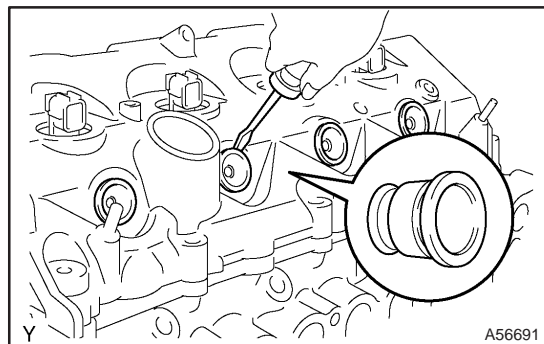


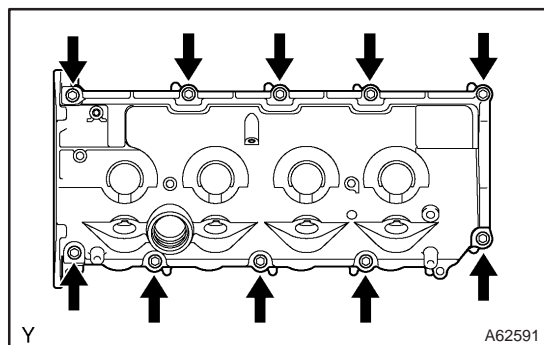
OVERHAUL

1. REMOVE OIL FILLER CAP SUB-ASSY



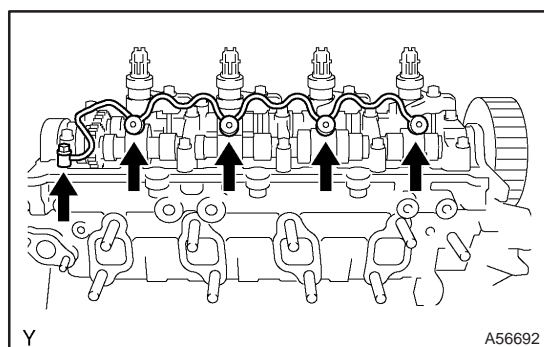
2. REMOVE NOZZLE HOLDER SEAL

- (a) Using a screwdriver, pry out the 4 nozzle holder seals.



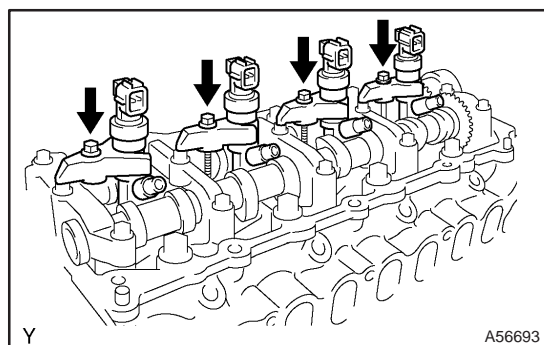
3. REMOVE CYLINDER HEAD COVER SUB-ASSY

- (a) Remove the 10 bolts, cylinder head cover and gasket.



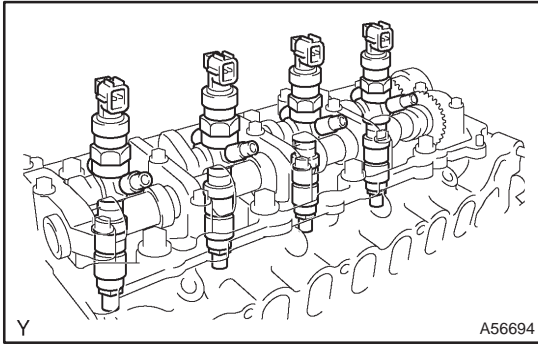
4. REMOVE NOZZLE LEAKAGE PIPE ASSY

- (a) Using a hexagon wrench (6mm), remove 4 hollow screws.
 (b) Remove the union bolt, nozzle leakage pipe and 5 gaskets from the cylinder head and injector.



5. REMOVE NOZZLE HOLDER CLAMP

- (a) Remove the 4 bolts, 4 washers and 4 nozzle holder clamps.

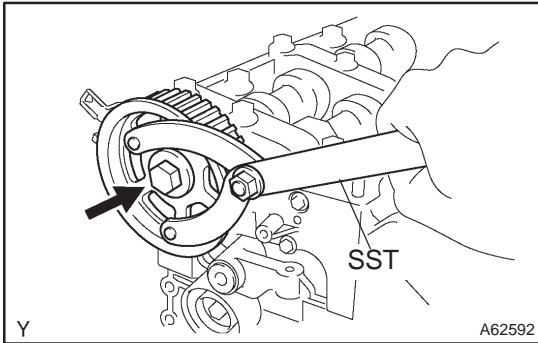


6. REMOVE INJECTOR ASSY

- (a) Remove the 4 injectors from the cylinder head.

HINT:

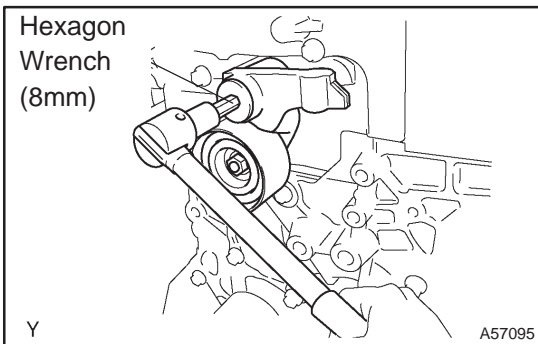
Arrange the injectors in correct order.



7. REMOVE CAMSHAFT TIMING PULLEY

- (a) Using SST, remove the pulley bolt.

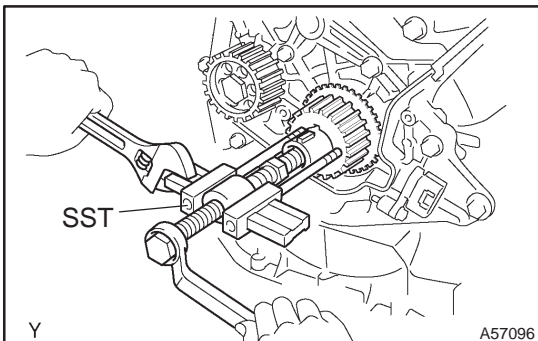
SST 09960-10010 (09962-01000, 09963-01000)



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

- (a) Using hexagon wrench (8mm), remove the idler pulley shaft, idler pulley and plate washer.

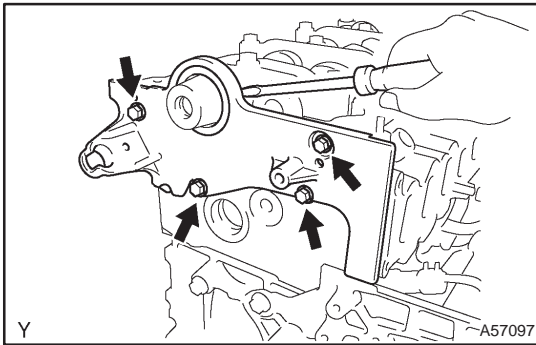
9. REMOVE TIMING BELT IDLER SUB-ASSY NO.2



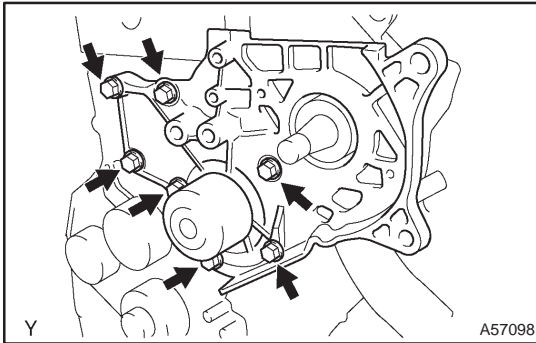
10. REMOVE CRANKSHAFT TIMING PULLEY

- (a) If the pulley cannot be removed by hand, use SST to remove the timing pulley.

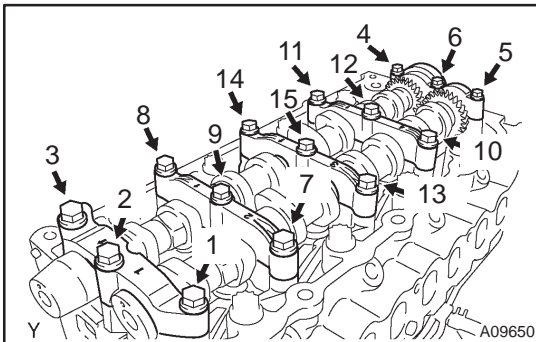
SST 09950-50013 (09951-05010, 09952-05010, 09953-05010, 09953-05020, 09954-05021)

**11. REMOVE CAMSHAFT OIL SEAL RETAINER**

- (a) Remove the 4 bolts.
- (b) Using a screwdriver, remove the oil seal retainer by prying the portions between the oil seal retainer and camshaft bearing cap.

