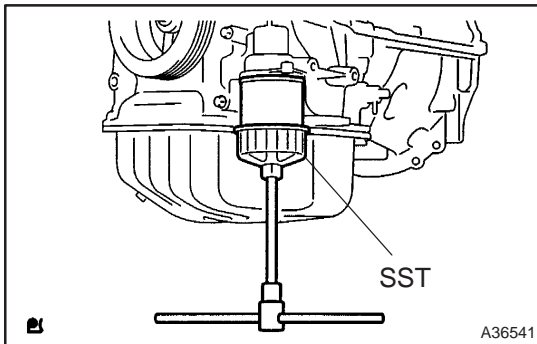


# PARTIAL ENGINE ASSY (1AZ-FE) OVERHAUL

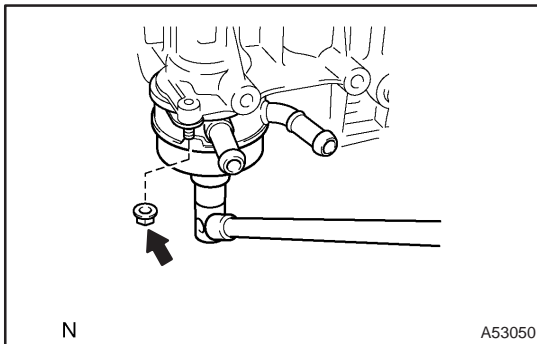
140DU-01

1. REMOVE OIL FILLER CAP SUB-ASSY
2. REMOVE OIL FILLER CAP GASKET
3. REMOVE VENTILATION VALVE SUB-ASSY
4. REMOVE SPARK PLUG



## 5. REMOVE OIL FILTER SUB-ASSY

- (a) Using SST, remove the oil filter.  
SST 09228-06501

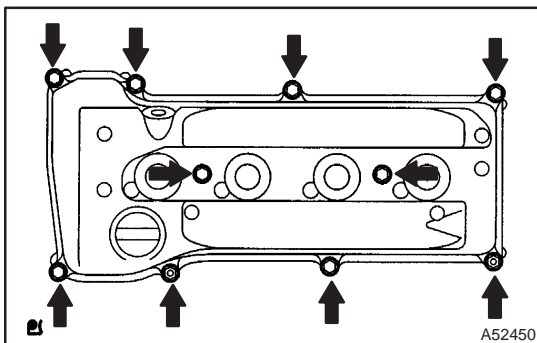


## 6. REMOVE OIL COOLER ASSY(W/ OIL COOLER)

- (a) Remove the flange nut.
- (b) Remove the union bolt and oil cooler.
- (c) Remove the O-ring from the oil cooler.

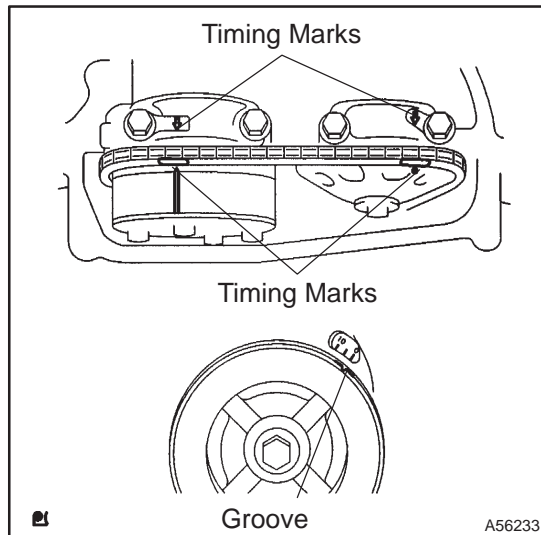
## 7. REMOVE OIL FILTER UNION(W/O OIL COOLER)

- (a) Using a 12 mm hexagon wrench, remove the oil filter union.

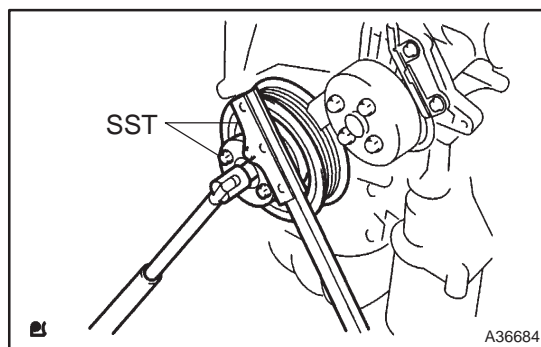


## 8. REMOVE CYLINDER HEAD COVER SUB-ASSY

- (a) Remove 8 bolts, 2 nuts, and cylinder head cover sub assembly.

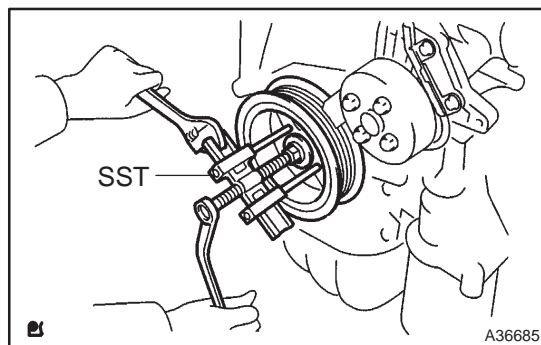
**9. REMOVE CYLINDER HEAD COVER GASKET****10. REMOVE CAMSHAFT POSITION SENSOR****11. REMOVE CRANKSHAFT PULLEY**

- (a) Turn the crankshaft pulley, and align its groove with the timing mark "0" of the timing chain cover.
- (b) Check that the timing marks of the camshaft timing sprockets are aligned with the timing marks of the No. 1 bearing cap as shown in the illustration.



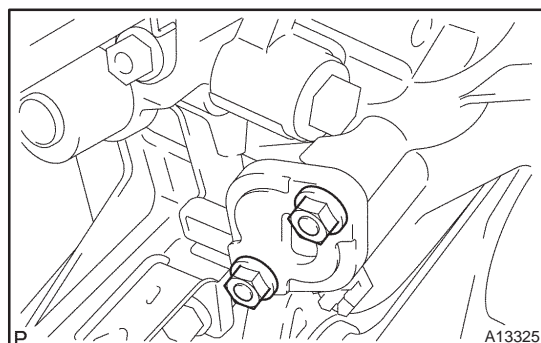
- (c) Using SST, fix the crankshaft pulley and loosen a pulley set bolt.

SST 09213-54015 (91651-60855), 09330-00021



- (d) Using a pulley set bolt and SST, remove the crankshaft pulley.

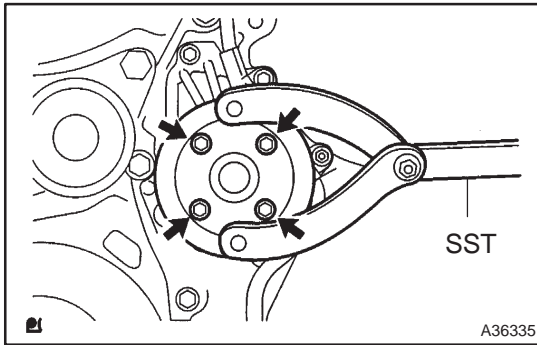
SST 09950-50013 (09951-05010, 09952-05010, 09953-05020, 09954-05021), 09950-40011 (09957-04010)

**12. REMOVE CHAIN TENSIONER ASSY NO.1**

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

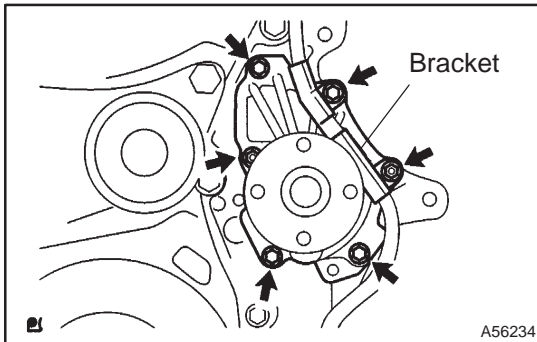
**NOTICE:**

**Be sure not to turn the crankshaft without the chain tensioner.**



### 13. REMOVE WATER PUMP PULLEY

- (a) Using SST, remove the water pump pulley.  
SST 09960-10010 (09962-01000, 09963-00600)

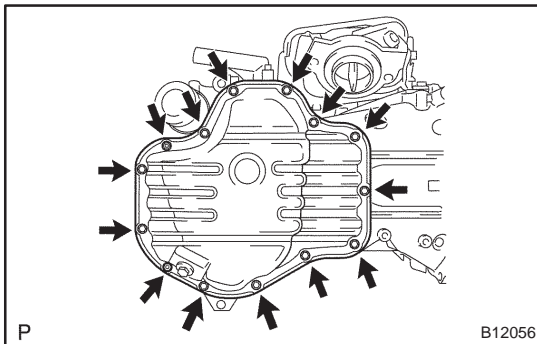


### 14. REMOVE WATER PUMP ASSY

- (a) Remove the 4 bolts, 2 nuts, bracket and water pump.

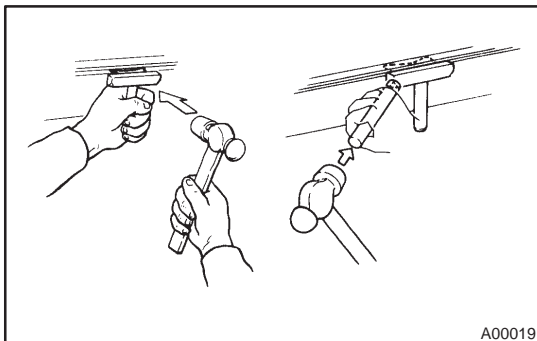
### 15. REMOVE CRANK POSITION SENSOR

### 16. REMOVE OIL PAN DRAIN PLUG



### 17. REMOVE OIL PAN SUB-ASSY

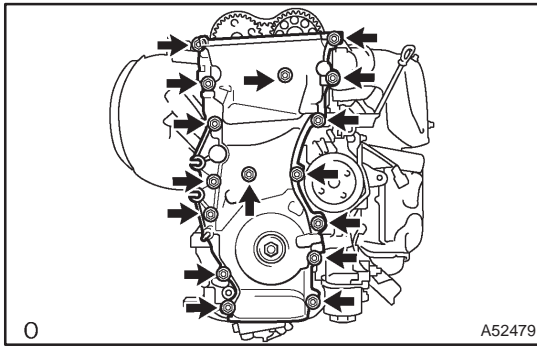
- (a) Remove the 12 bolts and 2 nuts.



- (b) Insert the blade of SST between the crank case and oil pan, cut off applied sealer and remove the oil pan.  
SST 09032-00100

#### NOTICE:

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

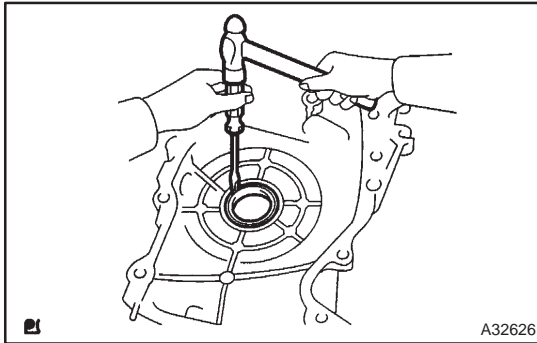


### 18. REMOVE TIMING CHAIN OR BELT COVER SUB-ASSY

- (a) Remove the 14 bolts and 2 nuts.
- (b) Remove the timing chain cover by prying the portions between the timing chain cover and cylinder head or cylinder block with a screwdriver.

#### NOTICE:

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



### 19. REMOVE TIMING GEAR CASE OR TIMING CHAIN CASE OIL SEAL

- (a) Using a screwdriver, remove the oil seal.

