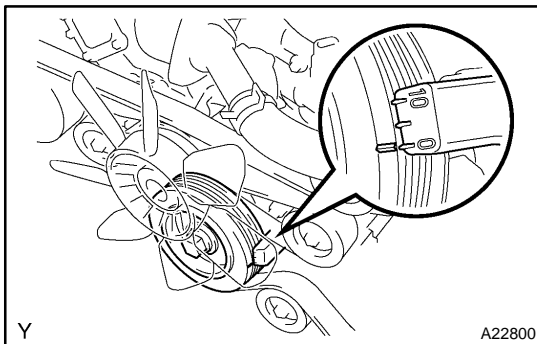


VALVE CLEARANCE INSPECTION

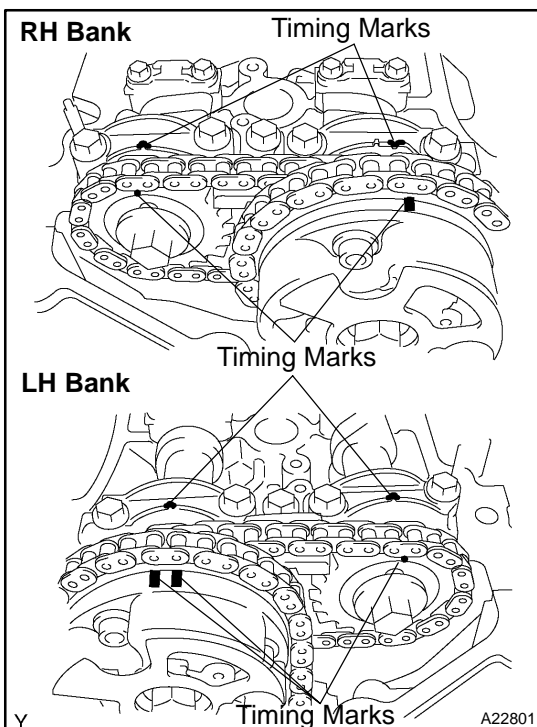
EM1XG-01

1. DRAIN ENGINE COOLANT (See page [CO-2](#))
2. REMOVE V-BANK COVER
3. REMOVE AIR CLEANER (See page [EM-62](#))
4. REMOVE INTAKE AIR SURGE TANK
(See page [EM-62](#))
5. REMOVE IGNITION COIL
6. REMOVE CYLINDER HEAD COVER
(See page [EM-62](#))



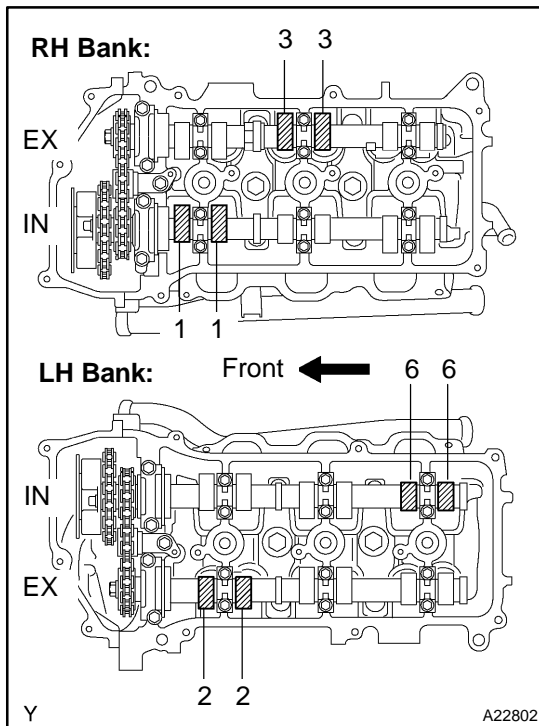
7. SET NO. 1 CYLINDER TO TDC/COMPRESSION

- (a) Turn the crankshaft pulley, and align its groove with the timing mark "0" of the timing chain cover.



- (b) Check that the timing marks of the camshaft timing gears are aligned with the timing marks of the bearing caps as shown in the illustration.

If not, turn the crankshaft 1 complete revolution (360 °) and align the timing marks as above.



8. INSPECT VALVE CLEARANCE

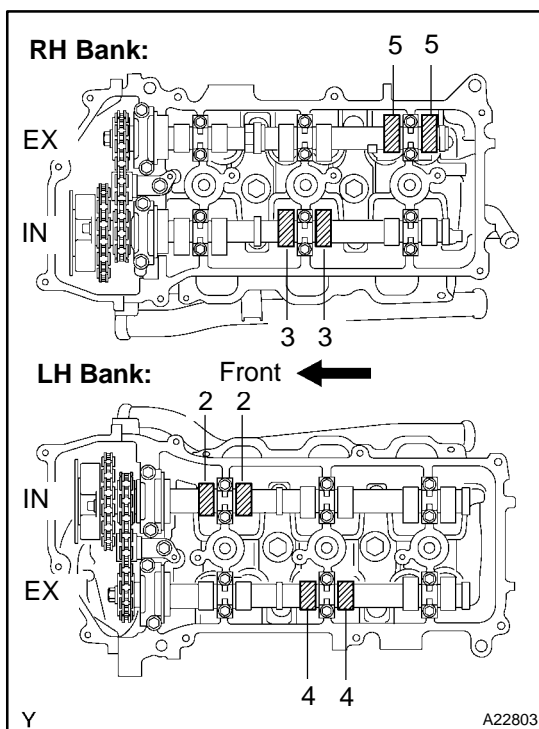
- (a) Check the valves indicated in the illustration.
- (1) Using a feeler gauge, measure the clearance between the valve lifter and camshaft.

Valve clearance (Cold):

Intake: 0.15 to 0.25 mm (0.006 to 0.010 in.)

Exhaust: 0.29 to 0.39 mm (0.011 to 0.015 in.)

- (2) Record the out-of-specification valve clearance measurements. They will be used later to determine the required replacement valve lifter.



- (b) Turn the crankshaft 2/3 of a revolution (240°), and check the valves indicated in the illustration.

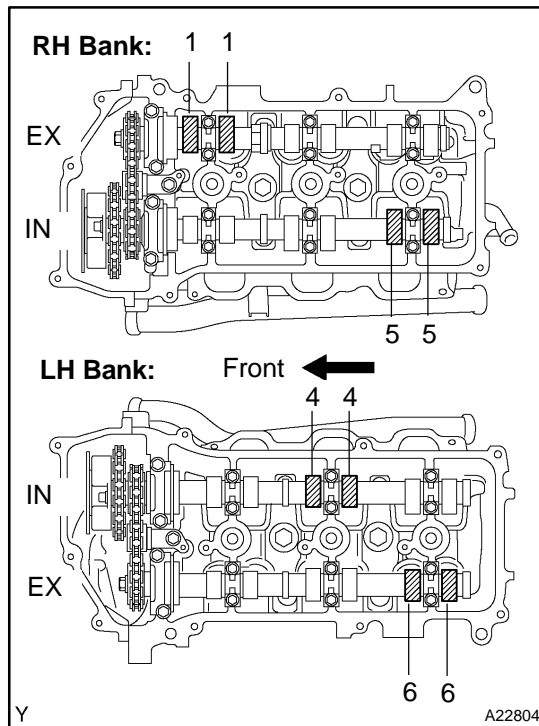
- (1) Using a feeler gauge, measure the clearance between the valve lifter and camshaft.

Valve clearance (Cold):

Intake: 0.15 to 0.25 mm (0.006 to 0.010 in.)

