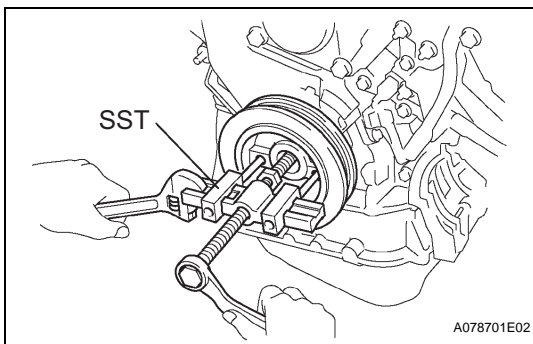
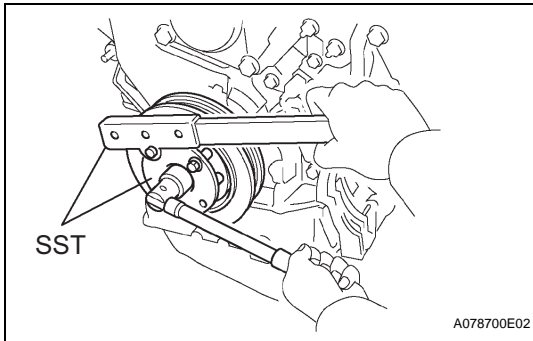


## DISASSEMBLY

1. REMOVE SPARK PLUG
2. REMOVE OIL FILLER CAP SUB-ASSEMBLY
3. REMOVE OIL FILLER CAP GASKET
4. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY LH
5. REMOVE CYLINDER HEAD COVER GASKET NO.2
6. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY
7. REMOVE CYLINDER HEAD COVER GASKET
8. REMOVE VENTILATION VALVE SUB-ASSEMBLY
9. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY
10. REMOVE VVT SENSOR
  - (a) Remove both the 2 camshaft oil control valves.
  - (b) Remove the O-ring from each camshaft oil control valve.
11. REMOVE OIL LEVEL GAGE SUB-ASSEMBLY
12. REMOVE OIL LEVEL GAGE GUIDE
13. REMOVE CRANKSHAFT PULLEY
  - (a) Using SST, loosen the pulley bolt.  
**SST 09213-54015 (91651-60855), 09330-00021**

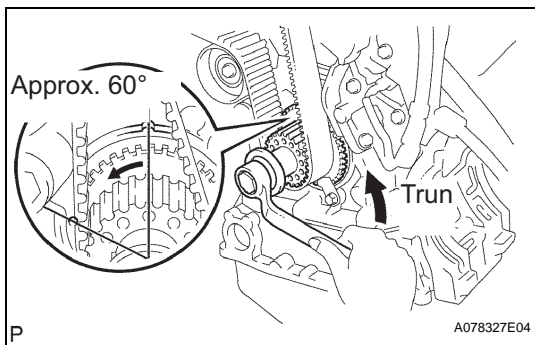
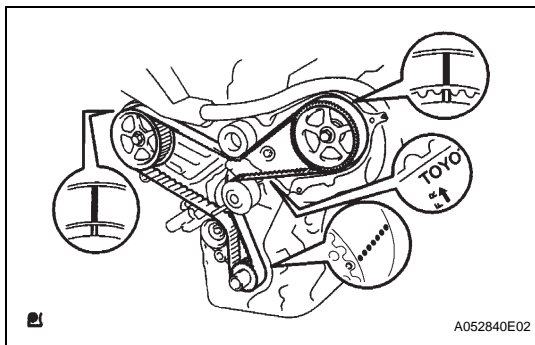
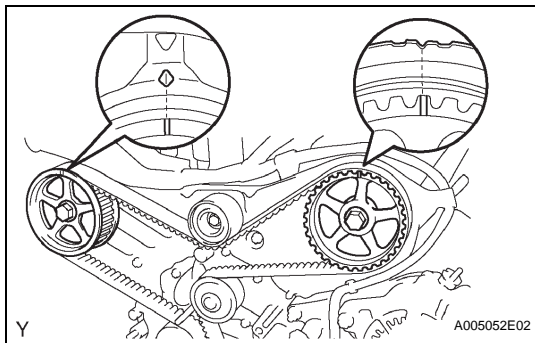
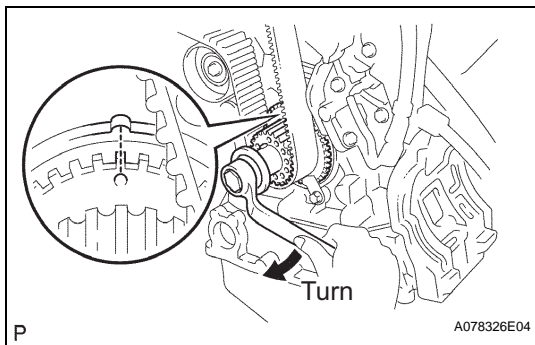


- (b) Using SST and the pulley bolt, remove the pulley.  
**SST 09950-50013 (09951-05010, 09952-05010, 09953-05020, 09954-05031)**

### NOTICE:

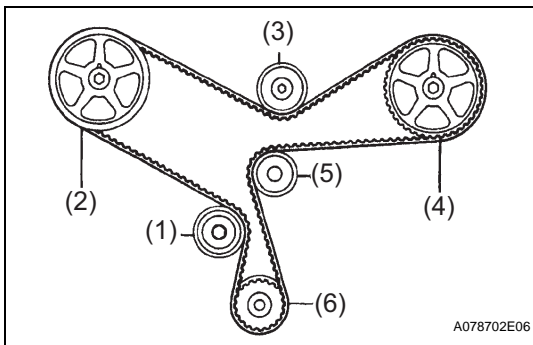
Before using SST, apply lubricating oil on the threads and tip of the SST center bolt 150.

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



## 18. REMOVE TIMING BELT

- (a) Set No. 1 cylinder to TDC/compression.
- (1) Temporarily install the crankshaft pulley bolt and washer to the crankshaft.
  - (2) Turn the crankshaft clockwise, and align the timing mark of the crankshaft timing pulley with the oil pump body.
  - (3) Check that timing marks of the camshaft timing pulleys and No. 3 timing belt cover are aligned. If not, turn the crankshaft 1 revolution (360°).
  - (4) Remove the crankshaft pulley bolt.
- (b) If re-using the timing belt, check that there are 3 installation marks on the timing belt as shown in the illustration.
- (1) If the installation marks have disappeared, put new installation marks on the timing belt before removing.
- (c) Set No. 1 cylinder to approximately 60° BTDC/compression.
- (1) Turn the crankshaft counterclockwise by approximately 60°.
- NOTICE:**  
If the timing belt is disengaged, having the crankshaft pulley at the wrong angle can cause the piston head and valve head to come into contact with each other when you remove the camshaft timing pulley and camshaft, causing damage. So always set the crankshaft pulley at the correct angle.
- (d) Remove the timing belt tensioner.
- NOTICE:**  
Do not reinstall the tensioner with its plunger extended.



