1412H–03

OVERHAUL

1. REMOVE OIL FILTER SUB–ASSY

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

2. REMOVE OIL COOLER ASSY (W/ OIL COOLER)

(a) Remove the bolt.

(b) Using a socket wrench 30 mm, remove the oil cooler relief valve and oil cooler.

3. REMOVE OIL FILTER BRACKET SUB–ASSY

(a) Remove the 2 bolts, nut, oil filter bracket, gasket and O–ring.

4. REMOVE OIL FILTER UNION

(a) Using a straight hexagon wrench 14, remove the oil filter union.

5. REMOVE CYLINDER BLOCK WATER DRAIN COCK SUB–ASSY

6. REMOVE W/HEAD TAPER SCREW PLUG NO.1 (W/O OIL COOLER)

7. REMOVE UNION (W/ OIL COOLER)

(a) Using a deep socket wrench 22 mm, remove the union.

8. REMOVE CAMSHAFT POSITION SENSOR (UNLEADED GASOLINE)

(a) Remove the bolt and camshaft position sensor.

9. REMOVE CRANKSHAFT POSITION SENSOR

(a) Remove the 2 bolts and crankshaft position sensor.

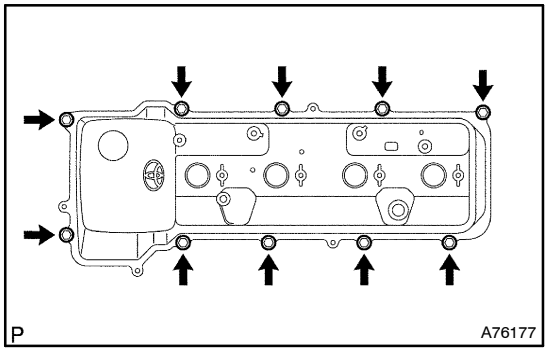
10. REMOVE OIL FILLER CAP SUB–ASSY

11. REMOVE VENTILATION VALVE SUB–ASSY

(a) Using a deep socket wrench 19 mm, remove the ventilation valve.

12. REMOVE SPARK PLUG

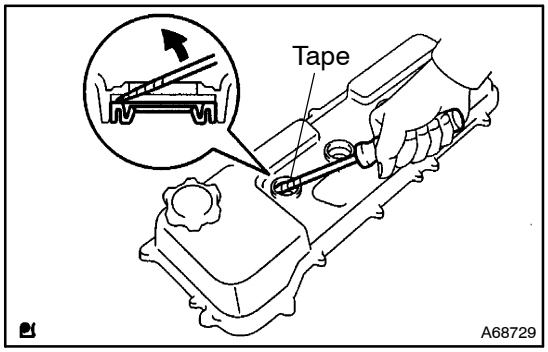
(a) Using a spark plug wrench, remove the spark plugs.



13. REMOVE CYLINDER HEAD COVER SUB–ASSY

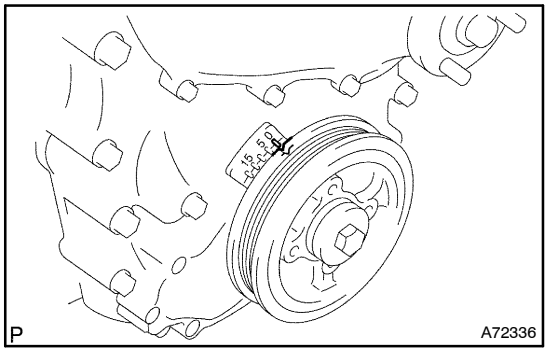
(a) Remove the 10 bolts, 10 washer seals and cylinder head cover.

(b) Remove the gasket from the cylinder head cover.



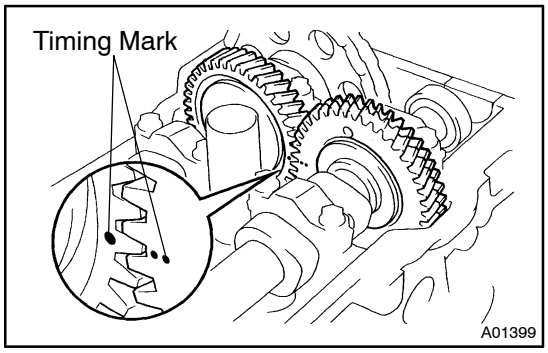
14. REMOVE SPARK PLUG TUBE GASKET

(a) Using a screwdriver with taping its tip, pry out the spark plug tube gasket.



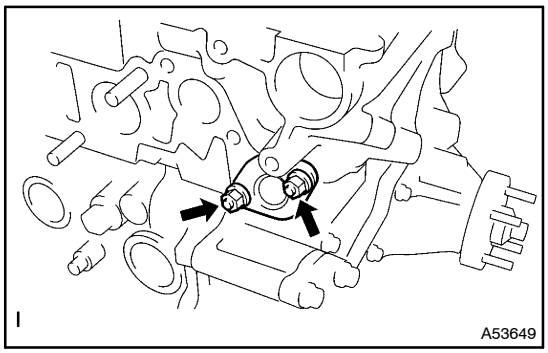
15. SET NO. 1 CYLINDER TO TDC/COMPRESSION

(a) Turn the crankshaft pulley clockwise and align its groove with the ”0” mark on the oil pump cover.



(b) Check that the timing marks (1 and 2 dots) of the camshaft drive and driven gears are in straight line on the cylinder head surface as shown in the illustration.

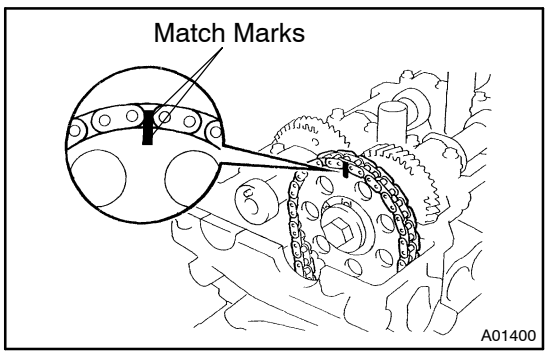
If not, turn the crankshaft 1 revolution (360°) and align the marks as above.



16. REMOVE CHAIN TENSIONER ASSY NO.1

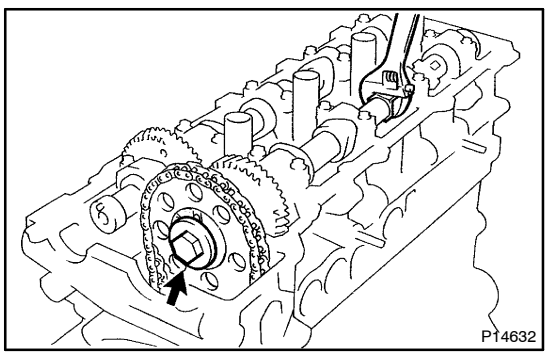
(a) Remove the 2 nuts, chain tensioner and gasket.

17. REMOVE SEMICIRCULAR PLUG



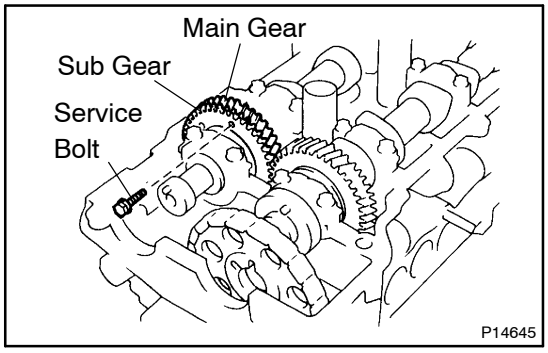
18. REMOVE CAMSHAFT TIMING GEAR OR SPROCKET

(a) Place the match marks on the camshaft timing gear and chain.



(b) Hold the camshaft with a wrench, remove the bolt.

(c) Remove the camshaft timing gear and chain from the camshaft and leave on the chain tensioner slipper and chain vibration damper.



19. REMOVE CAMSHAFT

NOTICE:

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

(a) Bring the service bolt hole of the driven sub gear upward by turning the hexagon wrench head portion of the camshaft No. 2 with a wrench.

(b) Secure the camshaft No.2 sub gear to the main gear with a service bolt.

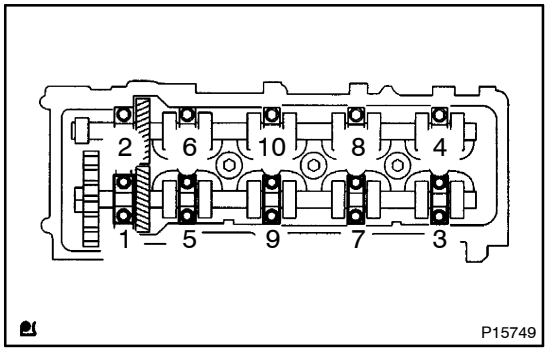
Torque: 5.0 N·m (51 kgf·cm, 44 in.·lbf)

Recommended service bolt:

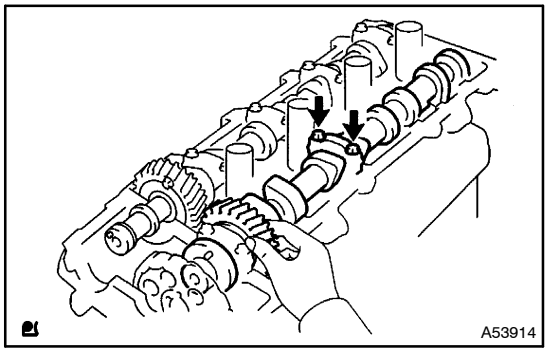
Thread diameter	6 mm
Thread pitch	1.0 mm
Bolt length	16 – 20 mm (0.63 – 0.79 in.)

HINT:

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



(c) Uniformly loosen and remove the 10 camshaft bearing cap bolts in several passes, in the sequence shown.



(d) Remove the 5 camshaft bearing caps and camshaft.

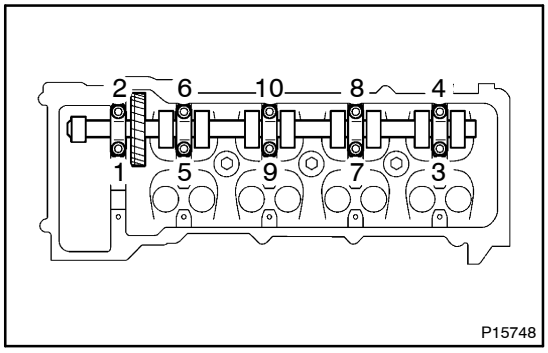
NOTICE:

Do not pry or attempt to force the camshaft with a tool or other object.

HINT:

If the camshaft is not being lifted out straight and level, reinstall the No. 3 camshaft bearing cap with the 2 bolts. Then alternately loosen and remove the camshaft bearing cap bolts with the camshaft gear pulled up.

(e) Remove the camshaft.



20. REMOVE NO.2 CAMSHAFT

NOTICE:

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

(a) Uniformly loosen and remove the 10 camshaft bearing cap bolts in several passes, in the sequence shown.

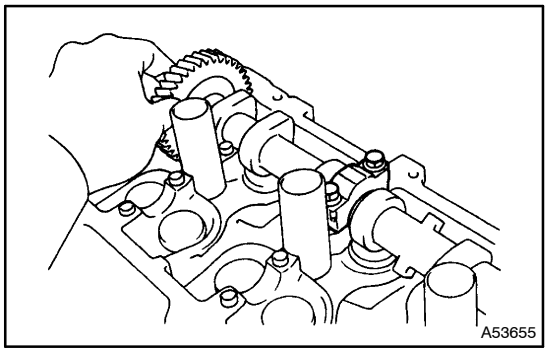
(b) Remove the 5 camshaft bearing caps and camshaft.

NOTICE:

Do not pry or attempt to force the camshaft with a tool or other object.

HINT:

If the camshaft is not being lifted out straight and level, reinstall the No. 3 camshaft bearing cap with the 2 bolts. Then alternately loosen and remove the camshaft bearing cap bolts with the camshaft gear pulled up.



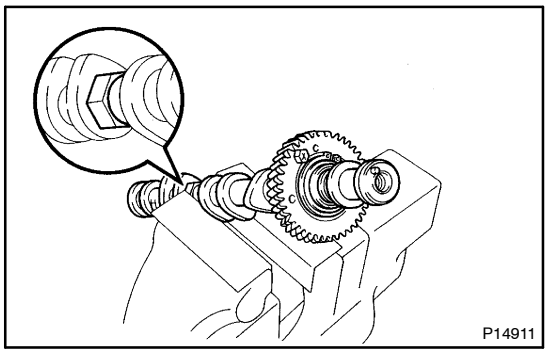
(c) Remove the No. 2 camshaft.

