

REASSEMBLY

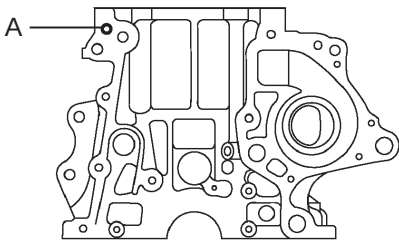
1. INSTALL STRAIGHT PIN

- (a) Using a plastic hammer, install 9 new straight pins into the cylinder block.

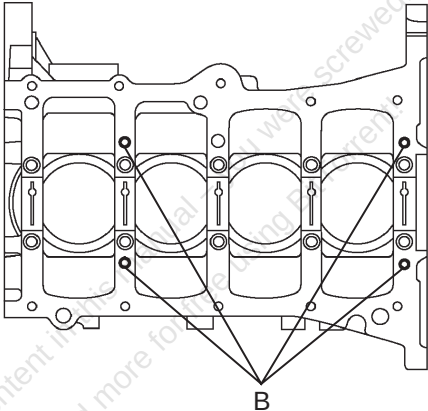
Standard protrusion

Item	Specification
A	5 mm (0.197 in.)
B	7.5 mm (0.295 in.)
C	12 mm (0.472 in.)
D	8 mm (0.315 in.)

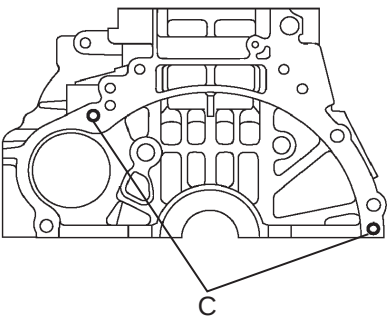
Front Side:



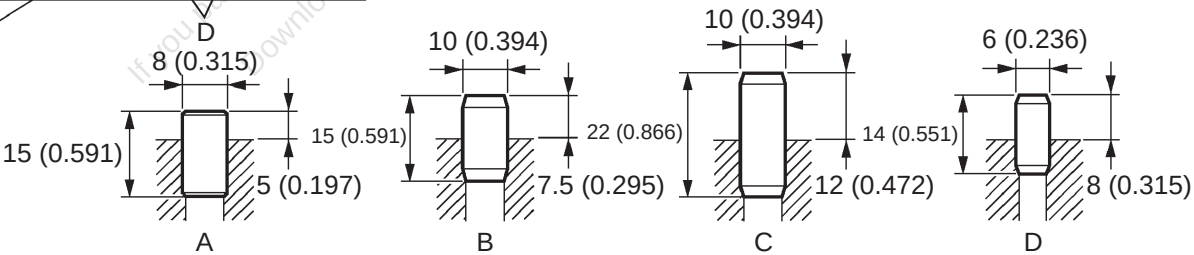
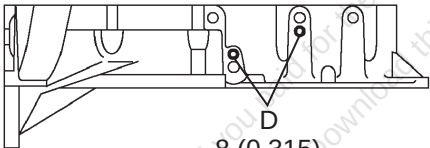
Lower Side:



Rear Side:



Bearing Cap Exhaust Side:



(mm (in.))

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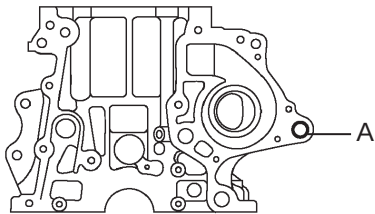
2. INSTALL RING PIN

- (a) Using a plastic hammer, install 5 new ring pins into the cylinder block.

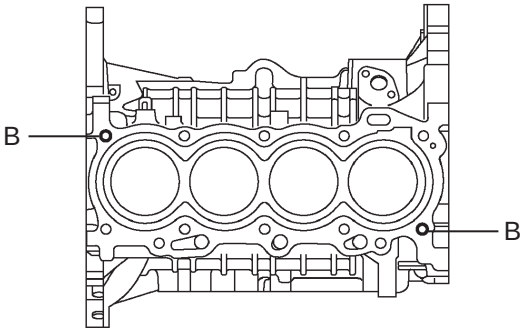
Standard protrusion

Item	Specification
A	6 mm (0.236 in.)
B	7 mm (0.276 in.)
C	10 mm (0.394 in.)

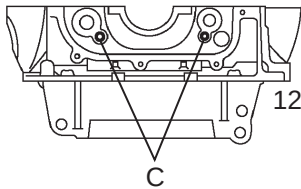
Front Side:



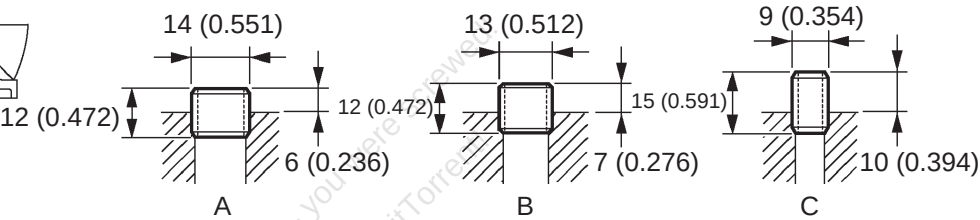
Upper Side:



Bearing Cap Front Side:



(mm (in.))



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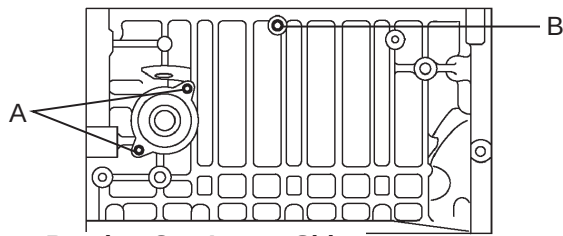
3. INSTALL STUD BOLT

- (a) Using "TORX" socket wrenches E5 and E7, install 9 stud bolts into the cylinder block.

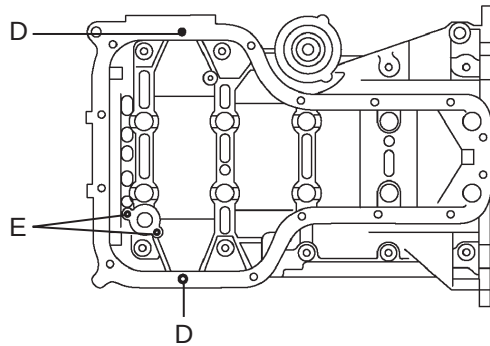
Torque

Item	Specification
A	5.0 N*m (51 kgf*cm, 44 in.*lbf)
B	11 N*m (112 kgf*cm, 8 ft.*lbf)
C	5.0 N*m (51 kgf*cm, 44 in.*lbf)
D	5.0 N*m (51 kgf*cm, 44 in.*lbf)
E	9.0 N*m (92 kgf*cm, 80 in.*lbf)

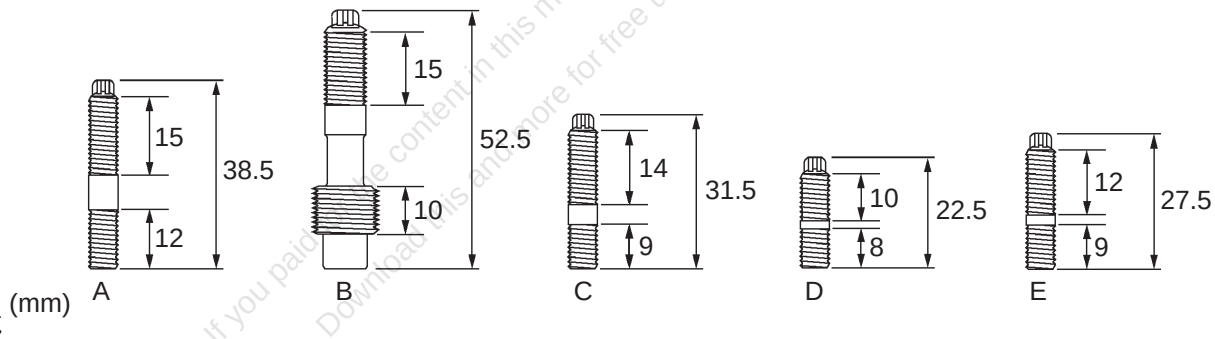
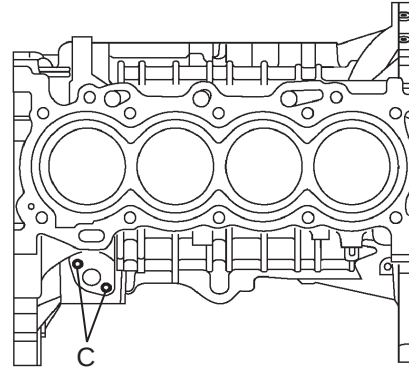
Intake Side:



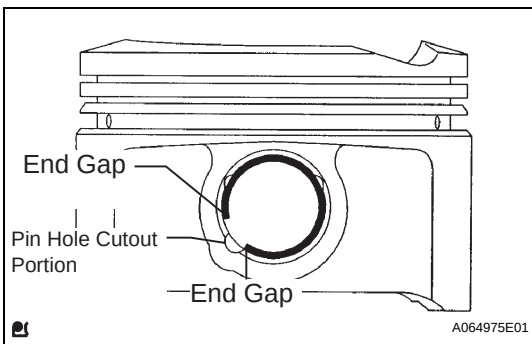
Bearing Cap Lower Side:



Upper Side:



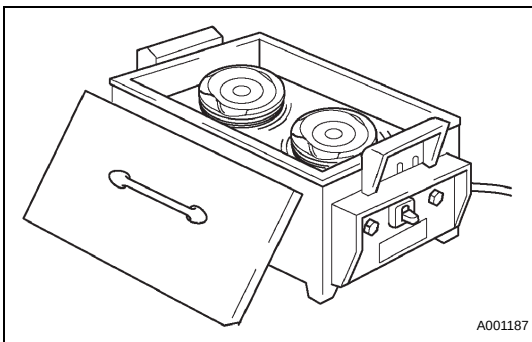
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**4. INSTALL W/PIN PISTON SUB-ASSEMBLY**

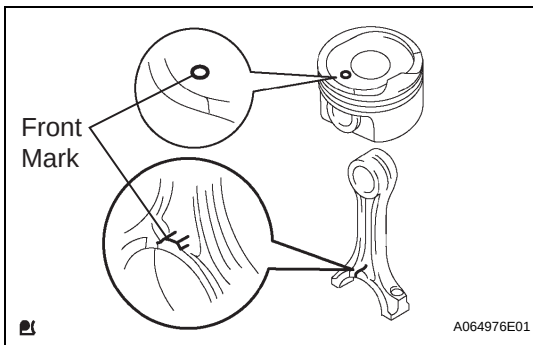
- (a) Using a small screwdriver, install a new snap ring onto one end of the piston pin hole.

HINT:

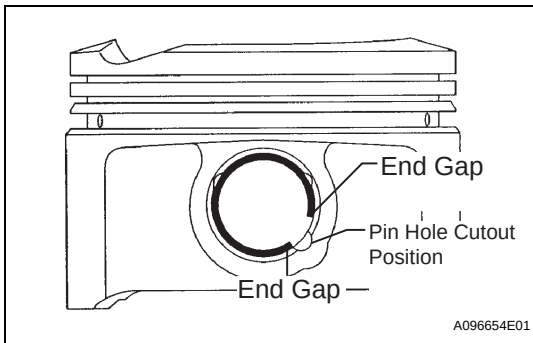
Make sure that the end gap of the snap ring is aligned with the pin hole cutout portion of the piston.



- (b) Gradually heat the piston up to 80 to 90°C (176 to 194°F).



- (c) Align the front mark on the piston with the one on the connecting rod, then push in the piston pin with your thumb.



- (d) Using a small screwdriver, install a new snap ring onto one end of the piston pin hole.

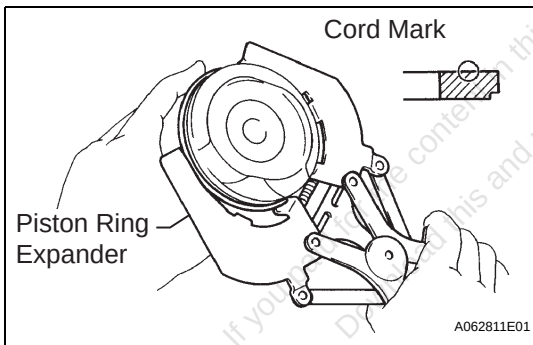
HINT:

Make sure that the end gap of the snap ring is aligned with the pin hole cutout portion of the piston.

5. INSTALL PISTON RING SET

HINT:

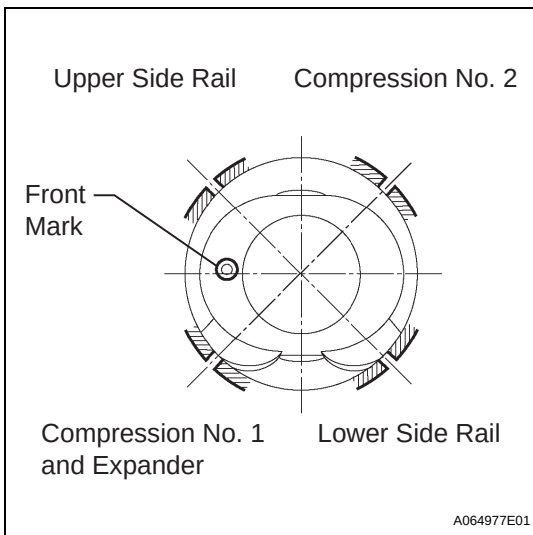
If reusing the piston rings, install them onto the matched pistons with the surfaces facing correctly.