(e) Remove the timing belt in the following order.

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

**19. REMOVE TIMING BELT IDLER SUB-ASSEMBLY NO.1**

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

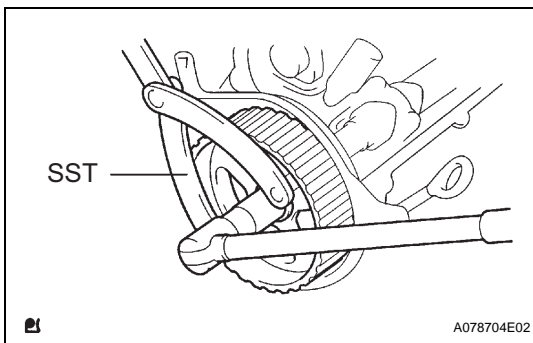
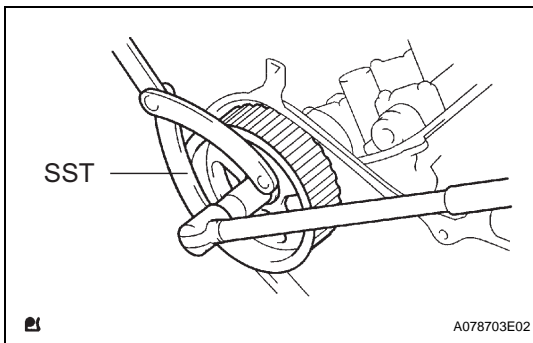
**20. REMOVE TIMING BELT IDLER SUB-ASSEMBLY NO.2**

**21. REMOVE CRANKSHAFT POSITION SENSOR**

**22. REMOVE CAMSHAFT TIMING PULLEY**

(a) Using SST, remove the bolt and the RH timing pulley.

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



(b) Using SST, remove the bolt and the LH timing pulley.

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

**HINT:**

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

**23. REMOVE TIMING BELT NO.3 COVER**

**24. REMOVE TIMING BELT IDLER BRACKET**

**25. REMOVE CRANKSHAFT TIMING PULLEY**

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

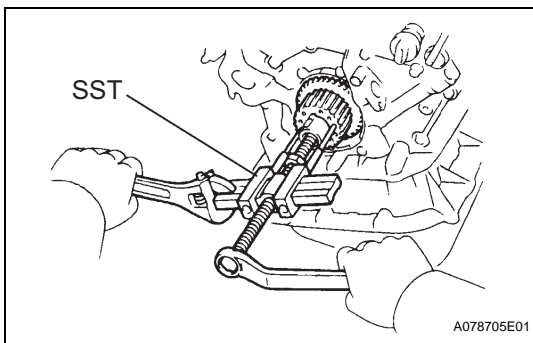
(b) Install the pulley bolt to the crankshaft.

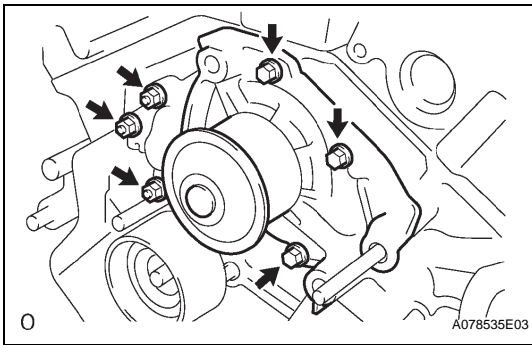
(c) Using SST, remove the crankshaft timing pulley.

**SST 09950-50013 (09951-05010, 09952-05010, 09953-05020, 09954-05011)**

**NOTICE:**

- Do not scratch the sensor part of the crankshaft timing pulley.
- Before using SST, apply lubricating oil to the threads and tip of the SST center bolt 150.





## 26. REMOVE WATER PUMP ASSEMBLY

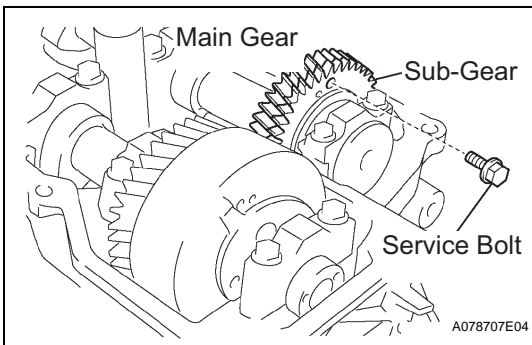
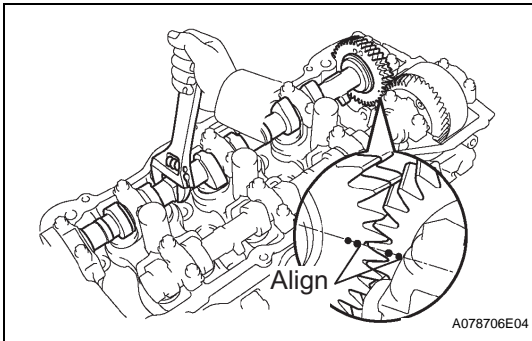
- (a) Remove the 3 bolts and 3 nuts, then remove the water pump and the gasket.

## 27. REMOVE CAMSHAFT

### NOTICE:

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

- (a) Align the timing marks (2-dot marks) of the camshaft drive and the driven gears by turning the camshaft with a wrench.



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

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

### Recommended service bolt

Thread diameter	6 mm
Thread pitch	1.0 mm
Bolt length	16 to 20 mm

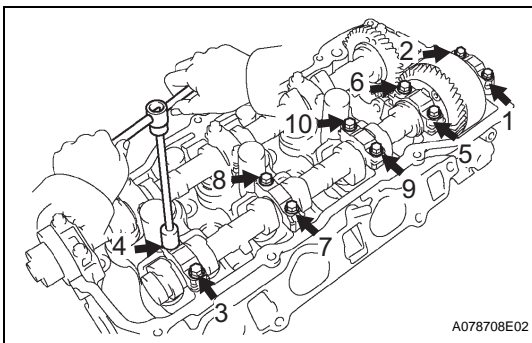
### HINT:

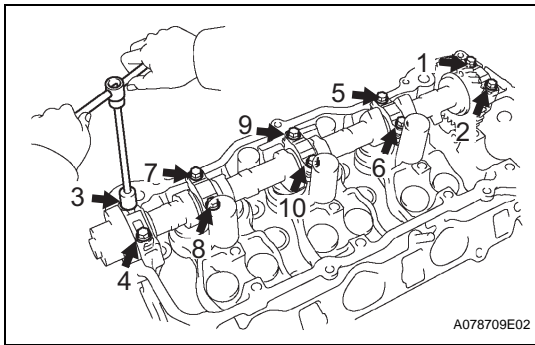
When removing the camshaft, make certain that the torsional spring force of the sub-gear has been eliminated by installation of the service bolt.

