

OVERHAUL

1. REMOVE SPARK PLUG

2. REMOVE OIL FILLER CAP SUB-ASSY

3. REMOVE CYLINDER HEAD COVER SUB-ASSY

- (a) Remove the 9 bolts, 9 seal washers, cylinder head cover and gasket.

4. REMOVE IDLER PULLEY SUB-ASSY NO. 2

- (a) Remove the pulley bolt, cover plate and idler pulley.

5. REMOVE TIMING BELT COVER SUB-ASSY NO. 2

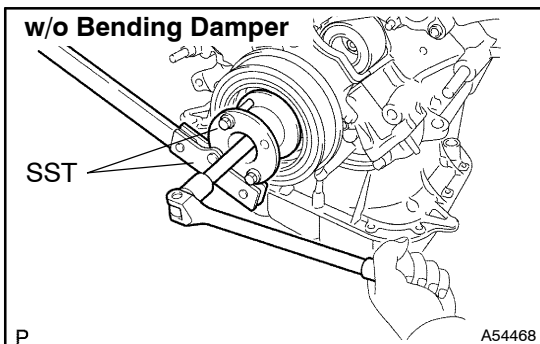
- (a) Remove the 2 bolts and timing belt cover.

6. REMOVE V-RIBBED BELT TENSIONER ASSY

- (a) Remove the bot, 2 nuts and belt tensioner.

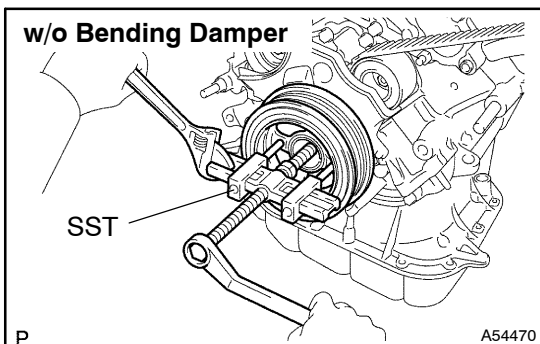
7. REMOVE IDLER PULLEY ASSY

- (a) Remove the 2 bots, 2 nuts and idler pulley.

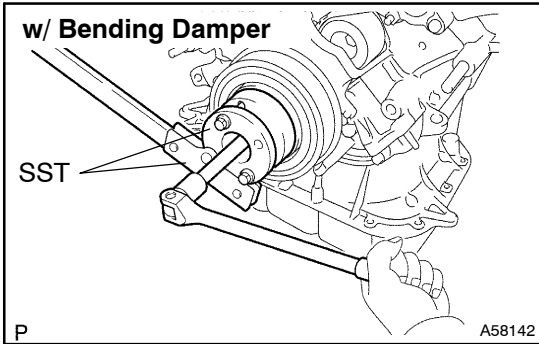


8. REMOVE CRANKSHAFT DAMPER SUB-ASSY

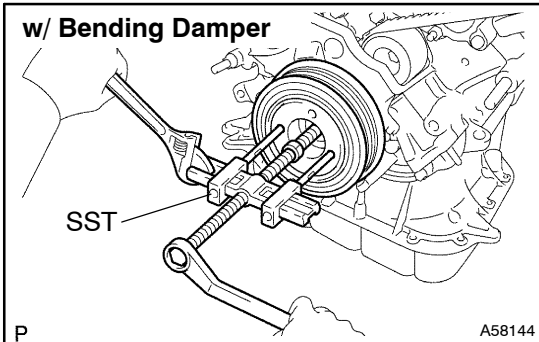
- (a) w/o Bending Damper:
Remove the crankshaft damper.
(1) Using SST, remove the damper bolt.
SST 09213-70011, 09330-00021



- (2) Using SST, remove the crankshaft damper.
SST 09950-50013 (09951-05010, 09952-05010,
09953-05010, 09953-05020, 09954-05021)



- (b) w/ Bending Damper:
Remove the crankshaft damper.
- (1) Using SST, remove the damper bolt.
SST 09213-54015, 09213-58013 (90105-08076),
09330-00021



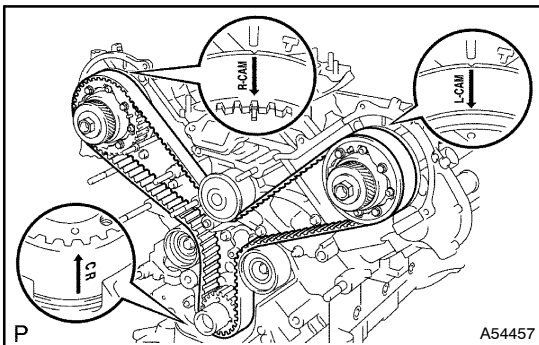
- (2) Using SST, remove the crankshaft damper.
SST 09950-50013 (09951-05010, 09952-05010,
09953-05010, 09953-05020, 09954-05030)

9. REMOVE TIMING BELT NO. 1 COVER

- (a) Remove the 4 bolts and timing belt cover.

10. REMOVE TIMING GEAR COVER SPACER

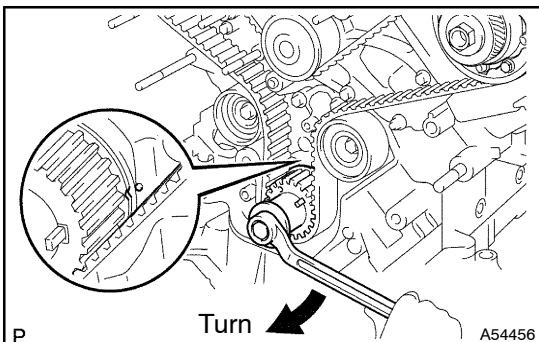
11. REMOVE CRANKSHAFT POSITION SENSOR PLATE NO. 1



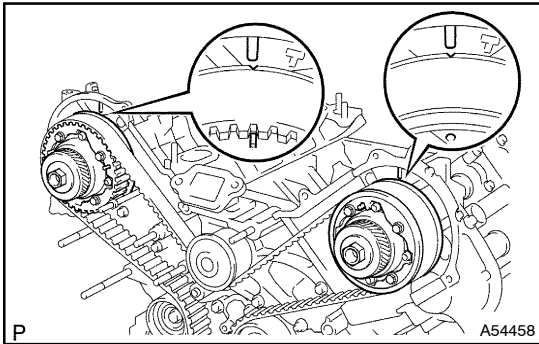
12. REMOVE TIMING BELT

- (1) Check that there are 3 installation marks on the timing belt by turning the crankshaft as shown in the illustration.

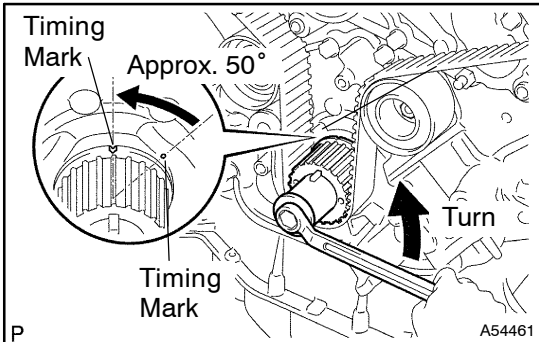
If the installation marks have disappeared, place a new installation mark on the timing belt before removing each part.



- (a) Set the No. 1 cylinder to approx. 50° BTDC/compression.
- (1) Using the crankshaft damper bolt, turn the crankshaft to align the timing marks of the crankshaft timing pulley and oil pump body.



- (2) Check that the timing marks of the camshaft timing pulleys and timing belt plates aligned. If not, turn the crankshaft 1 revolution (360°).

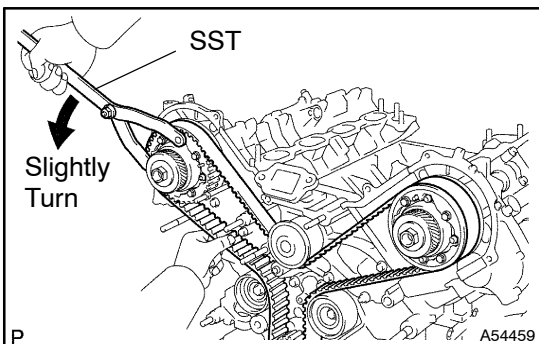


- (3) Using the crankshaft damper bolt, turn the crankshaft counterclockwise by approx. 50°.

NOTICE:

If the timing belt is disengaged, having the crankshaft pulley at the wrong angle can cause the piston head and valve head to come into contact with each other when you remove the camshaft timing pulley (steps 19. and 20.) and camshaft (steps 21. and 22.), causing damage. So always set the crankshaft pulley at the correct angle.

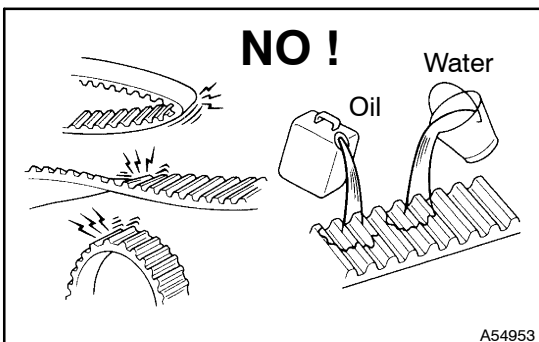
- (b) Alternately loosen the 2 bolts, and remove them, the belt tensioner and dust boot.



- (c) Using SST, loosen the tension between the camshaft timing pulley (RH bank) and crankshaft timing pulley by slightly turning the camshaft timing pulley counterclockwise.

SST 09960-10010 (09962-01000, 09963-00350)

- (d) Disconnect the timing belt from the timing belt idler No. 1, and remove the timing belt.

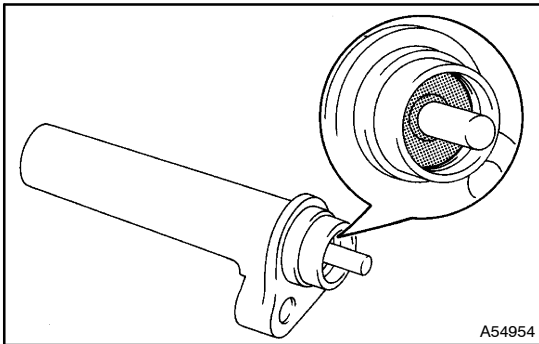
**13. INSPECT TIMING BELT****NOTICE:**

- Do not bend, twist or turn the timing belt inside out.
- Do not allow the timing belt to come into contact with oil, water or steam.
- Do not utilize timing belt tension when installing or removing the mount bolt of the camshaft timing pulley.

If there are any defects, as shown in the illustrations, check these points:

- (a) Premature parting
- Check for proper installation.
 - Check the timing cover gasket for damage and proper installation.

- (b) If the belt teeth are cracked or damaged, check to see if either camshaft is locked.
 - (c) If there is noticeable wear or cracks on the belt face, check to see if there are nicks on the side of the idler pulley lock and water pump.
 - (d) If there is wear or damage on only one side of the belt, check the belt guide and the alignment of each pulley.
 - (e) If there is noticeable wear on the belt teeth, check timing cover for damage and check gasket has been installed correctly and for foreign material on the pulley teeth.
- If necessary, replace the timing belt.



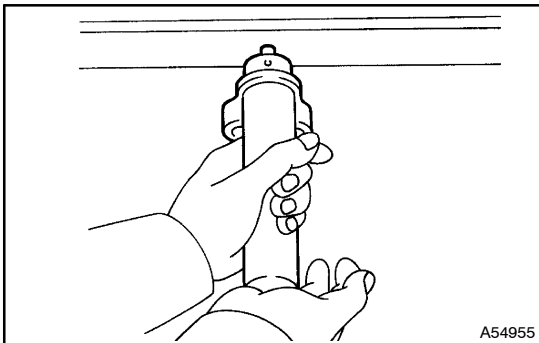
14. INSPECT TIMING BELT TENSIONER

- (a) Visually check the seal portion of the tensioner for oil leakage.

HINT:

If there is only the faintest trace of oil on the seal on the push rod side, the tensioner is all right.

If leakage is found, replace the tensioner.

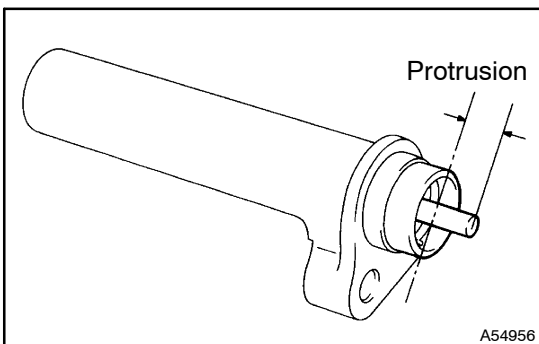


- (b) Hold the tensioner with both hands and push the push rod strongly as shown to check that it doesn't move.

If the push rod moves, replace the tensioner.

NOTICE:

Never hold the tensioner push rod facing downward.



- (c) Measure the protrusion of the push rod from the housing end.

Protrusion: 9.5 – 10.5 mm (0.374 – 0.413 in.)

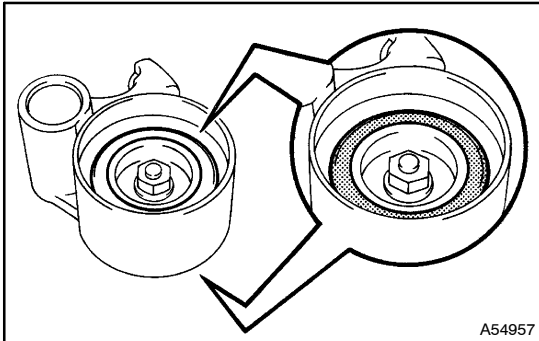
If the protrusion is not as specified, replace the tensioner.

