

ENGINE 4H SERIES

SECTION 6A3 ENGINE

(4HF1 / 4HF1-2 / 4HE1-TC / 4HG1 / 4HG1-T)

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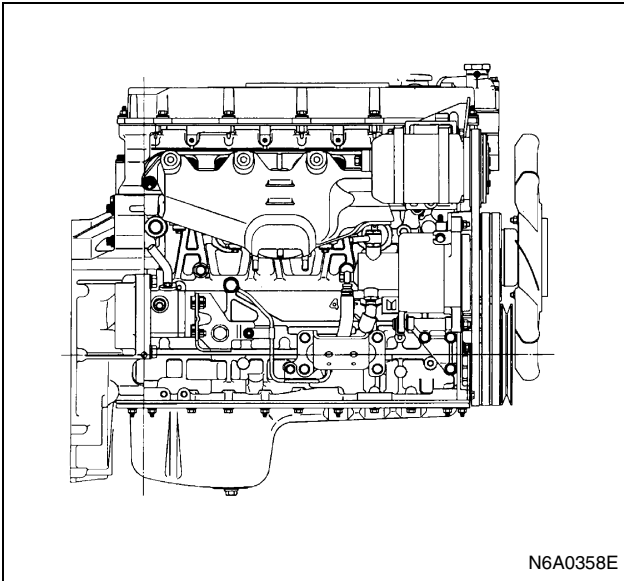
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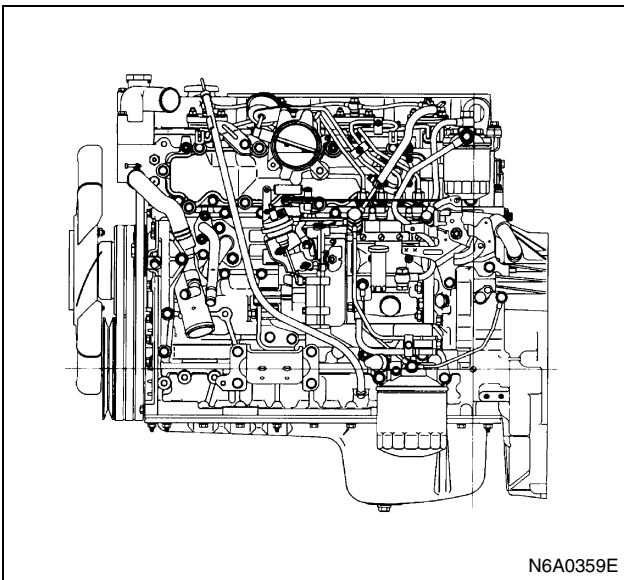
GENERAL DESCRIPTION

The engine is a four-cycle, four-cylinder, in-line, direct fuel injection type diesel engine with the piston displacement of 4,334 cc. It features a gear driven OHC (over-head camshaft) timing train and the unique mechanisms and systems designed for outstanding cleanness, economy and durability. Its torque characteristics promise dynamic ride at high speed, high power at low speed, and smooth and continuous torque at medium to high ranges.

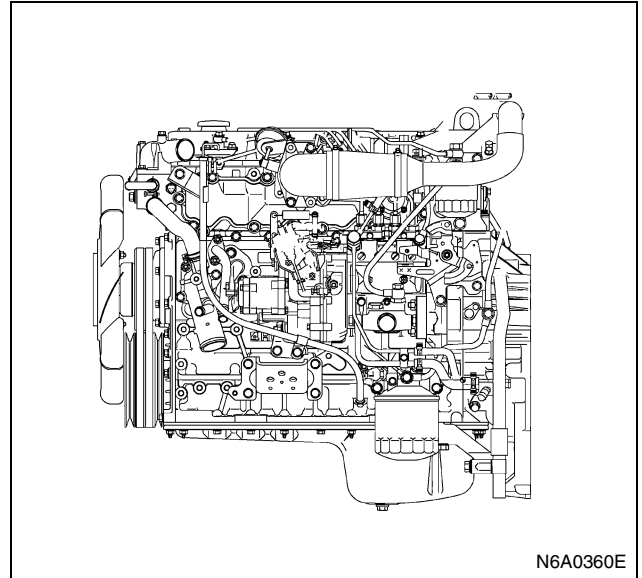
For 4HF1



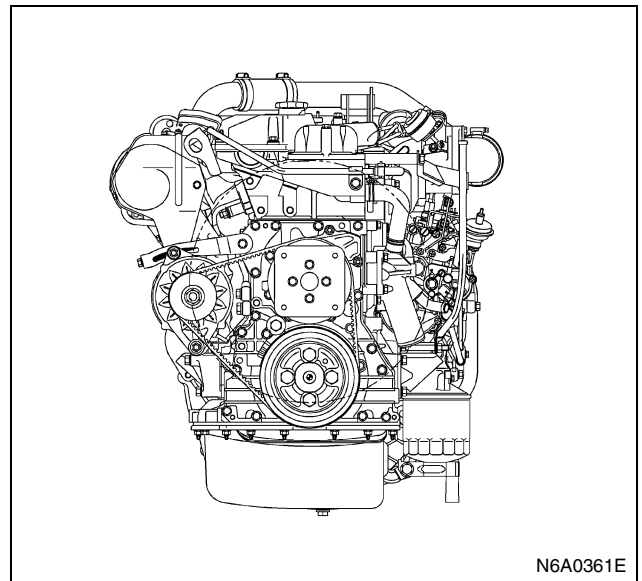
For 4HF1



For 4HG1-T

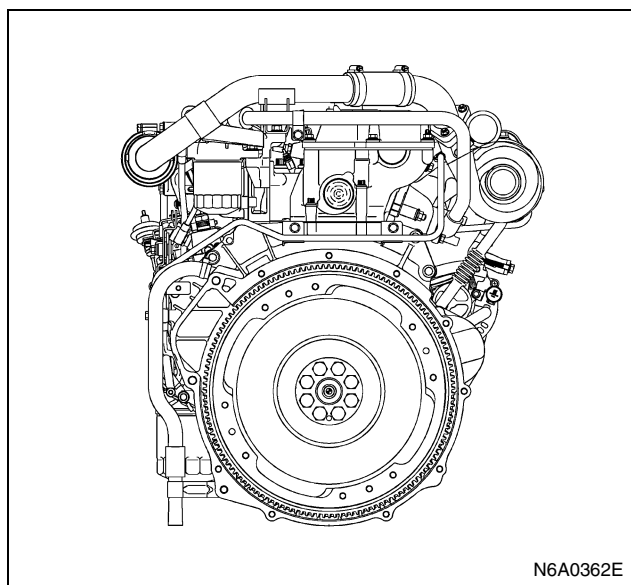


For 4HG1-T

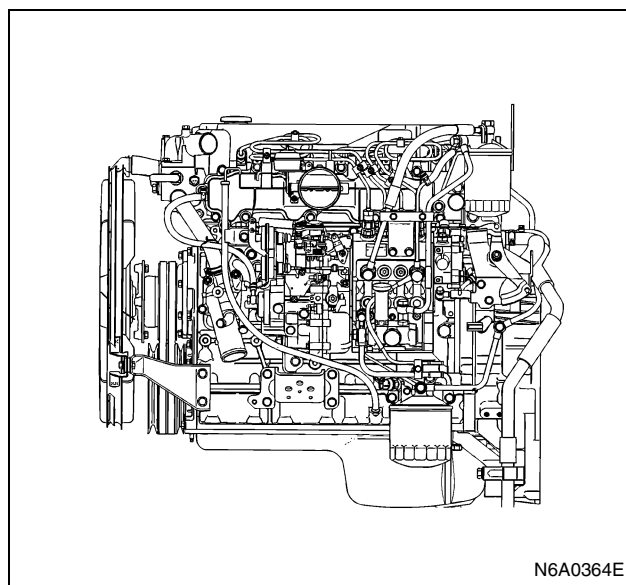


6A3-4 ENGINE (4HF1 / 4HF1-2 / 4HE1-TC / 4HG1 / 4HG1-T)

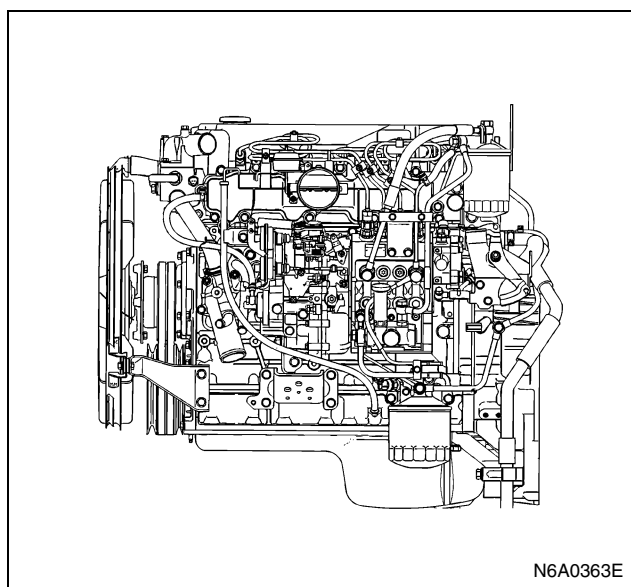
For 4HG1-T



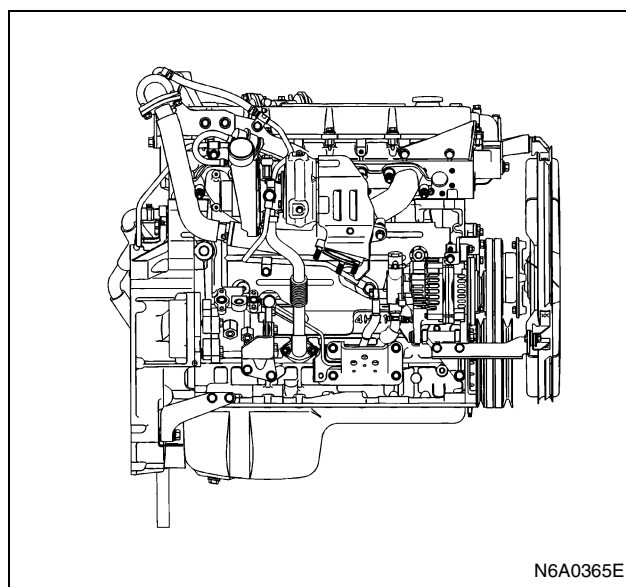
For 4HE1-TC (4HE1-XS) 98EPA

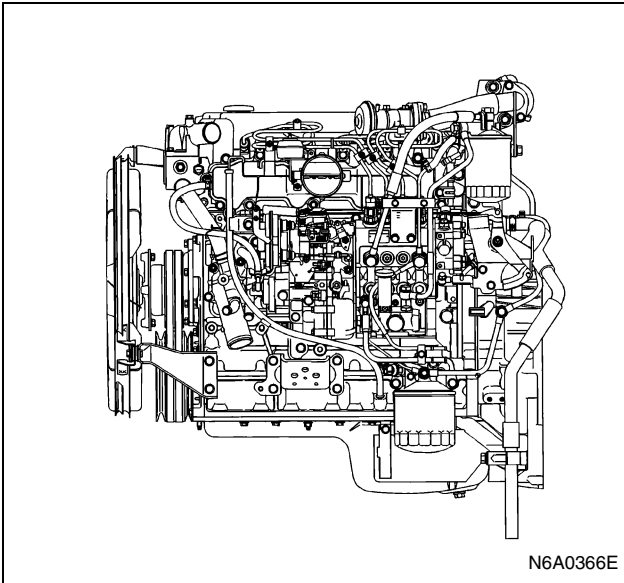
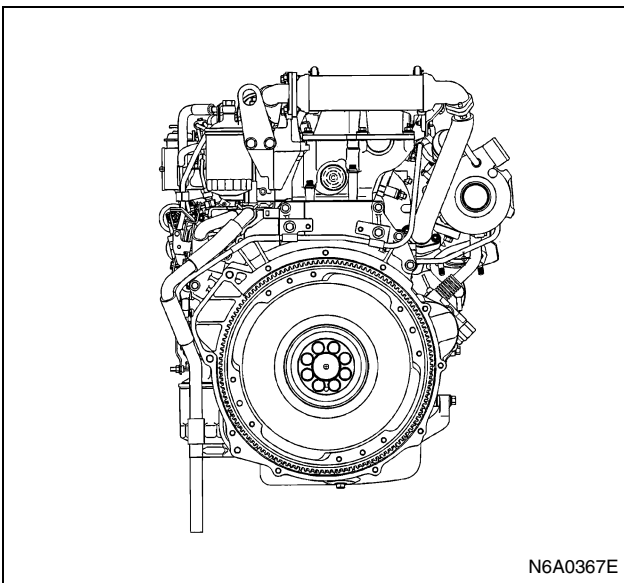


For 4HE1-TC (4HE1-XS) 98EPA



For 4HE1-TC (4HE1-XS) SPEC. EURO3

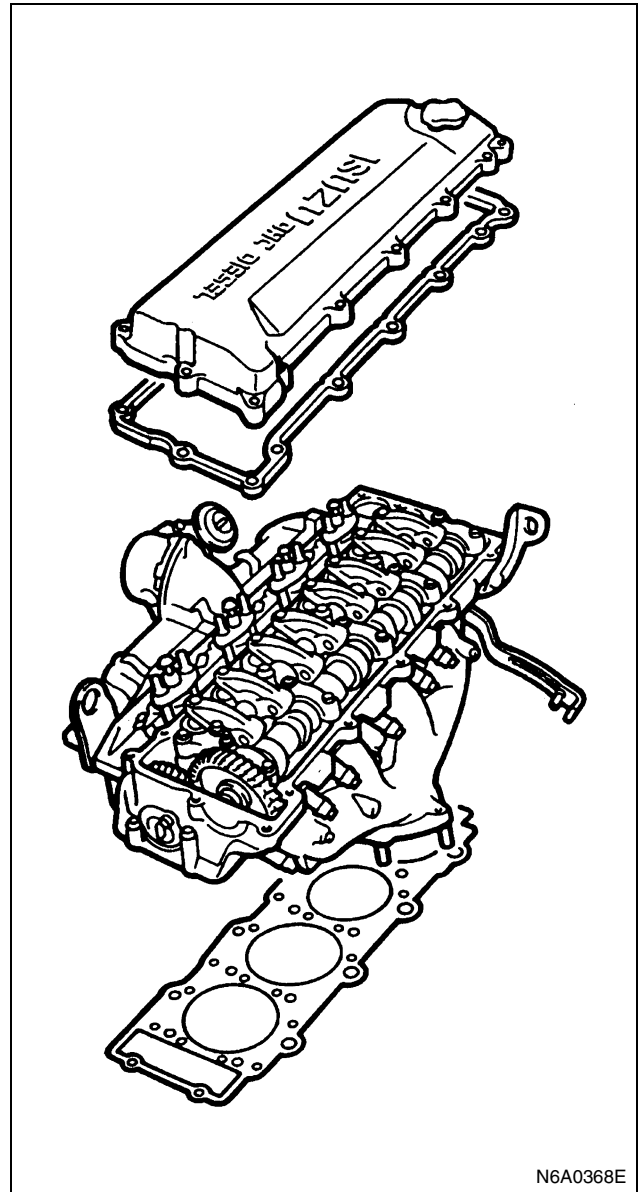


For 4HE1-TC (4HE1-XS) SPEC. EURO3**For 4HE1-TC (4HE1-XS) SPEC. EURO3****Cylinder Head**

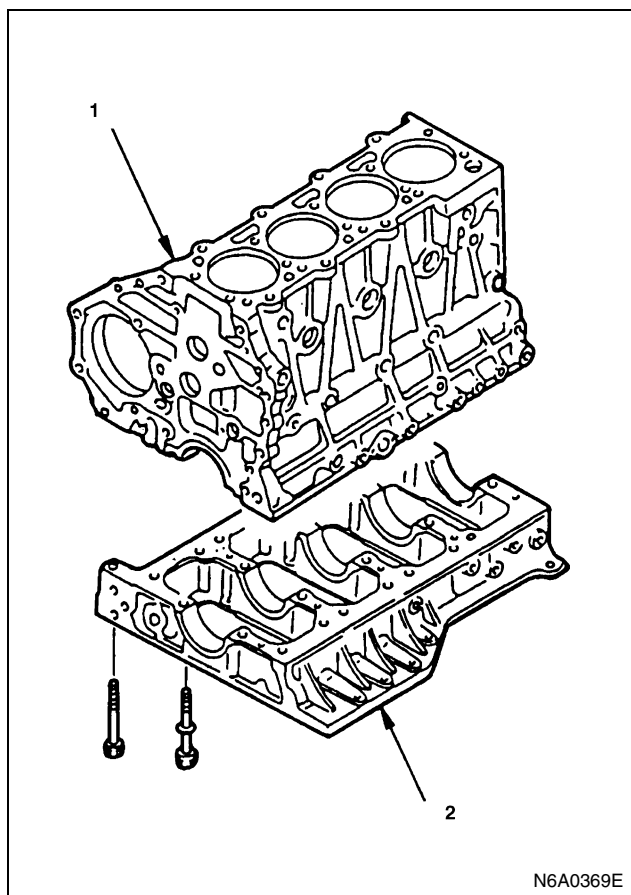
- The cylinder head is made of cast iron and has a crossflow layout with the intake system in the left side and the exhaust system in the right side, designed to reduce resistance in the intake and exhaust systems.
- The valve diameter is increased to offset the mass of the valve operating system reduced by the introduction of the OHC mechanism. In addition, the intake and exhaust ports are put in a smoother and less resistant layout to enhance intake and exhaust efficiency.
- The cylinder head gasket is of the laminated steel of least fatigue in combination with the angular cylinder head bolt tightening method, equally designed to increase reliability against gas and water leakage, in addition, selective assembly of gaskets of various thicknesses minimizes the wasted

space between the piston and the cylinder head to maintain performance at a high level.

- The cylinder head cover is made of aluminum to reduce noise.

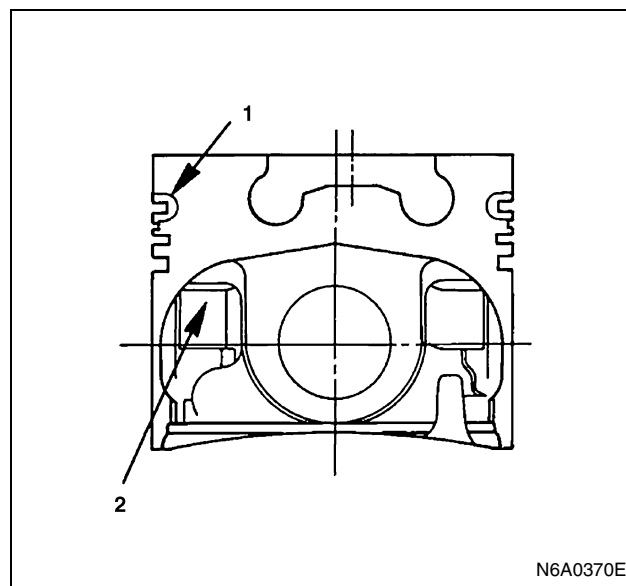
**Cylinder Block**

- The cylinder block (1) is made of cast iron having dry cylinder liner and five bearings. The bearing cap has a ladder frame (2) construction integrating the crankcase to increase rigidity.
- The cylinder liner is made of thin iron plus special alloys and is combined with the chrome-plated piston ring to ensure good resistance against wear.
- The oil pan is made of vibration-damping steel to reduce noise.



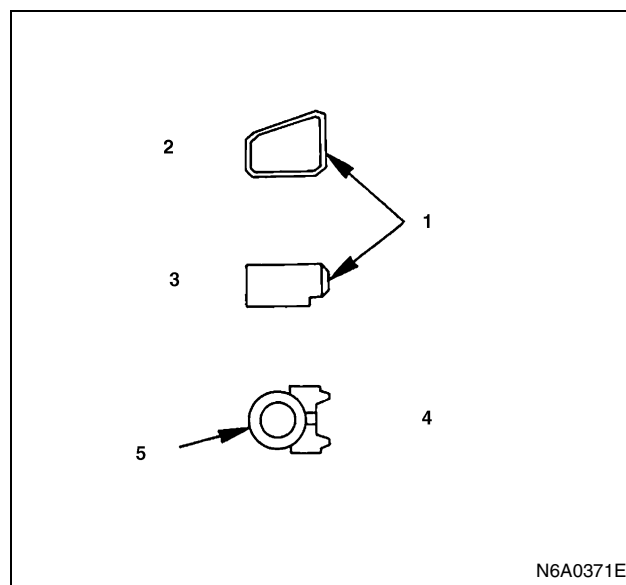
Piston, Connecting Rod and Crankshaft

- The piston is made of aluminum alloy. A ring trigger is cast into the top ring groove and chrome plating is applied to four sides of the top ring to ensure sufficient strength and wear resistance of the ring and the ring groove. The piston bottom has a thermal flow shape to increase cooling efficiency of the oiling jet. This design reduces thermal load while increasing rigidity (see figure).
- The combustion chamber has a square shelf of proven performance to ensure outstanding stability in exhaust gas control (see figure).
- The autothermic piston and offset piston pin reduces piston flapping and other noise.



Legend

1. Ring trigger
2. Strut

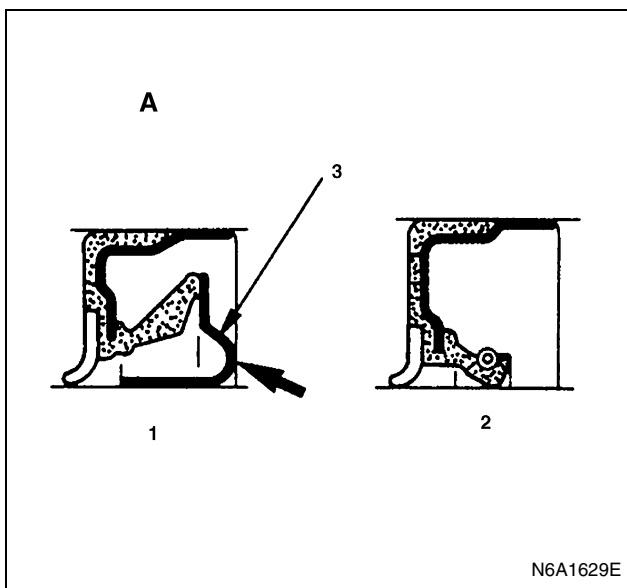


Legend

1. Chrome plated
2. Top ring
3. 2nd ring
4. Nitriding
5. Oil ring expander

- The crankshaft is made of cast carbon steel with five bearings and eight counterweights to reduce revolution load to the bearing. The ladder frame design that integrates the bearing cap and the crankcase increases bearing rigidity. The angular tightening method of the bearing bolt further increases reliability and durability.

- The connecting rod is made of cast carbon steel and the cap is bolted by angular tightening method to maintain reliability.
- The bearing, as well as the crank journal and crank pin bearings, are made of Kelmet metal. Oil clearance is controlled accurately through selective assembly by thickness to reduce noise and increase reliability.
- The crankshaft has the axial type oil seal that drastically improves durability and reliability. Compared with the conventional radial type (lips in a radial orientation), the axial type oil seal has lips in an axial orientation to minimize lip wear. It also precludes lip peeling and damage, spring dislocation and other problems associated with the radial type oil seal (see figure).

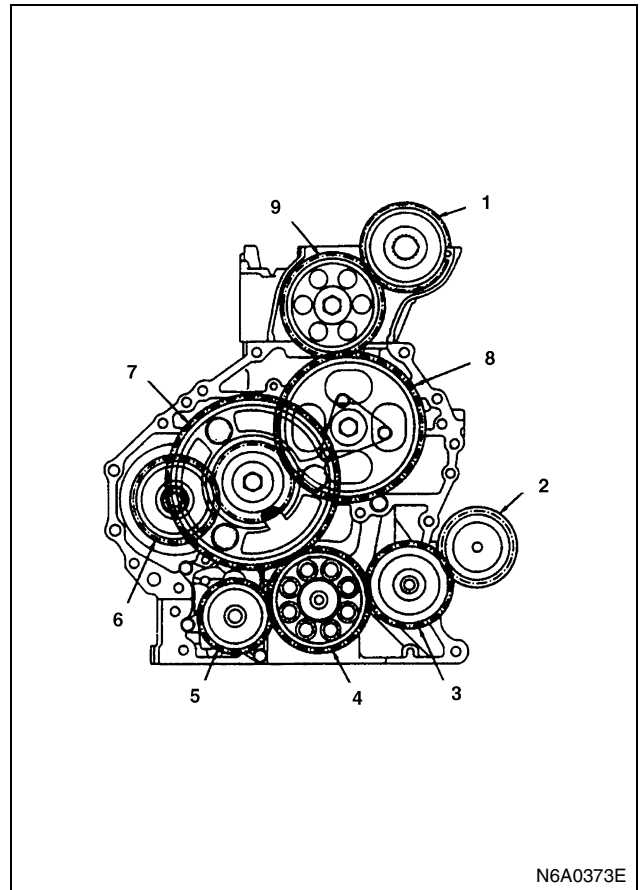


Legend

- A. Crankshaft oil seal
 1. Axial type
 2. Radial type
 3. Slinger

Valve Train

- The gear train is located at the end of the cylinder block to minimize influence of the torsional vibration of the crankshaft and the radiant sound. Noise is further reduced, to the same level as a timing belt driven system, by integrating the crank gear with the crankshaft by shrink fit and by careful turning of the gear precision, teeth contact ratio of gear, backlash, bearing rigidity, neutral frequency, etc. (See figure).

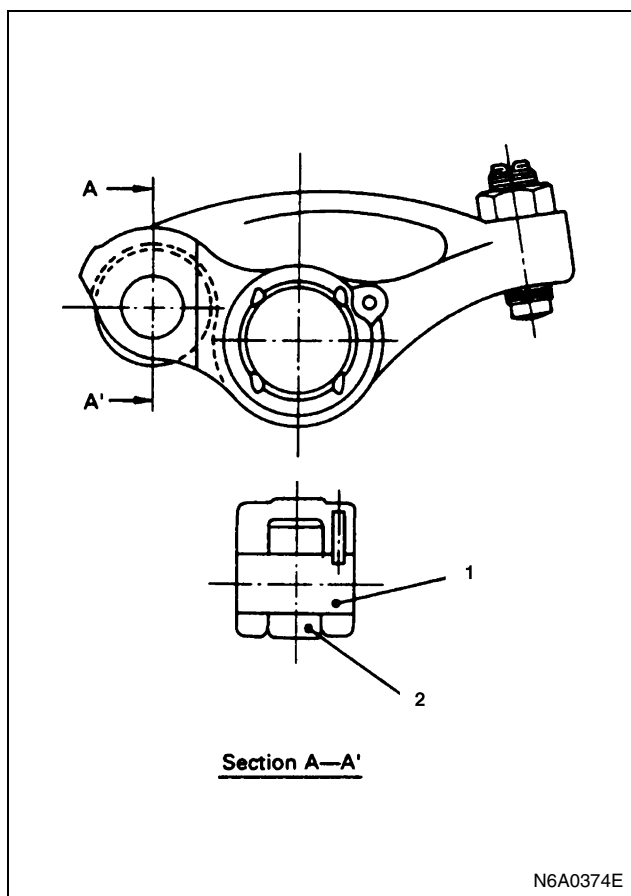


Legend

1. Camshaft gear
2. Power steering pump gear
3. Power steering pump idle gear
4. Crankshaft gear
5. Oil pump drive gear
6. Injection pump gear
7. Idle gear A
8. Idle gear B
9. Idle gear C

- Gears are of the forged type. Gears are tufftrided to secure sufficient durability.
- The camshaft is made of carbon steel with five bearings. The cam's nose and the journal are induction-hardened to secure sufficient durability.
- The cam has a Fourier-dyne profile to maximize the intake and exhaust valve lifts and the valve opening and closing timing is optimized to increase intake and exhaust efficiency.
- The valve spring is a single spring having an egg-shaped cross section to reduce weight while reducing stress. Coupled with the unique cam profile, the spring increases the jump-and bounce-free limit at high-speed operation to provide reserve characteristics.
- The rocker arm is made of diecast aluminum and is of the center pivot type having a roller. This increases reliability while reducing friction and con-

tributes to increased power output and fuel efficiency (See figure).



Legend

1. Pin
2. Roller

- The rocker shaft is chrome plated to secure sufficient durability.

Fuel System

LINE Pump

- The injection pump is of Bosch A type with the plunger outside diameter of 9.5 mm (0.37 in) and cam lift of 9 mm (0.35 in). The plunger has a special notch for advancing the timing at starting.
- The governor is of a mechanical RLD type to ensure sustained power at high speed.
- The timer is of the SCDM (eccentric) type.

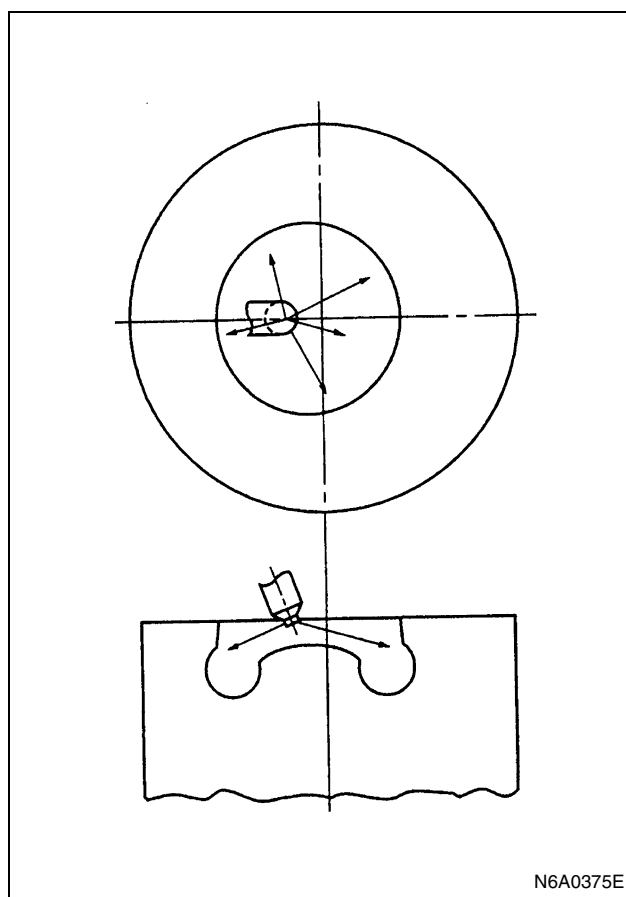
VE Pump

- A Bosch Distributor Type injection Pump is used. A single reciprocating / revolving plunger delivers the fuel uniformly to the injection nozzles, regardless of the number of cylinders.
- The governor, the injection timer, and the feed pump are all contained in the injection pump housing. The injection pump is compact, light weight, and provides reliable high-speed operation.

An android compensator is available as an option for vehicles to be operated at high altitudes. It adjusts the fuel and air mixing ratio.

Injection Nozzle

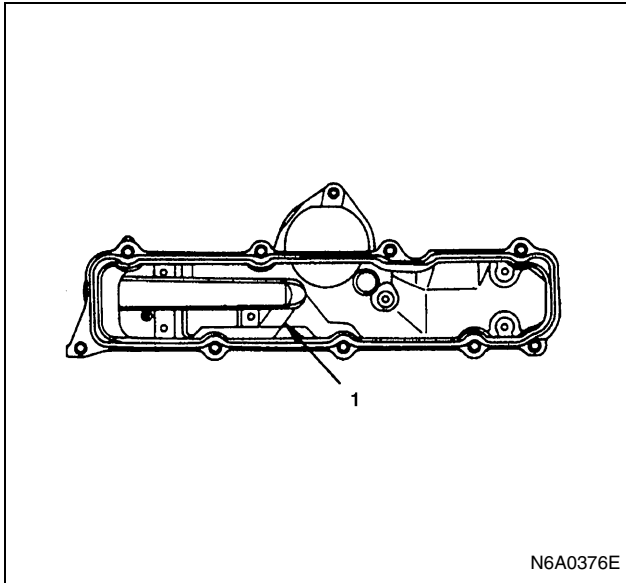
- The injection nozzle is of the P type to bring it as technically close as possible to the center of the combustion chamber. The nozzle inclination is also reduced to minimum to increase combustion efficiency. The nozzle has five jets and the valve opening pressure is set at 185 kg/cm² (2,630 psi, 18,142 kPa) (See figure).



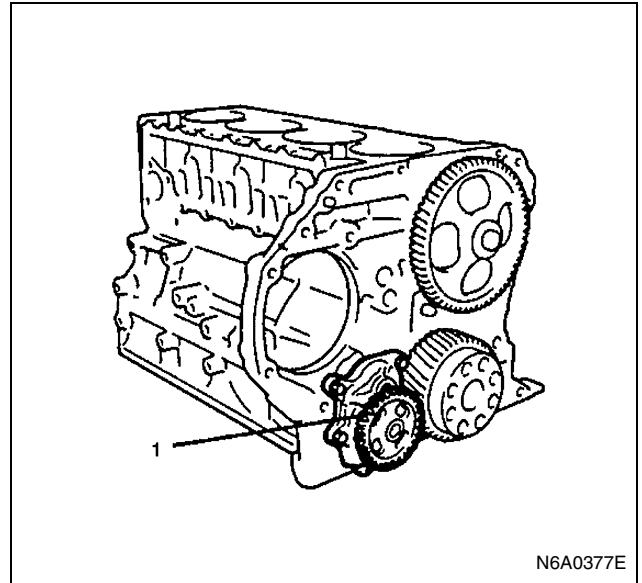
- The injection pipe is laid in such a way that the overall length is minimized to enhance performance.

Intake and Exhaust Systems

- The resin-made intake manifold is of the cover type having an inner cover made of rubber and steel. This design effectively reduces radiant sound and transmitted sound.
- The intake manifold has a straightening vane inside to stabilize swirl and improve performance. It also contains a built-in Positive Crankcase Ventilation (PCV) valve to minimize the overall size (See figure).
- The exhaust manifold is made of cast iron and heat-resisting alloys. Ports are shaped carefully to minimize exhaust resistance.

**Legend**

1. Straightening wall

**Legend**

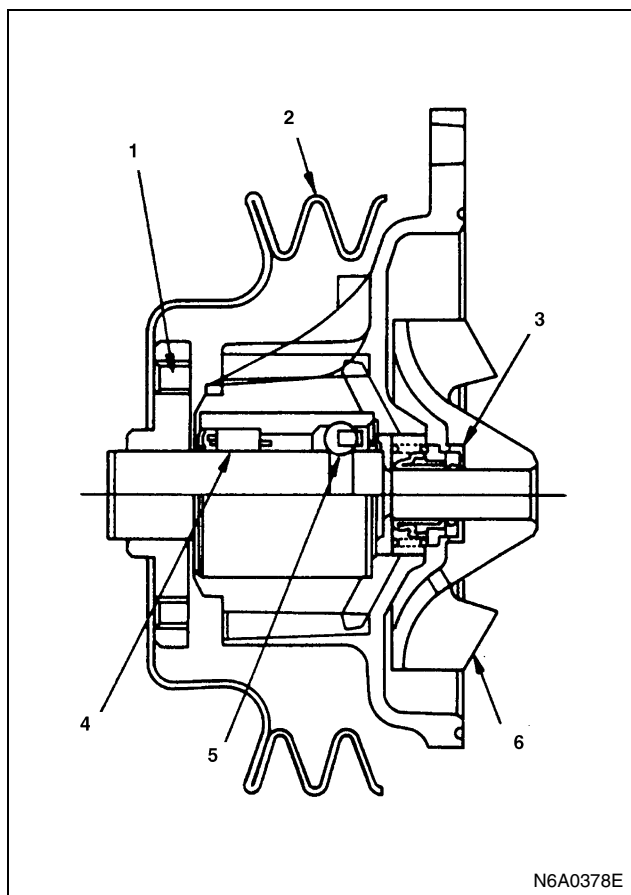
1. Oil pump gear

Lubrication System

- The oil pump is driven by the crank gear directly to increase durability while maintaining sufficient delivery.
The pump body is partially integrated with the cylinder block to reduce the overall size and weight (See figure)
- The oil filter is of the cartridge type integrating the full flow filter and bypass filter as a single unit. This presents several advantages such as an extended interval between oil exchanges and greater ease of maintenance resulting in cost reduction. The bypass valve is fitted to the body itself to avoid flow of foreign matter due to bypassing of oil thereby maintaining sufficient reliability.
- The oil cooler is of a large-capacity, water-cooled and multiple-partition type built into the side of the cylinder block. This design maintains necessary stability in oil temperature. It also has a bypass valve to minimize delay of the oil gallery pressure build-up for cold starting.

Cooling System

- The water pump is driven by a V-belt and the pump body is made of diecast aluminum. Part of the swirl chamber is built into the engine front cover to reduce the overall size and weight.
A sintered carbon type seal unit is chosen to secure reliability. The shaft bearing combines roller bearing and ball bearing to maintain necessary durability. The outlet for draining is located behind the pulley to prevent dust from entering the system as much as possible. (See figure)
- The cooling fan operation is regulated by a temperature-sensitive clutch to enhance fuel efficiency while reducing noise.

**Legend**

1. Fan center
2. Fan pulley
3. Seal unit
4. Roller bearing
5. Ball bearing
6. Impeller

Important Operations**1. Axial Type Oil Seal**

- As crankshaft front and rear oil seals are both axial type, attention must be paid to the following: when replacing, replace oil seal and slinger as a set.
- Be sure to use the special tool correctly since oil seal and slinger must be set accurately in their longitudinal direction.

2. Valve Cap

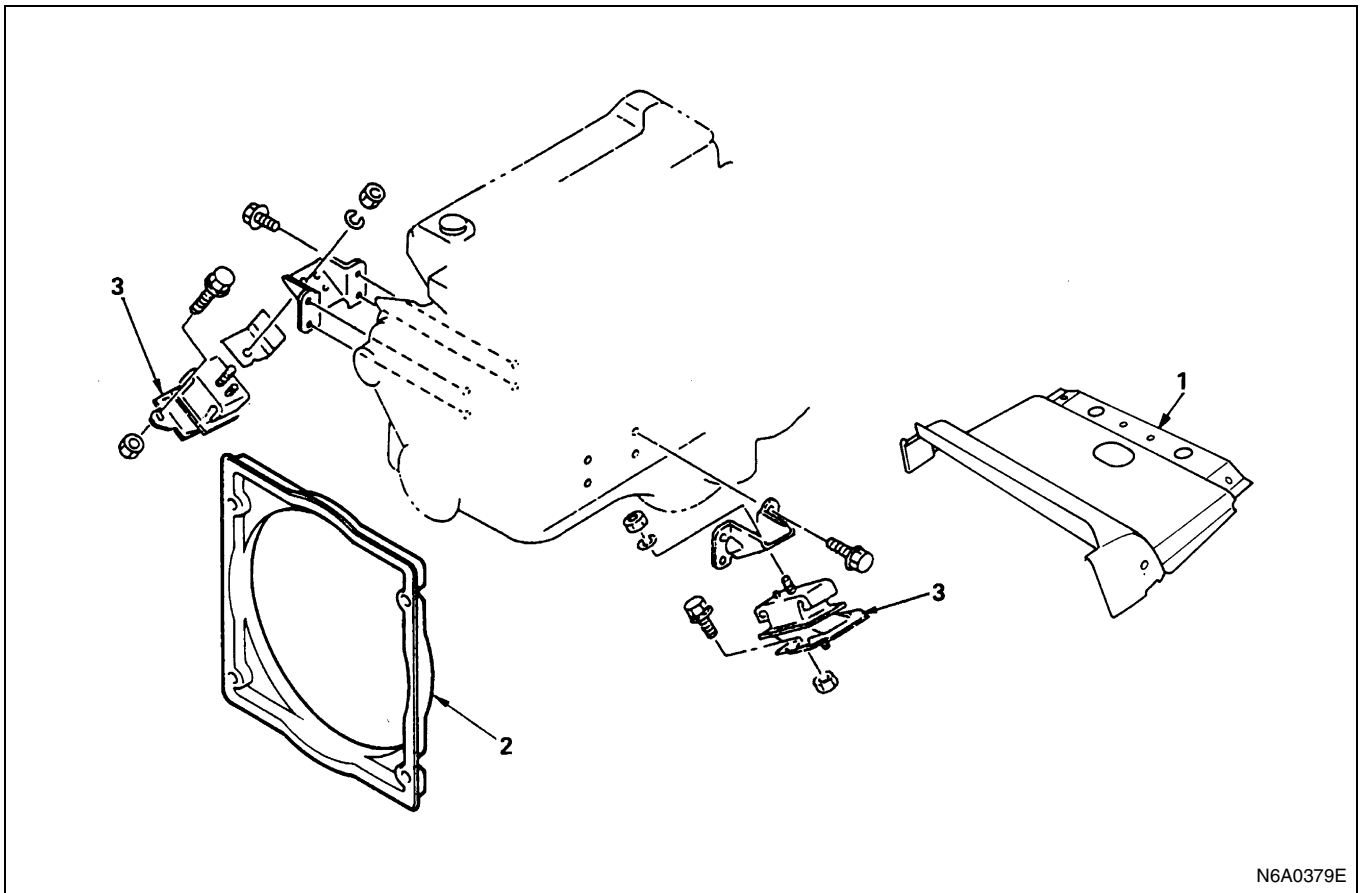
- As intake and exhaust valves have caps, take sufficient care not to let them fall into the gear case or oil return hole during disassembly or reassembly.

3. Application of Liquid Gasket

- Oil pan, crankcase, oil cooler, retainer front, and water pump are not sealed with sheet gasket but with liquid gasket only.
- Prior to application, be sure to remove old hardened liquid gasket or oil from those surfaces to which new gasket will be applied. Further, if the old gasket can hardly be removed, mask such surfaces with gasket remover (Three Bond PANDO-391D; ISUZU Genuine Parts No. 1-8844-0542-0) or equivalent in accordance with the instructions manual.
- Liquid gasket should be applied evenly so that no breaks and omissions may be made. Further, were O-ring is used should not be exposed to liquid gasket.

4. Plastic-Region Angular Bolt Tightening Method

- Clamping bolts of connecting rod and cylinder head (M14 only) are tightened by plastic region angular bolt tightening method. This method is applied with bolt threads and setting faces coated with molybdenum disulfide grease.

ENGINE MOUNT (RH,LH)**Component****Legend**

1. Transmission panel
2. Fan guide

3. Engine mount

Removal**Preparation**

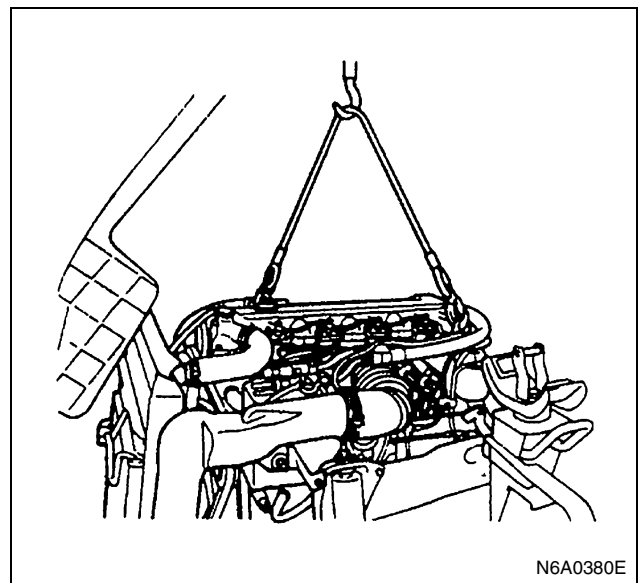
- Disconnect battery ground cable.
- Tilt the cab.

1. Transmission Panel**2. Fan Guide**

Remove the fan guide and hang it on the fan side.

3. Engine Mount

- 1) Hang the engine by the hoist before dismantling the engine mount.
- 2) Remove the nuts that fix the engine foot and the engine mount.
- 3) Remove the fixing bolts on the chassis frame side of the engine mount.
- 4) Hoist the engine assembly a little, and dismount the engine mount.



Installation

1. Engine Mount

Tighten the fixing bolts to the specified torque.

Tighten:

Chassis frame side bolt to 48 N·m (4.9 kg·m/35 lb·ft)

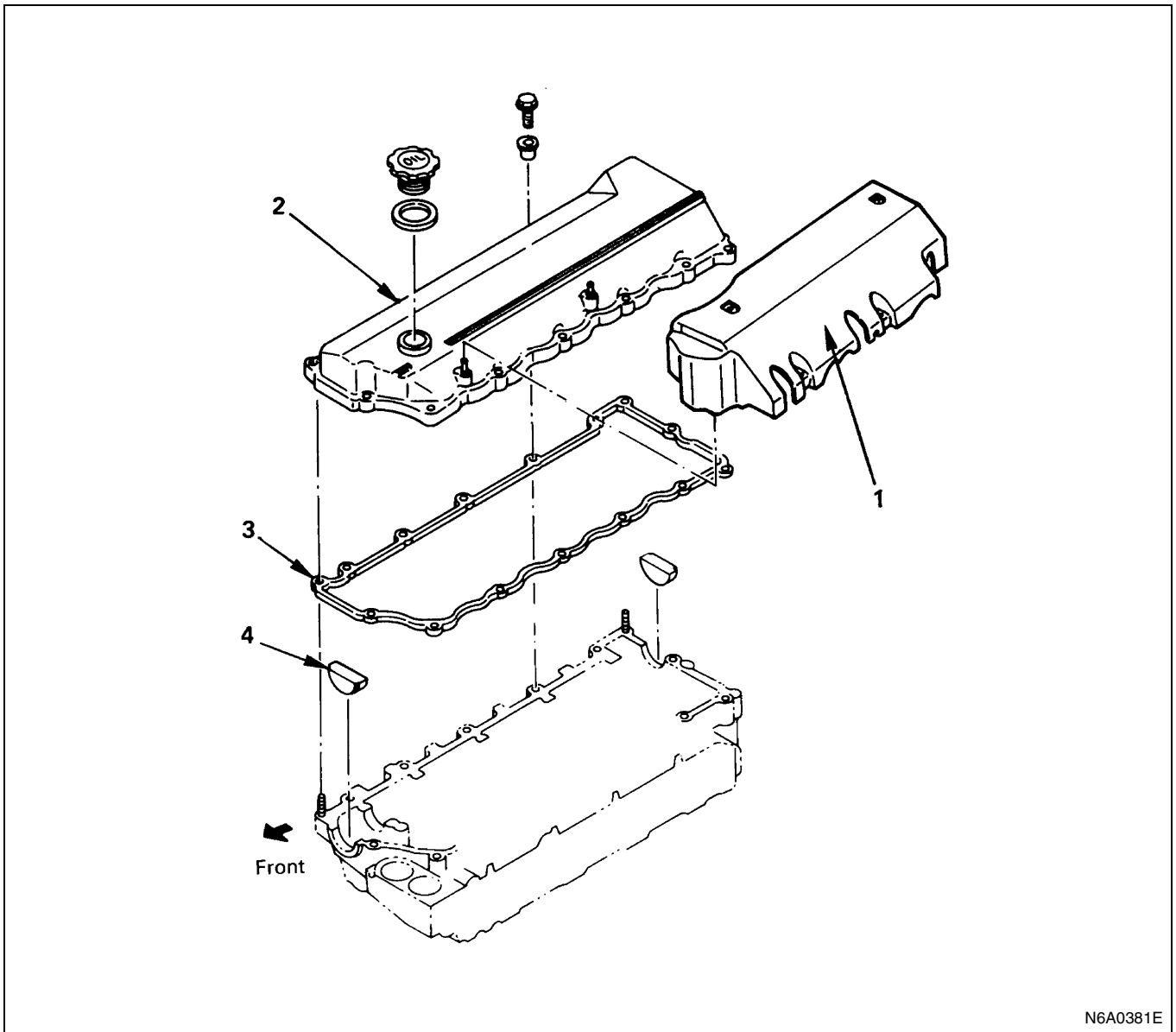
Tighten:

Engine foot side nut to 82 N·m (8.4 kg·m/61 lb·ft)

2. Fan Guide

3. Transmission Panel

- 1) Connect the negative battery cable.
- 2) Lower the cab
- 3) Start the engine, and check for any abnormal conditions with the engine mount.

CYLINDER HEAD COVER**Component**

N6A0381E

Legend

- | | |
|------------------------|-------------------------------|
| 1. Nozzle cover | 3. Cylinder head cover gasket |
| 2. Cylinder head cover | 4. Rubber plug |

Removal**Preparation**

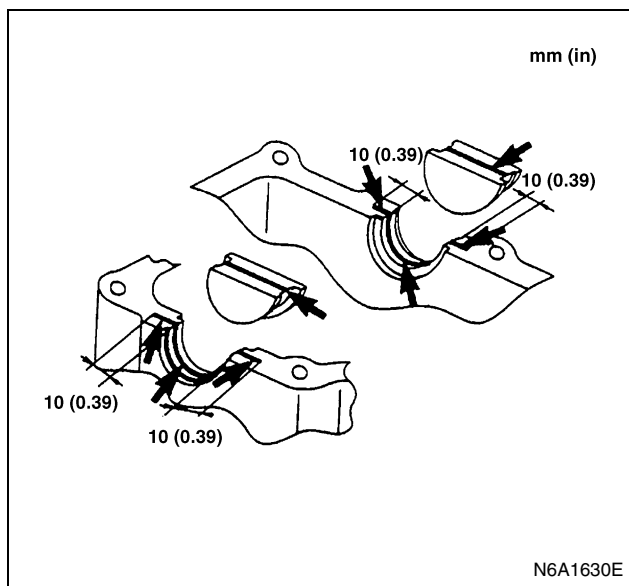
- Disconnect battery ground cable.
- Tilt the cab.

1. Nozzle Cover
2. Cylinder Head Cover
3. Cylinder Head Cover Gasket
4. Rubber Plug

Installation

1. Rubber Plug

- 1) Apply a 3 — 4 mm (0.12 — 0.16 in) bead of the recommended liquid gasket (Three Bond 1207B) or its equivalent to the cylinder head front and rear plug arch.
- 2) Install the rubber plugs to the cylinder head upper faces.
- 3) Apply a 3 — 4 mm (0.12 — 0.16 in) bead of the recommended liquid gasket (Three Bond 1207B) or its equivalent to the rubber plugs and cylinder head upper faces. Refer to arrows in the illustration.

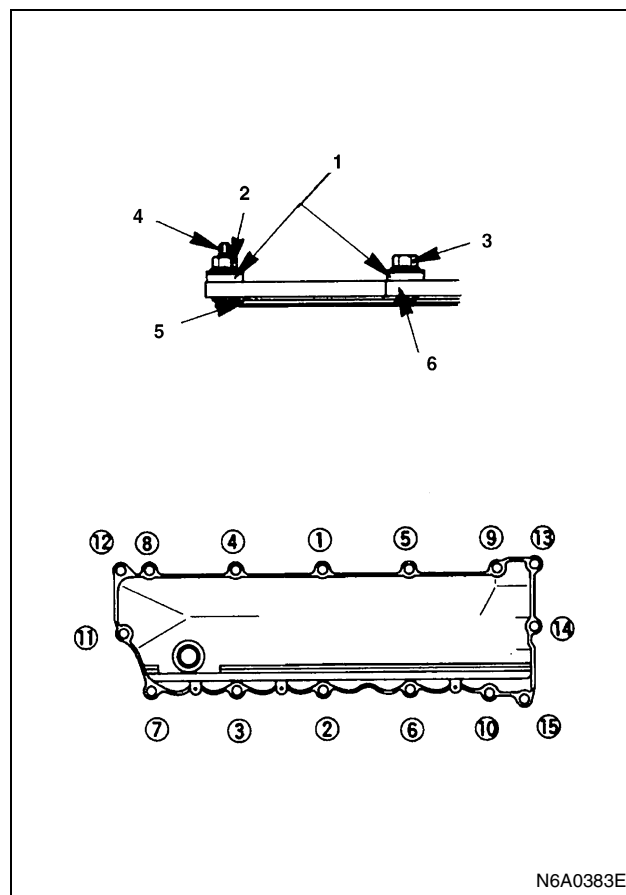


Install the cylinder head cover within 7 minutes after application of liquid gasket.

2. Cylinder Head Cover Gasket
Install the gasket to the cylinder head cover.
3. Cylinder Head Cover
 - 1) Install the cylinder head cover.
 - 2) Tighten the cylinder head cover nuts and bolts to the specified torque in the numerical order shown in the illustration.

Tighten:

Cylinder head cover nut and bolt to 18 N·m (1.8 kg·m/13 lb·ft)



Legend

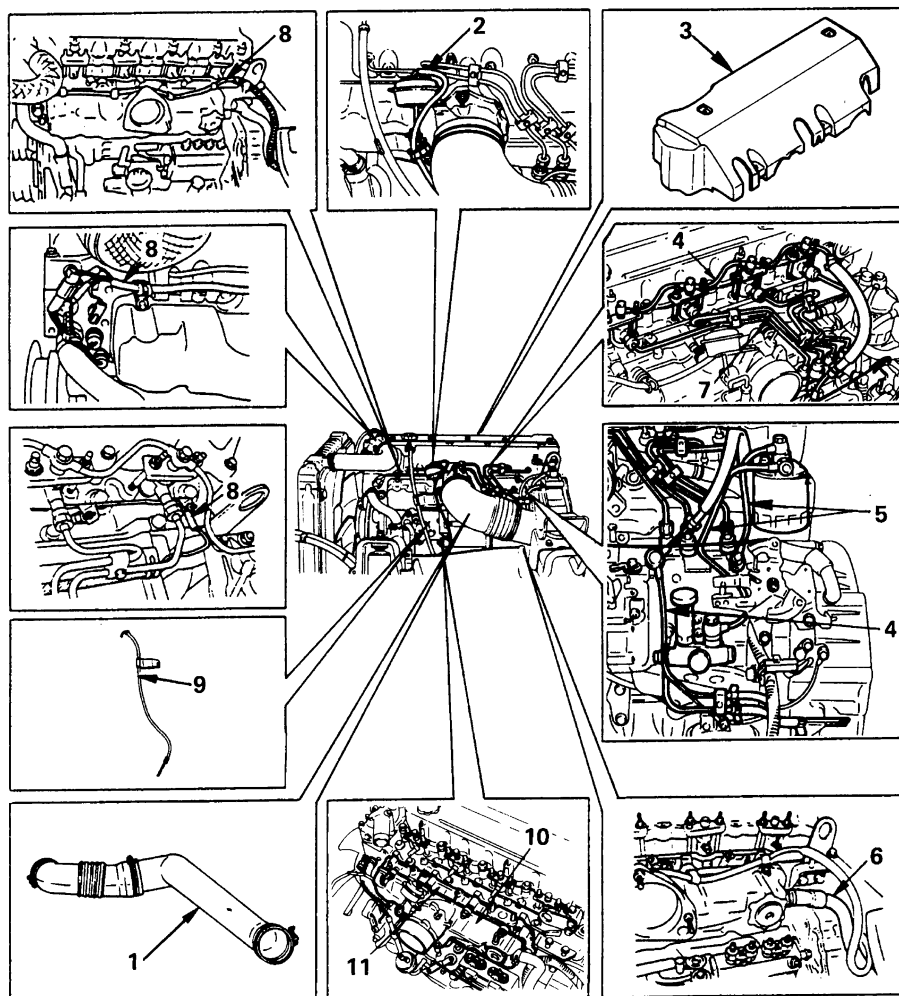
1. Mounting rubber
2. Nut
3. Bolt
4. Stud
5. Gasket
6. Head cover

4. Nozzle Cover

- Connect the negative battery cable.
- Lower the cab.
- Start engine and check for oil leakage carefully.

INLET COVER / INLET CASE**Component**

For 4HF1



N6A0384E

Legend

- | | |
|--------------------|-------------------------|
| 1. Intake air duct | 7. Injection pipe |
| 2. Vacuum hose | 8. Engine harness |
| 3. Nozzle cover | 9. Oil level guide tube |
| 4. Leak off pipe | 10. Inlet cover |
| 5. Fuel pipe | 11. Inlet case |
| 6. PCV hose | |

Removal**Preparation**

- Disconnect battery ground cable.
- Tilt the cab.

1. Intake Air Duct

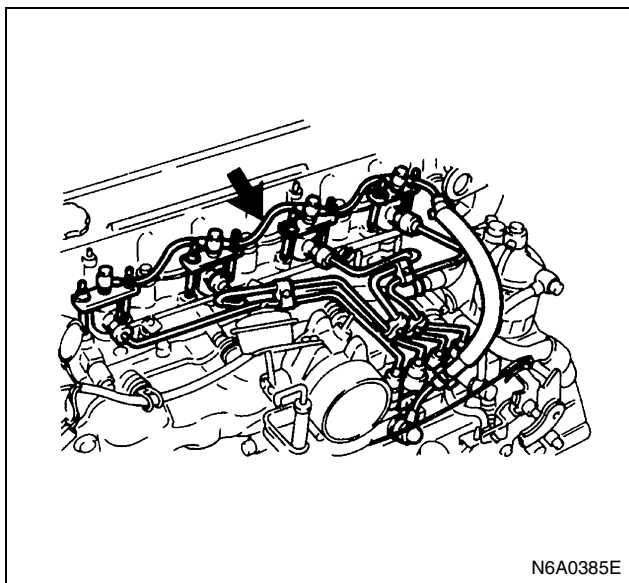
1) Remove the clips at the connections with the inlet cover and with the air cleaner.

2) Remove the intake air duct with the connector hose attached.

2. Vacuum Hose

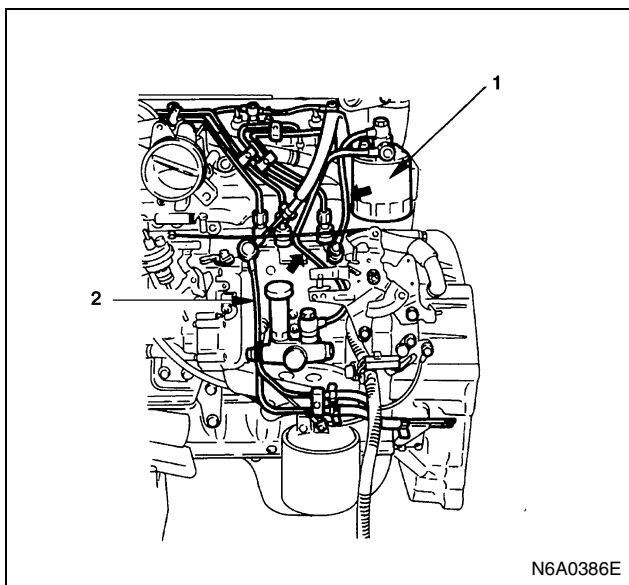
3. Nozzle Cover

4. Leak off Pipe



5. Fuel Pipe

Do not apply excessive force to the fuel pipes.

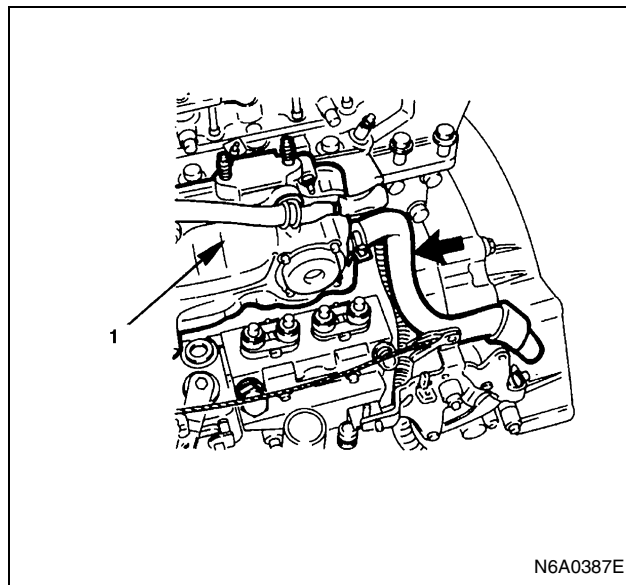


Legend

- 1. Fuel filter
- 2. Leak off

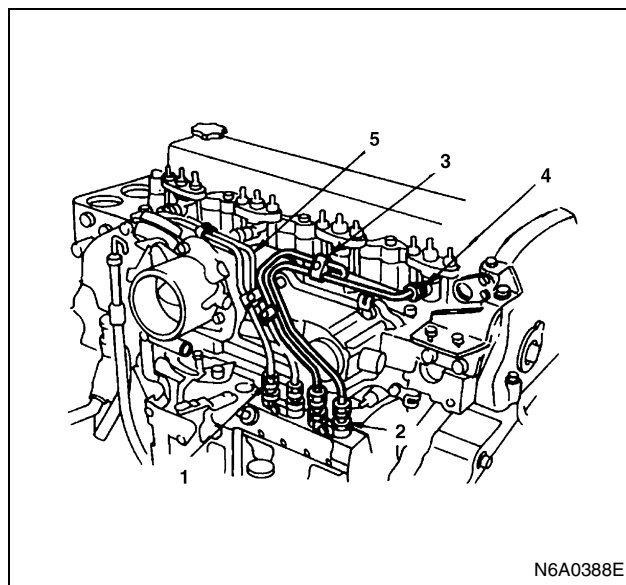
6. Positive Crankcase Ventilation (PCV) Hose

Disconnect the PCV hose from inlet cover (1).



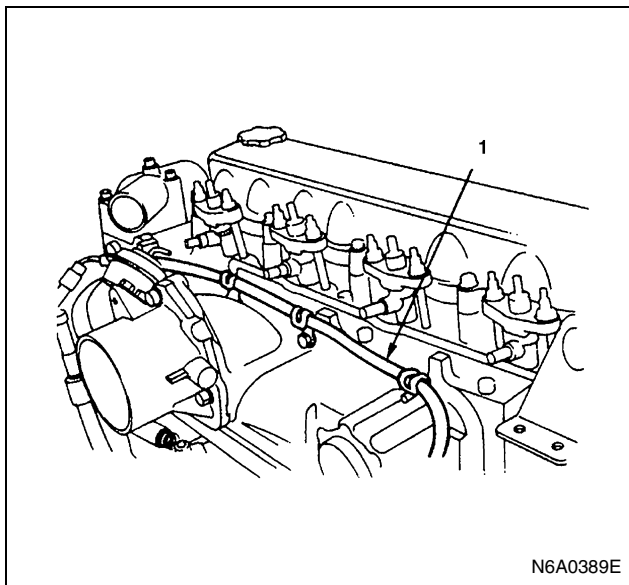
7. Fuel Injection Pipe

- 1) Loosen the injection pipe sleeve nuts (1).
- 2) Do not apply excessive force to the injection pipes (5).
- 3) Loosen the injection pipes clips (3).
- 4) Remove the injection pipe assembly.
Plug the delivery valve holder (2) ports and nozzle holder (4) ports with caps to prevent the entry of foreign material.



8. Engine Harness

Disconnect thermometer unit, thermo switch, tachometer sensor and glow plug harness connectors and separate harness from clips.

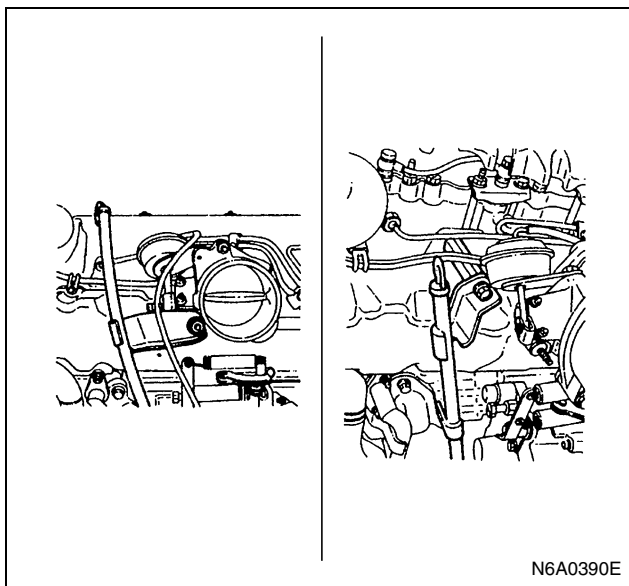


Legend

1. Engine harness

9. Oil Level Guide Tube

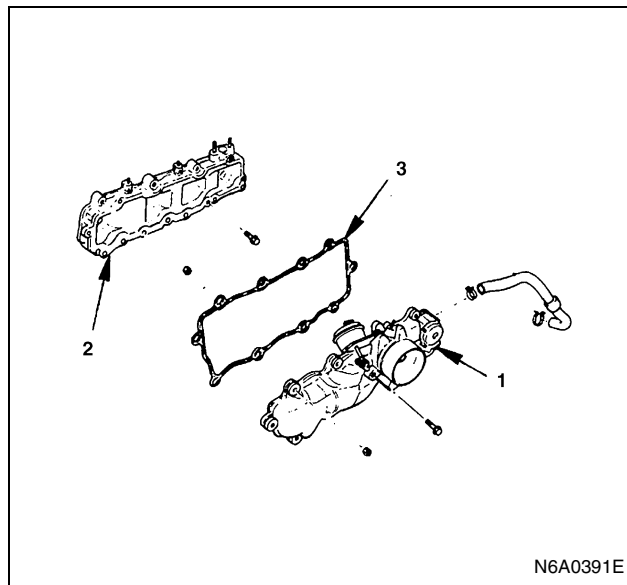
Remove the guide tube fixing bolt and pull out the guide tube.



10. Inlet Cover

11. Inlet Case

Remove the inlet case while removing the liquid gasket.



Legend

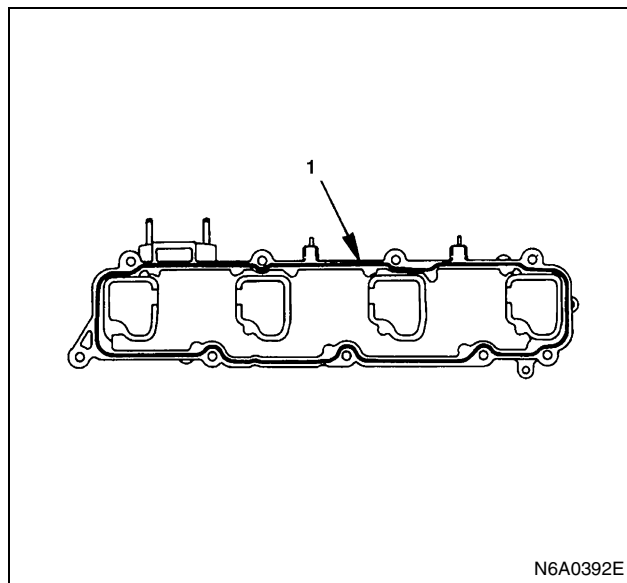
1. Inlet cover
2. Inlet case
3. Gasket

Installation

1. Inlet Case

- 1) Apply 2 — 3 mm (0.08 — 0.12 in) bead of the recommended liquid gasket (Three Bond 1207C) or its equivalent on the groove (1) of the inlet case fitting surfaces shown in the illustration.

- Clean the inlet case fitting surface of the cylinder head.



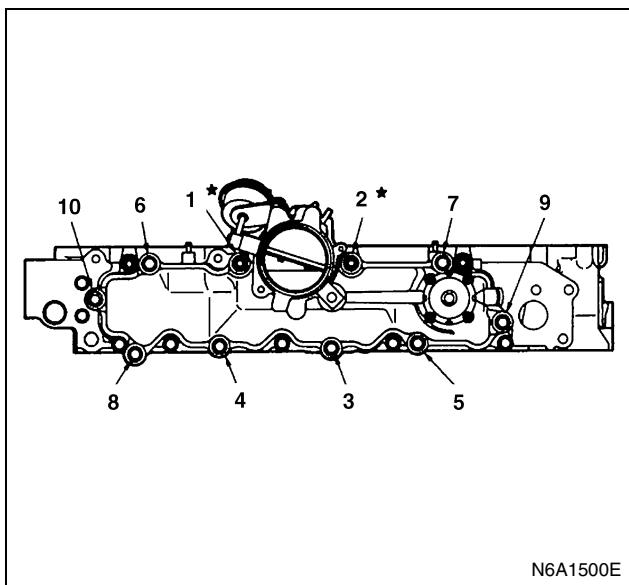
- 2) Install the inlet case to the cylinder head.
 - Install the inlet case within 7 minutes after application of liquid gasket.
- 3) Tighten the inlet case to the specified torque.

Tighten:

Inlet case nuts and bolts to 19 N·m (1.9 kg·m/ 14 lb·ft)

2. Inlet Cover

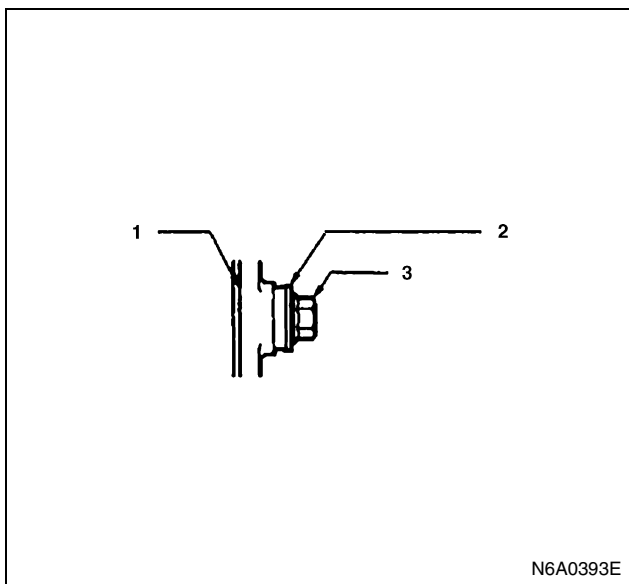
- 1) Attach harness clips ((1), (6) and (7)) and tighten the inlet cover bolts and nuts to the specified torque in the numerical order shown in the illustration.



- 2) ★ marks are located on the nut positions.

Tighten:

Inlet cover bolt and nut to 13 N·m (1.3 kg·m/9 lb·ft)


Legend

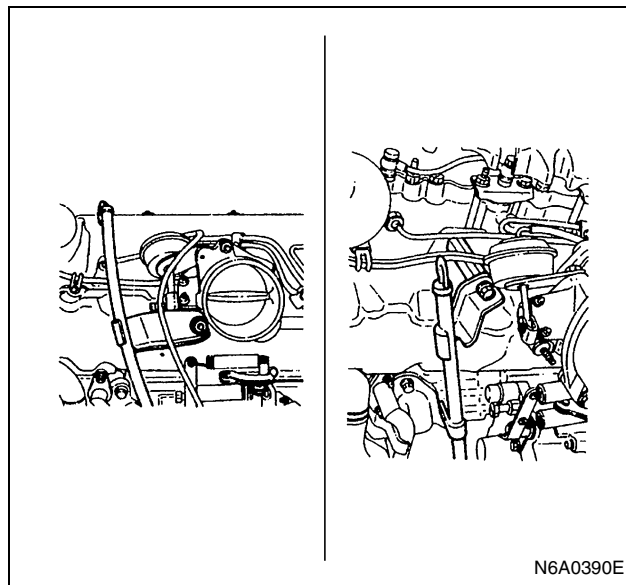
1. Inlet cover
2. Mounting rubber
3. Bolt

3. Oil Level Guide Tube

- 1) Install the O-rings to the guide tube lower portion and insert the guide tube completely to the cylinder body.
- 2) Tighten the guide tube bolt to the specified torque.

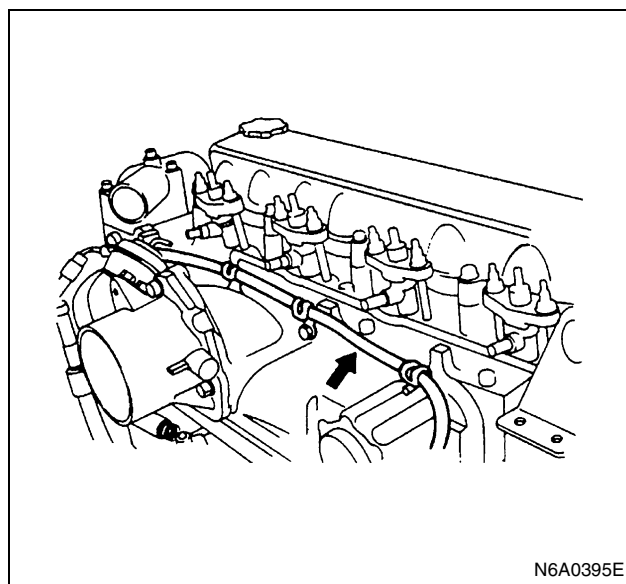
Tighten:

Guide tube bolt to 13 N·m (1.3 kg·m/9.4 lb·ft)



4. Engine Harness

Connect thermometer unit, thermo switch, tachometer sensor and glow plug harness connector and fasten the engine harness with clips.



5. Injection Pipe

- 1) Install the injection pipe assembly and temporarily tighten the injection pipe sleeve nuts.
- 2) Set the clips in the prescribed position shown in the illustration.

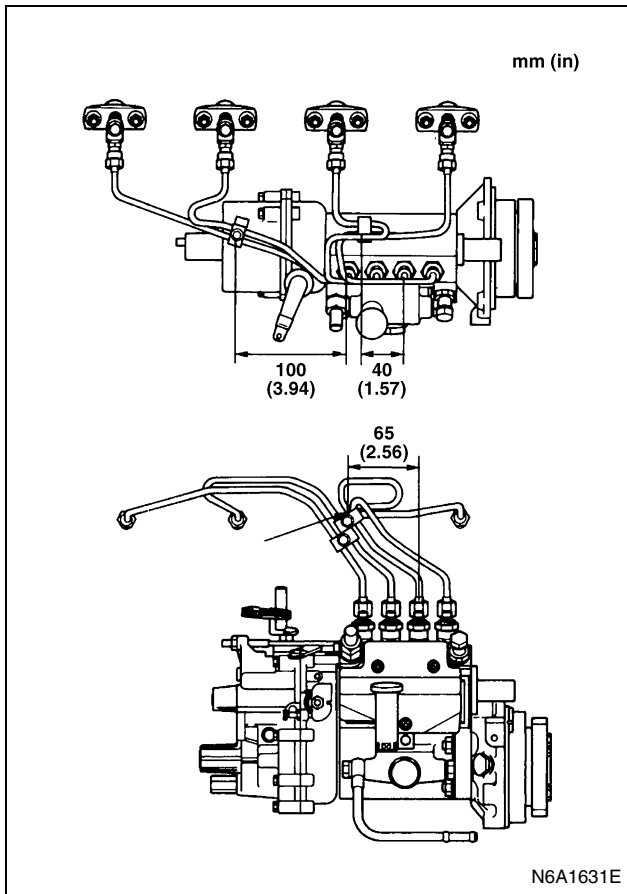
Caution:

Make absolutely sure that the clip is correctly positioned.

An improperly positioned clip will result in injection pipe breakage and fuel pulsing noise.

Tighten:

Clip screw to 3 N·m (0.3 kg·m/26 lb·in)



- 3) Tighten the injection pipe sleeve nuts to the specified torque.

Tighten:

Injection pipe sleeve nut to 29 N·m (3 kg·m/22 lb·ft)

Injection Pipe (4HF1-2 model only)

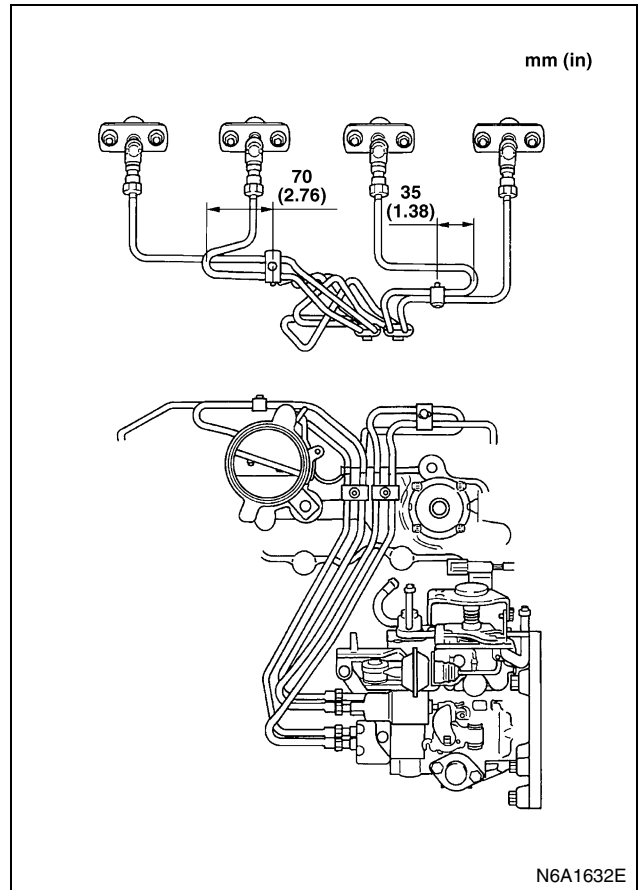
- 1) Install the injection pipe assembly and temporarily tighten the injection pipe sleeve nuts.
- 2) Set the clips in the prescribed position shown in the illustration.

Caution:

Make absolutely sure that the clip is correctly positioned. An improperly positioned clip will result in injection pipe breakage and fuel pulsing noise.

Tighten:

Clip screw to 3 N·m (0.3 kg·m/26 lb·in)

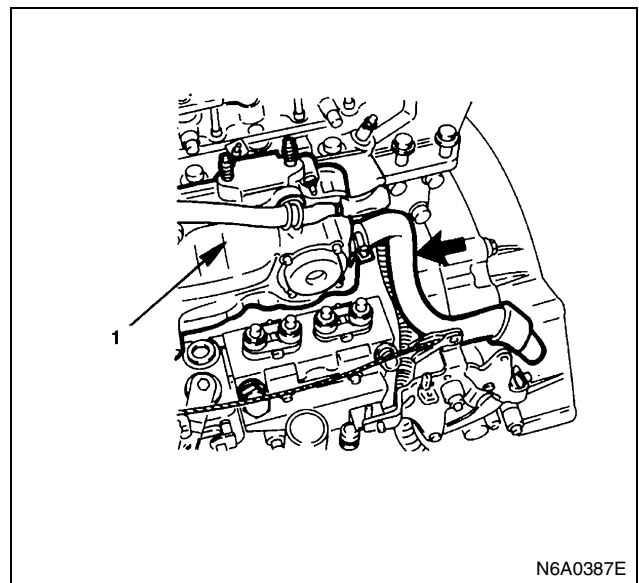


- 3) Tighten the injection pipe sleeve nuts to the specified torque.

Tighten:

Injection pipe sleeve nut to 29 N·m (3 kg·m/22 lb·ft)

6. Positive Crankcase Ventilation (PCV) Hose



Legend

1. Inlet cover

7. Fuel Pipe

Do not apply excessive force to the fuel pipe.

Tighten:

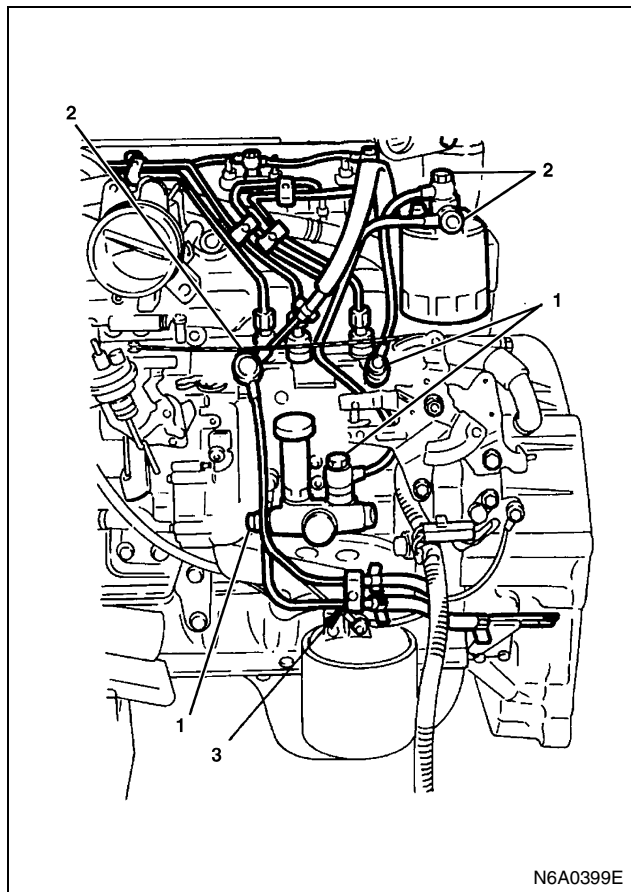
Fuel pipe joint bolt (1) to 41 N·m (4.2 kg·m/30 lb·ft)

Tighten:

Fuel pipe joint bolt (2) to 23 N·m (2.3 kg·m/17 lb·ft)

Tighten:

Clip screw to 4 N·m (0.4 kg·m/35 lb·in)



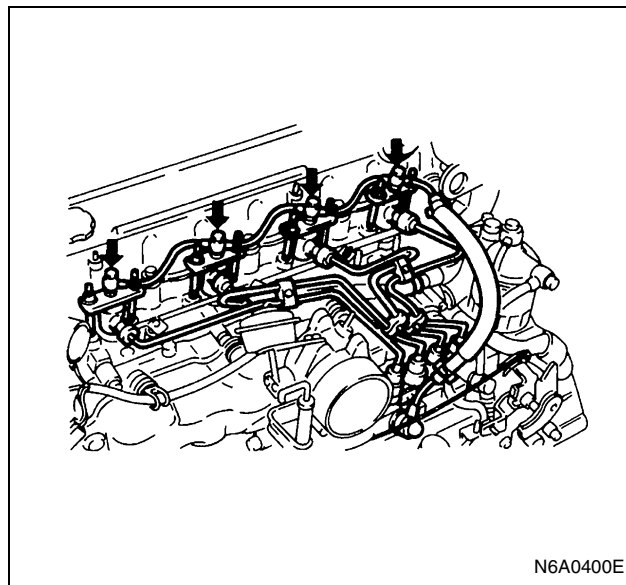
Legend

1. Fuel pipe joint bolt
2. Fuel pipe joint bolt
3. Clip

8. Leak Off Pipe

Tighten:

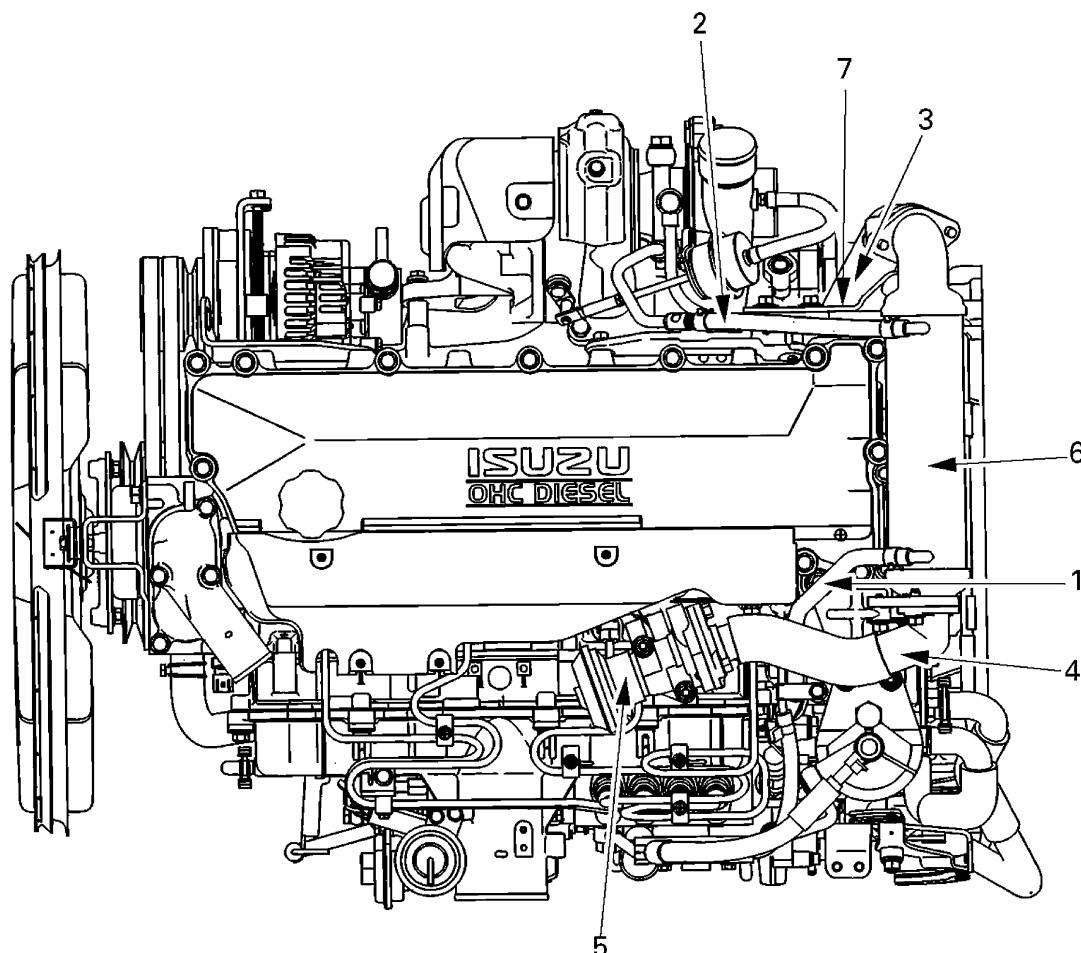
Leak-Off pipe joint bolt to 13 N·m (1.3 kg·m/113 lb·in)



9. Nozzle Cover
 10. Vacuum Hose
 11. Intake Air Duct
- Connect the negative battery cable.
 - Lower the cab.
 - Start engine and check for fuel leakage carefully.

4HE1-TC (4HE1-XS) for EURO3
EXHAUST GAS RECIRCULATION SYSTEM (EGR)

Component



N6A0401E

Legend

- | | |
|--------------------------|-----------------------|
| 1. Water hose (out) | 5. EGR valve |
| 2. Water hose (in) | 6. EGR cooler |
| 3. EGR pipe (right side) | 7. EGR cooler bracket |
| 4. EGR pipe (left side) | |

Removal

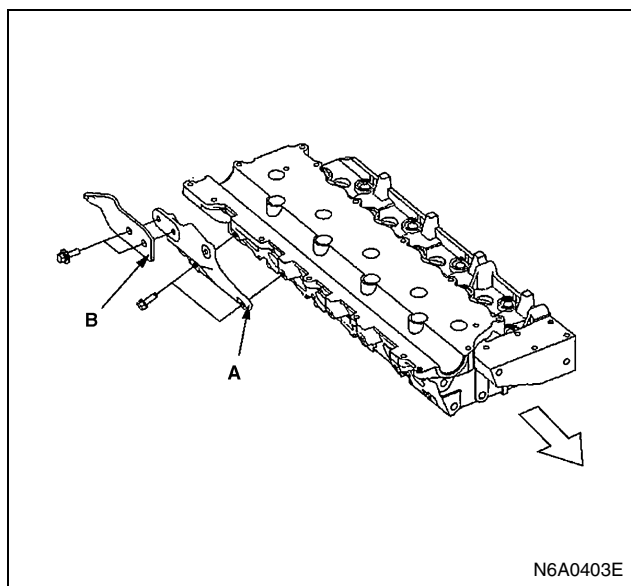
1. Water hose (out)
2. Water hose (in)
3. EGR pipe (right side)
4. EGR pipe (left side)
5. EGR valve
6. EGR cooler
7. EGR cooler bracket

Installation

1. EGR Cooler Bracket
Temporarily tighten the EGR cooler bracket (B) to the EGR cooler bracket (A).

Tighten:

EGR cooler bracket bolt (A) to 31 N·m (3.2 kg·m/23 lb·ft)

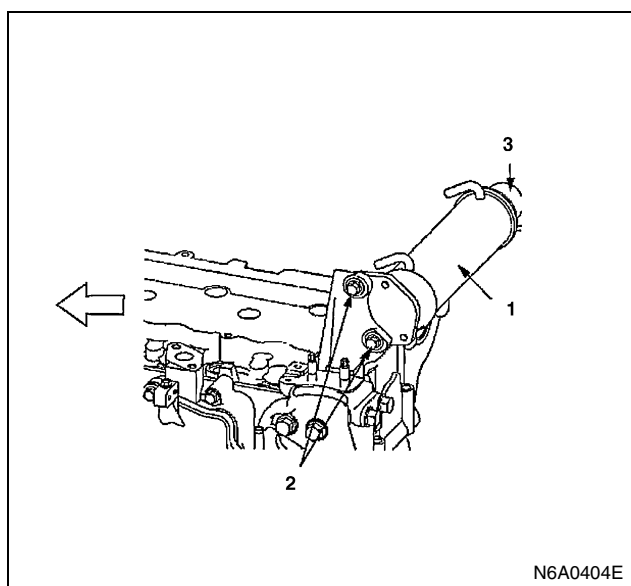


2. EGR Cooler

- 1) Temporarily tighten the EGR cooler bolts left side.
- 2) Tighten the EGR cooler bolt right side.