- (c) Using several steps, loosen and remove the 10 bearing cap bolts uniformly in the sequence shown in the illustration. Remove the 5 bearing caps and the camshaft.

### NOTICE:

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



**28. REMOVE NO.2 CAMSHAFT**

- (a) Using several steps, loosen and remove the 10 bearing cap bolts uniformly in the sequence shown in the illustration. Remove the 5 bearing caps and the No. 2 camshaft.

**NOTICE:**

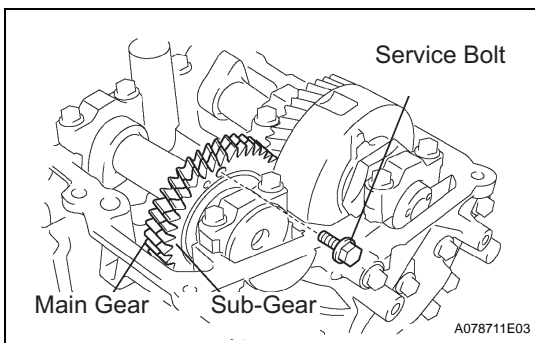
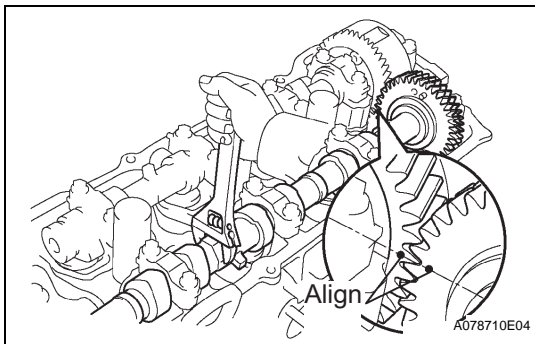
- Do not pry out the camshaft.
- Be careful not to damage the portion of the cylinder head receiving the shaft thrust.

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

**29. REMOVE NO.3 CAMSHAFT SUB-ASSEMBLY****NOTICE:**

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

- (a) Align the timing marks (1-dot marks) of the camshaft drive and the driven gears by turning the camshaft with a wrench.



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

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

**Recommended service bolt**

Thread diameter	6 mm
Thread pitch	1.0 mm
Bolt length	16 to 20 mm

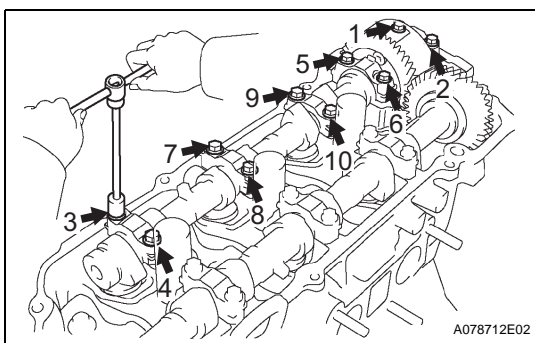
**HINT:**

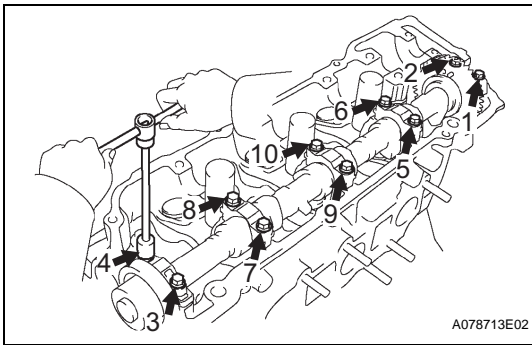
When removing the camshaft, make certain that the torsional spring force of the sub-gear has been eliminated by installation of the service bolt.

- (c) Using several steps, loosen and remove the 10 bearing cap bolts uniformly in the sequence shown in the illustration. Remove the 5 bearing caps and the No. 3 camshaft.

**NOTICE:**

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





### 30. REMOVE NO.4 CAMSHAFT SUB-ASSEMBLY

- (a) Using several steps, loosen and remove the 10 bearing cap bolts uniformly in the sequence shown in the illustration. Remove the 5 bearing caps and the No. 4 camshaft.

**NOTICE:**

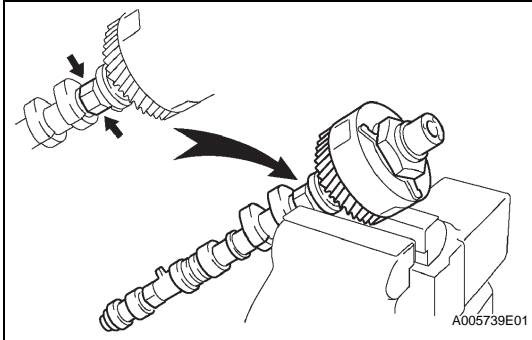
- Do not pry out the camshaft.
- Be careful not to damage the portion of the cylinder head which receiving the shaft thrust.

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

### 31. INSPECT CAMSHAFT TIMING GEAR ASSEMBLY

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

- (b) Check that the VVT-i will not turn.



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

- (d) Using the air gun, apply about 100 kPa (1 kgf/cm<sup>2</sup>, 14 psi) of air pressure to the port on the advance angle side.

**NOTICE:**

**Some oil spraying will occur. Be prepared to catch the spray with a shop rag.**

**HINT:**

This operation releases the lock pin for the most retard angle lock.

- (e) Under the condition above, turn VVT-i to the advance angle side (the white arrow marked direction in the illustration) by hand.

**Standard:**

**Must turn**

**HINT:**

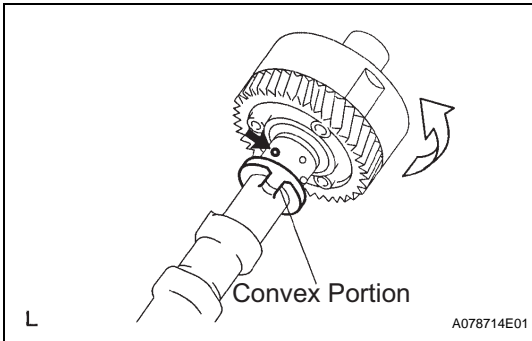
Depending on the air pressure, the VVT-i will turn to the advance angle side without applying force by hand. Also, if the pressure can be hardly applied because of the air leakage from the port, it might be difficult to get the lock-pin to release.

- (f) Check that the VVT-i moves freely within about 30° range. Avoid moving the VVT-i unit to the most retard angle position as the lock-pin will reengage.

**Standard:**

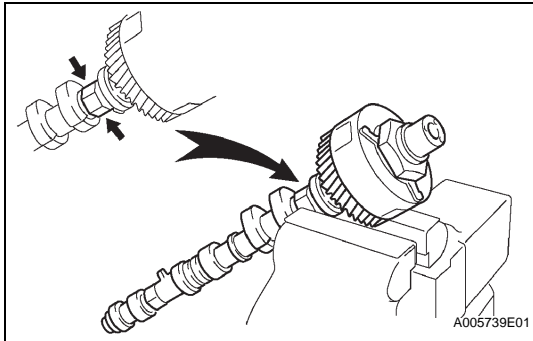
**Smooth movable range is about 30°**

- (g) Turn the VVT-i by hand and lock it at the most retard angle position.