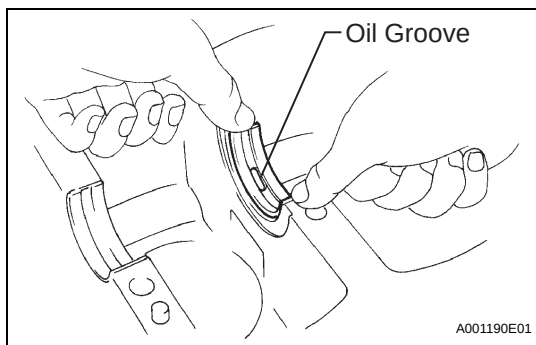
- (a) Install the oil ring expander and 2 side rails by hand.
(b) Using a piston ring expander, install the 2 compression rings with the code mark facing upward.

Code mark (No. 2 only):

2R



- (c) Position the piston rings so that the ring ends are as shown.

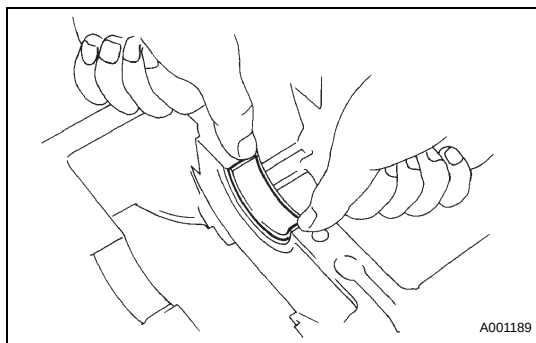


6. INSTALL CRANKSHAFT BEARING

- (a) Install the upper bearing with an oil groove onto the cylinder block.

NOTICE:

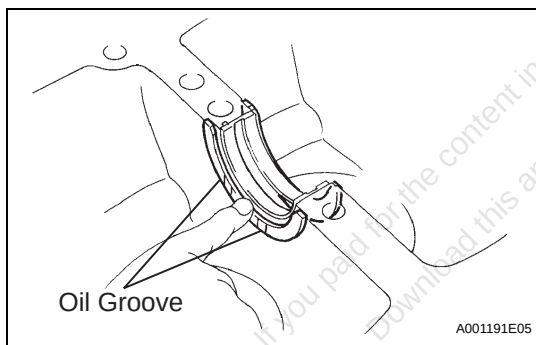
Do not apply engine oil to the bearing and its contact surface.



- (b) Install the lower bearing onto the bearing cap.

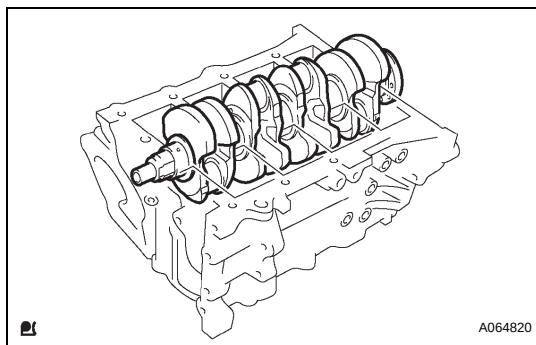
NOTICE:

Do not apply engine oil to the bearing and its contact surface.



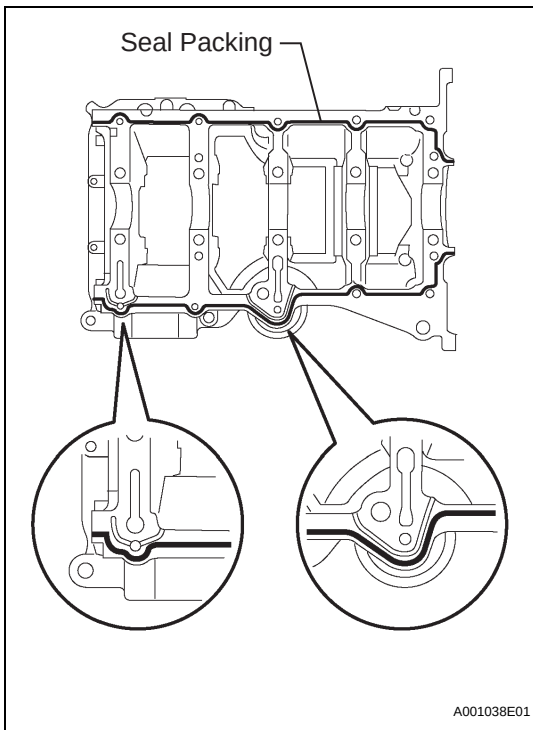
7. INSTALL CRANKSHAFT THRUST WASHER UPPER

- (a) Install the 2 thrust washers onto the No. 3 journal position of the cylinder block with the oil grooves facing outward.



8. INSTALL CRANKSHAFT

- (a) Apply engine oil to the upper bearing, then install the crankshaft onto the cylinder block.
- (b) Apply a light coat of engine oil to the bolt threads, bolt seats, and bearings of the bearing cap.



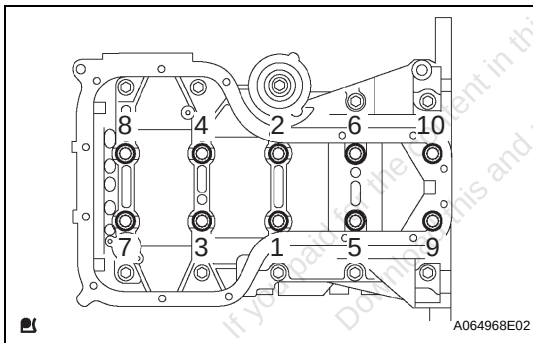
- (c) Apply a continuous bead of seal packing (Diameter 2.5 to 3.5 mm (0.098 to 0.138 in.)) as shown in the illustration.

Seal packing:

Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent

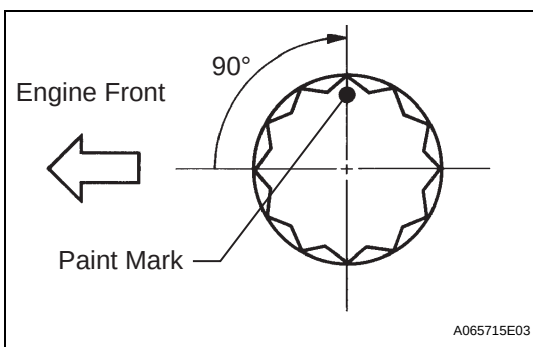
NOTICE:

- Remove any oil from the contact surface.
- Install the bearing cap sub-assembly within 3 minutes of applying seal packing.
- Do not put in engine oil for at least 2 hours after installation.

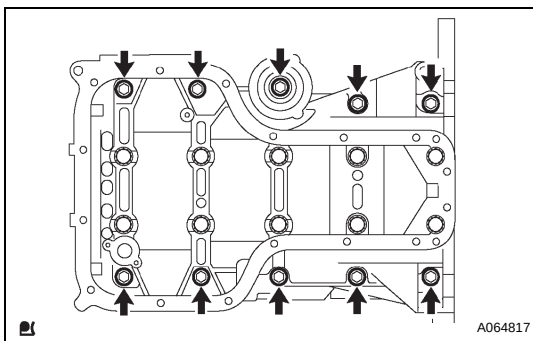


- (d) Tighten the bolts to the specified torque in several passes in the sequence shown.

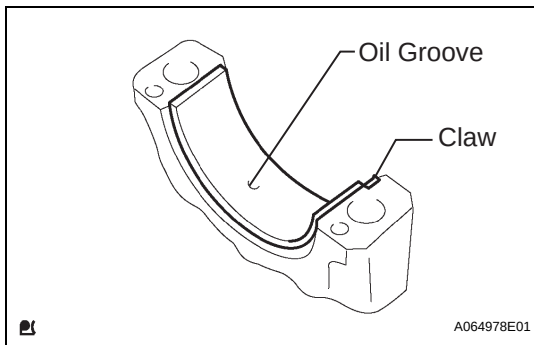
Torque: 44 N*m (449 kgf*cm, 33 ft.*lbf)



- (e) Mark the front of the bearing cap bolts with paint.
 (f) Retighten the bearing cap bolts by 90° as shown in the illustration.
 (g) Check that the painted mark of each bolt is now at a 90° angle to the front.



- (h) Tighten the 10 other bolts for the bearing cap.
Torque: 19 N*m (194 kgf*cm, 14 ft.*lbf)

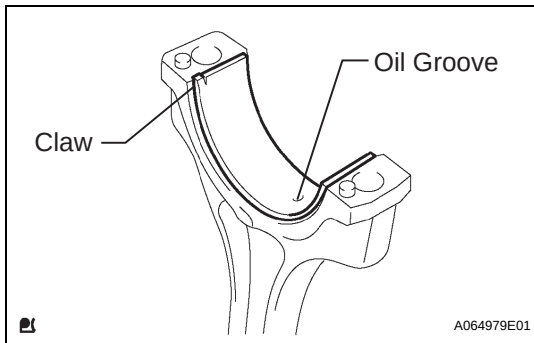


9. INSTALL CONNECTING ROD BEARING

- Align the connecting rod bearing claw with the oil groove of the connecting rod cap.
- Install the connecting rod bearing onto the connecting rod cap.

NOTICE:

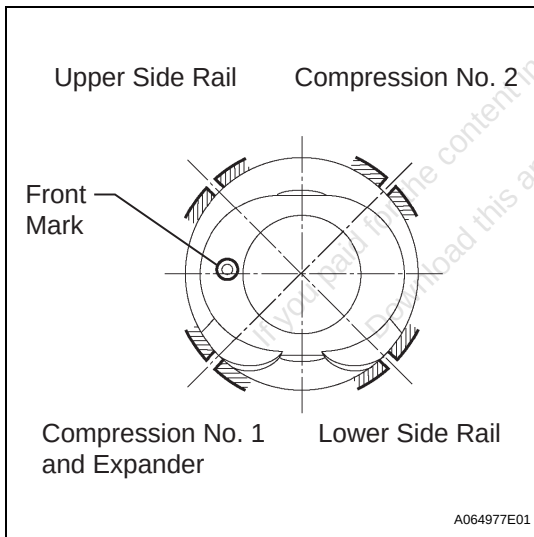
Do not apply engine oil to the bearing and its contact surface.



- Align the connecting rod bearing claw with the oil groove of the connecting rod.
- Install the connecting rod bearing onto the connecting rod.

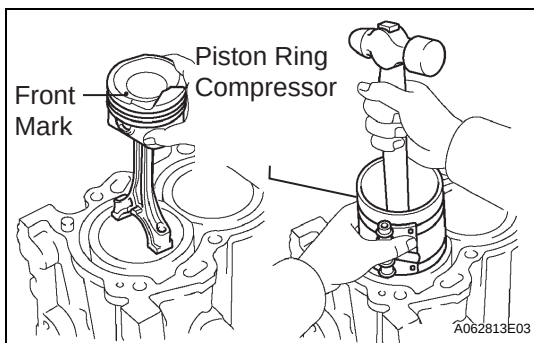
NOTICE:

Do not apply engine oil to the bearing and its contact surface.

