

CO/HC INSPECTION

EM0FQ-04

HINT:

This check is used only to determine whether or not the idle CO/HC complies with regulations.

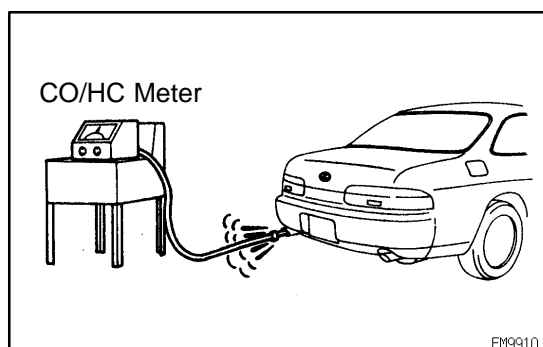
1. INITIAL CONDITIONS

- (a) Engine at normal operating temperature
- (b) Air cleaner installed
- (c) All pipes and hoses of air induction system connected
- (d) All accessories switched OFF
- (e) All vacuum lines properly connected

HINT:

All vacuum hoses for EGR system, etc. should be properly connected.

- (f) SFI system wiring connectors fully plugged
- (g) Ignition timing set correctly
- (h) Transmission in neutral position
- (i) Tachometer and CO/HC meter calibrated by hand

2. START ENGINE**3. RACE ENGINE AT 2,500 RPM FOR APPROX. 180 SECONDS**

- 4. INSERT CO/HC METER TESTING PROBE INTO AT LEAST 40 cm (1.3 ft) INTO TAILPIPE DURING IDLING**
- 5. IMMEDIATELY CHECK CO/HC CONCENTRATION AT IDLE AND/OR 2,500 RPM**

HINT:

When doing the 2 mode (2,500 rpm and idle) test, follow the measurement order prescribed by the applicable local regulations.

If the CO/HC concentration does not comply with regulations, perform troubleshooting in the order given below.

See the table below for possible causes, and then inspect and correct the applicable causes if necessary.

CO	HC	Problems	Causes
Normal	High	Rough idle	8. Faulty ignitions: <ul style="list-style-type: none"> • Incorrect timing • Fouled, shorted or improperly gapped plugs • Open or crossed high-tension cords • Cracked distributor caps 9. Incorrect valve clearance 10. Leaky EGR valve 11. Leaky intake and exhaust valves 12. Leaky cylinders
Low	High	Rough idle (fluctuating HC reading)	1. Vacuum leaks: <ul style="list-style-type: none"> • PCV hoses • EGR valve • Intake manifold • Throttle body • IAC valve • Brake booster line 2. Lean mixture causing misfire
High	High	Rough idle (Black smoke from exhaust)	1. Restricted air filter 2. Faulty SFI systems: <ul style="list-style-type: none"> • Faulty pressure regulator • Clogged fuel pressure regulator • Defective ECT sensor • Faulty ECM • Faulty injectors • Faulty throttle position sensor • Faulty MAF meter

COMPRESSION INSPECTION

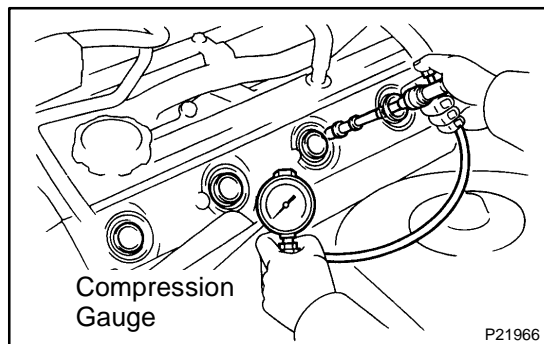
HINT:

If there is lack of power, excessive oil consumption or poor fuel economy, measure the compression pressure.

1. WARM UP AND STOP ENGINE

Allow the engine to warm up to normal operating temperature.

2. REMOVE SPARK PLUGS (See page IG-1)



3. CHECK CYLINDER COMPRESSION PRESSURE

- Insert a compression gauge into the spark plug hole.
- Fully open the throttle.
- While cranking the engine, measure the compression pressure.

HINT:

Always use a fully charged battery to obtain engine speed of 250 rpm or more.

- Repeat steps (a) through (c) for each cylinder.

NOTICE:

This measurement must be done in as short a time as possible.

Compression pressure:

1,226 kPa (12.5 kgf/cm², 178 psi) or more

Minimum pressure: 981 kPa (10.0 kgf/cm², 142 psi)

Difference between each cylinder:

98 kPa (1.0 kgf/cm², 14 psi) or less

- If the cylinder compression in one or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat steps (a) through (c) for cylinders with low compression.
 - If adding oil helps the compression, chances are that the piston rings and/or cylinder bore are worn or damaged.
 - If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket.

4. REINSTALL SPARK PLUGS (See page IG-1)

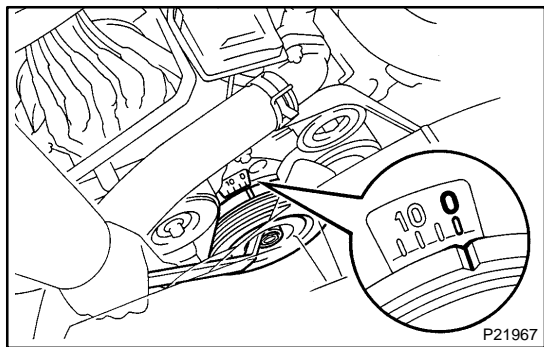
VALVE CLEARANCE INSPECTION

EM1GE-01

HINT:

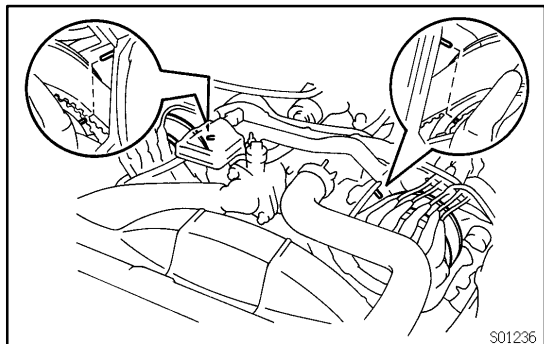
Inspect and adjust the valve clearance when the engine is cold.

1. **DRAIN ENGINE COOLANT**
2. **REMOVE BATTERY CLAMP COVER**
3. **REMOVE V-BANK COVER**
4. **REMOVE AIR CLEANER AND INTAKE AIR CONNECTOR ASSEMBLY**
5. **REMOVE NO. 3 TIMING BELT COVERS**
(See page [EM-18](#))
6. **REMOVE CYLINDER HEAD COVERS**
 - (a) Remove the RH cylinder head cover.
 - (1) Remove the throttle body (See page [SF-41](#)).
 - (2) Disconnect the high-tension cords and clamps from the cylinder head cover (See page [EM-40](#)).
 - (3) Remove the 8 bolts, 8 seal washers and cylinder head cover.
 - (b) Remove the LH cylinder head cover.
 - (1) Remove the oil dipstick for the transmission.
 - (2) Disconnect the EVAP hose (from the charcoal canister) from the VSV.
 - (3) Disconnect the engine wire clamp from the wire bracket on the delivery pipe.
 - (4) Disconnect the high-tension cords and clamps from the cylinder head cover (See page [EM-40](#)).
 - (5) Remove the 8 bolts, 8 seal washers and cylinder head cover.

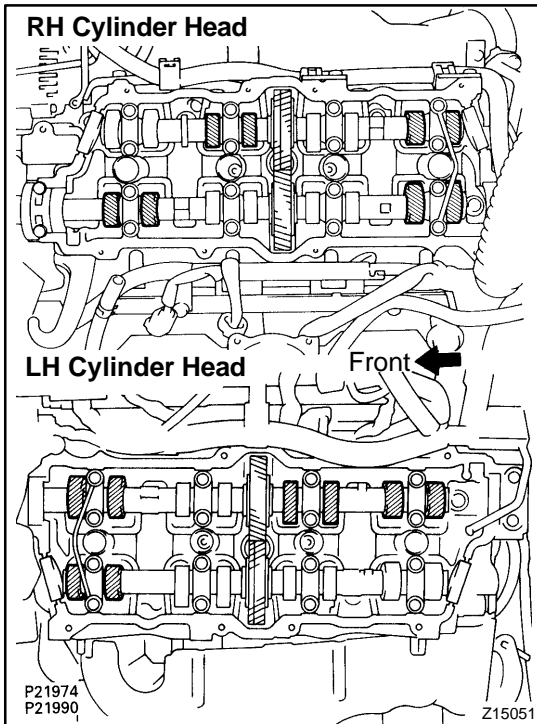


7. SET NO. 1 CYLINDER TO TDC/COMPRESSION

- (a) Turn the crankshaft pulley, and align its groove with timing mark "0" of the No. 1 timing belt cover.



- (b) Check that the timing marks of the camshaft timing pulleys and timing belt rear plates are aligned.
If not, turn the crankshaft 1 revolution (360°) and align the mark as above.

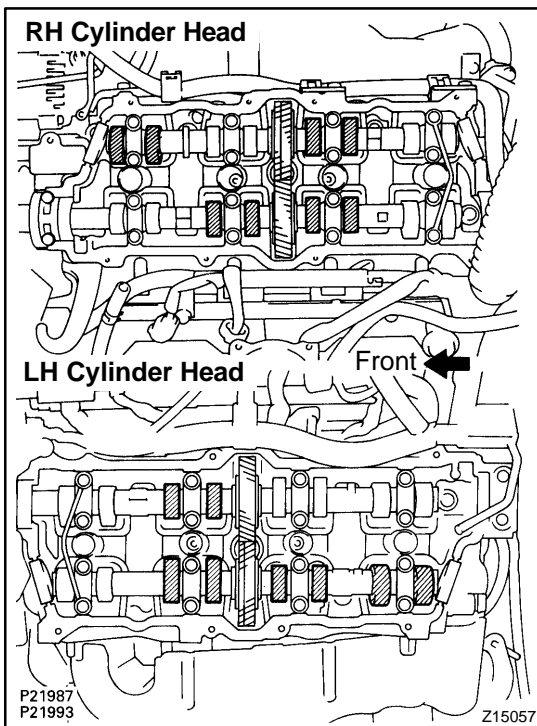


8. INSPECT VALVE CLEARANCE

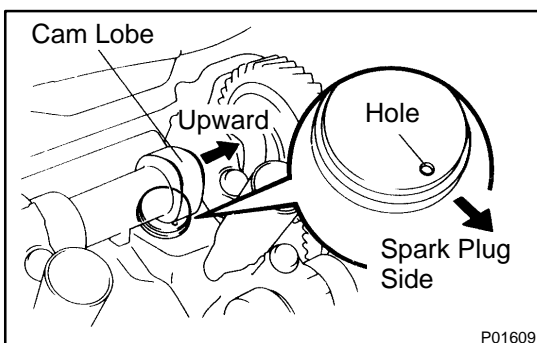
- (a) Check only the valves indicated.
 - (1) Using a feeler gauge, measure the clearance between the valve lifter and camshaft.
 - (2) Record the out-of-specification valve clearance measurements. They will be used later to determine the required replacement adjusting shim.

Valve clearance (Cold):

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

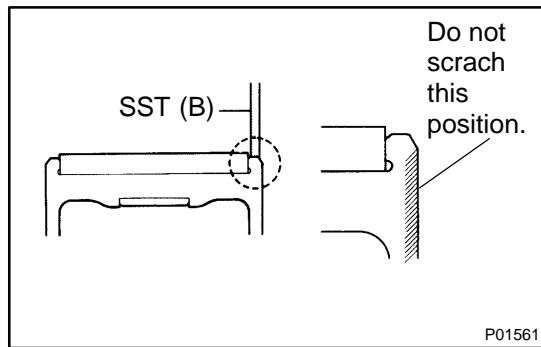


- (b) Turn the crankshaft 1 revolution (360°) and align the mark as above (See procedure in step 7).
- (c) Check only the valves indicated as shown. Measure the valve clearance (See procedure in step (a)).



9. ADJUST VALVE CLEARANCE

- (a) Disconnect the fuel return hose from the return hose.
- (b) Remove the adjusting shim.
 - (1) Turn the crankshaft so that the cam lobe of the camshaft on the adjusting valve upward.
 - (2) Position the hole of the adjusting shim facing the spark plug side.



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

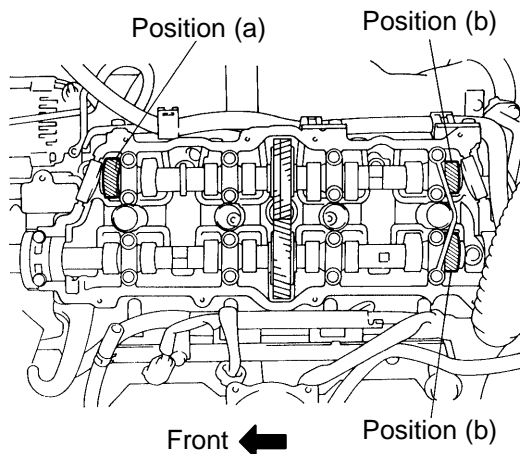
SST 09248-55040 (09248-05410), 09248-05021

NOTICE:

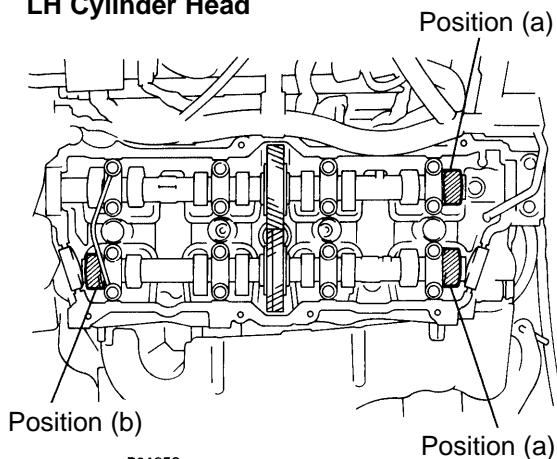
The valve lifter is made of aluminum, which is easily scratched. So when setting SST (B), take care not to scratch the face of the valve lifter.

Setting Method for SST for Camshaft End Portions

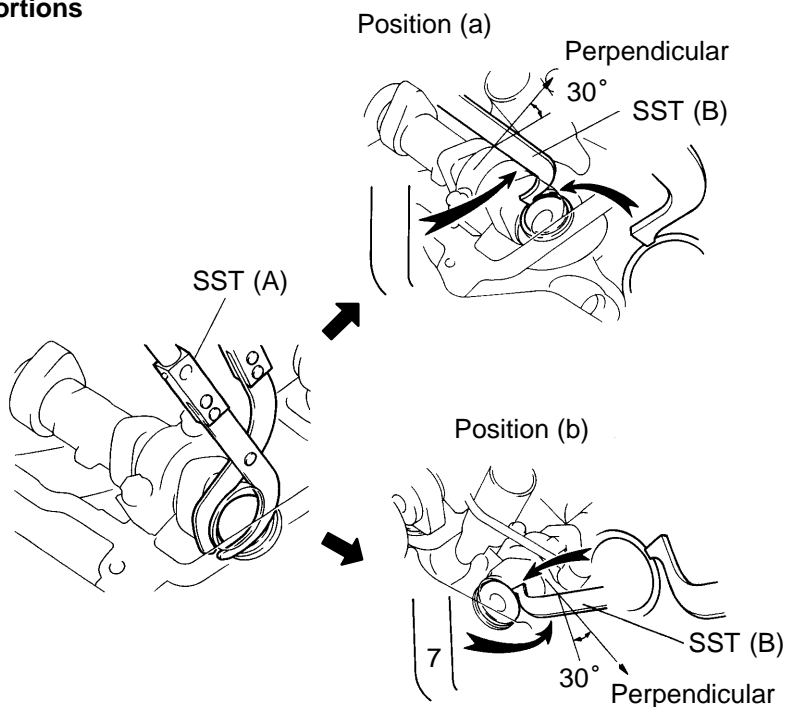
RH Cylinder Head



LH Cylinder Head



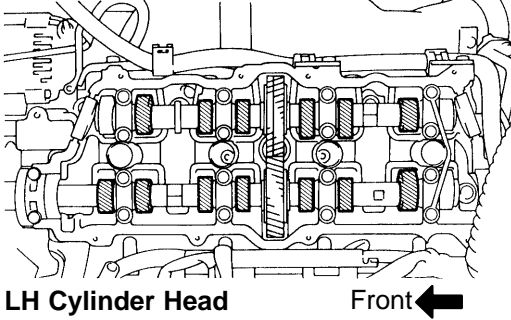
P21975 P21853
P21989 P21969 P21854



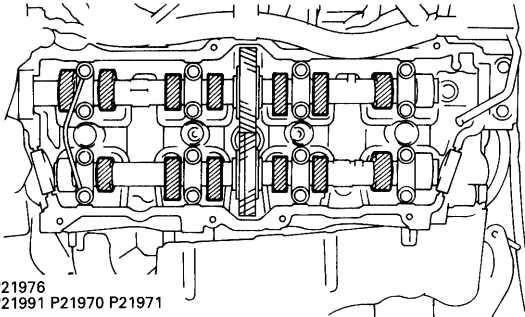
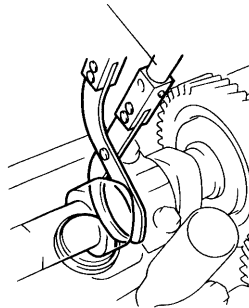
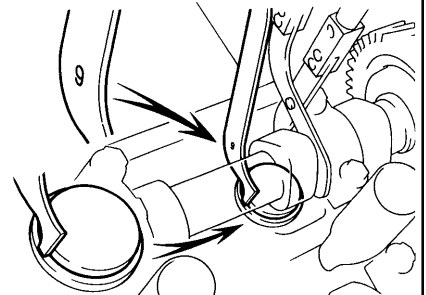
HINT:

- The width for insertion of SST (A) at the end portion of the exhaust camshaft is narrow, but SST (A) can be inserted easily by moving the cam lobe in the direction opposite to the side from which SST (B) is inserted.
- Apply SST (B) on the side marked with "7".
- It is easier to apply SST (B) when it is inserted at the angle shown in the illustration.

Z15053

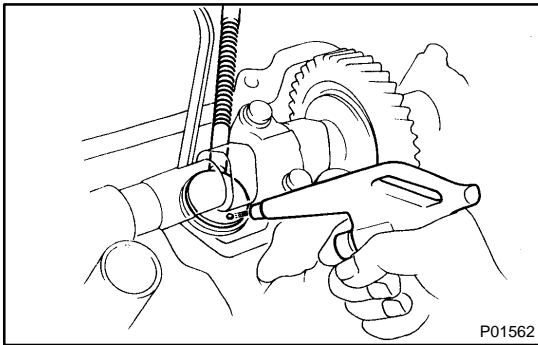
Setting Method for SST for Camshaft End Portions**RH Cylinder Head****LH Cylinder Head**

Front ←

P21976
P21991 P21970 P21971**SST (A)****SST (B)**

HINT:
Apply SST (B) on the side marked with "9".

Z15054

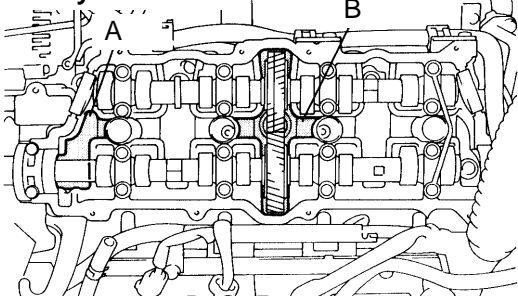


P01562

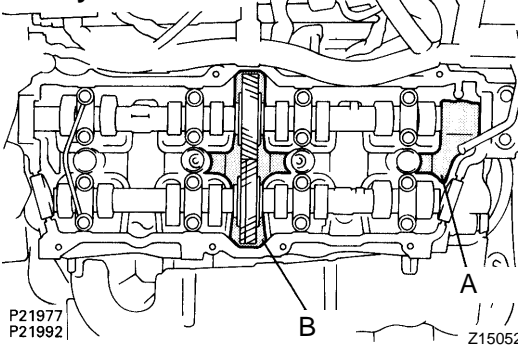
- (4) Using compressed air and a magnetic finger, remove the adjusting shim by blowing air into the shim hole.

HINT:

Remove the adjusting shim from the intake manifold side.

RH Cylinder Head**LH Cylinder Head**

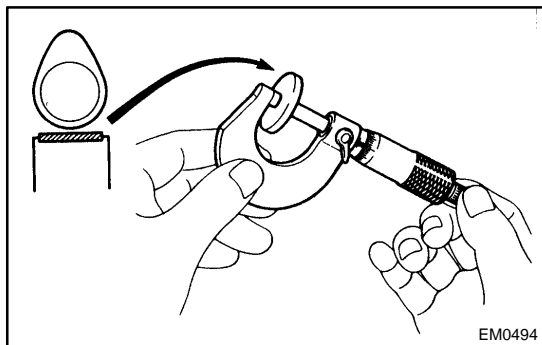
Front ←

P21977
P21992

Z15052

NOTICE:

Do not drop the adjusting shim into portions A and B. If dropped into portion A, the adjusting shim will pass through the cylinder head and cylinder block into the oil pan. If dropped into portion B, the adjusting shim cannot be recovered without removing the exhaust camshaft.



(c) Determine the replacement adjusting shim size according to these Formula or Charts:

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

T Thickness of removed shim

A Measured valve clearance

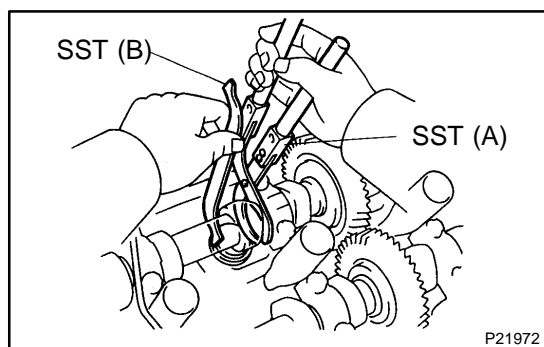
N Thickness of new shim

Intake	$N = T + (A - 0.20 \text{ mm (0.008 in.)})$
Exhaust	$N = T + (A - 0.30 \text{ mm (0.012 in.)})$

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

HINT:

Shims are available in 33 increments of 0.025 mm (0.0010 in.), from 2.50 mm (0.0984 in.) to 3.30 mm (0.1299 in.).



(d) Install a new adjusting shim.

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

SST 09248-55040 (09248-05410), 09248-05021

- (e) Recheck the valve clearance.
- (f) Reconnect the fuel return hose to the return hose.

10. REINSTALL CYLINDER HEAD COVERS

(See page [EM-66](#))

11. REINSTALL NO. 3 TIMING BELT COVERS (See page [EM-26](#))

12. REINSTALL AIR CLEANER AND INTAKE AIR CONNECTOR ASSEMBLY

13. REFILL WITH ENGINE COOLANT

14. START ENGINE AND CHECK FOR LEAKS

15. RECHECK ENGINE COOLANT LEVEL

16. REINSTALL V-BANK COVER

17. REINSTALL BATTERY CLAMP COVER

ENGINE MECHANICAL (1UZ-FE) - VALVE CLEARANCE

New shim thickness						mm (in.)
Shim No.	Thickness	Shim No.	Thickness	Shim No.	Thickness	
01	2.500 (0.0984)	19	2.775 (0.1093)	48	3.050 (0.1201)	
62	2.525 (0.0994)	23	2.800 (0.1102)	75	3.075 (0.1211)	
63	2.550 (0.1004)	70	2.825 (0.1112)	51	3.100 (0.1220)	
64	2.575 (0.1014)	28	2.850 (0.1122)	76	3.125 (0.1230)	
06	2.600 (0.1024)	71	2.875 (0.1132)	77	3.150 (0.1240)	
65	2.625 (0.1033)	33	2.900 (0.1142)	78	3.175 (0.1250)	
66	2.650 (0.1043)	72	2.925 (0.1152)	56	3.200 (0.1260)	
67	2.675 (0.1053)	38	2.950 (0.1161)	79	3.225 (0.1270)	
13	2.700 (0.1063)	73	2.975 (0.1171)	80	3.250 (0.1280)	
68	2.725 (0.1073)	43	3.000 (0.1181)	81	3.275 (0.1289)	
18	2.750 (0.1083)	74	3.025 (0.1191)	61	3.300 (0.1299)	

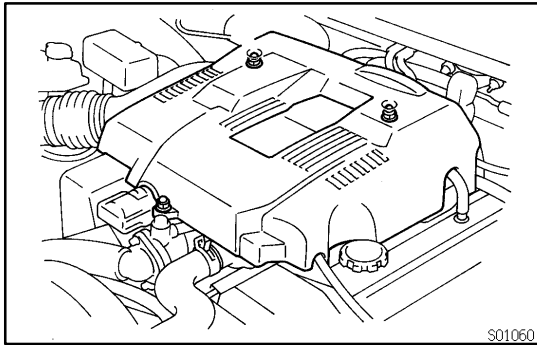
The 2.800 mm (0.1102 in.) shim is installed, and the measured clearance is 0.440 mm (0.0173 in.). Replace the 2.800 mm (0.1102 in.) shim with a No. 48 shim.

The 2.800 mm (0.1102 in.) shim is installed, and the measured clearance is 0.440 mm (0.0173 in.). Replace the 2.800 mm (0.1102 in.) shim with a No. 38 shim.

Shim No.	Thickness	Shim No.	Thickness	Shim No.	Thickness
01	2.500 (0.0984)	19	2.775 (0.1093)	48	3.050 (0.1201)
62	2.525 (0.0994)	23	2.800 (0.1102)	75	3.075 (0.1211)
63	2.550 (0.1004)	70	2.825 (0.1112)	51	3.100 (0.1220)
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68	2.725 (0.1073)	43	3.000 (0.1181)	81	3.275 (0.1289)
18	2.750 (0.1083)	74	3.025 (0.1191)	61	3.300 (0.1299)

New shim thickness mm (in.)

[illegible]



IGNITION TIMING INSPECTION

EM0FT-04

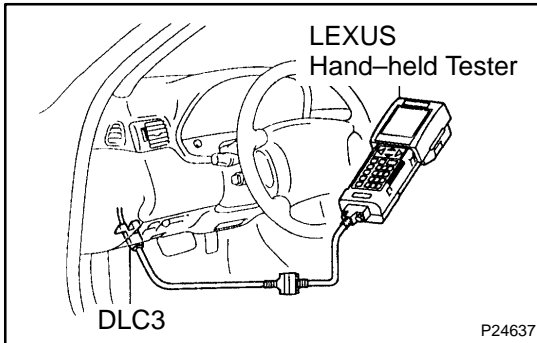
1. REMOVE BATTERY CLAMP COVER

2. REMOVE V-BANK COVER

Remove the 2 cap nuts, bolt and V-bank cover.

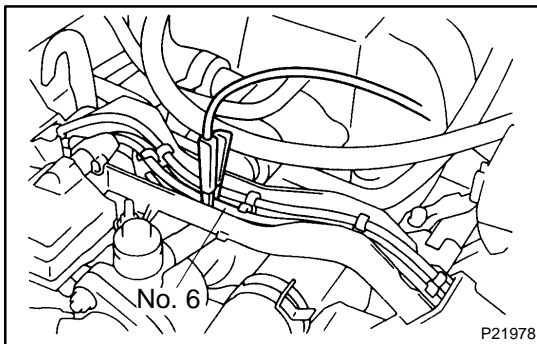
3. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.



4. CONNECT LEXUS HAND-HELD TESTER OR OBD II SCAN TOOL

- (a) Connect the hand-held tester or OBD II scan tool to the DLC3.
- (b) Please refer to the hand-held tester or OBD II scan tool operator's manual for further details.



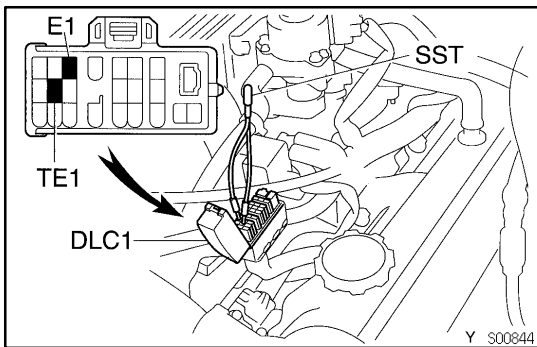
5. CONNECT TIMING LIGHT TO ENGINE

Connect the tester probe of a timing light to the high-tension cord for No. 6 cylinder.

6. CHECK IDLE SPEED

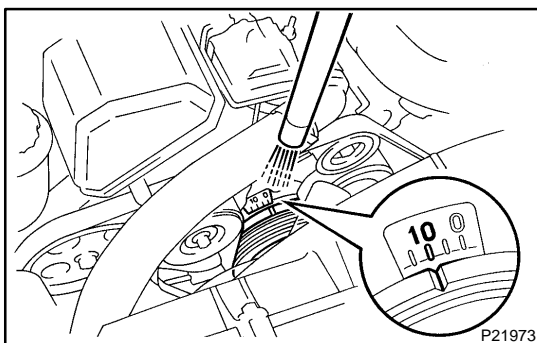
- (a) Race the engine speed at 2,500 rpm for approx. 90 seconds.
- (b) Check the idle speed.

Idle speed: 700 ± 50 rpm



7. INSPECT IGNITION TIMING

- (a) Using SST, connect terminals TE1 and E1 of the DLC1.
SST 09843-18020



- (b) Using a timing light, check the ignition timing.

Ignition timing:

8 – 12° BTDC @ idle

(Transmission in neutral position)

- (c) Remove the SST from the DLC1.
SST 09843-18020

8. DISCONNECT TIMING LIGHT FROM ENGINE

9. DISCONNECT LEXUS HAND-HELD TESTER OR OBD II SCAN TOOL

10. REINSTALL V-BANK COVER

11. REINSTALL BATTERY CLAMP COVER

IDLE SPEED INSPECTION

EM0FU-04

1. INITIAL CONDITIONS

- (a) Engine at normal operating temperature
- (b) Air cleaner installed
- (c) All pipes and hoses of air induction system connected
- (d) All accessories switched OFF
- (e) All vacuum lines properly connected

HINT:

All vacuum hoses for EGR system, etc. should be properly connected.

- (f) SFI system wiring connectors fully plugged
- (g) Ignition timing set correctly
- (h) Transmission in neutral position
- (i) Air conditioning switched OFF

2. CONNECT LEXUS HAND-HELD TESTER OR OBD II SCAN TOOL (See page [EM-11](#))

3. INSPECT IDLE SPEED

- (a) Race the engine speed at 2,500 rpm for approx. 90 seconds.
- (b) Check the idle speed.

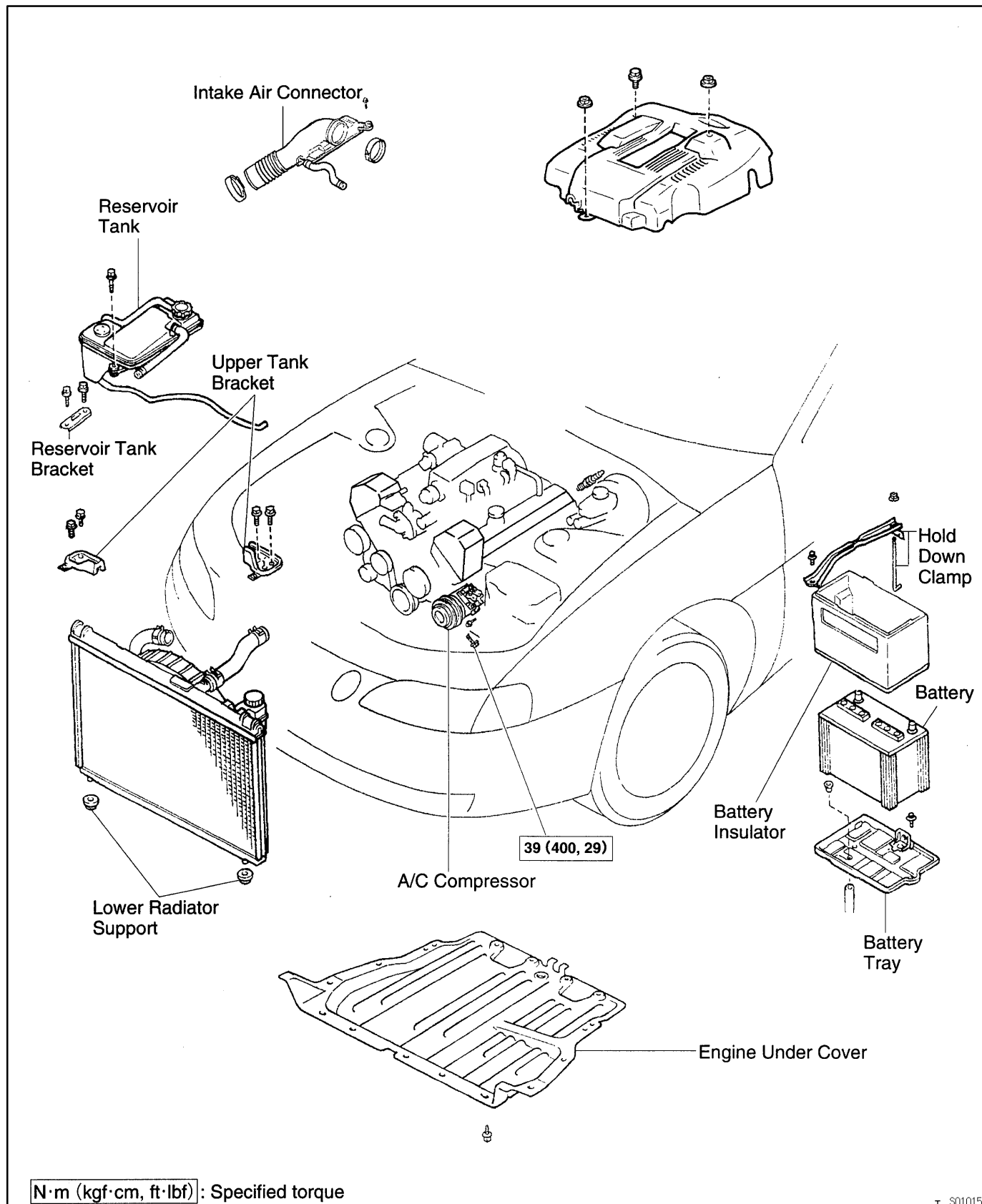
Idle speed: 700 ± 50 rpm

If the idle speed is not as specified, check the IAC valve and air intake system.

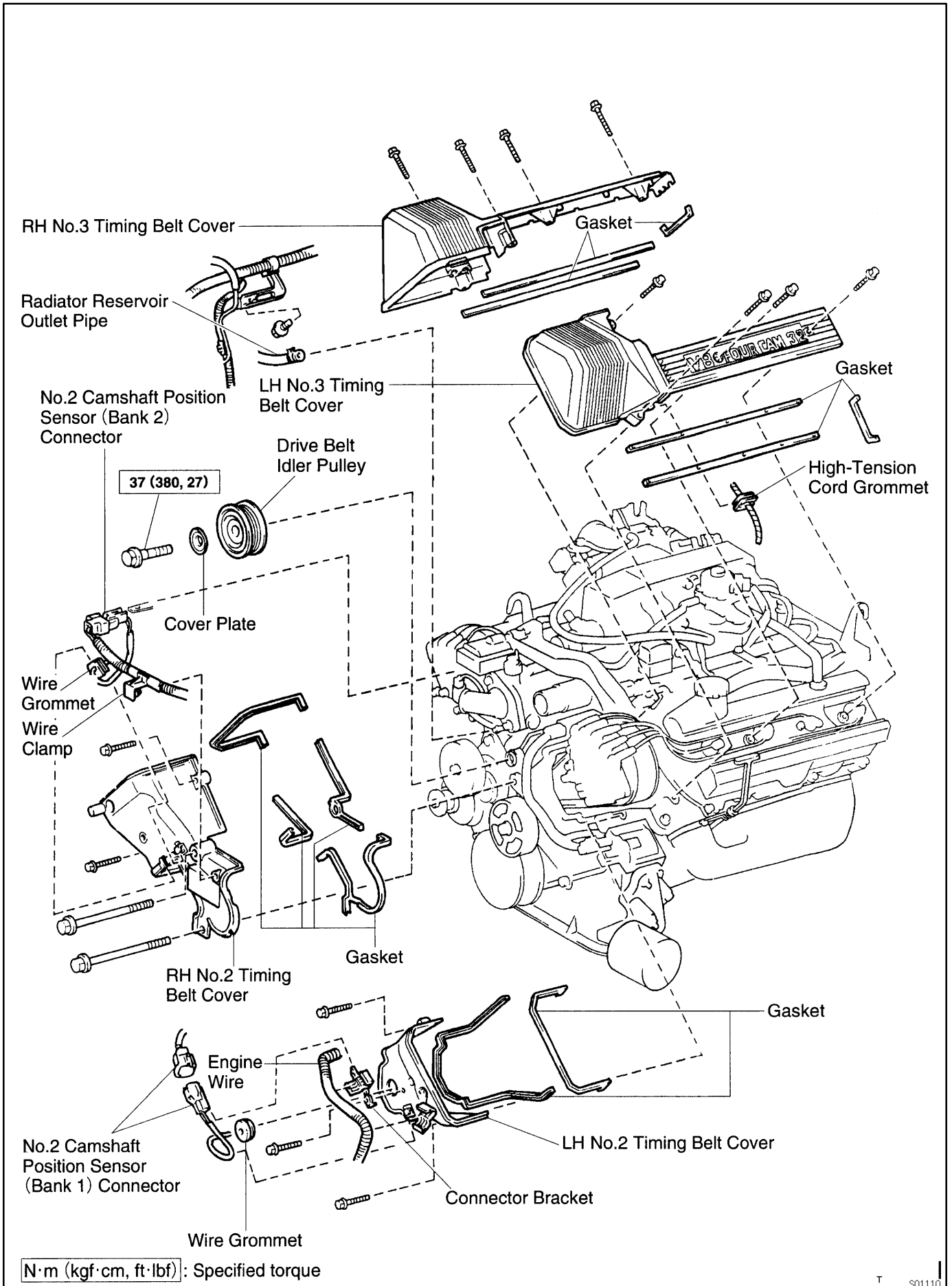
4. DISCONNECT LEXUS HAND-HELD TESTER OR OBD II SCAN TOOL

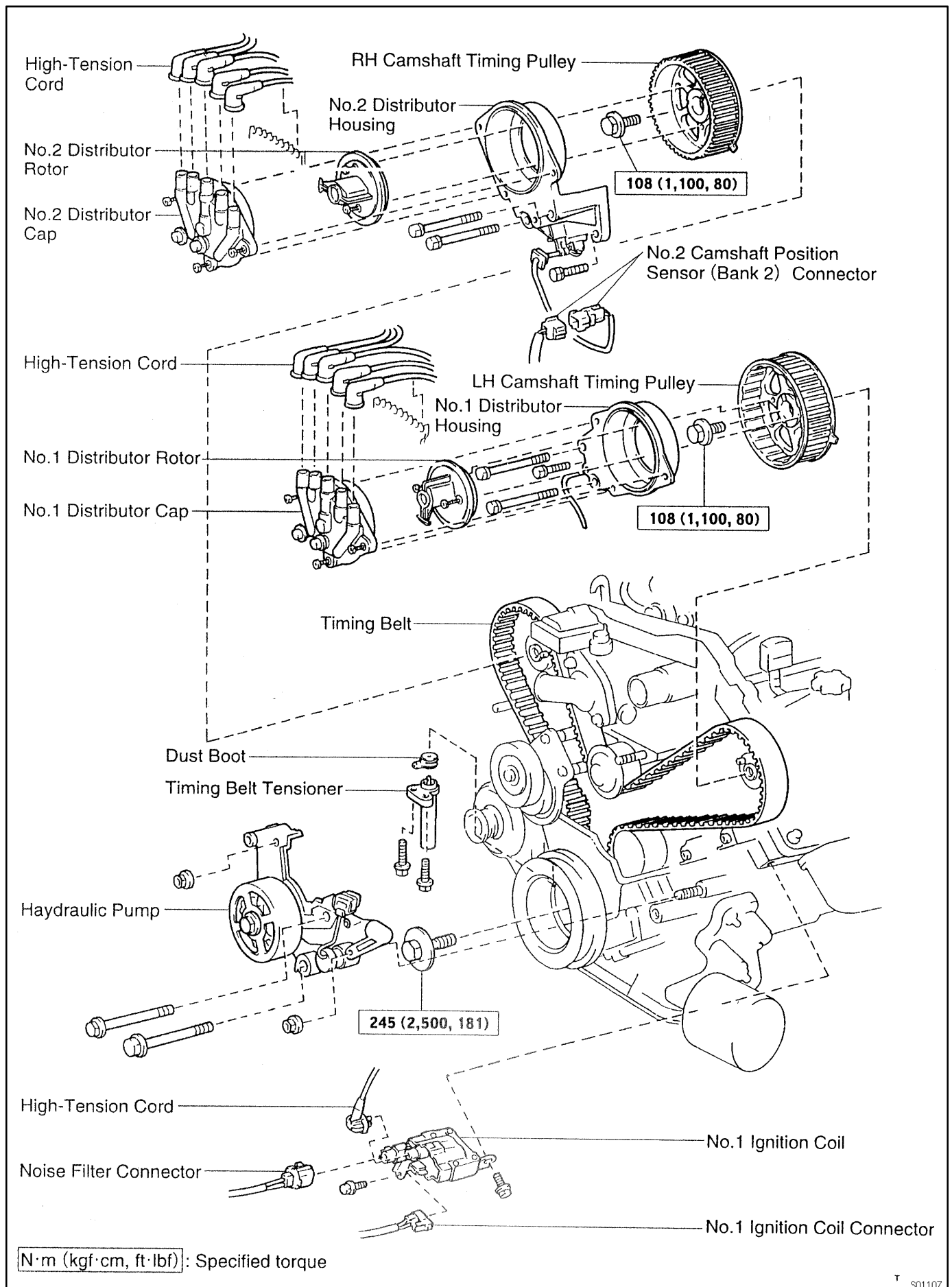
TIMING BELT COMPONENTS

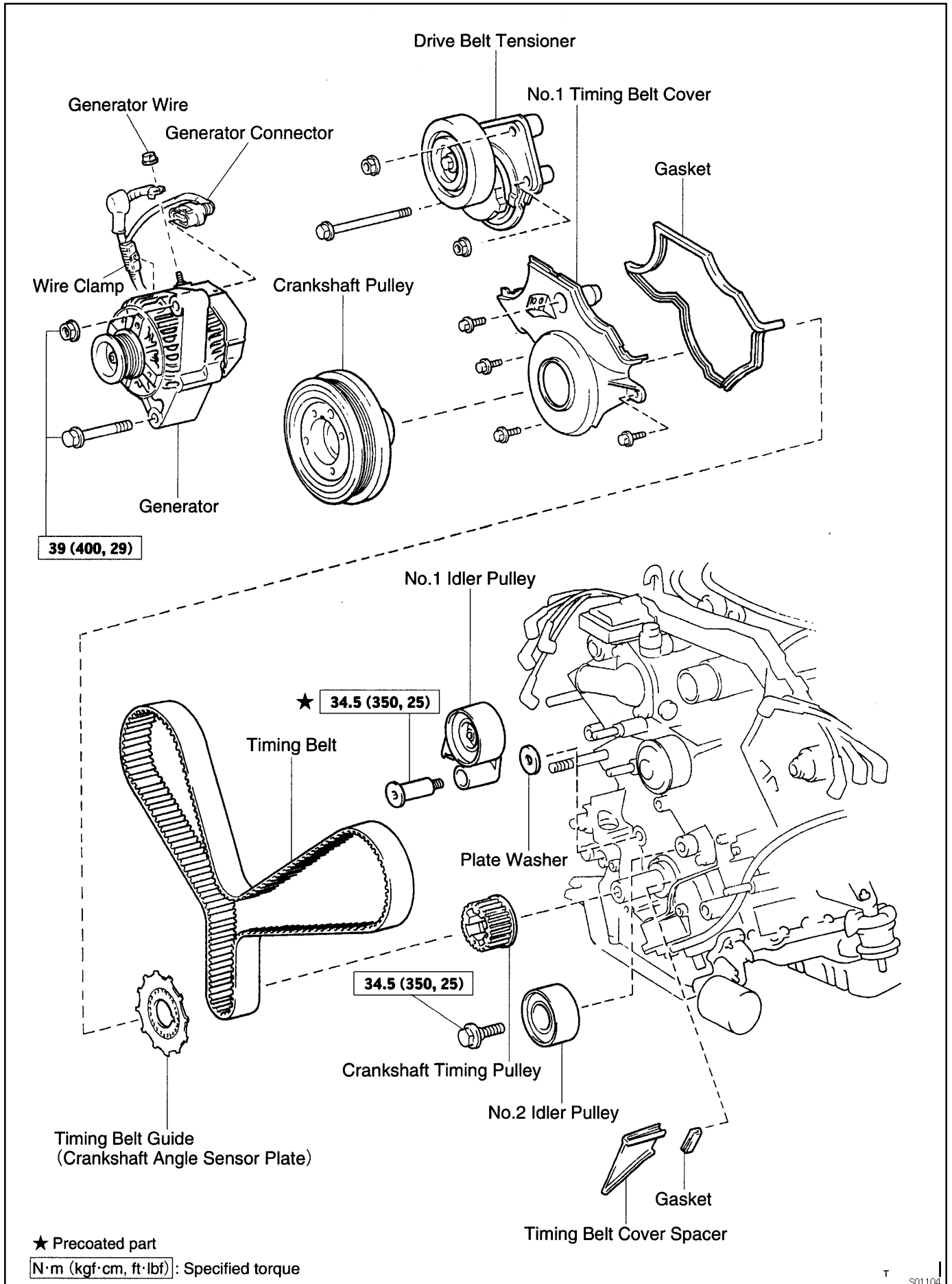
EM0FV-04



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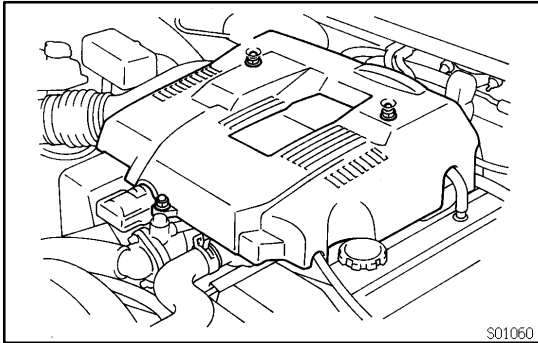






REMOVAL

1. REMOVE ENGINE UNDER COVER
2. DRAIN ENGINE COOLANT
3. REMOVE BATTERY CLAMP COVER

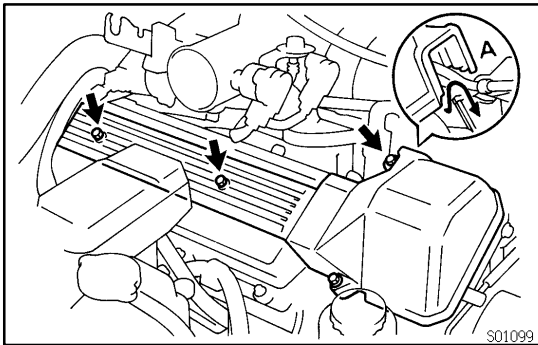


4. REMOVE V-BANK COVER

Remove the bolt, 2 cap nuts and V-bank cover.

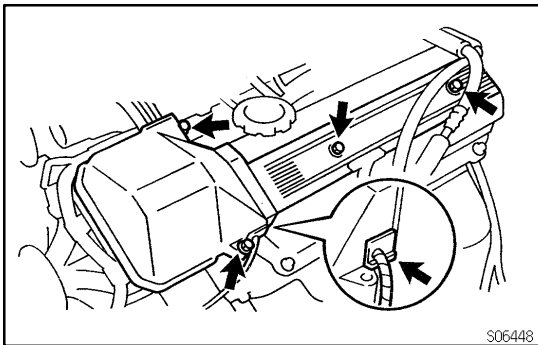
5. REMOVE AIR CLEANER AND INTAKE AIR CONNECTOR ASSEMBLY

6. REMOVE RADIATOR ASSEMBLY (See page [CO-20](#))



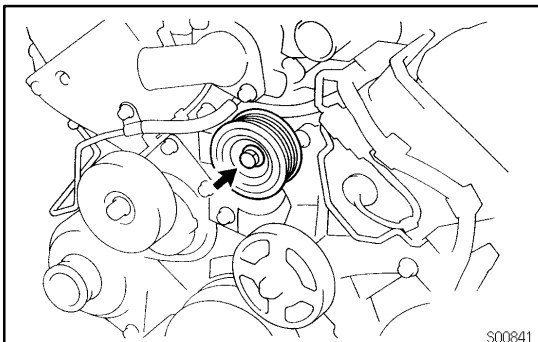
7. REMOVE RH NO. 3 TIMING BELT COVER

- (a) Disconnect the 2 air control valve hoses of the PS pump from the hose clamp on the timing belt cover.
- (b) Remove the 4 bolts and timing belt cover.



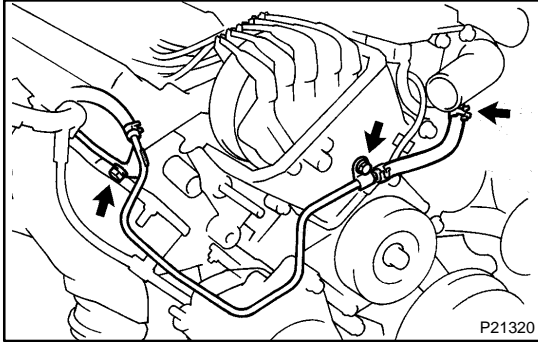
8. REMOVE LH NO. 3 TIMING BELT COVER

- (a) California:
Disconnect the EVAP hose clamp from the timing belt cover.
- (b) Remove the 4 bolts.
- (c) Disconnect the cord grommet from the timing belt cover, and remove the timing belt cover,

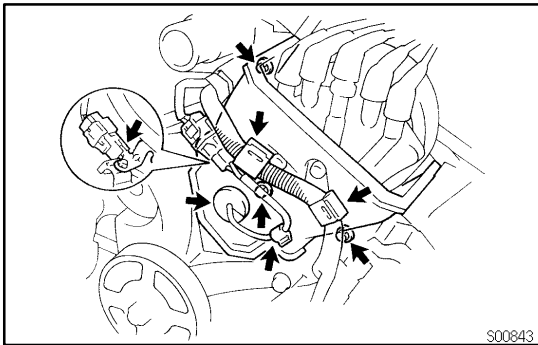


9. REMOVE DRIVE BELT IDLER PULLEY

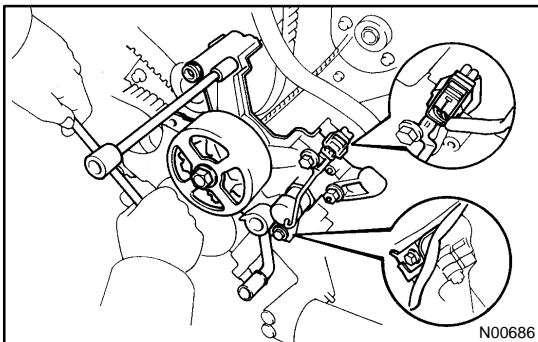
Remove the pulley bolt, cover plate and idler pulley.

**10. REMOVE RH NO. 2 TIMING BELT COVER**

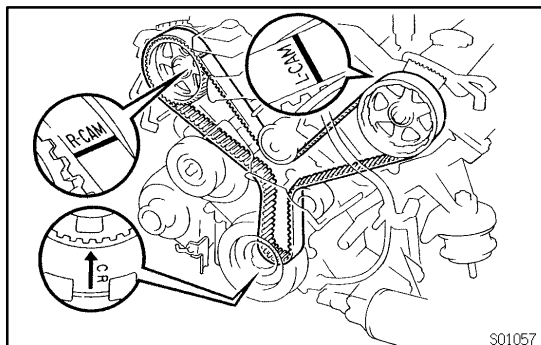
- (a) Disconnect the radiator reservoir outlet hose from the water inlet housing.
- (b) Remove the 2 bolts, disconnect the outlet pipe from the timing belt cover and LH cylinder hood.
- (c) Disconnect the No. 2 camshaft position sensor connector from the ignition coil bracket.
- (d) Remove the 4 bolts.
- (e) Disconnect the sensor wire from the timing belt cover.
- (f) Remove the wire grommet from the timing belt cover.
- (g) Disconnect the wire clamp from the timing belt cover.
- (h) Remove the timing belt cover and 4 gaskets.

**11. REMOVE LH NO. 2 TIMING BELT COVER**

- (a) Disconnect the engine wire from the 2 wire clamps.
- (b) Remove the 3 bolts.
- (c) Disconnect the No. 1 camshaft position sensor wire from the wire clamp on the timing belt cover.
- (d) Disconnect the sensor connector from the connector bracket, and remove the connector bracket.
- (e) Disconnect the sensor connector.
- (f) Remove the wire grommet from the timing belt cover.
- (g) Remove the timing belt cover and 2 gaskets.

12. REMOVE DISTRIBUTOR HOUSINGS(See page [IG-19](#))**13. REMOVE NO.1 IGNITION COIL (See page [IG-8](#))****14. DISCONNECT A/C COMPRESSOR FROM ENGINE**(See page [EM-87](#))**15. REMOVE HYDRAULIC PUMP**

- (a) Disconnect the solenoid valve connector.
- (b) Remove the 2 bolts and 2 nuts.
- (c) Disconnect the crankshaft position sensor wire clamp.
- (d) Remove the hydraulic pump.

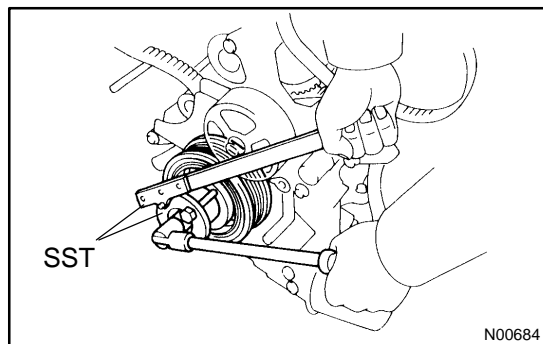


16. IF RE-USING TIMING BELT, CHECK INSTALLATION MARKS ON TIMING BELT

Check that there are 3 installation marks on the timing belt by turning the crankshaft pulley as shown in the illustration.

HINT:

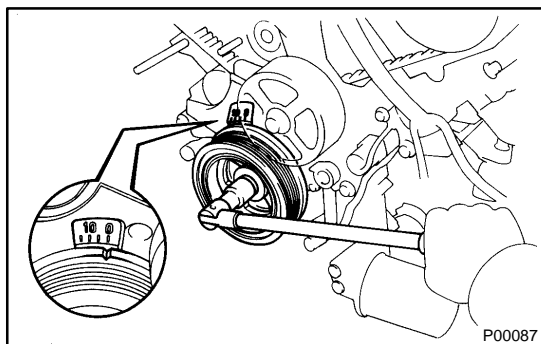
If the installation marks have disappeared, place a new installation mark on the timing belt before removing each part.



17. LOOSEN CRANKSHAFT PULLEY BOLT

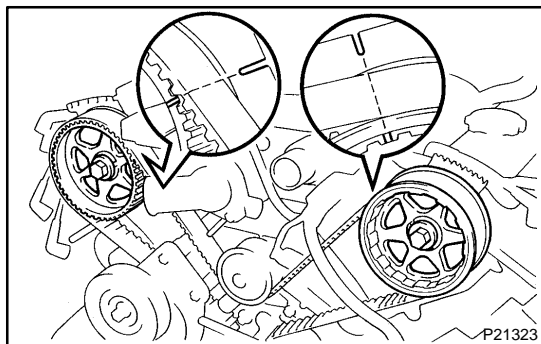
Using SST, loosen the pulley bolt.

SST 09213-54015 (90119-08216), 09330-00021

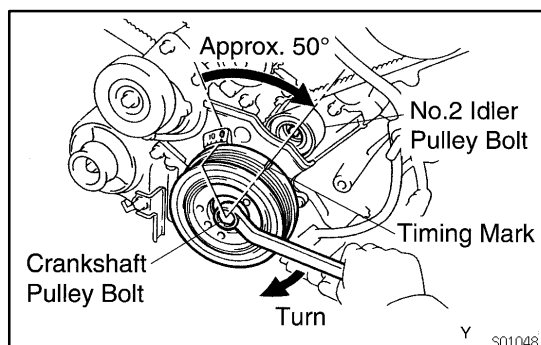


18. SET NO. 1 CYLINDER TO APPROX. 50° ATDC/COMPRESSION

- (a) Turn the crankshaft pulley and align its groove with timing mark "O" of the No. 1 timing belt cover.



- (b) Check that the timing marks of the camshaft timing pulleys and timing belt rear plates aligned. If not, turn the crankshaft 1 revolution (360°).



- (c) Turn the crankshaft pulley approx. 50° clockwise, and put the timing mark of the crankshaft pulley in line with the centers of the crankshaft pulley bolt and the idler pulley bolt.

