Pregio

Workshop Manual

FOREWORD

This Workshop Manual provides information covering normal service, repairs, and maintenance for all systems of the Pregio.

This manual is organised into Groups covering general systems. Within each Group, the information is further divided into Sections. There is one Section for each component or sub-system. Some Groups contain a Service Section to cover procedures common to several components or subsystems within the Group. In general, each Section contains an Outline Description, Troubleshooting, Adjustments, Removal, Installation, Disassembly, Assembly and Inspection procedures for the component covered in the Section. Diagnosis and Testing is included in the first section of some Groups to help you systematically locate and correct problems encountered. In most cases, Specifications are included at the end of each Section.

To aid in locating specific subjects in this manual, use the Table of Contents on the following pages.

As a further aid, there is an index on the first page of each Group which lists the Section title for each component covered within the group.
This Group Section breakdown is also indicated in the page number located at the top of each page.

Example : 42A-35 = (Group) 42A, (Page) 35.

The descriptions and specifications contained in this manual were in effect at the time this manual was approved for printing. Kia Motors Corporation reserves the right to discontinue models at any time, or change specifications or design without notice and without incurring obligation.

Kia Motors Corporation
SEOUL, KOREA

CONTENTS

Printed in Korea, February 2001
Pub. No. AERS [illegible]

WARNING

Appropriate service methods and proper repair procedures are essential for the safe, reliable operation of all motor vehicles as well as the personal safety of the individual doing the repair. There are numerous variations in procedures, techniques, tools, and parts for servicing vehicles, as well as in the skill of the individual doing the work. This manual cannot possibly anticipate all such variations and provide advice or caution to each. Accordingly, anyone who departs from the instruction provided in this manual must first establish that he compromises neither his personal safety nor the vehicle integrity by his choice of methods, tools, or parts. The following list contains general warnings that should always be followed while working on a vehicle.

- Always wear safety glasses for eye protection.
- Use safety stands whenever a procedure requires underbody work.
- Be sure ignition switch is always off unless otherwise specified by a procedure.
- Set the parking brake when working on the vehicle.
- Operate the engine only in a well ventilated area.
- Keep clear of moving parts when engine is running.
- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.
- Do not smoke while working on a vehicle.

CAUTION

Severe engine and transaxle damage may result from the use of poor quality fuels and lubricants that do not meet Kia specifications. You must always use high quality fuels and lubricants that meet the specifications described on the specification section in the relevant group of the Workshop Manual.

GENERAL INFORMATION

00

FUNDAMENTAL PROCEDURES

SYMBOLS

There are six symbols indicating oil, grease, and sealant. These symbols show the points of applying such materials during service.

Symbol	Meaning	Kind
	Apply oil	New engine oil or gear oil as appropriate
	Apply brake fluid	Only brake fluid
	Apply automatic transaxle fluid	Only ATF
	Apply grease	Appropriate grease
	Apply sealant	Appropriate sealant
	Apply petroleum jelly	Appropriate

Note

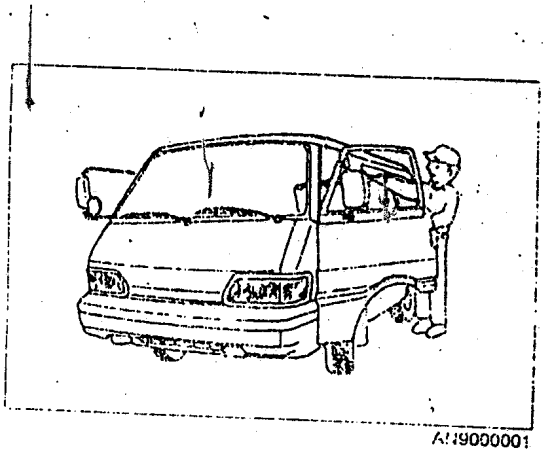
- **When speciall oil or grease is needed, this is shown in the illustration.**

NOTES, CAUTIONS, AND WARNINGS

As you read through the procedures, you will come across NOTES, CAUTIONS, and WARNINGS. Each one is there for a specific purpose. **NOTES** give you **added information** that will help you to complete a particular procedure. **CAUTIONS** are given to prevent you from making an error that could **damage the vehicle. WARNINGS** remind you to be especially careful in those areas where carelessness can cause **personal injury.** The following list contains some general WARNINGS you should follow when you work on a vehicle.

PROTECTION OF THE VEHICLE

Always be sure to cover fenders, seats, and floor areas before starting work.



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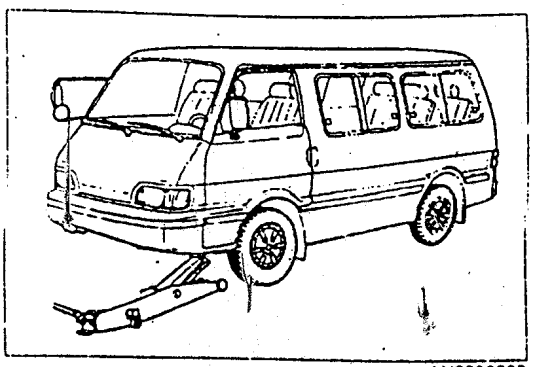
A WORD ABOUT SAFETY

The following precautions must be followed when jacking up the vehicle.

1. Block the wheels.
2. Use only the specified jacking positions.
3. Support the vehicle with safety stands.

Start the engine only after making certain the engine compartment is clear of tools and people.



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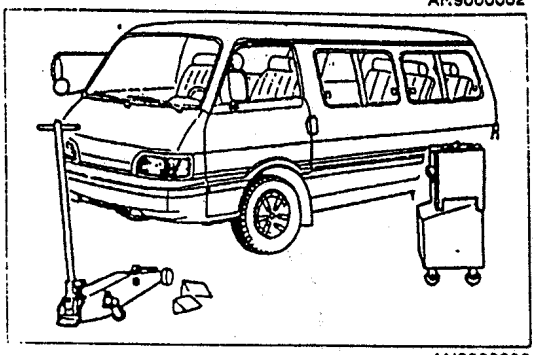
PREPARATION OF TOOLS AND MEASURING EQUIPMENT

Be sure that all necessary tools and measuring equipment are available before starting any work.



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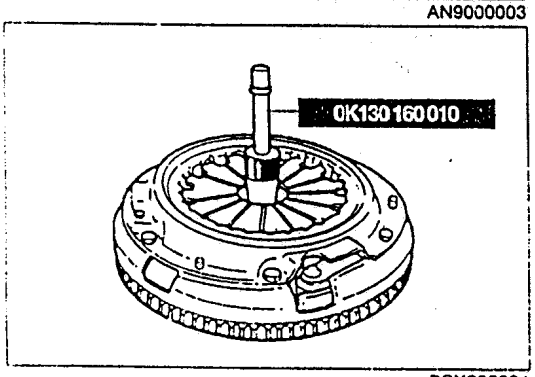
SPECIAL TOOLS

Use special tools when they are required.



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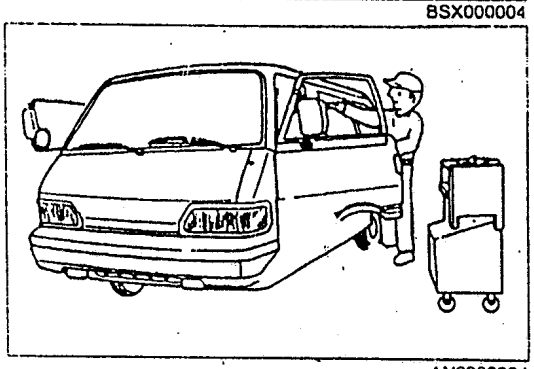
REMOVAL OF PARTS

While correcting a problem, try also to determine its cause. Begin work only after first learning which parts and subassemblies must be removed and disassembled for replacement of repair.



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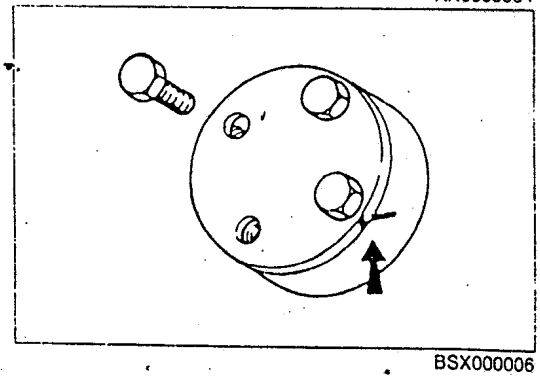
DISASSEMBLY

If the disassembly procedure is complex, requiring many parts to be disassembled, all parts should be disassembled in a way that will not affect their performance or external appearance and identified so that reassembly can be performed easily and efficiently.



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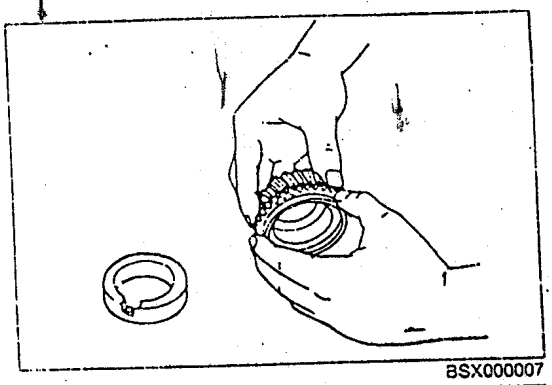
INSPECTION OF PARTS

When removed, each part should be carefully inspected for malfunctioning, deformation, damage, and other problems.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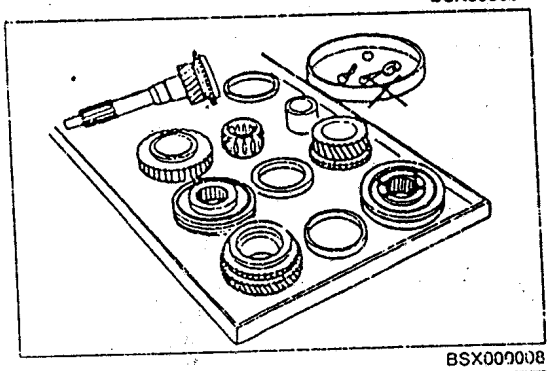
ARRANGEMENT OF PARTS

All disassembled parts should be carefully arranged for re-assembly.
Be sure to separate or otherwise identify the parts to be replaced from those that will be reused.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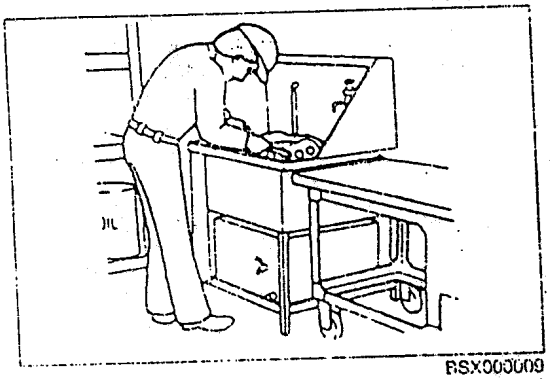
CLEANING PARTS FOR REUSE

All parts to be reused should be carefully and thoroughly cleaned in the appropriate method.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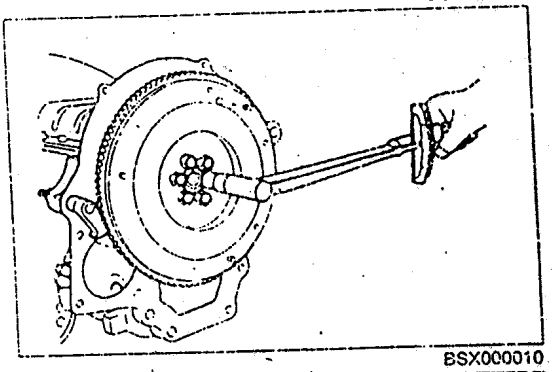
REASSEMBLY

Standard values, such as torques and certain adjustments, must be strictly observed in the reassembly of all parts.
If removed, these parts should be replaced with new ones:

1. Oil seals
2. Gaskets
3. O-rings
4. Lock washers
5. Cotter pins
6. Nylon nuts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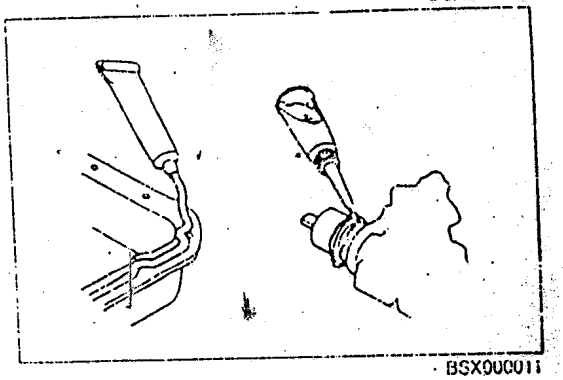
Depending on location :

1. Sealant should be spplied or new gaskets used.
2. Oil should be applied to the moving components of parts.
3. Specified oil or grease should be applied at the prescribed locations (such as oil seals) before reassembly.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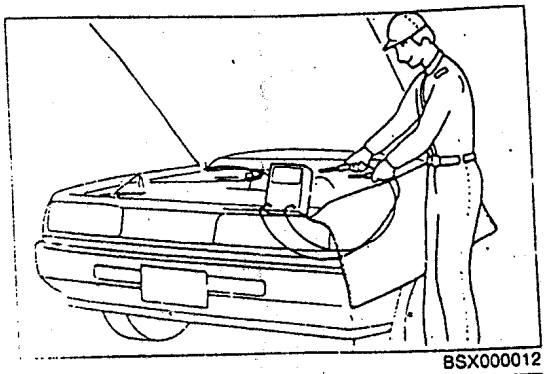
ADJUSTMENTS

Use suitable gauges and/or testers when making adjustments.



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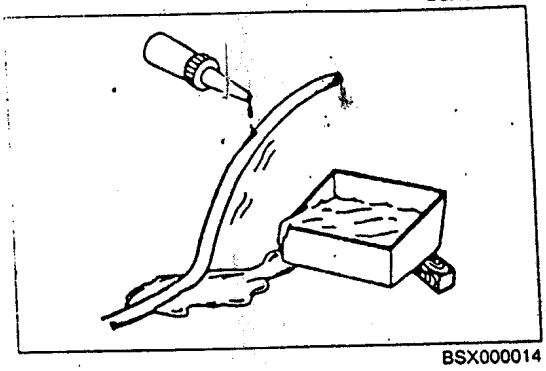
RUBBER PARTS AND TUBING

Prevent gasoline or oil from getting on rubber parts or tubing.



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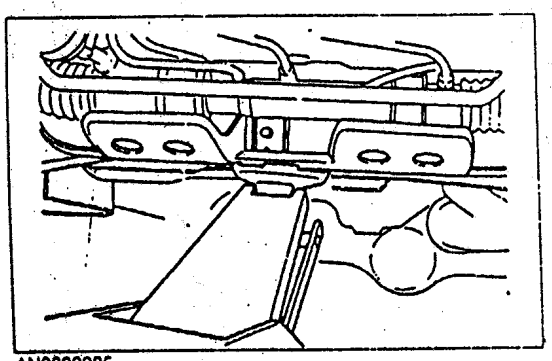
JACK AND SAFETY STAND POSITION

FRONT END
Jack position :
At the front crossmember



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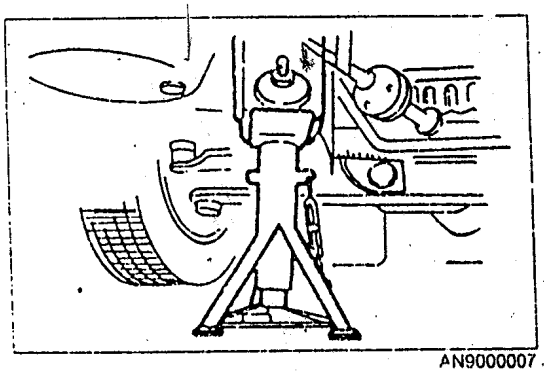
Safety stand positions :
On both sides of the body frame



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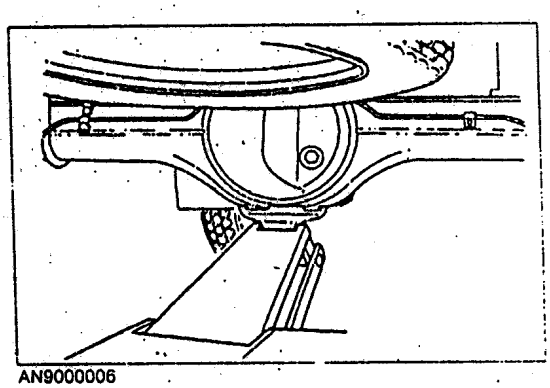
REAR END
Jack position :
At the center of the axle housing



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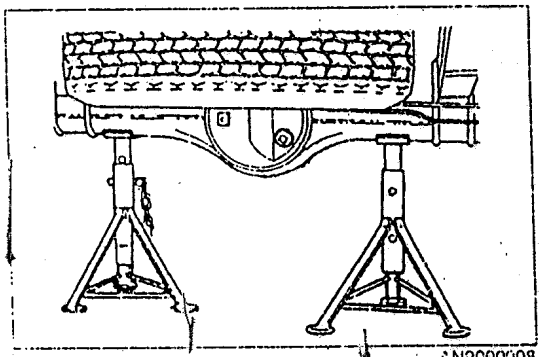
Safety stand position :
On both sides of the axle housing



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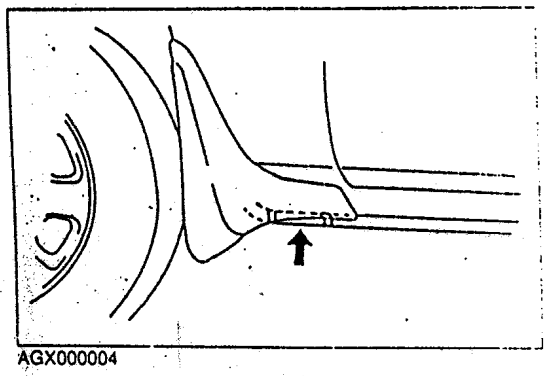
VEHICLE LIFT (2-SUPPORT TYPE) POSITIONS

FRONT END
Side sills



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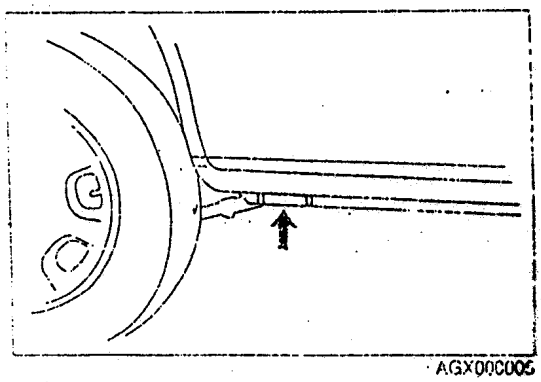
REAR END
Side sills



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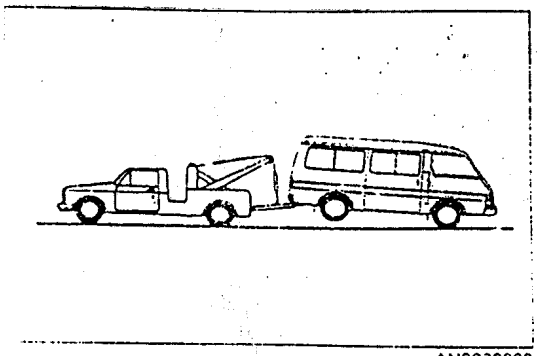
TOWING



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Proper towing equipment is necessary to prevent damage to the vehicle during any towing operation.
Laws and regulations applicable to vehicles in tow must always be observed.
As a rule, towed vehicles should be pulled with the driving wheels off the ground.

With either actomatic or manual transaxle :

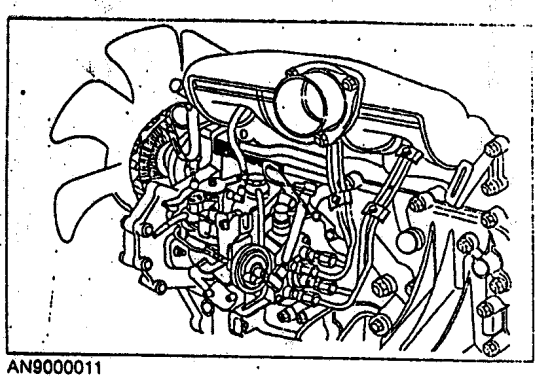
1. Set the ignition switch in the ACC position ;
2. Place the selector lever or shift lever in N (neutral) ;
3. Release the parking brake.

Caution

- **The power assist for the brakes and steering are inoperable while the engine is off.**
- **Do not use the hook loops under the front or rear of the vehicle for towing. These hook loops are designed ONLY for transport tiedown. If tiedown hook loops are used for towing the front or rear skirt and bumper will be damaged.**

IDENTIFICATION NUMBER LOCATIONS

ENGINE MODEL NUMBER



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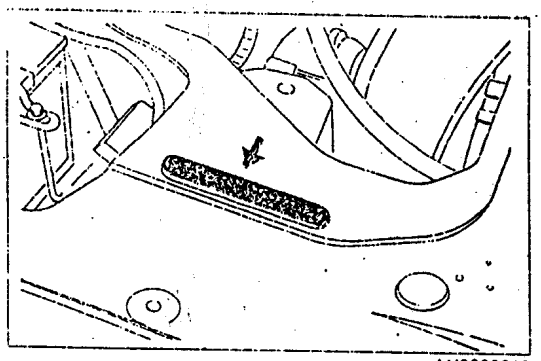
VEHICLE IDENTIFICATION NUMBER(VIN)



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UNITS

N·m (kg-m, or kg-cm, lb-ft or lb-in)	Torque
rpm	Revolutions per minute
A	Ampere(s)
V	Volt(s)
Ω	Ohm(s) (resistance)
kPa (kg/cm², psi)	Pressure (usually negative)
mmHg (inHg)	Pressure (usually negative)
W	Watt
liters (US qt, Imp qt)	Volume
mm (in)	Length

ABBREVIATIONS

ABDC	After bottom dead center
A/C	Air conditioner
ACC	Accessories
A/T	Automatic transaxle
ATDC	After top dead center
ATF	Automatic transaxle fluid
BAC	Bypass air control
BBDC	Before bottom dead center
BTDC	Before top dead center
CPU	Central processing unit
DRL	Daytime running lights
EC-AT	Electronically-controlled automatic transaxle
PCM	Powertrain control module
MFI	Multiport fuel injection
E/L	Electrical load
EX	Exhaust
GND	Ground
HLA	Hydraulic lash adjuster
IGN	Ignition
IN	Intake
INT	Intermittent
IAC	Idle air control
LH	Left hand
M	Motor
MIL	Malfunction indicator lamp
M/S	Manual steering
M/T	Manual transaxle
OD	Overdrive
OFF	Switch off
ON	Switch on
PCV	Positive crankcase ventilation
P/S	Power steering
PRC	Pressure regulator control
P/W	Power window
RH	Right hand
SST	Special service tool
ST	Start
SW	Switch
TDC	Top dead center
TNS	Tail number small lamp

J2 ENGINE

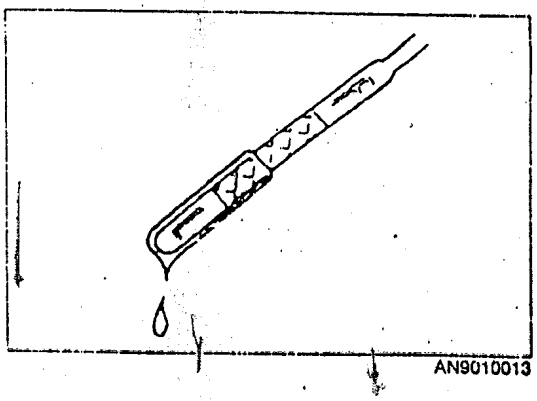
10A

TROUBLESHOOTING GUIDE

Problem	Possible Cause	Action
Insufficient power	Improper valve clearance	Adjustment
	Valve seat compression leakage	Repair
	Valve stem siezed	Replace
	Valve spring weak or broken	Replace
	Cylinder head gasket damaged	Replace
	Cylinder head cracked or distorted	Replace
	Piston ring sticking worn, damaged	Replace
	Piston cracked or worn	Replace
	Fuel system malfunctioning	Refer to Section 22A
	Intake and exhaust system malfunctioning	Refer to Section 20A
Excessive engine oil consumption	Piston ring or piston ring groove worn or sticking	Replace
	Piston or cylinder worn	Replace or repair
	Valve seal worn	Replace
	Valve stem and guide worn	Replace
	Oil leakage	Refer to Section 11A
Difficult to start	Worn piston, piston ring and cylinder	Replace
	Cylinder head damaged or distorted	Replace
	Fuel system malfunctioning	Refer to Section 22A
	Electric system malfunctioning	Refer to Section 20A
Abnormal combustion	Wrong adjustment of valve clearance	Adjustment
	Valve damaged or sticking	Replace
	Valve spring weak or broken	Replace
	Carbon deposit in combustion chamber	Removal
	Injection nozzle malfunctioning	Replace
	Fuel system malfunctioning	Refer to Section 22A
Poor idling	Improper valve clearance	Adjustment
	Improper valve to valve seat contact	Repair or Replace
	Cylinder head gasket damaged	Replace
	Fuel system malfunctioning	Refer to Section 22A
Engine noise	Excessive oil clearance of main bearing	Replace or Repair
	Main bearing seized or heat damage	Replace
	Excessive end play of crankshaft	Replace or Repair
	Excessive oil clearance of connecting rod bearing	Replace or Repair
	Connecting rod bearing seized or heat damage	Replace
	Connecting rod bush worn or seized	Replace

Problem	Possible Cause	Action
Engine noise	Worn cylinder	Replace
	Worn piston or piston pin	Replace
	Piston sticking	Replace
	Piston ring sticking or damaged	Replace
	Bent of connecting rod	Replace
	Excessive valve clearance	Adjustment
	Valve spring cracked	Replace
	Excessive valve guide clearance	Replace
	Water pump bearing malfunction	Replace
	Improper fan belt tension	Adjustment
	Alternator bearing malfunction	Replace
	Cooling fan bearing malfunction	Replace
	Exhaust gas leakage	Repair
	Gas leakage at nozzle holder Assembly	Repair

ENGINE TUNE-UP PROCEDURE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ENGINE OIL

Inspection

1. Be sure that vehicle is on level ground.
2. Warm up the engine to normal operating temperature and stop it.
3. Wait for 5 minutes, and then check oil level and its condition by using the oil level gauge.
4. Fill or replace oil if necessary.

Caution

- **Excessive filling oil over F level can cause engine failure.**

Note

- **Oil quantity is about 1.8 *l* (1.9US qt, 1.6Imp qt) between F and L level of oil level gauge.**

ENGINE COOLANT

Warning

- **Do not open the radiator cap when engine is hot.**
- **When opening the radiator cap, wrap it with thick cloth and open it with caution.**

Inspection

1. Verify if the coolant level is near the radiator filling cap.
2. Check if the level of reservoir tank is between F and L marked level, and fill coolant if necessary.

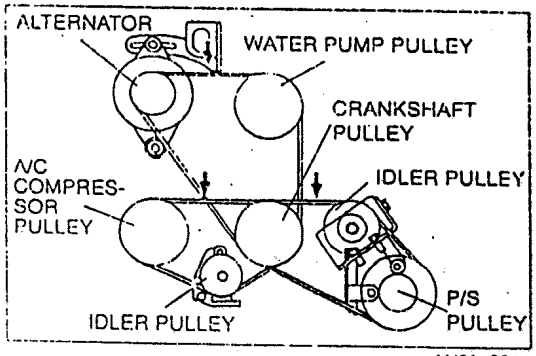
Inspection of contamination

Check if any foreign material is in engine coolant and engine oil, replace it if necessary.

DRIVE BELT

Inspection

1. Verify that the belt is correctly mounted on the pulleys as shown in the figure.
2. Check if the belt is worn, cracked or damaged, replace it if necessary.
3. Check the drive belt deflection by applying moderate pressure 10kg(98N, 22 lb) midway between the pulleys.



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Caution

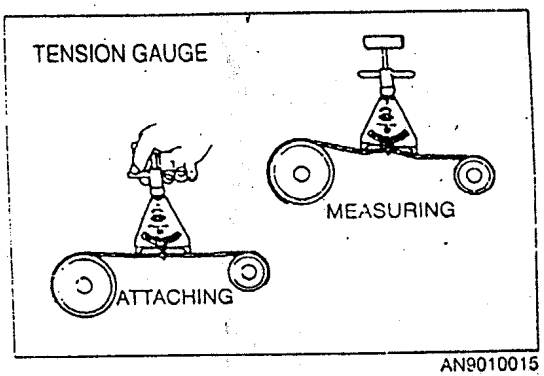
- **Measure the belt deflection between the specified pulleys.**
- **Consider the belt as a new one if it has been used on a running engine for less than five minutes.**
- **Check the belt deflection when the engine is cold or at least 30 minutes after the engine is stopped.**

mm(in)

Belt	New	Used
Alternator	9~11(0.35~0.43)	11~12(0.43~0.47)
P/C	9~11(0.35~0.43)	11~12(0.43~0.47)
A/C	7~9(0.27~0.35)	9~10(0.35~0.43)

- If the deflection is not correct, adjust the belt.

Note
- For inspecting the tension by the tension gauge



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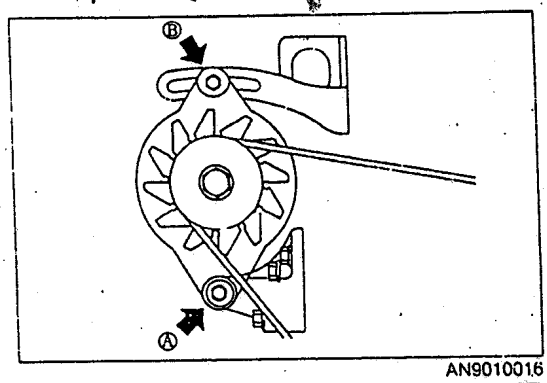
N(kg, lb)

Belt	New	Used
Alternator	441~539(45~55, 99~121)	382~441(39~45, 86~99)
P/C	363~441(37~45, 81~99)	323~362(33~37, 73~81)
A/C	421~627(43~64, 95~141)	304~421(31~43, 68~95)

Alternator drive belt

1. Loosen the mounting bolt Ⓐ for alternator and the adjusting bolt Ⓑ.
2. Adjust the belt deflection.
   Deflection (When applying 98 N(10 kg, 22 lb))
   New one : 9~11 mm(0.35~0.43 in)
   Used one : 11~12 mm(0.43~0.47 in)
3. After making the adjustment, tighten the mounting bolt Ⓐ and adjusting bolt Ⓑ.

   Tightening torque
   Ⓐ 37~52 N·m(3.8~5.3 kg-m, 28~38 lb)
   Ⓑ 19~25 N·m(1.9~2.6 kg-m, 14~19 lb)



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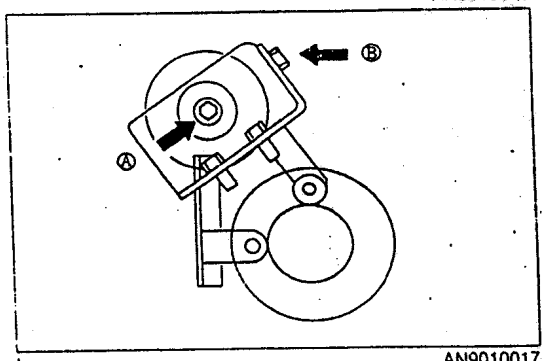
Power steering drive belt

1. Loosen the idler pulley mounting bolt Ⓐ.
2. Adjust the belt deflection by turning the adjusting bolt Ⓑ.

   Deflection (When applying 98 N(10kg, 22 lb))
   New one : 9~11 mm(0.35~0.43 in)
   Used one : 11~12 mm(0.43~0.47 in)
3. After making the adjustment, tighten the idler pulley mounting bolt.

   Tightening torque
   37~52 N·m(3.8~5.3 kg-m, 28~38 lb)



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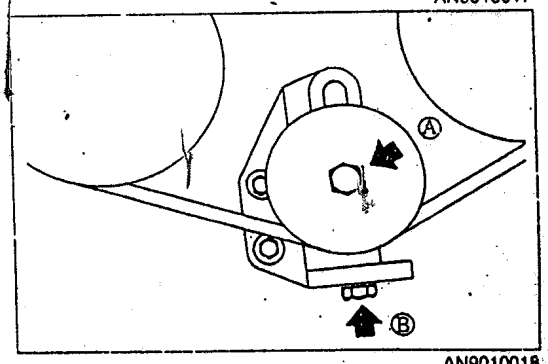
Air conditioner drive belt

Do it with the same way as measured for P/S belt tension, referring figure.
Adjust the belt deflection with the same way as described for "Power steering drive belt".

Deflection
New one : 7~9 mm(0.27~0.35 in)
Used one : 9~11 mm(0.35~0.43 in)



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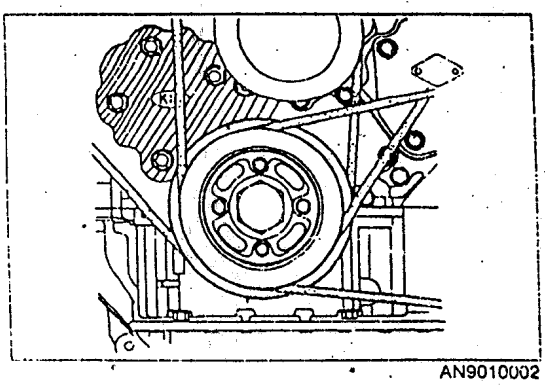
VALVE CLEARANCE

Inspection / Adjustment

1. Remove the cylinder head cover.
2. Set the No. 1 piston to TDC by rotating the crankshaft.



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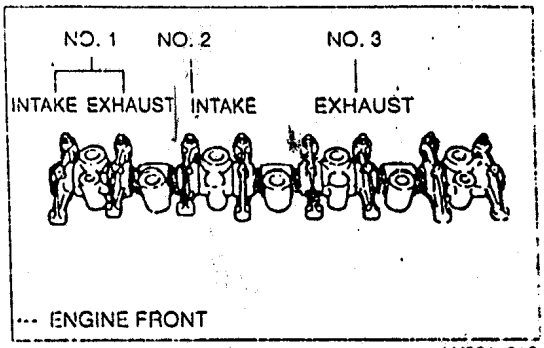
3. Check and adjust the valve clearance.

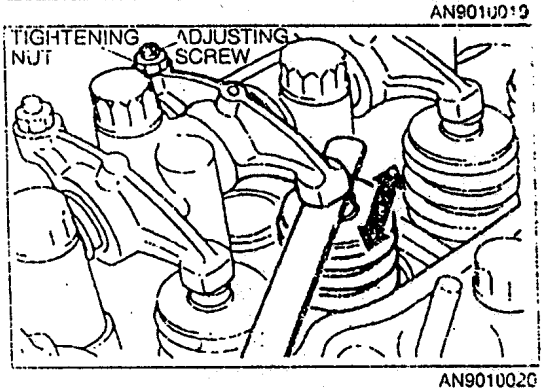
   Valve clearance (at cold) :
   Intake (No. 1, No. 2) : 0.30 mm(0.012 in)
   Exhaust (No. 1, No. 3) : 0.38 mm(0.015 in)



AN9010019

4. Loosen the tightening nut, rotate the adjusting screw and adjust the valve clearance.

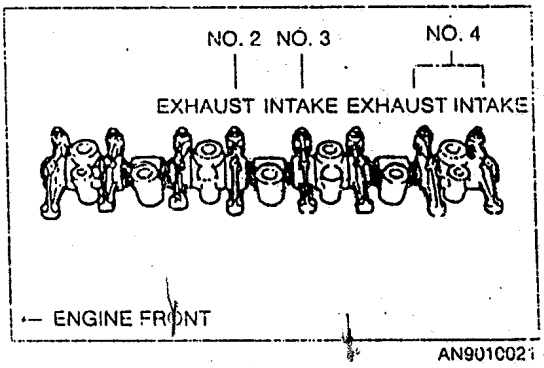
   Tightening torque : 12~18 N·m(1.2~1.8 kg-m, 8.7~13 lb)



AN9010020

5. Turn the crankshaft 1 revolution and check another valve.

   Intake : No. 3, No. 4
   Exhaust : No. 2, No. 4



AN9010021

IDLE SPEED

INJECTION TIMING, CAM LIFT

Preparation

1. Warm up the engine upto the normal operating temperature.
2. Operate the engine at idle.
   ① Put the change lever in neutral position.
   ② Put the steering in neutral.
   ③ Turn the ignition switch OFF.
3. Check if the deflection of accelerator cable is within the specification (refer to Section 20).

   Specification : 1~3 mm(0.04~0.12 in)

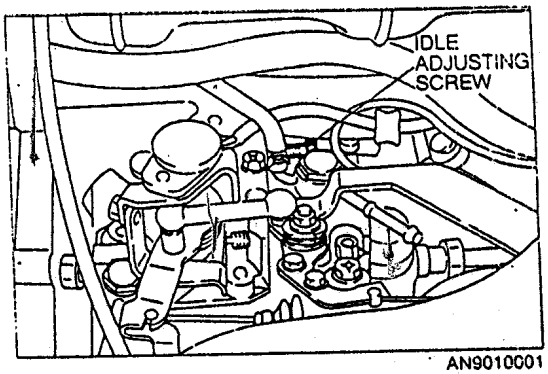
Inspection / Adjustment

1. measure the engine idle speed by using a tachometer.

   Specification : 700~750 rpm(A/T)
   750~790 rpm(M/T)
2. If it exceeds the specification, loosen the tightening nut and adjust it by rotating the idle adjust screw.

   Tightening torque : 5.0~8.8 N·m(0.5~0.9 kg-m, 3.7~6.5 lb-ft)

   Caution
   - **The idle speed adjustment should be done by the idle adjusting screw.**



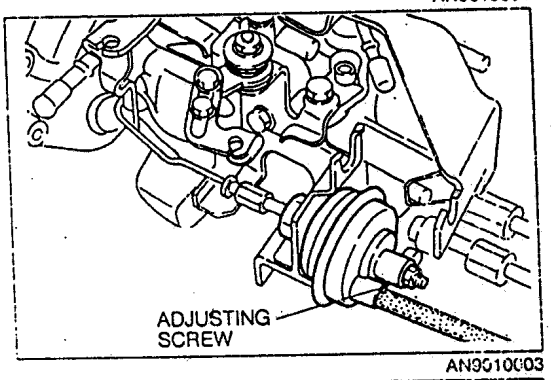
AN9010001

IDLE UP SPEED(A/T ONLY)

ON-VEHICLE MAINTENANCE

1. Check and adjust the idle speed.
2. Start the engine and turn the air conditioner switch ON.
3. Check that the idle speed is within the specified range.

   Specification : 850~900 rpm



AN9010003

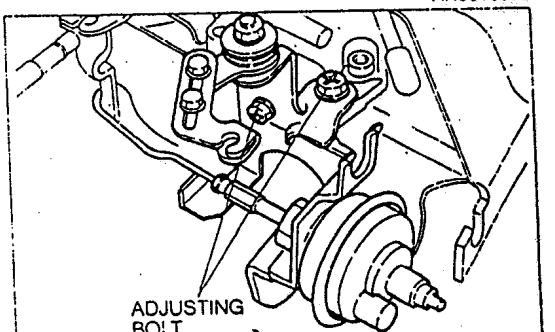
4. If it exceeds the specification, loosen the No. 1 idle diaphragm tightening nut and adjust it by rotating the idle adjusting screw.

   Tightening torque :
   1.18~1.47 N·m(0.12~0.15 kg-m, 0.87~1.09 lb-ft)

5. If adjustment can not be done, loosen the bolt and readjust it by using the actuator body.

   Tightening torque : 8~11 N·m(0.8~1.1 kg-m, 6~8 lb-ft)
6. Connect the vacuum hose and operate A/C, then turn the blower switch on and verify the engine speed.

   Specification ; 850~900 rpm

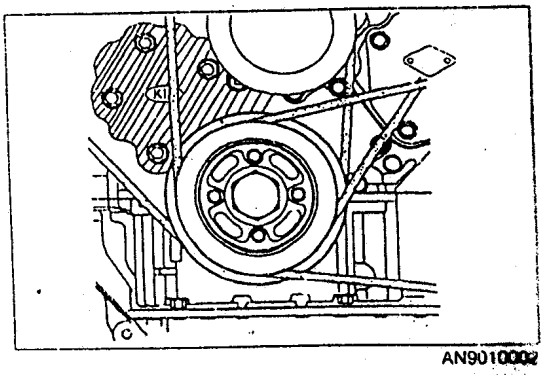


AN9010004

INJECTION TIMING

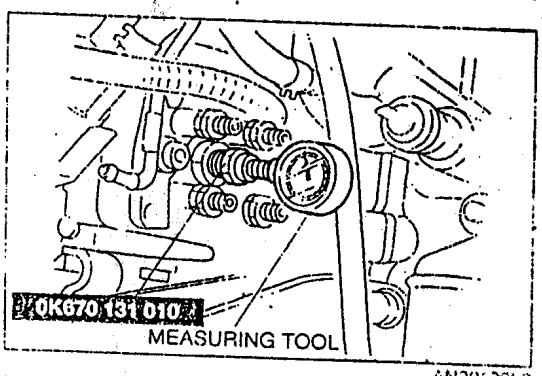
INSPECTION / ADJUSTMENT

1. Rotate the crankshaft slowly and align to ATDC 7°.


AN9010002

2. Remove the injection pipe between the injection pump and the nozzle.
3. After removing the cover of hydraulic part of injection pump, install SST.

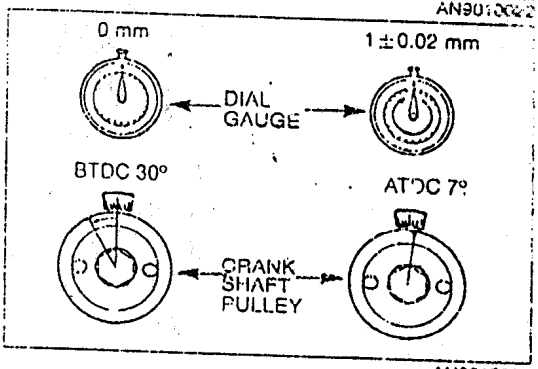
Caution
- **Be careful for fuel leak during removing the injection pump.**
- **Install it so that SST indicates about 2 mm(0.079 in).**



AN9010022

4. Rotate the crankshaft pulley in reverse to align it to BTDC 30°, then install the dial gauge so that its indicator can not be moved.
5. Align the indicator of dial gauge to 0, rotate the crankshaft pulley in left and right, and then verify the position of indicator.
6. Rotate the crankshaft pulley again to align it to ATDC 7°, and then check the dial gauge reading.

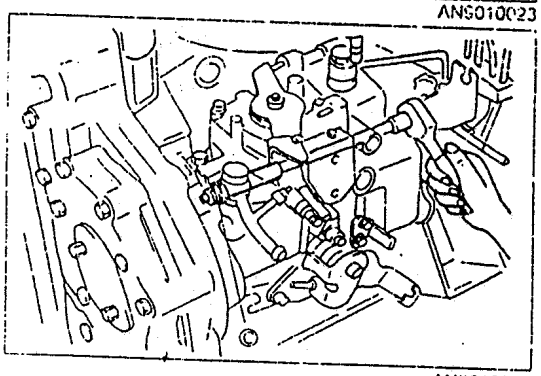
Specification : 1±0.02 mm (Lift)



AN9010023

7. If the dial gauge reading exceeds the specification, loosen the stay bolt of injection pump.
8. Loosen the tightening nut © for the injection pump by using a socket wrench.
9. Rotate the injection pump body so that the dial gauge indicates 0.98~1.02 mm (0.039~0.040 in)at ATDC 7°.
10. Tighten the stay bolt of injection pump and the tightening bolt.

Tightening torque : 19~25 N·m(1.9~2.6 kg-m, 14~19 lb-ft)

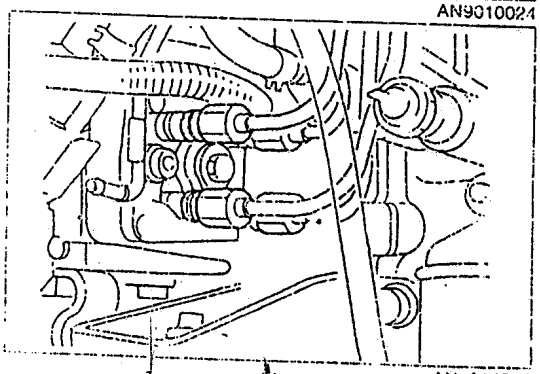

AN9010024

11. Remove SST.
12. Insert a cap after inserting a new gasket.

Tightening torque : 14~20 N·m(1.4~2.0 kg-m, 10~15 lb-ft)

13. Tighten the injection pipe temporarily and tighten nuts(4 EA) on pump side.

Tightening torque : 25~29 N·m(2.5~3.0 kg-m, 18~22 lb-ft)

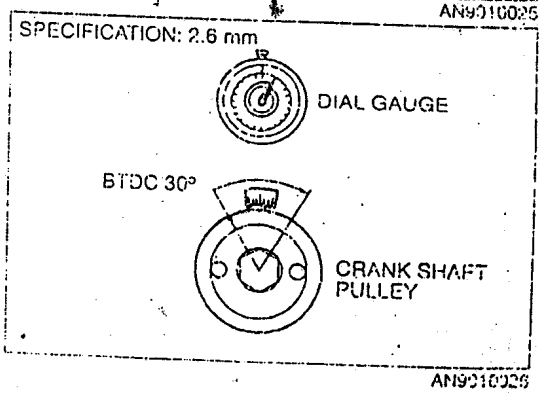

AN9010025

14. After starting engine, check if there is any fuel leakage.

INSPECTION OF CAM LIFT

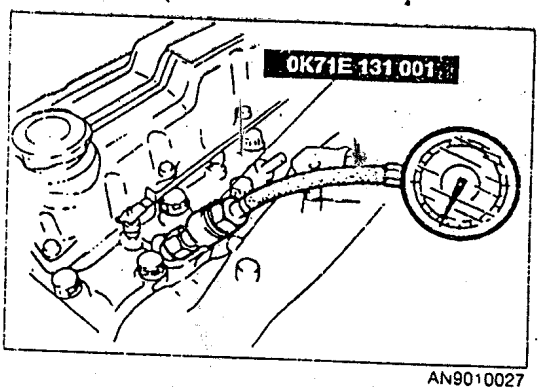
1. Check the maximum dial gauge reading during inspecting and adjusting injection timing.
2. Rotate the pulley so that it passes TDC, then check the maximum dial gauge reading.

Cam Lift : 2.6 mm(0.1 in)



AN9010026

COMPRESSION PRESSURE



AN9010027

INSPECTION

1. Warm up engine upto the normal operating temperature, stop engine and disconnect the connector of fuel cut solenoid.
2. Remove all injection pipes, nozzles and washers.
3. Attach **SST** to the nozzle hole.
4. Measure the compression pressure during cranking.

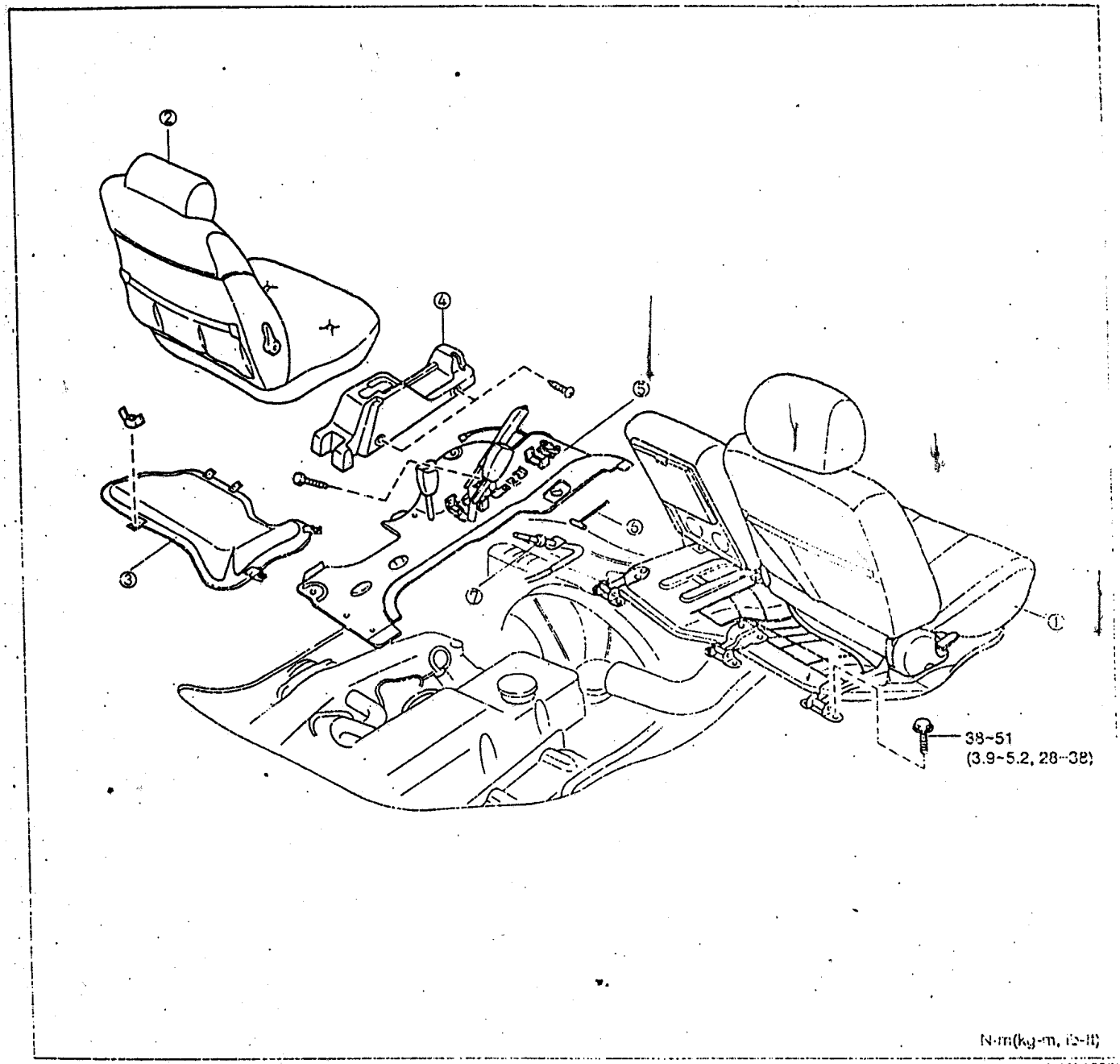
		Specification
Compression pressure (kg/cm² -rpm)	Normal	30.0-200
	Limit	27.0-200
Cylinder-to-cylinder pressure difference		below 3.0

5. Do above step 3 ~ step 4 again for each cylinder.
6. If the measure value is below the limit, consider it as abrasion or damage of piston and piston ring, misalignment of valve, damage of gasket etc..

REMOVAL / INSTALLATION

1. Remove the negative cable of battery.
2. Drain the engine coolant and transmission oil.
3. Remove in steps as shown in figure, and install in reverse order of removal.
4. After installing, fill the engine coolant, engine oil and transmission oil as specified.
5. After driving tests, check for water or oil leakage, and inspect the coolant level and engine oil level again.

STEP 1. (SEAT AND PARKING BRAKE FRAME)

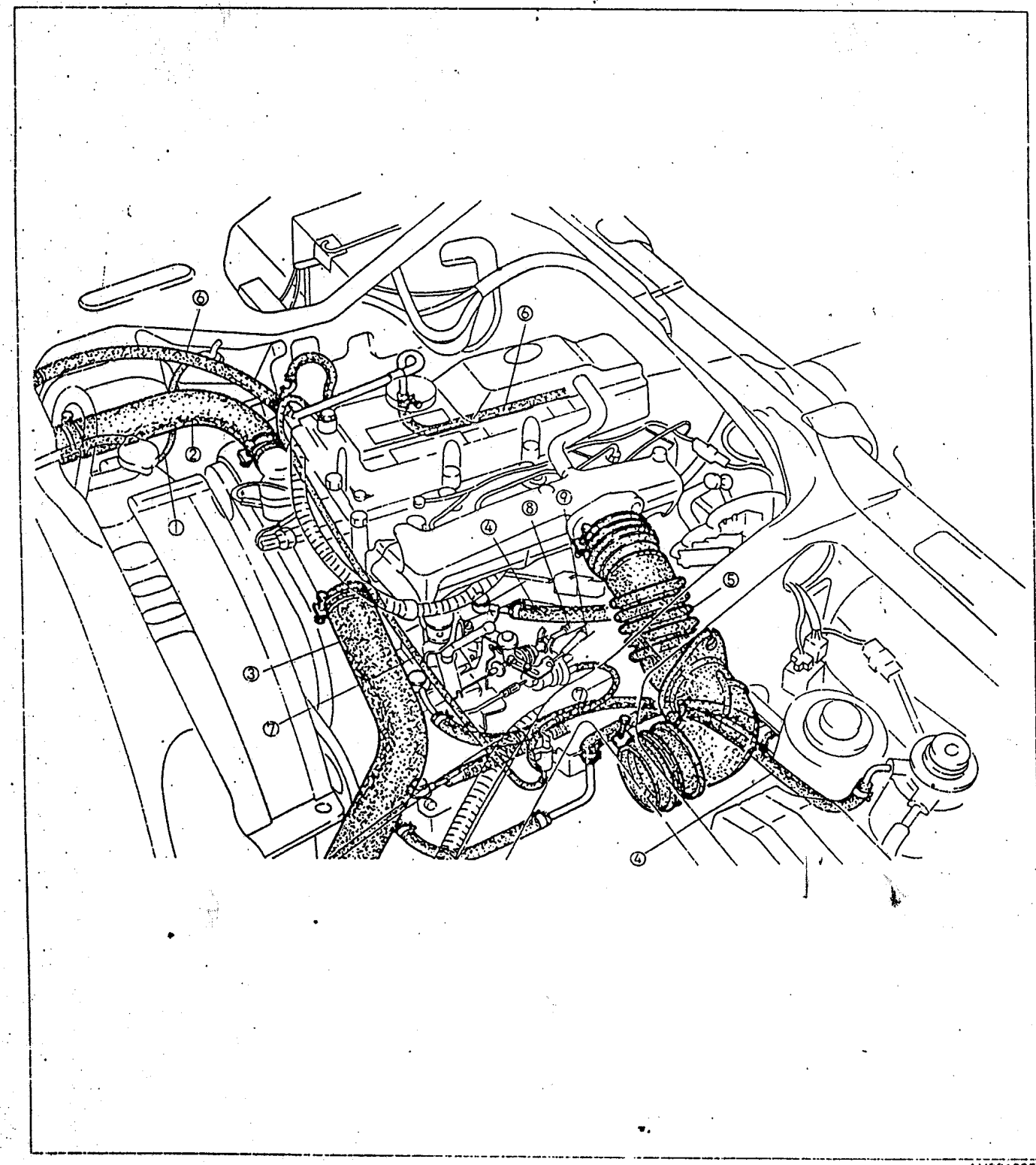


N·m(kg-m, ft-lb)

AN201006

1. Passenger seat
2. Driver seat
3. Service cover
4. Console box
5. Parking brake frame
6. Fuel tank opener cable
7. Parking brake cable

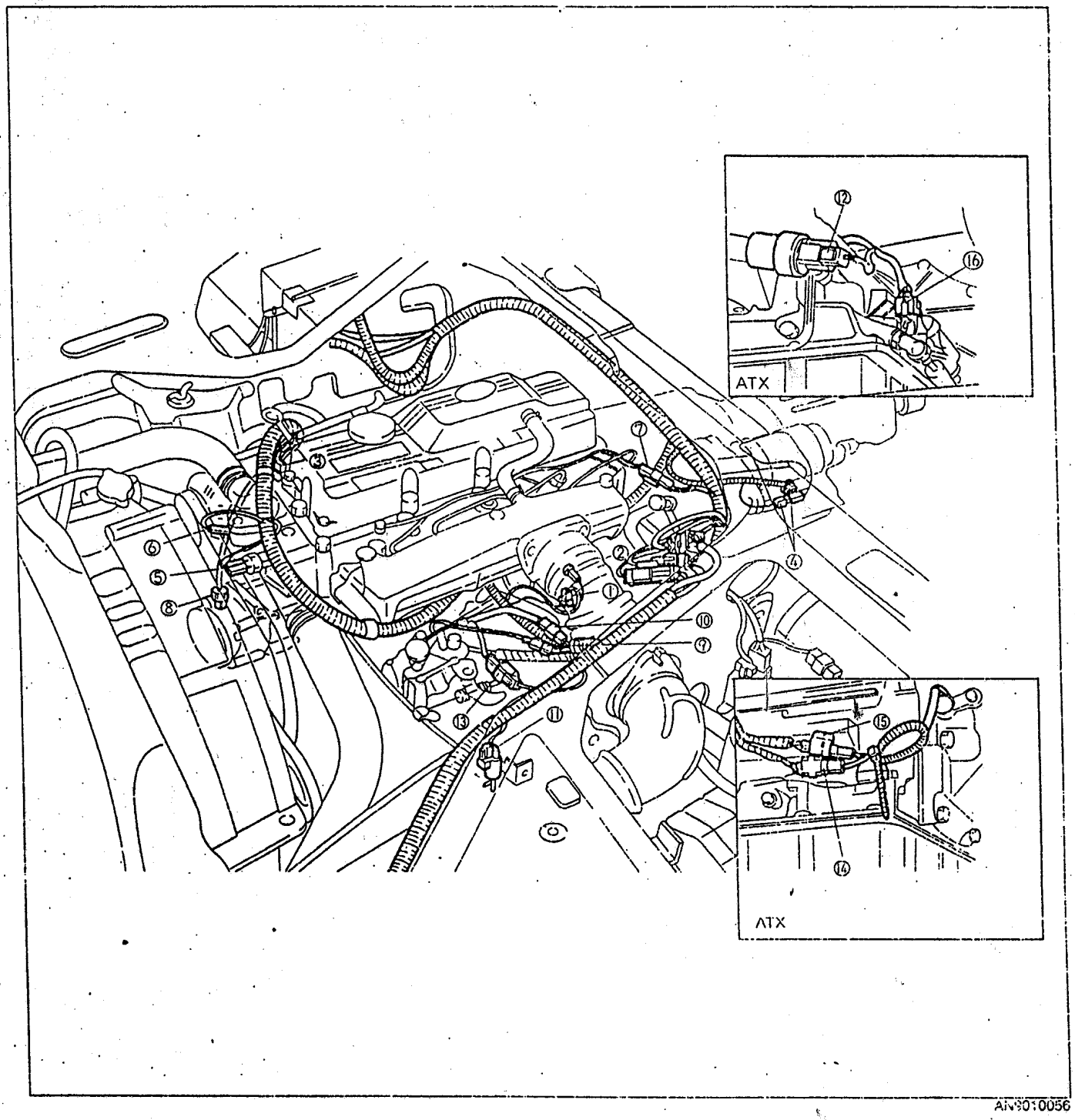
STEP 2. (HOSES AND ACCELERATOR CABLE)



AN9010055

1. Reserve tank hose
2. Radiator upper hose
3. Radiator lower hose
4. Fuel hose
5. Air hose
6. Heater hose
7. Solenoid hose
8. Accelerator cable
9. Throttle cable (ATX only)

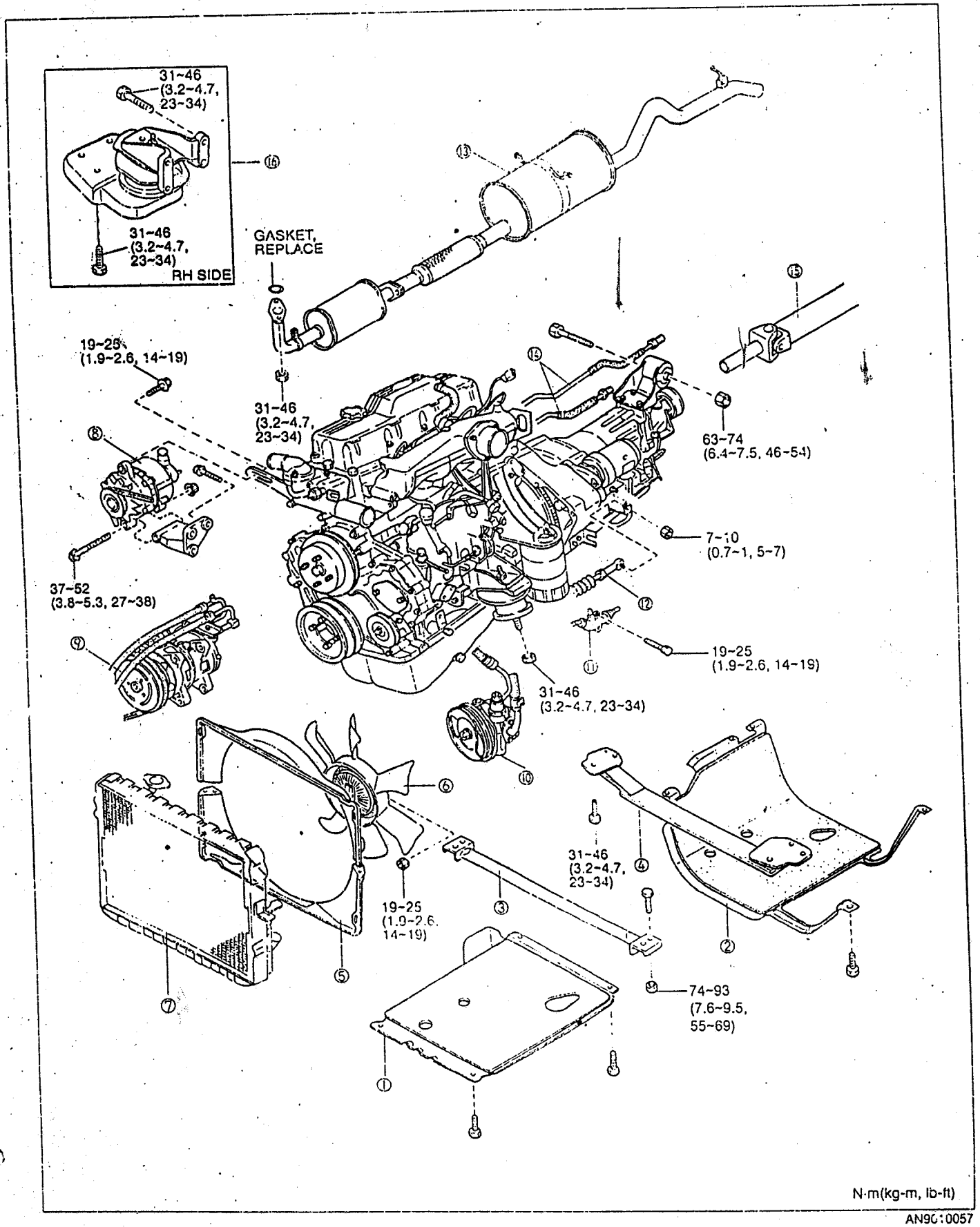
STEP 3. (WIRING HARNESS)



AK901005G

1. Oil pressure switch
2. Water thermo switch (ATX only)
3. Alternator connector
4. Starter
5. Thermo switch
6. Heat gage unit
7. Glow plug connector
8. Air con compressor connector
9. Fuel cut solenoid connector
10. Pickup connector
11. FICD solenoid connector
12. Speedsensor connector
13. TPS connector (ATX only)
14. Speed sensor connector (ATX only)
15. Solenoid sensor connector (ATX only)
16. Inhibitor switch connector (ATX only)

STEP 3.



AN90:0057

1. Engine under cover
2. Transmission under cover
3. Cross pipe
4. Cross member
5. Thermo modulator fan cover
6. Thermo modulator fan
7. Radiator
8. Alternator
9. Air con compressor
10. Power steering oil pump
11. Clutch release cylinder (MTX only)
12. Selector lever cable (ATX only)
13. Exhaust pipe
14. ATF pipe (ATX only)
15. Propeller shaft
16. Engine mount assembly

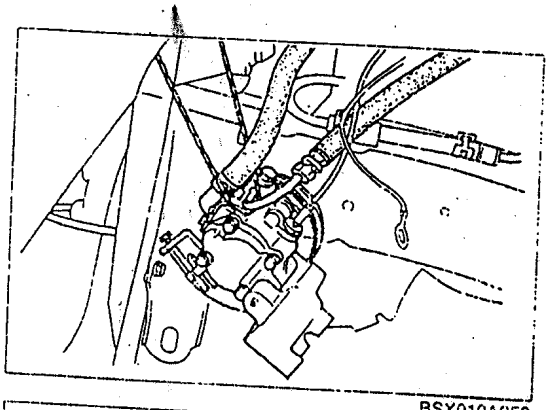
REMOVAL NOTE

Power steering oil pump

1. Remove the power steering oil pump with bracket from engine body.
2. Remove the power steering oil pump with oil hose attached, and fix it by wire somewhere the engine removal can not be interfered.

Caution

- **Be careful not to damage the hose.**



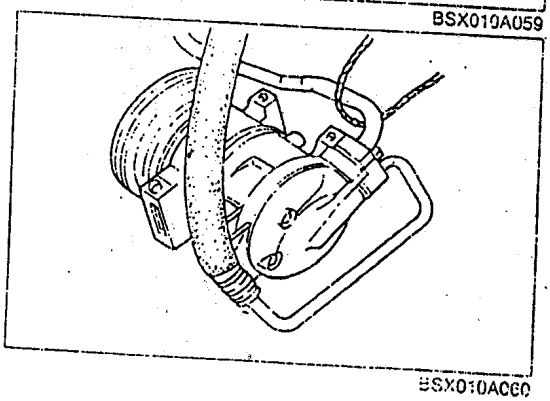
BSX010A059

Air con compressor

1. Remove the air con compressor with bracket from engine body.
2. Remove the air con compressor with hose attached, and fix it by wire somewhere the engine removal can not be interfered.

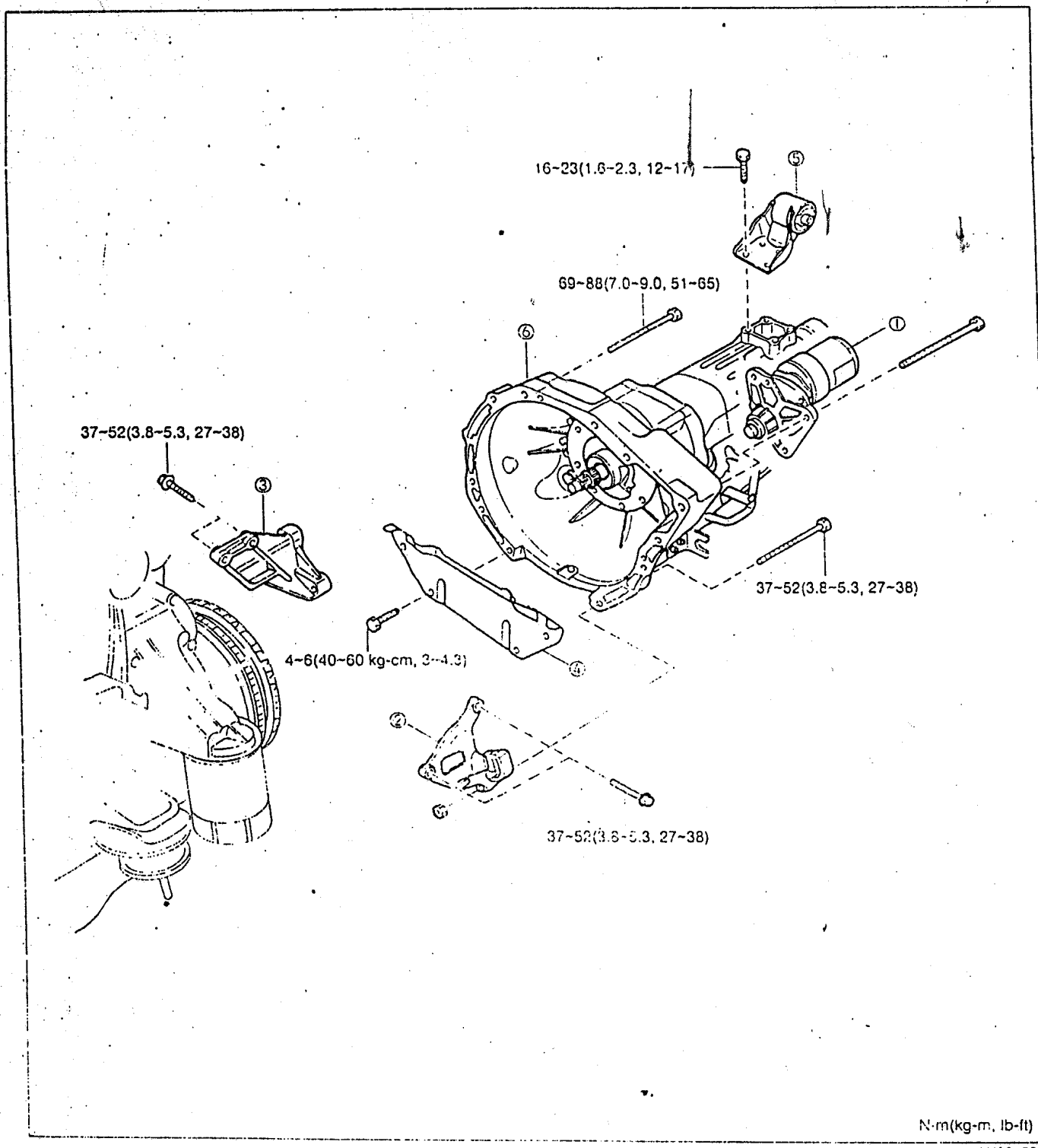
Caution

- **Be careful not to damage the hose.**



BSX010AC60

STEP 4. (ENGINE AND TRANSMISSION)



1. Starter motor
2. Gusset plate(LH)
3. Gusset plate(RH)
4. Under cover
5. Transmission mounting
6. Auto transmission

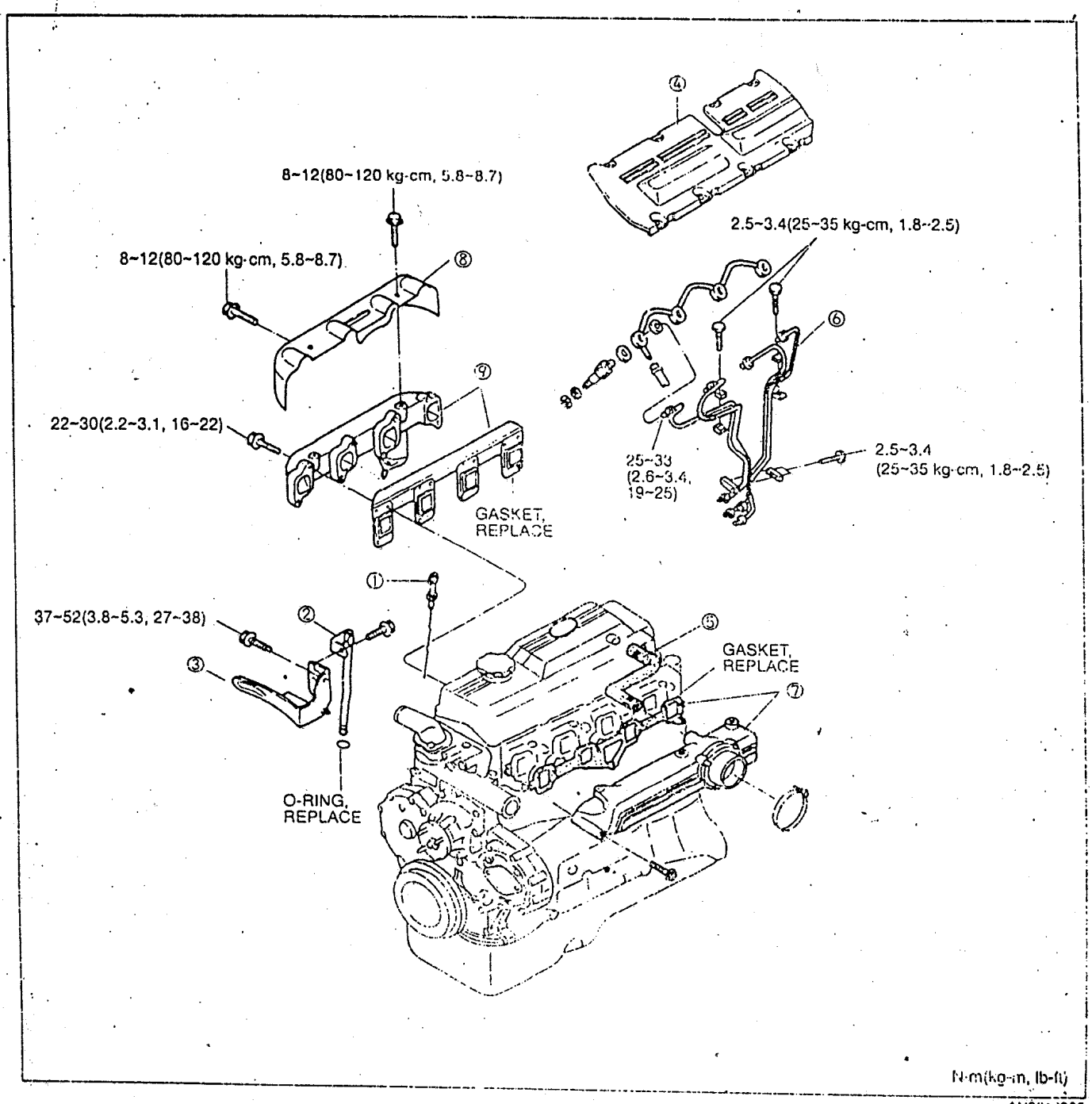
DISASSEMBLY / ASSEMBLY

1. Drain the engine oil.
2. Remove in the sequence shown in the figure below, and install in the reverse order of removal.
3. Refer to each notes for disassembly and assembly.

Caution

- **Mark all parts removed from cylinder so that those can be properly installed later. (Piston, piston ring, connecting rod, valve spring etc.)**
- **Wash parts thoroughly with steam cleaner, blow out any water left with compressed air.**
- **Keep the assembly order in mind during disassembly of any part or system. Careful also for any deformation, wear or damage.**

OTHERS



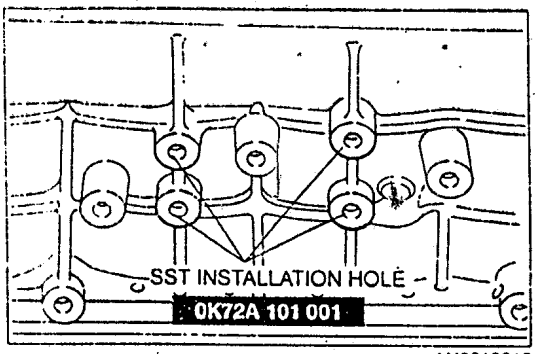
N·m(kg-m, lb-ft)

ANS010005

1. Oil level gauge
2. Oil level gauge Pipe
3. Alternator strap
4. Nozzle cover
5. PCV hose
6. Injection pipe
7. Intake manifold and gasket
8. Exhaust manifold insulator
9. Exhaust manifold and gasket

Disassembly note

1. Install **SST** to engine after removing the exhaust manifold and alternator.

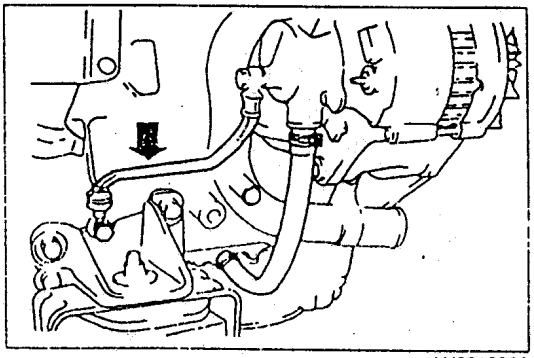


AN9010012

Assembly note

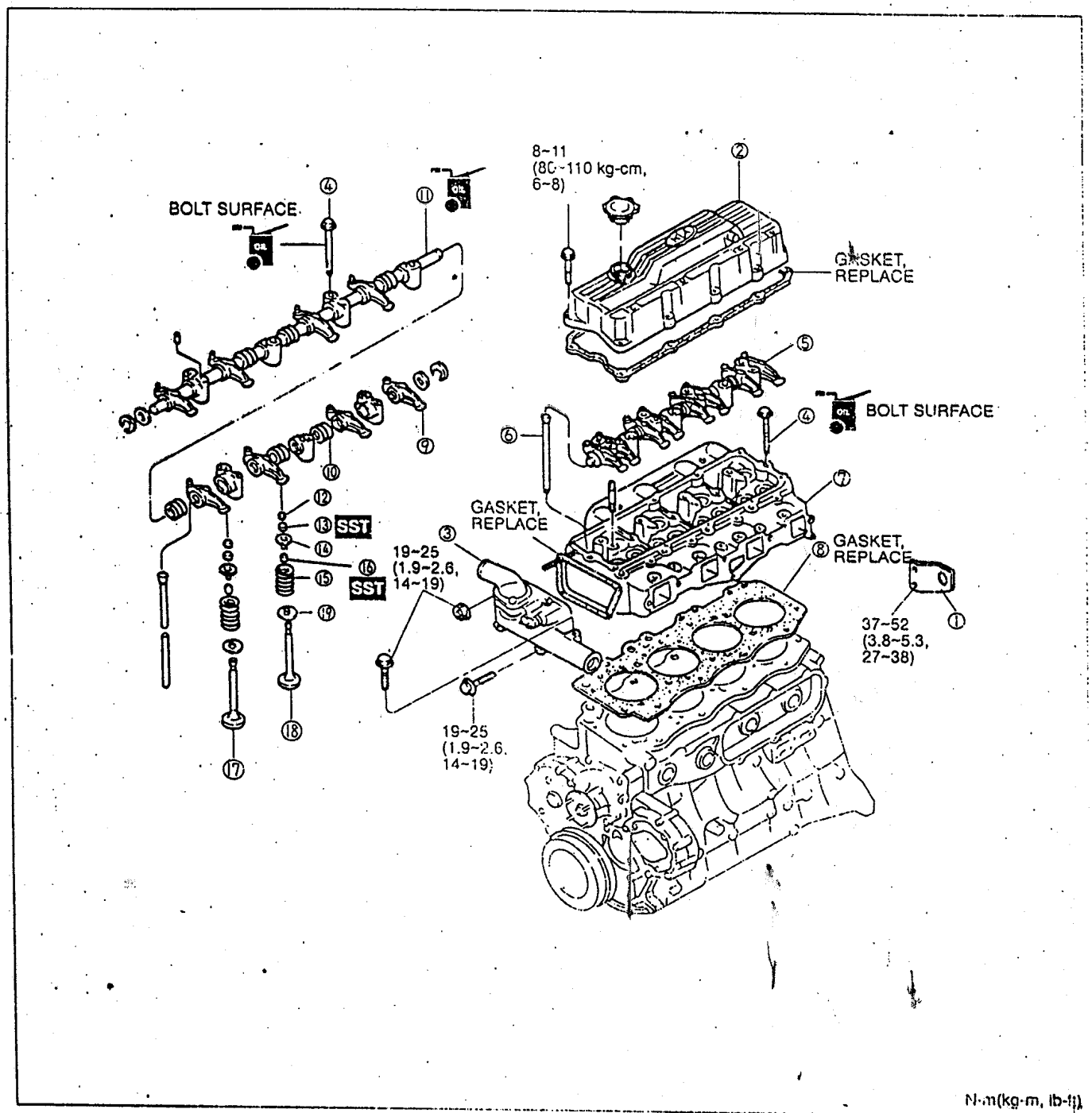
1. Install the oil hose after installing alternator.

Tightening torque : 588~882 N·m(60~90 kg-m, 435~653 lb-ft)



AN9010028

CYLINDER HEAD



N·m(kg-m, lb-ft)

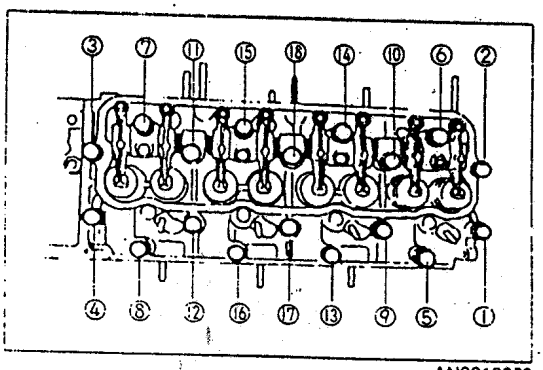
AN901003

1. Engine hanger
2. Cylinder head cover
3. Thermo case and gasket
4. Cylinder head bolt
5. Rocker arm and rocker arm shaft assembly
6. Push rod
7. Cylinder head
8. Cylinder head gasket
9. Rocker arm
10. Rocker arm spring
11. Rocker arm shaft
12. Valve cap
13. Valve cotter
14. Upper valve spring seat
15. Valve spring
16. Valve seal
17. Intake valve
18. Exhaust valve
19. Lower valve spring seat

DISASSEMBLY NOTE

Cylinder Head Bolt

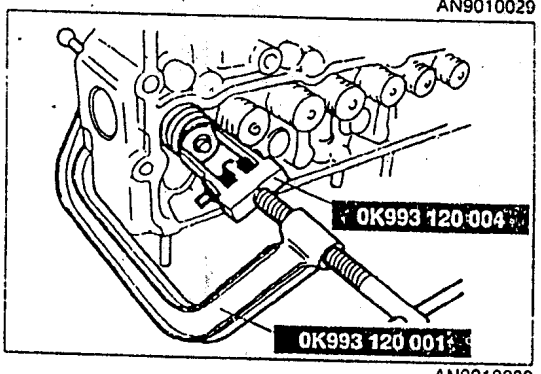
Loosen the cylinder head bolts in two or three steps in the numbered order as shown in the figure.



AN9010029

Valve Cotter

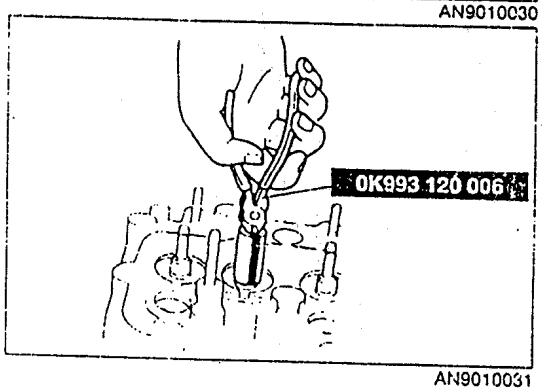
Remove the valve cotter by using SST as shown in the figure.



AN9010030

Valve Seal

Pull the valve seal out by using SST.

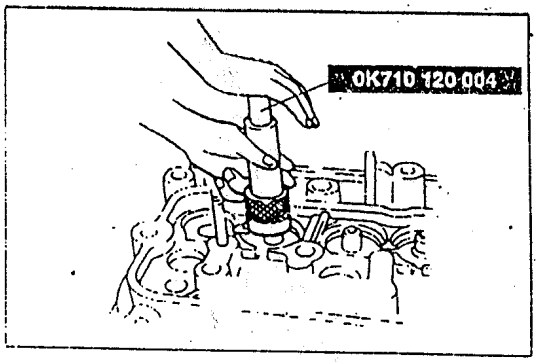


AN9010031

ASSEMBLY NOTE

Valve Seal

Push the valve seal by using SST as shown in the figure.



AN9010034

Cylinder Head Bolt

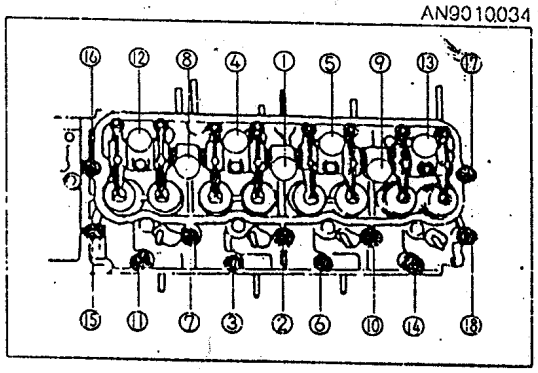
Note

- • mark in the figure means short bolt, ○ mark means long bolt.

Caution

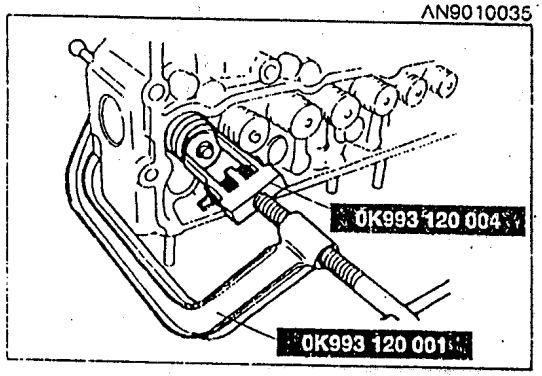
- Measure the length of cylinder head bolt, replace if necessary.

Long bolt : 158 mm(6.22 mm)
Short bolt : 123 mm(4.84 mm)



AN9010035

1. Apply engine oil onto the surface and thread of cylinder head bolt, and install to cylinder head.
2. Tighten cylinder head bolts with 44~74 N·m(4.5~7.5 kg-m, 33~54 lb-ft) of tightening torque, in the order shown in figure (1st temporary tightening).
3. Tighten it with rotating 90° (2nd tightening).
4. Tighten it with rotating 90° (3rd tightening).



AN9010036

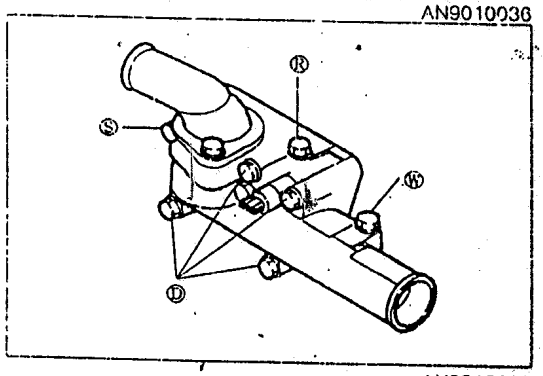
Valve Cotter

1. Compress the spring by using SST to install the valve cotter.
2. Check if the cotter is completely positioned, by tapping the end of valve stem slightly with a plastic hammer.

Water Outlet Housing

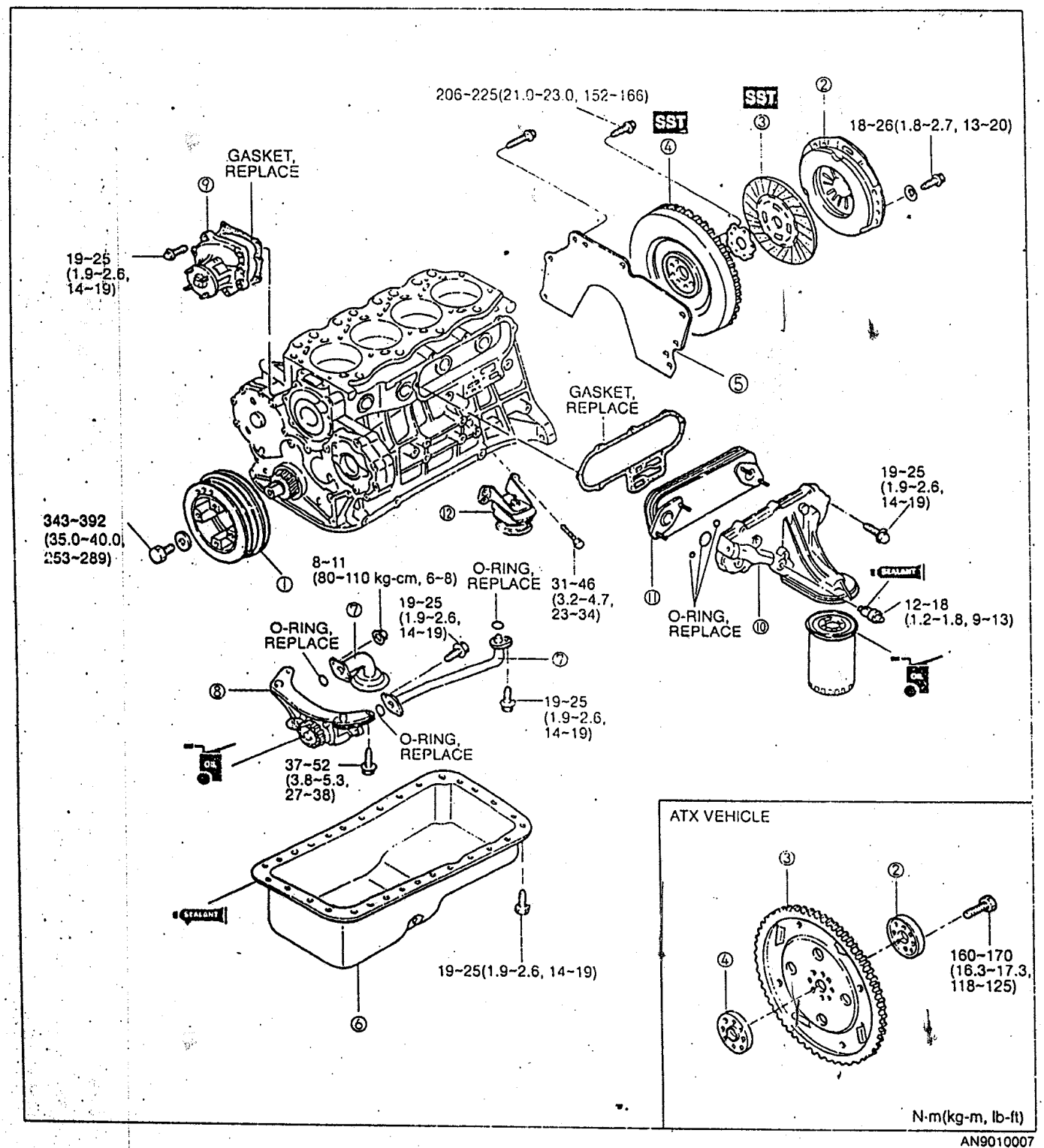
1. After tightening the thermo case to cylinder head temporarily by using "D" bolt and "S" nut, tighten "R" and "W" completely, then "D" and "S" completely.

Tightening torque
D, R, S, W : 19~25N·m(1.9~2.6 kg-m, 14~19 lb-ft)



AN9010009

FLYWHEEL AND OIL PAN



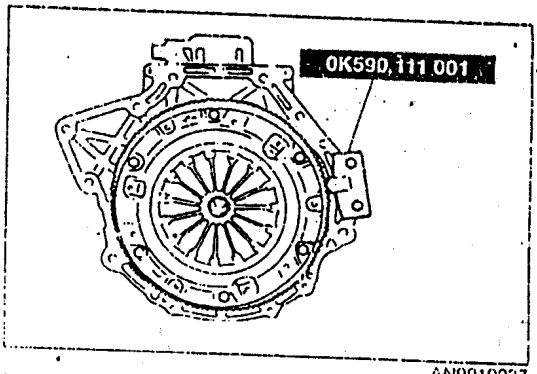
AN9010007

1. Crankshaft pulley
2. Clutch cover (MTX only), backing plate (ATX only)
3. Clutch disc (MTX only), drive plate (ATX only)
4. Flywheel (MTX only), adapter (ATX only)
5. End plate
6. Oil pan
7. Oil strainer and pipe
8. Oil Pump
9. Water pump and gasket
10. Oil filter body and gasket
11. Oil cooler
12. Engine mounting

DISASSEMBLY NOTE

Crankshaft Pulley, Clutch Cover

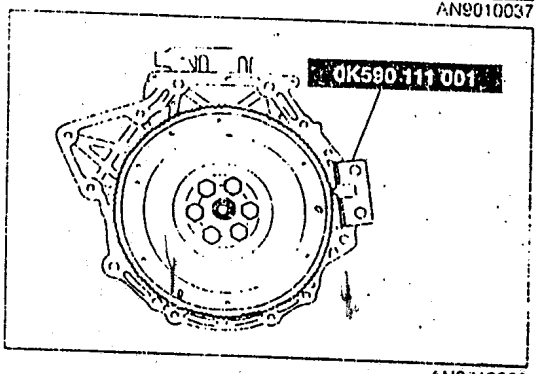
1. Hold the flywheel with the SST.
2. Remove the crankshaft pulley.
3. Remove the clutch cover by loosening the bolts in two or three steps.



AN9010037

Flywheel

1. Install SST to the flywheel link gear so that it can not be rotated. Hold the flywheel with the SST.
2. Loosen the tightening bolt for flywheel in two or three steps.

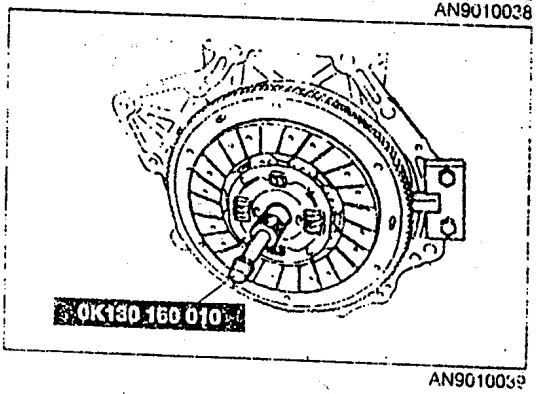


AN9010038

ASSEMBLY NOTE

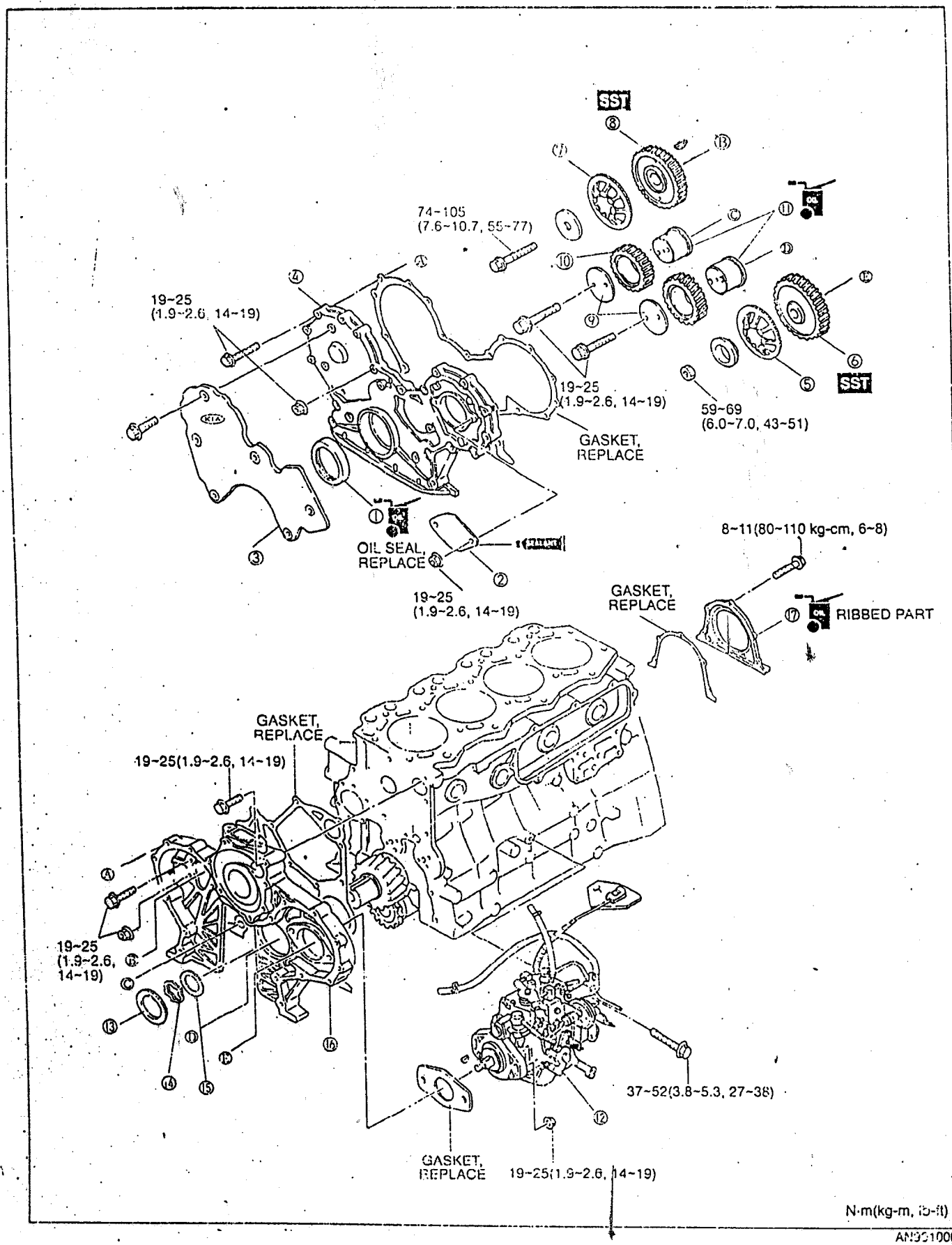
Clutch Disc, Clutch Cover

1. Align the center of clutch disc by using SST.



AN9010039

TIMING GEAR CASE

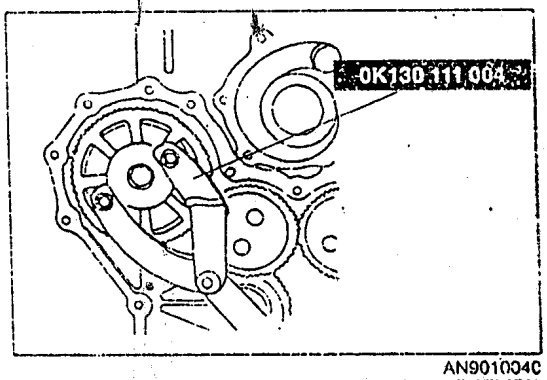


AN3S10008

1. Front oil seal
2. Injection pump gear cover
3. Seal plate
4. Timing gear cover
5. Friction gear
6. Injection pump gear
7. Friction gear
8. Camshaft gear
9. Thrust plate
10. Idle gear
11. Spindle
12. Fuel injection pump
13. Oil deflector
14. Friction gear spring
15. Friction gear
16. Timing gear case
17. Rear oil seal

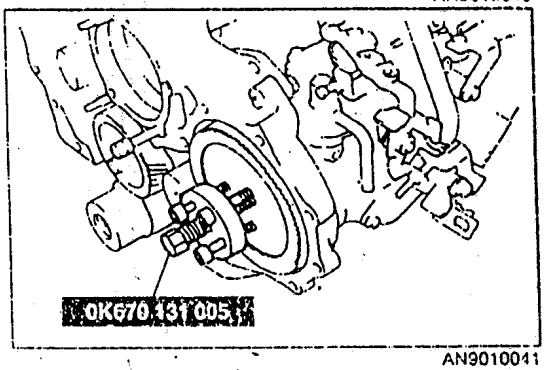
DISASSEMBLY NOTE
Camshaft Gear

1. Hold the camshaft gear with the SST.
2. Remove the lock nut of injection pump gear.



AN9010040

3. Remove the injection pump gear by using SST as shown in the figure.
4. Remove the camshaft gear and idling gear.

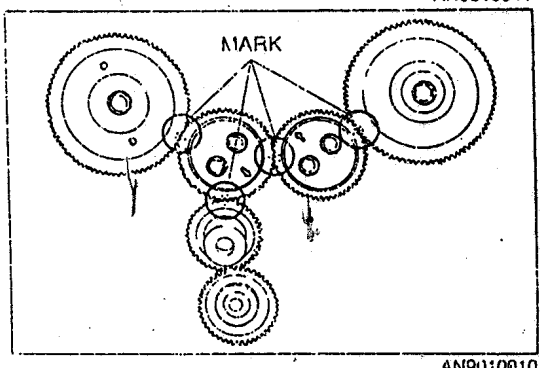


AN9010041

ASSEMBLY NOTE
Timing Gear

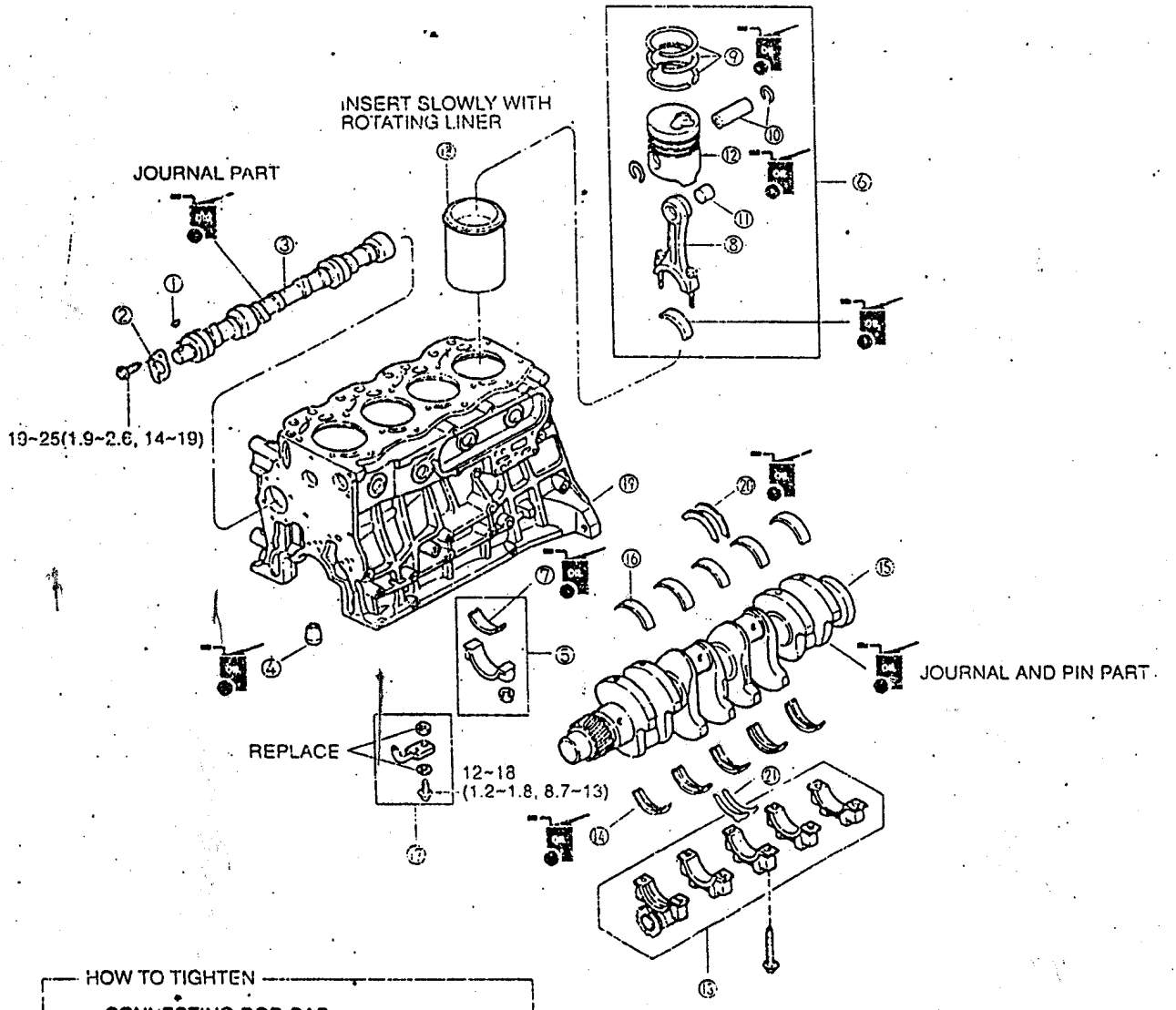
Note
- **Install the timing gear so that its mark can be aligned to BTDC 30°.**

1. Install all gears with aligning all matching marks of gear together as shown in the figure.



AN9010010

CYLINDER BLOCK



1. Woodruff key
2. Camshaft thrust plate
3. Camshaft
4. Tappet
5. Connecting rod cap
6. Connecting rod and piston assembly
7. Connecting rod bearing
8. Connecting rod
9. Piston ring
10. Snap ring and piston pin
11. Connecting rod bush
12. Piston
13. Main bearing cap
14. Lower main bearing
15. Crankshaft
16. Upper main bearing
17. Piston cooling jet
18. Cylinder liner
19. Cylinder block
20. Upper thrust metal
21. Lower thrust metal

DISASSEMBLY NOTE
Connecting Rod and Cap

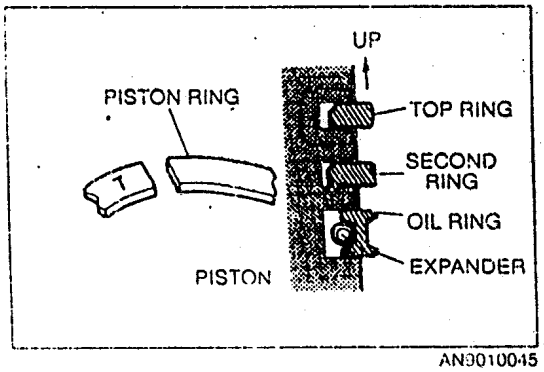
1. Before removing the connecting rod, clean the bearing, connecting rod and crankpin, and check the following.
   - Connecting rod side clearance. (refer to page 10A-28)
   - Crank pin oil clearance. (refer to page 10A-28)

Main Bearing Cap

1. Before removing the main bearing cap, clean the bearing and main journal cap, and check the following.
   - Crankshaft end play. (refer to page 10A-27)
   - Main journal oil clearance. (refer to page 10A-27)

ASSEMBLY NOTE
Piston Ring

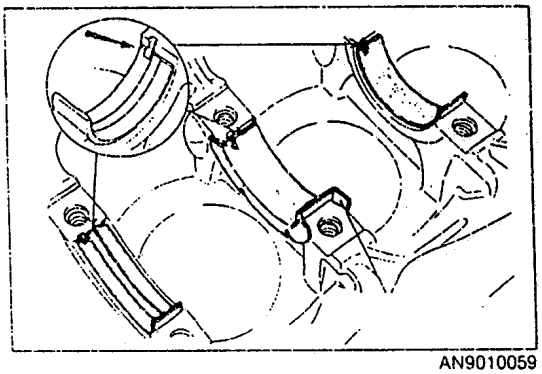
1. Assemble in the order of the oil ring expander, oil ring, second ring and top ring.