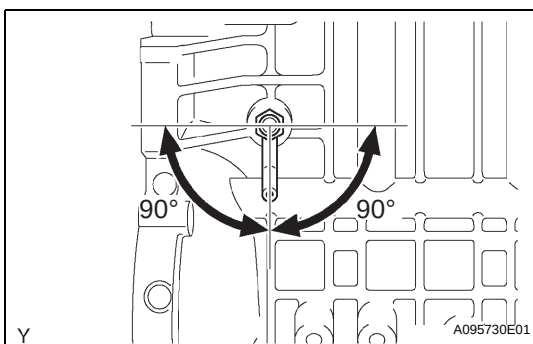
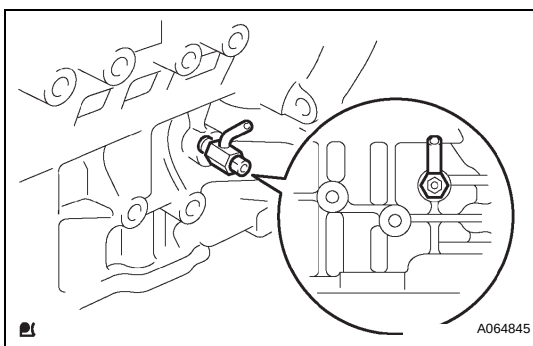
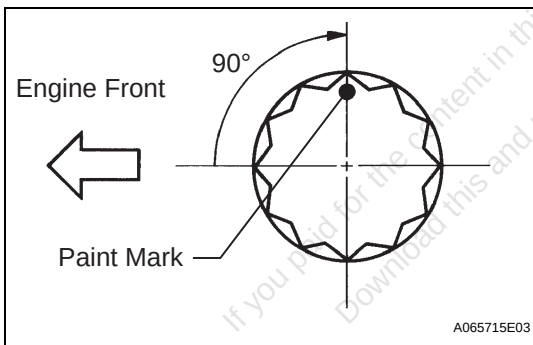
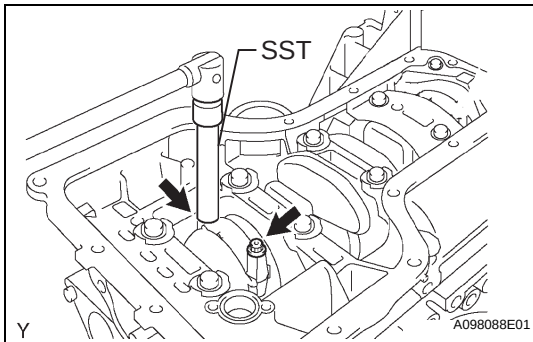
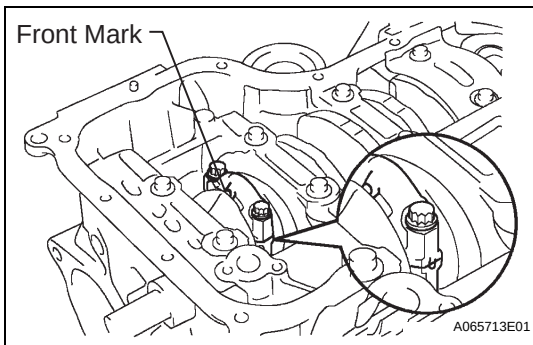


10. INSTALL CONNECTING ROD SUB-ASSEMBLY

- Position the piston rings so that the ring ends are as shown.
- Apply engine oil to the cylinder walls, pistons, and surfaces of the connecting rod bearings.



- Using a piston ring compressor, correctly push into the numbered piston and connecting rod assemblies each cylinder with the front mark of the piston facing forward.



- (d) Align the pin dowels of the connecting rod cap with the pins of the connecting rod, then install the connecting rod.

NOTICE:

Match the numbered connecting rod cap with the same numbered connecting rod.

- (e) Check that the protruding portion of the connecting rod.
- (f) Apply a light coat of engine oil to the threads and the bottom of the heads of the connecting rod cap bolts.
- (g) Using SST, tighten the bolts in several passes to the specified torque.

SST 09205-16010

Torque: 20 N*m (204 kgf*cm, 15 ft.*lbf)

- (h) Mark the front of the connecting cap bolts with paint.
- (i) Retighten the cap bolts by an additional 90° as shown in the illustration.
- (j) Check that the crankshaft turns smoothly.

11. INSTALL CYLINDER BLOCK WATER DRAIN COCK SUB-ASSEMBLY

- (a) Apply adhesive to 2 or 3 threads of the cylinder block water drain cock, then install it within 3 minutes of applying as shown in the illustration.

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

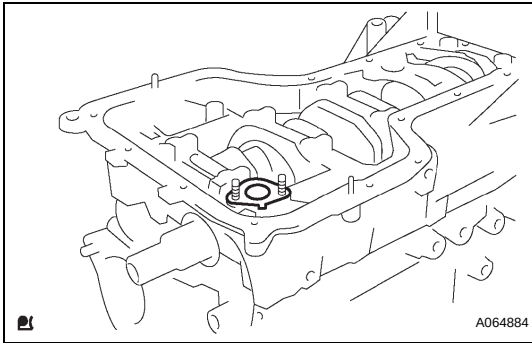
Adhesive:

Toyota Genuine Adhesive 1344, Three Bond 1344 or equivalent

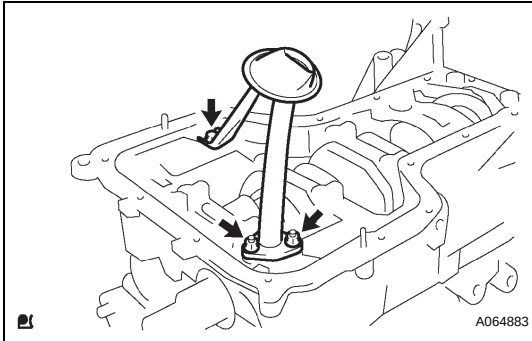
- (b) After tightening the drain cock to the specified torque, turn the cylinder block water drain cock clockwise until its drain port faces downward (Procedure "A").

NOTICE:

- **Do not put in coolant for at least an hour after installation.**
- **Do not turn the drain union more than 360° in procedure "A", and never loosen it after setting the union correctly.**

**12. INSTALL OIL STRAINER FLANGE GASKET**

- (a) Install a new gasket onto the cylinder block.

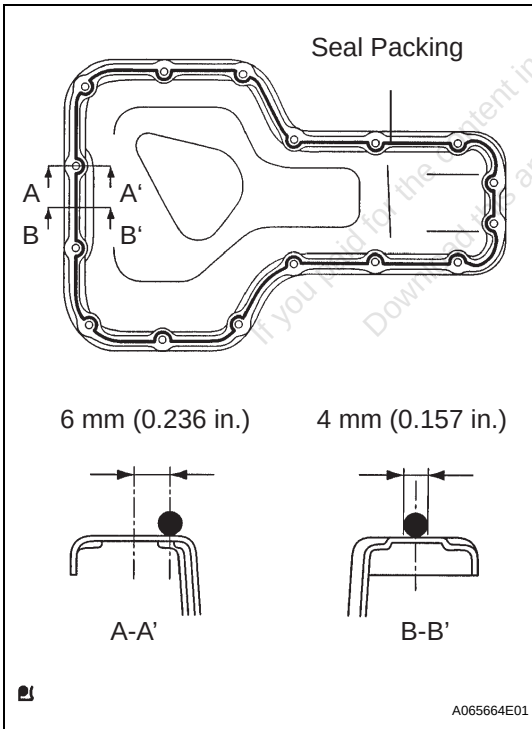
**13. INSTALL OIL STRAINER SUB-ASSEMBLY**

- (a) Install the oil strainer with the 2 nuts and bolt.

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

14. INSTALL OIL PAN SUB-ASSEMBLY

- (a) Remove any old packing material from the contact surface and thread holes.



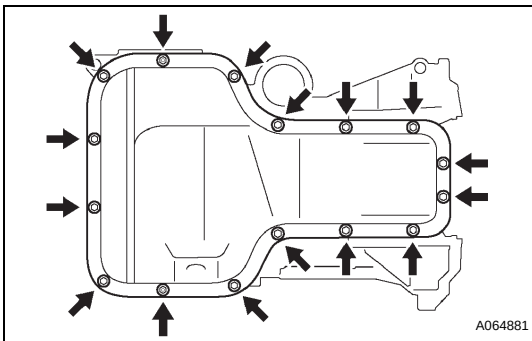
- (b) Apply a continuous bead of seal packing (Diameter 3.5 to 4.5 mm (0.138 to 0.177 in.)) as shown in the illustration.

Seal packing:

Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent

NOTICE:

- Remove any oil from the contact surface.
- Install the oil pan within 3 minutes of applying seal packing.
- Do not put in engine oil for at least 2 hours after installing the oil pan.

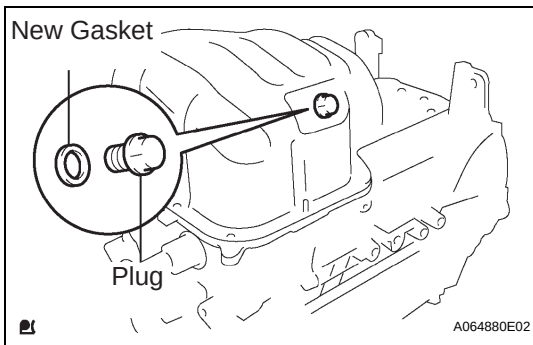


- (c) Install the oil pan with the 14 bolts and 2 nuts.

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

NOTICE:

- Tighten the bolts and nuts to the specified torque in two passes.
- Tighten the bolts and nuts within 15 minutes of applying sealant (if possible within 3 minutes).

**15. INSTALL OIL PAN DRAIN PLUG**

- (a) Place a new gasket on the oil pan drain plug, then install it onto the oil pan.

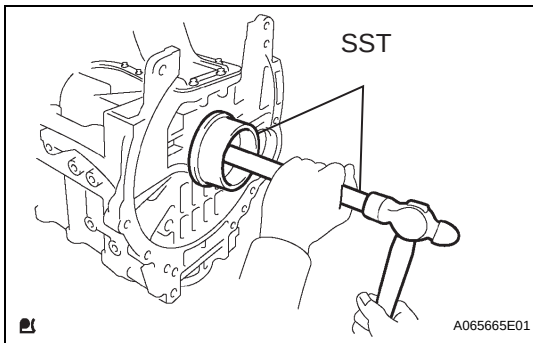
Torque: 37 N*m (377 kgf*cm, 27 ft.*lbf)

16. INSTALL ENGINE REAR OIL SEAL

- (a) Apply a light coat of multi-purpose grease to a new oil seal lip.

NOTICE:

Keep the lip free of foreign objects.

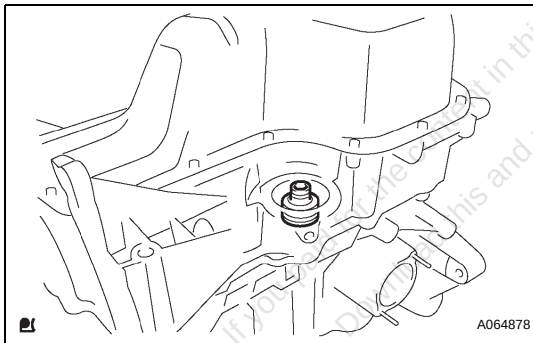


- (b) Using SST and a hammer, tap the new oil seal in until its surface is flush with the rear oil seal retainer edge.

SST 09223-15020, 09950-70010 (09951-07100)

NOTICE:

- Tap the oil seal in a vertical position.
- Wipe any extra grease off the crankshaft.

**17. INSTALL OIL FILTER UNION**

- (a) Using a socket hexagon wrench 12, install the oil filter union.

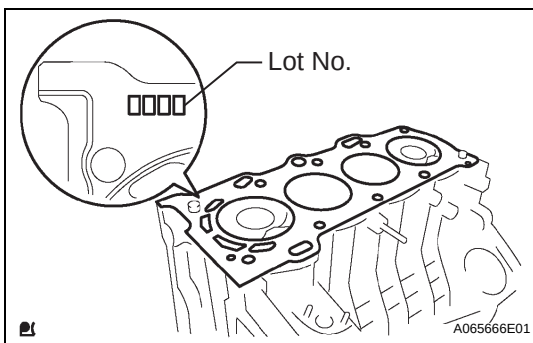
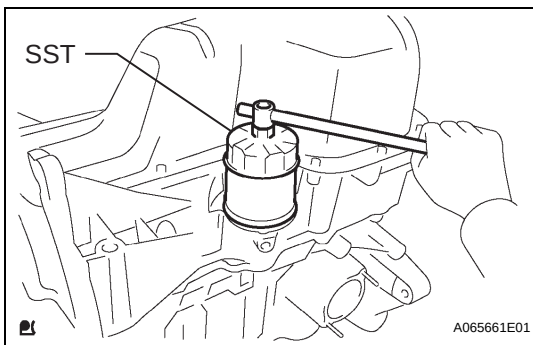
Torque: 30 N*m (306 kgf*cm, 22 ft.*lbf)

18. INSTALL OIL FILTER SUB-ASSEMBLY

- (a) Check and clean the oil filter installation surface.
- (b) Apply clean engine oil to the gasket of a new oil filter.
- (c) Lightly screw the oil filter into place, then tighten it until the gasket comes into contact with the seat.
- (d) Using SST, tighten it an additional 3/4 turn.

SST 09228-06501

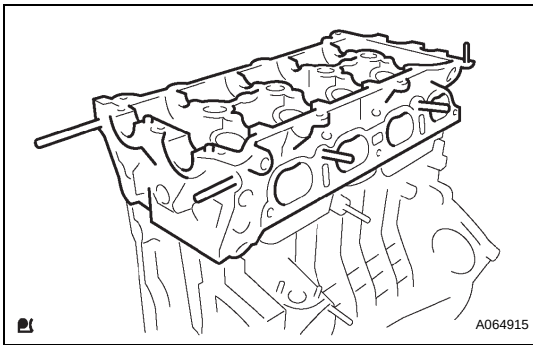
Torque: 13 N*m (133 kgf*cm, 10 ft.*lbf)

**19. INSTALL CYLINDER HEAD GASKET**

- (a) Place a new cylinder head gasket on the cylinder block surface with the Lot No. stamp upward.