NOTICE:

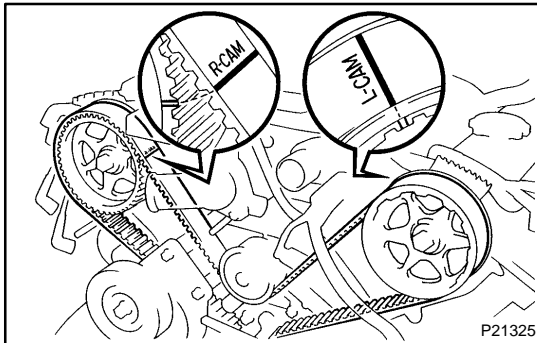
If the timing belt is disengaged, having the crankshaft pulley at the wrong angle can cause the piston head and valve head to come into contact with each other when you remove the camshaft timing pulley (step 19), causing dam-

age. So always set the crankshaft pulley at the correct angle.

(d) Remove the crankshaft pulley bolt.

NOTICE:

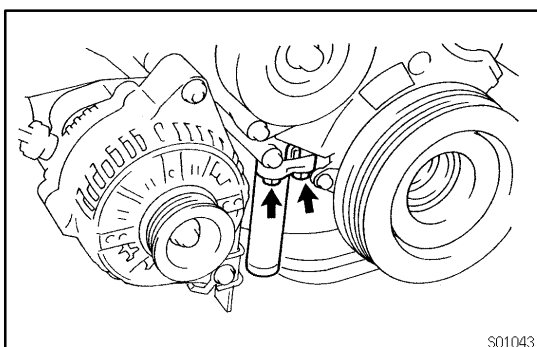
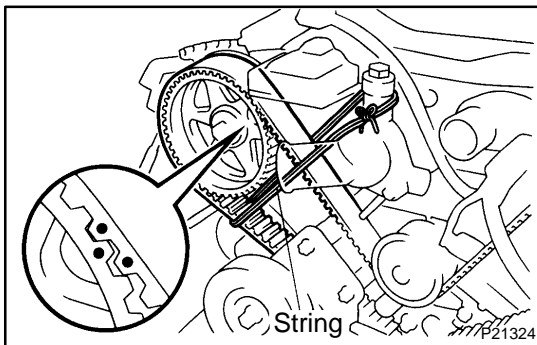
Do not turn the crankshaft pulley.



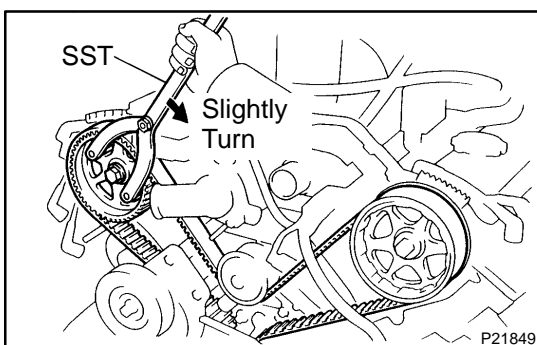
19. REMOVE TIMING BELT TENSIONER

HINT:

- When re-using timing belt:
If the installation marks have disappeared, before remove the timing belt, place 2 new installation marks on the timing belt to match the timing marks of the camshaft timing pulleys.
- When replacing timing belt tensioner only:
To avoid meshing of the timing pulley and timing belt, secure one of them with string. And place matchmarks on the timing belt and RH camshaft timing pulley.

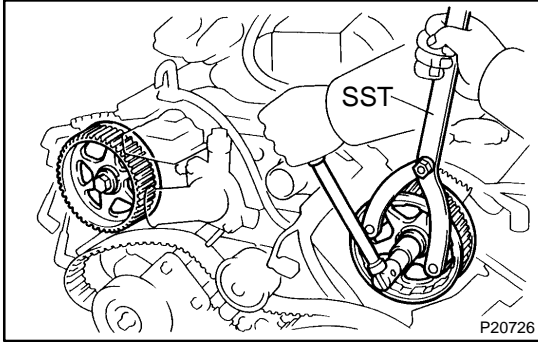


Alternately loosen the 2 bolts, and remove them, the belt tensioner and dust boot.



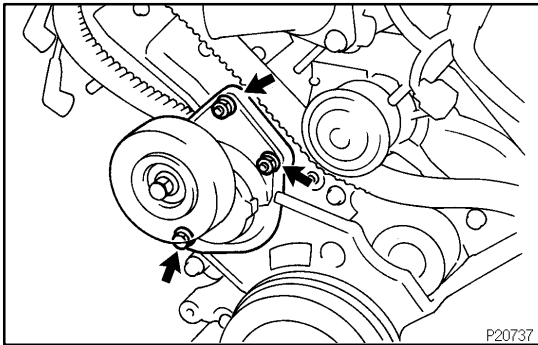
20. DISCONNECT TIMING BELT FROM CAMSHAFT TIMING PULLEYS

- Using SST, loosen the tension spring between the LH and RH camshaft timing pulleys by slightly turning the LH camshaft timing pulley clockwise.
SST 09960-10010 (09962-01000, 09963-01000)
- Disconnect the timing belt from the camshaft timing pulleys.

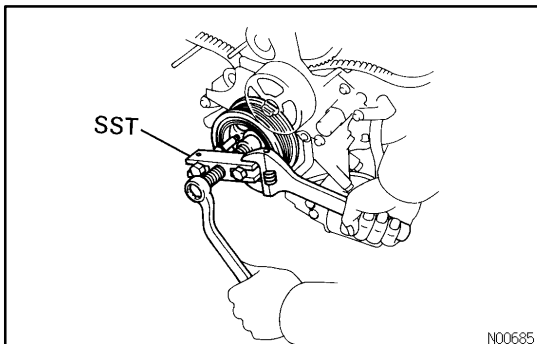
**21. REMOVE CAMSHAFT TIMING PULLEYS**

Using SST, remove the bolt and timing pulley. Remove the 2 timing pulleys.

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

22. REMOVE GENERATOR (See page CH-7)**23. REMOVE DRIVE BELT TENSIONER**

Remove the bolt, 2 nuts and belt tensioner.

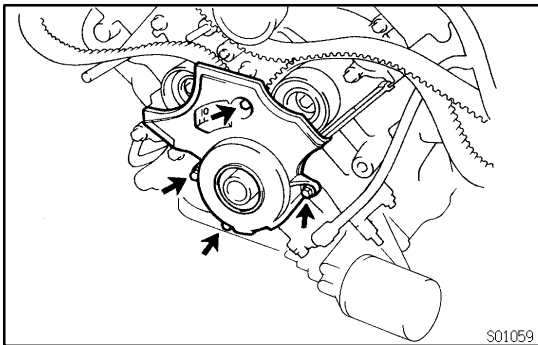
**24. REMOVE CRANKSHAFT PULLEY**

Using SST, remove the crankshaft pulley.

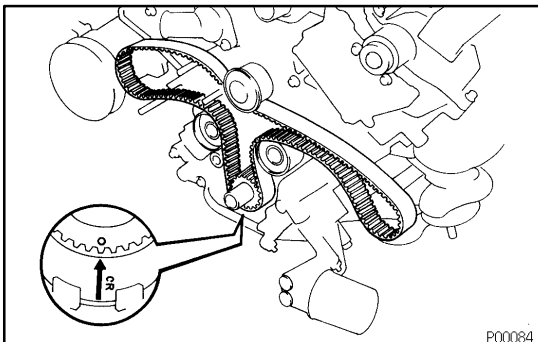
SST 09950-50010 (09951-05010, 09952-05010, 09953-05010, 09953-05020, 09954-05020)

NOTICE:

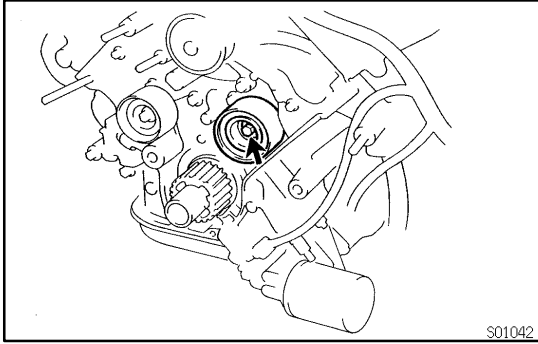
Do not turn the crankshaft pulley.

**25. REMOVE NO. 1 TIMING BELT COVER**

Remove the 4 bolts, timing belt cover and gasket.

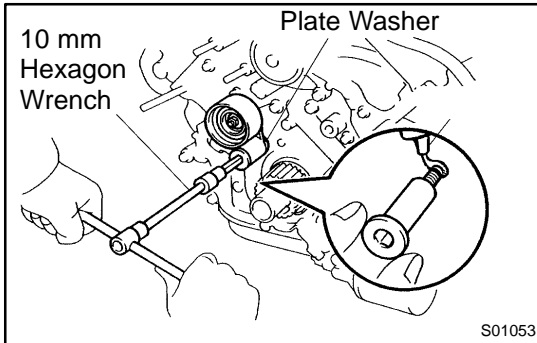
26. REMOVE TIMING BELT GUIDE**27. REMOVE TIMING BELT COVER SPACER****28. REMOVE TIMING BELT****HINT:**

If re-using the belt and the installation mark has disappeared from it, place a new installation mark on the timing belt to the match the dot mark of the crankshaft timing pulley.



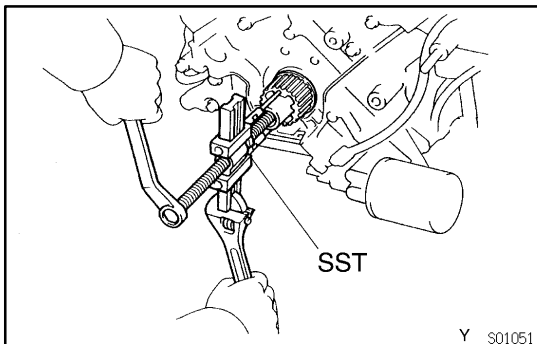
29. REMOVE NO. 2 IDLER PULLEY

Remove the bolt and idler pulley.



30. REMOVE NO. 1 IDLER PULLEY

Using a 10 mm hexagon wrench, remove the bolt, idler pulley and plate washer.



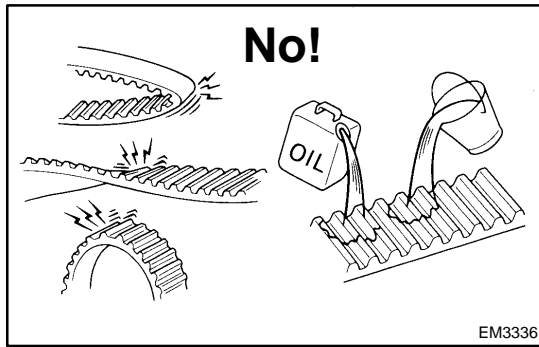
31. REMOVE CRANKSHAFT TIMING PULLEY

Using SST, remove the timing pulley.

SST 09950-50010 (09951-05010, 09952-05010, 09953-05010, 09953-05020, 09954-05010)

NOTICE:

Do not turn the timing pulley.



INSPECTION

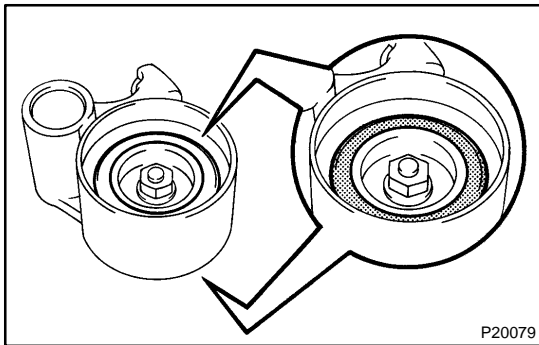
1. INSPECT TIMING BELT

NOTICE:

- Do not bend, twist or turn the timing belt inside out.
- Do not allow the timing belt to come into contact with oil, water or steam.
- Do not utilize timing belt tension when installing or removing the mount bolt of the camshaft timing pulley.

If there are any defects, as shown in the illustrations, check these points:

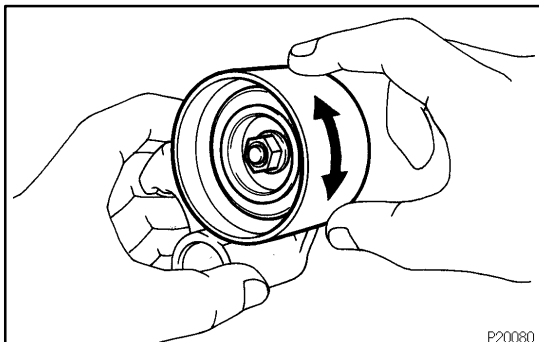
- Premature parting
 - Check for proper installation.
 - Check the timing cover gasket for damage and proper installation.
 - If the belt teeth are cracked or damaged, check to see if either camshaft is locked.
 - If there is noticeable wear or cracks on the belt face, check to see if there are nicks on the side of the idler pulley lock and water pump.
 - If there is wear or damage on only one side of the belt, check the belt guide and the alignment of each pulley.
 - If there is noticeable wear on the belt teeth, check timing cover for damage and check gasket has been installed correctly and for foreign material on the pulley teeth.
- If necessary, replace the timing belt.



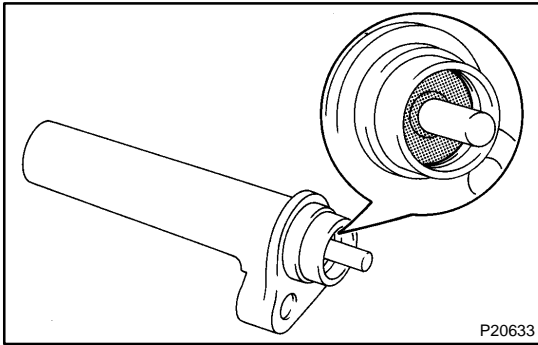
2. INSPECT IDLER PULLEYS

- Visually check the seal portion of the idler pulley for oil leakage.

If leakage is found, replace the idler pulley.



- Check that the idler pulley turns smoothly.
- If necessary, replace the idler pulley.



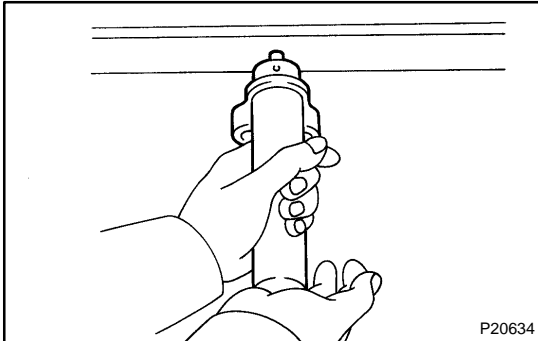
3. INSPECT TIMING BELT TENSIONER

- (a) Visually check the seal portion of the tensioner for oil leakage.

HINT:

If there is only the faintest trace of oil on the seal on the push rod side, the tensioner is all right.

If leakage is found, replace the tensioner.

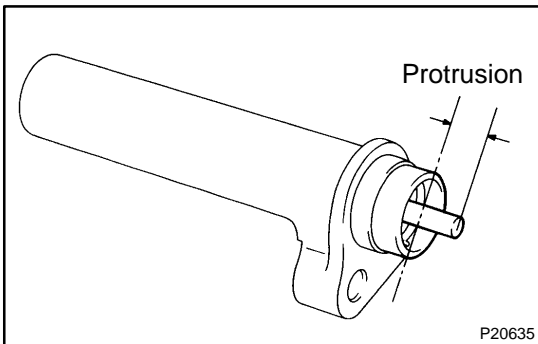


- (b) Hold the tensioner with both hands and push the push rod strongly as shown to check that it doesn't move.

If the push rod moves, replace the tensioner.

NOTICE:

Never hold the tensioner push rod facing downward.

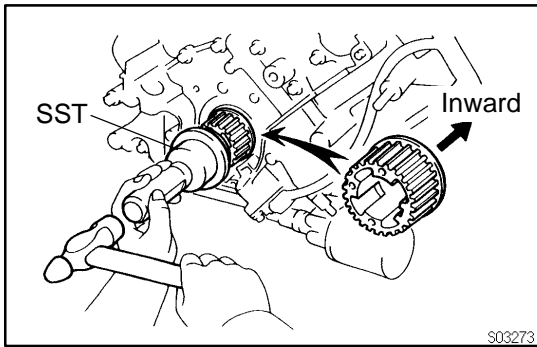


- (c) Measure the protrusion of the push rod from the housing end.

Protrusion: 10.5 – 11.5 mm (0.413 – 0.453 in.)

If the protrusion is not as specified, replace the tensioner.

4. INSPECT WATER PUMP (See page [CO-10](#))

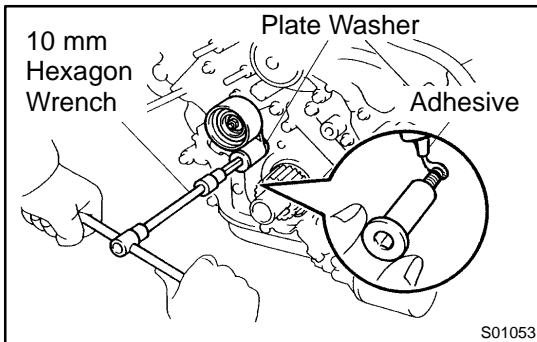


INSTALLATION

1. INSTALL CRANKSHAFT TIMING PULLEY

- Align the timing pulley set key with the key groove of the pulley.
- Using SST and a hammer, tap in the timing pulley, facing the flange side inward.

SST 09223-46011



2. INSTALL NO. 1 IDLER PULLEY

- Apply adhesive 2 or 3 threads of the pivot bolt.

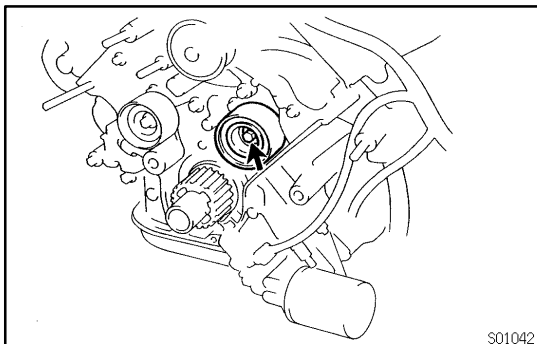
Adhesive:

Part No. 08833-00080, THREE BOND 1344, LOCTITE 242 or equivalent

- Using a 10 mm hexagon wrench, install the plate washer and idler pulley with the pivot bolt.

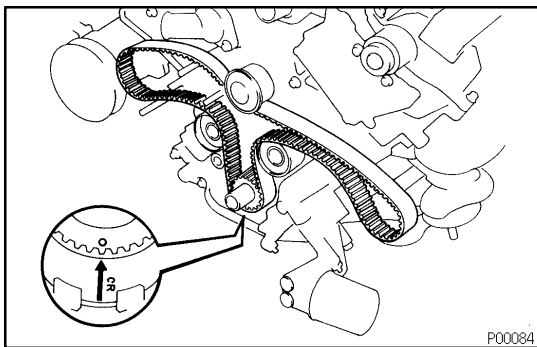
Torque: 34.5 N·m (350 kgf·cm, 25 ft·lbf)

- Check that the pulley bracket moves smoothly.



3. INSTALL NO. 2 IDLER PULLEY

- Install the idler pulley with the bolt.
- Torque: 34.5 N·m (350 kgf·cm, 25 ft·lbf)**
- Check that the idler pulley moves smoothly.



4. TEMPORARILY INSTALL TIMING BELT

NOTICE:

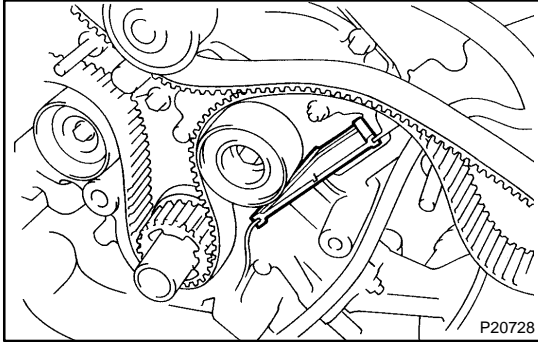
The engine should be cold.

- Remove any oil or water on the crankshaft pulley, oil pump pulley, water pump pulley, No. 1 idler pulley and No. 2 idler pulley, and keep them clean.

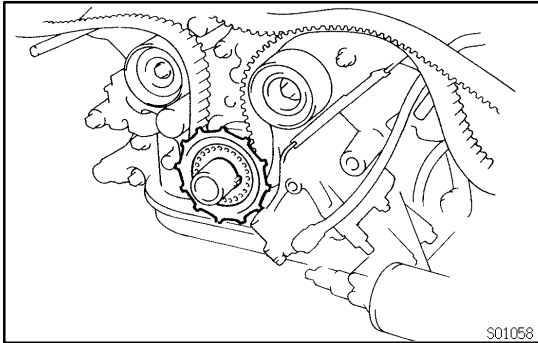
NOTICE:

Only wipe the pulleys; do not use any cleansing agent.

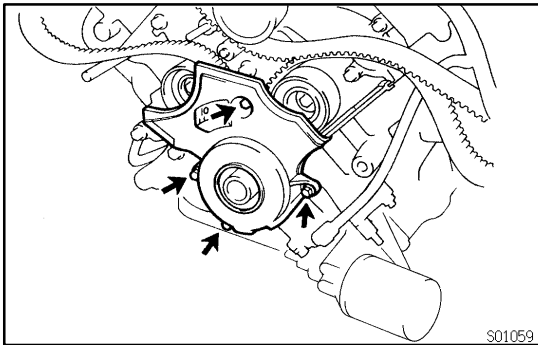
- Align the installation mark on the timing belt with the timing mark of the crankshaft timing pulley.
- Install the timing belt on the crankshaft timing pulley, No. 1 idler pulley and No. 2 idler pulley.

**5. INSTALL TIMING BELT COVER SPACER**

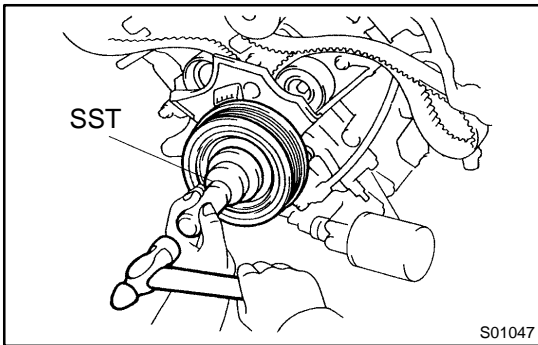
- (a) Install the gasket to the cover spacer.
- (b) Install the cover spacer.

**6. INSTALL TIMING BELT GUIDE**

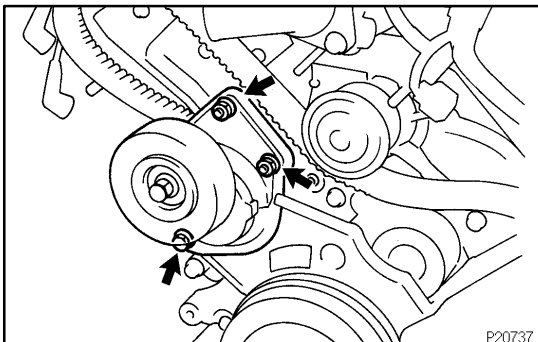
Install the belt guide, facing the cup side outward.

**7. INSTALL NO. 1 TIMING BELT COVER**

- (a) Install the gasket to the timing belt cover.
- (b) Install the timing belt cover with the 4 bolts.

**8. INSTALL CRANKSHAFT PULLEY**

- (a) Align the pulley set key with the key groove of the crankshaft pulley.
- (b) Using SST and a hammer, tap in the crankshaft pulley.
SST 09223-46011

**9. INSTALL DRIVE BELT TENSIONER**

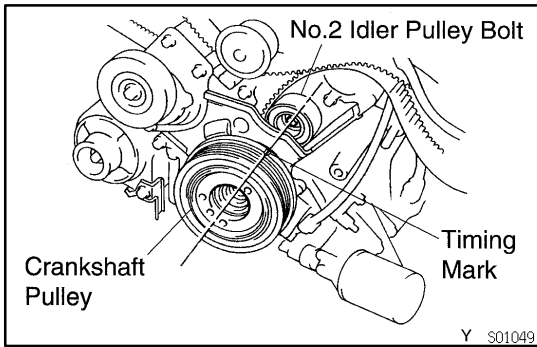
Install the belt tensioner with the bolt and 2 nuts.

Torque: 16 N·m (160 kgf-cm, 12 ft-lbf)

HINT:

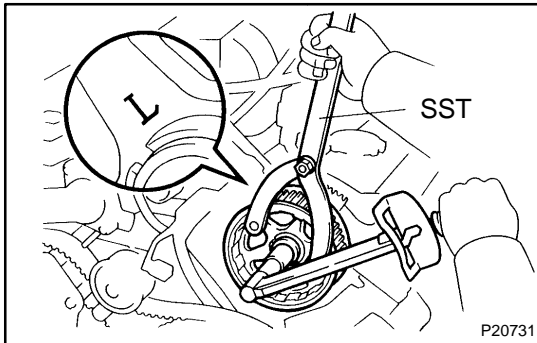
Use a bolt 106 mm (4.18 in.) in length.

10. INSTALL GENERATOR (See page CH-17)



11. CHECK CRANKSHAFT PULLEY POSITION

Check that the timing mark of the crankshaft pulley is aligned with the centers of the crankshaft pulley and the idler pulley bolt.

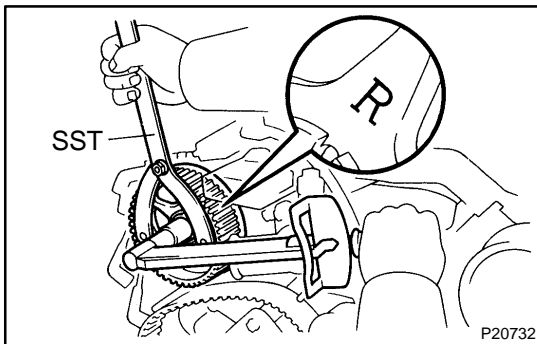


12. INSTALL LH CAMSHAFT TIMING PULLEY

- Align the camshaft knock pin with the knock pin groove of the timing pulley, and slide on the timing pulley.
- Slide the timing pulley on the camshaft, facing the "L" mark forward.
- Using SST, install the pulley bolt.

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

Torque: 108 N·m (1,100 kgf·cm, 80 ft·lbf)

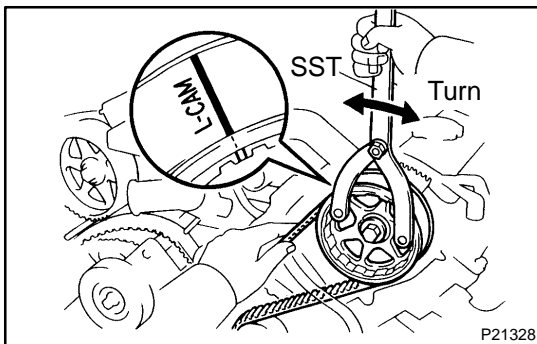


13. INSTALL RH CAMSHAFT TIMING PULLEY

- Align the camshaft knock pin with the knock pin groove of the timing pulley, and slide on the timing pulley.
- Slide the timing pulley on the camshaft, facing the "R" mark forward.
- Using SST, install the pulley bolt.

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

Torque: 108 N·m (1,100 kgf·cm, 80 ft·lbf)



14. CONNECT TIMING BELT TO LH CAMSHAFT TIMING PULLEY

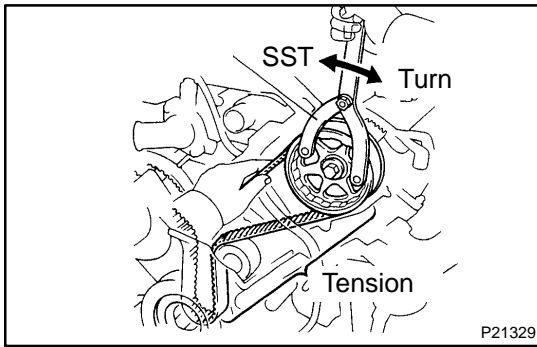
- Remove any oil or water on the LH camshaft timing pulley, and keep it clean.

NOTICE:

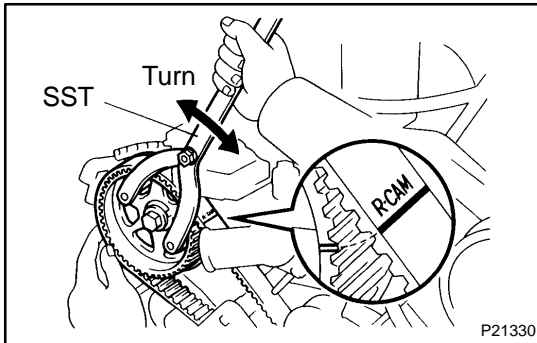
Only wipe the pulleys; do not use any cleansing agent.

- Using SST, turn the LH camshaft timing pulley. Align the installation mark on the timing belt with the timing mark of the camshaft timing pulley, and hang the timing belt on the LH camshaft timing pulley.

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



- (c) Using SST, turn the LH camshaft timing pulley counter-clockwise until there is tension between the crankshaft timing pulley and LH camshaft timing pulley.
SST 09960-10010 (09962-01000, 09963-01000)



15. CONNECT TIMING BELT TO RH CAMSHAFT TIMING PULLEY

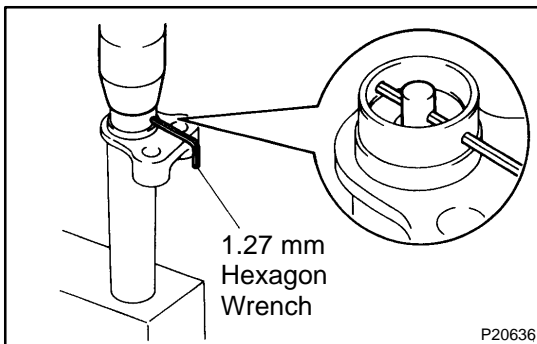
- (a) Remove any oil or water on the RH camshaft timing pulley and water pump pulley, and keep them clean.

NOTICE:

Only wipe the pulleys; do not use any cleansing agent.

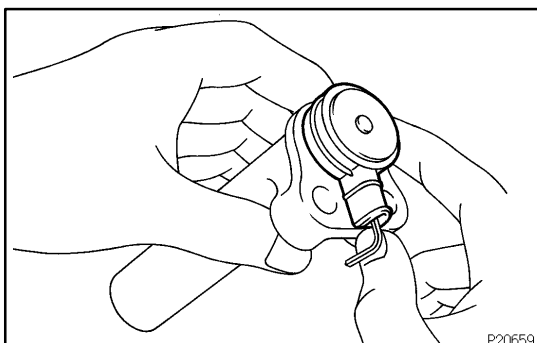
- (b) Using SST, turn the RH camshaft timing pulley. Align the installation mark on the timing belt with the timing mark of the camshaft timing pulley, and hang the timing belt on the RH camshaft timing pulley.

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

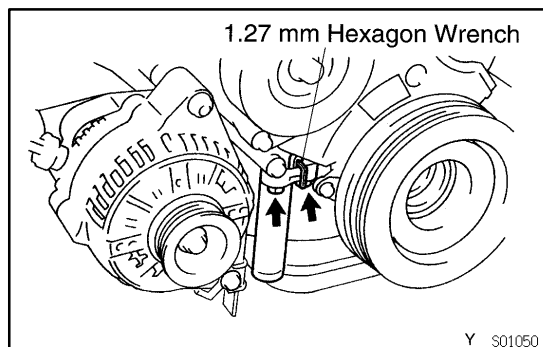


16. SET TIMING BELT TENSIONER

- (a) Using a press, slowly press in the push rod using 981 – 9,807 N (100 – 1,000 kgf, 220 – 2,205 lbf) of pressure.
(b) Align the holes of the push rod and housing, pass a 1.27 mm hexagon wrench through the holes to keep the setting position of the push rod.
(c) Release the press.



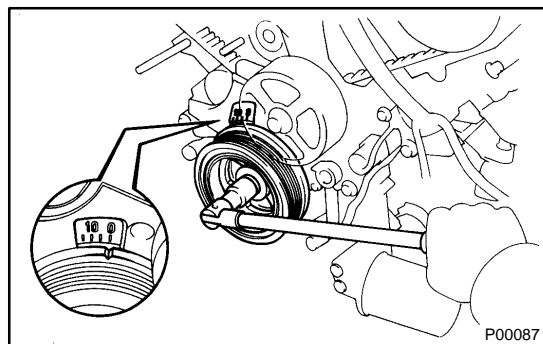
- (d) Install the dust boot to the belt tensioner.

**17. INSTALL TIMING BELT TENSIONER**

- (a) Temporarily install the belt tensioner with the 2 bolts.
- (b) Alternately tighten the 2 bolts.

Torque: 26 N·m (270 kgf-cm, 19 ft-lbf)

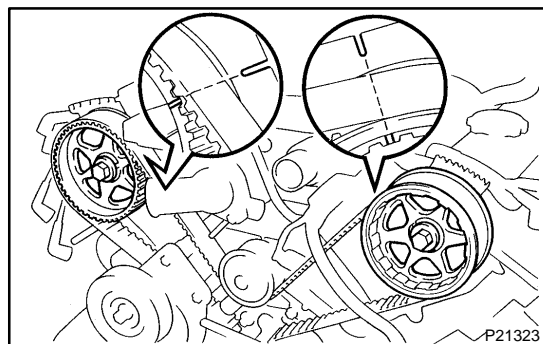
- (c) Using pliers, remove the 1.27 mm hexagon wrench from the belt tensioner.

**18. CHECK VALVE TIMING**

- (a) Temporarily install the crankshaft pulley bolt.
- (b) Slowly turn the crankshaft pulley 2 revolutions from TDC to TDC.

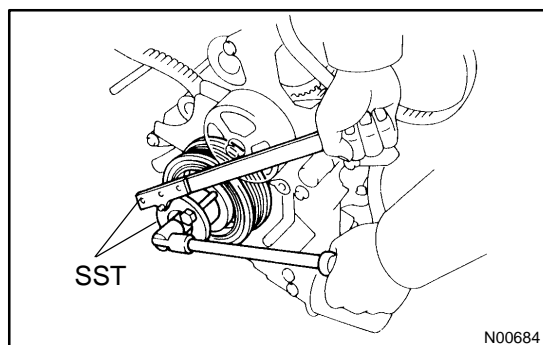
NOTICE:

Always turn the crankshaft pulley clockwise.



- (c) Check that each pulley aligns with the timing marks as shown in the illustration.

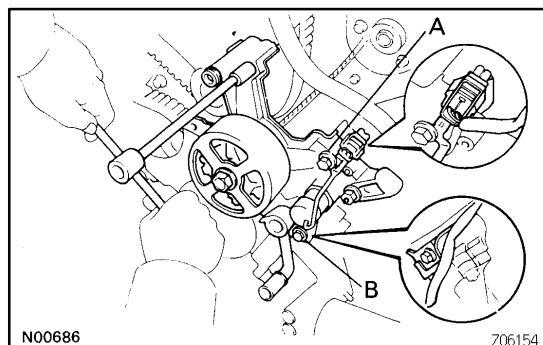
If the timing marks do not align, remove the timing belt and reinstall it.

**19. TIGHTEN CRANKSHAFT PULLEY BOLT**

Using SST, install the pulley bolt.

SST 09213-54015 (90119-08216), 09330-00021

Torque: 245 N·m (2,500 kgf-cm, 181 ft-lbf)

**20. INSTALL HYDRAULIC PUMP**

- (a) Install the hydraulic pump, solenoid valve connector clamp and crankshaft position sensor wire clamp with the 2 bolts and 2 nuts.

Torque:

16 N·m (160 kgf-cm, 12 ft-lbf) for 12 mm head

30 N·m (310 kgf-cm, 22 ft-lbf) for 14 mm head

HINT:

Each bolt length is indicated in the illustration.

Bolt length:

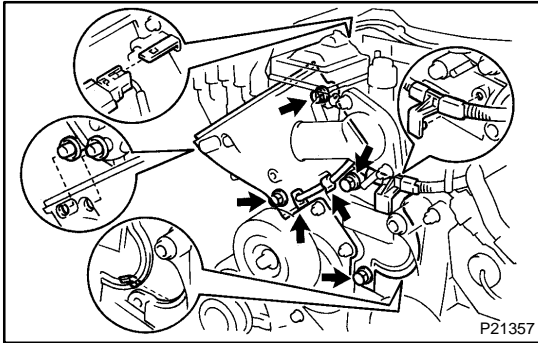
A	106 mm (4.17 in.)
B	114 mm (4.49 in.)

(b) Connect the solenoid valve connector.

21. INSTALL A/C COMPRESSOR (See page EM-96)

22. INSTALL NO. 1 IGNITION COIL (See page IG-9)

23. INSTALL DISTRIBUTOR HOUSINGS (See page IG-20)



24. INSTALL RH NO. 2 TIMING BELT COVER

(a) Install the 4 gaskets to the timing belt cover.

(b) Install the wire grommet to the timing belt cover.

(c) Fit the timing belt cover, matching it with the fan bracket.

(d) Fit the timing belt cover holes, matching them with the 2 grommets on the distributor.

(e) Install the timing belt cover with the 5 bolts.

Torque: 16 N·m (160 kgf·cm, 12 ft·lbf) for 12 mm head

HINT:

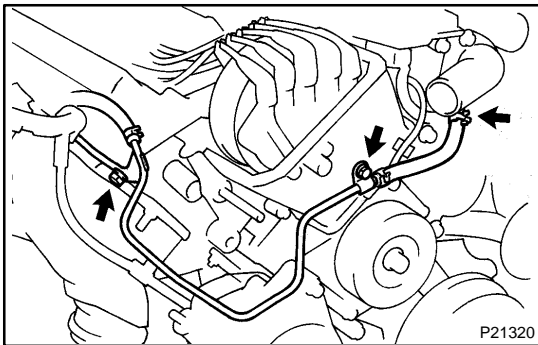
For 12 mm head:

Use bolts 106 mm (4.17 in.) in length.

(f) Install the No. 2 camshaft position sensor wire to the wire clamp on the timing belt cover.

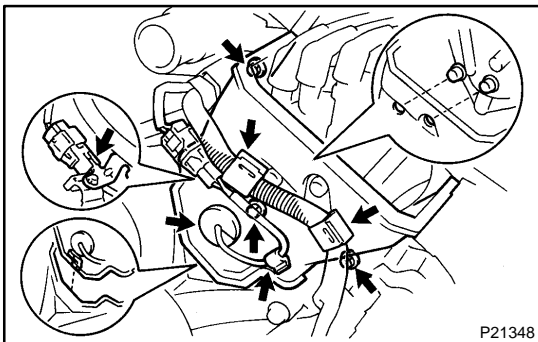
(g) Install the wire clamp to the timing belt cover.

(h) Install the sensor connector to the ignition coil bracket.



(i) Install the radiator reservoir outlet pipe to the RH cylinder head and timing belt cover with the 2 bolts.

(j) Connect the outlet hoses to the water inlet housing.



25. INSTALL LH NO. 2 TIMING BELT COVER

(a) Install the 2 gaskets to the timing belt cover.

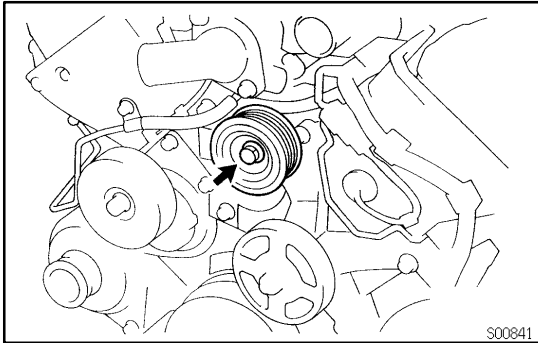
(b) Run the No. 1 camshaft position sensor wire through the timing belt cover hole.

(c) Fit the timing belt cover, matching it with the fan bracket.

(d) Fit the timing belt cover holes, matching them with the 2 grommets on the distributor.

(e) Install the timing belt cover and connector bracket with the 3 bolts.

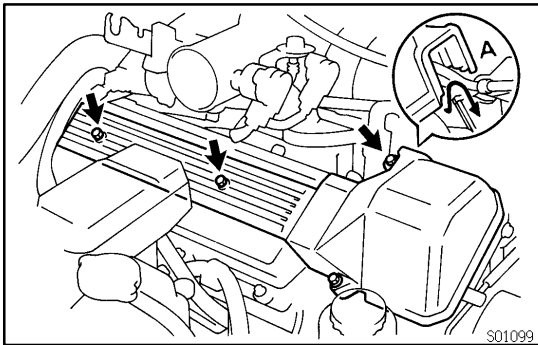
- (f) Install the wire grommet to the timing belt cover.
- (g) Install the sensor connector to the connector bracket.
- (h) Connect the sensor connector.
- (i) Install the sensor wire to the wire clamp on the timing belt cover.
- (j) Install the engine wire to the 2 wire clamps on the timing belt cover.



26. INSTALL DRIVE BELT IDLER PULLEY

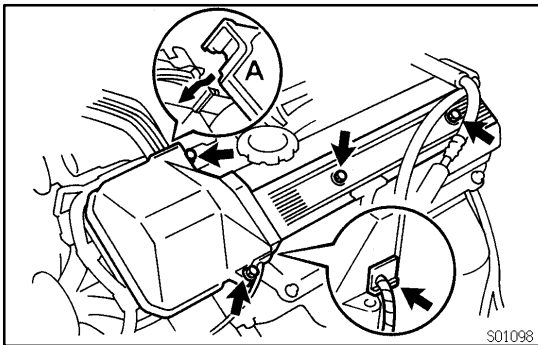
Install the idler pulley and cover plate with the bolt.

Torque: 37 N·m (380 kgf·cm, 27 ft·lbf)



27. INSTALL RH NO. 3 TIMING BELT COVER

- (a) Install the 2 gaskets to the timing belt cover.
- (b) Fit the portion A of the timing belt cover, matching it with the lower high-tension cord cover.
- (c) Install the timing belt cover with the 4 bolts.



28. INSTALL LH NO. 3 TIMING BELT COVER

- (a) Install the 3 gaskets to the timing belt cover.
- (b) Install the cord grommet to the high-tension cord (from the LH ignition coil).
- (c) Install the cord grommet to the timing belt cover.
- (d) Fit the portion A of the timing belt cover, matching it with the lower high-tension cord cover.
- (e) Install the timing belt cover with the 4 bolts.

