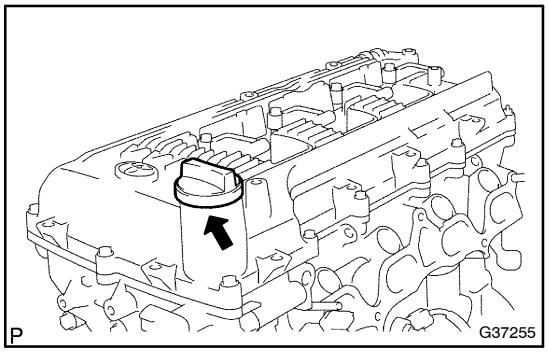
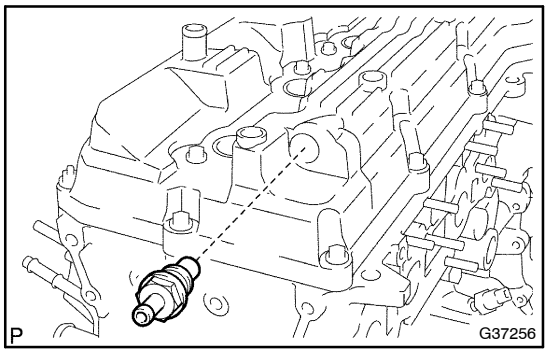
1421P–02

OVERHAUL



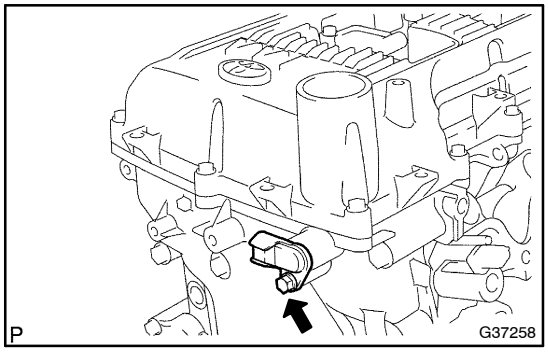
1. REMOVE OIL FILLER CAP SUB–ASSY

(a) Remove the oil filler cap sub–assy.



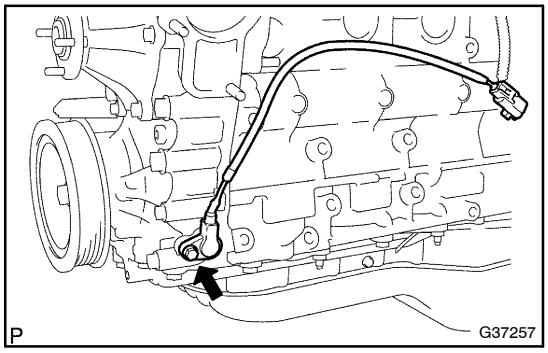
2. REMOVE VENTILATION VALVE SUB–ASSY

(a) Remove the ventilation valve sub–assy.



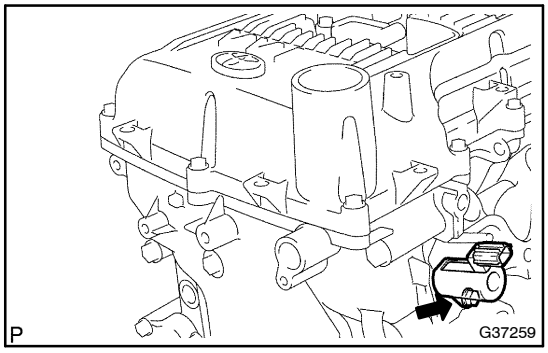
3. REMOVE CAMSHAFT POSITION SENSOR

(a) Remove the bolt and camshaft position sensor.



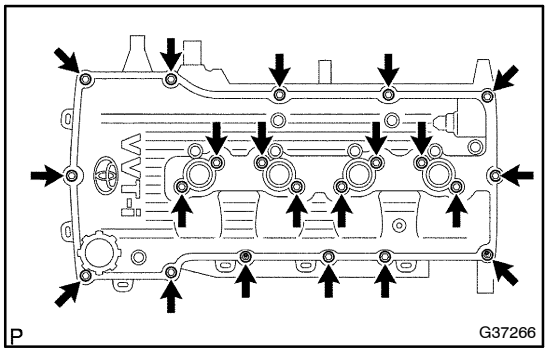
4. REMOVE CRANKSHAFT POSITION SENSOR

(a) Remove the bolt and crankshaft position sensor.



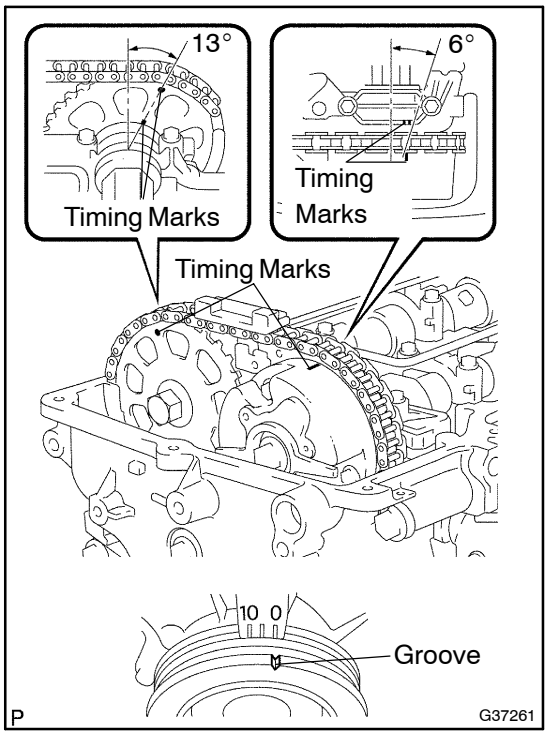
5. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSY

(a) Remove the bolt and camshaft timing oil control valve.



6. REMOVE CYLINDER HEAD COVER SUB–ASSY

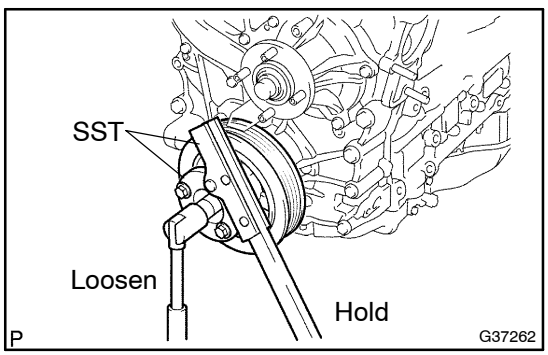
(a) Remove the 19 bolts, 2 nuts, head cover and 2 gaskets.



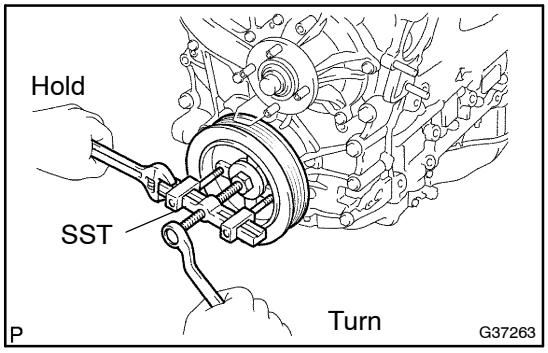
7. REMOVE CRANKSHAFT PULLEY

(a) Turn the crankshaft pulley, and align its groove with timing mark 0 of the timing chain cover.

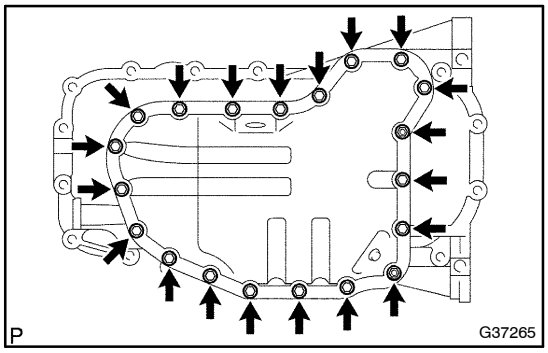
(b) Check that the timing marks of the camshaft timing gear and sprocket are aligned with the timing marks of the bearing cap No.1, as shown in the illustration.



(c) Using SST, loosen the crankshaft pulley bolt.
SST 09213–54015 (91651–60855), 09330–00021



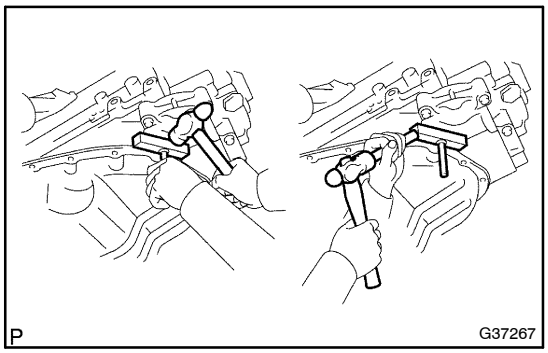
(d) Using SST, remove the crankshaft pulley bolt and crankshaft pulley.
SST 09950–50013 (09951–05010, 09952–05010, 09953–05010, 09954–05021)



8. REMOVE OIL PAN SUB–ASSY NO.2

(a) Remove the drain plug and gasket.

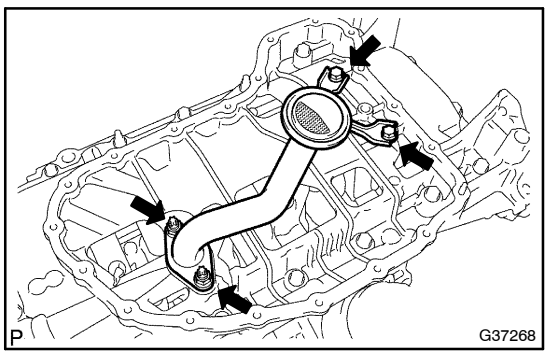
(b) Remove the 18 bolts and 2 nuts.



(c) Insert the blade of SST between the oil pans. Cut through the applied sealer and remove the oil pan sub–assy No.2.
SST 09032–00100

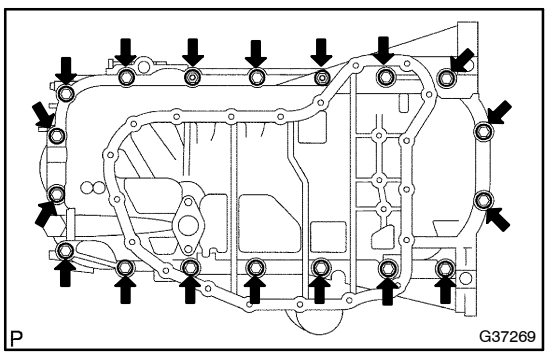
NOTICE:

Be careful not to damage the contact surfaces of the oil pans.



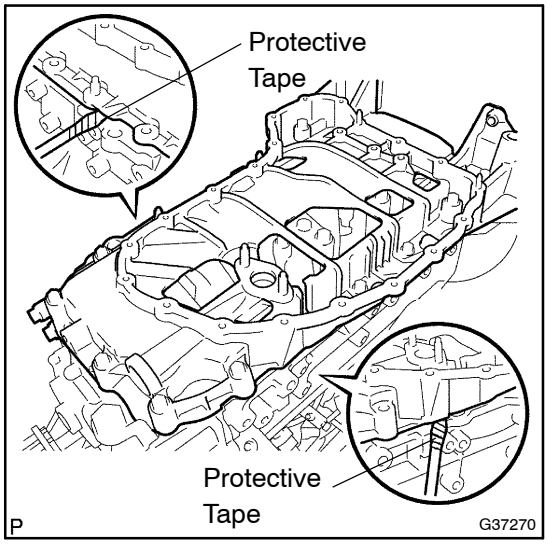
9. REMOVE OIL STRAINER SUB–ASSY

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



10. REMOVE OIL PAN SUB–ASSY

(a) Remove the 16 bolts and 2 nuts.



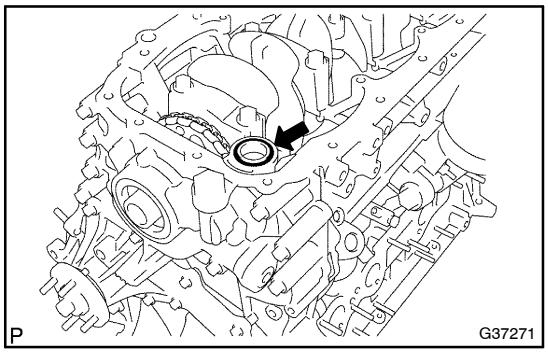
(b) Remove the oil pan by prying between the oil pan and cylinder block with a screwdriver.

NOTICE:

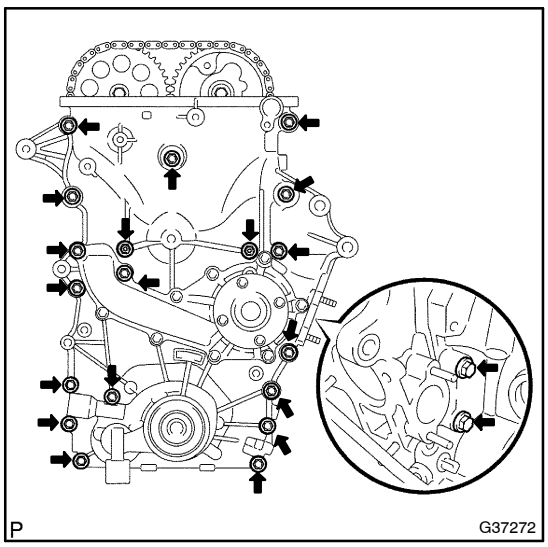
Be careful not to damage the contact surfaces of the cylinder block and oil pan.

HINT:

Tape the screwdriver tip before use.

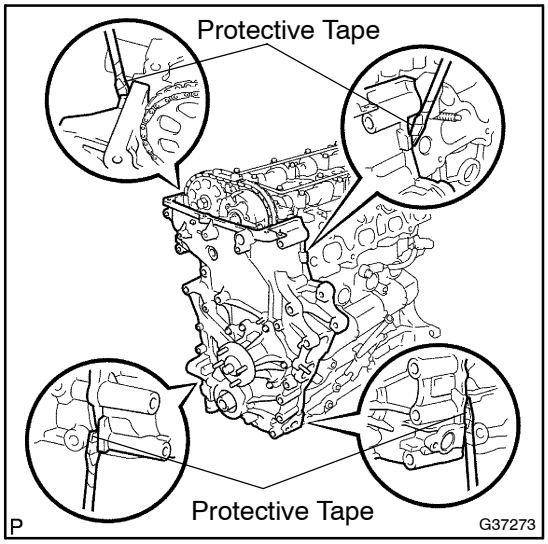


(c) Remove the O–ring.



11. REMOVE TIMING CHAIN COVER

(a) Remove the 19 bolts and 2 nuts as shown in the illustration.



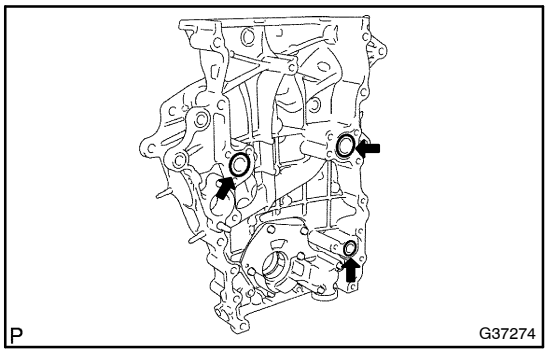
(b) Remove the timing chain cover by prying between the timing chain cover and cylinder head or cylinder block with a screwdriver.

HINT:

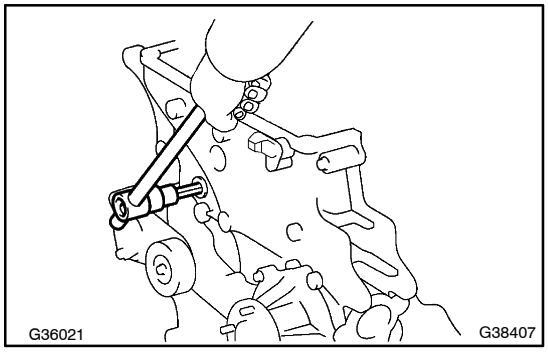
Tape the screwdriver tip before use.