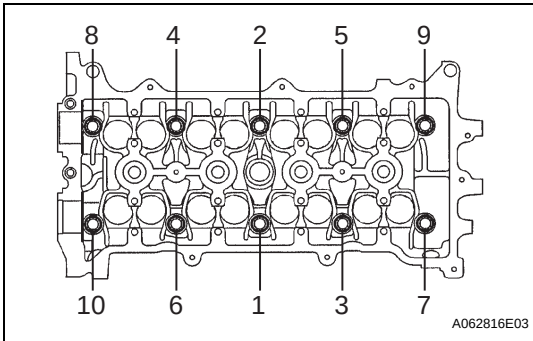
NOTICE:

- Make sure that the cylinder head gasket is mounted in the correct direction.
- Place the cylinder head gently in order to avoid damaging the gasket.



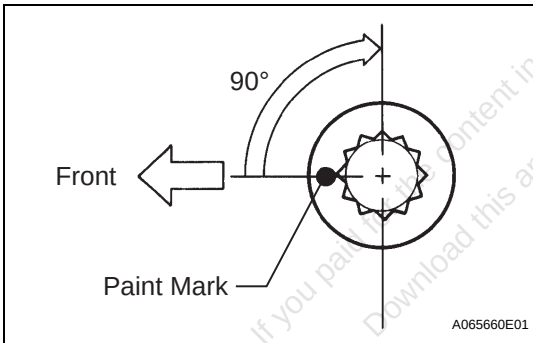
20. INSTALL CYLINDER HEAD SUB-ASSEMBLY

- Place the cylinder head on the cylinder block.
- Apply a light coat of engine oil to the threads and the bottom of the heads of the cylinder head bolts.

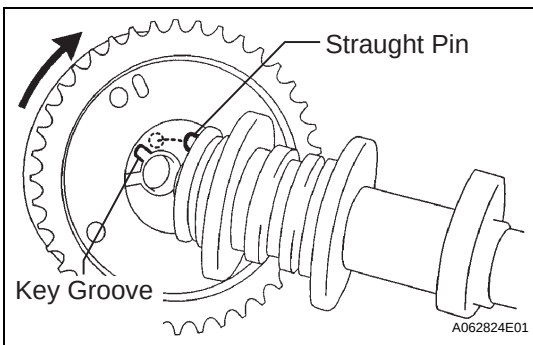


- Using several steps, uniformly install and tighten the 10 cylinder head bolts and plate washers with a bi-hexagon wrench 10 mm in the sequence shown in the illustration.

Torque: 49 N*m (500 kgf*cm, 36 ft.*lbf)



- Mark the front of the cylinder head bolts with paint.
- Retighten the cylinder head bolts by 90° in the sequence order shown.
- Check that the paint mark of each bolt is at 90° angle to the front.



21. INSTALL CAMSHAFT TIMING GEAR ASSEMBLY

- Put the camshaft timing gear together with the camshaft with the straight pin off the key groove.
- Turn the camshaft timing gear in the left as shown in the illustration while pushing it gently against the camshaft. Push further at the position where the pin fits into the groove.

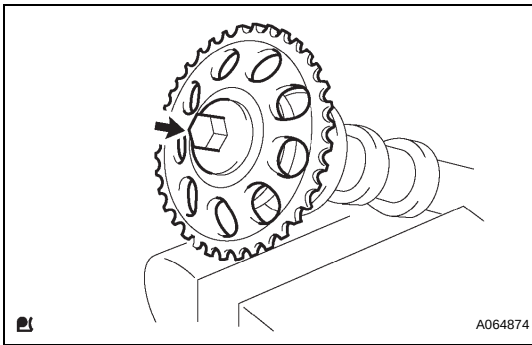
CAUTION:

Be sure not to turn the camshaft timing gear to the retard angle side (the right angle).

- Check that there is no clearance between the gear fringe and camshaft.
- Tighten the fringe bolt with the camshaft timing gear fixed.

Torque: 54 N*m (551 kgf*cm, 40 ft.*lbf)

- Check that the camshaft timing gear can move to the retard angle side (the right angle), and is locked in the most retarded position.

**22. INSTALL CAMSHAFT TIMING GEAR OR SPROCKET**

- (a) Clamp the camshaft in a vise, then install the camshaft timing gear with the bolt.

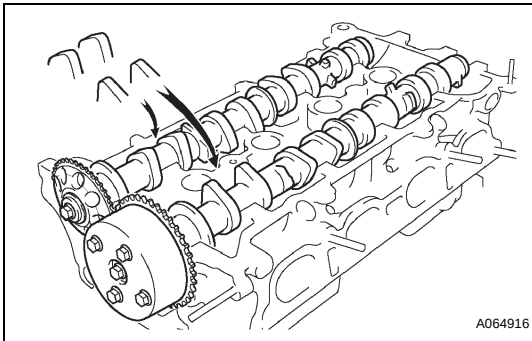
Torque: 54 N*m (551 kgf*cm, 40 ft.*lbf)

NOTICE:

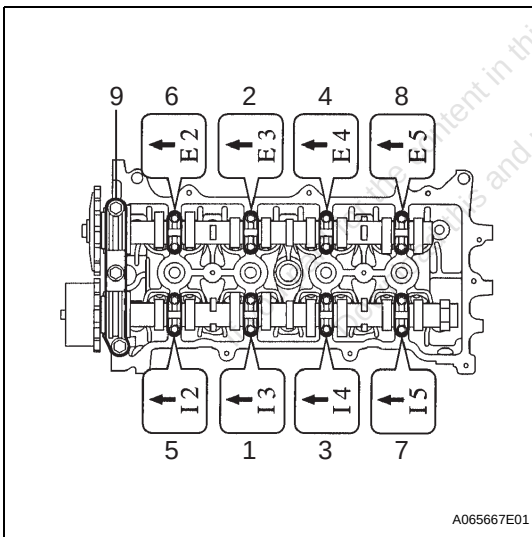
Be careful not to damage the camshaft.

23. INSTALL CAMSHAFT

- (a) Apply a light coat of engine oil to the camshaft journals.



- (b) Place the 2 camshafts on the cylinder head as shown in the illustration.



- (c) Examine the front marks and numbers and check that the sequence order is as shown in the illustration. Then tighten the bolts.

Torque: Bearing cap No. 1

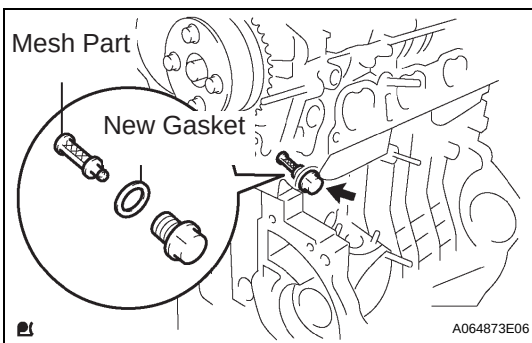
23 N*m (235 kgf*cm, 17 ft.*lbf)

Bearing cap No. 3

13 N*m (133 kgf*cm, 10 ft.*lbf)

HINT:

- Bearing cap No. 1 is used for bearings numbered from 9 to 11 in the illustration.
- Bearing cap No. 3 is used for bearings numbered from 1 to 8 in the illustration.

**24. INSTALL OIL CONTROL VALVE FILTER**

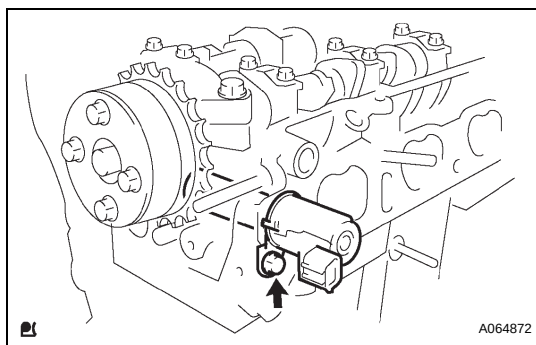
- (a) Check that there is no foreign objects on the mesh part of the oil control valve filter.

- (b) Install a new gasket and the oil control valve filter onto the bolt, then install it.

Torque: 30 N*m (306 kgf*cm, 22 ft.*lbf)

25. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

- (a) Apply a light coat of engine oil to a new O-ring, then install it onto the camshaft timing oil control valve.

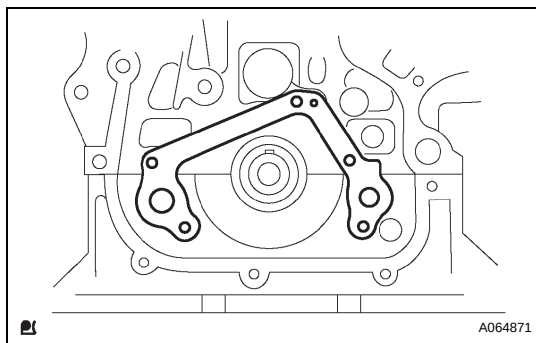


- (b) Install the camshaft timing oil control valve with the bolt.

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

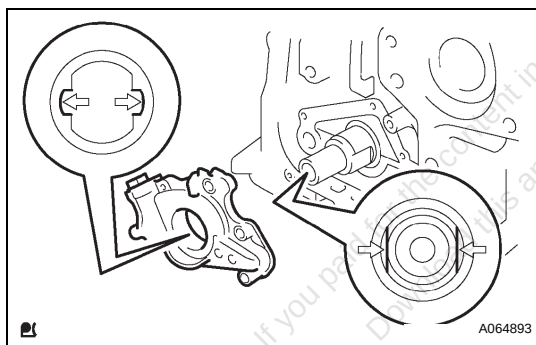
NOTICE:

Be careful not to twist the O-ring.



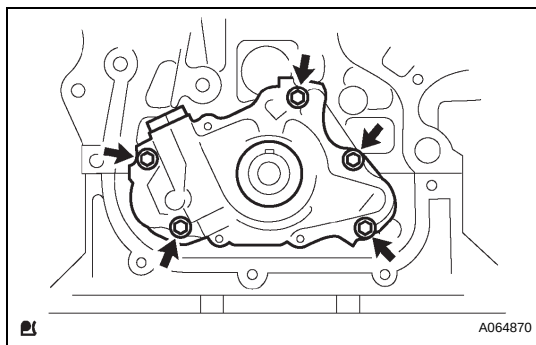
26. INSTALL OIL PUMP GASKET

- (a) Install a new gasket onto the cylinder block.



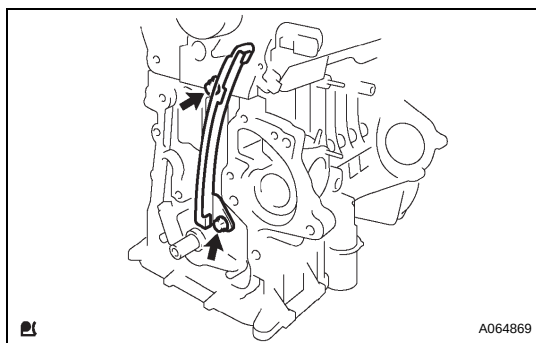
27. INSTALL OIL PUMP ASSEMBLY

- (a) Align the spline teeth of the oil pump drive rotor with the large teeth of the crankshaft, then slide on the oil pump.



- (b) Install the oil pump with the 5 bolts.

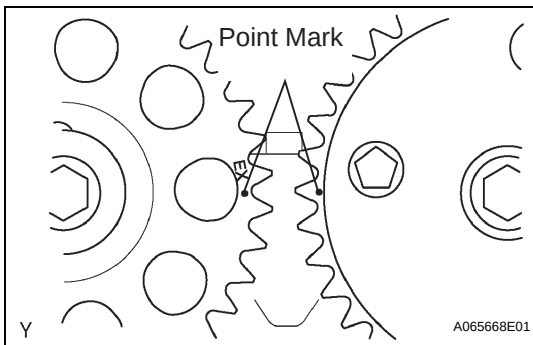
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)



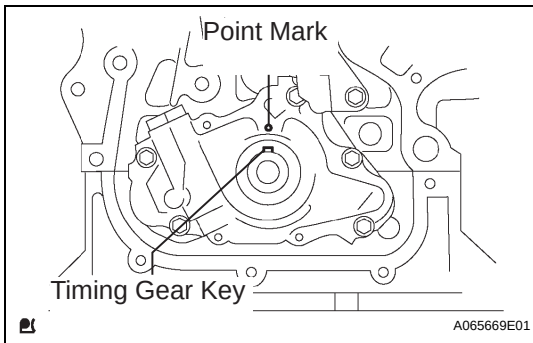
28. INSTALL CHAIN VIBRATION DAMPER NO.1

- (a) Install the chain vibration damper with the 2 bolts.

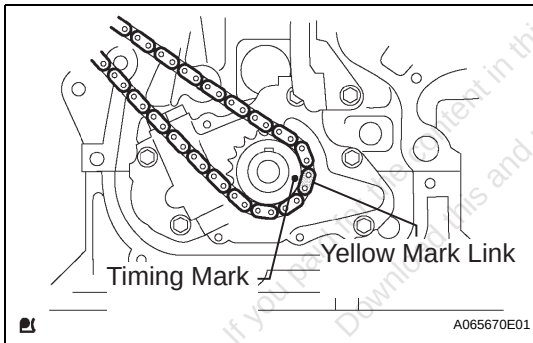
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)

**29. INSTALL CHAIN SUB-ASSEMBLY**

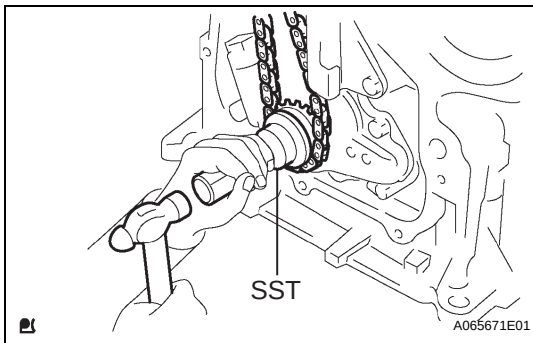
- (a) Set the No. 1 cylinder to the TDC/compression.
 - (1) Turn the hexagonal wrench head portion of the camshafts until the point marks of the 2 camshaft timing gears are aligned.



