

# ENGINE 4J SERIES

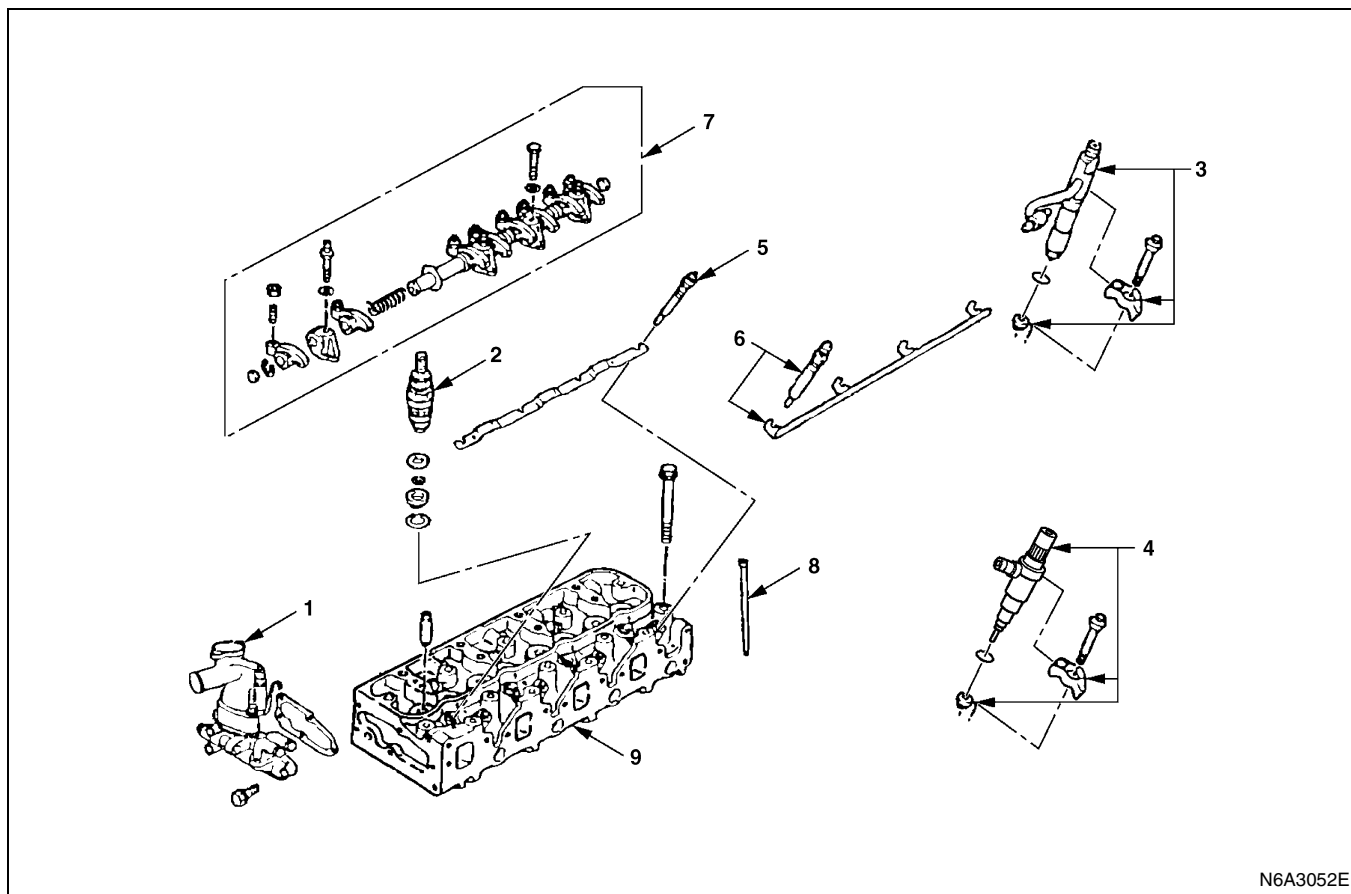
## SECTION 6A GENERAL ENGINE MECHANICAL

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## CYLINDER HEAD

### Component



N6A3052E

### Legend

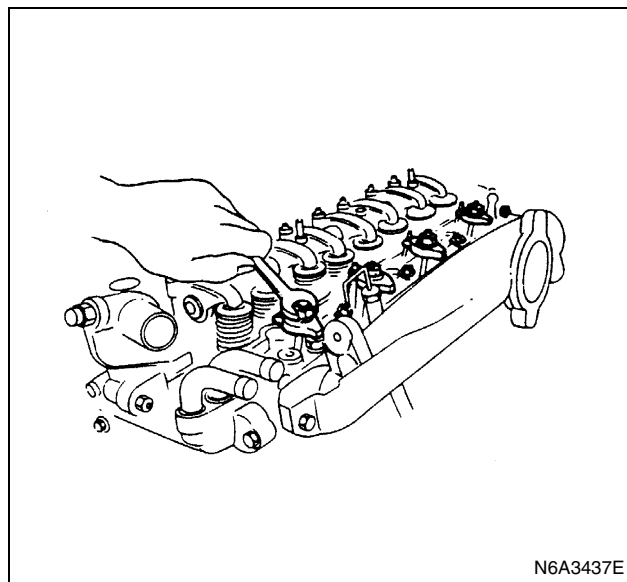
- |                                            |                                                 |
|--------------------------------------------|-------------------------------------------------|
| 1. Thermostat housing assembly             | 6. Glow plug and plug connector (4JB1, 4JB1-TC) |
| 2. Injection nozzle holder (4JG2)          | 7. Rocker arm shaft and rocker arm              |
| 3. Injection nozzle holder (4JB1, 4JB1-TC) | 8. Push rod                                     |
| 4. Injection nozzle holder (4JH1-TC)       | 9. Cylinder head                                |
| 5. Glow plug and plug connector (4JG2)     |                                                 |

### Notice:

- During disassembly, be sure that the valve train components are kept together and identified so that they can be re-installed in their original locations.
- Before removing the cylinder head from the engine and before disassembling the valve mechanism, make a compression test and note the results.

### Disassembly

1. Thermostat Housing Assembly
2. Injection Nozzle Holder (4JG2)
3. Injection Nozzle Holder (4JB1, 4JB1-TC)
4. Injection Nozzle Holder (4JH1-TC)
  - 1) Remove the nozzle holder bracket nuts.

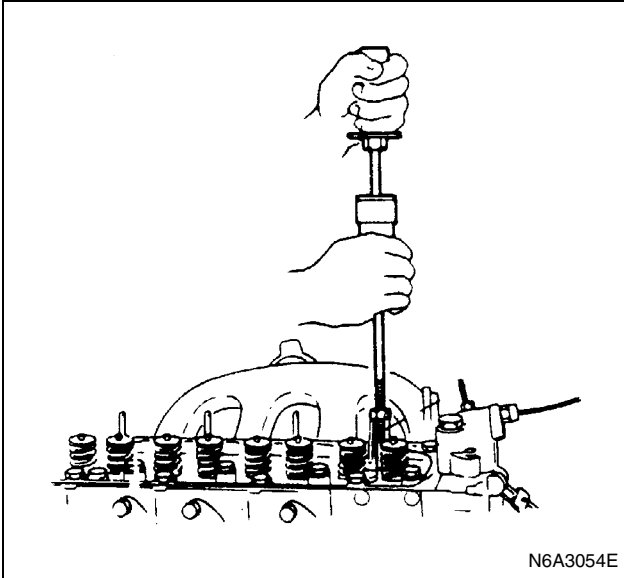


N6A3437E

- 2) Use the nozzle holder remover and the sliding hammer to remove the nozzle holder together with the holder bracket.

Nozzle Holder Remover: 5-8840-2034-0

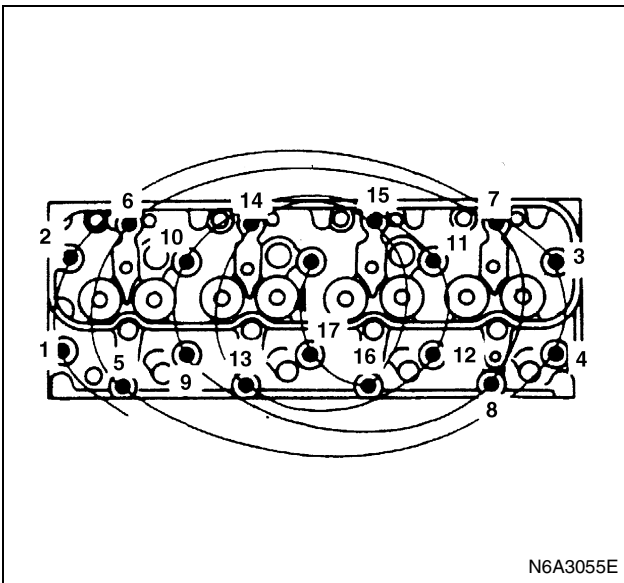
Sliding Hammer: 5-8840-0019-0



N6A3054E

5. Glow Plug and Glow Plug Connector (4JG2)
6. Glow Plug and Glow Plug Connector (4JB1, 4JB1-TC, 4JH1-TC)
7. Rocker Arm Shaft and Rocker Arm
8. Push Rod
9. Cylinder Head

- Loosen the cylinder head bolts a little at a time in the numerical order shown in the illustration.



N6A3055E

#### Notice:

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

#### Clean

- Cylinder head bolts
- Cylinder head

Carefully remove all varnish, soot and carbon to the bare metal. Do not use a motorized wire brush on any gasket sealing surface.

#### Inspection and Repair

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

- Cylinder head gasket and mating surfaces for leaks, corrosion and blow-by. If the gasket has failed, determine the cause;
  - Improper installation
  - Loose or warped cylinder head
  - Insufficient torque on head bolts
  - Warped case surface
- 1. Cylinder head bolts for damaged threads or stretching and damaged heads caused by improper use of tools.

#### Caution:

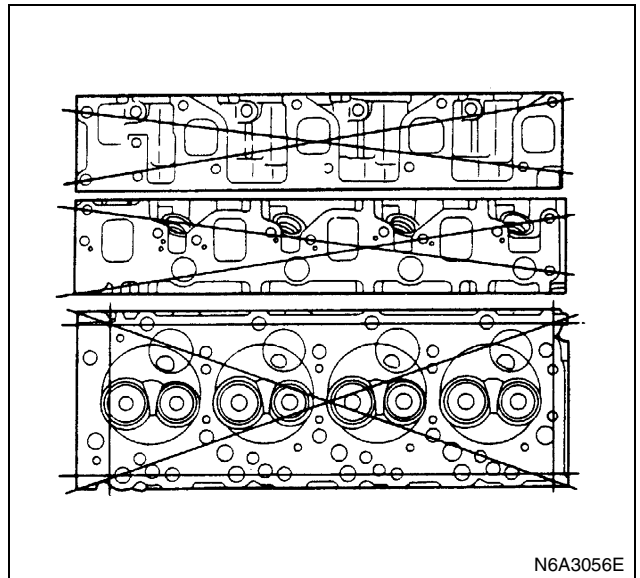
Suspected bolts must be replaced.

2. Cylinder head for cracks, especially between valve seats and in the exhaust ports.
3. Cylinder head deck for corrosion, sand particles in head and porosity.

#### Caution:

Do not attempt to weld the cylinder head. Replace it.

4. Cylinder head deck, intake and exhaust manifold mating surfaces for flatness. These surfaces may be re-conditioned by milling (except cylinder head lower face). If the surfaces are "out of flat" by more than specification, the surface should be ground to within specifications. If more than limit of specification, it should be replaced.



N6A3056E

## 6A-4 GENERAL ENGINE MECHANICAL

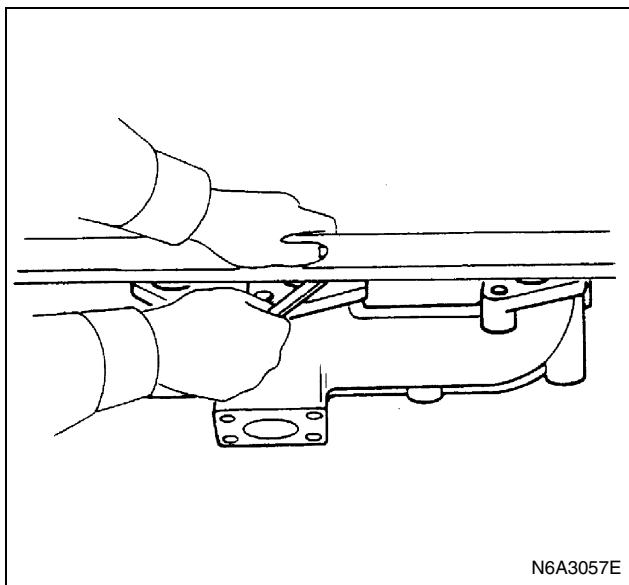
### Notice:

The cylinder head lower face cannot be reground.

| mm (in)                                       |                         |                |
|-----------------------------------------------|-------------------------|----------------|
|                                               | Standard                | Limit          |
| Standard Limit<br>Cylinder Head<br>Lower Face | 0.05 (0.002) or<br>less | 0.20 (0.0079)  |
| Cylinder Head<br>Height                       | 92 (3.622)              | 91.55 (3.6043) |

- Water jacket sealing plugs seating surfaces.
- Use a straight edge and a feeler gauge to measure the manifold cylinder head lifting face warpage. Regrind the exhaust manifold cylinder head lifting surfaces if the measured values are between the specified limit and the standard.  
If the measured values exceed the specified limit, the manifold must be replaced.

| Exhaust Manifold Warpage |  | mm (in)       |
|--------------------------|--|---------------|
| Standard                 |  | Limit         |
| 0.05 (0.002) or less     |  | 0.20 (0.0079) |

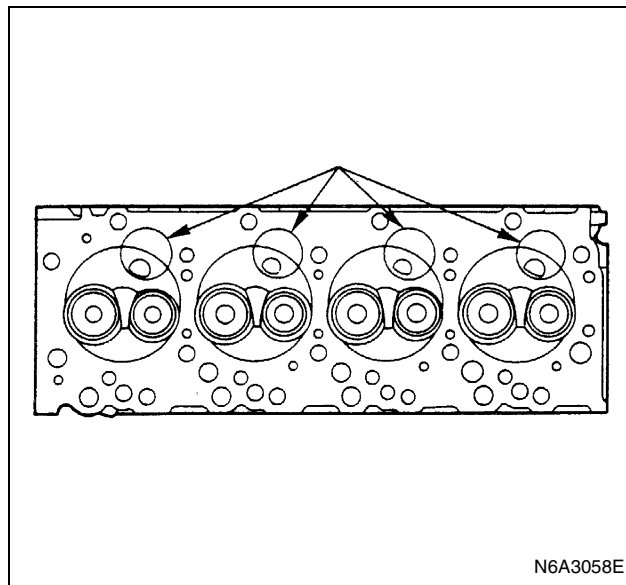


N6A3057E

### Hot Plug Depression (4JG2 only)

- Clean the cylinder head lower side, taking care not to damage the hot plug surfaces.
- Use a straight edge and feeler gauge to measure hot plug depression in a straight line from the No. 1 hot plug to the No. 4 hot plug.  
If the measured value exceeds the limit, the hot plugs must be replaced.

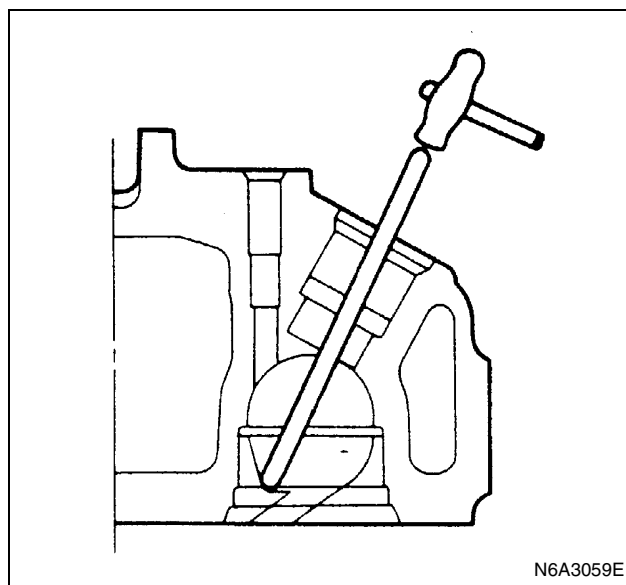
| Depression Limit | mm (in) |
|------------------|---------|
| 0.02 (0.0008)    |         |



N6A3058E

### Hot Plug Removal (4JG2 only)

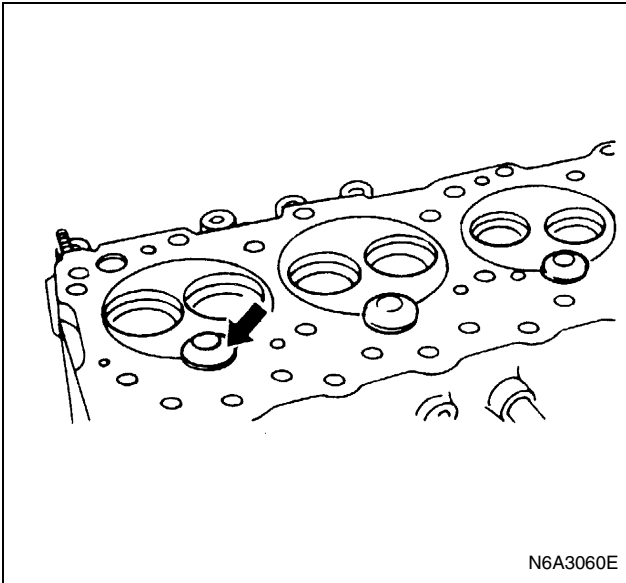
- Insert a 3.0 — 5.0 (0.12 — 0.20.) diameter bar into the nozzle holder fitting hole unit it makes contact with the hot plug.
- Lightly tap the bar with a hammer to drive the hot plug free.  
If the measured value exceeds the limit, the hot plugs must be replaced.



N6A3059E

### Combustion Chamber Inspection (4JG2 only)

- Remove the carbon adhering to the inside of the combustion chamber. Take care not to damage the hot plug fitting positions.



2. Inspect the inside of the combustion chamber, the hot plug, and the hot plug machined faces for cracking and other damage. If cracking or damage is present, the cylinder head must be replaced.

**Notice:**

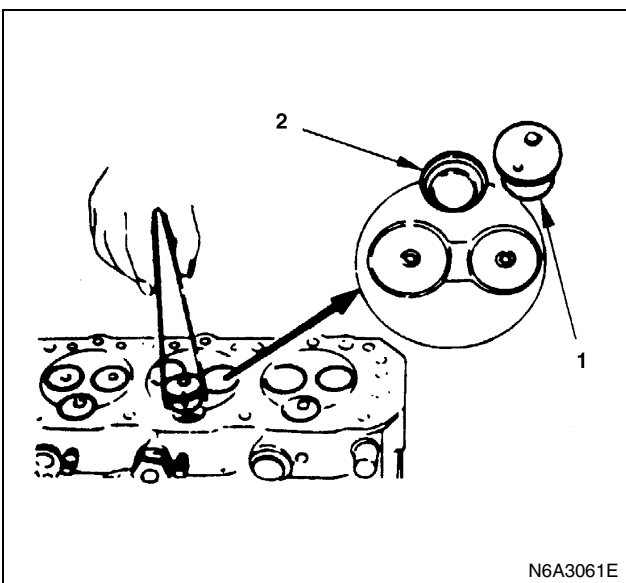
Be absolutely certain that there are no scratches or protuberance on the combustion chamber surfaces which will be in contact with the hot plug after it is installed. These flaws will prevent the hot plug from seating correctly.

**Hot Plug Inspection**

Inspect the hot plugs for excessive wear and other damage. Replace the hot plugs if either of these conditions are discovered.

**Hot Plug Installation (4JG2 only)**

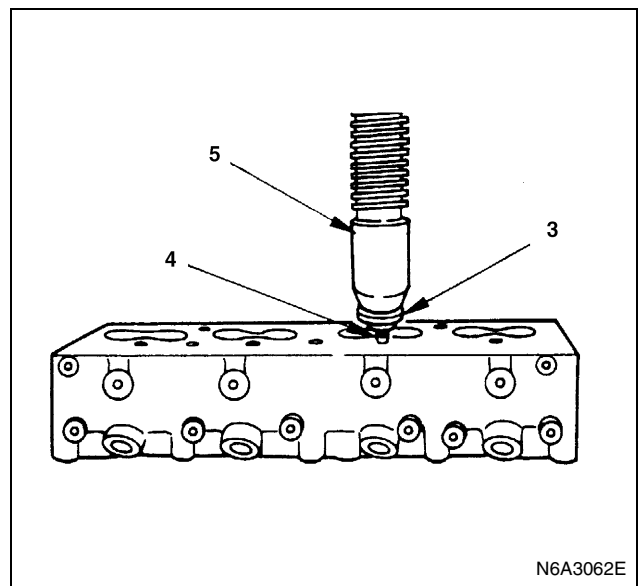
1. Align the hot plug knock ball (1) with the cylinder head groove (2) and tap it temporarily into position with a plastic hammer.



2. Place an appropriate metal plate (3) thick over the hot plug upper surface (4).
3. Use a press (5) to exert a pressure of 44130 — 53937N (4500 — 5500 kg/9923 — 12128 lbs.) on the metal plate covering the hot plug upper surface. This will drive the hot plug into position.
4. Lightly tap the hot plug heads to make sure that they are firmly seated.
5. Repeat the procedure Steps 1-4 for the remaining hot plugs.

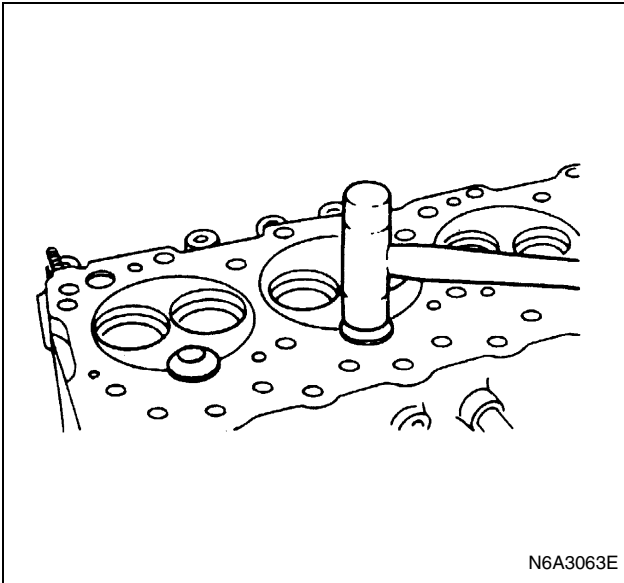
**Caution:**

Do not apply pressure greater than that specified. Damage to the cylinder head will result.



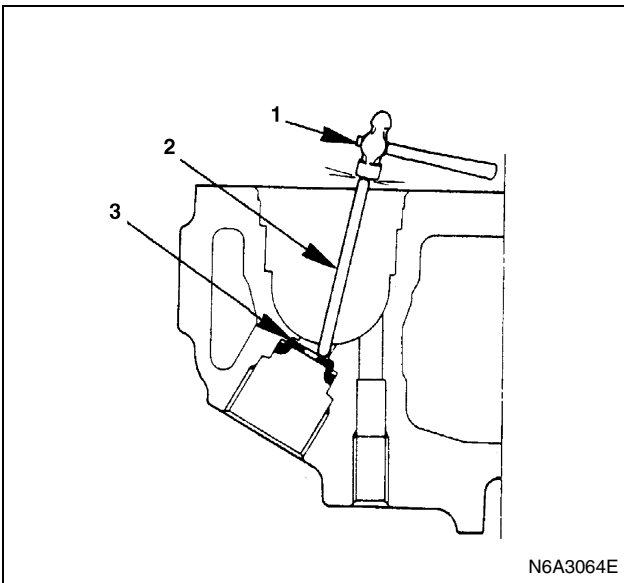
6. Use a surface grinder to grind off any hot plug surface protuberances. The hot plug surfaces must be perfectly flush with the cylinder head.
7. After grinding, make sure that the hot plug surfaces are completely free of protuberances. The hot plug surfaces must also be free of depressions.

Once again, lightly tap the hot plug heads to make sure that they are firmly seated.



### Heat Shield Removal (4JG2 only)

After removing the hot plugs, use a hammer (1) and a brass bar (2) to lightly tap the lower side of the heat shield (3) and drive it free.



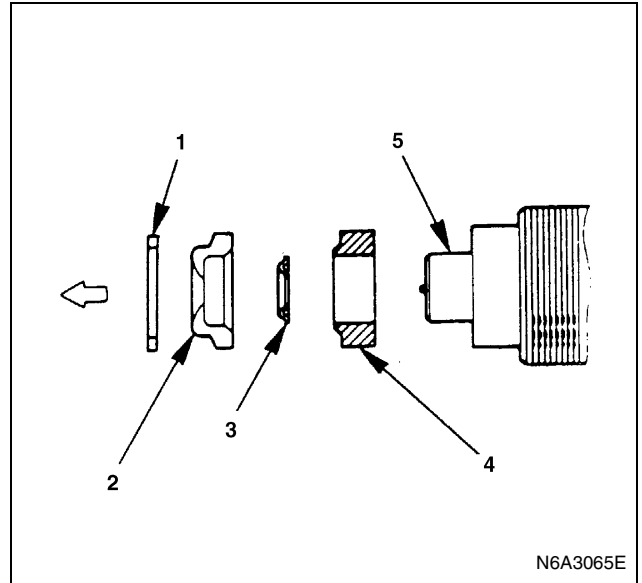
### Heat Shield Installation (4JG2 only)

Install the heat shield washer and the heat shield to the cylinder head from the nozzle holder installation hole side.

Lightly tap the flange into place with a brass bar. The heat shield flange side must be facing up.

#### Notice:

Always install a new heat shield. Never reuse the old heat shield.



### Legend

1. Gasket
2. Nozzle heat shield
3. Colgate washer
4. Gasket heat shield
5. Nozzle

## Reassembly

### Cylinder Head

#### 1. Hot plug

- Set the knock ball in the positioning groove on the cylinder head side according to the order of the cylinders, and hit it lightly with a plastic hammer.

#### Notice:

After being pressed into the cylinder head, the hot plugs were provided with surface grinding.

Accordingly, their dimensions are different individually among them, and take care not confuse the order of the cylinders.

### When replacing the hot plug with new one:

When assembling a new hot plug, set the knock ball in the positioning groove on the cylinder side and hit it lightly with a plastic hammer until the hot plug is set in stably.

With patch attached to the hot plug to prevent it from being damaged, press it in with a force of 4.5 to 5.5 ton applied.

After pressing the hot plug, grind its surface to the cylinder head.

And finally, hit the hot plug lightly with a plastic hammer and check it for any excessive sinking, protrusion or backlash.

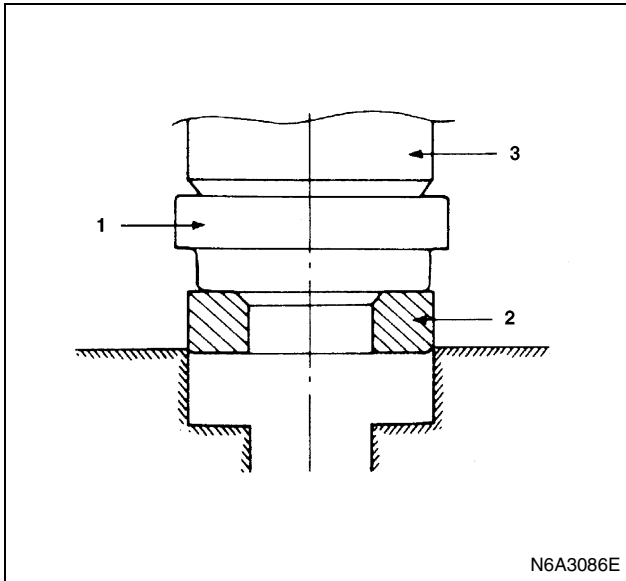
## 2. Valve Seat Insert Installation

- 1) Carefully place the attachment (1) (having a smaller outside diameter than the valve seat insert) on the valve seat insert (2).

### Notice:

The smooth side of the attachment must contact the valve seat insert.

- 2) Use the bench press (3) to gradually apply pressure to the attachment and press the valve seat insert into place.

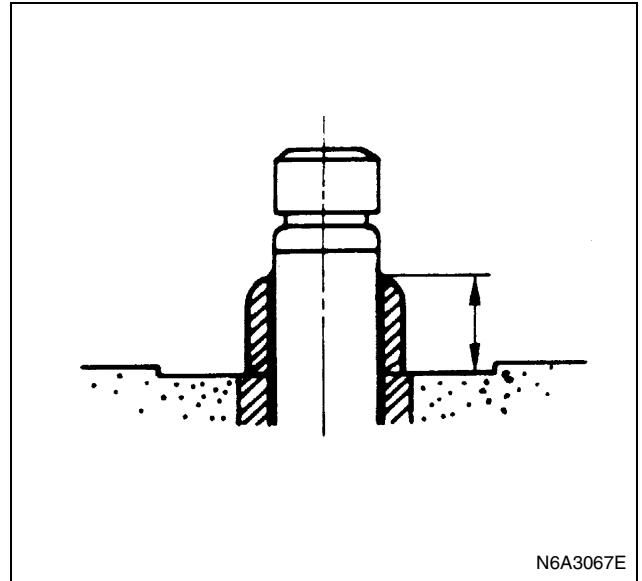


### Notice:

Do not apply an excessive amount of pressure with the bench press. Damage to the valve seat will result.

Measure the height of the valve guide upper end from the upper face of the cylinder head.

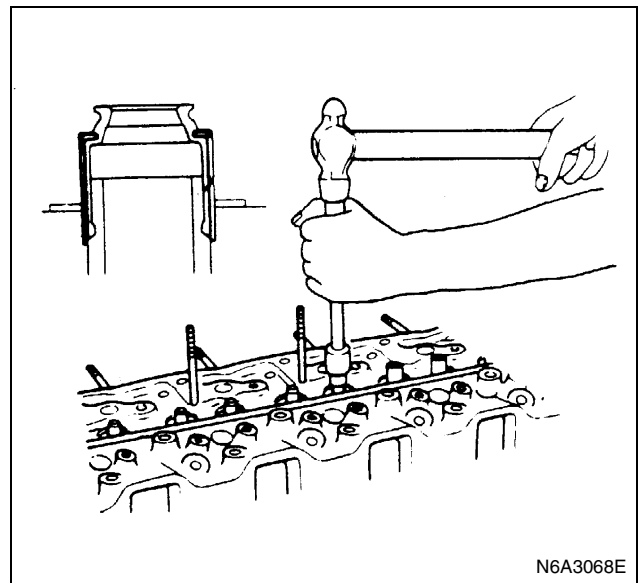
| Valve Guide Upper End Height (H) (Reference) | mm (in) |
|----------------------------------------------|---------|
| 13 (0.51)                                    |         |



### Notice:

If the valve guide has been removed, both the valve and the valve guide must be replaced as a set.

- 3) Spring lower seat
  - 4) Valve stem oil seal
    - Install a new oil controller in the valve.
    - Guide using special tool
- Oil seal installer: 5-8840-2003-0

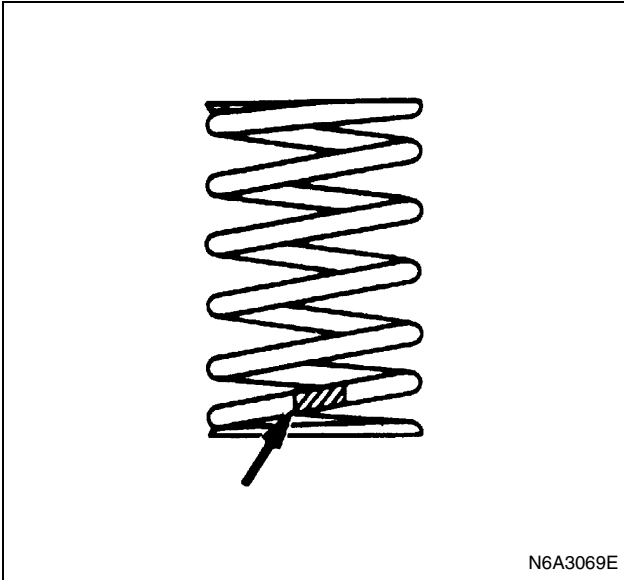


- 5) Valve
  - Apply engine oil to the outside of the valve stem before installing it.
- 6) Valve Spring
  - Attach the valve spring to the upper spring seat.

### Caution:

- The painted area of the valve spring should be facing downward.
- Apply compressed air to cylinder from the glow plug hole to hold the valve in place.
- Install split collar by special tool.

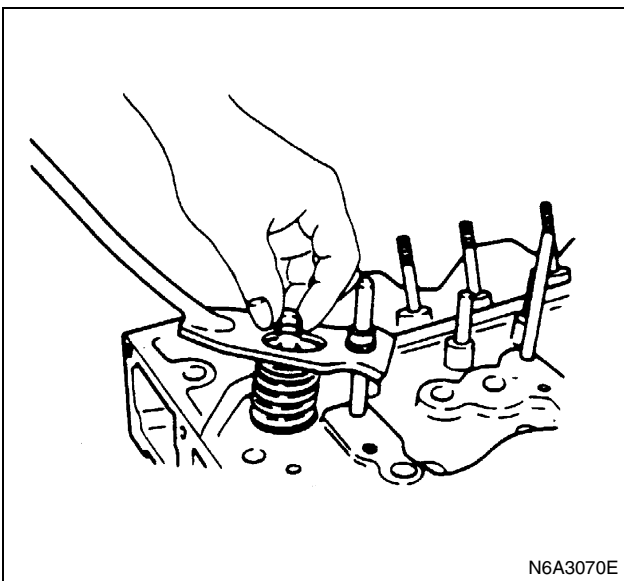
Valve spring compressor: 9-8523-1423-0 (J-29760)



### 7) Split Collar

- Use a spring compressor to push the valve spring into position.
- Install the spring seat split collar.
- Set the split collar by tapping lightly around the head of the collar with a rubber hammer.

Valve spring compressor: 9-8523-1423-0 (J-29760)



3. Push Rod
4. Rocker Arm Shaft and Rocker Arm

### Tighten:

- Rocker arm shaft fixing bolts to 54 N·m (5.5 kg·m/40 lb·ft)

### 5. Glow Plug and Glow Plug Connector (4JB1/4JB1-TC/4JH1-TC)

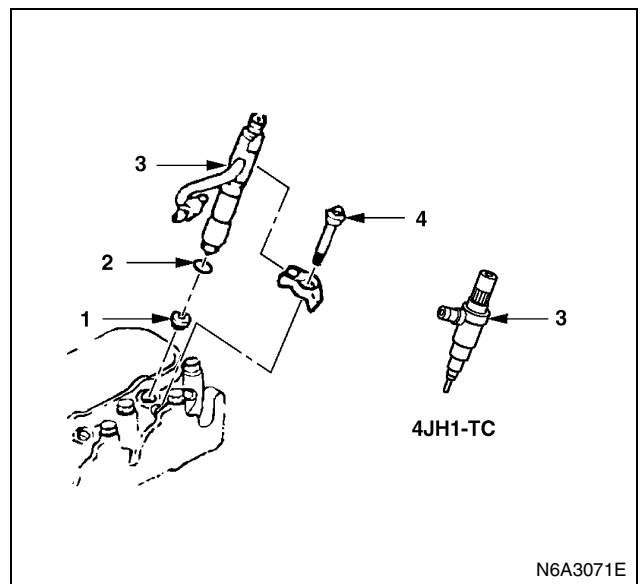
### Tighten:

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

6. Injection Nozzle Holder (4JB1/4JB1-TC only)
7. Injection Nozzle Holder (4JH1-TC only)
  - 1) Install the injection nozzle gasket (1) and the O-ring (2) to the injection nozzle holder (3). Be sure that the O-ring fits snugly in the injection nozzle groove.
  - 2) Apply engine oil to the cylinder head nozzle holder hole.
  - 3) Install the nozzle holder together with the nozzle holder bracket (4) to the cylinder head.

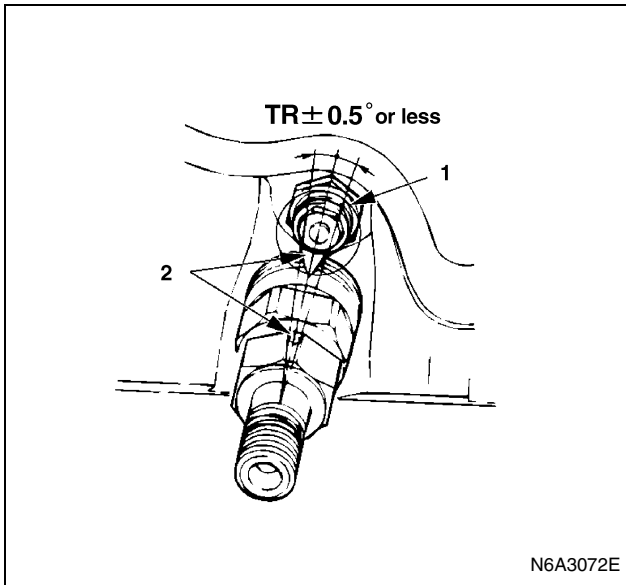
### Tighten:

37 N·m (3.8 kg·m/27 lb·ft)



### 8. Injection Nozzle (4JG2 only)

- Lightly tighten the holder nut to such extent that the nozzle holder can turn one word and one word.
- Set positioning confirmation drilled hole ( $\phi 2$ ) within a nozzle turning angle of  $\pm 5^\circ$  against the cylinder head side positioning boss.

**Tighten:**

Thermostat housing assembly fixing bolt to 19 N·m (1.9 kg·m/14 lb·ft)

**Legend**

1. Glow plug
2. Positioning boss

- Apply a wrench as illustrated and tighten the holder nut to the specified torque using a special tool.

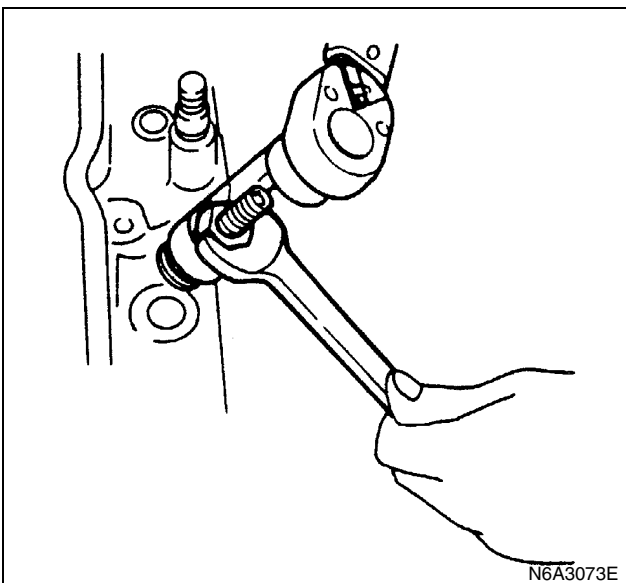
**Caution:**

- After tightening the holder nut, make sure that the drilled hole makes  $\pm 5^\circ$  or smaller with the cylinder head-side positioning boss.
- When mounting leak off pipe, injection nozzle and pipe, clean then with air so that dust may not enter.