**32. REMOVE CAMSHAFT TIMING GEAR ASSEMBLY****NOTICE:**

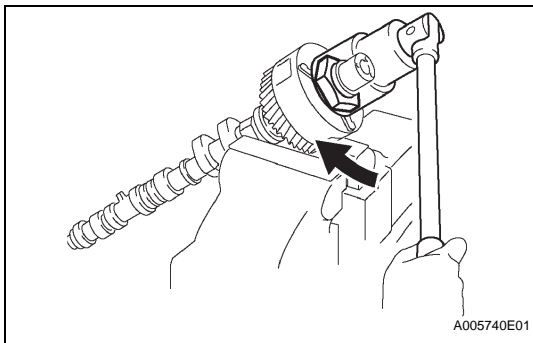
Do not remove or install the camshaft timing gear (VVT-i) unless you are replacing the VVT-i or the camshaft.



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

**NOTICE:**

Be careful not to damage the camshaft.



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

**NOTICE:**

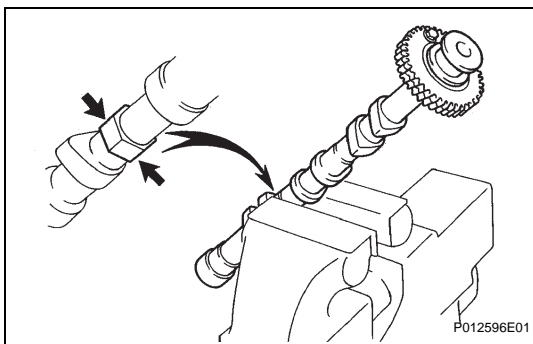
- Remove it with the lock-pin engaged and locked at the most retard angle position.
- The lock nut has LH threads.
- Never use any tool other than the socket wrench. Other tools will deform the cam angle rotor.

- (c) Remove the camshaft VVT-i.

**NOTICE:**

Never remove the 3 bolts on the gear.

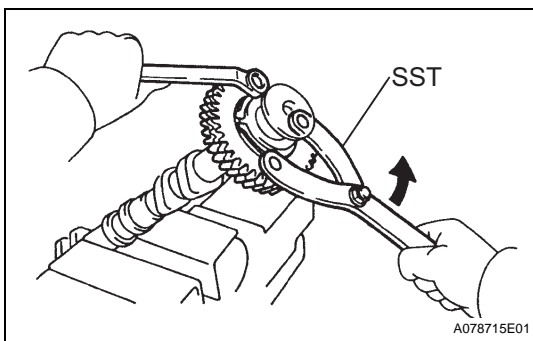
If it is difficult to remove VVT-i, tap it lightly using a plastic-faced hammer and then remove it.

**33. REMOVE CAMSHAFT SUB GEAR**

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

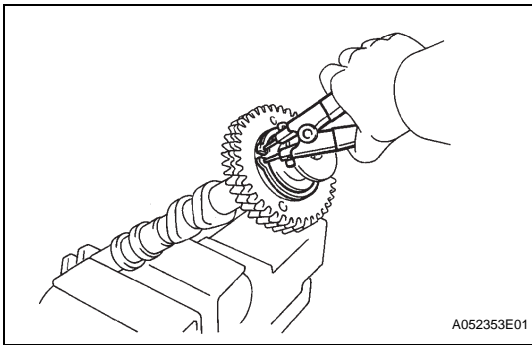
**NOTICE:**

Be careful not to damage the camshaft.



- (b) Using SST, turn the sub-gear counterclockwise, and remove the service bolt.

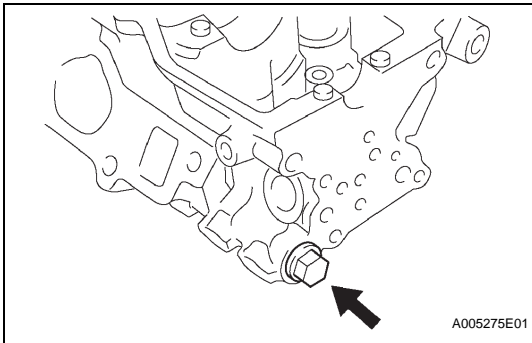
**SST 09960-10010 (09962-01000, 09963-00500)**



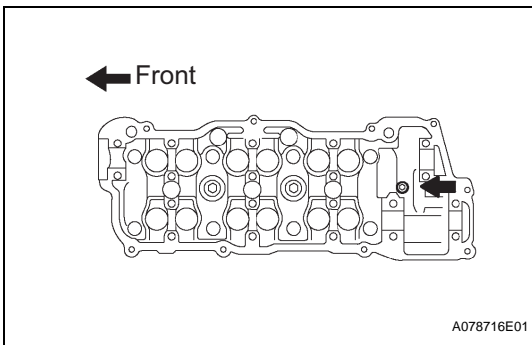
- (c) Using snap ring pliers, remove the snap ring.
  - (d) Remove the wave washer, camshaft sub-gear and camshaft gear bolt washer.
- HINT:  
Arrange the camshaft sub-gears and gear bolt washers (RH and LH sides) so that they can be returned to the original location when reassembling.

**34. REMOVE ENGINE HANGER NO.2****35. REMOVE CYLINDER HEAD COVER REAR****36. REMOVE OIL CONTROL VALVE FILTER**

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

**37. REMOVE CYLINDER HEAD SUB-ASSEMBLY**

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



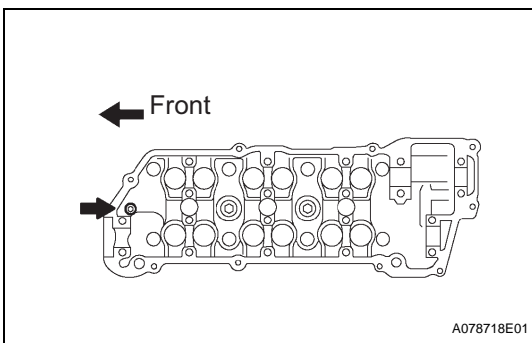
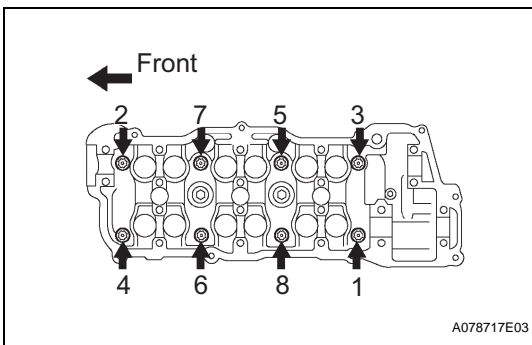
- (b) Using several steps, loosen the 8 cylinder head bolts uniformly in the sequence shown in the illustration. Remove the 8 cylinder head bolts and plate washers.

