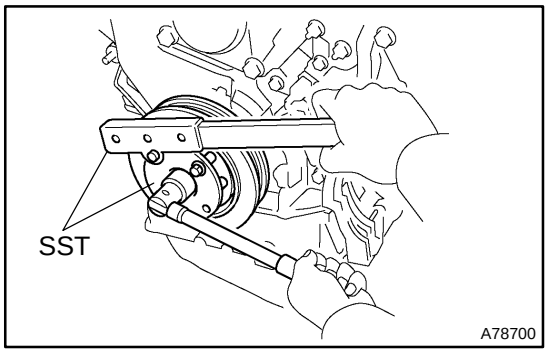
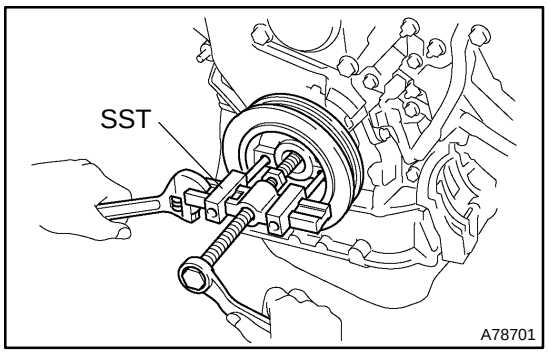
141IV−03

OVERHAUL

1. REMOVE SPARK PLUG
2. REMOVE OIL FILLER CAP SUB−ASSY
3. REMOVE OIL FILLER CAP GASKET
4. REMOVE CYLINDER HEAD COVER SUB−ASSY LH
5. REMOVE CYLINDER HEAD COVER GASKET NO.2
6. REMOVE CYLINDER HEAD COVER SUB−ASSY
7. REMOVE CYLINDER HEAD COVER GASKET
8. REMOVE VENTILATION VALVE SUB−ASSY
9. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSY
10. REMOVE VVT SENSOR
(a) Remove the sensor.
(b) Remove the O−ring from the sensor.
11. REMOVE OIL LEVEL GAGE SUB−ASSY
12. REMOVE OIL LEVEL GAGE GUIDE



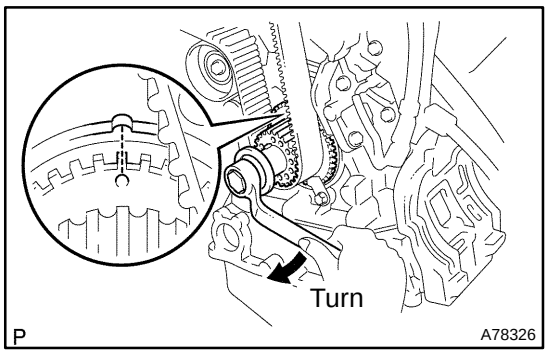
13. REMOVE CRANKSHAFT PULLEY
(a) Using SST, loosen the pulley bolt.
SST 09213−54015 (91651−60855), 09330−00021



(b) Using SST and the pulley bolt, remove the pulley.
SST 09950−50013 (09951−05010, 09952−05010, 09953−05020, 09954−05031)

NOTICE:
Before using SST, apply lubricating oil on the threads and tip of the center bolt 150.

14. REMOVE TIMING BELT NO.1 COVER
15. REMOVE TIMING BELT NO.2 COVER
16. REMOVE ENGINE MOUNTING BRACKET RH
17. REMOVE TIMING BELT GUIDE NO.2

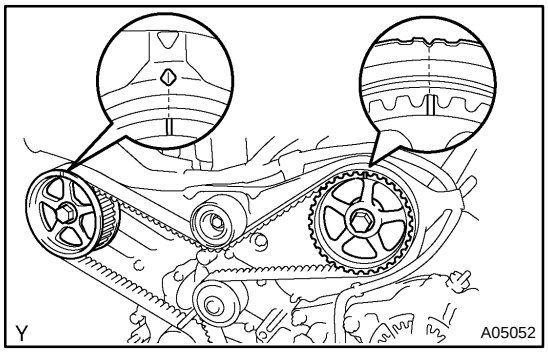


18. REMOVE TIMING BELT

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

(1) Temporarily install the crankshaft pulley bolt and washer to the crankshaft.

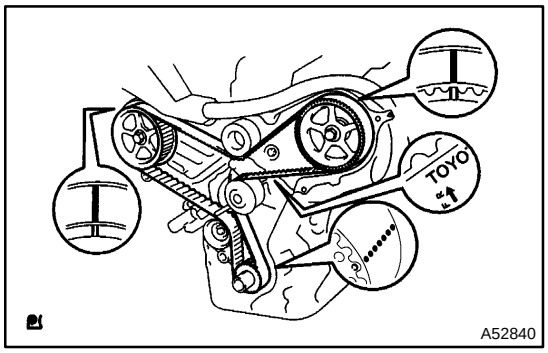
(2) Turn the crankshaft clockwise, and align the timing mark of the crankshaft timing pulley with the oil pump body.



(3) Check that timing marks of the camshaft timing pulleys and No. 3 timing belt cover are aligned.

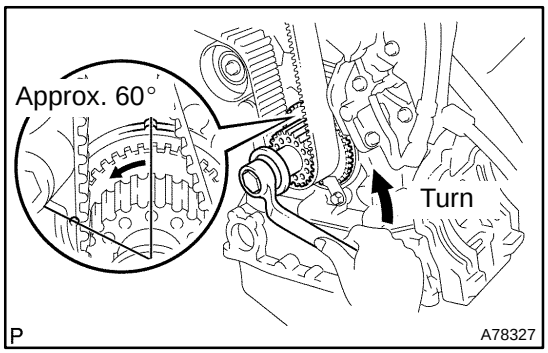
If not, turn the crankshaft 1 revolution (360°).

(4) Remove the crankshaft pulley bolt.



(b) If reusing the timing belt, check that there are 4 installation marks on the timing belt as shown in the illustration.

(1) If the installation marks have disappeared, put new installation marks on the timing belt before removing.



(c) Set the No. 1 cylinder to approximately 60° BTDC/ compression.

(1) Turn the crankshaft counterclockwise by approximately 60°.

NOTICE:

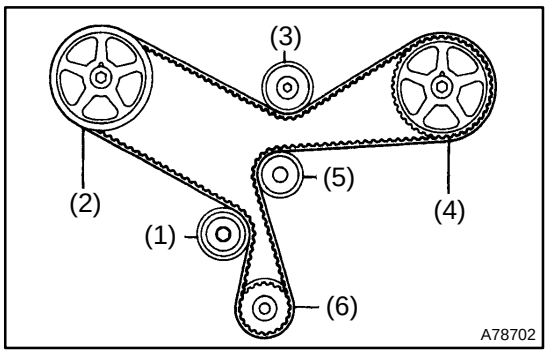
With timing belt removed:

The crankshaft pulley must be at the correct angle to avoid damage in later steps. If the crankshaft pulley is at the wrong angle and the camshaft timing pulley and the camshaft are removed, the piston head and valve head may come in contact and damaged.

(d) Remove the timing belt tensioner.

NOTICE:

Do not reinstall the tensioner with its plunger extended.



(e) Remove the timing belt in this order.

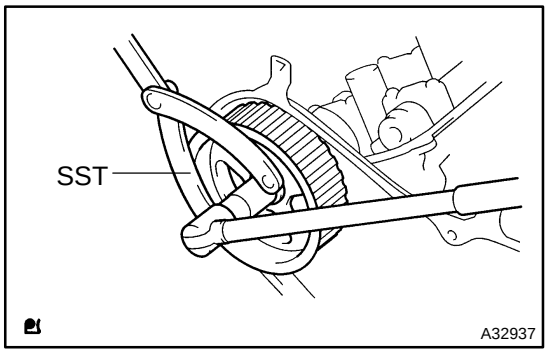
1st	No. 1 idler pulley
2nd	RH camshaft timing pulley
3rd	No. 2 idler pulley
4th	LH camshaft timing pulley
5th	Water pump pulley
6th	Crankshaft timing pulley

19. REMOVE TIMING BELT IDLER SUB−ASSY NO.1

(a) Using a socket hexagon wrench 10, remove the pivot bolt, timing belt idler No. 1 and plate washer.

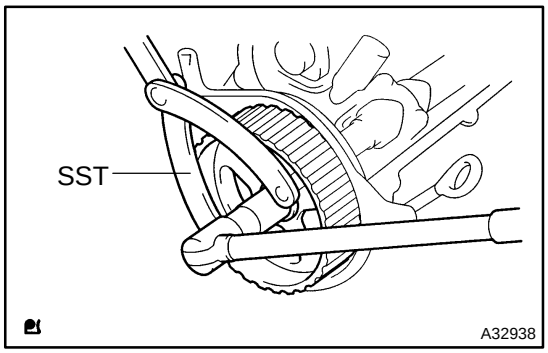
20. REMOVE TIMING BELT IDLER SUB−ASSY NO.2

21. REMOVE CRANKSHAFT POSITION SENSOR



22. REMOVE CAMSHAFT TIMING PULLEY

(a) Using SST, remove the bolt and RH timing pulley.
SST 09960−10010 (09962−01000, 09963−01000)

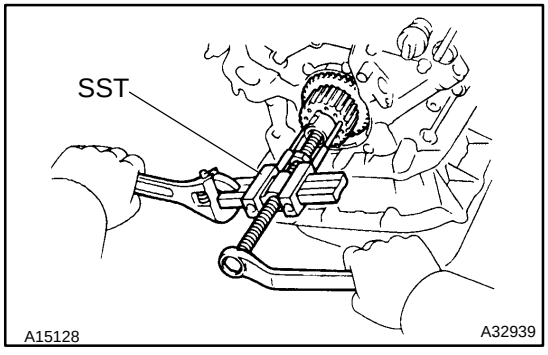


(b) Using SST, remove the bolt and LH timing pulley.
SST 09960−10010 (09962−01000, 09963−01000)

HINT:
Arrange the camshaft timing pulleys (RH and LH sides) so that they can be returned to the original locations when reassembling.

23. REMOVE TIMING BELT NO.3 COVER

24. REMOVE TIMING BELT IDLER BRACKET



25. REMOVE CRANKSHAFT TIMING PULLEY

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

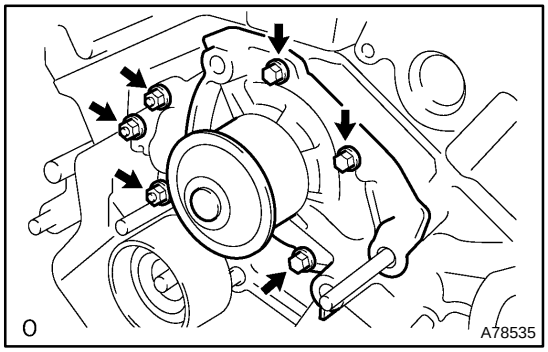
(b) Install the pulley bolt to the crankshaft.

(c) Using SST, remove the crankshaft timing pulley.
SST 09950−50013 (09951−05010, 09952−05010, 09953−05020, 09954−05011)

NOTICE:

- **Do not scratch the sensor part of the crankshaft timing pulley.**

- **Before using SST, apply lubricating oil on the threads and tip of the center bolt 150.**



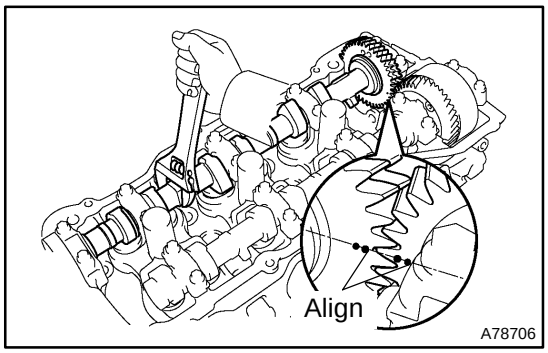
26. REMOVE WATER PUMP ASSY

(a) Remove the 3 bolts and 3 nuts, then remove the water pump and the gasket.

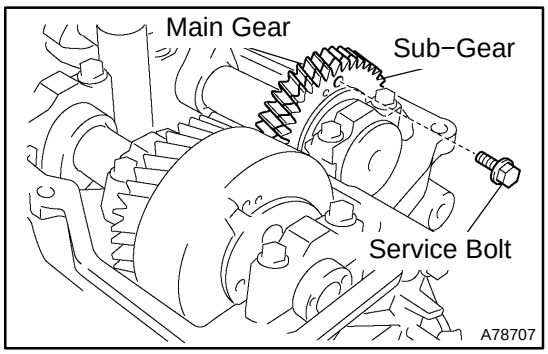
27. REMOVE CAMSHAFT

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, damage to the cylinder head or to the camshaft may result. To avoid this, the following steps should be carried out.



(a) Align the camshaft drive and driven gear's timing marks (2 dot marks each) by turning the camshaft with a wrench.



(b) Secure the exhaust camshaft sub−gear to the main gear with a service bolt.

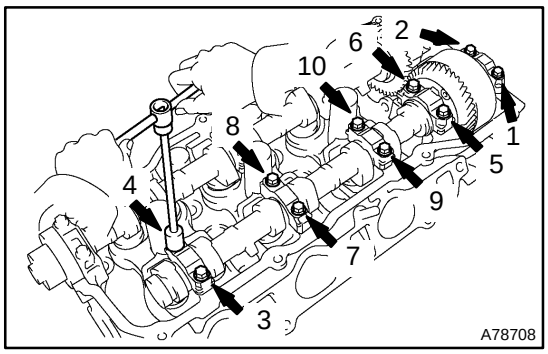
Recommended service bolt:

Item	Specified Condition
Thread diameter	6 mm
Thread pitch	1 mm
Bolt length	16 to 20 mm

Torque: 5.4 N·m (55 kgf·cm, 48 in.·lbf)

HINT:

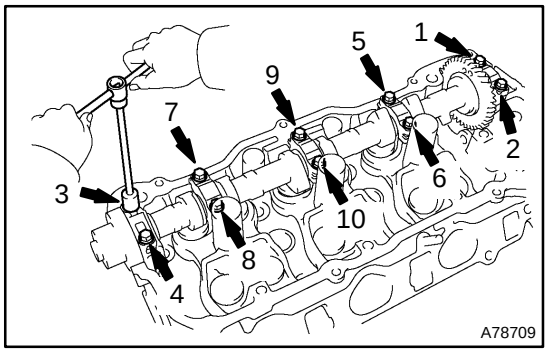
When removing the camshaft, make certain that the torsional spring force of the sub gear has been eliminated by installation of the service bolt.