Exhaust: 0.29 to 0.39 mm (0.011 to 0.015 in.)

- (2) Record the out-of-specification valve clearance measurements. They will be used later to determine the required replacement valve lifter.



- (c) Turn the crankshaft 2/3 of a revolution (240°), and check the valves indicated in the illustration.

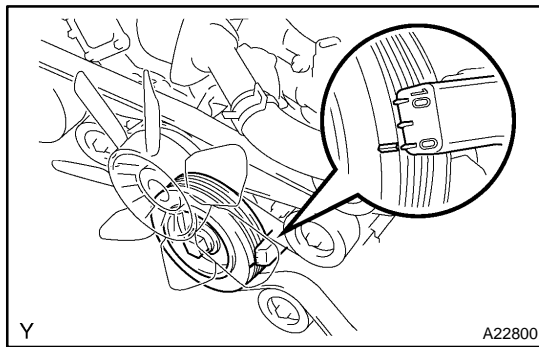
- (1) Using a feeler gauge, measure the clearance between the valve lifter and camshaft.

Valve clearance (Cold):

Intake: 0.15 to 0.25 mm (0.006 to 0.010 in.)

Exhaust: 0.29 to 0.39 mm (0.011 to 0.015 in.)

- (2) Record the out-of-specification valve clearance measurements. They will be used later to determine the required replacement valve lifter.



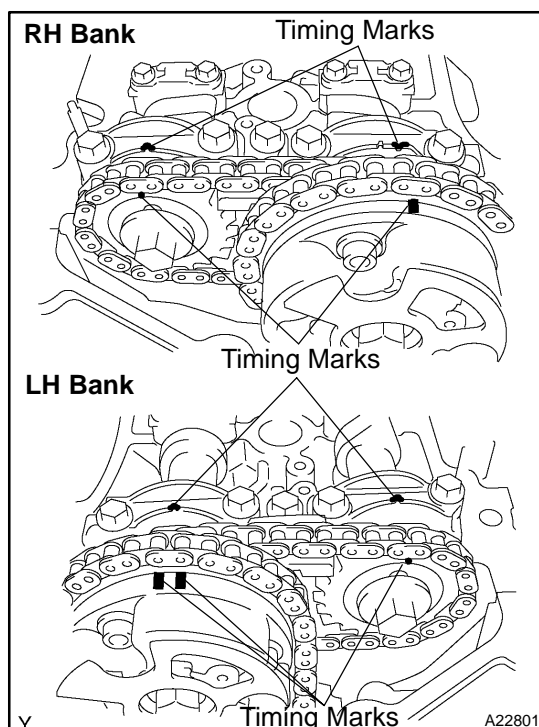
9. ADJUST VALVE CLEARANCE

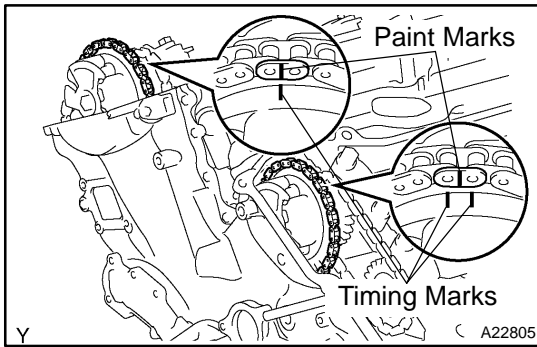
- (a) Set the No. 1 cylinder to the TDC/compression.

- (1) Turn the crankshaft pulley, and align the notch with the timing mark "0" of the timing chain cover.

- (2) Check that the timing marks of the camshaft timing gears are aligned with the timing marks of the bearing caps as shown in the illustration.

If not, turn the crankshaft 1 complete revolution (360°) and align the timing marks as above.





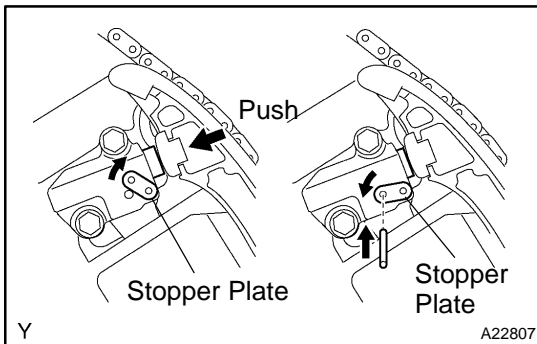
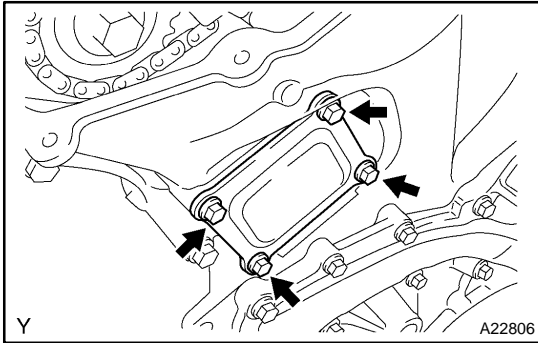
- (3) Place paint marks on the No. 1 chain links that correspond with the timing marks of the camshaft timing gears.

- (b) Remove the chain tensioner No. 1.

NOTICE:

- **Never rotate the crankshaft with the chain tensioner removed.**
- **When rotating the camshaft with the timing chain removed, turn the crankshaft counterclockwise 40 ° from the TDC first.**

- (1) Remove the 4 bolts, timing chain cover plate and gasket.

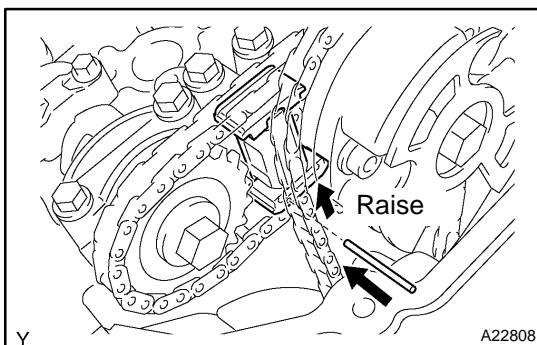


- (2) While rotating the stopper plate of the tensioner upward, push in the plunger of the chain tensioner as shown in the illustration.
- (3) While rotating the stopper plate of the tensioner downward, insert a bar of ϕ 3.5 mm (0.138 in.) into the holes in the stopper plate and tensioner to fix the stopper plate.
- (4) Remove the 2 bolts and chain tensioner No.1.

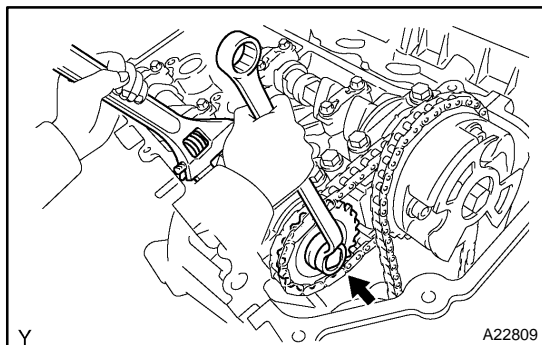
- (c) Remove the No. 2 camshaft.

NOTICE:

As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head which receives the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.



- (1) While raising up the chain tensioner No. 2, insert a pin of ϕ 1.0 mm (0.039 in.) into the hole to fix it.