**Tighten:**

Nozzle fixing to 64 N·m (6.5 kg·m/47 lb·ft)

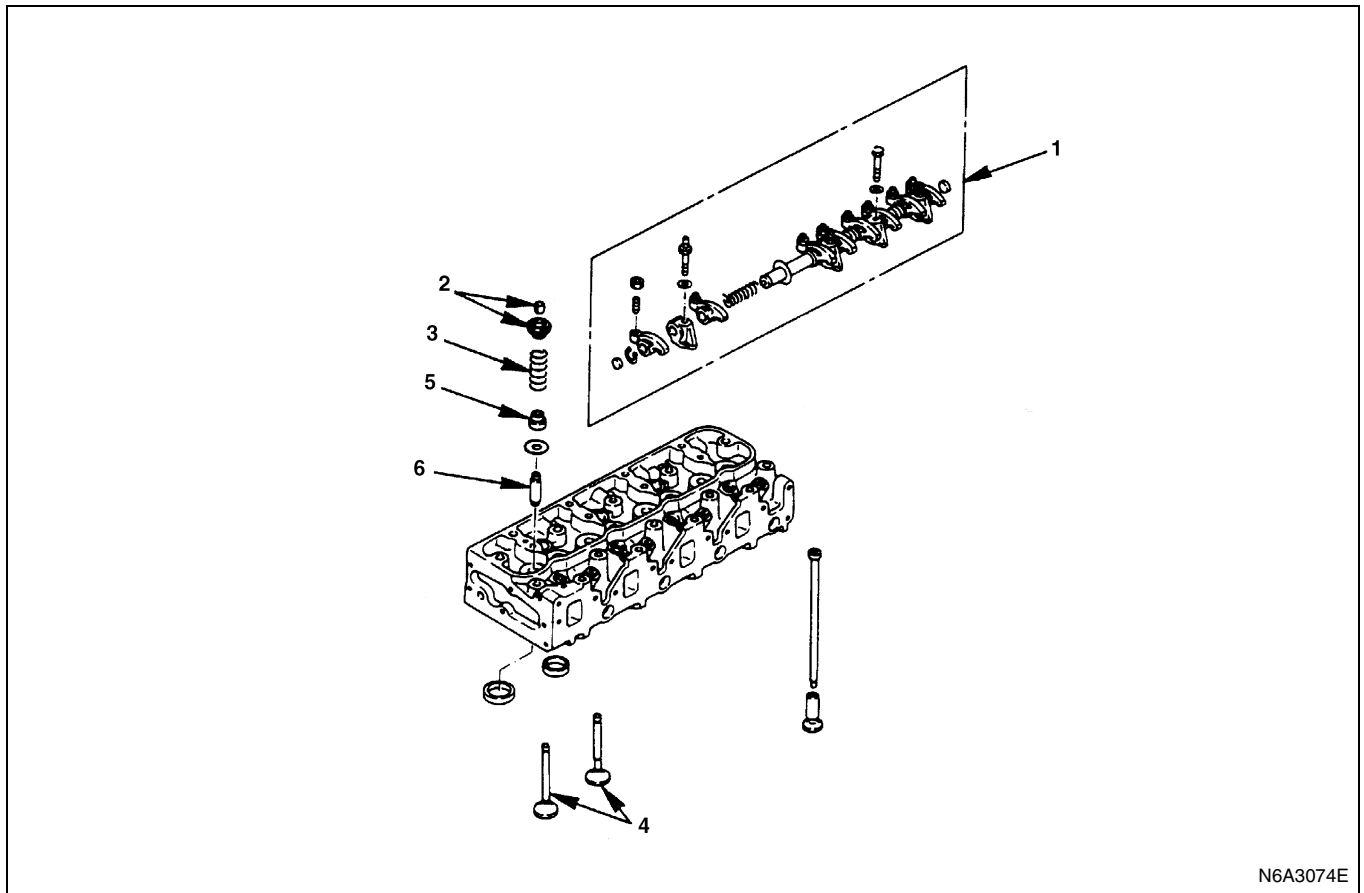
Wrench: Nozzle holder 5-8840-0259-0



## 9. Thermostat Housing Assembly

## VALVE SPRING, VALVE GUIDE OIL SEAL, VALVE GUIDE, PUSH ROD

### Component

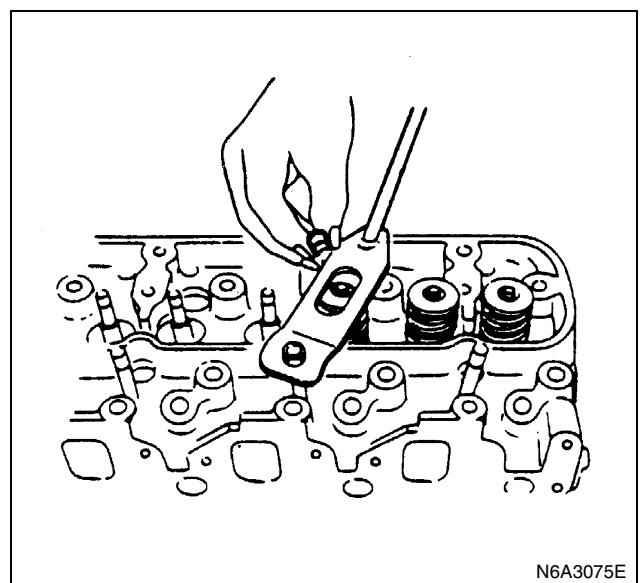


### Legend

- |                      |                         |
|----------------------|-------------------------|
| 1. Rock arm assembly | 4. Valve                |
| 2. Split collar      | 5. Valve guide oil seal |
| 3. Valve spring      | 6. Valve guide          |

### Disassembly

1. Rocker Arm Assembly
2. Split Collar  
Using special Tool, compress valve spring  
Valve spring compressor: 9-8523-1423-0 (J-29760)



3. Valve Spring
4. Valve

5. Valve Guide Oil Seal
6. Valve Guide  
Valve Guide Replacer: 9-8523-1212-0

## Inspection and Repair

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

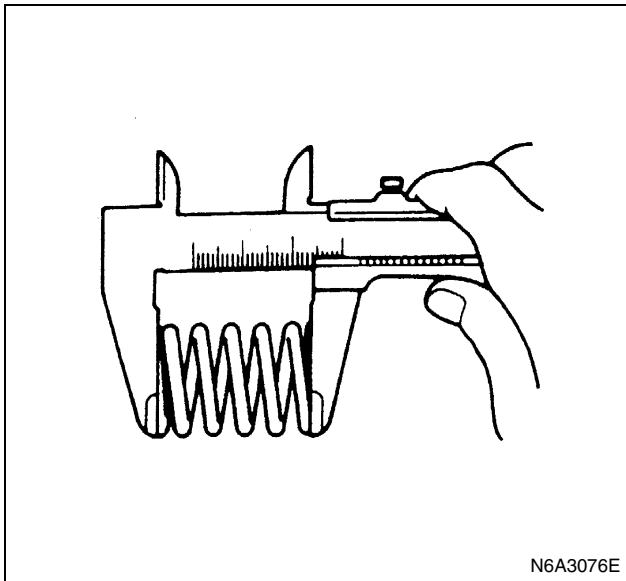
### Valve spring

#### Caution:

Visually inspect the valve springs and replace them if damage or abnormal wear is evident.

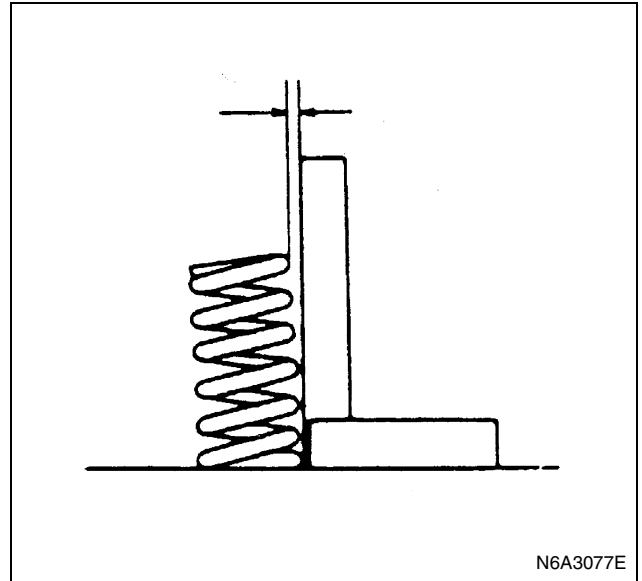
1. Free height
  - Measure the free height of the springs. The springs must be replaced if the height is below the specified limit.

| Free Height  |                 | mm (in) |
|--------------|-----------------|---------|
| Standard     | Limit           |         |
| 48.0 (1.891) | 47.100 (1.8560) |         |



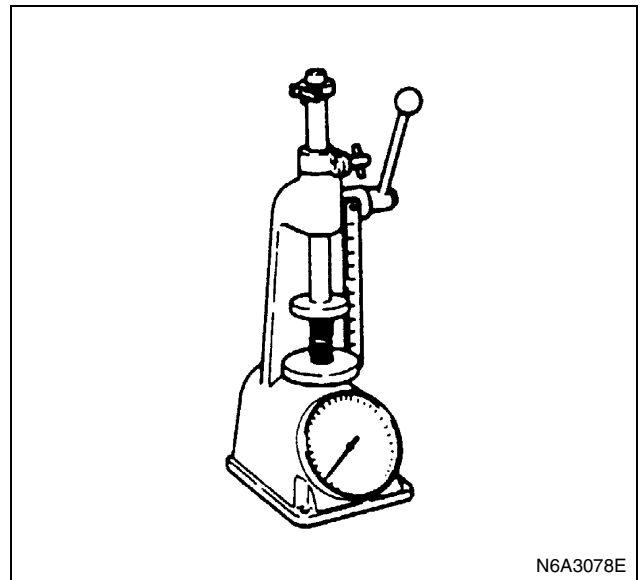
2. Squareness
  - Measure the valve spring squareness with a steel square.
  - Replace the valve springs if the measured value exceeds the specified limit.

| Limit       | mm (in) |
|-------------|---------|
| 1.7 (0.067) |         |



3. Spring tension
  - Use spring tester to compress the springs to the installed height. Measure the compressed spring tension. Replace the springs if the measured tension is below the specified limit.

| Tension                                 |                       | N (kg/lb)             |
|-----------------------------------------|-----------------------|-----------------------|
| At installed height<br>38.9 mm (1.5 in) | Standard              | Limit                 |
|                                         | 296.2 (30.2/<br>66.6) | 257.9 (26.3/<br>57.9) |



### Valve Guide

#### Caution:

Taking care not to damage the valve seat contact surface, when removing carbon adhering to the valve head. Carefully inspect the valve stem for scratching or abnormal wear. If these conditions are present, the valve and the valve guide must be replaced as a set.

## 6A-12 GENERAL ENGINE MECHANICAL

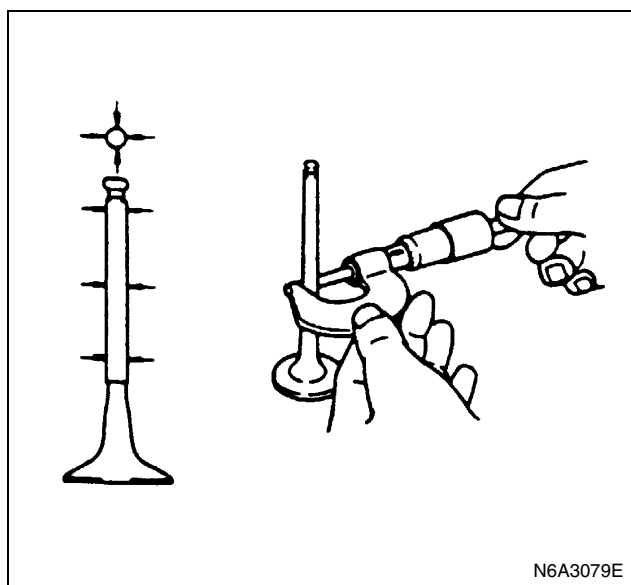
### 1. Valve Guide Clearance

- Measure the valve stem diameter with a micrometer.  
If the valve stem diameter is less than the specified limit, the valve and the valve guide must be replaced as a set.

|                        |         | mm (in)                            |                    |
|------------------------|---------|------------------------------------|--------------------|
|                        |         | Standard                           | Limit              |
| Diameter of Valve stem | Inlet   | 7.946 — 7.961<br>(0.3128 — 0.3134) | 7.880<br>(0.310.2) |
|                        | Exhaust | 7.921 — 7.936<br>(0.3118 — 0.3124) | 7.850<br>(0.3091)  |

- Measure the inside diameter of the valve guide with a micrometer.
- Subtract the measured outer diameter of the valve stem from the measured inner diameter of the valve guide. If the valve exceeds of the valve guide.  
If the valve exceeds the specified limit, the valve and the valve guide must be replaced as a set.

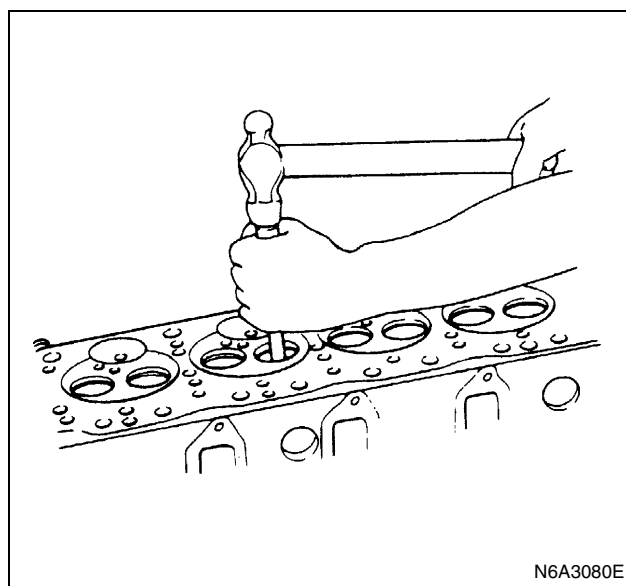
| Valve Guide Clearance |  | mm (in)                            |                   |
|-----------------------|--|------------------------------------|-------------------|
|                       |  | Standard                           | Limit             |
| Inlet clearance       |  | 0.039 — 0.069<br>(0.0015 — 0.0027) | 0.200<br>(0.0079) |
| Exhaust clearance     |  | 0.064 — 0.096<br>(0.0025 — 0.0038) | 0.250<br>(0.0098) |



### Valve Guide Replacement

- Using special tool, drive out the valve guide from the combustion chamber side.

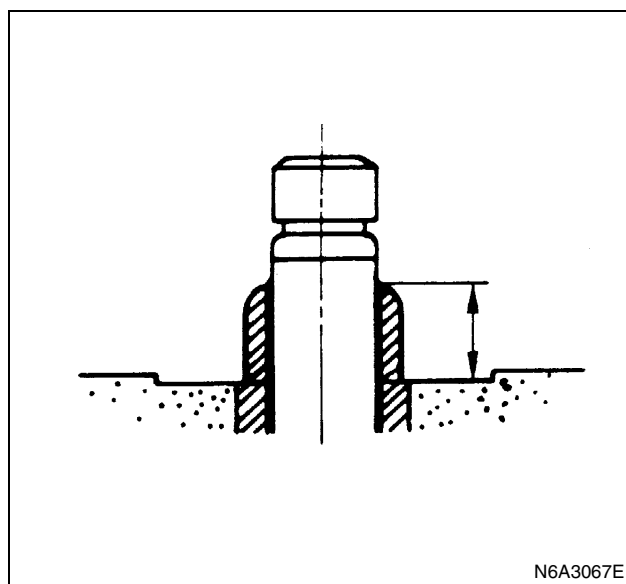
Valve guide replacer: 9-8523-1212-0



- Apply engine oil to the outside of the valve guide. Using special tool, drive in a new valve guide from cylinder head upper face side, and check the valve guide height.

Valve guide replacer: 9-8523-1212-0

| Height    | mm (in) |
|-----------|---------|
| 13 (0.51) |         |



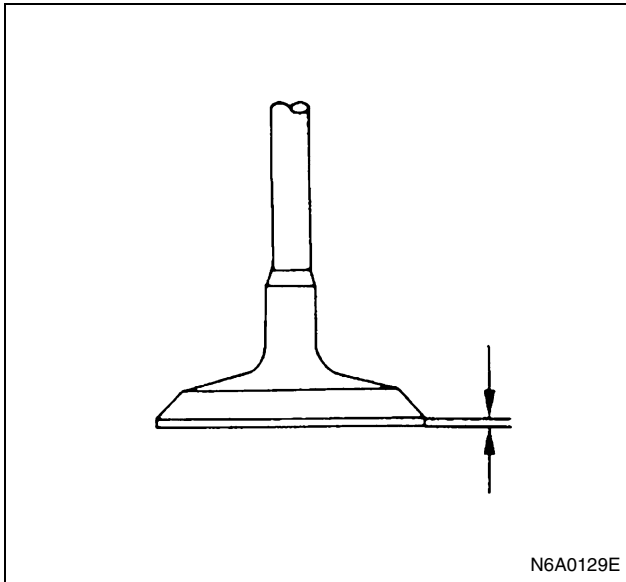
#### Notice:

If the valve guide has been removed, both the valve and the valve guide must be replaced as a set.

**Valve Thickness**

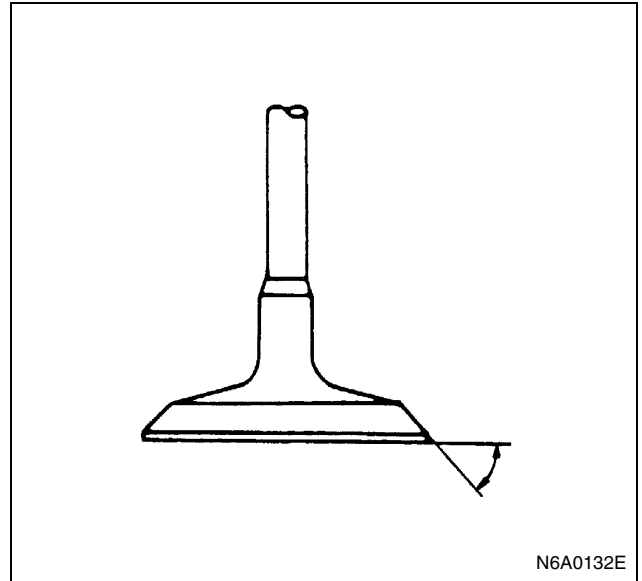
1. Measure the valve thickness
2. If the measured value is less than the specified limit the valve and the valve guide must be replaced as a set.

| Valve Thickness |          |               | mm (in)     |
|-----------------|----------|---------------|-------------|
|                 | Standard |               | Limit       |
| 4JB1<br>4JB1-TC | Inlet    | 1.79 (0.0705) | 1.5 (0.06)  |
|                 | Exhaust  | 1.83 (0.0720) |             |
| 4JG2            | Inlet    | 1.41 (0.0555) | 1.1 (0.043) |
|                 | Exhaust  | 1.39 (0.0547) |             |
| 4JH1-TC         | Inlet    | 1.41 (0.0555) | 1.1 (0.043) |
|                 | Exhaust  | 1.38 (0.0543) |             |

**Contact Surface Angle on Valve Seat on Valve**

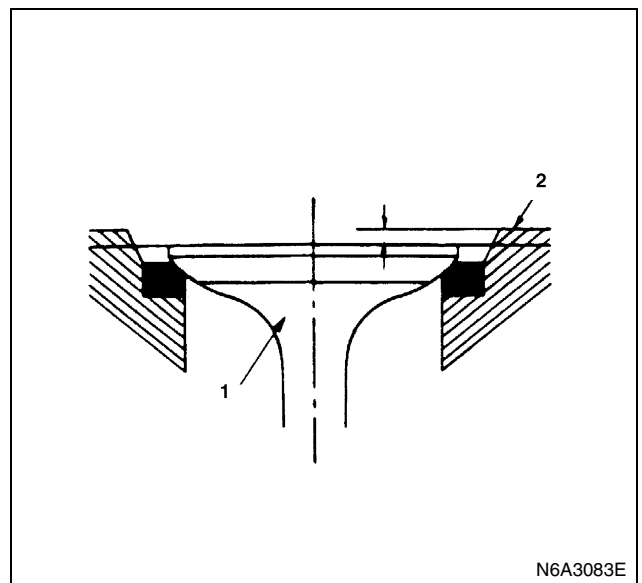
1. Measure contact surface angle on valve seat.
2. If the measured value exceeds the limit, replace valve guide and valve seat as a set.

| Standard | Degrees |
|----------|---------|
|          | 45°     |

**Valve Depression**

1. Install the valve (1) to the cylinder head (2).
  2. Use a depth gauge or a straight edge with steel rule to measure the valve depression from the cylinder head lower surface.
- If the measured value exceeds the specified limit, the valve seat insert must be replaced.

| Valve Depression |          |              | mm (in)      |
|------------------|----------|--------------|--------------|
|                  | Standard |              | Limit        |
| 4JB1<br>4JB1-TC  | Inlet    | 0.73 (0.029) | 1.28 (0.050) |
|                  | Exhaust  | 0.70 (0.028) | 1.20 (0.047) |
| 4JG2<br>4JH1-TC  | Inlet    | 1.1 (0.043)  | 1.6 (0.063)  |
|                  | Exhaust  |              |              |

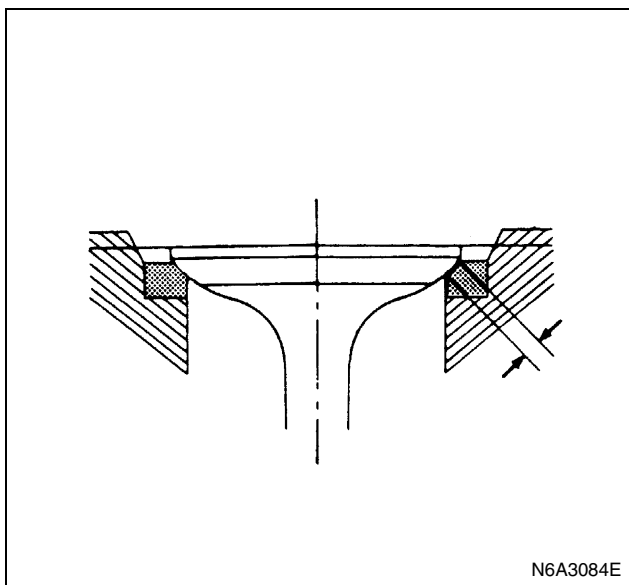
**Valve Contact Width**

1. Check the valve contact faces for roughness and unevenness. Make smooth the valve contact surfaces.

## 6A-14 GENERAL ENGINE MECHANICAL

- Measure the valve contact width.  
If the measured value exceeds the specified limit, the valve seat insert must be replaced.

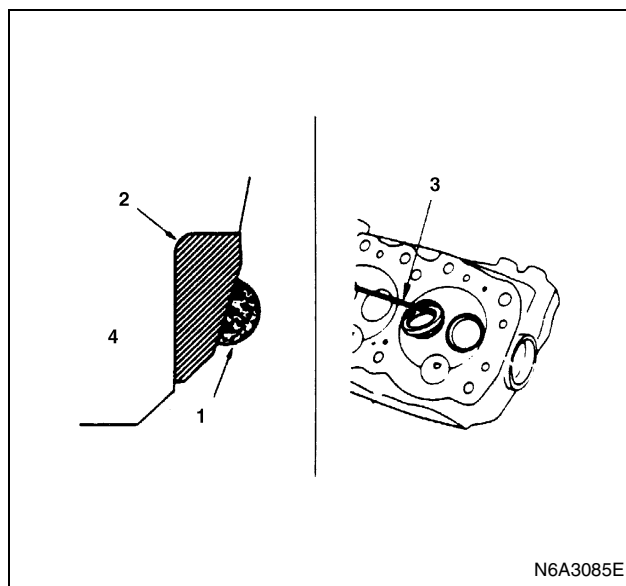
| Contact Width |              | mm (in)      |
|---------------|--------------|--------------|
|               | Standard     | Limit        |
| Inlet         | 1.7 (0.0670) | 2.2 (0.0866) |
| Exhaust       | 2.0 (0.0788) | 2.5 (0.0984) |



### Valve Seat Insert Replacement

#### Valve Seat Insert Removal

- Arc weld the tire inside circumference (1) of the valve seat insert (2).
- Allow the valve seat insert to cool for a few minutes.  
This will invite contraction and make removal of the valve seat insert easier.
- Use a screwdriver (3) to pry the valve seat insert free.  
Take care not to damage the cylinder head (4).
- Carefully remove carbon and other foreign material from the cylinder head insert bore.



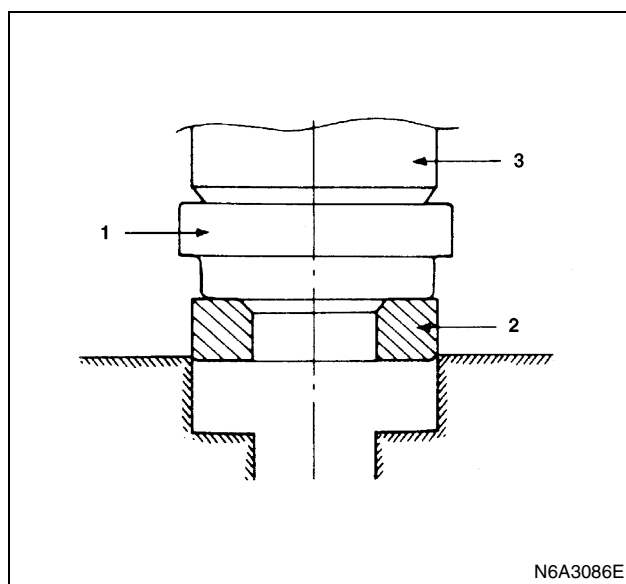
#### Valve Seat Insert Installation

- Carefully place the attachment (1) (having a smaller outside diameter than the valve seat insert) on the valve seat insert (2).

#### Notice:

The smooth side of the attachment must contact the valve seat insert.

- Use a bench press (3) to gradually apply pressure to the attachment and press the valve seat insert into place.



#### Notice:

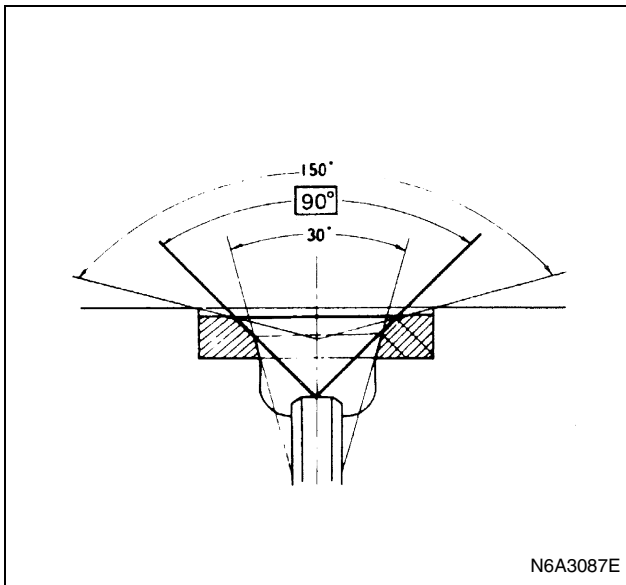
Do not apply an excessive amount of pressure with the bench press. Damage to the valve seat insert will result.

#### Valve Seat Insert Correction

- Remove the carbon from the valve seat insert surface.

2. Use a valve cutter (15°, 45°, and 75° blades) to minimize scratches and other rough areas, this will bring the contact width back to the standard value. Remove only the scratches and rough areas. Do not cut away too much. Take care not to cut away unblemished area of the valve seat surface.

| Valve Seat Angle | degree |
|------------------|--------|
| 45°              |        |

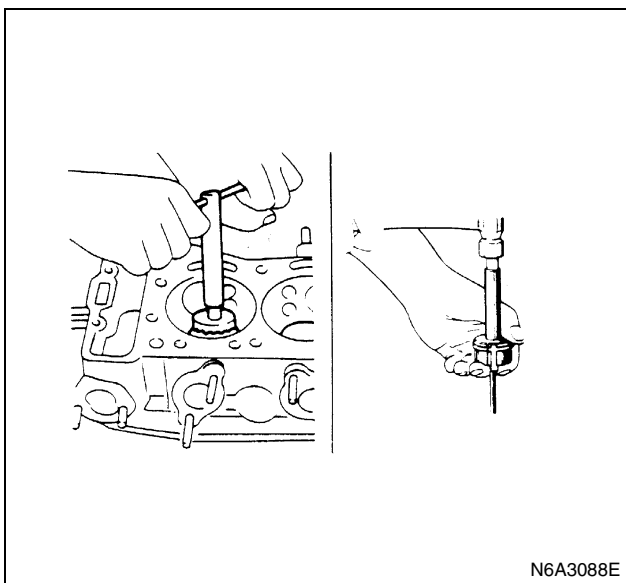


**Notice:**

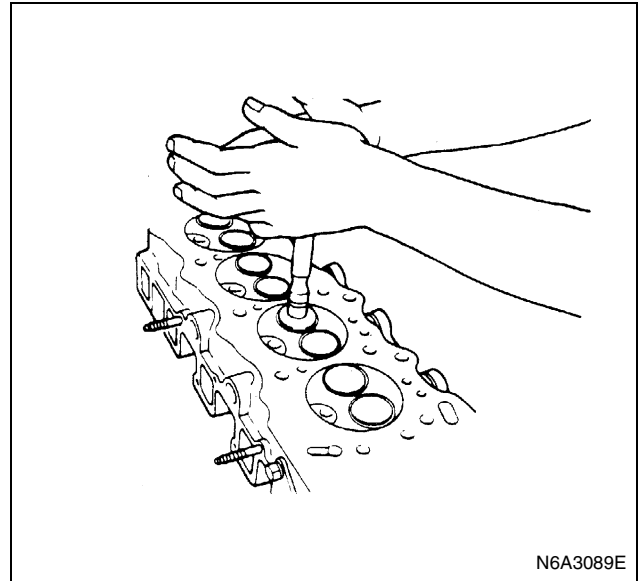
Use an adjustable valve cutter pilot.

Do not allow the valve cutter pilot to wobble inside the valve guide.

3. Apply abrasive compound to the valve seat insert surface.



4. Insert the valve into the valve guide.
5. Turn the valve while tapping it to fit the valve seat insert.

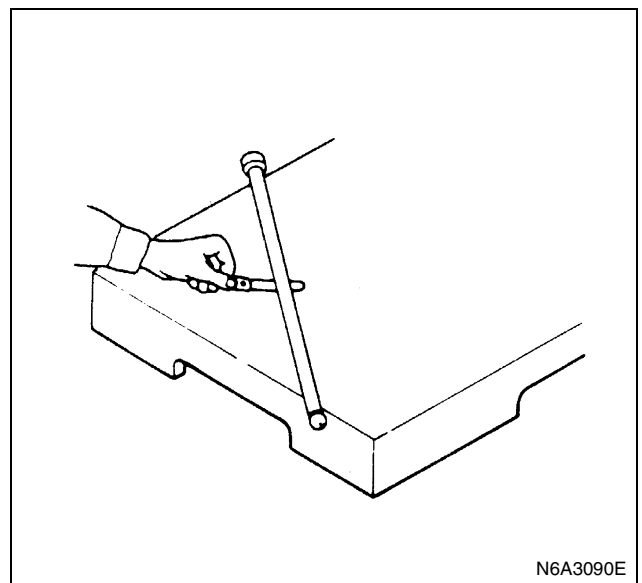


6. Check that the valve contract width is correct.
7. Check that the valve seat insert surface is in contact with the entire circumference of the valve.

**Push Rod Curvature**

1. Lay the push rod on a surface plate.
  2. Roll the push rod along the surface plate and measure the push rod curvature with a thickness gauge.
- If the measure value exceeds the specified limit, the push rod must be replaced.

| Push Rod Curvature Limit | mm (in) |
|--------------------------|---------|
| 0.4 (0.0157) or less     |         |



3. Visually inspect both ends of the push rod for excessive wear and damage. The push rod must be replaced if these conditions are discovered during inspection.

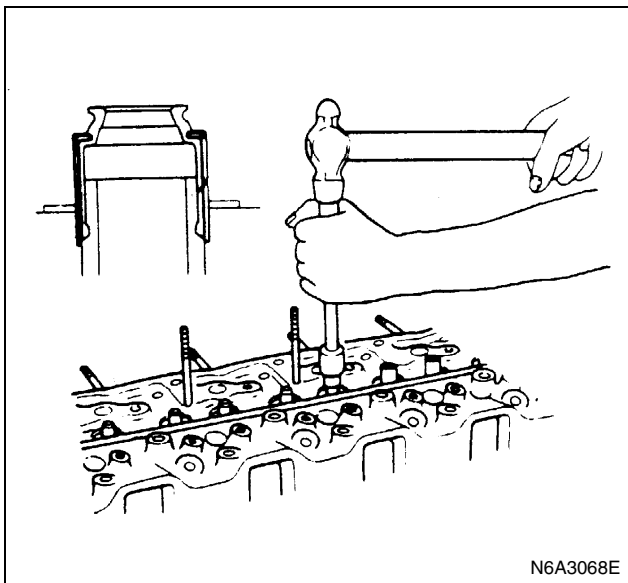
## Reassembly

### 1. Valve Guide

- Apply engine oil to the outside of the valve guide.  
Using special tool, drive in a new valve guide from the rocker arm shaft side.  
Valve guide replacer: 9-8523-1212-0

### 2. Valve Guide Oil Seal

- Using special tool, drive in a new oil seal  
Oil special tool, drive in a new oil seal  
Oil seal installer: 5-8840-2033-0

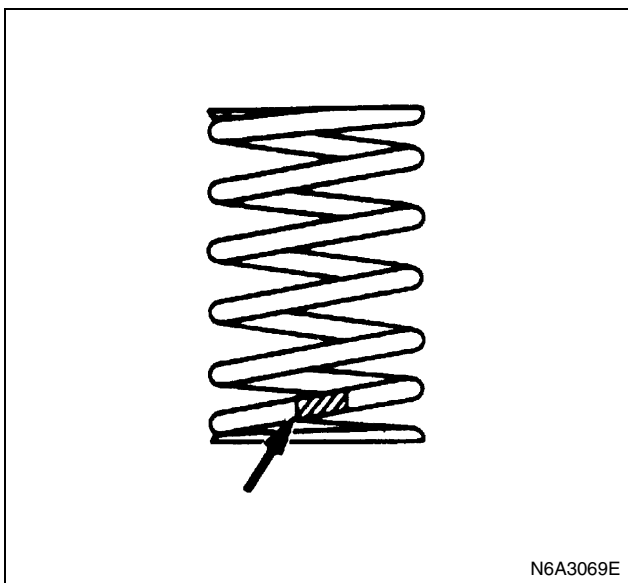


### 3. Valve

- Apply engine oil to the outside of the valve stem.

### 4. Valve Spring

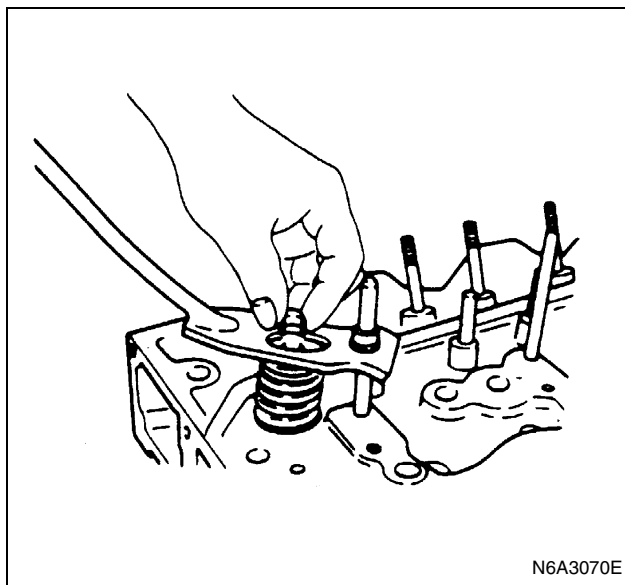
- Attach the valve seat to the upper spring seat.  
The painted area of the valve spring should be facing downward.



### 5. Split Collar

- Use a spring compressor to push the valve spring into position.
- Install the spring seat split collar.
- Set the split collar by tapping lightly around the head of the collar with a rubber hammer.

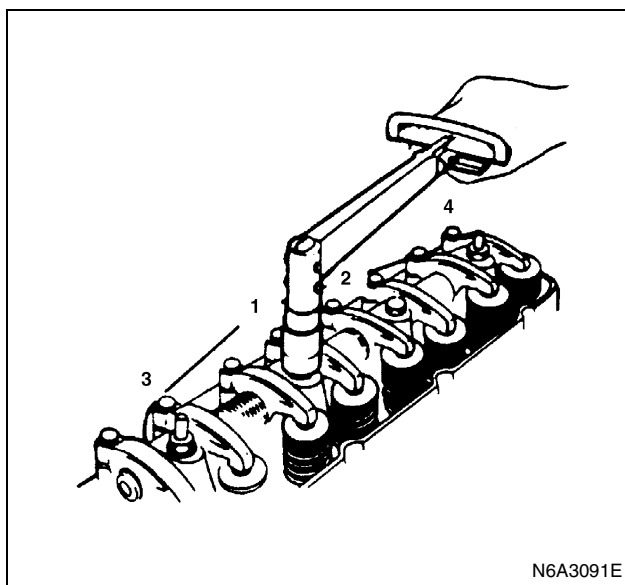
Valve spring compressor: 9-8523-1423-0 (J-29760)



### 6. Rocker Arm Assembly

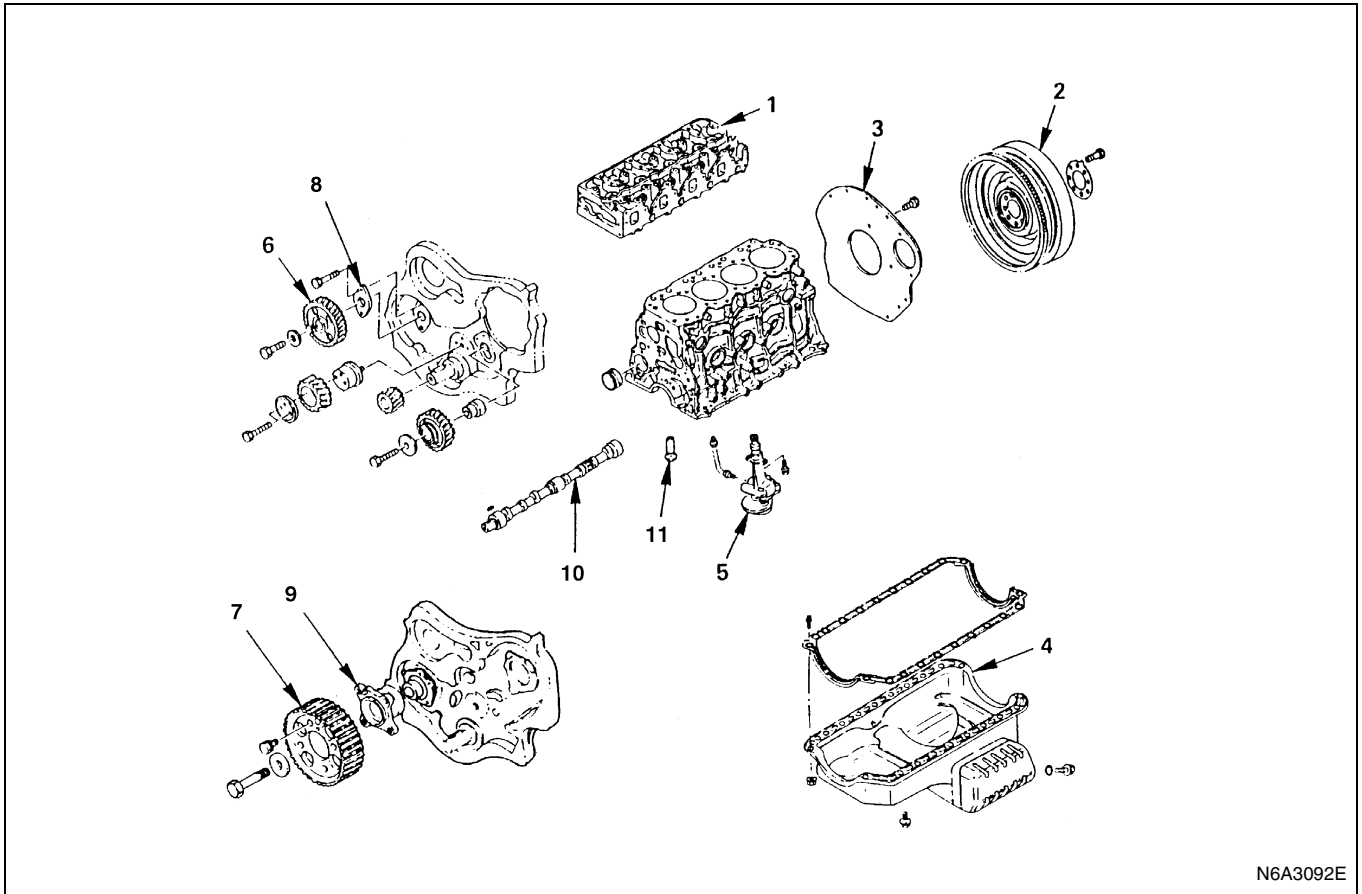
#### Tighten:

54 N·m (5.5 kg·m/40 lb·ft)



## CAMSHAFT, TAPPET

### Component



N6A3092E

### Legend

- |                              |                           |
|------------------------------|---------------------------|
| 1. Cylinder head assembly    | 7. Camshaft timing pulley |
| 2. Flywheel                  | 8. Camshaft thrust plate  |
| 3. Cylinder block rear plate | 9. Camshaft pulley center |
| 4. Oil pan assembly          | 10. Camshaft              |
| 5. Oil pump assembly         | 11. Tappet                |
| 6. Camshaft timing gear      |                           |

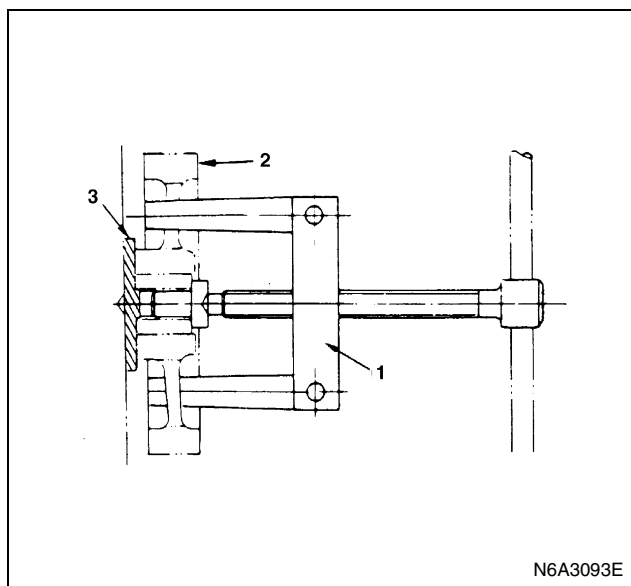
### Disassembly

1. Cylinder Head Assembly
2. Flywheel
3. Cylinder Block Rear Plate
4. Oil Pan Assembly
5. Oil Pump Assembly
6. Camshaft Timing Gear (Gear Drive Model)
  - Remove the camshaft timing gear bolt from the camshaft.

### Notice:

Hold the camshaft stationary to prevent the camshaft from turning.

- Use the universal puller (1) to pull out the camshaft timing gear (2).
- Universal Puller: 5-8521-0002-0  
Remove the thrust plate (3).



## 7. Camshaft Timing Pulley (Belt Drive Model)

- Use the timing pulley puller (2) to remove the pulley.