(c) Uniformly loosen and remove the 10 bearing cap bolts in the sequence shown in the illustration. Remove the 5 bearing caps and the camshaft.

NOTICE:

- **Do not pry out the camshaft.**
- **Be careful not to damage the portion of the cylinder head receiving the shaft thrust.**



28. REMOVE NO.2 CAMSHAFT

(a) Uniformly loosen and remove the 10 bearing cap bolts in the sequence shown in the illustration. Remove the 5 bearing caps and the No. 2 camshaft.

NOTICE:

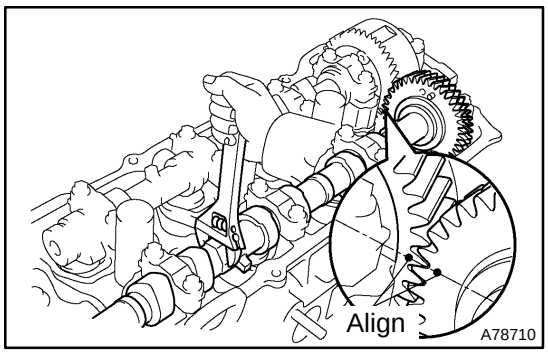
- **Do not pry out the camshaft.**
- **Be careful not to damage the portion of the cylinder head receiving the shaft thrust.**

(b) Remove the oil seal from the No. 2 camshaft.

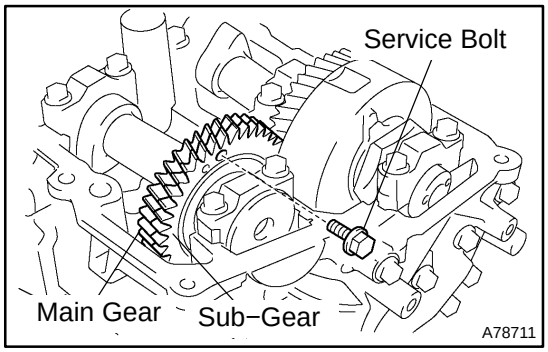
29. REMOVE NO.3 CAMSHAFT SUB−ASSY

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, damage to the cylinder head or to the camshaft may result. To avoid this, the following steps should be carried out.



(a) Align the camshaft drive and driven gear's timing marks (1 dot mark each) by turning the camshaft with a wrench.



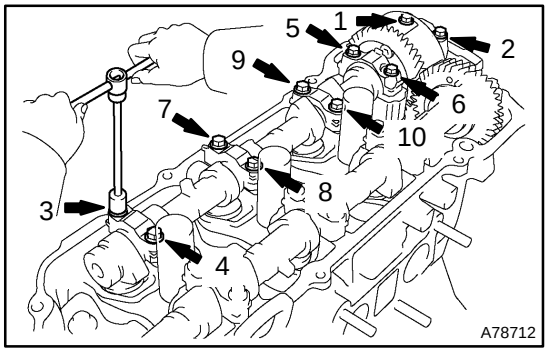
(b) Secure the exhaust camshaft sub−gear to the main gear with a service bolt.

Recommended service bolt:

Thread diameter	6 mm
Thread pitch	1 mm
Bolt length	16 to 20 mm

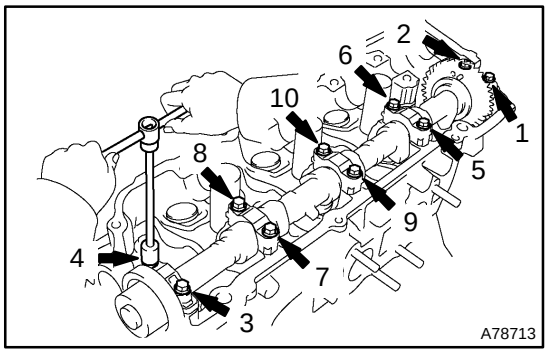
Torque: 5.4 N·m (55 kgf·cm, 48 in.·lbf)

HINT:
When removing the camshaft, make certain that the torsional spring force of the sub gear has been eliminated by installation of the service bolt.



(c) Uniformly loosen and remove the 10 bearing cap bolts in the sequence shown in the illustration. Remove the 5 bearing caps and the No. 3 camshaft.

NOTICE:
- **Do not pry out the camshaft.**
- **Be careful not to damage the portion of the cylinder head receiving the shaft thrust.**

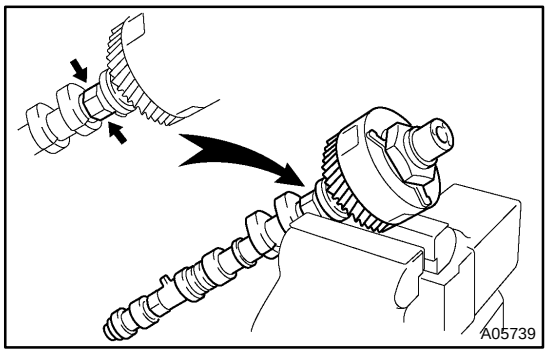


30. REMOVE NO.4 CAMSHAFT SUB−ASSY

(a) Uniformly loosen and remove the 10 bearing cap bolts in the sequence shown in the illustration. Remove the 5 bearing caps and the No. 4 camshaft.

NOTICE:
- **Do not pry out the camshaft.**
- **Be careful not to damage the portion of the cylinder head receiving the shaft thrust.**

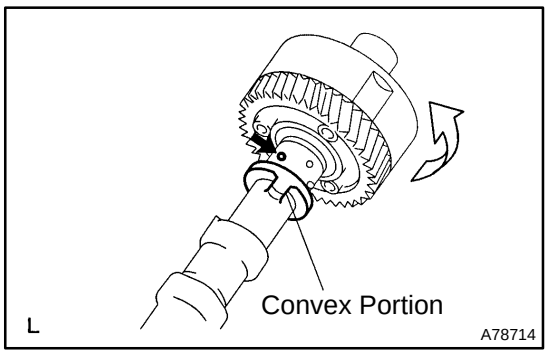
(b) Remove the oil seal from the No. 4 camshaft.



31. INSPECT CAMSHAFT TIMING GEAR ASSY

(a) Clamp the camshaft in a vise on the hexagonal lobe.

(b) Check that the VVT−i does not turn.



(c) Cover all the oil ports with vinyl tape except the port on the advanced angle side (nearest to the convex portion) shown in the illustration.

(d) Using an air gun, apply about 100 kPa (1 kgf/cm^2, 14 psi) of air pressure to the port on the advanced angle side.

NOTICE:

Some oil spraying will occur. Contain the spray with a shop rag.

HINT:

This operation releases the lock pin for the extreme retarded angle lock.

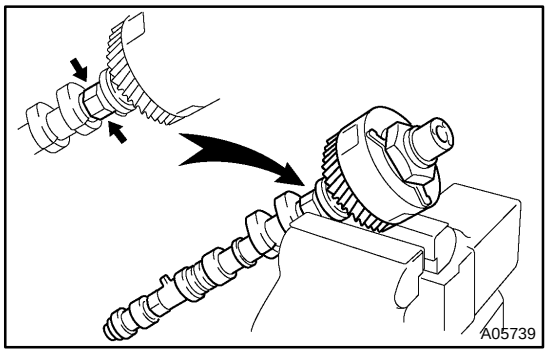
(e) Under the condition above, check that the VVT−i can be turned by hand to the advanced angle side, the direction of the white arrow in the illustration.

Standard: Must turn

HINT:
The VVT−i will turn to the advanced angle side without applying force by hand depending on the force of the air pressure applied. Also, if applying pressure to the oil path is difficult as a result of air leakage from the port, the lock−pin may be difficult to release.

(f) Check that the VVT−i moves freely within a 30° range. Avoid moving the VVT−i unit to the extreme retarded angle position as the lock−pin will re−engage.
Standard: Smooth movable range is about 30°

(g) Turn VVT−i by hand and lock it at the extreme retarded angle position.



32. REMOVE CAMSHAFT TIMING GEAR ASSY

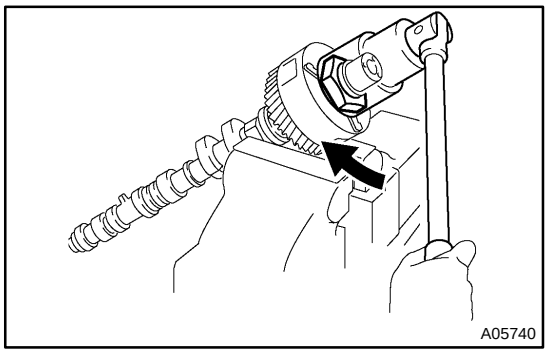
NOTICE:

Do not remove or install the timing gear (VVT−i) unless you are replacing the VVT−i or the camshaft.

(a) Clamp the camshaft in a vise on the hexagonal lobe.

NOTICE:

Do not damage the camshaft.



(b) Using a 46 mm socket wrench, remove the lock nut by turning it clockwise.

NOTICE:

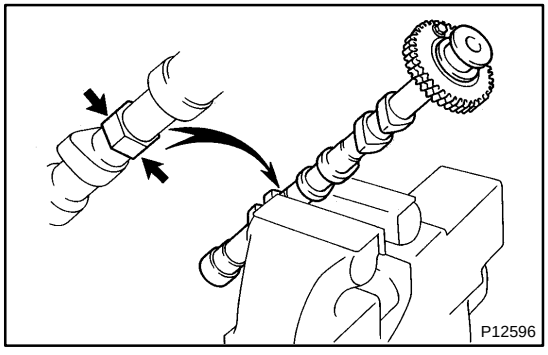
- **Remove it with the lock−pin engaged and locked at the extreme retarded angle position.**
- **The lock nut has LH threads.**
- **Only use the socket wrench. Other tools will deform the cam angle rotor.**

(c) Remove the timing gear (VVT−i).

NOTICE:

Never remove the 3 bolts on the gear.

If it is difficult to remove the VVT−i, tap it lightly using a plastic−faced hammer and then remove it.

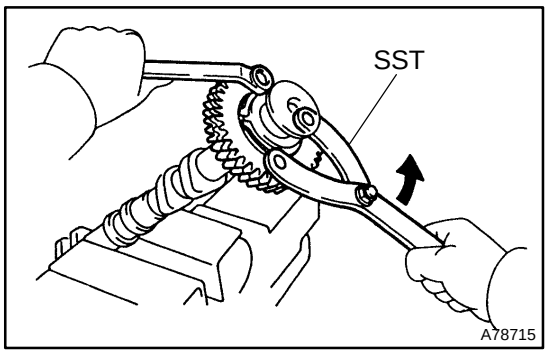


33. REMOVE CAMSHAFT SUB GEAR

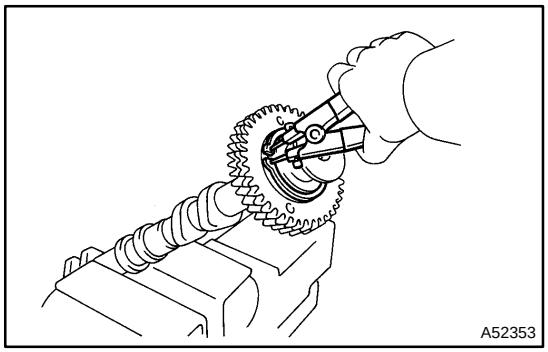
(a) Clamp the camshaft in a vise on the hexagonal lobe.

NOTICE:

Be careful not to damage the camshaft.



(b) Using SST, turn the sub gear counterclockwise, and remove the service bolt.
SST 09960−10010 (09962−01000, 09963−00500)

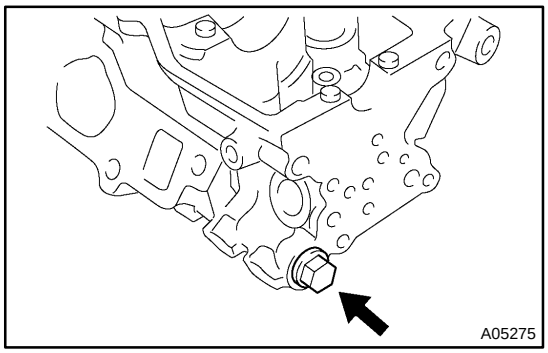


(c) Using snap ring pliers, remove the snap ring.
(d) Remove the wave washer, camshaft sub gear and camshaft gear bolt washer.

HINT:
Arrange the camshaft sub gears and gear bolt washers (RH and LH sides) so that they can be returned to the original location when reassembling.

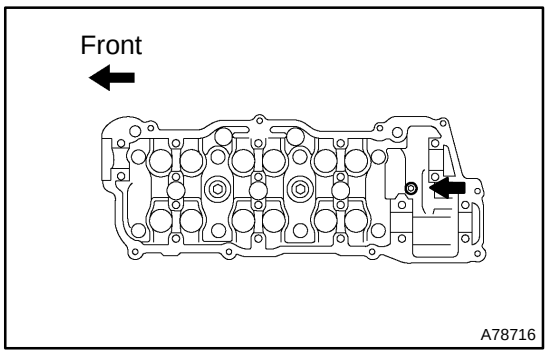
34. REMOVE ENGINE HANGER NO.2

35. REMOVE CYLINDER HEAD COVER REAR



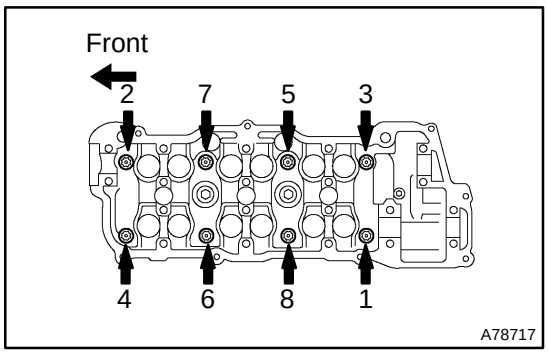
36. REMOVE OIL CONTROL VALVE FILTER

(a) Remove the plug, gasket and valve filter.