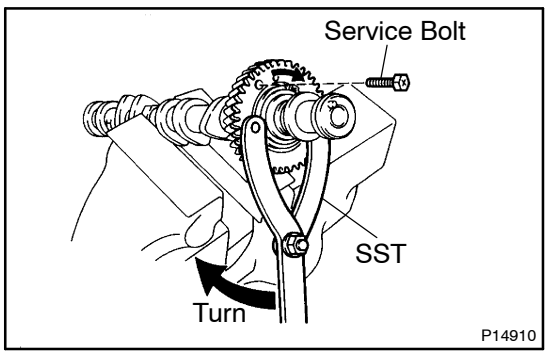
21. REMOVE CAMSHAFT SUB GEAR

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

NOTICE:

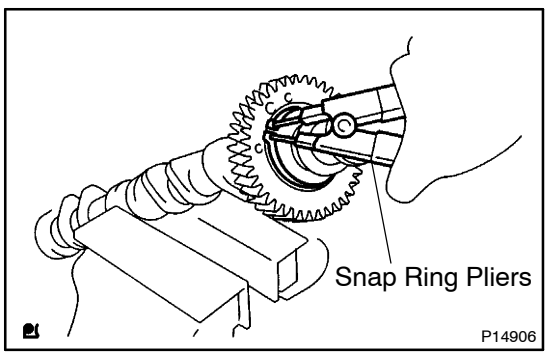
Be careful not to damage the camshaft.



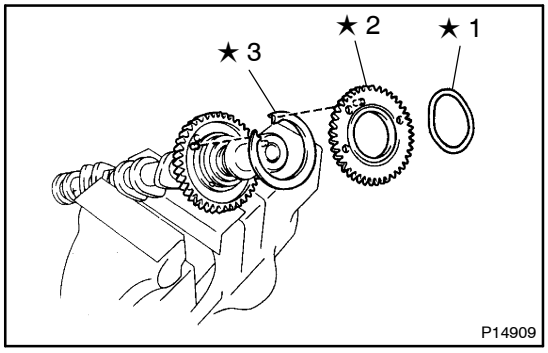


(b) Using SST, turn the camshaft sub gear clockwise, and remove the service bolt.

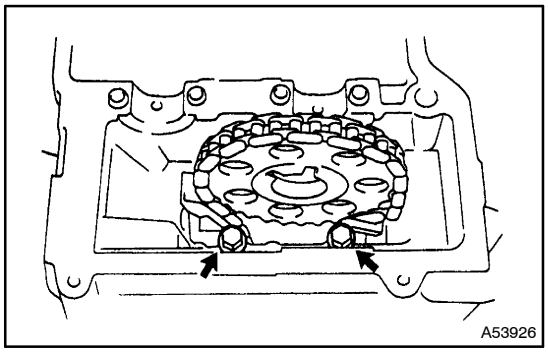
SST 09960–10010 (09962–01000, 09963–00500)



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

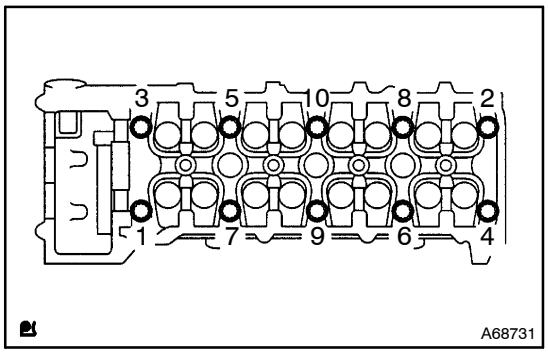


(d) Remove the wave washer (★ 1), camshaft sub gear (★ 2) and camshaft timing gear bolt washer (★ 3).



22. REMOVE CYLINDER HEAD SUB–ASSY

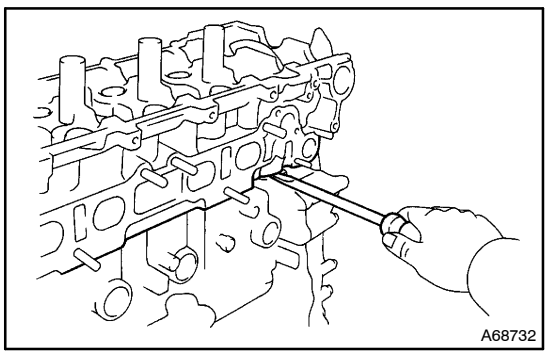
(a) Remove the 2 cylinder head bolts in front of the cylinder head before the other cylinder head bolts are removed.



(b) Using a socket wrench 14 mm (double hexagon), uniformly loosen and remove the 10 cylinder head bolts, in several passes, in the sequence shown.

NOTICE:

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



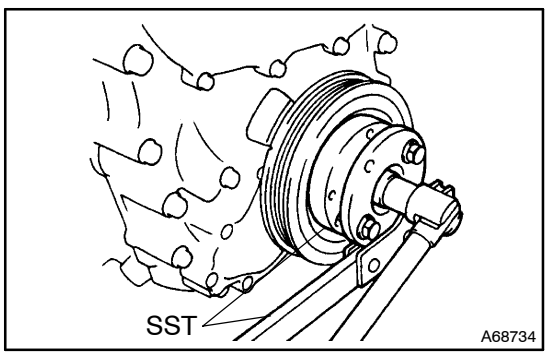
(c) Lift the cylinder head from the dowels on the cylinder block, and place the cylinder head on wooden blocks on a bench.

NOTICE:

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

HINT:

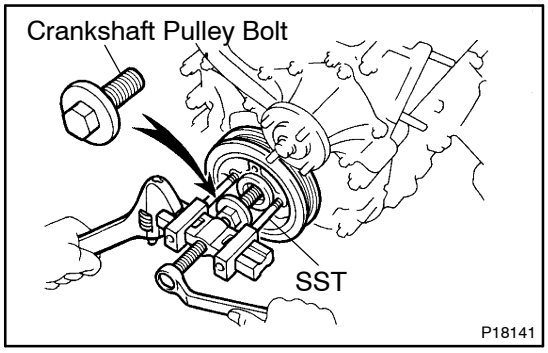
If the cylinder head is difficult to lift, pry between the cylinder head and cylinder block with a screwdriver.



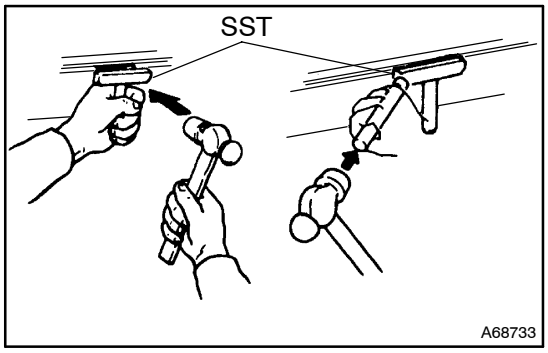
23. REMOVE CRANKSHAFT PULLEY

(a) Hold the crankshaft pulley with SST, loosen the crankshaft pulley bolt.

SST 09213–54015, 09330–00021



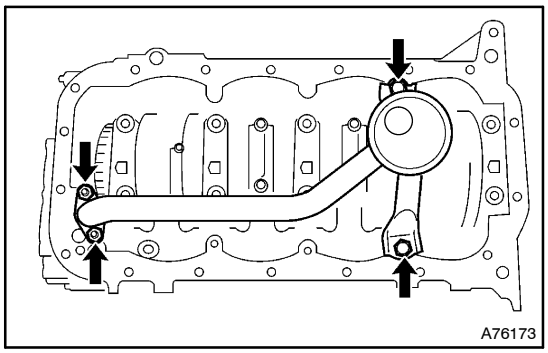
(b) Using SST, remove the crankshaft pulley and crankshaft pulley key.
SST 09950–50013 (09951–05010, 09952–05010, 09953–05010, 09954–05021)



24. REMOVE OIL PAN SUB–ASSY

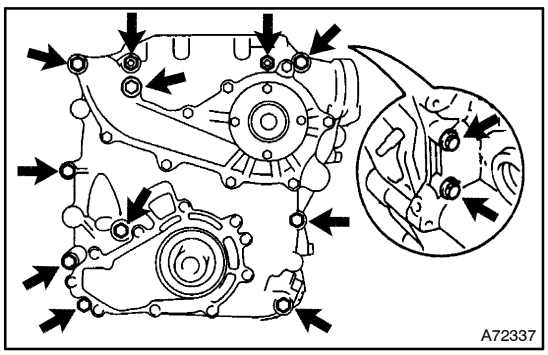
(a) Remove the 16 bolts and 2 nuts.
(b) Insert the blade of SST between the cylinder block and oil pan, cat off applied sealer and remove the oil pan.
SST 09032–00100

NOTICE:
Be careful not to damage the oil pan flanges of the oil pan and cylinder block.



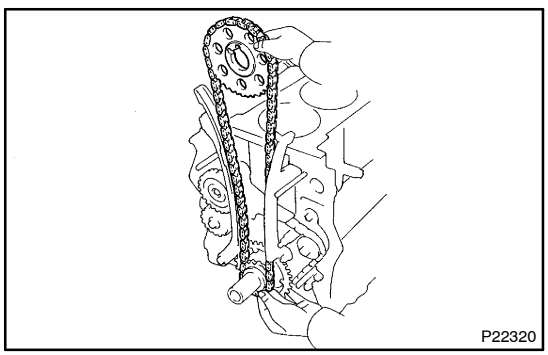
25. REMOVE OIL STRAINER SUB–ASSY

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

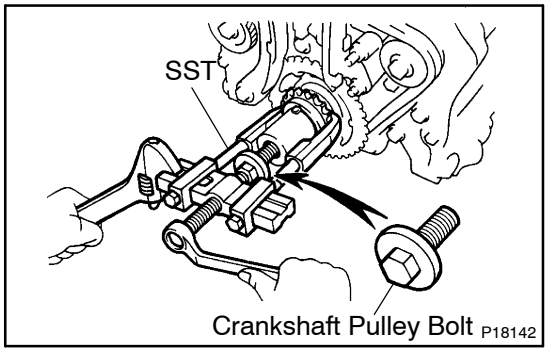


26. REMOVE TIMING GEAR CASE SUB–ASSY

(a) Remove the 11 bolts and 2 nuts.
(b) Using a plastic–faced hammer, loosen the timing gear case and remove the timing gear case and 2 gaskets.



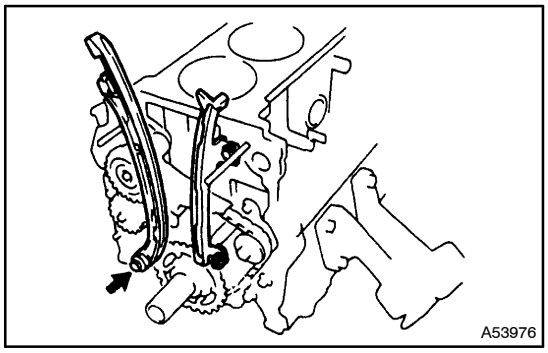
27. REMOVE CHAIN SUB–ASSY



28. REMOVE CRANKSHAFT TIMING GEAR OR SPROCKET

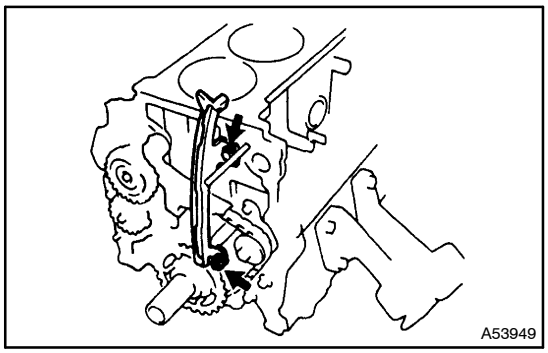
(a) Using SST, remove the crankshaft timing gear and crankshaft timing gear key.

SST 09950–40011 (09951–04010, 09952–04010, 09953–04010, 09954–04010, 09955–04061)



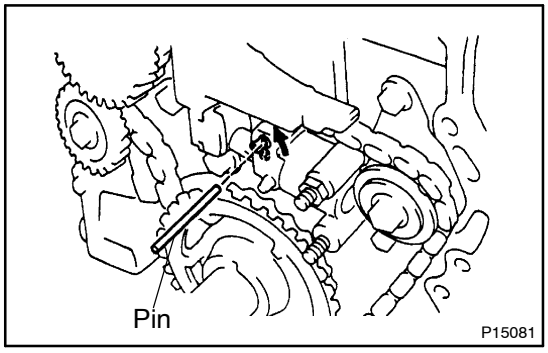
29. REMOVE CHAIN TENSIONER SLIPPER

(a) Remove the bolt and chain tensioner slipper.