Timing Pulley Puller: 5-8840-0086-0

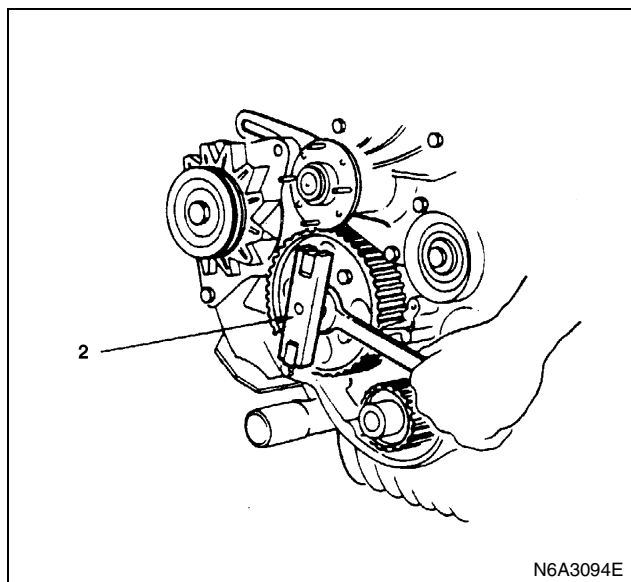
- Remove the stopper bolt.

## 8. Camshaft Thrust Plate (Gear Drive Model)

## 9. Camshaft Pulley Center (Belt Drive Model)

## 10. Camshaft

## 11. Tappet



## Inspection and Repair

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

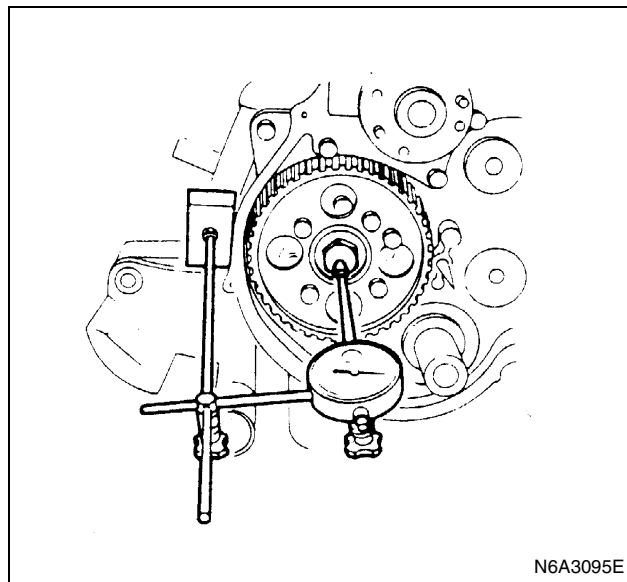
## 1. Measure the Camshaft Thrust Clearance

- Use a dial indicator to measure the camshaft end play.

This must be done before removing the camshaft gear.

If the camshaft end play exceeds the specified limit, the thrust plate must be replaced.

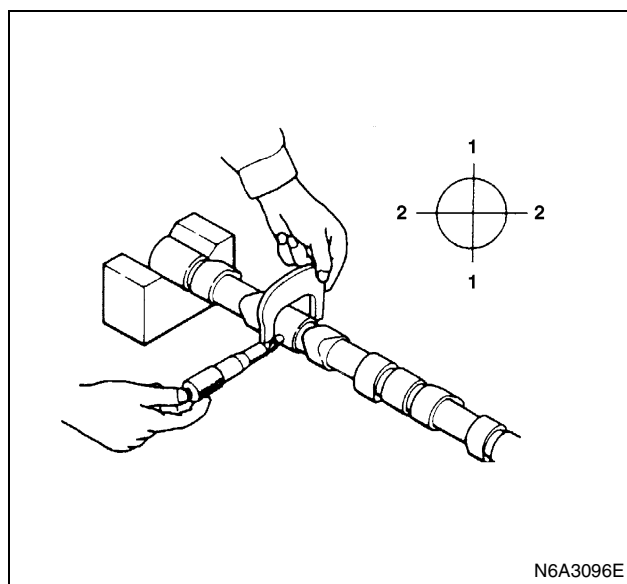
| Camshaft End Play |              | mm (in) |
|-------------------|--------------|---------|
| Standard          | Limit        |         |
| 0.08 (0.0031)     | 0.2 (0.0079) |         |



## 2. Camshaft Journal Diameter

- Use a micrometer to measure each camshaft journal diameter in two directions (1) and (2). If the measured value is less than the specified limit, the camshaft must be replaced.

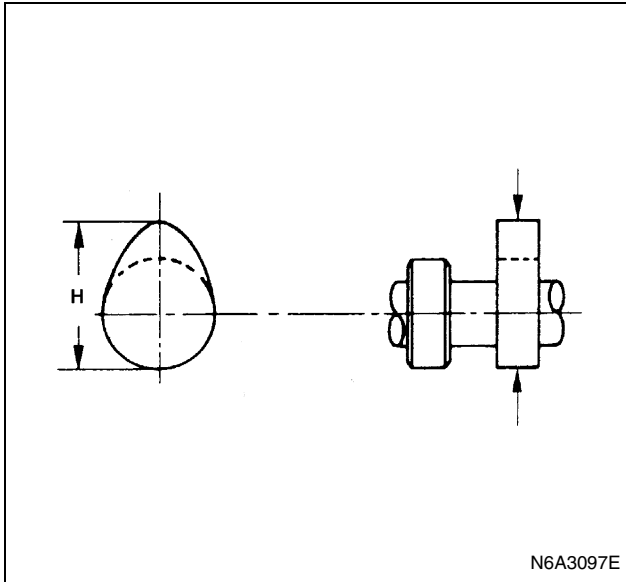
| Journal Diameter                  |                | mm (in) |
|-----------------------------------|----------------|---------|
| Standard                          | Limit          |         |
| 49.945 — 49.975 (1.9663 — 1.9675) | 49.60 (1.9528) |         |



### 3. Cam Height

- Measure the cam height H with a micrometer. If the measured value is less than the specified limit, the camshaft must be replaced.

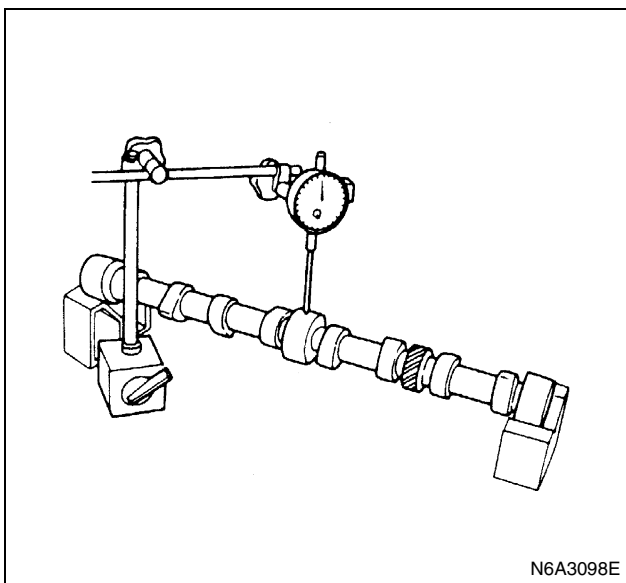
| Cam Height mm (in) |                |
|--------------------|----------------|
| Standard           | Limit          |
| 42.02 (1.6543)     | 41.65 (1.6398) |



### 4. Camshaft Run-Out

- Mount the camshaft on V-blocks.
- Measure the run-out with a dial indicator. If the measured value exceeds the specified limit, the camshaft must be replaced.

| Run-Out mm (in)      |               |
|----------------------|---------------|
| Standard             | Limit         |
| 0.02 (0.008) or less | 0.10 (0.0039) |



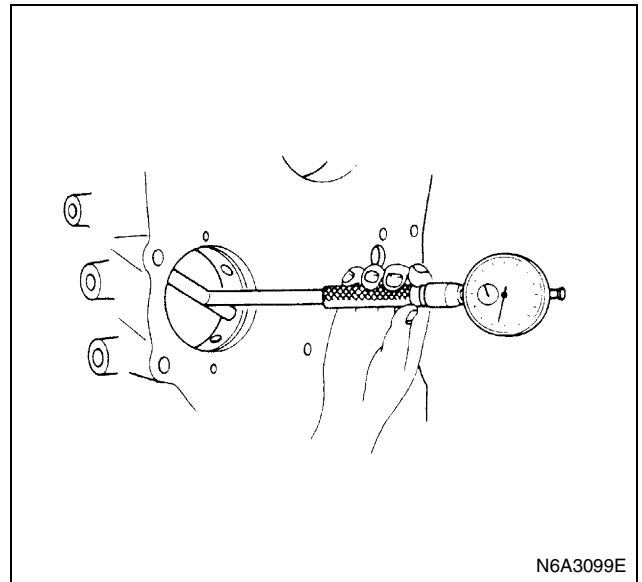
### 5. Camshaft and Camshaft Bearing Clearance

- Use an inside dial indicator to measure the camshaft bearing inside diameter.

| Camshaft Bearing Inside Diameter mm (in) |                |
|------------------------------------------|----------------|
| Standard                                 | Limit          |
| 50.00 — 50.03 (1.9685 — 1.9696)          | 50.08 (1.9716) |

| Camshaft Bearing Clearance mm (in) |              |
|------------------------------------|--------------|
| Standard                           | Limit        |
| 0.025 — 0.085 (0.0010 — 0.0033)    | 0.12 (0.005) |

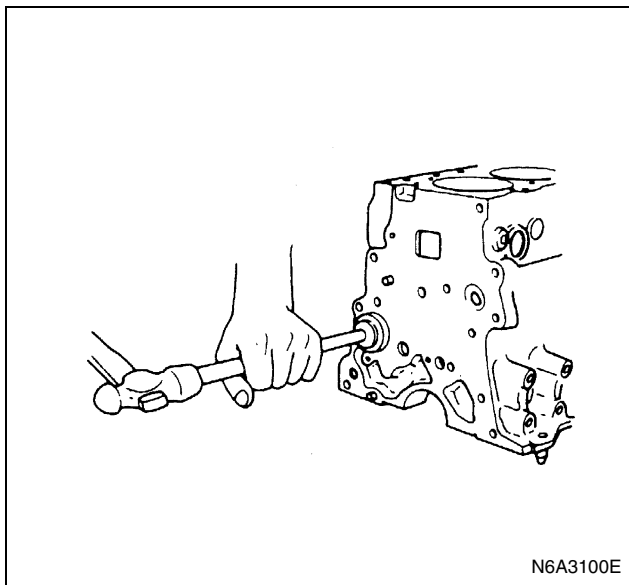
- If the clearance between the camshaft bearing inside diameter and the journal exceeds the specified limit, the camshaft bearing must be replaced.



### Camshaft Bearing Replacement

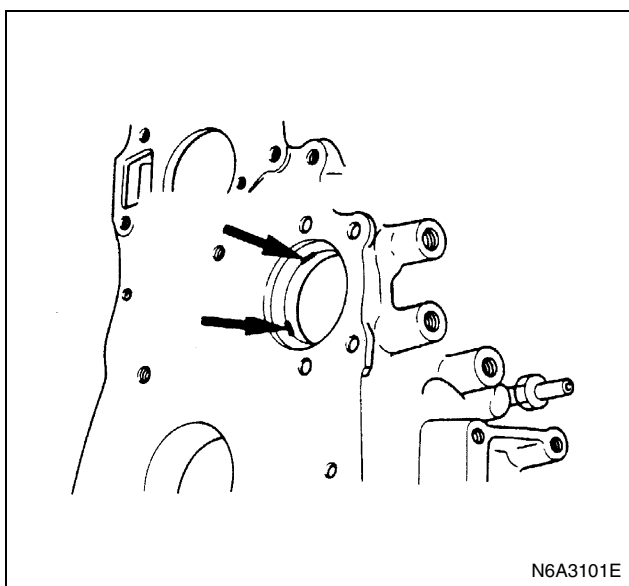
#### Camshaft Bearing Removal

- Remove the cylinder body plug plate.
- Use the bearing replacer to remove the camshaft bearing.  
Bearing Replacer: 5-8840-2038-0



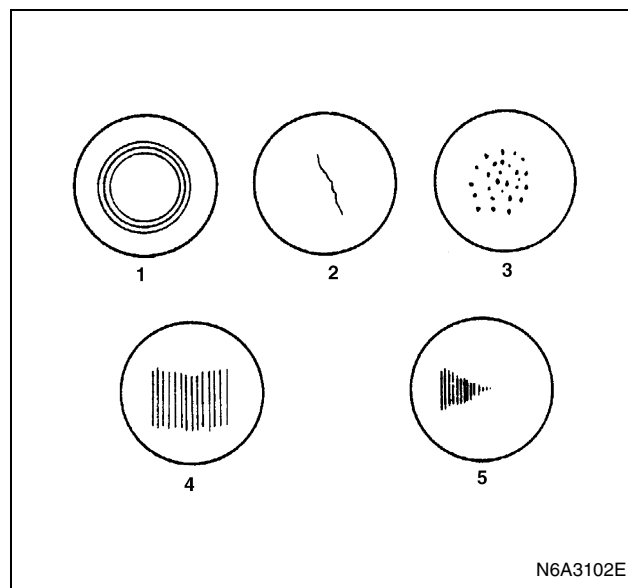
### Camshaft Bearing Installation

1. Align the bearing oil holes with the cylinder body oil holes.
2. Use the replacer to install the camshaft bearing.  
Bearing Replacer: 5-8840-2038-0



### Tappet

Visually inspect the tappet camshaft contact surfaces for pitting, cracking, and other abnormal conditions. The tappet must be replaced if any of these conditions are present.



### Legend

1. Normal contact
2. Cracking
3. Pitting
4. Irregular contact
5. Irregular contact

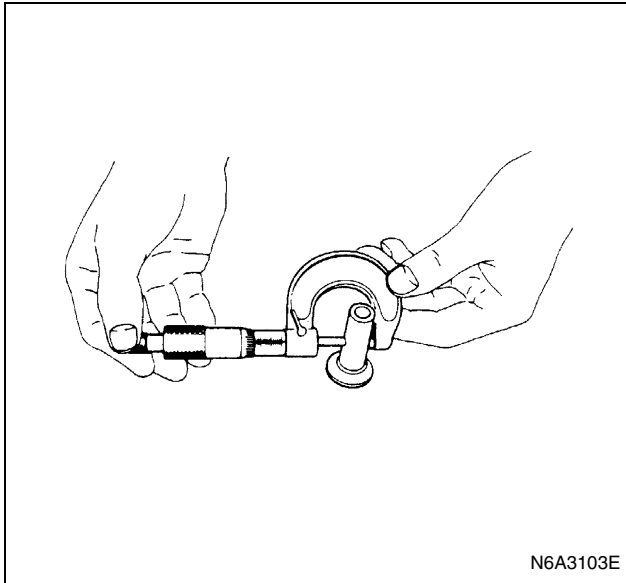
### Notice:

The tappet surfaces are spherical. Do not attempt to grind them with an oil stone or similar tool in an effort to repair the tappet. If the tappet is damaged, it must be replaced.

### Tappet Outside Diameter

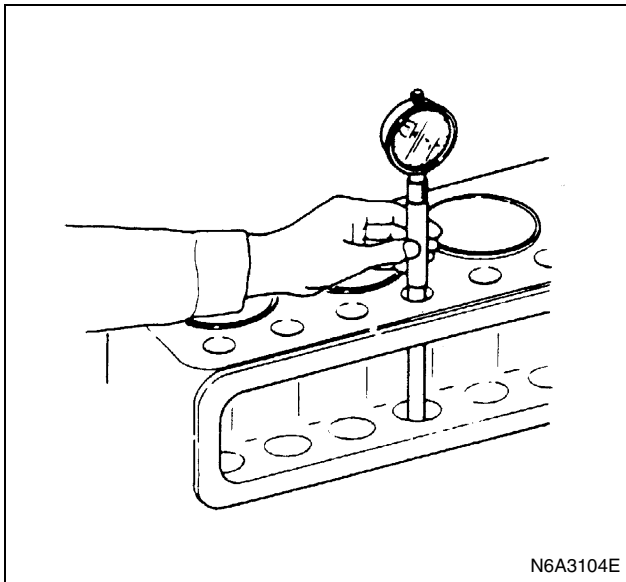
1. Measure the tappet outside diameter with a micrometer. If the measured value is less than the specified limit, the tappet must be replaced.

| Tappet Outside Diameter       |  | mm (in)       |
|-------------------------------|--|---------------|
| Standard                      |  | Limit         |
| 12.97 — 12.99 (0.510 — 0.511) |  | 12.95 (0.509) |



2. Measure the inside diameter tappet on the cylinder block and calculate the clearance.  
If the clearance exceeds the limit, replace tappet or/and cylinder block.

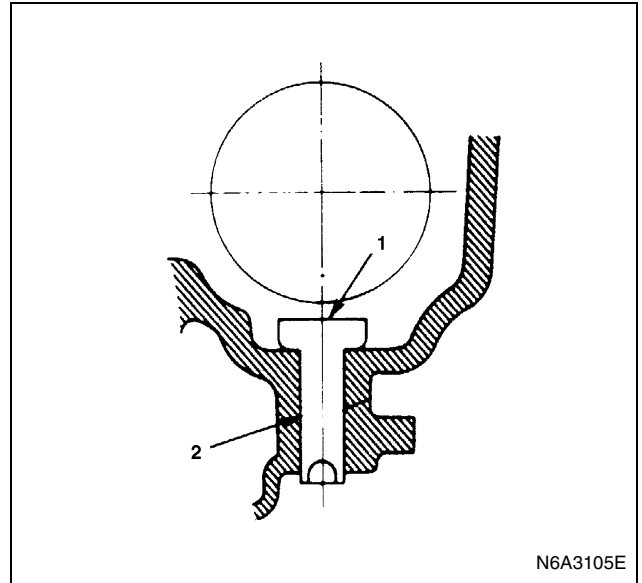
| Tappet and Cylinder Body Clearance |              | mm (in) |
|------------------------------------|--------------|---------|
| Standard                           | Limit        |         |
| 0.03 (0.001)                       | 0.10 (0.004) |         |



## Reassembly

### 1. Tappet

- 1) Apply a coat of engine oil to the tappet (1) and the cylinder body tappet insert holes (2).



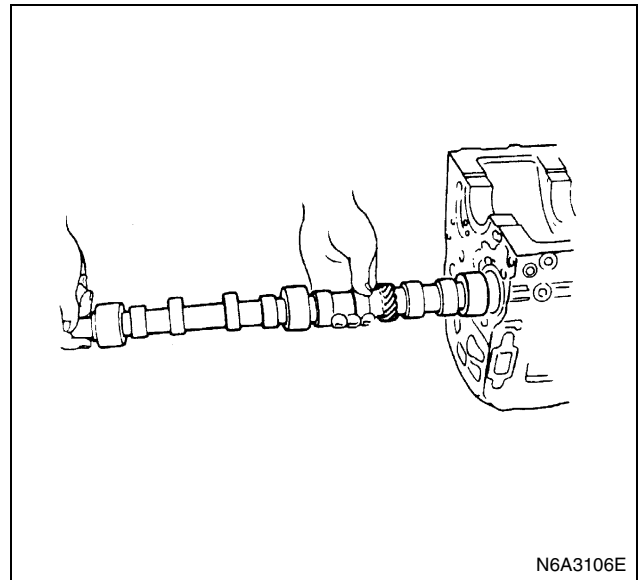
- 2) Locate the position mark applies at disassembly (if the tappet is to be reused).

### Notice:

The tappet must be installed before the camshaft.

### 2. Camshaft

- 1) Apply a coat of engine oil to the camshaft and the camshaft bearings.  
2) Install the camshaft to the cylinder body.  
Take care not damage the camshaft bearings.

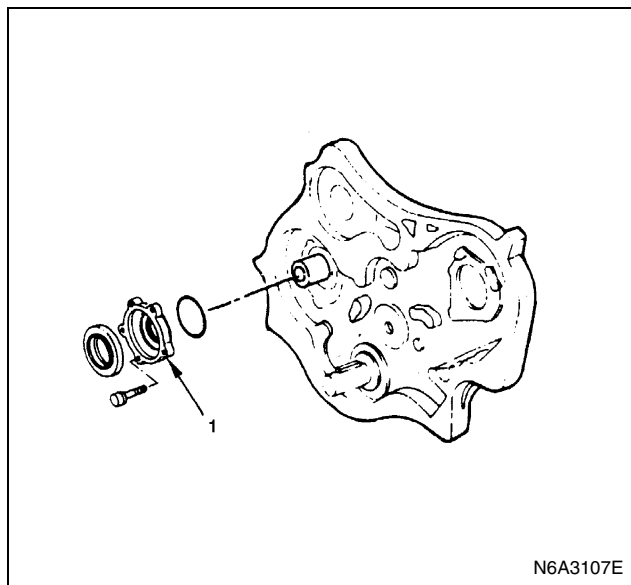


### 3. Camshaft Timing Pulley Center (Belt Drive Model)

- Apply engine oil to the oil seal lip portion of the oil seal retainer.
- Apply the recommended liquid gasket or its equivalent to the retainer.
- Install the oil seal retainer to the cylinder body.
- Tighten the retainer bolts to the specified torque.

**Tighten:**

Oil Seal Retainer Bolt to 19 N·m (1.9 kg·m/14 lb·ft)



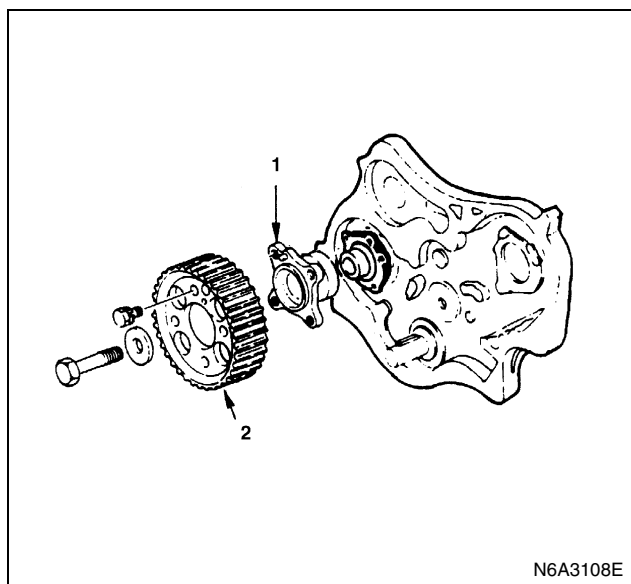
**Legend**

1. Retainer

- Align the camshaft timing pulley center with the camshaft key.
- Tighten the timing pulley bolts to the specified torque.

**Tighten:**

Timing Pulley Bolt to 8 N·m (0.8 kg·m/69 lb·ft)



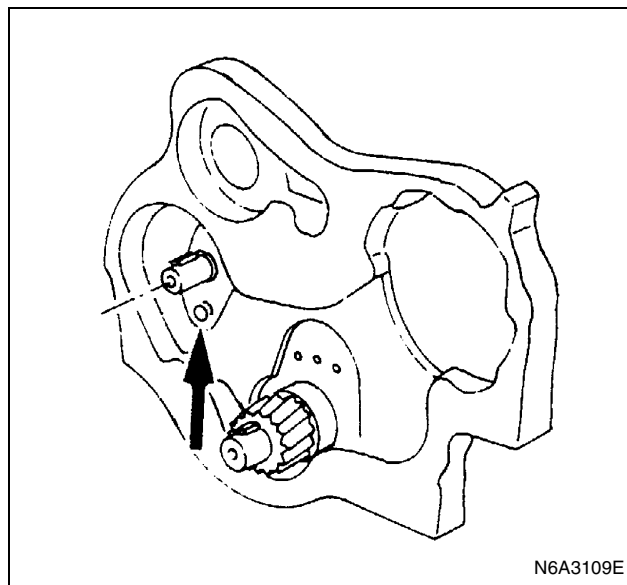
**Legend**

1. Timing pulley center  
2. Timing pulley

4. Camshaft Thrust Plate (Gear Drive Model)  
Install the thrust plate to the cylinder body and tighten the thrust plate bolts to specified torque.

**Tighten:**

Thrust Plate Bolt to 18 N·m (1.8 kg·m/13 lb·ft)

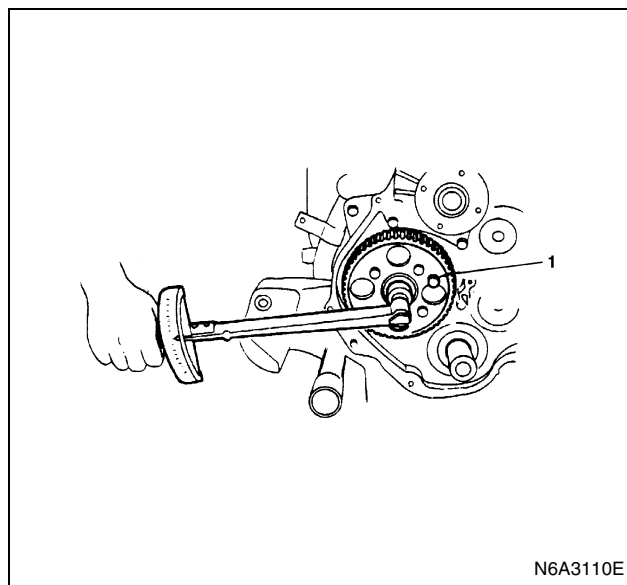


5. Camshaft Timing Pulley (Belt Drive Model)

- Prevent the camshaft from turning when tightening the timing center bolt.
- Tighten the timing pulley center bolt to the specified torque.

**Tighten:**

Center Bolt to 64 N·m (6.5 kg·m/47 lb·ft)



**Legend**

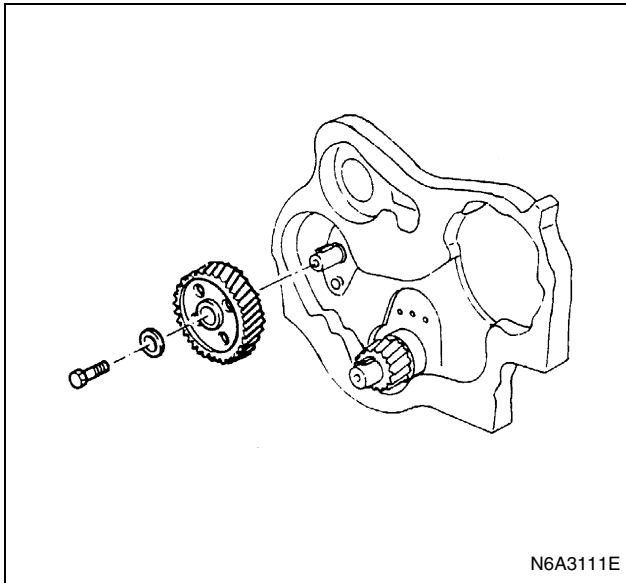
1. Lock bolt

6. Camshaft Timing Gear (Gear Drive Model)

- 1) Install the camshaft timing gear to the camshaft.  
The timing gear mark ("Y — Y") must be facing outward.
- 2) Tighten the timing gear to the specified torque

**Tighten:**

Timing Gear Bolt to 64 N·m (6.5 kg·m/47 lb·ft)



7. Oil Pump Assembly
8. Oil Pan Assembly  
Above works refer to "OIL PUMP" Section in this manual.
9. Cylinder Block Rear Plate
  - Tighten cylinder block rear plate fixing bolts to the specified torque.

**Tighten:**

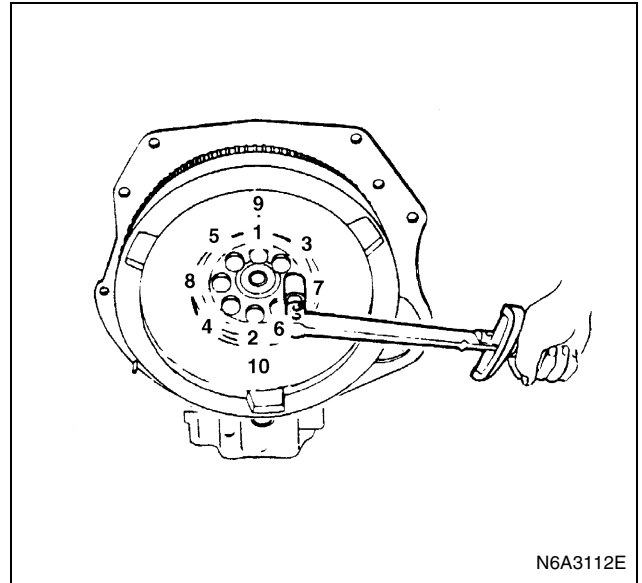
Rear Plate Bolt to 82 N·m (8.4 kg·m/61 lb·ft)

## 10. Flywheel

- Apply engine oil to fixing bolts.
- Tighten the flywheel bolts to the specified torque in two steps using the Angular Tightening Method.  
Follow the numerical order shown in the illustration.

**Tighten:**

- Flywheel Bolt to
  - 1st Step (Snug torque): 59 N·m (6.0 kg·m/43 lb·ft)
  - 2nd Step (Final torque): 60° — 90°



## 11. Cylinder Head Assembly

## 1) Hot plug

- Set the knock ball in the positioning groove on the cylinder head side according to the order of the cylinders, and hit it lightly with a plastic hammer.

**Notice:**

After being pressed into the cylinder head, the hot plugs were provided with surface grinding.

Accordingly, their dimensions are different individually among them, and take care not to confuse the order of the cylinders.

**When replacing the hot plug with new one:**

When assembling a new hot plug, set the knock ball in the positioning groove on the cylinder side and hit it lightly with a plastic hammer until the hot plug is set in stably.

With patch attached to the hot plug to prevent it from being damaged, press it in with a force of 4.5 ~ 5.5 ton applied.

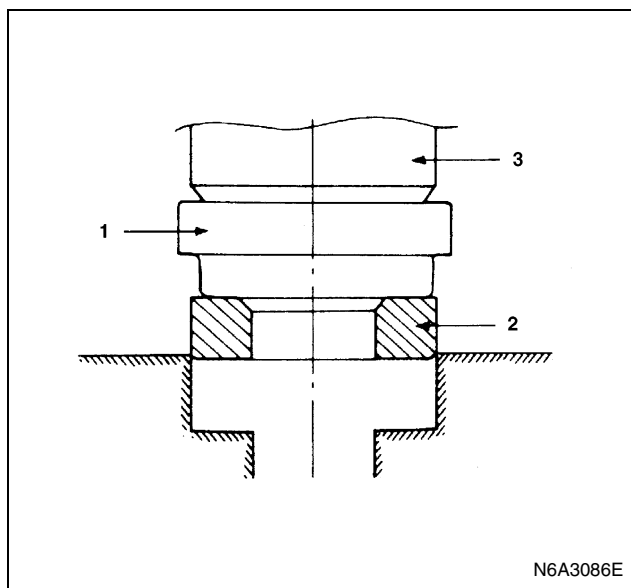
## 2) Valve Seat Insert Installation

- Carefully place the attachment (1) (having a smaller outside diameter than the valve seat insert) on the valve seat insert (2).

**Notice:**

The smooth side of the attachment must contact the valve seat insert.

- Use the bench press (3) to gradually apply pressure to the attachment and press the valve seat insert into place.



- 3) Spring Lower Seat
- 4) Valve Stem Oil Seal
- 5) Valve
- 6) Valve Spring
- 7) Split Collar

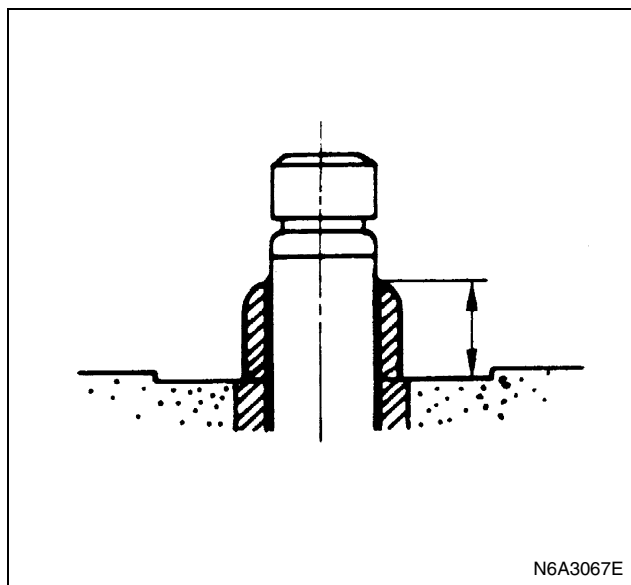
Above works refer to "VALVE" Section in this manual.

**Notice:**

Do not apply an excessive amount of pressure with the bench press. Damage to the valve seat insert will result.

Measure the height of the valve guide upper end from the upper face of the cylinder head.

| Valve Guide Upper End Height (H) (Reference) |
|----------------------------------------------|
| mm (in)                                      |
| 13 (0.51)                                    |

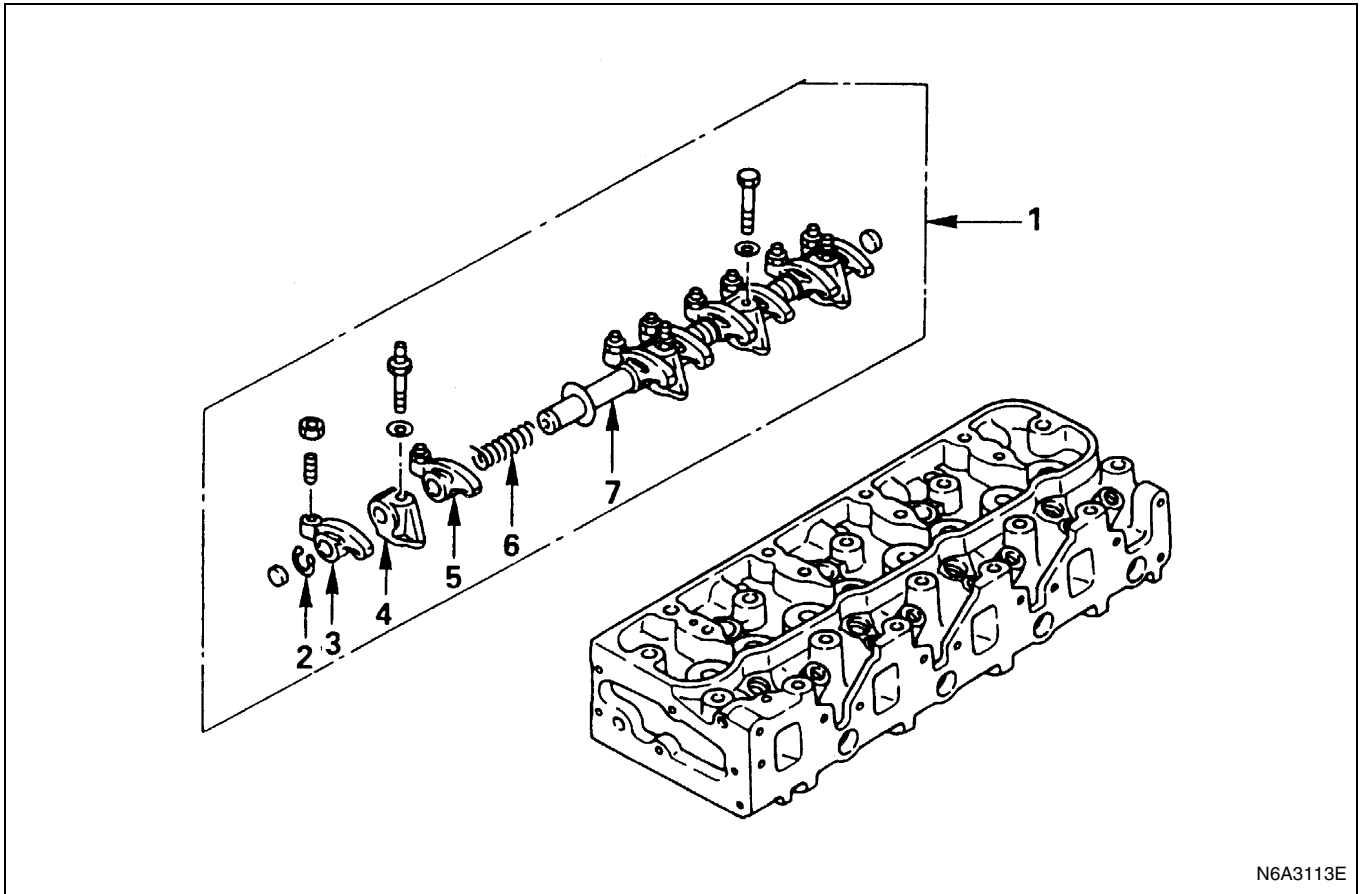


**Notice:**

If the valve guide has been removed, both the valve and the valve guide must be replaced as a set.

## ROCKER ARM ASSEMBLY

### Component



N6A3113E

### Legend

- |                               |                            |
|-------------------------------|----------------------------|
| 1. Rocker arm shaft assembly  | 5. Rocker arm              |
| 2. Rocker arm shaft snap ring | 6. Rocker arm shaft spring |
| 3. Rocker arm                 | 7. Rocker arm shaft        |
| 4. Rocker arm shaft bracket   |                            |

### Disassembly

1. Rocker Arm Shaft Assembly
2. Rocker Arm Shaft Snap Ring
3. Rocker Arm
4. Rocker Arm Shaft Bracket
5. Rocker Arm
6. Rocker Arm Shaft Spring
7. Rocker Arm Shaft

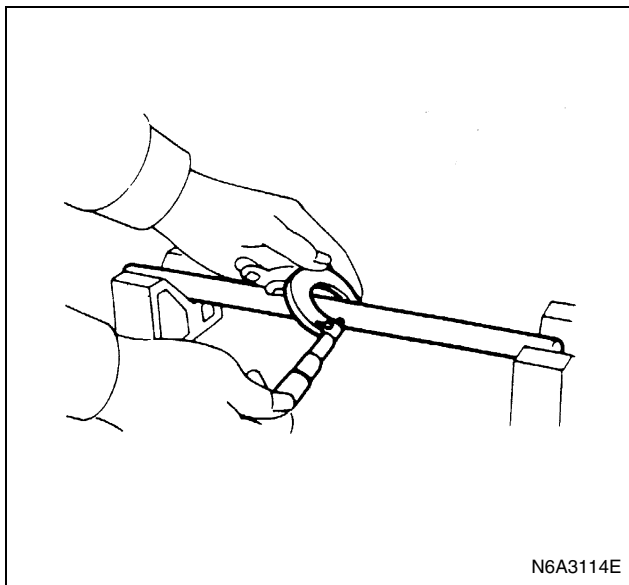
Replace the rocker shaft if the diameter exceeds the specified limit.

| mm (in)                         |              |
|---------------------------------|--------------|
| Standard                        | Limit        |
| 18.98 — 19.00 (0.7472 — 0.7480) | 18.9 (0.744) |

### Inspection and Repair

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

Use a micrometer to measure the rocker shaft outside diameter at the point where the rocker arm moves on the rocker shaft.



N6A3114E

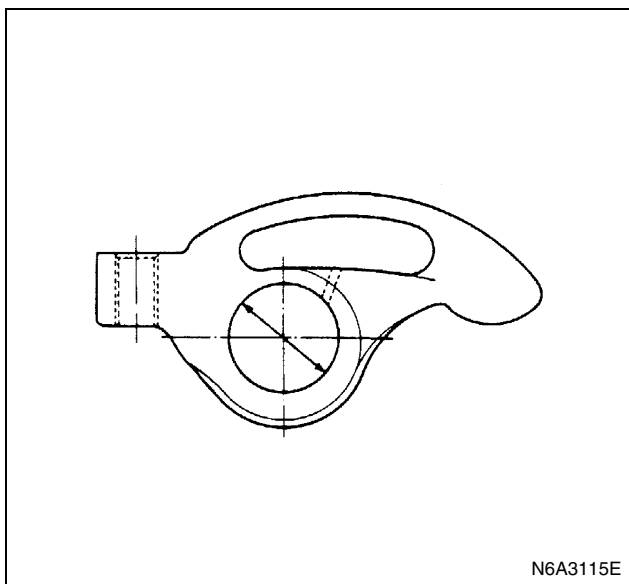
**Oil Clearance**

1. Use either a vernier caliper or a dial indicator to measure the rocker arm inside diameter.

| Rocker Arm Inside Diameter        |                 | mm (in) |
|-----------------------------------|-----------------|---------|
| Standard                          | Limit           |         |
| 19.036 — 19.060 (0.7494 — 0.7503) | 19.100 (0.7519) |         |

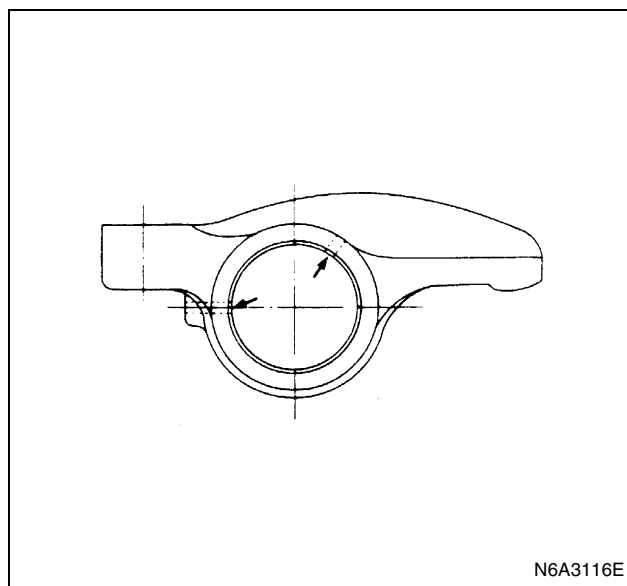
2. Measure the rocker arm shaft outside diameter.  
If the measured value exceeds the specified limit, replace either the rocker arm or the rocker arm shaft.

| Rocker Arm and Rocker Shaft Clearance |               | mm (in) |
|---------------------------------------|---------------|---------|
| Standard                              | Limit         |         |
| 0.06 — 0.08 (0.0024 — 0.0031)         | 0.10 (0.0039) |         |



N6A3115E

3. Check that the rocker arm oil port is free of obstructions.  
If necessary, use compressed air to clean the rocker arm oil port.