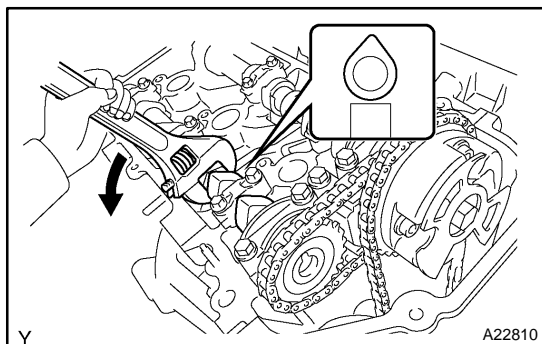


- (2) Hold the hexagonal portion of the No. 2 camshaft with a wrench, and remove the camshaft timing sprocket set bolt.

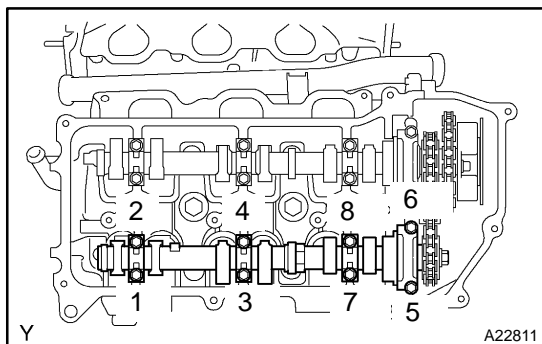
NOTICE:

Be careful not to damage the cylinder head and valve lifter with the wrench.

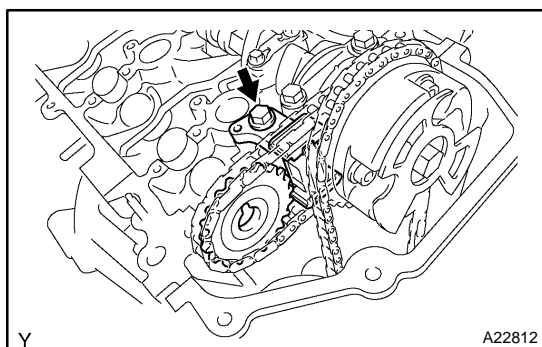
- (3) Separate the camshaft timing sprocket from the No. 2 camshaft.



- (4) Rotate the camshaft counterclockwise using the wrench so that the cam lobes of the No. 1 cylinder face upward as shown in the illustration.



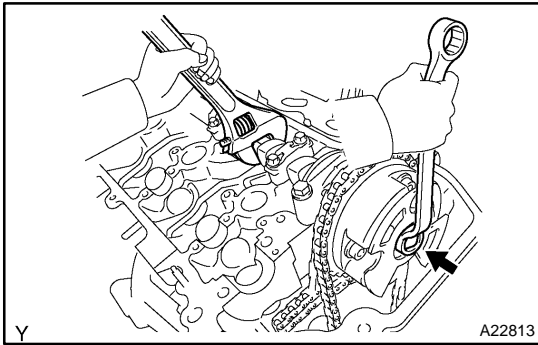
- (5) Using several steps, loosen and remove the 8 bearing cap bolts uniformly in the sequence as shown in the illustration.
- (6) Remove the 4 bearing caps and No. 2 camshaft.



- (d) Remove the chain tensioner No. 2.
 - (1) Remove the chain tensioner No. 2 bolt, and then remove the chain tensioner No. 2 and camshaft timing sprocket.
- (e) Remove the camshaft.

NOTICE:

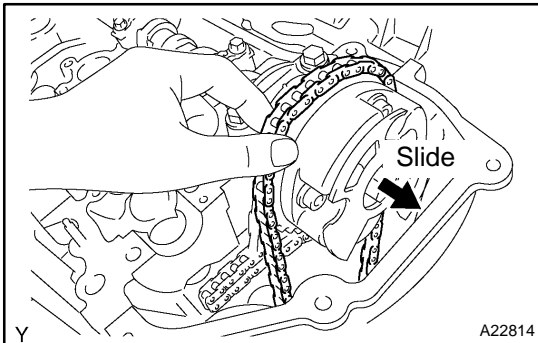
As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head which receives the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.



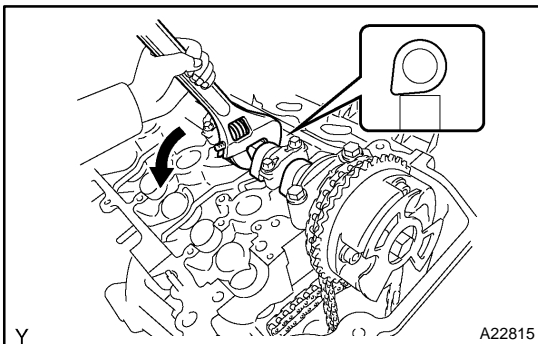
- (1) Hold the hexagonal portion of the No. 1 camshaft with a wrench, and loosen the camshaft timing gear assembly set bolt.

NOTICE:

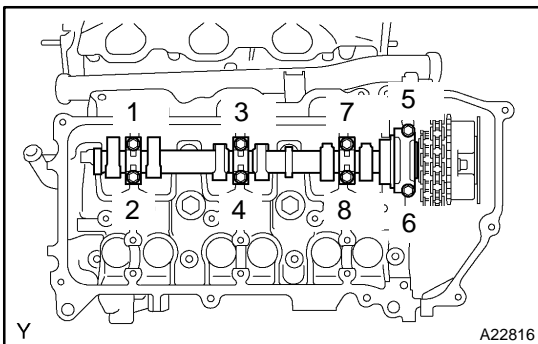
- **Be careful not to damage the cylinder head and valve lifter with the wrench.**
- **Do not disassemble the camshaft timing gear assembly.**



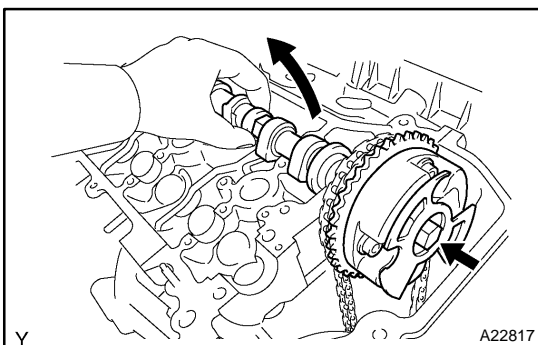
- (2) Slide the camshaft timing gear assembly and separate the No. 1 chain from the camshaft timing gear sprocket.



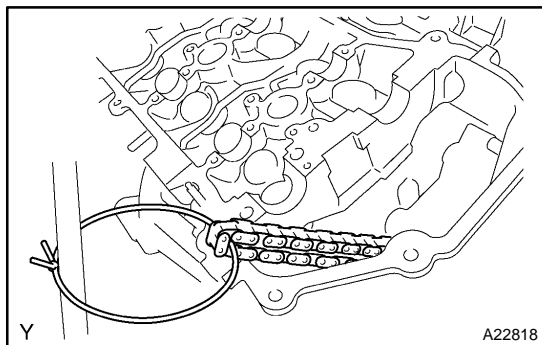
- (3) Rotate the No. 1 camshaft counterclockwise using a wrench so that the cam lobes of No. 1 cylinder face upward as shown in the illustration.



- (4) Using several steps, loosen and remove the 8 bearing cap bolts uniformly in the sequence as shown in the illustration.
- (5) Remove the 4 bearing caps.



- (6) Remove the camshaft timing gear assembly set bolt with the No. 1 camshaft lifted up, and then remove the No. 1 camshaft and camshaft timing gear assembly w/ No. 2 chain.