37. REMOVE CYLINDER HEAD SUB−ASSY

(a) Using a socket hexagon wrench 8, remove the hexagon bolt.

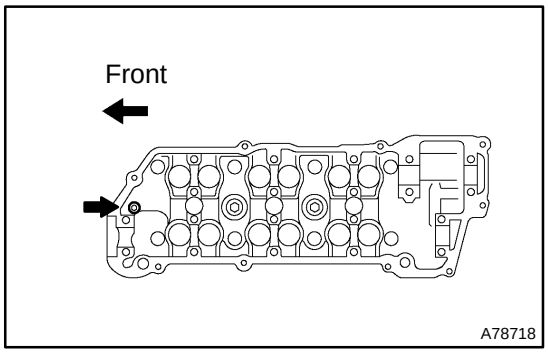


(b) Uniformly loosen the 8 cylinder head bolts in the sequence shown in the illustration. Remove the 8 cylinder head bolts and plate washers.

NOTICE:

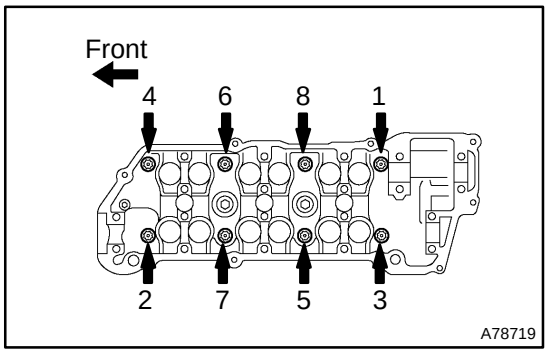
- **Be careful not to drop washers into the cylinder head.**
- **Head warpage or cracking could result from removing bolts in an incorrect order.**

38. REMOVE CYLINDER HEAD GASKET



39. REMOVE CYLINDER HEAD LH

(a) Using a socket hexagon wrench 8, remove the hexagon bolt.

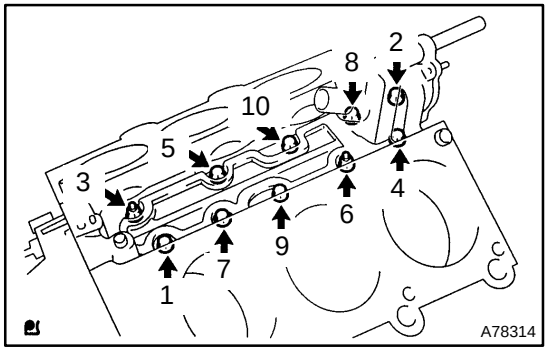


(b) Uniformly loosen the 8 cylinder head bolts in the sequence shown in the illustration. Remove the 8 cylinder head bolts and plate washers.

NOTICE:

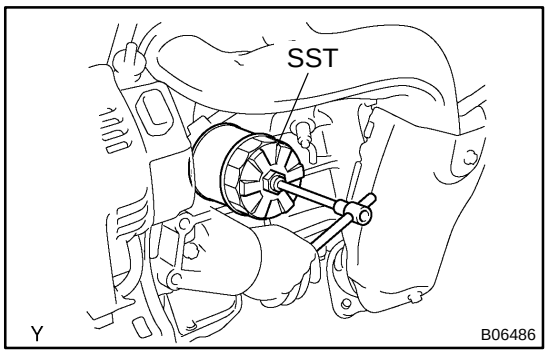
- **Be careful not to drop washers into the cylinder head.**
- **Head warpage or cracking could result from removing bolts in an incorrect order.**

40. REMOVE CYLINDER HEAD GASKET NO.2



41. REMOVE WATER INLET HOUSING

(a) Uniformly loosen and remove the 8 bolts and 2 nuts in the sequence shown in the illustration. Remove the water inlet housing.

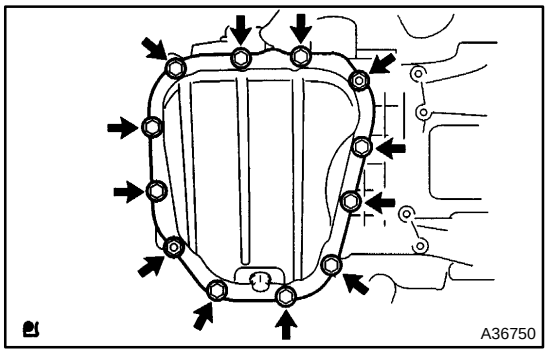


42. REMOVE OIL FILTER SUB−ASSY

(a) Using SST, remove the oil filter.
SST 09228−07501

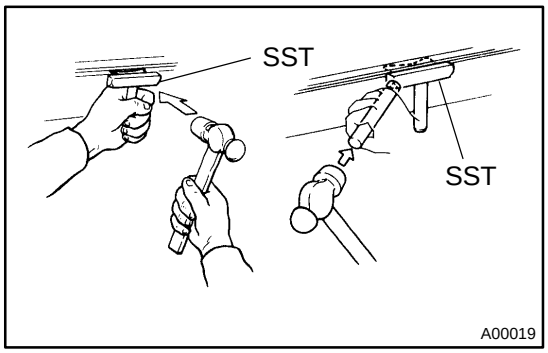
(b) Using a socket hexagon wrench 12, remove the oil filter union.

43. REMOVE OIL PAN DRAIN PLUG



44. REMOVE OIL PAN SUB−ASSY NO.2

(a) Remove the 10 bolts and 2 nuts.



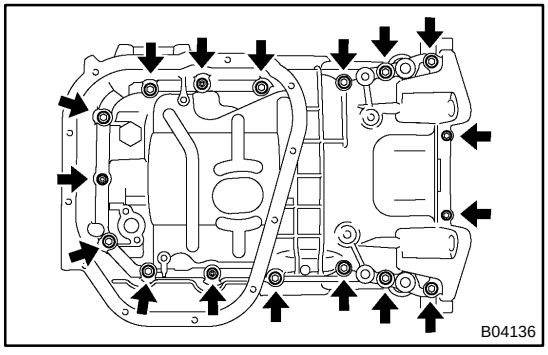
(b) Insert the blade of SST between oil pan No. 1 and oil pan No. 2, cut off the sealer and remove the oil pan No. 2.
SST 09032−00100

NOTICE:

- **Do not damage the contact surface of oil pan No. 1 and oil pan No. 2.**
- **Do not damage the flange portion of oil pan No. 2 during removal.**

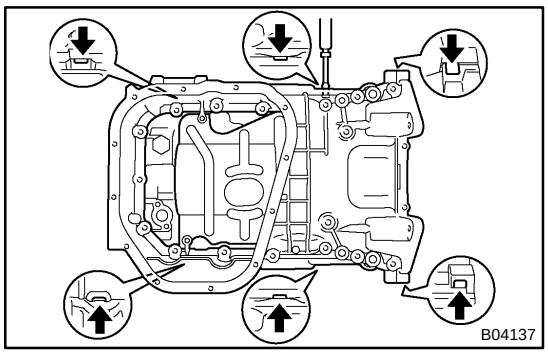
45. REMOVE OIL STRAINER SUB−ASSY

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



46. REMOVE OIL PAN SUB−ASSY

(a) Uniformly loosen and remove the 15 bolts and 2 nuts in the sequence shown in the illustration.

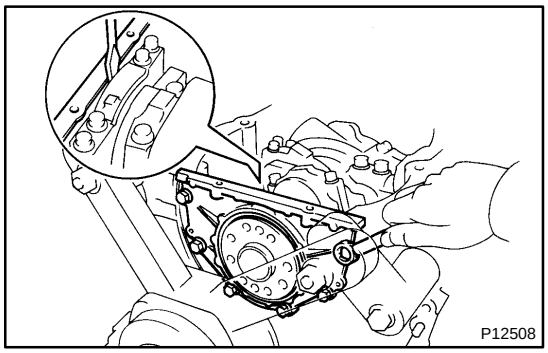


(b) Using a screwdriver, remove the oil pan by prying between the cylinder block and the oil pan.

NOTICE:

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

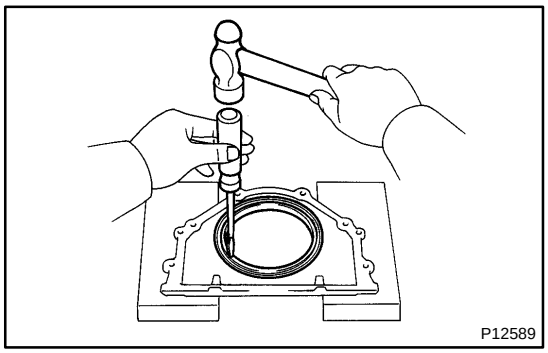
47. REMOVE OIL PAN BAFFLE PLATE



48. REMOVE ENGINE REAR OIL SEAL RETAINER

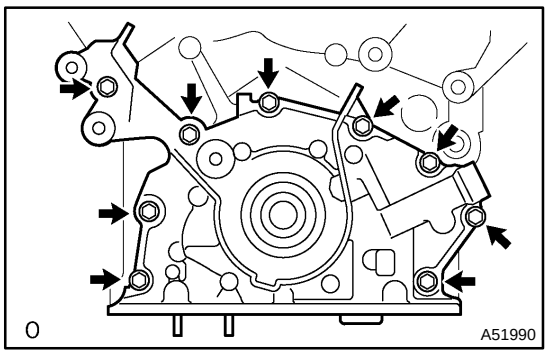
(a) Uniformly loosen and remove the 6 bolts.

(b) Using a screwdriver, remove the oil seal retainer by prying between the oil seal retainer and the main bearing cap.



49. REMOVE ENGINE REAR OIL SEAL

(a) Using a screwdriver and a hammer, tap out the oil seal.

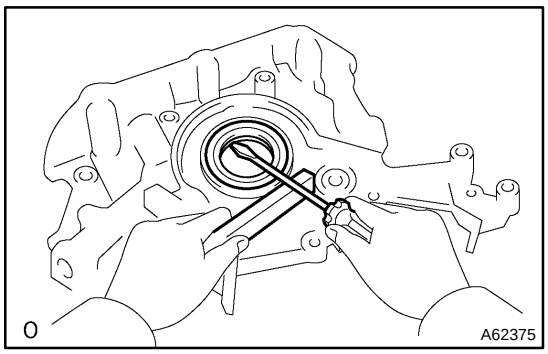


50. REMOVE OIL PUMP ASSY

(a) Remove the 9 bolts.

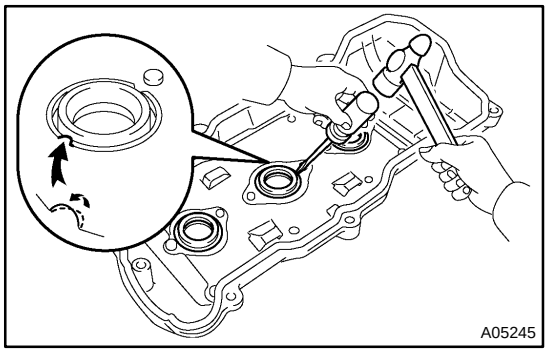
(b) Using a screwdriver, remove the oil pump by prying between the oil pump and the main bearing cap.

(c) Remove the O−ring.



51. REMOVE OIL PUMP SEAL

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



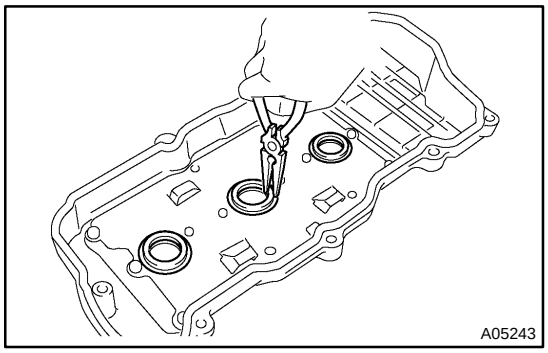
52. REMOVE SPARK PLUG TUBE GASKET

(a) Bend up the tab on the ventilation baffle plate which prevents the gasket from slipping out.

NOTICE:

Be careful not to damage the baffle plate of the cylinder head cover.

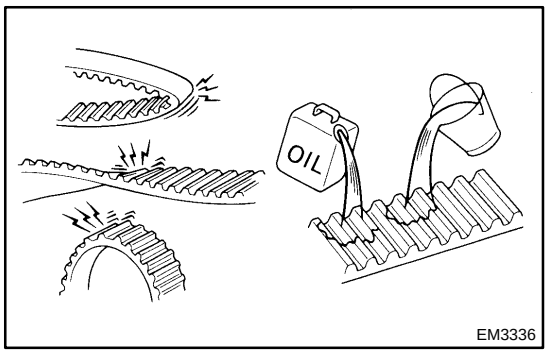
(b) Using a screwdriver and a hammer, tap out the gasket.



(c) Using needle−nose pliers, pry out the gasket.

NOTICE:

Be careful not to damage the cylinder head cover.



53. 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 mounting bolt of the camshaft timing pulley.**

Check the belt for any defects, as shown in the illustrations. Also, check these points below.

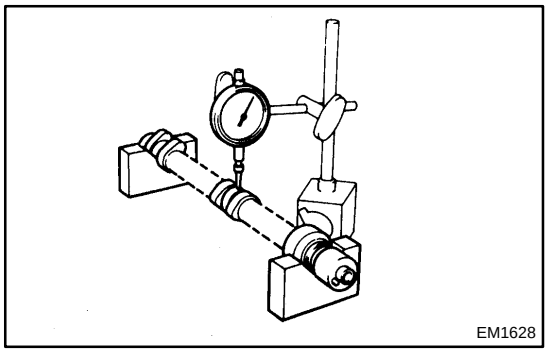
(a) If there is premature parting:
- Check for proper installation.
- Check the timing cover gasket for damage and proper installation.

(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 the timing cover for damage.
- Check that the gasket has been installed correctly.
- Check for foreign object on the pulley teeth.

If there is any doubt about the belt condition, replace the timing belt.