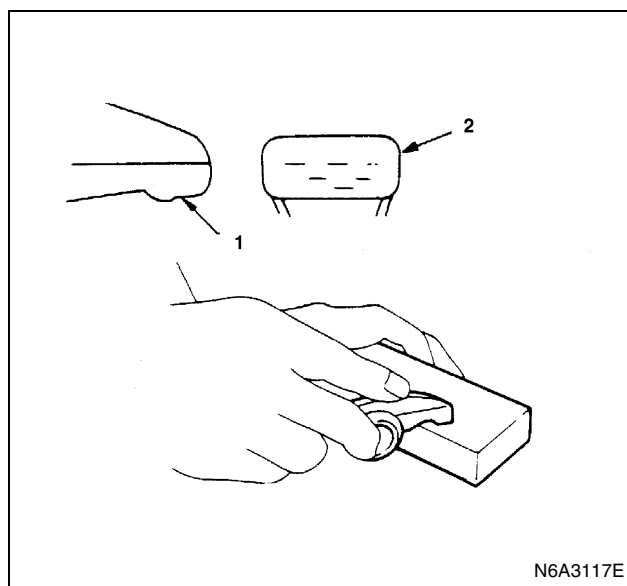
N6A3116E

**Rocker Arm Correction**

Inspect the rocker arm valve stem contact surface for step wear (1) and scoring (2).

If the contact surfaces have light step wear or scoring, they may be honed with an oil stone.

If the step wear or scoring is severe, the rocker arm must be replaced.

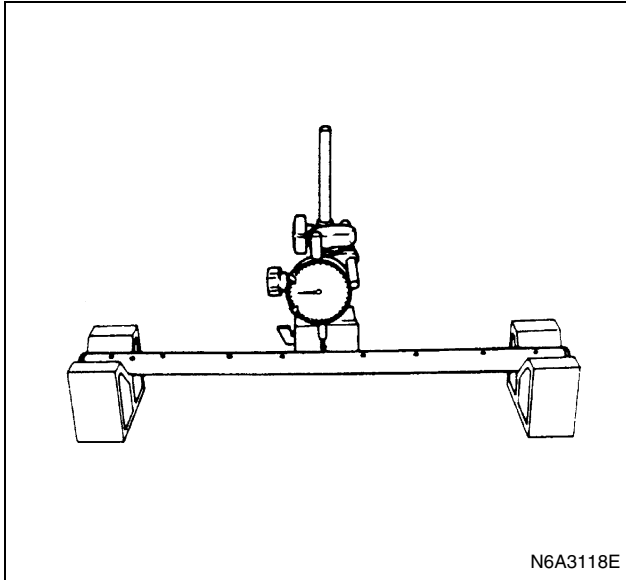


N6A3117E

**Rocker Arm Shaft Run-Out**

1. Place the rocker arm shaft on a V-block.
2. Use a dial indicator to measure the rocker arm shaft central portion run-out.  
If the run-out is very slight, correct the rocker arm shaft run-out with a bench press. The rocker arm must be at cold condition.  
If the measured rocker arm shaft run-out exceeds the specified limit, the rocker arm shaft must be replaced.

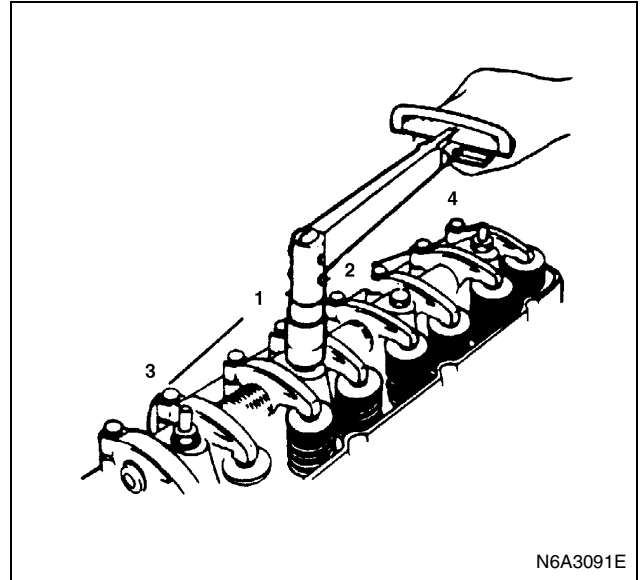
| Rocker Arm Shaft Run-Out |             | mm (in) |
|--------------------------|-------------|---------|
|                          | Limit       |         |
| 4JB1 / 4JB1-TC           | 0.2 (0.008) |         |
| 4JH1-TC                  |             |         |



## 6. Rocker Arm Shaft Snap Ring

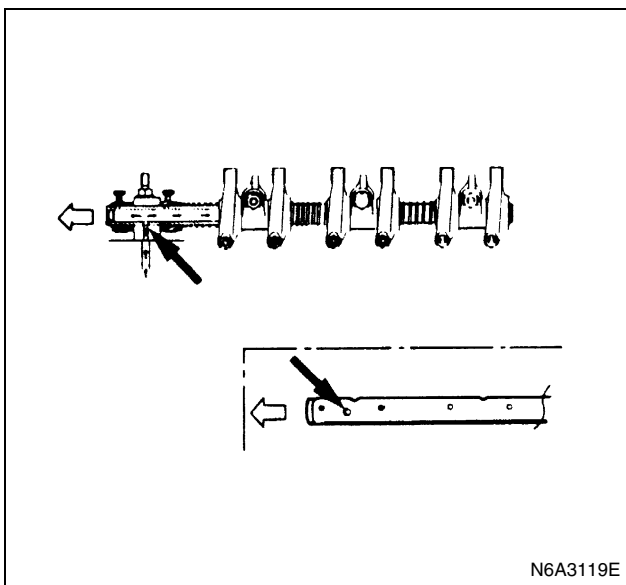
## 7. Rocker Arm Shaft Assembly

- Install the rocker arm shaft assembly in cylinder head.
- Tighten the rocker arm shaft fixing bolts to the specified torque.

**Reassembly**

## 1. Rocker Arm Shaft

- Apply a light coat of engine oil to the rocker arm shafts.
- Position the rocker arm shaft with the large oil hole (4φ) facing the front of the engine.
- Install the rocker shaft together with the rocker arm, the rocker arm shaft bracket, and the spring.



## 2. Rocker Arm Shaft Spring

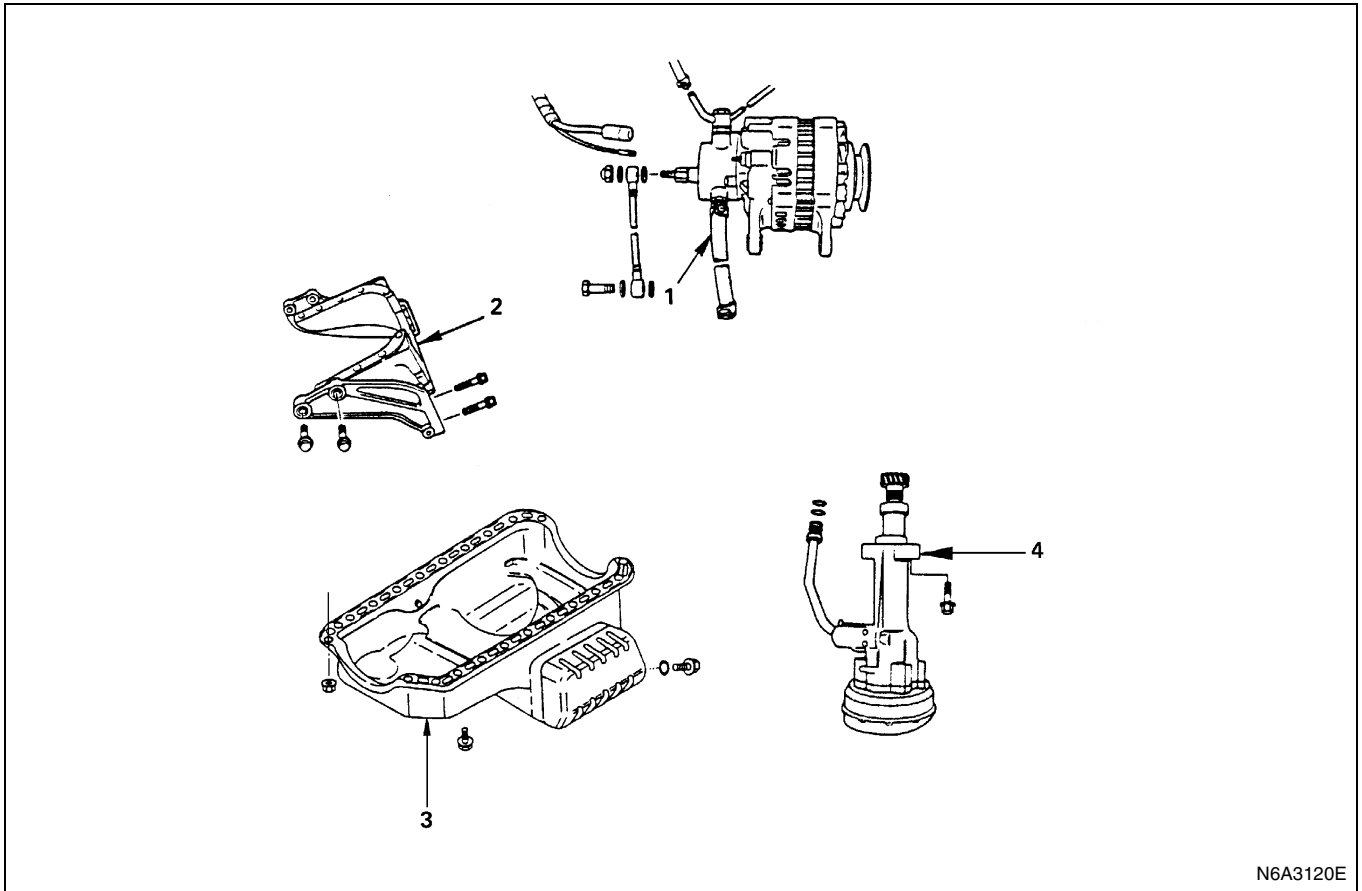
## 3. Rocker Arm

## 4. Rocker Arm Shaft Bracket

## 5. Rocker Arm

## OIL PUMP

### Component

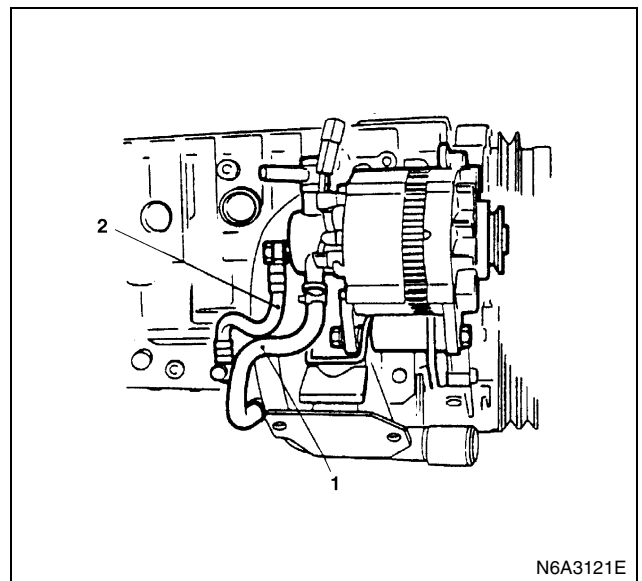


### Legend

- |                             |                      |
|-----------------------------|----------------------|
| 1. Vacuum pump oil hose     | 3. Oil pan assembly  |
| 2. Stiffener & space rubber | 4. Oil pump assembly |

### Removal

1. Vacuum Pump Oil Hose
  - Remove the oil hose (1) from oil pan.



2. Stiffener & Space Rubber
  - Remove the stiffener from of the oil pan left & right side.
  - Take out space rubber.
3. Oil Pan Assembly
4. Oil Pump Assembly

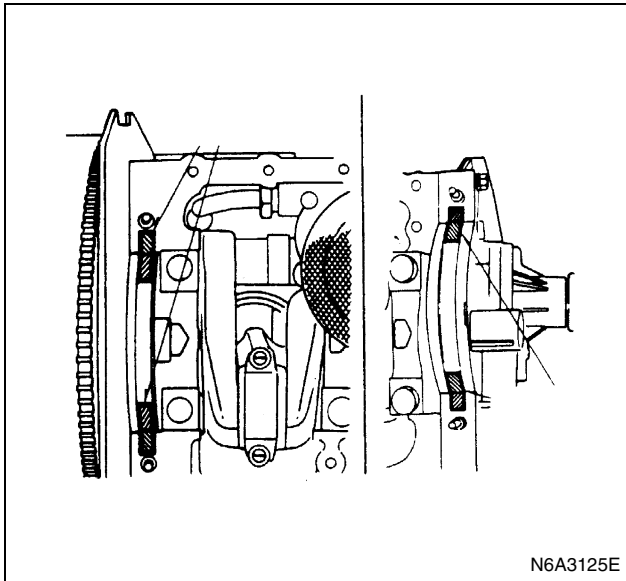
## Installation

1. Oil Pump Assembly
  - Apply molybdenum mixed engine oil to drive gear of camshaft and driven gear of oil pump.
  - Tighten the oil pump fixing bolt to the specified torque.

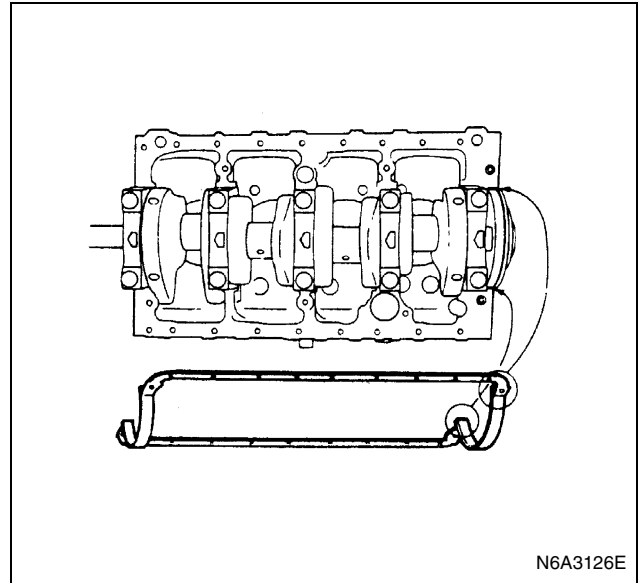
### Tighten:

19 N·m (1.9 kg·m/14 lb·ft)

2. Oil Pan Assembly
  - Apply the recommended liquid gasket or its equivalent to the No. 5 bearing cap arches, the grooves, the cylinder block and the timing gear case fitting face at the positions shown in the illustration.



- Fit the gasket rear lipped portion into the No. 5 groove.



- Be absolutely sure that the lipped portion is fitted snugly into the groove.
- Install the oil pan to the cylinder body.
- Tighten the oil pan bolts to the specified torque.

### Tighten:

Oil Pan Bolt to 19 N·m (1.9 kg·m/14 lb·ft)

3. Stiffener & Space Rubber
  - Install the space rubber.
  - Install the stiffener tighten to the specified torque.

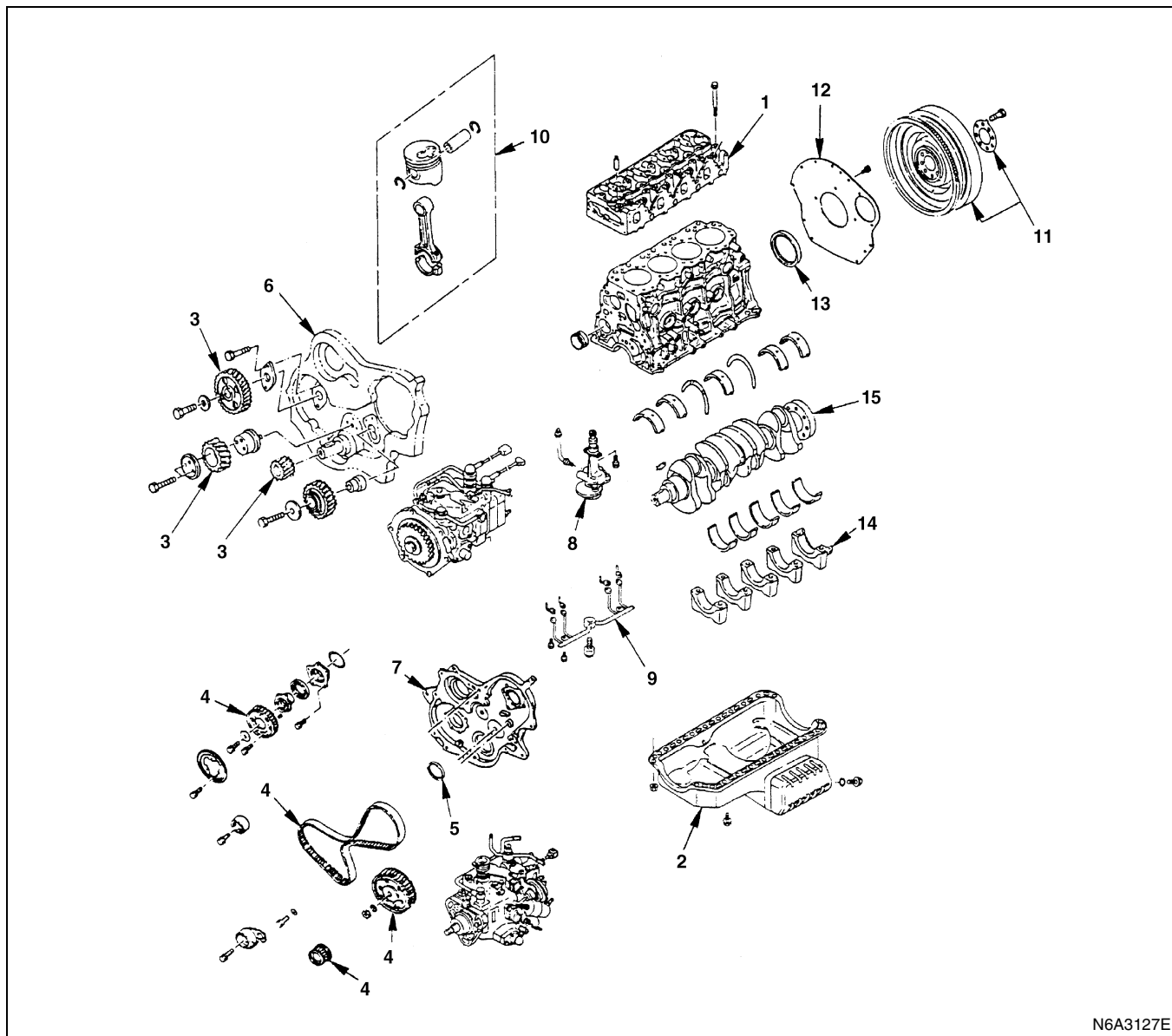
### Tighten:

- Engine Body Side to 37 N·m (3.8 kg·m/27 lb·ft)
- Clutch Housing Side to 78 N·m (8.0 kg·m/58 lb·ft)

4. Vacuum Pump Oil Hose
  - Install the oil hose to oil pan.

## CRANKSHAFT

### Component



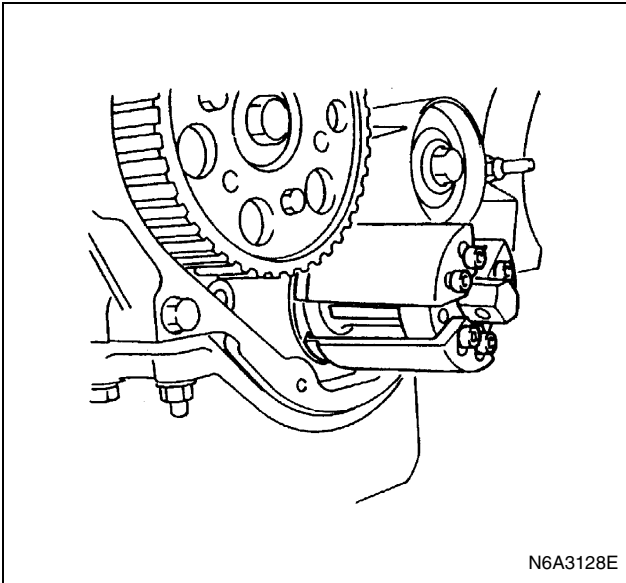
N6A3127E

### Legend

- |                                      |                               |
|--------------------------------------|-------------------------------|
| 1. Cylinder head assembly and gasket | 9. Piston cooling oil pipe    |
| 2. Oil pan assembly                  | 10. Piston and connecting rod |
| 3. Timing gear                       | 11. Flywheel                  |
| 4. Timing belt and pulley            | 12. Cylinder block rear plate |
| 5. Front oil seal                    | 13. Crankshaft rear oil seal  |
| 6. Timing gear housing               | 14. Main bearing cap          |
| 7. Timing pulley housing             | 15. Crankshaft                |
| 8. Oil pump assembly                 |                               |

### Disassembly

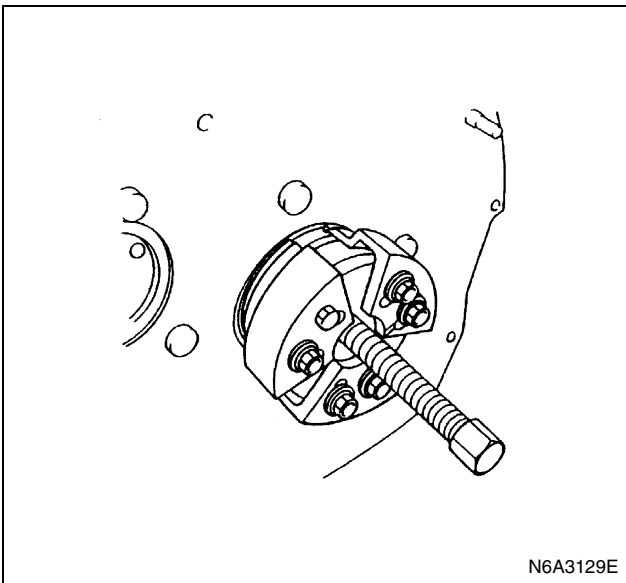
- |                                              |                                                                                                                                                                   |
|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Cylinder Head Assembly and Gasket         | 5. Front Oil Seal                                                                                                                                                 |
| 2. Oil Pan Assembly                          | <ul style="list-style-type: none"> <li>With the oil seal pushed in deep, install the special tool as shown in the illustration to remove the oil seal.</li> </ul> |
| 3. Timing Gear (Gear Drive Model)            | Remover: 5-8840-2362-0                                                                                                                                            |
| 4. Timing Belt and Pulley (Belt Drive Model) |                                                                                                                                                                   |



6. Timing Gear Housing
7. Timing Pulley Housing
8. Oil Pump Assembly
9. Piston Cooling Oil Pipe
10. Piston and Connecting Rod
11. Flywheel
12. Cylinder Block Rear Plate
13. Crankshaft Rear Oil Seal (Gear and Belt Drive Model)

- With the oil seal pushed in deep, install the special tool as shown in the illustration to remove the oil seal.

Remover: Rear Oil Seal 5-8840-2360-0



#### Notice:

Take care not to damage sealing surface of rear plate and crankshaft when removing oil seal.

14. Main Bearing Cap
15. Crankshaft

## Inspection and Repair

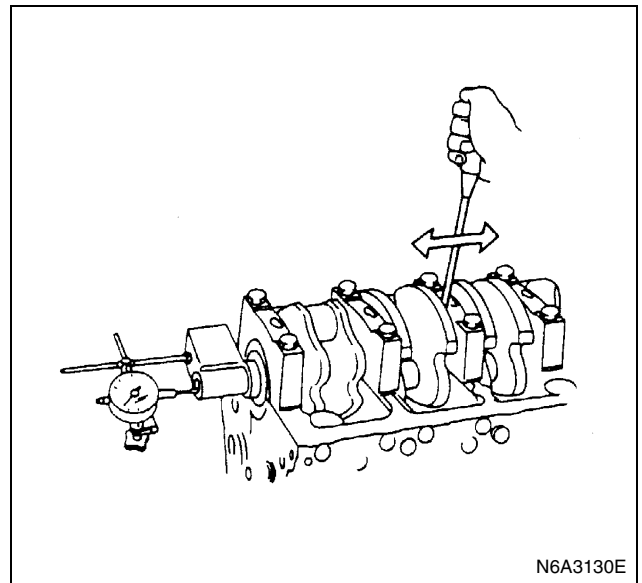
Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

1. Crankshaft  
Thrust clearance

Set the dial indicator as shown in the illustration and measure the crankshaft thrust clearance.

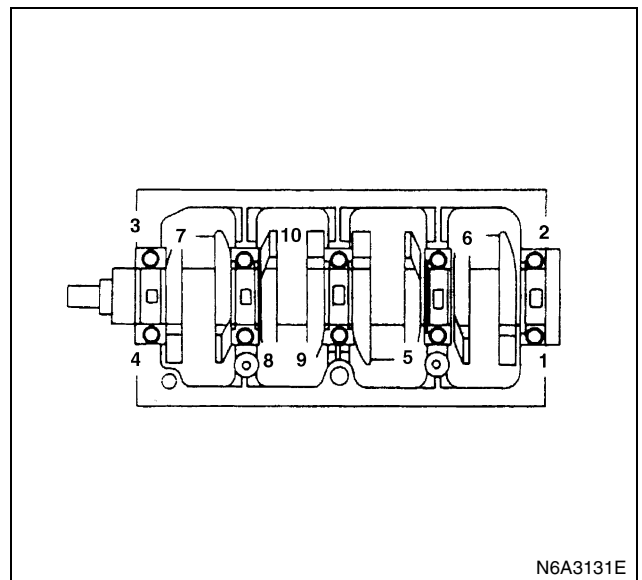
If the thrust clearance exceeds the specified limit, replace the thrust bearing as a set.

| Thrust clearance |               | mm (in) |
|------------------|---------------|---------|
| Standard         | Limit         |         |
| 0.10 (0.0039)    | 0.30 (0.0118) |         |



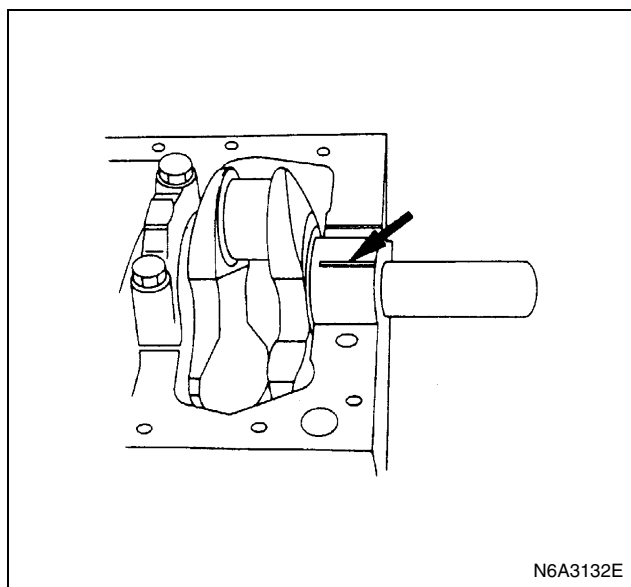
2. Main bearing clearance

- 1) Remove the main bearing caps in the sequence shown in the illustration.  
Arrange the removed main bearing caps in the cylinder number order.



## 6A-32 GENERAL ENGINE MECHANICAL

- 2) Remove the crankshaft. Remove the main bearings.
- 3) Clean the upper and lower bearings as well as the crankshaft main journal.
- 4) Check the bearings for damage or excessive wear.  
The bearings must be replaced as a set if damage or excessive wear is discovered during inspection.
- 5) Set the upper bearings and the thrust washers to their original positions. Carefully install the crankshaft.
- 6) Set the lower bearings to the bearing cap original position.
- 7) Apply plastigage to the crankshaft journal unit as shown in the illustration.



- 8) Install the main bearing caps. Apply engine oil to the bolt threads and the seats. Tighten the bolts to the specified torque.

### Tighten:

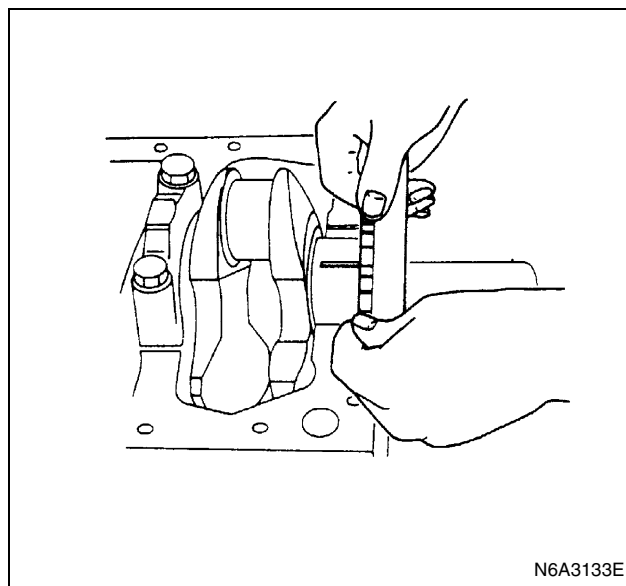
167 N·m (17 kg·m/123 lb·ft)

### Notice:

Do not allow the crankshaft to rotate.

- 9) Remove the main bearing caps.
- 10) Measure the plastigage width and determine the oil clearance. If the oil clearance exceeds the specified limit, replace the main bearings as a set and/or replace the crankshaft.
- 11) Clean the plastigage from the bearings and the crankshaft.
- 12) Remove the crankshaft and the bearings.

| Oil Clearance   |                                    | mm (in)       |
|-----------------|------------------------------------|---------------|
|                 | Standard                           | Limit         |
| 4JB1<br>4JB1-TC | 0.035 — 0.080<br>(0.0014 — 0.0036) | 0.11 (0.0043) |
| 4JG2            | 0.031 — 0.063<br>(0.0012 — 0.0025) |               |
| 4JH1-TC         | 0.037 — 0.068<br>(0.0015 — 0.0027) |               |

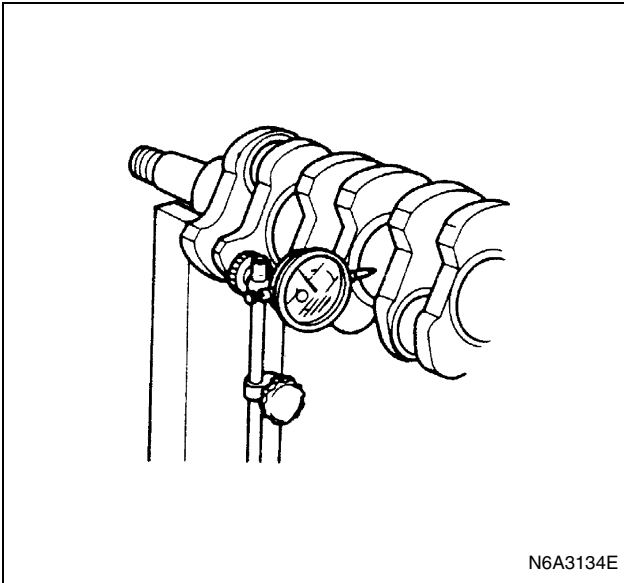


### 3. Run-out

- 1) Carefully set the crankshaft on the V-blocks. Slowly rotate the crankshaft and measure the runout.

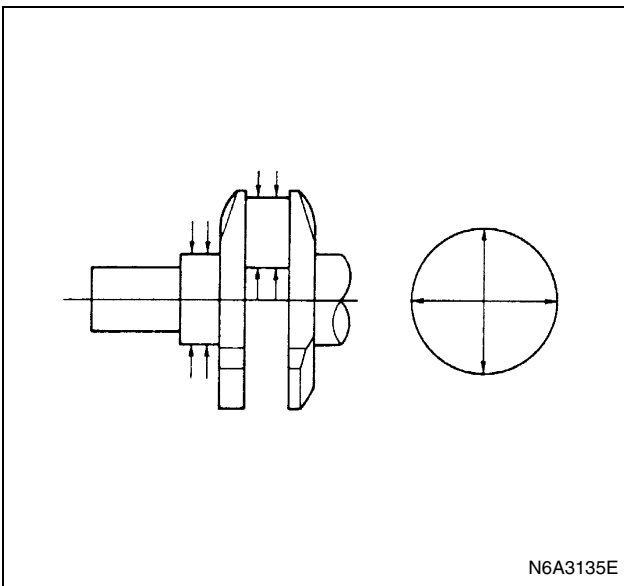
If the crankshaft runout exceeds the specified limit, the crankshaft must be replaced.

| Run-Out               |               | mm (in) |
|-----------------------|---------------|---------|
| Standard              | Limit         |         |
| 0.05 (0.0020) or less | 0.08 (0.0031) |         |



Measure the diameter and the uneven wear of main journal and crank pin.  
If the crankshaft wear exceeds the specified limit, crankshaft must be replaced.

|                       | mm (in)                              |                |
|-----------------------|--------------------------------------|----------------|
|                       | Standard                             | Limit          |
| Main journal diameter | 69.917 — 69.932<br>(2.7526 — 2.7532) | 69.91 (2.7524) |
| Crank pin diameter    | 52.915 — 52.930<br>(2.0833)          | 52.90 (2.0843) |
| Uneven wear limit     | 0.05 (0.0020) or less                | 0.08 (0.0031)  |



### Crankshaft Inspection

Inspect the surface of the crankshaft journals and crank pins for excessive wear and damage.  
Inspect the oil seal fitting surfaces for excessive wear and damage.  
Inspect the oil ports for obstructions.

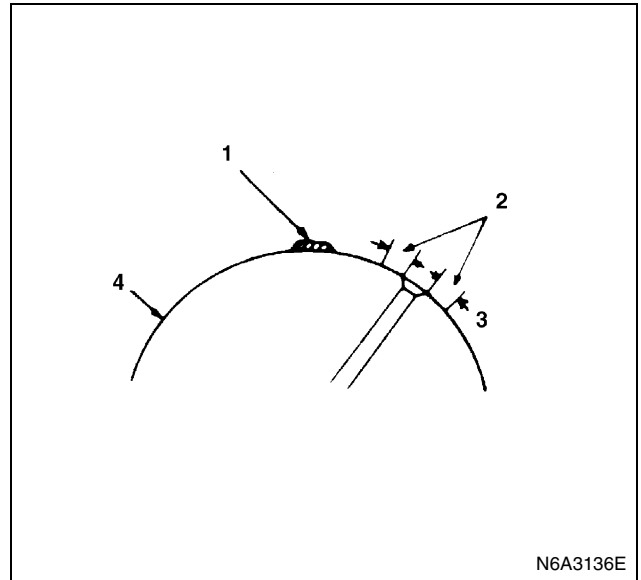
### Crankshaft Tufftriding Inspection

The portion to be tested must be held horizontally so as not let the test solution flow (1).

Test liquid should not be applied to the area around the oil port (2).

Approximately 10 mm (0.39 in) (3)

The sliding surface of the pin or journal (4).



### Notice:

To increase crankshaft strength, Tufftride Method (Soft nitriding) has been applied. Because of this, it is not possible to regrind the crankshaft surfaces.

1. Use an organic cleaner to thoroughly clean the crankshaft. There must be no traces of oil the surfaces to be inspected.
2. Prepare a 5 — 10% solution of ammonium cupric chloride (dissolved in distilled water).
3. Use a syringe to apply the solution to the surface to be inspected.  
Hold the surface to be inspected perfectly horizontal to prevent the solution from running.

### Notice:

Do not allow the solution to come in contact with the oil ports and their surrounding area.

### Testing

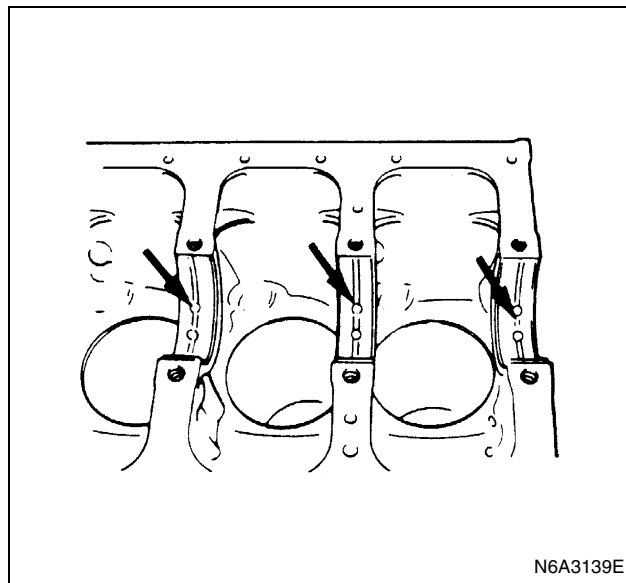
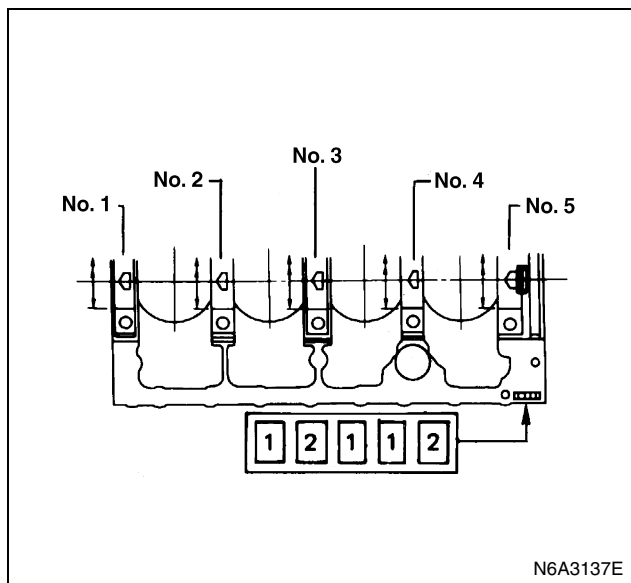
1. Wait for thirty to forty seconds.  
If there is no discoloration after thirty or forty seconds, the crankshaft is usable.  
If discoloration appears (the surface being tested will become the color copper), the crankshaft must be replaced.
2. Steam clean the crankshaft surface immediately after completing the test.

### Notice:

The ammonium cupric chloride solution is highly corrosive. Because of this, it is imperative that the surfaces being tested be cleaned immediately after completing the test.

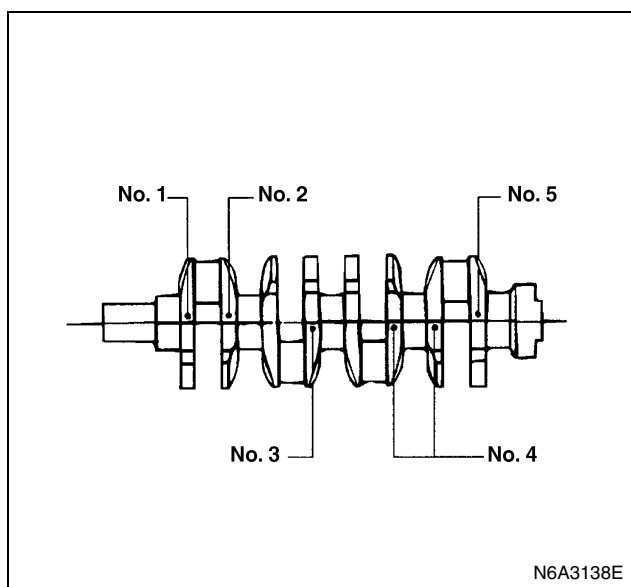
### Crankshaft Bearing Selection

When installing new crankshaft bearings or replacing old bearings, refer to the selection table.



### Notice:

Please note that some Crankshaft No. 4 journals made during a limited production period have their number (No. 4) marked on either their front or rear side of webs as shown below.



### Notice:

Although all upper journal bearings (cylinder body side) have oil grooves and holes, all lower bearings (bearing cap side) have no groove and hole.