Tighten:

EGR cooler bracket bolt (right side) to 33 N·m (3.4 kg·m/ 25 lb·ft)



Legend

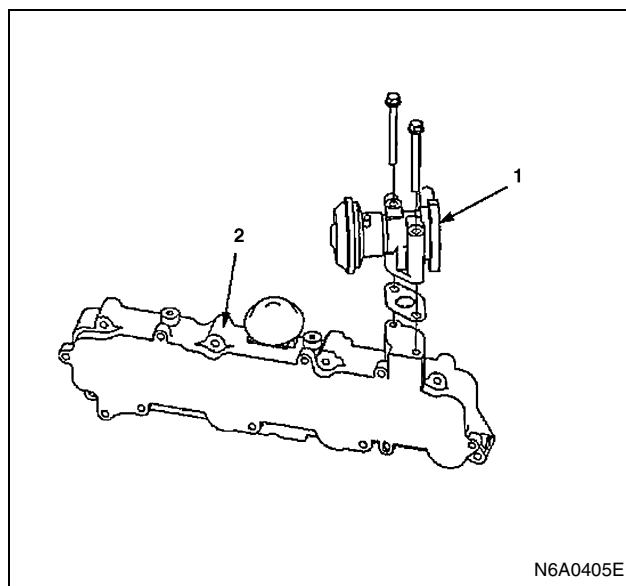
1. EGR cooler
2. Left side
3. Right side

3. EGR Valve

Insert the gasket and install the EGR valve to the intake manifold.

Tighten:

EGR valve bolt to 24 N·m (2.4 kg·m/17 lb·ft)



Legend

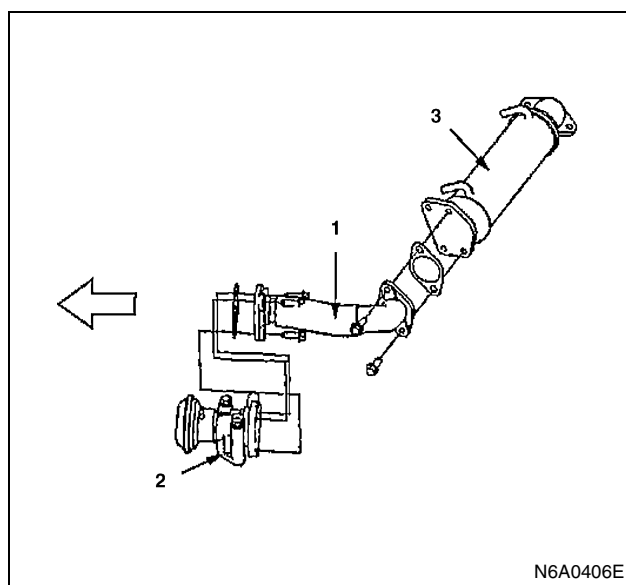
1. EGR valve
2. Inlet case

4. EGR Pipe (left side)

Insert the gasket into the left-hand EGR pipe (1). Install the pipe between the EGR valve (2) and the EGR cooler (3).

Tighten:

EGR pipe (left side) bolt to 24 N·m (2.4 kg·m/17 lb·ft)

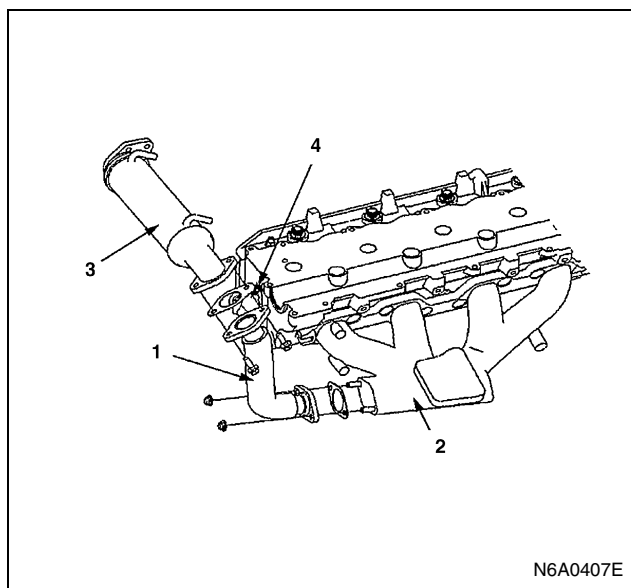


5. EGR Pipe (right side)

- 1) Insert the gasket into the right-hand EGR pipe (refer to the illustration). Install the pipe between the exhaust manifold and the EGR cooler.

Tighten:

EGR pipe nut and bolt to 28 N·m (2.9 kg·m/21 lb·ft)

**Legend**

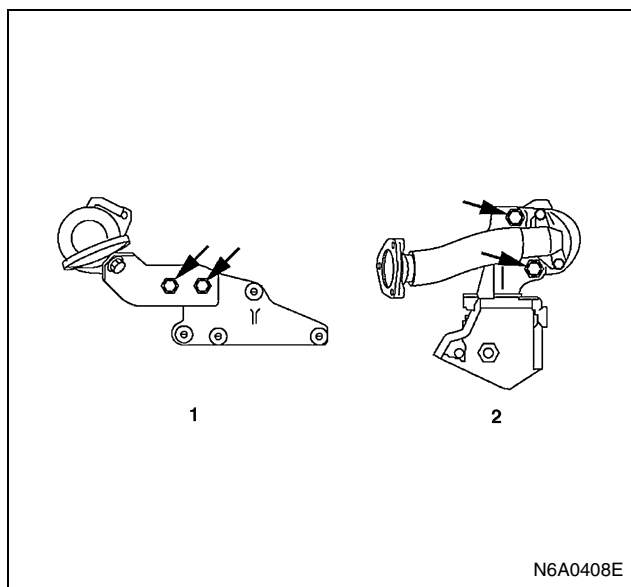
1. EGR pipe
2. Exhaust manifold
3. EGR cooler
4. TAB

- 2) Adjust bracket position to eliminate any play using the bracket adjustment holes. Tighten the bolts as shown by the arrows in the illustration.

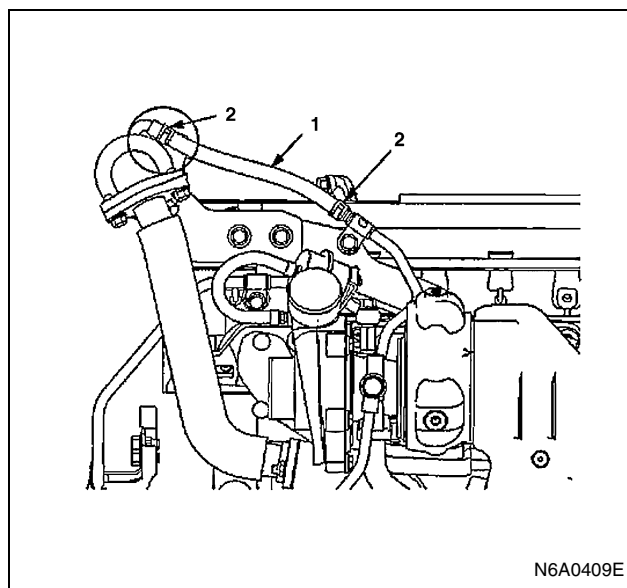
Tighten:

EGR cooler bracket bolt to

- Right side (1): 26 N·m (2.7 kg·m/20 lb·ft)
- Left side (2): 24 N·m (2.4 kg·m/17 lb·ft)

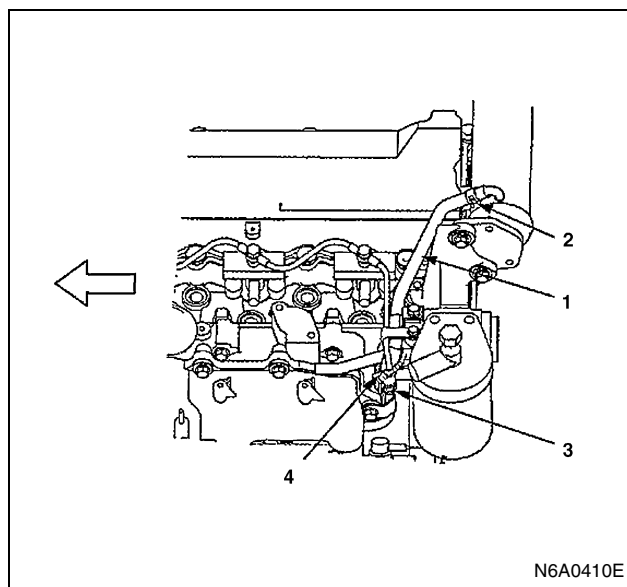


6. Water Hose (in)
Arrange the clips so that the jaws face the side of the engine.

**Legend**

1. Water hose (in)
2. Clip

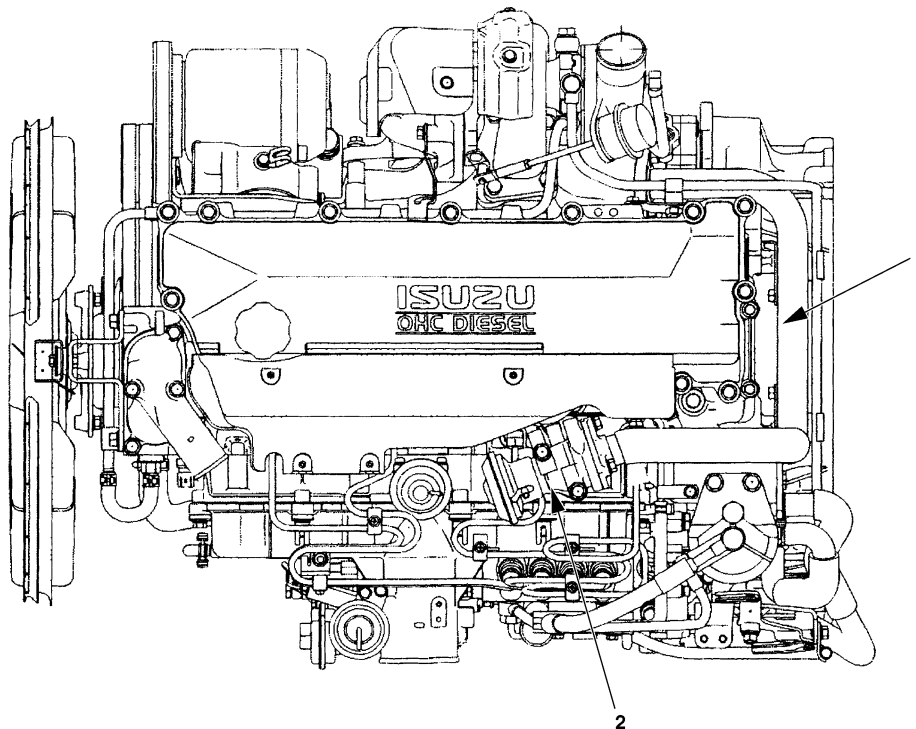
7. Water Hose (out)
Insert clip (2) so that the jaws face the side of the engine.
Install clip (3) so that the jaws face away from the engine.

**Legend**

1. Water hose (out)
2. Clip
3. Clip
4. Band clip

4HE1-TC (98EPA)
EXHAUST GAS RECIRCULATION SYSTEM (EGR)

Component



N6A1601E

Legend

1. EGR pipe assembly

2. EGR valve

Removal

1. EGR pipe assembly
2. EGR valve

Tighten:

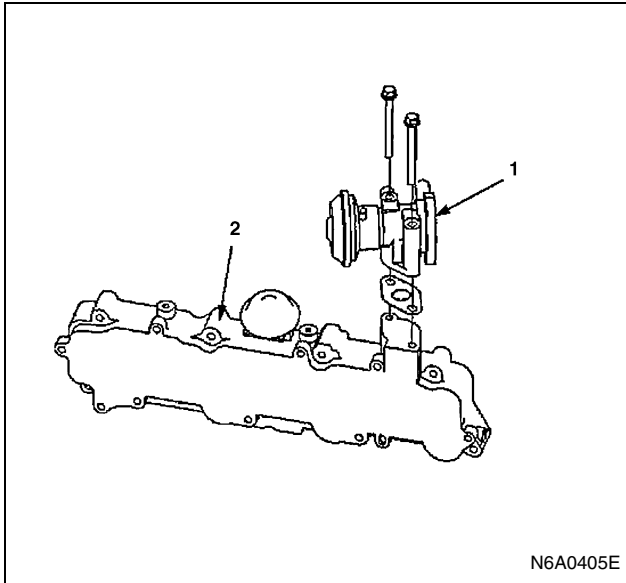
EGR valve bolt to 23.5 ± 5 N·m (2.4 ± 0.5 kg·m/ 17 ± 3.7 lb·ft)

Installation

1. EGR valve
Insert the gasket and install the EGR valve to the intake manifold.

Notice:

The gasket of 4HE1-XS and 4HE1-XN are different.

**Legend**

1. EGR valve
2. Inlet case

2. EGR Pipe assembly

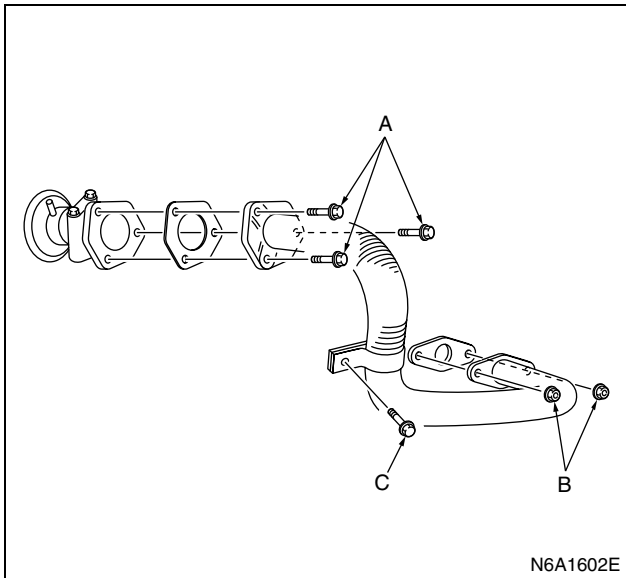
Install the EGR pipe assembly to the exhaust manifold and the EGR valve with gasket.

Tighten:

A: Bolt to 23.5 ± 5 N·m (2.4 ± 0.5 kg·m/ 17 ± 3.7 lb·ft)

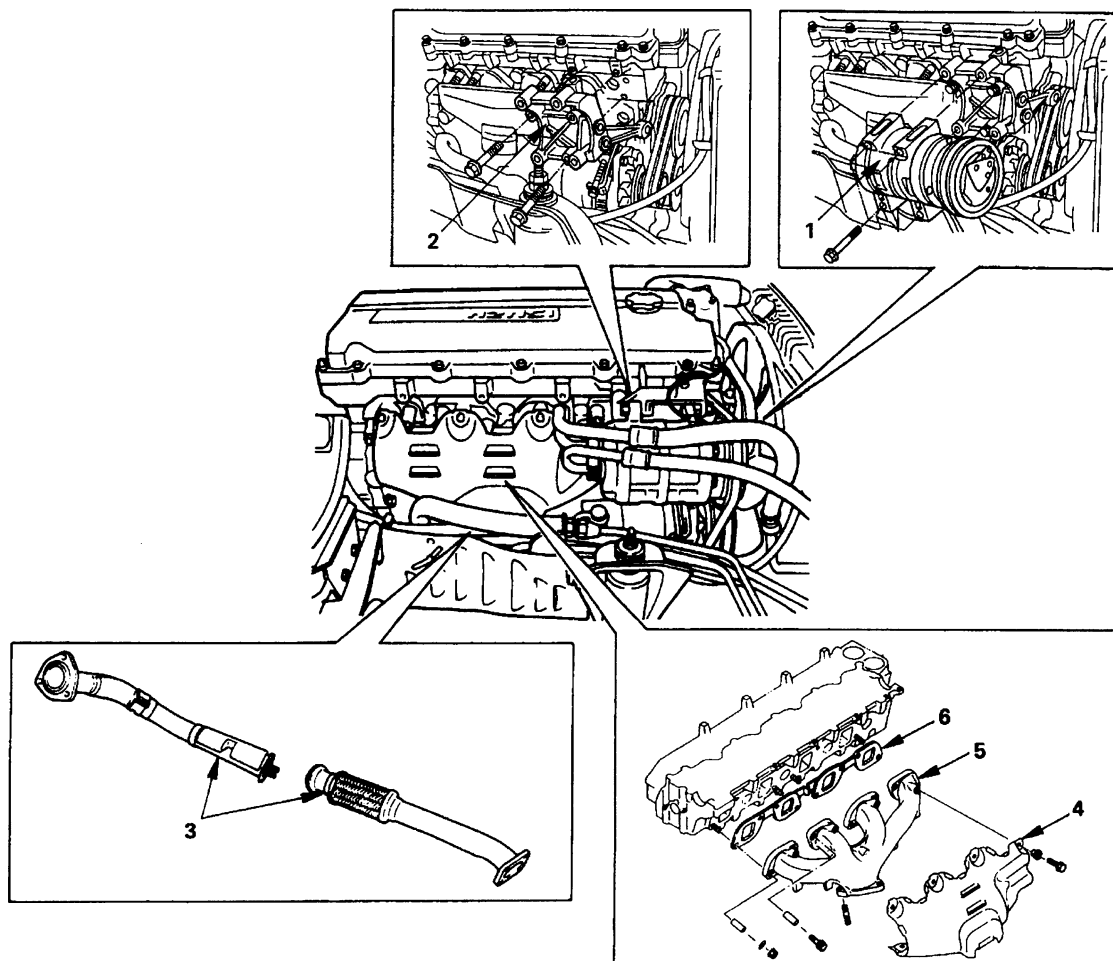
B: Nut to 28.4 ± 4 N·m (2.9 ± 0.4 kg·m/ 21 ± 3.1 lb·ft)

C: Bolt to 23.5 ± 5 N·m (2.4 ± 0.5 kg·m/ 17 ± 3.7 lb·ft)



EXHAUST MANIFOLD

Component



N6A0411E

Legend

- | | |
|--|---------------------|
| 1. A/C compressor (If equipped with A/C) | 4. Heat protector |
| 2. A/C compressor bracket (If equipped with A/C) | 5. Exhaust manifold |
| 3. Front exhaust Pipe | 6. Exhaust gasket |

Removal

Preparation

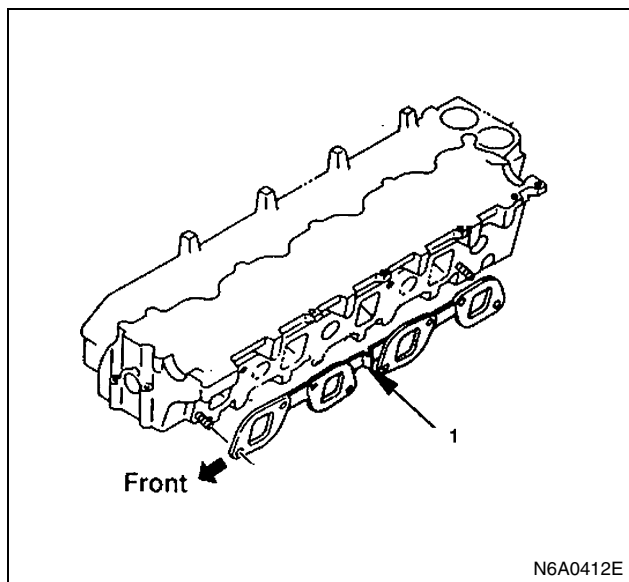
- Disconnect battery ground cable.
 - Tilt the cab.
1. Air Conditioning (A/C) Compressor (If equipped with A/C)
 - 1) Disconnect magnetic clutch harness connector.

- 2) Dismount the compressor together with the hoses from the A/C compressor bracket, and fasten it to the appropriate location with a wire.
2. A/C Compressor Bracket (If equipped with A/C)
3. Front Exhaust Pipe
4. Heat Protector
5. Exhaust Manifold
6. Exhaust Gasket

Installation

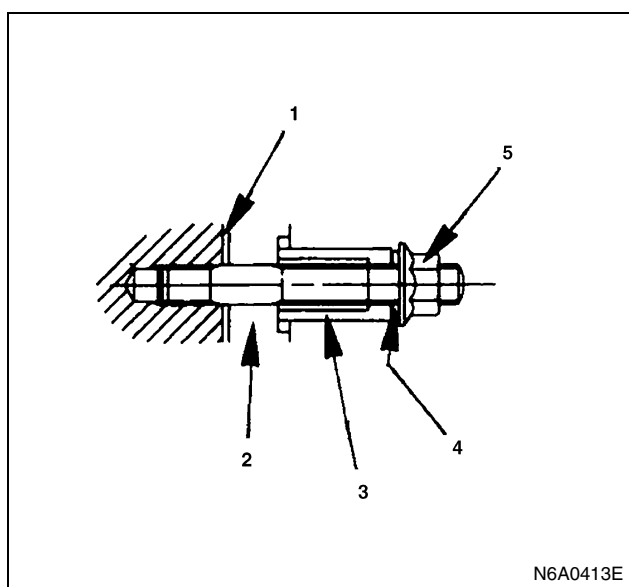
1. Exhaust Gasket

Insert the gasket into the stud provided to the cylinder head (with the projection (1) of the gasket on this side).



2. Exhaust Manifold

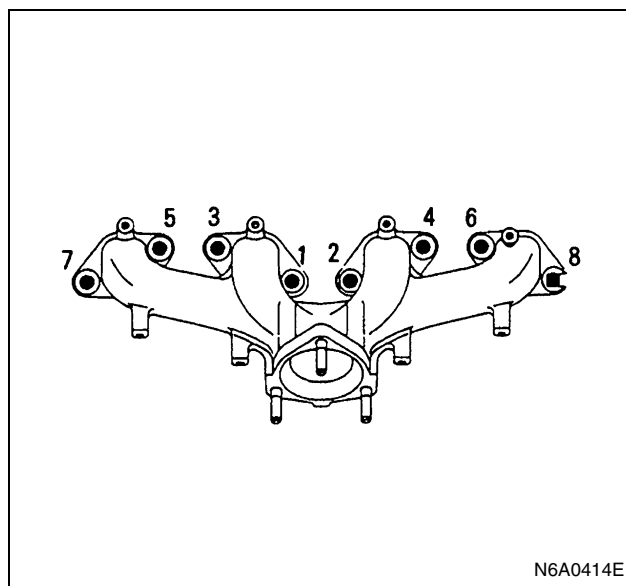
- 1) Install exhaust manifold gaskets (1), exhaust manifold (2), distance pieces (3), dish washers (4) and nuts (5) to the stud bolts shown in the illustration.



- 2) Tighten the nuts to the specified torque in the numerical order shown in the illustration.

Tighten:

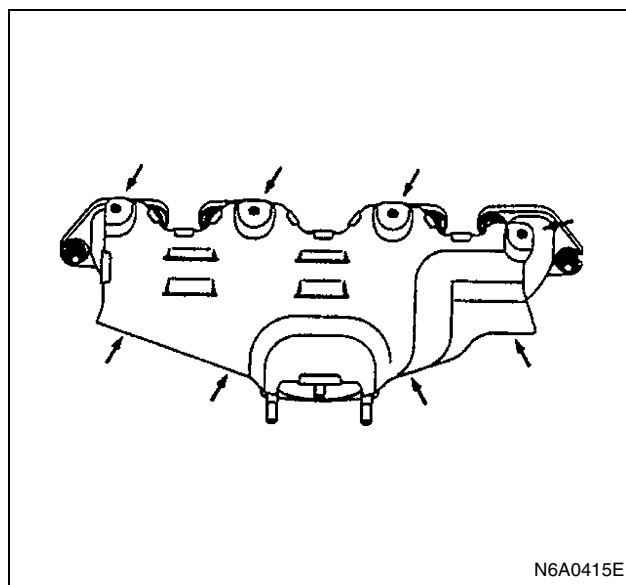
Exhaust manifold nut to 34 N·m (3.5 kg·m/25 lb·ft)



3. Heat Protector

Tighten:

Heat protector bolt to 10 N·m (1.0 kg·m/7 lb·ft)



4. Front Exhaust Pipe

Tighten:

Front exhaust pipe to

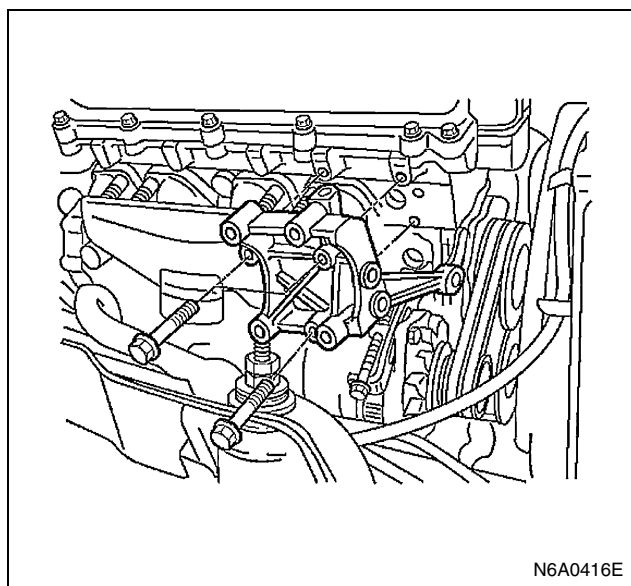
- Exhaust manifold side: 67 N·m (6.8 kg·m/49 lb·ft)
- Exhaust brake side: 17 N·m (1.7 kg·m/12 lb·ft)

5. Air Conditioning (A/C) Compressor Bracket (If equipped with A/C)

Tighten fixing bolts to the specified torque.

Tighten:

A/C compressor bracket bolt to 48 N·m (4.9 kg·m/35 lb·ft)



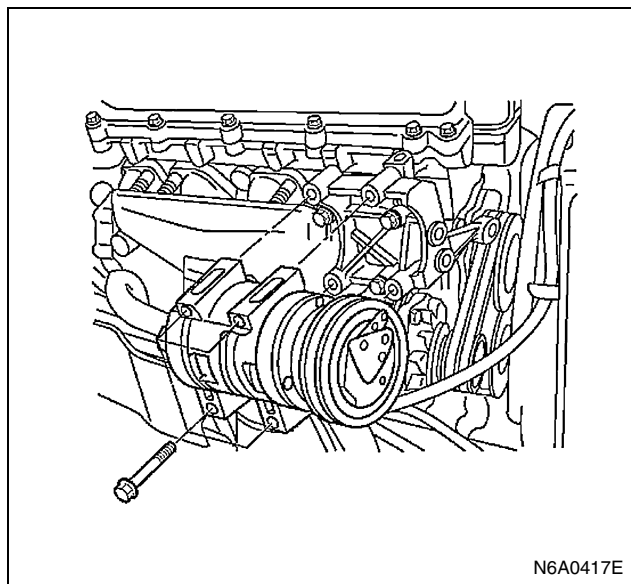
6. A/C Compressor (If equipped with A/C)
- 1) Tighten fixing bolts to the specified torque.

Tighten:

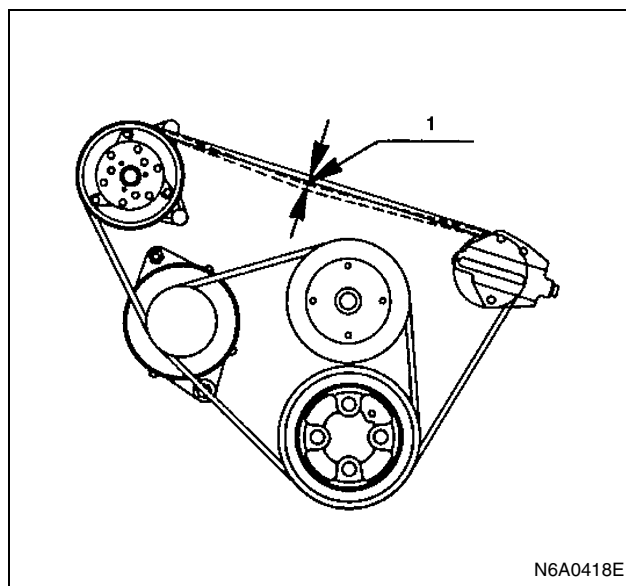
A/C compressor bolt to 48 N·m (4.9 kg·m/35 lb·ft)

Notice:

When tightening the compressor fixing bolts, tighten first the 2 bolts on the rear side, and then the remaining 2 on the front.



- 2) Install drive belt adjust belt tension by adjusting bolt and tighten locking nut to the specified torque.
- 3) Depress the drive belt mid-portion with a 98 N (10 kg/22 lb) force.


Legend

1. Belt deflection

Tighten:

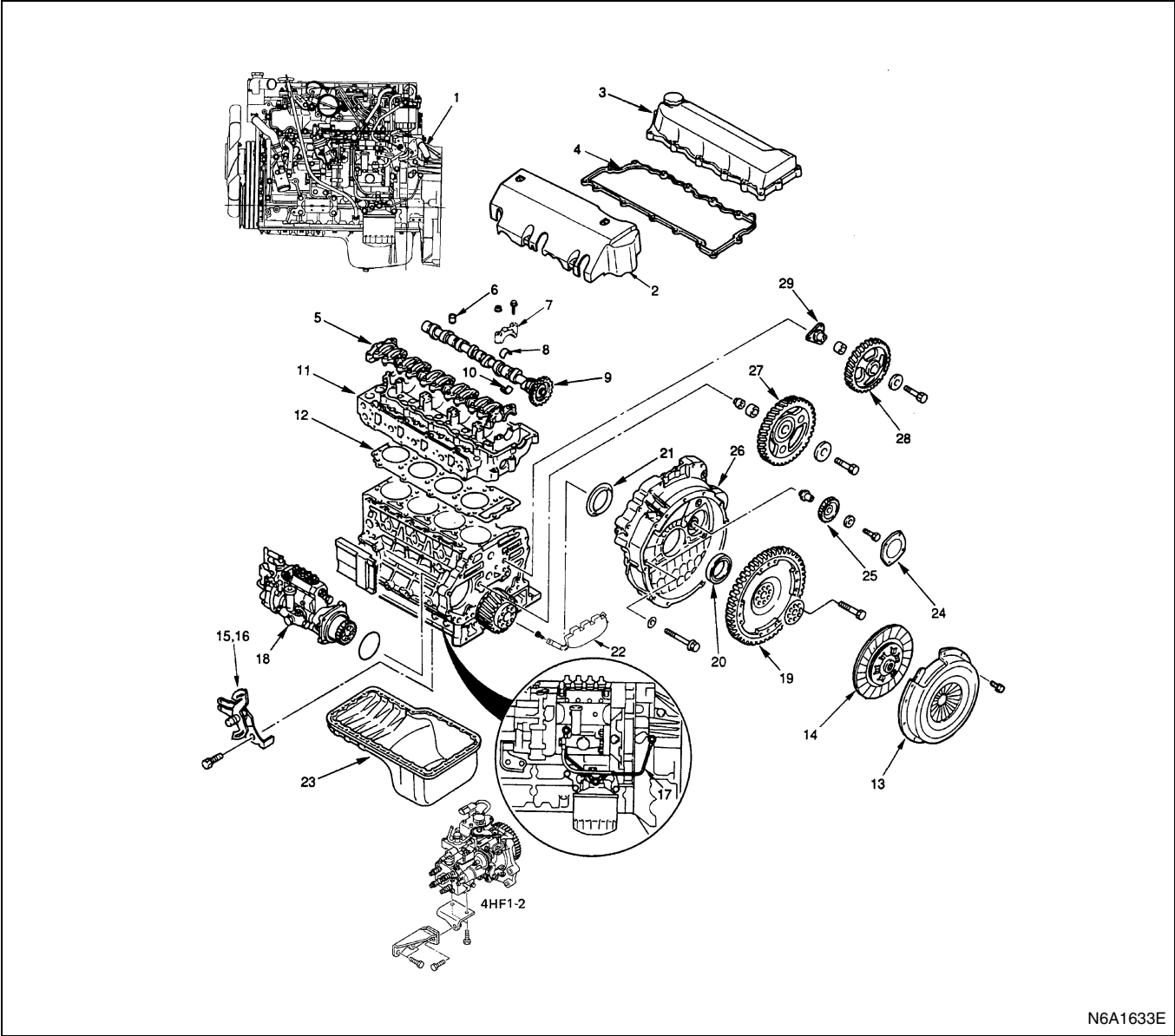
Locking nut to 27 N·m (2.8 kg·m/20 lb·ft)

- Connect the negative battery cable.
- Lower the cab.
- Start engine and check for gas leakage carefully.

Drive Belt Deflection	mm (in)
16 — 20 (0.63 — 0.79) ... New belt	
18 — 22 (0.71 — 0.87) ... Reuse belt	

TIMING GEAR REPLACEMENT

Component



Legend

- | | |
|------------------------------------|---|
| 1. Engine assembly | 16. Engine control lever assembly |
| 2. Nozzle cover | 17. Oil pipe |
| 3. Cylinder head cover | 18. Injection pump assembly |
| 4. Head cover gasket | 19. Flywheel |
| 5. Rocker arm shaft assembly | 20. Rear oil seal |
| 6. Valve cap | 21. Slinger |
| 7. Camshaft bearing cap | 22. Spacer rubber |
| 8. Camshaft bearing upper | 23. Oil pan |
| 9. Camshaft assembly | 24. Power steering pump idle gear cover |
| 10. Camshaft bearing lower | 25. Power steering pump idle gear |
| 11. Cylinder head assembly | 26. Flywheel housing |
| 12. Cylinder head gasket | 27. Idle gear A |
| 13. Clutch pressure plate assembly | 28. Idle gear B |
| 14. Driven plate | 29. Idle gear B shaft |
| 15. Engine control wire | |
-

Removal

Preparation

- Disconnect battery ground cable.
- Tilt the cab.
- Drain coolant and engine oil.

1. Engine Assembly

Above works refer to "ENGINE ASSEMBLY" section in this manual.

2. Nozzle Cover

3. Cylinder Head Cover

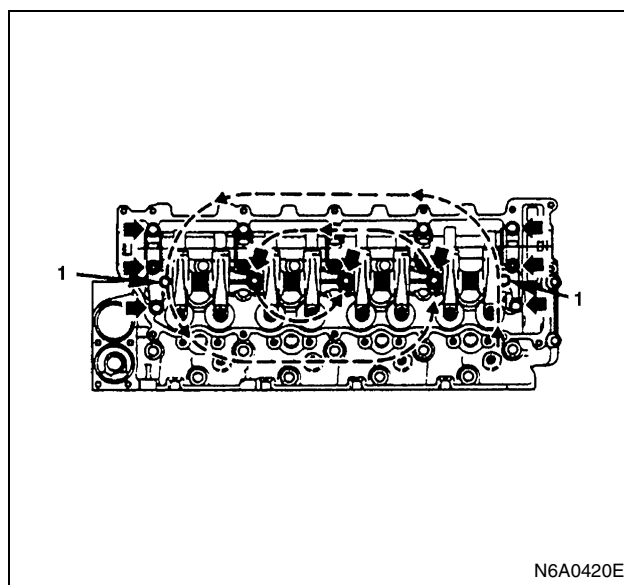
4. Head Cover Gasket

5. Rocker Arm Shaft Assembly

- 1) Loosen the rocker arm shaft bracket nuts and bolts in numerical order a little at a time and remove the rocker arm shaft assembly with the camshaft brackets.
- 2) Leave the (1) indicated bolt unremoved on this occasion, since it is the rocker arm fixing bolt.

Caution:

Failure to loosen the rocker arm shaft bracket nuts and bolts in numerical order a little at a time will adversely affect the rocker arm shaft.



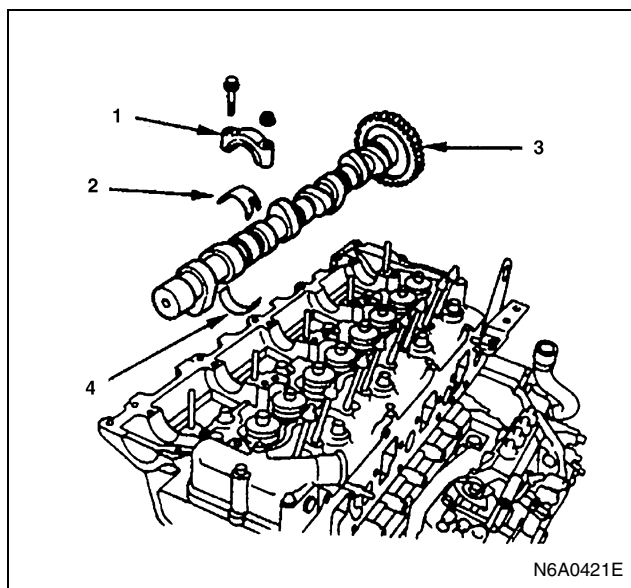
6. Valve Cap

Caution:

Take sufficient care not to let valve caps fall into the gear case or oil return hole.

7. Camshaft Bearing Cap
8. Camshaft Bearing Upper
9. Camshaft Assembly
10. Camshaft Bearing Lower

If the camshaft bearings are to be reinstalled, mark their fitting positions by tagging each bearing with the cylinder number from which it was removed.

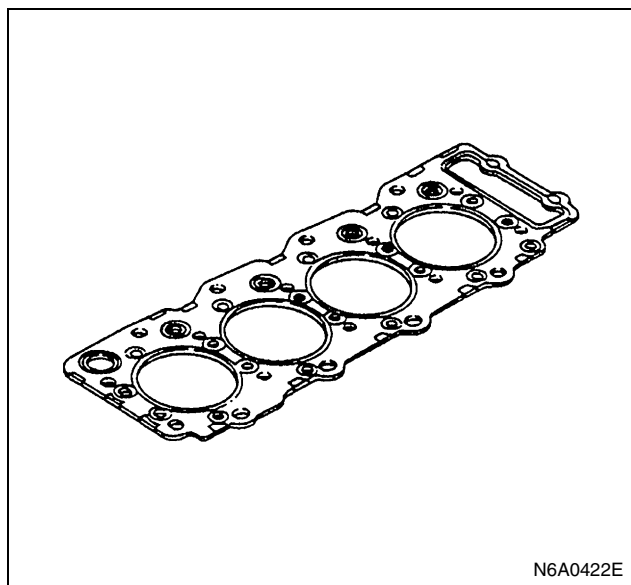
**Legend**

1. Camshaft bearing cap
2. Camshaft bearing upper
3. Camshaft assembly
4. Camshaft bearing lower

11. Cylinder Head Assembly
Above works refer to "CYLINDER HEAD" section in this manual.
12. Cylinder Head Gasket

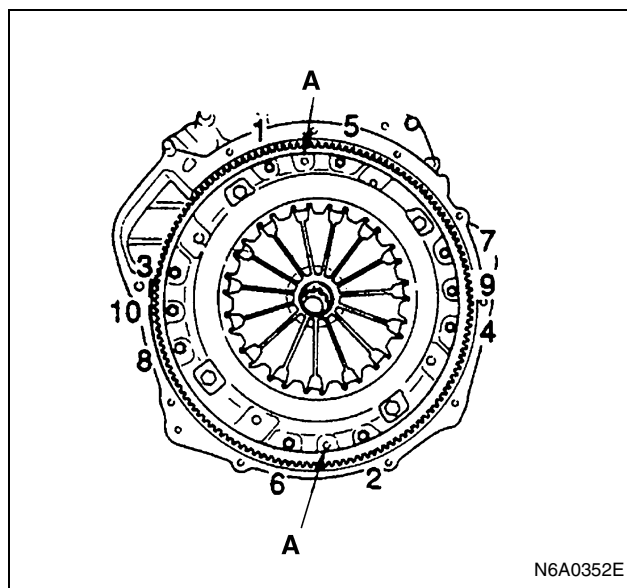
Caution:

Do not reuse the cylinder head gasket.



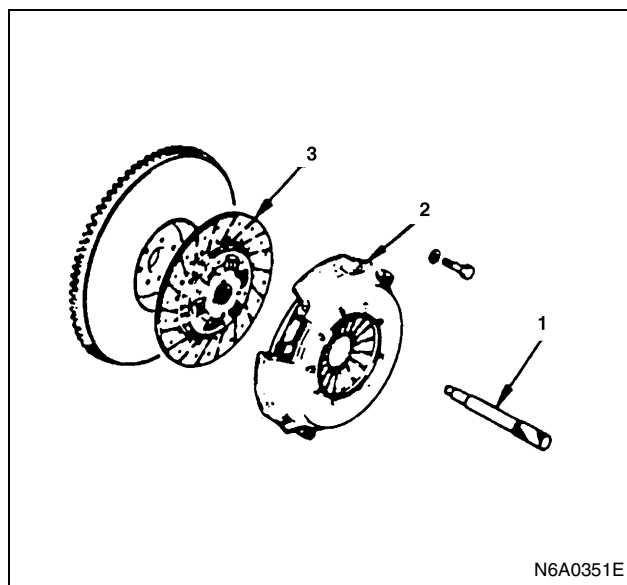
13. Clutch Pressure Plate Assembly

- 1) Insert the clutch pilot aligner to the clutch assembly.
Clutch Pilot Aligner: 5-8840-2240-0
- 2) Loosen the pressure plate bolts in numerical order a little at a time as shown in the illustration.

**Legend**

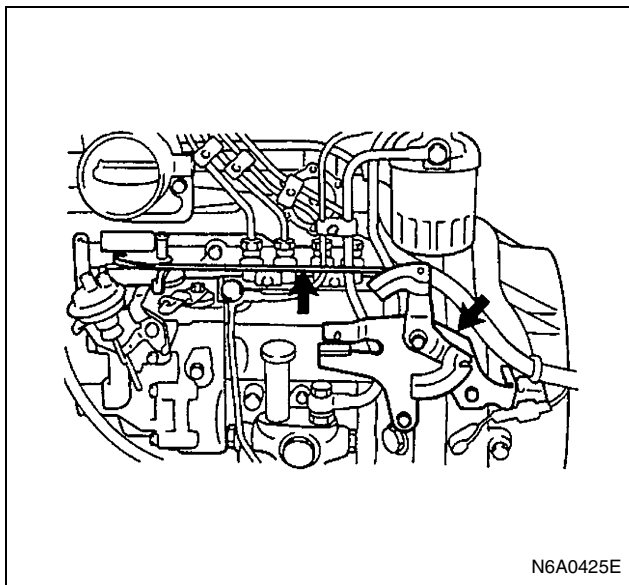
- A. Knock pin

- 3) Remove the pressure plate assembly.
14. Driven Plate
Remove the driven plate with the clutch pilot aligner.

**Legend**

1. Clutch pilot aligner
2. Clutch pressure plate assembly
3. Driven plate

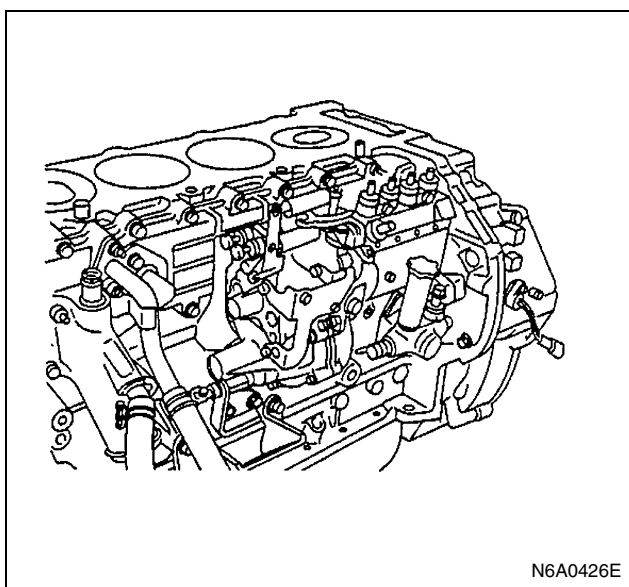
15. Engine Control Wire
16. Engine Control Lever Assembly



17. Oil Pipe

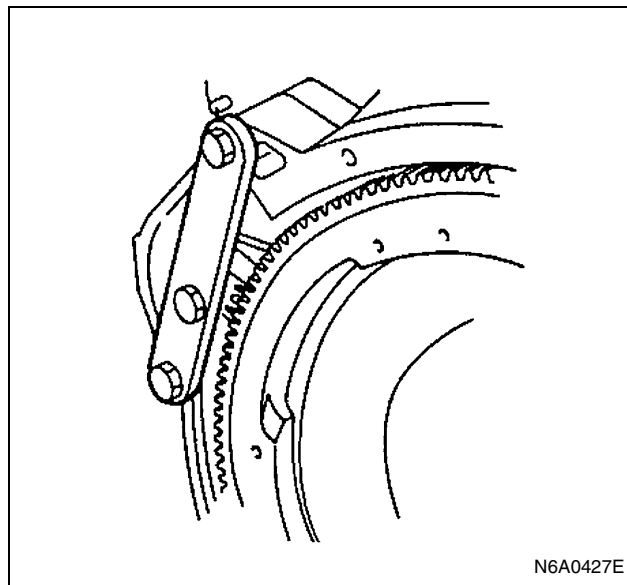
18. Injection Pump Assembly

- 1) Remove the injection pump bracket bolts and the injection pump rear bracket bolts.
- 2) Then remove the injection pump assembly.

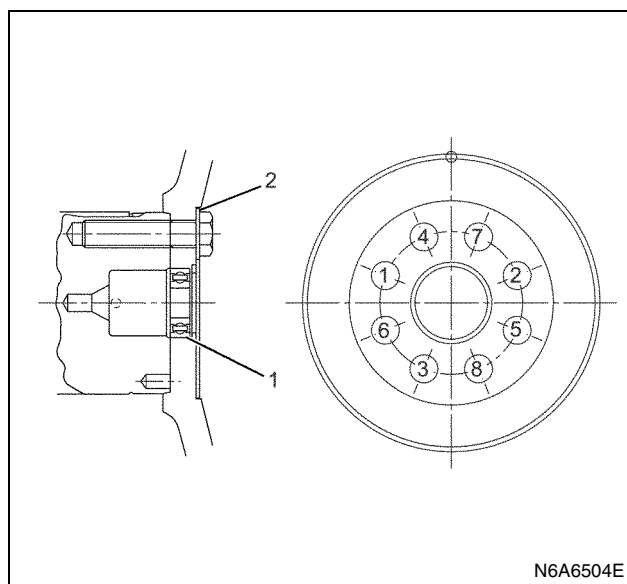


19. Flywheel

- 1) Use the crankshaft stopper to prevent the crankshaft from turning.
Crankshaft Stopper: 5-8840-2230-0



- 2) Loosen the flywheel bolts in numerical order a little at a time as shown in the illustration.



Legend

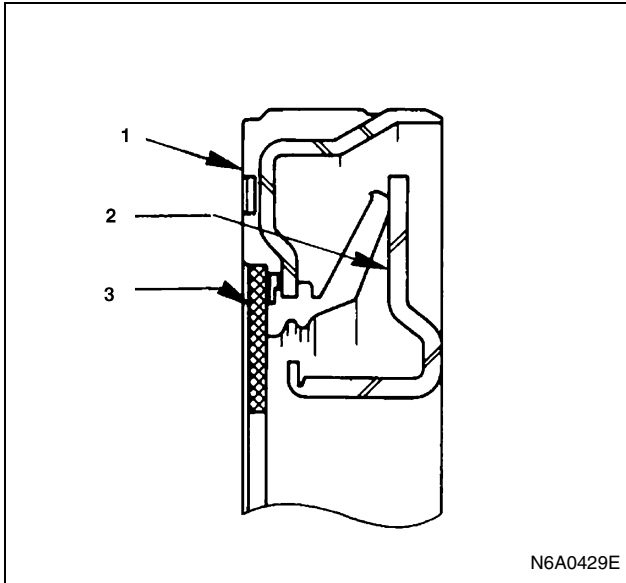
1. Washer
2. Pilot bearing

- 3) Remove the flywheel stopper and the flywheel assembly.

20. Crankshaft Rear Oil Seal

Caution:

Be careful not to damage the crankshaft oil seal contact surface during the removal procedure.

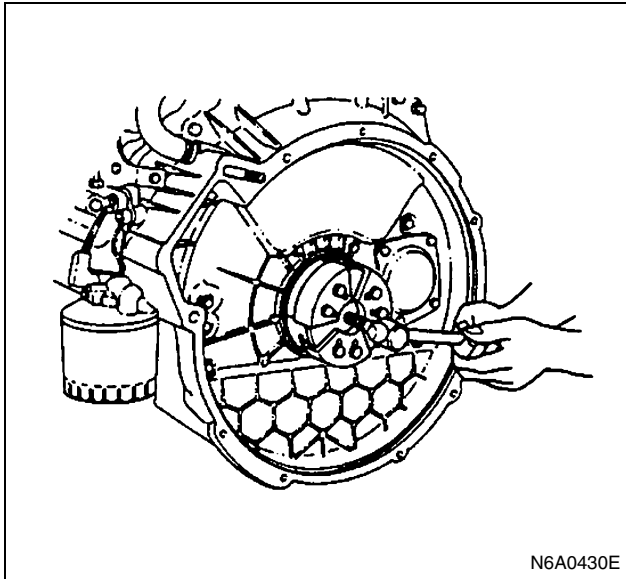
**Legend**

- 1. Oil seal
- 2. Slinger
- 3. Felt

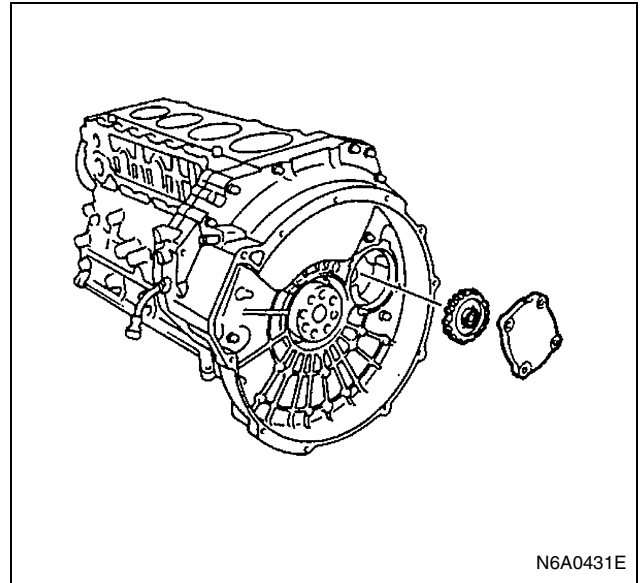
21. Crankshaft Rear Slinger

Use the slinger puller to pull out the slinger.

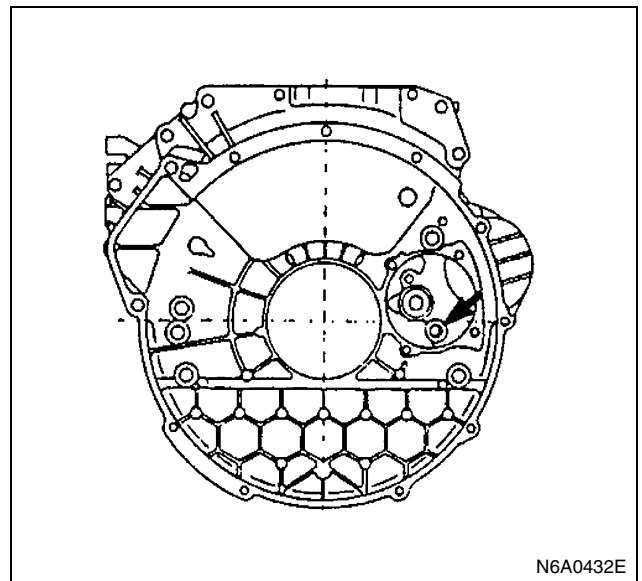
Slinger Puller: 5-8840-2360-0

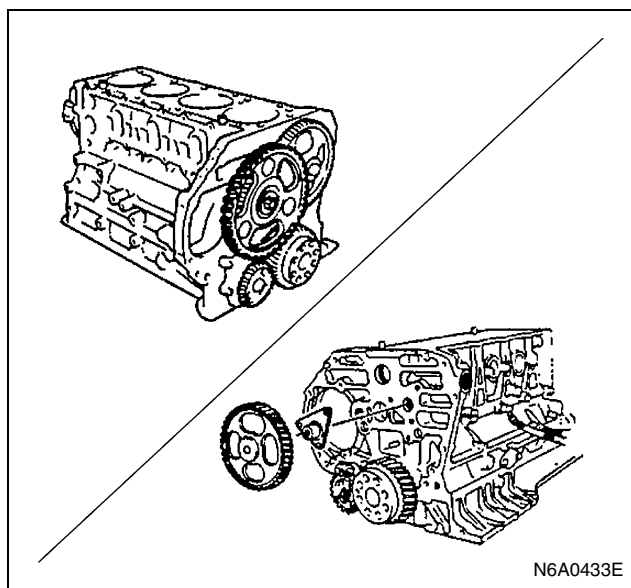
**22. Spacer Rubber**

(Remove the stiffener before removing the spacer rubber.)

23. Oil Pan**24. Power Steering Pump Idle Gear Cover****25. Power Steering Pump Idle Gear****26. Flywheel Housing****Notice:**

Be careful not to fail to remove the bolts shown in the illustration.

**27. Idle Gear A****28. Idle Gear B****29. Idle Gear B shaft**

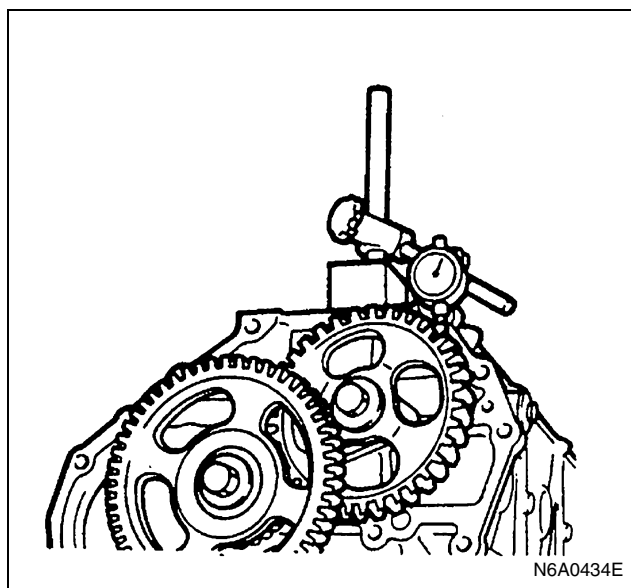


Inspection

Idle Gear Backlash Measurement

1. Set a dial indicator to the timing gear to be measured.
Hold both the gear to be checked and the adjoining gear stationary.
2. Move the gear to be checked right and left as far as possible. Take the dial indicator reading.

Timing Gear Backlash Gear to Gear		mm (in)
Standard	Limit	
0.10 — 0.17 (0.0039 — 0.0067)	0.30 (0.012)	

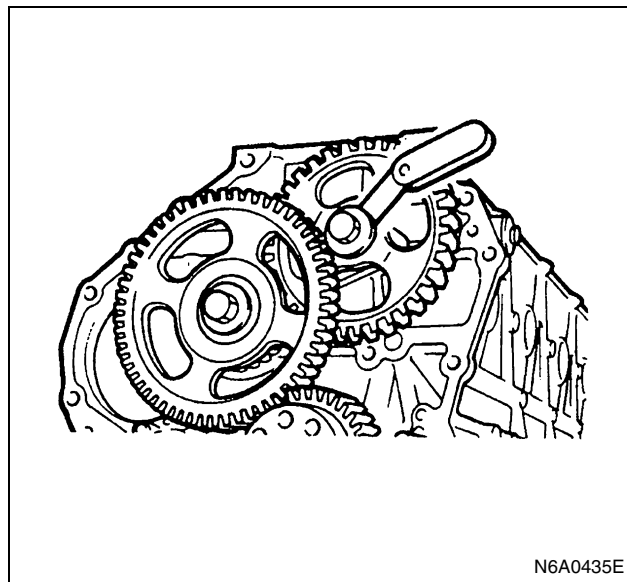


Idle Gear End Play Measurement

Insert a feeler gauge between the idler gear and the thrust collar to measure the gap and determine the idler gear end play.

If the measured value exceeds the specified limit, the thrust collar must be replaced.

Idle Gear End Play		mm (in)
Standard	Limit	
0.058 — 0.115 (0.002 — 0.005)	0.2 (0.008)	

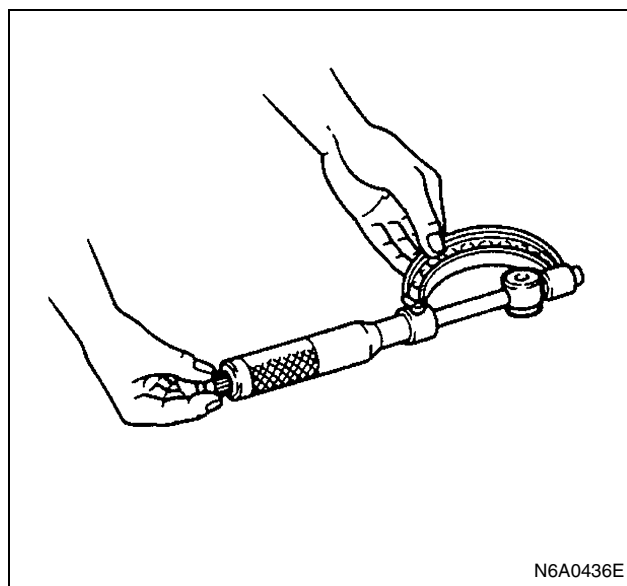


Idle Gear Shaft Outside Diameter

Use a micrometer to measure the idler gear shaft outside diameter.

If the measured value is less than the specified limit, the idler gear must be replaced.

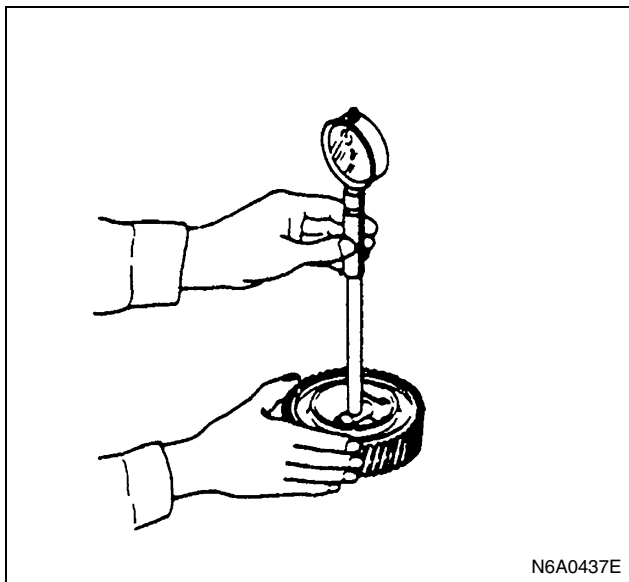
Idle Gear Shaft Outside Diameter		mm (in)
Standard	Limit	
29.959 — 29.980 (1.1795 — 1.1803)	29.80 (1.1732)	



Idle Gear Inside Diameter

Use an inside dial indicator or an inside micrometer to measure the idler gear inside diameter.

Idler Gear Inside diameter		mm (in)
Standard	Limit	
30.000 — 30.021 (1.1811 — 1.1819)	30.100 (1.1850)	



If the clearance between the idler gear shaft outside diameter and the idler gear inside diameter exceeds the limit, the idler gear must be replaced.

Idler Gear Shaft and Idler Gear clearance		mm (in)
Standard	Limit	
0.020 — 0.062 (0.0008 — 0.0024)	0.200 (0.0079)	

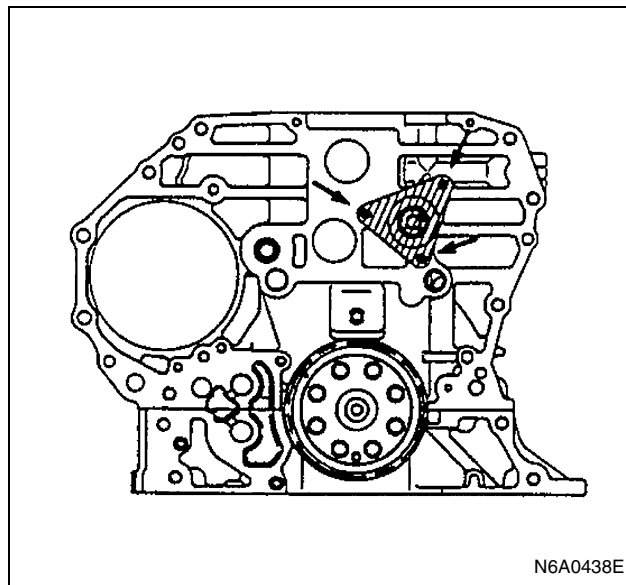
Installation

1. Idler Gear B Shaft

Tighten:

Idle gear B shaft bolt to 31 N·m (3.2 kg·m/23 lb·ft)

Apply the engine oil to the idle gear shaft after installation.

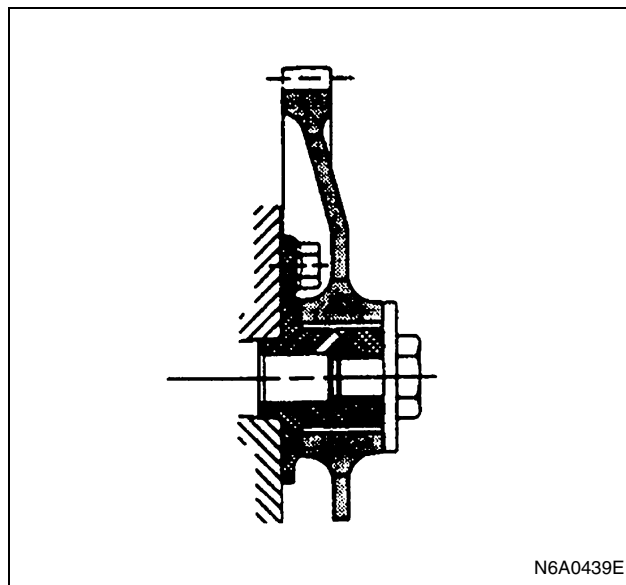


2. Idle Gear B

The face of the idle gear B with longer boss should be positioned toward the rear side shown in the illustration.

Tighten:

Idle gear B bolt to 110 N·m (11.2 kg·m/81 lb·ft)

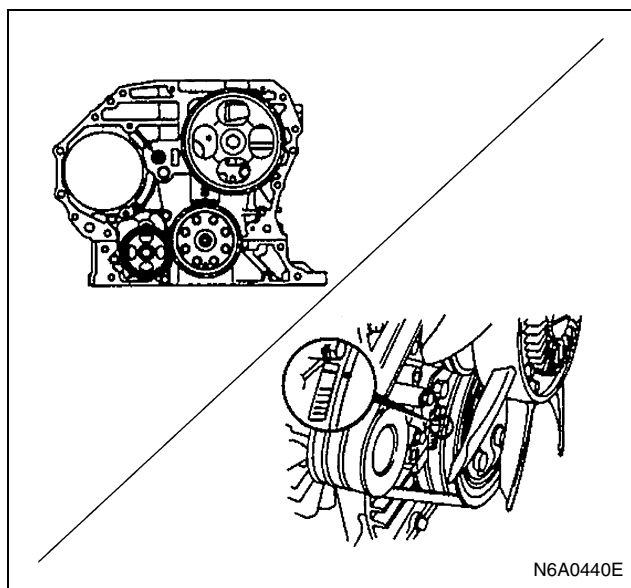


3. Idle Gear A

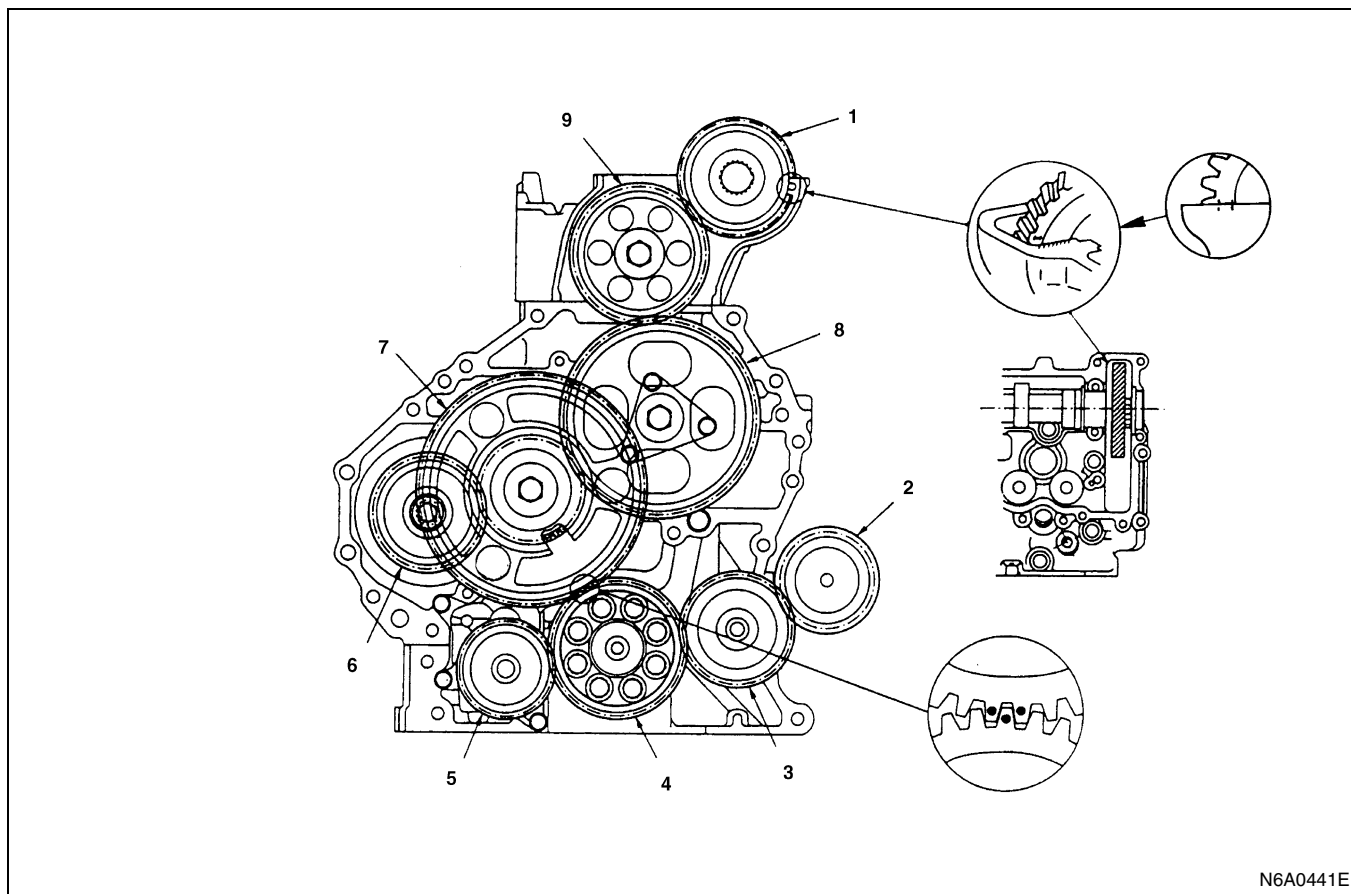
- 1) Turn the crankshaft clockwise so that the engagement mark of the crankshaft gear faces to the shaft center of the idle gear A and the No.1 cylinder piston comes to the top dead center.
- 2) Align the crankshaft gear with the engagement mark of the idle gear and install the idle gear A.

Tighten:

Idle gear A bolt to 133 N·m (13.6 kg·m/98 lb·ft)



Alignment Mark Position for Each Gear



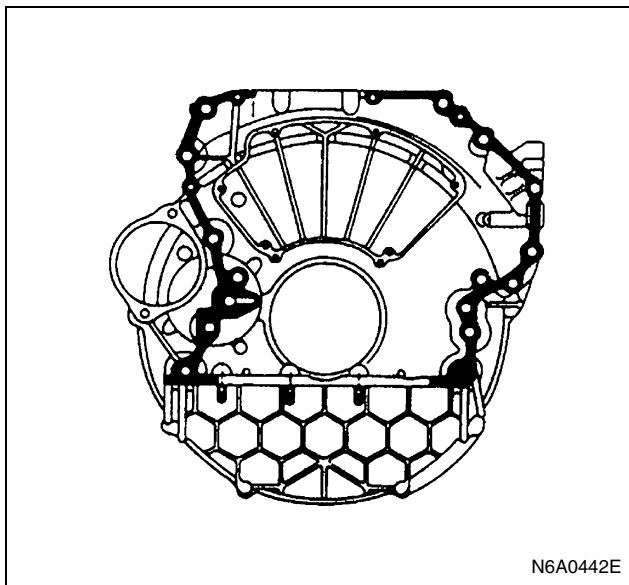
Legend

- | | |
|----------------------------------|------------------------|
| 1. Camshaft gear | 6. Injection pump gear |
| 2. Power steering pump gear | 7. Idle gear A |
| 3. Power steering pump idle gear | 8. Idle gear B |
| 4. Crankshaft gear | 9. Idle gear C |
| 5. Oil pump drive | |

4. Flywheel Housing

- 1) Carefully wipe any foreign material from the cylinder body rear face.

- 2) Apply the recommended liquid gasket (Three Bond 1207C) or its equivalent to the shaded areas shown in the illustration.

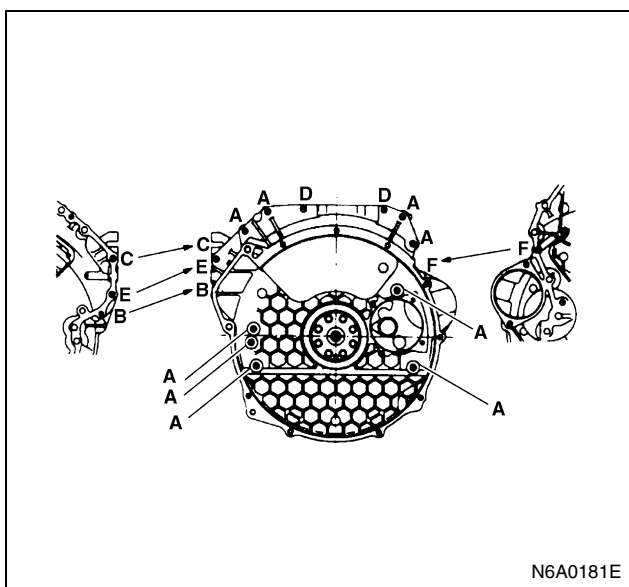


- 3) Align the cylinder body knock pins with the flywheel housing knock pin holes.
- 4) Tighten the flywheel housing bolts to the specified torque shown in the illustration.

Tighten:

Flywheel housing bolt to

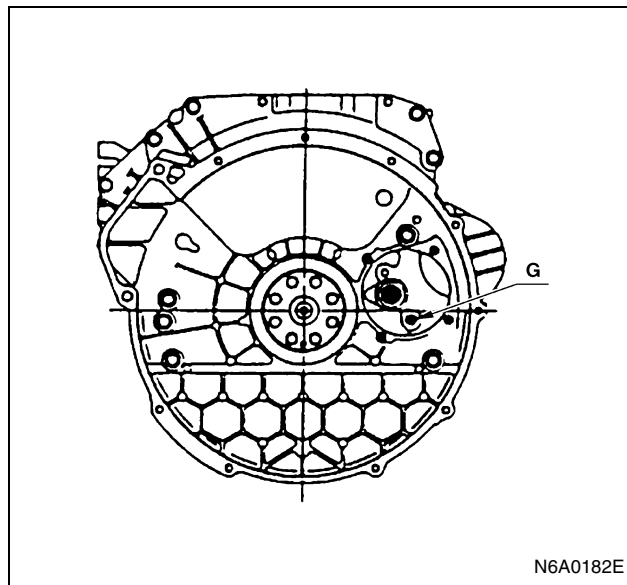
- (A): 96 N·m (9.8 kg·m/71 lb·ft)
- (B): 48 N·m (4.9 kg·m/35 lb·ft)
- (C): 94 N·m (9.6 kg·m/69 lb·ft)
- (D): 25 N·m (2.6 kg·m/19 lb·ft)
- (E): 76 N·m (7.7 kg·m/56 lb·ft)
- (F): 48 N·m (4.9 kg·m/35 lb·ft)



- Tighten the bolts marked with "E" or "B" from the injection pump side, and those with "F" from the cylinder body side.

Tighten:

Flywheel housing bolt (G) to 96 N·m (9.8 kg·m/71 lb·ft)

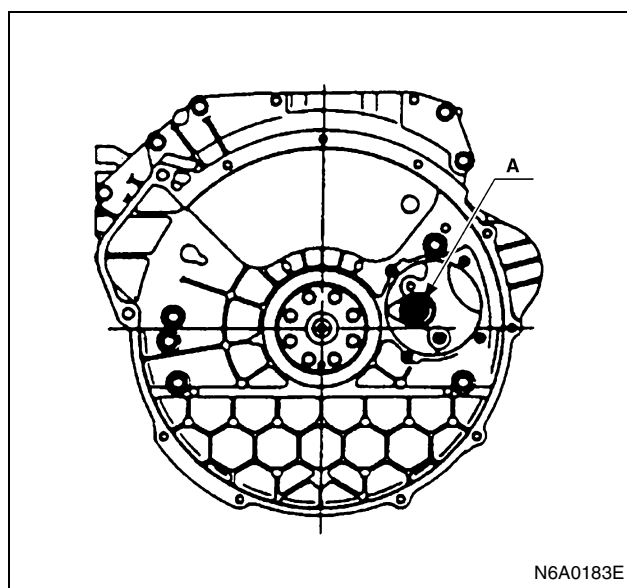


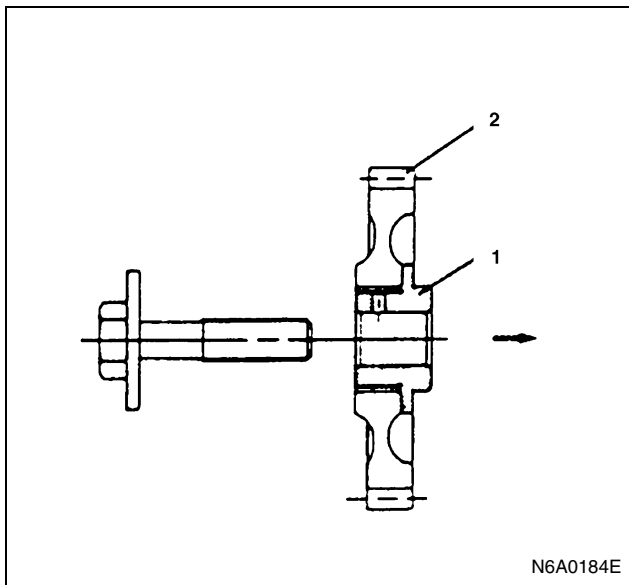
5. Power Steering Pump Idle Gear

- 1) Apply the engine oil to the idle gear shaft.
- 2) Install the idle gear shaft (1) with the idle gear (2) to the cylinder body A portion as shown in the illustration.

Tighten:

Idle gear shaft bolt to 135 N·m (13.6 kg·m/98 lb·ft)

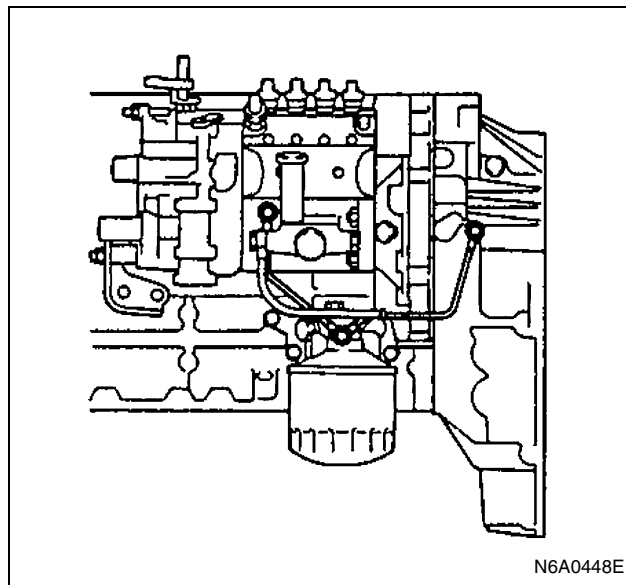




6. Power steering Pump Idle Gear Cover
Install the gear cover with the O-ring.

Tighten:

Gear cover bolt to 19 N·m (1.9 kg·m/14 lb·ft)

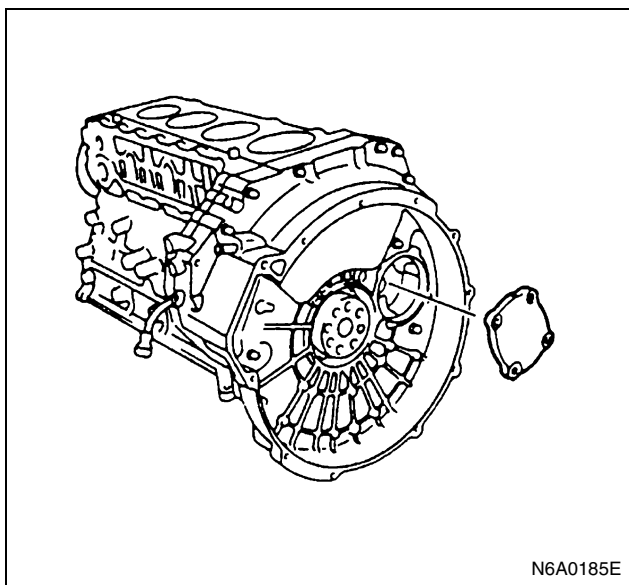


14. Engine Control Lever Assembly

Tighten:

Engine control lever bolt to 24 N·m (2.4 kg·m/17 lb·ft)

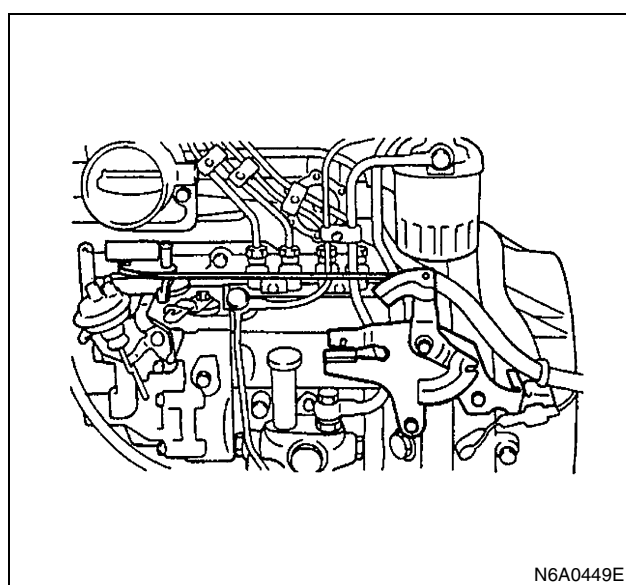
15. Engine Control Wire



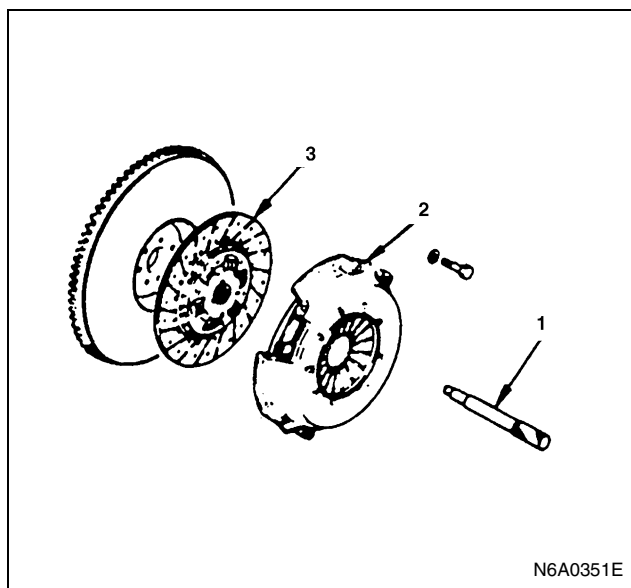
7. Oil Pan
8. Spacer Rubber
Above works refer to "OIL PAN" section in this manual.
9. Crankshaft Rear Slinger
10. Crankshaft Rear Oil Seal
11. Flywheel
Above works refer to "CRANKSHAFT REAR OIL SEAL" section in this manual.
12. Injection Pump Assembly
Above works refer to "INJECTION PUMP ASSEMBLY" section in this manual.
13. Oil Pipe

Tighten:

Oil pipe joint bolt to 17 N·m (1.7 kg·m/12 lb·ft)



16. Driven Plate
Use the clutch pilot aligner to install the driven plate.
Clutch Pilot Aligner: 5-8840-2240-0

**Legend**

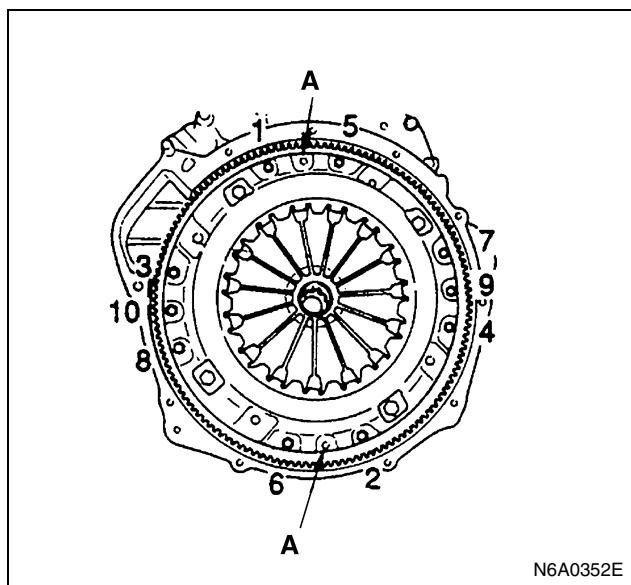
1. Clutch pilot aligner
2. Clutch pressure plate assembly
3. Driven plate

17. Clutch Pressure Plate Assembly

- 1) Align the clutch pressure plate with the flywheel knock pin.
- 2) Tighten the pressure plate bolts to the specified torque in numerical order.

Tighten:

Clutch pressure plate bolt to 40 N·m (4.1 kg·m/30 lb·ft)

**Legend**

- A. Knock pin

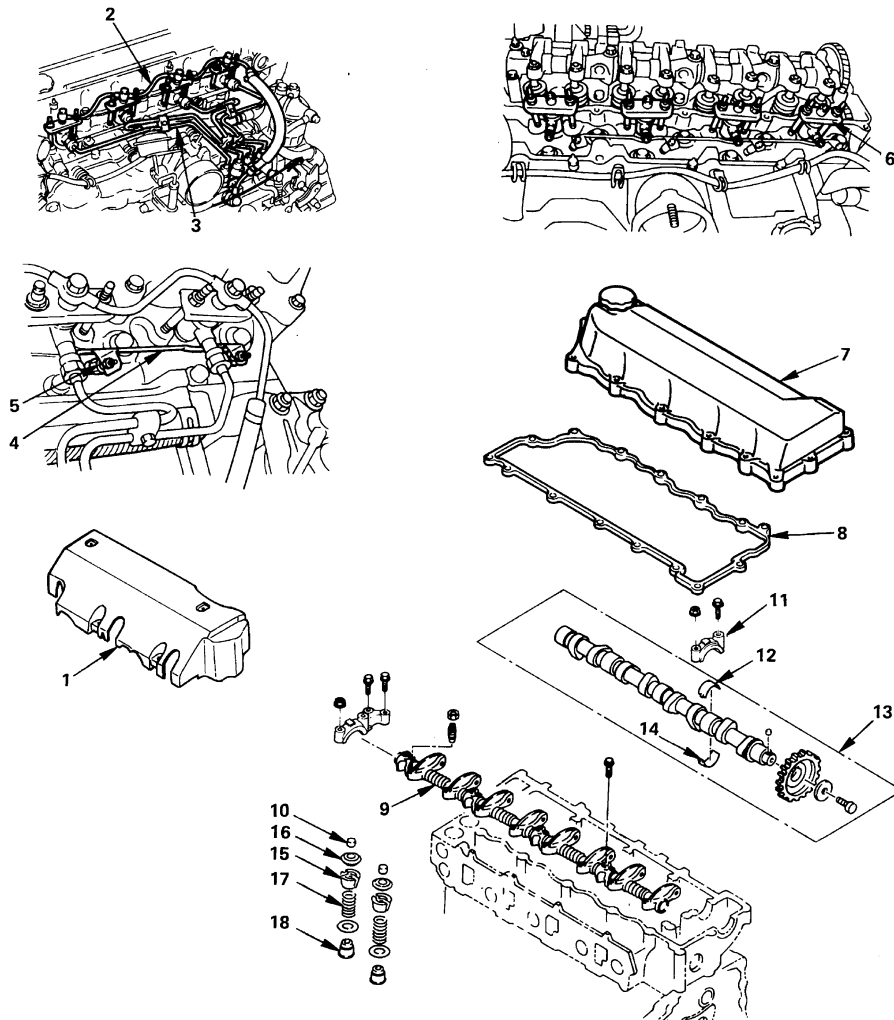
18. Cylinder Head Gasket

Above works refer to "CYLINDER HEAD GASKET" section in this manual.

19. Cylinder Head Assembly
Above works refer to "CYLINDER HEAD GASKET" section in this manual.
20. Camshaft Bearing Lower
21. Camshaft Assembly
22. Camshaft Bearing Upper
23. Camshaft Bearing Cap
24. Valve Cap
25. Rocker Arm Shaft Assembly
Above works refer to "CAMSHAFT ASSEMBLY" section in this manual.
26. Head Cover Gasket
27. Cylinder Head Cover
Above works refer to "CYLINDER HEAD COVER" section in this manual.
28. Nozzle Cover
29. Engine Assembly
Above works refer to "ENGINE ASSEMBLY" section in this manual.

VALVE GUIDE SEAL & VALVE SPRING

Component



N6A0452E

Legend

- | | |
|-------------------------------------|----------------------------|
| 1. Nozzle cover | 10. Valve cap |
| 2. Leak off pipe | 11. Camshaft bearing cap |
| 3. Injection pipe | 12. Camshaft bearing upper |
| 4. Glow plug connector | 13. Camshaft assembly |
| 5. Glow plug | 14. Camshaft bearing lower |
| 6. Injection nozzle holder assembly | 15. Cotter collar |
| 7. Cylinder head cover | 16. Spring upper seat |
| 8. Cylinder head cover gasket | 17. Valve spring |
| 9. Rocker arm shaft assembly | 18. Valve guide seal |

Removal

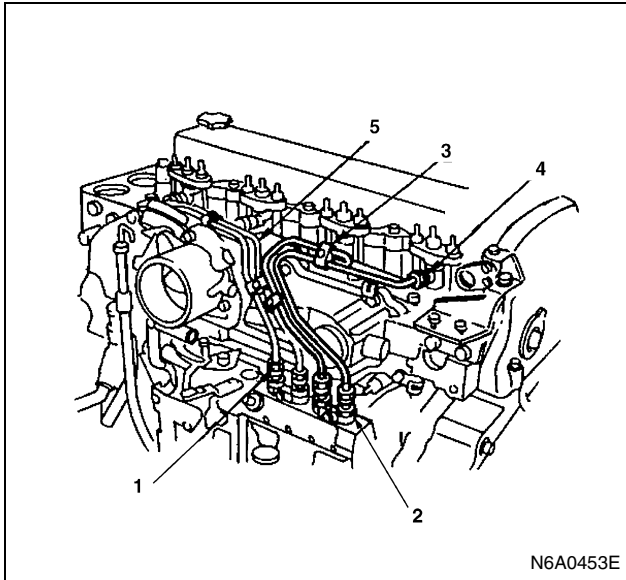
Preparation

- Disconnect battery ground cable.
- Tilt the cab.

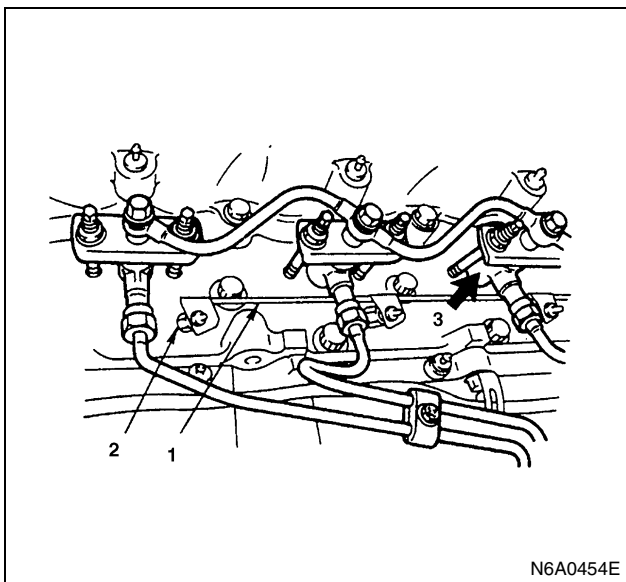
1. Nozzle Cover
2. Leak Off Pipe
3. Injection Pipe
 - Loosen the injection pipe sleeve nuts (1).