NOTICE:

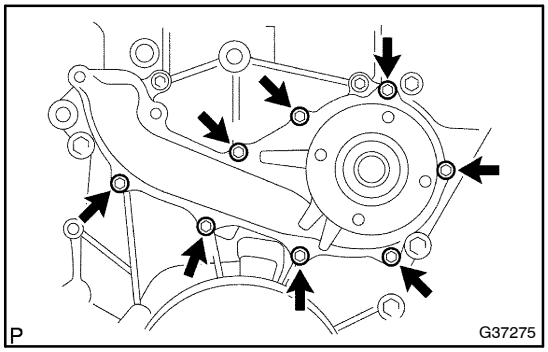
Be careful not to damage the contact surfaces of the cylinder head, cylinder block and timing chain cover.



(c) Remove the 3 O–rings.

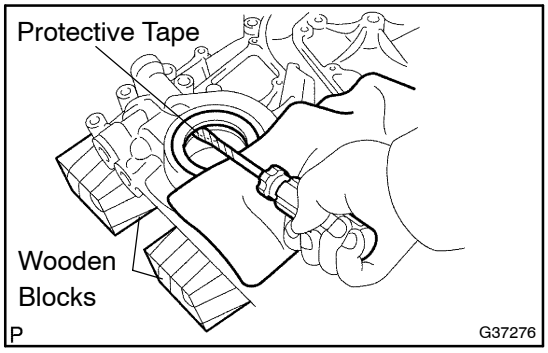


(d) Using a 10 mm socket hexagon wrench, remove the timing chain cover plug.



12. REMOVE WATER PUMP ASSY

(a) Remove the 8 bolts, water pump and gasket.

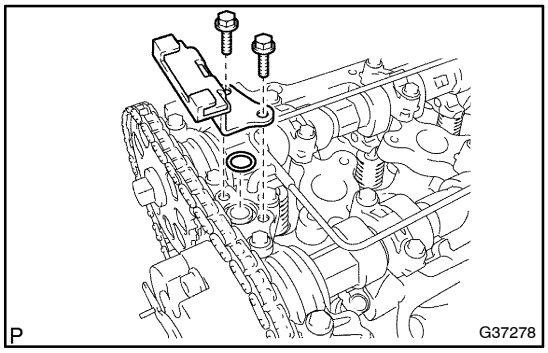


13. REMOVE TIMING CHAIN COVER OIL SEAL

(a) Using a screwdriver with its tip taped, pry out the oil seal.

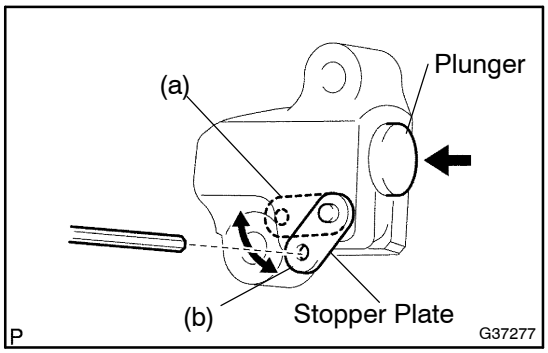
HINT:

Tape the screwdriver tip before use.



14. REMOVE TIMING CHAIN GUIDE

(a) Remove the 2 bolts, timing chain guide and O–ring.



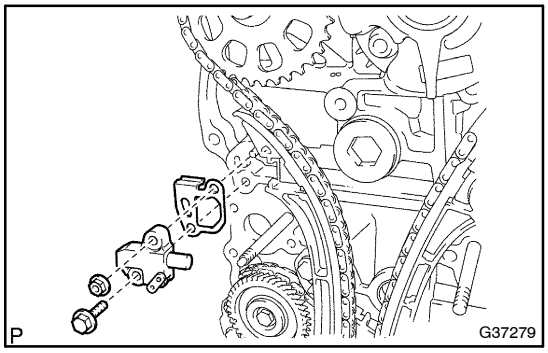
15. REMOVE CHAIN TENSIONER ASSY NO.1

NOTICE:

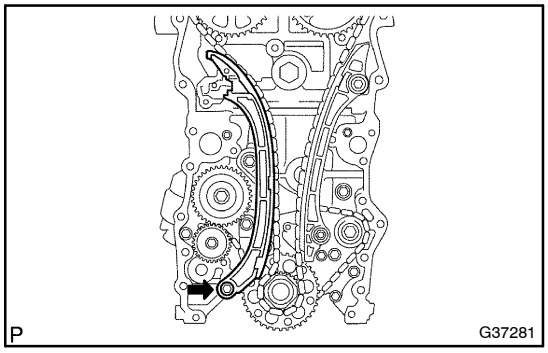
- **When the chain tensioner is removed, do not rotate the crankshaft.**
- **When the chain is removed and the camshaft needs to be rotated, rotate the crankshaft 90 degrees to the right.**

(a) Move the stopper plate upward to release the lock, and push the plunger deep into the tensioner.

(b) Move the stopper plate downward to set the lock, and insert a hexagon wrench into the stopper plate's hole.

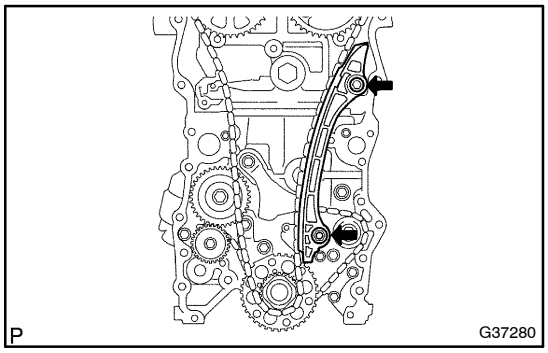


(c) Remove the bolt, nut, chain tensioner assy No.1 and gasket.



16. REMOVE CHAIN TENSIONER SLIPPER

(a) Remove the bolt and tensioner slipper.

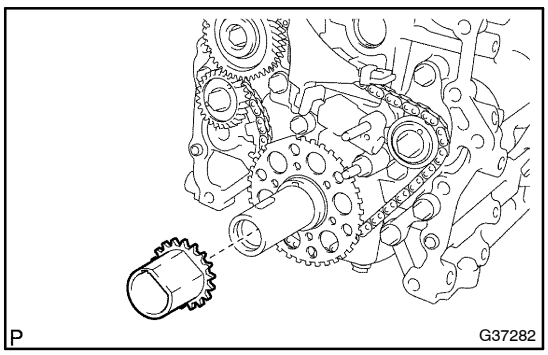


17. REMOVE CHAIN VIBRATION DAMPER NO.1

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

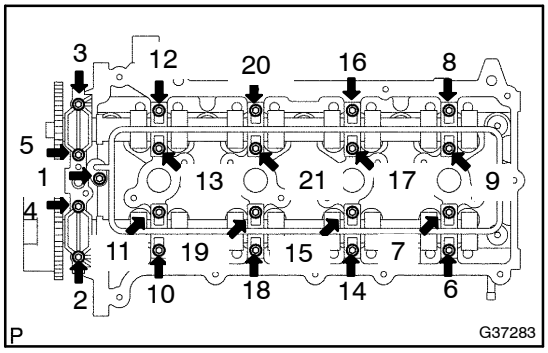
18. REMOVE CHAIN SUB–ASSY

(a) Remove the chain.



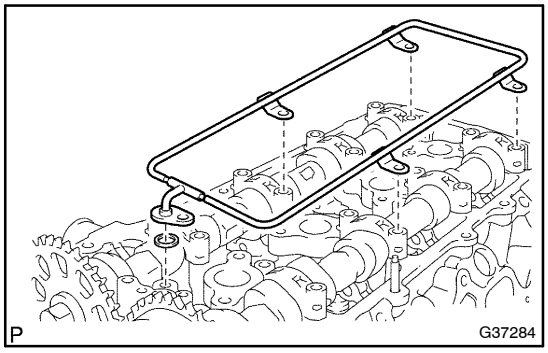
19. REMOVE CRANKSHAFT TIMING GEAR OR SPROCKET

(a) Remove the crankshaft timing gear from the crankshaft.

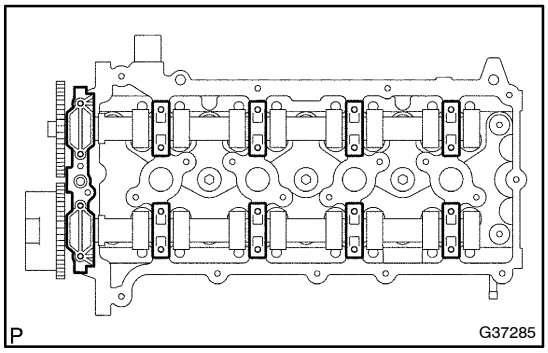


20. REMOVE CAMSHAFT BEARING CAP

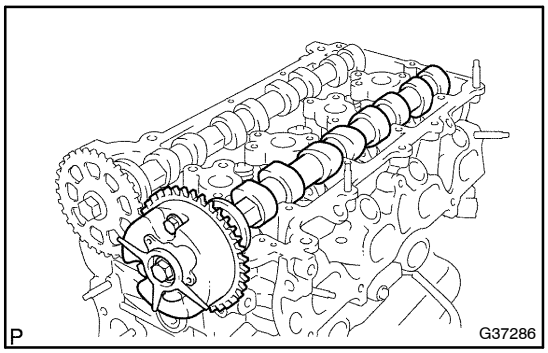
(a) Uniformly loosen and remove the 21 bearing cap bolts and 20 washers on the camshafts in the sequence shown in the illustration.



(b) Remove the oil delivery pipe and O–ring from the bearing caps.

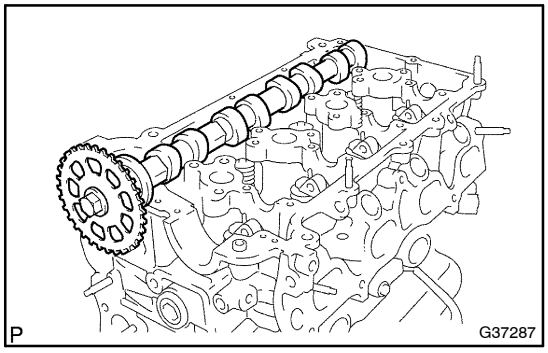


(c) Remove the 9 bearing caps.



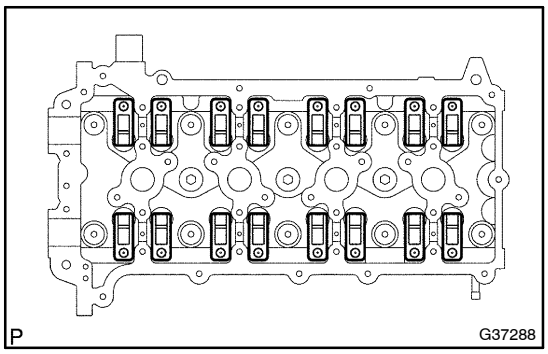
21. REMOVE CAMSHAFT

(a) Remove the camshaft sub–assy.



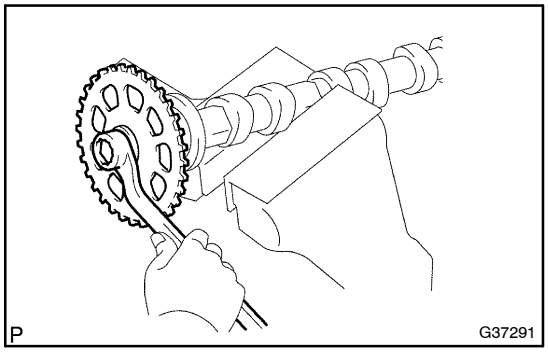
22. REMOVE NO.2 CAMSHAFT

(a) Remove the No.2 camshaft sub–assy.



23. REMOVE VALVE ROCKER ARM SUB–ASSY NO.1

(a) Remove the 16 valve rocker arm sub–assy.

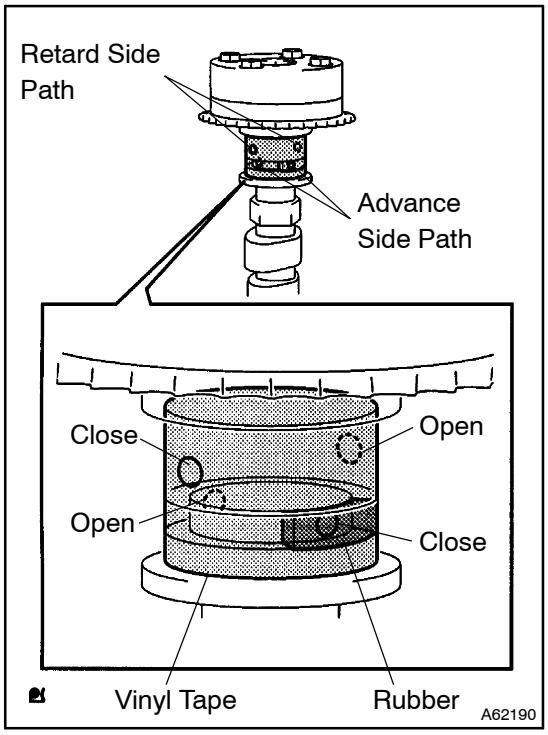


24. REMOVE CAMSHAFT TIMING SPROCKET

(a) Fix the camshaft with a vise and then remove the sprocket bolt and camshaft timing sprocket.

NOTICE:

Be careful not to damage the camshaft.



25. INSPECT CAMSHAFT TIMING GEAR ASSY

(a) Check the lock of the camshaft timing gear.

(1) Clamp the camshaft in a vise, and confirm that the camshaft timing gear is locked.

NOTICE:

Be careful not to damage the camshaft.

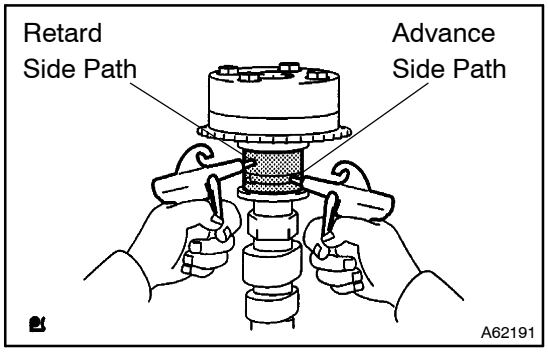
(b) Release the lock pin.

(1) Cover the 4 oil paths of the cam journal with vinyl tape as shown in the illustration.

HINT:

2 advance side paths are provided in the groove of the camshaft. Plug one of the paths with a rubber piece.

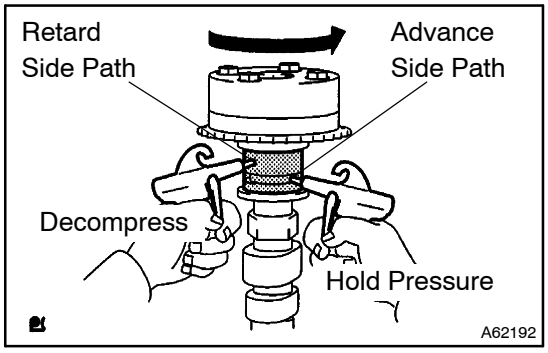
(2) Break through the tape of the advance side path and the retard side path on the opposite side to the hole of the advance side path, as shown in the illustration.



(3) Apply approximately 200 kPa (2.0 kgf/cm^2, 28 psi) of air pressure to the two broken paths.

CAUTION:

Some oil splashing will occur. Cover the paths with a shop rag.



(4) Check that the camshaft timing gear revolves in the advance direction when reducing the air pressure applied to the retard side path.

OK: Gear rotates in the advance direction.

HINT:

This operation releases the lock pin for the most retarded position.

(5) When the camshaft timing gear reaches the most advanced position, release the air pressure from the retard side path and advance side path, in that order.

NOTICE:

Do not release the air pressure from the advance side path first. The gear may abruptly shift in the retard direction and break the lock pin.

(c) Check for smooth rotation.

(1) Rotate the camshaft timing gear within its movable range several times, but do not turn it to the most retarded position. Check that the gear rotates smoothly.

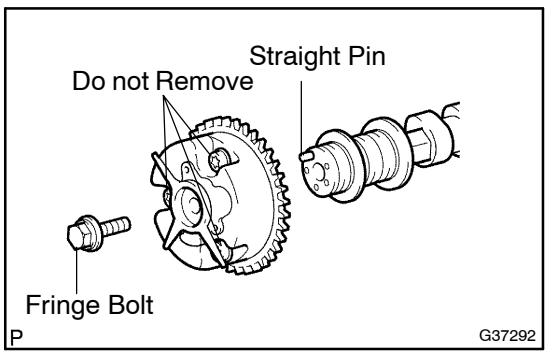
OK: Gear rotates in the advance direction.