15. REMOVE TIMING BELT IDLER SUB-ASSY NO. 1

- (a) Using a 10 mm hexagon wrench, remove the bolt, idler and plate washer.

16. REMOVE TIMING BELT IDLER SUB-ASSY NO. 2

- (a) Remove the bolt and idler.

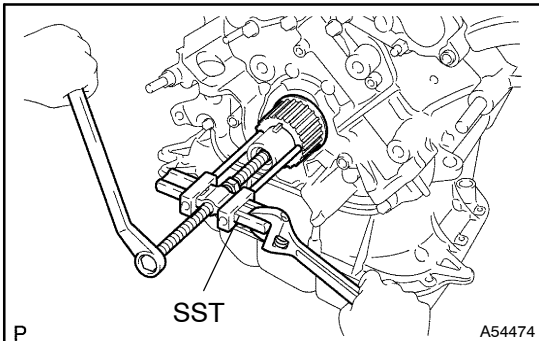


17. INSPECT TIMING BELT IDLER

- (a) Visually check the seal portion of the idler pulley for oil leakage.

If leakage is found, replace the idler pulley.

- (b) Check that the idler pulley turns smoothly.
If necessary, replace the idler.

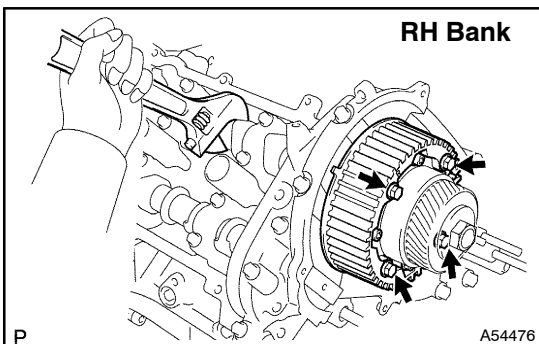


18. REMOVE CRANKSHAFT TIMING PULLEY

- (a) Using SST, remove the timing pulley.
SST 09950-50013 (09951-05010, 09952-05010, 09953-05010, 09953-05020, 09954-05010)

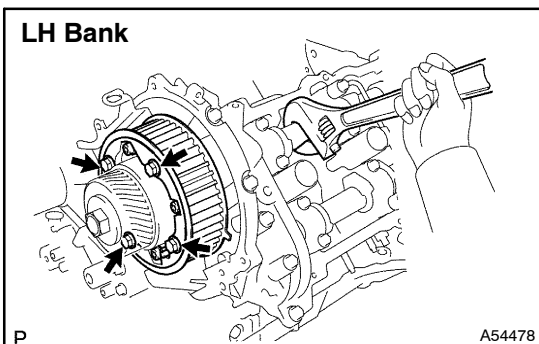
NOTICE:

Do not turn the timing pulley.



19. REMOVE CAMSHAFT TIMING PULLEY

- (a) Remove the 4 bolts and timing pulley.



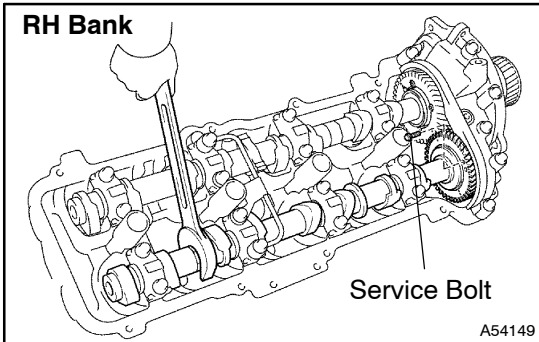
20. REMOVE CAMSHAFT TIMING PULLEY SUB-ASSY LH

- (a) Remove the 4 bolts and timing pulley.

21. REMOVE CAMSHAFT

NOTICE:

Since 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 receiving 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.



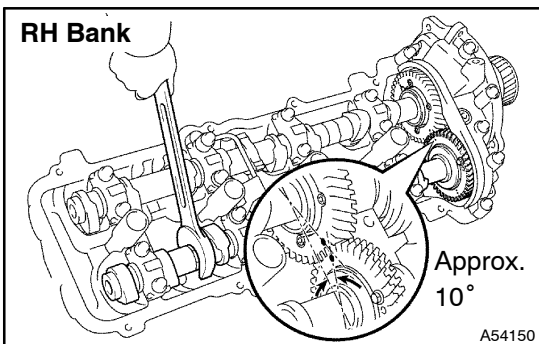
- (a) Remove the camshafts of the RH bank.
- (1) Boring the service bolt hole of the sub gear upward by turning the hexagon wrench head portion of the No. 2 camshaft with a wrench.
 - (2) Secure the sub gear to the main gear with a service bolt.

Recommended service bolt:

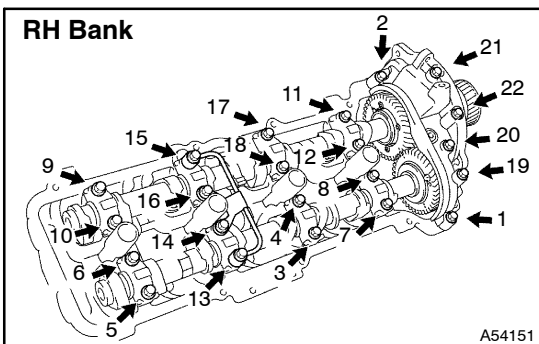
Thread diameter	6 mm
Thread pitch	1.0 mm
Bolt length	16 - 20 mm (0.63 - 0.79 in.)

HINT:

When removing the camshafts, make sure that the torsional spring force of the sub gear has been eliminated by the above operation.



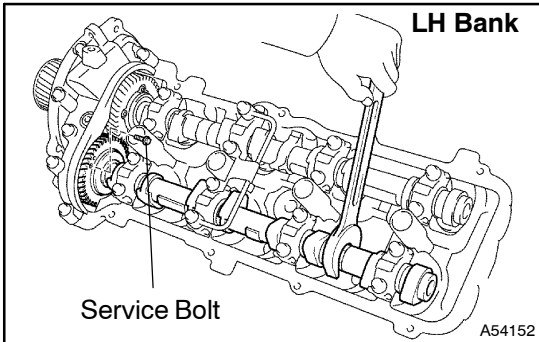
- (3) Set the timing mark (1 dot mark) of the camshaft main gear at approx. 10° angle by turning the hexagon wrench head portion of the No. 2 camshaft with a wrench.



- (4) Uniformly loosen the 22 bearing cap bolts in several passes, in the sequence shown.
- (5) Remove the 22 bearing cap bolts, 4 seal washers, oil feed pipe, 9 bearing caps, camshaft housing plug, oil control valve filter and 2 camshafts.

22. REMOVE NO. 3 CAMSHAFT SUB-ASSY**NOTICE:**

Since 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 receiving 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.



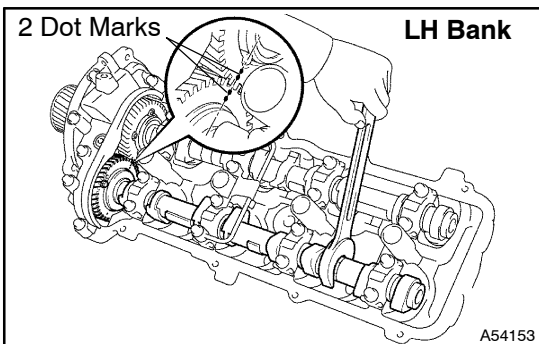
- (a) Remove the camshafts of the LH bank.
- (1) Boring the service bolt hole of the sub gear upward by turning the hexagon wrench head portion of the No. 4 camshaft with a wrench.
 - (2) Secure the sub gear to the main gear with a service bolt.

Recommended service bolt:

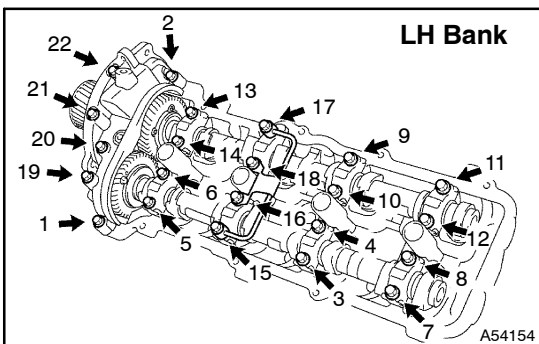
Thread diameter	6 mm
Thread pitch	1.0 mm
Bolt length	16 - 20 mm (0.63 - 0.79 in.)

HINT:

When removing the camshaft, make sure that the torsional spring force of the sub gear has been eliminated by the above operation.



- (3) Align the timing mark (2 dot marks) of the camshaft drive gear by turning the hexagon wrench head portion of the No. 4 camshaft with a wrench.



- (4) Uniformly loosen the 22 bearing cap bolts in several passes, in the sequence shown.
- (5) Remove the 22 bearing cap bolts, 4 seal washers, oil feed pipe, 9 bearing caps, camshaft housing plug, oil control valve filter and 2 camshafts.

23. REMOVE SEMICIRCULAR PLUG**24. REMOVE TIMING BELT PLATE RR RH NO. 2**

- (a) Remove the 2 bolts and timing belt plate.

25. REMOVE TIMING BELT PLATE RR RH

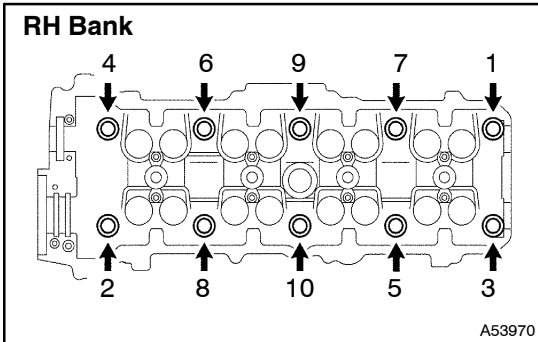
- (a) Remove the bolt, stud bolt and timing belt plate.

26. REMOVE TIMING BELT PLATE RR LH NO. 2

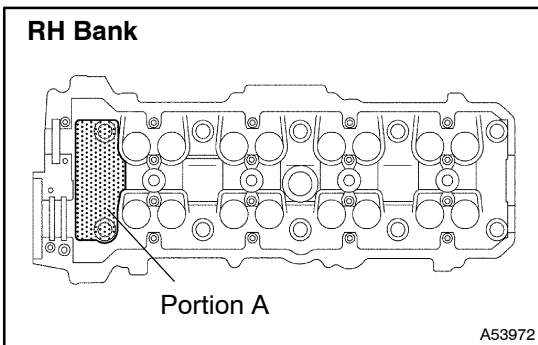
- (a) Remove the 2 bolts and timing belt plate.

27. REMOVE TIMING BELT PLATE RR LH

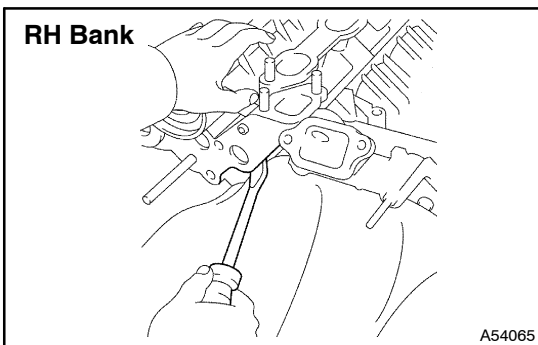
- (a) Remove the bolt and timing belt plate.

**28. REMOVE CYLINDER HEAD SUB-ASSY**

- (a) Uniformly loosen the 10 cylinder head bolts on one side of each cylinder head in several passes, in the sequence shown.

**NOTICE:**

- **Cylinder head warpage or cracking could result from removing bolts in incorrect order.**
- **Do not drop the plate washer for cylinder head bolt into portion A of the cylinder head. If dropped into portion A, the plate washer will pass through the cylinder head and cylinder block into the oil pan.**



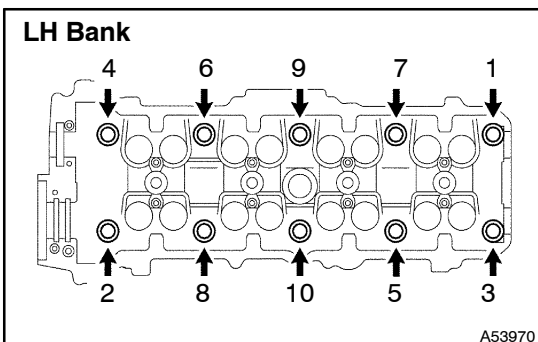
- (b) Lift the cylinder head from the dowels on the cylinder block, and place the cylinder head on wooden blocks on a bench.

HINT:

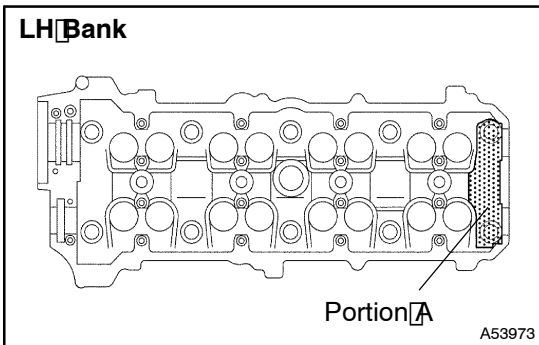
If the cylinder head is lift off, pry between the cylinder head and cylinder block with a screwdriver.