**NOTICE:**

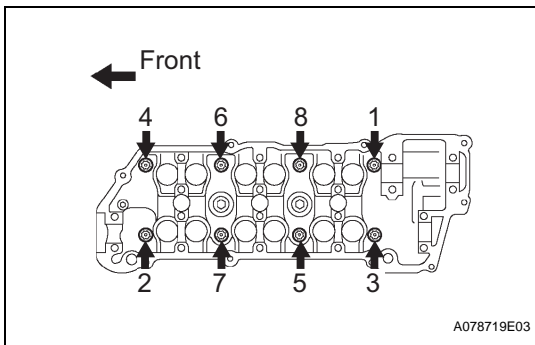
- Be careful not to drop the washers into the cylinder head.
- Head warpage or cracking could result from removing bolts in an incorrect order.

**38. REMOVE CYLINDER HEAD GASKET****39. REMOVE CYLINDER HEAD LH**

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







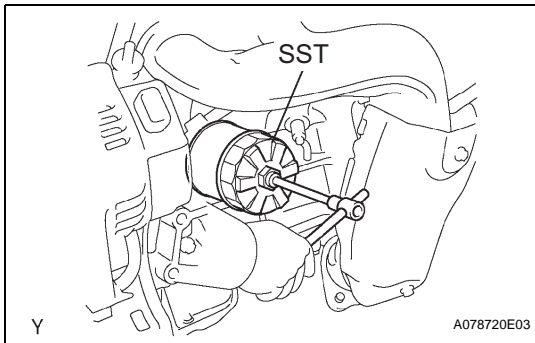
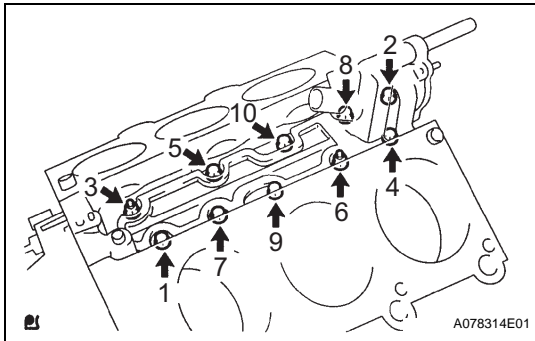
- (b) Using several steps, loosen the 8 cylinder head bolts uniformly in the sequence shown in the illustration. Remove the 8 cylinder head bolts and plate washers.

**NOTICE:**

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

**40. REMOVE CYLINDER HEAD GASKET NO.2****41. REMOVE WATER INLET HOUSING**

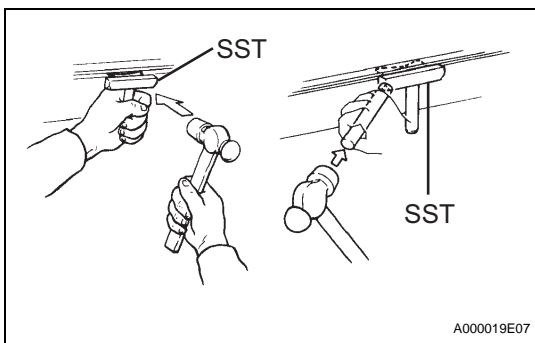
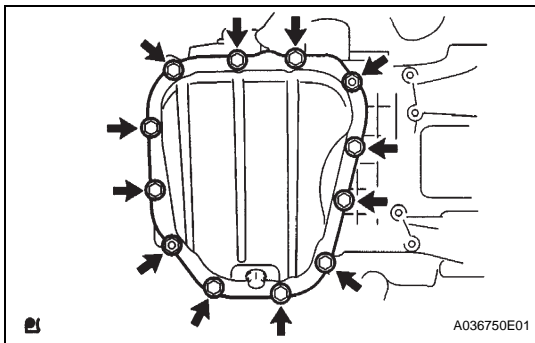
- (a) Remove the 8 bolts and 2 nuts, then remove the water inlet housing.

**42. REMOVE OIL FILTER SUB-ASSEMBLY**

- (a) Using SST, remove the oil filter.  
**SST 09228-07501**
- (b) Using a socket hexagon wrench 12, remove the oil filter union.

**43. REMOVE OIL PAN DRAIN PLUG****44. REMOVE OIL PAN SUB-ASSEMBLY NO.2**

- (a) Remove the 10 bolts and 2 nuts.



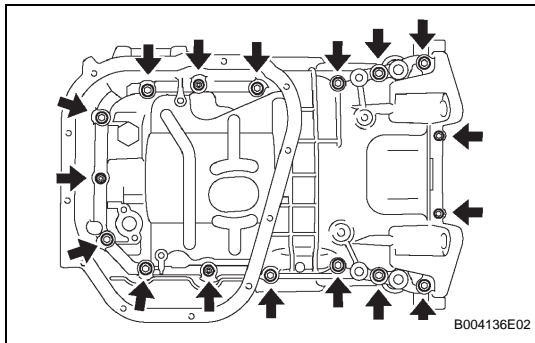
- (b) Insert the blade of SST between oil pan No. 1 and oil pan No. 2, cut off the sealer and remove the oil pan No. 2.

**SST 09032-00100****NOTICE:**

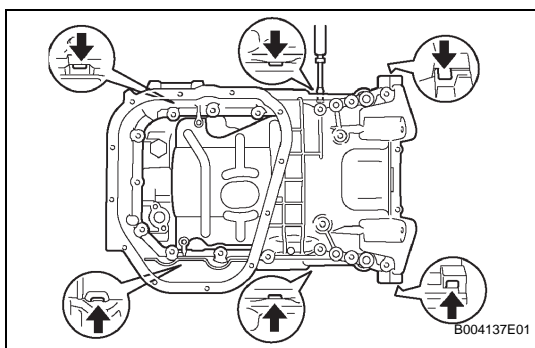
- Be careful not to damage the contact surfaces of oil pan No. 1 where the oil pan No. 2 is mounted.
- Do not damage the flange portion of oil pan No. 2 when removing.

**45. REMOVE OIL STRAINER SUB-ASSEMBLY**

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

**46. REMOVE OIL PAN SUB-ASSEMBLY**

- (a) Loosen and remove the 15 bolts and 2 nuts uniformly.



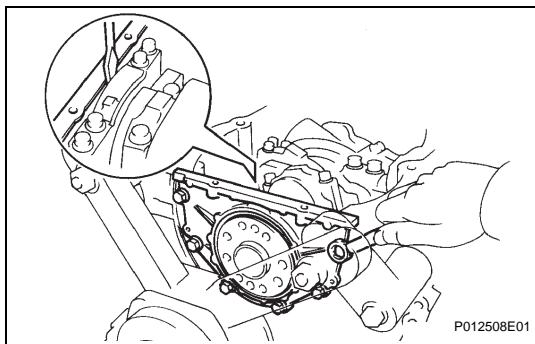
- (b) Using a screwdriver, remove the oil pan by prying between the cylinder block and the oil pan.