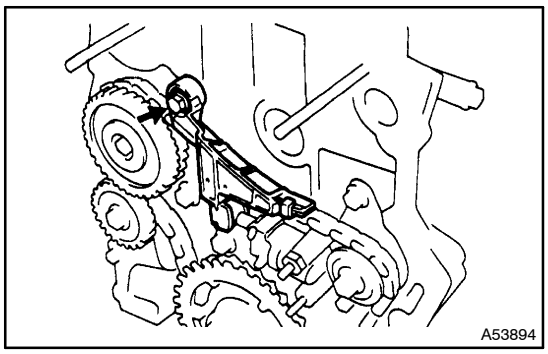
30. REMOVE CHAIN VIBRATION DAMPER NO.1

(a) Remove the bolt, nut and chain vibration damper.

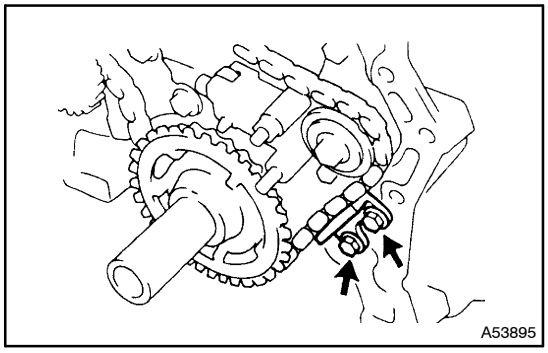


31. REMOVE CHAIN VIBRATION DAMPER NO.2

(a) Install a pin to the chain tensioner and lock the plunger.

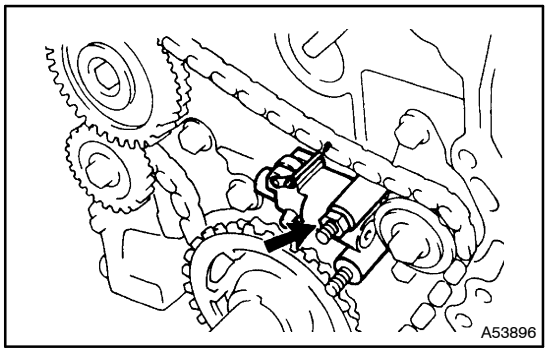


(b) Remove the bolt and chain vibration damper.



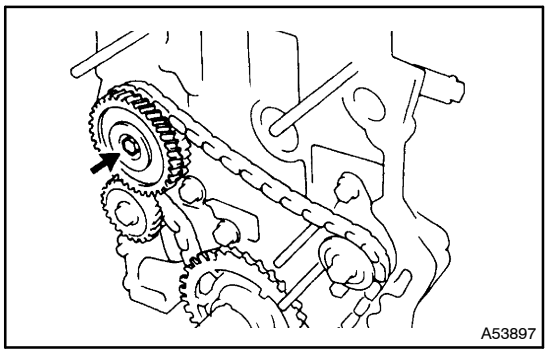
32. REMOVE CHAIN VIBRATION DAMPER NO.3

(a) Remove the 2 bolts and chain vibration damper.



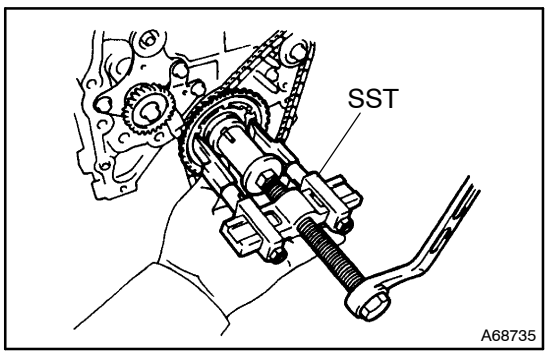
33. REMOVE CHAIN TENSIONER ASSY NO.2

(a) Remove the nut and chain tensioner.



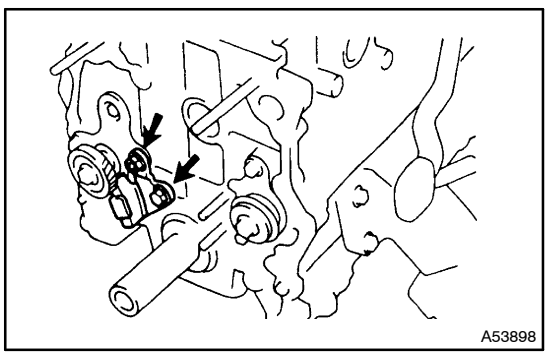
34. REMOVE NO.2 CHAIN SUB–ASSY

(a) Remove the bolt, balanceshaft drive gear shaft and balanceshaft drive gear.



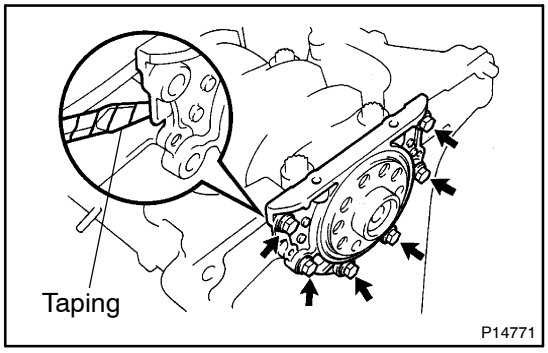
(b) Using SST and crankshaft pulley bolt, remove the crankshaft timing gear and chain.

SST 09950–40011 (09951–04010, 09952–04010, 09953–04020, 09954–04010, 09955–04061)



35. REMOVE CHAIN VIBRATION DAMPER NO.4

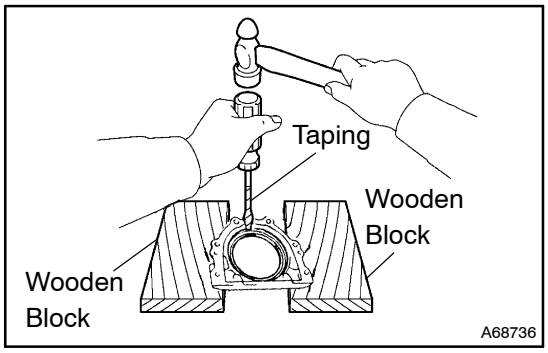
(a) Remove the 2 bolts and vibration damper.



36. REMOVE ENGINE REAR OIL SEAL RETAINER

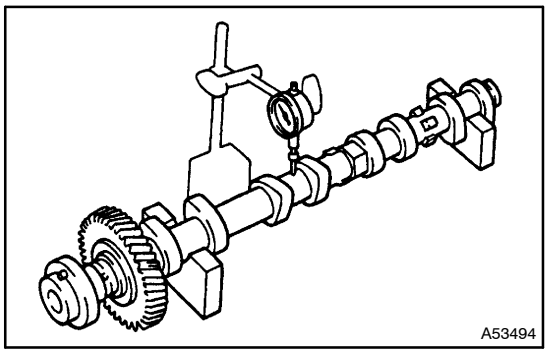
(a) Remove the 6 bolts.

(b) Using a screwdriver with taping its tip, remove the engine rear oil seal retainer by prying the portions between the engine rear oil seal retainer and cylinder block.



37. REMOVE ENGINE REAR OIL SEAL

(a) Using a screwdriver with taping its tip, tap out the engine rear oil seal.



38. INSPECT CAMSHAFT

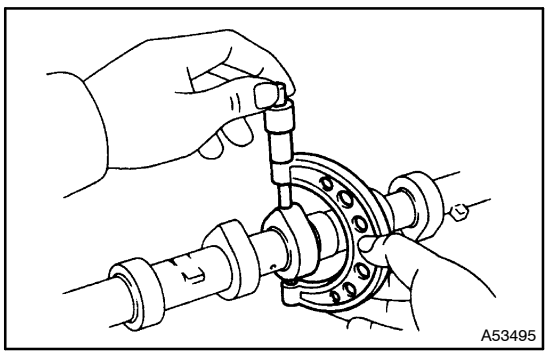
(a) Inspect camshaft for runout.

(1) Place the camshaft on V–blocks.

(2) Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout: 0.06 mm (0.0024 in.)

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



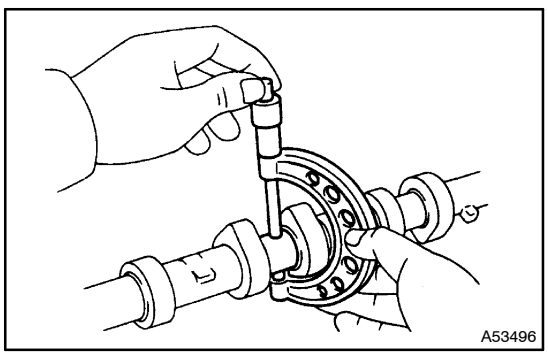
(b) Inspect cam lobes.

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

Standard cam lobe height:

45.31 – 45.41 mm (1.7839 – 1.7878 in.)

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



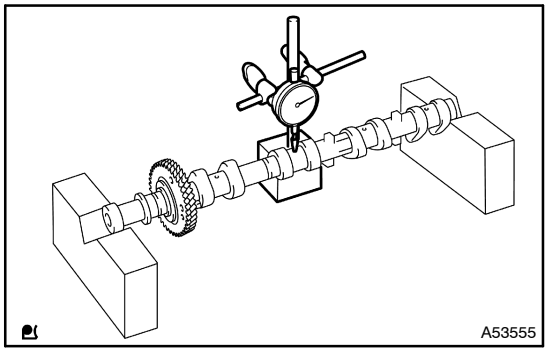
(c) Inspect camshaft journals.

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

Camshaft journal diameter:

26.959 – 26.975 mm (1.0614 – 1.0620 in.)

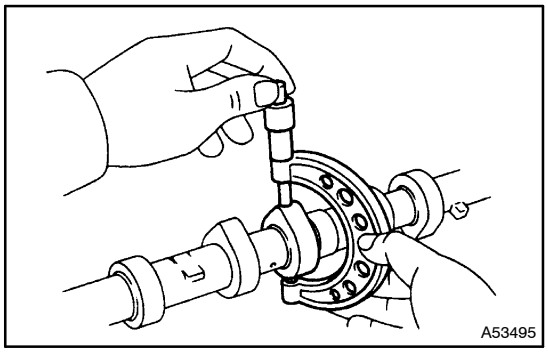
If the camshaft journal diameter is no as specified, check the oil clearance.



39. INSPECT NO.2 CAMSHAFT

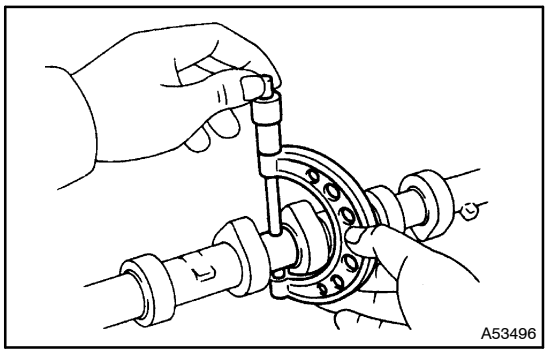
(a) Inspect camshaft for runout.
  (1) Place the camshaft on V–blocks.
  (2) Using a dial indicator, measure the circle runout at the center journal.
  Maximum circle runout: 0.06 mm (0.0024 in.)

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



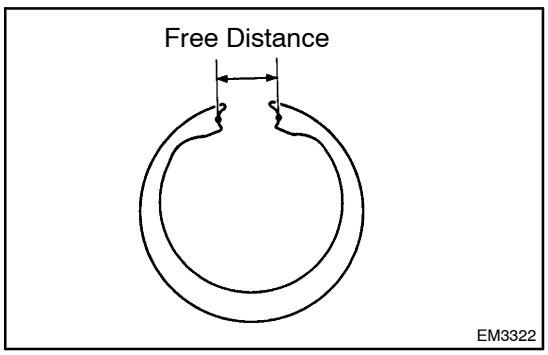
(b) Inspect cam lobes.
  (1) Using a micrometer, measure the cam lobe height.
  Standard cam lobe height:
  45.06 – 45.16 mm (1.7740 – 1.7779 in.)

If the cam love height is less than standard allowable, replace the camshaft.



(c) Inspect camshaft journals.
  (1) Using a micrometer, measure the camshaft journal diameter.
  Camshaft journal diameter:
  26.959 – 26.975 mm (1.0614 – 1.0620 in.)

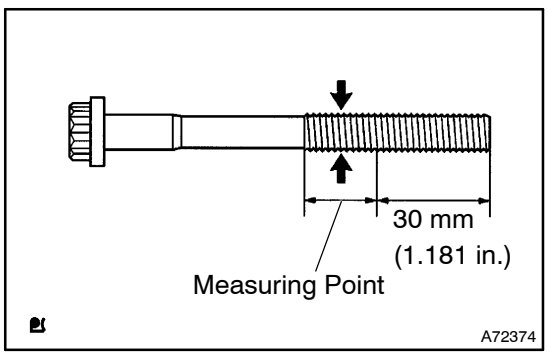
If the camshaft journal diameter is no as specified, check the oil clearance.