NOTICE:

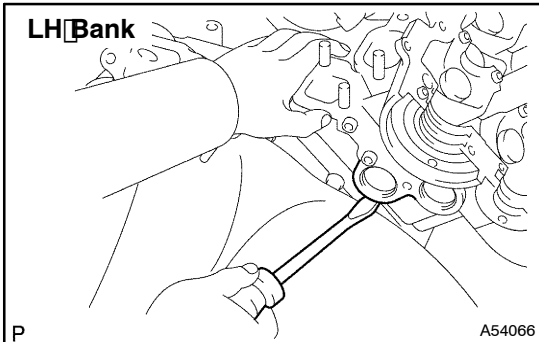
Be careful not to damage the contact surfaces of the cylinder head and cylinder block.

**29. REMOVE CYLINDER HEAD LH**

- (a) Uniformly loosen the 10 cylinder head bolts on one side of each cylinder head in several passes, in the sequence shown.

**NOTICE:**

- Cylinder head warpage or cracking could result from removing bolts in incorrect order.
- Do not drop the plate washer for cylinder head bolt into portion A of the cylinder head. If dropped into portion A, the plate washer will pass through the cylinder head and cylinder block into the oil pan.



- (b) Lift the cylinder head from the dowels on the cylinder block, and place the cylinder head on wooden blocks on a bench.

HINT:

If the cylinder head is lifted off, pry between the cylinder head and cylinder block with a screwdriver.

NOTICE:

Be careful not to damage the contact surfaces of the cylinder head and cylinder block.

30. REMOVE WATER PUMP ASSY

- (a) Remove the 5 bolts, 2 stud bolts and nut, water pump and gasket.

31. REMOVE OIL PAN SUB-ASSY NO. 2

(See page 17-7)

32. REMOVE OIL PAN Baffle PLATE

- (a) Remove the 3 bolts, 2 nuts and baffle plate.

33. REMOVE OIL PAN SUB-ASSY

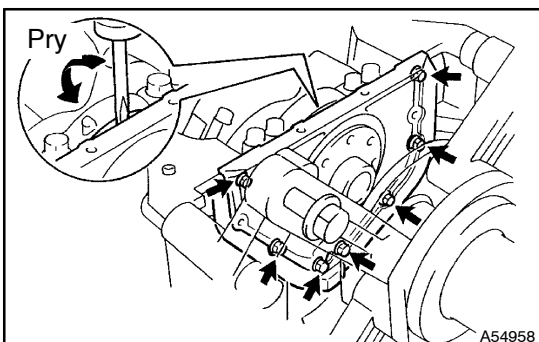
(See page 17-7)

34. REMOVE OIL STRAINER SUB-ASSY

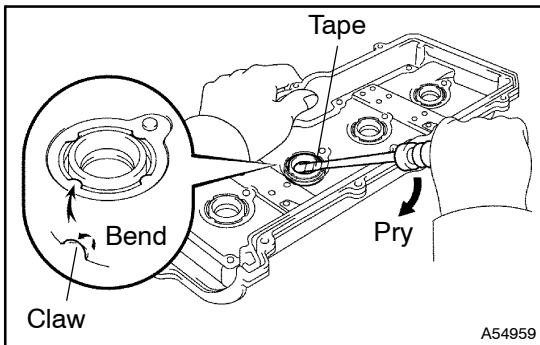
- (a) Remove the bolt, 2 nuts, oil strainer and gasket.

35. REMOVE OIL PUMP ASSY

(See page 17-7)

**36. REMOVE ENGINE REAR OIL SEAL RETAINER**

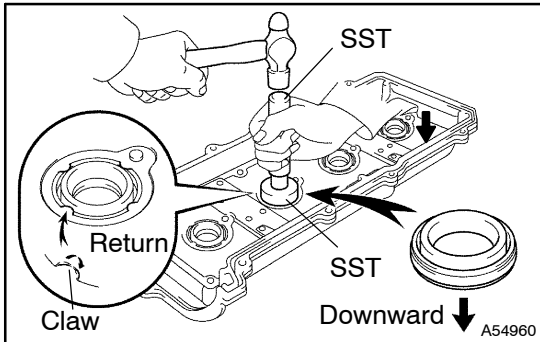
- (a) Remove the 7 bolts.
- (b) Using a screwdriver, remove the oil seal retainer by prying the portions between the oil seal retainer and crankshaft bearing cap.
- (c) Remove the O-ring.

**37. REMOVE SPARK PLUG TUBE GASKET**

- (a) Bend the 4 ventilation case claws installed on the cylinder head cover to an angle of 90° or more.
- (b) Using a screwdriver, pry out the gasket.

NOTICE:

Be careful not to damage the cylinder head cover. Tape the screwdriver tip.

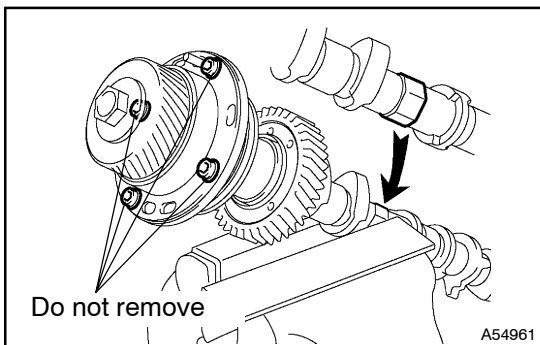
**38. INSTALL SPARK PLUG TUBE GASKET**

- (a) Using SST and a hammer, tap in a new gasket until its surface is flush with the upper edge of the head cover.
SST 09950-60010 (09951-00240, 09951-00440, 09952-06010), 09950-70010 (09951-07100)

NOTICE:

Be careful of the installation direction.

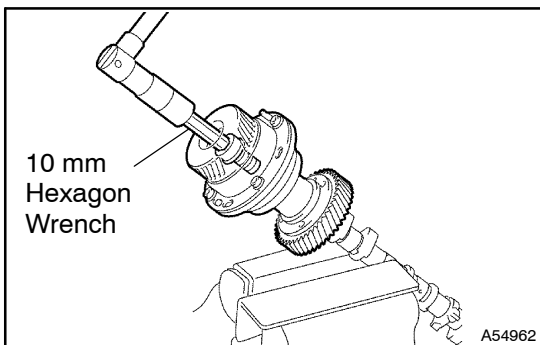
- (b) Apply a light coat of MP grease to the gasket lip.
- (c) Return the 4 ventilation case claws to its original position.

39. REMOVE CAMSHAFT TIMING TUBE ASSY

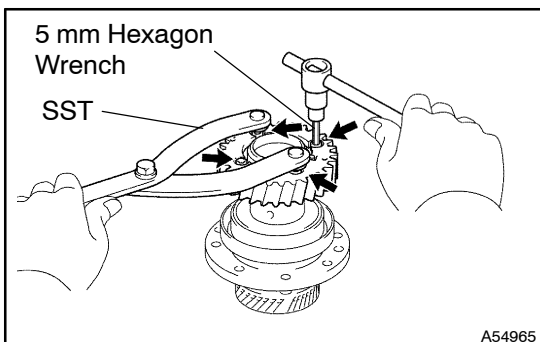
- (a) Mount the hexagon wrench head portion of the camshaft in a vise.

NOTICE:

- **Be careful not to damage the camshaft.**
- **The 4 bolts shown in the illustration determine the backlash of the gear in the timing tube, so do not remove them. If any of the 4 bolts are removed, install a new timing tube assy.**



- (b) Remove the screw plug and seal washer.
- (c) Using a 10 mm hexagon wrench, and remove the bolt.
- (d) Pull out the timing tube and drive gear assembly from the camshaft.

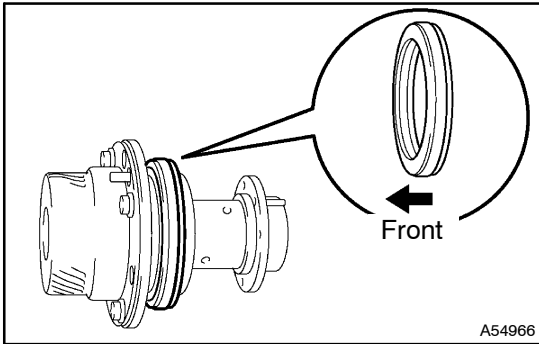


- (e) Using SST and a 5 mm hexagon wrench, and remove the 4 bolts, drive gear and oil seal.

SST 09960-10010 (09962-01000, 09963-00500)

NOTICE:

Be careful not to damage the timing tube.

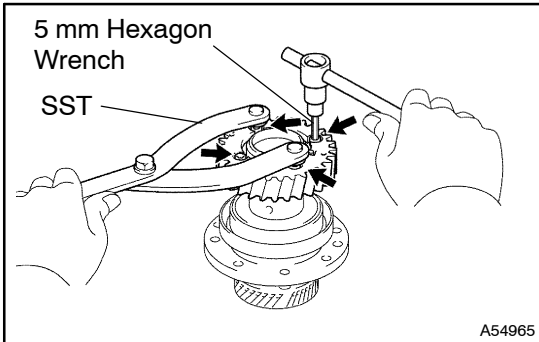


40. INSTALL CAMSHAFT SETTING OIL SEAL

- (a) Place a new oil seal to the timing tube.

NOTICE:

Be careful of the installation direction.



41. INSTALL CAMSHAFT TIMING TUBE ASSY

- (a) Align the timing tube knock pin with the knock pin groove of the drive gear, and temporarily install the drive gear with the 4 bolts.

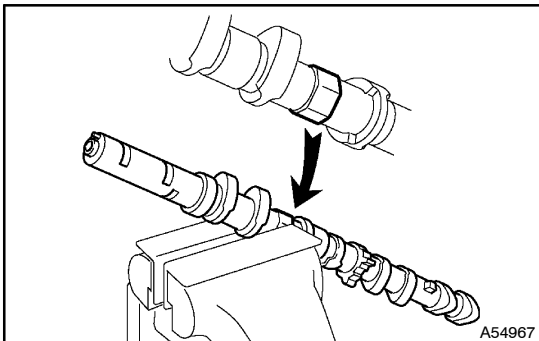
- (b) Using SST and a 5 mm hexagon wrench, uniformly tighten the 4 bolts in several passes.

SST 09960-10010 (09962-01000, 09963-00500)

Torque: 7.5 N·m (80 kgf·cm, 66 in·lbf)

NOTICE:

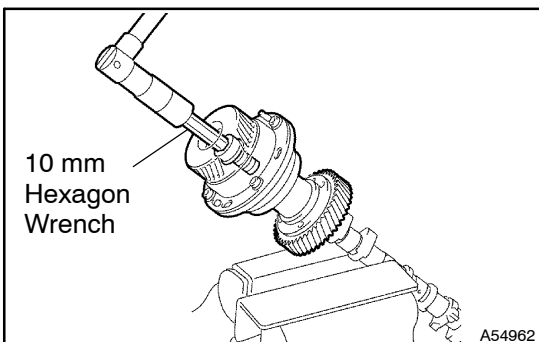
Be careful not to damage the timing tube.



- (c) Mount the hexagon wrench head portion of the camshaft in a vise.

NOTICE:

Be careful not to damage the camshaft.



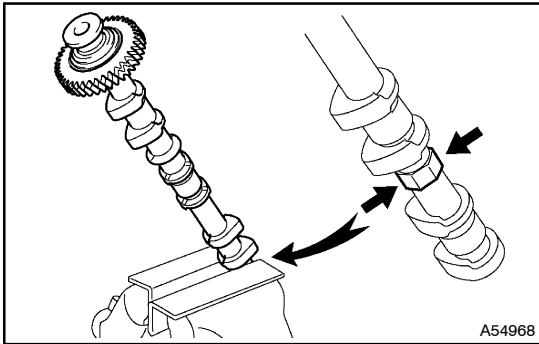
- (d) Align the camshaft knock pin with the knock pin groove of the timing tube, and push the timing tube by hand until you feel it touch the bottom.

- (e) Using a 10 mm hexagon wrench, install the bolt.

Torque: 78 N·m (790 kgf·cm, 58 ft·lbf)

- (f) Install the seal washer and screw plug.

Torque: 15 N·m (150 kgf·cm, 11 ft·lbf)

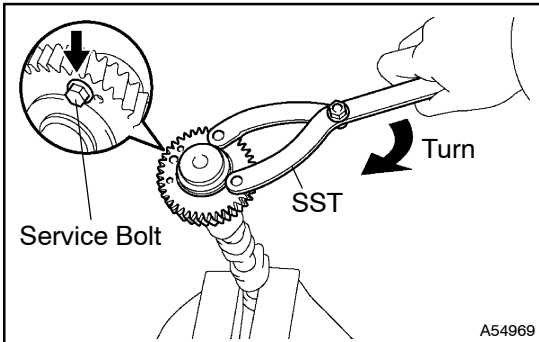


42. REMOVE CAMSHAFT SUB GEAR

- (a) Mount the hexagon wrench head portion of the camshaft in a vise.

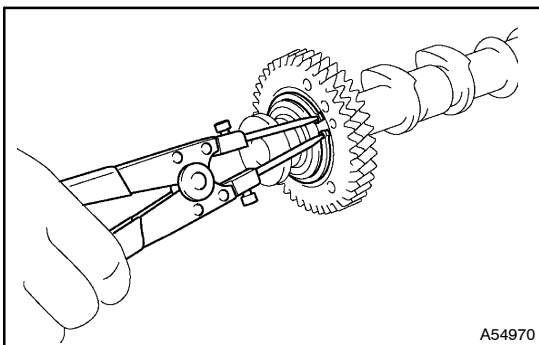
NOTICE:

Be careful not to damage the camshaft.



