

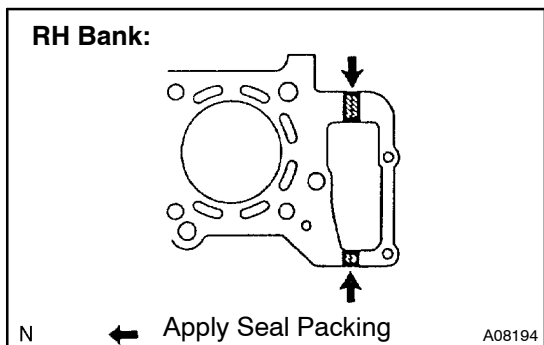
## INSTALLATION

### NOTICE:

Tighten the cylinder head bolt by the plastic region tightening method.

### 1. INSTALL OIL CONTROL VALVE FILTER

- (a) Check that foreign matters are not stuck on the mesh portion.
- (b) Install the oil control valve filter to the cylinder block in the directions shown in the illustration.



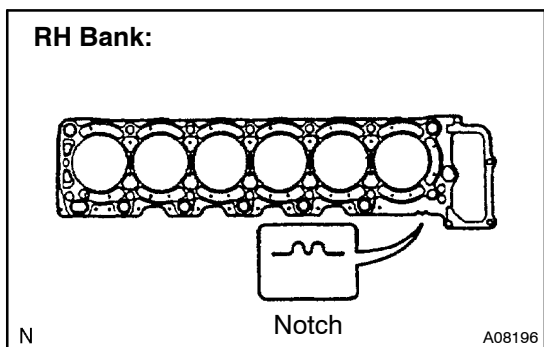
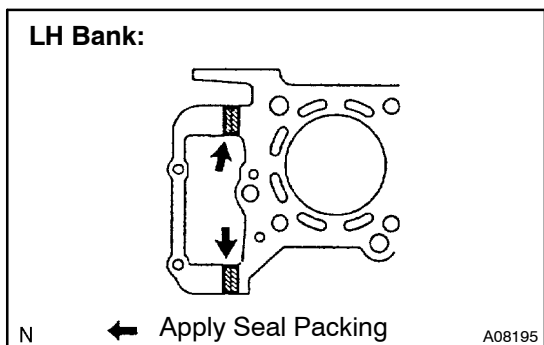
### 2. INSTALL 2 CYLINDER HEAD GASKETS

- (a) Remove oil or grease from the matching surface between the cylinder block and the timing chain case.
- (b) Apply seal packing black to the positions shown in the illustration.

**Seal Packing : Part No. 08826-00080 or equivalent**

### NOTICE:

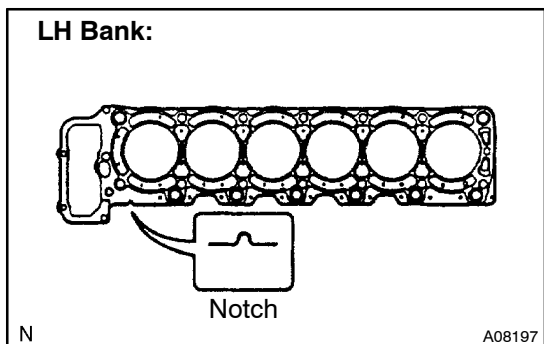
- After applying seal packing black, tighten the cylinder head bolt within 15 minutes.
- After installation, leave the cylinder head gasket without injecting engine oil at least for 2 hours.



- (c) Install a new cylinder head gasket on the cylinder block.

### HINT:

There are 2 notches on the RH side and a notch on the LH side.



**3. INSTALL EXHAUST MANIFOLD**

- (a) Install a new gasket and manifold with the 12 bolts to each cylinder head.
- (b) Install the heat insulator and 4 bolts to each manifold.

**Torque: 26 N·m (265 kgf·cm, 19 ft·lbf)**

**4. INSTALL CYLINDER HEAD WITH MANIFOLD**

- (a) Install the cylinder head on the block while adjusting it to the ring pin.

