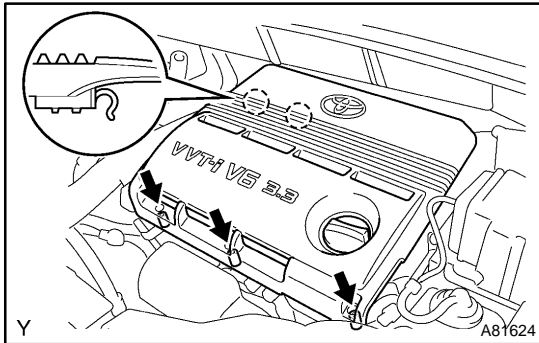


# VALVE CLEARANCE ADJUSTMENT

141AK-04

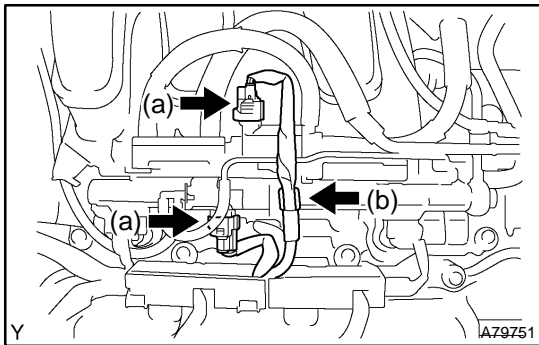
1. DRAIN COOLANT (See page 66-8 )
2. REMOVE FRONT WIPER ARM HEAD CAP
3. REMOVE FR WIPER ARM RH (See page 66-8 )
4. REMOVE FR WIPER ARM LH (See page 66-8 )
5. REMOVE COWL TOP VENTILATOR LOUVER SUB-ASSY (See page 66-8 )
6. REMOVE WIPER LINK ASSY (See page 66-8 )
7. REMOVE COWL TOP TO COWL BRACE INNER NO.1 (See page 11-13 )
8. REMOVE COWL TOP PANEL SUB-ASSY OUTER FRONT (See page 11-13 )
9. REMOVE FRONT FENDER APRON SEAL RH



## 10. REMOVE V-BANK COVER SUB-ASSY

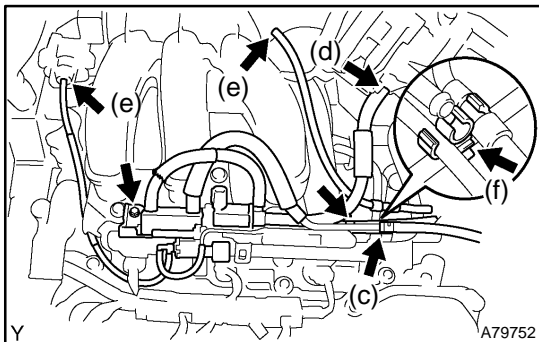
- (a) Using a socket hexagon wrench 5, remove the 3 nuts.
- (b) Remove the V-bank cover.

## 11. REMOVE AIR CLEANER CAP SUB-ASSY (See page 10-7 )

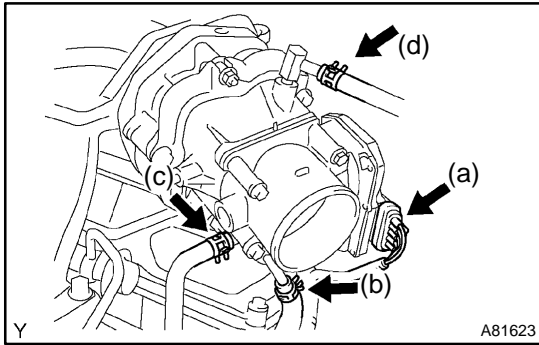


## 12. REMOVE EMISSION CONTROL VALVE SET

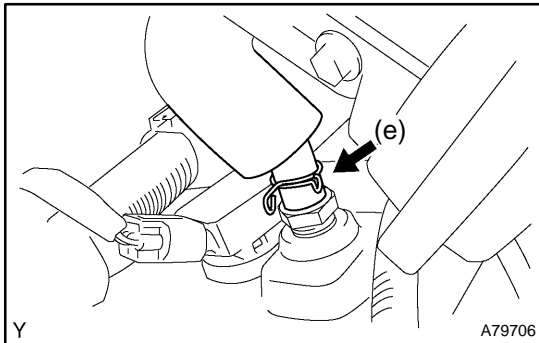
- (a) Disconnect the 2 VSV connectors.
- (b) Remove the wire harness clamp.



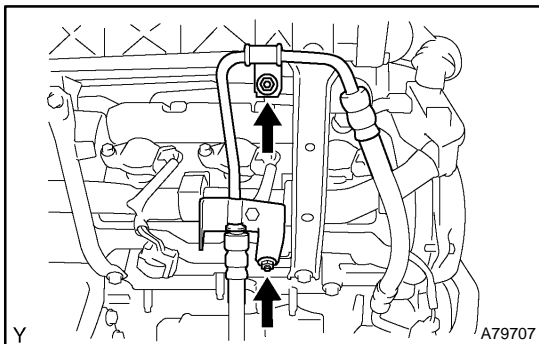
- (c) Disconnect the fuel vapor feed hose.
- (d) Disconnect the fuel vapor feed hose No. 2.
- (e) Disconnect the 2 vacuum hoses.
- (f) Remove the clamp.
- (g) Remove the 2 nuts and the emission control valve set.

**13. REMOVE INTAKE AIR SURGE TANK**

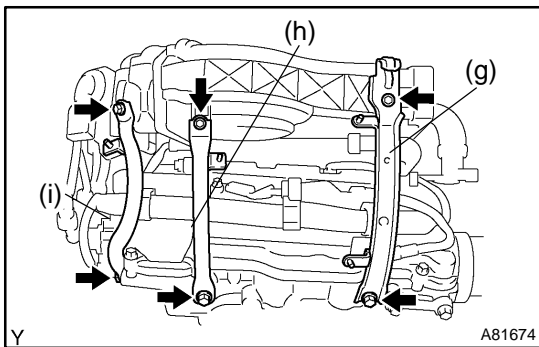
- (a) Disconnect the throttle motor connector.
- (b) Disconnect the water by-pass hose No. 3.
- (c) Disconnect the water by-pass hose No. 2.
- (d) Disconnect the union to check valve hose.



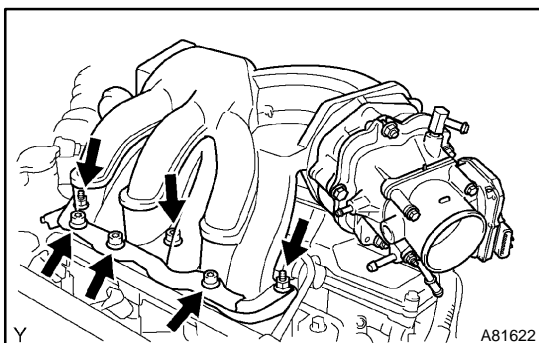
- (e) Disconnect the ventilation hose.



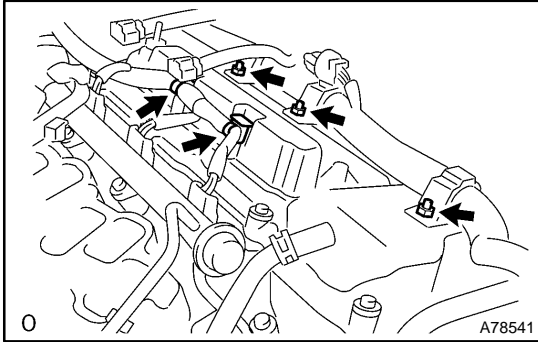
- (f) Remove the 2 set nuts of the pressure feed tube.



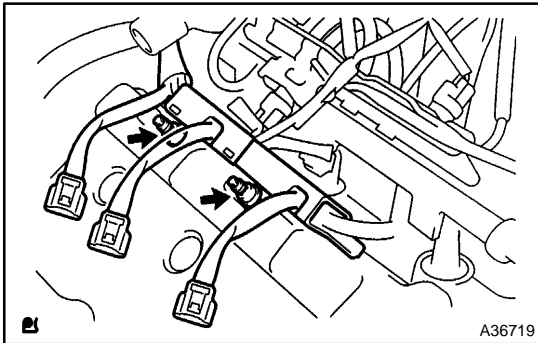
- (g) Remove the 2 bolts and the engine hanger No. 1.
- (h) Remove the 2 bolts and the surge tank stay No. 1.
- (i) Remove the 2 bolts and the surge tank stay No. 2.



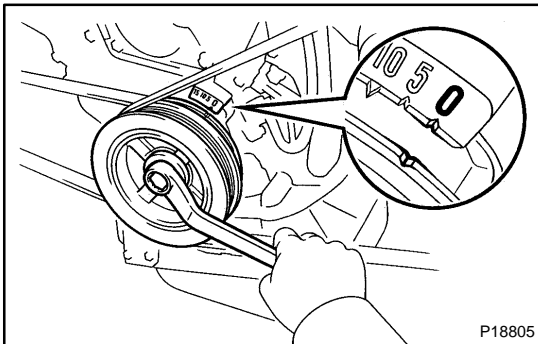
- (j) Using a socket hexagon wrench 8, remove the 4 bolts.
- (k) Remove the 2 nuts, the emission control valve bracket and the intake air surge tank.
- (l) Remove the gasket from the intake air surge tank.

**14. REMOVE RADIATOR HOSE INLET****15. REMOVE IGNITION COIL ASSY****16. REMOVE CYLINDER HEAD COVER SUB-ASSY**

- (a) Remove the 2 engine wire harness clamps.
- (b) Remove the 3 nuts and disconnect the engine wire harness.
- (c) Remove the 9 bolts and the cylinder head cover.

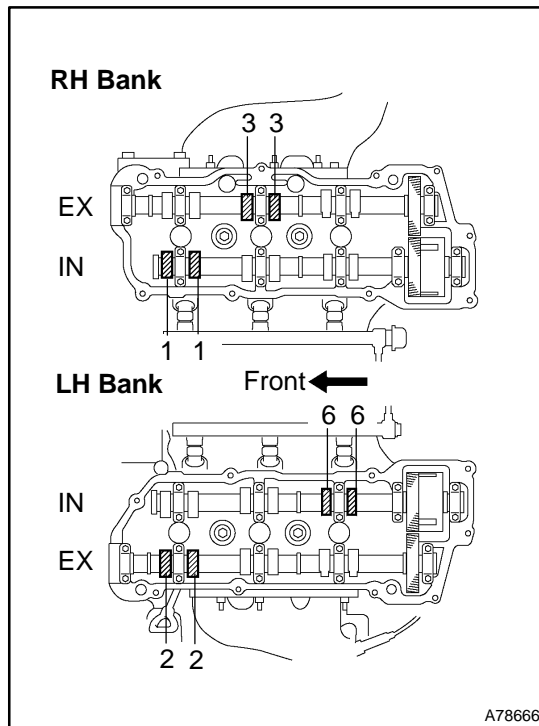
**17. REMOVE CYLINDER HEAD COVER SUB-ASSY LH**

- (a) Using an E6 torx<sup>®</sup> socket wrench, remove the 2 bolts and disconnect the engine wire harness protector.
- (b) Remove the 9 bolts and the cylinder head cover.

**18. INSPECT VALVE CLEARANCE**

- (a) Turn the crankshaft pulley, and align the timing notch with the timing mark "0" of the No. 1 timing belt cover.
- (b) Check that the valve lifters on the No. 1 (IN and EX) are both loose.

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



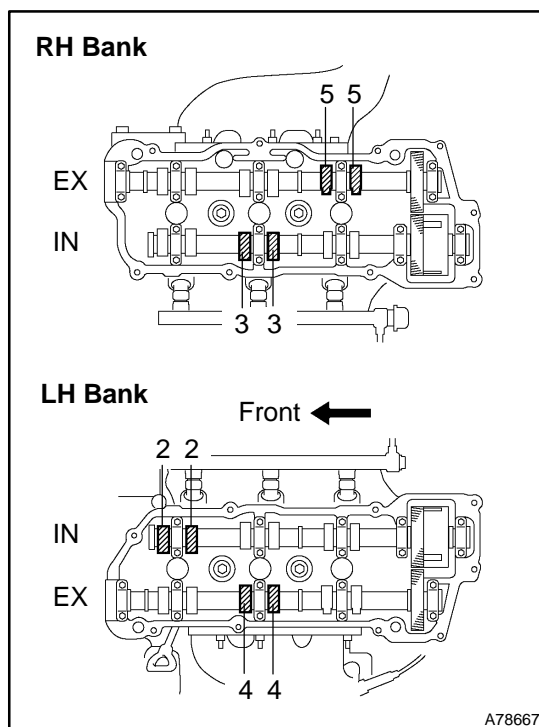
- (c) Check the valves indicated in the illustration on the left.
- (1) Using a feeler gauge, measure the clearance between the valve lifter and the camshaft.

**Valve clearance (Cold):**

**Intake 0.15 to 0.25 mm (0.006 to 0.010 in.)**

**Exhaust 0.25 to 0.35 mm (0.010 to 0.014 in.)**

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



- (d) Turn the crankshaft 2/3 of a revolution (240°), and check the valves indicated in the illustration on the left.

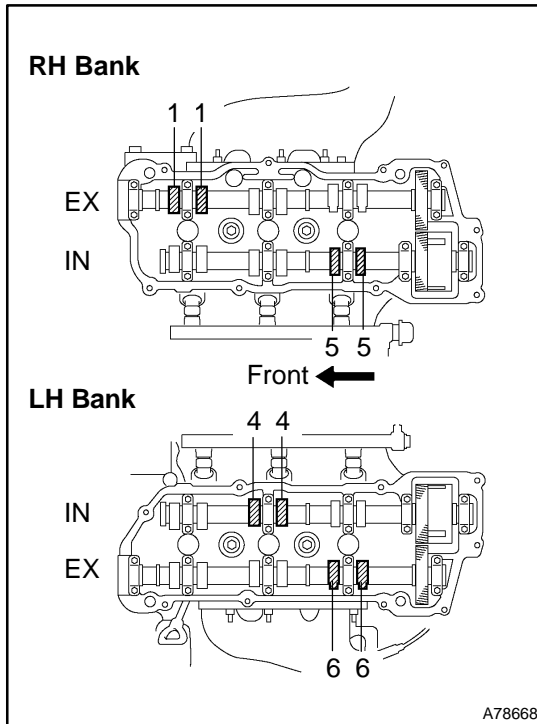
- (1) Using a feeler gauge, measure the clearance between the valve lifter and the camshaft.

**Valve clearance (Cold):**

**Intake 0.15 to 0.25 mm (0.006 to 0.010 in.)**

**Exhaust 0.25 to 0.35 mm (0.010 to 0.014 in.)**

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



- (e) Turn the crankshaft 2/3 of a revolution (240°), and check the valves indicated in the illustration on the left.

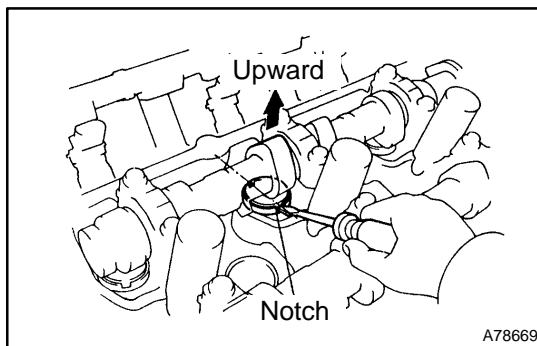
- (1) Using a feeler gauge, measure the clearance between the valve lifter and the camshaft.

**Valve clearance (Cold):**

**Intake 0.15 to 0.25 mm (0.006 to 0.010 in.)**

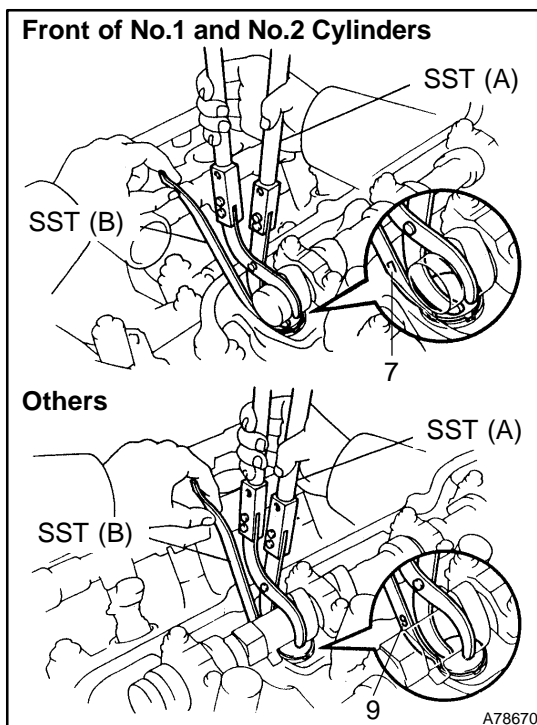
**Exhaust 0.25 to 0.35 mm (0.010 to 0.014 in.)**

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



**19. ADJUST VALVE CLEARANCE**

- (a) Turn the camshaft so that the cam lobe is facing upward.
- (b) Turn the valve lifter with a screwdriver so that the notches are perpendicular to the camshaft.



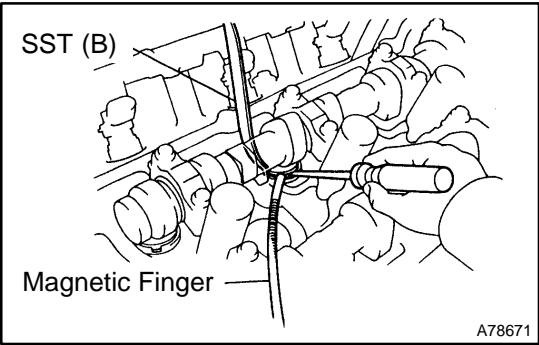
- (c) Using SST (A), press down the valve lifter and place SST (B) between the camshaft and valve lifter. Remove SST (A).

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

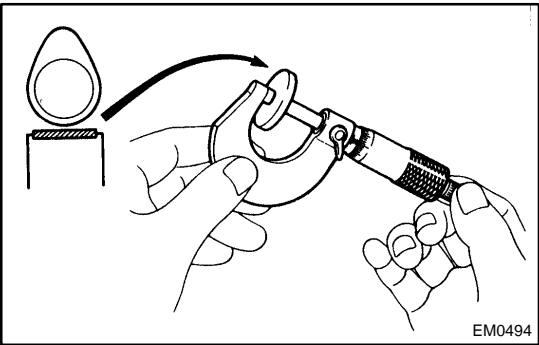
**HINT:**

- Apply SST (B) at a slight angle on the side marked with "9" or "7", at the position shown in the illustration.
- When SST (B) is inserted too deeply, it will get pinched by the shim. To prevent it from being stuck, insert it gently from the intake side, at a slight angle.

SST (A)	09248-05410
SST (B)	09248-05420



(d) Using a small screwdriver and magnetic finger, remove the adjusting shim.



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

A	Thickness of new shim
B	Thickness of used shim
C	Measured valve clearance

**Specified value (Cold):**

**Intake  $A = B + (C - 0.20 \text{ mm (0.008 in.)})$**

**Exhaust  $A = B + (C - 0.30 \text{ mm (0.012 in.)})$**

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

**EXAMPLE: (Intake)**

Measure valve clearance = 0.45 mm (0.0177 in.)

0.45 mm (0.0177 in.) - 0.20 mm (0.0078 in.) = 0.25 mm (0.0098 in.)

(Measured - Specification = Excess clearance)

Used shim measurement = 2.80 mm (0.1102 in.)

0.25 mm (0.0098 in.) + 2.80 mm (0.1102 in.) = 3.05 mm (0.1201 in.)

(Excess clearance + Used shim = Ideal new shim)

Closest new shim = 3.05 mm (0.1201 in.) = Shim No. "12"

**HINT:**

- Shims are available in 17 sizes in increments of 0.05 mm (0.0020 in.), from 2.50 mm (0.0984 in.) to 3.30 mm (0.1299 in.).
- Refer to new shim thickness table on next 2 pages.

### Adjusting Shim Selection Chart (Intake)

[illegible]

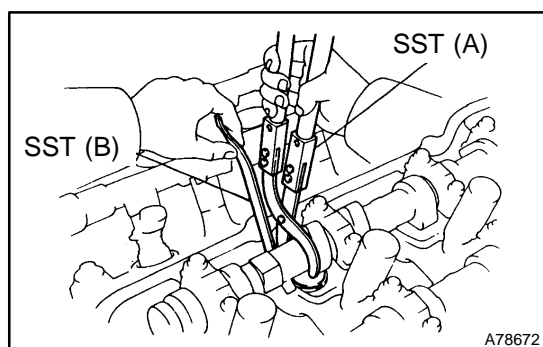
HINT: New shims have the thickness in millimeters imprinted on the face.

**Exhaust valve clearance (Cold):**  
**0.25 to 0.35 mm (0.010 to 0.014 in.)**

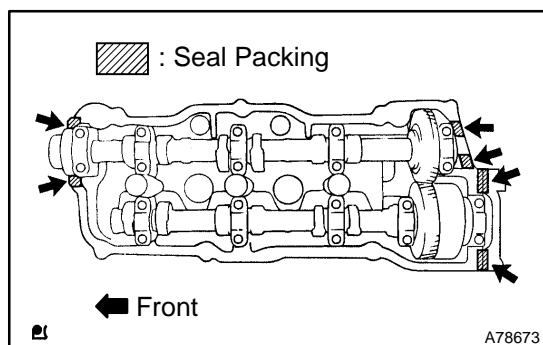
**HINT:** New shims have the thickness in millimeters imprinted on the face.

[illegible]





- (h) Place a new adjusting shim on the valve lifter, with imprinted numbers facing down.
- (i) Press down the valve lifter with SST (A), and remove SST (B).  
SST 09248-55040 (09248-05410, 09248-05420)
- (j) Recheck the valve clearance.



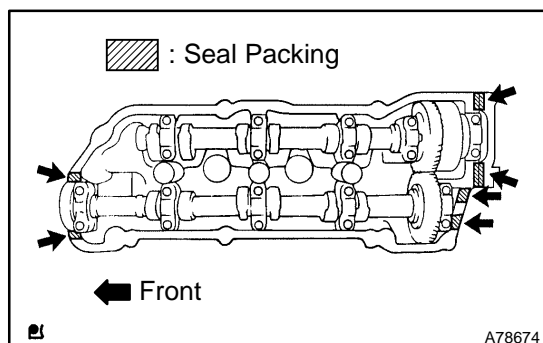
## 20. INSTALL CYLINDER HEAD COVER SUB-ASSY

- (a) Apply seal packing to the cylinder head as shown in the illustration.

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

### NOTICE:

- Remove any oil from the contact surface.
  - Install the cylinder head cover within 3 minutes after applying seal packing.
  - Do not start the engine within 2 hours after installing.
- (b) Install the cylinder head cover with the 9 bolts. Tighten the bolt uniformly in several steps.  
**Torque: 8.0 N·m (80 kgf·cm, 71 in·lbf)**
  - (c) Install the engine wire harness with the 3 nuts.  
**Torque: 8.4 N·m (85 kgf·cm, 74 in·lbf)**



## 21. INSTALL CYLINDER HEAD COVER SUB-ASSY LH

- (a) Apply seal packing to the cylinder head as shown in the illustration.

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

### NOTICE:

- Remove any oil from the contact surface.
  - Install the cylinder head cover within 3 minutes after applying seal packing.
  - Do not start the engine within 2 hours after installing.
- (b) Install the cylinder head cover with the 9 bolts. Tighten the bolt uniformly in several steps.  
**Torque: 8.0 N·m (80 kgf·cm, 71 in·lbf)**
  - (c) Using an E6 torx® socket wrench, install the engine wire harness protector with the 2 bolts.  
**Torque: 8.4 N·m (85 kgf·cm, 74 in·lbf)**

## 22. INSTALL IGNITION COIL ASSY

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

## 23. INSTALL INTAKE AIR SURGE TANK

- (a) Install a new gasket to the intake air surge tank.
- (b) Install the intake air surge tank and the emission control valve bracket with the 2 nuts.  
**Torque: 28 N·m (286 kgf·cm, 21 ft·lbf)**
- (c) Using a socket hexagon wrench 8, tighten the 4 bolts.  
**Torque: 28 N·m (286 kgf·cm, 21 ft·lbf)**
- (d) Install the surge tank stay No. 2 with the 2 bolts.  
**Torque: 20 N·m (199 kgf·cm, 14 ft·lbf)**

- (e) Install the surge tank stay No. 1 with the 2 bolts.

**Torque: 20 N·m (199 kgf·cm, 14 ft·lbf)**

- (f) Install the engine hunger No. 1 with the 2 bolts.

**Torque: 20 N·m (199 kgf·cm, 14 ft·lbf)**

- (g) Install the pressure feed tube with the 2 nuts.

**Torque: 7.8 N·m (80 kgf·cm, 69 in·lbf)**

- (h) Connect the ventilation hose.

- (i) Connect the union to check valve hose.

- (j) Connect the water by-pass hose No. 2.

- (k) Connect the water by-pass hose No. 3.

- (l) Connect the throttle motor connector.

**24. INSTALL EMISSION CONTROL VALVE SET**

**Torque: 8.0 N·m (82 kgf·cm, 71 in·lbf)**

**25. INSTALL AIR CLEANER CAP SUB-ASSY (See page 10-7 )**

**26. CONNECT VACUUM HOSE (See page 14-33 )**

**27. INSTALL V-BANK COVER SUB-ASSY**

- (a) Fit the 2 retainers and install the V-bank cover.

- (b) Using a socket hexagon wrench 5, tighten the 3 nuts.

**Torque: 7.9 N·m (81 kgf·cm, 70 in·lbf)**

**28. INSTALL COWL TOP PANEL SUB-ASSY OUTER FRONT (See page 11-13 )**

**29. INSTALL COWL TOP TO COWL BRACE INNER NO.1 (See page 11-13 )**

**30. INSTALL WIPER LINK ASSY (See page 66-8 )**

**31. INSTALL FR WIPER ARM LH (See page 66-8 )**

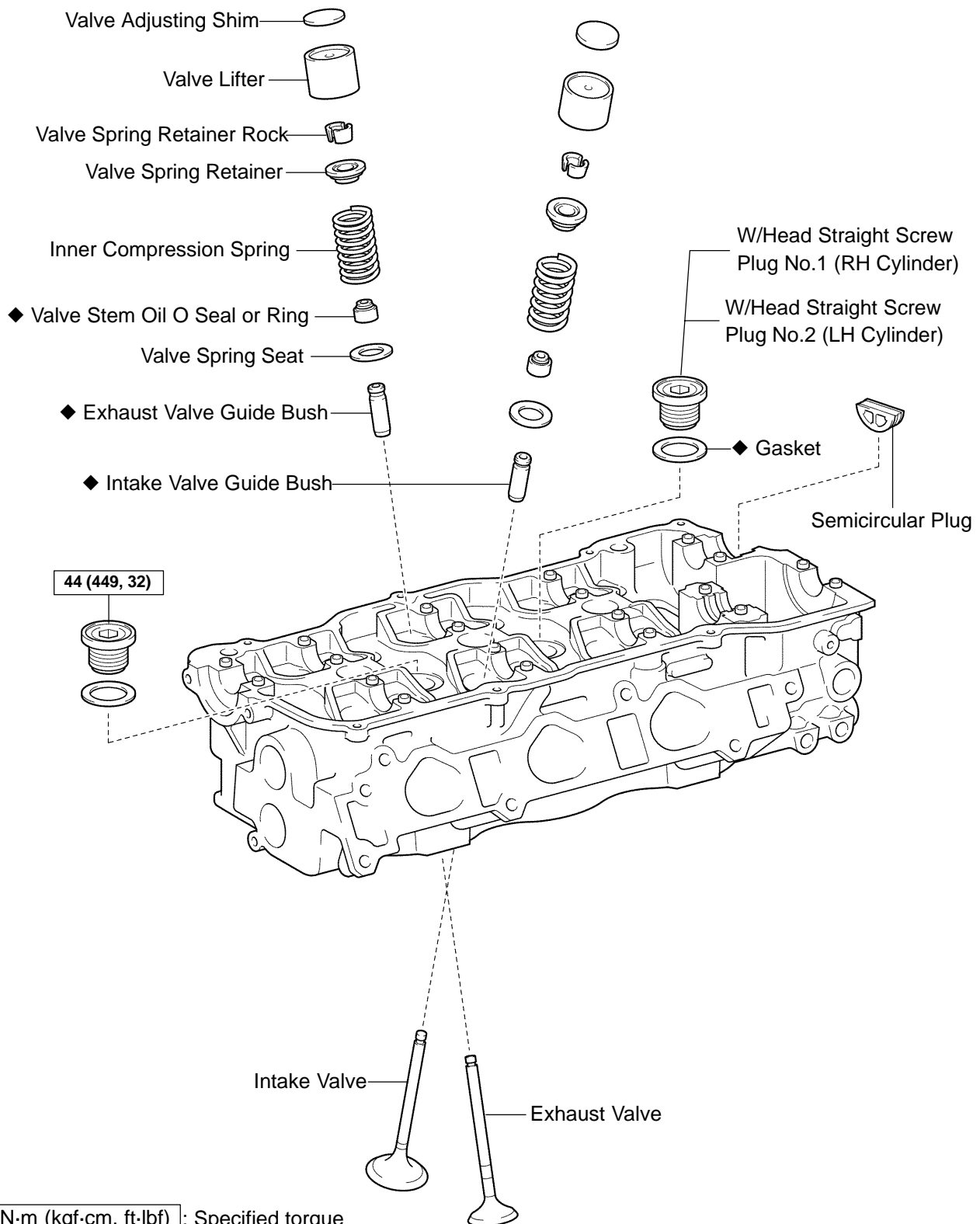
**32. INSTALL FR WIPER ARM RH (See page 66-8 )**

