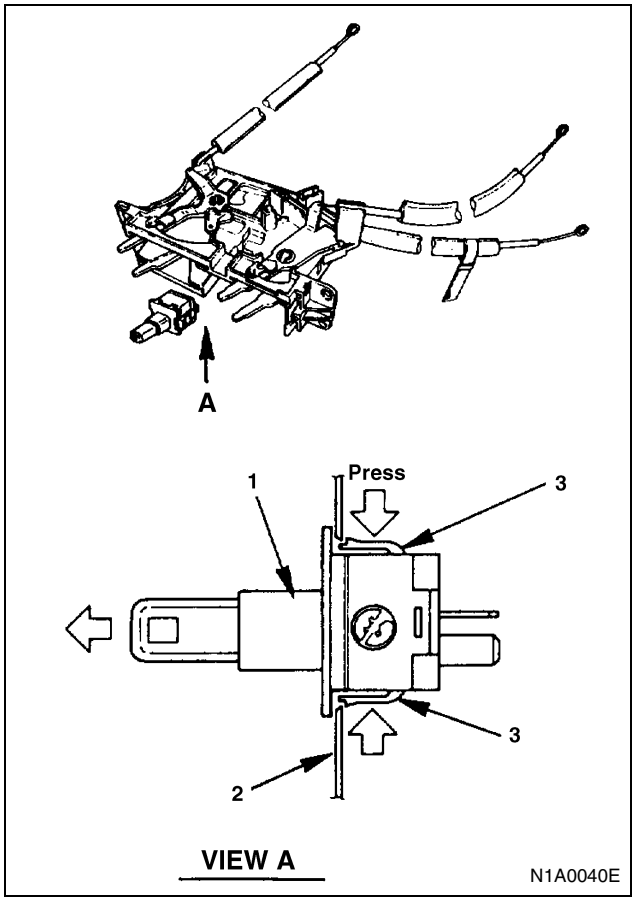
1. Center Cluster
   - While pulling the cluster with care, remove the upper and backside clips (1) of the cluster.
   - Disconnect the cigar lighter and illumination connectors.



2. Knob
3. Control Panel Bezel
   Push the four catches at both sides of the bezel to the inside, and remove the illumination bulb (1) from the bezel (2).



4. A/C Switch
   Push the catches at both sides of the A/C switch to the inside, and remove the switch by pulling it out.