- (b) Using SST, turn the sub gear clockwise, and remove the service bolt.

SST 09960-10010 (09962-01000, 09963-00500)

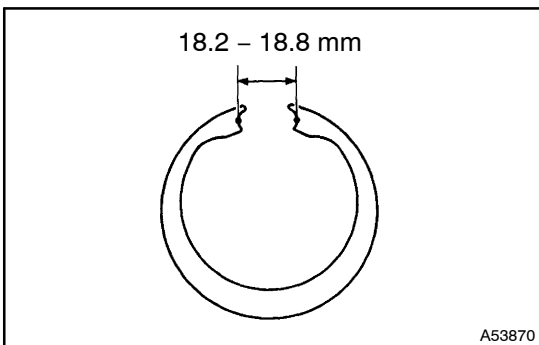


- (c) Using snap ring pliers, remove the snap ring.

- (d) Remove the wave washer, sub gear and gear bolt washer.

HINT:

Arrange the driven sub gears and gear bolt washers (RH and LH sides).

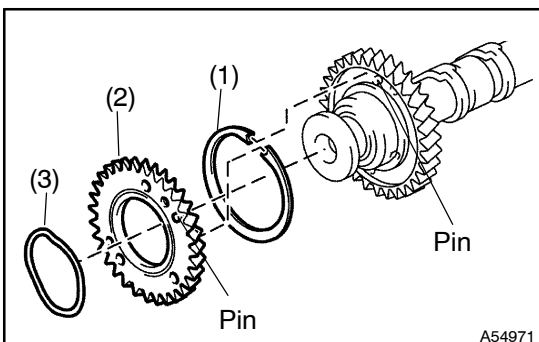


43. INSPECT CAMSHAFT TIMING GEAR BOLT WASHER

- (a) Using vernier calipers, measure the free distance between the washer ends.

Free distance: 18.2 - 18.8 mm (0.712 - 0.740 in.)

If the free distance is not as specified, replace the washer.

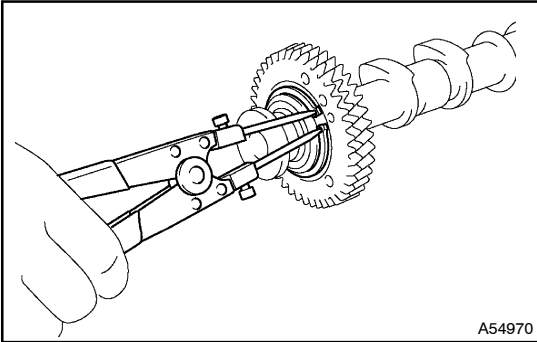


44. INSTALL CAMSHAFT SUB GEAR

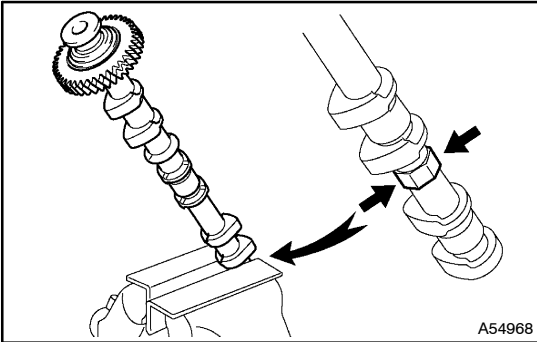
- (a) Install the gear bolt washer (1), sub gear (2) and wave washer (3).

HINT:

Attach the pins on the gears to the gear bolt washer ends.



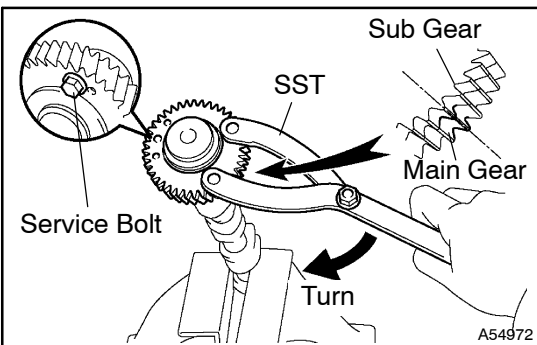
- (b) Using snap ring pliers, install the snap ring.



- (c) Mount the hexagon wrench head portion of the camshaft in a vise.

NOTICE:

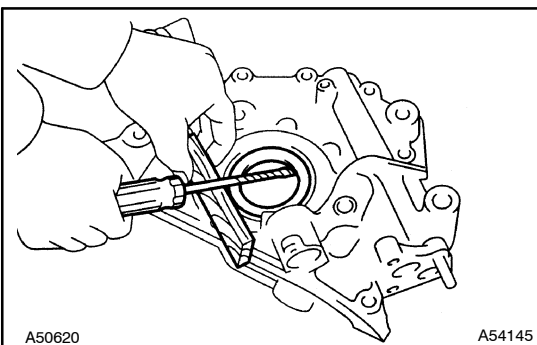
Be careful not to damage the camshaft.



- (d) Using SST, align the holes of the driven main gear and sub gear by turning the sub gear clockwise, and temporarily install a service bolt.

SST 09960-10010 (09962-01000, 09963-00500)

- (e) Align the gear teeth of the driven main gear and sub gear, and tighten the service bolt.



45. REMOVE OIL PUMP SEAL

HINT:

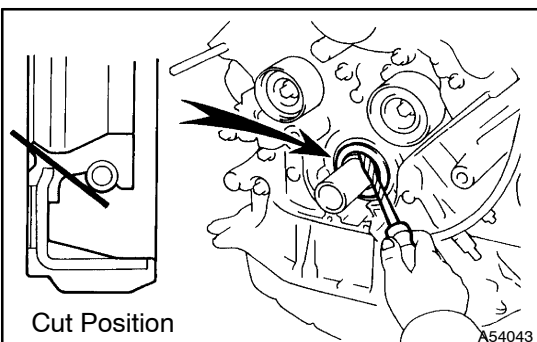
there are 2 methods ((a) and (b)) to remove the oil seal.

- (a) If the oil pump asy is removed from the cylinder block:

- (1) Using a screwdriver, pry out the oil seal.

NOTICE:

Be careful not to damage the oil pump body. Tape the screwdriver tip.

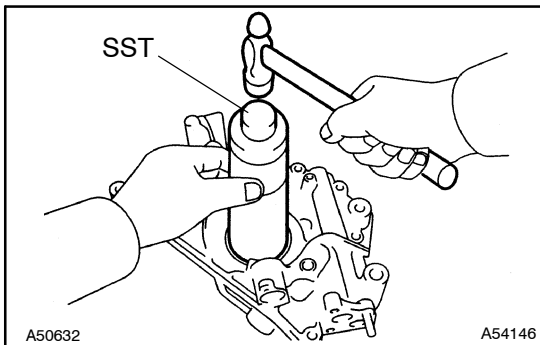


- (b) If the oil pump asy is installed to the cylinder block:

- (1) Using a knife, cut off the oil seal lip.
(2) Using a screwdriver, pry out the oil seal.

NOTICE:

Be careful not to damage the crankshaft. Tape the screwdriver tip.

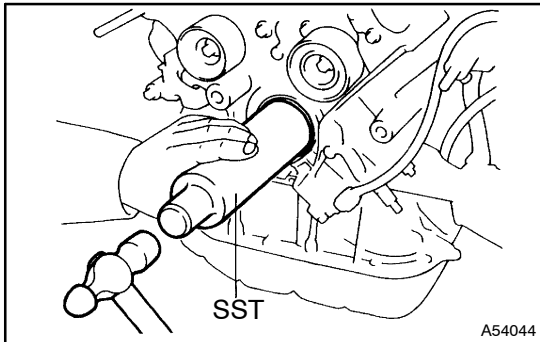


46. INSTALL OIL PUMP SEAL

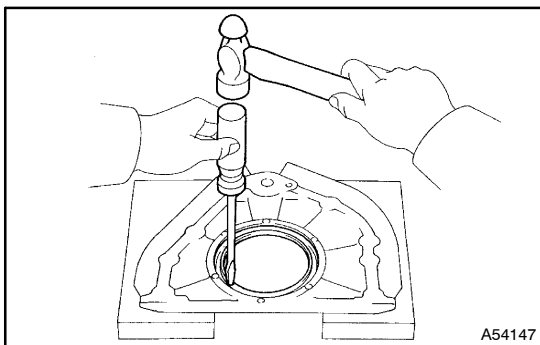
HINT:

there are 2 methods ((a) and (b)) to install the oil seal.

- (a) If the oil pump Assy is removed from the cylinder block:
- (1) Using SST and a hammer, tap in a new oil seal until its surface is flush with the oil pump body edge.
- SST 09316-60011 (09316-00011)
- (2) Apply MP grease to the oil seal lip.



- (b) If the oil pump Assy is installed to the cylinder block:
- (1) Apply MP grease to a new oil seal lip.
 - (2) Using SST and a hammer, tap in the oil seal until its surface is flush with the oil pump edge.
- SST 09316-60011 (09316-00011)

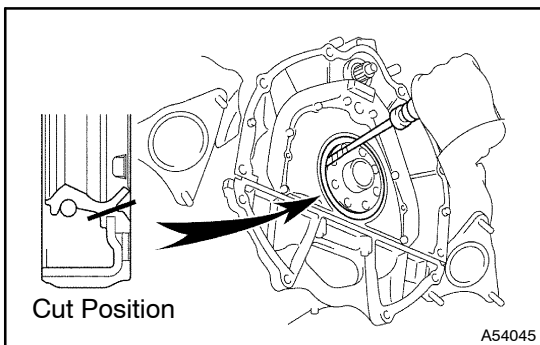


47. REMOVE ENGINE REAR OIL SEAL

HINT:

there are 2 methods ((a) and (b)) to remove the oil seal.

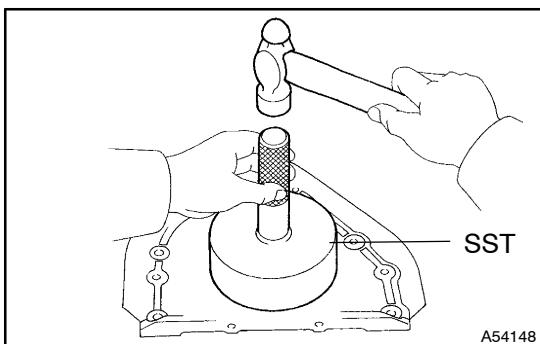
- (a) If the oil seal retainer is removed from the cylinder block:
- (1) Using a screwdriver and hammer, tap out the oil seal.



- (b) If the oil seal retainer is installed to the cylinder block:
- (1) Using a knife, cut off the oil seal lip.
 - (2) Using a screwdriver, pry out the oil seal.

NOTICE:

Be careful not to damage the crankshaft. Tape the screwdriver tip.

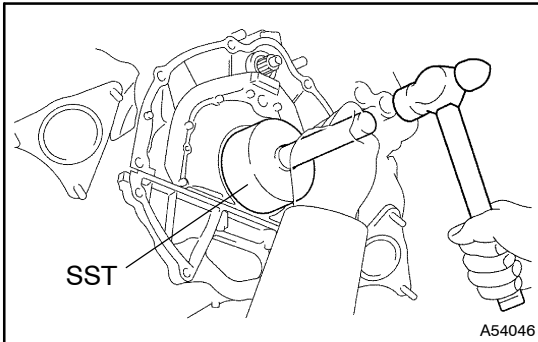


48. INSTALL ENGINE REAR OIL SEAL

HINT:

There are 2 methods (A and B) to install the oil seal.

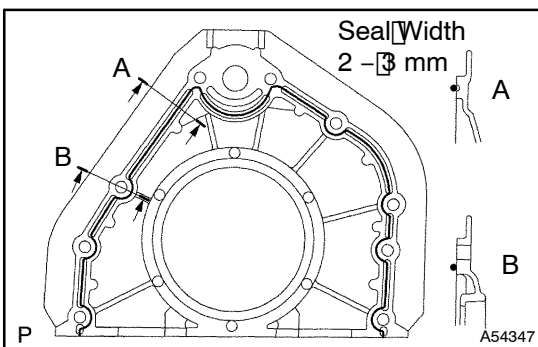
- (a) If the oil seal retainer is removed from the cylinder block:
- (1) Using SST and a hammer, tap in a new oil seal until its surface is flush with the oil seal retainer edge.
- SST 09223-56010
- (2) Apply MP grease to the oil seal lip.



- (b) If the oil seal retainer is installed to the cylinder block:
- (1) Apply MP grease to a new oil seal lip.
 - (2) Using SST and a hammer, tap in the oil seal until its surface is flush with the oil seal retainer edge.
- SST 09223-56010

49. INSTALL ENGINE REAR OIL SEAL RETAINER

- (a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the oil seal retainer and cylinder block.
- (1) Using a razor blade and gasket scraper, remove all the oil packing (FIPG) material from the gasket surfaces and sealing grooves.
 - (2) Thoroughly clean all components to remove all the loose material.
 - (3) Using a non-residue solvent, clean both sealing surfaces.

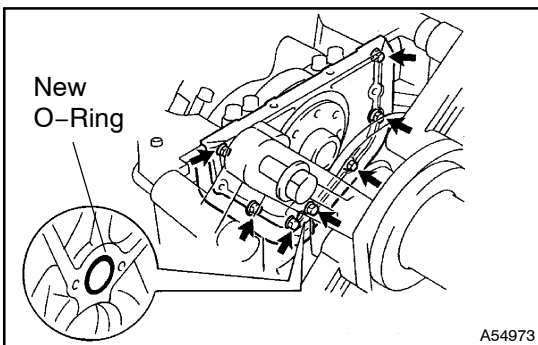


- (b) Apply seal packing to the oil seal retainer as shown in the illustration.