**NOTICE:**

**Apply seal packing black to the cylinder block and the timing chain cover and tighten the cylinder head bolt with in 15 minutes.**

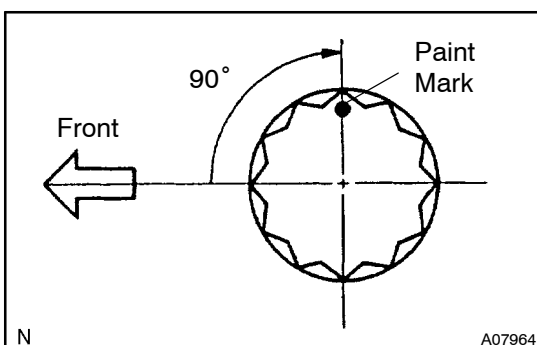
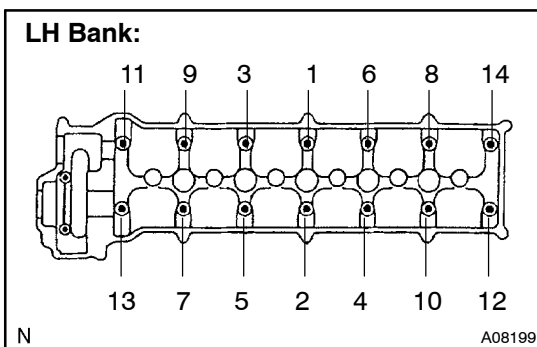
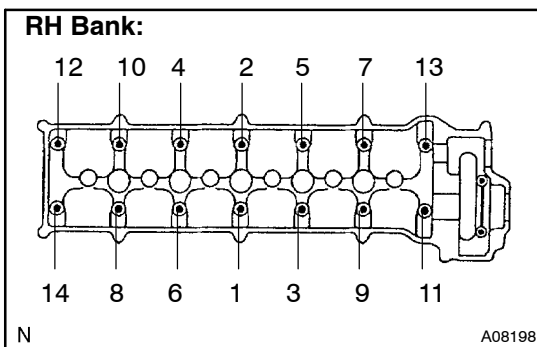
- (b) Apply a small quantity of engine oil to the thread portion and the seat face on the cylinder head bolt and the washer.

**NOTICE:**

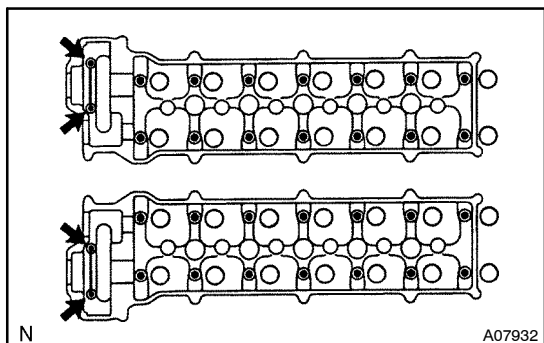
**Foreign matters or burrs must not be found on the thread portion and seat face of the cylinder head bolt.**

- (c) Set the washer on the cylinder head bolt and insert it in the cylinder head.
- (d) Tighten the head bolts with a socket wrench (12 mm, 12 square) temporarily in the order shown in the illustration several times, and then tighten them to the specified torque value.

**Torque: 54 N·m (550 kgf·cm, 40 ft·lbf)**



- (e) Put a paint mark on the engine front side of the cylinder head bolt.
- (f) Tighten the bolts by 90° in the same order as before using the paint mark as a reference.



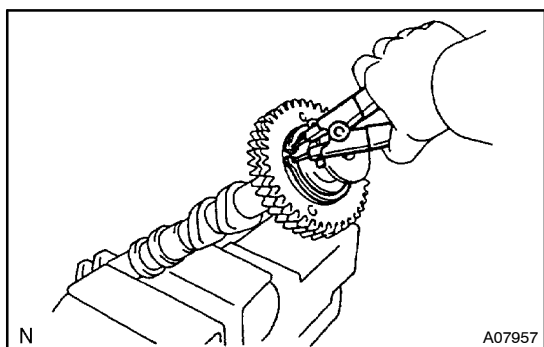
- (g) Install the bolts at the positions indicated by the arrow.  
**Torque: 21 N·m (215 kgf·cm, 16 ft·lbf)**

### 5. ASSEMBLE CAMSHAFT NO.1 AND NO.3

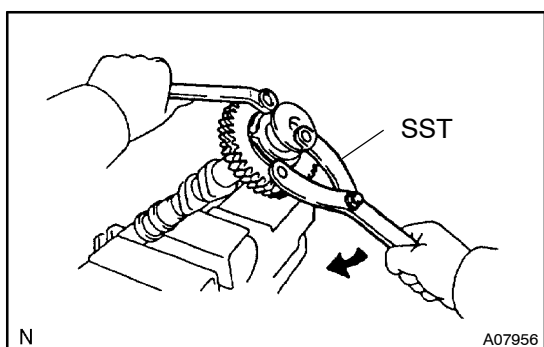
- (a) Install the camshaft gear spring, sub-gear and wave washer.  
 (b) Mount the hexagon head portion of camshaft in a vise.