**12. REMOVE WATER PUMP ASSY**

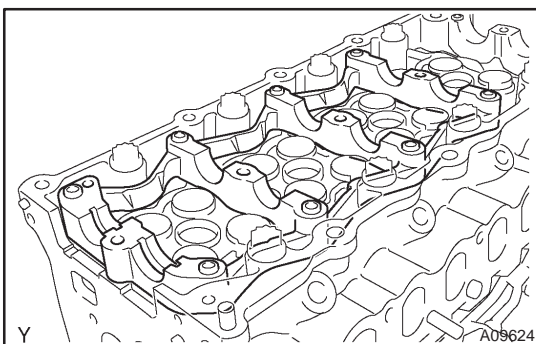
- (a) Remove the 7 bolts, water pump and gasket.

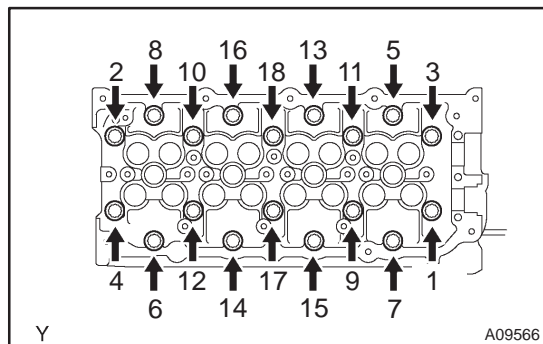
**13. REMOVE CAMSHAFT SUB-ASSY, NO.2**

- (a) Uniformly loosen and remove the 15 bearing cap bolts in several passes in the sequence shown.
- (b) Remove the 5 bearing caps.
- (c) Remove the camshaft No. 2.

14. REMOVE CAMSHAFT SUB-ASSY, NO.1

- (a) Remove the camshaft from the cylinder head.
- (b) Remove the camshaft carrier from the cylinder head.



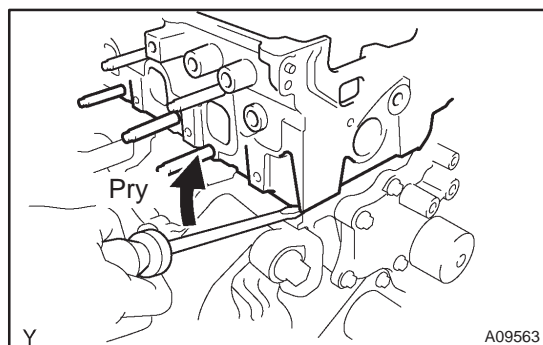


15. REMOVE CYLINDER HEAD SUB-ASSY

- (a) Uniformly loosen the 18 cylinder head bolts in several passes in the sequence shown. Remove the 18 cylinder head bolts and plate washers.

NOTICE:

Cylinder head warpage or cracking could result from removing bolts in incorrect order.



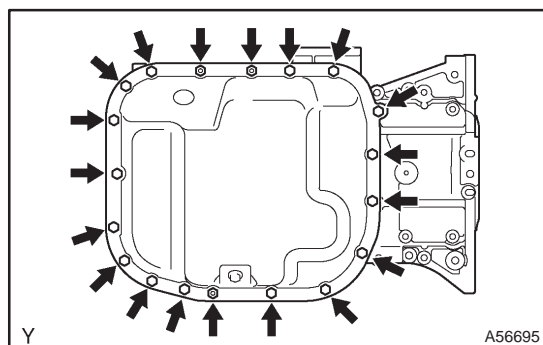
- (b) Lift the cylinder head from the dowels on the cylinder block, and place the cylinder head on wooden blocks on a bench.

HINT:

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

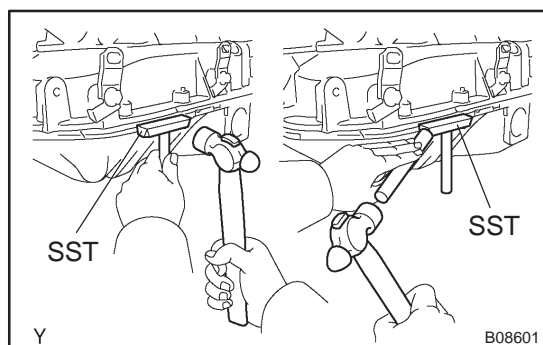
NOTICE:

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



16. REMOVE OIL PAN SUB-ASSY NO.2

- (a) Remove the 16 bolts and 3 nuts.

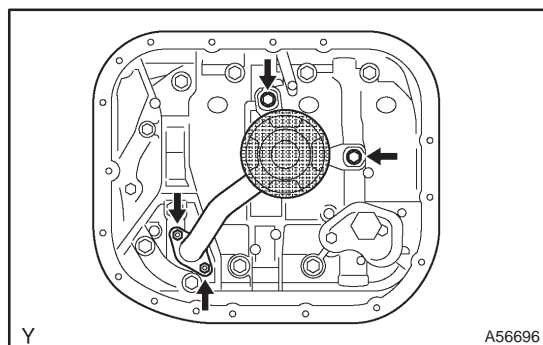


- (b) Insert the blade of SST between the No. 1 and No. 2 oil pans, and cut off the applied seal and remove the No. 2 oil pan.

SST 09032-00100

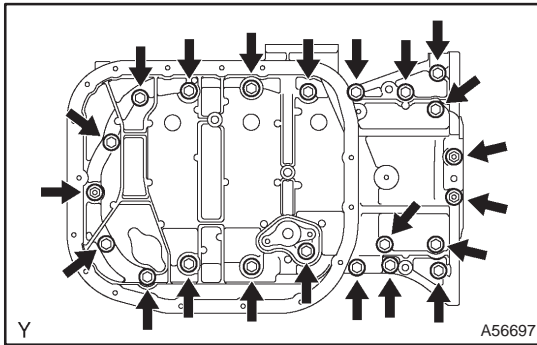
NOTICE:

Be careful not to damage the contact surfaces of the No. 1 and No. 2 oil pans.



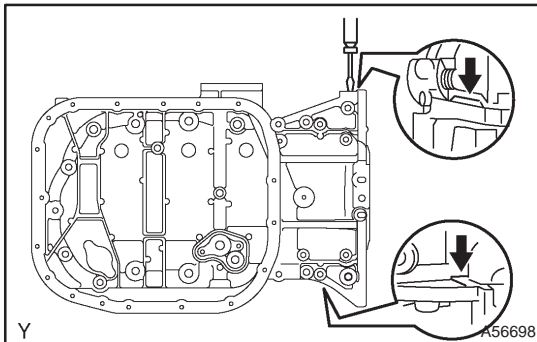
17. REMOVE OIL STRAINER SUB-ASSY

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



18. REMOVE OIL PAN SUB-ASSY

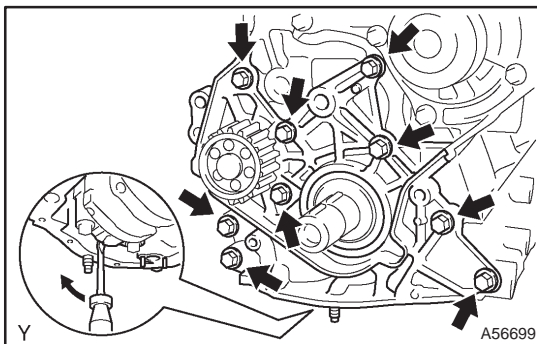
- (a) Remove the 19 bolts and 3 nuts.



- (b) Using a screwdriver, remove the oil pan by prying the portions between the cylinder block and No. 1 oil pan.

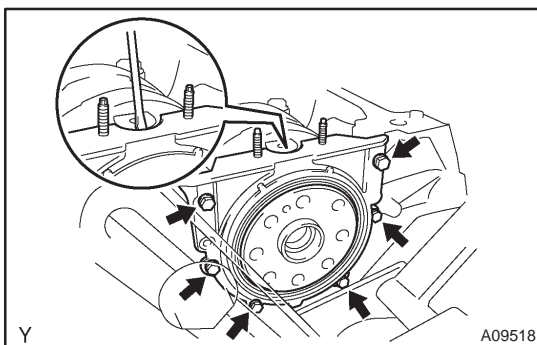
NOTICE:

Be careful not to damage the contact surfaces of the cylinder block and No. 1 oil pan.



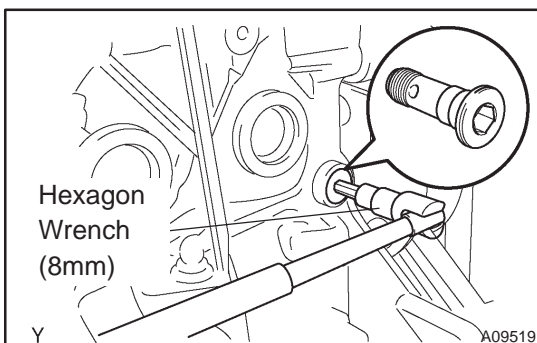
19. REMOVE OIL PUMP ASSY

- (a) Remove the 9 bolts.
 (b) Remove the oil pump by prying a screwdriver between the oil pump and main bearing cap.
 (c) Remove the gasket.