Do not apply excessive force to the injection pipes (5).

- Loosen the injection pipes clips (3). Remove the injection pipe assembly. Plug the delivery valve holder (2) ports and nozzle holder (4) ports with caps to prevent the entry of foreign material.



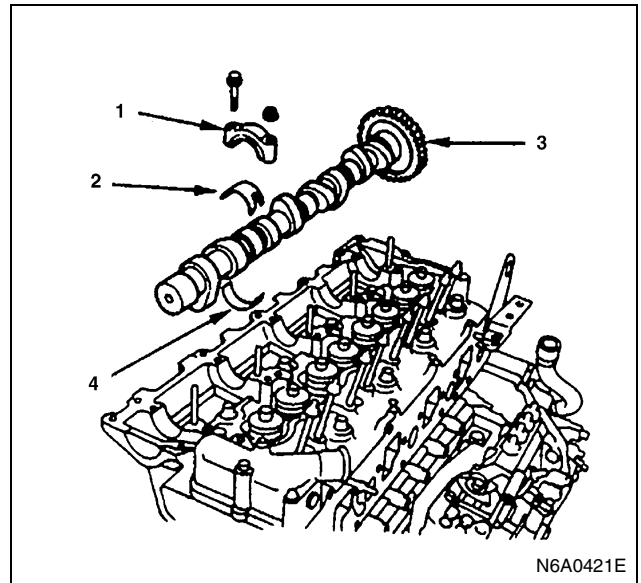
- Glow Plug Connector
- Glow Plug
- Injection Nozzle Holder Assembly
Mark the nozzle holder assemblies fitting positions by tagging each nozzle holder assembly with the cylinder number from which it was removed.



Legend

- Glow plug connector
- Glow plug
- Injection nozzle holder assembly

- Rocker Arm Shaft Assembly
Above works refer to "ROCKER ARM SHAFT ASSEMBLY" section in this manual.
- Valve Cap
- Camshaft Bearing Cap
- Camshaft Bearing Upper
- Camshaft Assembly
- Camshaft Bearing Lower
 - If the camshaft bearings are to be reinstalled, mark their fitting positions by tagging each bearing with the cylinder number from which it was removed.

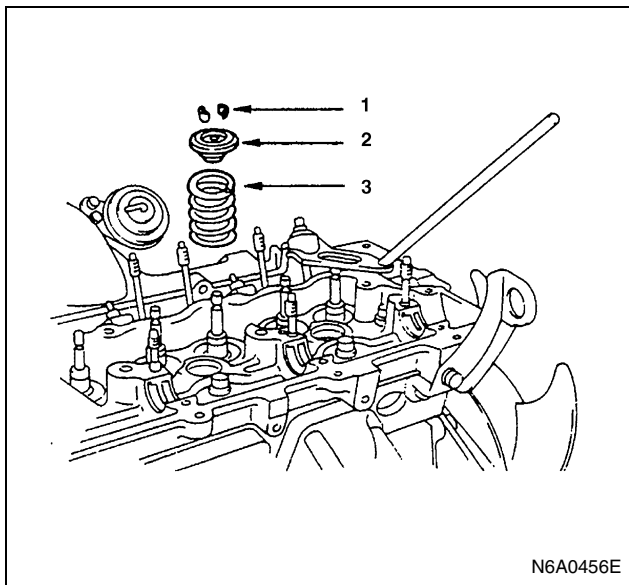


Legend

- Camshaft bearing cap
- Camshaft bearing upper
- Camshaft assembly
- Camshaft bearing lower

- Cotter Collar
 - Spring Upper Seat
 - Valve Spring
 - Apply compressed air to cylinder from the glow plug hole to hold the valve in place.
 - Using special tool, compress valve spring and remove cotter collar.
- Valve Spring Compressor: 5-8840-2228-0

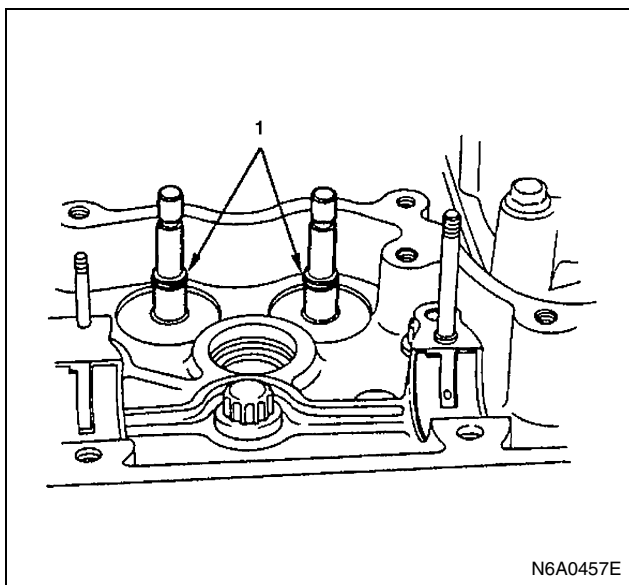
- Cylinder Head Cover
- Cylinder Head Cover Gasket



Legend

1. Cotter collar
2. Spring upper seat
3. Valve spring

18. Valve Guide Seal



Legend

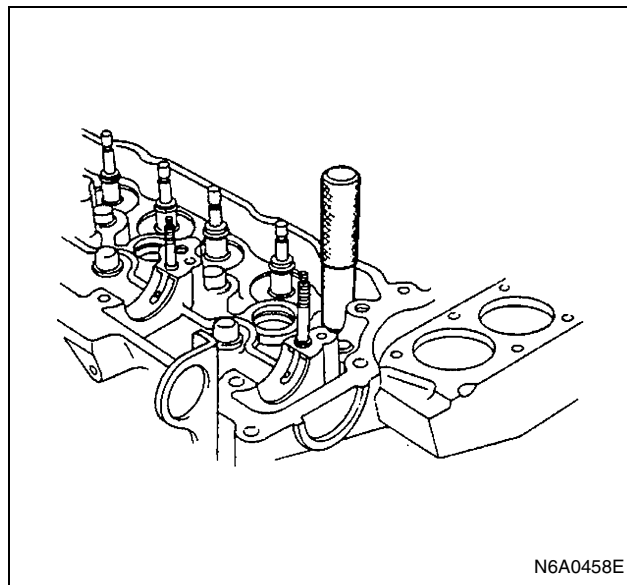
1. Oil seal

Installation

1. Valve Guide Seal

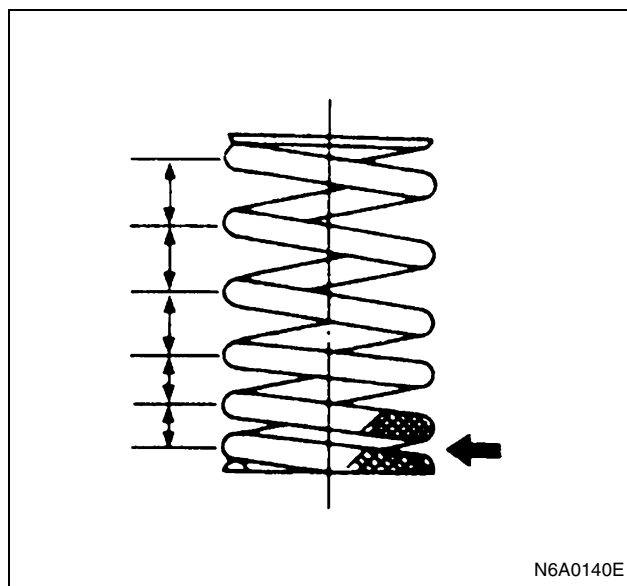
- Apply a coat of engine oil to the valve guide seal inner face.
- Use a valve guide seal installer to install the valve guide seal to the valve guide

Valve Guide Seal Installer: 8-9439-6815-0



2. Valve Spring

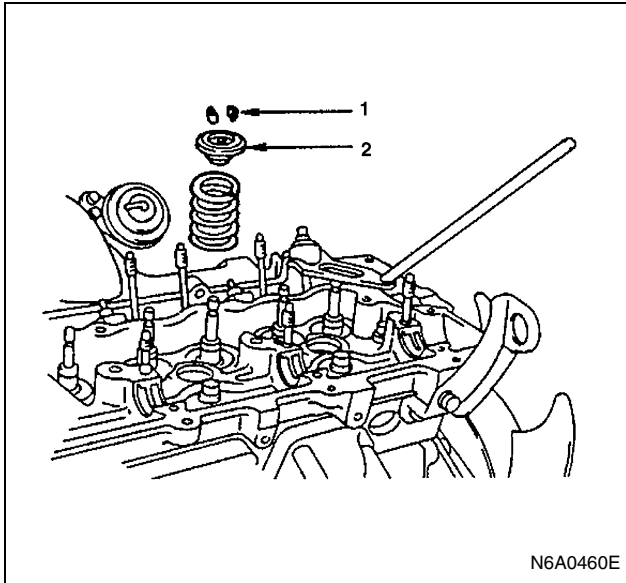
Install the valve spring with its fine pitched (or painted) end side down.



3. Spring Upper Seat

4. Cotter Collar

- 1) Use the valve spring compressor to push the valve spring into position.
Valve Spring Compressor: 5-8840-2228-0
- 2) Install the cotter collar to the valve stem.
- 3) Set the cotter collar by tapping around the head of the collar with a rubber hammer.

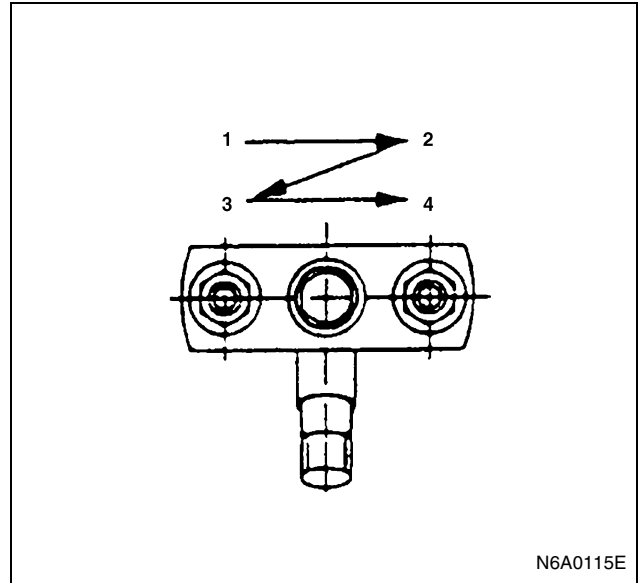
**Legend**

1. Cotter collar
2. Spring upper seat

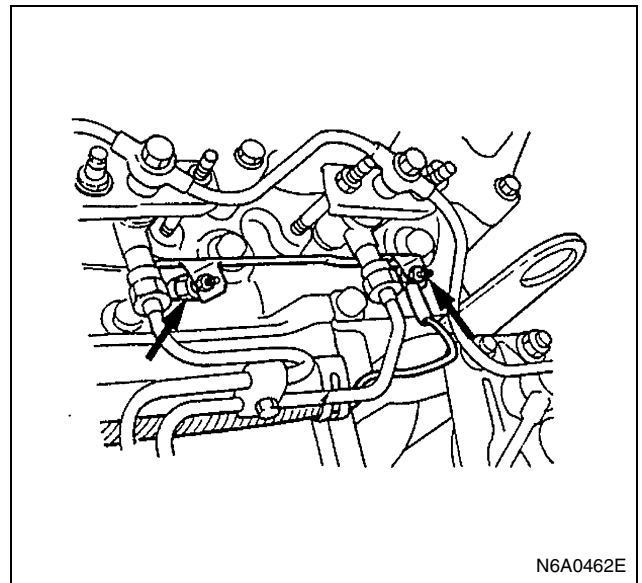
5. Camshaft Bearing Lower
6. Camshaft Assembly
7. Camshaft Bearing Upper
8. Camshaft Bearing Cap
9. Valve Cap
Above works refer to "CAMSHAFT ASSEMBLY" section in this manual.
10. Rocker Arm shaft Assembly
Above works refer to "ROCKER ARM SHAFT ASSEMBLY" section in this manual.
11. Cylinder Head Cover Gasket
12. Cylinder Head Cover
Above works refer to "CYLINDER HEAD COVER" section in this manual.
13. Injection Nozzle Holder Assembly
Tighten the nozzle holder flange nuts to the specified torque in the numerical order shown in the illustration.

Tighten:

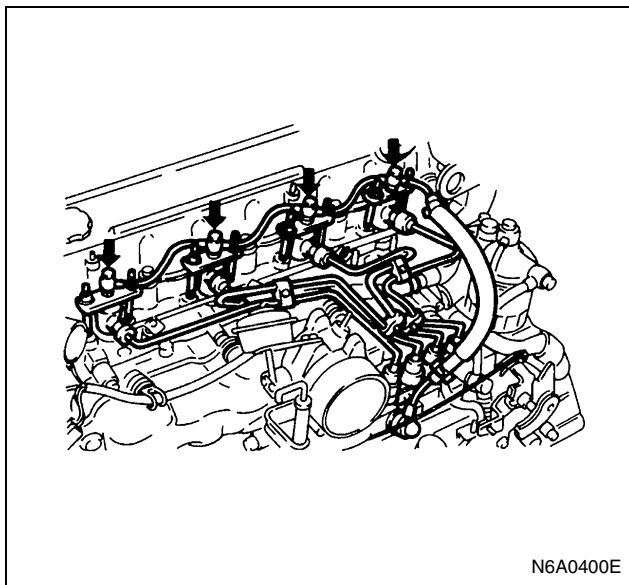
Nozzle holder flange nut to 19 N·m (1.9 kg·m/14 lb·ft)

**14. Glow Plug****Tighten:**

Glow plug to 23 N·m (2.3 kg·m/17 lb·ft)

**15. Glow Plug Connector****16. Injection Pipe****17. Leak Off Pipe**

Above works refer to "INJECTION PUMP ASSEMBLY" section in this manual.

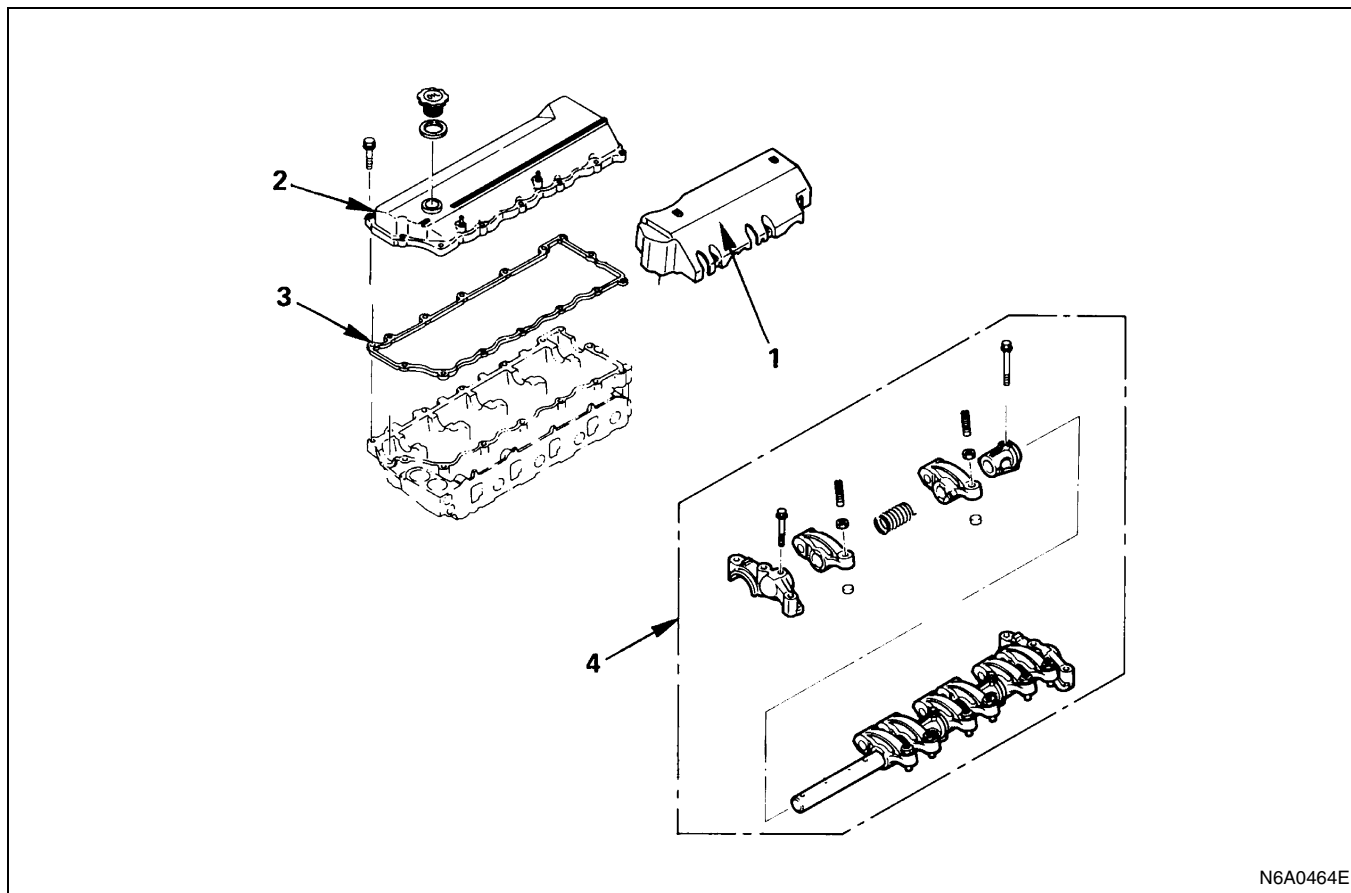


18. Nozzle Cover

- Connect the negative battery cable
- Lower the cab
- Start engine and check for fuel leakage carefully.

ROCKER ARM SHAFT ASSEMBLY

Component



N6A0464E

Legend

- | | |
|------------------------|-------------------------------|
| 1. Nozzle cover | 3. Cylinder head cover gasket |
| 2. Cylinder head cover | 4. Rocker arm shaft assembly |

Removal

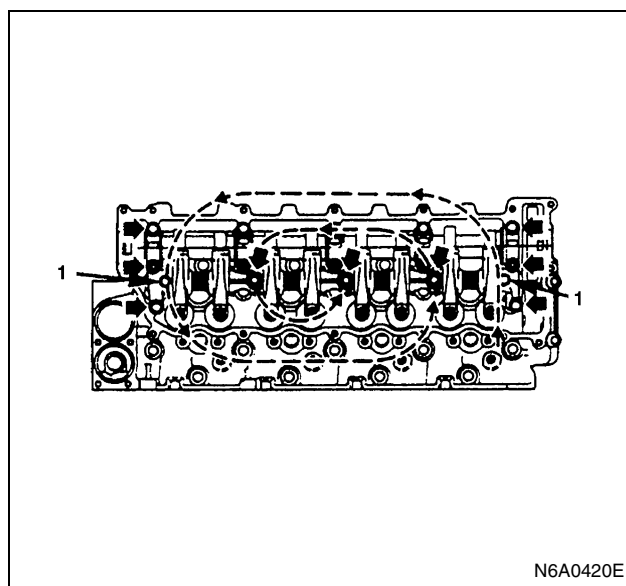
Preparation

- Disconnect battery ground cable.
- Tilt the cab.

1. Nozzle Cover
2. Cylinder Head Cover
3. Cylinder Head Cover Gasket
4. Rocker Arm Shaft Assembly
 - 1) Loosen the rocker arm shaft bracket nuts and bolts in numerical order a little at a time and remove the rocker arm shaft assembly with the camshaft brackets.
 - 2) Leave the (1) indicated bolt unremoved on this occasion, since it is the rocker arm fixing bolt.

Caution:

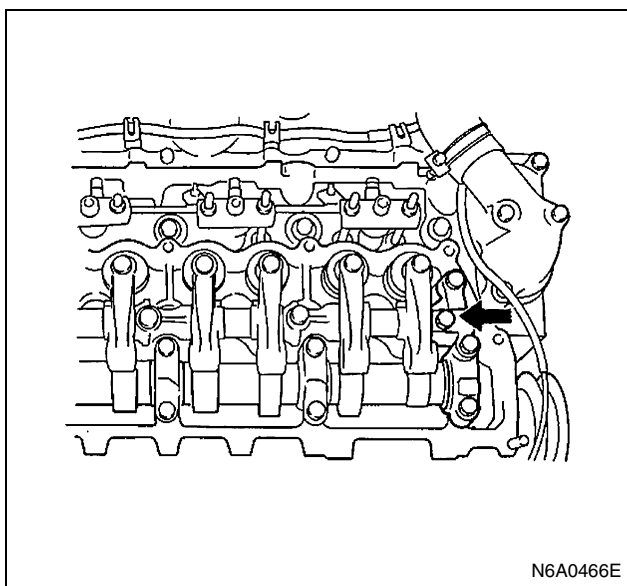
Failure to loosen the rocker arm shaft bracket nuts and bolts in numerical order a little at a time will adversely affect the rocker arm shaft.



N6A0420E

Installation**1. Rocker Arm Shaft Assembly**

- 1) Slightly loosen the bolts marked with the arrow in the illustration.



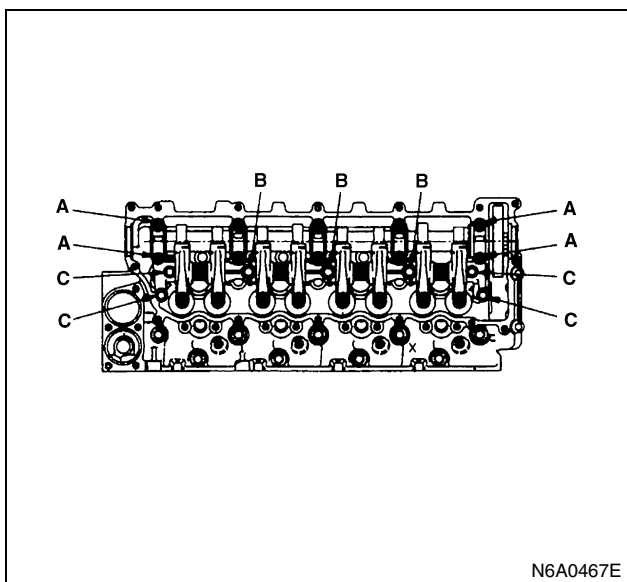
- 2) Loosen the rocker arm adjust screws and apply engine oil to the rocker arm roller portions.
- 3) Install the rocker arm assembly on the cylinder head.
- 4) Tighten the rocker arm shaft breaker nuts and bolts to the specified torque in numerical order a little at a time as shown in the illustration.

Tighten:

Rocker arm shaft bracket nut and bolt to

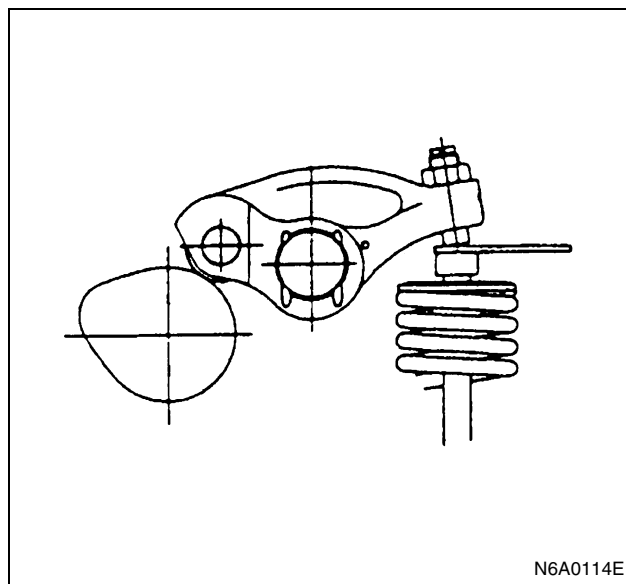
- Nut (A): 27 N·m (2.8 kg·m/20 lb·ft)
- Bolt (B): 56 N·m (5.7 kg·m/41 lb·ft)
- Bolt (C): 27 N·m (2.8 kg·m/20 lb·ft)

- 5) Apply engine oil to the threaded portion of the nuts marked with "A" and the bolts with "B" shown in the illustration left, and then tighten them to the specified torque.



Adjust the valve clearance.

Valve Clearance		mm (in)
At cold		0.4 (0.016)

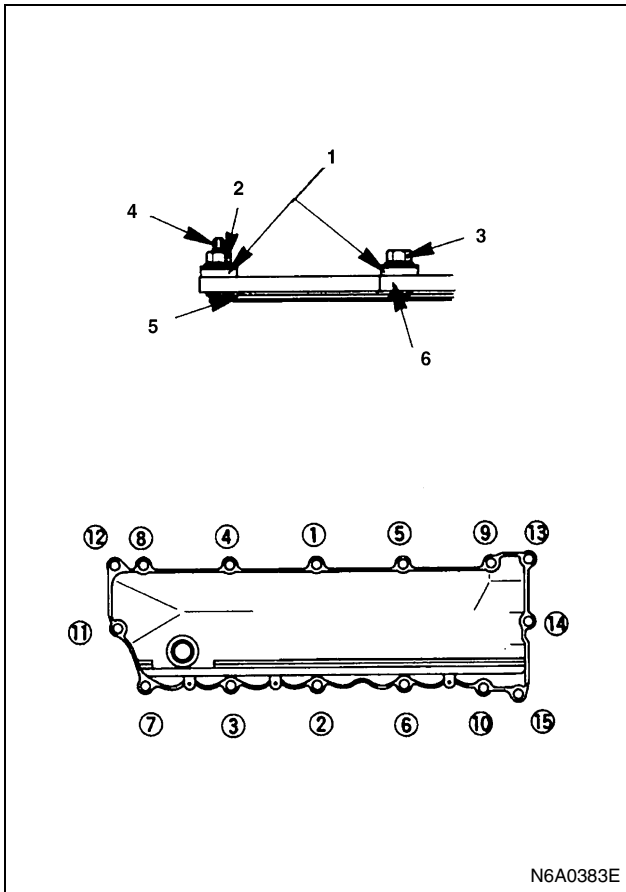


Above works refer to "SERVICING" VALVE CLEARANCE ADJUSTMENT" previously section in this manual.

2. Cylinder Head Cover Gasket
Install the gasket to the cylinder head cover.
3. Cylinder Head Cover
 - 1) Install the cylinder head cover.
 - 2) Tighten the cylinder head cover nuts and bolts to the specified torque in the numerical order shown in the illustration.

Tighten:

Cylinder head cover nut and bolt to 18 N·m (1.8 kg·m/13 lb·ft)

**Legend**

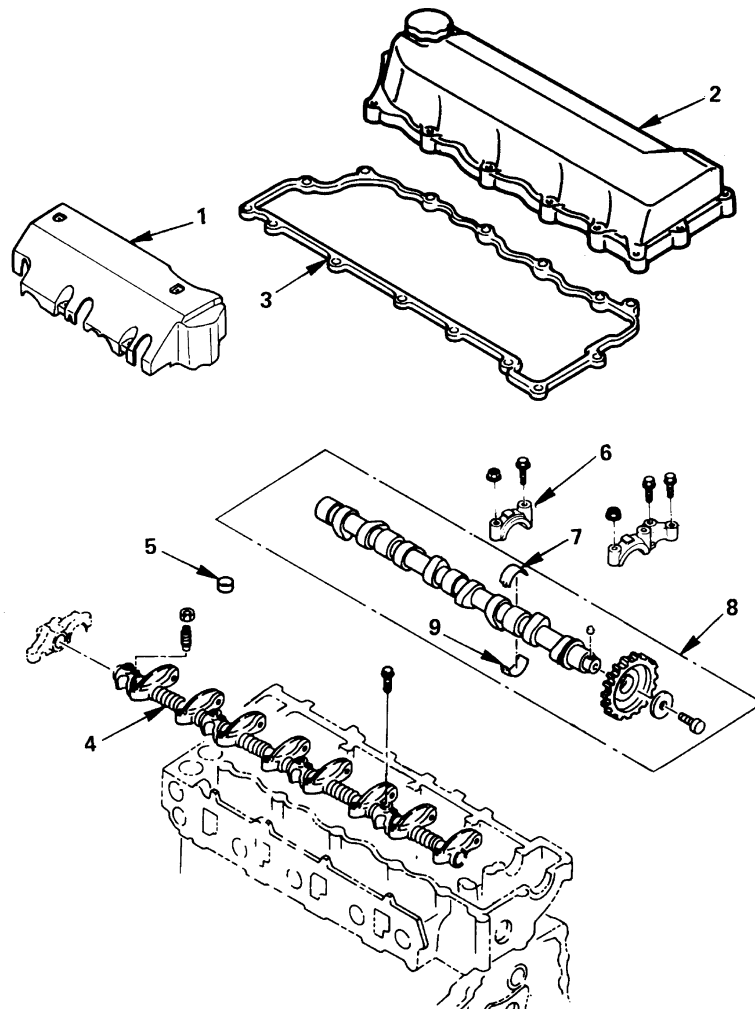
1. Mounting rubber
2. Nut
3. Bolt
4. Stud
5. Gasket
6. Head cover

4. Nozzle Cover

- Connect the battery ground cable.
- Lower the cab.
- Start the engine and check for the oil leakage carefully.

CAMSHAFT ASSEMBLY

Component



N6A0470E

Legend

- | | |
|-------------------------------|---------------------------|
| 1. Nozzle cover | 6. Camshaft bearing cap |
| 2. Cylinder head cover | 7. Camshaft bearing upper |
| 3. Cylinder head cover gasket | 8. Camshaft assembly |
| 4. Rocker arm shaft assembly | 9. Camshaft bearing lower |
| 5. Valve cap | |

Removal

Preparation

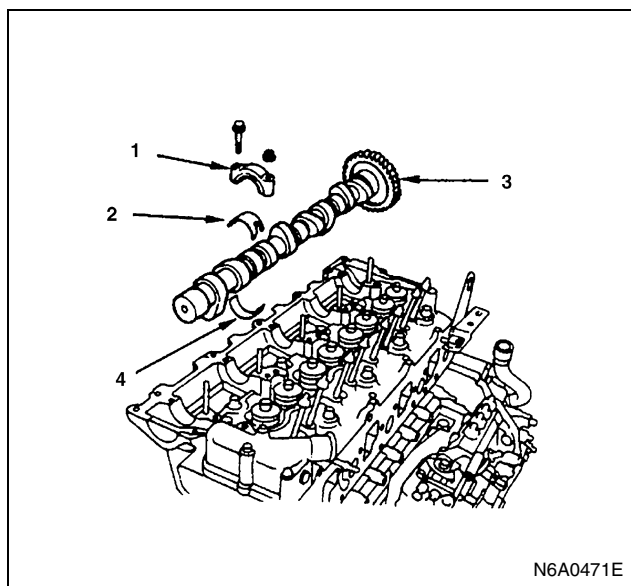
- Disconnect battery ground cable.
- Tilt the cab.

1. Nozzle Cover
2. Cylinder Head Cover
3. Cylinder Head Cover Gasket
4. Rocker Arm Shaft Assembly

Above works refer to "ROCKER ARM SHAFT ASSEMBLY" section in this manual.

5. Valve Cap
6. Camshaft Bearing Cap
7. Camshaft Bearing Upper
8. Camshaft Assembly
9. Camshaft Bearing Lower

- If the camshaft bearings are to be reinstalled, mark their fitting positions by tagging each bearing with the cylinder number from which it was removed.

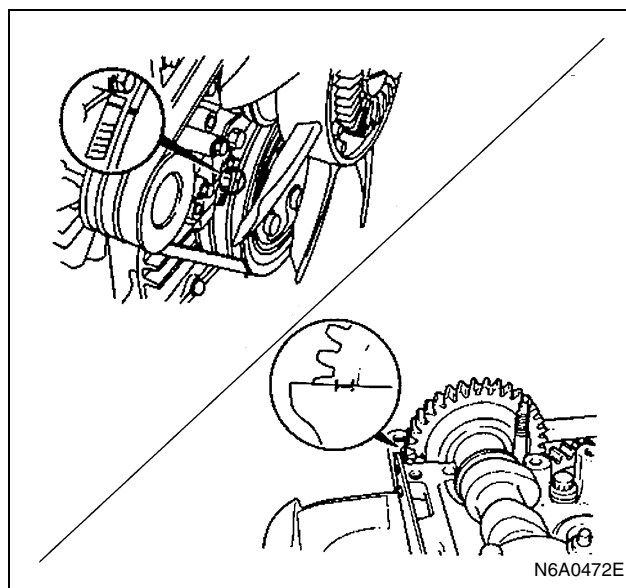


Legend

1. Camshaft bearing cap
2. Camshaft bearing upper
3. Camshaft assembly
4. Camshaft bearing lower

Installation

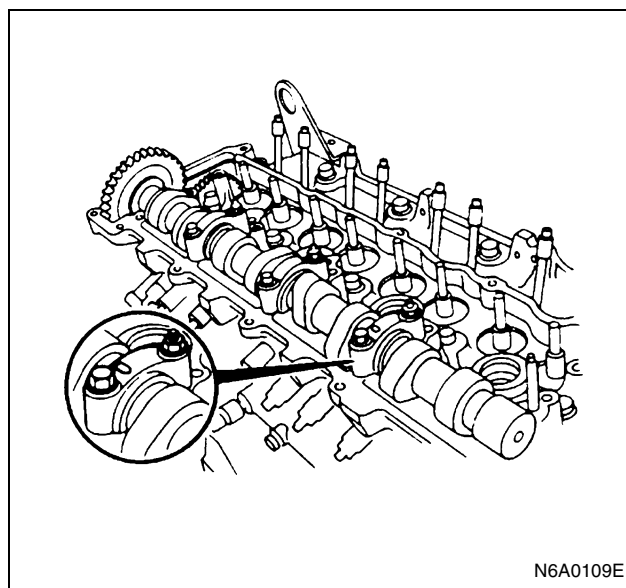
1. Camshaft Bearing Lower
2. Camshaft Assembly
 - 1) Turn the crankshaft in the direction of normal rotation until the timing mark on the crankshaft damper pulley is aligned with the TDC notched line.
 - 2) Apply engine oil to the camshaft journal and the camshaft bearing surfaces before installation.
 - 3) Carefully align the camshaft gear "I" mark and the cylinder head upper face shown in the illustration.



3. Camshaft Bearing Upper

4. Camshaft Bearing Cap

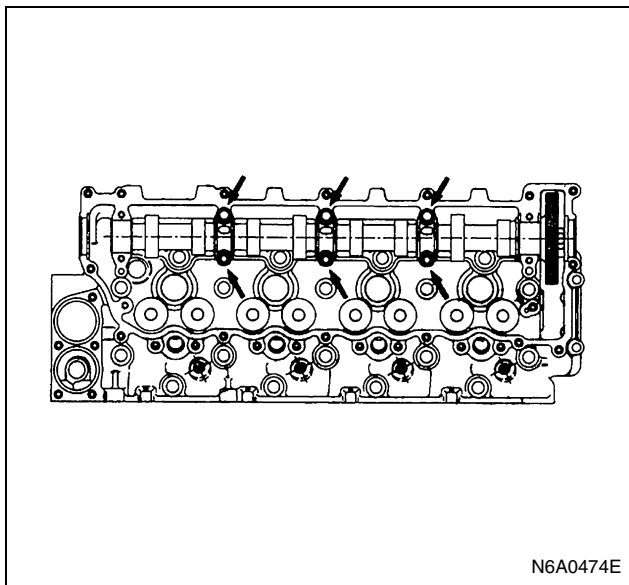
- Install the bearing caps with the bearing cap head mark (arrow) facing forward.
- Apply a coat of engine oil to the bearing cap bolt and stud threads.



- Tighten the bearing cap bolts and studs to the specified torque.

Tighten:

Camshaft bearing cap nut and bolt to 27 N·m (2.8 kg·m/ 20 lb·ft)

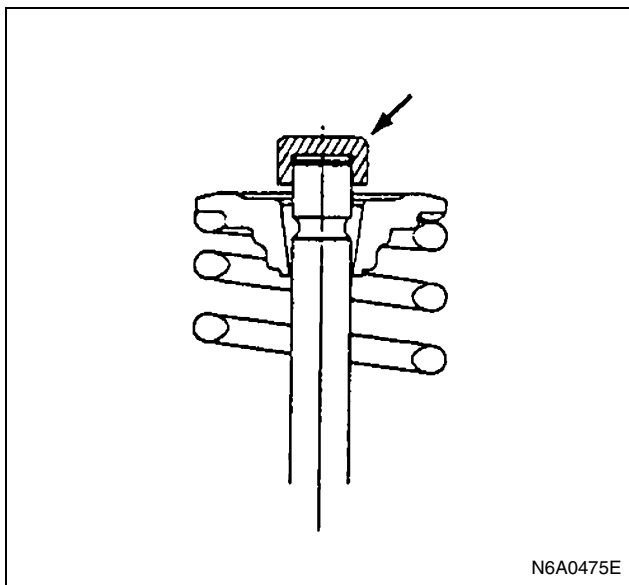


5. Valve Cap

Apply engine oil to the inside of the valve caps and install them to the valve stem end.

Caution:

Take sufficient care not to let the valve caps fall into the gear.



6. Rocker Arm Shaft Assembly

Above works refer to "ROCKER ARM SHAFT ASSEMBLY" section in this manual.

7. Cylinder Head Cover Gasket

8. Cylinder Head Cover

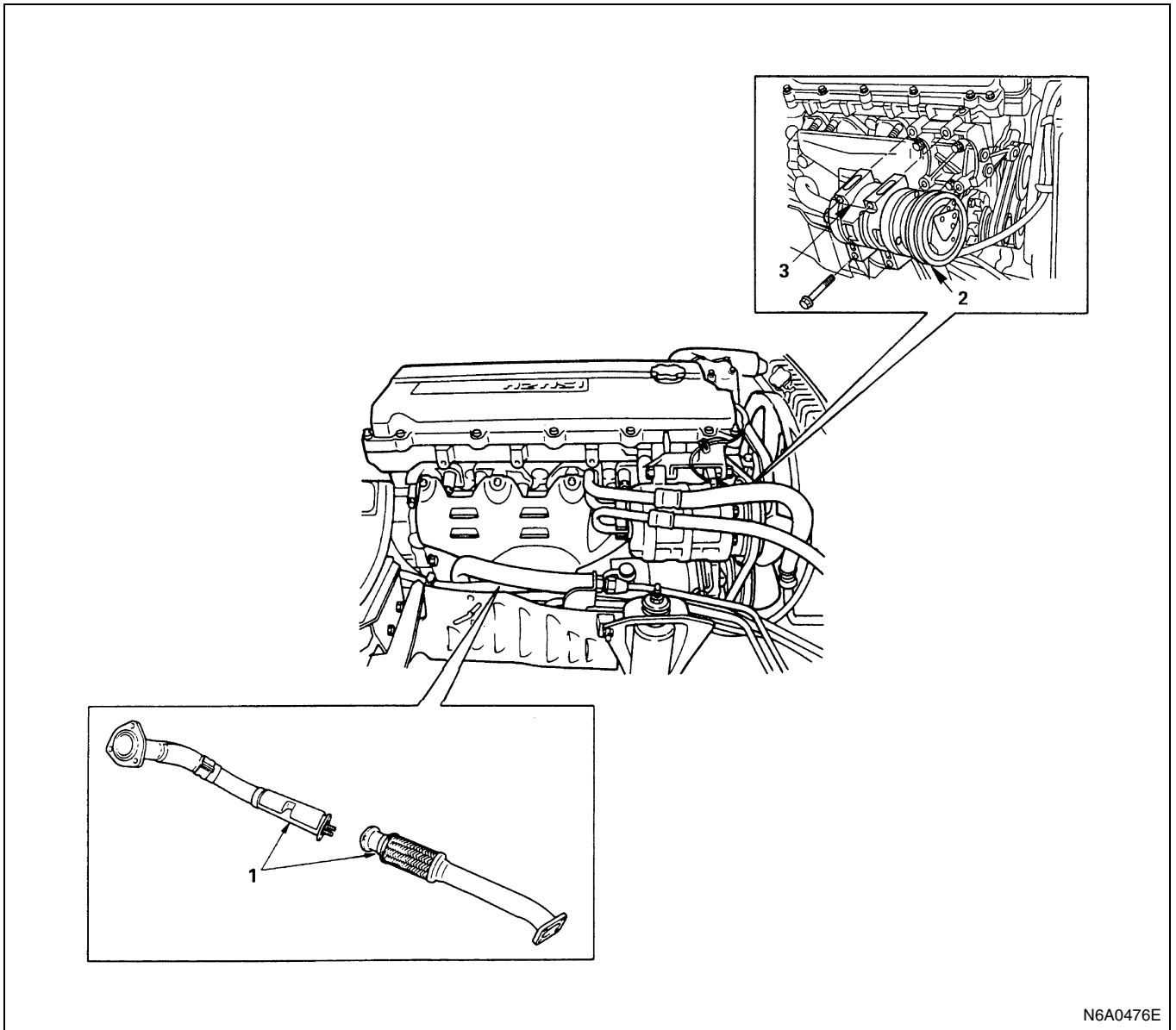
Above works refer to "CYLINDER HEAD COVER" section in this manual.

9. Nozzle Cover

- Connect the battery ground cable.
- Lower the cab.
- Start engine and check for oil leakage carefully.

CYLINDER HEAD

Component
Engine Right Side

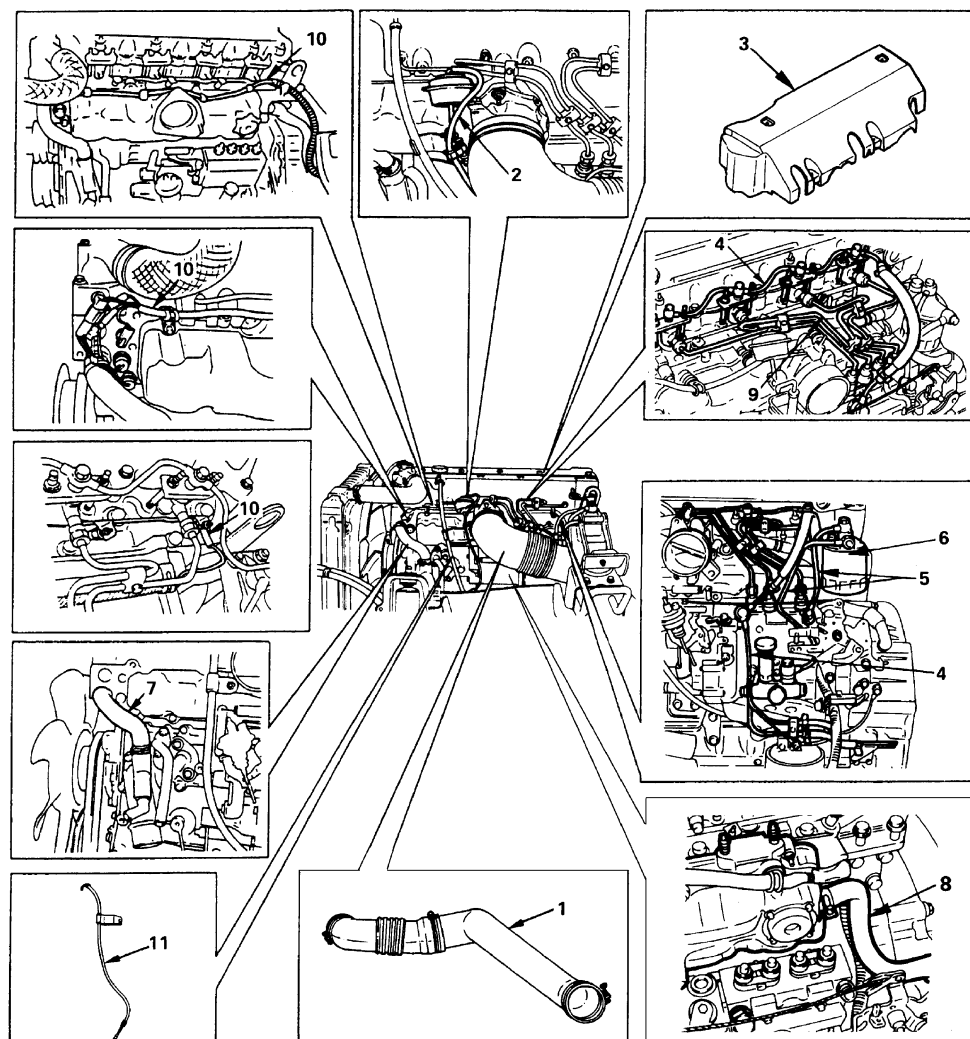


N6A0476E

Legend

- 1. Front exhaust pipe
- 2. A/C compressor drive belt (If equipped with A/C)
- 3. A/C compressor (If equipped with A/C)

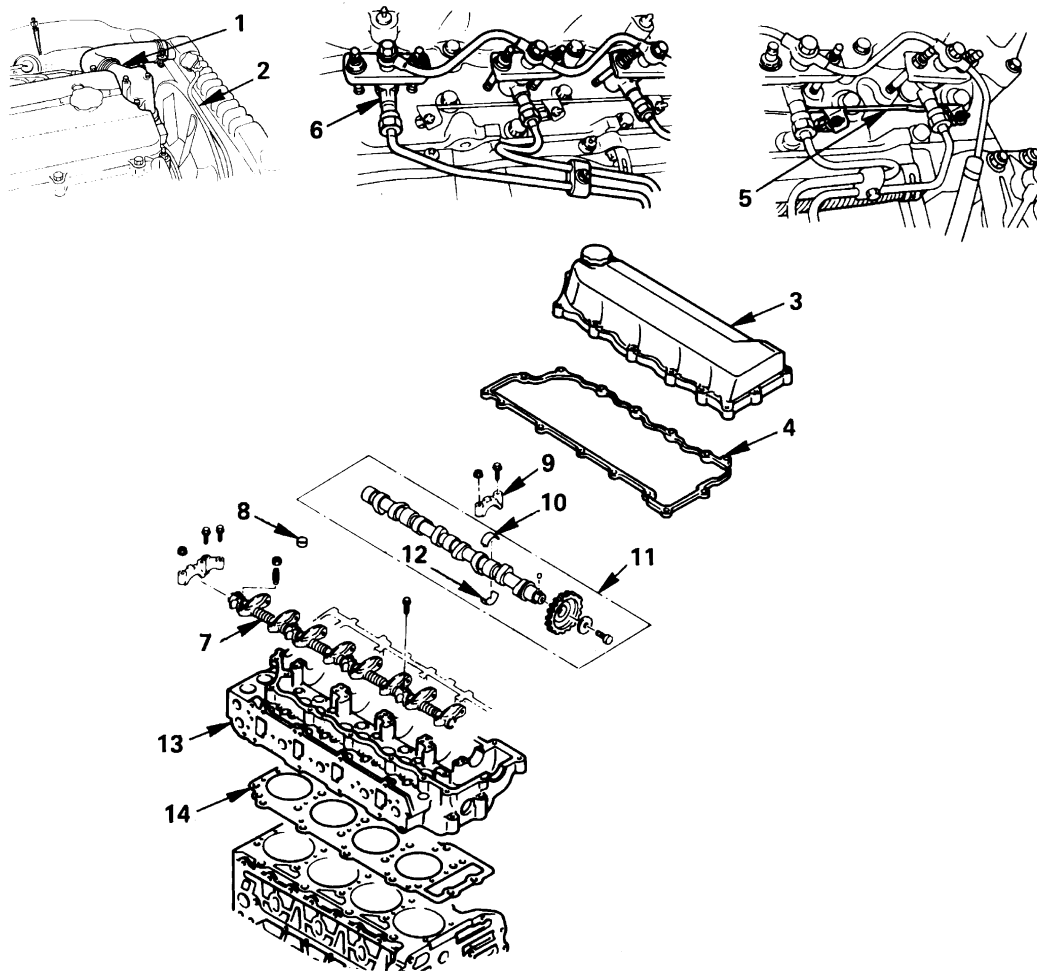
Engine Left Side



N6A0477E

Legend

- | | |
|----------------------------|--------------------------------|
| 1. Intake air duct | 7. Water bypass hose |
| 2. Vacuum hose | 8. PCV hose |
| 3. Nozzle cover | 9. Injection pipe |
| 4. Leak off pipe | 10. Engine harness |
| 5. Fuel pipe | 11. Oil level gauge guide tube |
| 6. Fuel filter and bracket | |

Cylinder Head Side

N6A0482E

Legend

- | | |
|--|----------------------------|
| 1. Radiator upper hose | 8. Valve cap |
| 2. Coolant reserve tank hose/bypass hose | 9. Camshaft bearing cap |
| 3. Cylinder head cover | 10. Camshaft bearing upper |
| 4. Cylinder head cover gasket | 11. Camshaft assembly |
| 5. Glow plug connector | 12. Camshaft bearing lower |
| 6. Injection nozzle holder assembly | 13. Cylinder head assembly |
| 7. Rocker arm shaft assembly | 14. Cylinder head gasket |

Removal**Preparation**

- Disconnect battery ground cable
- Tilt the cab.
- Drain coolant

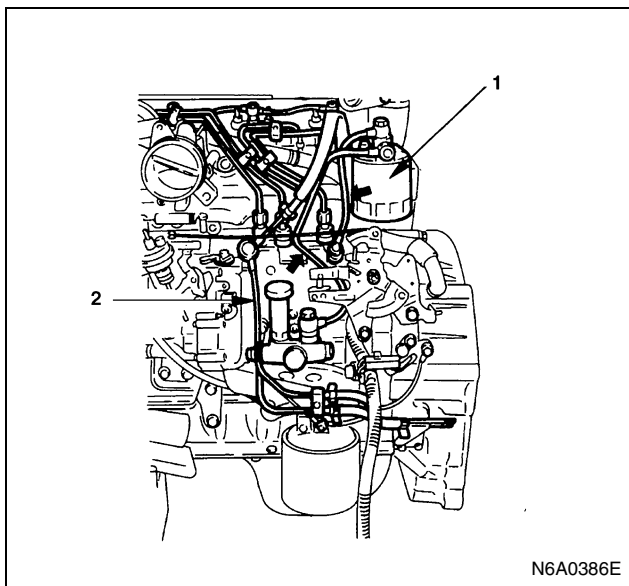
Engine Right Side

1. Front Exhaust Pipe

2. Air Conditioning (A/C) Compressor Drive Belt (If equipped with A/C)
3. A/C Compressor (If equipped with A/C)
 - 1) Disconnect magnetic clutch harness connector.
 - 2) Dismount the compressor together with the hoses from the A/C compressor bracket, and fasten it with a wire to the appropriate location.

Engine Left Side

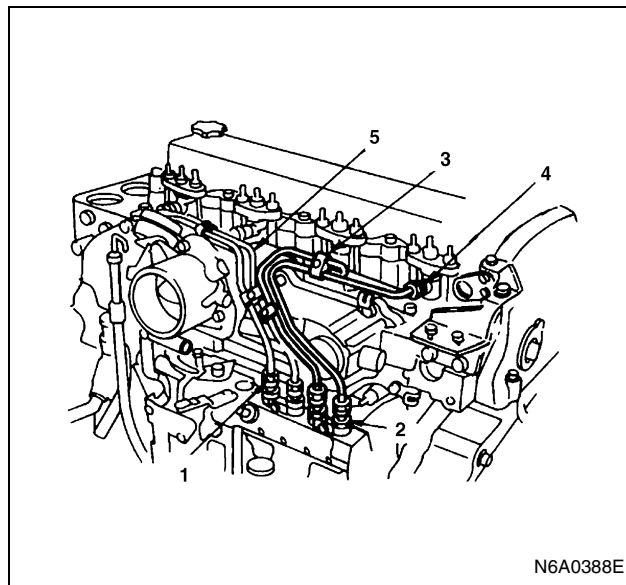
1. Intake Air Duct
 - 1) Remove the clips at the connections with the inlet cover and with the air cleaner.
 - 2) Remove the intake air duct with the connecting hoses attached.
2. Vacuum Hose
3. Nozzle Cover
4. Leak Off Pipe
5. Fuel Pipe



Legend

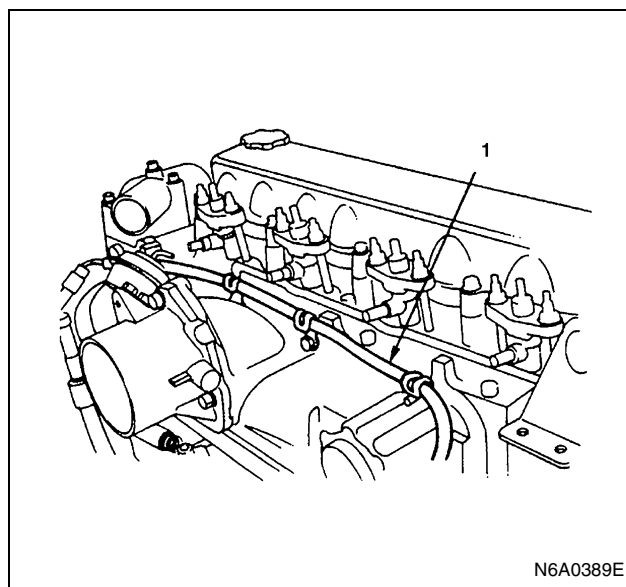
1. Fuel filter
2. Leak off

6. Fuel filter & Bracket
7. Water Bypass Hose
8. Positive Crankcase Ventilation (PCV) Hose
9. Injection Pipe
 - 1) Loosen the injection pipe sleeve nuts (1). Do not apply excessive force to the injection pipes (5).
 - 2) Loosen the injection pipes clips (3).
 - 3) Remove the injection pipe assembly. Plug the delivery valve holder (2) ports and nozzle holder (4) ports with caps to prevent the entry of foreign material.



10. Engine Harness

Disconnect thermometer unit, thermo switch, tachometer sensor and glow plug harness connectors an separate harness from clips.

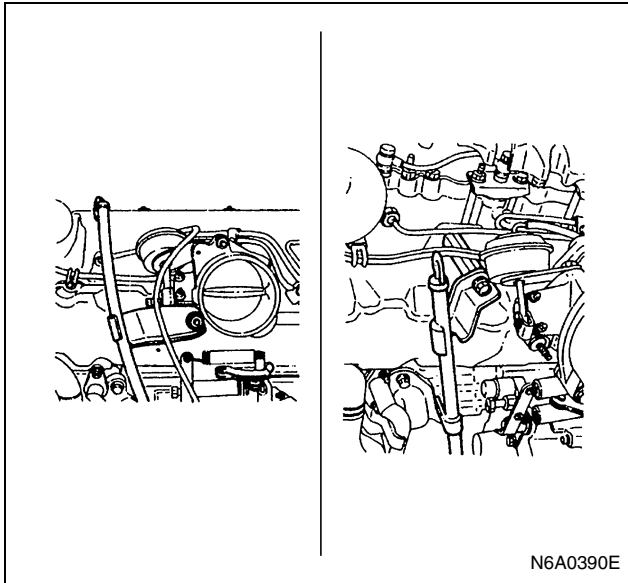


Legend

1. Engine harness

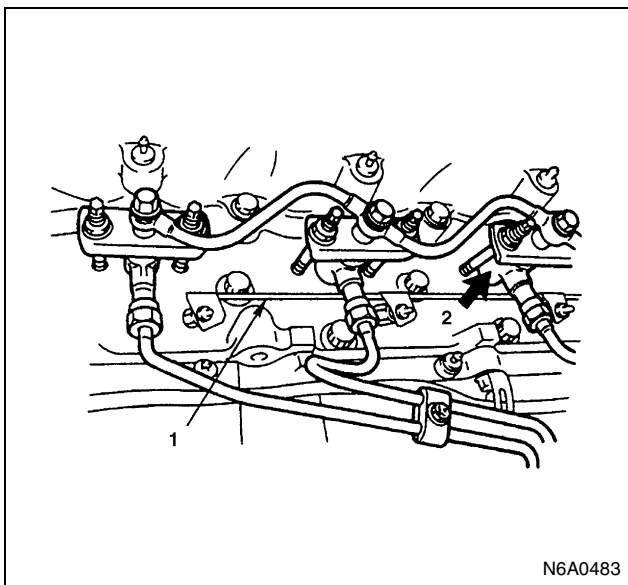
11. Oil Level Gauge Guide Tube

Remove the guide tube fixing bolt and pull out the guide tube.



Cylinder Head Side

1. Radiator Upper Hose
2. Coolant Reserve Tank Hose/Bypass Hose
3. Cylinder Head Cover
4. Cylinder Head Cover Gasket
5. Glow Plug Connector
6. Injection Nozzle Holder Assembly
Mark the nozzle holder assemblies fitting positions by tagging each nozzle holder assembly with the cylinder number from which it was removed.



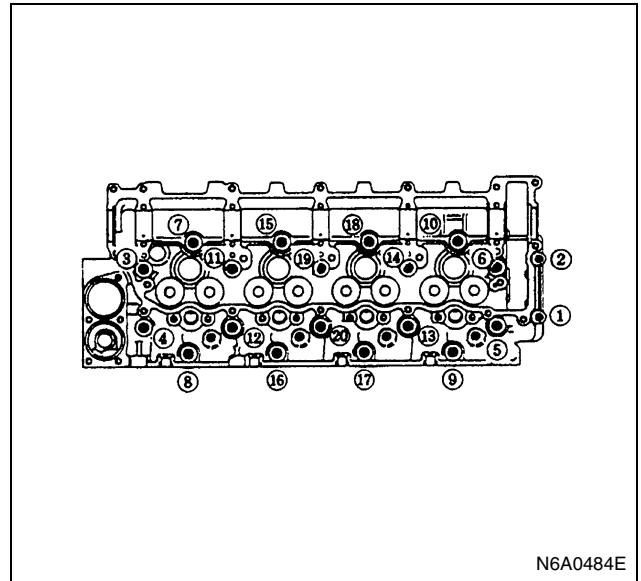
Legend

1. Glow plug connector
 2. Injection nozzle holder assembly
-
7. Rocker Arm Shaft Assembly
 8. Valve Cap
 9. Camshaft Bearing Cap
 10. Camshaft Bearing Upper
 11. Camshaft Assembly

12. Camshaft Bearing Lower
Above works refer to "ROCKER ARM SHAFT ASSEMBLY AND CAMSHAFT ASSEMBLY" section in this manual.
13. Cylinder Head Assembly
Loosen the cylinder head bolts in numerical order a little at a time.

Caution:

Failure to loosen the cylinder head bolts in numerical order a little at a time will adversely affect the cylinder head lower surface.



14. Cylinder Head Gasket

Caution:

Do not reuse the cylinder head gasket.

Installation

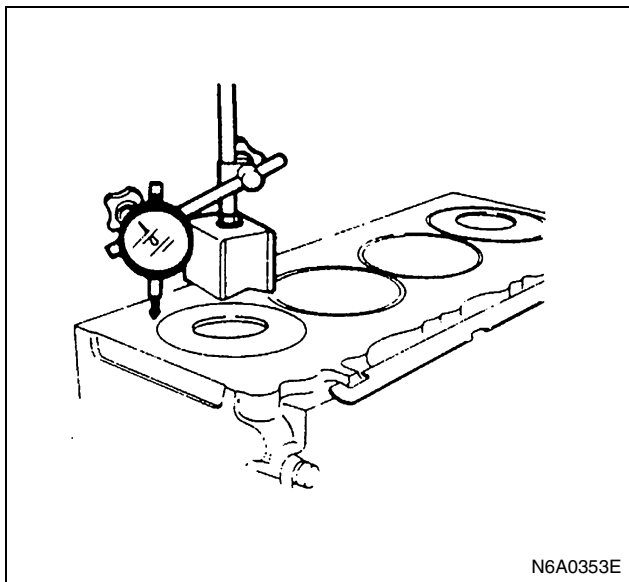
Cylinder Head Side

1. Cylinder Head Gasket
 - 1) When any of the cylinder block, crankshaft, crankshaft bearing, connecting rod, connecting rod bearing, and piston is replaced with a new one, cylinder head gasket thickness should be determined newly.
 - 2) When replacing the cylinder head gasket alone without replacing any of the parts mentioned in 1) above, the gasket to be used should be the same grade as the one used before.
 - 3) Correct cylinder head gasket thickness is important. Installing the wrong thickness gasket can result in greatly reduced engine performance.
 - 4) There are three cylinder head gaskets available.

Piston Head Projection Measurement

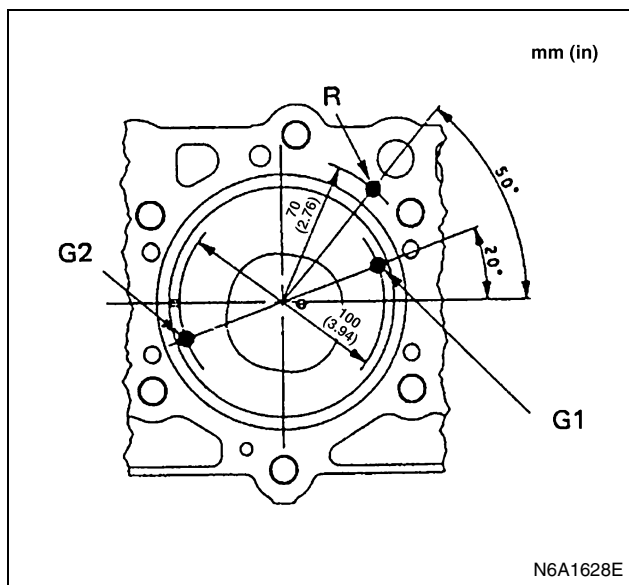
- Select a cylinder head gasket.
- Clean thoroughly the top faces of the piston head and the cylinder body.

- Use the dial gauge to measure the piston head projection. Take measurements at two location for each cylinder.
- The measurement points of the piston head and the reference point of the cylinder body are shown in the illustration.



Measurement points: Points G1 and G2 of the piston head

Reference point: Point R on the top face of the cylinder body



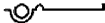
Notice:

Note that there are three types of a cylinder head gasket available as below, according to the piston projection.

- For each cylinder, calculate the average value (Ti) of the piston projection.
- Find the maximum value (Ti max) of the average of each cylinder.
- Based on the Timax obtained, select a gasket of the appropriate grade.

4HF1/4HF1-2/4HG1-T

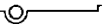
Cylinder Head Gasket Selection

mm (in)		
Gasket Grade	Ti max	Gasket Thickness (Reference)
A 	0.579 - 0.659 (0.0228 - 0.0259)	1.70 (0.0669)
B 	0.659 - 0.739 (0.0259 - 0.0291)	1.75 (0.0689)
C 	0.739 - 0.819 (0.0291 - 0.0322)	1.80 (0.0708)

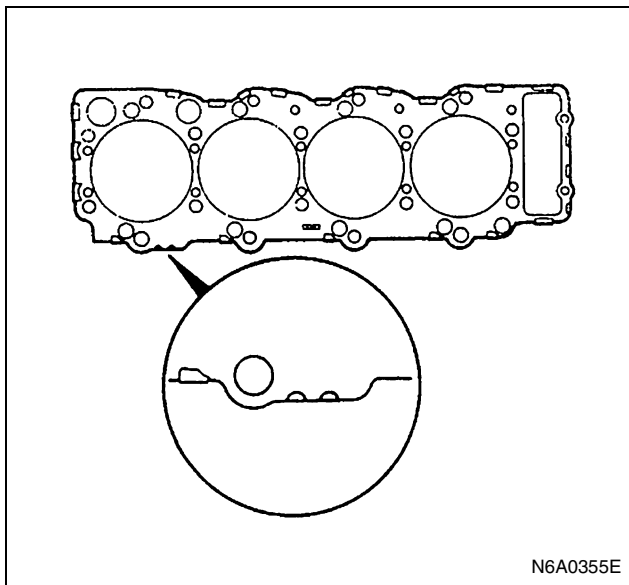
N6A1396E

4HE1-TC

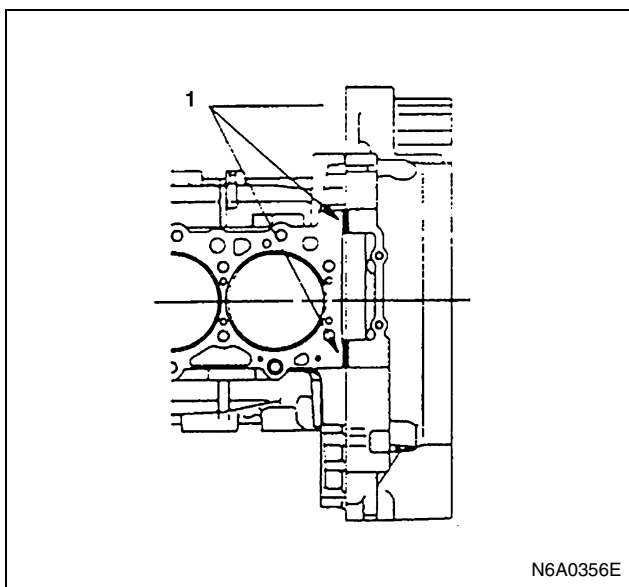
Cylinder Head Gasket Selection

mm (in)		
Gasket Grade	Ti max	Gasket Thickness (Reference)
A 	0.529 - 0.609 (0.0208 - 0.0240)	1.70 (0.0669)
B 	0.609 - 0.679 (0.0240 - 0.0267)	1.75 (0.0689)
C 	0.679 - 0.759 (0.0267 - 0.0300)	1.80 (0.0708)

N6A1397E



- 5) Apply a 3 mm (0.12 in) bead or recommended liquid gasket (Three Bond 1207C) or its equivalent to the shaded areas shown in the illustration.



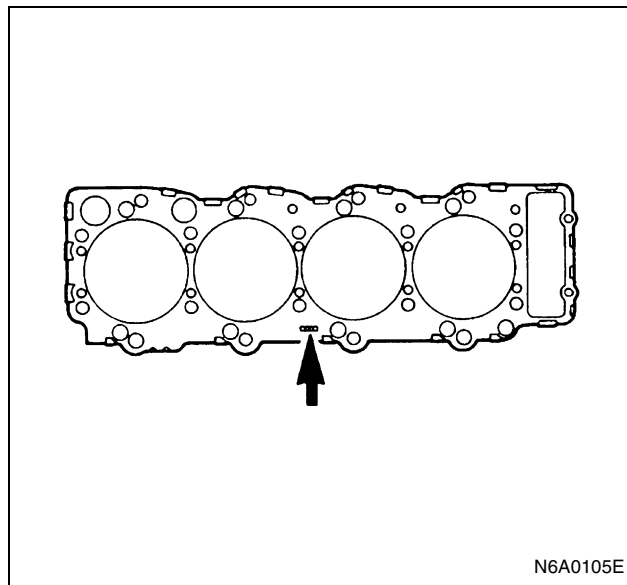
Legend

1. Bead width $\phi 3$

- 6) Install the cylinder head gasket with its "PART NUMBER" mark facing up and toward the left of the engine.

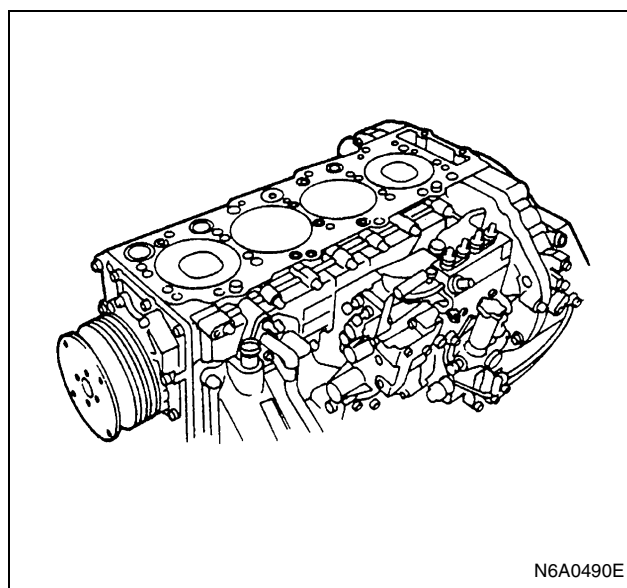
Caution:

Do not reuse the cylinder head gasket.



2. Cylinder Head Assembly

- 1) Align the cylinder body dowels and the cylinder head dowel holes.
- 2) Carefully place the cylinder head on the cylinder head gasket.

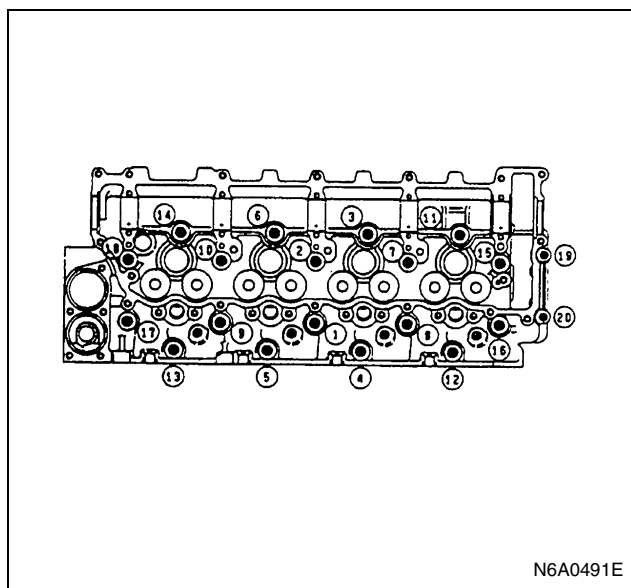


- 3) Apply a coat of molybdenum disulfide grease to the M14 cylinder head bolt threads and setting faces and apply a coat of engine oil to the M10 cylinder head bolt threads and setting faces.
- 4) Use the angular tightening method to tighten the bolts (M14) to the specified torque in three steps following the numerical order shown in the illustration.

Tighten:

Cylinder head bolt (M14: (1) — (18)) to

- 1st step: 98 N·m (10 kg·m/72 lb·ft)
- 2nd step: 147 N·m (15 kg·m/108 lb·ft)
- 3rd step: 30 — 60°



N6A0491E

- 5) Tighten the cylinder head to the flywheel housing bolts (M10) to the specified torque.

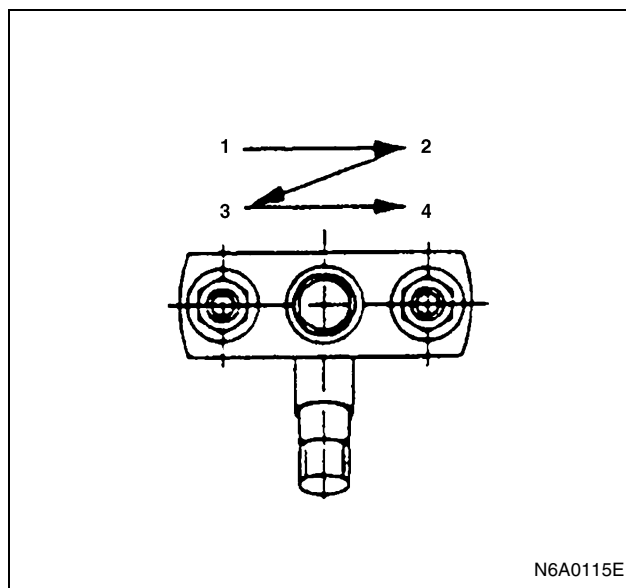
Tighten:

Cylinder head bolt (M10: (19), (20)) to 38 N·m (3.9 kg·m/28 lb·ft)

3. Camshaft Bearing Lower
4. Camshaft Assembly
5. Camshaft Bearing Upper
6. Camshaft Bearing Cap
7. Valve Cap
Above works refer to "CAMSHAFT ASSEMBLY" section in this manual.
8. Rocker Arm Shaft Assembly
Above works refer to "ROCKER ARM SHAFT ASSEMBLY" section in this manual.
9. Injection Nozzle Holder Assembly
Tighten the nozzle holder flange nuts to the specified torque in the numerical order shown in the illustration.

Tighten:

Nozzle holder flange nut to 19 N·m (1.9 kg·m/14 lb·ft)



N6A0115E

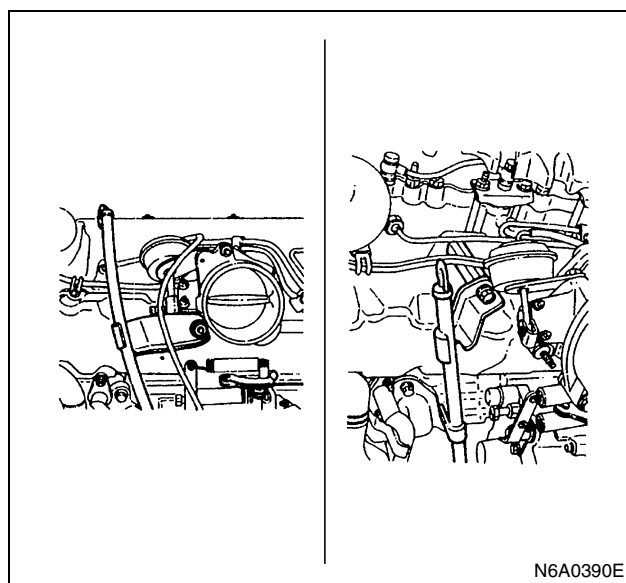
10. Glow Plug Connector
11. Head Cover Gasket
Install the gasket to the cylinder head cover.
12. Cylinder Head Cover
Above works refer to "CYLINDER HEAD COVER" section in this manual.
13. Coolant Reserve Tank Hose/Bypass Hose
14. Radiator Upper Hose

Engine Left Side

1. Oil Level Gauge Guide Tube
 - 1) Install the O-rings to the guide tube lower portion and insert the guide tube completely to the cylinder body.
 - 2) Tighten the guide tube bolt to the specified torque.

Tighten:

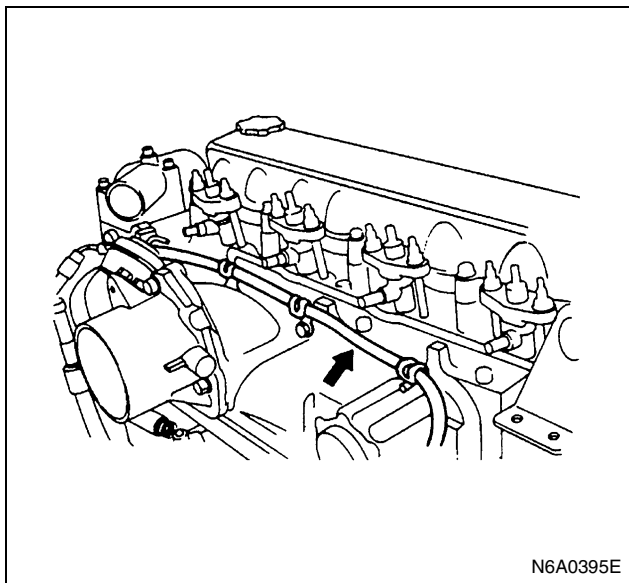
Guide tube bolt to 13 N·m (1.3 kg·m/113 lb·in)



N6A0390E

2. Engine Harness

Connect thermometer unit, thermo switch, tachometer sensor and glow plug harness connector and fasten the engine harness with clips.



3. Fuel Injection Pipe Assembly
Above works refer to "INJECTION PUMP ASSEMBLY" section in this manual.
4. Positive Crankcase Ventilation (PCV) Hose
5. Water Bypass Hose
6. Fuel Filter & Bracket

Tighten:

Fuel filter bracket to 34 N·m (3.5 kg·m/25 lb·ft)

7. Fuel Pipe

Do not apply excessive force to the fuel pipe.

Tighten:

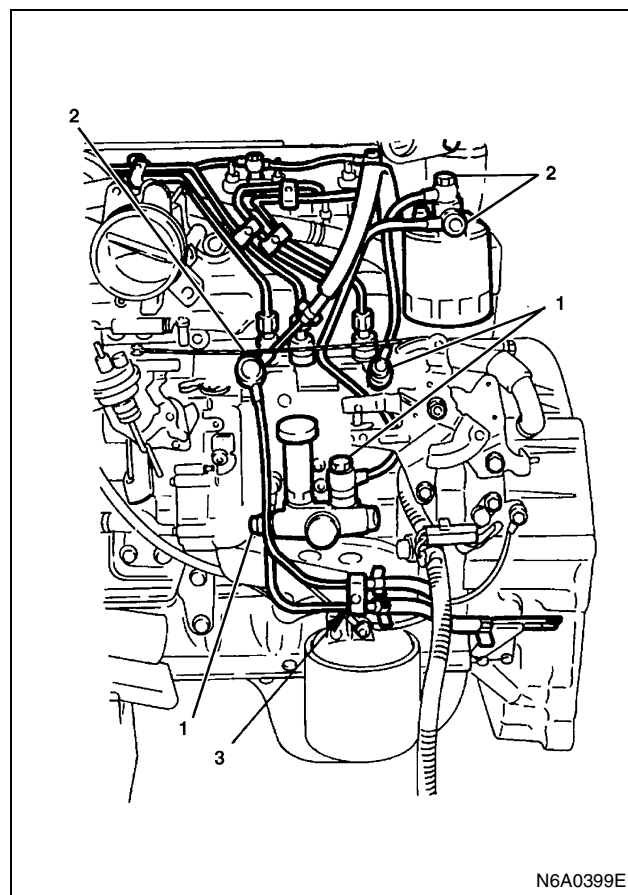
Fuel pipe joint bolt (1) to 41 N·m (4.2 kg·m/30 lb·ft)

Tighten:

Fuel pipe joint bolt (2) to 23 N·m (2.3 kg·m/17 lb·ft)

Tighten:

Clip screw to 4 N·m (0.4 kg·m/35 lb·in)



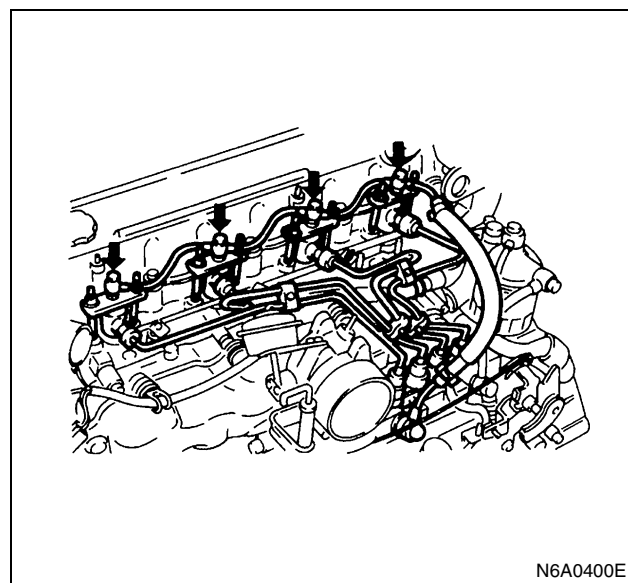
Legend

1. Fuel pipe joint bolt
2. Fuel pipe joint bolt
3. Clip

8. Leak Off Pipe

Tighten:

Leak-off pipe joint bolt to 13 N·m (1.3 kg·m/113 lb·in)



9. Nozzle Cover
10. Vacuum Hose

11. Intake Air Duct

Engine Right Side

1. Air Conditioning (A/C) Compressor (If equipped with A/C)

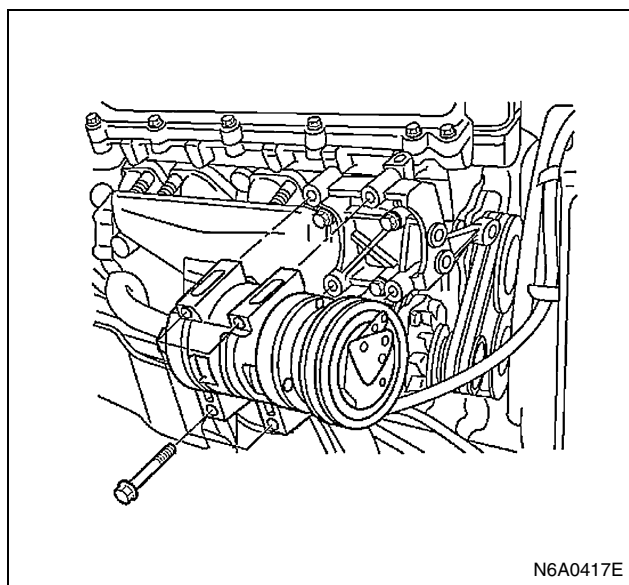
Tighten fixing bolts to the specified torque.

Tighten:

A/C compressor bolt to 48 N·m (4.9 kg·m/35 lb·ft)

Notice:

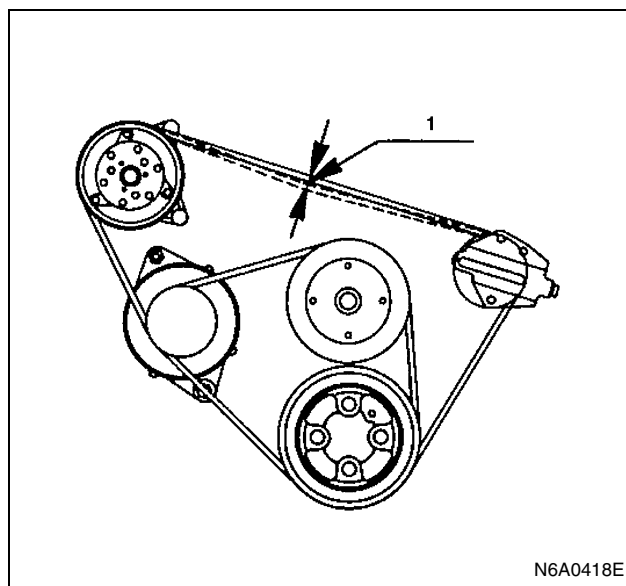
When tightening the compressor fixing bolts, tighten first the 2 bolts on the rear side, and then the remaining 2 on the front side.



2. A/C Compressor Drive Belt (If equipped with A/C)

- 1) Install drive belt adjust belt tension by adjusting bolt and tighten locking nut to the specified torque.
- 2) Depress the drive belt mid-portion with a 98 N (10 kg/22 lb) force.

Drive Belt Deflection	mm (in)
16 — 20 (0.63 — 0.79) ... New belt	
18 — 22 (0.71 — 0.87) ... Reuse belt	

**Legend**

1. Belt deflection

Tighten:

Locking nut to 27 N·m (2.8 kg·m/20 lb·ft)

3. Front Exhaust Pipe

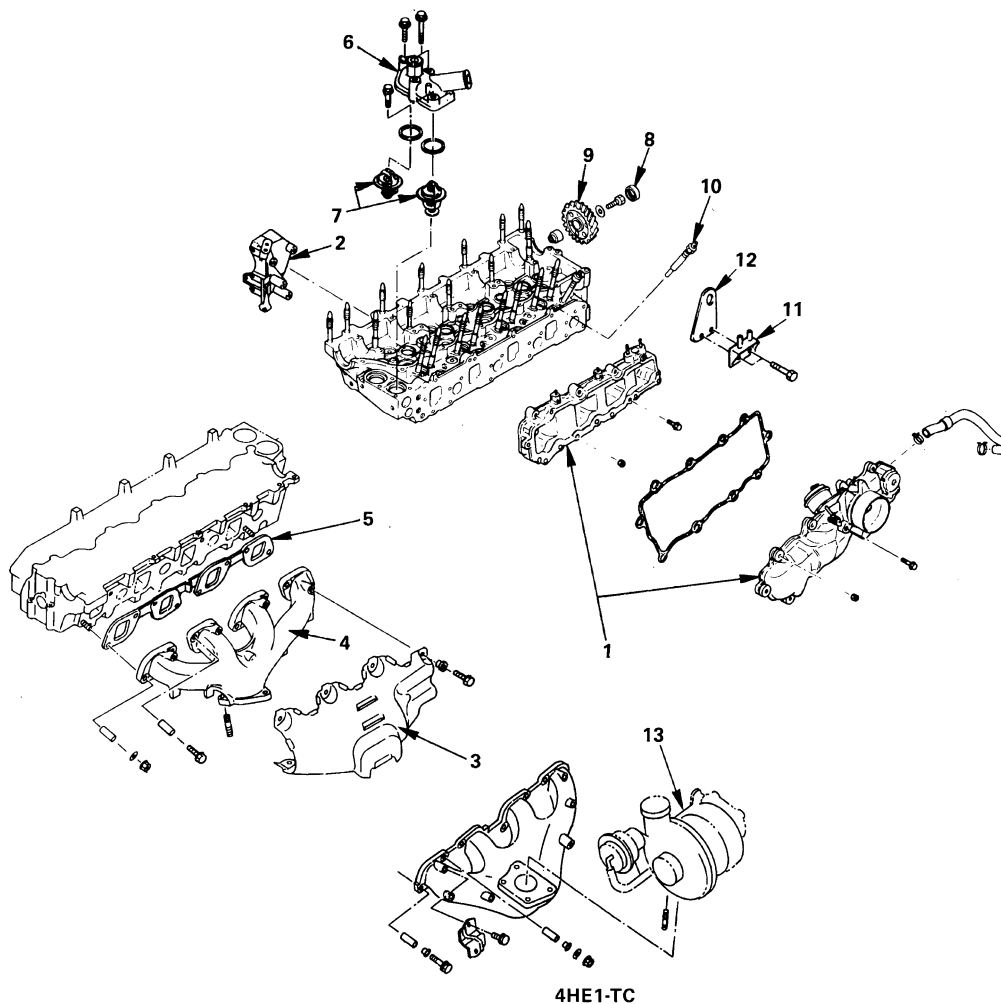
Tighten:

Front exhaust pipe to

- Exhaust manifold side: 67 N·m (6.8 kg·m/49 lb·ft)
- Exhaust brake side: 17 N·m (1.7 kg·m/12 lb·ft)
- Connect the negative battery cable.
- Lower the cab.
- Start engine and check for oil, fuel and water leakage carefully.

CIRCUMFERENCE PARTS OF CYLINDER HEAD

Component



N6A0499E

Legend

- | | |
|--|-------------------------|
| 1. Inlet cover/inlet case | 8. Idle gear C cover |
| 2. A/C compressor bracket (If equipped with A/C) | 9. Idle gear C |
| 3. Heat protector | 10. Glow plug |
| 4. Exhaust manifold | 11. Fuel filter bracket |
| 5. Exhaust gasket | 12. Engine hanger |
| 6. Water outlet pipe | 13. Turbocharger |
| 7. Idle gear C cover | |

Removal

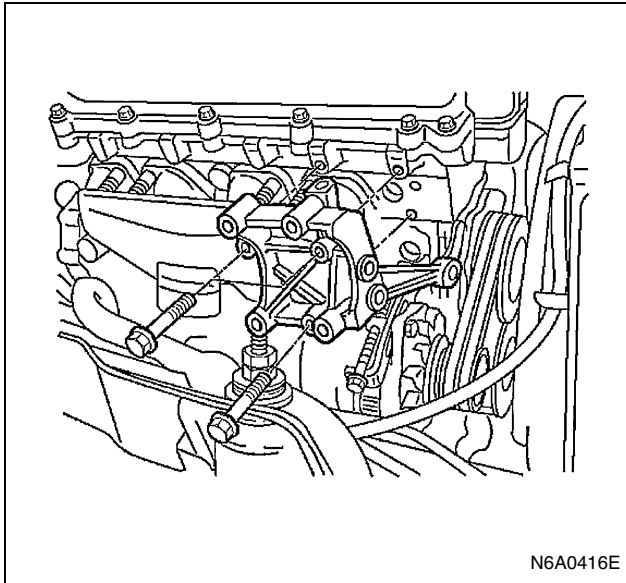
Preparation

- Disconnect battery ground cable
- Tilt the cab
- Drain coolant

- Remove each part from the cylinder head assembly.

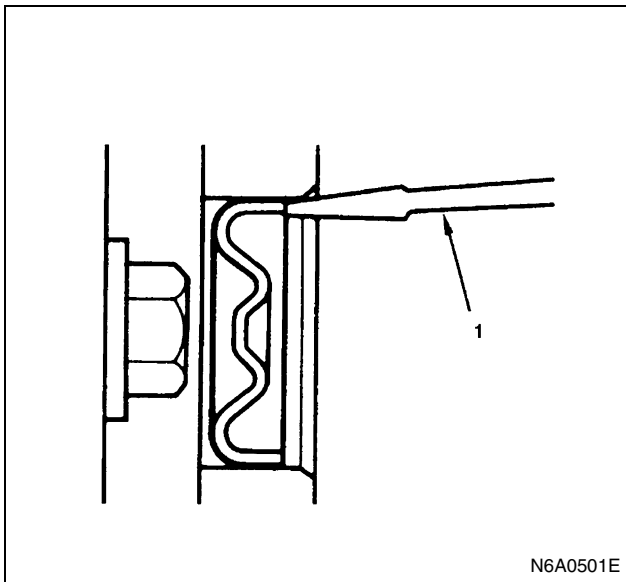
For details, refer to the "CYLINDER HEAD" in this section.