CAUTION:

Do not use an air pressure to perform the smooth operation check.

(d) Check the lock in the most retarded position.

(1) Confirm that the camshaft timing gear is locked at the most retarded position.

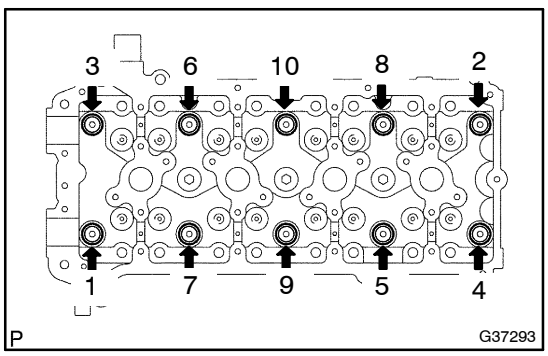


26. REMOVE CAMSHAFT TIMING GEAR ASSY

(a) Remove the fringe bolt and camshaft timing gear.

NOTICE:

- **Be sure not to remove the other 3 bolts.**
- **If planning to reuse the gear, be sure to release the straight pin lock before installing the gear.**



27. REMOVE CYLINDER HEAD SUB–ASSY

(a) Uniformly loosen the 10 bolts in the sequence shown in the illustration. Remove the 10 cylinder head bolts and plate washers.

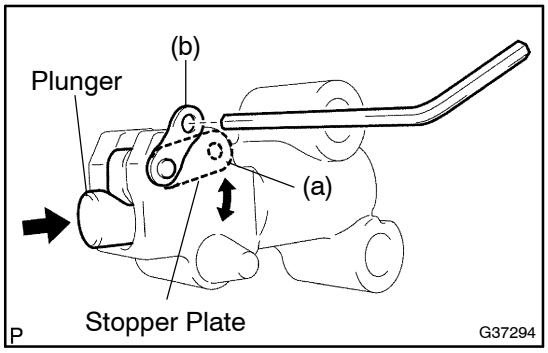
NOTICE:

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

(b) Remove the cylinder head.

28. REMOVE CYLINDER HEAD GASKET

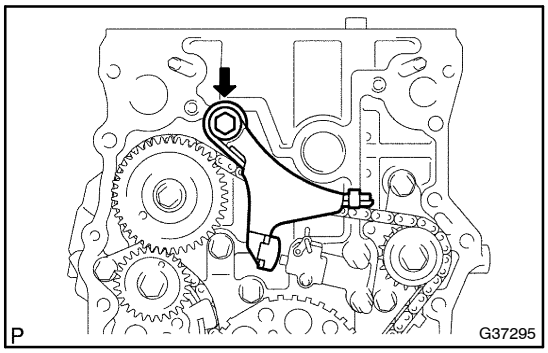
(a) Remove the cylinder head and gasket.



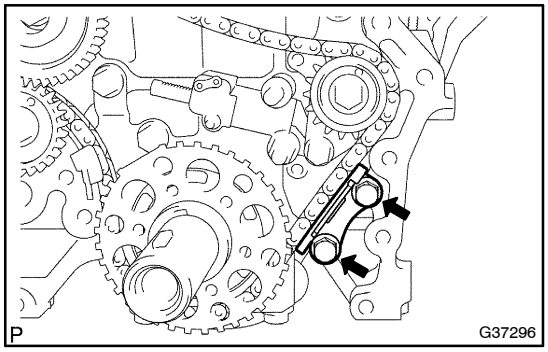
29. REMOVE CHAIN VIBRATION DAMPER NO.2

(a) Move the stopper plate downward to release the lock, and push the plunger deep into the tensioner.

(b) Move the stopper plate upward to set the lock, and insert a hexagon wrench into the stopper plate's hole.

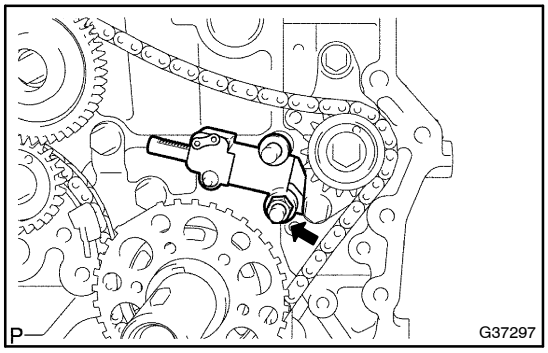


(c) Remove the bolt and chain vibration damper No.2.



30. REMOVE CHAIN VIBRATION DAMPER NO.3

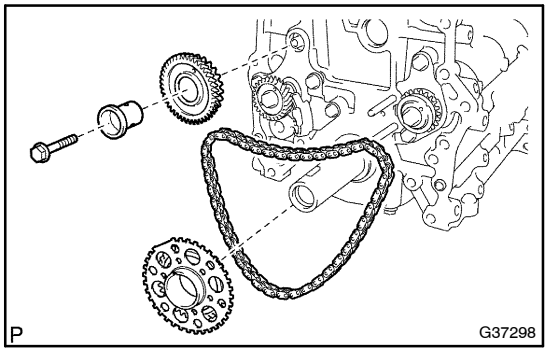
(a) Remove the 2 bolts and chain vibration damper No.3.



31. REMOVE CHAIN TENSIONER ASSY NO.2

(a) Remove the hexagon wrench from the tensioner assy No.2.

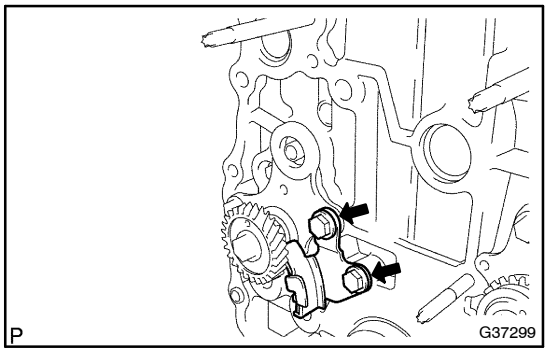
(b) Remove the nut and chain tensioner assy No.2.



32. REMOVE NO.2 CHAIN SUB–ASSY

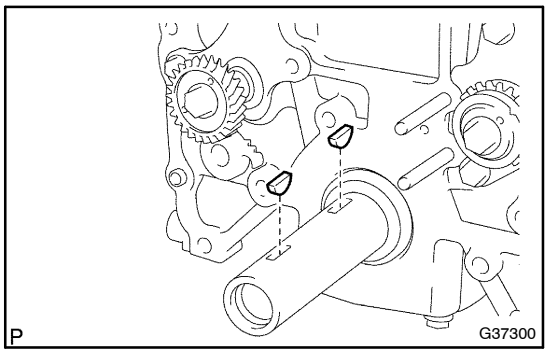
(a) Remove the bolt, balanceshaft drive gear shaft and balanceshaft drive gear.

(b) Remove the crankshaft timing sprocket No.2 and chain.



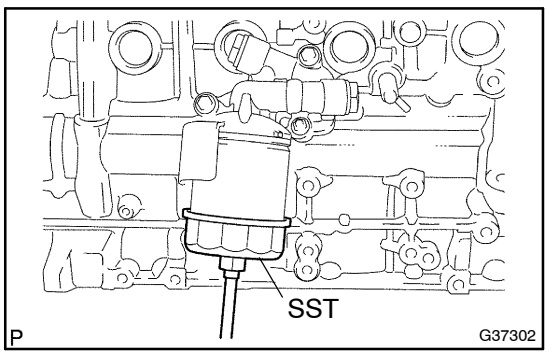
33. REMOVE CHAIN VIBRATION DAMPER NO.4

(a) Remove the 2 bolts and vibration damper No.4.



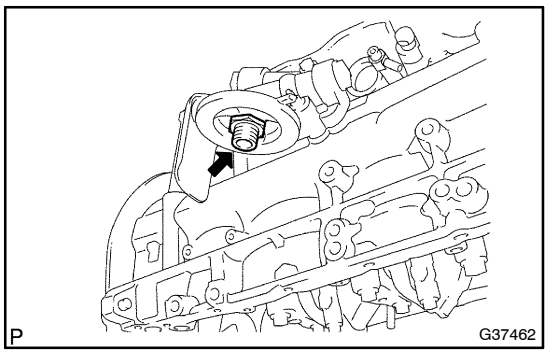
34. REMOVE CRANKSHAFT PULLEY SET CRANKSHAFT KEY

(a) Remove the 2 pulley set keys from the crankshaft.

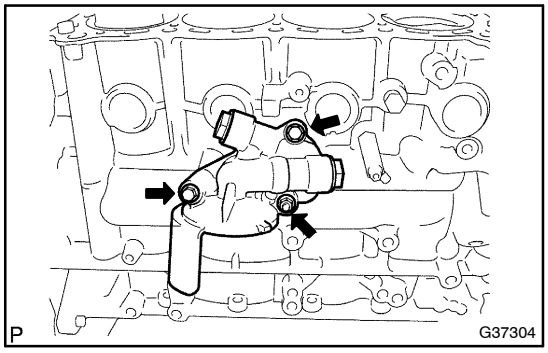


35. REMOVE OIL FILTER SUB–ASSY

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



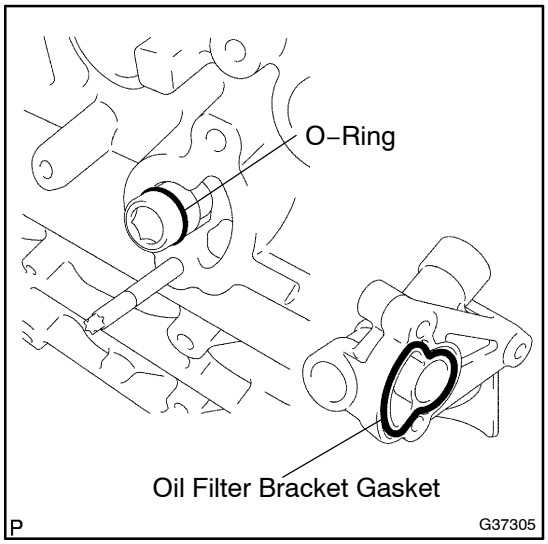
(b) Using a 27 mm socket wrench, remove the oil filter union.



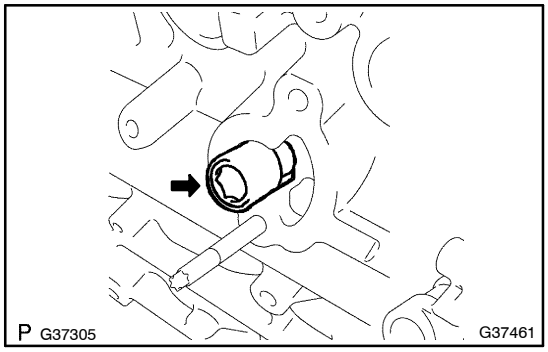
36. REMOVE OIL FILTER BRACKET SUB–ASSY

(a) Remove the 2 bolts and nut from the oil filter bracket.

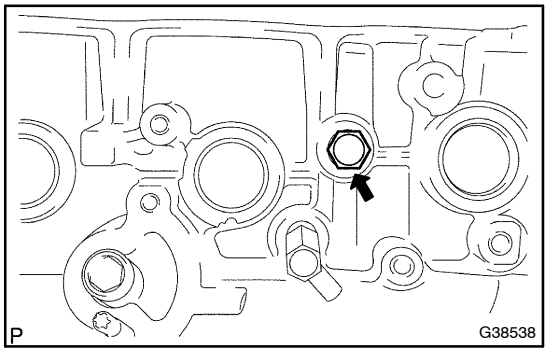
(b) Remove the 2 screw plugs and 2 gaskets from the oil filter bracket.



(c) Remove the oil filter bracket gasket and O–ring.

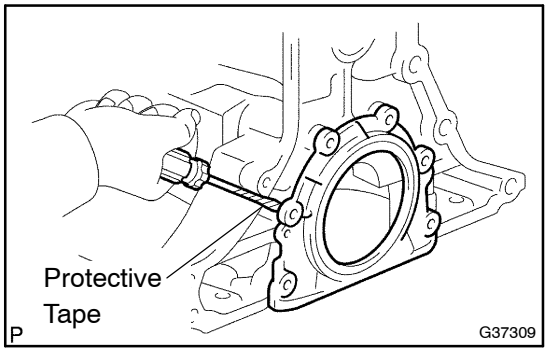


(d) Using a hexagon wrench, remove the oil filter bracket union.



37. REMOVE W/HEAD TAPER SCREW PLUG NO.1

(a) Remove the taper screw plug from the cylinder block.



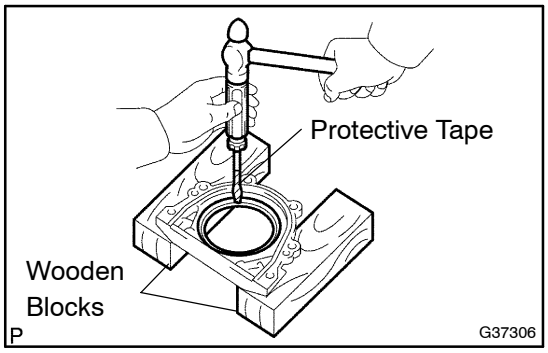
38. REMOVE ENGINE REAR OIL SEAL RETAINER

(a) Remove the 6 bolts.

(b) Using a screwdriver with its tip taped, pry out the oil seal retainer.

HINT:

Tape the screwdriver tip before use.



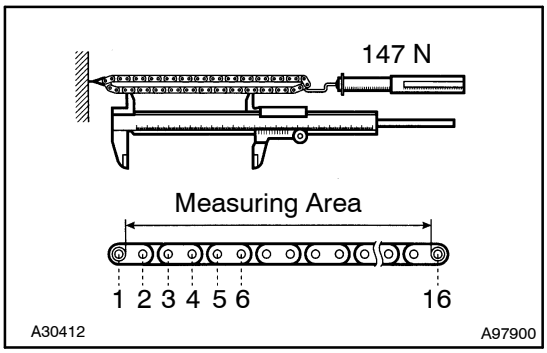
39. REMOVE ENGINE REAR OIL SEAL

(a) Place the oil seal retainer on wooden blocks.

(b) Using a screwdriver with its tip taped and a hammer, tap out the oil seal.

HINT:

Tape the screwdriver tip before use.



40. INSPECT CHAIN SUB–ASSY

(a) Pull the chain with a force of 147 N (15 kgf, 33 lbf) as shown in the illustration.

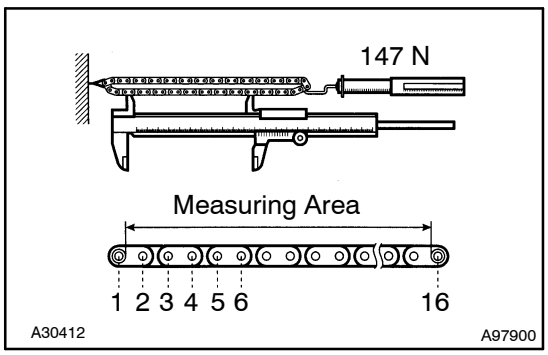
(b) Using vernier calipers, measure the length of 16 links.

Maximum chain elongation: 147.5 mm (5.807 in.)

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

NOTICE:

Perform the same measurement by pulling at random in 3 or more places to obtain an average.



41. INSPECT NO.2 CHAIN SUB–ASSY

(a) Pull the chain with a force of 147 N (15 kgf, 33 lbf) as shown in the illustration.

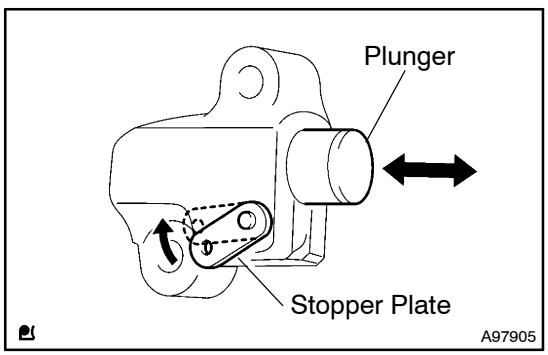
(b) Using vernier calipers, measure the length of 16 links.

Maximum chain elongation: 123.6 mm (4.866 in.)