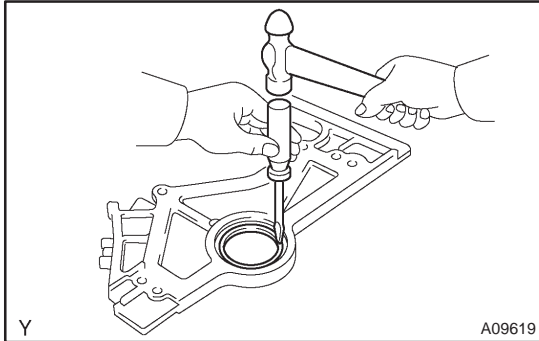
20. REMOVE ENGINE REAR OIL SEAL RETAINER

- (a) Remove the 6 bolts.
 (b) Using a screwdriver, remove the oil seal retainer by prying the portions between the oil seal retainer and main bearing cap.

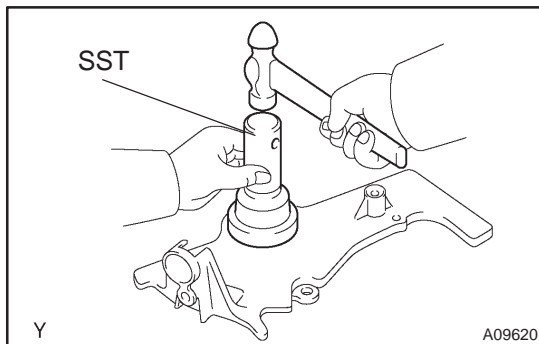


21. REMOVE OIL CHECK VALVE SUB-ASSY

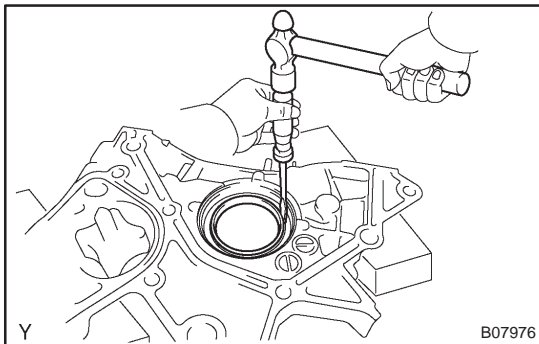
- (a) Using hexagon wrench (8mm), remove the pressure valve and gasket.

22. REMOVE CYLINDER BLOCK WATER DRAIN COCK SUB-ASSY**23. REMOVE CAMSHAFT OIL SEAL**

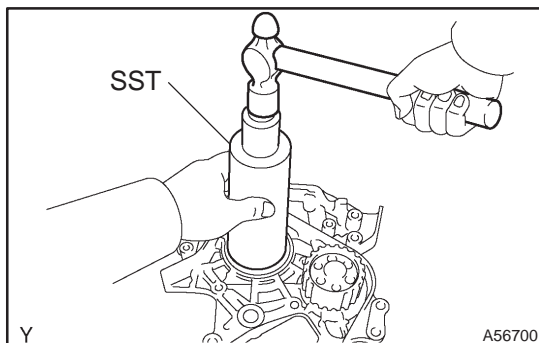
- (a) Using a screwdriver and a hammer, tap out the oil seal.

**24. INSTALL CAMSHAFT OIL SEAL**

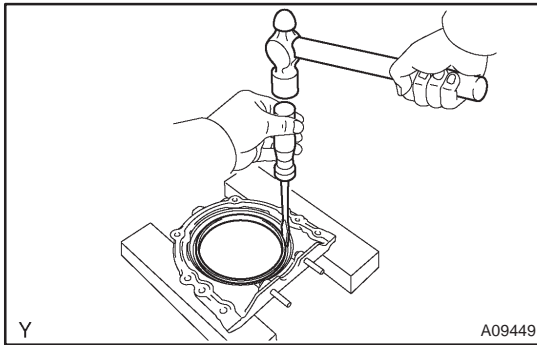
- (a) Using SST and a hammer, tap in a new oil seal until its surface is flush with the camshaft oil seal retainer edge.
SST 09223-46011

**25. REMOVE CRANKSHAFT SEAL**

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

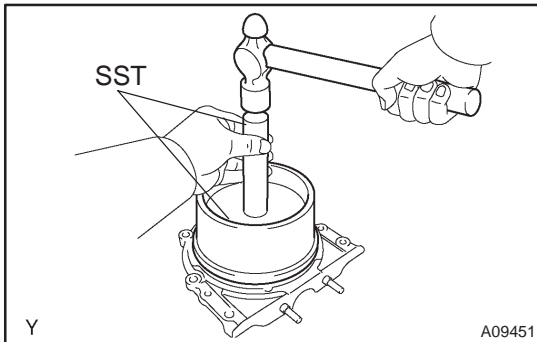
**26. INSTALL CRANKSHAFT SEAL**

- (a) Using SST and a hammer, tap in a new oil seal until its surface is flush with the oil pump edge.
SST 09316-60011 (09316-00011, 09316-00021)



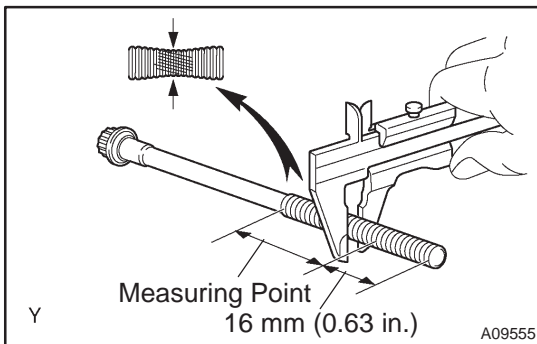
27. REMOVE ENGINE REAR OIL SEAL

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



28. 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)



29. INSPECT CYLINDER HEAD SET BOLT

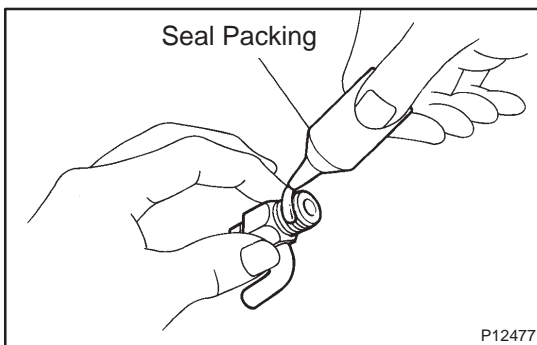
- (a) Using vernier calipers, measure the tension portion diameter of the bolt.

Standard outside diameter:

10.75 – 11.00 mm (0.4232 – 0.4331 in.)

Minimum outside diameter: 10.40 mm (0.4094 in.)

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



30. INSTALL CYLINDER BLOCK WATER DRAIN COCK SUB-ASSY

- (a) Apply seal packing 2 or 3 threads.

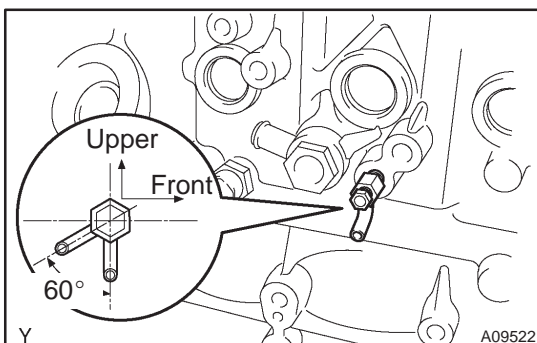
Seal packing: Part No. 08826-00100 or equivalent

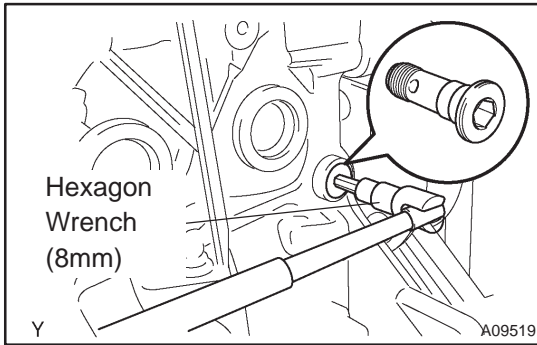
- (b) Install the drain union.

Torque: 29 N·m (291 kgf·cm, 21 ft·lbf)

HINT:

After applying the specified torque, if the drain pipe of the drain union is not at the position shown in the illustration, rotate the drain union further clockwise and make the drain pipe face downward.

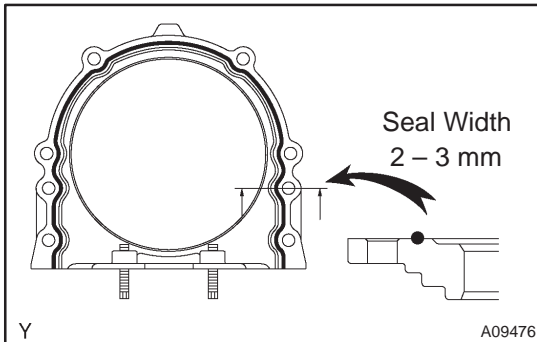




31. INSTALL OIL CHECK VALVE SUB-ASSY

- (a) Using hexagon wrench (8mm), install a new gasket and the pressure valve.