AN9010045

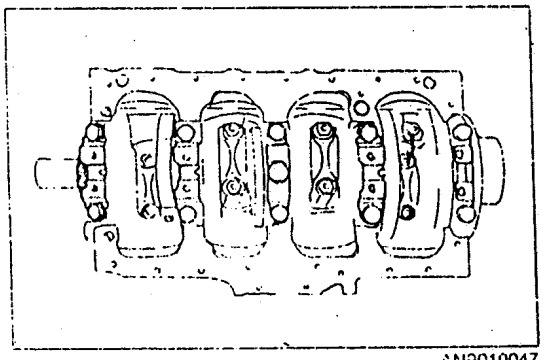
Crankshaft Main Journal Bearing Oil Clearance and End Play

1. Remove any foreign material or oil from the journal and bearing.
2. Install the upper main bearing to cylinder block.
3. Align the crankshaft to the cylinder block.
4. Install the plastic gauge onto the upper side of journal in axial direction.


AN9010059

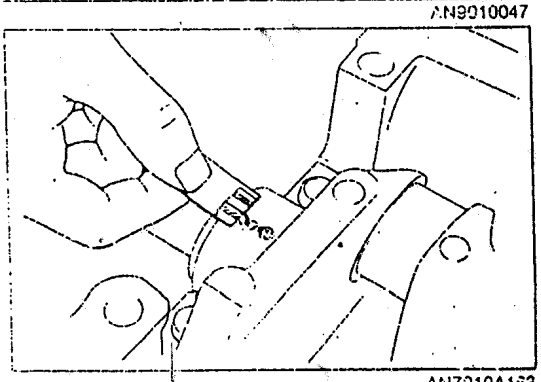
5. Loosen after tightening with 78 N·m(8.0 kg-m,58 lb-ft) and re-tighten with 44 N·m(4.5 kg-m, 33 lb-ft) then tighten 90° again.

   Caution
   - **Do not rotate the crankshaft when measuring the oil clearance.**

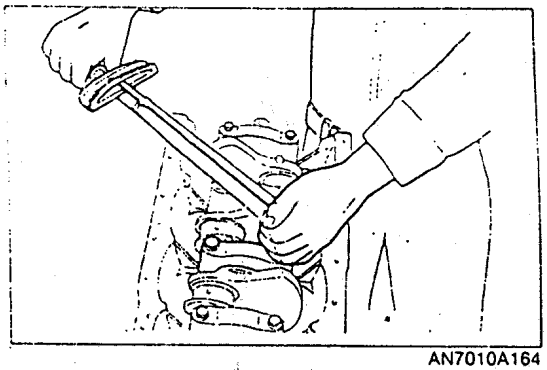

AN9010047

6. Remove the main bearing cap and measure the plasti gauge at each journal. If the oil clearance exceeds the maximum value, grind the crankshaft and use the undersized main bearing.

   Oil clearance :
   No.1, 2, 4, 5 : 0.038~0.071 mm(0.0015~0.0028 in)
   No.3 : 0.060~0.093 mm(0.0024~0.0037 in)
   Limit :
   No.1, 2, 4, 5 : 0.11 mm(0.0043 in)
   No.3 : 0.15 mm(0.0059 in)


AN7010A153

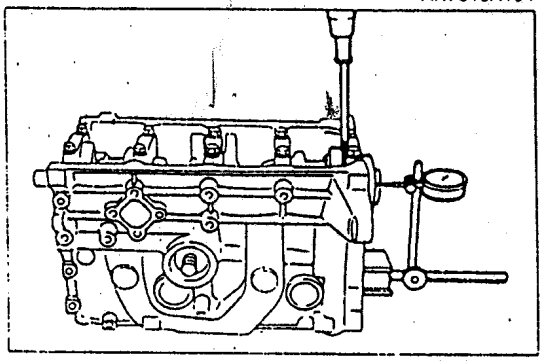
7. Apply a liberal amount of oil to the main bearing, thrust bearing and main journal.
8. Loosen after tightening with 78 N·m(8.0 kg-m, 58 lb-ft) and retighten with 44 N·m(4.5 kg-m, 33 lb-ft) then tighten 90° again.


AN7010A164

9. Check the crankshaft end play.

   End play : 0.14~0.30 mm(0.0055~0.0118 in)
   Maximum : 0.32 mm(0.0125 in)

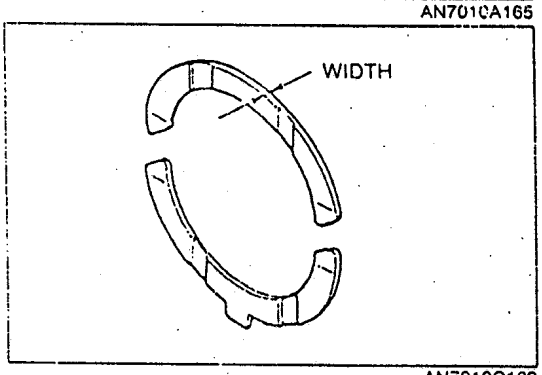
10. If the end play exceeds the maximum value, grind the crankshaft and use the oversized thrust bearing, or replace the crankshaft and thrust bearing.


AN7010A165

Thrust bearing width

mm(in)

Oversize	Specification
Standard	2.320~2.325(0.0913~0.0915)
0.25	2.445~2.450(0.0962~0.0964)
0.50	2.570~2.575(0.1012~0.1014)
0.75	2.695~2.700(0.1061~0.1063)

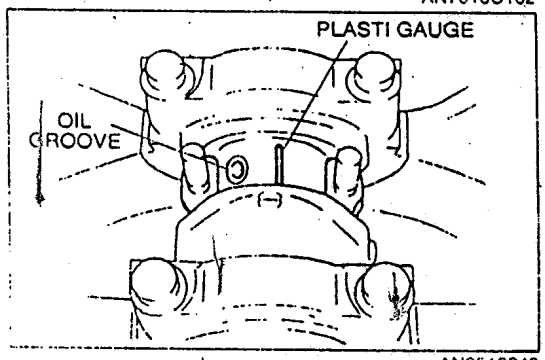


AN7010C162

Crank pin oil clearance / connecting rod side clearance

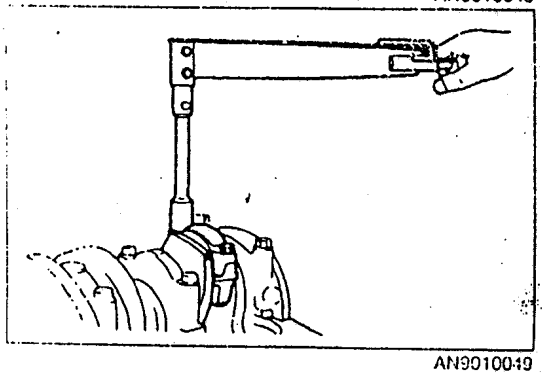
1. Place a piece of plasti gauge on the crankshaft at connecting rod journal.

   Caution
   - **Do not rotate the crankshaft when measuring the oil clearance.**

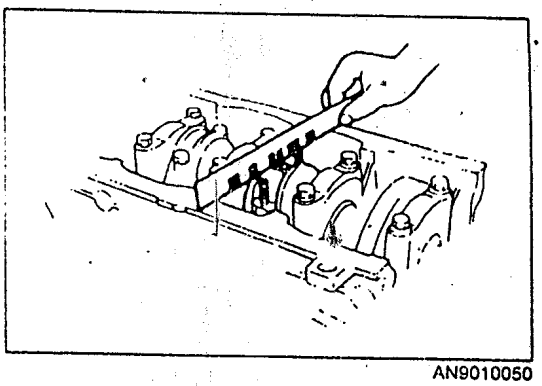


AN9010048

2. Remove any dirt or other material from the contact surface of the connecting rod bearing and connecting rod bearing cap.
3. Install the connecting rod bearing and the connecting rod cap, aligning the matching markes on the connecting rod and connecting rod cap.
4. Tighten the connecting rod cap nut as follows.
   (1) Apply engine oil to the thread of connecting rod and the surface of tightening nut, and tighten to 69 N·m(7.0 kg-m, 51 lb-ft) then loosen it.
   (2) Retighten with 44 N·m(4.5 kg-m, 33 lb-ft) then tighten 90° again.


AN9010049

5. Measure the oil clearance with the plasti gauge after assembling the connecting rod cap.


AN9010050

Standard : 0.036~0.067 mm(0.0014~0.0026 in)
Limit : 0.10 mm(0.0039 in)

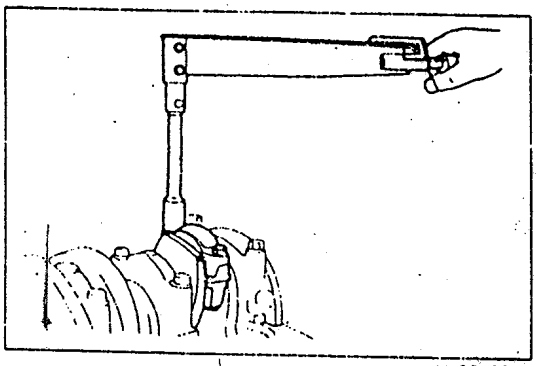
If it exceeds the limit value, replace the bearing or use the undersized bearing after grinding the crank pin.

mm(in)

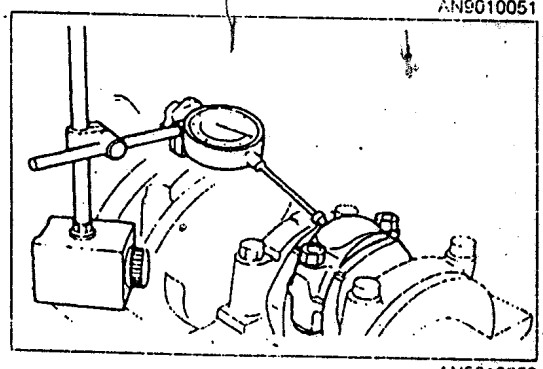
Bearing size	Crank pin grinding limit
Standard	57.106~57.124(2.2483~2.2490)
0.25 Under size	56.856~56.874(2.2384~2.2391)
0.50 Under size	56.606~56.624(2.2286~2.2293)
0.75 Under size	56.356~56.374(2.2187~2.2194)

6. Tighten the connecting rod cap as follows.
   (1) Apply engine oil to the lubricating surface of crank pin and connecting rod bearing.
   (2) Install the connecting rod cap, aligning the matching marks on the cap and on the connecting rod.
   (3) Tightening order of the connecting rod cap nut

   After applying engine oil to the thread of connecting rod tightening bolt and nut, tighten it to 69 N·m(7.0 kg-m, 51 lb-ft). and loosen it. Retighten with 29 N·m(3.0 kg-m, 22 lb-ft) then tighten 90° again.


AN9010051

7. Install a dial gauge.
8. Measure the side clearance while moving the connecting rod back and forth.


AN9010052

Standard : 0.239~0.390 mm(0.0094~0.0153 in)
Limit : 0.35 mm(0.0138 in)

If it exceeds the limit value, replace the connecting rod and cap.

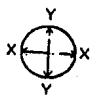
INSPECTION AND REPAIR

1. Clean all parts thoroughly and remove gasket fragments, dirt, oil or grease, carbon, moisture and other foreign material completely.

Caution
- **Do not give damage to the joints or sliding surface of aluminum alloy parts (cylinder head , piston).**

2. Check if all parts are suitable with following standard value, replace or repair if necessary.

Item			Specification	Remarks
Cylinder Head				
Distortion of head surface mm(in)	Longitudinal		0.25(0.010)	
	Lateral		0.10(0.004)	
Distortion of side surface mm(in)			0.15(0.006)	
Length of cylinder head mm(in)	Short bolt	Standard	121.7~122.3(4.79~4.81)	
		Limit	123.0(4.84)	
	Long bolt	Standard	156.7~157.3(6.17~6.19)	
		Limit	158.0(6.22)	
Valve				
Valve thickness (margin) mm(in)	Intake		1.35(0.05)	
	Exhaust		1.5(0.06)	
Valve stem diameter mm(in)	Intake	Standard	8.466~8.491(0.3333~0.3343)	
		Limit	8.395(0.3305)	
	Exhaust	Standard	8.440~8.463(0.3323~0.3332)	
		Limit	8.369(0.3295)	
Valve guide inner diameter mm(in)			8.518~8.540(0.3354~0.3362)	
Oil clearance mm(in)	Intake		0.027~0.074(0.0011~0.0029)	· Clearance between valve guide inner diameter and valve stem diameter
	Exhaust		0.055~0.100(0.0022~0.0039)	
	Limit		0.116(0.0046)	
Valve seat angle (°)	Intake		45	
	Exhaust		45	
Seat width mm(in)	Intake		2.41(0.095)	· Facing width between valve face and valve seat
	Exhaust		1.98(0.078)	
Valve seat sinking mm(in)	Standard	Intake	1.05~1.25(0.041~0.049)	
		Exhaust	0.90~1.10(0.035~0.043)	
	Limit	Intake	2.50(0.087)	
		Exhaust	2.50(0.087)	
Valve spring length mm(in)	Standard		49.5(1.95)	
	Limit		48.5(1.91)	
Valve spring squarenessmm(in)	Limit		1.63(0.064)	
Rocker Arm and Rocker Arm Shaft				
Rocker arm inner diameter mm(in)			19.000~19.021(0.748~0.749)	
Rocker arm shaft outer diameter mm(in)			18.959~18.980(0.746~0.747)	
Oil clearance mm(in)	Standard		0.020~0.062(0.0008~0.0024)	
	Limit		0.07(0.003)	
Push Rod				
Deflection mm(in)			0.4(0.016)	

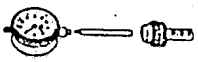
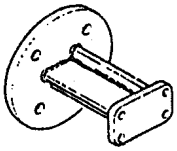
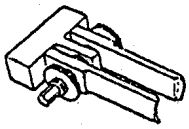
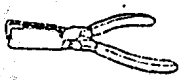
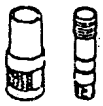
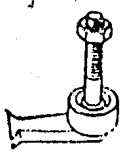
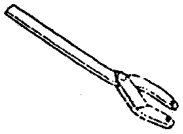
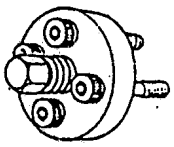
Item			Specification	Remarks
Cylinder Block				
Distortion mm(in)	Longitudinal		0.254(0.010)	
	Lateral		0.10(0.004)	
Cylinder bore inner diameter mm(in)	X-X axis		97.500~97.513(3.8386~3.8391)	
	Y-Y axis		97.513~97.526(3.8391~3.8396)	
Cylinder liner outer diameter mm(in)	Y-Y axis		97.480~97.493(3.8378~3.8383)	
	Y-Y axis		97.493~97.506(3.8383~3.8388)	
Piston, Piston Pin				
Piston outer diameter mm(in)			94.472~94.498 (3.7194~3.7204)	· Measured at aparted from the lower end of piston
Piston clearance mm(in)			0.039~0.065 (0.0015~0.0026)	· Difference between axial inner diameter of cylliner
Ring groove clearance mm(in)	Top ring		0.06~0.10(0.0024~0.0039)	· Clearance between piston ring groove and piston ring · Measured on all around.
	Second ring		0.04~0.08(0.0016~0.0032)	
	Oil ring		0.03~0.07(0.0012~0.0028)	
	Limit		0.30(0.012)	
End gap of piston ring mm(in)	Top ring		0.25~0.35(0.010~0.014)	
	Second ring		0.30~0.45(0.012~0.018)	
	Oil ring		0.20~0.40(0.008~0.016)	
	Limit		1.50(0.06)	
Piston pin outer diameter mm(in)			29.994~30.000(1.1809~1.1811)	
Connecting Rod				
Bush inner diameter mm(in)			30.012~30.033(1.1816~1.1824)	
Oil clearance mm(in)	Standard		0.012~0.039(0.0005~0.0015)	· Difference between bush inner diameter and piston
	Limit		0.05(0.002)	
Allowable twist mm(in)			0.05(0.002) per 100(3.937)	
Camshaft				
Runout mm(in)			0.08(0.0031)	
Cam height mm(in)	Standard	Intake	42.333(1.6667)	
		Exhaust	42.333(1.6667)	
	Limit	Intake	41.833(1.6470)	
		Exhaust	41.833(1.6470)	
Journal diameter (wear limit) mm(in)	No. 1		51.910~51.940(2.0437~2.0449)	· After measuring the journal wear in X and Y direction, replace if it exceeds. 
	No. 2		51.660~51.690(2.0339~2.0350)	
	No. 3		51.410~51.440(2.0240~2.0252)	
	No. 4		51.160~51.190(2.0142~2.0154)	
	Limit		0.08(0.003)	
Camshaft bearing inner diameter mm(in)	No. 1		52.000~52.030(2.0472~2.0484)	
	No. 2		51.750~51.780(2.0374~2.0386)	
	No. 3		51.500~51.530(2.0276~2.0287)	
	No. 4		51.250~51.280(2.0177~2.0120)	
Oil clearance mm(in)	Standard		0.06~0.12(0.0024~0.0047)	· Difference between camshaft bearing inner diameter and camshaft journal outer diameter
End plate (axial play) mm(in)	Camshaft		0.02~0.18(0.0008~0.0070)	
	Idle gear		0.05~0.18(0.0020~0.0070)	
	Limit		0.30(0.0118)	

Item			Specification	Remarks
Tappet				
Outer diameter		mm(in)	14.218~14.233(0.5598~0.5604)	
Bore in cylinder block		mm(in)	14.288~14.319(0.5625~0.5637)	
Clearance between cylinder block bore and tappet outer diameter mm(in)	Standard		0.055~0.101(0.0022~0.0040)	
	Limit		0.15(0.006)	

SPECIFICATION

Items			Specification
Engine			Diesel, 4-Cycles
Number and arrangement of cylinder			4-Cylinder in-line, Longitudinal
Combustion chamber type			Swirl
Total displacement (cc)			2665
Cylinder bore X stroke mm(in)			94.5 × 95.0(3.7205 ×3.7402)
Compression ratio			21.5
Compress pressure (kg/cm²-rpm)			30~200
Valve timing	Intake	Opening	BTDC 12°
		Closing	ABDC 40°
	Exhaust	Opening	BBDC 50°
		Closing	ATDC 12°
Valve clearance mm(in)	Intake		0.30(0.012)(engine cold condition)
	Exhaust		0.38(0.015)(engine cold condition)
Idle speed (rpm)			700~750(A/T), 750~790(M/T)
Injection timing(static)			ATDC 7°
Firing order			1—3—4—2

SPECIAL TOOLS

0K670 130 010 Cam lift measuring device 	Measuring cam lift amount	0K71E 131 001 Compression gauge adapter 	Measuring compression pressure
0K72A 101 001 Engine hanger 	Fixing engine	0K993 120 001 Valve spring arm 	Replacing valves
0K993 120 004 Pivot 	Assembling valve	0K993 120 006 Valve seal remover 	Removing valve seal
0K710 120 004 Valve seal installer 	Installing valve seal	0K590 111 001 Ring gear brake set 	Protecting engine from rotating
0K130 160 010 Clutch disc centering tool 	Assembling clutch disc	0K130 111 004 Holder coupling flange 	Removing camshaft gear
0K670 131 005 Injection pump gear remover 	Removing injection pump gear		

LUBRICATION SYSTEM (J2 ENGINE)

TROUBLESHOOTING GUIDE

Problem	Possible causes	ction
Engine hard starting	Improper engine oil Insufficient oil	Replace Add oil
Excessive oil consumption	Oil working up to or down from combustion chamber Oil leakage	Refer to Section 10A Repair
Low oil pressure	Insufficient oil Oil leakage Worn or damaged oil pump gear or rotor Worn plunger (in side oil pump), or weak spring Clogged oil strainer Excessive main bearing or connecting rod clearance	Add oil Repair Replace Replace Clean Refer to Section 10A
Warning light on during engine operation	Low oil pressure Malfunction of oil pressure switch Malfunction of electric system	Same as above Replace Repair

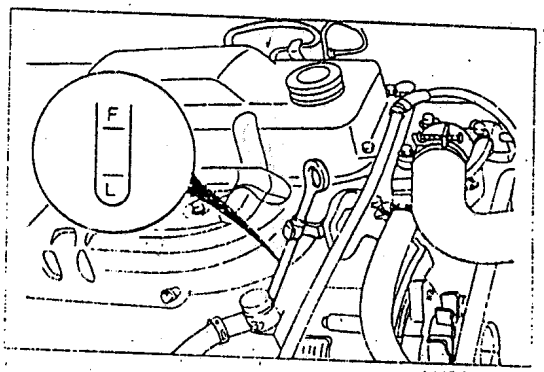
ENGINE OIL

INSPECTION

1. Be sure that the vehicle is on level ground
2. Start the engine and let it warm up to normal operating temperature.
3. Turn the engine off and wait for 5 minutes.
4. Check the engine oil level and its condition by using the oil level gauge.
5. Fill or replace oil if necessary.

Note

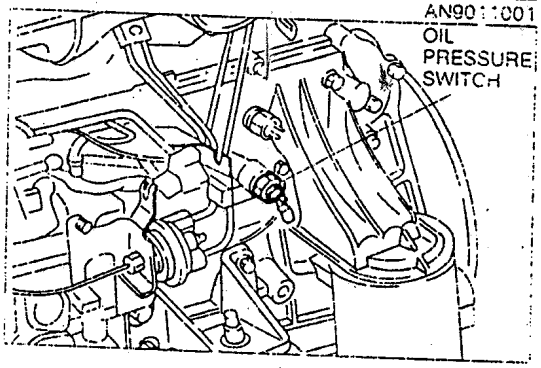
- **Check if oil quantity is between "L" and "F" mark of oil level gauge.**



AN901001

Oil Pressure

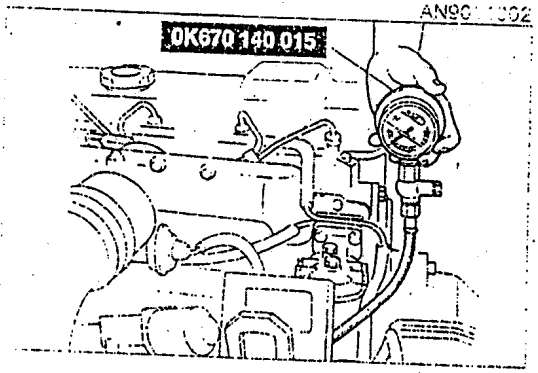
1. Remove the oil pressure switch.



AN901002

2. Connect SST to the attaching hole of oil pressure switch on cylinder block.
3. Start the engine and let it warm up to normal operating temperature.
4. Read the gauge indicating during keeping engine at 3000rpm.

Standard oil pressure :
352.8~431.2 kpa(3.6~4.4 kg/cm², 51.15~62.52 psi)



AN901003

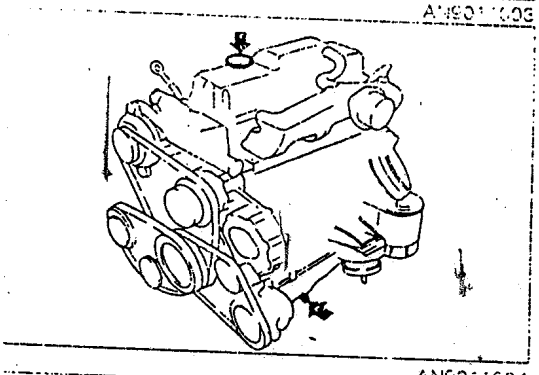
5. If oil pressure is not as specified standard, inspect each part and repair if necessary.

REPLACEMENT

1. Warm up the engine.
2. Remove the oil filler cap and oil pan drain plug.
3. Drain the oil into a suitable container.

Warning

- **Since oil is hot when engine is hot, wait a minute and drain oil carefully.**


AN901004

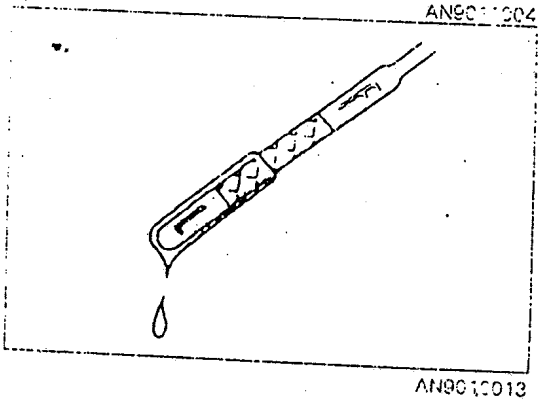
4. Install a new gasket and tighten the drain plug.

Tightening torque : 32~41 N·m(3.2~4.2 kg-m, 23~30 lb-ft)

5. Add the specified oil into the engine up to "F" level.
6. Tighten the oil filler cap.

Oil pan capacity : 5.7 *l* (6.0 US qt, 5.0 Imp qt)

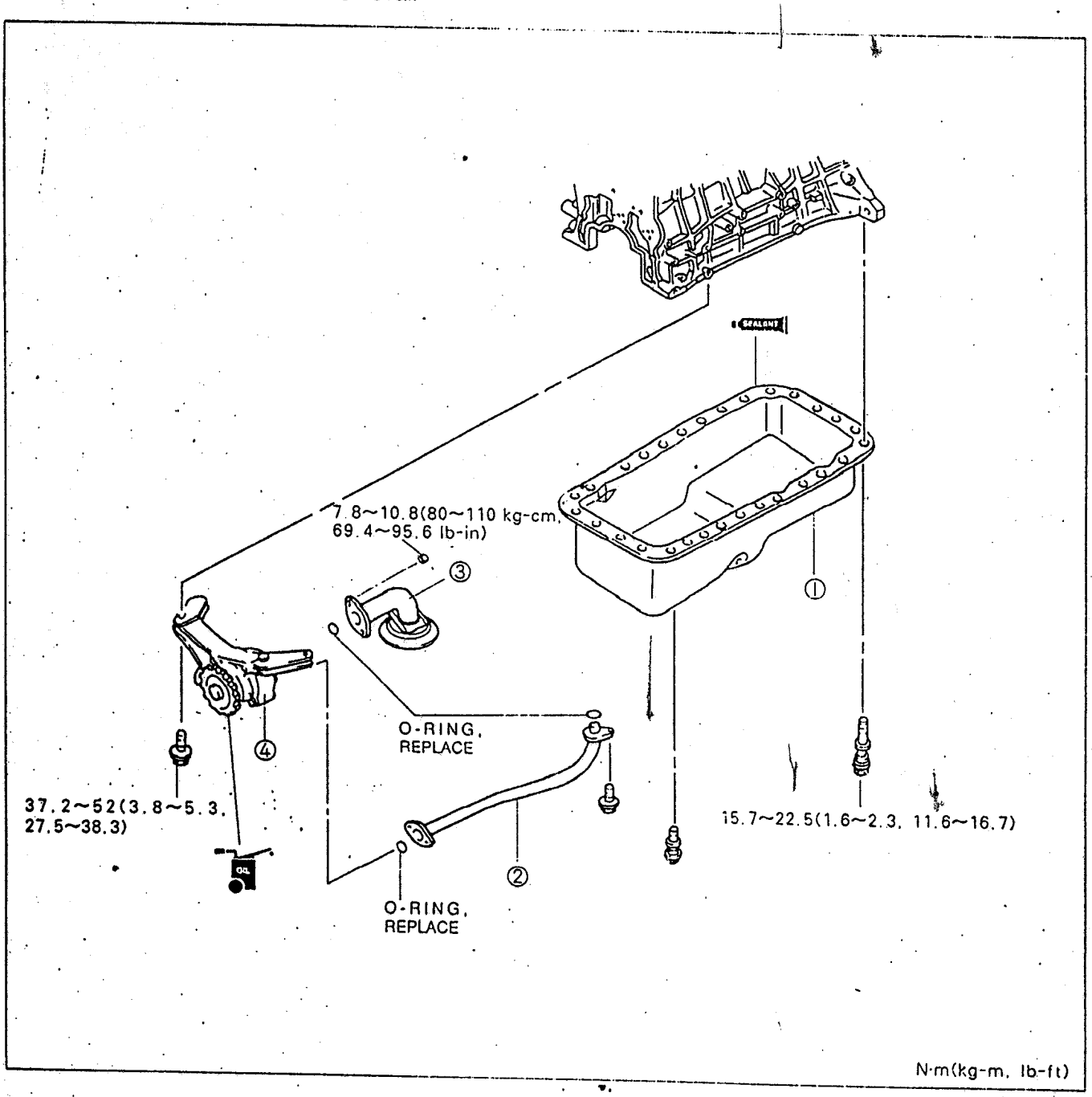
7. Check the oil level after running engine.


AN901013

OIL PUMP

REMOVAL / INSTALLATION

1. Remove the battery negative cable, then remove the under cover.
2. Drain the oil into a suitable container.
3. Remove each part in steps as shown in the figure.
4. Install in the reverse order of removal.

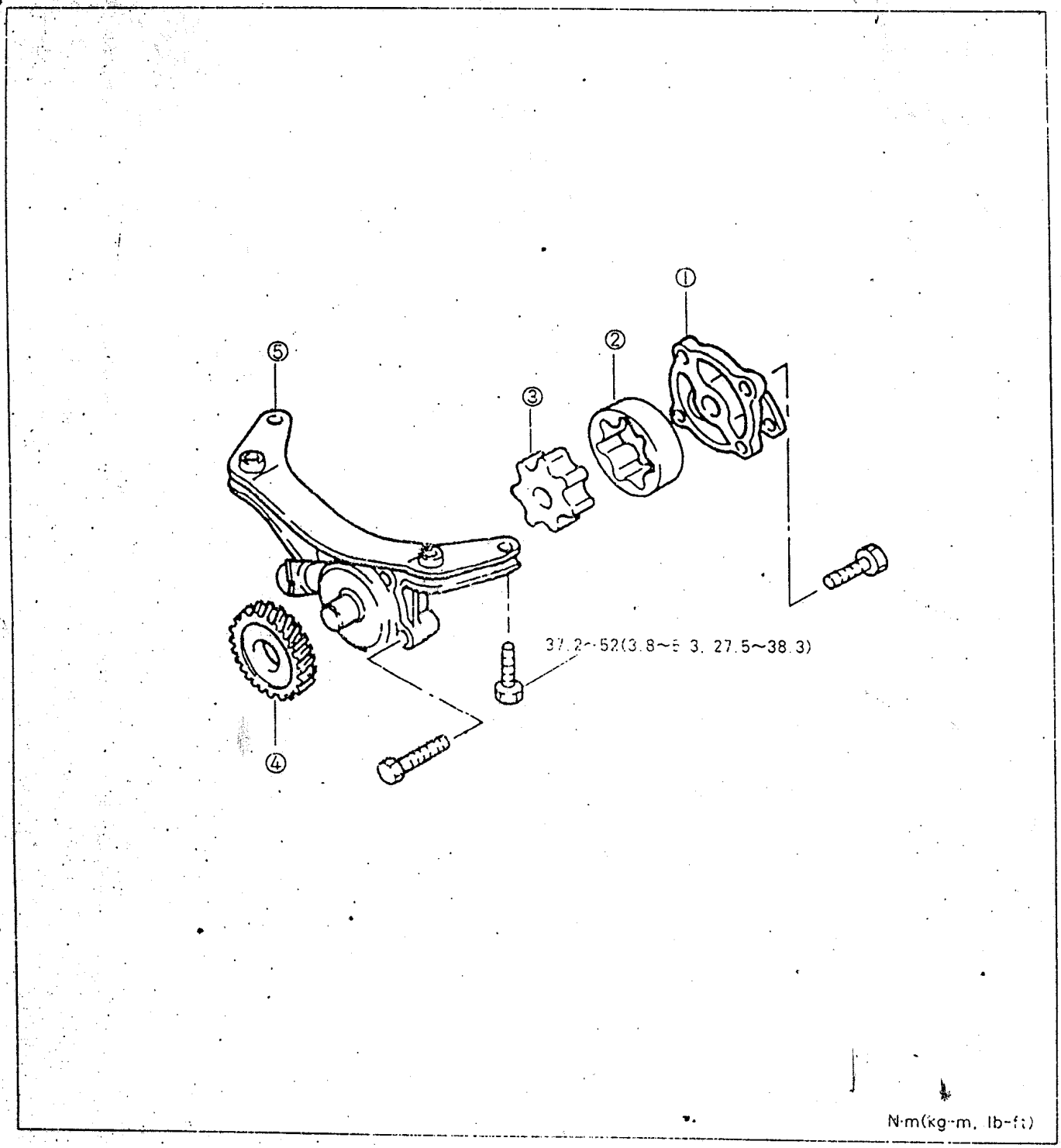


AN90I1005

1. Oil pan
2. Oil pipe
3. Oil strainer
4. Oil pump

DISASSEMBLY / ASSEMBLY

1. Disassemble in the sequence shown in the figure.
2. Assemble in the reverse order of disassembly.

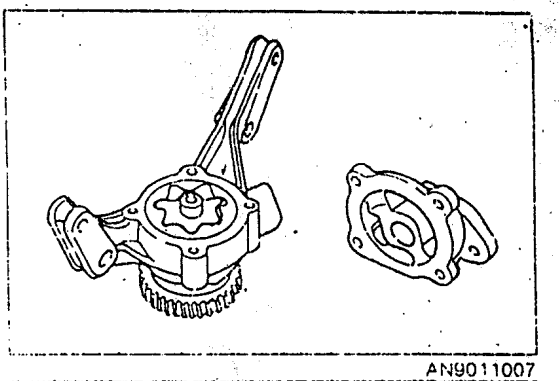


1. Pump cover
2. Outer rotor
3. Inner rotor
4. Drive gear (using press)
5. Pump body

INSPECTION

Inspect the followings, and repair if a problem is found.

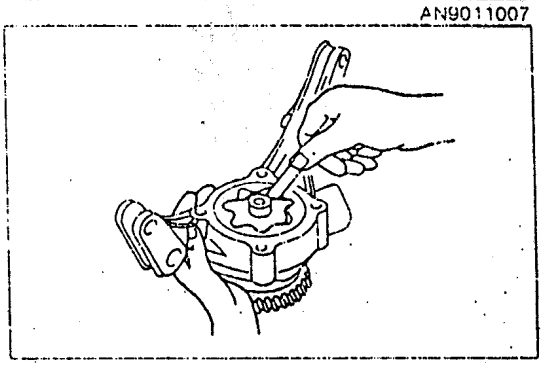
1. Distortion or damage of the pump body or cover.
2. Wear or damage of the valve.
3. Weak or crack of the valve spring.



AN9011007

4. The clearance between the inner and outer rotor.

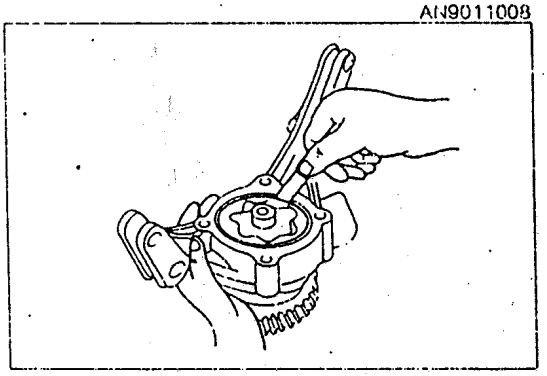
   Standard : 0.04~0.08 mm(0.0016~0.0031 in)
   Limit : 0.10 mm(0.0040 in)



AN9011008

5. The clearance between the outer rotor and the pump body.

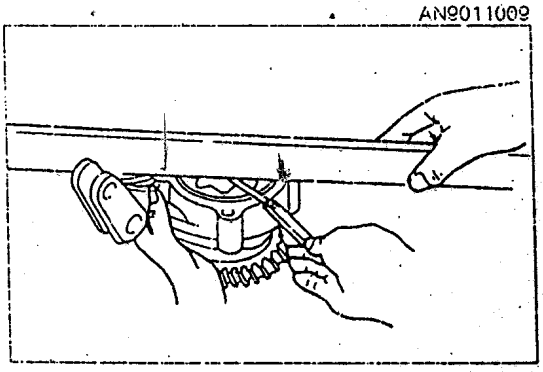
   Standard : 0.10~0.21 mm(0.0040~0.0083 in)
   Limit : 0.25 mm(0.0098 in)



AN9011009

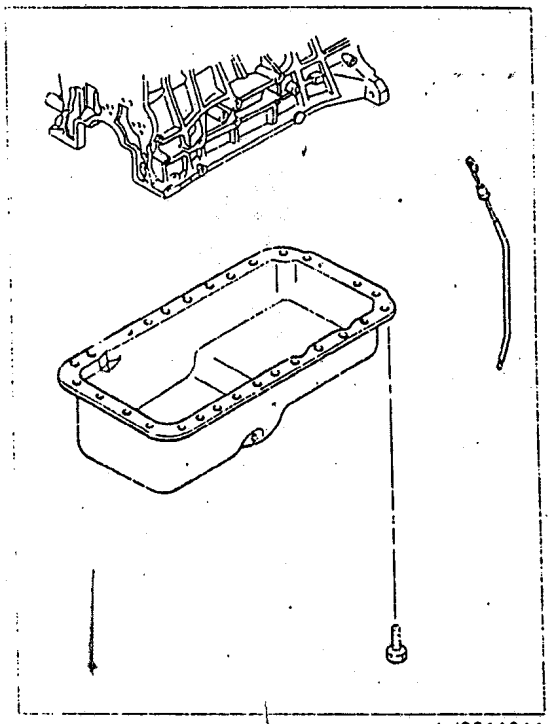
6. The clearance between the rotor and the pump cover.

   Standard : 0.03~0.10 mm(0.0012~0.0040 in)
   Limit : 0.15 mm(0.0059 in)



AN9011010

OIL PAN

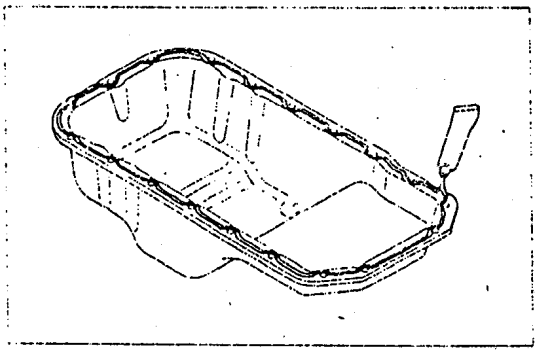

AN9011011

REMOVAL
1. Remove the battery negative cable.
2. Drain the engine oil.
3. Remove the under cover.
4. Remove the hose attached to the vacuum pump and the side of oil pan.
5. Remove the oil level gauge pipe from the rubber hose.
6. Remove the oil pan.

INSPECTION
1. Remove any dirt or chips in the oil pan.
2. Check the oil pan for crack, the thread of drain plug for damage and inspect the bolt holes for damage. Repair or replace if necessary.

INSTALLATION
1. Remove the old sealant thoroughly on the cylinder block and oil pan.
2. Apply a continuous bead of sealant to the oil pan along the inside of the bolt holes, and overlap the ends.
3. Tighten the oil pan installation bolts with specified torque.

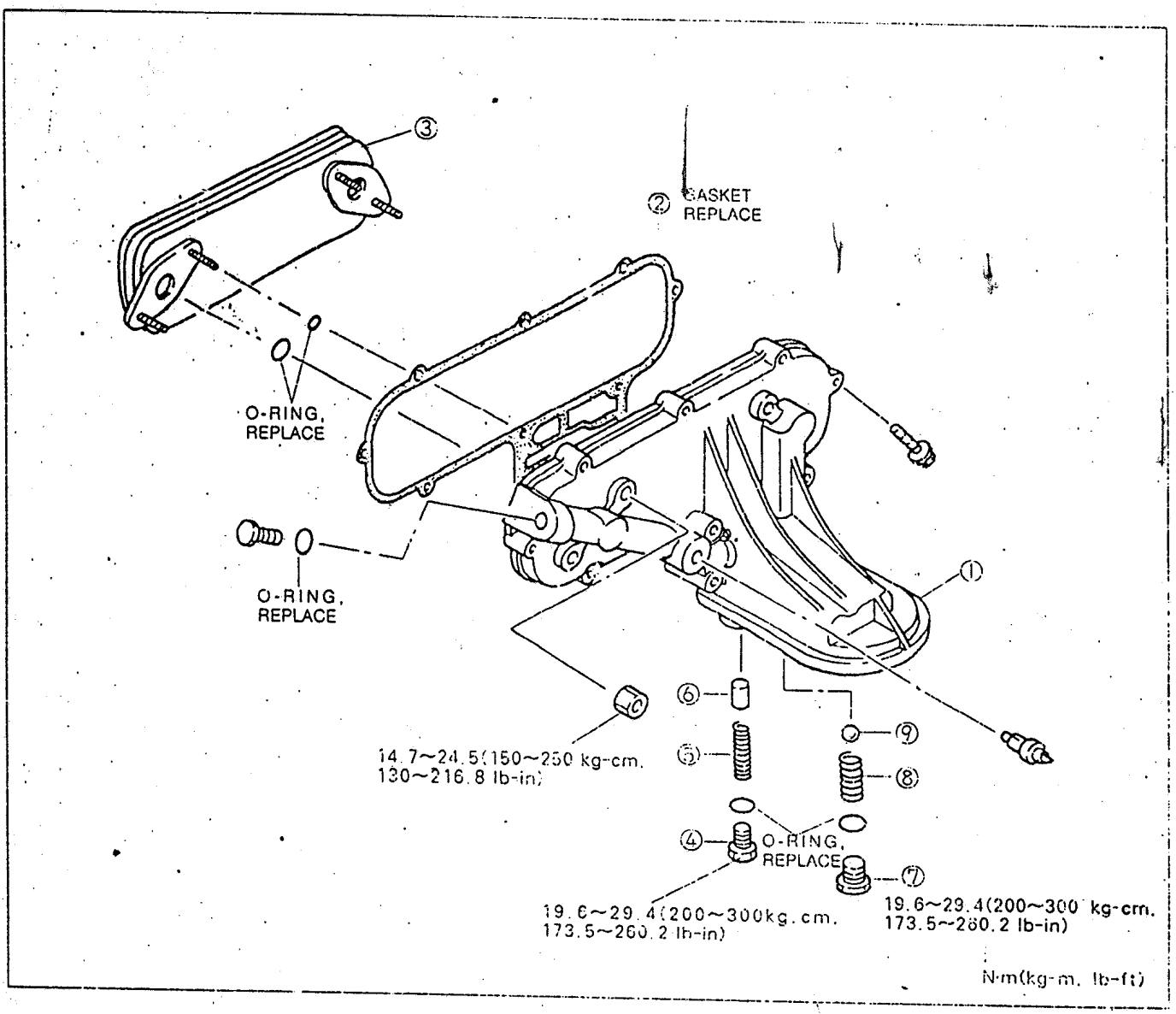
Tightening torque :
15.7~22.5 N·m(1.6~2.3 kg-m, 11.6~16.7 lb-ft)


AN7010A241

OIL COOLER

DISASSEMBLY / ASSEMBLY

1. Drain the engine coolant and oil.
2. Remove the fuel pipe.
3. Disassemble in steps as shown in the figure, assemble in the reverse order of disassembly.
4. Check for any oil leakage after assembling.



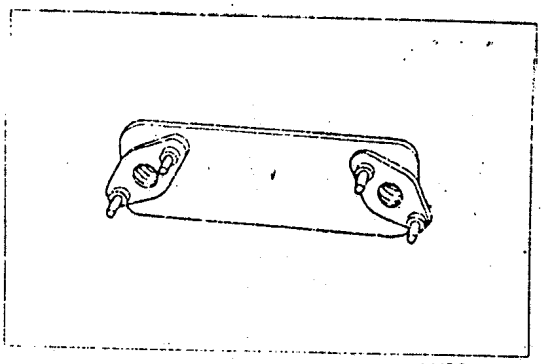
AN3011012

1. Oil cooler cover
2. Gasket
3. Oil cooler
4. Plug
5. Control spring
6. Plunger
7. Plug
8. Relief valve spring
9. Steel ball

INSPECTION

Oil Cooler

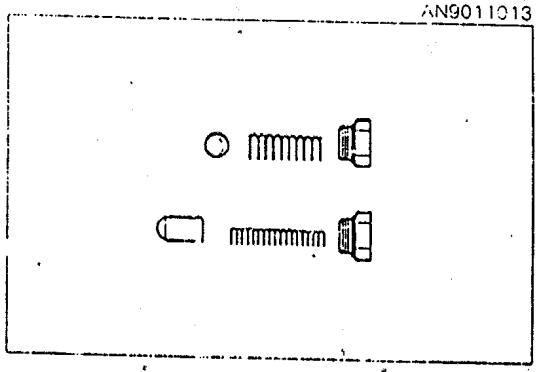
1. Inspect visually the core for clogging or damage, and replace it if a problem is found.



AN9011013

Plunger Control

1. Check the plunger control for connection or wear.
2. Check the plunger control spring for weak.

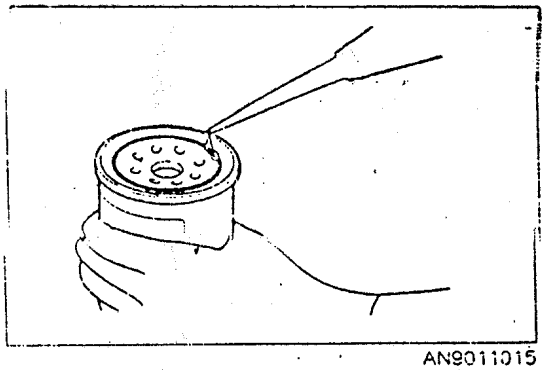


AN9011014

Oil Relief Valve

1. Check the steel ball for wear or damage.
2. Check the relief valve spring for weak.

OIL FILTER


AN9011015

REMOVAL / INSTALLATION

1. Remove the oil filter by using wrench.
2. Apply a small amount of engine oil to the "O" ring of the new oil filter

Caution
- **Do not use any tool for tightening.**

3. Tighten the oil filter by hand.

Tightening torque :
21.6~24.5 N·m(2.2~2.5 kg-m, 15.9~18.1 lb-ft)

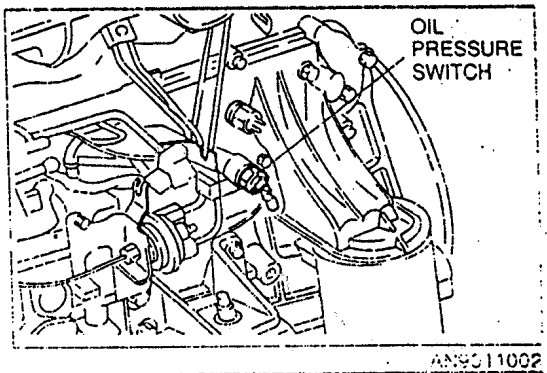
4. Add a specified amount of the engine oil.
5. Start the engine and check for leakage at the filter.

OIL PRESSURE SWITCH

INSPECTION

1. Turn the ignition switch on (no start), then check if the warning light is lit.
2. Start the engine and check if the warning light is turned off.

- The oil pressure switch is normal if it is lit in step 1 and turned off in step No. 2.
- Inspect the electric circuit if it is not lit in step 1, replace the oil pressure switch if no problem is found (refer to the electric wiring diagram).
- Measure the oil pressure if it is lit in step 1 and not turned off in step No. 2, replace the oil pressure switch if the oil pressure is normal.



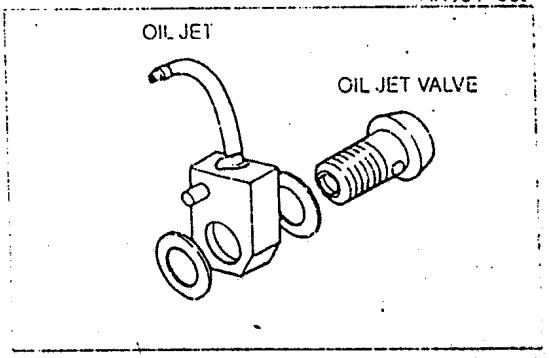
AN9011002

OIL JET

INSPECTION

1. Check the oil passage for clogging.
2. Check the oil jet valve spring for damage.

Valve opening pressure : 196 kpa(2.0 kg/cm², 28.4 psi)

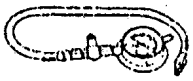


AN9011016

SPECIFICATION

Item			Specification
Lubrication system			Force-fed by gear pump
Total oil quantity		ℓ (US qt, Imp qt)	7.4 (7.8, 6.5)
Oil quantity in oil pan ('F' position)		ℓ (US qt, Imp qt)	5.7 (6.0, 5.0)
Force-fed pressure		kPa (kg/cm², psi)	353~432 (3.6~4.4, 51~63) - 3000rpm
Oil pump			Trochoid type
Oil filter body	Regulating valve opens at	kPa (kg/cm², psi)	392 (4.0, 57)
	Oil filter relief valve opens at	kPa (kg/cm², psi)	98 (1.0, 14)
	Oil cooler relief valve opens at	kPa (kg/cm², psi)	128 (1.3, 18)
Oil filter			Full-flow, paper element
Oil cooler			Built-in water cooled multi-plates type
Warning light operating pressure		kPa (kg/cm², psi)	29 (0.3, 4.3)
Engine oil			API Service CF-4 or CG-4 Four seasons : SAE, 5W-30 (-25℃~30℃) Four winter : SAE, 10W-30 (20℃~30℃) Four summer : SAE, 30 (0℃~30℃)

SERVICE SPECIAL TOOL (SST)

0K670 140 015 Oil pressure gauge		Measurement of oil pressure

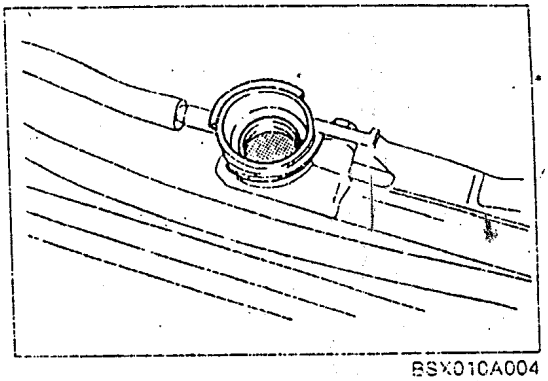
COOLING SYSTEM (J2 ENGINE)

12A

TROUBLESHOOTING GUIDE

Problem	Possible causes	Action
Coolant leaks	Damaged radiator core	Replace
	Coolant leaks from radiator hose and heater hose	Repair or Replace
	Coolant leaks from water thermo switch	Repair or Replace
	Malfunction of water seal (water pump)	Replace
	Loose or damaged thermostat cover and gasket	Repair or Replace
	Loose cylinder head bolts	Tighten
	Damaged cylinder head gasket	Replace
	Crack of cylinder block	Replace
	Crack of cylinder head	Replace
Corrosion	Impurities or deposits in coolant	Clean
Overheating	Clogged water jacket (water passage)	Clean
	Malfunction of thermostat	Replace
	Clogged radiator fins	Repair or Replace
	Malfunction of water pump	Replace
	Insufficient coolant	Add
	Malfunction of thermo modulator fan	Replace

ENGINE COOLANT


BSX010A004

INSPECTION

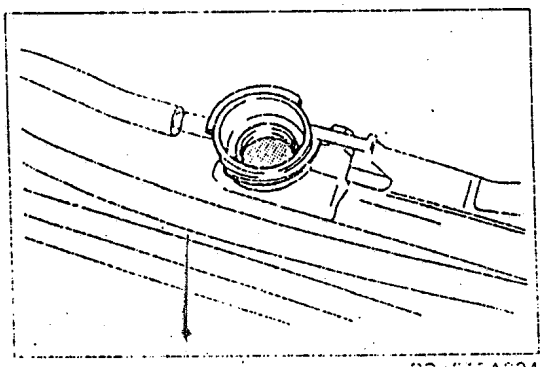
Coolant Level and Condition

1. Check the coolant level is near the radiator filler neck.
2. Check the level is between FULL and LOW of the reservoir tank. Add coolant as required.
3. Check the radiator cap and radiator filler neck for corrosion or scales.
4. Inspect for oil in either the reservoir tank or radiator filer neck. If oil is found in either place, it is likely there is a leaking head gasket.
5. Inspect for coolant leakage at the radiator, if necessary, repair or replace radiator.

REPLACEMENT

Warning

- **Do not open the radiator cap when engine is hot.**
- **When opening the radiator cap, wrap it with thick cloth.**
- **Drain hot coolant carefully.**


BSX010A004

1. Remove the radiator cap and loosen the drain plug.
2. Drain coolant into a suitable container.
3. Tighten the drain plug.
4. Add a sufficient amount of anti-freeze solution (Ethylene glycol) and coolant.

Coolant capacity
Without heater : 8.5 l(8.98 qt)
With heater : 9.5 l(10.04 qt)

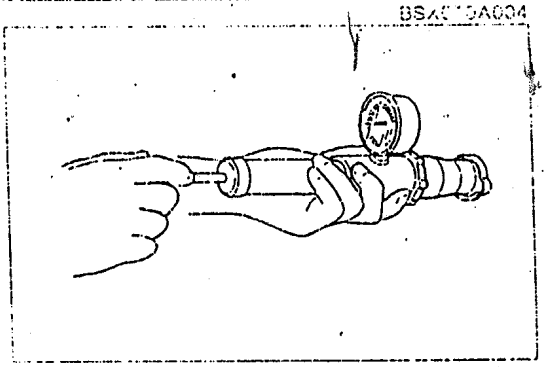
5. Add coolant upto the radiator filler neck during operating the engine at idle.
6. Install the radiator cap.

RADIATOR CAP

INSPECTION

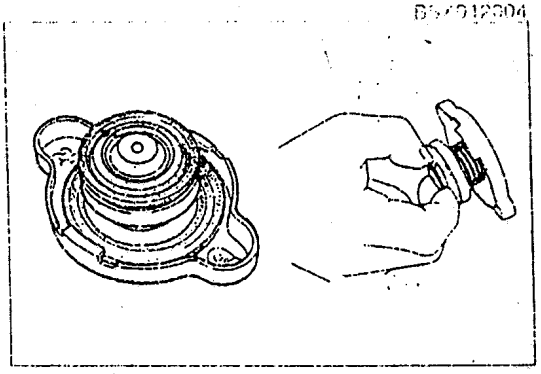
Radiator cap valve

1. Remove foreign material from between the radiator cap valve and the valve seat.
2. Attach the radiator cap tester to the radiator cap, and apply pressure gradually upto 93~123 kpa(0.95~1.25 kg/cm², 13.5~17.8 psi)
3. Wait about 10 seconds. Check that the indicated pressure has not decreased. Replace the radiator cap if the pressure has leaked off.


BSX012004

Radiator pressure valve

1. Pull the negative pressure valve to open it, and check if it closes completely when released.
2. Check for damage on contact surfaces and for cracked or deformed seal packing.
3. Replace the radiator cap if necessary.

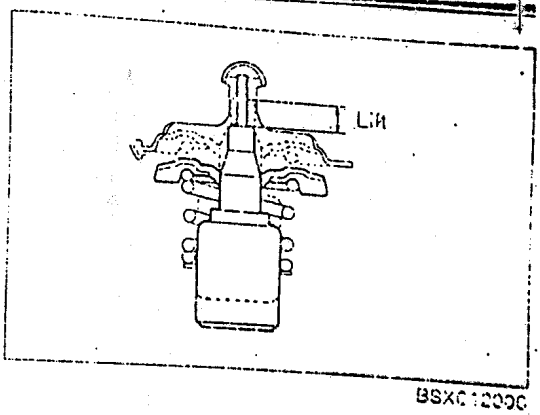

BSX012005

THERMOSTAT

INSPECTION

1. Check the thermostat vaive visually for air tightness.
2. Place the thermostat and a thermometer into water.
3. Heat the water gradually and check the following.

Items	Specification
Initial opening temperature °C (°F)	80.5~83.5(176.9~182.3)
Full-open temperature °C (°F)	95(203)
Full-open lift mm (in)	above 8.5(0.33)



BSXC12000

SPECIFICATION

Items		Specification
Thermostat	Type	Wax type
	Initial opening temperature °C (°F)	80.5~83.5(176.9~182.3)
	Full-open temperature °C (°F)	95(203)
	Full-open lift mm (in)	above 8.5(0.33)
Coolant capacity ℓ (qt)	With heater	9.5(10.0)
	Without heater	8.5(9.0)

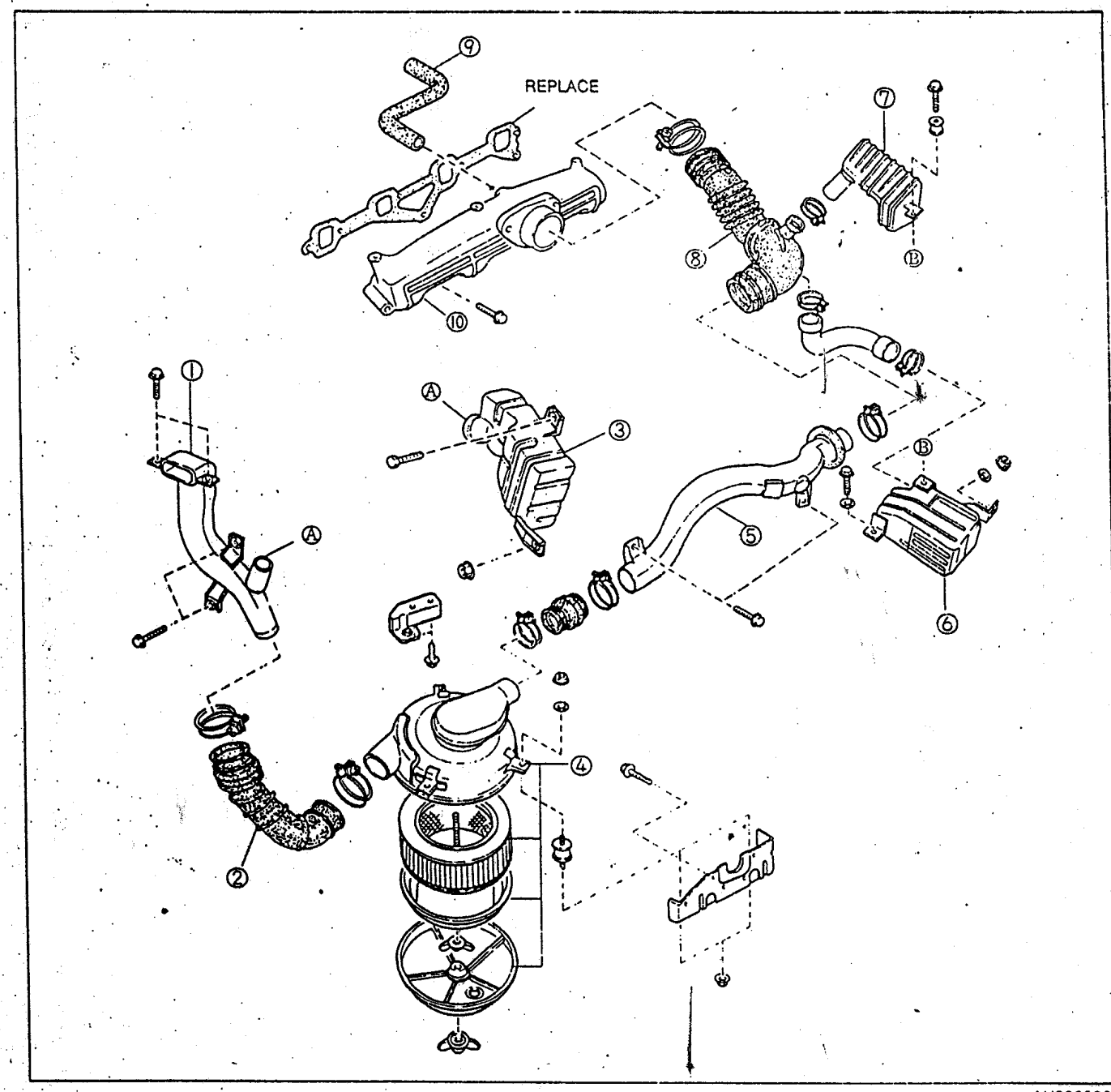
INTAKE AND EXHAUST SYSTEM (J2 ENGINE)

20

INTAKE SYSTEM

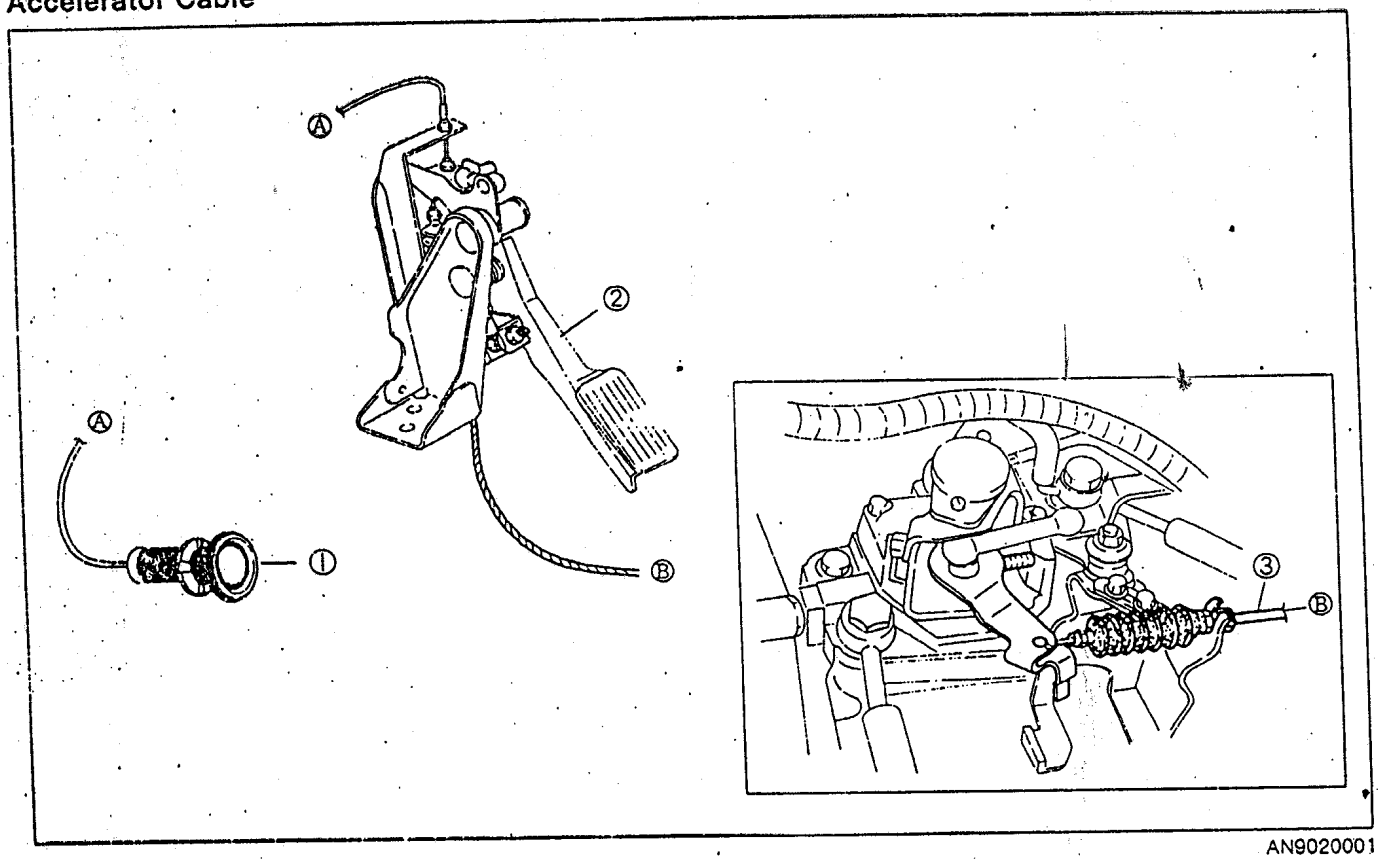
REMOVAL / INSTALLATION

1. Remove in the steps shown in the figure.
2. Inspect all parts, and repair or replace if necessary.
3. Install in the reverse order of removal.



1. Fresh air duct
2. Air hose
3. Resonance chamber
4. Air cleaner
5. Air inlet pipe
6. Resonance chamber
7. Resonance chamber
8. Air inlet hose
9. PCV hose
10. Intake manifold

Accelerator Cable



AN9020001

1. Idle adjusting knob
2. Accelerator pedal
3. Accelerator cable

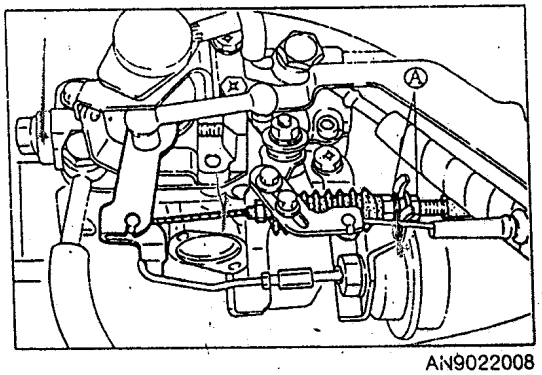
INSPECTION

Accelerator Cable

1. Inspect the cable deflection.

   Deflection : 1~3 mm(0.04~0.12 in)

   If it exceeds the limit, adjust by rotating the nut Ⓐ.

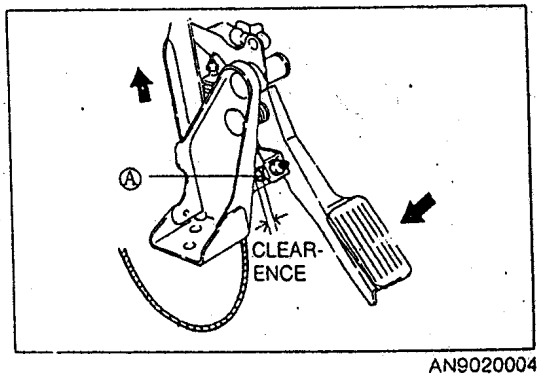


AN9022008

2. Depress the accelerator pedal fully, and check if the control lever touches the stopper bolt.

   Clearence : 0 mm

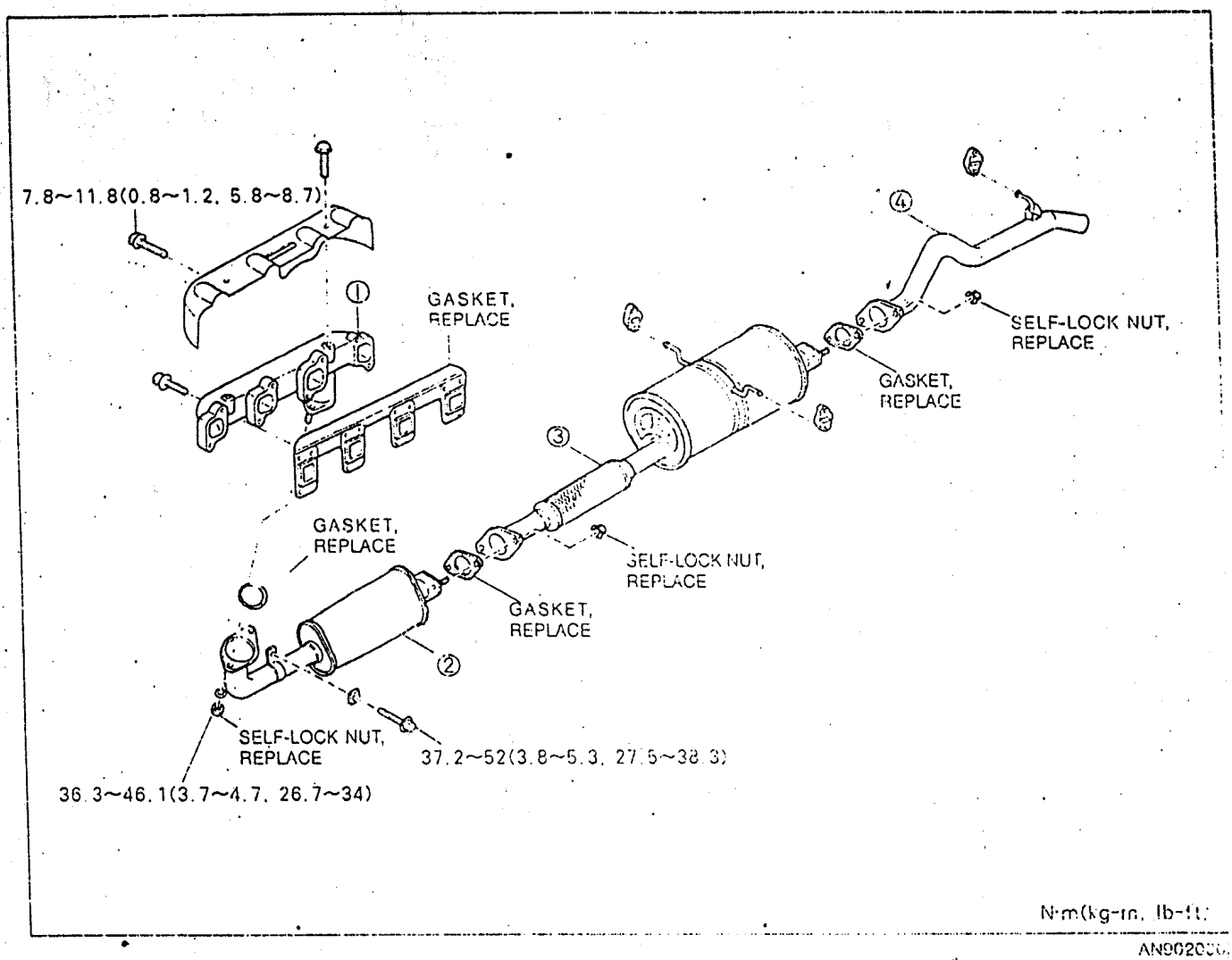
   Adjust it by rotating the nut Ⓐ if necessary.



AN9020004

EXHAUST SYSTEM

1. Remove in the steps shown in the figure.
2. Inspect all parts, and repair or replace if necessary.
3. Install in the reverse order of removal.



1. Exhaust manifold
2. Front pipe (combined with the pre-silencer)
3. Main silencer (combined with the bellows)
4. Tail pipe

SPECIFICATION

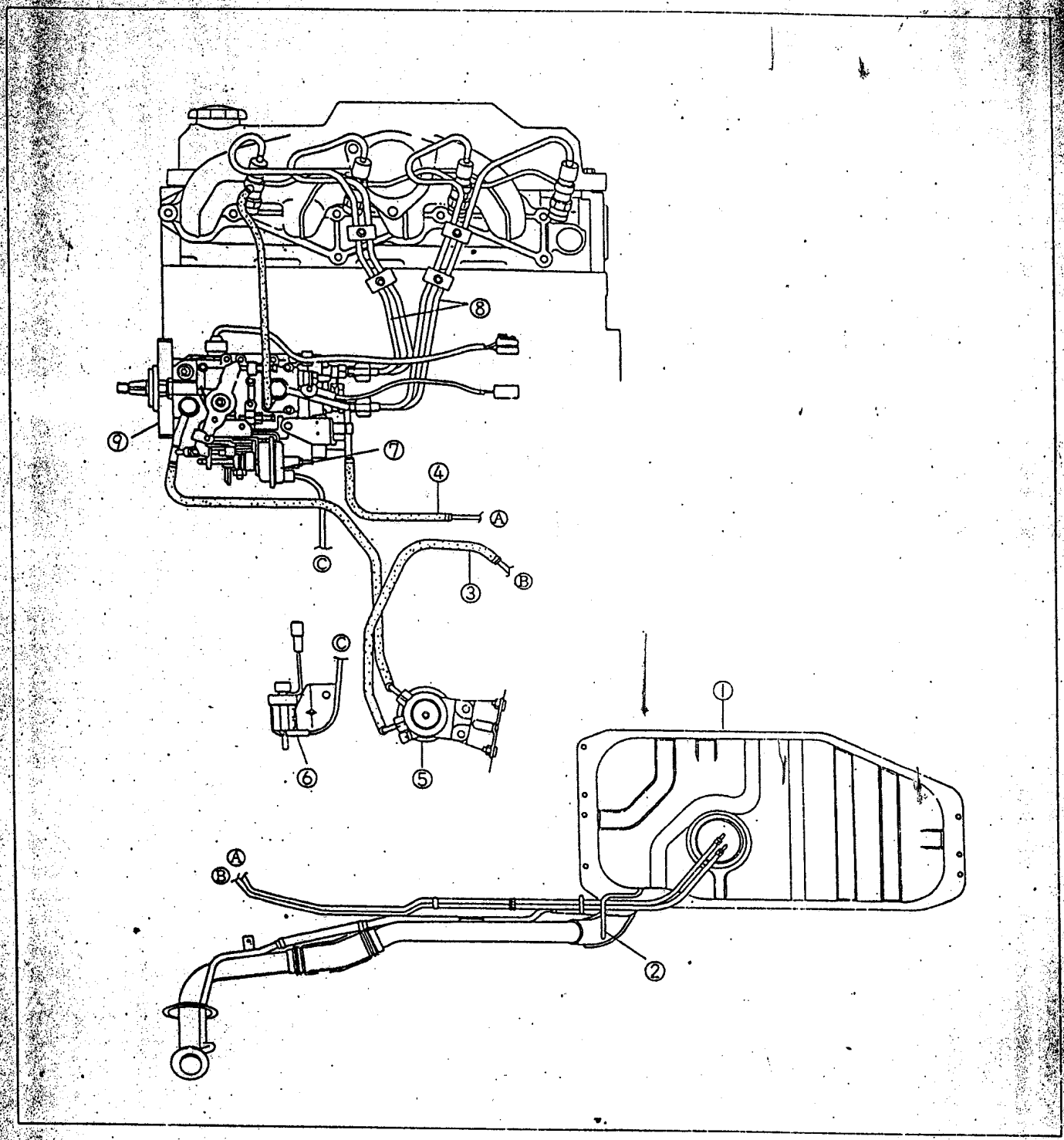
Items			Specification
Air Cleaner	Type		Paper Element
Accelerator Cable	Deflection	mm (in)	1 - 3(0.04~0.12)

FUEL SYSTEM (J2 ENGINE)

22A

OUTLINE

STRUCTURAL VIEW



AN9022001

1. Fuel tank
2. Check valve
3. Main hose
4. Return hose
5. Fuel filter (built-with sedimentor)
6. Solenoid valve (3-way)
7. Actuator
8. Injection pipe
9. Injection pump

TROUBLESHOOTING GUIDE

Problem	Possible causes	Action
Failure of engine starting	**Fuel filter**	
	Clogged	Replace
	Water or air in filter	Repair
	Injection pump	
	Fuel cut valve malfunctioning	Replace
	Improper injection timing	Adjust
	Air in pump	Repair
	Malfunction of parts in pump	Replace
	Fuel injection nozzle	
	Stuck needle valve	Replace
	Fuel leakage from nozzle	Replace
	Improper nozzle opening pressure	Adjust
	Malfunction of glow plug	Replace
Rough idle	**Fuel filter**	
	Refer to Failure of engine starting	
	Injection pump	
	Refer to Failure of engine starting	
	Fuel injection nozzle	
	Stuck needle valve	Replace
	Improper nozzle opening pressure	Adjust
	Improper installation of nozzle holder	Repair
	Leakage from nozzle holder washer	Replace
	Fuel injection pipe	
	Crack	Replace
	Leakage from connection	Repair
	Improper adjustment for idle speed	Adjust
Knocking	Incorrect injection timing	Adjust
	Low quality of fuel	Replace
	Improper fuel injection nozzle opening pressure	Adjust
	Stuck needle valve of fuel injection nozzle	Replace
	Fuel leakage from fuel injection nozzle	Replace
High fuel consumption	**Injection pump**	
	Incorrect injection timing	Adjust
	High idle speed	Adjust
	Fuel injection nozzle	
	Improper nozzle opening pressure	Repair
	Fuel leakage from nozzle	Replace
	Fuel leakage from nozzle holder washer	Replace
	Fuel leakage from connection	Repair
	Clogged fuel filter	Replace
Poor acceleration	**Fuel injection nozzle**	
	Improper nozzle opening pressure	Replace
	Stuck needle valve	Replace
	Fuel leakage from nozzle	Replace
	Injection pump	
	Refer to Failure of engine starting	
	Fuel injection pipe	
	Refer to Rough idle	
	Fuel filter	
	Water or air in filter	Replace or Repair
	Clogged	Replace
Excessive exhaust smoke	Clogged air cleaner	Clean or Replace
	Incorrect injection timing	Adjust
	Malfunction of nozzle or nozzle holder	Repair or Replace

FUEL TANK

REMOVAL / INSTALLATION

Warning

- Isolate all explosive sources during removing the fuel tank.
- When repairing the fuel tank, remove all fuel thoroughly in the tank.

Note

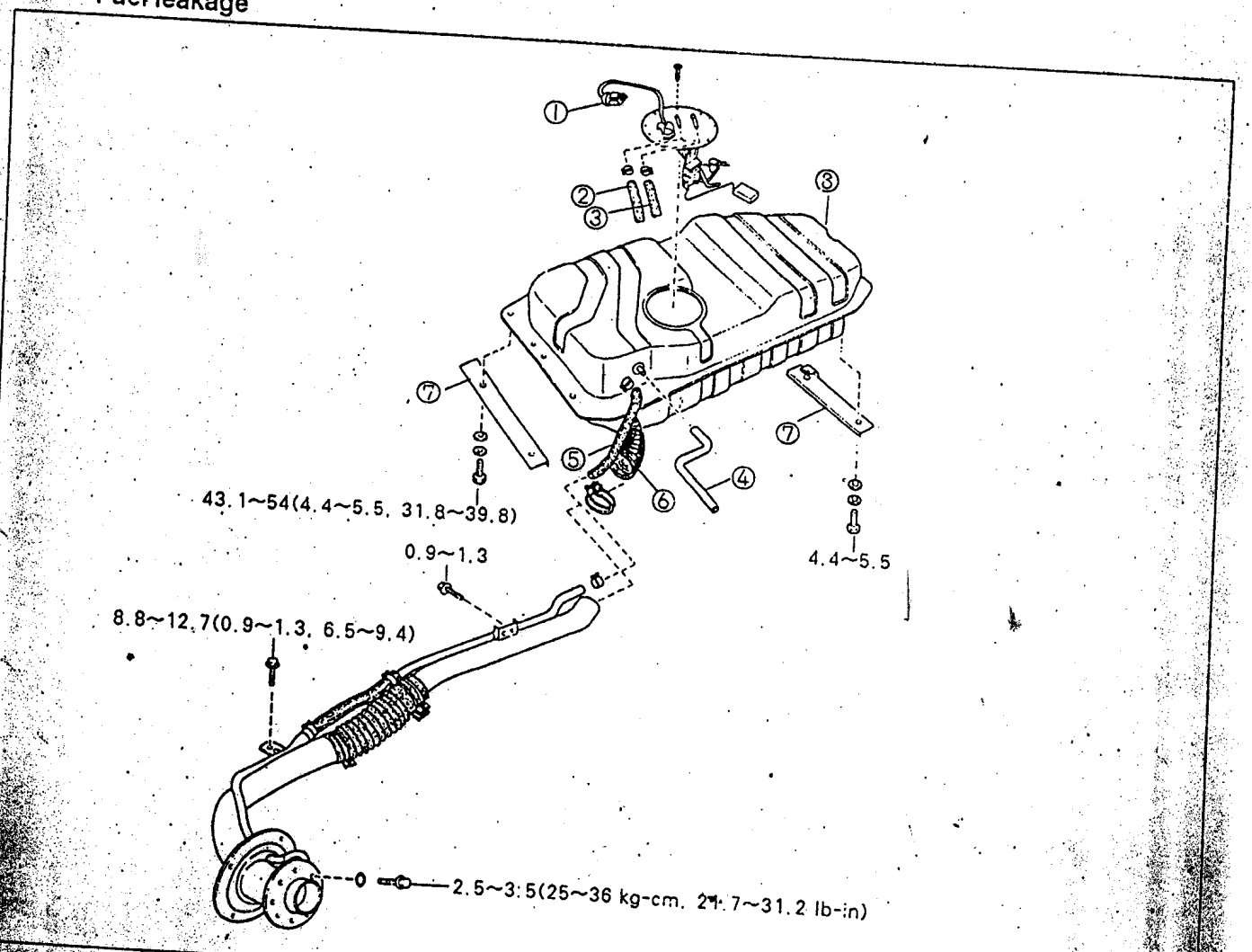
- Check the fuel tank for crack or wear, and repair or replace if necessary.

1. Remove the battery negative cable and the fuel cut solenoid valve connector.
2. Raise the vehicle up by jack and support it with safety stand.
3. Drain fuel by removing the drain plug, remove in the steps shown in the below figure..
4. Install in the reverse order of removal.

Note

Check the following after installation.

- Fuel hose for correct installation.
- Fuel leakage



1. Fuel level gauge connector
2. Return hose
3. Main hose
4. Ventilation hose (built-with check valve)
5. Bleeder hose
6. Joint hose
7. Fuel tank bracket
8. Fuel tank assembly

AN9022002

INSPECTION

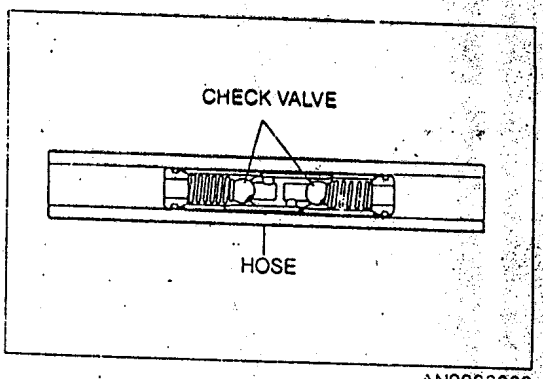
Check Valve (2-Way)

1. Remove the hose from the fuel tank.

Note
- Check any foreign material in hose.

2. Inspect air flow in both direction.
3. If it exceeds the specification, replace the hose assembly.

Warning
- Do not inhale fuel.



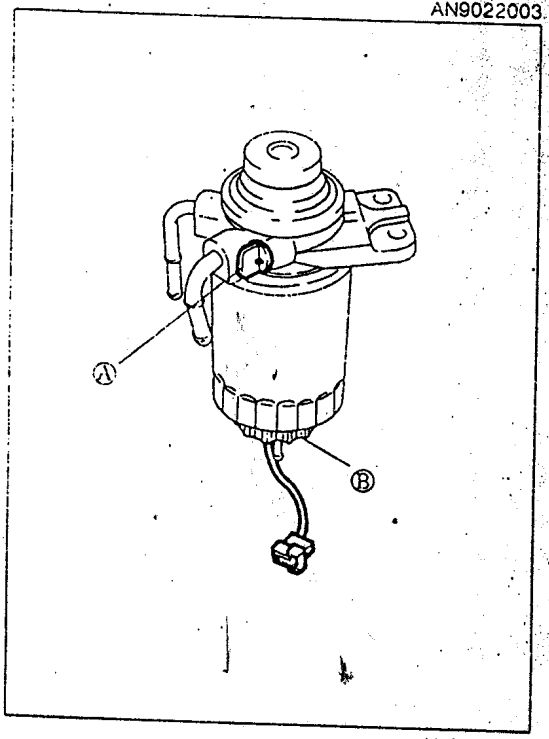
AN9022003

FUEL FILTER (BUILT-WITH SEDIMENTOR)

AIR BLEEDING

Caution
- In case that air is present in the injection system because of lack of fuel during engine operation, or the injection pump is replaced, air bleeding should be performed according to the following procedures, and then start engine and verify if fuel is not leaked.

1. Remove the fuel filter air bleeding plug Ⓐ.
2. Depress and release repeatedly the head of fuel filter until only fuel flows out.
3. Install the air bleeding plug while depressing the head of fuel filter.



AN9022004

DRAINING WATER

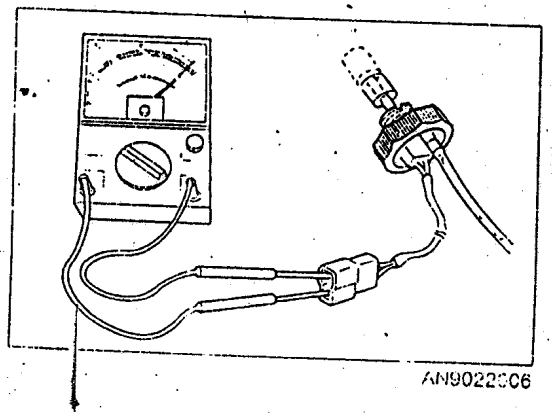
Note
- If the sedimentor warning light is lit, drain the water in the steps as shown below.

1. Remove the drain plug, and then drain the water while depressing and releasing repeatedly the head of fuel filter.
2. After draining the water, do air bleeding for the fuel filter.

DETECTOR

1. Remove the detector from the sedimentor.
2. Do the continuity test and verify that it is closed if the detector is moved upward and opened if downward.

Caution
- After installing the detector, air bleeding should be done.


AN9022006

INJECTION PUMP

IDLE SPEED

Inspection

1. Warm up engine upto the normal operating temperature (coolant temperature 60°C(140°F).
2. Connect a tachometer and check the idle speed.

Idle speed : 700~750 rpm

If the idle speed exceeds the specification, adjust it in the following steps.

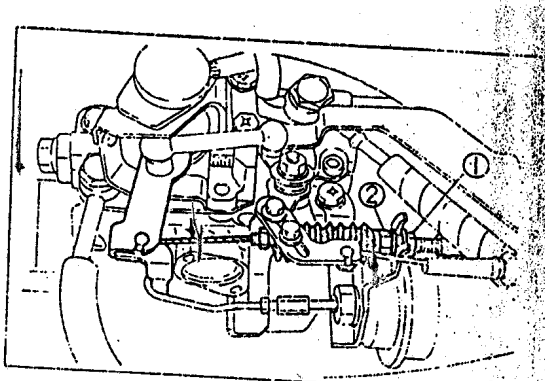
Adjustment

1. Inspect the deflection of accelerator cable.

Deflection : 1~3 mm(0.04~0.12 in)

Note

- **If the deflection exceeds the specification, adjust it while rotating the nut ② after loosening the accelerator cable lock nut ①.**

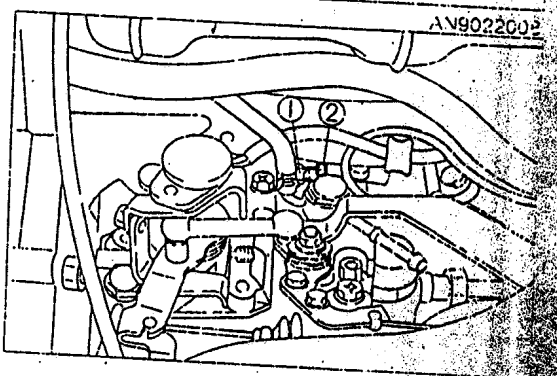


2. After loosening the lock nut ① of idle speed adjusting bolt, adjust idle speed by rotating the adjusting bolt ②.

Tightening torque : 5.9~8.8 N·m(0.6~0.9 kg-m, 4.4~6.5 lb-ft)

Note

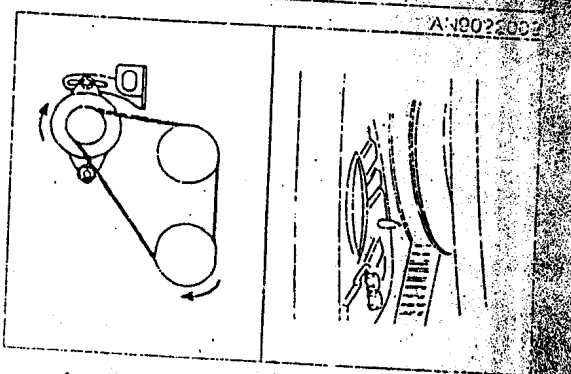
- **The idle speed is increased if turning the adjusting bolt clockwise, and decreased if turning it counterclockwise.**
- **Check if the adjusting lever is properly operated after adjusting (Refer page 20-4).**



INJECTION TIMING

Inspection

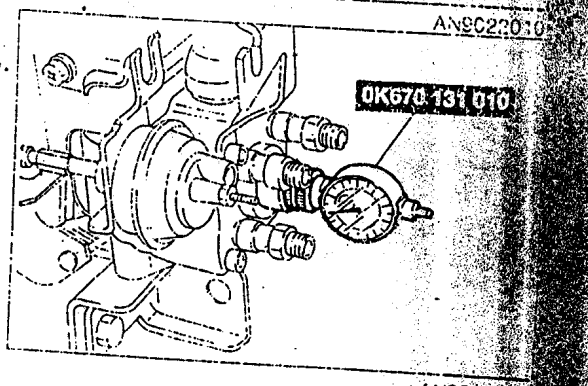
1. Remove the battery negative cable and the fuel cut solenoid valve connector.
2. Remove the intake hose.
3. Remove the fuel injection pipe from the injection pump.
4. Align the timing mark (ATDC 7°) on the crankshaft pulley with the indicator pin by rotating the alternator pulley.



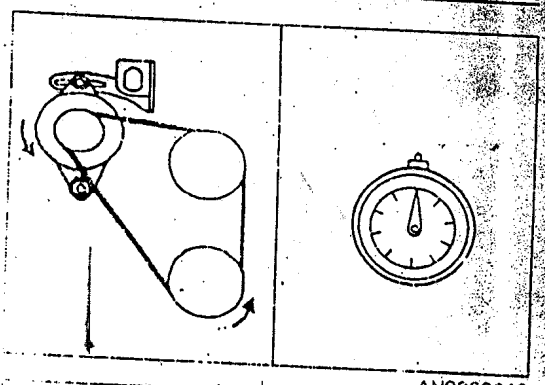
5. Remove the hydraulic head plug on the injection pump.
6. Insert SST (0K670 131 010) into the plug hole on the hydraulic head, and install the dial gauge so that its indicator can touches the plunger of pump.

Note

- **Install so that the indicator of dial gauge indicates about 2~3 mm(0.08~0.12 in).**



7. Slowly rotate the alternator pulley counterclockwise (in the reverse direction of engine revolution) until the indicator of dial gauge does not move.

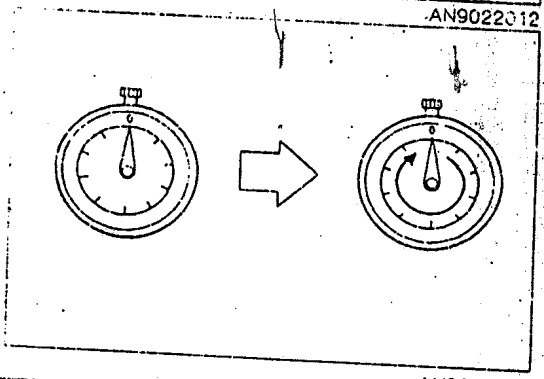

AN9022012

Note
- **The indicator of dial gauge stops when the crankshaft is turned about 30° counterclockwise.**

8. Align the indicator of dial gauge to "0".

Note
- **After aligning the indicator of dial gauge to "0", verify that the indicator of dial gauge is not moved from "0" by slightly rotating the alternator pulley in left and right.**

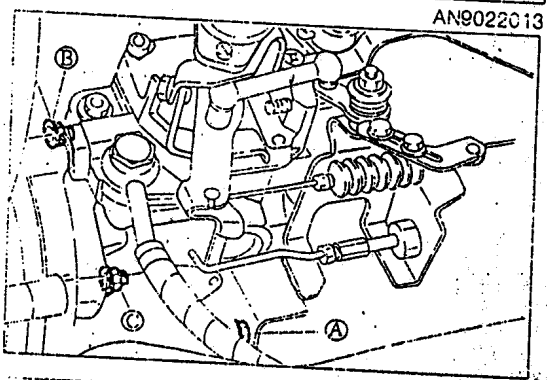
9. After rotating the alternator pulley clockwise (in same direction of engine revolution) so that the timing mark can be aligned with the indicator pin, verify that the indicator of dial gauge indicated 1±0.02 mm(0.04±0.0008 in) when the timing mark (ATDC 7°) can be aligned with the indicator pin.


AN9022013

If the injection timing is beyond specification, adjust it in the following procedures.

Adjustment

1. Loosen the nut (Ⓑ,Ⓒ) after removing the injection pump installation bolt Ⓐ.



AN9022014

2. Adjust the injection timing by moving the injection pump until the cam lift is 1±0.02mm.

Cam lift	Injection timing	Adjustment
Above 1±0.02mm (0.04±0.0008 in)	Advanced	Rotate the injection pump counterclockwise. (in the reverse direction of engine revolution)
Below 1±0.02mm	Retarded	Rotate the injection pump clockwise. (in the direction of engine revolution)

Note
- **Perform the air bleeding after adjusting injection timing.**

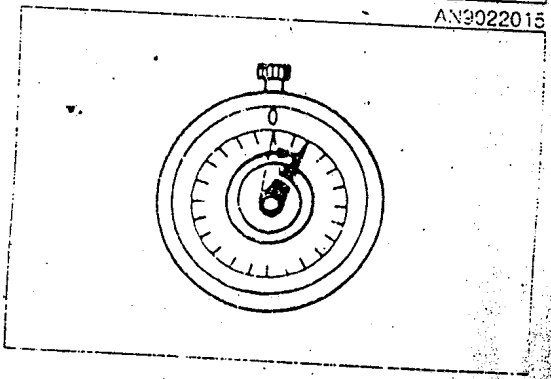
CAM LIFT

Inspection

1. Perform the injection pump adjusting procedures.
2. Rotate the alternator pulley clockwise (in the same direction of engine revolution) and read the maximum indicating of dial gauge indicator.

Cam lift : 2.6 mm(0.102 in)

Note
- **If the cam lift is smaller than specification, there is problem in the cam disc or roller assembly.**

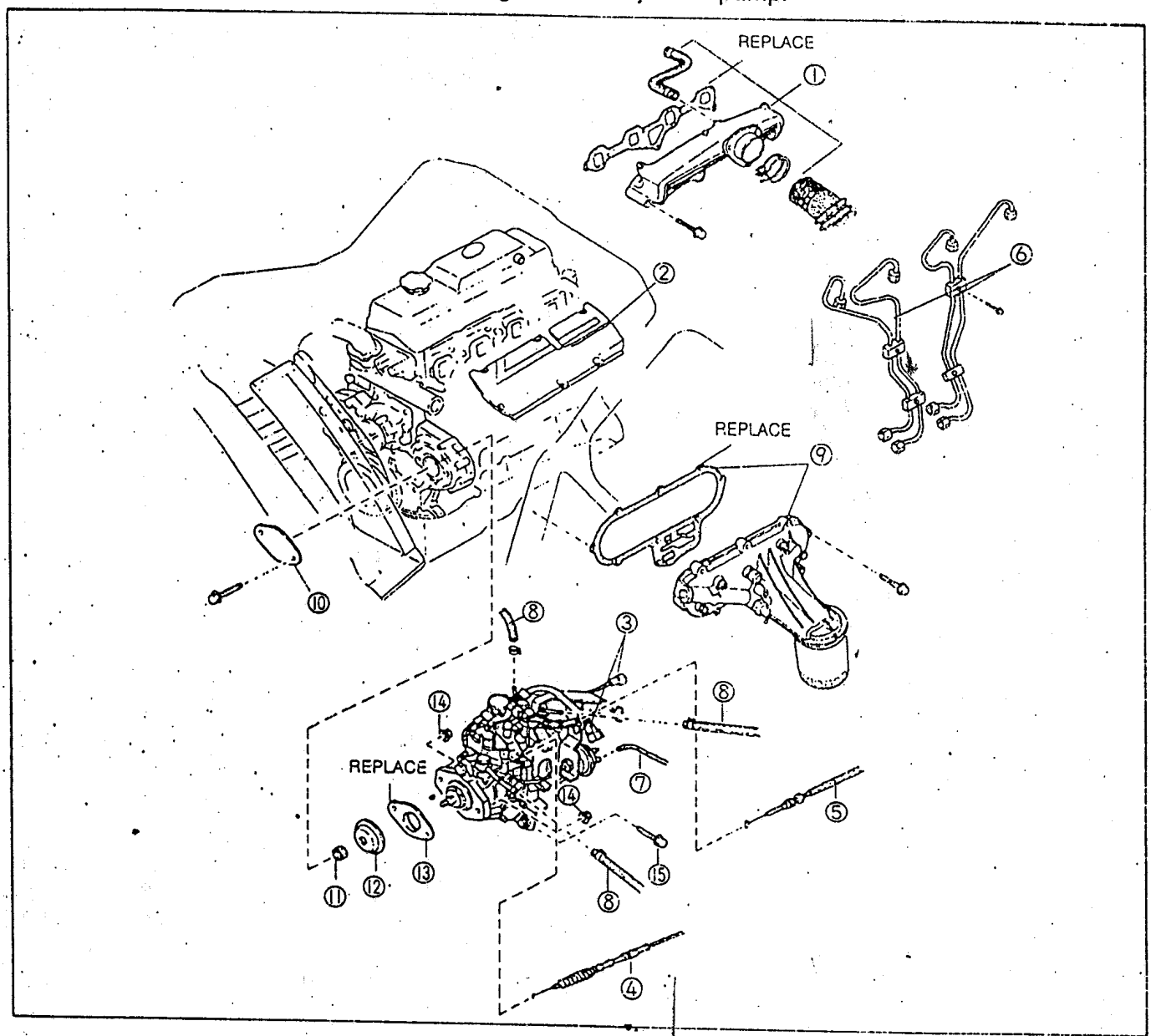

AN9022016

REMOVAL / INSTALLATION

1. Remove the battery negative cable.
2. Remove the service cover (Refer to Section 10).
3. Remove in the steps shown in the figure, referring to notes for removal.
4. Inspect all parts, and repair or replace if necessary.
5. Install in the reverse order of removal.

Caution

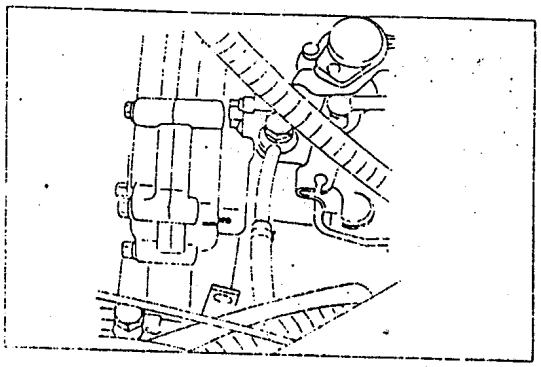
- **Check the injection timing, and adjust it if necessary (refer to page 22-7).**
- **After installation, perform air bleeding from the injection pump.**



1. PCV hose and intake manifold assembly
2. Nozzle cover
3. Fuel cut valve, pick up coil and throttle position sensor (ATX only) connector
4. Accelerator cable
5. Throttle cable (ATX only)
6. Injection pipe
7. Vacuum hose
8. Fuel hose
9. Oil filter assembly
10. Injection pump cover
11. Nut
12. Washer
13. Gasket
14. Nut
15. Bolt

Removal note

1. Mark matching line between the injection pump flange and bracket.

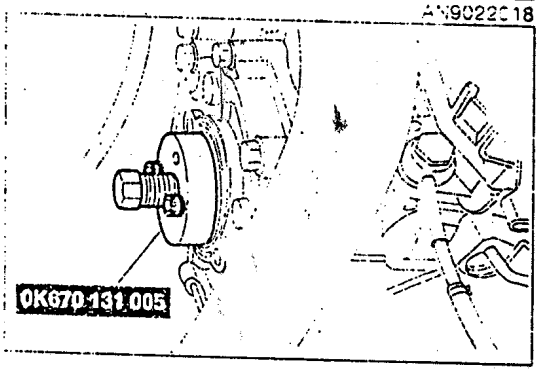


AN9022018

2. Remove the injection pump lock nut by using SST (0K670 131 005).

Caution

- Be careful for damage to the woodrufkey attached to the pump.

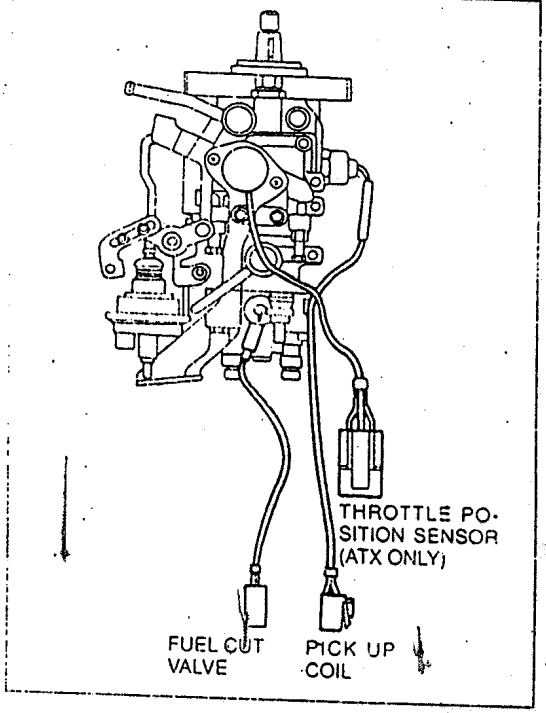


AN9022019

FUEL CUT VALVE

INSPECTION

1. Verify that engine stops when disconnecting the fuel cut valve connector during engine operation. If engine does not stop, inspect all related wiring harness, and replace the fuel cut valve if it is normal.



AN9022021

PICKUP COIL

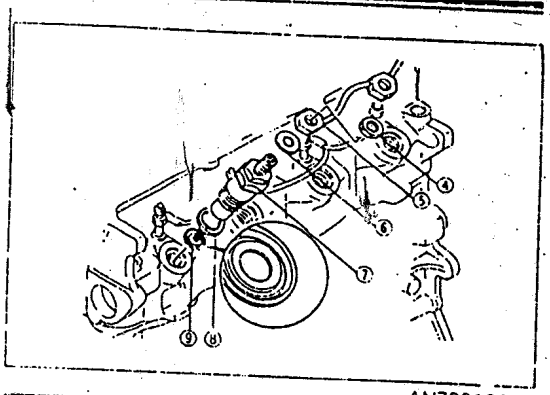
INSPECTION

1. Remove the pick up coil connector.
2. Do continuity test by using a ohmmeter.
3. Replace the pick up coil if its circuit is opened.

FUEL INJECTION NOZZLE

REMOVAL

1. Remove in the following steps.
   ① Battery negative cable
   ② Fuel cut valve connector assembly
   ③ Fuel injection pipe
   ④ Fuel return pipe lock nut
   ⑤ Fuel return pipe
   ⑥ Washer
   ⑦ Fuel injection nozzle
   ⑧ Nozzle washer
   ⑨ Corrugate washer



AN7021C031

INSPECTION

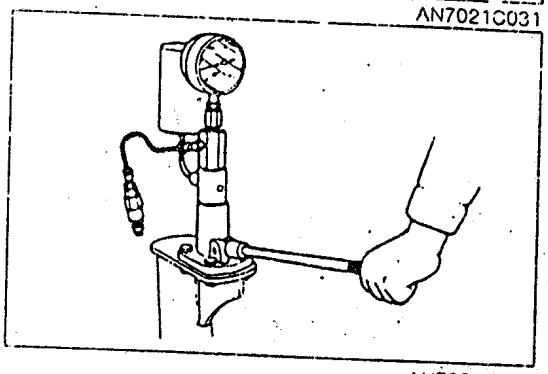
Note

- **Inspect the fuel injection nozzle by using diesel fuel at about 20°C(68°F)**

Injection Starting Pressure

1. Set the injection nozzle on the nozzle tester and bleed air by pumping handle several times.
2. Slowly push down the handle of nozzle tester and check injection starting pressure.