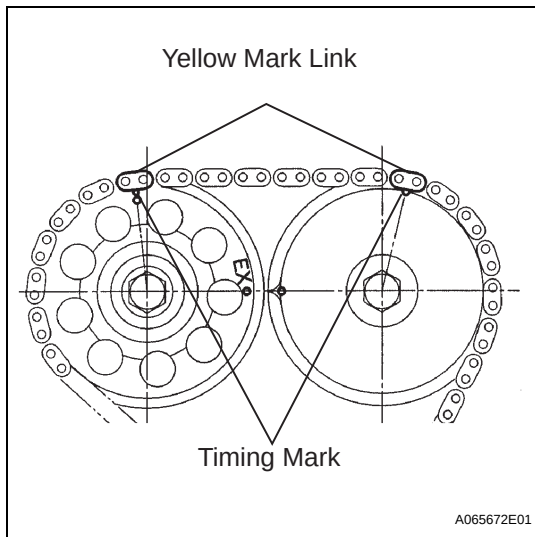
- (2) Using a crankshaft pulley bolt, turn the crankshaft to align the timing gear key with the point mark on the oil pump.



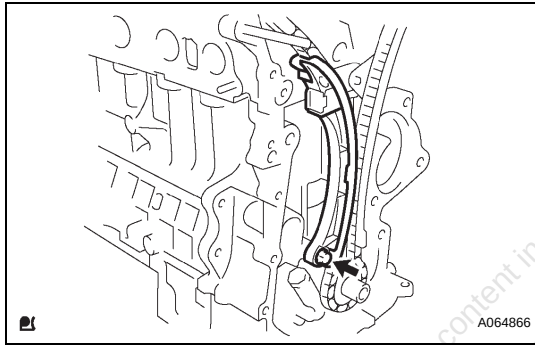
- (b) Install the chain onto the crankshaft timing gear with the yellow mark link aligned with the timing mark on the crankshaft timing gear.



- (c) Using SST, install the crankshaft timing gear.
SST 09223-22010

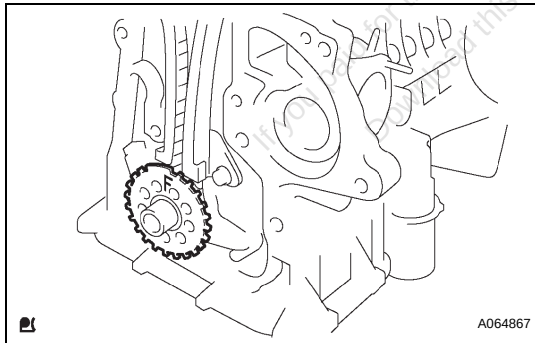


- (d) Install the chain onto the camshaft timing gears with the yellow mark links aligned with the timing marks on the camshaft timing gears.



30. INSTALL CHAIN TENSIONER SLIPPER

- (a) Install the chain tensioner slipper with the bolt.
Torque: 18.5 N*m (189 kgf*cm, 14 ft.*lbf)

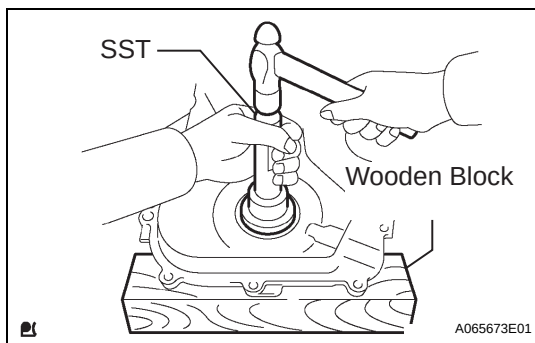


31. INSTALL CRANKSHAFT POSITION SENSOR PLATE NO.1

- (a) Install the crankshaft position sensor plate with the "F" mark facing forward.

32. INSTALL TIMING CHAIN OR BELT COVER OIL SEAL

- (a) Apply a light coat of multi-purpose grease to a new oil seal lip.
 (b) Place the timing chain cover on wooden blocks.



- (c) Using SST, tap the oil seal in until its surface is flush with the timing chain cover edge.

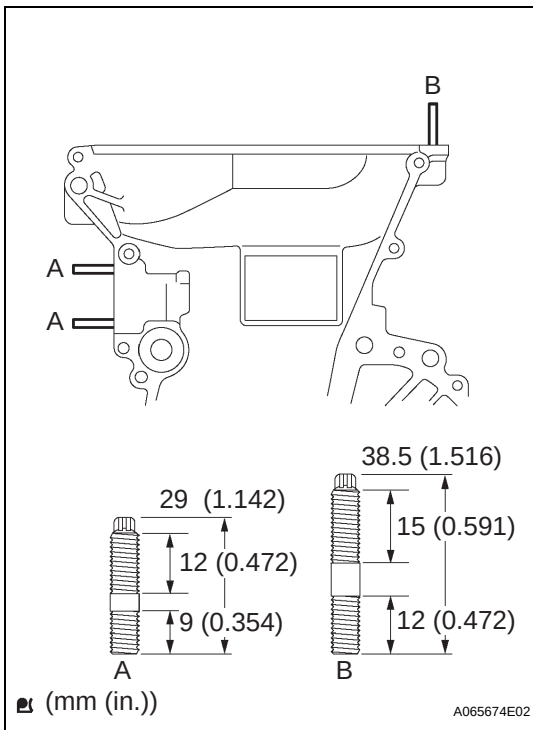
SST 09223-22010

NOTICE:

Keep the lip free off foreign objects.

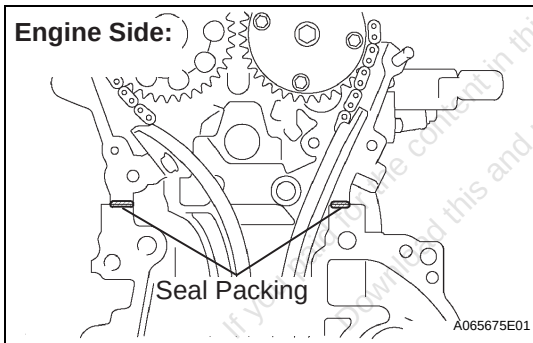
33. INSTALL TIMING CHAIN OR BELT COVER SUB-ASSEMBLY

- (a) Remove any old packing material from the contact surface.



- (b) Using a "TORX" socket wrench E5, install the 3 stud bolts.

Torque: 5.0 N*m (51 kgf*cm, 44 in.*lbf)



- (c) Apply a continuous bead of seal packing (Diameter 3.5 to 4.5 mm (0.138 to 0.177 in.)) as shown in the illustration.

Seal packing:

Water pump part:

**Toyota Genuine Seal Packing Black 1282B,
Three Bond 1282B or equivalent**

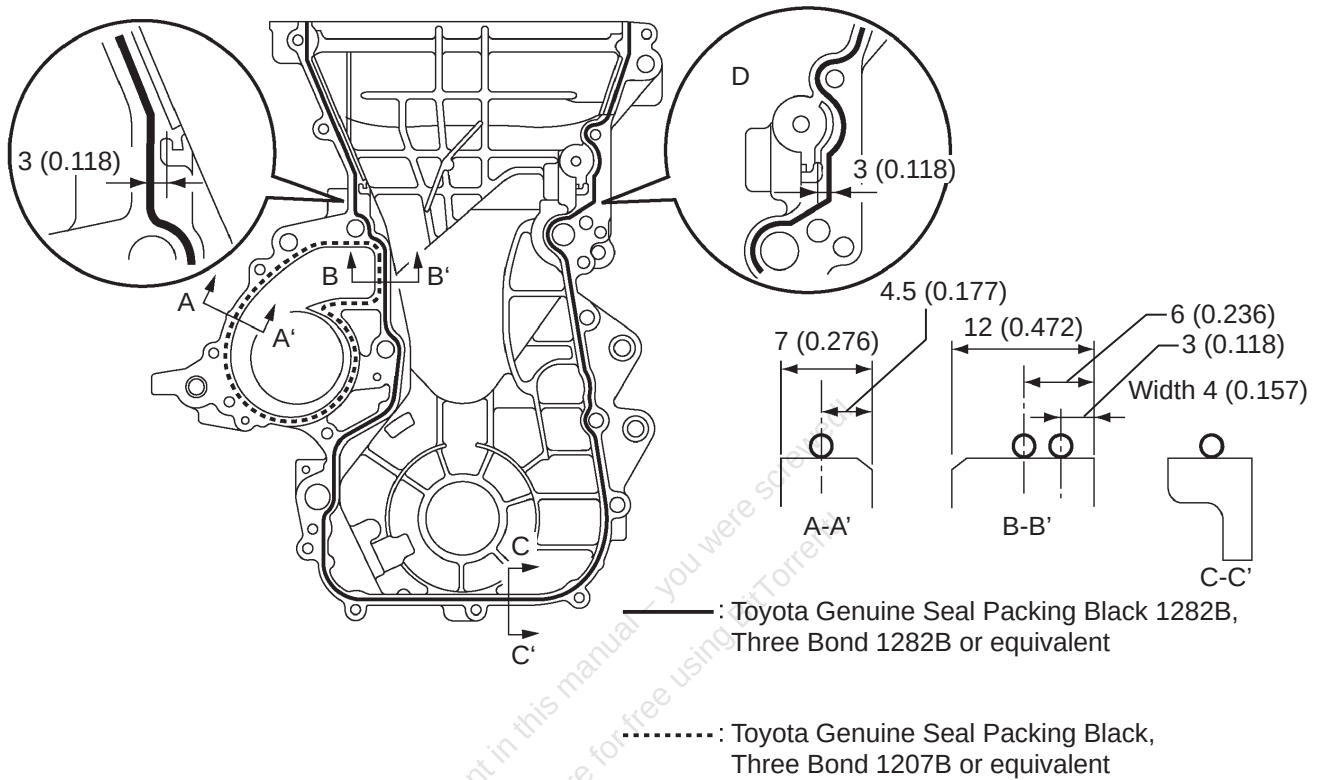
Other part:

**Toyota Genuine Seal Packing Black, Three
Bond 1207B or equivalent**

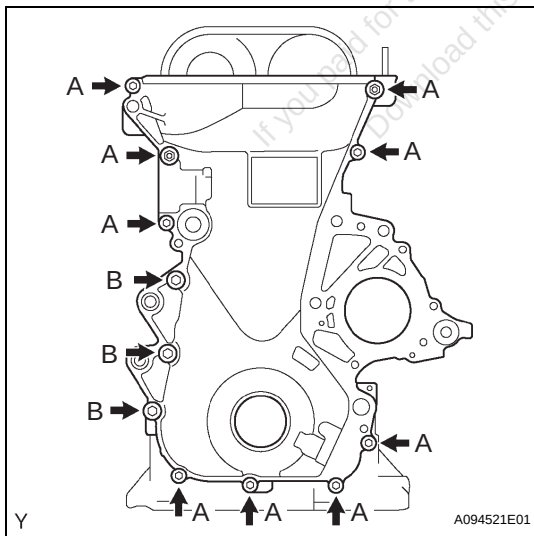
NOTICE:

- Remove any oil from the contact surface.
- Install the chain cover within 3 minutes of applying seal packing.
- Do not start the engine for at least 2 hours after installing the chain cover.
- Be careful to only apply the specified thickness / volume of seal packing in area D.

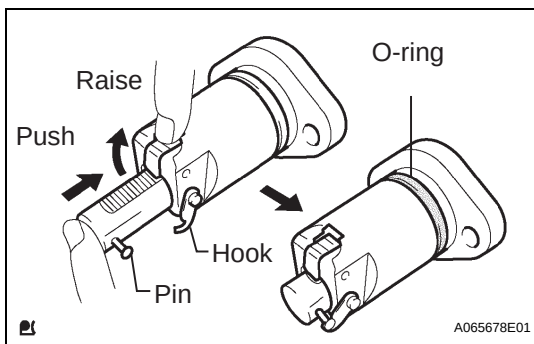
Timing Chain Cover Side:



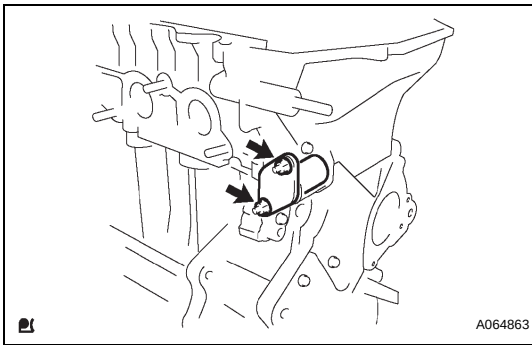
A151432E01



- (d) Install the timing chain cover with the 10 bolts and 2 nuts.