Torque: 30 N·m (310 kgf·cm, 22 ft·lbf)



32. INSTALL ENGINE REAR OIL SEAL RETAINER

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

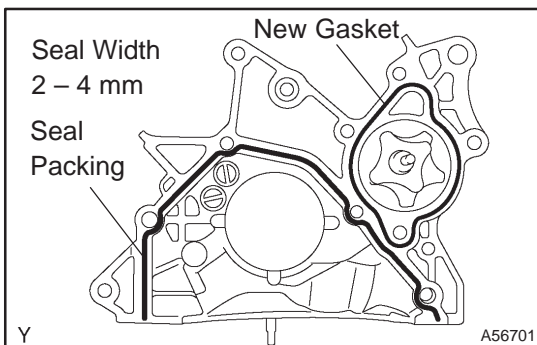
Seal packing: Part No. 08826-00080 or equivalent

NOTICE:

- Install a nozzle that has been cut to a 2 – 3 mm (0.08 – 0.12 in.) opening.
- Parts must be assembled within 15 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall the cap.

- (b) Install the oil seal retainer with 6 bolts. Uniformly tighten the bolt in several passes.

Torque: 7.4 N·m (75 kgf·cm, 65 in·lbf)



33. INSTALL OIL PUMP ASSY

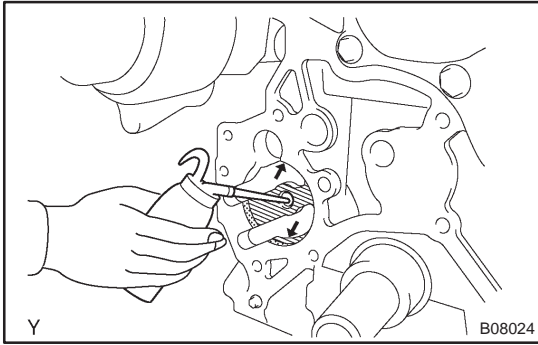
- (a) Apply seal packing to the oil pump as shown in the illustration.

Seal packing: Part No. 08826-00080 or equivalent

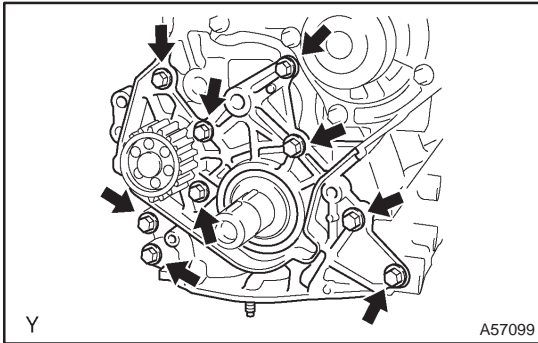
NOTICE:

- Avoid applying an excessive amount to the surface.
- Install a nozzle that has been cut to a 2 – 4 mm (0.08 – 0.16 in.) opening
- Parts must be assembled within 15 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall the cap.

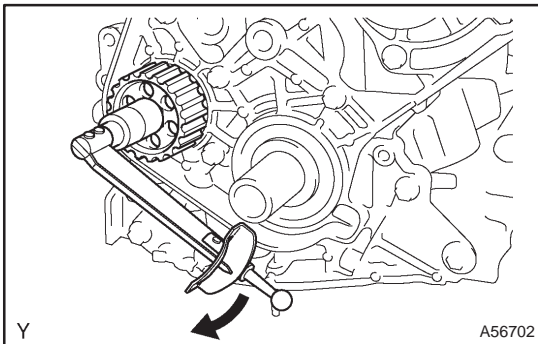
- (b) Install a new gasket to the oil pump.



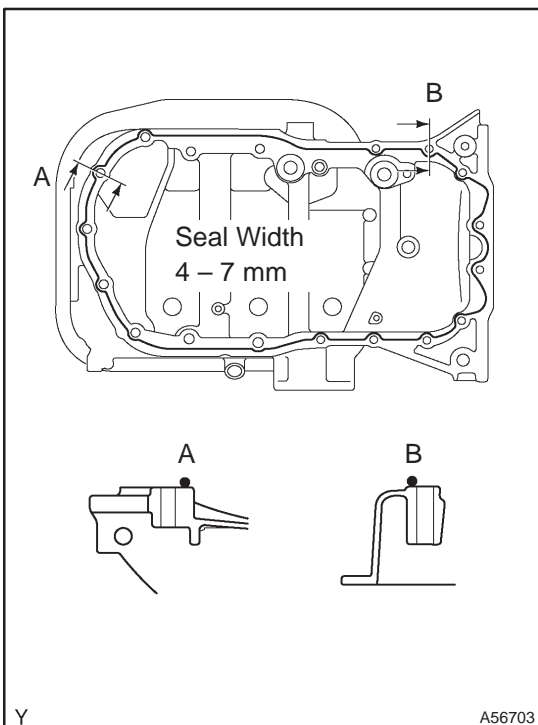
- (c) Pour in 0.5 cm³ (0.03 cu in.) or more of engine oil into the bushing of the cylinder block.
- (d) Apply engine oil to the cylinder block side where it contacts with the oil pump driven rotor.



- (e) Install the oil pump with the 9 bolts.
Torque: 31 N·m (320 kgf·cm, 23 ft·lbf)



- (f) Measure the oil pump rotating torque
 - (1) Check that the pump rotates smoothly without abnormal noise.
 - (2) Using a torque wrench, check the pump rotating torque.**Rotating torque: 3.0 N·m (30 kgf·cm, 26 in·lbf) or less**



34. INSTALL OIL PAN SUB-ASSY

- (a) Apply seal packing to the No. 1 oil pan as shown in the illustration.

Seal packing: Part No. 08826-00080 or equivalent

NOTICE:

- Install a nozzle that has been cut to a 4 – 7 mm (0.16 – 0.28 in.) opening.
- Parts must be assembled within 15 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall the cap.

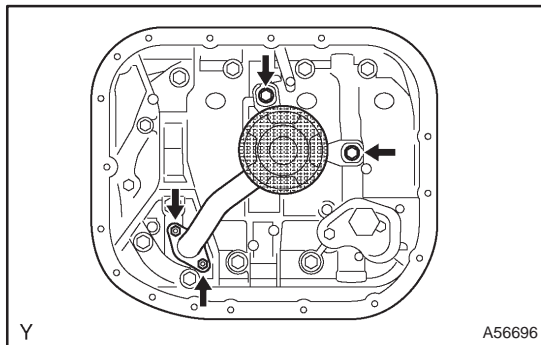
- (b) Install the oil pan with 19 bolts and 3 nuts.

Torque:

11 N·m (112 kgf·cm, 8 ft·lbf) for 10 mm head bolt and nut

21 N·m (210 kgf·cm, 15 ft·lbf) for 12 mm head bolt

42 N·m (429 kgf·cm, 31 ft·lbf) for 14 mm head bolt



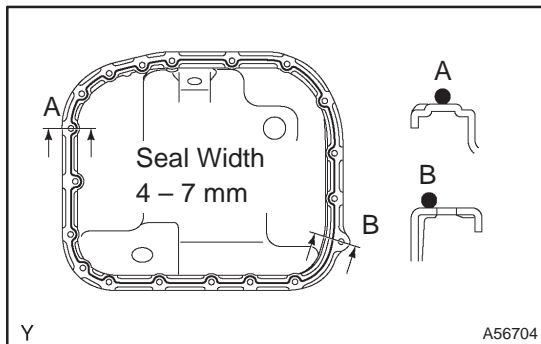
35. INSTALL OIL STRAINER SUB-ASSY

- (a) Install a new gasket and the oil strainer with the 2 bolts and 2 nuts.

Torque:

21 N·m (210 kgf·cm, 15 ft·lbf) for bolt

13 N·m (135 kgf·cm, 10 ft·lbf) for nut



36. INSTALL OIL PAN SUB-ASSY NO.2

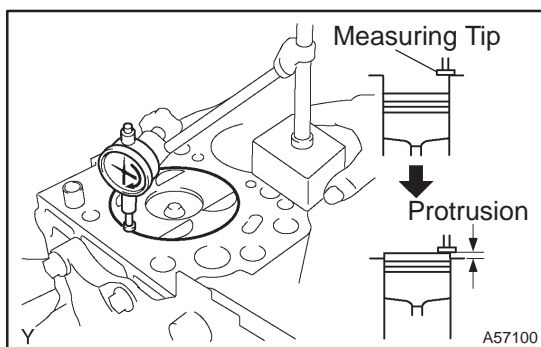
- (a) Apply a seal packing to the oil pan as shown in the illustration.

Seal packing: Part No. 08826-00080 or equivalent

NOTICE:

- Install a nozzle that has been cut to a 4 – 7 mm (0.16 – 0.28 in.) opening.
 - Parts must be assembled within 15 minutes of application. Otherwise the material must be removed and reapplied.
 - Immediately remove nozzle from the tube and reinstall the cap.
- (b) Install the oil pan with 16 bolts and 3 nuts. Uniformly tighten the bolts and nuts in several passes.