Injection starting pressure :
13230 kpa(135 kg/cm², 1918 psi)

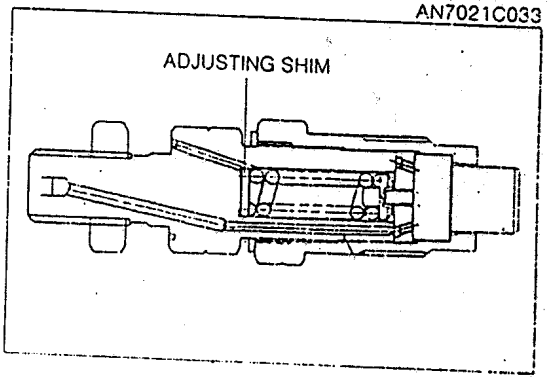


AN7021C033

3. If injection starting pressure is beyond the specification, adjust by using shim.

Note

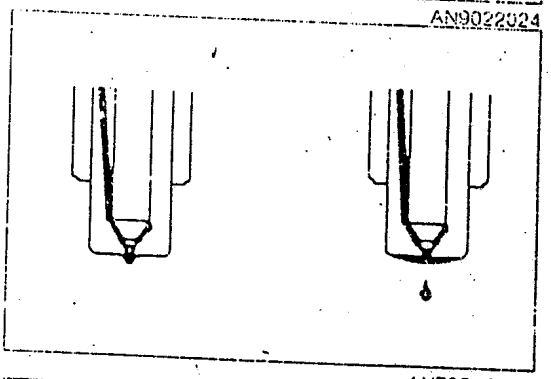
- **Shim type : from 0.50mm (0.02 in) to 1.54mm (0.06 in) (27 types in total at interval of 0.04mm(0.0016 in))**
- **If thickness is increased 0.04mm, injection pressure increases approximately 470 kpa. (4.8 kg/cm², 68 psi)**



Valve Seat

1. Apply a certain pressure 11270 kpa(115 kg/cm², 1634 psi)) and check if fuel leaks from the injection nozzle hole. If fuel leaks, disassemble, clean and check injection nozzle again, or replace it.

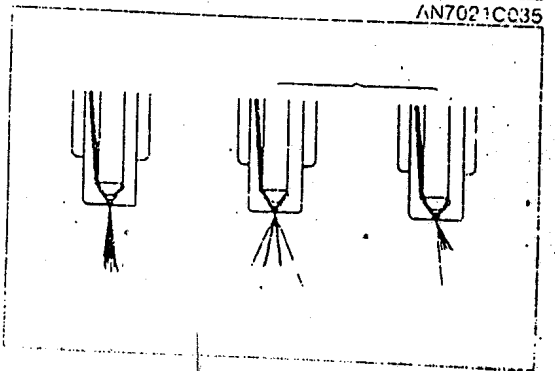
AN9022024



Atomizing Condition (Spray pattern)

1. Set the nozzle on the nozzle tester and bleed air by pumping handle several times.
2. In condition that pressure is not applied to nozzle, push handle several times quickly (push handle as quickly as possible so that a pulsation noise can be heard) and check atomizing condition.
   (1) Fuel should be sprayed uniformly and finely.
   (2) Injection angle and direction should be normal.
3. If atomizing condition is abnormal, disassemble, clean and check injection nozzle again, or replace it.

AN7021C035

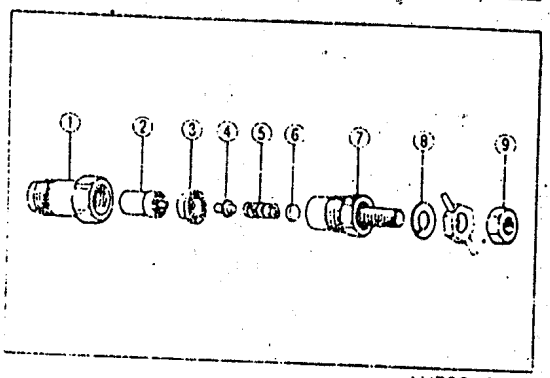


AN7021C036

NOZZLE BODY AND NEEDLE VALVE

Disassembly

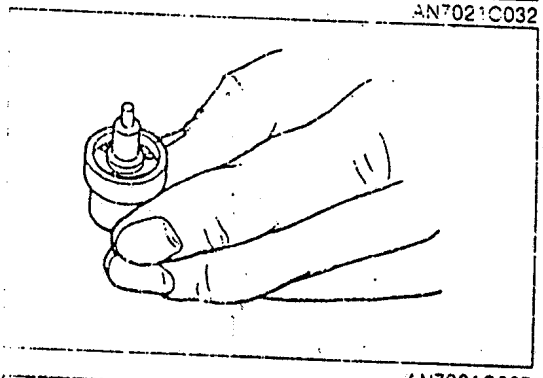
1. Disassemble in the following steps.
   - ① Retaining ring
   - ② Nozzle body and needle valve
   - ③ Distance piece
   - ④ Pressure pin
   - ⑤ Pressure spring
   - ⑥ Shim
   - ⑦ Nozzle holder
   - ⑧ Washer
   - ⑨ Nut



AN7021C032

Inspection

1. Check the valve seat and other parts of needle valve for damage.
2. Check the nozzle body for damage. Grasp the nozzle body vertically and insert about 2/3 of needle valve, then verify that the needle valve falls down to seat by its weight.



AN7021C037

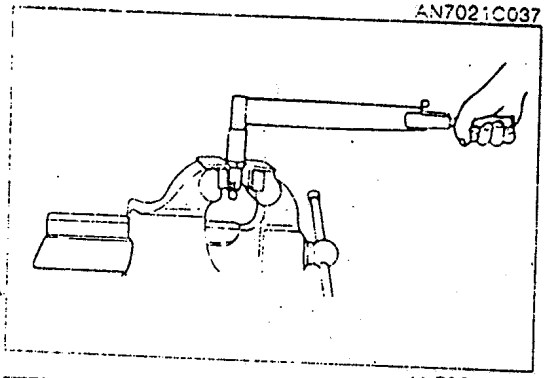
Assembly

When assembling the injection nozzle, be careful for the following.

Tightening torque : 29 N·m(3~5 kg-m, 49 lb-ft)

Caution

- After assembling the injection nozzle, inspect the injection starting pressure and atomizing condition.
- Keep the specified torque when assembling the nozzle body and nozzle holder.



AN7021C038

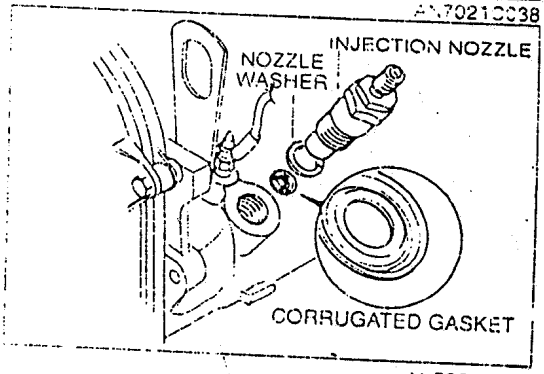
Installation

1. Install in the reverse order of removal.

Caution

- Do not reuse the washer and the corrugated gasket.
- When installing the corrugated gasket, the red-painted surface should be faced to the injection nozzle.
- Keep the specified torque when installing the injection nozzle.
- Bleed air when installing the injection nozzle.

Tightening torque : 5.9 N·m(6~7 kg-m, 69 lb-ft)

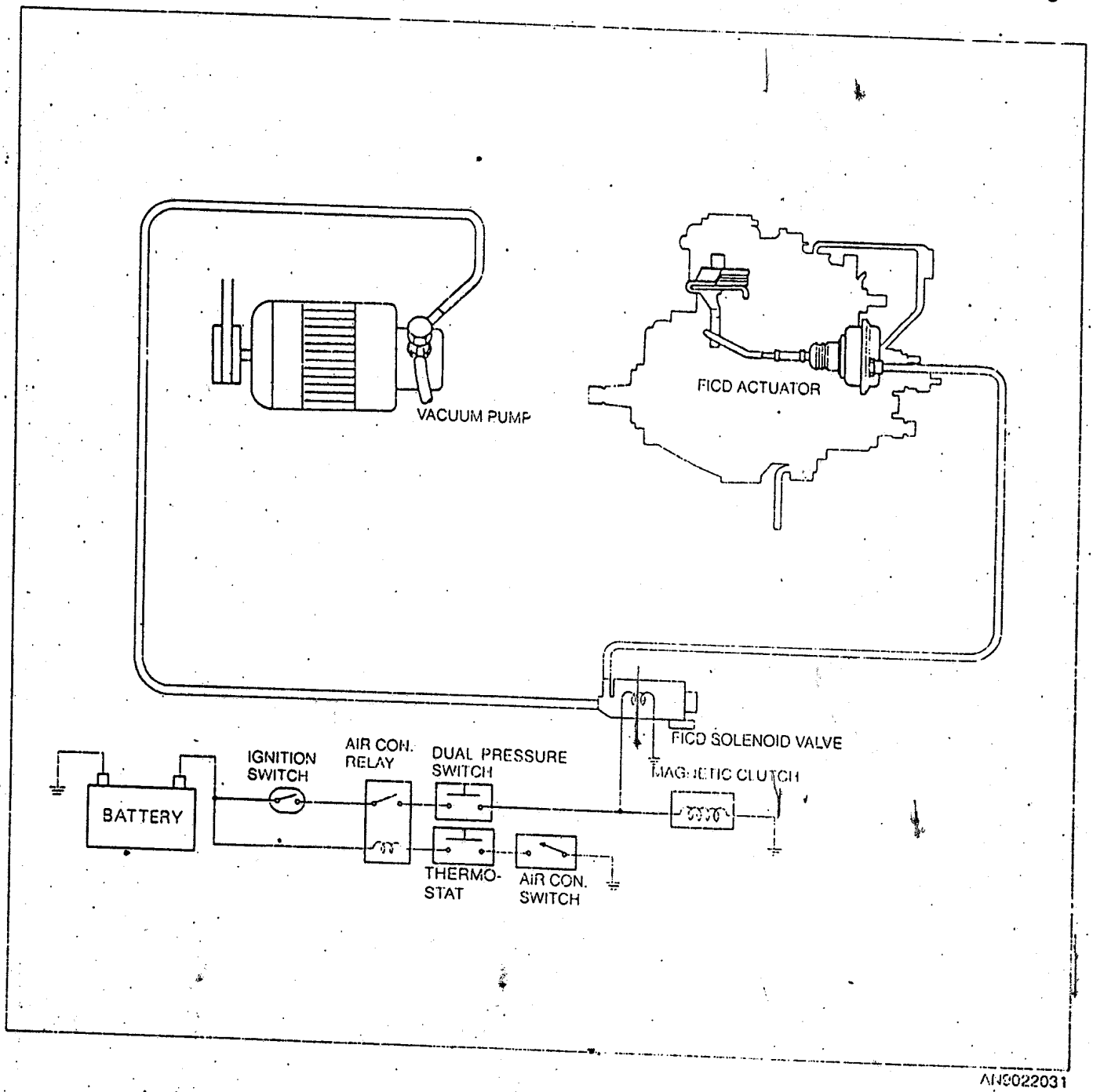


AN7021C039

FAST IDLE CONTROL DEVICE (FICD)

OUTLINE

Vacuum from the vacuum pump is applied to the actuator by the solenoid valve (3-way) when air conditioner is turned on, then pulls the control lever and idle speed increases so that it can be compensated according to operation of air conditioner.

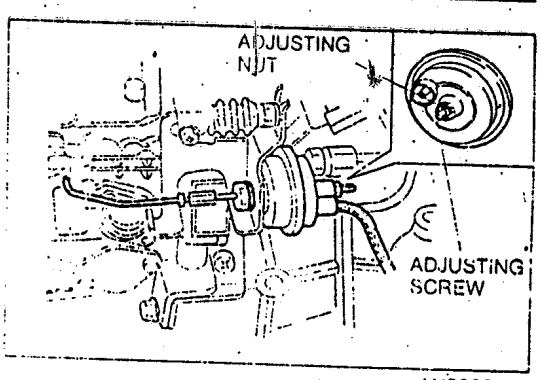


AN3022031

INSPECTION

1. Warm up the engine upto the normal operating temperature (coolant temperature 60°C(140°F)).
2. After turning the air conditioner on (air con. switch ON and blower switch ON), check the idle speed.

   Idle speed : 850~900 rpm



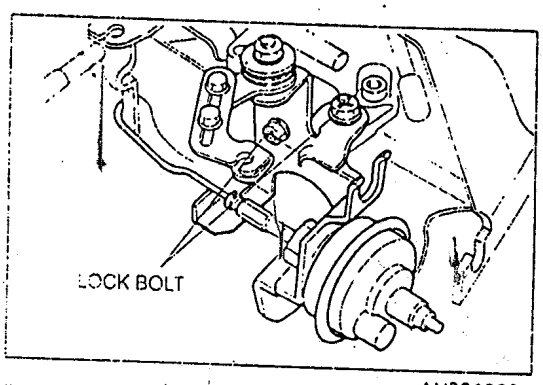
AN9022032

ADJUSTMENT

1. If idle speed is beyond the specification, loosen the actuator adjusting nut and adjust it by turning adjusting screw.

   Note
   Counterclockwise : Engine speed increases
   Clockwise : Engine speed decreases

2. If adjustment is impossible, loosen the actuator lock bolt and adjust engine speed again by moving the actuator body.

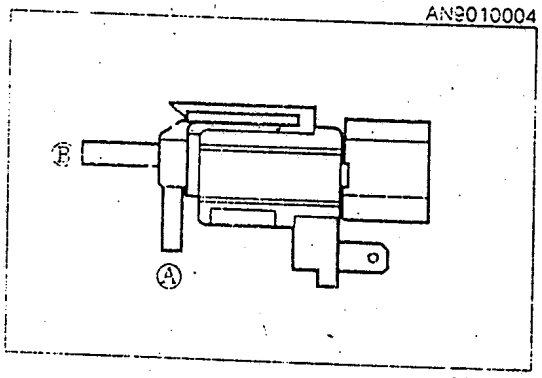


AN9010004

FICD SOLENOID VALVE

Inspection

1. After turning the air conditioner on, check if air flows from hose Ⓐ to Ⓑ.
2. After turning the air conditioner off, check if air does not flow from hose Ⓐ to Ⓑ.

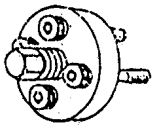
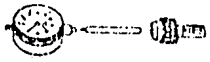


AN9022034

SPECIFICATION

Items		Specification
Fuel tank	Capacity ℓ (qt)	65±1(68.7±1.06)
Injection pump	Type	Distribution type (VE)
	Injection timing	ATDC 7° (Cam lift 1mm)
	Cam lift mm(in)	2.6(1.02)
	Rotating direction	Counterclockwise
	Governor type	Half all speed
	Driving method	Gear type
Idle speed rpm		700~750
Idle up speed rpm		850~900
Fuel filter (built-with sedimentor)		Cartridge type (with detector attached)
PCV device	Type	Closed
Fuel injection nozzle	Nozzle type	Throttle type
	Orifice diameter X number mm(in)	1.0×1(0.04×1)
	Injection starting pressure kpa(kg/cm², psi)	13230(135, 1918)

SPECIAL TOOLS

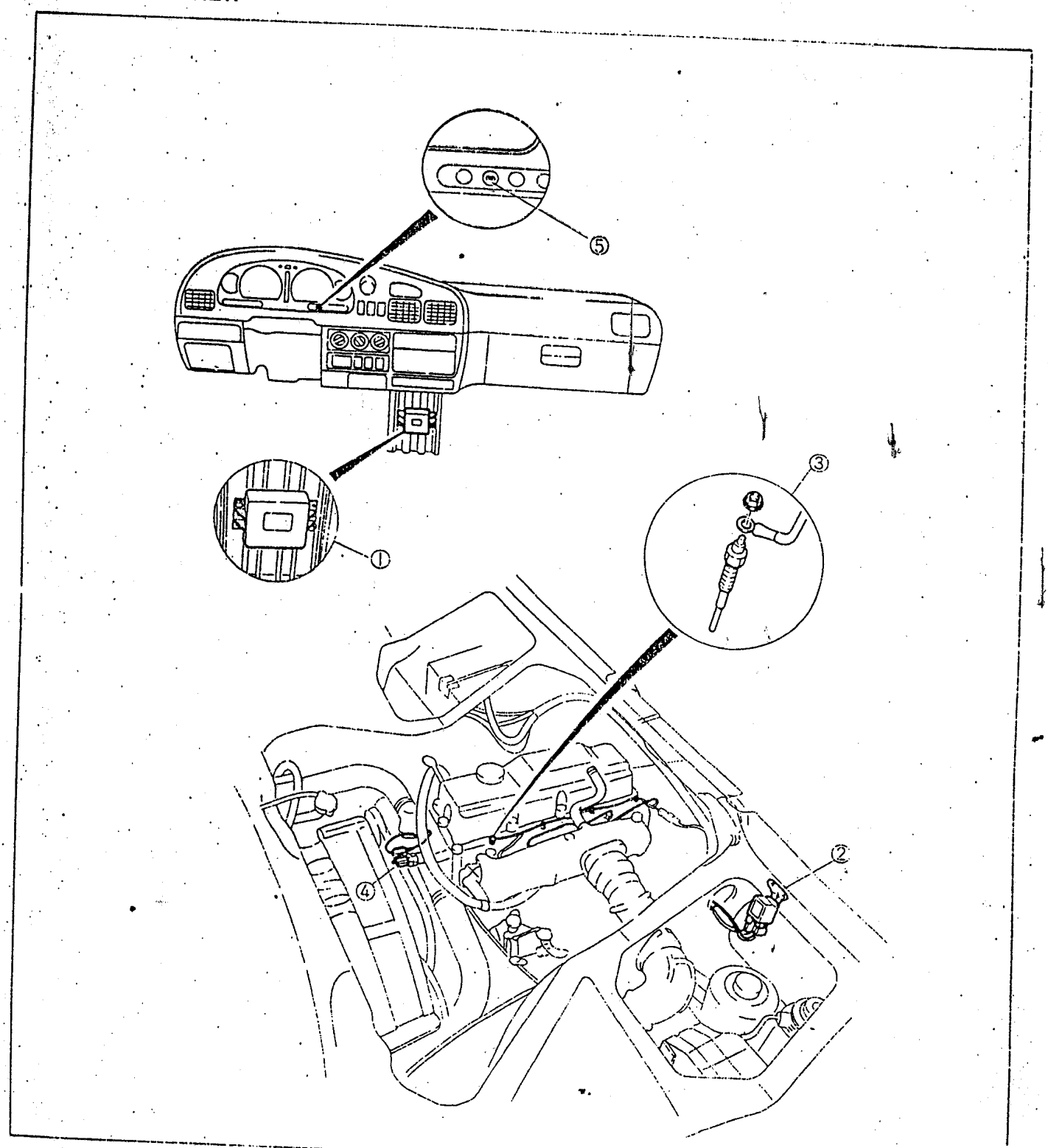
0K670 131 005 Extractor 	For removing injection pump	0K670 131 010 Cam lift measuring device 	For measuring cam lift

STARTING SYSTEM (J2 ENGINE)

31A

OUTLINE

STRUCTURAL VIEW



1. QSS control unit
2. Glow plug relay
3. Glow plug
4. Thermo switch
5. Glow indicator

AN9031001

STARTER

TROUBLESHOOTING GUIDE

Problem	Possible causes	Action
No engine cranking	Insufficient battery charging Loosed, corroded or worn battery cable Malfunction of inhibitor switch (ATX only) Malfunction of fuse and wiring Malfunction of starter Malfunction of ignition switch	After checking specific Repair or Replace Adjust or Repair Repair or Replace Repair or Replace Repair or Replace
Starter rotates slowly	Insufficient battery charging Loosed, corroded or worn battery cable Malfunction of starter	After checking specific Repair or Replace Repair or Replace
Starter rotates continuously	Malfunction of magnetic switch Malfunction of ignition switch Shorted wiring	Repair or Replace Repair or Replace Repair
Starter spins - No engine cranking	Worn pinion gear or starter malfunction Worn ring gear	Repair or Replace Replace

ON-VEHICLE MAINTENANCE

Pull-in Voltage

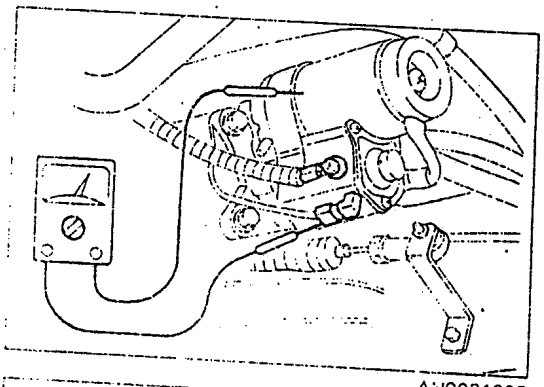
1. Inspect the battery voltage.

   Voltage : above 12.4V

2. After starting the engine, check if the starter rotates smoothly.
3. If the starter does not rotate, check the "S" terminal voltage during cranking engine.

   Voltage : above 8V

   - Above 8V : Inspect the starter.
   - Below 8V : Inspect wiring (main fuse, ignition switch and inhibitor switch (ATX only)).



AN9031005

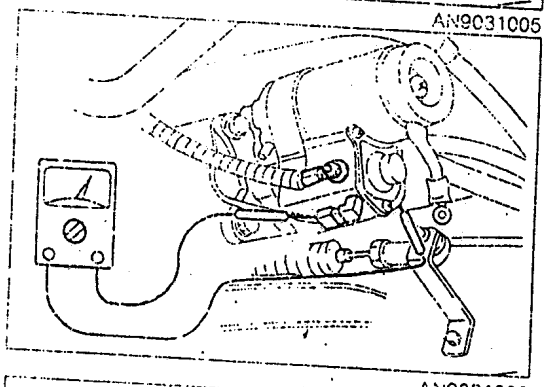
MAGNETIC SWITCH

Pull-in Coil

Note

- Remove the battery negative cable.
- Remove the "M" terminal of starting motor.

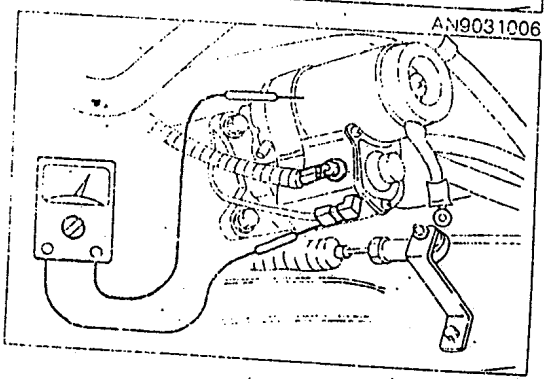
1. Do the continuity test between "S" and "M" terminal.
2. If it is opened, replace the magnetic switch.



AN9031006

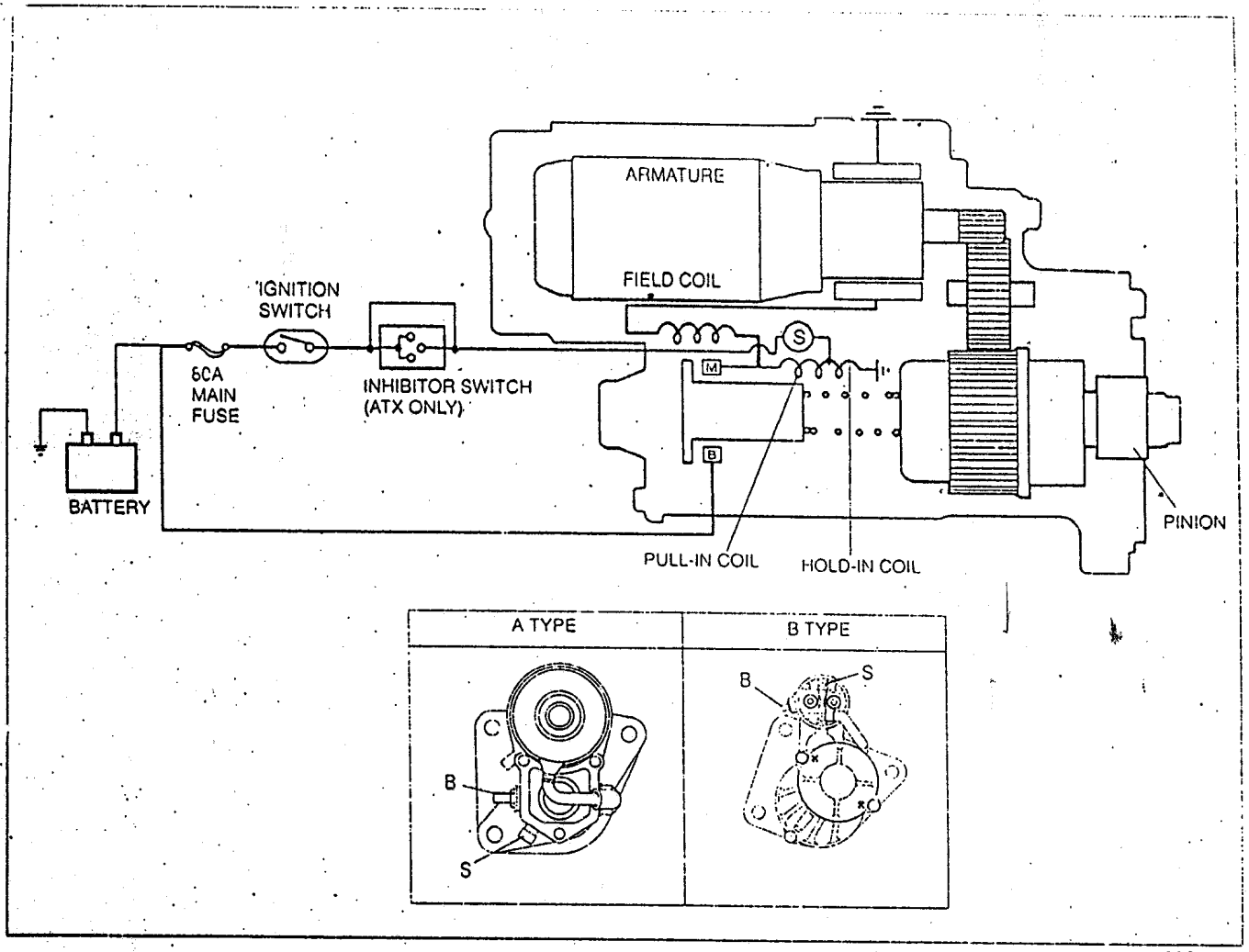
Hold-in Coil

1. Do the continuity test between "S" and switch body.
2. If it is opened, replace the magnetic switch.



AN9031007

WIRING DIAGRAM



AN9031002

INSPECTION

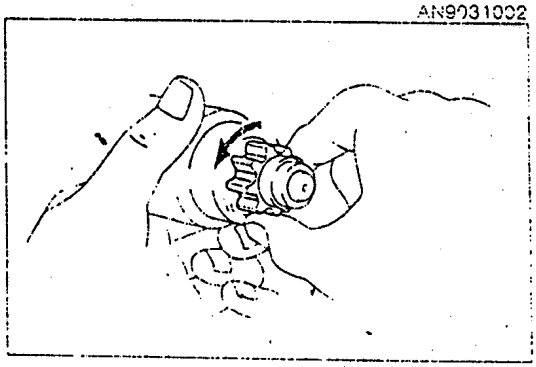
Clutch and Gear

1. Check the condition of the pinion gear, idle gear and clutch assembly, and replace if it is damaged.

Note
- **If any damage is found, check the ring gear in flywheel side for wear or damage.**

2. Check the rotating condition of the pinion gear, and replace the clutch assembly if necessary.

Note
- **Clockwise : fixed**
- **Counterclockwise : rotate**

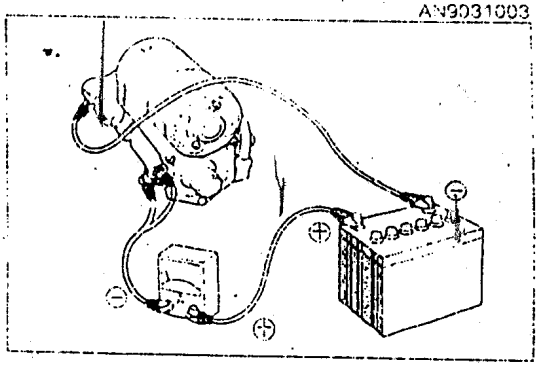


AN9031003

No-Load Test

1. Connect the battery and ammeter to the starter as shown in the figure.
2. When the pinion is projected, check if the starter is rotated smoothly and finely.
3. Verify the specified current with the ammeter.

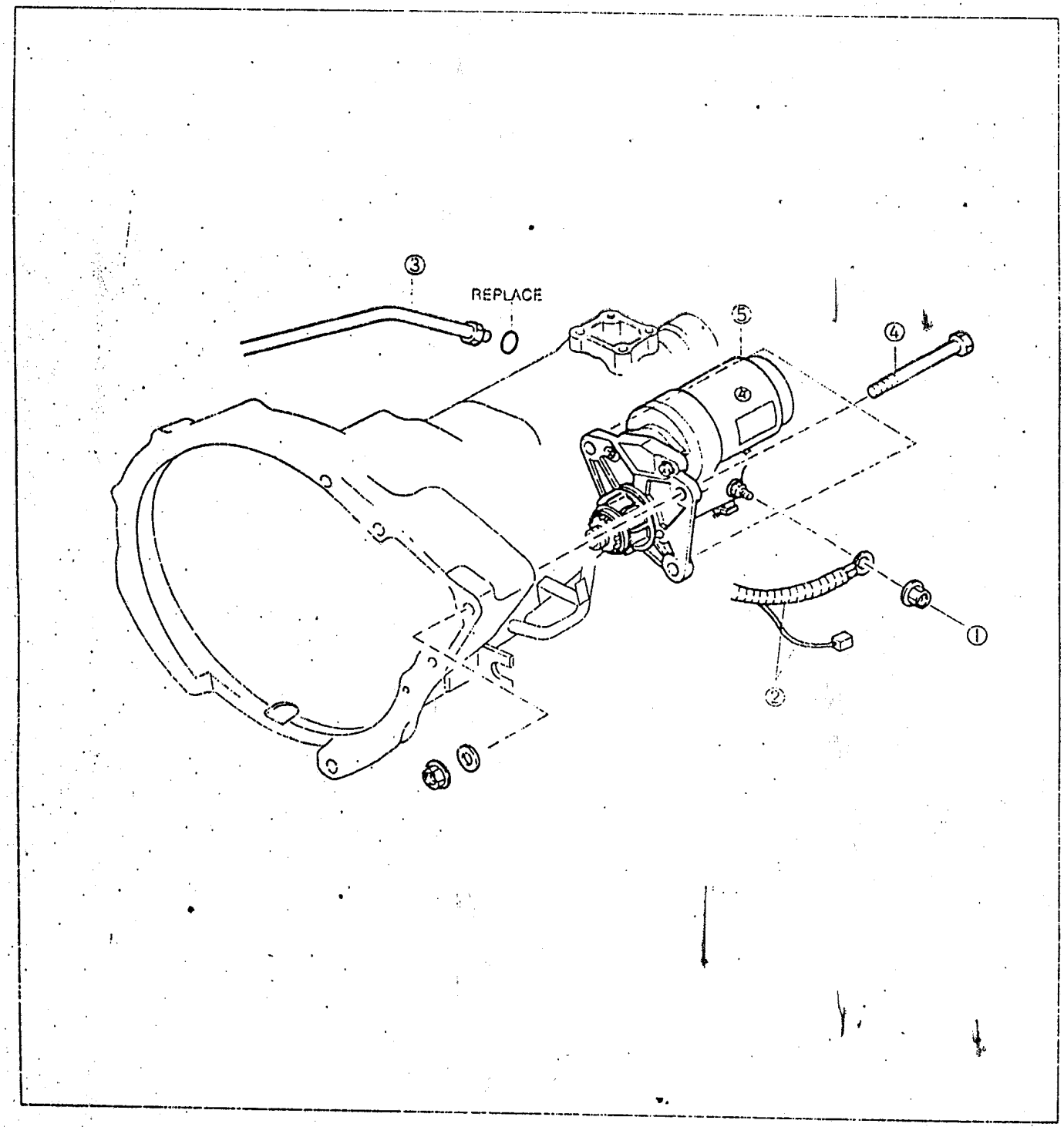
Current : Maximum 130A (at 11.0V)



AN9031004

REMOVAL / INSTALLATION

1. Remove the battery negative cable.
2. Remove in the steps as shown in the figure.
3. Install in the reverse order of removal.



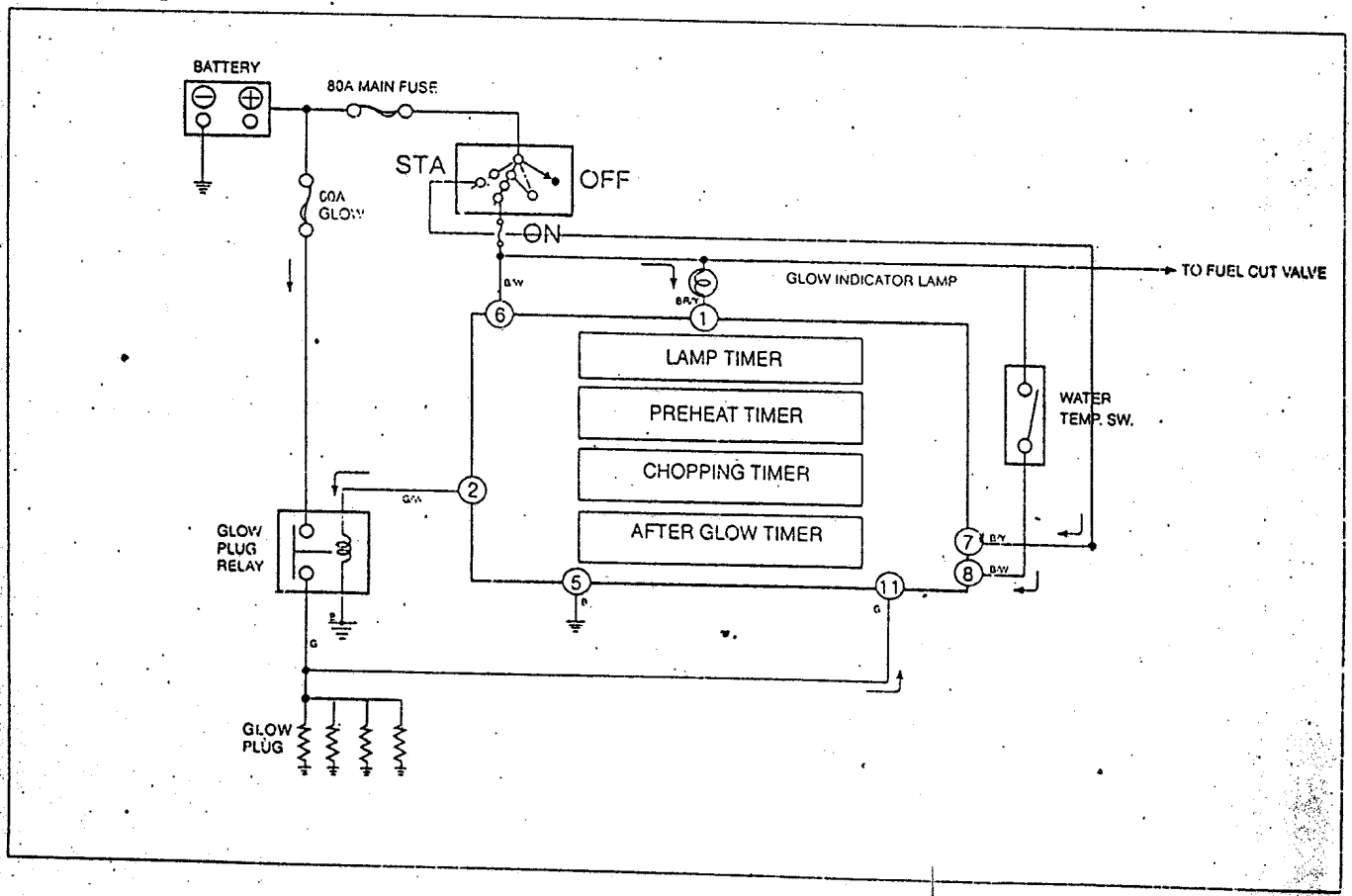
1. Nut
2. Connector ("S" and "B" terminal)
3. Filler gauge
4. Bolt
5. Starter

QUICK START SYSTEM (QSS)

TROUBLESHOOTING GUIDE

Problem	Possible causes	Action
Glow plug relay does not closes	Malfunction glow plug relay	Replace
	Malfunction control unit internal circuit	Replace
	Poor connection or open circuit between control unit No. 2 terminal and wiring	Repair
	Open or short circuit of starter (open circuit .Repair at control unit No. 7 terminal)	Repair
	Poor connection or open circuit between glow plug relay terminal and wiring	Repair
	Malfunction glow plug	Replace
Glow plug relay does not opens	Malfunction glow plug relay	Replace
	Failure of control unit internal circuit	Replace
Glow plug relay does not turns on and off	Poor connection for ignition switch	Repair or Replace
	Poor connection or open circuit of wiring for starter	Repair
	Failure of control unit internal circuit	Replace
Glow plug relay does not turns on and off for 15 seconds after turning ignition switch on	Failure of water thermo switch	Replace
	Failure of control unit internal circuit	Replace
	Failure of glow plug relay	Replace
	Poor connection or open circuit between control unit No. 8 terminal and water thermo switch	Repair

Circuit Diagram



AN9031009

OPERATING PATTERNS

1. Preheat timer
   - Operating condition ; ignition switch ON
   - Turns the glow relay on for 6~7 seconds in order to heat the glow plug quickly.

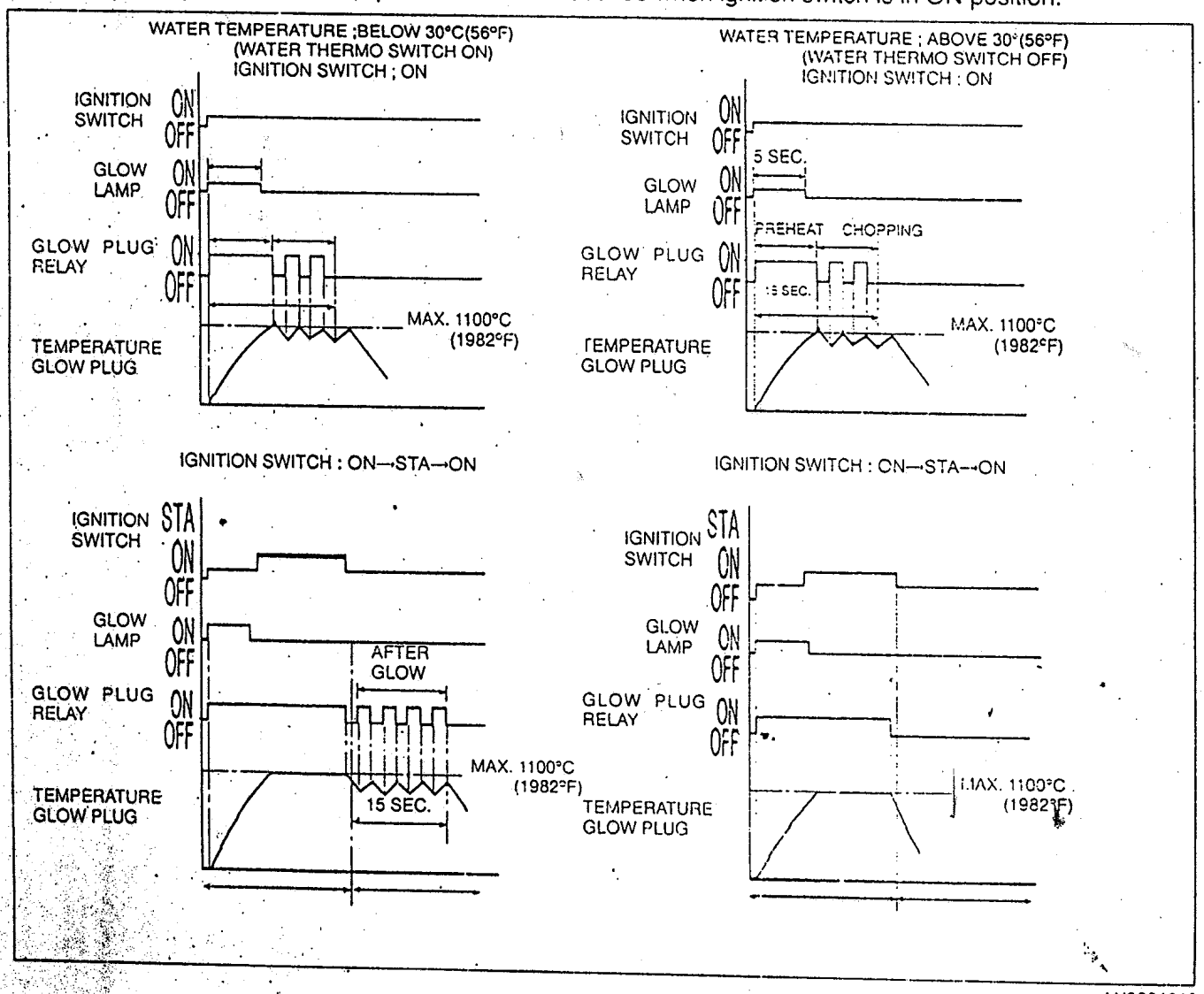
2. Chopping timer
   - Operating condition ; ignition switch ON
   - Keeps the heating temperature of glow plug through the preheat timer by turning the glow relay on and off..

   - Operating condition ; ignition switch ON → STA
   - Keeps the heating temperature of glow plug through the preheat timer while ignition switch is in STA position.

3. After glow timer
   - Operating condition ; ignition switch ON → STA → ON (when water temperature is below 30°C(56°F).
   - Turns the glow relay on and off for about 15 seconds in order to improve idle stability after starting and reduce white smoke when engine is cold.

   Note
   - **Turning the glow relay on and off can be verified by operation noise.**

4. Lamp timer
   - Turns the glow indicator lamp on for about 5 seconds when ignition switch is in ON position.



AN9031010

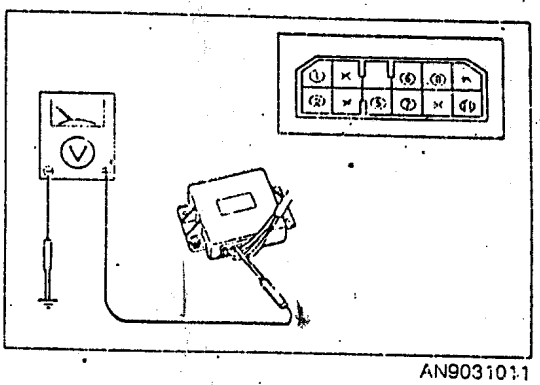
CONTROL UNIT

Inspection

1. Connect a voltmeter to the control unit as shown in the figure.
2. Referring to the following specification, inspect each terminal voltage, and replace the control unit if necessary

Note

- **If each terminal voltage is beyond specification, inspect the control unit after checking the connection condition at all wiring.**



AN9031011

Terminal Voltages

Terminal	Input	Output	Connected to	Operating Condition		Voltage	Remarks
1		o	Glow plug lamp (in meter set)	Ignition switch ON	For 5 sec	About 0V	
					After 5 sec	About 12V	
2		o	Glow plug relay	Ignition switch ON (without starting)	For 7 sec	About 12V	
					After 7 sec	About 0-12V (Glow relay on/off repeatedly)	
5	—	—	Ground	—		About 0V	
6	o		Ignition switch (ON)	Ignition switch ON		About 12V	
7	o		Ignition switch (START)	Ignition switch START		About 12V	
8	o		Water thermo switch	Ignition switch ON (without starting)		About 12V	Water temp. ; below 30°C
						About 0V	Water temp. ; above 30°C
11	o		Glow plug	Ignition switch START		About 12V	Water temp. ; below 30°C (56°F)
				For 15 sec. after starting		About 0-12V (Glow relay on/off repeatedly)	
				after 15 sec		About 0V	
				after starting		About 0V	Water temp. ; above 30°C

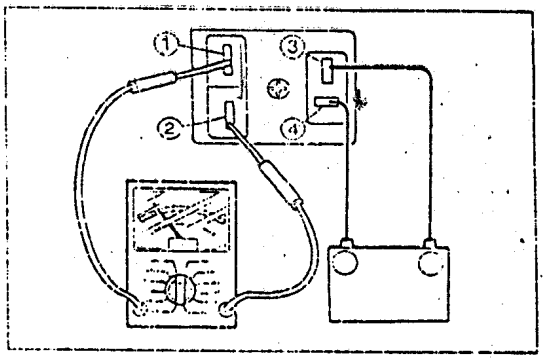
GLOW PLUG RELAY

Inspection

1. Measure the coil resistance (③~④ terminal) of the glow plug relay by ohmmeter.

   Resistance : About 13Ω

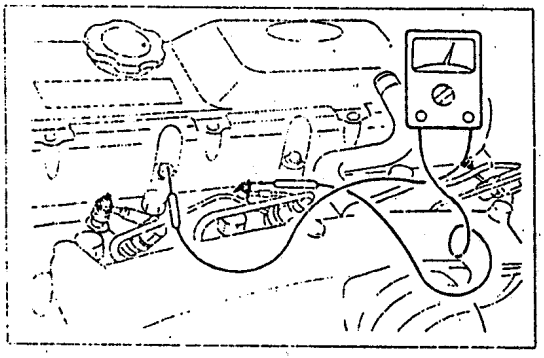
2. Check if ①~② terminal is opened.
3. Apply the battery voltage to ③~④ terminal, Check if ①~② terminal is closed. If not, replace it.



GLOW PLUG

Inspection

1. Do the continuity test with ohmmeter between the (+) terminal of glow plug and the cylinder head.
2. If it is opened, replace the glow plug.



REMOVAL / INSTALLATION

Remove in the following steps.

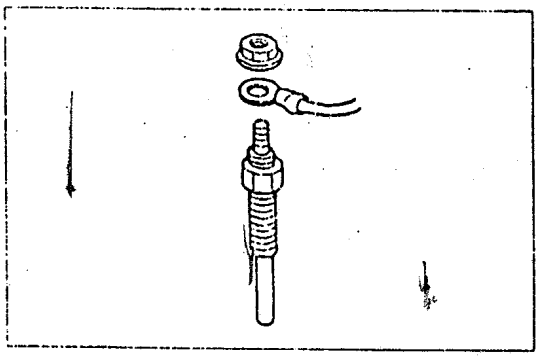
1. Glow plug connector tightening nut
2. Glow plug connector
3. Glow plug

Install is in the reverse order of removal.

Tightening torque : 15~20 N·m(1.5~2.0 kg-m, 11~15 lb-ft)

Note

- **Be sure to use the same type of glow plug. The assembling mark of glow plug is red.**

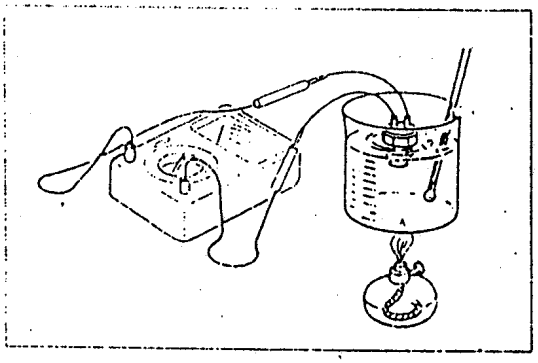


WATER THERMO SWITCH

Inspection

1. Check if the water thermo switch is closed at specified temperature, and replace if necessary.

   Specified temperature : below 30°C(56°F)



SPECIFICATION

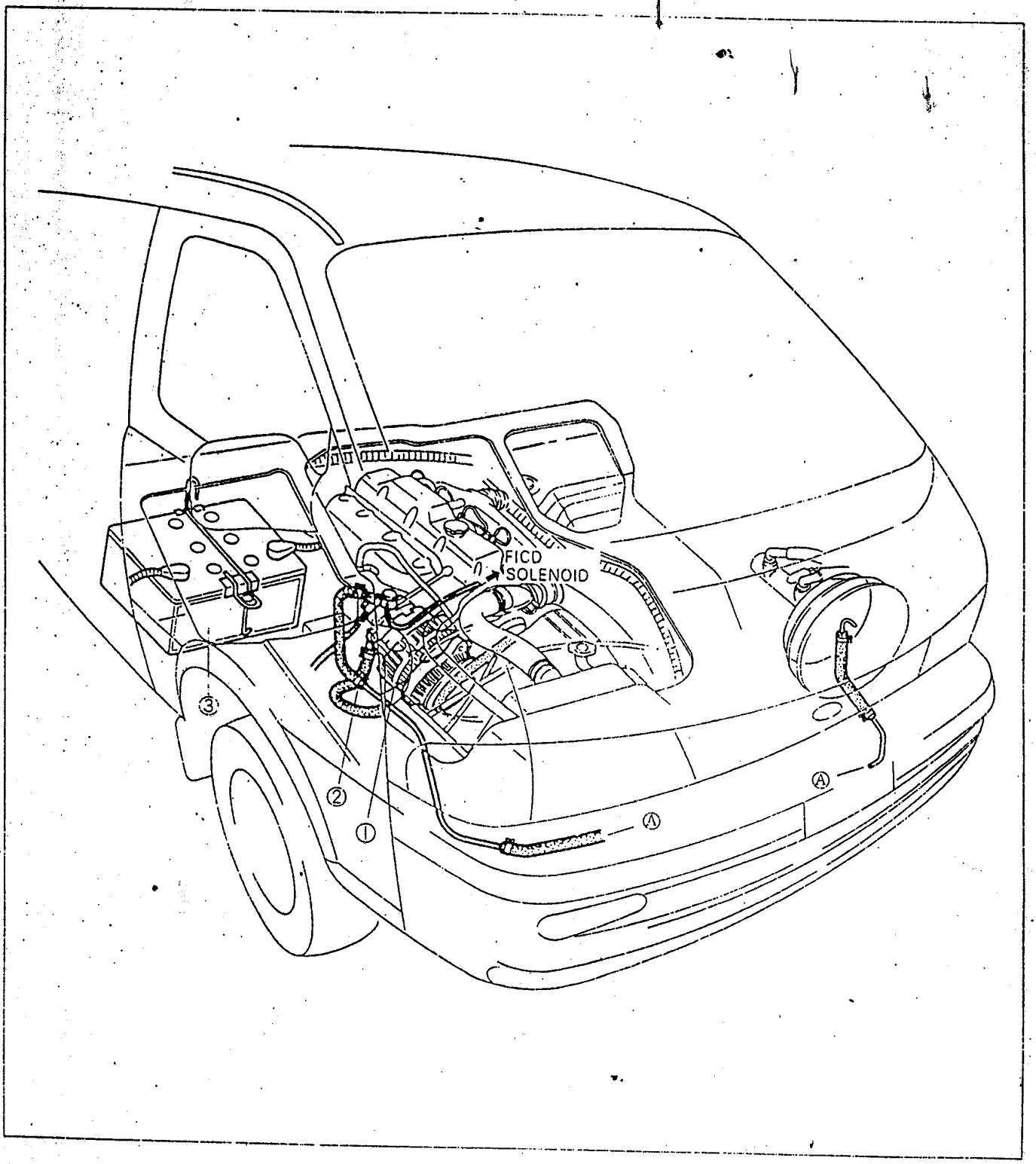
Items			Specification
Starter	Type		Electro-Magnetic engaged
	Voltage	V	12
	Output	Kw	2.2

CHARGING SYSTEM (J2 ENGINE)

32A

OUTLINE

STRUCTURAL VIEW



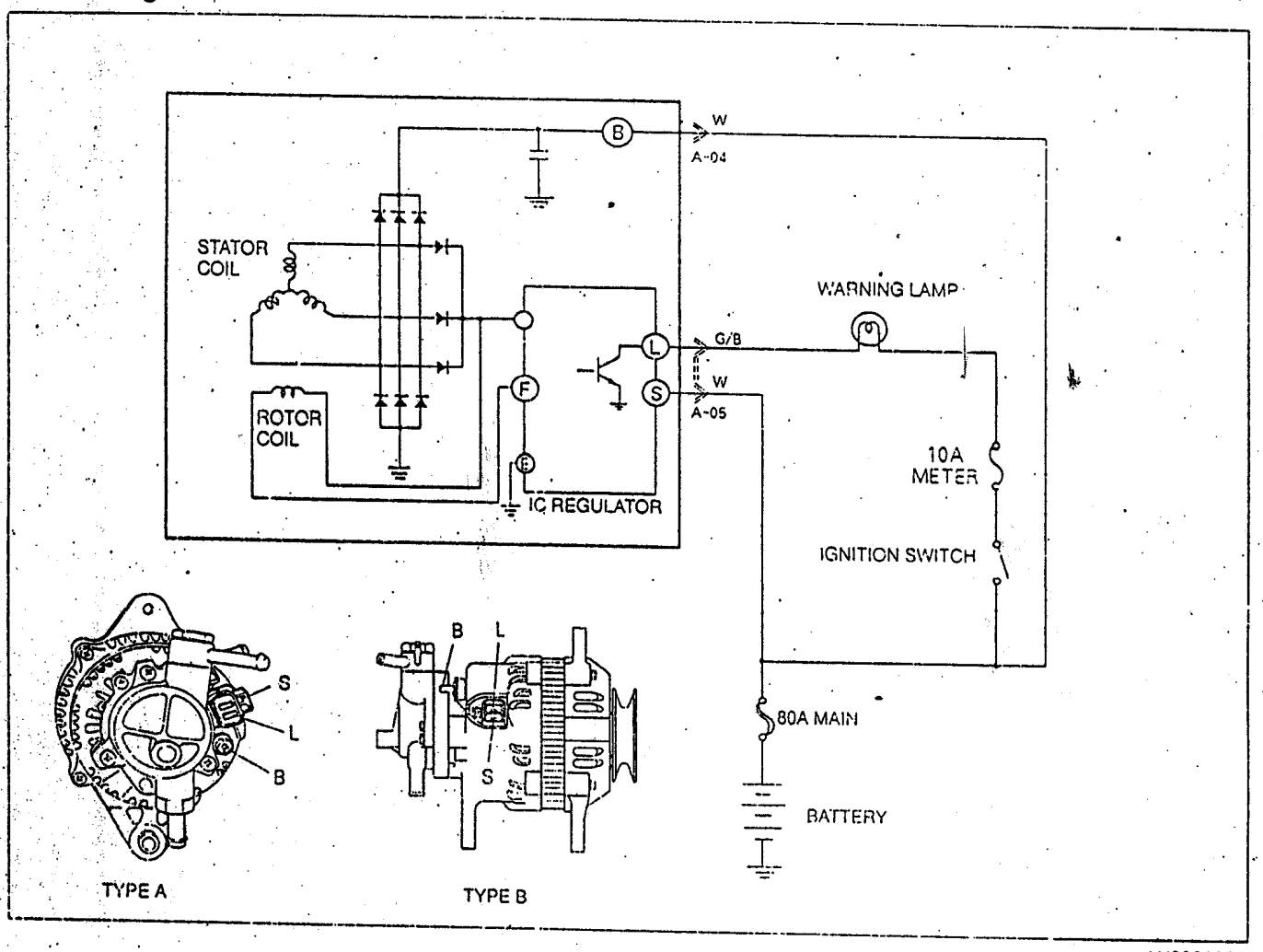
AN903200-1

1. Alternator
2. Vacuum pump
3. Battery

ALTERNATOR

This is battery voltage sensing type to directly sense the charging voltage from battery, and keeps the best charging condition by controlling the alternator output voltage.

Circuit Diagram



AN9032002

ON-VEHICLE MAINTENANCE

Drive Belt

1. Check visually the belt for wear, crack or loose, and replace if necessary.
2. Apply moderate pressure (10 kg, 98 N) to the center portion of belt and check the tension, and adjust if necessary.

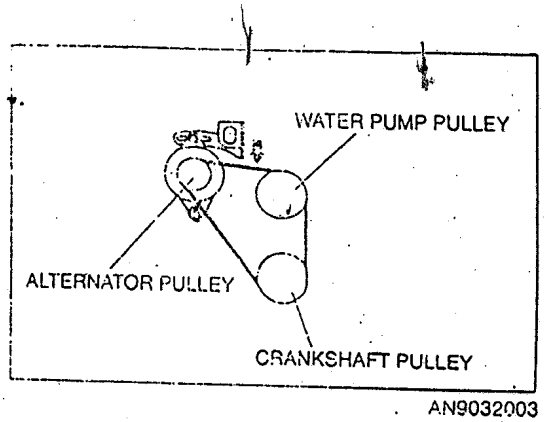
Deflection (Alternator drive belt)

mm(in)

Belt Type	New	Used
Alternator	8-10(0.31~0.39)	10-12(0.39~0.47)

Note

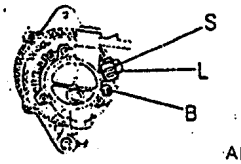
- New one means a belt driven for below 5 minutes.
- Inspection for deflection should be done when engine is cold or at 30 minutes after engine is stopped.

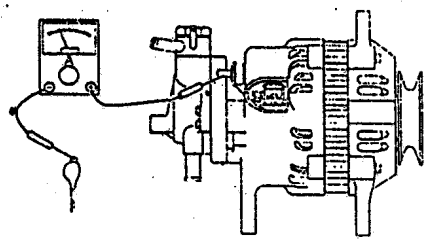


AN9032003

TROUBLESHOOTING GUIDE

ALTERNATOR

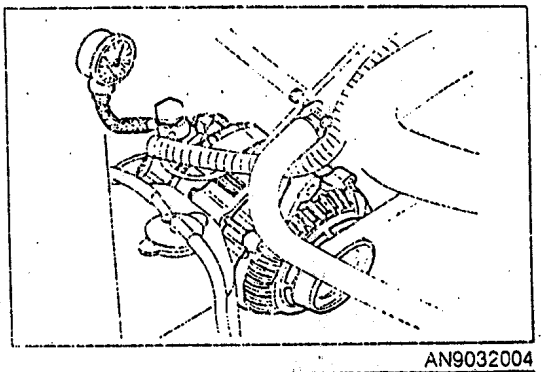
<table>
<tr><th>Step</th><th>Inspection</th><th></th><th>Actions</th></tr>
<tr><td>1</td><td>Measure the battery voltage
Standard ; Above 12.4V</td><td>Yes</td><td>Go to next step</td></tr>
<tr><td></td><td></td><td>No</td><td>Check the battery. (refer to page 32-6)</td></tr>
<tr><td>2</td><td>After starting engine, check if the warning lamp turns off.</td><td>Yes</td><td>Inspect step 4.</td></tr>
<tr><td></td><td></td><td>No</td><td>Go to next step.</td></tr>
<tr><td>3</td><td>Check if the alternator terminal
<table><tr><th>Terminal</th><th>Ig.switch ON</th><th>Idle(V)</th></tr><tr><td>B</td><td>about 12V</td><td>14.1~14.7</td></tr><tr><td>L</td><td>about 1V</td><td>14.1~14.7</td></tr><tr><td>S</td><td>about 12V</td><td>14.1~14.7</td></tr></table> 
AN9032002-1</td><td>Yes</td><td>· Inspect the bulb of warning lamp.
· Check the wiring between L terminal and the warning lamp.</td></tr>
<tr><td></td><td></td><td>No</td><td>Replace the alternator if no problem is found in wiring.</td></tr>
<tr><td>4.</td><td>1. 1.Connect a ammeter (min.100A) between B terminal and wiring
2. Turn off all electric load after starting engine.
3. Keep the engine speed to 2500~3000rpm.
4, Check if the output current increases when turning electric load on.

Caution
Do not connect B terminal to ground.
 
AN9032003</td><td>Yes</td><td>Charging system is normal.</td></tr>
<tr><td></td><td></td><td>No</td><td>Go to next step.</td></tr>
<tr><td>5</td><td>Check if the deflection of drive belt is normal</td><td>Yes</td><td>Replace the alternator</td></tr>
<tr><td></td><td></td><td>No</td><td>Adjust or replace the drive belt.</td></tr>
</table>

Vacuum Pump

1. Connect a tachometer to the alternator pulley.
2. Connect a vacuum gauge to the vacuum hose which is connected to the vacuum pump and the power brake unit, and then inspect the specification.

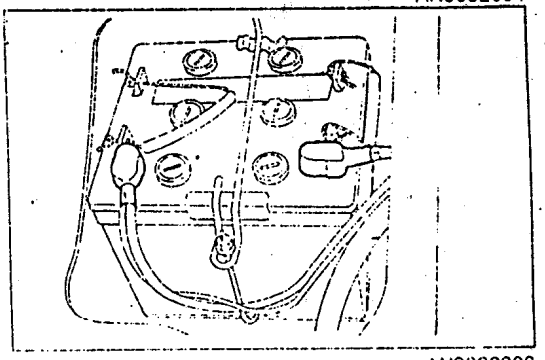
Alternator : 1500rpm (engine 750rpm)
after 20 seconds : above 58 kpa(440mmHg, 17.3 inHg)
Alternator : 3000rpm (engine 1500rpm)
after 20 seconds : above 77 kpa(580mmHg, 22.8 inHg)


AN9032004

BATTERY

Connection

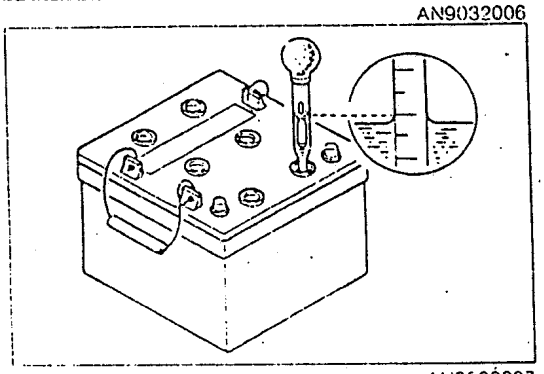
1. Check all terminals for looseness.
2. Check if the battery cable is corroded or damaged.
3. Inspect the rubber protector for proper coverage.
4. Clean terminals and coat them with grease after tightening


AN9032006

Electrolyte Level

1. Check if the electrolyte level is between the upper and lower level.
2. Add distilled water upto the upper level if it is insufficient.

Caution
- **Do not overfill distilled water.**


AN9032007

Specific Gravity

1. Measure the specific gravity of electrolyte by using a hydrometer.

Standard: 1.280 (at 25°C, 77°F)

2. If the specific gravity is below standard, charge the battery.

CHARGING

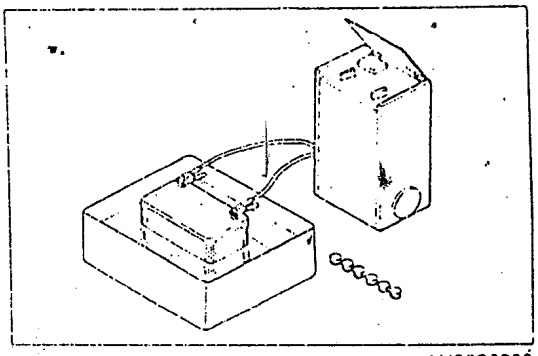
Battery	Normal charging (A)	Quick charging (A)
PT80-26HL	7-8A	40

1. Charge the battery, referring to a table of temperature vs. specific gravity.

Quick charging

Remove the battery from vehicle and do quick charging after removing the vent plugs.

Caution
- **Before inspecting or charging battery, turn all electric loads off and stop engine.**
- **Remove the negative terminal at first when removing, but connect the positive terminal at first, then the negative terminal later when installing.**
- **During quick charging, put the battery in a container filled with water to protect the battery from overheating.**


AN9032008

Normal charging

1. Stop engine.
2. Turn all electric loads off
3. After removing the negative terminal, do normal charging (7~8A).

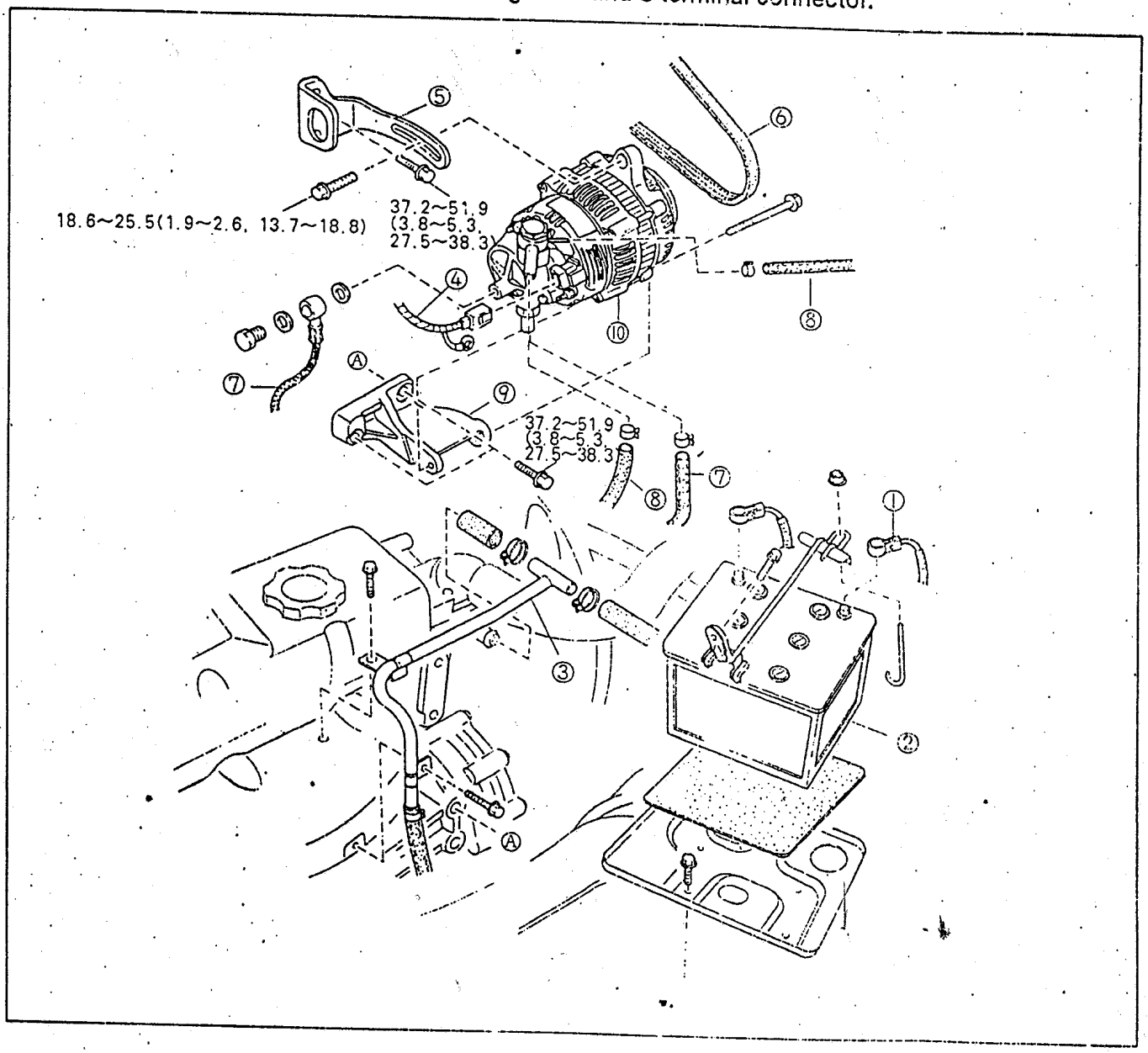
Note
- **Add distilled water if charging is necessary.**
- **If the specific gravity is below standard, do normal charging.**

REMOVAL / INSTALLATION

1. Remove in the steps shown in the figure (Refer to Section 10 for removal of the service cover).
2. Install in the reverse order of removal.

Caution

- Do not connect the battery in reverse.
- Do not use a high voltmeter.
- Pay attention to the B terminal of alternator since the battery voltage is always applied to it.
- Do not connect the L terminal to ground while the engine is running.
- Do not start the engine when removing the L and S terminal connector.



AN9032005

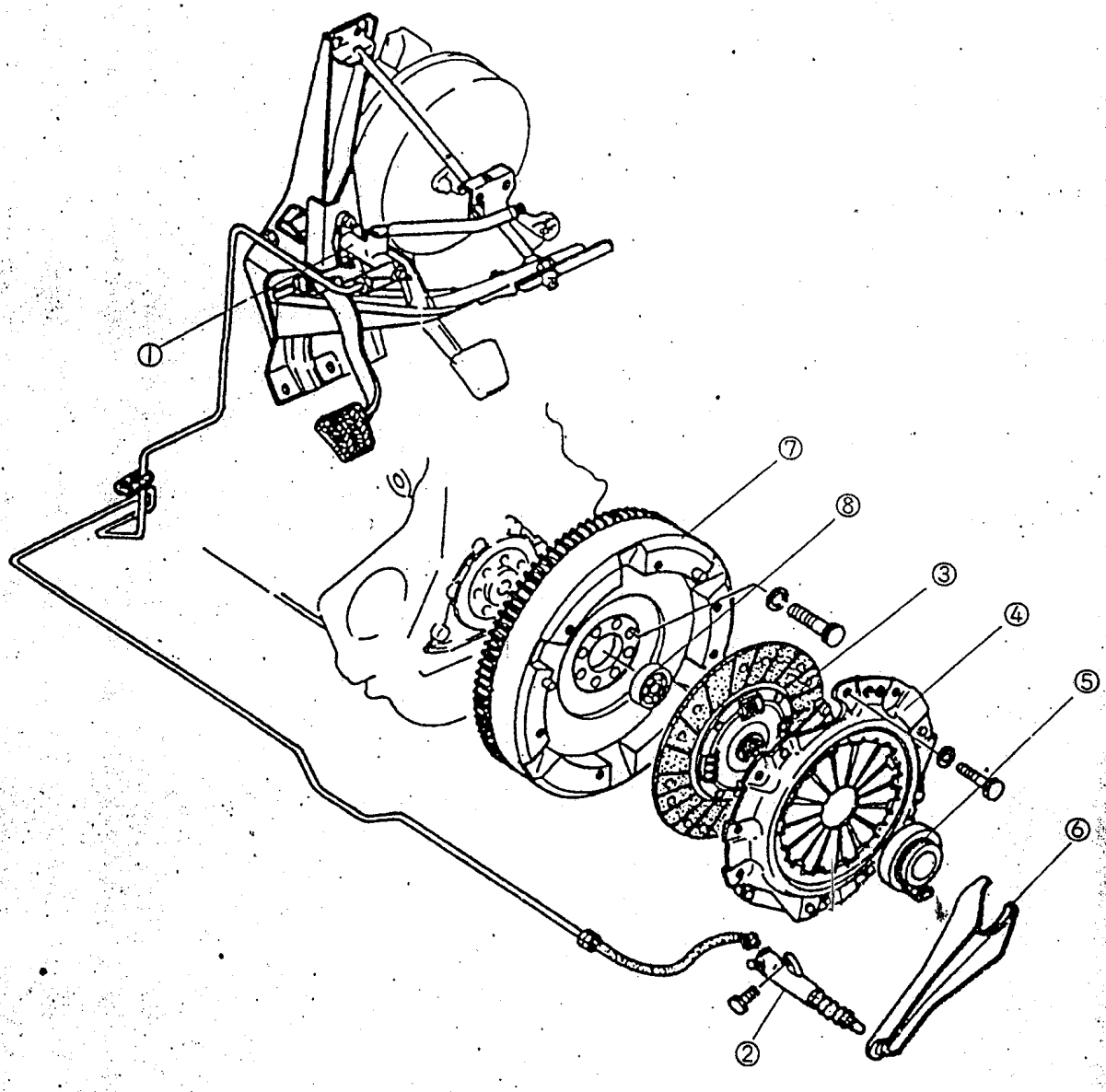
1. Battery negative terminal
2. Battery
3. Heater pipe assembly
4. Connector (L, S and B terminal)
5. Alternator strap
6. Drive belt
7. Oil hose
8. Vacuum hose
9. Alternator bracket
10. Alternator

SPECIFICATION

Items			Specification
Battery	Voltage	V	12V
	Type and Capacity (5Hr)		PT80-26HL (S0)
Alternator	Type		AC
	Output	V-A	12-75
	Regulator type		Transistor (built-with IC Regulator)
	Drive belt tension mm(in)	New one	8~10(0.31~0.39)
		Used one	10~12(0.39~0.47)

CLUTCH 40

STRUCTURAL VIEW



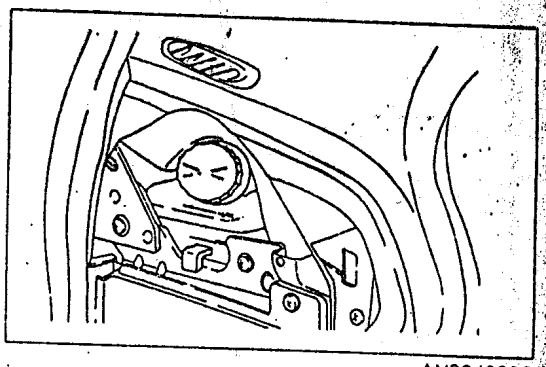
AN9040001

1. Clutch master cylinder
2. Clutch release cylinder
3. Clutch disk
4. Clutch cover
5. Clutch release bearing
6. Clutch release fork
7. Flywheel
8. Pilot bearing

TROUBLESHOOTING GUIDE

Problem	Possible causes	Action
Slipping	Excessively worn facing surface	Replace
	Hardened or oil contaminated facing surface	Repair or Replace
	Deformed clutch cover	Repair or Replace
	Damaged or fatigued diaphragm spring	Replace
	Excessive play of clutch pedal	Adjust
	Stuck clutch pedal	Repair or Replace
Faulty of disengagement	Damaged clutch disk and excessive runout	Replace
	Worn and corroded clutch disk spline rust	Replace or Remove
	Oil contaminated clutch disk	Repair or Replace
	Fatigued diaphragm spring	Replace
	Misadjusted clutch pedal	Adjust
	Insufficient clutch fluid	Add
	Leakage of clutch fluid	Repair or Add
Vibrates starting	Oil contaminated facing surface	Clean or Replace
	Fatigued torsion spring	Replace
	Hardened or deformed facing surface	Repair or Replace
	Loose clutch disc rivet	Replace
	Excessively deflected clutch cover	Replace
	Hardened or damaged flywheel surface	Repair or Replace
	Loose engine mount or fatigued rubber	Repair or Replace
Clutch pedal sticking	Failure of lubrication of pedal shaft	Repair or Replace
Abnormal noise	Damaged release bearing	Replace
	Failure of lubrication of release bearing sleeve	Lubricate or Replace
	Worn sliding part of release fork	Replace
	Fatigued torsion spring	Replace
	Worn or damaged pilot bearing	Replace
	Excessive end play of crankshaft	Adjust

ON-VEHICLE MAINTENANCE



AN9040002

Fluid Level

1. Clean the fluid container and cap.
2. Check the fluid level. If the fluid level is near or below "MIN" mark, add the specified fluid upto the "MAX" mark.

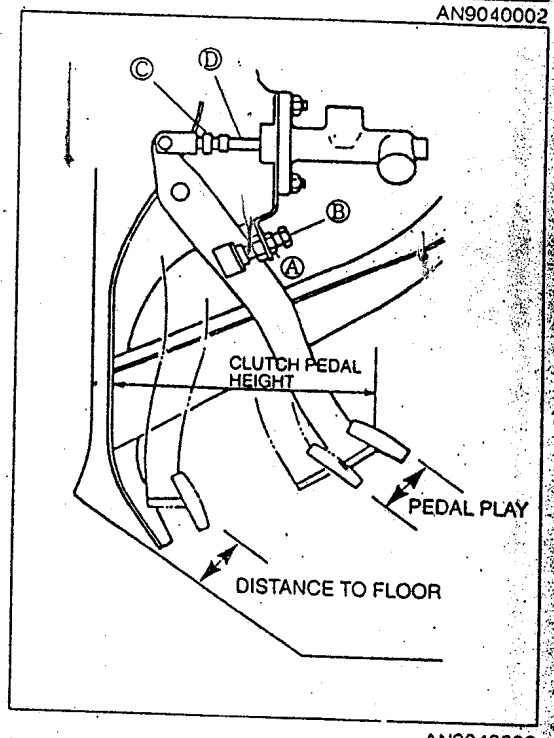
INSPECTION AND ADJUSTMENT

CLUTCH PEDAL HEIGHT

Inspection

Measure the distance from the center of the upper surface of pedal pad to the floor.

Pedal height : 195~196 mm(7.68~7.72 in)



AN9040003

Adjustment

1. Loosen the lock nut Ⓐ and adjust the pedal height by turning the adjust bolt Ⓑ.
2. Tighten the lock nut Ⓐ after adjusting.

PEDAL FREE PLAY

INSPECTION

Push the pedal lightly by hand until you feel the hydraulic pressure.

Pedal free play : 0.6~3.0 mm(0.024~0.118 in)

ADJUSTMENT

1. Loosen the lock nut Ⓒ and adjust the pedal free play by turning the push rod Ⓓ.
2. Measure the distance from the pedal to the floor when the clutch pedal is fully depressed.

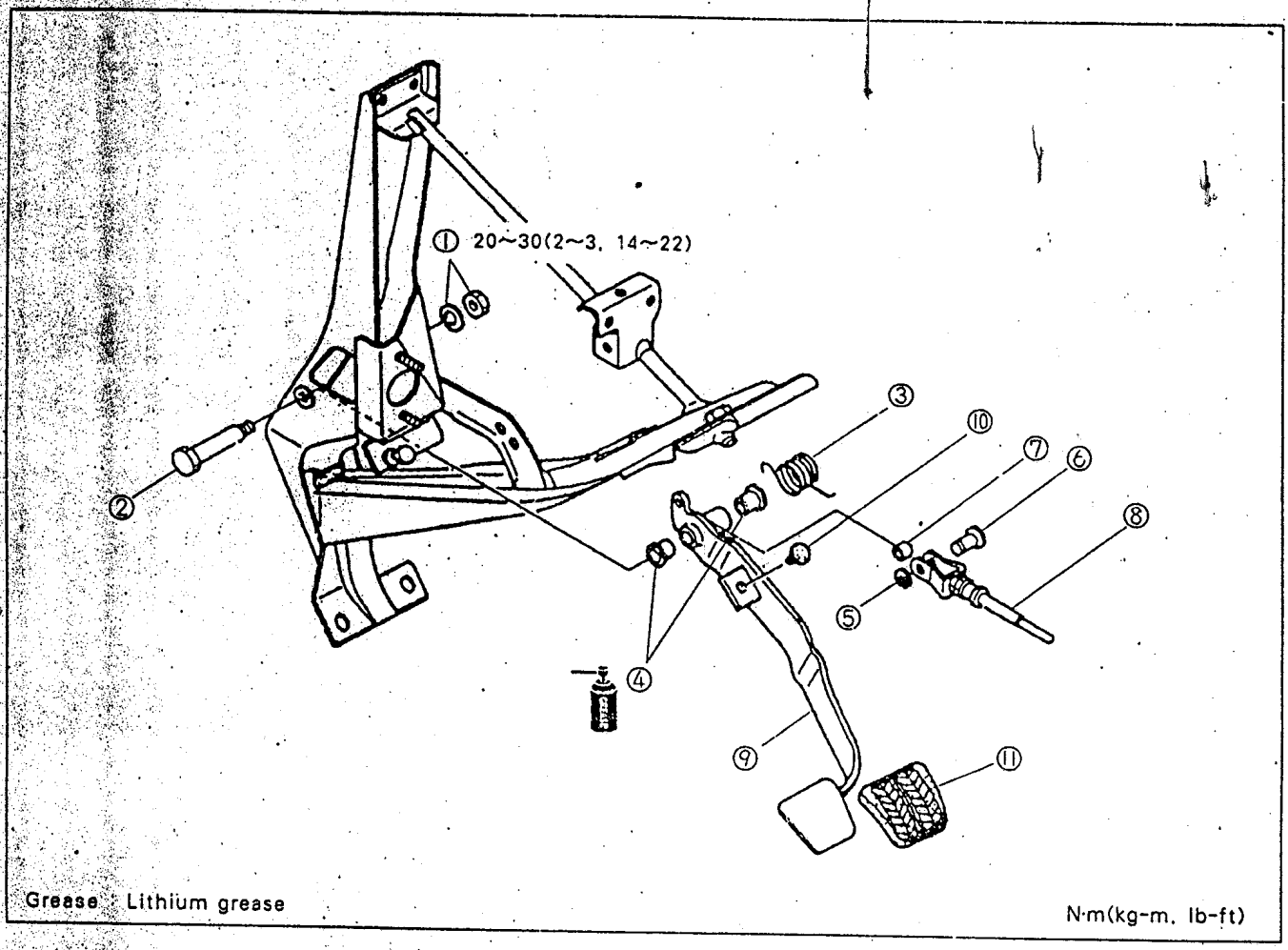
Distance to floor : 54 mm(2.13 in)

3. Tighten the lock nut.
4. Check the pedal height after adjusting.

CLUTCH PEDAL

REMOVAL / INSTALLATION

1. Remove in the steps shown in the figure.
2. Inspect all parts, and repair or replace if necessary.
3. Install in the reverse order of removal.
4. After installing, inspect and adjust the pedal height and free play if necessary.



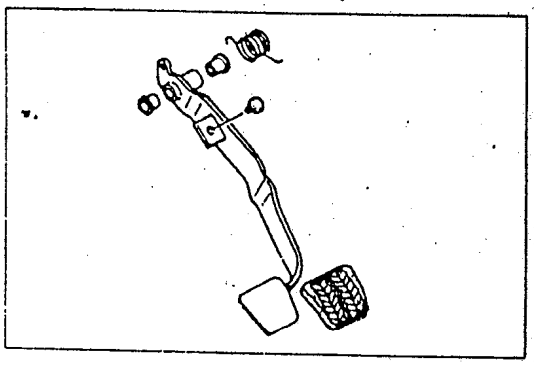
AN9040004

1. Nut and washer
2. Bolt
3. Return spring
4. Bushing
5. Clip
6. Pin
7. Spacer
8. Push rod
9. Clutch pedal
10. Stopper rubber
11. Pedal pad

INSPECTION

Clutch Pedal

1. Replace after inspecting wear of bushing, deflection of pedal and damage of return spring.



AN9040005

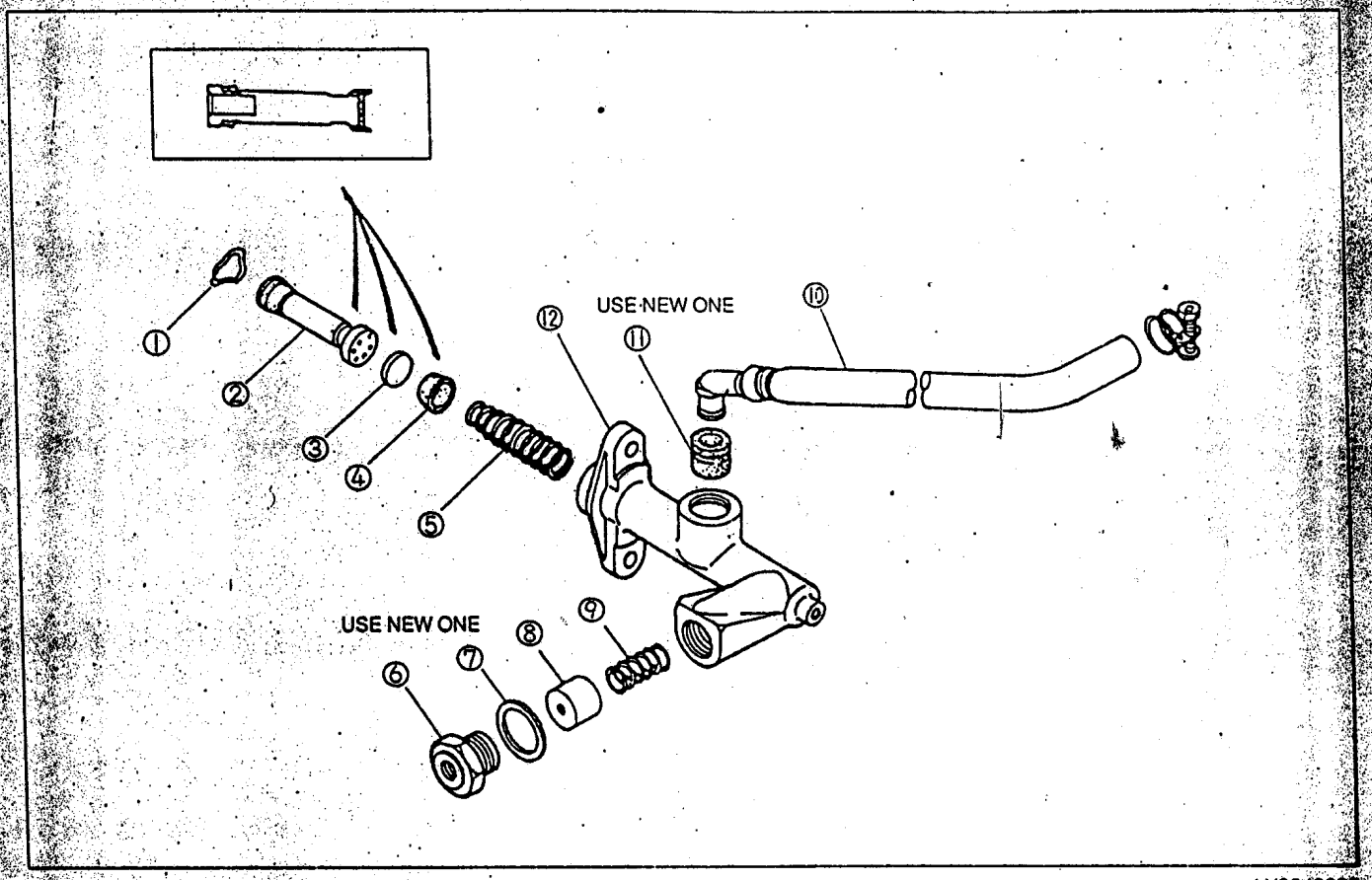
MASTER CYLINDER

REMOVAL / INSTALLATION

1. Remove in the steps shown in the figure.
2. Inspect all parts, and repair or replace if necessary.
3. Install in the reverse order of removal.

Caution

- **Drain the clutch fluid by using a container or clothes because it can give damage to painted surfaces. If the fluid is droped on painted surfaces, clean it immediately.**

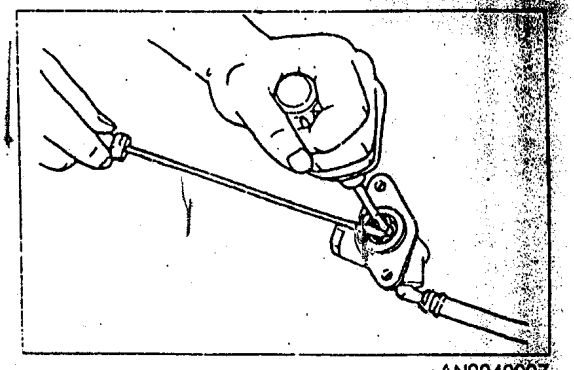


AN9040005

1. Stop wire
2. Piston and secondary assembly
3. Protector
4. Primary cup
5. Return spring
6. Plug
7. Sealing washer
8. Oneway valve
9. Oneway valve spring
10. Reserve tank hose
11. Bushing
12. Clutch master cylinder

How to disassemble stop wire

Remove the stop wire by using a screwdriver while pushing it down.

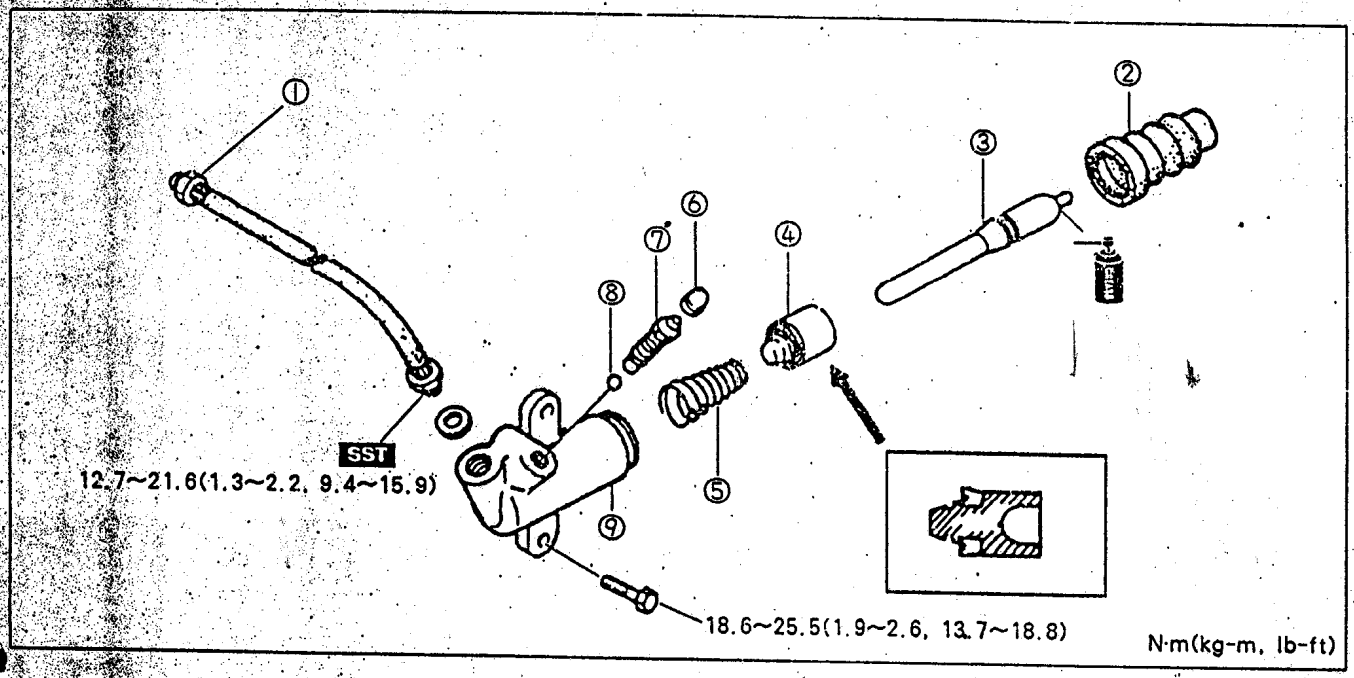


AN9040007

RELEASE CYLINDER

REMOVAL / INSTALLATION

1. Remove in the steps shown in the figure.
2. Inspect all parts, and repair or replace if necessary.
3. Install in the reverse order of removal.



AN9040008

1. Flexible hose
2. Boot
3. Push rod
4. Piston and cup assembly
5. Return spring cylinder
6. Bleeder plug cap
7. Bleeder plug
8. Steel ball
9. Clutch release cylinder

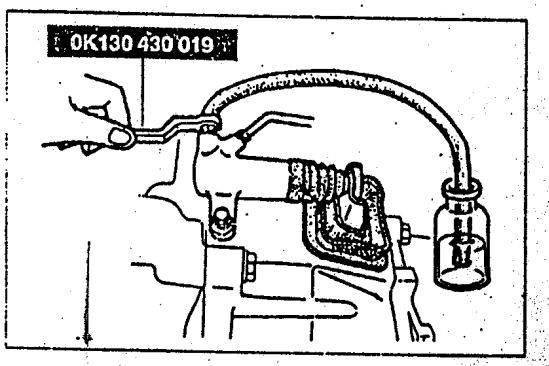
AIR BLEEDING

Warning

- **Air which soaked into the clutch hydraulic device during removing pipe for repair, should be bled, after disassembling and assembling the clutch master cylinder.**

Note

- **During air bleeding, the fluid in the reserve tank should be kept to 2/3 level.**
- **Drain the clutch fluid by using a container or clothes because it can give damage to painted surfaces. If the fluid is droped on painted surfaces, clean it immediately.**



AN9040009

1. Remove the bleeder cap from the clutch release cylinder and insert a vinyl hose into the bleeder plug.
2. Put the opposite end of vinyl hose into a container.
3. Pump the clutch pedal slowly several times.
4. While depressing the clutch pedal, loosen the bleeder screw so that the fluid and air can be blown out.
5. Repeat step 3 and 4 until the air bubble in fluid is gone.

   Tightening torque : 5.9~8.8 N·m(60~90 kg-cm, 52~78 lb-in)
6. Inspect the clutch pedal for correct operation.

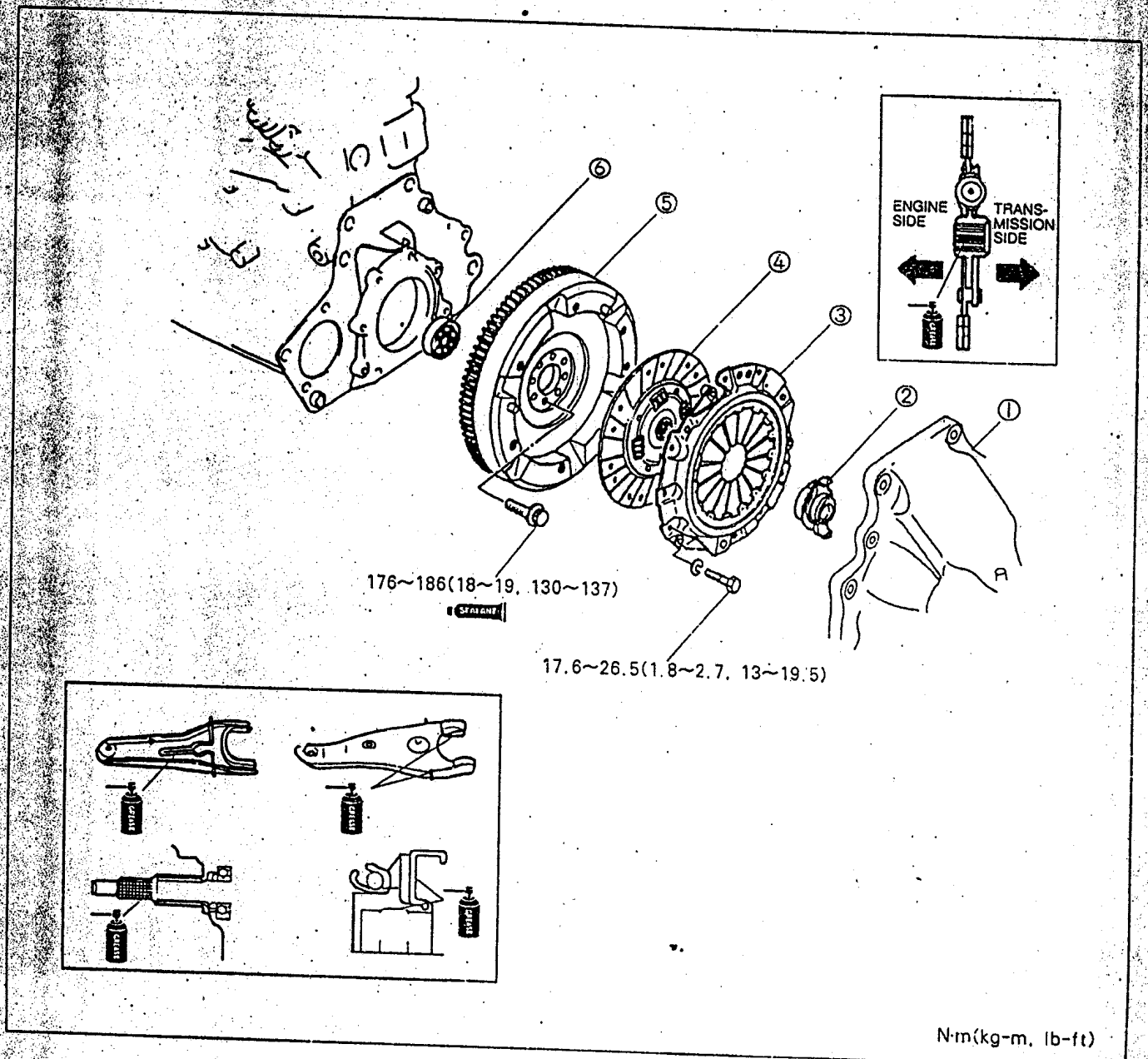
CLUTCH AND FLYWHEEL

Caution

- **Apply grease to the spline part of the clutch disk assembly (or to the transmission propeller shaft) and before installing it to the engine flywheel, insert into the transmission propeller spline and remove, and then wipe out grease left which is generated at the side surface of clutch disk spline (transmission side, engine side) or the transmission propeller shaft.**

REMOVAL / INSTALLATION

1. Remove in the steps shown in the figure.
2. Install in the reverse order of removal.
3. Apply grease to any place needed.



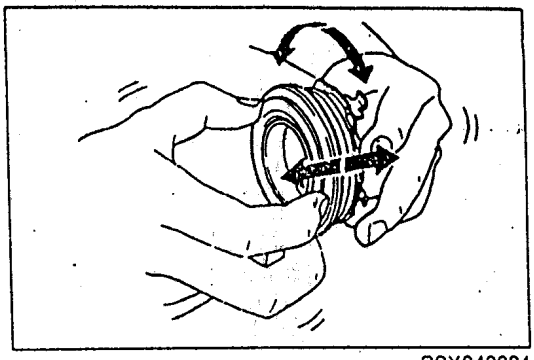
1. Transmission (Refer to section 42)
2. Release bearing
3. Clutch cover
4. Clutch disk
5. Flywheel
6. Bearing

INSPECTION

Release Bearing

Note
- Do not clean the release bearing with solvent. Solvent will remove sealed-in lubricant and will cause bearing failure.

1. By pushing and turning the release collar to the thrust side, replace it, if it is not rotated smoothly or it is noisy.

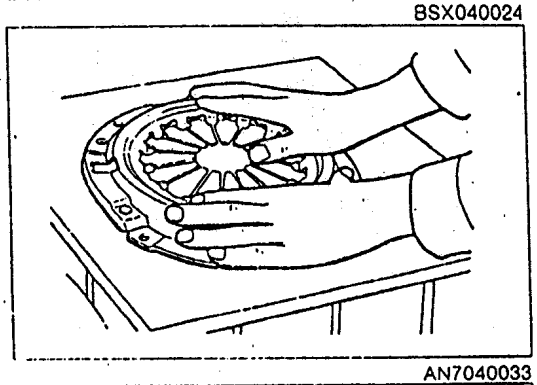


BSX040024

Clutch Cover

Note
- Repair for minor rust or discoloration by using a sandpaper.

1. Inspect the facing surface with the clutch disc for rust, crack and fatigue.
2. Inspect the facing surface with the clutch release bearing for wear and crack.

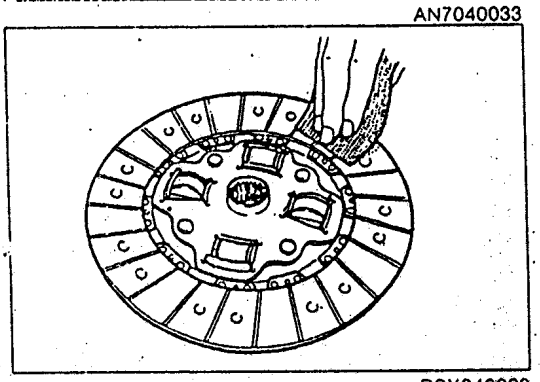


AN7040033

Clutch Disc

Note
- Repair for minor failure by using a sandpaper.

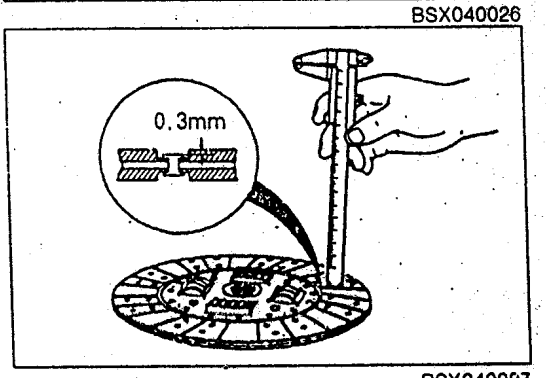
1. Inspect for hardened lining surface and oil on the lining surface.
2. Inspect loose rivet.



BSX040026

3. Measure the revet head depth with a slide caliper. Replace worn disc.

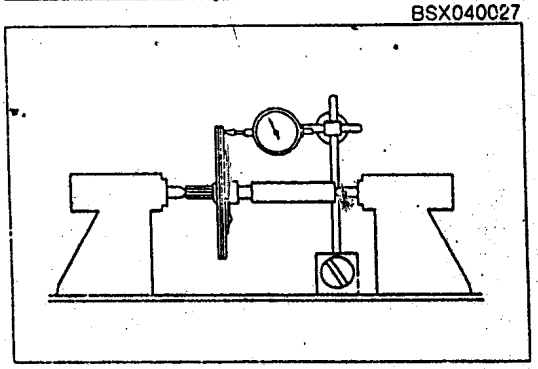
   Limit : 0.3 mm(0.012 in)



BSX040027

4. Measure runout of the clutch disc. Replace if it exceeds the limit.

   Limit : 0.7 mm(0.028 in)



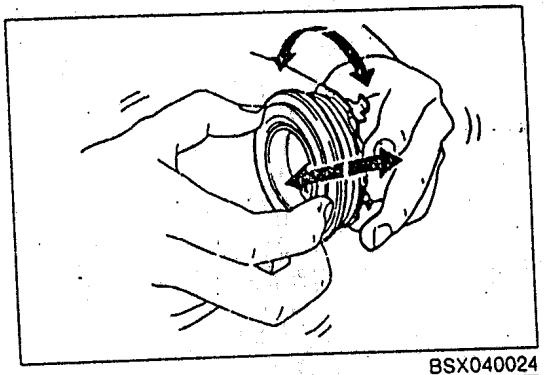
AN7040035

INSPECTION

Release Bearing

Note
- Do not clean the release bearing with solvent. Solvent will remove sealed-in lubricant and will cause bearing failure.

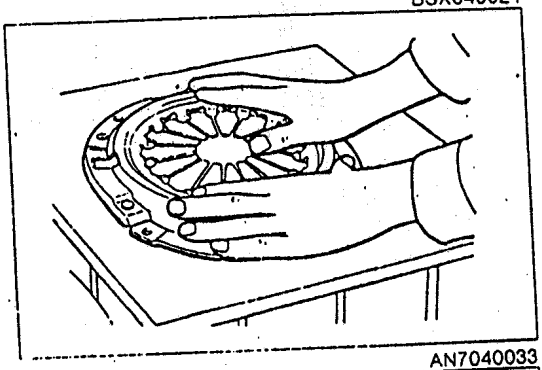
1. By pushing and turning the release collar to the thrust side, replace it, if it is not rotated smoothly or it is noisy.


BSX040024

Clutch Cover

Note
- Repair for minor rust or discoloration by using a sandpaper.

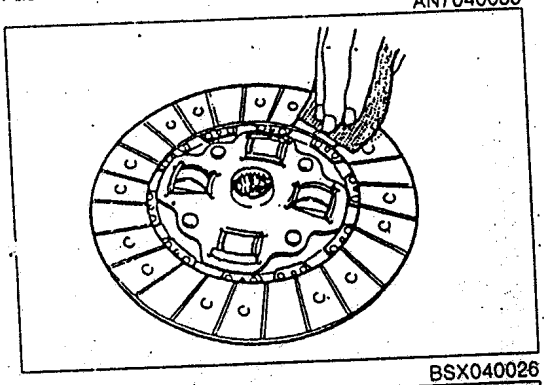
1. Inspect the facing surface with the clutch disc for rust, crack and fatigue.
2. Inspect the facing surface with the clutch release bearing for wear and crack.


AN7040033

Clutch Disc

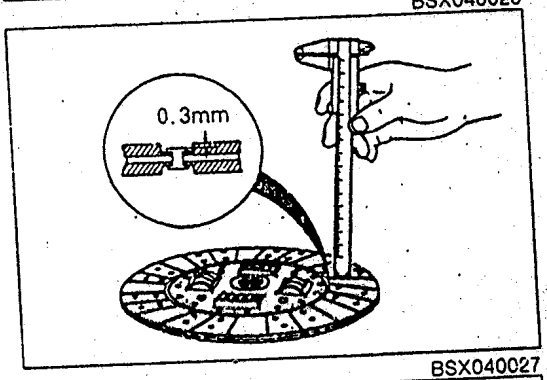
Note
- Repair for minor failure by using a sandpaper.