29. INSTALL RADIATOR ASSEMBLY (See page [CO-22](#))

30. INSTALL AIR CLEANER AND INTAKE AIR CONNECTOR ASSEMBLY

31. INSTALL V-BANK COVER

32. FILL WITH ENGINE COOLANT

33. START ENGINE AND CHECK FOR LEAKS

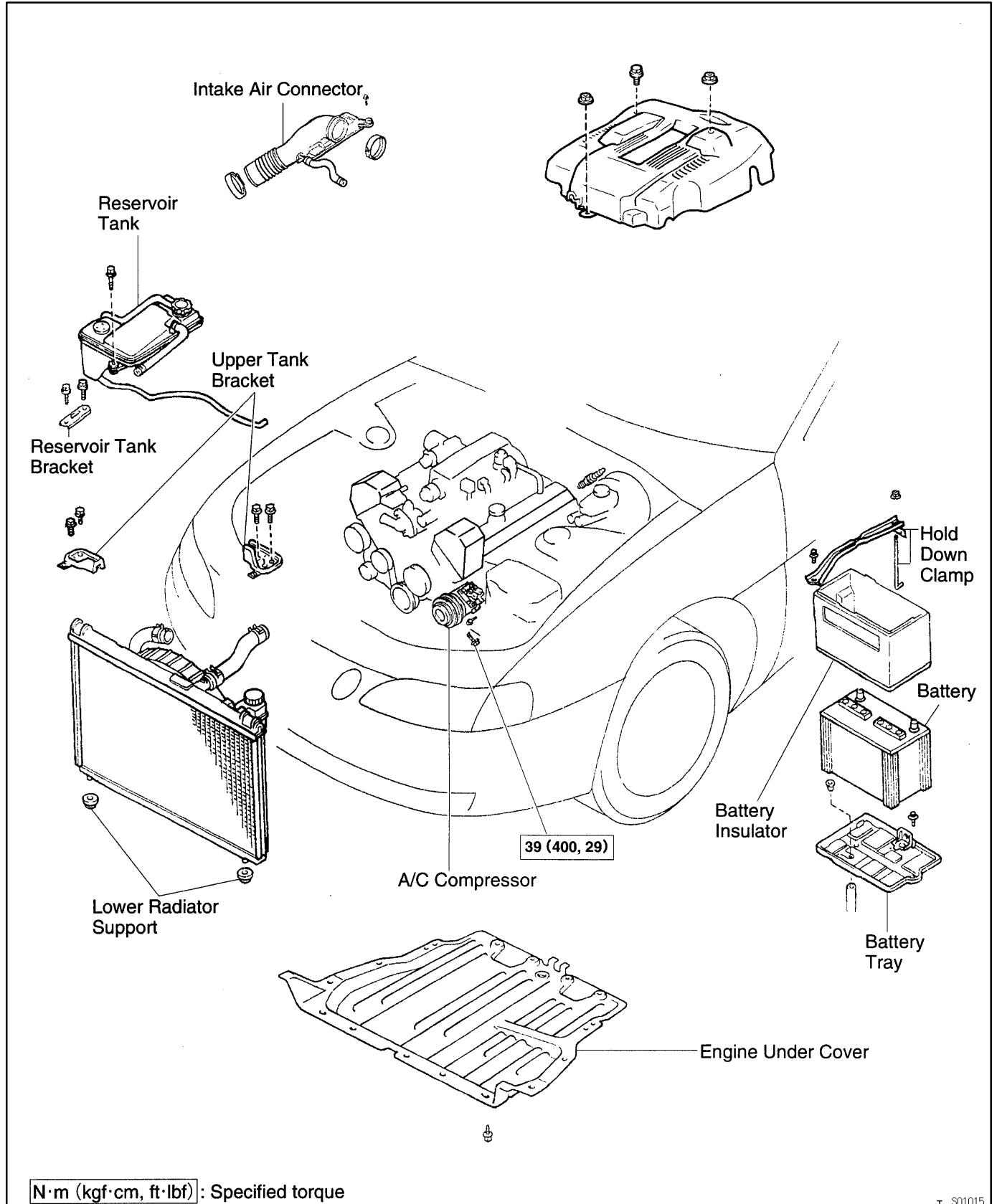
34. RECHECK ENGINE COOLANT LEVEL

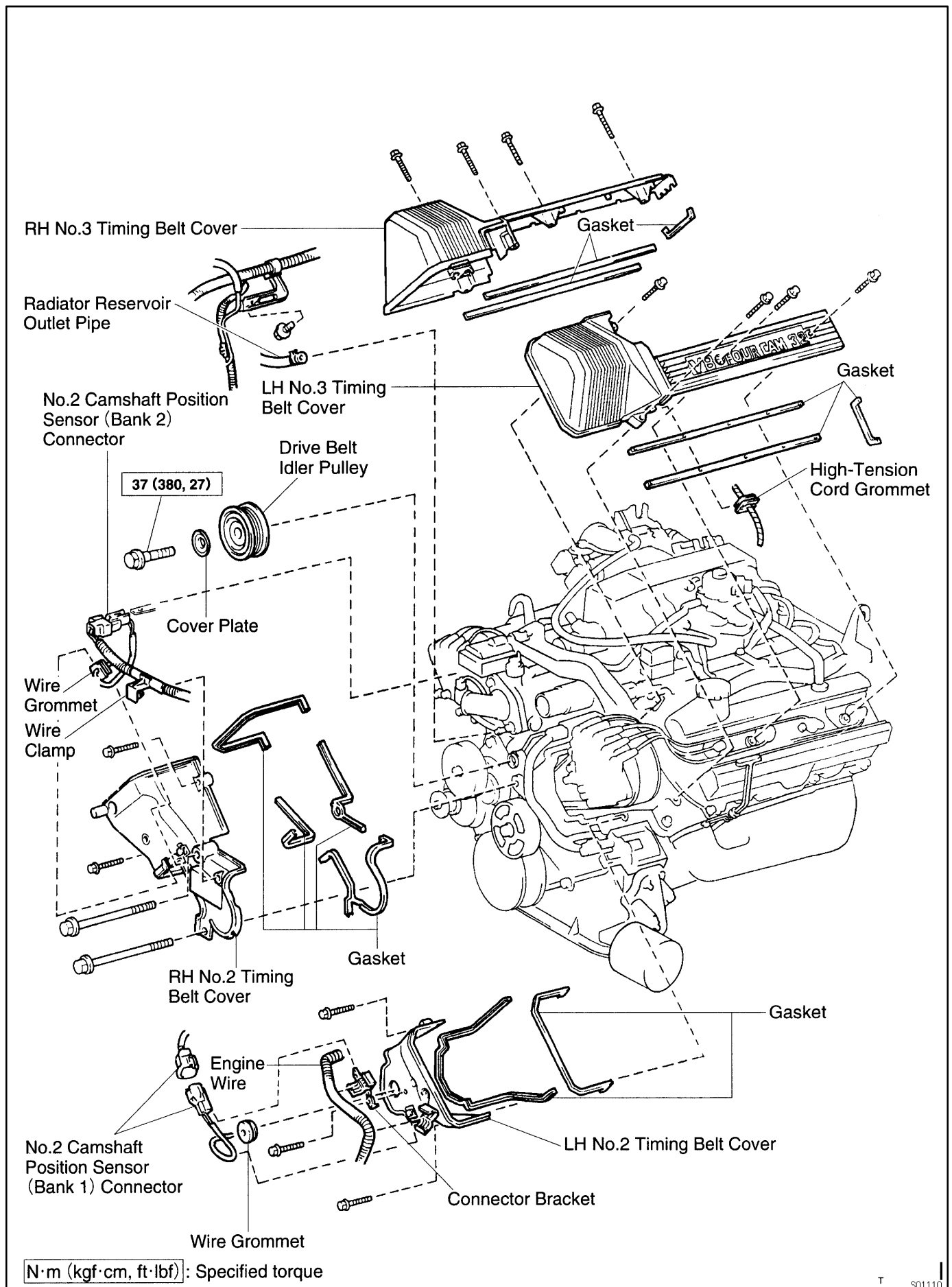
35. INSTALL BATTERY CLAMP COVER

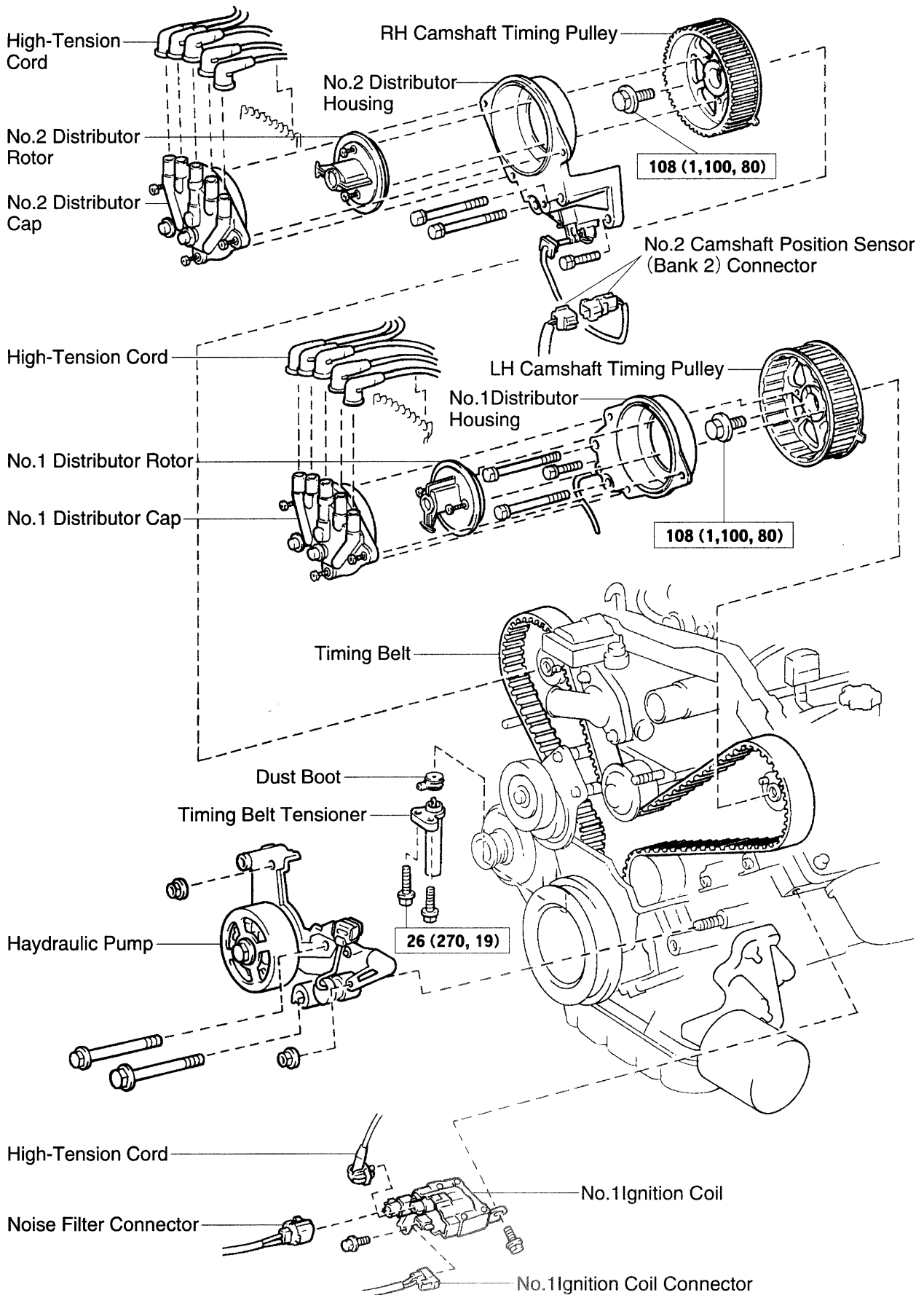
36. INSTALL ENGINE UNDER COVER

CYLINDER HEAD COMPONENTS

EM1GI-02

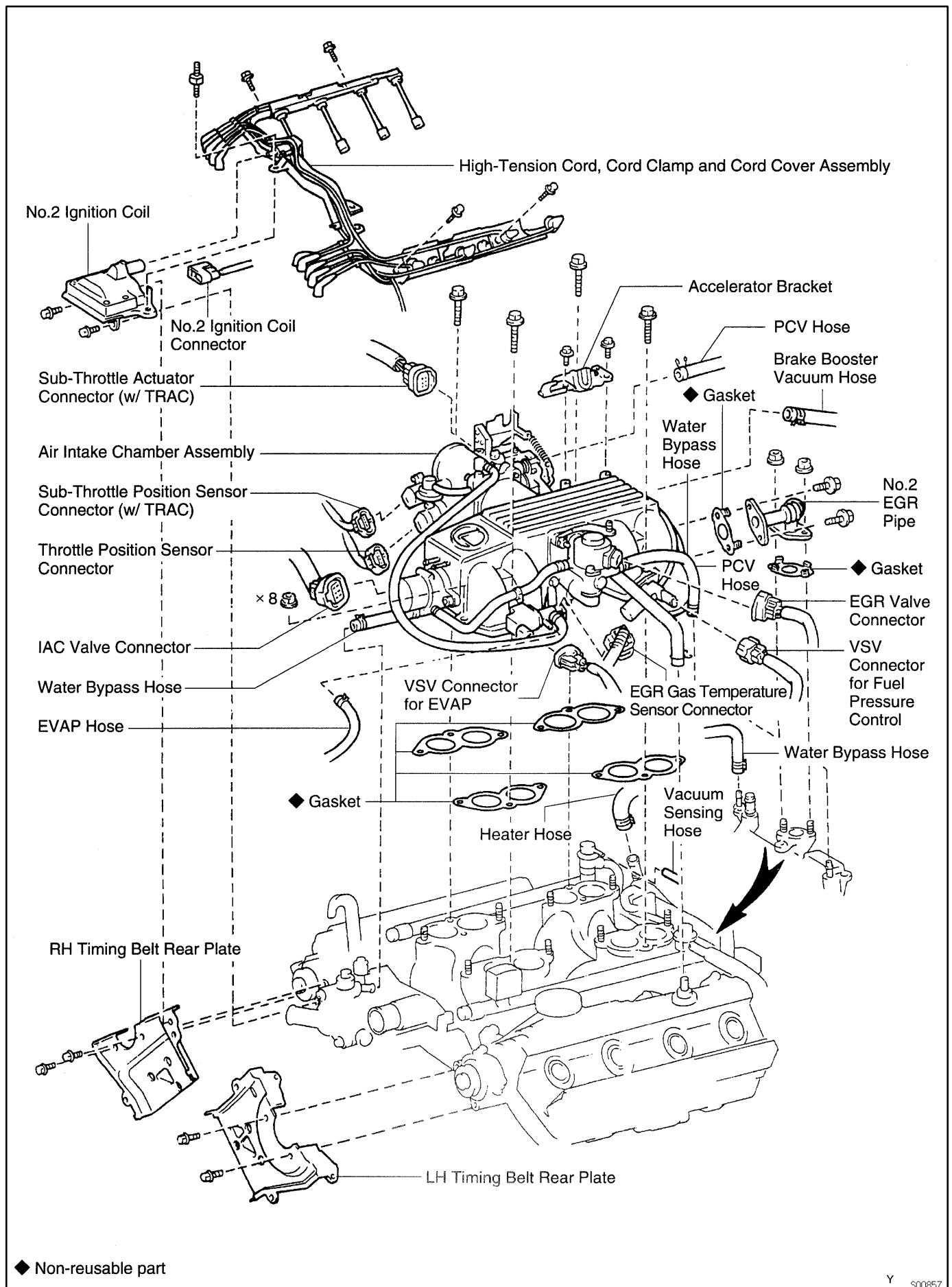


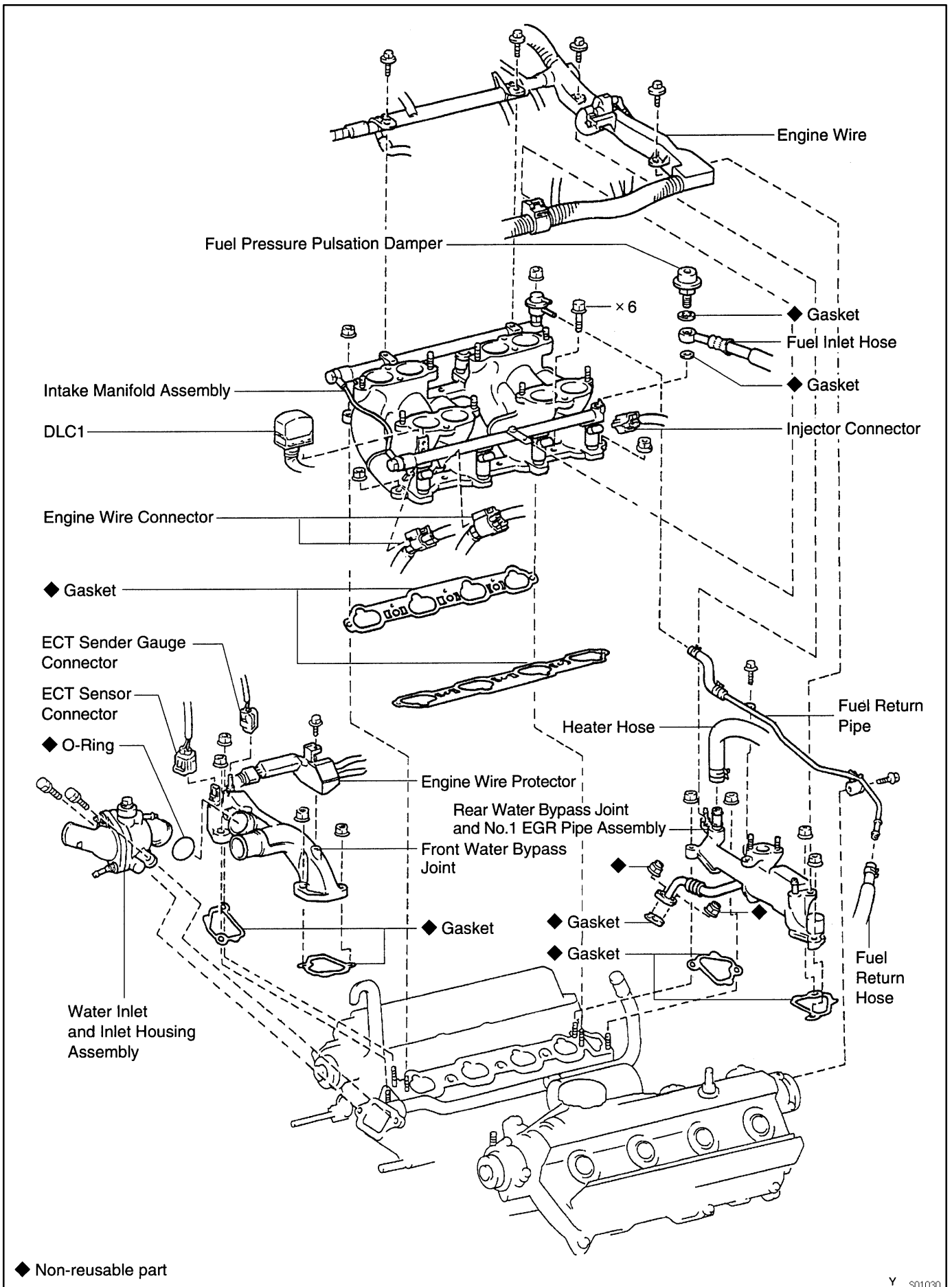


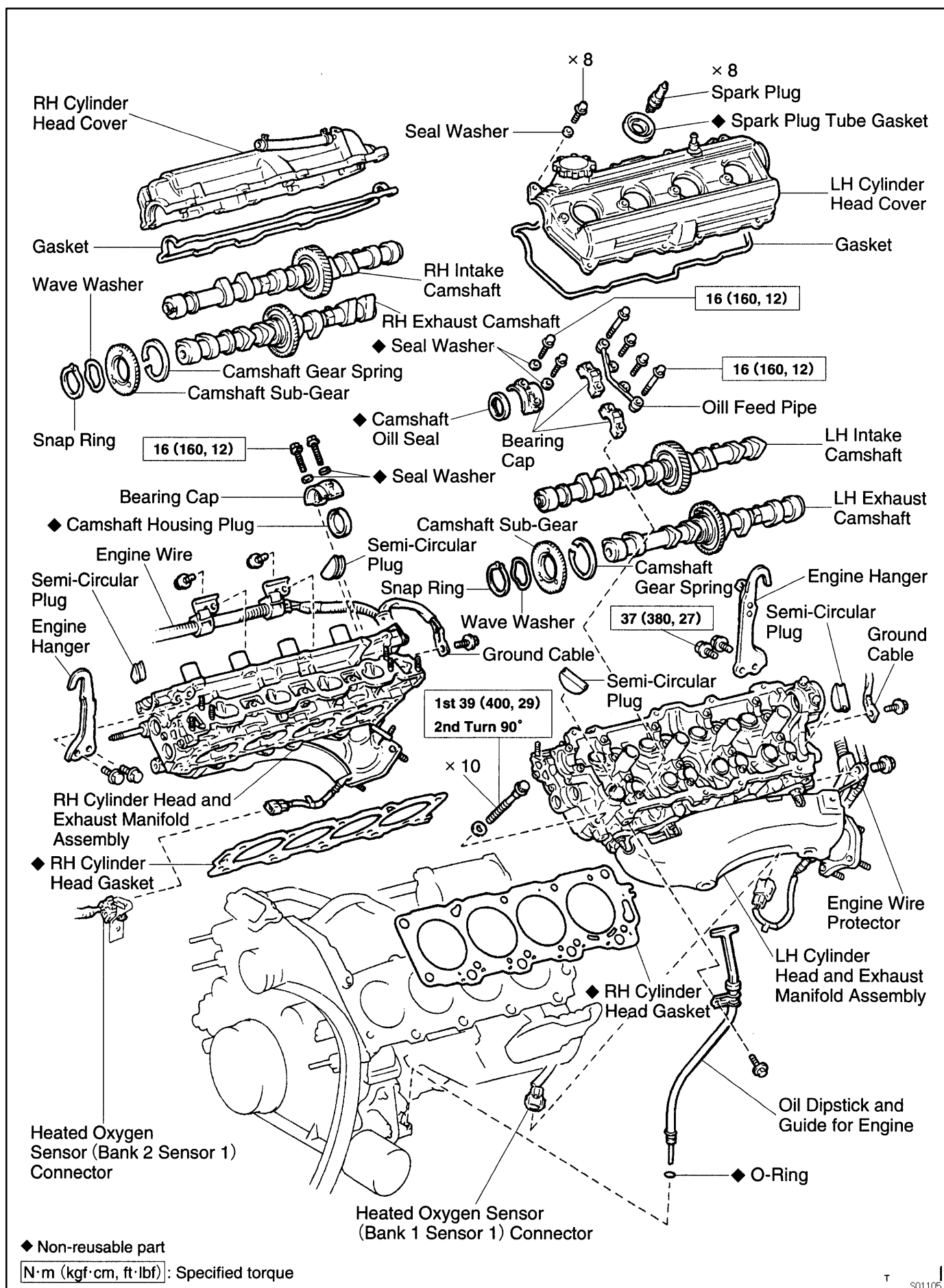


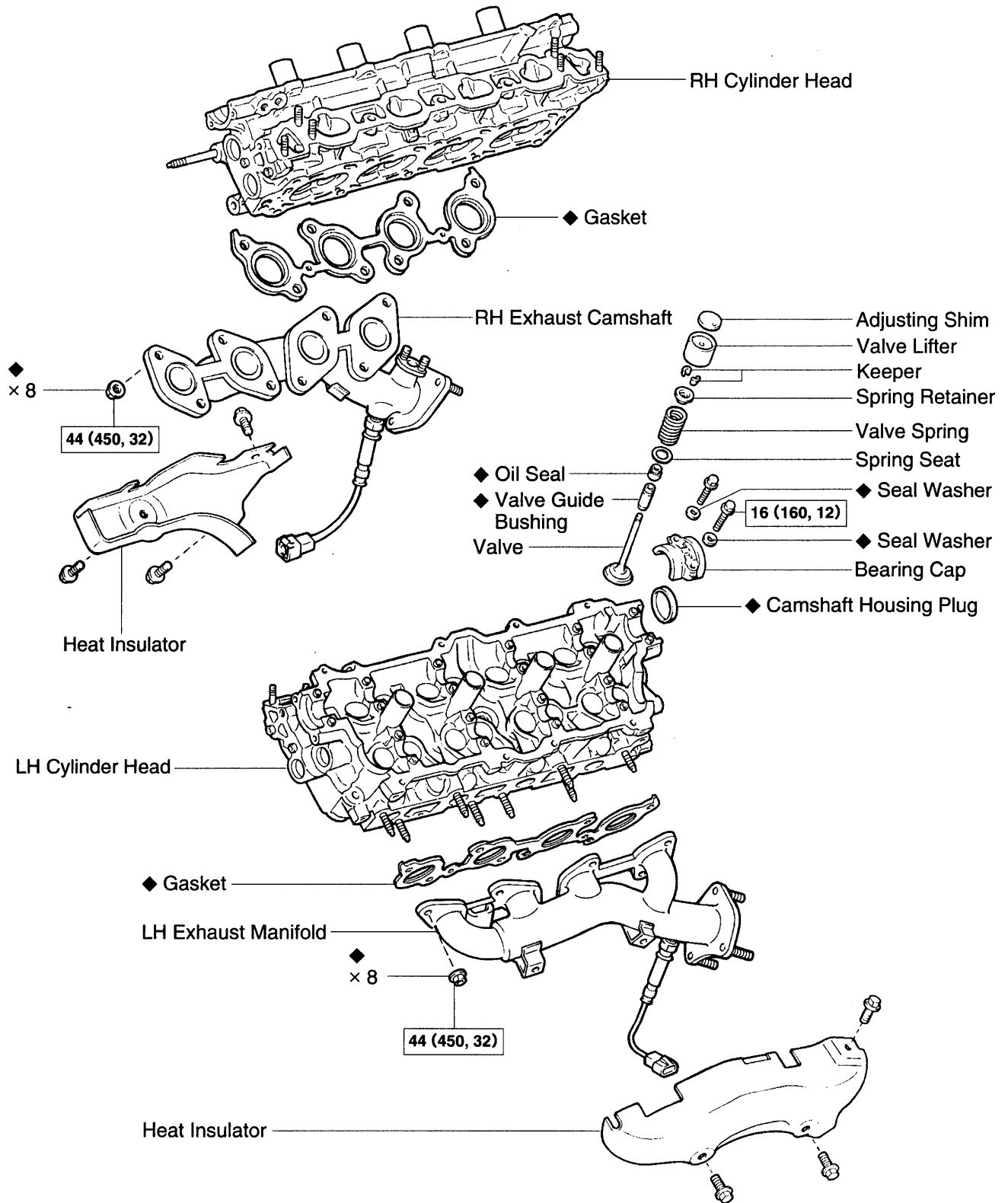
N·m (kgf·cm, ft·lbf): Specified torque

S01113









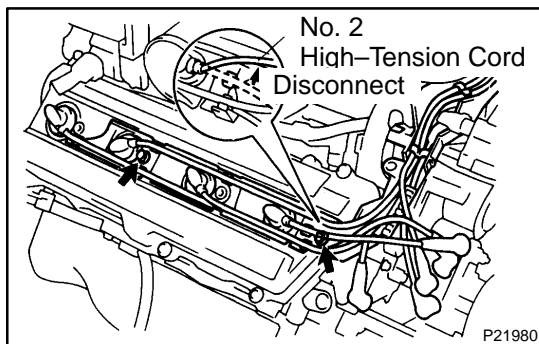
◆ Non-reusable part

N·m (kgf·cm, ft·lbf): Specified torque

T S01016

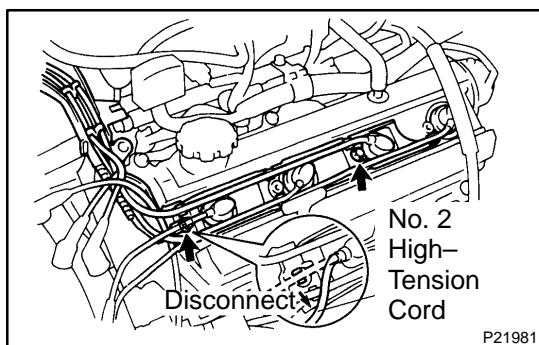
REMOVAL

1. **DISCONNECT TIMING BELT FROM CAMSHAFT TIMING PULLEYS** (See page [EM-18](#))
2. **REMOVE CAMSHAFT TIMING PULLEYS** (See page [EM-18](#))
3. **DISCONNECT PS PUMP FROM ENGINE**
 - (a) Disconnect the PS air hose from the air intake chamber.
 - (b) Disconnect the PS pump from the engine (See page [EM-87](#)).
4. **DISCONNECT FRONT EXHAUST PIPE FROM 2 FRONT TWC** (See page [EC-16](#))

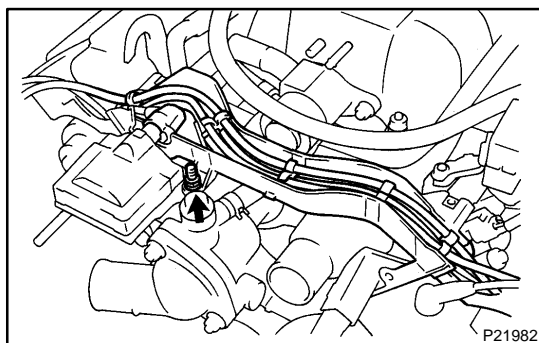


5. **REMOVE HIGH-TENSION CORDS, CORD CLAMPS AND CORD COVER ASSEMBLY**

- (a) Disconnect the No. 2 high-tension cord from the cord clamp on the RH front high-tension cord clamp.
- (b) Remove the 2 bolts holding the RH high-tension cord clamps to the RH cylinder head cover.



- (c) Disconnect the No. 1 high-tension cord from the cord clamp on the LH front high-tension cord clamp.
- (d) Remove the 2 bolts holding the LH high-tension cord clamps to the LH cylinder head cover.

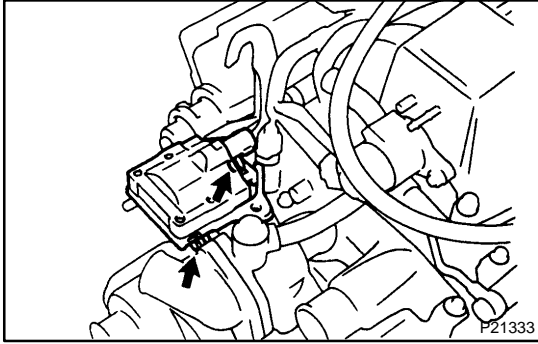


- (e) Remove the stud bolt holding the lower high-tension cord cover to the No. 2 ignition coil.
- (f) Disconnect the high-tension cords from the spark plugs, distributor caps and No. 2 ignition coil.

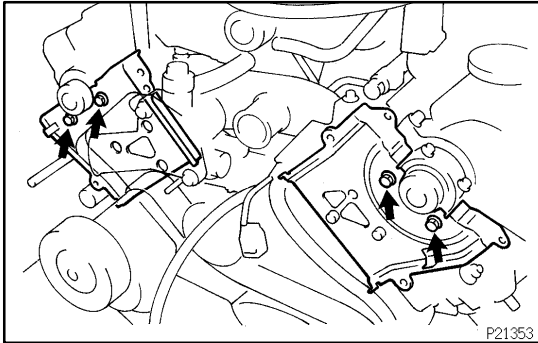
NOTICE:

Pulling on or bending the cords may damage the conductor inside.

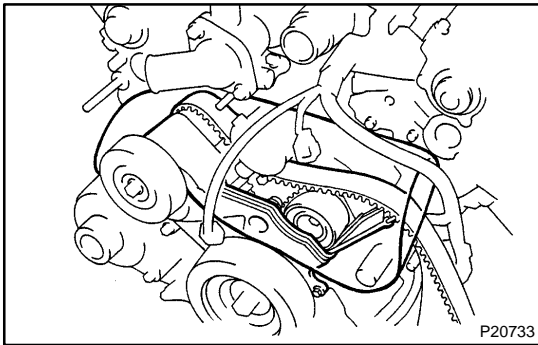
- (g) Remove the high-tension cords, cord clamps and cord cover assembly.

**6. REMOVE NO. 2 IGNITION COIL**

- (a) Disconnect the ignition coil connector.
- (b) Remove the 2 bolts and ignition coil.

**7. REMOVE TIMING BELT REAR PLATES**

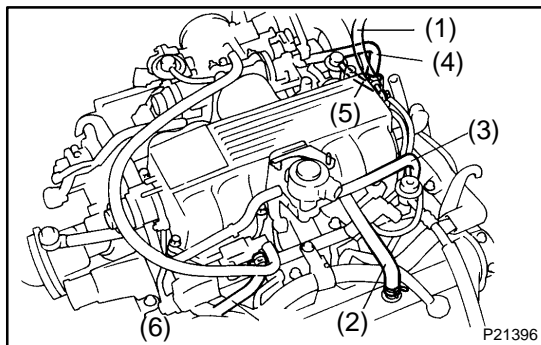
Remove the 2 bolts and rear plate. Remove the 2 rear plates.

**NOTICE:**

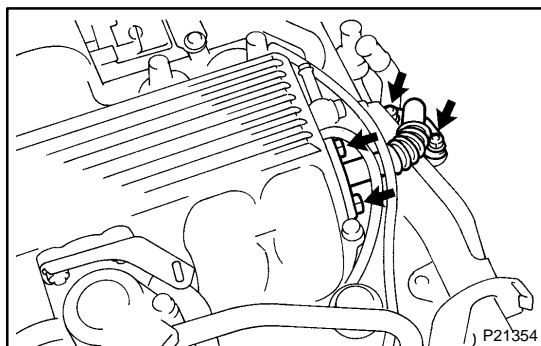
- Be careful not to drop anything inside the timing belt cover.
- Do not allow the belt to come into contact with oil, water or dust.

8. REMOVE AIR INTAKE CHAMBER ASSEMBLY

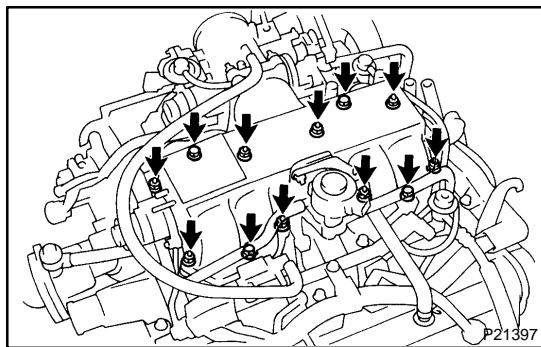
- (a) Disconnect these cables:
 - Accelerator cable
 - A/T throttle control cable
 - Cruise control actuator cable
- (b) Remove the 2 bolts and accelerator bracket.
- (c) Disconnect these connectors:
 - Throttle position sensor connector
 - w/ TRAC: Sub-throttle position sensor connector
 - w/ TRAC: Sub-throttle actuator connector
 - IAC valve connector
 - EGR valve connector
 - EGR gas temperature sensor connector
 - VSV connector for fuel pressure control
 - VSV connector for EVAP



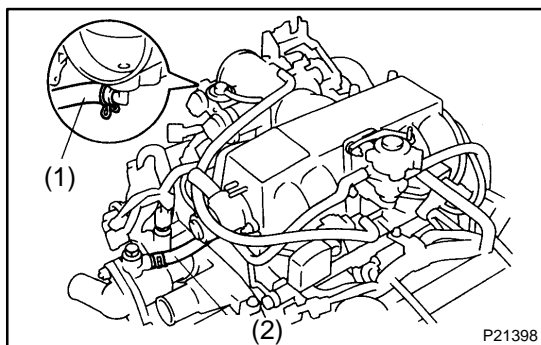
- (d) Disconnect these hoses:
- (1) Brake booster vacuum hose from union on air intake chamber
 - (2) PCV hose from PCV valve on LH cylinder head
 - (3) Water bypass hose (from EGR valve) from rear water bypass joint
 - (4) Water bypass hose (from throttle body) from rear water bypass joint
 - (5) Vacuum hose (from VSV for fuel pressure control) from fuel pressure regulator
 - (6) EVAP hose (from charcoal canister) from VSV for EVAP
- (e) Disconnect the heater hose from the water bypass pipe.



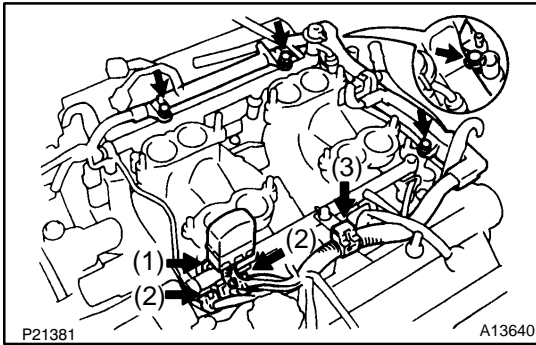
- (f) Remove the 2 bolts, 2 nuts, No.2 EGR pipe and 2 gaskets.



- (g) Remove the 4 bolts and 8 nuts.

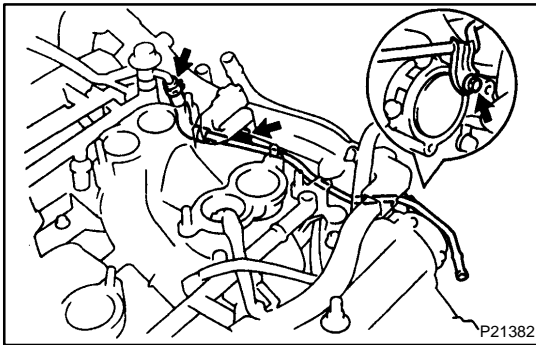


- (h) Disconnect these hoses, and remove the air intake chamber assembly and 4 gaskets:
- (1) PCV hose (from RH cylinder head) to throttle body
 - (2) Water bypass hose (from IAC valve) to water inlet housing
9. **DISCONNECT FUEL INLET HOSE FROM DELIVERY PIPE (See page [SF-30](#))**
10. **DISCONNECT FUEL RETURN HOSE FROM FUEL RETURN PIPE**



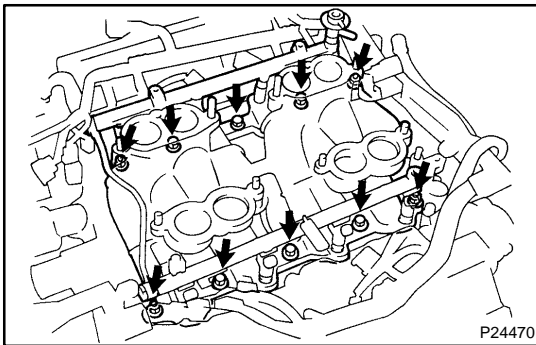
11. DISCONNECT ENGINE WIRE FROM DELIVERY PIPES AND REAR WATER BYPASS JOINT

- (a) Disconnect the A/T throttle cable from the clamps on the engine hanger and engine wire protector.
- (b) Disconnect the connectors and clamp:
 - (1) DLC1 from connector bracket on LH delivery pipe
 - (2) 2 engine wire connectors from connector bracket on LH delivery pipe
 - (3) Engine wire clamp from wire bracket on LH delivery pipe
- (c) Remove the 2 bolts, and disconnect the engine wire protector from the RH delivery pipe.
- (d) Remove the 2 bolts, and disconnect the engine wire protector from the water bypass joint.



12. REMOVE FUEL RETURN PIPE

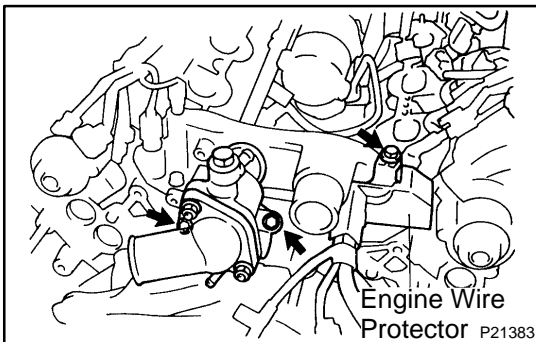
- (a) Disconnect the fuel hose from the fuel pressure regulator.
- (b) Remove the 2 bolts and fuel return pipe.



13. REMOVE INTAKE MANIFOLD ASSEMBLY

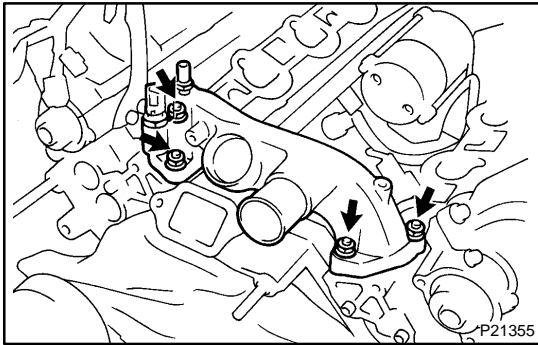
- (a) Disconnect the 8 injector connectors.
- (b) Remove the 6 bolts, 4 nuts, the intake manifold assembly and 2 gaskets.

14. REMOVE WATER INLET AND INLET HOUSING ASSEMBLY (See page CO-9)

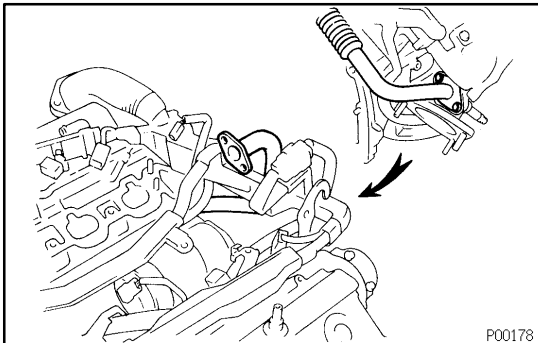


15. REMOVE FRONT WATER BYPASS JOINT

- (a) Disconnect these connectors:
 - ECT sensor connector
 - ECT sender gauge connector
- (b) Remove the bolt, and disconnect the engine wire protector from the water bypass joint.

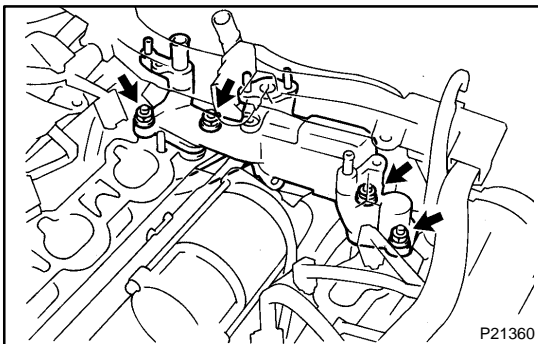


- (c) Remove the 4 nuts, water bypass joint and 2 gaskets.



16. REMOVE REAR WATER BYPASS JOINT AND NO. 1 EGR PIPE ASSEMBLY

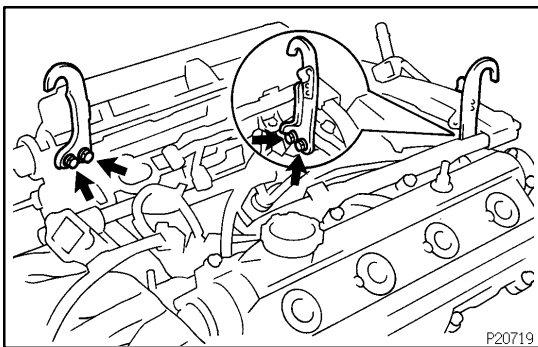
- (a) Remove the 2 bolts, nut and RH heat insulator (for the RH front side of the front exhaust pipe).
 (b) Remove the 2 bolts and RH heat insulator (for the RH front TWC).
 (c) Remove the 2 nuts holding the EGR pipe to the RH exhaust manifold.
 (d) Disconnect the heater hose from the water bypass joint.



- (e) Remove the 4 nuts, the water bypass joint, EGR pipe assembly and 2 gaskets.

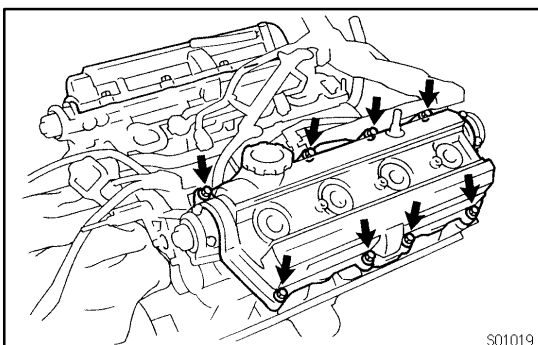
17. REMOVE OIL DIPSTICK AND GUIDE FOR A/T (See page EM-87)

18. REMOVE OIL DIPSTICK AND GUIDE FOR ENGINE (See page LU-9)



19. REMOVE ENGINE HANGERS

Remove the 4 bolts and 2 engine hangers.



20. REMOVE CYLINDER HEAD COVERS

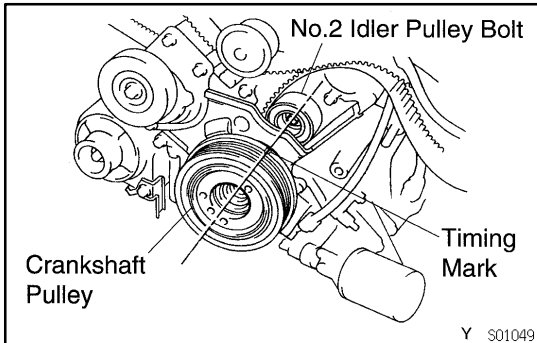
Remove the 8 bolts, 8 seal washers, cylinder head cover and gasket. Remove the 2 cylinder head covers.

21. IF NECESSARY, REMOVE SEMI-CIRCULAR PLUGS

22. REMOVE CAMSHAFTS

NOTICE:

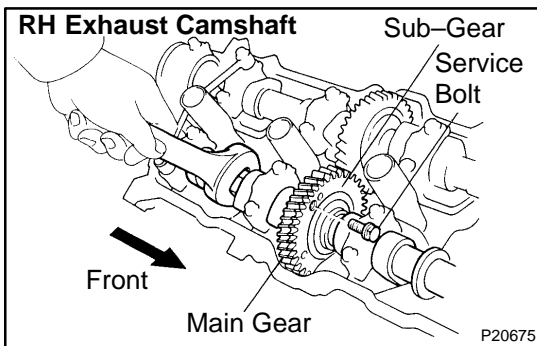
Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following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



- (a) Check the crankshaft pulley position.
Check that the timing mark of the crankshaft pulley is in aligned with the centers of the crankshaft pulley bolt and the idler pulley bolt.

NOTICE:

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, causing damage. So always set the crankshaft pulley at the correct angle.



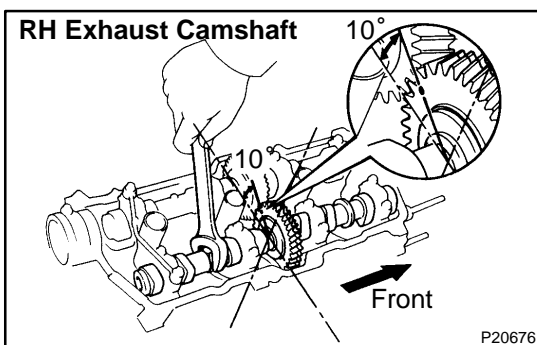
- (b) Remove the RH exhaust camshaft.
(1) Boring a service bolt hole of the sub-gear upward by turning the hexagon wrench head portion of the exhaust camshaft with a wrench.
(2) Secure the sub-gear to the main gear with a service bolt.

Recommended service bolt:

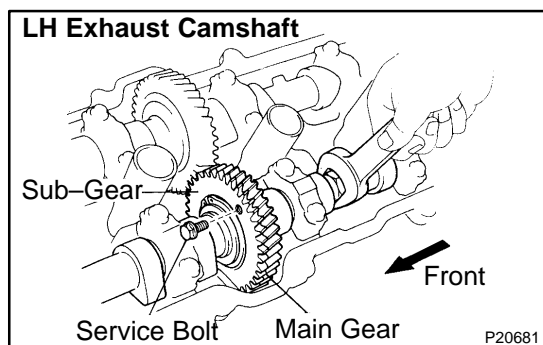
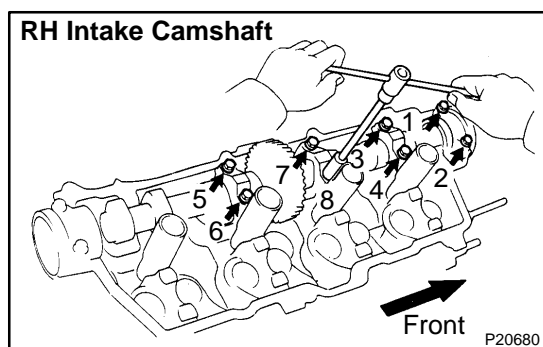
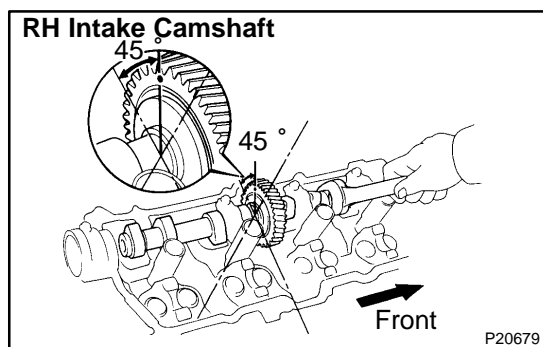
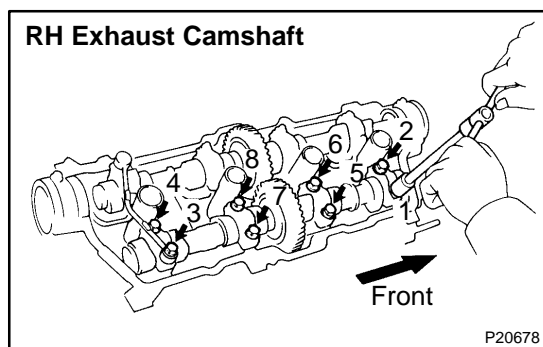
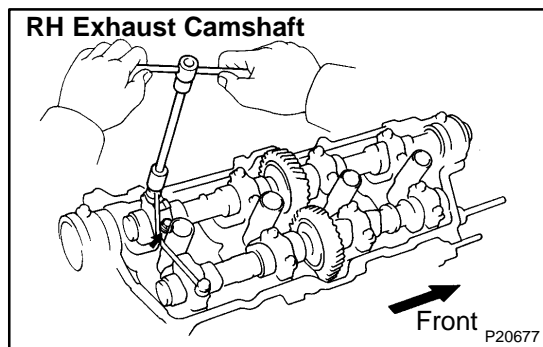
Thread diameter	6 mm
Thread pitch	1.0 mm
Bolt length	16 – 20 mm (0.63 – 0.79 in.)

HINT:

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



- (3) Set the timing mark (1 dot mark) of the camshaft main gear at approx. 10° angle by turning the hexagon wrench head portion of the exhaust camshaft with a wrench.



- (4) Alternately loosen and remove the 2 bearing cap bolts holding the intake camshaft side of the oil feed pipe to the cylinder head.

- (5) Uniformly loosen and remove the 8 bearing cap bolts in several passes, in the sequence shown.
 (6) Remove the oil feed pipe, 4 bearing caps and exhaust camshaft.

- (c) Remove the RH intake camshaft.
 (1) Remove the rear bearing cap.
 (2) Set the timing mark (1 dot mark) of the camshaft drive gear at approx. 45° angle by turning the hexagon wrench head portion of the intake camshaft with a wrench.

- (3) Uniformly loosen and remove the 8 bearing cap bolts in several passes, in the sequence shown.
 (4) Remove the 4 bearing caps, oil seal and intake camshaft.

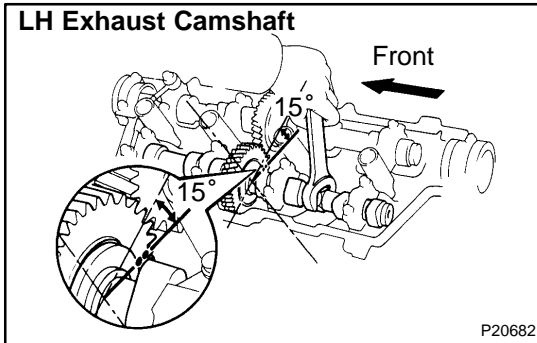
- (d) Remove the LH exhaust camshaft.
 (1) Boring a service bolt hole of the sub-gear upward by turning the hexagon wrench head portion of the exhaust camshaft with a wrench.
 (2) Secure the sub-gear to the main gear with a service bolt.

Recommended service bolt:

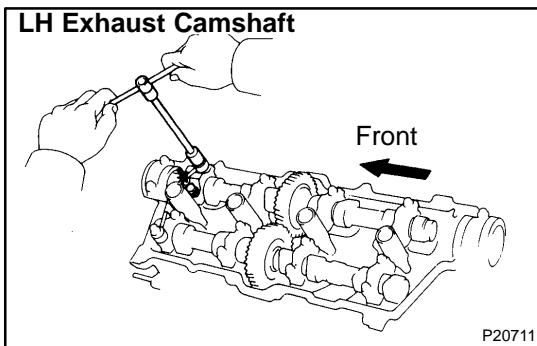
Thread diameter	6 mm
Thread pitch	1.0 mm
Bolt length	16 – 20 mm (0.63 – 0.79 in.)

HINT:

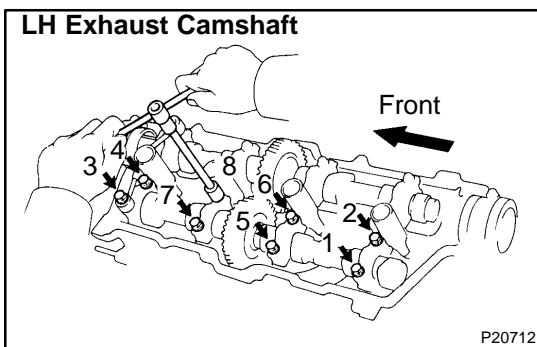
When removing the camshaft, make sure that the torsional spring force of the sub-gear has been eliminated by the above operation.



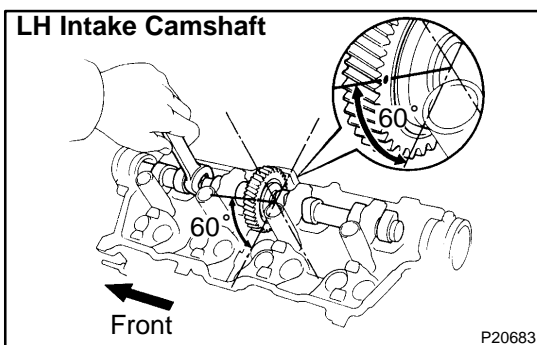
- (3) Set the timing mark (2 dot marks) of the camshaft drive gear at approx. 15° angle by turning the hexagon wrench head portion of the exhaust camshaft with a wrench.



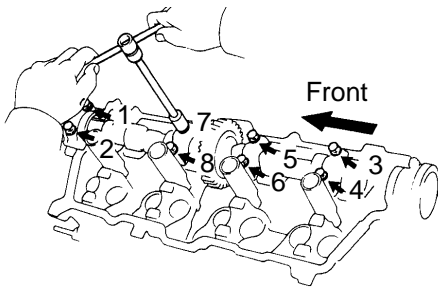
- (4) Alternately loosen and remove the 2 bearing cap bolts holding the intake camshaft side of the oil feed pipe to the cylinder head.



- (5) Uniformly loosen and remove the 8 bearing cap bolts in several passes, in the sequence shown.
 (6) Remove the oil feed pipe, 4 bearing caps and exhaust camshaft.



- (e) Remove the LH intake camshaft.
 (1) Remove the bearing cap second from the front.
 (2) Set the timing mark (1 dot mark) of the camshaft drive gear at approx. 60° angle by turning the hexagon wrench head portion of the intake camshaft with a wrench.

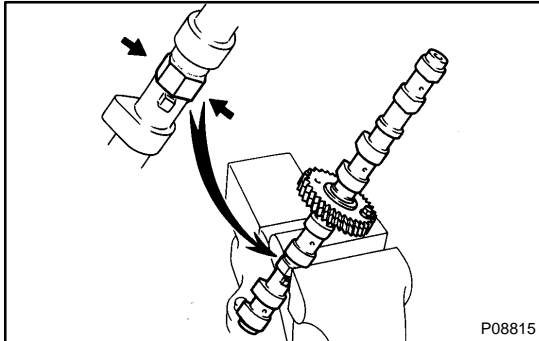
LH Intake Camshaft

P20684

- (3) Uniformly loosen and remove the 8 bearing cap bolts in several passes, in the sequence shown.
- (4) Remove the 4 bearing caps, oil seal and intake camshaft.

HINT:

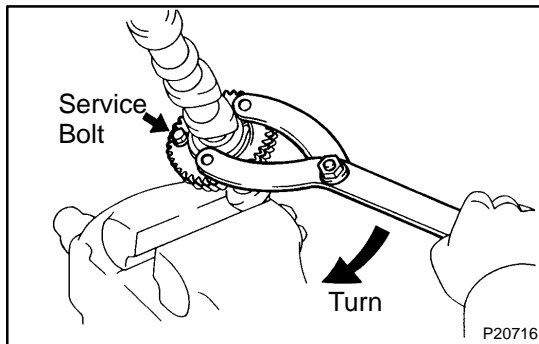
Arrange the bearing caps in correct order.



P08815

23. DISASSEMBLE EXHAUST CAMSHAFTS

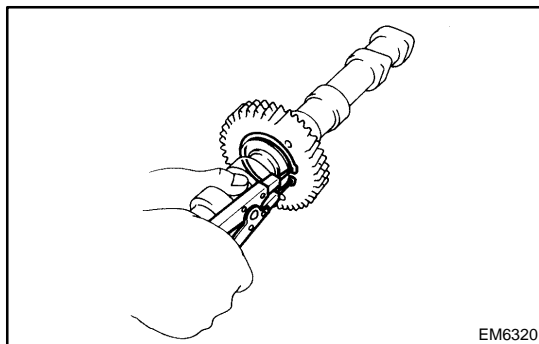
- (a) Mount the hexagon wrench head portion of the camshaft in a vise.

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

P20716

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

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



EM6320

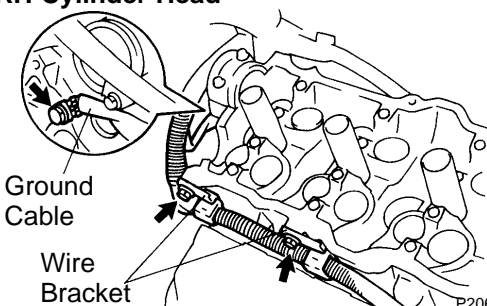
- (c) Using snap ring pliers, remove the snap ring.

- (d) Remove these parts:

- Wave washer
- Camshaft sub-gear
- Camshaft gear spring

HINT:

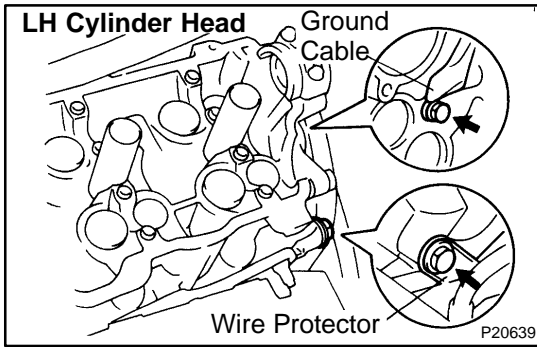
Arrange the camshaft sub-gears and gear spring (RH and LH sides).

RH Cylinder Head

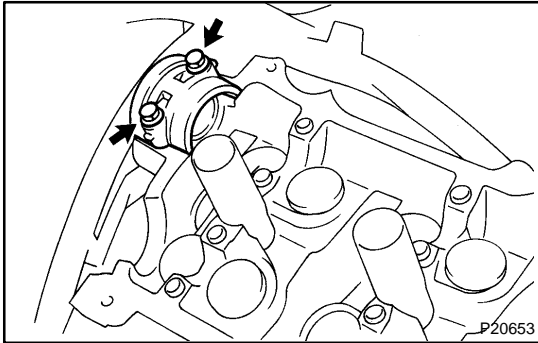
P20638

24. REMOVE CYLINDER HEAD AND EXHAUST MANIFOLD ASSEMBLIES

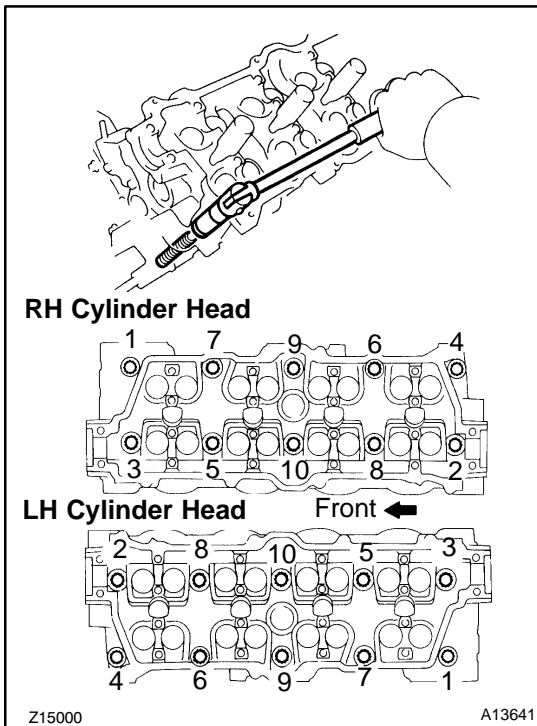
- (a) Disconnect the 2 heated oxygen sensor connectors.
- (b) Remove the bolt, and disconnect the ground cable from the RH cylinder head.
- (c) Remove the 2 bolts, and disconnect the engine wire from the RH cylinder head.



- (d) Remove the bolt, and disconnect the ground strap from the LH cylinder head.
- (e) Remove the bolt, and disconnect the engine wire protector from the LH cylinder head.



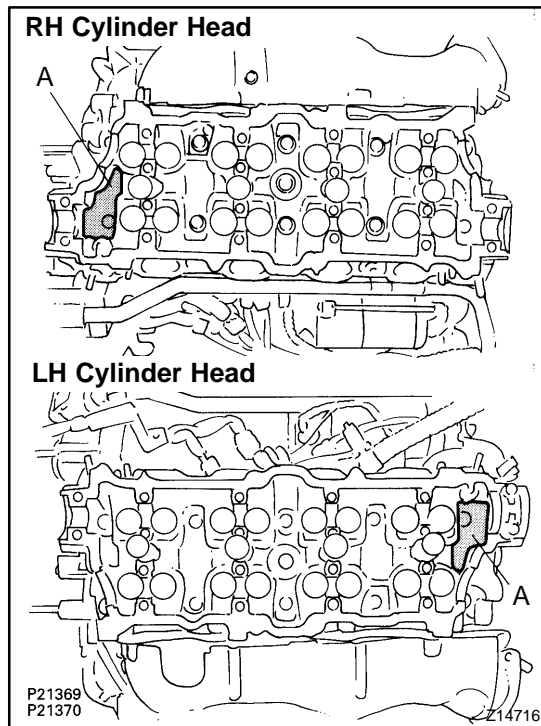
- (f) Remove the 2 bolts, seal washers, bearing cap and camshaft housing plug from the RH cylinder head.



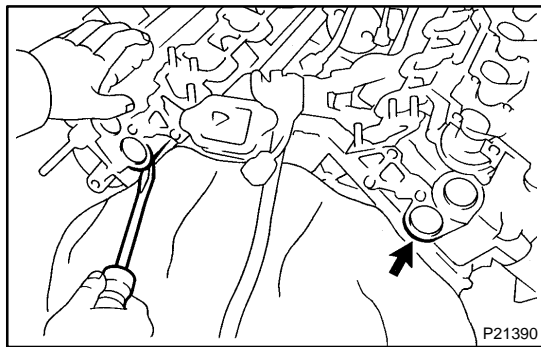
- (g) Uniformly loosen the 10 cylinder head bolts on one side of each cylinder head in several passes, in the sequence shown, then do the other side as shown. Remove the 20 cylinder head bolts and plate washers.

NOTICE:

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



- Do not drop the plate washer for cylinder head bolt into portion A of the cylinder head. If dropped into portion A, the plate washer will pass through the cylinder head and cylinder block into the oil pan.



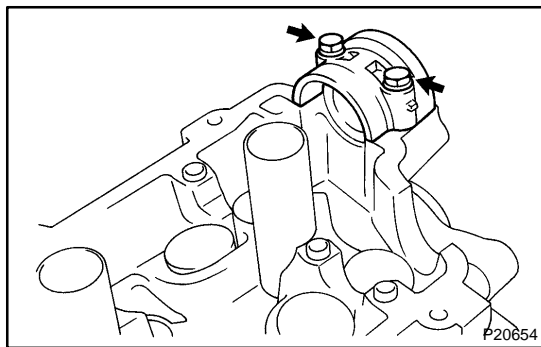
- (h) Lift the cylinder head from the dowels on the cylinder block, and place the 2 cylinder heads on wooden blocks on a bench.

HINT:

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

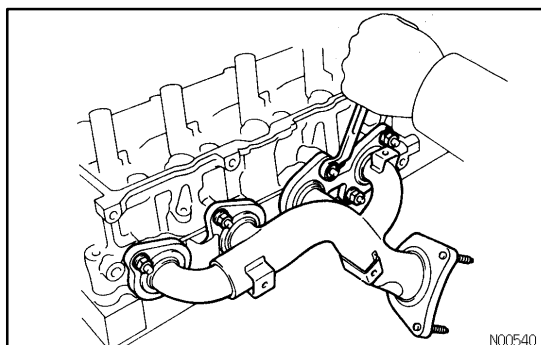
NOTICE:

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



25. REMOVE BEARING CAP FROM LH CYLINDER HEAD

Remove the 2 bolts, seal washers, bearing cap and camshaft housing plug from the cylinder head.

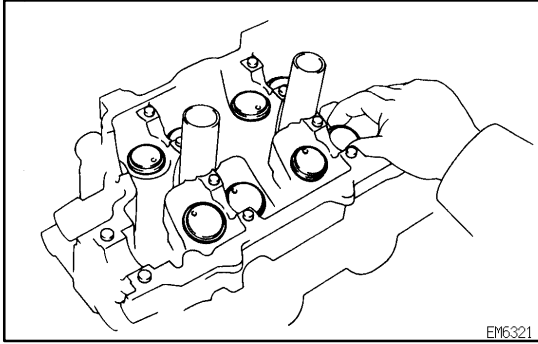


26. REMOVE LH EXHAUST MANIFOLD FROM CYLINDER HEAD

- Remove the 3 bolts and heat insulator.
- Remove the 8 nuts, exhaust manifold and gasket.

27. REMOVE RH EXHAUST MANIFOLD FROM CYLINDER HEAD

- Remove the 3 bolts and heat insulator.
- Remove the 8 nuts, exhaust manifold and gasket.

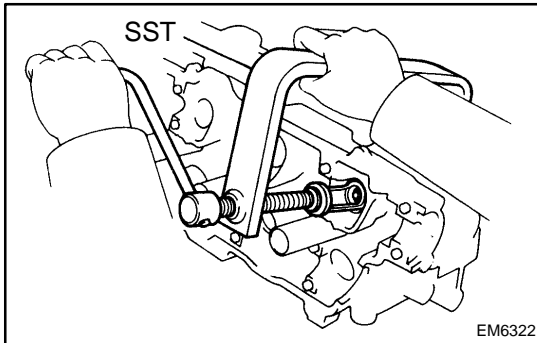


DISASSEMBLY

1. REMOVE VALVE LIFTERS AND SHIMS

HINT:

Arrange the valve lifters and shims in correct order.



2. REMOVE VALVES

- (a) Using SST, compress the valve spring and remove the 2 keepers.

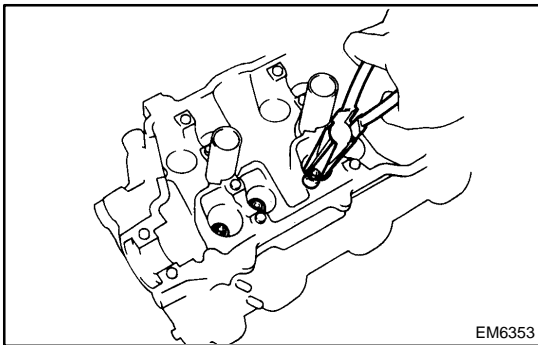
SST 09202-70020 (09202-00010)

- (b) Remove these parts:

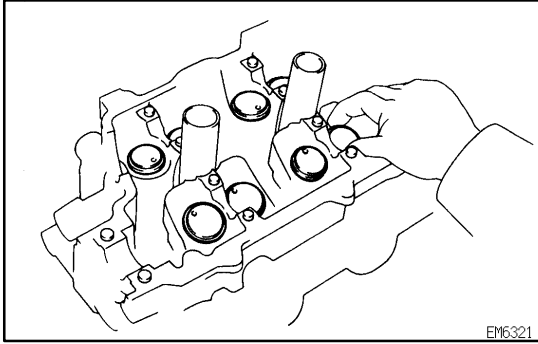
- Spring retainer
- Valve spring
- Valve
- Spring seat

HINT:

Arrange the valves, valve springs, spring seats and spring retainers incorrect order.



- (c) Using needle-nose pliers, remove the oil seal.

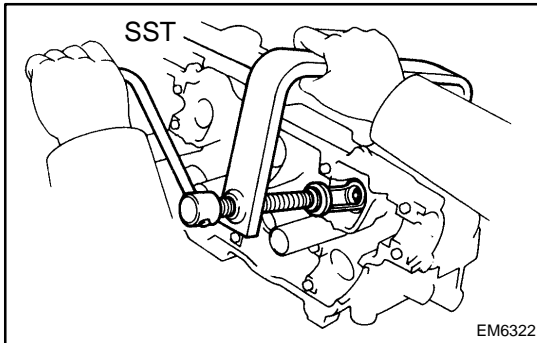


DISASSEMBLY

1. REMOVE VALVE LIFTERS AND SHIMS

HINT:

Arrange the valve lifters and shims in correct order.



2. REMOVE VALVES

- (a) Using SST, compress the valve spring and remove the 2 keepers.

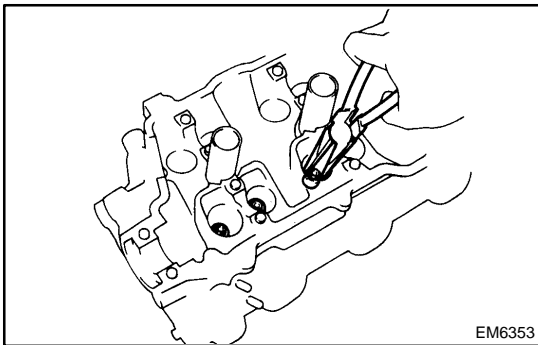
SST 09202-70020 (09202-00010)

- (b) Remove these parts:

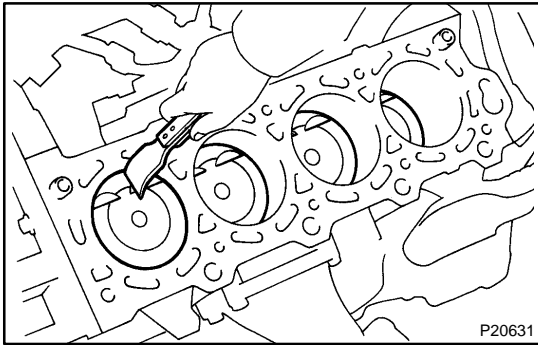
- Spring retainer
- Valve spring
- Valve
- Spring seat

HINT:

Arrange the valves, valve springs, spring seats and spring retainers incorrect order.



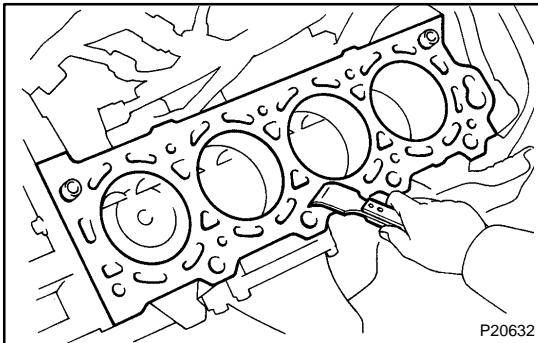
- (c) Using needle-nose pliers, remove the oil seal.



INSPECTION

1. CLEAN TOP SURFACES OF PISTONS AND CYLINDER BLOCK

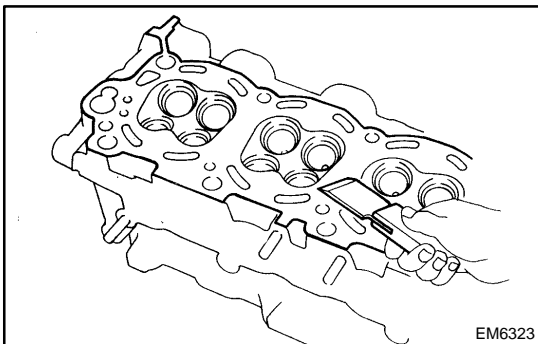
- (a) Turn the crankshaft, and bring each piston to top dead center (TDC). Using a gasket scraper, remove all the carbon from the piston top surface.