**33. ADD COOLANT (See page 66-8 )**

**34. CHECK FOR ENGINE COOLANT LEAKS (See page 66-8 )**

# CYLINDER HEAD ASSY COMPONENTS

141AZ-01

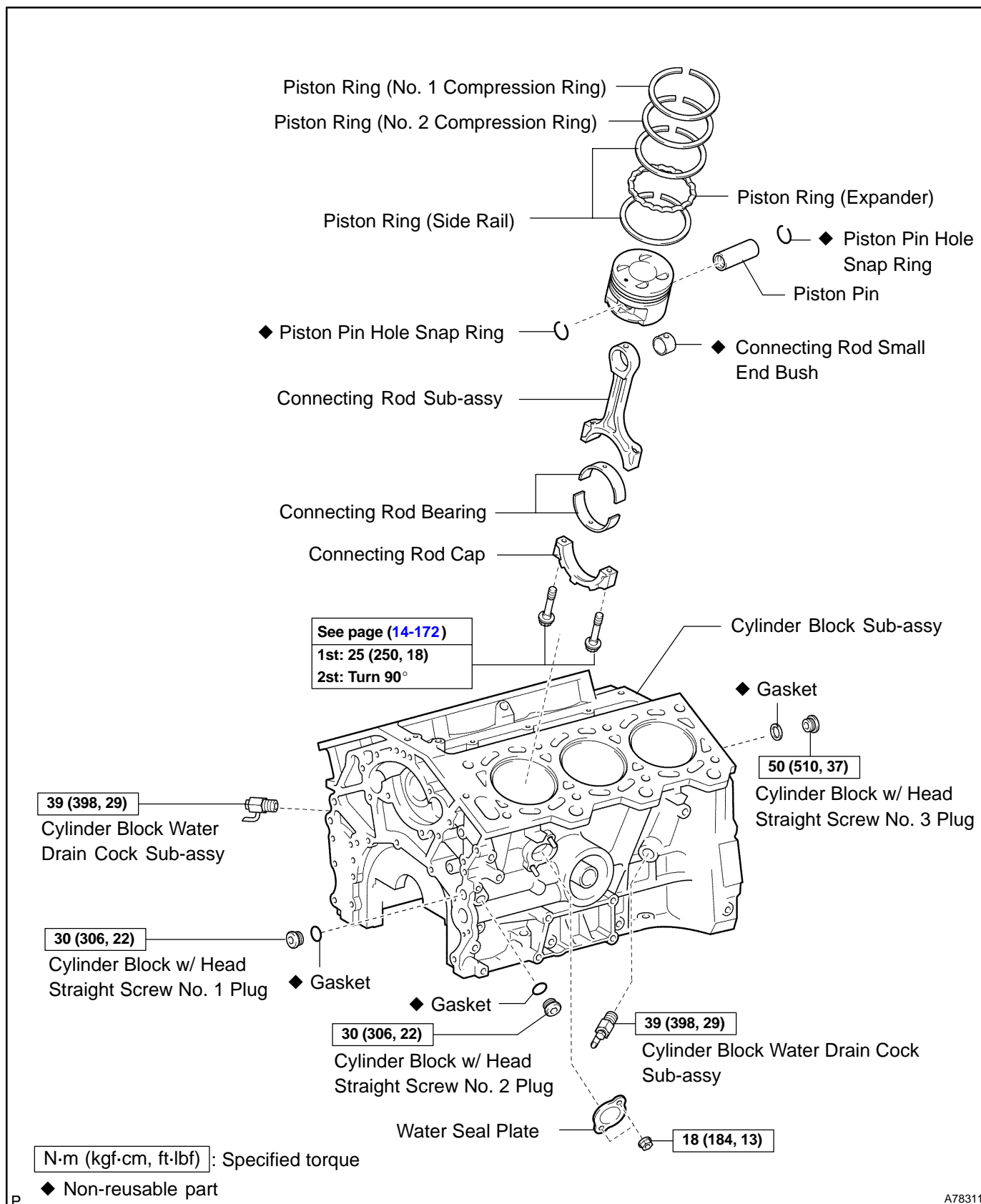


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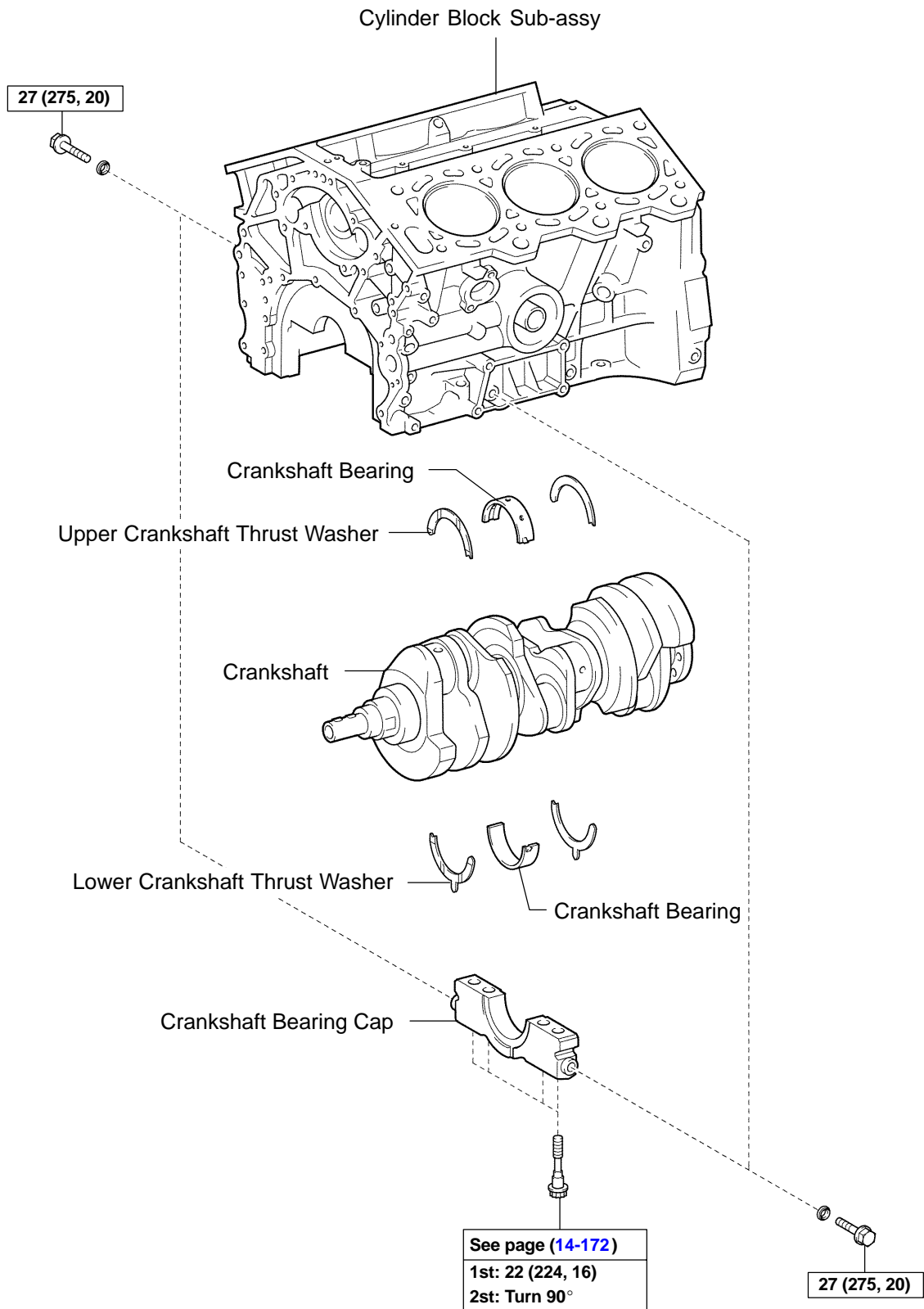
A78310

# CYLINDER BLOCK ASSY COMPONENTS

141B0-01



A78311



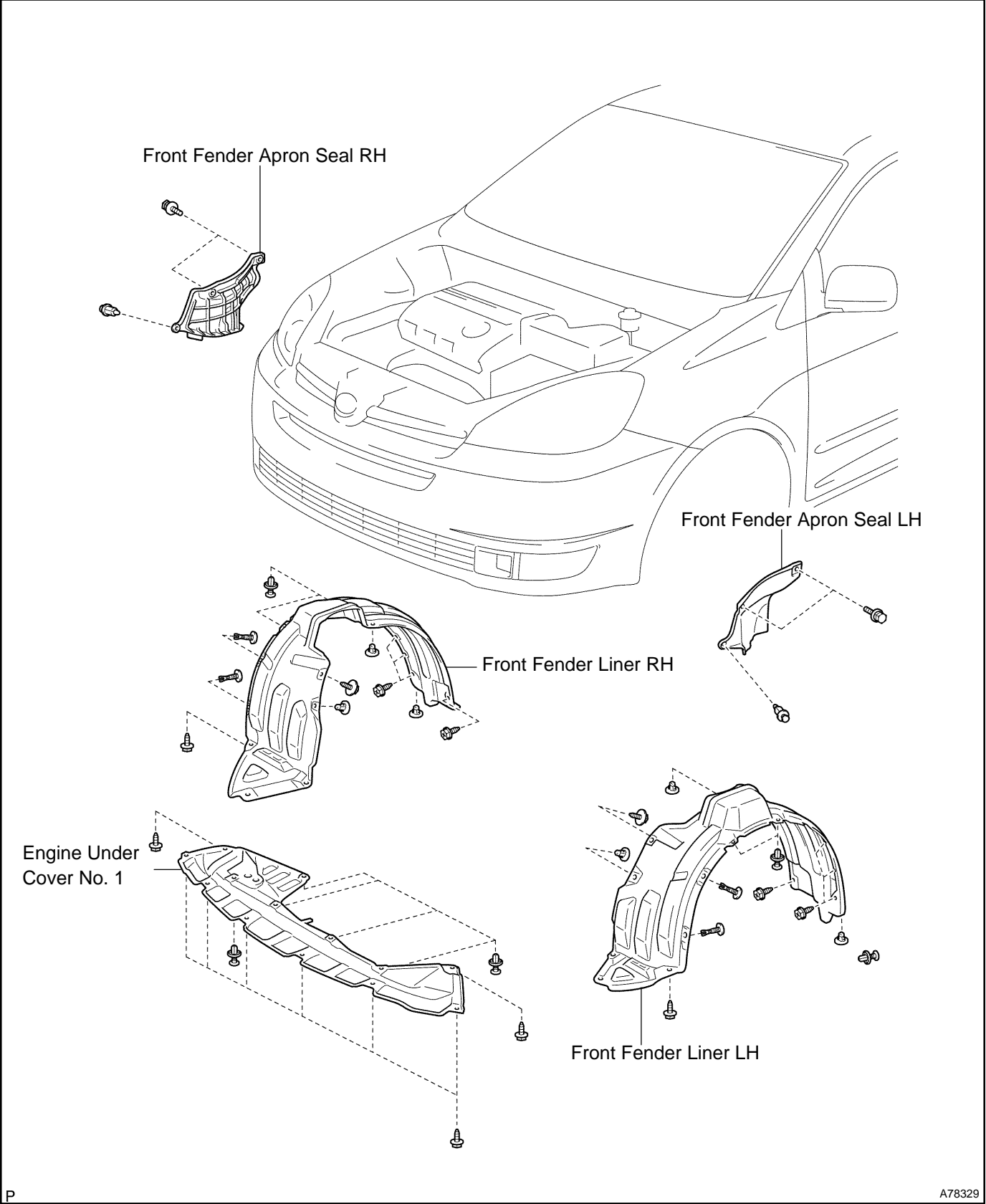
P N·m (kgf·cm, ft·lbf): Specified torque

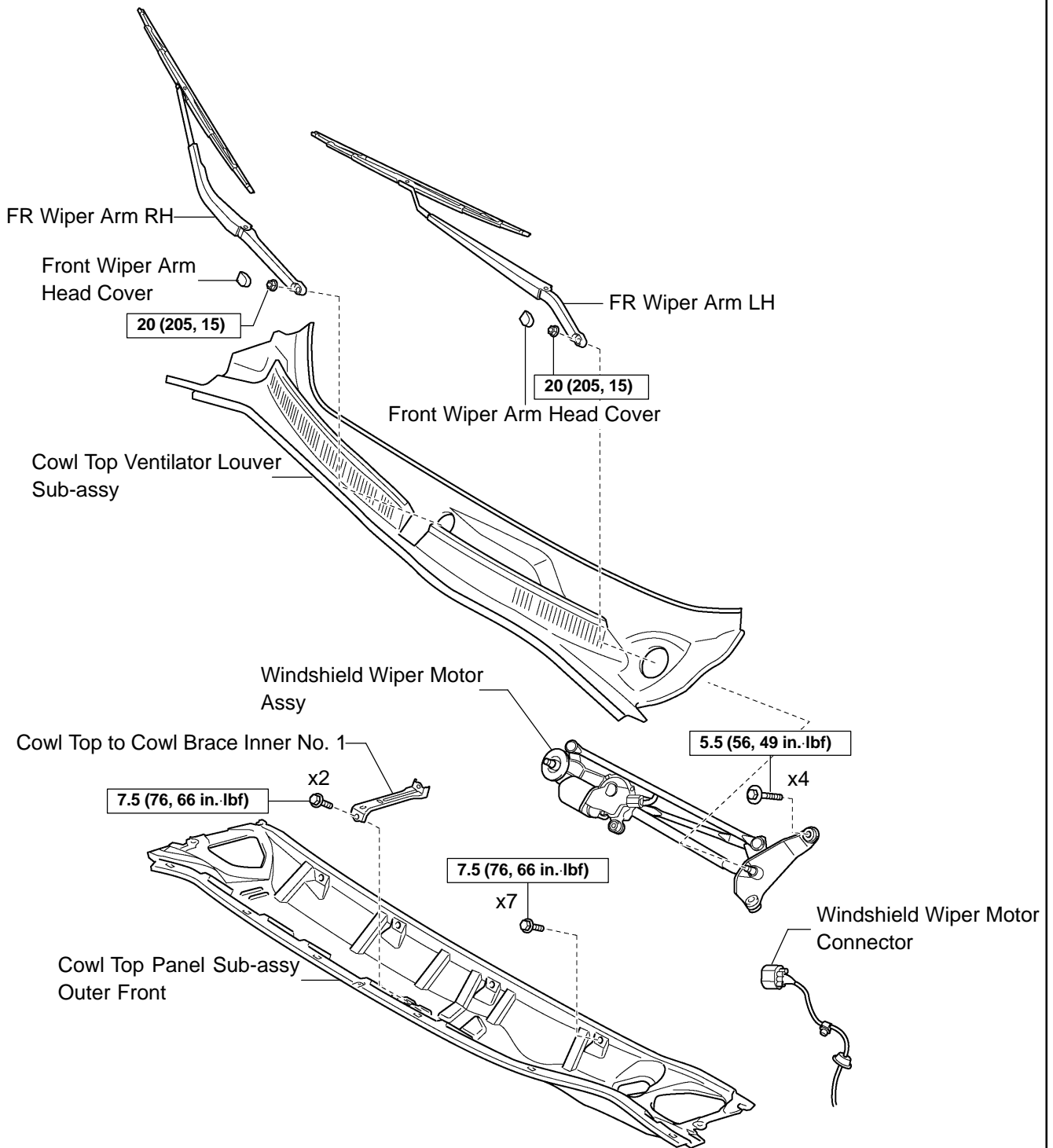
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# PARTIAL ENGINE ASSY

## COMPONENTS

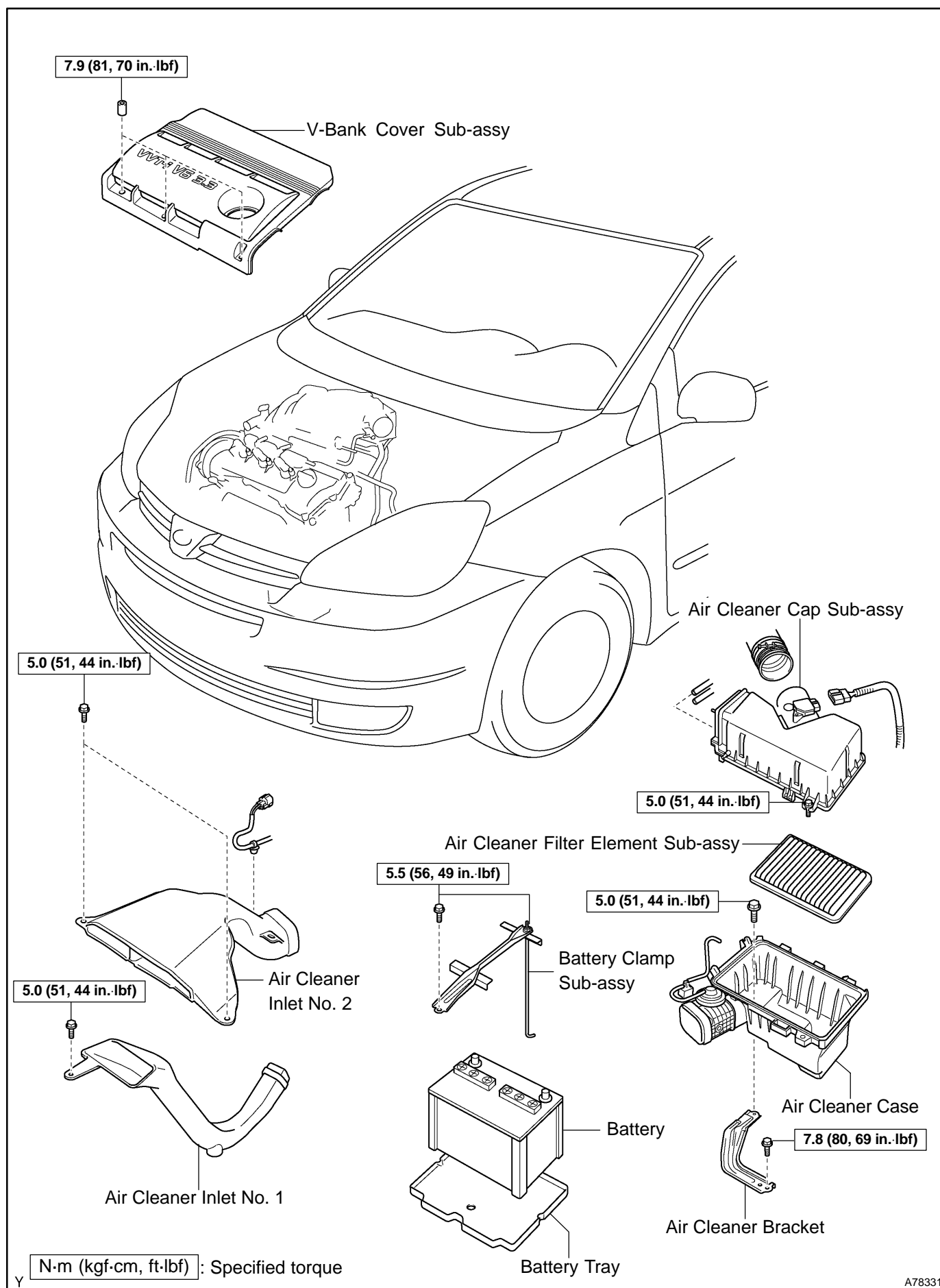
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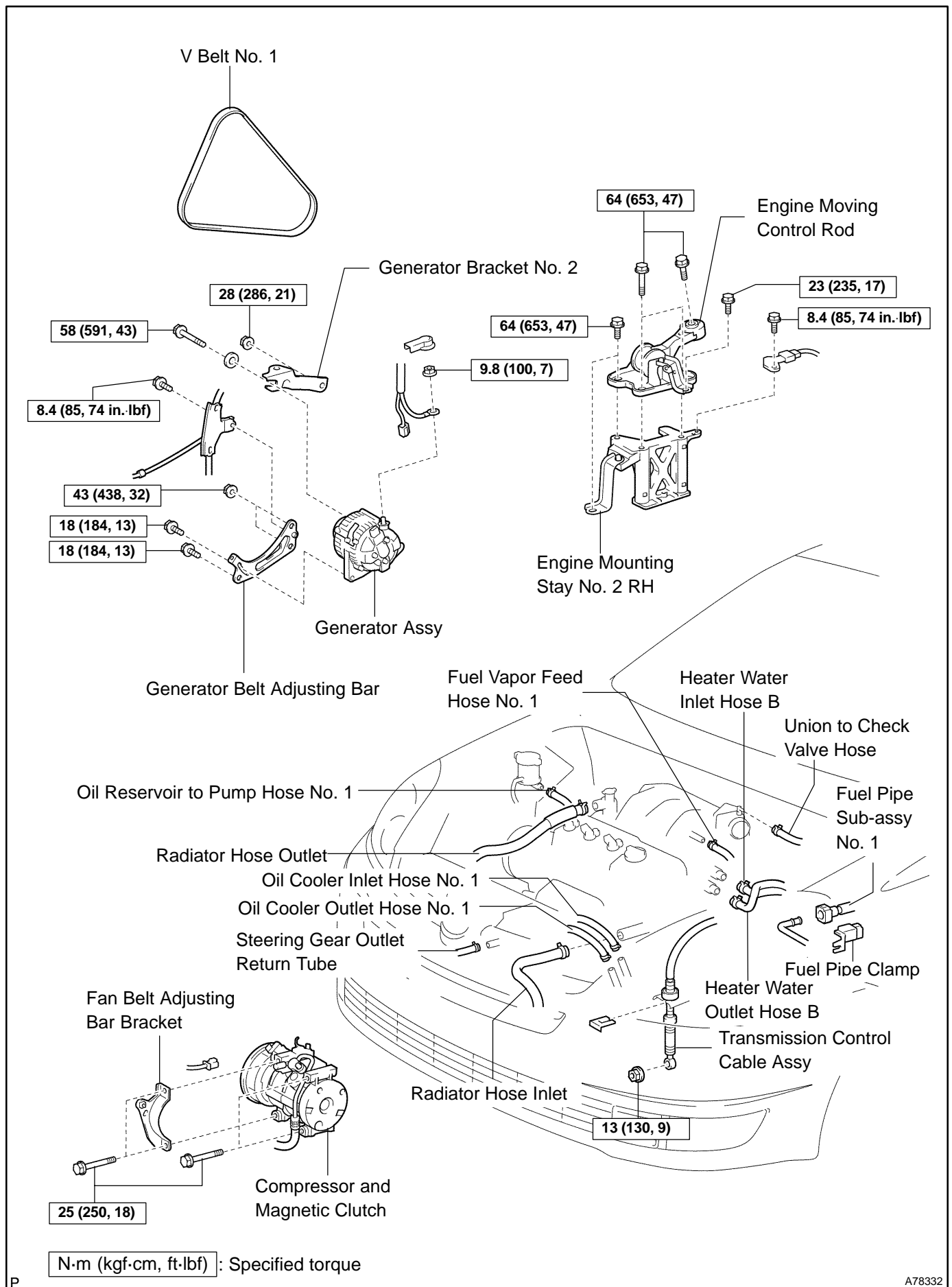
N·m (kgf·cm, ft·lbf) : Specified torque

A79467



A78331

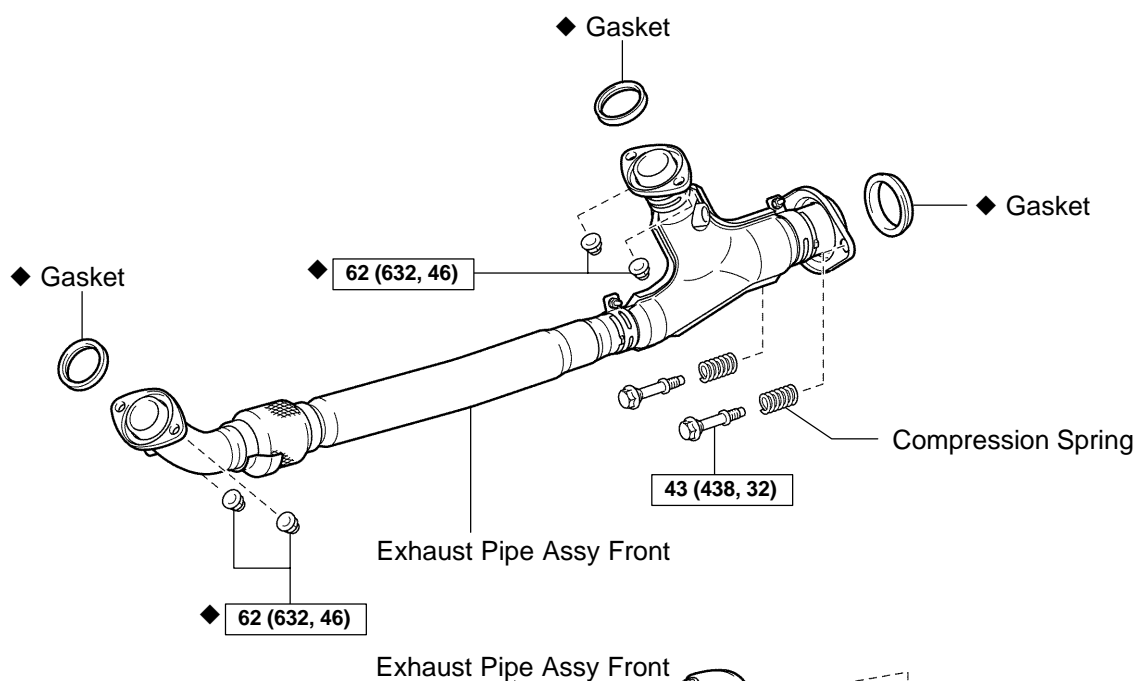




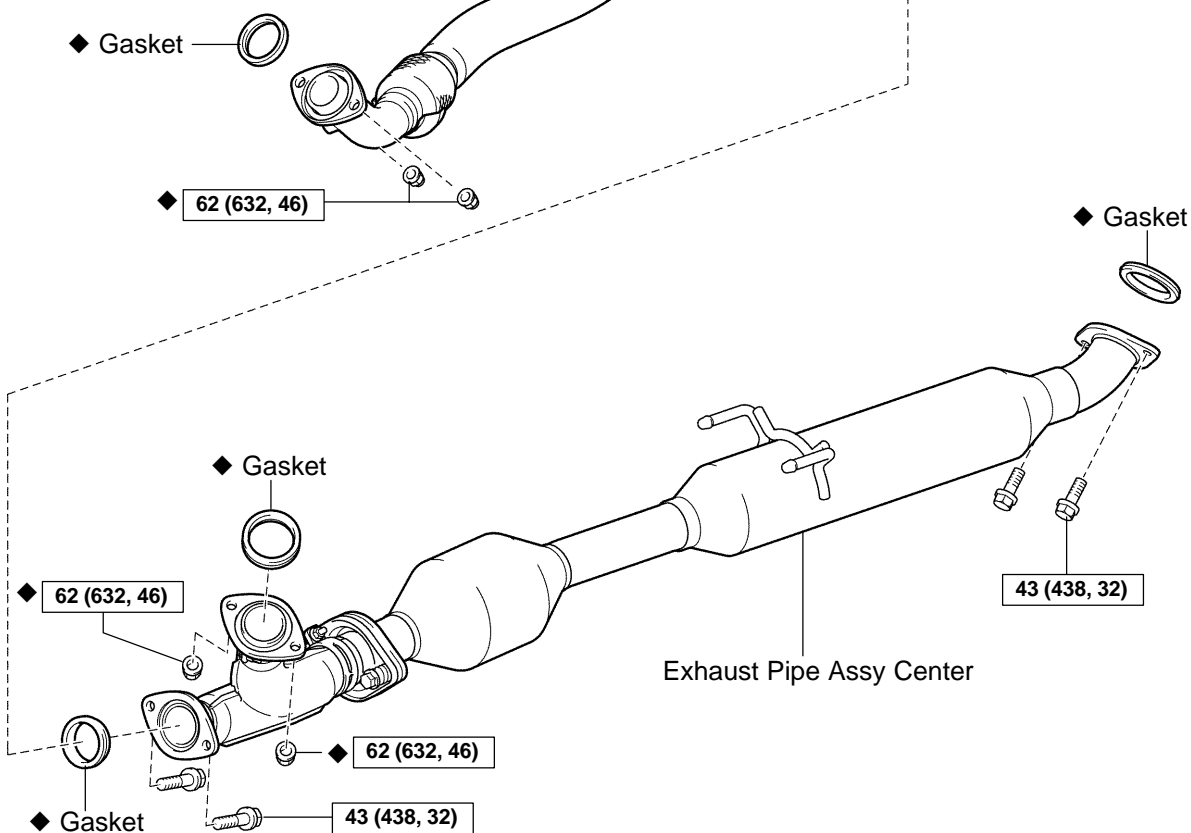
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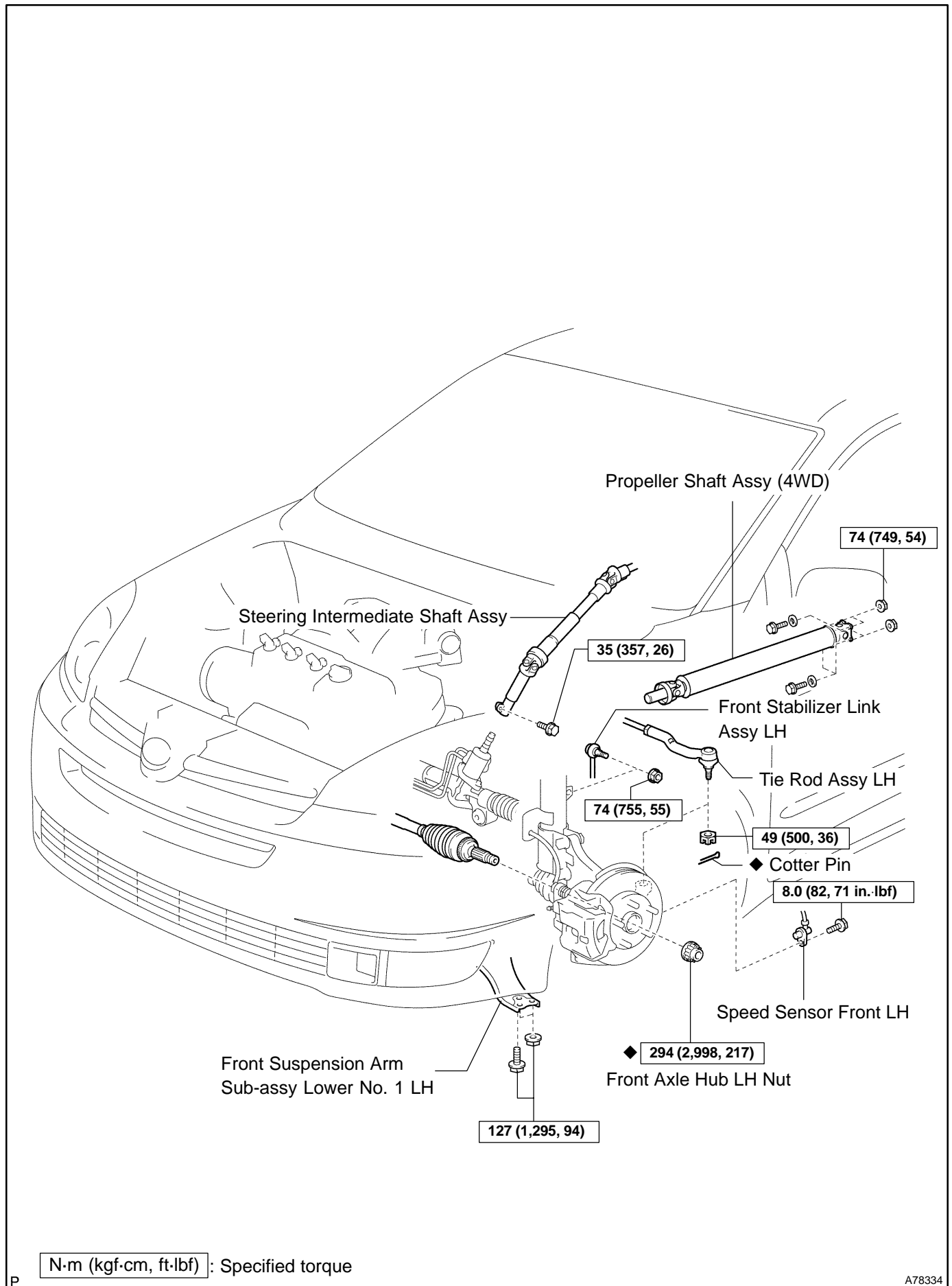
4WD:



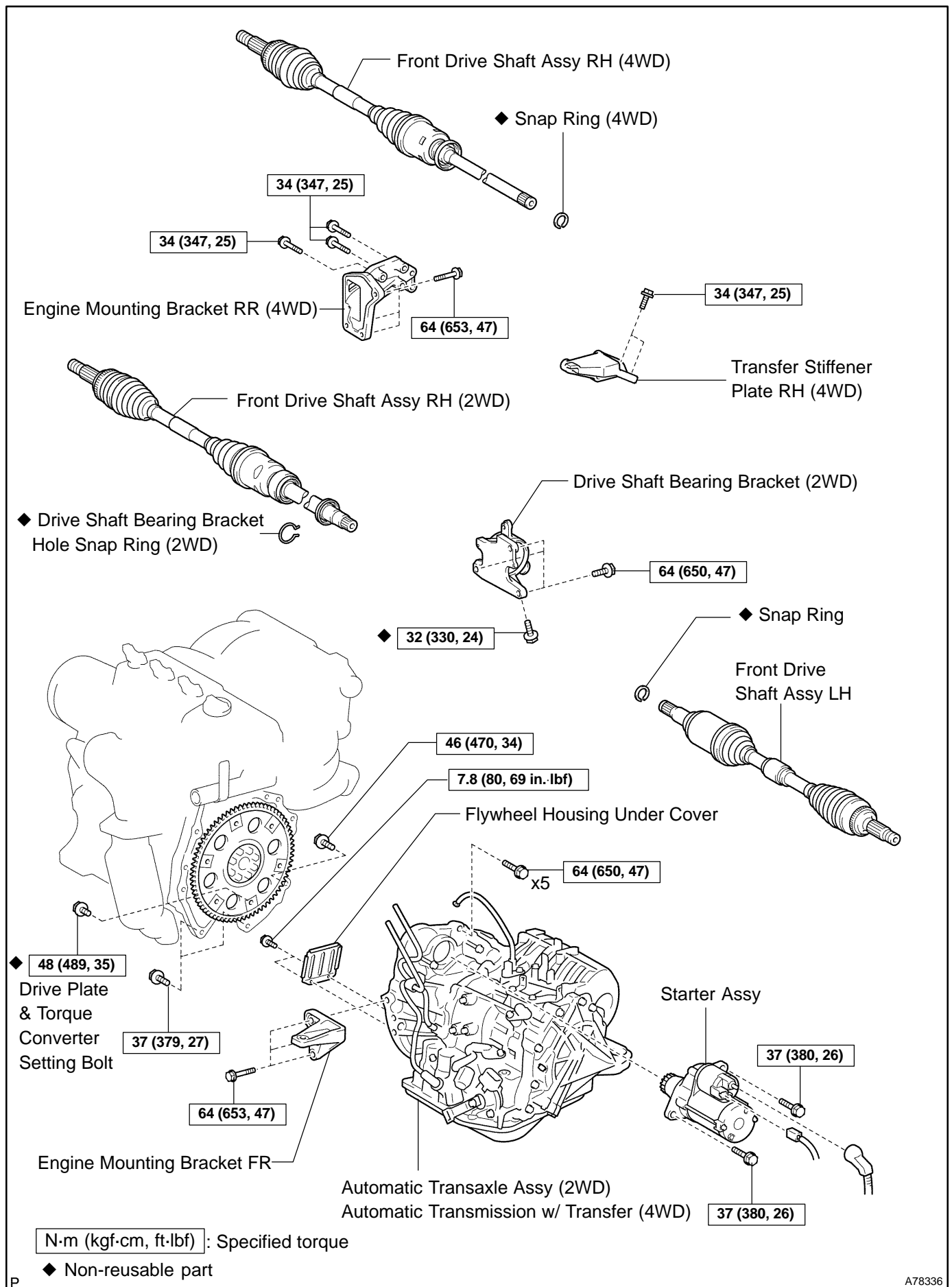
N·m (kgf·cm, ft·lbf) : Specified torque ◆ Non-reusable part

P

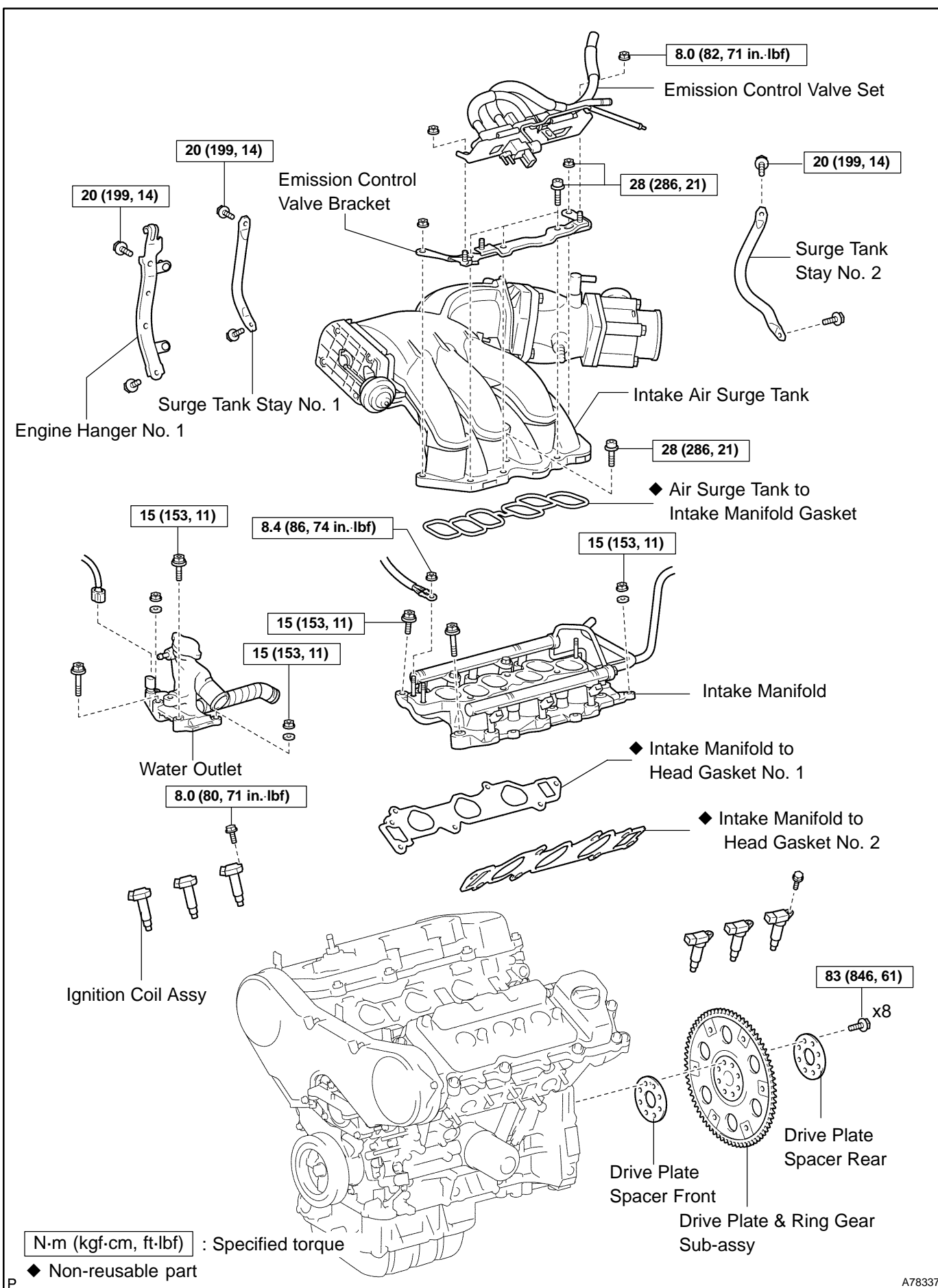
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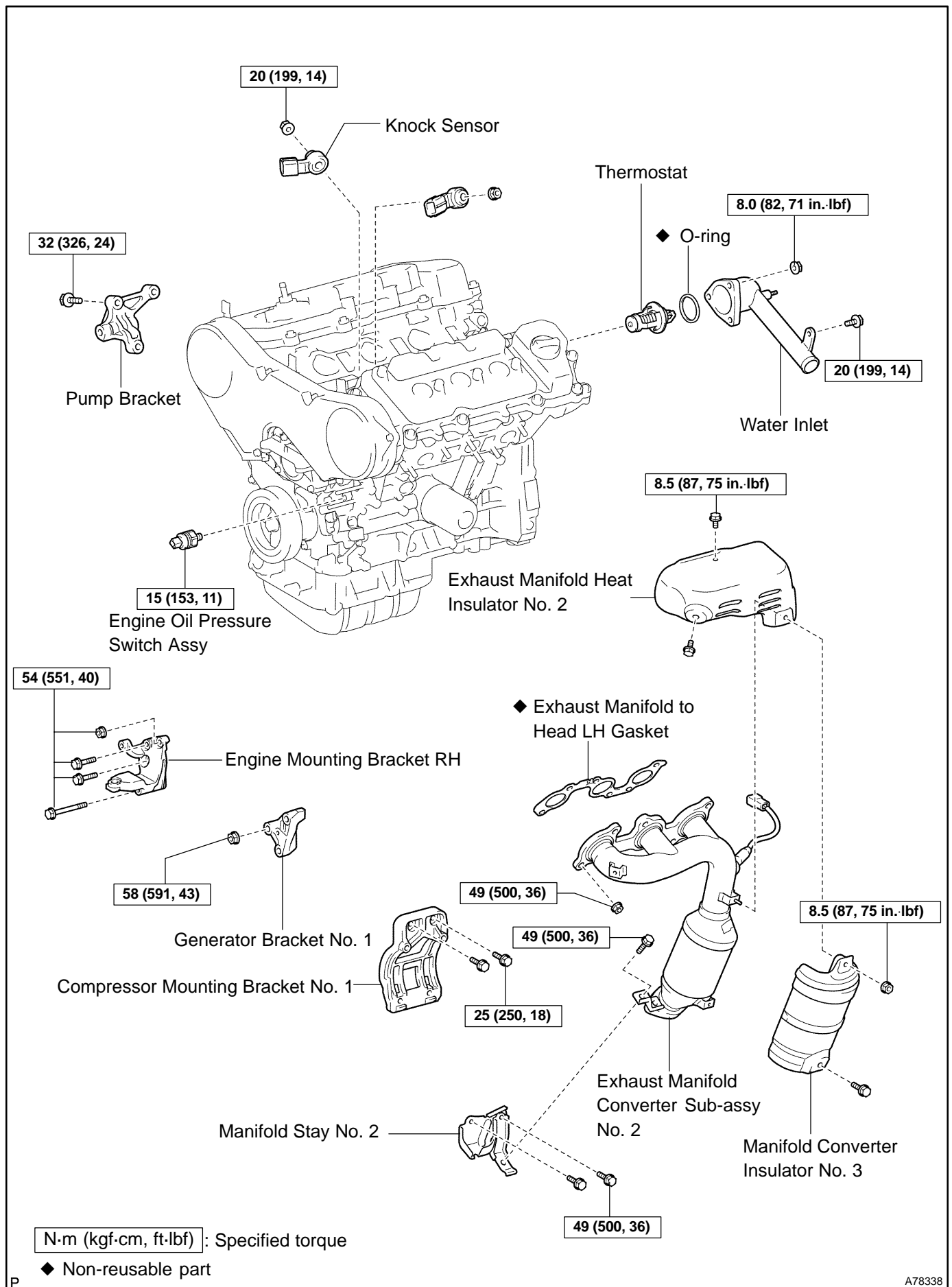




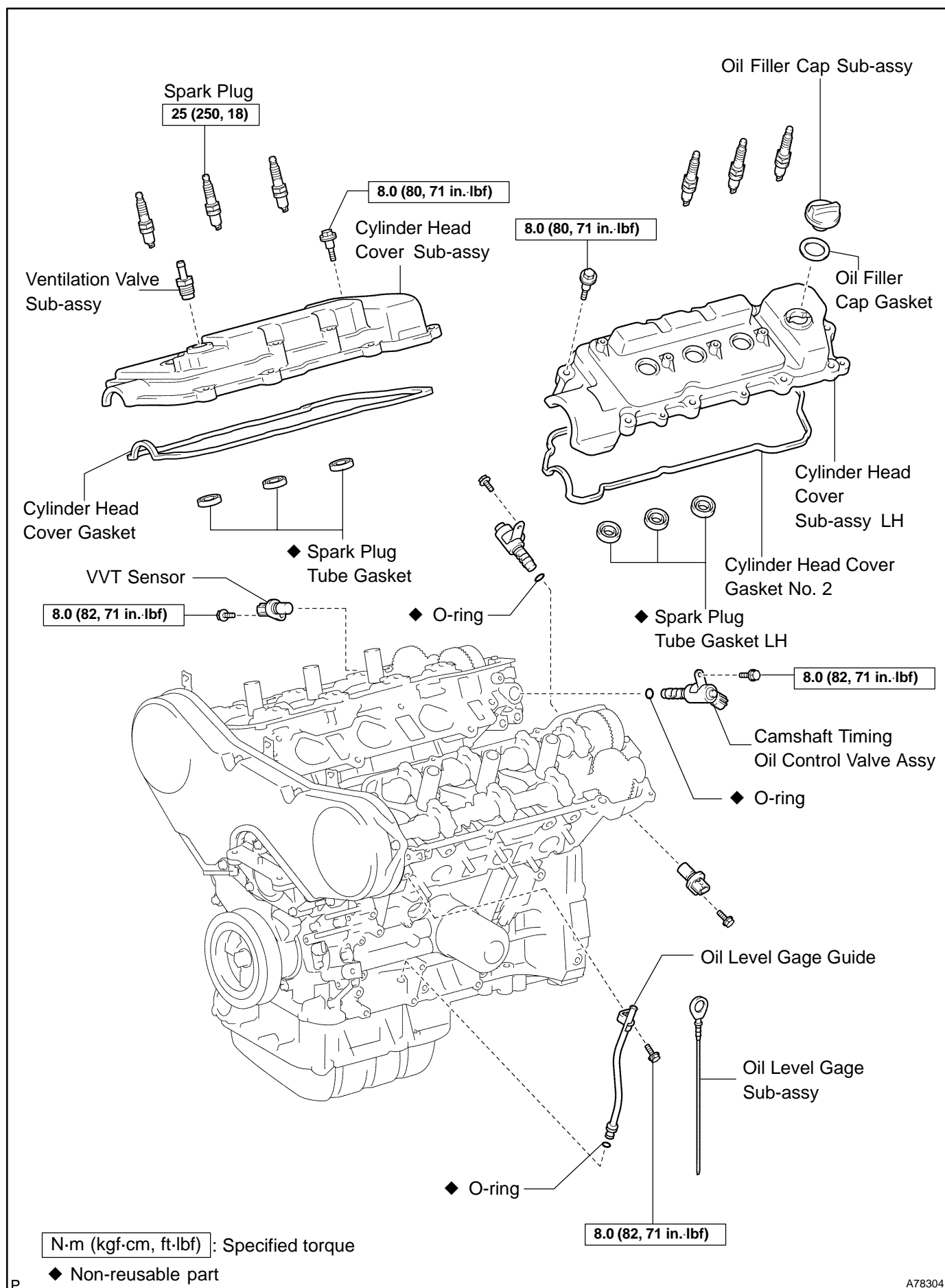
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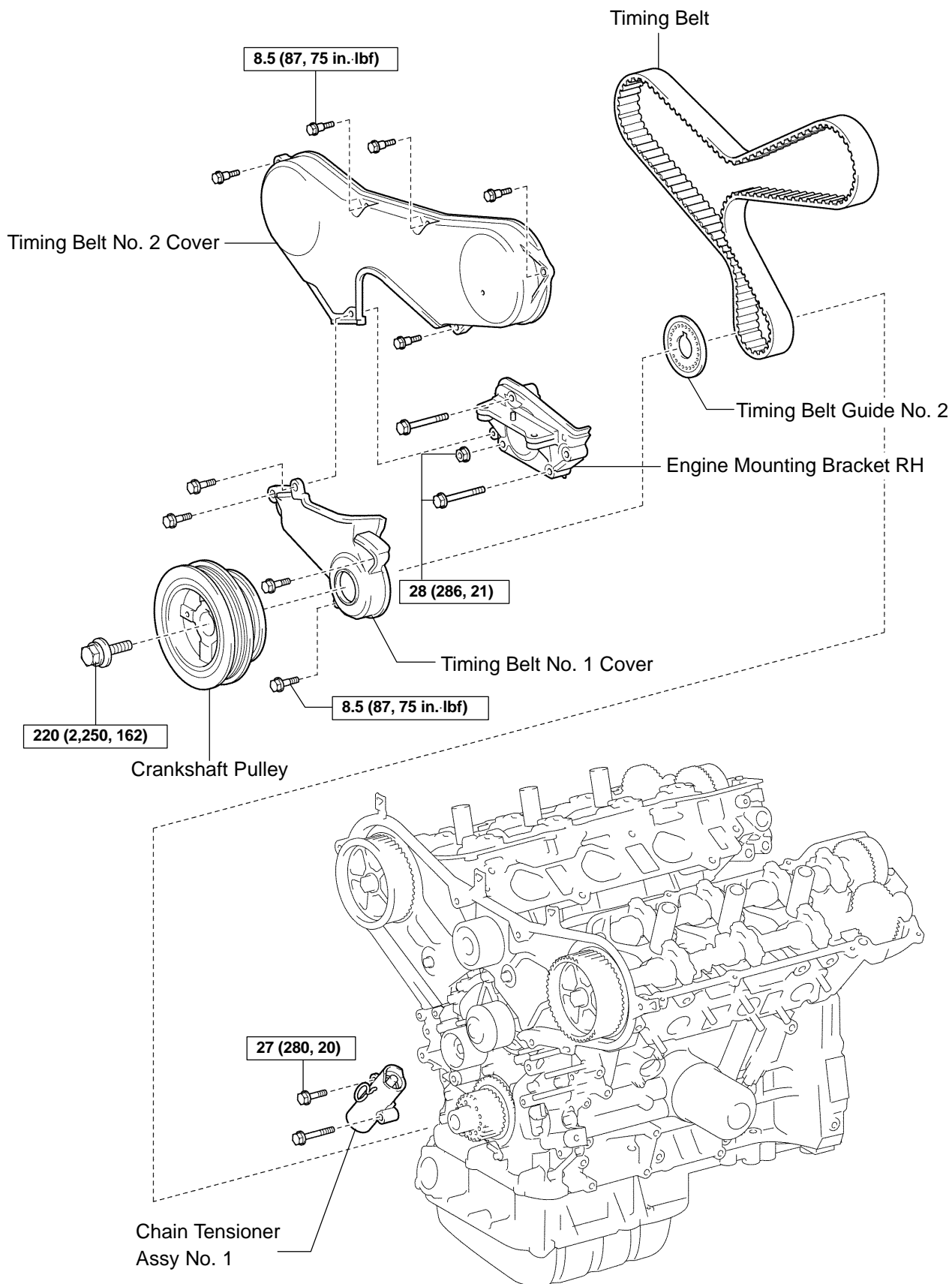


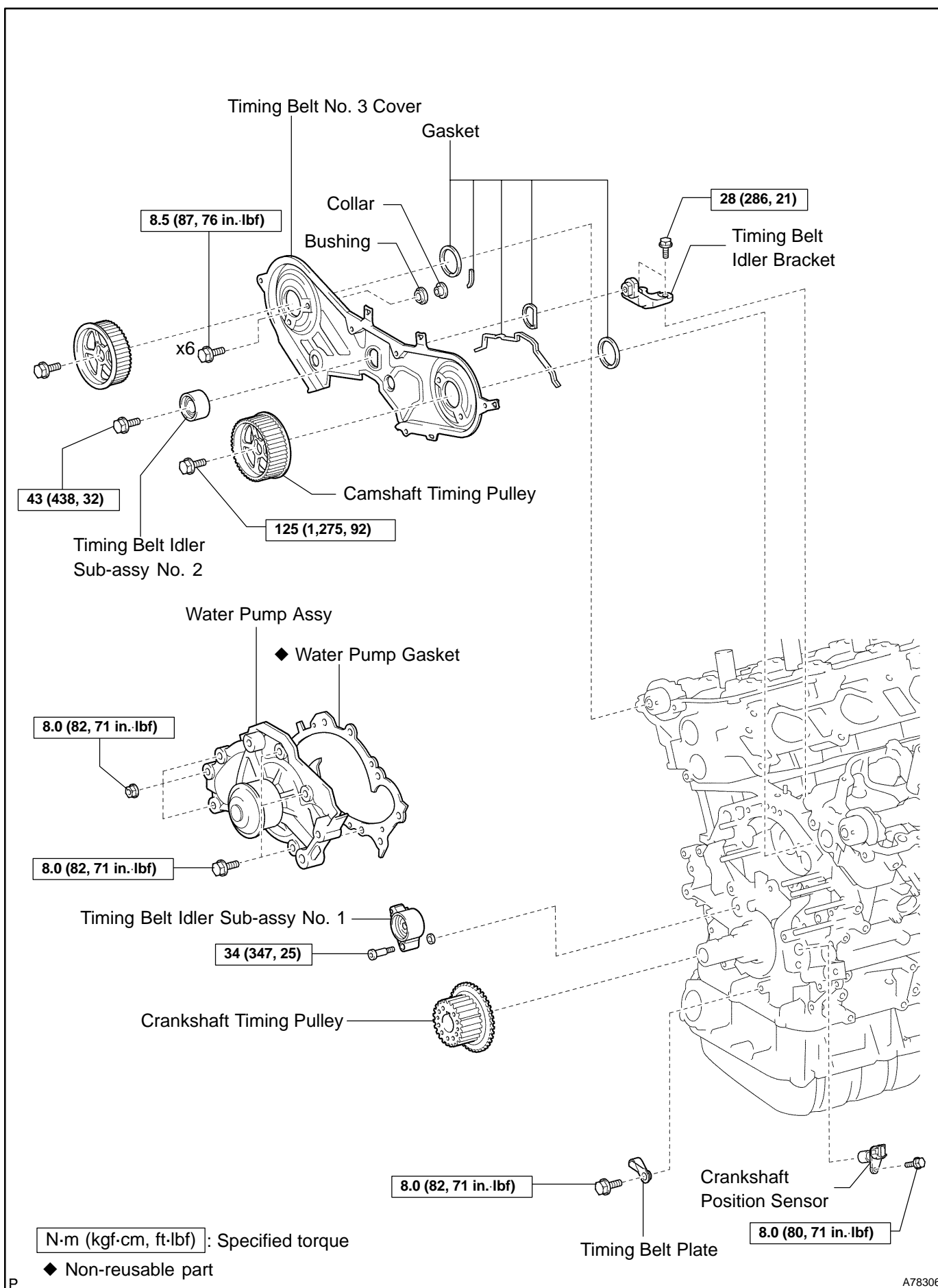
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A78304



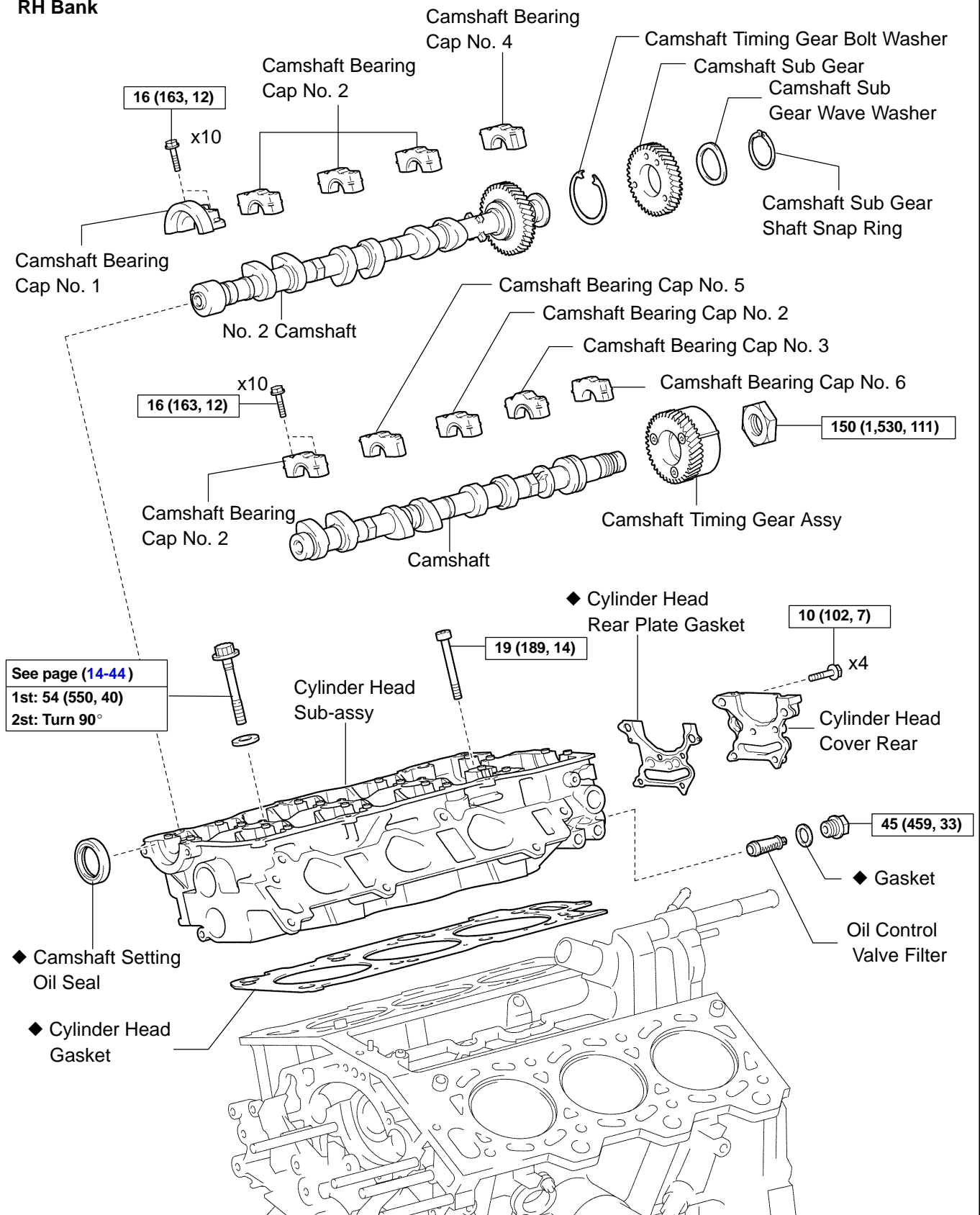




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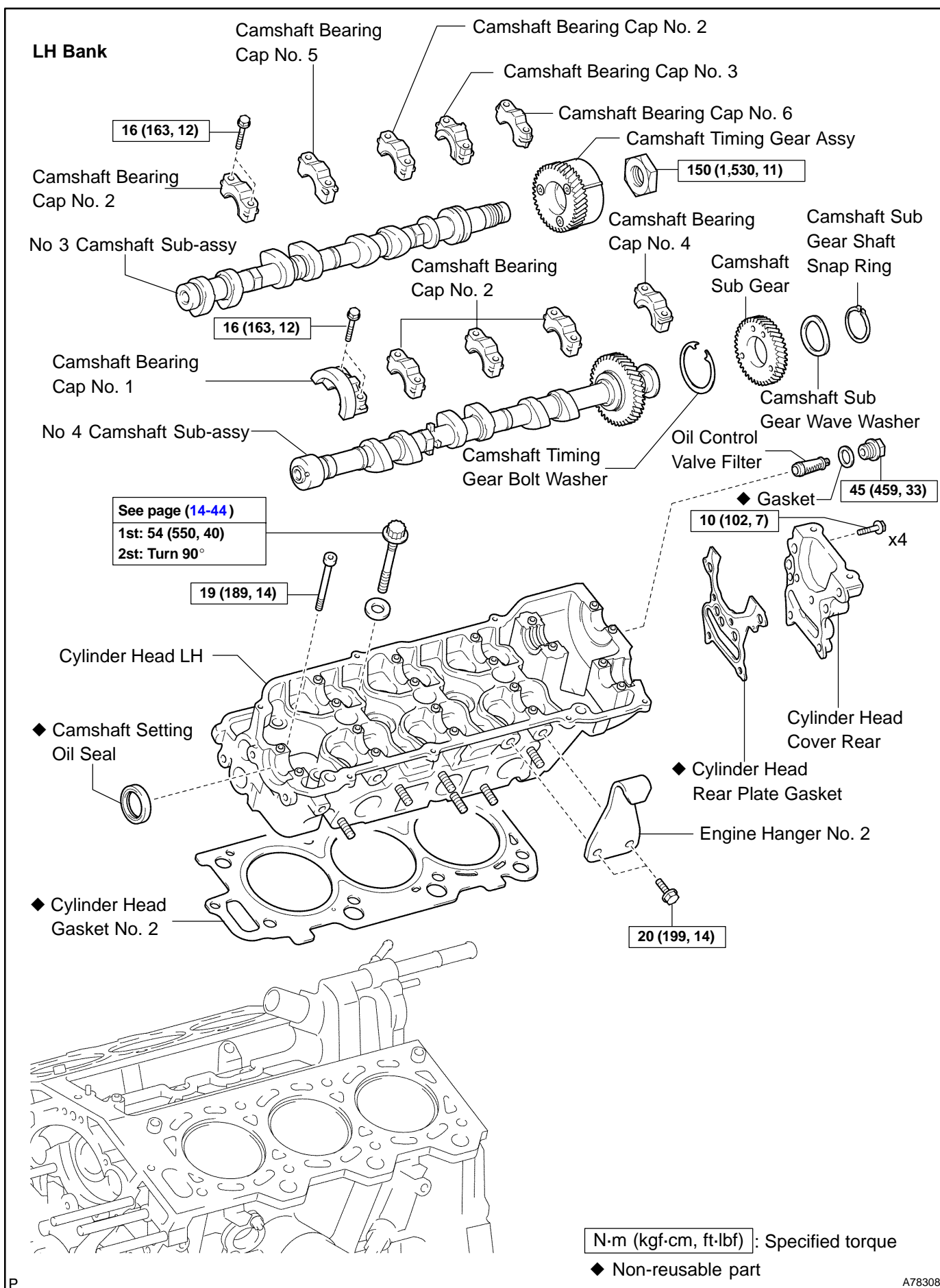
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## RH Bank