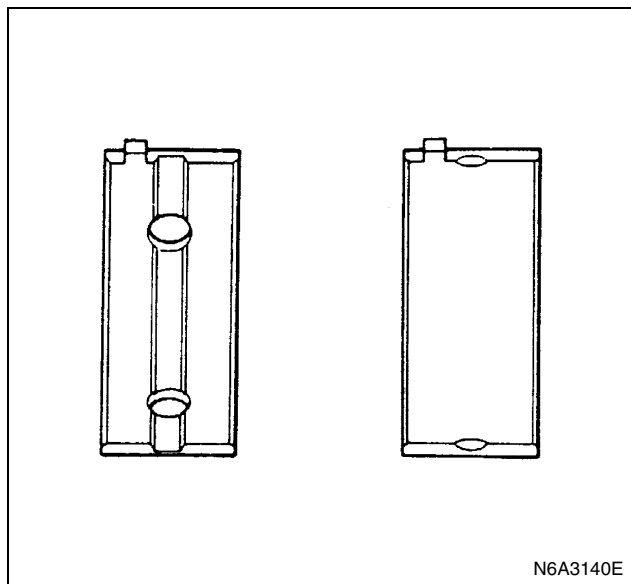
Play close attention to the distinction during the installation procedure.

| mm (in)                    |                                      |                    |                                      |                              |
|----------------------------|--------------------------------------|--------------------|--------------------------------------|------------------------------|
| Crankshaft Bearing Housing |                                      | Crankshaft Journal |                                      | Crankshaft Bearing Size Code |
| Grade Mark                 | Diameter                             | Grade Mark         | Diameter                             |                              |
| 1                          | 73.992 — 74.000<br>(2.9131 — 2.9134) | 1 or -             | 69.927 — 69.932<br>(2.7530 — 2.7532) | 4                            |
|                            |                                      | 2 or - -           | 69.922 — 69.927<br>(2.7528 — 2.7530) |                              |
|                            |                                      | 3 or - - -         | 69.917 — 69.922<br>(2.7556 — 2.7528) | 5                            |
| 2                          | 73.983 — 73.992<br>(2.9127 — 2.9131) | 1 or -             | 69.927 — 69.932<br>(2.7530 — 2.7532) | 2                            |
|                            |                                      | 2 or - -           | 69.922 — 69.927<br>(2.7528 — 2.7530) | 3                            |
|                            |                                      | 3 or - - -         | 69.917 — 69.922<br>(2.7556 — 2.7528) | 4                            |
| 3                          | 73.975 — 73.983<br>(2.9124 — 2.9127) | 1 or -             | 69.927 — 69.932<br>(2.7530 — 2.7532) | 1                            |
|                            |                                      | 2 or - -           | 69.922 — 69.927<br>(2.7528 — 2.7530) | 2                            |
|                            |                                      | 3 or - - -         | 69.917 — 69.922<br>(2.7526 — 2.7528) |                              |

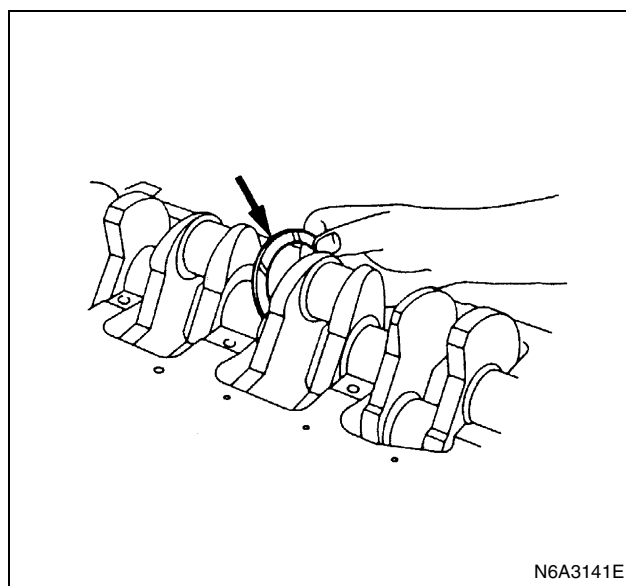
## Reassembly

### 1. Crankshaft

- Install the main bearings to the cylinder body and the main bearing caps.

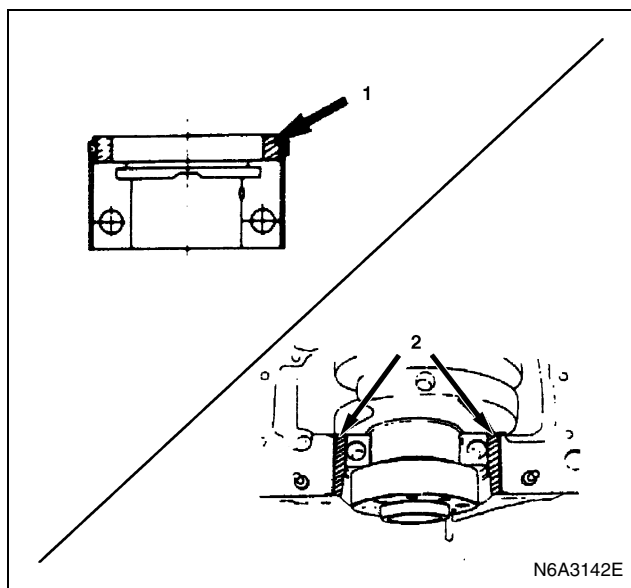


- Be sure that they are positioned correctly.
- Apply new engine oil to the upper and lower main bearing faces.
- Carefully mount the crankshaft.
- Apply engine oil to the thrust washer.
- Assemble the thrust washer to the No.3 bearing journal. The oil grooves must face the crankshaft.



### 2. Main Bearing Cap

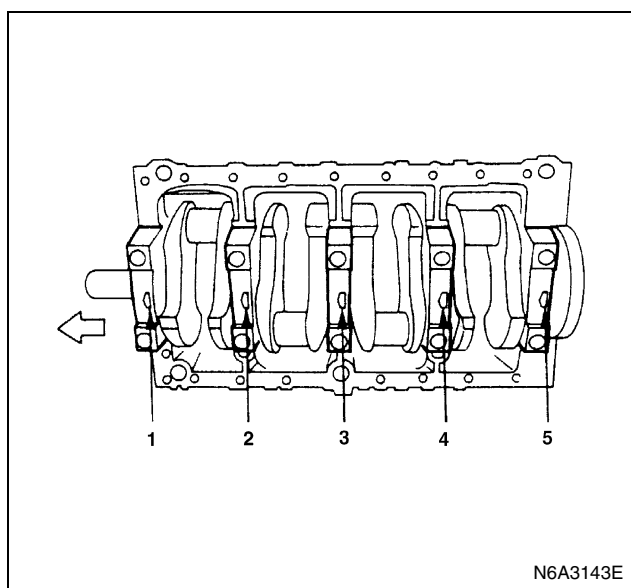
- Apply the recommended liquid gasket or its equivalent to the No. 5 crankshaft bearing cap (1) as shown in the illustration.
- Install the arch gasket (2) to the No. 5 bearing cap.  
Use your fingers to push the arch gasket into the bearing cap groove.

**Notice:**

Be sure that the bearing cap fitting surface is completely free of oil before applying the liquid gasket.

Do not allow the liquid gasket to obstruct the cylinder thread holes and bearings.

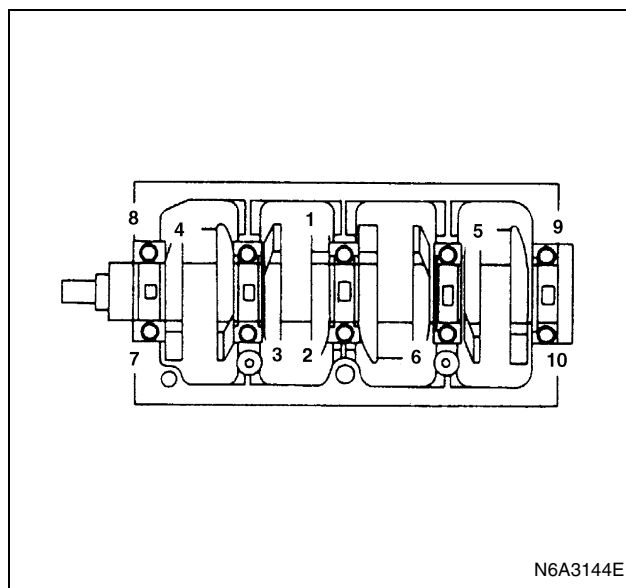
- Install the bearing caps with the bearing cap head arrow mark facing the front of the engine.



- Apply engine oil to the crankshaft bearing cap bolts.
- Tighten the crankshaft bearing cap bolts to the specified torque a little at a time in the sequence shown in the illustration.

**Tighten:**

167 N·m (17 kg·m/123 lb·ft)

**Notice:**

Check to see that the crankshaft turns smoothly by rotating it manually.

### 3. Crankshaft Rear Oil Seal (Gear and Belt Drive Model)

Use the oil seal installer to install the oil seal to the cylinder body.

Installer: Rear Oil Seal 5-8840-2359-0

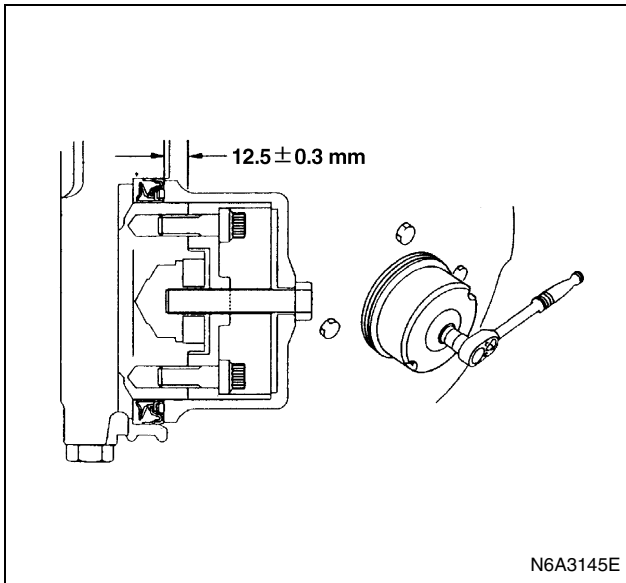
**Notice:**

Wipe off rust and scraps clean from the press-in portion of the oil seal.

Take note of the press-in direction of the oil seal.

- 1) Install the adapter of the special tool to the rear end of the crankshaft with two bolts.
- 2) Install the oil seal to the outer circumference of the adapter.
- 3) Insert the slave into the adapter portion, and tighten it in with the bolt (M12 × 1.75L=70) until the adapter section hits the slave.
- 4) Remove the adapter and the slave.
- 5) After installing the oil seal, check the measurement of the oil seal.

| Standard                  | mm (in) |
|---------------------------|---------|
| 12.2 — 12.8 (0.48 — 0.50) |         |



4. Cylinder Block Rear Plate  
Align the rear plate with the cylinder body knock pins.  
Tighten the rear plate to the specified torque

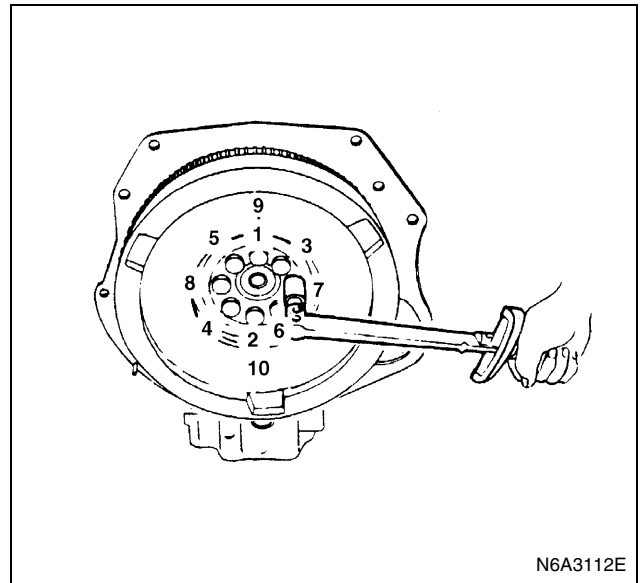
**Tighten:**

82 N·m (8.4 kg·m/61 lb·ft)

5. Flywheel
- 1) Thoroughly clean the remove the oil from the threads of crankshaft.
  - 2) Mount the flywheel on the crankshaft and then install the washer.
  - 3) Apply a coat of engine oil to the threads of the flywheel bolts.
  - 4) Align the flywheel with the crankshaft dowel pin.
  - 5) Tighten the flywheel bolts to the specified torque in two steps using the Angular Tightening Method.  
Follow the numerical order shown in the illustration.

**Tighten:**

- Flywheel Bolt to
  - 1st Step: 59 N·m (6.0 kg·m/43 lb·ft)
  - 2nd Step: 60° — 90°



6. Piston and Connecting Rod  
7. Piston Cooling Oil Pipe  
8. Oil Pump Assembly  
Above works refer to "PISTON AND CONNECTING ROD"  
Section in this manual.
9. Timing Pulley Housing  
1) Install the timing pulley housing to the cylinder body.

**Notice:**

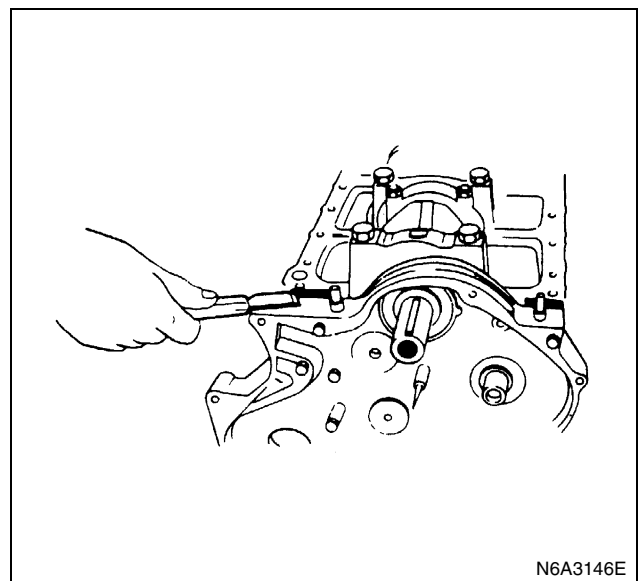
Take care not to twist the front oil seal.

- 2) Tighten the timing pulley housing bolt together with the timing pulley housing gasket to the specified torque.

**Tighten:**

19 N·m (1.9 kg·m/14 lb·ft)

- 3) Cut away the gasket protruding above the fitting surfaces (as shown in the illustration).



10. Timing Gear Housing

- 1) Install the timing gear housing to the cylinder body.
- 2) Tighten the timing gear housing bolt together with the timing gear housing gasket to the specified torque.

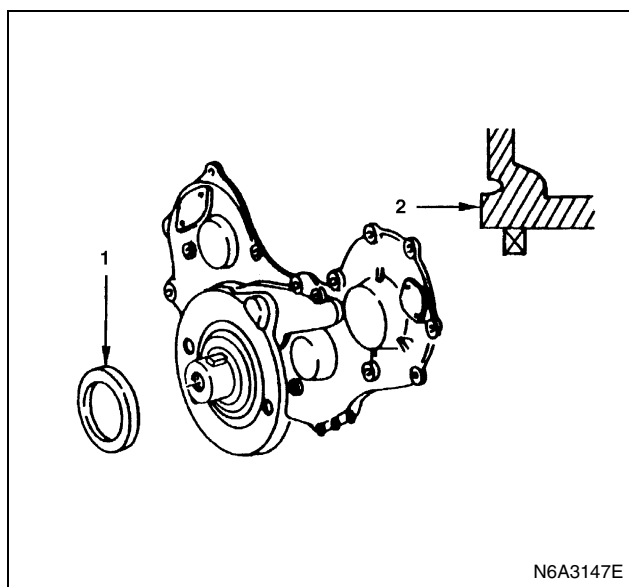
**Tighten:**

19 N·m (1.9 kg·m/14 lb·ft)

- 3) Cut away the gasket protruding above the fitting surface (as shown in the illustration).

## 11. Front Oil Seal (Gear Drive Model)

- Install oil seal using special tool.  
Installer: 5-8840-2061-0

**Legend**

1. Oil seal
2. Timing pulley housing

## 12. Front Oil Seal (Belt Drive model)

- Install oil seal using special tool.  
Installer: 5-8840-2361-0

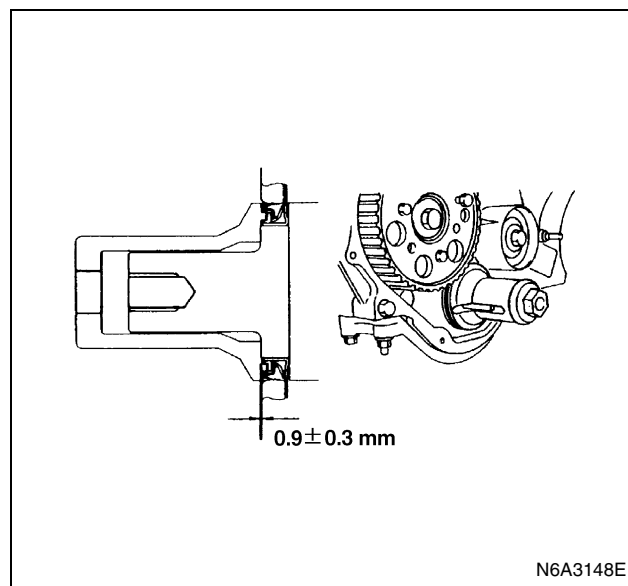
**Notice:**

Wipe off rust and scraps clean from the press-in portion of the oil seal.

Take note of the press-in direction of the oil seal.

- 1) With the oil seal attached to the sleeve, put it in the front end of the crankshaft.
- 2) With the edge of the oil seal attached securely to the crankshaft, tighten it with the center bolt until the sleeve hits securely against the reference plane at the front end of the crankshaft.
- 3) Remove the sleeve.
- 4) After pressing in the oil seal, check the measurement of the oil seal.

| Standard                  | mm (in) |
|---------------------------|---------|
| 0.6 — 1.2 (0.024 — 0.047) |         |

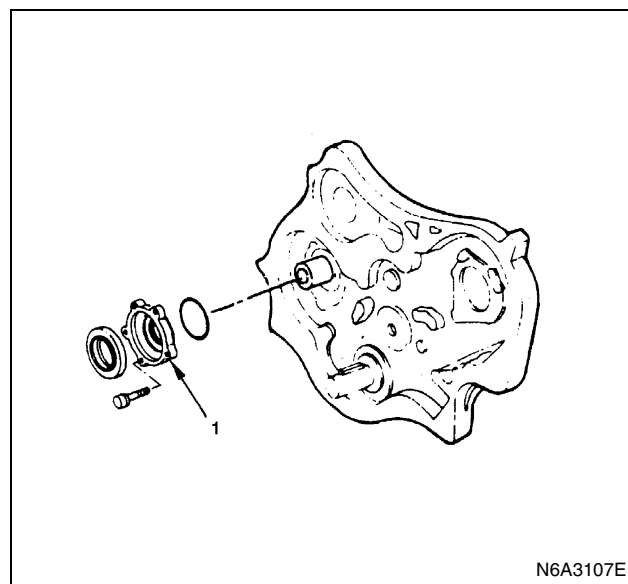


## 13. Camshaft Timing Pulley (Belt Drive model)

- 1) Apply engine oil to the oil seal lip portion of the oil seal retainer.
- 2) Apply the recommended liquid gasket or its equivalent to the retainer.
- 3) Install the oil seal retainer to the cylinder body.
- 4) Tighten the retainer bolts to the specified torque.

**Tighten:**

Oil Seal Retainer Bolt to 19 N·m (1.9 kg·m/14 lb·ft)

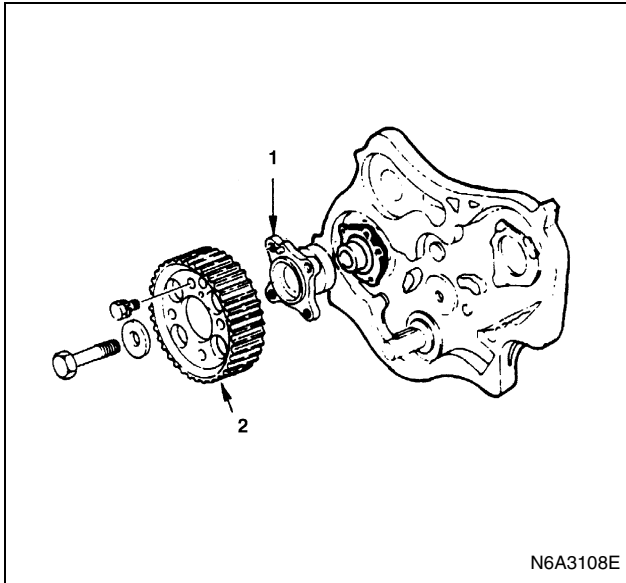
**Legend**

1. Retainer

- 5) Align the camshaft timing pulley center with the camshaft key.
- 6) Tighten the timing pulley bolts to the specified torque.

**Tighten:**

Timing Pulley Bolt to 8 N·m (0.8 kg·m/69 lb·ft)



N6A3108E

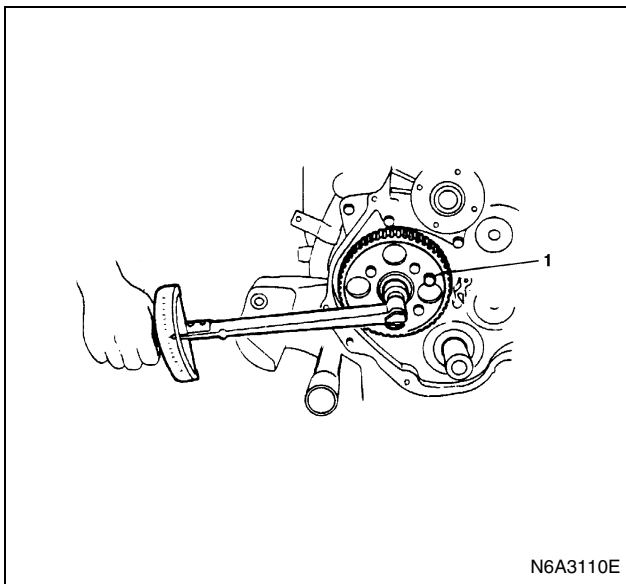
### Legend

1. Timing pulley center
2. Timing pulley

- 7) Prevent the camshaft from turning when tightening the timing center bolt.
- 8) Tighten the timing pulley center bolt to the specified torque.

### Tighten:

Center Bolt to 64 N·m (6.5 kg·m/47 lb·ft)



N6A3110E

### Legend

1. Lock bolt

- 9) Install the crank pulley.
- 10) Install the idle pulley and idler pulley.

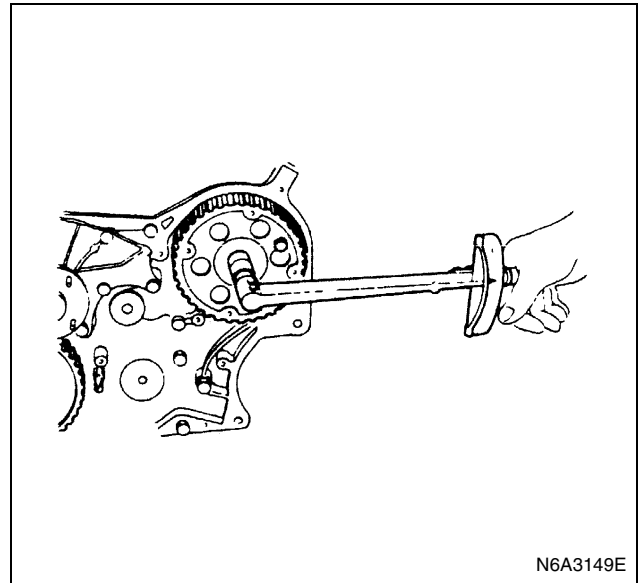
### Tighten:

76 N·m (7.8 kg·m/56 lb·ft)

- 11) Install the injection pump assembly and install timing pulley.
- 12) Align the timing pulley with the pump shaft key.
- 13) Install the stopper bolt to the timing pulley.  
This will prevent the timing pulley from moving.
- 14) Tighten the timing pulley nut to the specified torque.

### Tighten:

Injection Pump Timing Pulley Nut to 64 N·m (6.5 kg·m/47 lb·ft)



N6A3149E

- 15) Remove the stopper bolt from the injection timing.

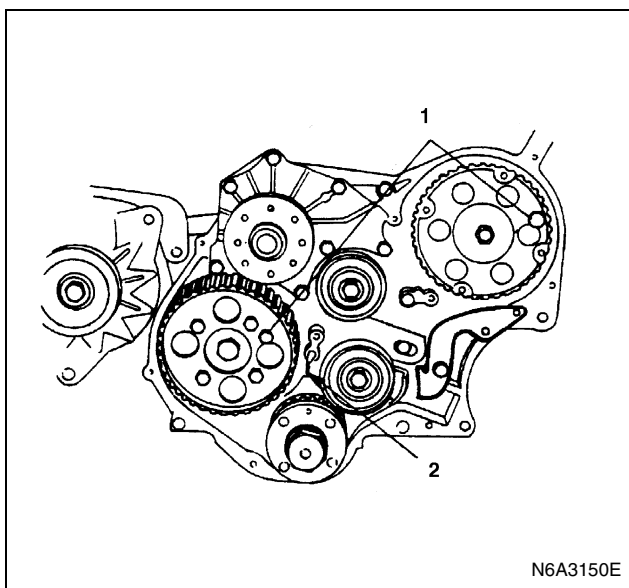
### 14. Timing Belt (Belt Drive model)

#### Notice:

- When the timing belt is removed, be sure to replace it with a new one.
- The tension of the timing belt may be affected by the changes in temperature. Be sure to install it while the engine cold.
- When the timing belt is bent forcibly, the cord may get snapped, thus resulting in the reduced strength. Do not bend it unnecessarily.

- 1) Check that the stopper bolts are properly installed to the camshaft timing pulley and the injection pump timing pulley.
- 2) Check that the timing pulley housing mark and the crankshaft timing pulley mark are aligned. The No. 1 cylinder should be at TDC on the compression stroke.

Rotate the crankshaft damper pulley clockwise to align the marks.

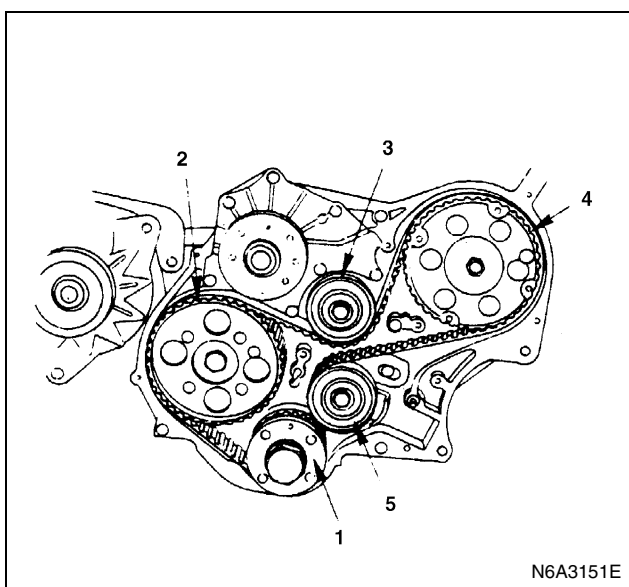
**Legend**

1. Lock bolt
2. Setting mark

- 3) Install the timing belt to the crankshaft timing pulley (1), the camshaft timing pulley (2), the tensioner idler (3), and the injection timing pulley (4).

Follow the numerical order.

- 4) Install the timing belt tensioner (5) to the timing pulley housing.
- 5) Temporarily tighten the tensioner bolt. The tensioner should move freely.

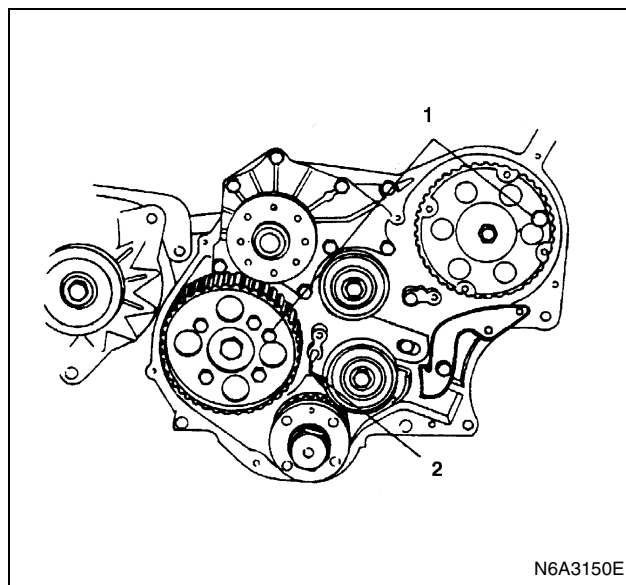
**Notice:**

The timing belt is easily damaged. Be careful.

**Notice:**

After completion of the installation of the timing belt, check to see if the alignment mark of the crankshaft timing pulley is in line with the alignment mark provided on the housing.

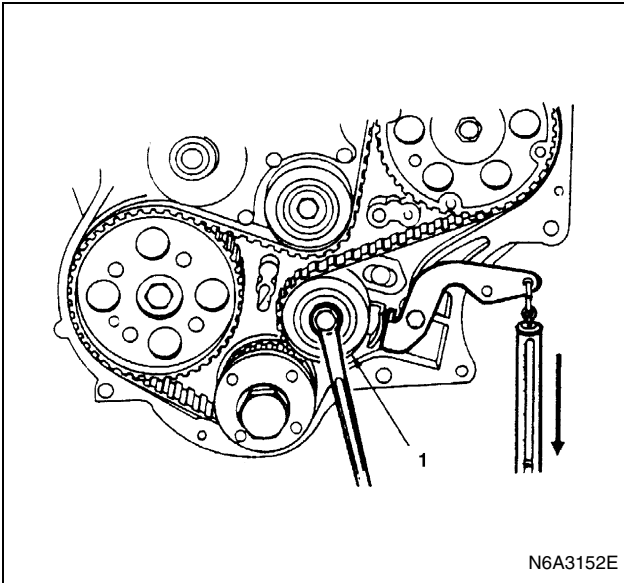
- When the alignment marks are not in line with each other, set them together and reinstall the timing belt.

**Legend**

1. Lock bolt
2. Setting mark

- 6) Set the tensioner adjusting lever to the timing pulley housing.
- 7) Remove the stopper bolts from the camshaft timing pulley and the injection pump timing pulley.
- 8) Attach the spring balancer.
- 9) Adjust the timing belt tension by pulling straight down on the spring balancer with the specified force.

| Tension Adjusting Lever Force | N (kg/lb) |
|-------------------------------|-----------|
| 98 — 118 (10 — 12/22 — 26)    |           |

**Legend**

1. Tensioner

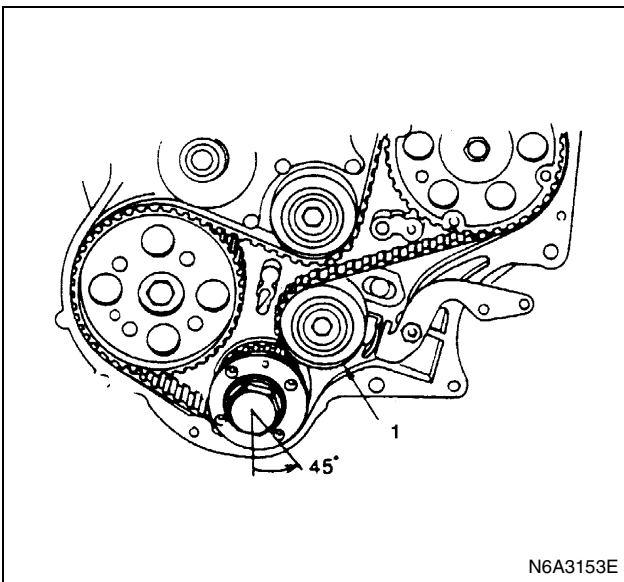
**Notice:**

Timing belt tension must be adjusted.

Failure to adjust the timing belt tension will result in timing belt damage.

10) Tighten the tension bolt.

11) Rotate the crankshaft 45 degrees counter-clockwise.

**Legend**

1. Tensioner

**Notice:**

Never rotate the crankshaft clockwise when adjusting the timing belt.

12) Readjust the timing belt tension.

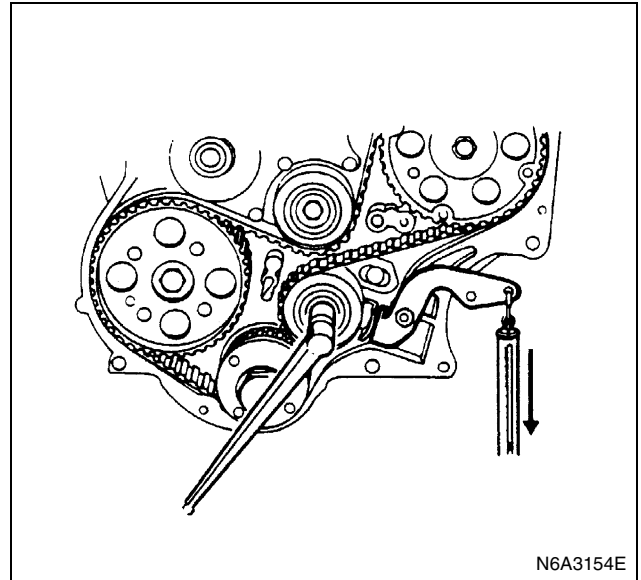
Refer to Step 9

This will remove any remaining timing belt slack.

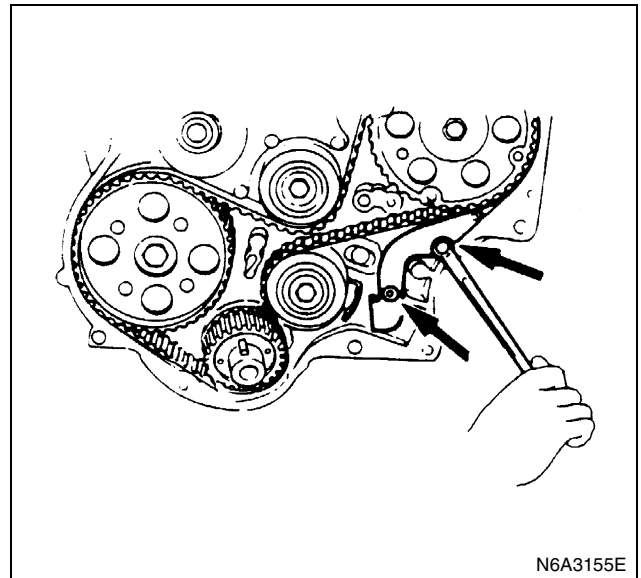
13) Tighten the tensioner bolt to the specified torque.

**Tighten:**

Tensioner Bolt to 76 N·m (7.7 kg·m/56 lb·ft)



14) Tighten the tension adjusting lever nut and bolt.

**Notice:**

If on-vehicle timing belt replacement is performed, the crankshaft must not be allowed to turn.

If the crankshaft is allowed to turn, piston and valve damage will result.

15. Flange: Camshaft Pulley (Belt Drive model)

16. Flange: Injection Pump Pulley (Belt Drive model)

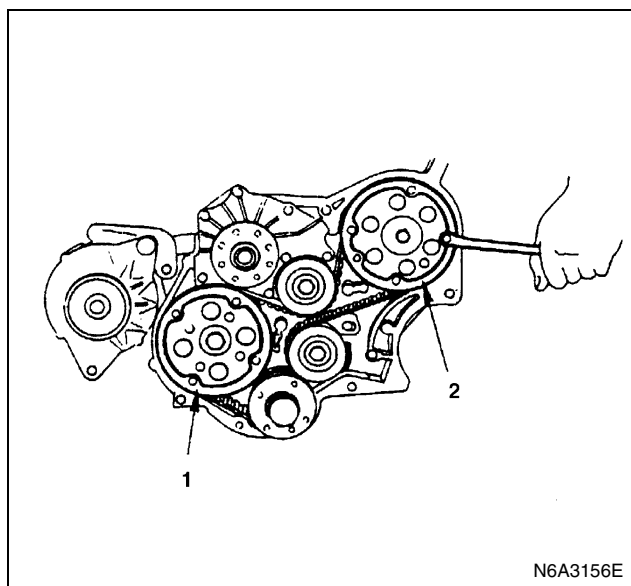
1) Install the timing pulley flange to the camshaft and injection pump timing pulley.

## 6A-42 GENERAL ENGINE MECHANICAL

- 2) Tighten the timing pulley flange bolts to the specified torque.

### Tighten:

Timing Pulley Flange Bolt to 19 N·m (1.9 kg·m/14 lb·ft)



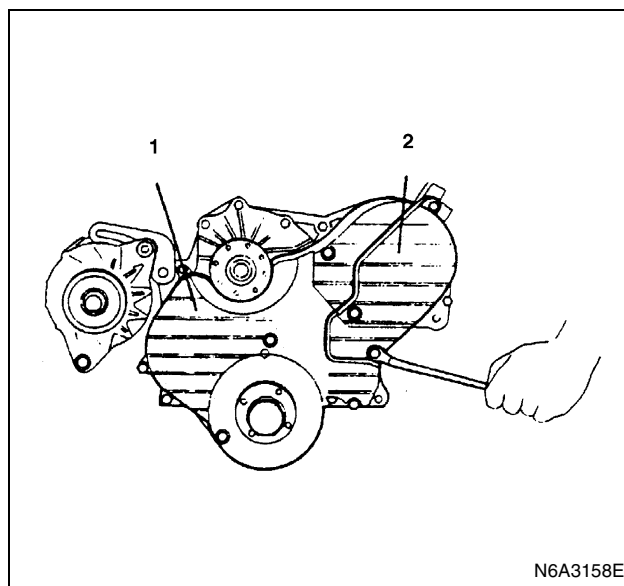
### Legend

1. Camshaft pulley
2. Injection pump pulley

- 2) Tighten the timing pulley cover bolts to the specified torque a little at a time.

### Tighten:

Timing Pulley Cover Bolt to 8 N·m (0.81 kg·m/6 lb·ft)

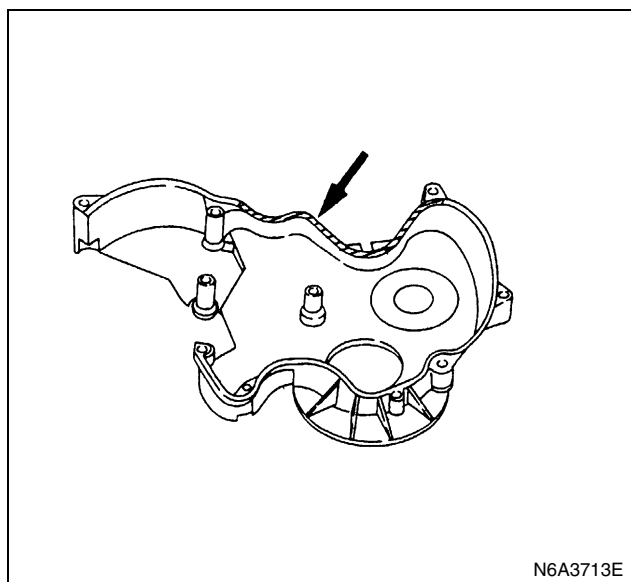


### Legend

1. Lower cover
2. Upper cover

### 17. Timing Pulley Lower Cover (Belt Drive model)

- 1) Apply the recommended liquid gasket or its equivalent to the timing pulley lower cover.



- 2) Install the lower cover to the timing pulley housing.
- 3) Use the lower cover guide bolts to prevent the liquid gasket from running.

### 18. Timing Pulley Upper Cover (Belt Drive model)

- 1) Install the upper cover to the lower cover and the pulley housing.

- 3) Remove the lower cover guide pin.

### Tighten:

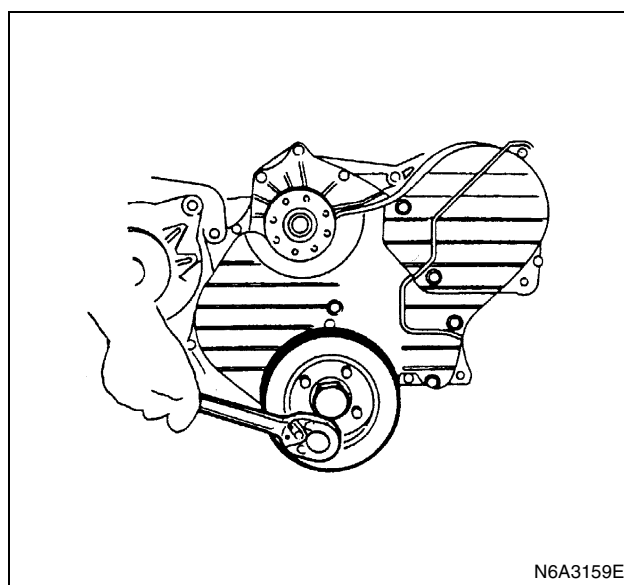
Crankshaft Center Pulley to 206 N·m (21 kg·m/152 lb·ft)

### 19. Crankshaft Damper Pulley (Belt Drive model)

- 1) Install the damper pulley and tighten bolts to the specified torque.

### Tighten:

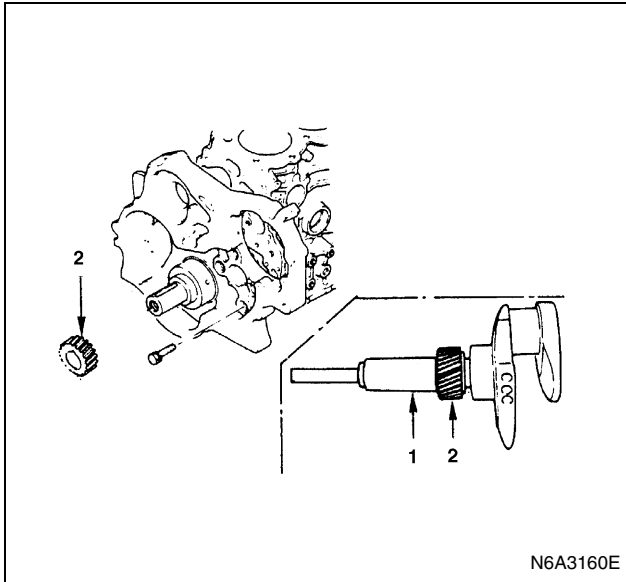
Pulley Bolts to 19 N·m (1.9 kg·m/14 lb·ft)



### 20. Crank Shaft Gear (Gear Drive model)

- 1) Install the crankshaft gear.