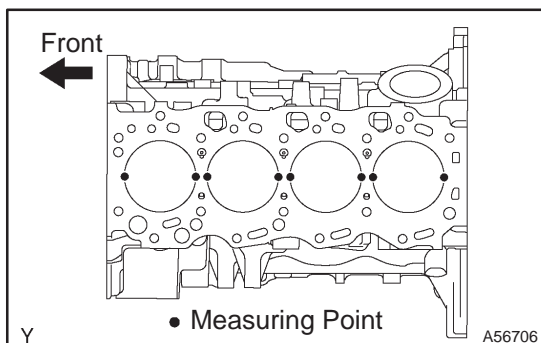
Torque: 12 N·m (120 kgf·cm, 9 ft·lbf)

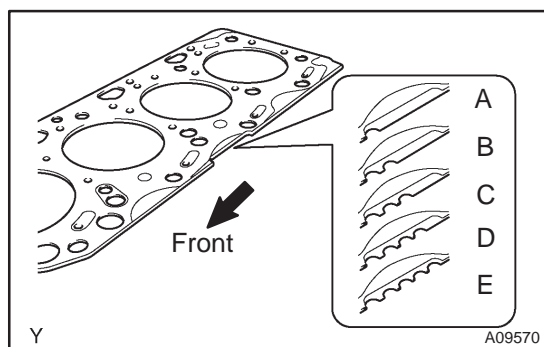


37. INSTALL CYLINDER HEAD SUB-ASSY

- (a) Check piston protrusions for each cylinder.
- (1) Find where the piston head protrudes most by slowly turning the crankshaft clockwise and counter-clockwise.
 - (2) Measure each cylinder at 2 places as shown in the illustration, marking a total of 8 measurements.
 - (3) For the piston protrusion valve of each cylinder, use the average of the 2 measurements of each cylinder.

Protrusion: 0.165 – 0.425 mm (0.0065 – 0.0168 in.)





(b) Select a new cylinder head gasket.

HINT:

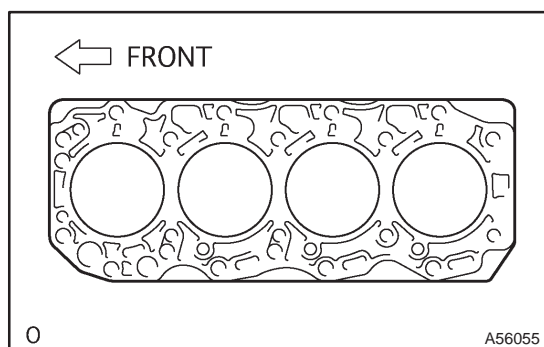
There are 5 sizes of new cylinder head gaskets, marked "A", "B", "C", "D", or "E" according.

New installed cylinder head gasket thickness:

A	0.85 – 0.95 mm (0.0335 – 0.0374 in.)
B	0.90 – 1.00 mm (0.0354 – 0.0394 in.)
C	0.95 – 1.05 mm (0.0374 – 0.0413 in.)
D	1.00 – 1.10 mm (0.0394 – 0.0433 in.)
E	1.05 – 1.15 mm (0.0413 – 0.0453 in.)

- (1) Select the largest piston protrusion value from the measurements made, then select a new appropriate gasket according to the table below.

Piston protrusion mm (in.)	Gasket size
0.165 – 0.220 (0.0065 – 0.0087)	Use A
0.220 – 0.270 (0.0087 – 0.0106)	Use B
0.270 – 0.320 (0.0106 – 0.0126)	Use C
0.320 – 0.370 (0.0126 – 0.0146)	Use D
0.370 – 0.425 (0.0146 – 0.0167)	Use E

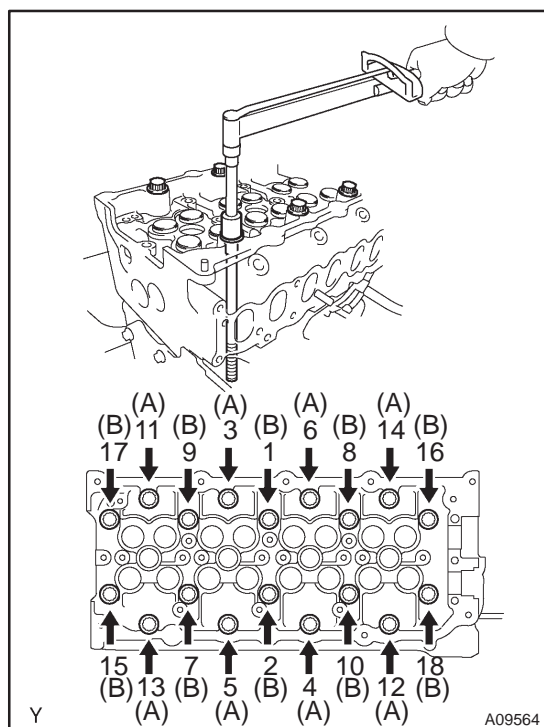


(c) Place a new cylinder head gasket in position on the cylinder block.

NOTICE:

Be careful of the installation direction.

(d) Place the cylinder head in position on the cylinder head gasket.



(e) Install the cylinder head bolts.

HINT:

The cylinder head bolts are tightened in 4 progressive steps (steps (3), (5), (6) and (7)).

- (1) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts and plate washers.
- (2) Install the plate washer to the cylinder head bolt.
- (3) Install and uniformly tighten the 18 cylinder head bolts and plate washers in several passes in the sequence shown.

Torque: 45 N·m (460 kgf·cm, 33 ft·lbf)

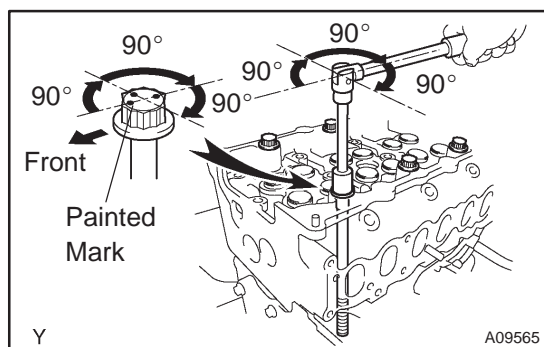
HINT:

Each bolt length is indicated in the illustration.

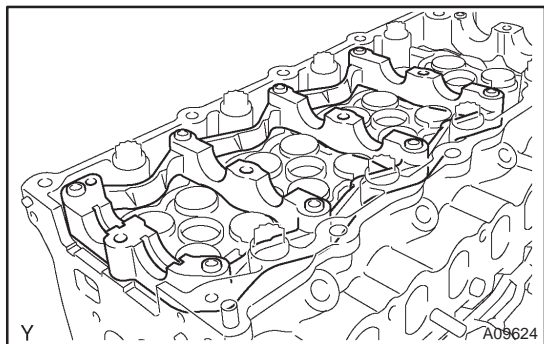
Bolt length:

(A)	160 mm (6.30 in.)
(B)	104 mm (4.09 in.)

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

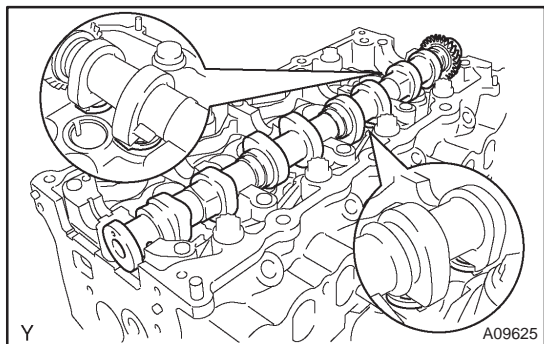


- (4) Mark the front of the cylinder head bolt with paint.
- (5) Retighten the cylinder head bolts additional 90° in the numerical order shown.
- (6) Retighten the cylinder head bolts additional 90° in the numerical order shown.
- (7) Retighten the cylinder head bolts additional 90° in the numerical order shown.
- (8) Check that the painted mark is at the intake manifold side now.

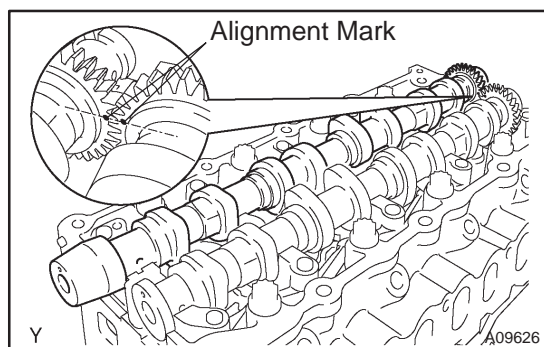


38. INSTALL CAMSHAFT SUB-ASSY, NO.1

- (a) Place the camshaft carrier in position on the cylinder head.

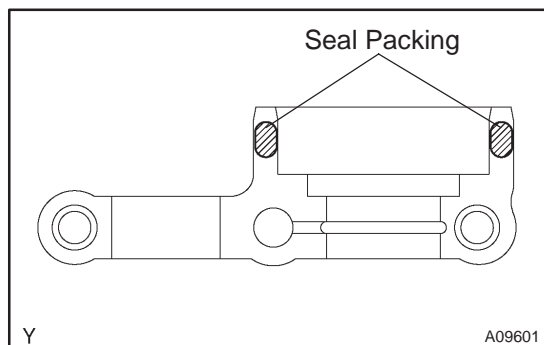


- (b) Apply engine oil to the cam and gear of the camshaft, and the journal of the camshaft carrier.
- (c) Place the intake camshaft on top of the camshaft carrier as shown in the illustration so that the No. 3 and No. 4 of cylinder cam lobes face downward.