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

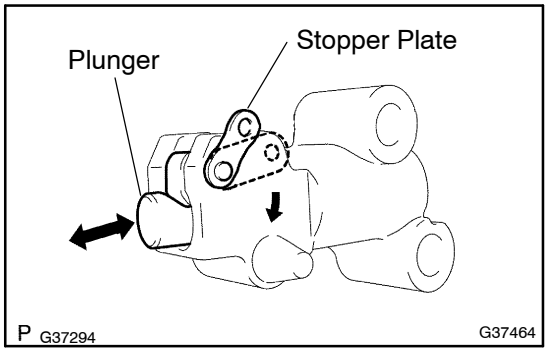
NOTICE:

Perform the same measurement by pulling at random in 3 or more places to obtain an average.



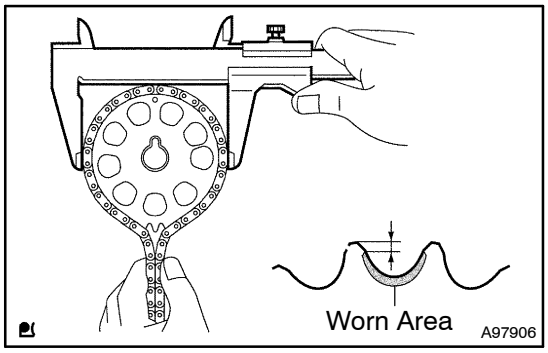
42. INSPECT CHAIN TENSIONER ASSY NO.1

(a) Move the stopper plate upward to release the lock. Push the plunger and check that it moves smoothly.



43. INSPECT CHAIN TENSIONER ASSY NO.2

(a) Move the stopper plate downward to release the lock. Push the plunger and check that it moves smoothly.



44. INSPECT CAMSHAFT TIMING GEAR OR SPROCKET

(a) Measure the distance between the most worn out sprocket tip and the beginning of the worn area below the tip.
Minimum distance: 1.0 mm (0.039 in.)

If the distance is less than the minimum, replace the sprocket.

HINT:

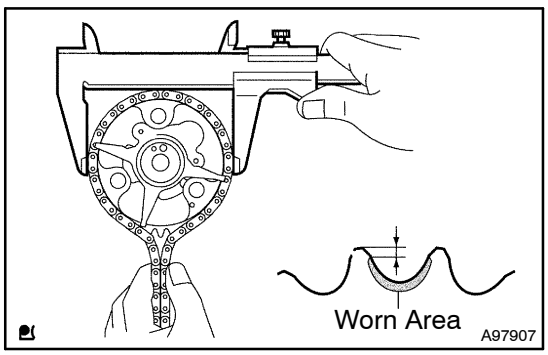
If the worn area is too small or difficult to distinguish from a normal area, perform steps (b) and (c) below.

(b) Wrap the chain around the sprocket.

(c) Using vernier calipers, measure the sprocket diameter with the chain.
Minimum sprocket diameter (w/ chain):
113.8 mm (4.480 in.)

HINT:

- The vernier calipers must contact the chain rollers for the measurement.
- If the diameter is less than the minimum, replace the chain and sprocket.



45. INSPECT CAMSHAFT TIMING GEAR ASSY

(a) Measure the distance between the most worn out timing gear tip and the beginning of the worn area below the tip.
Minimum distance: 1.0 mm (0.039 in.)

If the distance is less than the minimum, replace the timing gear.

HINT:

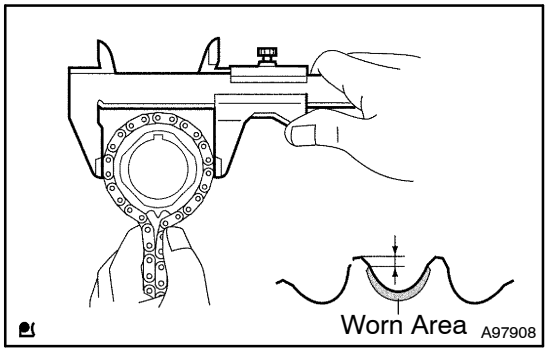
If the worn area is too small or difficult to distinguish from a normal area, perform steps (b) and (c) below.

(b) Wrap the chain around the timing gear.

(c) Using vernier calipers, measure the sprocket diameter with the chain.
Minimum sprocket diameter (w/ chain):
113.8 mm (4.480 in.)

HINT:

- The vernier calipers must contact the chain rollers for the measurement.
- If the diameter is less than the minimum, replace the chain and timing gear.



46. INSPECT CRANKSHAFT TIMING GEAR OR SPROCKET

(a) Measure the distance between the most worn out sprocket tip and the beginning of the worn area below the tip.

Minimum distance: 1.0 mm (0.039 in.)

If the distance is less than the minimum, replace the sprocket.

HINT:

If the worn area is too small or difficult to distinguish from a normal area, perform steps (b) and (c) below.

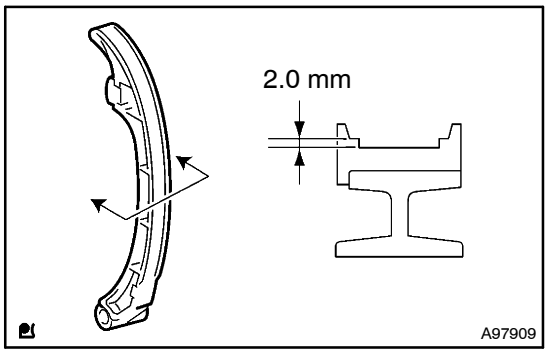
(b) Wrap the chain around the drive sprocket.

(c) Using vernier calipers, measure the sprocket diameter with the chain.

Minimum sprocket diameter (w/ chain): 59.4 mm (2.338 in.)

HINT:

- The vernier calipers must contact the chain rollers for the measurement.
- If the diameter is less than the minimum, replace the chain and sprocket.

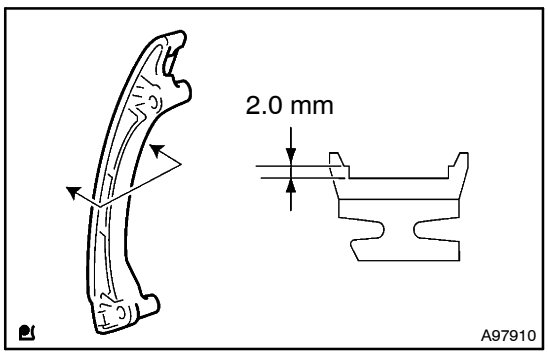


47. INSPECT CHAIN TENSIONER SLIPPER

(a) Using vernier calipers, measure the tensioner slipper wear.

Maximum wear: 2.0 mm (0.079 in.)

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

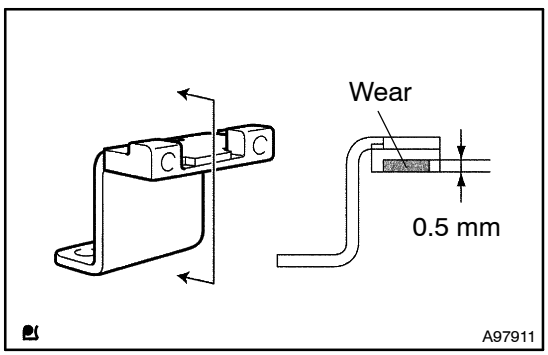


48. INSPECT CHAIN VIBRATION DAMPER NO.1

(a) Using vernier calipers, measure the vibration damper wear.

Maximum wear: 2.0 mm (0.079 in.)

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

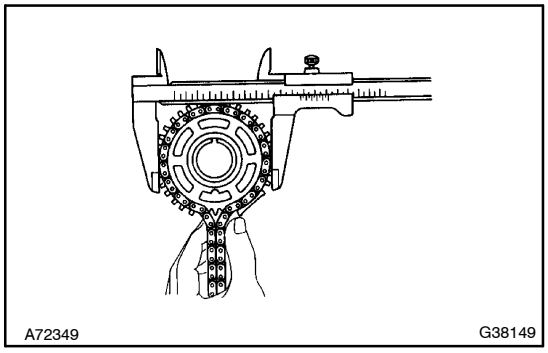


49. INSPECT TIMING CHAIN GUIDE

(a) Using vernier calipers, measure the chain guide wear.

Maximum wear: 0.5 mm (0.020 in.)

If the wear is greater than the maximum, replace the timing chain guide.



50. INSPECT CRANKSHAFT TIMING SPROCKET NO.2

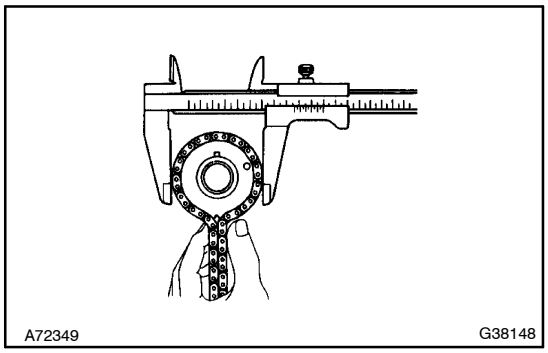
(a) Wrap the chain around the sprocket.

(b) Using vernier calipers, measure the sprocket diameter with the chain.

Minimum sprocket diameter (w/ chain):
96.7 mm (3.807 in.)

HINT:

- The vernier calipers must contact the chain rollers for the measurement.
- If the diameter is less than the minimum, replace the chain and sprocket.



51. INSPECT BALANCESHAFT DRIVE GEAR SUB–ASSY

(a) Wrap the chain around the sprocket.

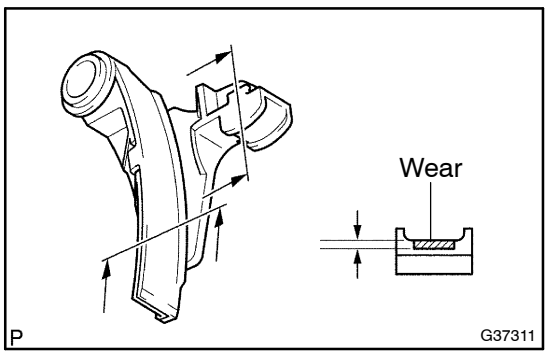
(b) Using vernier calipers, measure the sprocket diameter with the chain.

Minimum sprocket diameter (w/ chain):
75.9 mm (2.988 in.)

HINT:

The vernier calipers must contact the chain rollers for the measurement.

If the diameter is less than the minimum, replace the chain and sprocket.

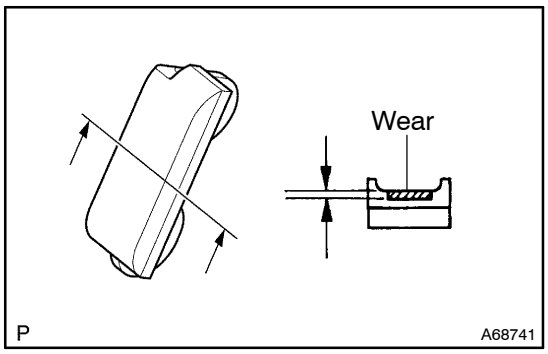


52. INSPECT CHAIN VIBRATION DAMPER NO.2

(a) Using vernier calipers, measure the vibration damper No.2 wear.

Maximum wear: 1.0 mm (0.039 in.)

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

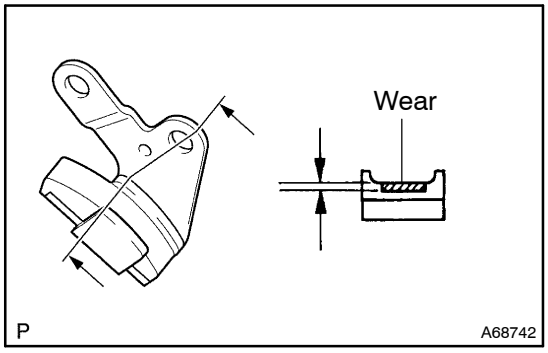


53. INSPECT CHAIN VIBRATION DAMPER NO.3

(a) Using vernier calipers, measure the vibration damper No.3 wear.

Maximum wear: 1.0 mm (0.039 in.)

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

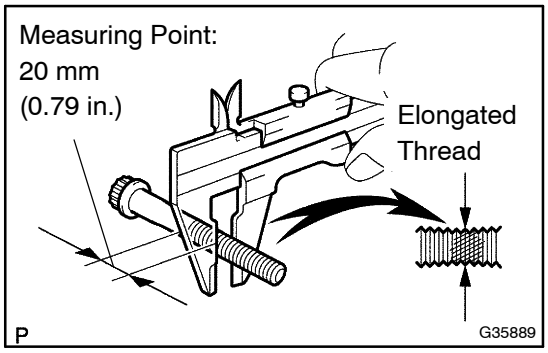


54. INSPECT CHAIN VIBRATION DAMPER NO.4

(a) Using vernier calipers, measure the vibration damper No.4 wear.

Maximum wear: 1.0 mm (0.039 in.)

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



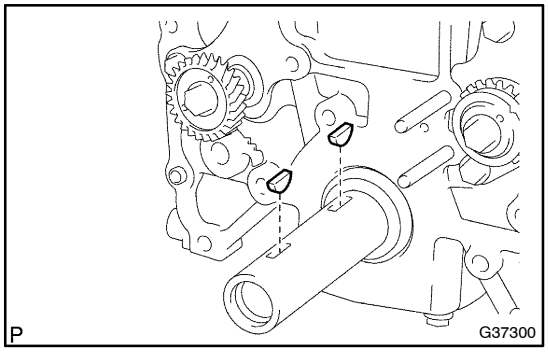
55. INSPECT CYLINDER HEAD SET BOLT

(a) Using vernier calipers, measure the minimum diameter of the elongated thread at the measuring point.

Standard outside diameter:
10.76 to 10.97 mm (0.4236 to 0.4319 in.)
Minimum outside diameter: 10.40 mm (0.4094 in.)

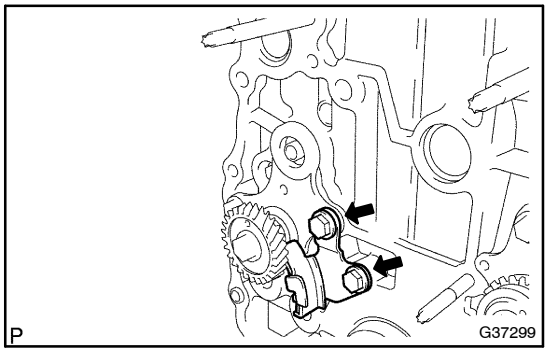
HINT:

- If a visual check reveals no excessively thin areas, check the center of the bolt (see illustration) and find the area that has the lowest diameter.
- If the diameter is less than the minimum, replace the cylinder head bolt.



56. INSTALL CRANKSHAFT PULLEY SET CRANKSHAFT KEY

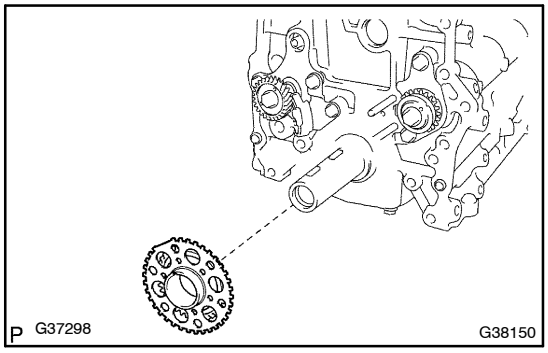
(a) Install the 2 pulley keys to the crankshaft.



57. INSTALL CHAIN VIBRATION DAMPER NO.4

(a) Install the vibration damper No.4 with the 2 bolts.

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



58. INSTALL NO.2 CHAIN SUB–ASSY

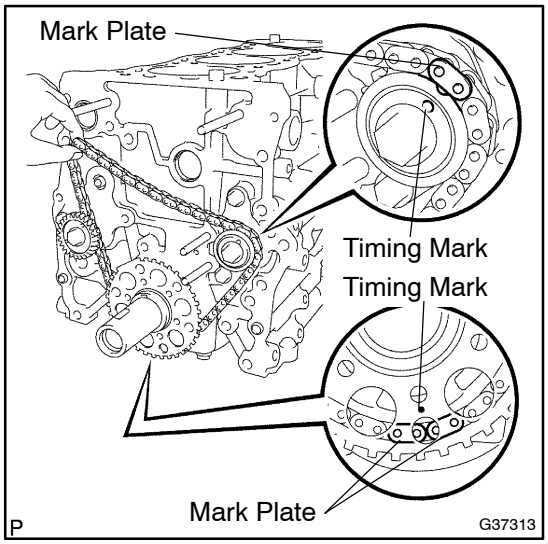
(a) Install the timing sprocket No.2 as shown in the illustration.