### 20. REMOVE CRANKSHAFT POSITION SENSOR PLATE NO.1

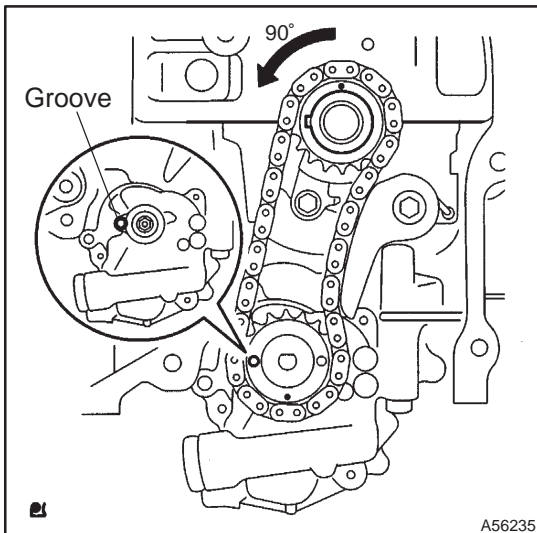
### 21. REMOVE TIMING CHAIN GUIDE

### 22. REMOVE CHAIN TENSIONER SLIPPER

### 23. REMOVE CHAIN VIBRATION DAMPER NO.1

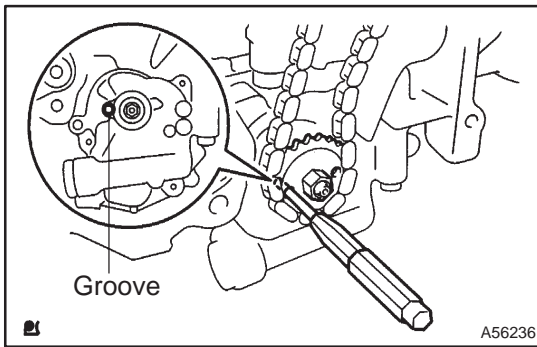
### 24. REMOVE CHAIN SUB-ASSY

### 25. REMOVE CRANKSHAFT TIMING GEAR OR SPROCKET

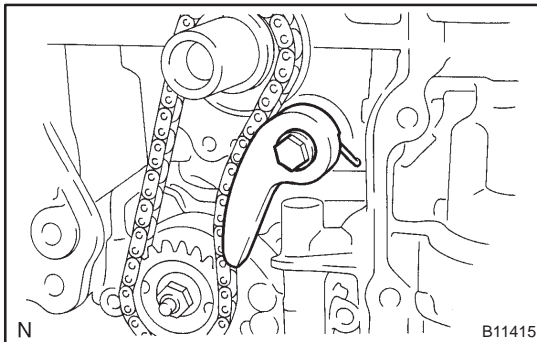


### 26. REMOVE NO.2 CHAIN SUB-ASSY

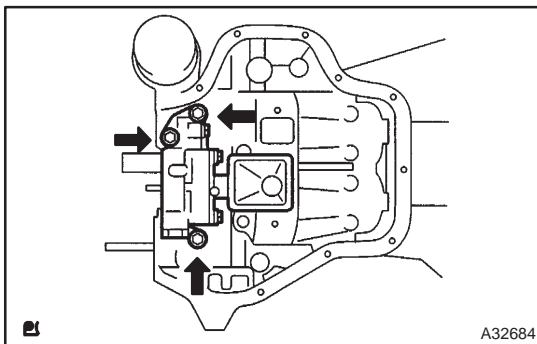
- (a) Turn the crankshaft counterclockwise 90°, and align an adjusting hole of the oil pump drive shaft gear with the groove of the oil pump.



- (b) Put a bar ( $\phi$  4 mm) in the adjusting hole of the oil pump drive shaft gear to lock in position, and remove a nut.

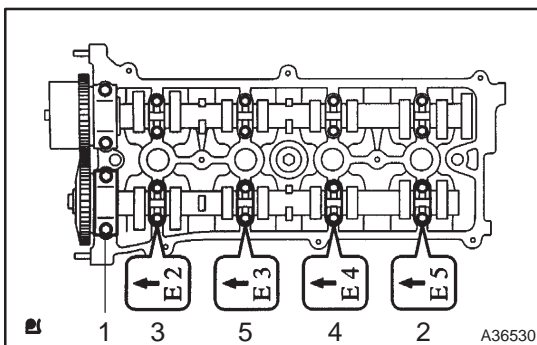


- (c) Remove bolt and a chain tensioner plate.  
(d) Remove the oil pump drive gear, oil pump drive shaft gear and No. 2 chain sub assembly.



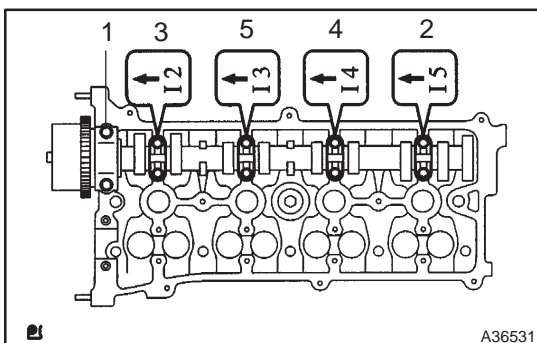
## 27. REMOVE OIL PUMP ASSY

- (a) Remove 3 bolts and the oil pump assembly.



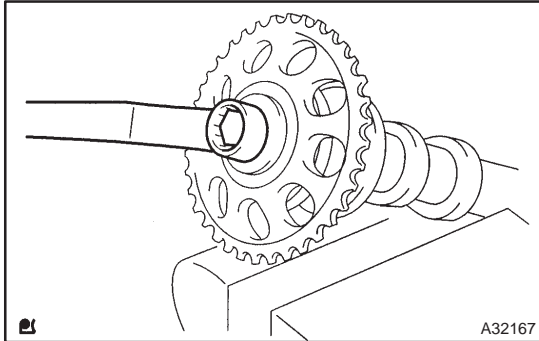
## 28. REMOVE NO.2 CAMSHAFT

- (a) Remove No. 1 and No. 2 camshaft bearing caps as the sequence shown in the illustration.  
(b) Remove No. 2 camshaft.



## 29. REMOVE CAMSHAFT

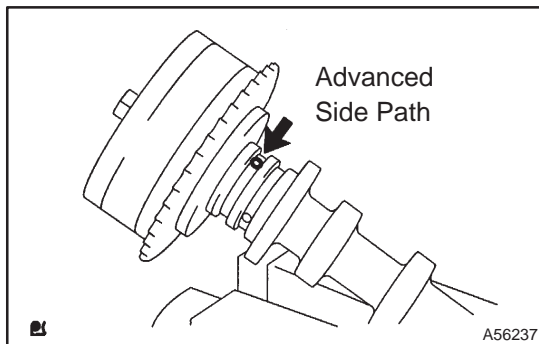
- (a) Remove No. 1 and No. 3 camshaft bearing caps as the sequence shown in the illustration.  
(b) Remove No. 1 camshaft.

**30. REMOVE CAMSHAFT BEARING NO.1****31. REMOVE CAMSHAFT TIMING GEAR OR SPROCKET**

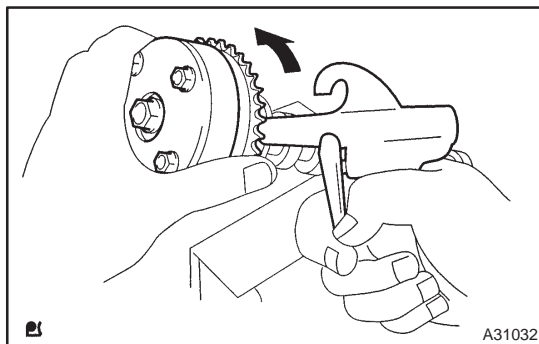
- (a) Fix the No. 2 camshaft with a vise, and remove the camshaft timing gear.

**NOTICE:**

**Be careful not to damage the camshaft.**

**32. REMOVE CAMSHAFT TIMING GEAR ASSY**

- (a) Fix the No. 1 camshaft with a vise, and make sure the camshaft timing gear assembly does not move.
- (b) Cover all the paths with vinyl tape except an advanced side path as shown in the illustration.



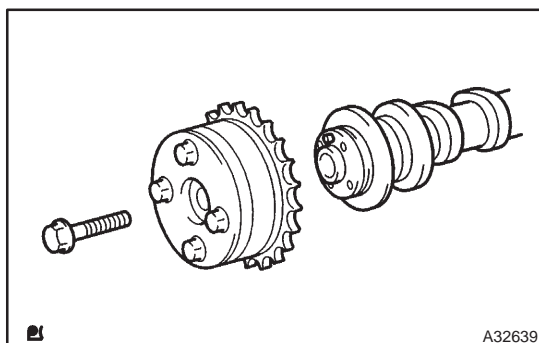
- (c) Put air pressure into the oil path with 150 kPa (1.5 kgf/cm<sup>2</sup> 21psi), and turn the camshaft timing gear assembly to the advance direction (counterclockwise) by force.

**NOTICE:**

**Cover the paths with shop rag to avoid oil splashing.**

**HINT:**

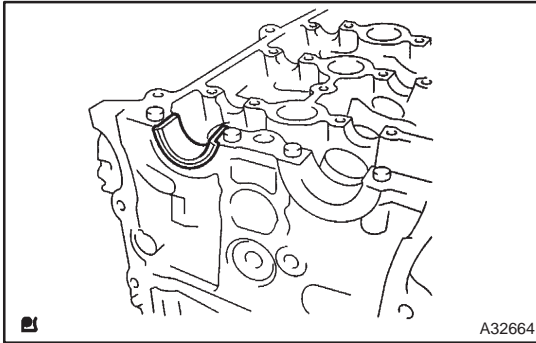
Depending on the air pressure, the VVT timing sprocket will turn to the advance angle side without applying force by hand. Also, under the condition that the pressure can be hardly applied because of the air leakage from the port, there may be the case that the lock pin could be hardly released.



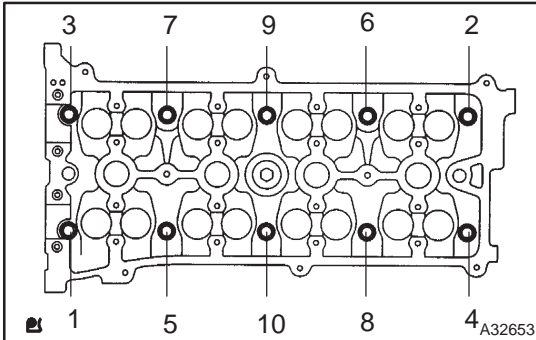
- (d) Remove a fringe bolt of camshaft timing gear assembly.

**NOTICE:**

- **Be sure not to remove the other 4 bolts.**
- **In case of reusing the camshaft timing gear assembly, release the straight pin lock first, and then install the gear.**



### 33. REMOVE CAMSHAFT BEARING NO.2



### 34. REMOVE CYLINDER HEAD SUB-ASSY

- (a) Using a 10 mm bi-hexagon wrench, uniformly loosen and remove the 10 cylinder head bolts, in several passes, in the sequence shown. 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 and incorrect order.

### 35. REMOVE CYLINDER HEAD GASKET

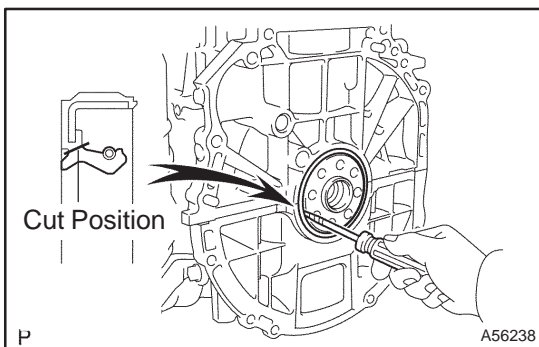
### 36. REMOVE CYLINDER BLOCK WATER DRAIN COCK SUB-ASSY

### 37. REMOVE UNION(W/ OIL COOLER)

### 38. REMOVE OIL CONTROL VALVE FILTER

- (a) Using a 6 mm socket hexagon wrench, remove a plug and oil control valve filter.

### 39. REMOVE W/HEAD TAPER SCREW PLUG NO.1

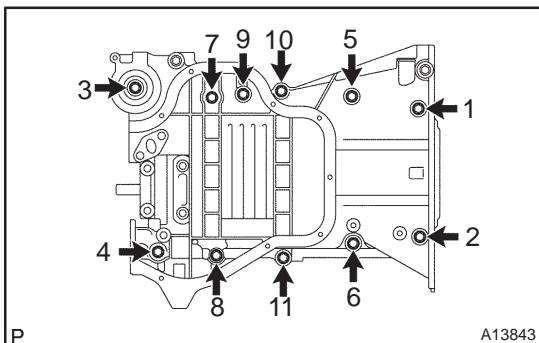


### 40. REMOVE ENGINE REAR OIL SEAL

- (a) Using a knife, cut off the oil seal lip.  
(b) Using a screwdriver with its tip taped, pry out the oil seal.

#### NOTICE:

After the removal, check the crankshaft is not damaged. If there is, mend it with a sandpaper (#400).



### 41. REMOVE STIFFENING CRANKCASE ASSY

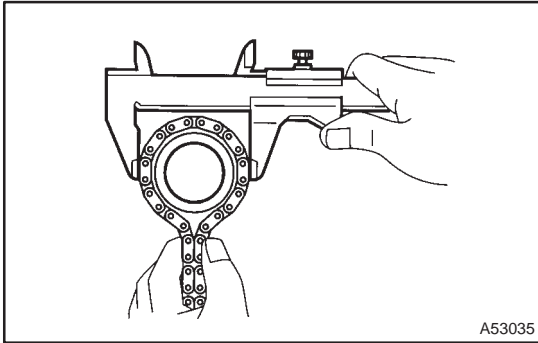
- (a) Uniformly loosen and remove the 11 bolts, in several passes, in the sequence shown.  
(b) Using a screwdriver, remove the crankcase by prying the portions between the crankcase and cylinder block.

#### NOTICE:

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

- (c) Remove the O-ring from the cylinder block.



**42. INSPECT OIL PUMP DRIVE GEAR**

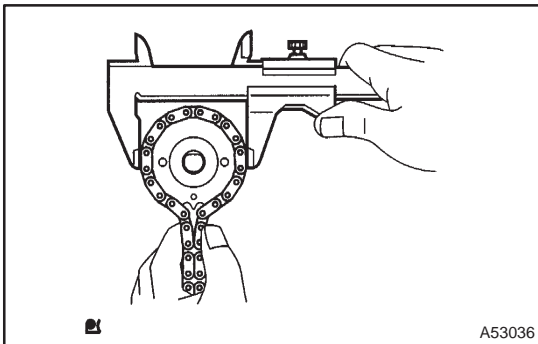
- (a) Wrap the chain around the drive gear.
- (b) Using vernier calipers, measure the drive gear diameter with the chain.

**NOTICE:**

**Vernier calipers must contact the chain rollers for the measuring.**

**Minimum gear diameter (w/chain): 48.2 mm (1.898 in.)**

- (c) If the diameter is less than minimum, replace the chain and drive gear.