- (7) Tie the No. 1 chain with a string as shown in the illustration.

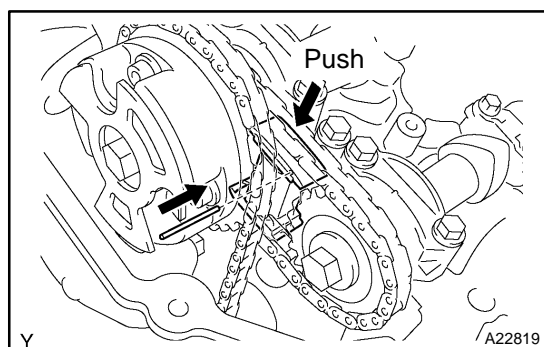
NOTICE:

Be careful not to drop anything inside the timing chain cover.

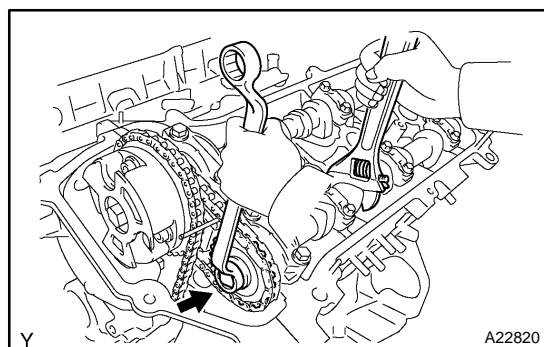
- (f) Remove the No. 4 camshaft.

NOTICE:

As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head which receives the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.



- (1) While pushing down the chain tensioner No. 2, insert a pin of $\phi 1.0$ mm (0.039 in.) into the hole to fix it.

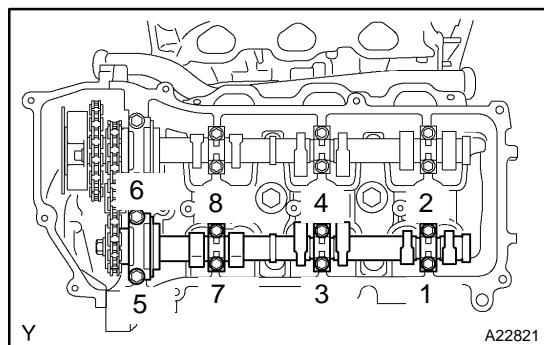


- (2) Hold the hexagonal portion of the No. 4 camshaft with a wrench, and remove the camshaft timing sprocket set bolt.

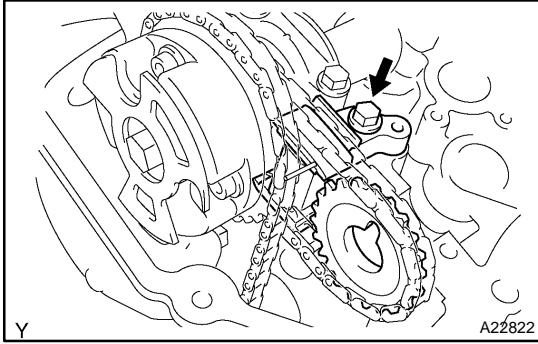
NOTICE:

Be careful not to damage the cylinder head and valve lifter with the wrench.

- (3) Separate the camshaft timing sprocket from the No. 4 camshaft.



- (4) Using several steps, loosen and remove the 8 bearing cap bolts uniformly in the sequence as shown in the illustration.
- (5) Remove the 4 bearing caps and No. 4 camshaft.

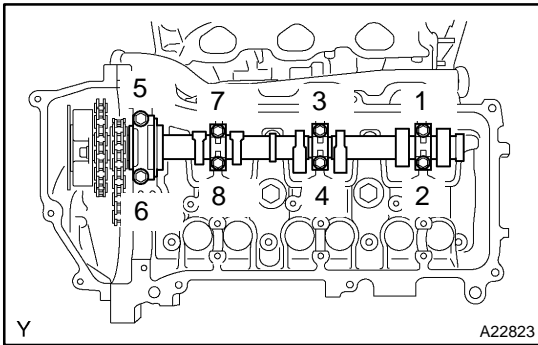


- (g) Remove the chain tensioner No. 2.
- (1) Remove the chain tensioner No. 3 bolt, and then remove the chain tensioner No. 3 and camshaft timing sprocket.

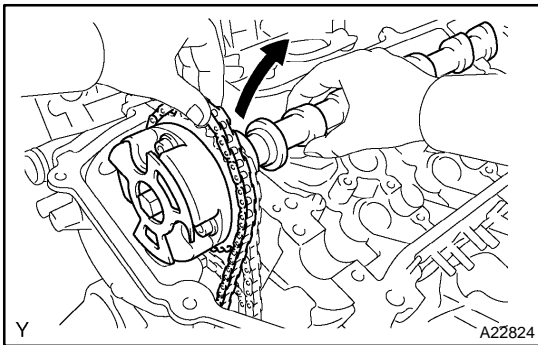
- (h) Remove the No. 3 camshaft.

NOTICE:

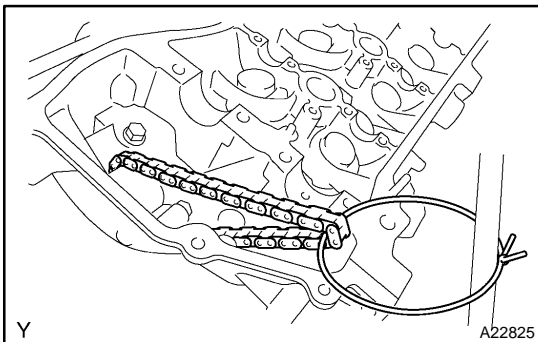
As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head which receives the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.



- (1) Using several steps, loosen and remove the 8 bearing cap bolts uniformly in the sequence as shown in the illustration.
- (2) Remove the 4 bearing caps.



- (3) Hold the No. 1 chain, and remove the No. 3 camshaft, camshaft timing gear assembly and No. 2 chain.

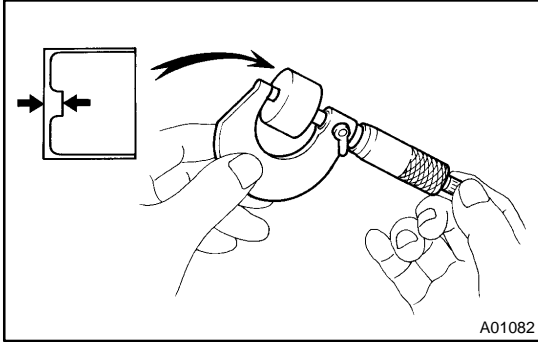


- (4) Tie the No. 1 chain with a string as shown in the illustration.

NOTICE:

Be careful not to drop anything inside the timing chain cover.

- (i) Remove the valve lifters.



(j) Determine the size of the valve lifter to be installed according to the following formulas or charts:

- (1) Using a micrometer, measure the thickness of the removed lifter.
- (2) Calculate the thickness of a new lifter so that the valve clearance comes within the specified value.

T: Thickness of removed lifter

A: Measured valve clearance

N: Thickness of new lifter

Intake:

$$N = T + (A - 0.20 \text{ mm (0.008 in.)})$$

Exhaust:

$$N = T + (A - 0.30 \text{ mm (0.012 in.)})$$

- (3) Select a new lifter with a thickness as close as possible to the calculated value.