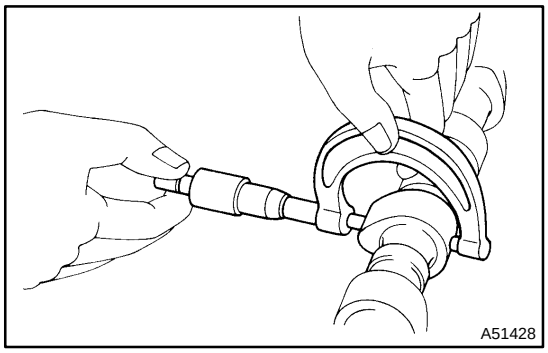

EM1628

54. INSPECT CAMSHAFT

(a) Inspect the camshaft for runout.
(1) Place the camshaft on V−blocks.
(2) Using a dial indicator, measure the runout at the center journal.

Maximum circle runout: 0.06 mm (0.0024 in.)

If the runout is greater than the maximum, replace the camshaft.


A51428

(b) Inspect the cam lobes.
(1) Using a micrometer, measure the cam lobe height.

Specified cam lobe height:

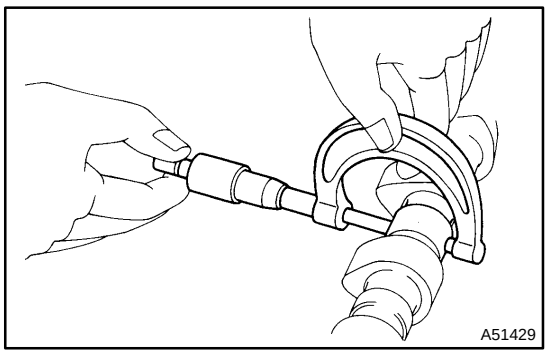
1MZ−FE

Item	Specified Condition
Intake	42.780 to 43.032 mm (1.6842 to 1.6942 in.)
Exhaust	42.610 to 42.864 mm (1.6776 to 1.6876 in.)

3MZ−FE

Item	Specified Condition
Intake	42.980 to 43.232 mm (1.6921 to 1.7020 in.)
Exhaust	42.860 to 43.110 mm (1.6874 to 1.6972 in.)

If the cam lobe height is less than the minimum, replace the camshaft.

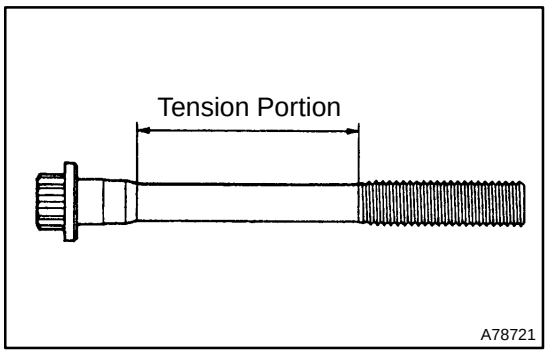

A51429

(c) Inspect the camshaft journals.
(1) Using a micrometer, measure the journal diameter.

Journal diameter:

26.959 to 26.975 mm (1.0614 to 1.0620 in.)

If the journal diameter is not as specified, check the oil clearance.

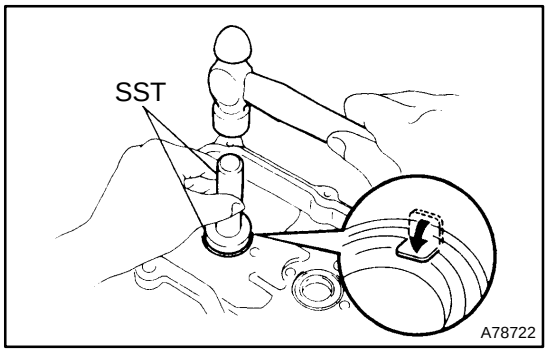


55. INSPECT CYLINDER HEAD SET BOLT

(a) Using a vernier caliper, measure the tension portion diameter of the bolt.

Specified outside diameter:
8.75 to 9.05 mm (0.3445 to 0.3563 in.)

If the diameter is less than the minimum, replace the bolt.



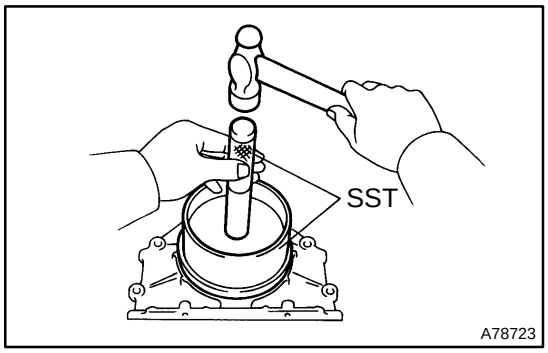
56. INSTALL SPARK PLUG TUBE GASKET

(a) Using SST and a hammer, tap in a new gasket until its surface is flush with the upper edge of the cylinder head cover.

SST 09950−60010 (09951−00430), 09950−70010 (09951−07100)

(b) Return the ventilation plate tab to its original position.

(c) Apply a light coat of MP grease to the gasket lip.



57. INSTALL ENGINE REAR OIL SEAL

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

SST 09223−15030, 09950−70010 (09951−07100)

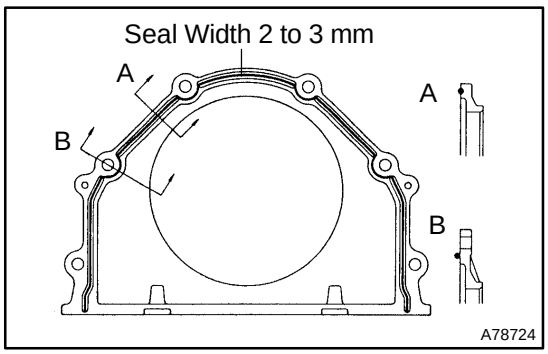
NOTICE:

- **Be careful not to tap the oil seal at an angle.**
- **Keep the gap between the rear oil seal retainer edge and the oil seal free of foreign matter.**

(b) Apply MP grease to the oil seal lip.

58. INSTALL ENGINE REAR OIL SEAL RETAINER

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



(b) Apply a continuous bead of seal packing (diameter 2 to 3 mm (0.08 to 0.12 in.)) as shown in the illustration.

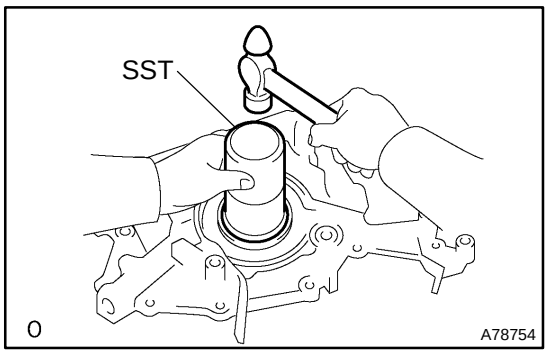
Seal packing: Part No. 08826−00080 or equivalent

NOTICE:

- **Remove any oil from the contact surface.**
- **Install the oil seal retainer within 3 minutes after applying seal packing.**
- **Do not expose the seal to engine oil for at least 2 hours after installing.**

(c) Install the oil seal retainer. Tighten the 6 bolts uniformly.

Torque: 8.0 N·m (82 kgf·cm, 71 in.·lbf)



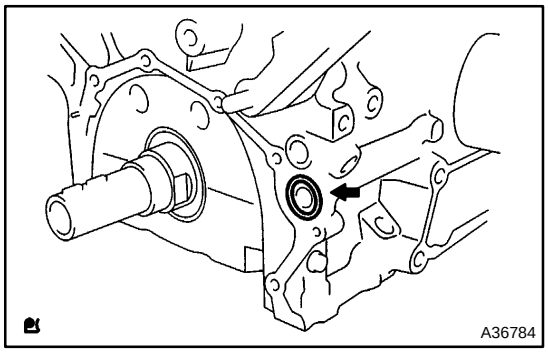
59. INSTALL OIL PUMP SEAL

(a) Using SST and a hammer, tap in a new oil seal until its surface is flush with the oil pump body edge.
SST 09223−00010

NOTICE:

- **Be careful not to tap the oil seal at an angle.**
- **Keep the gap between the oil pump body edge and the oil seal free of foreign matter.**

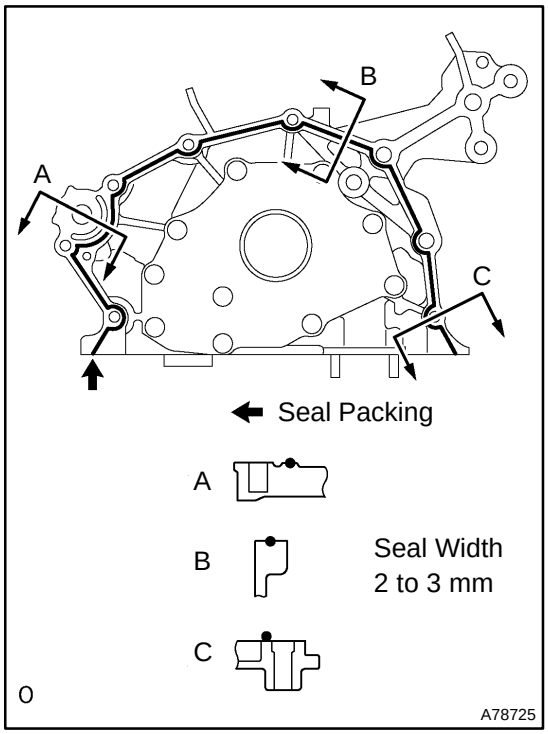
(b) Apply MP grease to the oil seal lip.



60. INSTALL OIL PUMP ASSY

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

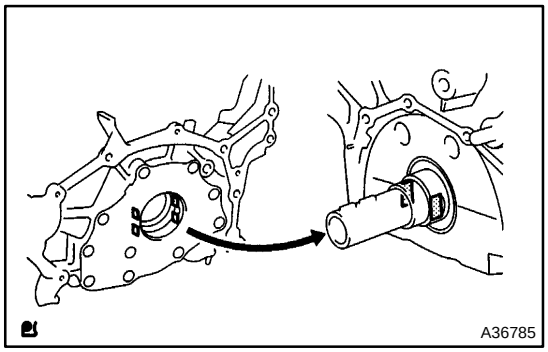
(b) Apply a light coat of engine oil to a new O−ring and place it on the cylinder block.



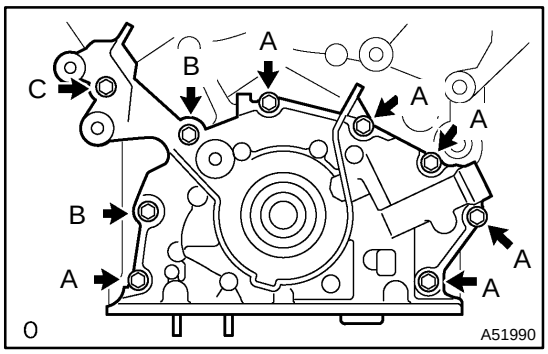
(c) Apply a continuous bead of seal packing (diameter 2 to 3 mm (0.08 to 0.12 in.)) as shown in the illustration.
Seal packing: Part No. 08826−00080 or equivalent

NOTICE:

- **Remove any oil from the contact surface.**
- **Apply seal packing to the inner side of the bolt holes.**
- **Install the oil pump within 3 minutes after applying seal packing.**
- **Do not expose the seal to engine oil for at least 2 hours after installing the oil pump.**



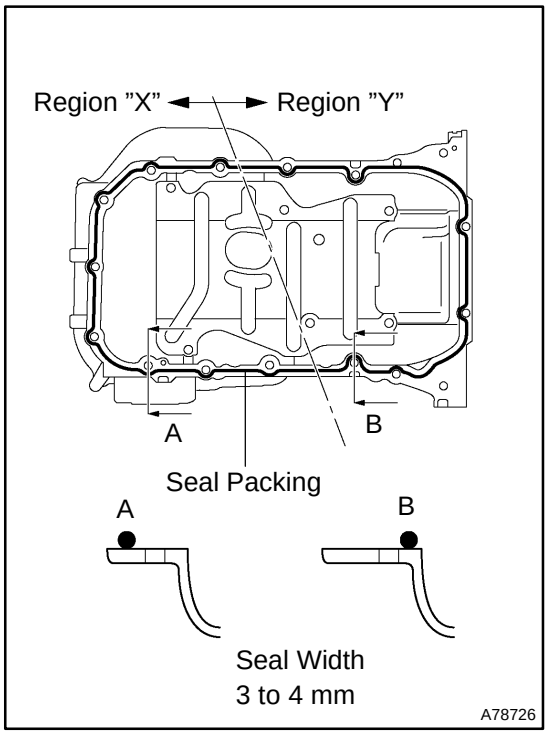
(d) Align the key of the oil pump drive gear with the keyway located on the crankshaft, and slide the oil pump into place.