1. Inspect for hardened lining surface and oil on the lining surface.
2. Inspect loose rivet.


BSX040026

3. Measure the revet head depth with a slide caliper. Replace worn disc.

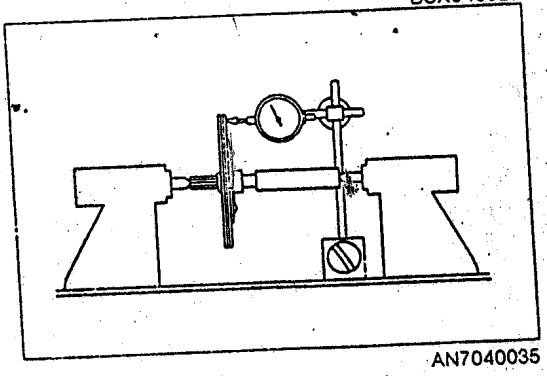
   Limit : 0.3 mm(0.012 in)



BSX040027

4. Measure runout of the clutch disc. Replace if it exceeds the limit.

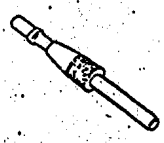
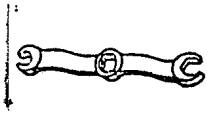
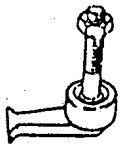
   Limit : 0.7 mm(0.028 in)


AN7040035

SPECIFICATIONS

Items			Specifications
Clutch control			Hydraulic type
Clutch cover	Type		Diaphragm spring
	Pressure force kg(N, lb)		530
Clutch disc	Outer diameter mm(in)		240(9.4)
	Inner diameter mm(in)		160(6.3)
	Thickness	Pressure plate side mm(in)	3.5(0.14)
		Flywheel side mm(in)	3.5
Clutch pedal	Type		Suspended
	Pedal ratio		6.3
	Full stroke mm(in)		155(6.1)
	Height mm(in)		195.5(7.7)
Master cylinder	Inner diameter mm(in)		15.9(0.63)
Release cylinder	Inner diameter mm(in)		19.1(0.75)
Clutch fluid			FMVSS No.116, DOT-3

SPECIAL TOOLS

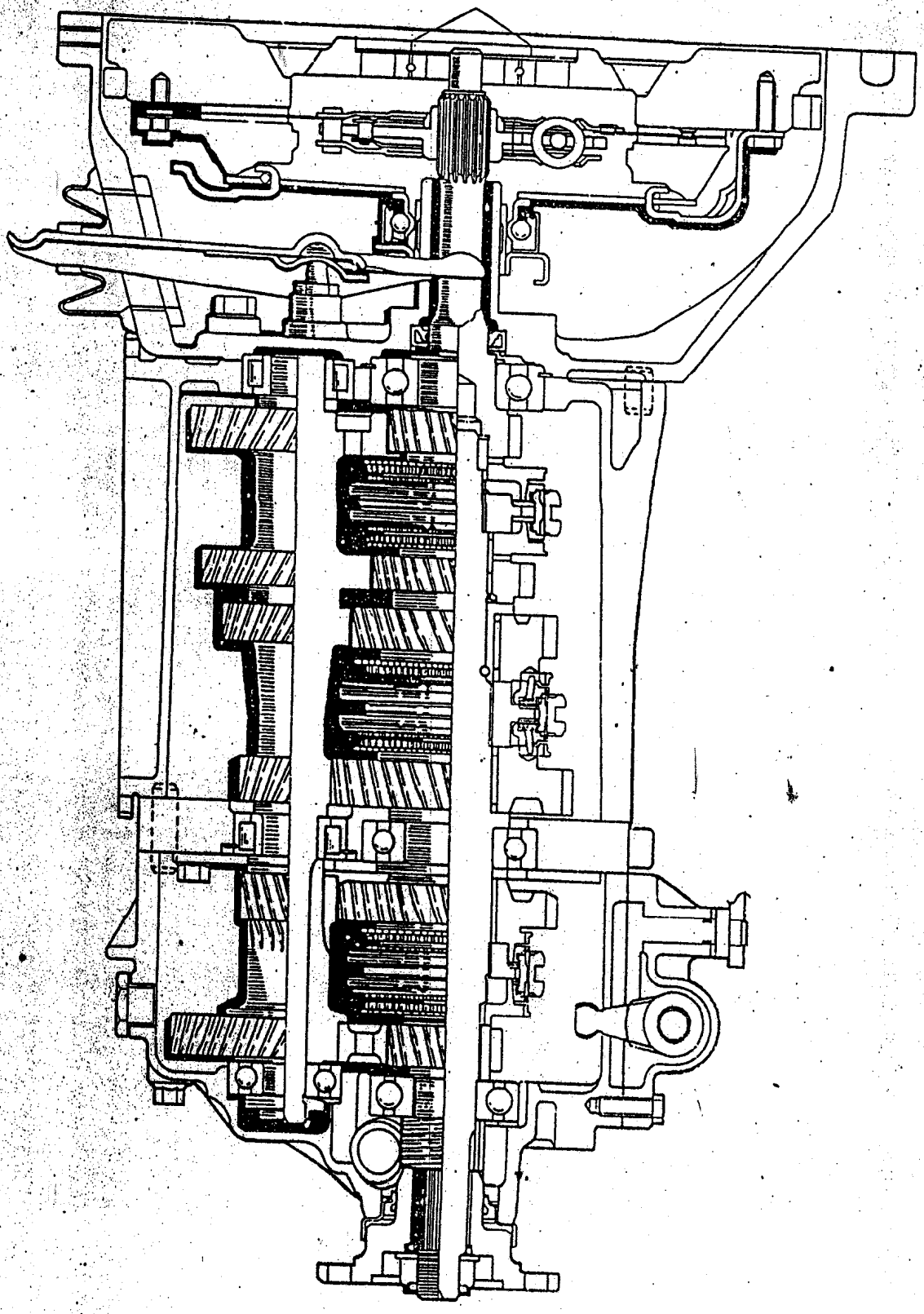
0K130 160 010 Clutch disc centering tool 	Clutch disc to center of flywheel	0K130 430 019 Flare nut wrench 	Removing the clutch pipe
0K410 111 012 Bearing puller 	Removing the pilot bearing	0K670 111 004 Ring gear brake 	Protecting the flywheel from rotating

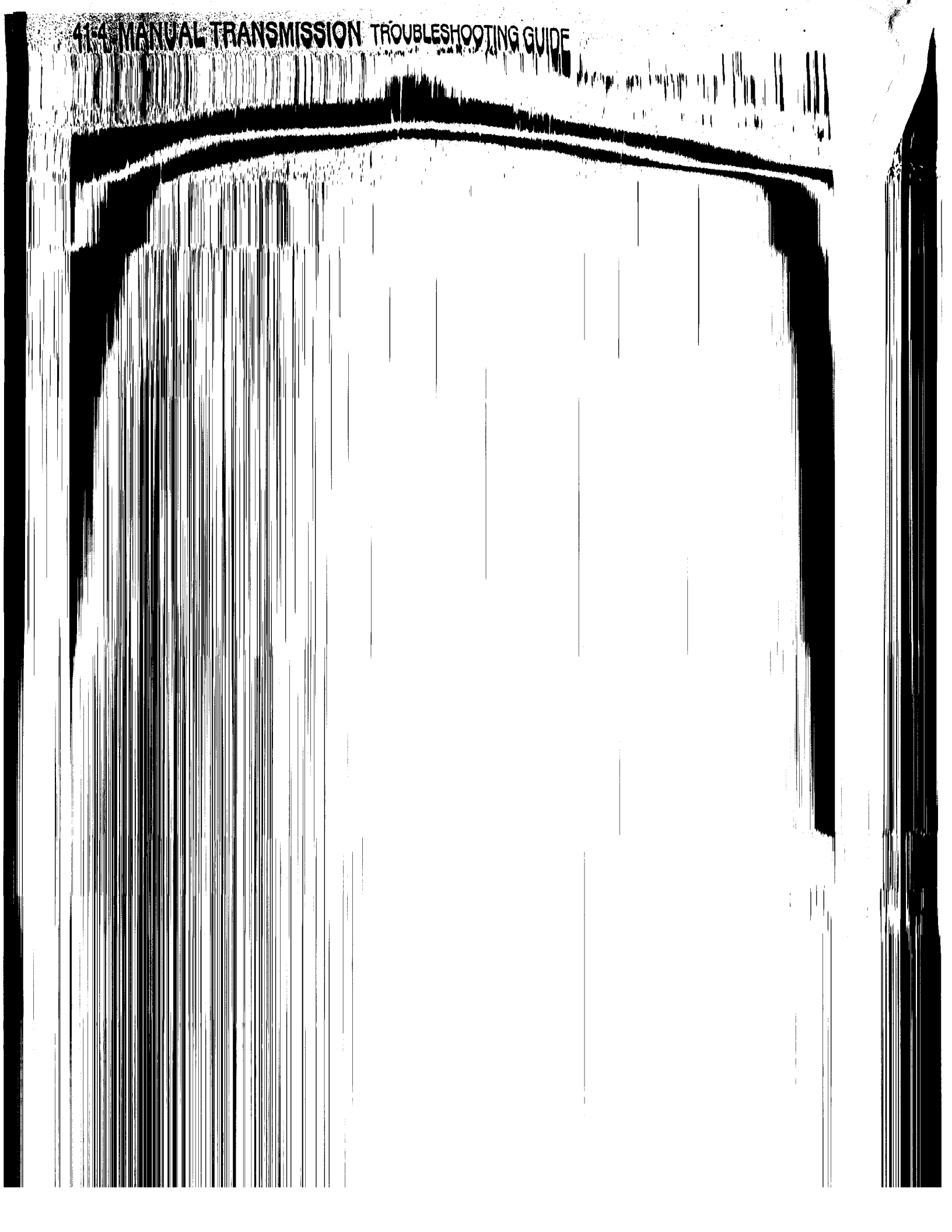
MANUAL TRANSMISSION

41

OUTLINE

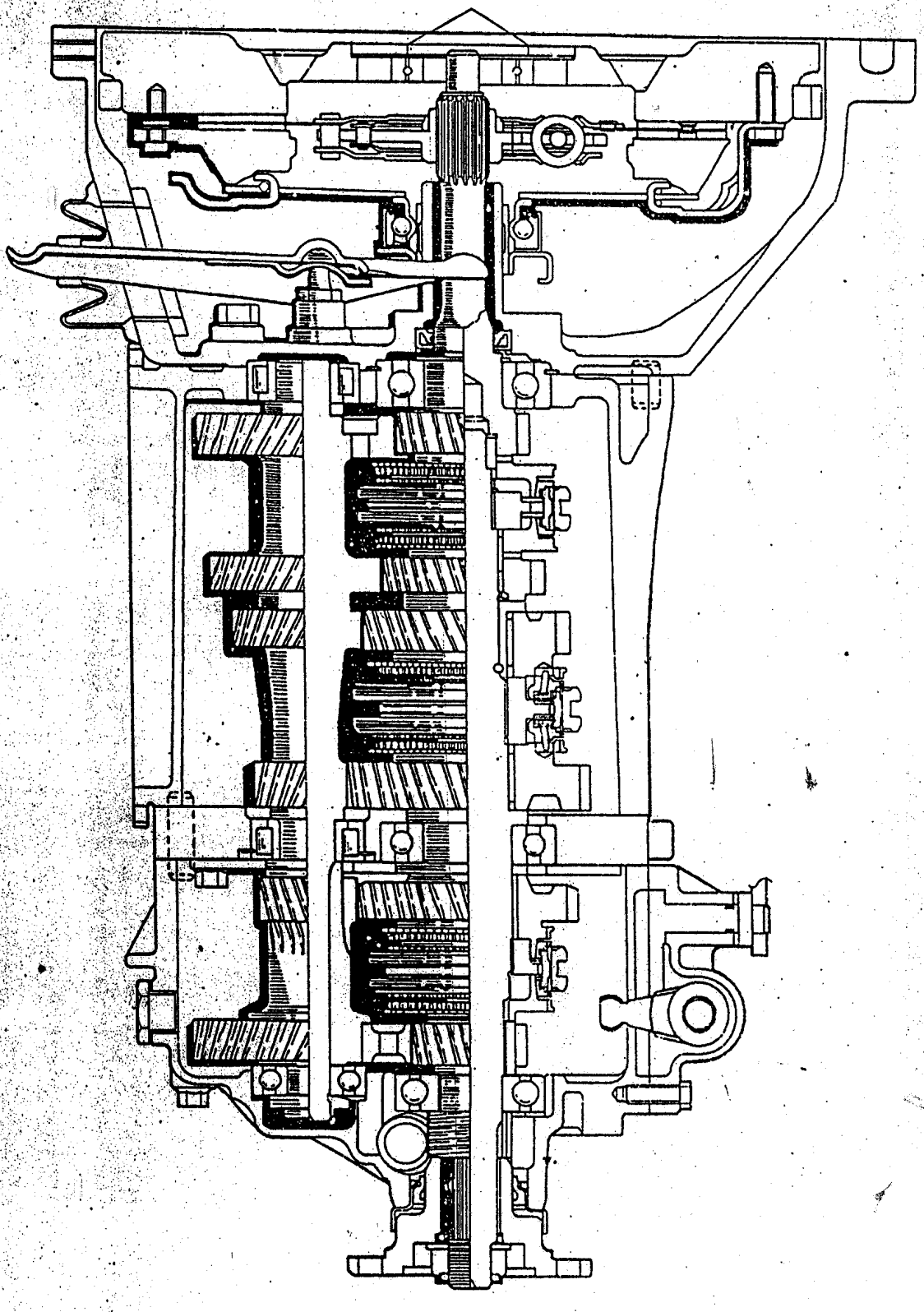
Control performance is improved by adapting the double synchronizer ring to the 1st and 2nd gear.





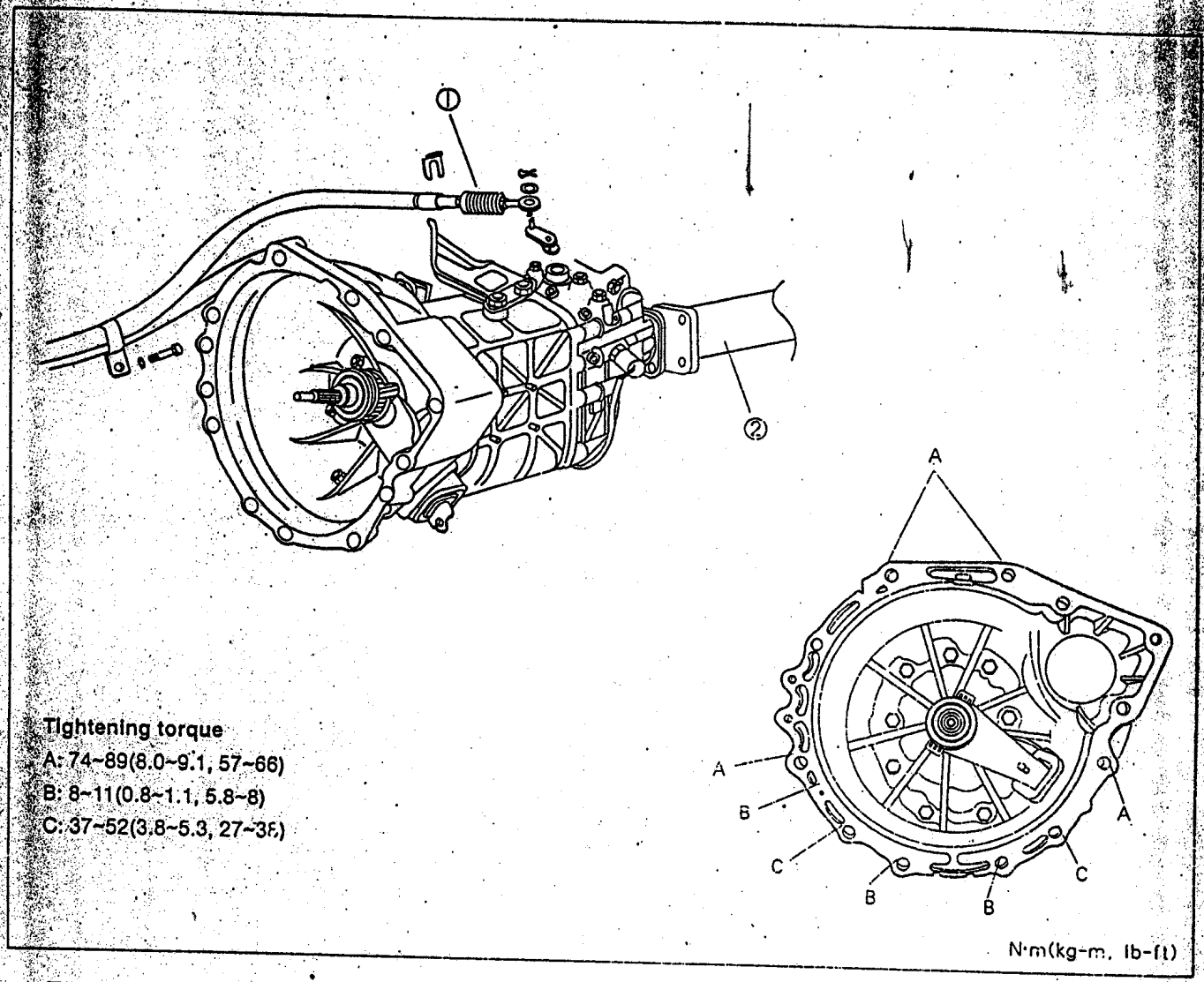
OUTLINE

Control performance is improved by adapting the double synchronizer ring to the 1st and 2nd gear.



REMOVAL/INSTALLATION

1. Disconnect the battery negative terminal.
2. Raise the vehicle by a lift and drain the transmission oil into a suitable container.
3. Remove in the steps shown in the figure.
4. Remove referring to notes for removal.
5. Install in the reverse order of removal.



Tightening torque
A: 74~89(8.0~9.1, 57~66)
B: 8~11(0.8~1.1, 5.8~8)
C: 37~52(3.8~5.3, 27~38)

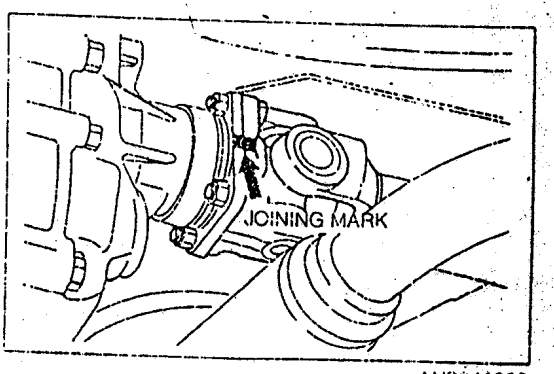
N·m(kg-m, lb-ft)

AN9041002A

1. Transmission control cable
2. Propeller shaft

Removal note

1. Mark the propeller shaft and transmission for identical installation position.

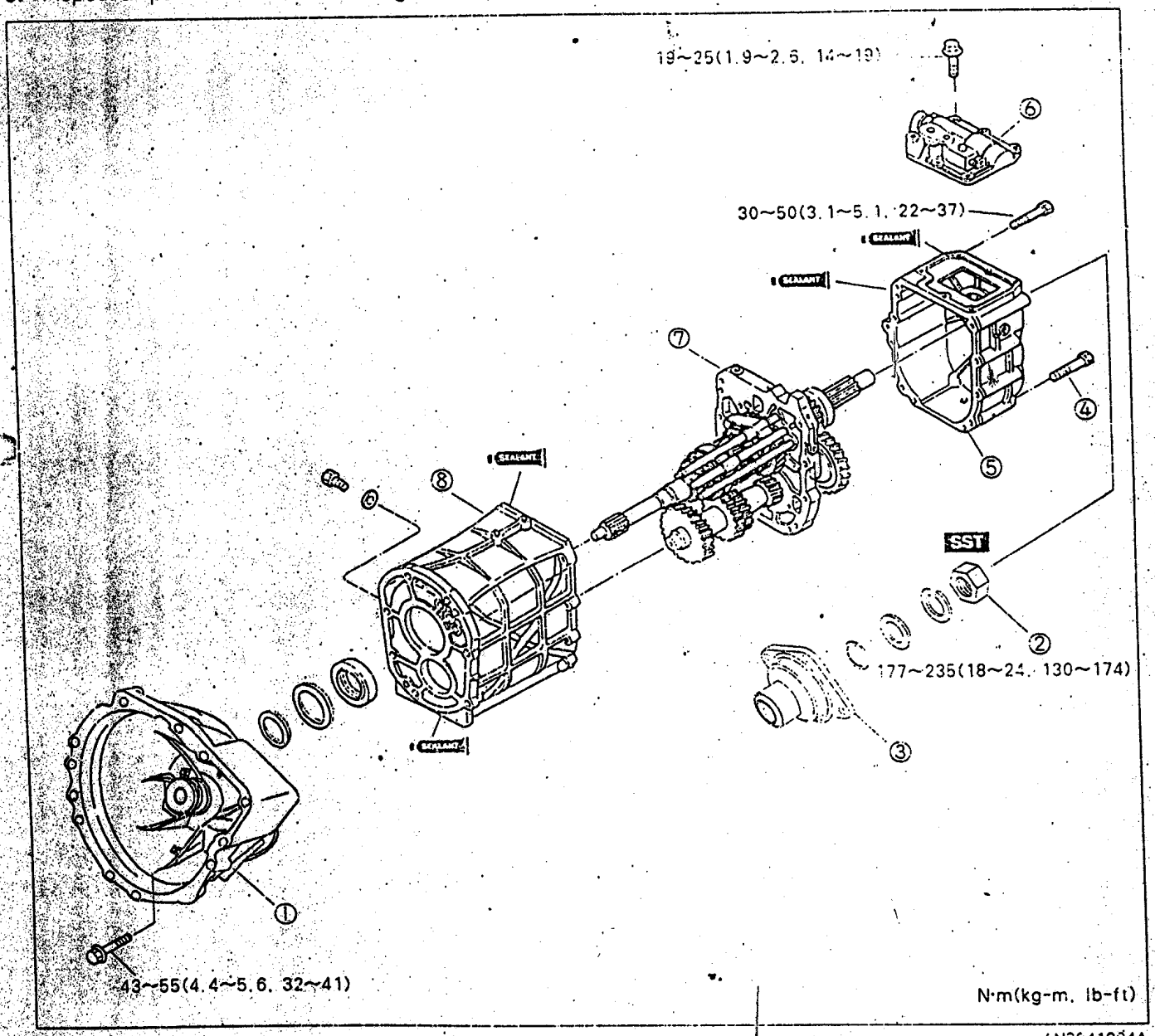


AN9041003

DISASSEMBLY/ASSEMBLY

Note
- Clean thoroughly the transmission case with steam air or solvent before disassembling.
- Clean the surface of all removed parts (except the ball bearing, the clutch release cylinder, and the rubber parts) with cleaning solvent, dry it with compressed air. After cleaning out all holes and passages with compressed air, check if there is clogged.

1. Remove in the steps shown in the figure, and refer to notes for disassembly.
2. Install in the reverse order of removal, and refer to notes for assembly.
3. Inspect all parts after disassembling, and repair or replace if necessary.

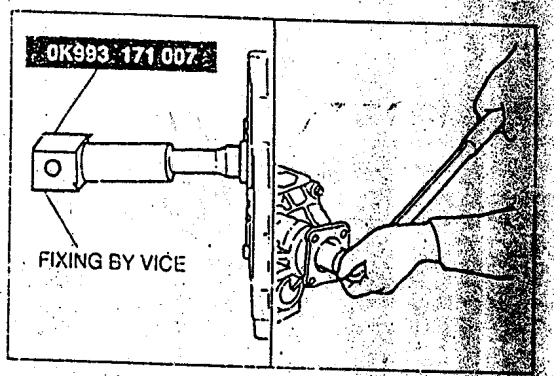


AN9041004A

1. Clutch housing
2. Lock nut
3. Companion flange
4. Bolt
5. Rear cover assembly
6. Top cover
7. Bearing housing assembly
8. Transmission case

Disassembly note

1. When disassembling the lock nut, insert SST into the main drive gear and fix SST with vice and disassemble it.



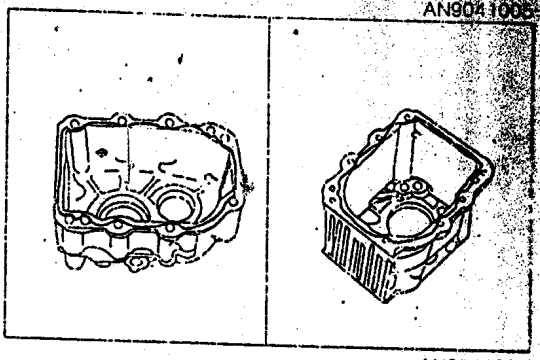
AN9041005

Assembly note

1. Apply sealant to the rear cover and the transmission case, and assemble it.

   Sealant specification : TB1104, TB1215, TB1216

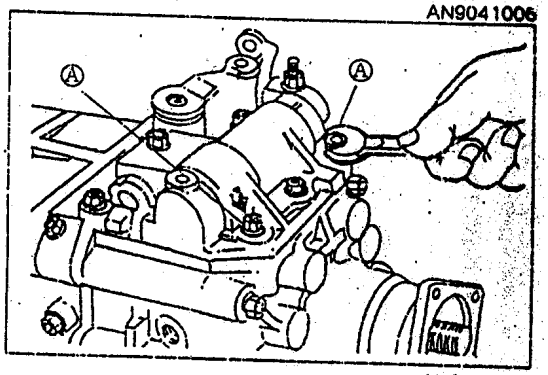
   Caution
   - **Within 30 minutes after applying sealant, install the rear cover to the transmission case.**



AN9041006

2. When tightening the top cover to the transmission case, tighten the reamer bolt and other bolts.

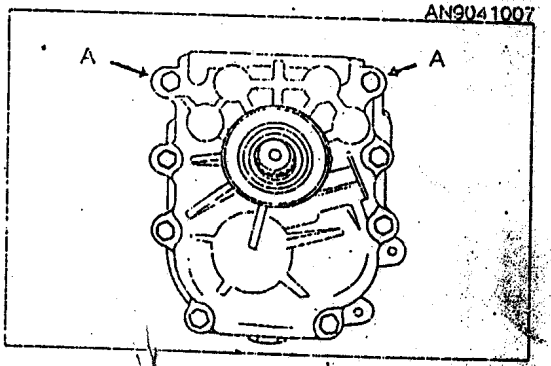
   Tightening torque : 19~25 N·m(1.9~2.6 kg-m, 14~19 lb-ft)



AN9041007

3. When assembling the rear cover, tighten the A part with a longer bolt.

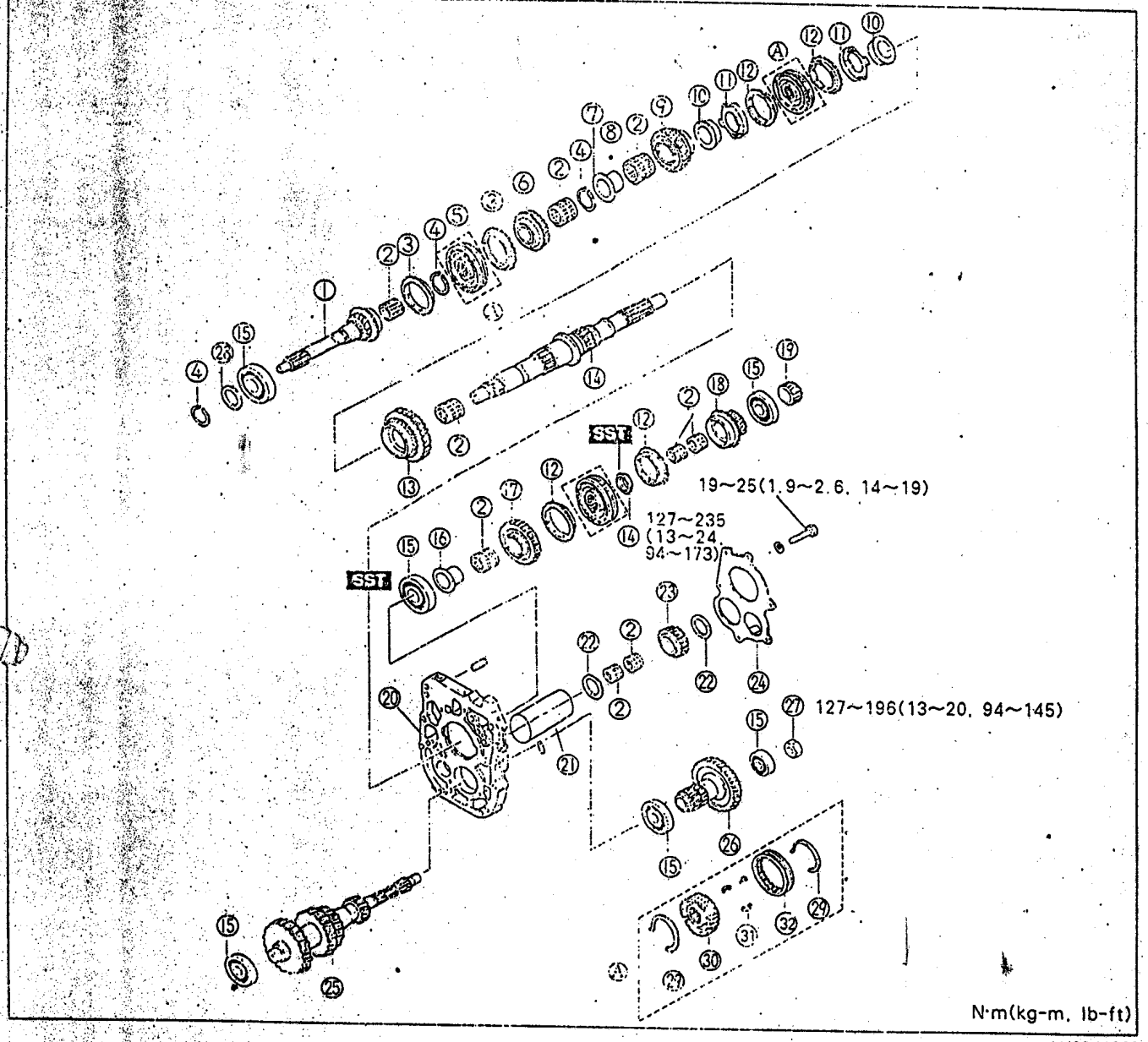
   Tightening torque : 30~50 N·m(3.1~5.1 kg-m, 22~37 lb-ft)



AN9041008

MAIN SHAFT/COUNTER SHAFT

1. Remove in the steps shown in the figure, and install in the reverse order of removal.
2. Refer to notes for disassembly and assembly.
3. Inspect all parts after disassembling, and repair or replace if necessary.



AN9041009

1. Main drive gear
2. Needle bearing
3. Synchronizer ring
4. Snap ring
5. Clutch hub assembly (3rd & 4th)
6. 3rd gear
7. 2nd gear sleeve
8. Steel ball
9. 2nd gear
10. Synchronizer inner ring
11. Double cone
12. Synchronizer ring
13. 1st gear
14. Main shaft
15. Bearing
16. Reverse gear sleeve
17. Reverse gear
18. 5th gear
19. Speedo drive gear
20. Bearing housing
21. Idle gear shaft
22. Thrust washer
23. Reverse idle gear
24. Bearing cover
25. Counter shaft
26. Counter gear assembly
27. Lock nut
28. Shim
29. Spring
30. Hub
31. Key
32. Sleeve

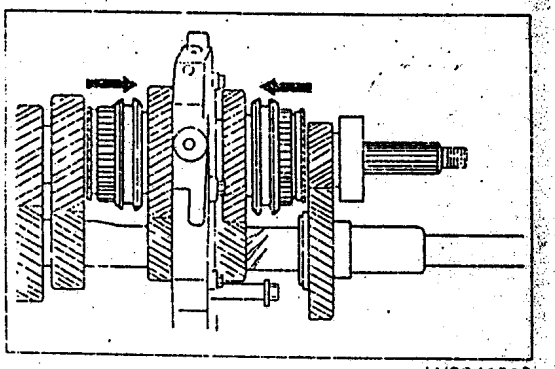
Caution

- **Be careful for the steel ball lost.**

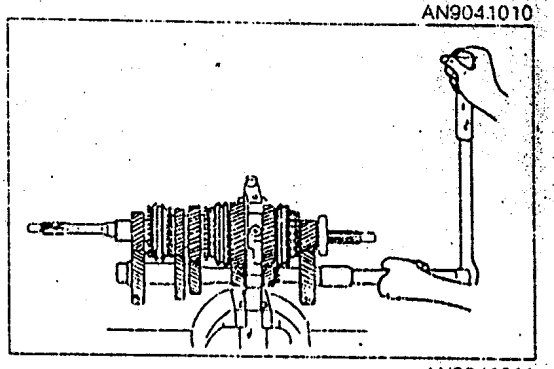
Disassembly and Assembly note

1. When disassembling the lock nut of the counter shaft, disassemble/assemble it after tooth matching 1st gear to reverse gear.

   Tightening torque :
   127~196 N·m(13~20 kg-m, 94~145 lb-ft)



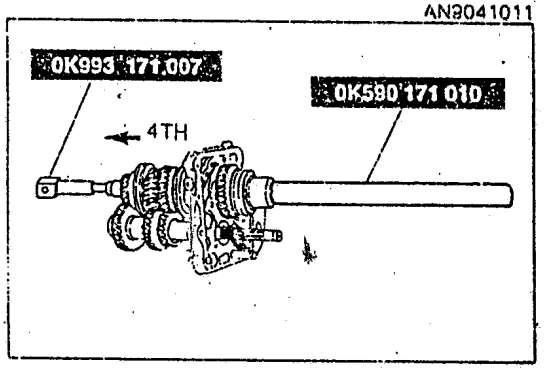
AN9041010



AN9041011

2. When disassembling the 5th/reverse clutch hub, disassemble / assemble it by using **SST** after tooth matching 4th gear, inserting to the main drive gear and fixing to vice.

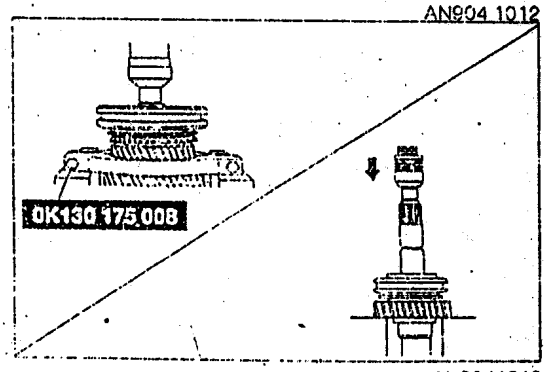
   Tightening torque :
   127~235 N·m(13~24 kg-m, 94~174 lb-ft)



AN904 1012

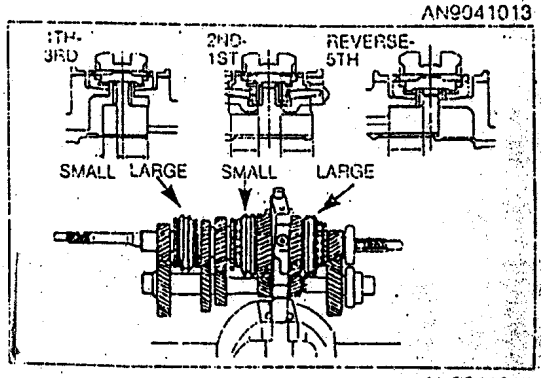
3. When disassembling the 3rd gear, put the puller to the 3rd gear and disassemble the clutch hub assembly, the synchronizer ring and 3rd gear in assembly by using a press.
4. When disassembling the 1st gear, disassemble the clutch hub assembly, the synchronizer ring and 1st gear in assembly by using a press.

   Caution
   - **Hold it by hand to avoid being dropped.**



AN9041013

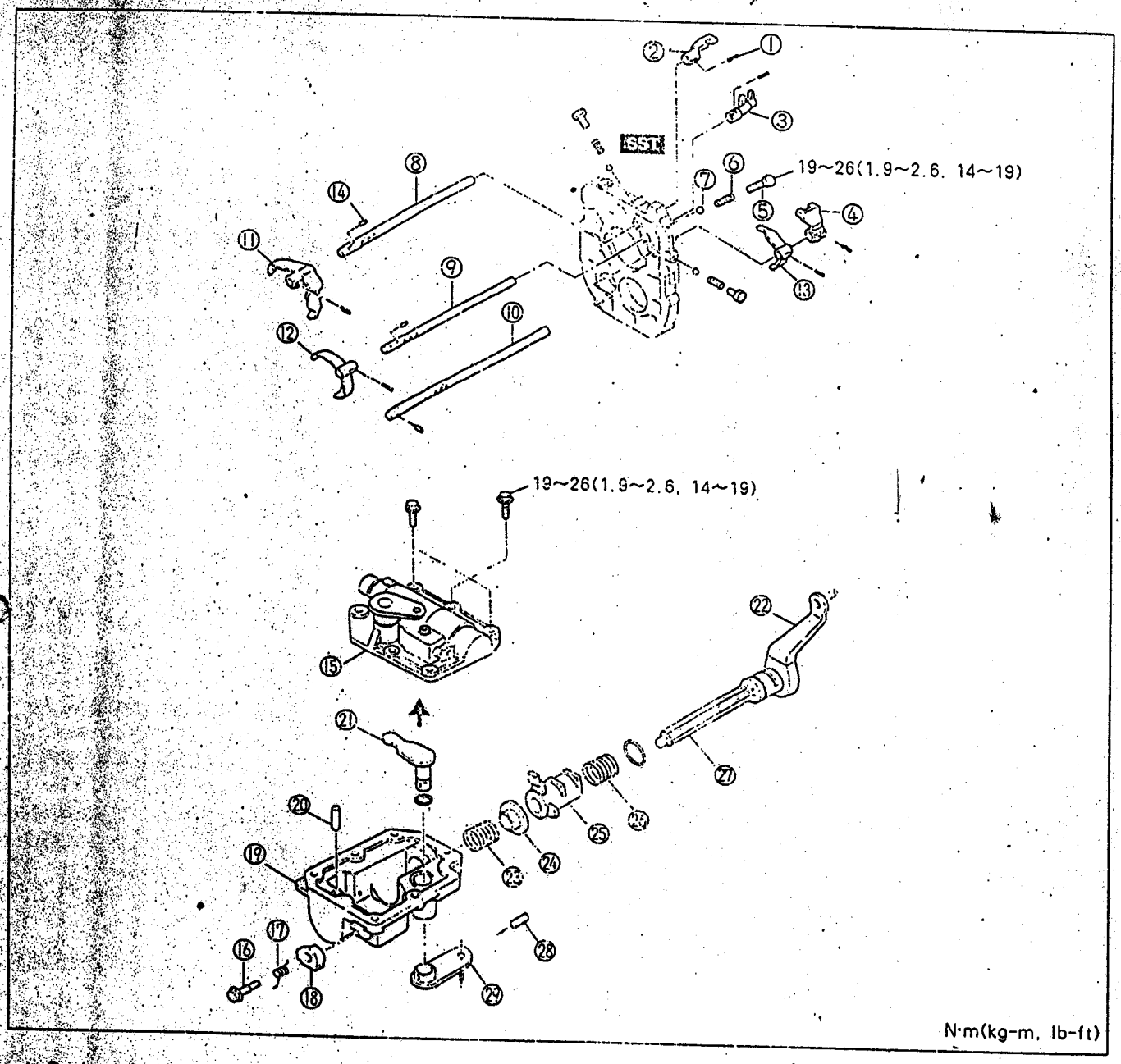
5. When assembling the clutch hub, assemble in direction as shown in the figure and push it by press.



AN9041014

SHIFT ROD AND TOP COVER

1. Remove in the steps shown in the figure, and install in the reverse order of removal.
2. Refer to notes for disassembly and assembly.
3. Inspect all parts after disassembling, and repair or replace if necessary.

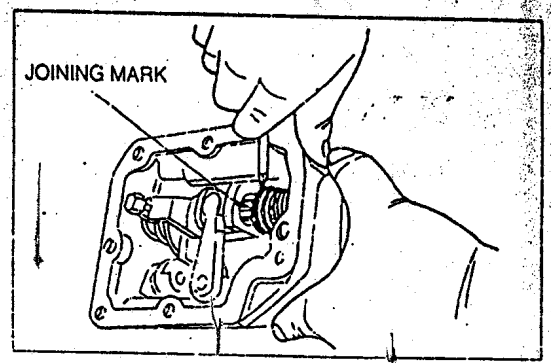


AN9041015

1. Spring pin
2. Shift end (1st & 2nd)
3. Shift end (3rd & 4th)
4. Shift end (5th & reverse)
5. Bolt
6. Spring
7. Steel ball
8. Shift rod (1st & 2nd)
9. Shift rod (3rd & 4th)
10. Shift rod (5th & reverse)
11. Shift fork (1st & 2nd)
12. Shift fork (3rd & 4th)
13. Shift fork (5th & reverse)
14. Interlock pin
15. Top cover assembly
16. Guide bolt
17. Spring
18. Gate
19. Top cover
20. Spring pin
21. Selection arm
22. Shift lever
23. Spring (1st & 2nd)
24. Stopper
25. Change lever
26. Spring (5th & reverse)
27. O-ring
28. Spring pin
29. Select lever

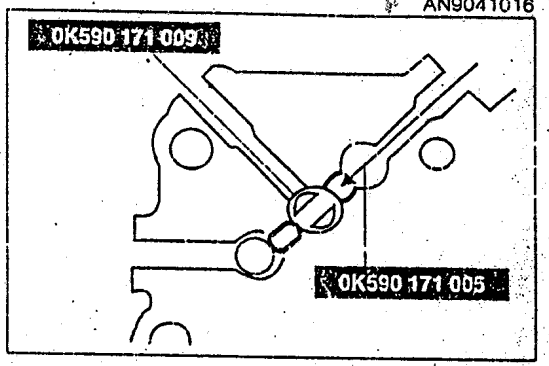
Disassembly and Assembly note

1. Mark the shift lever shaft and the shift lever for identical installation position.



AN9041016

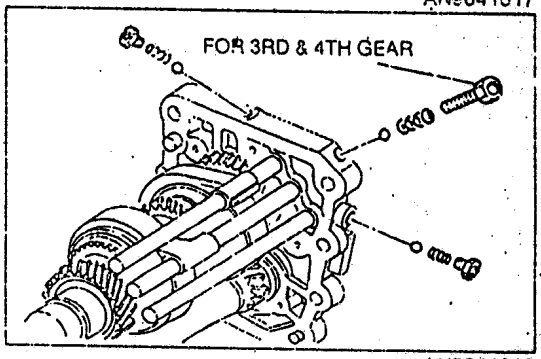
2. Assemble the interlock pin into the center of the bearing housing by using **SST**.



AN9041017

3. Assemble the ball spring plug by using a hexagon wrench. Pay attention to length of the plug.

   Long plug : for 3rd & 4th gear
   Tightening torque : 19~25 N·m(1.9~2.6 kg-m, 14~19 lb-ft)



AN9041018

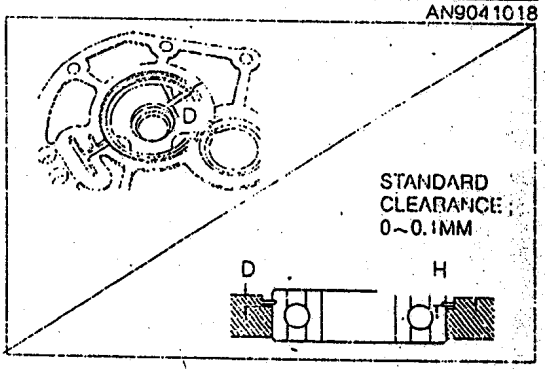
ADJUSTMENT OF BEARING SHIM

1. Measure the height (D) of part to where the main bearing of clutch housing is installed.
2. Measure the height (H) from the front end of bearing to the surface of transmission casing.

   Measure clearance : D-H

3. Adjust the standard clearance by using the adjusting shim.

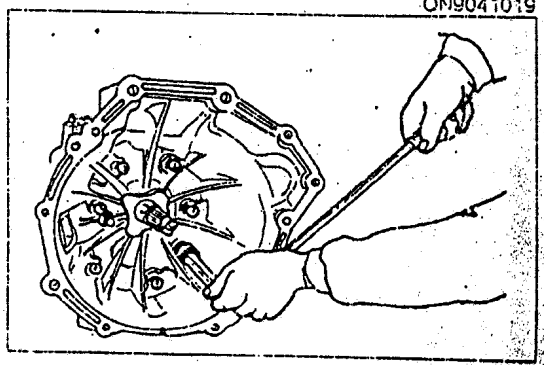
   Standard clearance : 0~0.1 mm(0~0.004 in)
   Thickness of adjusting shim :
   0.10 mm, 0.15 mm, 0.30 mm(0.004 in, 0.006 in, 0.012 in)



ON9041019

4. After inserting the shim, tighten the clutch housing to the transmission.

   Tightening torque : 43~55 N·m(4.4~5.6 kg-m, 32~41 lb-ft)


AN9041020

INSPECTION

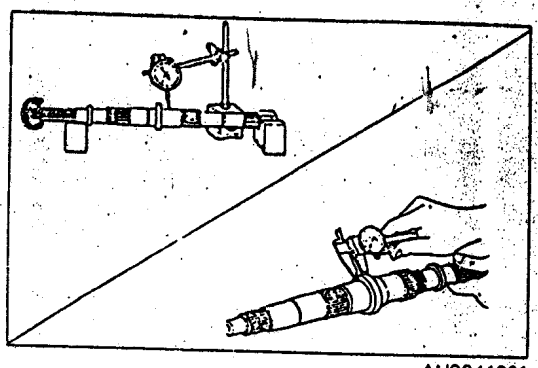
Main Shaft

1. Check the runout of shaft.

   Runout : 0.03 mm(0.012 in)

2. Measure the thickness of shaft flange.

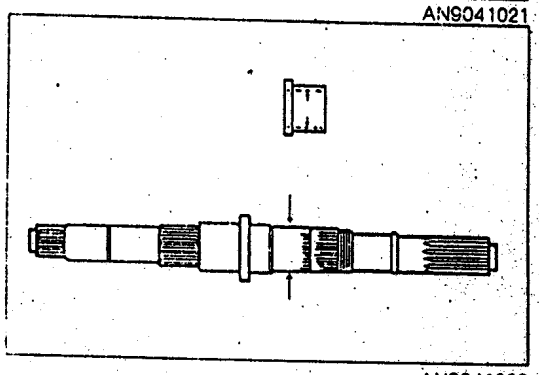
   Standard : 7.45~7.55 mm(0.293~0.297 in)



AN9041021

3. Measure the inner diameter of sleeve of reverse gear and the outer diameter of main shaft.

   Outer diameter of shaft :
   37.022~37.003 mm(1.4575~1.4568 in)
   Inner diameter of sleeve :
   37.040~37.056 mm(1.4582~1.4588 in)

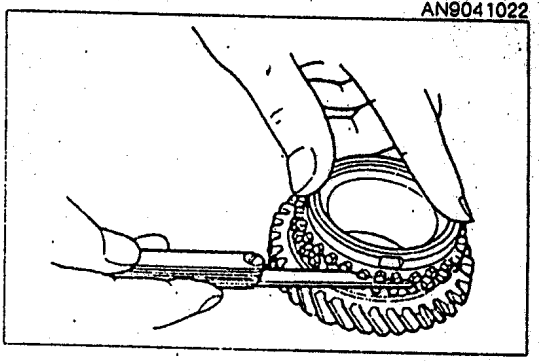


AN9041022

Synchronizer Ring

1. Measure the side clearance of the synchronizer ring and gear on its circumference after correctly putting the synchronizer ring on the gear.

   Standard clearance
   Double synchronizer ring : 1.3 mm(0.051 in)
   Single synchronizer ring : 1.5 mm(0.059 in)
   Limit : 0.8 mm(0.0315 in)

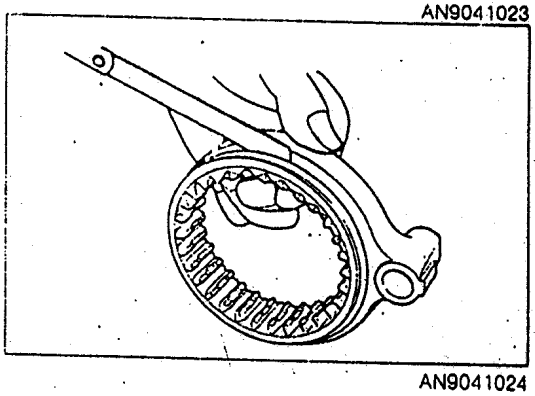


AN9041023

Clutch Hub Sleeve

1. Measure the clearance of the clutch hub and shift fork.

   Standard clearance : 0.2~0.3 mm(0.0078~0.0118 in)
   Limit : 0.8 mm(0.0315 in)

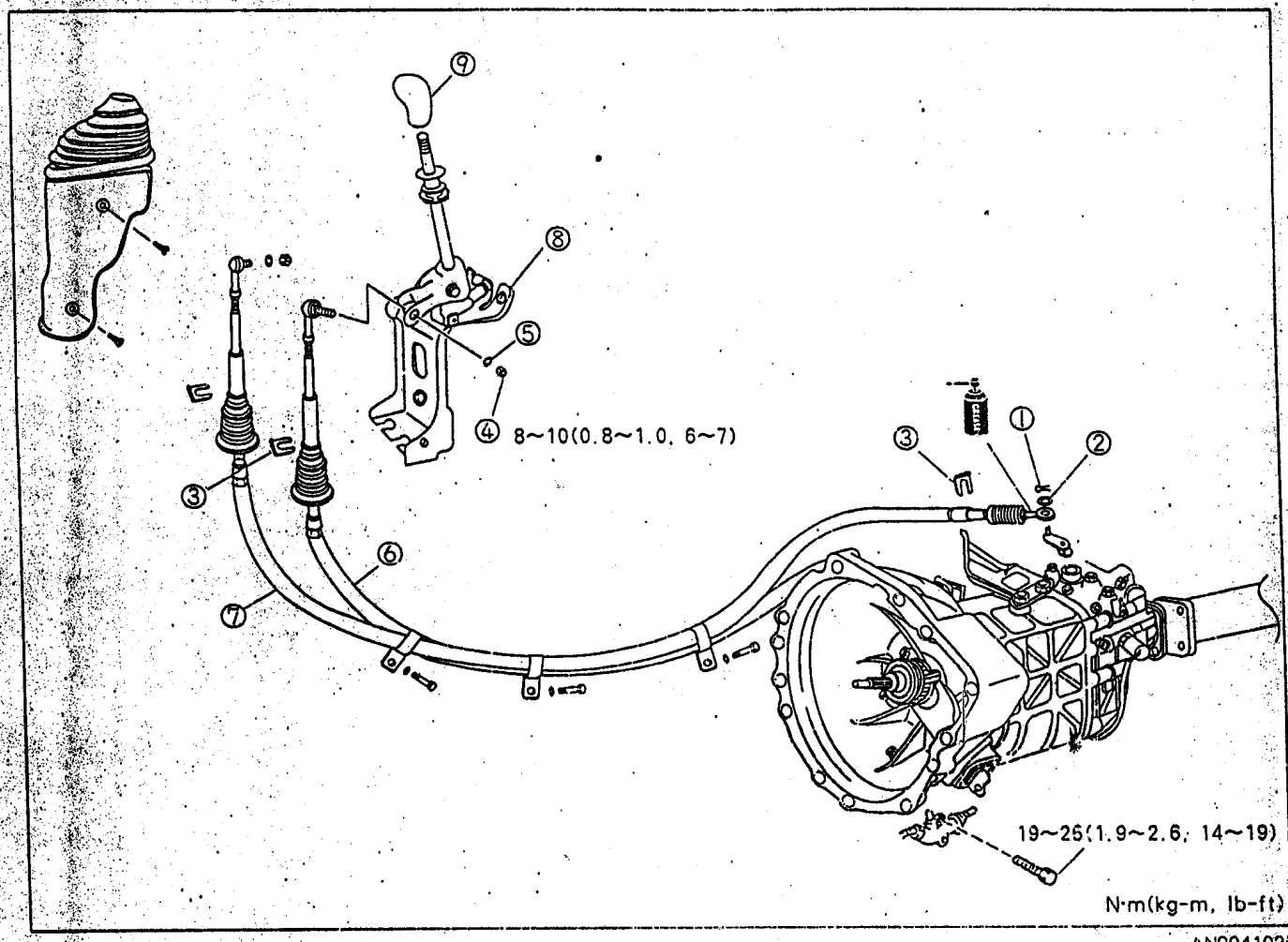


AN9041024

CHANGE CONTROL

DISASSEMBLY/ASSEMBLY

1. Remove in the steps shown in the figure.
2. Inspect all parts, and repair or replace if necessary.
3. Install referring the notes for installation.

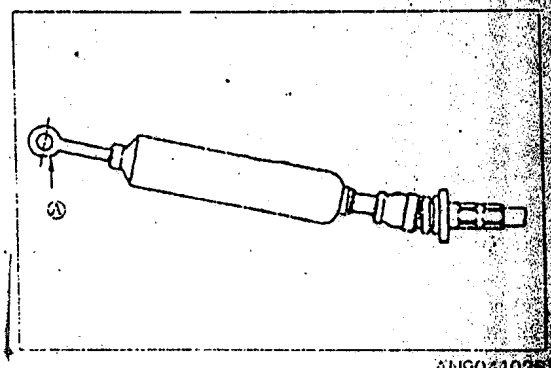


AN9041025

1. Snap pin
2. Washer
3. Clip
4. Nut
5. Spring washer
6. Shift cable
7. Select cable
8. Change lever assembly
9. Knob

Installation note

1. Hold the cable end Ⓐ and install it during paying attention to it not to be bent.
2. Note the color of select cable is red.



AN9041026

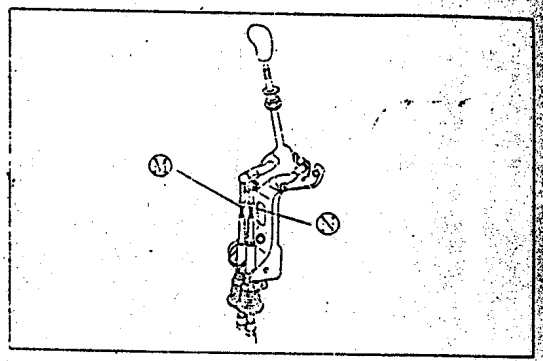
INSPECTION/ADJUSTMENT

1. When the change lever is trembled in left and right, loosen the nut Ⓜ and tighten after adjusting.

   Tightening torque : 10~15 N·m(1.0~1.5 kg-m, 7~11 lb-ft)

2. When the change lever is trembled in back and forth, loosen the nut Ⓝ and tighten after adjusting.

   Tightening torque : 10~15 N·m(1.0~1.5 kg-m, 7~11 lb-ft)

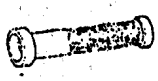
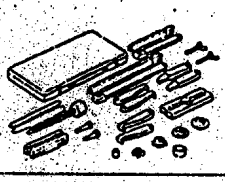
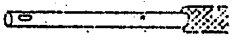
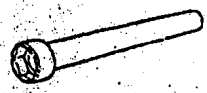
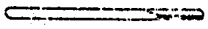
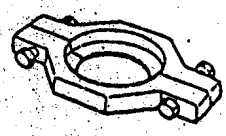
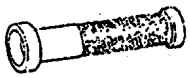


AN9041027

SPECIFICATIONS

Items		Specifications	
		12 seats Standrad	15 seats Standrad
Type		Forward ; 5-speed, Reverse ; 1-speed	
		Synchro mesh (1st and 2nd ; Double synchro)	
Gear ratio	1st	4.011	4.419
	2nd	2.272	2.543
	3rd	1.425	1.536
	4th	1.000	1.000
	5th	0.831	0.865
	Reverse	3.958	4.432
Oil	Capacity ℓ (qt)	2.2(2.32)	
	Grade	API Service Class GL4 Four Seasons ; SAE 75W-90	

SPECIAL TOOLS

0K993 171 007 Main shaft holder 	Fixing drive shaft	0K590 170 004 Main drive gear installer 	Assembling bearing
0K670 990 AA0 Bearing puller set 	Removing bearing	0K590 171 009 Shift fork guide assembly 	Assembling interlock pin 
0K590 171 010 Main shaft lock nut wrench 	Assembling/ Disassembling lock nut of hub	0K590 171 005 Interlock pin guide 	Assembling interlock pin
0K130 275 008 Fan pulley boss puller 	Removing gear and bearing	0K590 170 007/003 Transmission bearing installer 	Assembling bearing

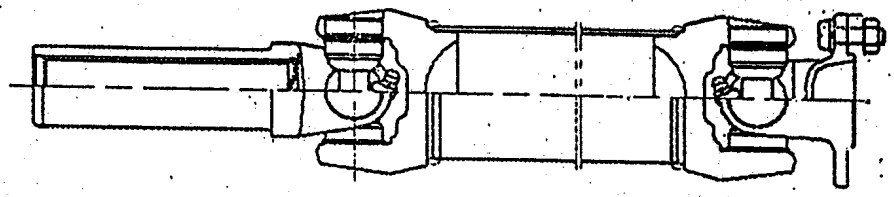
PROPELLER SHAFT

43

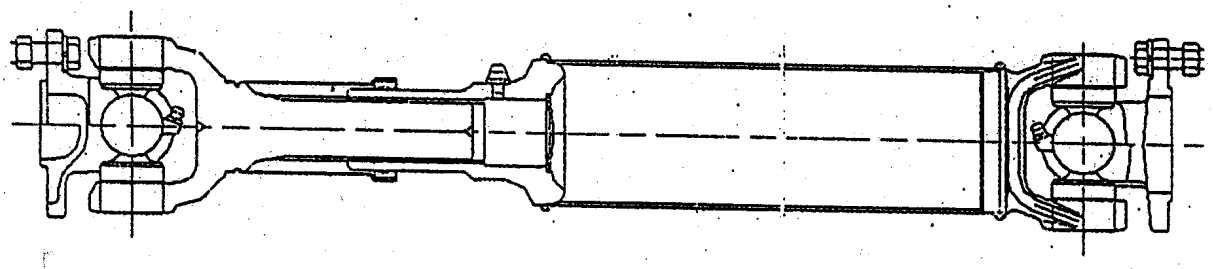
OUTLINE

STRUCTURAL VIEW

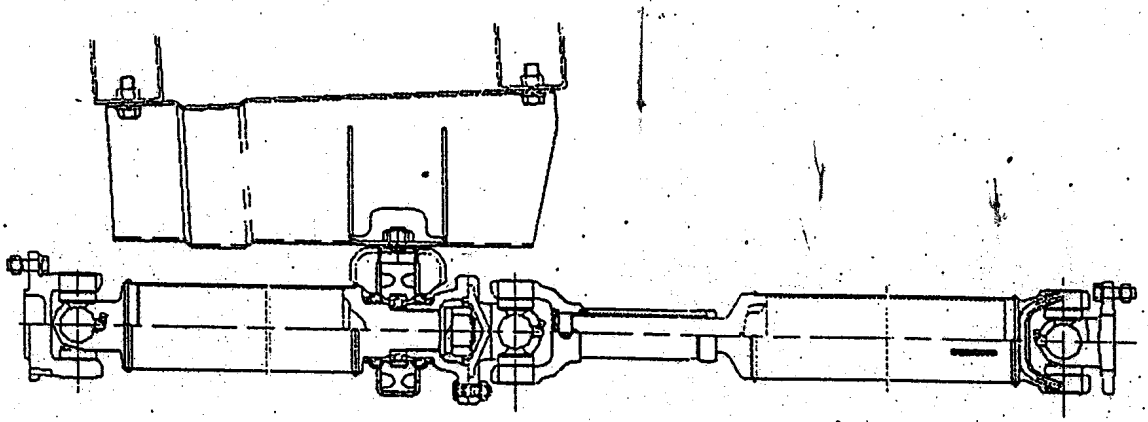
12 seats A/T



12 seats M/T



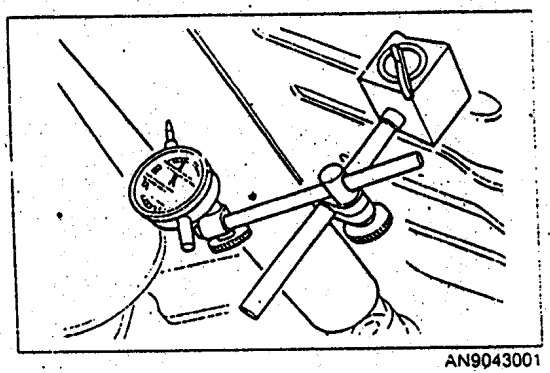
15 seats M/T



TROUBLESHOOTING GUIDE

Problem	Possible cause	Action
Vibration	Bent propeller shaft Imbalanced propeller shaft Cracked sleeve yoke spline Loose yoke joints	Replace Repair Replace Tighten
Noise	Cracked sleeve yoke spline Worn or cracked spider bearing Loose yoke joints	Replace Replace Tighten

INSPECTION


AN9043001

Spline backlash

1. Check for loose yoke joints and tighten if necessary.
2. Check for spline and universal joints backlash.

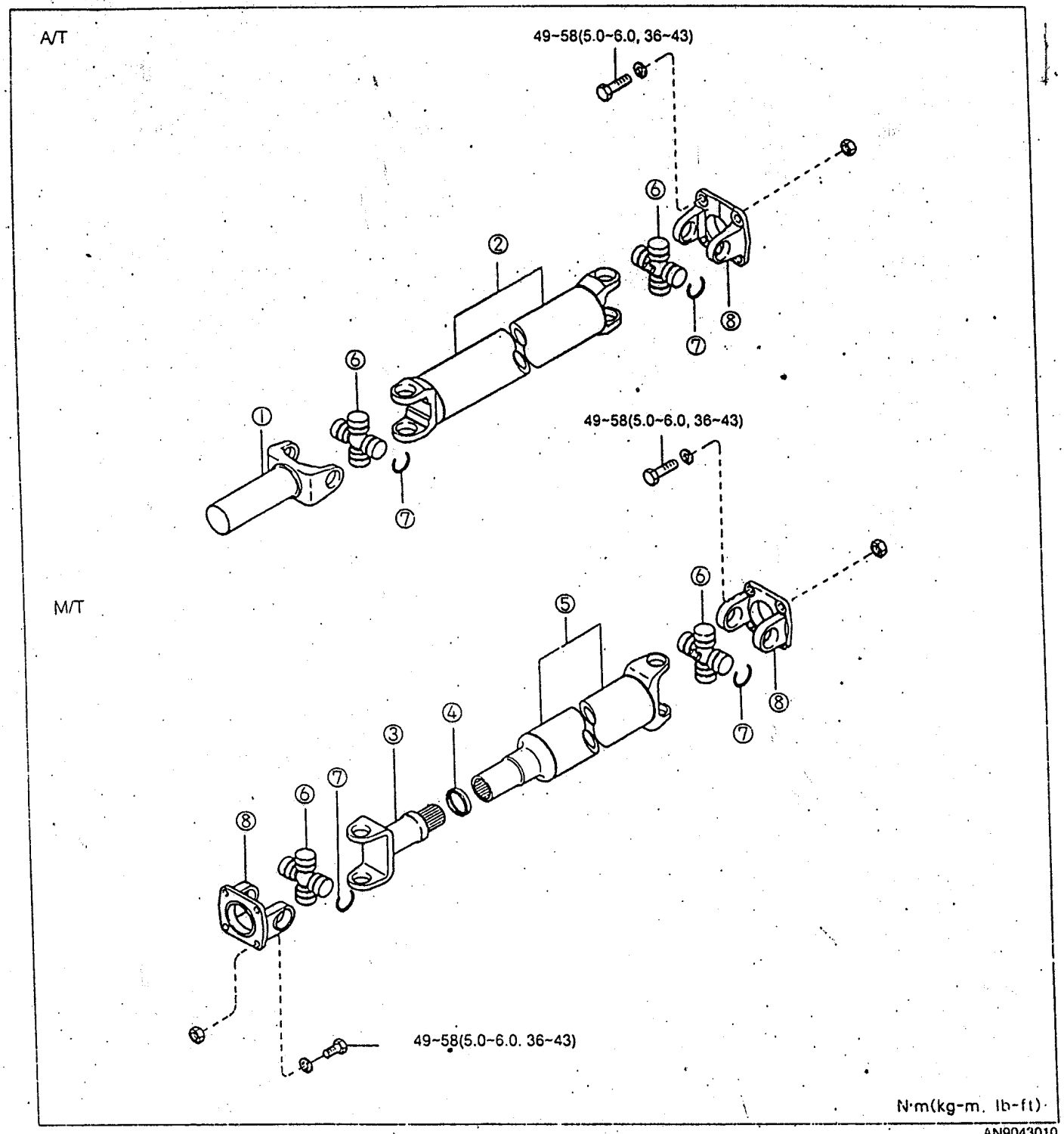
Bend

1. Raise the vehicle and support it with safety stand.
2. Measure how sharply propeller shaft is bent by turning wheels by hand and replace if necessary.

Limit : 0.4 mm(0.016 in)

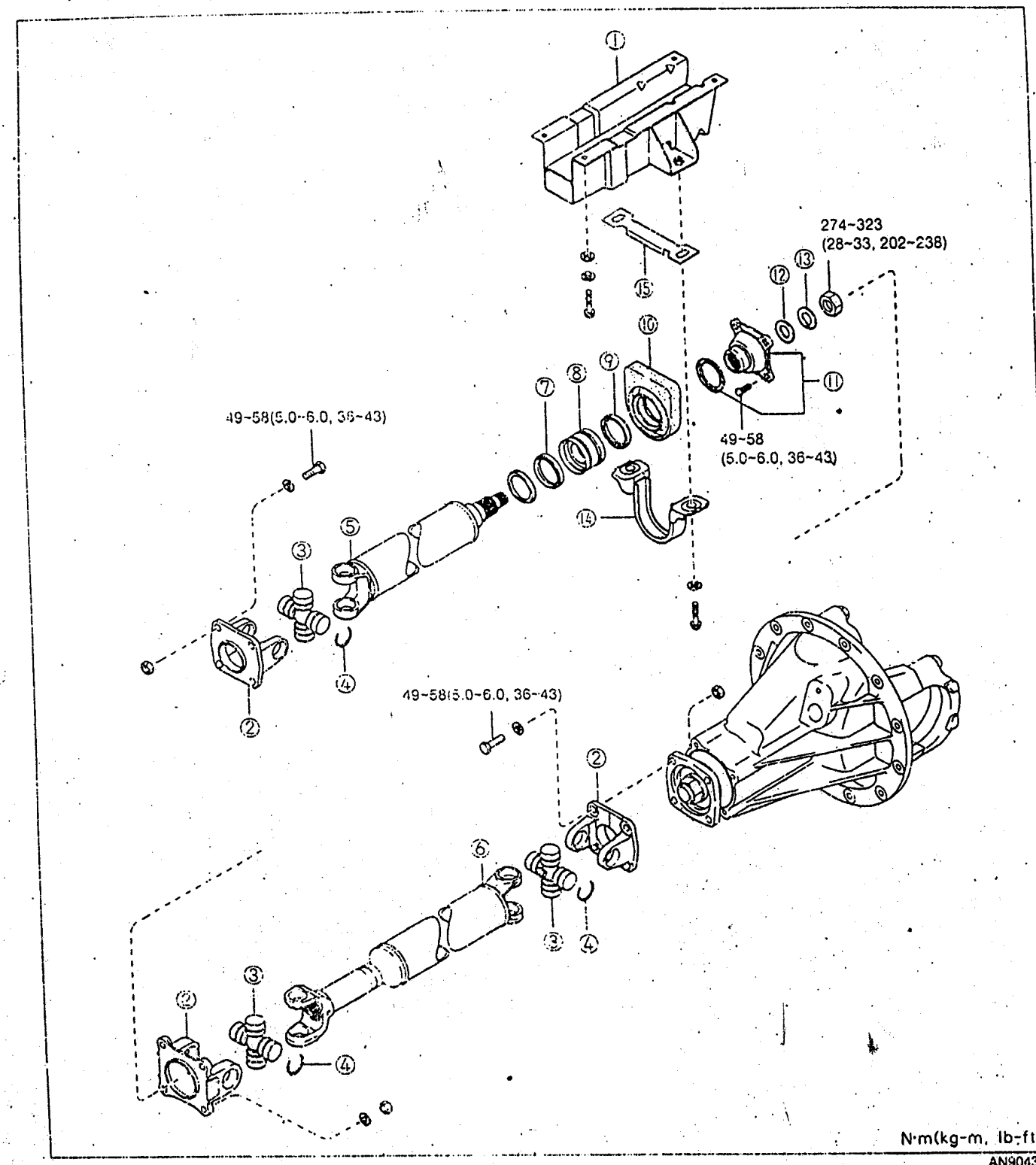
DISASSEMBLY/ASSEMBLY

12 seats



1. Sliding yoke(A/T)
2. Propellar shaft(A/T)
3. Sliding joint(M/T)
4. Dust seal
5. Universal joint yoke
6. Universal joint
7. Snap ring
8. Universal joint

15 seats



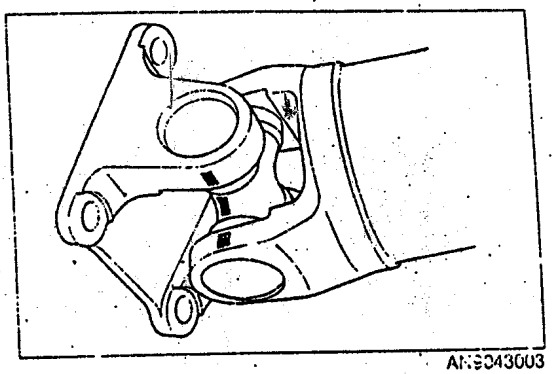
1. Center bearing bracket	6. Rear universal joint yoke	11. Companion flange
2. Universal joint yoke	7. Front oil seal	12. Plain washer
3. Universal joint	8. Center bearing	13. Washer spring
4. Snap ring	9. Rear oil seal	14. Center bearing support
5. Front universal joint yoke	10. Center bearing rubber	15. Rubber holder

DISASSEMBLY NOTE

1. Mark spider, yoke and propeller shaft for reassembling.

Caution

- **Incomplete joint between propeller shaft spider and yoke at the time of assembly may cause vibration.**



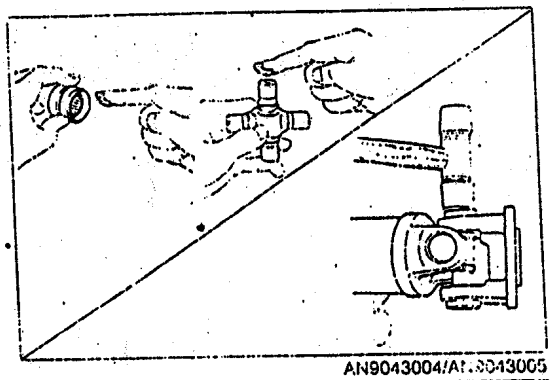
AN9043003

ASSEMBLY NOTE

1. Apply grease to spider and bearing.
2. Assemble yoke and spider to propeller shaft, and bearing to yoke by tapping with a plastic hammer.

Caution

- **Be sure to have assembly marks of spider and yoke go exactly right.**

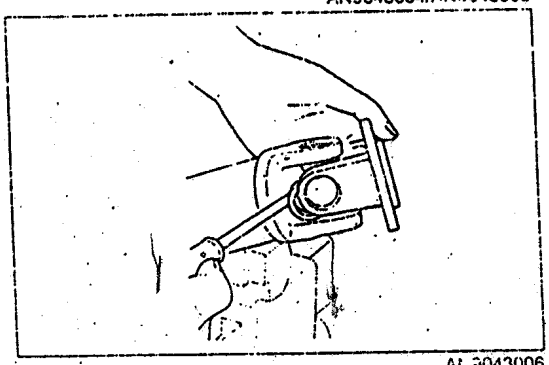


AN9043004/AN9043005

3. Assemble with a new snap ring.

Caution

- **Do not reuse snap rings.**
- **Use four(4) snap rings with same thickness.**
- **Ensure snap rings be completely seated and firm.**



AN9043006

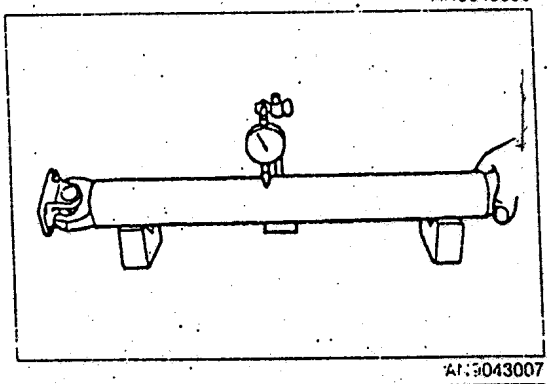
INSPECTION

1. Check for bend of propeller shaft.

Note

- **Measure from the center of propeller shaft.**

Limit : 0.4 mm(0.016 in)



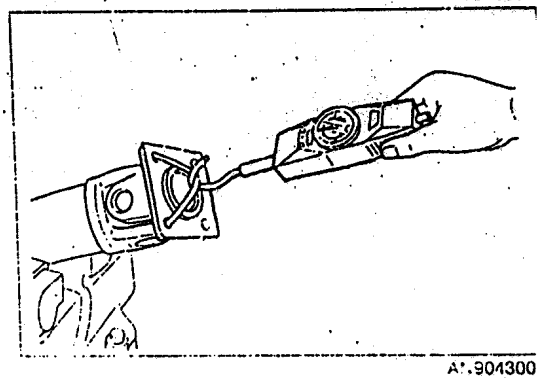
AN9043007

2. Check moving torques of universal joints.

Torque : A/T : 0.3~0.8 N·m(3~8 kg-cm, 2.6~7 lb-in)
M/T : 0.5~1.4 N·m(5~14 kg-cm, 4.3~12 lb-in)

Caution

- **Replace and adjust snap rings if the torques are not within specification. (Refer to Page 43-8)**



AN9043008

SPECIFICATIONS

1. Length(between joints) and diagram

mm(in)

Propeller shaft		Standard length		Outer diameter D (mm)
		Front	Rear	
12 seats	A/T	777(30.6)	-	ø 63.5(2.5)
	M/T	988~997(38.9~39.3)	-	
15 seats	M/T	553(21.8)	801~815(31.5~32.0)	ø 76.2(3)
				ø 76.2(3)

2. Snap ring

A/T

mm(in)

Part number	Thickness	Part number	Thickness
01757 25 171	1.22(0.048)	01757 25 176	1.32(0.0519)
01757 25 172	1.24(0.0488)	01757 25 177	1.34(0.0527)
01757 25 173	1.26(0.0496)	01757 25 178	1.36(0.0535)
01757 25 174	1.28(0 0504)	01757 25 179	1.38(0.0543)
01757 25 175	1.30(0.0511)		

M/T

mm(in)

Part number	Thickness	Part number	Thickness
0W001 25 171A	1.45(0.057)	0W001 25 175A	1.63(0.0641)
0W001 25 172A	1.48(0.0582)	0K410 25 071	1.60(0.0629)
0W001 25 173A	1.54(0.0606)	0K421 25 071	1.50(0.590)
0W001 25 174A	1.57(0.0618)		

3. Tightening torque

		N.m(kg-m, lb-ft)
Transmission x propeller shaft	A/T	--
	M/T	49~59(5~6, 36.3~43.5)
Propeller shaft x differential	A/T	49~59(5.0~6.0, 36.3~43.5)
	M/T	49~59(5~6, 36.3~43.5)

FRONT AND REAR AXLE

50

TROUBLESHOOTING GUIDE

FRONT AXLE

Problem	Possible cause	Action
Steering wheel vibration	Improper adjustment of wheel bearing	Adjust
	Worn or damaged wheel bearing	Adjust
Dragging or pulls to one side	Worn or damaged wheel bearing	Replace
	Improper adjustment of wheel bearing	Adjust
Excessive clearance of steering wheel	Poor adjustments of wheel bearing	Adjust

REAR AXLE

Problem	Possible cause	Action
Abnormal noise	Bearing housing bent	Replace
	Drive shaft bent	Replace
	Worn or damaged wheel bearing	Replace
	Worn drive shaft spline	Replace
Oil leaks	Worn or broken oil seal	Replace

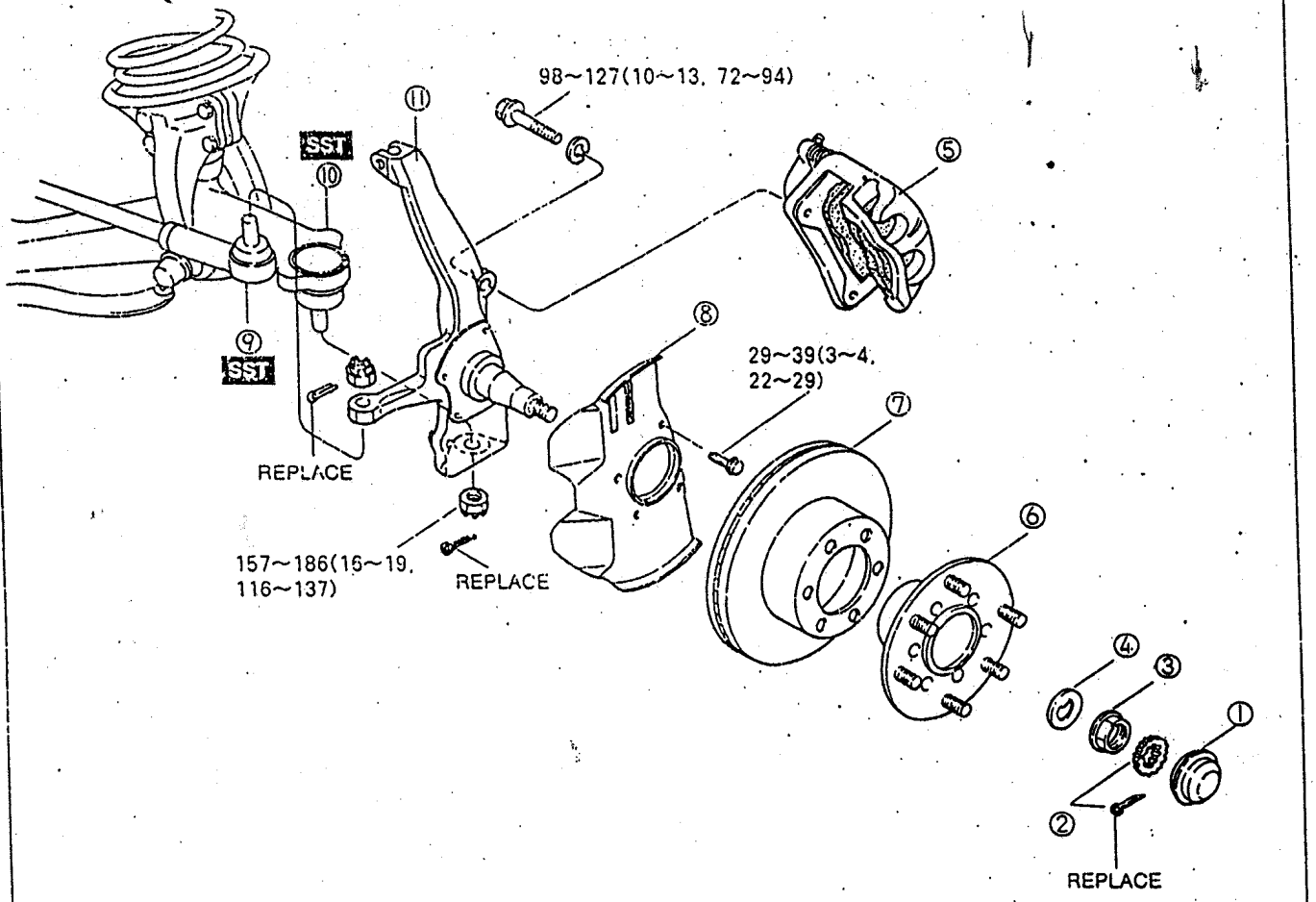
DIFFERENTIAL GEAR

Problem	Possible cause	Action
Abnormal noise	Shortage of differential oil	Add oil
	Improper adjustment of ring gear backlash	Replace
	Improper adjustment of ring gear backlash	Adjust
	Poor engagement of ring gear surfaces	Adjust
	Worn or damaged side bearing	Replace
	Worn or broken ring gear	Replace
	Worn or damaged drive pinion bearing	Replace
	Worn or damaged pinion and side gear	Replace
	Side gears contact with its case	Replace
	Worn gear spline	Replace
	Worn pinion shaft	Replace
	Loose companion flange nuts	Tighten
	Worn thrust washer	Replace
	Improper adjustment of side bearing preload	Adjust
	Worn output shaft spline	Replace
Overheat	Shortage of differential oil	Add oil
	Gear backlash shortage	Adjust
	Excessive bearing preload	Adjust
Oil leaks	Too much differential oil	Remove oil
	Air hole clogged	Repair
	Loose differential carrier	Tighten and repair
	Worn or damaged oil seal	Replace
Differential gear malfunction	Improper assembly	Repair

FRONT AXLE

REMOVAL/INSTALLATION

1. Remove as shown in the figure.
2. Check parts if necessary. Repair or replace as required.
3. Install in the reverse order of removal.
4. After installation, check wheel alignment.



AN9050001

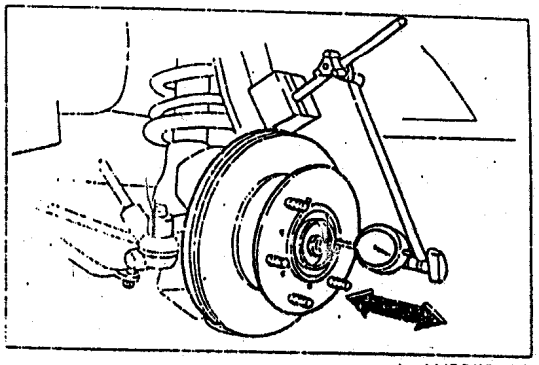
1. Hub cap
2. Dividing pin and cover set
3. Lock nut
4. Washer
5. Brake caliper assembly
6. Front wheel hub assembly
7. Disc plate
8. Dust cover
9. Tie-rod end
10. Lower arm
11. Knuckle spindle

INSPECTION

Wheel bearing play

1. Remove wheels and tires.
2. Remove brake caliper assembly.
3. Install dial gauge to wheel hub and measure wheel bearing play by pushing and pulling it to the shaft direction. Replace wheel bearing if necessary.

   Bearing play : 0.025~0.152 mm(0.001~0.006 in)



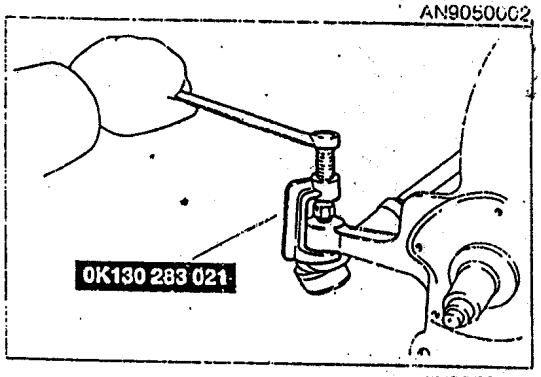
AN9050002

REMOVAL NOTE

Tie-rod end

Caution
- Be sure not to damage dust boot.

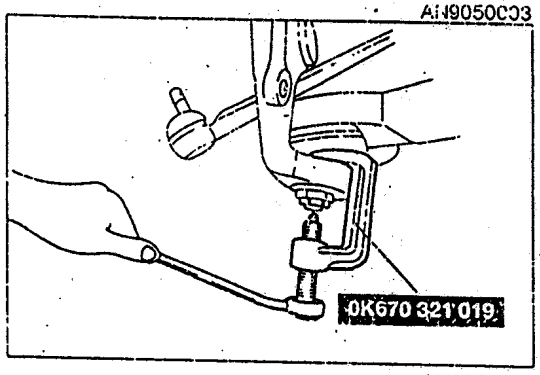
1. Loosen nut and remove tie-rod end using SST.



AN9050003

Lower arm

1. Loosen nut and remove lower arm using SST.

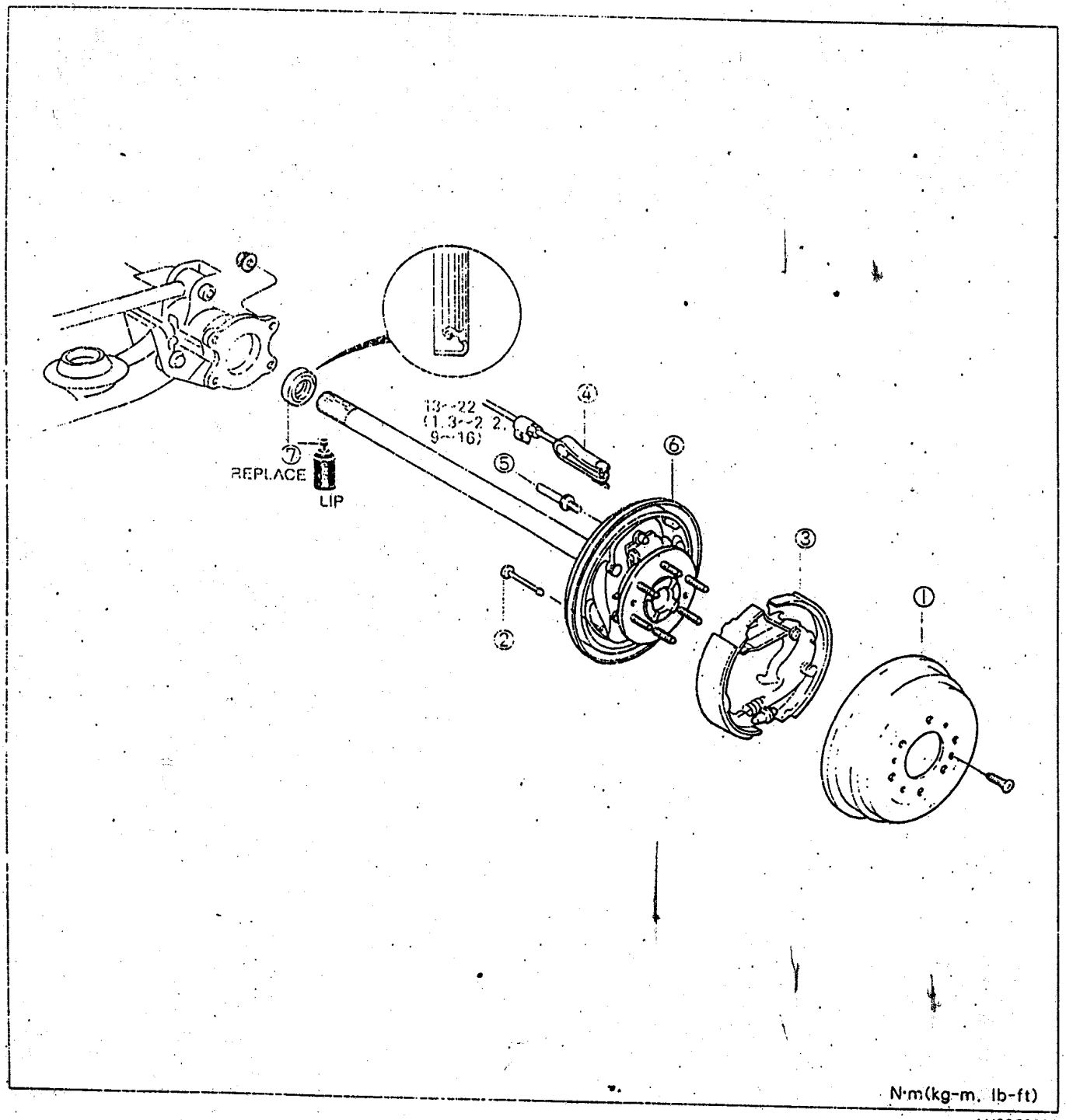


AN9050004

REAR AXLE

REMOVAL/INSPECTION/INSTALLATION

1. Remove as shown in the figure.
2. Check all parts, and repair or replace as required.
3. Install in the reverse order of removal.



AN9050005

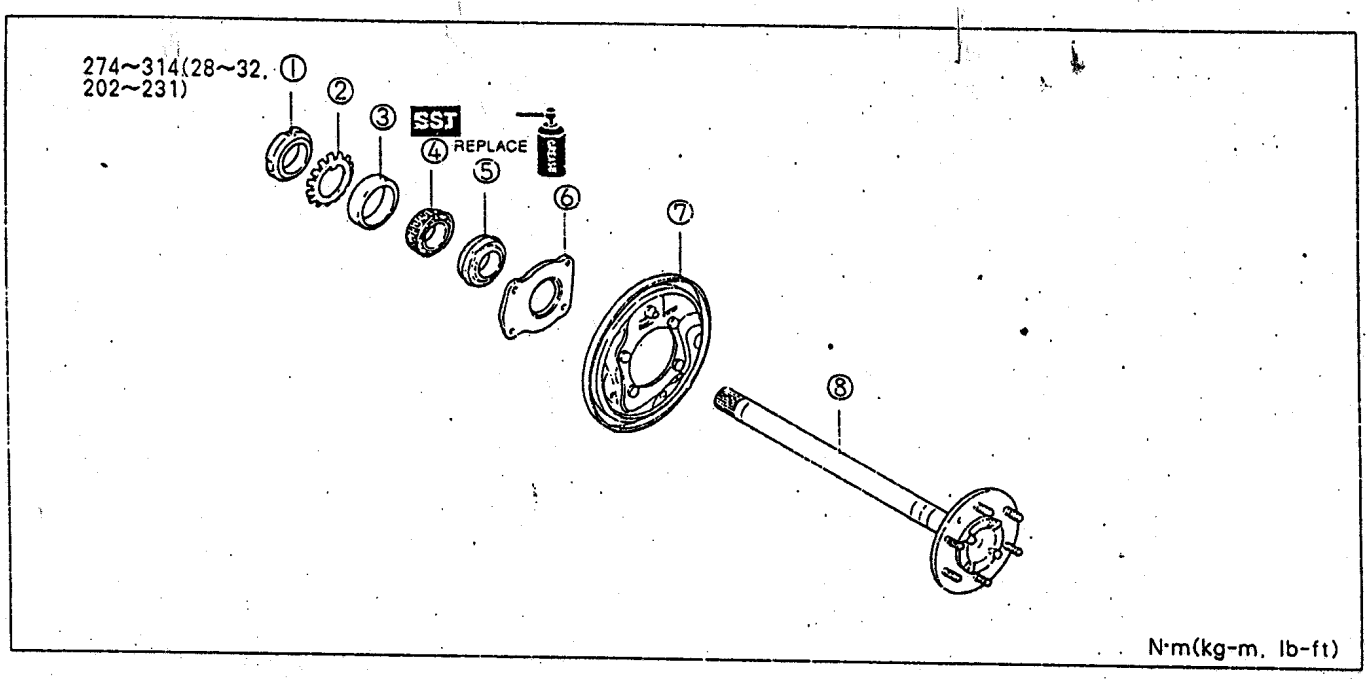
1. Brake drum
2. Hold pin
3. Brake shoe assembly
4. Parking brake cable
5. Brake pipe
6. Backing plate and rear axle shaft assembly
7. Oil seal

DISASSEMBLY/ASSEMBLY

1. Disassemble as shown in the figure.

Caution
- **Pay an extra attention to bearing lock nut of left wheel as it is left-handed nut.**

2. Assemble in the reverse order of disassembly.



AN9050006

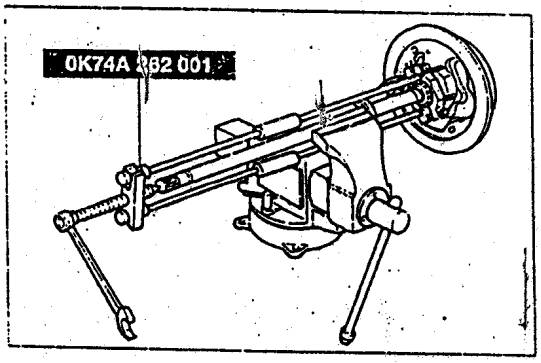
1. Lock nut
2. Lock washer
3. Bearing outer lace
4. Wheel bearing
5. Oil seal
6. Oil seal retainer
7. Backing plate
8. Rear axle shaft

DISASSEMBLY NOTE

Bearing

Caution
- **Put the protecting pad to the vise.**

1. Remove bearing using **SST.**
   - **Specification of grease : SHELL RETINAX LX2 or equivalent**



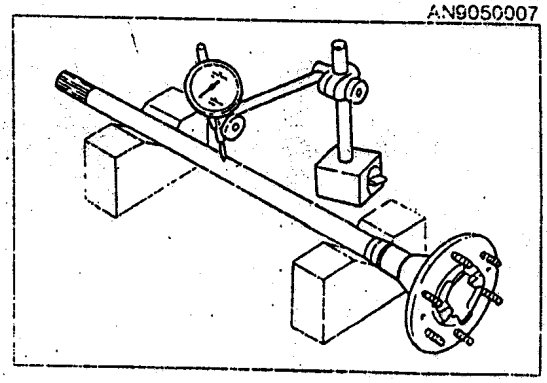
AN9050007

INSPECTION

Rear axle shaft

1. Measure shaft runout with the dial gauge.
2. Adjust axle shaft if runout is not within specification.

Runout : 0.5 mm(0.2 in)



AN9050008

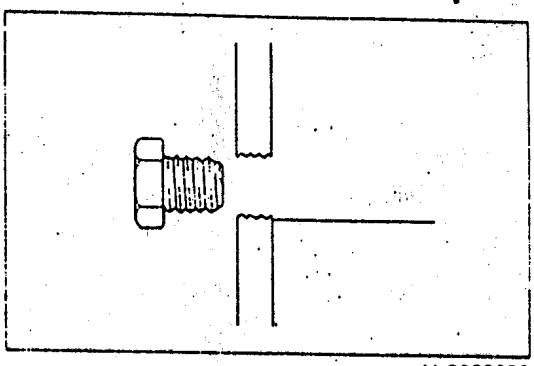
DIFFERENTIAL

DIFFERENTIAL OIL CHECK

Inspection

1. Remove filler plug.
2. Check if oil is enough to be seen from the filling hole. Supply more regular oil if oil is not enough.
3. Assemble filler plug.

   Tightening torque : 39~54 N·m(4.0~5.5 kg-m, 29~40 lb-ft)

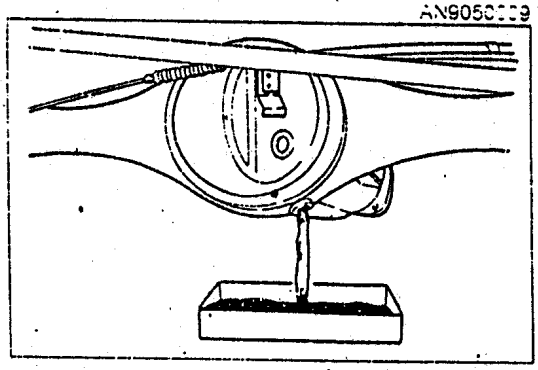


AN9050009

Replacement

1. Remove drain and filler plug and drain oil.
2. Clean plug.
3. Put sealant on the thread of drain plug.
4. Put new washer and tighten drain plug.

   Tightening torque : 39~54 N·m(4.0~5.5 kg-m, 29~40 lb-ft)



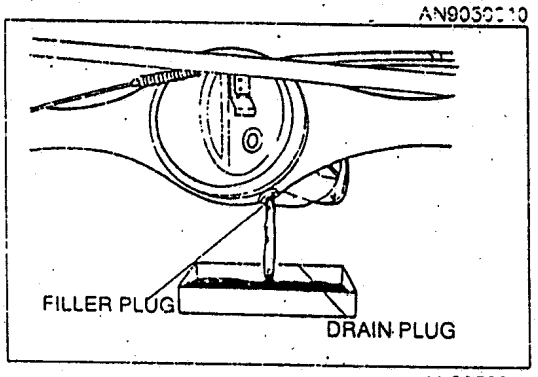
AN9050010

5. Add oil until the level reaches filling hole.

   Regular oil
   Spec. : Higher than -18°C(-0.4°F) : API GL-5, SAE 90
   Lower than -18°C(-0.4°F) : API GL-5, SAE 80
   Qty : 1.3L(1.37 qt)-12 seats, 1.6L(1.69 qt)-15 seats

6. Tighten filler plug.

   Tightening torque : 39~54 N·m(4.0~5.5 kg-m, 29~40 lb-ft)



AN9050011

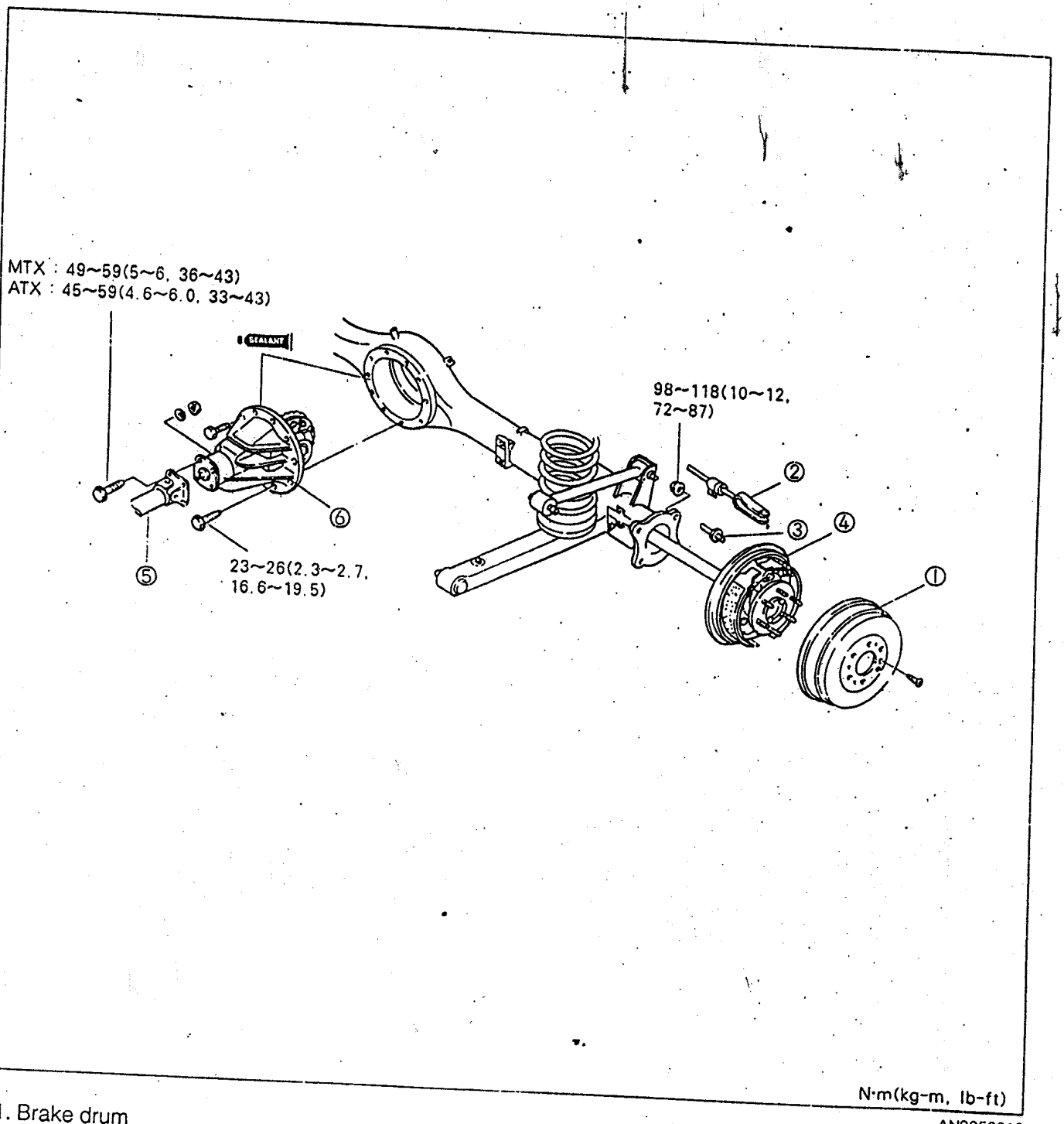
REMOVAL/INSTALLATION

1. Remove as shown in the figure.

Caution

- **Install differential within 10 min. after applying sealant. Wait for about 30 min. before filling oil.**

2. Install in the reverse order of removal.



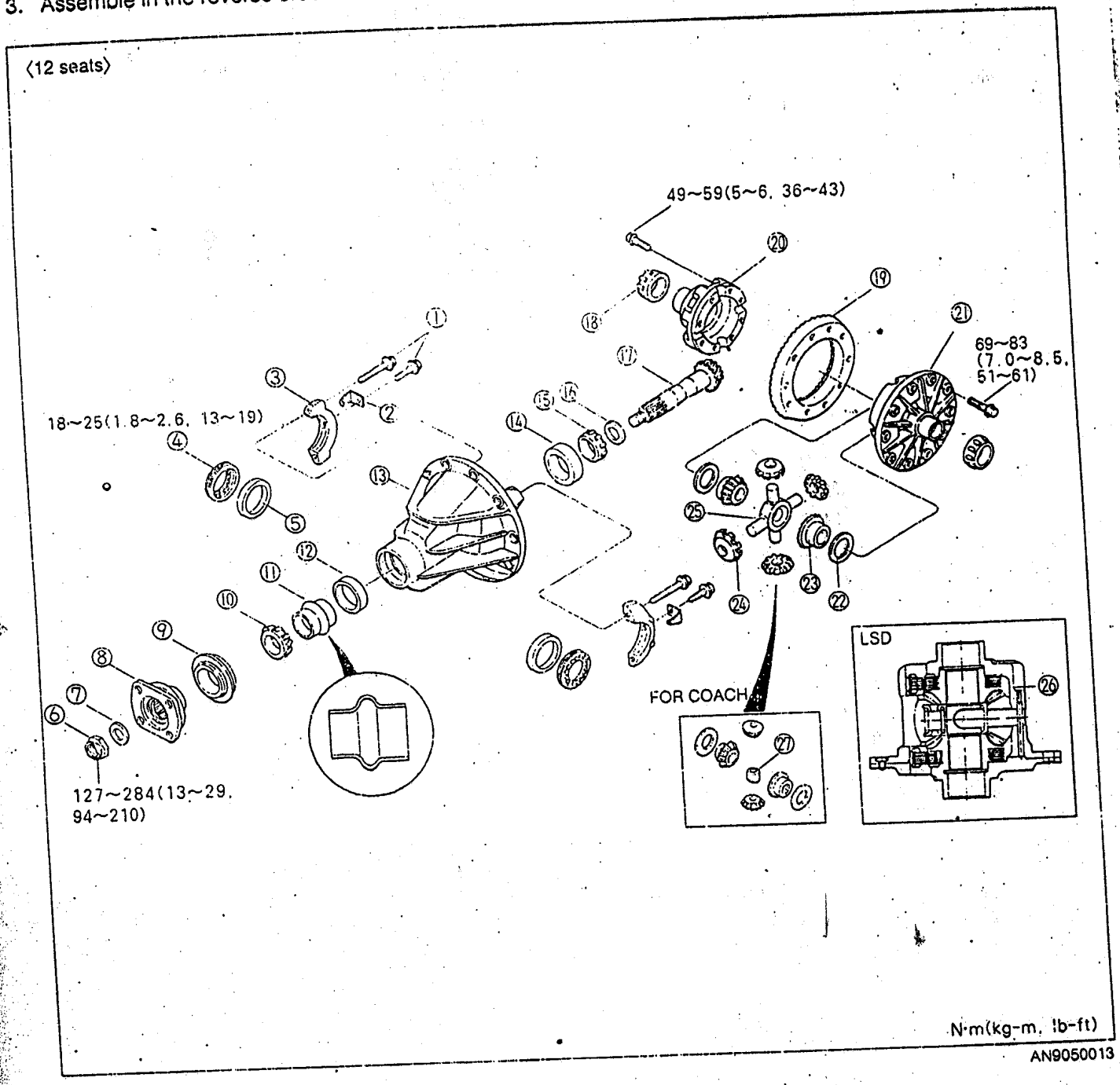
N·m(kg-m, lb-ft)

AN9050012

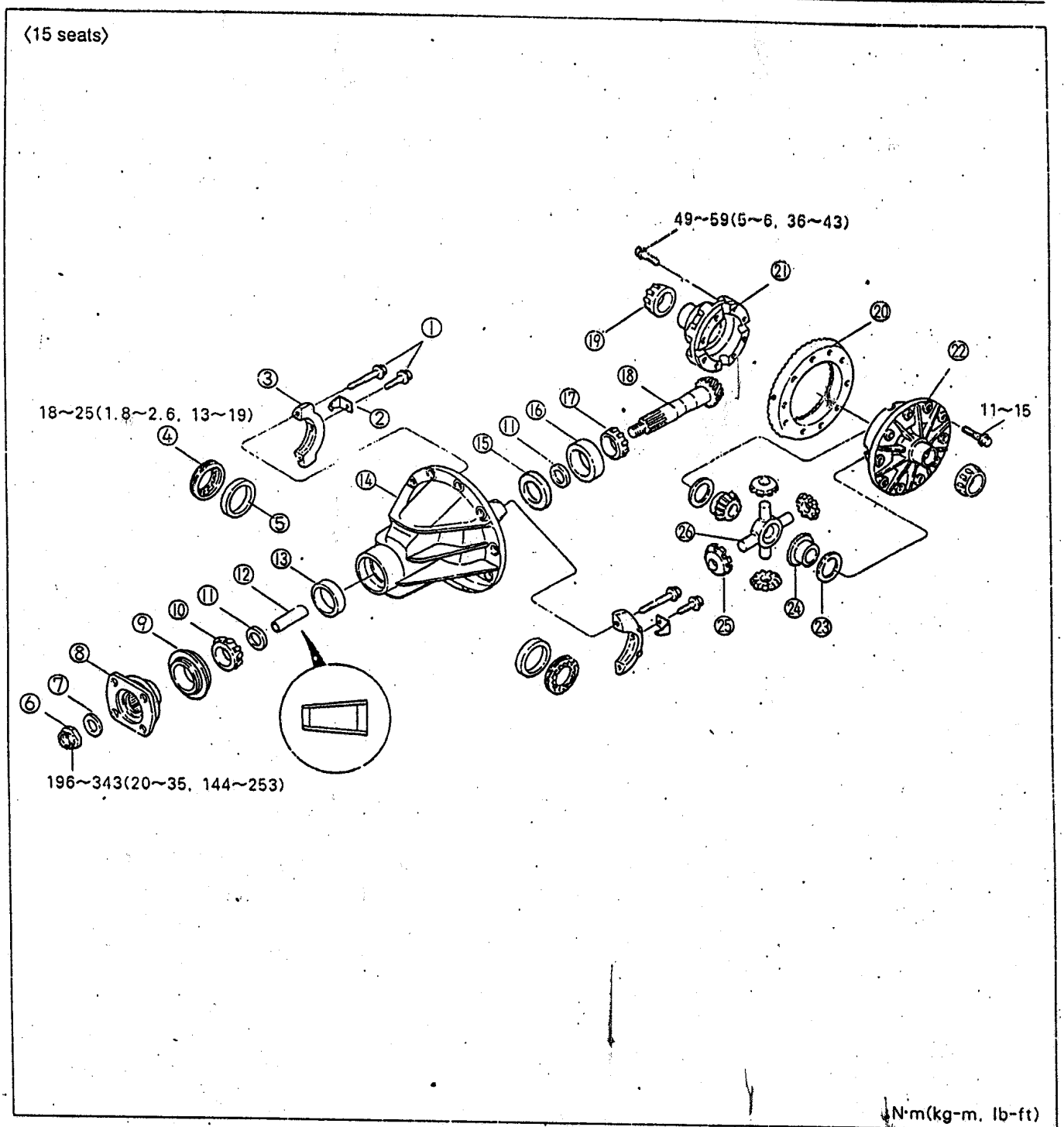
1. Brake drum
2. Parking brake cable
3. Brake pipe
4. Backing plate & rear axle assembly
5. Propeller shaft
6. Differential assembly

DISASSEMBLY/ASSEMBLY

1. Disassemble as shown in the figure, referring to the notes for disassembly.
2. Check every part and repair or replace, as required.
3. Assemble in the reverse order of disassembly, referring to the notes for assembly.