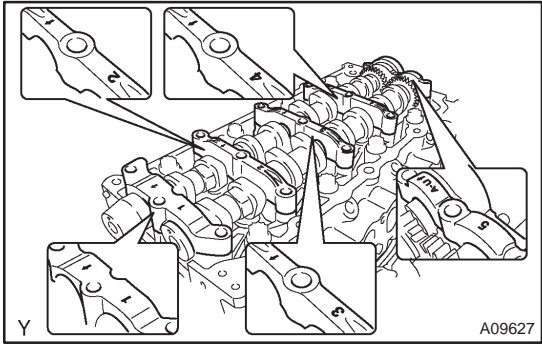
39. INSTALL CAMSHAFT SUB-ASSY, NO.2

- (a) Apply engine oil to the cam and gear of the camshaft, and the journal of the camshaft carrier.
- (b) Engage the exhaust camshaft gear to the intake camshaft gear by matching the alignment marks on each gear.
- (c) Roll down the exhaust camshaft onto the bearing journals while engaging gears with each other.

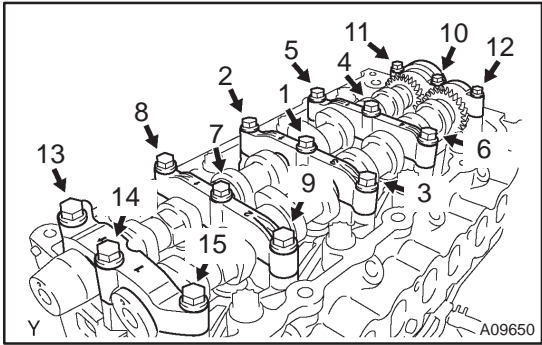


- (d) Install the camshaft bearing caps.
 - (1) Remove any old packing (FIPG) material from the No.5 camshaft bearing cap.
 - (2) Apply seal packing to the No. 5 camshaft bearing cap as shown in the illustration.

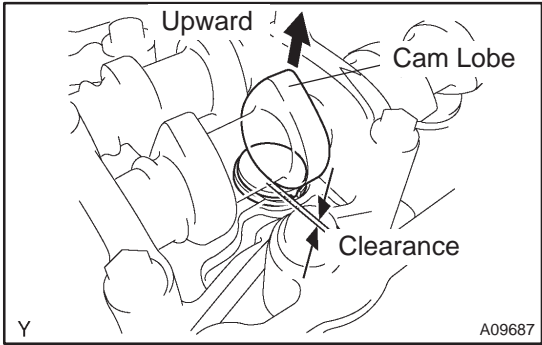
Seal packing: Part No. 08826-00080 or equivalent



(3) Place the 5 bearing caps in their proper locations.



(4) Install and uniformly tighten the 15 bearing cap bolts in several passes and in the sequence shown.
Torque: 20 N·m (204 kgf·cm, 15 ft·lbf)

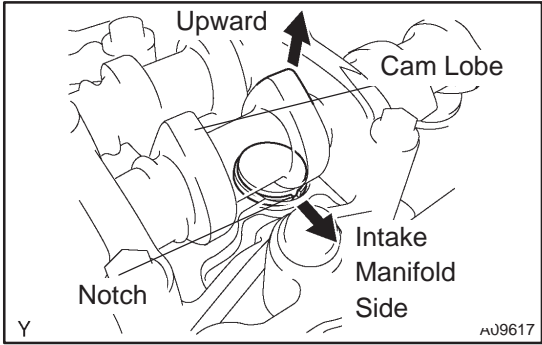


40. INSPECT VALVE CLEARANCE

- (a) Turn the crankshaft so that the cam lobe of the camshaft on the inspecting valve points upward.
- (b) Using a feeler gauge, measure the clearance between the valve lifter and the camshaft.
- (c) Measure the clearance at 16 places.
- (d) Record the out-of-specification valve clearance measurements. They will be used later to determine the required replacement adjusting shim.

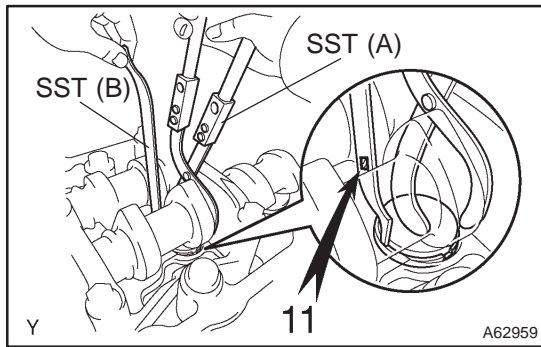
Valve clearance (Cold) :

Intake	0.20 – 0.30 mm (0.008 – 0.012 in.)
Exhaust	0.35 – 0.45 mm (0.014 – 0.018 in.)



41. ADJUST VALVE CLEARANCE

- (a) Remove the adjusting shim.
 - (1) Turn the crankshaft so that the cam lobe of the camshaft on the adjusting valve points upward.
 - (2) Position the notch of the valve lifter facing the intake manifold side.

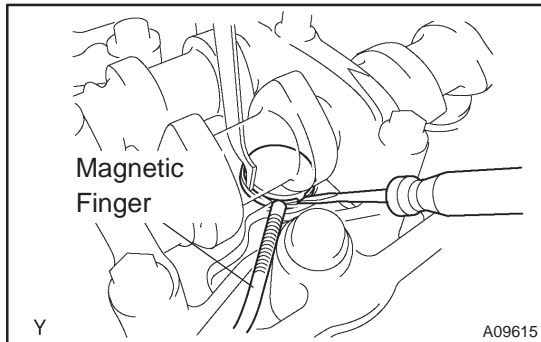


- (3) Using SST (A), press down the valve lifter and place SST (B) between the camshaft and valve lifter. Remove SST (A).

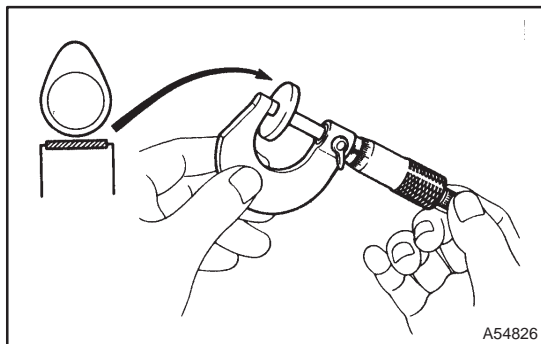
SST 09248-55050 (09248-05510, 09248-05520)

HINT:

Apply SST (B) on the side marked with "11".



- (4) Remove the adjusting shim with a small screwdriver and magnetic finger.



- (b) Determine the replacement adjusting shim size by following the formula:

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

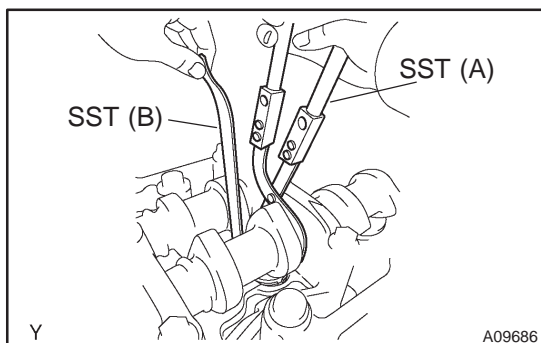
HINT:

- T Thickness of removed adjusting shim
- A Measured valve clearance
- N Thickness of new adjusting shim
- Intake: $N = T + (A - 0.25 \text{ mm (0.010 in.)})$
- Exhaust: $N = T + (A - 0.40 \text{ mm (0.016 in.)})$

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

HINT:

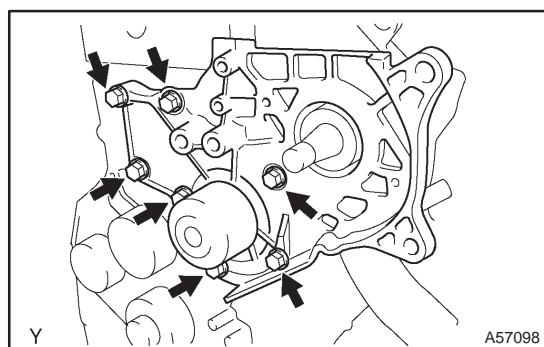
Shims are available in 17 sizes in increments of 0.05 mm (0.0020 in.), from 2.50 mm (0.0984 in.) to 3.30 mm (0.1299 in.).



- (c) Install a new adjusting shim.
- (1) Place a new adjusting shim on the valve lifter.
 - (2) Using SST (A), press down the valve lifter and remove SST (B).

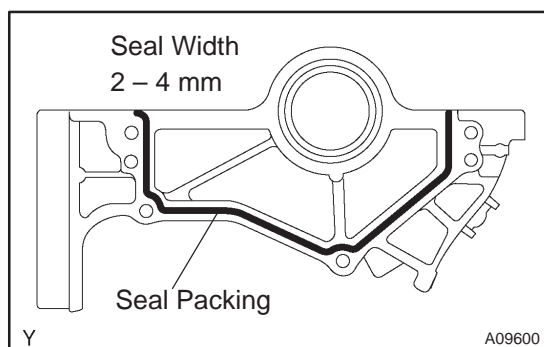
SST 09248-55050 (09248-05510, 09248-05520)

- (d) Recheck the valve clearance.