1. Inlet Cover/Inlet Case
2. Air Conditioning (A/C) Compressor Bracket (If equipped with A/C)

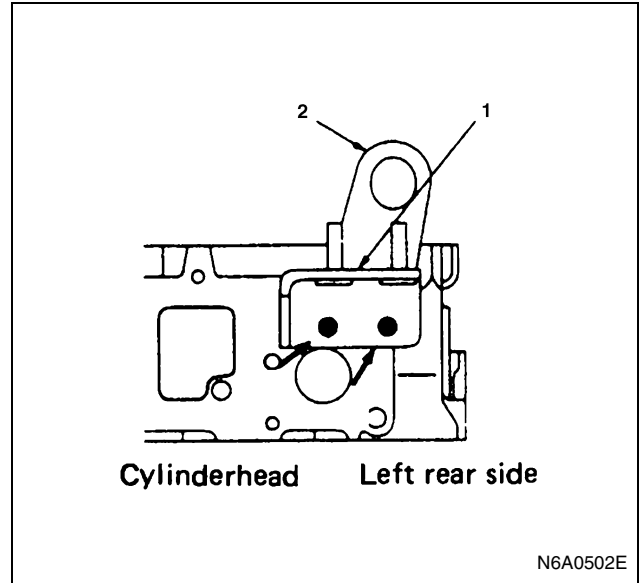


3. Heat Protector
4. Exhaust Manifold
5. Exhaust Gasket
6. Water Outlet Pipe
7. Thermostat
8. Idle Gear C Cover

Tap the outside of the sealing cup with a screwdriver (1) to deform one end of it and draw it out with pliers.



9. Idle Gear C
10. Glow Plug
11. Fuel Filter Bracket
12. Engine Hanger



Legend

1. Fuel filter bracket
2. Engine hanger

Installation

1. Engine Hanger
2. Fuel Filter Bracket

Tighten:

Fuel filter bracket bolt to 104 N·m (10.6 kg·m/77 lb·ft)

3. Glow Plug

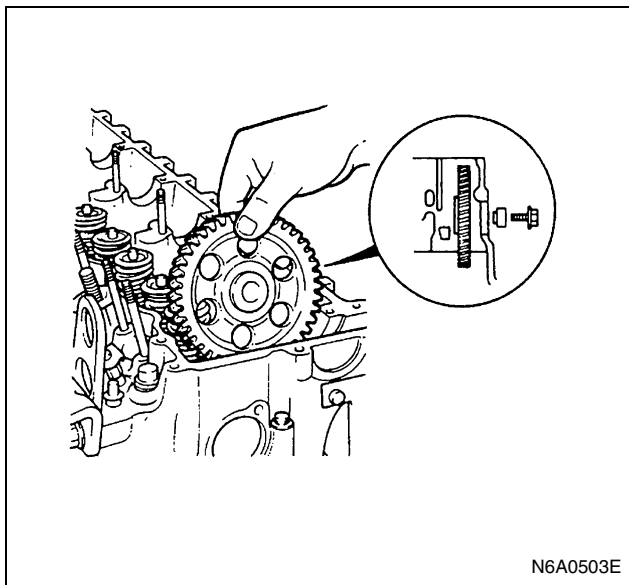
Tighten:

Glow plug to 23 N·m (2.3 kg·m/17 lb·ft)

4. Idle Gear C
 - 1) Apply engine oil to the idle gear shaft, bushing and idle gear before installation.
 - 2) Install the idle gear with the boss side facing to the camshaft as shown in the illustration.

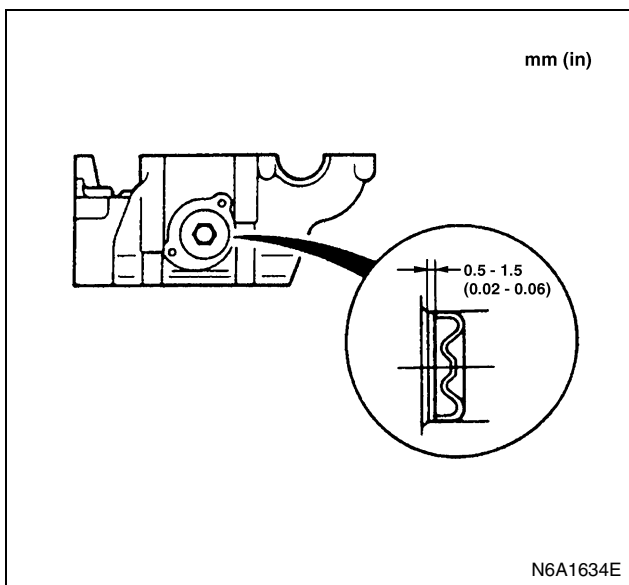
Tighten:

Idle gear C bolt to 95 N·m (9.7 kg·m/70 lb·ft)



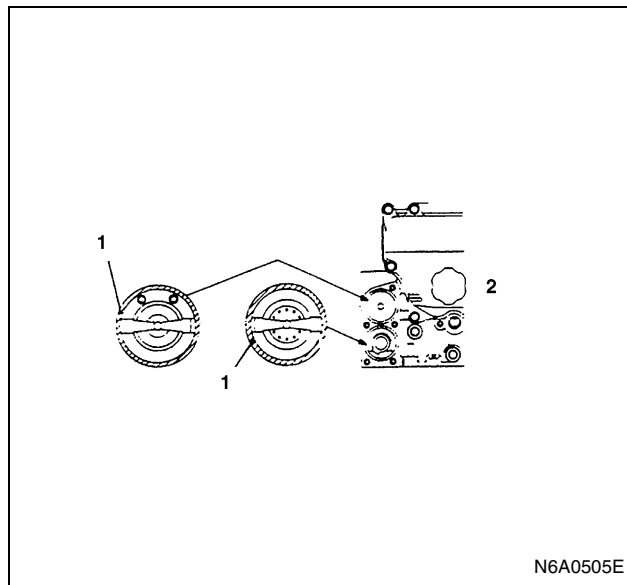
5. Idle Gear C Cover

- 1) Apply the recommended liquid gasket (LOC-TITE 262) or its equivalent to the outside of the sealing cup and install it to the cylinder head.
 - 2) Use the sealing cup installer and a hammer to drive the sealing cup into position from the cylinder head side as shown in the illustration.
- Sealing Cup Installer: 5-8840-2222-0



6. Thermostat

Install the gaskets to the thermostat and install them to the cylinder head as shown in the illustration.



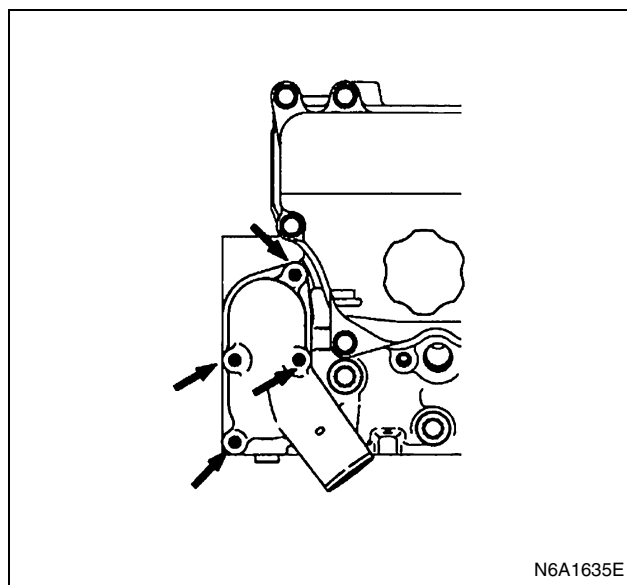
Legend

1. Gasket
2. Top face of the head

7. Water Outlet Pipe

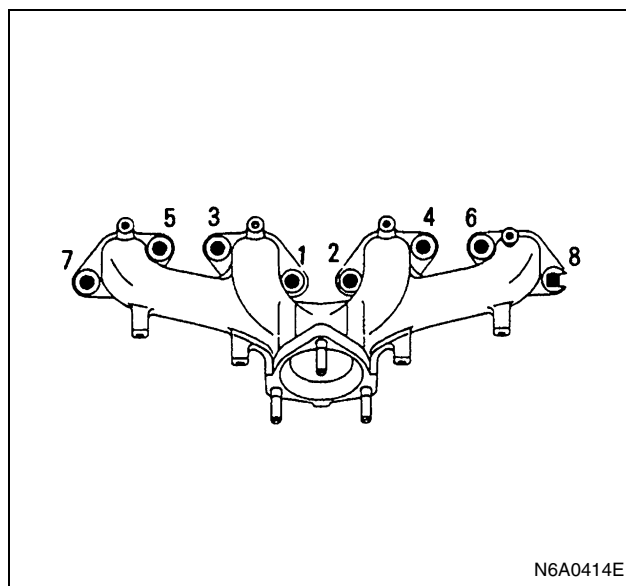
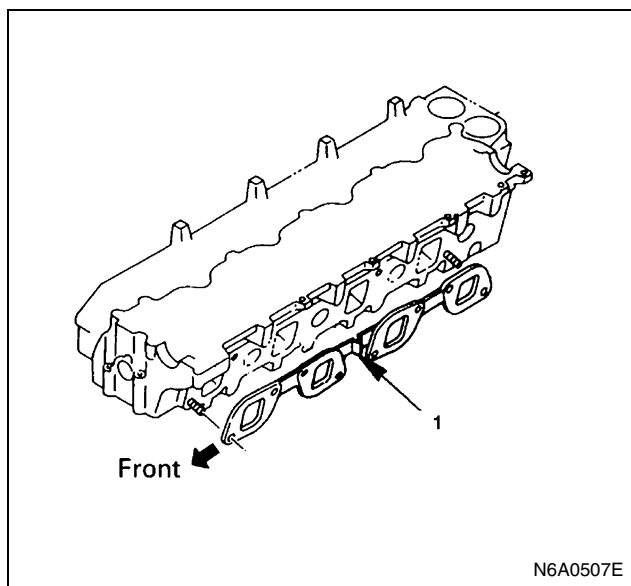
Tighten:

Water outlet pipe bolt to 24 N·m (2.4 kg·m/17 lb·ft)



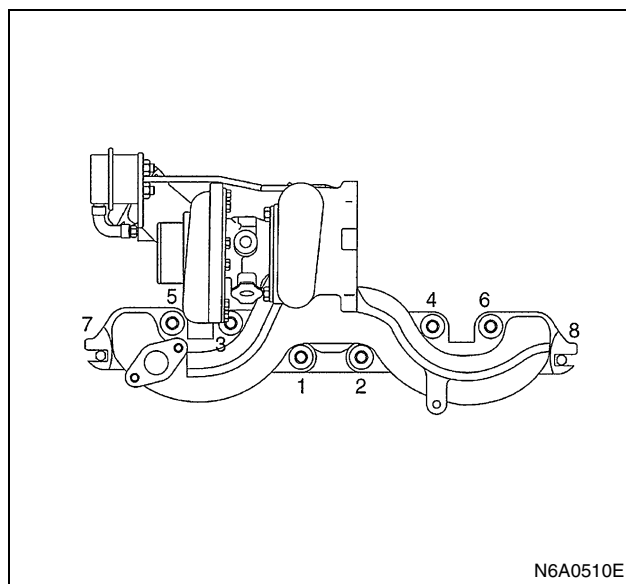
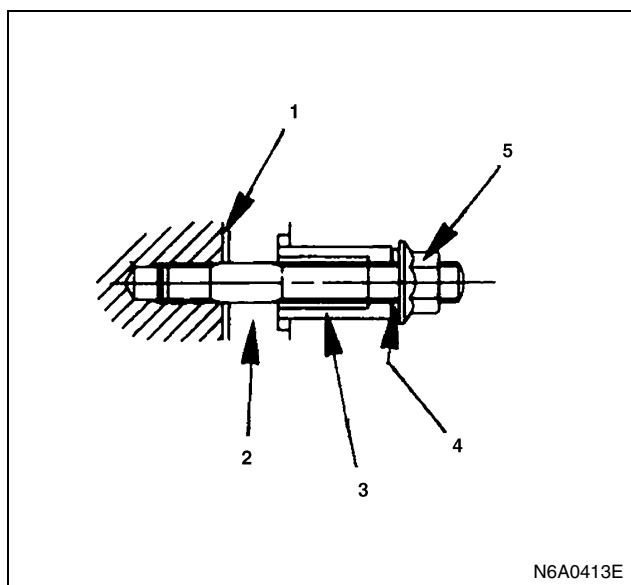
8. Exhaust Gasket

Insert the gasket into the stud provided to the cylinder head (with the projection (1) of the gasket on this side).



9. Exhaust Manifold

- 1) Install exhaust manifold gaskets (1), exhaust manifold (2), distance pieces (3), dish washers (4) and nuts (5) to the stud bolts shown in the illustration.



10. Heat Protector

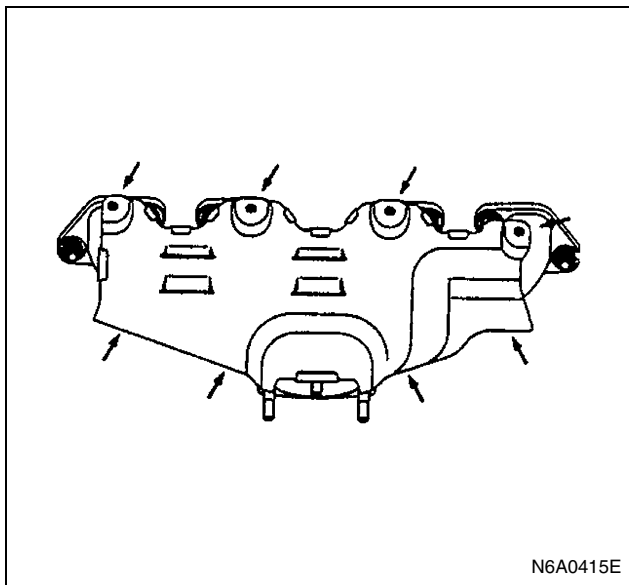
Tighten:

Heat protector bolt to 10 N·m (1.0 kg·m/87 lb·in)

- 2) Tighten the nuts to the specified torque in the numerical order shown in the illustration.

Tighten:

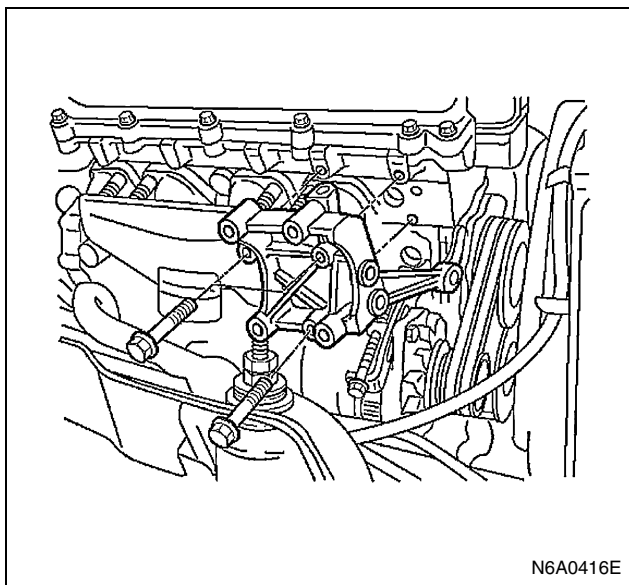
Exhaust manifold nut to 34 N·m (3.5 kg·m/25 lb·ft)



11. Air Conditioning (A/C) Compressor Bracket (If equipped with A/C)
Tighten fixing bolts to the specified torque.

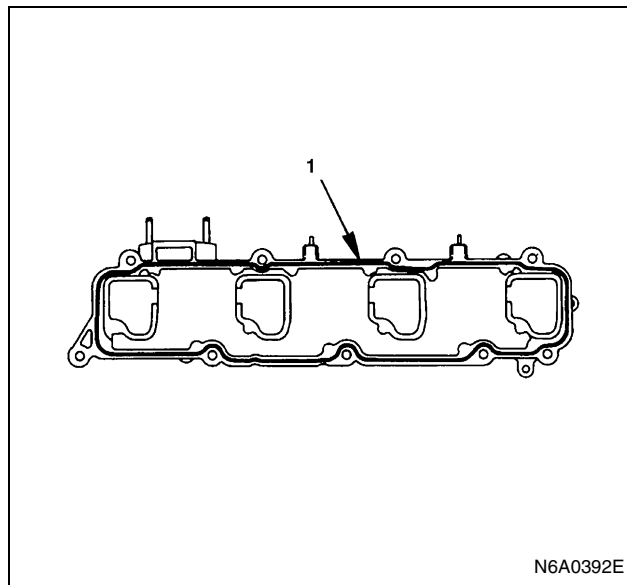
Tighten:

A/C compressor bracket bolt to 48 N·m (4.9 kg·m/35 lb·ft)

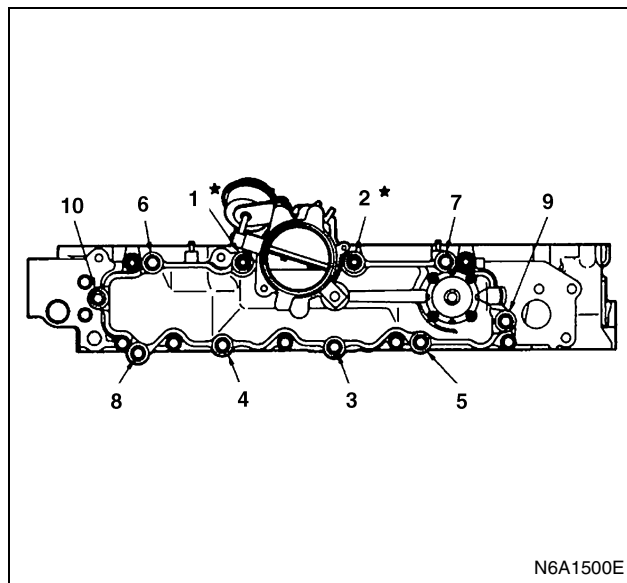


12. Inlet Cover/Inlet Case

- 1) Apply 2 — 3 mm (0.08 — 0.12 in) bead of the recommended liquid gasket (Three Bond 1207C) or its equivalent on the groove (1) of the inlet case fitting surfaces shown in the illustration.
- Clean the inlet case fitting surface of the cylinder head.



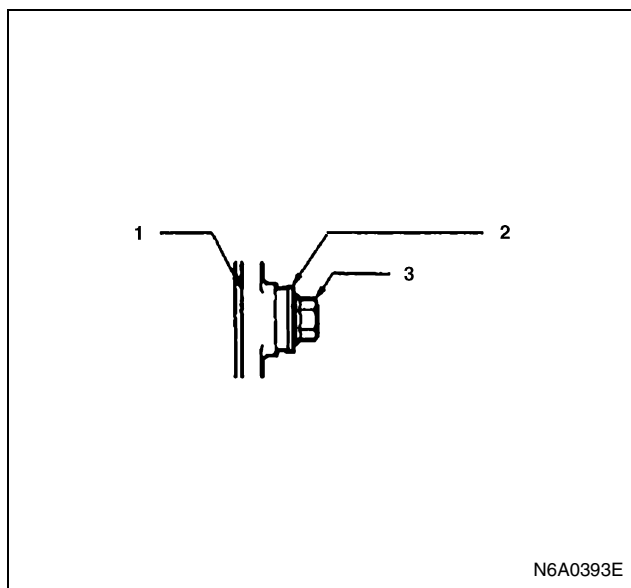
- 2) Install the inlet case to the cylinder head.
 - Install the inlet case within 7 minutes after application of liquid gasket.
 - Attach harness clips ((1), (6) and (7)) and tighten the inlet cover bolts and nuts to the specified torque in the numerical order shown in the illustration.



- ★ marks are located on nut positions.

Tighten:

Inlet cover bolt and nut to 13 N·m (1.3 kg·m/9 lb·ft)



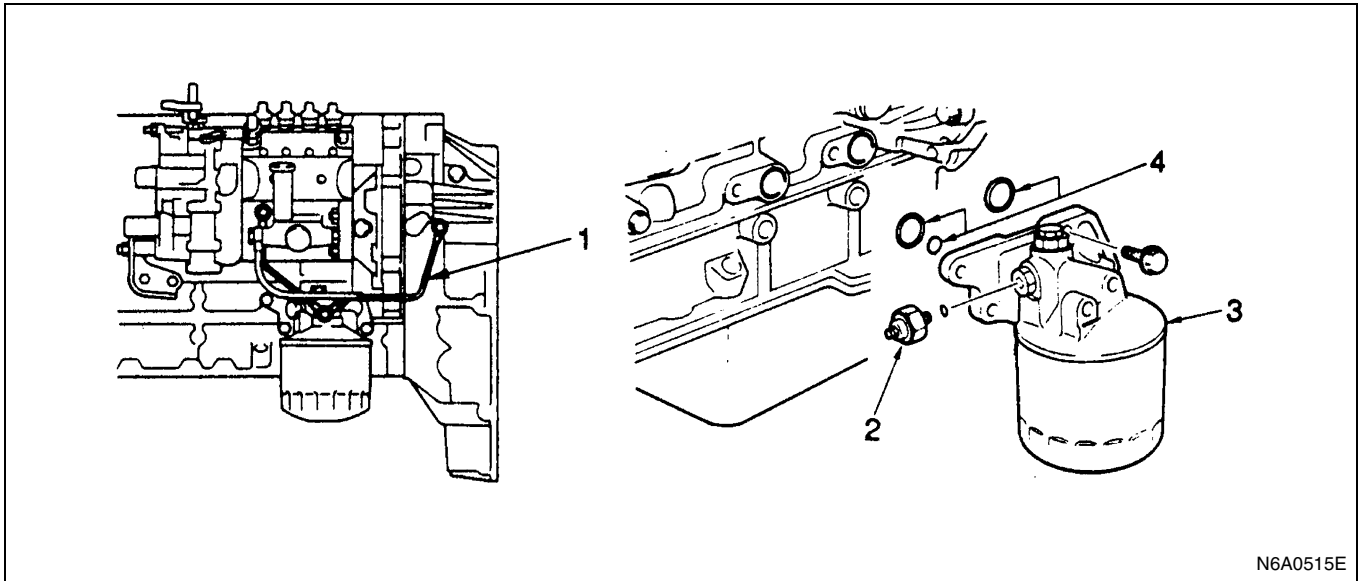
Legend

- 1. Inlet cover
- 2. Mounting rubber
- 3. Bolt

Refer to "CYLINDER HEAD" in this section, install the remaining parts.

OIL FILTER ASSEMBLY

Component



N6A0515E

Legend

- | | |
|------------------------|---------------|
| 1. Oil pipe | 3. Oil filter |
| 2. Oil pressure switch | 4. O-ring |

Removal

Preparation

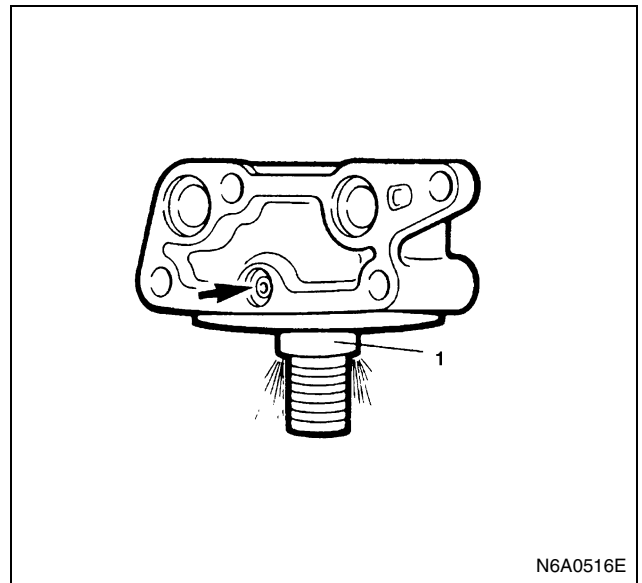
- Disconnect battery ground cable.
- Place a receptacle beneath the oil filter to contain the drained oil.

1. Oil Pipe
2. Oil Pressure Switch
3. Oil Filter
4. O-ring

Inspection

Oil Filter Cover

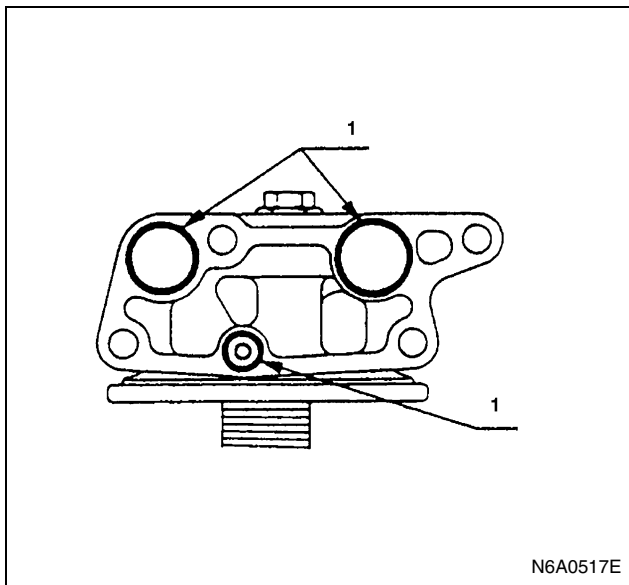
1. Check the partial filter orifice for any clogging.
2. Send air into the arrow-marked hole in the illustration, and check to see if the air blows out from the small holes in the center sleeve (1).



N6A0516E

Installation

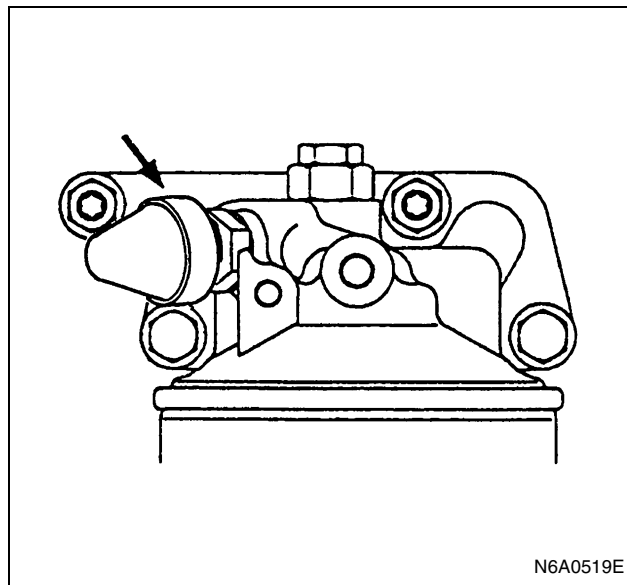
1. O-Ring
Apply a coat of engine oil to the O-rings (1) and install them to the cylinder body.



2. Oil Filter

Tighten:

Oil filter cover bolt to 48 N·m (4.9 kg·m/35 lb·ft)

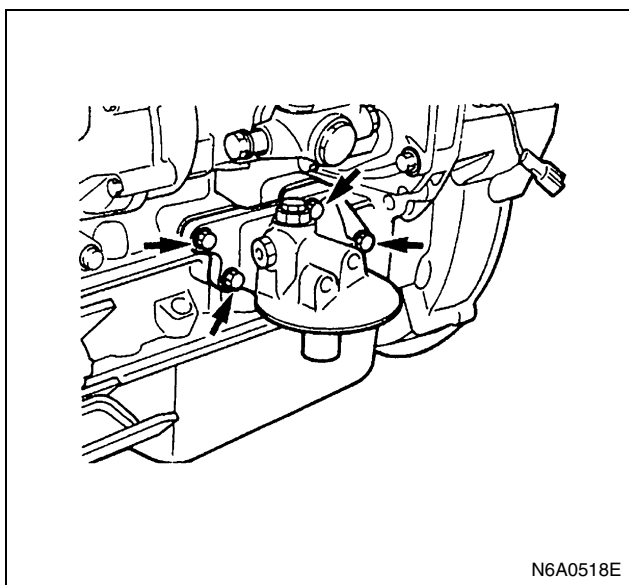


4. Oil Pipe

Tighten:

Oil pipe joint bolt to 17 N·m (1.7 kg·m/12 lb·ft)

- Connect battery ground cable.
- Start engine and check for oil leakage carefully.



3. Oil Pressure Switch

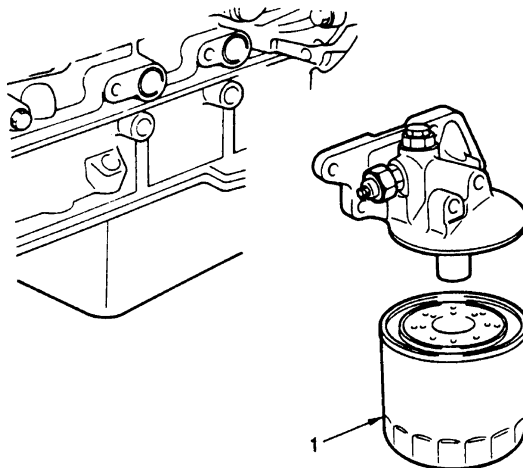
- 1) Apply the recommended liquid gasket (LOC-TITE 262) or its equivalent to at least 2 — 3 of the oil pressure switch threaded areas.
- 2) Install the oil pressure switch to the oil filter cover.

Tighten:

Oil pressure switch to 13 N·m (1.3 kg·m/113 lb·in)

OIL FILTER CARTRIDGE

Component



N6A0520E

Legend

1. Oil filter cartridge

Removal

Preparation

- Disconnect battery ground cable.
- Place a receptacle beneath the oil filter to contain the drained oil.

1. Oil Filter Cartridge

Use an oil filter wrench to remove the oil filter cartridge.

Oil Filter Wrench: 1-8522-1097-0

5-8840-2094-0 (4WD model)

Installation

1. Oil Filter Cartridge

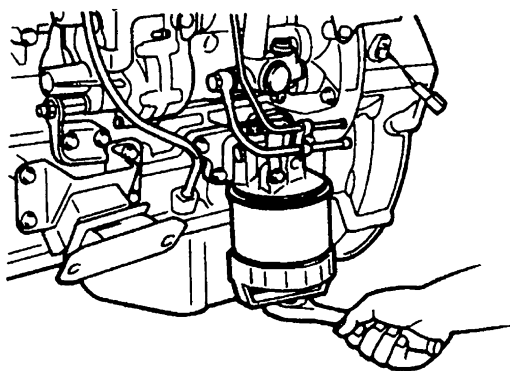
- 1) Clean the oil filter fitting face.
- 2) Apply a light coat of engine oil to the O-ring.
- 3) Turn in the new oil filter until the filter O-ring is fitted against the sealing face.
- 4) Use an oil filter wrench to install the new oil filter cartridge.

Oil Filter Wrench: 1-8522-1097-0

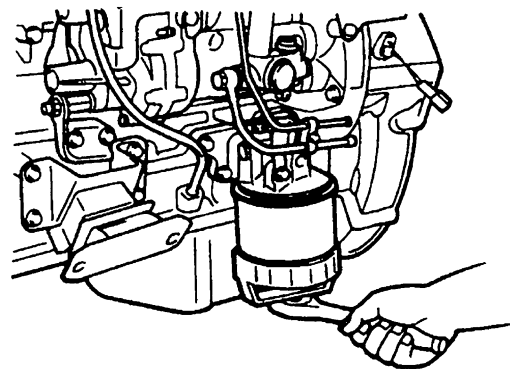
5-8840-2094-0 (4WD model)

Tighten:

Oil filter to 64 N·m (6.5 kg·m/47 lb·ft)



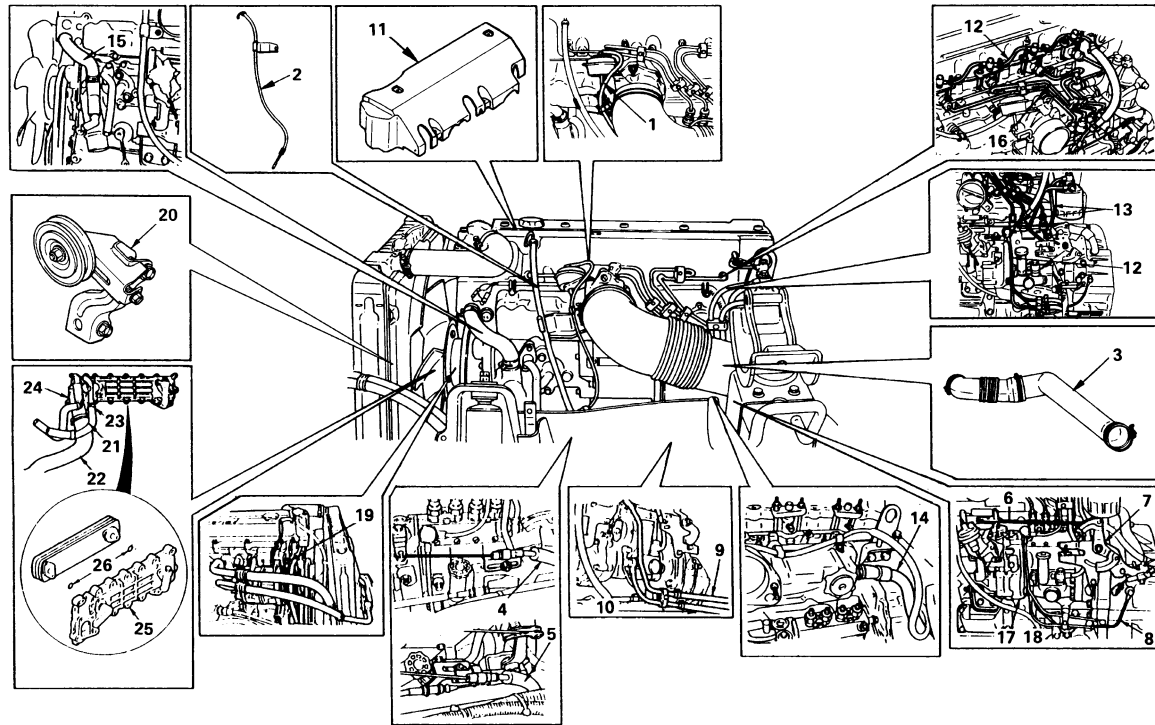
N6A0521E



N6A0521E

OIL COOLER

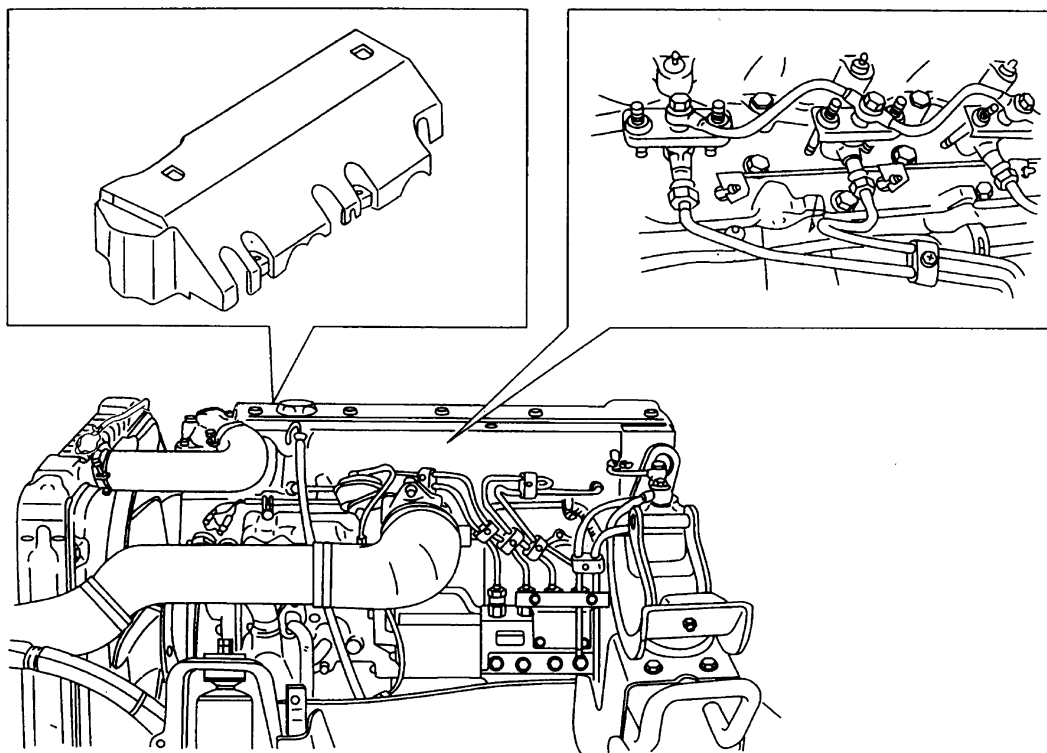
Component



N6A0523E

Legend

- | | |
|----------------------------------|--|
| 1. Vacuum hose | 14. PCV hose |
| 2. Oil level guide tube | 15. Water bypass hose |
| 3. Intake air duct | 16. Injection pipe |
| 4. Engine stop cable | 17. Injection pump assembly |
| 5. Accelerator control cable | 18. Injection pump rubber spacer |
| 6. Engine control cable | 19. A/C drive belt (If equipped with A/C) |
| 7. Engine control lever assembly | 20. Idle pulley bracket (If equipped with A/C) |
| 8. Oil pipe | 21. Heater hose |
| 9. Fuel return hose | 22. Radiator lower hose |
| 10. Fuel feed hose | 23. Heater pipe |
| 11. Nozzle cover | 24. Water suction pipe |
| 12. Leak off pipe | 25. Oil cooler assembly |
| 13. Fuel pipe | 26. O-ring |

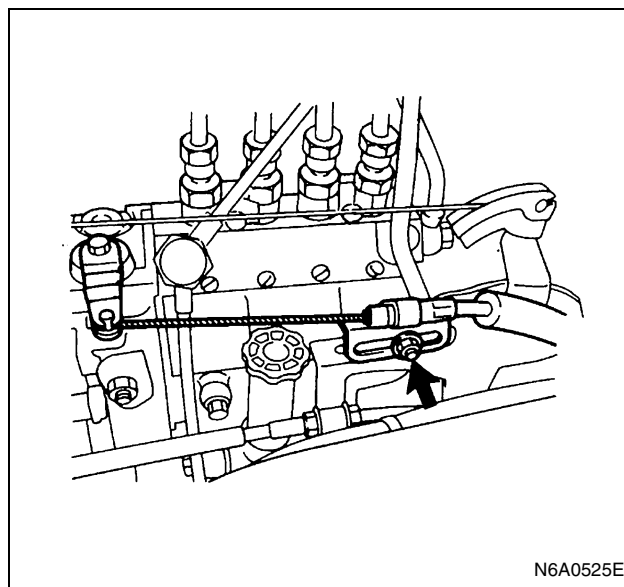


N6A0524E

Removal

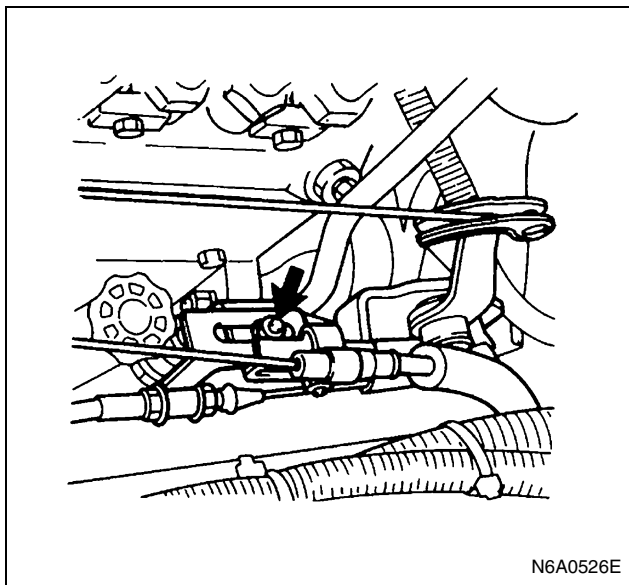
Preparation

- Disconnect the battery ground cable
- Drain coolant
- 1. Vacuum Hose
- 2. Oil Level Guide Tube
Remove the guide tube fixing bolt and pull out the guide tube.
- 3. Intake Air Duct
- 4. Engine Stop Cable
Loosen the locking nut at the bracket and disconnect engine stop cable from injection pump stop lever.

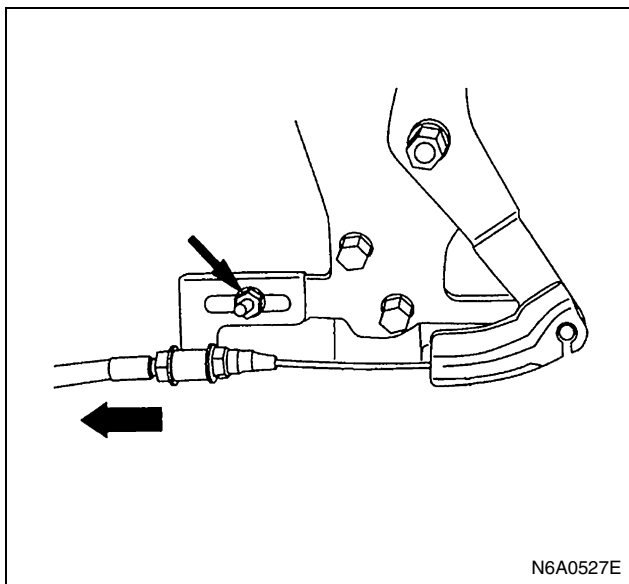


N6A0525E

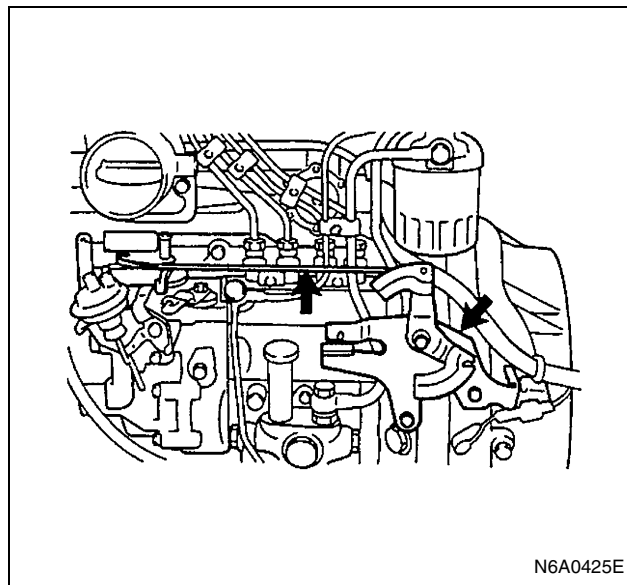
5. Accelerator Control Cable
Loosen the locking nut at the bracket and disconnect accelerator control cable from injection pump control lever.



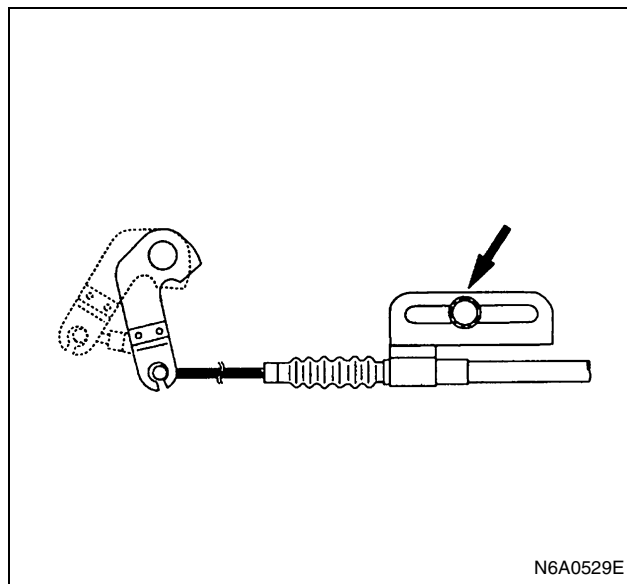
For 4HE1-TC



- 6. Engine Control Cable
- 7. Engine Control Lever Assembly

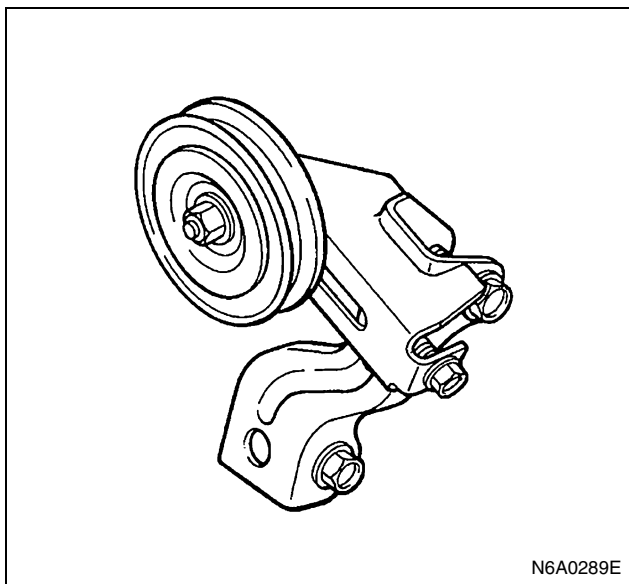


For 4HE1-TC

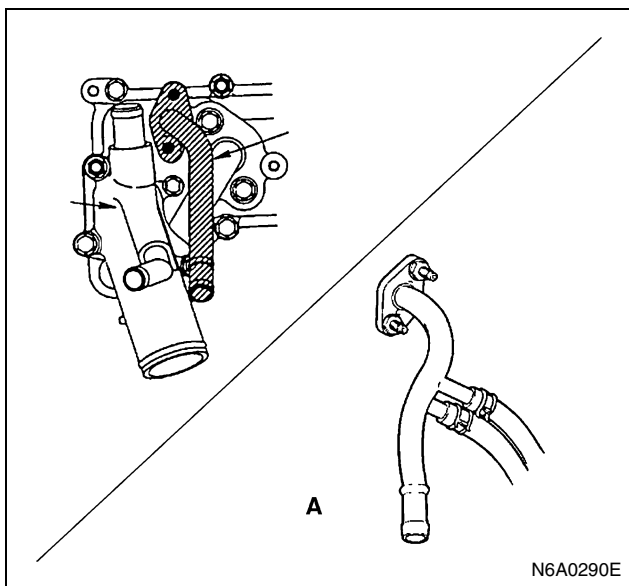


- 8. Oil Pipe
- 9. Fuel Return Hose
- 10. Fuel Feed Hose
Disconnect fuel hose from injection pump side and take care not to spill and enter dust.
- 11. Nozzle Cover
- 12. Leak Off Pipe
- 13. Fuel Pipe
- 14. Positive Crankcase Ventilation (PCV) Hose
- 15. Water Bypass Hose
- 16. Injection Pipe
- 17. Injection Pump Assembly
Above works refer to "INJECTION PUMP ASSEMBLY" section in this manual.
- 18. Injection Pump Rubber Spacer (for 4HF1/4HG1-T)
- 19. Air Conditioning (A/C) Drive Belt (If equipped with A/C)

20. Idle Pulley Bracket (If equipped with A/C)
After removal of the A/C drive belt, remove the 3 bracket fixing bolts. Then, remove the bracket with the tensioner and the idler attached.



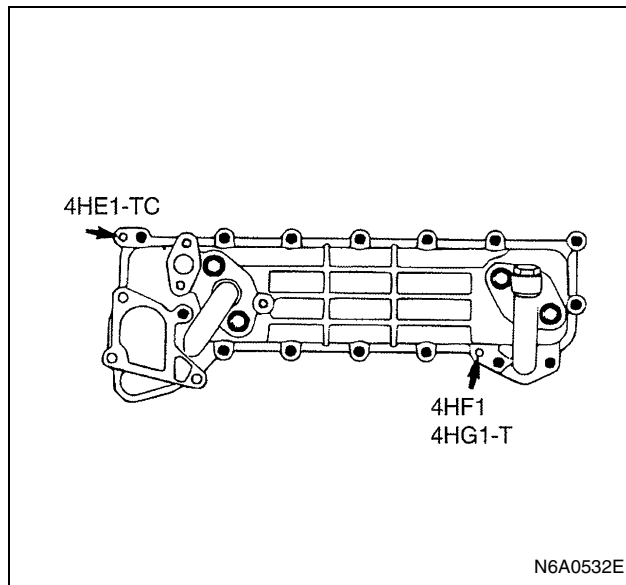
21. Heater Hose
22. Radiator Lower Hose
23. Heater Pipe



Legend

A. 4HF1-2

24. Water Suction Pipe
25. Oil Cooler Assembly
1) Remove the oil cooler bolts.
2) Install a oil cooler fixing bolt to the oil cooler replace hole as shown in the illustration, and tighten the bolt alternately a little at a time.

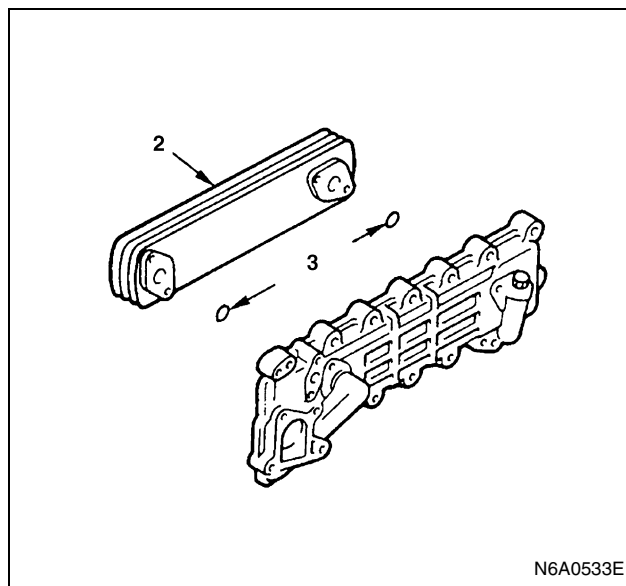


26. O-Ring

Disassembly

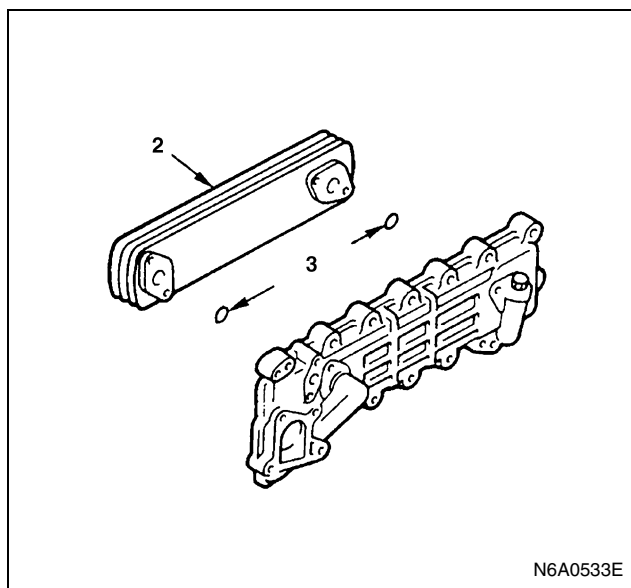
(Oil Cooler Assembly)

1. Element fixing bolts
2. Element
3. O-Ring



Reassembly

1. O-Ring
Apply a coat of engine oil to the O-rings and install the O-rings the oil cooler.
2. Element

**Legend**

- 2. Element
- 3. O-ring

- 3. Element fixing bolts

Tighten:

Element fixing bolts to 20 N·m (2.0 kg·m/14 lb·ft)

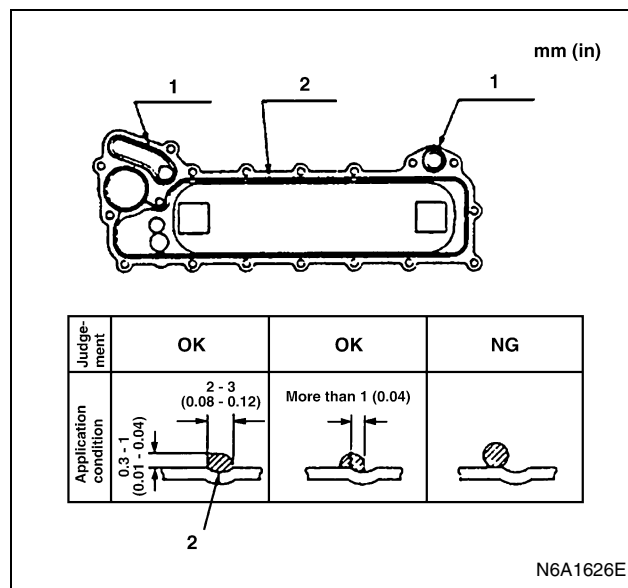
Installation

1. O-Ring
2. Oil Cooler Assembly
 - 1) Apply 2 — 3 mm (0.08 — 0.12 in) bead of the recommended liquid gasket (Three Bond 1207C) or its equivalent on the oil cooler fitting surface.
 - 2) Apply a coat of engine oil to the O-rings (2 pieces) and install the O-rings to the oil cooler.

Notice:

Take care that the O-ring is not smeared with liquid gasket.

- Install the oil cooler within 7 minutes after application of liquid gasket.
- For the dislocation of liquid gasket, refer to the illustration.

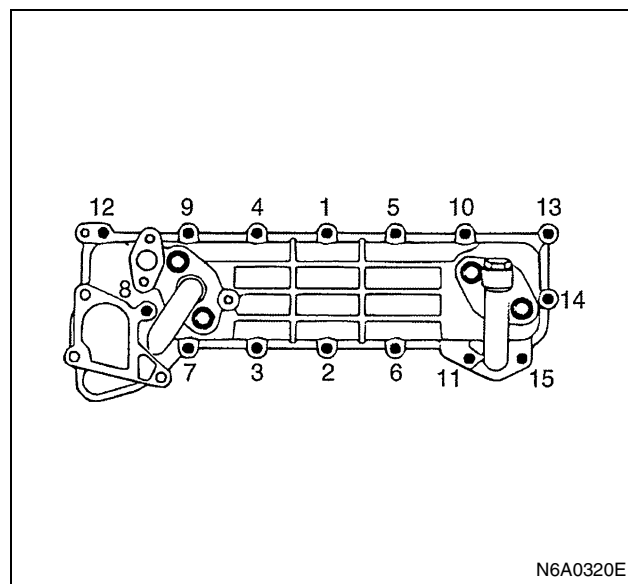
**Legend**

- 1. O-ring
- 2. Liquid gasket

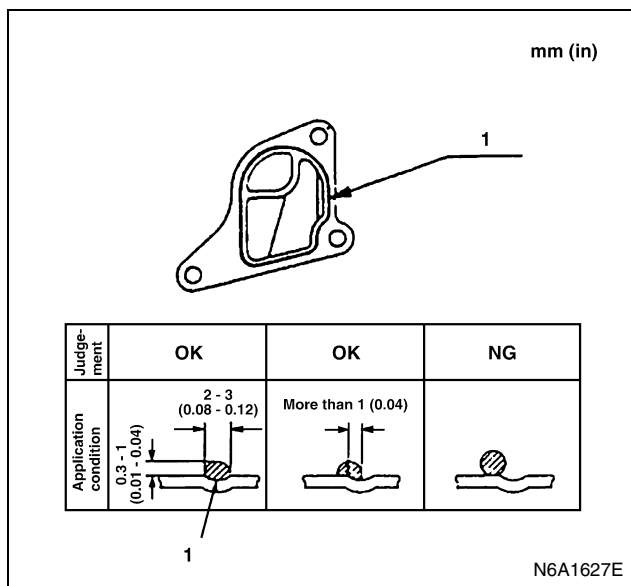
- 3) Tighten the oil cooler bolts and nut to the specified torque a little at a time in the sequence shown in the illustration.

Tighten:

Oil cooler bolt and nut to 24 N·m (2.4 kg·m/17 lb·ft)

**3. Water Suction Pipe**

- 1) Apply 2 — 3 mm (0.08 — 0.12 in) bead of the recommended liquid gasket (Three Bond 1207C) or its equivalent on the groove of the water suction pipe fitting surface.
- 2) Install the water suction pipe to the oil cooler.
 - For the dislocation of liquid gasket, refer to the illustration.

**Legend**

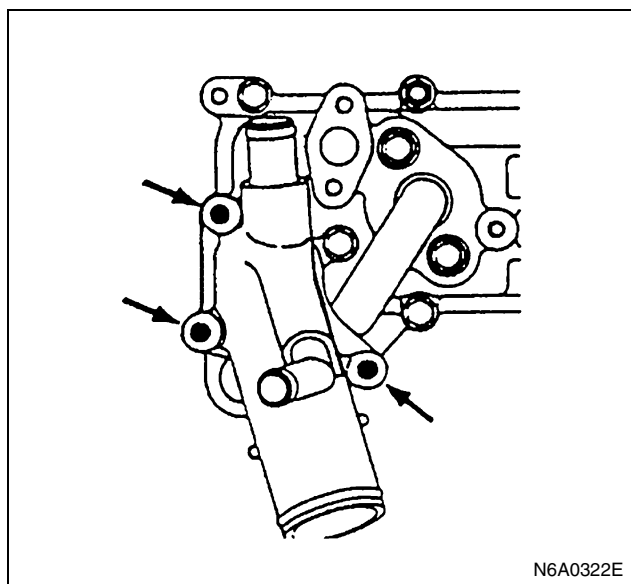
1. Liquid gasket

Tighten:

Water suction pipe bolt to 24 N·m (2.4 kg·m/17 lb·ft)

Notice:

Install the water suction pipe immediately after the installation of the oil cooler.

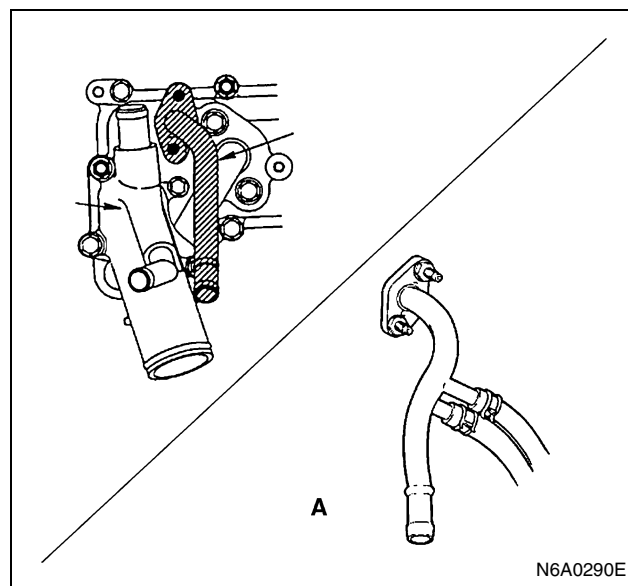


4. Heater Pipe

- 1) Install the O-ring to the heater pipe.
- 2) Install the heater pipe to the oil cooler.

Tighten:

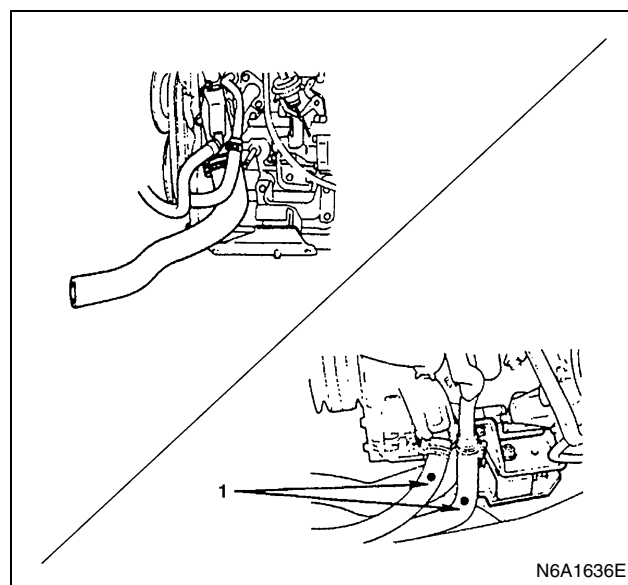
Heater pipe bolt to 24 N·m (2.4 kg·m/17 lb·ft)

**Legend**

- A. 4HF1-2

5. Radiator Lower Hose

6. Heater Hose

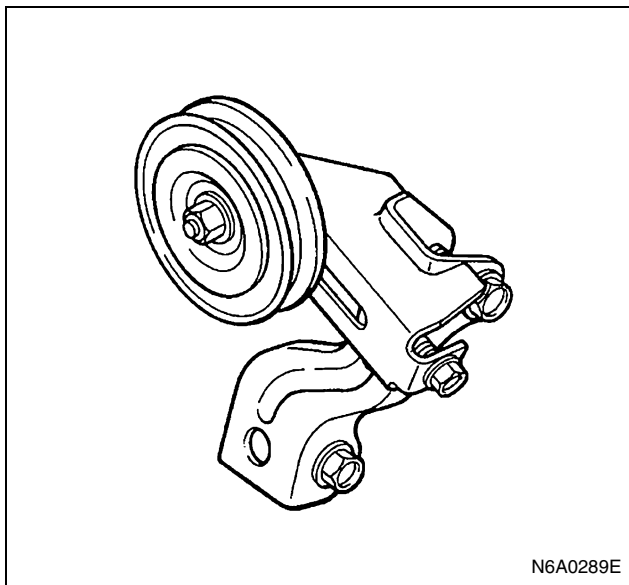
**Legend**

1. Mark

7. Idle Pulley Bracket (If equipped with A/C)

Tighten:

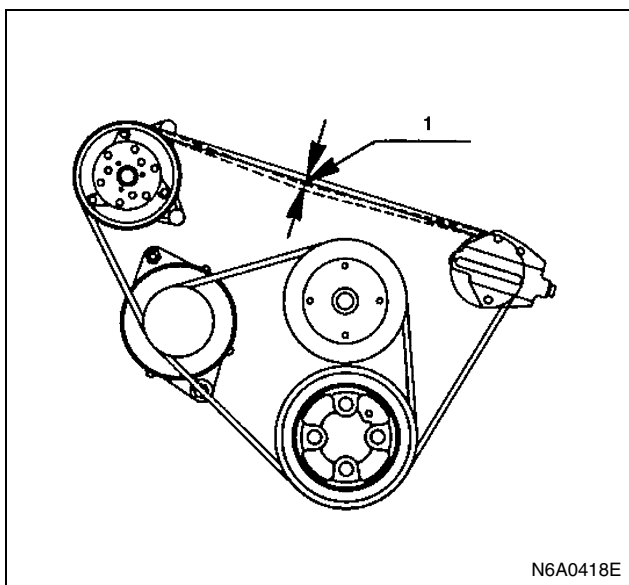
Idle pulley bracket bolt to 48 N·m (4.9 kg·m/35 lb·ft)



8. Air Conditioning (A/C) Drive Belt (If equipped with A/C)

- Install drive belt adjust belt tension by adjusting bolt and tighten locking nut to the specified torque.
- Depress the drive belt mid-portion with a 98 N (10 kg/22 lb) force.

Drive Belt Deflection	mm (in)
16 — 20 (0.63 — 0.79) ... New belt	
18 — 22 (0.71 — 0.87) ... Reuse belt	



Legend

1. Belt deflection

Tighten:

Locking nut to 27 N·m (2.8 kg·m/20 lb·ft)

- Injection Pump Rubber Spacer (4HF1/4HG1-T)
- Injection Pump Assembly

- Injection Pipe
- Water Bypass Hose
- Positive Crankcase Ventilation (PCV) Hose
- Fuel Pipe
- Leak Off Pipe
- Nozzle Cover
- Fuel Feed Hose
- Fuel Return Hose

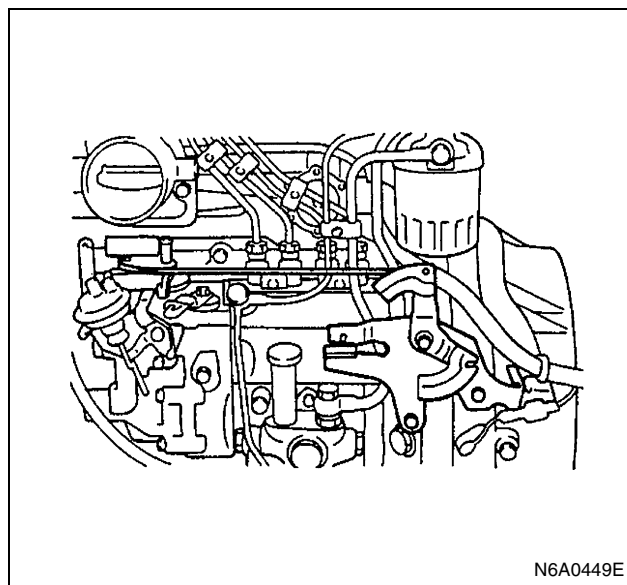
Air Bleeding

Above works refer to "INJECTION PUMP ASSEMBLY" section in this manual.

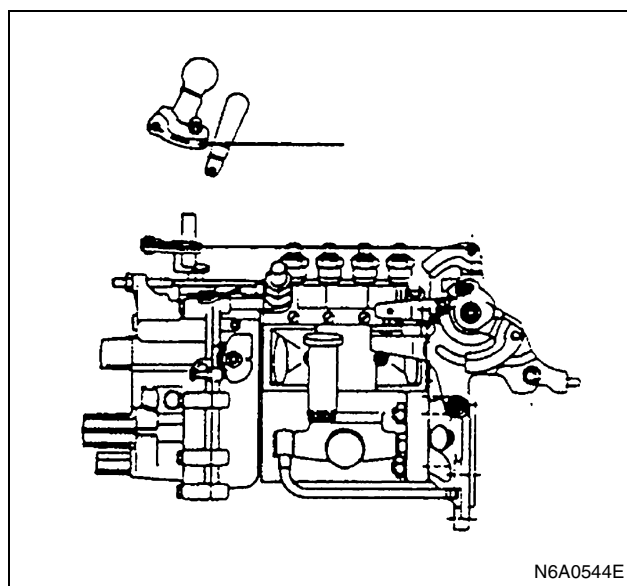
- Oil Pipe
- Engine Control Lever Assembly

Tighten:

Engine control lever bolt to 24 N·m (2.4 kg·m/17 lb·ft)



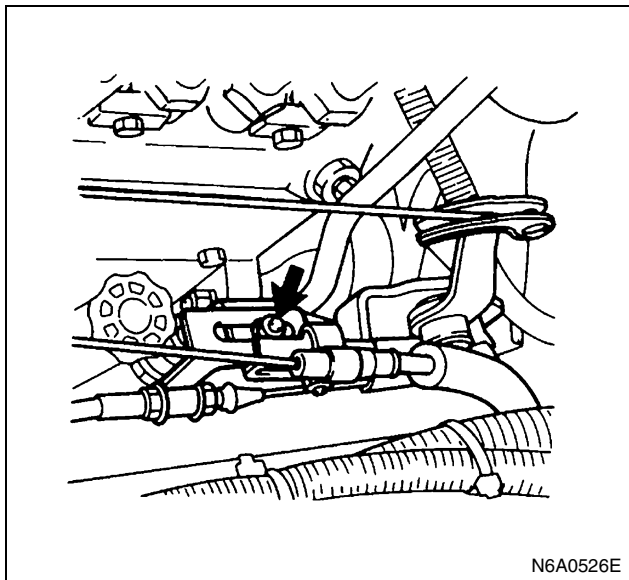
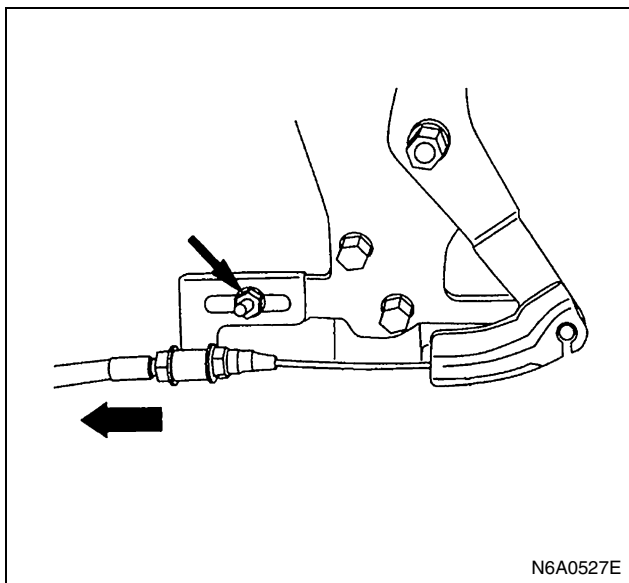
21. Engine Control Cable



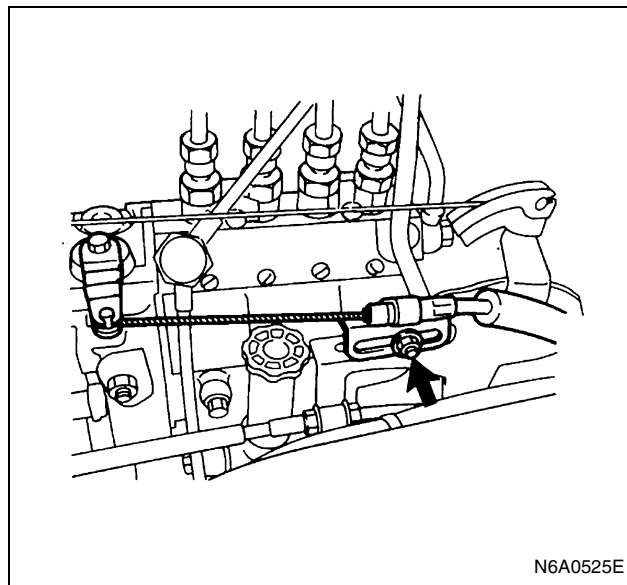
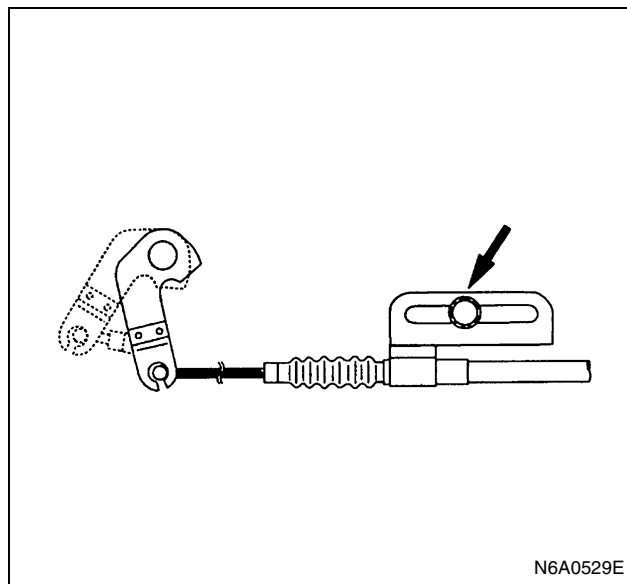
22. Accelerator Control Cable

- 1) Check to see if the idling control knob is turned to the utmost limit to the left.

- 2) Install the end tip of the cable to the engine control lever.
- 3) With the outer cable pulled toward the front of the vehicle, provide the engine control wire and the inner cable with the appropriate play. Then, fasten the clamp with a nut.

**For 4HE1-TC**

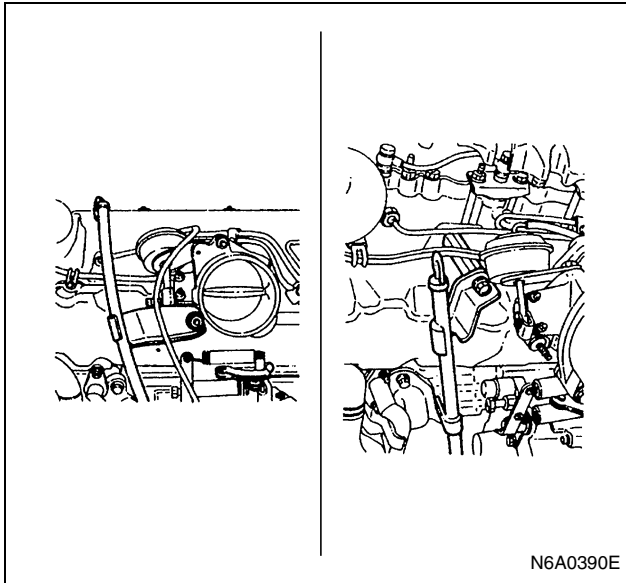
- 4) Check to see if the control lever of the injection pump is set at the idling position (with the lever attached to the stopper bolt).
23. Engine Stop Cable
- 1) Install the end tip of the cable to the engine stop lever.
 - 2) Pull the cable toward the rear of the vehicle, and fasten the clamp with a nut at the position where the lever stops.

**For 4HE1-TC**

24. Intake Air Duct
25. Oil Level Gauge Guide Tube
 - 1) Install the O-rings to the guide tube lower portion and insert the guide tube completely to the cylinder body.
 - 2) Tighten the guide tube bolt to the specified torque.

Tighten:

Guide tube bolt to 13 N·m (1.3 kg·m/113 lb-in)

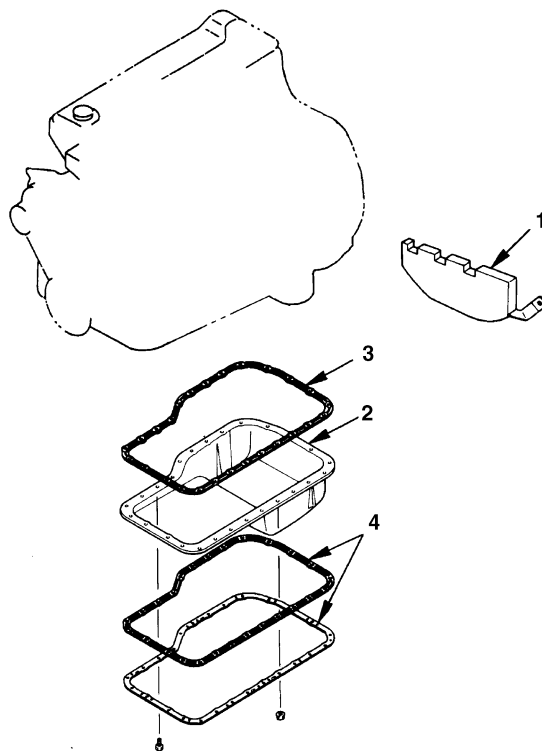


26. Vacuum Hose

- Pour coolant into radiator.
- Connect battery ground cable.
- Start engine and check for oil and water leakage carefully.

OIL PAN

Component



N6A0550E

Legend

1. Spacer rubber
2. Oil pan

3. Gasket
4. Rubber assembly

Removal

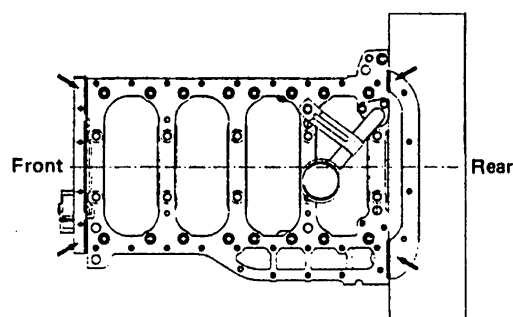
Preparation

- Disconnect battery ground cable
- Lift up car
- Drain engine oil

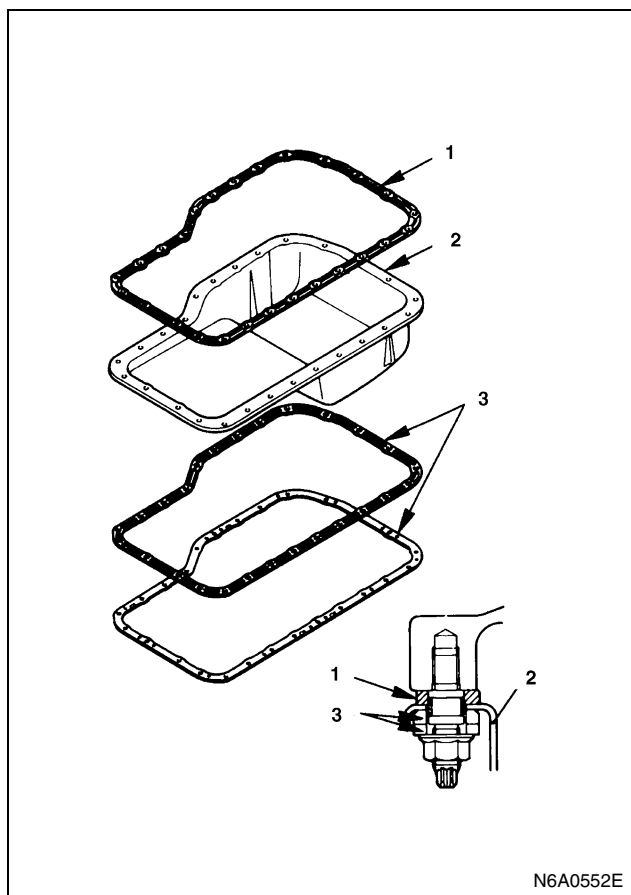
1. Spacer Rubber
 - Remove the stiffener before removing the spacer rubber.
2. Oil Pan

Installation

1. Oil Pan
 - 1) Apply a 3 mm (0.12 in) bead of recommended liquid gasket (Three Bond 1207C) or its equivalent to the shaded areas shown in the illustration.



N6A0551E



Legend

1. Gasket
2. Oil pan
3. Rubber assembly

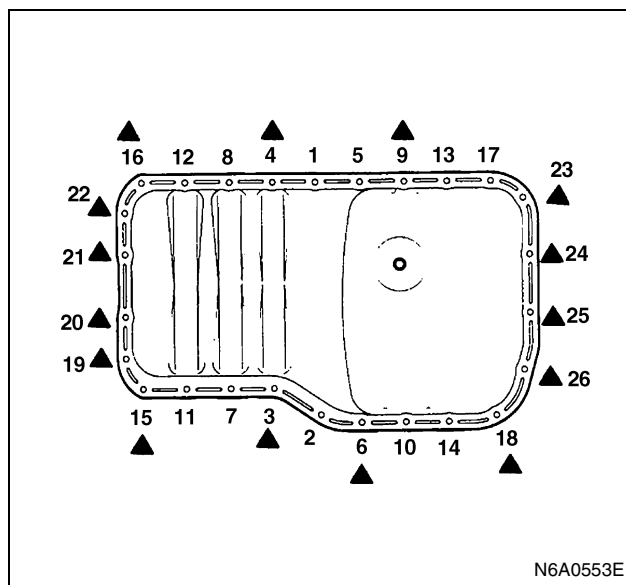
- 2) Tighten the oil pan nuts and bolts to the specified torque in the numerical order as shown in the illustration.

▲ marks are located on nut positions.

Tighten:

Oil Pan nuts and bolts to 11 N·m (1.1 kg·m/8 lb·ft)

Except 4HE1-TC

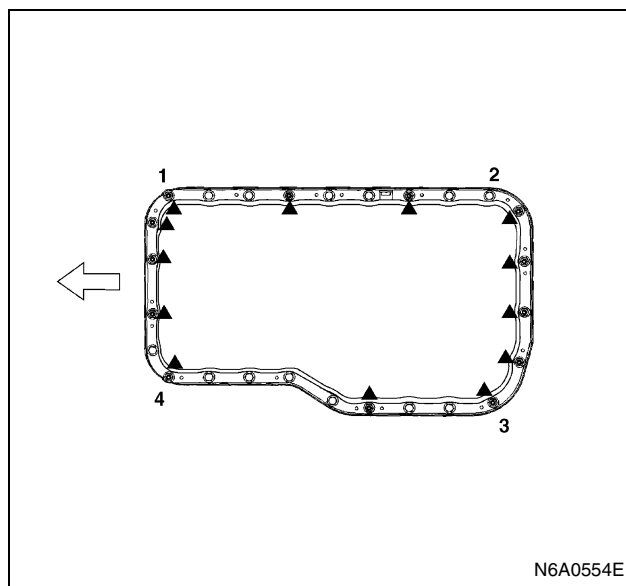


- Tighten bolts (1), (2), (3), and (4) in numerical order.
- Tighten the remaining bolts (numerical order is not required).

Tighten:

Oil pan nuts and bolts to 11 N·m (1.1 kg·m/8 lb·ft)

For 4HE1-TC



2. Spacer Rubber

Tighten:

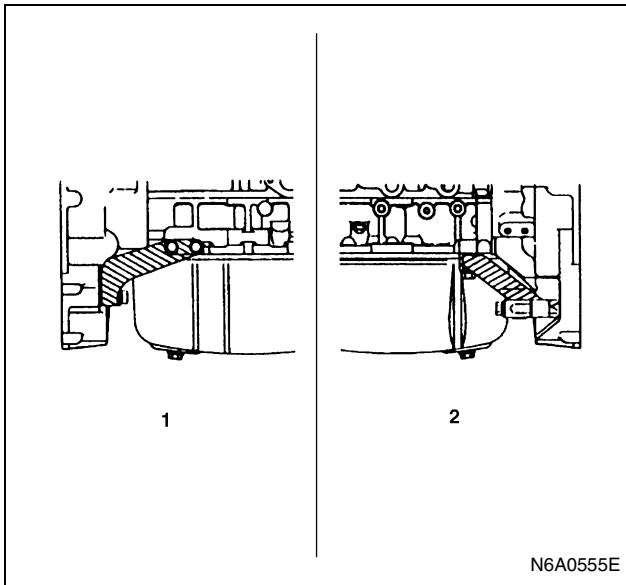
Spacer rubber bolts to 76 N·m (7.7 kg·m/56 lb·ft)

- Tighten the spacer rubber together with the stiffener.

Tighten:

Spacer rubber bolts to

- Cylinder body RH side: 48 N·m (4.9 kg·m/35 lb·ft)
- Cylinder body LH side: 128 N·m (12.9 kg·m/93 lb·ft)
- Flywheel housing side: 76 N·m (7.7 kg·m/56 lb·ft)

**Legend**

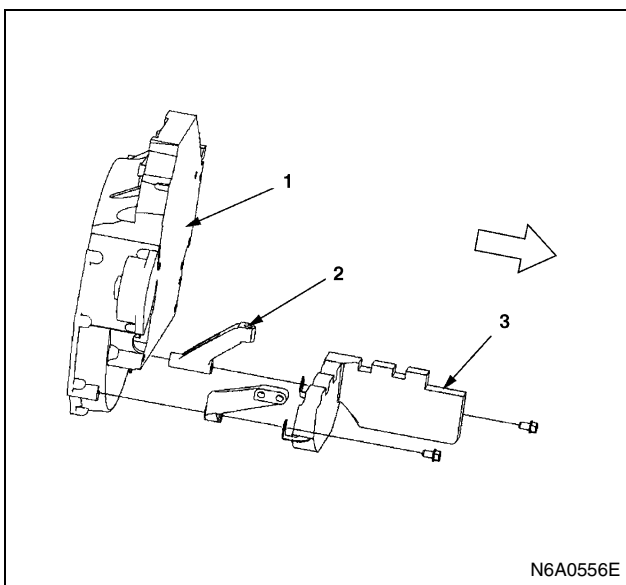
1. Right side
2. Left side

- 4HE1-TC engines use a larger rubber spacer than other engines.

Tighten:

Space rubber bolts to 76 N·m (7.7 kg·m/56 lb·ft)

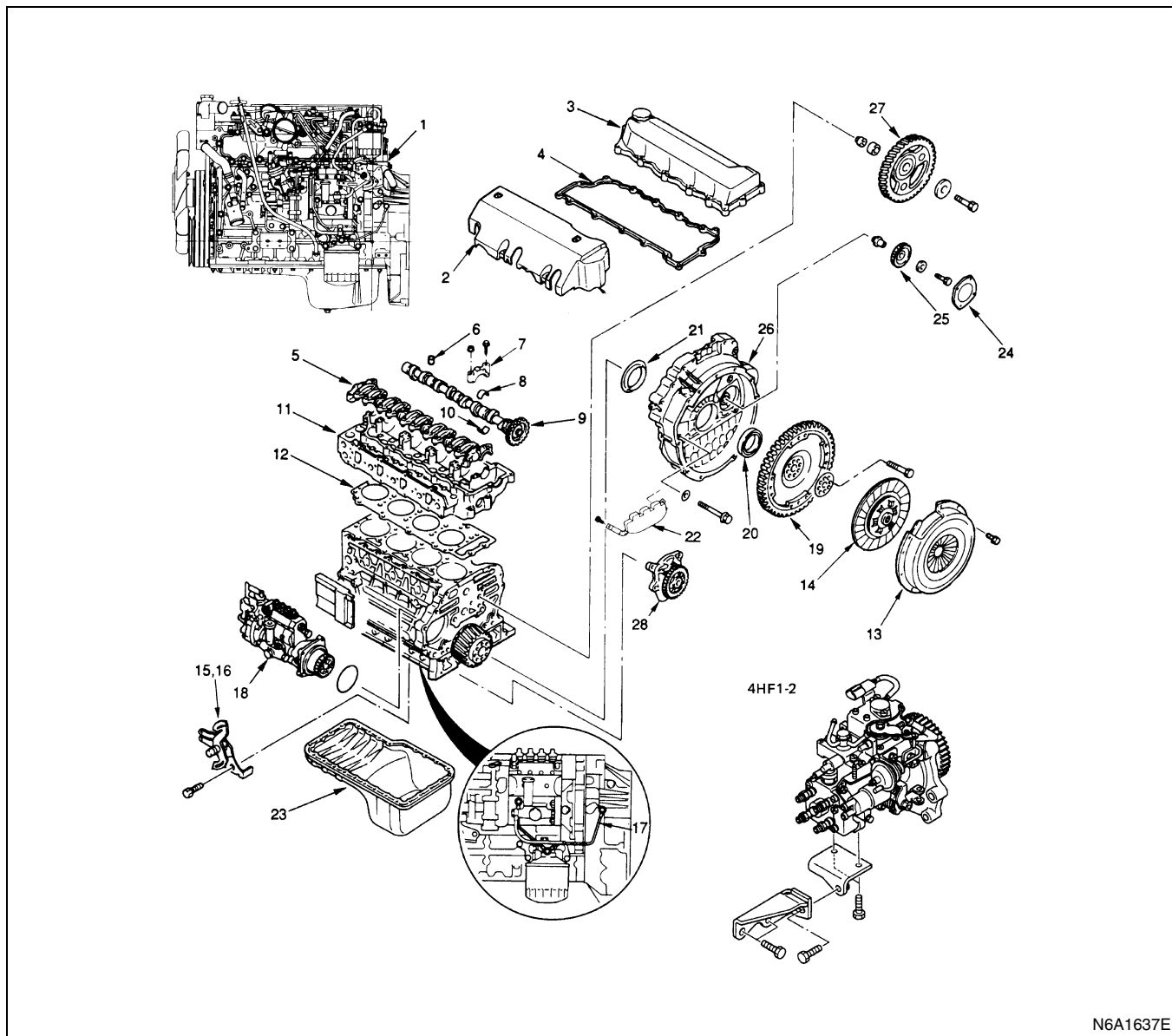
- Install the rubber spacer to the bracket from the outside of the spacer. Tighten the stiffener together with the rubber spacer.