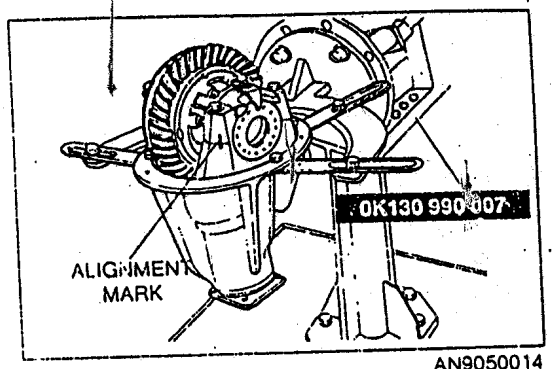


1. Bolt
2. Lock plate
3. Bearing cap
4. Adjusting screw
5. Bearing outer lace
6. Lock nut
7. Washer
8. Companion flange
9. Oil seal
10. Bearing inner lace
11. Collapsible spacer
12. Bearing outer lace
13. Differential carrier
14. Bearing outer lace
15. Bearing inner lace
16. Spacer
17. Drive pinion
18. Bearing inner lace
19. Ring gear
20. Gear case cover
21. Gear case
22. Thrust washer
23. Side gear
24. Pinion gear
25. Spider
26. LSD
27. Thrust block



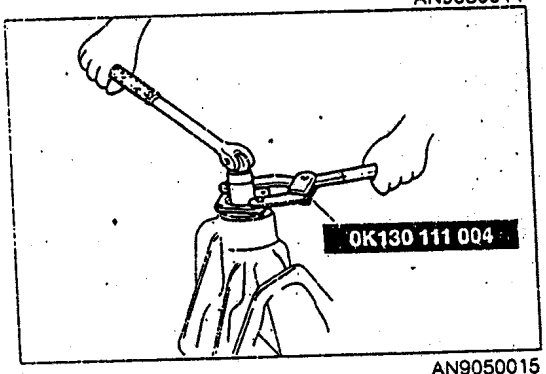
1. Bolt
2. Lock plate
3. Bearing cap
4. Adjusting screw
5. Bearing outer lace
6. Lock nut
7. Washer
8. Companion flange
9. Oil seal
10. Bearing inner lace
11. Shim
12. Spacer
13. Bearing outer lace
14. Differential carrier
15. Shim
16. Bearing outer lace
17. Bearing inner lace
18. Drive pinion
19. Bearing inner lace
20. Ring gear
21. Gear case cover
22. Gear case
23. Thrust washer
24. Side gear
25. Pinion gear
26. Spider

DISASSEMBLY NOTE
Differential carrier
1. Install differential gear assembly to SST.
2. Mark bearing cap and carrier for jointing.



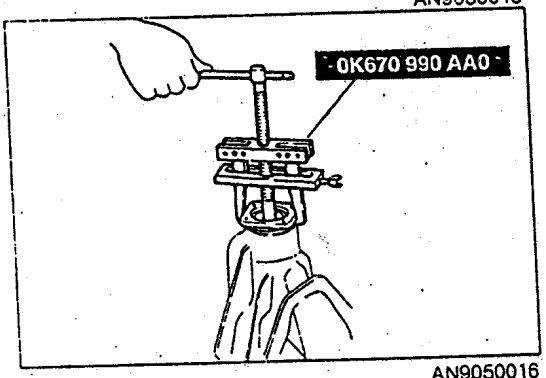
AN9050014

Companion flange
1. Remove lock nut, after holding companion flange with SST.



AN9050015

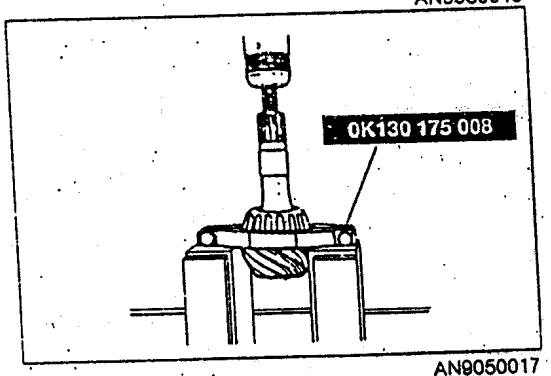
2. Remove companion flange using SST.



AN9050016

Rear bearing
Remove bearing using SST.

Note
- Use your hand for drive pinion not to drop.



AN9050017

Side bearing
Remove side bearing from gear case using SST.

Note
- Make an alignment mark on bearing for reassembly.

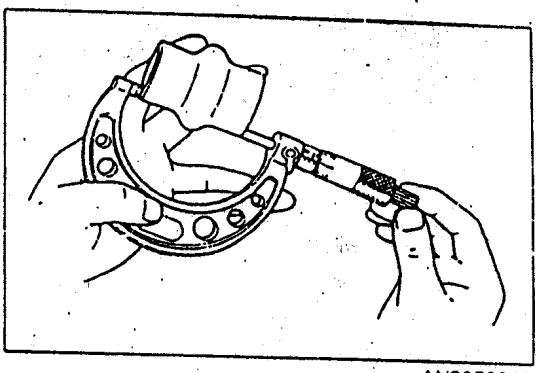
AN9050016

INSPECTION

Collapsible spacer : 12 seats

At the time of differential assembly, replace collapsible spacer with new one.

Standard length : 54.8~56.09 mm(2.16~2.21 in)

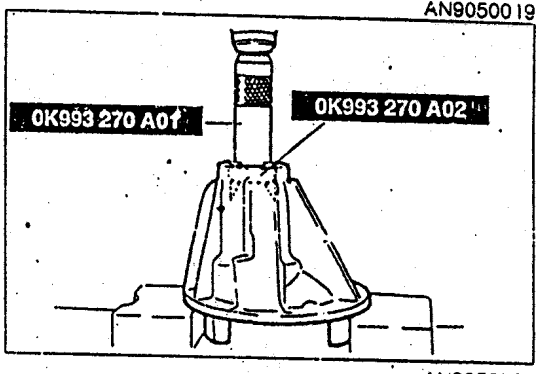


AN9050019

Assembly note

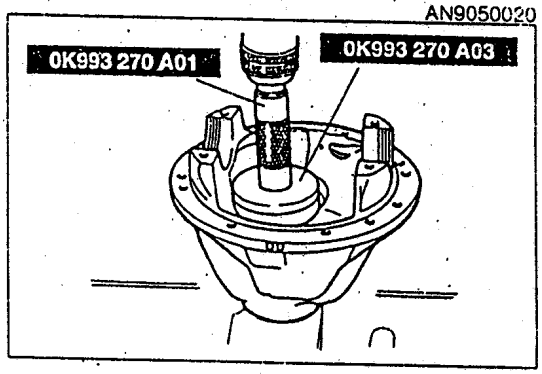
Adjustment of pinion height

1. Assemble front bearing outer lace using SST.



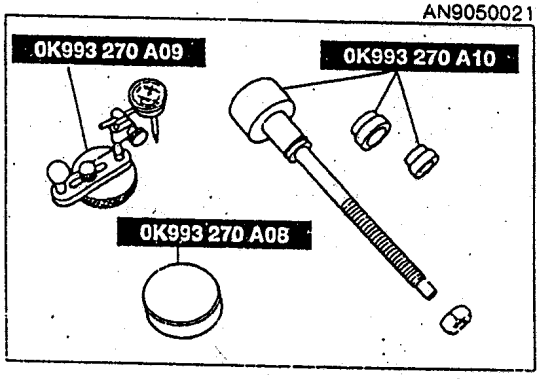
AN9050020

2. Assemble rear bearing outer lace using **SST**. (12 seats)
   Assemble rear bearing outer lace using **SST**. After adjusting to the differential carrier. (15 seats)



AN9050021

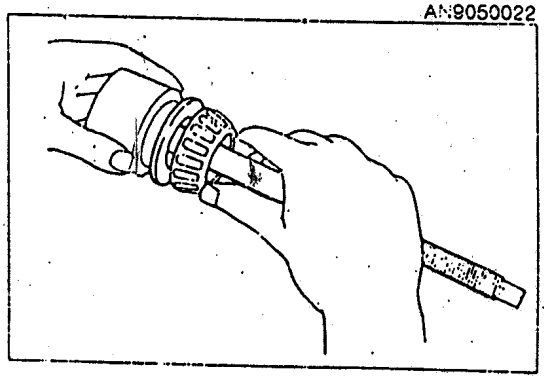
3. For assembly of pinion, use drive pinion model(0K993 270 A01), pinion height adjustment gauge body(0K993 270 A09) and gauge block(ht. 28 mm(1.102 in)).



AN9050022

4. Assemble spacer and rear bearing inner lace to pinion model and fix it with O-ring. (12 seats)
   Assemble rear bearing inner lace to pinion model and fix it with O-ring. (15 seats)

   Note
   - **Use spacer disassembled.(12 seats)**



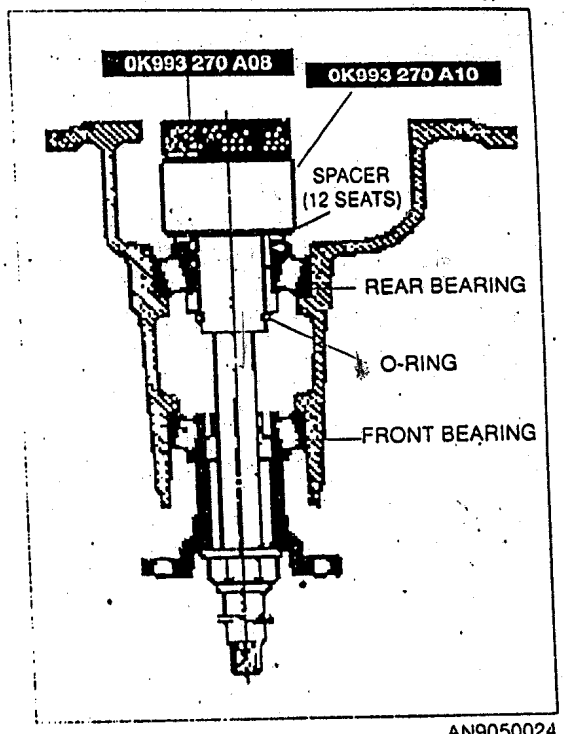
AN9050023

5. Install pinion model assembly to carrier.
6. Assemble front bearing, collar, companion flange washer, and lock nut.

Note
- Use washer and lock nut disassembled.

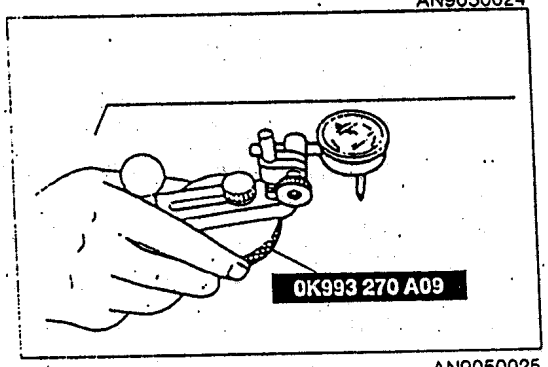
7. Tighten lock nut.

Note
- Tighten to the extent the companion flange can be screwed by hand.



AN9050024

8. Put pinion height adjusting gauge body at right angle and adjust it to 0.



AN9050025

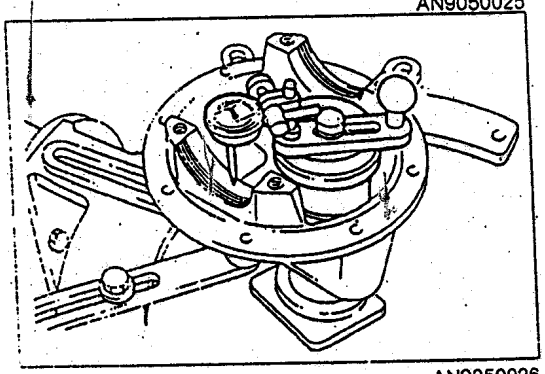
9. Put pinion height adjusting gauge body and gauge block to the upper side of pinion model.
10. Dial gauge needle should be placed at the lowest part of side bearing .
11. Measure minimum positions of both sides (LH, RH).

12. Add both values and divide it by 2.
13. If the value of the above step 12 is not within specification, use new spacer adding the values to current spacer.(12 seats)

Standard clearance : -0.025~0.025 mm(-0.001~0.001 in)

mm(in)

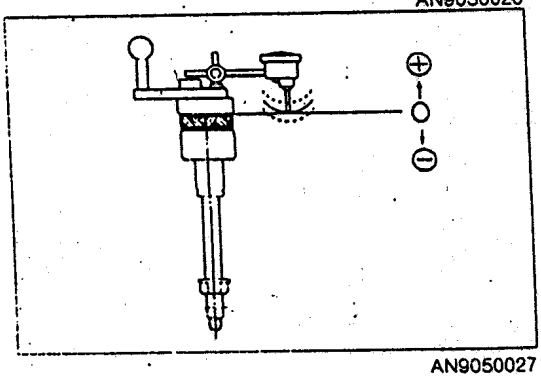
MARK	THICKNESS	MARK	THICKNESS
08	3.08(0.1212)	29	3.29(0.1295)
11	3.11(0.1224)	32	3.32(0.1307)
14	3.14(0.1236)	35	3.35(0.1318)
17	3.17(0.1248)	38	3.38(0.1330)
20	3.20(0.1259)	41	3.41(0.1342)
23	3.23(0.1271)	44	3.44(0.1354)
26	3.26(0.1283)	47	3.47(0.1366)


AN9050026

If the value of the above step 12 is not within specification, use new shim adding the values to current shim.(15 seats)

mm(in)

PARTS MUMBER	THICKNESS
K99963 - 6910	0.1(0.0039)
K99963 - 6912	0.125(0.0049)
K99963 - 6915	0.15(0.0059)



AN9050027

Adjustment of drive pinion preload(12 seats)

1. Install spacer.
2. Push rear bearing in using SST.

Note
- Keep pressuring until the sudden increase of necessary power.
- Place the spacer for adjusting pinion height, ensuring exact direction of installation.

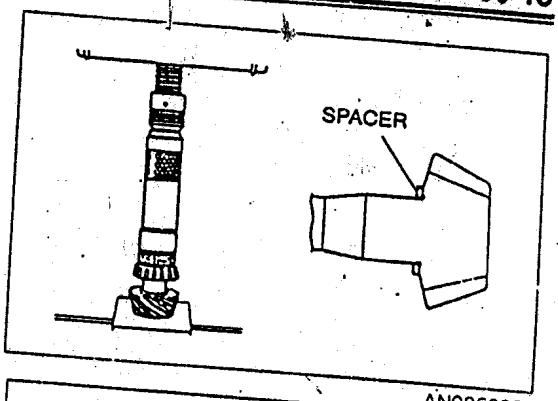
3. Install collapsible spacer.
4. Push front bearing in using SST.
5. Install drive pinion assembly.
6. Install companion flange and tighten lock nut.

Tightening torque :
127~284 N·m(13~29 kg-m, 94~210 lb-ft)

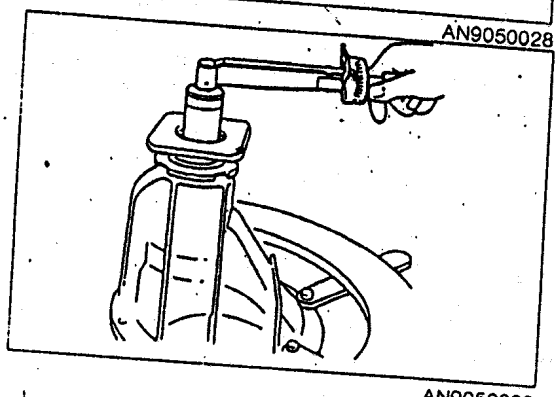
Note
- Do not install oil seal.

7. Turn companion flange by hand so that bearing be put at the right place.
8. Measure preload of drive pinion. If the result is not within specification, use new collapsible spacer and measure again.

Preload : 127~176 N·m(13~18 kg-cm, 94~130 lb-ft)



AN9050028


AN9050029

Adjustment of drive pinion preload(15 seats)

1. Push rear bearing in using SST to the drive pinion.

Note
- Keep pressuring until the sudden increase of necessary power.
- Place the shim for adjusting pinion height, ensuring exact direction of installation.

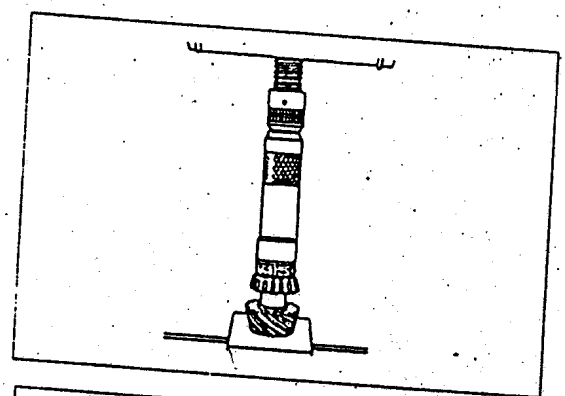
2. Install spacer.
3. Push the front bearing in using SST after installing the shim.
4. Install drive pinion assembly.
5. Install companion flange and tighten lock nut.

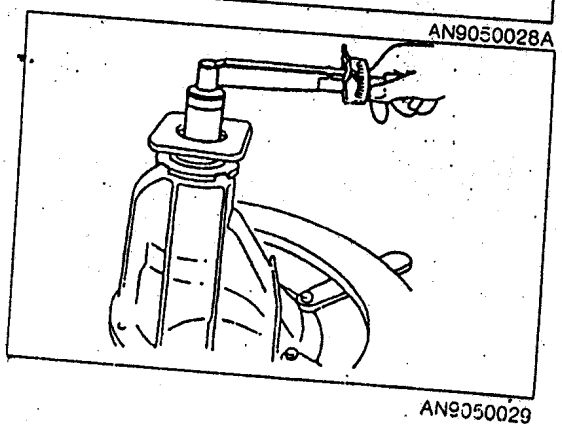
Tightening torque :
196~343 N·m(20~35 kg-m, 144~253 lb-ft)

Note
- Do not install oil seal.

6. Turn companion flange by hand so that bearing be put at the right place.
7. Measure preload of drive pinion. If the result is not within specification, adjust it with the shim and measure again.

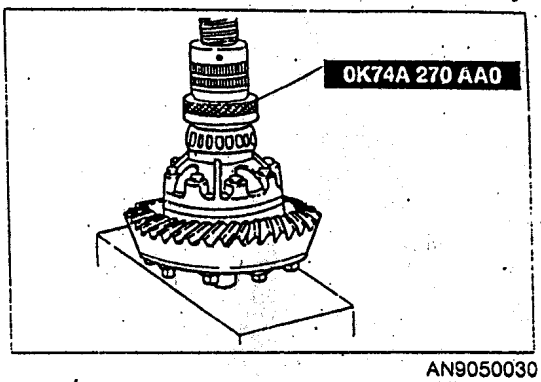
Preload : 147~196 N·m(15~20 kg-cm, 108~144 lb-ft)


AN9050028A


AN9050029

Backlash adjustment

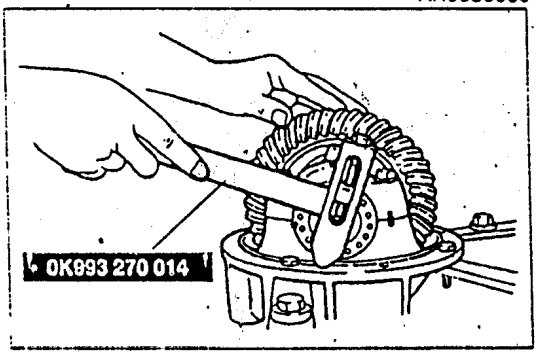
1. Insert bearing inner lace using **SST**.



AN9050030

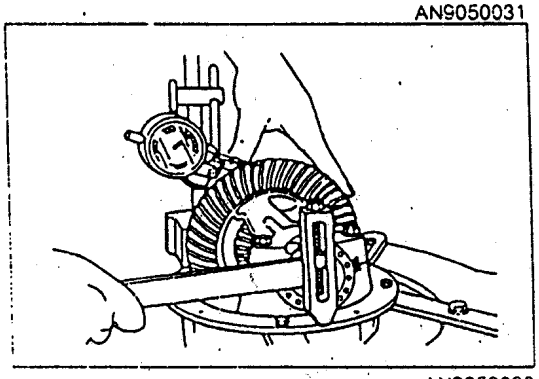
2. Install differential gear assembly to carrier
3. Pay attention to the marks of the adjuster for its right positioning.
4. Make sure that the mark of the cap identifies with one of the carrier at the time of installation of differential bearing cap.

   Tightening torque :
   72~106 N·m(7.4~10.9 kg-m, 53~78 lb-ft)



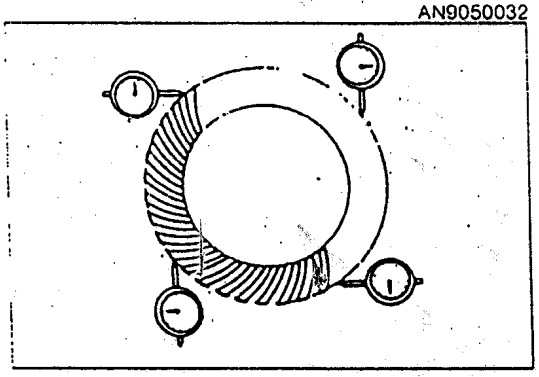
AN9050031

5. Mark ring gear every 90 degree and install dial indicator to carrier in the position that the indicator needle makes a right angle with side surfaces of ring gear.
6. Turn both bearing adjusters together using **SST** until the backlash reaches 0.09~0.11 mm(0.0035~0.0043 in).



AN9050032

7. Check backlash from three different marks. Be sure that the minimum backlash is not less than 0.05 mm and the difference between the minimum and maximum values does not exceed 0.07 mm(0.13 in).

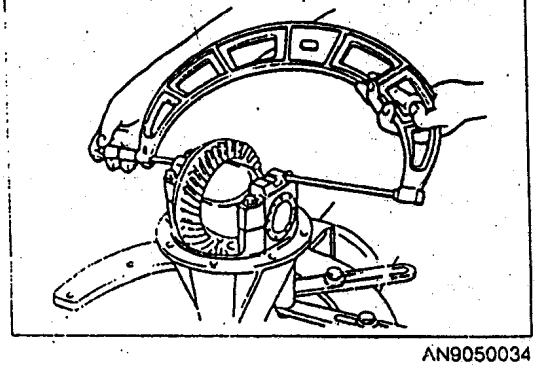


AN9050033

8. Tighten adjuster until the distance between the pilots on bearing cap reaches following values.

   Limit : 204.428~204.5 mm(8.048~8.051 in)(12 seats)
   219.428~219.5 mm(8.638~8.641 in)(15 seats)

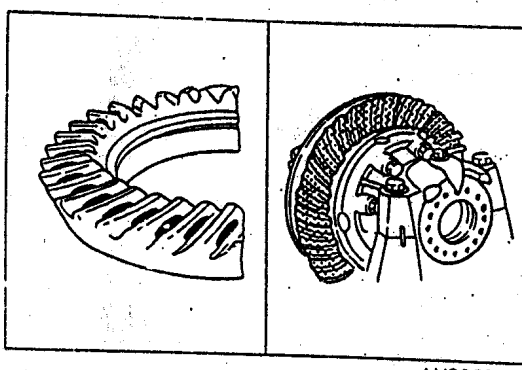
   Note
   - **Be careful adjustment of differential bearing preload not to effect the backlash of drive pinion and ring gear.**



AN9050034

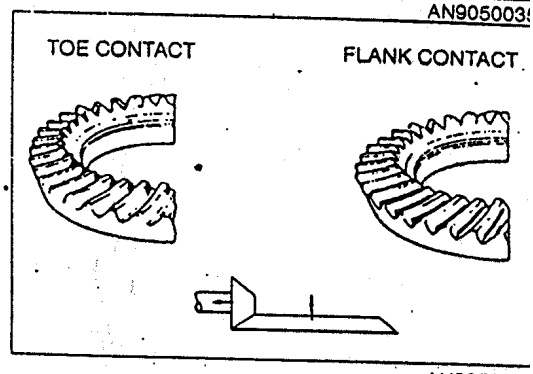
Ring gear-to-pinion gear contact adjustment

1. Coat both surfaces of 6-8 ring gear teeth with prussian blue or white grease.
2. Rotate the marked ring gear teeth back and forth past the pinion.
3. If the ring gear pinion marks are not near the center of the ring gear teeth, disassemble, and adjust pinion in or out.



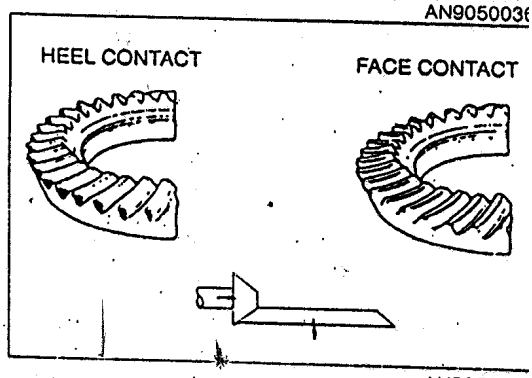
AN9050035

(1) Toe and flank contact marks
Use thinner pinion spacer to move pinion out.



AN9050036

(2) Heel and face contact marks
Use thicker pinion spacer to move pinion in.



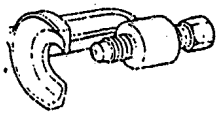
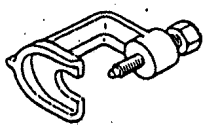
AN9050037

SPECIFICATIONS

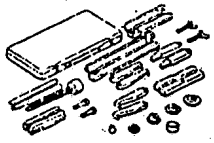
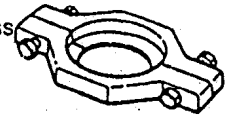
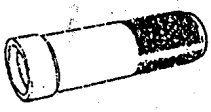
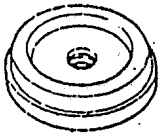
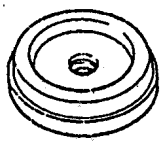
Items			ATX	MTX
Front axle				
Bearing preload(without oil seal)		N·m(kg-m, lb-ft)	39~78(4~8, 29~58)	
Rear axle				
Type			Semi float	
Bearing axial play		mm(in)	0.05(0.002)	
Differential				
Reduction gear			Hypoid gear	
Differential gear			Straight bevel gear	
Final gear ratio			4.444	4.222(12 seats), 4.111(15 seats)
Oil	Grade		API GL-5	
	Viscosity	Above -18°C(-4°F)	SAE 90	
		Below -18°C	SAE 80W	
	Amount	ℓ (qt)	1.3(1.373)(12 seats), 1.6(1.69)(15 seats)	

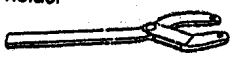
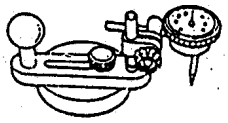
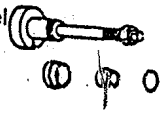
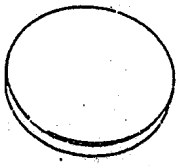
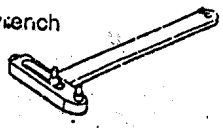
SPECIAL TOOLS

FRONT AXLE

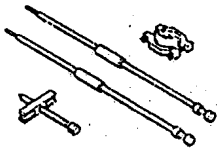
0K 130 283 021 Ball joint puller 	For disassembly of ball joint	0K670 321 019 Ball joint puller 	For disassembly of ball joint

DIFFERENTIAL

0K670 990 AA0 Bearing installer set 	For disassembly of side bearing	0K130 175 008 Pan puiley boss puller 	For disassembly of front, rear bearing
0K130 175 A13 Body 	For assembly of side bearing	0K993 270 A01 Handle 	For assembly of outer lace
0K993 270 A04 Attachment (Ø72) 	For(Front bearing) outer lace assembly	0K993 280 A03 Attachment (Ø62) 	For(Rear bearing) outer lacer assembly

0K74A 270 AA0 Attachment 	For side bearing assembly	0K130 111 004 Coupling flange holder disassembly 	For lock nut
0K993 270 A09 Drive pinion 	For adjusting height of drive pinion	0K 993 270 A10 Drive pinion model 	For adjusting height of
0K993 270 A08 Gauge block 	For adjusting height of drive pinion	0K993 270 014 Adjusting nut wrench 	For adjusting screw disassembly

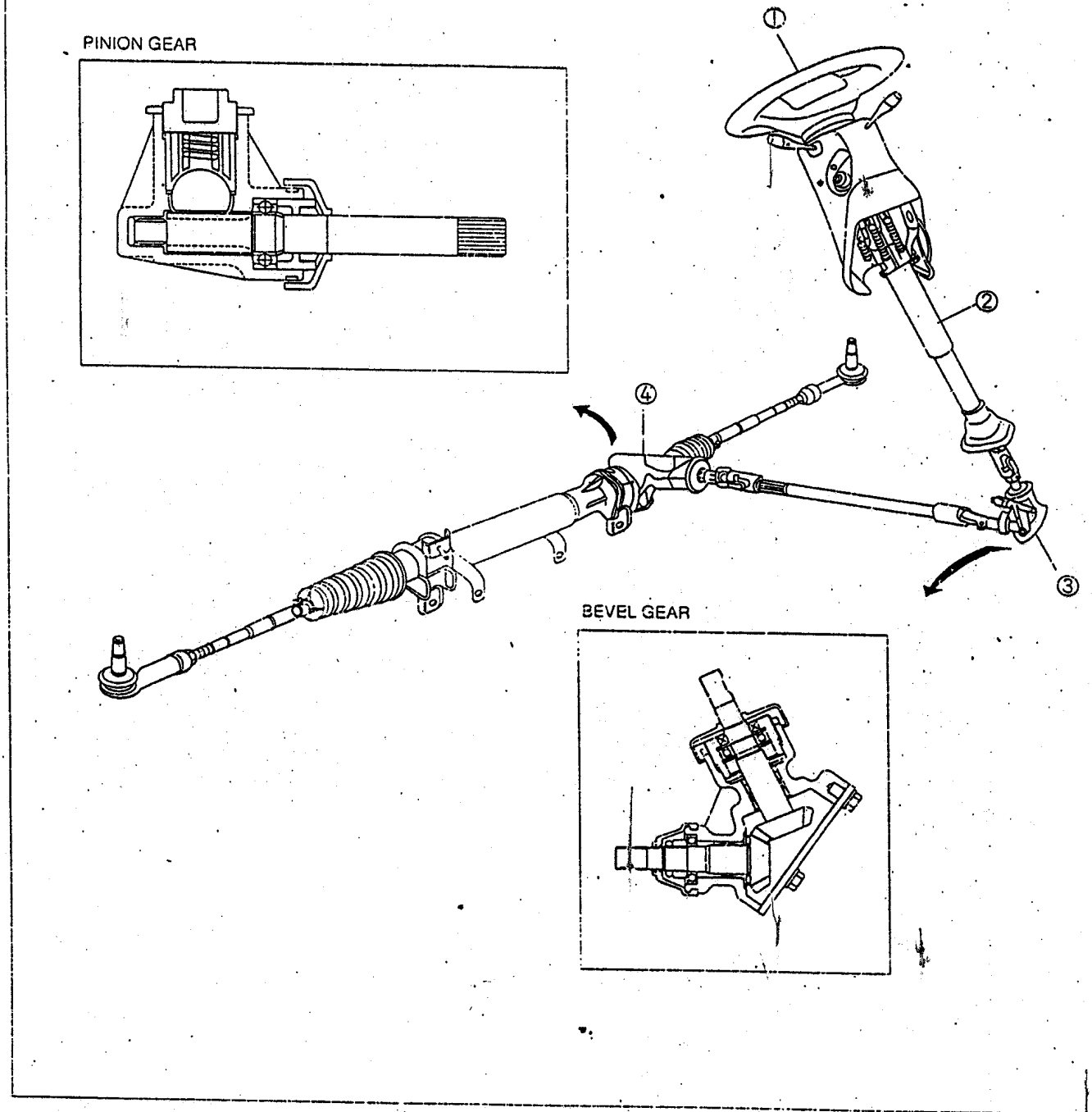
REAR AXLE

0K74A 262 001 Rear axle shaft bearing puller 	For rear axle shaft bearing disassembly

STEERING 51

MANUAL STEERING

STRUCTURAL VIEW



AN9054001

1. Steering wheel
2. Steering shaft
3. Bevel gear
4. Steering gear

TROUBLESHOOTING GUIDE

Problem	Possible cause	Action
Steering heavy	Improper tire air pressure	Adjust
	Incorrect adjustment of preload of bevel gear	Adjust
	Incorrect adjustment of preload of pinion	Adjust
	Incorrect adjusiment of wheel alignment	Adjust
	Unsmooth operation of linkage ball joints	Replace
	Unnecessary contact during steering shaft turning.	Repair/replace
Steering wheels don't return properly	Tires not properly inflated	Adjust
	Improper wheel alignment	Adjust
	Unsmooth operation of linkage ball joints	Replace
	Unnecessary contact during steering shaft turning	Repair/replace
	Incorrect adjustment of preload of bevel gear and pinion	Adjust
Erratic steering	Unnecessary contact during steering shaft turning and loose bolt	Repair/retighten
	Unsmooth operation of steering linkage	Repair/replace
	Improper adjustment of preload of bevel gear	Adjust
Steering wheel pulls to one side	Improper tire air pressure	Replace
	Incorrect adjustment of wheel bearing preload and worn wheel bearing	Adjust, Replace
	Misalignment of wheel	Adjust
	Poor steering gear	Replace
Abnormal noise	Steering linkage loose or worn	Replace, Tighten
	Worn steering joints	Replace
	Incorrect adjustment of backlash of gear box	Adjust
Leaks of bevel gear grease	Damaged gasket	Replace
	Damaged dust booth	Replace
	Damaged lip seal	Replace

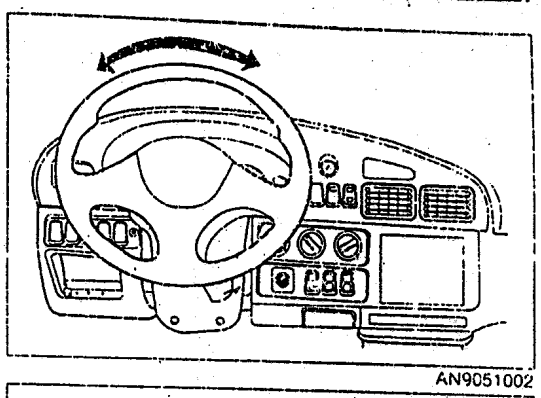
INSPECTION AND ADJUSTMENTS

Steering wheel play

1. Place the front wheels in the straight ahead position and check if the play meets the standard by turning the steering wheel from side to side.

   Play : 0~40 mm(0~1.57 in)

   Note
   - **When the standard is not met, check if each steering joint is worn or too much backlash of steering gear .**

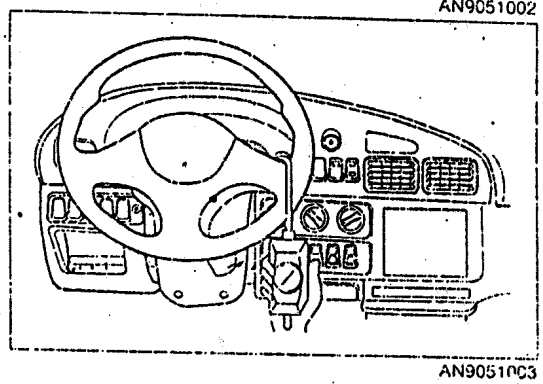

AN9051002

Steering wheel force

1. With the vehicle on the ground level, place the front wheels in the straight ahead position.
2. Attach a pull scale to the outer end of the steering wheel spoke and pull the spring scale to rotate the wheel.

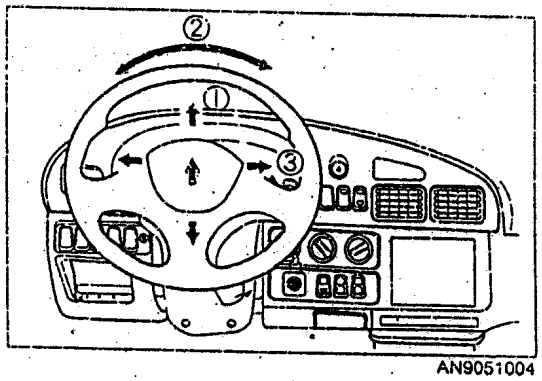
   Required force : 225 N(23 kg, 51 lb)

   Note
   - **When checking, turn wheel more than 5 times to have correct measurement.**
3. Check the followings if the results of the checking do not meet the standard.
   Pinion torques, ball joints torques, improper joints


AN9051003

Steering wheel looseness, rattle

1. Attempt to move wheel axially in and out ①, left & right side ②, ③ and check for worn column bearings, clunking of steering shaft joints, loose steering and column couplers.

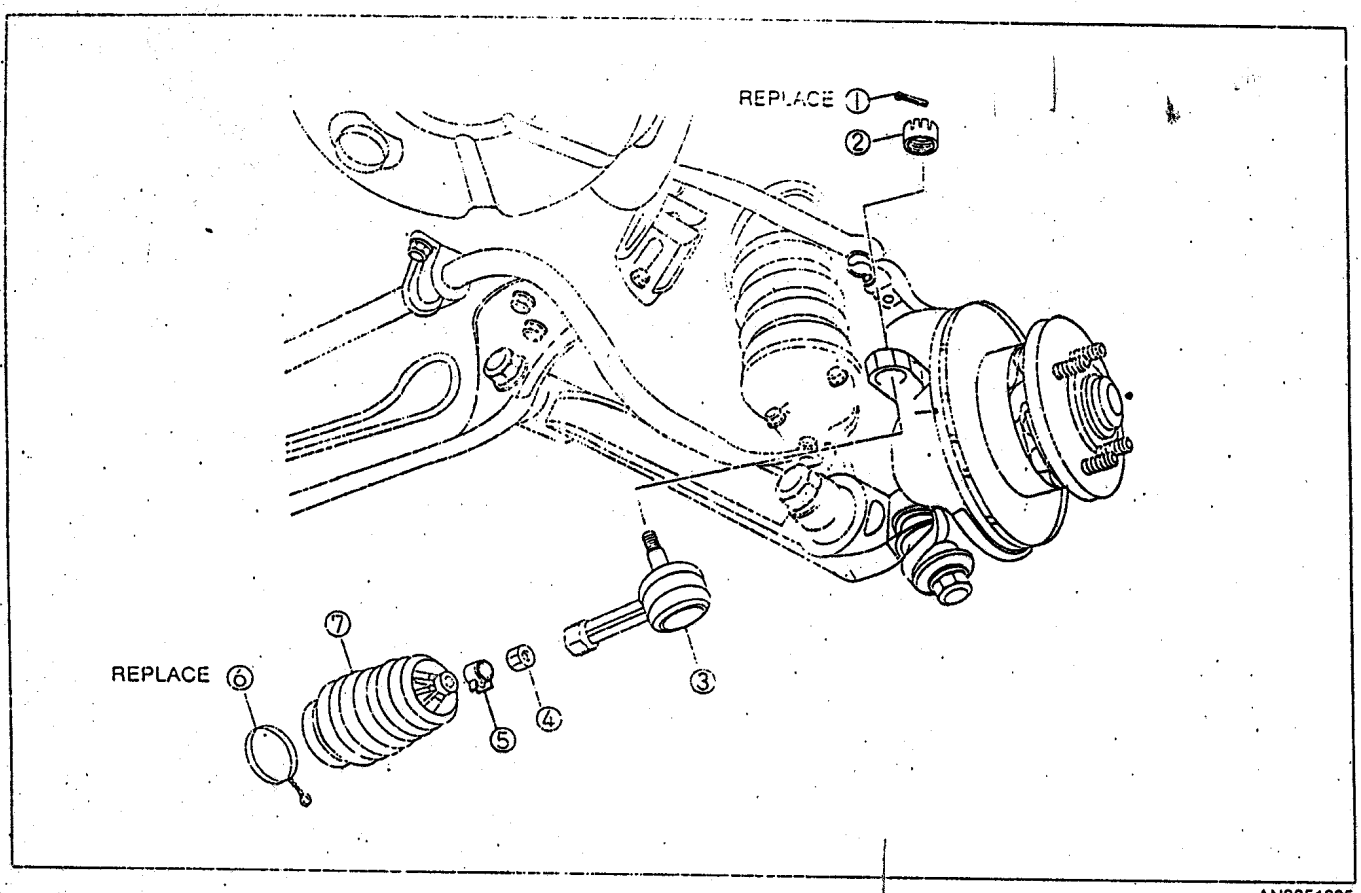


AN9051004

BOOT

Replacement

1. Remove tire and wheel.
2. Remove in the numerical order as shown in the figure.
3. Install in the reverse order of removal.
4. Check wheel alignment after installation.



AN9051005

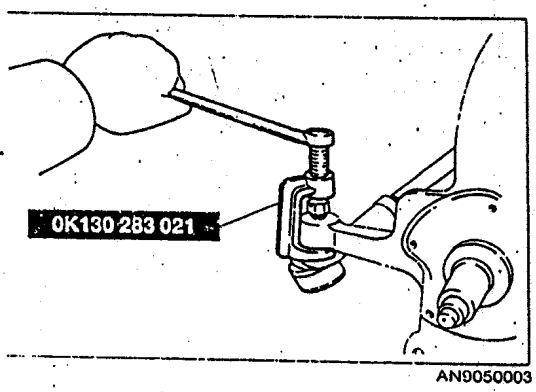
1. Cotter pin
2. Nut
3. Tie-rod end
4. Lock nut
5. Boot band
6. Boot wire
7. Boot

Removal

1. Remove cotter pin from tie-rod end stud and loosen until the nut reaches very end of stud.

   Caution
   - **Tighten screw temporarily ensuring its thread not to be damaged.**

2. Separate tie-rod end from steering knuckle using SST.

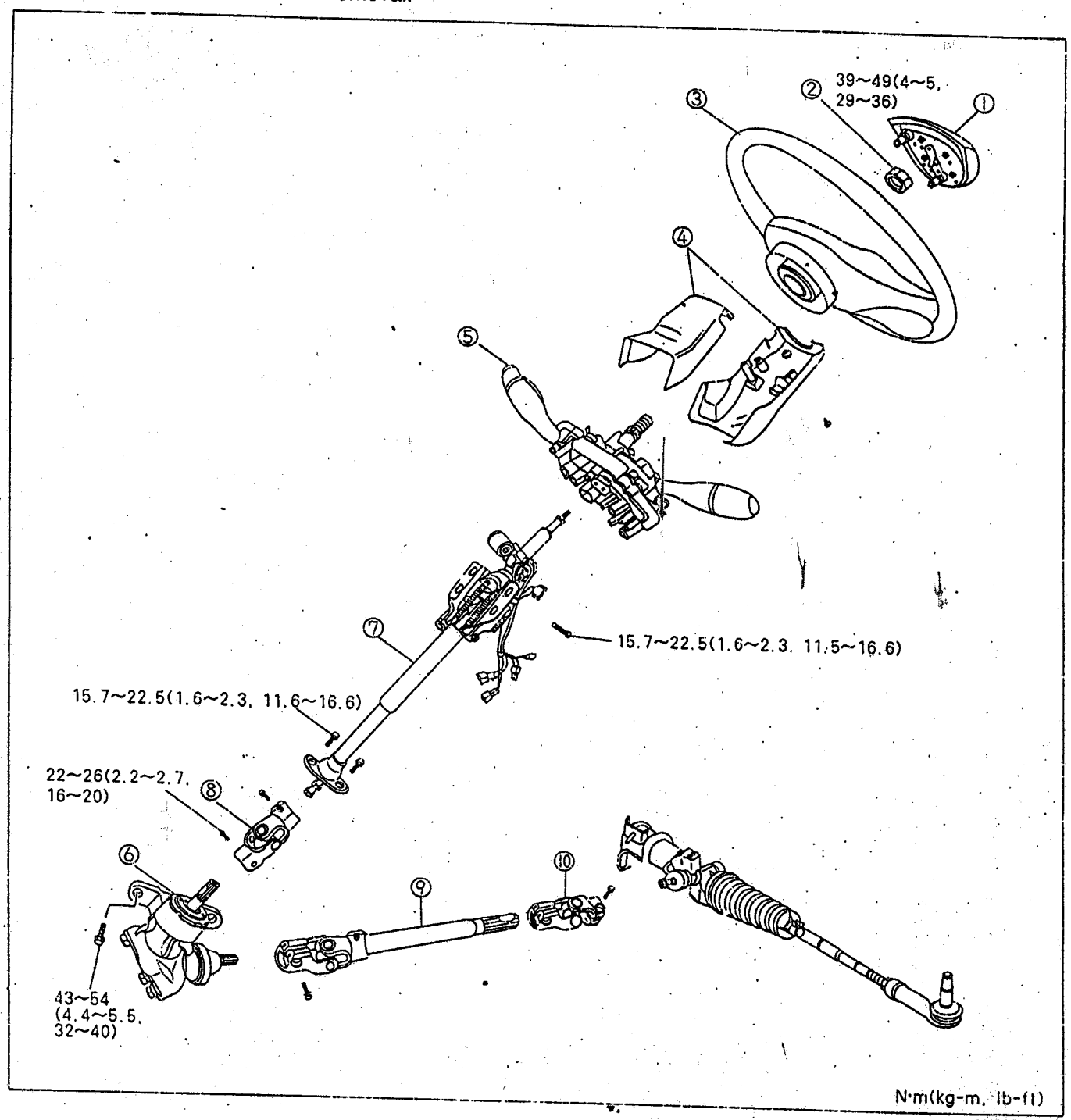


AN9050003

STEERING SHAFT ASSEMBLY

Removal and Installation

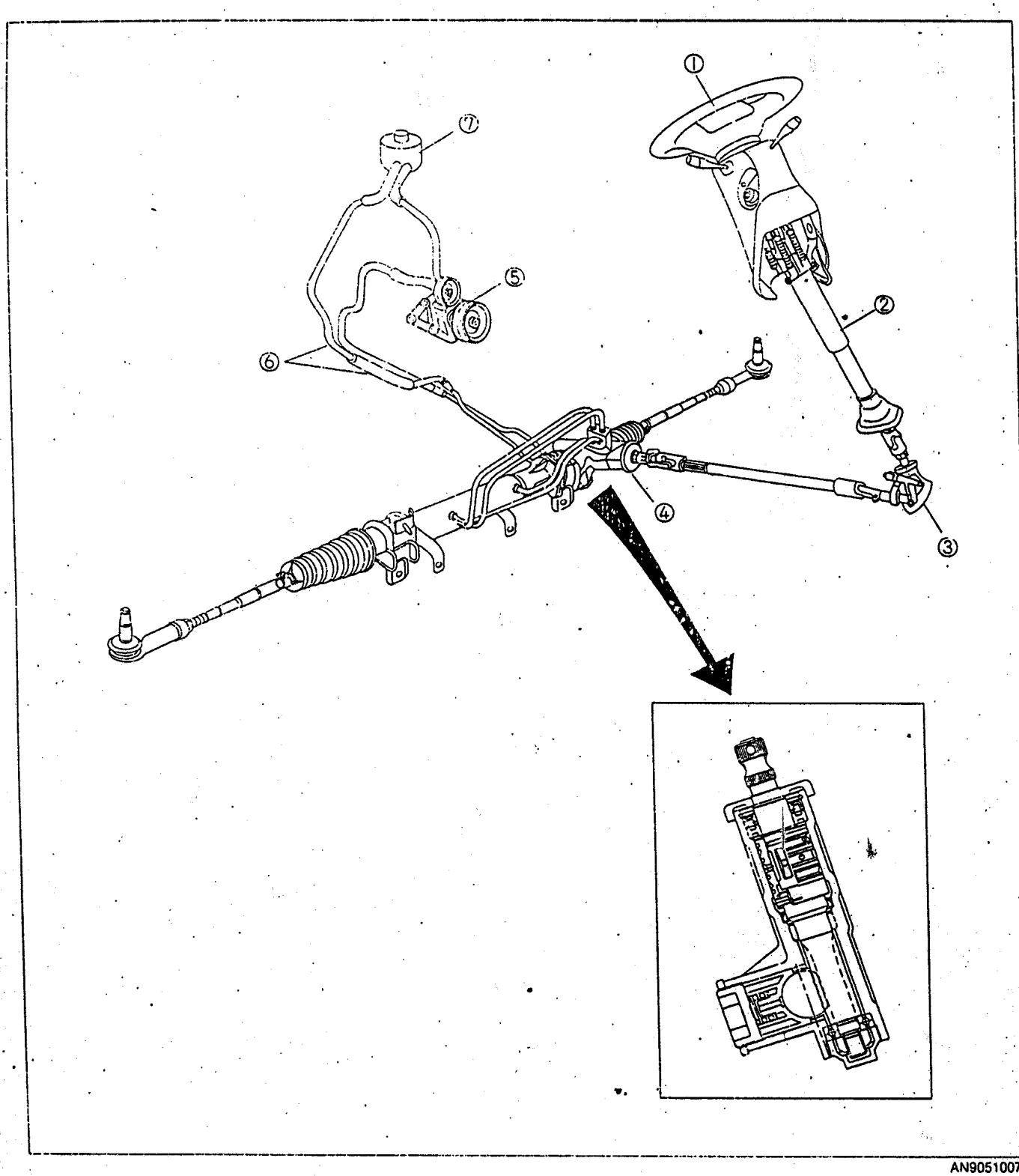
1. Remove the negative terminal of the battery.
2. Position vehicle straight ahead.
3. Remove in the numerical order as shown in the figure.
4. Install in the reverse order of removal.



1. Horn cap
2. Lock nut
3. Steering wheel
4. Column cover
5. Combination switch
6. Bevel gear
7. Steering shaft
8. Universal joint
9. Intermediate shaft
10. Universal joint

POWER STEERING

STRUCTURAL VIEW



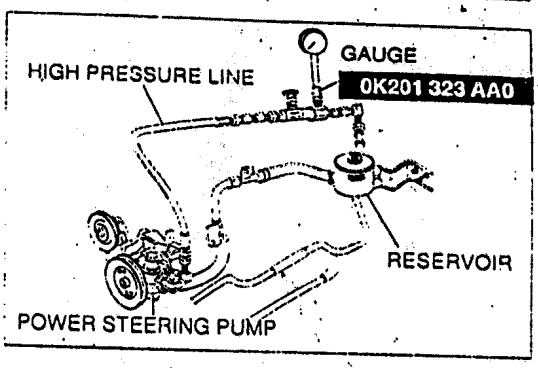
AN9051007A

1. Steering wheel
2. Steering shaft
3. Bevel gear
4. Steering gear
5. Oil pump
6. Oil pipe & hose
7. Reservoir

TROUBLESHOOTING GUIDE

Problem	Possible cause	Action
Steering heavy	Power steering belt loose or damaged	Adjust or replace
	Lack of power steering fluid or air in system	Add fluid or bleed air
	Hose kinked or twisted	Replace
	Pipe kinked	Replace
	Power steering fluid leak	Repair or replace
	Low pressure of fluid	Repair or replace
	Tires not properly inflated	Adjust
	Improper adjustment of wheel alignment	Adjust
	Poor operation of steering gear linkage	Repair or replace
	Steering column touching other parts	Repair or replace
Steering wheels don't return properly	Tires not properly inflated	Adjust
	Improper adjustment of wheel alignment	Adjust
	Poor operation of steering gear linkage	Repair or replace
	Steering gear out of order	Replace
Erratic steering	Loose power steering belt	Adjust
	Steering column out of order or loose bolts	Repair or tighten
	Unsmooth operation of steering linkage	Repair or replace
	Defective steering gear	Replace
Steering wheel pulls to one side	Tires not properly inflated	Adjust
	Incorrect adjustment of preload or worn wheel bearings	Adjust or replace
	Improper adjustment of wheel alignment	Adjust
	Steering gear out of order	Replace
Power steering fluid leaks	Trouble at hose couplings	Repair or replace
	Hose damaged or clogged	Replace
	Power steering fluid reservoir damaged	Replace
	Overflow	Air bleed , Adjust fluid amount
	Power steering pump out of order	Replace
	Steering gear malfunction	Replace
Noise	Power steering pump out of order	Tighten
	Loose steering gear	Tighten
	Loose power steering pump bracket	Tighten
	Loose power steering pump pulley nuts	Tighten
	Belt loose or excessive torgues	Adjust
	Air in system	Air bleed
	Steering gear out of order	Replace
	Power steering pump out of order	Replace
	Steering column or pressure hose touching other parts	Repair or replace
	Steering linkage loose	Adjust or replace

POWER STEERING PRESSURE TEST



AN9051008

Caution
- **Verify that power steering system gauge valve is opened for the system to operate.**
- **Do not leave steering wheel turned longer than 15 seconds.**

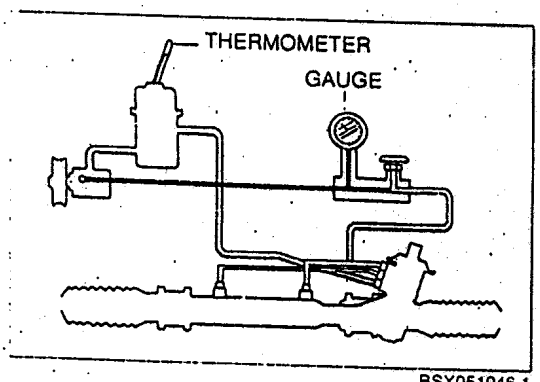
1. Remove high pressure pipe and install power steering system gauge using adapter.
2. Insert a thermometer into power steering fluid tank.
3. Perform air bleeding as following procedures.
   1) Check fluid level in the reservoir, and add fluid as necessary.
   2) Raise and support the front of the vehicle.
   3) Turn steering wheel to the extreme left and right 10 times.
   4) Check fluid level again, and add fluid if reduced.
   5) Until fluid reaches and remains at the proper level, repeat steps 3) and 4).
   6) Start engine and let idle.
   7) Turn steering wheel to the extreme left and right positions 10 times.
   8) Verify that any bubble is created. As bubbles indicate air in system, repeat steps 2)~7).

Caution
- **Check air leaks in system if bubbling keep taking place.**

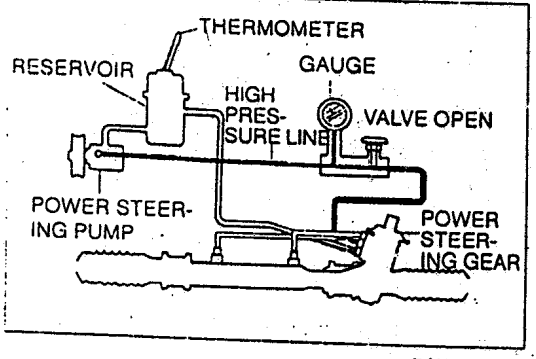
4. Check temperature of power steering fluid. If the temperature is not in the range of 50°C~60°C(92~110°F), turn steering wheel to the left and right positions until the specification is obtained.

Caution
- **Close valve for a second to read the pressure.**
- **Do not leave it closed for longer than 15 seconds.**

5. Close power steering system gauge valve, and measure power steering pump relief pressure increasing engine rpm to 1000~1500.
6. Increase engine rpm to 1000~1500 with power steering system gauge valve opened.
7. Read pressure with steering wheel in the extreme right or left.
8. Separate adapter from power steering system gauge. Reconnect high pressure line and tighten to 16~24 N·m(1.6~2.4 kg-m, 12~17 lb-ft).
9. Remove thermometer and bleed air as described in the step 3).



BSX051046-1



BSX051046-2

Steering wheel force

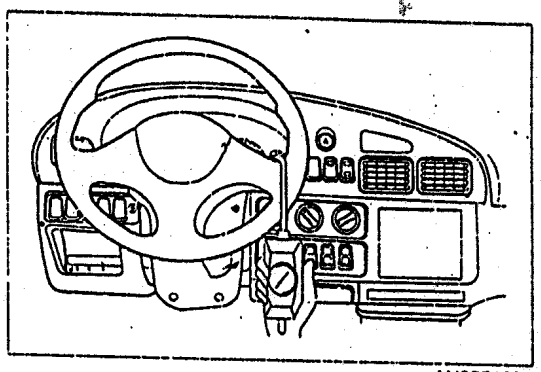
1. Put thermometer into power steering fluid tank.

Caution
- **Do not leave steering wheel turned for more than 15 seconds at a time.**

2. Start engine and turn steering wheel in the right and left positions several times until fluid temperature reaches 50°C~60°C(92~110°F).
3. Place vehicle on ground level with steering wheel in the straight ahead direction.
4. Attach a pull scale to the outer end of the steering wheel spoke and measure necessary force to rotate the wheel. The operational force should be less than 29.4 N(3.0 kg, 6.6 lb).

Caution
- **For accurate measure, pull the pull scale in a direction perpendicular to the radius of the steering wheel.**

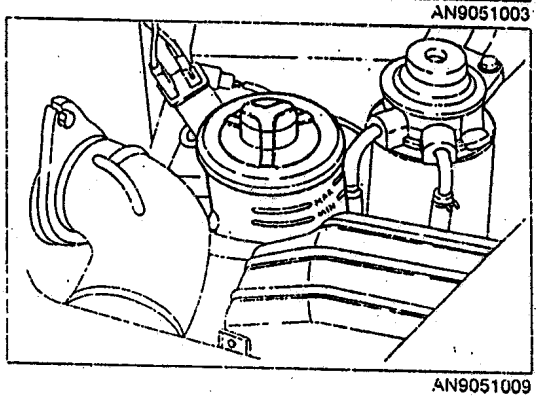
5. If the force exceeds specification, inspect for lack or leakage of steering fluid, air in system, power steering pump pressure, steering gear pressure and tire inflation.
6. Remove thermometer.



AN9051003

Power steering fluid check

1. Check the fluid level of the power steering at the reserve tank. Add fluid so that indicator comes between Max and Min.

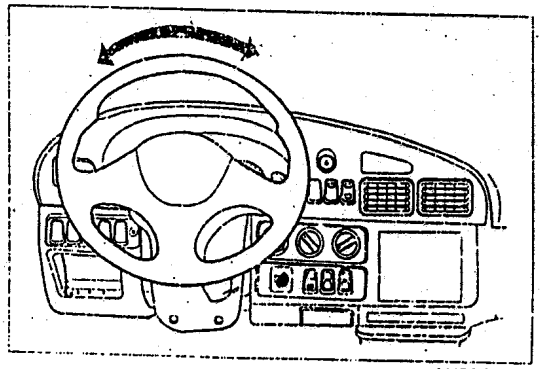


AN9051009

2. Let the engine run and make steering wheel 10 turns in the extreme right and left positions until normal operational temperature.
3. Stop engine with steering wheel in the straight ahead position.
4. Check steering fluid and add fluid so that indicator comes between Max and Min.

Air bleeding

1. Check the fluid level of the power steering.
2. Raise and support the front of the vehicle.
3. Turn steering wheel in the extreme left and right positions several times with engine off.
4. Check the fluid level again and add fluid as required.
5. Repeat the step 2 and 3 until fluid reaches and remains at the proper level.
6. Start the engine and let run at idle speed.
7. Turn steering wheel in the extreme right and left positions several times.
8. Check the power steering fluid at the reserve tank. There should be no foam in the fluid.
9. Add fluid if necessary, and repeat the step 7 and 8.

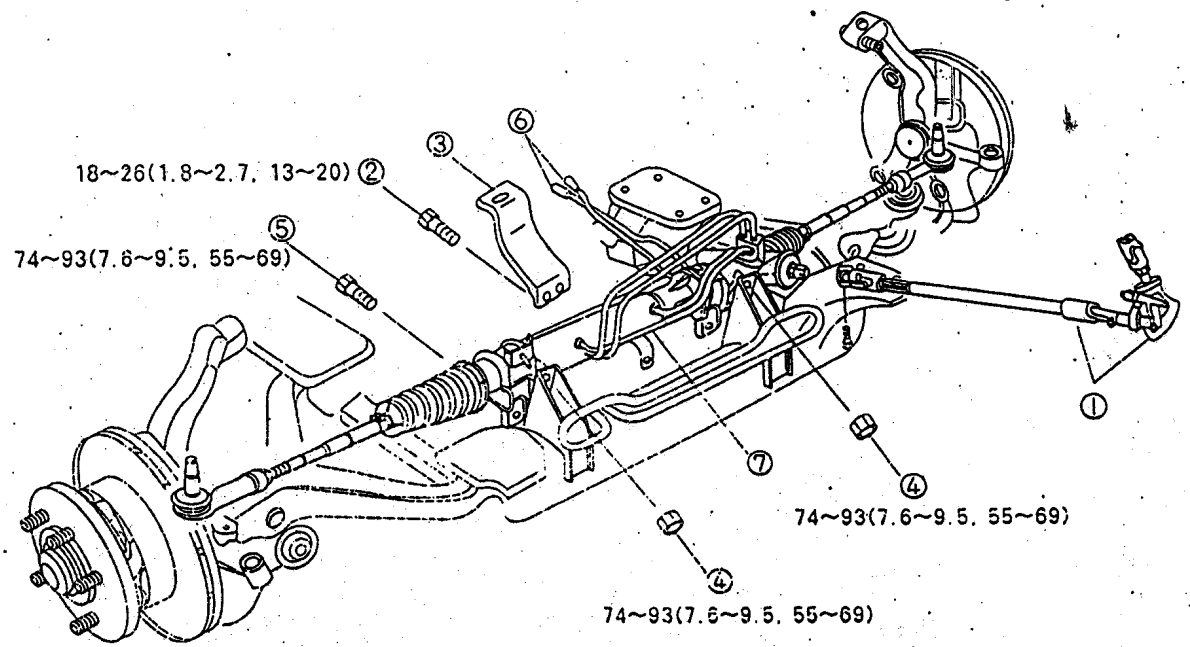


AN9051002

STEERING GEAR AND LINKAGE

REMOVAL AND INSTALLATION

1. Loosen wheel nug nut.
2. Raise and support the front part of vehicle with jack stands.
3. Remove tires.
4. Remove in the numerical order as shown in the figure for next procedure.
5. Install in the reverse of order removal..
6. After installation, bleed air from steering system and adjust toe-in as required.



1. Bevel gear and intermediate shaft
2. Bolt
3. Bracket
4. Nut
5. Bolt
6. Return pipe and pressure pipe
7. Steering gear and linkage

POWER STEERING OIL PUMP

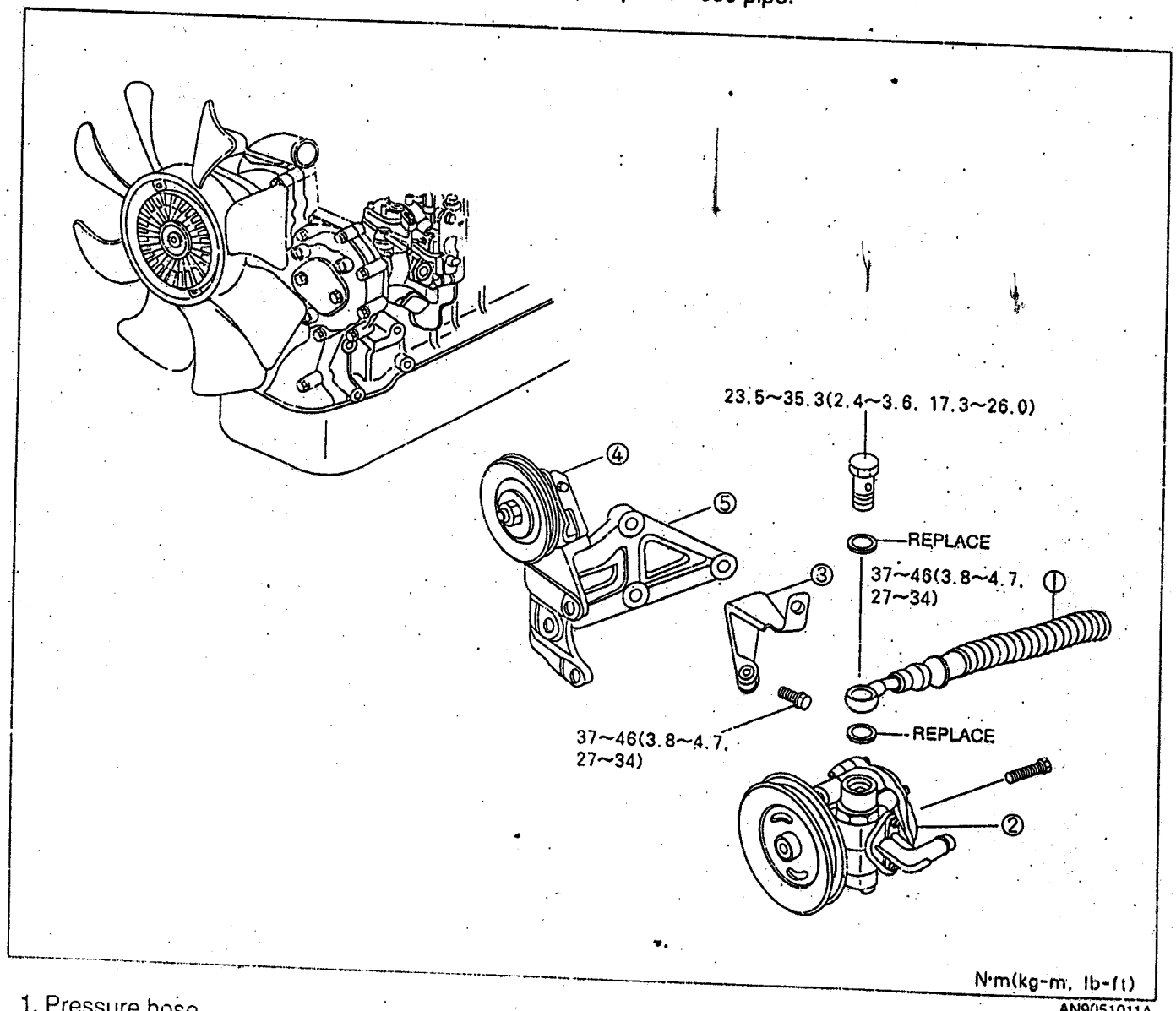
REMOVAL AND INSTALLATION

1. Remove in the numerical order as shown in the figure.

Caution

- **When disconnecting pressure pipe and return hose, prepare a suitable container to catch power steering fluid as it drains.**

2. Install in the reverse order of removal.
3. After installation, following should be done.
   1) Adjust belt.
   2) Add power steering fluid and bleed air.
   3) Inspect for fluid leak at connecting point of oil pump and hose pipe.

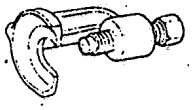
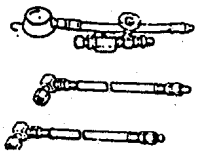


1. Pressure hose
2. Oil pump assembly
3. Bracket
4. Tensioner and bracket
5. Oil pump bracket

SPECIFICATIONS

Items			Manual steering	Power steering
Steering wheel	Outer diameter	mm(in)	390(15.4)	
	Turns lock to lock	12 seats(15 seats)	4.0(4.87)	4.0(4.19)
Steering shaft & joints	Type		Collapsible	
	Joints type		Universal joints	
	Tilt stroke		±7.7°	
Steering gear & linkage	Type		Rack & pinion	
	Gear ratio		∞	
	Power assist		—	Engine speed sensing type
	Rack stroke		164	
Bevel gear	Gear ratio		1.125	
	teeth		Input : 16 Output : 18	
Maximum steering angle	Inner		39.12°	
	Outer		33.80°	
Oil	Capacity	ℓ	—	1.07(1.13)
	Type		—	PSF-Ⅲ

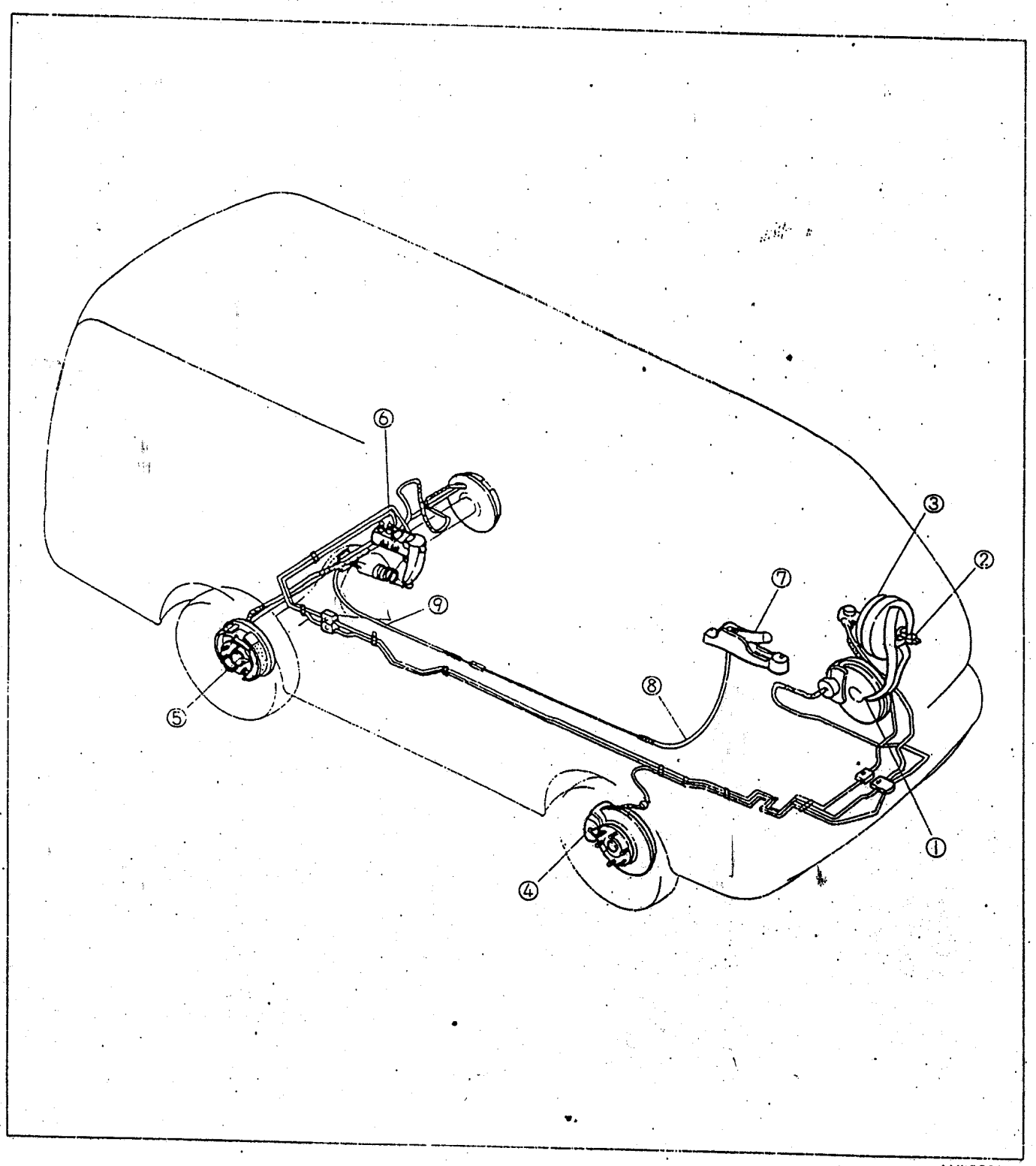
SPECIAL TOOLS

0K130 283 021 Puller, ball joint 	For tie rod end disassembly and assembly	0K201 323 AA0 Gauge set 	For measuring oil seal

BRAKE SYSTEM 52

OUTLINE

STRUCTURAL VIEW



AN9052001

1. Brake pedal
2. Brake master cylinder
3. Power brake unit
4. Front disc plate
5. Rear drum brake
6. Load sensing proportioning valve(LSPV)
7. Parking brake lever
8. Parking brake cable(front)
9. Parking brake cable(rear)

TROUBLESHOOTING GUIDE

Problem	Possible cause	Action
Poor braking	Brake fluid leak	Repair
	Air in pipe	Bleed air
	Worn pad and lining	Replace
	Pad or lining stained with brake fluid, grease or water	Clean or replace
	Harden surface of pad or lining, poor contact	Grind or replace
	Malfunction of disc brake piston	Replace
	Malfunction of master cylinder or wheel cylinder	Repair or replace
	Malfunction of power brake unit	Replace
	Malfunction of check valve(vacuum hose)	Replace
	Damaged vacuum hose	Replace
	Aged flexible hose	Replace
	Malfunction of LSPV	Adjust or replace
Pull to right or left	Worn pad or lining	Replace
	Pad or lining stained with brake fluid, grease or water	Clean or replace
	Harden surface of pad or lining, poor contact	Grind or replace
	Abnormally worn disc or lining or twisted	Repair or replace
	Backing plate bolts loose or deformed	Tighten or replace
	Malfunction of wheel cylinder	Repair or replace
	Incorrect adjustment of wheel alignment	Refer to Section 54
	Inconsistent tire air pressure	Refer to Section 53
Brakes do not release	No clearance of brake pedal	Adjust
	Incorrect adjustment of push rod clearance	Adjust
	Clogged master cylinder return port	Clean
	Poor returning of shoe	Clean or replace
	Poor returning of wheel cylinder	Clean or replace
	Malfunction of disc brake piston seal	Replace
	Excessively worn disc plate	Replace
	Incorrect adjustment of wheel bearing preload	Refer to Section 50
Excessive pedal stroke	Incorrect adjustment of pedal play	Adjust
	Worn lining	Replace
	Damaged master cylinder	Replace
	Air in pipe	Bleed air
Noise or vibration during braking	Worn pad or lining	Replace
	Damaged surface of pad or lining	Grind or replace
	Brakes do not release	Repair
	Foreign matter on or scratched disc plate	Clean
	Loose bolts of backing plate or caliper	Tighten
	Damaged surface of disc or drum	Repair
	Poor pads or lining contacts	Repair or replace
	Lack of grease in each moving part	Apply grease
Malfunction of parking brakes	Excessive lever stroke	Adjust
	Stuck or damaged brake cable	Repair or replace
	Lining stained with brake fluid or oil	Clean or replace
	Harden lining surface or poor contact	Grind or replace

ON-VEHICLE INSPECTION

HEIGHT OF BRAKE PEDAL

Inspection

Check if the distance between center of pedal face and floor mat meets the specification.

Height of pedal : 244 mm(9.6 in)

Adjustment

1. Loosen lock nut ⓐ, and adjust height by rotating push rod ⓑ.
2. After adjusting, tighten lock nut ⓐ.

PEDAL PLAY

Inspection

1. Depress the pedal several times to get air out of system.
2. Lightly depress the pedal by hand and check the pedal play.

Pedal play : 7~9 mm(0.28~0.35 in)

Adjustment

1. Loosen lock nut ⓐ, and adjust height by rotating push rod ⓑ.
2. After adjusting the play, tighten lock nut ⓐ.

Note

- **After adjusting pedal height and play, check if stop lamps work properly and adjust as required.**

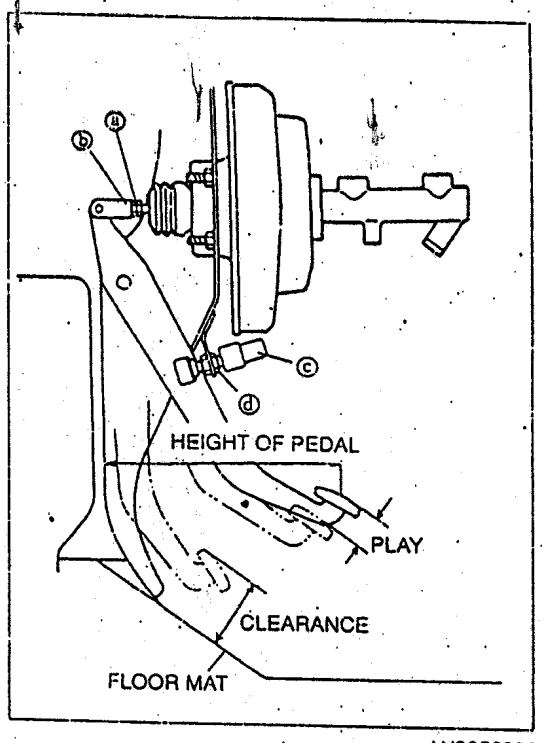
PEDAL-TO-FLOOR CLEARANCE

Inspection

1. Apply pedal with 588N (60kg, 132 lb) force after starting engine, and inspect if the clearance between floor and center of pedal face is as specified.

Pedal-to-floor clearance : 74 mm(2.9 in)

2. If the distance is less than the specification, check for the followings.
   (1) Air in brake system
   (2) Worn pads
   (3) Excessive clearance of shoe
   (4) Automatic adjuster malfunction



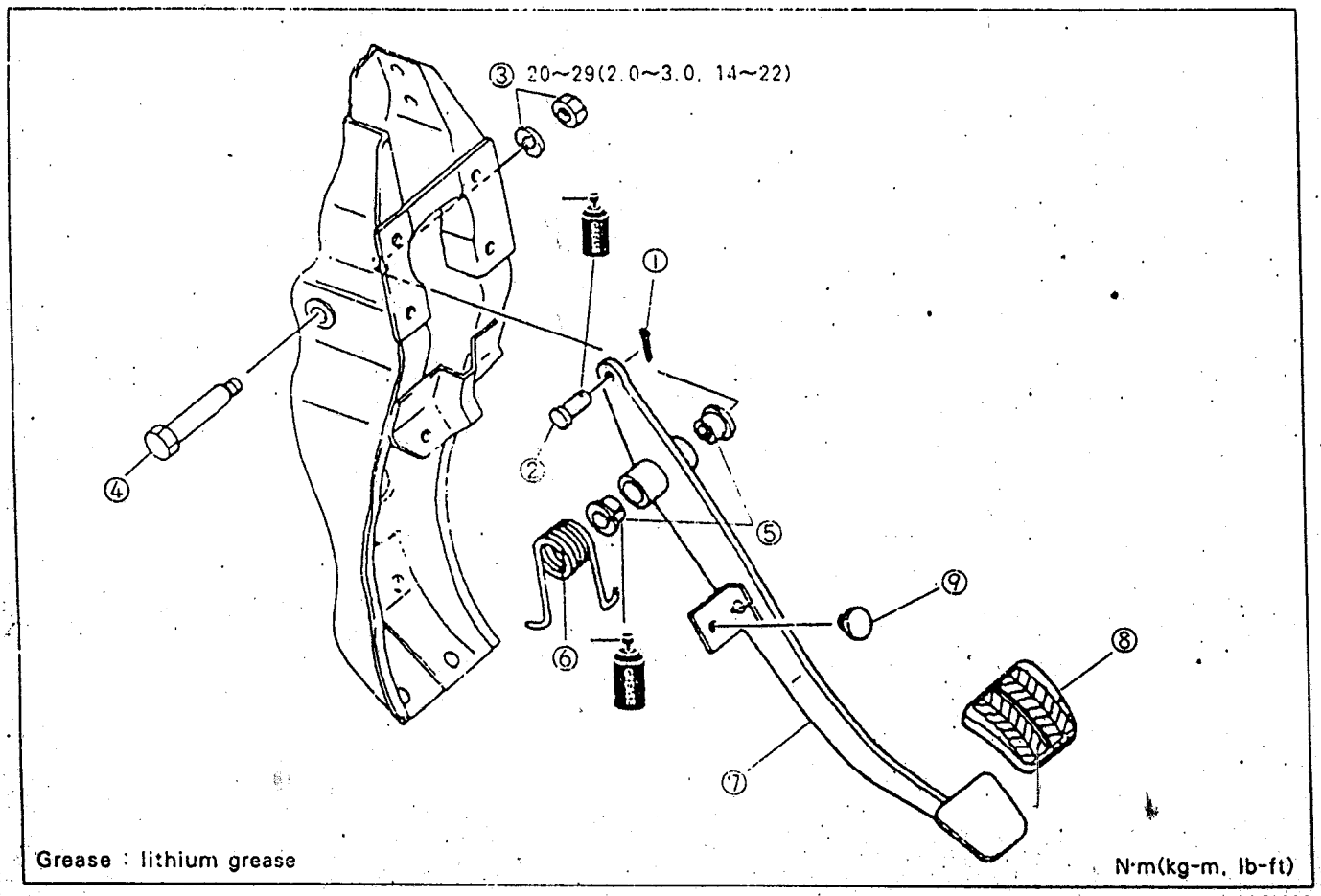
AN9052002

Disassembly part			Air bleeding location			
			Front		LSPV	Rear
			Right	Left		Right
Master cylinder			O	O	O	O
LSPV			—	—	O	O
Wheel cylinder	Front	Right	O	O	—	—
		Left	O	O	—	—
	Rear	Right	—	—	—	O
		Left	—	—	—	O

BRAKE PEDAL

REMOVAL/INSTALLATION

1. Remove in the order as shown in the figure.
2. Inspect all parts and repair or replace as required.
3. Install in the reverse order of removal.
4. After installation, inspect and adjust pedal height and play.



AN9052003

1. Pin joint
2. Snap pin
3. Nut/washer
4. Bolt
5. Bushing(2EA)
6. Return spring
7. Brake pedal
8. Pedal pad
9. Stop rubber

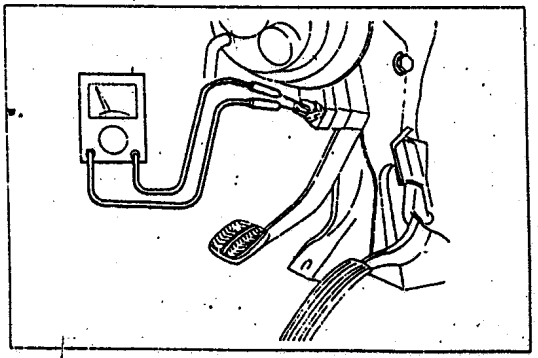
INSPECTION

Brake pedal

1. Inspect for worn bushing, pedal bounce, damaged return spring, and bent bolts, and replace if necessary.

Stop lamp switch

1. Disconnect stop lamp switch connector.
2. Connect an ohmmeter and check for continuity when applying pedal.

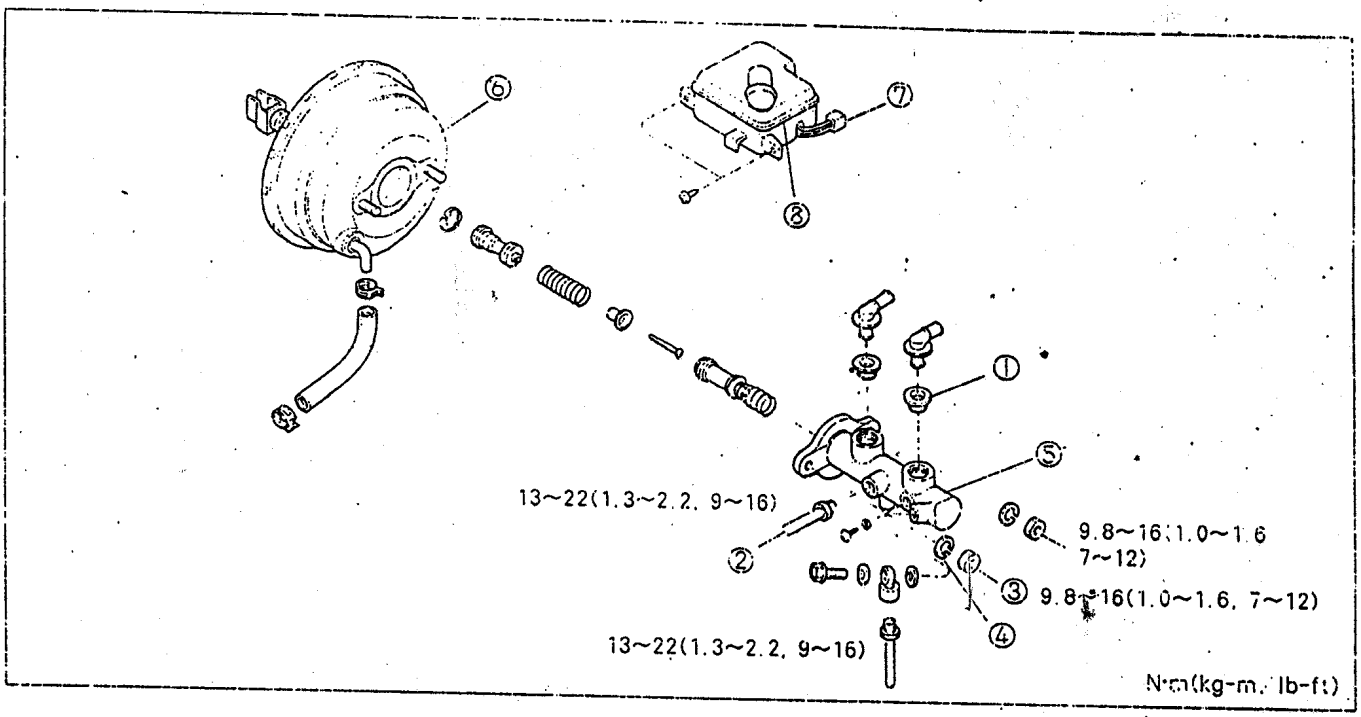


AN9052004

MASTER CYLINDER

REMOVAL/INSTALLATION

1. Remove in the order as shown in the figure.
2. Install in the reverse order of removal.
3. After installation, fill reservoir tank, check for fluid leakage and bleed brake system.



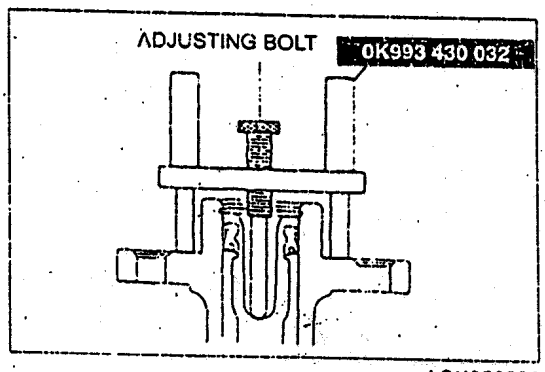
AN9060005

1. Rubber packing
2. Brake pipe
3. Nut
4. Spring washer
5. Master cylinder
6. Power brake unit
7. Brake fluid level sensor connector
8. Reservoir tank

INSPECTION

Master cylinder

1. Measure clearance between power brake unit push rod and master cylinder piston using **SST**.



AGX052008

2. If the clearance is not within specification, adjust it once again by rotating push rod.

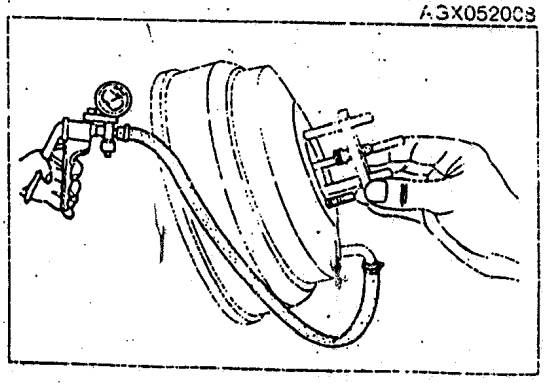
Note

mm(in)

Vacuum pressure mmHg(kpa)	Clearance between push rod and pision (mm)
500(66)	0.1~0.4(0.004~0.016)

Brake fluid level sensor

1. Check for continuity with brake fluid level in the range of MIN+3mm(0.118 in) using an ohmmeter.

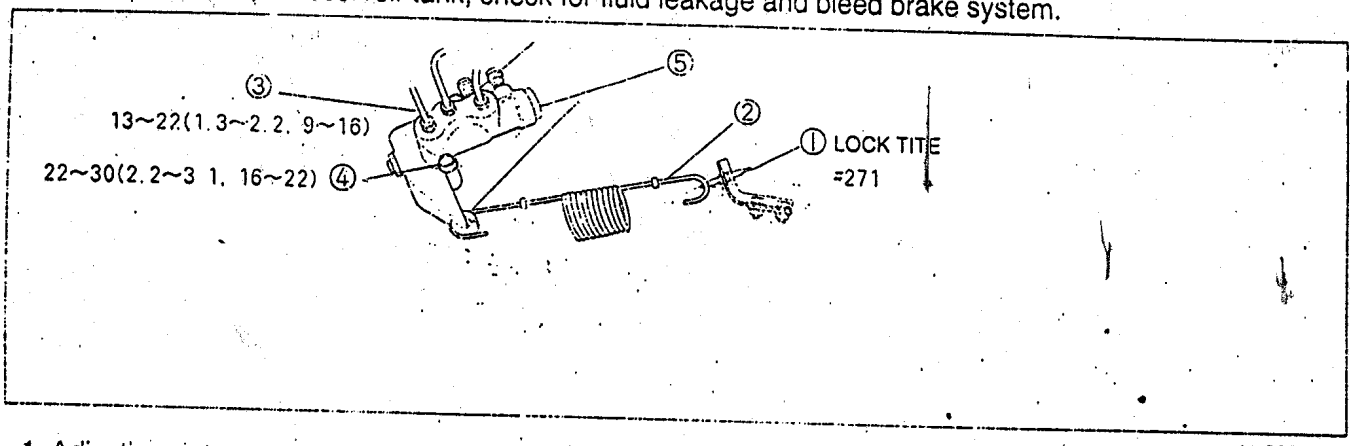


AN9052006

LOAD SENSING PROPORTIONING VALVES(LSPV)

REMOVAL/INSTALLATION

1. Remove in the order as shown in the figure.
2. Install in the reverse order of removal.
3. After installation, fill reservoir tank, check for fluid leakage and bleed brake system.



AN9052007

1. Adjusting nut
2. Spring
3. Brake pipe
4. Bolt
5. LSPV

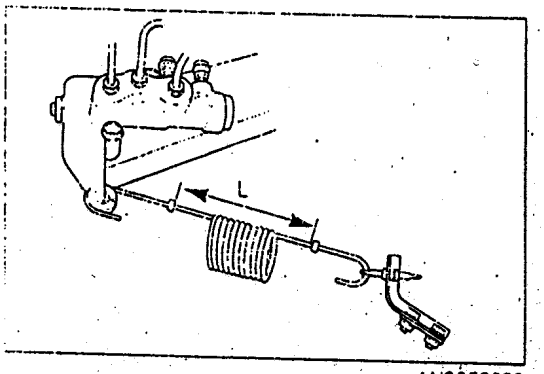
INSPECTION

Spring

1. Inspect length of spring after placing vehicle on the ground level with no occupants.

   Specification : 89.5~90.5 mm(3.52~3.56 in)

2. If the length is not within the specification, adjust by rotating adjusting nut and apply lock tite. (#271)



AN9052008

LSPV

1. Install pressure gauge in front and rear brake wheel.
2. Bleed air in brake line.
3. Apply brake pedal until fluid pressure of front wheel reaches A', B' and inspect if the fluid pressure A, B of rear wheel is within specification.

kg/cm²(psi)

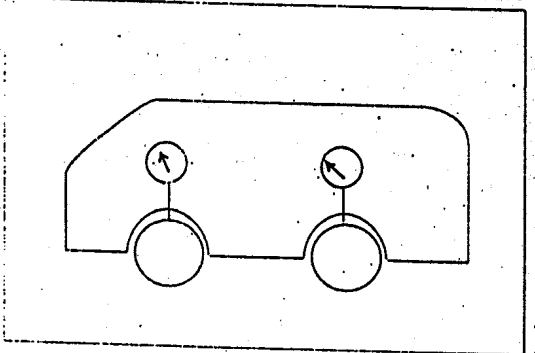
Vehicle		With no occupants				Normal condition			
		A	A'	B	B'	a	a'	b	b'
12 seats	12P	16 (227)	16 (227)	26 (369)	50 (711)	55 (782)	55 (782)	69 (980)	100 (1421)
	9P	13 (185)	13 (185)	24 (341)	50 (711)	32 (455)	32 (455)	46 (654)	80 (1137)
	6 VAN	12 (171)	12 (171)	23 (327)	50 (711)	62 (881)	62 (881)	76 (1080)	110 (1563)
	3 VAN	12 (171)	12 (171)	23 (327)	50 (711)	60 (853)	60 (853)	75 (1066)	110 (1563)

kg/cm²(psi)

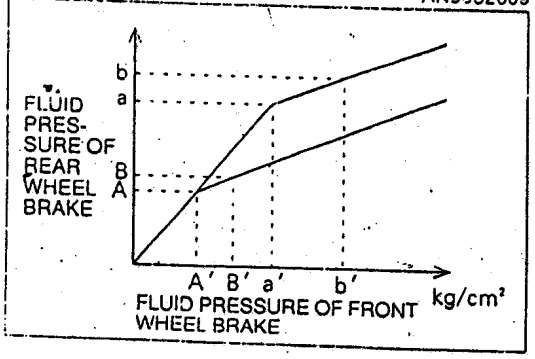
Vehicle		With no occupants				Normal condition			
		A	A'	B	B'	a	a'	b	b'
15 seats	15P	26 (369)	26 (369)	36 (512)	60 (860)	96 (1365)	96 (1365)	110 (1564)	143 (2033)
	3 VAN	34 (483)	34 (483)	42 (597)	62 (876)	106 (1507)	106 (1507)	120 (1706)	153 (2176)
	6 VAN	30 (427)	30 (427)	40 (569)	63 (901)	110 (1564)	110 (1564)	125 (1778)	160 (2275)

Caution

- In case of defective LSPV, replace as an assembly.



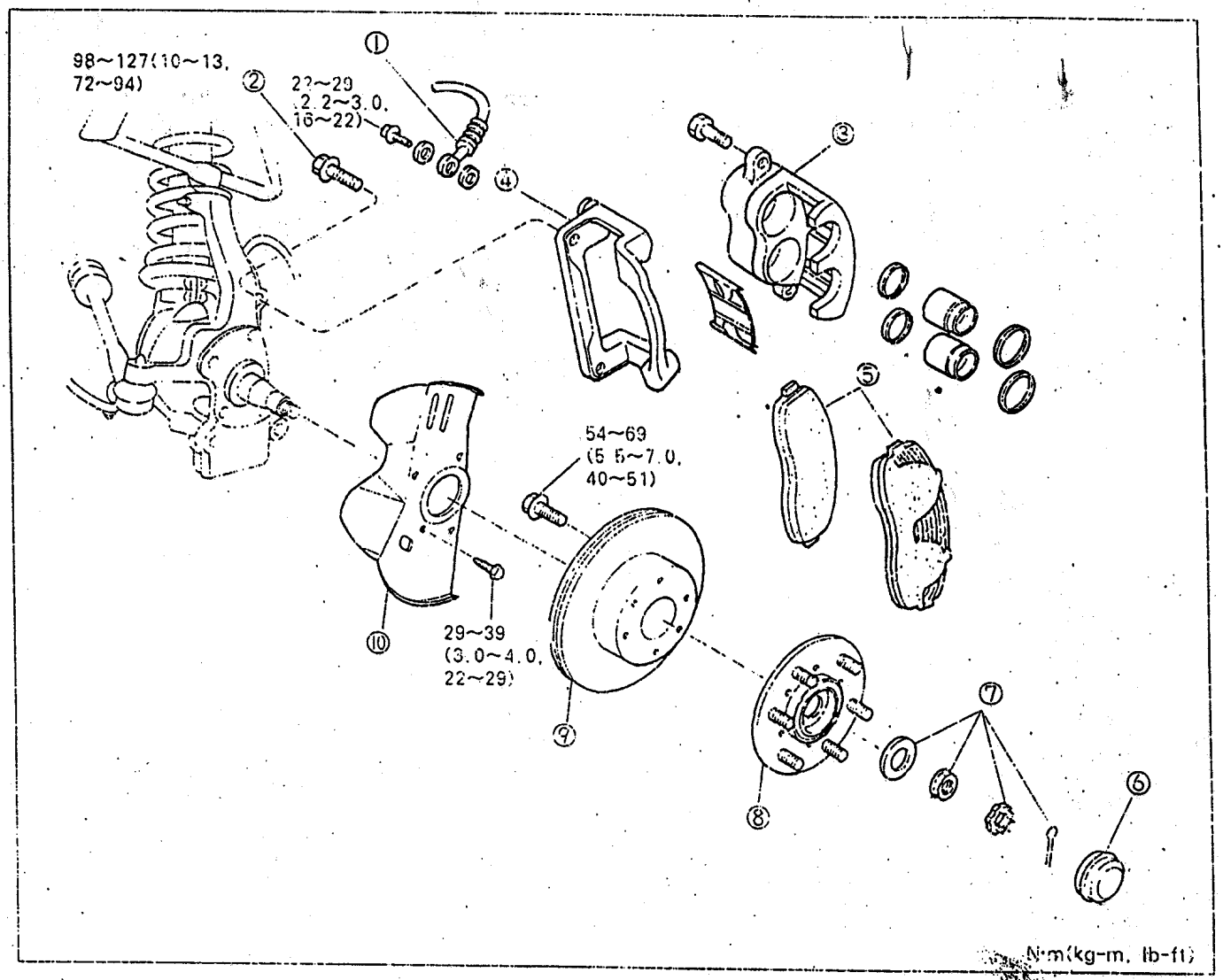
AN9052009



AN9052017

FRONT DISC BRAKE

REMOVAL/INSTALLATION



1. Flexible hose
2. Bolt
3. Caliper
4. Supporting plate
5. Brake pads
6. Hub cap
7. Pin washer nut
8. Front hub
9. Disc plate
10. Dust cover

Inspection

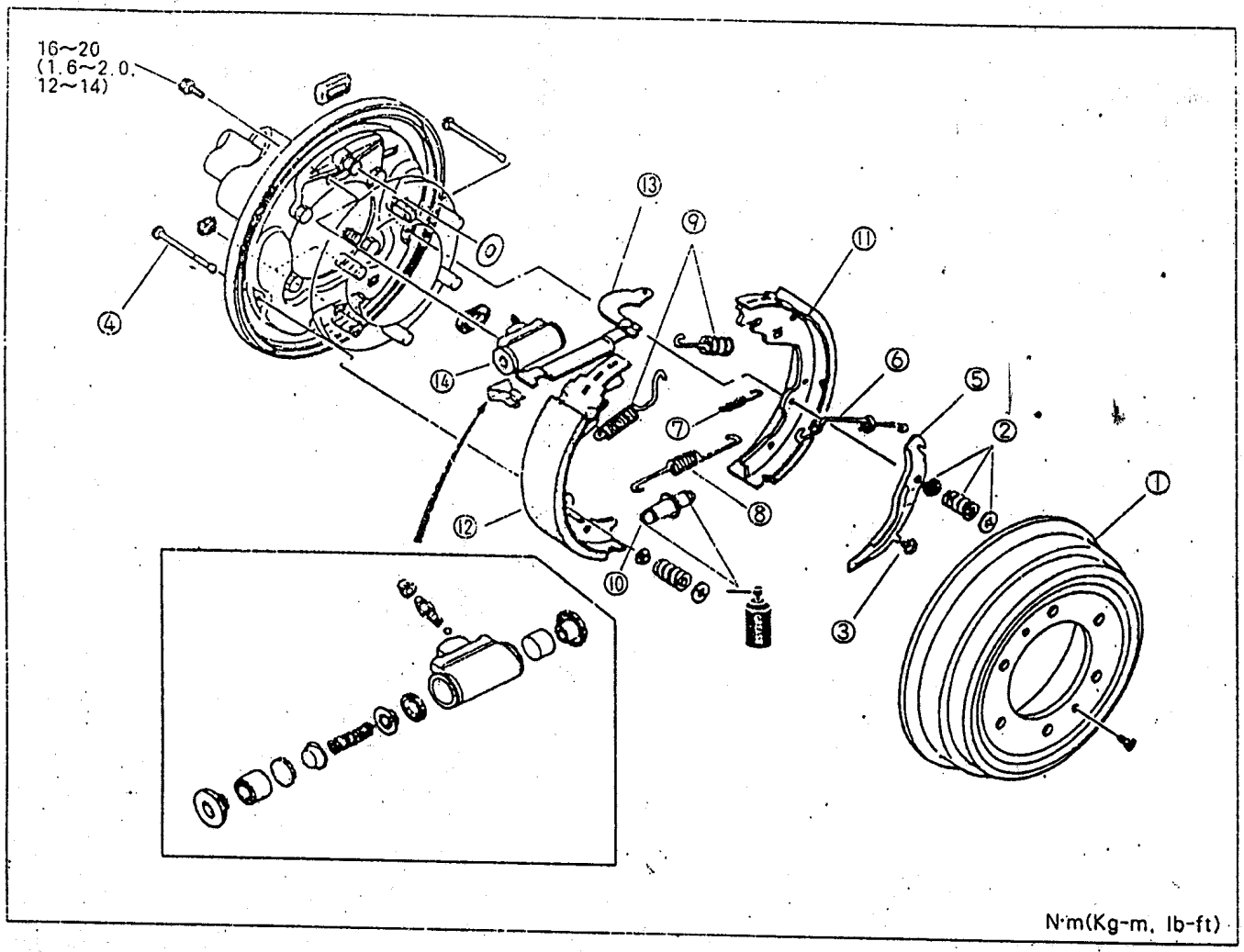
1. Thickness of disc pad
   Standard : 11.0~11.5 mm(0.433~0.452 in)
   Minimum: 1.5 mm(0.059 in)
2. Disc plate
   Standard : 26 mm(1.023 in)
   Minimum: 24 mm(0.944 in)
3. Runout (mm) (at 8~12 mm(0.315~0.472 in) from the outside edge of disc)
   Maximum: 0.1 mm(0.004 in)

Caution

- **Do not allow grease and oil on the brake pad surfaces.**

REAR DRUM BRAKE

REMOVAL/INSTALLATION



1. Brake drum
2. Shoe hold spring sleeve
3. Back spring
4. Shoe hold pin
5. Adjusting lever
6. Link
7. Pull off spring
8. Shoe spring
9. Return spring
10. Adjuster
11. Secondary shoe
12. Primary shoe
13. Operating lever, anti-rattle spring
14. Wheel cylinder

INSPECTION

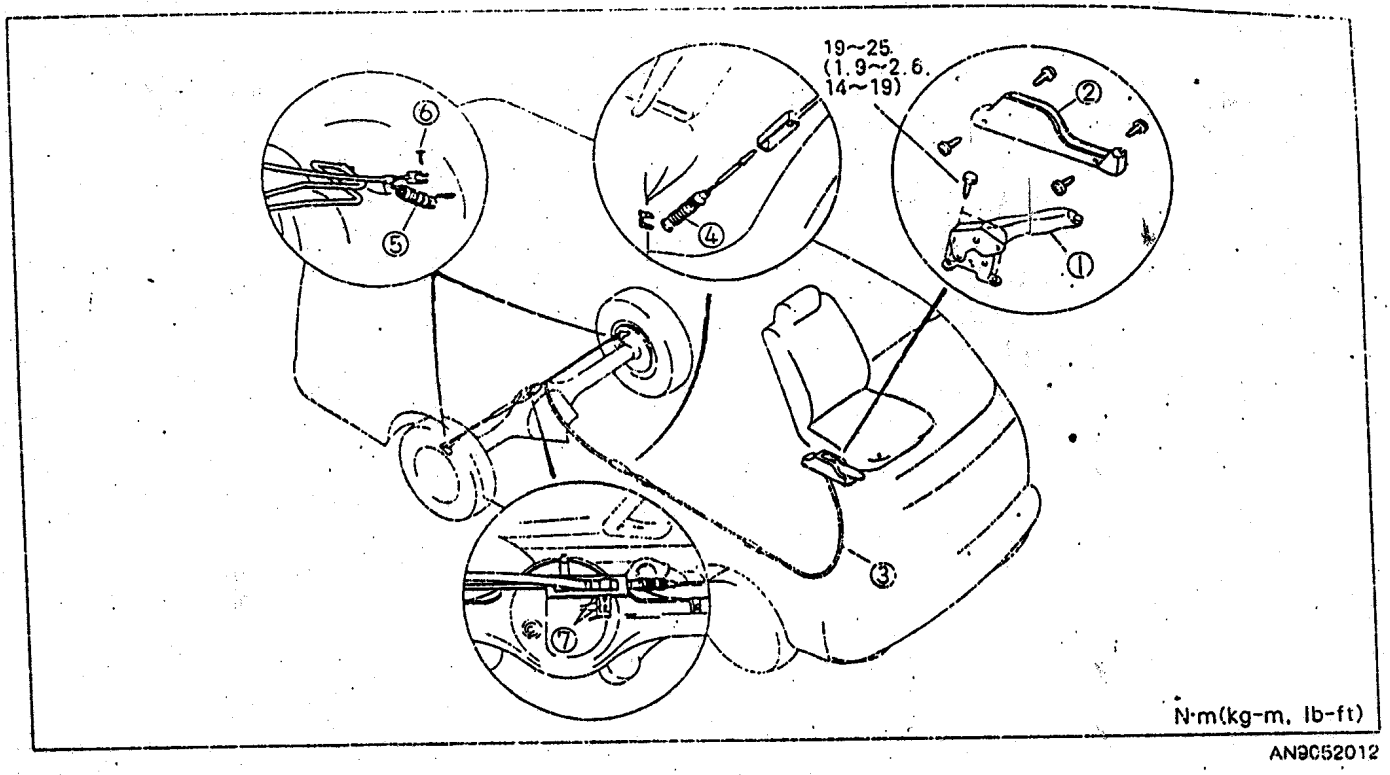
1. Thickness of lining pads
   Specification : 5.0 mm(0.2 in)
   Minimum: 1.0 mm(0.04 in)
2. Inner diameter of drum
   Specification : 260.0 mm(10.2 in)
   Limit : 261.5 mm(10.3 in)

Caution

- **At the time of assembly of shoes, do not confuse primary shoe with secondary one.**
- **Apply rubber grease lightly at the contact surface of shoe and back plate.**
- **Grease, oil or any foreign material must be kept off lining surfaces.**
- **After installation, adjust brakes.**

PARKING BRAKE

REMOVAL/INSTALLATION



AN9052012

1. Parking brake lever cover
2. Parking brake lever
3. Front parking cable
4. Rear parking cable
5. Return spring
6. Pin
7. Bolt

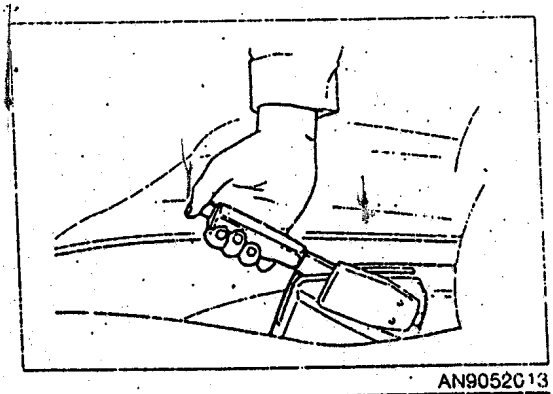
INSPECTION

1. Check parking brake lever strokes when pulled with 294N (30kg, 66 lb) of force.

   Specification : 4~14 notches

2. Turn the ignition switch on and pull the parking brake one notch, and check that the parking brake warning lamp illuminates.