- 2) Use the crankshaft gear installer (1) to install the crankshaft gear (2).  
The crankshaft gear timing mark ("X — X") or ("· — ·") must be facing outward.  
Crankshaft Gear Installer: 9-8522-0020-0

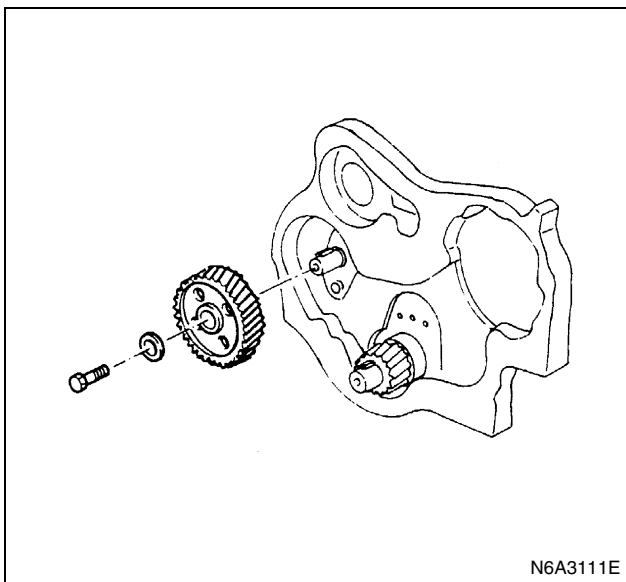


#### 21. Crankshaft Timing Gear (Gear Drive model)

- 1) Install the camshaft timing gear to the camshaft.  
The timing gear mark ("Y — Y") or ("· — ·") must be facing outward.
- 2) Tighten the timing gear to the specified torque.

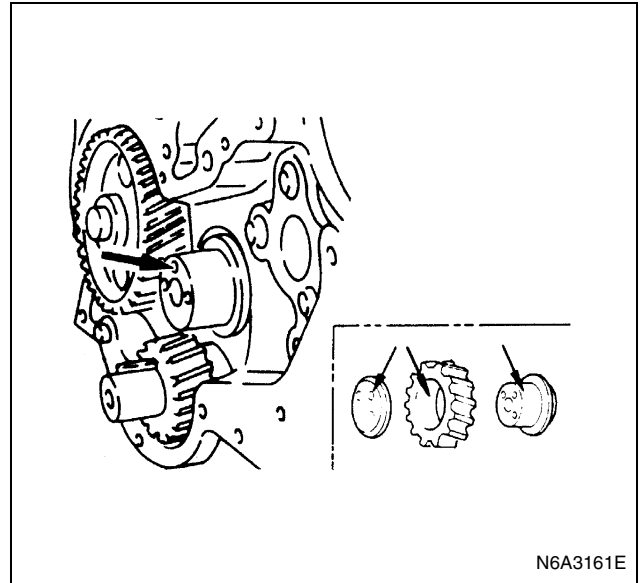
##### Tighten:

64 N·m (6.5 kg·m/47 lb·ft)



#### 22. Idle Gear (Gear Drive model)

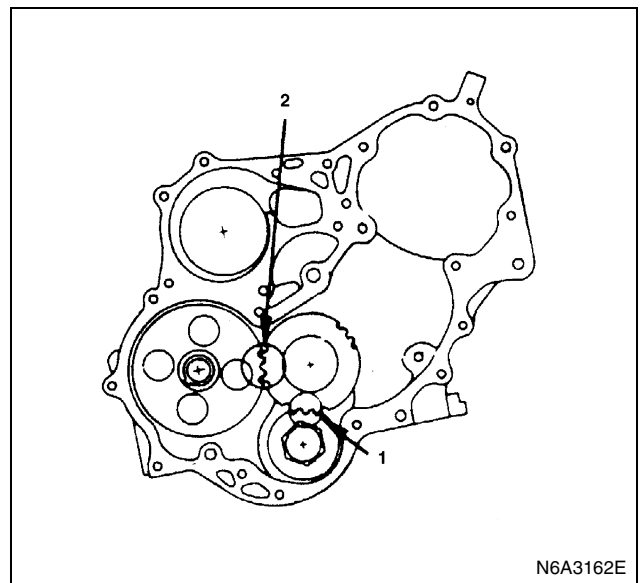
- 1) Apply engine oil to the idle gear and the idler gear shaft.  
The idler shaft oil hole must be facing up.
- 2) Position the idler gear setting marks "X" or "·" and "Y" or "·" so that they are facing the front of the engine.



- 3) Align the idler gear "X" or "·" setting mark with the crankshaft timing gear (1) "X — X" or "· — ·" setting mark.
- 4) Align the idler gear "Y" setting mark with the camshaft timing gear (1) "Y — Y" or "· — ·" setting mark.
- 5) Install the thrust collar and bolts to the cylinder body through the shaft.  
The thrust collar oil hole must be facing up, and the thrust collar chamfered must be outward.
- 6) Tighten the idler gear bolt to the specified torque.

##### Tighten:

19 N·m (1.9 kg·m/14 lb·ft)



#### 23. Idler Gear "B" and Shaft (Gear Drive model)

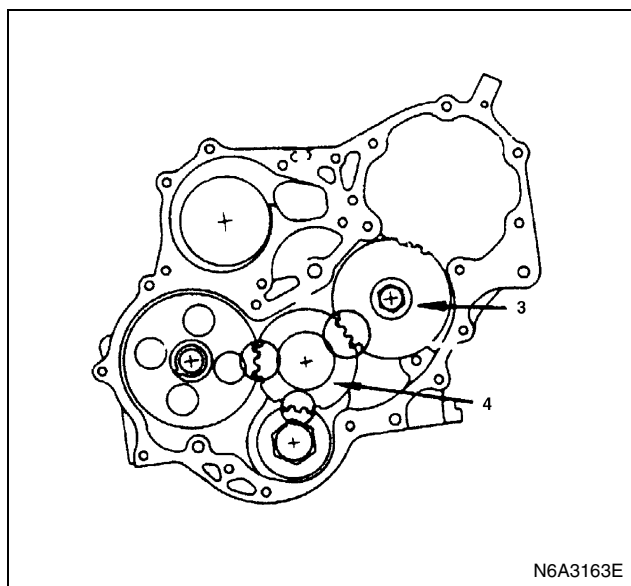
- 1) Apply engine oil to the idler gear and the idler gear shaft.
- 2) Align the idler gear "B" (3) "Z" or "·" setting mark with the idler gear "A" (4) "Z — Z" or "· — ·" setting mark.

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- 3) Tighten the idler gear bolt to the specified torque.

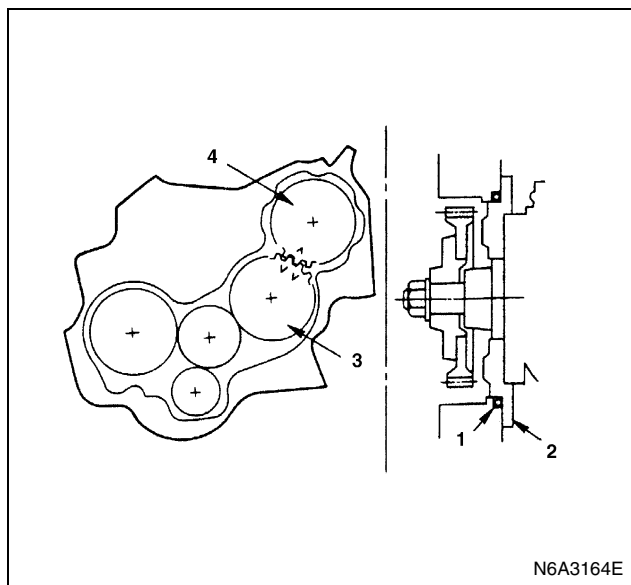
### Tighten:

76 N·m (7.7 kg·m/56 lb·ft)

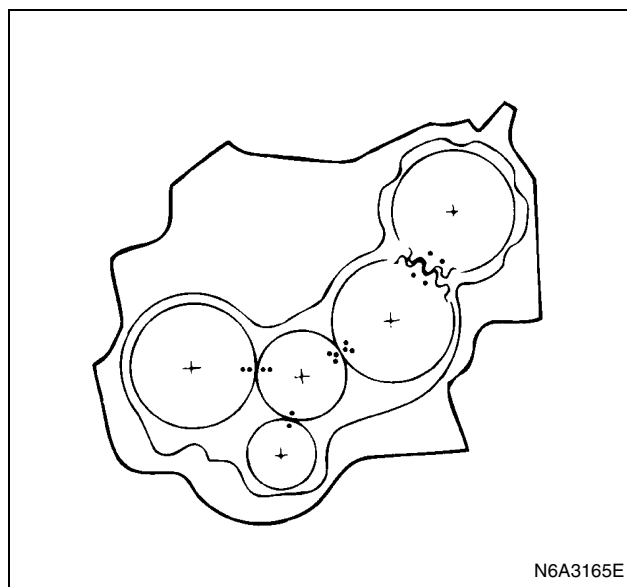


### 24. Injection Pump (Gear Drive model)

- 1) Install the O-ring (1) to the injection pump flange (2).
- 2) Install the injection pump to the timing gear case.  
Align the idler gear "B" (3) "V — V" or "∴ — ∴" mark.

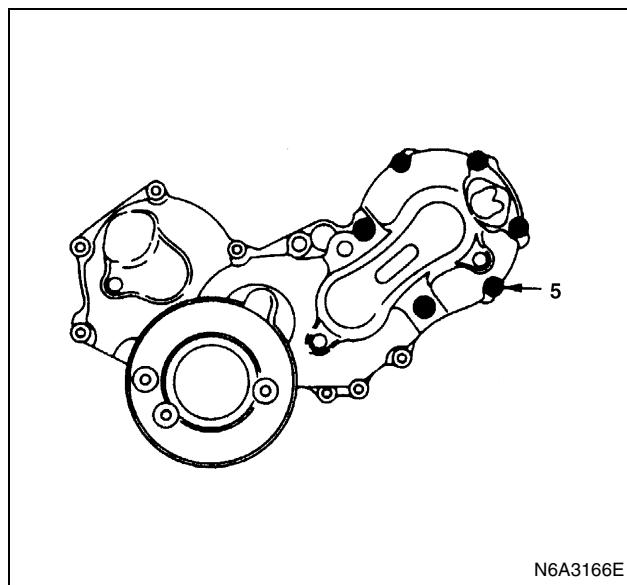


| Gear                           | 4JB1-TC<br>4JG2 | 4JH1-TC |
|--------------------------------|-----------------|---------|
| Crank gear A/Idle gear "A"     | X — X           | . — .   |
| Idle gear "A" — Cam gear       | Y — Y           | .. — .. |
| Idle gear "A" — Idle gear "B"  | Z — Z           | ∴ — ∴   |
| Idle gear "B" — Injection pump | V — V           | : — :   |



- 3) Temporarily tighten the six injection pump bolts (5).

The injection pump bolts will be finally tightened after the injection pump rear bracket bolts.

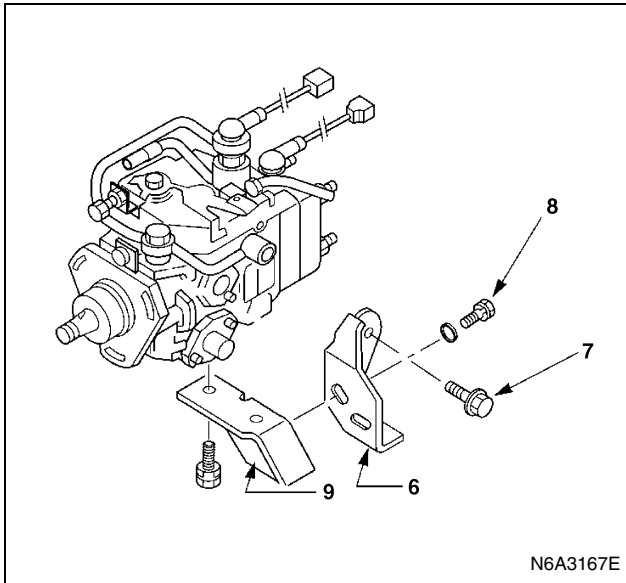


- 4) Install the injection pump rear bracket (6) and the rear bracket bolts (7) to the cylinder body.

- 5) Install the rear bracket bolts (8) to the injection pump bracket (9).  
Do not tighten the bolts.  
The rear bracket bolts (7) and (8) will be finally tightened to the specified torque.

**Tighten:**

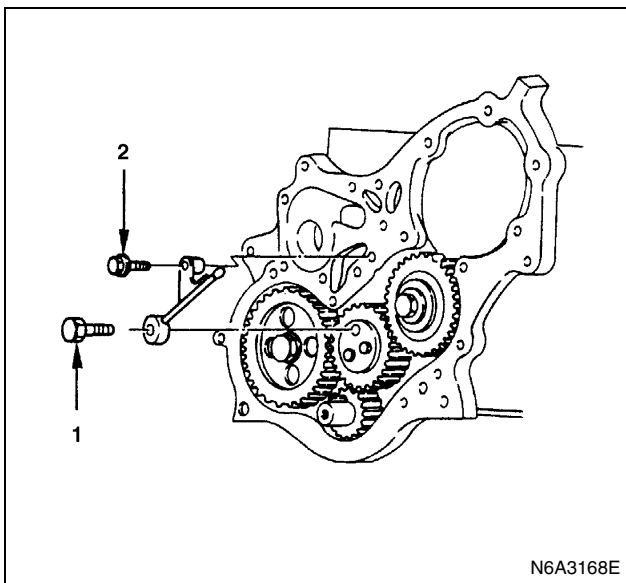
19 N·m (1.9 kg·m/14 lb·ft)


**25. Timing Gear Oil Pipe (Gear Drive model)**

- 1) Install the oil pipe to the timing gear case and idler gear "A".
- 2) Tighten the oil pipe eye bolt (1) and bolt (2) to the specified torque.

**Tighten:**

13 N·m (1.3 kg·m/9 lb·ft)

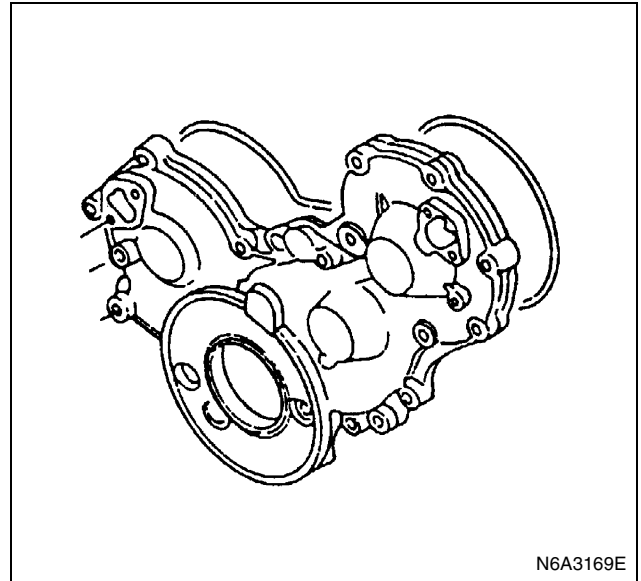

**26. Timing Gear Case Cover (Gear Drive model)**

- 1) Align the gear case with the timing gear case knock pin and then install the timing gear case cover.

- 2) Tighten the gear case cover bolts to the specified torque.

**Tighten:**

8 N·m (0.8 kg·m/69 lb·in)


**27. Crankshaft Damper Pulley (Gear Drive model)**

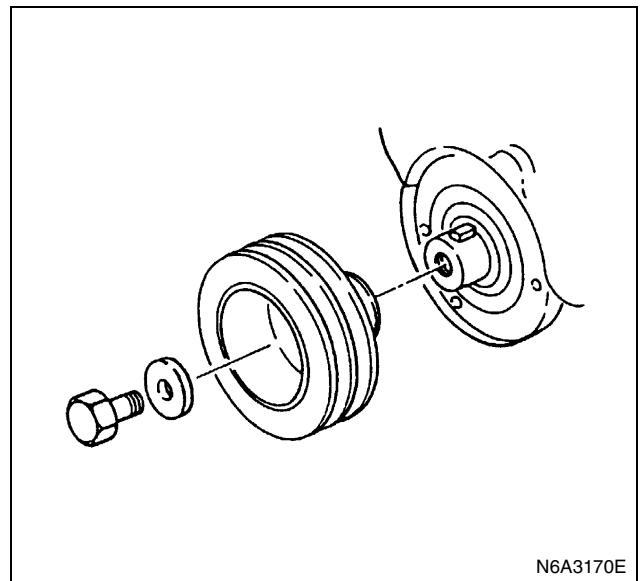
- Tighten the crankshaft damper pulley bolt to the specified torque.

**Notice:**

Hold the flywheel ring gear stationary to prevent the crankshaft from turning when tightening the damper pulley.

**Tighten:**

206 N·m (21 kg·m/152 lb·ft)


**28. Cooling Fan Assembly (Gear Drive model)**

- 1) Mount fan pulley, distance piece, and cooling fan asm (in this order) on the water pump, and tighten to the specified torque.

**Tighten:**

8 N·m (0.8 kg·m/69 lb·in)

29. AC Generator, Power Steering Pump Drive Belt  
(Gear Drive model)

- 1) Install AC Generator, Power Steering pump drive belt and adjust belt tension.
- 2) Depress the drive belt mid-portion with a 98 N (10 kg/22 lb) force.

| Drive Belt Deflection | mm (in) |
|-----------------------|---------|
| 8 (0.31) — 12 (0.47)  |         |

- 3) Tighten the idler lock nut to the specified torque.

**Tighten:**

27 N·m (2.8 kg·m/20 lb·ft)

30. Fan Shroud (Gear Drive model)

- 1) Install the fan shroud and reservoir tank hose.
- 2) Pour coolant
- 3) Start the engine and check coolant leakage.

31. Oil Pan Assembly

Above works refer to "OIL PUMP" Section in this manual.

32. Cylinder Head Assembly and Gasket

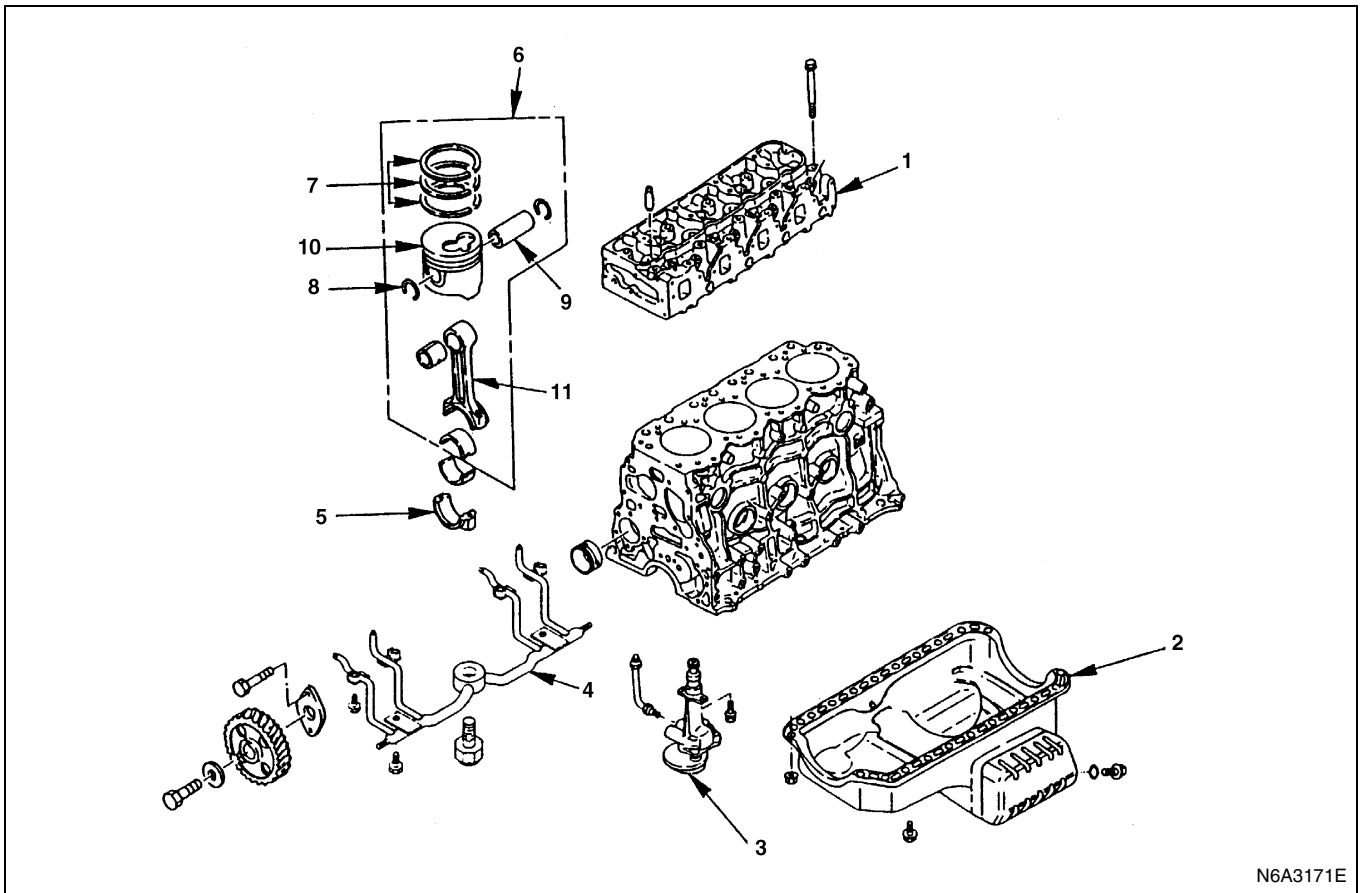
- Piston Head Projection Measurement Point
- Cylinder Head Assembly
- Push Rod
- Rocker Arm Shaft Assembly

Valve clearance adjustment.

Above works refer to "CYLINDER BLOCK" Section in this manual.

## PISTON AND CONNECTING ROD

### Component



N6A3171E

### Legend

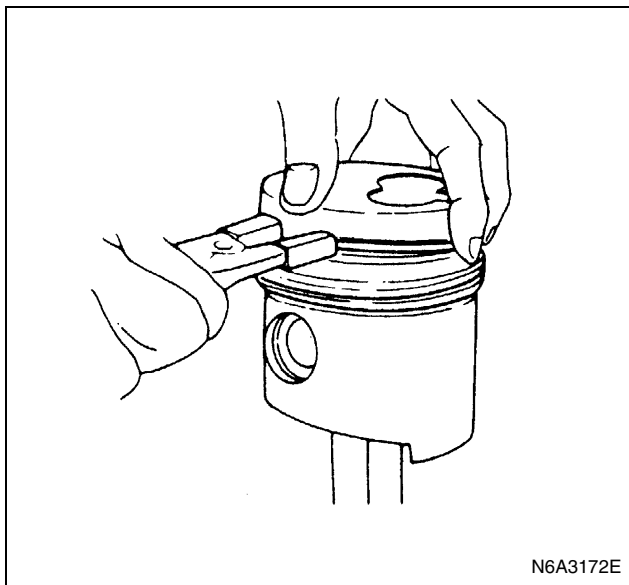
- |                               |                         |
|-------------------------------|-------------------------|
| 1. Cylinder head assembly     | 7. Piston ring          |
| 2. Oil pan assembly           | 8. Piston pin snap ring |
| 3. Oil pump assembly          | 9. Piston pin           |
| 4. Piston cooling oil pipe    | 10. Piston              |
| 5. Connecting rod bearing cap | 11. Connecting rod      |
| 6. Piston and connecting rod  |                         |

### Disassembly

1. Cylinder Head Assembly
2. Oil Pan Assembly
3. Oil Pump Assembly
4. Piston Cooling Oil Pipe
5. Connecting Rod Bearing Cap
6. Piston and Connecting Rod
  - Remove carbon deposits from the upper portion of the cylinder wall with a scraper before removing the piston and connecting rod.
7. Piston Ring
 

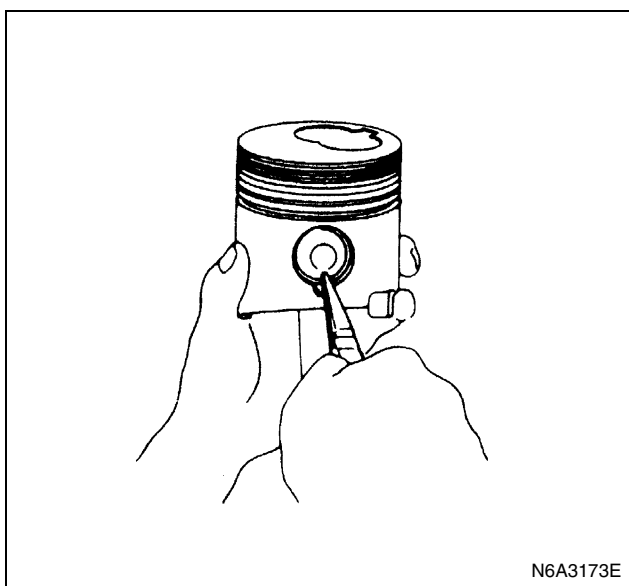
Remove the piston rings with a piston ring expander.

Arrange the removed piston rings in the cylinder number order.



#### 8. Piston Pin Snap Ring

- Use a pair of pliers to remove the piston pin snap rings.



#### 9. Piston Pin

#### Notice:

Keep the parts removed from each cylinder separate. All parts must be reinstalled in their original positions.

#### 10. Piston

#### 11. Connecting Rod

### Inspection and Repair

#### Piston and Piston Ring

##### Pistons

Carefully clean away all the carbon adhering to the piston head and the piston ring grooves.

#### Notice:

Never use a wire brush to clean the pistons. Damage will result.

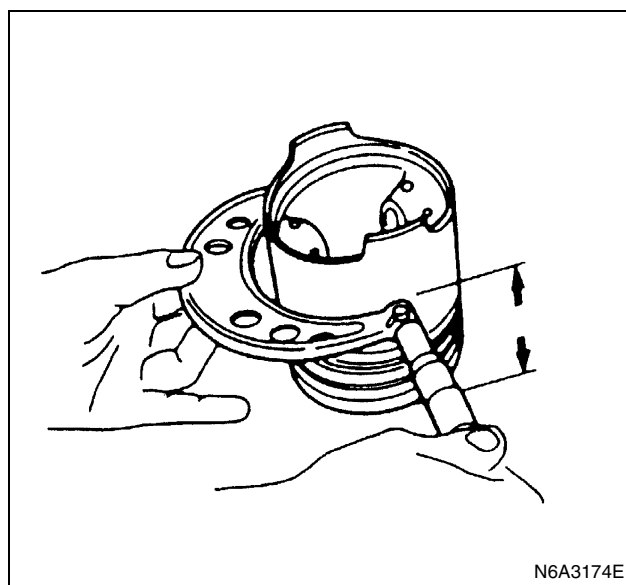
Visually check each piston for cracking, scoring, and other signs of excessive wear.

If any of the above conditions are present, the piston must be replaced.

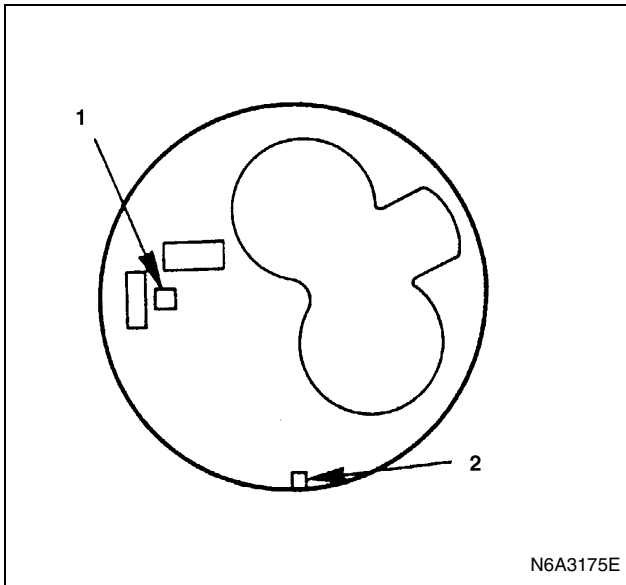
#### Piston Diameter

- Measure the piston outside diameter with micrometer at the piston grading position.

| Piston Grading Position |  | mm (in)       |
|-------------------------|--|---------------|
| 4JB1 / 4JB1-TC          |  | 74 (2.913)    |
| 4JG2, 4JH1-TC           |  | 71.00 (2.797) |



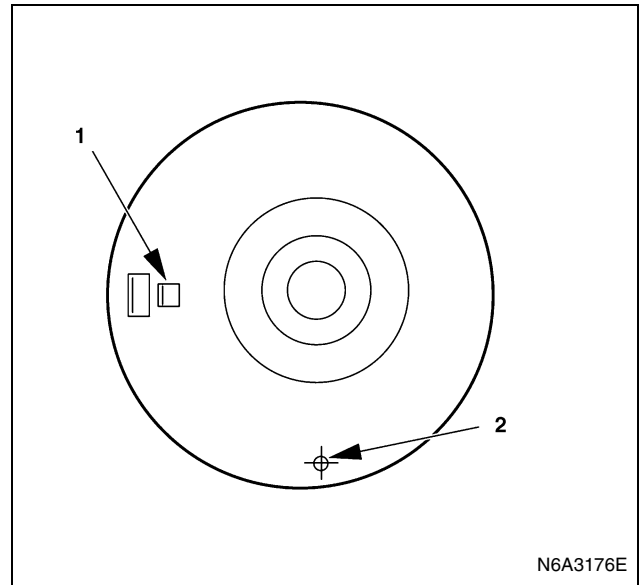
| 4JB1 / 4JB1-TC |                                   | mm (in) |
|----------------|-----------------------------------|---------|
| Size Mark      | Outside Diameter                  |         |
| A              | 92.985 — 92.994 (3.6608 — 3.6612) |         |
| B              | 92.995 — 93.004 (3.6612 — 3.6616) |         |
| C              | 93.005 — 93.014 (3.6616 — 3.6620) |         |
| D              | 93.015 — 93.024 (3.6620 — 3.6624) |         |

**Legend**

1. G-mark
2. Front mark

| 4JG2      |                                   | mm (in) |
|-----------|-----------------------------------|---------|
| Size Mark | Outside Diameter                  |         |
| A         | 95.365 — 95.374 (3.7545 — 3.7549) |         |
| B         | 95.375 — 95.384 (3.7549 — 3.7553) |         |
| C         | 95.385 — 95.394 (3.7553 — 3.7557) |         |
| D         | 95.395 — 95.404 (3.7557 — 3.7561) |         |

| 4JH1-TC   |                                     | mm (in) |
|-----------|-------------------------------------|---------|
| Size Mark | Outside Diameter                    |         |
| A         | 95.355 — 95.364 (37.5413 — 37.5449) |         |
| B         | 95.365 — 95.374 (37.5453 — 37.5488) |         |
| C         | 95.375 — 95.384 (37.5492 — 37.5528) |         |
| D         | 95.385 — 95.394 (37.5531 — 37.5567) |         |

**Legend**

1. G-mark
2. Front mark

The grading position for piston outside diameter is represented by the 'G' as shown in Figure.

Measure the cylinder bore inside diameter (refer to "inspection of the cylinder Block" in this Section).

If the piston clearance does not conform to the specified value, the piston and/or cylinder liners must be replaced.

| Piston Clearance |                                 | mm (in) |
|------------------|---------------------------------|---------|
| 4JB1 / 4JB1-TC   | 0.061 (0.0024)                  |         |
| 4JG2             | 0.066 (0.0026)                  |         |
| 4JH1-TC          | 0.057 — 0.075 (0.0022 — 0.0029) |         |

**Selection Method of Piston Grade for Service Parts.**

If you find piston grade A from size mark or piston outside diameter measurement result, you will select AX for service piston grade.

The stamped piston grade on the head of piston for service parts.

| Service piston grade |                     |
|----------------------|---------------------|
| Piston Size Mark     | Service Parts Grade |
| A                    | AX                  |
| B                    | AX                  |
| C                    | CX                  |
| D                    | CX                  |

| Service piston diameter |                                   | mm (in) |
|-------------------------|-----------------------------------|---------|
| Piston Grade            | 4JB1 / 4JB1-TC                    |         |
| AX                      | 92.989 — 93.004 (3.6610 — 3.6616) |         |
| CX                      | 93.005 — 93.020 (3.6616 — 3.6622) |         |

| Piston Grade | 4JG2                              |  |
|--------------|-----------------------------------|--|
| AX           | 95.369 — 95.384 (3.7547 — 3.7553) |  |
| CX           | 95.385 — 95.400 (3.7553 — 3.7559) |  |

| Piston Grade | 4JH1-TC                           |  |
|--------------|-----------------------------------|--|
| AX           | 95.359 — 95.374 (3.7543 — 3.7549) |  |
| CX           | 95.375 — 95.390 (3.7549 — 3.7555) |  |

**Notice:**

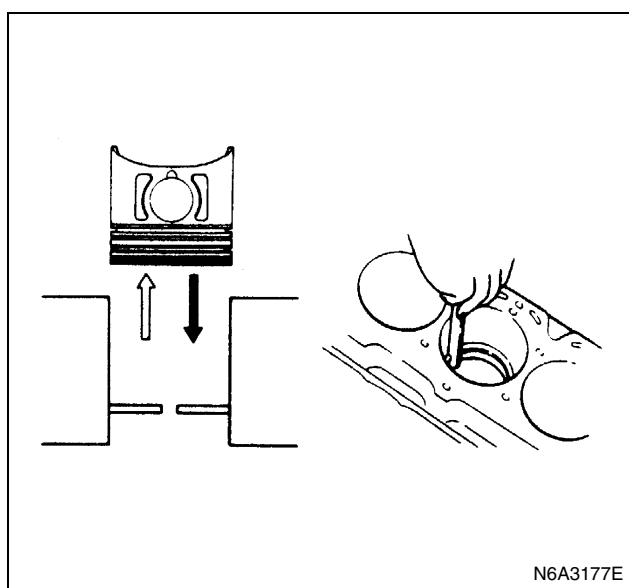
It is most important that the correct piston grade be used. Failure to select the correct piston grade will result in engine failure. Always measure the cylinder bore and select the correct piston grade.

**Piston Rings**

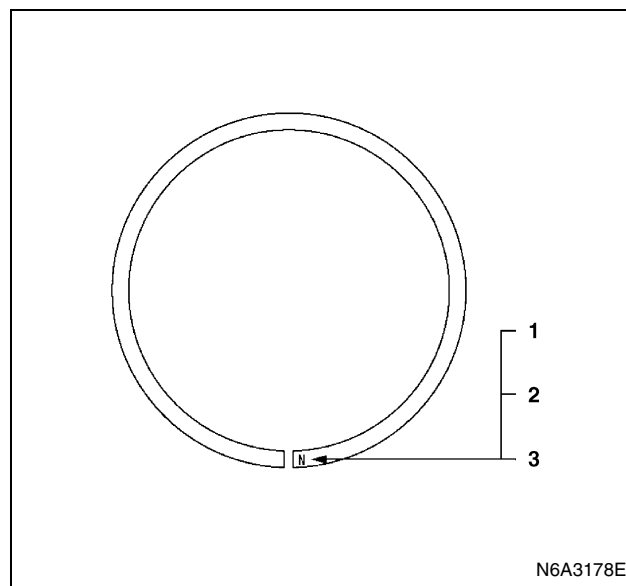
Any worn or damaged part discovered during engine overhaul must be replaced with a new one.

## 1. Ring end gap measurement

- Insert the piston ring into the bore.
- Push the ring by the piston, at a right angle to the wall, into the point ring at which the cylinder bore diameter is the smallest.



- The top mark of the piston ring are shown in the illustration.

**Legend**

1. N mark (Top ring) (2nd ring) (4JB1)
2. 1N mark (Top ring) 2N mark (2nd ring) (4JG2)
3. R mark (Top ring) (2nd ring) (4JH-TC)

| 4JB1 / 4JB1-TC   |     |                                  | mm (in)        |
|------------------|-----|----------------------------------|----------------|
|                  |     | Standard                         | Limit          |
| Compression ring | 1st | 0.20 — 0.40<br>(0.0079 — 0.0157) | 1.5<br>(0.059) |
|                  | 2nd | 0.20 — 0.40<br>(0.0079 — 0.0157) |                |
| Oil ring         |     | 0.10 — 0.30<br>(0.0039 — 0.0118) |                |

| 4JG2             |     |                                  | mm (in)        |
|------------------|-----|----------------------------------|----------------|
|                  |     | Standard                         | Limit          |
| Compression ring | 1st | 0.20 — 0.35<br>(0.0079 — 0.0138) | 1.5<br>(0.059) |
|                  | 2nd | 0.37 — 0.52<br>(0.0146 — 0.0205) |                |
| Oil ring         |     | 0.20 — 0.40<br>(0.0079 — 0.0157) |                |

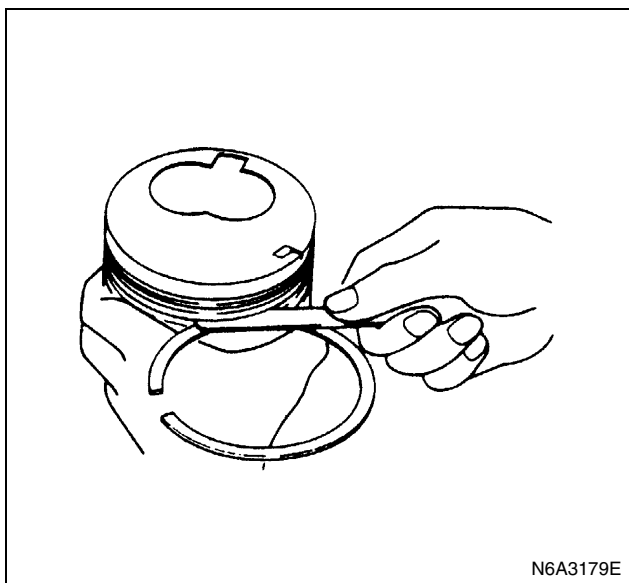
| 4JH1-TC          |     |                                  | mm (in)        |
|------------------|-----|----------------------------------|----------------|
|                  |     | Standard                         | Limit          |
| Compression ring | 1st | 0.30 — 0.50<br>(0.0118 — 0.0197) | 1.5<br>(0.059) |
|                  | 2nd | 0.30 — 0.50<br>(0.0118 — 0.0197) |                |
| Oil ring         |     | 0.25 — 0.45<br>(0.0098 — 0.0117) |                |

2. Measure the clearance between the piston ring groove and the piston ring with a feeler gauge. If the piston ring groove/piston ring clearance exceeds the specified limit, the piston must be replaced.

| 4JB1 / 4JB1-TC   |     | mm (in)                            |                |
|------------------|-----|------------------------------------|----------------|
|                  |     | Standard                           | Limit          |
| Compression ring | 1st | 0.090 — 0.125<br>(0.0035 — 0.0049) | 1.5<br>(0.059) |
|                  | 2nd | 0.050 — 0.075<br>(0.0020 — 0.0030) |                |
| Oil ring         |     | 0.03 — 0.07<br>(0.0012 — 0.0028)   |                |

| 4JG2             |     | mm (in)                          |                |
|------------------|-----|----------------------------------|----------------|
|                  |     | Standard                         | Limit          |
| Compression ring | 1st | 0.09 — 0.13<br>(0.0035 — 0.0051) | 1.5<br>(0.059) |
|                  | 2nd | 0.05 — 0.07<br>(0.0020 — 0.0028) |                |
| Oil ring         |     | 0.03 — 0.07<br>(0.0012 — 0.0028) |                |

| 4JH1-TC          |     | mm (in)                           |                |
|------------------|-----|-----------------------------------|----------------|
|                  |     | Standard                          | Limit          |
| Compression ring | 1st | 0.09 — 0.13<br>(0.0035 — 0.0051)  | 1.5<br>(0.059) |
|                  | 2nd | 0.05 — 0.09 (0.002 — 0.0035)      |                |
| Oil ring         |     | 0.03 — 0.07<br>(0.00118 — 0.0028) |                |



N6A3179E

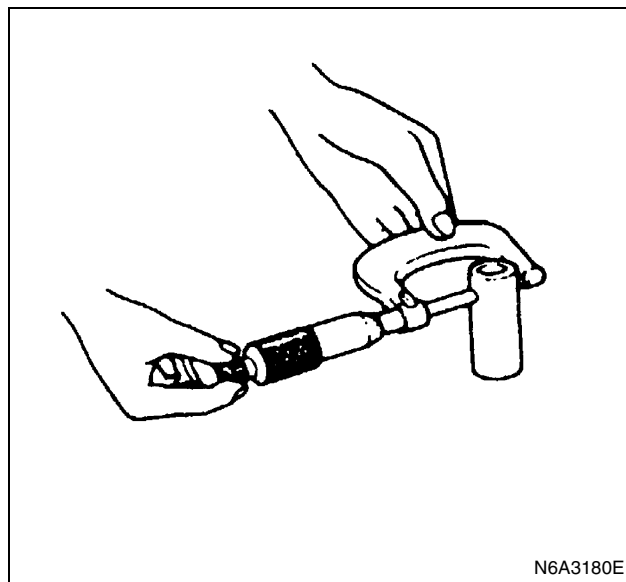
### Piston Pin

Visually inspect the piston pin for cracks, flaws, and other damage and replace if necessary.

1. Use a micrometer to measure the piston pin outside diameter in both directions at three different positions.

If the measurement exceed the specified limit the piston pin must be replaced.