**NOTICE:**

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

**47. REMOVE OIL PAN Baffle PLATE****48. REMOVE ENGINE REAR OIL SEAL RETAINER**

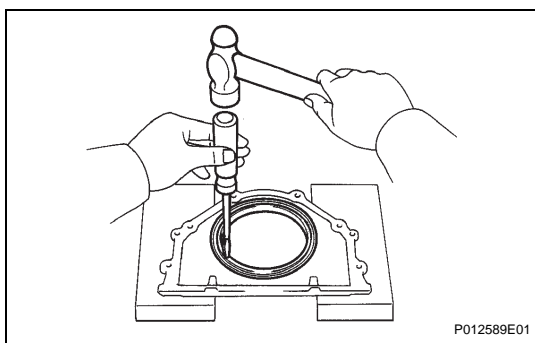
- (a) Remove the 6 bolts.

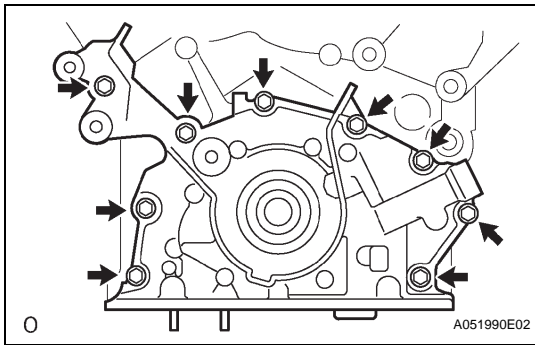


- (b) Using a screwdriver, remove the oil seal retainer by prying between the oil seal retainer and the main bearing cap.

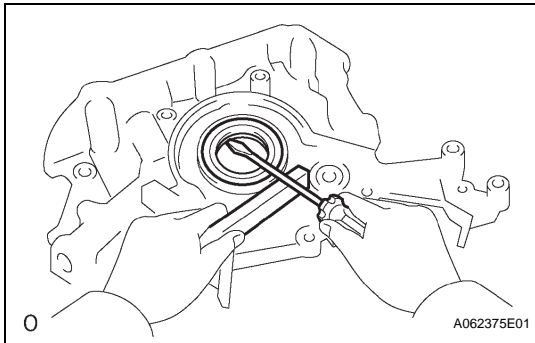
**49. REMOVE ENGINE REAR OIL SEAL**

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

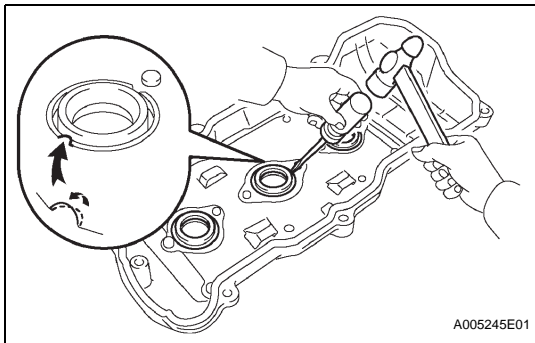


**50. REMOVE OIL PUMP ASSEMBLY**

- (a) Remove the 9 bolts.
- (b) Using a screwdriver, remove the oil pump by prying between the oil pump and the main bearing cap.
- (c) Remove the O-ring.

**51. REMOVE OIL PUMP SEAL**

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

**52. REMOVE SPARK PLUG TUBE GASKET**

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

**NOTICE:**

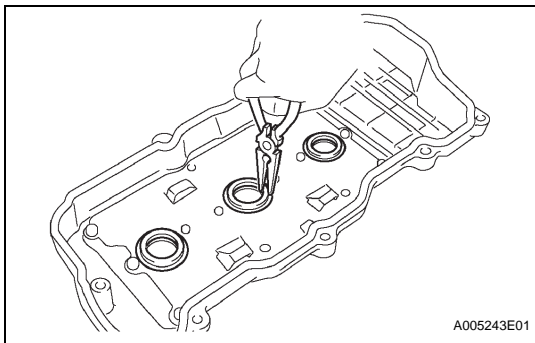
**Be careful not to damage the baffle plate of the cylinder head cover.**

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

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

**NOTICE:**

**Be careful not to damage the cylinder head cover.**

**53. REMOVE CYLINDER BLOCK WATER DRAIN COCK SUB-ASSEMBLY****54. REMOVE WATER SEAL PLATE****55. REMOVE CYLINDER BLOCK W/ HEAD STRAIGHT SCREW NO.1 PLUG**

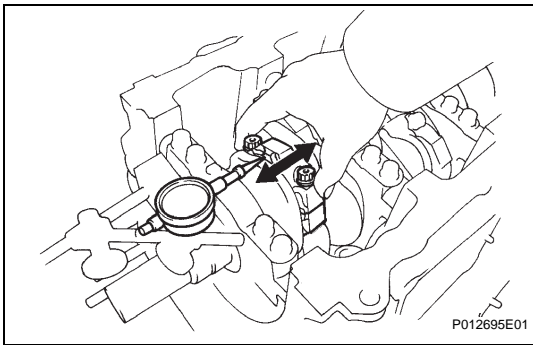
- (a) Using a socket hexagon wrench 10, remove the screw plug.

**56. REMOVE CYLINDER BLOCK W/ HEAD STRAIGHT SCREW NO.2 PLUG**

- (a) Using a socket hexagon wrench 10, remove the screw plug.

**57. REMOVE CYLINDER BLOCK W/ HEAD STRAIGHT SCREW NO.3 PLUG**

- (a) Using a socket hexagon wrench 10, remove the screw plug.

**58. INSPECT CONNECTING ROD THRUST CLEARANCE**

- (a) Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.

**Standard thrust clearance:**

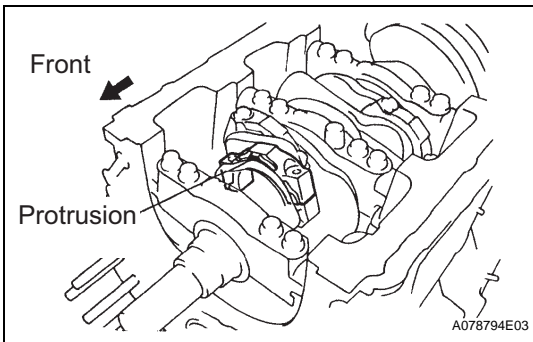
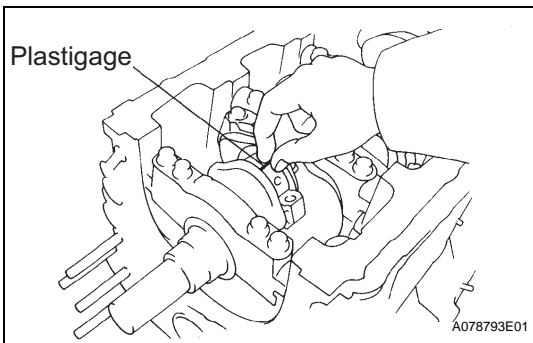
**0.15 to 0.30 mm (0.0059 to 0.0118 in.)**