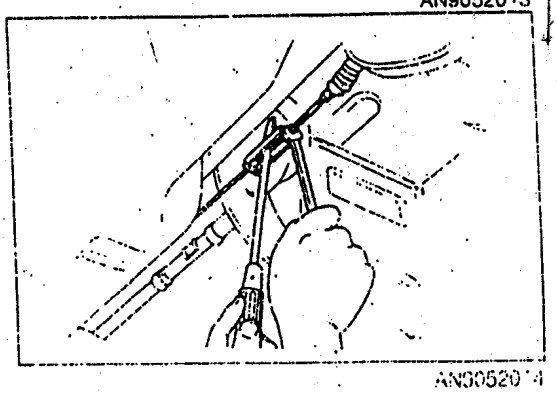
Parking brake one notch	Warning lamp (Ⓘ) (Ⓟ) Light stay on



AN9052013

ADJUSTMENT

1. Start engine before adjusting and apply brake pedal several times while moving vehicle backward.
2. Check that the rear brakes do not drag.

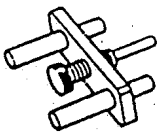
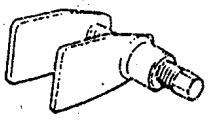
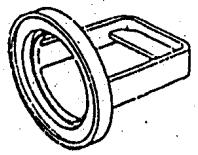
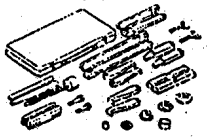
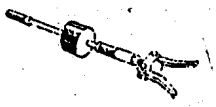


AN9052014

SPECIFICATIONS

Items			Specifications
Brake pedal	Type		Suspension type
	Pedal lever ratio	mm(in)	4.07(0.16)
	Maximum stroke	mm(in)	145(5.7)
Master cylinder	Type		Tandem(Level sensor installed)-pararrel type
	Cylinder inner diameter	mm(in)	ø 23.81(For ABS ø 25.4) (0.94, 1)
Front disc brake	Type		Ventilated disc
	Cylinder bore	mm(in)	ø 46 × 2(1.8 × 2)
	Pad size(area x thickness)	mm² × mm(in² × in)	6080 × 10(9.4 × 0.4)
	Disc plate size (outer diameter x thickness)	mm(in)	258 × 25(10.16 × 1.02)
Rear drum brake	Type		Duo servo
	Wheel cylinder inner diameter		ø 19.05mm(0.75)
	Lining size(width x length x thickness)	mm(in)	261 × 45 × 7mm(10.3 × 1.8 × 0.28)
	Drum inner diameter	mm(in)	ø 260mm(10.24)
	Shoe clearance adjusting		Auto adjusting
Power brake unit	Type		Hydrovac type
	Outer diameter	mm(in)	188+215(7.4+8.46)
Braking control system	Type		LSPV<LOAD SENSING PROPORTIONING VALVE>
Brake fluid			FMVSS NO. 116, DOT-3
Parking brakes	Type		Mechanical rear wheel braking
	Operation method		Floor lever

SPECIAL TOOLS

0K130 430 019 Flare nut wrench 	For brake pipes removal/installation	0K993 430 032 Adjusting gauge 	For adjusting push rod clearance
0K130 430 017 Disc brake expand tool 	For disc pads assembly	0K201 660 001 Sensor rotor installer 	For installing sensor rotor
0K670 990 AA0 Bearing installer set 	For removing sensor rotor	0K011 270 001 Bearing outer Lace remover 	For removing front hub bearing outer lace

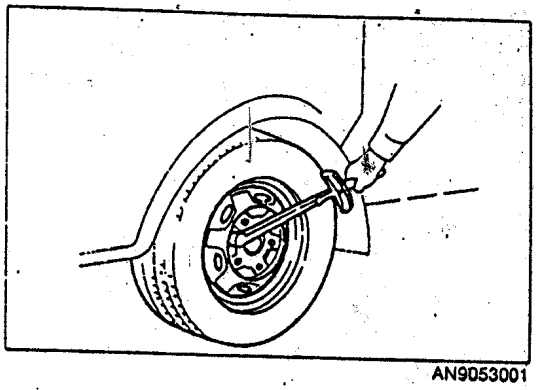
WHEELS AND TIRES

53

TROUBLESHOOTING GUIDE

Problem	Possible cause	Action
Excessive or uneven tire wear	Improper tire pressure	Adjust
	Imbalanced wheels	Adjust
	Imbalanced tire spinning	Adjust
	Severe driving	Obtain new driving habits
	Improper toe-in	Refer to section 54
	Poor braking function	Refer to section 52
Rapid tire wear	Excessive tire pressure	Adjust
	High speed driving with deflated tires	Adjust
Tires squeaking noise	Improper tire pressure	Adjust
	Aged tires	Replace
Road noise and body vibration	Deflated tires	Adjust
	Imbalanced wheels	Adjust
	Damaged wheels or tires	Repair or replace
	Uneven tire wear	Replace
Steering wheel vibration	Irregular tire wear	Replace
	Imbalanced or damaged wheels	Repair or replace
	Damaged tires	Replace
	Imbalanced tire pressure	Adjust
	Loose hub nuts	Tighten
	Imbalanced wheels	Adjust
Brakes leads to one side	Imbalanced tire pressure	Adjust
	Defected brakes	Refer to section 52
Steering wheel not properly returning	Improper tire pressure	Adjust
	Irregular tire wear(of right and left tires)	Replace
	Imbalanced tire pressure	Adjust
	Different type of tires used	Replace
	Improper tightening of hub nut	Tighten
Unstable driving	Imbalanced tire pressure	Adjust
	Imbalanced or damaged wheels	Repair or replace
	Loose hub nuts	Tighten
Excessive steering wheel play	Loose hub nuts	Tighten
	Improper adjustment of front wheel bearing preload	Refer to section 50

REMOVAL/INSTALLATION


AN9053001

CAUTIONS FOR REMOVING TIRES FROM WHEEL

1. Be careful not to damage the tire bead, the wheel rim bead or the outer edge of the wheel rim.
2. Apply soapy water to the edge of the wheel and tire bead (to make an installation easier).
3. Remove rust, dust, or mud from the edge of the wheel and tire bead with wire brush, sandpaper and cloth.
4. Use only cloth for aluminum wheels. Wire brush and sandpaper are not allowed.
5. Stones, glass, and pins should be removed from tread.
6. Properly install air valve.

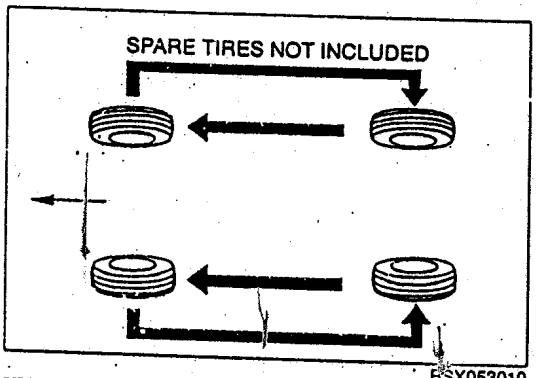
1. Clean contacting surface of wheels and hub.
2. Tighten hub nut to specified torque.

Tightening torque : 88~108 N·m(9~11 kg-m, 65~80 lb-ft)

Note
- **Do not use oil for hub nuts and wheels**
- **Oil may cause loose hub nut and weakened tightening.**

TIRE ROTATION

Tires will be rotated at every 8,000 km driving. Rotation will increase tire life and help tires to wear evenly.



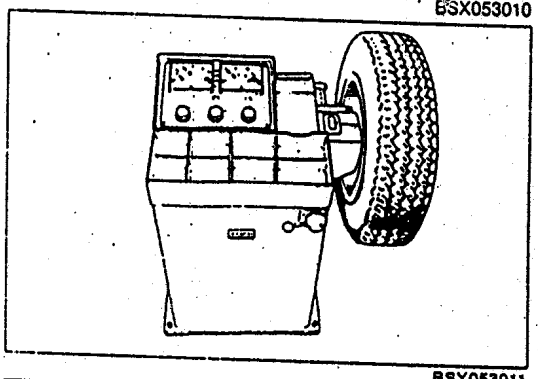
BSX053010

Caution
- **Install less worn and less damaged tires to front wheel.**
- **After rotation, use specified tire pressure.**

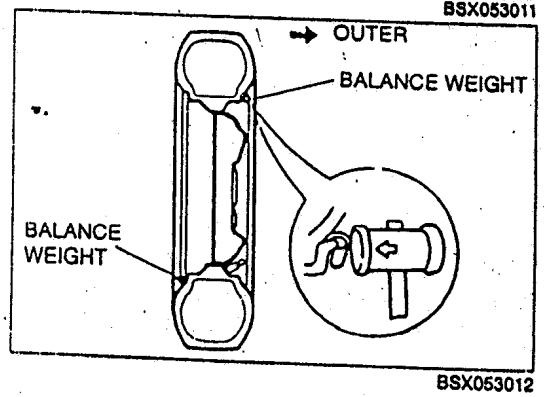
WHEEL BALANCE

Standard wheel balance must be met whenever a tire is repaired or wheels are not balanced.

1. Wheel balance quantity : Less than 100g
2. Wheel balance weight : Less than 60g/use 1EA


BSX053011

Note
- Do not use more than 2 balance weights at inner or outer wheels.
- Balance once again by installing wheel tire if total weight exceeds 100g.
- When installed balance weight, it must not come out more than 1mm from the surface of wheel. Balance weight
- Use specifications of aluminum wheel balance weight for aluminum wheels.



BSX053012

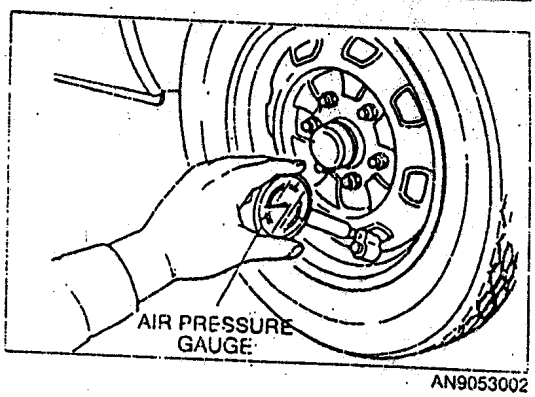
INSPECTION AND ADJUSTMENT

AIR PRESSURE

Inspect pressure of all tires including spare ones, using air pressure gauge.

kgf/cm²(psi)

Vehicle	Tire type	Air pressure	
		Front wheel	Rear wheel
12 seats van	195R14-8PR	3.0(43)	4.0(57)
15 seats coach	205/75R14-8PR	3.5(50)	4.5(65)
12 seats coach	P205/75R14-8PR	3.5(50)	3.5(50)
15 seats van	P215/70R14	2.4(34)	2.4(34)



AN9053002

SPECIFICATIONS

Items			Specifications			
Wheels	Size		6-JJ×14WDC			
	Offset mm(in)		50±1.0(2±0.04)			
	Pitch circle diameter mm(in)		ø 139.7(5.5)			
	Material		Steel(aluminum)			
Tires	Size		195R14-8PR	205/75R14-8PR	P205/75R14-8PR	P215/70R14
	Air pressure kgf/cm²(psi)	Front wheel	3.0(43)	3.5(50)	3.5(50)	2.4(34)
		Rear wheel	4.0(57)	4.5(65)	3.5(50)	

SIZE OF WHEELS AND TIRES

N·m (kg-m, lb-ft))

Item	Torque
Hub nuts	88~108(9~11, 65~80)

SUSPENSION

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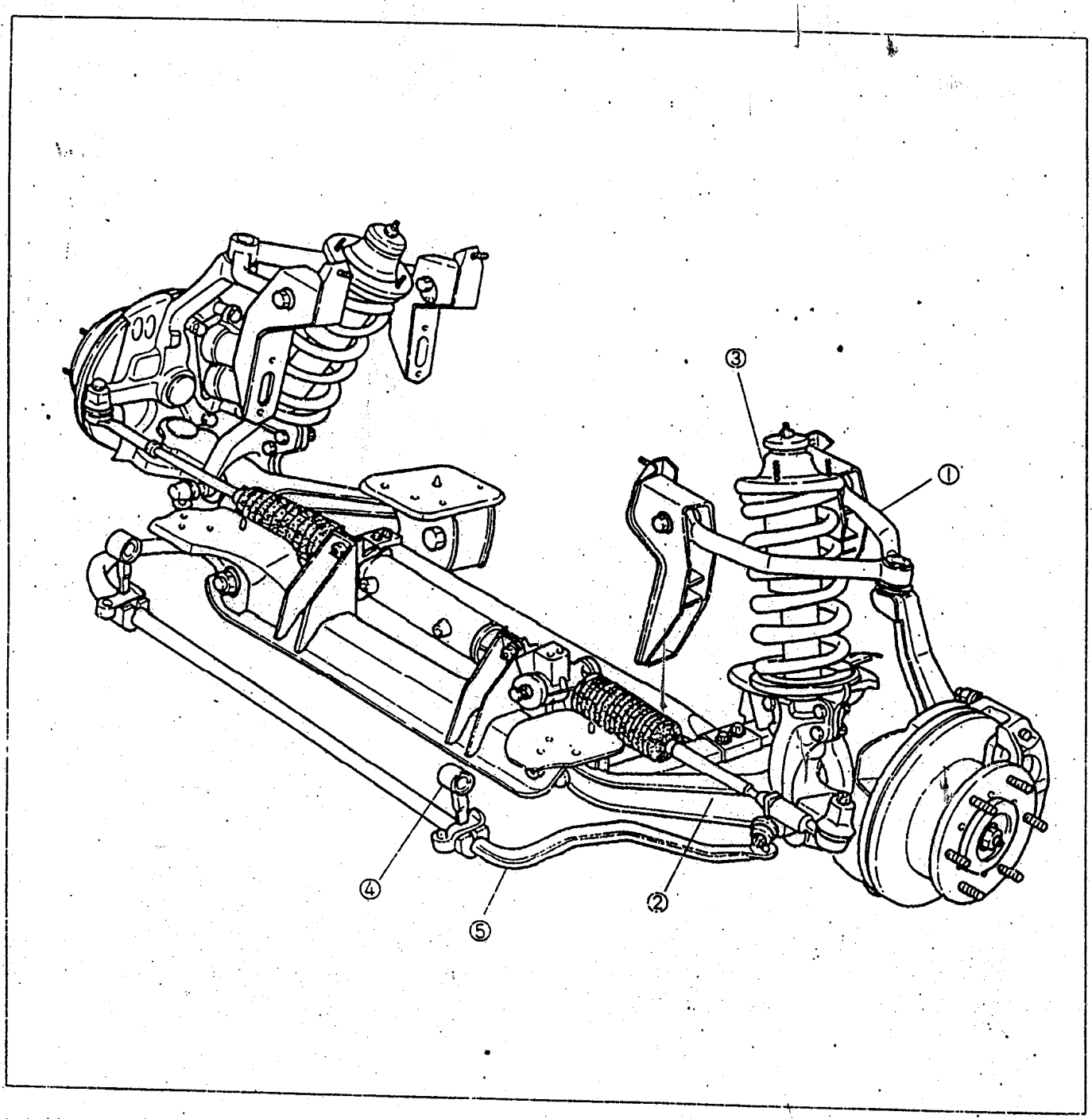
OUTLINE

FRONT SUSPENSION



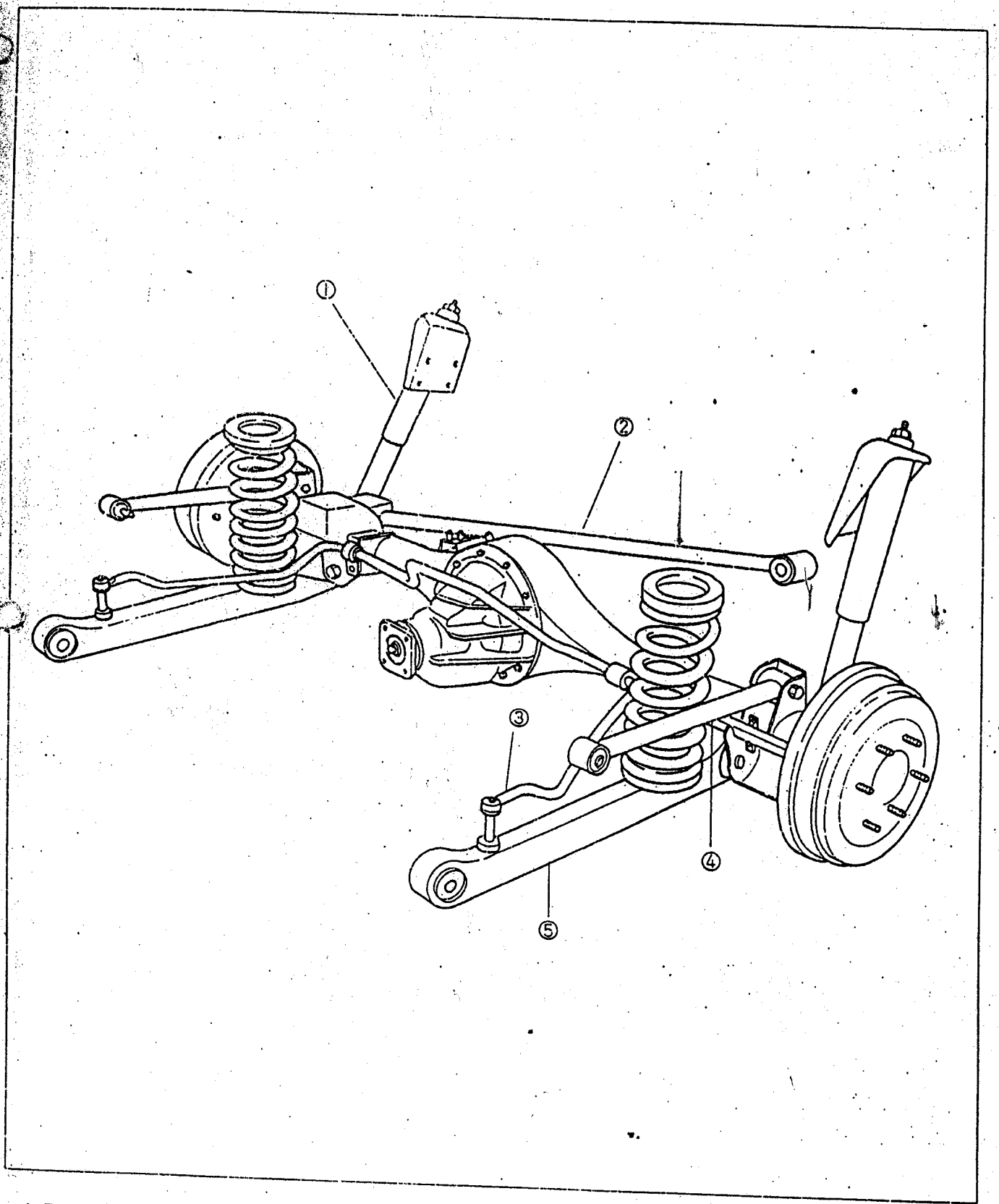
AN9054001

1. Upper arm
2. Lower arm
3. Front shock absorber and spring
4. Pivot link
5. Stabilizer

Caution

- **Tightening front suspension nuts and links to specifications should be performed with vehicle grounded.**

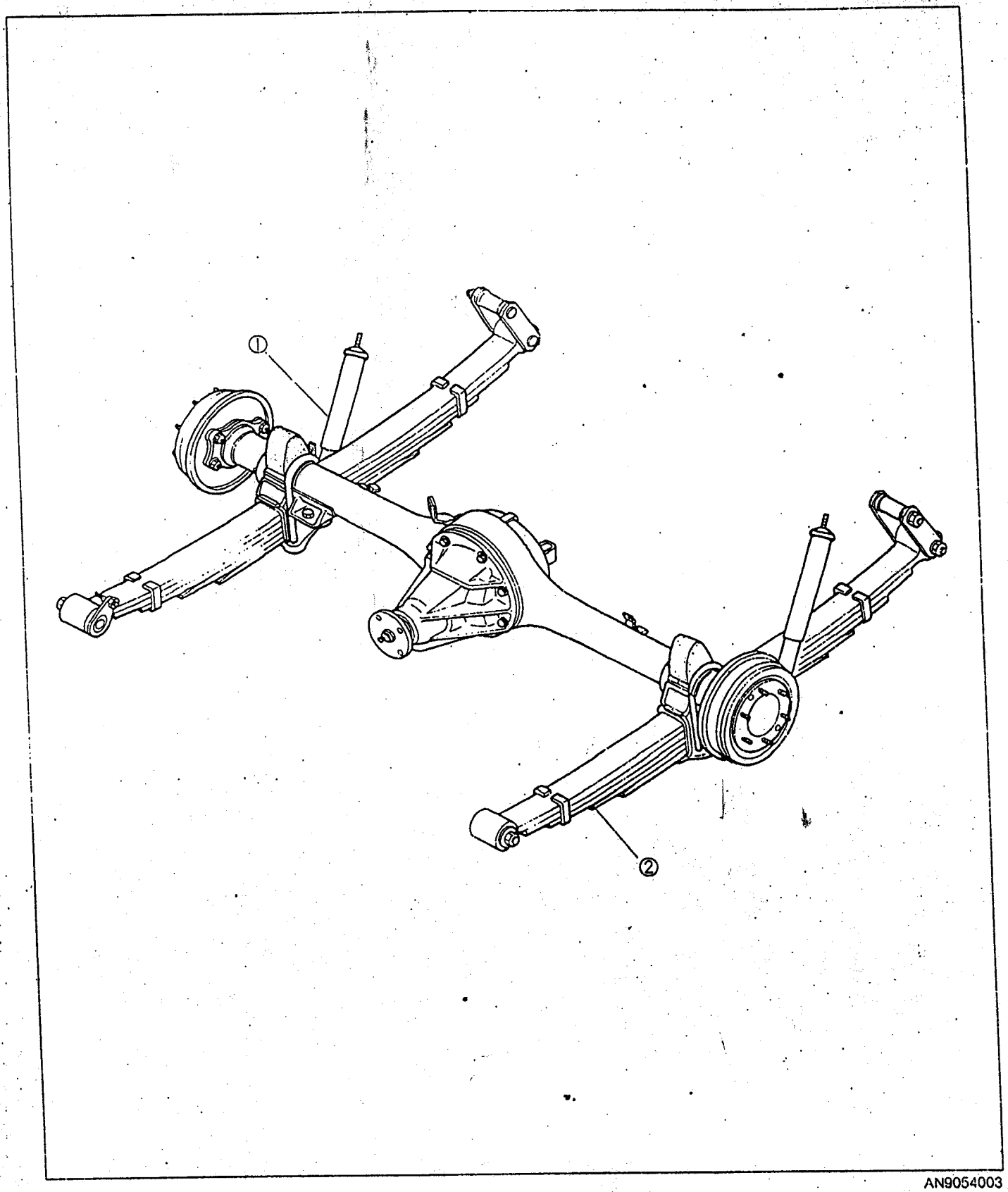
REAR SUSPENSION(5 LINK TYPE) : 12 seats coach



AN9054002

1. Rear shock absorber
2. Panhard rod
3. Stabilizer
4. Upper arm assembly
5. Lower arm assembly

REAR SUSPENSION(LEAF SPRING TYPE) : Van, 15 seats



AN9054003

1. Rear shock absorber
2. Leaf spring assembly

TROUBLESHOOTING GUIDE

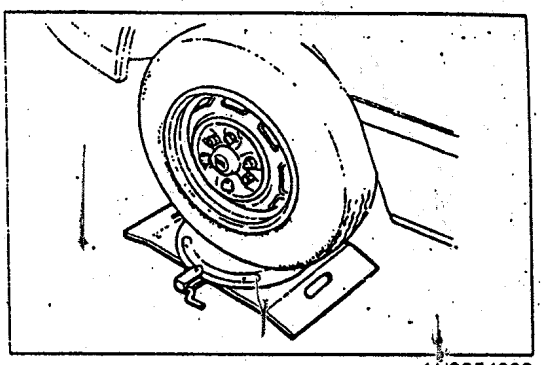
Problem	Possible cause	Action
Body rolls	Damaged stabilizer	Replace
	Worn and damaged stabilizer bushings	Replace
	Worn and damaged lower arm bushings	Replace
	Malfunctioning shock absorber	Replace
Poor riding	Damaged coil spring and leaf springs broken	Replace
	Malfunctioning shock absorber	Replace
Noise from suspension	Inadequate lubrication or wear of lower arm ball joints	Replace, Lubricate
	Loose bolts and nuts	Tighten
	Malfunctioning shock absorber	Replace
	Worn and damaged stabilizer bushings	Replace
	Worn and damaged lower arm bushings	Replace
Unstable ride	Improper tire pressure	Adjust
	Damaged coil springs	Replace
	Poor shock absorber	Replace
	Worn and damaged upper arm and lower arm bushings	Replace
	Worn and damaged stabilizer bushings	Replace
	Improper wheel alignment	Adjust
	Damaged ball joints of upper arm and lower arm	Replace
	Failure of steering system	Refer to section 51
	Deformed wheel and unbalanced wheel	Refer to section 53
	Loose bolts and nuts	Tighten
Heavy steering wheel	Inadequate lubrication or wear of lower arm ball joints	Lubricate, Replace
	Improper wheel alignment	Adjust
	Failure of steering system	Refer to section 51
	Deformed wheel and unbalanced wheel	Refer to section 53
Steering pulls to one side	Rusted coil spring and leaf spring broken	Replace
	Worn and damaged stabilizer bushings	Replace
	Worn and damaged lower arm bushings	Replace
	Damaged lower arm ball joints	Replace
	Improper wheel alignment	Adjust
	Failure of steering system	Refer to section 51
	Failure of brake system	Refer to section 52
	Distorted wheel and imbalanced wheel	Refer to section 53
	Improper tire pressure	Adjust
Steering wheel vibrates	Damaged lower arm ball joints	Replace
	Poor shock absorber	Replace
	Loose shock absorber bolts and nuts	Tighten
	Worn and damaged lower arm bushings	Replace
	Worn and damaged stabilizer bushings	Replace
	Improper wheel alignment	Adjust
	Worn and damaged wheel bearing	Replace
	Failure of steering system	Refer to section 51
	Deformed wheel and unbalanced wheel	Refer to section 53
Steering wheel does not return to center position	Stuck and damaged lower arm ball joints	Replace
	Improper wheel alignment	Adjust
	Failure of steering system	Refer to section 51
	Deformed wheel and unbalanced wheel	Refer to section 53

MAXIMUM STEERING ANGLE

Inspection

1. Position the front wheel on turning radius gauge and measure steering angle.

Specification : Inner : 39.12°
Outer : 33.80°

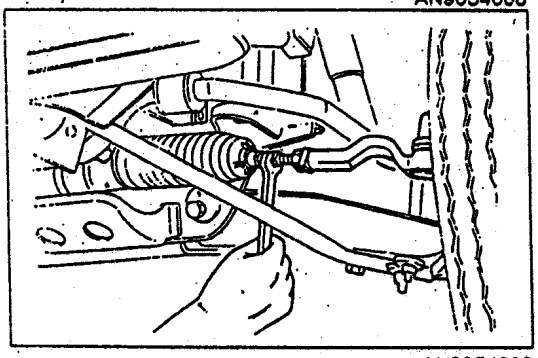


AN9054008

Adjustment

1. Loosen the left and right tie-rod lock nuts and turn the tie-rod evenly.
2. After adjusting steering angle, adjust toe-in and then tighten lock nuts.

Torque : 69~78 N·m(7.0~ 8.0 kg-m, 51~58 lb-ft)



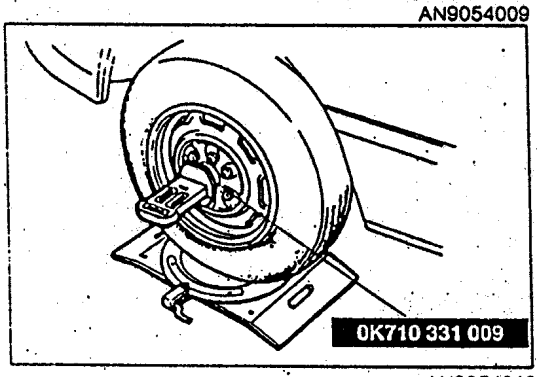
AN9054009

CAMBER AND CASTER

INSPECTION

1. Place the front wheel on turning radius gauge.
2. Remove the front wheel hub.
3. Attach a caster/camber gauge.
4. Measure the caster and camber.

Camber : +0.2±0.5 (No Passenger Load)
-0.25±0.5 (6 Passenger Load)
Caster : 2.8±0.5 (No Passenger Load)
3.4±0.5 (6 Passenger Load)



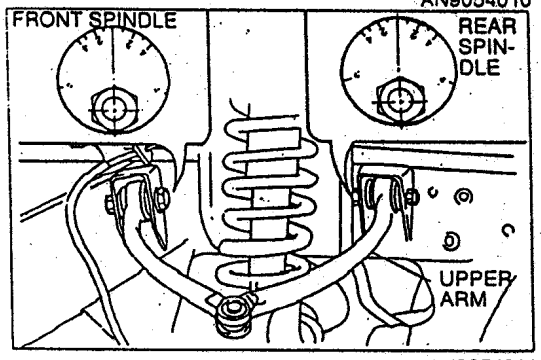
AN9054010

CAMBER ADJUSTMENT(RIGH ONE)

1. Turn the front spindle clockwise until the number "2" mark is aligned with the vertical line on the spindle bracket.
2. Turn the rear spindle counterclockwise until the number "2" mark is aligned with the vertical line on the spindle bracket.

Note

- **Each numerical point indicated on the spindle increases the camber by 0.4 degrees when turned to the vertical line.**



AN9054011

CASTER ADJUSTMENT(RIGHT ONE)

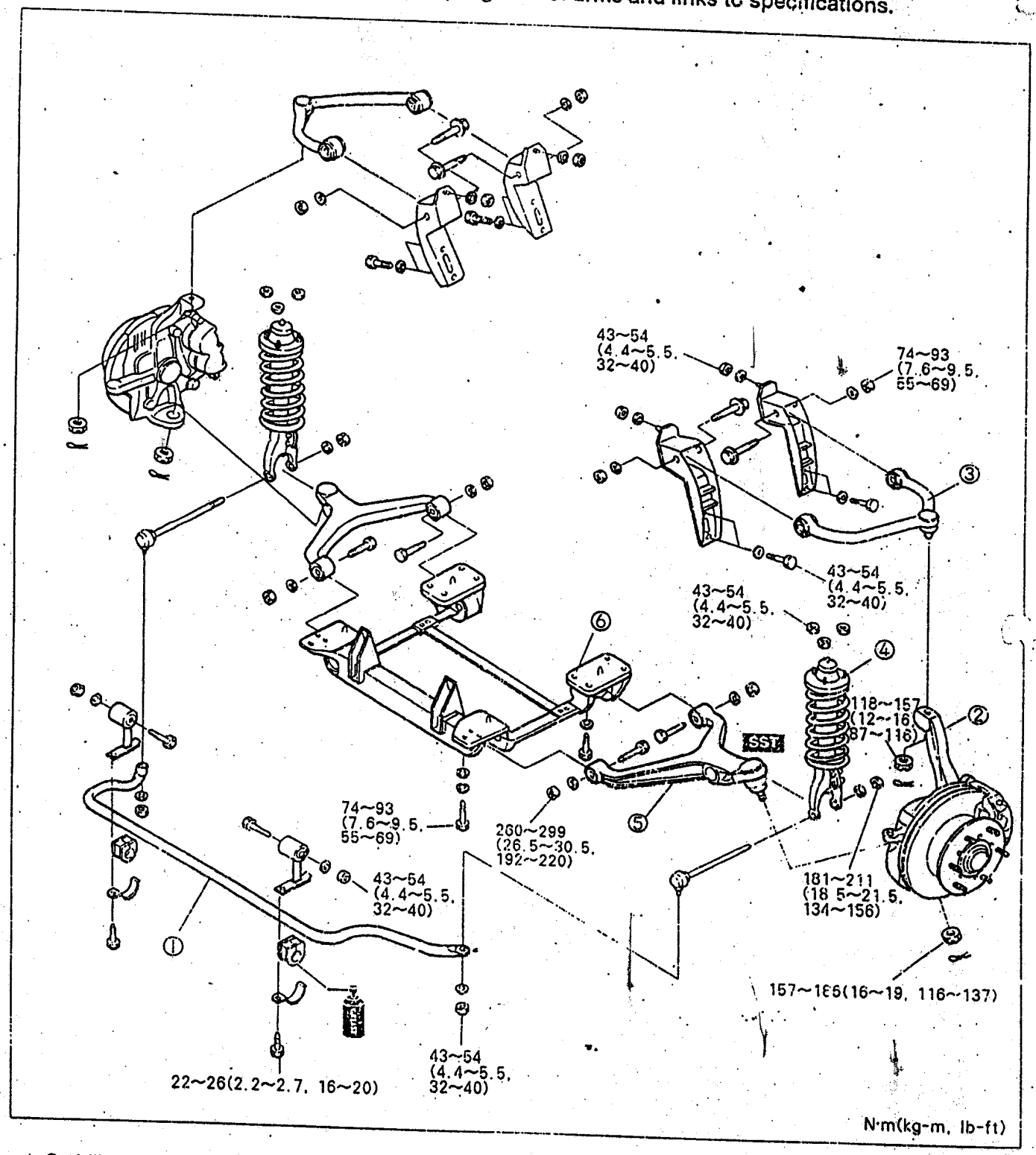
1. Turn the front spindle clockwise until the number "2" mark is aligned with the vertical line on the spindle bracket.
2. Turn the rear spindle clockwise until the number "2" mark is aligned with the vertical line on the spindle bracket.

Note

- **Each numerical point indicated on the spindle increases the caster by 0.55 degrees, when turned to the vertical line.**

FRONT SUSPENSION

Note
- Be sure to ground vehicle when torquing nuts of arms and links to specifications.



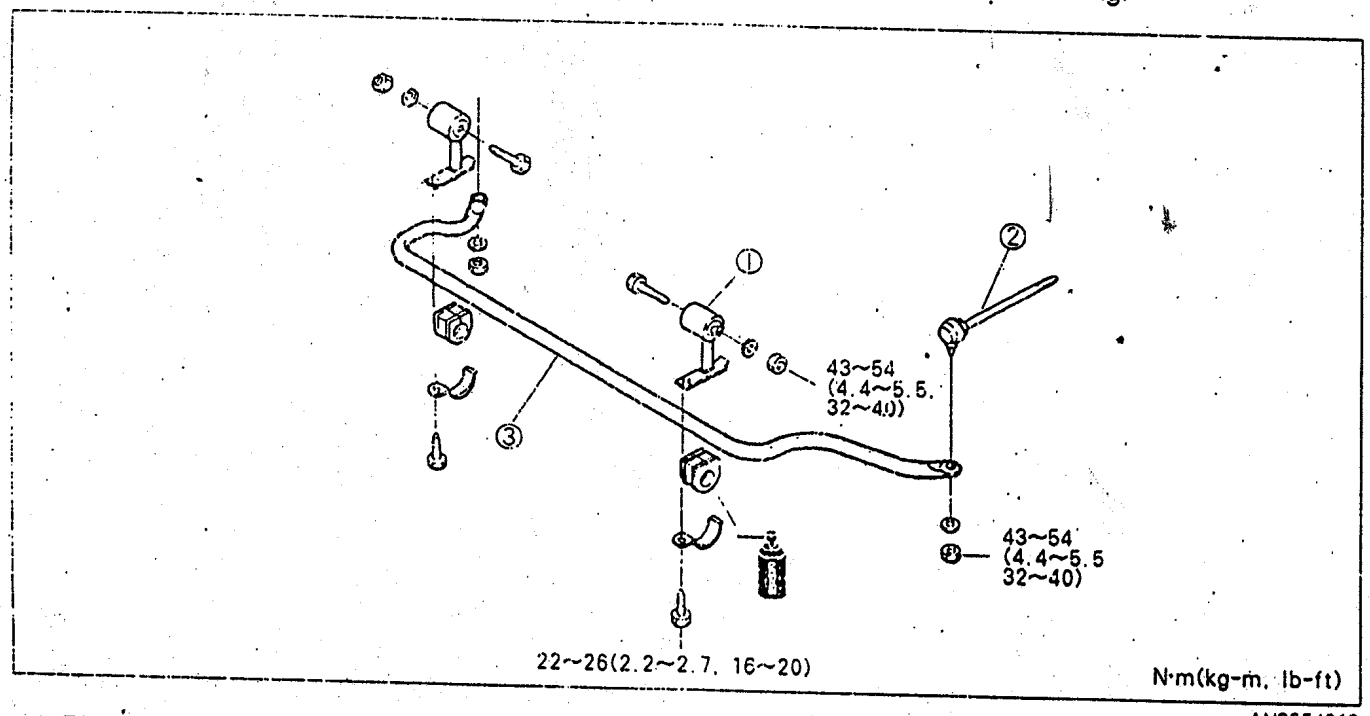
AN9054012

1. Stabilizer bar
2. Knuckle steering
3. Upper arm assembly
4. Front shock absorber assembly
5. Lower arm assembly
6. Cross member assembly

STABILIZER

REMOVAL/INSPECTION/INSTALLATION

1. Raise the front part of the vehicle on jack stands.
2. Remove in the order as shown in the figure.
3. Inspect all parts and repair or replace if necessary.
4. Install in the reverse order or removal. Refer to the notes for installation when installing.

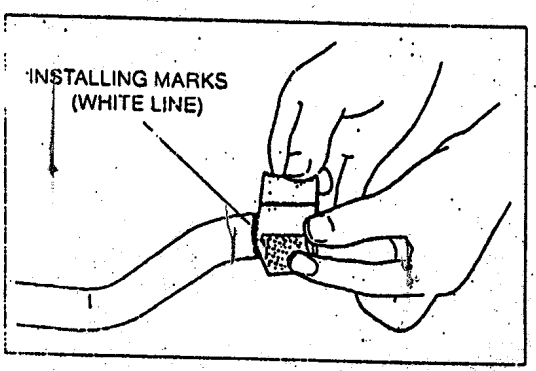


AN9054013

1. Pivot link
2. Drop link
3. Stabilizer

Installation note

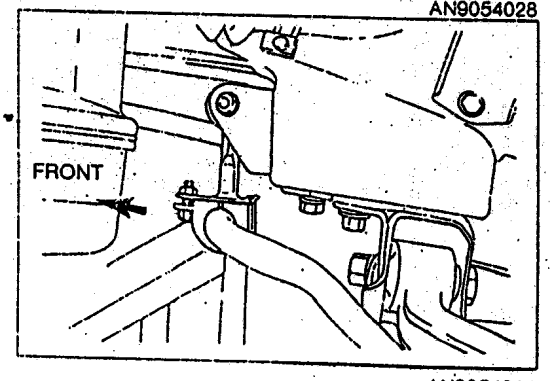
1. Apply rubber grease to inside of stabilizer bushings.
2. Align bush to the marks on the stabilizer.



AN9054028

Caution

- **Be sure not to change assembly direction of pivot link**
- **Tighten bolts and nuts to specifications.**

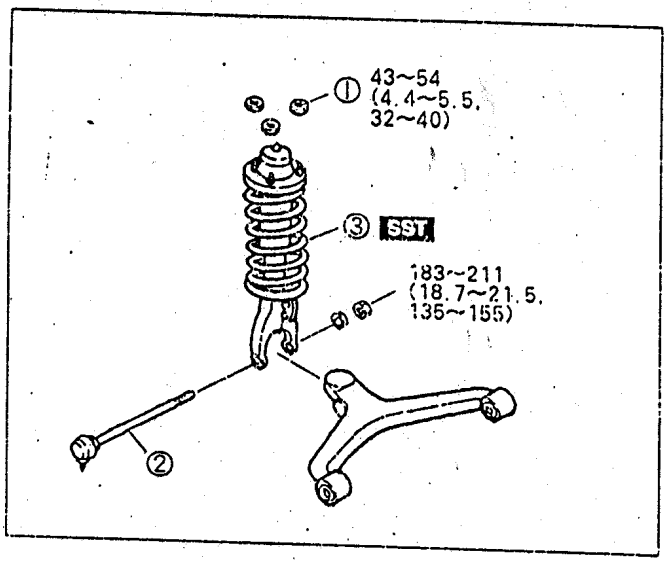


AN9054014

FRONT SHOCK ABSORBER AND SPRING

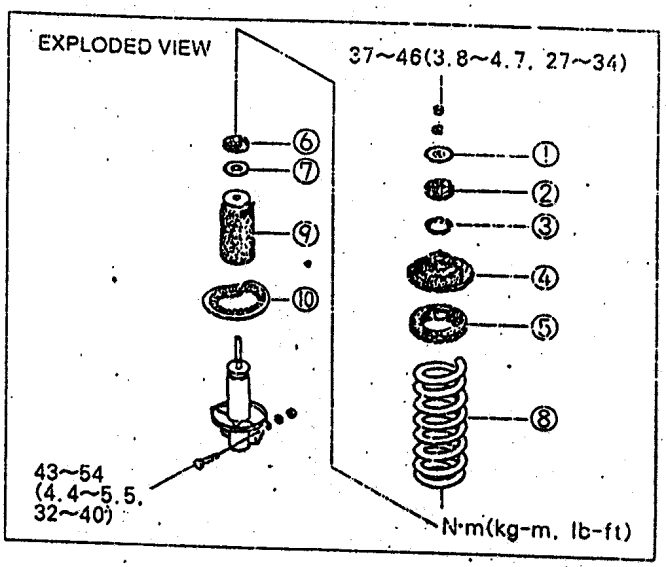
REMOVAL/INSTALLATION

1. Raise the front part of the vehicle on jack stands.
2. Remove wheels.
3. Remove in the order as shown in the figure.
4. Inspect all parts and repair or replace if necessary.
5. Install in the reverse order of installation.



AN9054015

1. Nut
2. Drop link
3. Shock absorber and spring



AN9054029

1. Upper retainer
2. Upper insulator
3. Centering washer
4. Mountain block
5. Upper spring seat
6. Lower insulator
7. Lower retainer
8. Coil spring
9. Dust boot and jounce stop
10. Lower spring seat

1. Attach shock absorber to vise.

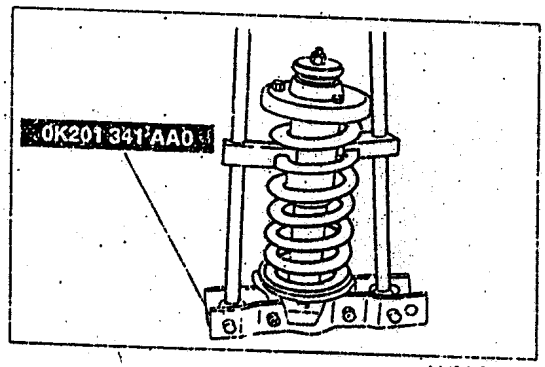
   Caution
   - Install protecting panel to vise.

2. Press coil spring using SST.
3. Set the end of the coil spring to the lower spring seat and install coil spring.
4. Tighten the piston rod nuts to specifications.

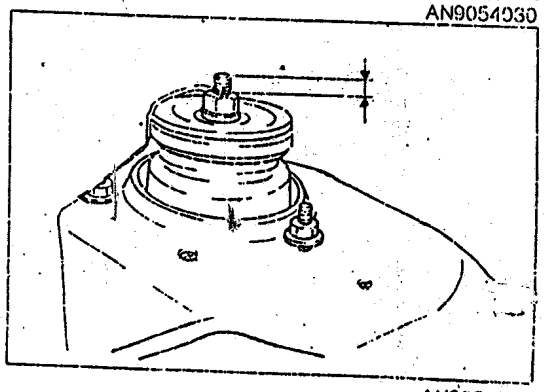
   Tightening torque : 37~46 N·m(3.8~4.7 kg-m, 28~34 lb-ft)

5. Measure the projected thread of piston rod end. (12 seats)

   Specification : 8.8 ± 0.5 mm(0.35 ± 0.02 in)



AN9054030

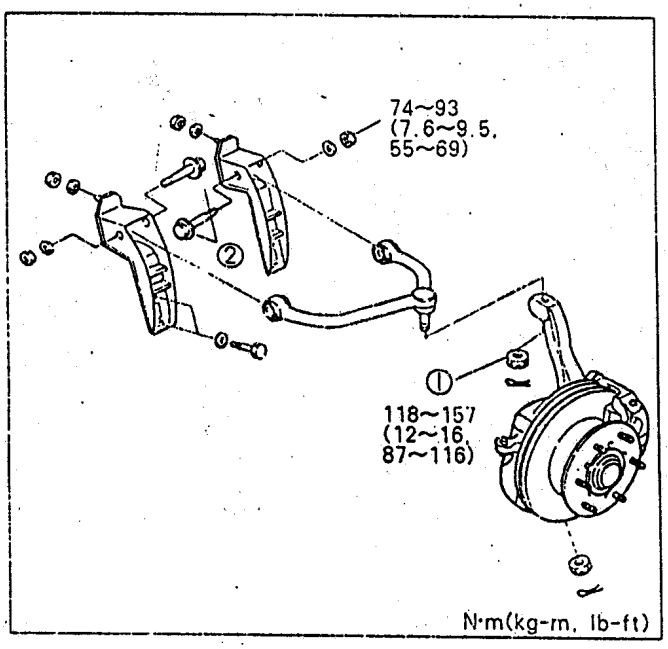


AN9054016

UPPER ARM

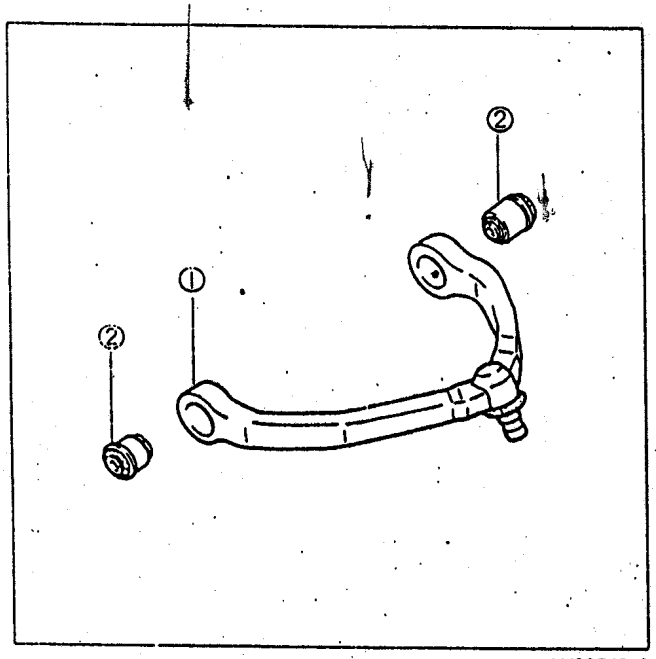
REMOVAL/INSPECTION/INSTALLATION

1. Raise the front part of the vehicle on jack stands.
2. Remove wheels.
3. Remove in the order as shown in the figure.
4. Inspect all parts and repair or replace if necessary.
5. Install in the reverse order of removal.



AN9054017

1. Nut
2. Front/rear spindle

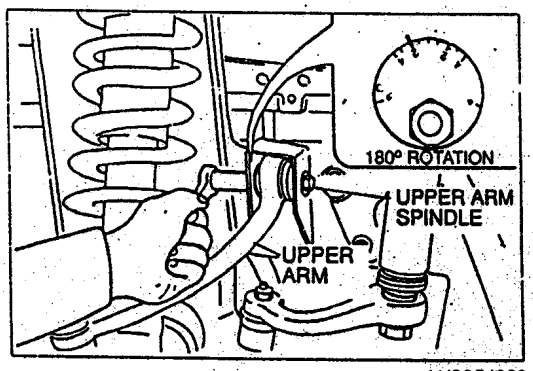


AN9054018

1. Upper arm
2. Bushing

Removal note

1. Before loosening upper spindle nuts, mark bracket and spindle for installation.

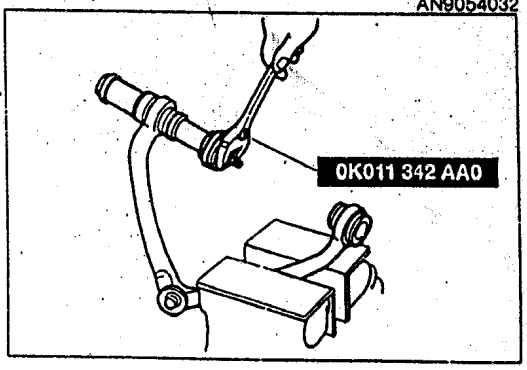


AN9054032

2. Replace upper arm bushing using SST.

Caution

- Use soapy water when replacing with new bushing.
- Replace dust boot only when failure is detected.
- When reinstalling upper arm, adjust camber and caster.

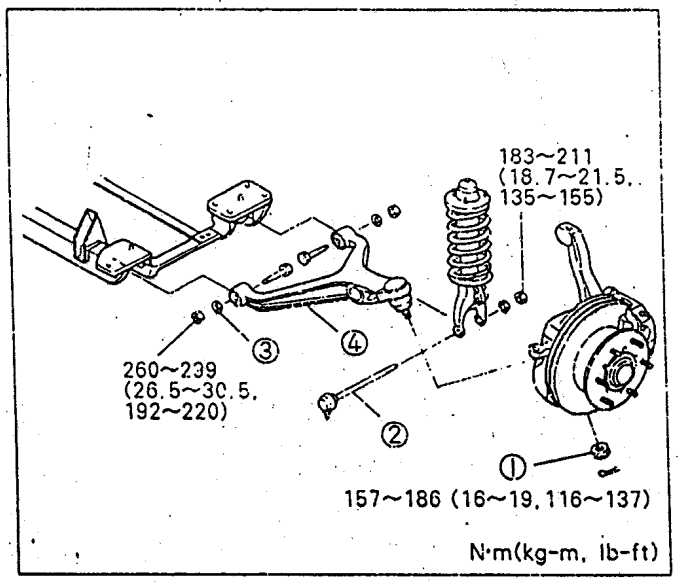


AN9043031

LOWER ARM

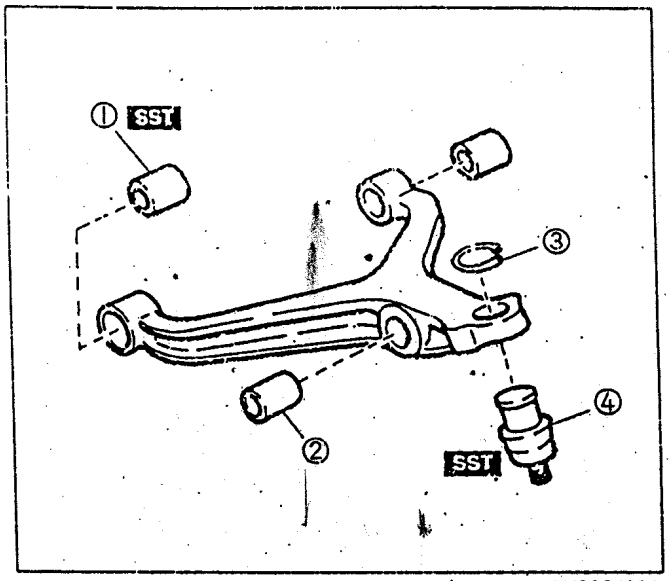
REMOVAL/INSPECTION/INSTALLATION

1. Raise the front part of the vehicle on jack stands.
2. Remove wheels.
3. Remove in the order as shown in the figure.
4. Inspect all parts and repair or replace if necessary.
5. Install in the reverse order of removal.



AN9054020

1. Nut(knuckle)
2. Drop link
3. Nut(lower arm)
4. Lower arm

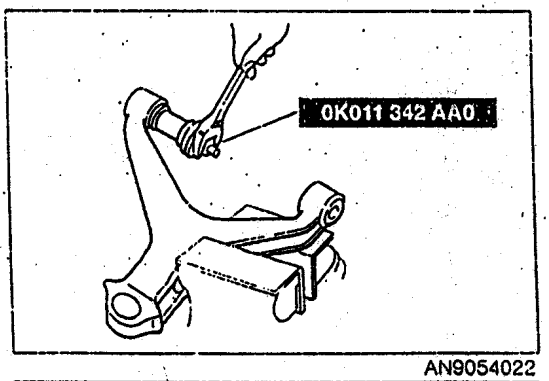


AN9054021

1. Bushing
2. Bushing
3. Snap ring
4. Ball joint

Removal note

1. Replace lower arm bushing after installing SST to lower arm.

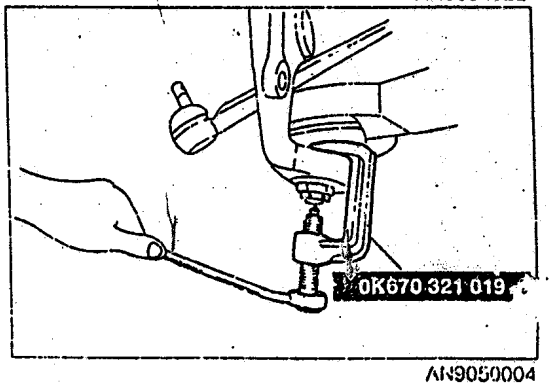


AN9054022

2. Remove knuckle after installing SST.

Caution

- **Apply soapy water when replacing with new bushing.**
- **When reinstalling lower arm, adjust wheel alignment if necessary.**

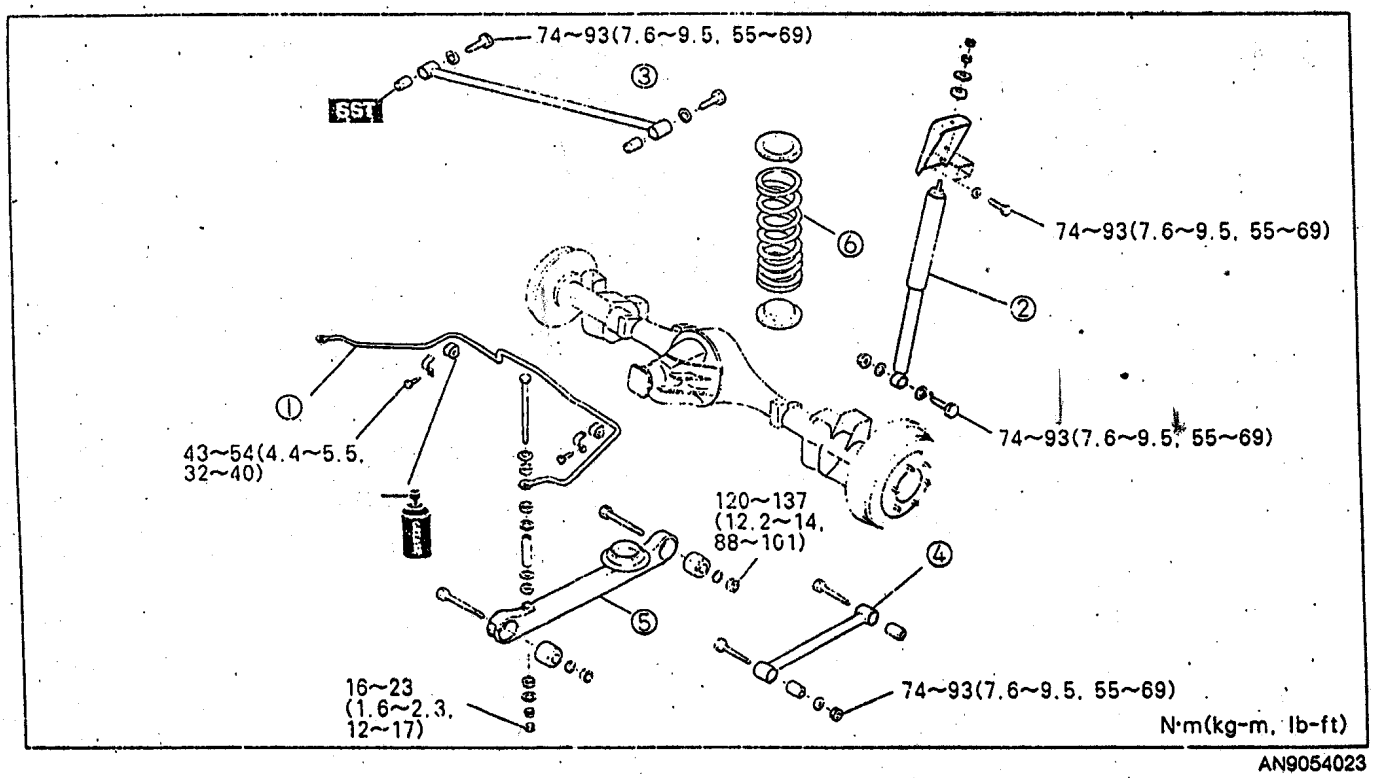


AN9050004

REAR SUSPENSION(5 LINK TYPE) : 12 seats coach

REMOVAL/INSPECTION/INSTALLATION

1. Remove in the order as shown in the figure and install in the reverse order of removal.
2. Inspect all parts and replace if necessary.



AN9054023

1. Stabilizer bar
2. Shock absorber
3. Panhard rod
4. Upper arm assembly
5. Lower arm assembly
6. Spring

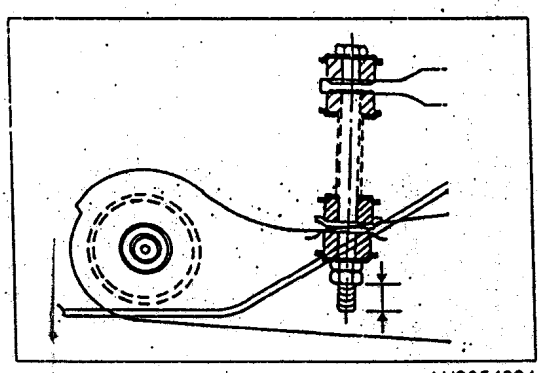
Inspection

1. Tighten the stabilizer nuts so that the specified length of the thread is exposed.

   Specification : 21~25 mm(0.83~0.98 in)

2. Tighten the shock absorber nuts until the specified length of the thread is exposed.

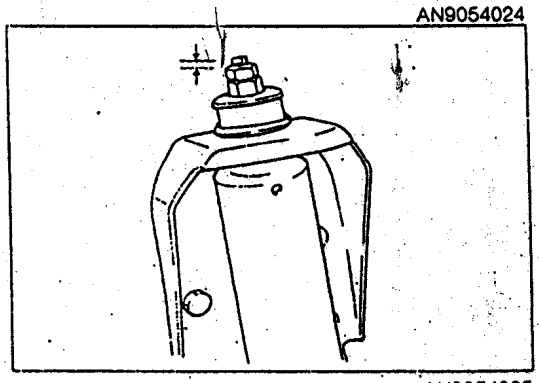
   Specification : 10.5~11.5 mm(0.41~0.45 in)



AN9054024

Caution

- **Tighten bolts and nuts lightly, and after lowering the vehicle(no passenger load condition) tighten it to the specified torque.**
- **Do not remove rear jounce stop unless damage is detected.**

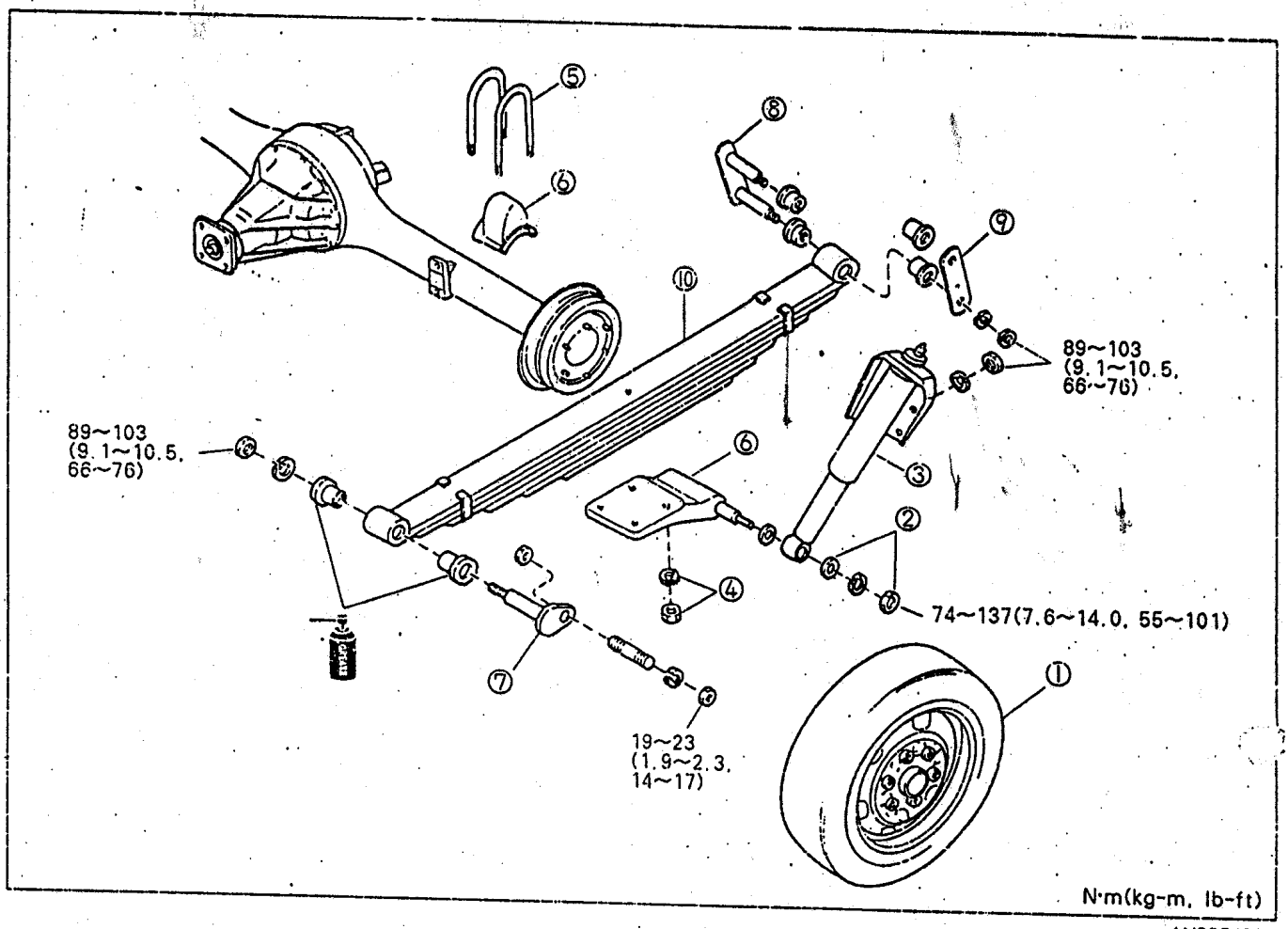


AN9054025

REAR SUSPENSION(LEAF SPRING TYPE) : Van, 15 seats

REMOVAL/INSPECTION/INSTALLATION

1. Raise the rear part of the vehicle and support it with safety stands.
2. Remove in the order as shown in the figure and install in the reverse order of removal.
3. Inspect all parts and replace if necessary.



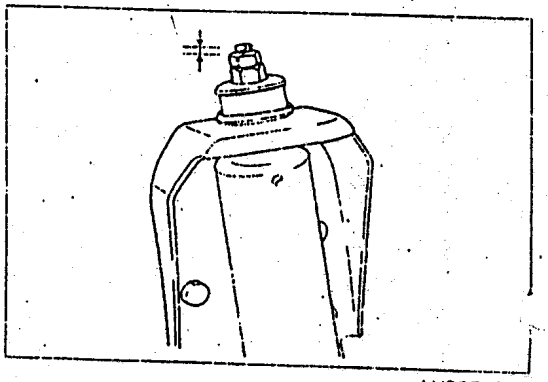
AN9054026

1. Wheel and tire
2. Nut, washer, retainer and bushing
3. Shock absorber
4. Nut and washer
5. U bolt and set plate
6. Stopper rubber and spring clamp
7. Spring pin
8. Shackle pin
9. Shackle plate
10. Leaf spring assembly

Caution

- Tighten bolts and nuts lightly, and after lowering the vehicle(no passenger load condition) tighten it to specified torque.
- Fit leaf spring dowel into axle casing hole.
- Tighten the shock absorber nuts until the specified length of the thread is exposed.

Specification : 10.5~11.5 mm(0.41~0.045 in)



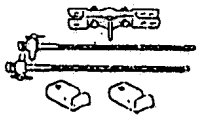
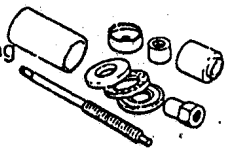
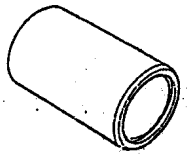
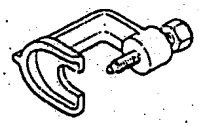
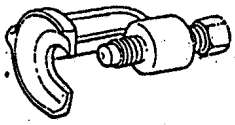
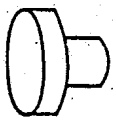
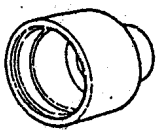
AN9054025

SPECIFICATIONS

Items				Specifications
Front	Suspension type			Double wishbone type coil spring
	Wheel alignment	Toe-in	No passenger load	+2.5±2.5
			6 passenger load	+2.5±2.5
		Camber	No passenger load	+0.2±0.5
			6 passenger load	−0.25±0.5
		Caster	No passenger load	2.8±0.5
			6 passenger load	3.4±0.5
	Shock absorber type			Double acting type
	Stabilizer type			Tortion bar type
Rear	Suspension type			5 link rigid axle, Leaf spring*
	Shock absorber type			Double acting type

* Specification for van/15seats.

SPECIAL TOOLS

0K201 341 AA0 Coil spring compressor 	For removing, installing coil springs	0K011 342 AA0 Rubber bushing replacer 	For removing, installing rubber bushing
0K710 342 017 Dust boot installer 	For installing tie rod boot	0K670 321 019 Ball joint remover 	For removing ball joint
0K130 283 021 Ball joint puller 	Tie rod and ball joints	0K710 331 009 Caster, camber gauge adapter 	For gauge adapter
0K993 283 025 Dust boot installer 	For installing dust boot		

BODY 60

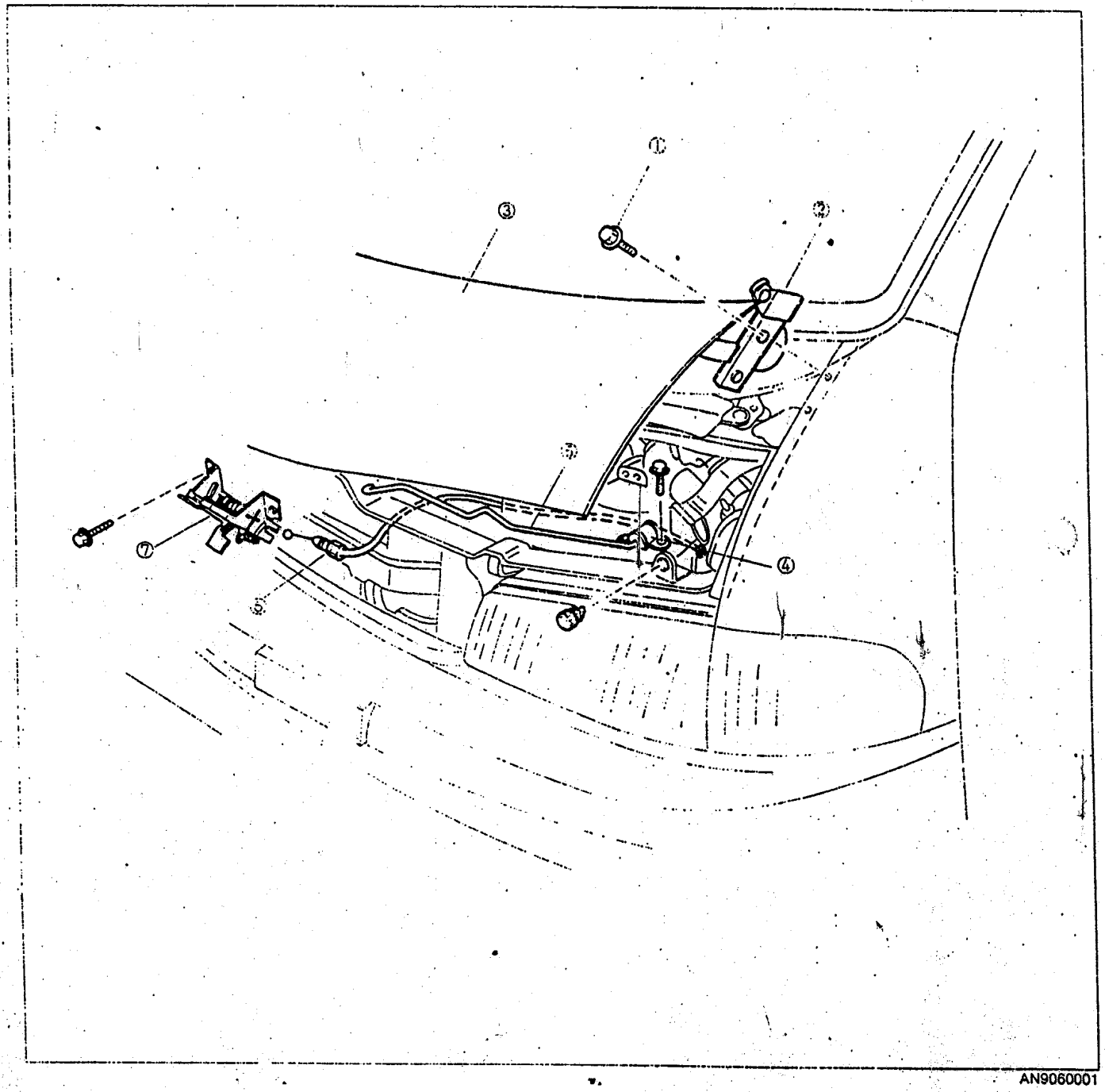
BONNET

REMOVAL/INSTALLATION

1. Remove in the order as shown in the figure.
2. Install in the reverse order of removal.

Caution

- **Remove the bonnet with another person for secure safety.**



AN9060001

1. Bolt
2. Bonnet hinge
3. Bonnet
4. Bonnet stay holder
5. Bonnet stay
6. Release wire
7. Bonnet lock

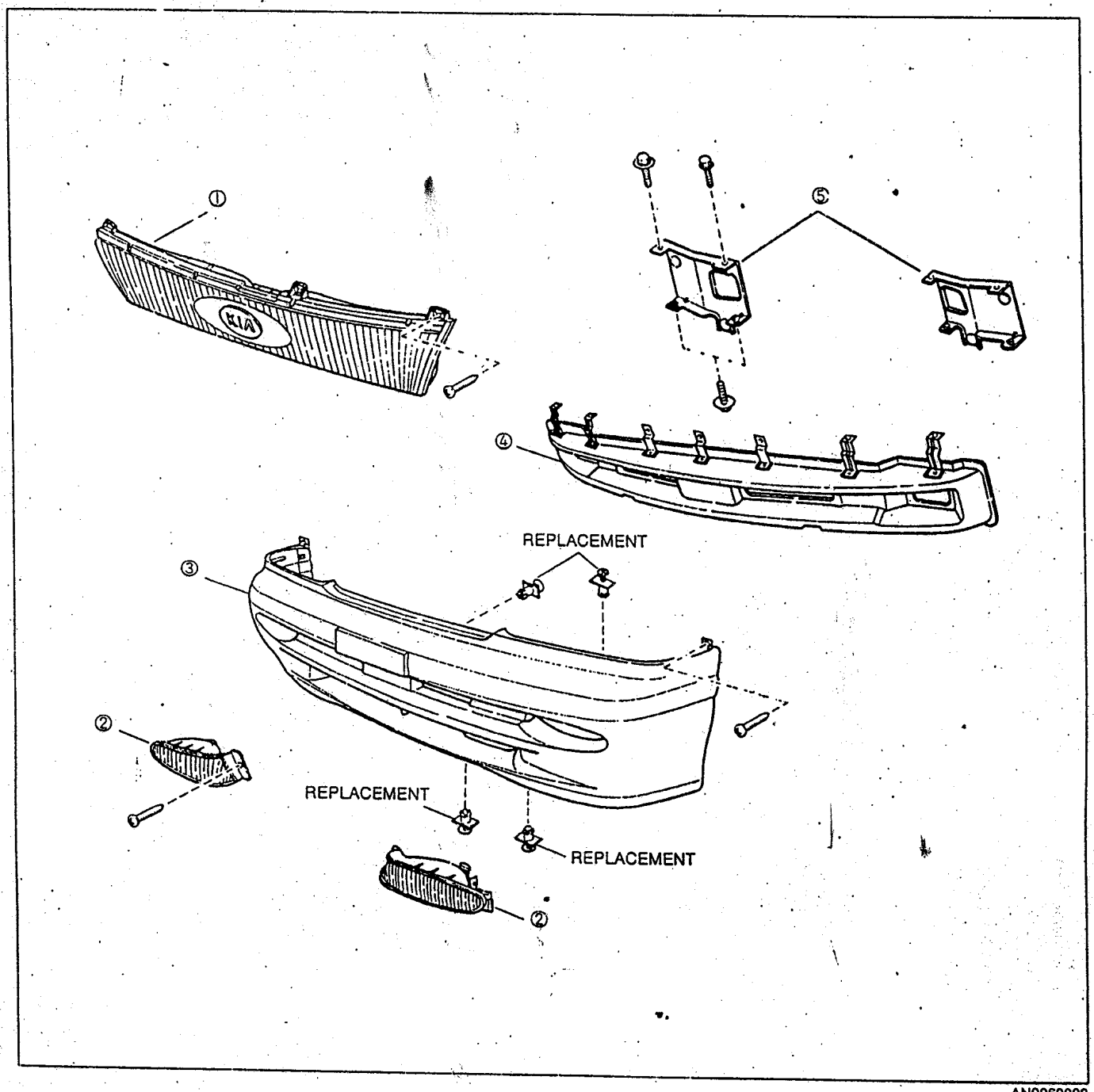
FRONT BUMPER

REMOVAL/INSTALLATION

1. Remove the combination lamp and the head lamp.
2. Remove in the order as shown in the figure.
3. Install in the reverse order of removal.

Note

- **When installing, use new fasteners.**



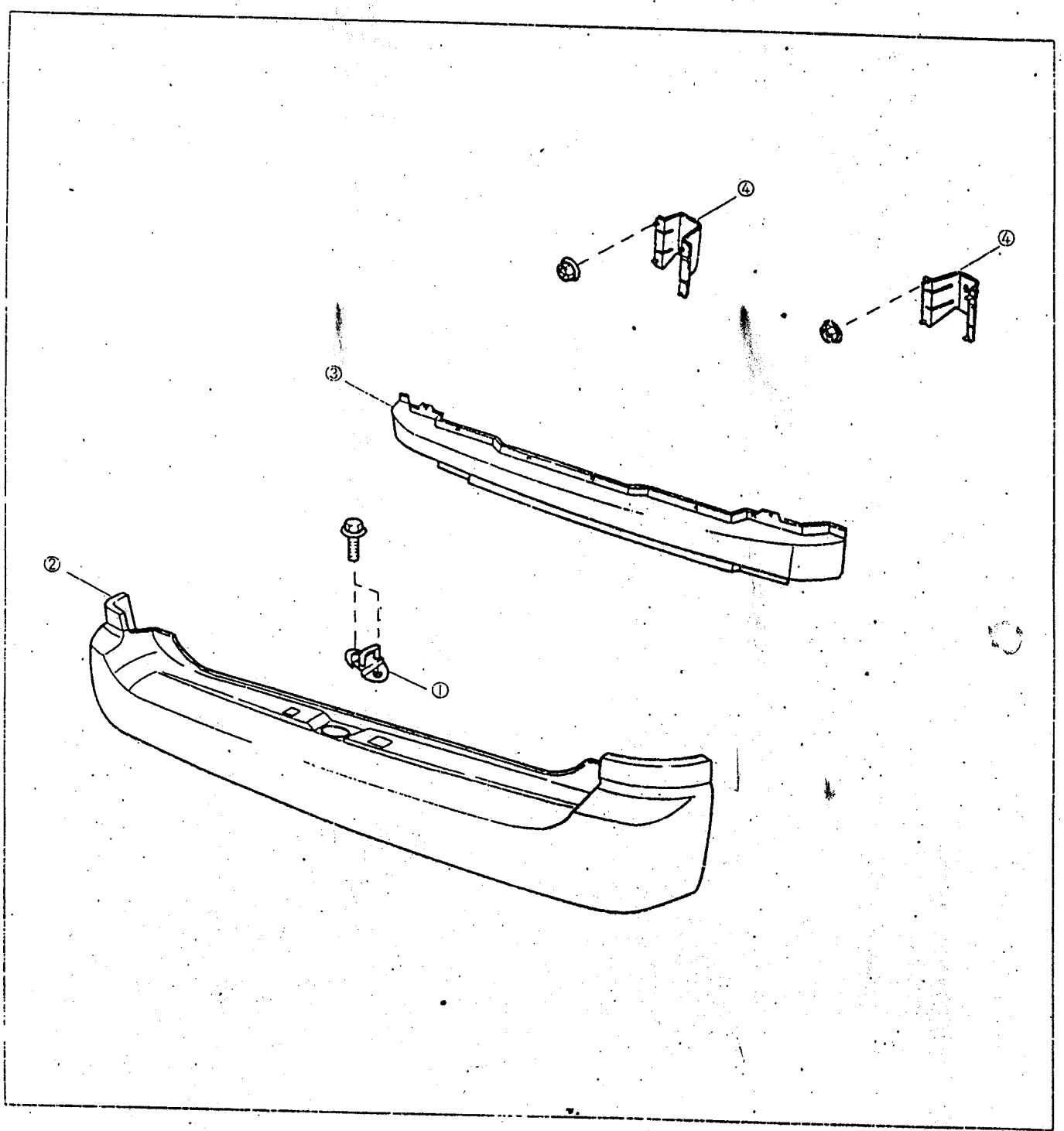
AN9060002

1. Dummy grill lamp
2. Fog lamp
3. Bumper face
4. Reinforcement
5. Bumper stay

REAR BUMPER

REMOVAL/INSTALLATION

1. Disassemble in the order as shown in the figure.
2. Install in the reverse order of removal.



AN9060003

1. Back door striker
2. Bumper face
3. Reinforcement
4. Bumper stay

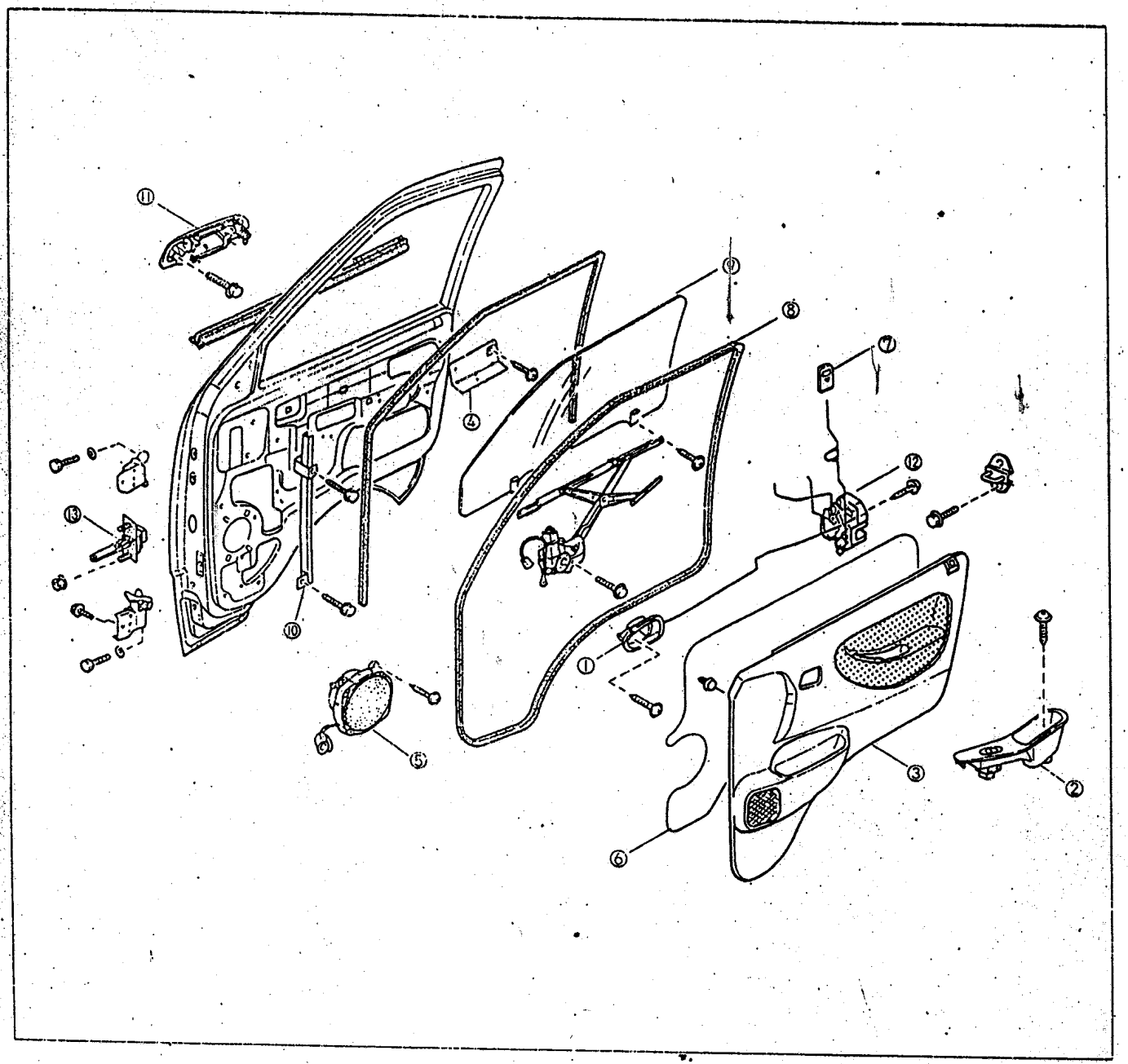
FRONT DOOR

REMOVAL/INSTALLATION

1. Remove in the order as shown in the figure.
2. Install in the reverse order of removal.

Caution

- **Remove the screen carefully to use again.**
- **Apply grease to the checker slide part before installing.**



AN9060004

1. Inner handle
2. Door pull handle
3. Door trim
4. Pull handle bracket
5. Speaker
6. Screen
7. Door lock knob
8. Weatherstrip
9. Glass
10. Glass guide
11. Outer handle
12. Door lock assembly
13. Checker

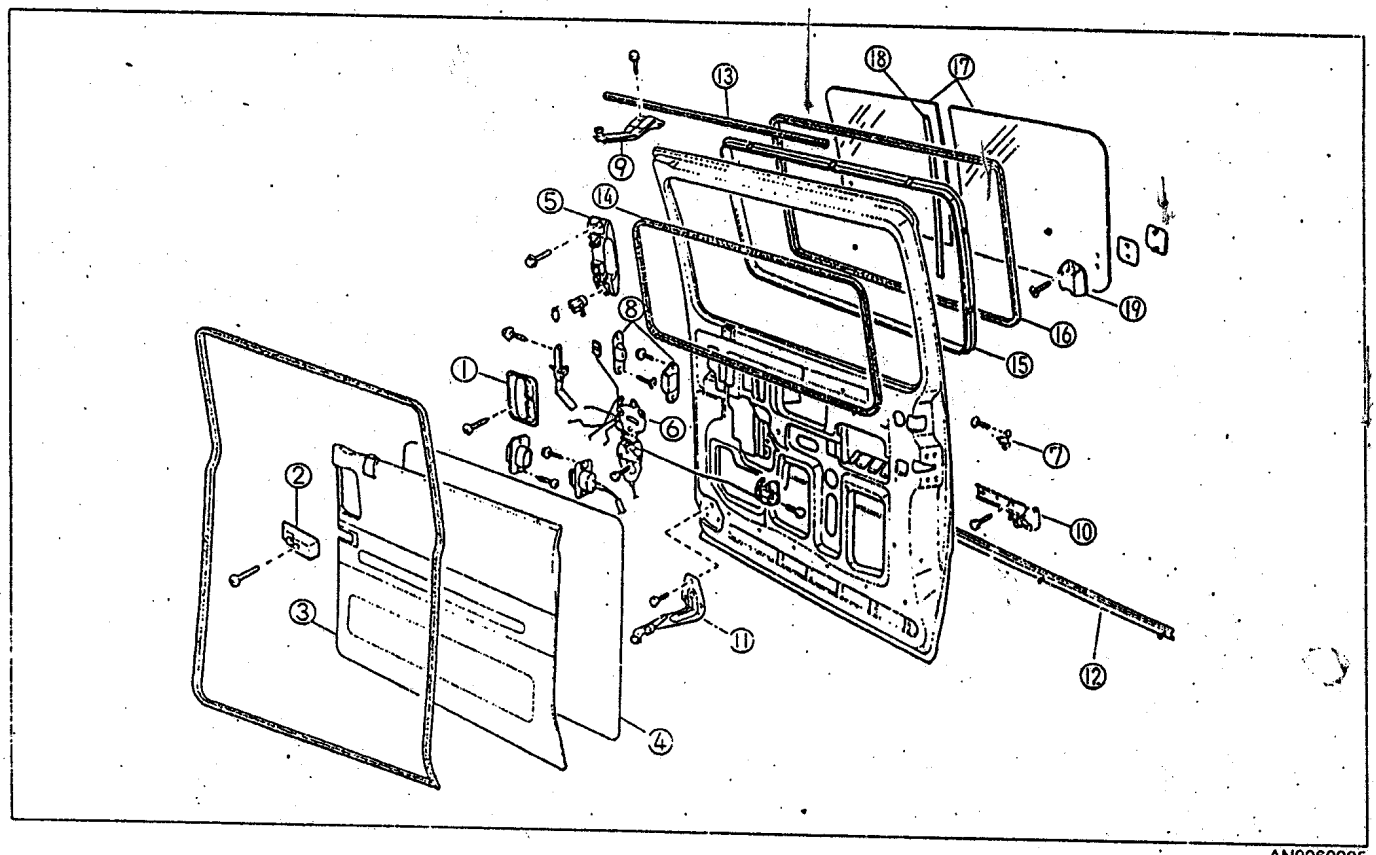
SLIDE DOOR

REMOVAL/INSTALLATION

1. Install a jack under the slide door panel with a wooden block wrapped by cloth.
2. Remove in the order as shown in the figure.
3. Install in the reverse order of removal.

Caution

- **Remove the screen carefully to use again.**

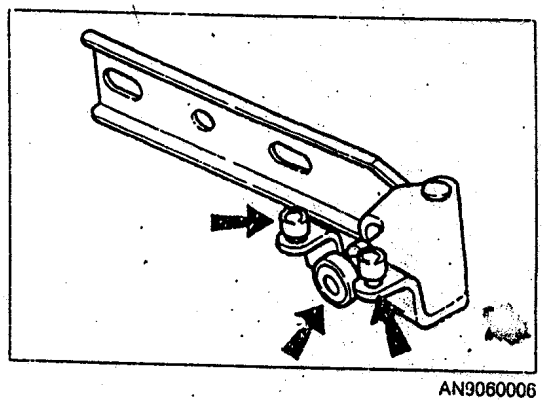


AN9060005

1. Inner handle
2. Pull open stopper
3. Door trim
4. Screen
5. Outer handle
6. Door lock and remote controller
7. Striker
8. Wedge and striker
9. Upper roller
10. Center roller
11. Lower roller
12. Center guide rail
13. Weatherstrip
14. Shimming welt
15. Chassis
16. Glass run channel
17. Sliding glass
18. Center seal
19. Lock

INSTALLATION NOTE

1. Apply grease to the frictional part.
2. Check the roller bearing for damage and operation.
3. Check and adjust the operating force of the door.
4. Check the standard clearance of door each part.



AN9060006

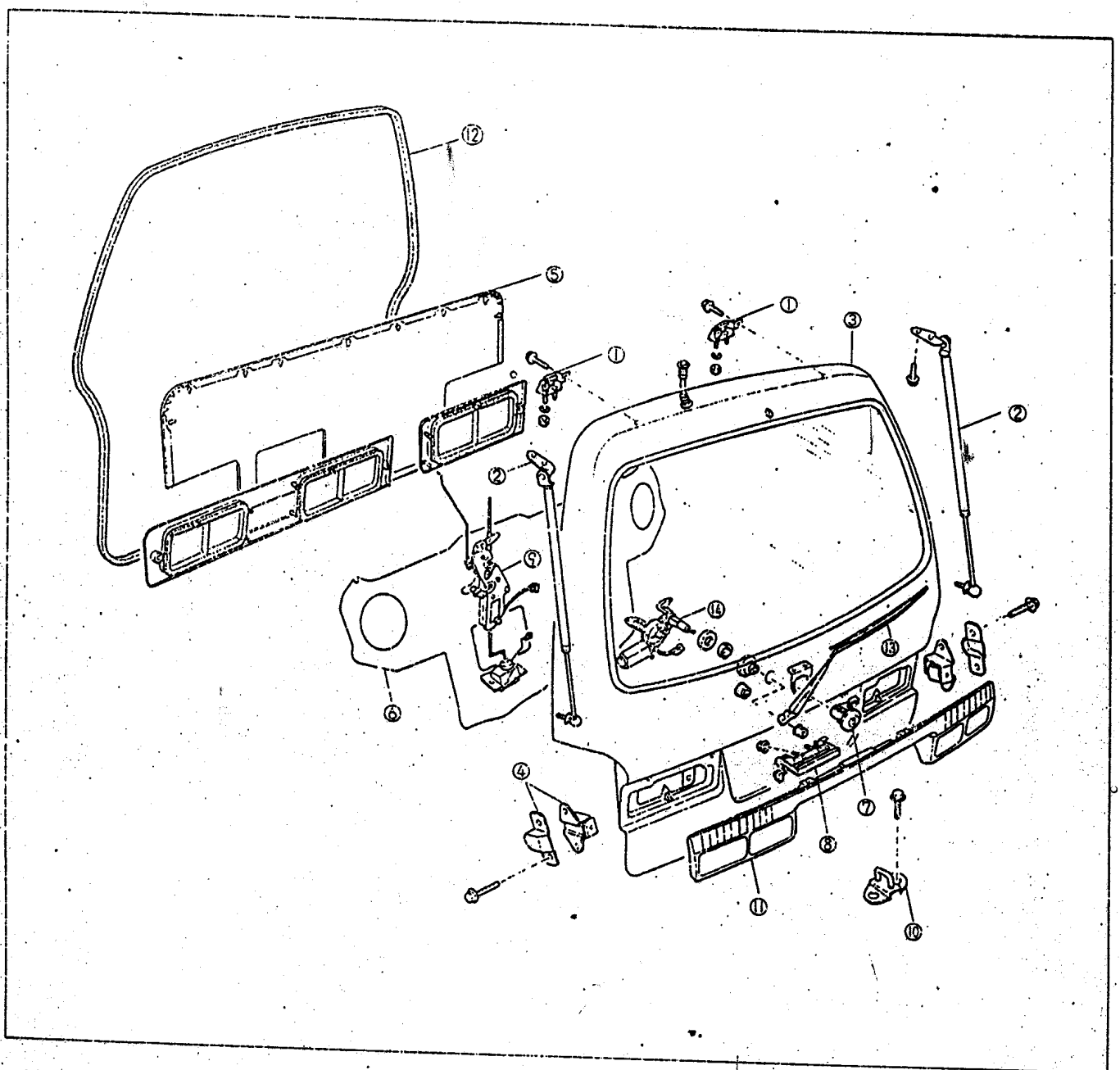
BACK DOOR

REMOVAL/INSTALLATION

1. Remove in the order as shown in the figure.
2. Install in the reverse order of removal.

Caution

- Remove the screen carefully to use again.
- Work with another person for secure safety.

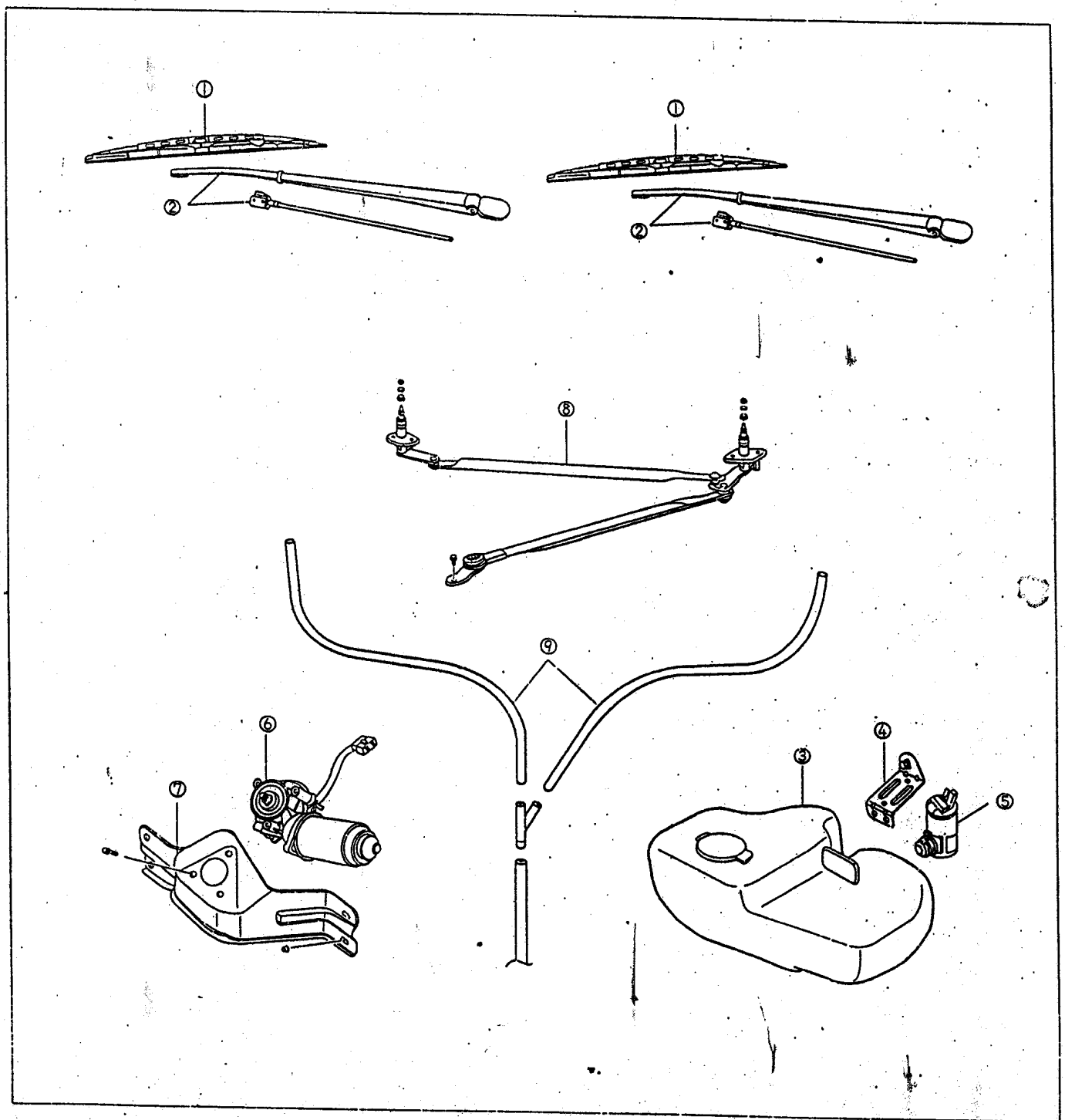


1. Hinge
2. Stay damper
3. Back door assembly
4. Dovetail and wedge
5. Door trim
6. Screen
7. Key cylinder
8. Outer handle
9. Door lock and remote controller
10. Striker
11. Back door garnish
12. Weatherstrip
13. Back door wiper arm and blade
14. Back door wiper motor

WINDSHIELD WIPER AND WASHER

REMOVAL/INSTALLATION

1. Remove in the order as shown in the figure.
2. Install in the reverse order of removal.
3. Check the wiper motor switch.



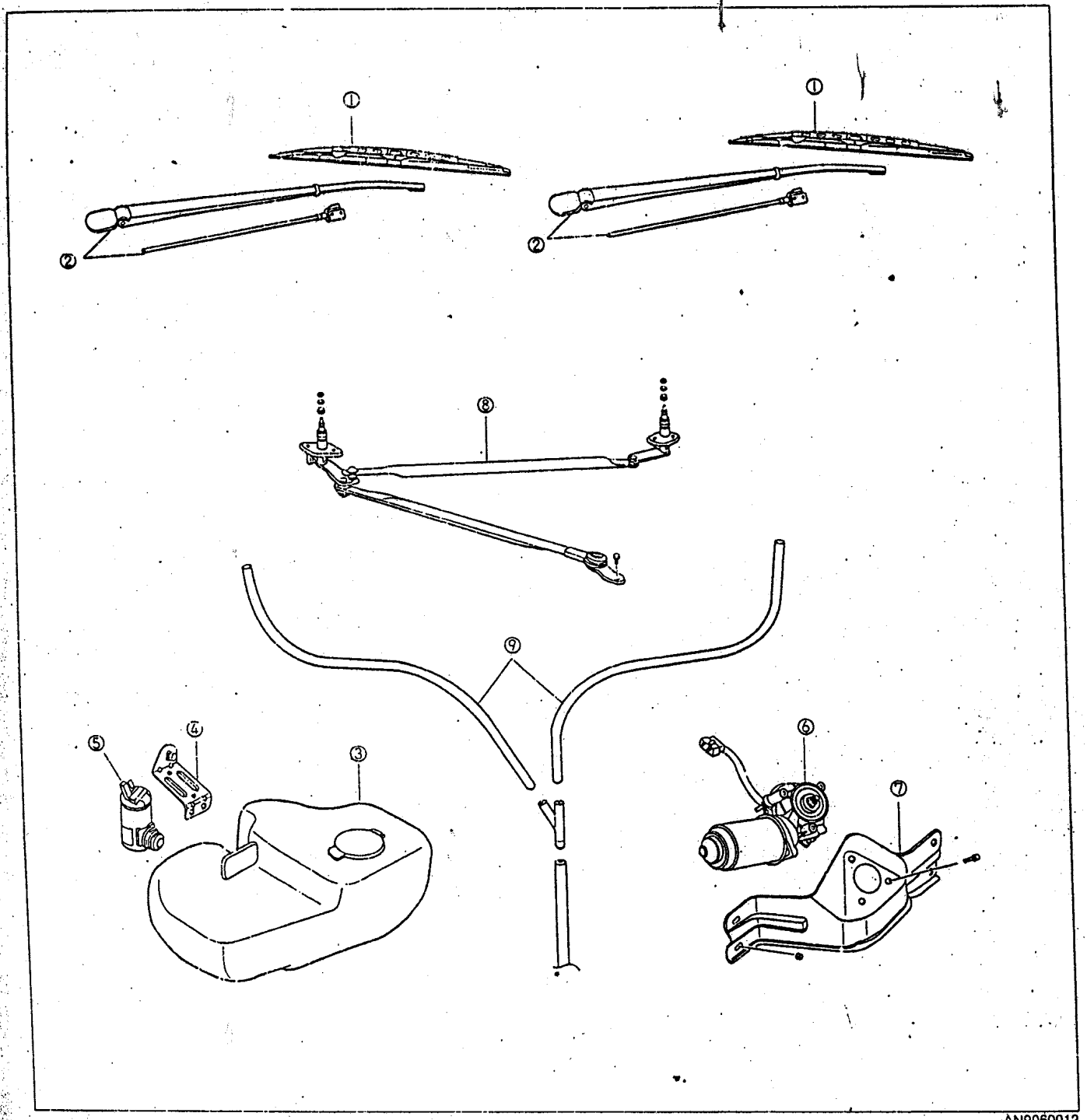
AN9060012

1. Wiper blade
2. Wiper arm and washer nozzle
3. Washer tank
4. Washer tank and bracket
5. Washer motor
6. Wiper motor
7. Wiper motor bracket
8. Wiper link
9. Washer hose

WINDSHIELD WIPER AND WASHER (Only for RHD)

REMOVAL/INSTALLATION

1. Remove in the order as shown in the figure.
2. Install in the reverse order of removal.
3. Check the wiper motor switch.