Seal packing: Part No. 08826-00080 or equivalent

- (1) Install a nozzle that has been cut to a 3-4 mm (0.12-0.16 in.) opening.
 - (2) Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
 - (3) Immediately remove nozzle from the tube and re-install cap.
- (c) Install a new O-ring to the cylinder block.
- (d) Install the oil seal retainer with the 7 bolts.

Torque: 8.0 N·m (80 kgf·cm, 71 in.-lbf)



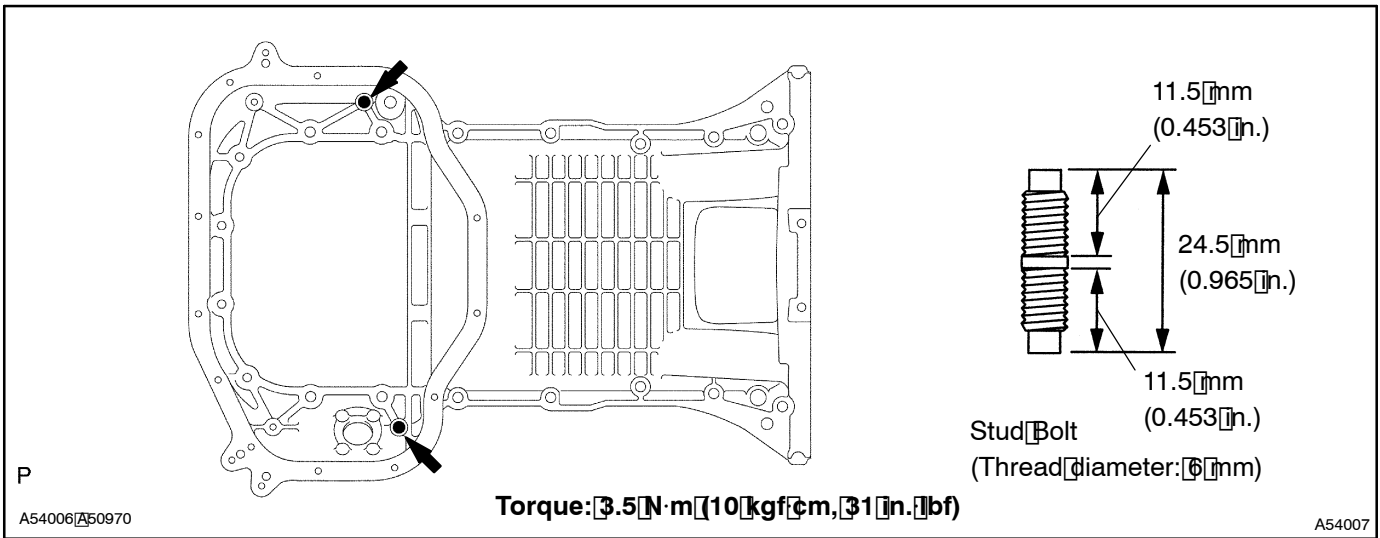
50. INSTALL OIL PUMP ASSY

(See page 17-7)

51. INSTALL OIL STRAINER SUB-ASSY

(See page 17-7)

52. INSTALL OIL PAN STUD BOLT



53. INSTALL OIL PAN SUB-ASSY

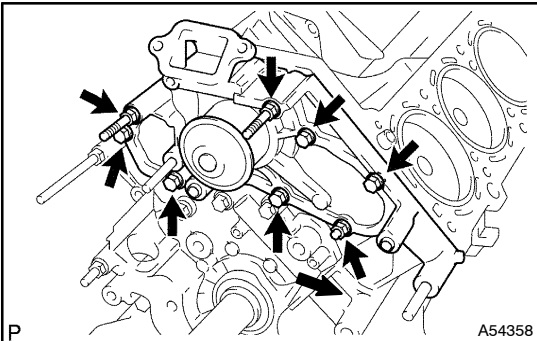
(See page 17-7)

54. INSTALL OIL PAN BAFFLE PLATE

(See page 17-7)

55. INSTALL OIL PAN SUB-ASSY NO. 2

(See page 17-7)



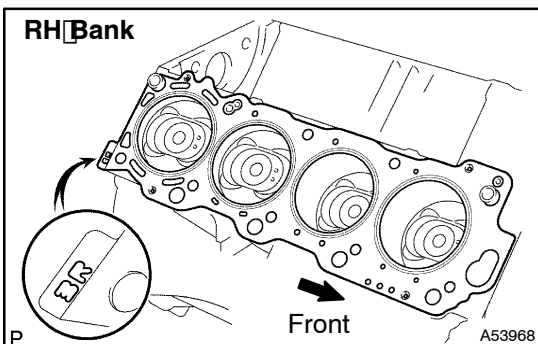
56. INSTALL WATER PUMP ASSY

- (a) Install a new gasket and water pump with the 5 bolts, 2 stud bolts and nut. Uniformly tighten the bolts, stud bolts and nut in several passes.

Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)

HINT:

Use bolts 30 mm (1.18 in.) in length.



57. INSTALL CYLINDER HEAD SUB-ASSY

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

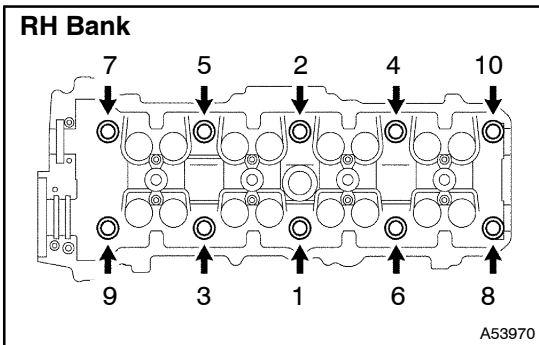
HINT:

On the rear side of the cylinder head gasket are marks to distinguish the RH and LH banks, a "3R" mark for the RH bank

NOTICE:

Be careful of the installation direction.

- (b) Place the cylinder head on the cylinder head gasket.



(c) Install the cylinder head bolts.

HINT:

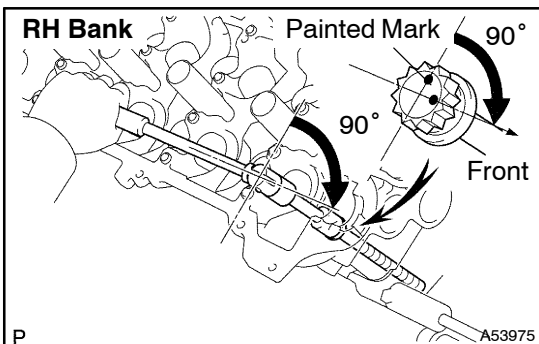
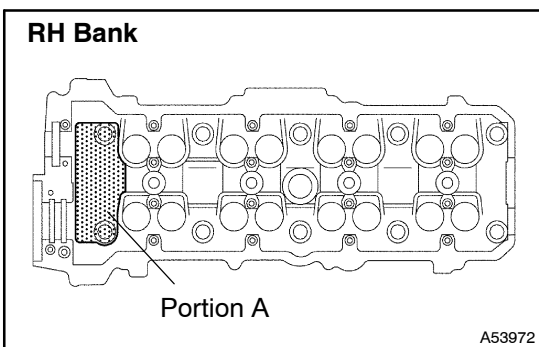
- The cylinder head bolts are tightened in 2 progressive steps (steps (3) and (5)).
- If any cylinder head bolt is broken or deformed, replace it.
 - (1) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.
 - (2) Install the plate washer to the cylinder head bolt.
 - (3) Install and uniformly tighten the 10 cylinder head bolts on one side of the cylinder head in several passes in the sequence shown.

Torque: 59 N·m (600 kgf·cm, 44 ft·lbf)

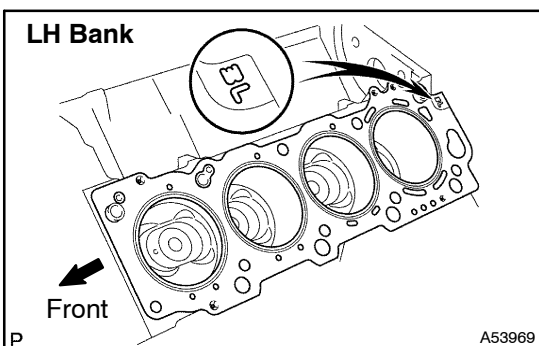
If any one of the cylinder head bolts does not meet the torque specification, replace the cylinder head bolt.

NOTICE:

Do not drop the plate washer for cylinder head bolt into portion A of the cylinder head. If dropped into portion A, the plate washer will pass through the cylinder head and cylinder block into the oil pan.



- (4) Mark the front of the cylinder head bolt head with paint.
- (5) Retighten the cylinder head bolts by 90° in the numerical order shown.
- (6) Check that the painted mark is now at a 90° angle to front.



58. INSTALL CYLINDER HEAD LH

(a) Place a new cylinder head gasket on the cylinder block.

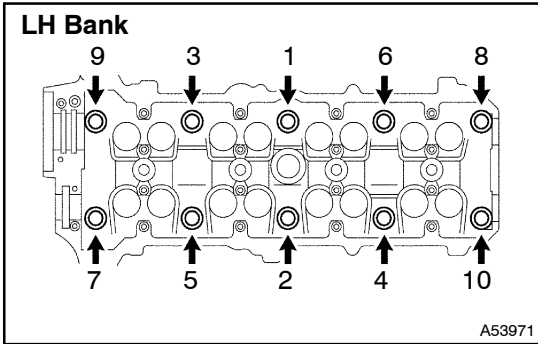
HINT:

On the rear side of the cylinder head gasket are marks to distinguish the RH and LH banks, a "3L" mark for the LH bank

NOTICE:

Be careful of the installation direction.

(b) Place the cylinder head on the cylinder head gasket.



(c) Install the cylinder head bolts.

HINT:

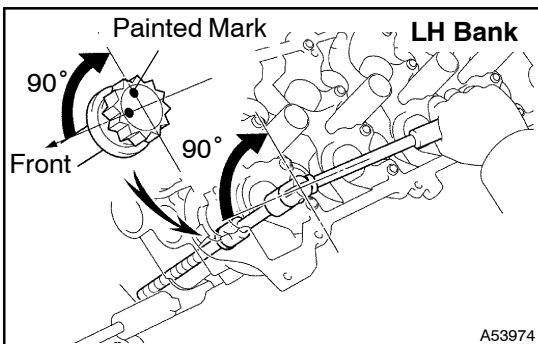
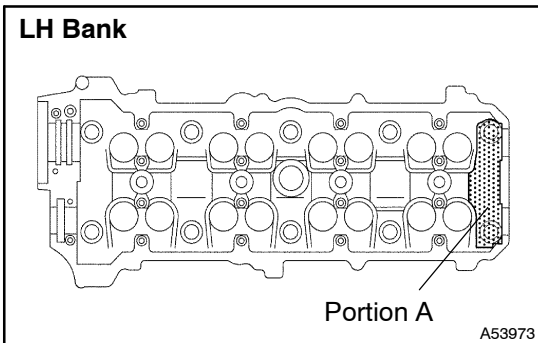
- The cylinder head bolts are tightened in 2 progressive steps (steps (3) and (5)).
- If any cylinder head bolt is broken or deformed, replace it.
 - (1) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.
 - (2) Install the plate washer to the cylinder head bolt.
 - (3) Install and uniformly tighten the 10 cylinder head bolts on one side of the cylinder head in several passes in the sequence shown

Torque: 59 N·m (600 kgf·cm, 44 ft·lbf)

If any one of the cylinder head bolts does not meet the torque specification, replace the cylinder head bolt.

NOTICE:

Do not drop the plate washer for cylinder head bolt into portion A of the cylinder head. If dropped into portion A, the plate washer will pass through the cylinder head and cylinder block into the oil pan.



- (4) Mark the front of the cylinder head bolt head with paint.
- (5) Retighten the cylinder head bolts by 90° in the numerical order shown.
- (6) Check that the painted mark is now at a 90° angle to front.