42. INSTALL WATER PUMP ASSY

- (a) Install a new gasket and the water pump with the 7bolts.
Torque: 31 N·m (320 kgf·cm, 23 ft·lbf)



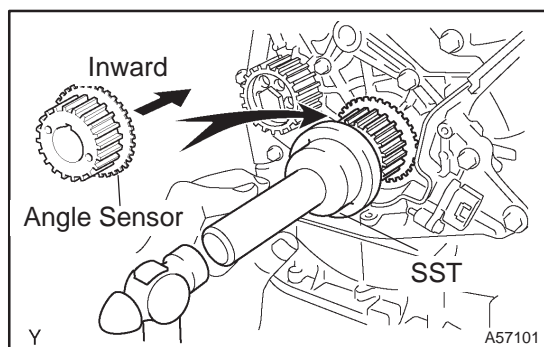
43. INSTALL CAMSHAFT OIL SEAL RETAINER

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

Seal packing: Part No. 08826-00080 or equivalent

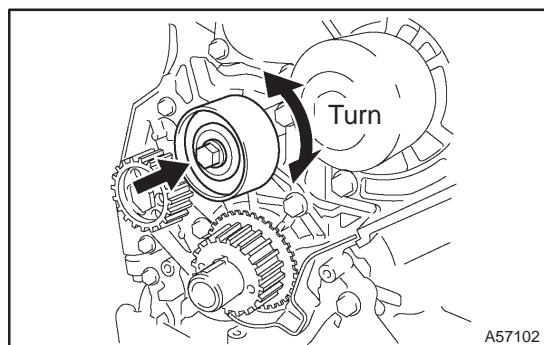
NOTICE:

- Install a nozzle that has been cut to a 2 - 4 mm (0.08 - 0.16 in.) opening.
 - Parts must be assembled within 15 minutes of application. Otherwise the material must be removed and reapplied.
 - Immediately remove nozzle from the tube and reinstall the cap.
- (b) Install the oil seal retainer with 4 bolts. Uniformly tighten the 4 bolts in several passes.
Torque: 8.8 N·m (90 kgf·cm, 78 in·lbf)



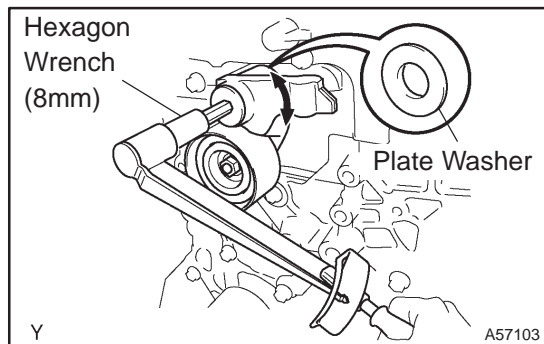
44. INSTALL CRANKSHAFT TIMING PULLEY

- (a) Align the pulley set key with the key groove of the timing pulley.
- (b) Using SST and a hammer, tap in the timing pulley, facing the angle sensor inward.
SST 09223-46011

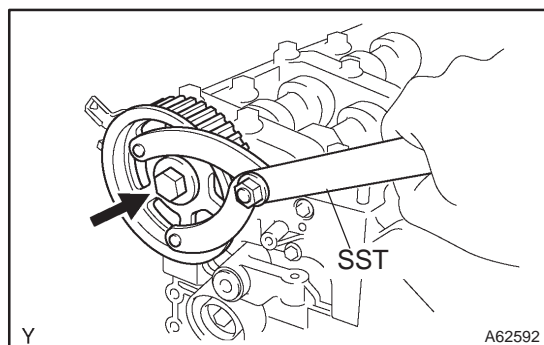


45. INSTALL TIMING BELT IDLER SUB-ASSY NO.2

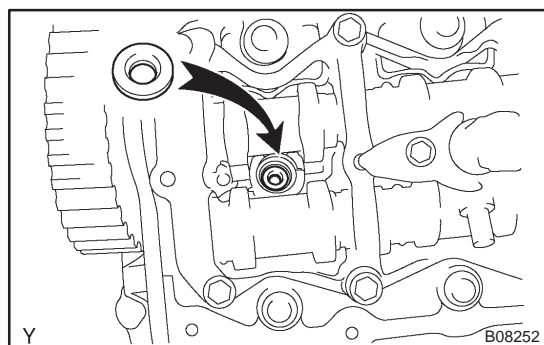
- (a) Install the idler pulley with the bolt.
Torque: 47 N·m (475 kgf·cm, 34 ft·lbf)
- (b) Check that the idler pulley moves smoothly.

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

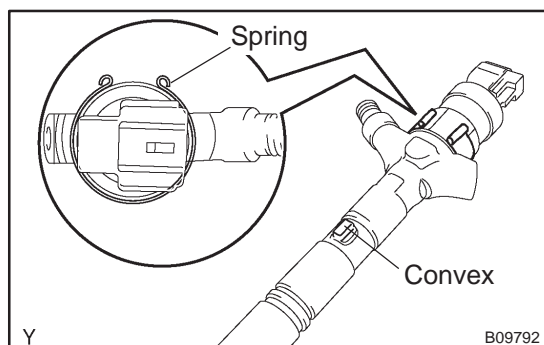
- (a) Using an hexagon wrench (8mm), install the plate washer and idler pulley with the idler pulley shaft.
Torque: 35 N·m (350 kgf·cm, 25 ft·lbf)
- (b) Check that the pulley bracket moves smoothly.

**47. INSTALL CAMSHAFT TIMING PULLEY**

- (a) Install the pulley set key to the key groove of the camshaft.
- (b) Align the pulley set key with the key groove of the timing pulley, and slide on the timing pulley.
- (c) Using SST, install the pulley bolt.
SST 09960-10010 (09962-01000, 09963-01000)
Torque: 88 N·m (899 kgf·cm, 65 ft·lbf)

**48. INSTALL INJECTOR ASSY**

- (a) Install 4 new nozzle seats to the cylinder head.

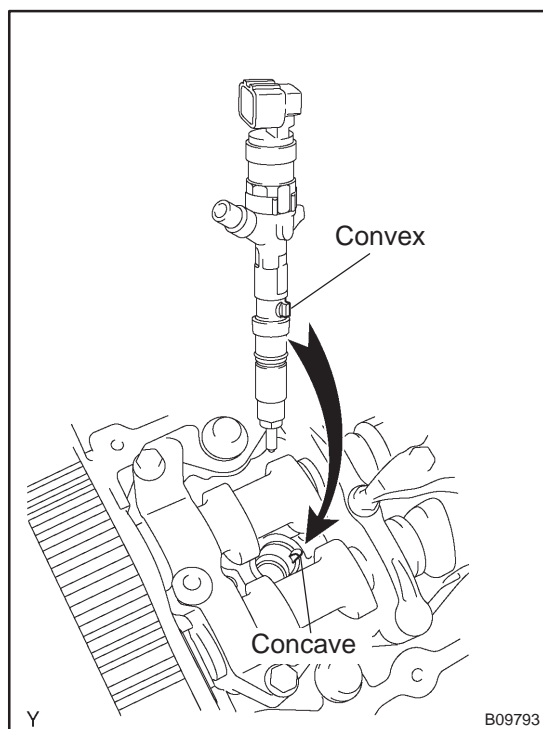


- (b) Set the spring to each injector.

NOTICE:

Be sure to make the opening direction of the spring and the direction of the injector positioning convex meet.

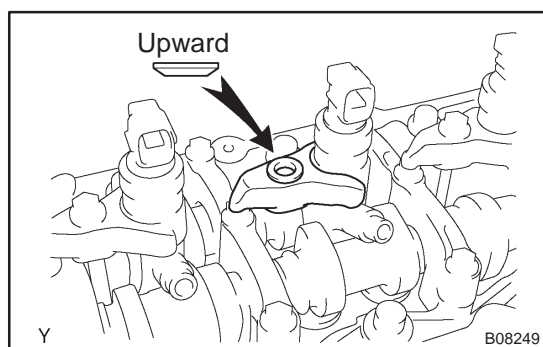
- (c) Install a new back-up ring and O-ring to each injector.
- (d) Apply a light coat of oil onto O-ring for each injector.



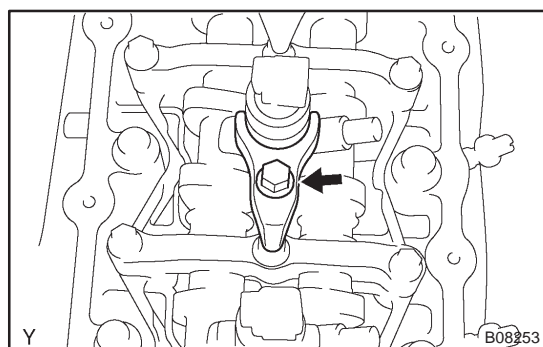
- (e) Meet the injector positioning convex to the positioning concave at the cylinder head side and install the injector to the cylinder head.