#### NOTICE:

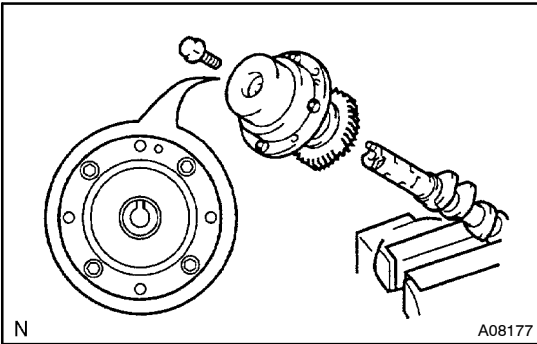
**Be careful not to damage the camshaft.**



- (c) Using snap ring pliers, install the snap ring.



- (d) Using SST, align the holes of the camshaft main gear and sub-gear by turning camshaft sub-gear counterclockwise, and temporarily install a service bolt.  
 SST 09960-10010 (09962-01000, 09963-00500)  
 (e) Align the gear teeth of the main gear and sub-gear, and tighten the service bolt.



## 6. ASSEMBLE CAMSHAFT NO.2

- (a) Check the knock pin position of the camshaft and assemble the camshaft gear assembly with the bolt.

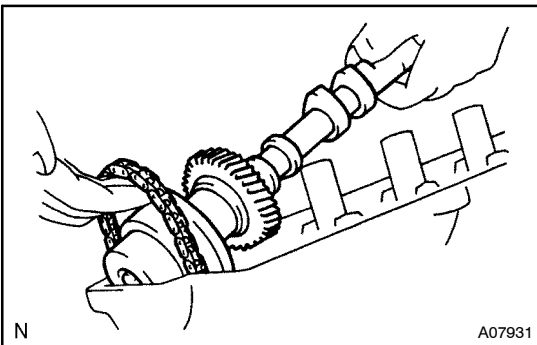
**Torque: 47 N·m (480 kgf·cm, 35 ft·lbf)**

- (b) Move the drive tube by hand. At that time, check that the drive tube can revolve about 30° smoothly.

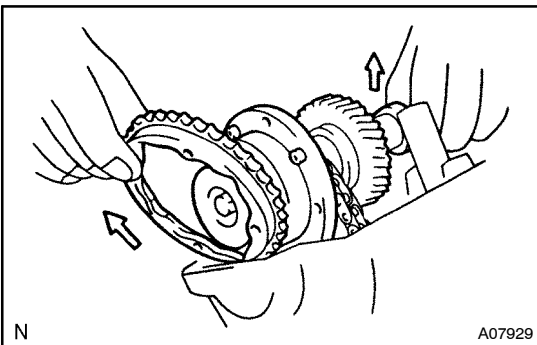
## 7. INSTALL CAMSHAFT NO.2

### NOTICE:

The camshaft thrust clearance is small. Accordingly, install the camshaft while keeping it level. If not, excessive force will be applied to the thrust portion, thereby causing burrs to the thrust receiving portion of the cylinder head journal. Be sure to perform the work according to the following procedure.

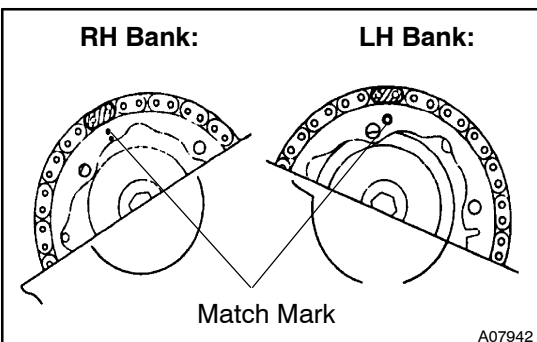


- (a) Apply engine oil to the cam and gear portions of the camshaft and the journal portion of the cylinder head.
- (b) Install the camshaft on the cylinder head through the timing chain.



## 8. INSTALL CAMSHAFT TIMING SPROCKET

Make the camshaft float slightly and install the camshaft sprocket.



## 9. INSTALL CHAIN

Assemble the chain while aligning the matching mark of the chain with the match mark of the sprocket.