For 4HE1-TC**Legend**

1. Flywheel housing
2. Stiffener
3. Space rubber

OIL PUMP ASSEMBLY

Component



N6A1637E

Legend

- | | |
|------------------------------------|---|
| 1. Engine assembly | 15. Engine control wire |
| 2. Nozzle cover | 16. Engine control lever assembly |
| 3. Cylinder head cover | 17. Oil pipe |
| 4. Head cover gasket | 18. Injection pump assembly |
| 5. Rocker arm shaft assembly | 19. Flywheel |
| 6. Valve cap | 20. Rear oil seal |
| 7. Camshaft bearing cap | 21. Slinger |
| 8. Camshaft bearing upper | 22. Spacer rubber |
| 9. Camshaft assembly | 23. Oil pan |
| 10. Camshaft bearing lower | 24. Power steering pump idle gear cover |
| 11. Cylinder head assembly | 25. Power steering pump idle gear |
| 12. Cylinder head gasket | 26. Flywheel housing |
| 13. Clutch pressure plate assembly | 27. Idle gear A |
| 14. Driven plate | 28. Oil pump assembly |

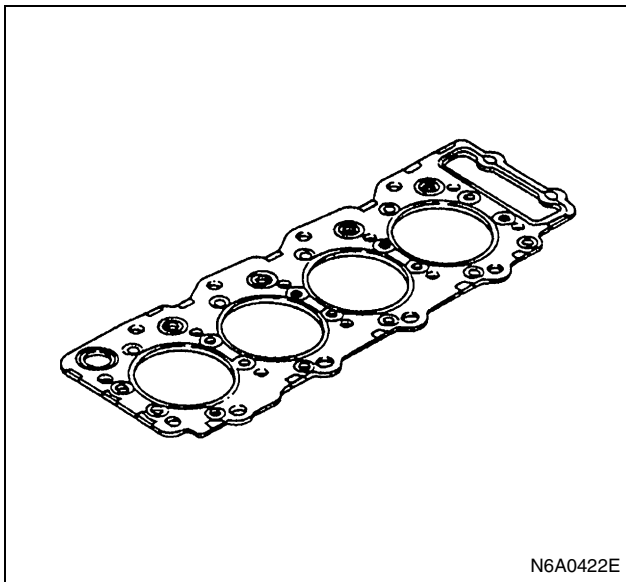
Removal

Preparation

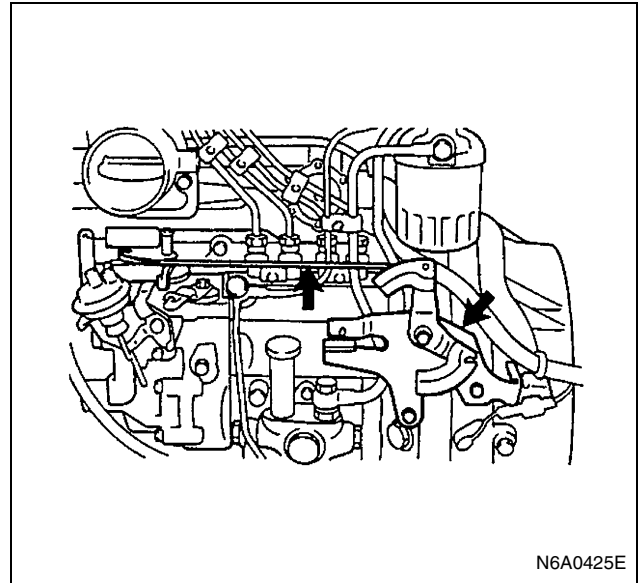
- Disconnect battery ground cable.
 - Tilt the cab.
 - Drain coolant and engine oil
1. Engine Assembly
Above works refer to "ENGINE ASSEMBLY" section in this manual.
 2. Nozzle Cover
 3. Cylinder Head Cover
 4. Head Cover Gasket
 5. Rocker Arm Shaft Assembly
 6. Valve Cap
 7. Camshaft Bearing Cap
 8. Camshaft Bearing Upper
 9. Camshaft Assembly
 10. Camshaft Bearing Lower
Above works refer to "ROCKER ARM SHAFT ASSEMBLY AND CAMSHAFT ASSEMBLY" section in this manual.
 11. Cylinder Head Assembly
Above works refer to "CYLINDER HEAD" section in this manual.
 12. Cylinder Head Gasket

Caution:

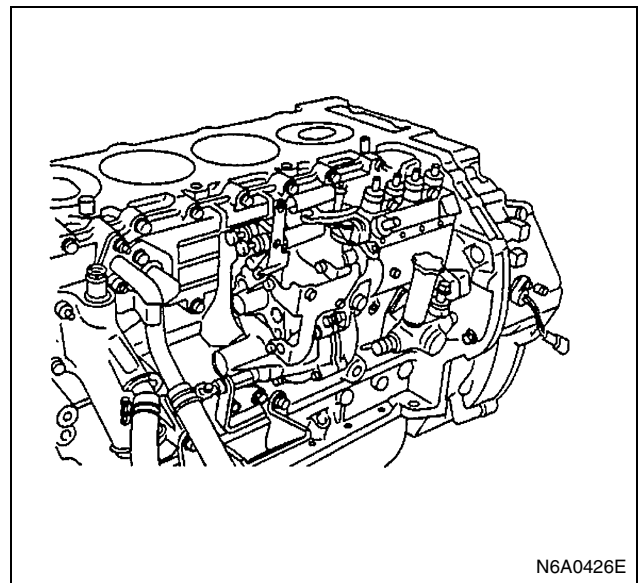
Do not reuse the cylinder head gasket.



13. Clutch Pressure Plate Assembly
14. Driven Plate
Above works refer to "TIMING GEAR REPLACEMENT" section in this manual.
15. Engine Control Wire
16. Engine Control Lever Assembly



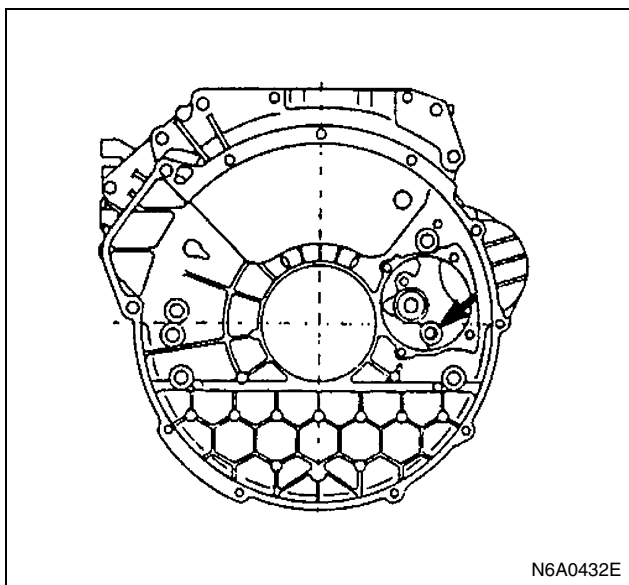
17. Oil Pipe
18. Injection Pump Assembly
 - 1) Remove the injection pump bracket bolts and the injection pump rear bracket bolts.
 - 2) Then remove the injection pump assembly.



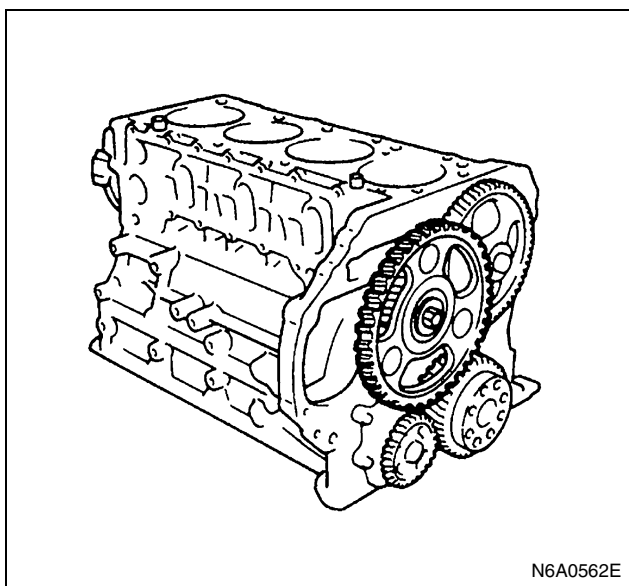
19. Flywheel
20. Crankshaft Rear Oil Seal
21. Crankshaft Rear Slinger
Above works refer to "CRANKSHAFT REAR OIL SEAL" section in this manual.
22. Spacer Rubber
Remove the stiffener before removing the spacer rubber.
23. Oil Pan
24. Power Steering Pump Idle Gear Cover
25. Power Steering Pump Idle Gear
26. Flywheel Housing

Notice:

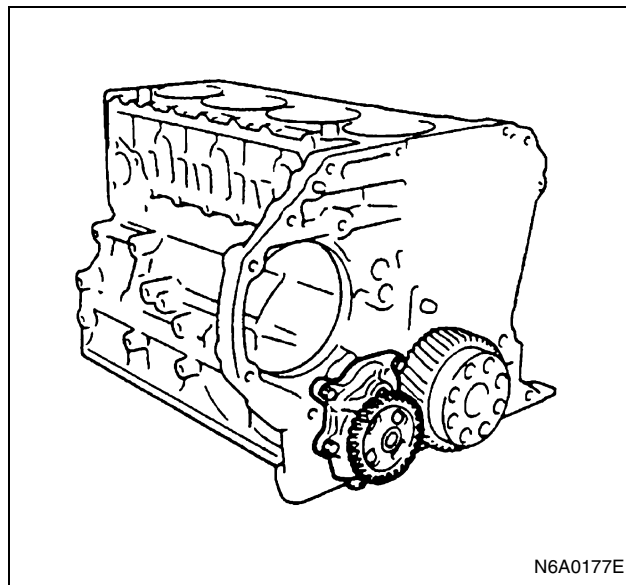
Be careful not to fail to remove the bolts shown in the illustration.



27. Idle Gear A



28. Oil Pump Assembly

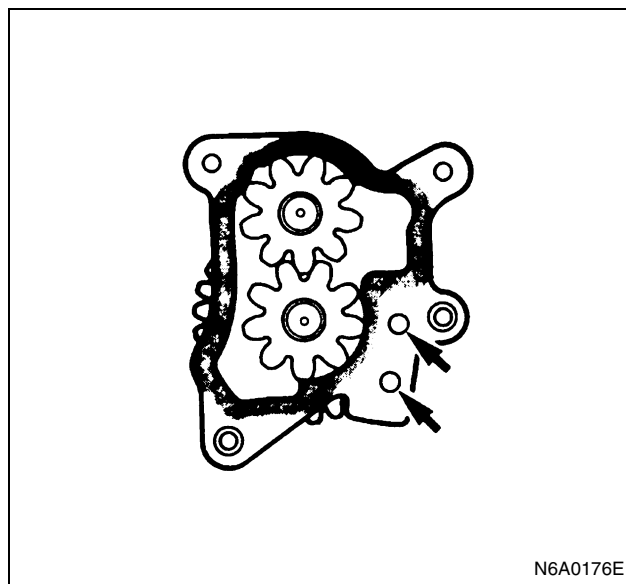


Installation

1. Oil Pump Assembly
 - 1) Carefully wipe any foreign material from the cylinder body rear surface.
 - 2) Apply the recommended liquid gasket (Three Bond 1141E) or its equivalent to the shaded areas shown in the illustration.

Caution:

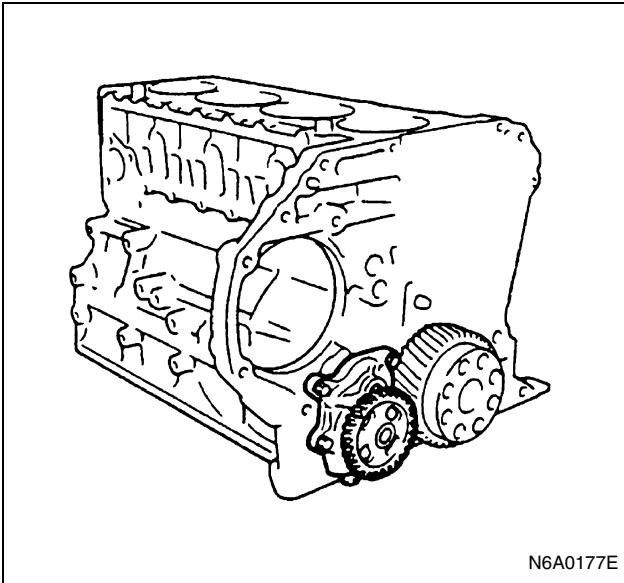
Be careful that no liquid gasket gets into the holes in the arrow-marked portion in the illustration and the inside of the oil pump cover.



- 3) Install the oil pump to the cylinder body.
- 4) Tighten the oil pump to the specified torque.

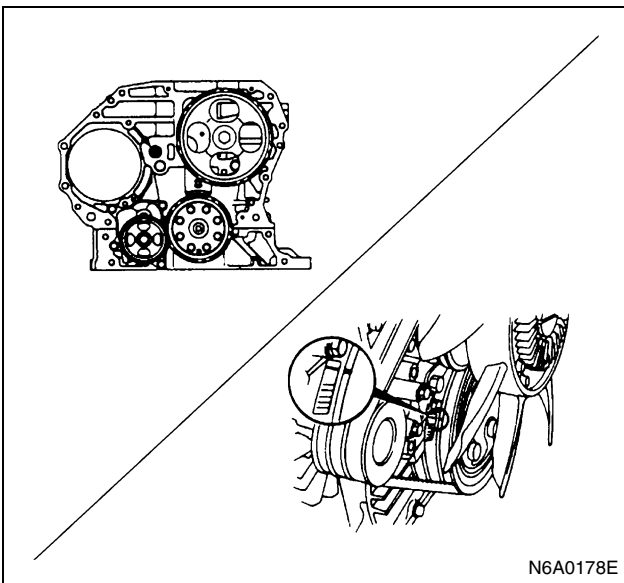
Tighten:

Oil pump bolt to 31 N·m (3.2 kg·m/23 lb·ft)



2. Idle Gear A

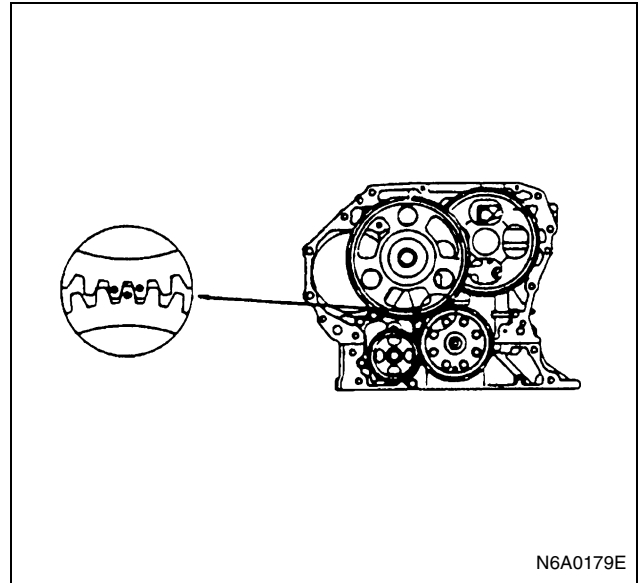
- 1) Turn the crankshaft clockwise so that the engagement mark of the crankshaft gear faces to the shaft center of the idle gear A and the No.1 cylinder piston comes to the top dead center.



- 2) Align the crankshaft gear with the engagement mark of the idle gear and install the idle gear A.

Tighten:

Idle gear A bolt to 133 N·m (13.6 kg·m/98 lb·ft)



3. Flywheel Housing
4. Power Steering Pump Idle Gear
5. Power Steering Pump Idle Gear Cover
Above works refer to "TIMING GEAR REPLACEMENT" section in this manual.
6. Oil Pan
7. Spacer Rubber
Above works refer to "OIL PAN" section in this manual.
8. Crankshaft Rear Slinger
9. Crankshaft Rear Oil Seal
10. Flywheel
Above works refer to "CRANKSHAFT REAR OIL SEAL" section in this manual.
11. Injection Pump Assembly
Above works refer to "INJECTION PUMP ASSEMBLY" section in this manual.
12. Oil Pipe
13. Engine Control Lever Assembly
14. Engine Control Wire
Above works refer to "INJECTION PUMP ASSEMBLY" section in this manual.
15. Driven Plate
16. Clutch Pressure Plate Assembly
Above works refer to "TIMING GEAR REPLACEMENT" section in this manual.
17. Cylinder Head Gasket
Above works refer to "CYLINDER HEAD" section in this manual.
18. Cylinder Head Assembly
Above works refer to "CYLINDER HEAD" section in this manual.
19. Camshaft Bearing Lower
20. Camshaft Assembly
21. Camshaft Bearing Upper
22. Camshaft Bearing Cap
23. Valve Cap

6A3-86 ENGINE (4HF1 / 4HF1-2 / 4HE1-TC / 4HG1 / 4HG1-T)

Above works refer to "CAMSHAFT ASSEMBLY" section in this manual.

24. Rocker Arm Shaft Assembly

Above works refer to "ROCKER ARM SHAFT ASSEMBLY" section in this manual.

25. Head Cover Gasket

26. Cylinder Head Cover

Above works refer to "CYLINDER HEAD COVER" section in this manual.

27. Nozzle Cover

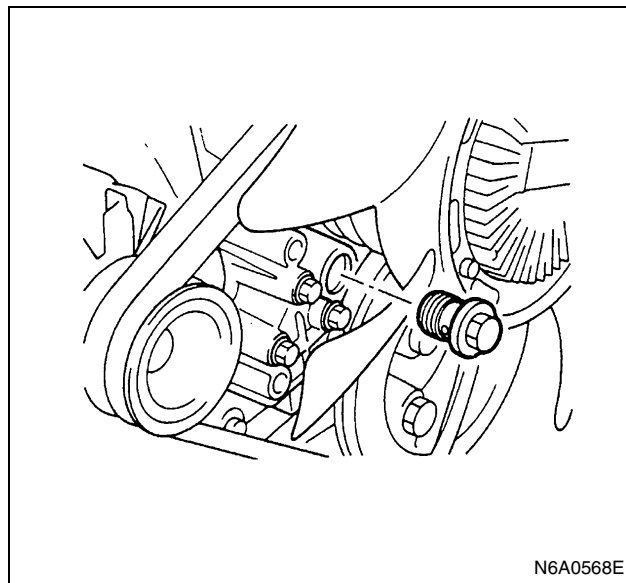
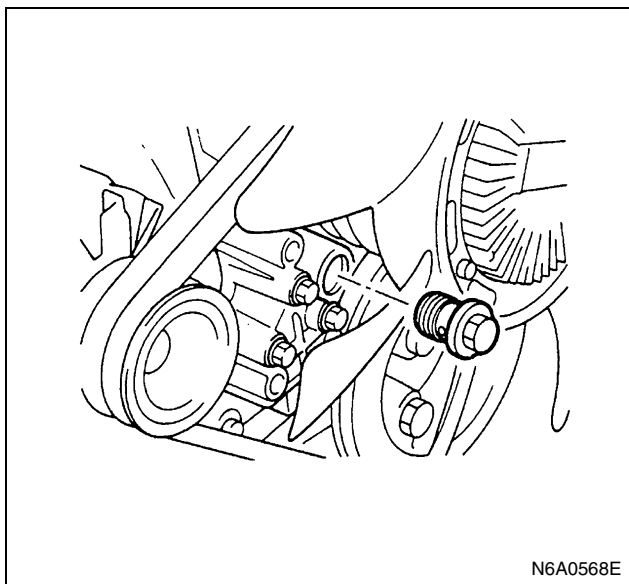
28. Engine Assembly

Above works refer to "ENGINE ASSEMBLY" section in this manual.

OIL RELIEF VALVE

Removal

1. Oil Relief Valve



Inspection and Repair

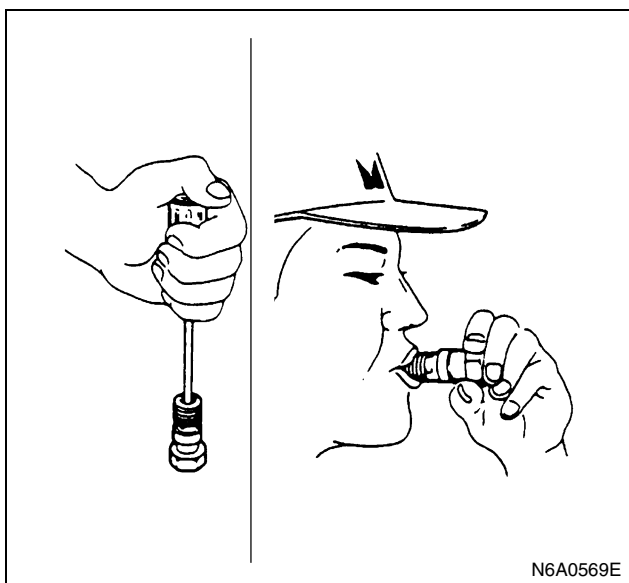
Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

Valve

Push the valve with a screwdriver to check it for binding. When the valve is binding, replace the relief valve with a new one.

Spring

Blow the valve and check it for air leak. When there is any air leak in the valve, replace it with a new one.



Installation

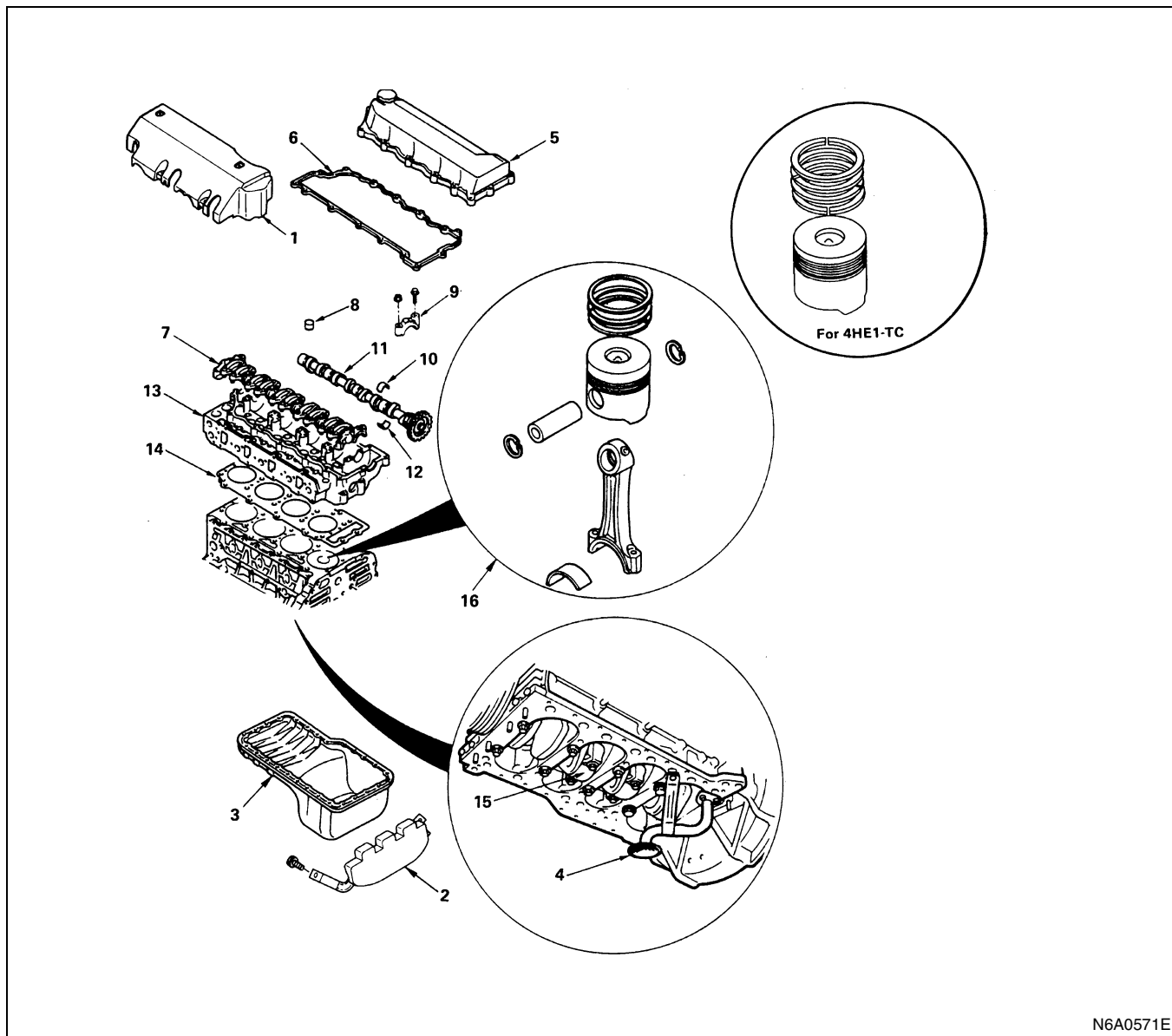
1. Oil Relief Valve

Tighten:

Oil relief valve to 39 N·m (4.0 kg·m/29 lb·ft)

PISTON, PISTON RING, PISTON PIN AND CONNECTING ROD

Component



N6A0571E

Legend

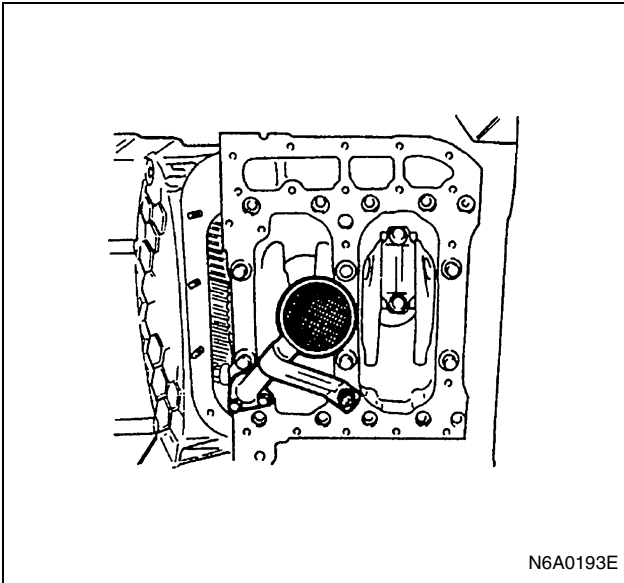
- | | |
|-------------------------------|--|
| 1. Nozzle cover | 9. Camshaft bearing cap |
| 2. Spacer rubber | 10. Camshaft bearing upper |
| 3. Oil pan | 11. Camshaft assembly |
| 4. Oil pump strainer | 12. Camshaft bearing lower |
| 5. Cylinder head cover | 13. Cylinder head assembly |
| 6. Cylinder head cover gasket | 14. Cylinder head gasket |
| 7. Rocker arm shaft assembly | 15. Connecting rod cap |
| 8. Valve cap | 16. Piston and connecting rod assembly |

Removal

Preparation

- Disconnect battery ground cable.
- Tilt the cab.
- Drain coolant and engine oil.

1. Nozzle Cover
2. Spacer Rubber
Remove the stiffener before removing the spacer rubber.
3. Oil Pan
4. Oil Pump Strainer



5. Cylinder Head Cover
6. Cylinder Head Cover Gasket
7. Rocker Arm Shaft Assembly
Above works refer to "ROCKER ARM SHAFT ASSEMBLY" section in this manual.
8. Valve Cap

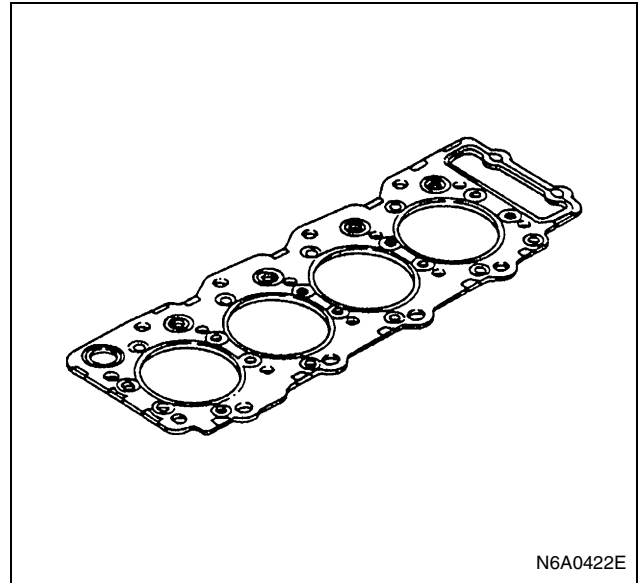
Caution:

Take sufficient care not to let valve caps fall into the gear case or oil return hole.

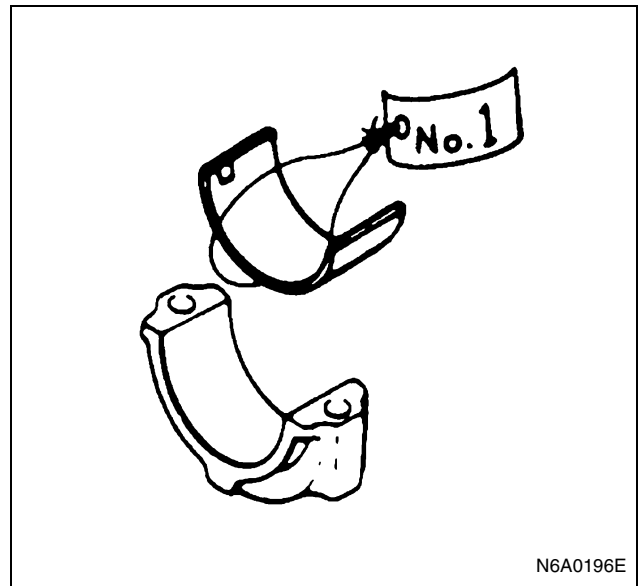
9. Camshaft Bearing Cap
10. Camshaft Bearing Upper
11. Camshaft Assembly
12. Camshaft Bearing Lower
Above works refer to "CAMSHAFT ASSEMBLY" section in this manual.
13. Cylinder Head Assembly
Above works refer to "CYLINDER HEAD" section in this manual.
14. Cylinder Head Gasket

Caution:

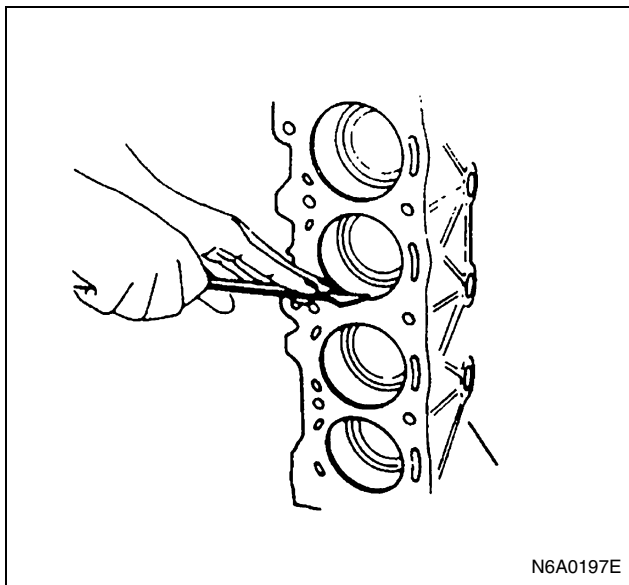
Do not reuse the cylinder head gasket.



15. Connecting Rod Cap
 - 1) Take out the connecting rod bearing cap bolts and remove the bearing cap with the lower bearing.
 - 2) If the connecting rod lower bearings are to be reinstalled, mark their fitting positions by tagging each bearing with the cylinder number from which it was removed.



16. Piston and Connecting Rod Assembly
 - 1) To facilitate smooth removal of piston, remove carbon from the upper part of the cylinder wall using a scraper or equivalent.



- 2) Remove the piston and connecting rod assembly upward by pushing on the edge of the connecting rod with a hammer handle or equivalent.
- 3) If the connecting rod bearing are to be reinstalled, mark their fitting positions by tagging each bearing with the cylinder number from which it was removed.

Caution:

Do not bend or damage the oiling jet.

Notice:

When removing the piston and connecting rod assembly, pull the connecting rod in parallel with the cylinder bore.

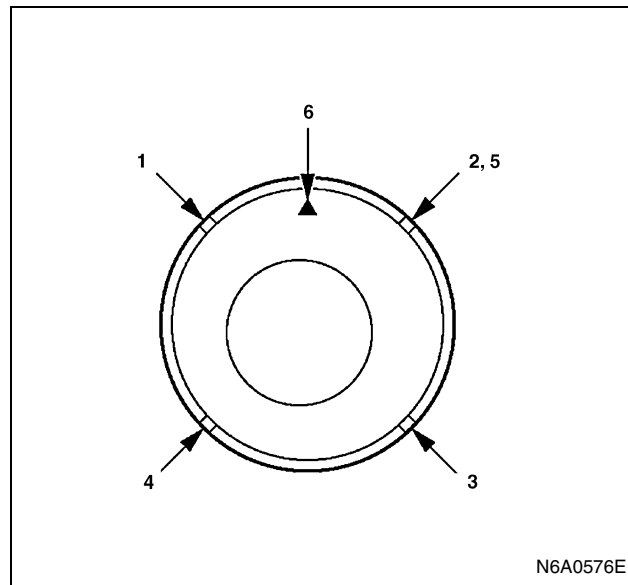
Installation

1. Piston and Connecting Rod Assembly

Notice:

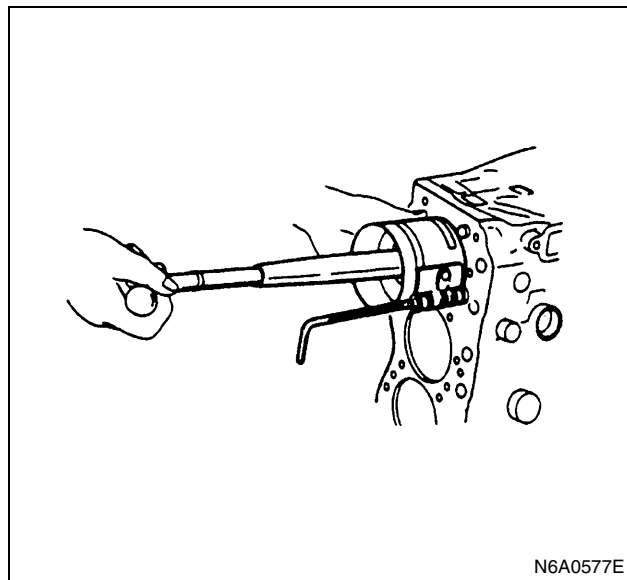
When installing new connecting rod and/or connecting rod bearings, refer to the selection table. Above works refer to "CRANKSHAFT" section 6A in this manual.

- 1) Apply a coat of engine oil to the circumference of each piston ring and piston.
- 2) Position the piston ring gaps as shown in the illustration.


Legend

1. 1st compression ring
2. 2nd compression ring
3. 3rd compression ring (4HE1-TC only)
4. Oil ring
5. Coil expander
6. Front mark

- 3) Apply a coat of molybdenum disulfide grease to the two piston skirts.
This will facilitate smooth break-in when the engine is first started after reassembly.
- 4) Apply a coat of engine oil to the upper bearing surfaces.
- 5) Apply a coat of engine oil to the cylinder wall.
- 6) Position the piston head front mark so that it is facing the front of the engine.
- 7) Use the piston ring compressor to compress the piston rings.
Piston Ring Compressor: 5-8840-9018-0



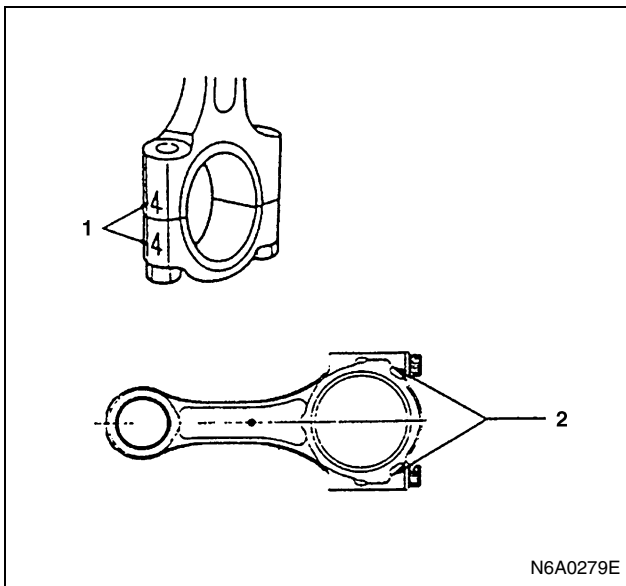
- 8) Use a hammer grip to push the piston in until the connecting rod makes contact with the crankpin.
At the same time, rotate the crankshaft until the crankpin is at bottom dead center.

Caution:

Do not bend or damage the oiling jet.

2. Connecting Rod Cap

- 1) Install the connecting rod bearing caps.
- 2) Align the bearing cap cylinder number marks and the connecting rod cylinder number marks.
- 3) Apply a coat of molybdenum disulfide grease to the threads and setting faces of each connecting rod cap bolts.

**Legend**

1. Alignment
2. Boss discriminating the front from rear

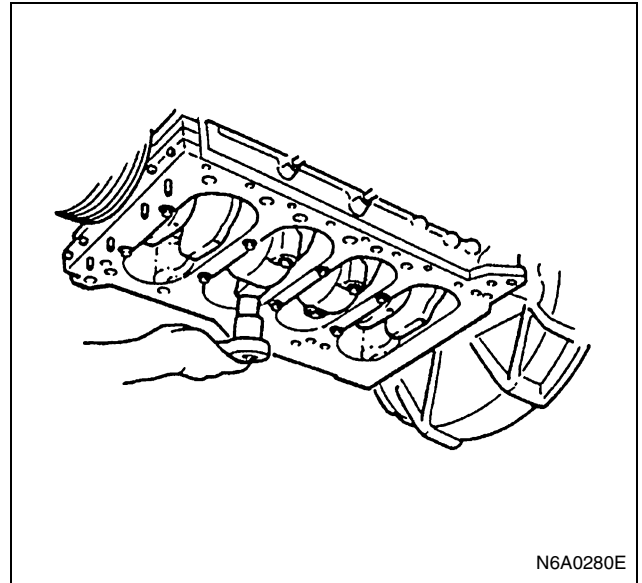
- 4) Tighten the connecting rod caps to the specified torque.

Tighten:

Connecting rod bearing cap bolt to

- 1st step: 39 N·m (4.0 kg·m/29 lb·ft)
- 2nd step: 60°
- 3rd step: 30°

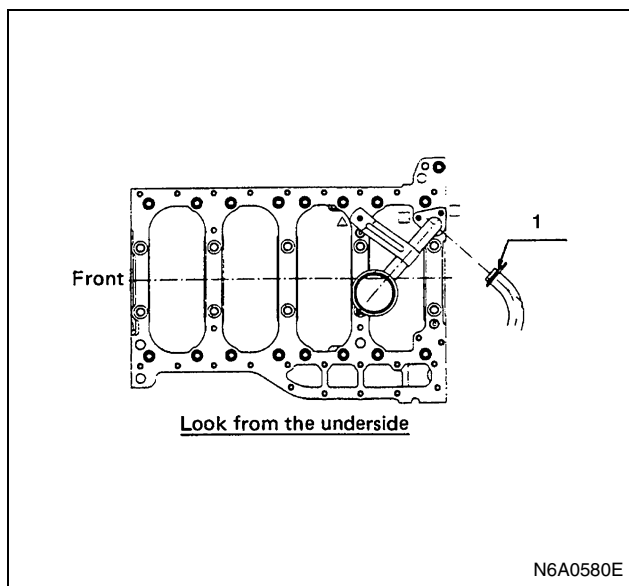
Angle gauge: 5-8840-0266-0



3. Cylinder Head Gasket
Above works refer to "CYLINDER HEAD" section in this manual.
4. Cylinder Head Assembly
Above works refer to "CYLINDER HEAD" section in this manual.
5. Camshaft Bearing Lower
6. Camshaft Assembly
7. Camshaft Bearing Upper
8. Camshaft Bearing Cap
9. Valve Cap
Above works refer to "CAMSHAFT ASSEMBLY" section in this manual.
10. Rocker Arm Shaft Assembly
Above works refer to "ROCKER ARM SHAFT ASSEMBLY" section in this manual.
11. Cylinder Head Cover Gasket
Above works refer to "CYLINDER HEAD" section in this manual.
12. Cylinder Head Cover
Above works refer to "CYLINDER HEAD COVER" section in this manual.
13. Oil Pump Strainer
Install the O-ring (1) to the oil pump strainer pipe and install the oil pump strainer to the cylinder body shown in the illustration.

Tighten:

Oil pump strainer bolt to 24 N·m (2.4 kg·m/17 lb·ft)



14. Oil Pan

15. Spacer Rubber

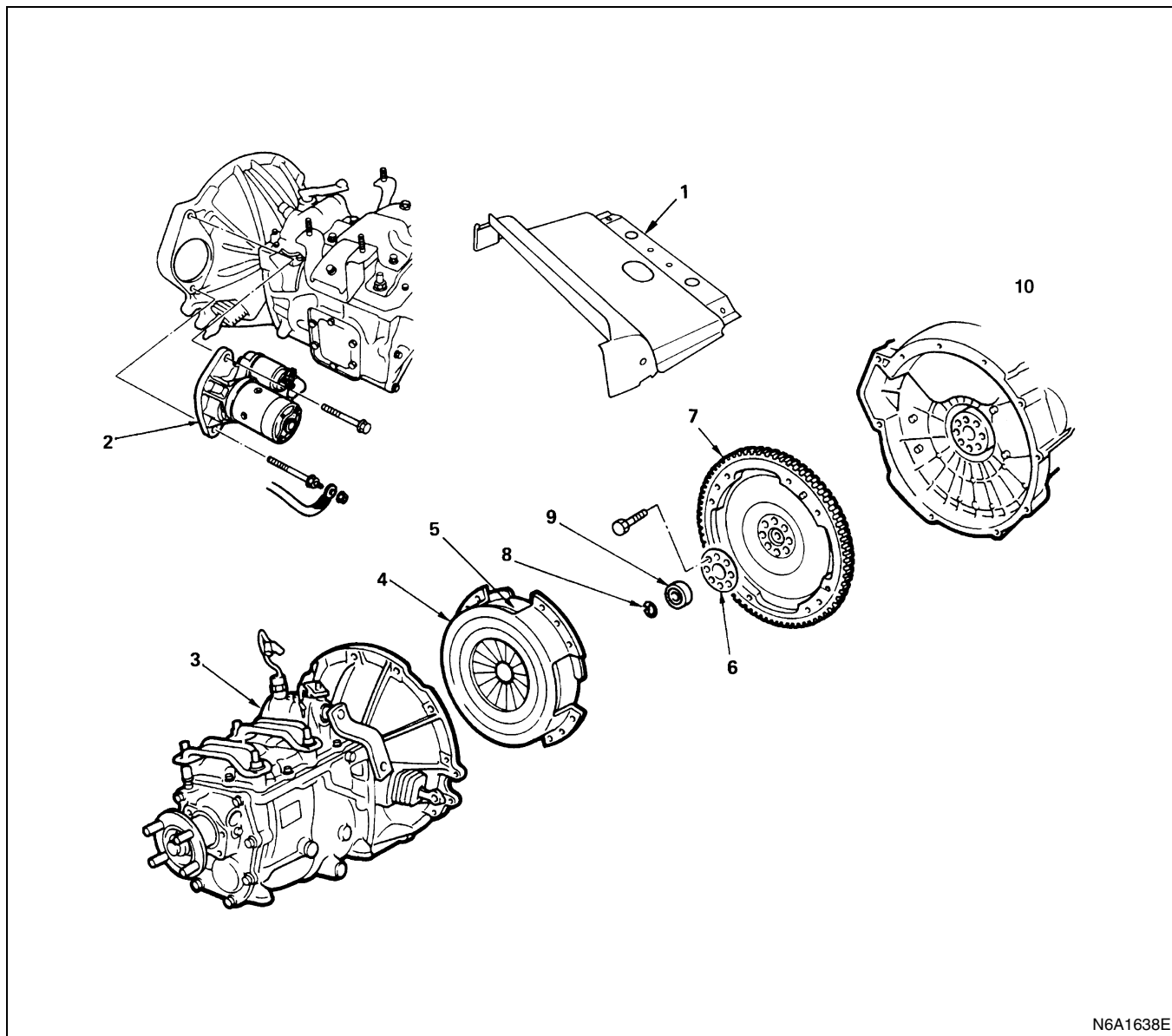
Above works refer to "OIL PAN" section in this manual.

16. Nozzle Cover

- Pour engine oil and coolant into the engine
- Connect battery ground cable
- Start the engine and check for coolant and oil leakage

FLYWHEEL AND PILOT BEARING

Component



N6A1638E

Legend

- | | |
|-----------------------------------|----------------------|
| 1. Transmission panel | 6. Washer |
| 2. Starter | 7. Flywheel assembly |
| 3. Transmission assembly | 8. Snap ring |
| 4. Clutch pressure plate assembly | 9. Pilot bearing |
| 5. Driven plate | 10. Engine side |

Removal

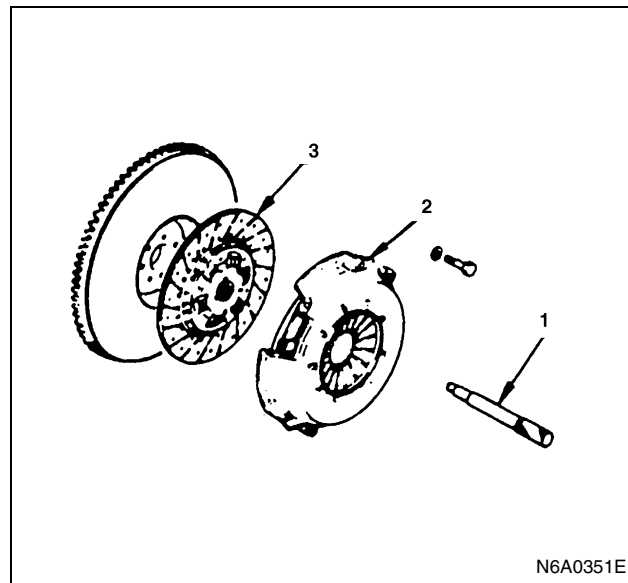
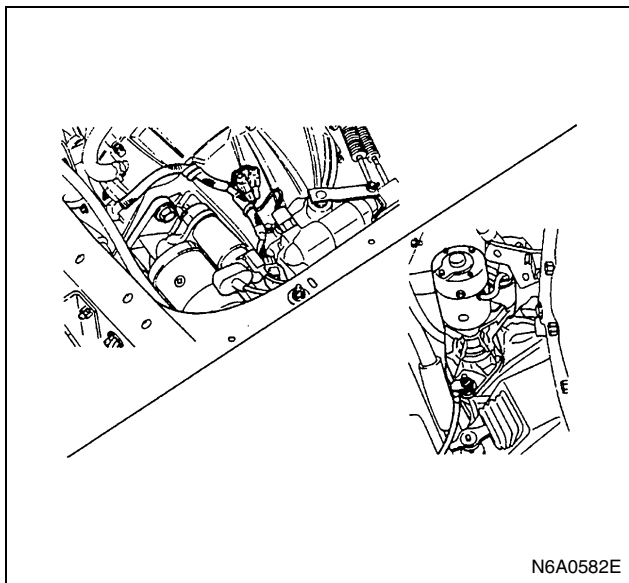
Preparation

- Disconnect battery ground cable.

1. Transmission Panel
2. Starter

- 1) Disconnect the battery cable at the starter motor.

- 2) Remove the starter assembly from flywheel housing.

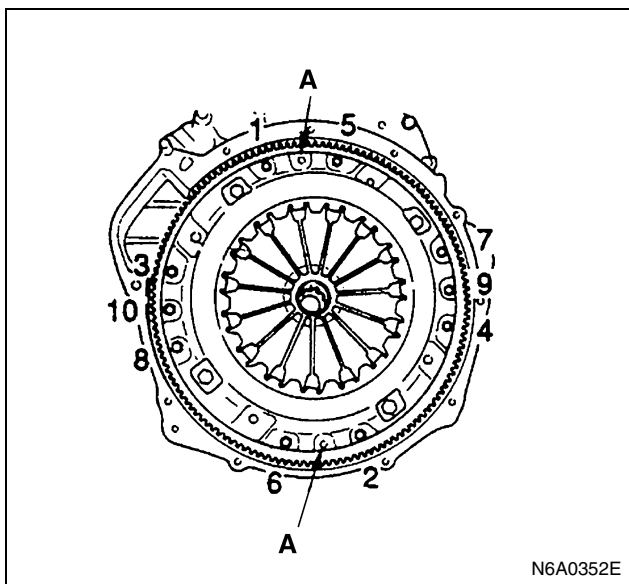


3. Transmission Assembly
Above works refer to "ENGINE ASSEMBLY" section in this manual.
4. Clutch Pressure Plate Assembly
 - 1) Insert the clutch pilot aligner to the clutch assembly.
Clutch Pilot Aligner: 5-8840-2240-0
 - 2) Loosen the pressure plate bolts in numerical order a little at a time as shown in the illustration.

Legend

1. Clutch pilot aligner
2. Clutch pressure plate assembly
3. Driven plate

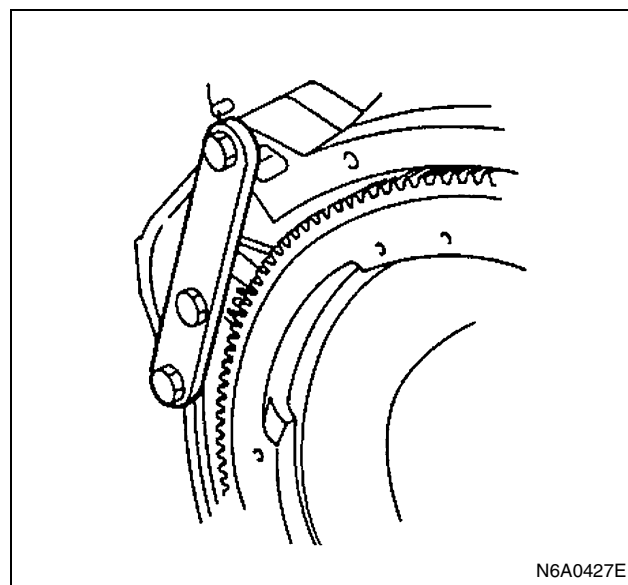
6. Washer
7. Flywheel Assembly
 - 1) Use the crankshaft stopper to prevent the crankshaft from turning.
Crankshaft Stopper: 5-8840-2230-0



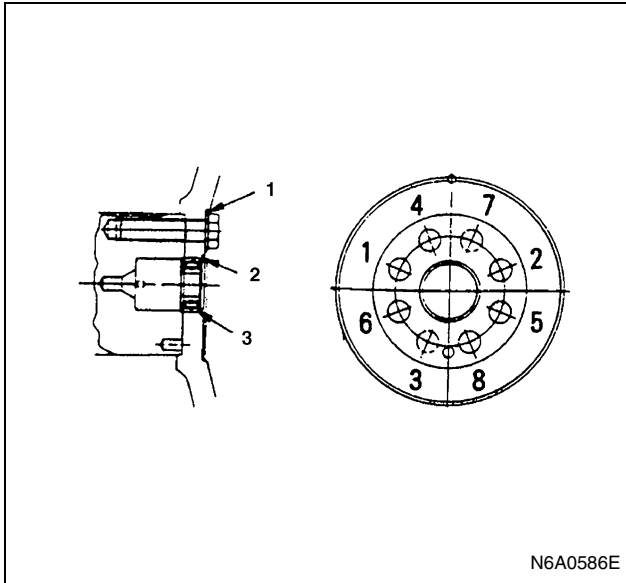
Legend

- A. Knock pin

- 3) Remove the pressure plate assembly.
5. Driven Plate
Remove the driven plate with the clutch pilot aligner.



- 2) Loosen the flywheel bolts in numerical order a little at a time as shown in the illustration.



Legend

1. Washer
2. Snap ring
3. Pilot bearing

3) Remove the flywheel stopper and the flywheel assembly.

8. Snap Ring
Use a snap ring pliers to remove the snap ring from the flywheel.
9. Pilot Bearing

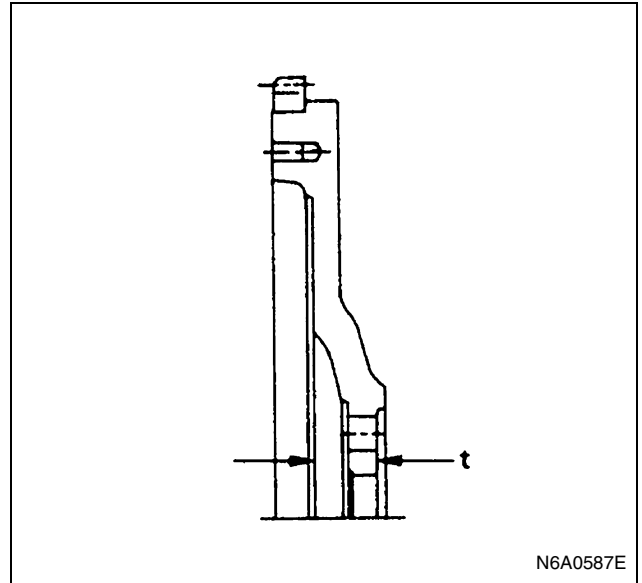
Inspection and Repair

Flywheel

1. Inspect the flywheel friction surface for excessive wear and heat cracks.
2. Measure the flywheel thickness (t) between the flywheel friction surface and crankshaft setting face.
If the measured value is between the standard and the specified limit, the flywheel may be reground.
If the measured value exceeds the specified limit, the flywheel must be replaced.

Flywheel Thickness (t)		mm (in)
Engine model	Standard	Limit
Others	31.4 — 31.6 (1.236 — 1.244)	31.0 (1.220)
4HG1-TC	37.4 — 37.6 (1.472 — 1.480)	37.0 (1.457)

Flywheel Friction Surface Roughness	mm (in)
Less than 0.006 (0.00024)	



Ring Gear

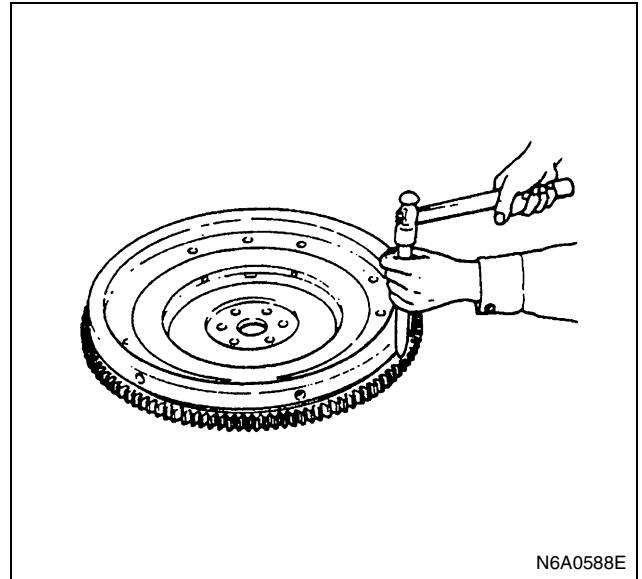
Inspect the ring gear

If the ring gear teeth are broken or excessively worn, the ring gear must be replaced.

Ring Gear Replacement

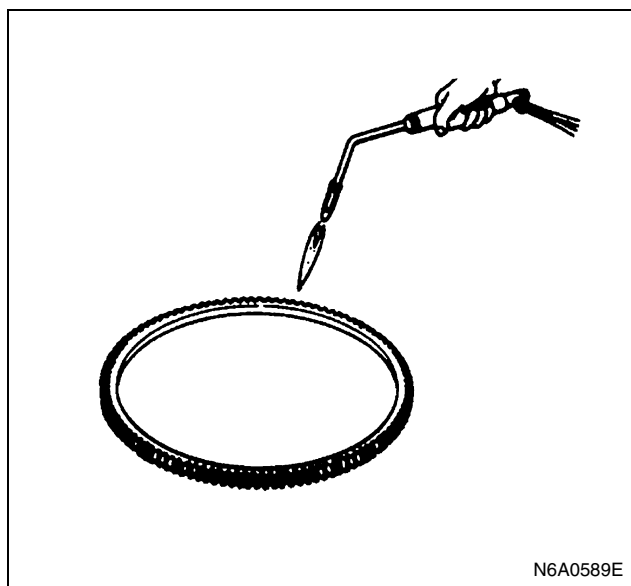
REMOVAL

Strike around the edges of the ring gear with a hammer and chisel to remove it.



INSTALLATION

1. Heat the ring gear evenly with a gas burner to invite thermal expansion.



2. Install the ring gear when it is sufficiently heated.
The ring gear must be installed with the chamfer facing the clutch.

Pilot Bearing

Check the pilot bearing for wear or damage and replace with a new one if any abnormal condition is noticeable.

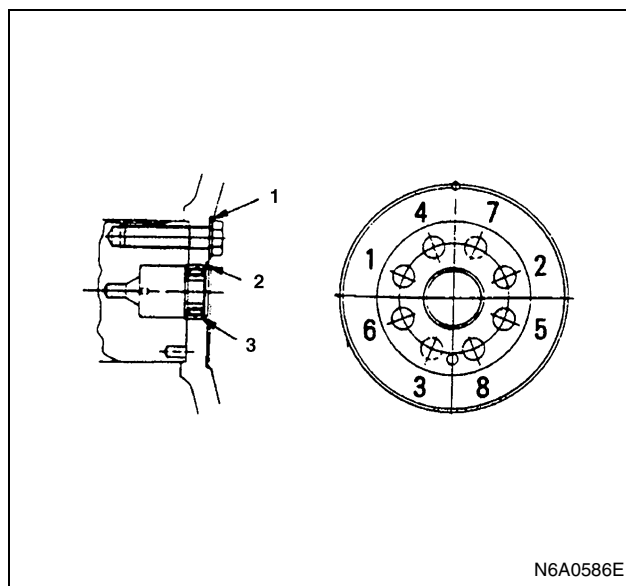
Installation

1. Pilot Bearing
2. Snap Ring
3. Flywheel Assembly
4. Washer
 - 1) Align the flywheel with the crankshaft knock pin and temporarily tighten the flywheel bolts.
 - 2) Use the crankshaft stopper to prevent the crankshaft from turning.
Crankshaft stopper: 5-8840-2230-0
 - 3) Install the washer and the flywheel bolts and tighten to the specified torque in numerical order show in the illustration.

Tighten:

Flywheel bolt to

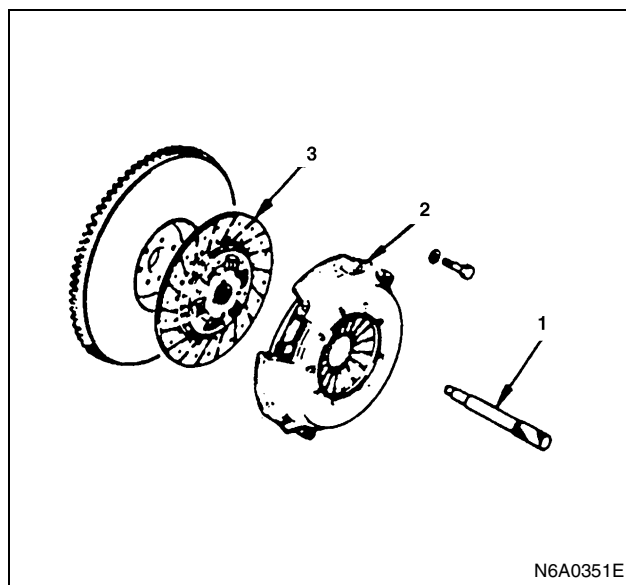
- 1st step: 78 N·m (8.0 kg·m/58 lb·ft)
- 2nd step: 90 — 120°



Legend

1. Washer
2. Snap ring
3. Pilot bearing

- 4) Remove the crankshaft stopper.
5. Driven Plate
Use the clutch pilot aligner to install the driven plate.
Clutch Pilot Aligner: 5-8840-2240-0



Legend

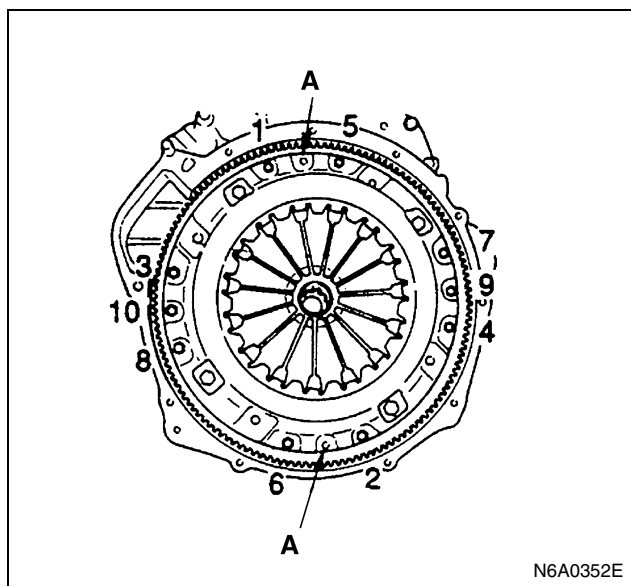
1. Clutch pilot aligner
2. Clutch pressure plate assembly
3. Driven plate

6. Clutch Pressure Plate Assembly
 - 1) Align the clutch pressure plate with the flywheel knock pin.

- 2) Tighten the pressure plate bolts to the specified torque in numerical order.

Tighten:

Clutch pressure plate bolt to 40 N·m (4.1 kg·m/30 lb·ft)

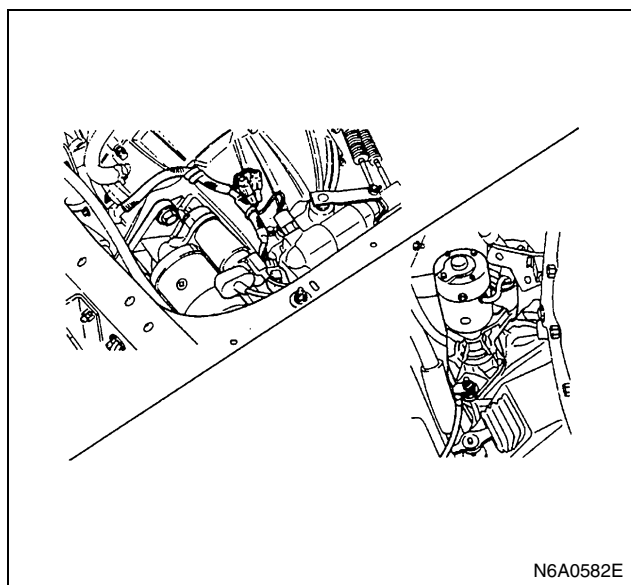
**Legend**

A. Knock pin

7. Transmission Assembly
Above works refer to "ENGINE ASSEMBLY" section in this manual.
8. Starter

Tighten:

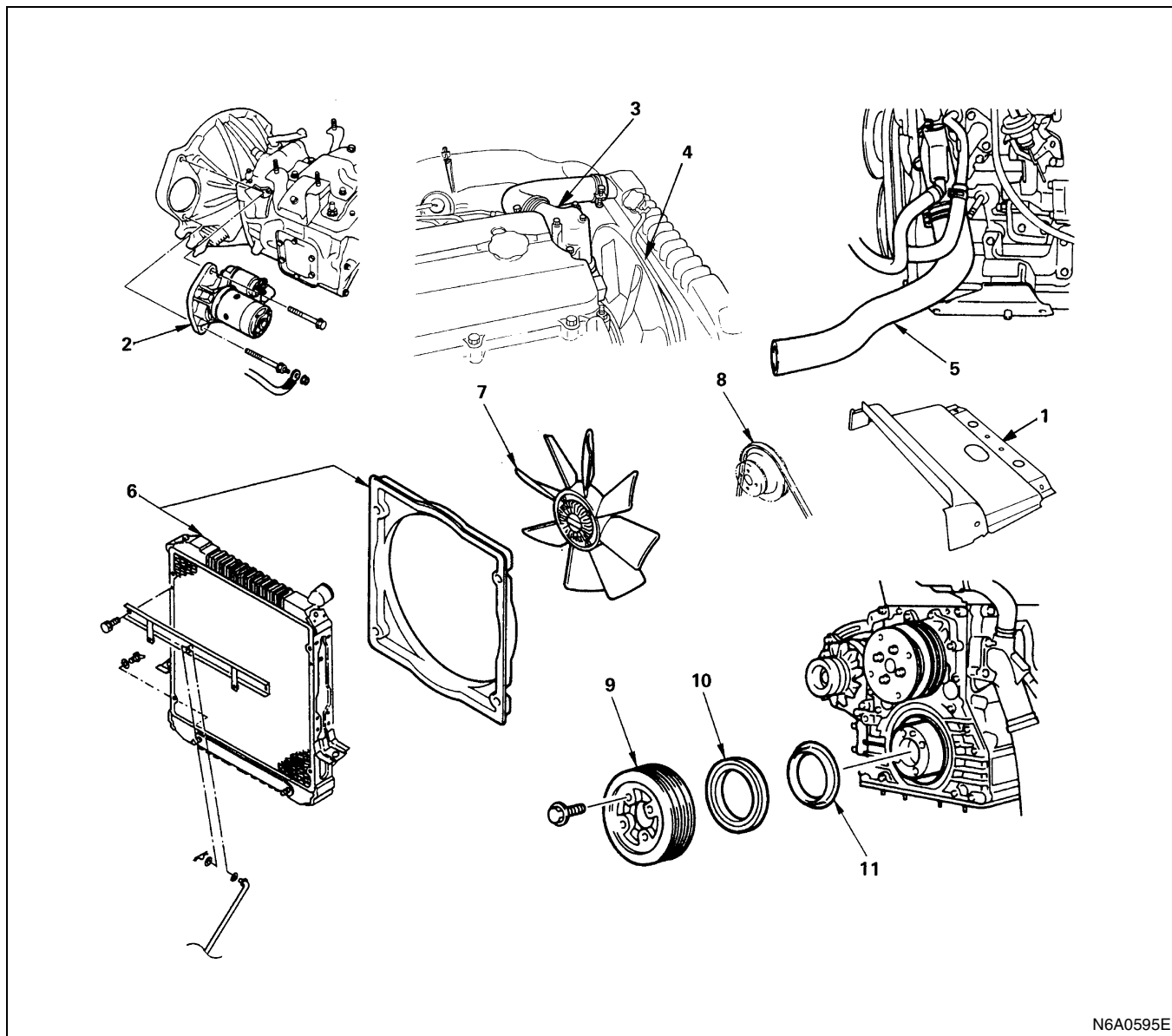
Starter bolt to 76 N·m (7.7 kg·m/56 lb·ft)



9. Transmission Panel
 - Connect the battery ground cable.

CRANKSHAFT FRONT OIL SEAL

Component



N6A0595E

Legend

- | | |
|--|-------------------------------|
| 1. Transmission panel (Australia only) | 7. Fan assembly |
| 2. Starter | 8. Fan belt |
| 3. Radiator upper hose | 9. Crankshaft damper pulley |
| 4. Coolant reserve tank hose/Bypass hose | 10. Crankshaft front oil seal |
| 5. Radiator lower hose | 11. Crankshaft front slinger |
| 6. Radiator (with guide) | |

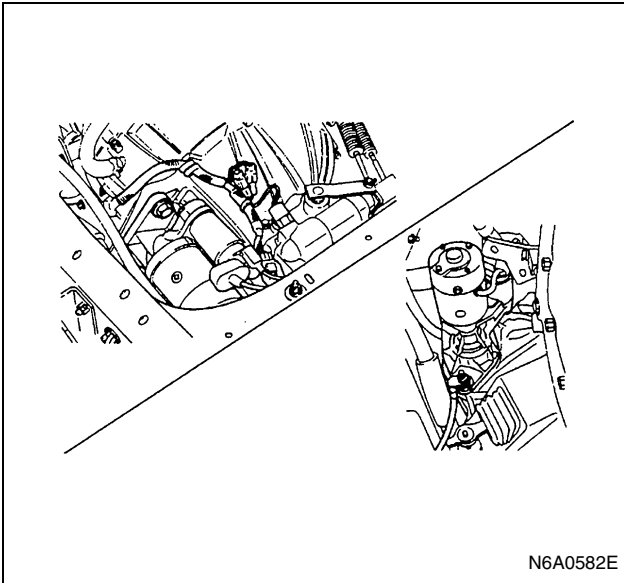
Removal

Preparation

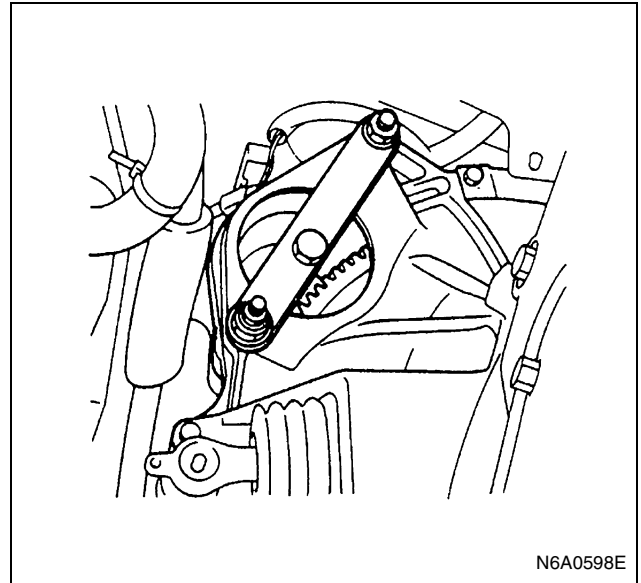
- Disconnect battery ground cable.
- Tilt the cab.
- Drain coolant

1. Transmission Panel
2. Starter

- Disconnect the battery cable at the starter motor.
- Remove the starter assembly from flywheel housing.



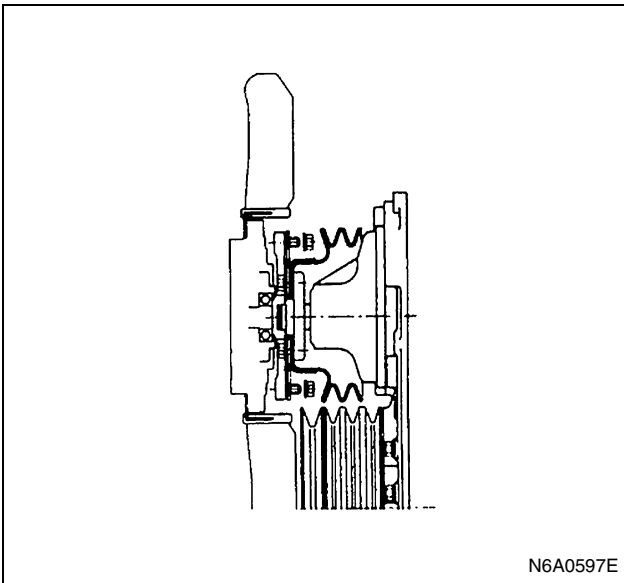
3. Radiator Upper Hose
4. Coolant Reserve Tank Hose/Bypass Hose
5. Radiator Lower Hose
6. Radiator (with Guide)
7. Fan Assembly



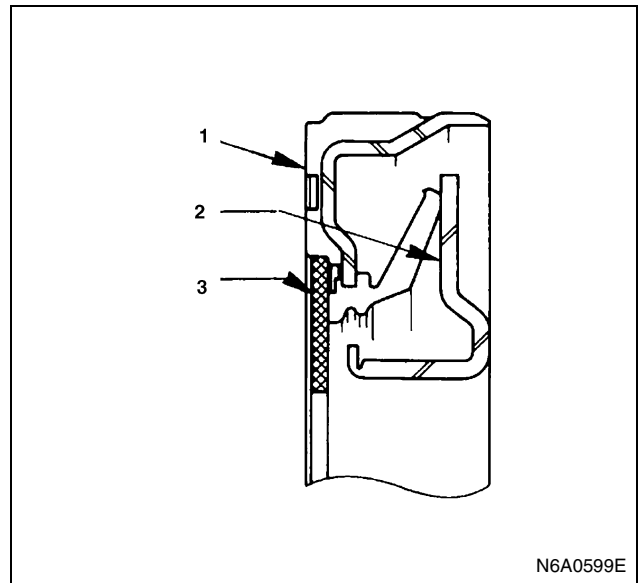
- 2) Loosen the damper pulley bolts and remove the damper pulley.
10. Crankshaft Front Oil Seal

Caution:

Be careful not to damage the crankshaft oil seal contact surface during the removal procedure.



8. Fan Belt
 9. Crankshaft Damper Pulley
 - 1) Use the crankshaft stopper to prevent the crankshaft from turning.
- Crankshaft Stopper: 5-8840-2230-0



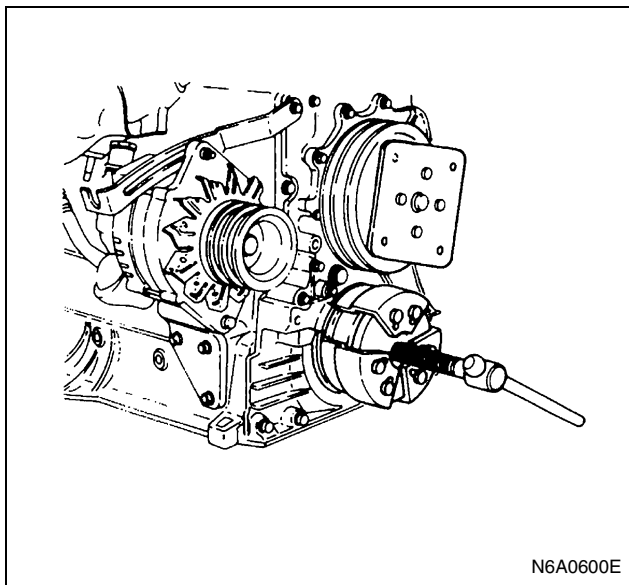
Legend

1. Oil seal
2. Slinger
3. Felt

11. Crankshaft Front Slinger

Use the slinger puller to pull out the slinger.

Slinger Puller: 5-8840-2360-0



Installation

1. Crankshaft Front Slinger

Press in the slinger using the oil seal setting tool kit.

Oil Seal Setting Tool Kit: 5-8840-2431-0

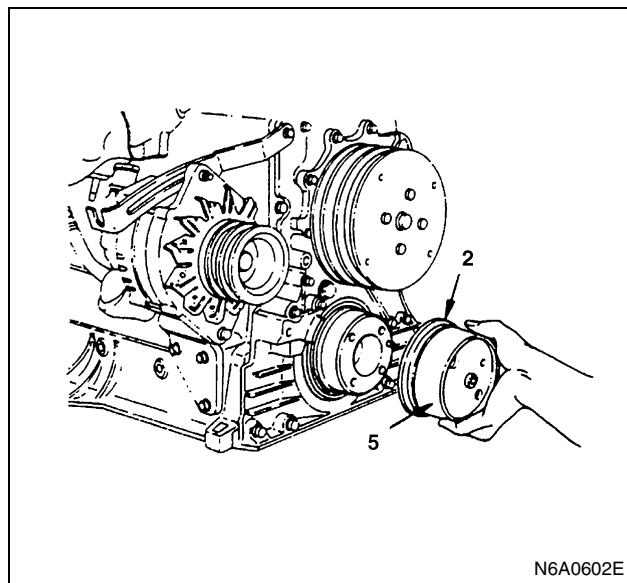
Front slinger and oil seal setting tools

Part Name	Stamp	Slinger	Oil Seal
Adapter	FT	○	○
Sleeve	FT	○	○
Oil seal adapter ring	FT		○
Center bolt	—	○	○
Adapter bolt	—	○	○

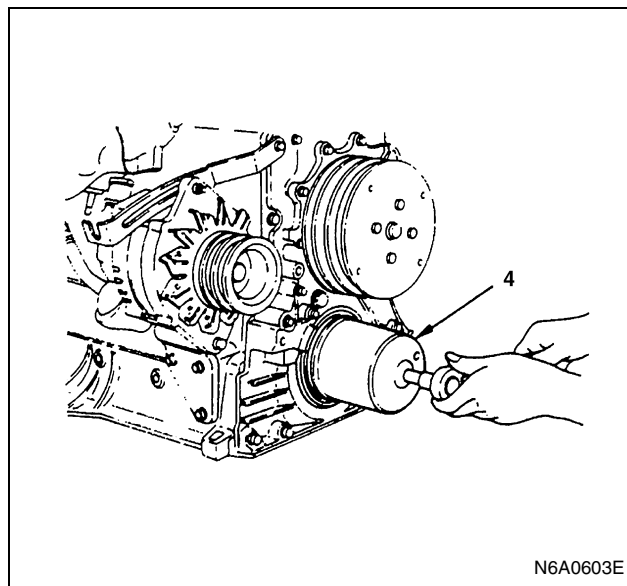
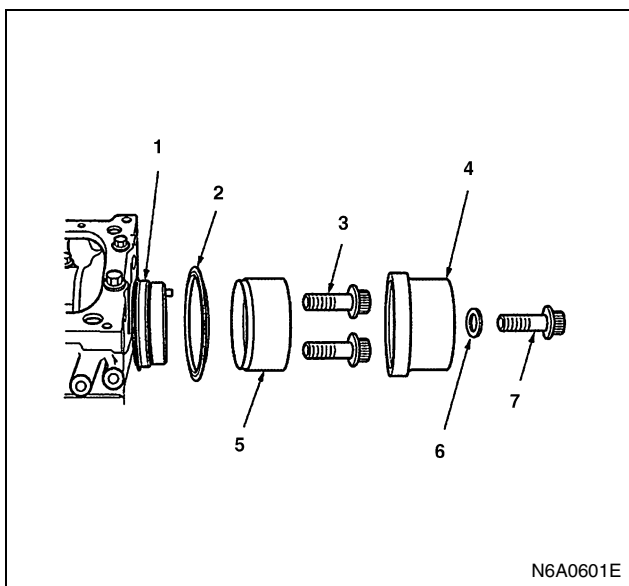
Legend

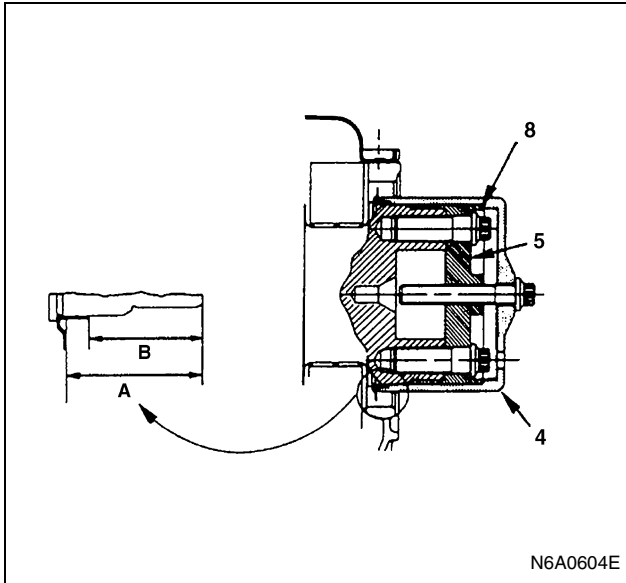
1. Crankshaft
2. Slinger
3. Adapter bolt
4. Sleeve
5. Adapter
6. Washer (5 mm (0.20 in))
7. Center bolt

- 1) Insert the slinger (2) into the end of adapter (5) and install the adapter on the crankshaft.



- 2) Cover the sleeve (4) and tighten the bolt until the sleeve comes to contact the adapter stopper (8).





- 3) With the slinger pressed in, make sure of measurements specified in the illustration as well as of slinger deflection.

(A): 40.5 ± 0.3 mm (1.594 ± 0.012 in)

(B): 34.0 ± 0.1 mm (1.339 ± 0.004 in)

Notice:

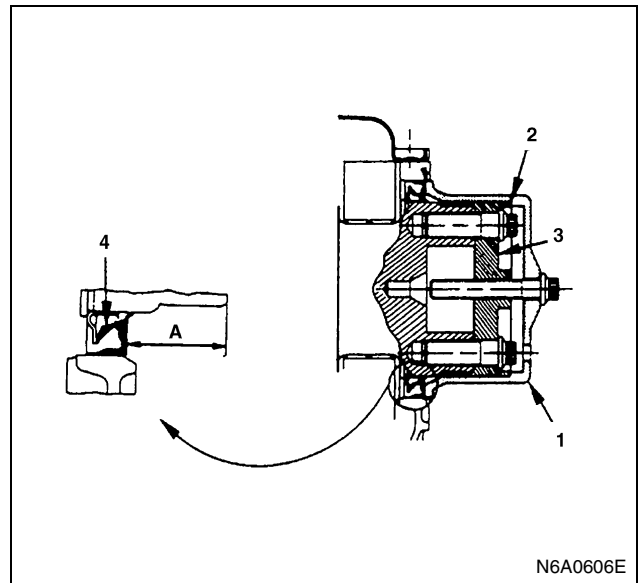
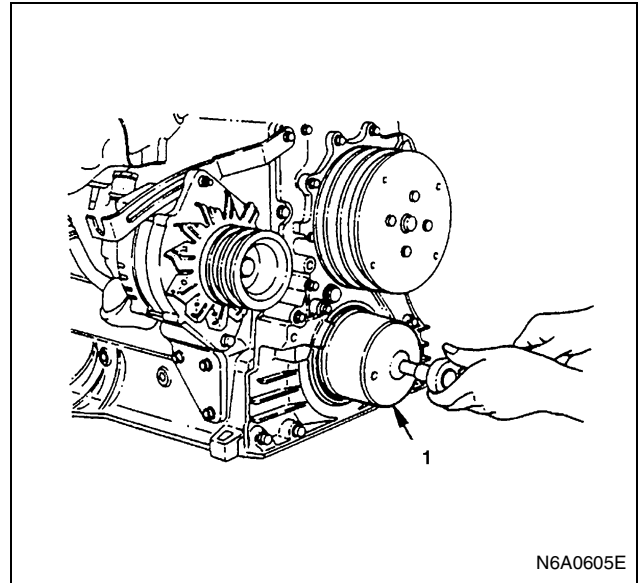
Be sure to replace the slinger and oil seal as a set.
Use about 5 mm (0.20 in) thickness plain washer on the center bolt.

2. Crankshaft Front Oil Seal

- 1) Apply engine oil to the lip of the oil seal.
 - 2) Press in the oil seal using the front oil seal setting tool kit.
 - Remove the slinger sleeve and insert the oil seal (4) into the adapter (3).
 - Install the oil seal sleeve (1) to the adapter (3) and tighten the center bolt until the sleeve comes to contact the adapter stopper (2).
 - With the oil seal pressed in, make sure of the measurements specified in the illustration.
- (A): 31 ± 0.3 mm (1.220 ± 0.012 in)

Notice:

Be sure to replace the slinger and oil seal as a set.
Use about 5 mm (0.20 in) thickness plain washer on the center bolt.

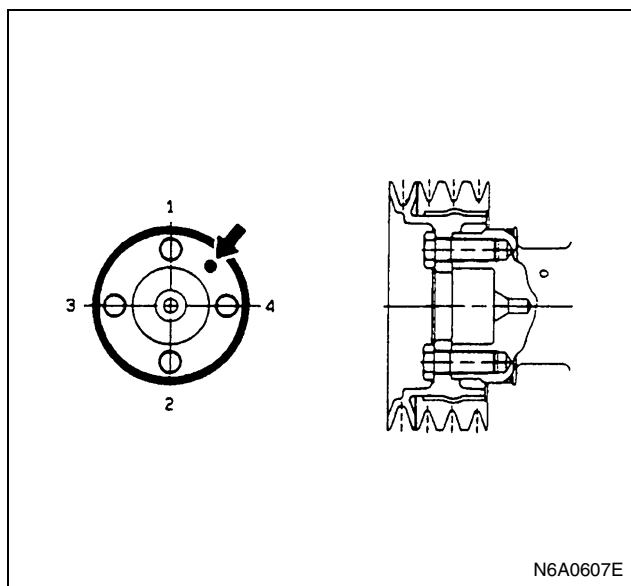


3. Crankshaft Damper Pulley

- 1) Apply a coat of engine oil to the threads of the bolts.
- 2) Align the damper pulley with the crankshaft knock pin and tighten the bolts to the specified torque in numerical order.

Tighten:

Damper pulley bolt to 200 N·m (20.4 kg·m/147 lb·ft)



N6A0607E

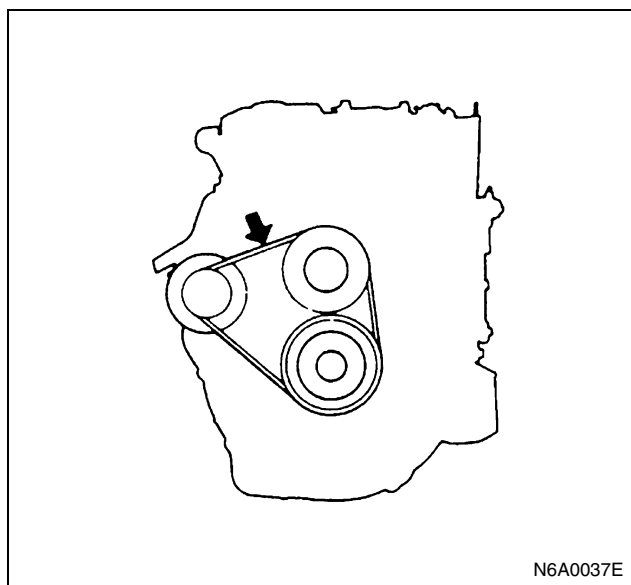
4. Fan Belt

Check the drive belt tension.

Depress the drive belt mid-portion with a 98 N (10 kg/22 lb) force.

Drive Belt Deflection	mm (in)
8 — 12 (0.31 — 0.47) ... New belt	
10 — 14 (0.39 — 0.55) ... Reuse belt	

Check the drive belt for cranking and other damage.



N6A0037E

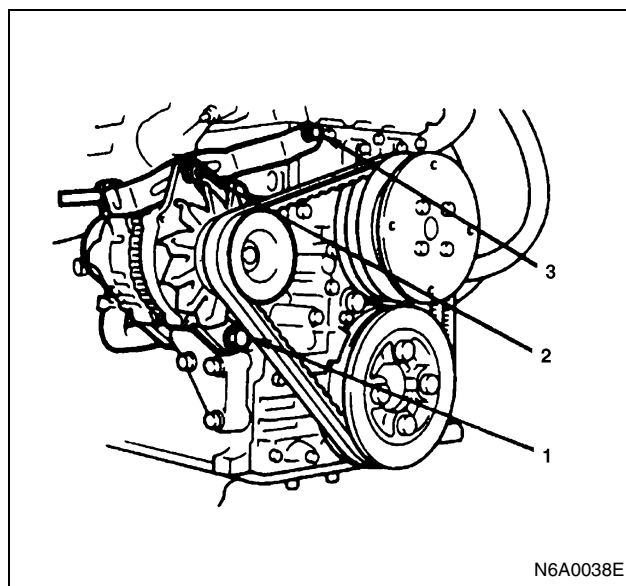
Fan Belt Adjustment

Fan belt tension is adjusted by moving the generator.