NOTICE:

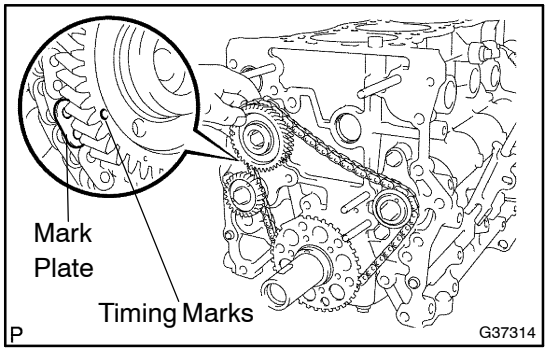
Check that the No.1 cylinder is at TDC and that the weights of the No.1 and No.2 balanceshafts are at the bottom side.

HINT:

Install the sensor plate with the front mark facing forward.

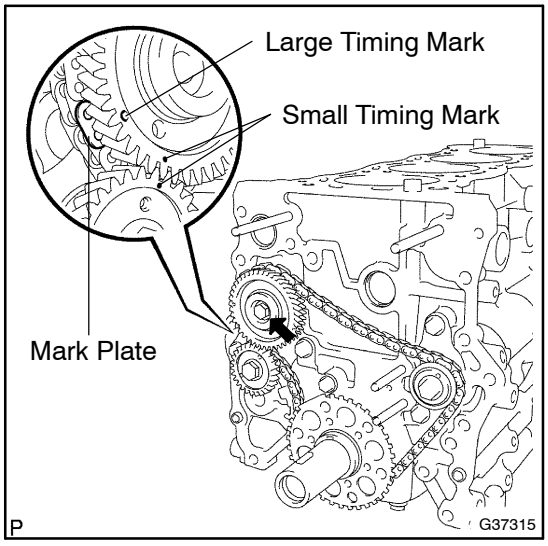


(b) As shown in the illustration, install the chain on the sprocket and gear with the painted marks aligned with the timing marks on the sprocket and gear.



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

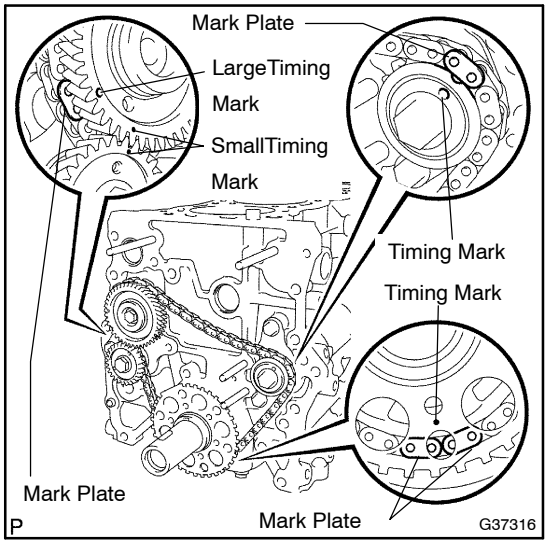
(d) Insert the balanceshaft drive gear shaft through the balanceshaft drive gear so that it fits into the thrust plate hole.



(e) Align the small timing mark of the balanceshaft drive gear with the timing mark of the balanceshaft timing gear.

(f) Install the bolt to the balanceshaft drive gear and tighten it.

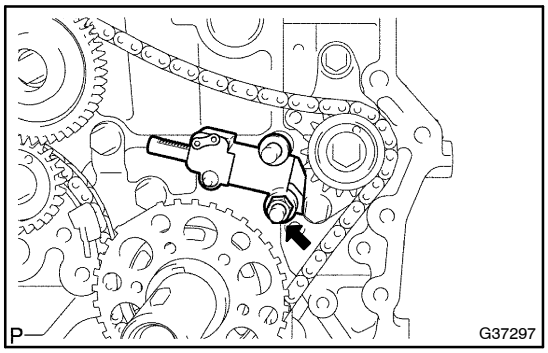
Torque: 25 N·m (255 kgf·cm, 18 ft·lbf)



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

NOTICE:

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

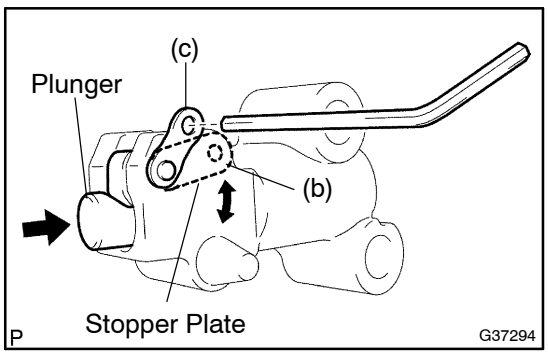


59. INSTALL CHAIN TENSIONER ASSY NO.2

(a) Install the chain tensioner assy No.2 with the nut.
Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)

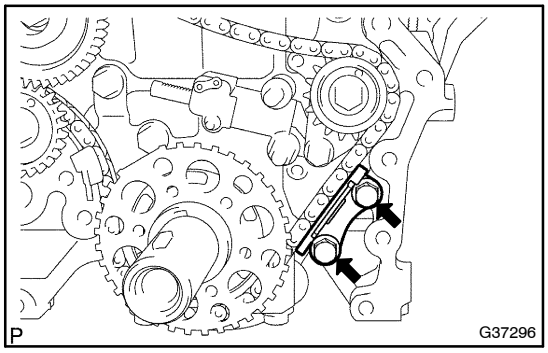
NOTICE:

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.



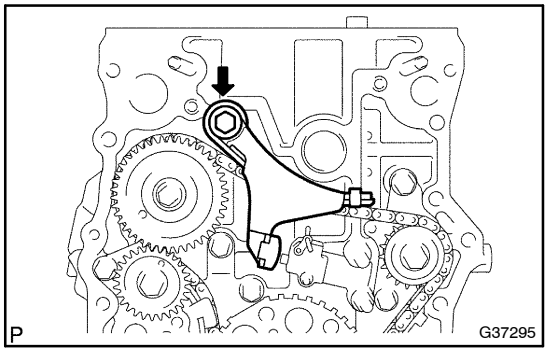
(b) Move the stopper plate downward to release the lock, and push the plunger deep into the tensioner.

(c) Move the stopper plate upward to set the lock, and insert a hexagon wrench into the stopper plate's hole.



60. INSTALL CHAIN VIBRATION DAMPER NO.3

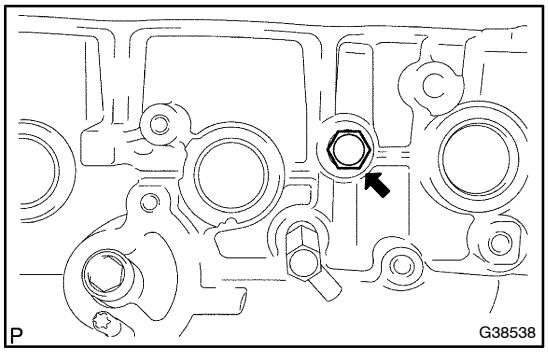
(a) Install the chain vibration damper No.3 with the 2 bolts.
Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)



61. INSTALL CHAIN VIBRATION DAMPER NO.2

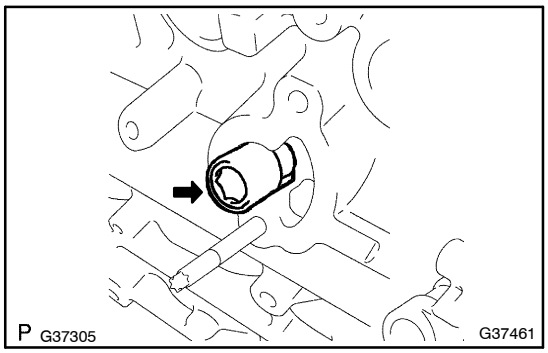
(a) Install the chain vibration damper No.2 with the bolt.
Torque: 27 N·m (270 kgf·cm, 20 ft·lbf)

(b) Remove a pin from the chain tensioner assy No.2 and release the plunger.



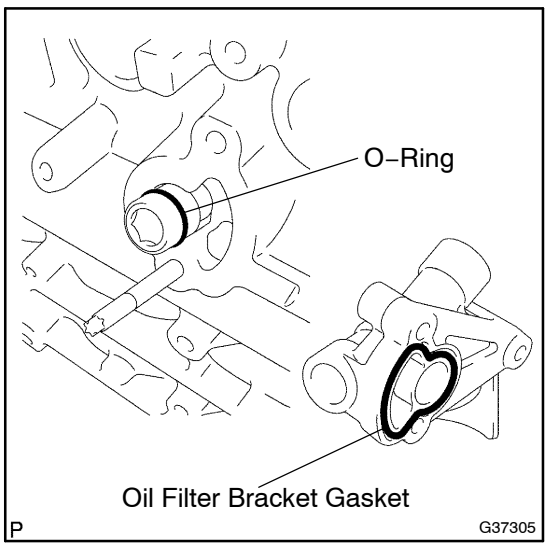
62. INSTALL W/HEAD TAPER SCREW PLUG NO.1

(a) Install the screw plug No.1 to the cylinder block.
Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)



63. INSTALL OIL FILTER BRACKET SUB–ASSY

(a) Using a hexagon wrench, install the oil filter bracket union.
Torque: 25 N·m (255 kgf·cm, 18 ft·lbf)



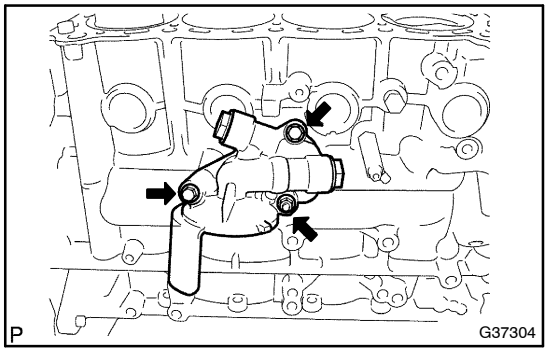
(b) Install a new oil filter bracket gasket to the oil filter bracket.

(c) Install a new O–ring to the oil filter bracket union.

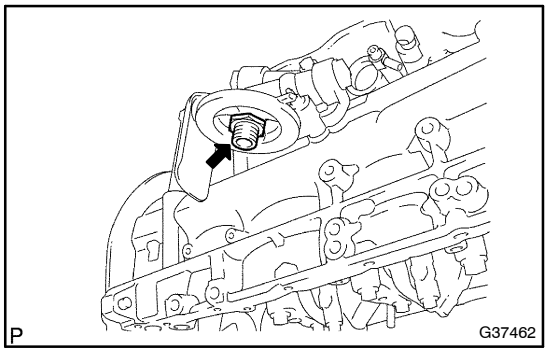
NOTICE:

Apply a light coat of engine oil to the new O–ring and oil filter bracket.

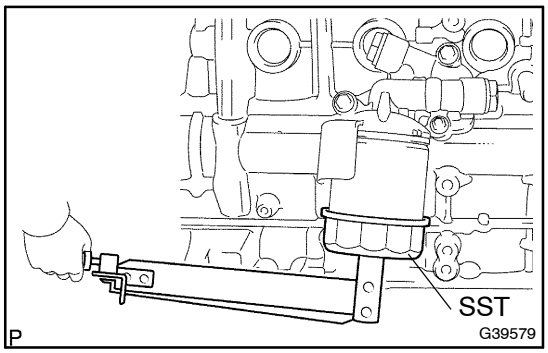
(d) Install 2 new gaskets and the 2 screw plugs to the oil filter bracket.
Torque: 49 N·m (500 kgf·cm, 36 ft·lbf)



(e) Install the oil filter bracket with the 2 bolts and nut.
Torque: 25 N·m (255 kgf·cm, 18 ft·lbf)

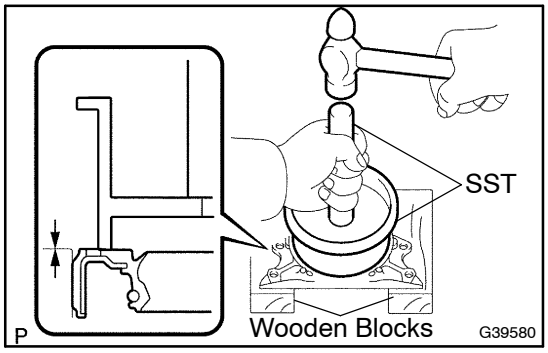


(f) Using a 27 mm socket wrench, install the oil filter union.
Torque: 43 N·m (439 kgf·cm, 32 ft·lbf)



64. INSTALL OIL FILTER SUB–ASSY

(a) Check and clean the oil filter installation surface.
(b) Apply clean engine oil to the gasket of a new oil filter.
(c) Lightly screw the oil filter into place, and tighten it until the gasket contacts the seat.
(d) Using SST, tighten the oil filter.
SST 09228–07501
(1) When using a torque wrench:
Using a torque wrench, tighten the oil filter.
Torque: 17 N·m (175 kgf·cm, 13 ft·lbf)
(2) When not using a torque wrench:
Tighten it an additional 3/4 turn.

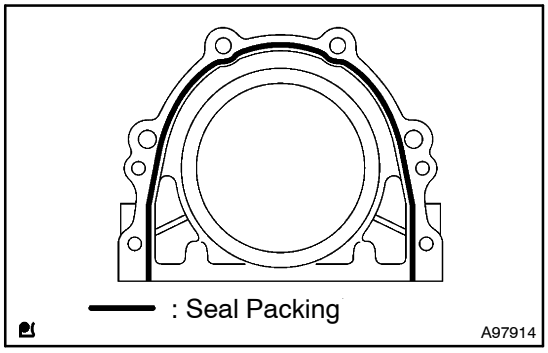


65. INSTALL ENGINE REAR OIL SEAL

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

NOTICE:

- **Keep the lip free from foreign matter.**
- **Do not tap the oil seal at an angle.**

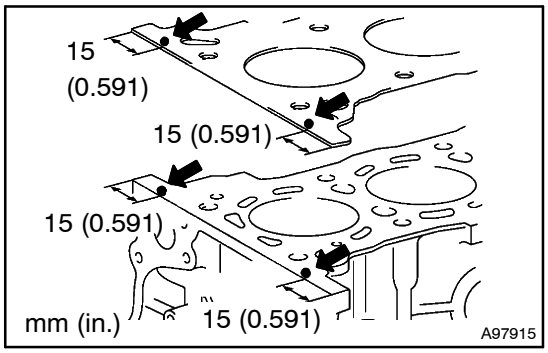


66. INSTALL ENGINE REAR OIL SEAL RETAINER

(a) Apply seal packing in a continuous bead as shown in the illustration.
Seal packing: Part No. 08826–00080 or equivalent
Seal width: 2 to 3 mm (0.079 to 0.118 in.)

NOTICE:
- **Remove any oil from the contact surface.**
- **Install the crankcase within 3 minutes after applying seal packing.**
- **Do not start the engine for at least 4 hours after installing.**

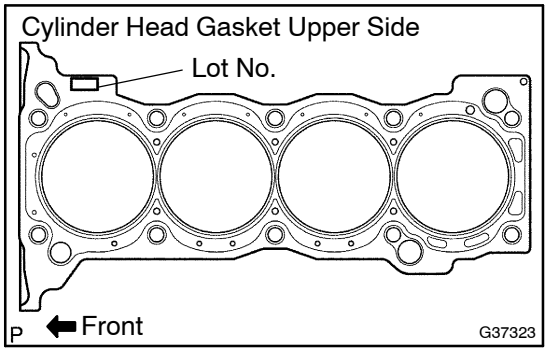
(b) Install the oil seal retainer with the 6 bolts.
Torque: 13 N·m (133 kgf·cm, 10 ft·lbf)



67. INSTALL CYLINDER HEAD GASKET

(a) Apply a continuous bead (seal width: 4 to 7 mm (0.15 to 0.28 in.)) of seal packing to the cylinder block upper side and cylinder head gasket upper side as shown in the illustration.
Seal packing: Part No. 08826–00100 or equivalent
Seal width: 4 to 7 mm (0.15 to 0.28 in.)

NOTICE:
- **Remove any oil from the contact surface.**
- **Install the cylinder head gasket within 3 minutes after applying the seal packing.**
- **Install the cylinder head bolt within 15 minutes after applying the seal packing.**
- **Do not put into engine oil within 4 hours of installation.**



(b) Install a new cylinder head gasket on the cylinder block surface with the Lot No. stamp upper side facing upward.