- (b) Using a gasket scraper, remove all the gasket material from the cylinder block surface.
- (c) Using compressed air, blow carbon and oil from the bolt holes.

CAUTION:

Protect your eyes when using high pressure compressed air.

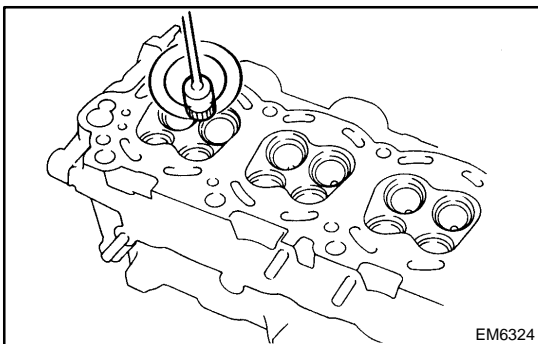


2. CLEAN CYLINDER HEAD

- (a) Remove the gasket material.
Using a gasket scraper, remove all the gasket material from the cylinder block contact surface.

NOTICE:

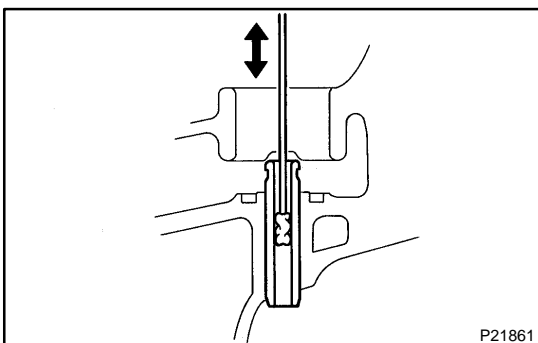
Be careful not to scratch the cylinder block contact surface.



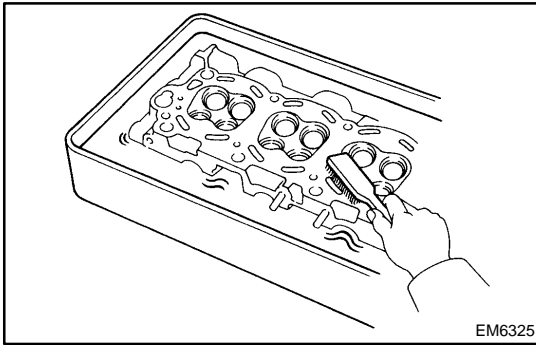
- (b) Clean the combustion chambers.
Using a wire brush, remove all the carbon from the combustion chambers.

NOTICE:

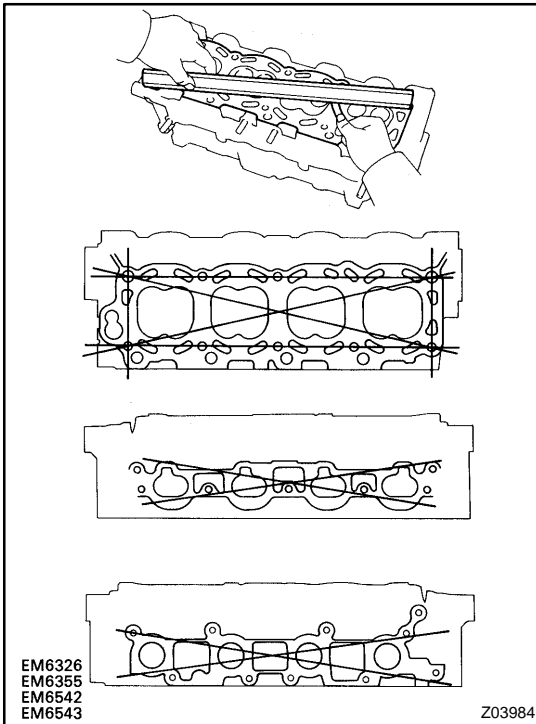
Be careful not to scratch the cylinder block contact surface.



- (c) Clean the valve guide bushings.
Using a valve guide bushing brush and solvent, clean all the guide bushings.



- (d) Clean the cylinder head.
Using a soft brush and solvent, thoroughly clean the cylinder head.

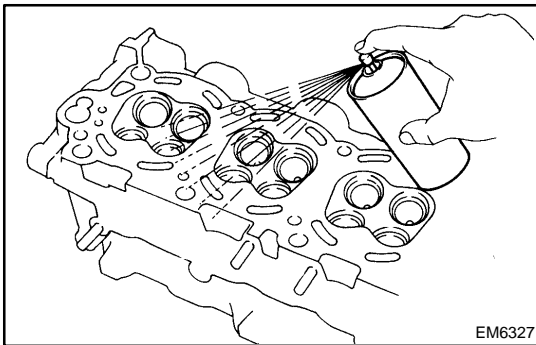


3. INSPECT CYLINDER HEAD

- (a) Inspect for flatness.
Using a precision straight edge and feeler gauge, measure the surfaces contacting the cylinder block and the manifolds for warpage.

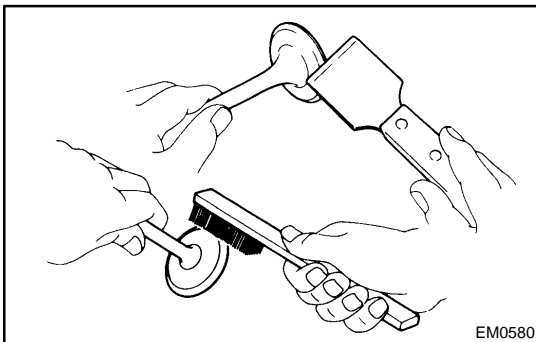
Maximum warpage: 0.10 mm (0.0039 in.)

If warpage is greater than maximum, replace the cylinder head.



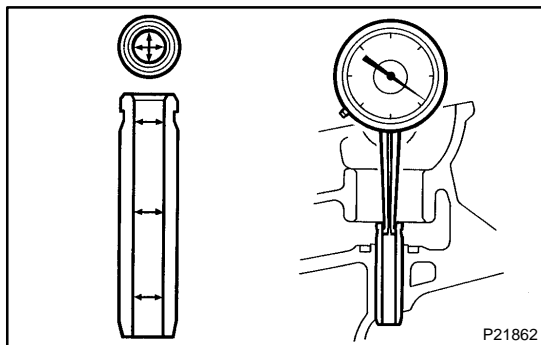
- (b) Inspect for cracks.
Using a dye penetrant, check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks.

If cracked, replace the cylinder head.



4. CLEAN VALVES

- (a) Using a gasket scraper, chip off any carbon from the valve head.
(b) Using a wire brush, thoroughly clean the valve.

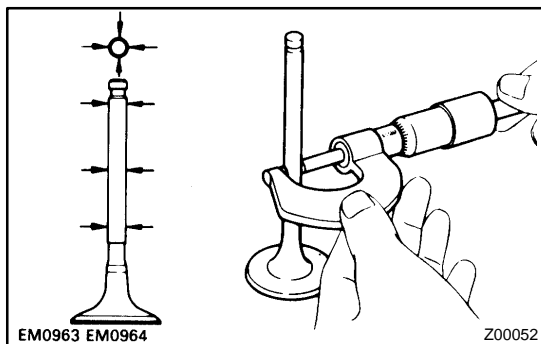


5. INSPECT VALVE STEMS AND GUIDE BUSHINGS

- (a) Using a caliper gauge, measure the inside diameter of the guide bushing.

Bushing inside diameter:

6.010 – 6.030 mm (0.2366 – 0.2374 in.)



- (b) Using a micrometer, measure the diameter of the valve stem.

Valve stem diameter:

Intake	5.970 – 5.985 mm (0.2350 – 0.2356 in.)
Exhaust	5.965 – 5.980 mm (0.2348 – 0.2354 in.)

- (c) Subtract the valve stem diameter measurement from the guide bushing inside diameter measurement.

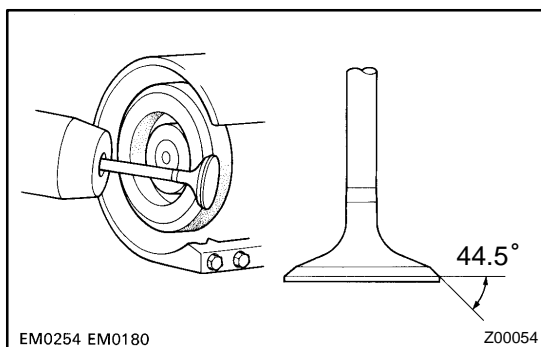
Standard oil clearance:

Intake	0.025 – 0.060 mm (0.0010 – 0.0024 in.)
Exhaust	0.030 – 0.065 mm (0.0012 – 0.0026 in.)

Maximum oil clearance:

Intake	0.08 mm (0.0031 in.)
Exhaust	0.10 mm (0.0039 in.)

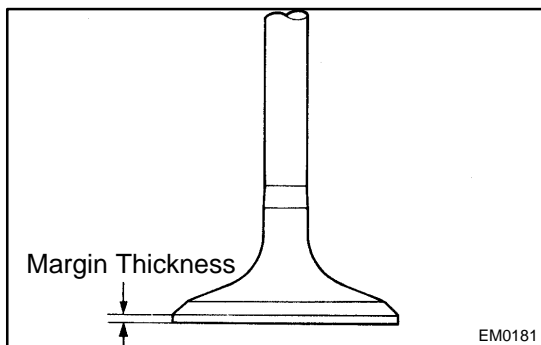
If the clearance is greater than maximum, replace the valve and guide bushing (See page [EM-62](#)).



6. INSPECT AND GRIND VALVES

- (a) Grind the valve enough to remove pits and carbon.
 (b) Check that the valve is ground to the correct valve face angle.

Valve face angle: 44.5°

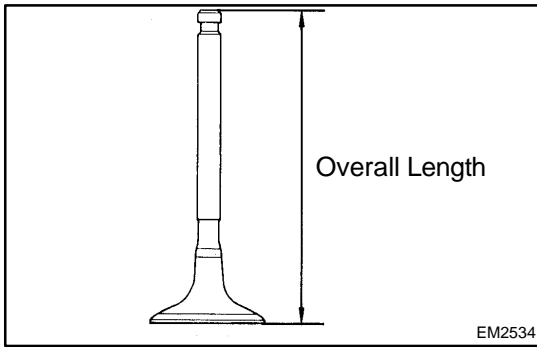


- (c) Check the valve head margin thickness.

Standard margin thickness: 1.0 mm (0.039 in.)

Minimum margin thickness: 0.5 mm (0.020 in.)

If the margin thickness is less than minimum, replace the valve.



(d) Check the valve overall length.

Standard overall length:

Intake	95.05 mm (3.7421 in.)
Exhaust	96.90 mm (3.8150 in.)

Minimum overall length:

Intake	94.55 mm (3.7224 in.)
Exhaust	96.40 mm (3.7953 in.)

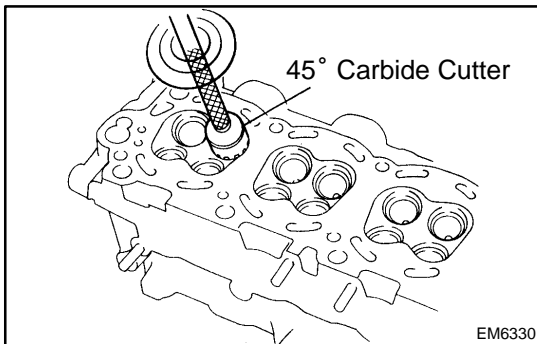
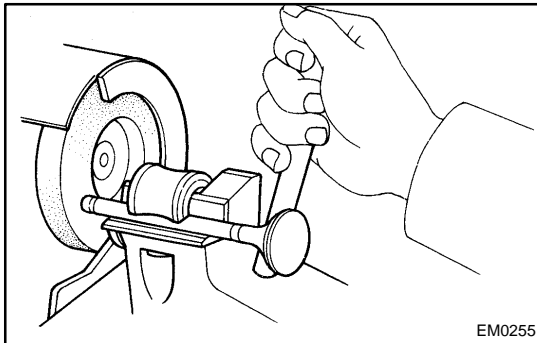
If the overall length is less than minimum, replace the valve.

(e) Check the surface of the valve stem tip for wear.

If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.

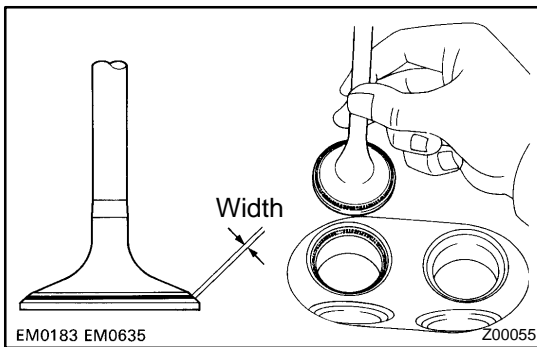
NOTICE:

Do not grind off more than minimum.



7. INSPECT AND CLEAN VALVE SEATS

(a) Using a 45° carbide cutter, resurface the valve seats. Remove only enough metal to clean the seats.



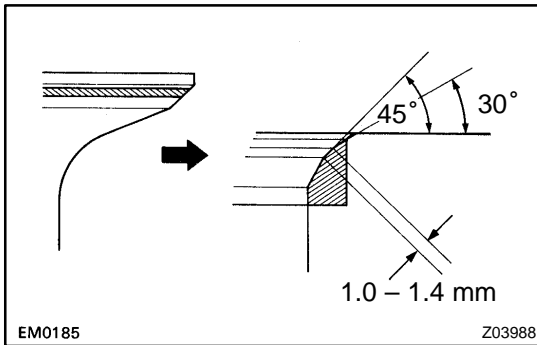
(b) Check the valve seating position.

Apply a light coat of prussian blue (or white lead) to the valve face. Lightly press the valve against the seat. Do not rotate valve.

(c) Check the valve face and seat for these:

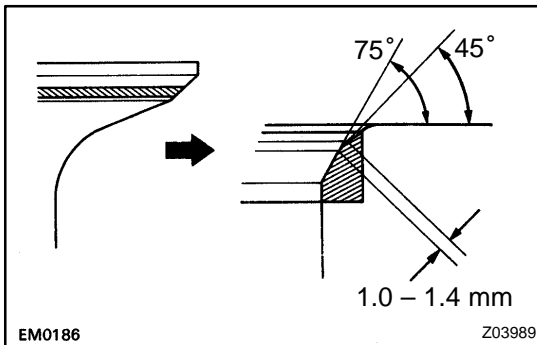
- If blue appears 360° around the face, the valve is concentric. If not, replace the valve.
- If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
- Check that the seat contact is in the middle of the valve face with these width:

1.0 – 1.4 mm (0.039 – 0.055 in.)

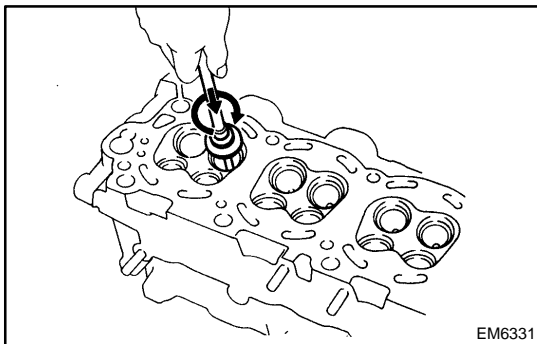


If not, correct the valve seats as follows:

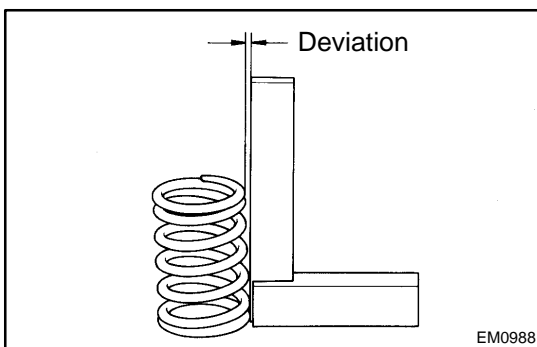
- If the seating is too high on the valve face, use 30° and 45° cutters to correct the seat.



- If the seating is too low on the valve face, use 75° and 45° cutters to correct the seat.



- Hand-lap the valve and valve seat with an abrasive compound.
- After hand-lapping, clean the valve and valve seat.

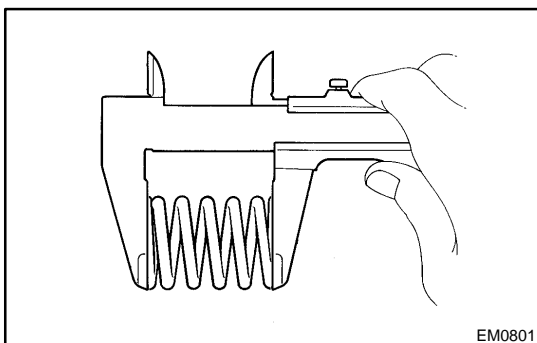


8. INSPECT VALVE SPRINGS

- Using a steel square, measure the deviation of the valve spring.

Maximum deviation: 2.0 mm (0.079 in.)

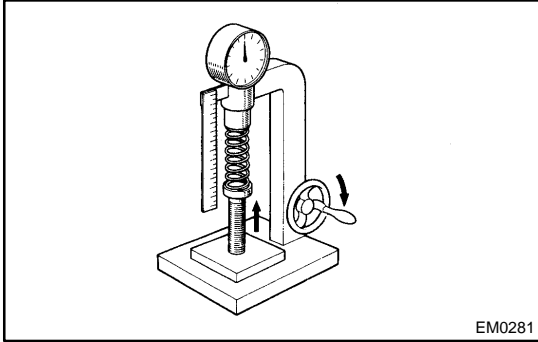
If the deviation is greater than maximum, replace the valve spring.



- Using vernier calipers, measure the free length of the valve spring.

Free length: 51.8 mm (2.039 in.)

If the free length is not as specified, replace the valve spring.



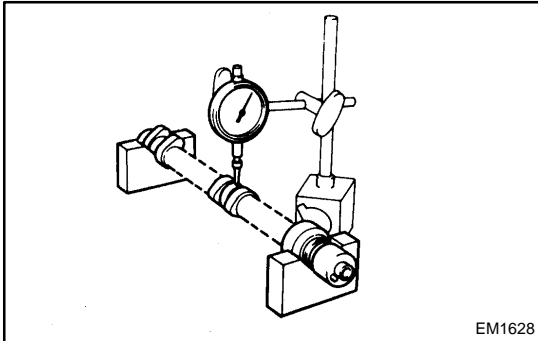
- (c) Using a spring tester, measure the tension of the valve spring at the specified installed length.

Installed tension:

186 – 206 N (19.0 – 21.0 kgf, 41.9 – 46.3 lbf)

at 32.9 mm (1.295 in.)

If the installed tension is not as specified, replace the valve spring.



9. INSPECT CAMSHAFTS AND BEARINGS

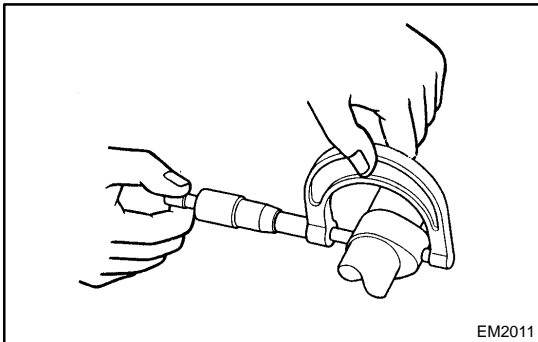
- (a) Inspect the camshaft for runout.

(1) Place the camshaft on V-blocks.

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

Maximum circle runout: 0.08 mm (0.0031 in.)

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



- (b) Inspect the cam lobes.

Using a micrometer, measure the cam lobe height.

Standard cam lobe height:

Intake	42.210 – 42.310 mm (1.6618 – 1.6657 in.)
Exhaust	41.960 – 42.060 mm (1.6520 – 1.6559 in.)

Minimum cam lobe height:

Intake	42.06 mm (1.6559 in.)
Exhaust	41.81 mm (1.6461 in.)

If the lobe height is less than minimum, replace the camshaft.

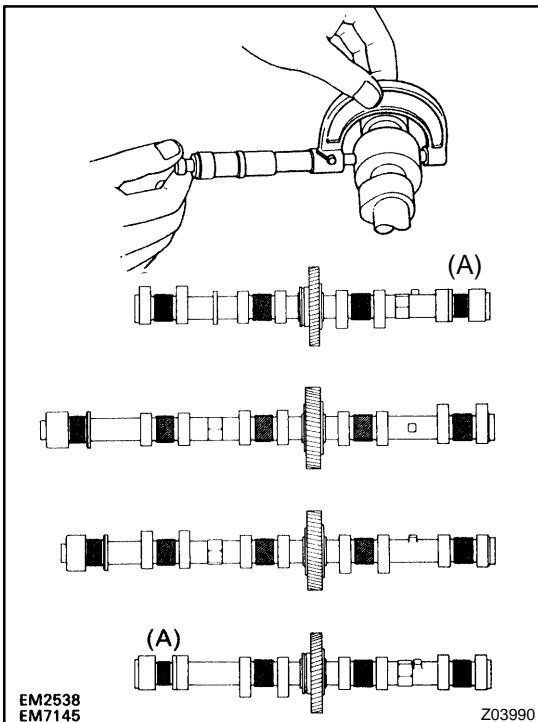
- (c) Inspect the camshaft journals.

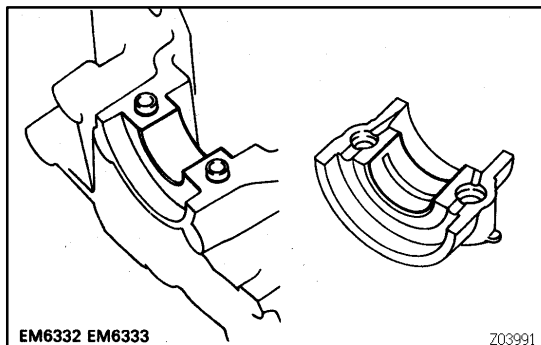
Using a micrometer, measure the journal diameter.

Journal diameter:

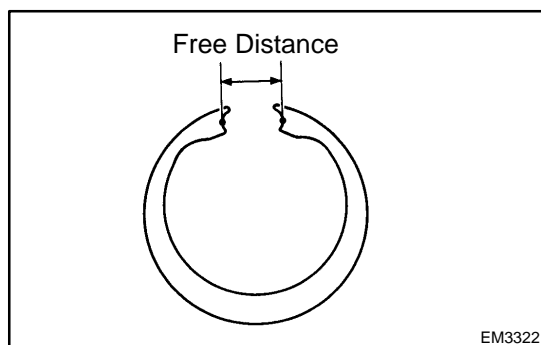
Exhaust camshaft thrust portion (A)	23.959 – 23.975 mm (0.9433 – 0.9439 in.)
Others	26.954 – 26.970 mm (1.0612 – 1.0618 in.)

If the journal diameter is not as specified, check the oil clearance.

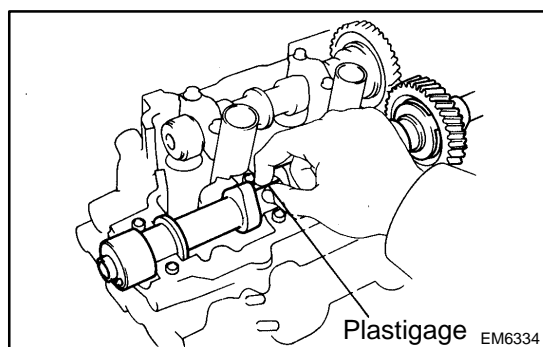




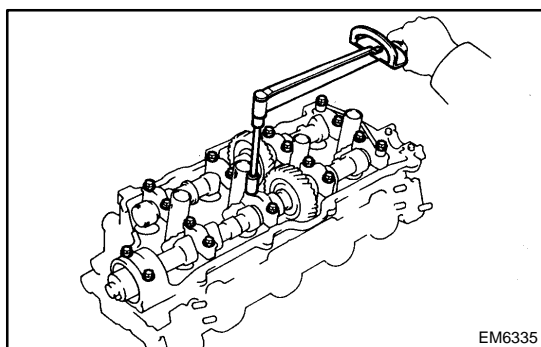
- (d) Inspect the camshaft bearings.
Check that bearings for flaking and scoring.
If the bearings are damaged, replace the bearing caps and cylinder head as a set.



- (e) Inspect the camshaft gear spring.
Using vernier calipers, measure the free distance between the spring ends.
Free distance: 18.2 – 18.8 mm (0.712 – 0.740 in.)
If the free distance is not as specified, replace the gear spring.



- (f) Inspect the camshaft journal oil clearance.
(1) Clean the bearing caps and camshaft journals.
(2) Place the camshafts on the cylinder head.
(3) Lay a strip of Plastigage across each of the camshaft journals.

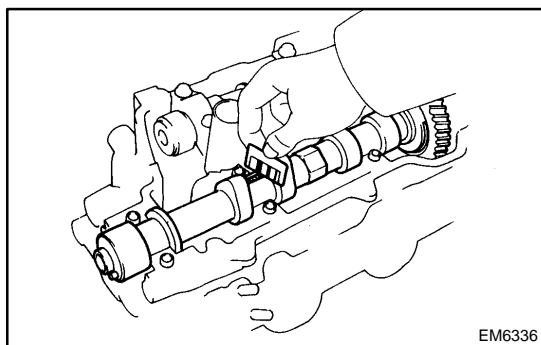


- (4) Install the bearing caps (See page [EM-66](#)).
Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)

NOTICE:

Do not turn the camshaft.

- (5) Remove the bearing caps.



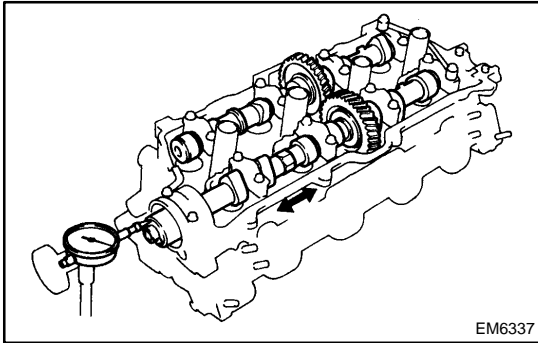
- (6) Measure the Plastigage at its widest point.
Standard oil clearance:

Exhaust camshaft thrust portion	0.025 – 0.061 mm (0.0010 – 0.0024 in.)
Others	0.030 – 0.067 mm (0.0012 – 0.0026 in.)

Maximum oil clearance: 0.10 mm (0.0039 in.)

If the oil clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

- (7) Completely remove the Plastigage.
- (8) Remove the camshafts.



- (g) Inspect the camshaft thrust clearance.
 - (1) Install the camshaft (See page [EM-66](#)).
 - (2) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

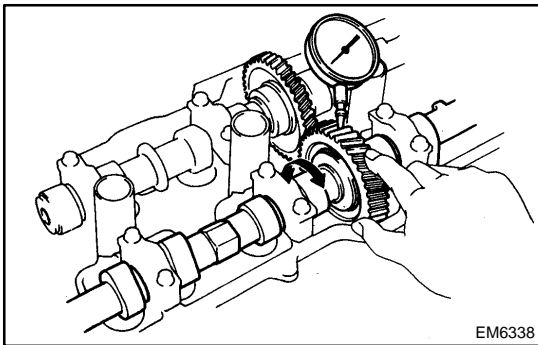
Standard thrust clearance:

0.040 – 0.090 mm (0.0016 – 0.0035 in.)

Maximum thrust clearance: 0.12 mm (0.0047 in.)

If the thrust clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

- (3) Remove the camshafts.



- (h) Inspect the camshaft gear backlash.
 - (1) Install the camshafts without installing the exhaust cam sub-gear (See page [EM-66](#)).
 - (2) Using a dial indicator, measure the backlash.

Standard backlash:

0.020 – 0.200 mm (0.0008 – 0.0079 in.)

Maximum backlash: 0.30 mm (0.0188 in.)

If the backlash is greater than maximum, replace the camshafts.

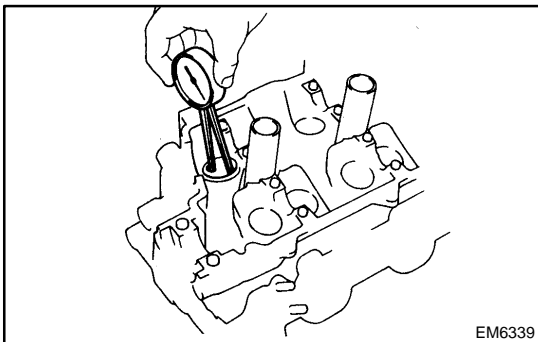
- (3) Remove the camshafts.

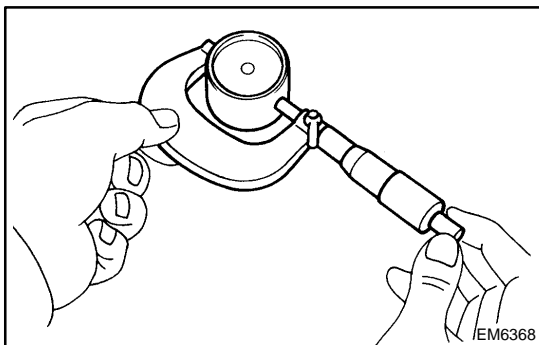
10. INSPECT VALVE LIFTERS AND LIFTER BORES

- (a) Using a caliper gauge, measure the lifter bore diameter of the cylinder head.

Lifter bore diameter:

31.000 – 31.016 mm (1.2205 – 1.2211 in.)





- (b) Using a micrometer, measure the lifter diameter.

Lifter diameter:

30.966 – 30.976 mm (1.2191 – 1.2195 in.)

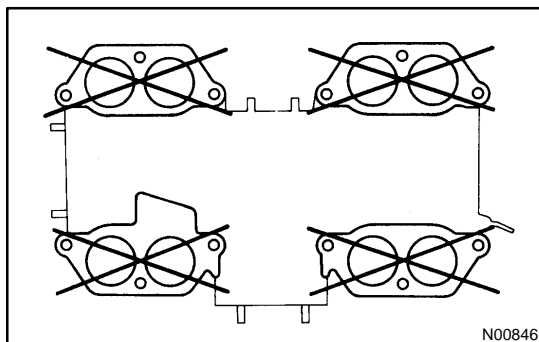
- (c) Subtract the lifter diameter measurement from the lifter bore diameter measurement.

Standard oil clearance:

0.024 – 0.050 mm (0.0009 – 0.0020 in.)

Maximum oil clearance: 0.07 mm (0.0028 in.)

If the oil clearance is greater than maximum, replace the lifter.
If necessary, replace the cylinder head.

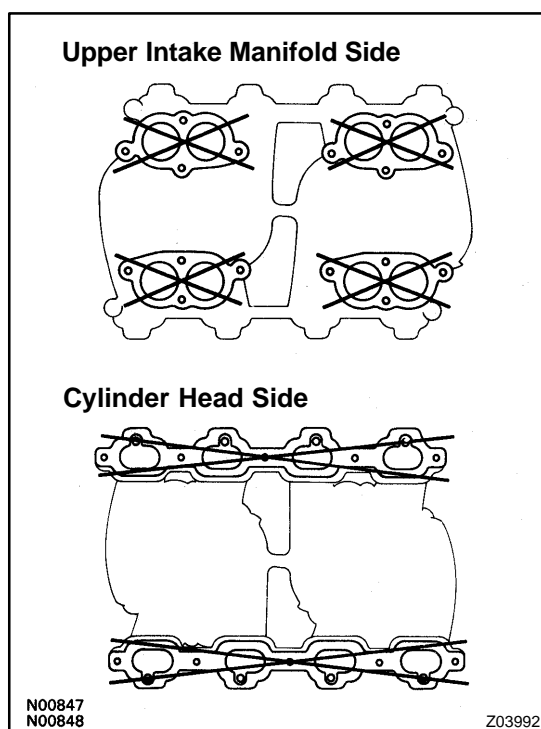


11. INSPECT AIR INTAKE CHAMBER

Using a precision straight edge and feeler gauge, measure the surface contacting the intake manifold for warpage.

Maximum warpage: 0.15 mm (0.0059 in.)

If warpage is greater than maximum, replace the chamber.

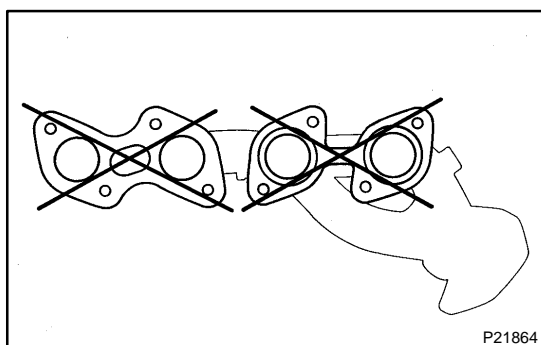


12. INSPECT INTAKE MANIFOLD

Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder head and air intake chamber for warpage.

Maximum warpage: 0.15 mm (0.0059 in.)

If warpage is greater than maximum, replace the manifold.

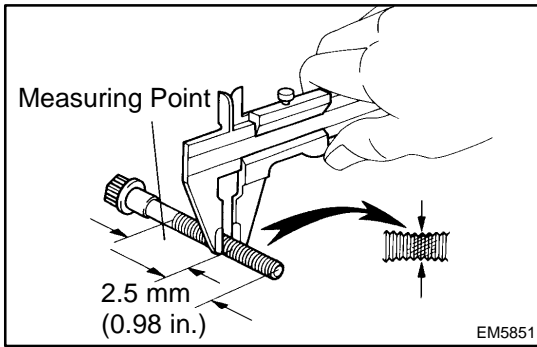


13. INSPECT EXHAUST MANIFOLD

Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder head for warpage.

Maximum warpage: 0.50 mm (0.0197 in.)

If warpage is greater than maximum, replace the manifold.



14. INSPECT CYLINDER HEAD BOLTS

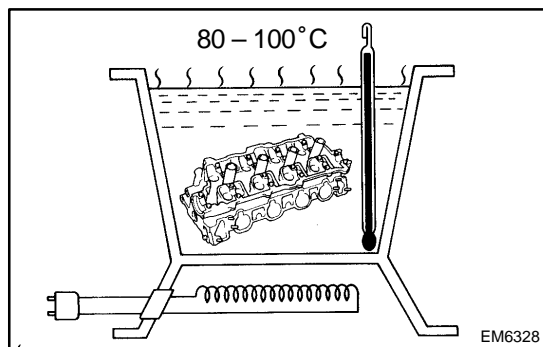
Using vernier calipers, measure the thread outside diameter of the bolt.

Standard outside diameter:

9.770 – 9.960 mm (0.3846 – 0.3921 in.)

Minimum outside diameter: 9.60 mm (0.3780 in.)

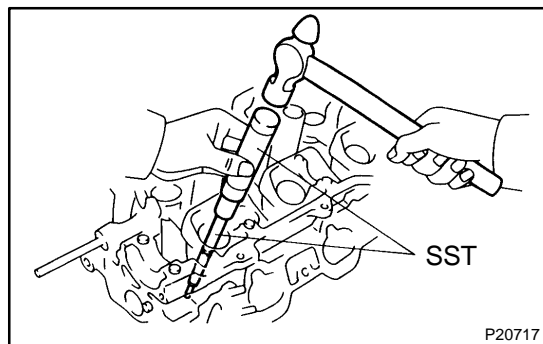
If the diameter is less than minimum, replace the bolt.



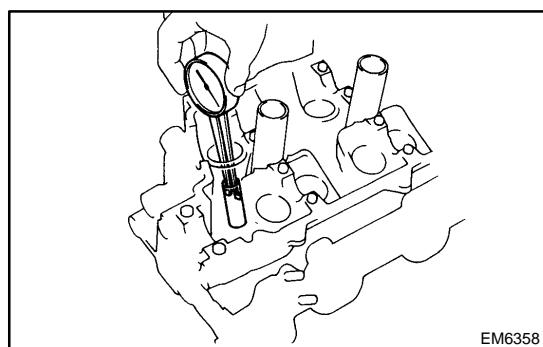
REPLACEMENT

1. REPLACE VALVE GUIDE BUSHINGS

- (a) Gradually heat the cylinder head to 80 – 100°C (176 – 212°F).



- (b) Using SST and a hammer, tap out the guide bushing.
SST 09201-10000 (09201-01060), 09950-70010 (09951-07100)



- (c) Using a caliper gauge, measure the bushing bore diameter of the cylinder head.

Both intake and exhaust

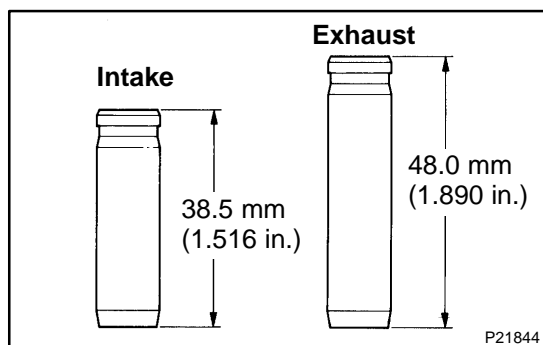
Bushing bore diameter mm (in.)	Bushing size
10.985 – 11.012 (0.4325 – 0.4335)	Use STD
11.035 – 11.062 (0.4344 – 0.4355)	Use O/S 0.05

- (d) Select a new guide bushing (STD or O/S 0.05).

If the bushing bore diameter of the cylinder head is greater than 11.012 mm (0.4335 in.), machine the bushing bore to these dimension:

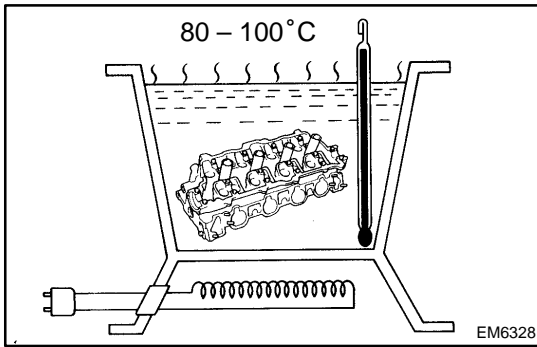
11.035 – 11.062 mm (0.4344 – 0.4355 in.)

If the bushing bore diameter of the cylinder head is greater than 11.062 mm (0.4355 in.), replace the cylinder head.

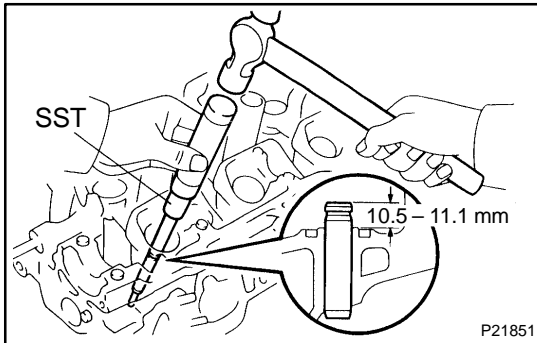


HINT:

Different the bushings are used for the intake and exhaust.

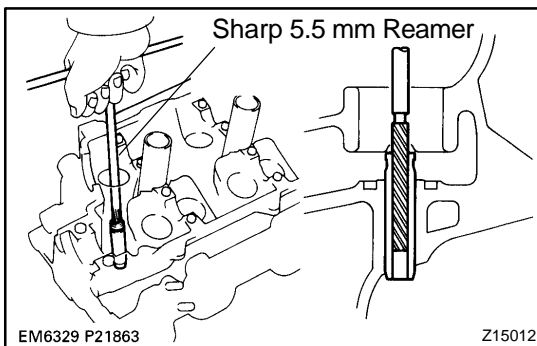


- (e) Gradually heat the cylinder head to 80 – 100°C (176 – 212°F).

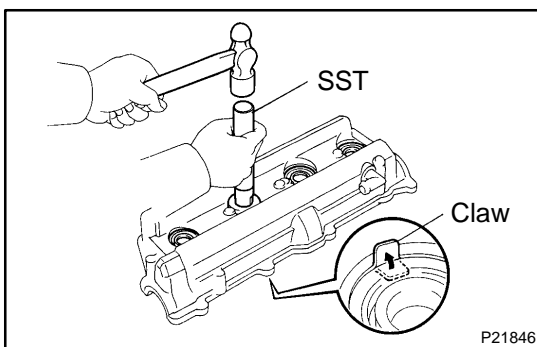


- (f) Using SST and a hammer, tap in a new guide bushing until there is 10.5 – 11.1 mm (0.413 – 0.437 in.) protruding from the cylinder head.

SST 09201-10000 (09201-01060), 09950-70010 (09951-07100)



- (g) Using a sharp 6 mm reamer, ream the guide bushing to obtain the standard specified clearance (See page [EM-52](#)) between the guide bushing and valve stem.

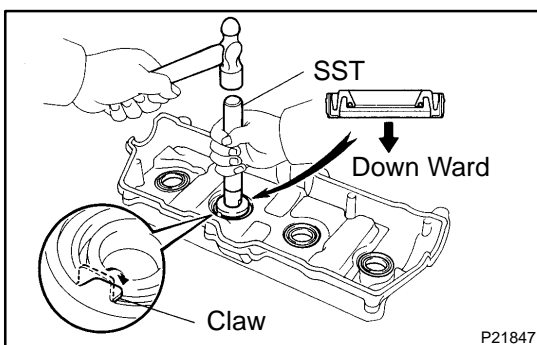


2. REPLACE SPARK PLUG TUBE GASKETS

- (a) Bend the ventilation case claw installed on the cylinder head cover to an angle of 90° or more.

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

SST 09950-60010 (09551-00240, 09951-00460, 09952-06010), 09950-70010 (09951-07100)



- (c) Using SST and a hammer, tap in a new gasket until its surface is flush with the upper edge of the cylinder head cover.

SST 09950-60010 (09551-00240, 09951-00460, 09952-06010), 09950-70010 (09951-07100)

NOTICE:

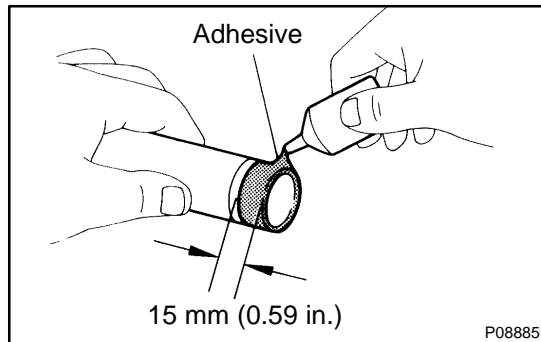
Be careful of the installation direction.

- (d) Apply a light coat of MP grease to the gasket lip.
(e) Return the ventilation case claw to its original position.

REASSEMBLY

HINT:

- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets and oil seals with new ones.



1. INSTALL SPARK PLUG TUBES

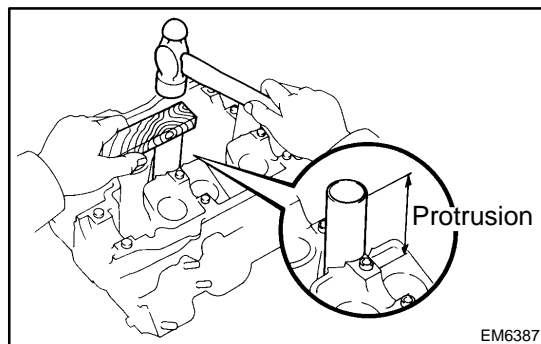
HINT:

When using a new cylinder head, spark plug tubes must be installed.

- (a) Apply adhesive to the end of the spark plug tube.

Adhesive:

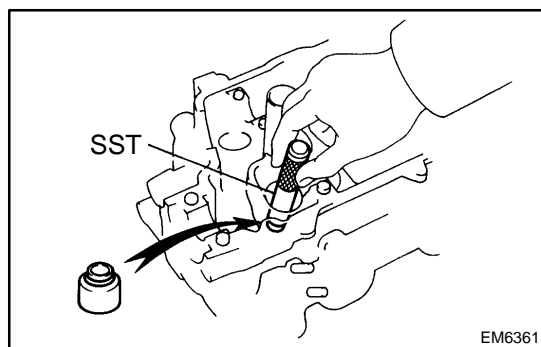
Part No. 08833-00070, THREE BOND 1324 or equivalent



- (b) Using a wooden block and hammer, tap in a new spark plug tube until there is 48.4 – 49.6 mm (1.906 – 1.953 in.) protruding from the camshaft bearing cap installation surface of the cylinder head.

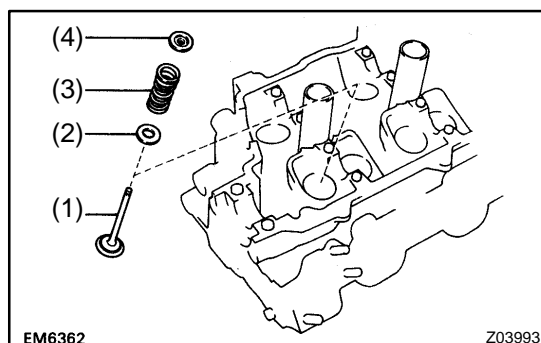
NOTICE:

Avoid tapping a new spark plug tube in too far by measuring the amount of the protrusion while tapping.

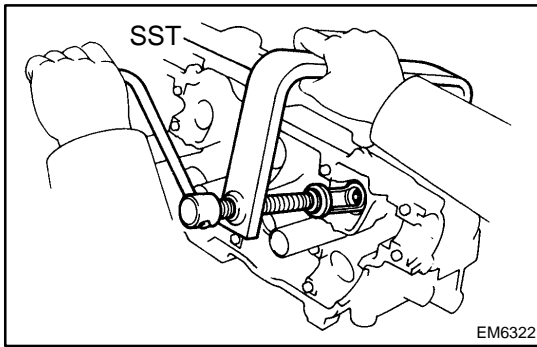


2. INSTALL VALVES

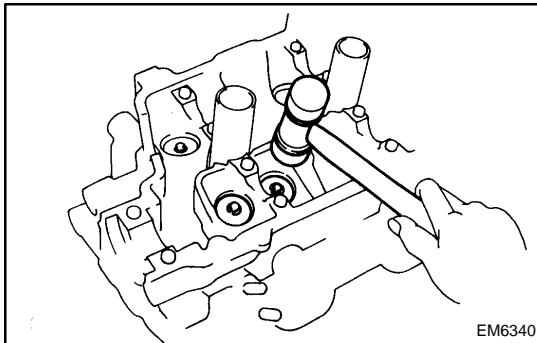
- (a) Using SST, push in a new oil seal.
SST 09201-41020



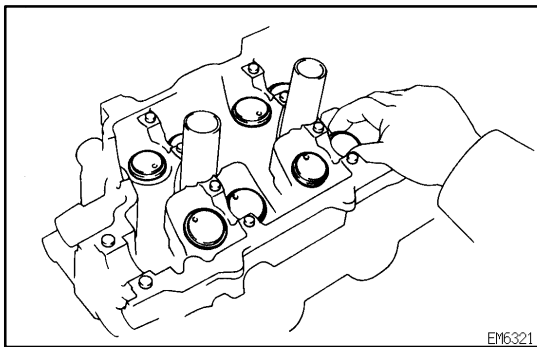
- (b) Install these parts:
- (1) Valve
 - (2) Spring seat
 - (3) Valve spring
 - (4) Spring retainer



- (c) Using SST, compress the valve spring and place the 2 keepers around the valve stem.
SST 09202-70020 (09202-00010)

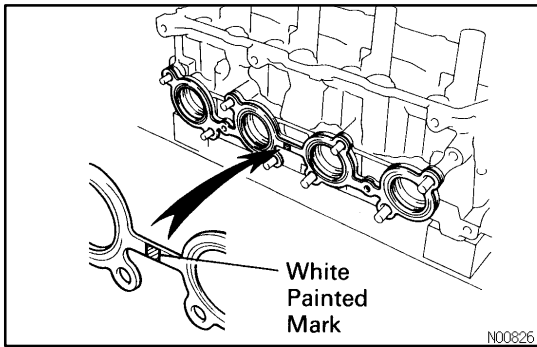


- (d) Using a plastic-faced hammer, lightly tap the valve stem tip to assure proper fit.



3. INSTALL VALVE LIFTERS AND SHIMS

- (a) Install the valve lifter and shim.
(b) Check that the valve lifter rotates smoothly by hand.



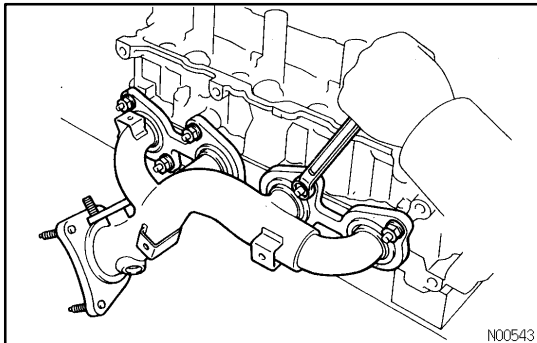
INSTALLATION

1. INSTALL RH EXHAUST MANIFOLD TO CYLINDER HEAD

- (a) Place a new gasket on the cylinder head with the white painted marks facing the manifold side.

NOTICE:

Be careful of the installation direction.

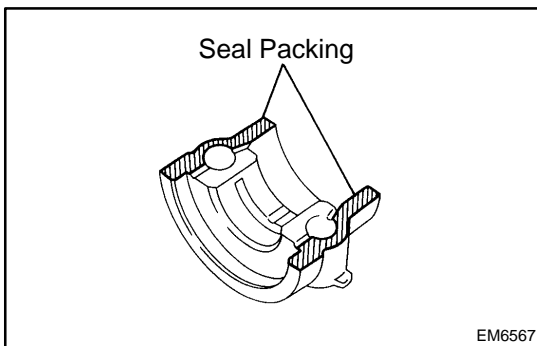


- (b) Install the exhaust manifold with 8 new nuts. Uniformly tighten the nuts in several passes.

Torque: 44 N·m (450 kgf-cm, 32 ft-lbf)

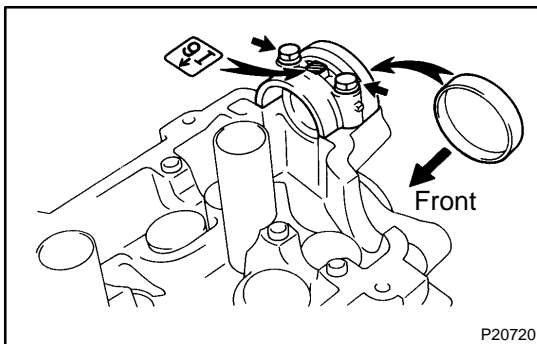
- (c) Install the heat insulator with the 3 bolts.

2. INSTALL LH EXHAUST MANIFOLD TO CYLINDER HEAD



3. INSTALL BEARING CAP TO LH CYLINDER HEAD

- (a) Remove any old packing (FIPG) material.
 - (b) Apply seal packing to the bearing caps as shown.
- Seal packing: Part No. 08826-00080 or equivalent**

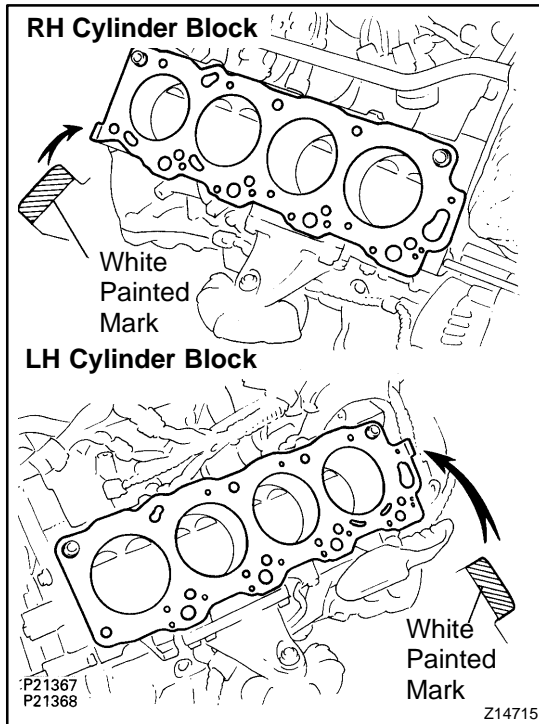


- (c) Place a new camshaft housing plug on the cylinder head, facing the cup side forward.
- (d) Install the bearing cap (mark "16") in position with the arrow mark facing forward.
- (e) Install a new seal washer to the bearing cap bolt.
- (f) Apply a light coat of engine oil on the threads of the bearing cap bolt.
- (g) Install the 2 bearing cap bolts. Alternately tighten bearing cap bolts.

Torque: 16 N·m (160 kgf-cm, 12 ft-lbf)

HINT:

Use silver colored bolts 38 mm (1.50 in.) in length.



4. INSTALL CYLINDER HEAD AND EXHAUST MANIFOLD ASSEMBLIES

- (a) Place the cylinder head on the cylinder block.
- (1) Place 2 new cylinder head gaskets in position on the cylinder block.

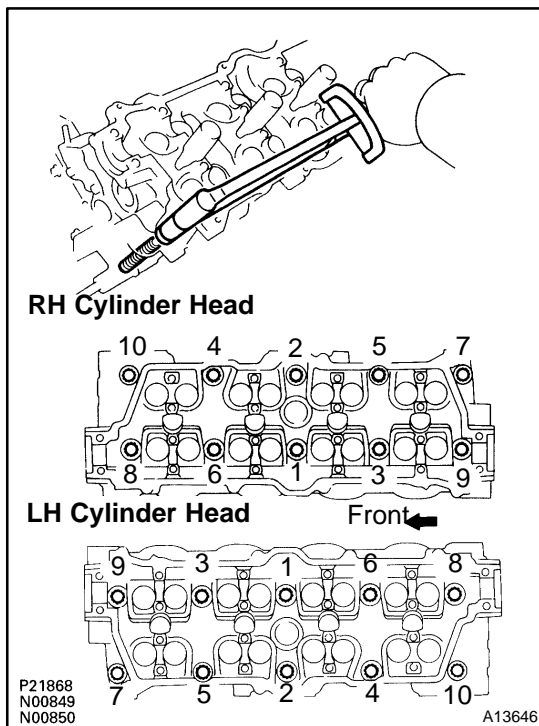
HINT:

On the rear side of the cylinder head gasket are painted marks to distinguish the LH and RH banks, a white painted mark for the RH bank and a yellow painted mark for the LH bank.

NOTICE:

Be careful of the installation direction.

- (2) Place the 2 cylinder heads in position on the cylinder head gaskets.



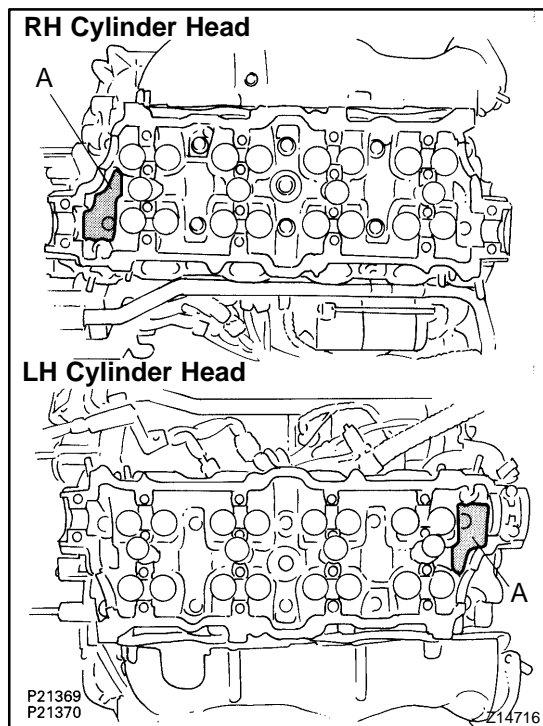
- (b) Install the cylinder head bolts.

HINT:

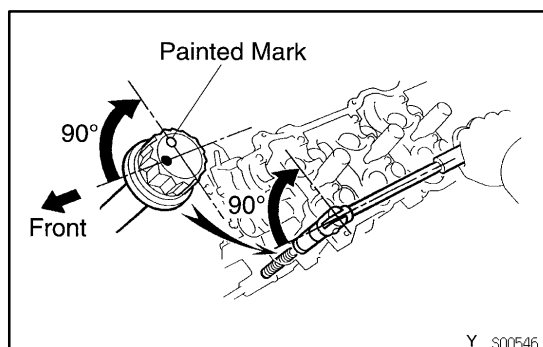
- The cylinder head bolts are tightened in 2 progressive steps (steps (c) and (e)).
 - If any cylinder head bolt is broken or deformed, replace it.
- (1) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.
- (2) Install the plate washer to the cylinder head bolt.
- (3) Install and uniformly tighten the 10 cylinder head bolts on one side of the cylinder head in several passes in the sequence shown, then do the other side as shown.

Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

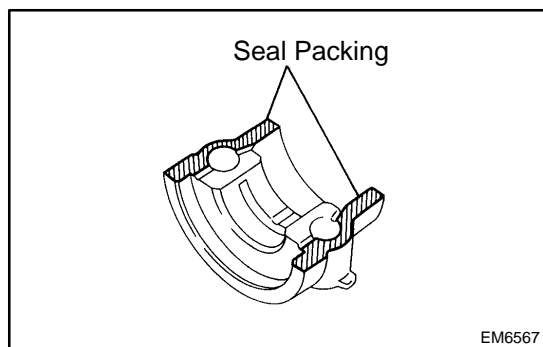
If any one of the cylinder head bolts does not meet the torque specification, replace the cylinder head bolt.