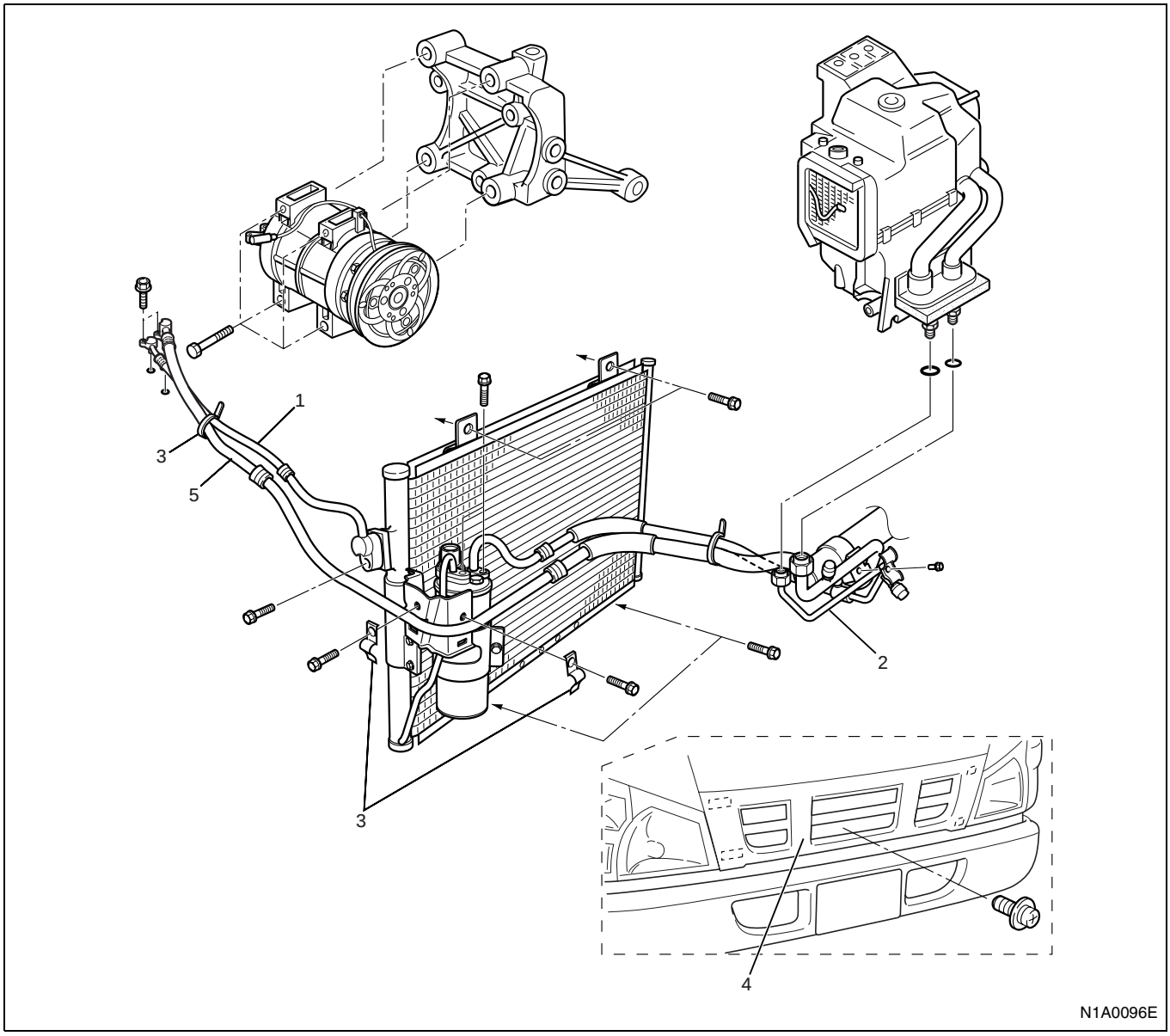
Legend

1. A/C switch
2. Control lever
3. Catch

Installation

To install, follow the removal steps in the reverse order.