**Maximum thrust clearance:**

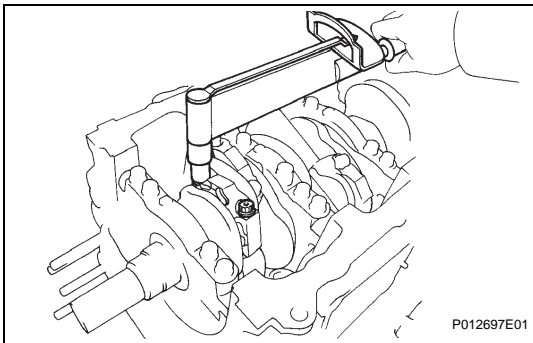
**0.35 mm (0.0138 in.)**

**59. INSPECT CONNECTING ROD OIL CLEARANCE**

- (a) Check that the matchmarks on the connecting rod and cap are aligned to ensure correct reassembly.
- (b) Remove the 2 connecting rod cap bolts.
- (c) Clean the crank pin, the bearing and the connecting rod.
- (d) Check the crank pin and bearing for pitting and scratches.
- (e) Lay a strip of Plastigage across the crank pin.

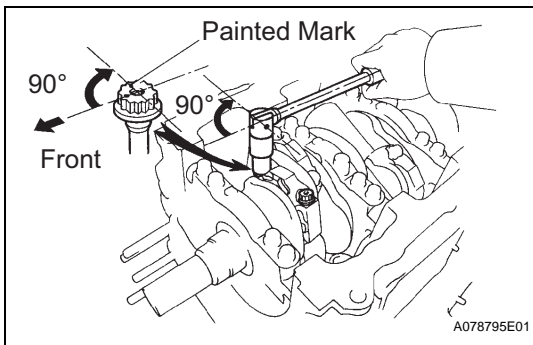


- (f) Check that the protrusion of the connecting rod cap is facing the correct direction.
- (g) Apply a light coat of engine oil to the threads of the connecting rod cap bolts.



- (h) Tighten the bolts in several steps to by the specified torque.

**Torque: 25 N\*m (250 kgf\*cm, 18 ft.\*lbf)**

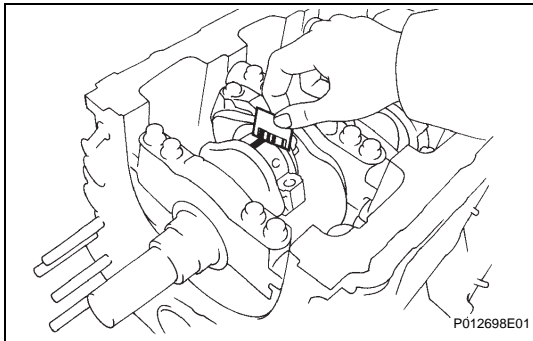


- (i) Mark the front side of each connecting cap bolt with paint.
- (j) Retighten the cap bolts by 90° as shown in the illustration.

**NOTICE:**

**Do not turn the crankshaft.**

- (k) Remove the 2 bolts, the connecting rod cap and the lower bearing.



- (l) Measure the Plastigage at its widest point.

**Standard oil clearance:**

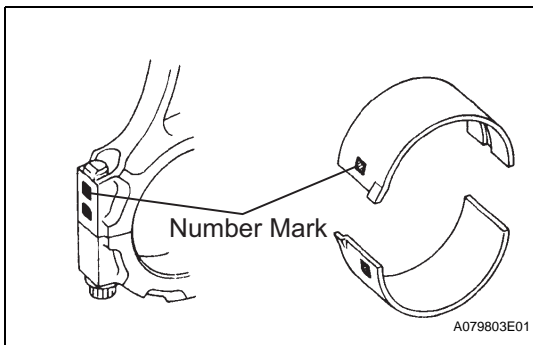
**0.038 to 0.066 mm (0.0015 to 0.0026 in.)**

**Maximum oil clearance:**

**0.08 mm (0.0031 in.)**

**NOTICE:**

**Completely remove the Plastigage.**

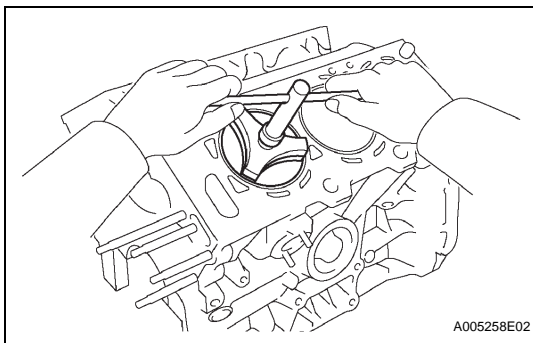


- (m) If replacing the bearing, replace it with one having the same number as marked on the connecting rod. There are 4 sizes of standard bearings, marked "1", "2", "3" and "4" accordingly.

**HINT:**

Standard bearing center wall thickness

Mark	mm (in.)
"1"	1.484 to 1.487 (0.0584 to 0.0585)
"2"	1.488 to 1.490 (0.0585 to 0.0587)
"3"	1.491 to 1.493 (0.0587 to 0.0588)
"4"	1.494 to 1.496 (0.0588 to 0.0589)



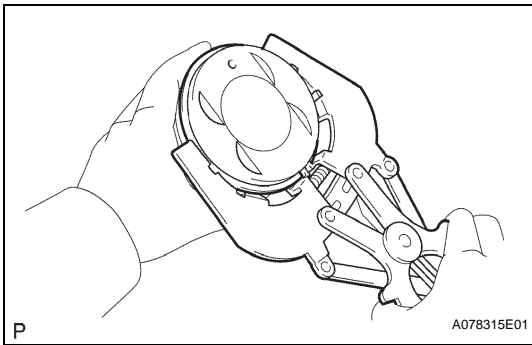
### 60. REMOVE PISTON SUB-ASSEMBLY WITH CONNECTING ROD

- (a) Using a ridge reamer, remove all the carbon from the top of the cylinder.
- (b) Push out the piston and the connecting rod assembly from the top of the cylinder block.

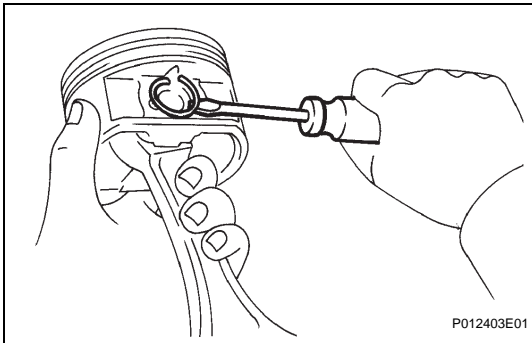
**HINT:**

- Keep the bearings, the connecting rod and the cap together.
- Arrange the piston and the connecting rod assemblies in correct order so they can be returned to the original locations when re-assembling.