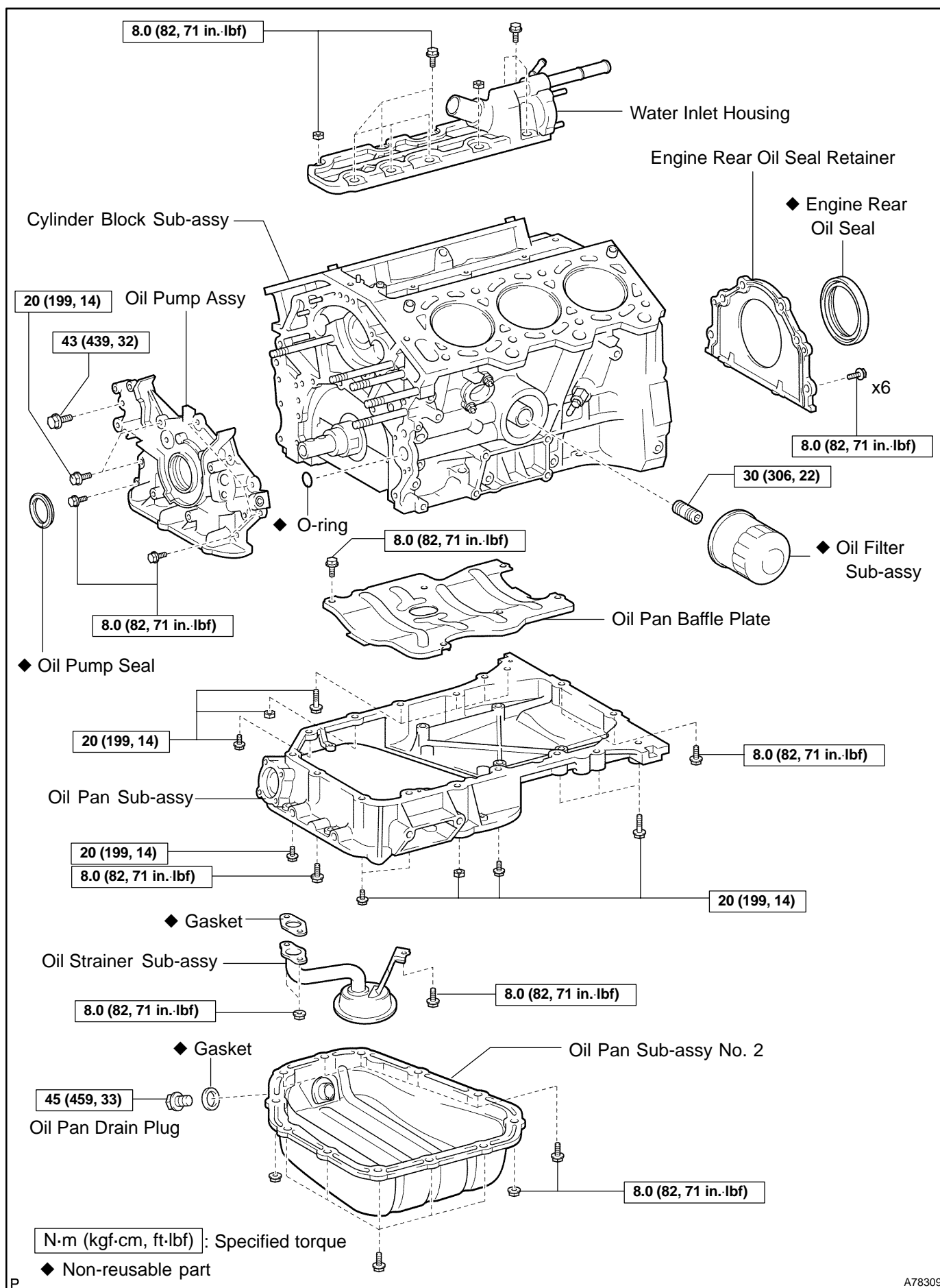


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A78308

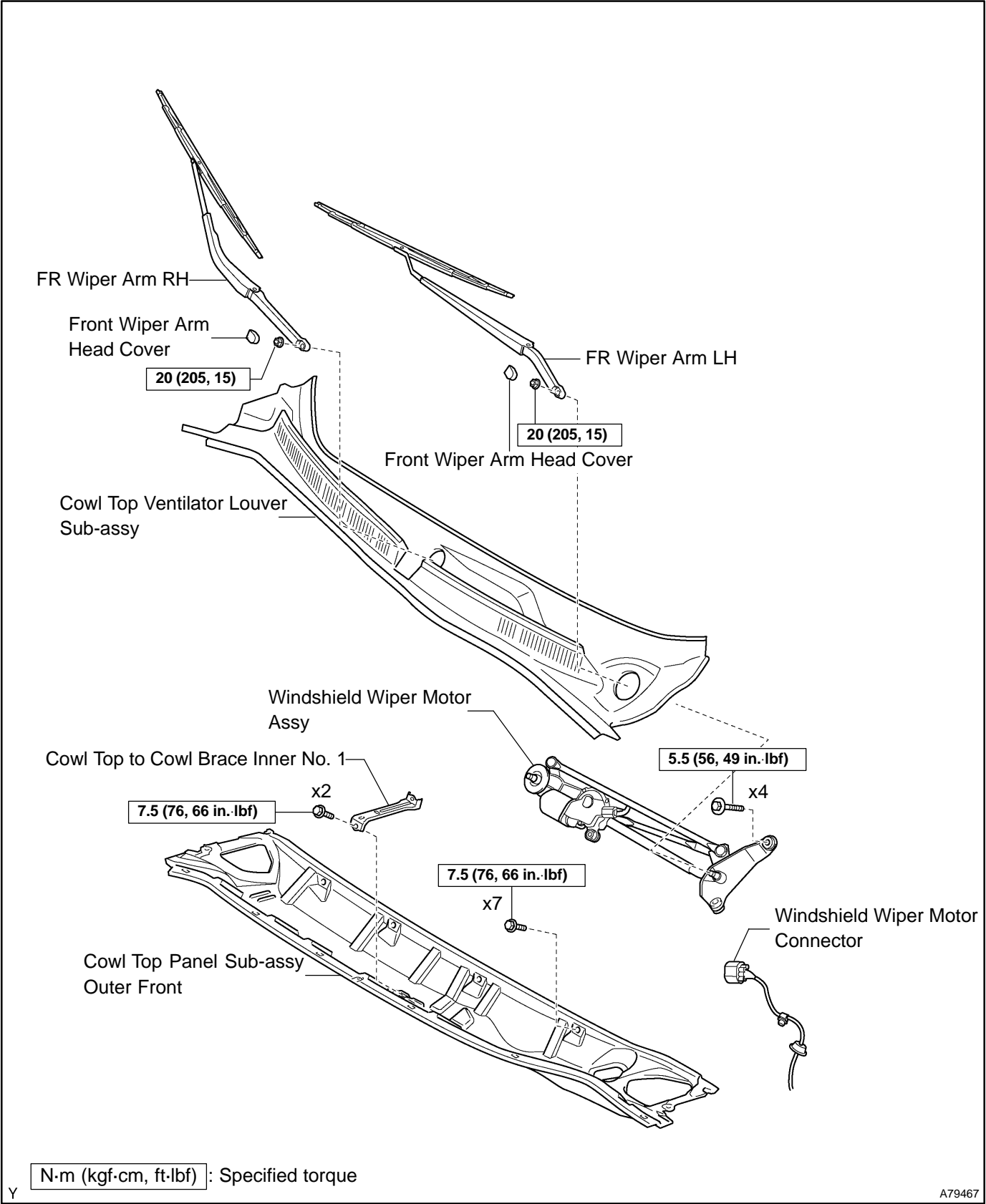


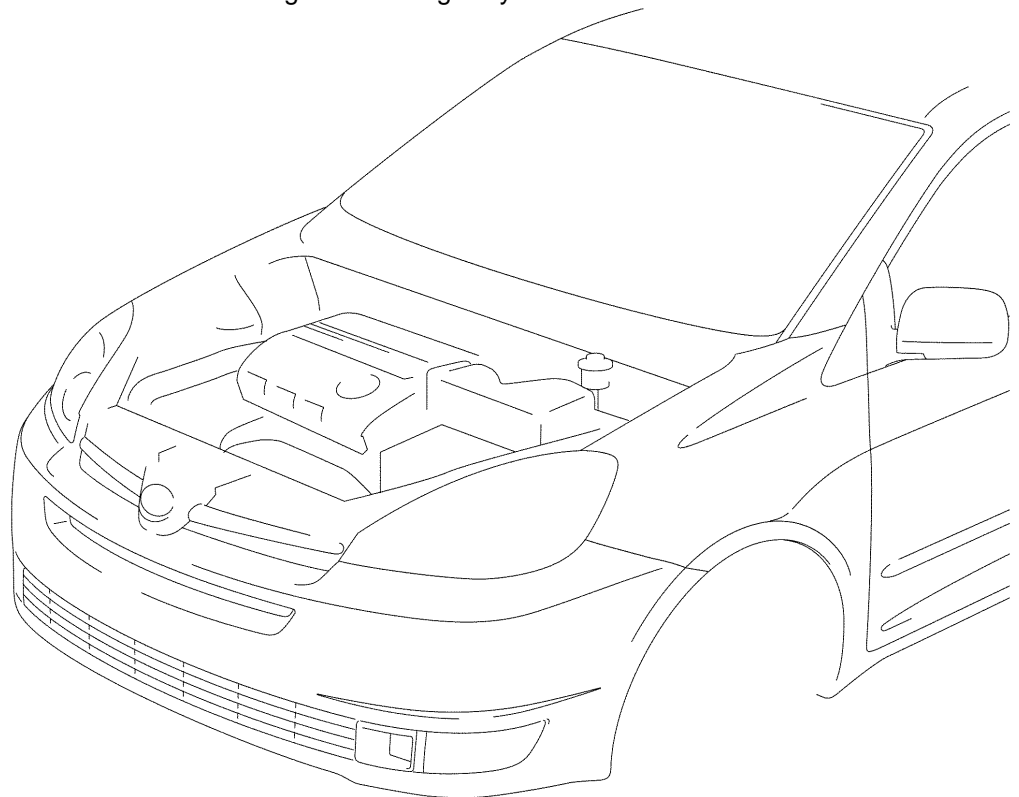
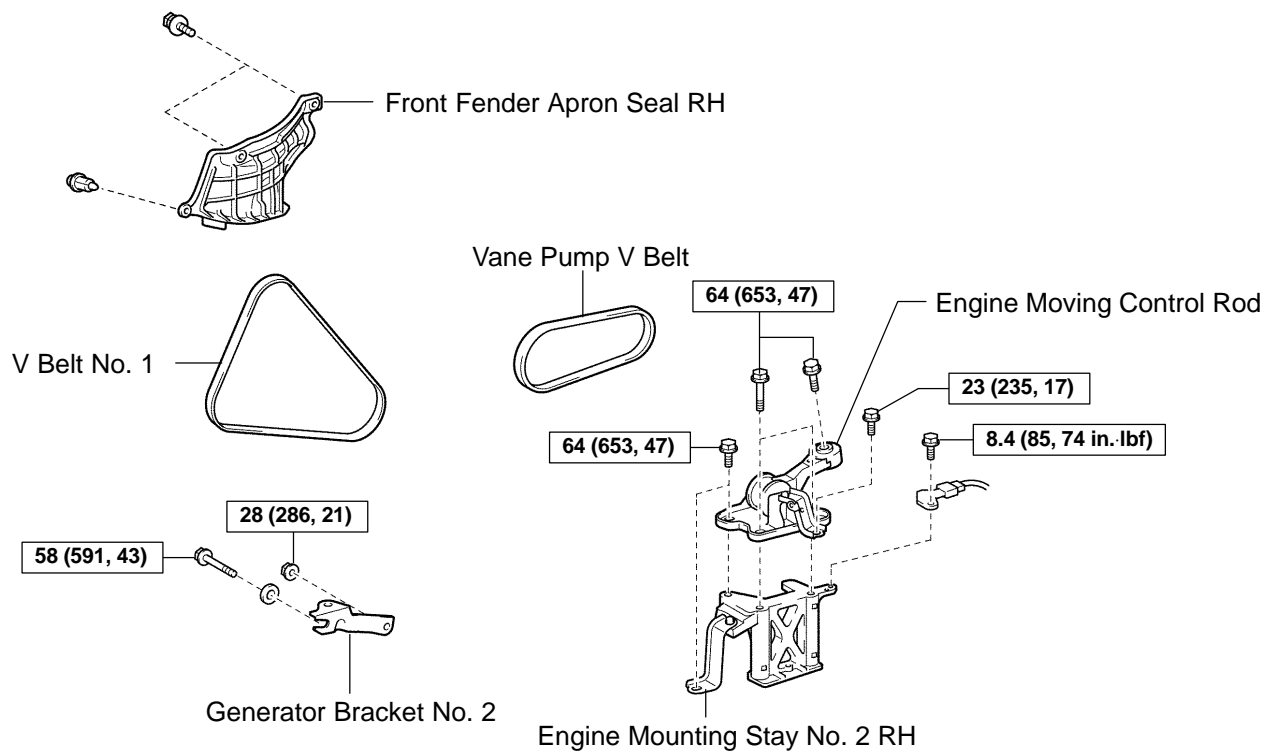
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A78309

# TIMING BELT COMPONENTS

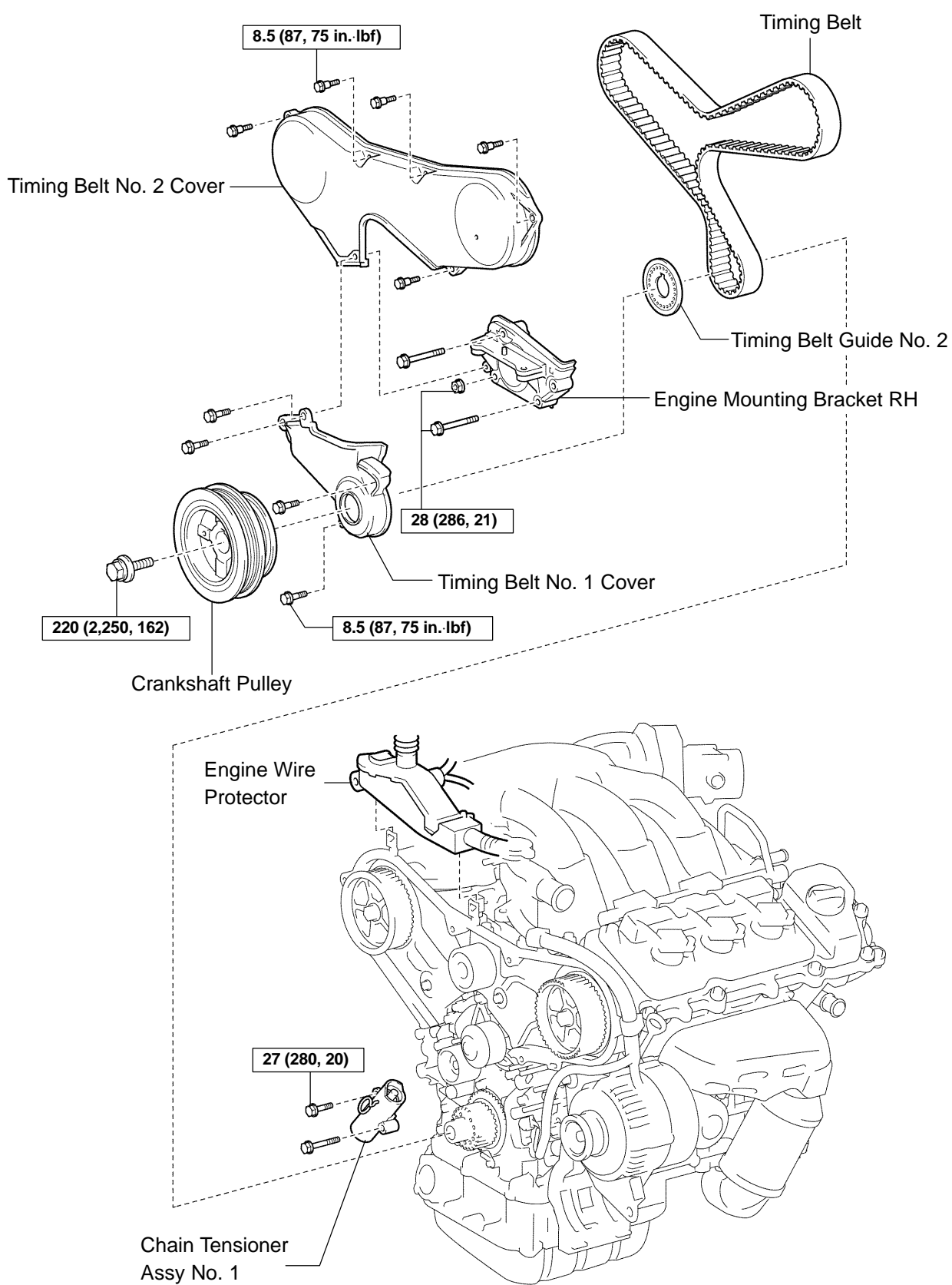
141AO-01





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

A78352



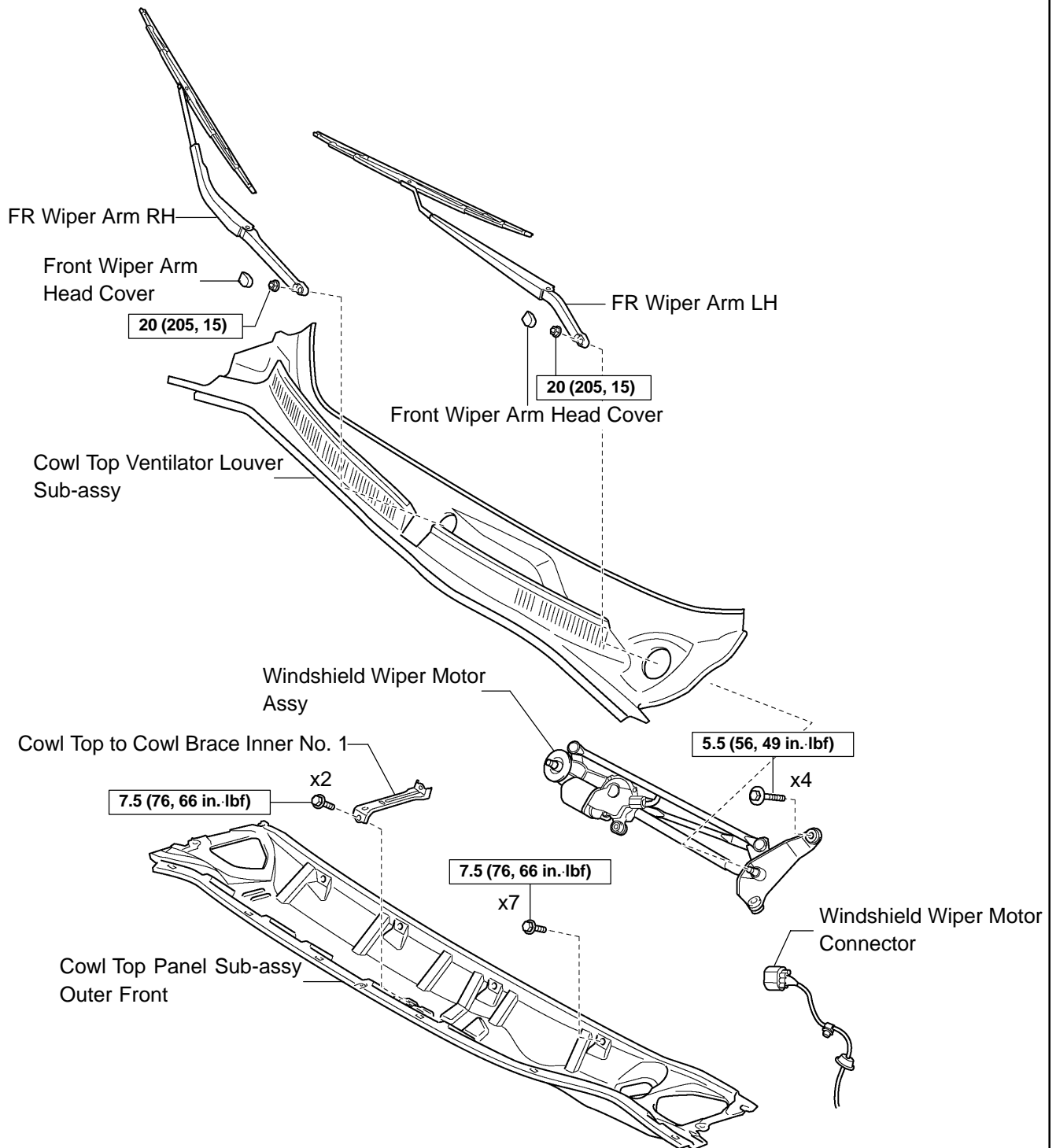
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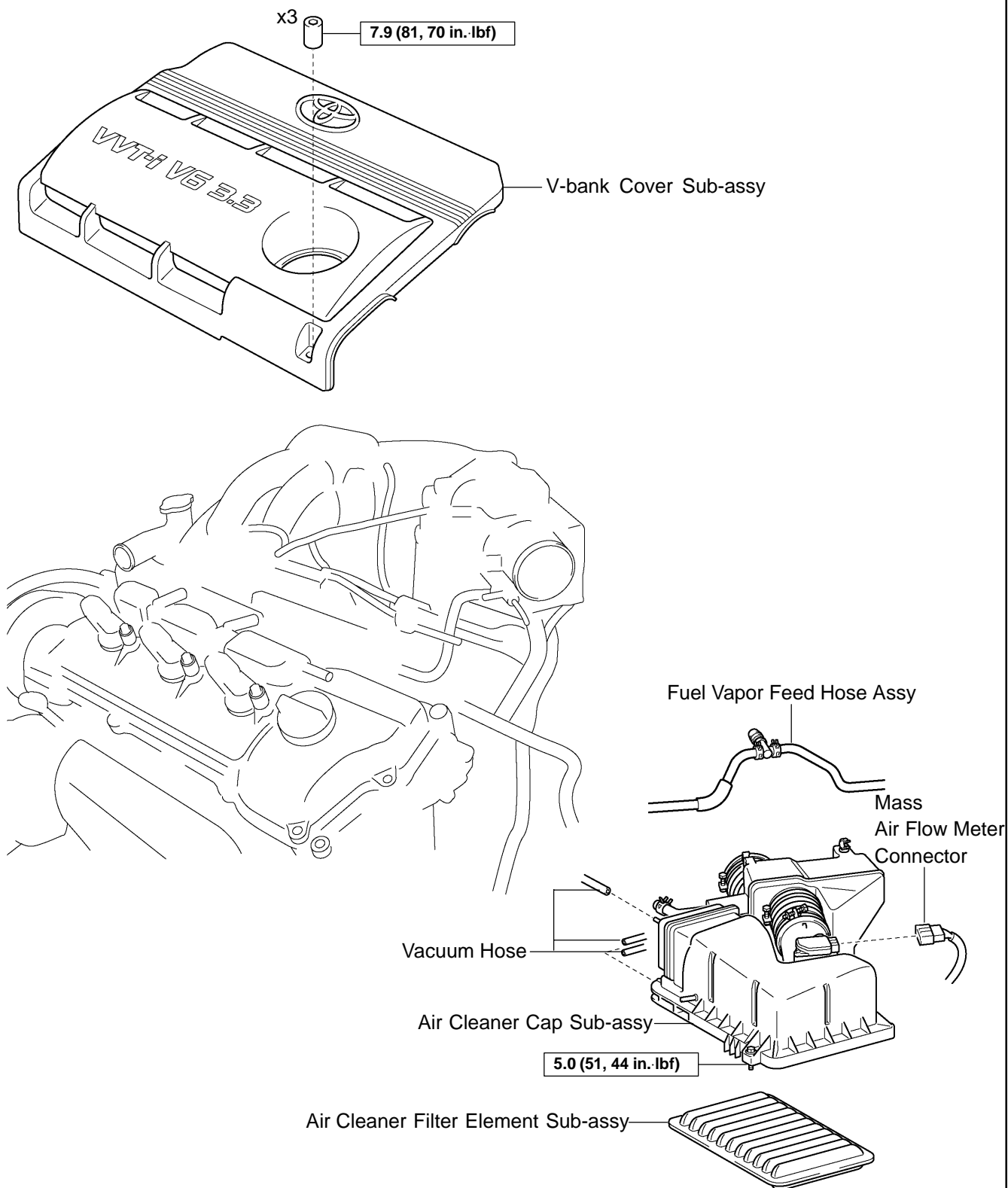
# CAMSHAFT (RH BANK) COMPONENTS

141AQ-01



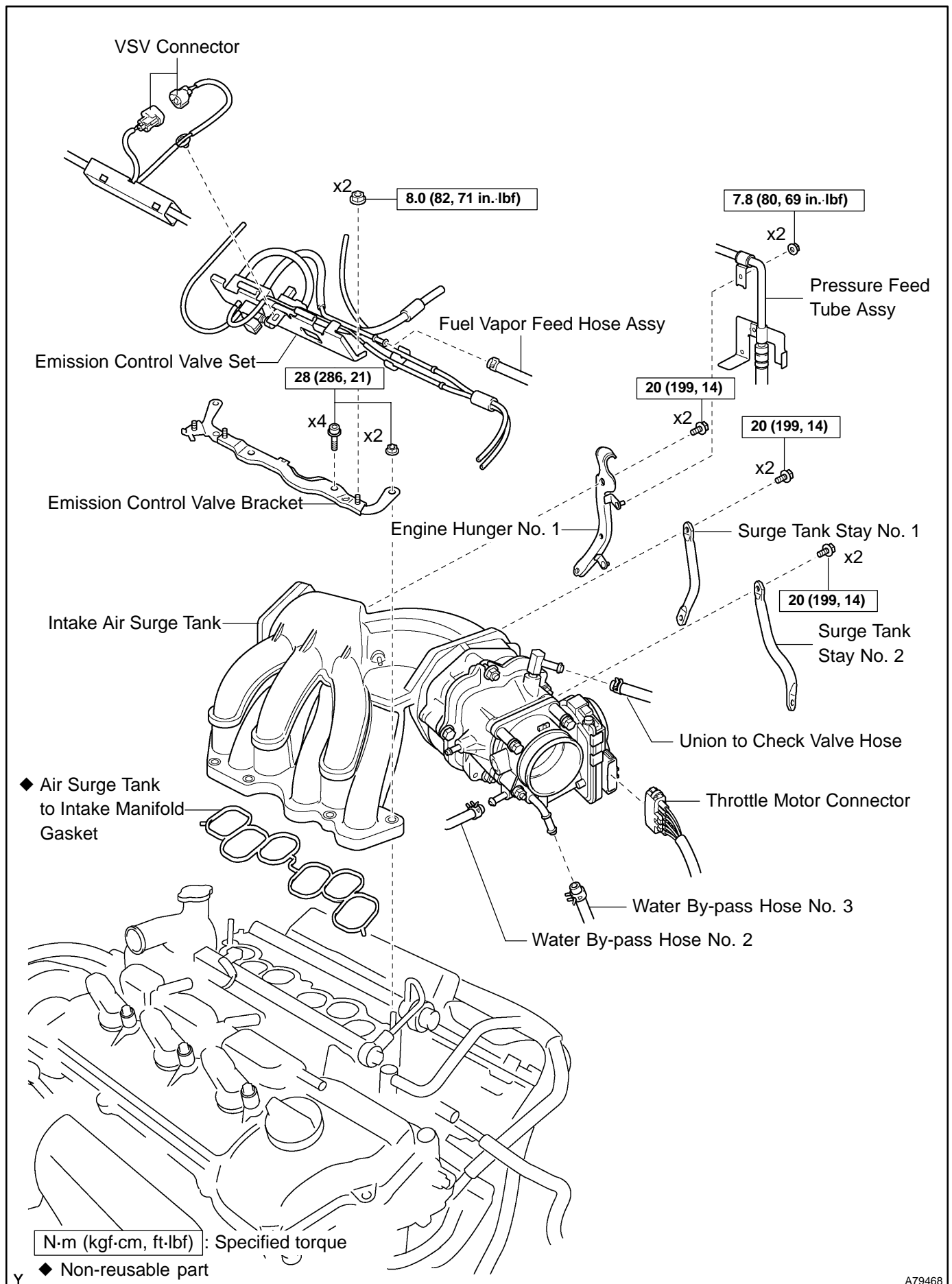
N-m (kgf-cm, ft-lbf) : Specified torque

A79467

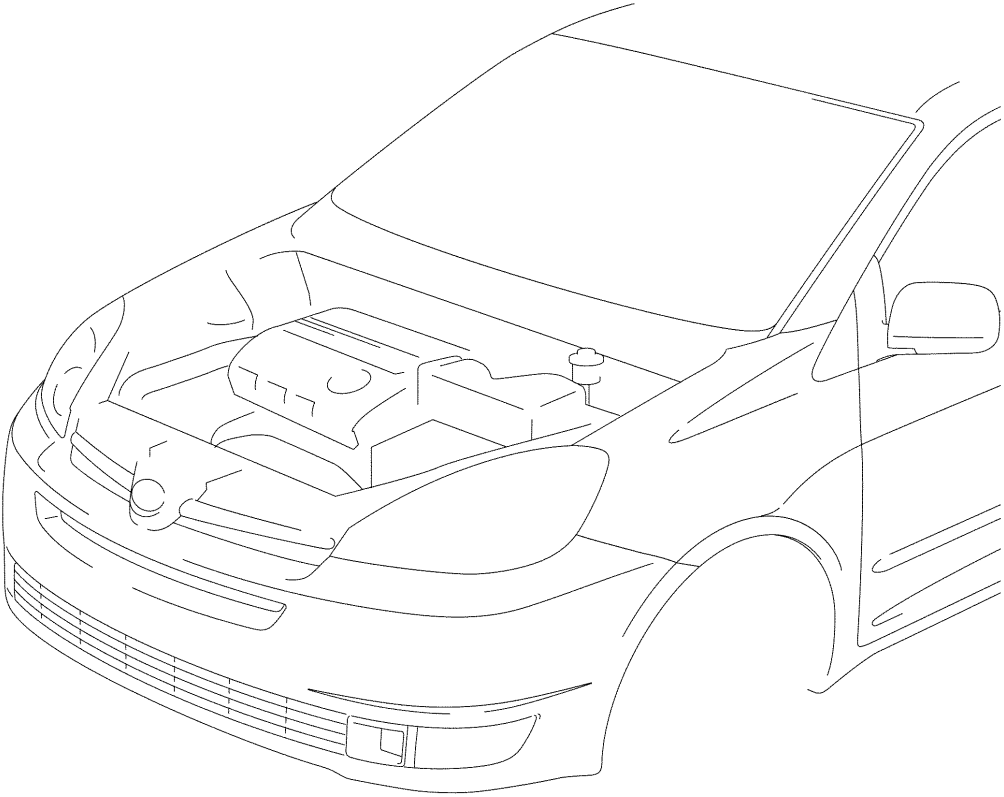
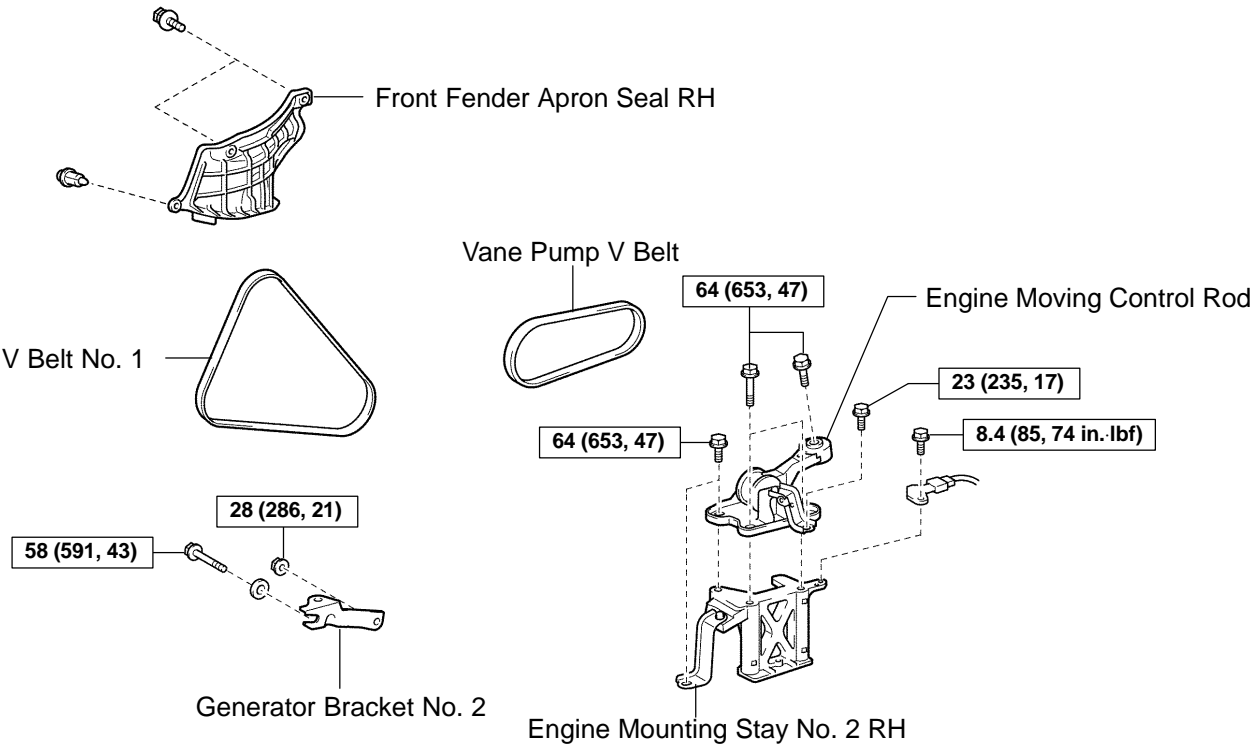