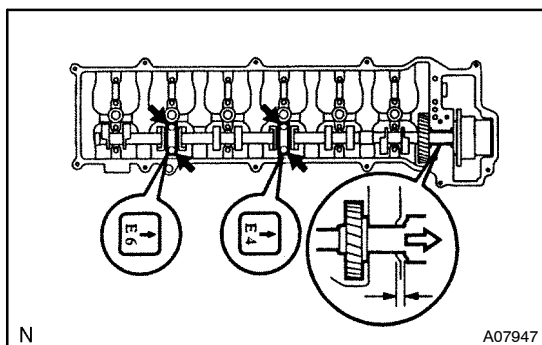
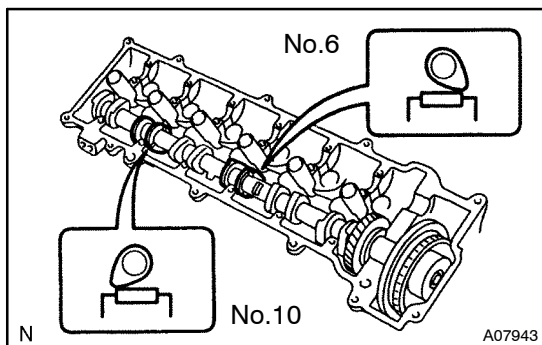
### HINT:

Because the camshaft revolves, don't assemble the timing sprocket and the camshaft.

**10. INSTALL CAMSHAFT NO.2 (RH Bank exhaust side)****NOTICE:**

The camshaft thrust clearance is small. Accordingly, install the camshaft while keeping it level. If not, excessive force will be applied to the thrust portion, thereby causing burrs to the thrust receiving portion of the cylinder head journal. Be sure to perform the work according to the following procedure.

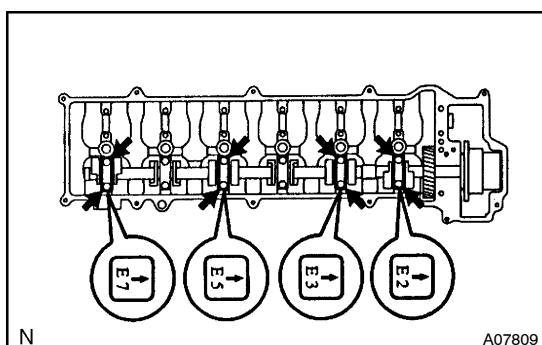
- (a) Apply engine oil to the cam and gear portions of the camshaft and the journal portion of the cylinder head.
- (b) Revolve the camshaft so that the cam noses of cylinders No.6 and No.10 of camshaft No.2 may face in the direction shown in the illustration.

**11. INSTALL CAMSHAFT BEARING CAP (RH Bank exhaust side)**

- (a) Push camshaft No.2 toward the front until it touches the thrust receiving surface of the cylinder head.
- (b) Check the front mark and the stamped number and temporarily tighten the bolts equally until camshaft bearing caps No.4 and No.6 touch the cylinder head.

**NOTICE:**

- Tighten the bolt of each bearing alternately.
- As the bolt is tightened gradually, cause the camshaft to go down horizontally and smoothly.
- Make sure the camshaft bearing cap is installed on the correct position and in the correct direction.



- (c) Check the front mark and the stamped number and temporarily fix camshaft bearing caps No.2, No.3, No.5 and No.7 on the cylinder head with bolts.

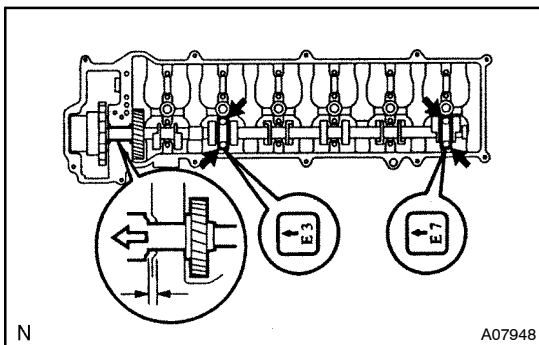
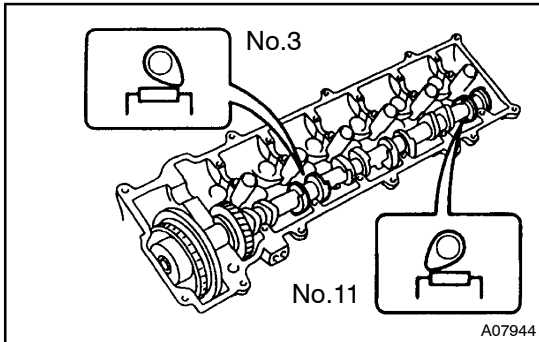
**NOTICE:**