40. INSPECT CAMSHAFT TIMING GEAR BOLT WASHER

(a) Using vernier calipers, measure the free distance between the washer ends.
  Free distance:
  22.5 – 22.9 mm (0.886 – 0.902 in.)

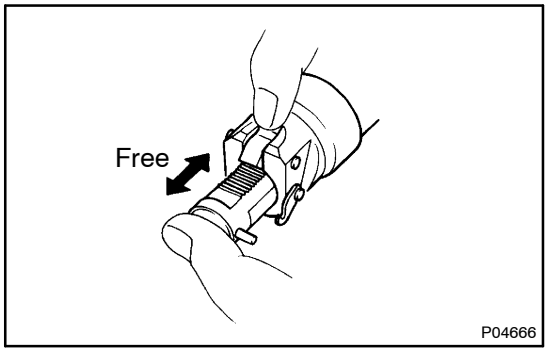
If the free distance is not as specified, replace the camshaft timing gear bolt washer.



41. INSPECT CYLINDER HEAD SET BOLT

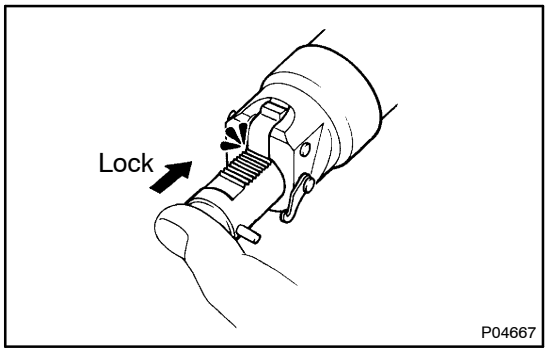
(a) Using vernier calipers, measure the minimum diameter of the elongated thread at the measuring point.
  Standard out side diameter:
  10.76 – 10.97 mm (0.4236 – 0.4319 in.)
  Minimum outside diameter: 10.40 mm (0.4094 in.)

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

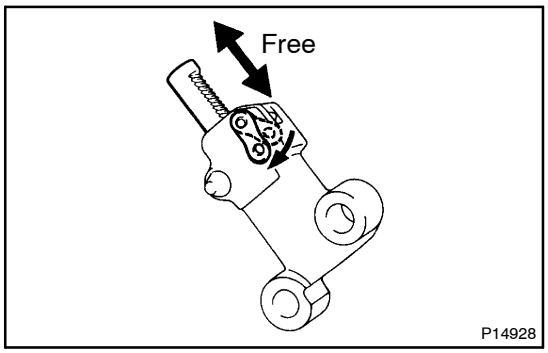


42. INSPECT CHAIN TENSIONER ASSY NO.1

(a) Check that the plunger moves smoothly when the ratchet pawl is raised with your finger.

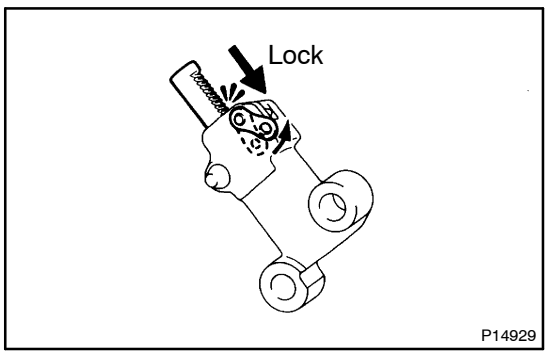


(b) Released the ratchet pawl and check that the plunger is locked in place by the ratchet pawl and does not move when pushed with your finger.

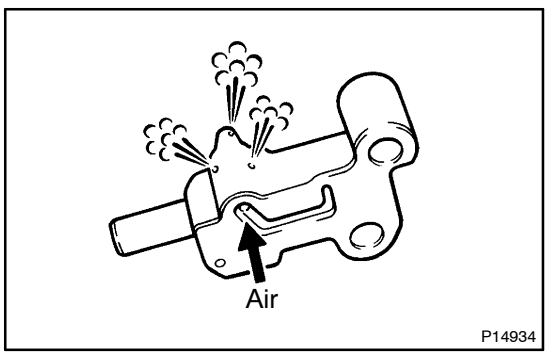


43. INSPECT CHAIN TENSIONER ASSY NO.2

(a) Check that the plunger moves smoothly when the ratchet pawl is raised with your finger.

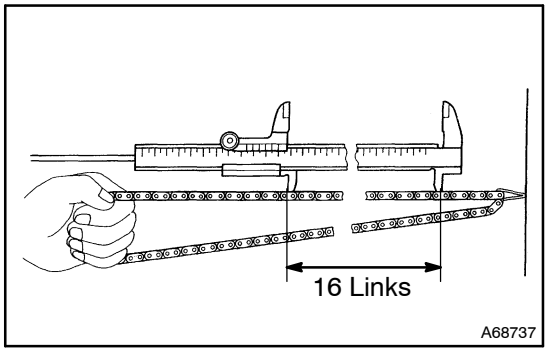


(b) Release the ratchet pawl and check that the plunger is locked in place by the ratchet pawl and does not move when pushed with your finger.



(c) Check the oil jet for damage or clogging.

If necessary, replace the chain tensioner.



44. INSPECT CHAIN SUB–ASSY

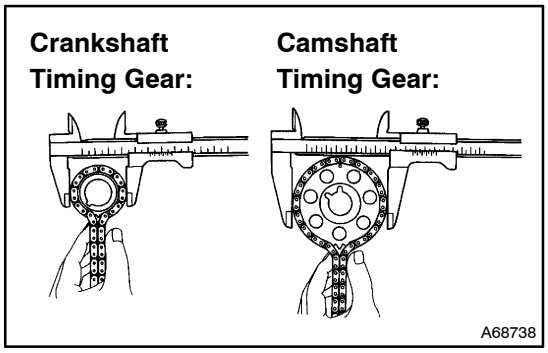
(a) Using vernier calipers, measure the length of 16 links with the chain fully stretched.

Maximum chain elongation: 147.5 mm (5.807 in.)

If the elongation is greater than maximum, replace the chain.

HINT:

Make the same measurements pulling at 3 or more places selected at random.



(b) Wrap the chain around the crankshaft timing gear and camshaft timing gear.

(c) Using vernier calipers, measure the crankshaft timing gear and camshaft timing gear with the chain.

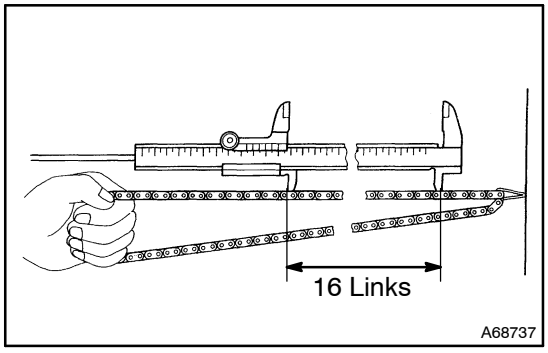
Minimum gear diameter (w/ chain):

Crankshaft timing gear	59.4 mm (2.339 in.)
Camshaft timing gear	113.8 mm (4.480 in.)

If the diameter is less than minimum, replace the chain, crankshaft timing gear and camshaft timing gear.

NOTICE:

Vernier calipers must contact the chain rollers for measuring.



45. INSPECT NO.2 CHAIN SUB–ASSY

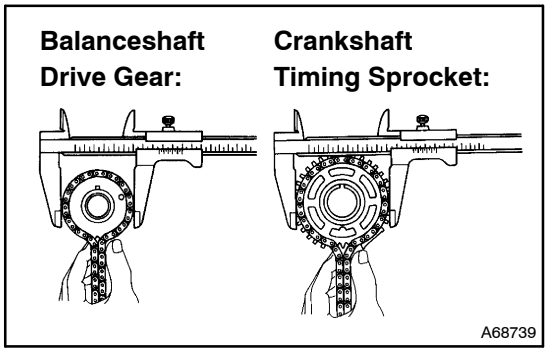
(a) Using vernier calipers, measure the length of 16 links with the chain fully stretched.

Maximum chain elongation: 123.6 mm (4.866 in.)

If the elongation is greater than maximum, replace the chain.

HINT:

Make the same measurements pulling at 3 or more places selected at random.



(b) Wrap the chain around the balanceshaft drive gear and crankshaft timing sprocket.

(c) Using vernier calipers, measure the balanceshaft drive gear and crankshaft timing sprocket with the chain.

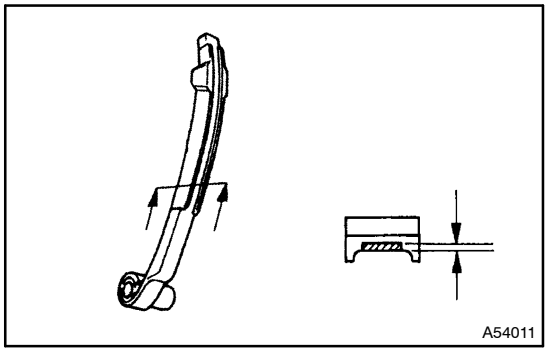
Minimum gear or sprocket diameter (w/ chain):

Balanceshaft drive gear	75.9 mm (2.988 in.)
Crankshaft timing sprocket	96.7 mm (3.807 in.)

If the diameter is less than minimum, replace the chain, crankshaft timing sprocket and balanceshaft drive gear.

NOTICE:

Vernier calipers must contact the chain rollers for measuring.

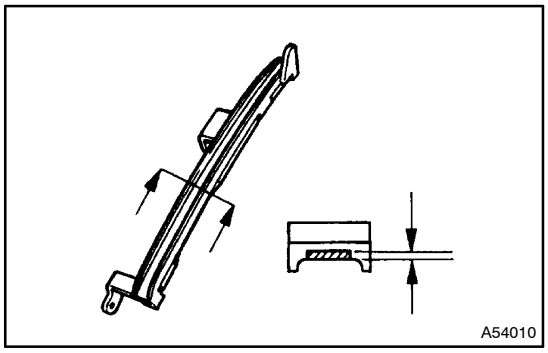


46. INSPECT CHAIN TENSIONER SLIPPER

(a) Using vernier calipers, measure the chain tensioner slipper diameter wears.

Maximum wear: 1.0 mm (0.039 in.)

If the wear is greater than maximum, replace the chain tensioner slipper.

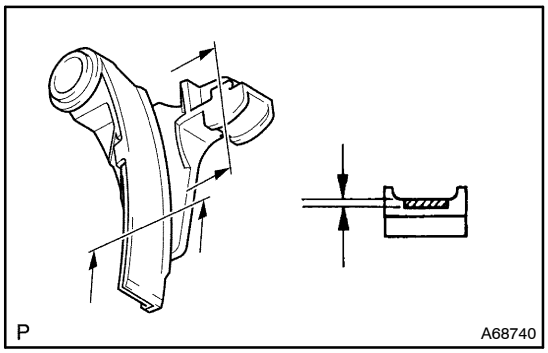


47. INSPECT CHAIN VIBRATION DAMPER NO.1

(a) Using vernier calipers, measure the chain vibration damper diameter wears.

Maximum wear: 1.0 mm (0.039 in.)

If the wear is greater than maximum, replace the chain vibration damper.

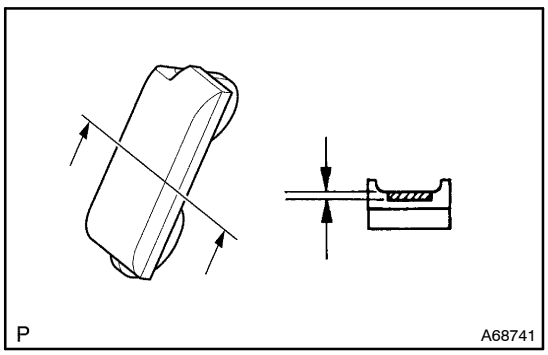


48. INSPECT CHAIN VIBRATION DAMPER NO.2

(a) Using vernier calipers, measure the chain vibration damper diameter wears.

Maximum wear: 1.0 mm (0.039 in.)

If the wear is greater than maximum, replace the chain vibration damper.

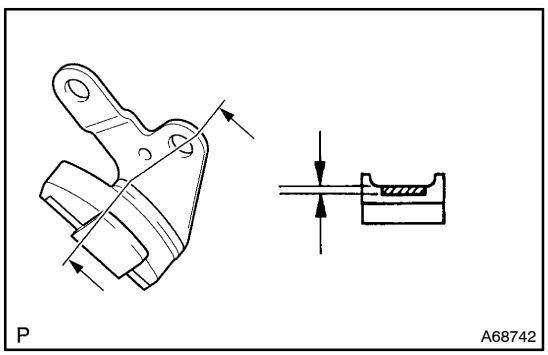


49. INSPECT CHAIN VIBRATION DAMPER NO.3

(a) Using vernier calipers, measure the chain vibration damper diameter wears.

Maximum wear: 1.0 mm (0.039 in.)