(e) Install the oil pump with the 9 bolts. Tighten the bolts uniformly in several steps.
Torque:
8.0 N·m (82 kgf·cm, 71 in.·lbf) for bolt A
20 N·m (204 kgf·cm, 15 ft·lbf) for bolt B
43 N·m (439 kgf·cm, 32 ft·lbf) for bolt C

61. INSTALL CRANKSHAFT POSITION SENSOR
Torque: 8.0 N·m (80 kgf·cm, 71 in.·lbf)

62. INSTALL OIL PAN BAFFLE PLATE
Torque: 8.0 N·m (82 kgf·cm, 71 in.·lbf)

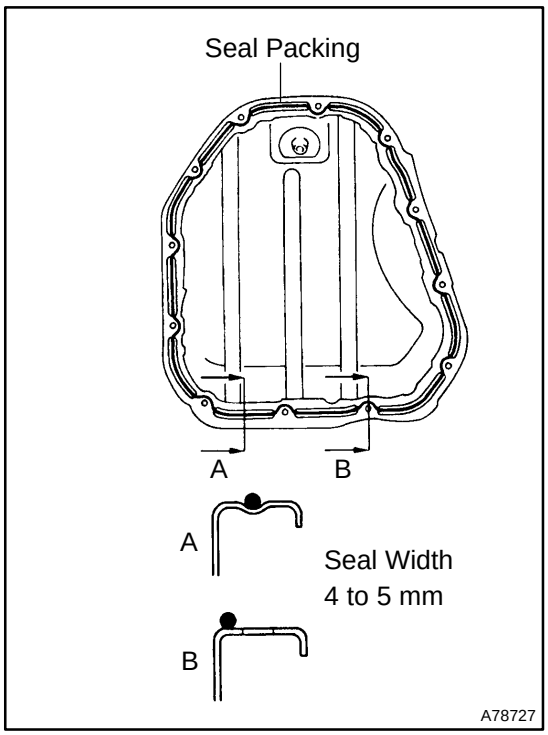


63. INSTALL OIL PAN SUB−ASSY
(a) Remove any old seal packing from the contact surface.
(b) Apply a continuous bead of seal packing (diameter 3 to 4 mm (0.12 to 0.16 in.)) as shown in the illustration.
Seal packing: Part No. 08826−00080 or equivalent

NOTICE:
- **Remove any oil from the contact surface.**
- **Apply seal packing to the outer side of the bolt holes in region ”X”.**
- **Apply seal packing to the inner side of the bolt holes in region ”Y”.**
- **Install the oil pan within 3 minutes after applying seal packing.**
- **Do not expose the seal to engine oil for at least 2 hours after installing.**

(c) Install the oil pan No. 1 with the 15 bolts and 2 nuts. Tighten the bolts uniformly in several steps.
Torque:
8.0 N·m (82 kgf·cm, 71 in.·lbf) for 10 mm head
20 N·m (199 kgf·cm, 14 ft·lbf) for 12 mm head

64. INSTALL OIL STRAINER SUB−ASSY
(a) Install a new gasket and the oil strainer with the bolt and 2 nuts.
Torque: 8.0 N·m (82 kgf·cm, 71 in.·lbf)



65. INSTALL OIL PAN SUB−ASSY NO.2

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

(b) Apply a continuous bead of seal packing (diameter 4 to 5 mm (0.16 to 0.20 in.)) as shown in the illustration.

Seal packing: Part No. 08826−00080 or equivalent

NOTICE:

- **Remove any oil from the contact surface.**
- **Apply seal packing to the inner side of the bolt holes.**
- **Install the oil pan within 3 minutes after applying seal packing.**
- **Do not expose the seal to engine oil for at least 2 hours after installing.**

(c) Install the oil pan No. 2 with the 10 bolts and 2 nuts.

Torque: 8.0 N·m (82 kgf·cm, 71 in.·lbf)

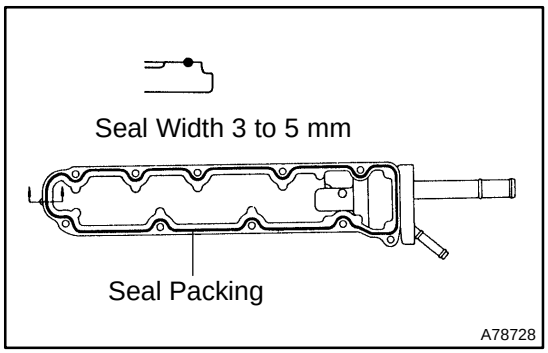
66. INSTALL OIL PAN DRAIN PLUG

(a) Install the drain plug with a new gasket.

Torque: 45 N·m (459 kgf·cm, 33 ft·lbf)

67. INSTALL WATER INLET HOUSING

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

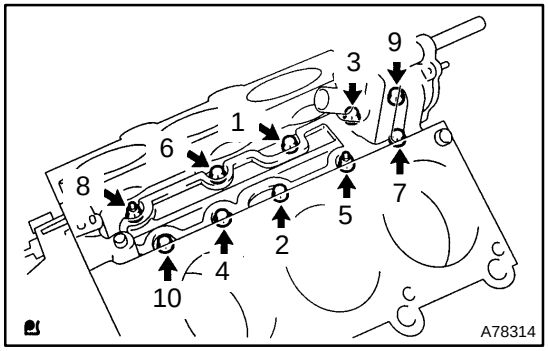


(b) Apply a continuous bead of seal packing (diameter 3 to 5 mm (0.12 to 0.20 in.)) as shown in the illustration.

Seal packing: Part No. 08826−00100 or equivalent

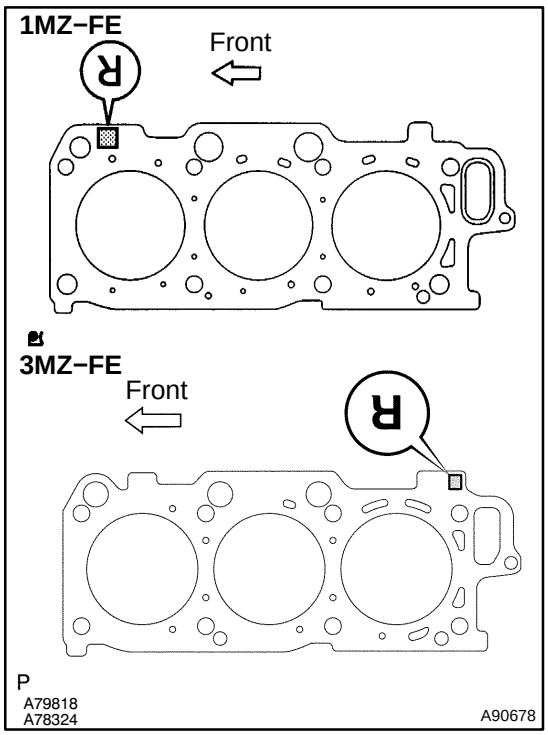
NOTICE:

- **Remove any oil from the contact surface.**
- **Install the water inlet housing within 3 minutes after applying seal packing.**
- **Do not expose the seal to coolant for at least 2 hours after installing.**



(c) Install the water inlet housing with the 8 bolts and 2 nuts. Uniformly tighten the bolts and nuts in the sequence shown in the illustration.

Torque: 8.0 N·m (82 kgf·cm, 71 in.·lbf)



68. INSTALL CYLINDER HEAD GASKET

(a) Place a new cylinder head gasket on the cylinder block with the R mark upside down, as shown in the illustration.

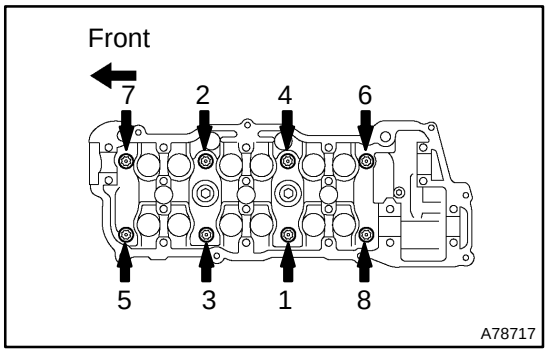
NOTICE:

- **Remove any oil from the contact surface.**
- **Make sure the cylinder head gasket is facing in the correct direction.**
- **Place the cylinder head on the gasket carefully in order not to damage the gasket at the bottom part of the head.**

69. INSTALL CYLINDER HEAD SUB−ASSY

NOTICE:

The cylinder head bolts are tightened in 2 successive steps.

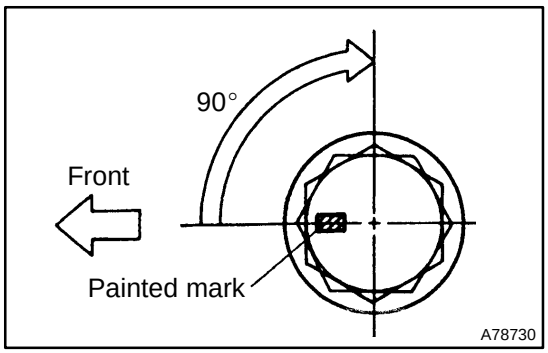


(a) Apply a light coat of engine oil on the threads of the cylinder head bolts.

(b) Install the plate washers to the cylinder head bolts.

(c) Uniformly install and tighten the 8 cylinder head bolts in the sequence shown in the illustration.

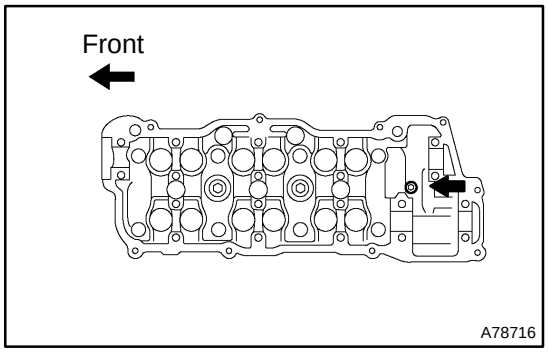
Torque: 54 N·m (550 kgf·cm, 40 ft·lbf)



(d) Mark the front side of each cylinder head bolt head with paint as shown in the illustration.

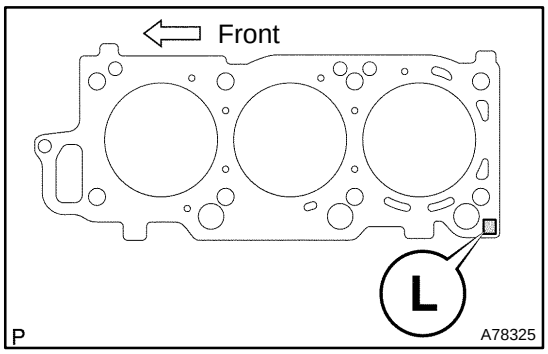
(e) Retighten the cylinder head bolts by 90° in the same sequence as step (c).

(f) Check that each painted mark is now at a 90° angle to the front.



(g) Using a socket hexagon wrench 8, install the hexagon bolt.

Torque: 19 N·m (189 kgf·cm, 14 ft·lbf)



70. INSTALL CYLINDER HEAD GASKET NO.2

(a) Place a new cylinder head gasket on the cylinder block with the L mark as shown in the illustration.

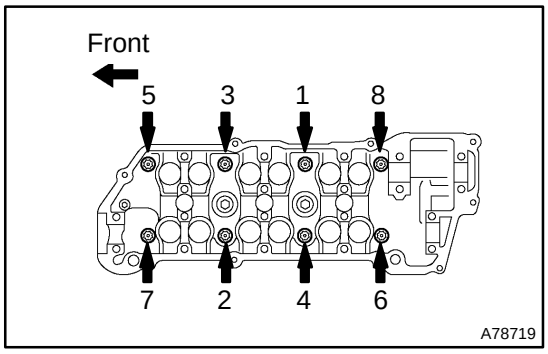
NOTICE:

- **Remove any oil from the contact surface.**
- **Make sure the cylinder head gasket is facing in the correct direction.**
- **Place the cylinder head on the gasket carefully in order not to damage the gasket at the bottom part of the head.**

71. INSTALL CYLINDER HEAD LH

NOTICE:

The cylinder head bolts are tightened in 2 successive steps.

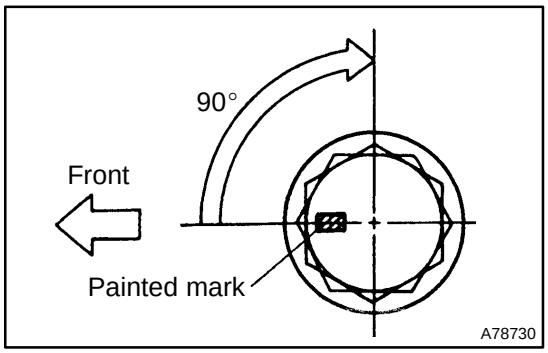


(a) Apply a light coat of engine oil on the threads of the cylinder head bolts.

(b) Install the plate washers to the cylinder head bolts.

(c) Uniformly install and tighten the 8 cylinder head bolts in the sequence shown in the illustration.

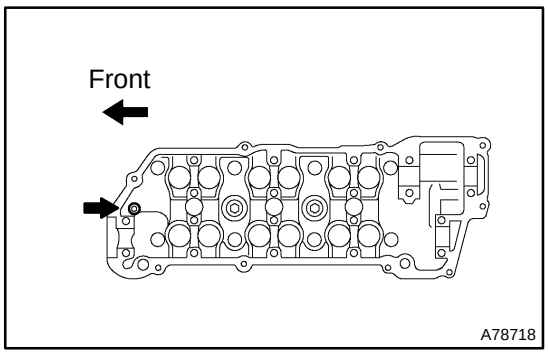
Torque: 54 N·m (550 kgf·cm, 40 ft·lbf)



(d) Mark the front side of each cylinder head bolt head with paint as shown in the illustration.

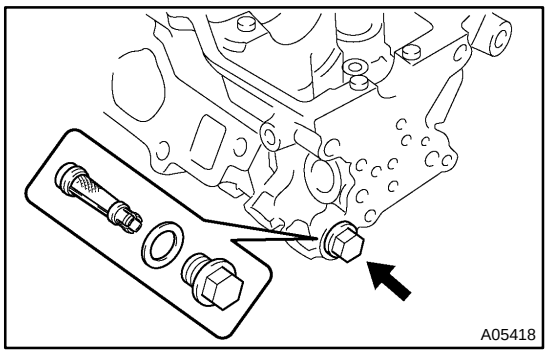
(e) Retighten the cylinder head bolts by 90° in the same sequence as step (c).

(f) Check that each painted mark is now at a 90° angle to the front.



(g) Using a socket hexagon wrench 8, install the hexagon bolt.

Torque: 19 N·m (189 kgf·cm, 14 ft·lbf)



72. INSTALL OIL CONTROL VALVE FILTER

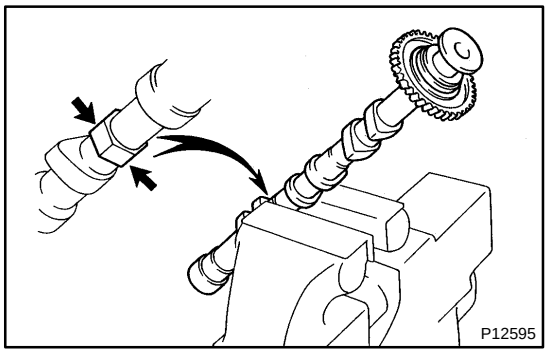
(a) Check that no foreign matter is on the mesh part of the filter.

(b) Assemble the valve filter and the plug.