- Tighten the bolt of each bearing alternately.
  - Make sure the camshaft bearing cap is installed on the correct position and in the correct direction.
- (d) Tighten each bolt equally to the specified torque value.  
**Torque: 16 N·m (165 kgf·cm, 12 ft·lbf)**

**12. INSTALL CAMSHAFT NO.2 (LH Bank exhaust side)****NOTICE:**

The camshaft thrust clearance is small. Accordingly, install the camshaft while keeping it level. If not, excessive force will be applied to the thrust portion, thereby causing burrs to the thrust receiving portion of the cylinder head journal. Be sure to perform the work according to the following procedure.

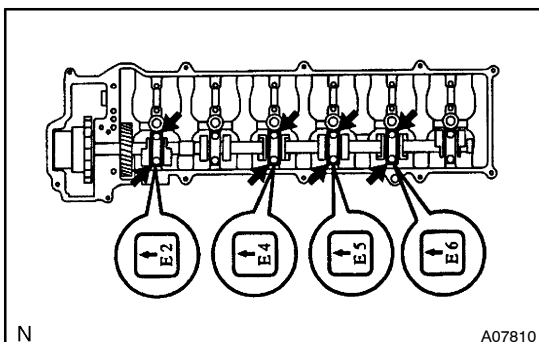
- (a) Apply engine oil to the cam and gear portions of the camshaft and the journal portion of the cylinder head.
- (b) Revolve the camshaft so that the cam noses of cylinders No.3 and No.11 of camshaft No.2 may face in the direction shown in the illustration.

**13. INSTALL CAMSHAFT BEARING CAP (LH Bank exhaust side)**

- (a) Push camshaft No.2 toward the front until it touches the thrust receiving surface of the cylinder head.
- (b) Check the front mark and the stamped number and temporarily tighten the bolts equally until camshaft bearing caps No.3 and No.7 touch the cylinder head.

**NOTICE:**

- Tighten the bolt of each bearing alternately.
- As the bolt is tightened gradually, cause the camshaft to go down horizontally and smoothly.
- Make sure the camshaft bearing cap is installed on the correct position and in the correct direction.



- (c) Check the front mark and the stamped number and temporarily fix camshaft bearing caps No.2, No.4, No.5 and No.6 equally on the cylinder head with bolts.

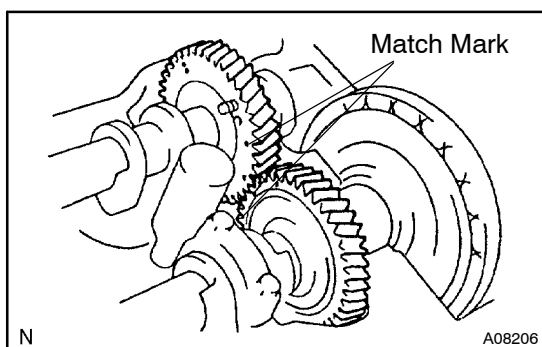
**NOTICE:**

- Tighten the bolt of each bearing alternately.
  - Make sure the camshaft bearing cap is installed on the correct position and in the correct direction.
- (d) Tighten each bolt equally to the specified torque value.  
**Torque: 16 N·m (165 kgf·cm, 12 ft·lbf)**

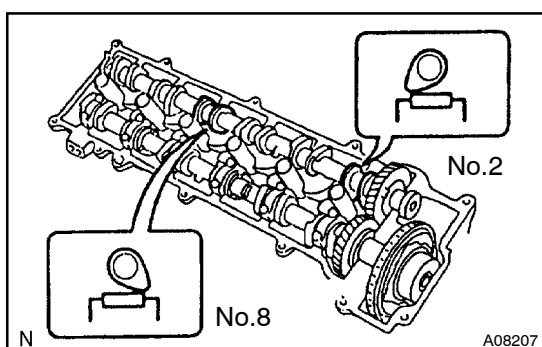
**14. INSTALL CAMSHAFT NO.1 (RH Bank intake side)****NOTICE:**

The camshaft thrust clearance is small. Accordingly, install the camshaft while keeping it level. If not, excessive force will be applied to the thrust portion, thereby causing burrs to the thrust receiving portion of the cylinder head journal. Be sure to perform the work according to the following procedure.