59. INSTALL CAMSHAFT

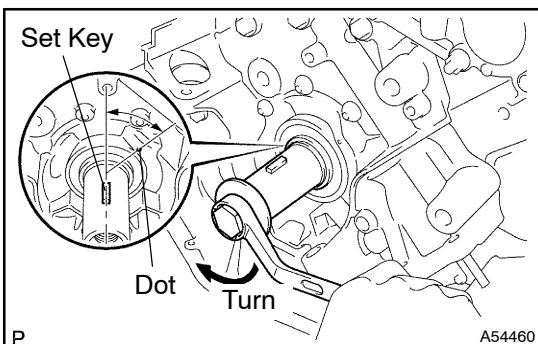
NOTICE:

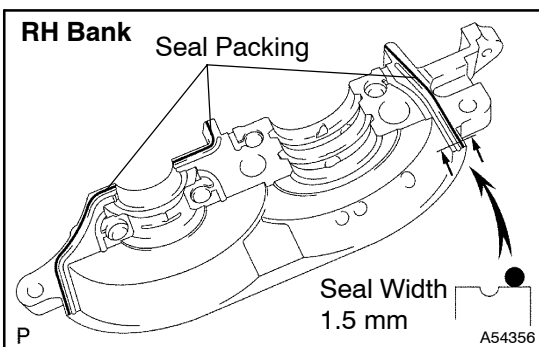
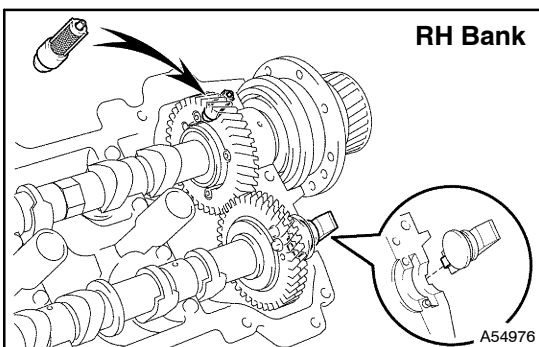
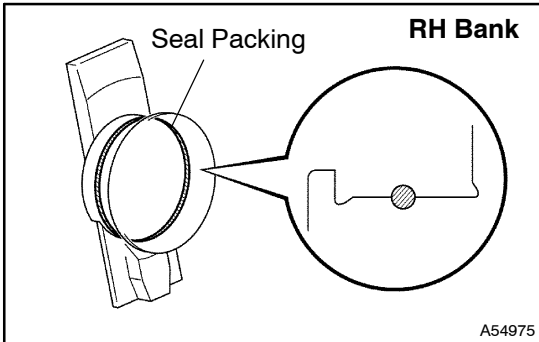
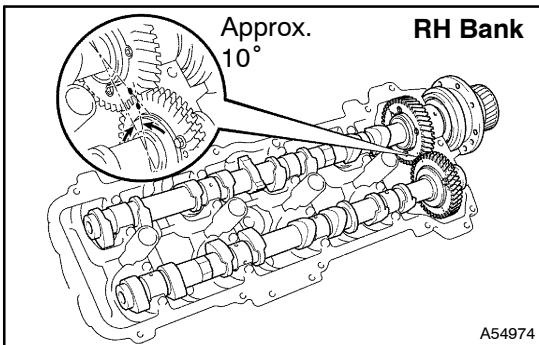
Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following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

- (a) Set the crankshaft position.
 - (1) Using the crankshaft damper bolt, turn the crankshaft, and set the set key of the crankshaft at the position of 90° counterclockwise from the timing mark (dot) of the oil pump body.

NOTICE:

Having the crankshaft at the wrong angle can cause the piston head and valve head to come into contact with each other when you install the camshaft, causing damage. So always set the crankshaft at the correct angle.





- (b) Install the camshafts of the RH bank.
- (1) Apply MP grease to the thrust portion of the camshafts.
 - (2) Align the timing marks (1 dot mark) of the camshaft drive and driven main gears, and place the 2 camshafts.
 - (3) Set the timing mark (1 dot mark) of the camshaft drive and driven main gears at approx. 10° angle.

- (4) Apply seal packing to the camshaft housing plug.
 - Remove the old packing (FIPG) material.
 - Apply seal packing to the housing plug.

Seal packing: Part No. 08826-00080 or equivalent

- (5) Install the camshaft housing plug to the cylinder head as shown in the illustration.
- (6) Install the oil control valve filter to the cylinder head.

NOTICE:

Be careful of the installation direction.

- (7) Apply seal packing to the front bearing cap.
 - Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the bearing cap and cylinder head.

Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and groove.

Thoroughly clean all components to remove all the loose material.

Using a non-residue solvent, clean both sealing surfaces.
 - Apply seal packing to the bearing cap as shown in the illustration.

Install a nozzle that has been cut to a 1.5 – 2.0 mm (0.059 – 0.79 in.) opening.

Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.

Immediately remove nozzle from the tube and reinstall cap.

Seal packing: Part No. 08826-00080 or equivalent

NOTICE:

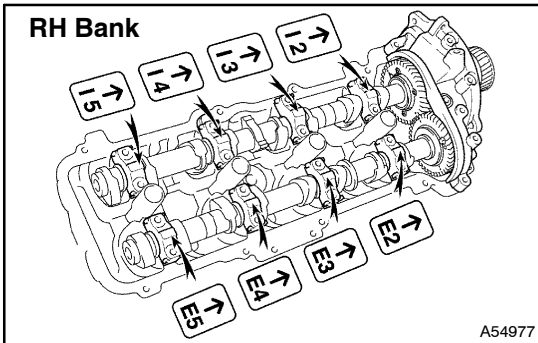
Do not apply seal packing to the front bearing cap grooves.

(8) Install the front bearing cap.

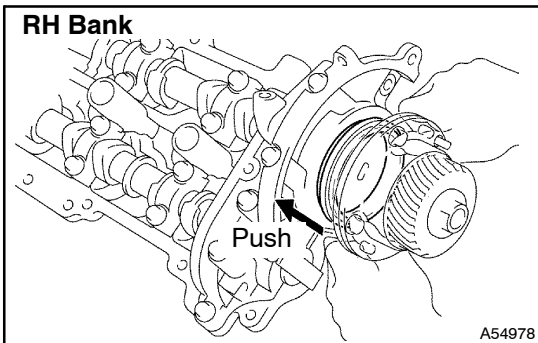
HINT:

Installing the front bearing cap will determine the thrust portion of the camshaft.

(9) Install the other bearing caps in the sequence shown with the arrow mark facing forward.

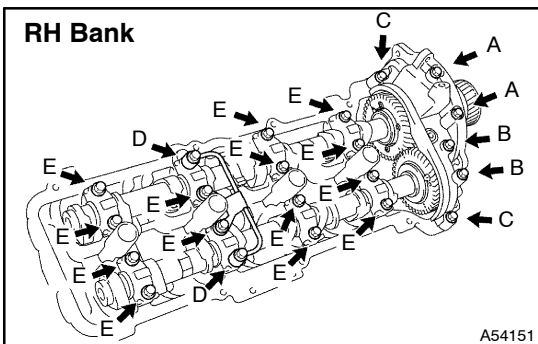


A54977



A54978

(10) Push in the camshaft setting oil seal.



A54151

(11) Install a new seal washer to the bearing cap bolt (A and B).

(12) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts (D and E).

NOTICE:

Do not apply engine oil under the heads of the bearing cap bolt (A), (B) and (C).

HINT:

Each bolt length is indicated in the illustration.

Bolt length:

94 mm (3.70 in.) for A with seal washer

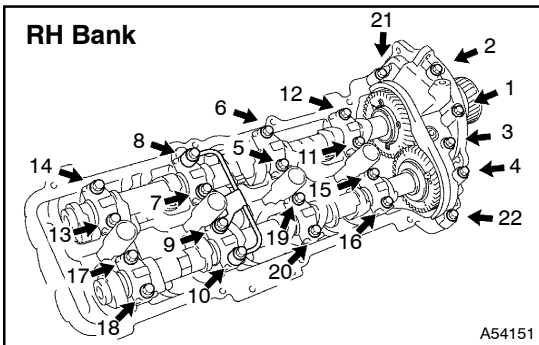
72 mm (2.83 in.) for B with seal washer

25 mm (0.98 in.) for C

52 mm (2.05 in.) for D

38 mm (1.50 in.) for E

(13) Install the oil feed pipe and the 22 bearing cap bolts as shown in the illustration.

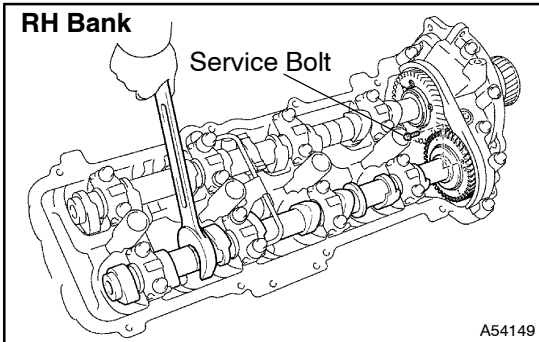


(14) Uniformly tighten the 22 bearing cap bolts in several passes, in the sequence shown.

Torque:

7.5 N·m (80 kgf·cm, 66 in·lbf) for bolt C

16 N·m (160 kgf·cm, 12 ft·lbf) for others



(15) Remove the service bolt.

60. INSTALL NO. 3 CAMSHAFT SUB-ASSY

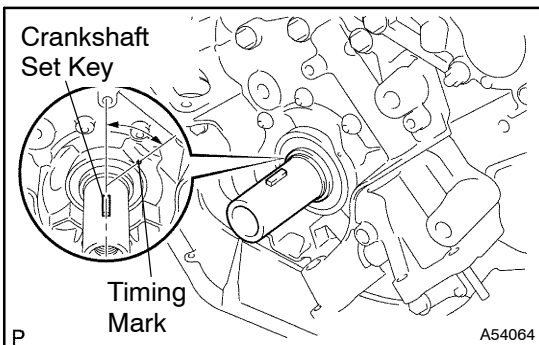
NOTICE:

Since 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 receiving 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.

(a) Check the set key of the crankshaft is at the position of 90° counterclockwise from the timing mark (dot) of the oil pump body.

NOTICE:

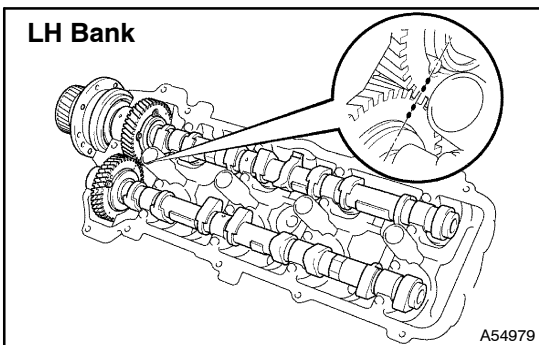
Having the crankshaft at the wrong angle can cause the piston head and valve head to come into contact with each other when you install the camshaft, causing damage. So always set the crankshaft at the correct angle.



(b) Install the camshafts of the LH bank.

(1) Apply MP grease to the thrust portion of the camshafts.

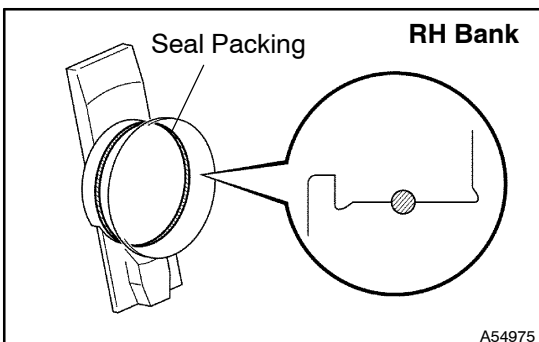
(2) Align the timing marks (2 dot marks) of the camshaft drive and driven main gears, and place the 2 camshafts.

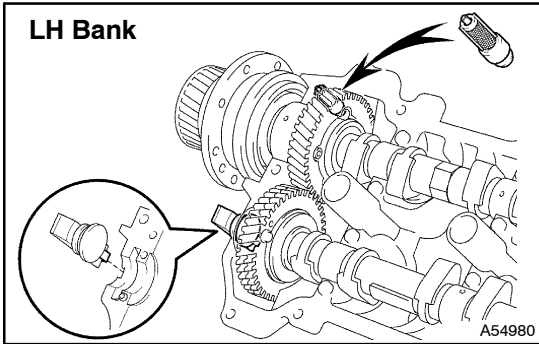


(3) Apply seal packing to the camshaft housing plug.

- Remove the old packing (FIPG) material.
- Apply seal packing to the housing plug.

Seal packing: Part No. 08826-00080 or equivalent

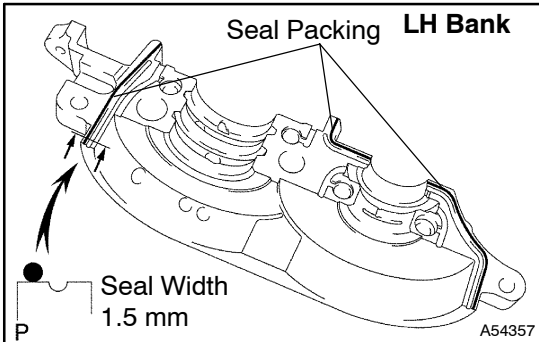




- (4) Install the camshaft housing plug to the cylinder head as shown in the illustration.
- (5) Install the oil control valve filter to the cylinder head.

NOTICE:

Be careful of the installation direction.

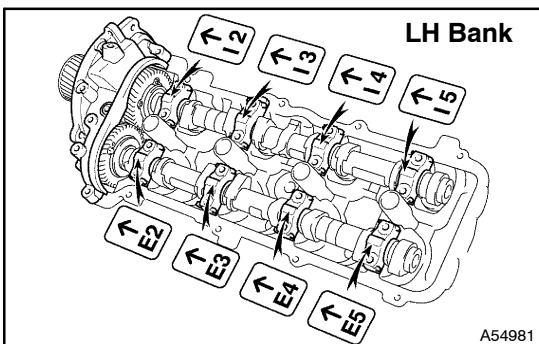


- (6) Apply seal packing to the front bearing cap.
 - Remove any old packing (FIPG) material and be care not to drop any oil on the contact surfaces of the bearing cap and cylinder head. Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and groove. Thoroughly clean all components to remove all the loose material. Using a non-residue solvent, clean both sealing surfaces.
 - Apply seal packing to the bearing cap as shown in the illustration. Install a nozzle that has been cut to a 1.5 – 2.0 mm (0.059 – 0.79 in.) opening. Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied. Immediately remove nozzle from the tube and reinstall cap.

Seal packing: Part No. 08826-00080 or equivalent

NOTICE:

Do not apply seal packing to the front bearing cap grooves.