AN9060012

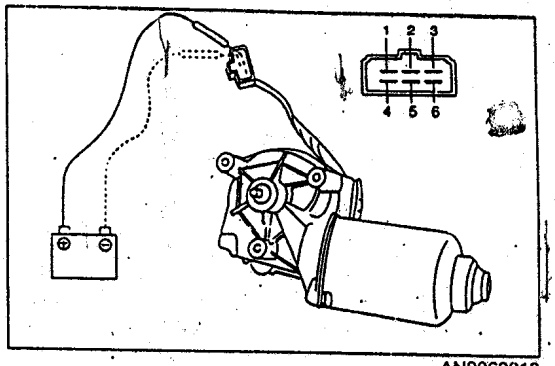
1. Wiper blade
2. Wiper arm and washer nozzle
3. Washer tank
4. Washer tank and bracket
5. Washer motor
6. Wiper motor
7. Wiper motor bracket
8. Wiper link
9. Washer hose

INSPECTION

Wiper motor

1. Disconnect the wiper motor connector.
2. Check if current passes between terminals by an ohmmeter.
3. Check if the motor is operated when 12V is connected to the motor connector.

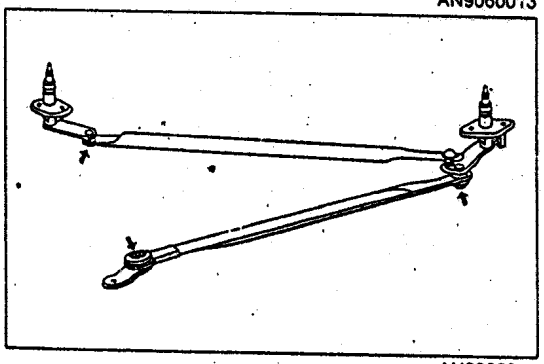
	2	3	6	1
OFF	O		O	
LOW	O			O
HIGH		O		O



AN9060013

Link assembly

1. Check if each part of the link is moved smoothly by hand. If not, disconnect the connecting part and apply grease to it.

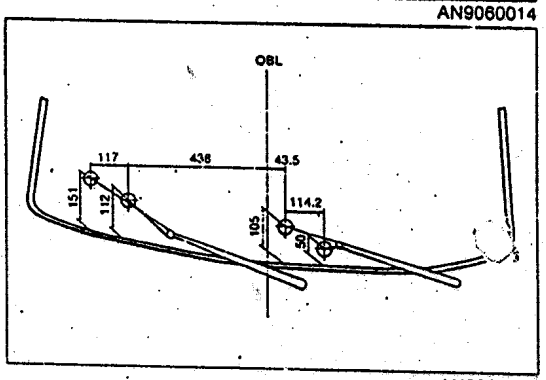


AN9060014

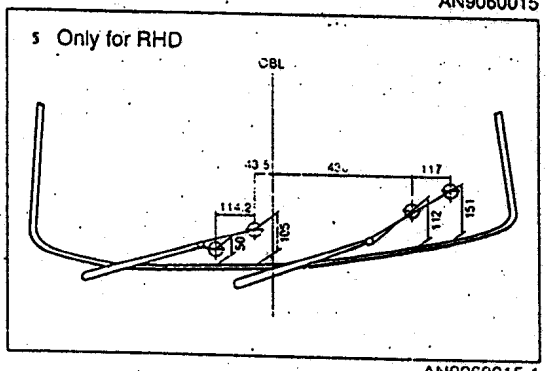
ADJUSTMENT

Washer fluid spray points

1. Adjust the spraying points of the washer fluid by inserting a needle or similar material into the nozzle holes.



AN9060015

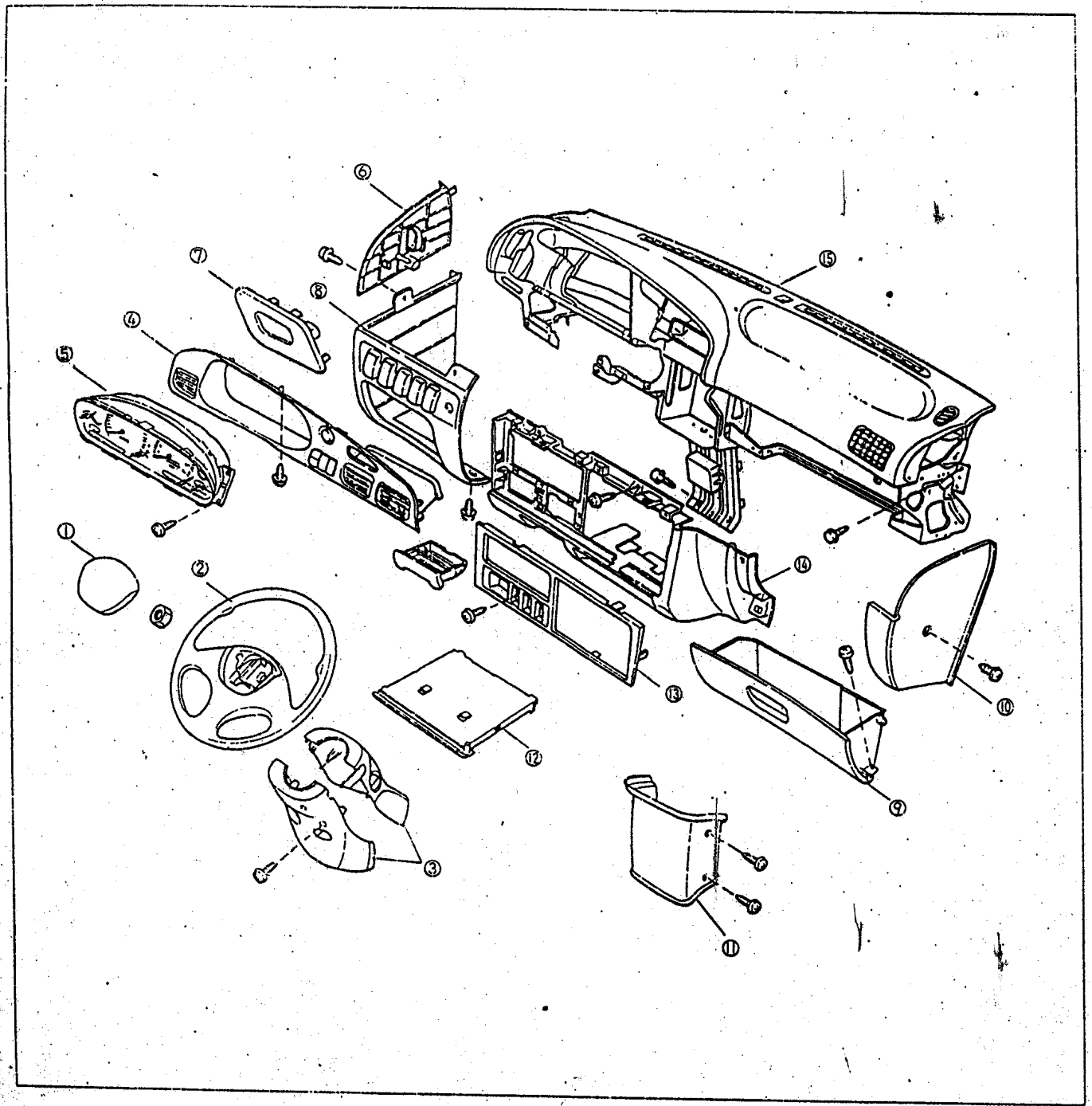


AN9060015-1

INSTRUMENT PANEL

REMOVAL/INSTALLATION

1. Remove in the order as shown in the figure.
2. Install it in the reverse order of removal.

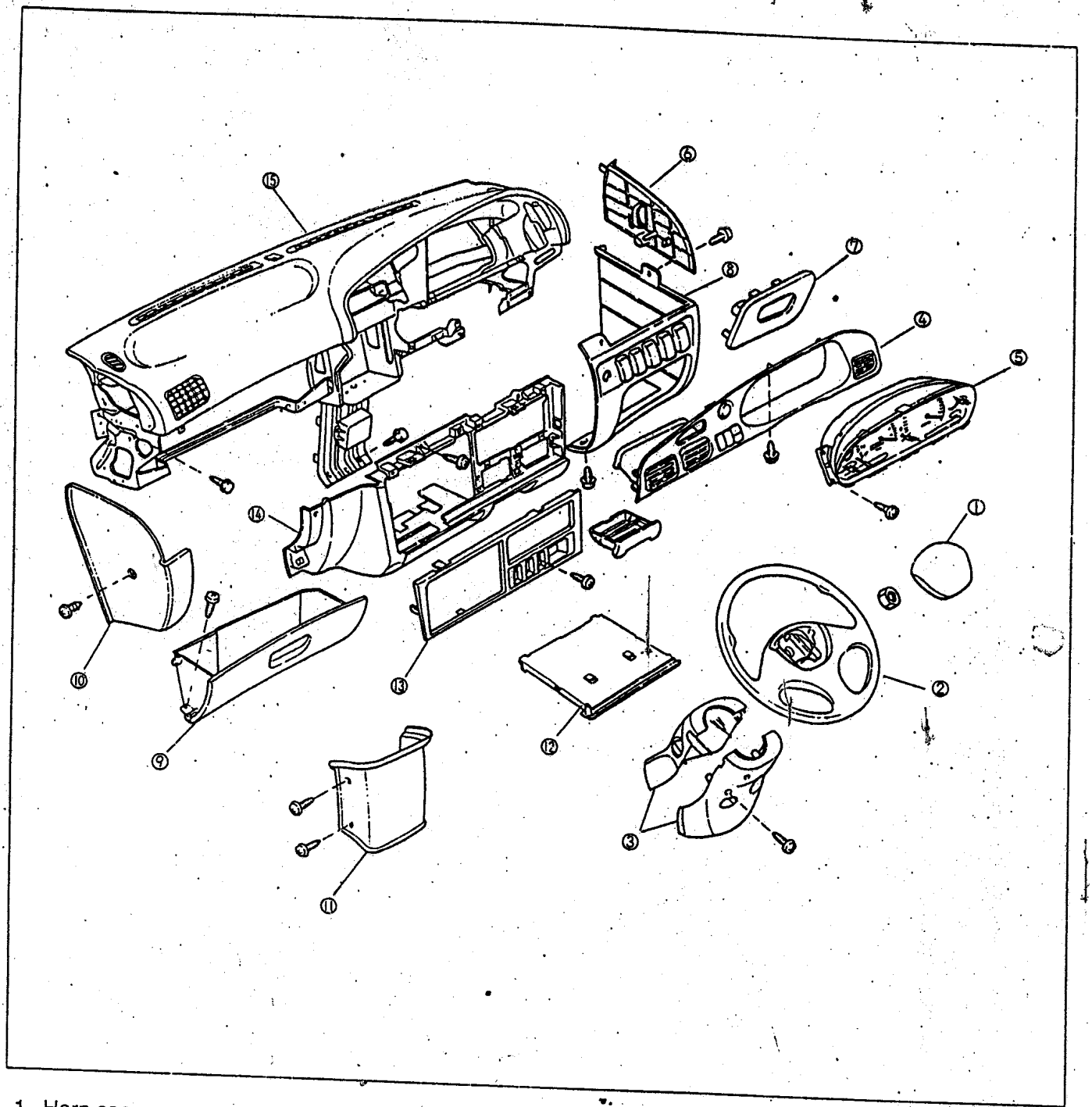


1. Horn cap
2. Steering wheel
3. Column cover
4. Meter hood
5. Meter set
6. Side cover
7. Fuse box cover
8. Lower cover(LH)
9. Glove box
10. Lower cover(RH)
11. Center lower cover
12. Cup holder
13. Switch cover
14. Center panel
15. Instrument panel

INSTRUMENT PANEL (Only for RHD)

REMOVAL/INSTALLATION

1. Remove in the order as shown in the figure.
2. Install it in the reverse order of removal.



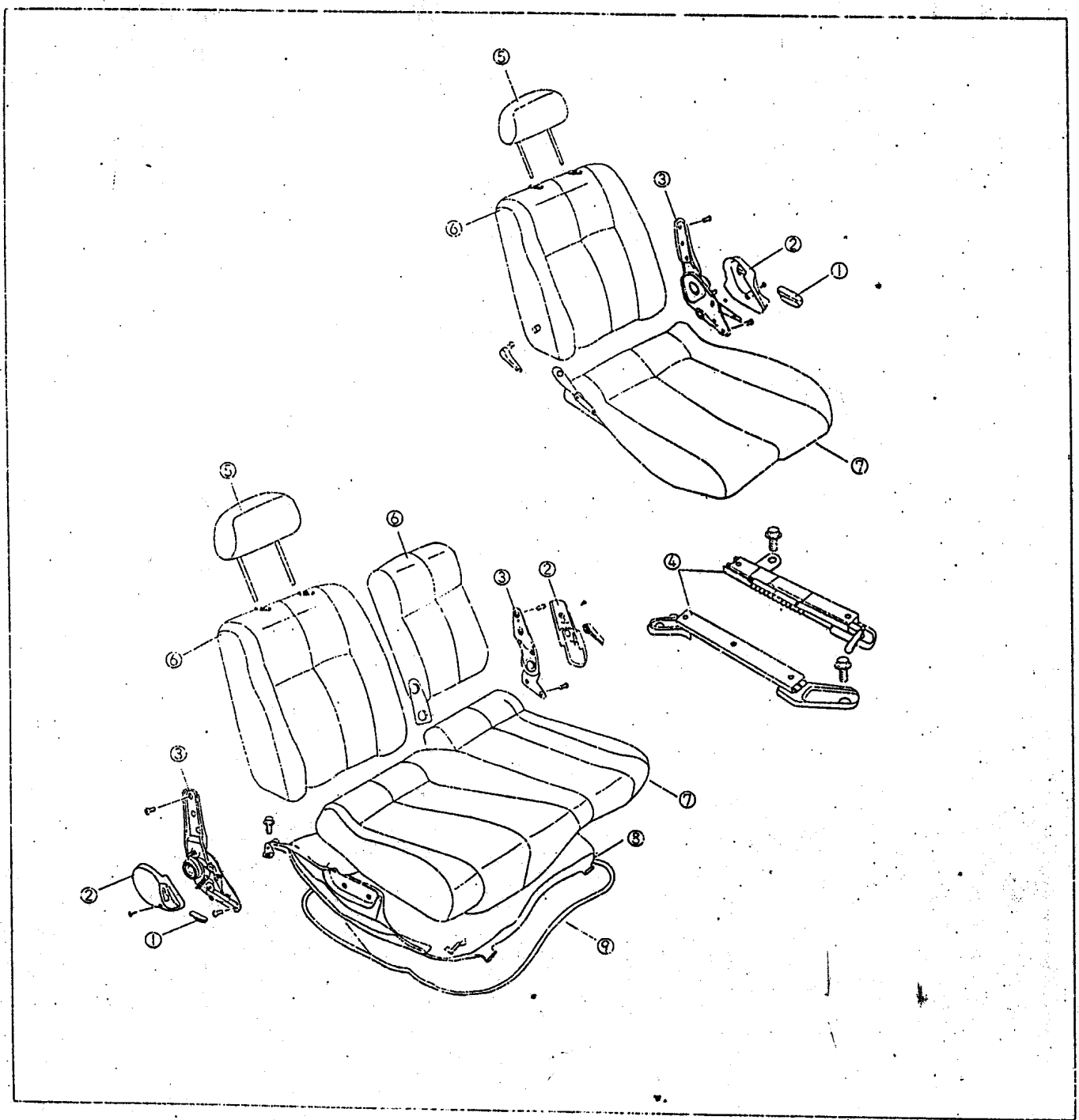
1. Horn cap
2. Steering wheel
3. Column cover
4. Meter hood
5. Meter set
6. Side cover
7. Fuse box cover
8. Lower cover(LH)
9. Glove box
10. Lower cover(RH)
11. Center lower cover
12. Cup holder
13. Switch cover
14. Center panel
15. Instrument panel

SEAT

FRONT SEAT

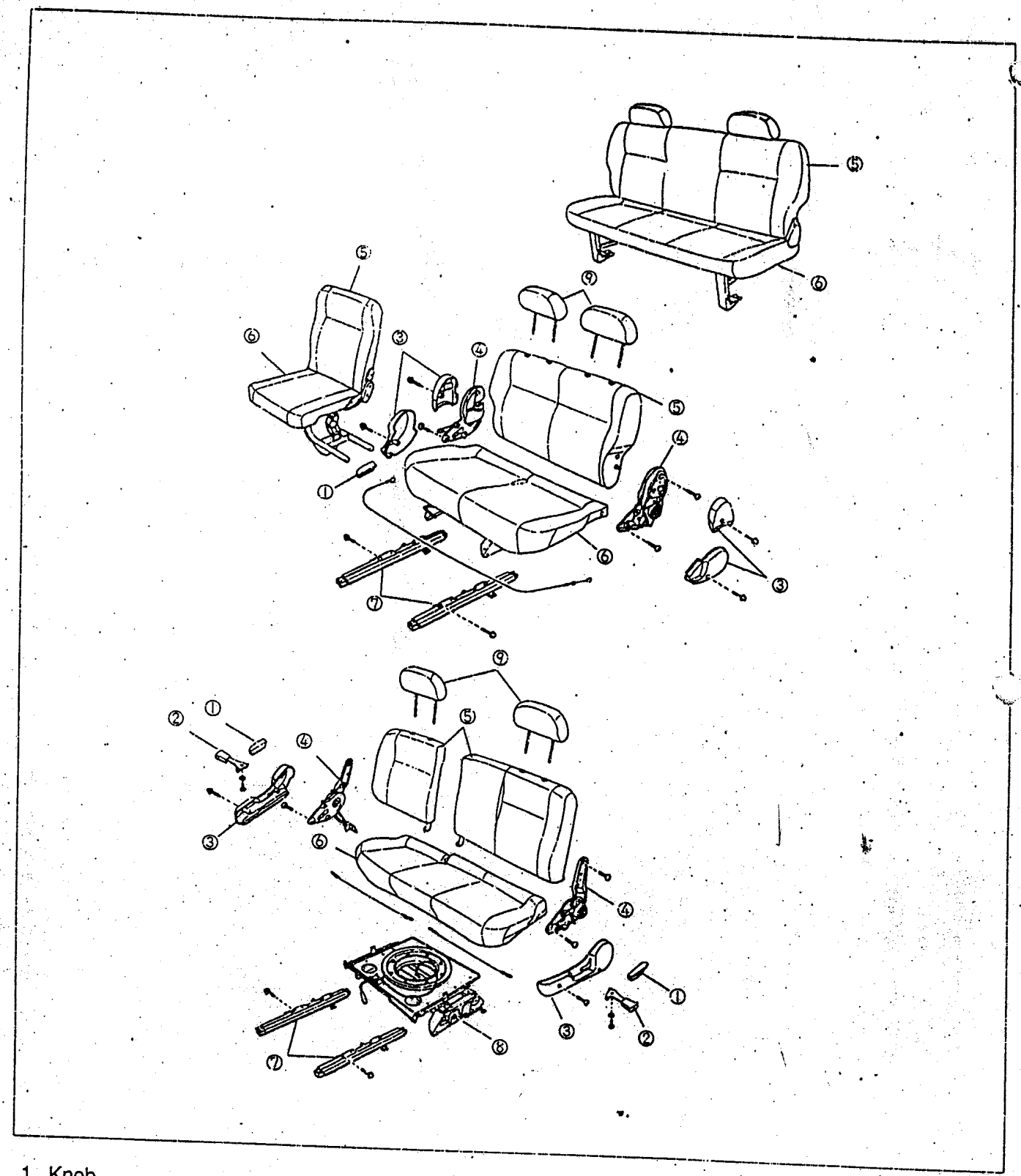
Removal/Installation

1. Remove in the order as shown in the figure.
2. Install it in the reverse order of removal.



1. Knob
2. Cover
3. Reclining nuckle
4. Seat adjust
5. Head rest
6. Seat back
7. Seat cushion
8. Seat under cover
9. Seal

REAR SEAT



AN9060018

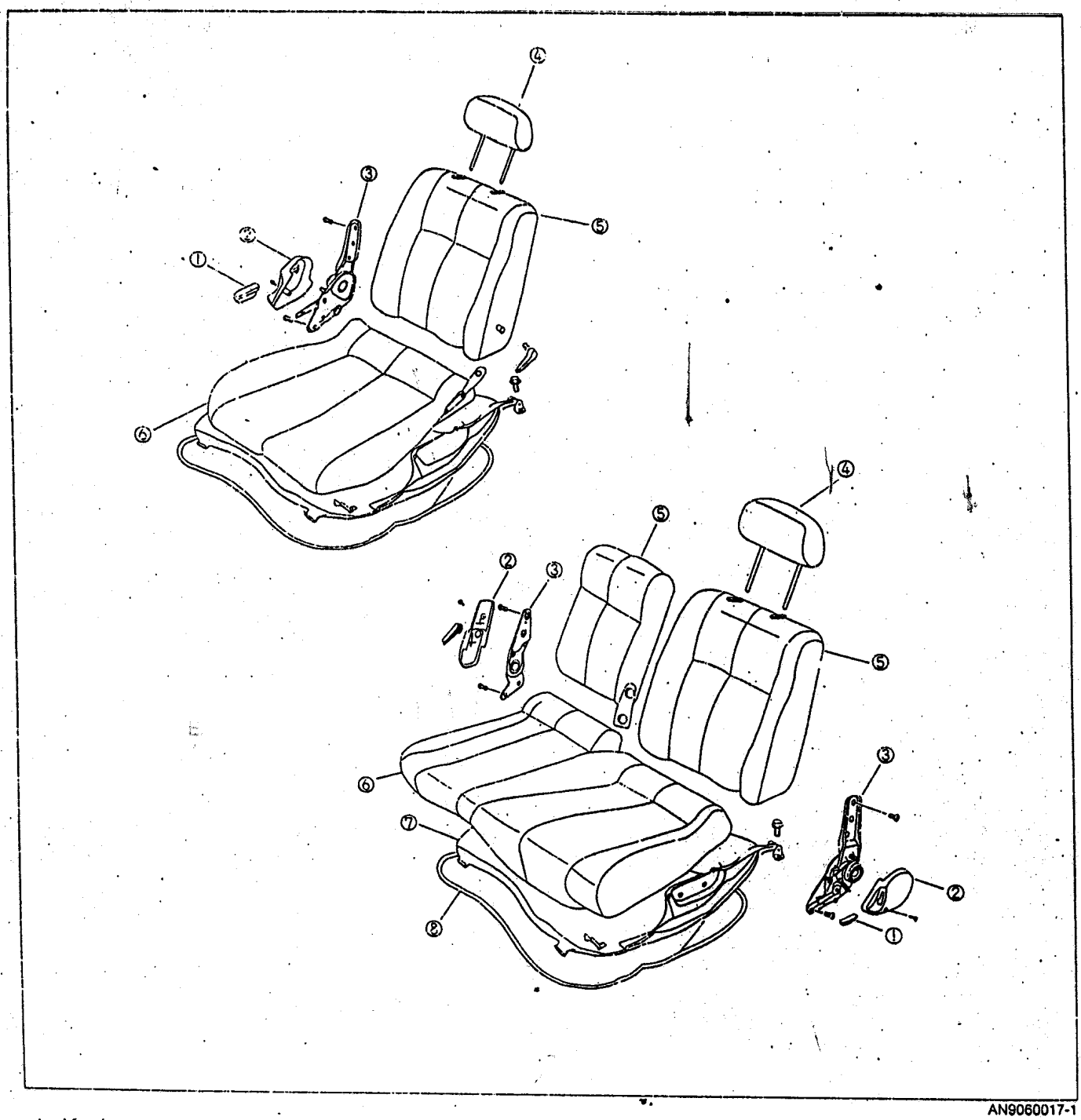
1. Knob
2. Turn lever
3. Side cover
4. Reclining nuckle
5. Seat back
6. Cushion
7. Seat adjust
8. Turn base
9. Head rest

SEAT (Only for RHD)

FRONT SEAT

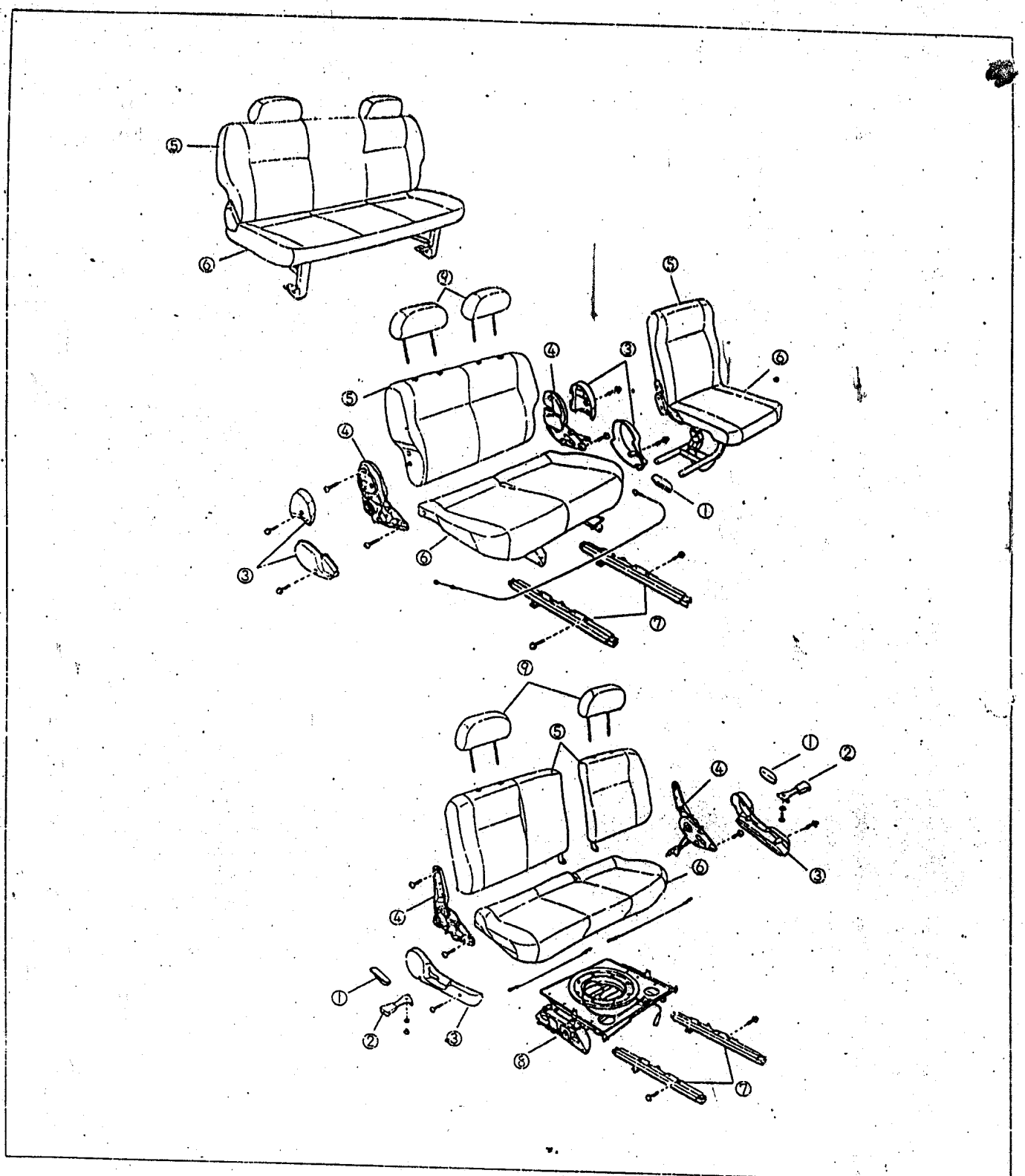
Removal/Installation

1. Remove in the order as shown in the figure.
2. Install it in the reverse order of removal.



1. Knob
2. Cover
3. Reclining nuckle
4. Head rest
5. Seat back
6. Seat cushion
7. Seat under cover
8. Seal

REAR SEAT



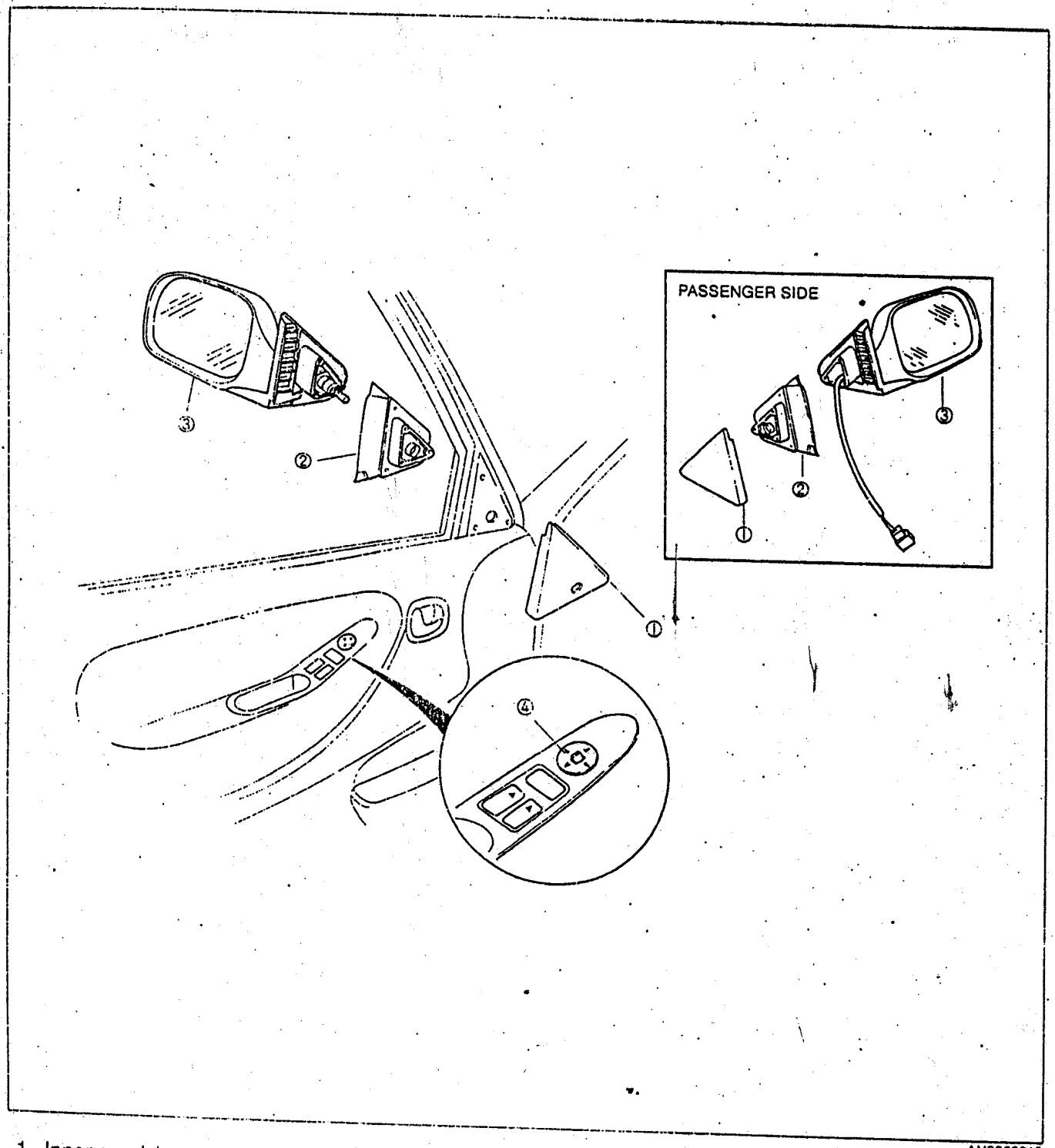
AN9060010-1

1. Knob
2. Turn lever
3. Side cover
4. Reclining nuckle
5. Seat back
6. Cushion
7. Seat adjust
8. Turn base
9. Head rest

DOOR MIRROR

REMOVAL/INSTALLATION

1. Remove in the order as shown in the figure.
2. Install it in the reverse order of removal.



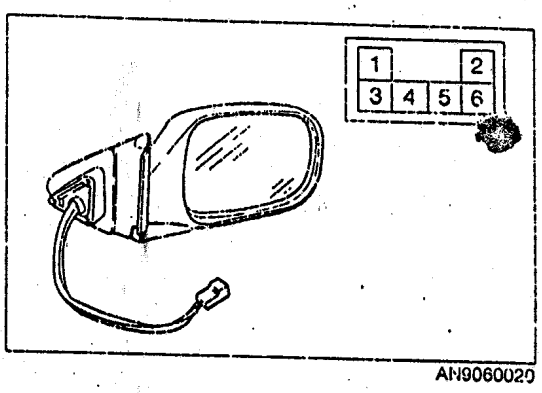
AN9060019

1. Inner garnish
2. Seal
3. Door mirror
4. Remote controller switch

INSPECTION

Remote control mirror

1. Check if current passes between the battery terminals by an ohmmeter.



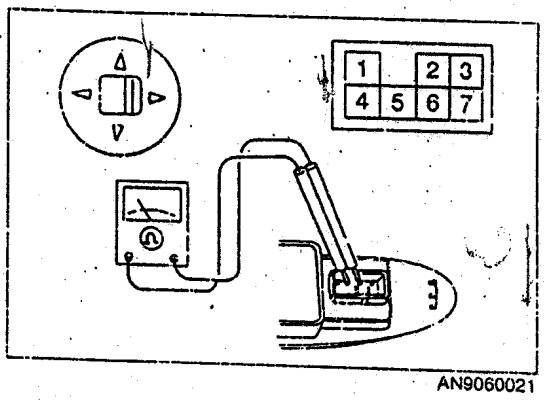
AN9060020

Items	Terminal	5	1	4	2	6	⊕	⊖
Remote motor	up		O	O			O	O
	down		O	O			O	O
	left	O		O			O	O
	right	O		O			O	O
Heater	—				O	O	O	O

O—O : continuity

Remote control mirror switch

1. Disconnect the remote control mirror switch.
2. Check if current passes between the battery terminals by an ohmmeter.



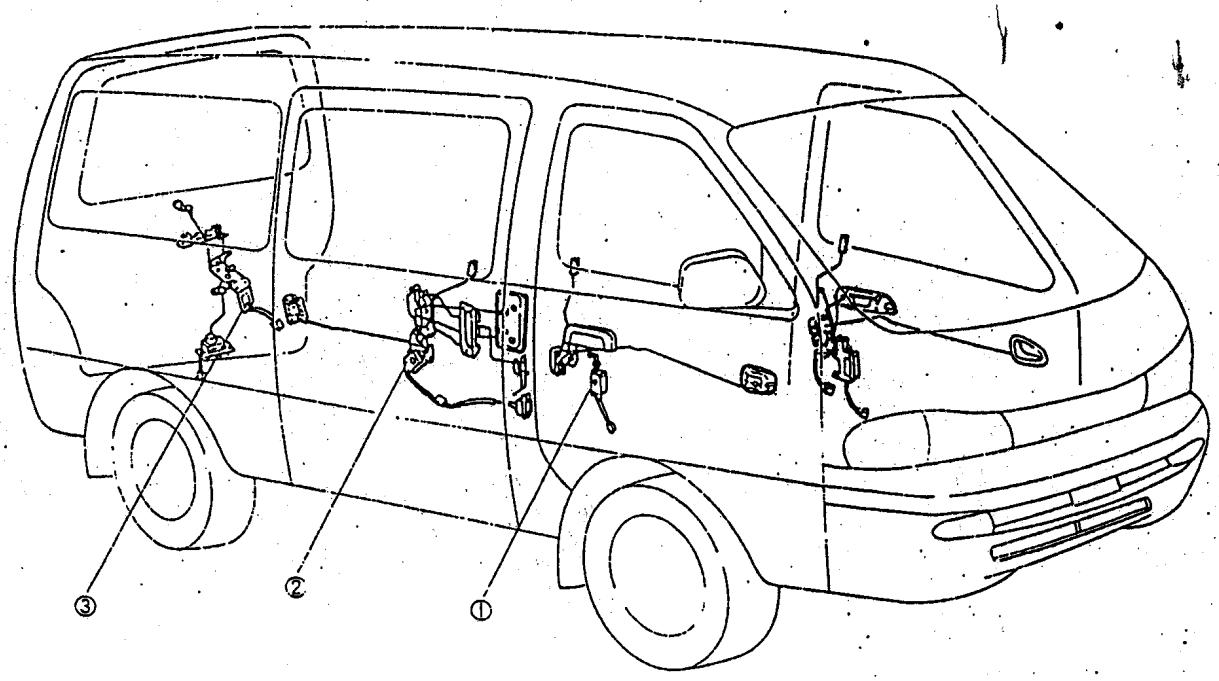
AN9060021

Items	Terminal	3	2	6	7	4	1	5
Passenger side	up	O	O			O		O
	down	O	O			O		O
	left	O	O				O	O
	right	O	O				O	O

O—O : continuity

POWER DOOR LOCK SYSTEM

STRUCTURAL VIEW

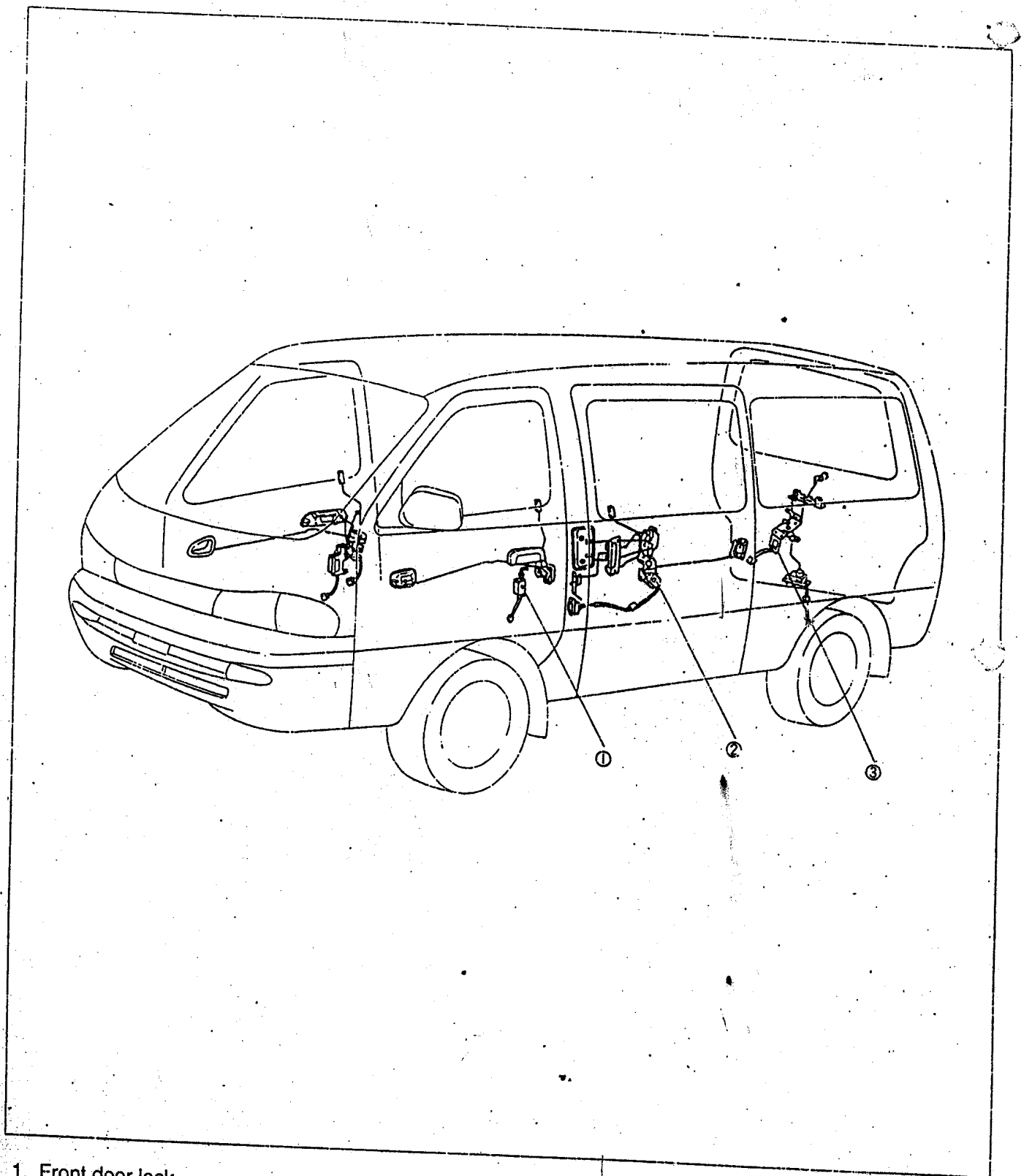


AN9060022

1. Front door lock
2. Slide door lock controller
3. Back door lock controller

POWER DOOR LOCK SYSTEM (Only for RHD)

STRUCTURAL VIEW

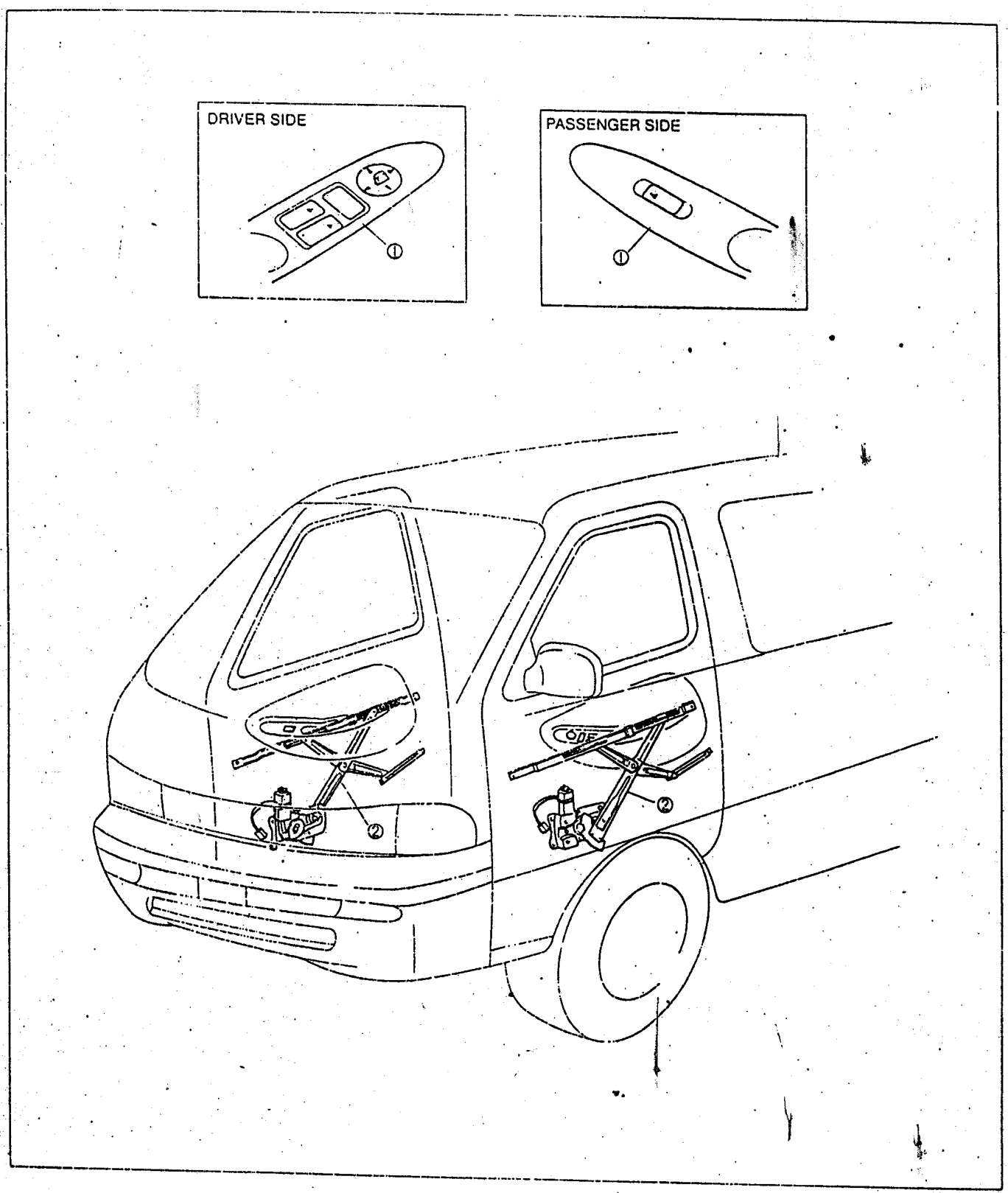


1. Front door lock
2. Slide door lock controller
3. Back door lock controller

AN9060022-1

POWER WINDOW SYSTEM

STRUCTURAL VIEW



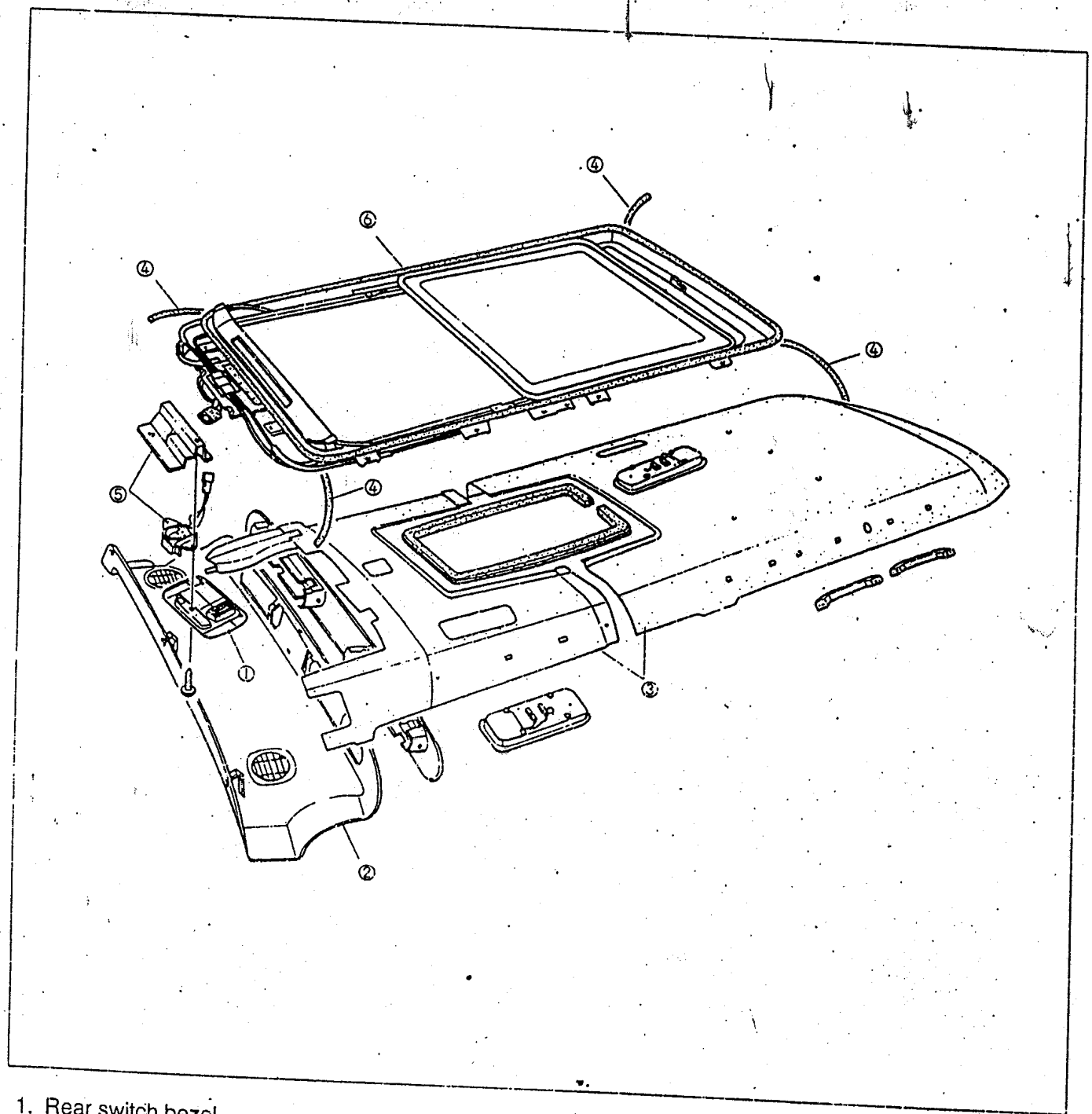
AN9060023

1. Power window switch
2. Power window regulator

SUNROOF

REMOVAL/INSTALLATION

1. Remove each pillar trim.
2. Remove it in the order as shown in the figure.
3. Install it in the reverse order of removal.



AN9060024

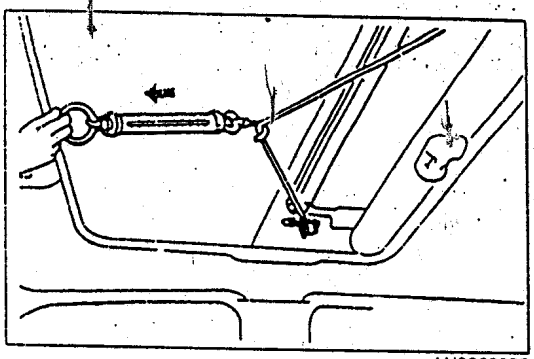
1. Rear switch bezel
2. Aircon system cover
3. Top sealing
4. Drain hose
5. Rear switch and bracket
6. Sliding sunroof assembly

INSPECTION

1. Inspection for the friction resisting force of the roof lid glass
   After removing the sunroof motor, check the friction resisting force of the roof lid glass as follows.
   (1) Remove the top ceiling.
   (2) Remove the decoration cover.
   (3) Tie a wire at the front of the roof lid glass installation nuts.
   (4) Remove the motor with the roof lid glass open.
   (5) Measure the friction resisting force of the roof lid glass by a spring balancer.

   Standard : 216 N (22 kg, 48 lb)

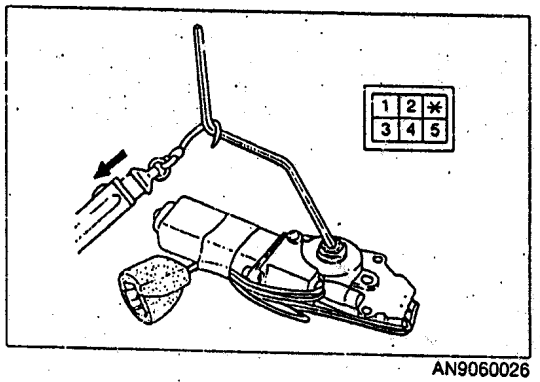
   (6) If the friction resisting force of the roof lid glass is above the standard, check the followings.
   - assembled status of the sunroof assembly, deformation and inclusion of foreign material
   - stuck drive cable
   - inclined roof lid glass


AN9060025

2. Inspection for the sliding force of the sunroof motor clutch.
   (1) After inserting the emergency handle into the hexagonal hole of the motor drive shaft, install a gauge as shown in the figure.
   (2) After connecting battery power source between the connector terminals 1 and 3 of the sunroof motor, rotate the motor.
   (3) Measure the load of the pull scale when the rotating force of the sunroof motor and the tensile force are balanced.

   Standard : 29~59 N (3~6 kg, 22~44 lb)

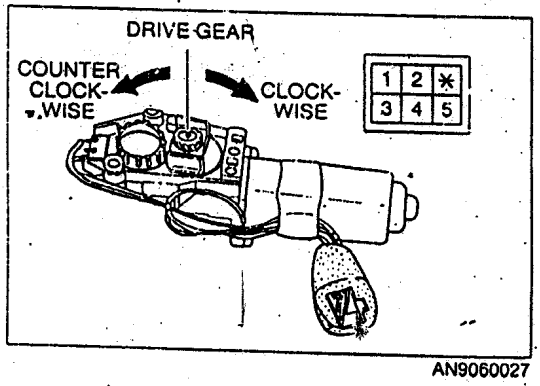
   Caution
   - **Maintain the pull scale in a direction perpendicular to the emergency handle.**
   - **If the emergency handle other than the one provided in the vehicle is used, the sliding force of the clutch may change that be sure to use the one provided in the vehicle.**
   - **If the sliding force of the clutch is out of the standard, replace the sunroof motor.**



AN9060026

3. Inspection for the sunroof motor.
   Check the rotating direction of the drive gear when the battery is connected to the connector terminals.

Rotating direction of the drive gear	Battery connecting terminals	
	1	3
Clockwise	⊖	⊕
Counterclockwise	⊕	⊖



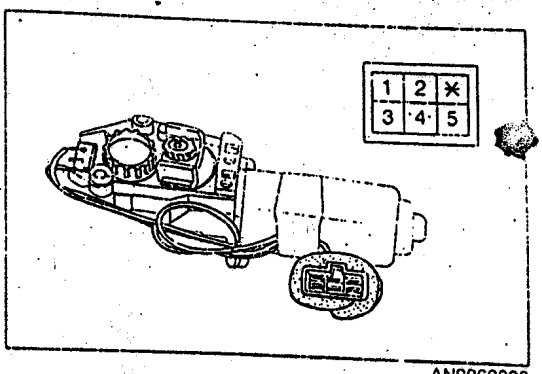
AN9060027

SPECIFICATIONS

Items					Specifications	Coach	Van
Cooling capacity	Maximum cooling	Front evaporator		(Kcal/h)	4100	O	O
		Rear evaporator		(Kcal/h)	3300	O	
	Air flow	Front evaporator		(m³/h)	440	O	O
		Rear evaporator		(m³/h)	400	O	
	Power consumption	Front motor		(W-V)	216-12	O	O
		Rear motor		(W-V)	108-12	O	
Heating capacity	Maximum heating	Front heater		(Kcal/h)	4900	O	O
		Rear heater		(Kcal/h)	4100	O	
	Blower capacity	Front heater		(m³/h)	350	O	O
		Rear evaporator		(m³/h)	270	O	
	Power consumption	Front heater		(W-V)	216-12	O	O
		Rear heater		(W-V)	168-12	O	
Air Con components	Compressor	Type			Wabble-plate type	O	O
		Outlet flow		(cc/Rev)	179		
		Number of cylinder			7		
		Maximum speed		(rpm)	8000		
		Oil (capacity)		(cc)	Sun pag 56(255)		
	Magnetic clutch	Type			Magnetic	O	O
		Power consumption		(W-V)	43-12		
	Main condenser	Type			Parallel flow tyoe	O	O
		Heat dissipation		(Kcal/h)	8500		
		Blower capacity		(m³/h)	1450		
	Sub condenser	Type			Parallel flow type	O	
		Heat dissipation		(Kcal/h)	4000		
		Blower capacity		(m³/h)	900		
	Front evaporator	Type			Laminated type	O	O
		Expansion valve			Block type		
		Thermostat		OFF (°C)	0.5		
		(For defroster)		ON (°C)	4		
	Rear evaporator	Type			Fin and tube type	O	
		Expansion valve			Uniform internal pressure type		
	Receiver drier	Drier			ZEOLITE (XH-9)	O	O
	Dual pressure switch(kg/cm².G)	High pressure	OFF	(kg/cm²)	32±2	O	O
			DIFF	(kg/cm²)	5±2		
		Low pressure	OFF	(kg/cm²)	2.0±0.2		
			DIFF	(kg/cm²)	0.25		
Heater component	Heater core				Aluminum type tube	O	O
	Mode actuator				Eletric drive		
Pressure of refrigerant	High pressure side			(kg/cm²)	13.0~20	O	O
	Low pressure side			(kg/cm²)	1.5~3.5		
Used refrigerant(charged amount)				(g)	R-134a (12 seats coack:1150)	O	O
					R-134a (15 seats coack:1300)		
					R-134a (Van:800)		

4. Check for current passing of the limit switch..
   (1) After removing the limit switch from the motor, operate and check it.

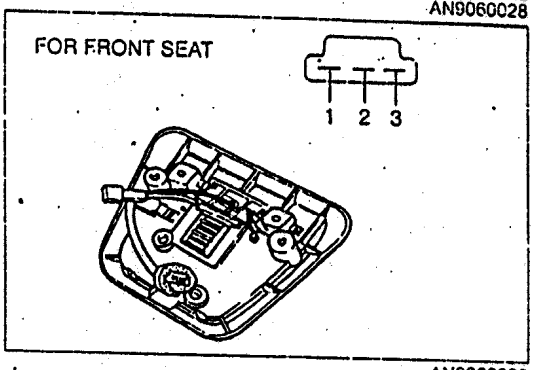
Switch operating condition	Terminals				
	1	2	3	4	5
ON		⊖		○	
OFF					



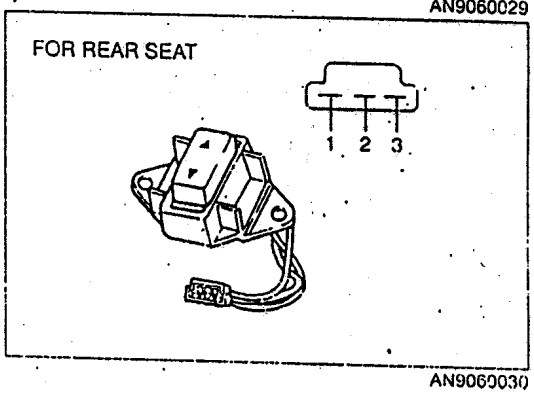
AN9060028

5. Check for current passing of the sunroof switch. (for front seat)

Switch condition		Terminals		
		1	2	3
For front seat	Open		○	○
	Close	○	○	
For rear seat	Open	○	○	
	Close		○	○



AN9060029



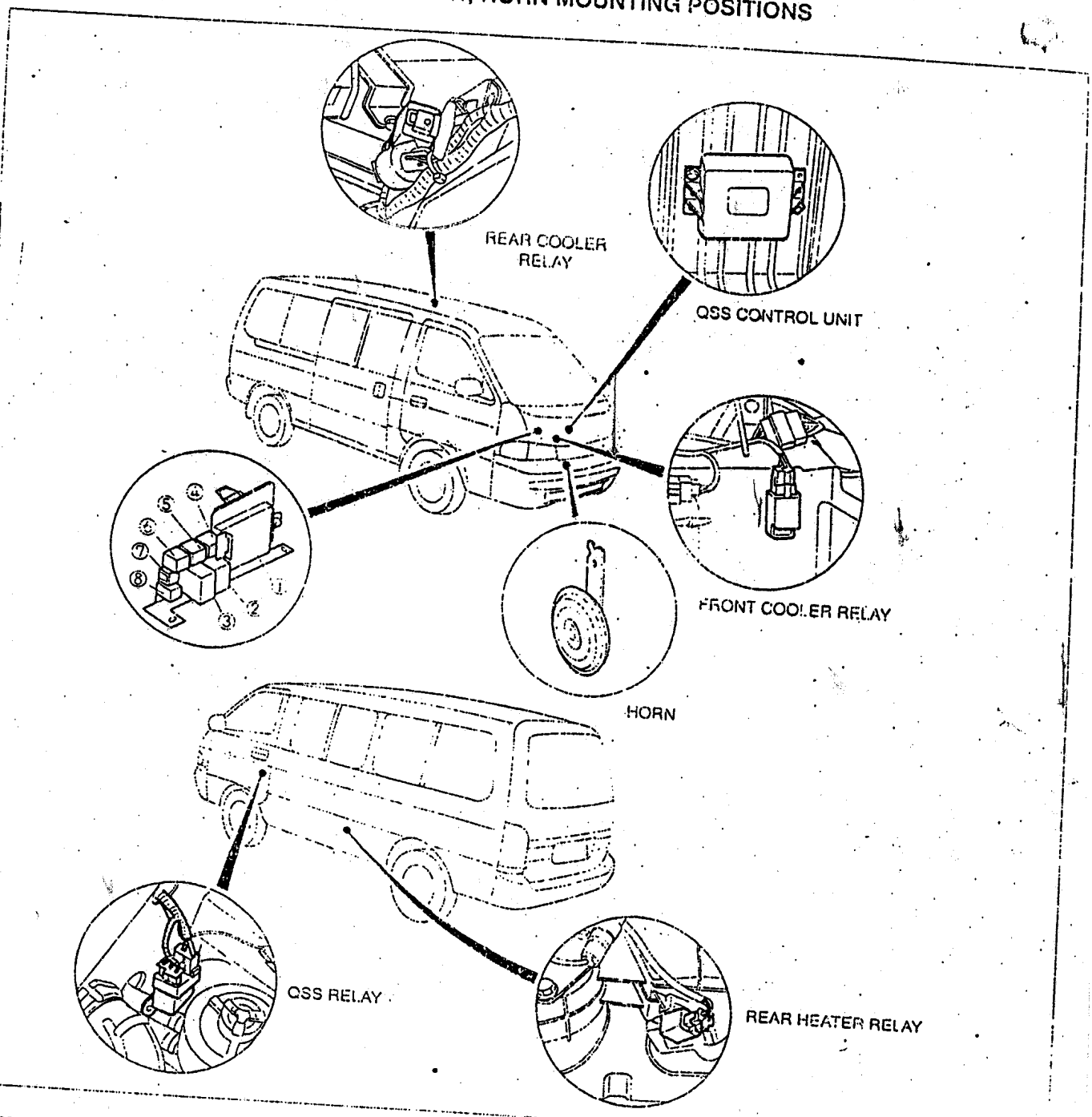
AN9060030

BODY ELECTRICAL SYSTEM

61

OUTLINE

LAMP, RELAY, TCU, QSS CONTROL UNIT, HORN MOUNTING POSITIONS



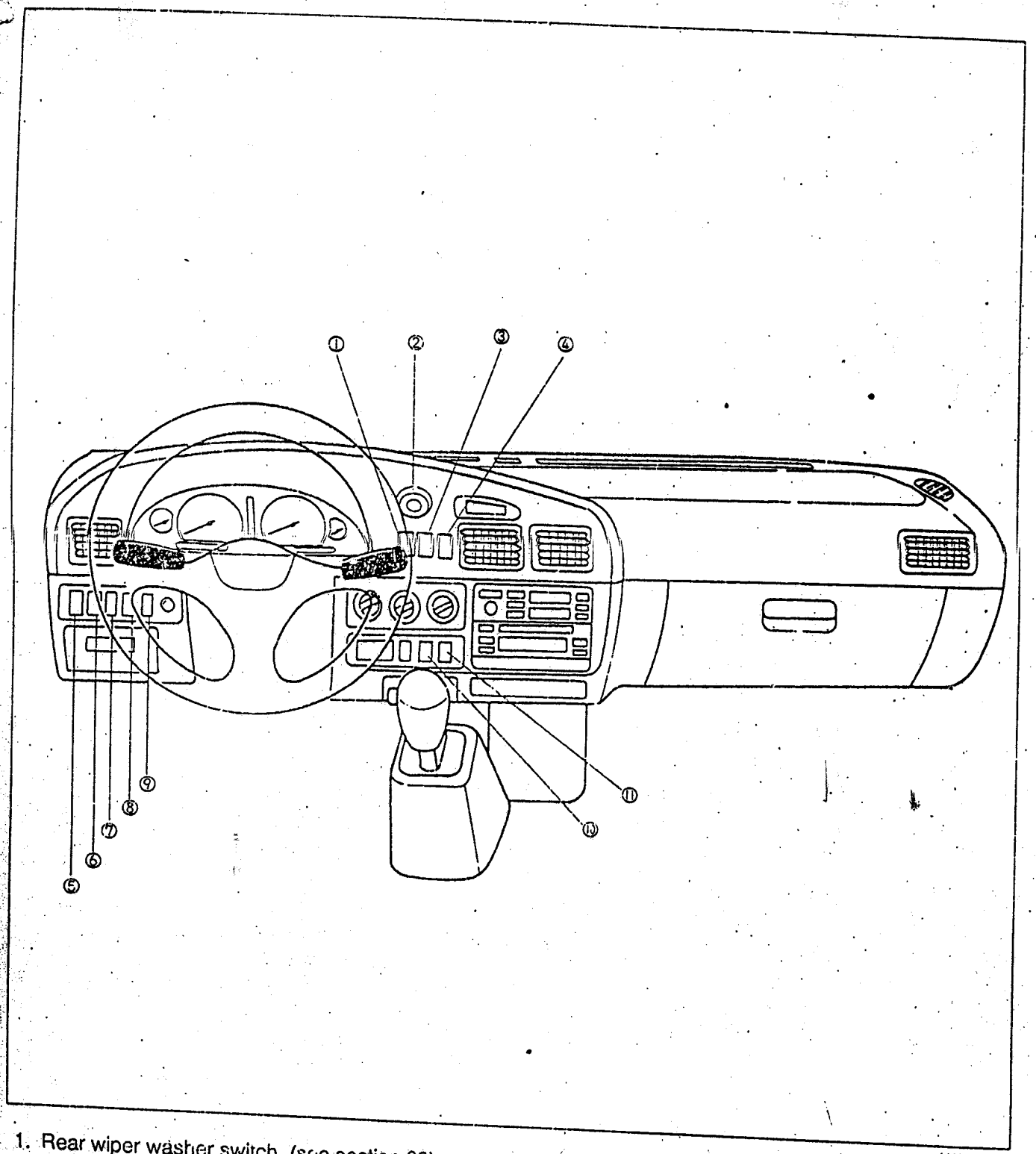
AN9061001

Lamp specifications

Front side			Rear side		
Lamp	Quantity	Capacity (W)	Lamp	Quantity	Capacity (W)
Head lamp	2	60/55	Turn signal	2	27
Fog lamp	2	27	Number plate lamp	2	5
Position lamp	2	4	Backup lamp	2	27
Turn signal	2	21	Back door stop lamp	2	27/8
—	—	—	Tail lamp		
—	—	—	Stop lamp	2	27/8
—	—	—	Tail lamp		

No.	Name
1	Timer control unit
2	Hazard flasher unit
3	Intermittent wiper relay
4	Horn relay
5	Front heater relay
6	Rear defrost relay
7	Power window relay
8	ABS relay

SWITCH INSTALLATION POSITION



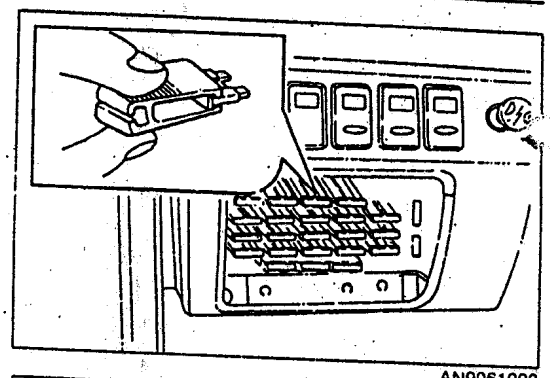
AN9061002

1. Rear wiper washer switch. (see section 60)
2. Hazard switch
3. Fresh, recirculation switch. (see section 62)
4. Front aircon main switch. (see section 62)
5. Rear room lamp switch.
6. Fog lamp switch.
7. Rear heater main switch. (see section 62)
8. Rear airconditioner main switch. (see section 62)
9. Side mirror defroster switch. (see section 60)
10. Rear defroster switch
11. EC-AT switch. (see section 42)

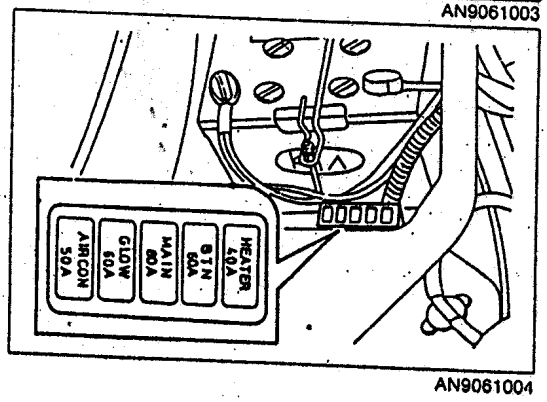
MAIN FUSE AND FUSE

DESCRIPTION

- The electric circuit of a vehicle is protected by the main fuses and fuses.
- The main fuse is located in the front of the battery which is in the right of the engine room.
- There are 5 main fuses in the main fuse box.
- 5 main fuses consist of glow (60A), main (80A), BTN (60A), heater (40A), and aircon (50A).
- The fuse box is located in the left bottom of the driver seat. The fuse is the cartridge type that use a special plug to replace it. Replace it with one of same capacity.
- To install it, match the fuse to the terminal (fuse box) and insert it straight.



AN9061003



AN9061004

FUSE CHART

Main fuse and fuse		Related circuits
Main (80A)	—	• Alternator / QSS / starter
	ABS (30A)	• ABS
	Head (30A)	• Head lamp
	Meter (10A)	• Meter set / EC-AT / turn hazard / backup lamp / rear defrost / sun roof / aircon & heater
	Engine (10A)	• QSS/EC-AT/ABS
	Wiper (15A)	• Wiper & washer / aircon & heater
	Radio (10A)	• Mirror defrost / power mirror / clock / audio
	Cigar (10A)	• Cigar lighter
Glow (60A)	—	• QSS
BTN (60A)	Defrost (20A)	• Power mirror / rear defrost
	Power window (30A)	• Power window
	Stop (20A)	• Stop lamp
	Sun roof (20A)	• Sunroof
	Room (15A)	• Room lamp / TCU / audio / clock / EC-AT / meter & warning lamp
	Door lock (30A)	• TCU
	Hazard (15A)	• Turn & hazard
	Tail INT(15A)	• Turn & hazard / audio / clock / EC-AT / meter & warning lamp / cigar lighter / power mirror / aircon & heater
	Tail EXT(15A)	• position lamp / number plate lamp / tail lamp / fog lamp /
	Fog lamp (10A)	• Fog lamp
Aircon (50A)	Front aircon (30A)	• Aircon
	Rear aircon (20A)	• Aircon
Heater (40A)	Front heater (30A)	• Heater
	Rear heater (20A)	• Heater

INTERIOR LIGHTING SYSTEM

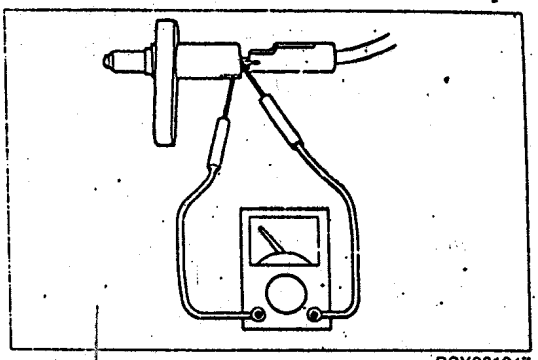
DOOR SWITCH

Inspection

Check if current passes between the door switch terminals.

Status	Continuity
OFF	X
ON	O

O : continuity X : no continuity



BSX061047

REAR ROOM LAMP SWITCH

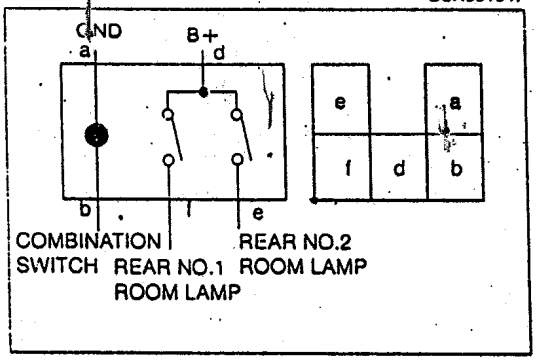
Note

- **The rear room lamp switch is installed at the left of the instrument panel.**

1. Check if current passes between the switch terminals.

Status \ Terminals	a	b	c	d	e	f
OFF	O—●—O					
ON				O——O——O		

●: illumination lamp (1.4W)
O—O : continuity



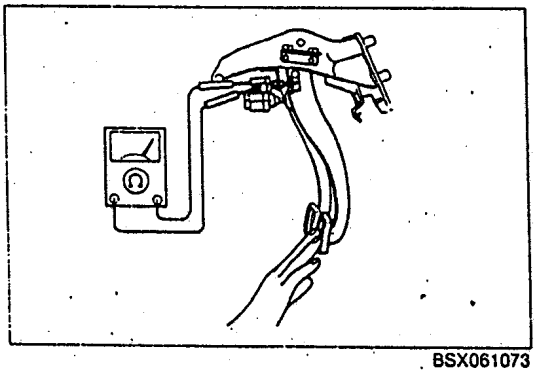
AN9061006

EXTERIOR LIGHTING SYSTEM

STOP LAMP SWITCH

Inspection

1. Disconnect the battery negative terminal.
2. Disconnect the stop lamp switch connector.
3. Install an ohmmeter between the stop lamp switch terminals.
4. Check if current passes between terminals when the brake pedal is depressed.



BSX061073

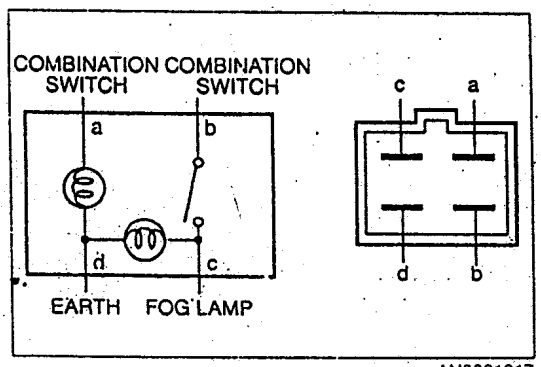
FOG LAMP SWITCH

Inspection

1. Check if current passes between switch terminals.

Status \ Terminals	a	a	c	d
OFF	O——●——O O——●——O			
ON		O——O		

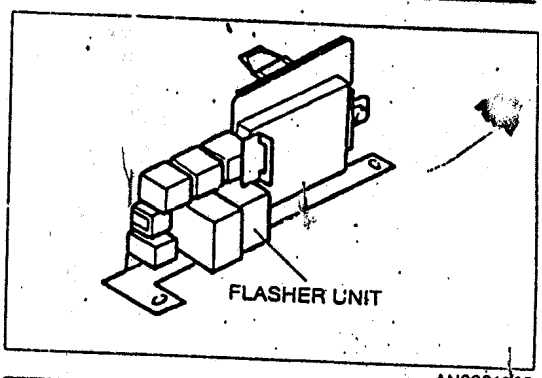
O—O : continuity
● : illumination (1.4W)



AN9061017

FLASHER UNIT

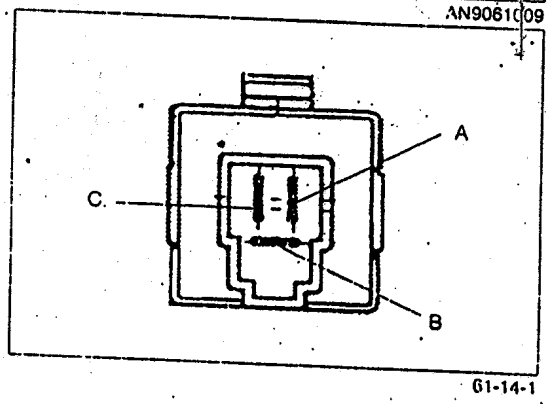
Note
- **The flasher unit is installed at the right top of the instrument panel.**



AN9061009

Inspection
1. Disconnect the flasher unit.
2. Apply 12V to the terminal A and ground terminal C.
3. Connect a test light between the terminal B and C of flasher unit.

Test light	Action
Blink	Normal
Non-blink	Replace the flasher unit



61-14-1

HAZARD SWITCH
Inspection

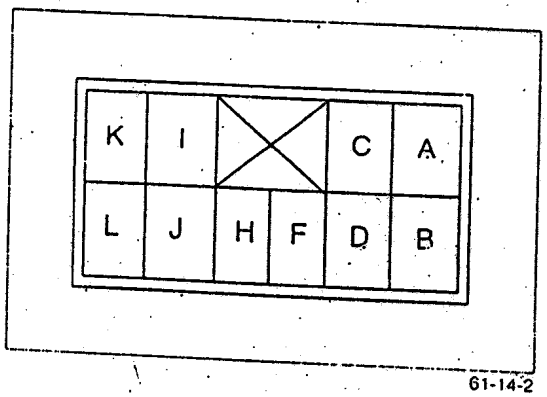
Note
- **The hazard switch is installed at the center of the instrument panel.**

Inspection
1. Disconnect the hazard switch.
2. Check for continuity between following terminals of hazard switch.

Position	Terminals							
	B	C	D	F	H	I	J	L
OFF	O	O				O		
					O			
ON				O	O			
		O	O				O	O
						O		

O—O : indicate continuity

3. If not as specified, replace hazard switch.



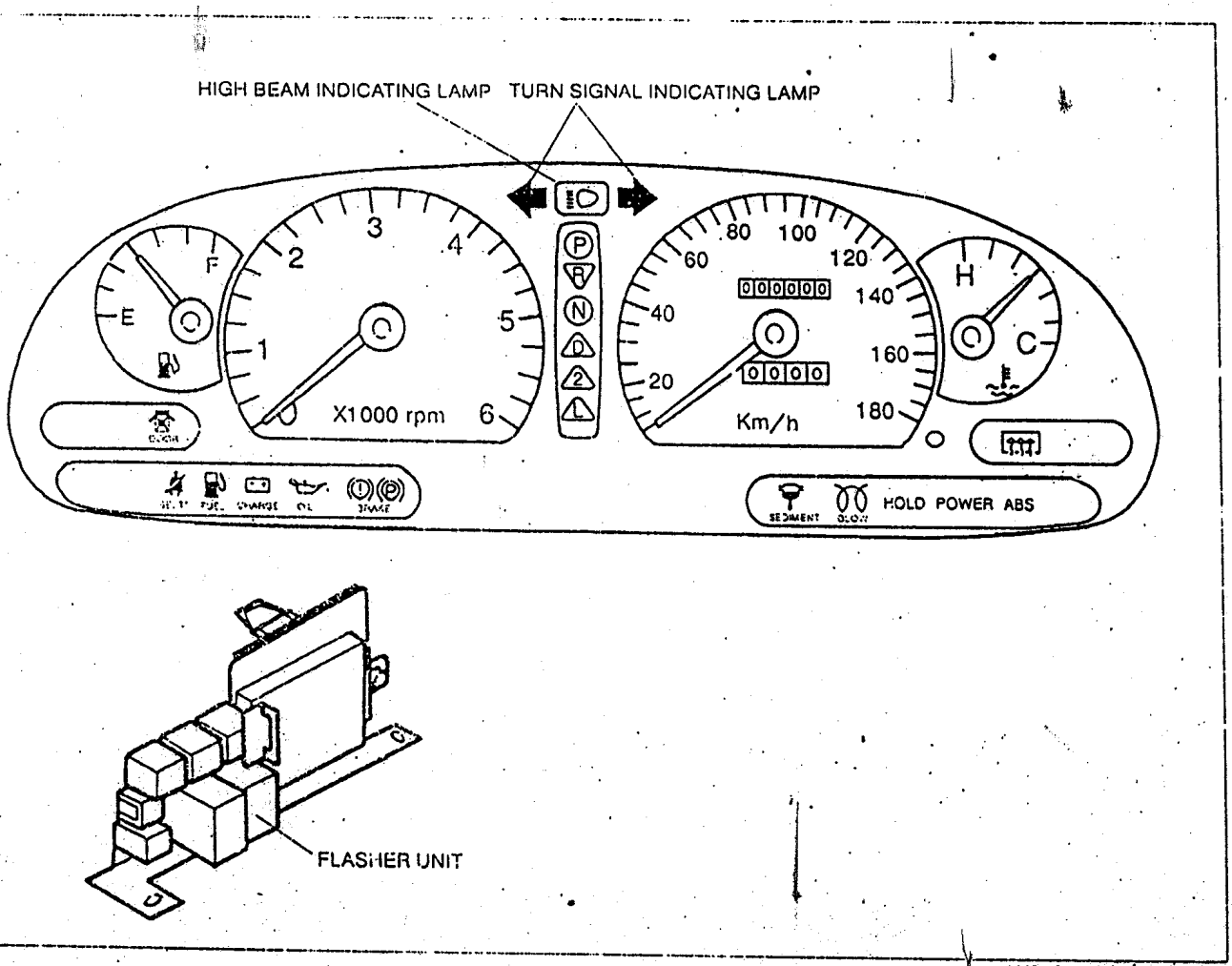
61-14-2

SWITCH

MULTIFUNCTION SWITCH

Description and operation

- The head lamp switch is located at the left of the multifunction switch installed on the steering column and should be replaced as assembly if necessary.
- The low beam head lamp is operated when the rotary switch located at the end of the multifunction switch is rotated by 2 turns counterclockwise.
- The multifunction switch is equipped with 2 functions of high beam and flash-to-pass. The high beam head lamp is turned on when the multifunction switch is pushed to the instrument panel and is turned off when it is pulled to the low beam.
- During the operation of the high beam head lamp, the high beam indicating lamp is illuminated.
- For the flash-to-pass function, the head lamp is operated separately by the rotary switch.
- If the multifunction switch is pulled upwards, the high beam head lamp is illuminated and if the switch is returned, the spring pressure returns the switch to OFF position.



AN9031009/AN9061018

- The head lamp / turn signal switch, a part of the multifunction switch installed on the steering column and the turn signal is operated by the multifunction switch when the ignition switch is in ON position.
- The turn signal switch and the hazard switch is separated but same switch contact is used for operation.
- The flasher unit is located at the right top of the instrumental panel.

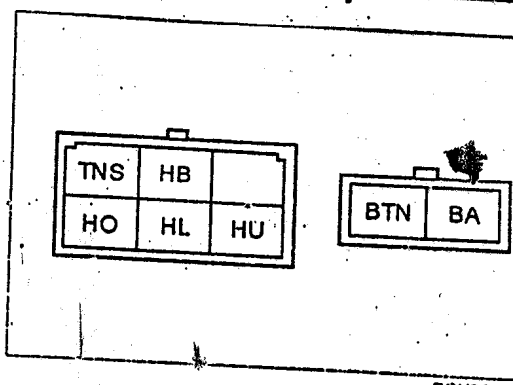
Inspection

1. Check if current passes between each terminal by an ohmmeter.

Light, dimmer and passing switch

Light	Dimmer, passing	BTN	TNS	BA	HU	HL	HB
OFF	HU						
	HL						
	HF			O—O			
P	HU	O—O					
	HL	O—O					
	HF	O—O		O—O			
H	HU	O—O		O—O			O
	HL	O—O		O		O	O
	HF	O—O		O—O			O

O—O : continuity

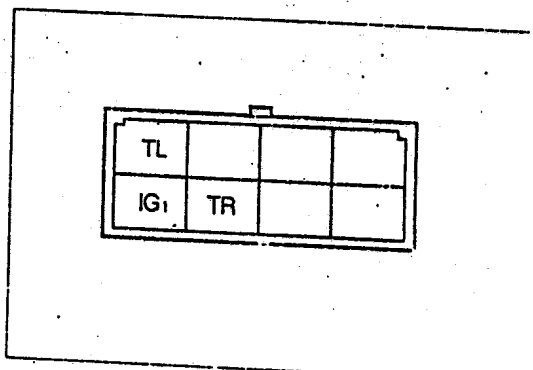


BSX0610

Turn signal switch

Position	IG1	TL	TR
Left	O	O	
N(OFF)			
Right	O		O

O—O : continuity

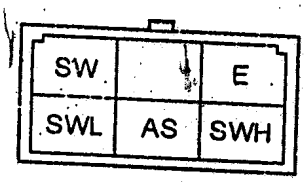


BSX061094

Wiper & washer switch

Wiper	One touch	INT	E	AS	SWL	SWH
OFF	OFF			O	O	
	↕		X	X		
	ON		O		O	
INT		O	O	O	O	
↕			X	X		
LO			O		O	
HI			O			O

O—O : continuity



BSX061095

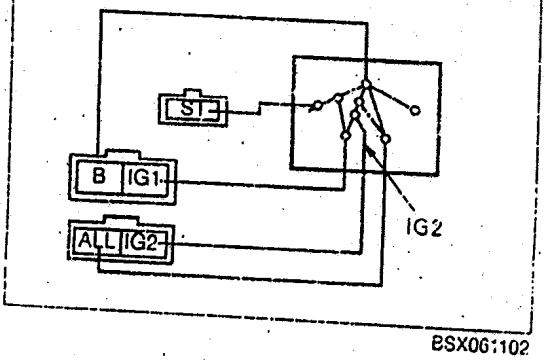
IGNITION SWITCH

Inspection

Check for continuity between terminal by an ohmmeter.

Position	B	ACC	IG1	IG2	ST
ACC	O	O			
ON	O	O	O	O	
ST	O		O		O

O—O : continuity



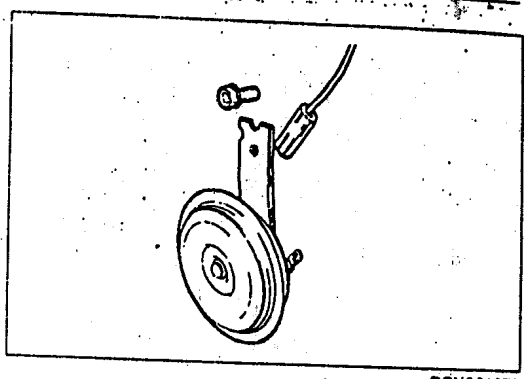
BSX061102

HORN

REMOVAL / INSTALLATION

Note
- **The horn is located at the center of the front bumper.**

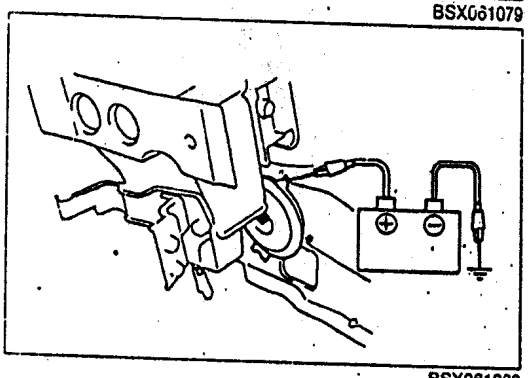
1. Disconnect the battery negative terminal.
2. Disconnect the horn connector.
3. Remove the horn bracket bolt.
4. Remove the horn.



BSX061079

INSPECTION

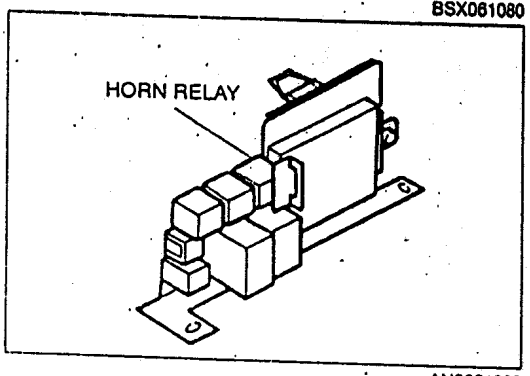
1. Disconnect the horn connector.
2. Check the horn sound by supplying battery 12V to the horn directly.
3. Replace the horn if necessary.



BSX061080

HORN RELAY

Note
- **The horn relay is located at the right top of the instrument panel.**

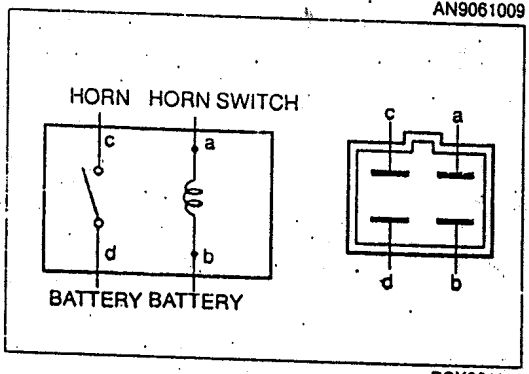


AN9061009

1. Disconnect the battery negative terminal.
2. Remove the relay after disconnecting the horn relay connector.
3. Check if current passes between relay terminals.

Connected to		a	b	c	d
12V	Earth				
—	—	O—O			
a	b			O—O	

O—O : continuity



BSX061114

REAR WINDOW DEFROSTER

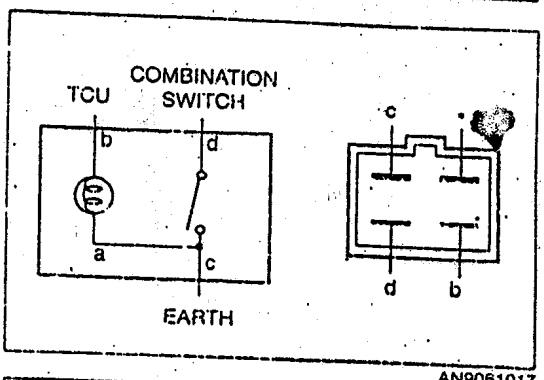
DEFROSTER SWITCH

Inspection

Check for continuity between terminals by an ohmmeter.

Status \ Terminals	a	b	c	d
OFF		O—●—O		
ON			O—— ——O	

O—O : continuity
● : illumination (1.4W)



AN9061017

DEFROSTER RELAY

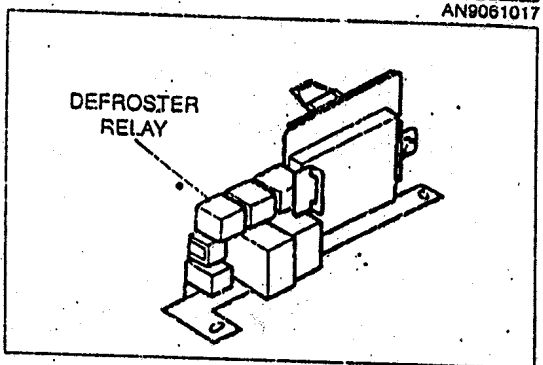
Note
- **The rear window defroster relay is located at the right top of the instrument panel.**

Inspection

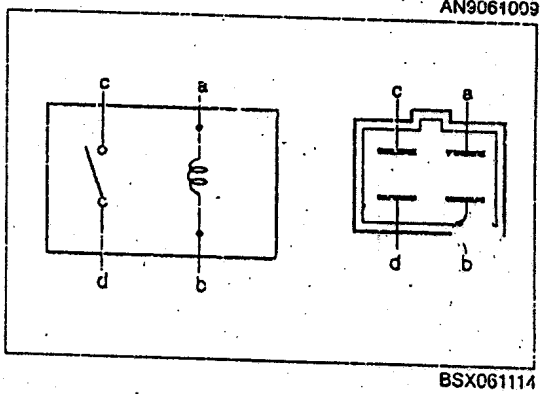
1. Remove the relay after disconnecting the rear window defroster relay.
2. Check if current passes between relay terminals.

Connected to		a	b	c	d
12V	Earth				
—	—	O——O			
a	b			O——O	

O—O : continuity



AN9061009



BSX061114

TIMER CONTROL UNIT(TCU)

DESCRIPTION

"Key In Ignition" warning chime

If the key is not removed after turning off the ignition switch and opening the door when the keyless switch is closed, the warning sound is generated.

"Lights On" warning chime

If the ignition switch is turned off and the door is opened when the combination switch is closed, the warning sound is generated.

Key illumination timer

If the door is opened when the keyless switch is open, the timer starts operating and the key illumination is operated for 20~40 seconds. If the keyless switch is turned on, it stops operating immediately.

Time lag power window timer

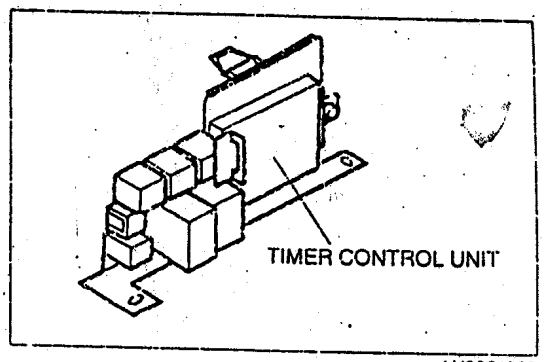
If the ignition switch is turned off, the timer starts operating to supply the power to the power window motors for about 30 seconds.

Rear window defroster control timer

If the defroster switch is turned on when the key switch is closed, the defroster control timer starts operating and stops operating after about 12~18 minutes. If the key switch or defroster switch is turned off during the defroster control timer operation, the defroster control timer stops operating.

REMOVAL

Note
- The timer control unit is located at the right top of the instrument panel.



AN9061009

INSPECTION

Measure the voltage on terminals of the timer control unit.

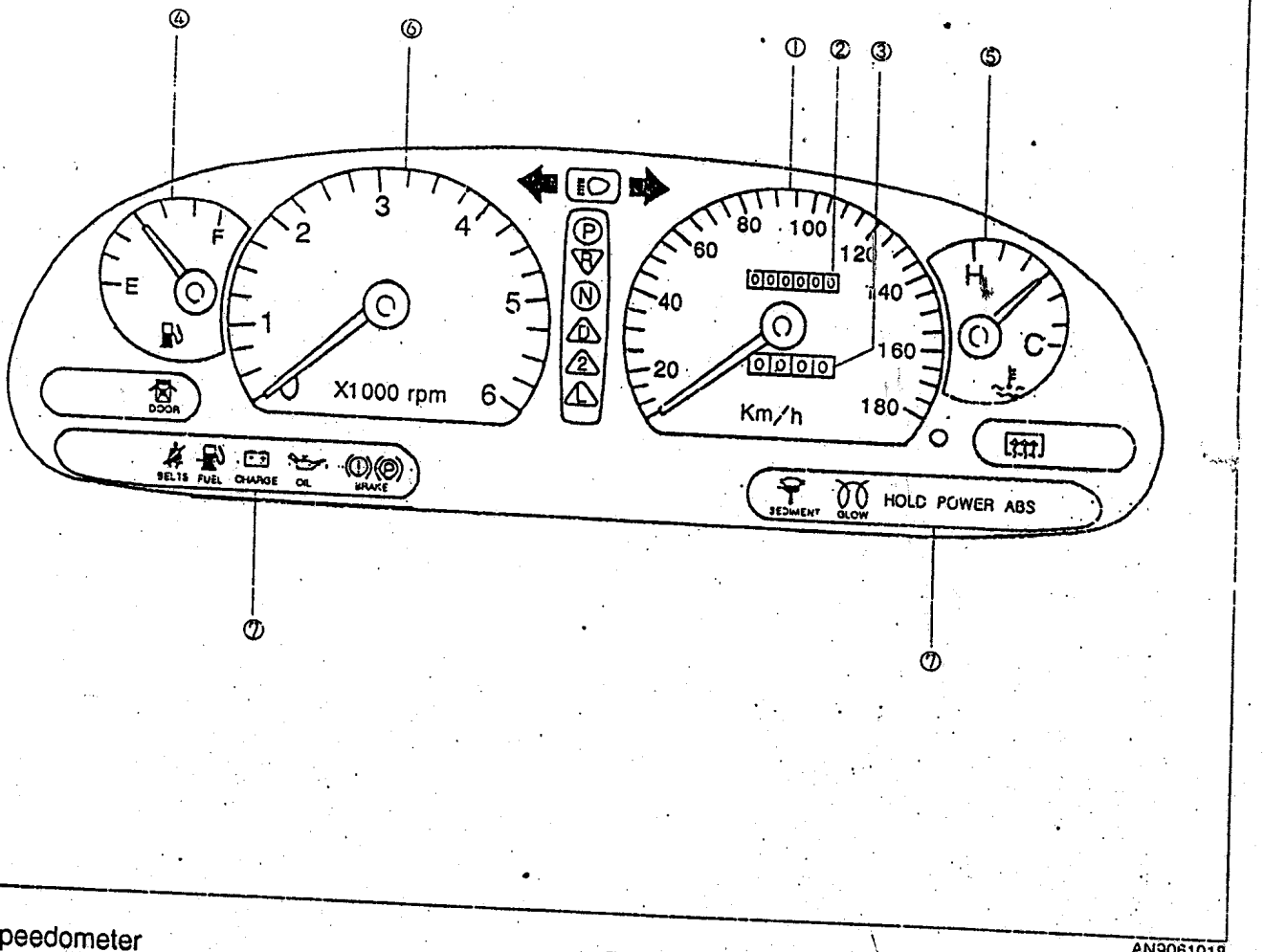
Termina	Input	Output	Connected to	Measuring condition	Results (V)
A		O	Power window relay	Power window operating	below 1.2
				Power window not operating	12
B		O	Key hole illumination	ON	below 1.2
				OFF	12
C		O	Defroster relay	Defroster switch ON	below 1.2
				Defroster switch OFF	12
D	O		Defroster switch	Defroster switch ON	0
				Defroster switch OFF	12
E		O	Meter set (seat belt warning lamp)	ON (fastened)	0
				OFF (not fastened)	12
F	O		Power door lock main switch (lock)	Locked	0
				Unlocked	12
G	O		Key switch	IG key ON	12
				IG key OFF	0
H	O		Power door lock main switch (unlock)	Locked	12
				Unlocked	0
I	O		Power door lock link switch (unlock)	Locked	12
				Unlocked	0
J	O		Power door lock link switch (lock)	Locked	0
				Unlocked	12
K			—	—	—
L			—	—	—
M		O	Horn relay	Horn switch ON	1.2
				Horn switch OFF	12
N	O		Combination switch		12
					0
O	—		—	—	—
P	O		Key reminder switch	IG key ON	12
				IG key is removed from IG switch	0
Q	—	—	Earth	—	0
R	—	—	Battery (for door lock only)	Always	12

Termina	Input	Output	Connected to	Measuring condition	Results (V)
S		O	Power door lock motor (lock)	Locked	12
				Others	0
T	O		Door switch	ON (door open)	0
				OFF (door closed)	12
U		O	Power door lock motor (unlock)	Unlocked	12
				Others	0
V	—	—	Battery	Always	12

INSTRUMENT PANEL(METERS)

DESCRIPTION AND OPERATION

The meter consists of speedometer, tachometer and odometer.
Fuel and coolant temperature gauges are installed and warning and indicating lamps consist of turn signal lamps and warning lamp.
The meter is divided into 2 parts and consists of meter and 3 connectors connected to the rear.



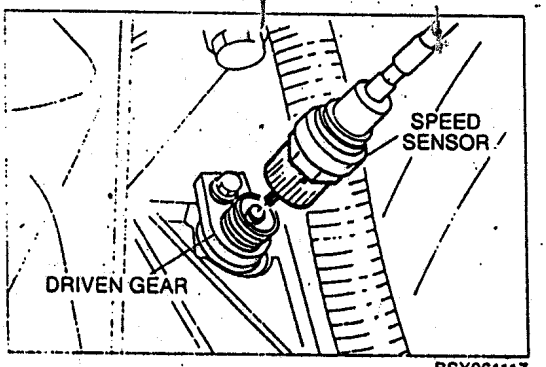
AN9061018

1. Speedometer
2. Odometer
3. Tripmeter
4. Fuel gauge
5. Coolant temperature gauge
6. Tachometer
7. Warning and indicating lamp

Speedometer and odometer

- The cableless type speedometer is adopted.
- For the cableless type speedometer, current is supplied to the cross coil according to the pulse signal from the speed sensor mounted on the transmission to indicate the reading.
- The amount of current through the cross coil is determined by the indicator angle calculated by the calculating element based on the number of pulses counted for the specified time.
- The current is supplied to one cross coil according to the result calculated by the calculating element. Magnetic field is generated and the indicator indicates the speed by this current through the cross coil.

The speed sensor is driven by the output shaft of the transmission. The magnet in the speed sensor attached on the driven gear changes the magnetic field at the coil. The coil generates current by the change of magnetic field. AC signal of 4 pulses per 1 rotation of the speed sensor is send to the meter.

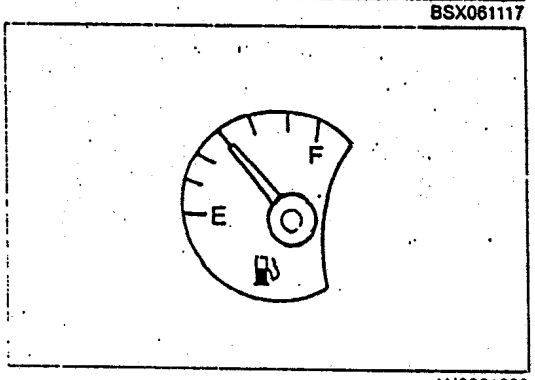


BSX061117

Fuel gauge

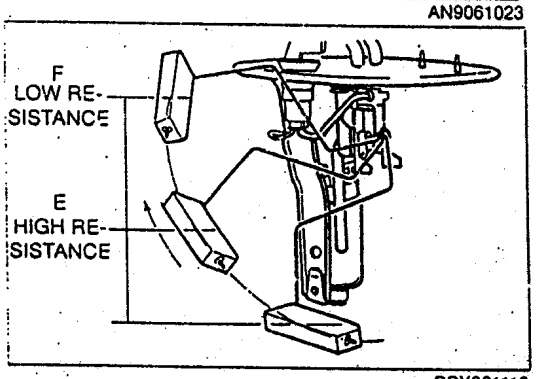
The fuel gauge is the coil type of which indicator reading is moved by the amount of current passing through the cross coil from the variable resistance sensor in the fuel tank. If the fuel tank is full of fuel, the resistance of the fuel gauge decreases to increase the current that the fuel gauge indicates "F". To the contrary, if the fuel tank is empty, current decreases that the fuel gauge indicates "E".

The current through the resistor is determined by the variable resistor of the fuel gauge. The variable resistor is adjusted by the fuel amount in the fuel tank. The float attached to the fuel gauge floats on the surface of fuel to inform the fuel gauge of the fuel amount. If the fuel amount changes, the level of float also changes so that the amount of current passing through the circuit is changed. The higher the level of the float is, the less the resistance of the circuit becomes.



AN9061023

The amount of the current passing through the coil is determined by the resistance of the fuel gauge unit. The resistance of the fuel gauge unit is changed according to the amount of fuel in the fuel tank. The float attached to the fuel gauge floats on the surface of fuel and follows the fuel level when the amount of fuel changes. As the resistance differs at each position, the amount of current passing through the circuit is changed. The higher the level of the float is, the less the resistance of the circuit becomes.

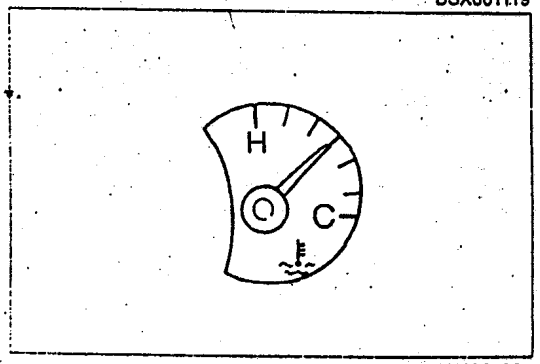


BSX061119

Coolant temperature gauge

The engine coolant temperature gauge is located at the right of the meter. The gauge os of coil type and the reading is indicated according to the amount of current. The resistance of the coolant temperature sensor mounted on the engine changes according to temperature to change the amount of current. Consequently, the gauge indicates the result. If the coolant temperature is low, the resistance of the sensor increases and the amount of current passing through the circuit is also reduced.

If the coolant temperature is high, the resistance of the temperature sensor decreases to increase current and the reading indicates "H" area. To the contrary, if the coolant temperature is low, the resistance of the temperature sensor increases to decrease current and the reading indicates "C" area.



AN9061024

Problem	Possible Cause	Action
The speedo meter does not operate or operates wrong.	• Speedometer malfunction • Speed sensor malfunction • Driven gear malfunction • Circuit broken	Replace Replace Replace Repair
The tachometer does not operate.	• Tachometer • Circuit broken	Replace Repair
The coolant temperature gauge does not operate.	• Circuit broken • Coolant temperature gauge malfunction • Coolant temperature sensor malfunction	Repair Replace Replace
The fuel gauge does not operate.	• Circuit broken • Fuel gauge unit malfunction • Fuel gauge malfunction	Repair Replace Replace

THE SPEEDOMETER DOES NOT OPERATE OR OPERATES WRONG.