- (a) Apply engine oil to the cam and gear portions of the camshaft and the journal portion of the cylinder head.
- (b) Revolve the camshaft timing gear of camshaft No.2 completely counterclockwise, as viewed from the front, by hand. (Set the maximum lag angle status.)



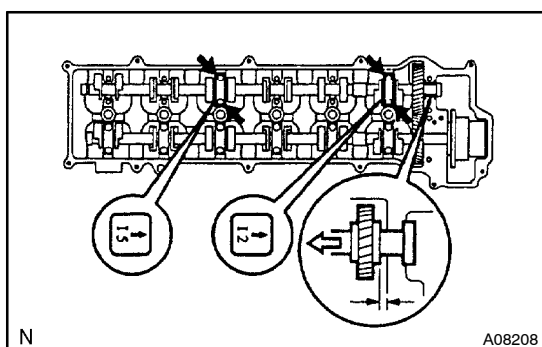
- (c) Align the match marks of the camshaft with camshaft No.2 as shown in the illustration and set the camshaft on the cylinder head.

**15. INSTALL CAMSHAFT BEARING CAP (RH Bank intake side)**

- (a) Check that the cam noses of cylinders No.2 and No.8 of the camshaft face in the direction shown in the illustration.

**NOTICE:**

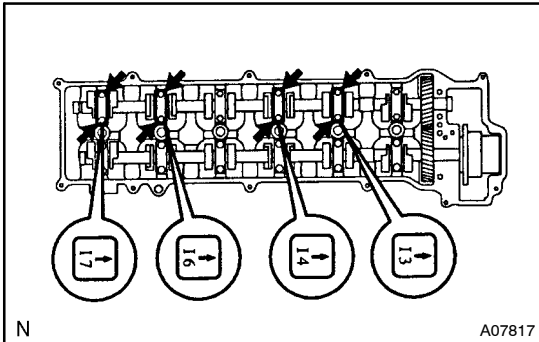
If the cam noses do not face in the direction shown in the illustration, check the matching marks of the camshaft sub-gear and the camshaft timing gear again.



- (b) Continue to push the camshaft toward the rear until it touches the thrust receiving surface of the cylinder head.
- (c) Check the front mark and the stamped number and temporarily fix camshaft bearing caps No.2, and No.5 equally.

**NOTICE:**

- Tighten the bolt of each bearing alternately.
- As the bolt is tightened gradually, cause the camshaft to go down horizontally and smoothly.
- Make sure the camshaft bearing cap is installed on the correct position and in the correct direction.



- (d) Check the front mark and stamped number and temporarily fix camshaft bearing caps No.3, No.4, No.6 and No.7 on the cylinder head equally with bolts.

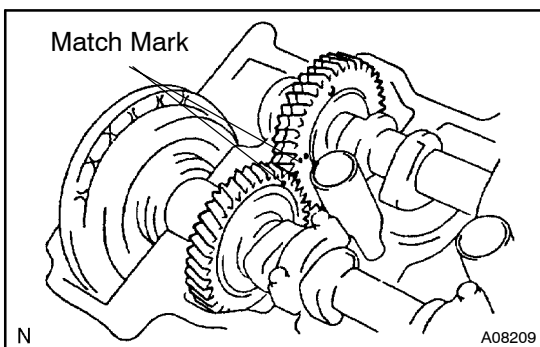
**NOTICE:**

- **Tighten the bolt of each bearing alternately.**
  - **Make sure the camshaft bearing cap is installed on the correct position and in the correct direction.**
- (e) Remove the sub-gear fixing bolts.
- (f) Check the front mark and the stamped number and temporarily fix camshaft bearing cap No.1 on the cylinder head equally with bolts.
- (g) Tighten each bolt equally to the specified torque value.  
**Torque: 16 N·m (165 kgf·cm, 12 ft·lbf)**

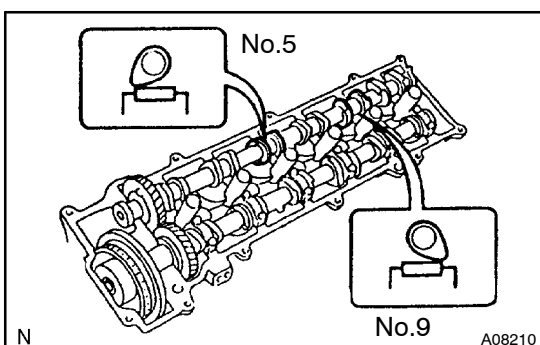
**16. INSTALL CAMSHAFT NO.3 (LH Bank intake side)****NOTICE:**

**The camshaft thrust clearance is small. Accordingly, install the camshaft while keeping it level. If not, excessive force will be applied to the thrust portion, thereby causing burrs to the thrust receiving portion of the cylinder head journal. Be sure to perform the work according to the following procedure.**

- (a) Apply engine oil to the cam and gear portions of the camshaft and the journal portion of the cylinder head.
- (b) Revolve the camshaft timing gear of camshaft No.2 completely counterclockwise, as viewed from the front, by hand. (Set the maximum lag angle status.)