HINT:

Lifters are available in 35 sizes in increments of 0.020 mm (0.0008 in.), from 5.060 mm (0.1992 in.) to 5.740 mm (0.2260 in.).

γ A22827

EXAMPLE:
The 5.340 mm (0.2102 in.) lifter is installed, and the measured clearance is 0.480 mm (0.0189 in.).
Replace the 5.340 mm (0.2102 in.) shim with a new No. 48 lifter.

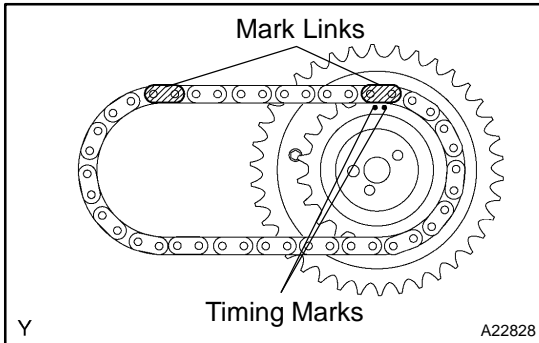
VALVE CLEARANCE

No.	Thickness	No.	Thickness	No.	Thickness
06	5.060(0.1992)	30	5.300(0.2087)	54	5.540(0.2181)
08	5.080(0.2000)	32	5.320(0.2094)	56	5.560(0.2189)
10	5.100(0.2008)	34	5.340(0.2102)	58	5.580(0.2197)
12	5.120(0.2016)	36	5.360(0.2110)	60	5.600(0.2205)
14	5.140(0.2024)	38	5.380(0.2118)	62	5.620(0.2213)
16	5.160(0.2031)	40	5.400(0.2126)	64	5.640(0.2220)
18	5.180(0.2039)	42	5.420(0.2134)	66	5.660(0.2228)
20	5.200(0.2047)	44	5.440(0.2142)	68	5.680(0.2236)
22	5.220(0.2055)	46	5.460(0.2150)	70	5.700(0.2244)
24	5.240(0.2063)	48	5.480(0.2157)	72	5.720(0.2252)
26	5.260(0.2071)	50	5.500(0.2165)	74	5.740(0.2260)
28	5.280(0.2079)	52	5.520(0.2173)		

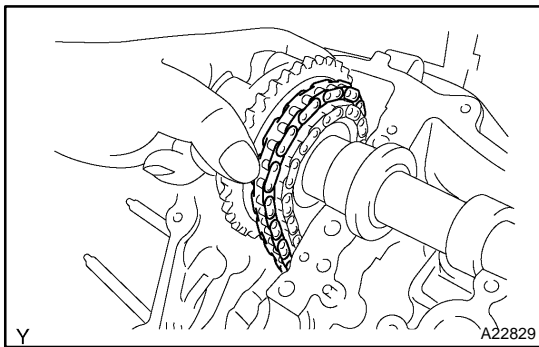
(k) Install the No. 3 camshaft.

NOTICE:

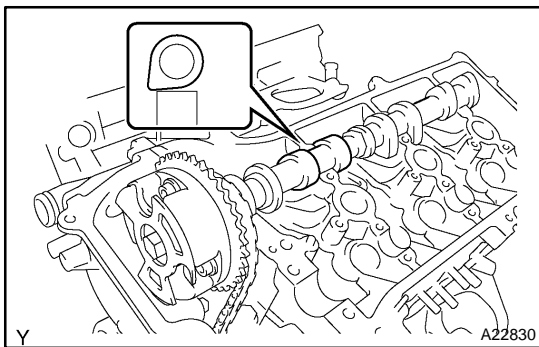
As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head which receives the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.



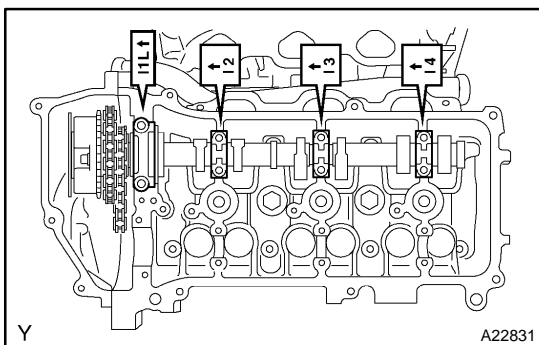
- (1) Align the mark link (yellow) with the timing mark (2-dot mark) of the camshaft timing gear assembly as shown in the illustration.
- (2) Apply new engine oil to the thrust portions and journals of the camshafts.



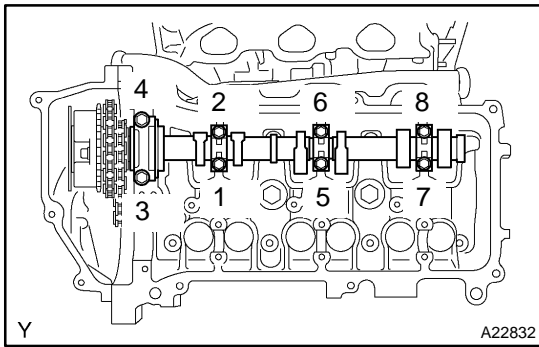
- (3) Temporarily put the No. 1 chain on the No. 2 chain of the camshaft timing gear assembly.



- (4) Set the No. 3 camshaft onto the LH cylinder head with the cam lobes of the No. 2 cylinder facing downward as shown in the illustration.



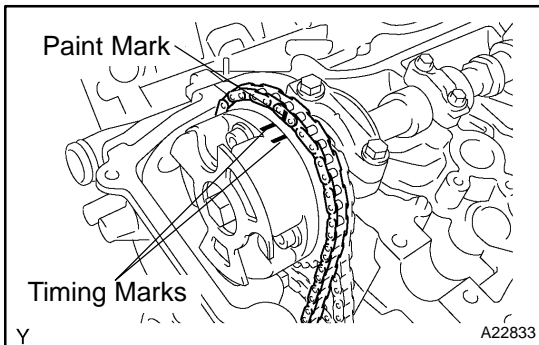
- (5) Install the 4 bearing caps in their proper locations.
- (6) Apply a light coat of engine oil to the threads of the bearing cap bolts.



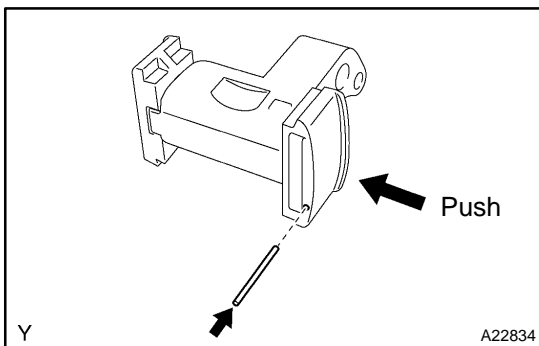
- (7) Install the 8 bearing cap bolts. Using several steps, tighten the bolts uniformly in the sequence as shown in the illustration.

Torque:

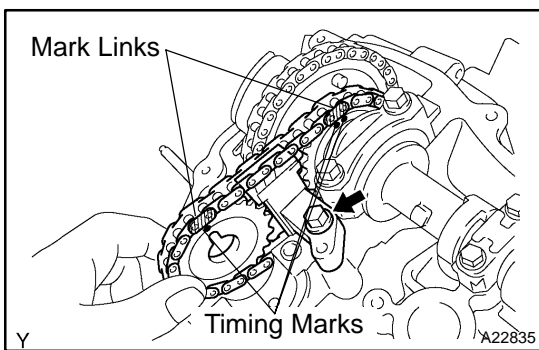
9.0 N·m (92 kgf·cm, 80 in.-lbf) for 10 mm (0.39 in.) head
24 N·m (245 kgf·cm, 18 ft.-lbf) for 12 mm (0.47 in.) head



- (8) Set the paint mark of the No. 1 chain between the timing marks of the camshaft timing gear assembly.