N·m (kgf·cm, ft·lbf) : Specified torque

A81680

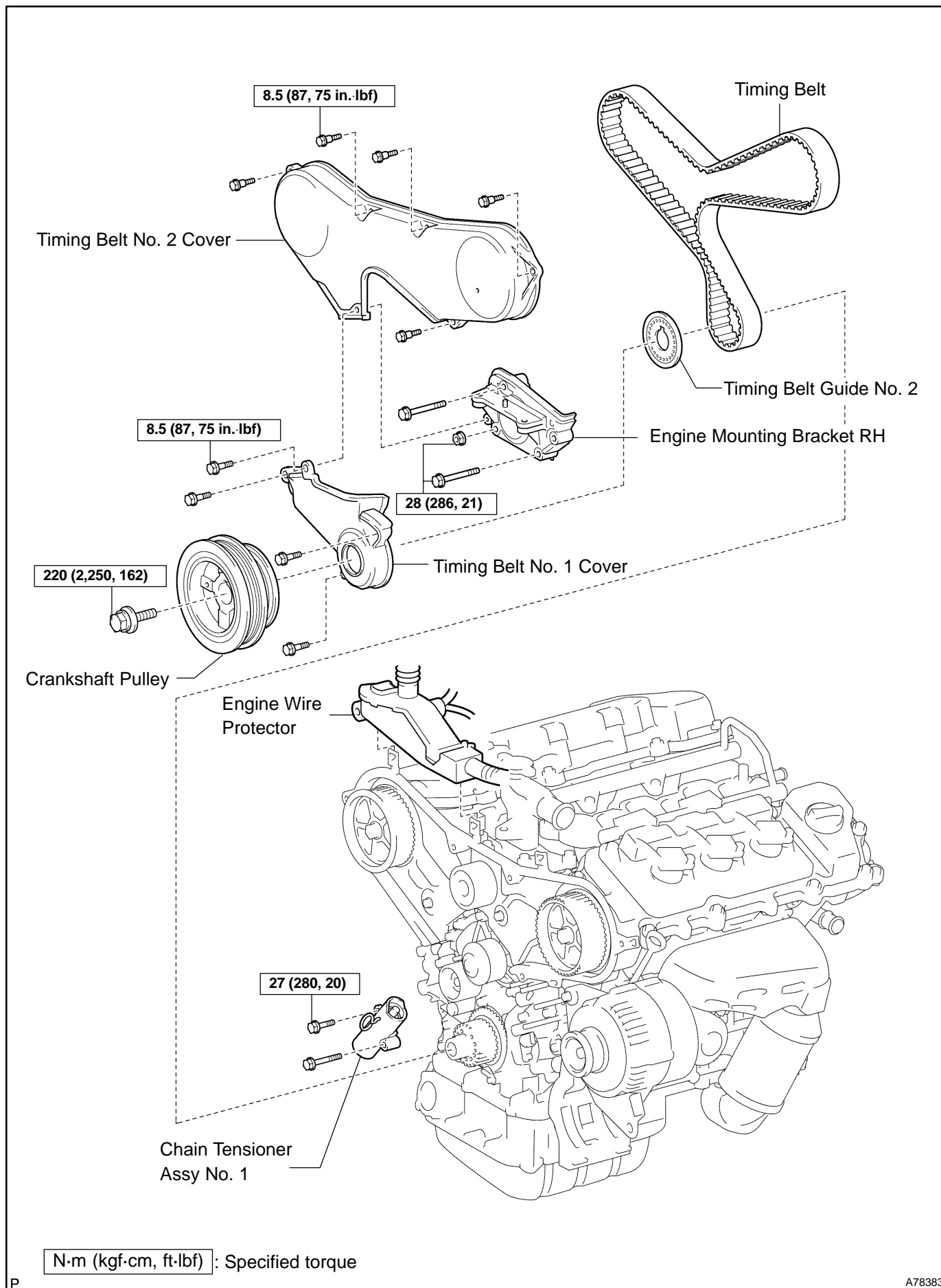


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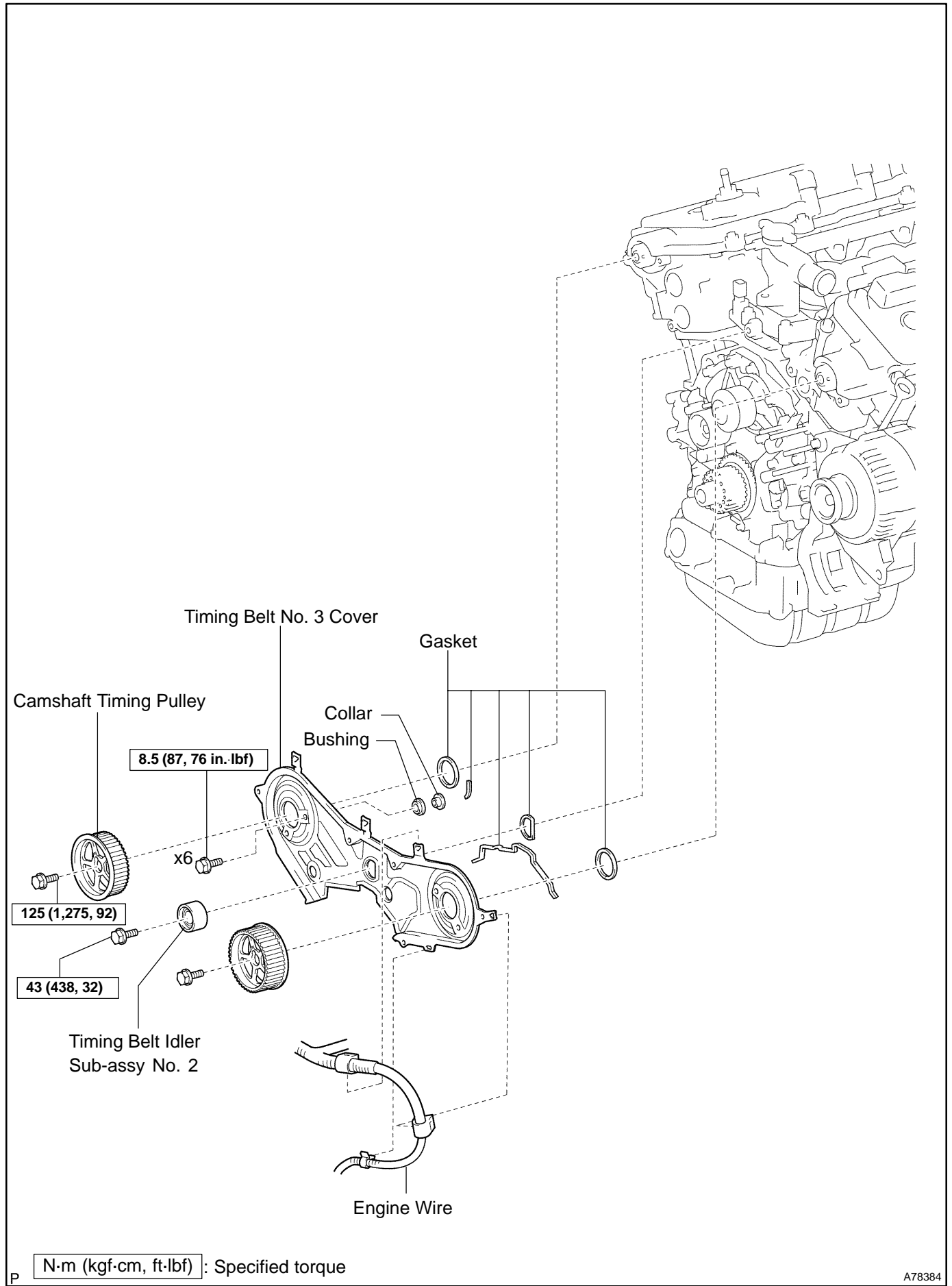
N·m (kgf·cm, ft·lbf) : Specified torque

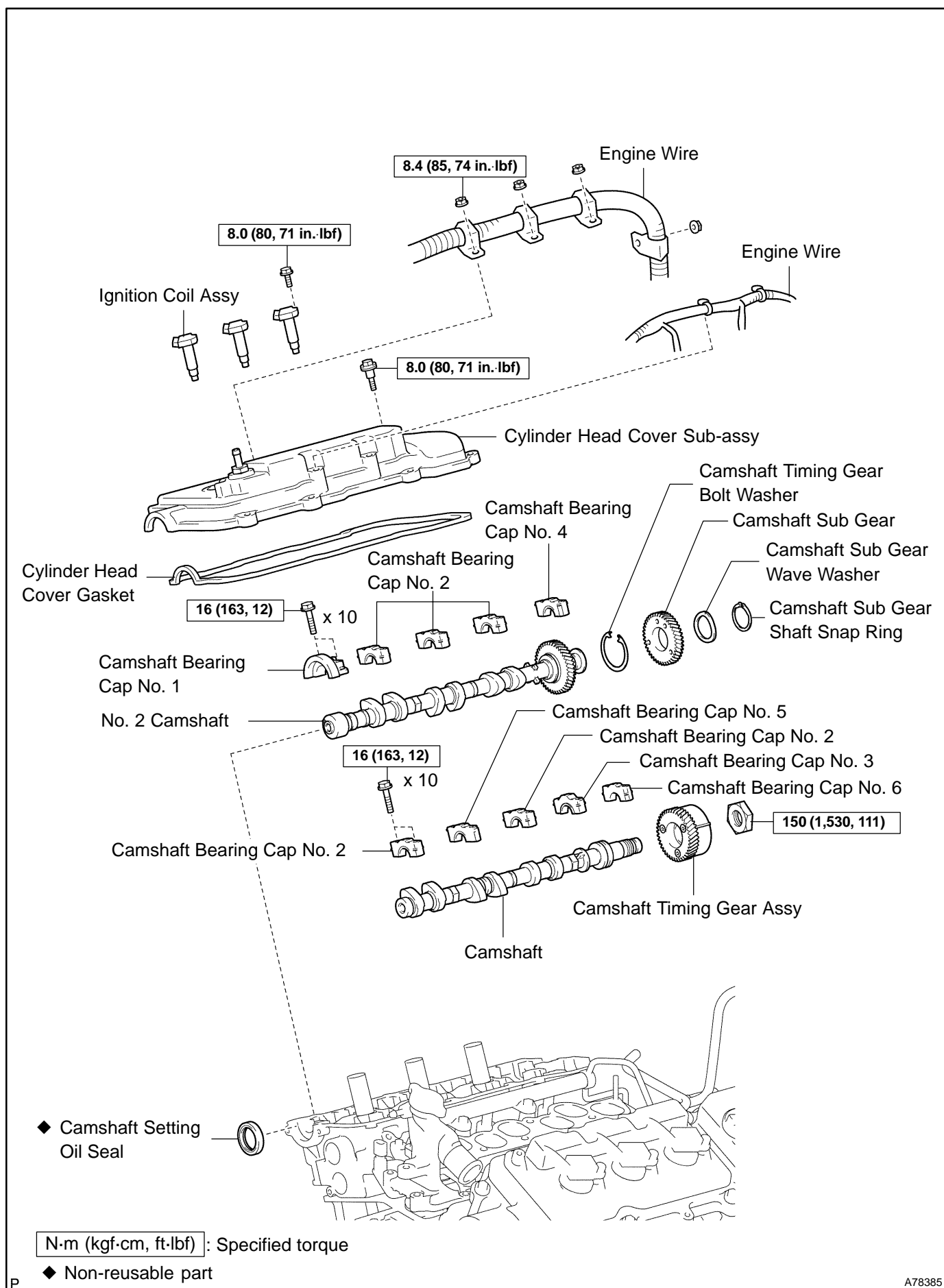
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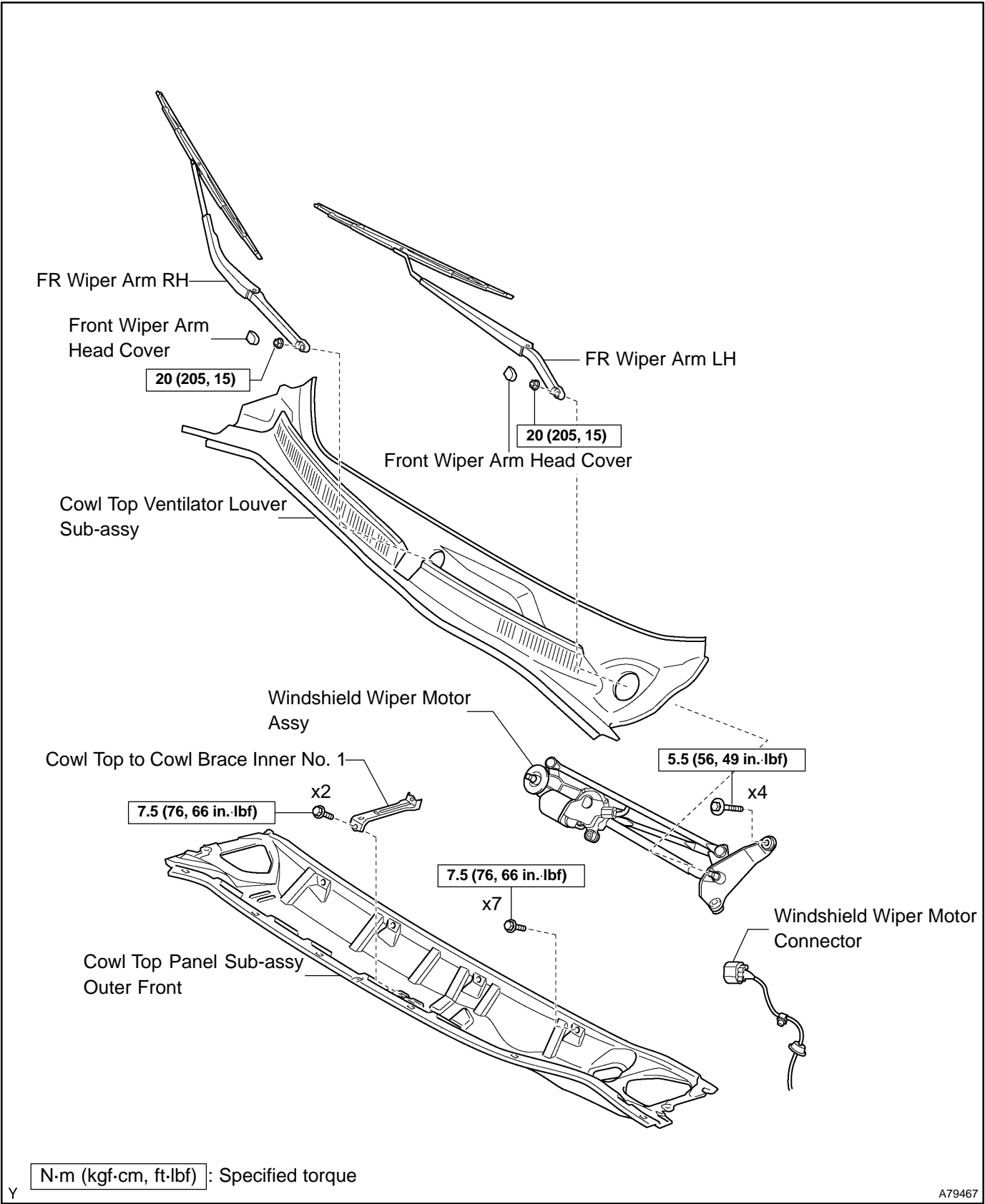




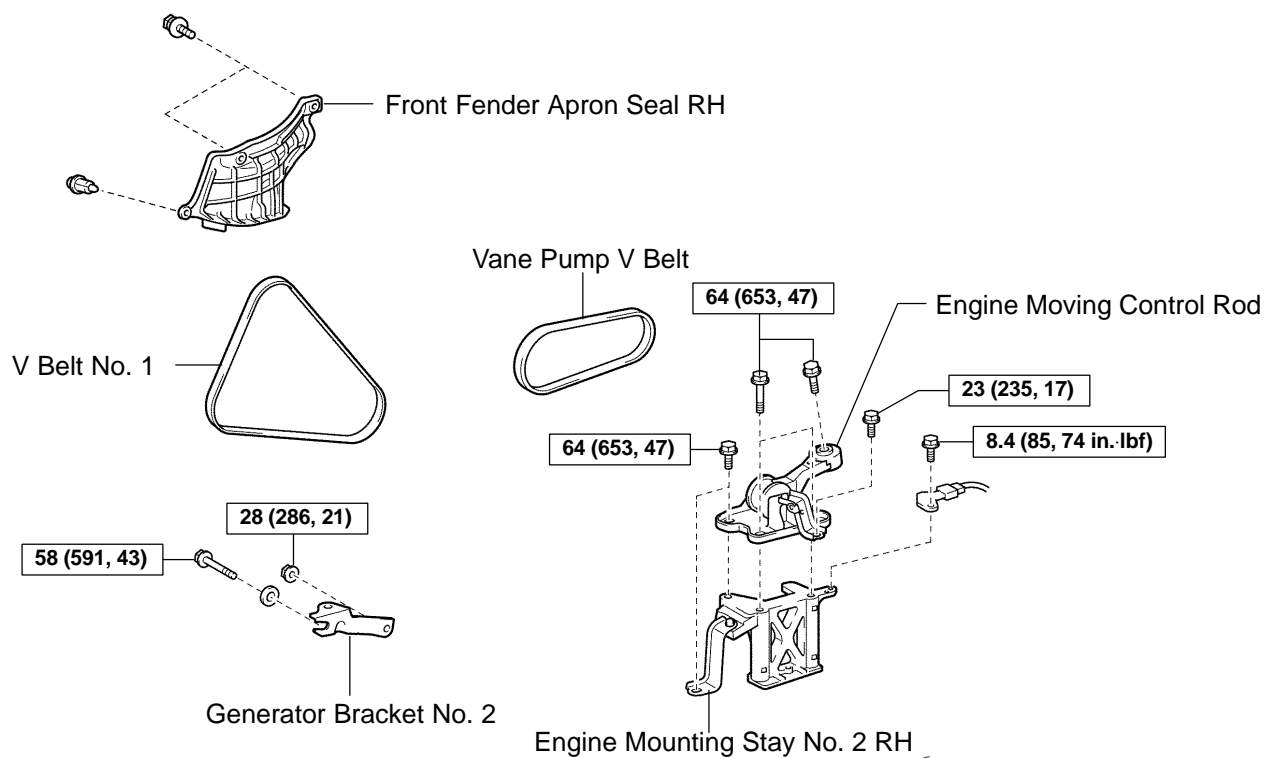
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# CAMSHAFT (LH BANK) COMPONENTS

141AS-01



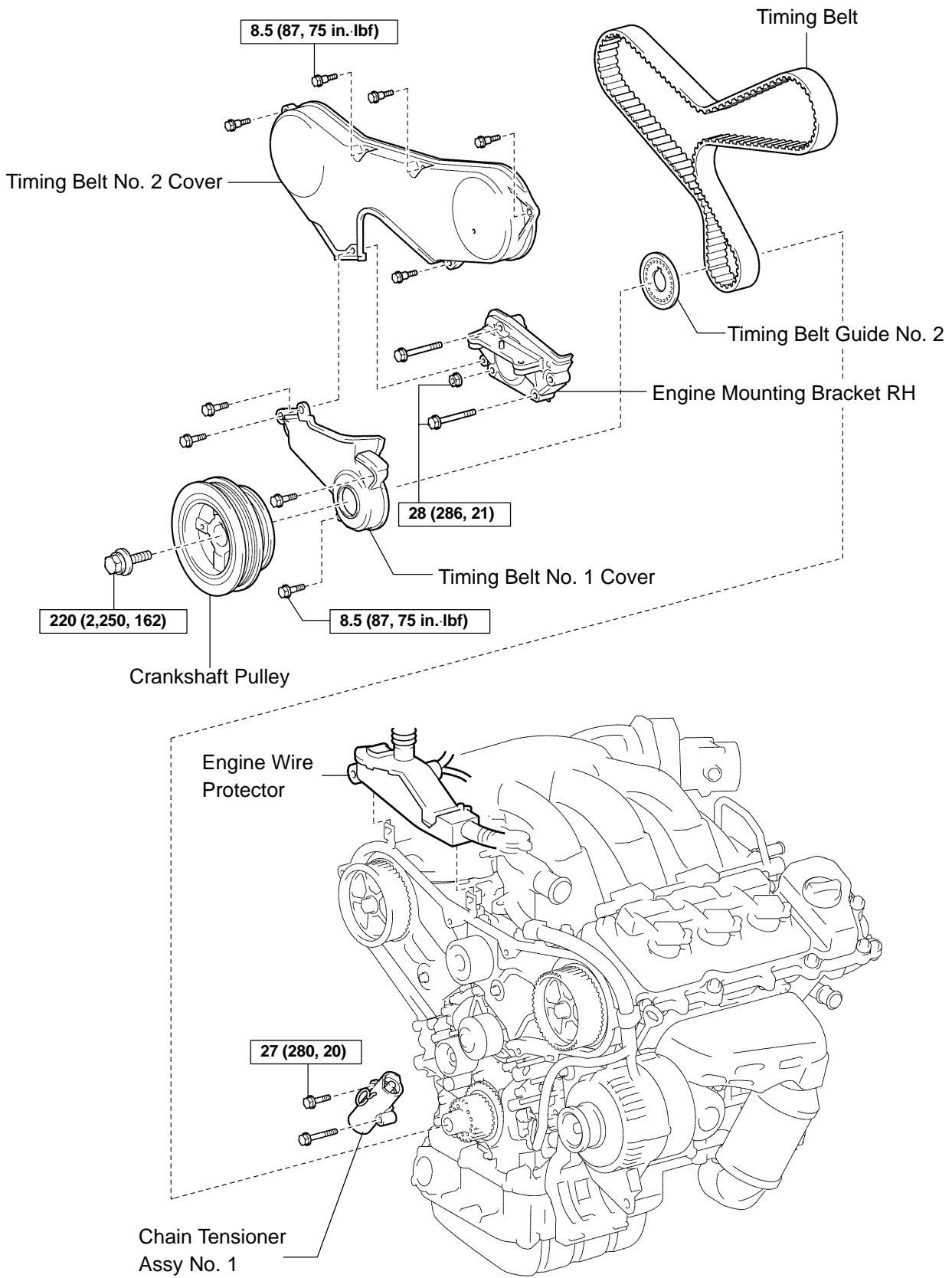




P

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

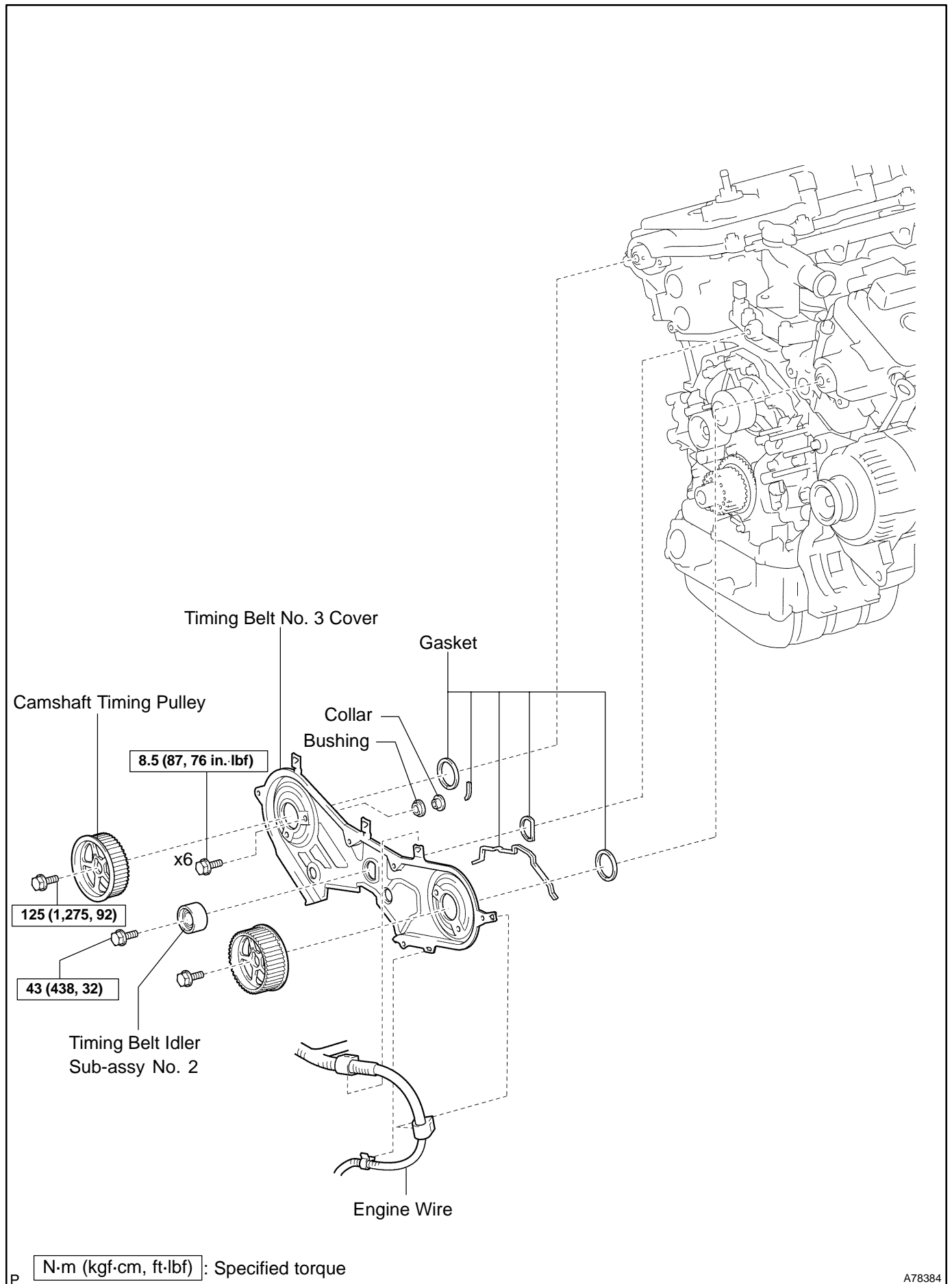
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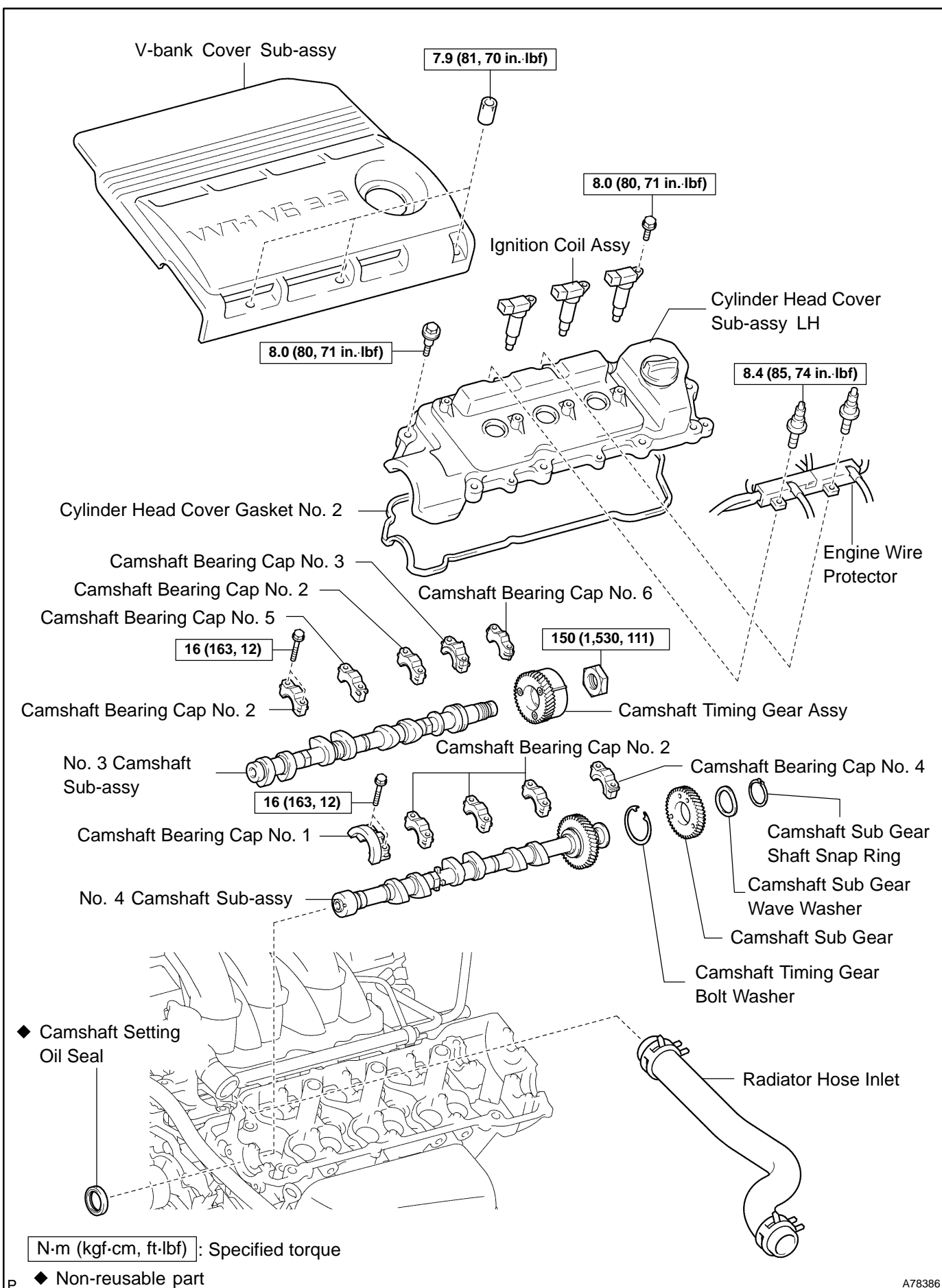
N·m (kgf·cm, ft·lbf) : Specified torque