If the wear is greater than maximum, replace the chain vibration damper.

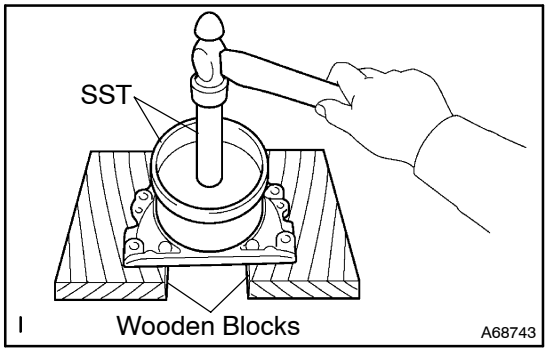


50. INSPECT CHAIN VIBRATION DAMPER NO.4

(a) Using vernier calipers, measure the chain vibration damper diameter wears.

Maximum wear: 1.0 mm (0.039 in.)

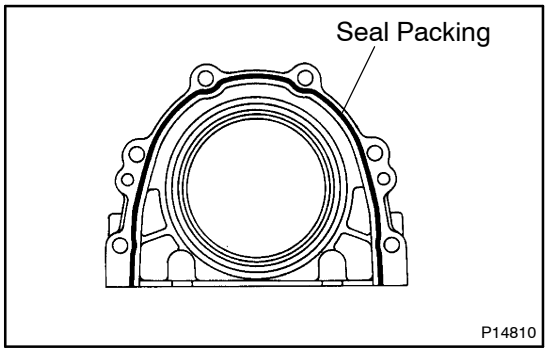
If the wear is greater than maximum, replace the chain vibration damper.



51. INSTALL ENGINE REAR OIL SEAL

(a) Using SST, tap in a new engine rear oil seal until its surface is flush with the engine rear oil seal retainer edge.
SST 09223–15030, 09950–70010 (09951–07150)

(b) Apply MP grease to the engine rear oil seal.



52. INSTALL ENGINE REAR OIL SEAL RETAINER

(a) Apply seal packing in the shape of bend (diameter 2 – 3 mm (0.08 – 0.12 in.) the places as shown in the illustration.
Seal packing: Part No. 08826–00080 or equivalent

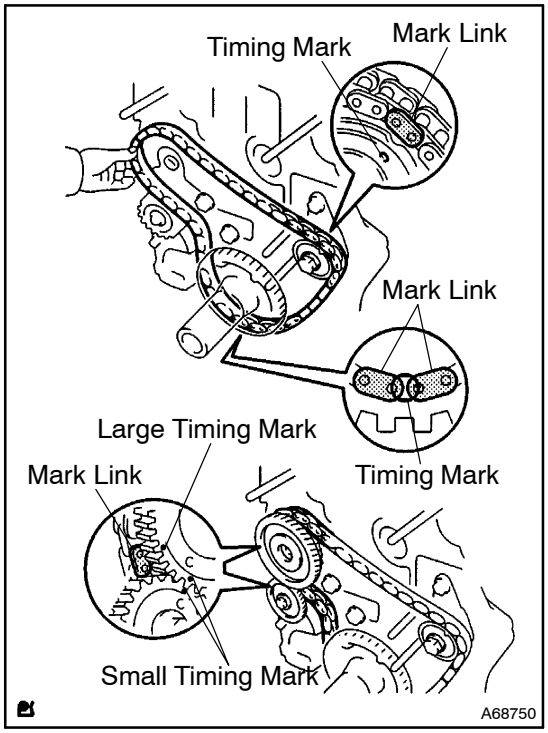
NOTICE:

- **Remove any oil from the contact surface**
- **Install the cylinder head cover within 3 minutes after applying seal packing.**
- **Do not put into the engine oil within 2 hours after installing.**

(b) Install the engine rear oil seal retainer with the 6 bolts.
Torque: 14 N·m (135 kgf·cm, 10 ft·lbf)

53. INSTALL CHAIN VIBRATION DAMPER NO.4

(a) Install the vibration damper with the 2 bolts.
Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)



54. INSTALL NO.2 CHAIN SUB–ASSY

NOTICE:

Check that No. 1 cylinder is at TDC and that the weights of the No. 1 and No. 2 balanceshaft are at the bottom side.

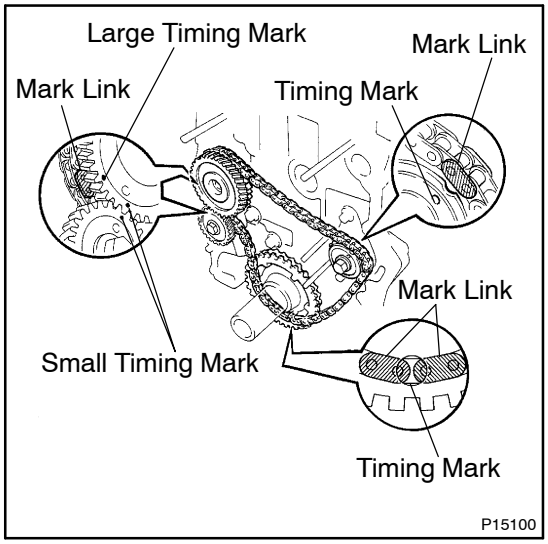
(a) Install the chain by matching its mark links with the timing marks on the crankshaft timing sprocket and balanceshaft timing sprocket.

(b) Fit the other mark link of crankshaft timing sprocket behind the large timing mark of the balanceshaft drive gear.

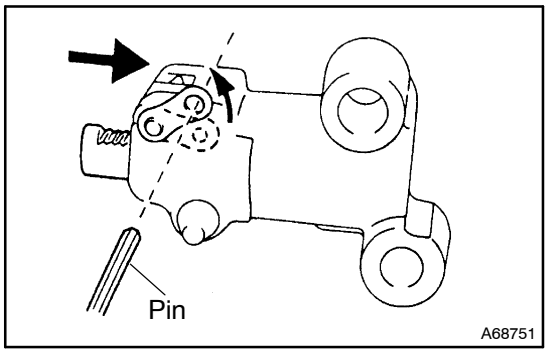
(c) Insert the balanceshaft drive gear shaft through the balanceshaft drive gear so that it fits into the thrust plate hole.

(d) Then align the small timing mark of the balanceshaft drive gear with the timing mark of the balanceshaft timing gear.

(e) Install the bolt to the balanceshaft drive gear and tighten it.
Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)



(f) Check that each timing mark is matched with the the corresponding mark link.



55. INSTALL CHAIN TENSIONER ASSY NO.2

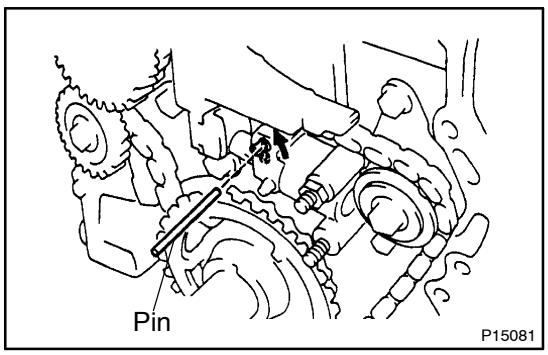
NOTICE:

Assemble the chain tensioner with the pin installed, then remove the pin after assembly. When doing this, avoid pushing the vibration damper against the chain.

(a) Install the chain tensioner with the nut.
Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)

56. INSTALL CHAIN VIBRATION DAMPER NO.3

(a) Install the chain vibration damper with the 2 bolts.
Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)



57. INSTALL CHAIN VIBRATION DAMPER NO.2

(a) Install the chain vibration damper with the bolt.
Torque: 27 N·m (270 kgf·cm, 20 ft·lbf)

(b) Remove a pin from the chain tensioner and free the plunger.

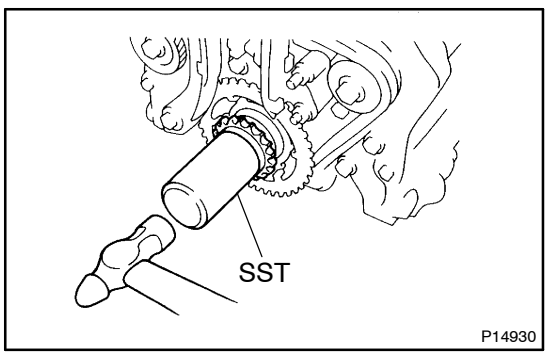
58. INSTALL CHAIN VIBRATION DAMPER NO.1

(a) Install the chain vibration damper with the bolt and nut.
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)

59. INSTALL CHAIN TENSIONER SLIPPER

(a) Install the chain tensioner slipper with the bolt.
Torque: 27 N·m (270 kgf·cm, 20 ft·lbf)

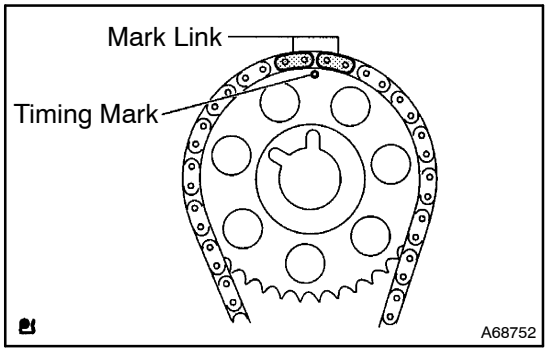
(b) Check that the chain tensioner slipper moves smoothly.



60. INSTALL CRANKSHAFT TIMING GEAR OR SPROCKET

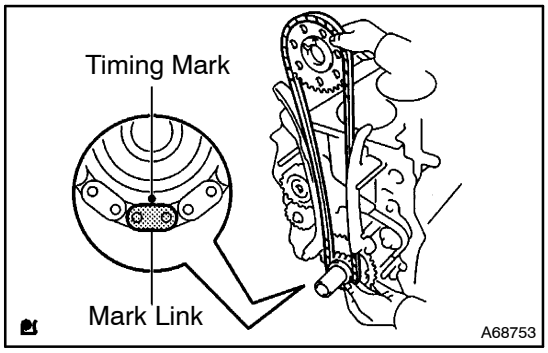
(a) Install the crankshaft timing gear key.

(b) Using SST, install the crankshaft timing gear.
SST 09636–20010

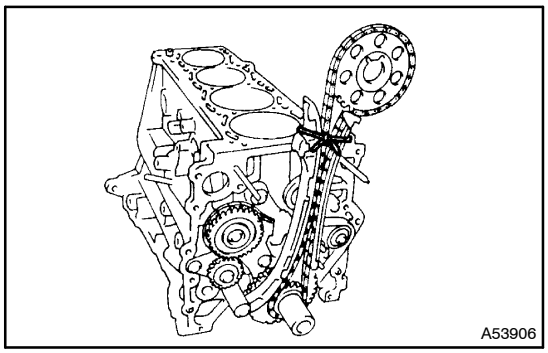


61. INSTALL CHAIN SUB–ASSY

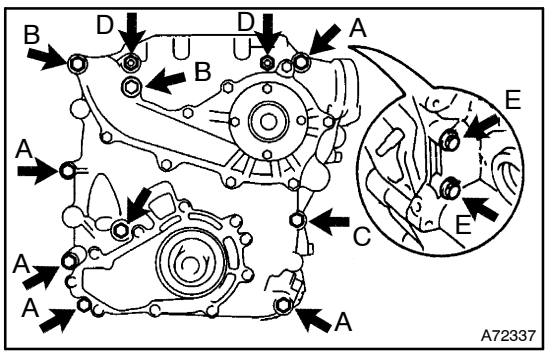
(a) Align the timing mark between the mark link of the chain, and install the chain to the camshaft timing gear.



(b) Align the timing mark of the crankshaft timing gear with the mark link of the chain and install the chain.



(c) Tie the chain with a cord as shown in the illustration, and make sure it doesn't come loose.



62. INSTALL TIMING GEAR CASE SUB–ASSY

(a) Install 2 gaskets to the cylinder block.

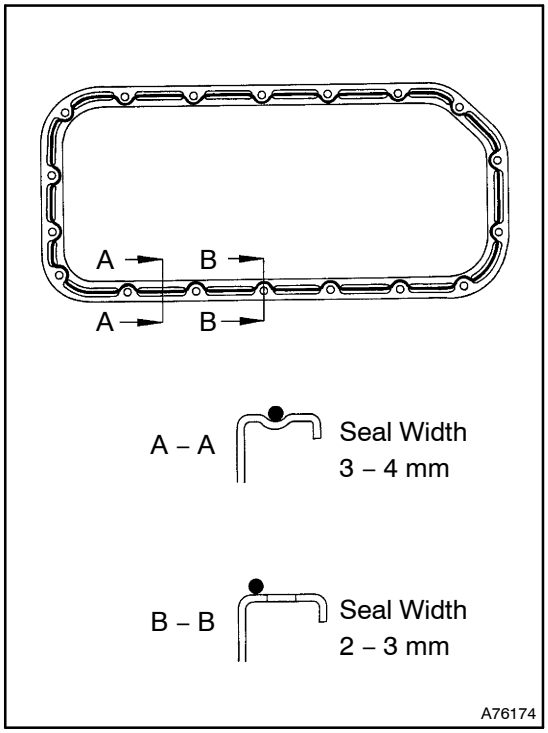
(b) Install the timing gear case with the 11 bolts and 2 nuts.