Step 1

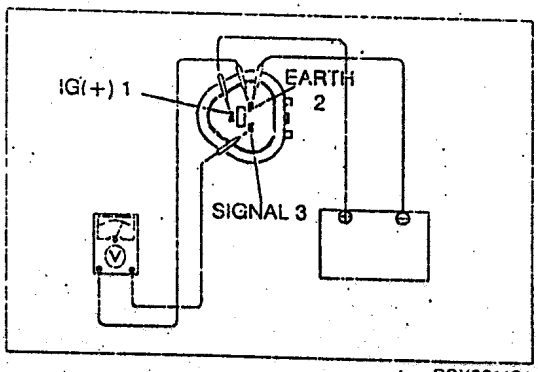
1. Check if the meter set and the speed sensor connector are connected correctly.
2. If normal, check for step 2 items.

Step 2 : speed sensor check

1. Disconnect the speed sensor connector mounted on the speedo driven gear of the transmission.
2. Remove the speedo sensor.
3. After connecting battery positive terminal to the No. 1 terminal of the speed sensor, connect battery negative terminal to the No. 2 terminal of the sensor.
4. Connect negative and positive terminals of the tester to No. 2 and No. 3 terminal of the speed sensor, respectively.
5. Rotate the speed sensor shaft.
6. Check if voltage change from 0V to 12V between the No. 3 and No. 2 terminals.

Note

- **If voltage does not change 4 times per 1 rotation of the speed sensor shaft, replace the speed sensor.**



BSX061121

Step 3 : speedometer check

1. Remove the meter set.
2. Check if current passes between "BK(B)" and "CH(R/L)" terminals of the speedometer. If voltage does not change 4 times per 1 rotation of the speedo sensor, replace the speedo meter.

The tachometer does not operate.

1. Remove the instrument cluster (meter).
2. Connect the test tachometer to "AL"(LG/R) and "BK"(B) tachometer terminals of the instrument wire harness.
3. Start the engine.
4. Check if the test tachometer indicates the engine speed.

Indicated engine speed	Action
Normal	Replace the tachometer.
Abnormal	Repair the wire harness (between instrument cluster and tacho sensor)

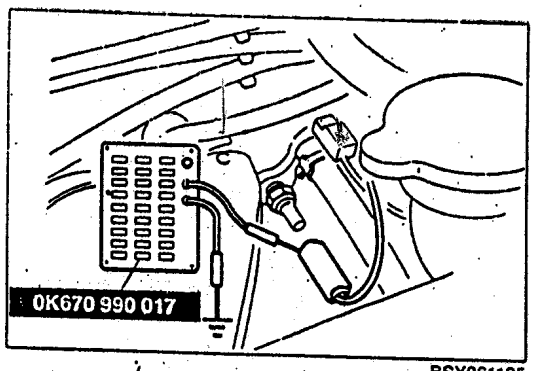
The coolant temperature gauge does not operate.

1. Disconnect the connector of the coolant temperature switch.
2. Connect the SST red cord to the connector and ground the black cord.
3. Adjust the resistance of the SST to the value in the figure.
4. Turn on the ignition switch and check if the indicator indicates the correct value.

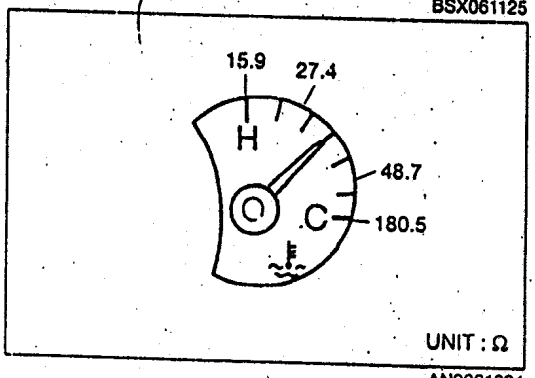
Gauge Status	Action
Normal	Replace the coolant temperature sensor.
Abnormal	Refer to the step. 7

Caution

- **Perform the above items for more than 2 minutes to understand the condition correctly.**
- **The allowable indicating error is twice of the indicator width.**

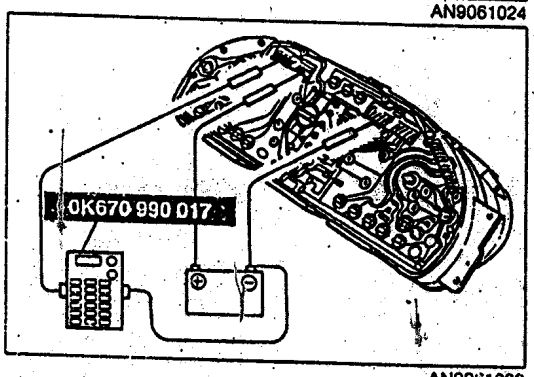


BSX061125



AN9061024

5. Remove the instrument cluster (meter set).
6. Supply 12V voltage to the "CF" terminal and ground the "BK" terminal.
7. Connect the SST red and black cords to "CN" terminal and battery negative terminal respectively.

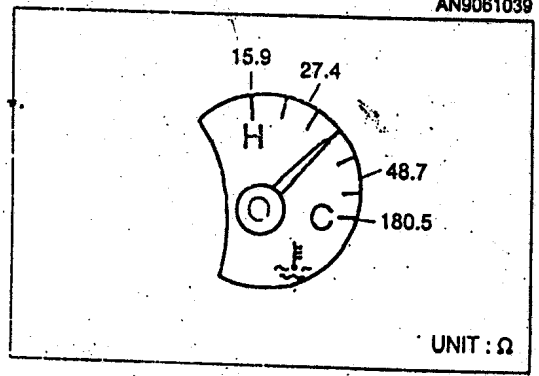


AN9061039

8. Adjust the resistance of the SST to the value in the figure.
9. Check if the indicator indicates the correct resistance value.

Caution

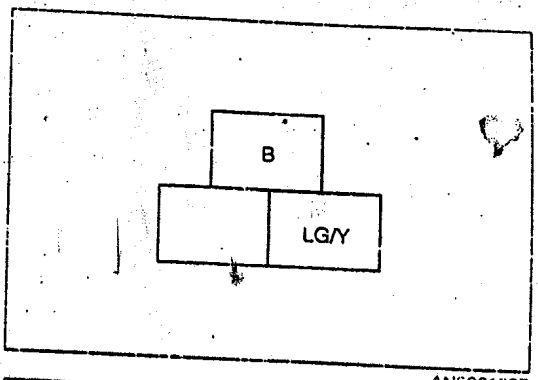
- **Perform the above items for more than 2 minutes to understand the condition correctly.**
- **The allowable indicating error is twice of the indicator width.**



AN9061024

The fuel gauge does not operate.

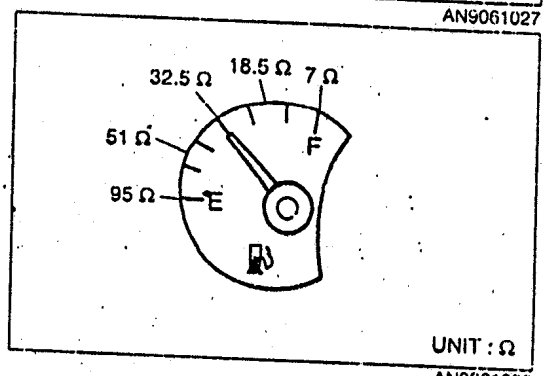
1. Disconnect the connector from the fuel gauge sender unit.
2. Connect the **SST** red cord to the "LG/Y" terminal and ground the black cord.



AN9061027

3. Adjust the resistance of the **SST** to the value in the figure.
4. Turn on the ignition switch and check if the indicator indicates the correct value.

Gauge status	Action
Normal	Replace the coolant temperature sensor.
Abnormal	Refer to the step. 7.

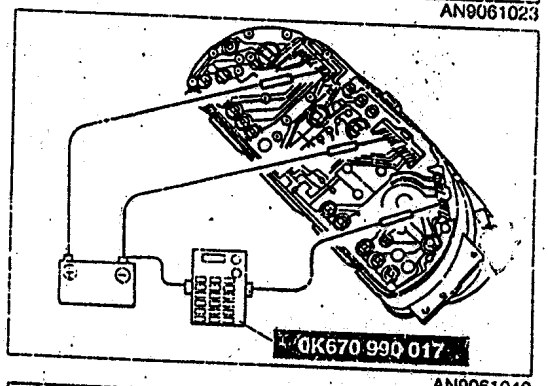


AN9061023

Caution

- **Perform the above items for more than 2 minutes to understand the condition correctly.**
- **The allowable indicating error is twice of the indicator width.**

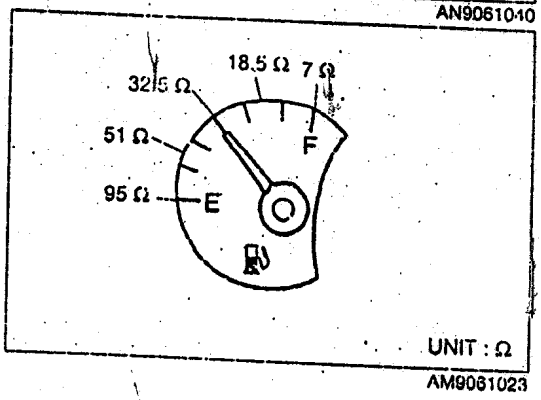
5. Remove the instrument cluster.
6. Supply 12V voltage to the "CF" terminal and ground the "BK" terminal.
7. Connect the **SST** red and black cords to "AC" terminal and battery negative terminal respectively.



AN9061040

8. Adjust the resistance of the **SST** to the value in the figure.
9. Check if the indicator indicates the correct resistance value.

Indicated engine speed	Action
Normal	Repair the wire harness. (between instrument cluster and fuel gauge sender unit)
Abnormal	Replace the fuel gauge.



AM9061023

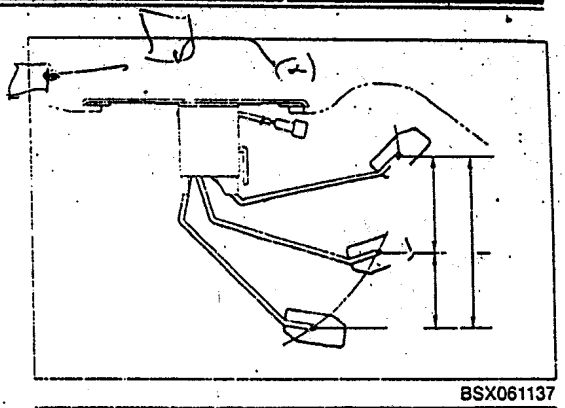
Caution

- **Perform the above items for more than 2 minutes to understand the condition correctly.**
- **The allowable indicating error is twice of the indicator width.**

FUEL GAUGE SENDER UNIT

Inspection

1. Disassemble the fuel tank gauge unit.
2. Disconnect the fuel gauge sender unit connector.
3. Check the resistance by moving the unit arm from F to E position slowly.
4. If abnormal, replace the fuel sender unit.



BSX061137

Resistance

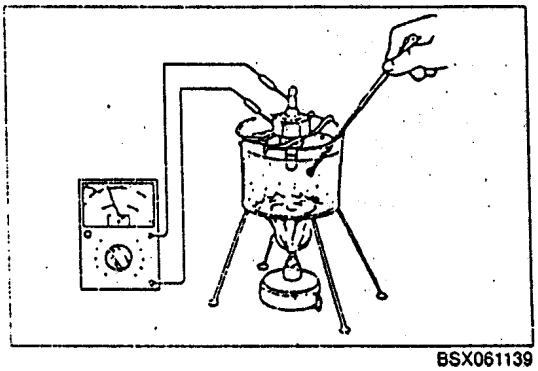
Position	Resistance (Ω)	Position	Resistance (Ω)
E	1·0±7	3/4	18.5±3
1/4	51±5.5	F	3±2
2/4	32.5±4	—	—

COOLANT TEMPERATURE SENSOR

Inspection

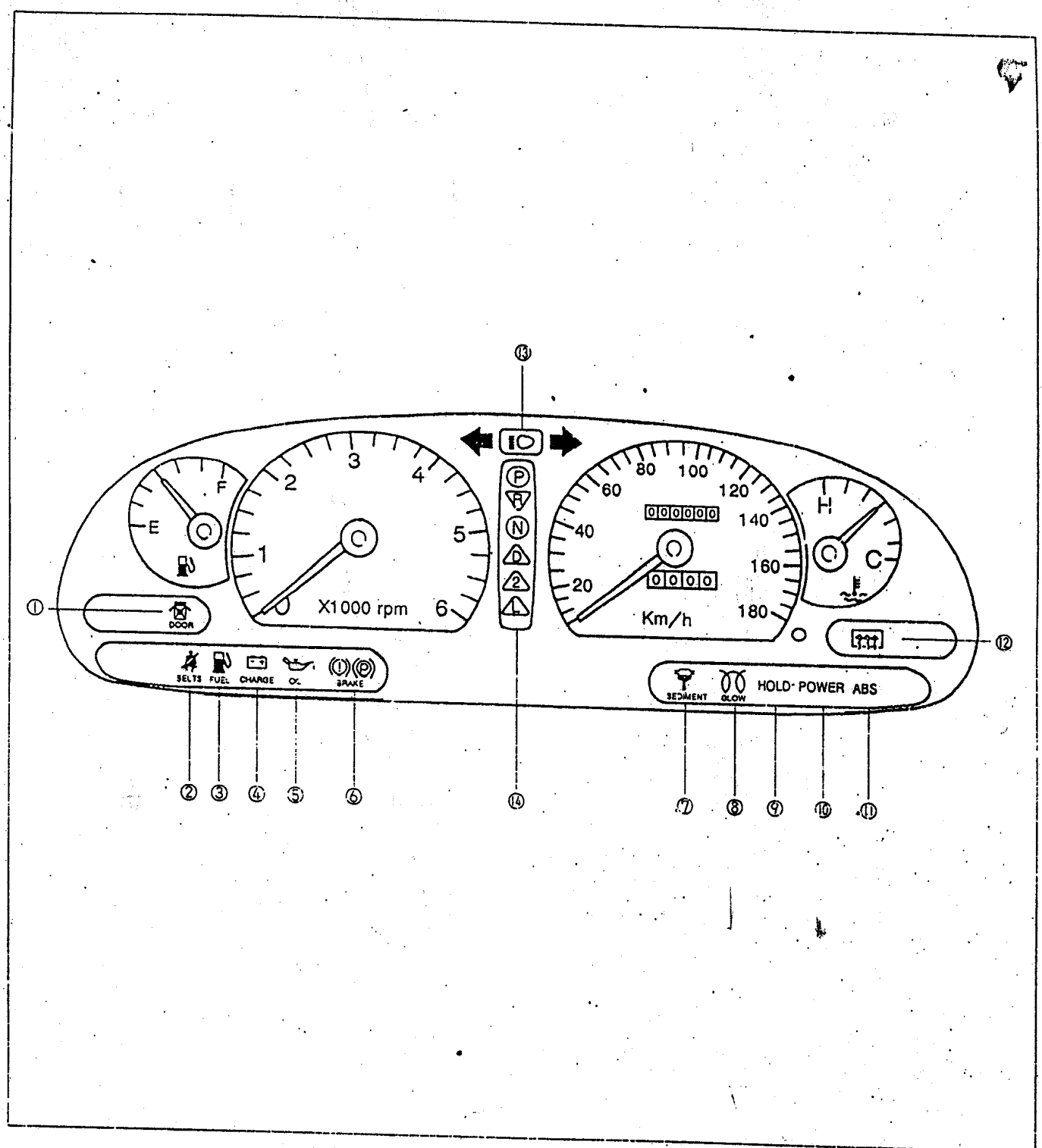
1. Remove the sensor.
2. Position the sensor as shown in the figure.
3. Measure the resistance heating the water gradually.
4. If the resistance is out of the standard, replace it.

Standard : 190~260 (at 50°C (92°F))



BSX061139

WARNING LAMP



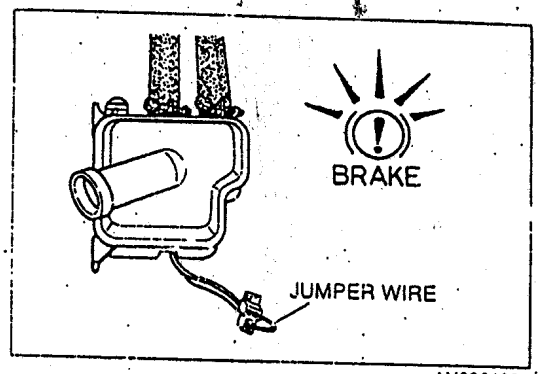
AN9061018

1. Door ajar warning lamp
2. Seat belt warning lamp
3. Low fuel level warning
4. Alternator warning lamp
5. Engine oil pressure warning lamp
6. Brake fluid level and brake system lamp
7. Sedimentor warning lamp
8. Glow plug indicator light
9. Hold mode indicator (ATX vehicle)
10. Power mode indicator (ATX vehicle)
11. ABS warning lamp (ABS vehicle)
12. Rear window defroster indicator
13. High beam indicator
14. Auto transmission range indicator

Brake system warning lamp

1. Disconnect the brake fluid switch connector.
2. Connect a jumper wire between Y/B and B terminals.
3. Start the engine and check if the brake warning lamp is illuminated.

Note
- Before checking, release the parking brake.

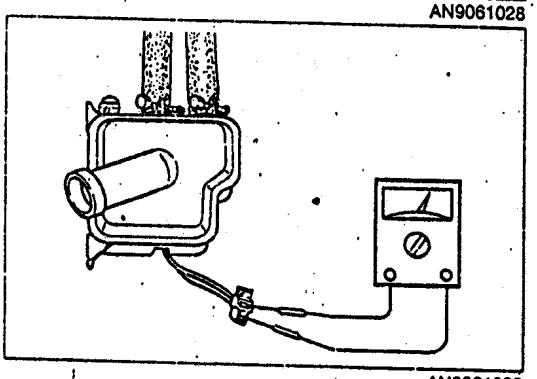


AN9061028

4. If not illuminated, check fuse, bulb and wiring and replace as necessary.

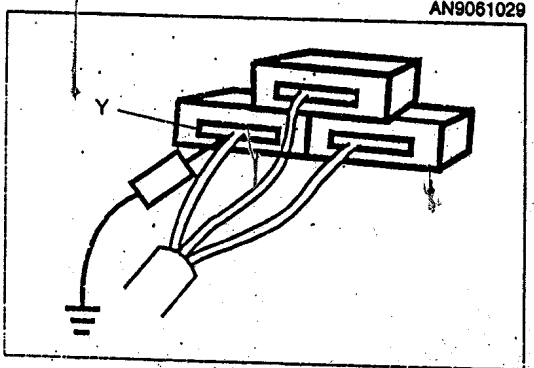
Brake fluid switch

Connect an ohmmeter to the connector terminal of the brake fluid switch. Check the current passing condition according to amount of the brake fluid. The current should pass when the level is below the "MIN" mark and should not pass when the level is above the "MAX" mark. If abnormal, replace the switch.


AN9061029

Low fuel level warning lamp

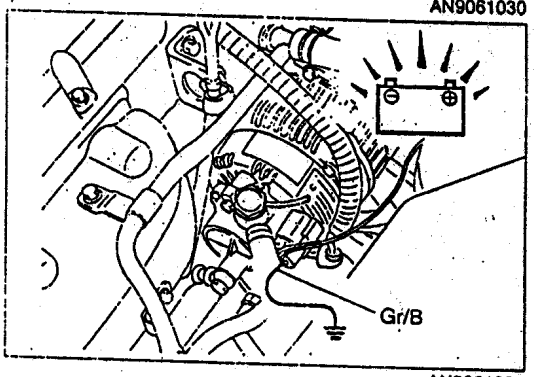
1. Disconnect the connector from the fuel tank unit.
2. Ground the Y terminal.
3. Start the engine and check the low fuel level warning lamp is illuminated.
4. If not illuminated, check fuse, bulb and wiring and replace as necessary.



AN9061030

Alternator warning lamp

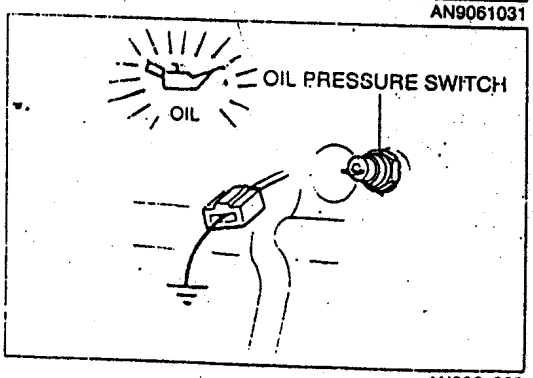
1. Start the engine and ground the "GR/B" wire to the body.
2. Check if the charging warning lamp is illuminated.
3. If not illuminated, check the warning lamp and alternator and repair or replace them.



AN9061031

Engine oil pressure warning lamp

1. Disconnect the oil pressure switch connector.
2. Start the engine and ground the Y/R wire to the body.
3. Check if the oil pressure warning lamp is illuminated. If not illuminated, check the bulb or oil pressure switch and replace it or repair the wiring.



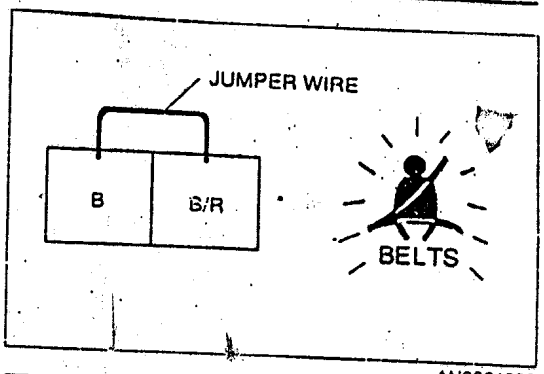
AN9061032

Seat belt warning lamp

1. Disconnect the connector from the seat belt buckle switch.
2. Connect a jumper wire between "B/R" and B terminals.
3. Turn on the engine switch and check if warning lamp and chime operate for about 6 seconds.
4. If abnormal, check fuse, buckle switch, wire harness and time control unit. If necessary, replace or repair them.

Seat belt switch

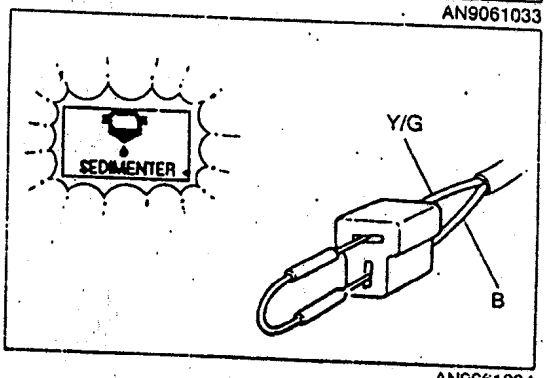
Seat belt status	Continuity
Engaged	No
Released	Yes



AN9061033

Sedimenter warning lamp

1. Disconnect the connector from the sedimenter sensor.
2. Connect a jumper wire between "Y/G" and "B" terminals.
3. Turn on the engine switch and check if warning lamp is illuminated.
4. If abnormal, check fuse and wire harness.



AN9061034

SPEAKER

Inspection

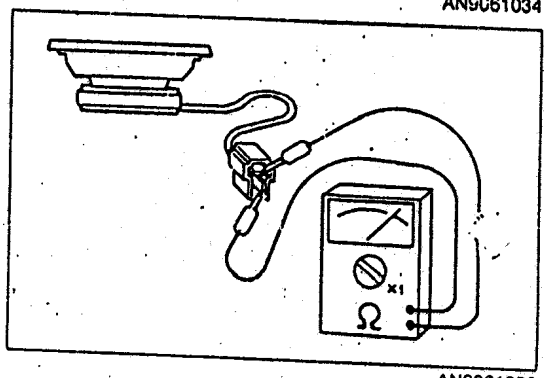
1. Measure the resistance by an ohmmeter.

Note

- **Set the ohmmeter to x 1 Ω range.**

Resistance

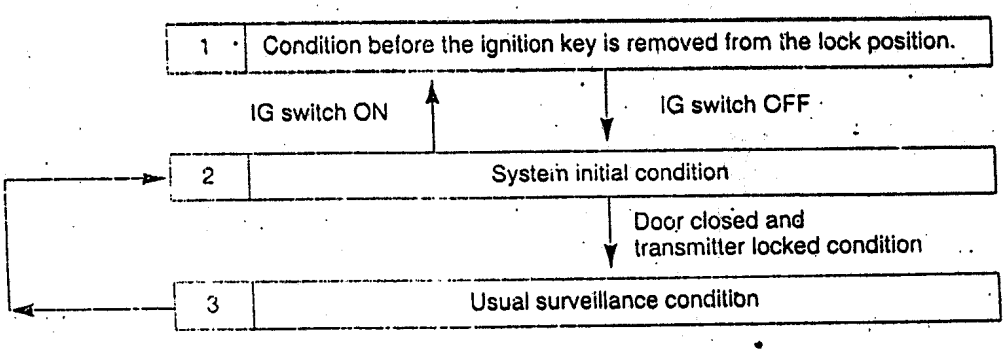
Front speaker : about 4 Ω
Rear speaker : about 8 Ω
Back door speaker : about 8 Ω



AN9061036

KEYLESS ENTRY SYSTEM

SYSTEM FLOW



Note

- Surveillance condition
  If the lock switch on the transmitter is pressed when the IG key is not inserted and the door is closed, the door is locked and the horn operates and then it enters surveillance condition.
- Cancel of surveillance condition
  cancel 1 : transmitter unlock switch ON
  The driver / passenger side door is unlocked by a normal key. (key cylinder switch ON)
  cancel 2 : keyless switch ON (IG switch ACC)

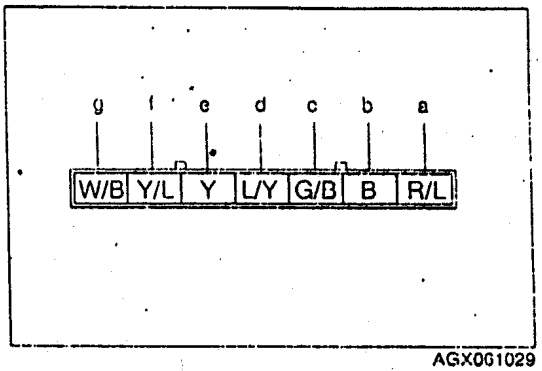
OPERATING CONDITION

System status						Output		Note
	Timer time	Keyless switch	IG switch	Door switch	Door key	Horn / hazard	service stop	
1	—	one is turned ON		—	—	OFF	OFF	can not be remote controlled
2	—	OFF	OFF	—	—	OFF	OFF	
3	—	OFF	OFF	OFF	OFF	OFF	OFF	horn operation (18 ms)

PASSWORD ENTERING METHOD

1. Turn the ignition switch to ACC position. (keyless switch ON)
2. Set the operation mode of the transmitter main body to [memory 1].
3. After entering the password, send it by the transmitter.

4. Set the operation mode of the receiver to [operation].
5. Remove the ignition switch and press lock/unlock switch on the transmitter to check if the system operates.



AGX061029

INSPECTION

Receiver

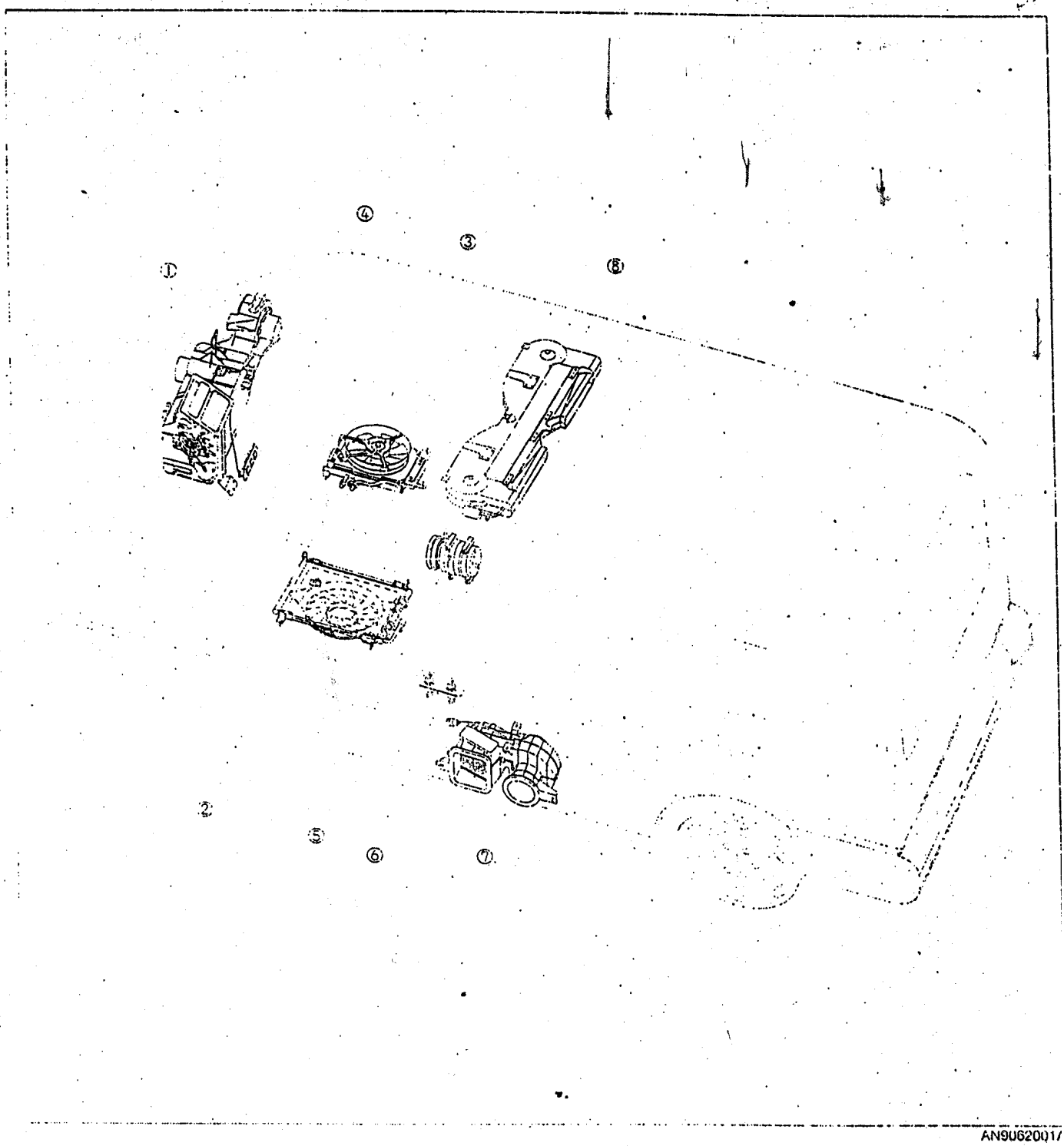
Terminal	Wire Color	Measuring condition	Voltage	Note
a(power supply)	R/L	Always	12V	
b(earth)	B	Always	0 Ω	
c(keyless switch)	G/B	Keyless switch ON	12V	0V for
d(ignition switch)	L/Y	Ignition switch in ACC	12V	OFF
e(lock)	Y	Lock switch ON	0V	
f(unlock)	Y/L	Unlock switch ON	(for 150ms)	
g(set)	W/B	Operation mode in memory position	5V	

AIR CONDITIONER

62

OUTLINE

STRUCTURAL VIEW

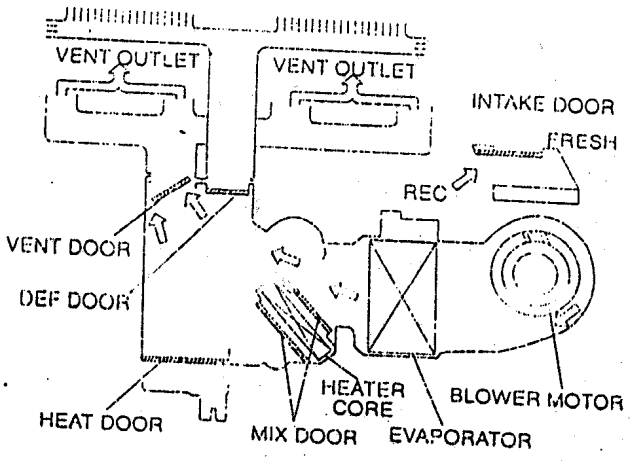


AN90620017

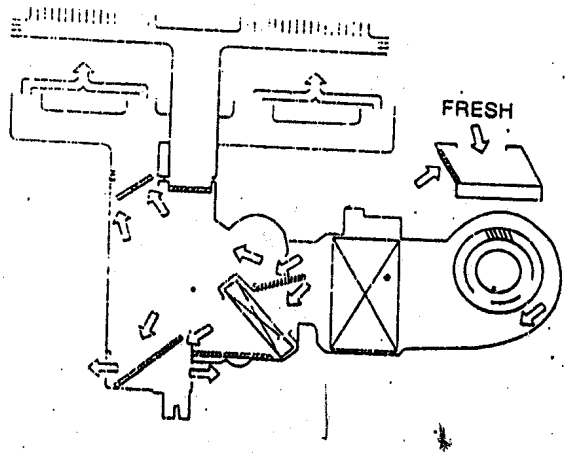
1. HVAC unit
2. Main condenser
3. Sub condenser
4. Front control
5. Compressor
6. Rear control
7. Rear heater
8. Evaporator

AIR FLOW

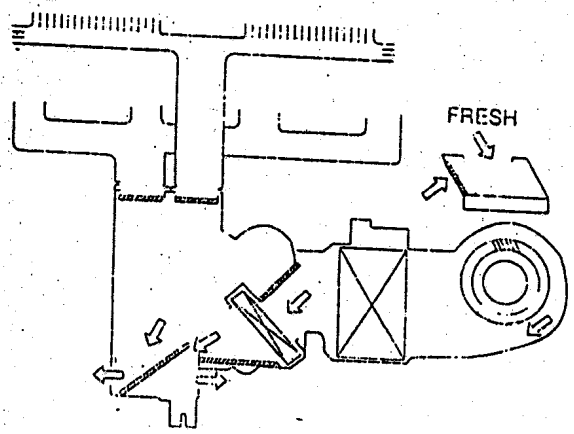
Vent mode



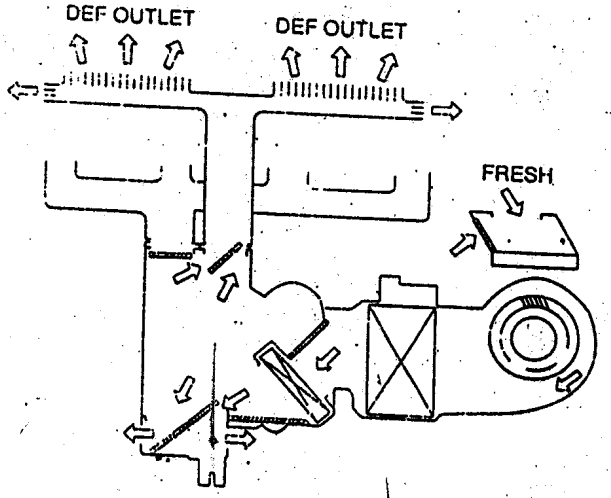
Bi-level mode



Heat mode

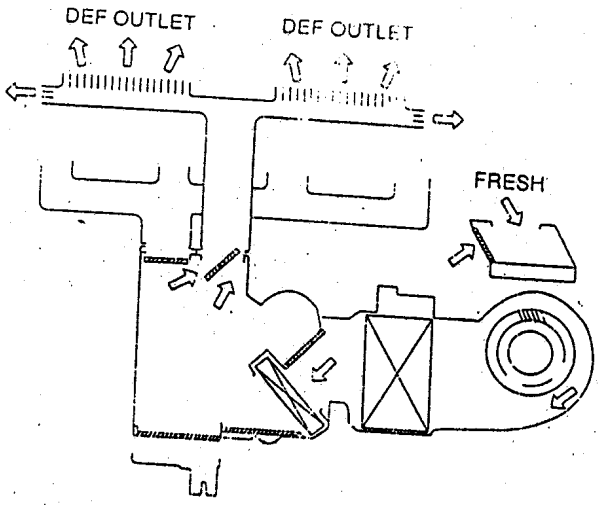


Def/Heat mode

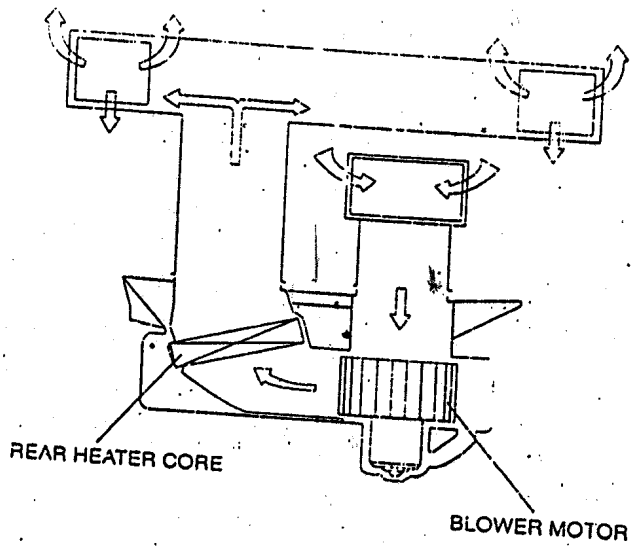


AN9062004

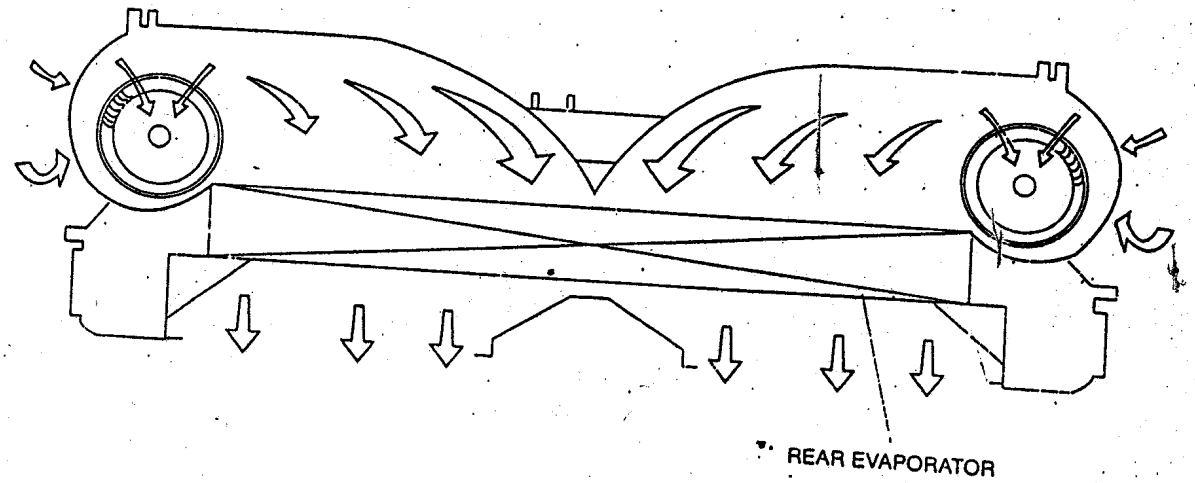
Def



Heater(Rear)

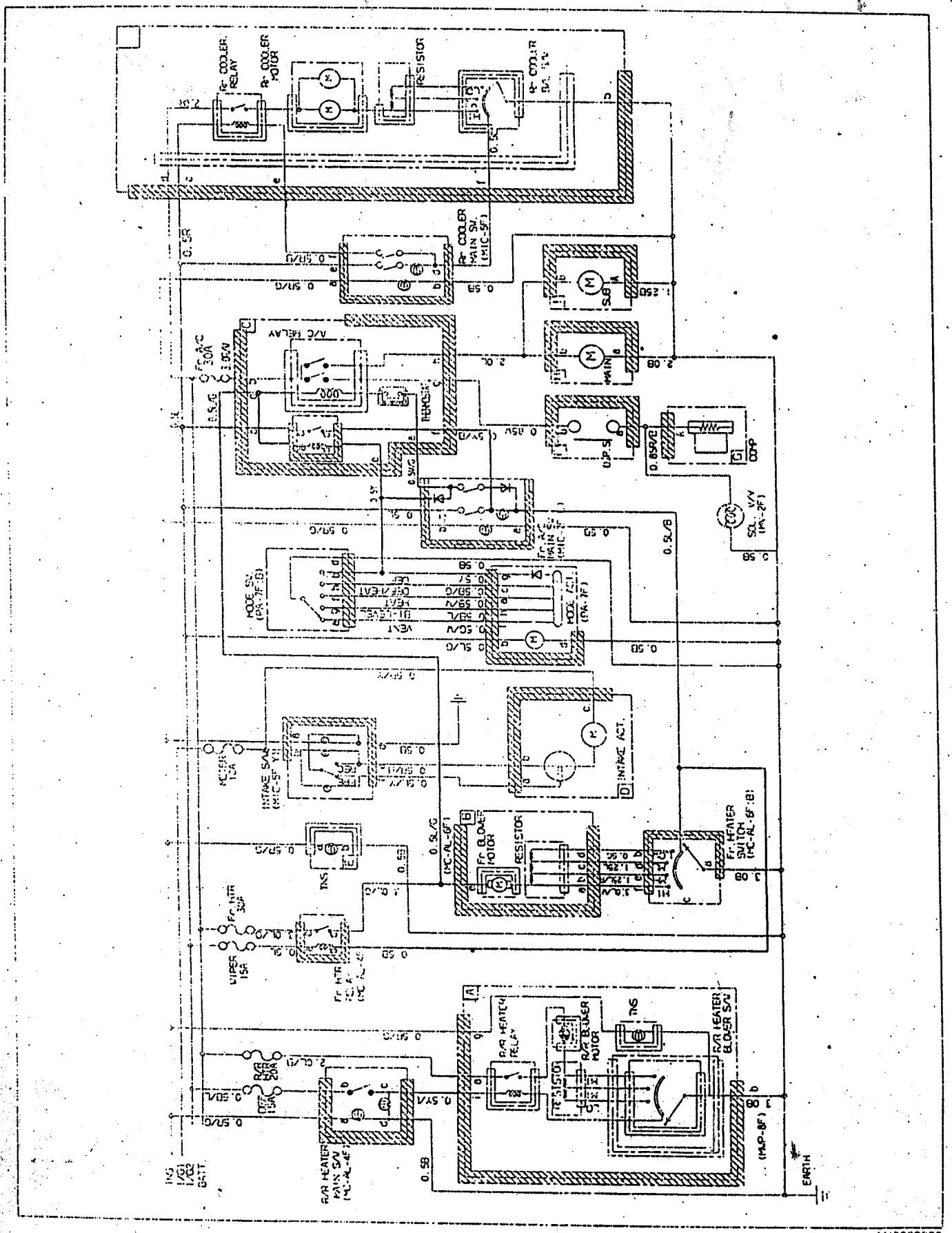


Rear cooler



AN9062005

WIRING DIAGRAM



AN9082050

REFRIGERANT SYSTEM

REPAIR/REPLACE

Working Procedures

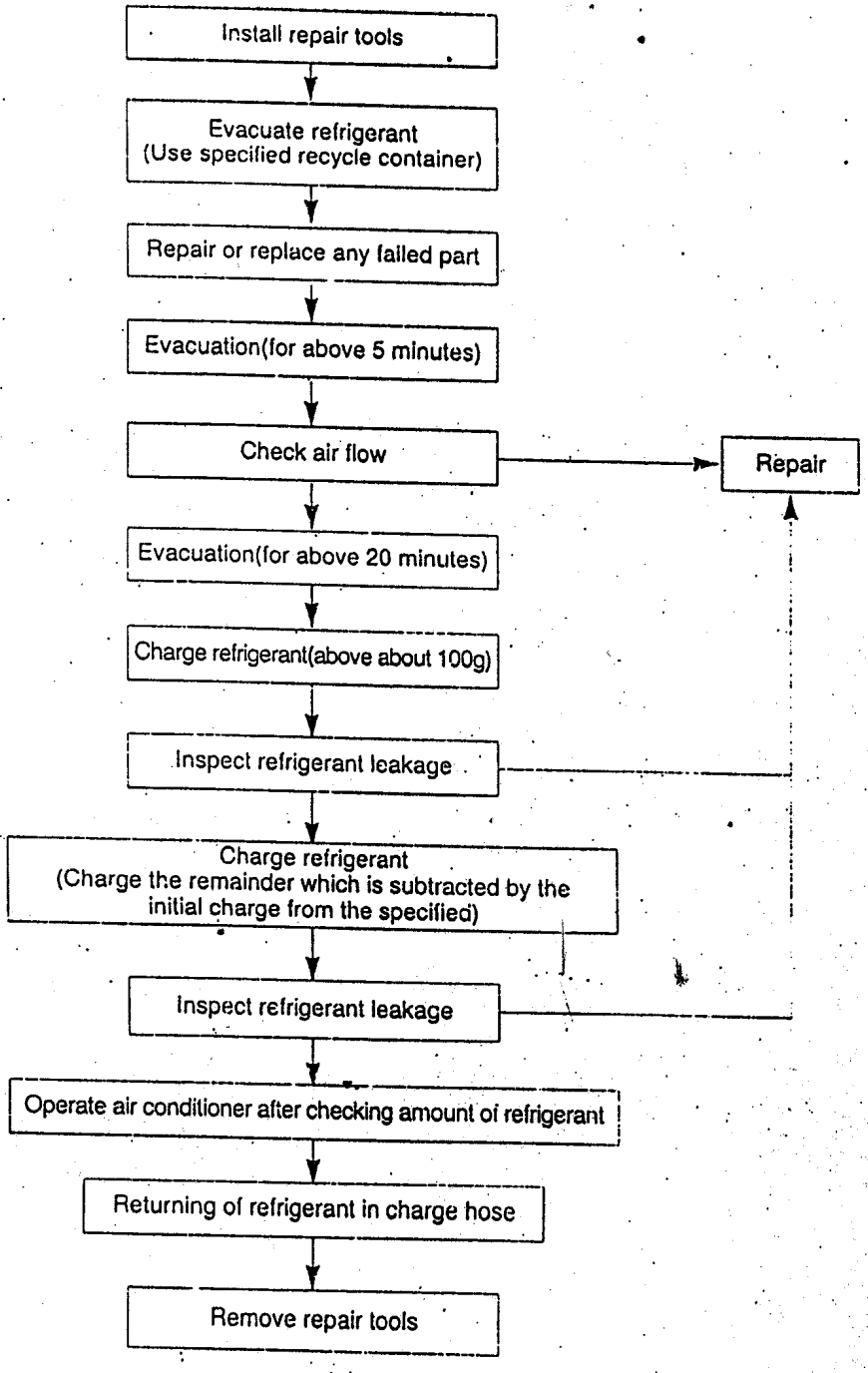
In order to return the compressor oil in the refrigerant line to the compressor, repair or replace the refrigerant system after operating the oil return.

Operating Condition

1. Operate the engine at about 2,000 rpm.
2. Turn the A/C switch on after turning the blower switch to maximum speed.
3. Operate for about 20 minutes after turning the temperature control lever to the maximum cooing position.

Note

- The reading of manifold gauge indicator might be changed by the ambient temperature.



DISCHARGING REFRIGERANT

1. Connect the manifold gauge and the refrigerant discharger as shown in figure.

Caution

- **Pay attention to misconnecting of the high and low pressure valve in reverse.**

2. Evacuate the refrigerant gradually by opening the high pressure side valve slowly.

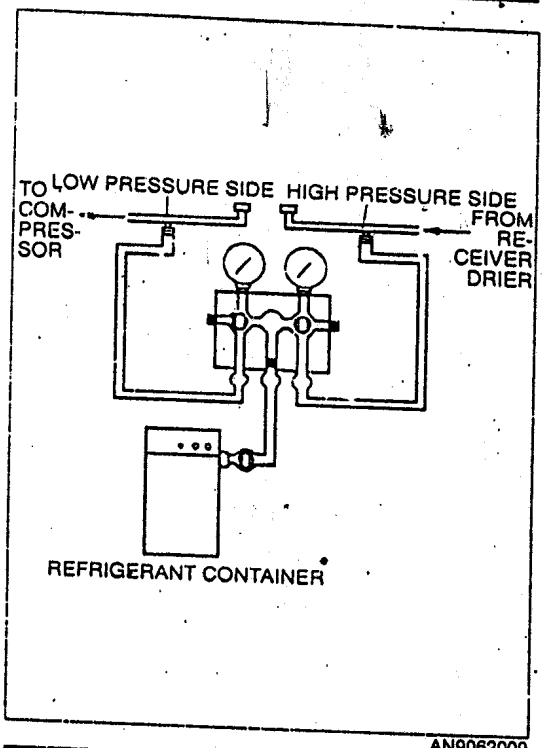
Note

- **Open the valve slowly in order not to spray the compressor oil.**

3. Open the low pressure side valve slowly if the manifold gauge is below 3.5 kg/cm² (50 psi, 343 kPa).
4. Open the both low and high pressure side valve slowly if the manifold gauge indicates 0 kg/cm² (0 psi, 0 kPa).

Caution

- **Evacuate the refrigerant certainly into the specified container.**



AN9062009

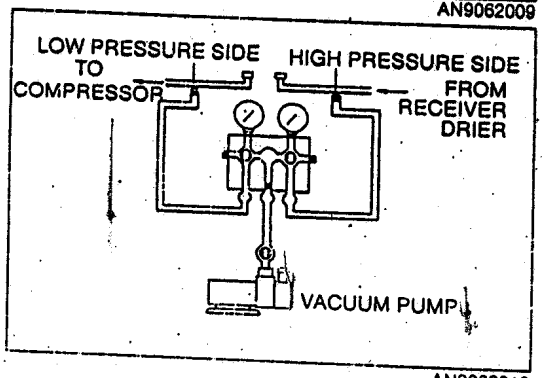
EVACUATING SYSTEM

Evacuation

Note

- **Do the evacuation certainly if the air conditioner system is exposed under air.**
- **Do the evacuation for about 15 minutes after installing components, and for about 30 minutes if components is exposed under air after repair.**

1. Connect the manifold gauge and the vacuum pump as shown in figure.
2. Open the both valves after operating the vacuum pump.
3. When the low pressure side gauge indicates about 710 mmHg (28 inHg 94 kPa), stop to operate the vacuum pump after closing the both valves.



AN9062010

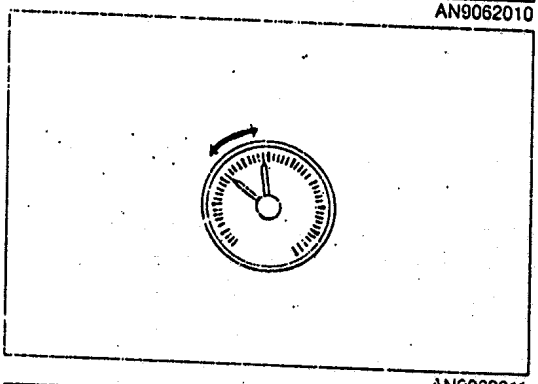
Inspection Air Flow

1. Inspect any pressure change at about 5 to 10 minutes after above evacuation step 3, and repair if necessary.

Evacuation

If no pressure change is found, evacuate for about 20 minutes again.

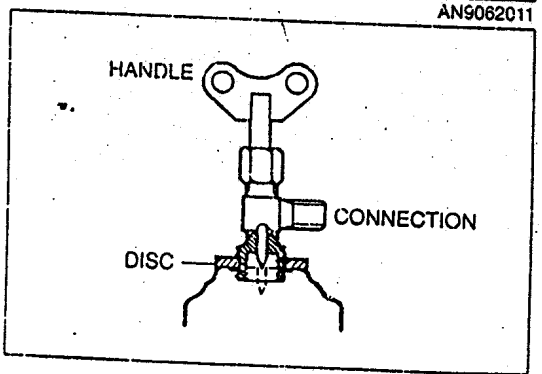
1. Open the both valves after operating the vacuum pump.
2. Continue to evacuate for about 20 minutes, until the low pressure side gauge indicates about 750 mmHg.
3. Stop to operate the vacuum pump after closing the both valves.



AN9062011

Installation of Refrigerant Container

1. Before connecting the valve to the refrigerant container, fully turn the handle in counterclockwise.
2. Turn in counterclockwise until the disc is positioned to the highest level.
3. Connect the center hose of manifold gauge to the connection and fully turn the disc in clockwise.
4. Turn the handle in clockwise until a hole can be generated on the sealed tab.
5. Turn the handle in counterclockwise so that the refrigerant flows into the center hose of manifold gauge. Do not open the high and low pressure valve at this time.
6. Evacuate air in hose by pushing the low pressure valve of the manifold gauge.



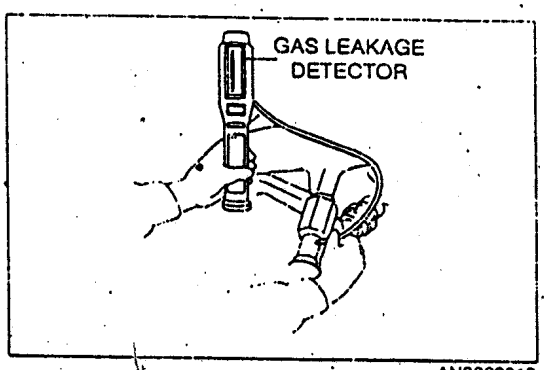
AN9062012

LEAKAGE INSPECTION

Note
- **Inspect for leakage after evacuating.**

1. After installing the refrigerant container, open the high pressure side valve of the manifold gauge set.
2. Close the high pressure valve after charging the refrigerant, until the low pressure gauge indicates 1 kg/cm² (98 kPa, 14 psi)
3. Inspect for leakage from each connection in system, by using the gas leakage detector.
4. If any leakage is found, replace or repair after inspecting the O-ring status and the tightening torque of connection.
5. If no leakage is found, continue to charger the refrigerant.

Caution
- **To have the correct leakage inspection, do it on place ventilated well.**



AN9062013

Charging Refrigerant

1. Evacuate and inspect air flow, leakage.

Note
- **After charging about 100g of refrigerant at engine stop, charge an appropriate amount of refrigerant by using a pressure gauge during engine operation.**
- **When replacing the charging container, evacuate air in hose by pushing the low pressure side valve of the manifold gauge.**

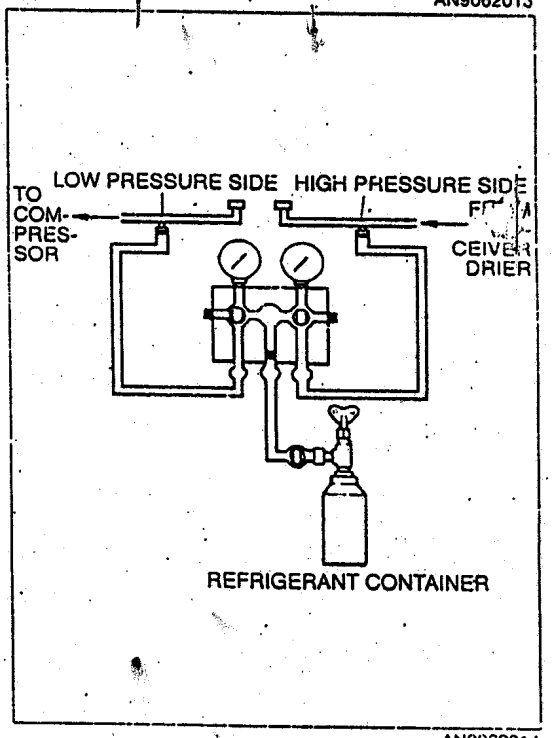
2. Open the low pressure side valve of the manifold gauge set and charge the refrigerant.

First refrigerant charging : 100g

3. If the refrigerant does not flow well in cycle, start engine and turn air conditioner on.
   - Temperature control lever : max. cool
   - Blower speed : 4th
   - Engine speed : 1300~1500 rpm

Caution
- **When charging the refrigerant during engine operation, charge with the refrigerant container stood up straightly, and do not open the high pressure side valve.**

4. Open the low pressure side valve of the manifold gauge set and charge the specified amount of refrigerant.



AN9062014

Vehicle	First refrigerant charging	Second refrigerant charging	Specified amount of refrigerant
12 seats coach	100g	1050g	1150±50g
15 seats coach	100g	1200g	1300±50g
Van	100g	700g	800±20g

Caution
- Pay attention to the handle not to contact with water when the ambient temperature is low and charge after warming up the refrigerant container with above 40°C of warm water.
- When the ambient temperature is high, charge while cooling down the refrigerant container and the condenser etc.

Warning
- Do not directly heat up the refrigerant container or do not heat it to above 40°C (74°F).

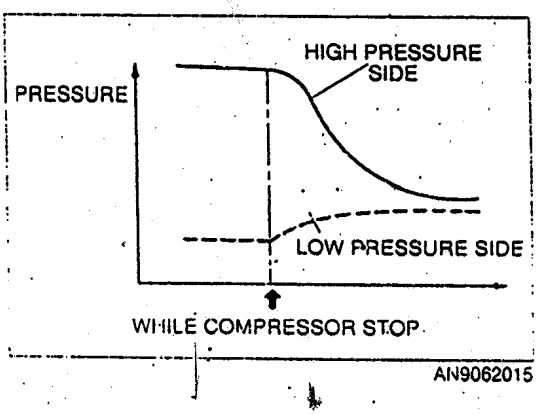
Note
- Inspect the gauge pressure when the ambient temperature is 30~35°C (56~65°F).

High pressure gauge :
1274~1960 kPa (13~20 Kg-cm², 185~284 psi)
Low pressure gauge :
147~343 kPa (1.5~3.5 Kg-cm², 21~50 psi)

5. Close the low pressure side valve.
6. Close the valve and the refrigerant container valve after stopping engine.

Inspection of Refrigerant Leakage
Clean the connection by clean clothes after finishing the refrigerant related work, and inspect any leakage at high pressure side by using a leakage detector.

Note
- Because the pressure of high pressure side decreases slowly and the pressure of low pressure side increases slowly if the circulation of refrigerant is stopped, the refrigerant leakage can be correctly detected by inspecting the high pressure side.



INSPECTING PROCEDURES
High pressure side
Compressor outlet → Condenser inlet → Receiver drier inlet → Cooling unit inlet

Low pressure side
Compressor inlet → Cooling unit outlet

Compressor
Inspect the shaft seal, bolt hole and magnetic clutch.

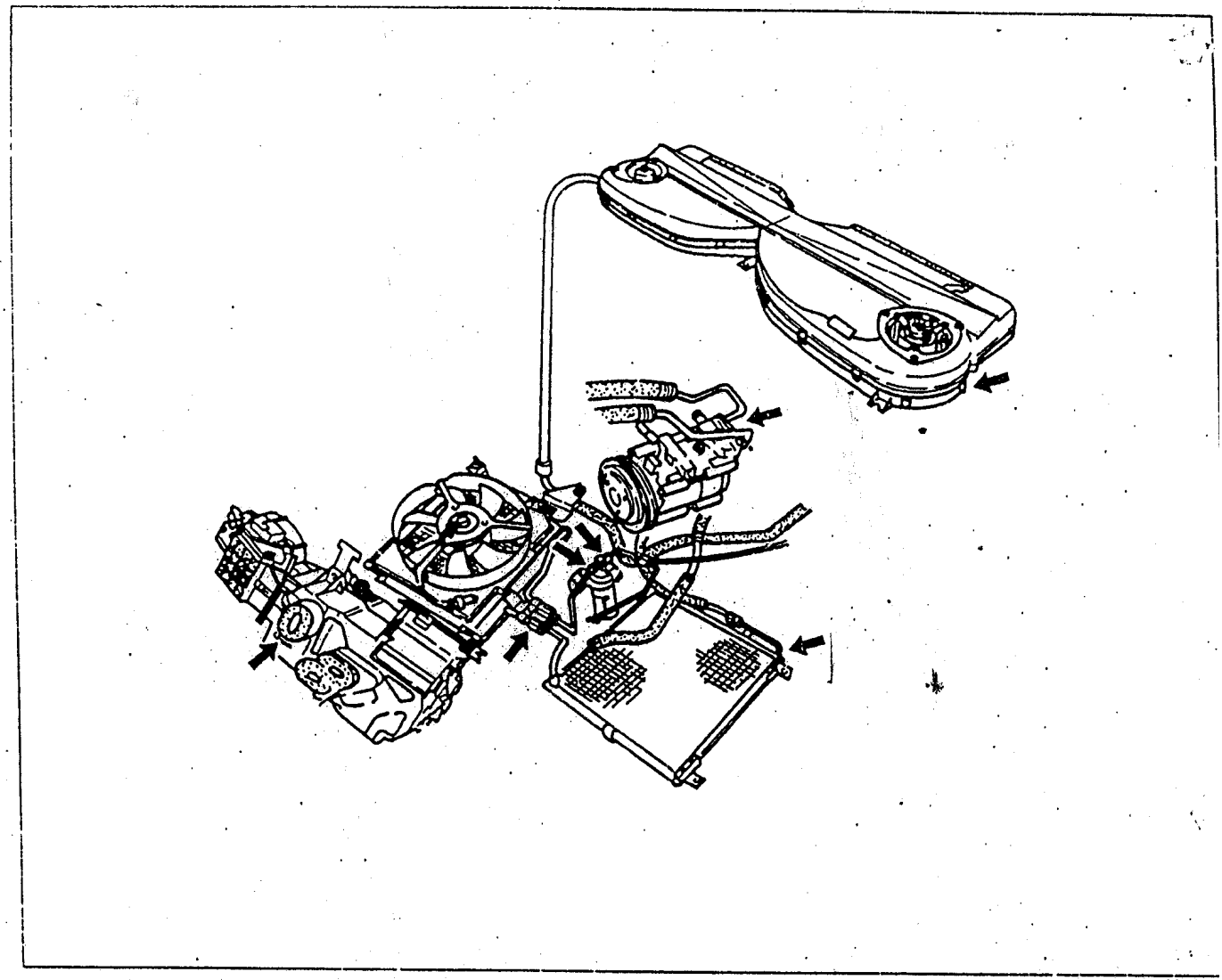
Receiver Drier
Inspect the D.P.S. and plug connection.

Connection Valve
Inspect all valve parts.
Inspect the anti-leakage cap is connected correctly.
Inspect any foreign material in cap.

Inside of Cooling Unit
Insert a leakage detector indicator into the drain hose immediately after stopping engine, and check for leakage(for above about 10 minutes).

Note
- When inspecting the inside of cooling unit, do it after ventilating, since the refrigerant can be leaked in the unit.

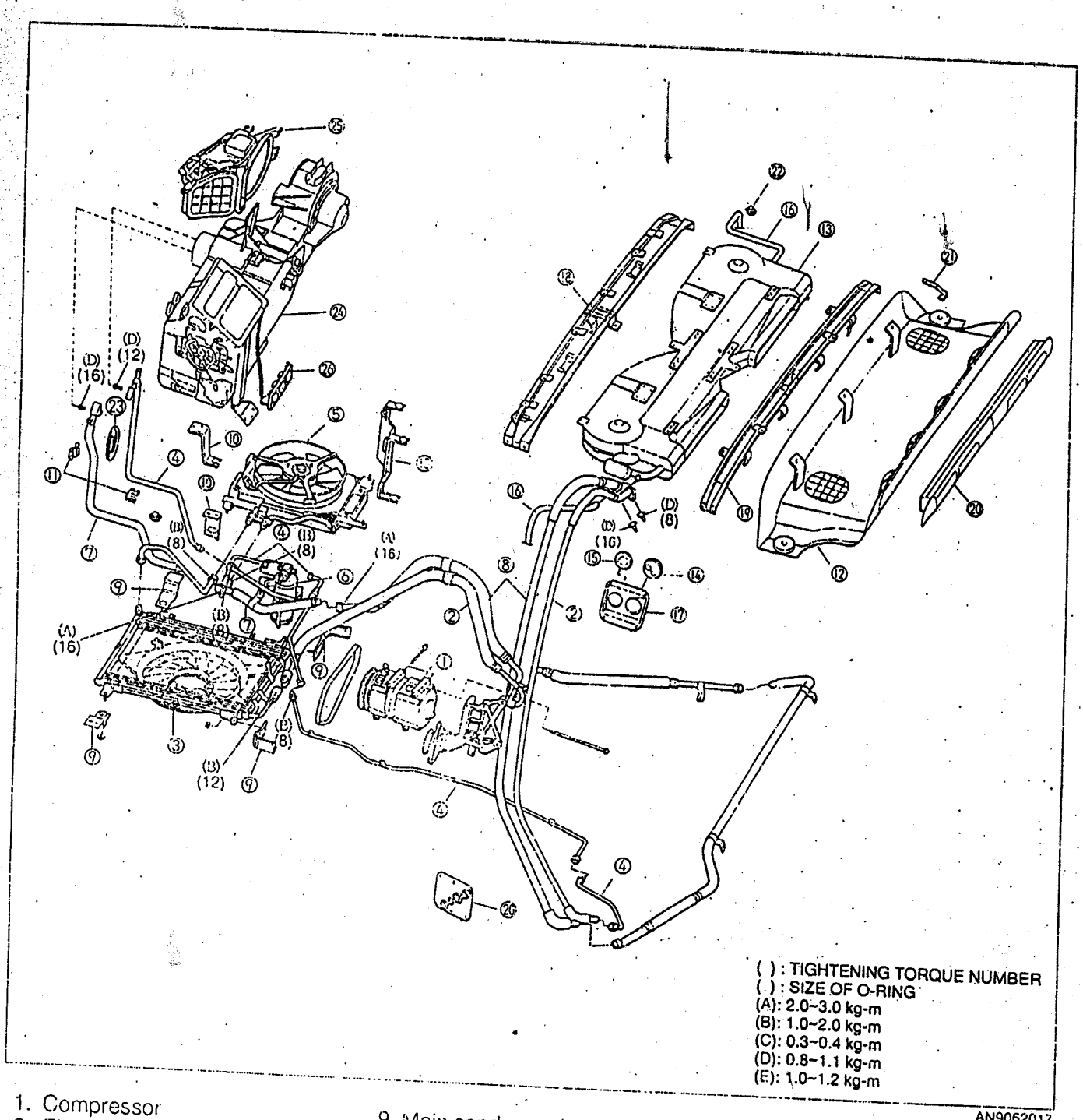
Inspection point



AN906201

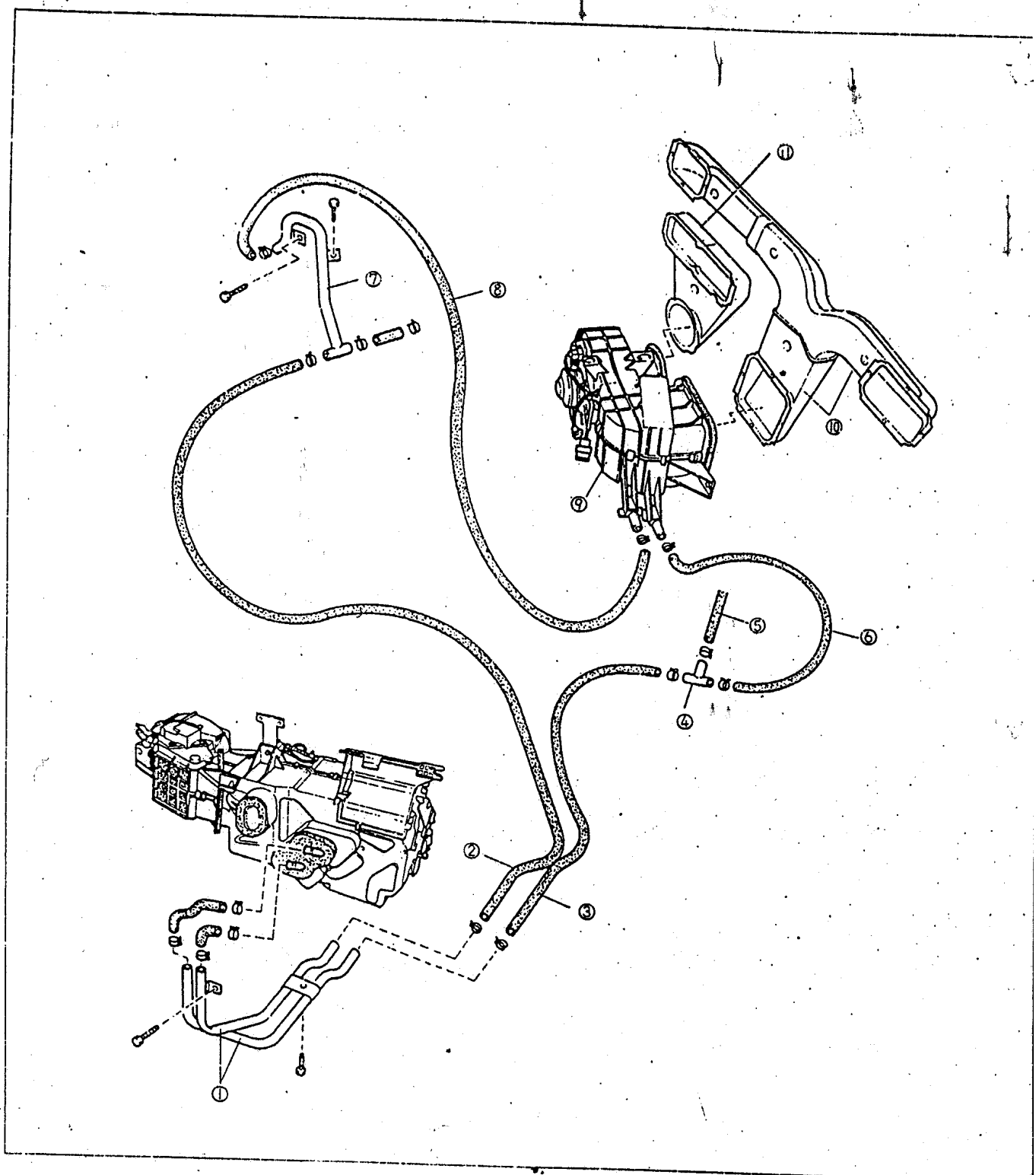
REMOVAL/INSTALLATION

STRUCTURAL VIEW
Front & Rear Cooler



1. Compressor
2. Flexible hose(high pressure side)
3. Main condenser
4. Pipe(high pressure side)
5. Sub condenser
6. Receiver tank assembly
7. Pipe(low pressure side)
8. Flexible fose(low pressure side)
9. Main condenser bracket
10. Sub condenser bracket
11. Clip
12. Rear cooler cover
13. Rear cooler unit
14. Grommet(high pressure side)
15. Grommet(low pressure side)
16. Drain hose
17. Upper cover bracket
18. Front bracket assembly
19. Rear bracket assembly
20. Grille housing
21. Cover bracket(RH)
22. Grommet
23. Dash cover
24. Front HVAC unit
25. Intake duct
26. Front heater control assembly

Heater



AN9062018

1. Front heater pipe assembly
2. Heater hose No.1
3. Heater hose No.2
4. Joint pipe
5. Heater hose No.4
6. Rear heater hose No.2
7. Front heater pipe assembly
8. Rear heater hose No.1
9. Rear heater unit
10. Rear heater duct No.1
11. Rear heater duct No.2

FRONT HEATER CONTROL ASSEMBLY

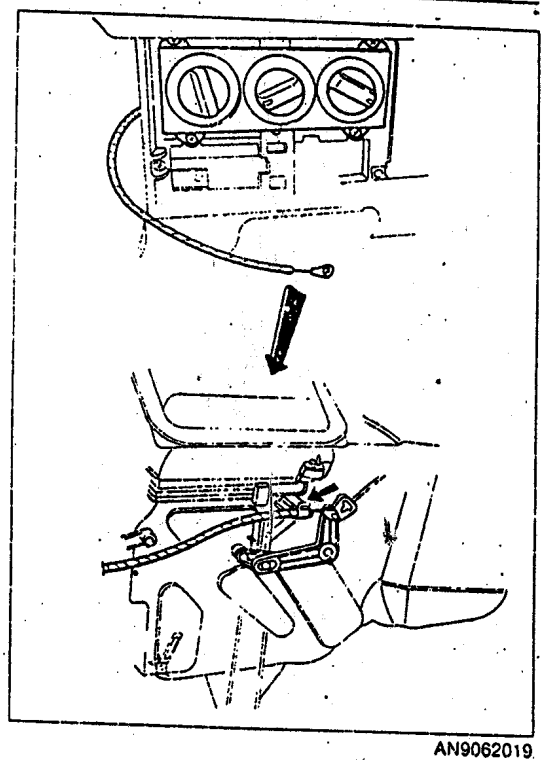
Removal note

Note
- Remove the instrument panel(Refer to Section 60).
- Install in the reverse order of removal.

1. Remove the blower and mode lever connector after removing the lock bolt of front heater control assembly.
2. Remove the temperature control wire from the clip.

Installation note

1. Put the heat control lever on the maximum cooling position.
2. Fix the temperature control wire to the clip while pulling the temperature control lever upto the maximum cooling position.
3. Inspect the control lever for smooth moving, correct maximum cooling/heating position.

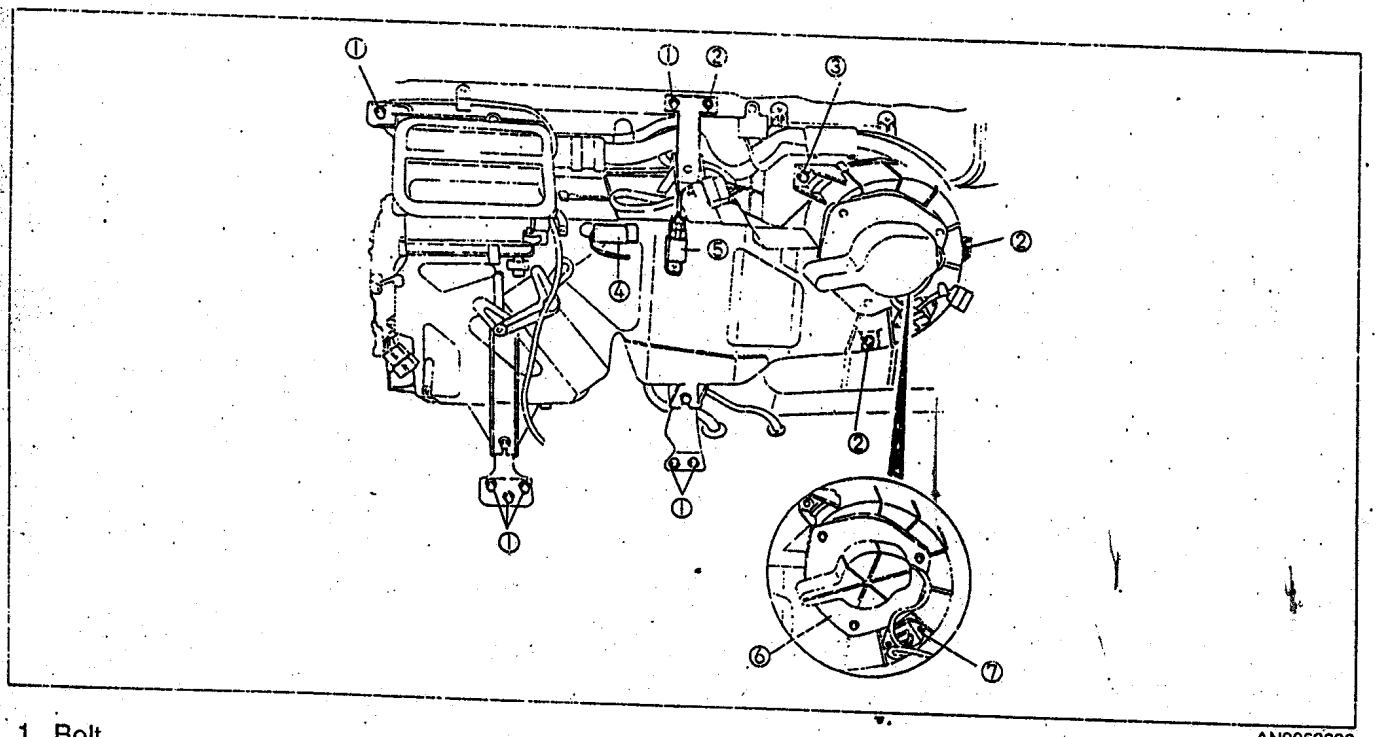


AN9062019

HVAC UNIT

Removal note

1. Drain the engine coolant.
2. Remove the instrument panel.
3. Do the refrigerant related work.
4. Install in the reverse order of removal.

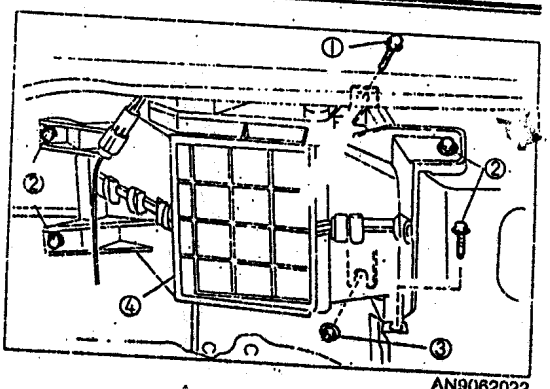


AN9062020

1. Bolt
2. Nut
3. Bolt(tightened with the intake duct assembly together)
4. Thermostat
5. Front air con relay
6. Blower motor
7. Resistor

Intake duct assembly

1. Remove bolts and nuts as shown in the figure after removing the head lamp and shroud panel.
   ① Bolt (tightened with HVAC unit)
   ② Bolt
   ③ Nut
   ④ Intake duct assembly

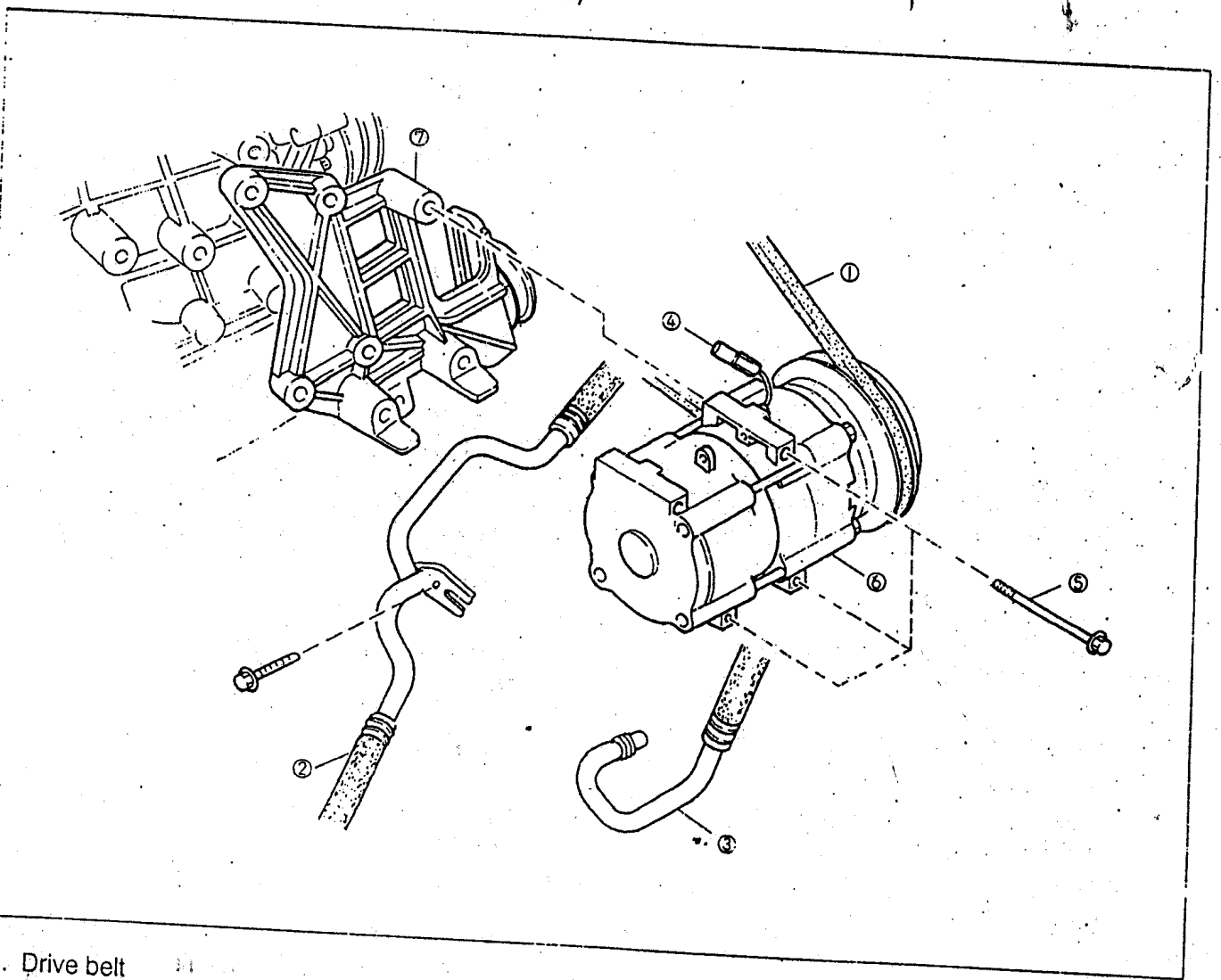


AN9062022

COMPRESSOR

Removal note

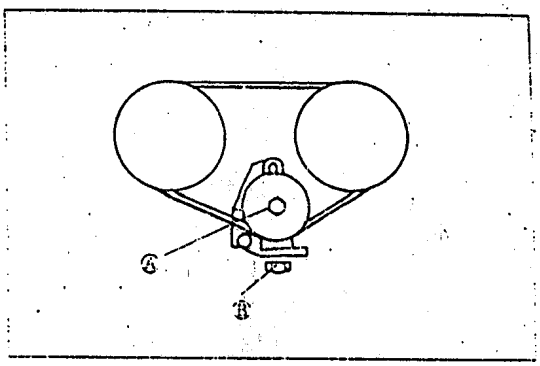
1. Remove the battery negative cable.
2. Remove the service cover. (Refer to Section 10)
3. After removing the magnetic clutch connector, remove the heater hose and alternator. (Refer to Section 32)



AN9062023

1. Drive belt
2. Low pressure hose
3. High pressure hose
4. Connector
5. Bolt
6. Compressor
7. Compressor bracket

ADJUSTMENT OF TENSION



AN9062024

Note
- New one means one used within 5 minutes.

1. Check the belt deflection by applying moderate pressure 10kg(98N) midway between the pulleys.

   Deflection
   New one : 8~9 mm (0.31~0.35 in)
   Used one : 9~10 mm (0.35~0.39 in)

2. If it is beyond specification, adjust the tension after loosening the mounting bolt Ⓐ and turning the adjusting bolt Ⓑ.

Handling of compressor oil

If the compressor oil is insufficient, it causes the compressor to be stuck due to the failure of lubrication, if it is too much, it causes the failure of cooling. In following case, inspect the oil amount, and replace or add it.

- When oil is leaked due to the refrigerant leakage in system.
- When the refrigerant leakage is suddenly discharged in system.
- When any related components is replaced.

Caution
- The compressor oil for new refrigerant(R-134a) should be definitely used.
- Do not let moisture, dust or metal chip etc. of foreign material flow into.
- Store the compressor oil in a steel can, in order to avoid moisture intrusion (Do not use any poly-container).
- Plug any opening with cap or vinyl tape immediately after replacing components.
- Add following amount of the compressor oil when replacing the related components.

Replaced components	Amount of oil(cc)
Condenser	50
Cooling unit(Evaporator core)	30
Receiver drier	30
Refrigerant piping	10

Caution
- Before replacing components, do operation for returning oil. (Refer to page 62-11)

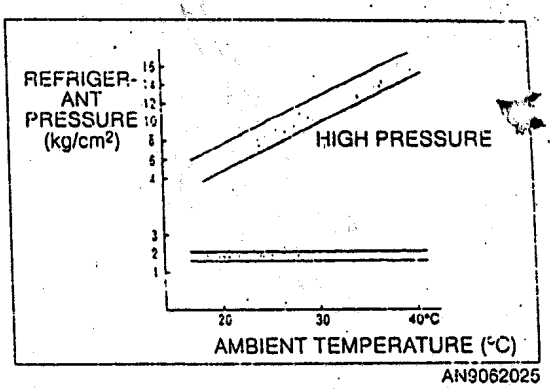
If the compressor is replaced, evacuate following amount of the compressor oil from the new compressor and add the remainder.

Oil amount : 265 -
(Amount left in old compressor + (15~20))

TROUBLESHOOTING GUIDE

INSPECTION OF REFRIGERANT PRESSURE

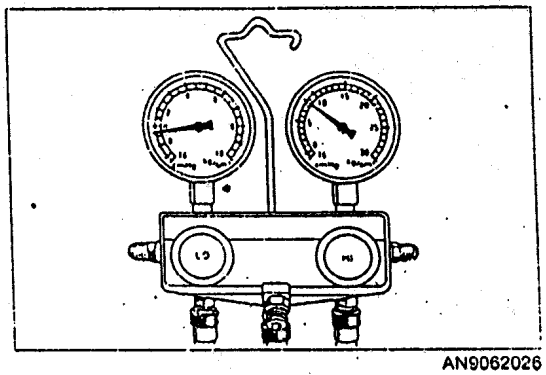
1. Open all doors and windows in service area.
2. Install the manifold gauge set.
3. Start engine and keep the speed at 2,000 rpm.
4. After turning the air conditioner on, keep it at about 18°C.
5. Inspect the high and low refrigerant pressure.
6. Check if the high and low refrigerant pressure keep status as shown in the figure.



AN9062025

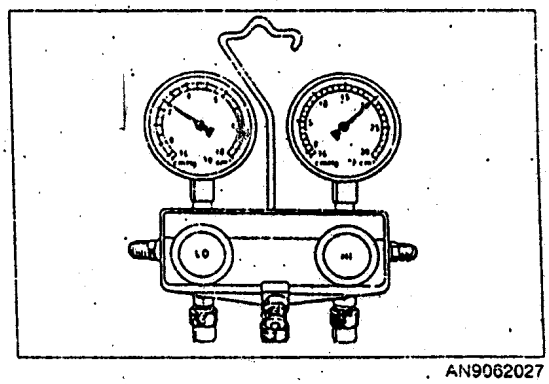
1	High pressure side : 8.0~10.0kg/cm²(114-142psi), Low pressure side : 1.0kg/cm²(14psi)
[Troubleshooting hint] • Insufficient refrigerant	

Step	Inspection		Actions
1	Inspect leakage of refrigerant or contamination at the pipe connection.	Yes	Tighten again. (Refer to page 62-16)
		No	Go to next step.
2	Inspect leakage of refrigerant in pipe and refrigerant system by using a leakage detector.	Yes	Repair the leakage.
		No	System is OK. Add refrigerant.


AN9062026

2	High pressure side : above 23kg/cm²(327psi), Low pressure side : about 2.5~3kg/cm2(36psi)
[Troubleshooting hint] • Overcharged refrigerant • Frozen condenser	

Step	Inspection		Actions
1	Inspect the condenser fin for any the condenser disforma-tion or contamination	Yes	Clean, repair or replace.
		No	Refrigerant is overcharged.

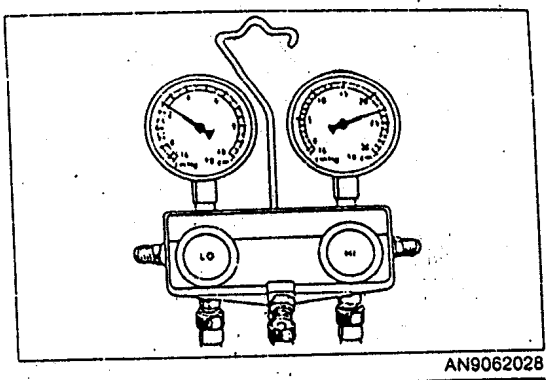

AN9062027

3	High pressure side : about 20~25kg/cm²(327psi), Low pressure side : 2.5~3.5kg/cm²(36psi)

[Troubleshooting hint]
- Air in system

Discharged refrigerant → Vacuum → Charge refrigerant
(Refer to page 62-11)

Note
- When it is operated with air in system for a long time, repair the receiver drier and replace if necessary.

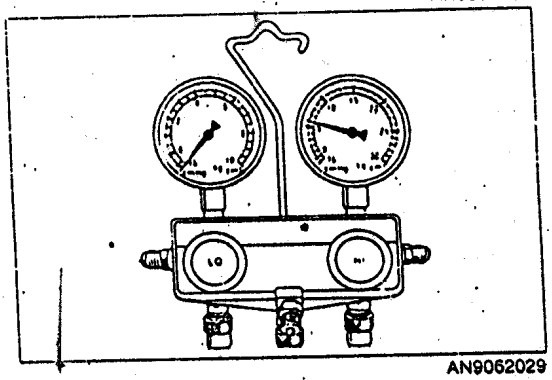


AN9062028

4	High pressure side : above 6kg/cm²(85psi), Low pressure side : about760mmHg (vacuum)

[Troubleshooting hint]
- Refrigerant gas is not circulated.

Step	Inspection		Actions
1	• After installing the manifold gauge, start engine. • Turn the air conditioner on. • Set the blower switch to 3-speed. • After turning the air conditioner off, wait for 10 minutes. • Measure the high and low pressure again after 5 minutes, and check if it indicates to normal pressure. High pressure : 13.0~19.0 kg/cm² Low pressure : 1.5~3.3 kg/cm²	Yes	Moisture in system Replace the receiver drier.
		No	Foreign material in system. Replace the expansion valve.



AN9062029

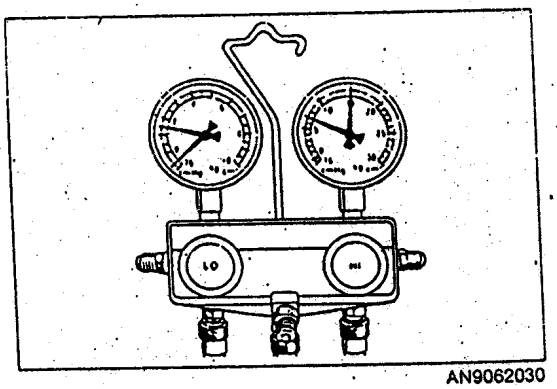
5	High pressure side : 6~18kg/cm²(100~256psi), Low pressure side : 500mmHg(vacuum) Wobbled Needle

[Troubleshooting hint]
- Refrigerant gas is not circulated because the expansion valve is frozen due to moisture in system.

Caution
- Inspect the pressure of refrigerant carefully, because the pressure can be normally indicated when moisture in system is frozen.

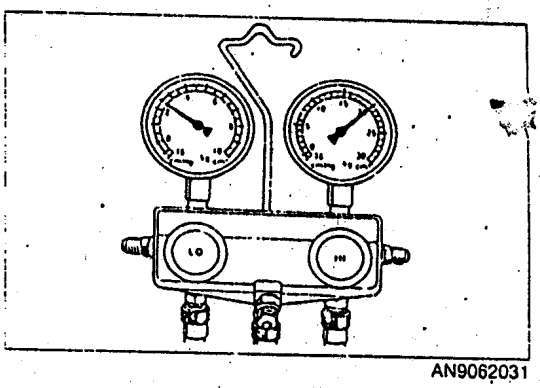
Discharged refrigerant → Vacuum → Charge refrigerant

Note
- If the pressure is not good even after refrigerant related work, Replace the receiver drier.



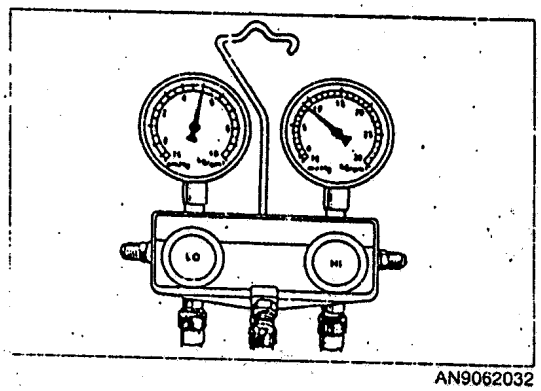
AN9062030

6	High pressure side : 22.0~23.0kg/cm²(313~327psi), Low pressure side :2.5kg/cm²(36psi)		
[Troubleshooting hint] • The pressure of refrigerant has problem due to failure of the expansion valve or sensing bulb.			
Step	**Inspection**		**Actions**
1	Inspect the installation of sensing bulb.	Yes	Replace the expansion valve.
		No	Repair or adjust it.



AN9062031

7	High pressure side : 7.0~11.0kg/cm²(100-156psi), Low pressure side :4.0~6.0kg/cm²(57-85psi)
[Troubleshooting hint] • The pressure of refrigerant has problem due to insufficient compression of compressor.	
Inspect the compressor and replace if necessary.	



AN9062032

INSPECTION

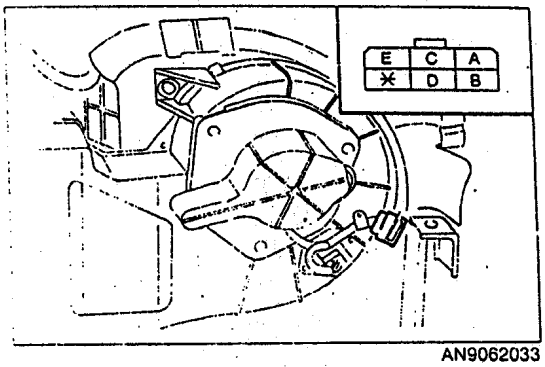
HVAC BLOWER MOTOR

1. Check if the circuit between the terminal A and E is closed, with the ignition switch OFF.
2. Measure the resistance between the terminal A and B.

   Resistance : 0~5 Ω
3. Measure the resistance between the terminal A and C.

   Resistance : 1~3 Ω
4. Measure the resistance between the terminal A and D.

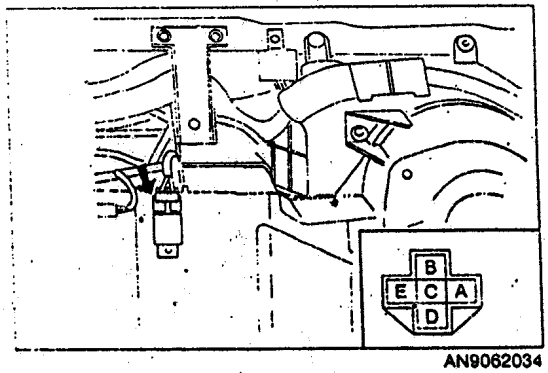
   Resistance : 2~5 Ω



AN9062033

FRONT AIR CON RELAY

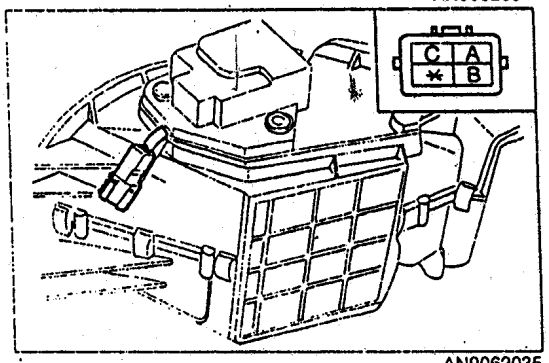
1. Check if the circuit between the terminal A and E is closed, with the ignition switch OFF.
2. After applying 12V of voltage between the terminal A and E, check if the battery voltage appears on between the terminal B and body.
3. After applying 12V of voltage between the terminal A and E, check if the battery voltage appears on between the terminal C and body.



AN9062034

INTAKE ACTUATOR

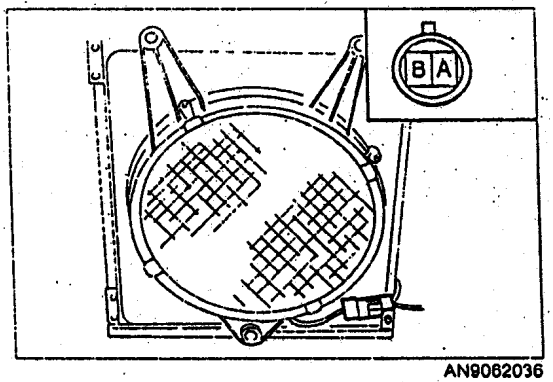
1. After applying battery voltage between the (+) terminal of C and (-) terminal of A, check if the intake actuator rotates in fresh mode.
2. After applying battery voltage between the (+) terminal of C and (-) terminal of B, check if the intake actuator rotates in recirculation mode.



AN9062035

MAIN CONDENSER

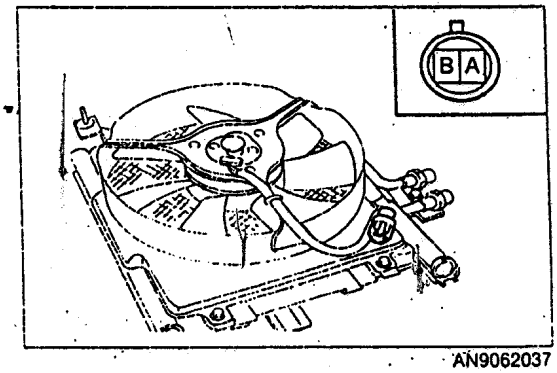
1. Check if the circuit between the terminal A and B is closed, with the ignition switch OFF.



AN9062036

SUB CONDENSER

1. Check if the circuit between the terminal A and B is closed, with the ignition switch OFF.



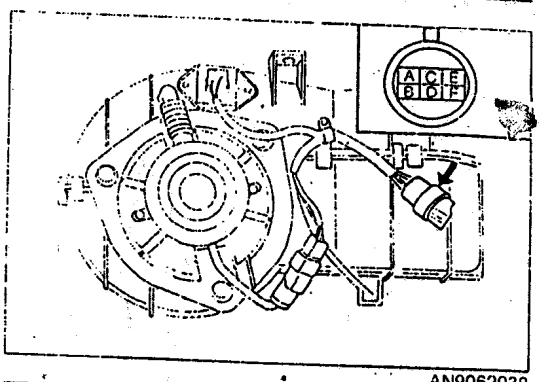
AN9062037

REAR HEATER RELAY, BLOWER MOTOR AND RESISTOR ASSEMBLY

1. Check if the circuit between the terminal B and C is closed, with the ignition switch OFF.
2. Measure the resistance between the terminal D and E by using an ohmmeter.

   Resistance : 0~6 Ω
3. Measure the resistance between the terminal D and F by using an ohmmeter.

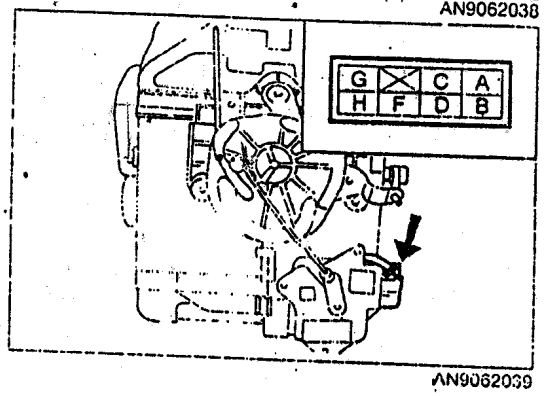
   Resistance : 1~8 Ω



AN9062038

MODE ACTUATOR

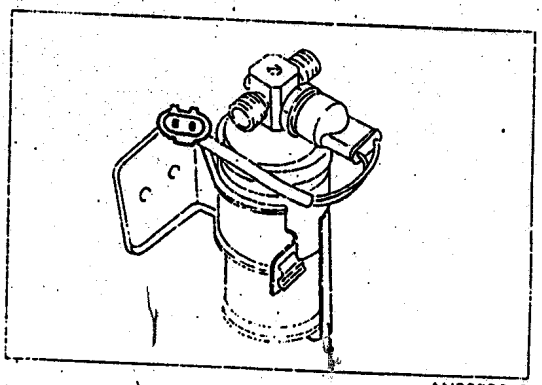
1. After applying battery voltage to B terminal (+) and D, F terminal (-), check if it rotates in the vent mode.
2. After applying battery voltage to B terminal (+) and D, H terminal (-), check if it rotates in the bi-level mode.
3. After applying battery voltage to B terminal (+) and D, A terminal (-), check if it rotates in the heat mode.
4. After applying battery voltage to B terminal (+) and D, C terminal (-), check if it rotates in the def / heat mode.
5. After applying battery voltage to B terminal (+) and D, G terminal (-), check if it rotates in the def mode.



AN9062039

DUAL PRESSURE SWITCH

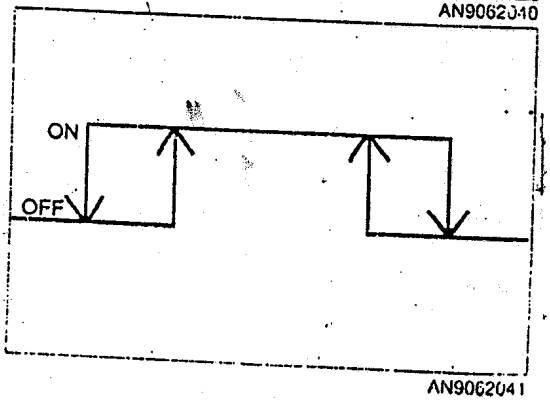
1. After connecting the manifold gauge set, check if the pressure of high pressure side indicates 2.1~21 kg/cm² (30~299 psi).
2. After disconnecting the dual pressure switch connector, check if the circuit between two terminals is closed.
3. If it is not closed, replace the dual pressure switch.



AN9062040

Note

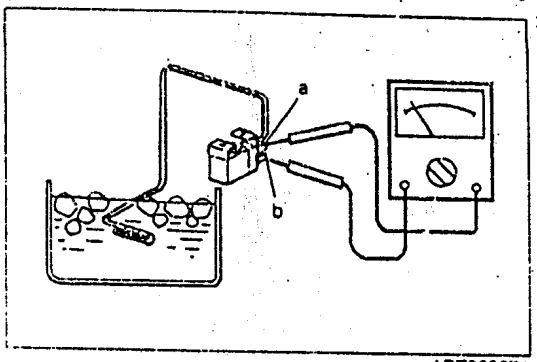
- **In order to protect a component, turn the magnetic clutch off if the pressure of refrigerant is abnormally high(3136±196 kPa, 32±2 kg / cm², 455±28 psi) or low(196±20 kPa, 2±0.2 kg / cm², 28±2.8 psi).**



AN9062041

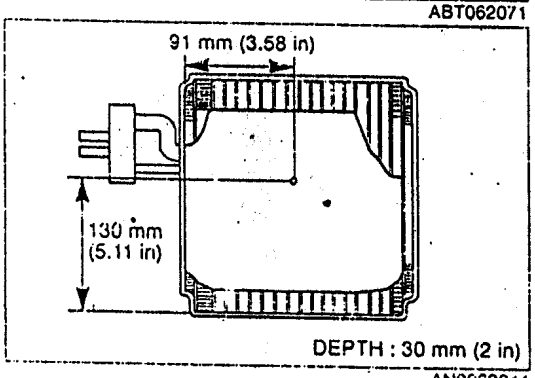
THERMOSTAT

1. After putting the sensing bulb into water, inspect the continuity at above 4°C(39°F) and replace the thermostat if necessary.



ABT062071

INSTALLATION POSITION OF THERMOSTAT



AN9062044

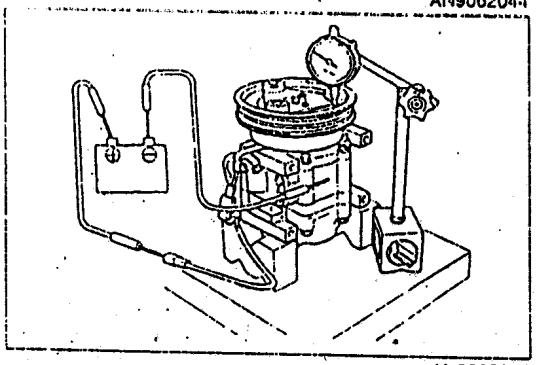
COMPRESSOR

Clearance

Measure the clearance between the pressure plate and the rotor pulley in following steps.

1. Put the compressor onto the block gauge.
2. After putting the dial gauge indicator onto the pressure plate, measure the clearance between the pressure plate and the pulley with the battery voltage applied.

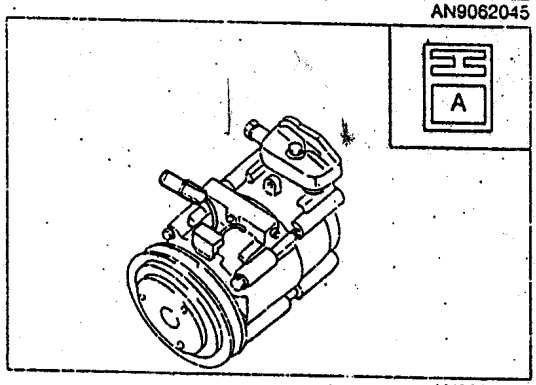
   Clearance : 0.5±0.2 mm (0.02±0.008 in)



AN9062045

MAGNETIC CLUTCH

1. Inspect the continuity between each terminal of the stator.
2. Replace the stator if it is not closed.



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