Torque: Bolt A and nut A**13 N*m (133 kgf*cm, 10 ft.*lbf)****Bolt B****18.5 N*m (189 kgf*cm, 14 ft.*lbf)****34. INSTALL CHAIN TENSIONER ASSEMBLY NO.1**

- Check that the O-ring is clean, then set the hook as shown in the illustration.
- Apply a light coat of engine oil to the O-ring.



- (c) Install the chain tensioner with the 2 nuts.

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

NOTICE:

- Be careful not to twist the O-ring.
- When installing the chain tensioner, set the hook again if the hook releases the plunger.

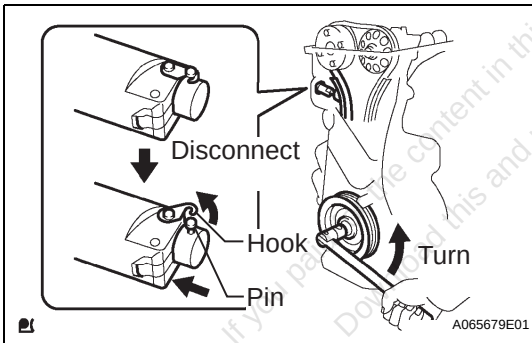
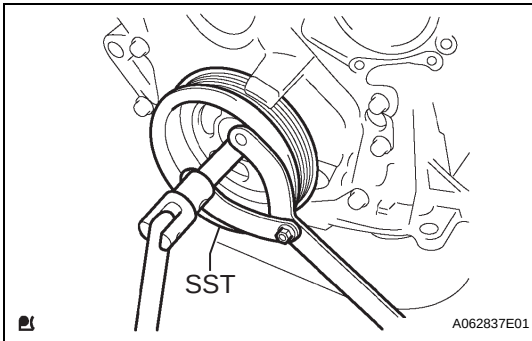
35. INSTALL CRANKSHAFT PULLEY

- (a) Align the pulley set key with the key groove of the crankshaft pulley, then slide on the crankshaft pulley.

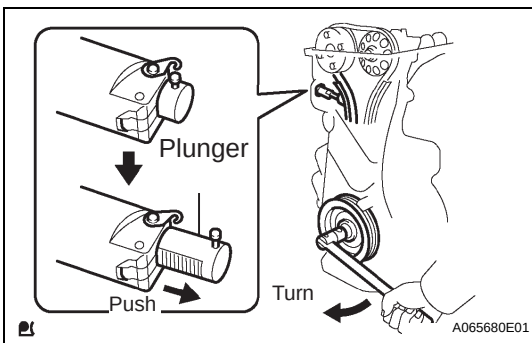
- (b) Using SST, install the crankshaft pulley bolt.

SST 09960-10010 (09962-01000, 09963-01000)

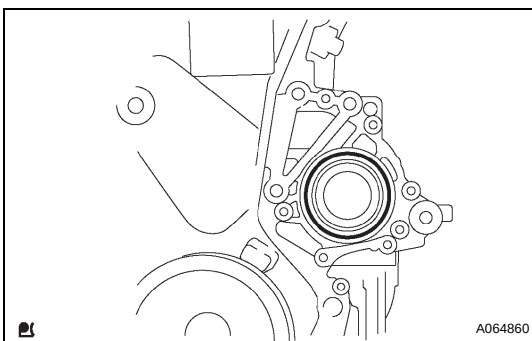
Torque: 138 N*m (1,407 kgf*cm, 102 ft.*lbf)



- (c) Turn the crankshaft counterclockwise to disconnect the plunger knock pin from the hook.



- (d) Turn the crankshaft clockwise, then check that the slipper is pushed by the plunger. If the plunger is not extended, push the slipper into the chain tensioner using a screwdriver so that the hook is released from the knock pin and the plunger can be extended.

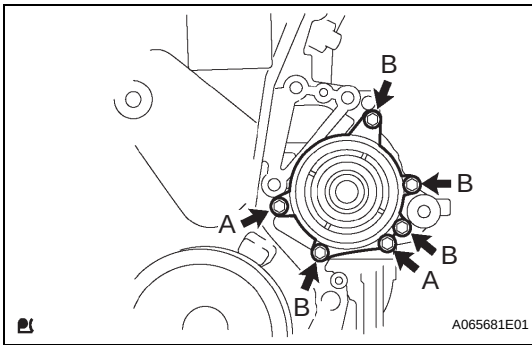


36. INSTALL WATER PUMP O-RING

- (a) Install a new O-ring onto the timing chain cover.

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**37. INSTALL WATER PUMP ASSEMBLY**

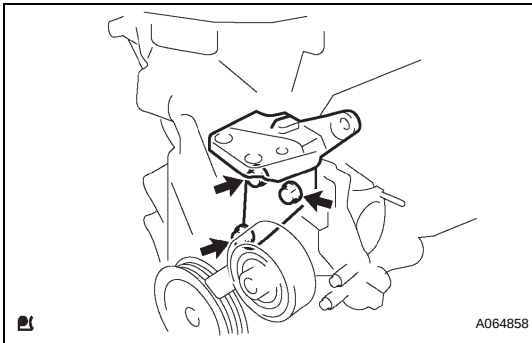
- (a) Install the water pump with the 6 bolts.

Torque: Bolt A

9.0 N*m (92 kgf*cm, 80 in.*lbf)

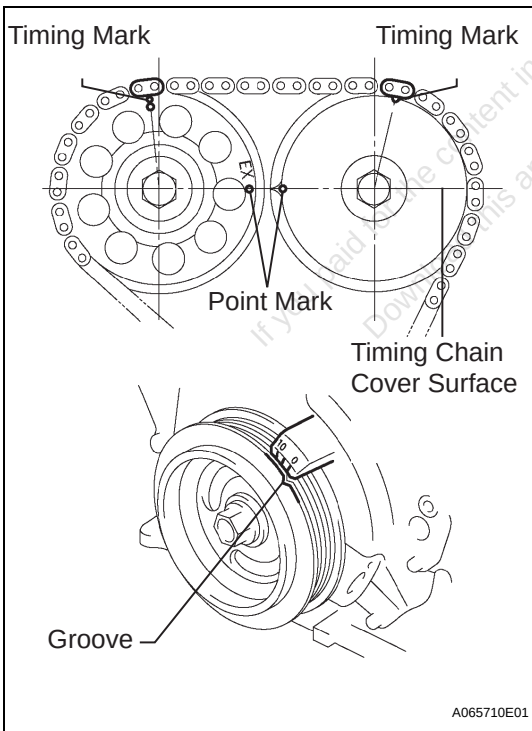
Bolt B

11 N*m (112 kgf*cm, 8 ft.*lbf)

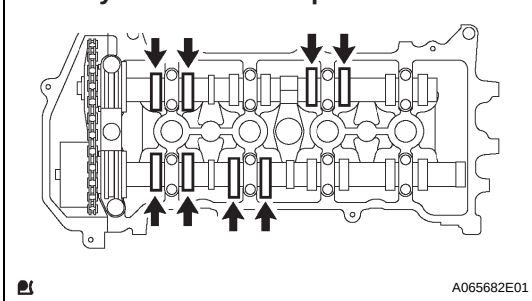
**38. INSTALL ENGINE MOUNTING BRACKET RH**

- (a) Install the engine mounting bracket RH with the 3 bolts.

Torque: 47 N*m (479 kgf*cm, 35 ft.*lbf)

**39. CHECK VALVE CLEARANCE**

- (a) Set the No. 1 cylinder to the TDC/compression.
- (1) Turn the crankshaft pulley until its groove and timing mark "0" of the timing chain cover are aligned.
 - (2) Check that the point marks of the camshaft timing gears are in a straight line on the timing chain cover surface as shown in the illustration. If not, turn the crankshaft 1 revolution (360°) to align the marks as above.

No. 1 Cylinder TDC/Compression:

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

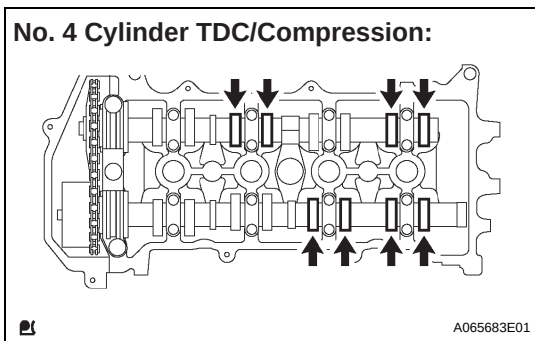
Valve clearance (Cold):

Intake:

0.15 to 0.25 mm (0.0059 to 0.0098 in.)

Exhaust:

0.25 to 0.35 mm (0.0098 to 0.0138 in.)



- (2) Record any out-of-specification valve clearance measurements. They will be used later to determine the required replacement valve lifters.
- (c) Turn the crankshaft 1 revolution (360°) to set the No. 4 the cylinder to the TDC/compression.

- (d) Check only the valves indicated.

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

Valve clearance (Cold):

Intake:

0.15 to 0.25 mm (0.0059 to 0.0098 in.)

Exhaust:

0.25 to 0.35 mm (0.0098 to 0.0138 in.)

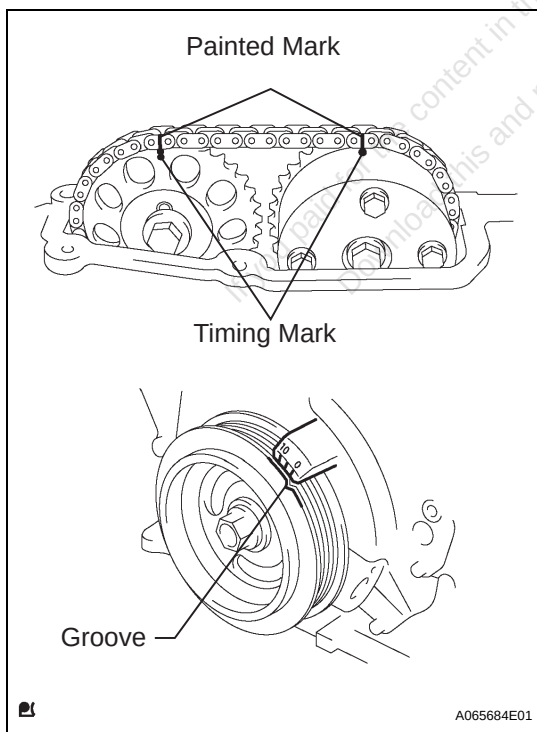
- (2) Record any out-of-specification valve clearance measurements. They will be used later to determine the required replacement valve lifters.

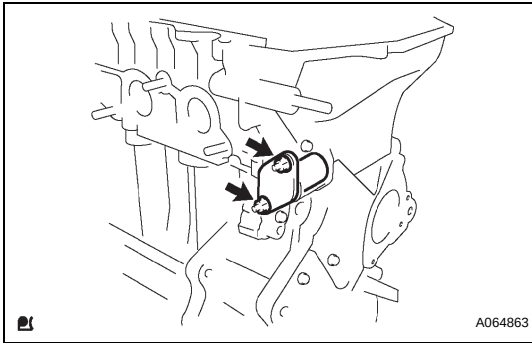
40. ADJUST VALVE CLEARANCE

NOTICE:

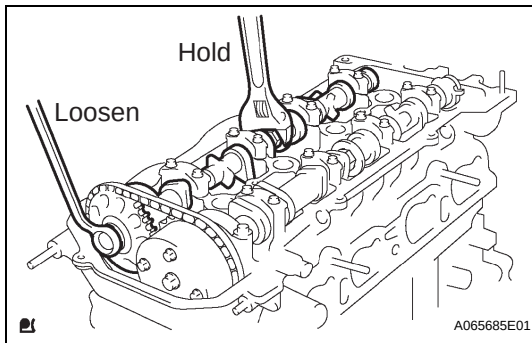
Do not to turn the crankshaft without the chain tensioner.

- (a) Set the No. 1 cylinder to the TDC/compression.
- (b) Place painted marks on the chain and camshaft timing gears.





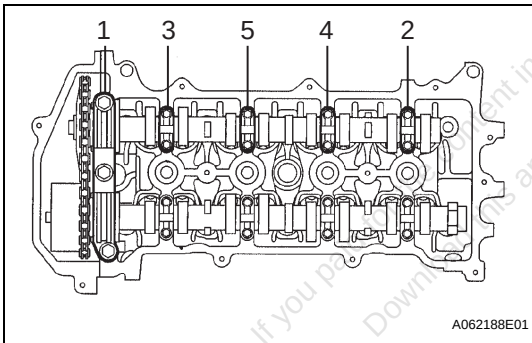
- (c) Remove the 2 nuts, then remove the chain tensioner.