- (l) Install the chain tensioner No. 2.
 (1) While pushing in the tensioner, insert a pin of ϕ 1.0 mm (0.039 in.) into the hole to fix it.



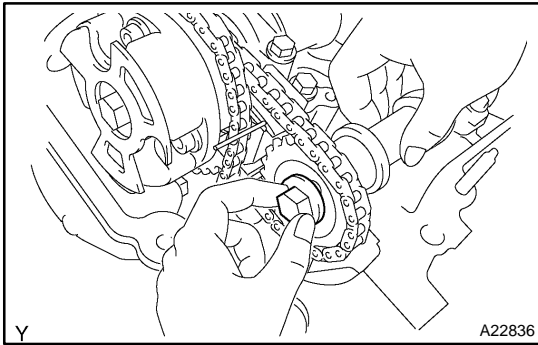
- (2) Temporarily install the camshaft timing assembly and chain tensioner No. 2 and align the mark links (yellow) with the timing marks (1-dot mark and 2-dot mark) of the camshaft timing sprocket and camshaft timing gear assembly.
 (3) Tighten the chain tensioner No. 3 bolt.

Torque: 19 N·m (194 kgf·cm, 14 ft.-lbf)

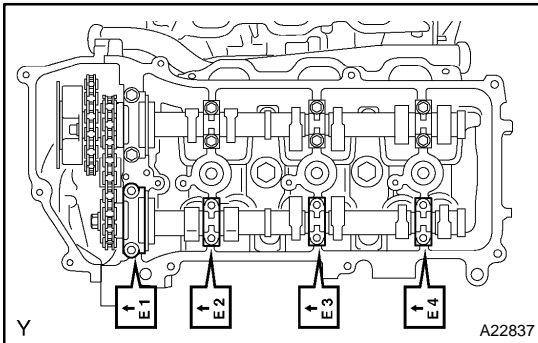
- (m) Install the No. 4 camshaft.

NOTICE:

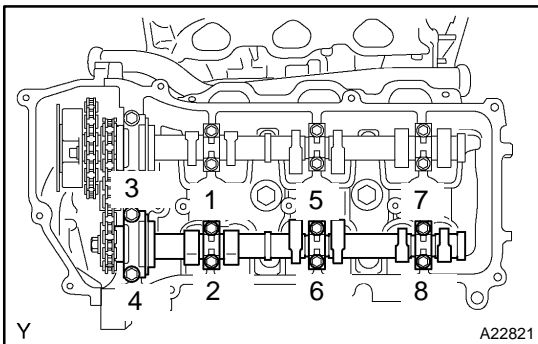
As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head which receives the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.



- (1) Align the knock pin hole on the camshaft timing sprocket with the knock pin of the No. 4 camshaft, and insert the No. 4 camshaft into the camshaft timing sprocket.
- (2) Temporarily install the camshaft timing sprocket set bolt.



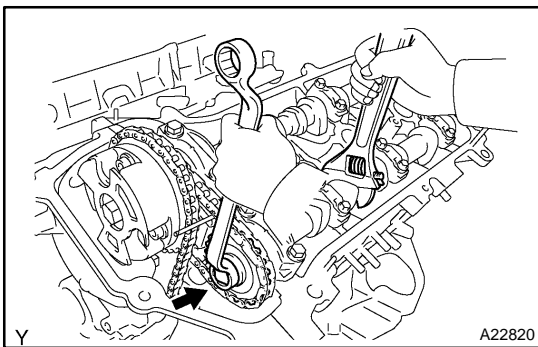
- (3) Install the 4 bearing caps in their proper locations.
- (4) Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.



- (5) Install the 8 bearing cap bolts. Using several steps, tighten the bolts uniformly in the sequence as shown in the illustration.

Torque:

9.0 N·m (92 kgf·cm, 80 in.-lbf) for 10 mm (0.39 in.) head
24 N·m (245 kgf·cm, 18 ft.-lbf) for 12 mm (0.47 in.) head



- (6) Hold the hexagonal portion of the No. 4 camshaft with a wrench, and tighten the camshaft timing sprocket set bolt.

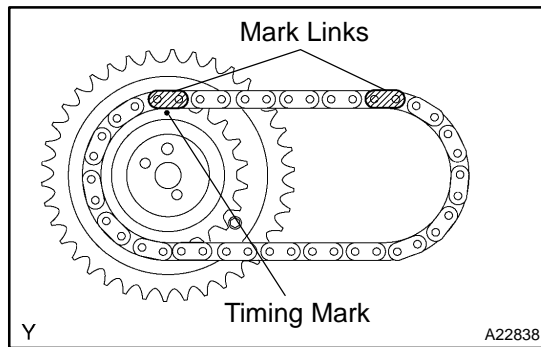
Torque: 100 N·m (1,020 kgf·cm, 74 ft.-lbf)

- (7) Remove the pin from the chain tensioner No. 2.

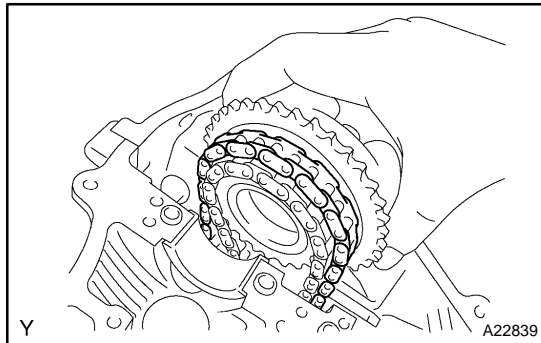
- (n) Install the camshaft.

NOTICE:

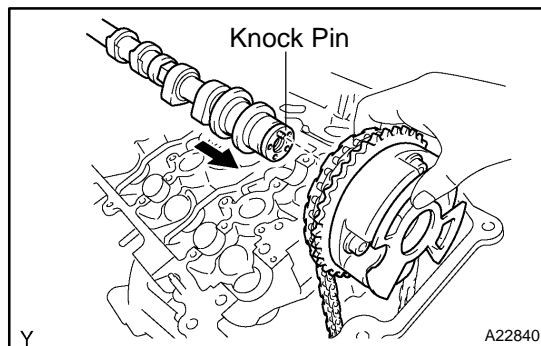
As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head which receives the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.



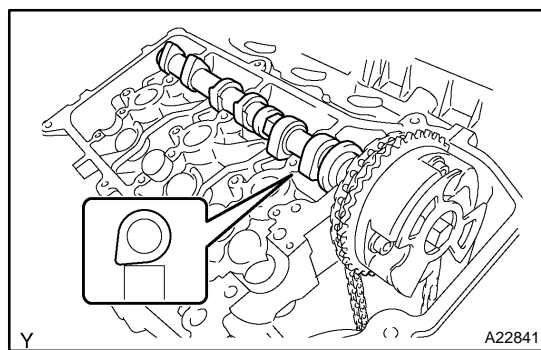
- (1) Align the mark link (yellow) with the timing mark (1-dot mark) of the camshaft timing gear assembly as shown in the illustration.
- (2) Apply new engine oil to the thrust portions and journals of the camshafts.