Tighten:

Belt to

- (1): 40 N·m (4.1 kg·m/30 lb·ft)
- (2): 24 N·m (2.4 kg·m/17 lb·ft)
- (3): 46 N·m (4.7 kg·m/34 lb·ft)

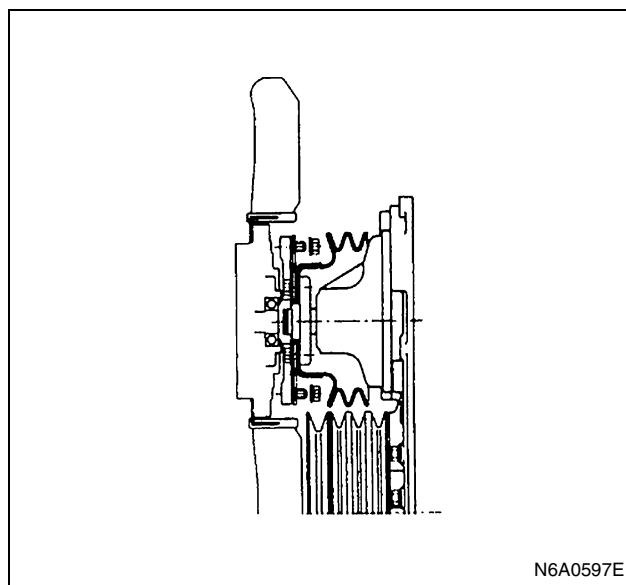


N6A0038E

5. Fan Assembly

Tighten:

Fan bolt to 24 N·m (2.4 kg·m/17 lb·ft)

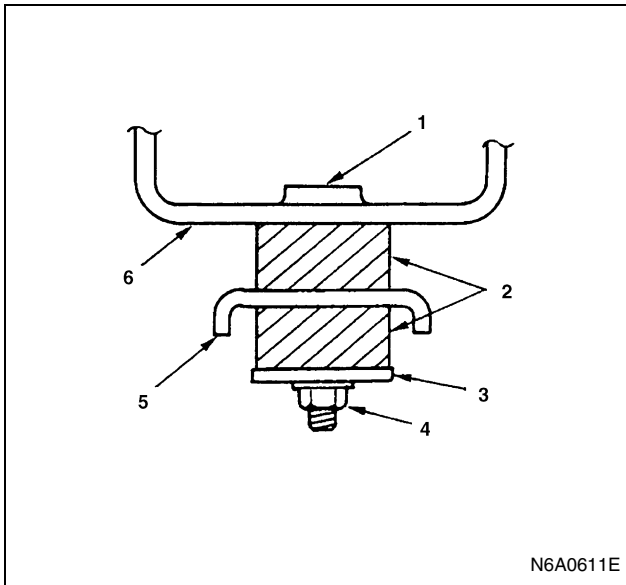


N6A0597E

6. Radiator (with Guide)

Tighten:

Radiator bolt to 55 N·m (5.6 kg·m/41 lb·ft)

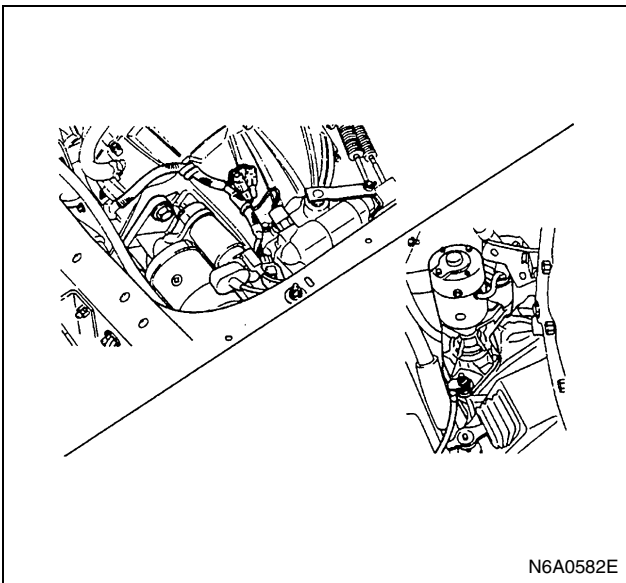
**Legend**

1. Stud bolt
2. Rubber
3. Washer
4. Flange nut
5. Flame side bracket
6. Radiator side bracket

7. Radiator Lower Hose
8. Coolant reserve Tank Hose/Bypass Hose
9. Radiator Upper Hose
10. Starter

Tighten:

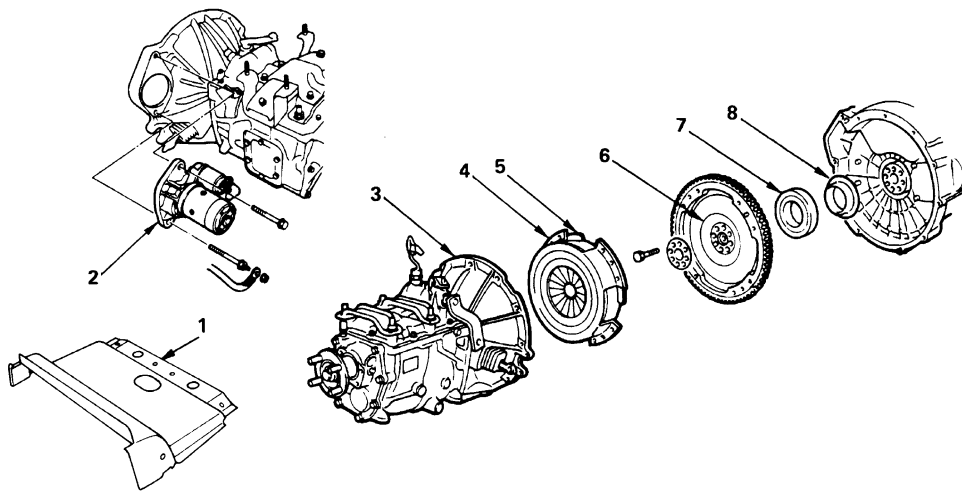
Starter bolt to 76 N·m (7.7 kg·m/56 lb·ft)



11. Transmission Panel
 - Connect battery ground cable.
 - Pour engine coolant into engine.

CRANKSHAFT REAR OIL SEAL

Component



N6A1639E

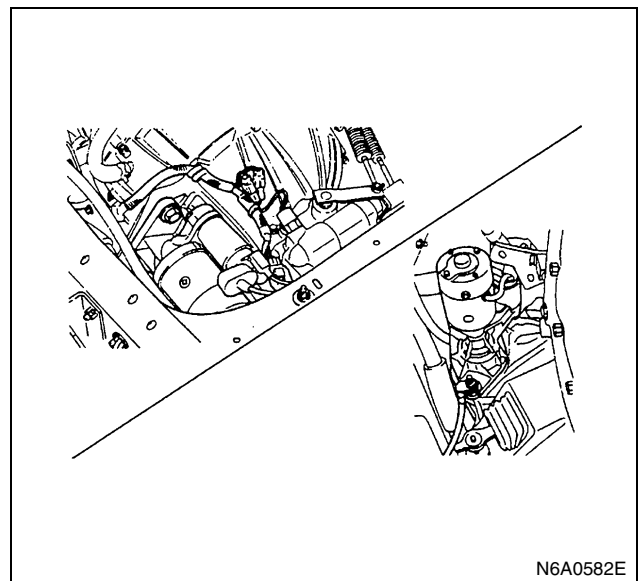
Legend

- | | |
|-----------------------------------|-----------------------------|
| 1. Transmission panel | 5. Driven plate |
| 2. Starter | 6. Flywheel assembly |
| 3. Transmission assembly | 7. Crankshaft rear oil seal |
| 4. Clutch pressure plate assembly | 8. Crankshaft rear slinger |

Removal

Preparation

- Disconnect battery ground cable.
1. Transmission Panel
 2. Starter
 - 1) Disconnect the battery cable at the starter motor.
 - 2) Remove the starter assembly from flywheel housing.



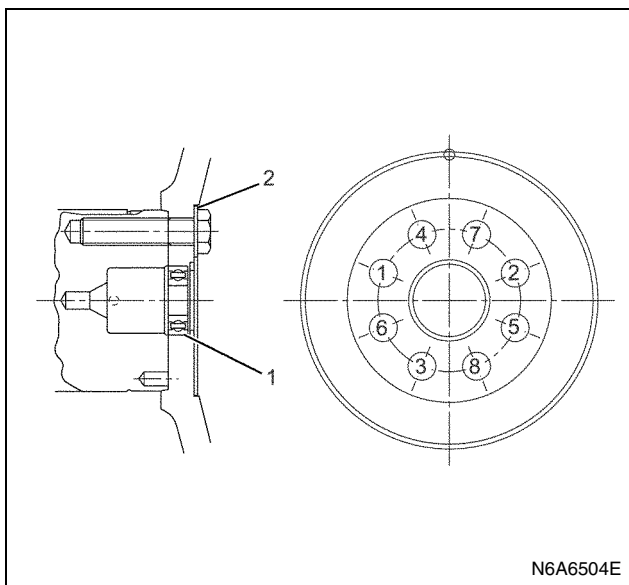
N6A0582E

3. Transmission Assembly

Above works refer to "ENGINE ASSEMBLY" section in this manual.

4. Clutch Pressure Plate Assembly
5. Driven Plate
6. Flywheel Assembly

Above works refer to "FLYWHEEL AND PILOT BEARING" section in this manual.



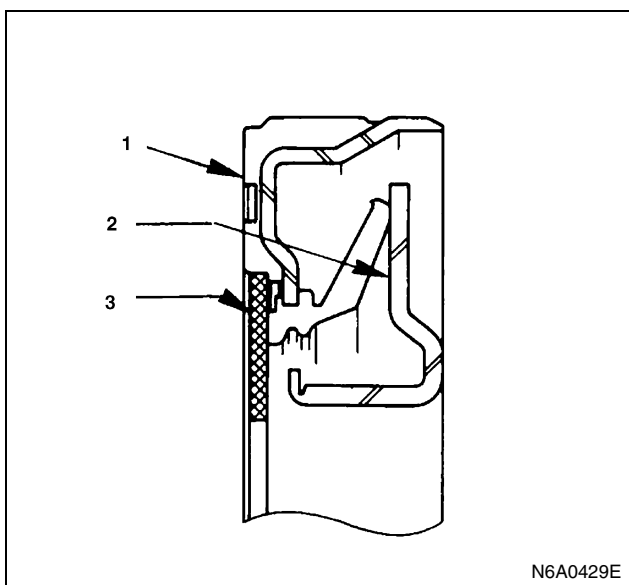
Legend

1. Washer
2. Pilot bearing

7. Crankshaft Rear Oil Seal

Caution:

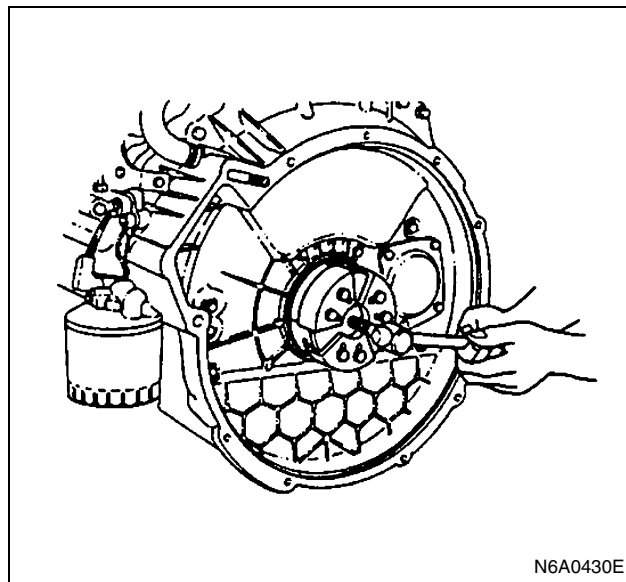
Be careful not to damage the crankshaft oil seal contact surface during the removal procedure.



Legend

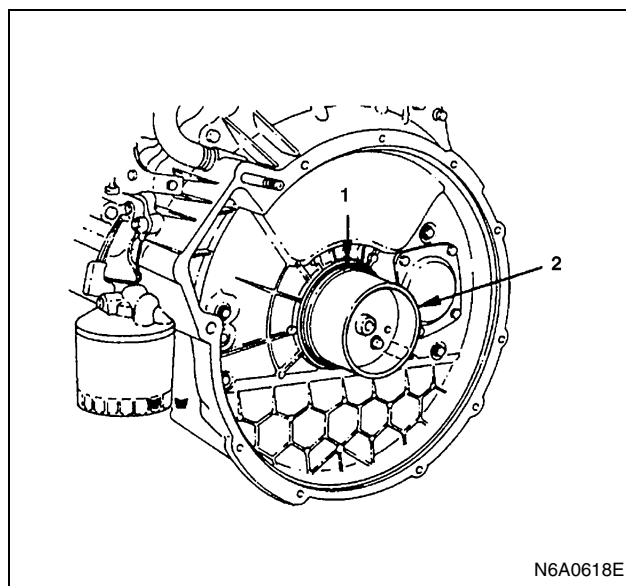
1. Oil seal
2. Slinger
3. Felt

8. Crankshaft Rear Slinger
Use the slinger puller to pull out the slinger.
Slinger Puller: 5-8840-2360-0

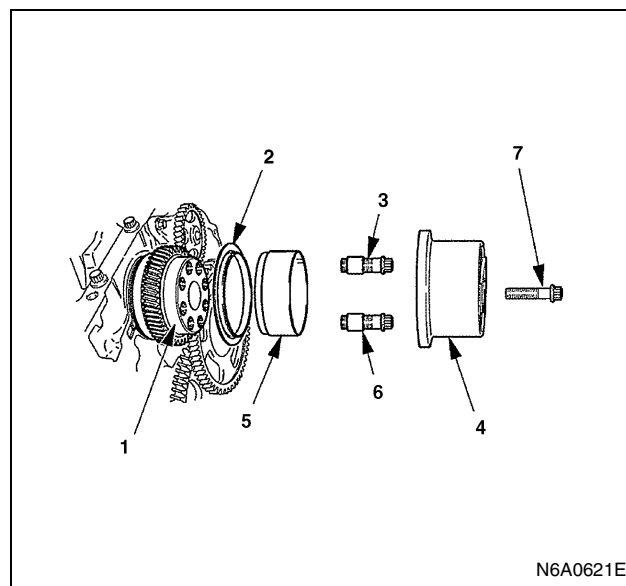
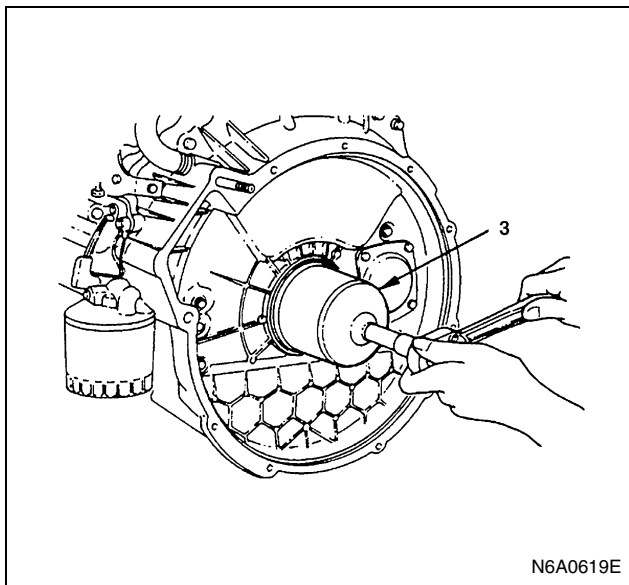


Installation

1. Crankshaft Rear Slinger
Press in the slinger using oil seal setting tool kit.
 - Insert the slinger (1) into the end of adapter (2) and install the adapter on the crankshaft.

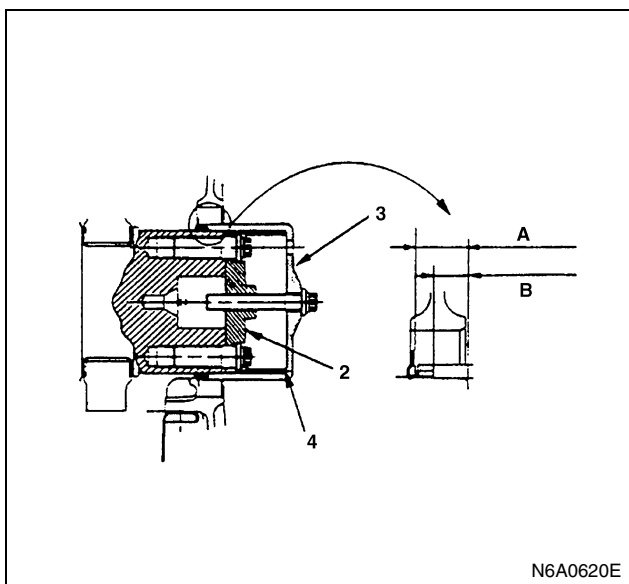


- Cover the sleeve (3) and tighten the bolt until the sleeve comes to contact the adapter stopper (4).



Legend

1. Crankshaft
2. Slinger
3. Adapter bolt
4. Sleeve
5. Adapter
6. Collar
7. Center bolt



- Make sure of measurements specified in the illustration as well as of slinger deflection.
(A): 17.3 ± 0.3 mm (0.681 ± 0.012 in)
(B): 10.8 ± 0.1 mm (0.425 ± 0.004 in)

Notice:

Be sure to replace the slinger and oil seal as a set.

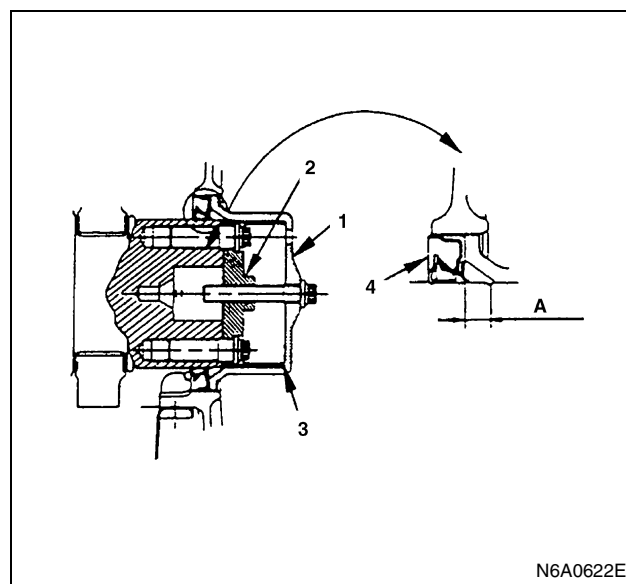
Oil Seal Setting Tool Kit: 5-8840-2431-0

Rear slinger and oil seal setting tools

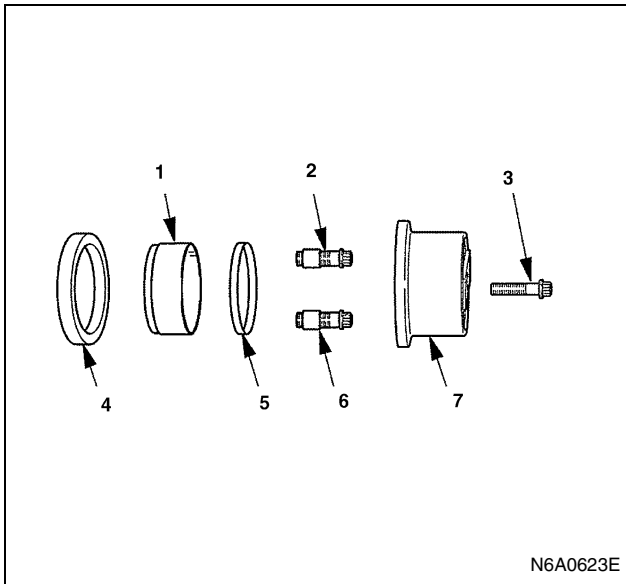
Part Name	Stamp	Slinger	Oil Seal
Adapter	RR	○	○
Sleeve	RR	○	○
Oil seal adapter ring	RR		○
Center bolt	—	○	○
Adapter bolt	—	○	○
Adapter bolt collar	RR	○	○

2. Crankshaft Rear Oil Seal

- 1) Apply engine oil to the lip of the oil seal.
- 2) Press in the oil seal using rear oil seal setting tool kit.
 - Remove the slinger sleeve and insert the oil seal (4) into the adapter (2).
 - Install the adapter ring into the sleeve.
 - Install the oil seal sleeve (1) to the adapter (2) and tighten the center bolt until the sleeve comes to contact the adapter stopper (3).



- Make sure of the measurements specified in the illustration.
(A): 7.8 ± 0.3 mm (0.307 ± 0.012 in)



Legend

1. Adapter
2. Adapter bolt
3. Center bolt
4. Oil seal
5. Ring
6. Collar
7. Sleeve

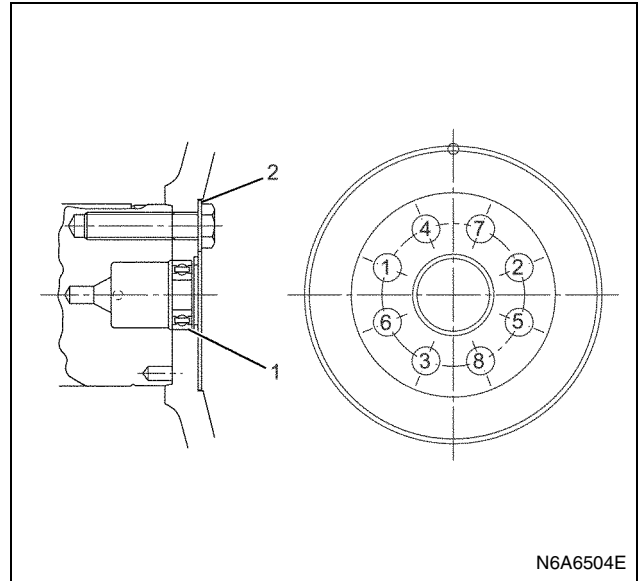
3. Flywheel Assembly

- 1) Apply a coat of molybdenum disulfide grease to the flywheel bolt threads and setting faces.
- 2) Align the flywheel with the crankshaft knock pin and temporarily tighten the flywheel bolts.
- 3) Use the crankshaft stopper to prevent the crankshaft from turning.
Crankshaft Stopper: 5-8840-2230-0
- 4) Install the washer and the flywheel bolts and tighten to the specified torque in numerical order show in the illustration.

Tighten:

Flywheel bolt to

- 1st step: 78 N·m (8.0 kg·m/58 lb·ft)
- 2nd step: 90 — 120°



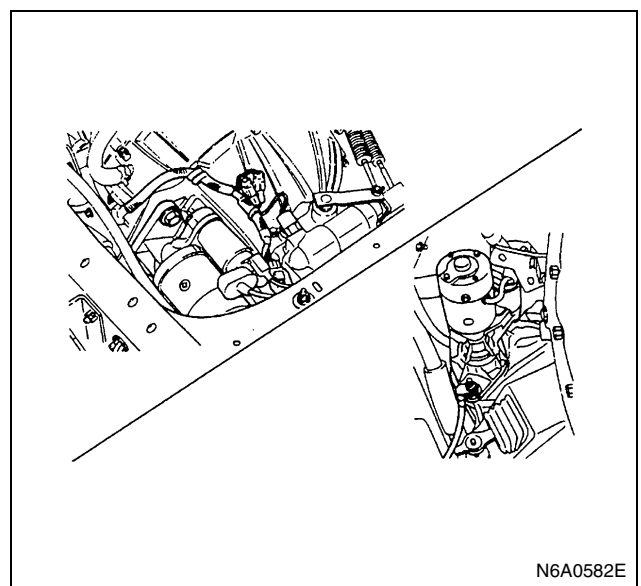
Legend

1. Washer
2. Pilot bearing

- 5) Remove the crankshaft stopper.
4. Driven Plate
5. Clutch Pressure Plate Assembly
Above works refer to "FLYWHEEL AND PILOT BEARING" section in this manual.
6. Transmission Assembly
Above works refer to "ENGINE ASSEMBLY" section in this manual.
7. Starter

Tighten:

Starter bolt to 76 N·m (7.7 kg·m/56 lb·ft)

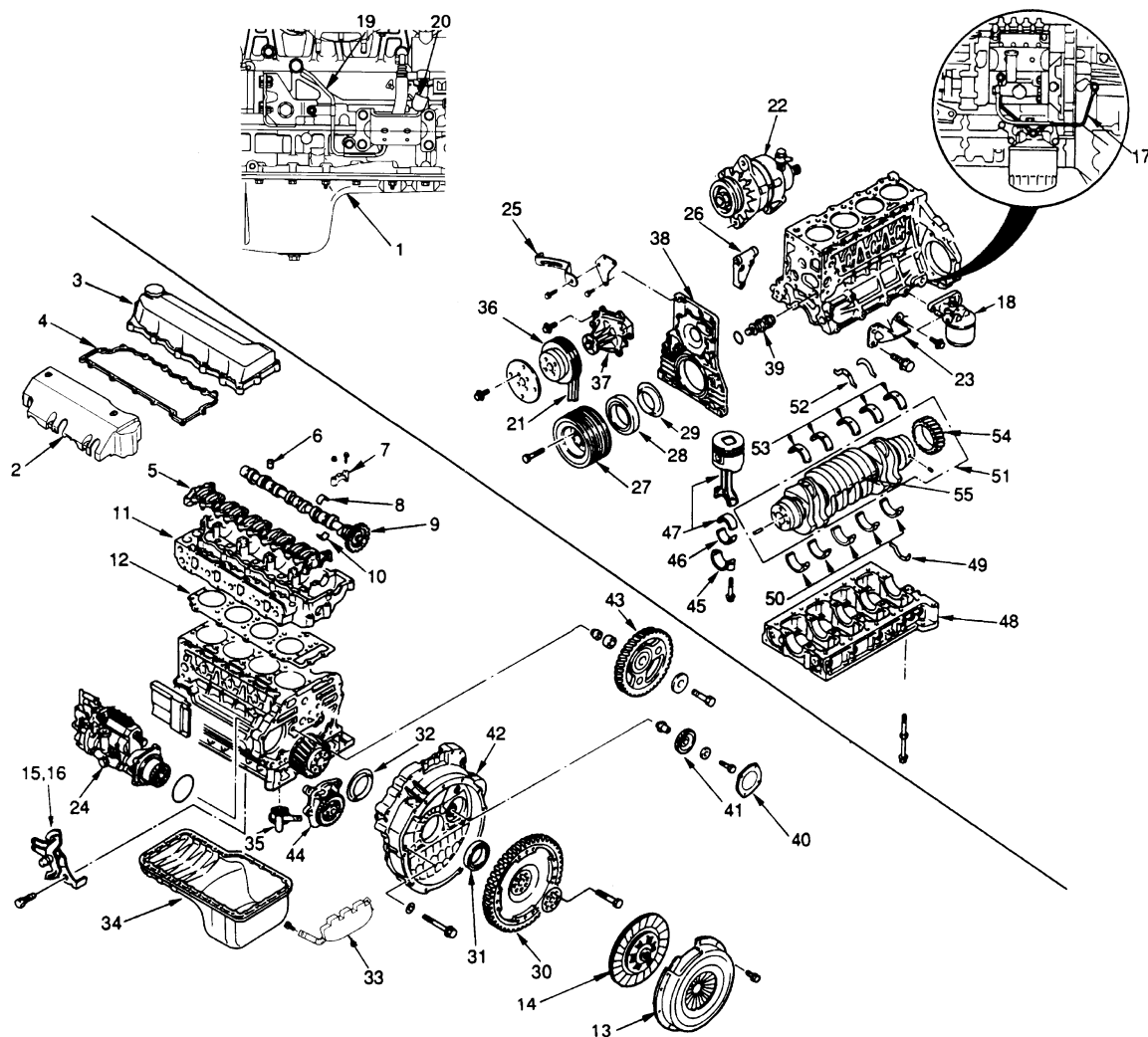


8. Transmission Panel

- Connect the battery ground cable.

CRANKSHAFT

Component



Legend

- | | |
|------------------------------------|---|
| 1. Engine cover | 29. Crankshaft front slinger |
| 2. Nozzle cover | 30. Flywheel |
| 3. Cylinder head cover | 31. Crankshaft rear oil seal |
| 4. Cylinder head cover gasket | 32. Crankshaft rear slinger |
| 5. Rocker arm shaft assembly | 33. Spacer rubber |
| 6. Valve cap | 34. Oil pan |
| 7. Camshaft bearing cap | 35. Oil pump strainer |
| 8. Camshaft bearing upper | 36. Water pump pulley |
| 9. Camshaft assembly | 37. Water pump |
| 10. Camshaft bearing lower | 38. Front retainer |
| 11. Cylinder head assembly | 39. Oil thermo valve |
| 12. Cylinder head gasket | 40. Power steering pump idle gear cover |
| 13. Clutch pressure plate assembly | 41. Power steering pump idle gear |
| 14. Driven plate | 42. Flywheel housing |
| 15. Engine control wire | 43. Idle gear A |
| 16. Engine control lever assembly | 44. Oil pump assembly |
| 17. Oil pipe | 45. Connecting rod cap assembly |
| 18. Oil filter assembly | 46. Connecting rod lower bearing |
| 19. Vacuum pump oil pipe | 47. Piston and connecting rod assembly |
| 20. Vacuum pump rubber hose | 48. Crankcase |
| 21. Fan belt | 49. Thrust bearing lower |
| 22. Generator | 50. Crankshaft bearing lower |
| 23. Engine foot | 51. Crankshaft assembly |
| 24. Injection pump assembly | 52. Thrust bearing upper |
| 25. Fan belt adjust plate | 53. Crankshaft bearing upper |
| 26. Generator bracket | 54. Crankshaft gear |
| 27. Crankshaft pulley | 55. Crankshaft |
| 28. Crankshaft front oil seal | |

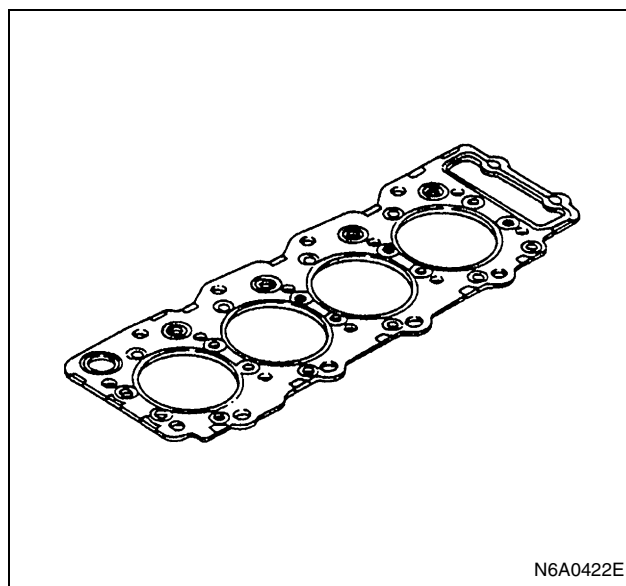
Removal**Preparation**

- Disconnect battery ground cable.
 - Tilt the cab
 - Drain coolant and engine oil
1. Engine Assembly
Above works refer to "ENGINE ASSEMBLY" section in this manual.
 2. Nozzle Cover
 3. Cylinder Head Cover
 4. Cylinder Head Cover Gasket
 5. Rocker Arm Shaft Assembly
Above works refer to "ROCKER ARM SHAFT ASSEMBLY" section in this manual.
 6. Valve Cap
 7. Camshaft Bearing Cap
 8. Camshaft Bearing Upper
 9. Camshaft Assembly
 10. Camshaft Bearing Lower
Above works refer to "CAMSHAFT ASSEMBLY" section in this manual.
 11. Cylinder Head Assembly
Above works refer to "CYLINDER HEAD" section in this manual.

12. Cylinder Head Gasket

Caution:

Do not reuse the cylinder head gasket.



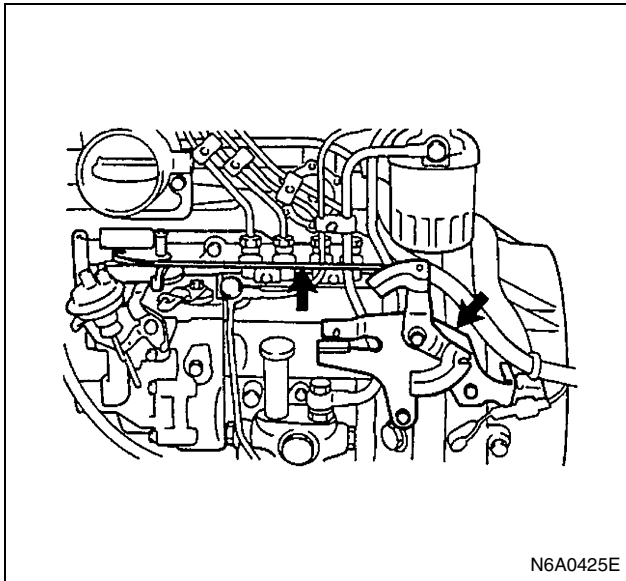
N6A0422E

13. Clutch Pressure Plate Assembly
14. Driven Plate

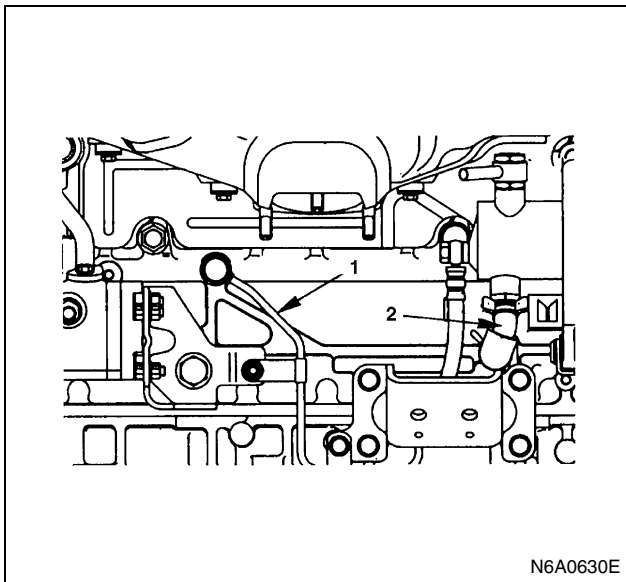
6A3-110 ENGINE (4HF1 / 4HF1-2 / 4HE1-TC / 4HG1 / 4HG1-T)

Above works refer to "FLYWHEEL AND PILOT BEARING" section in this manual.

15. Engine Control Wire
16. Engine Control Lever Assembly



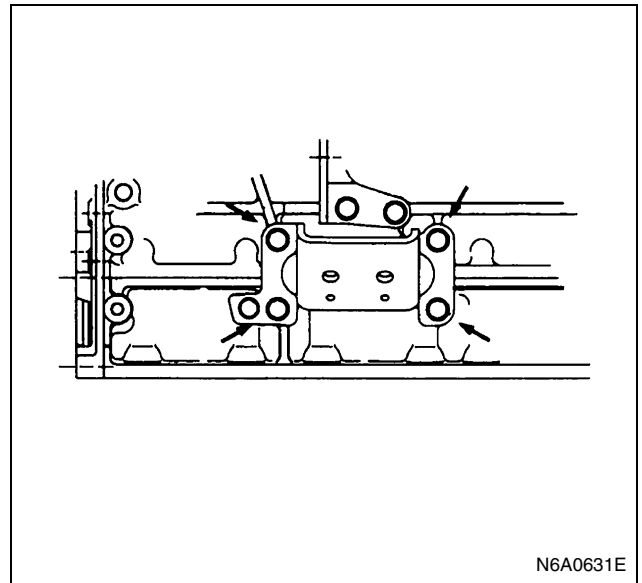
17. Oil Pipe
18. Oil Filter Assembly
19. Vacuum Pump Oil Pipe
20. Vacuum Pump Rubber Hose



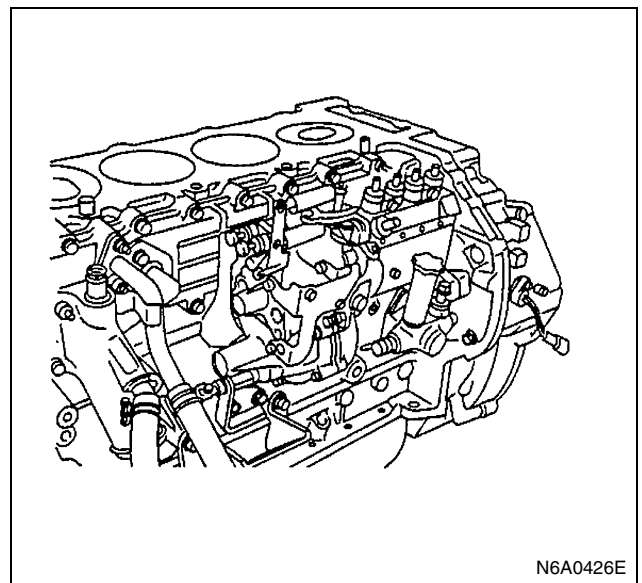
Legend

1. Vacuum pump oil pipe
2. Vacuum pump rubber hose

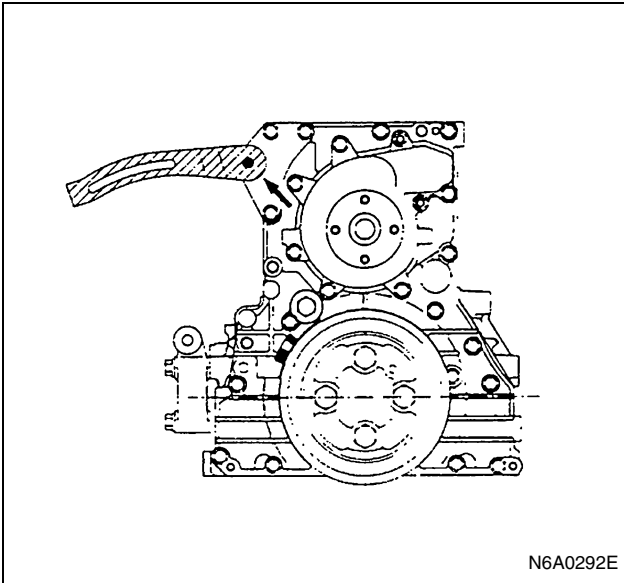
21. Fan Belt
22. Generator
23. Engine Foot



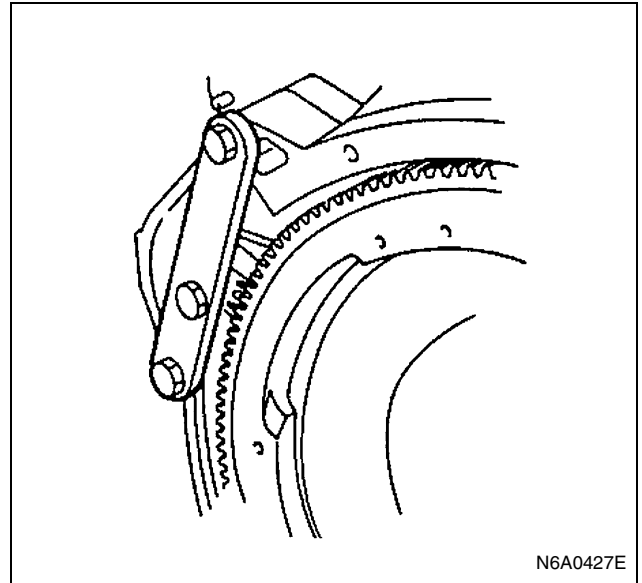
24. Injection Pump Assembly
 - 1) Remove the injection pump bracket bolts and the injection pump rear bracket bolts.
 - 2) Then remove the injection pump assembly.



25. Fan Belt Adjust Plate



26. Generator Bracket



- 2) Loosen the damper pulley bolts and remove the damper pulley.

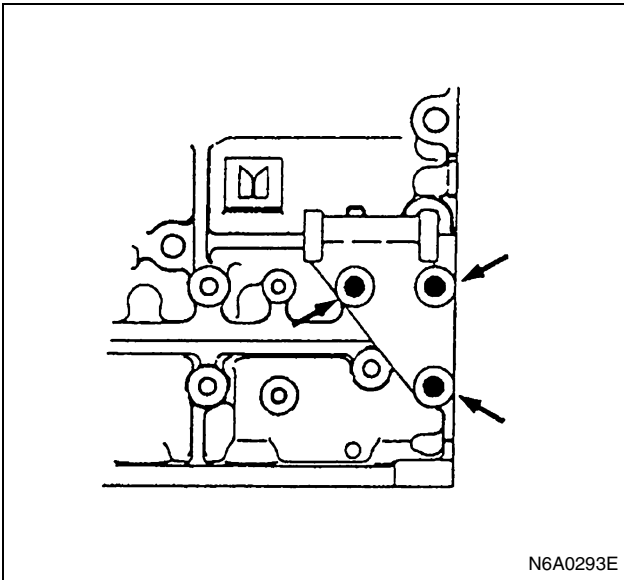
28. Crankshaft Front Oil Seal

29. Crankshaft Front Slinger

Above works refer to "CRANKSHAFT FRONT OIL SEAL" section in this manual.

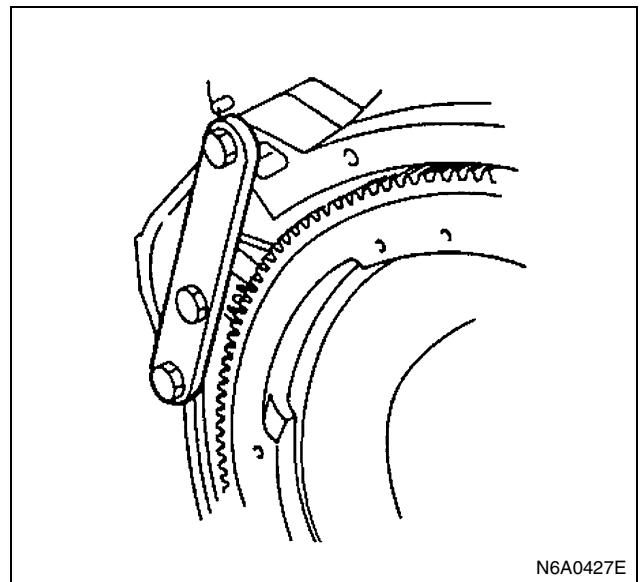
30. Flywheel

- 1) Use the crankshaft stopper to prevent the crankshaft from turning
Crankshaft Stopper: 5-8840-2230-0

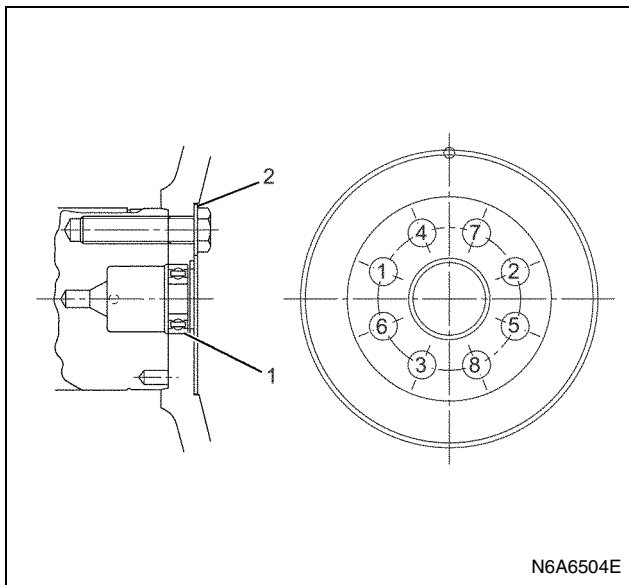


27. Crankshaft Damper Pulley

- 1) Use the crankshaft stopper to prevent the crankshaft from turning.
Crankshaft Stopper: 5-8840-2230-0



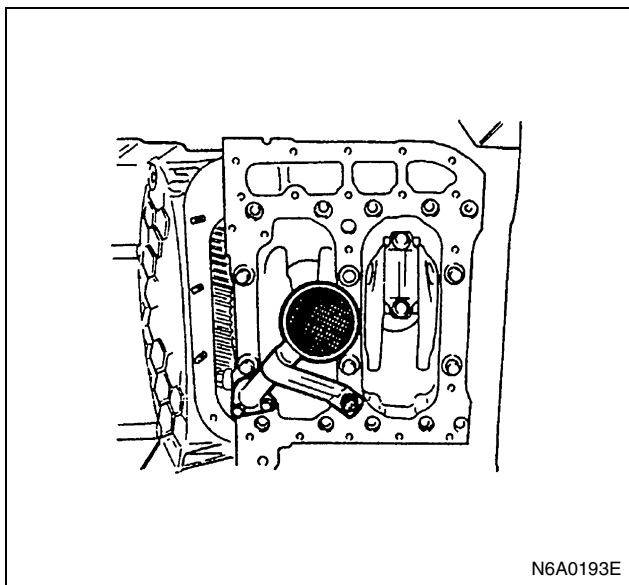
- 2) Loosen the flywheel bolts in numerical order a little at a time as shown in the illustration.
- 3) Remove the flywheel stopper and the flywheel assembly.



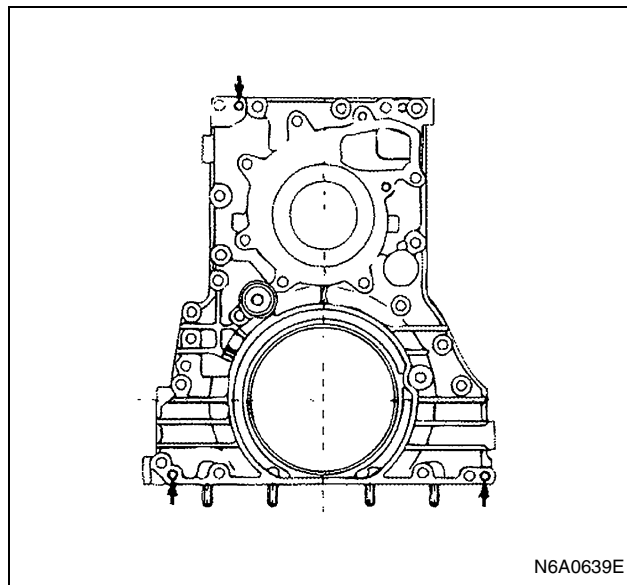
Legend

1. Washer
2. Pilot bearing

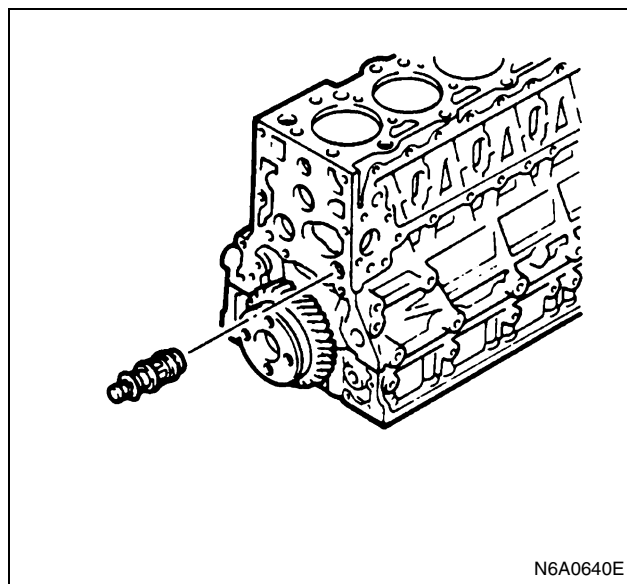
31. Crankshaft Rear Oil Seal
32. Crankshaft Rear Slinger
Above works refer to "CRANKSHAFT REAR OIL SEAL" section in this manual.
33. Spacer Rubber
Remove the stiffener before removing the spacer rubber.
34. Oil Pan
35. Oil Pump Strainer



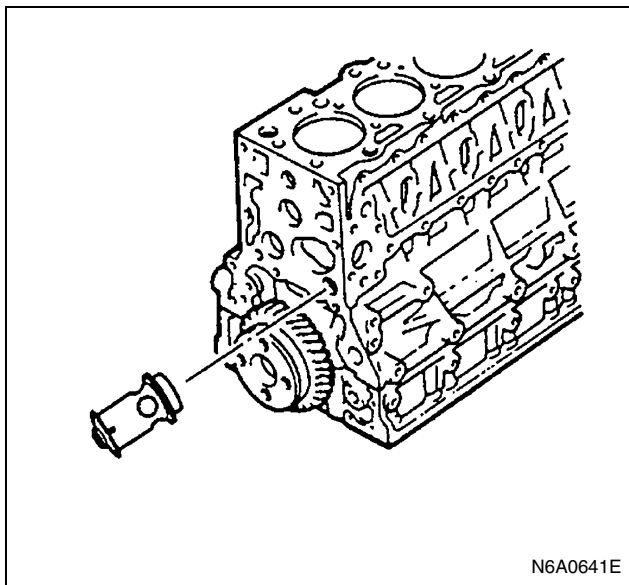
36. Water Pump Pulley
37. Water Pump
38. Front Retainer
Install the three front retainer fixing bolts to the front retainer replacer holes as shown in the illustration, and tighten the bolts alternately a little at a time.



39. Oil Thermo Valve (4HF1, 4HF1-2, 4HG1, 4HG1-T)
Pull out the thermo valve from the cylinder body.



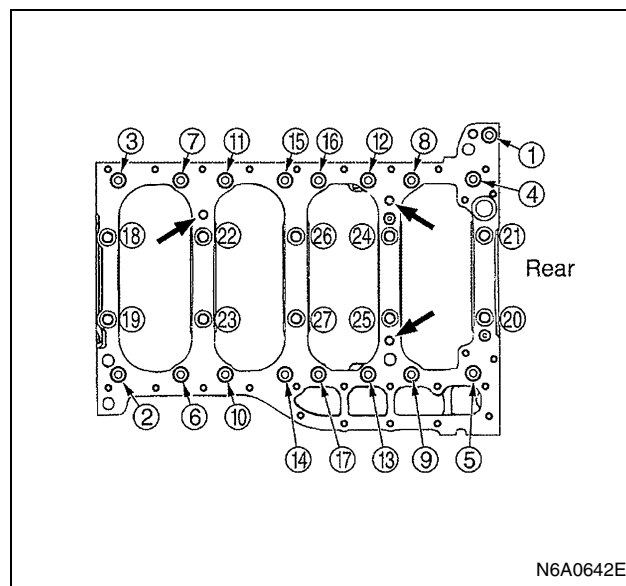
40. Bypass Valve (4HE1-TC)
Pull out the bypass valve from the cylinder body.



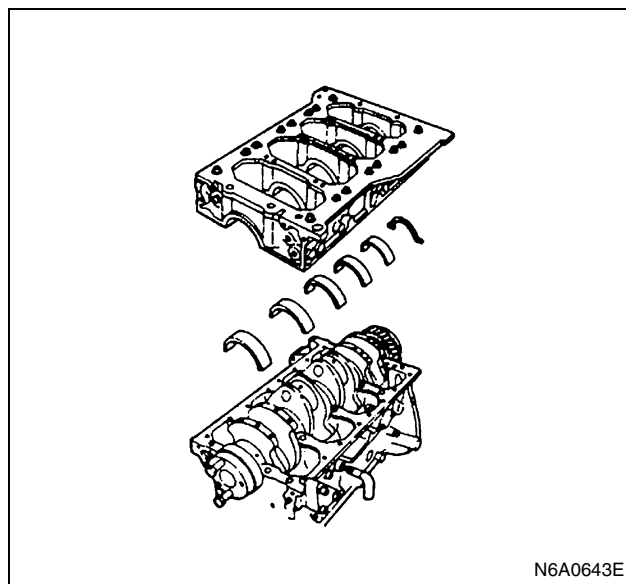
41. Power Steering Pump Idle Gear Cover
42. Power Steering Pump Idle Gear
43. Flywheel Housing
44. Idle Gear A
45. Oil Pump Assembly
Above works refer to "TIMING GEAR REPLACEMENT" section in this manual.
46. Connecting Rod Cap Assembly
47. Connecting Rod Lower Bearing
48. Piston and Connecting Rod Assembly
Above works refer to "PISTON AND CONNECTING ROD" section in this manual.
49. Crankcase
 - 1) Loosen the crankcase bolts in numerical order a little at a time.
 - 2) Install the three crankcase fixing bolts (See arrow marks) to the crankcase replacer holes as shown in the illustration, and tighten the bolts alternate a little at a time.

Notice:

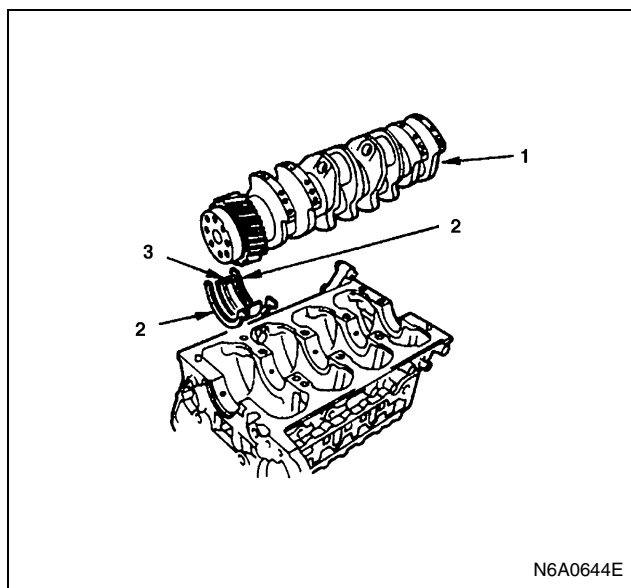
When removing the crankcase, be sure to remove the oil pump and the generator bracket before that.



50. Thrust Bearing Lower
51. Crankshaft Bearing Lower



52. Crankshaft Assembly
53. Thrust Bearing Upper
54. Crankshaft Bearing Upper



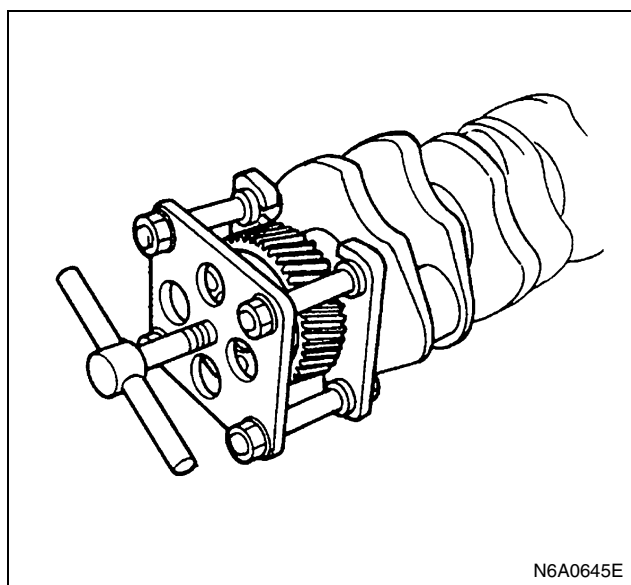
Legend

1. Crankshaft assembly
2. Thrust bearing upper
3. Crankshaft bearing upper

55. Crankshaft Gear

- 1) Use the crankshaft gear remover to remove the crankshaft gear.

Crankshaft Gear Remover: 8-9439-6818-0



- 2) Remove the crankshaft feather key.

56. Crankshaft

Installation

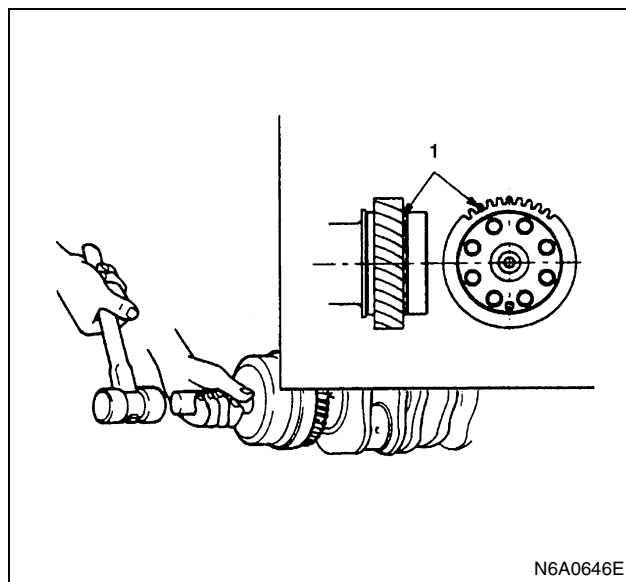
1. Crankshaft
2. Crankshaft Gear
 - 1) Use a piston heater to heat the crankshaft gear to 170 — 250°C (338 — 482°F).
 - 2) With the alignment mark "S" on the side of the crankshaft gear turned outward, align the groove on the gear side with the crankshaft pin

position and hammer it in with a crankshaft gear installer until it hits the bottom.

Caution:

When hammered in with the gear slanted, the crankshaft gear may be caught in the middle and cannot be hammered in fully. Gear it in quickly enough not to allow a shaft line along the gear and the crankshaft to slant.

Crankshaft Gear Installer: 8-9439-6819-0



Legend

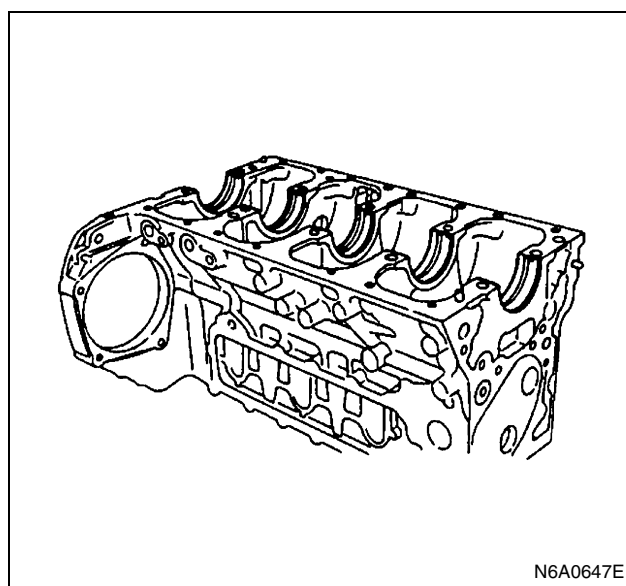
1. Alignment mark

3. Crankshaft Bearing Upper

When replacing the crankshaft or the crankshaft bearing with a new one, select the crankshaft bearing according to the respective grades stamped on the crankshaft and the cylinder body.

Refer to the "CRANKSHAFT".

All upper bearings have oil grooves.



- 1) Carefully wipe any foreign material from the upper bearing.

Caution:

Do not apply engine oil to the bearing back faces and the cylinder body bearing fitting surfaces.

- 2) Locate the position mark applied at disassembly if the removed upper bearings are to be re-used.

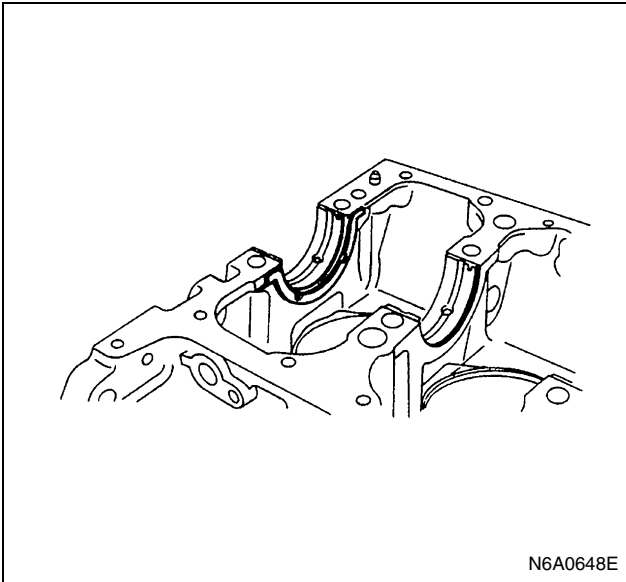
4. Thrust Bearing Upper

Install the thrust bearing upper to the front side of the cylinder body No.5 journal. At this time, the thrust bearing upper may be pasted to the cylinder body with grease.

However, be sure to wipe off any excessive grease.

Caution:

The thrust bearing oil grooves must be facing the sliding faces.



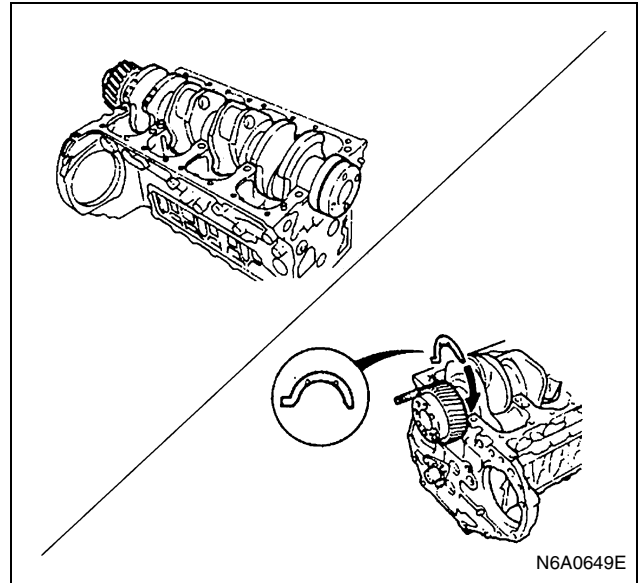
5. Crankshaft Assembly

Apply an ample coat of engine oil to the crankshaft journals and the crankshaft bearing surfaces before installing the crankshaft with timing gear.

- While pressing on the installed crankshaft toward the rear side, insert the thrust bearing upper into the rear side of the cylinder body No.5 journal.

Caution:

The thrust bearing oil grooves must be facing the sliding faces.



6. Crankshaft Bearing Lower

All lower bearings does not have oil grooves.

- 1) Carefully wipe any foreign material from the lower bearing.

Caution:

Do not apply engine oil to the bearing back faces and the crankcase bearing fitting surfaces.

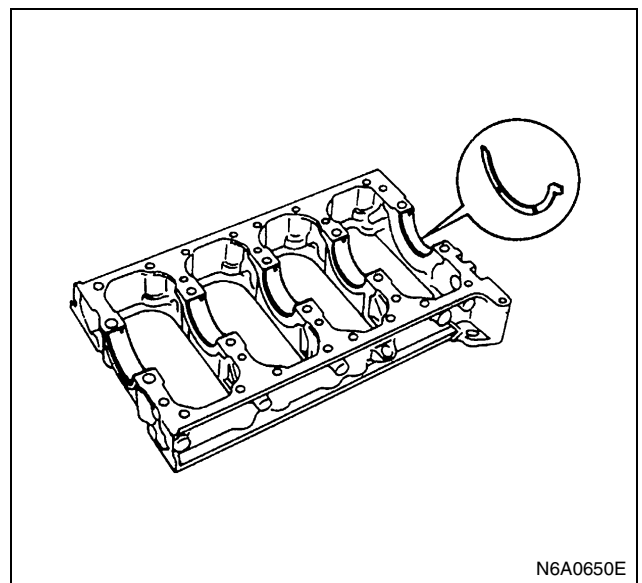
- 2) Locate the position mark applied at disassembly if the removed lower bearings are to be re-used.

7. Thrust Bearing Lower

Install the thrust bearing lower to the rear side of the crankcase No.5 journal.

Caution:

The thrust bearing oil grooves must be facing the sliding faces.



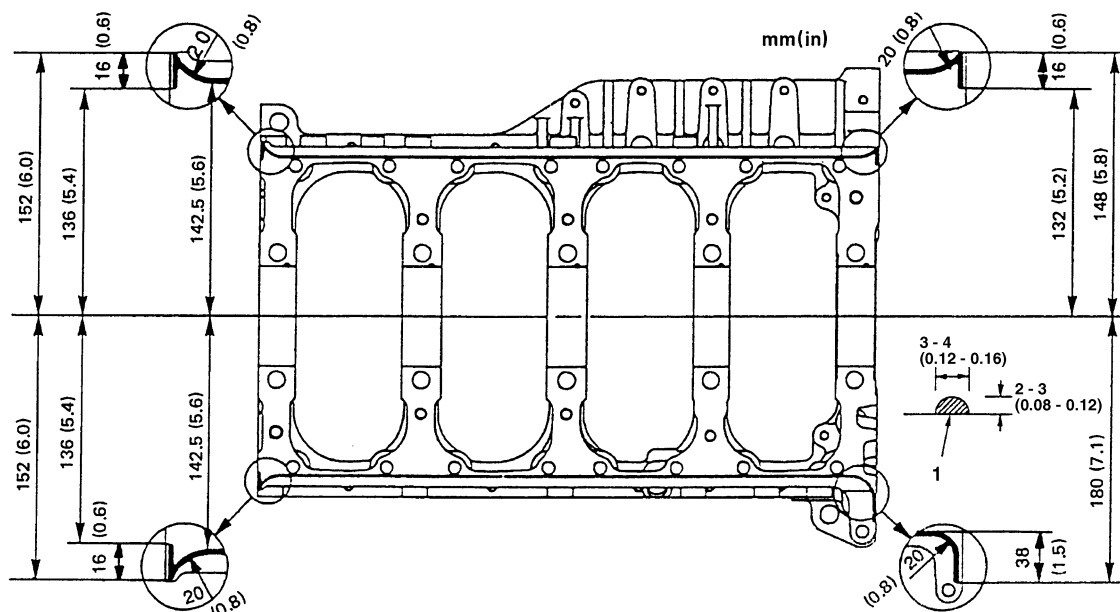
6A3-116 ENGINE (4HF1 / 4HF1-2 / 4HE1-TC / 4HG1 / 4HG1-T)

8. Crankcase

- 1) Apply a 3 mm (0.12 in) bead of recommended liquid gasket (Three Bond 1207C) or its equivalent to the crankcase upper surface as shown in the illustration.

- 2) Carefully place the crankcase on the cylinder body.

- Install the crankcase within 20 minutes after application of liquid gasket.



N6A1622E

Legend

1. Liquid gasket

- 3) Tighten the crankcase to the specified torque in the numerical order shown in the illustration.

Tighten:

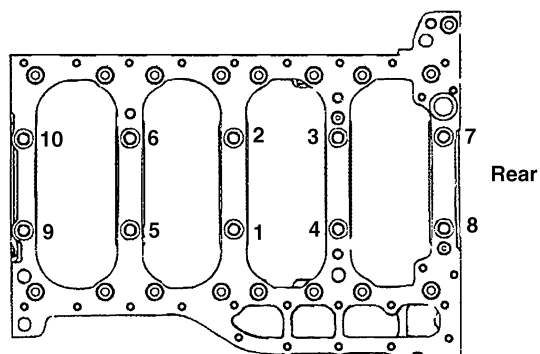
Crankcase bolt (M14: (1) — (10)) to

- 1st step: 98 N·m (10 kg·m/72 lb·ft)
- 2nd step: 132 N·m (13.5 kg·m/98 lb·ft)
- 3rd step: 30 — 60°

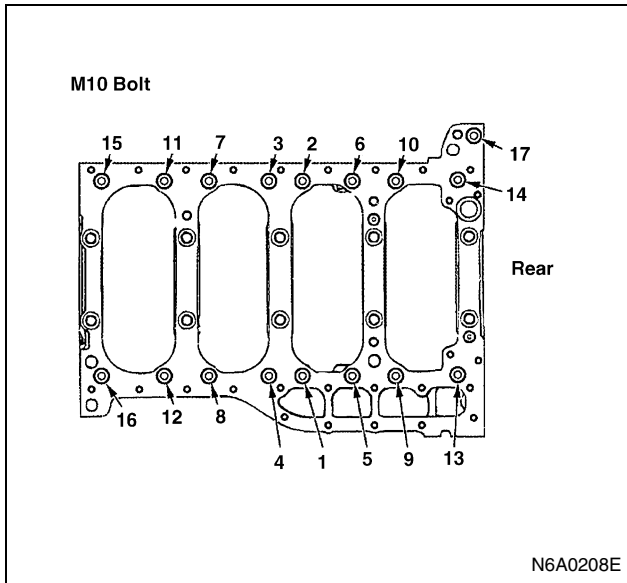
Crankcase bolt (M10: (1) — (17)) to 37 N·m (3.8 kg·m/27 lb·ft)

Angle gauge: 5-8840-0266-0

M14 Bolt



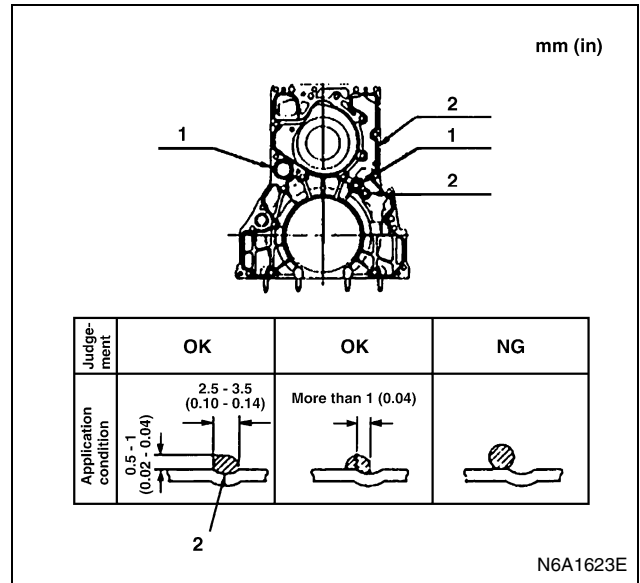
N6A1415E



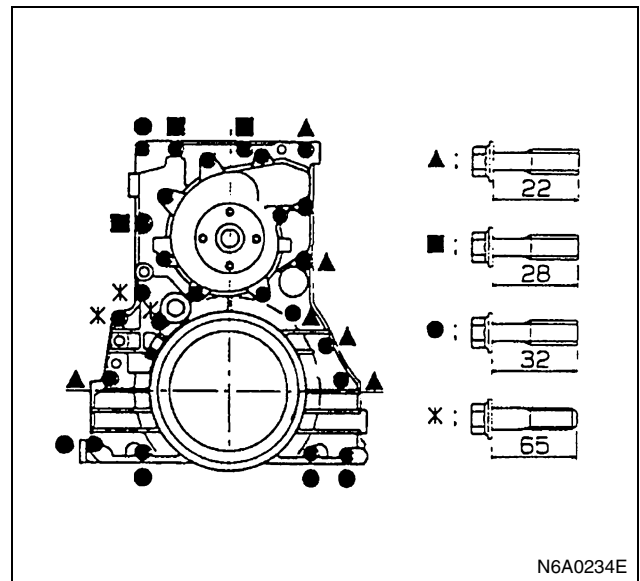
9. Piston and Connecting Rod Assembly
10. Connecting Rod Lower Bearing
11. Connecting Rod Cap Assembly
Above works refer to "PISTON AND CONNECTING ROD" section in this manual.
12. Oil Pump Assembly
13. Idle Gear A
Above works refer to "OIL PUMP ASSEMBLY" section in this manual.
14. Flywheel Housing
15. Power Steering Pump Idle Gear
16. Power Steering Pump Idle Gear Cover
17. Oil Thermo Valve
Above works refer to "TIMING GEAR REPLACEMENT" section in this manual.
18. Front Retainer
 - 1) Carefully wipe any foreign material from the cylinder body front face.
 - 2) Apply 2.5 — 3.5 mm (0.10 — 0.14 in) bead of the recommended liquid gasket (Three Bond 1207C) or its equivalent on the groove of the front retainer fitting surface shown in the illustration.
 - 3) Install the O-rings (2 pieces) to the front retainer.
 - Install the front retainer within 7 minutes after application of liquid gasket.
 - For the dislocation of liquid gasket, refer to the illustration.
 - 4) Align the cylinder body knock pins with the front retainer knock pin holes.

Tighten:

Front retainer bolt to 24 N·m (2.4 kg·m/17 lb·ft)

**Legend**

1. O-ring
2. Liquid gasket

**19. Water Pump Assembly**

- 1) Apply 3 — 4 mm (0.12 — 0.16 in) bead of the recommended liquid gasket (Three Bond 1207C) or its equivalent on the water pump fitting surface.
- 2) Install the water pump to the front retainer.

Tighten:

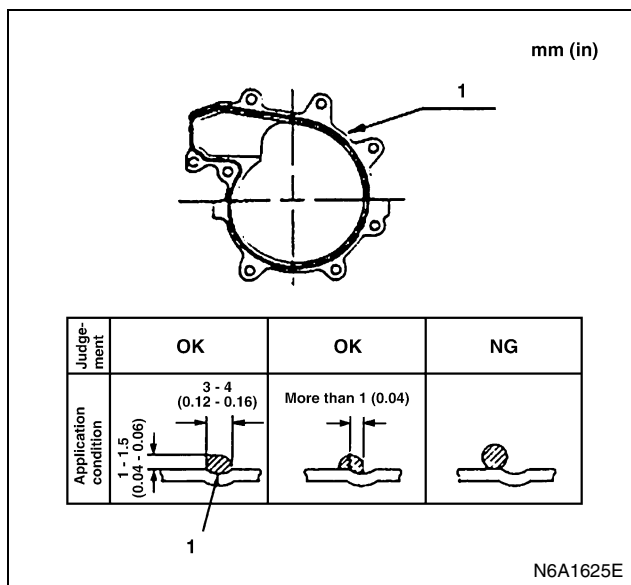
Water pump bolt to 24 N·m (2.4 kg·m/17 lb·ft)

- Install the water pump within 7 minutes after application of liquid gasket.
- For the dislocation of liquid gasket, refer to the illustration.

Caution:

The water pump clamping bolt is also used to tighten the front retainer. So, install the water pump before liquid

gasket gets dry immediately after installation of the front retainer.



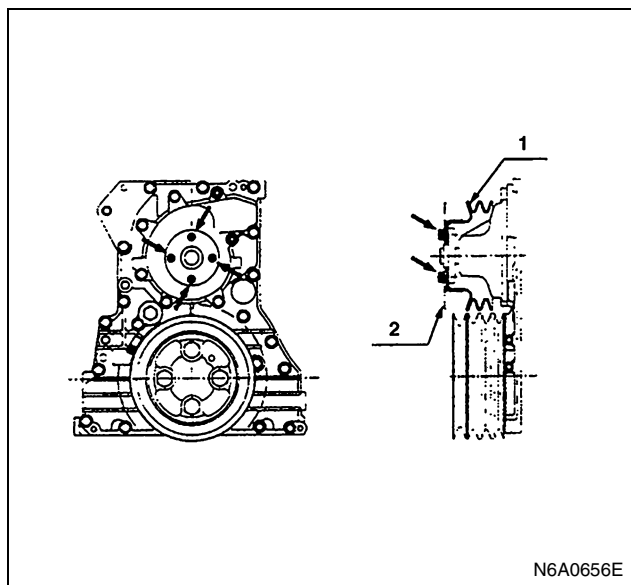
Legend

1. Liquid gasket

20. Water Pump Pulley

Tighten:

Water pump pulley bolt to 24 N·m (2.4 kg·m/17 lb·ft)



Legend

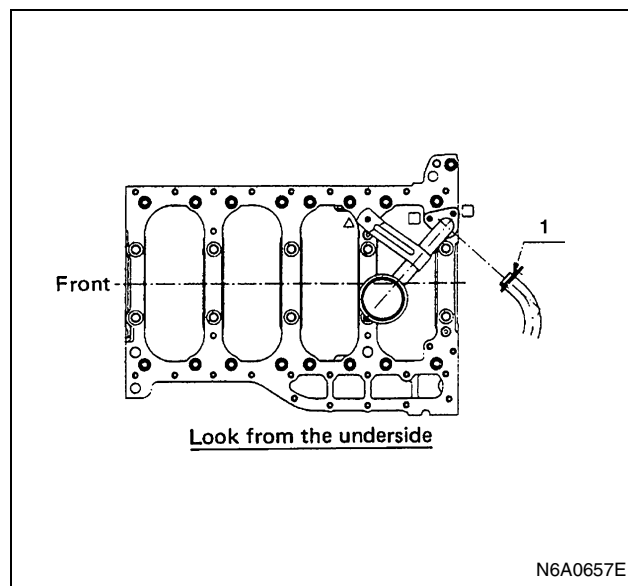
1. Pulley
2. Set plate

21. Oil Pump Strainer

Install the O-ring (1) to the oil pump strainer pipe and install the oil pump strainer to the cylinder body shown in the illustration.

Tighten:

Oil pump strainer bolt to 24 N·m (2.4 kg·m/17 lb·ft)



22. Oil Pan

23. Spacer Rubber

Above works refer to "OIL PAN" section in this manual.

24. Crankshaft Rear Slinger

25. Crankshaft Rear Oil Seal

Above works refer to "CRANKSHAFT REAR OIL SEAL" section in this manual.

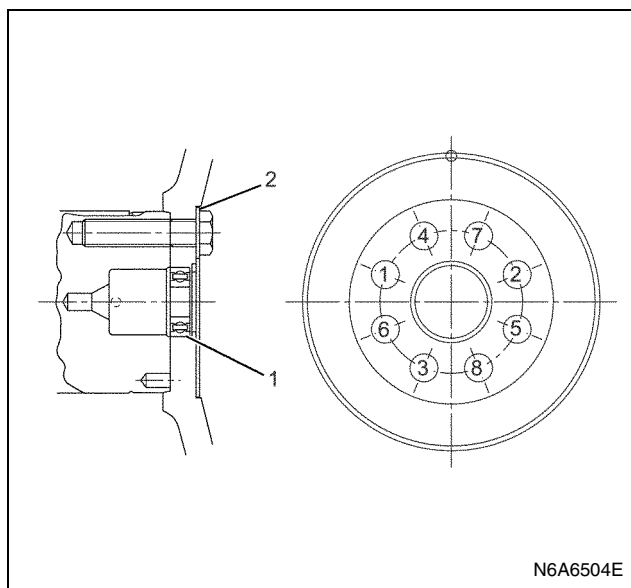
26. Flywheel

- 1) Align the flywheel with the crankshaft knock pin and temporarily tighten the flywheel bolts.
- 2) Use the crankshaft stopper to prevent the crankshaft from turning.
Crankshaft Stopper: 5-8840-2230-0
- 3) Install the washer and the flywheel bolts and tighten to the specified torque in numerical order show in the illustration.

Tighten:

Flywheel bolt to

- 1st step: 78 N·m (8.0 kg·m/58 lb·ft)
- 2nd step: 90 — 120°

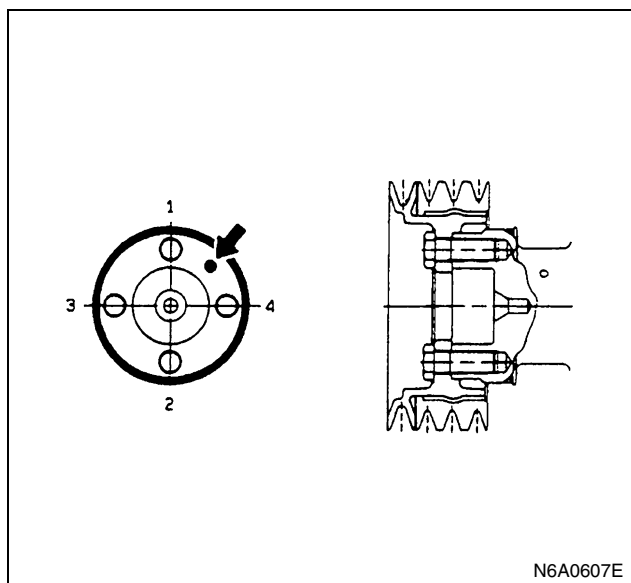
**Legend**

1. Washer
2. Pilot bearing

- 4) Remove the crankshaft stopper.
27. Crankshaft Front Slinger
28. Crankshaft Front Oil Seal
Above works refer to "CRANKSHAFT FRONT OIL SEAL" section in this manual.
29. Crankshaft Damper Pulley
 - 1) Apply a coat of engine oil to the threads of the bolts.
 - 2) Align the damper pulley with the crankshaft knock pin and tighten the bolts to the specified torque in numerical order.

Tighten:

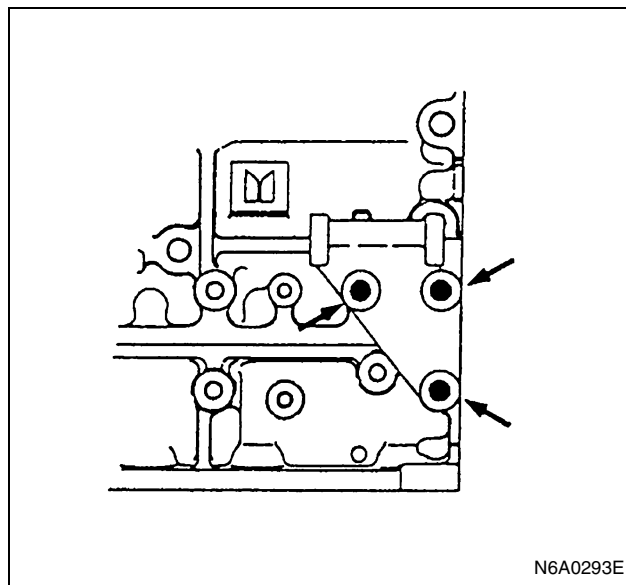
Damper pulley bolt to 200 N·m (20.4 kg·m/147 lb·ft)



30. Generator Bracket

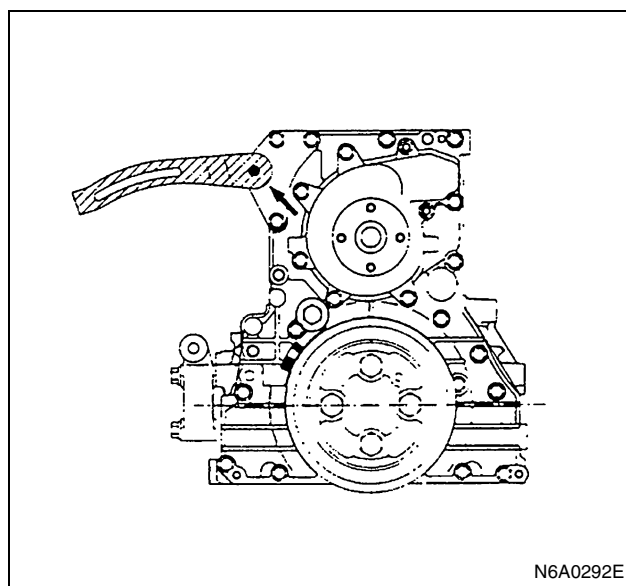
Tighten:

Generator bracket bolt to 48 N·m (4.9 kg·m/35 lb·ft)



31. Fan Belt Adjust Plate

Install the adjust plate and temporarily tighten the adjust plate bolt.



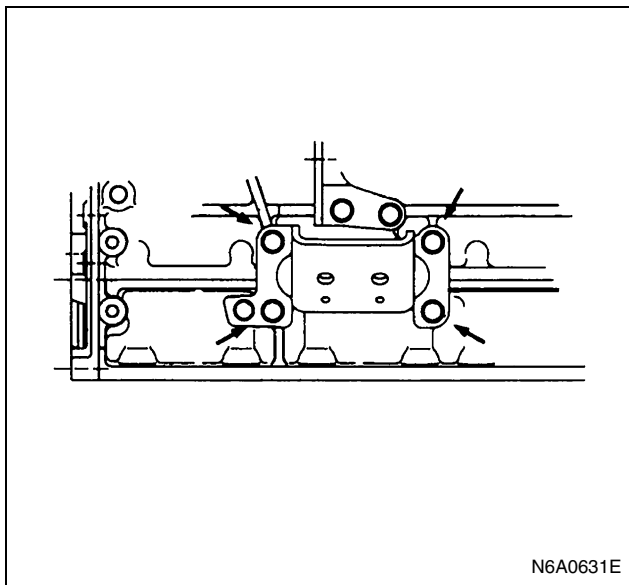
32. Injection Pump Assembly

Above works refer to "INJECTION PUMP ASSEMBLY" section 6C in this manual.

33. Engine Foot

Tighten:

Engine foot bolt to 51 N·m (5.2 kg·m/38 lb·ft)



34. Generator

Notice:

When tightening the generator, tighten in advance the fan belt temporarily after its adjustment.

- Insert through the lower fixing bolt from the rear side as shown in the illustration, and tighten it with a nut on the front side.

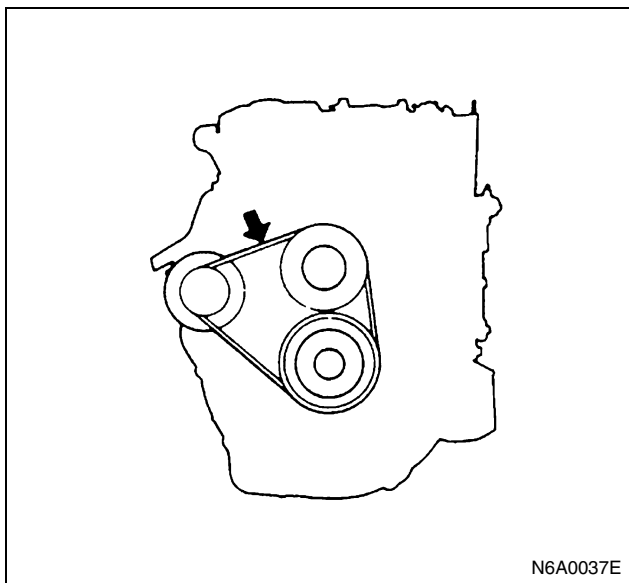
35. Fan Belt

Check the drive belt tension.

Depress the drive belt mid-portion with a 98 N (10 kg/22 lb) force.

Drive Belt Deflection	mm (in)
8 — 12 (0.31 — 0.47) ... New belt	
10 — 14 (0.39 — 0.55) ... Reuse belt	

Check the drive belt for cranking and other damage.

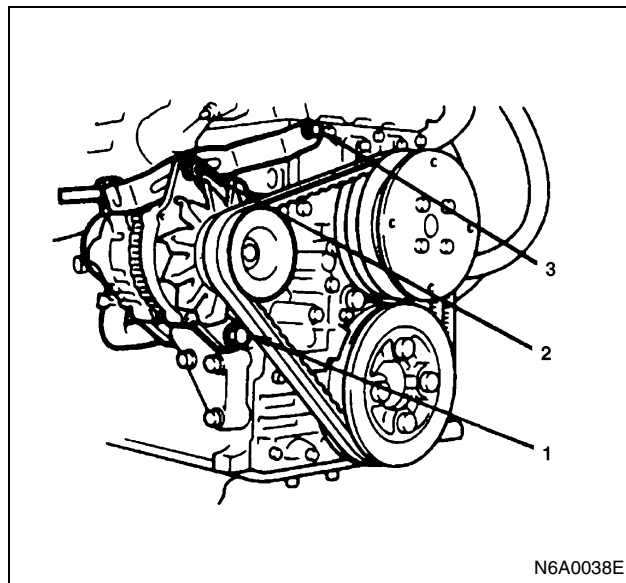
**Fan Belt Adjustment**

Fan belt tension is adjusted by moving the generator.

Tighten:

Bolt to

- (1): 40 N·m (4.1 kg·m/30 lb·ft)
- (2): 24 N·m (2.4 kg·m/17 lb·ft)
- (3): 46 N·m (4.7 kg·m/34 lb·ft)



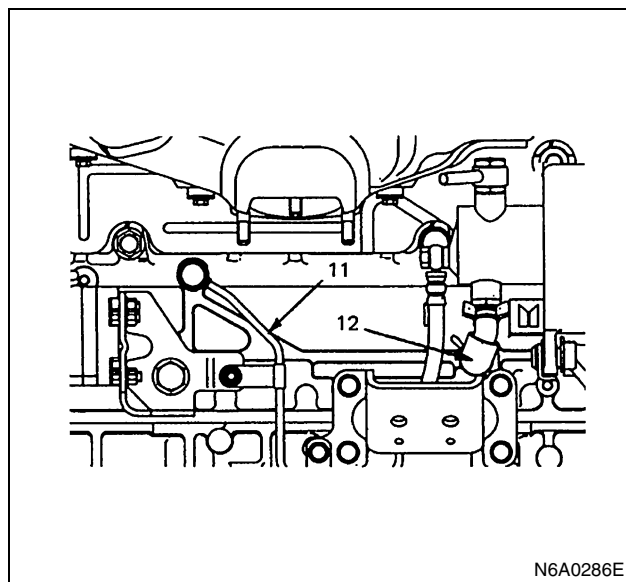
36. Vacuum Pump Rubber Hose (12)

37. Vacuum Pump Oil Pipe (11)

Tighten:

Vacuum pump oil pipe to

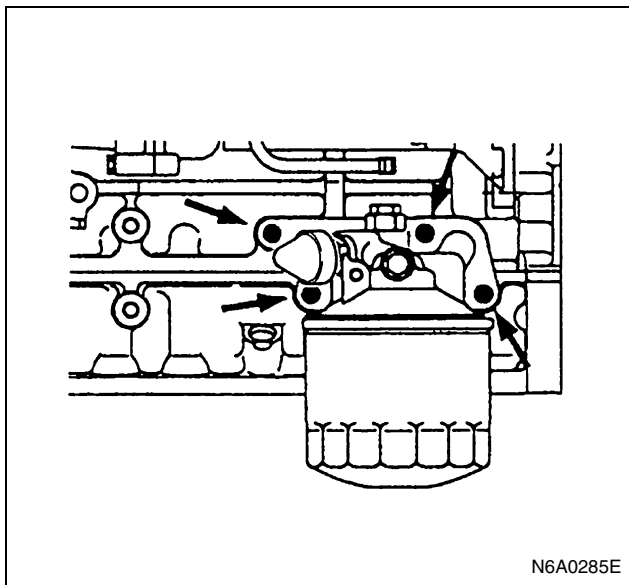
- Cylinder body side: 41 N·m (4.2 kg·m/30 lb·ft)
- Generator side: 23 N·m (2.3 kg·m/17 lb·ft)



38. Oil Filter Assembly

Tighten:

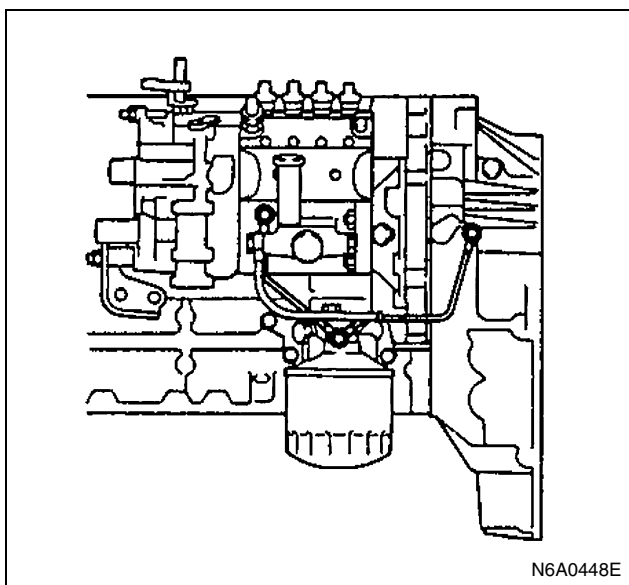
Oil filter bolt to 48 N·m (4.9 kg·m/35 lb·ft)



39. Oil Pipe

Tighten:

Oil pipe joint bolt to 17 N·m (1.7 kg·m/12 lb·ft)

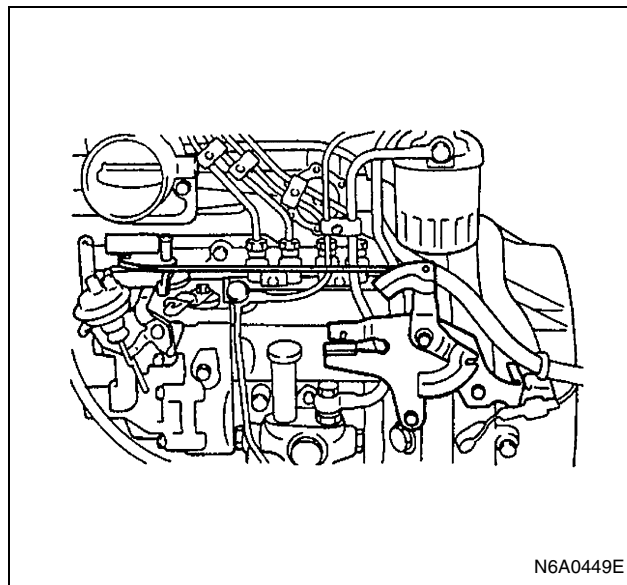


40. Engine Control Lever Assembly

Tighten:

Engine control lever bolt to 24 N·m (2.4 kg·m/17 lb·ft)

41. Engine Control Wire



42. Driven Plate

43. Clutch Pressure Plate Assembly
Above works refer to "FLYWHEEL AND PILOT BEARING" section in this manual.

44. Cylinder Head Gasket
Above works refer to "CYLINDER HEAD" section in this manual.

45. Cylinder Head Assembly
Above works refer to "CYLINDER HEAD" section in this manual.

46. Camshaft Bearing Lower

47. Camshaft Assembly

48. Camshaft Bearing Upper

49. Camshaft Bearing Cap

50. Valve Cap

Above works refer to "CAMSHAFT ASSEMBLY" section in this manual.