**43. INSPECT OIL PUMP DRIVE SHAFT GEAR**

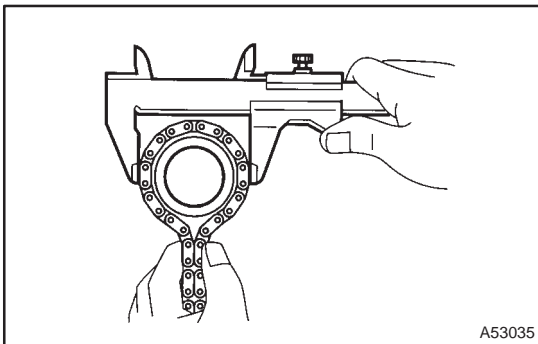
- (a) Wrap the chain around the drive shaft gear.
- (b) Using vernier calipers, measure the drive shaft gear diameter with the chain.

**NOTICE:**

**Vernier calipers must contact the chain rollers for the measuring.**

**Minimum gear diameter (w/chain): 48.2 mm (1.898 in.)**

- (c) If the diameter is less than minimum, replace the chain and drive shaft gear.

**44. INSPECT CRANKSHAFT TIMING GEAR OR SPROCKET**

- (a) Wrap the chain around the timing gear.
- (b) Using vernier calipers, measure the timing gear diameter with the chain.

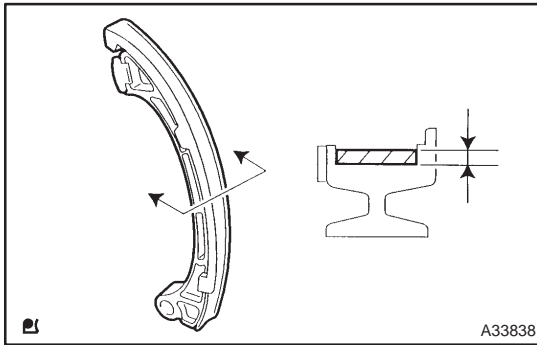
**NOTICE:**

**Vernier calipers must contact the chain rollers for the measuring.**

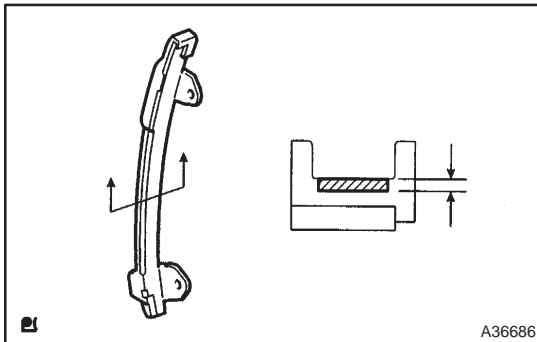
**Minimum gear diameter (w/chain): 51.6 mm (2.031 in.)**

- (c) If the diameter is less than minimum, replace the chain and timing gear.

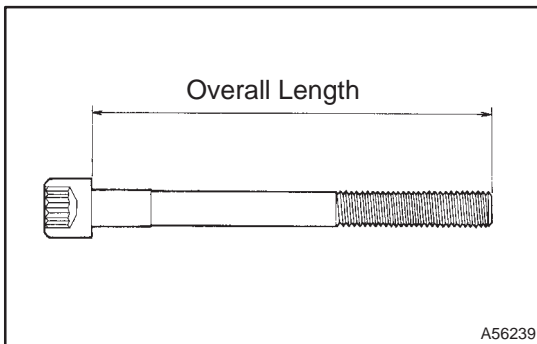


**45. INSPECT CHAIN TENSIONER SLIPPER**

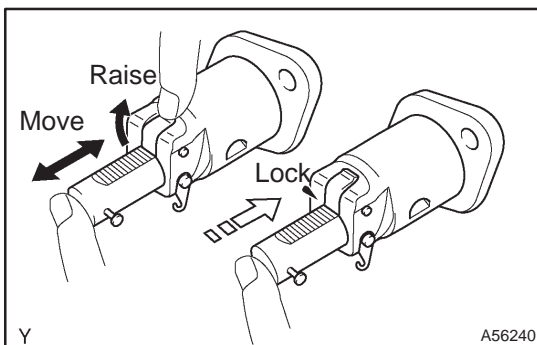
- (a) Measure the chain tensioner slipper wears.  
**Maximum wear: 1.0 mm (0.039 in.)**
- (b) If the wear is greater than maximum, replace the chain tensioner slipper.

**46. INSPECT CHAIN VIBRATION DAMPER NO.1**

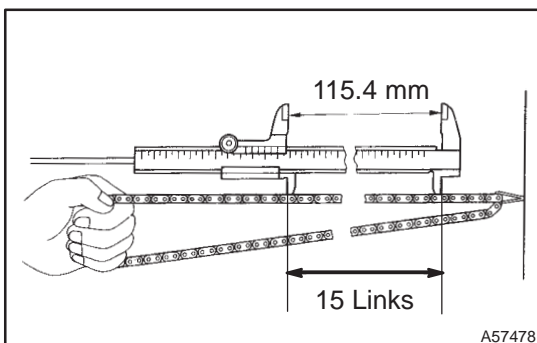
- (a) Measure the chain vibration damper No. 1 wears.  
**Maximum wear: 1.0 mm (0.039 in.)**
- (b) If the wear is greater than maximum, replace the chain vibration damper No. 1.

**47. INSPECT CYLINDER HEAD SET BOLT**

- (a) Using vernier calipers, measure the length of head bolts from the seat to the end.  
**Standard bolt length: 161.3 – 162.7 mm (6.350 – 6.405 in.)**  
**Maximum bolt length: 164.2 mm (6.465 in.)**
- (b) If the length is greater than maximum, replace the bolt.

**48. INSPECT CHAIN TENSIONER ASSY NO.1**

- (a) Check the plunger moves smoothly when the ratchet pawl is raised, and when the ratchet pawl is released, the plunger is locked in place.
- (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 finger.

**49. INSPECT CHAIN SUB-ASSY**

- (a) Using vernier calipers, measure the length of the 15 links with the chain fully stretched.  
**Maximum chain elongation: 115.4 mm (4.543 in.)**

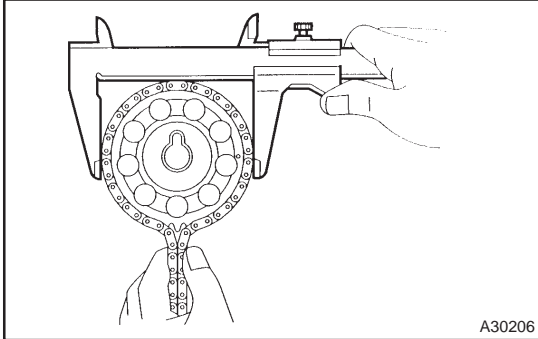
If the elongation is greater than maximum, replace the chain.  
**HINT:**

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

- (b) If the elongation is greater than maximum, replace the chain.

**NOTICE:**

**Make the same measurements pulling at 3 or more places selected at random, and average the length.**

**50. INSPECT CAMSHAFT TIMING GEAR OR SPROCKET**

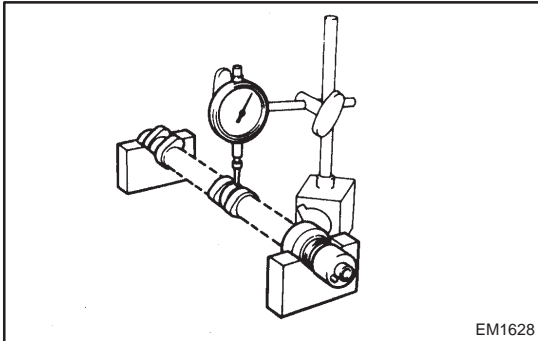
A30206

- (a) Wrap the chain around the timing sprocket.  
 (b) Using a vernier calipers, measure the timing sprocket diameter with the chain.

**Minimum sprocket diameter (w/chain):  
 97.3 mm (3.831 in.)**

**NOTICE:**

**Vernier calipers must contact the chain rollers for the measuring.**

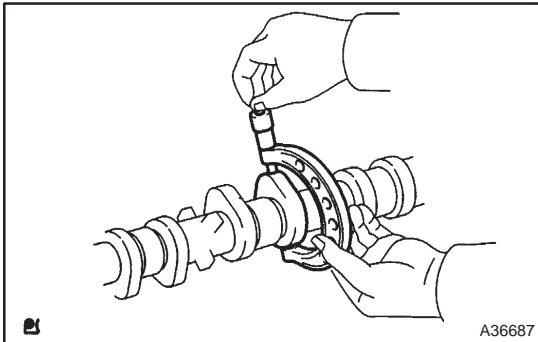
**51. INSPECT CAMSHAFT**

EM1628

- (a) Inspect the 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: 0.03 mm (0.0012 in.)**

- (b) If the circle runout is greater than maximum, replace the camshaft.



A36687

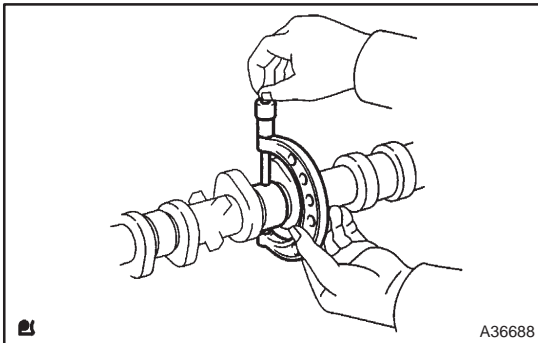
- (c) Inspect cam lobe height.  
 (1) Using a micrometer, measure the cam lobe height.

**Standard cam lobe height:**

**46.495 – 46.595 mm (1.8305 – 1.8345 in.)**

**Minimum cam lobe height: 46.385 mm (1.8262 in.)**

- (d) If the cam lobe height is less than minimum, replace the camshaft.



A36688

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

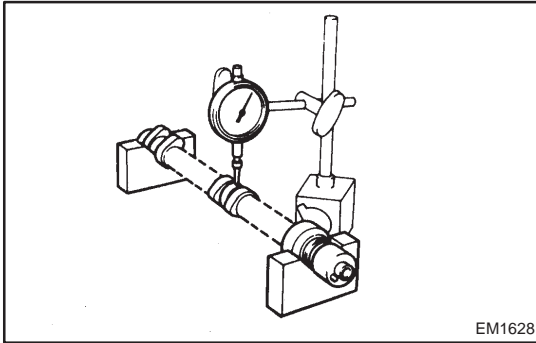
**No. 1 journal diameter:**

**35.971 – 35.985 mm (1.4162 – 1.4167 in.)**

**Other journal diameter:**

**22.959 – 22.975 mm (0.9039 – 0.9045 in.)**

- (f) If the journal diameter is not as specified, check the oil clearance.

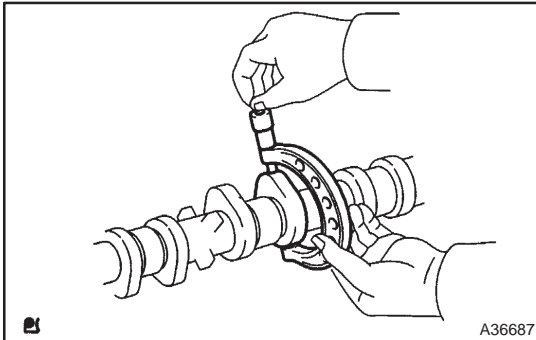


## 52. INSPECT NO.2 CAMSHAFT

- (a) Place the camshaft on V-blocks.
- (b) Using a dial indicator, measure the circle runout at the center journal.

**Maximum circle runout: 0.03 mm (0.0012 in.)**

- (c) If the circle runout is greater than maximum, replace the camshaft.



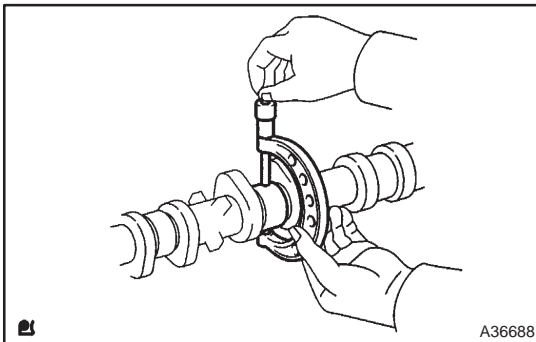
- (d) Inspect cam lobe height.
- (1) Using a micrometer, measure the cam lobe height.

**Standard cam lobe height:**

**45.983 – 46.083 mm (1.8104 – 1.8143 in.)**

**Minimum cam lobe height: 45.873 mm (1.8060 in.)**

- (e) If the cam lobe height is less than minimum, replace the camshaft.



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

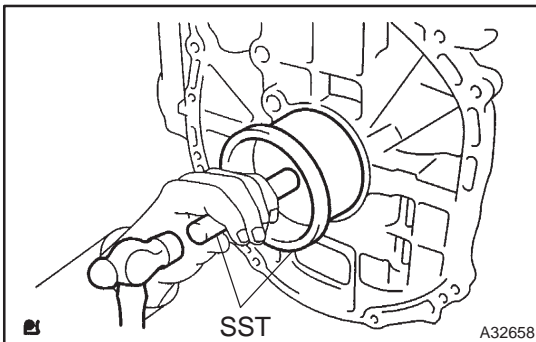
**No. 1 journal diameter:**

**35.971 – 35.985 mm (1.4162 – 1.4167 in.)**

**Other journal diameter:**

**22.959 – 22.975 mm (0.9039 – 0.9045 in.)**

- (g) If the journal diameter is not as specified, check the oil clearance.