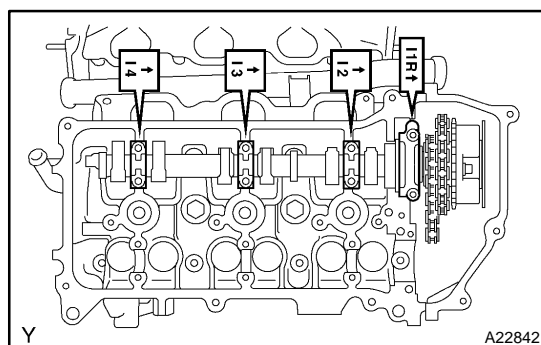
- (3) Temporarily put the No. 1 chain on the No. 2 chain of the camshaft timing gear assembly.



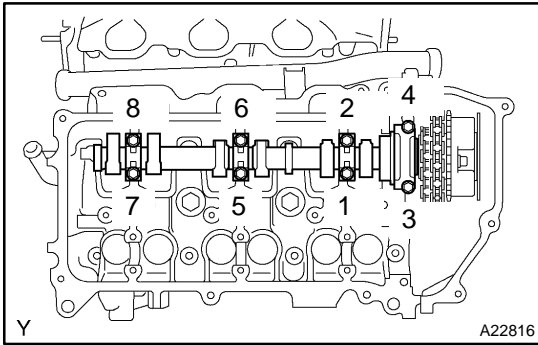
- (4) Align the knock pin hole on the camshaft timing gear assembly with the knock pin of the No. 1 camshaft, and insert the No. 1 camshaft into the camshaft timing gear assembly.
- (5) Temporarily install the camshaft timing gear assembly set bolt.



- (6) Set the No. 1 camshaft onto the RH cylinder head with the cam lobes of the No. 1 cylinder facing downward as shown in the illustration.



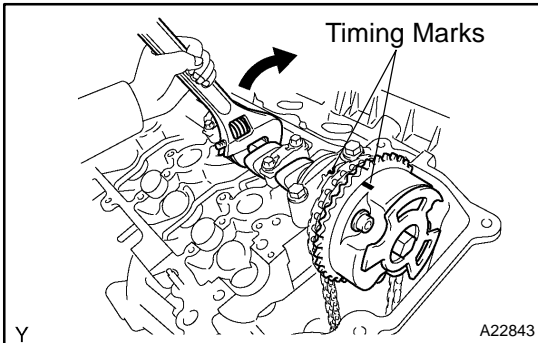
- (7) Install the 4 bearing caps in their proper locations.
- (8) Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.



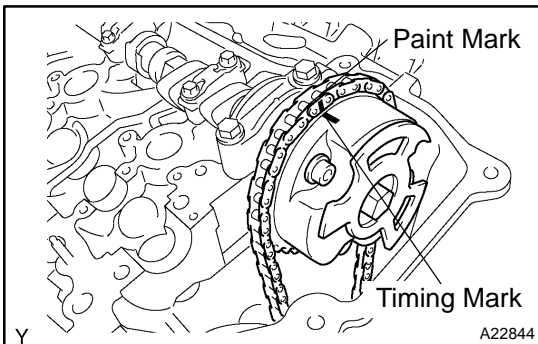
- (9) Install the 8 bearing cap bolts. Using several steps, tighten the bolts uniformly in the sequence as shown in the illustration.

Torque:

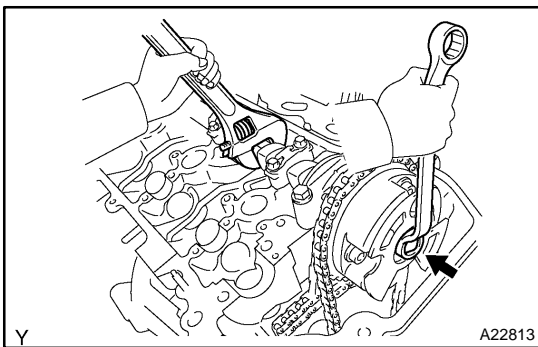
9.0 N·m (92 kgf·cm, 80 in.-lbf) for 10 mm (0.39 in.) head
24 N·m (245 kgf·cm, 18 ft·lbf) for 12 mm (0.47 in.) head



- (10) Rotate the No. 1 camshaft clockwise using the hexagonal portion of the No. 1 camshaft so that the timing mark of the camshaft timing gear assembly is aligned with the timing mark of the camshaft bearing cap.

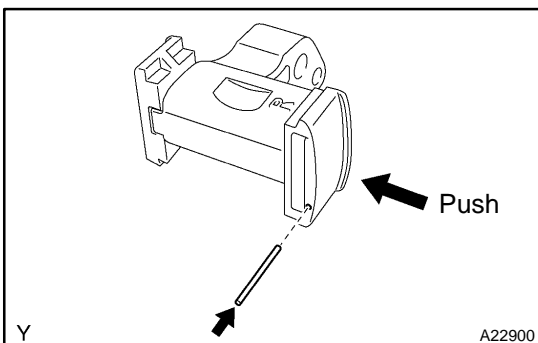


- (11) Align the paint mark of the No. 1 chain with the timing mark of the camshaft timing gear assembly.

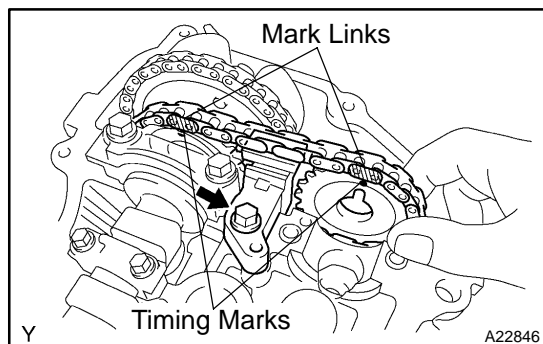


- (12) Hold the hexagonal portion of the No. 1 camshaft with a wrench, and tighten the camshaft timing gear assembly set bolt.

Torque: 100 N·m (1,020 kgf·cm, 74 ft·lbf)



- (o) Install the chain tensioner No. 2.
 (1) While pushing in the tensioner, insert a pin of ϕ 1.0 mm (0.039 in.) into the hole to fix it.



- (2) Temporarily install the camshaft timing gear and chain tensioner No. 2 and align the mark links (yellow) with the timing marks (1-dot mark) of the camshaft timing gear assembly and camshaft timing sprocket.

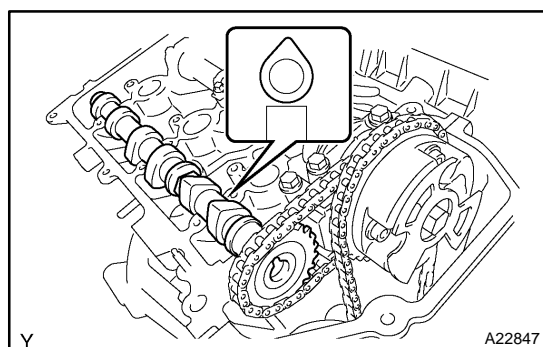
- (3) Tighten the chain tensioner No. 2 bolt.

Torque: 19 N·m (194 kgf·cm, 14 ft·lbf)

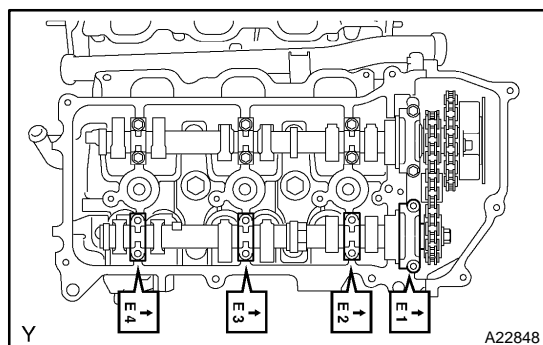
- (p) Install the No. 2 camshaft.