P

A78353



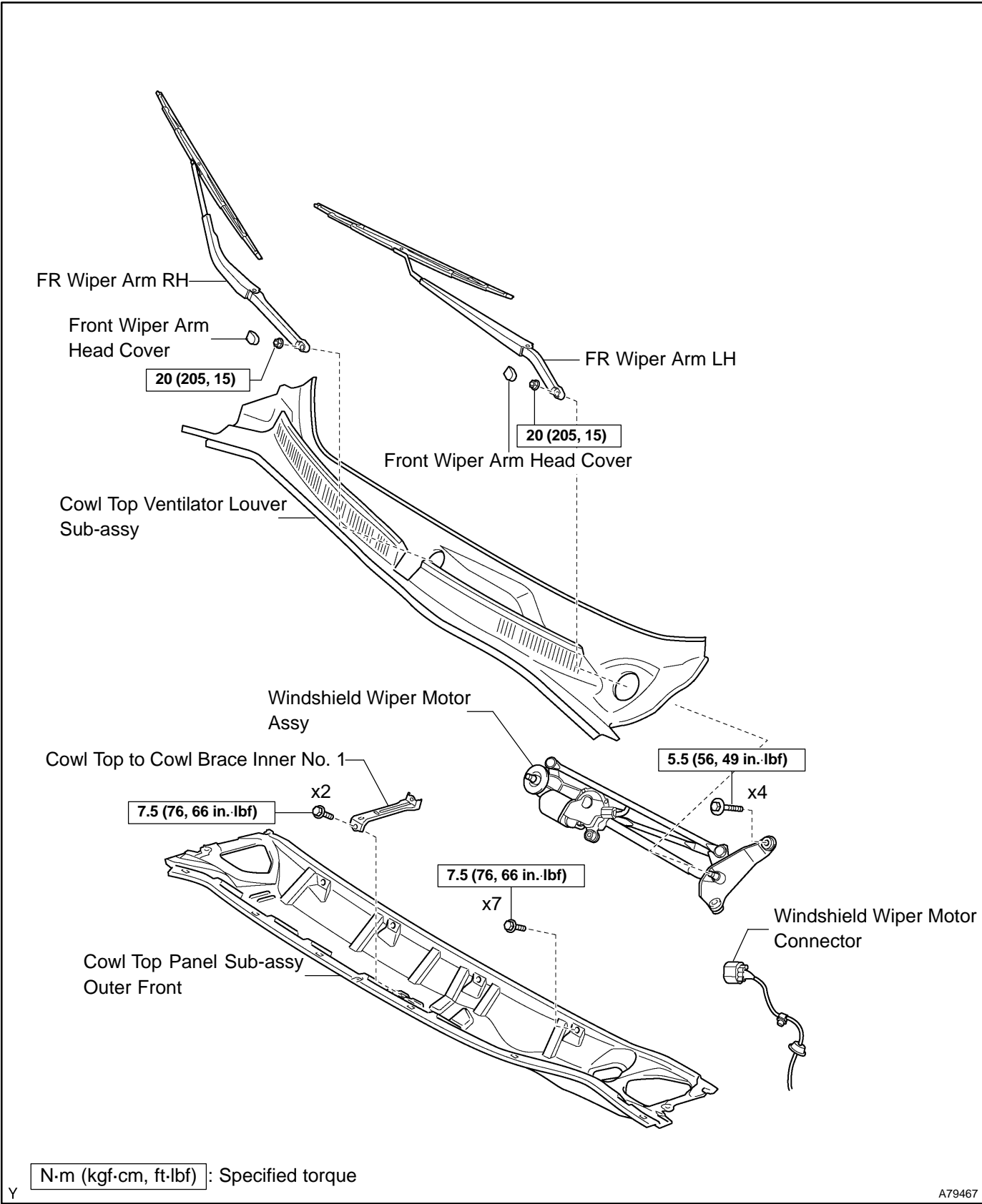
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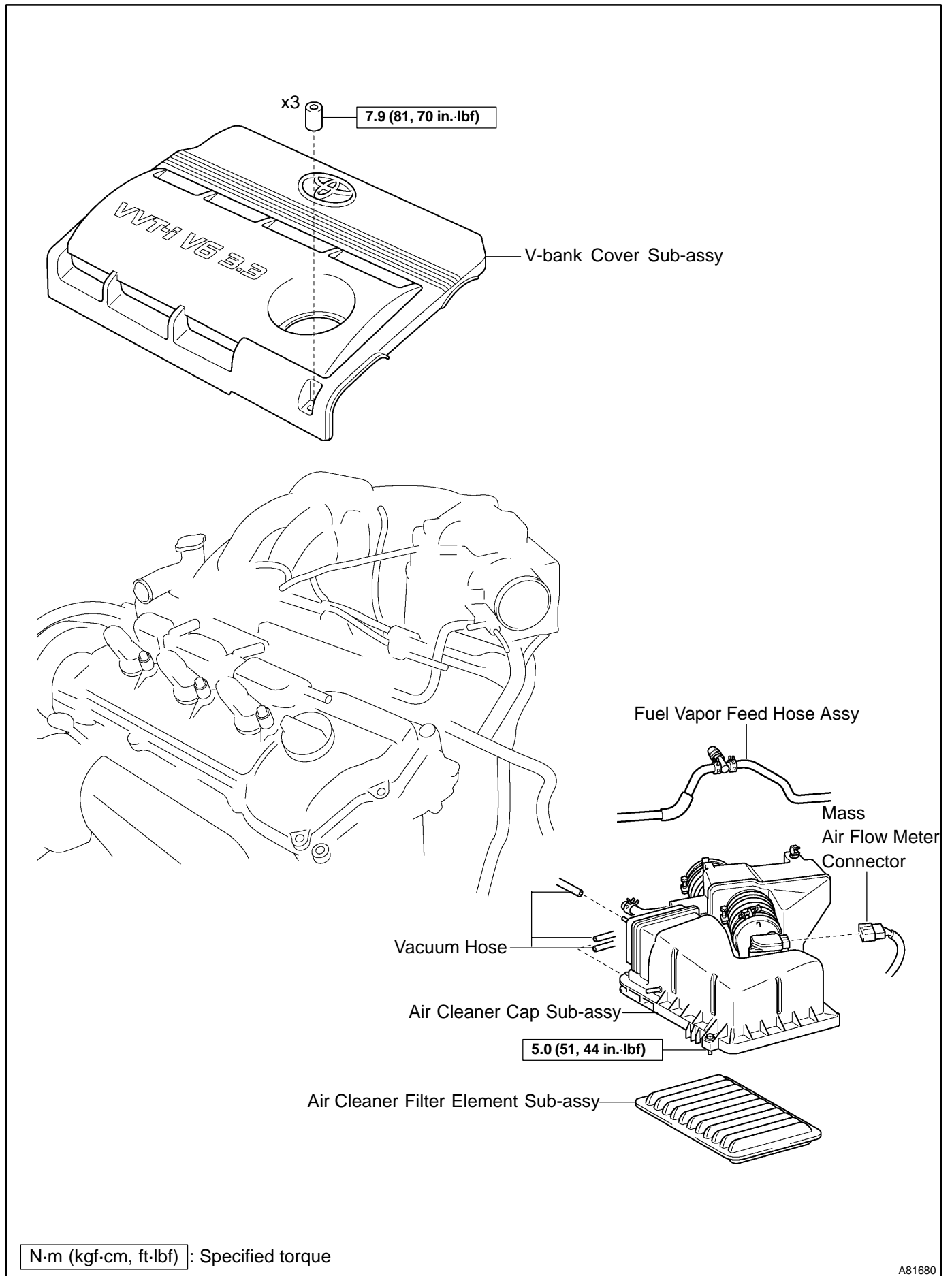


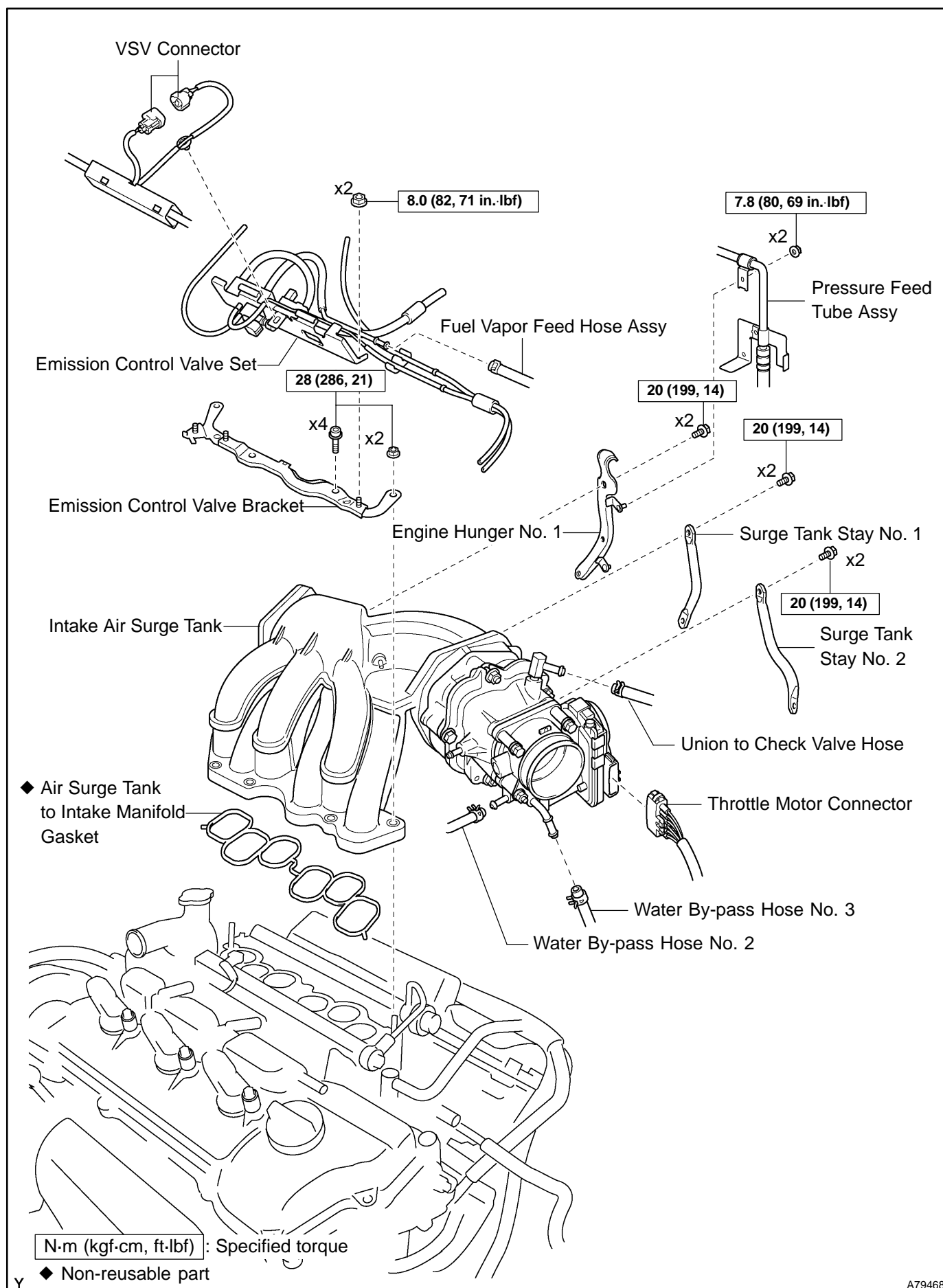
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# CYLINDER HEAD GASKET COMPONENTS

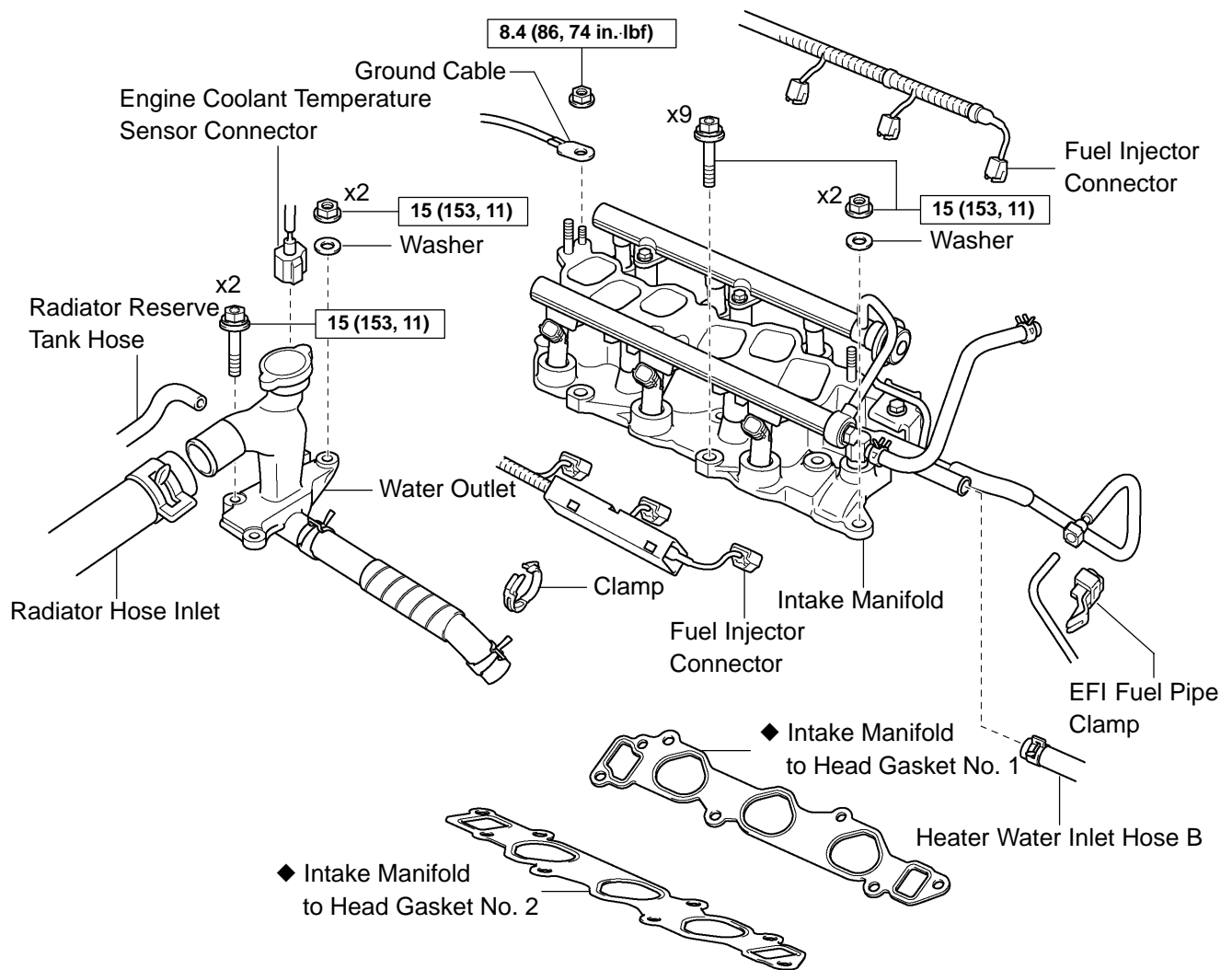
141AU-01







A79470

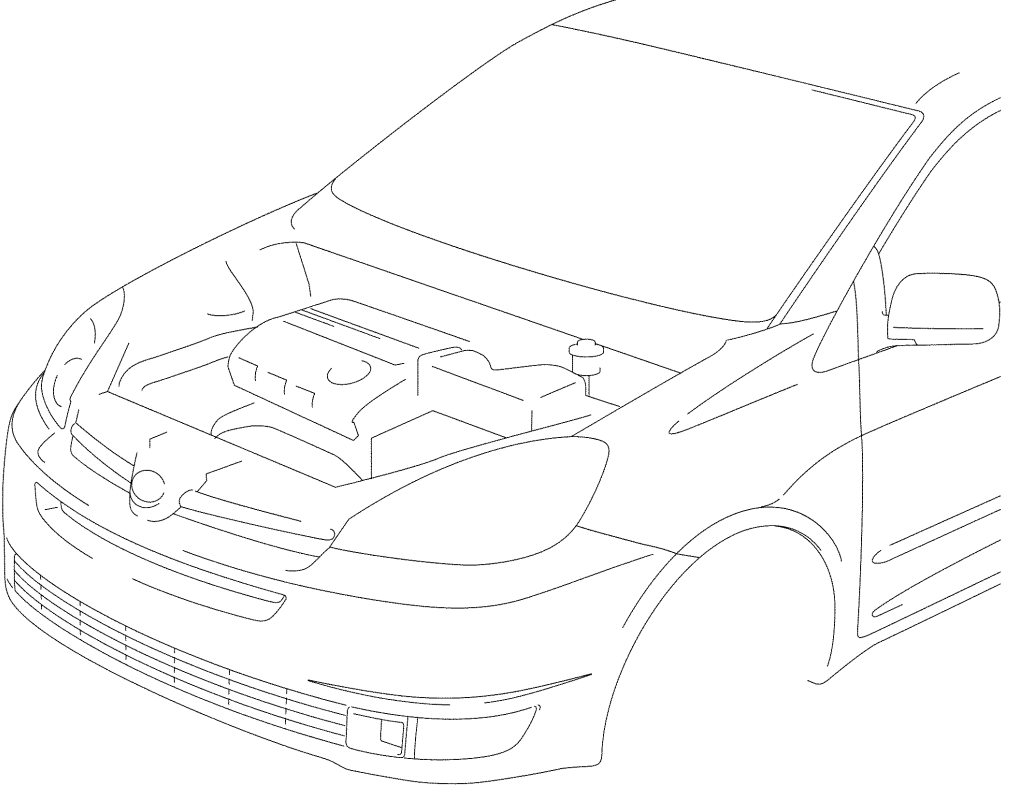
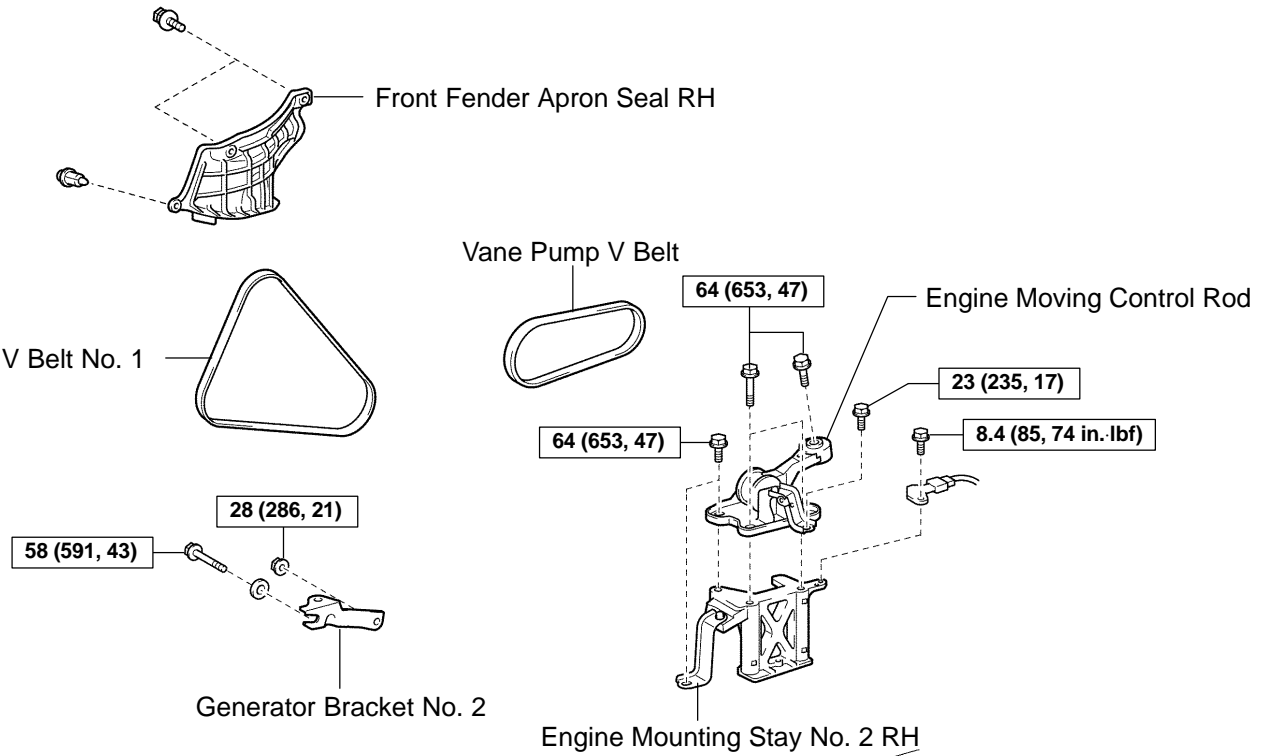


N·m (kgf·cm, ft·lbf) : Specified torque

◆ Non-reusable part

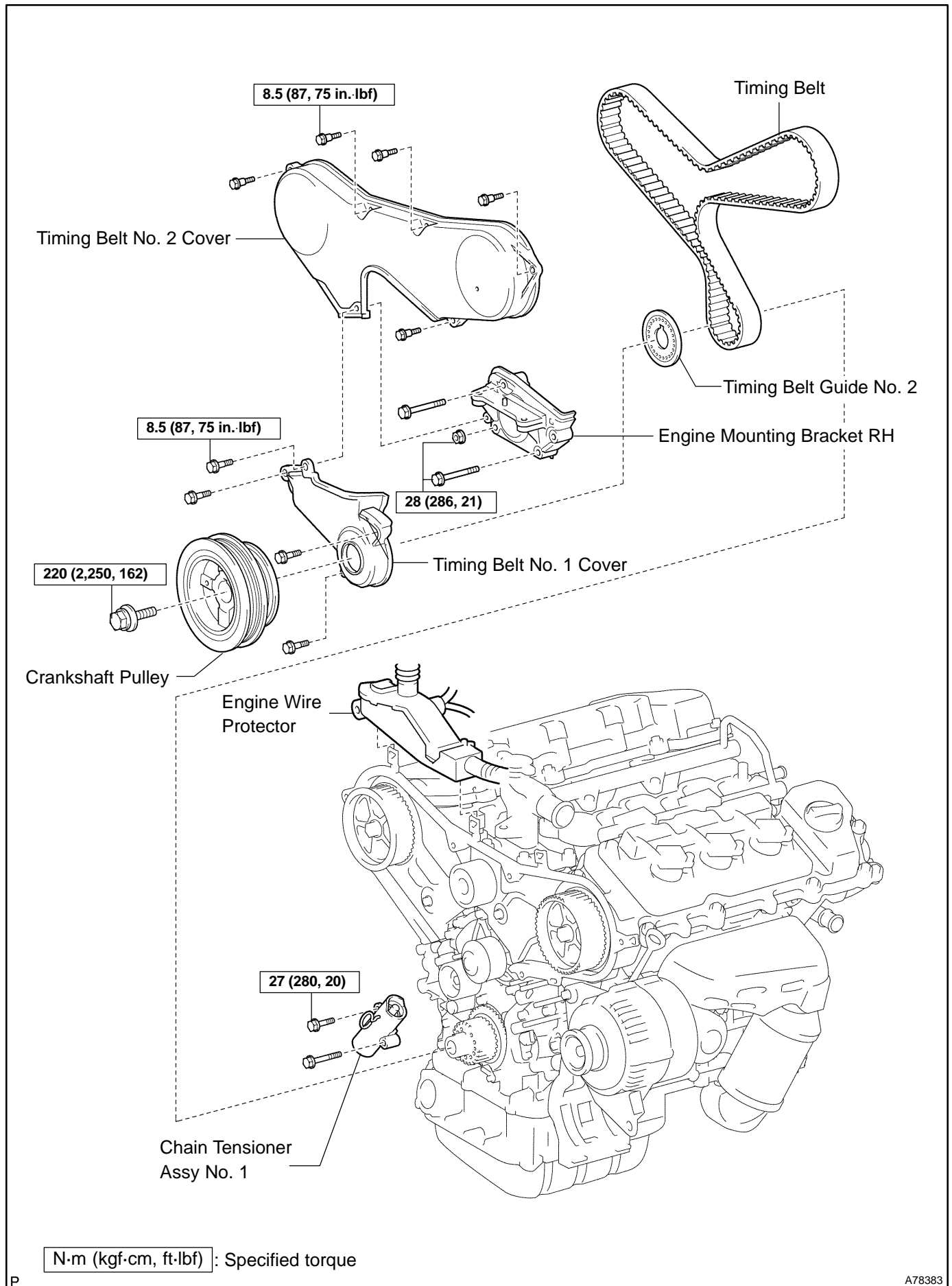
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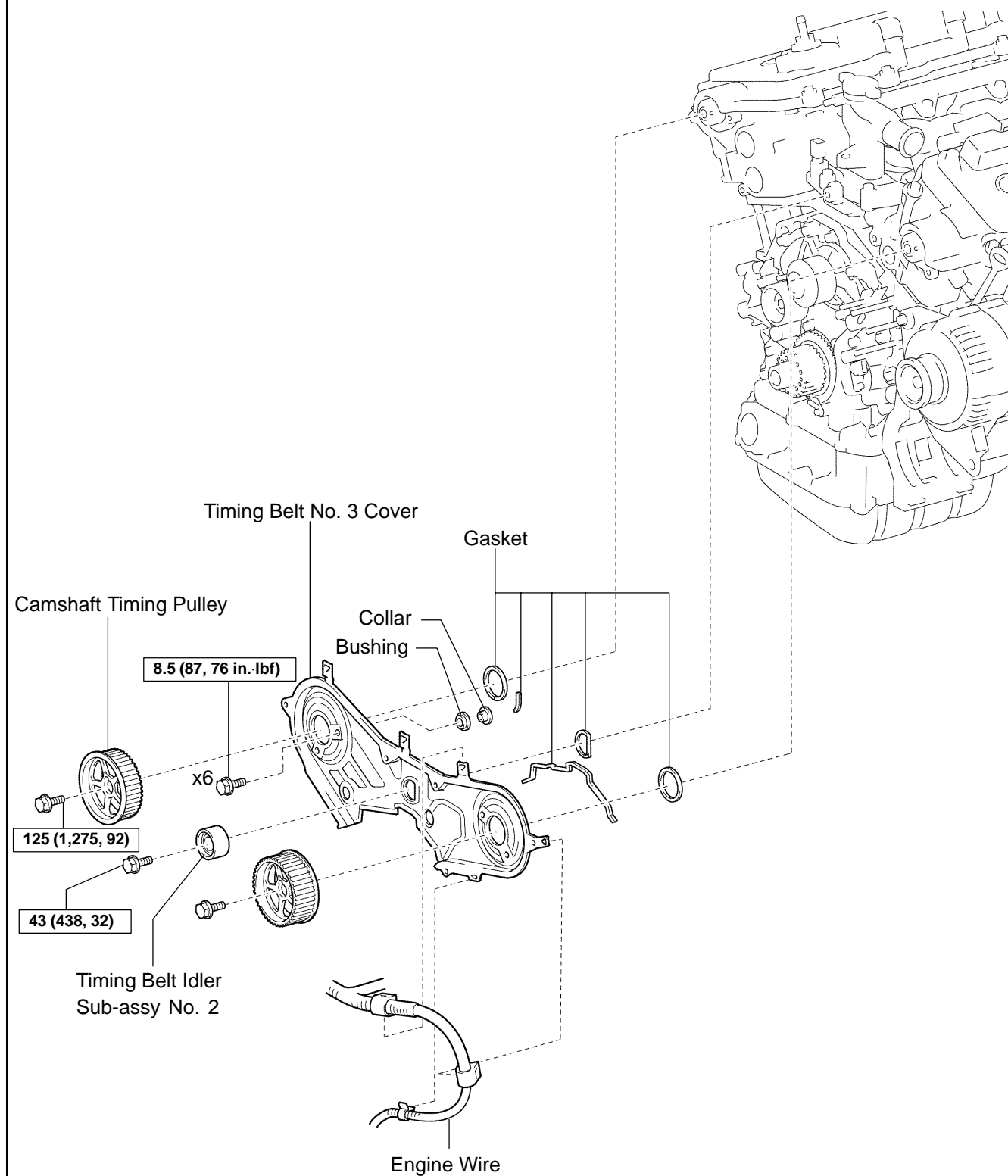
N·m (kgf·cm, ft·lbf) : Specified torque

A78352



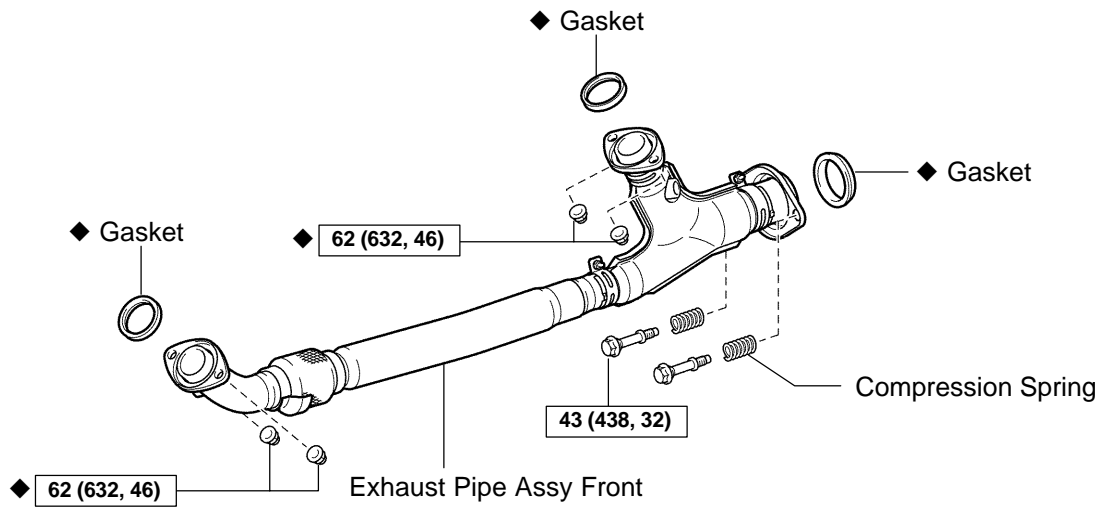
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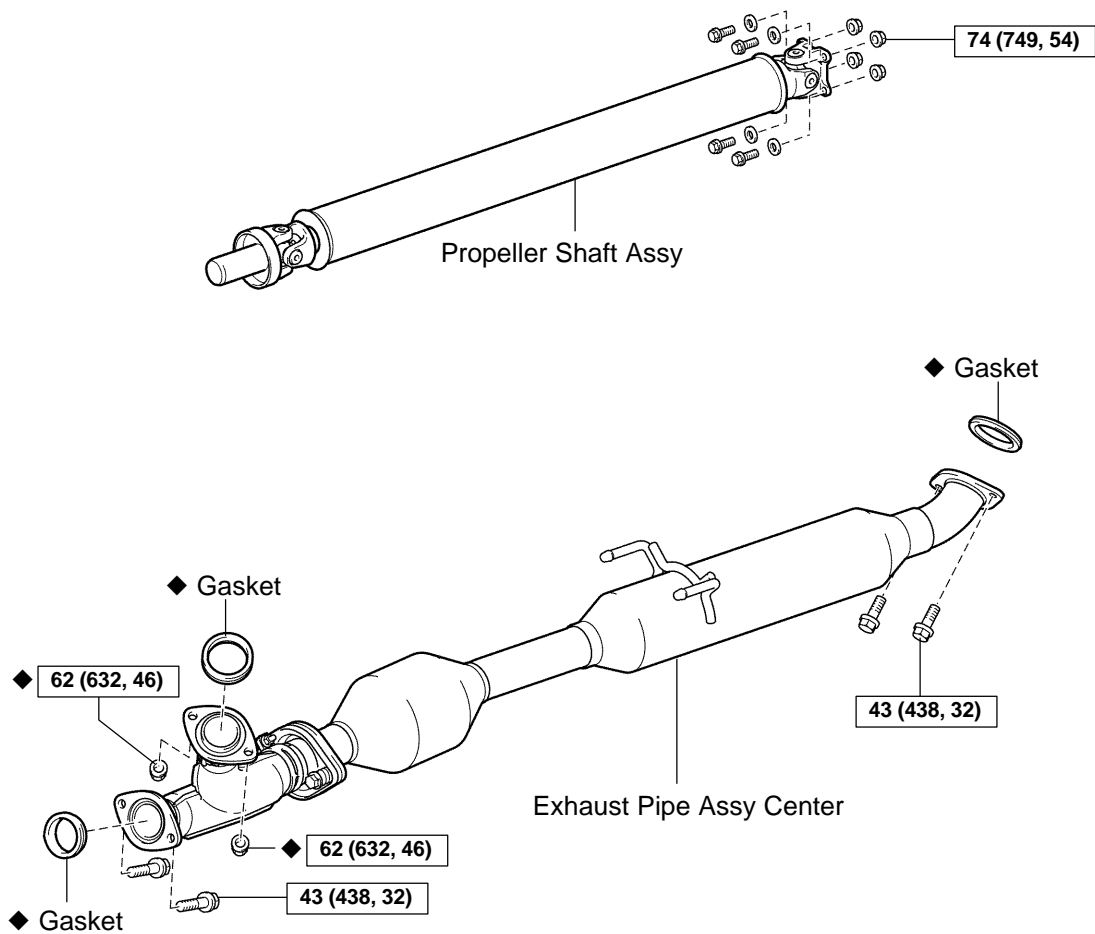