**NOTICE:**

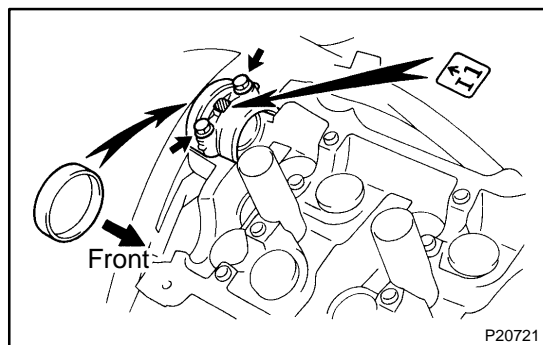
Do not drop the plate washer for cylinder head bolt into portion A of the cylinder head. If dropped into portion A, the plate washer will pass through the cylinder head and cylinder block into the oil pan.



- (4) Mark the front of the cylinder head bolt head with paint.
- (5) Retighten the cylinder head bolts by 90° in the numerical order shown.
- (6) Check that the painted mark is now at a 90° angle to front.



- (c) Install the bearing cap to RH cylinder head.
 - (1) Remove any old packing (FIPG) material.
 - (2) Apply seal packing to the bearing caps as shown.**Seal packing: Part No. 08826-00080 or equivalent**

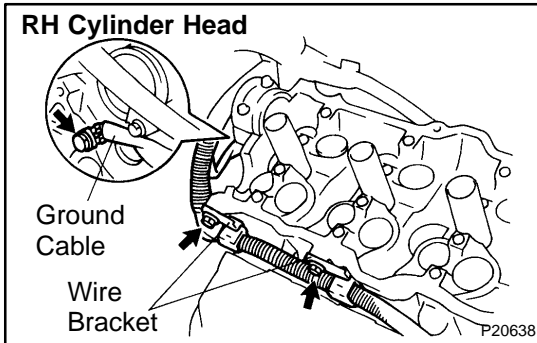


- (3) Place a new camshaft housing plug on the cylinder head, facing the cup side forward.
- (4) Install the bearing cap (mark "11") in position with the arrow mark facing rearward.
- (5) Install a new seal washer to the bearing cap bolt.
- (6) Apply a light coat of engine oil on the threads of the bearing cap bolt.
- (7) Install the 2 bearing cap bolts. Alternately tighten bearing cap bolts.

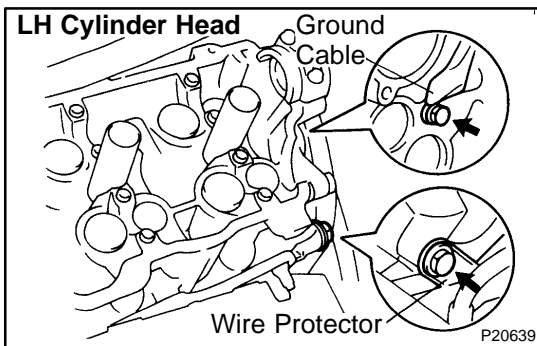
Torque: 16 N·m (160 kgf-cm, 12 ft-lbf)

HINT:

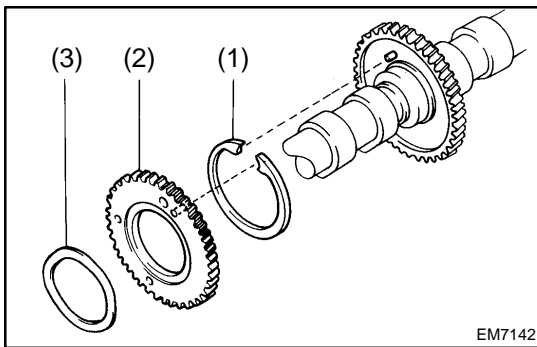
Use silver colored bolts 38 mm (1.50 in.) in length.



- (d) Install the engine wire.
- (1) Install the engine wire to the RH cylinder head with the 2 bolts.
 - (2) Install the ground cable to RH cylinder head with the bolt.



- (3) Install the engine wire protector to the LH cylinder head with the bolt.
- (4) Install the ground cable to LH cylinder head with the bolt.
- (5) Connect the 2 heated oxygen sensor connectors.



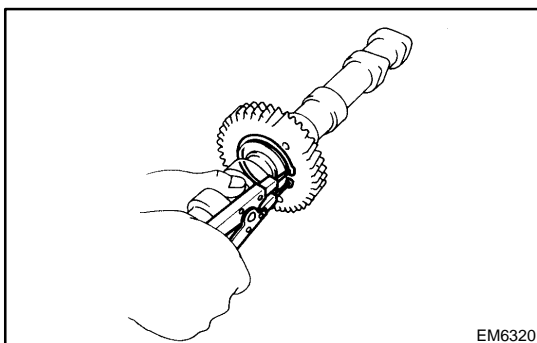
5. ASSEMBLE EXHAUST CAMSHAFT

- (a) Install these parts:
- (1) Camshaft gear spring
 - (2) Camshaft sub-gear

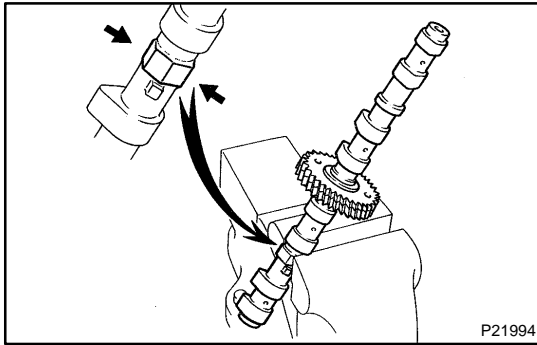
HINT:

Attach the pins on the gears to the gear spring ends.

- (3) Wave washer



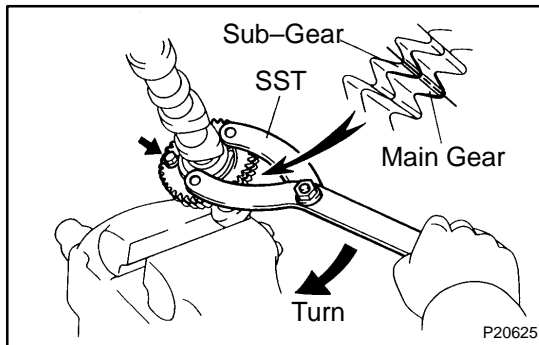
- (b) Using snap ring pliers, install the snap ring.



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

NOTICE:

Be careful not to damage the camshaft.

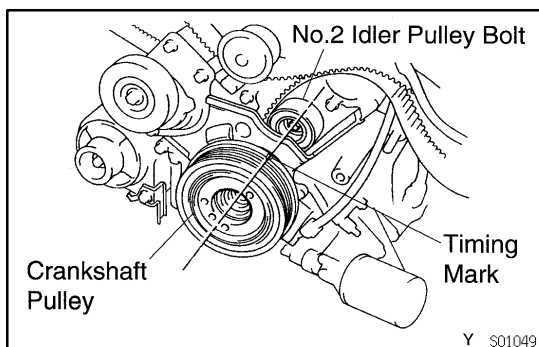


- (d) Using SST, align the holes of the camshaft main gear and sub-gear by turning camshaft sub-gear counterclockwise, and temporarily install a service bolt.
SST 09960-10010 (09962-01000, 09963-00500)
- (e) Align the gear teeth of the main gear and sub-gear, and tighten the service bolt.

6. INSTALL CAMSHAFTS

NOTICE:

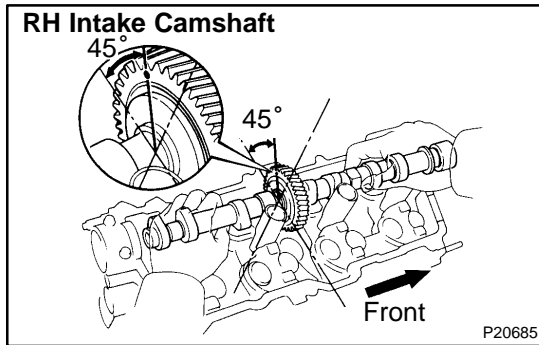
Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following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



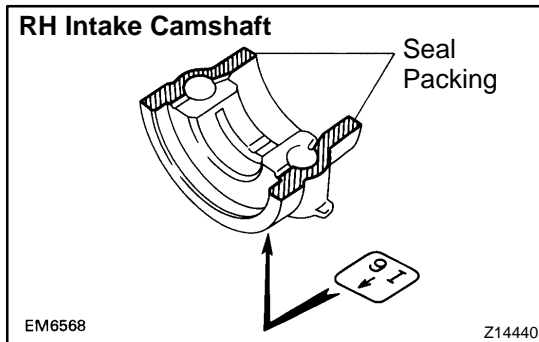
- (a) Set the crankshaft pulley position.
Turn the crankshaft pulley clockwise or counterclockwise, and put the timing mark of the crankshaft pulley in line with the centers of the crankshaft pulley bolt and the idler pulley bolt.

NOTICE:

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 install the camshaft, causing damage. So always set the crankshaft pulley at the correct angle.

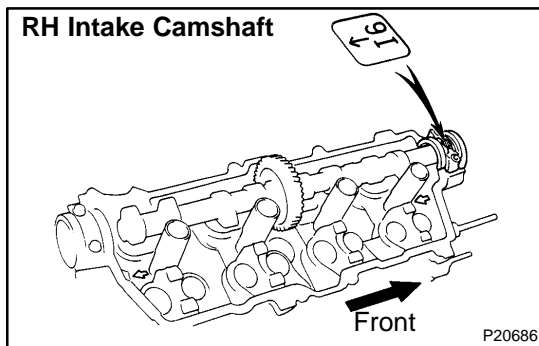


- (b) Install the RH intake camshaft.
- (1) Apply MP grease to the thrust portion of the intake camshaft.
 - (2) Place the intake camshaft at 45° angle of the timing mark (1 dot mark) on the cylinder head.



- (3) Remove any old packing (FIPG) material.
- (4) Apply seal packing to the bearing cap (mark "I6") as shown.

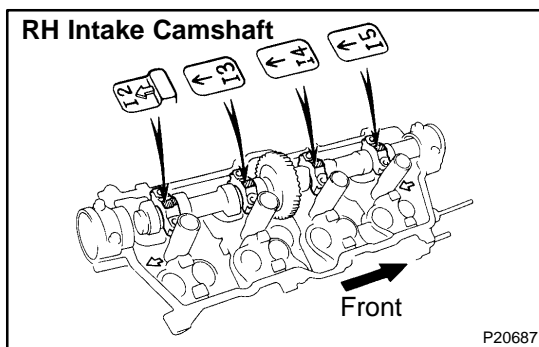
Seal packing: Part No. 08826-00080 or equivalent



- (5) Install the front bearing cap (mark "I6") with the arrow mark facing rearward.

HINT:

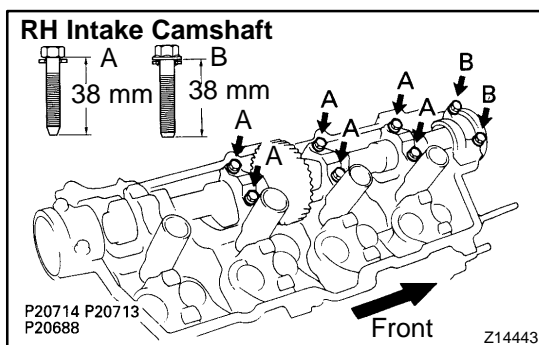
- Installing the front bearing cap will determine the thrust portion of the camshaft.
- Align the arrow marks at the front and rear of the cylinder head with the mark on the bearing cap.



- (6) Install the other bearing cap in the sequence shown with the arrow mark facing rearward.

HINT:

Align the arrow marks at the front and rear of the cylinder head with the mark on the bearing cap.



- (7) Apply a light coat of engine oil on the threads and under the heads (A only) of the bearing cap bolts.

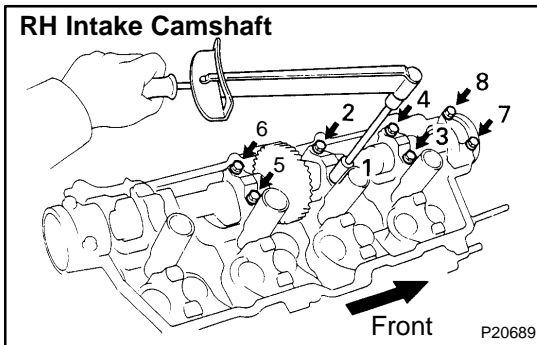
HINT:

Do not apply engine oil under the heads of the bearing cap bolt (B).

- (8) Install a new seal washer to the bearing cap bolt (B). Install the 8 bearing cap bolts as shown.

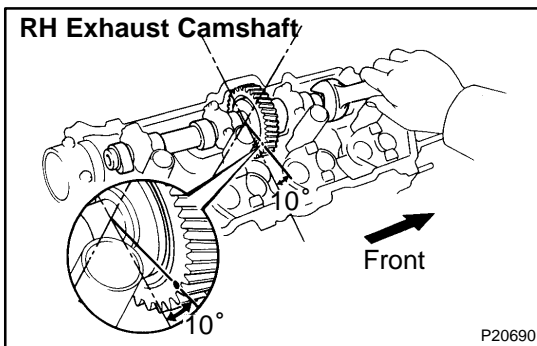
HINT:

- Use bearing cap bolts 38 mm (1.50 in.) in length. The bolts are black (A) or silver (B) in color. Install the 2 silver bolts to the front bearing cap. Install the 6 black bolts to the other positions.
- After installing the oil feed pipe, install the 2 bolts to rear bearing cap as directed in step B (i).

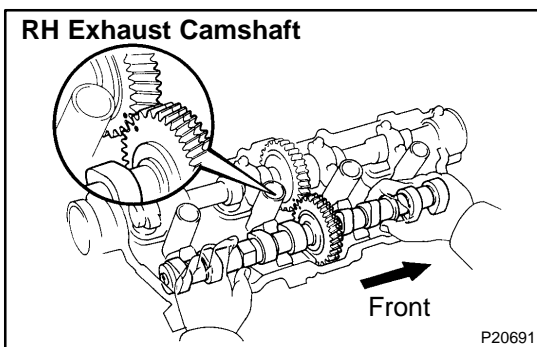


- (9) Uniformly tighten the 8 bearing cap bolts in several passes, in the sequence shown.

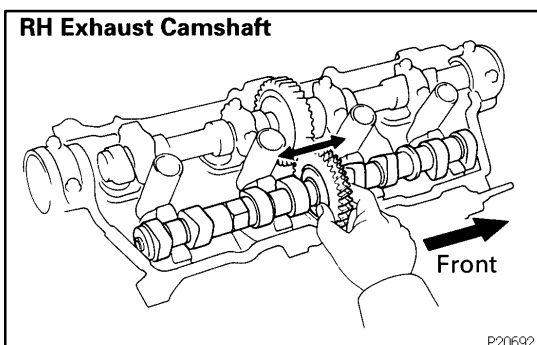
Torque: 16 N·m (160 kgf-cm, 12 ft-lbf)



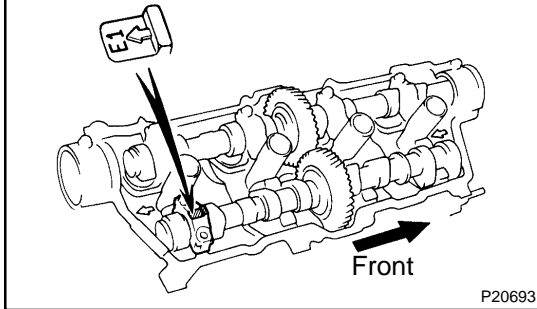
- (c) Install the RH exhaust camshaft.
- (1) Set the timing mark (1 dot mark) of the camshaft drive gear at 10° angle by turning the hexagon wrench head portion of the intake camshaft with a wrench.



- (2) Apply MP grease to the thrust portion of the exhaust camshaft.
- (3) Align the timing marks (1 dot mark) of the camshaft drive and driven gears.
- (4) Place the exhaust camshaft on the cylinder head.



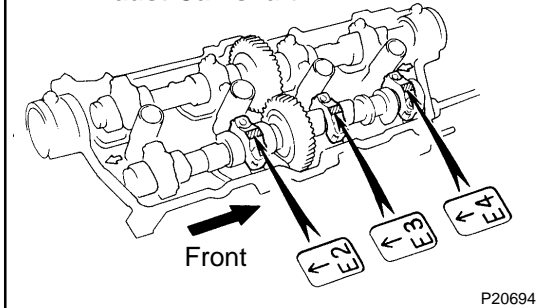
- (5) Check that the exhaust camshaft moves smoothly in the thrust direction.

RH Exhaust Camshaft

- (6) Install the rear bearing cap (mark "E1") with the arrow mark facing rearward.

HINT:

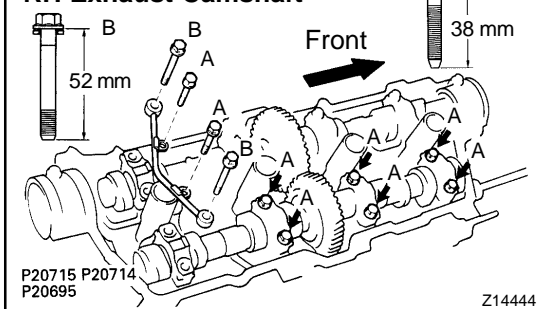
- Installing the rear bearing cap will determine the thrust portion of the camshaft.
- Align the arrow marks at the front and rear of the cylinder head with the mark on the bearing cap.

RH Exhaust Camshaft

- (7) Install the other bearing cap in the sequence shown with the arrow mark facing rearward.

HINT:

Align the arrow marks at the front and rear of the cylinder head with the mark on the bearing cap.

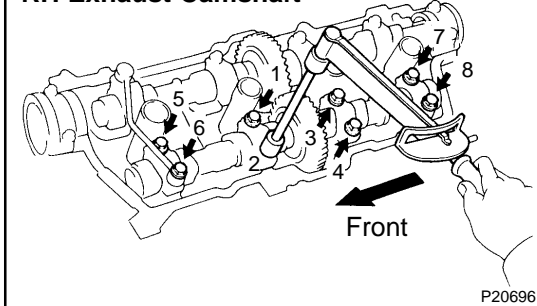
RH Exhaust Camshaft

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

- (9) Install the oil feed pipe and 10 bolts.

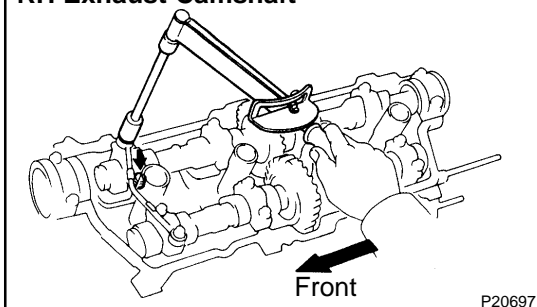
HINT:

Use bearing cap bolts 38 mm (1.50 in.) and 52 mm (2.05 in.) in length. Use black colored 38 mm (1.50 in.) bolts. Install the 2 (52 mm (2.05 in.)) bolts in outside positions of the oil feed pipe. Install the 8 (38 mm (1.50 in.)) bolts in the other positions.

RH Exhaust Camshaft

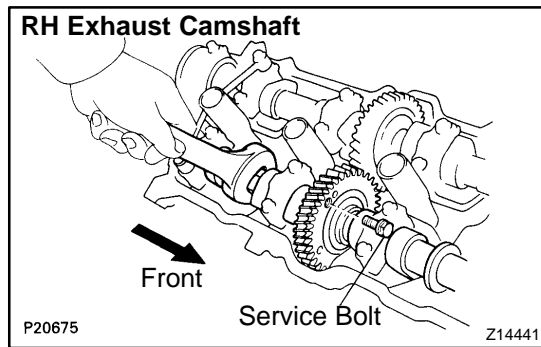
- (10) Uniformly tighten the 8 bolts on the bearing caps of the exhaust camshaft in several passes, in the sequence shown.

Torque: 16 N·m (160 kgf-cm, 12 ft-lbf)

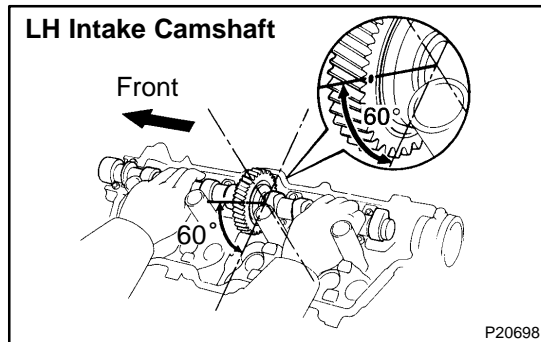
RH Exhaust Camshaft

- (11) Alternately tighten the 2 bolts on the rear bearing caps of the intake camshaft in several passes.

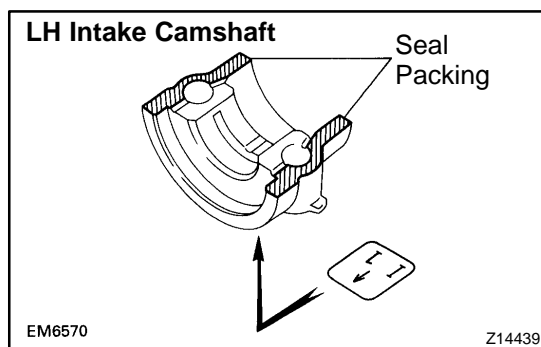
Torque: 16 N·m (160 kgf-cm, 12 ft-lbf)



- (12) Boring the service bolt installed in the driven sub-gear upward by turning the hexagon wrench head portion of the camshaft with a wrench.
- (13) Remove a service bolt.

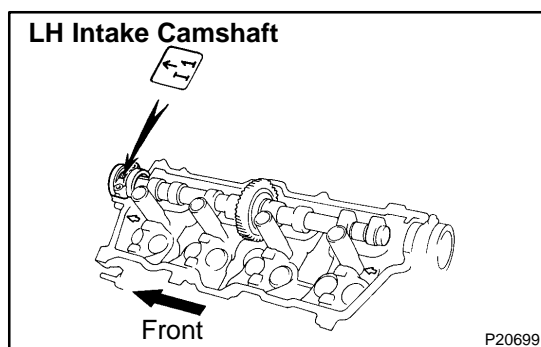


- (d) Install the LH intake camshaft.
 - (1) Apply MP grease to the thrust portion of the intake camshaft.
 - (2) Place the intake camshaft at 60° angle of the timing mark (1 dot mark) on the cylinder head.



- (3) Remove any old packing (FIPG) material.
- (4) Apply seal packing to the bearing cap (mark "I1") as shown.

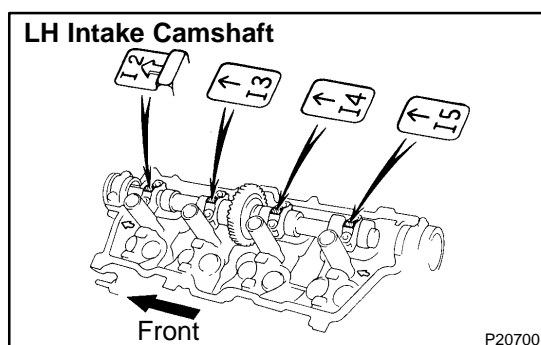
Seal packing: Part No. 08826-00080 or equivalent



- (5) Install the front bearing cap (mark "I1") with the arrow mark facing forward.

HINT:

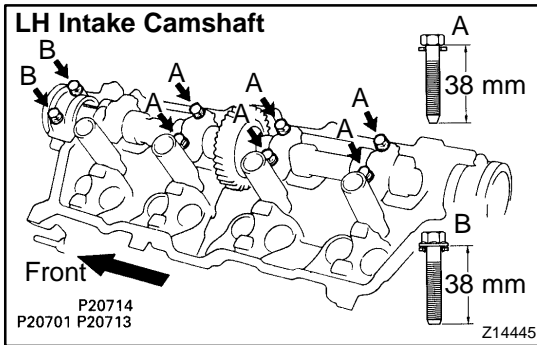
- Installing the front bearing cap will determine the thrust portion of the camshaft.
- Align the arrow marks at the front and rear of the cylinder head with the mark on the bearing cap.



- (6) Install the other bearing cap in the sequence shown with the arrow mark facing forward.

HINT:

Align the arrow marks at the front and rear of the cylinder head with the mark on the bearing cap.



- (7) Apply a light coat of engine oil on the threads and under the heads (A only) of the bearing cap bolts.

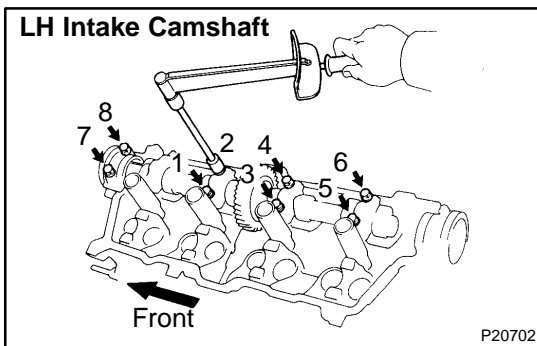
HINT:

Do not apply engine oil under the heads of the bearing cap bolt (B).

- (8) Install a new seal washer to the bearing cap bolt (B). Install the eight bearing cap bolts as shown.

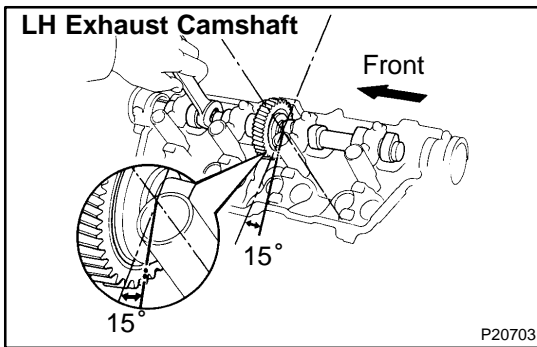
HINT:

- Use bearing cap bolts 38 mm (1.50 in.) in length. The bolts are black (A) or silver (B) in color. Install the 2 silver bolts to the front bearing cap. Install the 6 black bolts to the other positions.
- After installing the oil feed pipe, install the 2 bolts to the bearing cap second from the front as directed in step B (i).



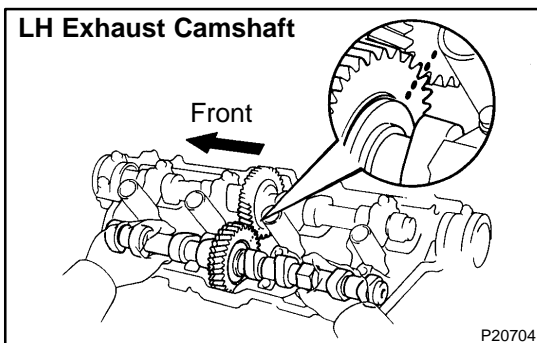
- (9) Uniformly tighten the 8 bearing cap bolts in several passes, in the sequence shown.

Torque: 16 N·m (160 kgf-cm, 12 ft-lbf)

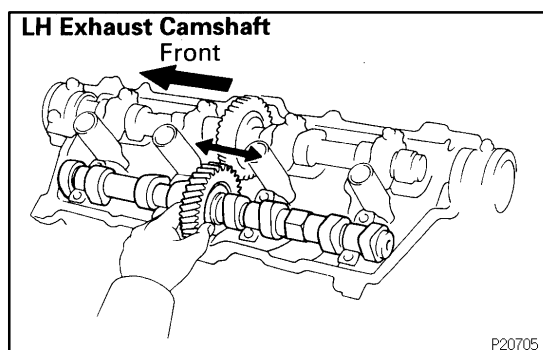


- (e) Install the LH exhaust camshaft.

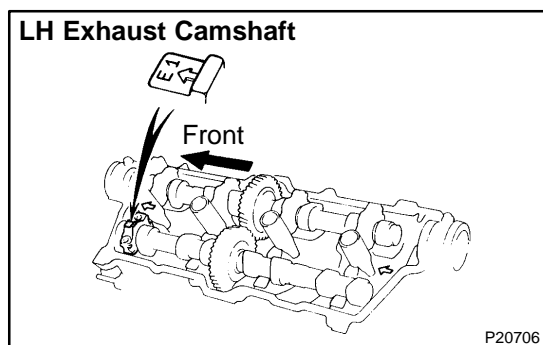
- (1) Set the timing mark (2 dot marks) of the camshaft drive gear at 15° angle by turning the hexagon wrench head portion of the intake camshaft with a wrench.



- (2) Apply MP grease to the thrust portion of the exhaust camshaft.
- (3) Align the timing marks (2 dot marks) of the camshaft drive and driven gears.
- (4) Place the exhaust camshaft on the cylinder head.



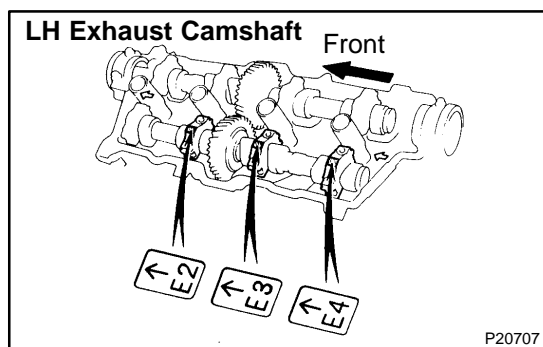
- (5) Check that the exhaust camshaft moves smoothly in the thrust direction.



- (6) Install the front bearing cap (mark "E1") with the arrow mark facing forward.

HINT:

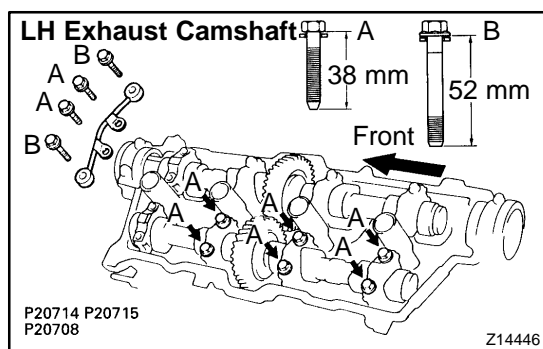
- Installing the front bearing cap will determine the thrust portion of the camshaft.
- Align the arrow marks at the front and rear of the cylinder head with the mark on the bearing cap.



- (7) Install the other bearing cap in the sequence shown with the arrow mark facing forward.

HINT:

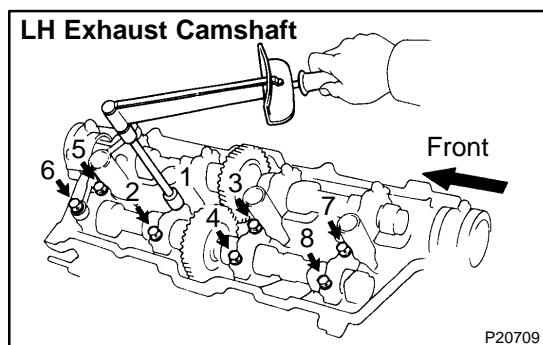
Align the arrow marks at the front and rear of the cylinder head with the mark on the bearing cap.



- (8) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.
- (9) Install the oil feed pipe and 10 bolts.

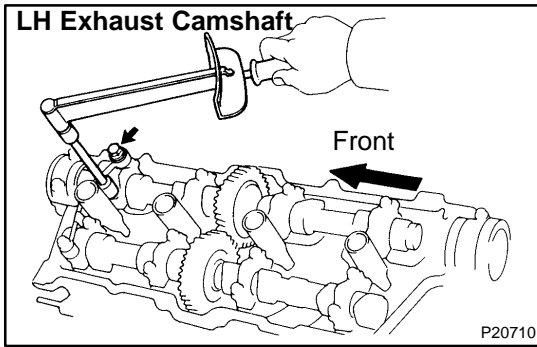
HINT:

Use bearing cap bolts 38 mm (1.50 in.) and 52 mm (2.05 in.) in length. Use black colored 38 mm (1.50 in.) bolts. Install the 2 (52 mm (2.05 in.)) bolts in outside positions of the oil feed pipe. Install the 8 (38 mm (1.50 in.)) bolts in the other positions.



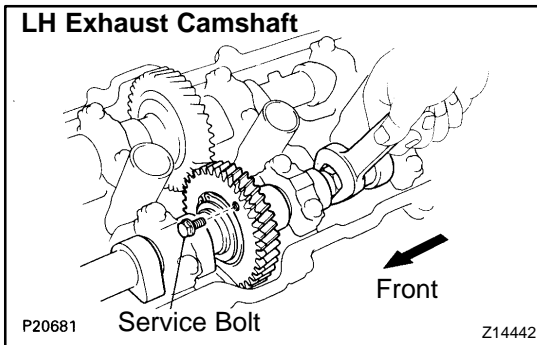
- (10) Uniformly tighten the 8 bolts on the bearing caps of the exhaust camshaft in several passes, in the sequence shown.

Torque: 16 N·m (160 kgf-cm, 12 ft-lbf)



- (11) Alternately tighten the 2 bolts on the bearing cap of the intake camshaft second from the front in several passes.

Torque: 16 N·m (160 kgf-cm, 12 ft-lbf)

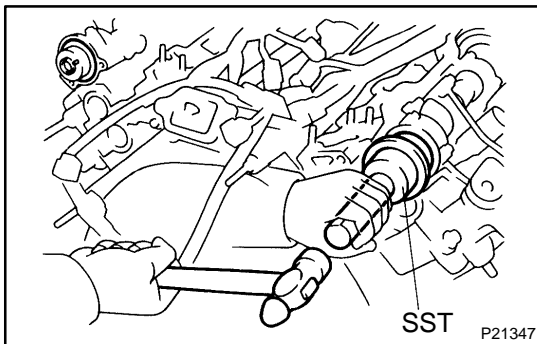


- (12) Boring a service bolt installed in the driven sub-gear upward by turning the hexagon wrench head portion of the camshaft with a wrench.

- (13) Remove a service bolt.

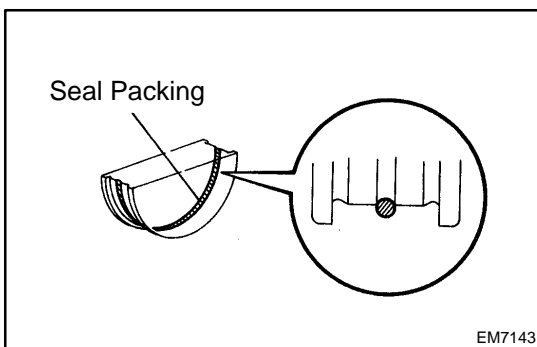
7. CHECK AND ADJUST VALVE CLEARANCE (See page EM-4)

Turn the camshaft and position the cam lobe upward, and check and adjust the valve clearance.



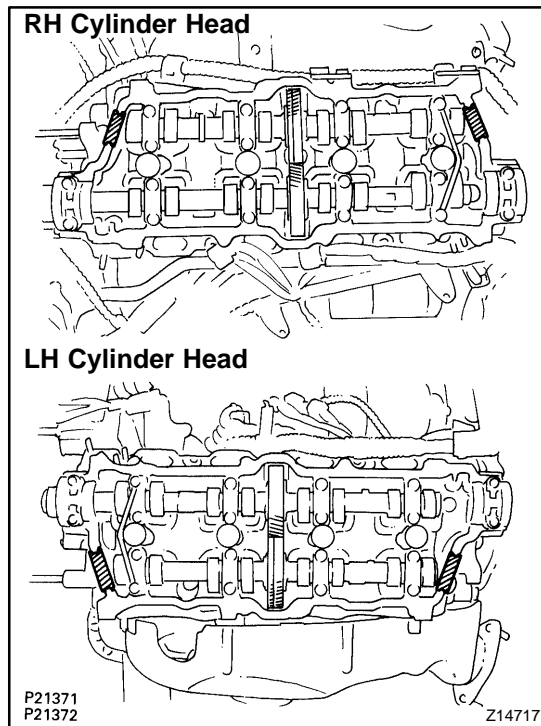
8. INSTALL CAMSHAFT OIL SEALS

- Apply MP grease to a new oil seal lip.
- Using SST and a hammer, tap in the 2 oil seals.
SST 09223-46011

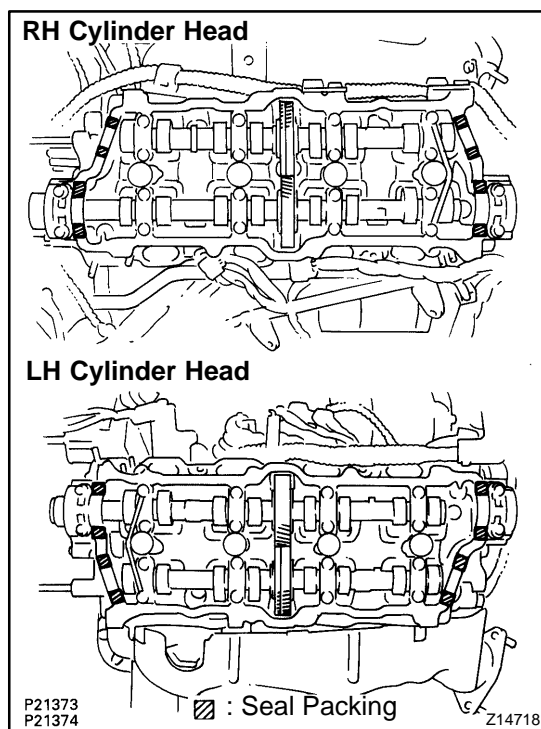


9. INSTALL SEMI-CIRCULAR PLUGS

- Remove any old packing (FIPG) material.
- Apply seal packing to the semi-circular plug grooves.
Seal packing: Part No. 08826-00080 or equivalent



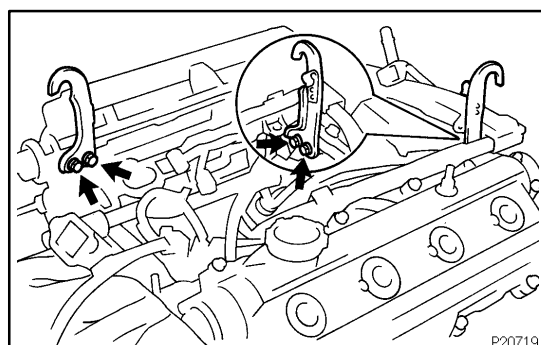
- (c) Install the 4 semi-circular plugs to the cylinder heads.



10. INSTALL CYLINDER HEAD COVER

- Remove any old packing (FIPG) material.
 - Apply seal packing to the cylinder heads as shown in the illustration.
- Seal packing: Part No. 08826-00080 or equivalent**
- Install the gasket to the cylinder head cover.
 - Install the seal washer to the bolt.
 - Install the cylinder head cover with the 8 bolts. Uniformly tighten the bolts in several passes. Install the 2 cylinder head covers.

Torque: 6.0 N·m (60 kgf-cm, 53 in.-lbf)



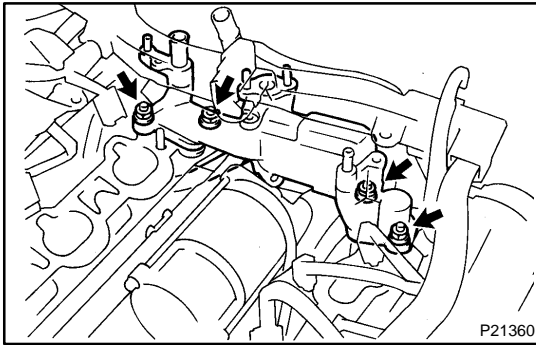
11. INSTALL ENGINE HANGERS

Install the 2 engine hangers each with 2 bolts.

Torque: 37 N·m (380 kgf-cm, 27 ft-lbf)

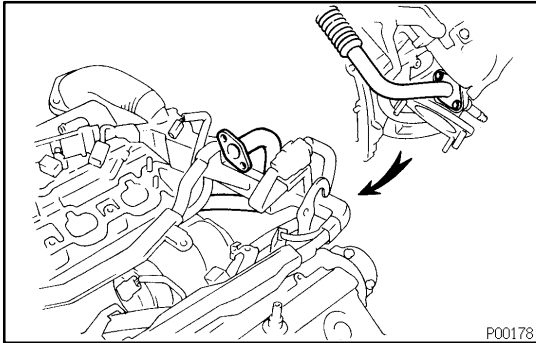
12. INSTALL OIL DIPSTICK AND GUIDE FOR ENGINE (See page [LU-17](#))

13. INSTALL OIL DIPSTICK AND GUIDE FOR A/T (See page [EM-96](#))



- 14. INSTALL REAR WATER BYPASS JOINT AND NO. 1 EGR PIPE ASSEMBLY**
- Install 2 new gaskets to the cylinder head.
 - Install a new gasket to the RH exhaust manifold.
 - Attach the water bypass joint and EGR pipe assembly to the cylinder heads and RH exhaust manifold.
 - Install the 4 nuts holding the water bypass joint to the cylinder heads. Alternately tighten the nuts.

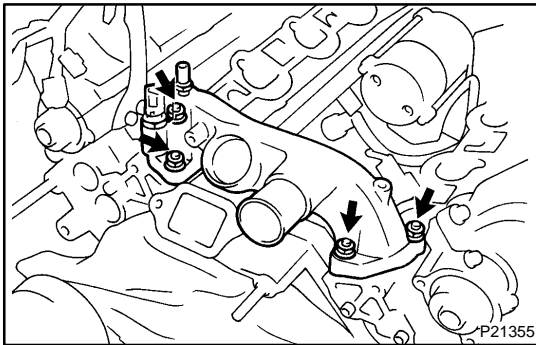
Torque: 18 N·m (185 kgf-cm, 13 ft-lbf)



- Install 2 new nuts holding the EGR pipe to the RH exhaust manifold.

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

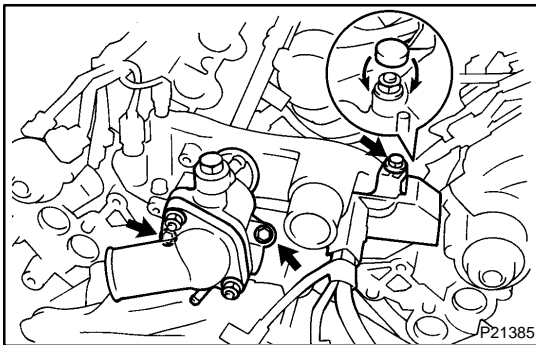
- Connect the heater hose to the water bypass joint.
- Install the RH heat insulator (for the RH front TWC) with the 2 bolts.
- Install the RH heat insulator (for the RH front side of the front exhaust pipe) with the 2 bolts and nut.



15. INSTALL FRONT WATER BYPASS JOINT

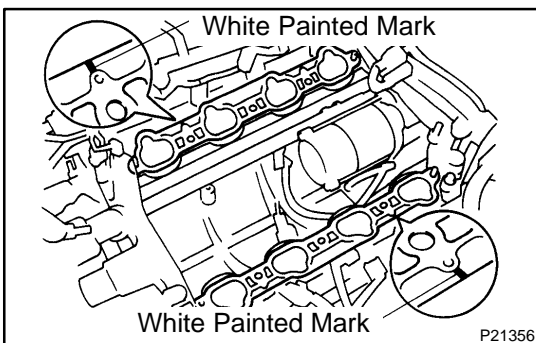
- Install 2 new gaskets and the water bypass joint with the 4 nuts. Alternately tighten the nuts.

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



- Install the engine wire protector with the bolt.
- Attach the engine wire protector to the water bypass joint nut.
- Connect these connectors:
 - ECT sensor connector
 - ECT sender gauge connector

16. INSTALL WATER INLET AND INLET HOUSING ASSEMBLY (See page CO-11)

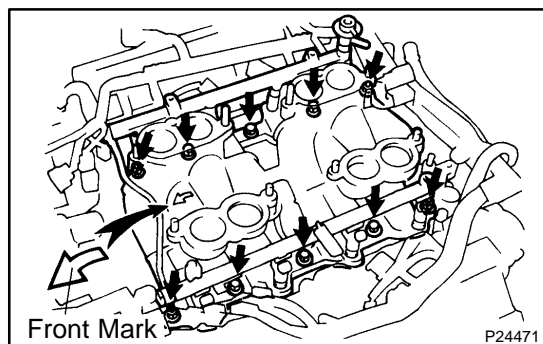


17. INSTALL INTAKE MANIFOLD ASSEMBLY

- Place 2 new gaskets on the cylinder heads with white painted mark facing upward.

NOTICE:

Align the port holes of the gasket and cylinder head. Be careful of the installation direction.



- (b) Place the intake manifold on the cylinder heads with the arrow mark facing forward.

NOTICE:

Be careful of the installation direction.

- (c) Install and uniformly tighten the 6 bolts and 4 nuts in several passes.

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

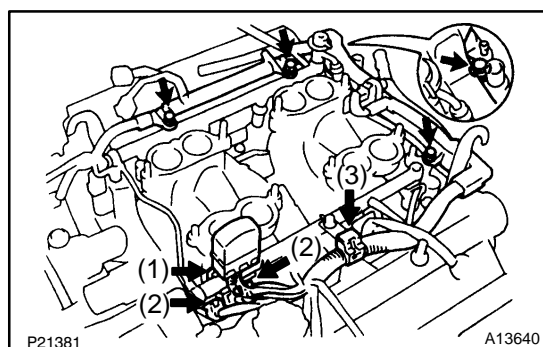
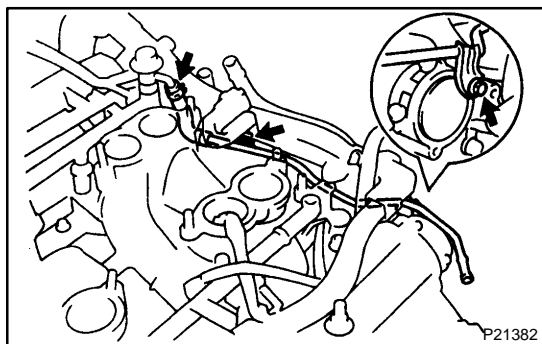
HINT:

Use a bolt 30 mm (1.18 in.) in length.

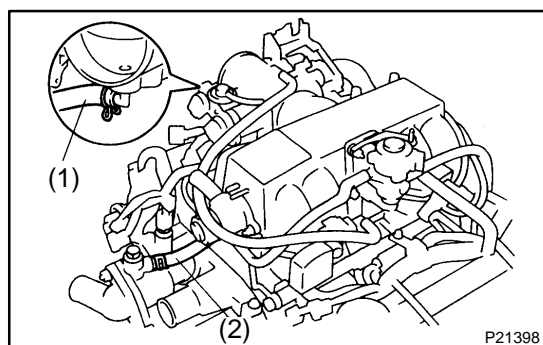
- (d) Connect the 8 injector connectors.

18. INSTALL FUEL RETURN PIPE

- (a) Install the fuel return pipe with the 2 bolts.
(b) Connect the fuel hose to the fuel pressure regulator.

**19. INSTALL ENGINE WIRE TO DELIVERY PIPE AND REAR WATER BYPASS JOINT**

- (a) Install these connectors:
- (1) DLC1 to connector bracket on LH delivery pipe
 - (2) 2 engine wire connectors to connector bracket on LH delivery pipe
 - (3) Engine wire clamp to wire bracket on LH delivery pipe
- (b) Install the engine wire protector to the RH delivery pipe with the 2 bolts.
(c) Install the engine wire protector to the rear water bypass joint with the 2 bolts.
(d) Install the A/T throttle cable to the clamps on the engine wire protector and engine hanger.

20. CONNECT FUEL RETURN HOSE TO FUEL RETURN PIPE**21. CONNECT FUEL INLET HOSE TO LH DELIVERY PIPE**
(See page [SF-27](#))**22. INSTALL AIR INTAKE CHAMBER ASSEMBLY**

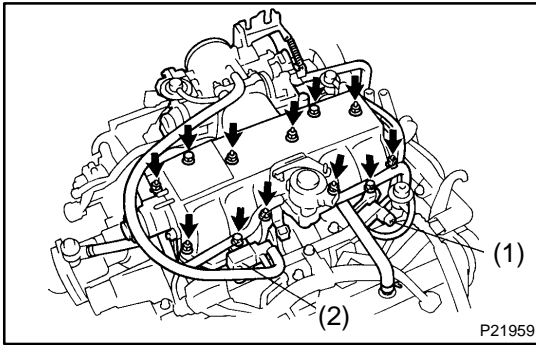
- (a) Place 4 new gaskets on the intake manifold.

HINT:

Gaskets can only be used twice before being replaced.

- (b) Connect these hoses, and place the air intake chamber assembly on the intake manifold:

- (1) PCV hose (from RH cylinder head) to throttle body
- (2) Water bypass hose (from IAC valve) to water inlet housing



- (c) Install the air intake chamber and these parts with the 4 bolts and 8 nuts: Uniformly tighten the bolts and nuts several passes.

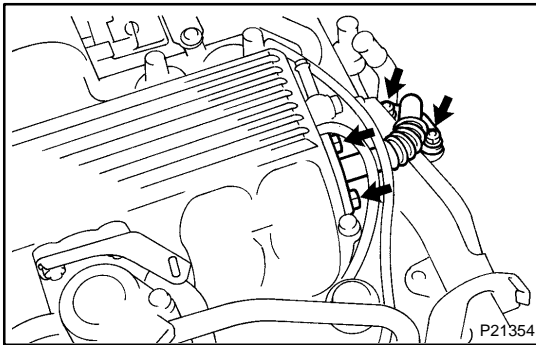
(1) VSV for fuel pressure control

(2) VSV for EVAP

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

HINT:

Use bolt 40 mm (1.57 in.) in length.



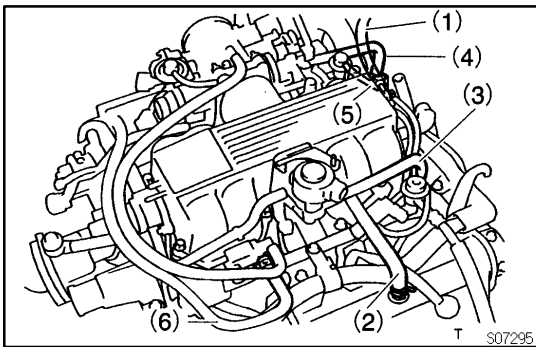
- (d) Install 2 new gaskets and No.2 EGR pipe with the 2 bolts and 2 nuts.

Torque: 22.5 N·m (230 kgf·cm, 17 ft·lbf)

HINT:

Use bolt 20 mm (0.79 in.) in length.

- (e) Connect the heater hose to the water bypass pipe.



- (f) Connect these hoses:

- (1) Brake booster vacuum hose to union on air intake chamber
- (2) PCV hose to PCV valve on LH cylinder head
- (3) Water bypass hose (from EGR valve) to rear water bypass joint
- (4) Water bypass hose (from throttle body) to rear water bypass joint
- (5) Vacuum hose (from VSV for fuel pressure control) to fuel pressure regulator
- (6) EVAP hose (from charcoal canister) to VSV for EVAP

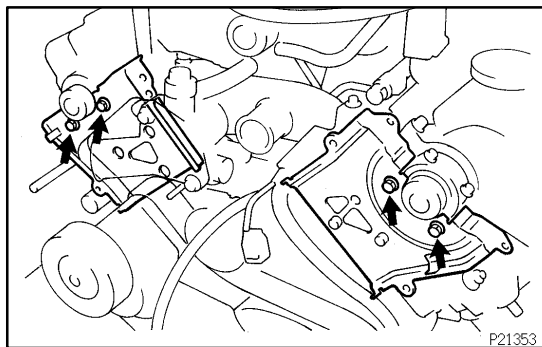
- (g) Connect these connectors:

- Throttle position sensor connector
- w/ TRAC:
Sub-throttle position sensor connector
- w/ TRAC:
Sub-throttle actuator connector
- IAC valve connector
- EGR valve connector
- EGR gas temperature sensor connector
- VSV connector for fuel pressure control
- VSV connector for EVAP

- (h) Install the accelerator bracket with the 2 bolts.

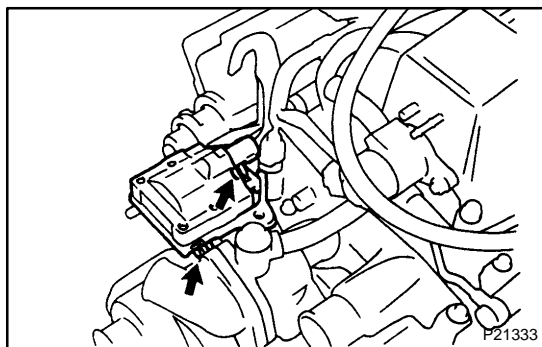
- (i) Connect these cables:

- Accelerator cable
- A/T throttle control cable
- Cruise control actuator cable

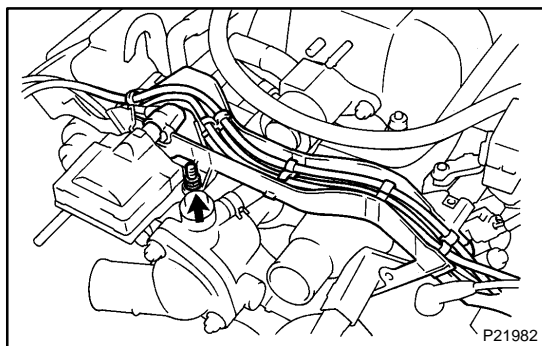
**23. INSTALL TIMING BELT REAR PLATES**

Install the rear plate with the 2 bolts. Install the 2 rear plates.

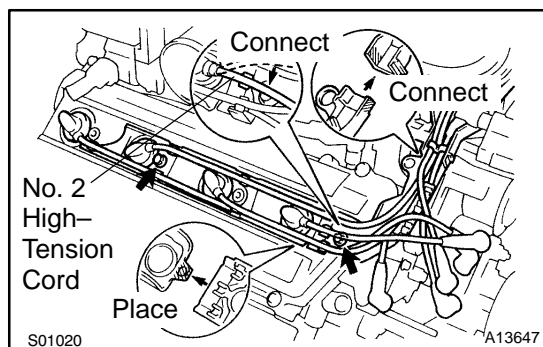
Torque: 7.5 N·m (80 kgf·cm, 66 in.-lbf)

**24. INSTALL NO. 2 IGNITION COIL**

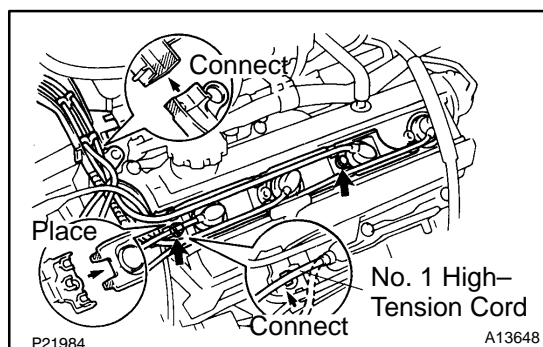
- (a) Install the ignition coil with the 2 bolts.
- (b) Connect the ignition coil connector.

**25. INSTALL HIGH-TENSION CORDS, CORD CLAMPS AND CORD COVER ASSEMBLY**

- (a) Connect the high-tension cords to the spark plugs, distributor caps and No. 2 ignition coil.
- (b) Install the lower high-tension cord cover with the stud bolt.



- (c) Connect the RH front high-tension cord clamp to the lower high-tension cord cover.
- (d) Place the RH front high-tension cord clamp to the RH rear high-tension cord clamp.
- (e) Install the 2 bolts holding the RH high-tension cord clamps to the RH cylinder head cover.
- (f) Connect the No. 2 high-tension cord to the cord clamp on the RH front high-tension cord clamp.



- (g) Connect the LH front high-tension cord clamp to the lower high-tension cord cover.
- (h) Place the LH front high-tension cord clamp to the LH rear high-tension cord clamp.
- (i) Install the 2 bolts holding the LH high-tension cord clamps to the LH cylinder head cover.
- (j) Connect the No. 1 high-tension cord to the cord clamp on the LH front high-tension cord clamp.