51. Rocker Arm Shaft Assembly
Above works refer to "ROCKER ARM SHAFT ASSEMBLY" section in this manual.

52. Cylinder Head Cover Gasket
Above works refer to "CYLINDER HEAD" section in this manual.

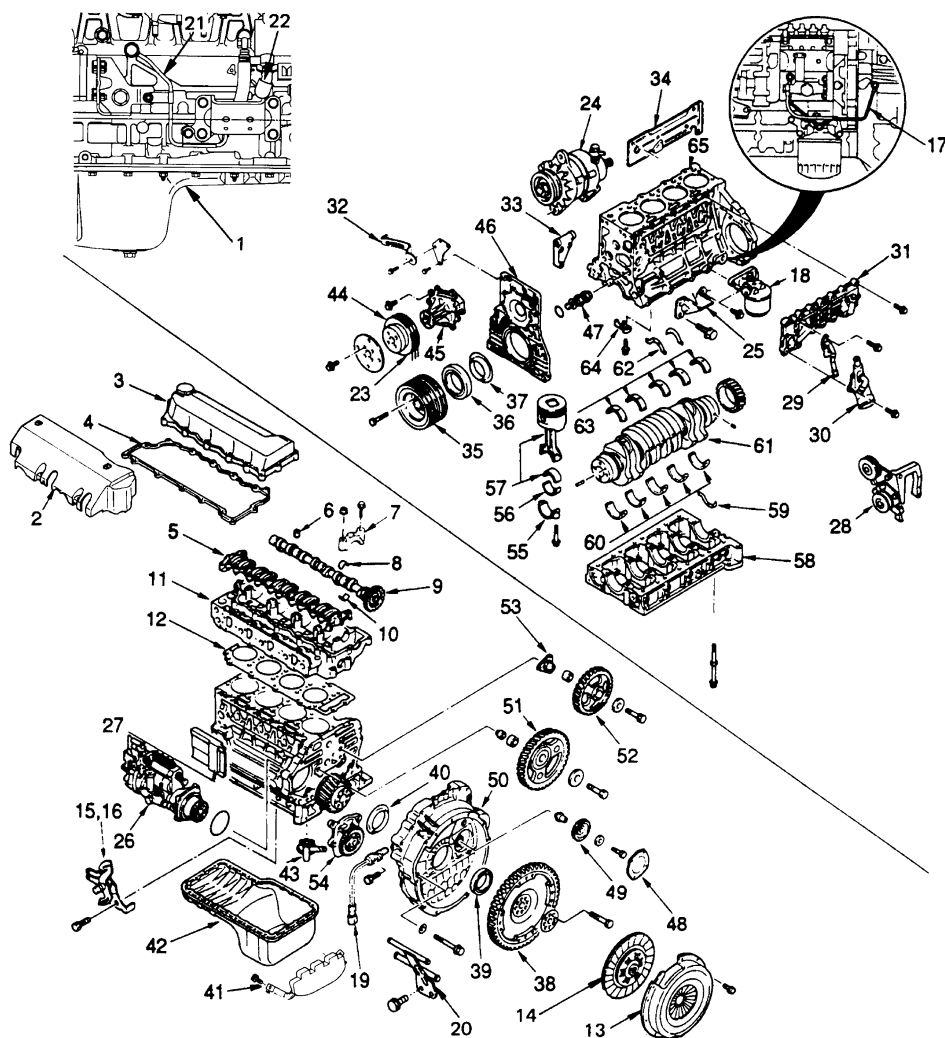
53. Cylinder Head Cover
Above works refer to "ROCKER ARM SHAFT ASSEMBLY" section in this manual.

54. Nozzle Cover

55. Engine Assembly
Above works refer to "ENGINE ASSEMBLY" section in this manual.

CYLINDER BLOCK

Component



Legend

- | | |
|------------------------------------|---|
| 1. Engine assembly | 34. Cover |
| 2. Nozzle cover | 35. Crankshaft pulley |
| 3. Cylinder head cover | 36. Crankshaft front oil seal |
| 4. Cylinder head cover gasket | 37. Crankshaft front slinger |
| 5. Rocker arm shaft assembly | 38. Flywheel assembly |
| 6. Valve cap | 39. Crankshaft rear oil seal |
| 7. Camshaft bearing cap | 40. Crankshaft rear slinger |
| 8. Camshaft bearing upper | 41. Spacer rubber |
| 9. Camshaft assembly | 42. Oil pan |
| 10. Camshaft bearing lower | 43. Oil pump strainer |
| 11. Cylinder head assembly | 44. Water pump pulley |
| 12. Cylinder head gasket | 45. Water pump |
| 13. Clutch pressure plate assembly | 46. Front retainer |
| 14. Driven plate | 47. Oil thermo valve |
| 15. Engine control wire | 48. Power steering pump idle gear cover |
| 16. Engine control lever assembly | 49. Power steering pump idle gear |
| 17. Oil pipe | 50. Flywheel housing |
| 18. Oil filter assembly | 51. Idle gear A |
| 19. Tachometer sensor | 52. Idle gear B |
| 20. Fuel pipe bracket | 53. Idle gear B shaft |
| 21. Vacuum pump oil pipe | 54. Oil pump assembly |
| 22. Vacuum pump rubber hose | 55. Connecting rod cap |
| 23. Fan belt | 56. Connecting rod lower bearing |
| 24. Generator | 57. Piston and connecting |
| 25. Engine foot | 58. Crankcase |
| 26. Injection pump assembly | 59. Thrust bearing lower |
| 27. Injection pump rubber spacer | 60. Crankshaft bearing lower |
| 28. Idle pulley bracket | 61. Crankshaft assembly |
| 29. Heater pipe | 62. Thrust bearing upper |
| 30. Water suction pipe | 63. Crankshaft bearing upper |
| 31. Oil cooler assembly | 64. Piston oil jet |
| 32. Fan belt adjust plate | 65. Cylinder block |
| 33. Generator bracket | |

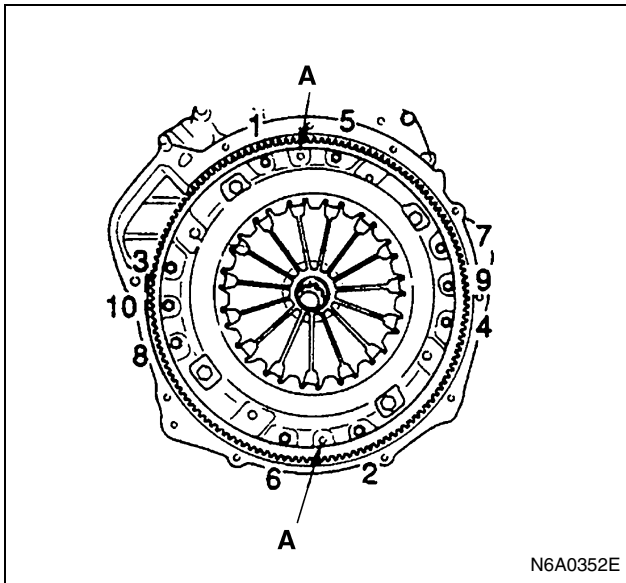
Removal**Preparation**

- Disconnect battery ground cable.
- Tilt the cab
- Drain coolant and engine oil

- | | |
|--|--|
| 1. Engine Assembly | 7. Camshaft Bearing Cap |
| Above works refer to "ENGINE ASSEMBLY" section in this manual. | 8. Camshaft Bearing Upper |
| 2. Nozzle Cover | 9. Camshaft Assembly |
| 3. Cylinder Head Cover | 10. Camshaft Bearing Lower |
| 4. Cylinder Head Cover Gasket | Above works refer to "CAMSHAFT ASSEMBLY" section in this manual. |
| 5. Rocker Arm shaft Assembly | 11. Cylinder Head Assembly |
| Above works refer to "ROCKER ARM SHAFT ASSEMBLY" section in this manual. | Above works refer to "CYLINDER HEAD" section in this manual. |
| 6. Valve Cap | 12. Cylinder Head Gasket |
| | 13. Clutch Pressure Plate Assembly |
| | 1) Insert the clutch pilot aligner to the clutch assembly. |
| | Clutch Pilot Aligner: 5-8840-2240-0 |
| | 2) Loosen the pressure plate bolts in numerical order a little at a time as shown in the illustration. |

Caution:

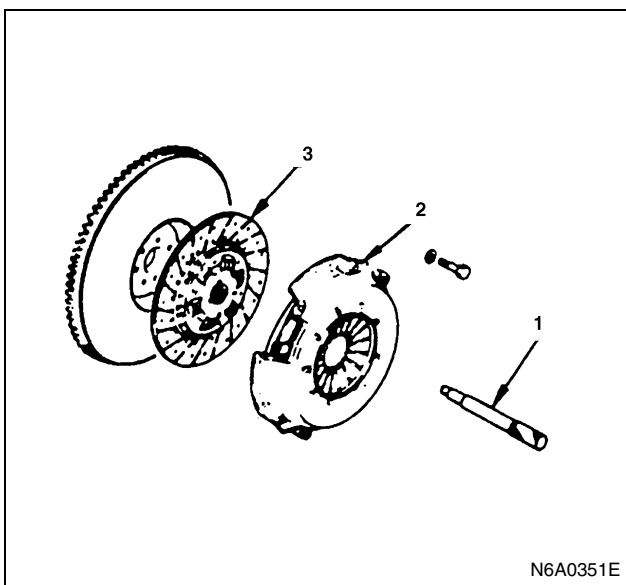
Take sufficient care not to let valve caps fall into the gear case or oil return hole.



Legend

A. Knock pin

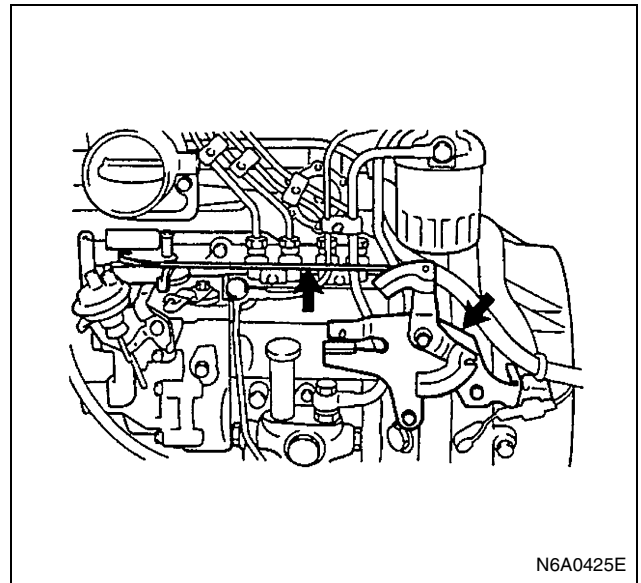
- 3) Remove the pressure plate assembly.
14. Driven Plate
Remove the driven plate with the clutch pilot aligner.



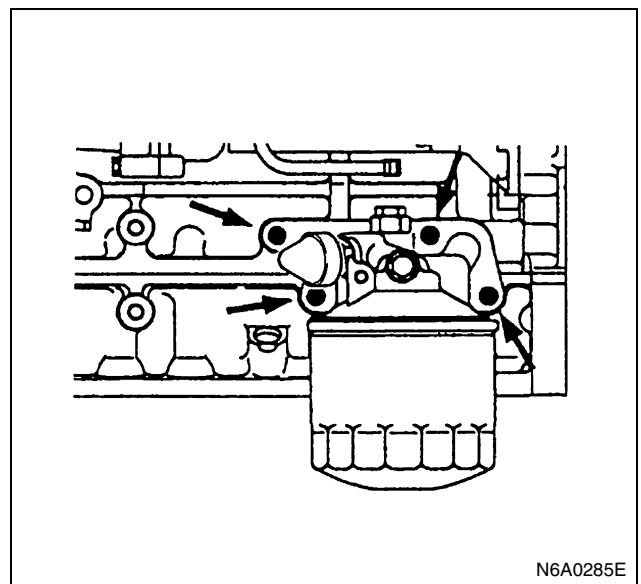
Legend

1. Clutch pilot aligner
2. Clutch pressure plate assembly
3. Driven plate

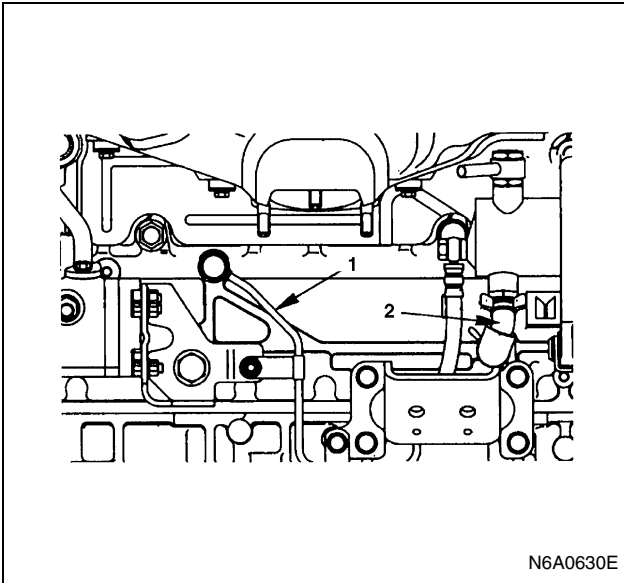
15. Engine Control Wire
16. Engine Control Lever Assembly



17. Oil Pipe
18. Oil Filter Assembly



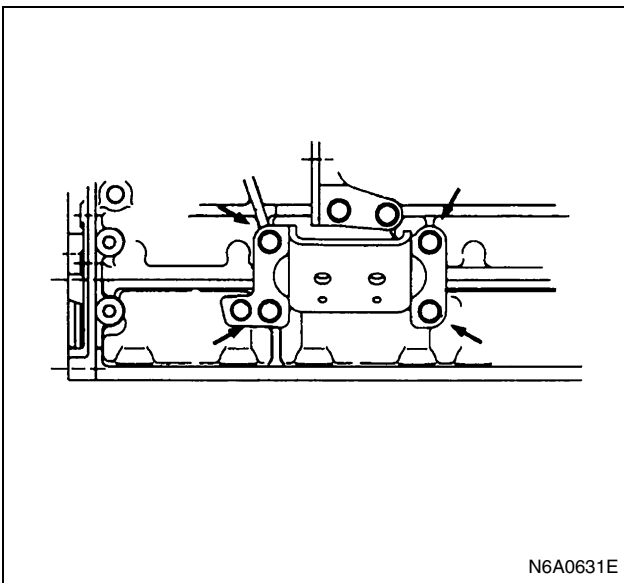
19. Tachometer Sensor
20. Fuel Pipe Bracket
21. Vacuum Pump Oil Pipe
22. Vacuum Pump Rubber Hose



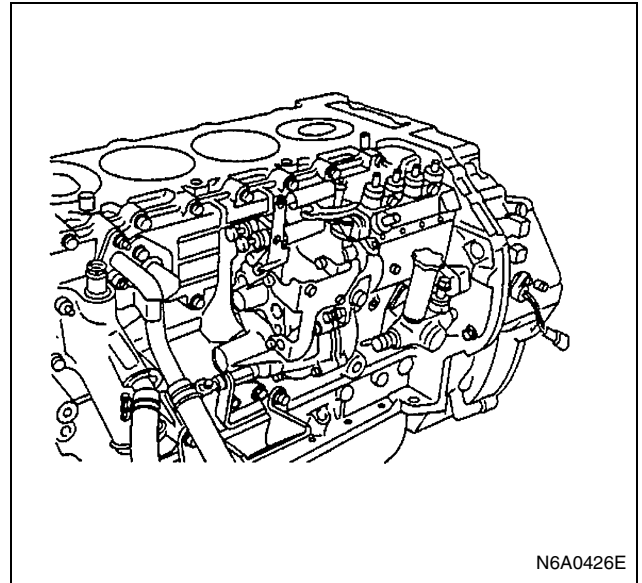
Legend

1. Vacuum pump oil pipe
2. Vacuum pump rubber hose

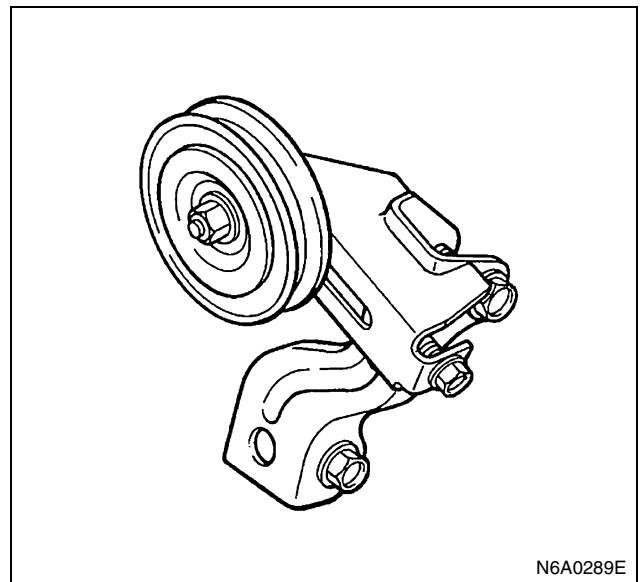
23. Fan Belt
24. Generator
25. Engine Foot



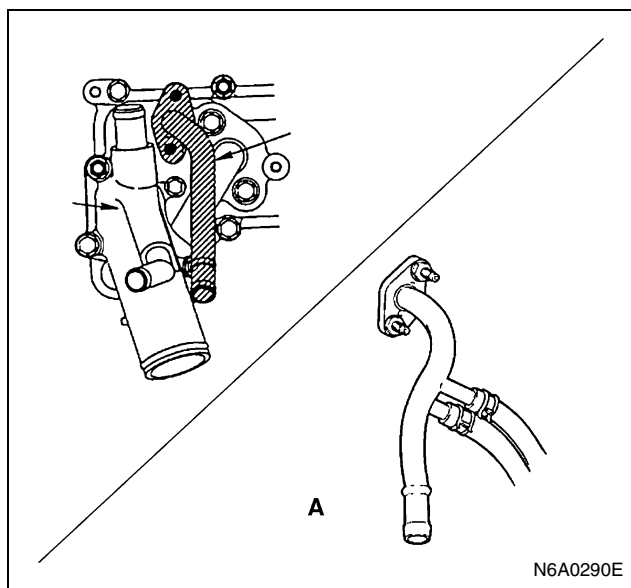
26. Injection Pump Assembly
 - 1) Remove the injection pump bracket bolts and the injection pump rear bracket bolts.
 - 2) Then remove the injection pump assembly.



27. Injection Pump Rubber Spacer
28. Idle Pulley Bracket (If equipped with A/C)



29. Heater Pipe



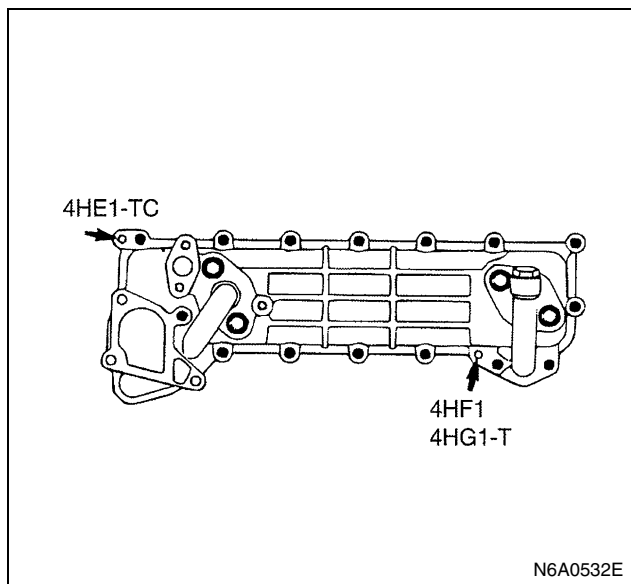
Legend

A. 4HF1-2

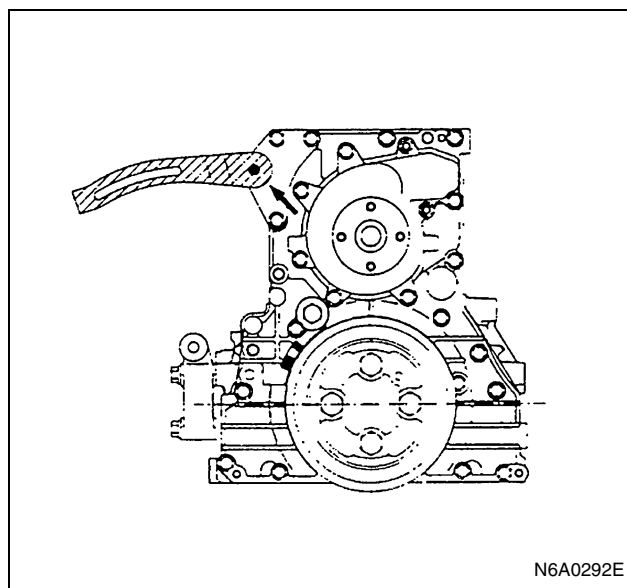
30. Water Suction Pipe

31. Oil Cooler Assembly

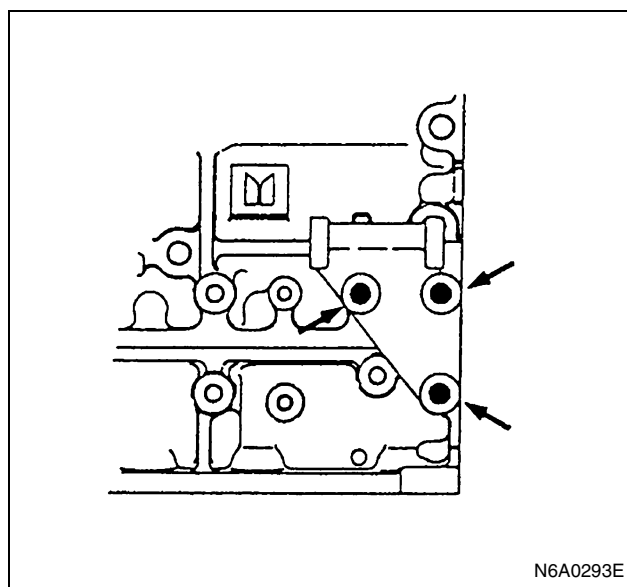
- 1) Remove the oil cooler bolts.
- 2) Install a oil cooler fixing bolt to the oil cooler replacer hole as shown in the illustration, and tighten the bolt alternately a little at a time.



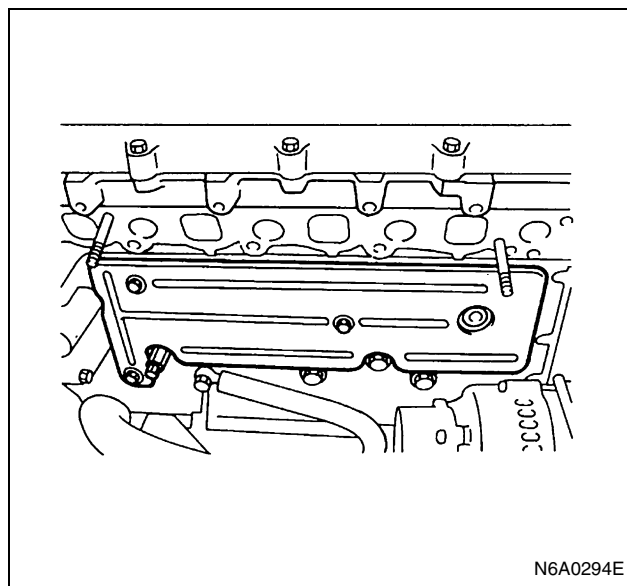
32. Fan Belt Adjust Plate



33. Generator Bracket

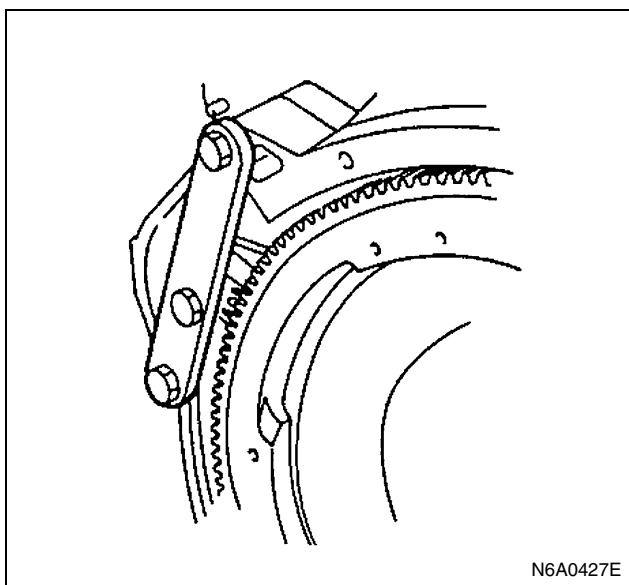


34. Cover



35. Crankshaft Damper Pulley

- 1) Use the crankshaft stopper to prevent the crankshaft from turning.
Crankshaft Stopper: 5-8840-2230-0



- 2) Loosen the damper pulley bolts and remove the damper pulley.

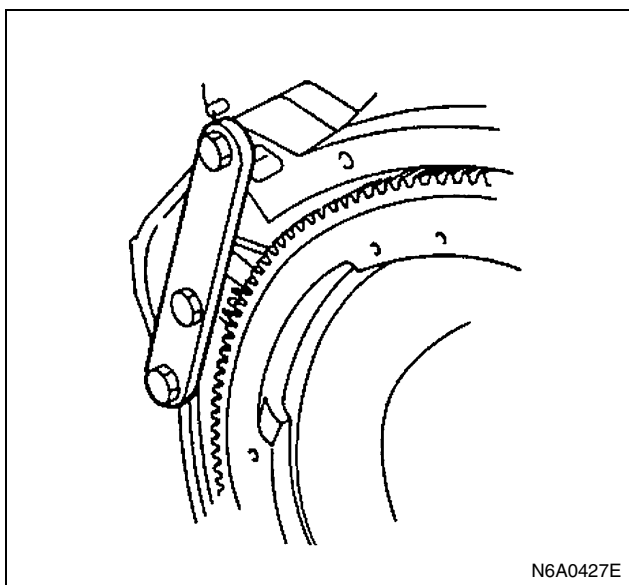
36. Crankshaft Front Oil Seal

37. Crankshaft Front Slinger

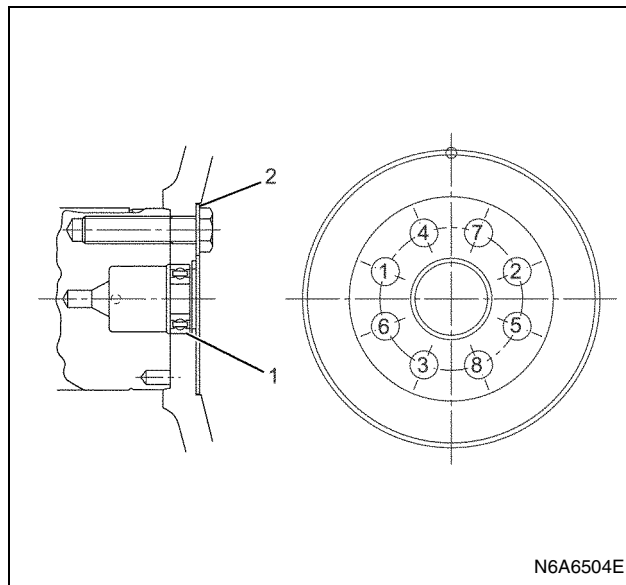
Above works refer to "CRANKSHAFT FRONT OIL SEAL" section in this manual.

38. Flywheel Assembly

- 1) Use the crankshaft stopper to prevent the crankshaft from turning.
Crankshaft Stopper: 5-8840-2230-0



- 2) Loosen the flywheel bolts in numerical order a little at a time as shown in the illustration.
- 3) Remove the flywheel stopper and the flywheel assembly.

**Legend**

1. Washer
2. Pilot bearing

39. Crankshaft Rear Seal

40. Crankshaft Rear Slinger

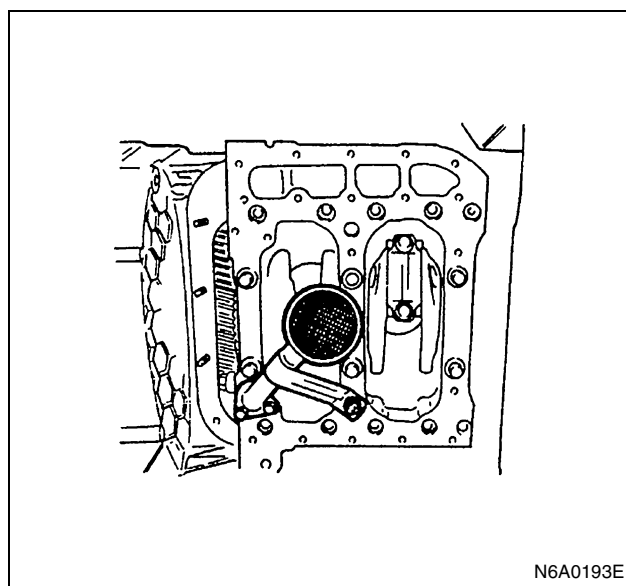
Above works refer to "CRANKSHAFT REAR OIL SEAL" section in this manual.

41. Spacer Rubber

Remove the stiffener before removing the spacer rubber.

42. Oil Pan

43. Oil Pump Strainer

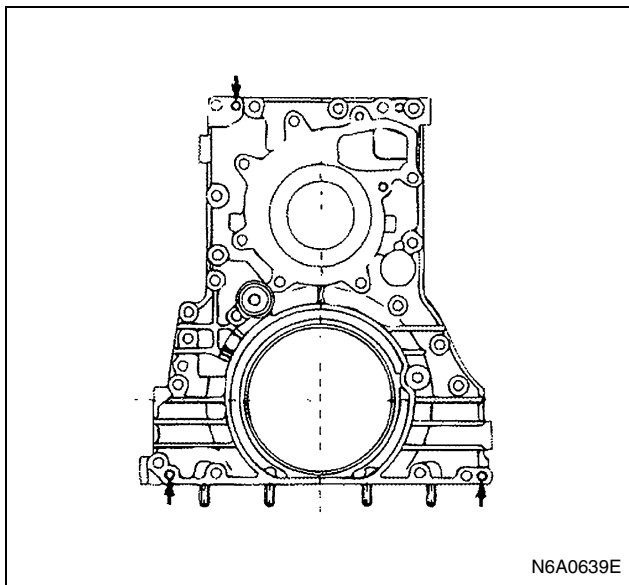


44. Water Pump Pulley

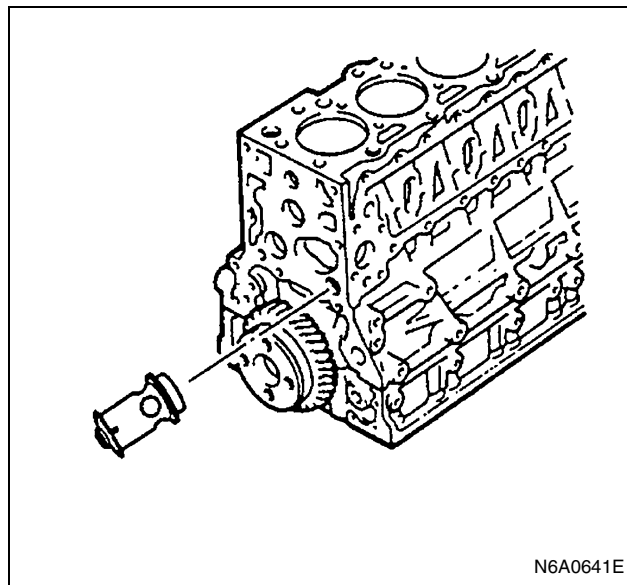
45. Water Pump

46. Front Retainer

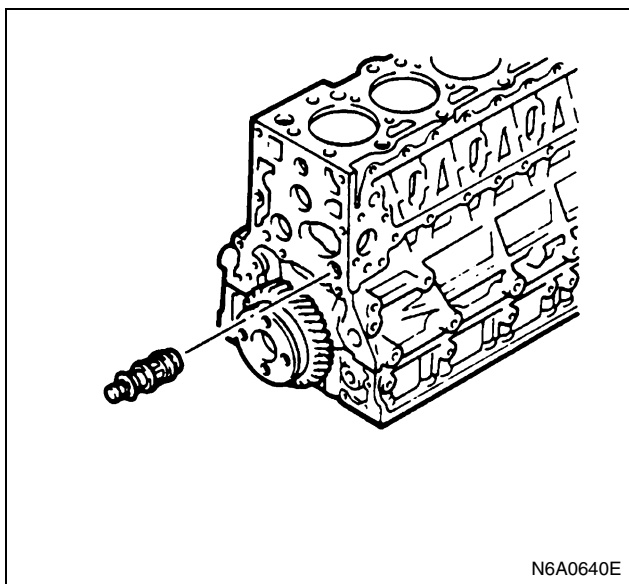
Install the three front retainer fixing bolts to the front retainer replacer holes as shown in the illustration, and tighten the bolts alternately a little at a time.



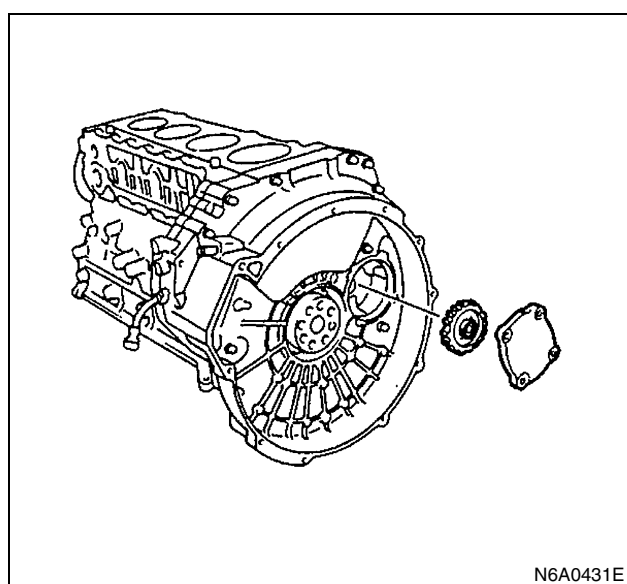
47. Oil Thermo Valve (4HF1, 4HF1-2, 4HG1, 4HG1-T)
Pull out the thermo valve from the cylinder body.



49. Power Steering Pump Idle Gear Cover
50. Power Steering Pump Idle Gear



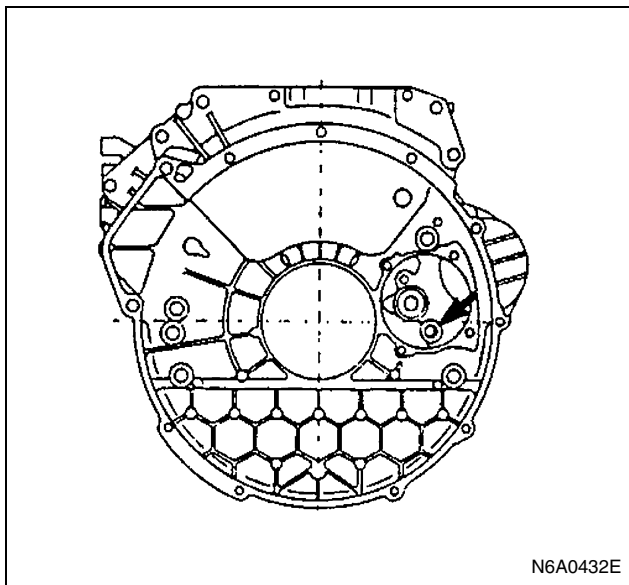
48. Bypass Valve (4HE1-TC)
Pull out the bypass valve from the cylinder body.



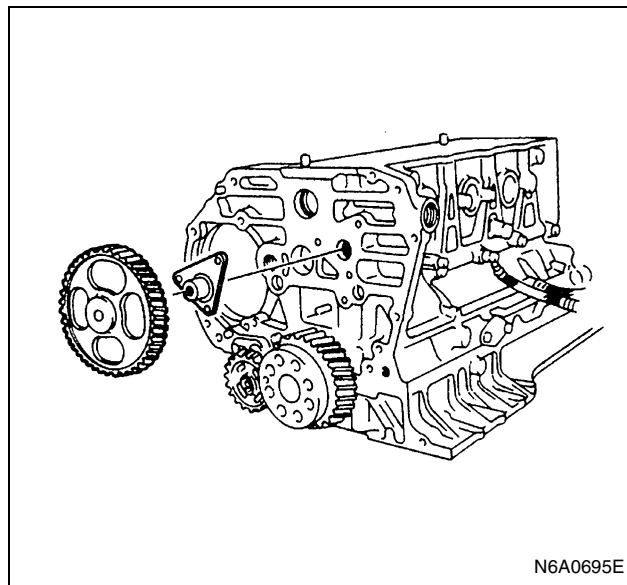
51. Flywheel Housing

Notice:

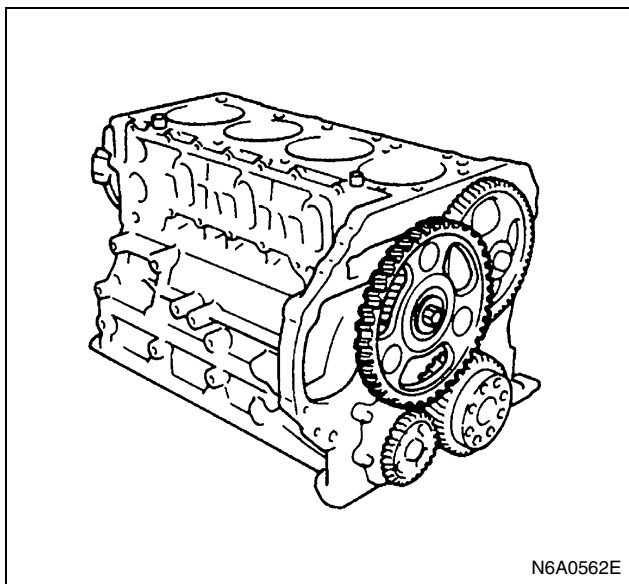
Be careful not to fail to remove the bolts shown in the illustration.



52. Idle Gear A

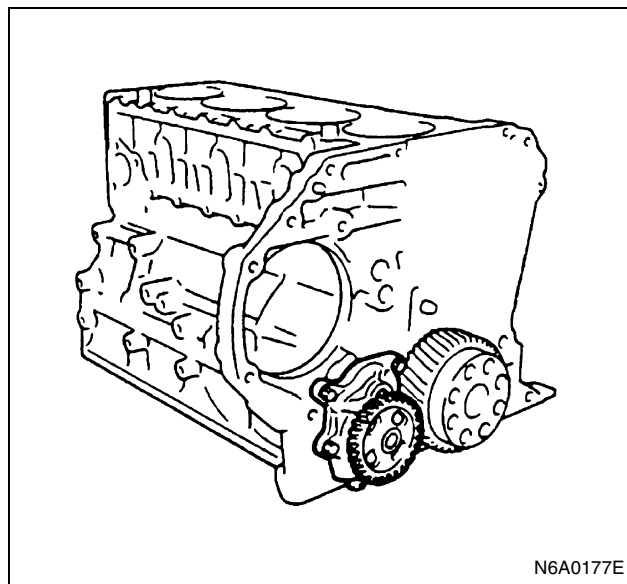


55. Oil Pump Assembly



53. Idle Gear B

54. Idle Gear B Shaft



56. Connecting Rod Cap

57. Connecting Rod Lower Bearing

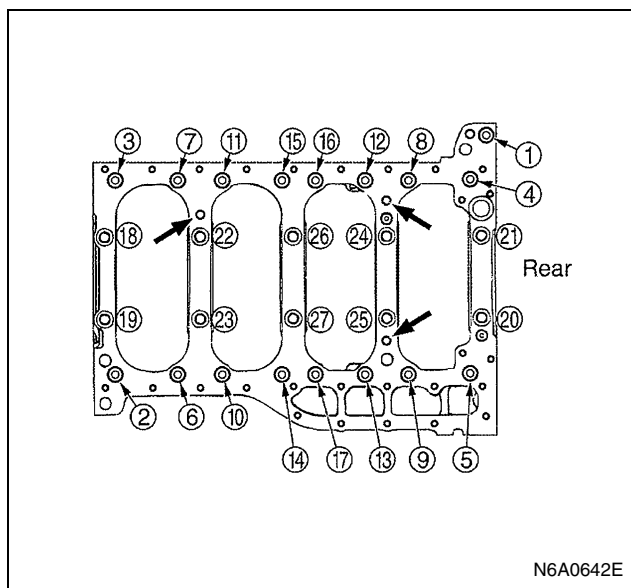
58. Piston and Connecting Rod Assembly
Above works refer to "PISTON AND CONNECTING ROD" section in this manual.

59. Crankcase

- 1) Loosen the crankcase bolts in numerical order a little at a time.
- 2) Install the three crankcase fixing bolts (See arrow marks) to the crankcase replacer holes as shown in the illustration, and tighten the bolts alternate a little at a time.

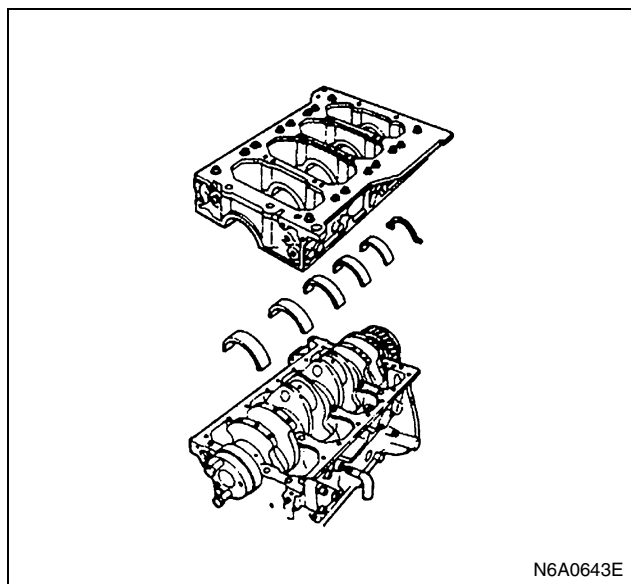
Notice:

When removing the crankcase, be sure to remove the oil pump and the generator bracket before that.



60. Thrust Bearing Lower

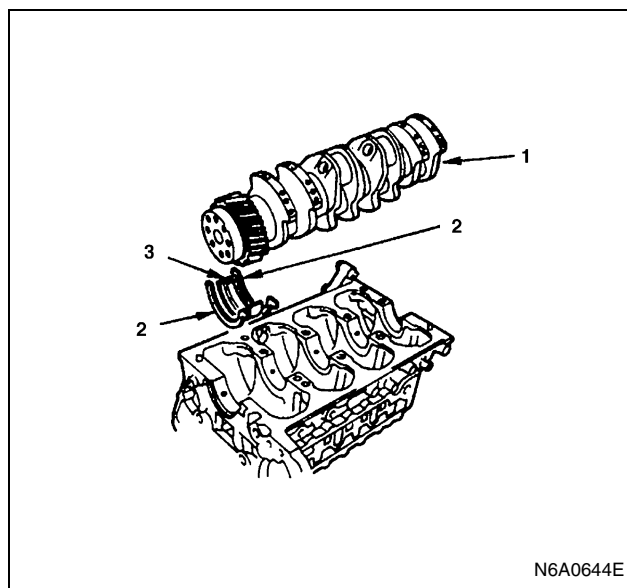
61. Crankshaft Bearing Lower



62. Crankshaft Assembly

63. Thrust Bearing Upper

64. Crankshaft Bearing Upper



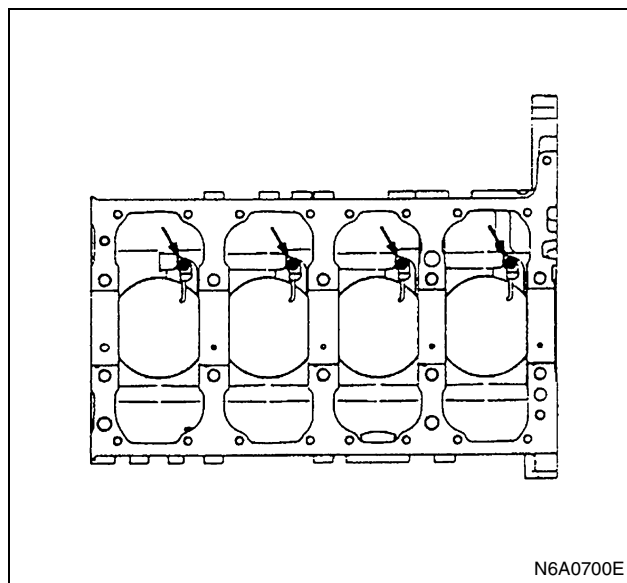
Legend

1. Crankshaft assembly
2. Thrust bearing upper
3. Crankshaft bearing upper

65. Oiling Jet

Loosen the check valves to remove both the check valves and the oiling jets.

Take care not to bend or damage the oiling jets.



66. Cylinder Block

Installation

1. Cylinder Block

Use compressed air to thoroughly clean the inside and outside surfaces of the cylinder body, the oil holes, and the water jackets.

2. Oiling Jet

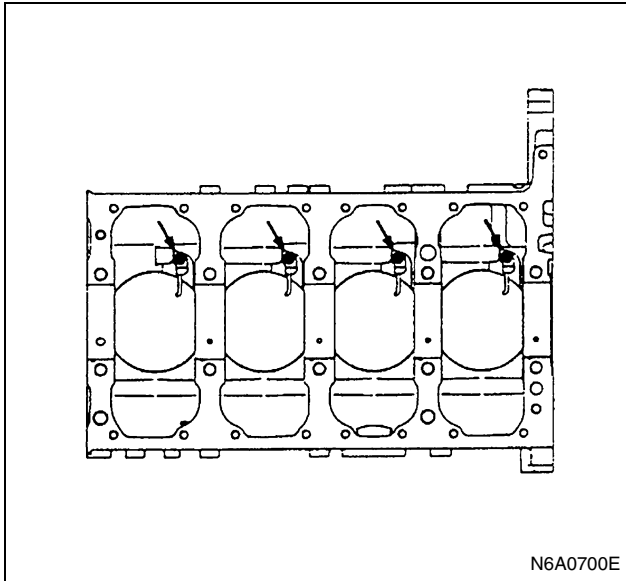
1) Install the oiling jets together with the check valves.

Take care not to damage the oiling jet nozzles.

- 2) Tighten the check valves and oiling jets to the specified torque.

Tighten:

Check valve and oiling jet to 21 N·m (2.1 kg·m/15 lb·ft)

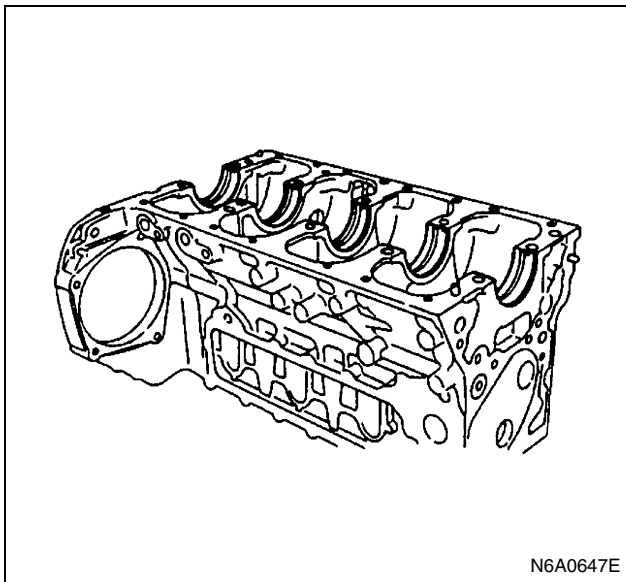


3. Crankshaft Bearing Upper

When replacing the crankshaft or the crankshaft bearing with a new one, select the crankshaft bearing according to the respective grades stamped on the crankshaft and the cylinder body.

Refer to the "CRANKSHAFT" in section 6A.

All upper bearings have oil grooves.



- 1) Carefully wipe any foreign material from the upper bearing.

Caution:

Do not apply engine oil to the bearing back faces and the cylinder body bearing fitting surface.

- 2) Locate the position mark applied at disassembly if the removed upper bearings are to be re-used.

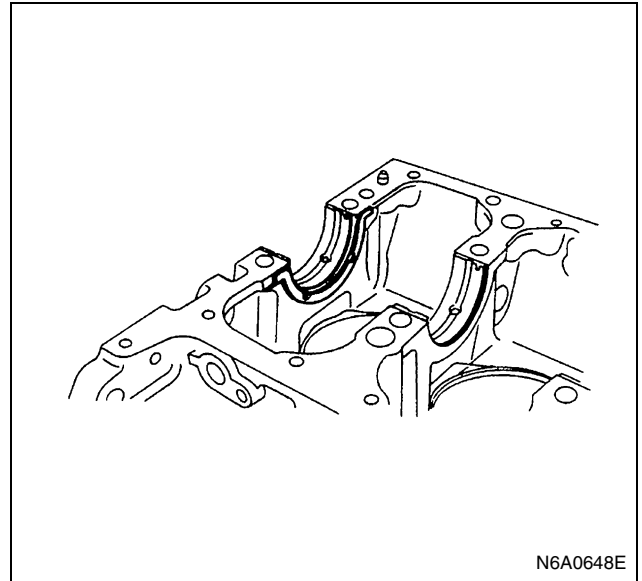
4. Thrust Bearing Upper

Install the thrust bearing upper to the front side of the cylinder body No.5 journal. At this time, the thrust bearing upper may be pasted to the cylinder body with grease.

However, be sure to wipe off any excessive grease.

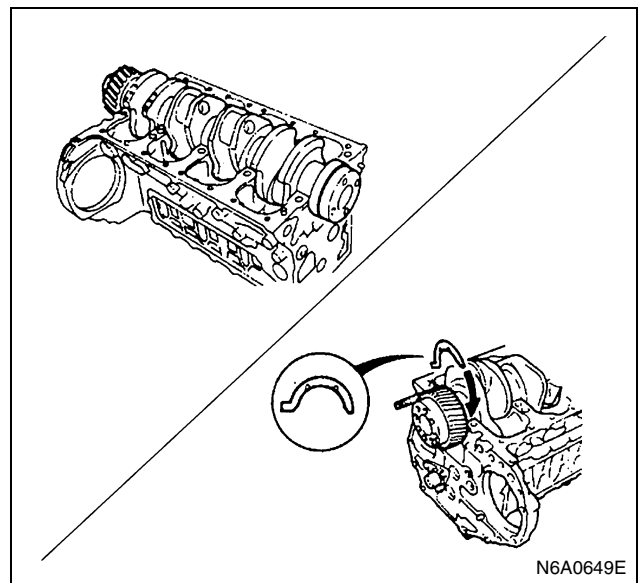
Caution:

The thrust bearing oil grooves must be facing the sliding faces.



5. Crankshaft Assembly

Apply an ample coat of engine oil to the crankshaft journals and the crankshaft bearing surfaces before installing the crankshaft with timing gear.



6. Crankshaft Bearing Lower

All lower bearings do not have oil grooves.

- 1) Carefully wipe any foreign material from the lower bearing.

Caution:

Do not apply engine oil to the bearing back faces and the crankcase bearing fitting surfaces.

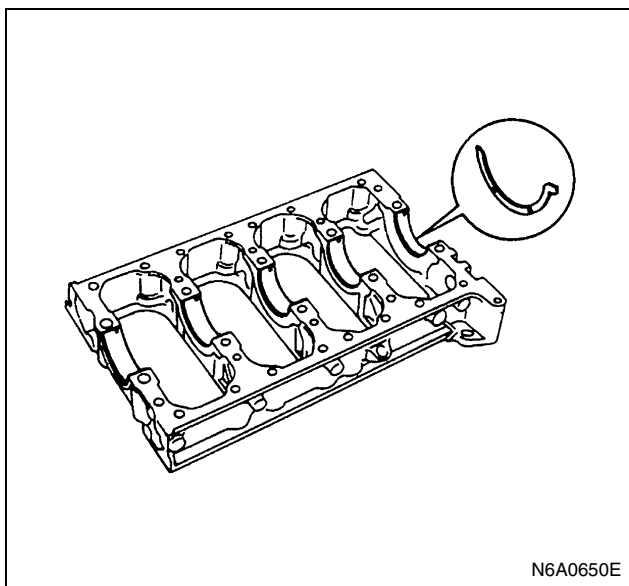
- 2) Locate the position mark applied at disassembly if the removed lower bearings are to be re-used.

7. Thrust Bearing Lower

Install the thrust bearing lower to the rear side of the crankcase No.5 journal.

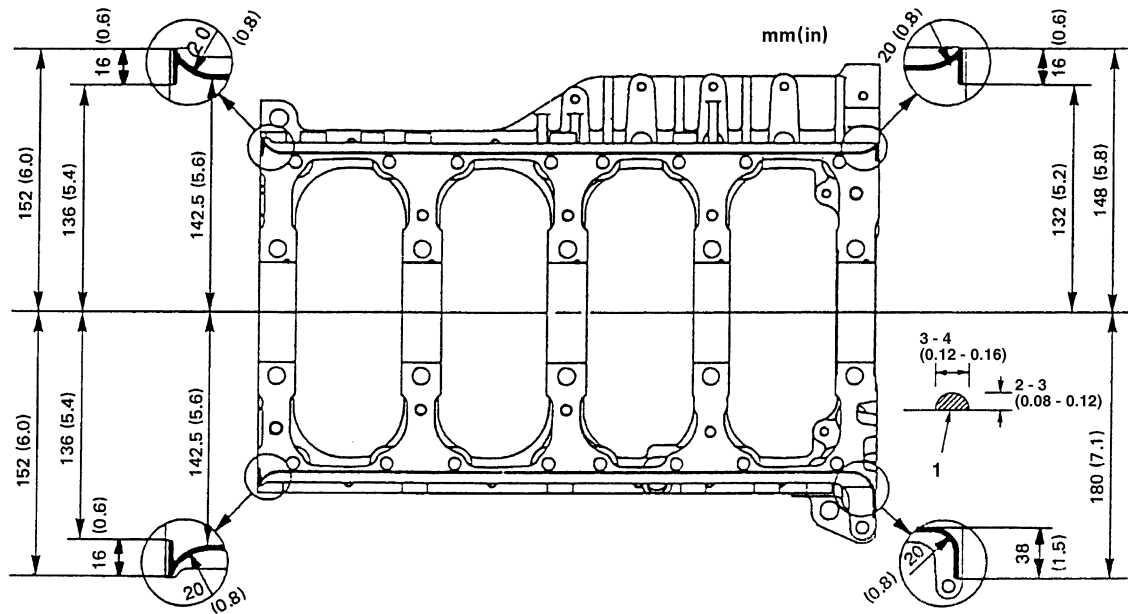
Caution:

The thrust bearing oil grooves must be facing the sliding faces.



8. Crankcase

- 1) Apply a 3 mm (0.12 in) bead of recommended liquid gasket (Three Bond 1207C) or its equivalent to the crankcase upper surface as shown in the illustration.
- 2) Carefully place the crankcase on the cylinder body.
 - Install the crankcase within 20 minutes after application of liquid gasket.



N6A1622E

Legend

1. Liquid gasket

- 3) Tighten the crankcase to the specified torque in the numerical order shown in the illustration.

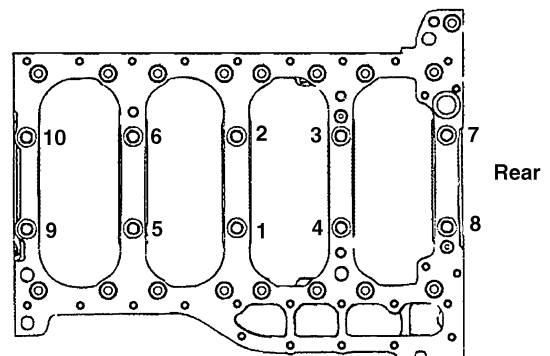
Tighten:

Crankcase bolt (M14: (1) — (10)) to

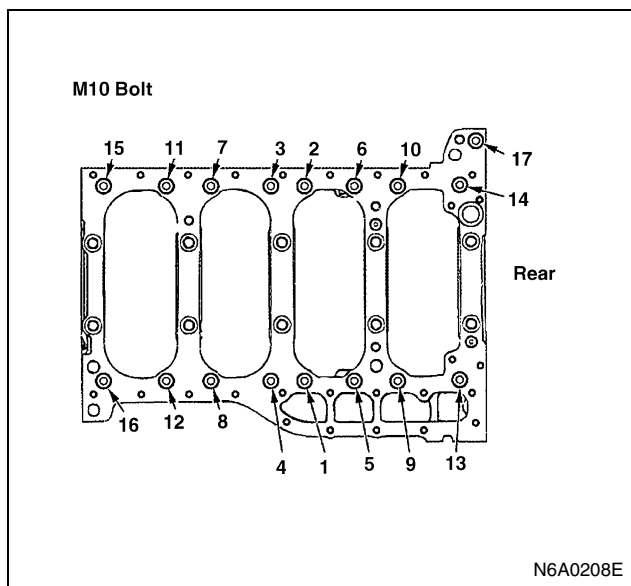
- 1st step: 98 N·m (10 kg·m/72 lb·ft)
- 2nd step: 132 N·m (13.5 kg·m/98 lb·ft)
- 3rd step: 30 — 60°

Crankcase bolt (M10: (1) — (17)) to 37 N·m (3.8 kg·m/27 lb·ft)

Angle gauge: 5-8840-0266-0

M14 Bolt

N6A1415E

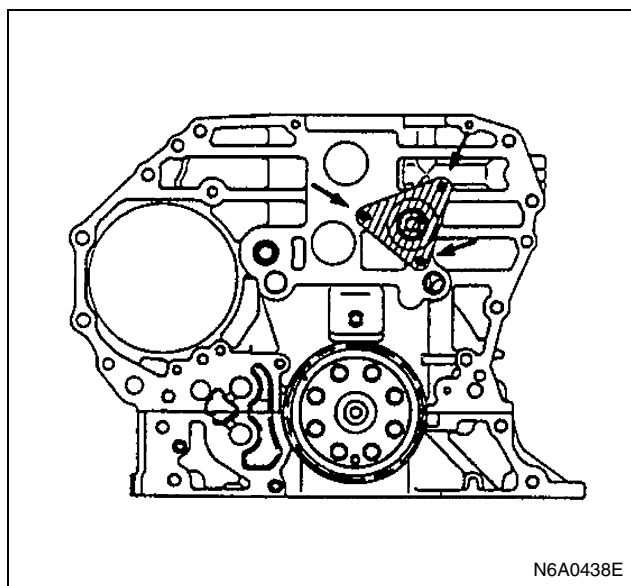


9. Piston and Connecting Rod Assembly
10. Connecting Rod Bearing
11. Connecting Rod Cap
Above works refer to "PISTON AND CONNECTING ROD" section in this manual.
12. Oil Pump Assembly
Above works refer to "OIL PUMP ASSEMBLY" section in this manual.
13. Idle Gear B Shaft

Tighten:

Idle gear B shaft bolt to 31 N·m (3.2 kg·m/23 lb·ft)

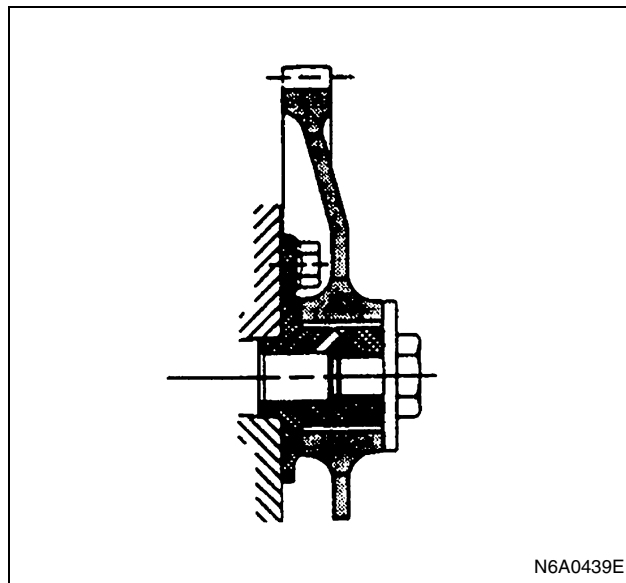
Apply the engine oil to the idle gear shaft after installation.



14. Idle Gear B
The face of the idle gear B with longer boss should be positioned toward the rear side shown in the illustration

Tighten:

Idle gear B bolt to 110 N·m (11.2 kg·m/81 lb·ft)

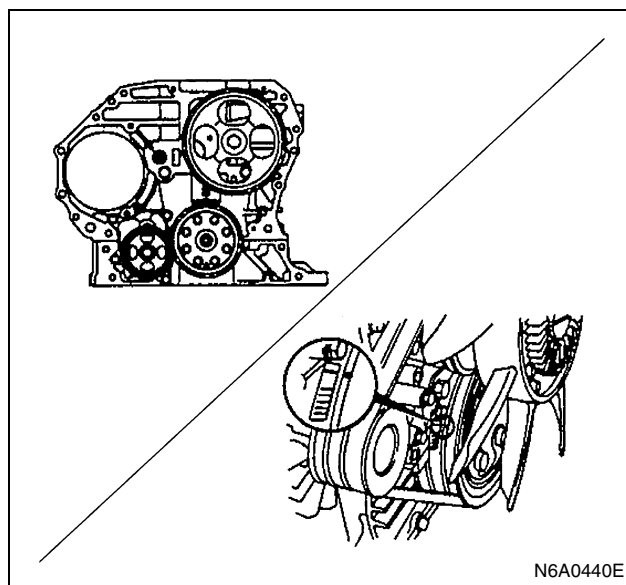


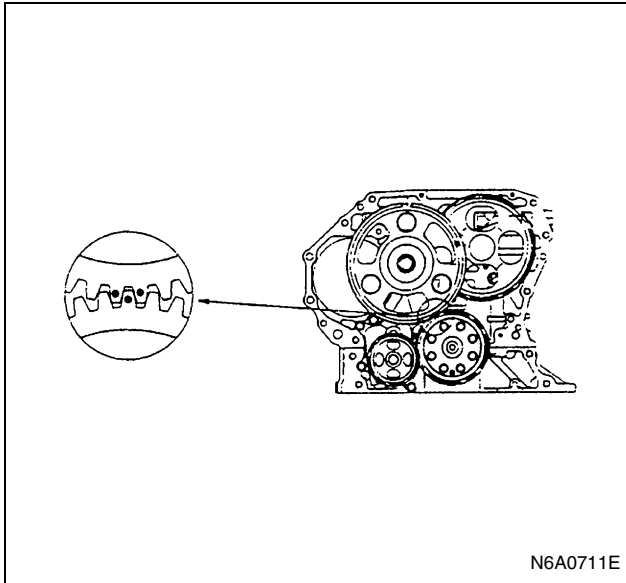
15. Idle Gear A

- 1) Turn the crankshaft clockwise so that the engagement mark of the crankshaft gear faces to the shaft center of the idle gear A and the No.1 cylinder piston comes to the top dead center.
- 2) Align the crankshaft gear with the engagement mark of the idle gear and install the idle gear A.

Tighten:

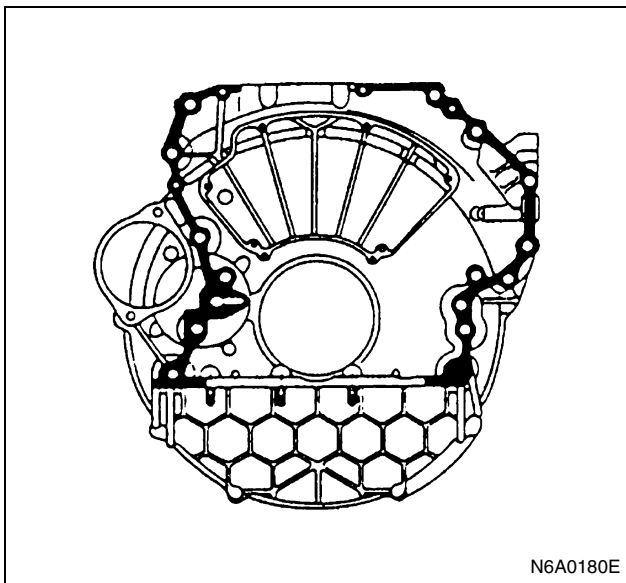
Idle gear A bolt to 133 N·m (13.6 kg·m/98 lb·ft)





16. Flywheel Housing

- 1) Carefully wipe any foreign material from the cylinder body rear face.
- 2) Apply the recommended liquid gasket (Three Bond 1207C) or its equivalent to the shaded areas shown in the illustration.

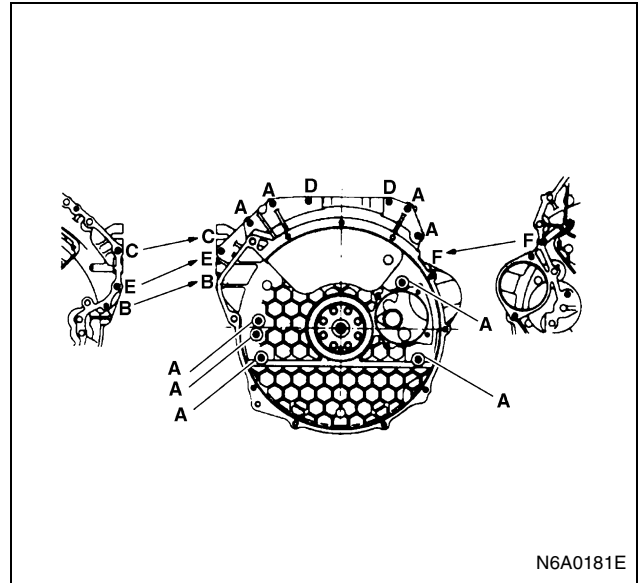


- 3) Align the cylinder body knock pins with the flywheel housing knock pin holes.
- 4) Tighten the flywheel housing bolts to the specified torque shown in the illustration.

Tighten:

Flywheel housing bolt to

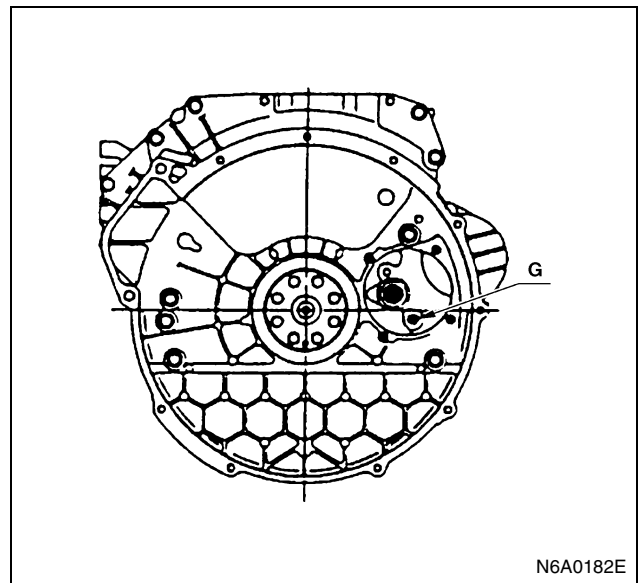
- (A): 96 N·m (9.8 kg·m/71 lb·ft)
- (B): 48 N·m (4.9 kg·m/35 lb·ft)
- (C): 94 N·m (9.6 kg·m/69 lb·ft)
- (D): 25 N·m (2.6 kg·m/19 lb·ft)
- (E): 76 N·m (7.7 kg·m/56 lb·ft)
- (F): 48 N·m (4.9 kg·m/35 lb·ft)



- Tighten the bolts marked with "E" or "B" from the injection pump side, and those with "F" from the cylinder body side.

Tighten:

Flywheel housing bolt (G) to 96 N·m (9.8 kg·m/71 lb·ft)

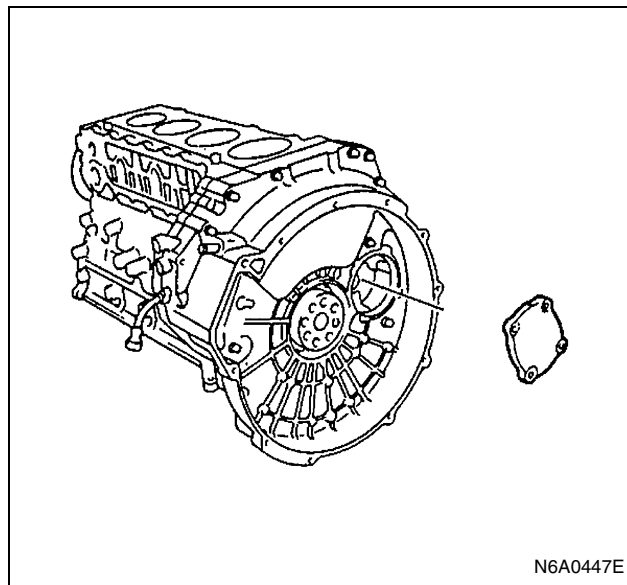
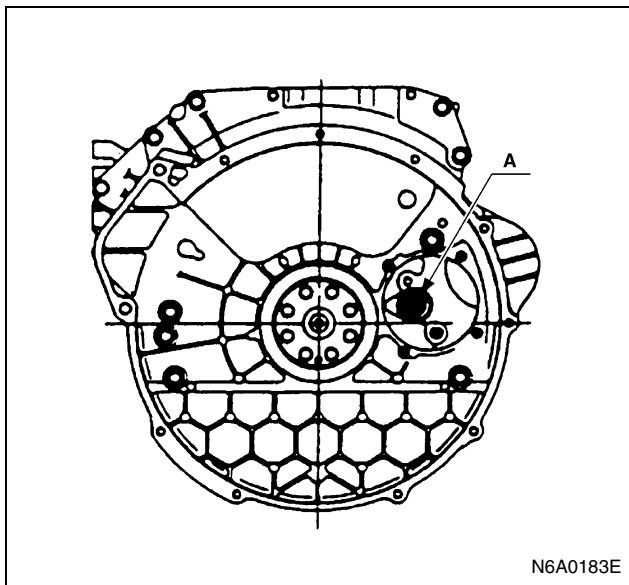


17. Power Steering Pump Idle Gear

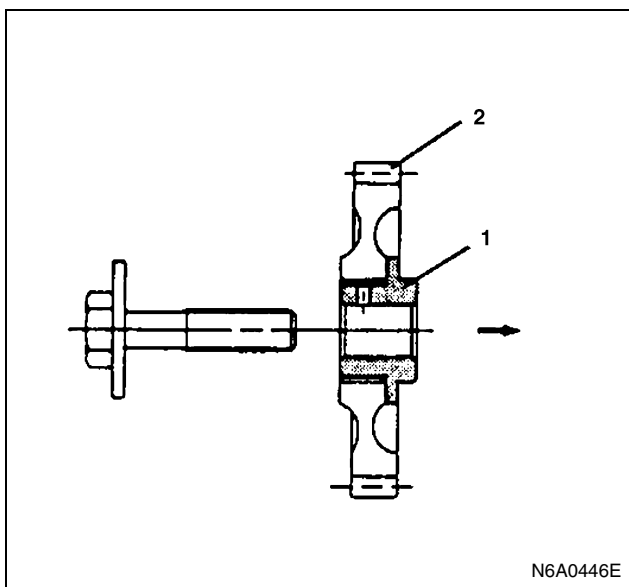
- 1) Apply the engine oil to the idle gear shaft.
- 2) Install the idle gear shaft (1) with the idle gear (2) to the cylinder body A portion as shown in the illustration.

Tighten:

Idle gear shaft bolt to 133 N·m (13.6 kg·m/98 lb·ft)



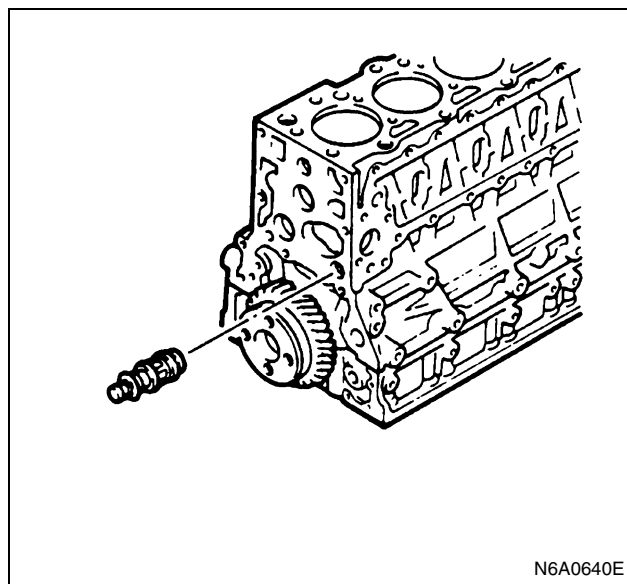
19. Oil Thermo Valve (4HF1, 4HF1-2, 4HG1, 4HG1-T)
Insert the oil thermo valve into the cylinder body.



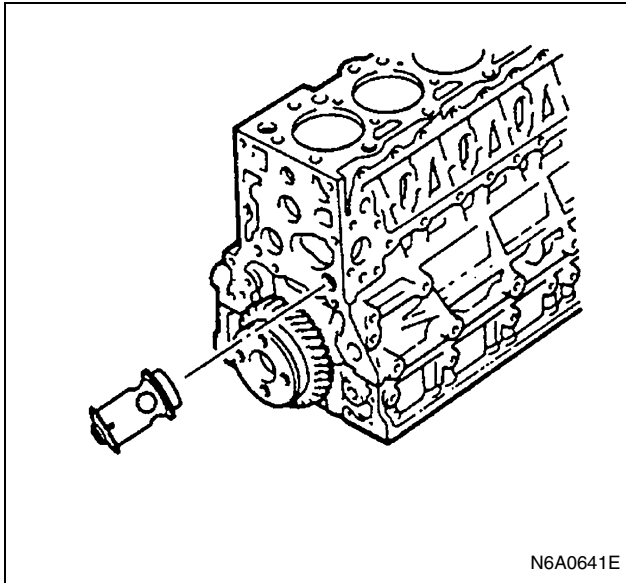
18. Power Steering Pump Idle Gear Cover
Install the gear cover with the O-ring.

Tighten:

Gear cover bolt to 19 N·m (1.9 kg·m/14 lb·ft)



20. Bypass Valve (4HE1-TC)
Insert the bypass valve into the cylinder body.

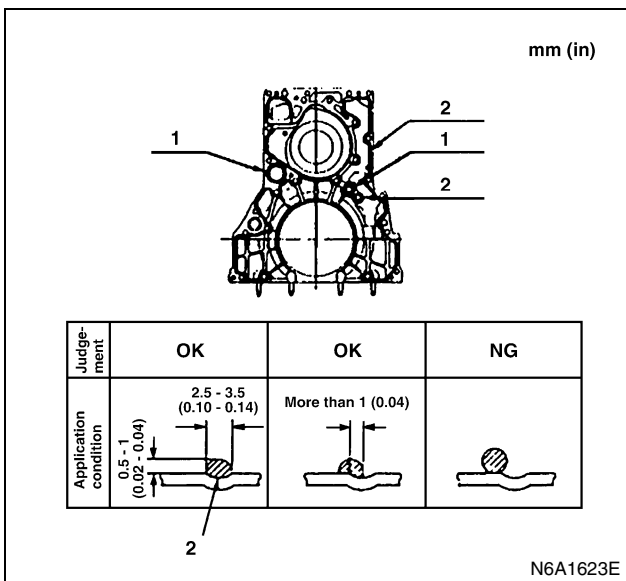


21. Front Retainer

- 1) Carefully wipe any foreign material from the cylinder body front face.
- 2) Apply a 2.5 — 3.5 mm (0.10 — 0.14 in) bead of the recommended liquid gasket (Three Bond 1207C) or its equivalent on the groove of the front retainer fitting surface shown in the illustration.
- 3) Install the O-rings (2 pieces) to the front retainer.
 - Install the front retainer within 7 minutes after application of the liquid gasket.
 - For the dislocation of liquid gasket, refer to the illustration.
- 4) Align the cylinder body knock pins with the front retainer knock pin holes.

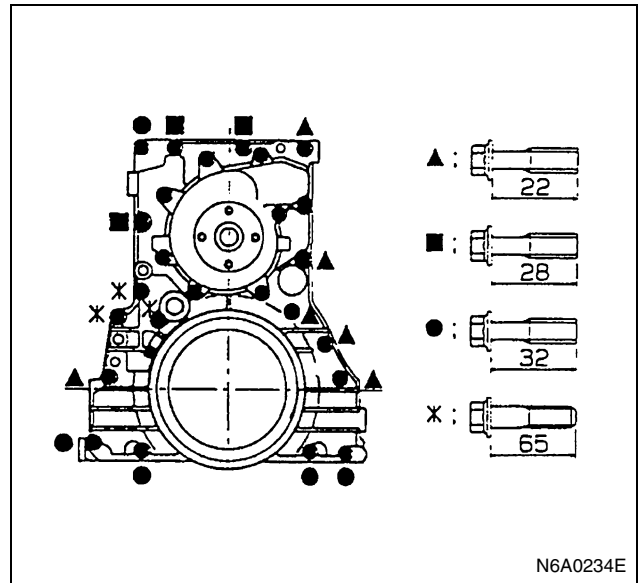
Tighten:

Front retainer bolt to 24 N·m (2.4 kg·m/17 lb·ft)



Legend

1. O-ring
2. Liquid gasket



22. Water Pump Assembly

- 1) Apply 3 — 4 mm (0.12 — 0.16 in) bead of the recommended liquid gasket (Three Bond 1207C) or its equivalent on the water pump fitting surface.
- 2) Install the water pump to the front retainer.

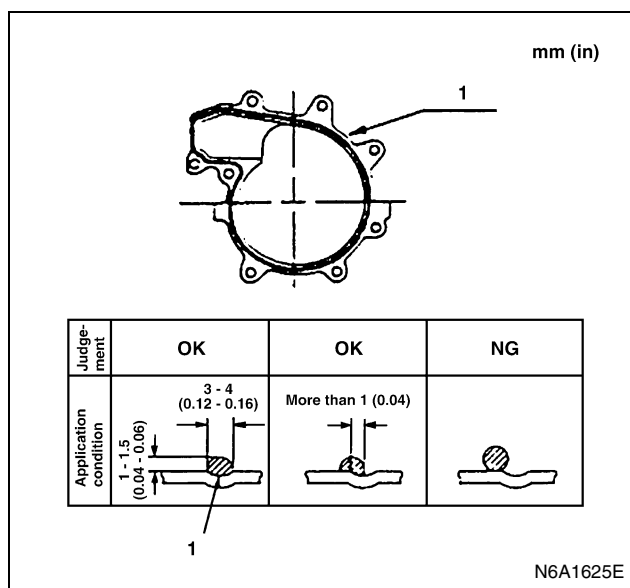
Tighten:

Water pump bolt to 24 N·m (2.4 kg·m/17 lb·ft)

- Install the water pump within 7 minutes after application of liquid gasket.
- For the dislocation of liquid gasket, refer to the illustration.

Caution:

The water pump clamping bolt is also used to tighten the front retainer. So, install the water pump before liquid gasket gets dry immediately after installation of the front retainer.

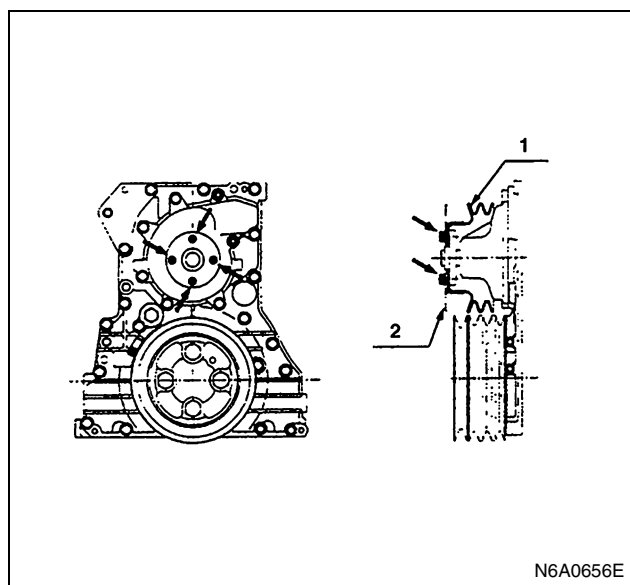
**Legend**

1. Liquid gasket

23. Water Pump Pulley

Tighten:

Water pump pulley bolt to 24 N·m (2.4 kg·m/17 lb·ft)

**Legend**

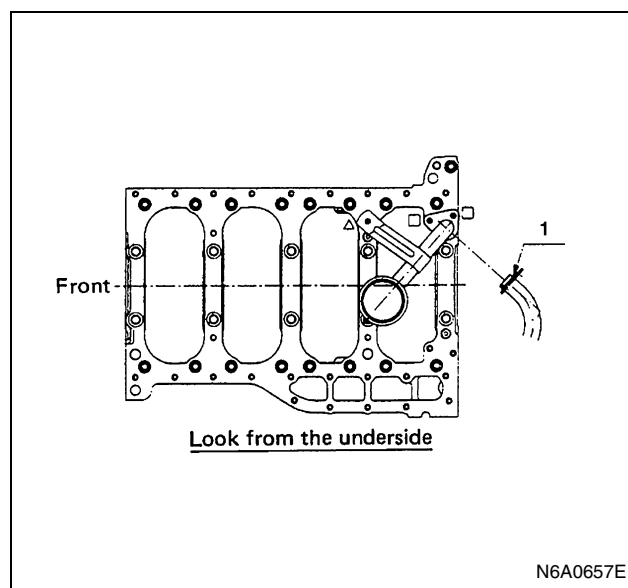
1. Pulley
2. Set plate

24. Oil Pump Strainer

Install the O-ring (1) to the oil pump strainer pipe and install the oil pump strainer to the cylinder body shown in the illustration.

Tighten:

Oil pump strainer bolt to 24 N·m (2.4 kg·m/17 lb·ft)



25. Oil Pan

Above works refer to "OIL PAN" section in this manual.

26. Spacer Rubber

Above works refer to "OIL PAN" section in this manual.

27. Crankshaft Rear Slinger

28. Crankshaft Rear Oil Seal

Above works refer to "CRANKSHAFT REAR OIL SEAL" section in this manual.

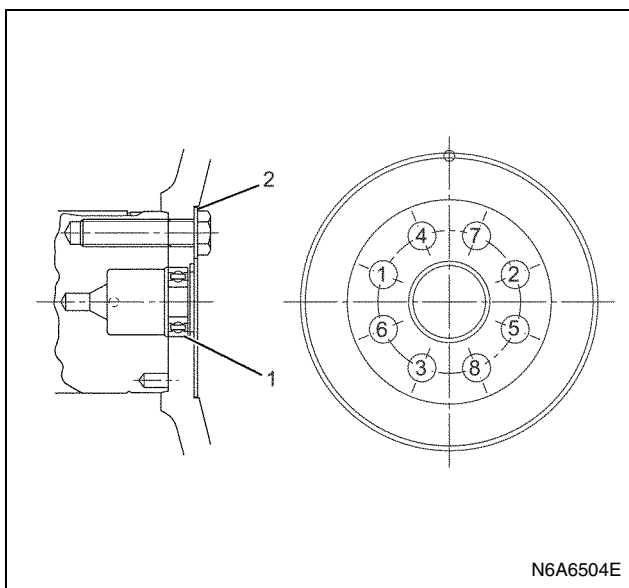
29. Flywheel Assembly

- 1) Align the flywheel with the crankshaft knock pin and temporarily tighten the flywheel bolts.
- 2) Use the crankshaft stopper to prevent the crankshaft from turning.
Crankshaft Stopper: 5-8840-2230-0
- 3) Install the washer and the flywheel bolts and tighten to the specified torque in the numerical order show in the illustration.

Tighten:

Flywheel bolt to

- 1st step: 78 N·m (8.0 kg·m/58 lb·ft)
- 2nd step: 90 — 120°

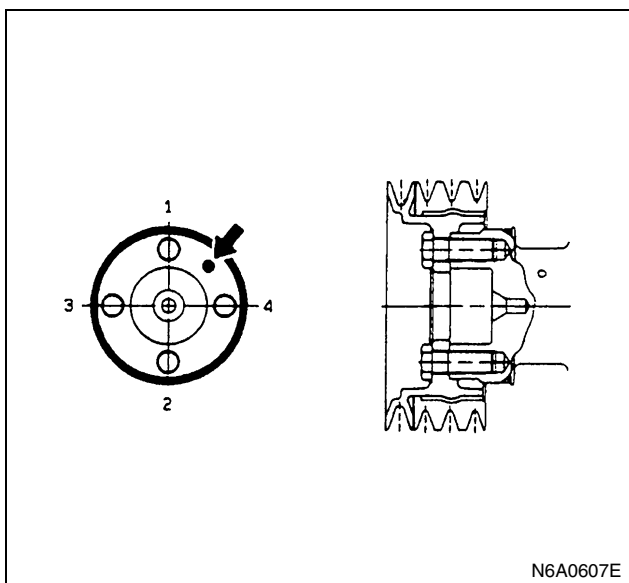
**Legend**

1. Washer
2. Pilot bearing

- 4) Remove the crankshaft stopper.
30. Crankshaft Front Slinger
31. Crankshaft Front Oil Seal
Above works refer to "CRANKSHAFT FRONT OIL SEAL" section in this manual.
32. Crankshaft Damper Pulley
 - 1) Apply a coat of the engine oil to the threads of the bolts.
 - 2) Align the damper pulley with the crankshaft knock pin and tighten the bolts to the specified torque in the numerical order.

Tighten:

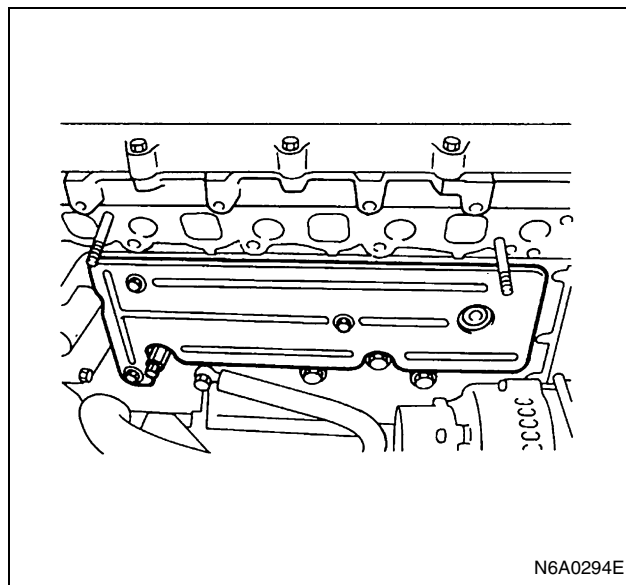
Damper pulley bolt to 200 N·m (20.4 kg·m/147 lb·ft)



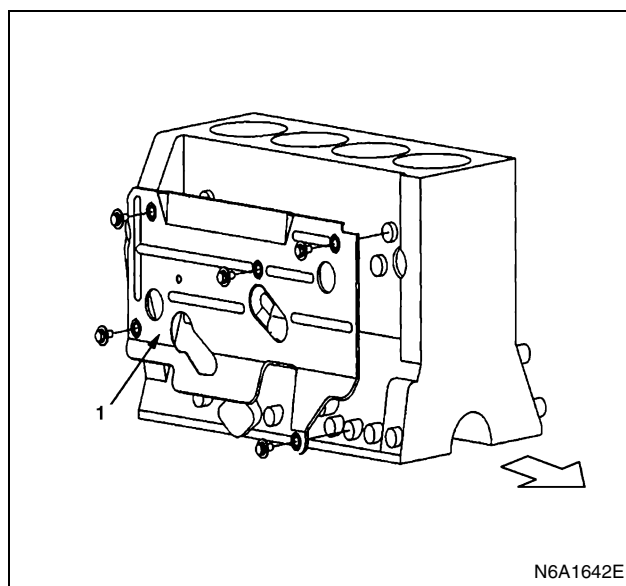
33. Cover

Tighten:

Cover Bolt to 13 N·m (1.3 kg·m/113 lb·in)

**4HE1-TC**

4HE1-TC engines use a larger rubber spacer than other engines.