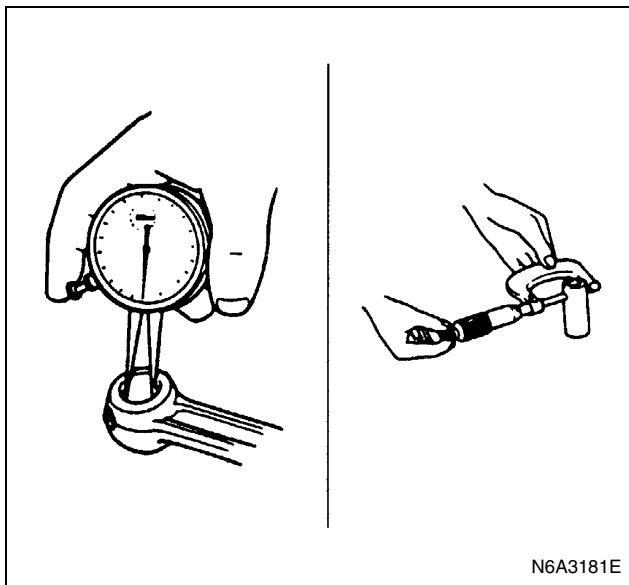
| Piston pin outside diameter |  | mm (in)                              |                 |
|-----------------------------|--|--------------------------------------|-----------------|
|                             |  | Standard                             | Limit           |
| 4JB1<br>4JB1-TC<br>4JH1-TC  |  | 30.995 — 31.000<br>(1.2202 — 1.2204) | 30.970 (1.2190) |
| 4JG2                        |  | 33.995 — 34.000<br>(1.3384 — 1.3386) | 33.970 (1.3374) |



N6A3180E

2. Measure the inside diameter of the connecting rod small end. If the clearance between the small end and pin does not conform to the specified value, the connecting rod or bushing and pin must be replaced.

| mm (in)   |                                    |               |
|-----------|------------------------------------|---------------|
|           | Standard                           | Limit         |
| Clearance | 0.008 — 0.020<br>(0.0003 — 0.0008) | 0.05 (0.0020) |



N6A3181E

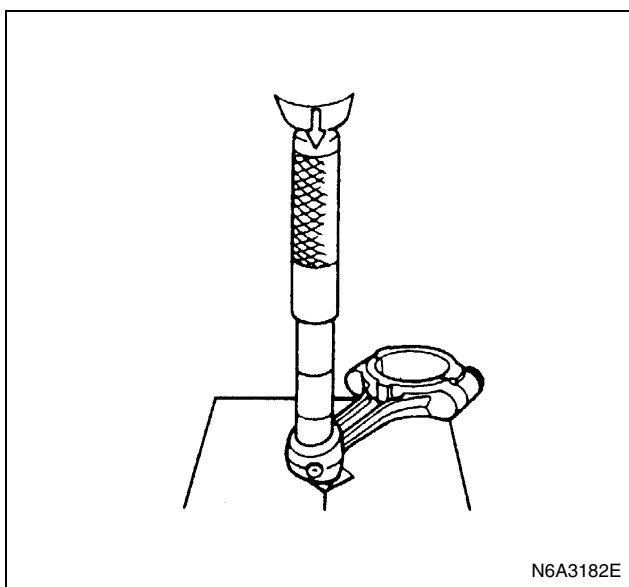
3. Insert the piston pin into the piston and rotate it. If the pin rotates smoothly with no backlash, the clearance is normal. If there is backlash or roughness, measure the clearance. If the clearance exceeds the specified limit, the piston and the piston pin must be replaced.

| mm (in)   |                                      |               |
|-----------|--------------------------------------|---------------|
|           | Standard                             | Limit         |
| Clearance | 0.002 — 0.004<br>(0.00008 — 0.00016) | 0.04 (0.0016) |

### Bushing Replacement

Removal: Use a suitable bar and bench press or hammer.

Installation: Use a suitable bar and bench press.



N6A3182E

### Notice:

Align the bushing with the connecting rod oil port.

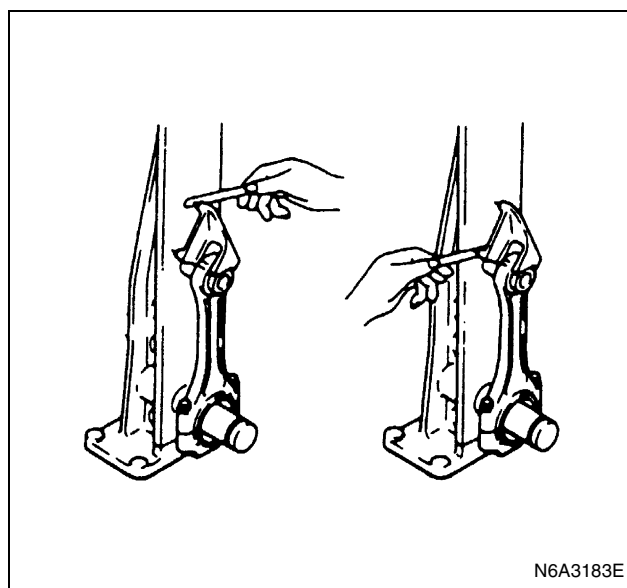
After installing a new bushing, finish the bushing bore with a pin hole grinder.

### Connecting Rods

1. Check the connecting rod alignment with a connecting rod aligner.

If either the bend or the twist exceeds the specified limit, the connecting rod must be replaced.

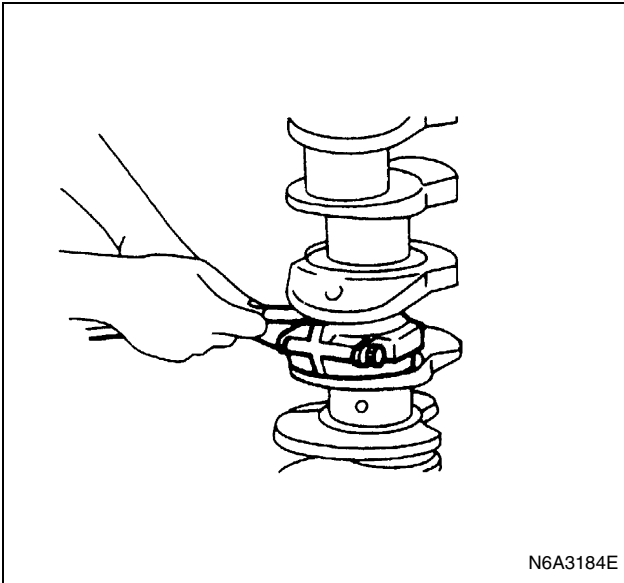
| mm (in)              |                       |               |
|----------------------|-----------------------|---------------|
|                      | Standard              | Limit         |
| Bend per 100 (3.94)  | 0.08 (0.0031) or less | 0.20 (0.0079) |
| Twist per 100 (3.94) | 0.05 (0.0020) or less | 0.15 (0.0059) |



N6A3183E

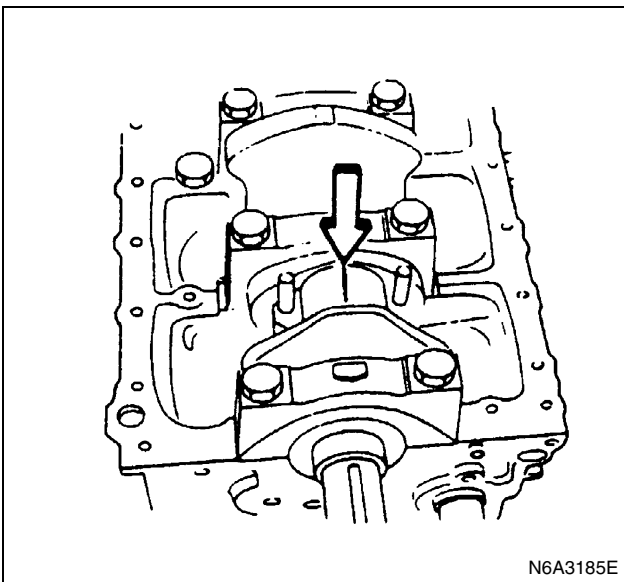
2. Measure the connecting rod thrust clearance. Use a feeler gauge to measure the thrust clearance at the big end of the connecting rod. If the clearance exceeds the specified limit, the connecting rod must be replaced.

| Thrust Clearance |                | mm (in) |
|------------------|----------------|---------|
| Standard         | Limit          |         |
| 0.230 (0.0091)   | 0.350 (0.0138) |         |



3. Measure the oil clearance between the connecting rod and the crankshaft by:

- 1) Remove the connecting rod cap nuts and the rod caps.  
Arrange the removed rod caps in the cylinder number order.
- 2) Clean the rod bearings and the crankshaft pins.
- 3) Carefully check the rod bearings.  
If even one bearing is found to be damaged or badly worn, the entire bearing assembly must be replaced as a set. Reinstall the bearings in their original positions.  
Apply plastigage to the crank pin.



- 4) Put the plastigage, and reinstall the rod caps to their original positions.
- 5) Tighten the cap nuts in 2 steps, using angular tightening method as shown in the following specifications. (4JG2, 4JH1-TC, 4JB1-TC)

#### Tighten:

- 4JH1-TC, 4JB1-TC to  
1st Step: 29 N·m (3 kg·m/22 lb·ft)  
2nd Step: 45° — 60°
- 4JB1 to 83 N·m (8.5 kg·m/61 lb·ft)

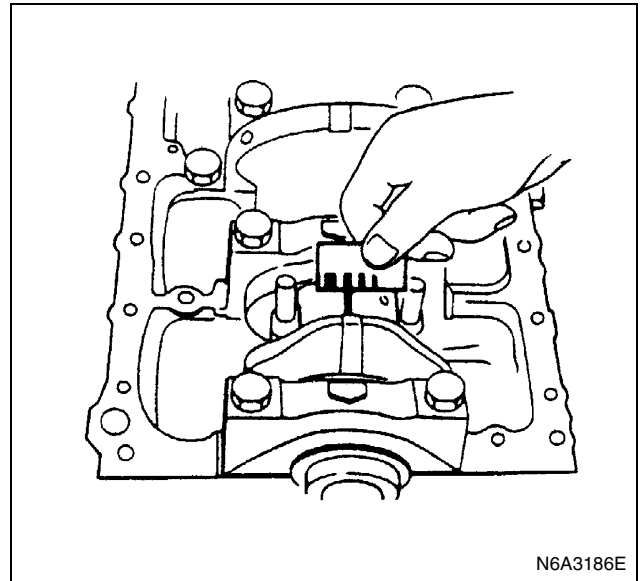
#### Notice:

Do not allow the crankshaft to rotate.

- 6) Remove the rod caps.
- 7) Measure the width of the plastigage and determine the oil clearance. If the oil clearance exceeds the limit, replace the rod bearings as a set.
- 8) Remove the plastigage from the bearings and the crankshaft pins.

Crankshaft Journal and Bearing Clearance

| mm (in)           |                                    |                |
|-------------------|------------------------------------|----------------|
|                   | Standard                           | Limit          |
| 4JB1 /<br>4JB1-TC | 0.029 — 0.066<br>(0.0011 — 0.0026) | 0.100 (0.0039) |
| 4JG2<br>4JH1-TC   | 0.029 — 0.083<br>(0.0011 — 0.0033) |                |



#### Reassembly

1. Connecting Rod
2. Piston
3. Piston Pin

Apply a coat of engine oil to the piston pin and the piston pin hole.

## 6A-54 GENERAL ENGINE MECHANICAL

### 4. Piston Pin Snap Ring

Apply a thin coat of engine oil to the piston pin.

Try to insert the piston pin into the piston pin hole with normal finger pressure.

Weigh each piston and connecting rod assembly.

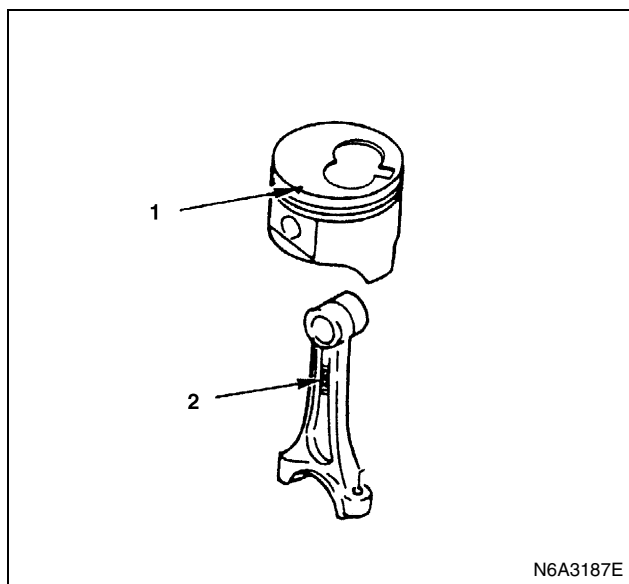
Select piston and connecting rod combinations so that the weight variation of the different assemblies is held within the specified limits.

| g (oz)                            |                      |
|-----------------------------------|----------------------|
| Variance in weight after assembly | Less than 3 (0.1058) |

#### Notice:

When changing piston/connecting rod combinations, do not change the piston/piston pin combination

- Attach the piston to the connecting rod with the piston front mark and the connecting rod ISUZU mark on the same side.

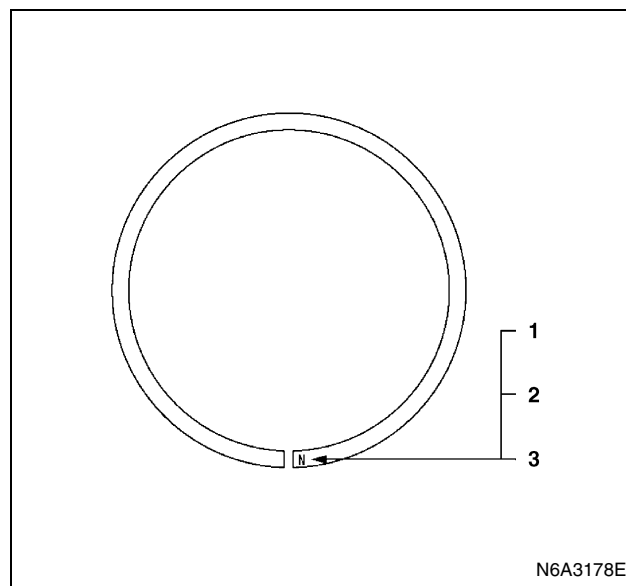


#### Legend

1. Front mark
2. ISUZU mark

### 5. Piston Ring

- Install the piston rings with the piston ring expander.
- The compression ring must be set with the N mark facing up.
- Discrimination mark is painted as shown in the illustration.



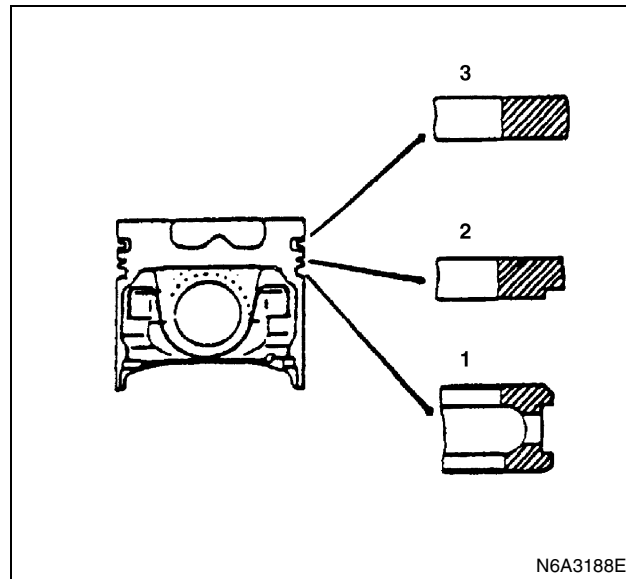
#### Legend

1. N mark (Top ring) (2nd ring) (4JB1)
2. 1N mark (Top ring) 2N mark (2nd ring) (4JG2)
3. R mark (Top ring) (2nd ring) (4JH-TC)

- Install piston rings in the following sequence.

- 1) Oil ring

**4JB1, 4JH1-TC**



#### Legend

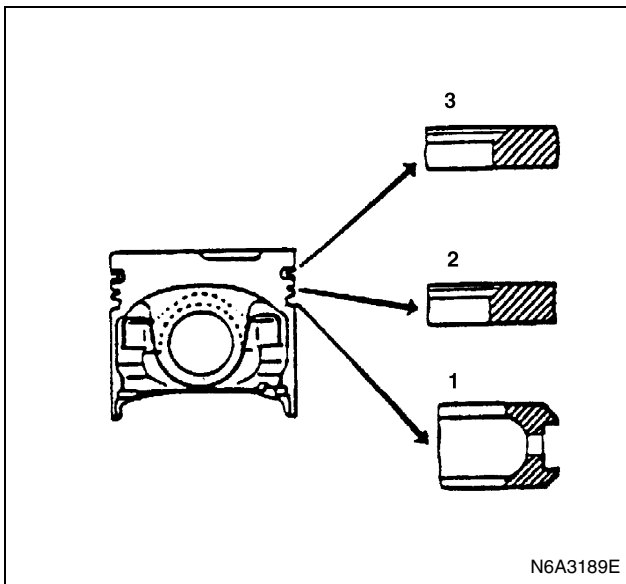
1. Expander ring
2. Upper side rail
3. Lower side rail

- 2) 2nd compression ring

- 3) 1st compression ring

- The compression ring must be set with the 1N or 2N mark (4JG2) facing up.
- 1st compression ring: 1N (4JG2), N (4JB1), R (4JH1-TC)

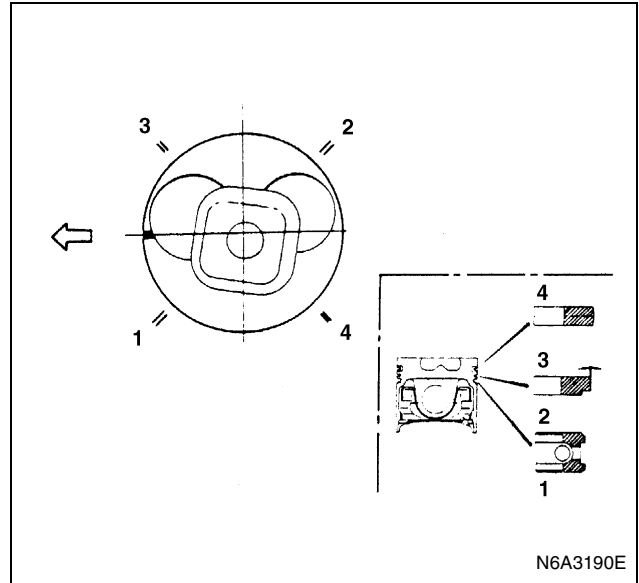
- 2nd compression ring: 2N (4JG2), N (4JB1), R (4JH1-TC)
- After installation, apply engine oil to the entire circumference of the piston rings. Check to see that all the rings rotate smoothly.
- Insert the bearings into the connecting rods and caps.  
Apply new engine oil to the bearing faces.  
Cap side bearings have no oil hole.  
Connecting rod side bearings oil hole should be aligned with oil hole on the connecting rod.

**4JG2****Legend**

1. Oil ring
2. Compression ring No. 2
3. Compression ring No. 1

**6. Piston and Connecting Rod**

- Apply engine oil to the cylinder bores, the connecting rod bearings and the crankshaft pins.
- Check to see that the piston ring end gaps are correctly positioned.
- Insert the piston/connecting rod assemblies into each cylinder with the piston ring compressor.
- The front marks must be facing the front of the engine.

**Legend**

1. Expander ring
2. Expander ring
3. Upper side rail
4. Lower side rail

**7. Connecting Rod Bearing Cap**

- Tighten the cap nuts in 2 steps, using angular tightening method as shown in the following specifications.

**Tighten:**

4JH1-TC, 4JB1-TC to

- 1st Step: 29 N·m (3.0 kg·m/22 lb·ft)
- 2nd Step: 45° — 60°

4JB1 to 83 N·m (8.5 kg·m/61 lb·ft)

After tightening the cap nuts, check to see that the crankshaft rotates smoothly.

**8. Piston Cooling Oil Pipe**

- Install the piston cooling oil pipe to the cylinder body.
- Tighten the oil pipe bolts and relief valve to the specified torque.

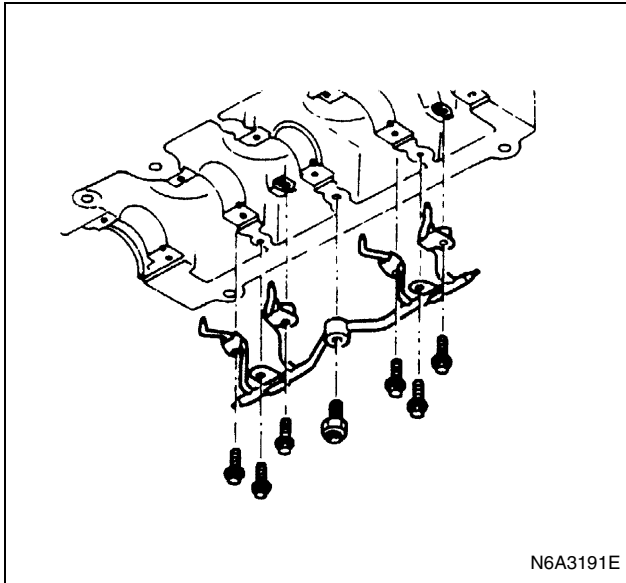
**Tighten:**

Oil Pipe Bolt to

- M8 × 1.25: 19 N·m (1.9 kg·m/14 lb·ft)
- M6 × 1.00: 8 N·m (0.8 kg·m/69 lb·in)

Oil Pressure Regulating Valve to

- M16 × 1.5: 29 N·m (3.0 kg·m/22 lb·ft)



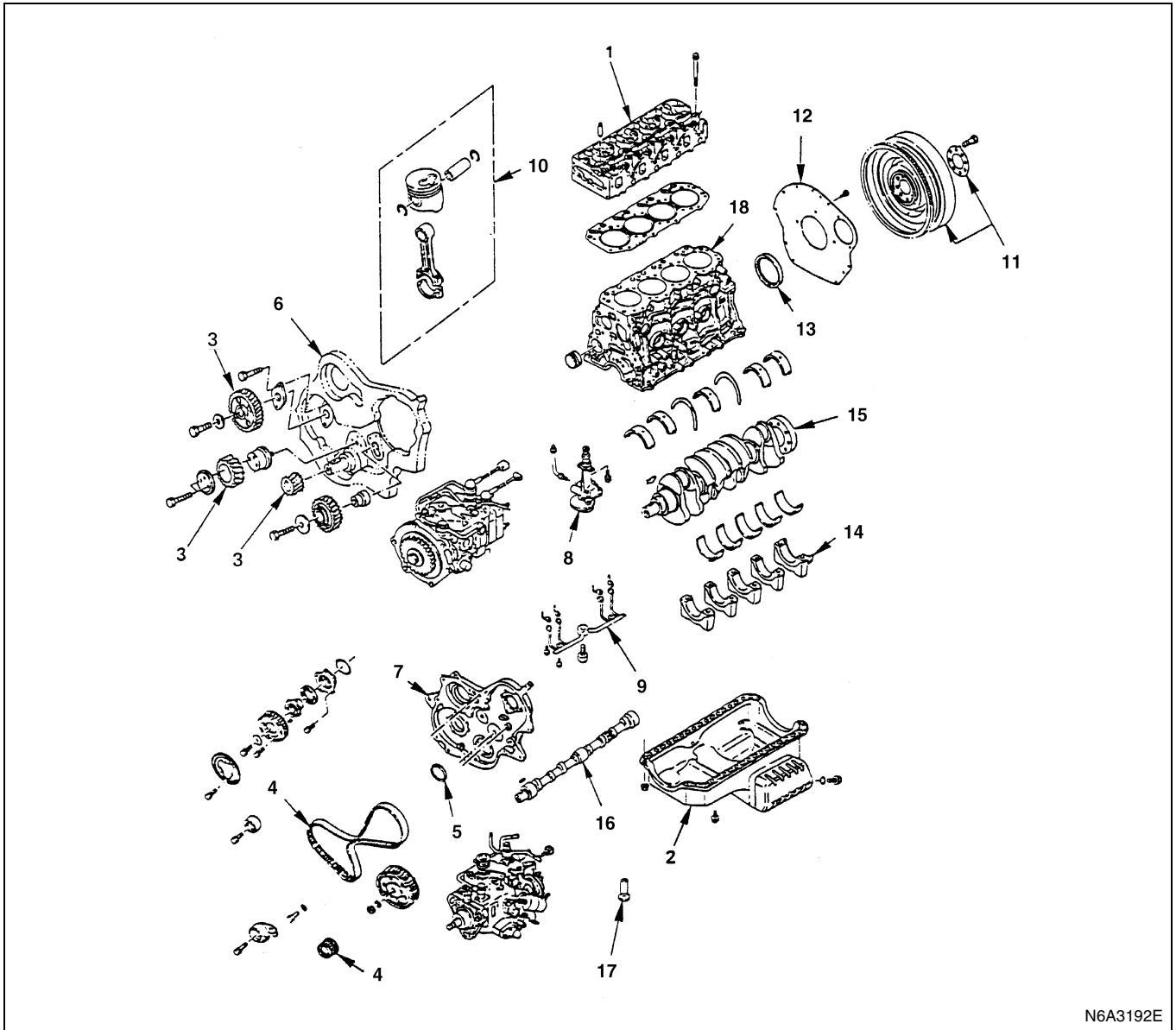
**Notice:**

Check that there is no interference between the piston and the oiling jet pipe by slowly rotating the crankshaft.

9. Oil Pump Assembly
10. Oil Pan Assembly  
Above works refer to "OIL PUMP" Section in this manual.
11. Cylinder Head Assembly
  - Piston Head Projection Measurement Point
  - Cylinder Head Assembly
  - Push Rod
  - Rocker Arm Shaft AssemblyValve clearance adjustment.  
Above works refer to "CYLINDER BLOCK" Section in this manual.

## CYLINDER BLOCK

### Component



N6A3192E

### Legend

- |                                      |                               |
|--------------------------------------|-------------------------------|
| 1. Cylinder head assembly and gasket | 10. Piston and connecting rod |
| 2. Oil pan assembly                  | 11. Flywheel                  |
| 3. Timing gear                       | 12. Cylinder block rear plate |
| 4. Timing belt and pulley            | 13. Crankshaft rear oil seal  |
| 5. Front oil seal (Belt Drive Model) | 14. Main bearing cap          |
| 6. Timing gear housing               | 15. Crankshaft                |
| 7. Timing pulley housing             | 16. Camshaft                  |
| 8. Oil pump assembly                 | 17. Tappet                    |
| 9. Piston cooling oil pipe           | 18. Cylinder block            |

### Disassembly

- |                                      |                                      |
|--------------------------------------|--------------------------------------|
| 1. Cylinder Head Assembly and Gasket | 4. Timing Belt and Pulley            |
| 2. Oil Pan Assembly                  | 5. Front Oil Seal (Belt Drive Model) |
| 3. Timing Gear                       | 6. Timing Gear Housing               |
|                                      | 7. Timing Pulley Housing             |

8. Oil Pump Assembly
9. Piston Cooling Oil Pipe
10. Piston and Connecting Rod
11. Flywheel
12. Cylinder Block Rear Plate
13. Crankshaft Rear Oil Seal
14. Main Bearing Cap
15. Crankshaft
16. Camshaft
17. Tappet
18. Cylinder Block

## Inspection and Repair

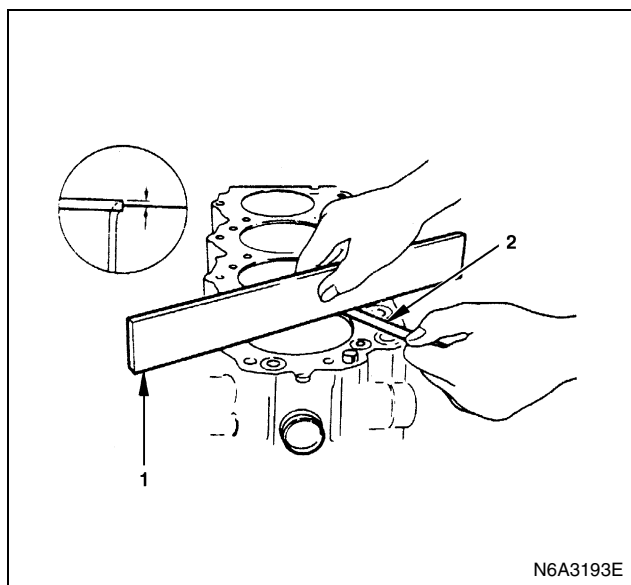
Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

1. Remove the gasket and any other material adhering the upper surface of the cylinder block.  
Be very careful not to allow any material to accidental drop into the cylinder block.  
Be very careful not to scratch the cylinder block.
2. Carefully remove the oil pump, Rear Seal retainer and oil pan installation surface seal.
3. Wipe the cylinder block clean.

## Cylinder Liner Projection Inspection

1. Hold a straight edge (1) along the top edge of the cylinder liner to be measured.
2. Use a feeler gauge (2) to measure each cylinder line projection.  
The difference in the cylinder liner projection height between any two adjacent cylinders must not exceed 0.03 mm (0.0012 in).

| Standard                    | mm (in) |
|-----------------------------|---------|
| 0.0 — 0.1 (0.0000 — 0.0039) |         |



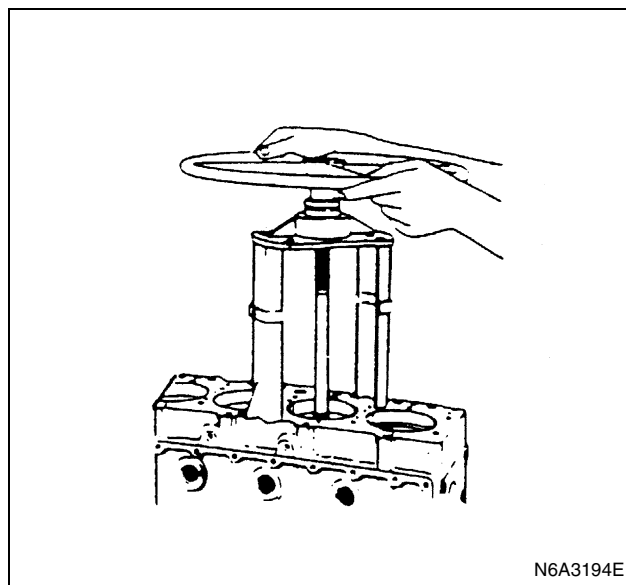
## Flatness

1. Remove the cylinder body dowel.
2. Set the cylinder liner remover to the cylinder liner.
3. Check that the remover shaft ankle is firmly gripping the cylinder liner bottom edge.
4. Slowly turn the remover shaft handle counterclockwise to pull the cylinder liner free.

Cylinder Liner Remover Ankle:

5-8840-2304-0 (4JG2/4JH1-TC)

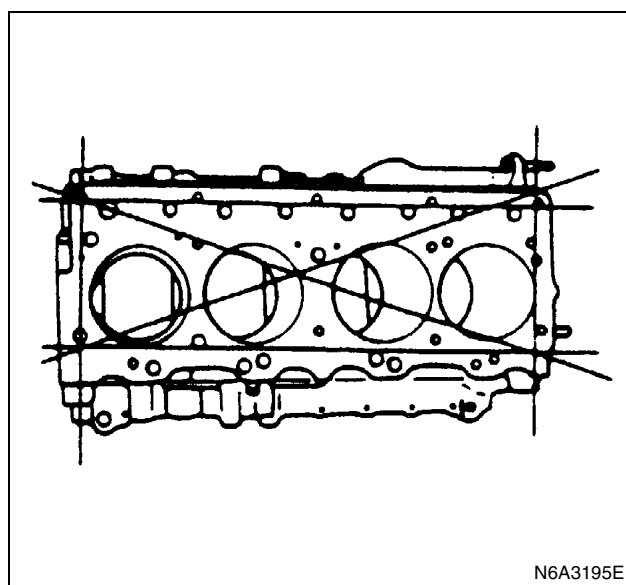
5-8840-2039-0 (4JB1/4JB1-TC)



## Notice:

Take care not to damage the cylinder body upper during the cylinder liner removal procedure.

5. Use a straight edge and a feeler gauge to measure the four sides and the two diagonals of the cylinder body upper face.  
If the measured values exceeds the limit, the cylinder body must be replaced.

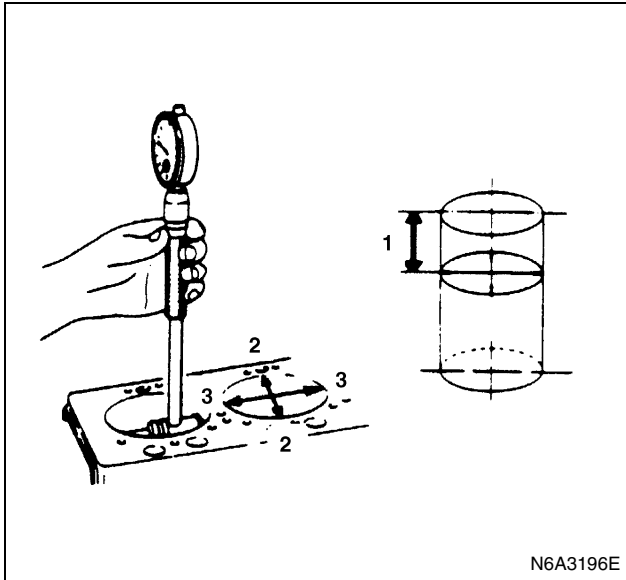


### Cylinder Liner Bore Measurement

Use a cylinder indicator to measure the cylinder liner bore at measuring point (1) in the thrust (2) — (2) and axial (3) direction of the crankshaft.

Measuring Point (1) 20mm (0.79 in)

If the measured value exceeds the specified limit, the cylinder liner must be replaced.



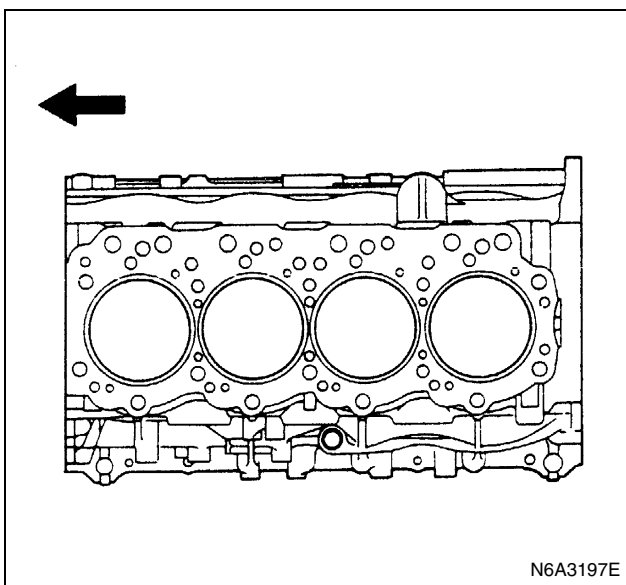
#### Notice:

The inside of the dry type cylinder liner is chrome plated. It cannot be rebored or honed.

If the inside of the cylinder liner is scored or scorched, the cylinder liner must be replaced.

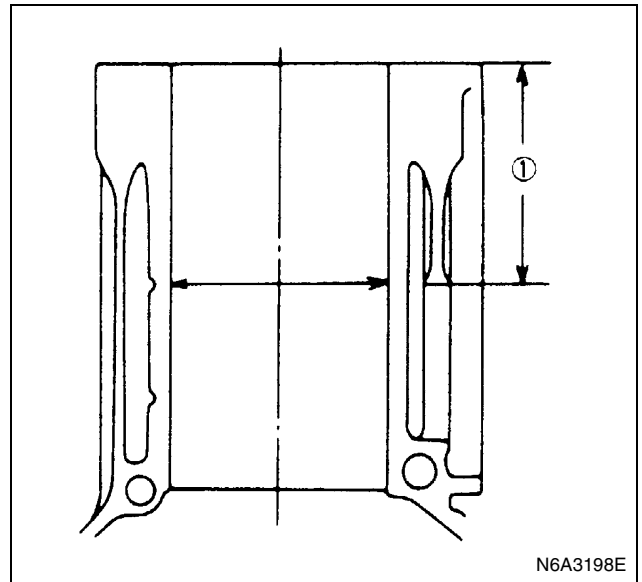
### Cylinder Liner Grade Selection

Measure the cylinder body inside diameter and select the appropriate cylinder liner grade.



If the cylinder liner fitting interference (1) is too small, engine cooling efficiency will be adversely effected.

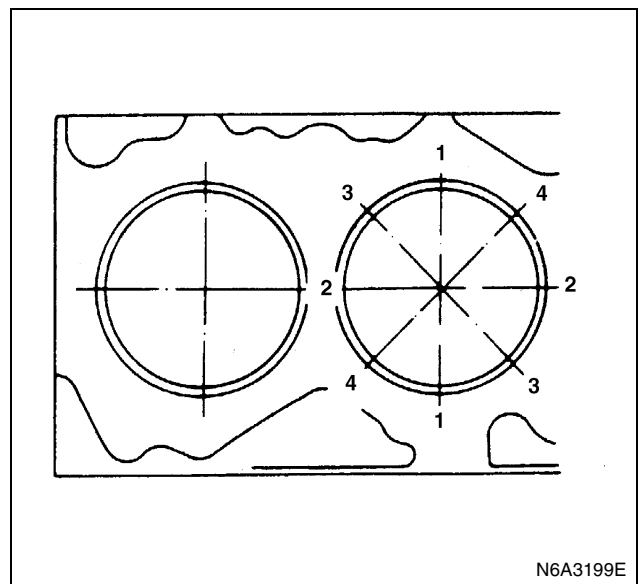
If the cylinder liner fitting interference is too large, it will be difficult to insert the cylinder liner into the cylinder body.



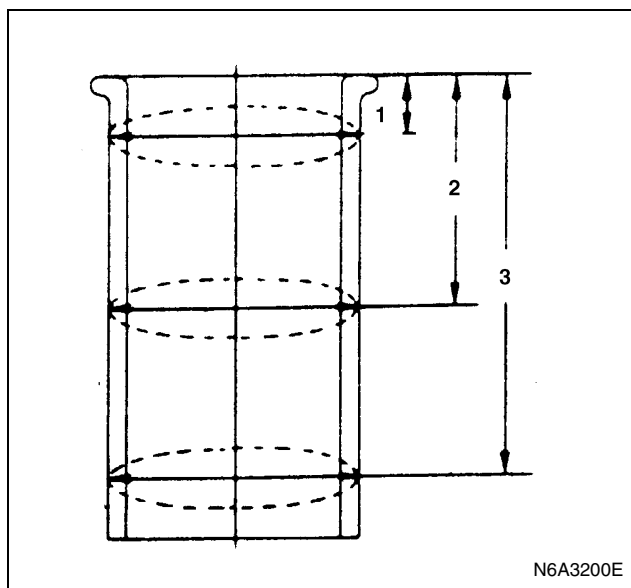
### Cylinder Body Bore Measurement

1. Take measurements at measuring point (A) across positions (1) — (1), (2) — (2), (3) — (3), and (4) — (4).

Measuring Point (A) 98mm (3.86 in).



| Standard Lifting Interference  | mm (in) |
|--------------------------------|---------|
| 0.01 — 0.019 (0.0004 — 0.0007) |         |



2. Calculate the average value of the four measurements to determine the correct cylinder grade.
3. Consult the following table with the resultant diameter for the correct liner application.

#### Selection method of cylinder liner and piston grade for service parts.

The production line stamped cylinder liner grade on the top of cylinder body, the cylinder liner outside diameter grade 1, 2, 3, 4.

If you find cylinder liner outside diameter grade 1 and piston outside diameter B on the cylinder body or result of measurement for each parts, you will select service parts grade for cylinder liner 1, AX grade and for piston AX grade.

The stamping grade code on the service parts are;  
For cylinder liner grade stamped on the outside of cylinder liner.

For piston grade stamped on the head of piston.

| 4JB1 / 4JB1-TC      |                                      |                                      |                  | mm (in)                           |
|---------------------|--------------------------------------|--------------------------------------|------------------|-----------------------------------|
| Liner outside Grade | Cylinder bore diameter average       | Liner outside diameter               | Liner bore Grade | Service liner bore measurement    |
| 1                   | 95.001 — 95.010<br>(3.7402 — 3.7406) | 95.011 — 95.020<br>(3.7406 — 3.7409) | AX               | 93.035 (3.6628) — 93.050 (3.6634) |
|                     |                                      |                                      | CX               | 93.051 (3.6634) — 93.066 (3.6640) |
| 2                   | 95.011 — 95.020<br>(3.7406 — 3.7409) | 95.021 — 95.030<br>(3.7410 — 3.7413) | AX               | 93.035 (3.6628) — 93.050 (3.6634) |
|                     |                                      |                                      | CX               | 93.051 (3.6634) — 93.066 (3.6640) |
| 3                   | 95.021 — 95.030<br>(3.7410 — 3.7413) | 95.031 — 95.040<br>(3.7414 — 3.7417) | AX               | 93.035 (3.6628) — 93.050 (3.6634) |
|                     |                                      |                                      | CX               | 93.051 (3.6634) — 93.066 (3.6640) |
| 4                   | 95.031 — 95.040<br>(3.7414 — 3.7417) | 95.041 — 95.050<br>(3.7418 — 3.7421) | AX               | 93.035 (3.6628) — 93.050 (3.6634) |
|                     |                                      |                                      | CX               | 93.051 (3.6634) — 93.066 (3.6640) |

| 4JG2 / 4JH1-TC      |                                      |                                      |                  | mm (in)                           |
|---------------------|--------------------------------------|--------------------------------------|------------------|-----------------------------------|
| Liner outside Grade | Cylinder bore diameter average       | Liner outside diameter               | Liner bore Grade | Service liner bore measurement    |
| 1                   | 97.001 — 97.010<br>(3.8189 — 3.8193) | 97.011 — 97.020<br>(3.8193 — 3.8197) | AX               | 95.435 (3.7573) — 95.450 (3.7579) |
|                     |                                      |                                      | CX               | 95.451 (3.7579) — 95.466 (3.7585) |
| 2                   | 97.011 — 97.020<br>(3.8193 — 3.8197) | 97.021 — 97.030<br>(3.8197 — 3.8201) | AX               | 95.435 (3.7573) — 95.450 (3.7579) |
|                     |                                      |                                      | CX               | 95.451 (3.7579) — 95.466 (3.7585) |
| 3                   | 97.021 — 97.030<br>(3.8197 — 3.8201) | 97.031 — 97.040<br>(3.8201 — 3.8205) | AX               | 95.435 (3.7573) — 95.450 (3.7579) |
|                     |                                      |                                      | CX               | 95.451 (3.7579) — 95.466 (3.7585) |
| 4                   | 97.031 — 97.040<br>(3.8201 — 3.8205) | 97.041 — 97.050<br>(3.8205 — 3.8209) | AX               | 95.435 (3.7573) — 95.450 (3.7579) |
|                     |                                      |                                      | CX               | 95.451 (3.7579) — 95.466 (3.7585) |

#### Notice:

It is most important that the correct piston grade be used. Failure to select the correct piston grade will result in engine failure. Always measure the cylinder bore and select the correct piston grade.