26. INSTALL FRONT TWC AND CONNECT FRONT EXHAUST PIPE TO FRONT TWC (See page EC-16)

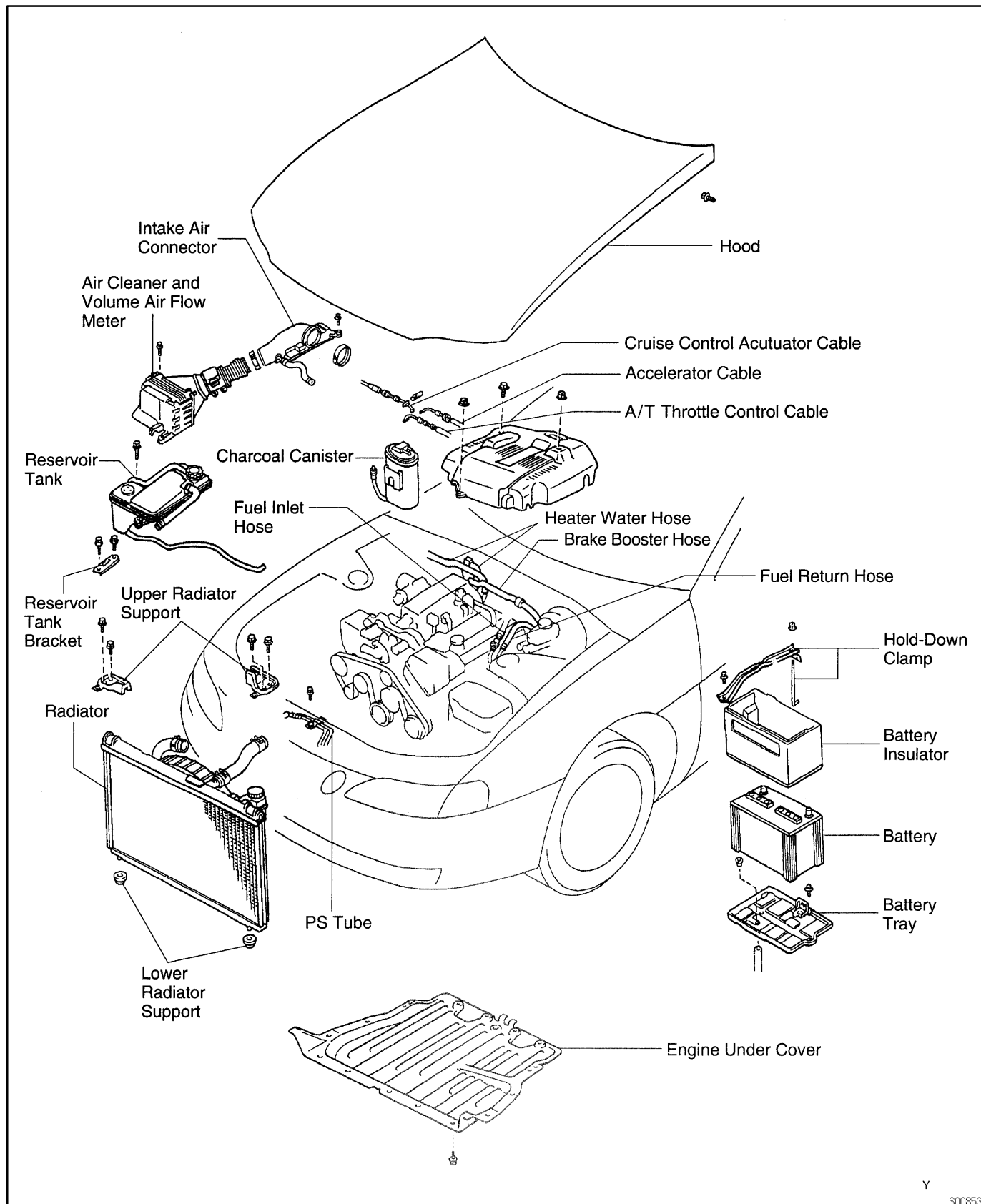
27. INSTALL PS PUMP

- (a) Install the PS pump (See page [EM-96](#)).
- (b) Connect the PS air hose to the air intake chamber.

28. INSTALL CAMSHAFT TIMING PULLEYS (See page [EM-26](#))**29. CONNECT TIMING BELT TO CAMSHAFT TIMING PULLEYS (See page [EM-26](#))****30. CHECK ENGINE OIL LEVEL**

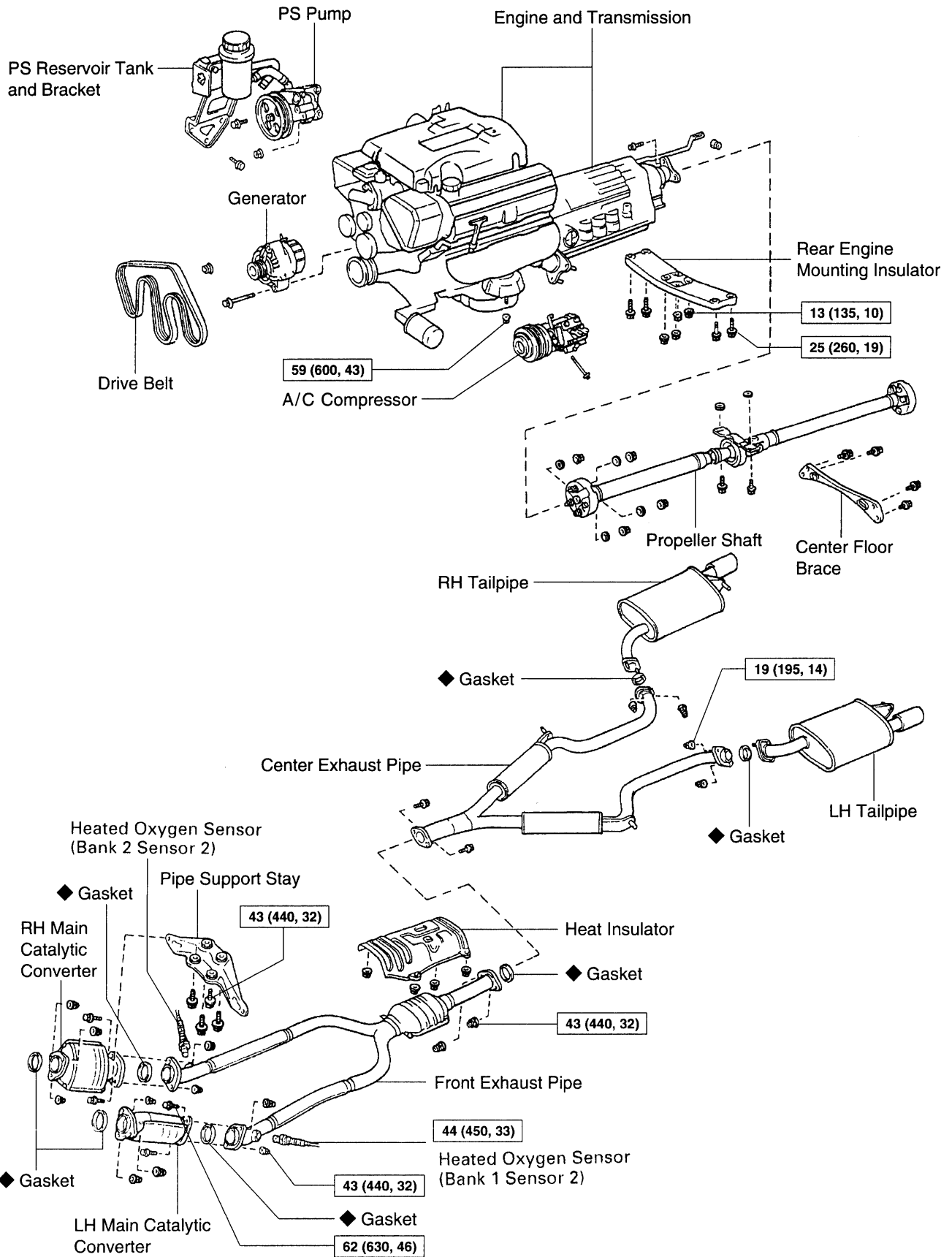
ENGINE UNIT COMPONENTS

EM06-04



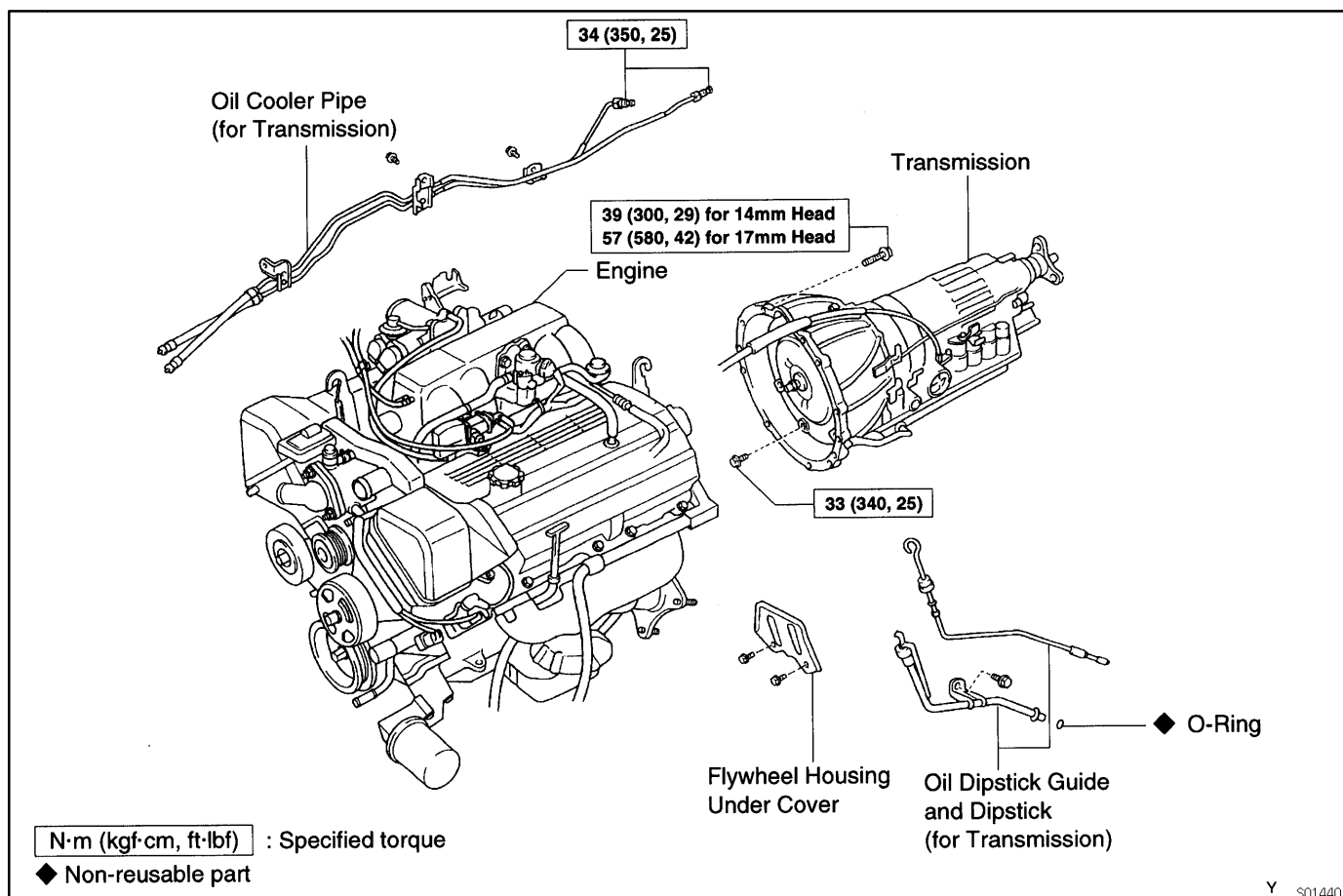
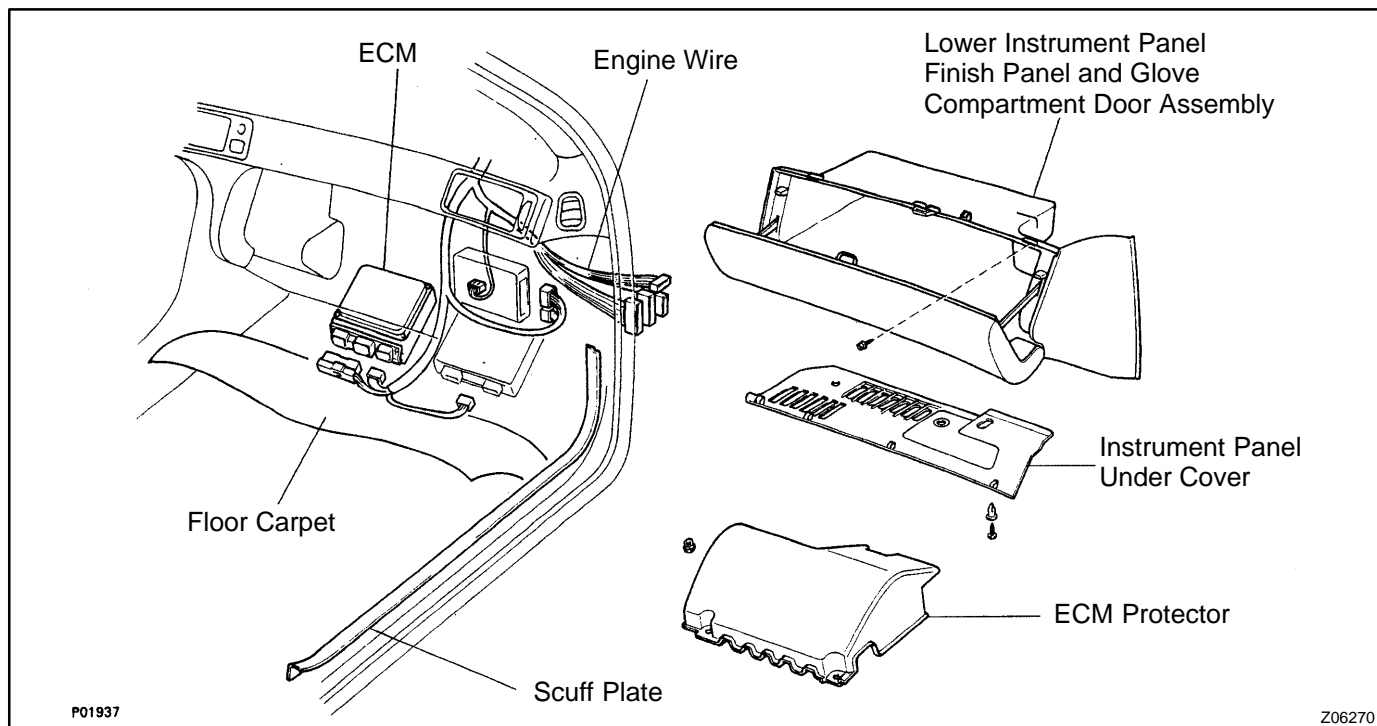
Y

S00853



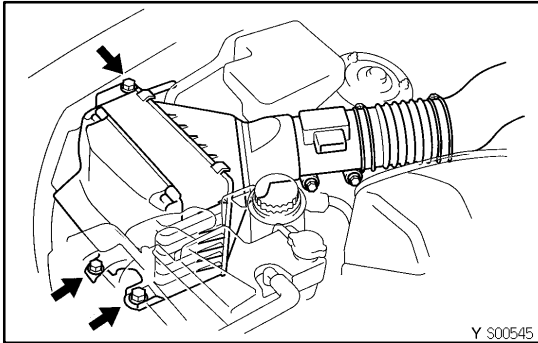
N·m (kgf-cm, ft-lbf) : Specified torque

◆ Non-reusable part

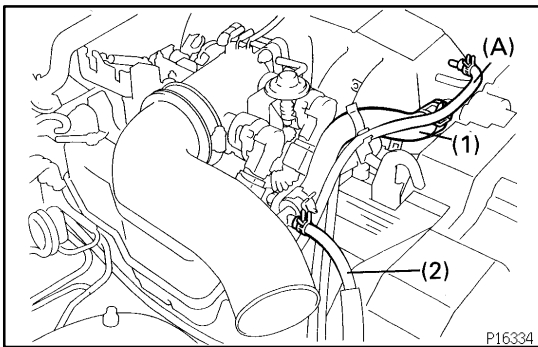


REMOVAL

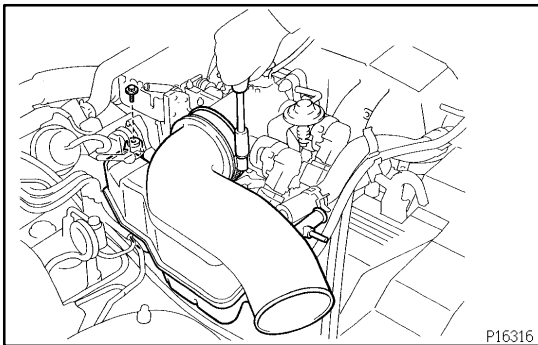
1. REMOVE HOOD
2. REMOVE ENGINE UNDER COVER
3. REMOVE V-BANK COVER AND BATTERY
4. DRAIN ENGINE COOLANT
5. DRAIN ENGINE OIL
6. REMOVE DRIVE BELT (See page [CH-7](#))
7. DISCONNECT CONTROL CABLES FROM THROTTLE BODY



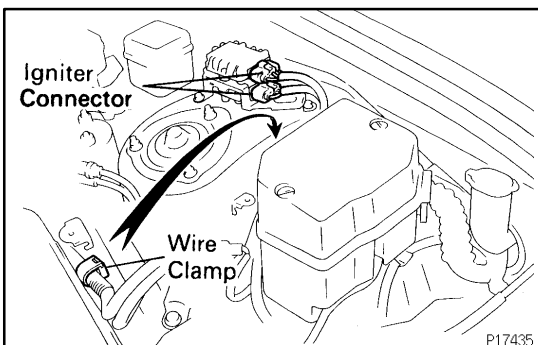
8. REMOVE AIR CLEANER
 - (a) Disconnect the MAF meter connector.
 - (b) Remove the 2 bolts.
 - (c) Remove the hose clamp bolt holding the air cleaner hose to the intake air connector.
 - (d) Remove the 3 bolts.
 - (e) Disconnect the air cleaner hose from the intake air connector.
 - (f) Disconnect the air duct from the air cleaner case, and remove the air cleaner.



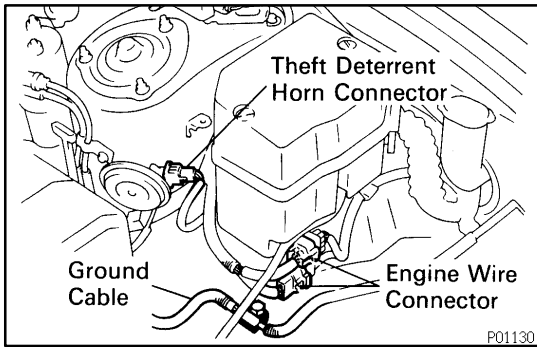
9. DISCONNECT VACUUM HOSE (A) (FROM PS AIR CONTROL VALVE) FROM PS AIR INTAKE CHAMBER
10. REMOVE INTAKE AIR CONNECTOR
 - (a) Disconnect these hoses from the intake air connector:
 - (1) Air hose (from IAC valve)
 - (2) Air hose (from air control valve on PS pump)
 - (3) EVAP hose



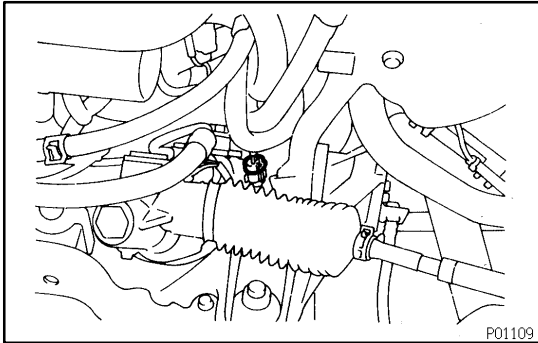
- (b) Remove the hose clamp bolt holding the intake air connector to the throttle body.
- (c) Remove the bolt and intake air connector.
11. REMOVE RESERVOIR TANK AND RADIATOR ASSEMBLY (See page [CO-20](#))



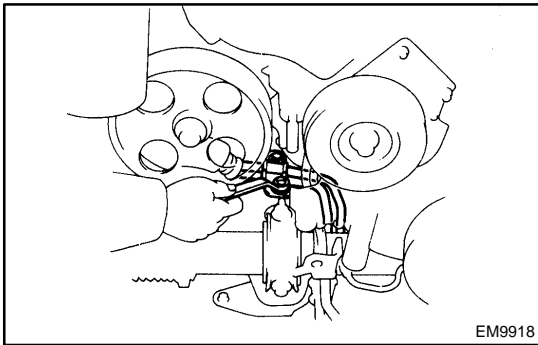
12. DISCONNECT IGNITER CONNECTORS
 - (a) Disconnect the 2 igniter connectors.
 - (b) Disconnect the wire clamp from the body.



13. DISCONNECT ENGINE WIRE CONNECTORS
14. DISCONNECT THEFT DETERRENT HORN CONNECTOR
15. DISCONNECT GROUND CABLE FROM BODY

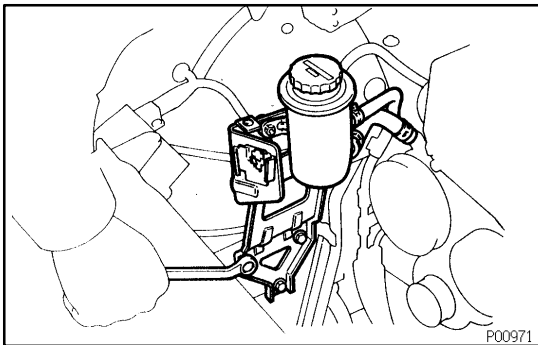


16. DISCONNECT POWER STEERING (PS) SOLENOID VALVE CONNECTOR
17. REMOVE GENERATOR (See page [CH-7](#))



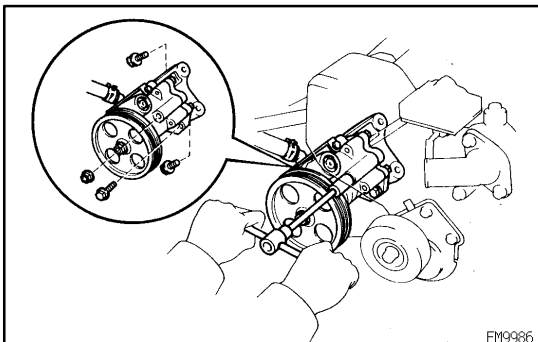
18. DISCONNECT POWER STEERING (PS) TUBES FROM SUSPENSION CROSSMEMBER

Remove the clamp bolt, and disconnect the PS tubes.



19. DISCONNECT POWER STEERING (PS) RESERVOIR TANK AND BRACKET FROM BODY

Remove the 3 bolts, and disconnect the reservoir tank and bracket assembly.

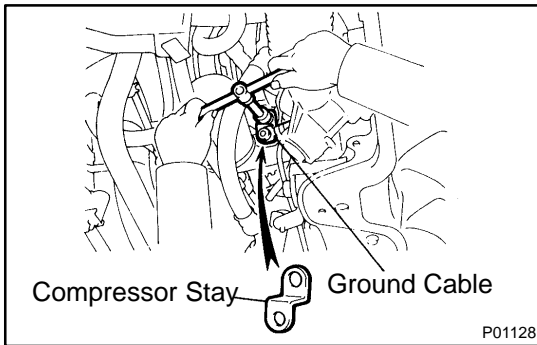


20. DISCONNECT POWER STEERING (PS) PUMP FROM ENGINE

Remove the nut and 3 bolts, and disconnect the PS pump from the engine.

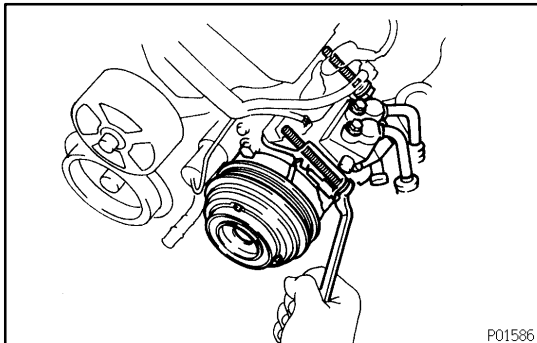
HINT:

Put aside the PS pump, and suspend it.



21. DISCONNECT AIR CONDITIONING (A/C) COMPRESSOR FROM ENGINE

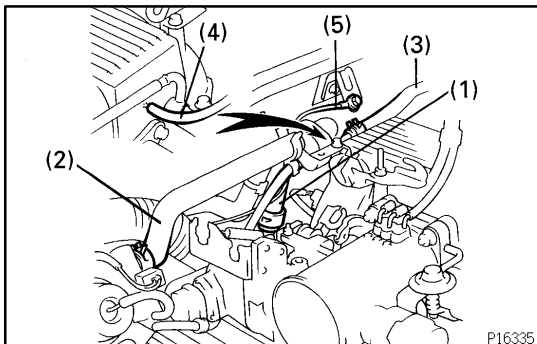
- (a) Disconnect the A/C compressor connector.
- (b) Remove the nut, and disconnect the ground cable from the A/C compressor stay.
- (c) Remove the bolt and A/C compressor stay.



- (d) Remove the 2 bolts, and disconnect the A/C compressor from the engine.

HINT:

Put aside the A/C compressor, and suspend it.



22. DISCONNECT HOSES

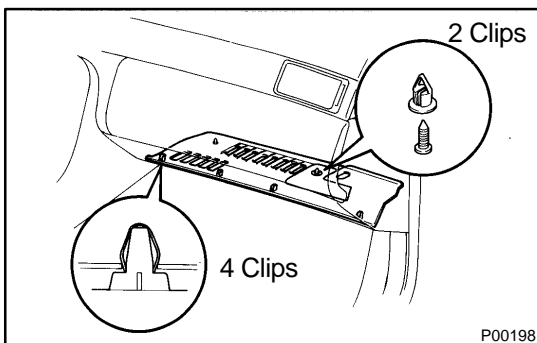
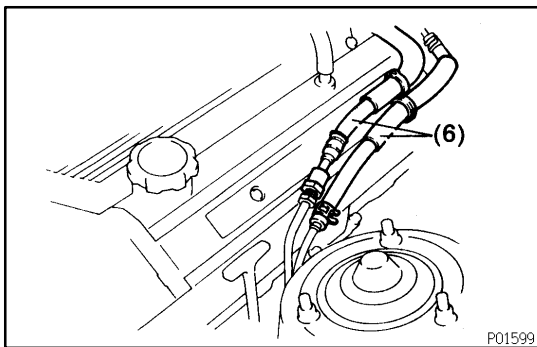
Disconnect these hoses and ground strap:

- (1) Heater water hose from water bypass hose
- (2) Heater water hose from heater water valve
- (3) Brake booster hose from union on air intake chamber
- (4) Vacuum hose (from VSV for heater water valve) from air intake chamber
- (5) Ground strap from bracket on body
- (6) Fuel inlet hose from fuel tube.
- (7) Fuel return hose from return pipe.

HINT:

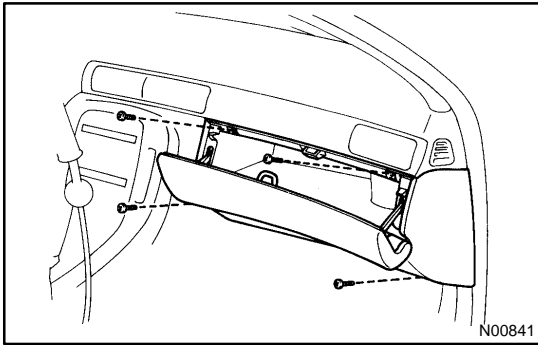
Plug the hose ends.

23. REMOVE CHARCOAL CANISTER (See page EC-6)

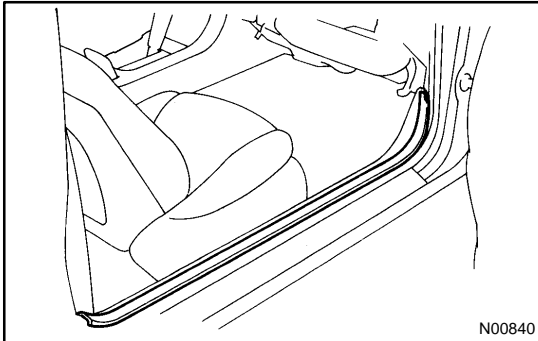


24. DISCONNECT ENGINE WIRE FROM CABIN

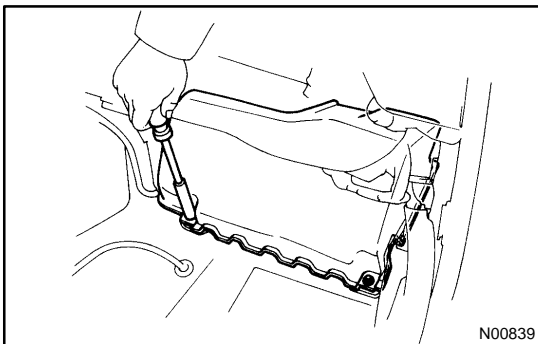
- (a) Remove the 2 clips, and pull out the instrument panel under cover.



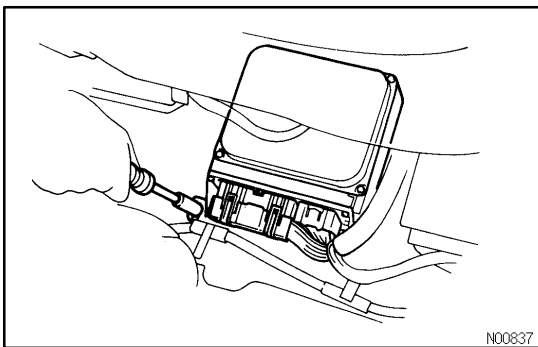
- (b) Remove the 4 screws.
- (c) Disconnect the connectors, and remove the lower instrument panel finish panel and glove compartment door assembly



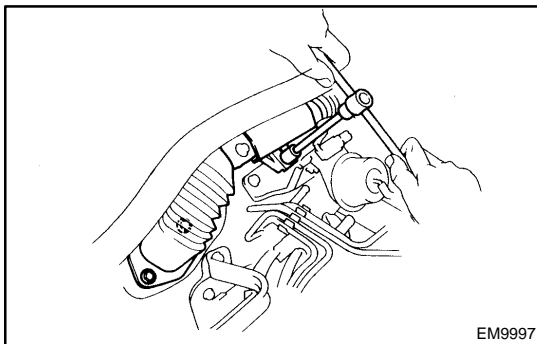
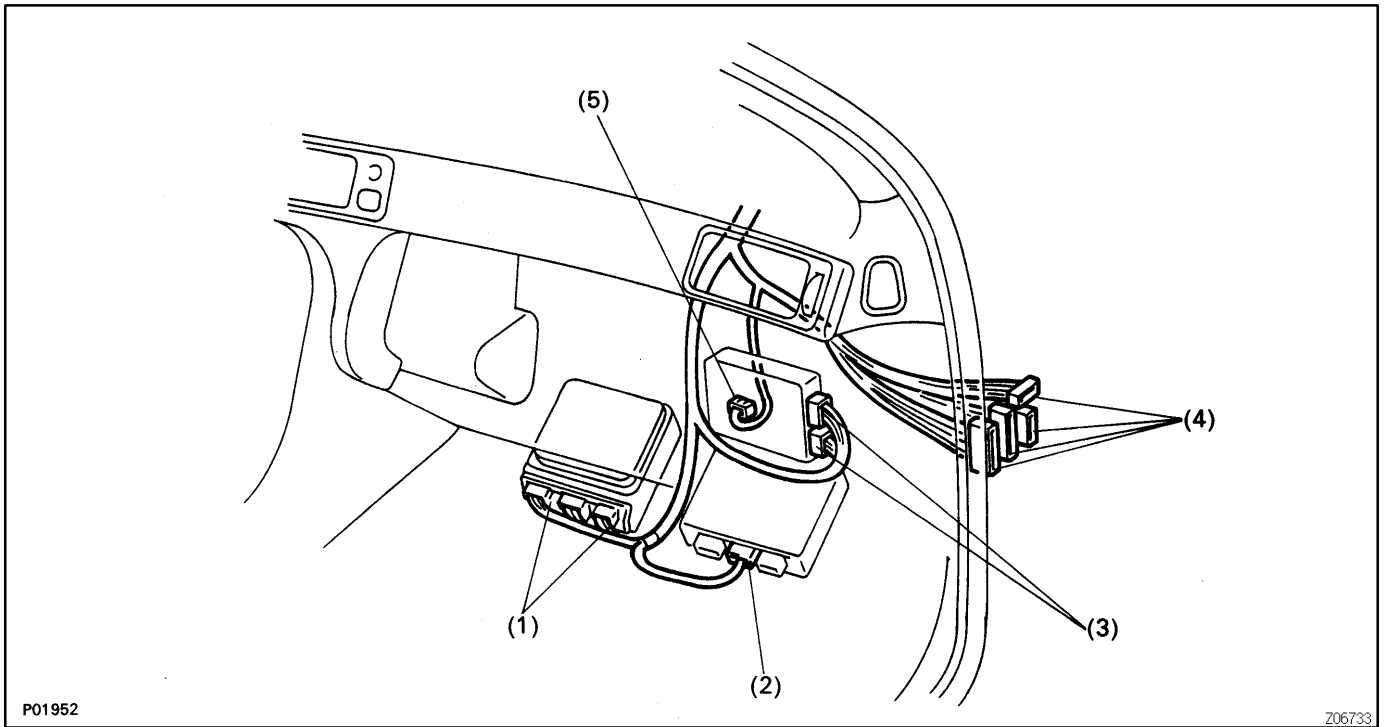
- (d) Pull out the scuff plate.



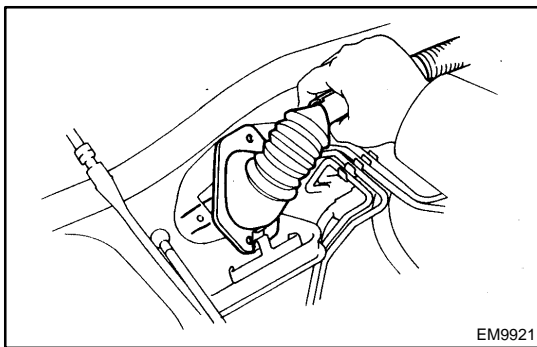
- (e) Take out the front side of the floor carpet.
- (f) Remove the 2 nuts and ECM protector.



- (g) Remove the nut, and disconnect the ECM from the floor panel.
- (h) Disconnect these connectors:
 - (1) 2 connectors from ECM
 - (2) Connector from ABS & TRAC ECU
 - (3) 2 connectors from TRAC ECU
 - (4) 4 connectors from connector cassette
 - (5) Connector from A/C control assembly



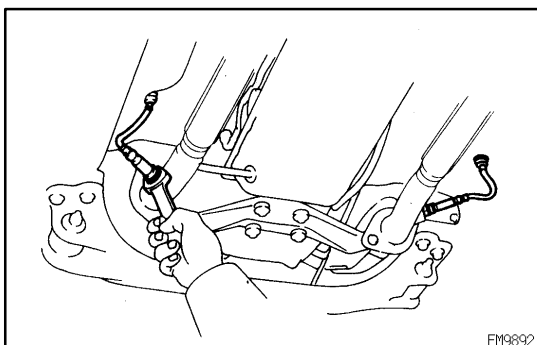
- (i) Remove the bolt holding the engine wire clamp to the heater water valve bracket.
- (j) Remove the 2 bolts holding the engine wire clamp to the body.



- (k) Pull out the engine wire from the cabin.

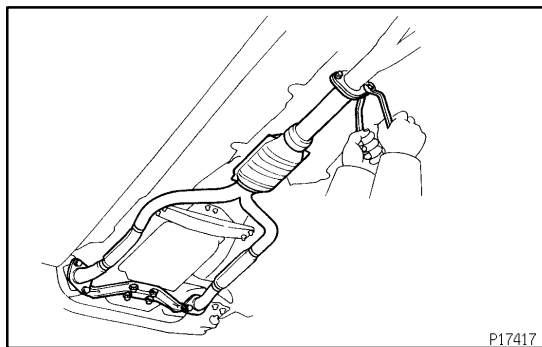
NOTICE:

Be careful not to damage the engine wire.



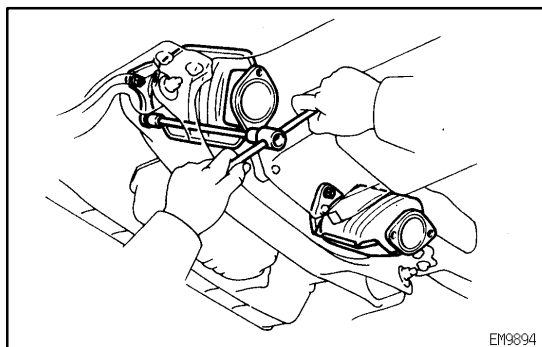
25. DISCONNECT HEATED OXYGEN SENSORS (BANK1, 2 SENSOR2) FROM FRONT EXHAUST PIPE

- (a) Disconnect the 2 wire grommets from the floor panel.
- (b) Disconnect the 2 oxygen sensors from the exhaust pipe.



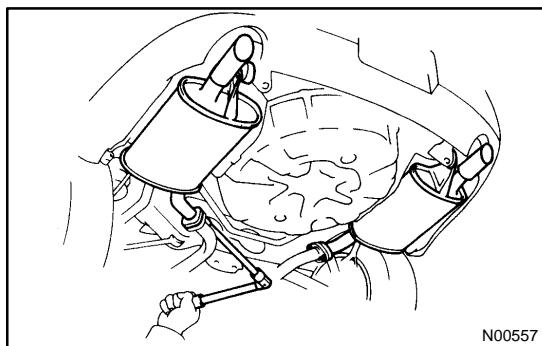
26. REMOVE FRONT EXHAUST PIPE

- (a) Remove the 4 bolts holding the pipe support bracket to the transmission.
- (b) Remove the 2 bolts and nuts holding the front exhaust pipe to the center exhaust pipe.
- (c) Remove the 4 bolts and 2 bracket holding the front exhaust pipe to the TWC.
- (d) Remove the pipe support bracket, front exhaust pipe and 3 gaskets.



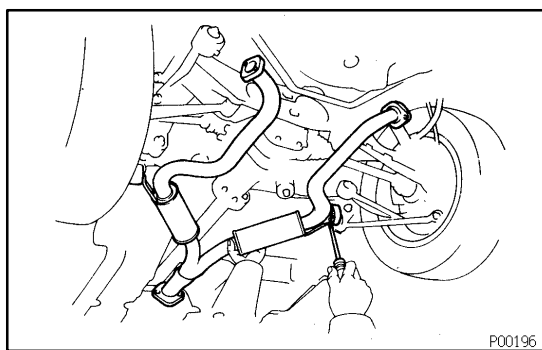
27. REMOVE FRONT TWC

Using a 14 mm deep socket wrench, remove the 3 nuts, TWC and gasket. Remove the 2 TWCs.



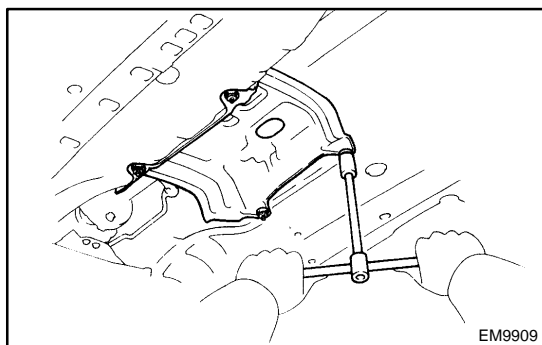
28. REMOVE TAILPIPE

- (a) Remove the 4 nuts holding the tailpipes to the center exhaust pipe.
- (b) Disconnect the hook from the ring on tailpipe bracket, and remove the tailpipe and gasket. Remove the 2 tailpipes.



29. REMOVE CENTER EXHAUST PIPE

Disconnect the 2 hooks of the exhaust pipe from the rings on exhaust pipe brackets, and remove the exhaust pipe.



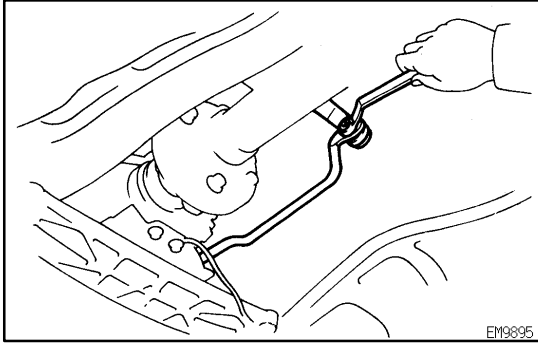
30. REMOVE HEAT INSULATOR FOR FRONT EXHAUST PIPE

Remove the 4 nuts and heat insulator.

31. REMOVE CENTER FLOOR CROSSMEMBER BRACE

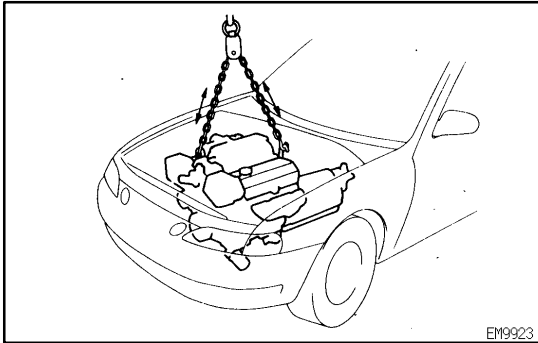
Remove the 4 bolts and crossmember brace.

32. REMOVE PROPELLER SHAFT (See page [PR-9](#))



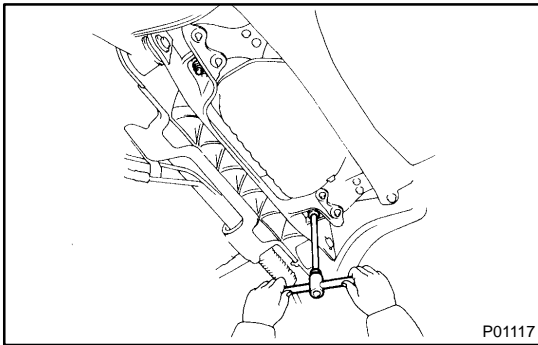
33. DISCONNECT TRANSMISSION CONTROL ROD FROM SHIFT LEVER

Remove the nut, and disconnect the control rod from the shift lever.

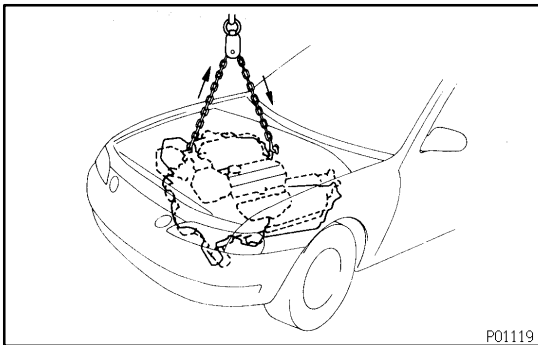


34. REMOVE ENGINE AND TRANSMISSION ASSEMBLY FROM VEHICLE

- (a) Attach the engine chain hoist to the engine hangers.



- (b) Remove the 2 nuts holding the engine mounting insulators to the front suspension crossmember.
 (c) Remove the 4 bolts, 4 nuts and rear engine mounting member. Disconnect the ground strap.



- (d) Lift the engine out of the vehicle slowly and carefully.

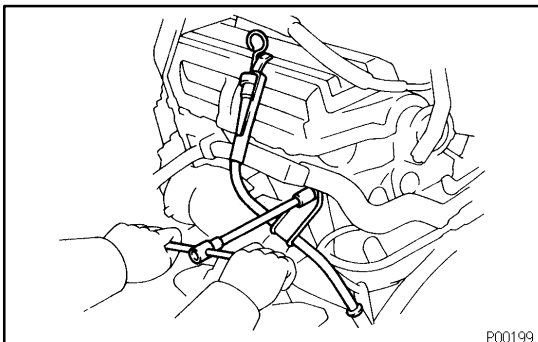
HINT:

Make sure the engine is clear of all wires, hoses and cables.

NOTICE:

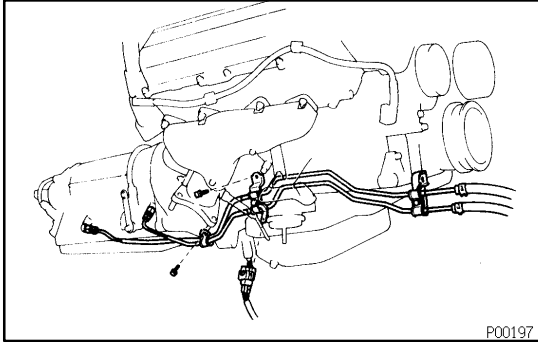
Be careful not hit the PS gear housing, PNP switch and ABS actuator.

- (e) Place the engine and transmission assembly onto the stand.



35. REMOVE OIL DIPSTICK GUIDE AND DIPSTICK FOR TRANSMISSION

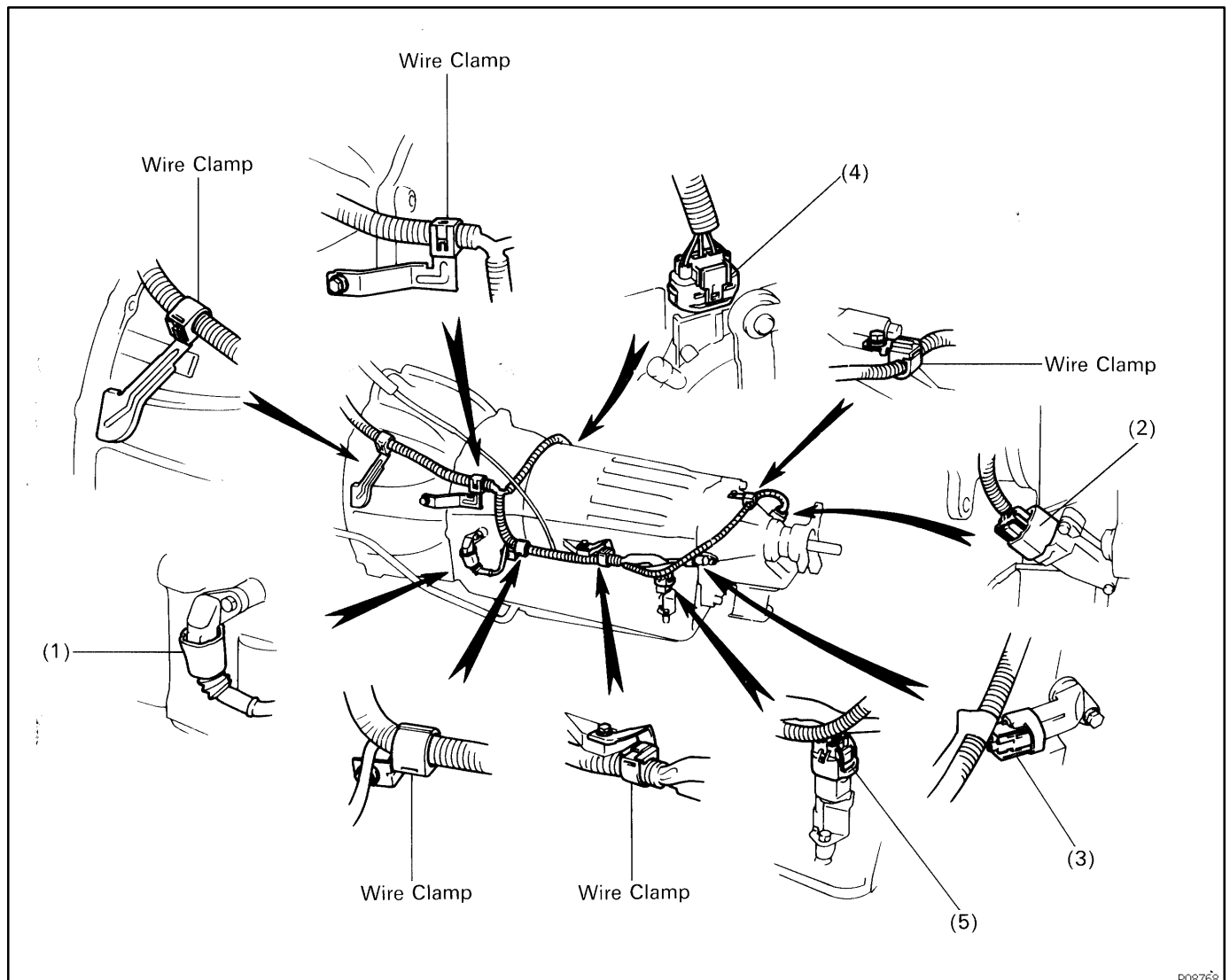
- (a) Remove the bolt.
 (b) Pull out the dipstick guide and dipstick from the port of transmission.
 (c) Remove the O-ring from the dipstick guide.

**36. REMOVE OIL COOLER PIPES FOR TRANSMISSION**

- (a) Remove the 2 bolts.
- (b) Loosen the 2 union nuts, and remove the oil cooler pipes.

37. DISCONNECT ENGINE WIRE

- (a) Disconnect these connector:
 - (1) O/D direct clutch speed sensor connector
 - (2) No. 1 VSS connector for Speedometer
 - (3) No. 2 VSS connector for ECM
 - (4) PNP switch connector
 - (5) Solenoid connector
- (b) Disconnect the 5 wire clamps from the brackets on transmission.

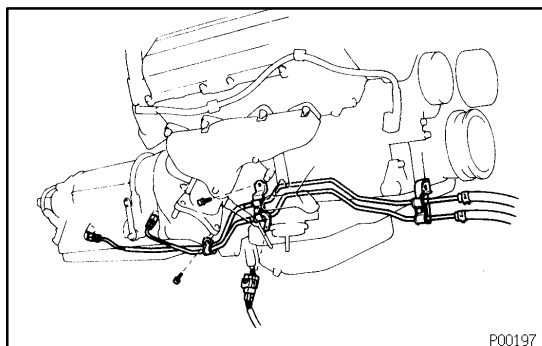


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38. REMOVE TRANSMISSION (See page [AT-15](#))

INSTALLATION

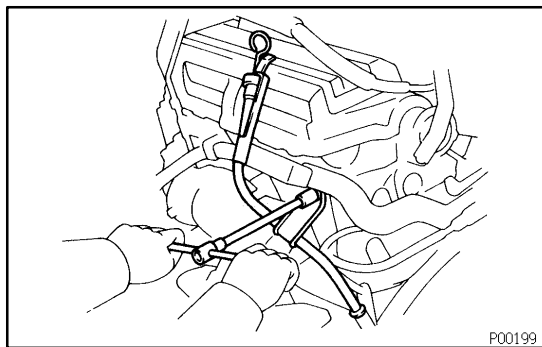
1. **INSTALL TRANSMISSION TO ENGINE (See page AT-15)**
2. **CONNECT ENGINE WIRE**
 - (a) Connect these parts:
 - (1) O/D direct clutch speed sensor connector
 - (2) No. 1 VSS connector for speedometer
 - (3) No. 2 VSS connector for ECM
 - (4) PNP switch connector
 - (5) Solenoid connector
 - (b) Install the 5 wire clamps to the brackets on the transmission.



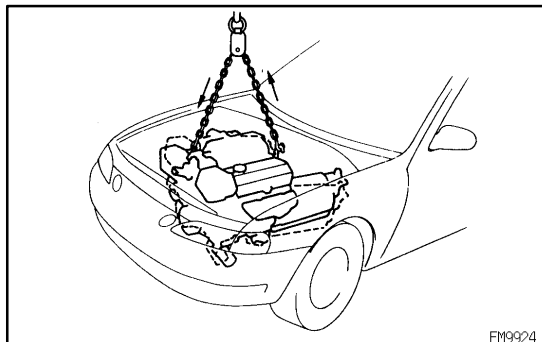
3. **INSTALL OIL COOLER PIPE FOR TRANSMISSION**
 - (a) Temporarily install the oil cooler pipe with the 2 pipe brackets and 2 bolts.
 - (b) Connect the 2 oil cooler pipes to the unions on the transmission.

Torque: 34 N·m (350 kgf-cm, 25 ft-lbf)

- (c) Tighten the 2 pipe clamp bolts.



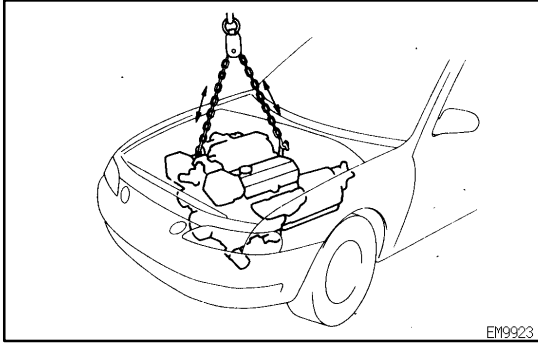
4. **INSTALL OIL DIPSTICK GUIDE AND DIPSTICK FOR TRANSMISSION**
 - (a) Install a new O-ring to the dipstick guide.
 - (b) Apply soapy water to the O-ring.
 - (c) Connect the dipstick guide end to the dipstick tube of the oil pan.
 - (d) Install the dipstick guide with the bolt.
 - (e) Install the dipstick.



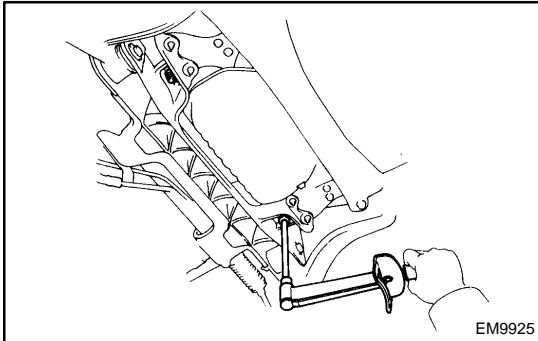
5. **INSTALL ENGINE AND TRANSMISSION ASSEMBLY IN VEHICLE**
 - (a) Attach the engine chain hoist to the engine hangers.
 - (b) Slowly lower the engine and transmission assembly into the engine compartment.

NOTICE:

Be careful not to hit the PS gear housing and PNP switch.



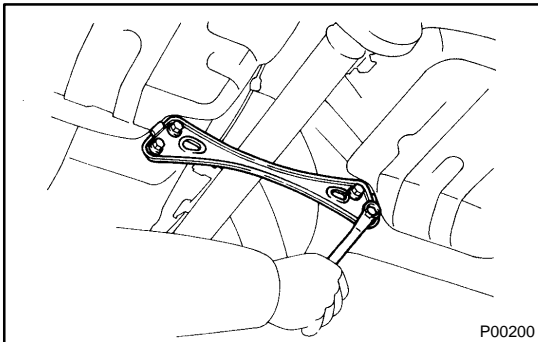
- (c) Insert the stud bolts of the front engine mounting brackets into the stud bolt holes of the front suspension crossmember.
- (d) Keep the engine level.
- (e) Install the rear engine mounting member with the 4 bolts and 4 nuts.

Torque:**25 N·m (250 kgf-cm, 19 ft-lbf) for bolt****13 N·m (135 kgf-cm, 10 ft-lbf) for nut**

- (f) Install the 2 nuts holding the engine mounting brackets to the front suspension crossmember.

Torque: 59 N·m (600 kgf-cm, 43 ft-lbf)**6. CONNECT TRANSMISSION CONTROL ROD FROM SHIFT LEVER**

Connect the control rod to the shift lever with the nut.

7. INSTALL PROPELLER SHAFT (See page [PR-14](#))**8. INSTALL CENTER FLOOR CROSSMEMBER BRACE**

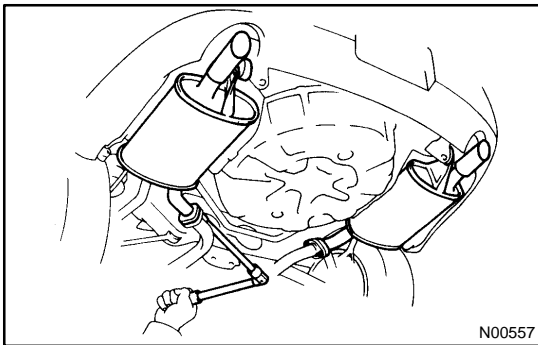
Install the crossmember brace with the 4 nuts.

Torque: 13 N·m (130 kgf-cm, 9 ft-lbf)**9. INSTALL HEAT INSULATOR FOR FRONT EXHAUST PIPE**

Install the heat insulator with the 4 bolts.

10. INSTALL CENTER EXHAUST PIPE

Install the 2 hooks of the exhaust pipe to the rings on the exhaust pipe brackets.

**11. INSTALL TAILPIPE**

- (a) Install the hook of the tailpipe to the ring on the tailpipe bracket.

- (b) Install a new gasket and tailpipe to the center exhaust pipe with 2 bolts. Install the 2 tailpipes.

Torque: 19 N·m (195 kgf-cm, 14 ft-lbf)**12. INSTALL FRONT TWC**

Using a 14 mm deep socket wrench, install a new gasket and the TWC with 3 new nuts. Install the 2 TWC.

Torque: 62 N·m (630 kgf-cm, 46 ft-lbf)**13. INSTALL FRONT EXHAUST PIPE**

- (a) Temporarily install the pipe support bracket with the 4 bolts.

- (b) Temporarily install 3 new gaskets and the exhaust pipe with the 6 bolts and nuts.

- (c) Tighten the 4 bolts and nuts holding the TWC to the front exhaust pipe.

Torque: 43 N·m (440 kgf-cm, 32 ft-lbf)

- (d) Tighten the 2 bolts and nuts holding the front exhaust pipe to the center exhaust pipe.

Torque: 43 N·m (440 kgf·cm, 32 ft·lbf)

- (e) Tighten the 4 bolts holding the pipe support bracket to the transmission.

Torque: 43 N·m (440 kgf·cm, 32 ft·lbf)

14. INSTALL HEATED OXYGEN SENSORS (BANK 1, 2 SENSOR 2)

Install the 2 oxygen sensors to the front exhaust pipe.

Torque: 44 N·m (450 kgf·cm, 33 ft·lbf)

HINT:

- Before installing the oxygen sensor, twist the sensor wire counterclockwise 3 and 1/2 turns.
- After installing the oxygen sensor, check that the sensor wire is not twisted. If it is twisted, remove the oxygen sensor and reinstall it.