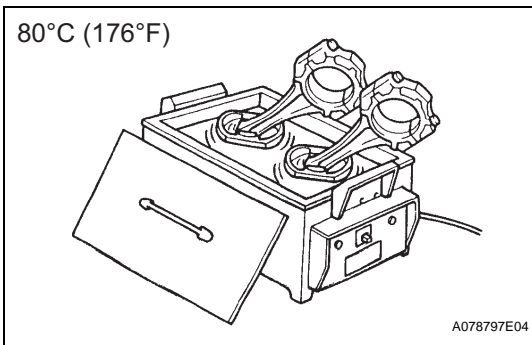
### 61. REMOVE CONNECTING ROD BEARING

**62. REMOVE PISTON RING SET**

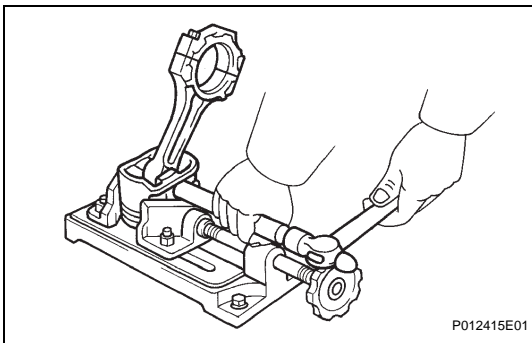
- (a) Using a piston ring expander, remove the 2 compression rings.
- (b) Remove the 2 side rails and oil ring by hand.

**63. REMOVE PISTON PIN HOLE SNAP RING**

- (a) Using a small screwdriver, pry out the 2 snap rings.

**64. REMOVE W/ PIN PISTON SUB-ASSEMBLY**

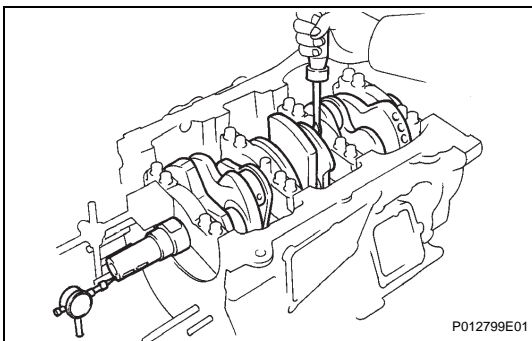
- (a) Gradually heat the piston to approximately 80°C (176°F).



- (b) Using a plastic-faced hammer and a brass bar, lightly tap out the piston pin and remove the connecting rod.

**HINT:**

- The piston and pin are a matched set.
- Store the pistons, the pins, the rings, the connecting rods and the bearings in correct order so that they can be returned to the original locations when re-assembling.

**65. INSPECT CRANKSHAFT THRUST CLEARANCE**

- (a) Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

**Standard thrust clearance:**

**0.04 to 0.24 mm (0.0016 to 0.0094 in.)**

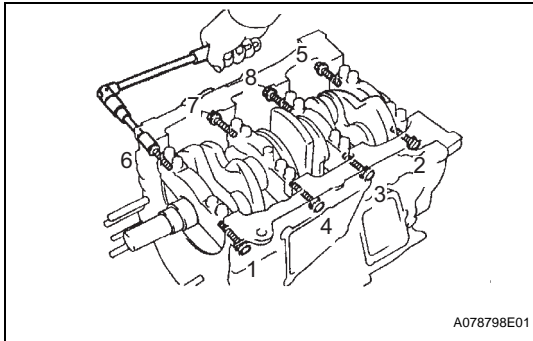
**Maximum thrust clearance:**

**0.30 mm (0.0118 in.)**

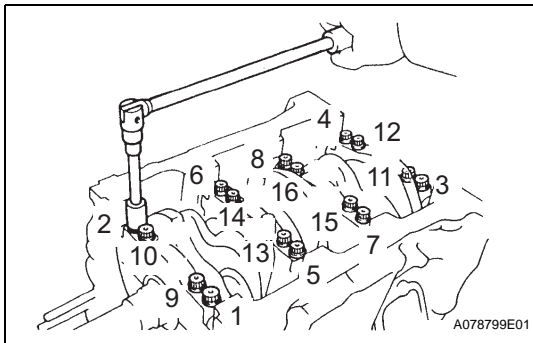
If the thrust clearance is greater than maximum, replace the thrust washers as a set. Check the crankshaft for wear, repair or replace if necessary.

## HINT:

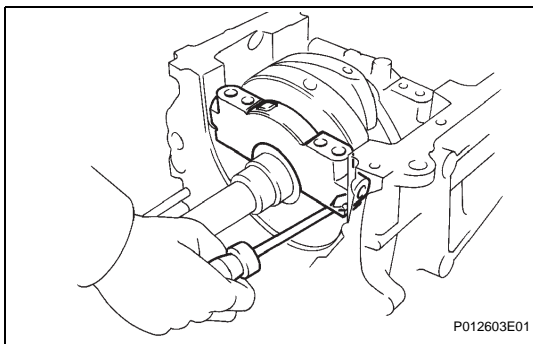
Thrust washer thickness is 1.93 to 1.98 mm (0.0760 to 0.0780 in.)

**66. REMOVE CRANKSHAFT**

- (a) Using several steps, loosen and remove the 8 main bearing cap bolts and seal washers uniformly in the sequence shown in the illustration.



- (b) Using several steps, loosen and remove the 16 main bearing cap bolts uniformly in the sequence shown in the illustration.

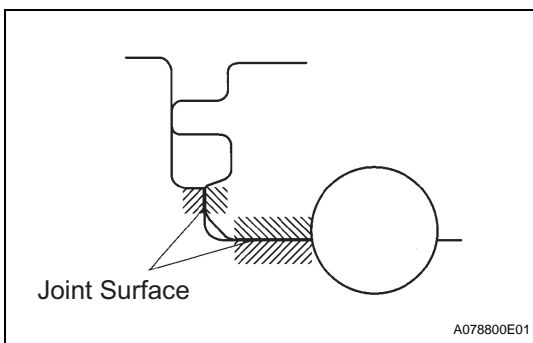


- (c) Using a screwdriver, pry out the main bearing caps. Remove the 4 main bearing caps and the lower bearings.

**NOTICE:**

- Carefully pry out the main bearing cap by alternating lifting a little at a time on each end the cap.
- Be careful not to damage the joint surface of the cylinder block and the main bearing cap.

- (d) Check the damaged the joint surface of the cylinder block and the bearing cap.

**67. REMOVE CRANKSHAFT THRUST WASHER SET****68. REMOVE CRANKSHAFT BEARING**