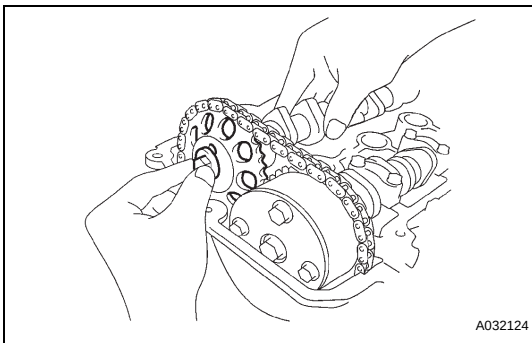
- (d) While holding the camshaft with a wrench, loosen the camshaft timing gear set bolt.

NOTICE:

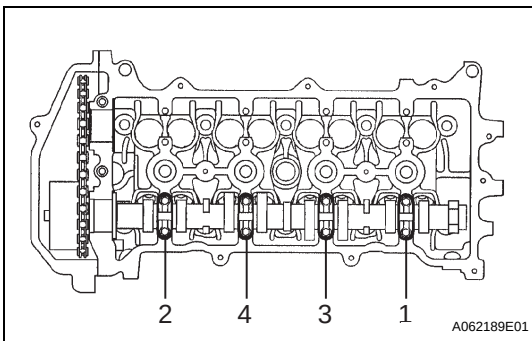
Be careful not to damage the valve lifter.



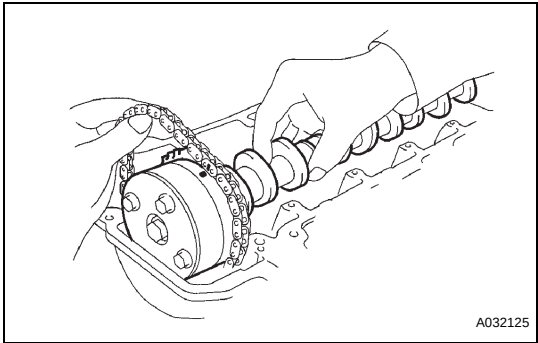
- (e) Using several steps, uniformly loosen and remove the 11 bolts in the sequence shown, then remove the 5 bearing caps.



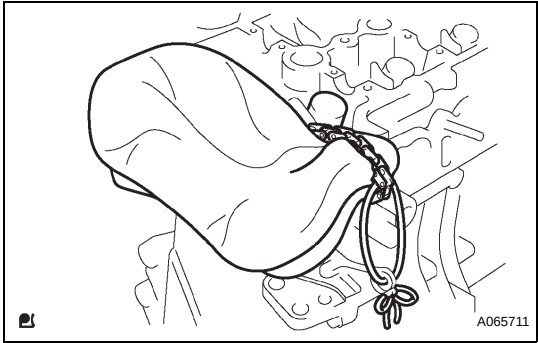
- (f) Remove the camshaft timing gear as shown in the illustration.



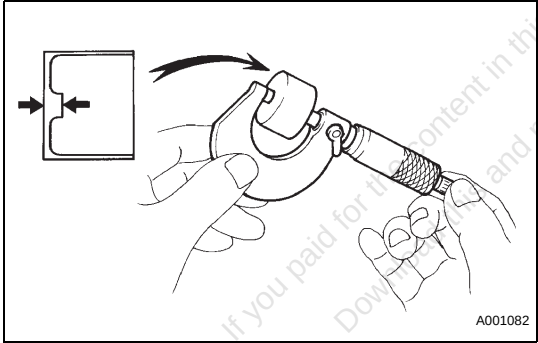
- (g) Using several steps, uniformly loosen and remove the 8 bolts in the sequence shown, then remove the 4 bearing caps.



- (h) Remove the camshaft and camshaft timing gear while holding the timing chain by hand.



- (i) Tie the timing chain with a string as shown in the illustration.
NOTICE:
Be careful not to drop anything inside the timing chain cover.
(j) Remove the valve lifters.



- (k) Using a micrometer, measure the thickness of the removed valve lifters.
(l) Calculate the thickness of a new lifter so that the valve clearance comes within the specified values.

A	Thickness of new lifter
B	Thickness of used lifter
C	Measured valve clearance

Valve clearance:

Intake:

$$A = B + (C - 0.20 \text{ mm (0.0079 in.)})$$

Exhaust:

$$A = B + (C - 0.30 \text{ mm (0.0118 in.)})$$

Example (Intake):
Measured intake valve clearance = 0.40 mm (0.0158 in.)
 $0.40 \text{ mm (0.0158 in.)} - 0.20 \text{ mm (0.0079 in.)} = 0.20 \text{ mm (0.0079 in.)}$
(Measured - Specification = Excess clearance)
Used lifter measurement = 5.250 mm (0.2067 in.)
 $0.20 \text{ mm (0.0079 in.)} + 5.250 \text{ mm (0.2067 in.)} = 5.450 \text{ mm (0.2146 in.)}$
(Excess clearance + Used lifter = Ideal new lifter)
Closest new lifter = 5.460 mm (0.2150 in.)
Select No. 46 lifter

HINT:

- Select a new lifter with a thickness as close to the calculated values as possible.
- 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.).
- Refer to the New Lifter Thickness table on the next 2 pages.

[illegible]

The 5.250 mm (0.2067 in.) lifter is installed, and the measured clearance is 0.400 mm (0.0157 in.).

Replace the 5.250 mm (0.2067 in.) lifter with a new No. 46 lifter.

New Lifter Thickness mm (in.)

Lifter No.	Thickness	Lifter No.	Thickness	Lifter 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)		

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Valve Lifter Selection Chart (Exhaust)

		Measured Clearance mm (in.)																Installed Shim Thickness mm (in.)	
0.000 - 0.030 (0.0000 - 0.0012)																			5.060 (0.1992)
0.031 - 0.050 (0.0012 - 0.0020)																			5.080 (0.2000)
0.051 - 0.070 (0.0020 - 0.0028)																			5.100 (0.2008)
0.071 - 0.090 (0.0028 - 0.0035)																			5.120 (0.2016)
0.091 - 0.110 (0.0036 - 0.0043)																			5.140 (0.2024)
0.111 - 0.130 (0.0044 - 0.0051)																			5.160 (0.2031)
0.131 - 0.150 (0.0052 - 0.0059)																			5.180 (0.2039)
0.151 - 0.170 (0.0059 - 0.0067)																			5.200 (0.2047)
0.171 - 0.190 (0.0067 - 0.0075)																			5.210 (0.2051)
0.191 - 0.210 (0.0075 - 0.0083)																			5.220 (0.2055)
0.211 - 0.230 (0.0083 - 0.0091)																			5.230 (0.2059)
0.231 - 0.249 (0.0091 - 0.0098)																			5.240 (0.2063)
0.250 - 0.350 (0.0098 - 0.0138)																			5.250 (0.2067)
0.351 - 0.370 (0.0138 - 0.0146)																			5.260 (0.2071)
0.371 - 0.390 (0.0146 - 0.0154)																			5.270 (0.2075)
0.391 - 0.410 (0.0154 - 0.0161)																			5.280 (0.2079)
0.411 - 0.430 (0.0162 - 0.0169)																			5.290 (0.2083)
0.431 - 0.450 (0.0170 - 0.0177)																			5.300 (0.2087)
0.451 - 0.470 (0.0178 - 0.0185)																			5.310 (0.2091)
0.471 - 0.490 (0.0185 - 0.0193)																			5.320 (0.2094)
0.491 - 0.510 (0.0193 - 0.0201)																			5.330 (0.2098)
0.511 - 0.530 (0.0201 - 0.0209)																			5.340 (0.2102)
0.531 - 0.550 (0.0209 - 0.0217)																			5.350 (0.2106)
0.551 - 0.570 (0.0217 - 0.0224)																			5.360 (0.2110)
0.571 - 0.590 (0.0225 - 0.0232)																			5.370 (0.2114)
0.591 - 0.610 (0.0233 - 0.0240)																			5.380 (0.2118)
0.611 - 0.630 (0.0241 - 0.0248)																			5.390 (0.2122)
0.631 - 0.650 (0.0248 - 0.0256)																			5.400 (0.2126)
0.651 - 0.670 (0.0256 - 0.0264)																			5.410 (0.2130)
0.671 - 0.690 (0.0264 - 0.0272)																			5.420 (0.2134)
0.691 - 0.710 (0.0272 - 0.0280)																			5.430 (0.2138)
0.711 - 0.730 (0.0280 - 0.0287)																			5.440 (0.2142)
0.731 - 0.750 (0.0288 - 0.0295)																			5.450 (0.2146)
0.751 - 0.770 (0.0296 - 0.0303)																			5.460 (0.2150)
0.771 - 0.790 (0.0304 - 0.0311)																			5.470 (0.2154)
0.791 - 0.810 (0.0311 - 0.0319)																			5.480 (0.2157)
0.811 - 0.830 (0.0319 - 0.0327)																			5.490 (0.2161)
0.831 - 0.850 (0.0327 - 0.0335)																			5.500 (0.2165)
0.851 - 0.870 (0.0335 - 0.0343)																			5.510 (0.2169)
0.871 - 0.890 (0.0343 - 0.0350)																			5.520 (0.2173)
0.891 - 0.910 (0.0351 - 0.0358)																			5.530 (0.2177)
0.911 - 0.930 (0.0359 - 0.0366)																			5.540 (0.2181)
0.931 - 0.950 (0.0367 - 0.0374)																			5.550 (0.2185)
0.951 - 0.970 (0.0374 - 0.0382)																			5.560 (0.2189)
0.971 - 0.990 (0.0382 - 0.0390)																			5.570 (0.2193)
0.991 - 1.010 (0.0390 - 0.0398)																			5.580 (0.2197)
1.011 - 1.030 (0.0398 - 0.0406)																			5.590 (0.2201)
																			5.600 (0.2205)
																			5.620 (0.2213)
																			5.640 (0.2220)
																			5.660 (0.2228)
																			5.680 (0.2236)
																			5.700 (0.2244)
																			5.720 (0.2252)
																			5.740 (0.2260)

Exhaust valve clearance (Cold):
0.25 to 0.35 mm (0.0098 to 0.0138 in.)

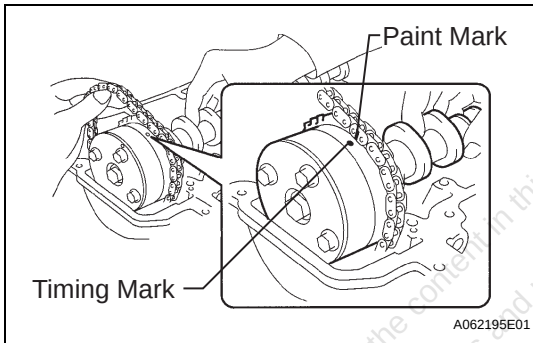
EXAMPLE:

The 5.340 mm (0.2102 in.) lifter is installed, and the measured clearance is 0.440 mm (0.0173 in.).

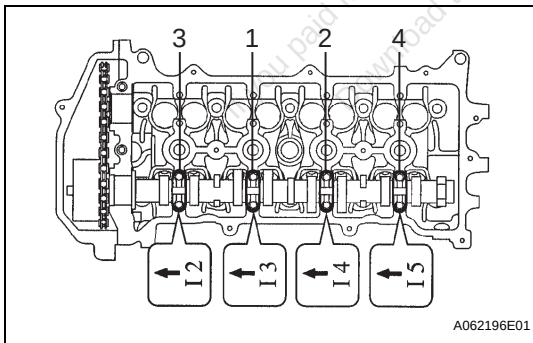
Replace the 5.340 mm (0.2102 in.) lifter with a new No. 48 lifter.

New Lifter Thickness mm (in.)

Lifter No.	Thickness	Lifter No.	Thickness	Lifter 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)		

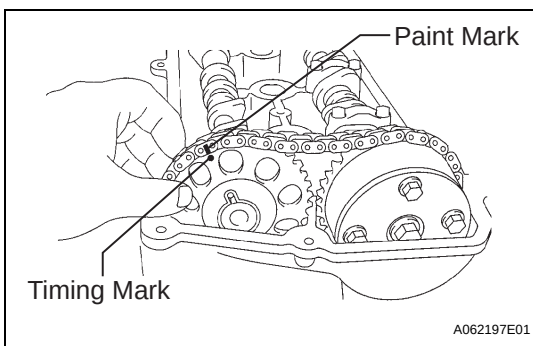


- (m) Install the timing chain onto the camshaft timing gear with the paint mark aligned with the timing mark on the camshaft timing gear as shown in the illustration.

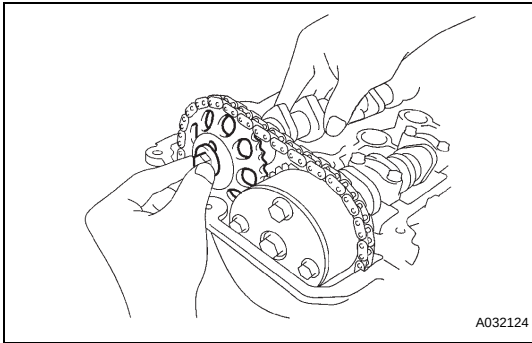


- (n) Examine the front marks and numbers and check that the sequence order is as shown in the illustration. Then tighten the bolts.