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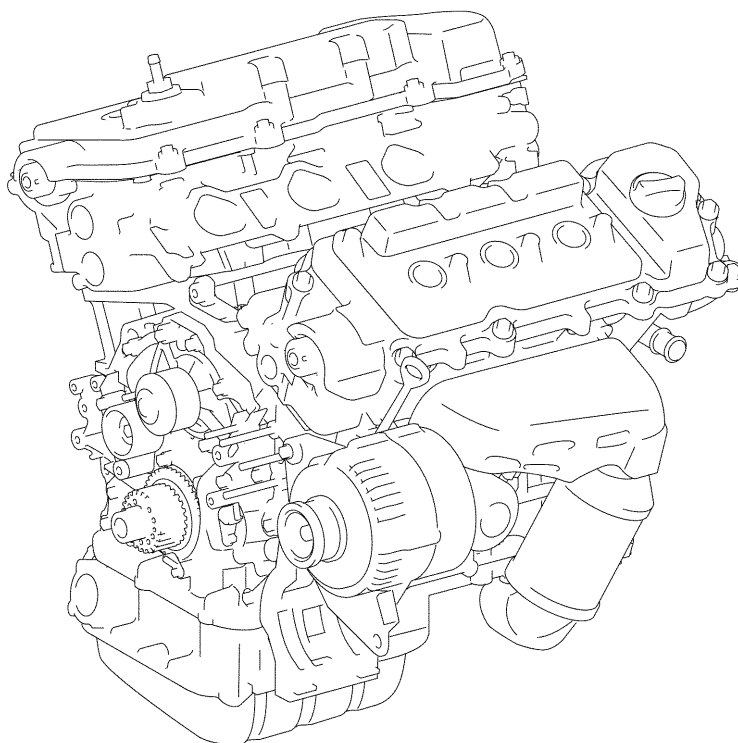
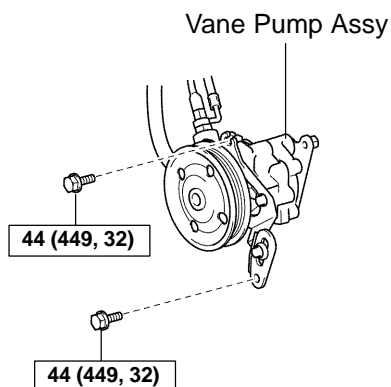
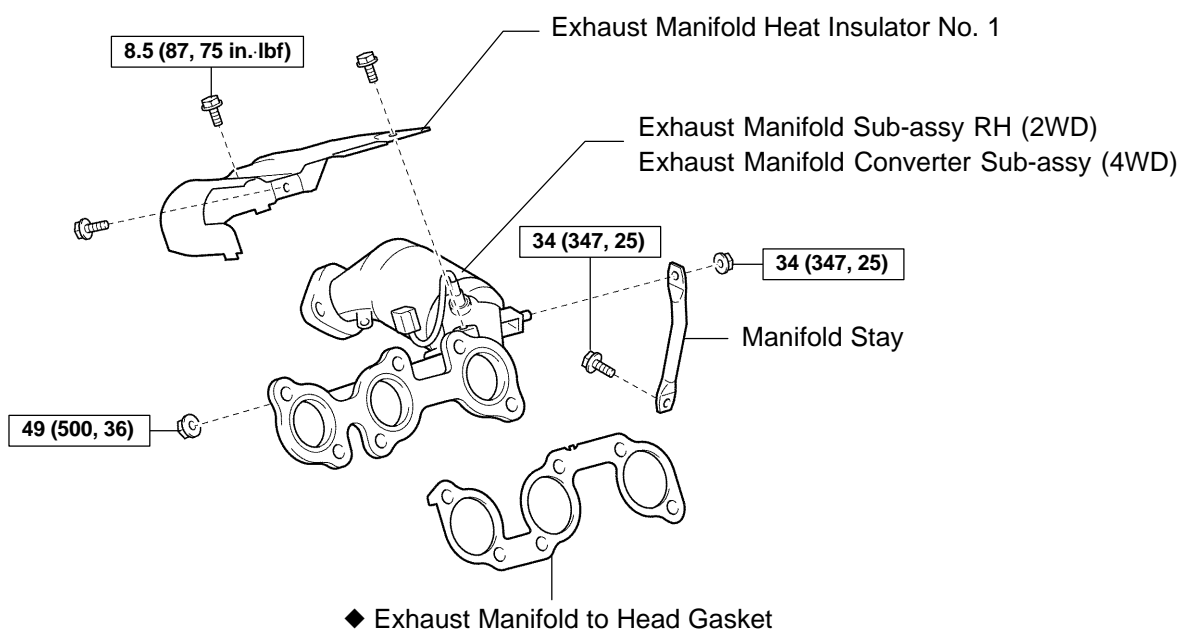
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N·m (kgf·cm, ft·lbf) : Specified torque

◆ Non-reusable part

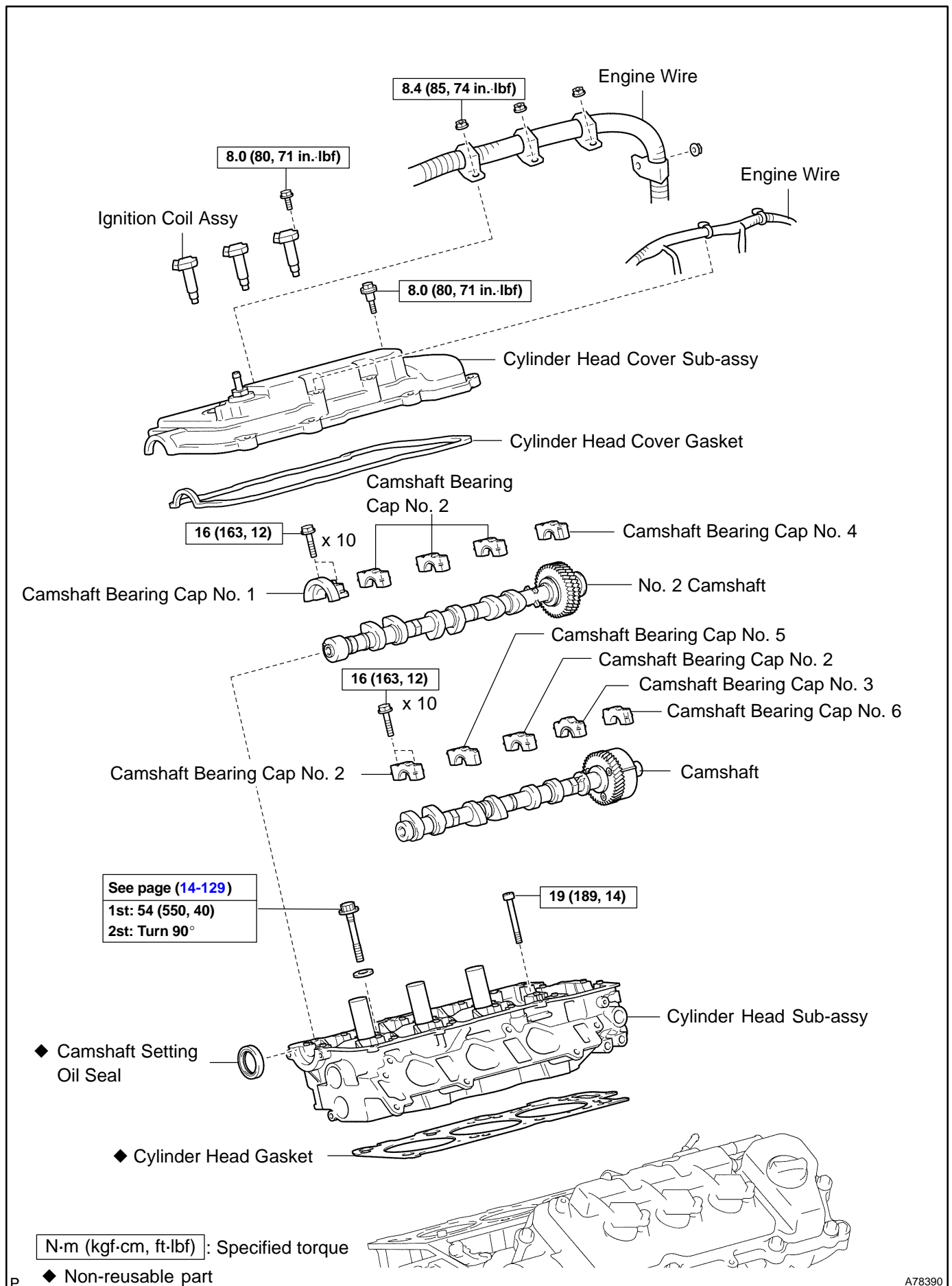
A78388



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

◆ Non-reusable part

A78389

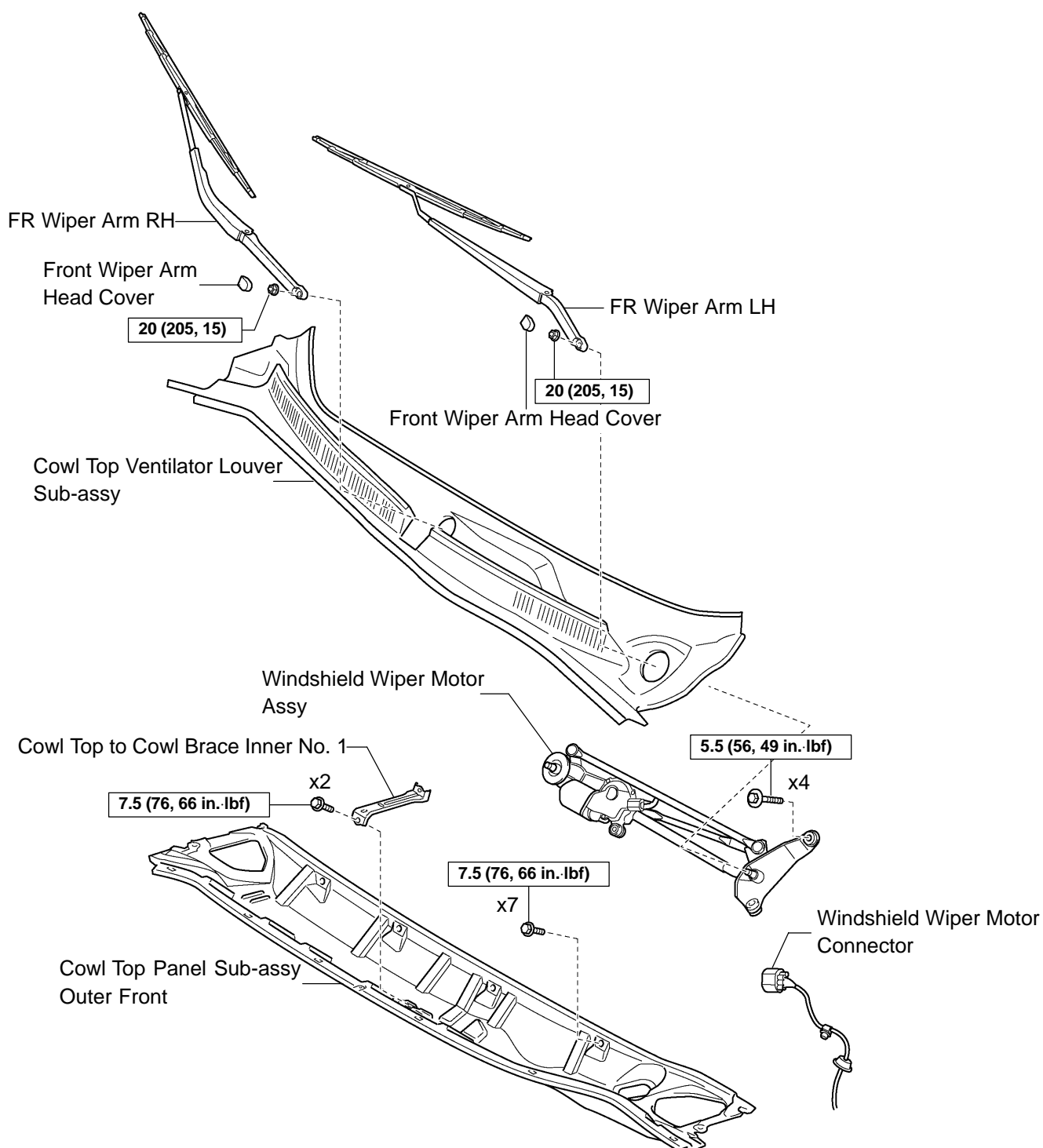


A78390

# CYLINDER HEAD GASKET NO.2

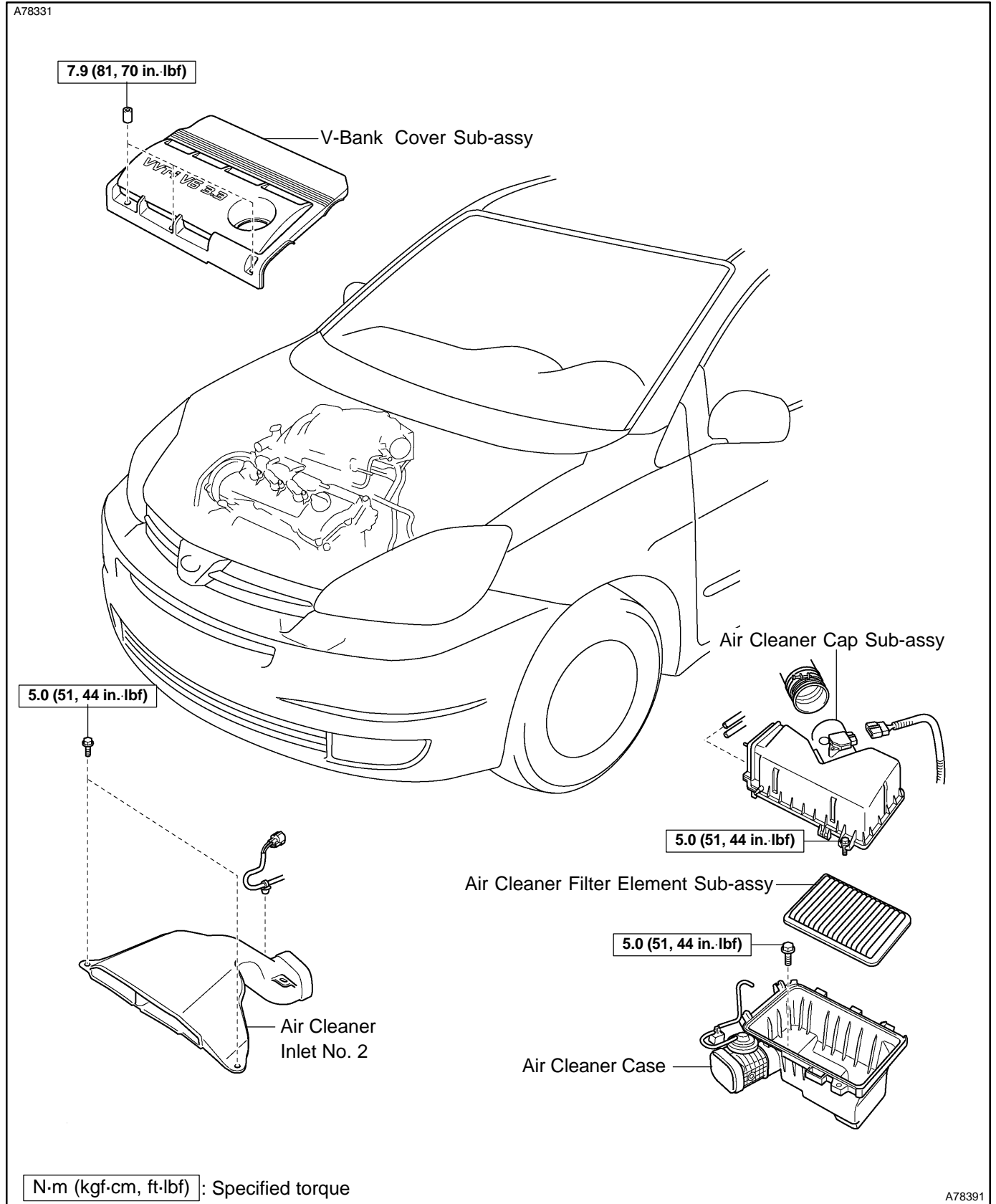
## COMPONENTS

141AW-01

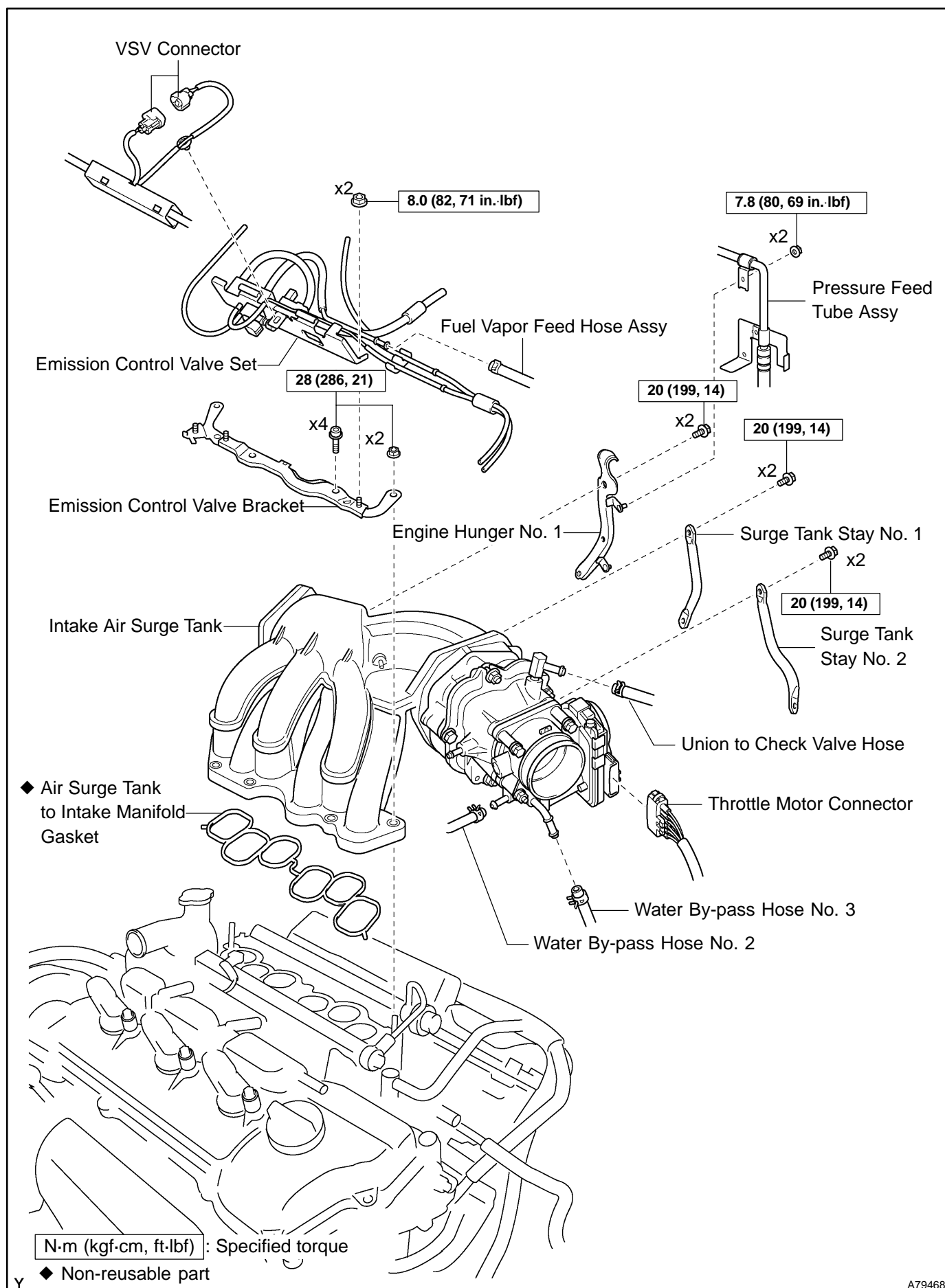


N-m (kgf-cm, ft-lbf) : Specified torque

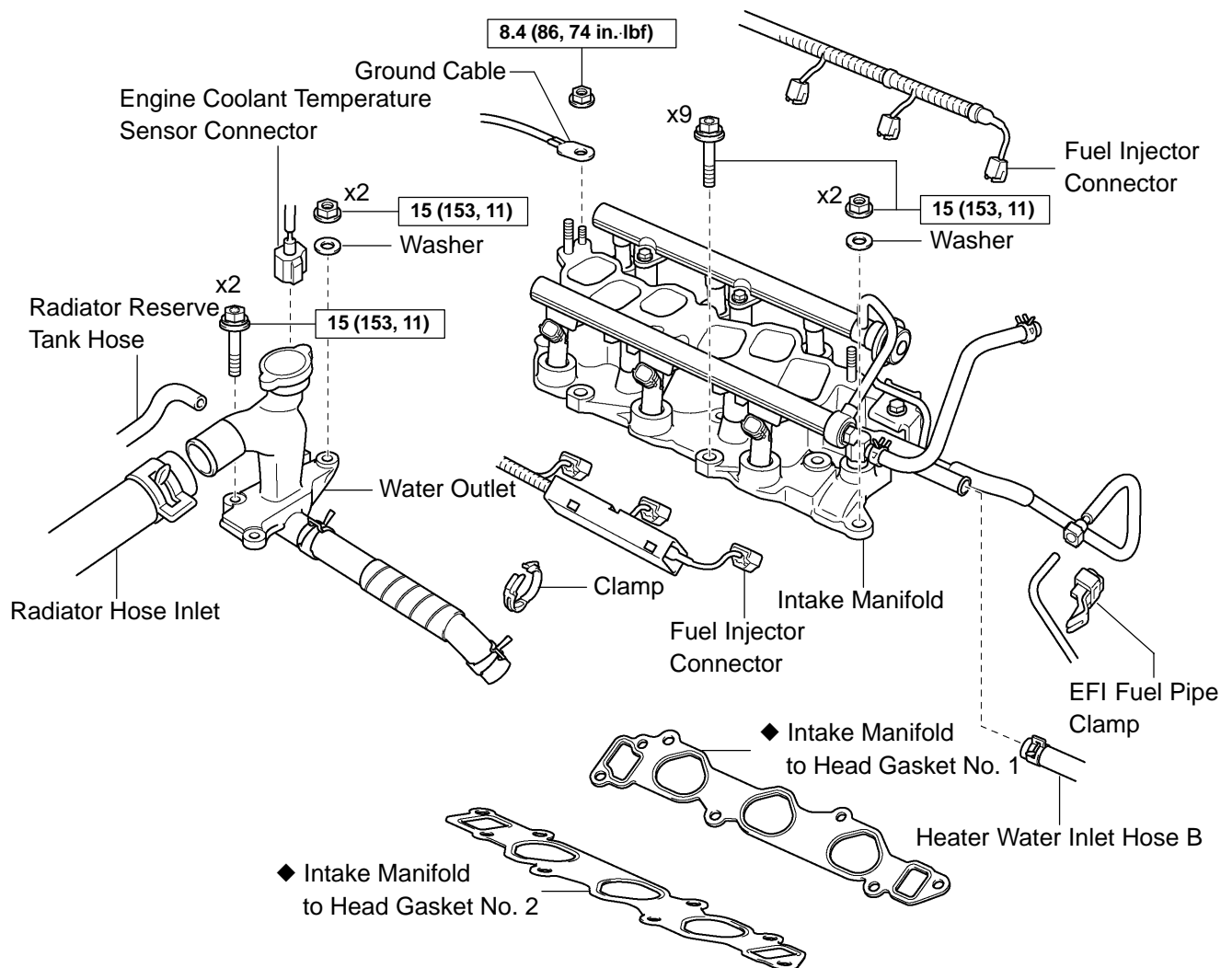
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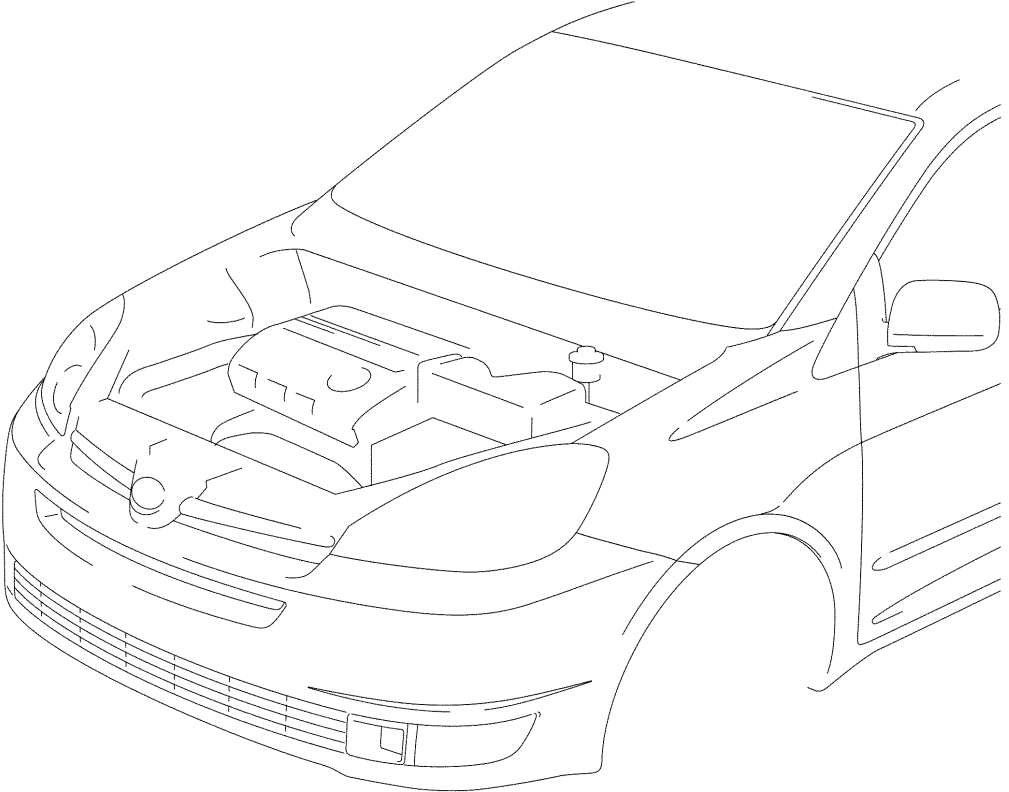
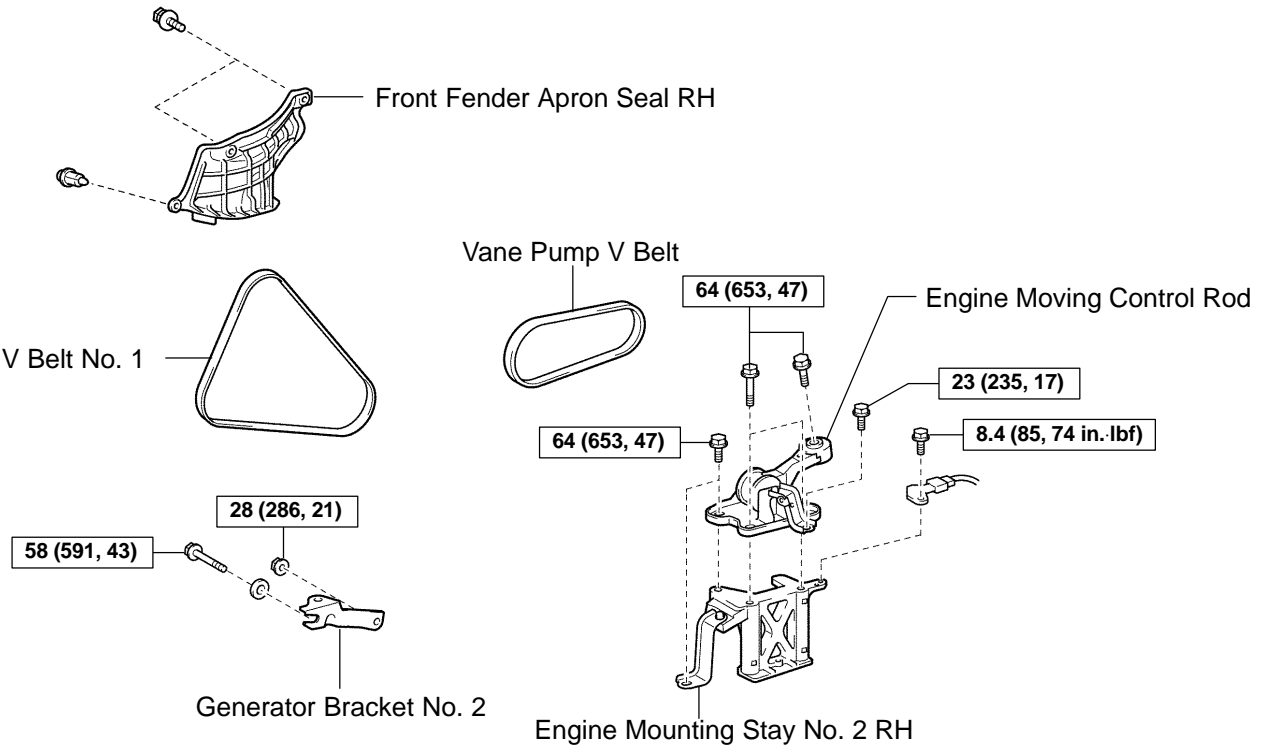
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N·m (kgf·cm, ft·lbf) : Specified torque