## 53. INSTALL ENGINE REAR OIL SEAL

- (a) Apply MP grease to a new oil seal lip.

**NOTICE:**

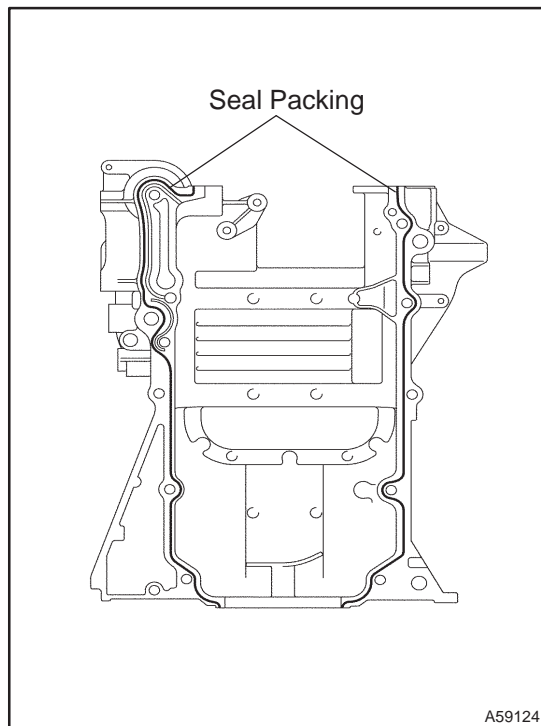
**Keep the lip off the foreign materials.**

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

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

**NOTICE:**

**Wipe off extra grease on the crank shaft.**



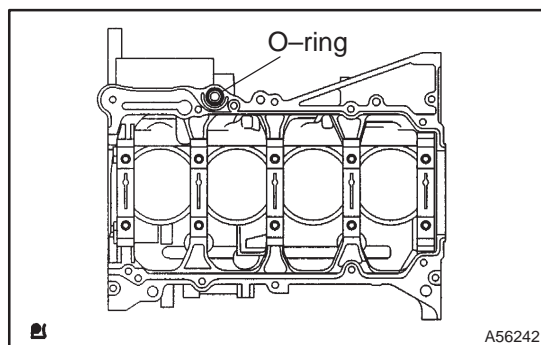
#### 54. INSTALL STIFFENING CRANKCASE ASSY

- (a) Apply seal packing in the shape of bead (Diameter 2.5 mm – 3 mm (0.098 – 0.118 in.)) the places shown in the illustration.

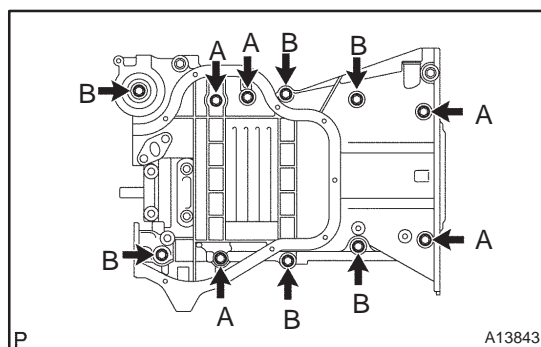
**Seal packing: Part No. 08826-00080 or equivalent**

**NOTICE:**

- Remove any oil from the contact surface.
- Install the crank case within 3 minutes after applying seal packing.
- Do not start the engine within 2 hours after installing.



- (b) Install a new O-ring the place shown in the illustration.



- (c) Temporarily install the crank case with the 11 bolts.

**HINT:**

Each bolt length is indicated in the illustration.

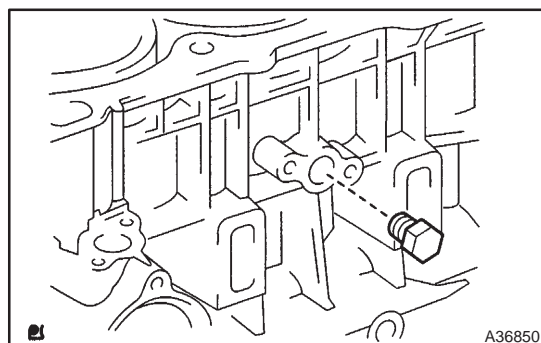
**Bolt length:**

**112 mm (4.41 in.) for A of 12 mm head**

**35 mm (1.38 in.) for B of 12 mm head**

- (d) Uniformly tighten the bolts, stud bolts and nuts in several passes.

**Torque: 33 N·m (332 kgf·cm, 24 ft·lbf)**



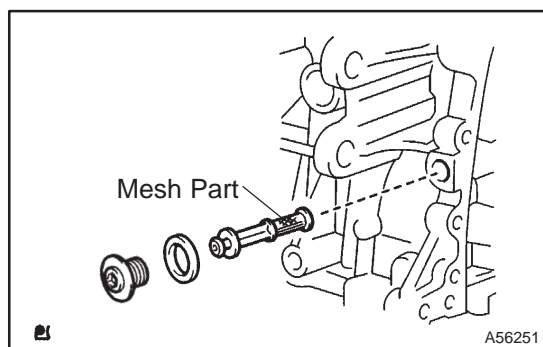
#### 55. INSTALL W/HEAD TAPER SCREW PLUG NO.1

- (a) Apply adhesive to the threads of the plug and install.

**Adhesive:**

**Part No. 08833-00070, THREE BOND 1324 or equivalent.**

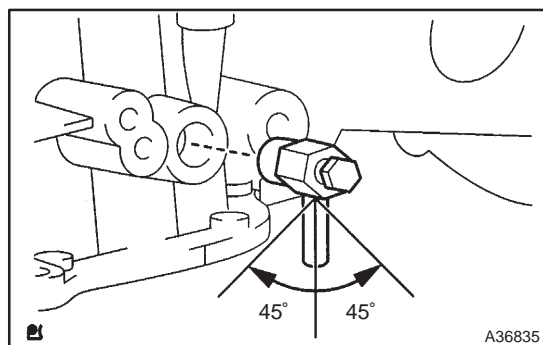
**Torque: 26 N·m (265 kgf·cm, 19 ft·lbf)**



### 56. INSTALL OIL CONTROL VALVE FILTER

- (a) Check that no foreign substance on the mesh part of the filter.
- (b) Using a 8 mm socket hexagon wrench, install the oil control valve filter with a new gasket.

**Torque: 30 N·m (306 kgf·cm, 22 ft·lbf)**



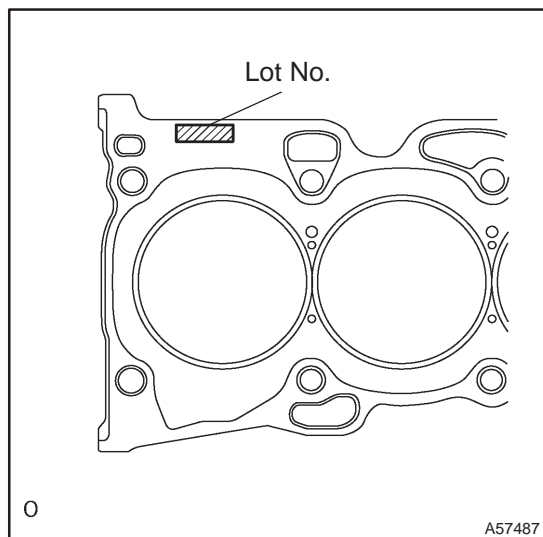
### 57. INSTALL CYLINDER BLOCK WATER DRAIN COCK SUB-ASSY

- (a) Install the water drain cock sub assembly within the range shown in the illustration.

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

### 58. INSTALL UNION(W/ OIL COOLER)

**Torque: 40 N·m (408 kgf·cm, 29 ft·lbf)**



### 59. INSTALL CYLINDER HEAD GASKET

- (a) Place a new cylinder head gasket on the cylinder block surface with the Lot No. stamp upward.

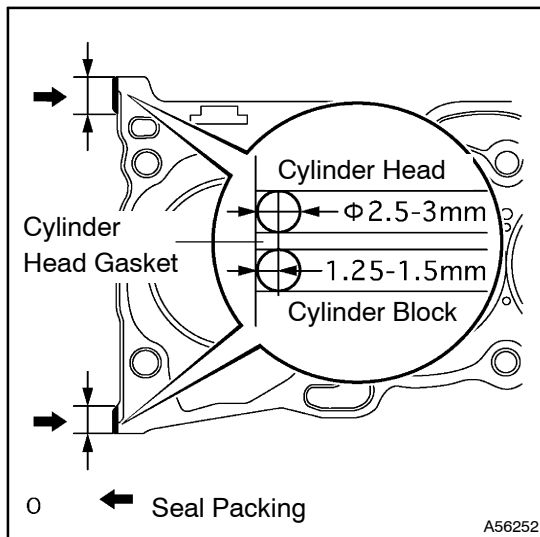
#### NOTICE:

- **Remove any oil from contact surface.**
- **Be careful of the installation direction.**
- **Place the cylinder head quietly in order not to damage the gasket with the bottom part of the head.**

### 60. INSTALL CYLINDER HEAD SUB-ASSY

#### HINT:

The cylinder head bolts are tightened in 2 progressive steps.



- (a) Apply seal packing in the shape of bead (Diameter 2.5 – 3 mm (0.098 – 0.118 in.)) consequently as shown in the illustration.

**Seal packing: Part No. 08826-00080 or equivalent**

**NOTICE:**

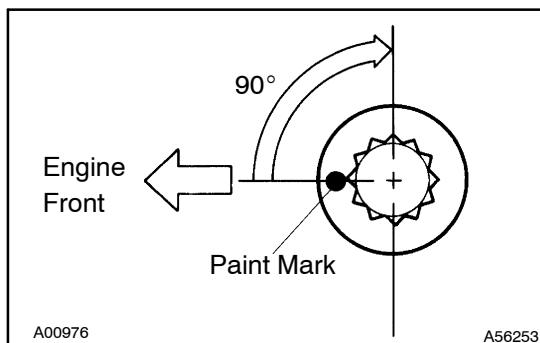
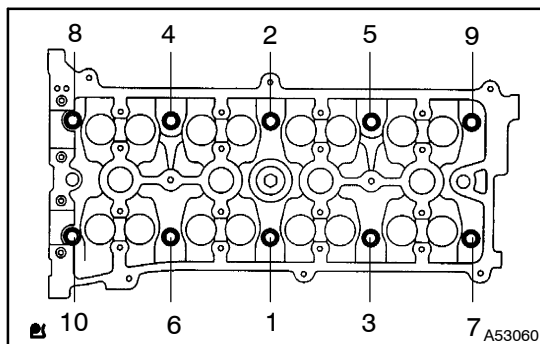
- **Remove any oil from contact surface.**
  - **Install the cylinder head within 3 minutes after applying seal packing.**
  - **After installing the cylinder head, cylinder head bolts must be tightened within 15 minutes.**
- (b) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.
- (c) Install bolts and plate washers to the cylinder head.

**NOTICE:**

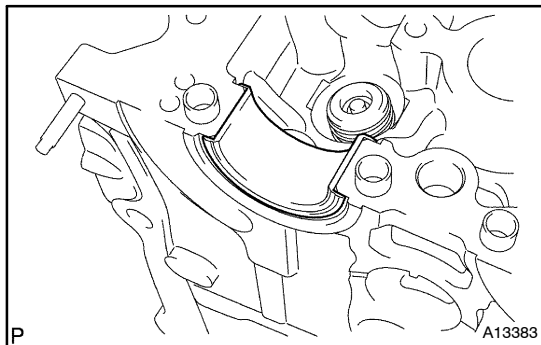
**Do not drop the washers into the cylinder head.**

- (d) Using a 10 mm bi-hexagon wrench, temporarily tighten each bolts in the several passes, as the sequence shown in the illustration, and fully tighten with specified torque.

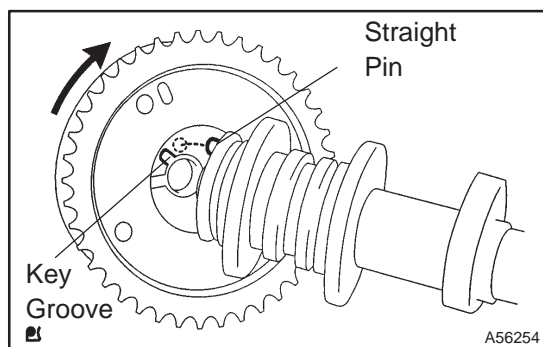
**Torque: 79 N·m (806 kgf·cm, 58 ft·lbf)**



- (e) Mark the front side of each cylinder head bolt with paint.
- (f) Retighten the cylinder head bolts by 90° in the sequence shown.
- (g) Check that the painted marks are now at a 90° angle to the front.



## 61. INSTALL CAMSHAFT BEARING NO.2



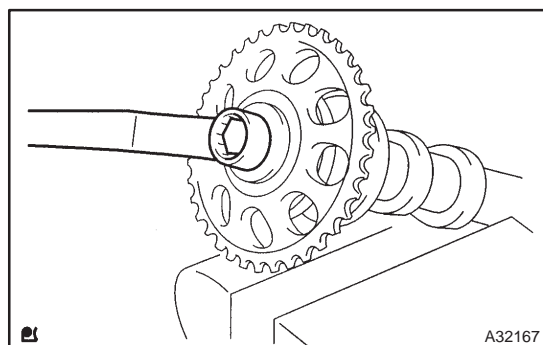
## 62. INSTALL CAMSHAFT TIMING GEAR ASSY

- Put the camshaft timing gear assembly and the camshaft together with the straight pin of the key groove.
- Turn the camshaft timing gear assembly to the left direction (as shown in the illustration) with pushing it lightly against the camshaft. Push further at the position where the pin gets into the groove.