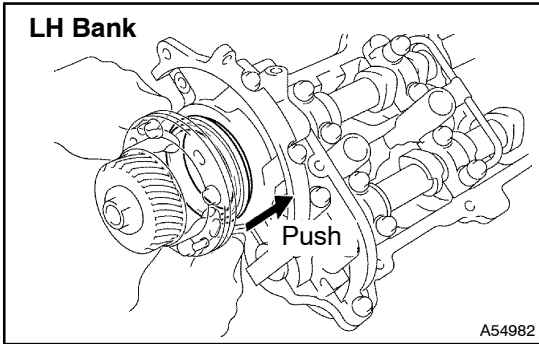


- (7) Install the front bearing cap.

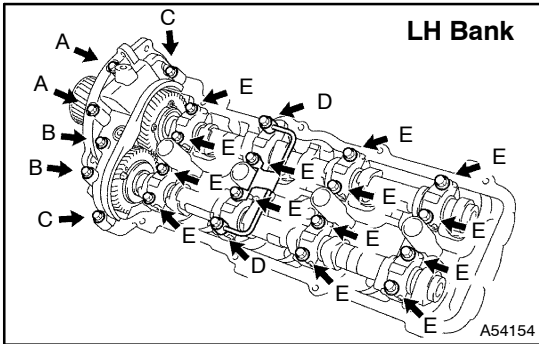
HINT:

Installing the front bearing cap will determine the thrust portion of the camshaft.

- (8) Install the other bearing cap in the sequence shown with the arrow mark facing forward.



(9) Push in the camshaft setting oil seal.



(10) Install a new seal washer to the bearing cap bolt (A and B).

(11) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts (D and E).

NOTICE:

Do not apply engine oil under the heads of the bearing cap bolt (A), (B) and (C).

HINT:

Each bolt length is indicated in the illustration.

Bolt length:

94 mm (3.70 in.) for A with seal washer

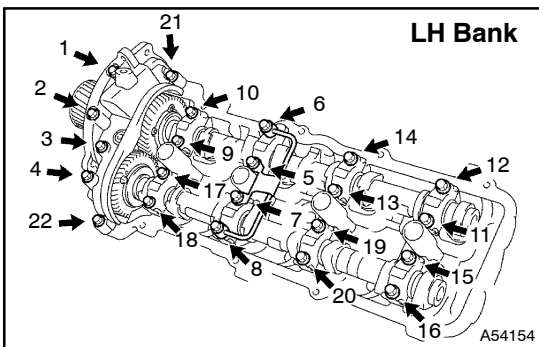
72 mm (2.83 in.) for B with seal washer

25 mm (0.98 in.) for C

52 mm (2.05 in.) for D

38 mm (1.50 in.) for E

(12) Install the oil feed pipe and the 22 bearing cap bolts as shown in the illustration.

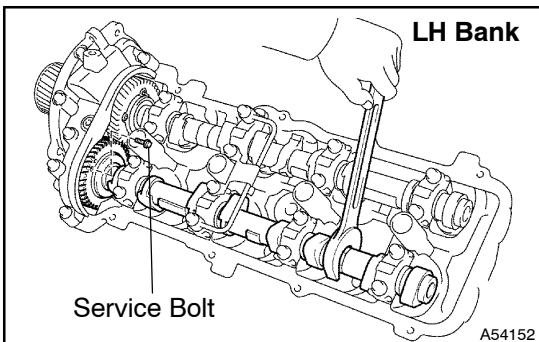


(13) Uniformly tighten the 22 bearing cap bolts in several passes, in the sequence shown.

Torque:

7.5 N·m (80 kgf·cm, 66 in.·lbf) for bolt C

16 N·m (160 kgf·cm, 12 ft·lbf) for others



(14) Remove the service bolt.

61. INSTALL TIMING BELT PLATE RR RH

- (a) Install the timing belt plate with the bolt and stud bolt.
Torque: 7.5 N·m (80 kgf·cm, 66 in·lbf)

62. INSTALL TIMING BELT PLATE RR RH NO. 2

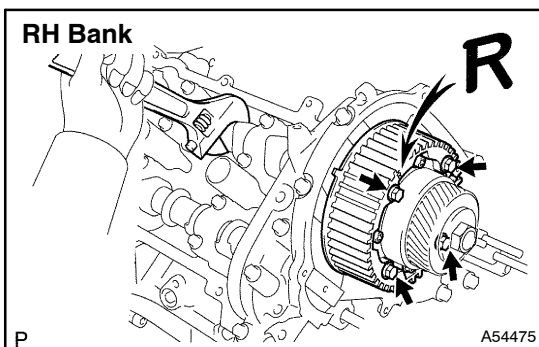
- (a) Install the timing belt plate with the 2 bolts.
Torque: 7.5 N·m (80 kgf·cm, 66 in·lbf)

63. INSTALL TIMING BELT PLATE RR LH

- (a) Install the timing belt plate with the bolt.
Torque: 7.5 N·m (80 kgf·cm, 66 in·lbf)

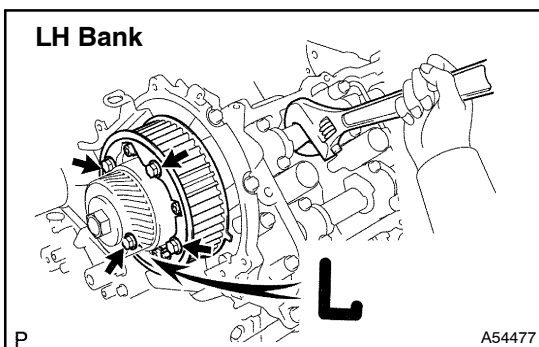
64. INSTALL TIMING BELT PLATE RR LH NO. 2

- (a) Install the timing belt plate with the 2 bolts.
Torque: 7.5 N·m (80 kgf·cm, 66 in·lbf)

**65. INSTALL CAMSHAFT TIMING PULLEY**

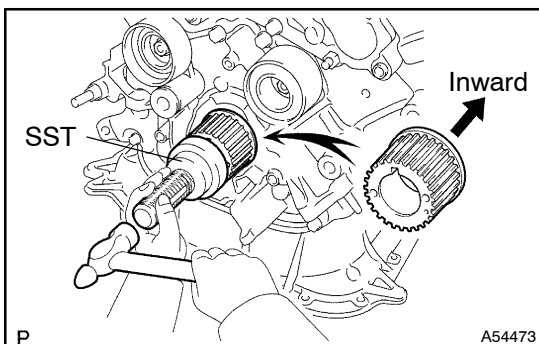
- (a) Align the camshaft timing tube knock pin with the knock pin groove of the timing pulley.
 (b) Attach the timing pulley to the camshaft timing tube, facing the "R" mark forward.
 (c) Hold the hexagon wrench head portion of the camshaft, install the 4 pulley bolts.

Torque: 7.5 N·m (80 kgf·cm, 66 in·lbf)

**66. INSTALL CAMSHAFT TIMING PULLEY SUB-ASSY LH**

- (a) Align the camshaft timing tube knock pin with the knock pin groove of the timing pulley.
 (b) Attach the timing pulley to the camshaft timing tube, facing the "L" mark forward.
 (c) Hold the hexagon wrench head portion of the camshaft, install the 4 pulley bolts.

Torque: 7.5 N·m (80 kgf·cm, 66 in·lbf)

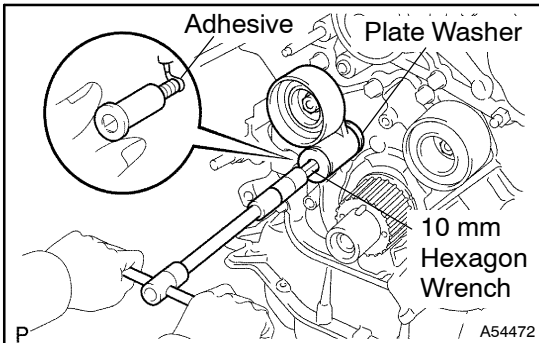
**67. INSTALL CRANKSHAFT TIMING PULLEY**

- (a) Align the timing pulley set key with the key groove of the pulley.
 (b) Using SST and a hammer, tap in the timing pulley, facing the flange side inward.

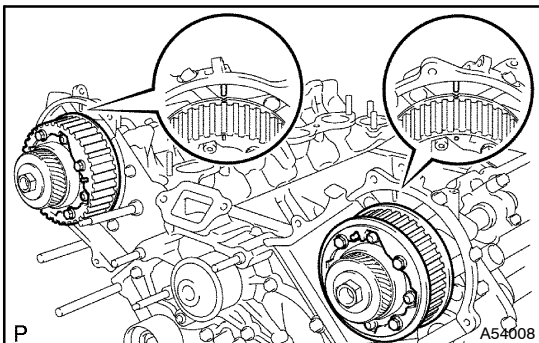
SST 09223-46011

68. INSTALL TIMING BELT IDLER SUB-ASSY NO. 2

- (a) Install the idler with the bolt.
Torque: 34.5 N·m (350 kgf·cm, 25 ft·lbf)
- (b) Check that the idler moves smoothly.

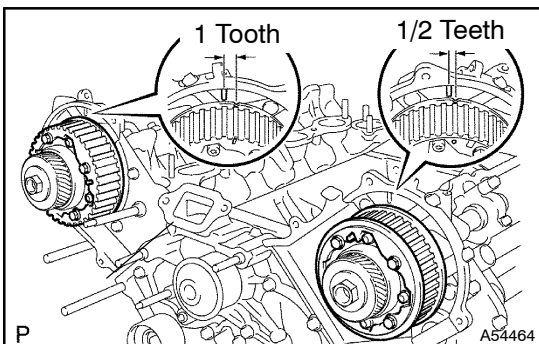
**69. INSTALL TIMING BELT IDLER SUB-ASSY NO. 1**

- (a) Apply adhesive 2 or 3 threads of the pivot bolt.
Adhesive:
Part No. 08833-00080, THREE BOND 1344, LOCTITE 242 or equivalent
- (b) Using a 10 mm hexagon wrench, install the plate washer and idler with the pivot bolt.
Torque: 34.5 N·m (350 kgf·cm, 25 ft·lbf)
- (c) Check that the idler bracket moves smoothly.

**70. INSTALL TIMING BELT****NOTICE:**

The engine should be cold.

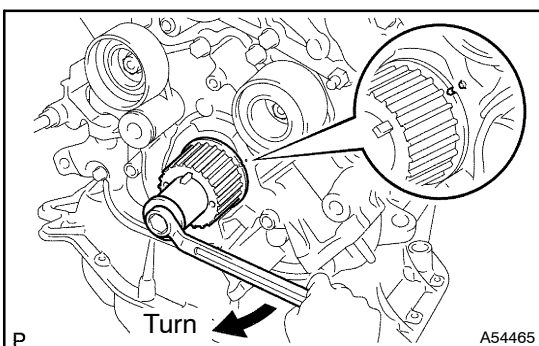
- (a) Set the No. 1 cylinder to TDC/compression.
- (1) Turn the hexagon wrench head portion of the camshaft to align the timing marks of the camshaft timing pulleys and timing belt plates aligned.

**HINT:**

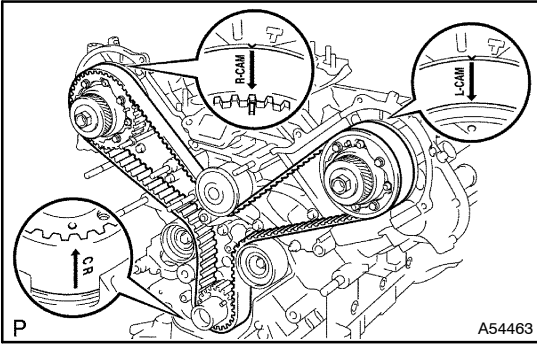
Setting positions of the camshaft timing pulleys by turning them slightly clockwise makes it easy to install the timing belt:

Camshaft timing pulley of LH bank: 1/2 teeth

Camshaft timing pulley of RH bank: 1 tooth



- (2) Using the crankshaft damper bolt, turn the crankshaft to align the timing marks of the crankshaft timing pulley and oil pump body.

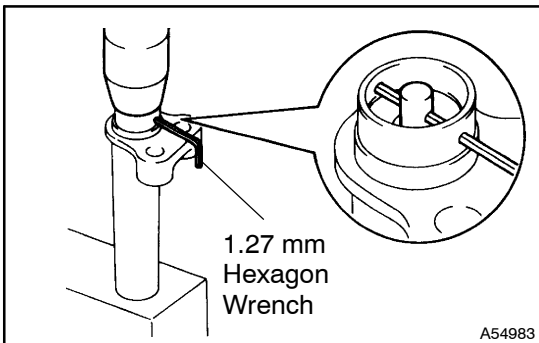


- (b) Install the timing belt.
- (1) Remove any oil or water on the each pulley, and keep them clean.

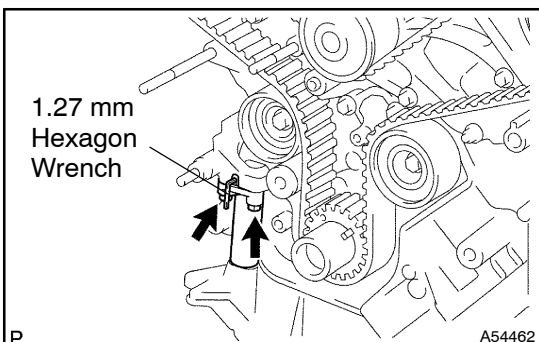
NOTICE:

Only wipe the pulleys; do not use any cleansing agent.