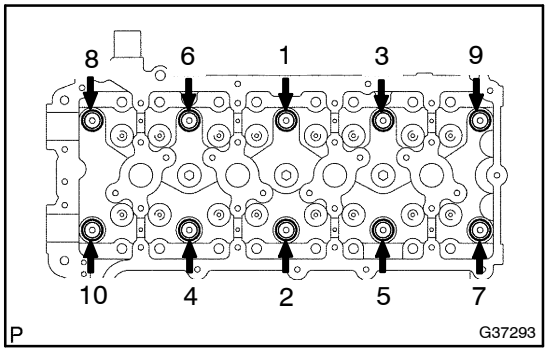
NOTICE:
- **Make sure that the installation direction is correct.**
- **Place the cylinder head gently to avoid damaging the gasket with the bottom part of the head.**

68. INSTALL CYLINDER HEAD SUB–ASSY

HINT:
The cylinder head bolts are tightened in 3 progressive steps.

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

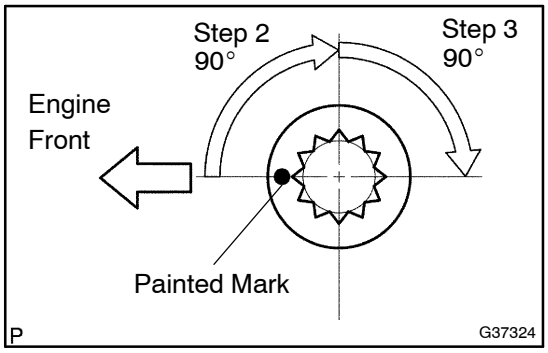
(b) Apply a light coat of engine oil to the threads and under the heads of the cylinder head bolts.



(c) Step 1

(1) Install and uniformly tighten the 10 cylinder head bolts with the plate washers, in several steps, in the sequence shown.

Torque: 39 N·m (398 kgf·cm, 29 ft·lbf)



(d) Step 2

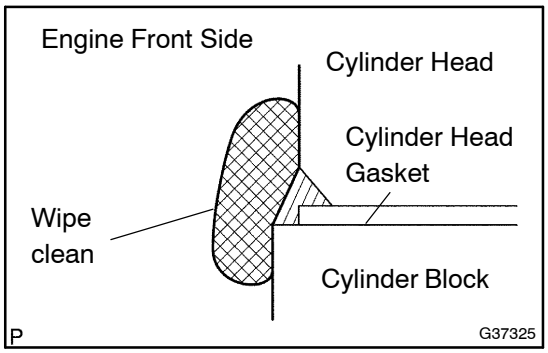
(1) Mark the cylinder head bolt head with paint as shown in the illustration.

(2) Retighten the cylinder head bolts by 90°.

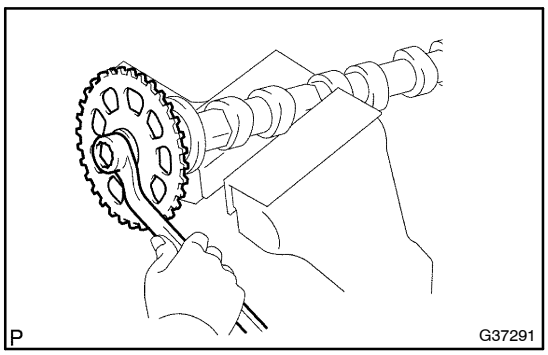
(e) Step 3

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

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



(f) Seal packing will seep out on the engine's front side. Thoroughly wipe clean any seal packing.



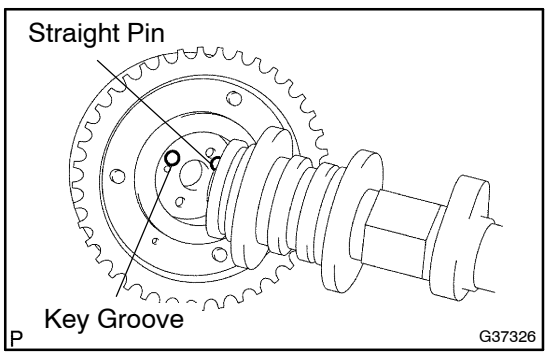
69. INSTALL CAMSHAFT TIMING SPROCKET

(a) Clamp the camshaft in a vise and then install the camshaft timing sprocket to the camshaft with the sprocket bolt.

Torque: 78 N·m (795 kgf·cm, 58 ft·lbf)

NOTICE:

Be careful not to damage the camshaft in the vise.



70. INSTALL CAMSHAFT TIMING GEAR ASSY

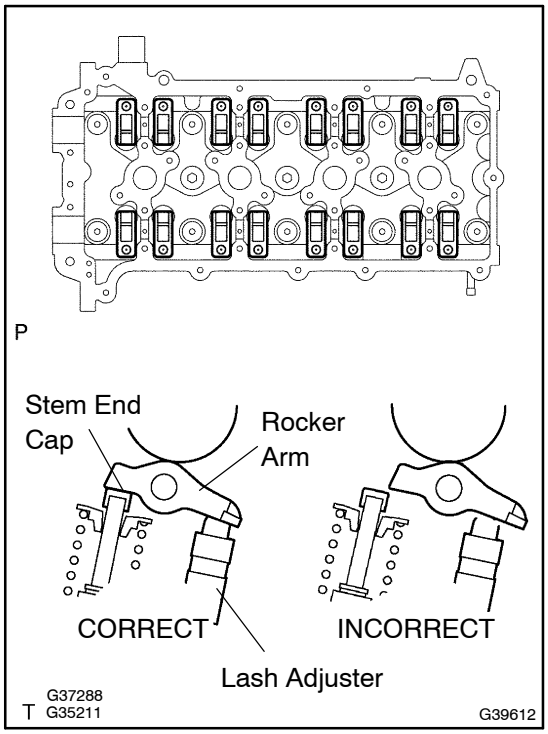
(a) Put the camshaft timing gear and camshaft together by aligning the key groove and straight pin.

(b) Lightly press the gear against the camshaft, and turn the gear. Push further at the position where the pin enters the groove.

CAUTION:

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

(c) Check that there is no clearance between the gear's fringe and the camshaft.
(d) Tighten the fringe bolt with the camshaft timing gear fixed.
Torque: 78 N·m (795 kgf·cm 58 ft·lbf)
(e) Check that the camshaft timing gear can move in the retard direction (the right angle), and is locked at the most retarded position.

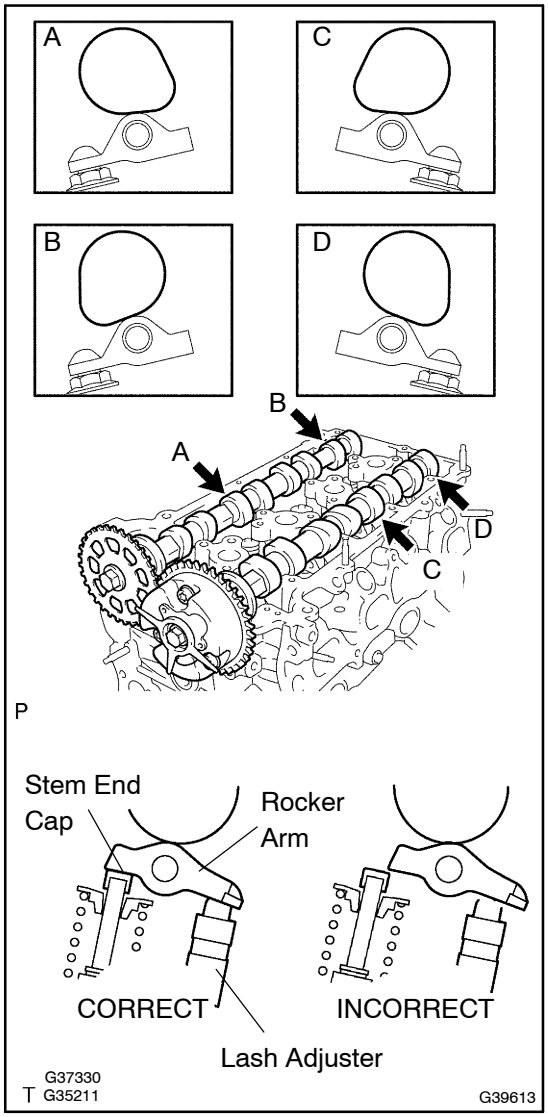


71. INSTALL VALVE ROCKER ARM SUB–ASSY NO.1

(a) Set the 16 rocker arms to the lash adjusters.

NOTICE:

Before and after setting the camshaft and No.2 camshaft, firmly set the rocker arm to the lash adjuster.



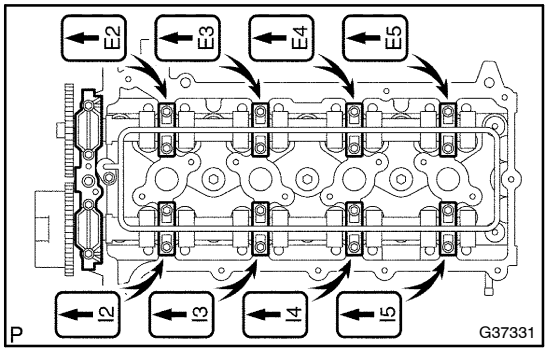
72. INSTALL CAMSHAFTS

(a) Apply clean engine oil to the camshaft's cam portion and the cylinder head journals.

(b) Set the camshaft and No.2 camshaft as shown in the illustration.

NOTICE:

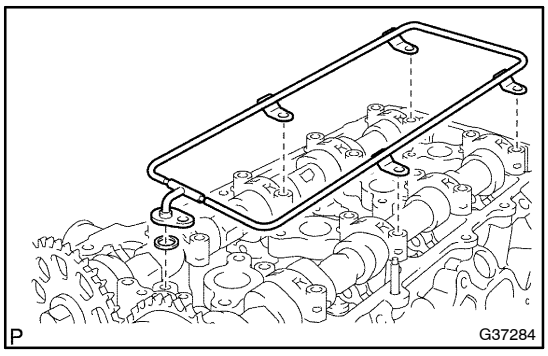
Before and after setting the camshaft and No.2 camshaft, firmly set the rocker arm to the lash adjuster.



73. INSTALL CAMSHAFT BEARING CAP

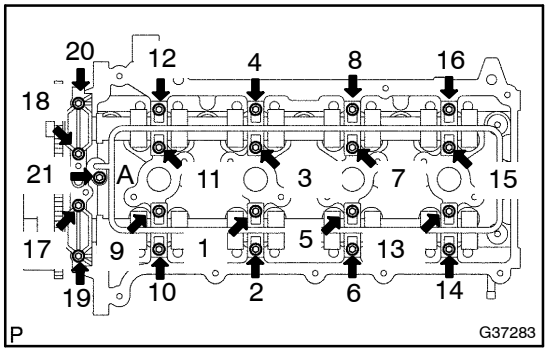
(a) Temporarily install the camshaft bearing cap No.1.

(b) Check the proper location of each camshaft bearing cap No.2 and install them.

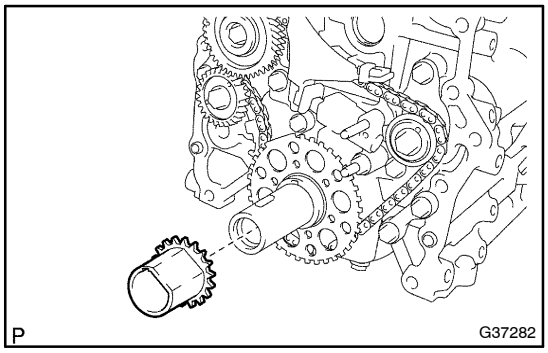


(c) Install a new O–ring to the camshaft bearing cap No.1.

(d) Temporarily install the oil delivery pipe.

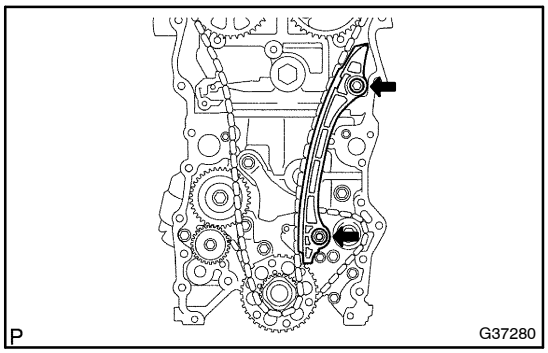


(e) Tighten the 21 bolts and 20 washers in the order shown in the illustration.
Torque:
12 N·m (122 kgf·cm, 9 ft·lbf) for bolt A
16 N·m (160 kgf·cm, 11 ft·lbf) for except bolt A



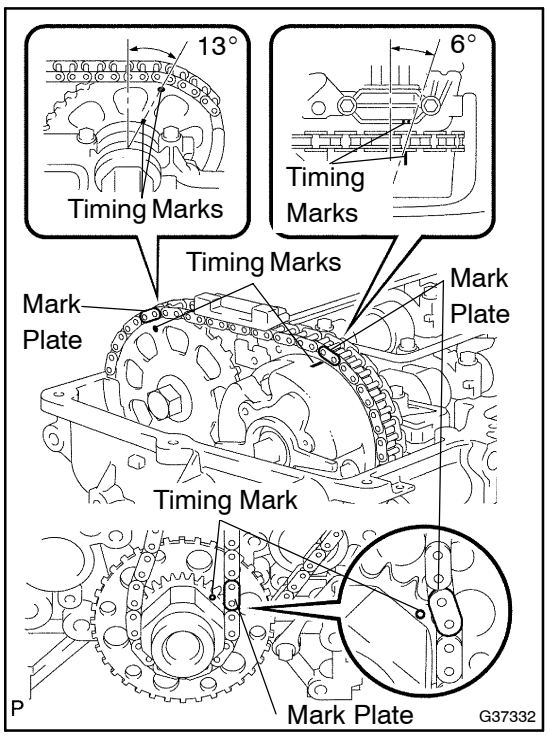
74. INSTALL CRANKSHAFT TIMING SPROCKET

(a) Install the timing sprocket as shown in the illustration.



75. INSTALL CHAIN VIBRATION DAMPER NO.1

(a) Install the vibration damper with the bolt and nut.
Torque: 21 N·m (214 kgf·cm, 15 ft·lbf)

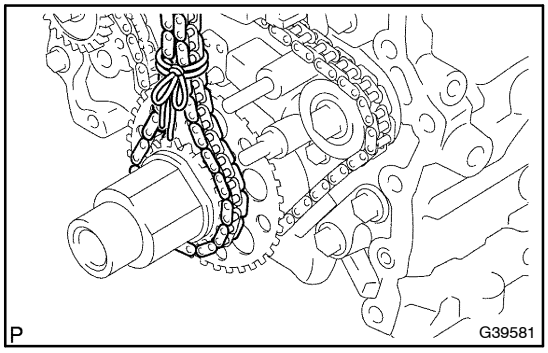


76. INSTALL CHAIN SUB–ASSY

(a) As shown in the illustration, install the chain on the sprocket and gear with the painted marks aligned with the timing marks on the sprocket and gear.

HINT:

- The camshaft mark plate is yellow.
- The crankshaft mark plate is orange.



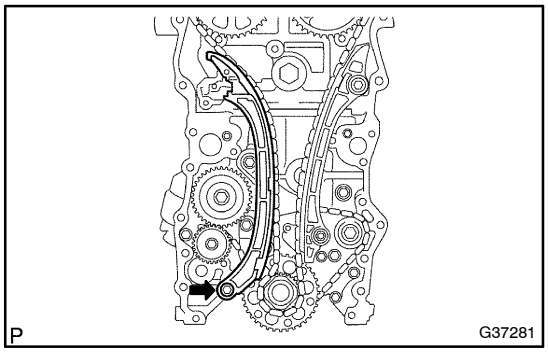
(b) Use a rope to tie the chain of the crankshaft timing sprocket. Tie the rope near the sprocket.

NOTICE:

After the chain tensioner has been installed, the rope must be removed.

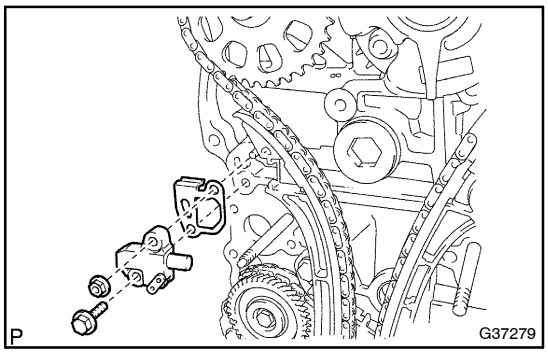
HINT:

The rope is tied so that the chain will not jump a tooth.