- (c) Adjust the match marks of camshaft No.3 and camshaft No.2 as shown in the illustration and set camshaft No.3 on the cylinder head.

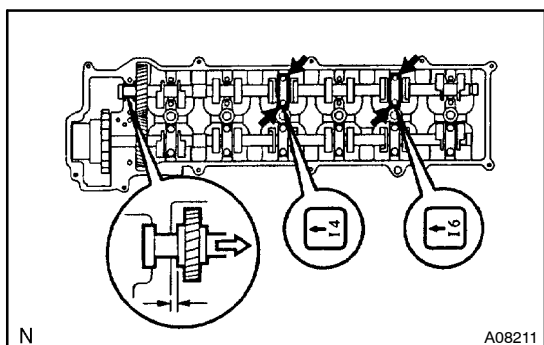
**17. INSTALL CAMSHAFT BEARING CAP (LH Bank intake side)**

- (a) Check that the cam noses of cylinders No.5 and No.9 of camshaft No.3 face in the direction shown in the illustration.

**NOTICE:**

**If the cam noses do not face in the direction shown in the illustration, check the matching marks of the sub-gear of cylinder No.9 and the camshaft timing gear.**

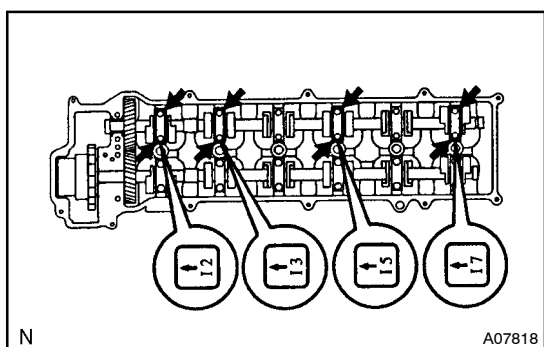




- (b) Continue to push camshaft No.3 toward the rear until it touches the thrust receiving surface of the cylinder head.
- (c) Check the front mark and the stamped number and temporarily fix camshaft bearing caps No.4 and No.6 equally with bolts.

**NOTICE:**

- **Tighten the bolt of each bearing alternately.**
- **As the bolt is tightened gradually, cause the camshaft to go down horizontally and smoothly.**
- **Make sure the camshaft bearing cap is installed on the correct position and in the correct direction.**



- (d) Check the front mark and stamped number and temporarily fix camshaft bearing caps No.2, No.3, No.5 and No.7 equally with bolts.

**NOTICE:**

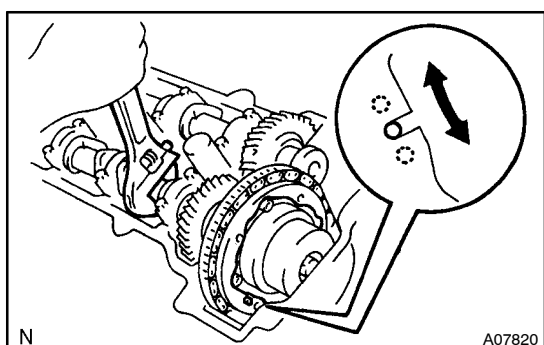
- **Tighten the bolt of each bearing alternately.**
  - **Make sure the camshaft bearing cap is installed on the correct position and in the correct direction.**
- (e) Remove the sub-gear fixing bolts.
- (f) Check the front mark and the stamped number and temporarily fix camshaft bearing cap No.1 on the cylinder head equally with bolts.
- (g) Tighten each bolt equally to the specified torque valve.