Torque:
20 N·m (200 kgf·cm, 14 ft·lbf) for bolt A
25 N·m (250 kgf·cm, 18 ft·lbf) for bolt B
44 N·m (440 kgf·cm, 32 ft·lbf) for bolt C
20 N·m (200 kgf·cm, 14 ft·lbf) for nut D
18 N·m (185 kgf·cm, 13 ft·lbf) for bolt E

63. INSTALL OIL STRAINER SUB–ASSY

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

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



64. INSTALL OIL PAN SUB–ASSY

(a) Apply seal packing in the shape of bend (diameter 2 – 3 mm (0.08 – 0.12 in.) or 3 – 4 (0.12 – 0.16 in.)) the places as shown in the illustration.

Seal packing: Part No. 08826–00080 or equivalent

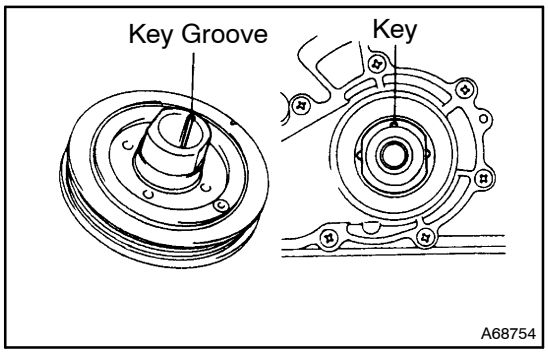
NOTICE:

- **Remove any oil from the contact surface**
- **Install the oil pan within 3 minutes after applying seal packing.**
- **Do not put into engine oil within 4 hours after installing.**

(b) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the oil pan and cylinder block.

(c) Install the oil pan with the 16 bolts and 2 nuts.

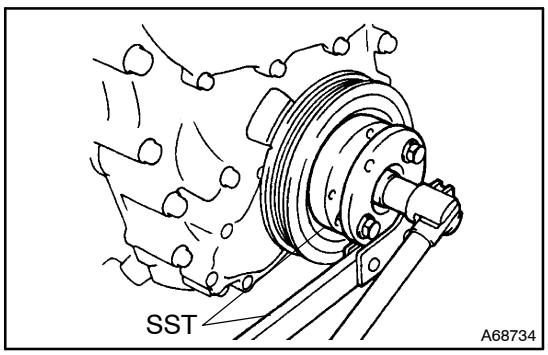
Torque: 13 N·m (130 kgf·cm, 9 ft·lbf)



65. INSTALL CRANKSHAFT PULLEY

(a) Install the crankshaft pulley key.

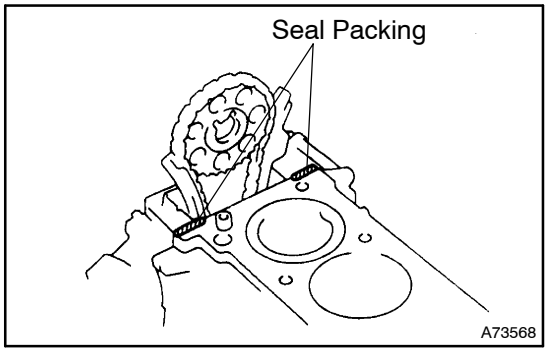
(b) Align the pulley set key with the key groove of the crankshaft pulley, and slide on the crankshaft pulley.



(c) Using SST, install and torque the crankshaft pulley bolt.

SST 09213–54015, 09330–00021

Torque: 260 N·m (2,650 kgf·cm, 193 ft·lbf)



66. INSTALL CYLINDER HEAD SUB–ASSY

HINT:

The cylinder head bolts are tightened in 2 progressive steps.

(a) Apply seal packing to the 2 locations as shown.
Seal packing: Part No. 08826–00080 or equivalent

NOTICE:

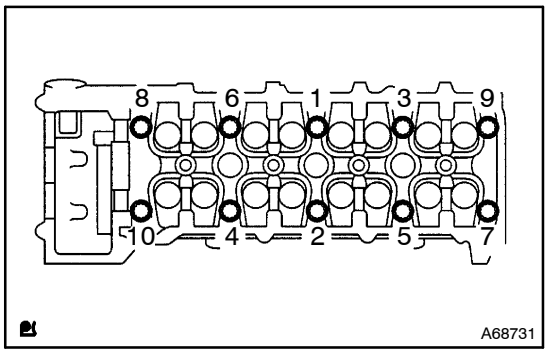
- **Remove any oil from the contact surface**
- **Install the cylinder head bolt within 5 minutes after applying seal packing.**
- **Do not put into the engine oil within 2 hours after installing.**

(b) Place a new cylinder head in portion on the cylinder block.

NOTICE:

Be careful of the installation direction.

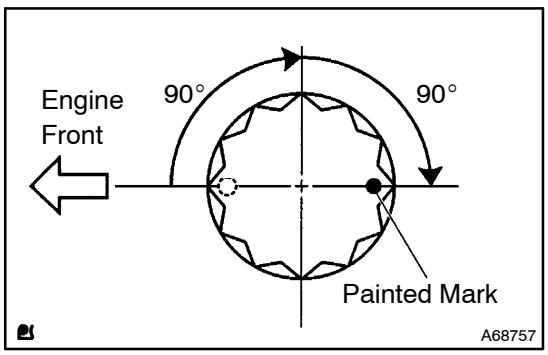
(c) Place the cylinder head in position on the cylinder head gasket.



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

(e) Using a socket wrench 14 mm (double hexagon), Install and uniformly tighten the 10 cylinder head bolts and plate washers in several passes, in the sequence shown.
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

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



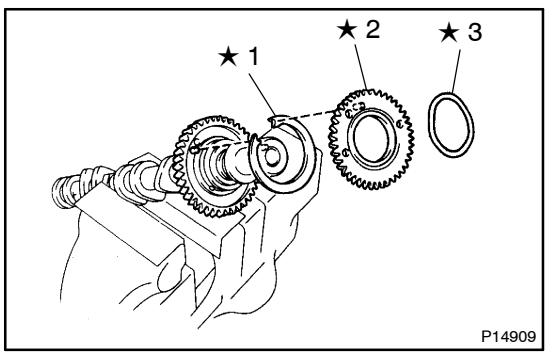
(f) Mark the from of the cylinder head bolt head with paint.

(g) Retighten the cylinder head bolts by 90° in the numerical order shown.

(h) Retighten the cylinder head bolts by an additional 90°.

(i) Check that the painted mark is now facing rearward.

(j) Install and torque the 2 mounting bolts.
Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)



67. INSTALL CAMSHAFT SUB GEAR

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

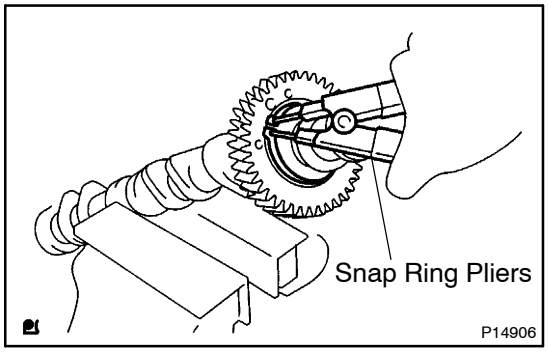
NOTICE:

Be careful not to damage the camshaft.

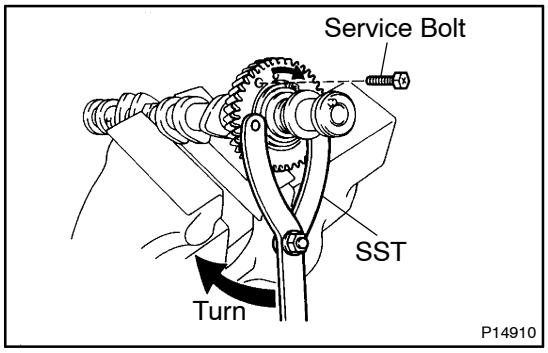
(b) Install the camshaft timing gear bolt washer (★ 1), camshaft sub gear (★ 2) and wave washer (★ 3) to the camshaft.

HINT:

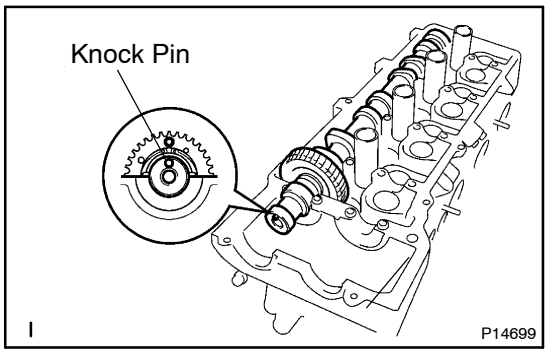
Align the pins on the gears with the spring ends.



(c) Using snap ring pliers, install the shaft snap ring.



(d) Using SST, align the holes of the camshaft main gear and sub gear by turning sub gear clockwise, and install a service bolt.
SST 09960–10010 (09962–01000, 09963–00500)
Torque: 5.0 N·m (51 kgf·cm, 44 in.·lbf)



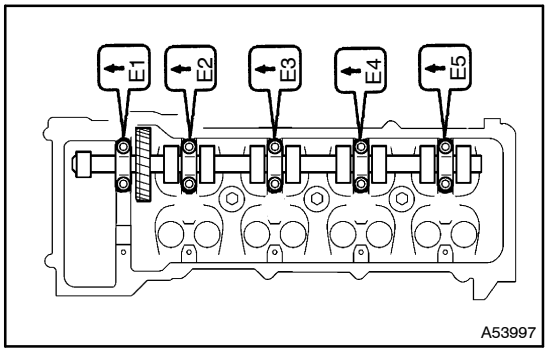
68. INSTALL NO.2 CAMSHAFT

NOTICE:

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

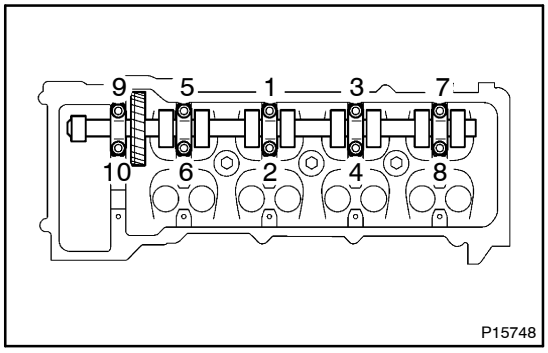
(a) Apply MP grease to the thrust portion of the camshaft No. 2.

(b) Place the camshaft No. 2 with knock pin facing upward of camshaft angle on the cylinder head.

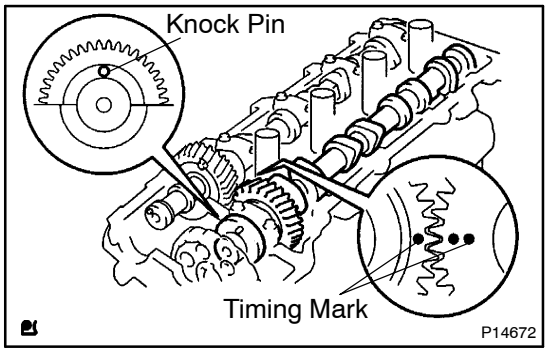


(c) Install the 5 camshaft bearing caps in their proper location.

(d) Apply a light coat of engine oil on the threads and under the heads of the camshaft bearing cap bolts.



(e) Install and uniformly tighten the 10 camshaft bearing cap bolts in several, in the sequence shown.
Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)



69. INSTALL CAMSHAFT

NOTICE:

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

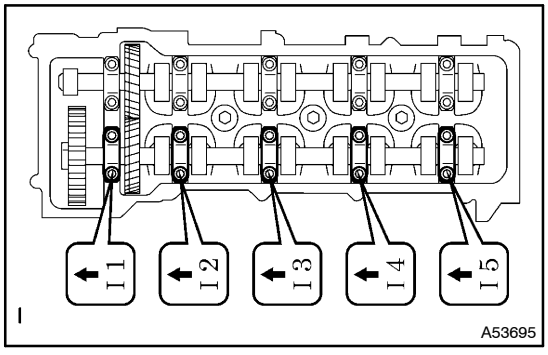
(a) Apply MP grease to the thrust portion of the camshaft.

(b) Engage the camshaft gear to the camshaft No.2 gear by matching the timing marks (1 and 2 dots) on each gear.