### CAUTION:

**Be sure not to turn the camshaft timing gear to the retard angle side (to the right angle).**

- Check that there is no clearance between the gear's fringe and the camshaft.
- Tighten the fringe bolt with the camshaft timing gear fixed.  
**Torque: 54 N·m (551 kgf·cm, 50 ft·lbf)**
- Check that the camshaft timing gear assembly can move to the retard angle side (the right direction), and is locked at the most retarded position.

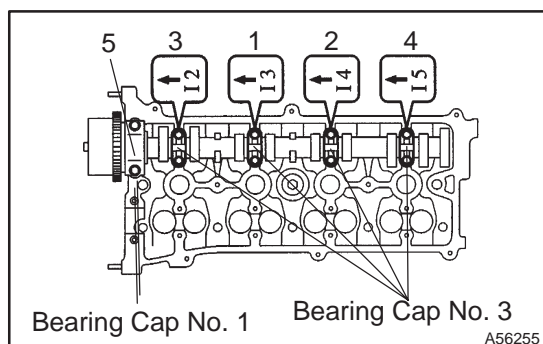


## 63. INSTALL CAMSHAFT TIMING GEAR OR SPROCKET

- Fix the camshaft No. 2 to the vise, and install camshaft No. 2 timing gear.

**Torque: 54 N·m (551 kgf·cm, 40 ft·lbf)**

## 64. INSTALL CAMSHAFT BEARING NO.1



## 65. INSTALL CAMSHAFT

- Tighten camshaft bearing cap No.1 and No. 3 as the sequence shown in the illustration.

### Torque:

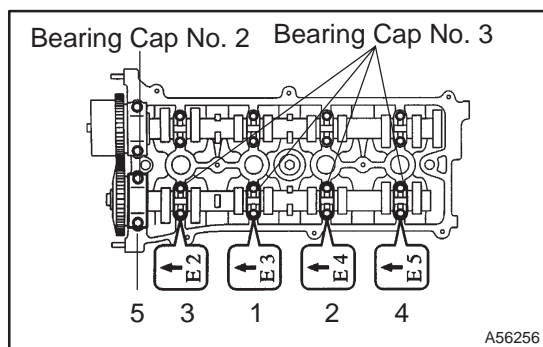
**Bearing cap No. 1 29.5 N·m (300 kgf·cm, 22 ft·lbf)**

**Bearing cap No. 3 9 N·m (90 kgf·cm, 80 in·lbf)**

### NOTICE:

- Tighten the bolts after deciding the position for the thrust direction of the camshaft by bearing cap No. 1.
- Install the camshaft with its timing mark of camshaft timing gear on top.





## 66. INSTALL NO.2 CAMSHAFT

- (a) Tighten camshaft bearing cap No.2 and No. 3 as the sequence shown in the illustration.

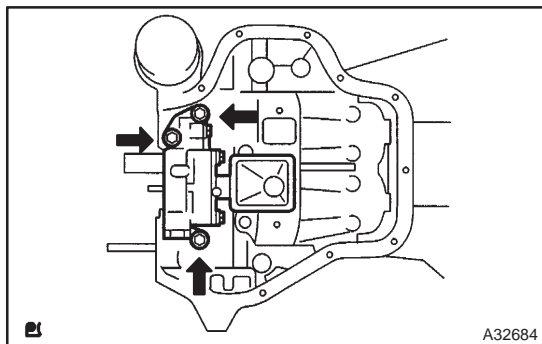
### Torque:

**Bearing cap No. 2** 29.5 N·m (300 kgf·cm, 22 ft·lbf)

**Bearing cap No. 3** 9 N·m (90 kgf·cm, 80 in·lbf)

### NOTICE:

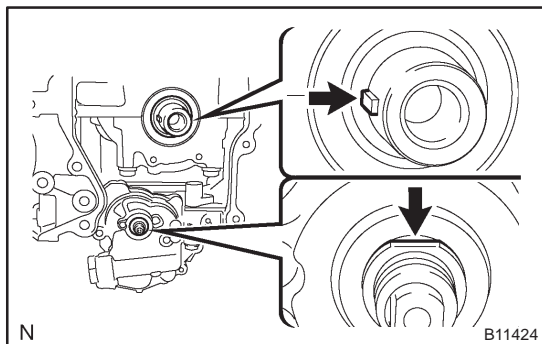
- Tighten the bolts after deciding the position for the thrust direction of the camshaft by bearing cap No. 2.
- Install the camshaft with its timing mark of camshaft timing gear on top.



## 67. INSTALL OIL PUMP ASSY

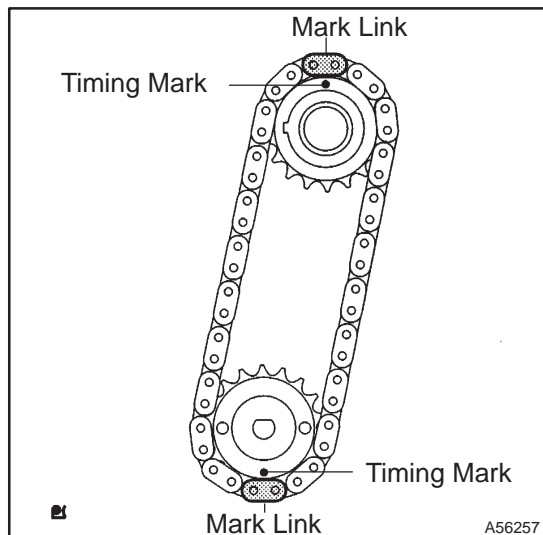
- (a) Install oil pump assembly with 3 bolts and a new gaskets.

**Torque: 19 N·m (195 kgf·cm, 15 ft·lbf)**

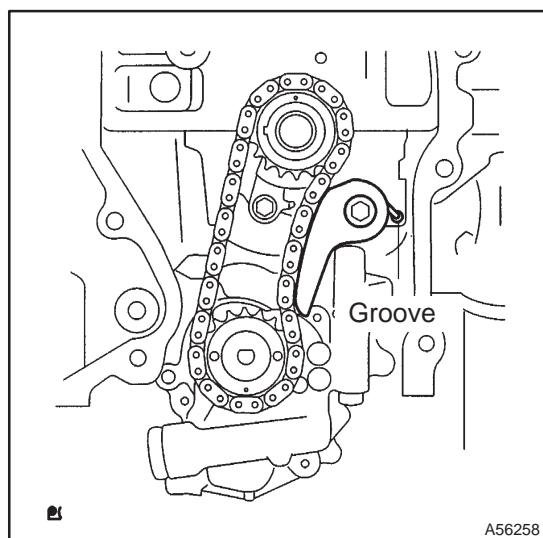


## 68. INSTALL NO.2 CHAIN SUB-ASSY

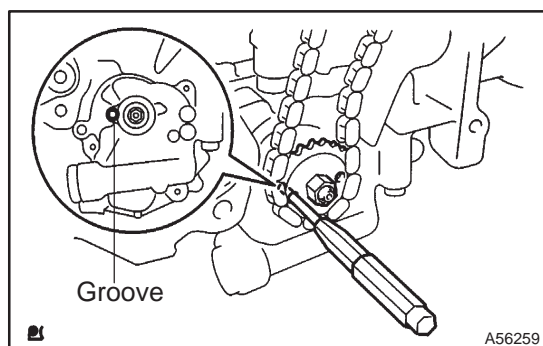
- (a) Set the crankshaft key into the left horizontal position.  
(b) Turn the cutout of the drive shaft to the top.



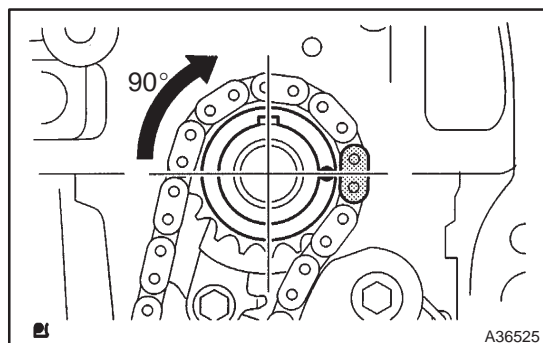
- (c) Align the mark links (yellow colored links) with the timing marks of gear as shown in the illustration.  
(d) Insert the gear with chain to the crankshaft and oil pump shaft.  
(e) Temporarily tighten the oil pump drive shaft gear by a nut.



- (f) Insert the damper spring into the adjusting hole, and install the chain tensioner plate by a bolt.  
**Torque: 12 N·m (120 kgf·cm, 9 ft·lbf)**



- (g) Align an adjusting hole of the sprocket with the groove of the oil pump.  
 (h) Put a bar ( $\phi$  4mm) into the adjusting hole of the sprocket to lock in position, and assemble a nut.  
**Torque: 29.5 N·m (300 kgf·cm, 20 ft·lbf)**

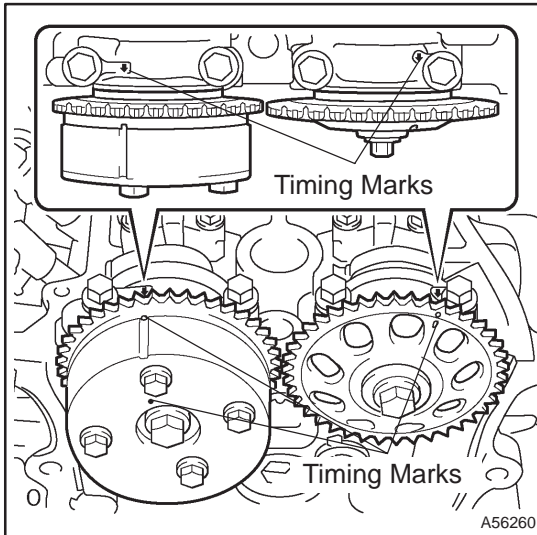


- (i) Rotate the crankshaft clockwise  $90^\circ$ , and align the crankshaft key with the top.

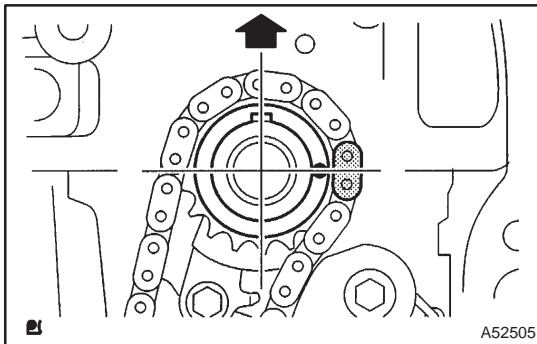
## 69. INSTALL CRANKSHAFT TIMING GEAR OR SPROCKET

## 70. INSTALL CHAIN VIBRATION DAMPER NO.1

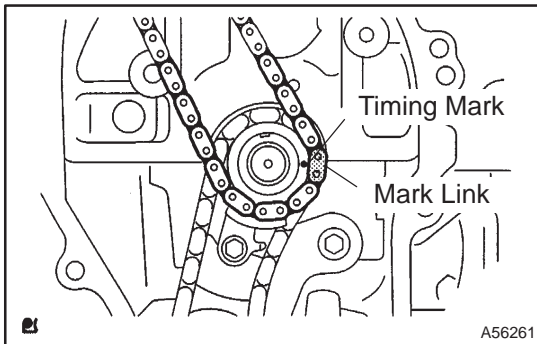
- (a) Install the chain vibration damper with the 2 bolts.  
**Torque: 9 N·m (90 kgf·cm, 80 in·lbf)**

**71. INSTALL CHAIN SUB-ASSY**

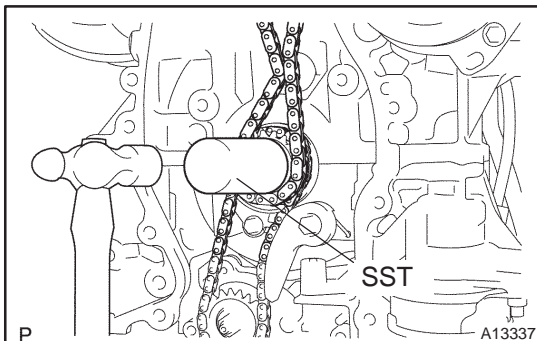
- (a) Set No. 1 cylinder to TDC/compression.  
 (1) Align the timing marks of the camshaft timing sprockets and No. 1 bearing caps.



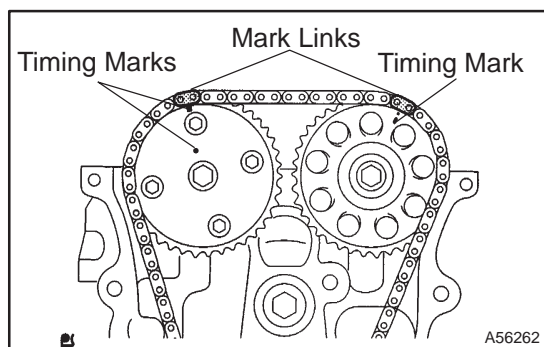
- (2) Using the crankshaft pulley bolt, turn the crankshaft and set the set key on the crankshaft upward.