NOTICE:

- At this time, insert the injector until it touches the nozzle sheet surface.
 - When installing the injector to the cylinder head and in case that the injector comes to float up with the reaction of O-ring, pull out the injector once, install it again.
 - During the time after equipping the head cover and before installing the injection pipe, install the irregular object prevention cover.
 - Do not exchange the injector cylinder.
- (f) Place the 4 nozzle holder clamps to each injector.

**49. INSTALL NOZZLE HOLDER CLAMP**

- (a) Set the washer on the nozzle holder clamp as shown in the illustration.



- (b) Tighten the bolts.

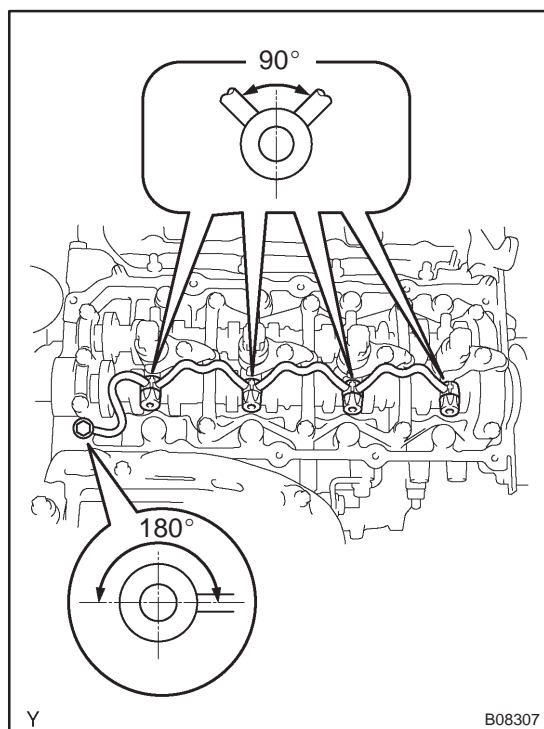
HINT:

Apply a light coat of engine oil on the threads and under the heads of the nozzle holder clamp bolts.

Torque: 27 N·m (275 kgf·cm, 20 ft·lbf)

NOTICE:

At this time, the clamp has its cam cap bolt as a fulcrum and clip the injector at the fork portion.



50. INSTALL NOZZLE LEAKAGE PIPE ASSY

- (a) Place the leakage pipe and 5 new gaskets.

NOTICE:

Do the installation of the gasket crew within the angle range shown in the illustration.

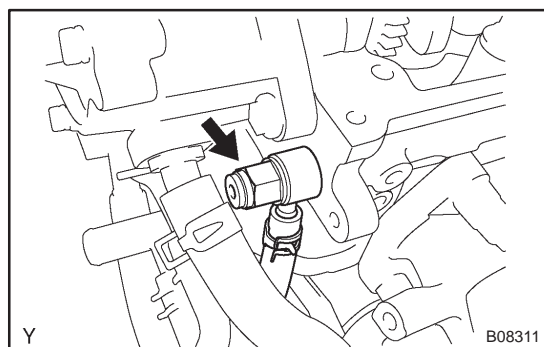
- (b) Apply a light coat of oil onto 4 hollow screws and union bolt.
 (c) Tighten the 4 hollow screws and union bolt by hand.
 (d) Tighten the 4 hollow screws and union bolt.

Torque:

Hollow screw 18 N·m (184 kgf·cm, 13 ft·lbf)

Union bolt 22 N·m (224 kgf·cm, 16 ft·lbf)

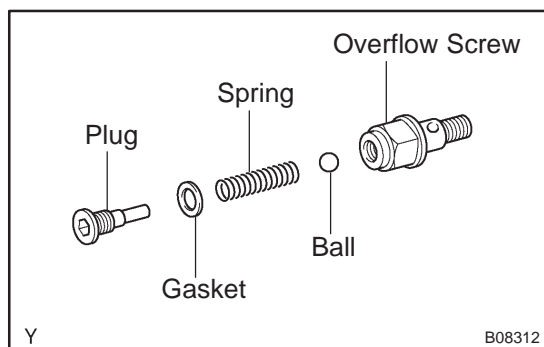
- (e) Check that there is no leak from nozzle leakage pipe connection.



- (1) Disconnect the fuel hose, and remove the check valve, No. 2 nozzle leakage pipe and gasket.
 (2) Purchase a new check valve.

HINT:

Part No. 23122-27010



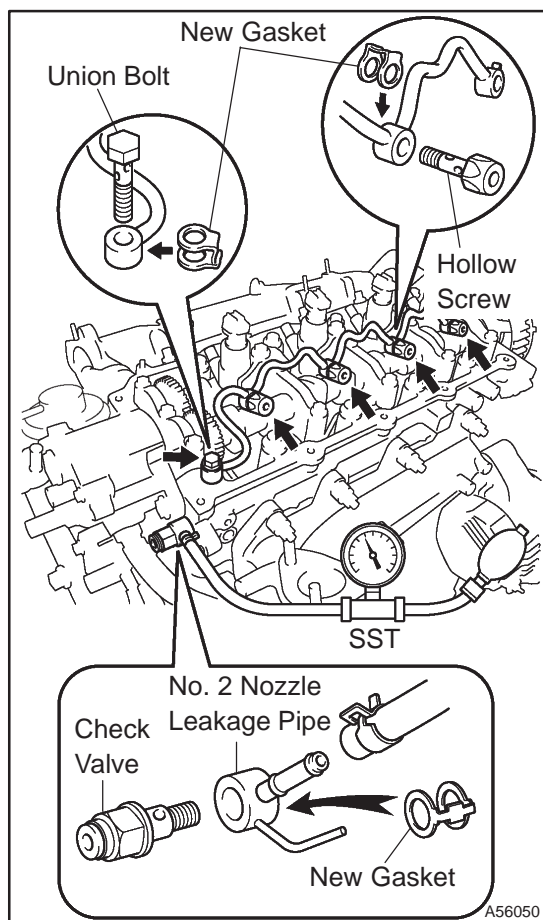
- (3) Remove the plug, gasket, spring and ball.
 (4) Install the plug with the gasket to the overflow screw.

Torque: 9.8 N·m (100 kgf·cm, 7 ft·lbf)

- (5) Install the No. 2 nozzle leakage pipe and gasket with the check valve to the cylinder head.

Torque: 21 N·m (214 kgf·cm, 15 ft·lbf)

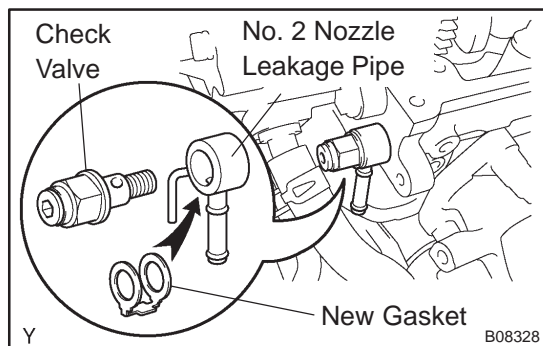
- (6) Apply a light coat of soapy water (any fluid to detect fuel leakage) on the nozzle leakage pipe connection.



- (7) Using SST (turbocharger pressure gauge), apply the SST to the fuel return side of the No. 2 nozzle leakage pipe, and maintain 100 kPa (1 kgf/cm², 14.5 psi) of pressure for 600 seconds to check that there are no bubbles from the soap-applied places.

SST 09992-00242

- (8) After checking fuel leaks, wipe off soapy water from nozzle leakage pipe connection.
- (9) Remove SST, check valve, No. 2 nozzle leakage pipe and gasket.



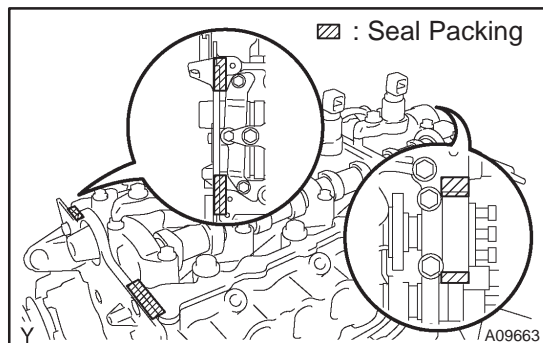
- (10) Reinstall the No. 2 nozzle leakage pipe and a new gasket with the check valve.

Torque: 21 N·m (214 kgf·cm, 15 ft·lbf)

HINT:

Never reinstall the disassembled check valve on the engine.

- (11) Reconnect the fuel hose to the No. 2 nozzle leakage pipe.



51. INSTALL CYLINDER HEAD COVER SUB-ASSY

- (a) Remove any old packing (FIPG) material.
- (b) Apply seal packing to the cylinder head.
Seal packing: Part No. 08826-00080 or equivalent
- (c) Install the gasket to the head cover.
- (d) Install the cylinder head cover with 10 bolts.
Torque: 13 N·m (135 kgf·cm, 10 ft·lbf)
- (e) Install 4 new nozzle holder seals.