(c) Install a new gasket and the plug.
Torque: 45 N·m (459 kgf·cm, 33 ft·lbf)

73. INSTALL CYLINDER HEAD COVER REAR

(a) Install a new gasket and the rear cover with the 4 bolts.
Torque: 10 N·m (102 kgf·cm, 7 ft·lbf)

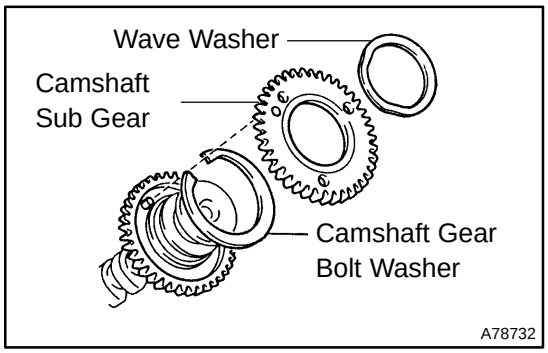


74. INSTALL CAMSHAFT SUB GEAR

(a) Clamp the camshaft in a vise on the hexagonal lobe.

NOTICE:

Be careful not to damage the camshaft.

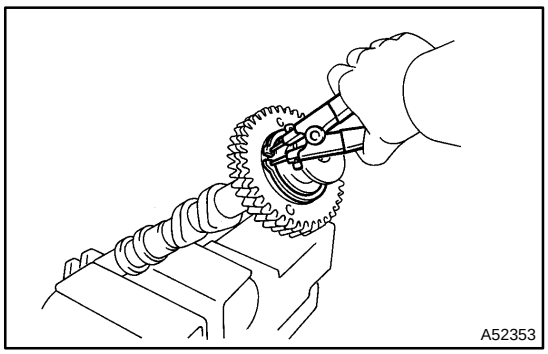


(b) Install the camshaft gear bolt washer and the camshaft sub gear.

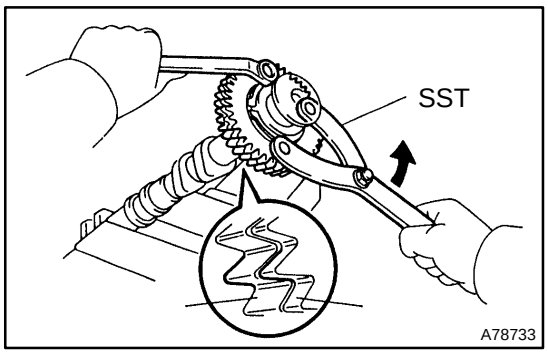
HINT:

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

(c) Install the wave washer.



(d) Using snap ring pliers, install the snap ring.



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

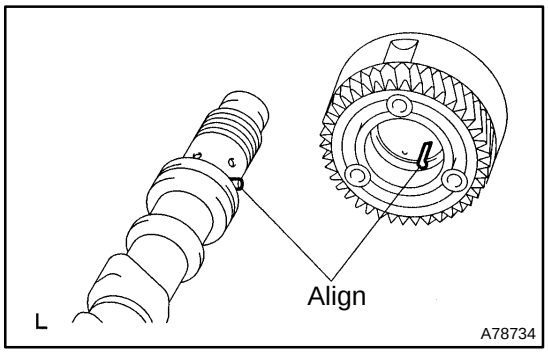
(f) Align the gear teeth of the main gear and sub gear, and tighten the service bolt.
Torque: 5.4 N·m (55 kgf·cm, 48 in.·lbf)

NOTICE:

Be careful not to damage the camshaft journals.

HINT:

When installing the camshaft, make certain that the torsional spring force of the sub gear has been eliminated by installation of the service bolt.



75. INSTALL CAMSHAFT TIMING GEAR ASSY

(a) Align the alignment pin with the alignment pin groove and install the VVT−i on the camshaft.

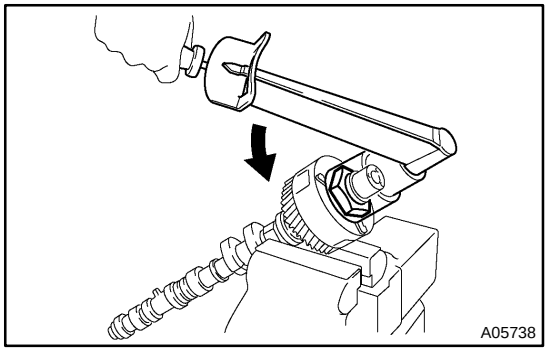
NOTICE:

Install the VVT−i with the lock−pin engaged and locked at the extreme retarded angle position.

(b) Apply engine oil on the nut, the mounting surface of the VVT−i and the screw threads.

NOTICE:

- **Be sure to apply the oil, otherwise the specified torque cannot be obtained.**
- **New nuts must be used when replacing the VVT−i unit.**



(c) Using a 46 mm socket wrench, install and tighten a lock nut by turning it counterclockwise.
Torque: 150 N·m (1,530 kgf·cm, 111 ft·lbf)

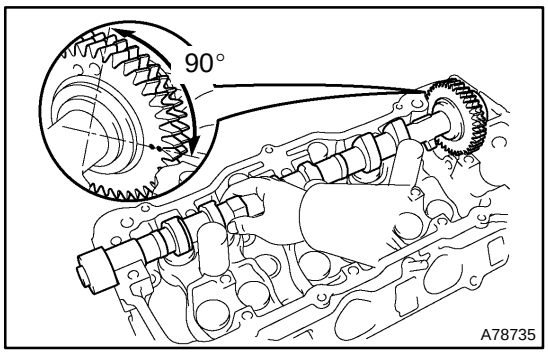
NOTICE:

- **The lock nut has LH threads.**
- **Never use any tool other than the socket wrench. Other tools will deform the cam angle rotor.**

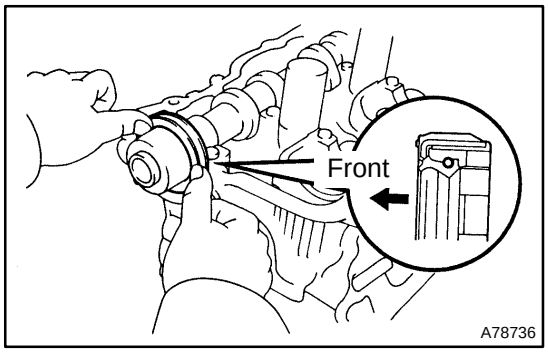
76. INSTALL NO.2 CAMSHAFT

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, damage to the cylinder head or to the camshaft may result. To avoid this, the following steps must be carried out.



(a) Apply new engine oil to the thrust portion and journal of the camshaft.
(b) Place the No. 2 camshaft at a 90° angle of the timing mark (2 dot marks) on the cylinder head.
(c) Apply MP grease to a new oil seal lip.

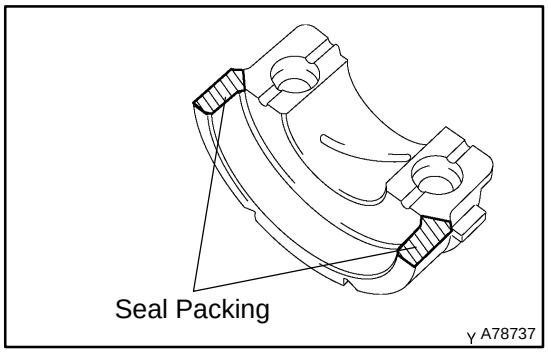


(d) Install the oil seal to the camshaft.

NOTICE:

- **Do not turn over the oil seal lip.**
- **Insert the oil seal until it stops.**

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

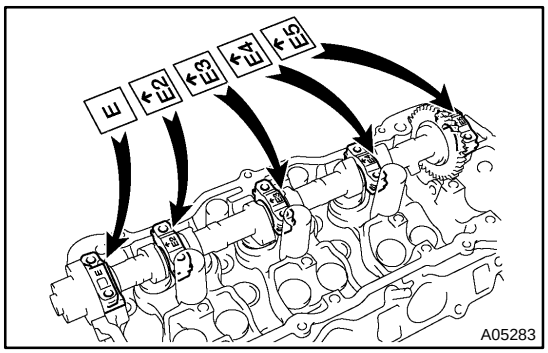


(f) Apply seal packing to the No. 1 bearing cap as shown in the illustration.

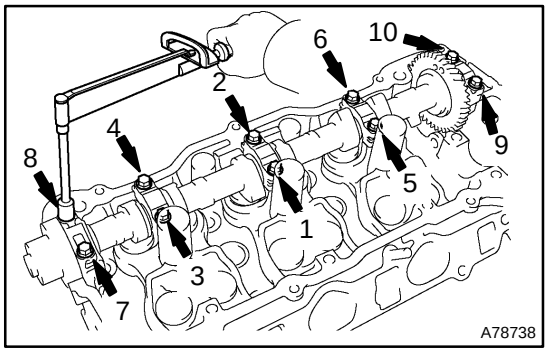
Seal packing: Part No. 08826−00080 or equivalent

NOTICE:

- **Install the No. 1 bearing cap within 5 minutes after applying seal packing.**
- **Do not expose the seal to engine oil for at least 2 hours after installing.**



(g) Install the 5 bearing caps in their proper locations.
(h) Apply a light coat of engine oil on the threads of the bearing cap bolts.



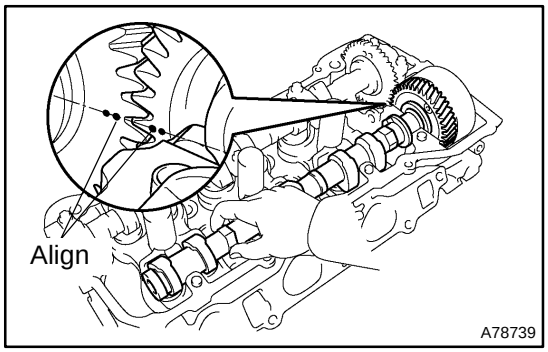
(i) Uniformly tighten the 10 bearing cap bolts in the sequence shown in the illustration.

Torque: 16 N·m (163 kgf·cm, 12 ft·lbf)

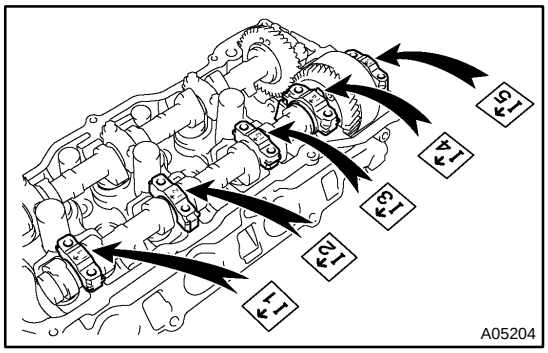
77. INSTALL CAMSHAFT

NOTICE:

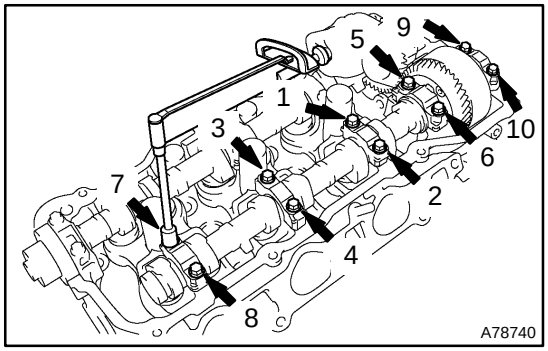
Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, damage to the cylinder head or to the camshaft may result. To avoid this, the following steps must be carried out.



(a) Apply new engine oil to the thrust portion and journal of the camshaft.
(b) Align the camshaft drive and driven gear's timing marks (2 dot marks each).
(c) Place the camshaft on the cylinder head.



(d) Install the 5 bearing caps in their proper locations.
(e) Apply a light coat of engine oil on the threads of the bearing cap bolts.

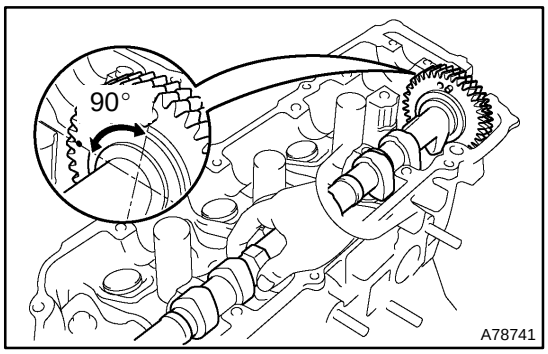


(f) Uniformly tighten the 10 bearing cap bolts uniformly in the sequence shown in the illustration.
Torque: 16 N·m (163 kgf·cm, 12 ft·lbf)
(g) Remove the service bolt.

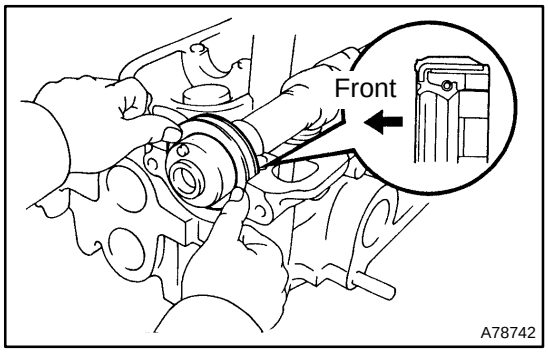
78. INSTALL NO.4 CAMSHAFT SUB−ASSY

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, damage to the cylinder head or to the camshaft may result. To avoid this, the following steps must be carried out.



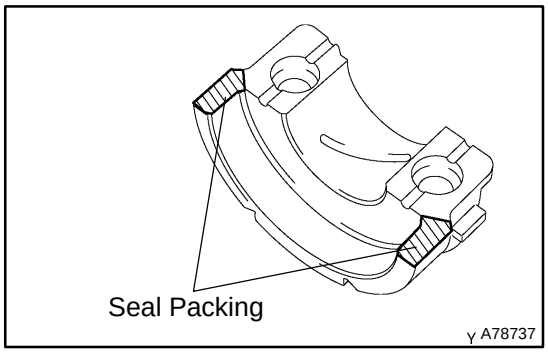
(a) Apply new engine oil to the thrust portion and journal of the camshaft.
(b) Place the No. 4 camshaft at a 90° angle of the timing mark (1 dot mark) on the cylinder head.
(c) Apply MP grease to a new oil seal lip.