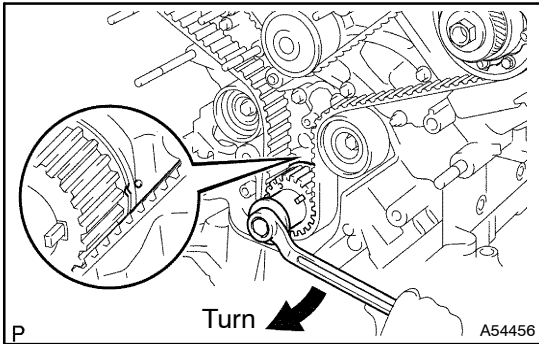
- (2) Face the front mark (arrow) on the timing belt forward.
- (3) Connect the timing belt to the crankshaft timing pulley.
 - Align the installation mark on the timing belt with the timing mark of the crankshaft timing pulley.
- (4) Connect the timing belt to the idler No. 2.
- (5) Connect the timing belt to the camshaft timing pulley LH.
 - Align the installation mark on the timing belt with the timing mark of the camshaft timing pulley.
- (6) Connect the timing belt to the water pump pulley.
- (7) Connect the timing belt to the camshaft timing pulley (RH bank).
 - Align the installation mark on the timing belt with the timing mark of the camshaft timing pulley.
- (8) Connect the timing belt to the idler No. 1.



- (c) Set the belt tensioner.
- (1) Using a press, slowly press in the push rod using 981 – 9,807 N (100 – 1,000 kgf, 220 – 2,205 lbf) of pressure.
 - (2) Align the holes of the push rod and housing, pass a 1.27 mm hexagon wrench through the holes to keep the setting position of the push rod.
 - (3) Release the press.
 - (4) Install the dust boot to the belt tensioner.



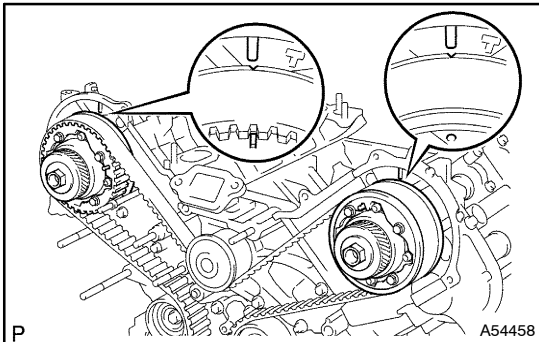
- (d) Install the belt tensioner.
- (1) Temporarily install the belt tensioner with the 2 bolts.
 - (2) Alternately tighten the 2 bolts.
- Torque: 26 N·m (270 kgf·cm, 19 ft·lbf)**
- (3) Using pliers, remove the 1.27 mm hexagon wrench from the belt tensioner.



- (e) Check the valve timing.
- (1) Using the crankshaft damper bolt, slowly turn the crankshaft pulley 2 revolutions from TDC to TDC.

NOTICE:

Always turn the crankshaft pulley clockwise.



- (2) Check that each pulley aligns with the timing marks as shown in the illustration.

If the timing marks do not align, remove the timing belt and reinstall it.

71. INSTALL CRANKSHAFT POSITION SENSOR PLATE NO. 1

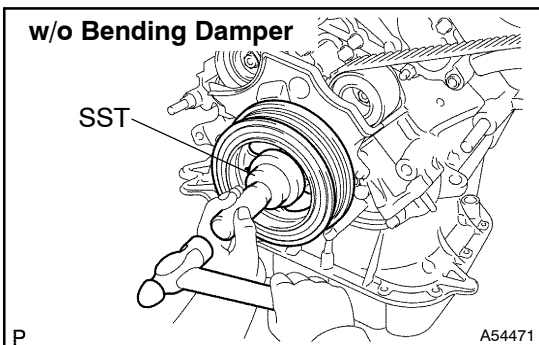
- (a) Install the sensor plate, facing the cup side outward.

72. INSTALL TIMING GEAR COVER SPACER

- (a) Install the gasket to the cover spacer.
 (b) Install the cover spacer.

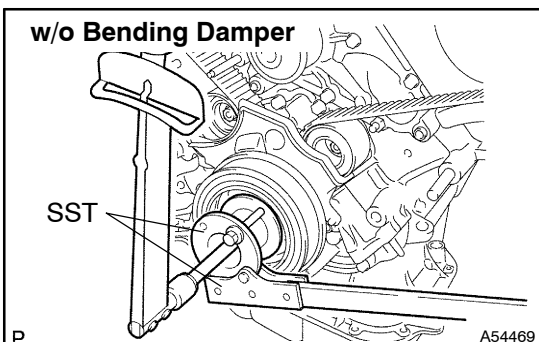
73. INSTALL TIMING BELT NO. 1 COVER

- (a) Install the timing belt cover with the 4 bolts.

**74. INSTALL CRANKSHAFT DAMPER SUB-ASSY**

- (a) w/o Bending Damper:
 Install the crankshaft damper.
- (1) Align the pulley set key with the key groove of the crankshaft damper.
- (2) Using SST and a hammer, tap in the crankshaft damper.

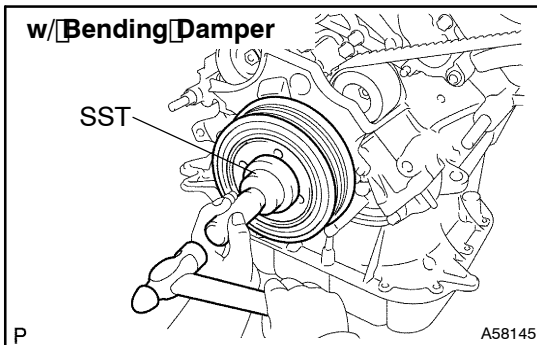
SST 09223-46011



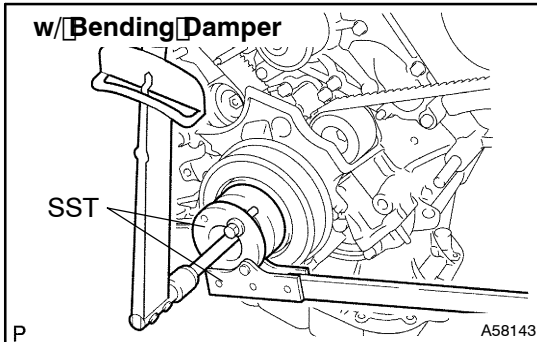
- (3) Using SST, install the damper bolt.

SST 09213-70011, 09330-00021

Torque: 245 N·m (2,500 kgf·cm, 181 ft·lbf)

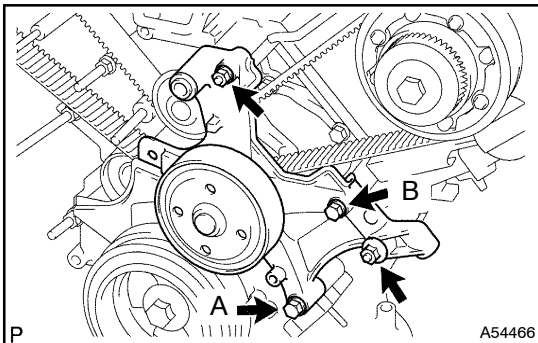


- (b) w/ Bending Damper:
Install the crankshaft damper.
- (1) Align the pulley set key with the key groove of the crankshaft damper.
 - (2) Using SST and a hammer, tap in the crankshaft damper.
- SST 09223-46011



- (3) Using SST, install the damper bolt.
- SST 09213-54015, 09213-58013 (90105-08076) 09330-00021
- Torque: 245 N·m (2,500 kgf·cm, 181 ft·lbf)**

75. ADJUST VALVE CLEARANCE (See page 14-7)



76. INSTALL IDLER PULLEY ASSY

- (a) Install the idler pulley with the 2 bolts and 2 nuts.
- Torque:**
16 N·m (160 kgf·cm, 12 ft·lbf) for 12 mm head
39 N·m (400 kgf·cm, 29 ft·lbf) for 14 mm head

HINT:

Each bolt length is indicated in the illustration.

Bolt Length:

106 mm (4.17 in.) for 12 mm head (A)

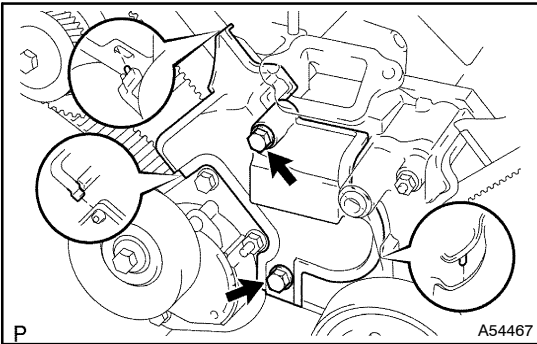
114 mm (4.49 in.) for 14 mm head (B)

77. INSTALL V-RIBBED BELT TENSIONER ASSY

- (a) Install the belt tensioner with the bolt and 2 nuts.
- Torque: 16 N·m (160 kgf·cm, 11 ft·lbf)**

HINT:

Use a bolt 106 mm (4.18 in.) in length.

**78. INSTALL TIMING BELT COVER SUB-ASSY NO. 2**

- (a) Fit the timing belt cover, matching the claws and pin with each part.
- (b) Install the timing belt cover with the 2 bolts.

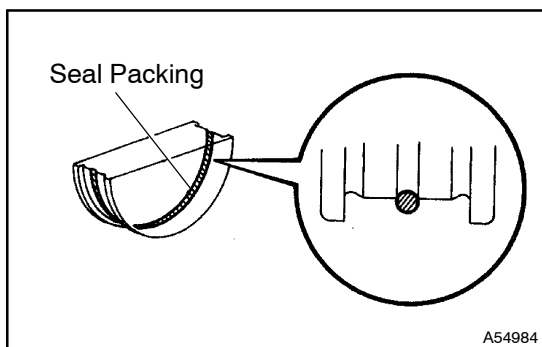
Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)

HINT:

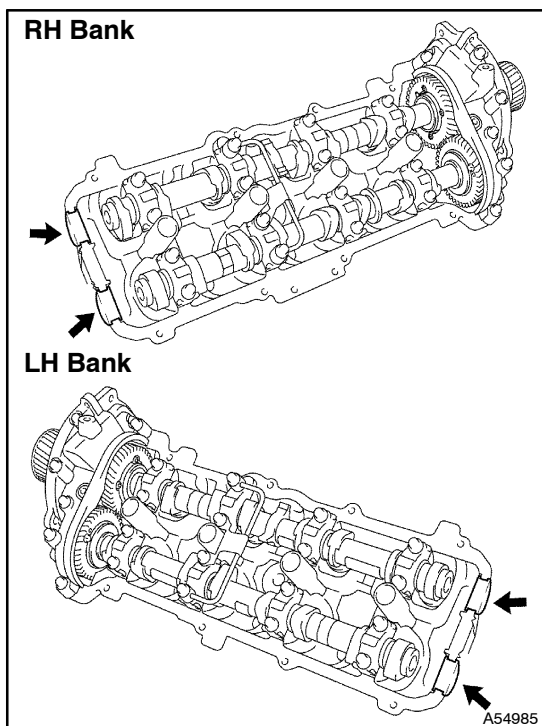
Use bolts 106 mm (4.17 in.) in length.

79. INSTALL IDLER PULLEY SUB-ASSY NO. 2

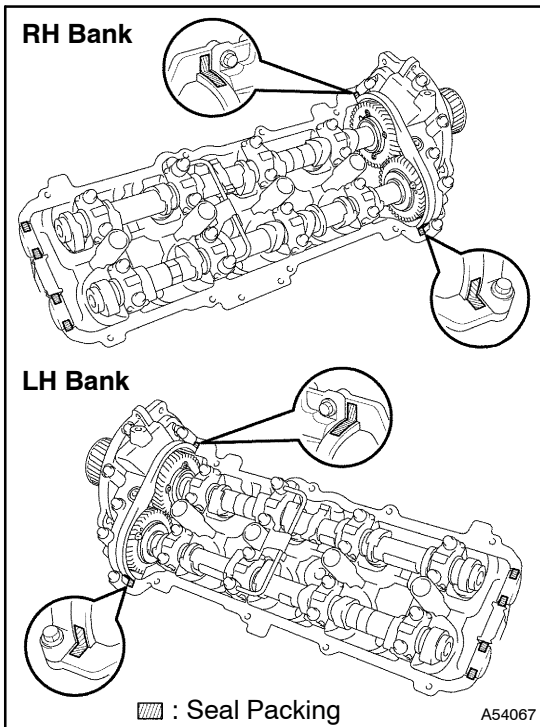
- (a) Install the idler pulley and cover plate with the bolt.
- Torque: 39 N·m (398 kgf·cm, 29 ft·lbf)**

**80. INSTALL SEMICIRCULAR PLUG**

- (a) Remove any old packing (FIPG) material.
 - (b) Apply seal packing to the semicircular plug grooves.
- Seal packing: Part No. 08826-00080 or equivalent**



- (c) Install the 4 semicircular plugs to the cylinder heads as shown in the illustration.



81. INSTALL CYLINDER HEAD COVER SUB-ASSY

- (a) Remove any old packing (FIPG) material.
- (b) Apply seal packing to the cylinder heads as shown in the illustration.

Seal packing: Part No. 08826-00080 or equivalent

- (c) Install the gasket to the cylinder head cover.
- (d) Install the seal washer to the bolt.
- (e) Install the cylinder head cover with the 9 bolts. Uniformly tighten the bolts in several passes.

Torque: 6.0 N·m (60 kgf·cm, 53 in.·lbf)

82. INSTALL OIL FILLER CAP SUB-ASSY

83. INSTALL SPARK PLUG