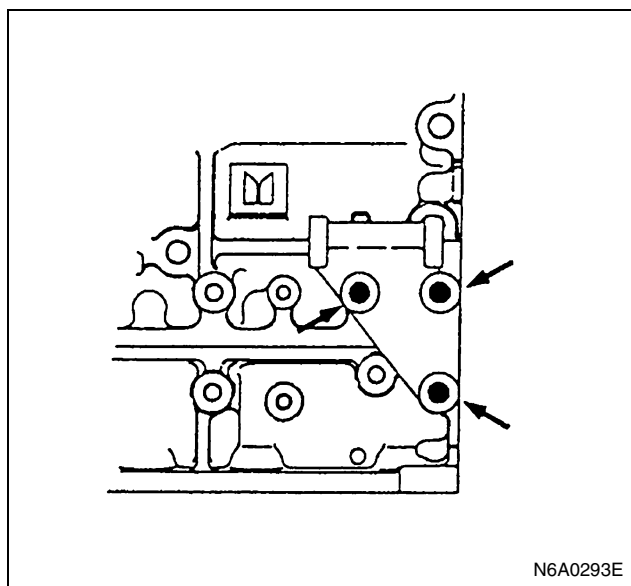
**Legend**

1. Cover

34. Generator Bracket

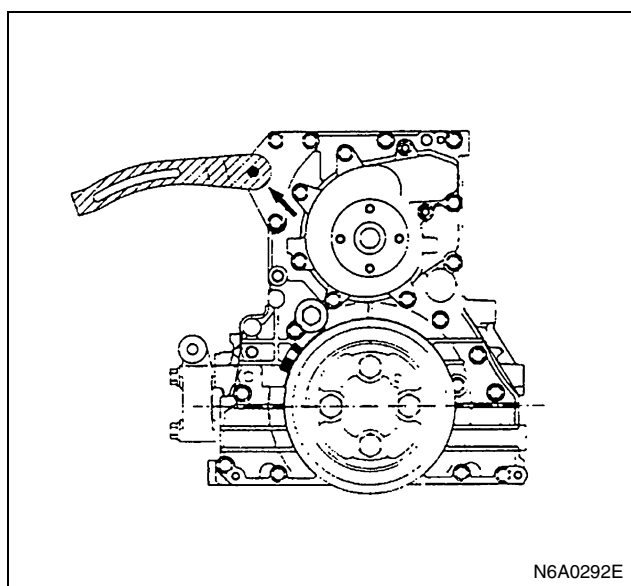
Tighten:

Generator bracket bolt to 48 N·m (4.9 kg·m/35 lb·ft)



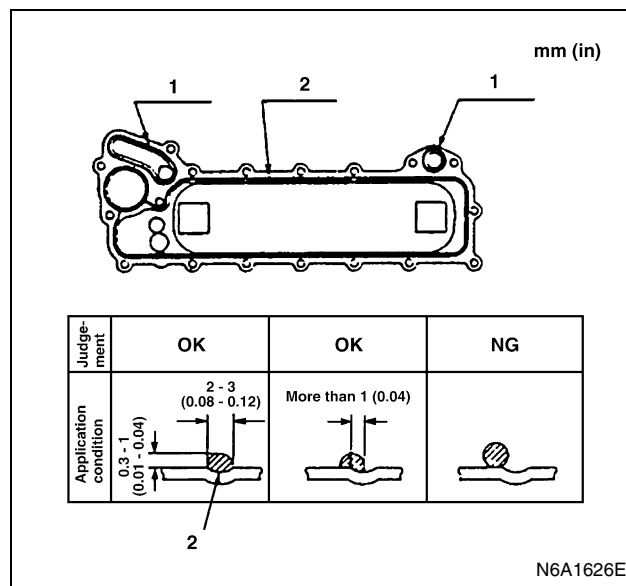
35. Fan Belt Adjust Plate

Install the adjust plate and temporarily tighten the adjust plate bolt.



36. Oil Cooler Assembly

- 1) Apply 2 — 3 mm (0.08 — 0.12 in) bead of the recommended liquid gasket (Three Bond 1207C) or its equivalent on the oil cooler fitting surface.
- 2) Apply a coat of engine oil to the O-rings (2 pieces) and install the O-rings to the oil cooler.

**Legend**

1. O-ring
2. Liquid gasket

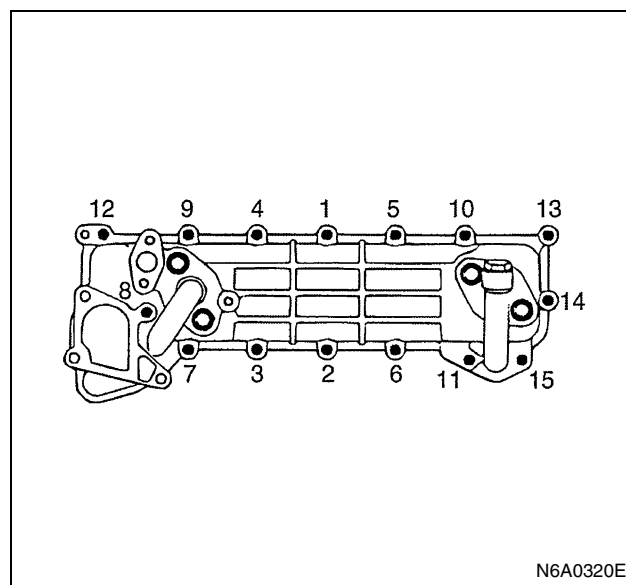
Notice:

Take care that the O-ring does not get smeared with liquid gasket.

- Install the oil cooler within 7 minutes after application of the liquid gasket.
 - For the dislocation of the liquid gasket, refer to the illustration.
- 3) Tighten the oil cooler bolts and nut to the specified torque a little at a time in the sequence shown in the illustration.

Tighten:

Oil cooler bolt and nut to 24 N·m (2.4 kg·m/17 lb·ft)

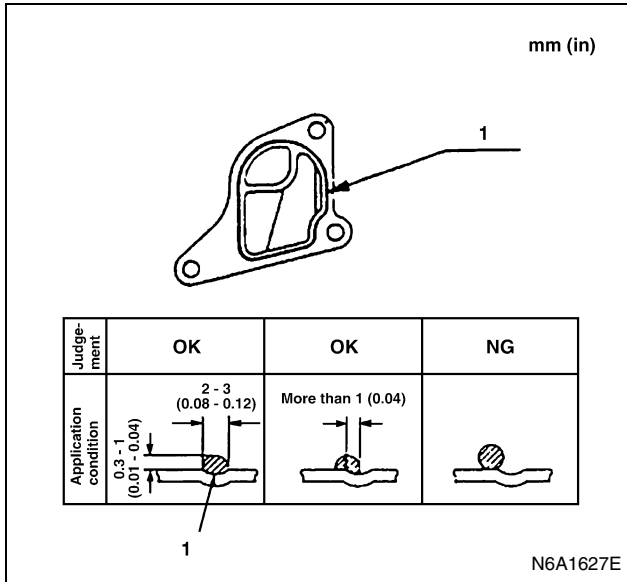


37. Water Suction Pipe

- 1) Apply a 2 — 3 mm (0.12 — 0.16 in) bead of the recommended liquid gasket (Three Bond

1207C) or its equivalent on the groove of the water suction pipe fitting surface.

- 2) Install the water suction pipe to the oil cooler.
 - For the dislocation of liquid gasket, refer to the illustration.



Legend

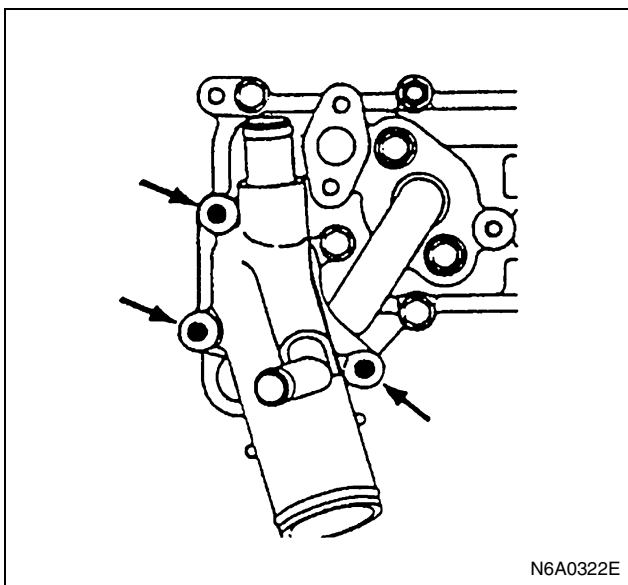
1. Liquid gasket

Tighten:

Water suction pipe bolt and nuts to 24 N·m (2.4 kg·m/17 lb·ft)

Notice:

Install the water suction pipe immediately after the installation of the oil cooler.

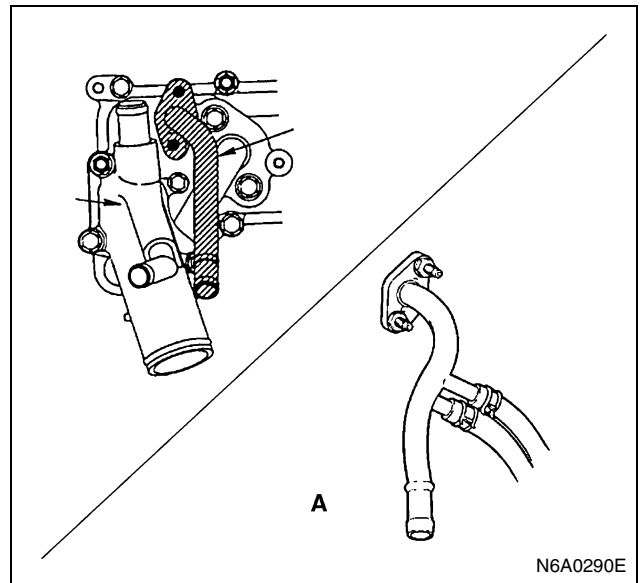


38. Heater Pipe

- 1) Install the O-ring to the heater pipe.
- 2) Install the heater pipe to the oil cooler.

Tighten:

Heater pipe bolt to 24 N·m (2.4 kg·m/17 lb·ft)



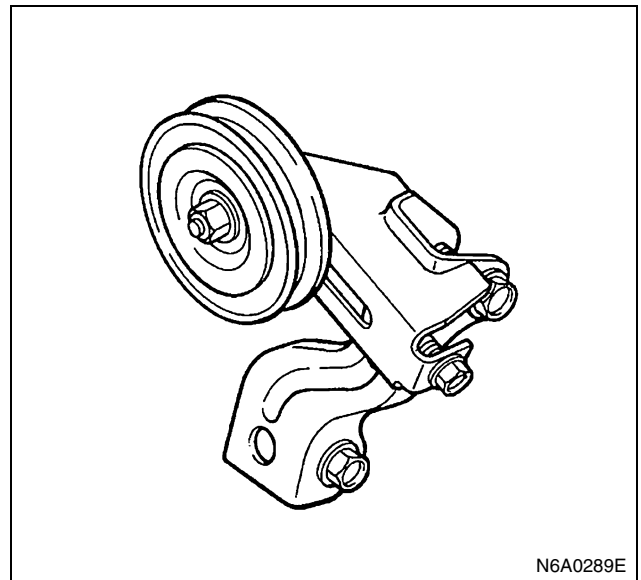
Legend

- A. 4HF1-2

39. Idle Pulley Bracket (If equipped with A/C)

Tighten:

Idle pulley bracket bolt to 48 N·m (4.9 kg·m/35 lb·ft)



40. Injection Pump Rubber Spacer

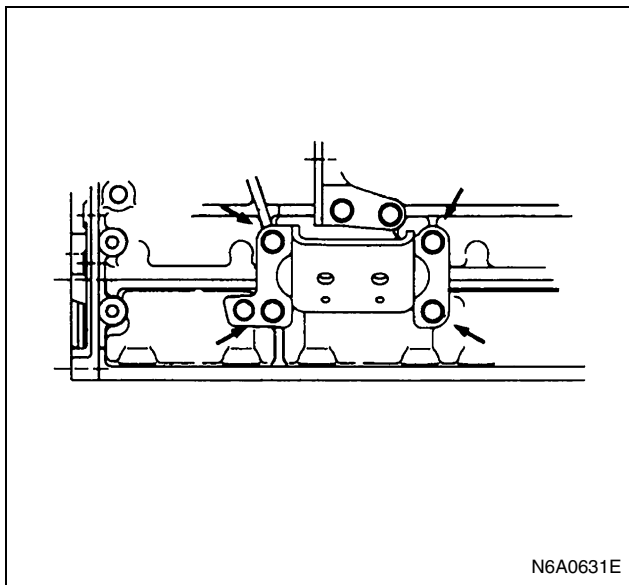
41. Injection Pump Assembly

Above works refer to "INJECTION PUMP ASSEMBLY" section in this manual.

42. Engine Foot

Tighten:

Engine foot bolt to 51 N·m (5.2 kg·m/38 lb·ft)

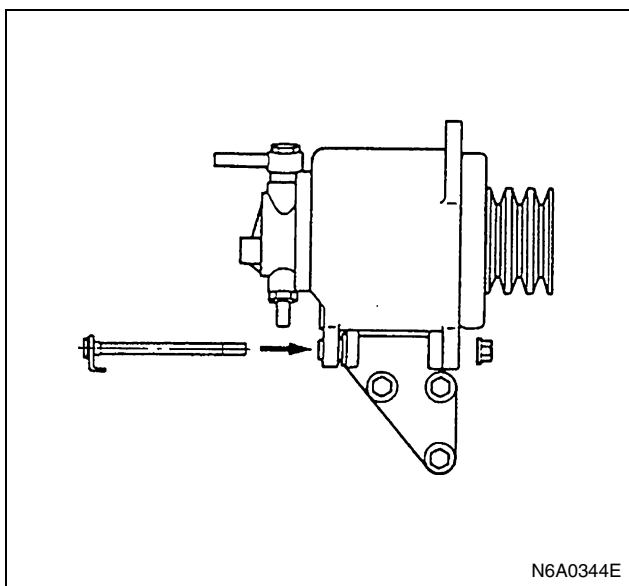


43. Generator

Notice:

When tightening the generator, tighten in advance the fan belt temporarily after its adjustment.

- Insert through the lower fixing bolt from the rear side as shown in the illustration, and tighten it with a nut on the front side.



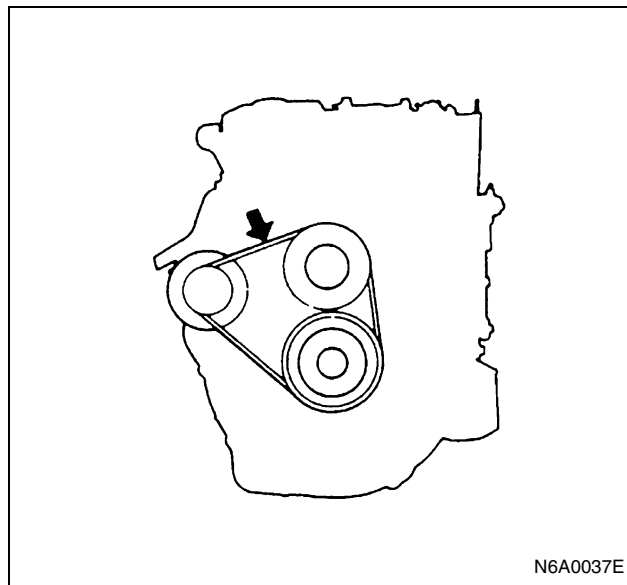
44. Fan Belt

Check the drive belt tension.

Depress the drive belt mid-portion with a 98 N (10 kg/22 lb) force.

Drive Belt Deflection	mm (in)
8 — 12 (0.31 — 0.47) ... New belt	
10 — 14 (0.39 — 0.55) ... Reuse belt	

Check the drive belt for cranking and other damage.

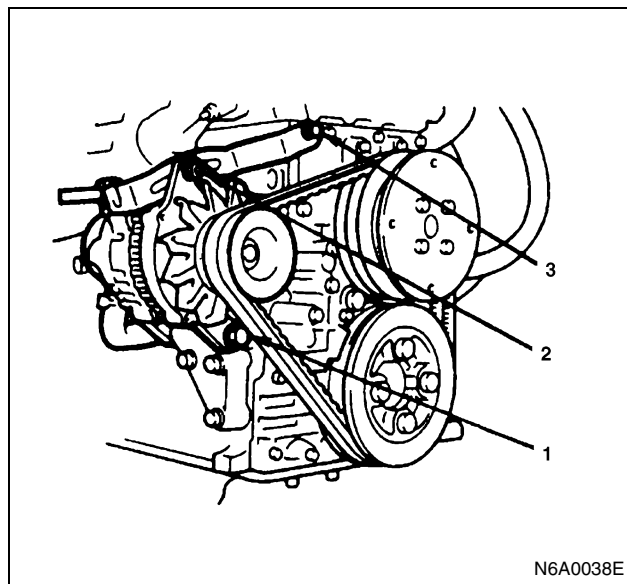
**Fan Belt Adjustment**

Fan belt tension is adjusted by moving the generator.

Tighten:

Bolt to

- (1): 40 N·m (4.1 kg·m/30 lb·ft)
- (2): 24 N·m (2.4 kg·m/17 lb·ft)
- (3): 46 N·m (4.7 kg·m/34 lb·ft)



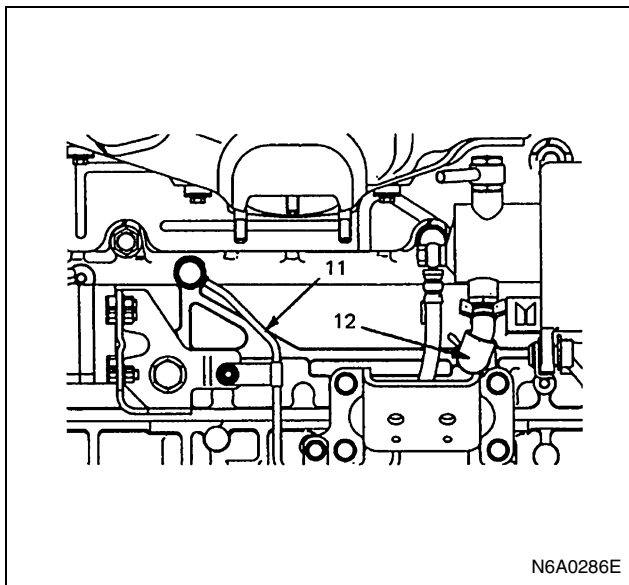
45. Vacuum Pump Rubber Hose (12)

46. Vacuum Pump Oil Pipe (11)

Tighten:

Vacuum pump oil pipe to

- Cylinder body side: 41 N·m (4.2 kg·m/30 lb·ft)
- Generator side: 23 N·m (2.3 kg·m/17 lb·ft)

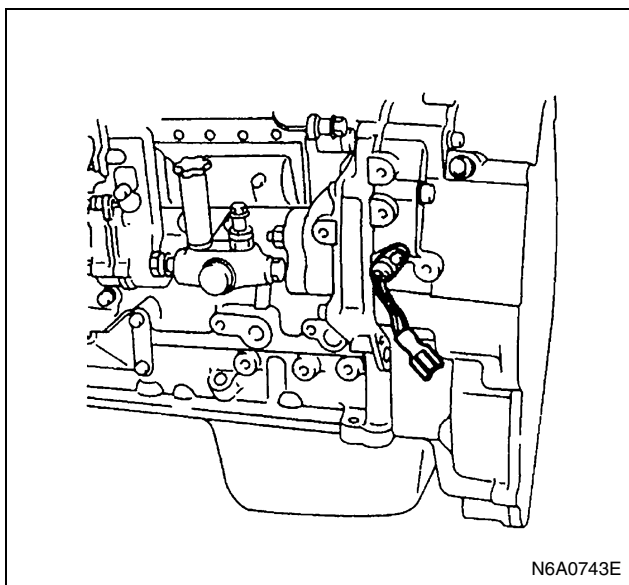


N6A0286E

- 47. Fuel Pipe Bracket
- 48. Tachometer Sensor

Tighten:

Tachometer bolt to 8 N·m (0.8 kg·m/69 lb·in)

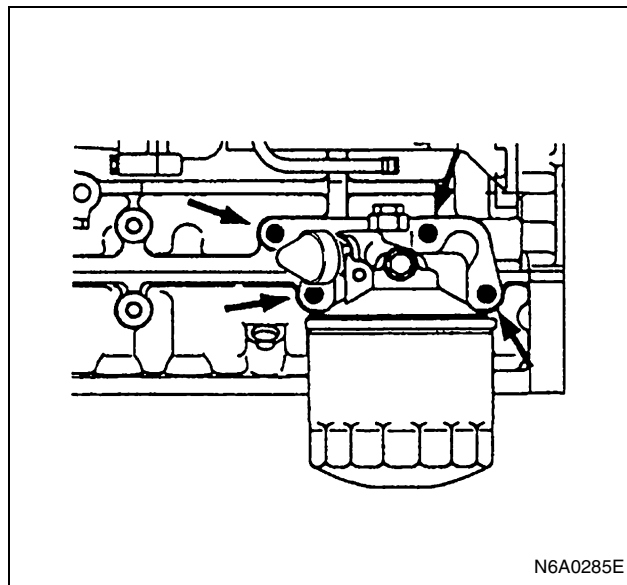


N6A0743E

- 49. Oil Filter Assembly

Tighten:

Oil filter bolt to 8 N·m (4.9 kg·m/35 lb·ft)



N6A0285E

- 50. Oil Pipe

Tighten:

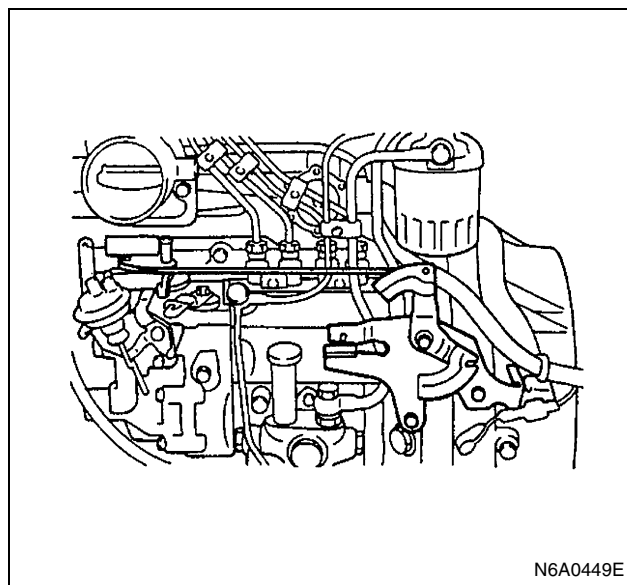
Oil pipe joint bolt to 17 N·m (1.7 kg·m/12 lb·ft)

- 51. Engine Control Lever Assembly

Tighten:

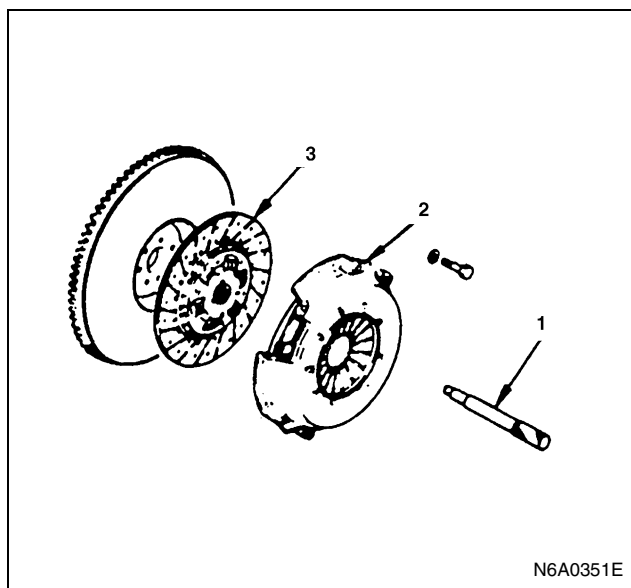
Engine control lever bolt to 24 N·m (2.4 kg·m/17 lb·ft)

- 52. Engine Control Wire



N6A0449E

- 53. Driven Plate
Use the clutch pilot aligner to install the driven plate.
Clutch Pilot Aligner: 5-8840-2240-0



Legend

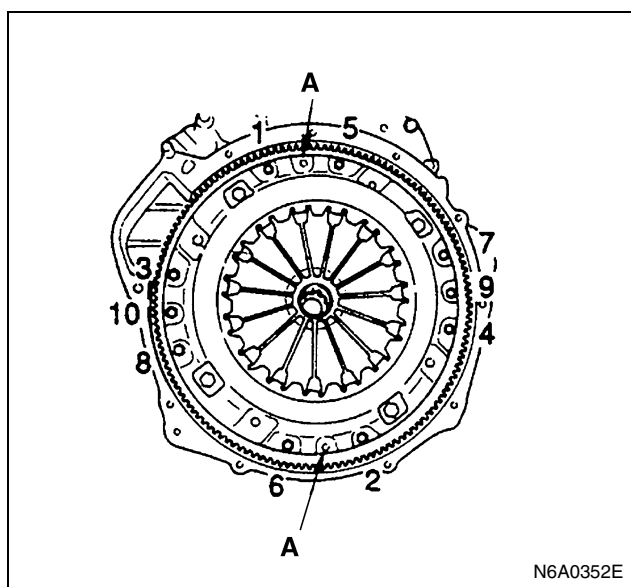
1. Clutch pilot aligner
2. Clutch pressure plate assembly
3. Driven plate

54. Clutch Pressure Plate Assembly

- 1) Align the clutch pressure plate with the flywheel knock pin.
- 2) Tighten the pressure plate bolts to the specified torque in numerical order.

Tighten:

Clutch pressure plate bolt to 40 N·m (4.1 kg·m/30 lb·ft)



Legend

- A. Knock pin

55. Cylinder Head Gasket

56. Cylinder Head Assembly

Above works refer to "CYLINDER HEAD" section in this manual.

57. Camshaft Bearing Lower

58. Camshaft Assembly

59. Camshaft Bearing Upper

60. Camshaft Bearing Cap

61. Valve Cap

Above works refer to "CAMSHAFT ASSEMBLY" section in this manual.

62. Rocker Arm Shaft Assembly

Above works refer to "ROCKER ARM SHAFT ASSEMBLY" section in this manual.

63. Head Cover Gasket

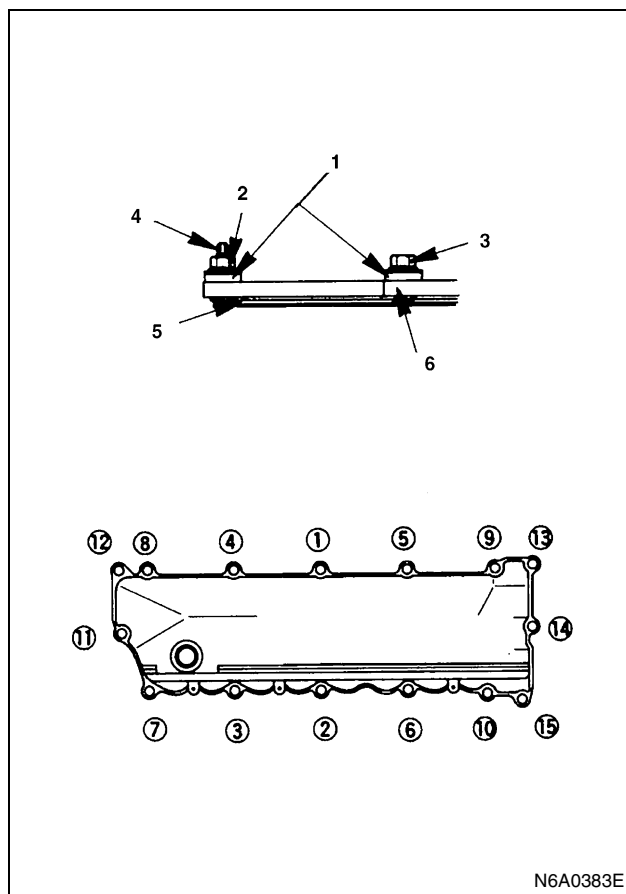
Above works refer to "CYLINDER HEAD" section in this manual.

64. Cylinder Head Cover

- 1) Install the cylinder head cover.
- 2) Tighten the cylinder head cover nuts and bolts to the specified torque in the numerical order shown in the illustration.

Tighten:

Cylinder head cover nut and bolt to 18 N·m (1.8 kg·m/13 lb·ft)



Legend

1. Mounting rubber
 2. Nut
 3. Bolt
 4. Stud bolt
 5. Gasket
 6. Head cover
-

65. Nozzle Cover

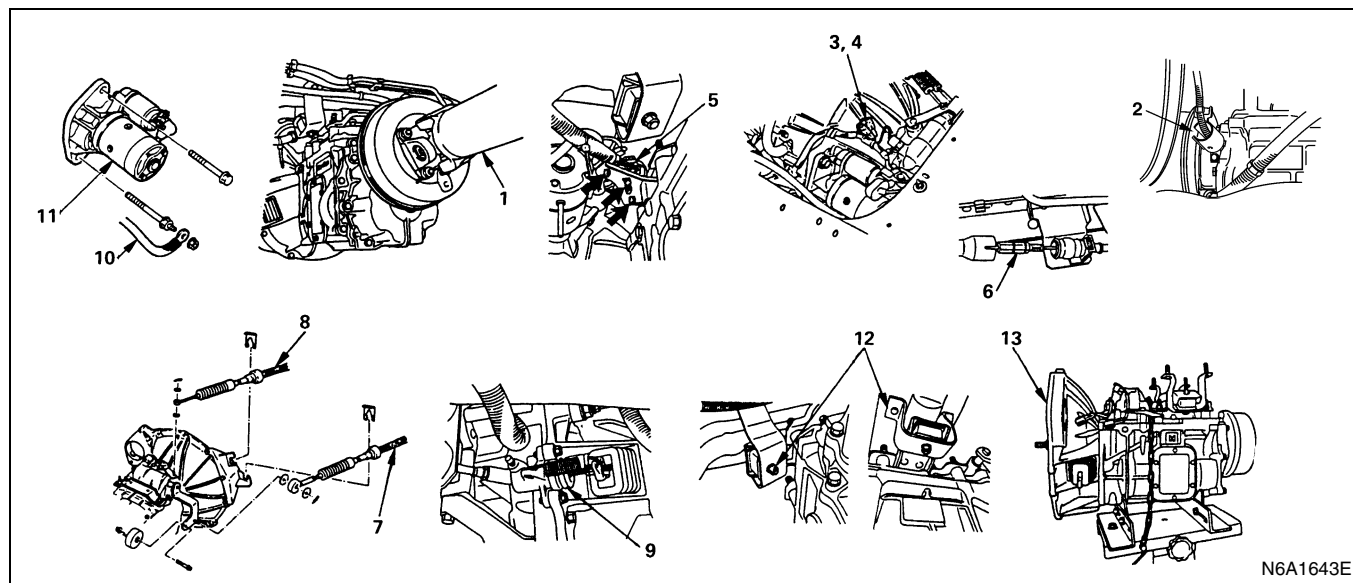
66. Engine Assembly

Above works refer to "ENGINE ASSEMBLY" section in this manual.

ENGINE ASSEMBLY

Component

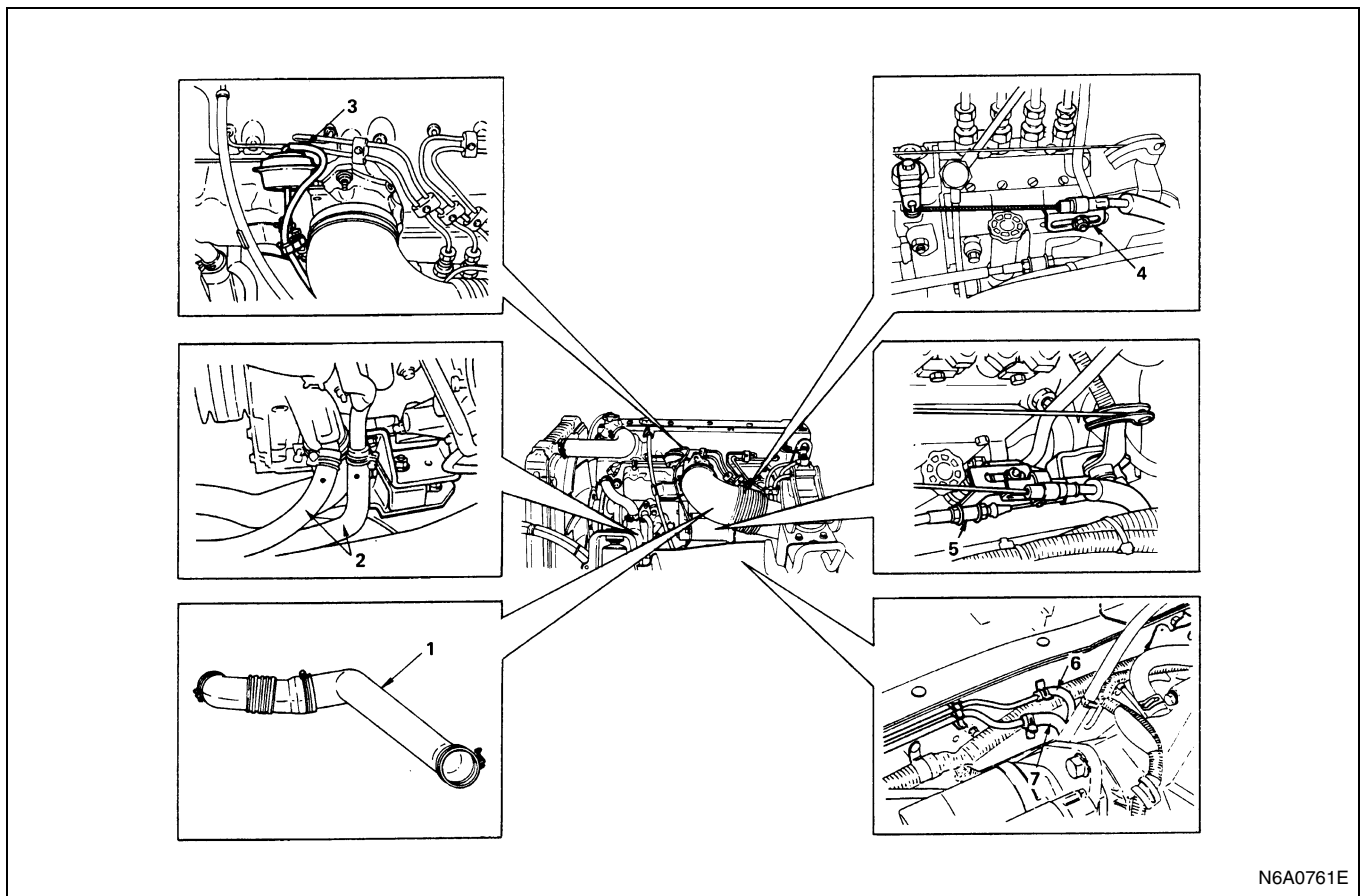
Transmission Side



N6A1643E

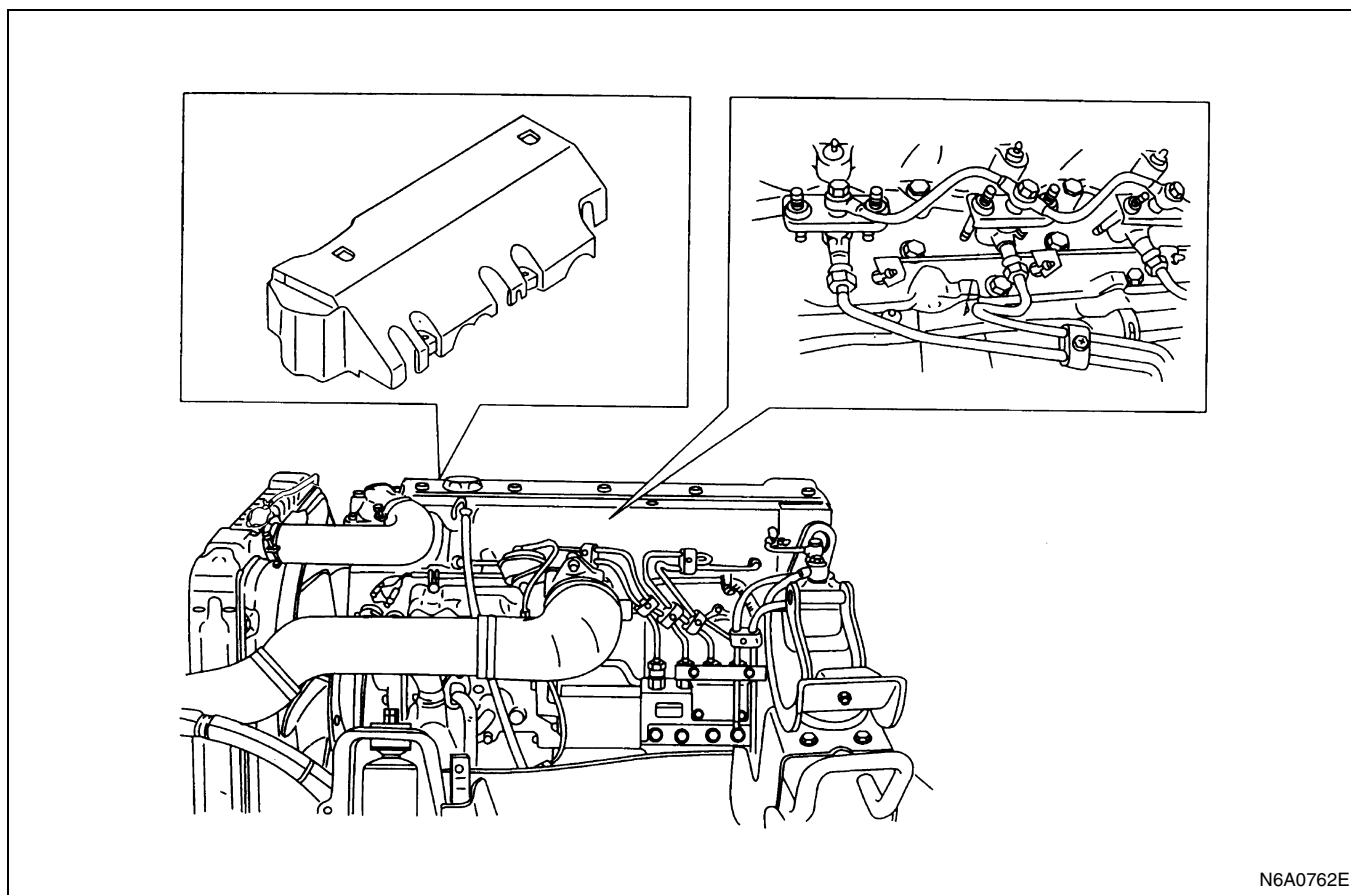
Legend

- | | |
|-------------------------------|-------------------------------|
| 1. Propeller shaft assembly | 8. Select cable |
| 2. Car speed sensor connector | 9. Clutch slave cylinder |
| 3. Neutral switch connector | 10. Starter earth cable |
| 4. Back-up lamp connector | 11. Starter |
| 5. Harness connector | 12. Transmission mounting nut |
| 6. Parking brake cable | 13. Transmission assembly |
| 7. Shift cable | |

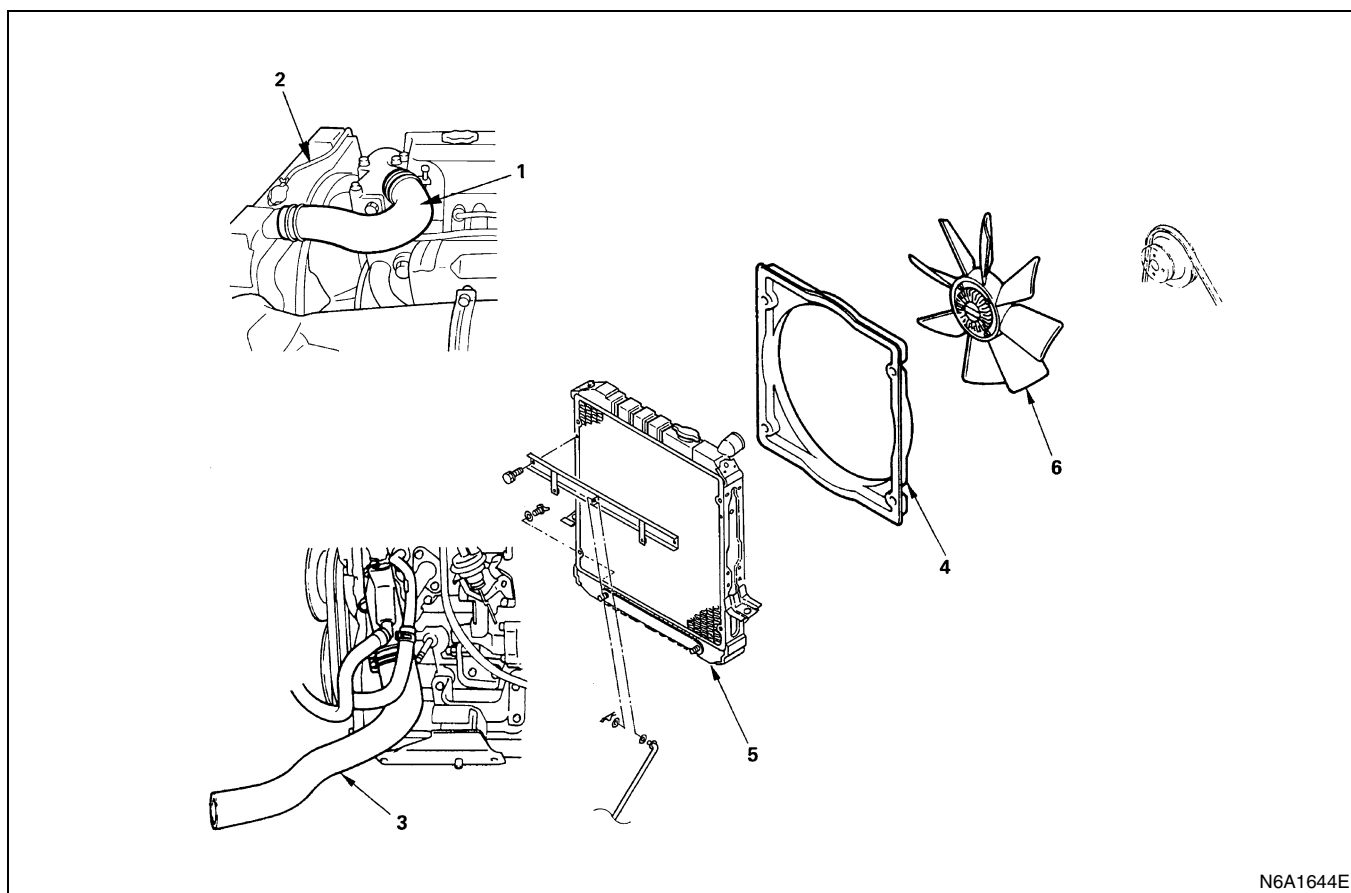
Engine Left Side**Legend**

- | | |
|----------------------|------------------------------|
| 1. Intake air duct | 5. Accelerator control cable |
| 2. Heater hose | 6. Fuel return hose |
| 3. Vacuum hose | 7. Fuel feed hose |
| 4. Engine stop cable | |

Engine Upper Side

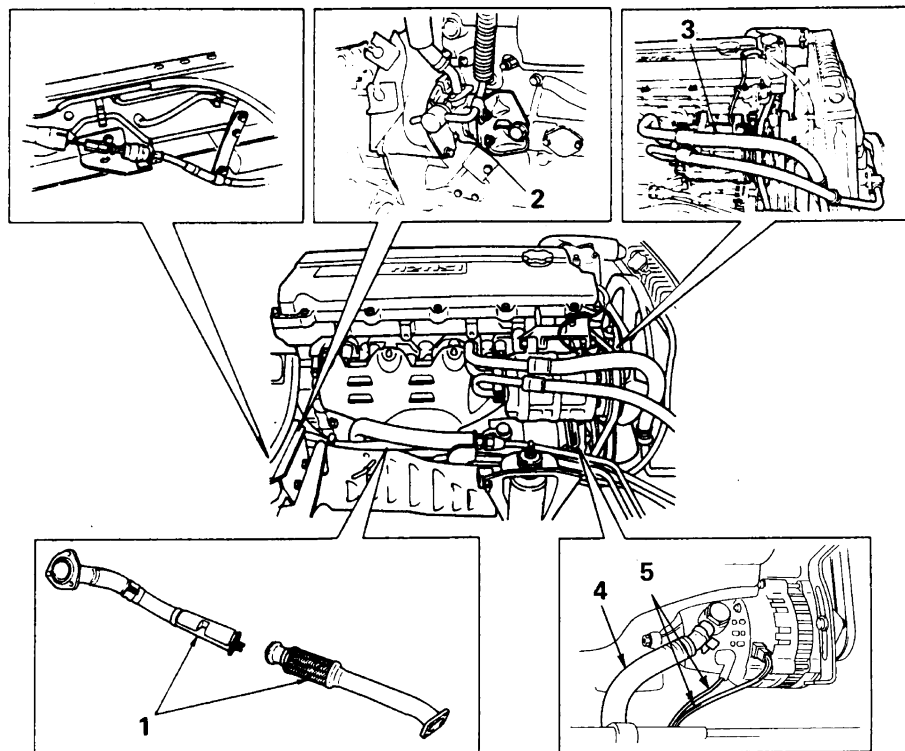


Engine Front Side



Legend

- | | |
|--|--------------|
| 1. Radiator upper hose | 4. Fan guide |
| 2. Coolant reserve tank hose/Bypass hose | 5. Radiator |
| 3. Radiator lower hose | 6. Fan |

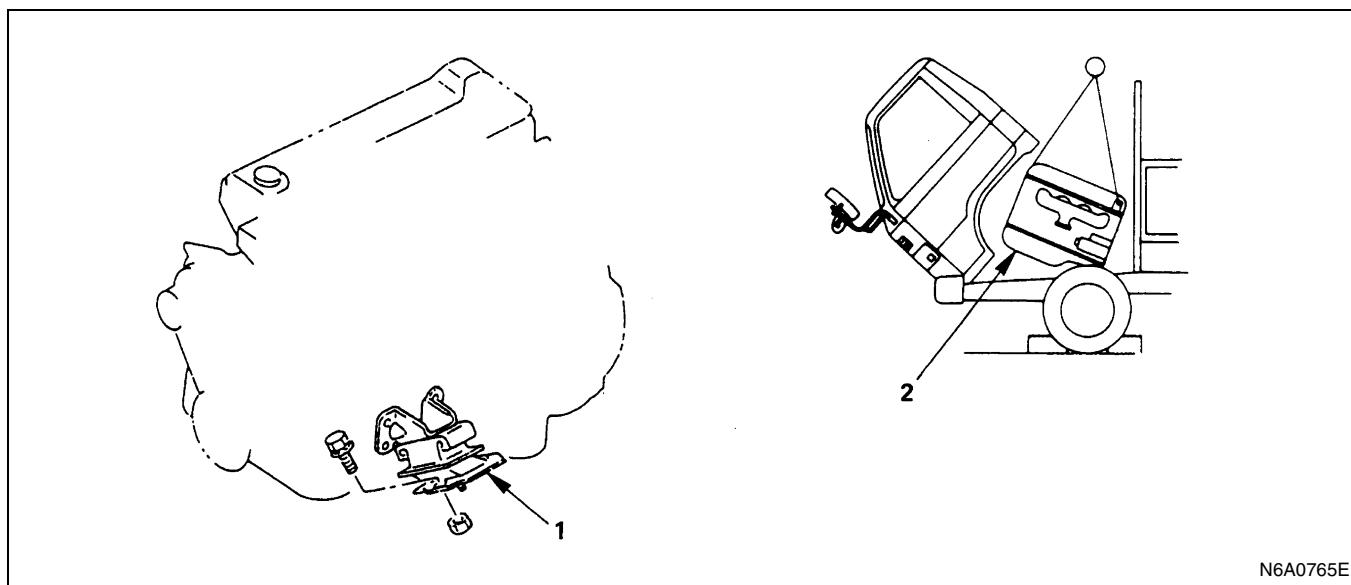
Engine Right Side

N6A0764E

Legend

- | | |
|------------------------|--------------------|
| 1. Front exhaust pipe | 4. A/C vacuum hose |
| 2. Power steering pump | 5. A/C harness |
| 3. A/C compressor | |

Engine Mounting Side



Legend

1. Engine mount

2. Engine assembly

Removal

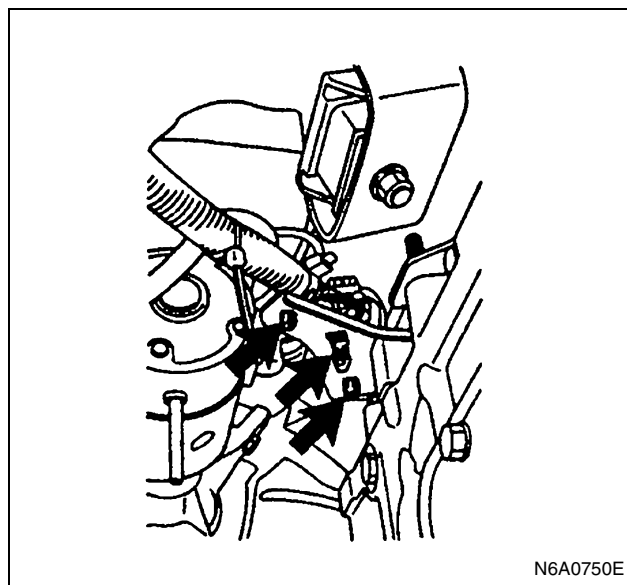
Preparation

- Disconnect battery ground cable
- Tilt the cab
- Remove the transmission panel
- Drain coolant

Transmission Side

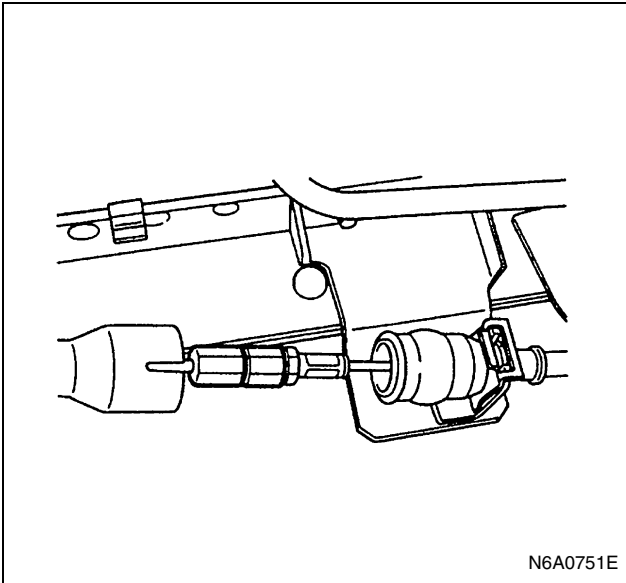
1. Propeller shaft Assembly
 - 1) Put in advance an alignment mark to the drum and the flange yoke.
 - 2) Put the drum and the flange yoke aside and hang them with a wire so that they do not interfere with servicing work.
2. Car Speed Sensor Connector
3. Neutral Switch Connector
4. Back-up Lamp Connector
5. Harness Connector

Remove the connectors from the harness bracket. At that time, take care not to cause any damages to the clips.

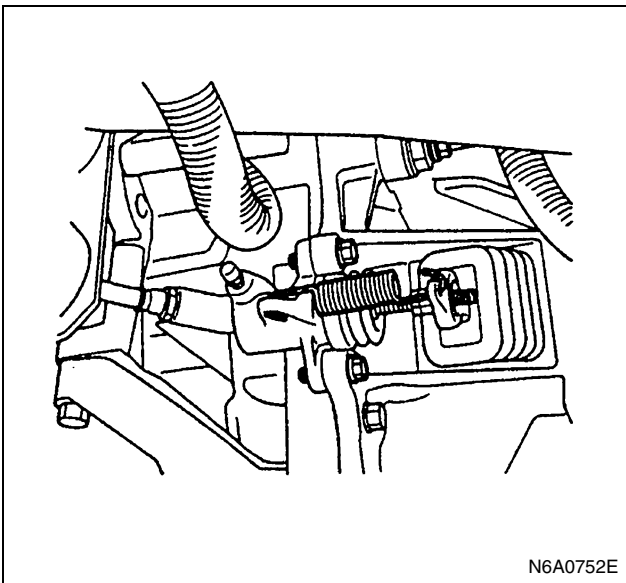


6. Parking Brake Cable

Remove the clip and slide the cover provided in the middle of the cable. Then, loosen the longer nut on the front side of the vehicle to disconnect the parking brake cable.



7. Shift Cable
8. Select Cable
9. Clutch Slave Cylinder
 - 1) Disconnect the clutch return spring from the clutch slave cylinder.
 - 2) Remove the slave cylinder from the clutch shift fork.



10. Starter Earth Cable
11. Starter
 - 1) Disconnect the battery cable at the starter motor.
 - 2) Remove the starter assembly from flywheel housing.
12. Transmission Mounting Nut
 - 1) Check that the engine lifting is securely supporting the engine.
 - 2) Remove the engine rear mounting bracket nuts from the No.3 crossmember.
13. Transmission Assembly

Remove the transmission nuts and bolts from the flywheel housing.

- Remove the transmission by pulling it toward the rear of the vehicle while slowly lowering the transmission jack.

Engine Left Side

1. Intake Air Duct
2. Heater Hose
3. Vacuum Hose
4. Engine Stop Cable
Loosen locking nut at bracket and disconnect engine stop cable from injection pump stop lever.
5. Accelerator Control Cable
Loosen locking nut at bracket and disconnect accelerator control cable from injection pump control lever.
6. Fuel Return Hose
7. Fuel Feed Hose
Disconnect fuel hose from injection pump side and take care not to spill and enter dust.

Engine Front Side

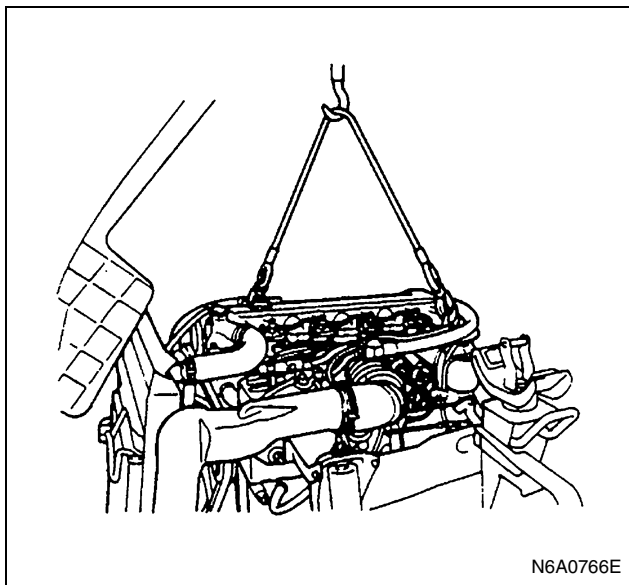
1. Radiator Upper Hose
2. Coolant Reserve Tank Hose/Bypass Hose
3. Radiator Lower Hose
4. Fan Guide
5. Radiator
6. Fan

Engine Right Side

1. Front Exhaust Pipe
2. Power Steering Pump
Remove the power steering pump from the engine side with the bracket attached, and fasten it with a wire to the appropriate location, together with the hoses.
3. Air Conditioning (A/C) Compressor (If equipped with A/C)
 - 1) Remove the A/C compressor drive belt.
 - 2) Dismount the compressor from the A/C compressor bracket, and fasten it with a wire to the appropriate location, together with the hoses.
4. A/C Vacuum Hose
Disconnect the vacuum hoses from vacuum pump side.
5. A/C Harness
Disconnect the B terminal cable and harness connector from generator.

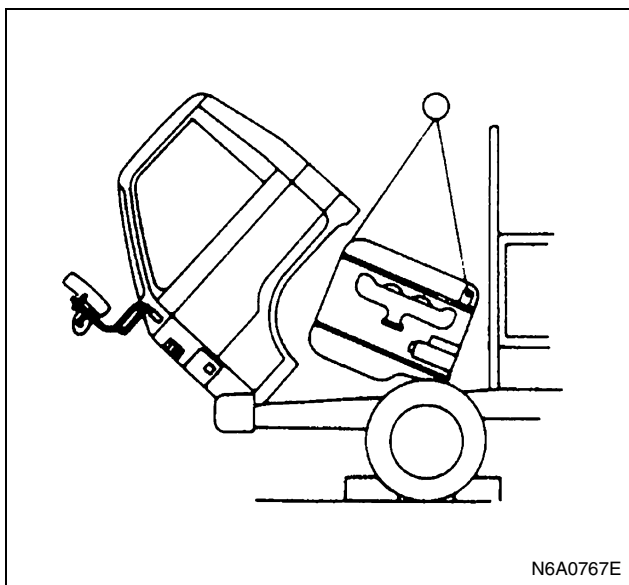
Engine Mounting Side

1. Engine Mount
Attach lifting wires to the engine lifting hangers and slightly raise the engine.
Remove the engine mounting rubber nuts attaching the engine mounting crossmembers.

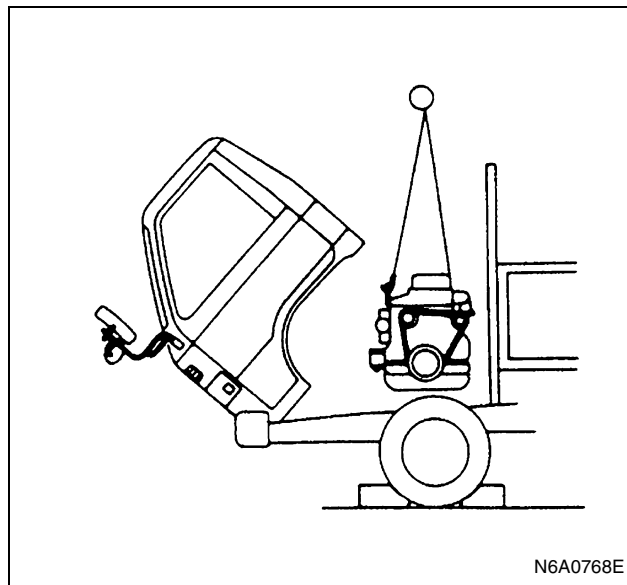


2. Engine Assembly

- 1) Make sure that the connecting pipes, hoses, and cables have all been removed from the engine.
- 2) Operate the hoist to slowly raise the engine until it is clear of the chassis frame.



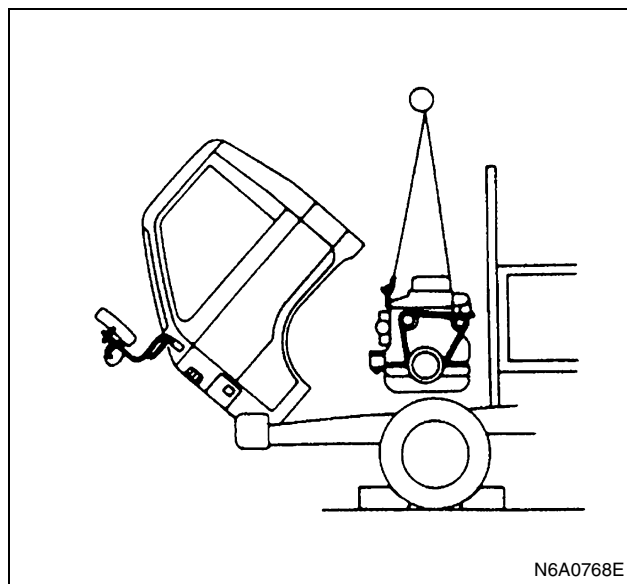
- 3) Rotate the engine 90 degrees.
- 4) Continue to lift the engine from the chassis.
- 5) Carefully move the hoist and engine.
- 6) Set the engine on an engine stand.



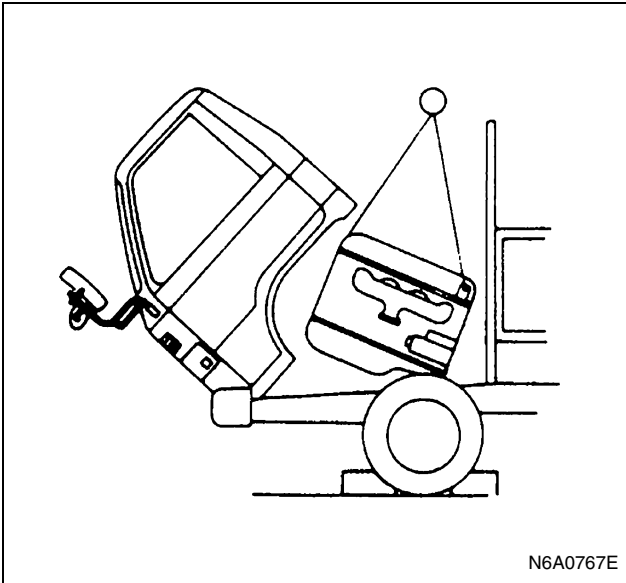
Installation

Engine Mounting Side

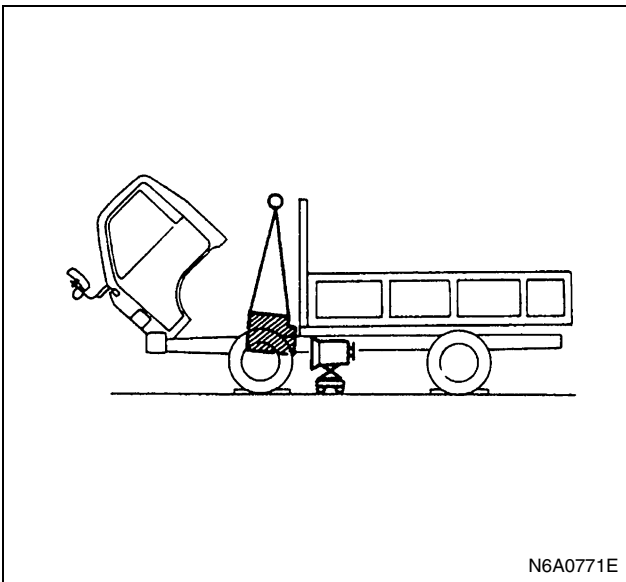
1. Engine Assembly
 - 1) Attach a lifting wire to the engine lifting hangers.
 - 2) Operate the hoist to position the engine above the chassis frame.
 - 3) Carefully lower the engine until it is just above the chassis frame.



- 4) Rotate the engine 90° to position it for final installation.
- 5) Carefully set the engine to the chassis. The front of the engine should be held higher than the rear at this time. Be careful not to damage the exposed parts.



- 6) Lower the engine until it contacts the engine mounting crossmember.
- 7) Set the engine mounting rubbers to the engine mounting crossmember.
- 8) Temporarily tighten the engine mounting rubber bolts.
The bolts will be finally tightened after the transmission has been installed to the engine and the engine rear mounting bracket and the No.3 crossmember connected.



2. Engine Mount
Install the engine mount with it set to the holes of the engine mount crossmember. Then tighten it to the specified torque.

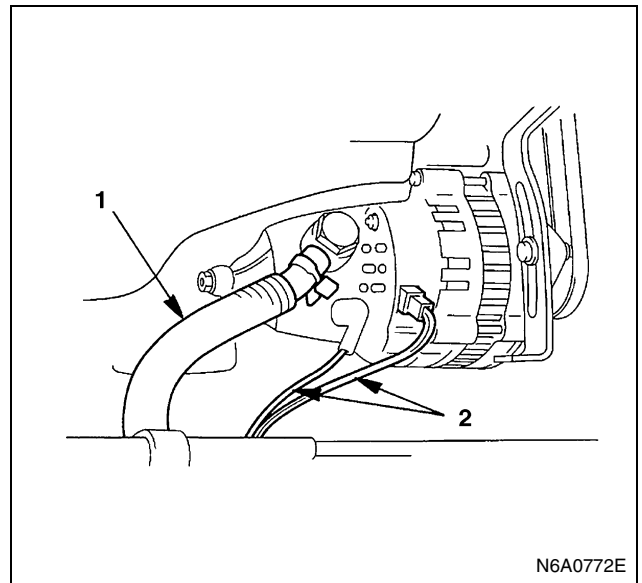
Tighten:

Mounting rubber nut to 48 N·m (4.9 kg·m/35 lb·ft)

Engine Right Side

1. ACG Harness
2. ACG Vacuum Hose

- 1) Connect the B terminal cable and the harness connector.
- 2) Connect the vacuum hoses to the vacuum pump.

**Legend**

1. ACG vacuum hose
2. ACG harness

3. Air Conditioning (A/C) Compressor

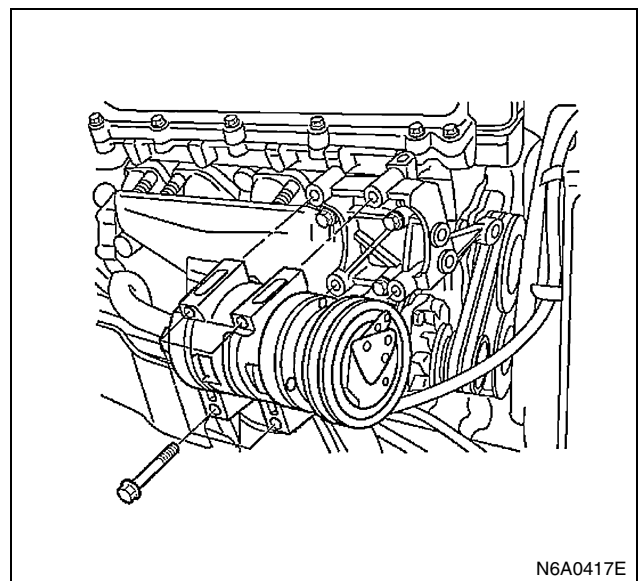
- Tighten the fixing bolts to the specified torque.

Tighten:

A/C compressor bolt to 48 N·m (4.9 kg·m/35 lb·ft)

Notice:

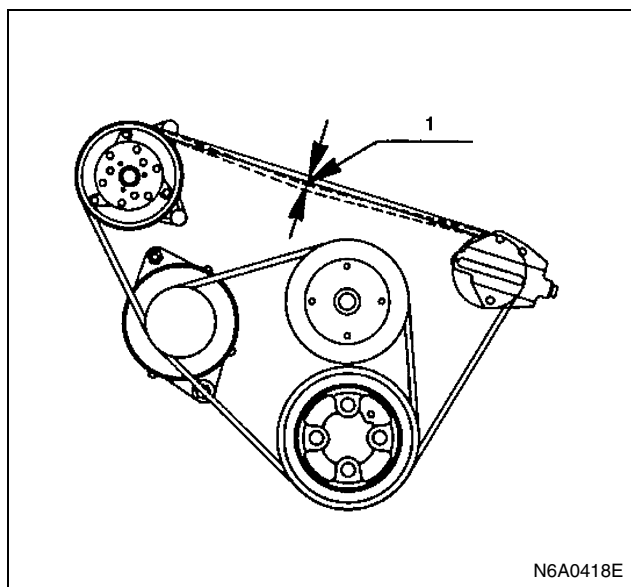
When tightening the compressor fixing bolts, tighten the first 2 bolts on the rear side, and then the remaining 2 on the front.



6A3-154 ENGINE (4HF1 / 4HF1-2 / 4HE1-TC / 4HG1 / 4HG1-T)

- Install the drive belt adjust belt tension by adjusting bolt and tighten the locking nut to the specified torque.
- Depress the drive belt mid-portion with a 98 N (10 kg/22 lb) force.

Drive Belt Deflection	mm (in)
16 — 20 (0.63 — 0.79) ... New belt	
18 — 22 (0.71 — 0.87) ... Reuse belt	



N6A0418E

Legend

1. Belt deflection

Tighten:

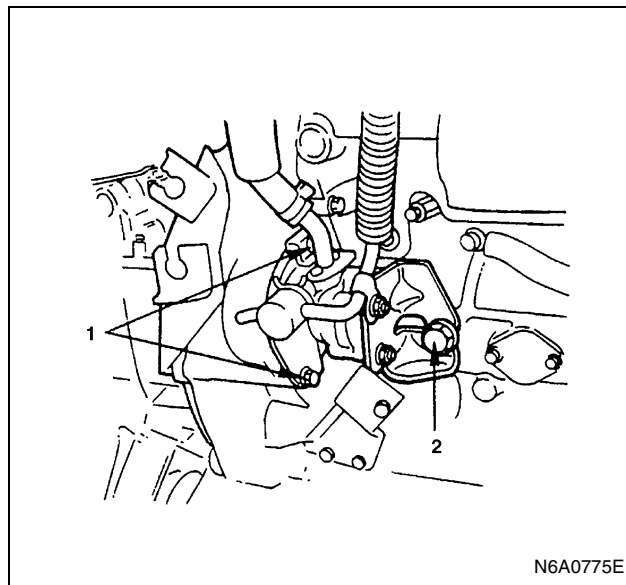
Locking nut to 27 N·m (2.8 kg·m/20 lb·ft)

4. Power Steering Pump

Tighten:

Bolt to

- (1): 43 N·m (4.4 kg·m/32 lb·ft)
- (2): 44 N·m (4.5 kg·m/33 lb·ft)



N6A0775E

5. Front Exhaust Pipe

Tighten:

Front exhaust pipe to

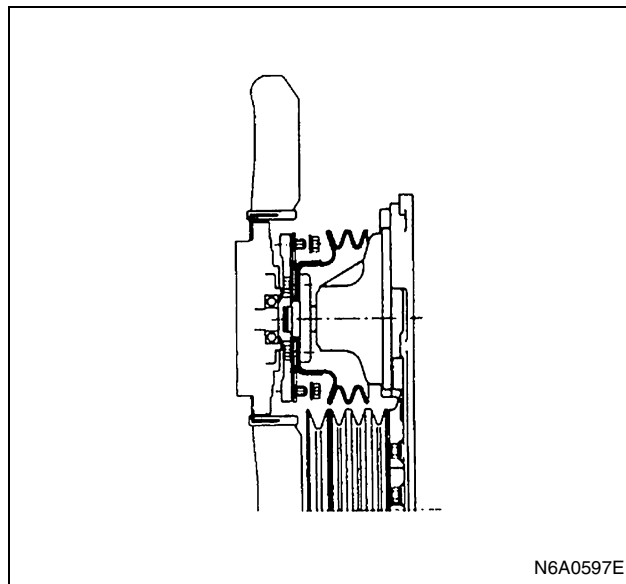
- Exhaust manifold side: 67 N·m (6.8 kg·m/49 lb·ft)
- Exhaust brake side: 17 N·m (1.7 kg·m/12 lb·ft)
- Cylinder body side: 17 N·m (1.7 kg·m/12 lb·ft)

Engine Front Side

1. Fan

Tighten:

Fan bolt to 24 N·m (2.4 kg·m/17 lb·ft)

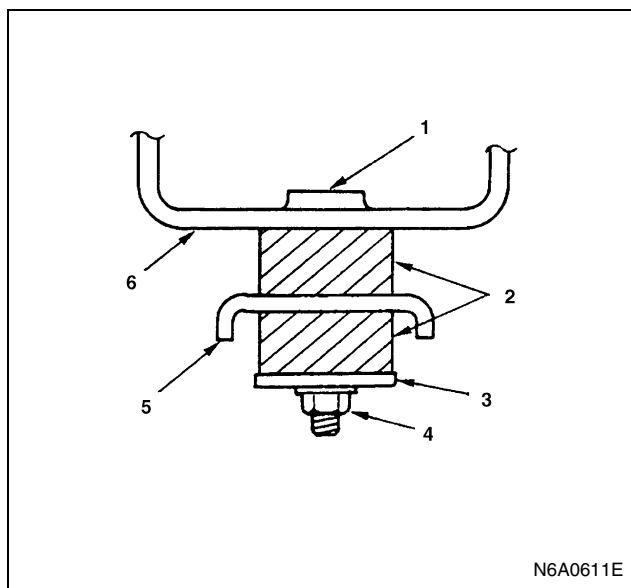


N6A0597E

2. Radiator

Tighten:

Radiator bracket bolt to 55 N·m (5.6 kg·m/41 lb·ft)



N6A0611E

Legend

1. Stud bolt
2. Rubber
3. Washer
4. Flange nut
5. Flame side bracket
6. Radiator side bracket

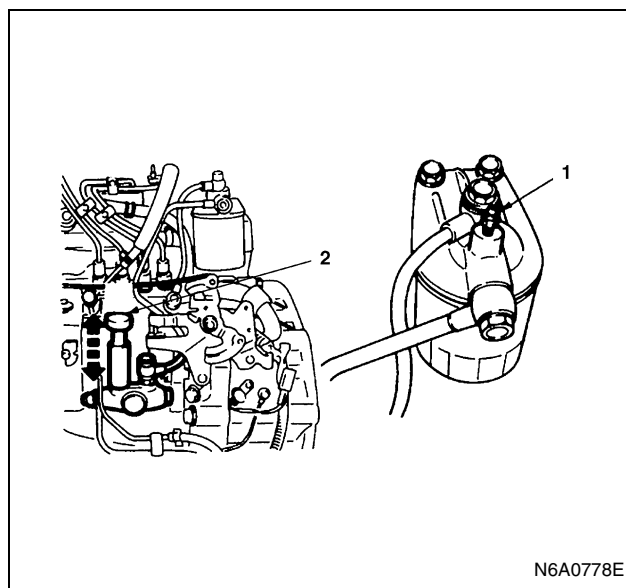
3. Fan Guide
4. Radiator Lower Hose
5. Coolant Reserve Tank Hose/Bypass Hose
6. Radiator Upper Hose

Engine Left Side

1. Fuel Feed Hose
2. Fuel Return Hose

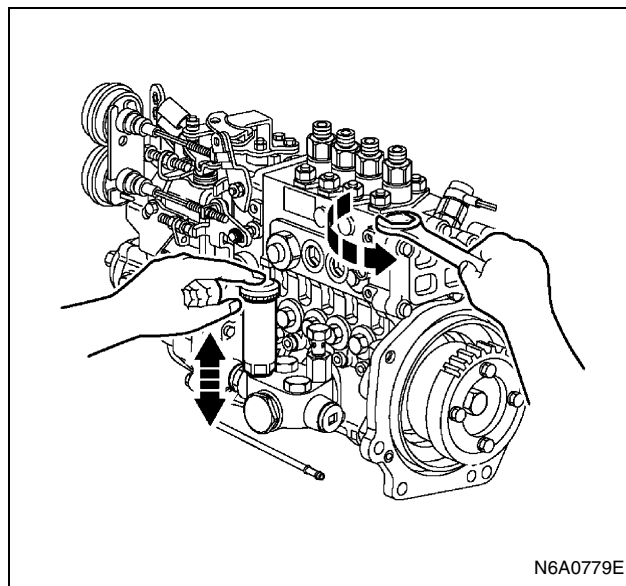
Air Bleeding

- 1) Loosen the priming pump cap (2) at the side of the injection pump.
- 2) Loosen the bleeder valve (1) (4HF1) at the top of the fuel filter.



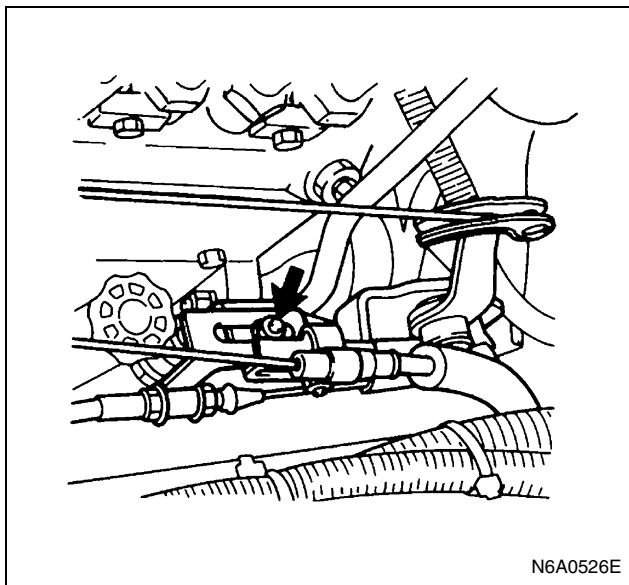
N6A0778E

- 3) Operate the priming pump to bleed the air from the injection pump.
- 4) Retighten the bleeder valve.
- 5) Operate the priming pump.
Check for fuel leakage from around the injection pump and the fuel filter.
- 6) Lock the priming pump cap to the injection pump.

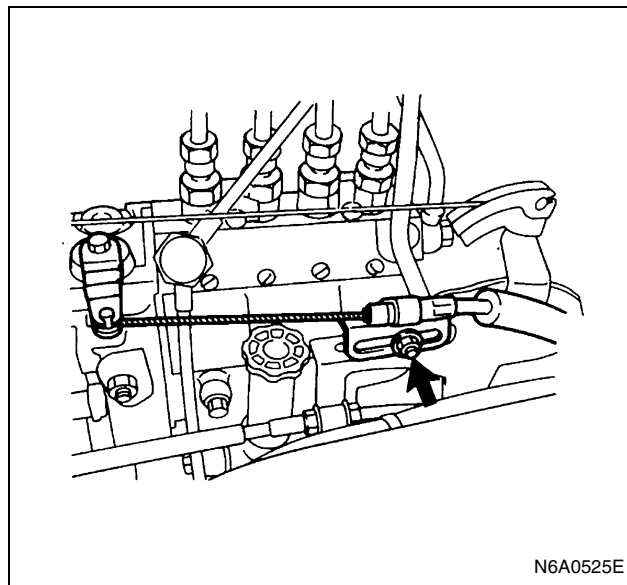
For 4HE1-TC

N6A0779E

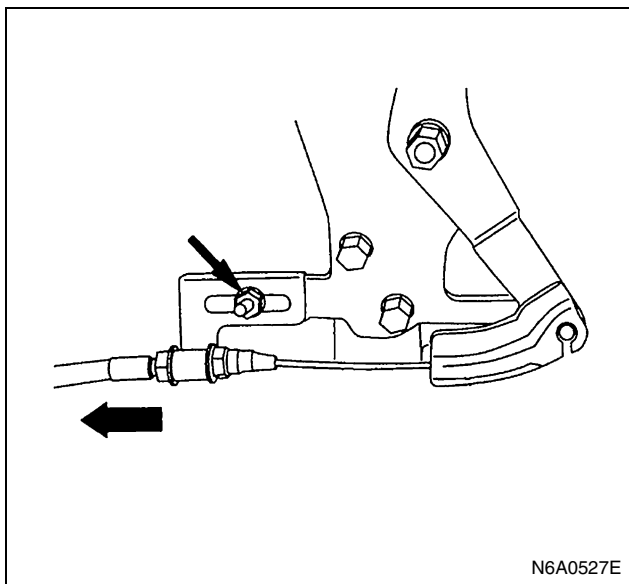
3. Accelerator Control Cable
 - 1) Check to see if the idling control knob is turned to the extreme left.
 - 2) Attach the end tip of the cable to the engine control lever.
 - 3) Pull the outer cable toward the front of the vehicle, and provide the engine control wire and the inner cable with an appropriate play before fastening the clamp with a nut.



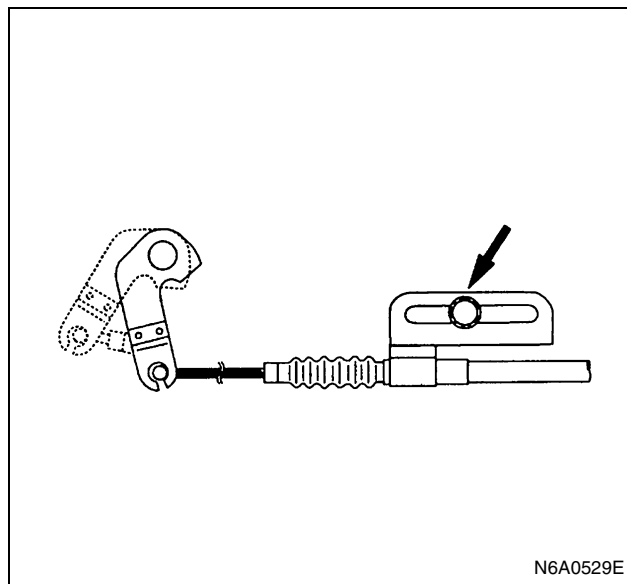
For 4HE1-TC



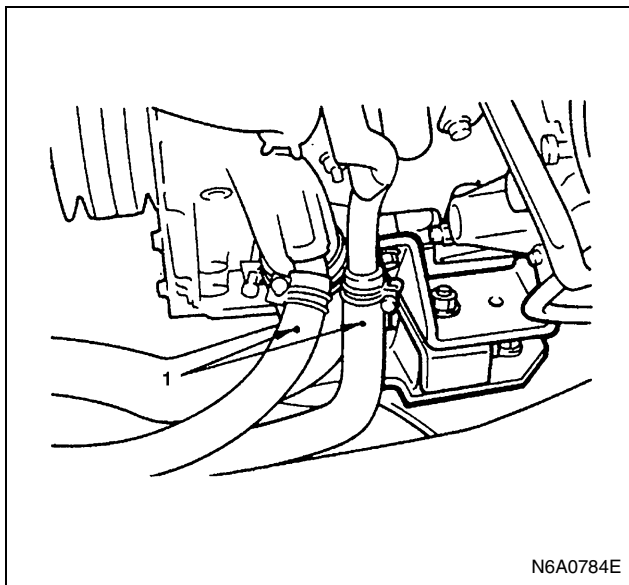
For 4HE1-TC



- 4) Check to see if the control lever of the injection pump is at the idle position (with the lever in touch with the stopper bolt).
4. Engine Stop Cable
 - 1) Attach the end tip of the cable to the engine stopper lever.
 - 2) Pull the cable toward the rear side of the vehicle, and fasten the clamp with a nut at the position where the lever stops.



5. Vacuum Hose
6. Heater Hose
Install the hose with its mark (1) turned up.

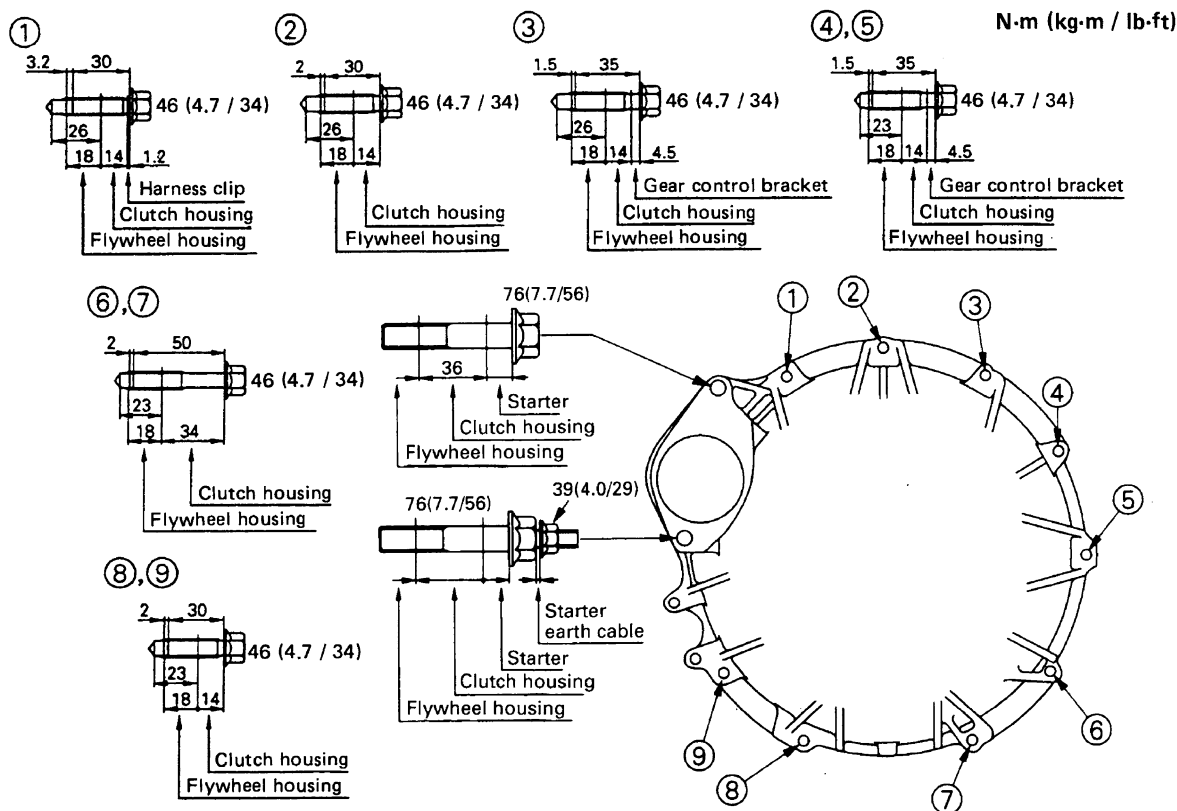


7. Intake Air Duct

Transmission Side

1. Transmission Assembly

Fasten the transmission to the transmission jack with a chain in the same manner as when dismounting it, and tighten the clutch housing clamping bolt to the specified torque.
(Refer to the illustration below.)



2. Transmission Mounting Nut

Tighten:

Transmission mounting nut to 40 N·m (4.1 kg-m/30 lb-ft)

3. Starter

4. Starter Earth Cable

Refer to the preceding page.

5. Clutch Slave Cylinder

1) Install the clutch slave cylinder.

Tighten:

Slave cylinder bolts to 16 N·m (1.6 kg-m/12 lb-ft)

2) Install the clutch return spring to the clutch shift fork.

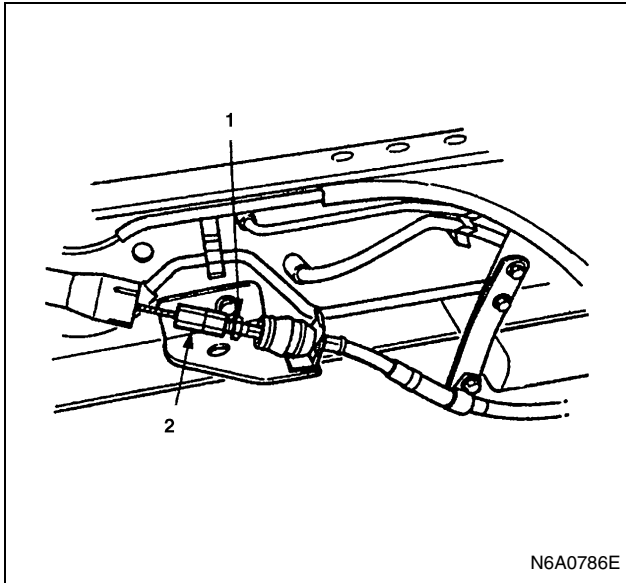
6. Select Cable

7. Shift Cable

8. Parking Brake Cable

1) With the lock nut (1) of the parking brake side cable tightened to the limit, rotate the nut (2) to connect it with the front side cable.

2) After tightening the front side nut (2) to the limit, fasten the parking brake cable with the lock nut (1).



- 3) Pull the parking brake lever to the limit (with the operating force of about 147 N (15 kg/33 lb) at the hand), adjust the lever with the lever adjusting nut so that the number of notches becomes 6 to 8 notches.

9. Harness Connector
10. Back-up Lamp Connector
11. Neutral Switch Connector
12. Car Speed Sensor Connector
13. Propeller Shaft Assembly

Tighten:

Propeller shaft bolt to 103 N·m (10.5 kg·m/76 lb·ft)

Engine Warm-Up

After completing the required maintenance procedures, start the engine and allow it to warm up. Then check the following:

- 1) Engine idling speed
Refer to "Servicing" for the idling speed adjustment procedure.
- 2) Engine noise level
- 3) Engine oil, coolant and fuel leakage
- 4) Engine control cable operation
- 5) Clutch engagement
- 6) Indicator warning light operation