NOTICE:

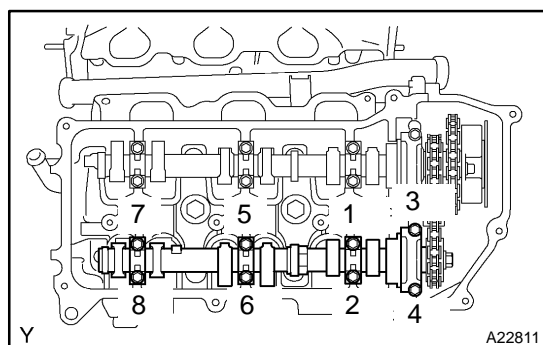
As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head which receives the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.



- (1) Set the No. 2 camshaft onto the RH cylinder head with the cam lobes of No. 1 cylinder facing upward as shown in the illustration.



- (2) Install the 4 bearing caps in their proper locations.
- (3) Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.

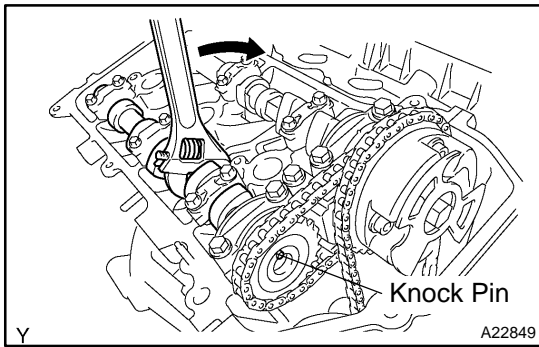


- (4) Install the 8 bearing cap bolts. Using several steps, tighten the bolts uniformly in the sequence as shown in the illustration.

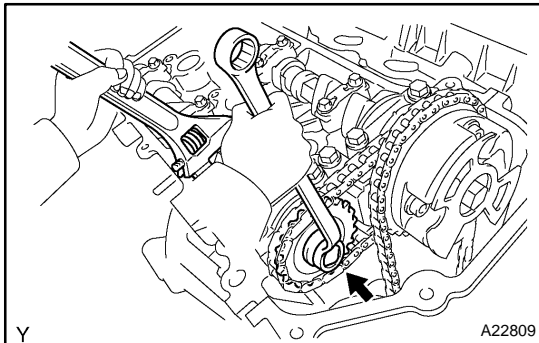
Torque:

9.0 N·m (92 kgf·cm, 80 in·lbf) for 10 mm (0.39 in.) head

24 N·m (245 kgf·cm, 18 ft·lbf) for 12 mm (0.47 in.) head



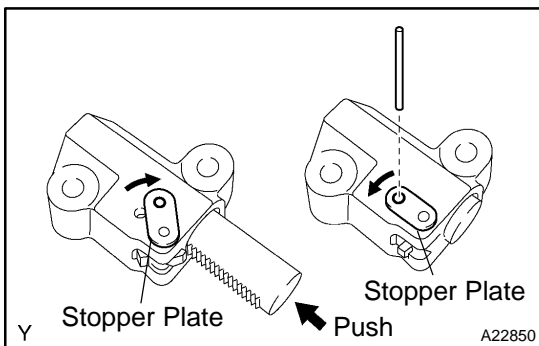
- (5) Rotate the No. 2 camshaft clockwise using a wrench so that the knock pin of the No. 2 camshaft is aligned with the knock pin hole of the camshaft timing sprocket.



- (6) Hold the hexagonal portion of the No. 2 camshaft with a wrench, and install the camshaft timing sprocket set bolt.

Torque: 100 N·m (1,020 kgf·cm, 74 ft·lbf)

- (7) Remove the pin from the chain tensioner No. 2.



- (q) Install the chain tensioner No. 1.

- (1) While turning the stopper plate of the tensioner clockwise, push in the plunger of the tensioner as shown in the illustration.
- (2) While turning the stopper plate of the tensioner counterclockwise, insert a bar of ϕ 3.5 mm (0.138 in.) into the holes on the stopper plate and tensioner to fix the stopper plate.

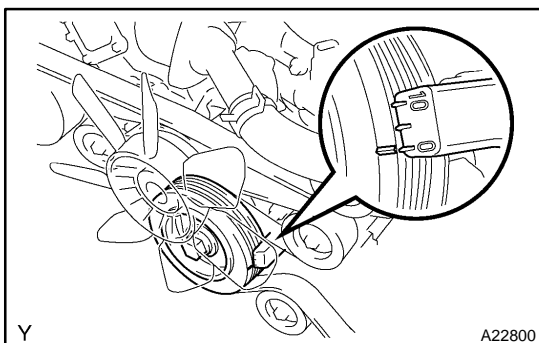
- (3) Install the chain tensioner with the 2 bolts.

Torque: 10 N·m (102 kgf·cm, 7 ft·lbf)

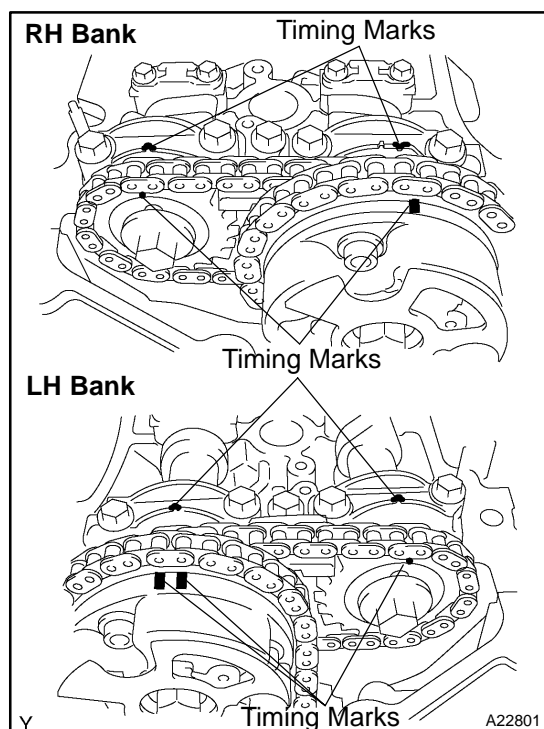
- (4) Remove the bar from the chain tensioner.

- (5) Install a new gasket and the timing chain cover plate with the 4 bolts.

Torque: 9.0 N·m (92 kgf·cm, 80 in·lbf)



- (6) Turn the crankshaft pulley 2 complete revolutions slowly, and align the notch with the timing mark "0" of the timing chain cover.



(7) Check that the timing marks of the camshaft timing gear assembly and camshaft timing sprocket are aligned with the timing marks of the bearing caps as shown in the illustration.

10. **INSTALL CYLINDER HEAD COVER** (See page [EM-89](#))
11. **INSTALL IGNITION COIL**
12. **INSTALL INTAKE AIR SURGE TANK**
(See page [EM-89](#))
13. **INSTALL AIR CLEANER** (See page [EM-89](#))
14. **ADD ENGINE COOLANT** (See page [CO-2](#))
15. **INSTALL V-BANK COVER**
16. **INSPECT IGNITION TIMING** (See page [EM-23](#))