- (b) Align the mark plate (blue or orange colored link) with the timing mark of the crankshaft timing gear.



- (c) Using SST, install the sprocket.  
 SST 09309-37010



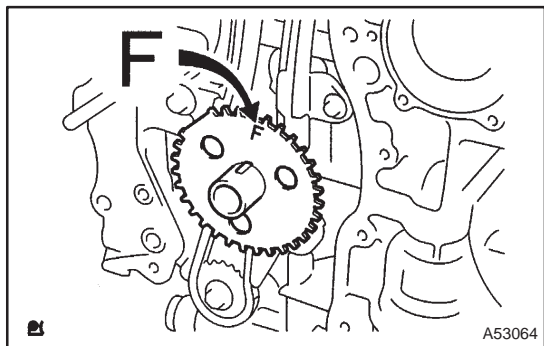
- (d) Align the mark links (gold or yellow colored links) with the timing marks of the camshaft timing gear, and install the chain.

## 72. INSTALL CHAIN TENSIONER SLIPPER

**Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)**

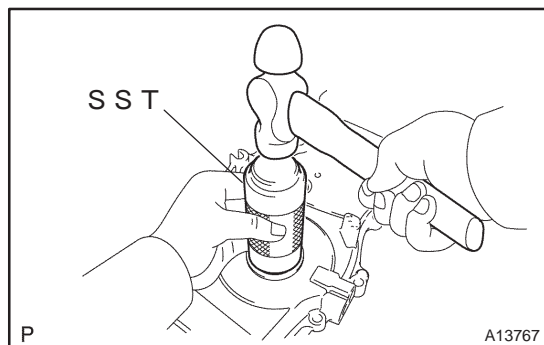
## 73. INSTALL TIMING CHAIN GUIDE

**Torque: 9 N·m (90 kgf·cm, 80 in·lbf)**



## 74. INSTALL CRANKSHAFT POSITION SENSOR PLATE NO.1

- (a) Install crank angle sensor plate with the "F" mark facing forward.

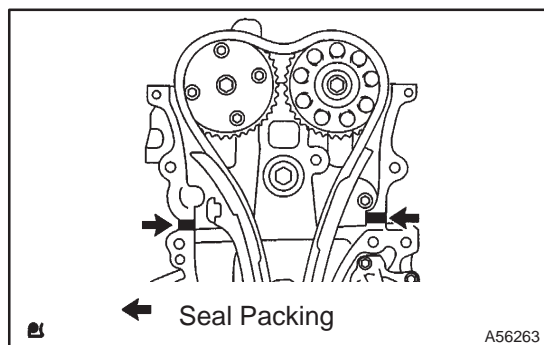


## 75. INSTALL TIMING GEAR CASE OR TIMING CHAIN CASE OIL SEAL

- (a) Using SST and a hammer, tap in a new oil seal until its surface is flush with the timing chain cover edge.  
SST 09309-37010  
(b) Apply a light coat of MP grease to the lip of a new oil seal.

### NOTICE:

**Keep the lip off foreign materials.**



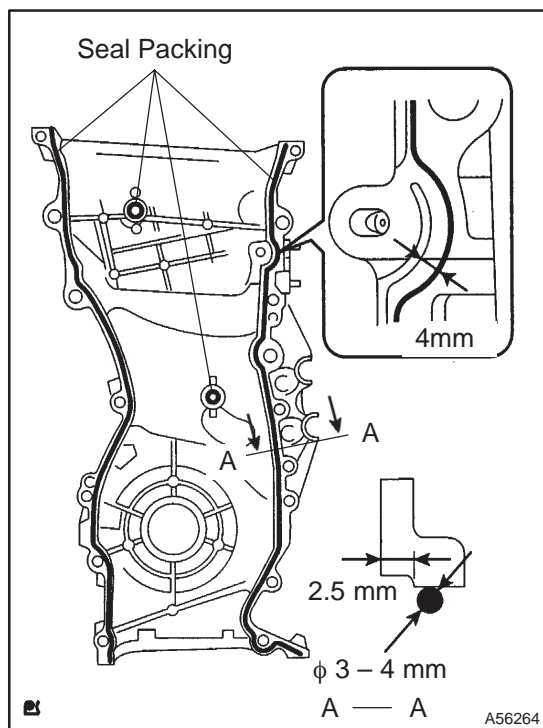
## 76. INSTALL TIMING CHAIN OR BELT COVER SUB-ASSY

### NOTICE:

- Remove any oil from the contact surface.
  - Install the chain cover within 3 minutes after applying seal packing.
  - Do not start the engine within 2 hours after installing.
- (a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the timing chain cover, cylinder head and cylinder block.

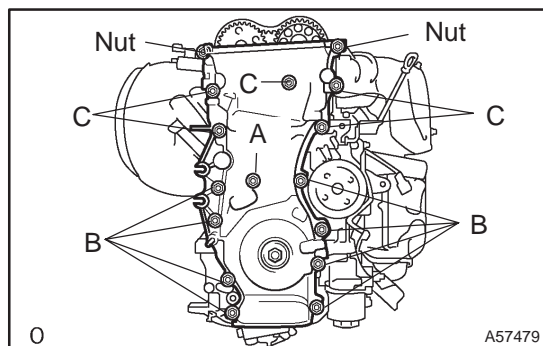
- (b) Apply seal packing in the shape of bead (Diameter 2 mm (0.09 in.)) as shown in the illustration.

**Seal packing: Part No. 08826-00080 or equivalent**



- (c) Apply seal packing in the shape of bead (Diameter 3 – 4 mm (0.118 – 0.157 in.)) as shown in the illustration.

**Seal packing: Part No. 08826-00080 or equivalent**



- (d) Install the timing chain cover with the 14 bolts and 2 nuts.

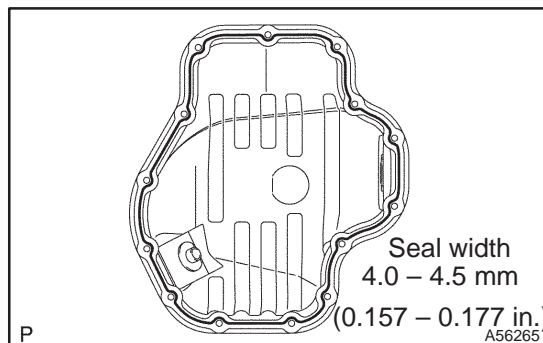
**Torque:**

**Bolt A 9.0 N·m (90 kgf·cm, 80 in·lbf)**

**Bolt B 21 N·m (220 kgf·cm, 15 ft·lbf)**

**Bolt C 43 N·m (440 kgf·cm, 32 ft·lbf)**

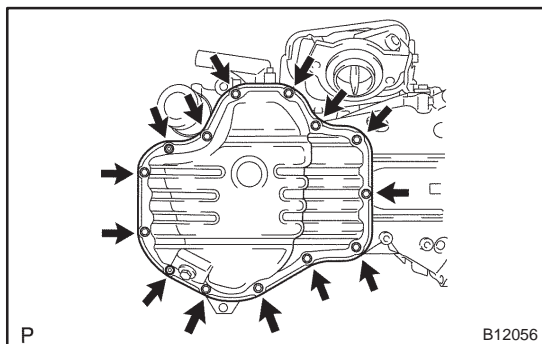
**Nut 9.0 N·m (90 kgf·cm, 80 in·lbf)**



## 77. INSTALL OIL PAN SUB-ASSY

### NOTICE:

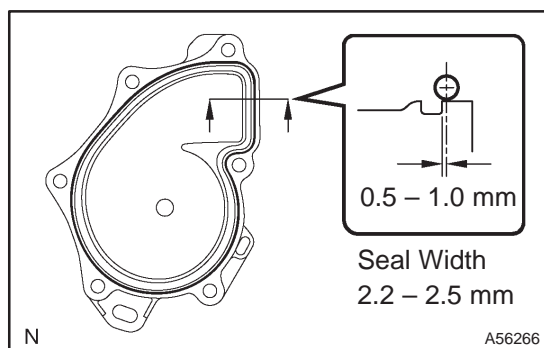
- Remove any oil from the contact surface.
  - Install the oil pan within 3 minutes after applying seal packing.
  - Do not start the engine within 2 hours after installing.
- (a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the cylinder block and oil pan.
- (b) Apply seal packing in the shape of bead (Diameter 3 mm – 4 mm (0.157 in.)) as shown in the illustration, and install the oil pan.
- Seal packing: Part No. 08826-00080 or equivalent**



- (c) Install the oil pan with the 12 bolts and 2 nuts.  
**Torque: 9.0 N·m (90 kgf·cm, 80 in·lbf)**

## 78. INSTALL OIL PAN DRAIN PLUG

- (a) Install an oil pan drain plug with a new gasket.  
**Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)**

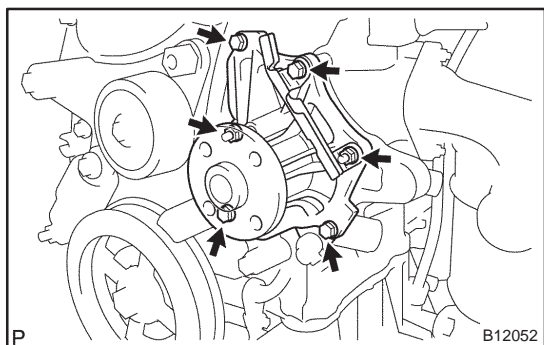


## 79. INSTALL WATER PUMP ASSY

- (a) Clean the contact surface of the cylinder block.  
 (b) Apply seal packing in the shape of bead (Diameter 2.2 – 2.5 mm) to the outside edge of the water pump.  
**Seal packing: Part No. 08826-00100 or equivalent**

### NOTICE:

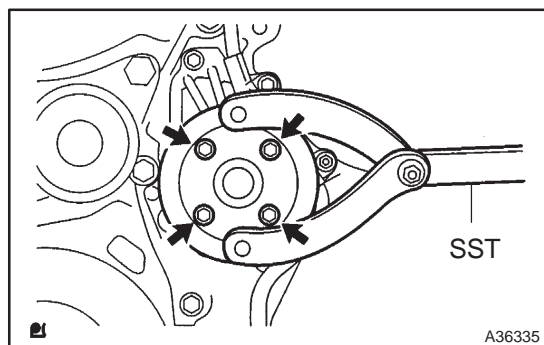
- Remove any oil from the contact surface.
- Install the water pump within 5 minutes after applying seal packing.
- Do not start the engine within 2 hours after installing.



- (c) Install the water pump assembly with 4 bolts and 2 nuts.  
**Torque: 9.0 N·m (90 kgf·cm, 80 in·lbf)**

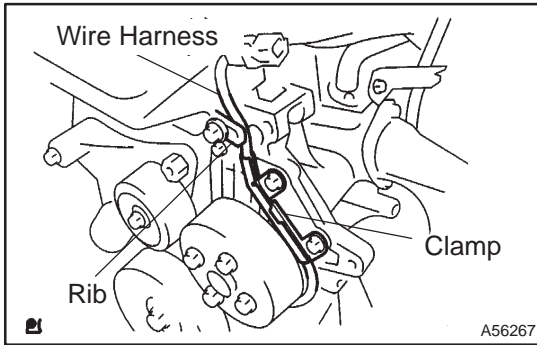
### NOTICE:

**Tighten the outside bolts and nuts with the clamp.**

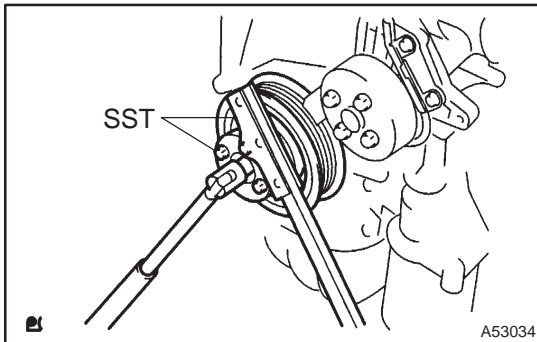


## 80. INSTALL WATER PUMP PULLEY

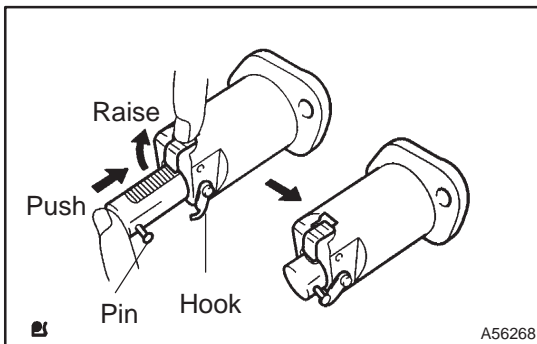
- (a) Using SST, install the water pump pulley.  
 SST 09960-10010 (09962-01000, 09963-00600)  
**Torque: 26 N·m (265 kgf·cm, 19 ft·lbf)**

**81. INSTALL CRANK POSITION SENSOR**

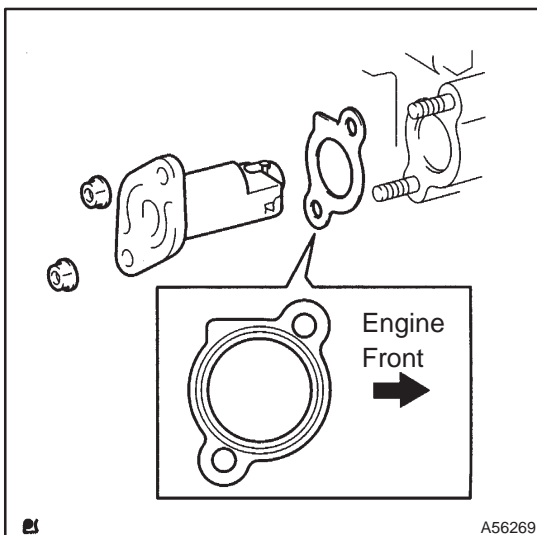
- (a) Install the bolt and crankshaft position sensor.  
**Torque: 9.0 N·m (90 kgf·cm, 80 in·lbf)**
- (b) Confirm the wire harness of the crank position sensor is placed as shown in the illustration.