(d) Install the oil seal to the camshaft.

NOTICE:

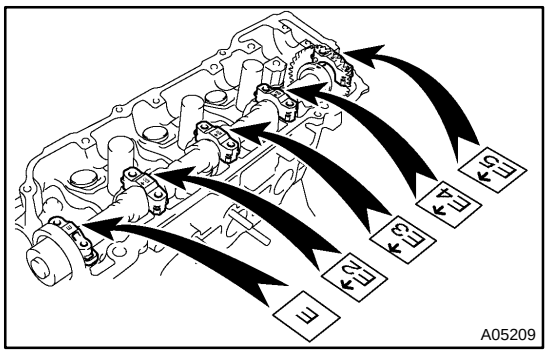
- **Do not turn over the oil seal lip.**
- **Insert the oil seal until it stops.**



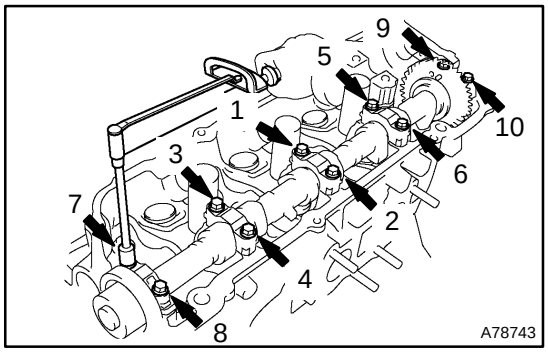
(e) Remove any old packing material from the contact surface.
(f) Apply seal packing to the No. 1 bearing cap as shown in the illustration.
Seal packing: Part No. 08826−00080 or equivalent

NOTICE:

- **Install the No. 1 bearing cap within 5 minutes after applying seal packing.**
- **Do not expose the seal to engine oil for at least 2 hours after installing.**



(g) Install the 5 bearing caps in their proper locations.
(h) Apply a light coat of engine oil on the threads of the bearing cap bolts.



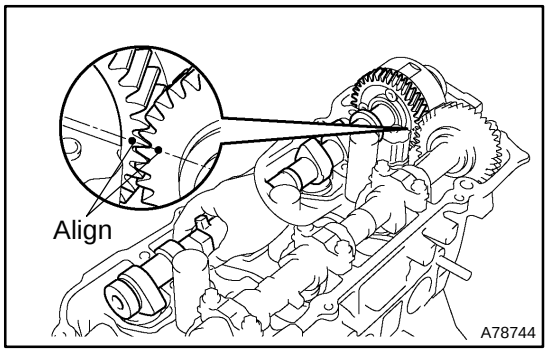
(i) Uniformly tighten the 10 bearing cap bolts in the sequence shown in the illustration.
Torque: 16 N·m (163 kgf·cm, 12 ft·lbf)

79. INSTALL NO.3 CAMSHAFT SUB−ASSY

NOTICE:

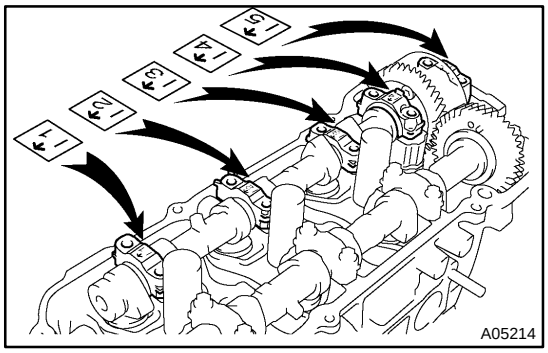
Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, damage to the cylinder head or to the camshaft may result. To avoid this, the following steps must be carried out.

(a) Apply new engine oil to the thrust portion and journal of the camshaft.



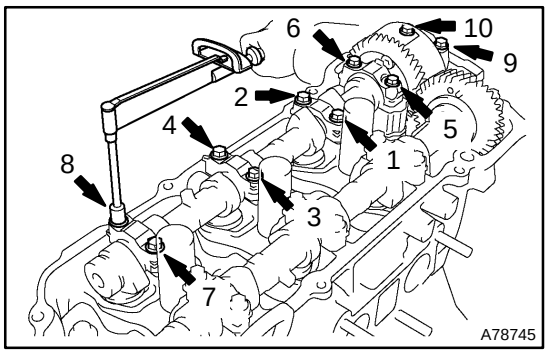
(b) Align the camshaft drive and driven gear's timing marks (1 dot mark each).

(c) Place the camshaft on the cylinder head.



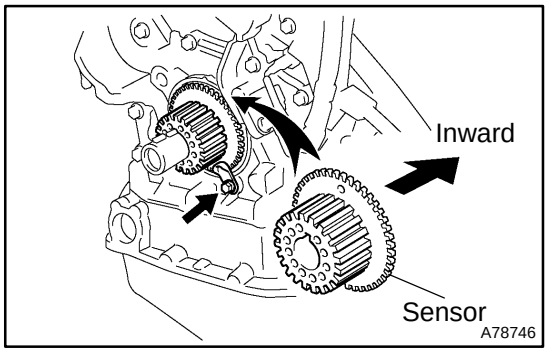
(d) Install the 5 bearing caps in their proper locations.

(e) Apply a light coat of engine oil on the threads of the bearing cap bolts.



(f) Uniformly tighten the 10 bearing cap bolts in the sequence shown in the illustration.
Torque: 16 N·m (163 kgf·cm, 12 ft·lbf)

(g) Remove the service bolt.



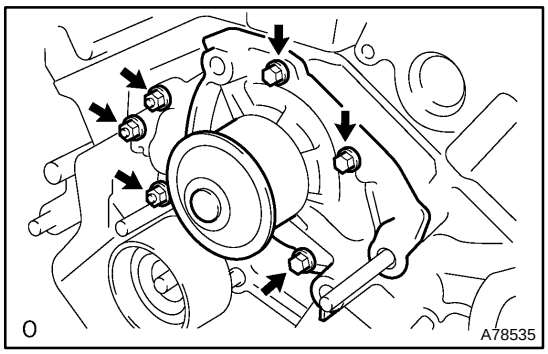
80. INSTALL CRANKSHAFT TIMING PULLEY

(a) Align the keyway of the timing pulley with the key located on the crankshaft and slide the timing pulley into place.

NOTICE:

Do not scratch the sensor area of the crankshaft timing pulley.

(b) Install the timing belt plate with the bolt.
Torque: 8.0 N·m (82 kgf·cm, 71 in.·lbf)



81. INSTALL WATER PUMP ASSY

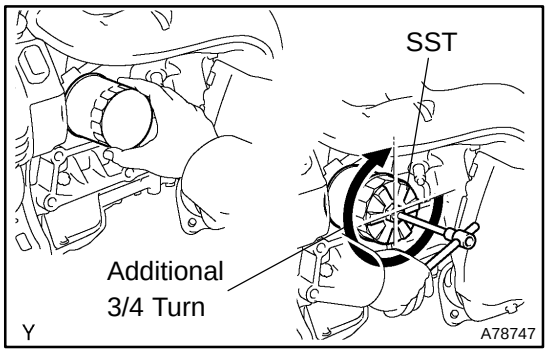
(a) Install a new gasket and the water pump with the 3 bolts and 3 nuts.
Torque: 8.0 N·m (82 kgf·cm, 71 in.·lbf)

82. INSTALL OIL LEVEL GAGE GUIDE

(a) Apply a light coat of engine oil to a new O−ring and install it to the level gage guide.
(b) Install the level gage guide.
Torque: 8.0 N·m (82 kgf·cm, 71 in.·lbf)

83. INSTALL OIL FILTER SUB−ASSY

(a) Using a socket hexagon wrench 12, install the oil filter union.
Torque: 30 N·m (306 kgf·cm, 22 ft·lbf)
(b) Check and clean the oil filter installation surface.
(c) Apply clean engine oil to the gasket of a new oil filter.
(d) Lightly screw the oil filter into place, and tighten it until the gasket contacts the seat.
(e) Using SST, tighten it an additional 3/4 turn.
SST 09228−07501

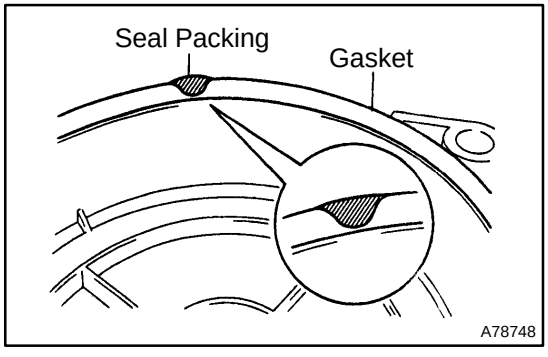


84. INSTALL TIMING BELT IDLER BRACKET
Torque: 28 N·m (286 kgf·cm, 21 ft·lbf)

85. INSTALL TIMING BELT NO.3 COVER

(a) Visually check for cracks and breaks on the gasket of the timing belt cover.

HINT:
If water is entering through cracks or breaks in the gasket, repair according to these guidelines: 1) if the crack length is within 2 to 3 cm (0.79 to 1.18 in.), repair with seal packing; or 2) if the crack length is over 3 cm (1.18 in.), replace the gasket.



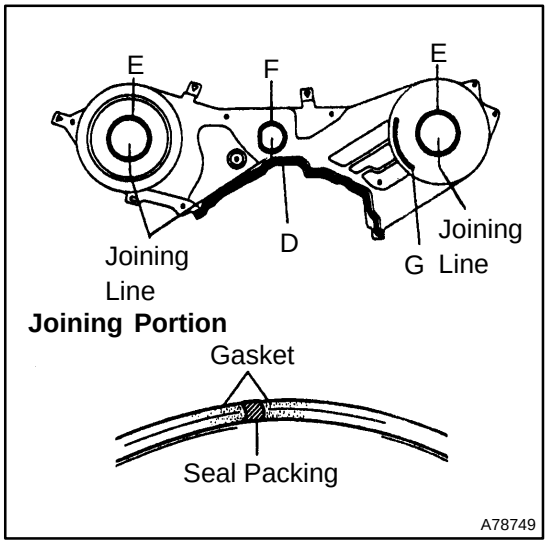
(b) If the timing belt cover gasket needs to be repaired, follow the procedure below.
(1) Repair the cracks and breaks by applying the seal packing to the damaged area.
Seal packing: Part No. 08826−00080 or equivalent

NOTICE:
When applying the seal packing, apply it as wide and high as the gasket.

(c) If the timing belt cover gasket needs to be replaced, follow the procedure below.

(1) Using a screwdriver and gasket scraper, remove the remaining gasket.

NOTICE:
Be careful not to damage the timing belt cover.



(2) Remove the backing paper from a new gasket, and affix the gasket along the groove of the timing belt cover as shown in the illustration.

NOTICE:
- **Affix the gasket in the center of the groove.**
- **At the corners, try to keep the gasket thickness uniform.**

Length:

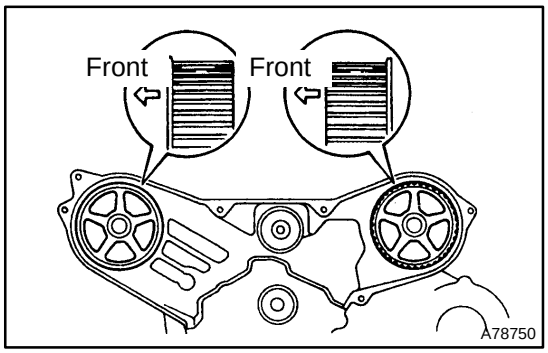
Gasket	D	E	F	G
Specified Condition	335 mm (13.19 in.)	180 mm (7.09 in.)	133 mm (5.24 in.)	72 mm (2.83 in.)

(3) If there is a gap on the joint of the gasket, apply seal packing to close the gap.

Seal packing: Part No. 08826−00080 or equivalent

NOTICE:
When applying the seal packing, apply it as wide and high as the gasket.

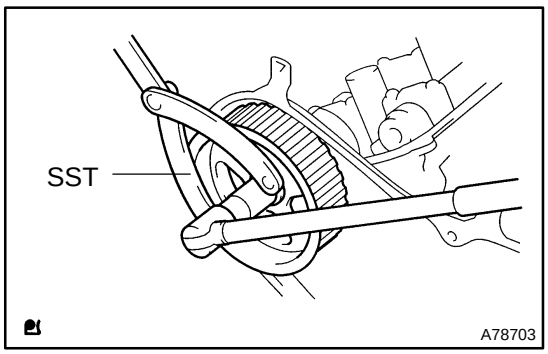
(d) Install the timing belt cover with the 6 bolts.
Torque: 8.5 N·m (87 kgf·cm, 76 in.·lbf)



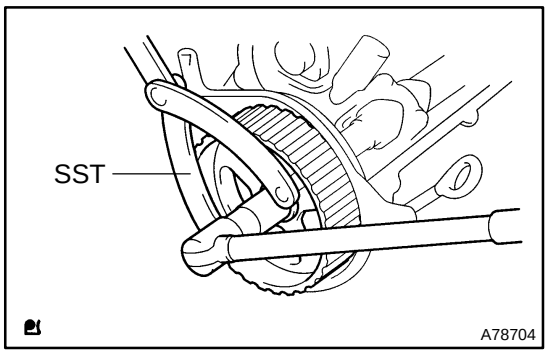
86. INSTALL CAMSHAFT TIMING PULLEY

(a) Install the camshaft timing pulley with the belt guide properly oriented and tighten the bolt temporarily.

HINT:
- Face the belt guide of the RH timing pulley towards the front of the engine.
- Face the belt guide of the LH timing pulley towards the rear of the engine.