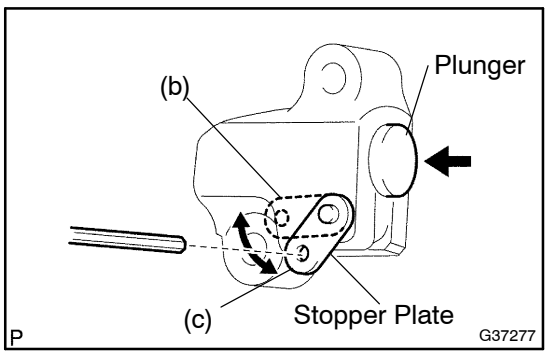
77. INSTALL CHAIN TENSIONER SLIPPER

(a) Install the tensioner slipper with the bolt.
Torque: 21 N·m (214 kgf·cm, 15 ft·lbf)



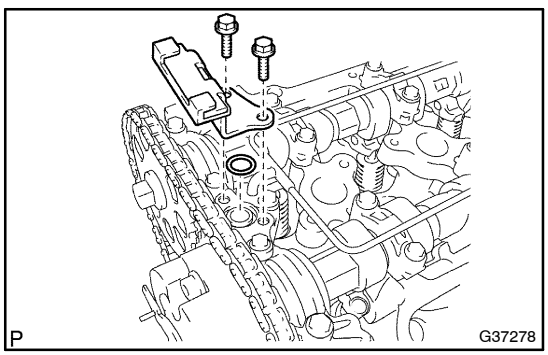
78. INSTALL CHAIN TENSIONER ASSY NO.1

(a) Install a new gasket and the chain tensioner No.1 with the bolt and nut.
Torque: 10 N·m (102 kgf·cm, 7 ft·lbf)



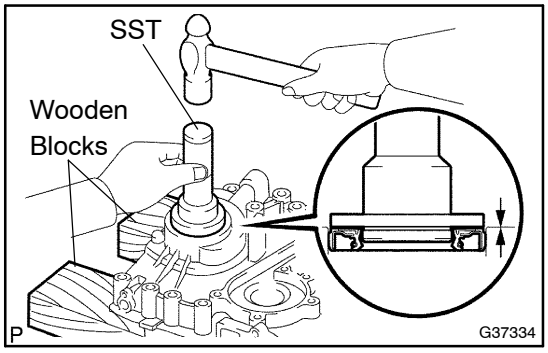
(b) Move the stopper plate upward to release the lock, and push the plunger deep into the tensioner.

(c) Move the stopper plate downward to set the lock, and insert a hexagon wrench into the stopper plate's hole.



79. INSTALL TIMING CHAIN GUIDE

(a) Install a new O–ring and the chain guide with the 2 bolts.
Torque: 10 N·m (102 kgf·cm, 7 ft·lbf)



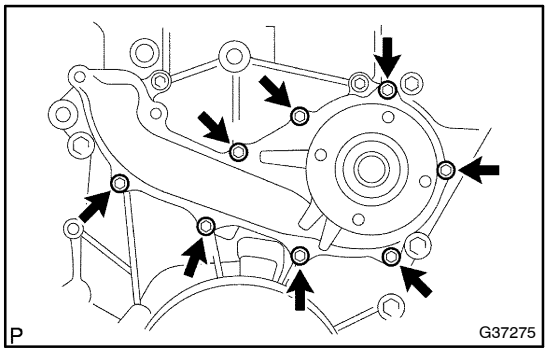
80. INSTALL TIMING CHAIN COVER OIL SEAL

(a) Place the timing chain cover on wooden blocks.

(b) Using SST, tap in a new oil seal until its surface is flush with the timing gear case edge.
SST 09223–50010

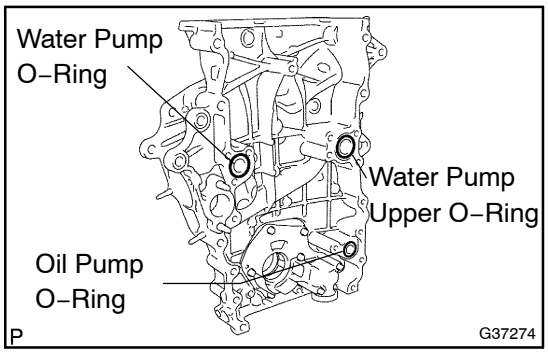
NOTICE:

- **Keep the lip free from foreign matter.**
- **Do not tap the oil seal at an angle.**



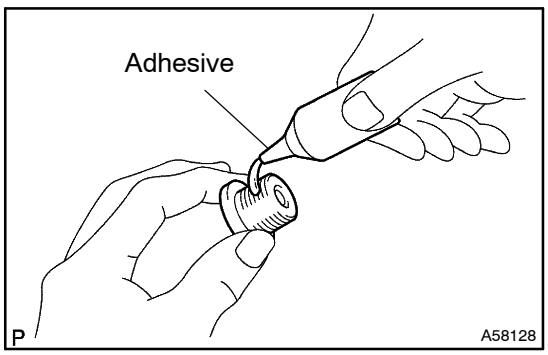
81. INSTALL WATER PUMP ASSY

(a) Install a new gasket and the water pump with the 8 bolts.
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)

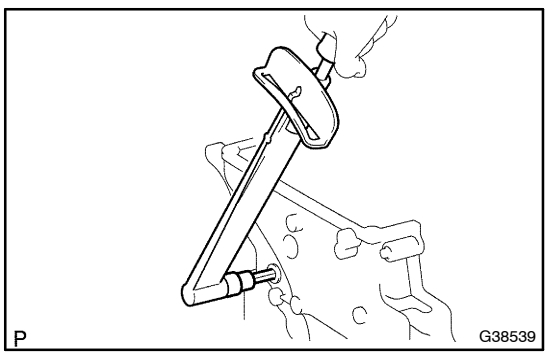


82. INSTALL TIMING CHAIN COVER

(a) Install 3 new O–rings to the timing chain cover as shown in the illustration.



(b) Apply adhesive to the timing gear case plug.
Adhesive:
Part No. 08833–00070, THREE BOND 1324 or equivalent



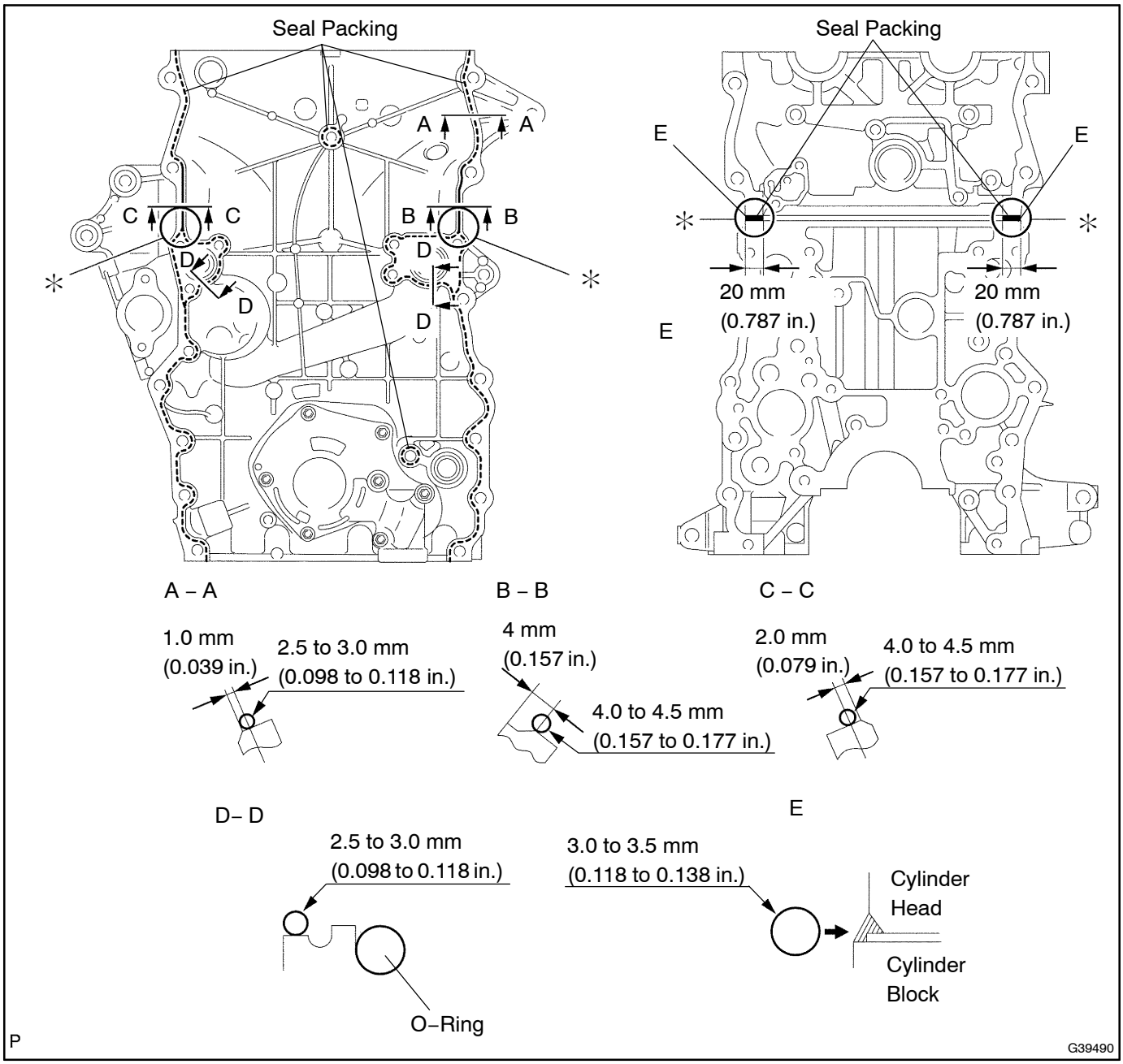
(c) Using a 10 mm socket hexagon wrench, install the timing chain cover plug.
Torque: 17 N·m (170 kgf·cm, 12 ft·lbf)

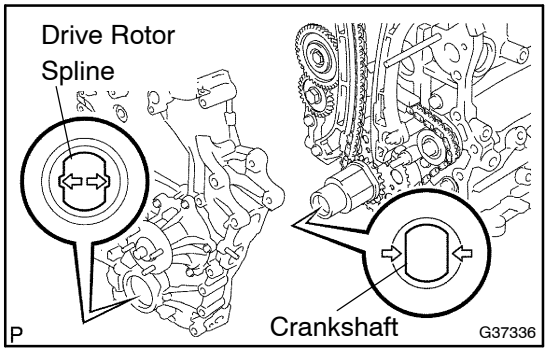
(d) Apply seal packing in a continuous bead to the timing chain cover as shown in the following illustration.
Seal packing: Part No. 08826–00080 or equivalent
Seal width:

Position	Specified Condition
A – A,	2.5 to 3.0 mm (0.098 to 0.118 in.)
B – B, C – C	4.0 to 4.5 mm (0.157 to 0.177 in.)
D – D	2.5 to 3.0 mm (0.098 to 0.118 in.)
E	3.0 to 3.5 mm (0.118 to 0.138 in.)

NOTICE:

- **Be sure to clean and degrease the contact surfaces, especially 4 areas indicated by ✳ in the illustration.**
- **When the contact surfaces are wet, wipe off with an oil–free cloth before applying seal packing.**
- **Install the crankcase within 3 minutes and tighten the bolts within 15 minutes after applying seal packing.**
- **Do not start the engine for at least 4 hours after installing.**





(e) Align the oil pump's drive rotor spline and the crankshaft as shown in the illustration. Install the spline and chain cover to the crankshaft.

(f) Temporarily install the the timing chain cover with the 19 bolts and 2 nuts, but do not tighten the bolts and nuts yet.

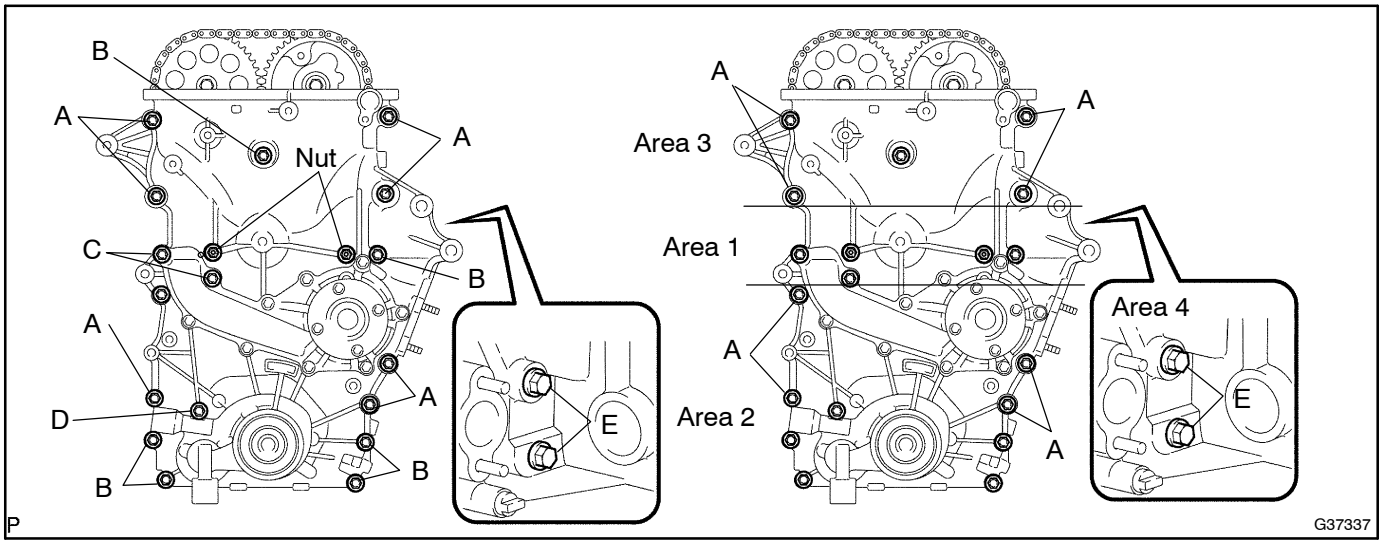
(g) Excluding bolts A, fully tighten the bolts and nuts in this order: Area 1, Area 2 and Area 3.
Torque: 21 N·m (214 kgf·cm, 15 ft·lbf)

HINT:
Bolt length:
75 mm (2.95 in.) for bolt A (M10)
75 mm (2.95 in.) for bolt B (M8)
87 mm (3.43 in.) for bolt C
95 mm (3.74 in.) for bolt D

(h) Fully tighten the bolts labeled A in this order: Area 2 and Area 3.
Torque: 46 N·m (469 kgf·cm, 34 ft·lbf)

(i) Fully tighten the bolts labeled E in Area 4.
Torque: 21 N·m (214 kgf·cm, 15 ft·lbf)