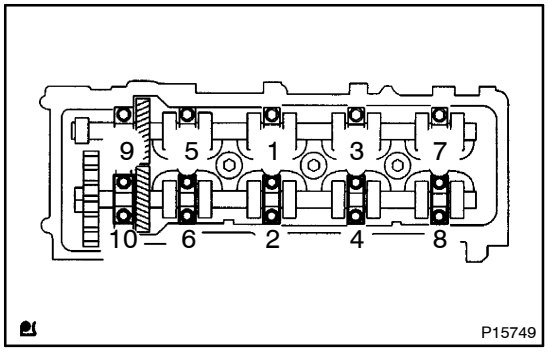
NOTICE:

There are also timing marks (for TDC) on each gear as shown in the illustration. Do not use these marks.

(c) Roll down the camshaft onto the bearing journal while engaging gears with each other.

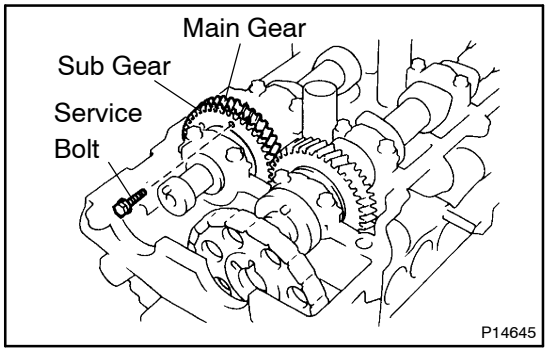


(d) Install the 5 camshaft bearing caps in their proper location.

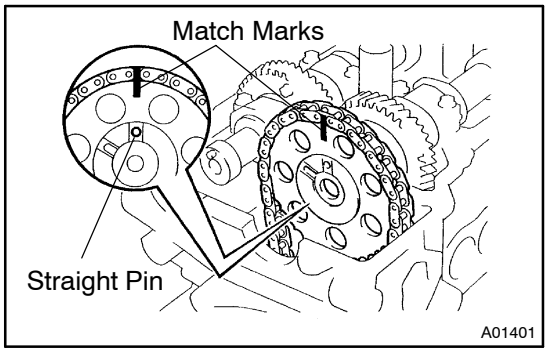


(e) Apply a light coat of engine oil on the threads and under the heads of the camshaft bearing cap bolts.

(f) Install and uniformly tighten the 10 camshaft bearing cap bolts in several, in the sequence shown.
Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)



(g) Remove the service bolt.
(h) Check that the camshafts turn smoothly.

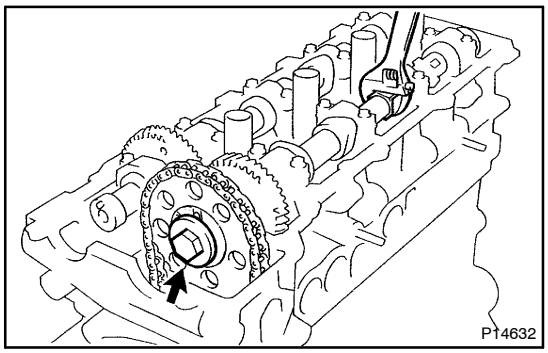


70. INSTALL CAMSHAFT TIMING GEAR OR SPROCKET

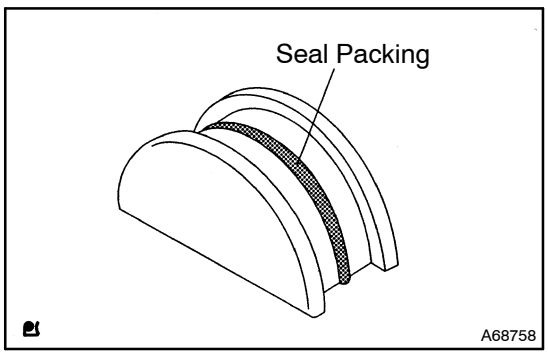
HINT:

Check that the match marks on the camshaft timing gear and chain air aligned.

(a) Place the gear over the straight pin of the camshaft.



(b) Hold the camshaft with a wrench, torque the bolt.
Torque: 74 N·m (750 kgf·cm, 54 ft·lbf)



71. INSTALL SEMICIRCULAR PLUG

(a) Apply seal packing to the semicircular plug as shown.
Seal packing: Part No. 08826–00080 or equivalent

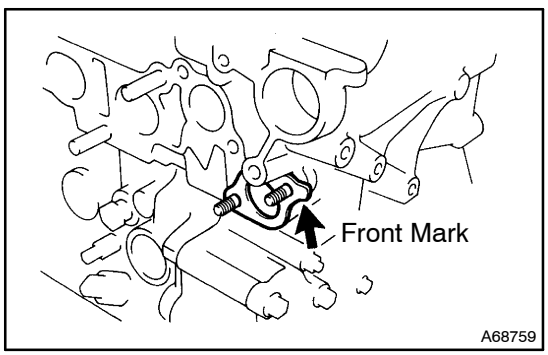
NOTICE:

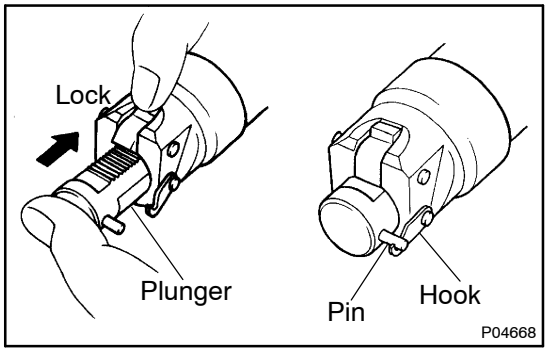
- **Remove any oil from the contact surface**
- **Install the semicircular plug within 3 minutes after applying seal packing.**
- **Do not put into the engine oil within 2 hours after installing.**

(b) Install the semicircular plug.

72. INSTALL CHAIN TENSIONER ASSY NO.1

(a) Place a new gasket so that the front mark is toward the front side.



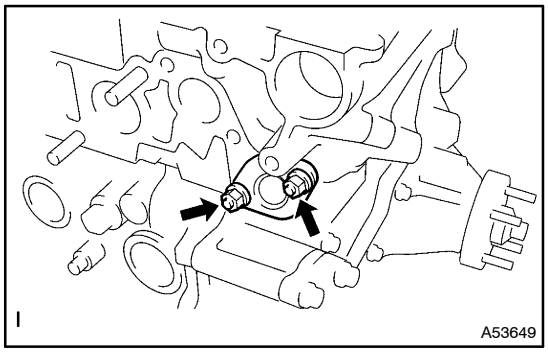


(b) Release the ratchet pawl, fully push in the plunger and apply the hook to the pin so that the plunger cannot spring out.

(c) Turn the crankshaft pulley clockwise to provide some slack for the chain on the tensioner side.

NOTICE:

Do not turn the pulley counterclockwise.



(d) Push the chain tensioner by head until it touches the head installation surface, then install the 2 nuts.

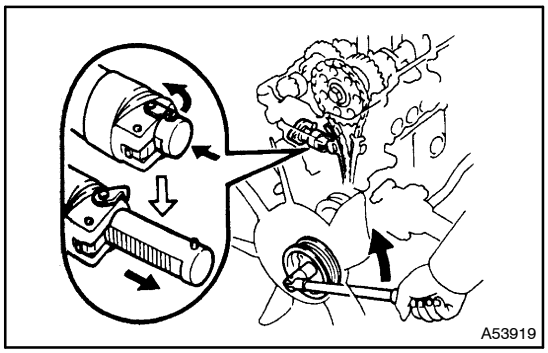
(e) Tighten the 2 nuts.

Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)

(f) Check that the hook of the chain tensioner is not released.

NOTICE:

If the plunger springs out during installation of the chain tensioner, repeat the operation in step (b) before installing the chain tensioner.

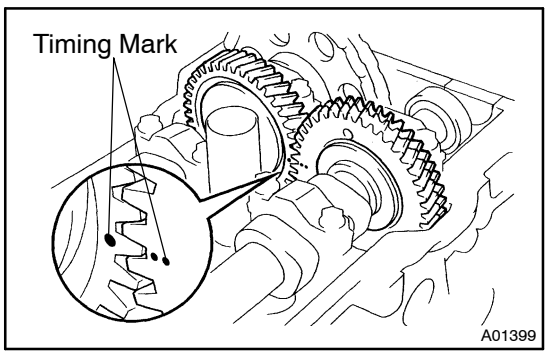


(g) Set chain tensioner

(1) Turn the crankshaft to the left so that the hook of the chain tensioner is released from the pin of the plunger, causing the plunger to spring out and the chain tensioner slipper to be pushed into the chain.

HINT:

If the plunger does not spring out, press the chain tensioner slipper in to the chain tensioner with a screwdriver so that the hook is released and the plunger springs out.



(h) Check valve timing

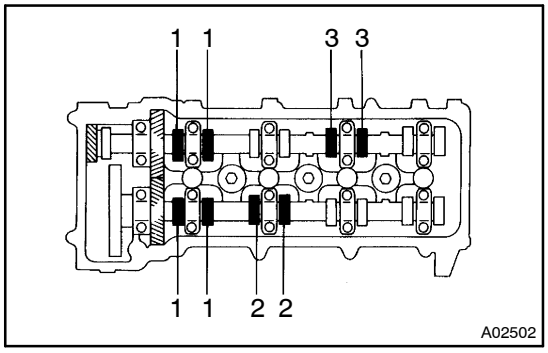
(1) Turn the crankshaft pulley, and align its groove with the timing mark ”0” of the oil pump cover.

NOTICE:

Always turn the crankshaft clockwise.

(2) Check that the timing marks (1 and 2 dots) of the camshaft drive and driven gears are in straight line on the cylinder head surface as shown in the illustration.

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



73. INSPECT VALVE CLEARANCE

(a) Check only the valves indicated

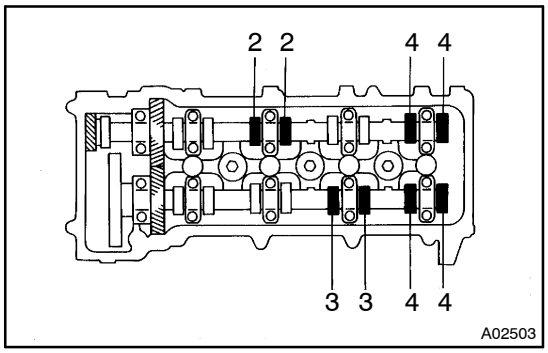
(1) Using a feeler gauge, measure the clearance between the valve lifter and camshaft.

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

Valve clearance (Cold):

Intake	0.15 – 0.25 mm (0.006 – 0.010 in.)
Exhaust	0.25 – 0.35 mm (0.010 – 0.014 in.)

(b) Turn the crankshaft pulley 1 revolution (360°) and align its groove with timing mark ”0” of the oil pump cover.



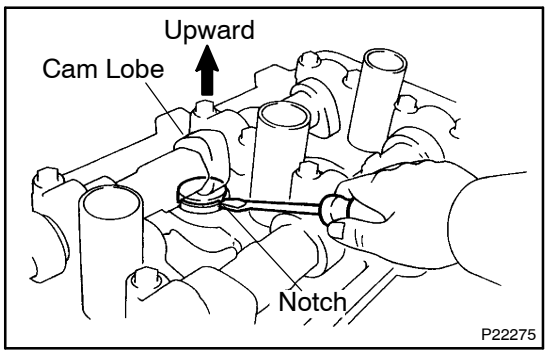
(c) Check only the valves indicated

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

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

Valve clearance (Cold):

Intake	0.15 – 0.25 mm (0.006 – 0.010 in.)
Exhaust	0.25 – 0.35 mm (0.010 – 0.014 in.)

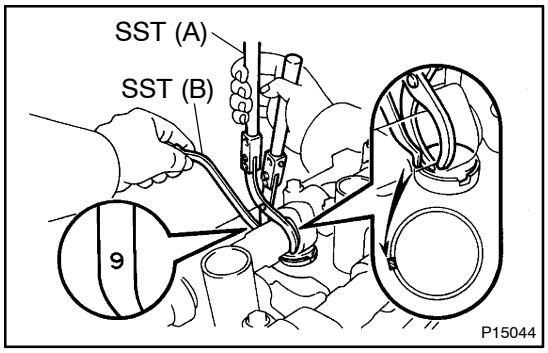


74. ADJUST VALVE CLEARANCE

(a) Remove the adjust shim.

(1) Turn the crankshaft to position the cam lobe of the camshaft on the adjusting valve upward.

(2) Position the notch of the valve lifter toward the spark plug side.