**Torque: 16 N·m (165 kgf·cm, 12 ft·lbf)**

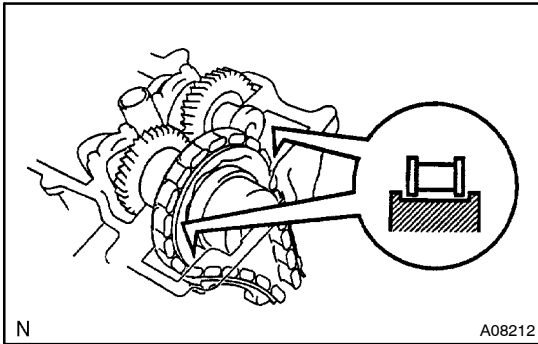
**18. INSTALL CAMSHAFT OIL FEED PIPE**

Install the camshaft oil feed pipe with 2 bolts.

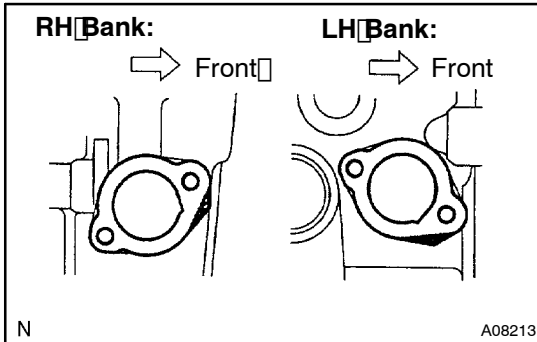
**Torque: 16 N·m (165 kgf·cm, 12 ft·lbf)**

**19. INSTALL CAMSHAFT TIMING GEAR**

Move camshaft No.2 by using the hexagon portion for service of camshaft No.2 and install the camshaft timing gear so that the sprocket may be aligned with to the knock pin of the camshaft timing gear.

**20. INSTALL CHAIN TENSIONER NO. 1**

- (a) Check that the chain is securely set in the vibration damper and the tensioner slipper.



- (b) Install a new gasket as shown in the illustration.

- (c) Install tensioner No. 1 with 2 nuts.

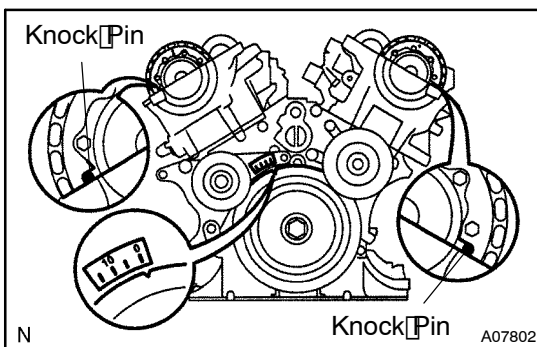
**21. INSTALL CAMSHAFT TIMING SPROCKET BOLTS**

- (a) Revolve the crankshaft and tighten 4 set bolts.

**Torque: 8.0 N·m (80 kgf·cm, 69 in·lbf)**

- (b) Revolve the crankshaft and tighten the set bolts again.

**Torque: 8.0 N·m (80 kgf·cm, 69 in·lbf)**



- (c) Check that the knock pin of the camshaft aligns with the top surface of the cylinder head.

**22. INSTALL WATER PUMP ASSEMBLY AND WATER BY-PASS JOINT FR**

- (a) Install the water by-pass joint FR with a new gasket and 2 bolts.

**Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)**

- (b) Install the water pump assembly with 2 new O-rings, 2 bolts and 3 nuts.

**Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)**

- (c) Connect the 3 hoses.

**23. CONNECT EXHAUST MANIFOLD LH AND RH**

- Install 2 new gaskets and the 2 catalytic converter supports with the 4 bolts.

**Torque: 43 N·m (440 kgf·cm, 32 ft·lbf)**

**24. INSTALL INTAKE MANIFOLD WITH FUEL INJECTOR**

- (a) Install 2 new gaskets and the intake manifold with fuel injector.

- (b) Install the 4 nuts and 10 bolts.

**Torque: 25 N·m (255 kgf·cm, 18 ft·lbf)**

- (c) Connect the fuel return hose and fuel tube.

**25. INSTALL CYLINDER HEAD COVER LH AND RH**

**(See page EM-22)**

- (a) Install the cylinder head cover LH and RH.

- (b) Install the 2 ignition coil with the high-tension codes.

- (c) Connect the engine wire.

- (d) Install the intake air surge tank LH and RH with the intake air connector.

- (e) Install the throttle body assembly LH and RH.

- (f) Install the emission control valve set.

- (g) Install the air cleaner assembly LH and RH with the air flow meter.
- (h) Install the air cleaner inlet and V-bank cover.