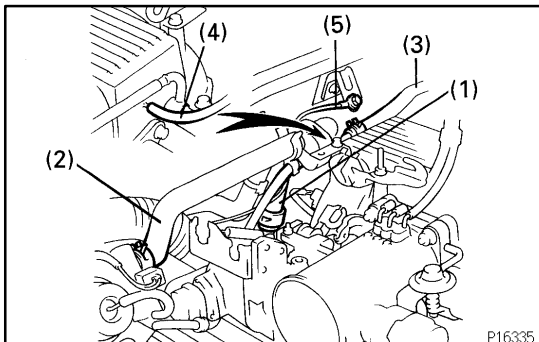
15. CONNECT ENGINE WIRE TO CABIN

- (a) Push in the engine wire through the cowl panel.

NOTICE:

Be careful not to damage the engine wire. Tape the engine wire.

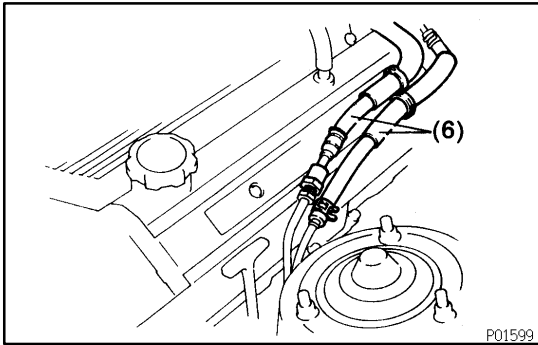
- (b) Install the engine wire retainer with the 3 bolts.
- (c) Connect these connectors:
- (1) 2 connectors to ECM
 - (2) Connector to ABS & TRAC ECU
 - (3) 2 connectors to TRAC ECU
 - (4) 4 connectors to connector cassette
 - (5) Connector to A/C control assembly
- (d) Install the ECM with the nut.
- (e) Install the ECM protector with the 2 nuts.
- (f) Install the floor carpet.
- (g) Install the scuff plate.
- (h) Connect the connectors.
- (i) Install the lower instrument panel finish panel and glove compartment door assembly with the 4 screws.
- (j) Install the instrument panel under cover with the 2 clips.



16. CONNECT HOSES

Connect these hoses and ground strap:

- (1) Heater water hose to water bypass hose
- (2) Heater water hose to heater water valve
- (3) Brake booster hose to union on air intake chamber
- (4) Vacuum hose (from VSV for heater water valve) to air intake chamber
- (5) Ground strap to bracket on body



(6) 2 fuel hose

SST 09278-54012

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

HINT:

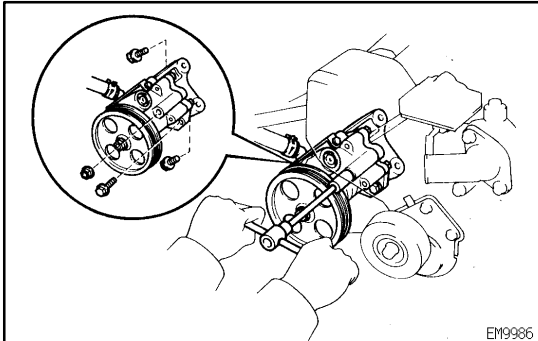
Use a torque wrench with a fulcrum length of 30 cm (11.81 in.).

17. INSTALL AIR CONDITIONING (A/C) COMPRESSOR

Torque:

49 N·m (500 kgf·cm, 36 ft·lbf) for bolt

29 N·m (300 kgf·cm, 22 ft·lbf) for nut



18. INSTALL POWER STEERING (PS) PUMP

Install the PS pump with the nut and 3 bolts. Alternately tighten the bolts and nut.

Torque:

39 N·m (400 kgf·cm, 29 ft·lbf) for bolt

43 N·m (440 kgf·cm, 32 ft·lbf) for nut

19. INSTALL POWER STEERING (PS) RESERVOIR TANK AND BRACKET

20. INSTALL POWER STEERING (PS) TUBES

21. INSTALL GENERATOR (See page CH-17)

22. INSTALL POWER STEERING (PS) SOLENOID VALVE CONNECTOR

23. INSTALL GROUND CABLE TO BODY

24. CONNECT THEFT DETERRENT HORN CONNECTOR

25. CONNECT ENGINE WIRE CONNECTORS

26. CONNECT IGNITER CONNECTORS

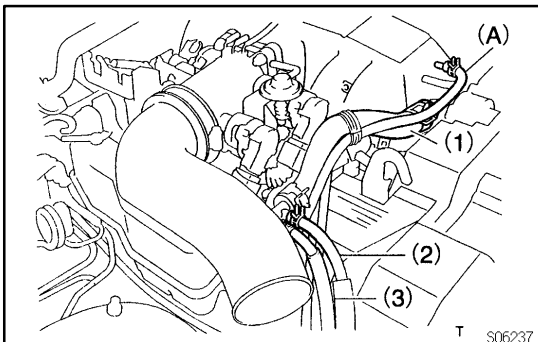
(a) Connect the 2 igniter connectors.

HINT:

Connect the yellow taped connector to the igniter on the rear side.

(b) Install the wire clamp.

27. INSTALL RADIATOR ASSEMBLY (See page CO-50)



28. INSTALL INTAKE AIR CONNECTOR

(a) Connect the intake air connector to the throttle body.

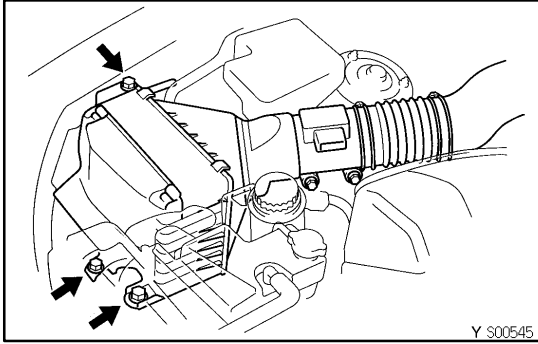
(b) Install the hose clamp and bolt.

(c) Connect these hoses to the intake air connector:

(1) Air hose (from IAC valve)

(2) Air hose (from air control valve on PS pump)

29. CONNECT VACUUM HOSE (A) (FROM PS AIR CONTROL VALVE) TO AIR INTAKE CHAMBER

**30. INSTALL AIR CLEANER**

- (a) Connect the air cleaner case to the air duct.
- (b) Connect the air cleaner hose to the intake air connector.
- (c) Install the air cleaner with the 3 bolts.
- (d) Tighten the hose clamp bolt holding the air cleaner hose to the intake air connector.
- (e) Connect the MAF meter connector.

31. CONNECT CONTROL CABLES TO THROTTLE BODY**32. INSTALL DRIVE BELT (See page [CH-17](#))****33. INSTALL BATTERY****34. FILL WITH ENGINE COOLANT****35. FILL WITH ENGINE OIL****36. INSTALL V-BANK COVER AND BATTERY****37. START ENGINE AND CHECK FOR LEAKS****38. CHECK TRANSMISSION FLUID LEVEL****39. DO ENGINE ADJUSTMENT****40. INSTALL ENGINE UNDER COVER****41. INSTALL HOOD****42. DO ROAD TEST**

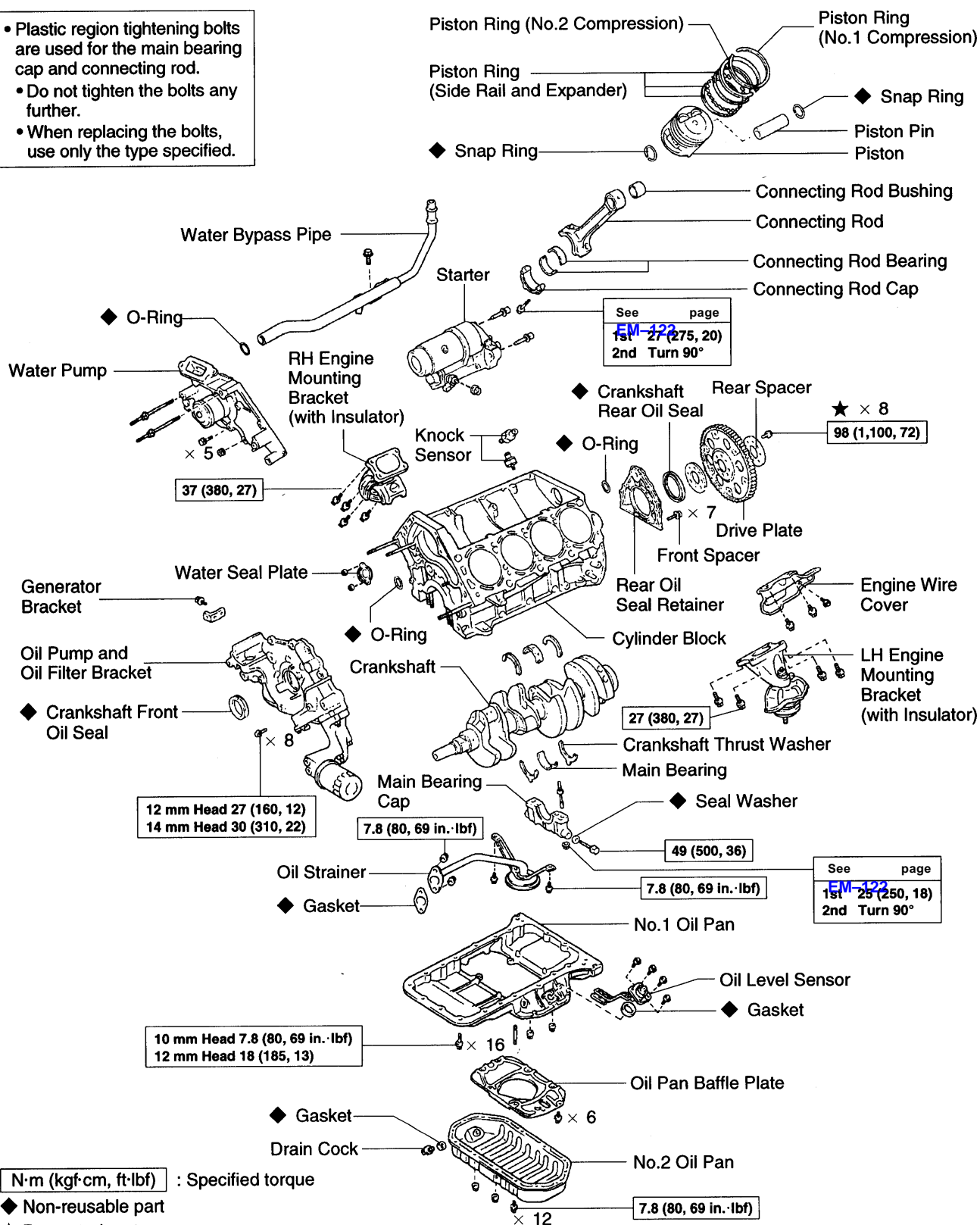
Check for abnormal noises, shock slippage, correct shift points and smooth operation.

43. RECHECK ENGINE COOLANT AND OIL LEVELS

CYLINDER BLOCK COMPONENTS

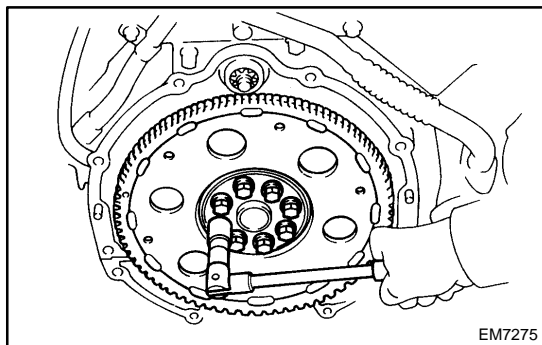
EM1GR-01

- Plastic region tightening bolts are used for the main bearing cap and connecting rod.
- Do not tighten the bolts any further.
- When replacing the bolts, use only the type specified.



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DISASSEMBLY

1. REMOVE DRIVE PLATE

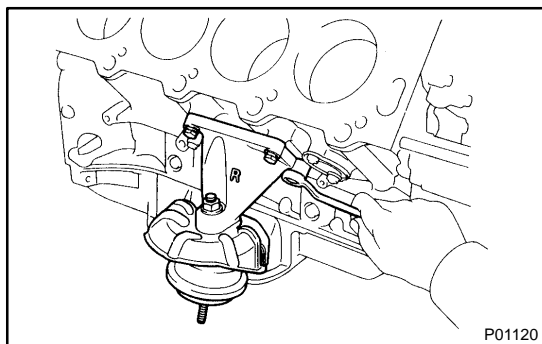
Remove the 8 bolts, front spacer, drive plate and rear spacer.

2. INSTALL ENGINE TO ENGINE STAND FOR DISASSEMBLY

3. REMOVE TIMING BELT AND PULLEYS

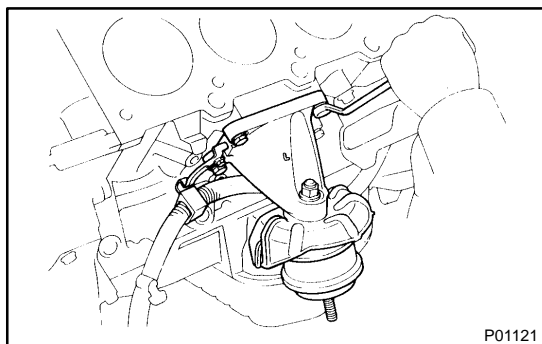
(See page [EM-18](#))

4. REMOVE CYLINDER HEAD (See page [EM-40](#))



5. REMOVE RH ENGINE MOUNTING BRACKET

Remove the 4 bolts and mounting bracket.



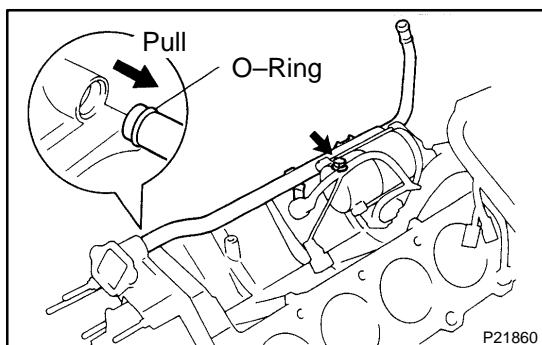
6. REMOVE LH ENGINE MOUNTING BRACKET

(a) Remove the 4 bolts and mounting bracket.

(b) Remove the bolt, and disconnect the engine wire from the mounting bracket.

7. REMOVE STARTER (See page [ST-6](#))

8. REMOVE KNOCK SENSORS (See page [SF-63](#))



9. REMOVE WATER BYPASS PIPE

(a) Remove the 2 bolts.

(b) Pull out the water bypass pipe from the water pump.

(c) Remove the O-ring from the water bypass pipe

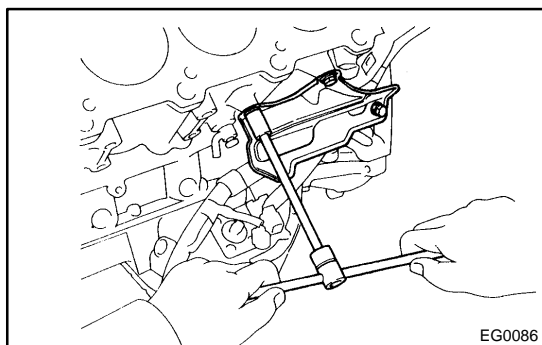
(d) Remove the engine wire.

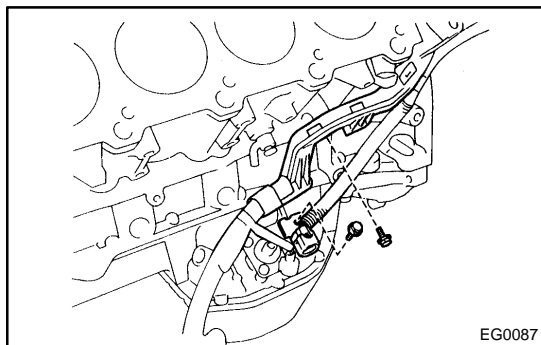
10. REMOVE ENGINE WIRE

(a) Disconnect these connector:

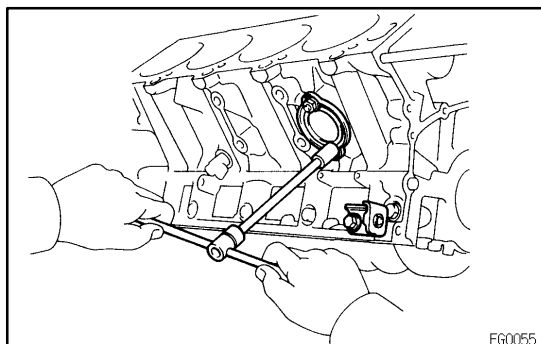
- Crankshaft position sensor connector
- Oil pressure switch connector
- Oil level sensor connector

(b) Remove the 3 bolts and engine wire cover from the LH side of the cylinder block.

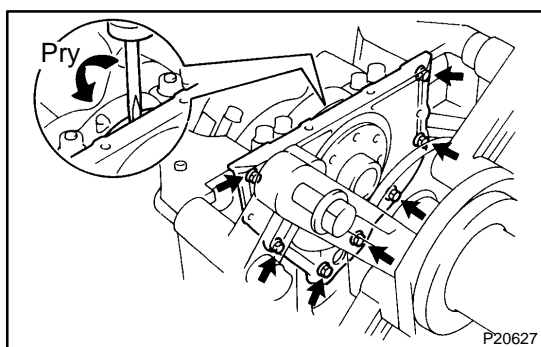




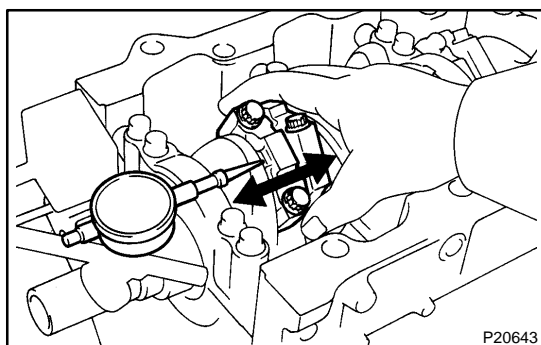
- (c) Remove the 2 bolts and engine wire.
11. **REMOVE WATER PUMP** (See page [CO-9](#))
 12. **REMOVE NO. 2 AND NO. 1 OIL PANS**
(See page [LU-9](#))
 13. **REMOVE OIL PUMP** (See page [LU-9](#))
 14. **REMOVE GENERATOR BRACKET**
Remove the bolt and generator bracket.



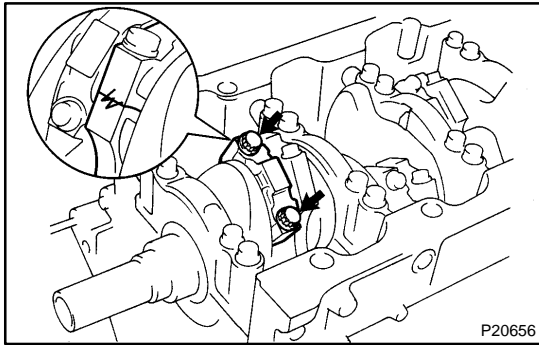
15. **REMOVE WATER SEAL PLATE**
Remove the 2 bolts and seal plate.



16. **REMOVE REAR OIL SEAL RETAINER**
 - (a) Remove the 7 bolts.
 - (b) Using a screwdriver, remove the oil seal retainer by prying the portions between the oil seal retainer and main bearing cap.
 - (c) Remove the O-ring.

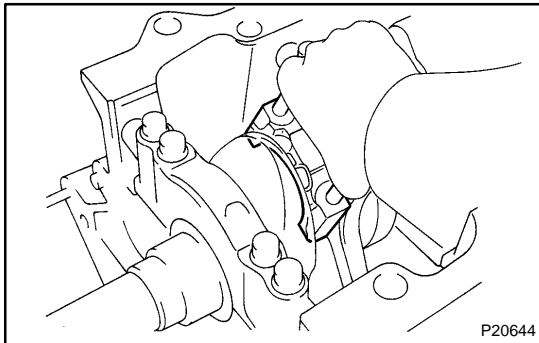


17. **CHECK CONNECTING ROD THRUST CLEARANCE**
Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.
Standard thrust clearance:
0.160 – 0.290 mm (0.0063 – 0.0138 in.)
Maximum thrust clearance: 0.35 mm (0.0138 in.)
 If the thrust clearance is greater than maximum, replace the connecting rod assembly(s). If necessary, replace the crankshaft.
Connecting rod thickness:
22.880 – 22.920 mm (0.9008 – 0.9024 in.)



18. REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE

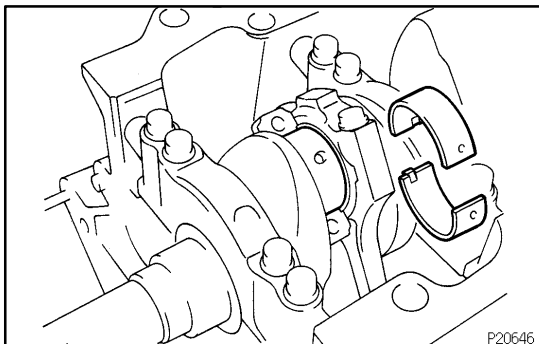
- (a) Check the matchmarks on the connecting rod and cap to ensure correct reassembly.
- (b) Remove the 2 connecting rod cap bolts.



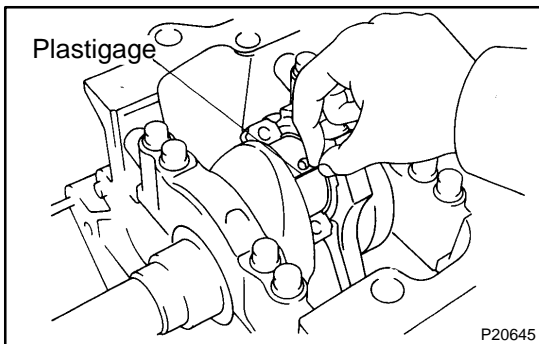
- (c) Using the 2 removed connecting rod cap bolts, remove the connecting rod cap and lower bearing by wiggling the connecting rod cap right and left.

HINT:

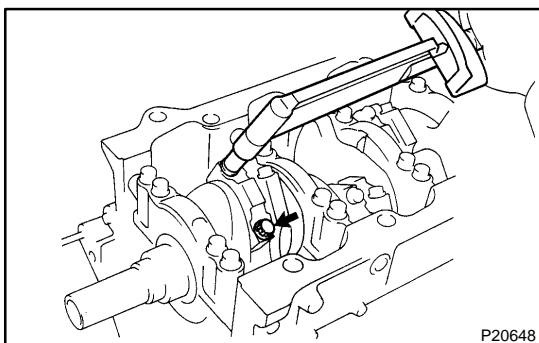
Keep the lower bearing inserted with the connecting rod cap.



- (d) Clean the crank pin and bearing.
- (e) Check the crank pin and bearing for pitting and scratches. If the crank pin or bearing is damaged, replace the bearings. If necessary, replace the crankshaft.



- (f) Lay a strip of Plastigage across the crank pin.

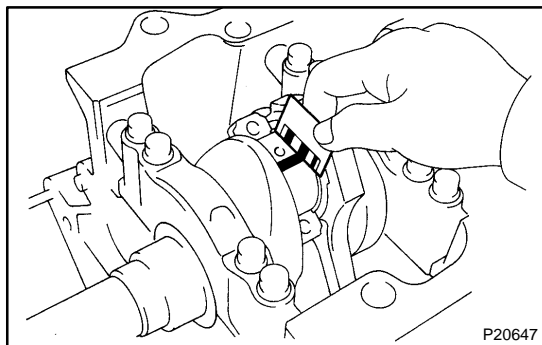


- (g) Install the connecting rod cap with the 2 bolts (See page [EM-122](#)).

NOTICE:

Do not turn the crankshaft.

- (h) Remove the 2 bolts, connecting rod cap and lower bearing (See procedure (b) and (c) above).



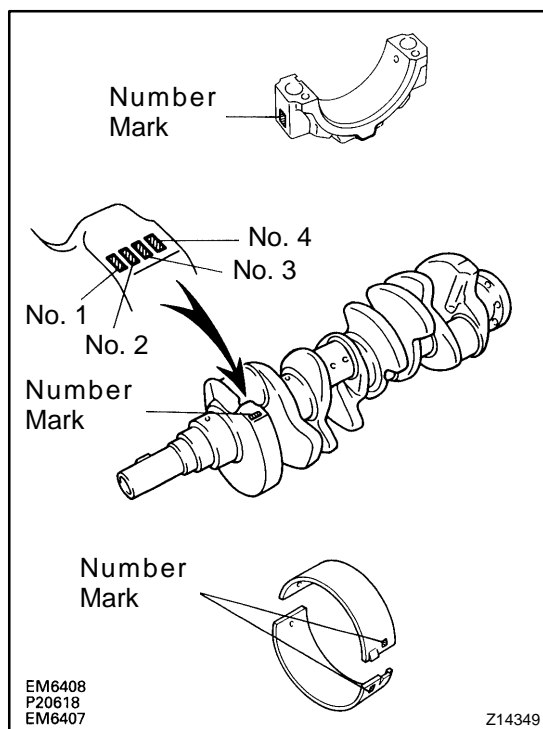
- (i) Measure the Plastigage at its widest point.

Standard oil clearance:

0.027 – 0.053 mm (0.0011 – 0.0021 in.)

Maximum oil clearance: 0.065 mm (0.0026 in.)

If the oil clearance is greater than maximum, replace the bearings. If necessary, replace the crankshaft.



HINT:

If using a standard bearing, replace it with one having the same number. If the number of the bearing cannot be determined, select the correct bearing by adding together the numbers imprinted on the connecting rod cap and crankshaft, then selecting the bearing with the same number as the total. There are 6 sizes of standard bearings, marked "2", "3", "4", "5", "6" and "7" accordingly.

	Number mark											
Connecting rod cap	1	1	2	1	2	3	2	3	4	3	4	4
Crankshaft	1	2	1	3	2	1	3	2	1	3	2	3
Use bearing	2	3		4			5			6	7	

EXAMPLE:

Connecting rod cap "3" + Crankshaft "1"
= Total number 4 (Use bearing "4")

Reference

Connecting rod big end inside diameter:

Mark "1"	55.000 – 55.006 mm (2.1654 – 2.1656 in.)
Mark "2"	55.006 – 55.012 mm (2.1656 – 2.1658 in.)
Mark "3"	55.012 – 55.018 mm (2.1658 – 2.1661 in.)
Mark "4"	55.018 – 55.024 mm (2.1661 – 2.1663 in.)

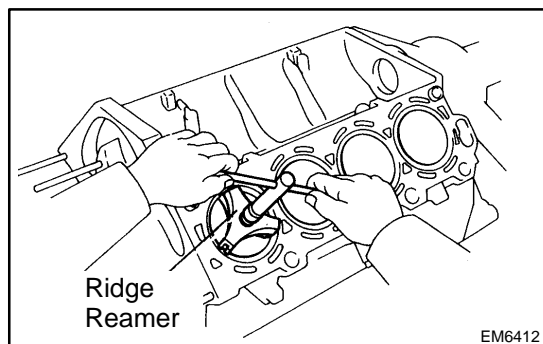
Crankshaft crank pin diameter:

Mark "1"	51.994 – 52.000 mm (2.0470 – 2.0472 in.)
Mark "2"	51.988 – 51.994 mm (2.0468 – 2.0470 in.)
Mark "3"	51.982 – 51.988 mm (2.0465 – 2.0468 in.)

Standard sized bearing center wall thickness:

Mark "2"	1.484 – 1.487 mm (0.0584 – 0.0585 in.)
Mark "3"	1.487 – 1.490 mm (0.0585 – 0.0587 in.)
Mark "4"	1.490 – 1.493 mm (0.0587 – 0.0588 in.)
Mark "5"	1.493 – 1.496 mm (0.0588 – 0.0589 in.)
Mark "6"	1.496 – 1.499 mm (0.0589 – 0.0590 in.)
Mark "7"	1.499 – 1.502 mm (0.0590 – 0.0591 in.)

- (j) Completely remove the Plastigage.

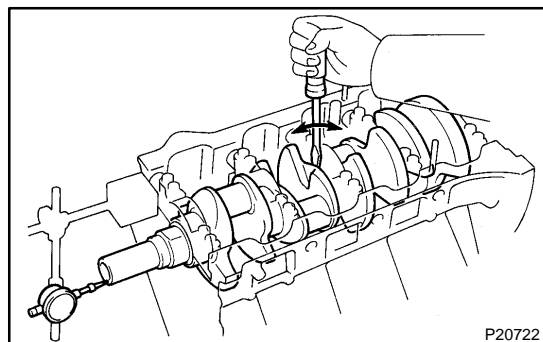


19. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES

- Using a ridge reamer, remove all the carbon from the top of the cylinder.
- Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

HINT:

- Keep the bearings, connecting rod and cap together.
- Arrange the piston and connecting rod assemblies in correct order.



20. CHECK CRANKSHAFT THRUST CLEARANCE

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

Standard thrust clearance:

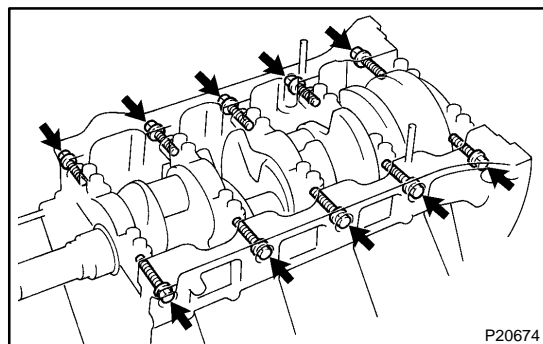
0.020 – 0.220 mm (0.0008 – 0.0087 in.)

Maximum thrust clearance: 0.30 mm (0.0118 in.)

If the thrust clearance is greater than maximum, replace the thrust washers as a set.

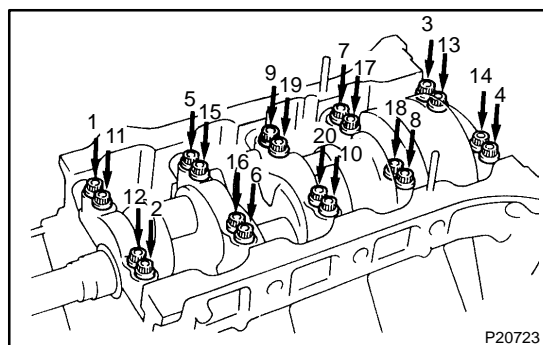
Thrust washer thickness:

2.440 – 2.490 mm (0.0961 – 0.0980 in.)

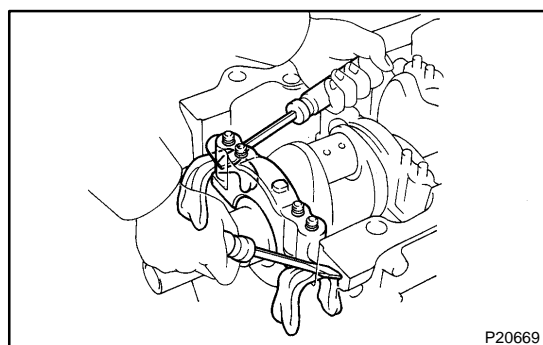


21. REMOVE MAIN BEARING CAPS AND CHECK OIL CLEARANCE

- Remove the 10 main bearing cap bolts.



- Uniformly loosen and remove the 20 main bearing cap nuts in several passes, in the sequence shown.



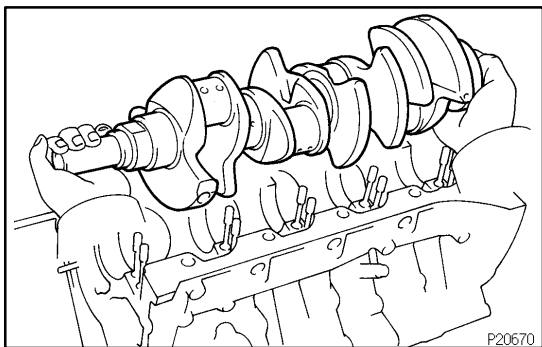
- Using 2 screwdrivers, pry out the main bearing cap, and remove the 5 main bearing caps, 5 lower bearings and 2 lower thrust washers (No.3 main bearing cap only).

NOTICE:

Be careful not to damage the cylinder block.

HINT:

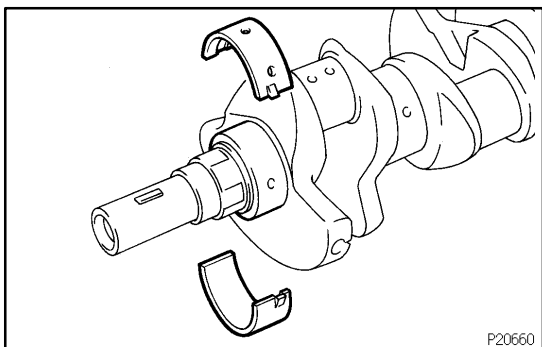
- Keep the lower bearing and main bearing cap together.
- Arrange the main bearing caps and lower thrust washers in correct order.



- (d) Lift out the crankshaft.
- (e) Remove the 2 upper thrust washers.

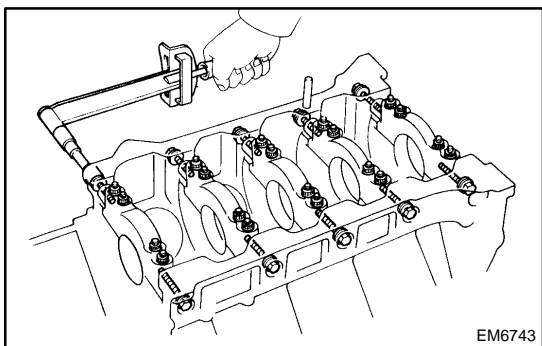
HINT:

- Arrange the upper thrust washers in correct order.
- Keep the upper bearings together with the cylinder block.

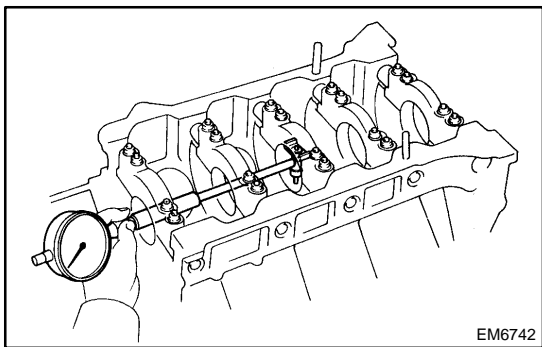


- (f) Clean each main journal and bearing.
- (g) Check each main journal and bearing for pitting and scratches.

If the journal or bearing is damaged, replace the bearings. If necessary, replace the crankshaft.



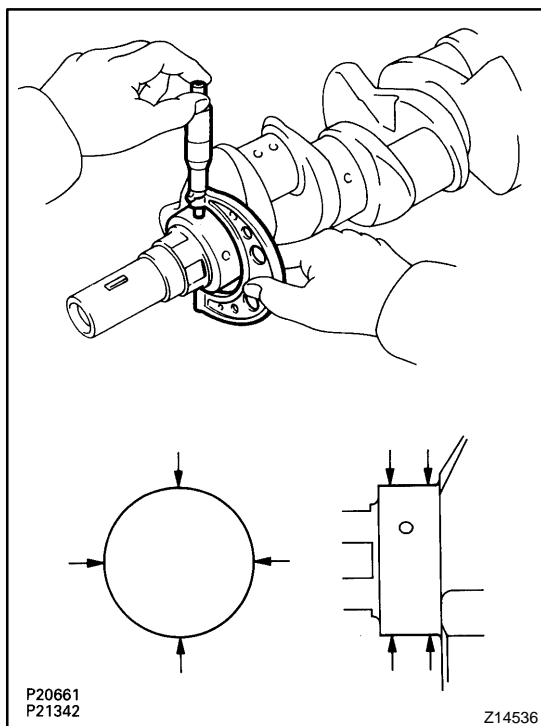
- (h) Install the 10 main bearings and 5 main bearing caps with the 20 nuts and 10 bolts. Do not install the crankshaft (See page [EM-122](#)).



- (i) Using a cylinder gauge, measure the inside diameter of the main bearing.

Bearing inside diameter:

67.026 – 67.033 mm (2.6388 – 2.6391 in.)



- (j) Using a micrometer, measure the diameter of the main journal.

Main journal diameter:

66.988 – 67.000 mm (2.6373 – 2.6378 in.)

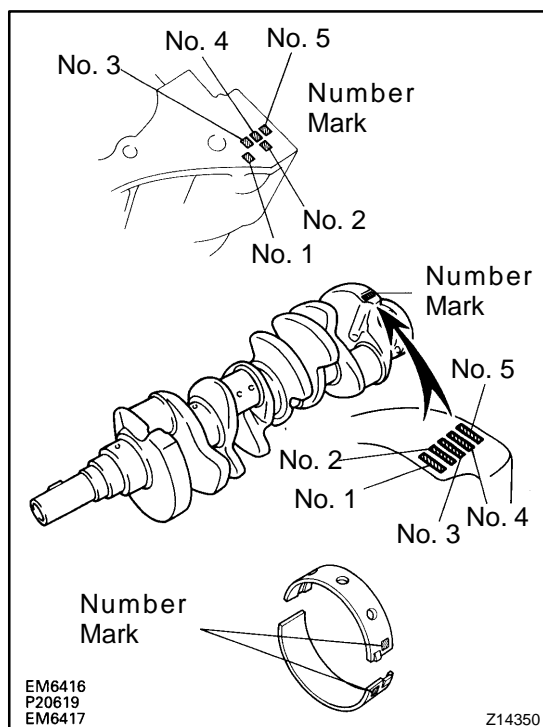
- (k) Subtract the main journal diameter measurement from the main bearing inside diameter measurement.

Standard clearance:

No. 1 and No. 5	0.014 – 0.033 mm (0.0006 – 0.0013 in.)
Others	0.026 – 0.045 mm (0.0010 – 0.0018 in.)

Maximum clearance:

No. 1 and No. 5	0.043 mm (0.0017 in.)
Others	0.055 mm (0.0022 in.)



HINT:

If using a standard bearing, replace it with one having the same number. If the number of the bearing cannot be determined, select the correct bearing by adding together the numbers imprinted on the cylinder block and crankshaft, then refer to the table below for the appropriate bearing number. There are 5 sizes of the standard bearings. For No.1 and No. 5 position bearings, use bearings marked "3", "4", "5", "6" and "7". For others position bearings, use bearings marked "1", "2", "3", "4" and "5".

		Total number " " : Number mark				
Cylinder block (A) + Crankshaft (B) =		0 – 5	6 – 11	12 – 17	18 – 23	24 – 28
Use bearing	No. 1 and No. 5	"3"	"4"	"5"	"6"	"7"
	Others	"1"	"2"	"3"	"4"	"5"

EXAMPLE

Cylinder block "06" + Crankshaft "08"

= Total number 14

(Use bearing "5" (No. 1 and No. 5), "3" (Others))

Reference

Cylinder block main journal bore diameter (A):

Mark "00"	72.000 mm (2.8346 in.)
Mark "01"	72.001 mm (2.8347 in.)
Mark "02"	72.002 mm (2.8347 in.)
Mark "03"	72.003 mm (2.8348 in.)
Mark "04"	72.004 mm (2.8348 in.)
Mark "05"	72.005 mm (2.8348 in.)

Mark "06"	72.006 mm (2.8349 in.)
Mark "07"	72.007 mm (2.8349 in.)
Mark "08"	72.008 mm (2.8350 in.)
Mark "09"	72.009 mm (2.8350 in.)
Mark "10"	72.010 mm (2.8350 in.)
Mark "11"	72.011 mm (2.8351 in.)
Mark "12"	72.012 mm (2.8351 in.)
Mark "13"	72.013 mm (2.8352 in.)
Mark "14"	72.014 mm (2.8352 in.)
Mark "15"	72.015 mm (2.8352 in.)
Mark "16"	72.016 mm (2.8353 in.)

Crankshaft main journal diameter (B):

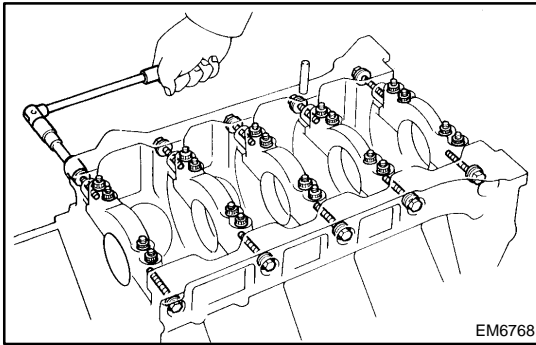
Mark "00"	67.000 mm (2.6378 in.)
Mark "01"	66.999 mm (2.6378 in.)
Mark "02"	66.998 mm (2.6377 in.)
Mark "03"	66.997 mm (2.6377 in.)
Mark "04"	66.996 mm (2.6376 in.)
Mark "05"	66.995 mm (2.6376 in.)
Mark "06"	66.994 mm (2.6376 in.)
Mark "07"	66.993 mm (2.6375 in.)
Mark "08"	66.992 mm (2.6375 in.)
Mark "09"	66.991 mm (2.6374 in.)
Mark "10"	66.990 mm (2.6374 in.)
Mark "11"	66.989 mm (2.6374 in.)
Mark "12"	66.988 mm (2.6373 in.)

**Standard bearing center wall thickness:
No. 1 and No. 5**

Mark "3"	2.492 – 2.495 mm (0.0981 – 0.0982 in.)
Mark "4"	2.495 – 2.498 mm (0.0982 – 0.0983 in.)
Mark "5"	2.498 – 2.501 mm (0.0983 – 0.0985 in.)
Mark "6"	2.501 – 2.504 mm (0.0985 – 0.0986 in.)
Mark "7"	2.504 – 2.507 mm (0.0986 – 0.0987 in.)

Other

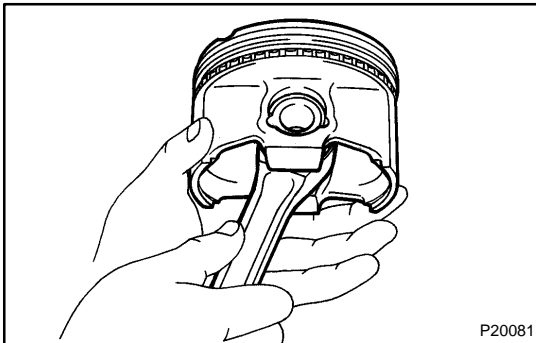
Mark "1"	2.486 – 2.489 mm (0.0979 – 0.0980 in.)
Mark "2"	2.489 – 2.492 mm (0.0980 – 0.0981 in.)
Mark "3"	2.492 – 2.495 mm (0.0981 – 0.0982 in.)
Mark "4"	2.459 – 2.498 mm (0.0982 – 0.0983 in.)
Mark "5"	2.498 – 2.501 mm (0.0983 – 0.0985 in.)



- (l) Remove the 10 bolts, 20 nuts, 5 main bearing caps and 5 lower main bearing (See procedure (a) to (c) above).
- (m) Remove the 5 upper main bearings from the cylinder block.

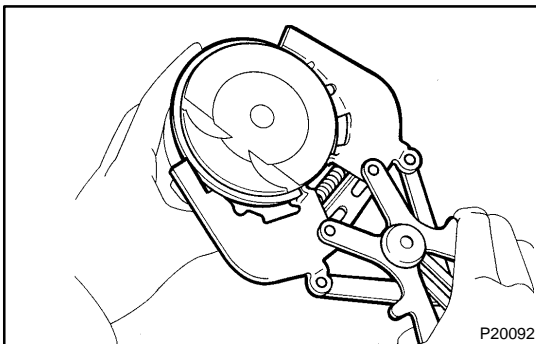
HINT:

Arrange the main bearing caps, bearings and thrust washers in correct order.

**22. CHECK FIT BETWEEN PISTON AND PISTON PIN**

Try to move the piston back and forth on the piston pin.

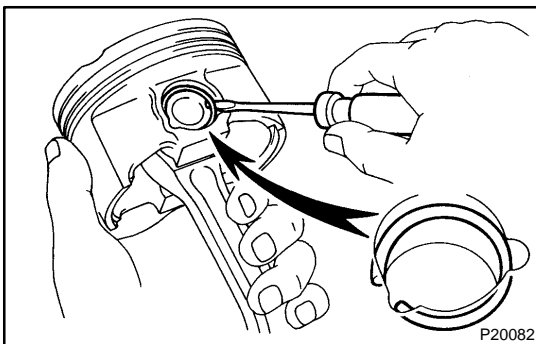
If any movement is felt, replace the piston and pin as a set.

**23. REMOVE PISTON RINGS**

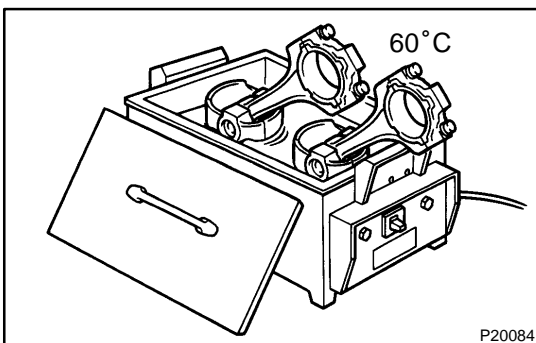
- (a) Using a piston ring expander, remove the 2 compression rings.
- (b) Remove the 2 side rails and oil ring by hand.

HINT:

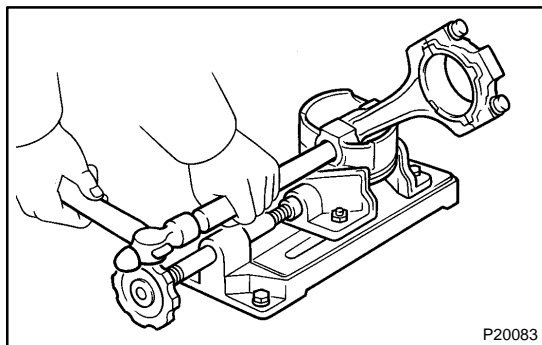
Arrange the piston rings in correct order only.

**24. DISCONNECT CONNECTING ROD FROM PISTON**

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



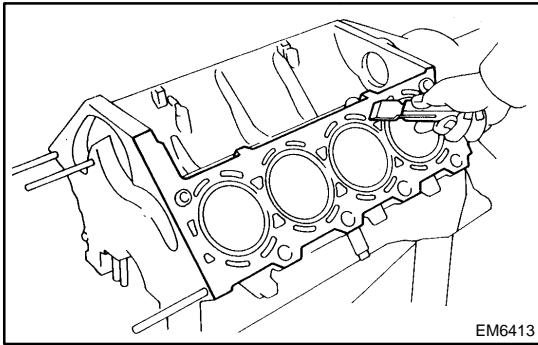
- (b) Gradually heat the piston to approx. 60°C (140°F).



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

HINT:

- The piston and pin are a matched set.
- Arrange the pistons, pins, rings, connecting rods and bearings in correct order.



EM6413

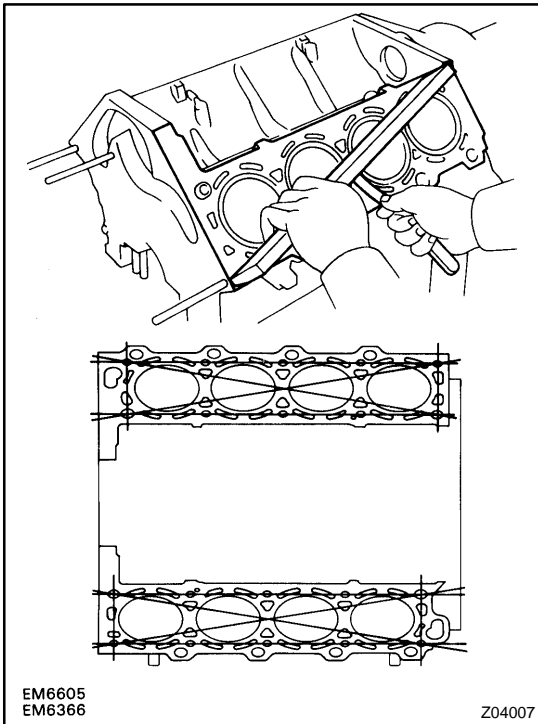
INSPECTION

1. CLEAN CYLINDER BLOCK

- (a) Using a gasket scraper, remove all the gasket material from the top surface of the cylinder block.
- (b) Using a soft brush and solvent, thoroughly clean the cylinder block.

NOTICE:

If the cylinder is washed at high temperatures, the cylinder liner sticks out beyond the cylinder block, so always wash the cylinder block at a temperature of 45° or less.

EM6605
EM6366

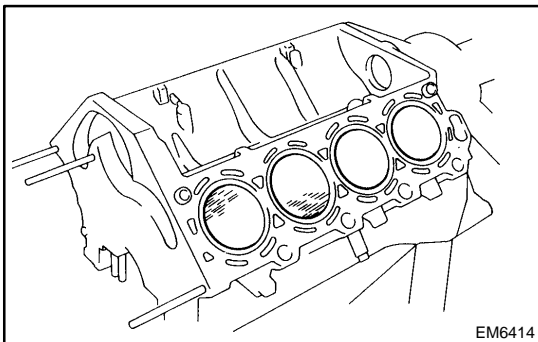
Z04007

2. INSPECT CYLINDER BLOCK

- (a) Inspect for flatness.
Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder head gasket for warpage.

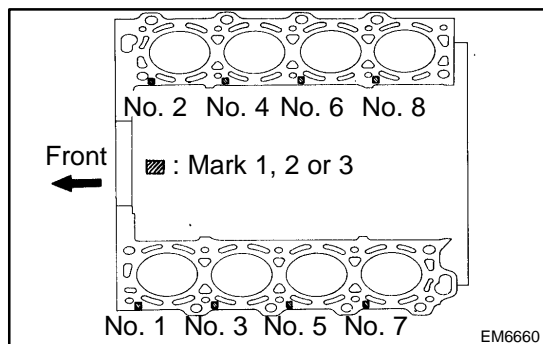
Maximum warpage: 0.07 mm (0.0028 in.)

If warpage is greater than maximum, replace the cylinder block.



EM6414

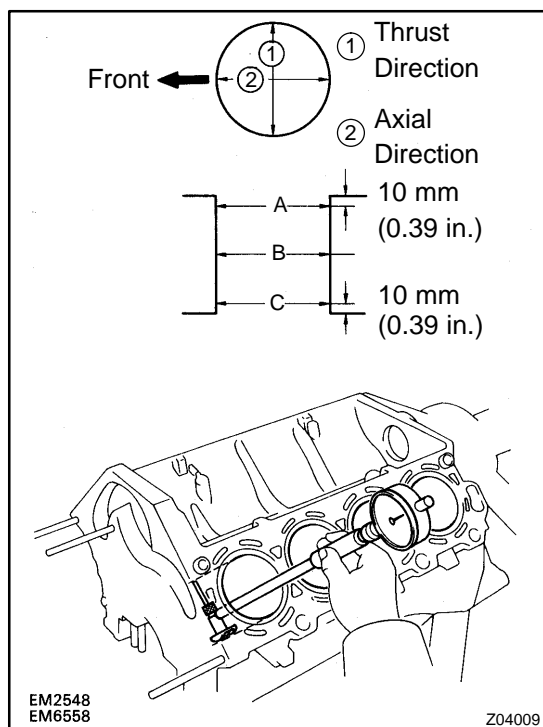
- (b) Visually check the cylinder for vertical scratches.
If deep scratches are present, replace the cylinder block.



(c) Inspect the cylinder bore diameter.

HINT:

There are 3 sizes of the standard cylinder bore diameter, marked "1", "2" and "3" accordingly. The mark is stamped on the top of the cylinder block.



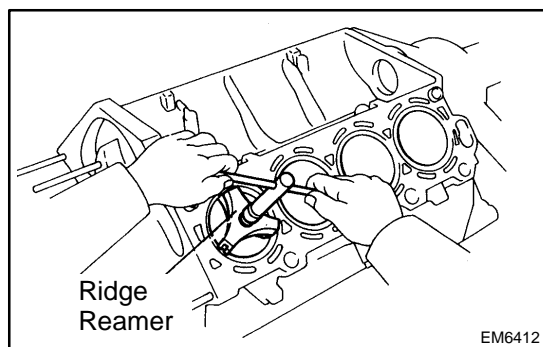
Using a cylinder gauge, measure the cylinder bore diameter at positions A, B and C in the thrust and axial directions.

Standard diameter:

Mark "1"	87.500 – 87.510 mm (3.4449 – 3.4453 in.)
Mark "2"	87.510 – 87.520 mm (3.4453 – 3.4457 in.)
Mark "3"	87.520 – 87.530 mm (3.4457 – 3.4461 in.)

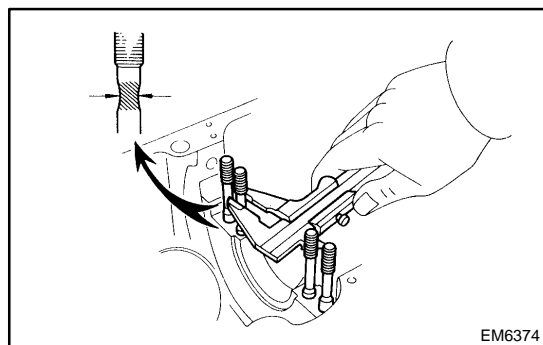
Maximum diameter: 87.73 mm (3.4539 in.)

If the diameter is greater than maximum, replace the cylinder block.



(d) Remove the cylinder ridge.

If the wear is less than 0.2 mm (0.008 in.), using a ridge reamer, grind the top of the cylinder.



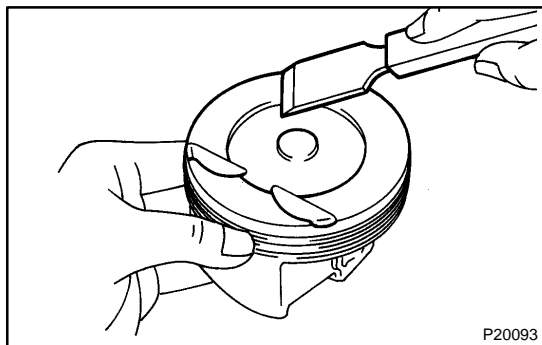
(e) Using vernier calipers, measure the tension portion diameter of the stud bolt.

Standard diameter:

7.500 – 7.600 mm (0.2953 – 0.2992 in.)

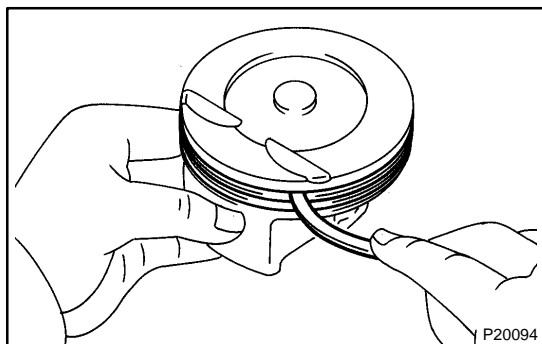
Minimum diameter: 7.40 mm (0.2913 in.)

If the diameter is less than minimum, replace the stud bolt (See page [EM-119](#)).

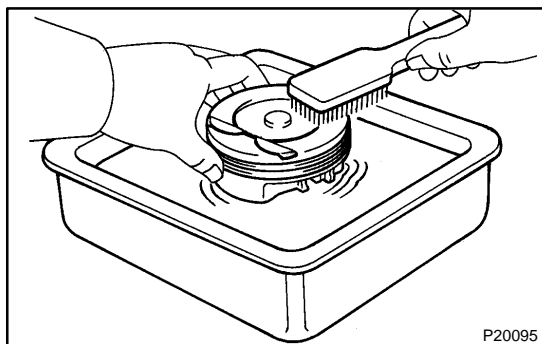


3. CLEAN PISTON

- (a) Using a gasket scraper, remove the carbon from the piston top.



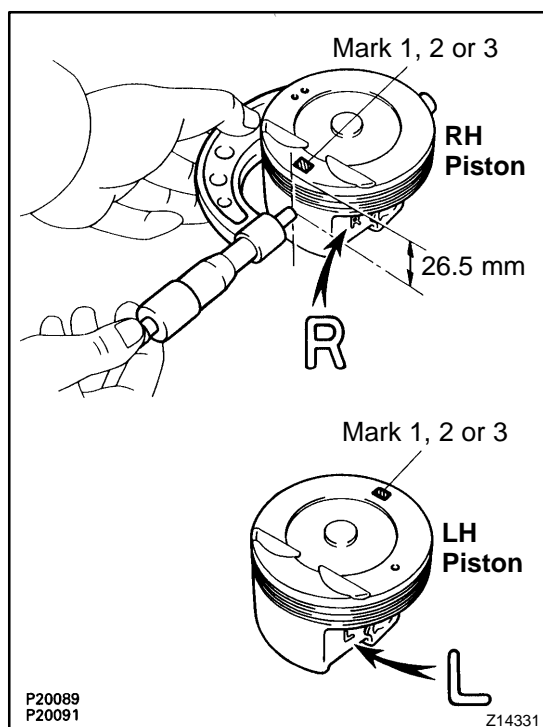
- (b) Using a groove cleaning tool or broken ring, clean the piston ring grooves.



- (c) Using solvent and a brush, thoroughly clean the piston.

NOTICE:

Do not use a wire brush.



4. INSPECT PISTON AND CONNECTING ROD

- (a) Inspect the piston oil clearance.

HINT:

There are 3 sizes of the standard piston diameter, marked "1", "2" and "3" accordingly. The mark is stamped on the piston top.

- (1) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 26 mm (1.02 in.) from the piston head.