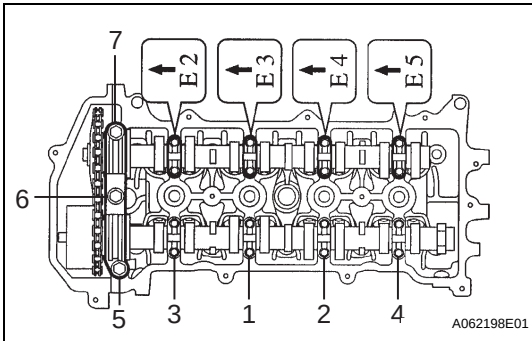
Torque: 13 N*m (133 kgf*cm, 10 ft.*lbf)



- (o) Put the No. 2 camshaft on the cylinder head with the paint mark of the chain aligned with the timing mark on the camshaft timing gear.



- (p) Temporarily install the camshaft timing gear set bolt.

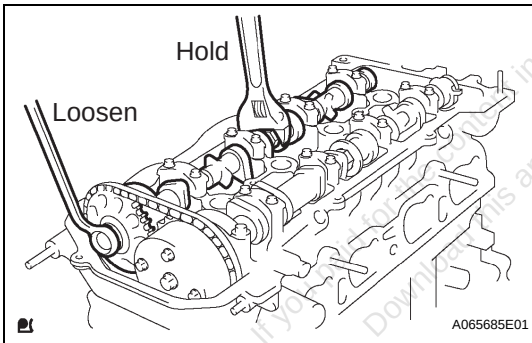


- (q) Examine the front marks and numbers and check that the sequence order is as shown in the illustration. Then tighten the bolts.

Torque: 13 N*m (133 kgf*cm, 10 ft.*lbf)

- (r) Install the bearing cap No. 1.

Torque: 23 N*m (235 kgf*cm, 17 ft.*lbf)

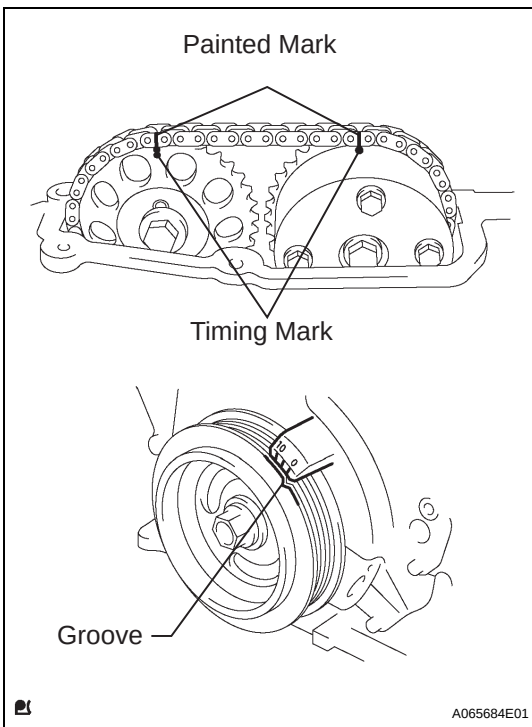


- (s) While holding the camshaft with a wrench, tighten the camshaft timing gear set bolt.

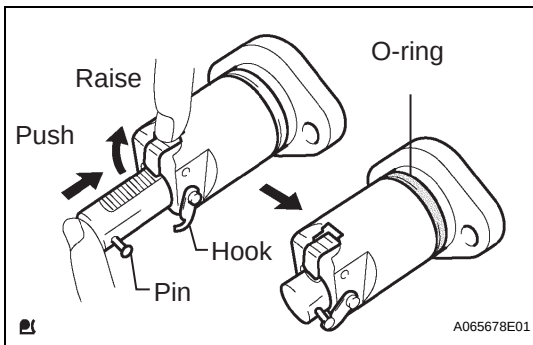
Torque: 54 N*m (551 kgf*cm, 40 ft.*lbf)

NOTICE:

Be careful not to damage the valve lifter.

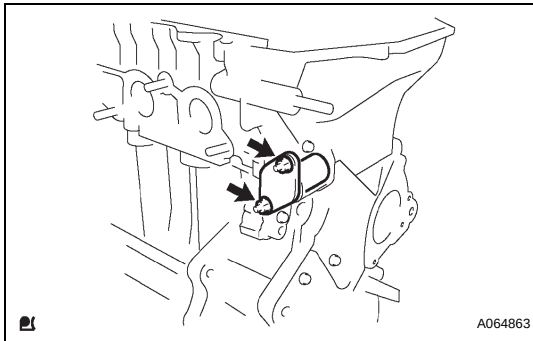


- (t) Check that each timing mark is aligned with its corresponding painted mark on the timing chain as shown in the illustration. Also, check that the groove is aligned with timing mark "0" of the timing chain cover.



(u) Install the chain tensioner.

- (1) Check that the O-ring is clean, and set the hook as shown in the illustration.
- (2) Apply a light coat of engine oil to the O-ring.

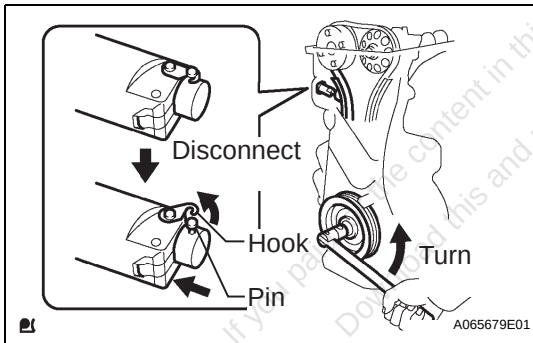


(3) Install the chain tensioner with the 2 nuts.

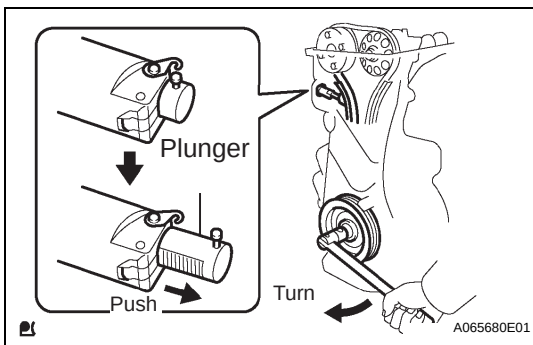
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)

NOTICE:

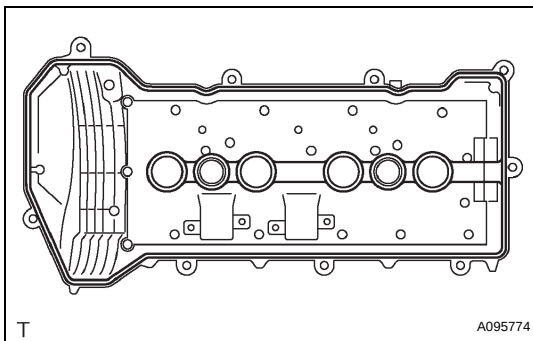
- Be careful not to twist the O-ring.
- When installing the chain tensioner, set the hook again if the hook releases the plunger.



(4) Turn the crankshaft counterclockwise to disconnect the plunger knock pin from the hook.



(5) Turn the crankshaft clockwise, then check that the slipper is pushed by the plunger. If the plunger is not extended, push the slipper into the chain tensioner using a screwdriver so that the hook is released from the knock pin and the plunger can be extended.

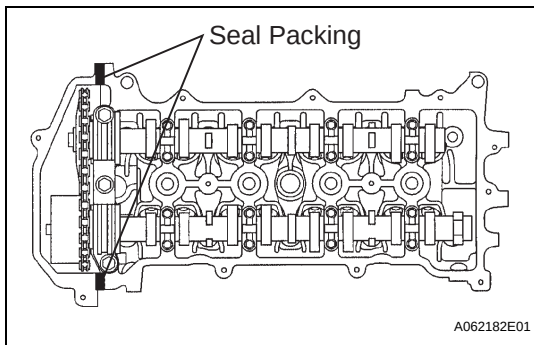


41. INSTALL CYLINDER HEAD COVER GASKET

- (a) Install the gasket onto the cylinder head cover.

42. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY

- (a) Remove any old packing material from the contact surface.



- (b) Apply seal packing to the 2 locations as shown in the illustration.

Seal packing:

Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent

NOTICE:

- Remove any oil from the contact surface.
- Install the cylinder head cover within 3 minutes of applying the seal packing.
- Do not put in engine oil for at least 2 hours after installation.

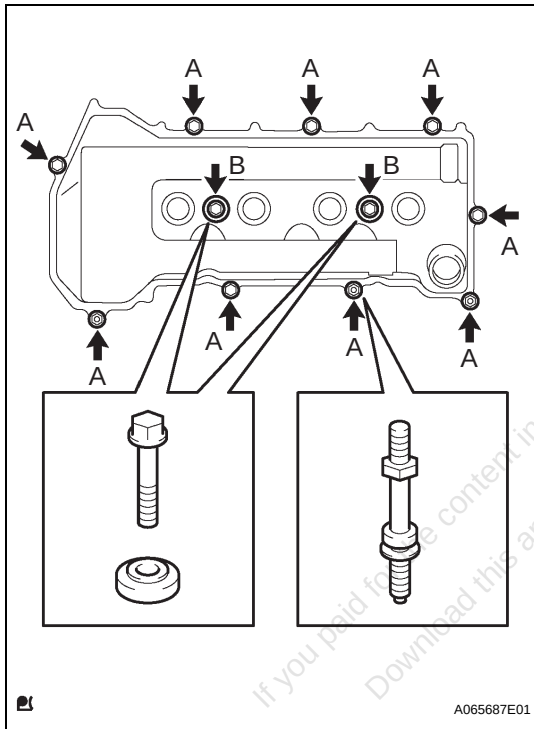
- (c) Install the cylinder head cover with the 9 bolts, 2 seal washers and 2 nuts.

Torque: Bolt A and nut A

11 N*m (112 kgf*cm, 8 ft.*lbf)

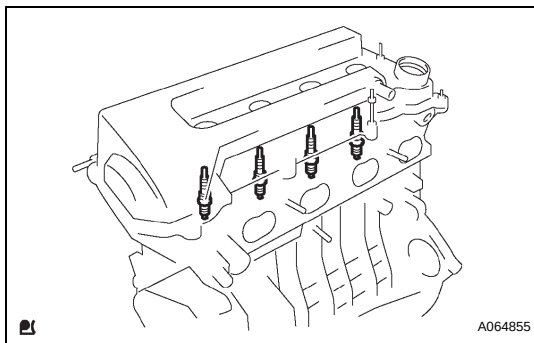
Bolt B

9.0 N*m (92 kgf*cm, 80 in.*lbf)



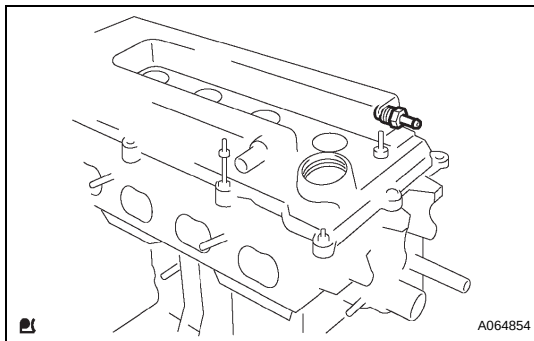
43. INSTALL SPARK PLUG

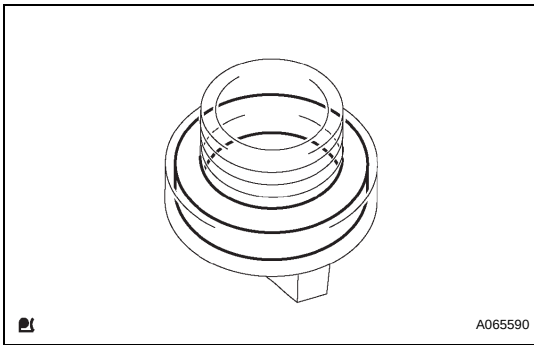
- (a) Using a spark plug wrench, install the spark plugs.
Torque: 25 N*m (255 kgf*cm, 18 ft.*lbf)



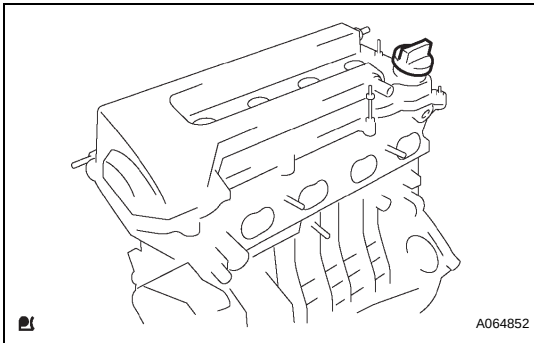
44. INSTALL VENTILATION VALVE SUB-ASSEMBLY

- (a) Install the ventilation valve onto the cylinder head cover.
Torque: 30 N*m (306 kgf*cm, 22 ft.*lbf)



**45. INSTALL OIL FILLER CAP GASKET**

- (a) Install the gasket onto the oil filler cap.

**46. INSTALL OIL FILLER CAP SUB-ASSEMBLY**

- (a) Install the oil filler cap onto the cylinder head cover.