Cylinder liner kit clearances are preset. However, the cylinder liner installation procedure may result in slight decreases in cylinder liner clearances. Always measure the cylinder liner clearance after installation to be sure that it is correct.

## Cylinder Liner Installation

1. Cylinder Liner Installation Using The Special Tool.
  - 1) Use new kerosene or diesel oil to thoroughly clean the cylinder liners and bores.
  - 2) Use compressed air to blow-dry the cylinder liner and bore surfaces.

Cylinder Liner Installer

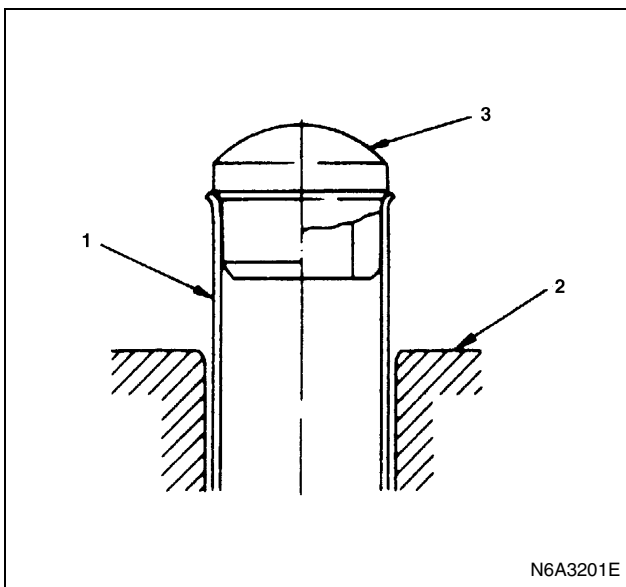
: 5-8840-2313-0 (4JG2 / 4JH1-TC)

: 5-8840-2040-0 (4JB1 / 4JB1-TC)

### Notice:

All foreign material must be carefully removed from the cylinder liner and the cylinder bore before installation.

- 3) Insert the cylinder liner (1) into the cylinder body (2) from the top of the cylinder body.

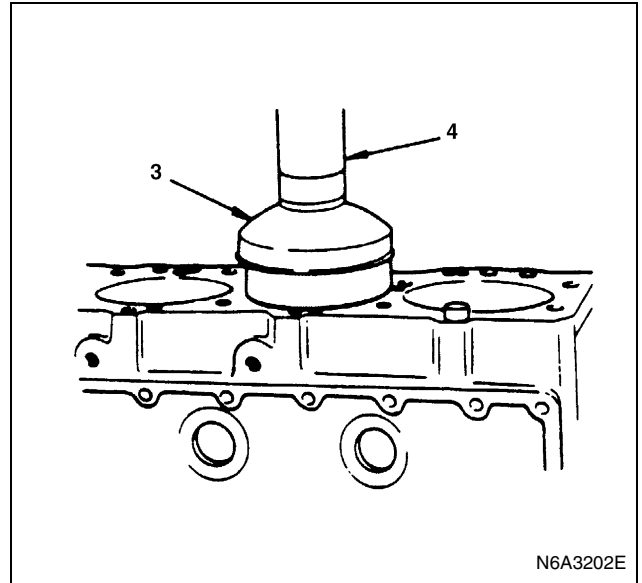


- 4) Set the cylinder liner installer (3) to the top of the cylinder liner.  
Position the cylinder body so that the installer center is directly beneath the bench press shaft center (4).

Cylinder Liner Installer

: 5-8840-2313-0 (4JG2 / 4JH1-TC)

: 5-8840-2040-0 (4JB1 / 4JB1-TC)



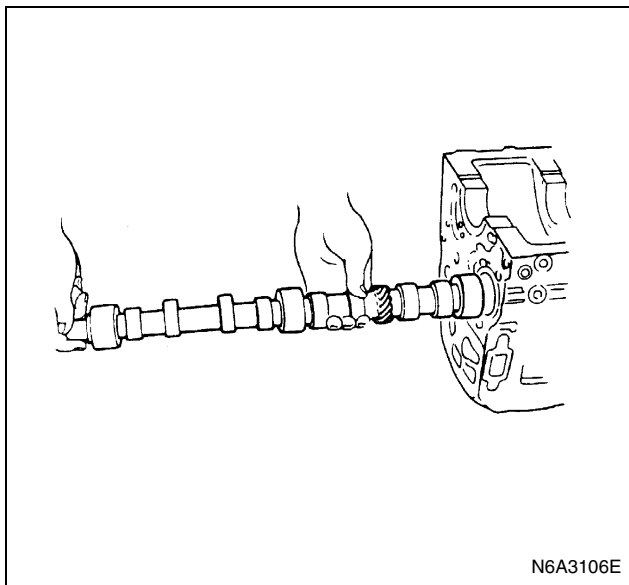
### Notice:

Check that the cylinder liner is set perpendicular to the bench press and that there is no wobble.

- 5) Use the bench press to apply a seating force of 500 kg (1,102.5 lb/4,900 N) to the cylinder liner.
- 6) Apply a force 2,500 kg (5,512.5 lb/24,500 N) to fully seat the cylinder liner.
- 7) After installing the cylinder liner, measure the cylinder liner projection.
- 8) After installing the cylinder liner, measure the cylinder liner projection.  
Refer to "Cylinder Liner Projection Inspection" in this Section.  
Measure the cylinder liner bore inside diameter and select the appropriate piston grade.

## Reassembly

1. Cylinder Block
2. Tappet
3. Camshaft
  - Apply a coat of engine oil to the tappet and the cylinder body tappet insert holes.
  - Locate the position mark applied at disassembly (if the tappet is to be reused).
  - Apply a coat of engine oil to the camshaft and the camshaft bearings.
  - Install the camshaft to the cylinder body.  
Take care not to damage the camshaft bearings.



4. Crankshaft
5. Main Bearing Cap
6. Crankshaft Rear Oil Seal
7. Cylinder Block Rear Plate
8. Flywheel

Above works refer to "CRANKSHAFT" Section in this manual.

#### 9. Piston and Connecting Rod

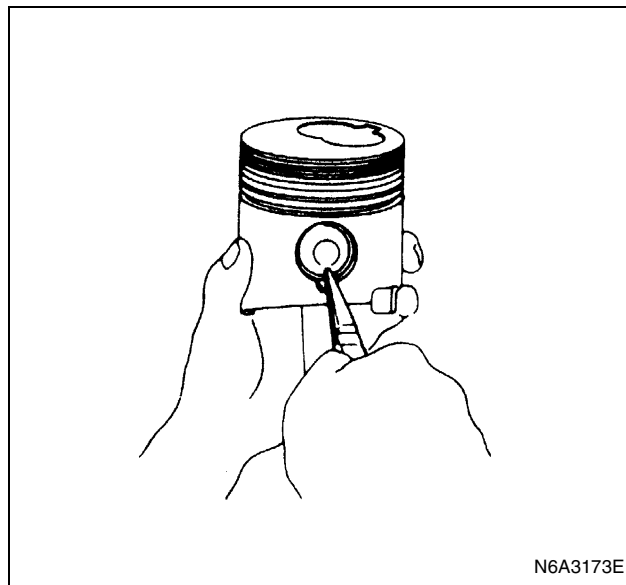
- 1) Try to insert the piston pin into the piston pin hole with normal finger pressure.

Weigh each piston and connecting rod assembly.

Select piston and connecting rod combinations so that the weight variation of the different assemblies is held within the specified limits.

| g (oz)                            |                      |
|-----------------------------------|----------------------|
| Variance in weight after assembly | Less than 3 (0.1058) |

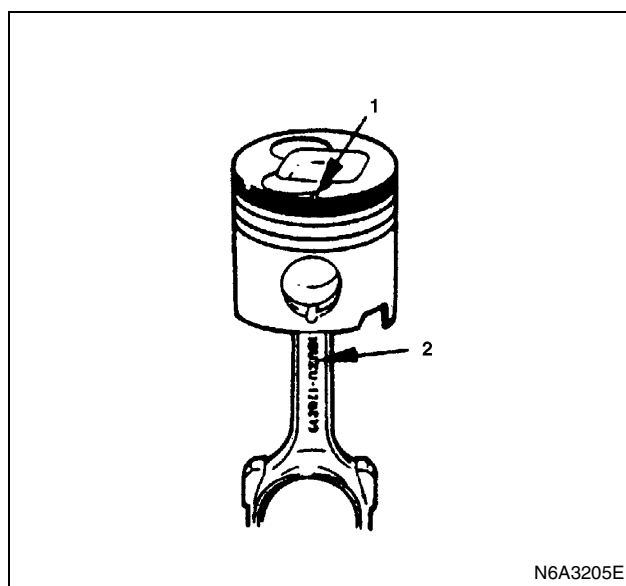
- 2) Clamp the connecting rod in a vise.  
Take care not to damage the connecting rod.
- 3) Use a pair of pliers to install the piston pin snap ring to the piston.



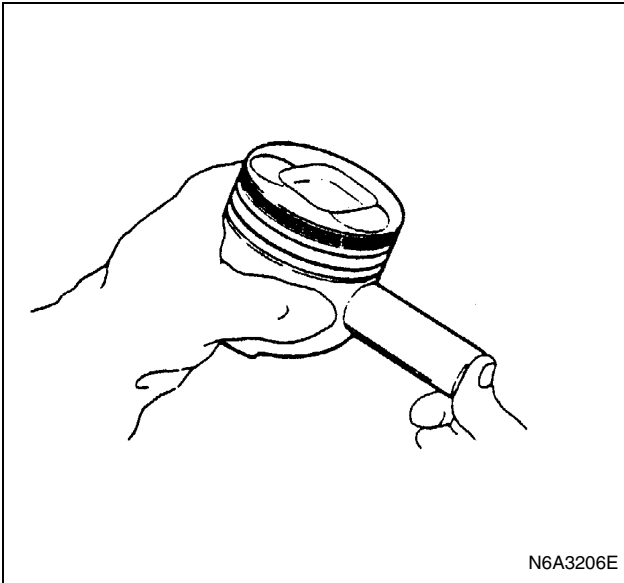
#### Notice:

When changing piston/connecting rod combinations, do not change the piston/piston pin combination.

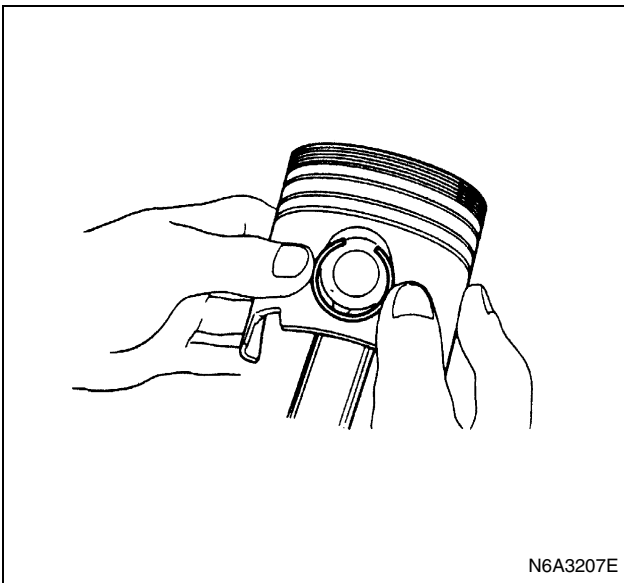
- 4) Install the piston to the connecting rod.  
The piston head front mark (1) and the connecting rod "ISUZU" casting mark (2) must be facing the same direction.



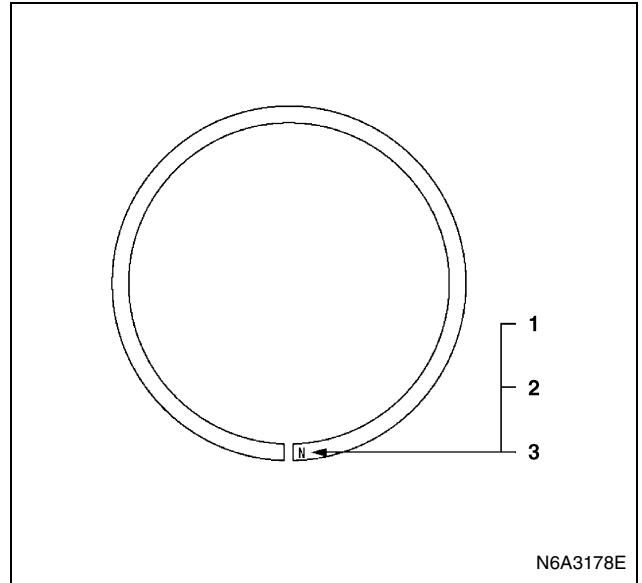
- 5) Apply a coat of engine oil to the piston pin and the piston pin hole.  
Use your fingers to force the piston pin into the piston until it makes contact with the snap ring.



- 6) Use your fingers to force the piston pin snap ring into the piston snap ring groove. Check that the connecting rod moves smoothly on the piston pin.



- 7) Install the piston rings with the piston ring expander. The compression ring must be set with the 1N, 2N mark (4JG2) facing up. Discrimination mark is painted as shown in the illustration.



#### Legend

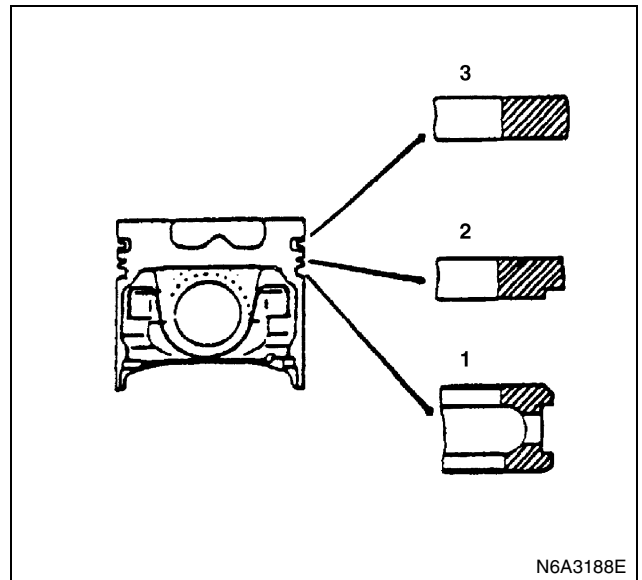
1. N mark (Top ring) (2nd ring) (4JB1)
2. 1N mark (Top ring) 2N mark (2nd ring) (4JG2)
3. R mark (Top ring) (2nd ring) (4JH-TC)

- 8) Use a piston ring replacer to install the three piston rings.

Piston Ring Replacer:

Install the piston rings in the numerical order shown in the illustration.

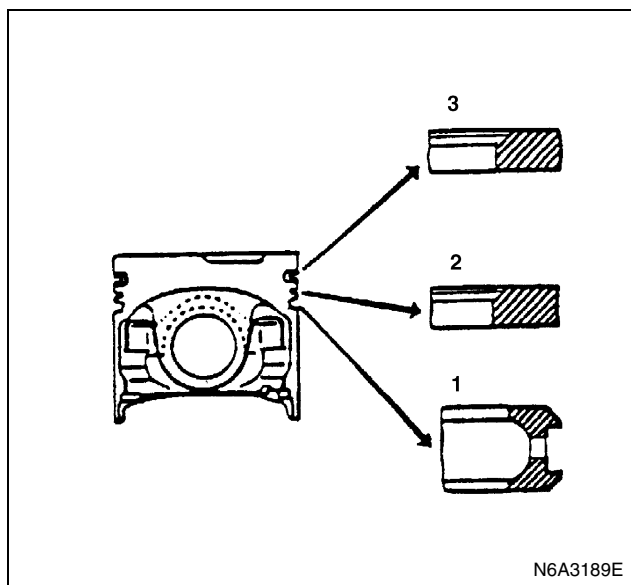
4JB1, 4JH1-TC



#### Legend

1. Oil ring
2. 2nd compression ring
3. 1st compression ring

## 4JG2

**Legend**

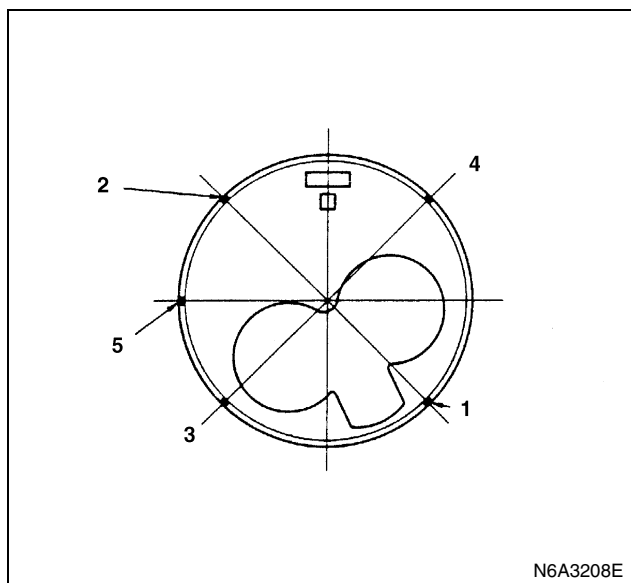
1. Oil ring
2. Compression ring No. 2
3. Compression ring No. 1

**Notice:**

Install the compression rings with the stamped side facing up.

Insert the expander coil into the oil ring groove so that there is no gap on either side of the expander coil before installing the oil ring.

- 9) Apply engine oil to the piston ring surfaces.
- 10) Check that the piston rings rotate smoothly in the piston ring grooves.
- 11) Position the piston ring gaps as shown in the illustration.

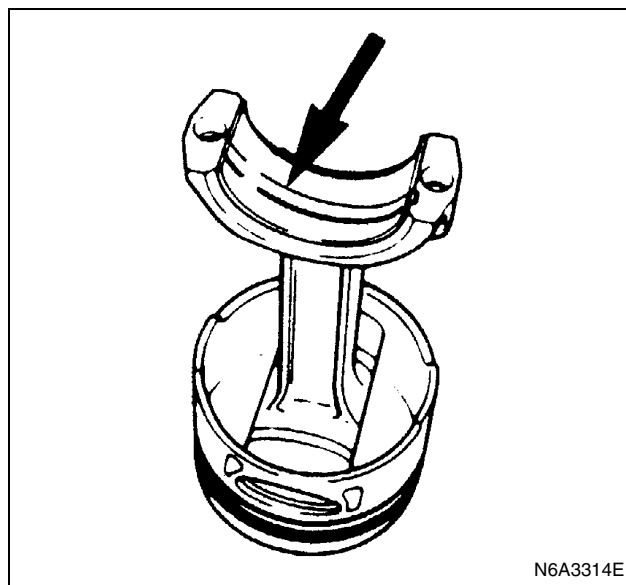
**Legend**

1. No. 1 Compression ring
2. No. 2 Compression ring
3. Oil ring
4. Expand ring
5. Front mark

12) Carefully wipe any oil or other foreign material from connect rod bearing back face and the connecting rod bearing fitting surface.

13) Apply a coat of engine oil to the upper bearing surfaces.

Apply a coat of engine oil to the cylinder wall.



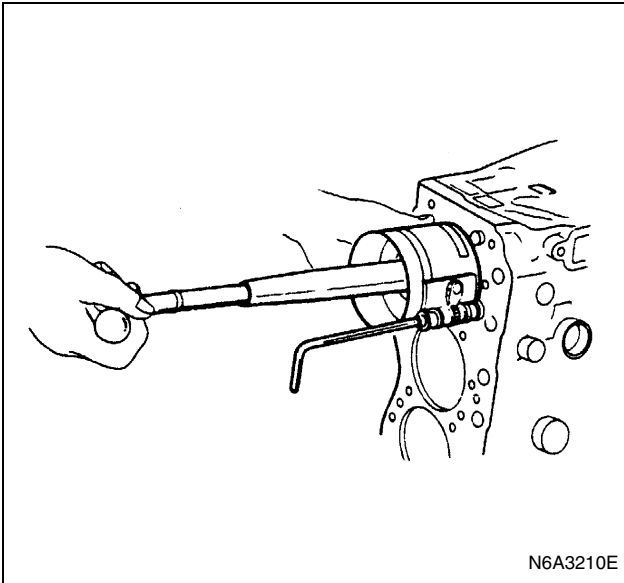
14) Position the piston head from mark so that it is facing the front of engine.

Use the piston ring compressor to compress the piston rings.

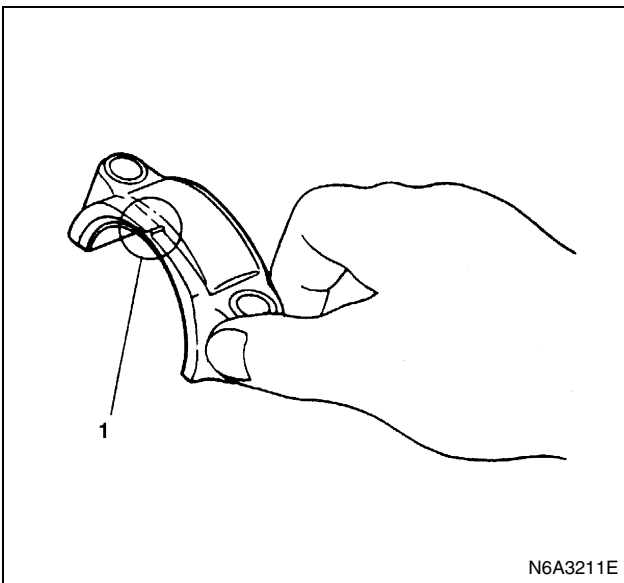
Piston Ring Compressor: 5-8840-9018-0 (J-8037)

15) 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 BDC.



- 16) Position the bearing cap front mark so that it is facing the front of the engine.
- 17) Install the connecting rod bearing caps. Align the bearing cap cylinder number marks and the connecting rod cylinder number marks.



#### Legend

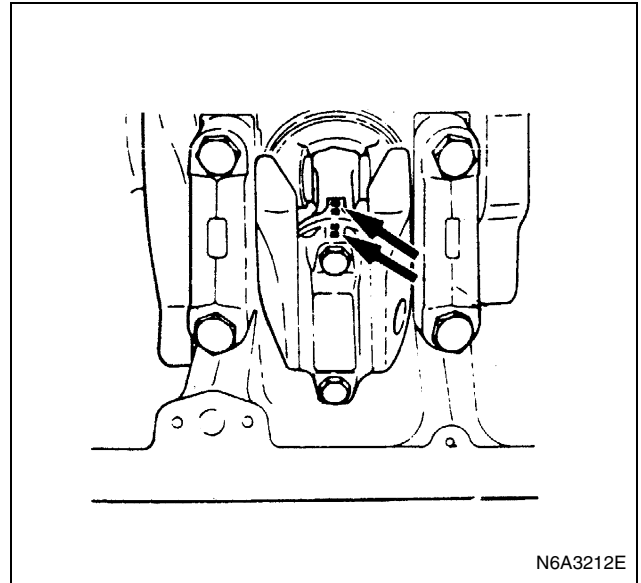
1. Front mark

- 18) Apply a coat of engine oil to the threads and setting faces of each connecting rod cap bolt.
- 19) Tighten the connecting rod bearing cap bolts to the specified torque in two steps using the Angular Tightening Method.

#### Tighten:

Connecting Rod Bearing Cap Bolt to

- 4JB1-TC, 4JH1-TC
  - 1st Step: 29 N·m (3.0 kg·m/22 lb·ft)
  - 2nd Step: 45° — 60°
- 4JB1: 83 N·m (8.5 kg·m/61 lb·ft)



#### Notice:

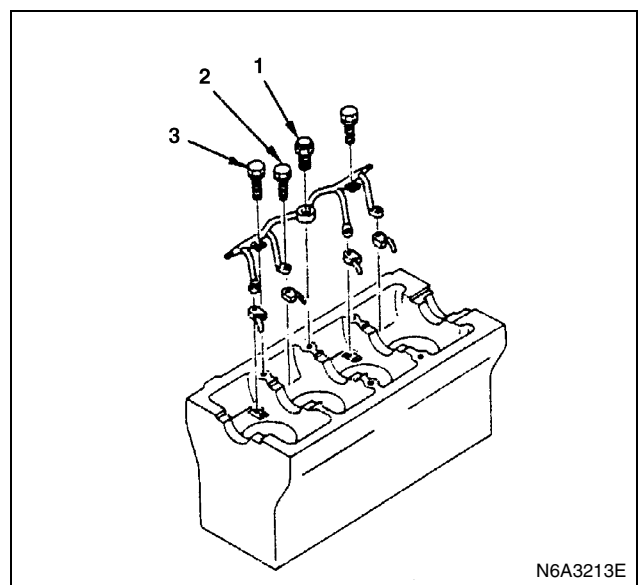
Check to see that the crankshaft turns smoothly by rotating it manually.

#### 10. Piston Cooling Oil Pipe

- 1) Fix the oil jet pipes with knock pins on the cylinder block.
- 2) Install the oil pipe for piston cooling in the cylinder block, tightening a relief valve (1) and four joint bolts (2) to the specified torque.

#### Tighten:

- Oil pipe fixing bolts to
  - M8: 19 N·m (1.9 kg·m/14 lb·ft)
  - M6: 8 N·m (0.8 kg·m/69 lb·in)
- Relief valve fixing bolt to 29 N·m (3 kg·m/22 lb·ft)

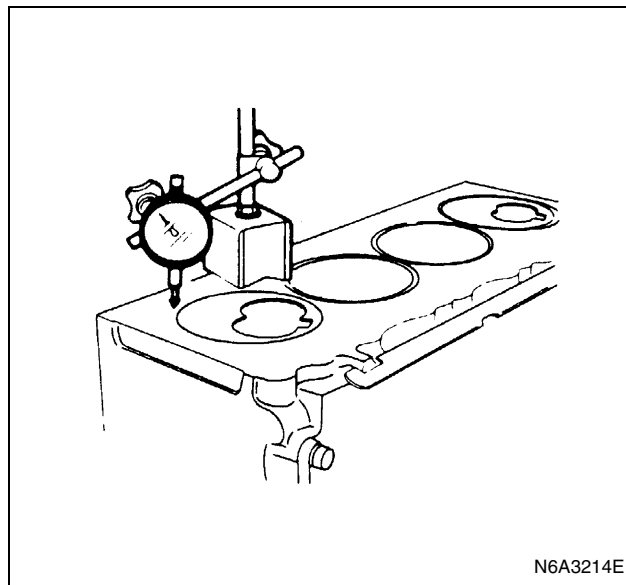


#### Caution:

After installed the piston assembly. Check and see that there is appropriate clearance between pistons and oil jet pipes by rotating crankshaft slowly.

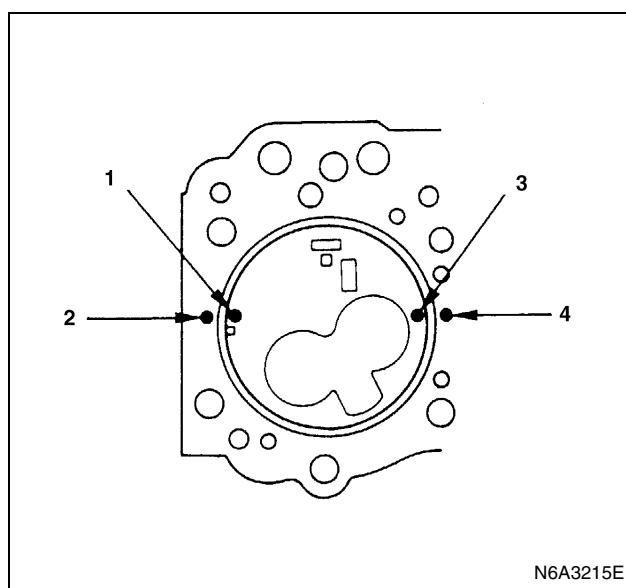
11. Oil Pump Assembly  
Above works refer to "OIL PUMP" Section in this manual.
12. Timing Pulley Housing
13. Timing Gear Housing
14. Front Oil Seal (Belt Drive Model)
15. Timing Belt and Pulley
  - 1) Camshaft Timing Pulley
  - 2) Timing Belt
  - 3) Flange: Camshaft Pulley
  - 4) Timing Pulley Lower Cover
  - 5) Timing Pulley Upper Cover
  - 6) Crankshaft Damper Pulley
16. Timing Gear (Gear Drive Model)
  - 1) Crankshaft Gear
  - 2) Crankshaft Timing Gear
  - 3) Idle Gear
  - 4) Idler Gear "B" and Shaft
  - 5) Injection Pump
  - 6) Timing Gear Oil Pipe
  - 7) Timing Gear Case Cover
  - 8) Crankshaft Damper Pulley
  - 9) Cooling Fan Assembly
  - 10) AC Generator, Power Steering Pump Drive Belt
  - 11) Fan Shroud

Above works refer to "CRANKSHAFT" Section in this manual.
17. Oil Pan Assembly  
Above works refer to "OIL PUMP" Section in this manual.
18. Cylinder Head Assembly and Gasket
  - 1) Cylinder head gasket is determined by the piston head projection from the cylinder body upper surface, in order to improve engine performance.  
Three types of gasket are provided by the difference of thickness. Select the adequate one out of three grades of gasket, according to the following procedure.  
Before measurement, clear off carbon from the piston head and cylinder body surface and also clean the place where a gasket was installed.



#### Piston Head Projection Measurement Point

- 2) Use a dial indicator to measure the piston projection amount.
- 3) Refer to the illustration for the piston head projection measuring positions.  
All measuring positions should be as close as possible to the cylinder liner.
- 4) Measure the points (1) (2) (3) (4) and obtain two difference (1) — (2) and (3) — (4) on each cylinder.  
Calculate the average value of the piston head projection on each cylinder.
- 5) Obtain the maximum value in the four cylinders.
- 6) Determine the gasket grade required to the maximum value described above in accordance with the following table.



4JB1 / 4JB1-TC

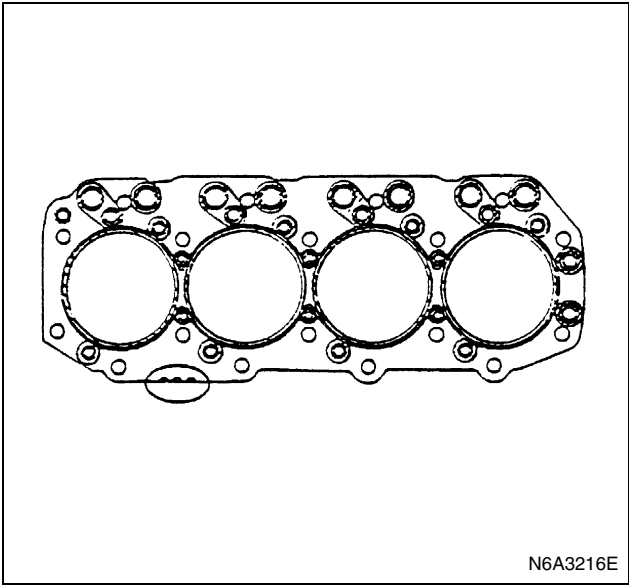
Cylinder Head Gasket Thickness

| mm (in) |                                                                                   |                                  |                  |
|---------|-----------------------------------------------------------------------------------|----------------------------------|------------------|
| 1       |                                                                                   | 2                                | 3                |
| A       |  | 0.758 - 0.813<br>(0.030 - 0.032) | 1.60<br>(0.0630) |
| B       |  | 0.813 - 0.859<br>(0.032 - 0.034) | 1.65<br>(0.0650) |
| C       |  | 0.859 - 0.914<br>(0.034 - 0.036) | 1.70<br>(0.0670) |

N6A3690E

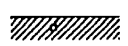
- Legend**
- 1. Gasket grade mark
  - 2. Piston projection
  - 3. Gasket thickness (Reference)

4JB1



**Notice:**  
The difference between the highest measured piston head projection and the lowest measured piston head projection must not exceed 1.0mm (0.039 in).

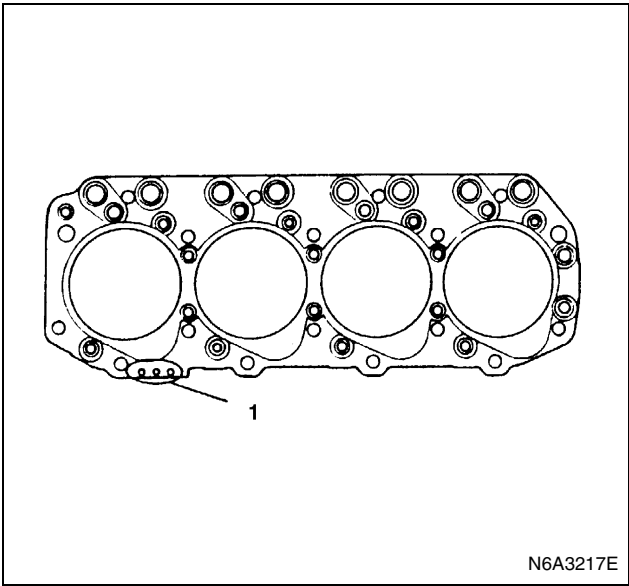
4JG2 Cylinder Head Gasket Thickness

| mm (in) |                                                                                    |                                |                  |
|---------|------------------------------------------------------------------------------------|--------------------------------|------------------|
| 1       |                                                                                    | 2                              | 3                |
| A       |  | 0.658-0.713<br>(0.0259-0.0281) | 1.60<br>(0.0630) |
| B       |  | 0.713-0.759<br>(0.0281-0.0299) | 1.65<br>(0.0650) |
| C       |  | 0.759-0.814<br>(0.0299-0.0320) | 1.70<br>(0.0670) |

N6A3693E

- Legend**
- 1. Gasket mark
  - 2. Average piston projection
  - 3. Gasket thickness

4JG2



- Legend**
- 1. Gasket mark

## 6A-68 GENERAL ENGINE MECHANICAL

4JH1-TC

Cylinder Head Gasket Thickness

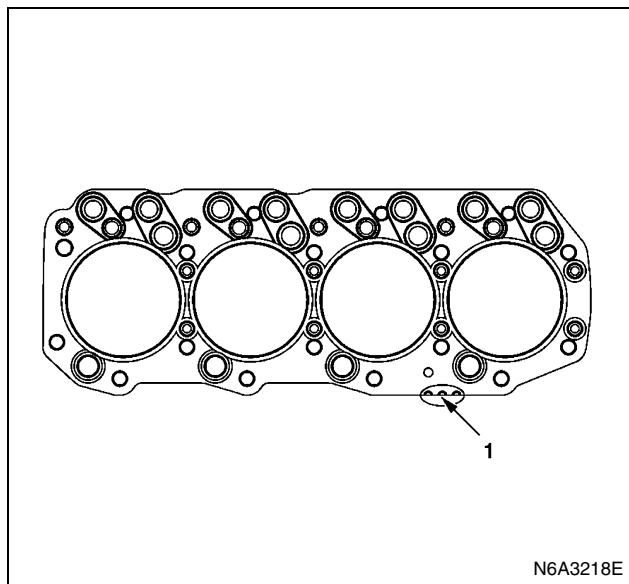
| mm (in) |                                    |                  |
|---------|------------------------------------|------------------|
| 1       | 2                                  | 3                |
| A       | 0.215 - 0.265<br>(0.0085 - 0.0104) | 1.3<br>(0.5118)  |
| B       | 0.265 - 0.315<br>(0.0104 - 0.0124) | 1.35<br>(0.5315) |
| C       | 0.315 - 0.365<br>(0.0124 - 0.0144) | 1.4<br>(0.5512)  |

N6A3691E

### Legend

1. Gasket grade mark
2. Piston projection
3. Gasket thickness (Reference)

4JH1



### Legend

1. Grade mark

### Notice:

The difference between the highest measured piston head projection and the lowest measured piston head projection must not exceed 1.0mm (0.039 in).

### Cylinder Head Assembly

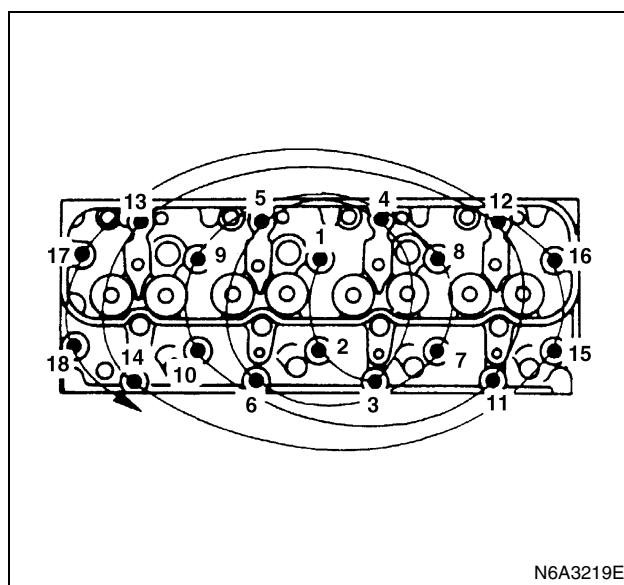
1. Install the dowel in cylinder block.
2. Install the cylinder head gasket with top mark up.

3. Clean up cylinder head lower surface and cylinder body upper surface.
4. Install the cylinder head as softly.
5. Apply molybdenum disulfide grease to screw and seat of cylinder head bolts.
6. Tighten the cylinder head bolts to the specific torque in three step following the numerical and shown in the illustration.

### Tighten:

Cylinder Head Bolts to

- 1st Step: 49 N·m (5 kg·m/36 lb·ft)
- 2nd Step: 60° — 75°
- 3rd Step: 60° — 75°

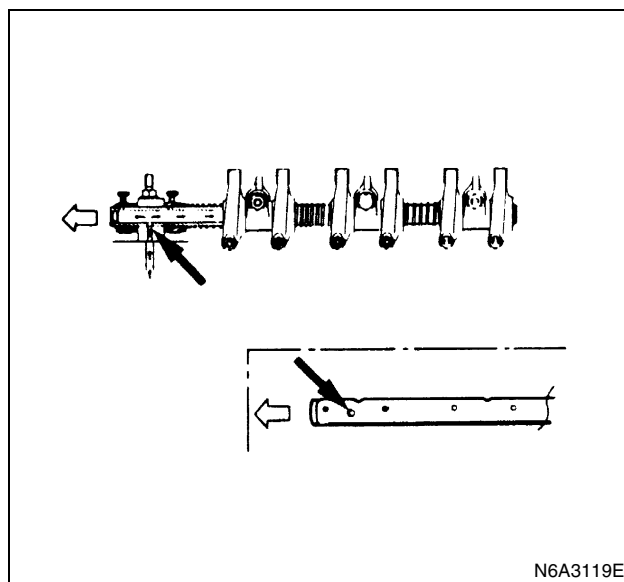


### Push Rod

- Apply engine oil to push rod and into the cylinder head.

### Rocker Arm Shaft Assembly

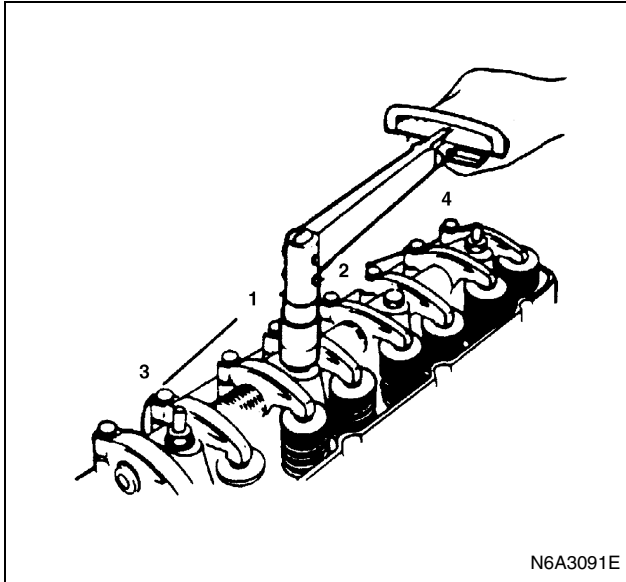
1. Loosen all adjusting screws.
2. Position the rocker arm shaft with the large oil hole (4φ) facing the front of the engine.



3. Tighten the rocker arm shaft bracket bolts to the specified torque in the numerical order shown in the illustration.

**Tighten:**

Rocker Arm Shaft Bracket Bolt to 54 N·m (5.5 kg·m/40 lb·ft)



- Valve clearance adjustment.