Piston diameter:

Mark "1"	87.410 – 87.420 mm (3.4413 – 3.4417 in.)
Mark "2"	87.420 – 87.430 mm (3.4417 – 3.4421 in.)
Mark "3"	87.430 – 87.440 mm (3.4421 – 3.4425 in.)

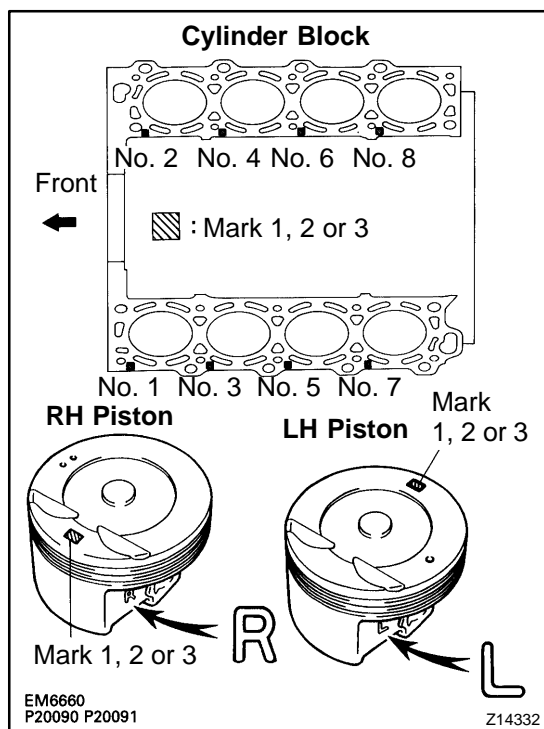
- (2) Measure the cylinder bore diameter in the thrust directions (See step 2).
 (3) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

Standard oil clearance:

0.080 – 0.100 mm (0.0031 – 0.0039 in.)

Maximum oil clearance: 0.12 mm (0.0047 in.)

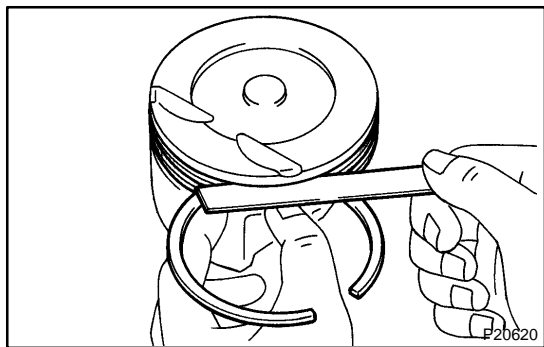
If the oil clearance is greater than maximum, replace all the 8 pistons. If necessary, replace the cylinder block.



HINT:

Use new cylinder block:

- Use a piston with the same number mark as the cylinder diameter marked on the cylinder block.
- The shape of the piston varies for the RH and LH banks. The RH piston is marked with "R", the LH piston with "L".

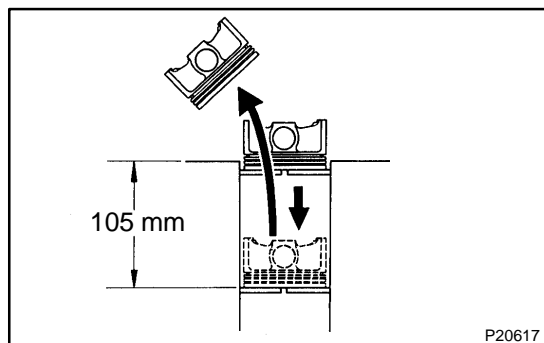


- (b) Inspect the piston ring groove clearance.
Using a feeler gauge, measure the clearance between new piston ring and the wall of the ring groove.

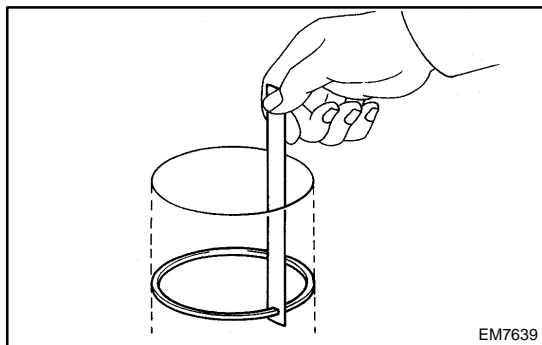
Ring groove clearance (No. 1 and No. 2):

0.020 – 0.060 mm (0.0008 – 0.0024 in.)

If the clearance is not as specified, replace the piston.



- (c) Inspect the piston ring end gap.
- (1) Insert the piston ring into the cylinder bore.
 - (2) Using a piston, push the piston ring a little beyond the bottom of the ring travel, 105 mm (4.13 in.) from the top of the cylinder block.



(3) Using a feeler gauge, measure the end gap.

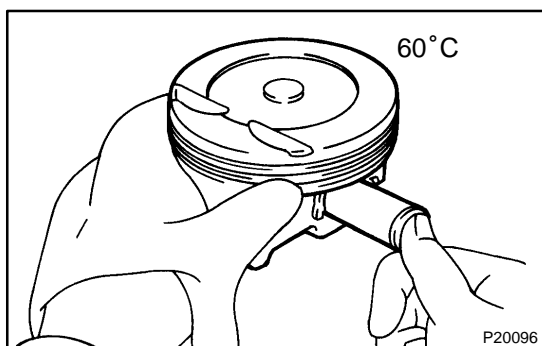
Standard end gap:

No. 1	0.250 – 0.450 mm (0.0098 – 0.0177 in.)
No. 2	0.350 – 0.500 mm (0.0138 – 0.0197 in.)
Oil (Side rail)	0.150 – 0.550 mm (0.0059 – 0.0217 in.)

Maximum end gap:

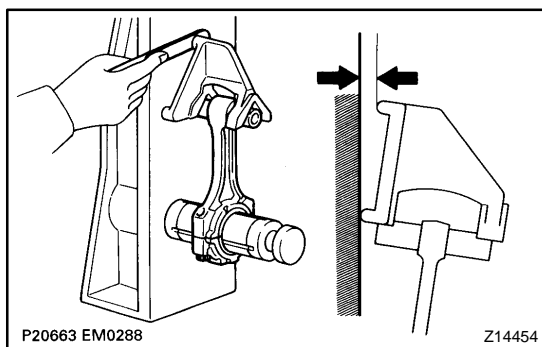
No. 1	1.05 mm (0.0413 in.)
No. 2	1.10 mm (0.0443 in.)
Oil (Side rail)	1.15 mm (0.0453 in.)

If the end gap is greater than maximum, replace the piston ring.
If the end gap is greater than maximum, even with a new piston ring, replace the cylinder block.



(d) Inspect the piston pin fit.

At 60°C (140°F), you should be able to push the piston pin into the piston pin hole with your thumb.



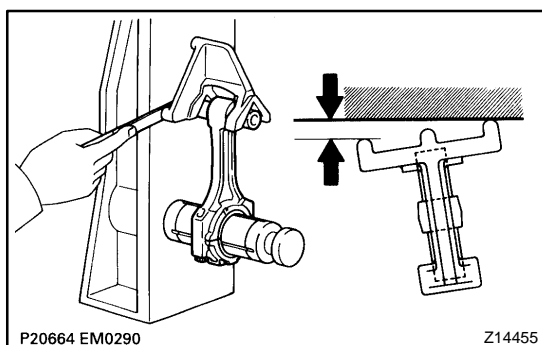
(e) Using a rod aligner and feeler gauge, check the connecting rod alignment.

(1) Check for bend.

Maximum bend:

0.05 mm (0.0020 in.) per 100 mm (3.94 in.)

If bend is greater than maximum, replace the connecting rod assembly.

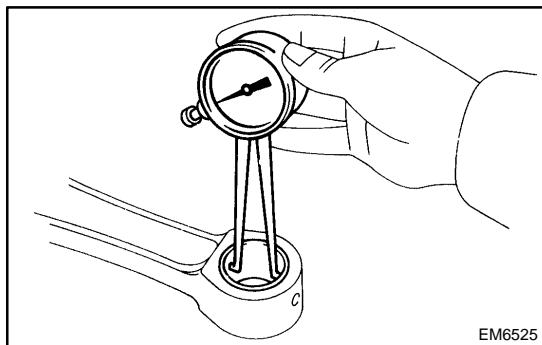


(2) Check for twist

Maximum twist:

0.15 mm (0.0059 in.) per 100 mm (3.94 in.)

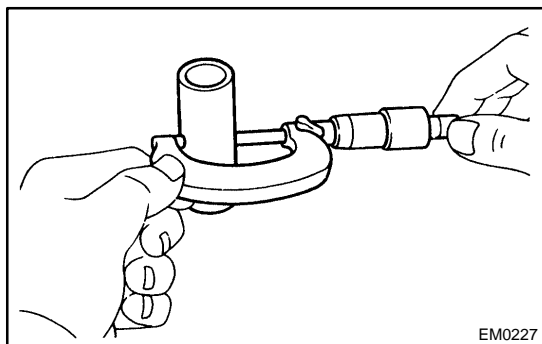
If twist is greater than maximum, replace the connecting rod assembly.



- (f) Inspect the piston pin oil clearance.
- (1) Using a caliper gauge, measure the inside diameter of the connecting rod bushing.

Bushing inside diameter:

22.005 – 22.014 mm (0.8663 – 0.8667 in.)



- (2) Using a micrometer, measure the piston pin diameter.

Piston pin diameter:

21.997 – 22.006 mm (0.8660 – 0.8664 in.)

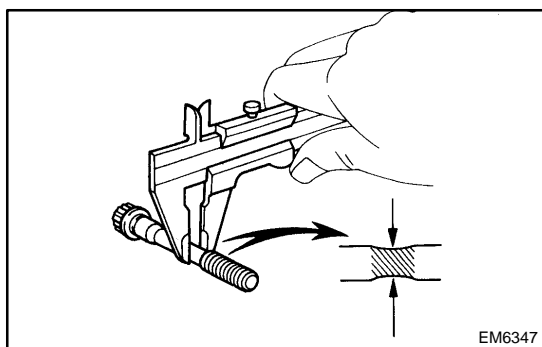
- (3) Subtract the piston pin diameter measurement from the bushing inside diameter measurement.

Standard oil clearance:

0.005 – 0.011 mm (0.0002 – 0.0004 in.)

Maximum oil clearance: 0.05 mm (0.0020 in.)

If the oil clearance is greater than maximum, replace the bushing (See page [EM-119](#)). If necessary, replace the piston and piston pin as a set.



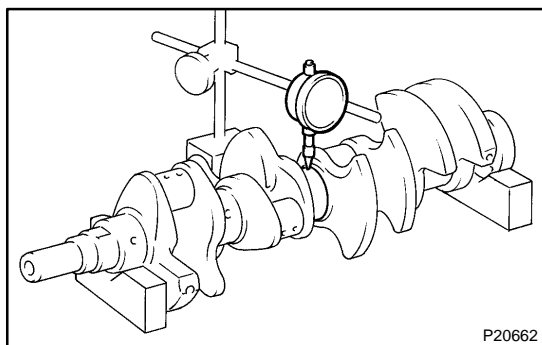
- (g) Inspect the connecting rod bolts.
- Using vernier calipers, measure the tension portion of the connecting rod bolt.

Standard diameter:

7.200 – 7.300 mm (0.2835 – 0.2874 in.)

Minimum diameter: 7.00 mm (0.2756 in.)

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

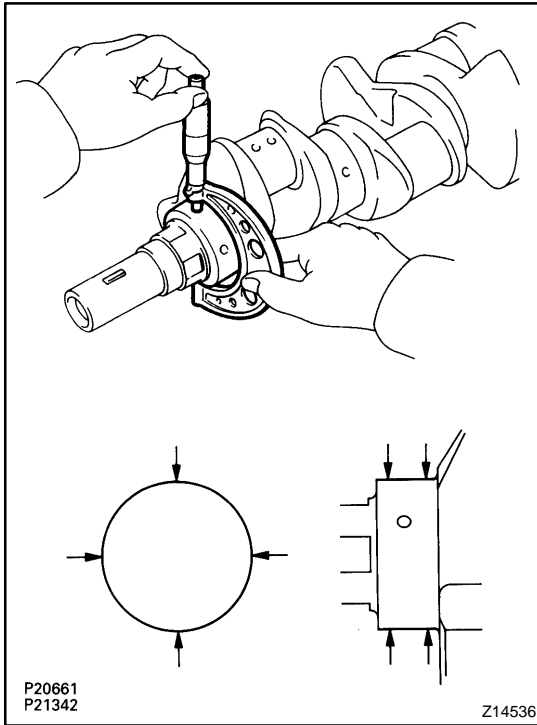


5. INSPECT CRANKSHAFT FOR CIRCLE RUNOUT

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

Maximum circle runout: 0.08 mm (0.0031 in.)

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

**6. INSPECT MAIN JOURNALS AND CRANK PINS**

- (a) Using a micrometer, measure the diameter of each main journal and crank pin.

Main journal diameter:

66.988 – 67.000 mm (2.6373 – 2.6378 in.)

Crank pin diameter:

51.982 – 52.000 mm (2.0465 – 2.0472 in.)

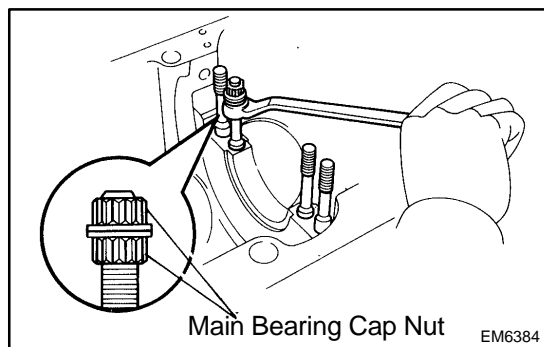
If the diameter is not as specified, check the oil clearance (See page [EM-102](#)). If necessary, replace the crankshaft.

- (b) Check each main journal and crank pin for taper and out-of-round as shown.

Maximum taper and out-of-round:

0.02 mm (0.0008 in.)

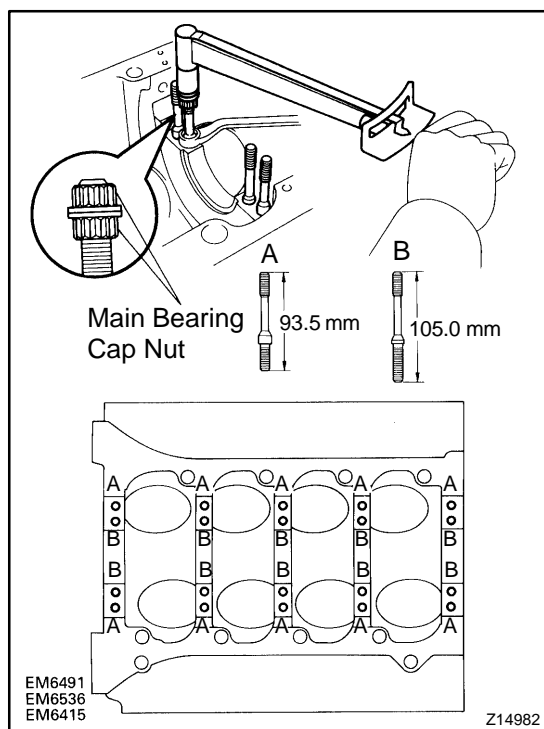
If the taper and out-of-round is greater than maximum, replace the crankshaft.



REPLACEMENT

1. REPLACE MAIN BEARING CAP STUD BOLTS

- (a) Using the 2 main bearing cap nuts, remove the stud bolt.



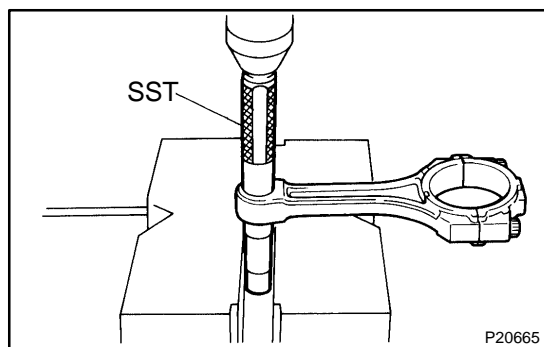
- (b) Apply a light coat of engine oil on the threads and under flange of new stud bolts.

- (c) Using the 2 main bearing cap nuts, install the stud bolt.

Torque: 15 N·m (150 kgf-cm, 11 ft-lbf)

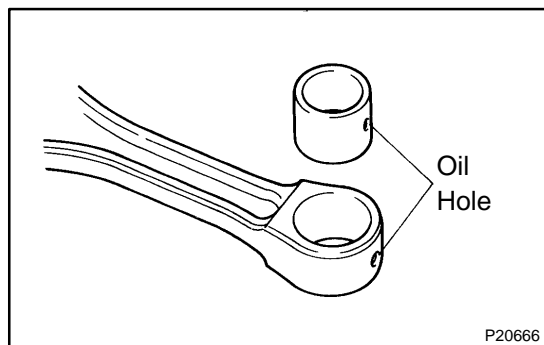
HINT:

Stud bolts come in lengths of 93.5 mm (3.681 in.) and 105.0 mm (4.134 in.). Install the 105.0 mm (4.134 in.) bolts in inside positions. Install the 93.5 mm (3.681 in.) bolts in outside positions. If the oil clearance is greater than maximum, replace the bushing. If necessary, replace the piston and piston pin as a set.



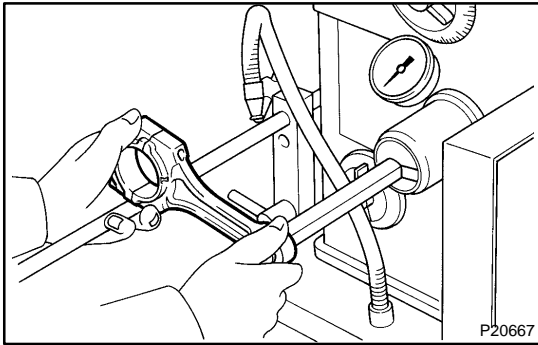
2. REPLACE CONNECTING ROD BUSHINGS

- (a) Using SST and a press, press out the bushing.
SST 09222-30010

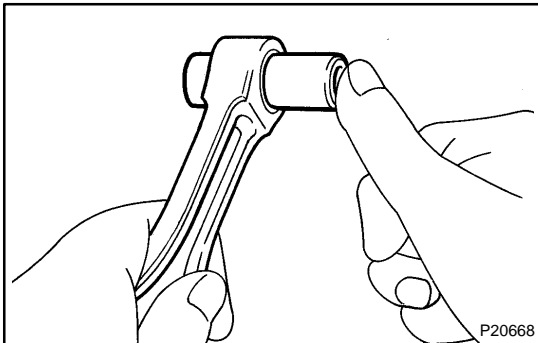


- (b) Align the oil holes of a new bushing and the connecting rod.

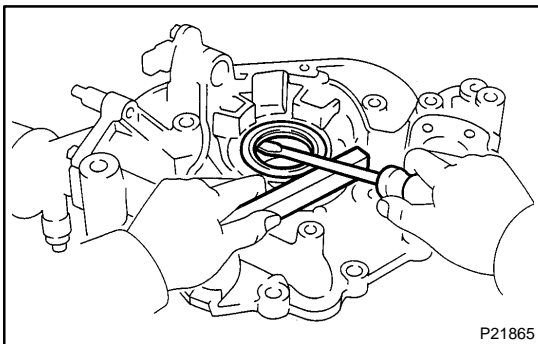
- (c) Using SST and a press, press in the bushing.
SST 09222-30010



- (d) Using a pin hole grinder, hone the bushing to obtain the standard specified clearance (See page [EM-112](#)) between the bushing and piston pin.



- (e) Check the piston pin fit at normal room temperature. Coat the piston pin with engine oil, and push it into the connecting rod with your thumb.



3. REPLACE CRANKSHAFT FRONT OIL SEAL

HINT:

There are 2 methods ((a) and (b)) to replace the oil seal.

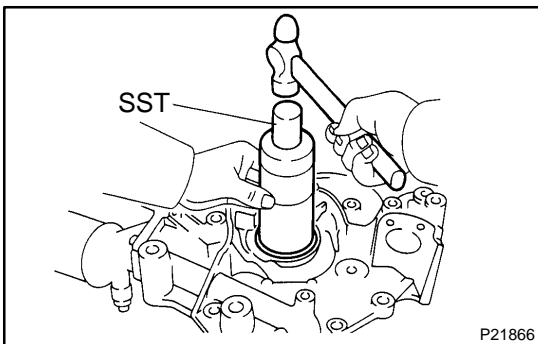
- (a) If the oil pump is removed from the cylinder block:

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

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

SST 09316-60011 (09316-00011)

- (3) Apply MP grease to the oil seal lip.



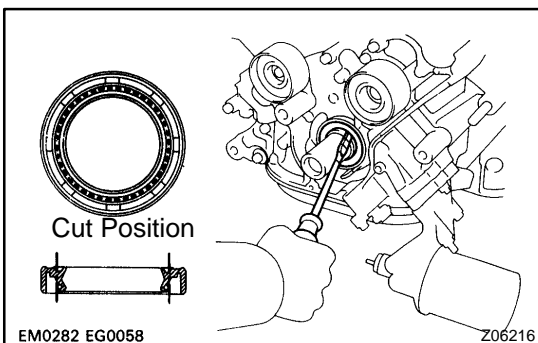
- (b) If the oil pump is installed to the cylinder block:

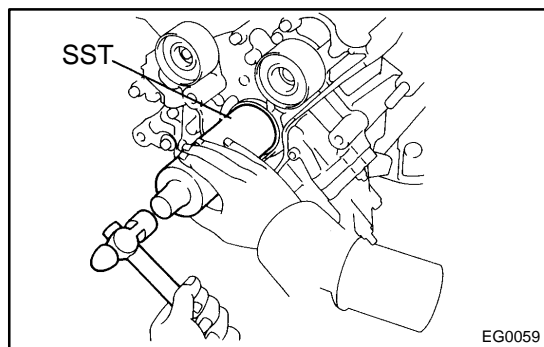
- (1) Using a knife, cut off the oil seal lip.

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

NOTICE:

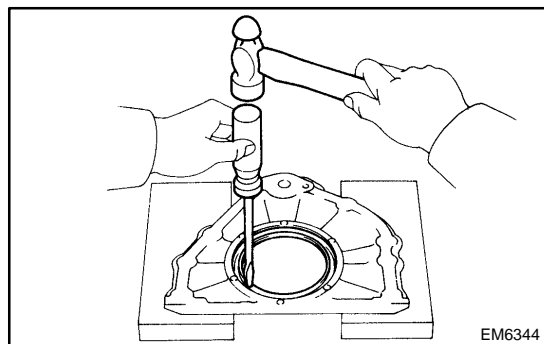
Be careful not to damage the crankshaft. Tape the screwdriver tip.





- (3) Apply MP grease to a new oil seal lip.
- (4) Using SST and a hammer, tap in the oil seal until its surface is flush with the oil pump body edge.

SST 09316-60011 (09316-00011)



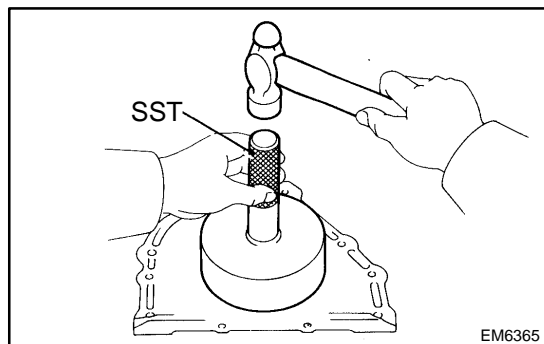
4. REPLACE CRANKSHAFT REAR OIL SEAL

HINT:

There are 2 methods ((a) and (b)) to replace the oil seal.

- (a) If the rear oil seal retainer is removed from the cylinder block:

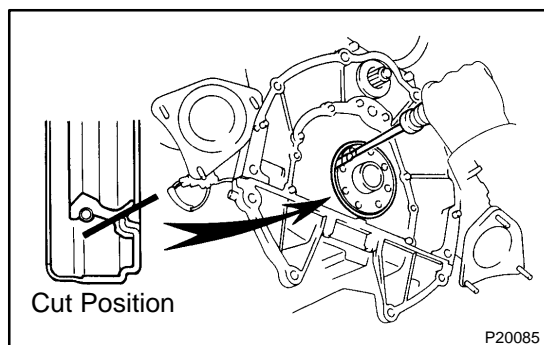
- (1) Using a screwdriver and hammer, tap out the oil seal.



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

SST 09223-56010

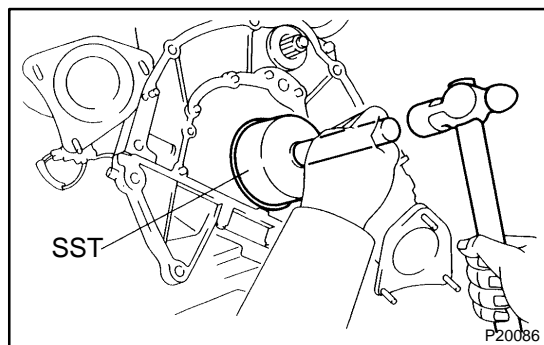
- (b) Apply MP grease to the oil seal lip.



- (c) If the rear oil seal retainer is installed to the cylinder block:
- (1) Using a knife, cut off the oil seal lip.
- (2) Using a screwdriver, pry out the oil seal.

NOTICE:

Be careful not to damage the crankshaft. Tape the screwdriver tip.



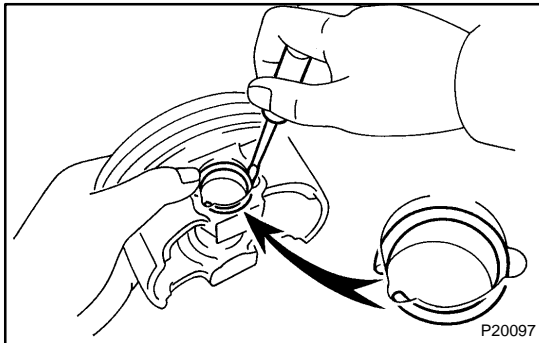
- (3) Apply MP grease to a new oil seal lip.
- (4) Using SST and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.

SST 09223-56010

REASSEMBLY

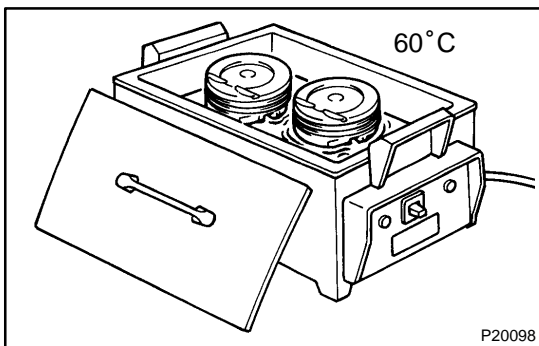
HINT:

- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O-rings and oil seals with new parts.

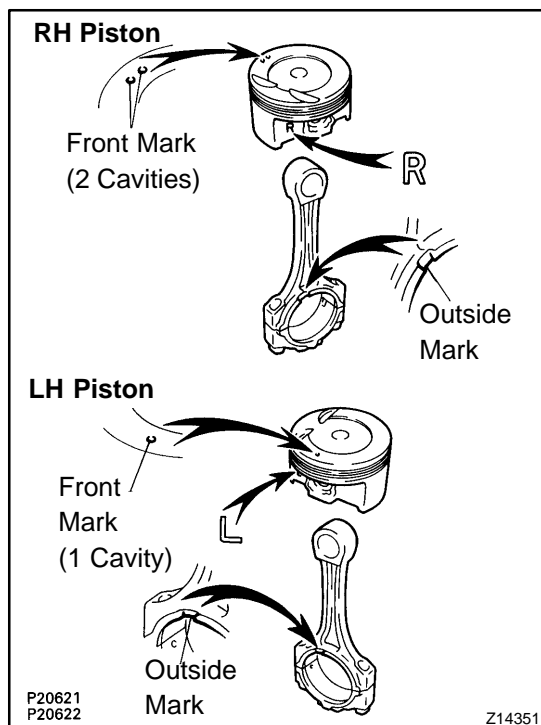


1. ASSEMBLE PISTON AND CONNECTING ROD

- (a) Using a small screwdriver, install a new snap ring on one side of the piston pin hole.



- (b) Gradually heat the piston to about 60°C (140°F).

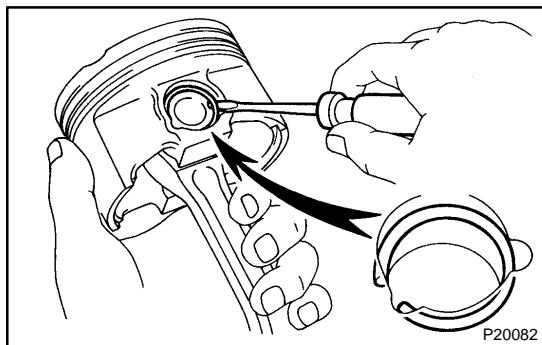


- (c) Coat the piston pin with engine oil.
- (d) Position the piston front mark with respect to the outside mark on the connecting rod as shown in the diagram.

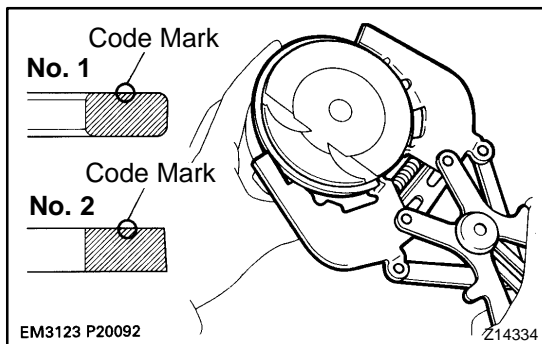
NOTICE:

The installation directions of the piston and connecting rod are different for the RH and LH banks. The RH piston is marked with "R", the LH piston with "L".

- (e) Align the piston pin holes of the piston and connecting rod, and push in the piston pin with your thumb.



- (f) Using a small screwdriver, install a new snap ring on the other side of the piston pin hole.

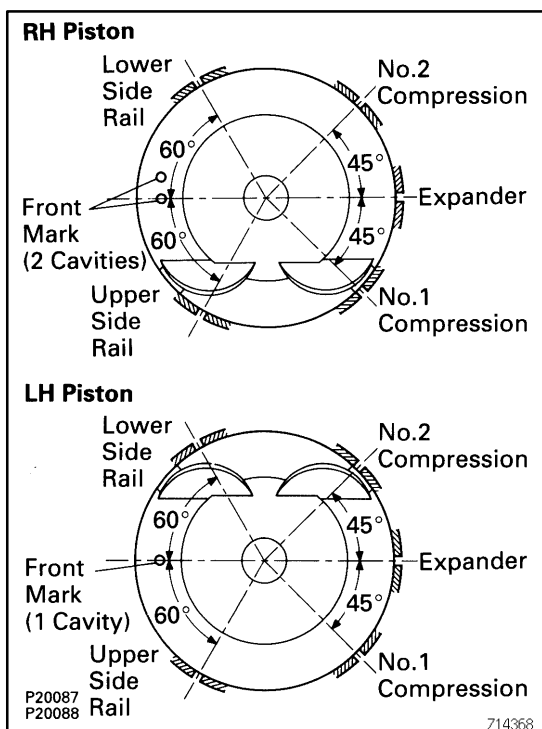


2. INSTALL PISTON RINGS

- (a) Install the oil ring expander and 2 side rails by hand.
(b) Using a piston ring expander, install the 2 compression rings with the code mark facing upward.

Code mark:

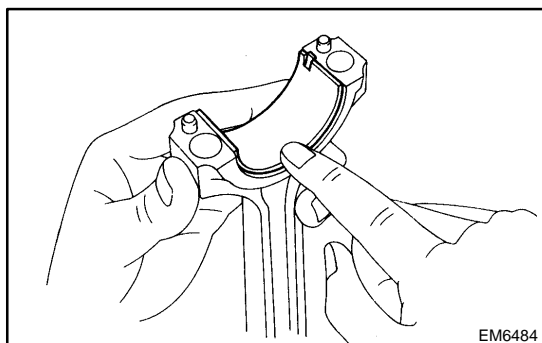
No. 1	1R or T
No. 2	2R or 2T



- (c) Position the piston rings so that the ring ends are as shown.

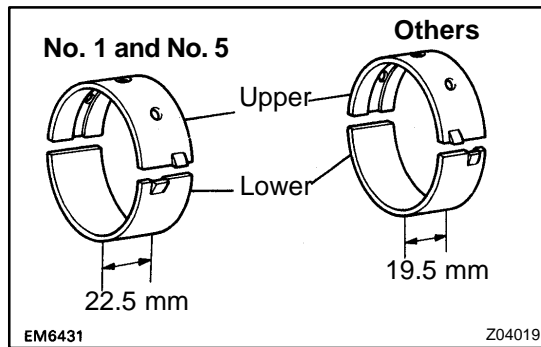
NOTICE:

Do not align the ring ends.



3. INSTALL BEARINGS

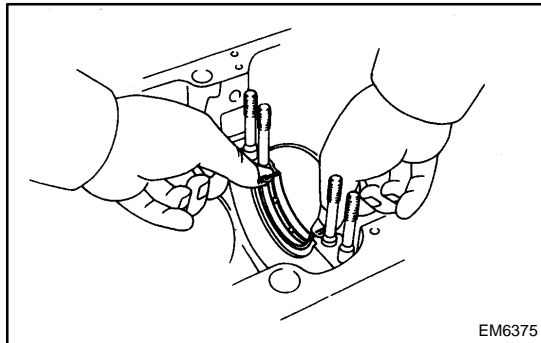
- (a) Align the bearing claw with the groove of the connecting rod or connecting cap.
(b) Install the bearings in the connecting rod and connecting rod cap.



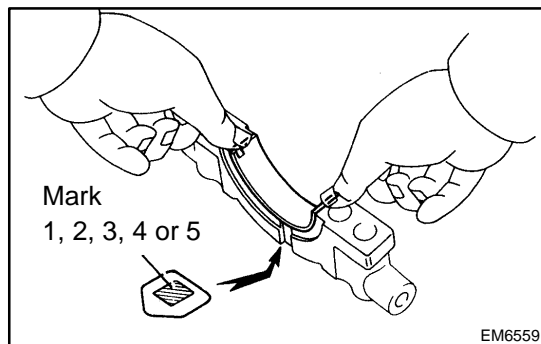
4. INSTALL MAIN BEARINGS

HINT:

- Main bearings come in widths of 19.5 mm (0.768 in.) and 22.5 mm (0.886 in.). Install the 22.5 mm (0.886 in.) bearings in the No. 1 and No. 5 cylinder block journal positions with the main bearing cap. Install the 19.5 mm (0.768 in.) bearings in the other positions.
- Upper bearings have an oil groove and oil holes; lower bearings do not.



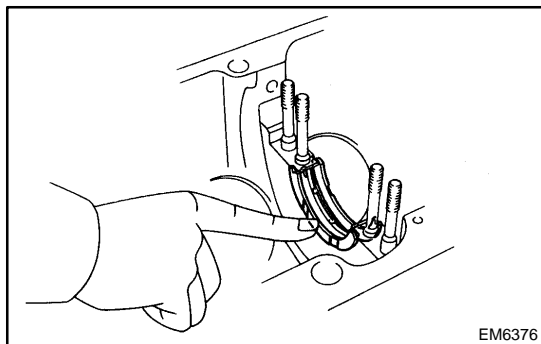
- (a) Align the bearing claw with the claw groove of the cylinder block, and push in the 5 upper bearings.



- (b) Align the bearing claw with the claw groove of the main bearing cap, and push in the 5 lower bearings.

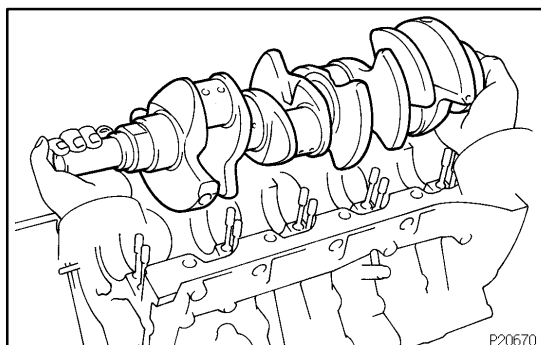
HINT:

A number is marked on each main bearing cap to indicate the installation position.

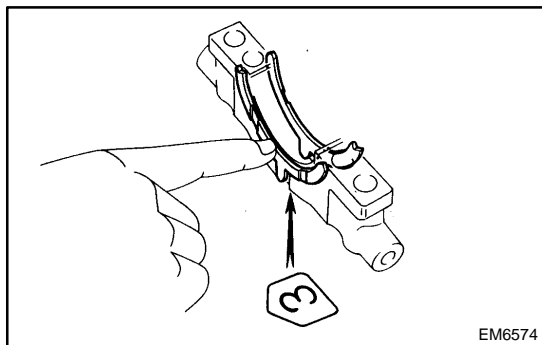


5. INSTALL UPPER THRUST WASHERS

Install the 2 thrust washers under the No. 3 journal position of the cylinder block with the oil grooves facing outward.



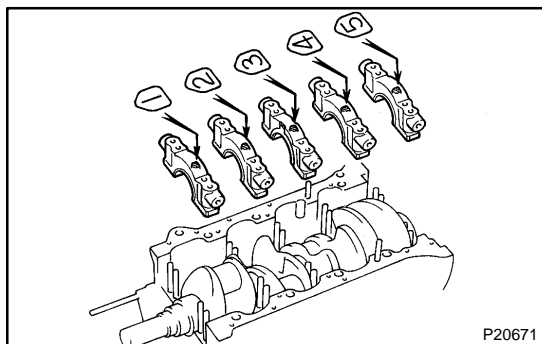
6. PLACE CRANKSHAFT ON CYLINDER BLOCK



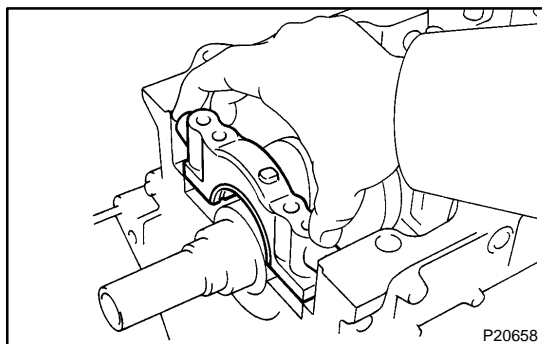
7. INSTALL MAIN BEARING CAPS AND LOWER THRUST WASHERS

- (a) Place the main bearing caps and lower thrust washers on the cylinder block.

- (1) Install the 2 thrust washers on the No. 3 bearing cap with the grooves facing outward.



- (2) Install the 5 main bearing caps in their proper locations.

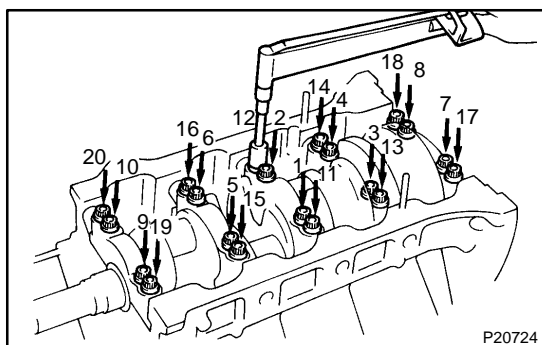


HINT:

Place the bearing caps level and let them return to their original position by their own weight.

NOTICE:

Do not install the main bearing cap by tapping it.



- (b) Install the main bearing cap nuts.

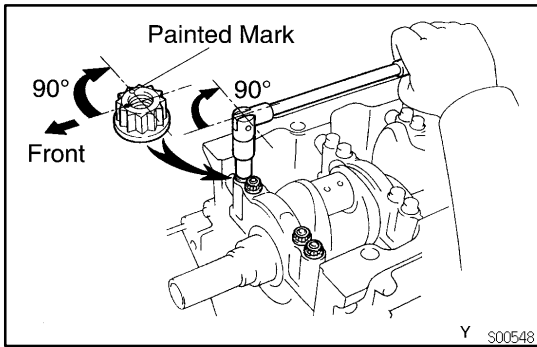
HINT:

- The main bearing cap nuts are tightened in 4 progressive steps (steps (b) and (d)).
- If any one of the main bearing cap stud nuts is broken or deformed, replace it.

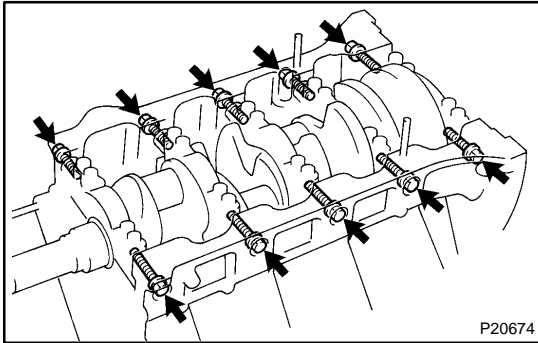
- (1) Apply a light coat of engine oil on the threads and under the main bearing cap nuts.
- (2) Install and uniformly tighten the 20 main bearing cap nuts in several passes, in the sequence shown.

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

If any one of the main bearing cap nuts does not meet the torque specification, replace the main bearing cap stud bolt.

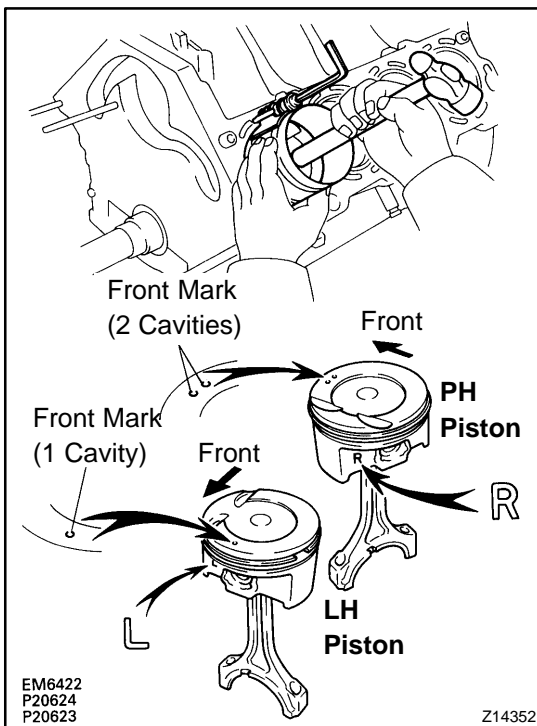


- (3) Mark the front of the main bearing cap nut with paint.
- (4) Retighten the main bearing cap nuts by 90° in the numerical order shown.
- (5) Check that the painted mark is now at a 90° angle to the front.



- (c) Install the main bearing cap bolts.
 - (1) Install a new seal washer to the main bearing cap bolt.
 - (2) Install and uniformly tighten the 10 main bearing cap bolts.
- Torque: 49 N·m (500 kgf·cm, 36 ft·lbf)**
- (3) Check that the crankshaft turns smoothly.

8. CHECK CRANKSHAFT THRUST CLEARANCE (See page EM-102)

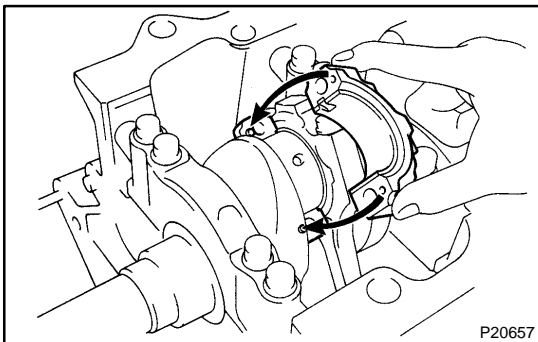


9. INSTALL PISTON AND CONNECTING ROD ASSEMBLES

Using a piston ring compressor, push the correctly numbered piston and connecting rod assemblies into each cylinder with the front mark of the piston facing forward.

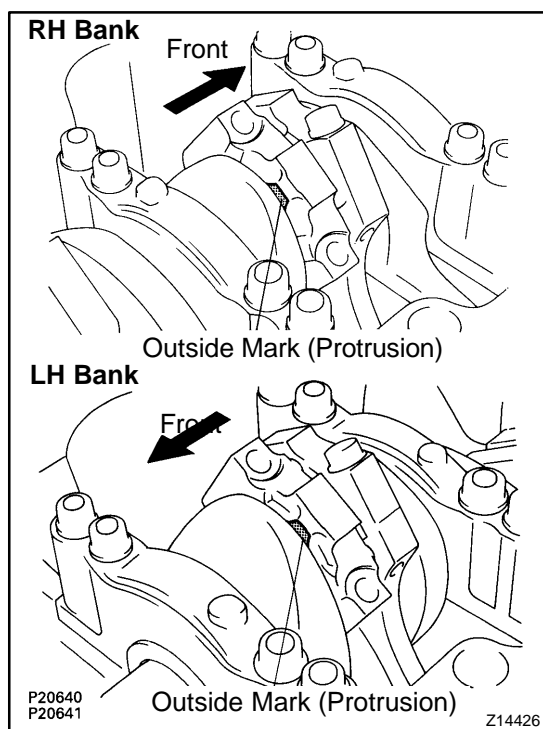
NOTICE:

The shape of the piston varies for the RH and LH banks. The RH piston is marked with "R", the LH piston with "L".

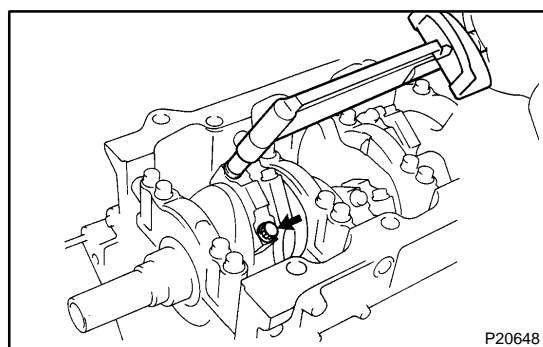


10. INSTALL CONNECTING ROD CAPS

- (a) Place the connecting rod cap on the connecting rod.
 - (1) Match the numbered connecting rod cap with the connecting rod.
 - (2) Align the pin groove of the connecting rod cap with the pins of the connecting rod, and install the connecting rod cap.



- (3) Check that the outside mark of the connecting rod cap is facing in correct direction.



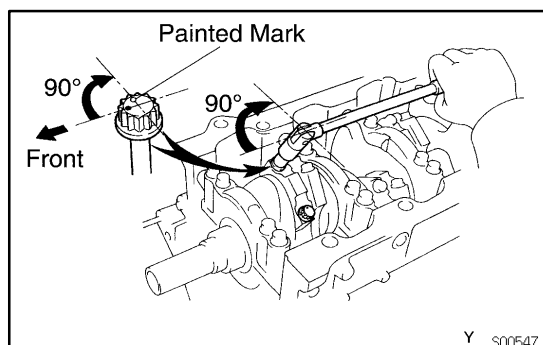
- (b) Install the connecting rod cap bolts.

HINT:

- The connecting rod cap bolts are tightened in 4 progressive steps (steps (b) and (d)).
 - If any one of the connecting rod cap bolts is broken or deformed, replace it.
- (1) Apply a light coat of engine oil on the threads and under the heads of the connecting rod cap bolts.
 - (2) Install and alternately tighten the 2 connecting rod cap bolts in several passes.

Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)

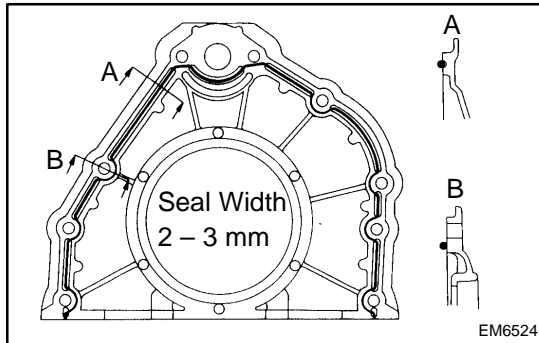
If any one of the connecting rod cap bolts does not meet the torque specification, replace the connecting rod cap bolts.



- (3) Mark the front of the connecting cap bolt with paint.
 - (4) Retighten the cap bolts 90° as shown.
 - (5) Check that the painted mark is now at a 90° angle to the front.
 - (6) Check that the crankshaft turns smoothly.
- 11. CHECK CONNECTING ROD THRUST CLEARANCE**
(See page [EM-102](#))
- 12. INSTALL REAR OIL SEAL RETAINER**

- (a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the oil seal retainer and cylinder block.

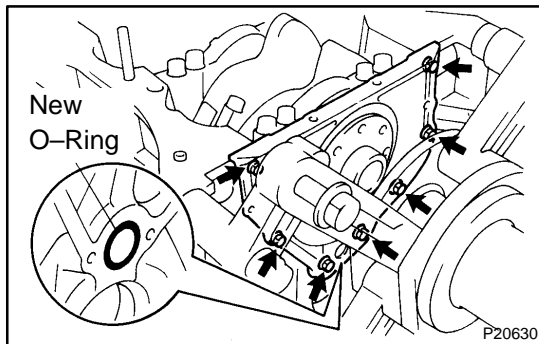
- Using a razor blade and gasket scraper, remove all the oil packing (FIPG) material from the gasket surfaces and sealing grooves.
- Thoroughly clean all components to remove all the loose material.
- Using a non-residue solvent, clean both sealing surfaces.



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

Seal packing: Part No. 08826-00080 or equivalent

- Install a nozzle that has been cut to a 2 – 3 mm (0.08 – 0.12 in.) opening.
- Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.



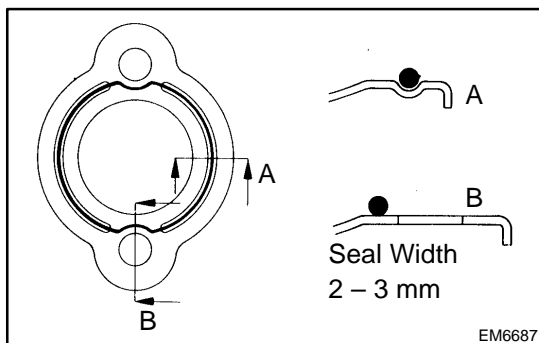
- (c) Install a new O-ring to the cylinder block.
(d) Install the oil seal retainer with the 7 bolts.

Torque: 8.0 N·m (80 kgf·cm, 71 in.-lbf)

13. INSTALL WATER SEAL PLATE

- (a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the seal plate and cylinder block.

- Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and sealing groove.
- Thoroughly clean all components to remove all the loose material.
- Using a non-residue solvent, clean both sealing surfaces.



- (b) Apply seal packing to the seal plate as shown in the illustration.

Seal packing: Part No. 08826-00080 or equivalent

- Install a nozzle that has been cut to a 2 – 3 mm (0.08 – 0.12 in.) opening.
- Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.

- (c) Install the seal plate with the 2 nuts. Alternately tighten the nuts in several passes.

Torque: 14 N·m (145 kgf-cm, 10 ft-lbf)

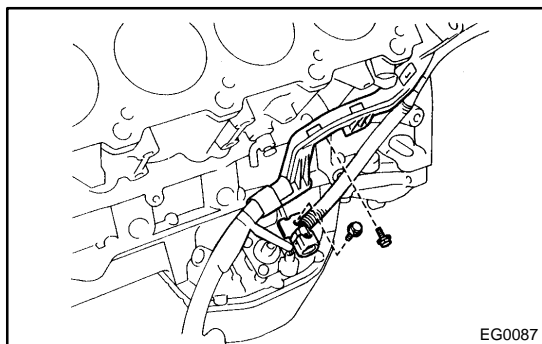
14. REMOVE GENERATOR BRACKET

15. INSTALL OIL PUMP (See page [LU-17](#))

16. INSTALL NO. 1 AND NO. 2 OIL PANS

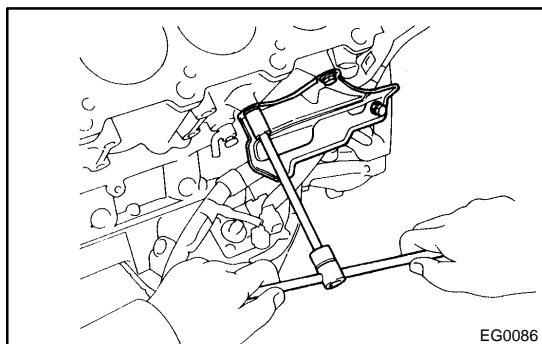
(See page [LU-17](#))

17. INSTALL WATER PUMP (See page [CO-11](#))



18. INSTALL ENGINE WIRE

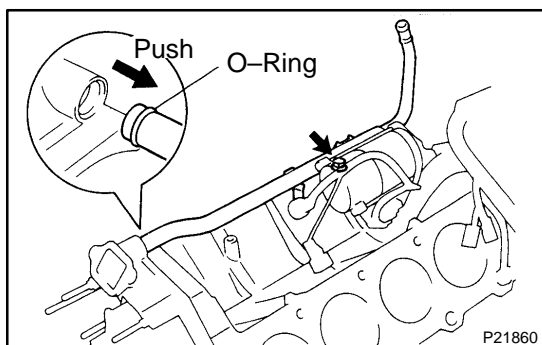
- (a) Install the engine wire to the LH side of the cylinder block with the 2 bolts.



- (b) Install the engine wire cover with the 3 bolts.

- (c) Connect these connector:

- Crankshaft position sensor connector
- Oil pressure switch connector
- Oil level sensor connector



19. INSTALL WATER BYPASS PIPE

- (a) Install a new O-ring to the water bypass pipe.
 (b) Apply soapy water to the O-ring.
 (c) Push the water bypass pipe end into the pipe hole of the water pump.
 (d) Install the water bypass pipe with the 2 bolts.
Torque: 18 N·m (185 kgf-cm, 13 ft-lbf)
 (e) Install the engine wire.

20. INSTALL KNOCK SENSORS (See page [SF-63](#))

21. INSTALL STARTER (See page [ST-19](#))

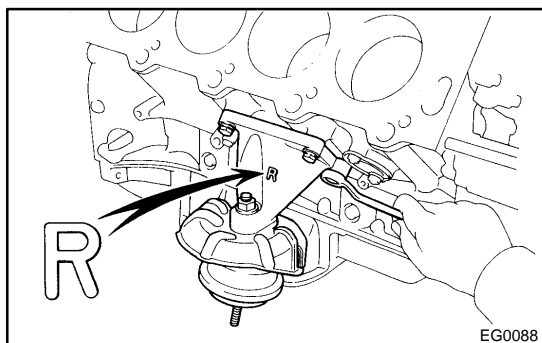
22. INSTALL RH ENGINE MOUNTING BRACKET

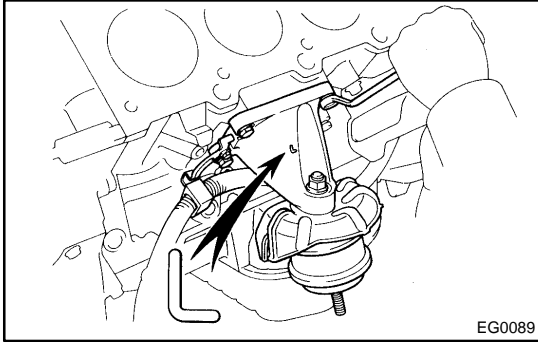
Install the mounting bracket with the 4 bolts.

Torque: 37 N·m (380 kgf-cm, 27 ft-lbf)

HINT:

The RH mounting bracket is marked with "R".



**23. INSTALL LH ENGINE MOUNTING BRACKET**

- (a) Install the mounting bracket with the 4 bolts.

HINT:

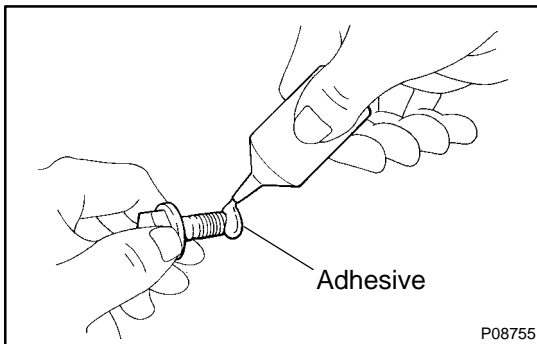
The LH mounting bracket is marked with "L".

Torque: 37 N·m (380 kgf-cm, 27 ft-lbf)

- (b) Install the engine wire to the mounting bracket with the bolt.

24. INSTALL CYLINDER HEADS (See page EM-66)**25. INSTALL TIMING BELT AND PULLEYS**

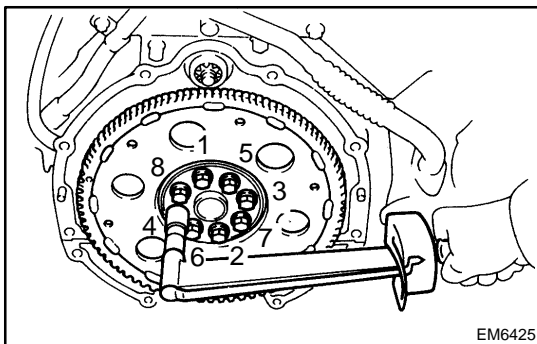
(See page EM-26)

26. DISCONNECT ENGINE FROM ENGINE STAND**27. INSTALL DRIVE PLATE**

- (a) Apply adhesive to 2 or 3 threads of the bolt end.

Adhesive:

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



- (b) Install the front spacer, drive plate and rear plate on the crankshaft.

- (c) Install and uniformly tighten the 8 bolts in several passes, in the sequence shown.

Torque: 98 N·m (1,000 kgf-cm, 72 ft-lbf)

EM0GE-04