**82. INSTALL CRANKSHAFT PULLEY**

- (a) Using SST, tighten the set bolt.  
SST 09213-54015 (91651-60855), 09330-00021  
**Torque: 170 N·m (1735 kgf·cm, 125 ft·lbf)**

**83. INSTALL CHAIN TENSIONER ASSY NO.1**

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

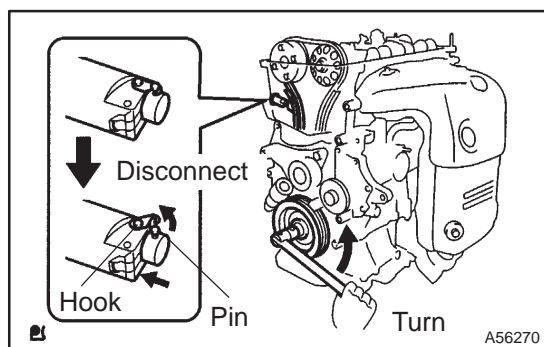


- (b) Install a new gasket chain tensioner with 2 nuts.  
**Torque: 9.0 N·m (90 kgf·cm, 80 in·lbf)**

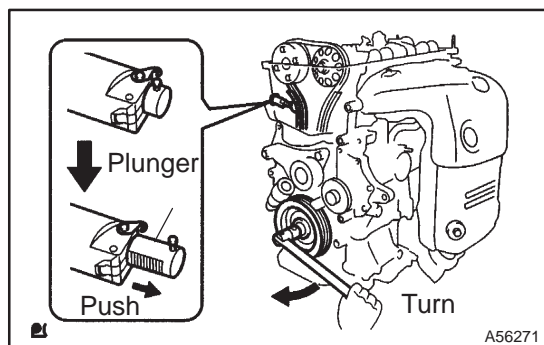
**NOTICE:**

If the hook is released while inserting, apply the hook again, and insert the chain tensioner.

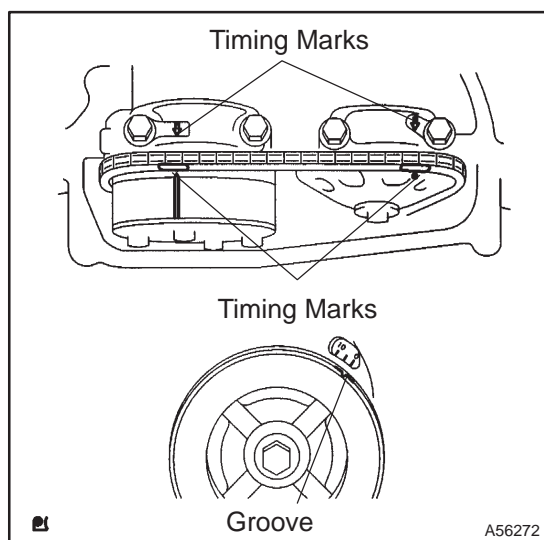




- (c) Turn the crankshaft counterclockwise, and check the plunger knock pin is disconnected from the hook.

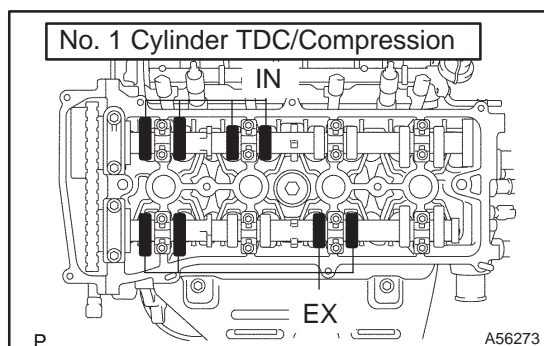


- (d) Turn the crankshaft clockwise, and check the plunger is pushed by the plunger.



#### 84. INSPECT VALVE CLEARANCE

- (a) Turn the crankshaft pulley, and align its groove with the timing mark "0" of the timing chain cover.
- (b) Check that the timing marks of the camshaft timing sprockets are aligned with the timing marks of the No. 1 bearing cap as shown in the illustration.



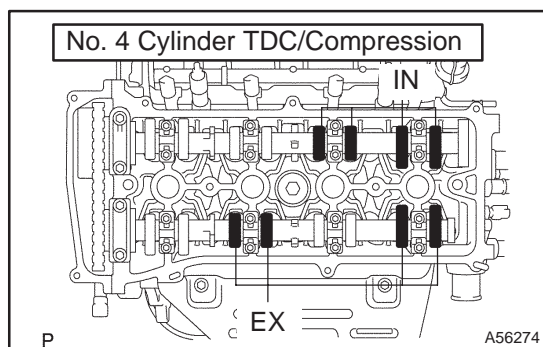
- (c) Check only the valve indicated.
- (1) Using a feeler gauge, measure the clearance between the valve lifter and camshaft.
  - (2) Record the out-of-specification valve clearance measurements. They will be used later to determine the required replacement valve lifter.

#### Valve clearance (cold):

**Intake 0.19 – 0.29 mm (0.008 – 0.011 in.)**

**Exhaust 0.30 – 0.40 mm (0.012 – 0.016 in.)**

- (d) Turn the crankshaft 1 revolution (360°) clockwise, and set No.4 cylinder to TDC/compression.

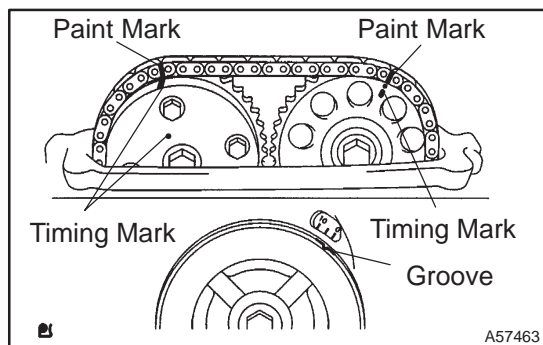


- (e) Check only the valve indicated.
- (1) Using a feeler gauge, measure the clearance between the valve lifter and camshaft.
  - (2) Record the out-of-specification valve clearance measurements. They will be used later to determine the required replacement valve lifter.

**Valve clearance (cold):**

**Intake 0.19 – 0.29 mm (0.008 – 0.011 in.)**

**Exhaust 0.30 – 0.40 mm (0.012 – 0.016 in.)**

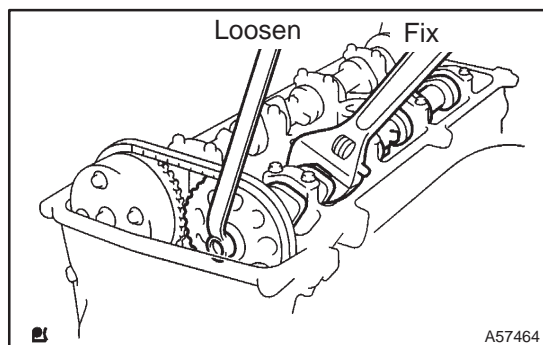


## 85. ADJUST VALVE CLEARANCE

**NOTICE:**

**Do not turn the crankshaft without the chain tensioner.**

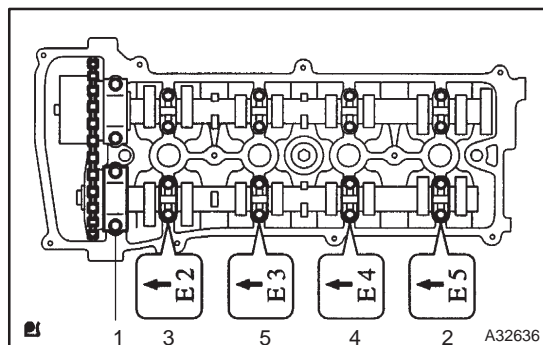
- (a) Turn the crankshaft 1 revolution (360°) clockwise, and set No. 1 cylinder to TDC/compression.
- (b) Place matchmarks on the timing chain and camshaft timing gear.
- (c) Remove the 2 bolts and chain tensioner.



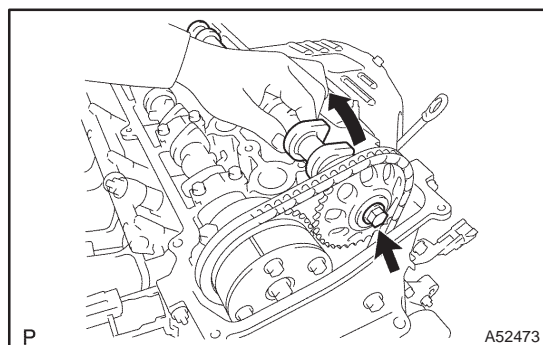
- (d) Fix the camshaft with a spanner and so on, then loosen the camshaft timing gear set bolt.

**NOTICE:**

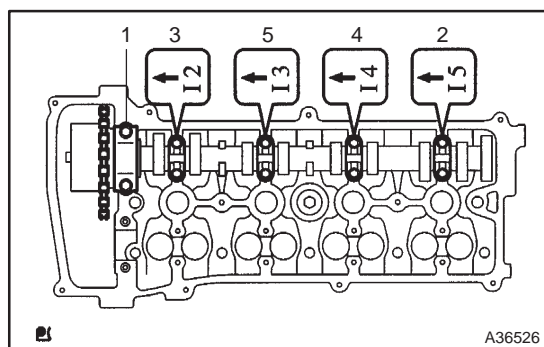
**Be careful not to damage the valve lifter.**



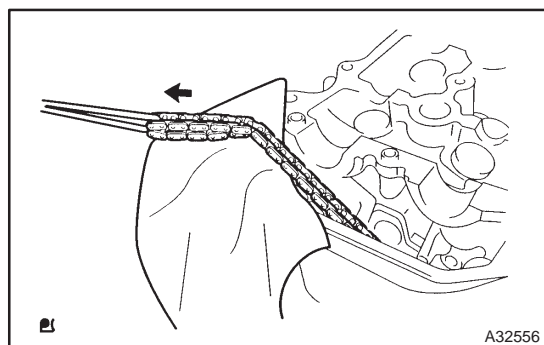
- (e) Loosen the camshaft bearing cap bolts on No. 2 camshaft in the sequence shown in the illustration in several passes, and remove the caps.



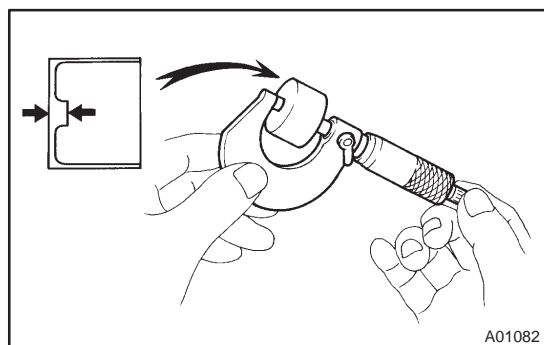
- (f) Raising the camshaft, remove the set bolt.
- (g) Remove the timing chain sprocket from the camshaft with timing chain.
- (h) Remove the timing chain sprocket from the timing chain.



- (i) Loosen the camshaft bearing cap bolts on camshaft in the sequence shown in the illustration, in several passes, and remove the caps.
- (j) Remove the intake camshaft.



- (k) Tie the timing chain with a string.



- (l) Using a micrometer, measure the thickness of the removed lifter.
- (m) Calculate the thickness of a new lifter so that the valve clearance comes within the specified value.

A	Thickness of the new lifter
B	Thickness of the used lifter
C	Measured valve clearance

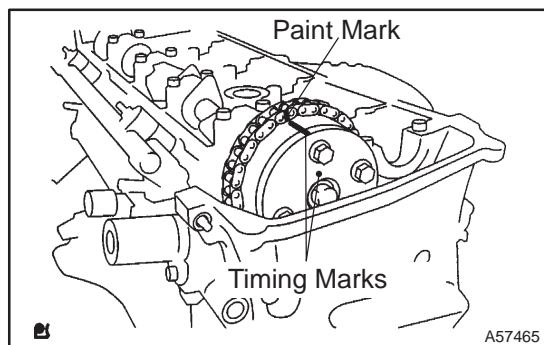
#### Valve clearance:

**Intake  $A = B + (C - 0.24 \text{ mm (0.0094 in.)})$**

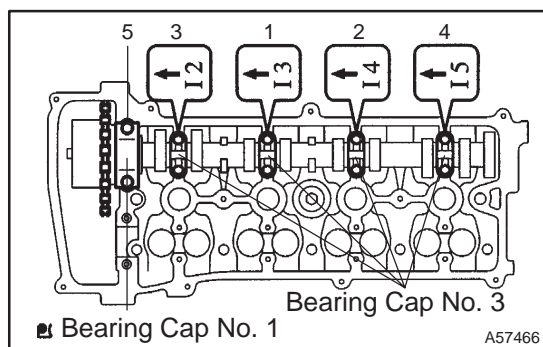
**Exhaust  $A = B + (C - 0.35 \text{ mm (0.0138 in.)})$**

#### HINT:

- Select a new lifter with a thickness as close as possible to the calculated values.
- Lifter are available in 35 sizes in increments of 0.020 mm (0.0008 in.), from 5.060 mm (0.1992 in.) to 5.740 mm (0.2260 in.).