(b) Using SST, tighten the RH pulley bolt.
SST 09960−10010 (09962−01000, 09963−01000)
Torque: 125 N·m (1,275 kgf·cm, 92 ft·lbf)



(c) Using SST, tighten the LH pulley bolt.
SST 09960−10010 (09962−01000, 09963−01000)
Torque: 125 N·m (1,275 kgf·cm, 92 ft·lbf)

87. INSTALL TIMING BELT IDLER SUB−ASSY NO.2
Torque: 43 N·m (438 kgf·cm, 32 ft·lbf)

88. INSTALL TIMING BELT IDLER SUB−ASSY NO.1

(a) Using a socket hexagon wrench 10, install the plate washer and timing belt idler No. 1 with the pivot bolt.
Torque: 34 N·m (347 kgf·cm, 25 ft·lbf)

89. INSTALL TIMING BELT

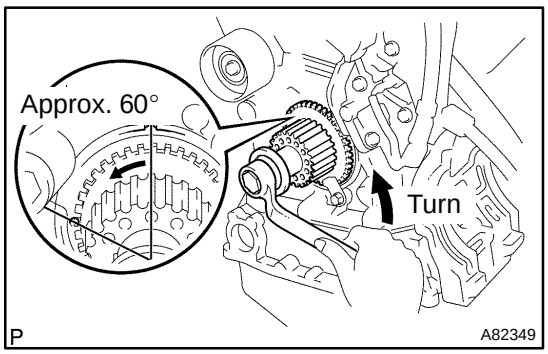
(a) Remove any oil or water on the pulleys, and keep them clean.

NOTICE:

- **If there is a trace of water and/or oil on the timing belt, repair the leakage and install a new timing belt.**
- **Only wipe the pulleys. Do not use cleaning agents on the pulleys.**

(b) Inspect the idler pulleys.
(1) Check that the idler pulley turns smoothly.
(2) Visually check the sealed portion of the idler pulley for oil leakage.

(c) Inspect the water pump.
(1) Turn the pulley, and check that the water pump bearing moves smoothly without any noise.
(2) Visually check the drain hole for coolant leakage.

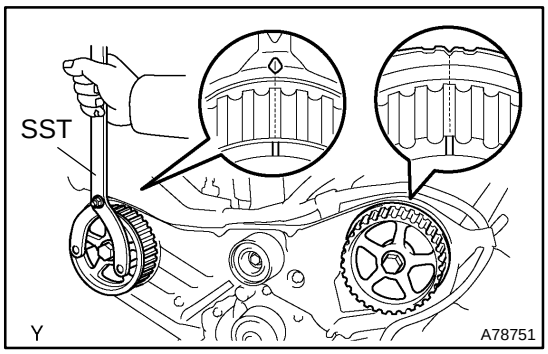


(d) Temporarily install the crankshaft pulley bolt and washer to the crankshaft.

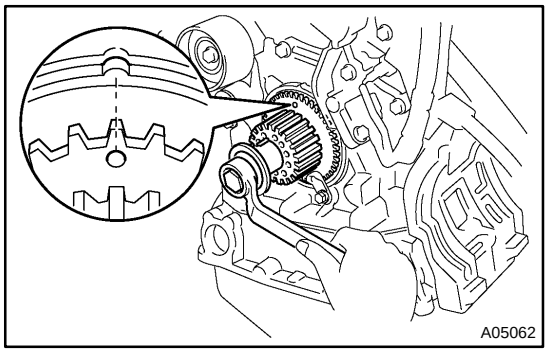
(e) Turn the crankshaft counterclockwise by approximately 60°.

NOTICE:

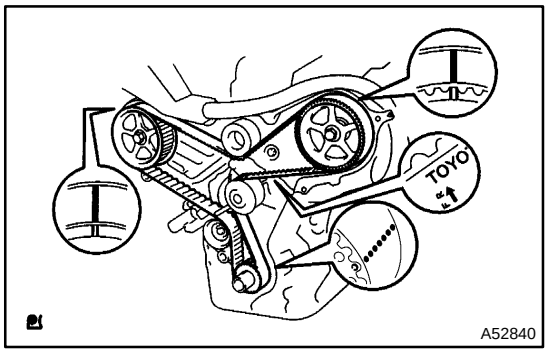
To prevent contacting the piston head and the valve head from colliding, set the crankshaft pulley at approximately 60° BTDC/compression position.



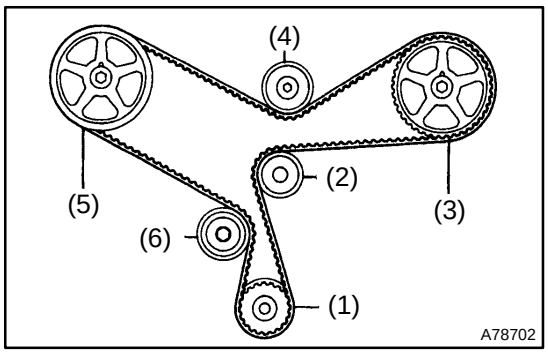
(f) Using SST, turn the crankshaft pulley, and align the timing marks of the timing pulley with the No. 3 timing belt cover.
SST 09960−10010 (09962−01000, 09963−01000)



(g) Turn the crankshaft, and align the timing mark of the crankshaft timing pulley with the oil pump body.

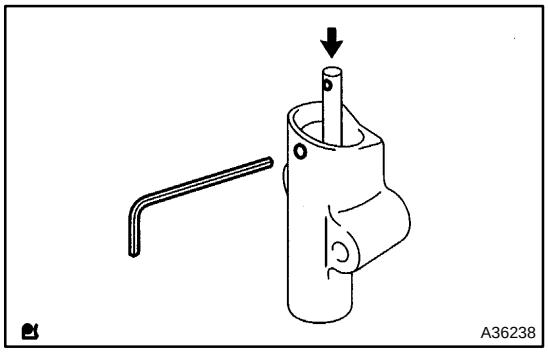


(h) Face the front mark on the timing belt forward.
(i) Align the installation mark on the timing belt with the timing mark of the crankshaft timing pulley.
(j) Align the installation marks on the timing belt with the timing marks of the camshaft timing pulleys.



(k) Install the timing belt in this order.

1st	Crankshaft timing pulley
2nd	Water pump pulley
3rd	LH camshaft timing pulley
4th	No. 2 idler pulley
5th	RH camshaft timing pulley
6th	No. 1 idler pulley



90. INSTALL TIMING BELT TENSIONER ASSY

(a) Set the timing belt tensioner uprightly on the press.
(b) Slowly press in the push rod.

NOTICE:

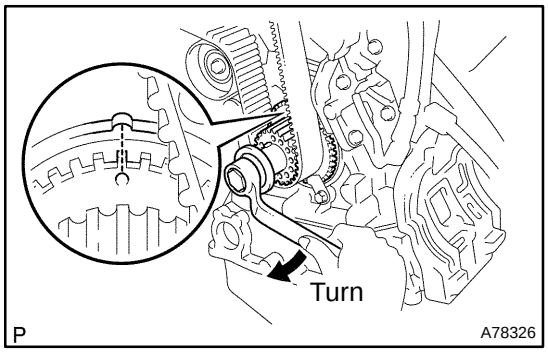
Do not apply pressure of more than 9.8 kN (1,000 kgf, 2,205 lbf) to the rod.

(c) Align the holes of the push rod and housing, pass a 1.5 mm hexagon wrench through the holes to keep the setting position of the push rod.
(d) Release the press.

(e) Temporarily install the tensioner with the 2 bolts.
Torque: 27 N·m (280 kgf·cm, 20 ft·lbf)

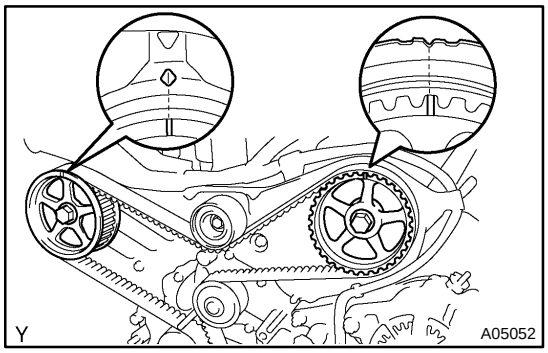
NOTICE:
Install the tensioner's bolts uniformly and evenly. Installing the tenioner at an angle may cause it to malfunction.

(f) Remove the 1.5 mm hexagon wrench from the tensioner.



(g) Turn the crankshaft 2 revolutions slowly, and align the timing mark of the crankshaft timing pulley with the oil pump body.

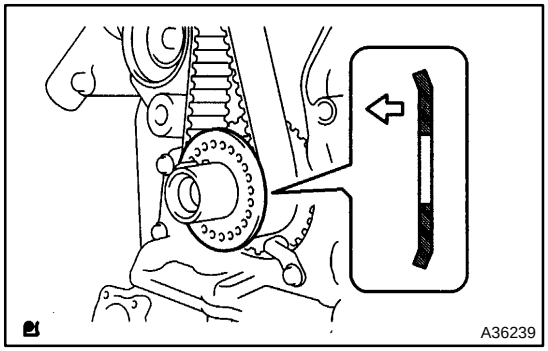
NOTICE:
Always turn the crankshaft clockwise.



(h) Check that the timing marks of the RH and LH timing pulleys are aligned with the timing marks of the No. 3 timing belt cover as shown in the illustration.

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

(i) Remove the crankshaft pulley bolt.



91. INSTALL TIMING BELT GUIDE NO.2

(a) Install the timing belt guide, facing the cup side toward the engine front.

92. INSTALL ENGINE MOUNTING BRACKET RH
Torque: 28 N·m (286 kgf·cm, 21 ft·lbf)

93. INSTALL TIMING BELT NO.2 COVER

(a) Visually check for cracks and breaks on the gasket of the timing belt cover.

If there is a trace that water is entering at the visual check, replace the timing belt cover.

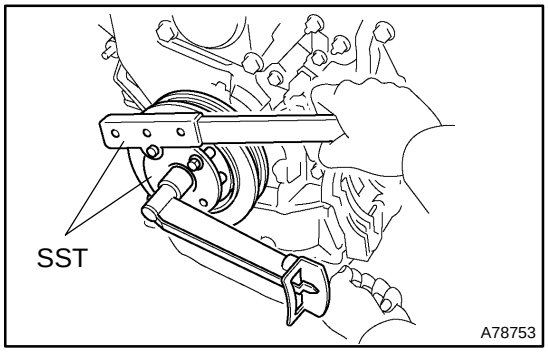
(b) Install the timing belt cover.
Torque: 8.5 N·m (87 kgf·cm, 75 in.·lbf)

94. INSTALL TIMING BELT NO.1 COVER

(a) Visually check for cracks and breaks on the gasket of the timing belt cover.

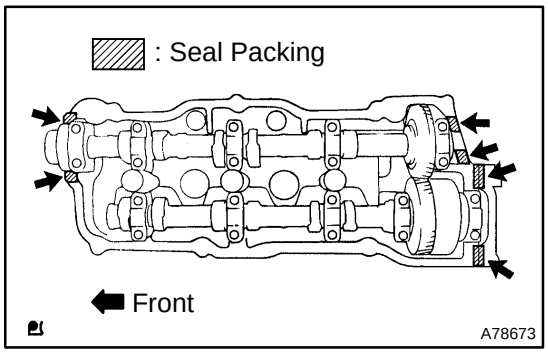
If there is a trace that water is entering at the visual check, replace the timing belt cover.

(b) Install the timing belt cover.
Torque: 8.5 N·m (87 kgf·cm, 75 in.·lbf)



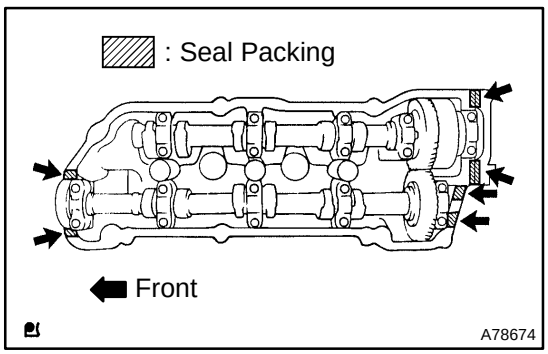
95. INSTALL CRANKSHAFT PULLEY
(a) Align the keyway of the pulley with the key located on the crankshaft and slide the pulley into place.
(b) Using SST, install the pulley bolt.
SST 09213−54015 (91651−60855), 09330−00021
Torque: 220 N·m (2,250 kgf·cm, 162 ft·lbf)

96. INSTALL VVT SENSOR
Torque: 8.0 N·m (82 kgf·cm, 71 in.·lbf)
97. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSY
Torque: 8.0 N·m (82 kgf·cm, 71 in.·lbf)
98. INSTALL ENGINE HANGER NO.2
Torque: 20 N·m (204 kgf·cm, 15 ft·lbf)
99. INSPECT VALVE CLEARANCE (See page 14−142)
100. ADJUST VALVE CLEARANCE (See page 14−142)



101. INSTALL CYLINDER HEAD COVER SUB−ASSY
(a) Install the gasket to the cylinder head cover.
(b) Apply seal packing to the cylinder head as shown in the illustration.
Seal packing: Part No. 08826−00080 or equivalent
NOTICE:
- **Remove any oil from the contact surface.**
- **Install the cylinder head cover within 3 minutes after applying seal packing.**
- **Do not start the engine for at least 2 hours after installing.**

(c) Install the cylinder head cover with the 9 bolts. Tighten the bolts uniformly in several steps.
Torque: 8.0 N·m (80 kgf·cm, 71 in.·lbf)



102. INSTALL CYLINDER HEAD COVER SUB−ASSY LH
(a) Install the gasket to the cylinder head cover.
(b) Apply seal packing to the cylinder head as shown in the illustration.
Seal packing: Part No. 08826−00080 or equivalent
NOTICE:
- **Remove any oil from the contact surface.**
- **Install the cylinder head cover within 3 minutes after applying seal packing.**

- **Do not start the engine for at least 2 hours after installing.**

(c) Install the cylinder head cover with the 9 bolts. Tighten the bolts uniformly in several steps.
Torque: 8.0 N·m (80 kgf·cm, 71 in.·lbf)

103. INSTALL VENTILATION VALVE SUB−ASSY

(a) Apply adhesive to 2 or 3 threads.
Adhesive:
Part No. 08833−00070, THREE BOND 1324 or eguivalent

(b) Install the ventilation valve.
Torque: 19 N·m (193 kgf·cm, 14 ft·lbf)

104. INSTALL GASKET, OIL FILLER CAP

105. INSTALL OIL FILLER CAP SUB−ASSY

106. INSTALL SPARK PLUG
Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)