HINT:
Bolt length:
35 mm (1.37 in.) for bolt E



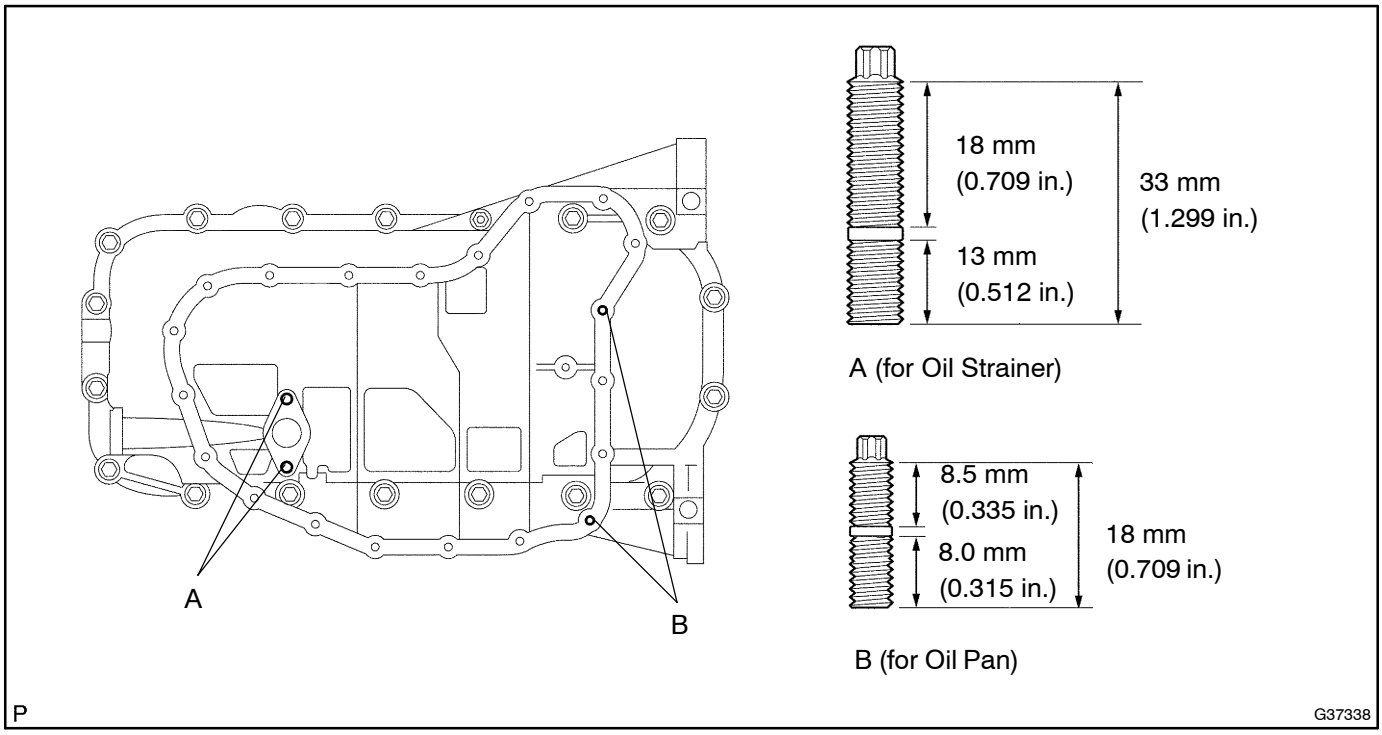
83. INSTALL OIL PAN SUB–ASSY

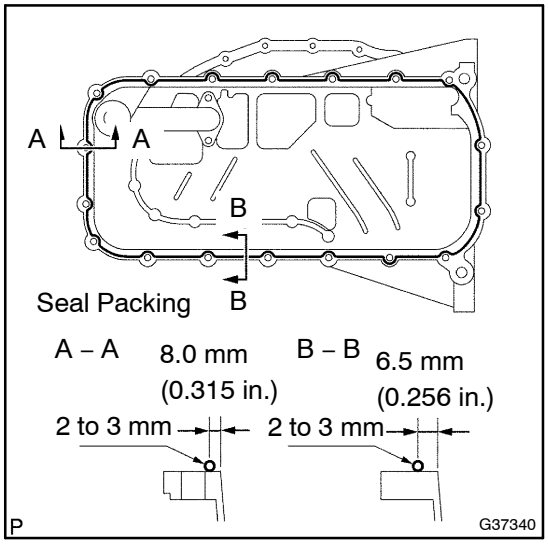
(a) Install the stud bolt.

(1) Using an E5 torx® socket wrench, install the stud bolts labeled A for the oil pan as shown in the illustration.

(2) Using an E7 torx® socket wrench, install the stud bolts labeled B for the oil strainer as shown in the illustration.

Torque:
7.5 N·m (76 kgf·cm, 66 in.·lbf) for stud bolt A
3.0 N·m (31 kgf·cm, 27 in.·lbf) for stud bolt B



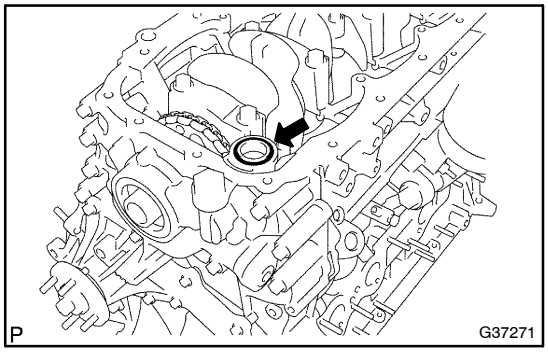


(b) Apply seal packing in a continuous bead as shown in the illustration.

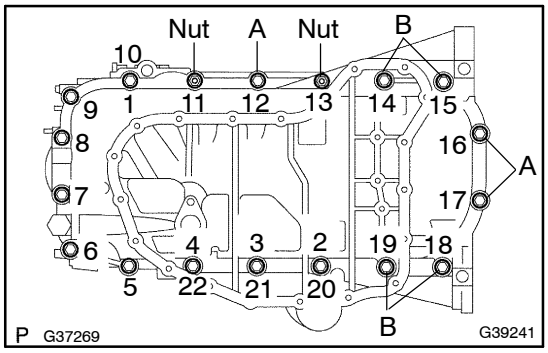
Seal packing: Part No. 08826–00080 or equivalent
Seal width: 2 to 3 mm (0.08 to 0.12 in.)

NOTICE:

- **Remove any oil from the contact surface.**
- **Install the crankcase within 3 minutes after applying seal packing.**
- **Do not start the engine for at least 4 hours after installing.**



(c) Install a new O–ring.



(d) Temporarily install the oil pan with the 16 bolts and 2 nuts.

HINT:

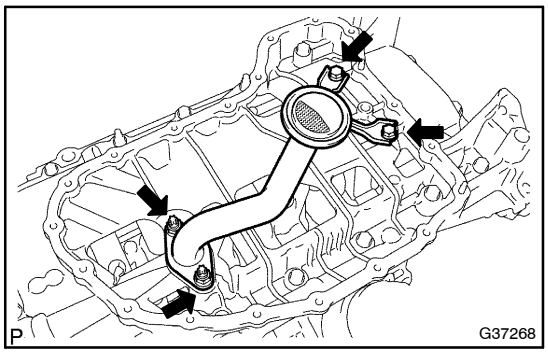
Bolt length:

20 mm (0.79 in.) for bolt A

40 mm (1.57 in.) for bolt B

(e) Uniformly tighten the 16 bolts and 2 nuts in the sequence shown in the illustration.

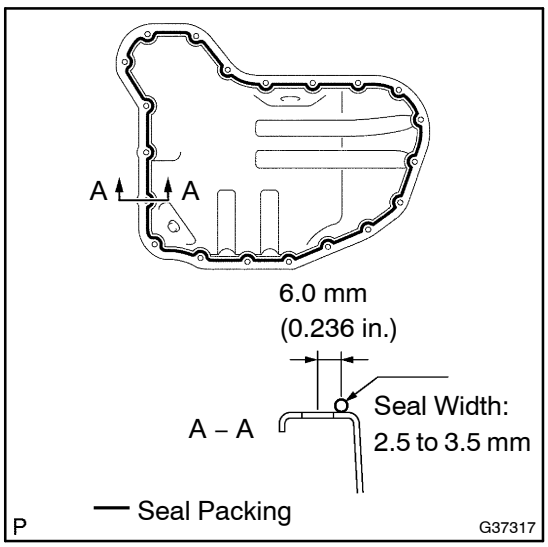
Torque: 26 N·m (265 kgf·cm, 19 ft·lbf)



84. INSTALL OIL STRAINER SUB–ASSY

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

Torque: 26 N·m (265 kgf·cm, 19 ft·lbf)



85. INSTALL OIL PAN SUB–ASSY NO.2

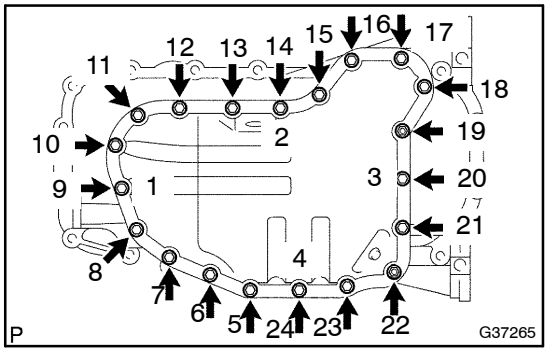
(a) Apply seal packing in a continuous bead as shown in the illustration.

Seal packing: Part No. 08826–00080 or equivalent

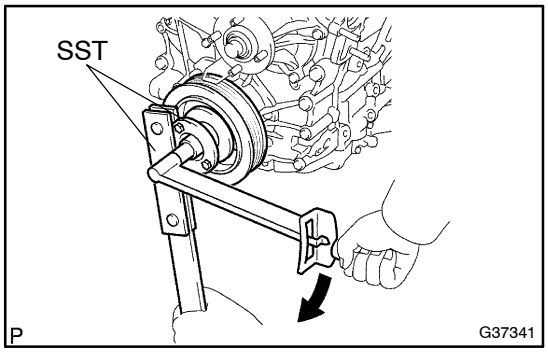
Seal width: 2.5 to 3.5 mm (0.098 to 0.138 in.)

NOTICE:

- **Remove any oil from the contact surface.**
- **Install the crankcase within 3 minutes after applying seal packing.**
- **Do not start the engine for at least 4 hours after installing.**

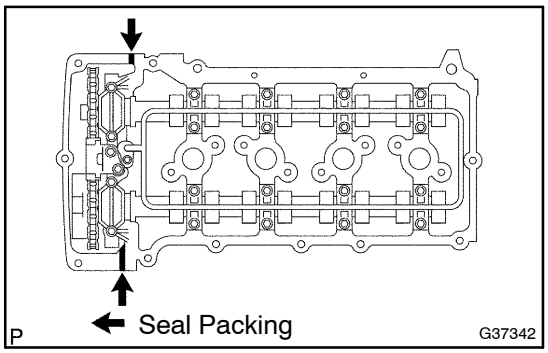


(b) Temporarily install the oil pan with the 18 bolts and 2 nuts.
(c) Uniformly tighten the 18 bolts and 2 nuts in the sequence shown in the illustration.
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)
(d) Install a new gasket and the drain plug.
Torque: 38 N·m (382 kgf·cm, 28 ft·lbf)



86. INSTALL CRANKSHAFT PULLEY
(a) Align the pulley set key with the key groove of the pulley, and slide on the pulley.
(b) Using SST, install the new pulley bolt.
SST 09213–54015 (91651–60855), 09330–00021
Torque: 260 N·m (2,650 kgf·cm, 192 ft·lbf)

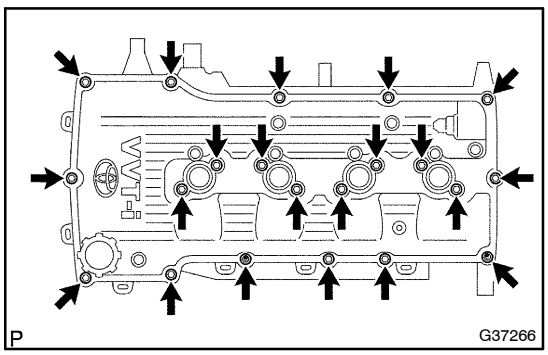
NOTICE:
Do not reuse the pulley bolt.

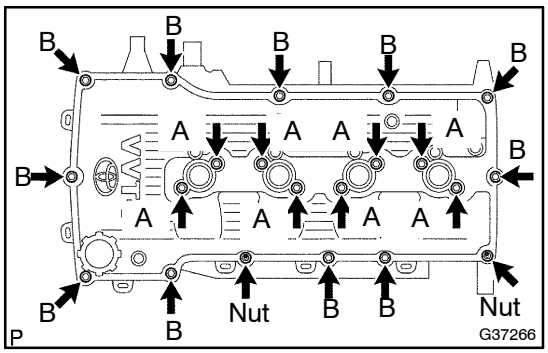


87. INSTALL CYLINDER HEAD COVER SUB–ASSY
(a) Apply seal packing as shown in the illustration.
(b) Install the 2 gaskets to the head cover.
Seal packing: Part No. 08826–00080 or equivalent

NOTICE:
- **Remove any oil from the contact surface.**
- **Install the crankcase within 3 minutes after applying seal packing.**
- **Do not start the engine for at least 4 hours after installing.**

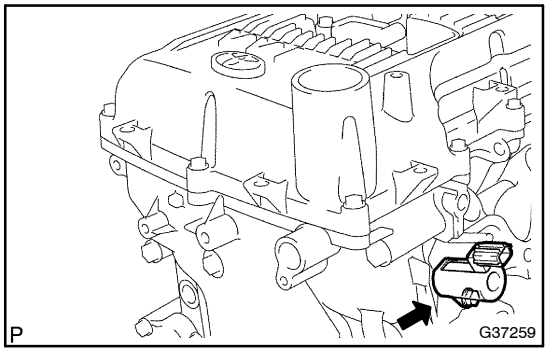
(c) Temporarily install the cover with the 19 bolts and 2 nuts.





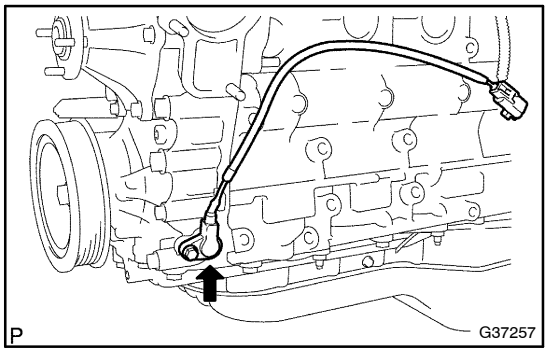
(d) Fully tighten the bolts (A) shown in the illustration.
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)
(e) Fully tighten the bolts (B) shown in the illustration.
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)

HINT:
Make sure the tightening torque of bolts (A).



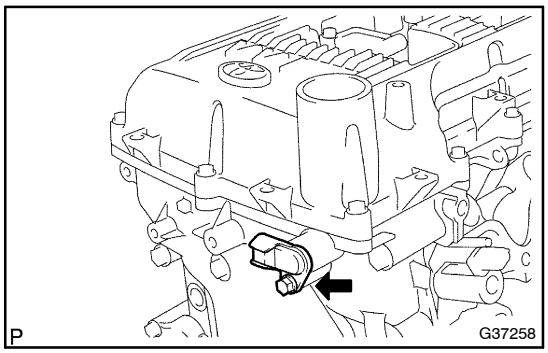
88. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSY

(a) Install the camshaft timing oil control valve assy with the bolt.
Torque: 8.0 N·m (82 kgf·cm, 71 in.·lbf)



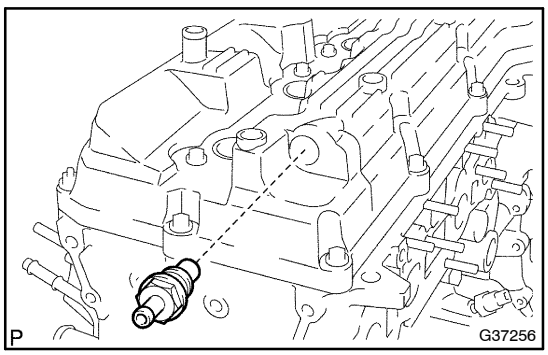
89. INSTALL CRANKSHAFT POSITION SENSOR

(a) Apply engine oil to the O–ring.
(b) Install the crankshaft position sensor with the bolt.
Torque: 8.5 N·m (87 kgf·cm, 75 in.·lbf)



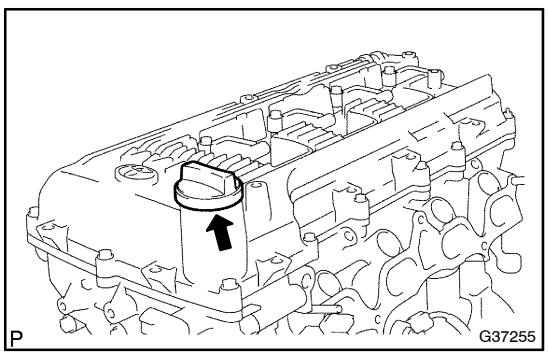
90. INSTALL CAMSHAFT POSITION SENSOR

(a) Apply engine oil to the O–ring.
(b) Install the camshaft position sensor with the bolt.
Torque: 8.5 N·m (87 kgf·cm, 75 in.·lbf)



91. INSTALL VENTILATION VALVE SUB–ASSY

(a) Install the ventilation valve sub–assy.
Torque: 5.0 N·m (51 kgf·cm, 44 in.·lbf)



92. INSTALL OIL FILLER CAP SUB–ASSY

(a) Install the oil filler cap assy.