- (n) Install the timing chain on the camshaft timing gear, with the painted links aligned with the timing marks on the camshaft timing sprockets.

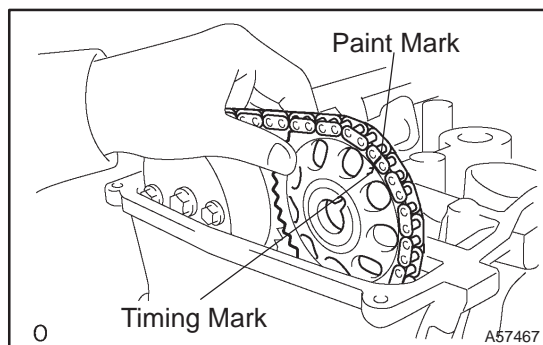


- (o) Examine the front marks and numbers and tighten the bolts in the order shown in the illustration.

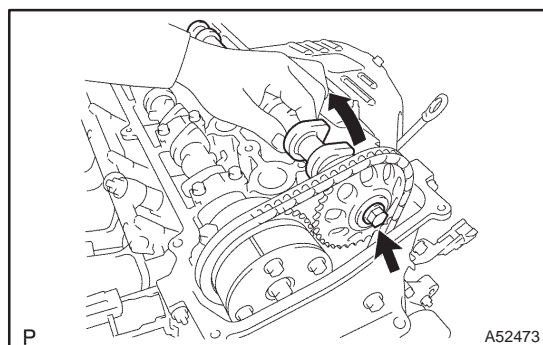
**Torque:**

**Bearing cap No. 1 29.5 N·m (300 kgf·cm, 22 ft·lbf)**

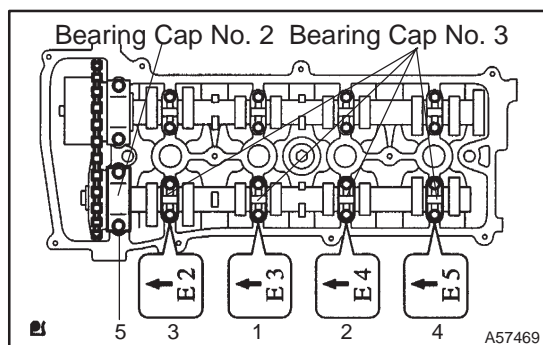
**Bearing cap No. 3 9.0N·m (90 kgf·cm, 80 in·lbf)**



- (p) Put the camshaft No. 2 on the cylinder head with the painted links of chain aligned with the timing mark on the camshaft timing sprockets.



- (q) Raising the camshaft, tighten the set bolt temporarily.

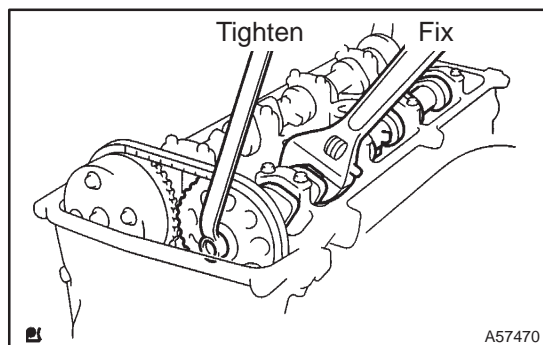


- (r) Examine the front marks and numbers and tighten the bolts in the sequence shown in the illustration.

**Torque:**

**Bearing cap No. 2 29.5 N·m (300 kgf·cm, 22 ft·lbf)**

**Bearing cap No. 3 9.0N·m (90 kgf·cm, 80 in·lbf)**

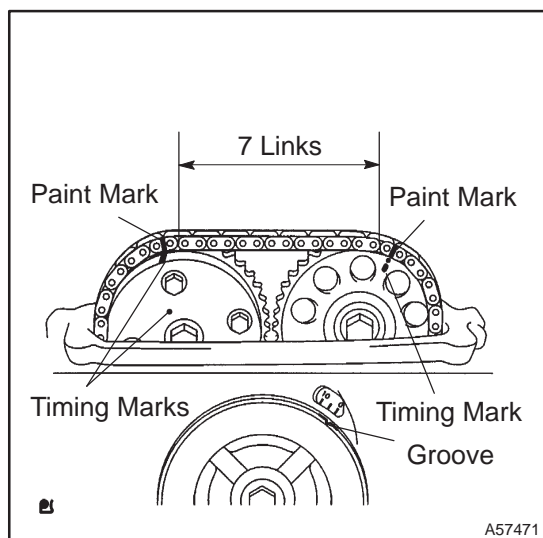


- (s) Fix the camshaft with a spanner and so on, then tighten the camshaft timing gear set bolt.

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

**NOTICE:**

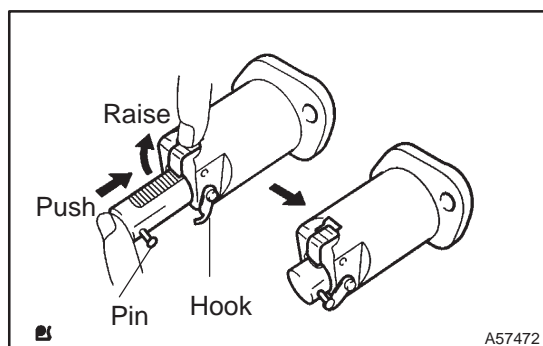
**Be careful not to damage the valve lifter.**



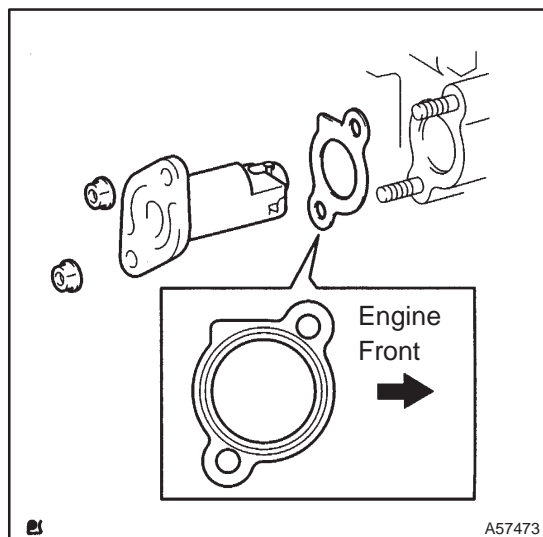
- (t) As shown in the illustration, check the matchmarks on the timing chain and camshaft timing sprockets and the alignment of the pulley groove with timing mark of the chain cover.

HINT:

There are 7 links between the timing marks.



- (u) Install chain tensioner.
- (1) Release the ratchet pawl, fully push in the plunger and apply the hook to the pin so that the plunger cannot spring out.

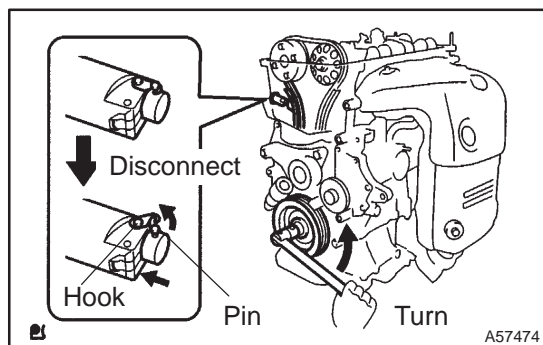


- (2) Install a new gasket and chain tensioner with the 2 nuts.

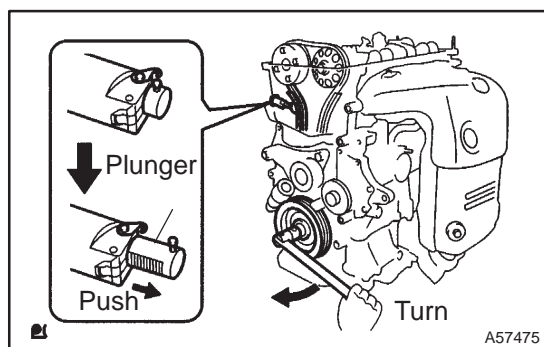
**Torque: 9.0N·m (90 kgf·cm, 80 in·lbf)**

**NOTICE:**

**When installing the tensioner, set the hook again if the hook releases the plunger.**



- (3) Turn the crankshaft counterclockwise, and disconnect the plunger knock pin from the hook.



- (4) Turn the crankshaft clockwise, and check that the slipper is pushed by the plunger.

## 86. INSTALL CAMSHAFT POSITION SENSOR

**Torque: 9.0 N·m (90 kgf·cm, 80 in·lbf)**

## 87. INSTALL CYLINDER HEAD COVER GASKET

- (a) Install the gasket to the cylinder head cover.

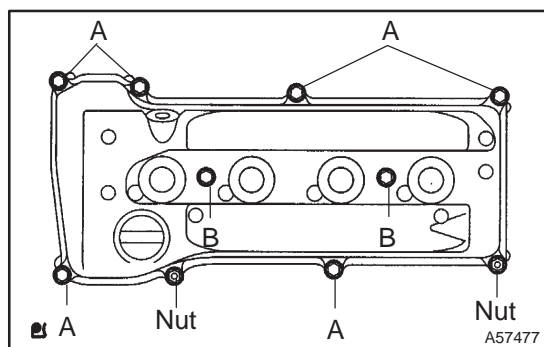
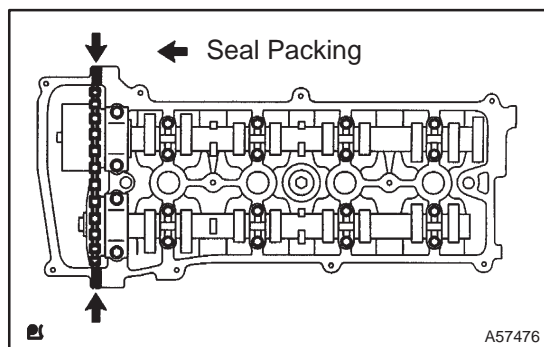
## 88. INSTALL CYLINDER HEAD COVER SUB-ASSY

- (a) Remove any old packing (FIPG) material.
- (b) Apply seal packing to 2 locations 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 engine oil 2 hours after installing.



- (c) Install the cylinder head cover with the 8 bolts and 2 nuts.

### Torque:

**Bolt A 11 N·m (112 kgf·cm, 8 ft·lbf)**

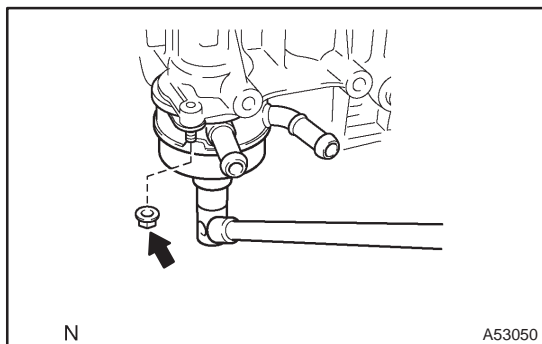
**Bolt B 14 N·m (143 kgf·cm, 10 ft·lbf)**

**Nut 11 N·m (112 kgf·cm, 8 ft·lbf)**

## 89. INSTALL OIL FILTER UNION(W/O OIL COOLER)

- (a) Using a 12 mm hexagon wrench, install the oil filter union.

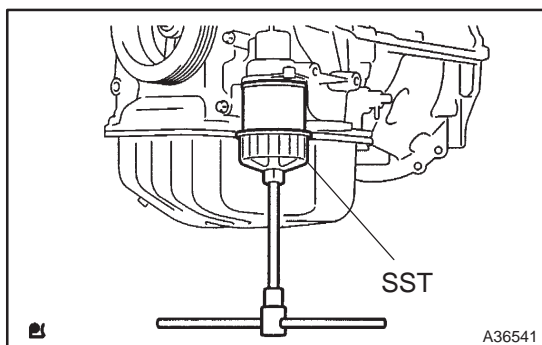
**Torque: 30 N·m (306 kgf·cm, 22 ft·lbf)**

**90. INSTALL OIL COOLER ASSY(W/ OIL COOLER)**

- (a) Install a new O-ring to the oil cooler.
- (b) Apply a light coat of engine oil on the threads and under the head of the union bolt.
- (c) Install the oil cooler and union bolt.
- (d) Install the flange nut.

**Torque: 78.5 N·m (800 kgf·cm, 58 ft·lbf)**

**Torque: 9.0 N·m (90 kgf·cm, 80 in·lbf)**

**91. 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 it an additional 3/4 turn.

SST 09228-06501

**92. INSTALL SPARK PLUG**

**Torque: 19 N·m (194 kgf·cm, 14 ft·lbf)**

**93. INSTALL VENTILATION VALVE SUB-ASSY**

- (a) Apply adhesive on the threads of the ventilation valve.

**Torque: 19 N·m (194 kgf·cm, 14 ft·lbf)**

**Adhesive: Part No. 08833-00070 THREE BOND 1324 or equivalent**

**94. INSTALL OIL FILLER CAP GASKET**

- (a) Install the gasket to the oil filter cap.

**95. INSTALL OIL FILLER CAP SUB-ASSY**