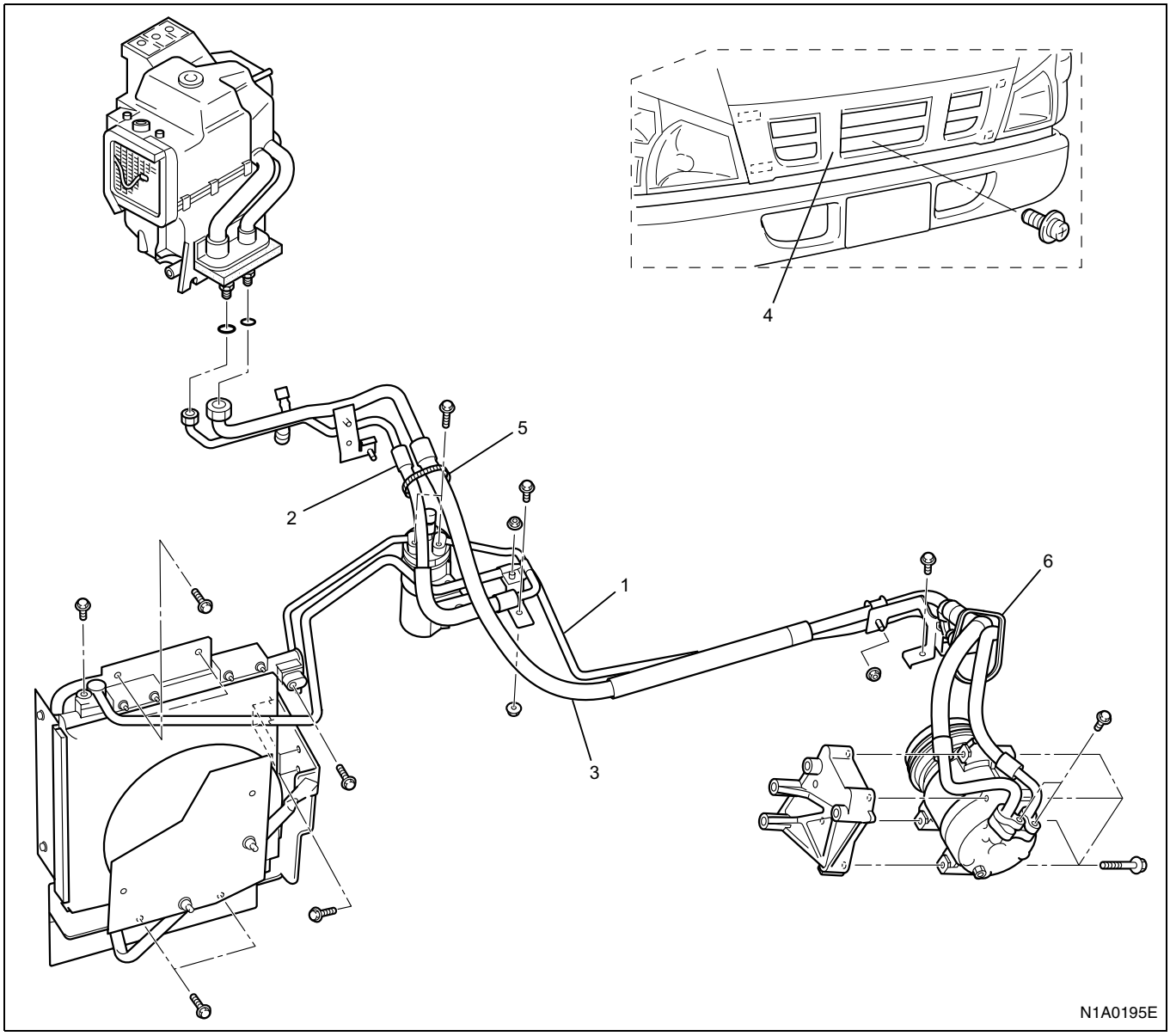
Refrigerant Line (Except 4HK1-TC Engine Model For Australia)



Legend

1. Refrigerant line (Compressor — Condenser)
2. Refrigerant line (Receiver / Drier — Evaporator)
3. Clamp / Clip
4. Front grille
5. Refrigerant line (Compressor — Evaporator)

Refrigerant Line (4HK1-TC Engine Model For Australia)



Legend

1. Refrigerant line (Compressor — Condenser)
2. Refrigerant line (Receiver / Drier — Evaporator)
3. Refrigerant line (Compressor — Evaporator)
4. Front grille
5. Band clip
6. Band clip

Removal

Preparation:
Disconnect the battery ground cable.
Discharge and recover refrigerant.

1. Front grille
2. Clamp / Clip (Except 4HK1-TC Engine Model For Australia)
3. Band clip (4HK1-TC Engine Model For Australia)
4. Refrigerant line (Compressor — Condenser)
5. Refrigerant line (Compressor — Evaporator)
6. Refrigerant line (Receiver / Drier — Evaporator)

- Use a back-up wrench when disconnecting and re-connecting the refrigerant lines.
- When removing the refrigerant line connecting part, the connecting part should immediately be plugged or capped to prevent foreign matter from being mixed into the line.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. O-rings cannot be reused. Always replace new ones.
2. Be sure to apply new specified compressor oil to the O-rings when connecting refrigerant lines.
3. If installing a new refrigerant line, be sure to add 10 cc (0.3 lmp fl oz) of new specified compressor oil to a new one.
4. Tighten the refrigerant line to the specified torque. (Refer to “SERVICE INFORMATION” for FIXING TORQUE in section 00.)