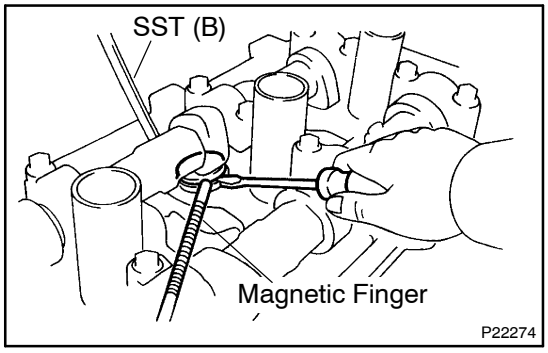


(3) Using SST (A), press down the valve lifter and place SST (B) between the camshaft and valve lifter flange. Remove SST (A).

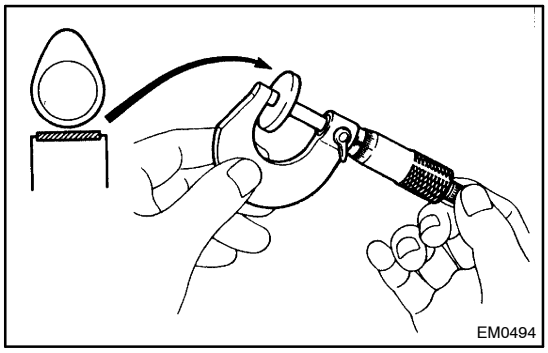
SST 09248–55040 (09248–05410, 09248–05420)

HINT:

Apply SST (B) at slight angle on the side marked with ”9”, at the position shown in the illustration.



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



(b) Determine the replacement adjusting shim size by these Formula or Charts.

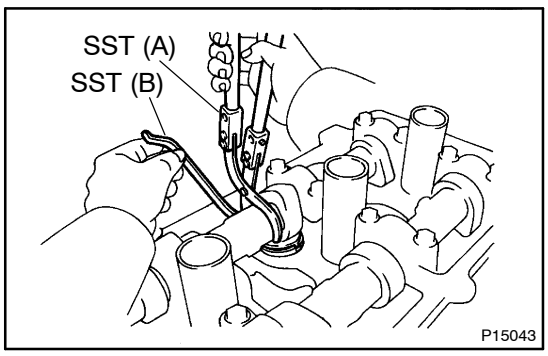
(1) Using a micrometer, measure the thickness of the removed shim.

(2) Calculate the thickness of a new shim so that the valve clearance comes within the specified valve.

T.....Thickness of removed shim
A.....Measured valve clearance
N.....Thickness of a new shim
Intake N = T + (A – 0.20 mm (0.008 in.))
Exhaust N = T + (A – 0.30 mm (0.012 in.))

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

HINT:
Shims are available in 17 sized 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 09248–55040 (09248–05410, 09248–05420)

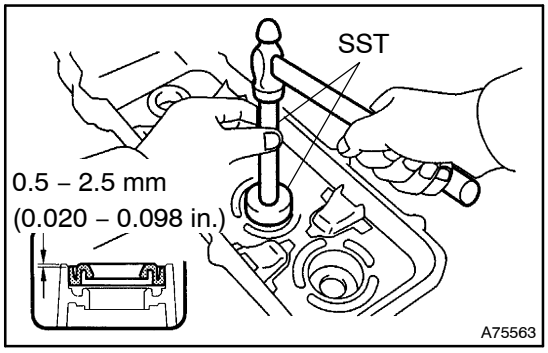
(d) Recheck the valve clearance.

Adjusting Shim Selection Chart (Intake)

| Measured clearance mm (in.) \ Installed shim thickness mm (in.) | 2.500 (0.0984) | 2.520 (0.0992) | 2.540 (0.1000) | 2.550 (0.1004) | 2.560 (0.1008) | 2.580 (0.1016) | 2.600 (0.1024) | 2.620 (0.1031) | 2.640 (0.1039) | 2.650 (0.1043) | 2.660 (0.1047) | 2.680 (0.1055) | 2.700 (0.1063) | 2.710 (0.1067) | 2.720 (0.1071) | 2.730 (0.1075) | 2.740 (0.1079) | 2.750 (0.1083) | 2.760 (0.1087) | 2.770 (0.1091) | 2.780 (0.1094) | 2.790 (0.1098) | 2.800 (0.1102) | 2.810 (0.1106) | 2.820 (0.1110) | 2.830 (0.1114) | 2.840 (0.1118) | 2.850 (0.1122) | 2.860 (0.1126) | 2.870 (0.1130) | 2.880 (0.1134) | 2.890 (0.1138) | 2.900 (0.1142) | 2.910 (0.1146) | 2.920 (0.1150) | 2.930 (0.1154) | 2.940 (0.1157) | 2.950 (0.1161) | 2.960 (0.1166) | 2.970 (0.1169) | 2.980 (0.1173) | 2.990 (0.1177) | 3.000 (0.1181) | 3.010 (0.1185) | 3.020 (0.1189) | 3.030 (0.1193) | 3.040 (0.1197) | 3.050 (0.1201) | 3.060 (0.1205) | 3.070 (0.1209) | 3.080 (0.1213) | 3.090 (0.1217) | 3.100 (0.1220) | 3.120 (0.1228) | 3.140 (0.1236) | 3.150 (0.1240) | 3.160 (0.1244) | 3.180 (0.1252) | 3.200 (0.1260) | 3.220 (0.1268) | 3.240 (0.1276) | 3.250 (0.1280) | 3.260 (0.1283) | 3.280 (0.1291) | 3.300 (0.1299) |
|---|---|---

Adjusting Shim Selection Chart (Exhaust)

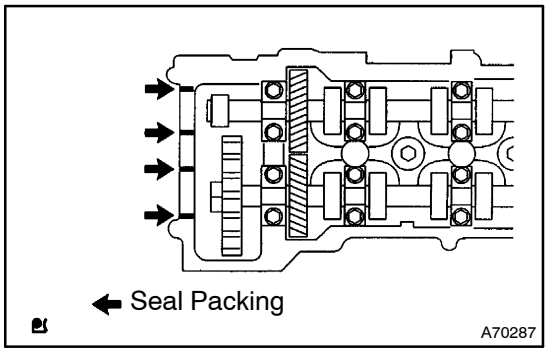
| | 2.500 (0.0984) | 2.520 (0.0992) | 2.540 (0.1000) | 2.550 (0.1004) | 2.560 (0.1008) | 2.580 (0.1016) | 2.600 (0.1024) | 2.620 (0.1031) | 2.640 (0.1039) | 2.650 (0.1043) | 2.660 (0.1047) | 2.680 (0.1055) | 2.700 (0.1063) | 2.710 (0.1067) | 2.720 (0.1071) | 2.730 (0.1075) | 2.740 (0.1079) | 2.750 (0.1083) | 2.760 (0.1087) | 2.770 (0.1091) | 2.780 (0.1094) | 2.790 (0.1098) | 2.800 (0.1102) | 2.810 (0.1106) | 2.820 (0.1110) | 2.830 (0.1114) | 2.840 (0.1118) | 2.850 (0.1122) | 2.860 (0.1126) | 2.870 (0.1130) | 2.880 (0.1134) | 2.890 (0.1138) | 2.900 (0.1142) | 2.910 (0.1146) | 2.920 (0.1150) | 2.930 (0.1154) | 2.940 (0.1157) | 2.950 (0.1161) | 2.960 (0.1166) | 2.970 (0.1169) | 2.980 (0.1173) | 2.990 (0.1177) | 3.000 (0.1181) | 3.010 (0.1185) | 3.020 (0.1189) | 3.030 (0.1193) | 3.040 (0.1197) | 3.050 (0.1201) | 3.060 (0.1205) | 3.070 (0.1209) | 3.080 (0.1213) | 3.090 (0.1217) | 3.100 (0.1220) | 3.120 (0.1228) | 3.140 (0.1236) | 3.150 (0.1240) | 3.160 (0.1244) | 3.180 (0.1252) | 3.200 (0.1260) | 3.220 (0.1268) | 3.240 (0.1276) | 3.250 (0.1280) | 3.260 (0.1283) | 3.280 (0.1291) | 3.300 (0.1299) |
|---|---|---



75. INSTALL SPARK PLUG TUBE GASKET

(a) Using SST, tap in a new spark plug tube gasket as shown in the illustration.
SST 09950–60010 (09951–00260, 09951–00490, 09952–06010), 09950–70010 (09951–07150)

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



76. INSTALL CYLINDER HEAD COVER SUB–ASSY

(a) Apply seal packing to the 4 locations as shown.
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 put into the engine oil within 2 hours after installing.**

(b) Install the cylinder head cover with 10 seal washers and 10 bolts.
Torque: 5.5 N·m (55 kgf·cm, 48 in.·lbf)

77. INSTALL SPARK PLUG

(a) Using a spark plug wrench, install the spark plug.
Torque: 19 N·m (200 kgf·cm, 14 ft·lbf)

78. INSTALL VENTILATION VALVE SUB–ASSY

(a) Apply adhesive to 2 or 3 threads of the bolt end.
Adhesive: Part No. 08833–00070, THREE BOND 1324 or equivalent

(b) Using a deep socket wrench 19 mm, install the ventilation valve.
Torque: 27 N·m (270 kgf·cm, 20 ft·lbf)

79. INSTALL OIL FILLER CAP SUB–ASSY

80. INSTALL CRANKSHAFT POSITION SENSOR

(a) Apply a light coat of engine oil to an O–ring of the crankshaft position sensor.

(b) Install the crankshaft position sensor with the 2 bolts.
Torque: 8.5 N·m (85 kgf·cm, 75 in.·lbf)

81. INSTALL CAMSHAFT POSITION SENSOR (UNLEADED GASOLINE)

(a) Apply a light coat of engine oil to an O–ring of the camshaft position sensor.

(b) Install the camshaft position sensor with the bolt.
Torque: 5.5 N·m (55 kgf·cm, 48 in.·lbf)

82. INSTALL W/HEAD TAPER SCREW PLUG NO.1 (W/O OIL COOLER)

(a) Apply adhesive to 2 or 3 threads of the bolt end.
Adhesive: Part No. 08833–00070, THREE BOND 1324 or equivalent

NOTICE:

- **Remove any oil from the contact surface**
- **Install the w/ head taper screw plug 5 minutes after applying adhesive.**
- **Do not put into the engine coolant within 1 hours after installing.**

(b) Install the w/ head taper screw plug.
Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)

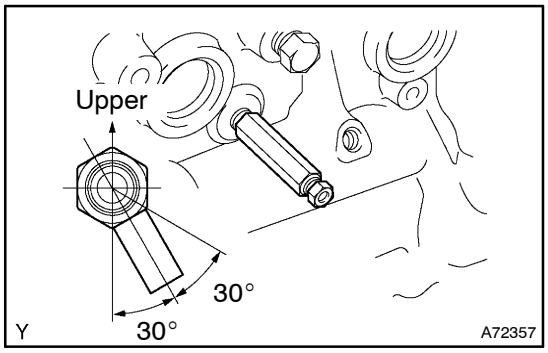
83. INSTALL UNION (W/ OIL COOLER)

(a) Apply adhesive to 2 or 3 threads of the bolt end.
Adhesive: Part No. 08833–00070, THREE BOND 1324 or equivalent

NOTICE:

- **Remove any oil from the contact surface**
- **Install the union 5 minutes after applying adhesive.**
- **Do not put into the engine coolant within 1 hours after installing.**

(b) Using a straight hexagon wrench 14, install the union.
Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)



84. INSTALL CYLINDER BLOCK WATER DRAIN COCK SUB–ASSY

(a) Apply adhesive to 2 or 3 threads of the bolt end.
Adhesive:
Part No. 08833–00070, THREE BOND 1324 or equivalent

NOTICE:

- **Remove any oil from the contact surface**
- **Install the cylinder block water drain cock 5 minutes after applying adhesive.**
- **Do not put into the engine coolant within 1 hours after installing.**

(b) Install the cylinder block water drain cock.
Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)

HINT:
The port may be set within 30° of either side of the prescribed position.

85. INSTALL OIL FILTER UNION

(a) Using a straight hexagon wrench 14, install the oil filter union.
Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)

86. INSTALL OIL FILTER BRACKET SUB–ASSY

(a) Install a new gasket, an new O–ring and the oil filter bracket with the 2 bolts and nut.
Torque: 28 N·m (290 kgf·cm, 21 ft·lbf)

87. INSTALL OIL COOLER ASSY (W/ OIL COOLER)

(a) Using a socket wrench 30 mm, install the oil cooler with the oil cooler relief valve.
Torque: 28 N·m (290 kgf·cm, 21 ft·lbf)

(b) Install the bolt
Torque: 7.8 N·m (80 kgf·cm, 69 in.·lbf)

88. INSTALL OIL FILTER SUB–ASSY

(a) Check and clean the oil filter installation surface.
(b) Apply a light coat of engine oil to an O–ring of the oil filter.
(c) Lightly screw the oil filter into place, and tighten it until an O–ring contacts the seat.
(d) Using SST, tighten it an additional 3/4 turn.
SST 09228–07501