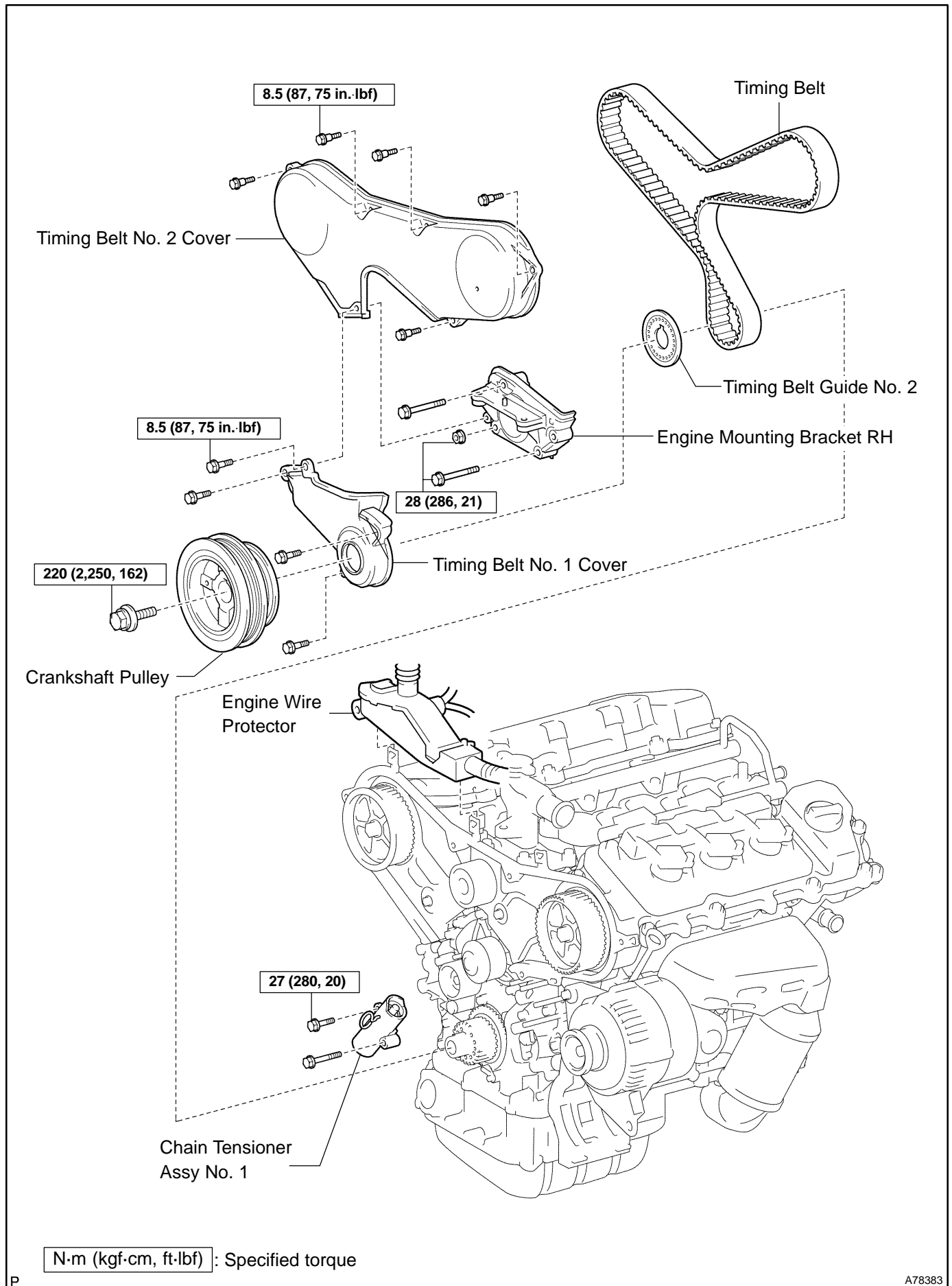
◆ Non-reusable part

A78387



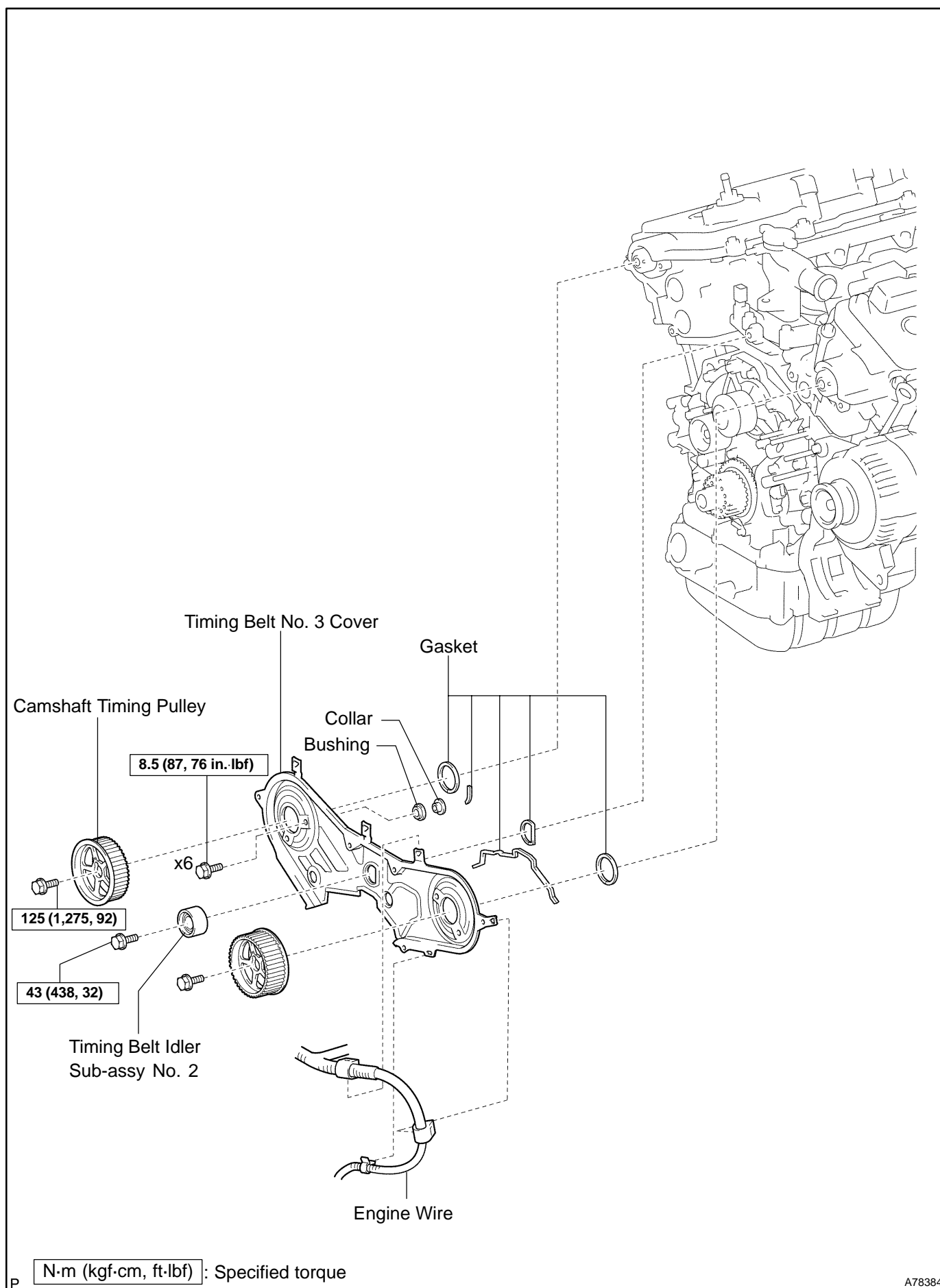
N·m (kgf·cm, ft·lbf) : Specified torque

A78352



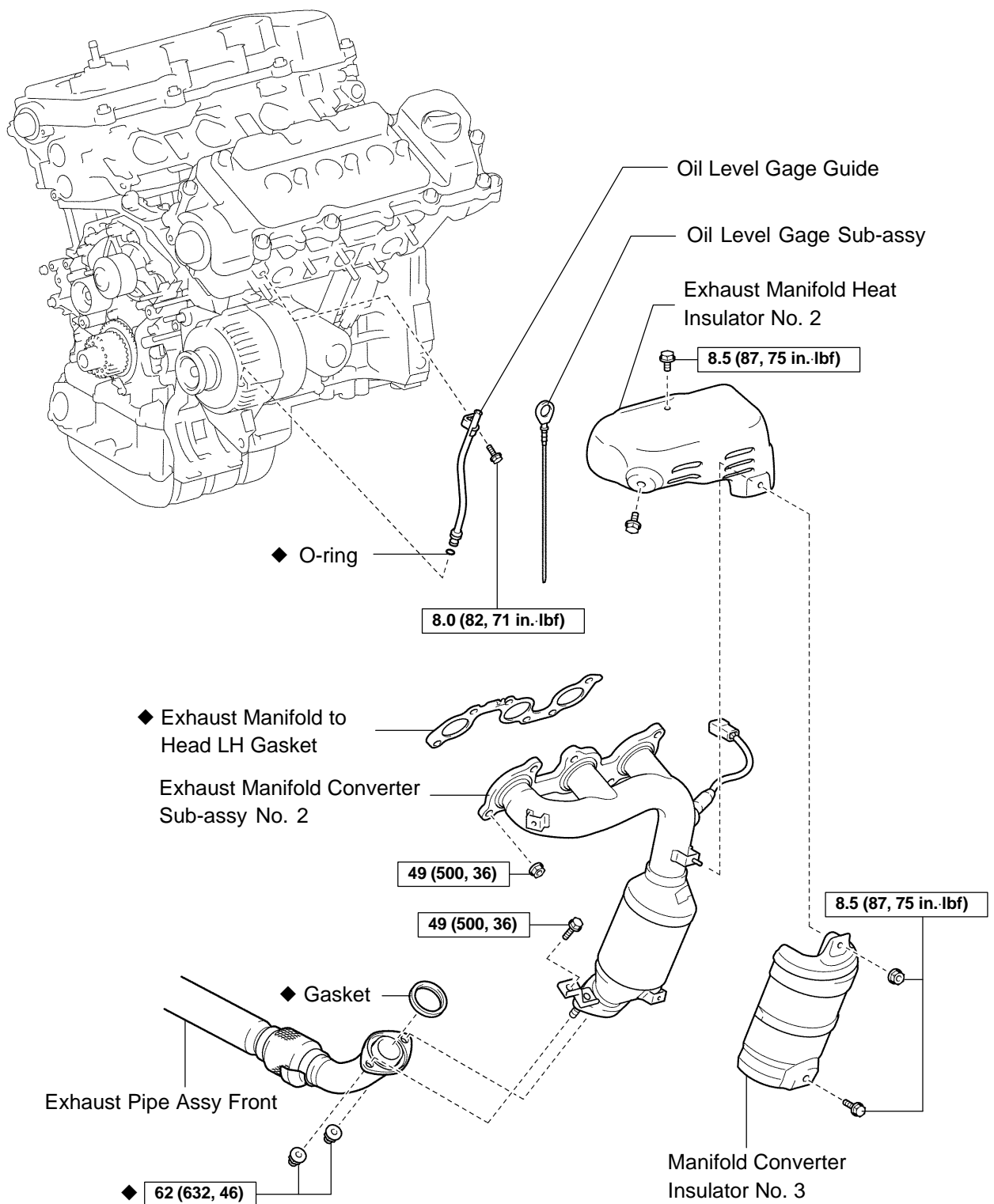
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A78383



P

A78384

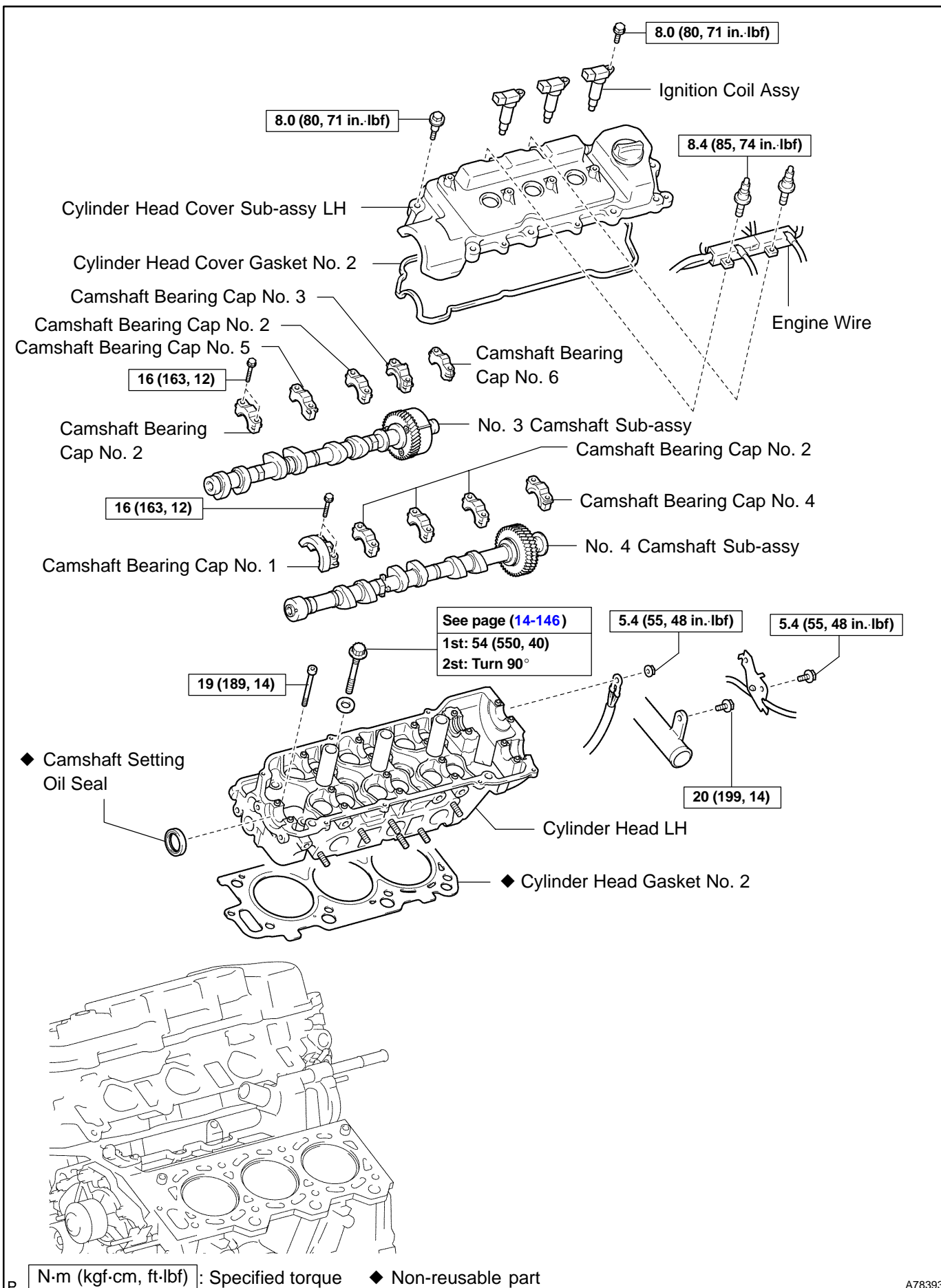


N·m (kgf·cm, ft·lbf) : Specified torque

◆ Non-reusable part

P

A78392



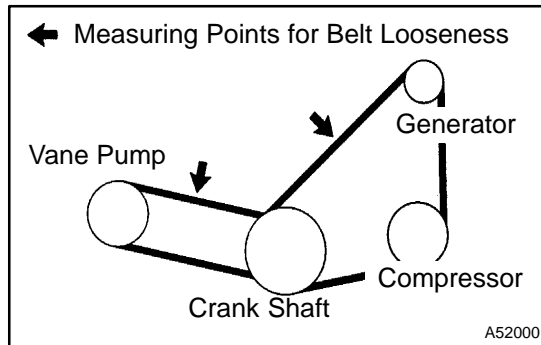
A78393

# ENGINE

## INSPECTION

1404Q-12

1. INSPECT COOLANT (See page 16-1 )
2. INSPECT ENGINE OIL
3. INSPECT BATTERY  
Standard specific gravity: 1.25 to 1.29 at 20°C (68°F)
4. INSPECT AIR CLEANER FILTER ELEMENT SUB-ASSY
5. INSPECT SPARK PLUG (See page 18-3 )



### 6. INSPECT V-RIBBED BELT

#### (a) Belt deflection:

Pressing force: 98 N (10 kgf, 221 lbf)

	New belt mm (in.)	Used belt mm (in.)
V ribbed belt (For fan and generator)	9.1 to 10.5 (0.358 to 0.413)	11.0 to 13.5 (0.433 to 0.531)
V ribbed belt (for vane pump)	8 to 10 (0.315 to 0.394)	11 to 14 (0.433 to 0.551)

#### (b) Tension:

	New belt N (kg , lb)	Used belt N (kg , lb)
V ribbed belt (for fan and generator)	617 to 853 (63 to 87 , 139 to 192)	294 to 490 (30 to 50 , 66 to 110)
V ribbed belt (for vane pump)	588 to 686 (60 to 70 , 132 to 154)	245 to 392 (25 to 40 , 55 to 88)

### NOTICE:

- Check the drive belt deflection at the specified point.
- When installing a new belt, set its tension value as specified.
- When checking a belt used for over 5 minutes, confirm the deflection value is within the specified one.
- When reinstalling a belt used for over 5 minutes, perform the check based on the used deflection value.
- V-ribbed belt tension and deflection value should be checked after 2 revolutions of engine cranking.
- When using a belt tension gauge, confirm the accuracy first by using a master gauge.

### 7. INSPECT IGNITION TIMING

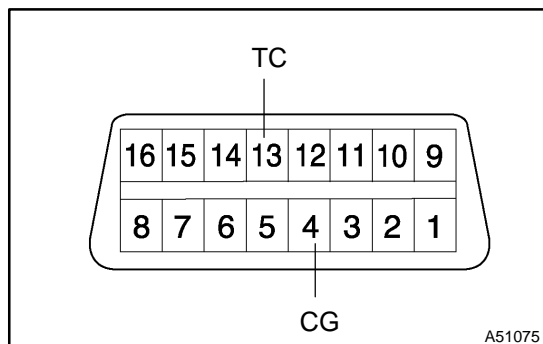
- (a) Warm up engine.
- (b) When using hand-held tester.
  - (1) Connect the hand-held tester to the DLC3.

#### HINT:

Please refer to the hand-held tester operator's manual for further details.

**Ignition timing : 8 to 12° BTDC**





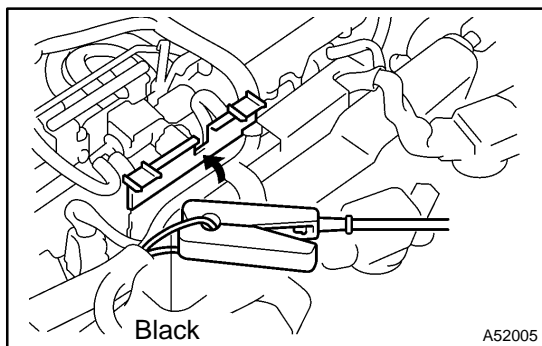
- (c) When not using hand-held tester.
- (1) Using SST, connect terminals 13 (TC) and 4 (CG) of DLC3.

SST 09843-18040

**NOTICE:**

- **Be careful not to connect incorrectly. It causes breakage of the engine.**
- **Turn OFF all electrical systems.**
- **Operate the inspection when the cooling fan motor is turned OFF.**

- (2) Remove the V-bank cover.



- (3) Pull out the wire harness as shown in the illustration. Connect the clip of the timing light to the engine.

**NOTICE:**

**Use a timing light which can detect the first signal.**

- (4) Inspect ignition timing at idle.

**Ignition timing : 8 to 12° BTDC**

**NOTICE:**

**When checking the ignition timing, the transmission is in neutral position.**

**HINT:**

After engine rpm is kept at 1,000 to 1,300 rpm. for 5 seconds, check that it returns idle speed.

- (5) Disconnect terminals 13 (TC) and 4 (CG) of the DLC3.

- (6) Inspect ignition timing at idle.

**Ignition timing : 7 to 24° BTDC**

- (7) Confirm that ignition timing moves to advanced angle when the engine rpm is increased.

- (8) Remove the timing light.

**8. INSPECT ENGINE IDLE SPEED**

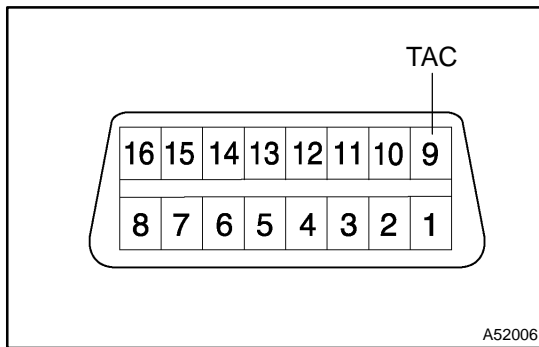
- (a) Warm up the engine.
- (b) When using hand-held tester.

- (1) Connect the hand-held tester to the DLC3.

**Idle speed: 550 to 650 rpm.**

**HINT:**

Please refer to the hand-held tester operator's manual for further details.



- (c) When not using hand-held tester.
- (1) Using SST, connect the tachometer test probe to terminal 9 (TAC) of DLC3.

SST 09843-18040

- (2) Check the idle speed.

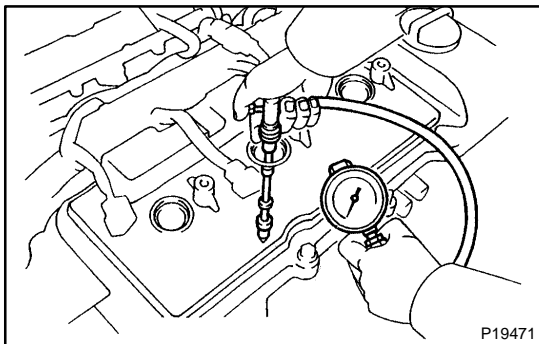
**Idle speed: 550 to 650 rpm.**

**NOTICE:**

- **Check idle speed with cooling fan OFF.**
- **Switch off all accessories and air conditioning.**

**9. INSPECT COMPRESSION**

- (a) Stop a warm engine.
- (b) Disconnect the injector connectors.
- (c) Remove the intake air surge tank. (See page 14-7 )
- (d) Remove the ignition coil.
- (e) Remove the spark plugs.



- (f) Inspect cylinder compression pressure.
- (1) Insert a compression gauge into the spark plug hole.
  - (2) While cranking the engine, measure the compression pressure.

**Compression pressure:**

**1.5 MPa (15.3 kgf/cm<sup>2</sup>, 218 psi)**

**Minimum pressure:**

**1.0 MPa (10.2 kgf/cm<sup>2</sup>, 145 psi)**

**Difference between each cylinder:**

**100 kPa (1.0 kgf/cm<sup>2</sup>, 15 psi)**

**NOTICE:**

- **Always use a fully charged battery to obtain engine speed of 250 rpm or more.**
  - **Check other cylinder's compression pressure in the same way.**
  - **This measurement must be done in as short a time as possible.**
- (3) If the cylinder compression is low, pour a small amount of engine oil into the cylinder through the spark plug hole and inspect again.

**HINT:**

- If adding oil increases the compression, it is likely that the piston rings and/or cylinder bore are worn or damaged.
- If pressure stays low, a valve may be sticking or seating improperly, or there may be leakage past the gasket.

**10. INSPECT CO/HC**

- (a) Start the engine.
- (b) Race the engine at 2,500 rpm. for approx. 180 seconds.
- (c) Insert CO/HC meter testing probe at least 40 cm (1.3 ft) into tailpipe during idling.
- (d) Immediately check CO/HC concentration at idle and/or 2,500 rpm.

**HINT:**

- Complete the measuring within 3 minutes.
  - When doing the 2 mode (idle and 2,500 rpm) test, the procedure may vary according to local regulations.
- (e) If the CO/HC concentration does not comply with regulations, troubleshoot in the order given below.
- (1) Check heated oxygen sensor operation. (See page [12-6](#) )
  - (2) 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	4. Faulty ignitions: <ul style="list-style-type: none"> <li>• Incorrect timing</li> <li>• Fouled, shorted or improperly gapped plugs</li> </ul> 5. Incorrect valve clearance 6. Leaky intake and exhaust valves 7. Leaky cylinders
Low	High	Rough idle (Fluctuating HC reading)	1. Vacuum leaks: <ul style="list-style-type: none"> <li>• PCV hoses</li> <li>• Intake manifold</li> <li>• Throttle body</li> <li>• Brake booster line</li> </ul> 2. Lean mixture causing misfire
High	High	Rough idle (Black smoke from exhaust)	1. Restricted air filter 2. Plugged PCV valve 3. Faulty EFI systems: <ul style="list-style-type: none"> <li>• Faulty pressure regulator</li> <li>• Defective water temperature sensor</li> <li>• Defective mass air-flow meter</li> <li>• Faulty ECM</li> <li>• Faulty injectors</li> <li>• Faulty throttle position sensor</li> </ul>

## OVERHAUL

### 1. REMOVE W/HEAD STRAIGHT SCREW PLUG NO.1 (RH CYLINDER)

- (a) Using a 14 mm straight hexagon wrench, remove the 2 screw plugs.

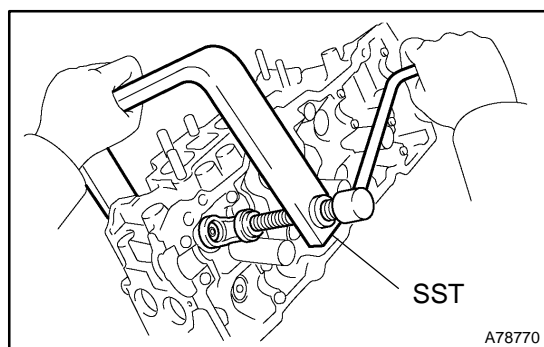
### 2. REMOVE W/HEAD STRAIGHT SCREW PLUG NO.2 (LH CYLINDER)

- (a) Using a 14 mm straight hexagon wrench, remove the 2 screw plugs.

### 3. REMOVE VALVE LIFTER

HINT:

Store the lifters in correct order so that they can be returned to the original locations when re-assembling.



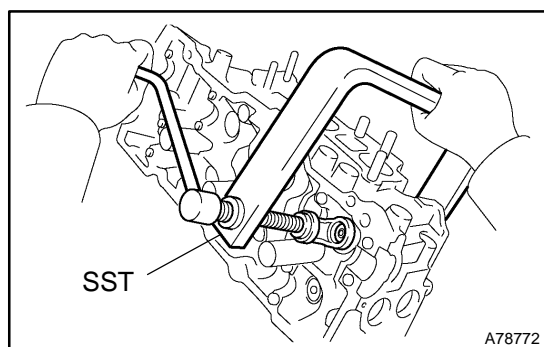
### 4. REMOVE INTAKE VALVE

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

SST 09202-70020 (09202-00010)

HINT:

Store the valves, valve springs, spring seats and spring retainers in correct order so that they can be returned to the original locations when re-assembling.



### 5. REMOVE EXHAUST VALVE

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

SST 09202-70020 (09202-00010)

HINT:

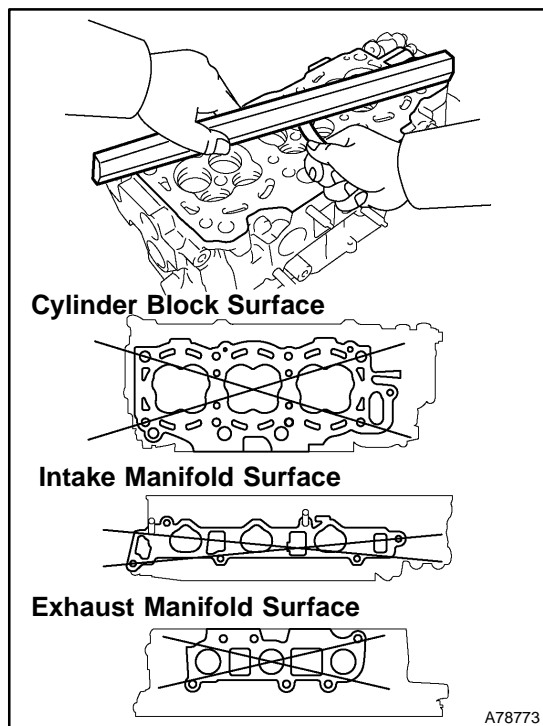
Store the valves, valve springs, spring seats and spring retainers in correct order so that they can be returned to the original locations when re-assembling.

### 6. REMOVE VALVE STEM OIL O SEAL OR RING

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

### 7. REMOVE VALVE SPRING SEAT

### 8. REMOVE SEMICIRCULAR PLUG



## 9. INSPECT CYLINDER HEAD FOR FLATNESS

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

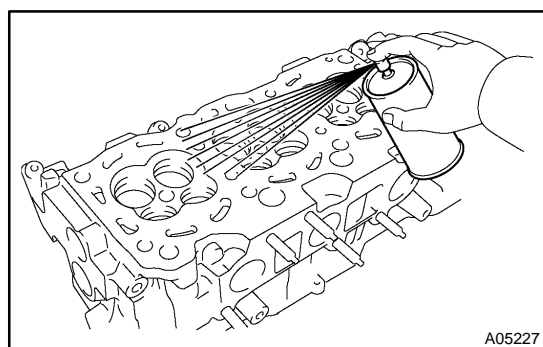
**Maximum warpage:**

**Cylinder block surface 0.05 mm (0.0020 in.)**

**Intake manifold surface 0.10 mm (0.0039 in.)**

**Exhaust manifold surface 0.10 mm (0.0039 in.)**

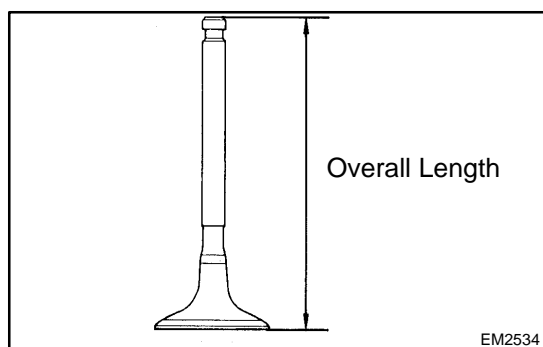
If warpage is greater than maximum, replace the cylinder head.



## 10. INSPECT CYLINDER HEAD FOR CRACKS

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

If cracked, replace the cylinder head.

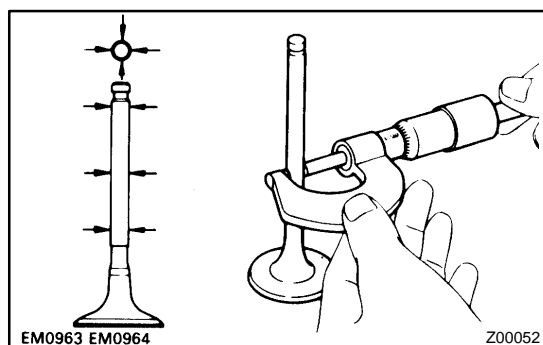


## 11. INSPECT INTAKE VALVE

- (a) Check the valve overall length.

**Standard overall length: 95.45 mm (3.7579 in.)**

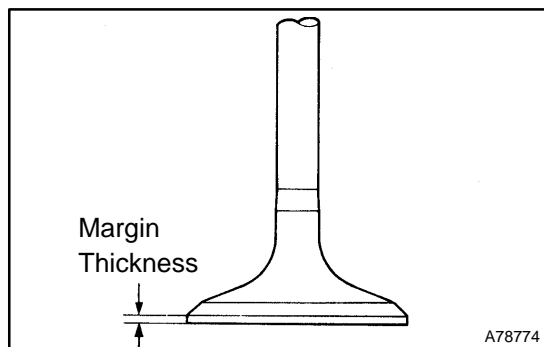
**Minimum overall length: 94.95 mm (3.7382 in.)**



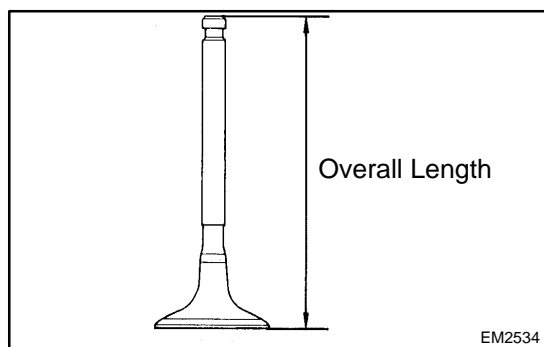
- (b) Using a micrometer, measure the diameter of the valve stem.

**Valve stem diameter:**

**5.470 to 5.485 mm (0.2154 to 0.2159 in.)**

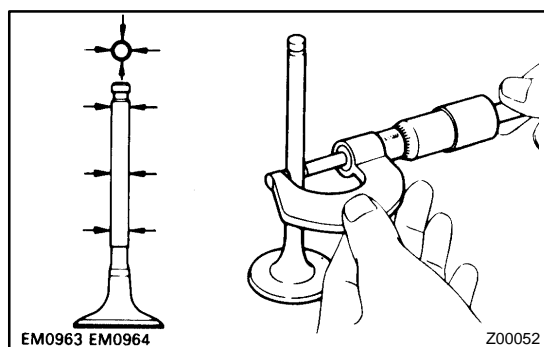


- (c) Check the valve head margin thickness.  
**Standard margin thickness: 1.0 mm (0.039 in.)**  
**Minimum margin thickness: 0.5 mm (0.020 in.)**

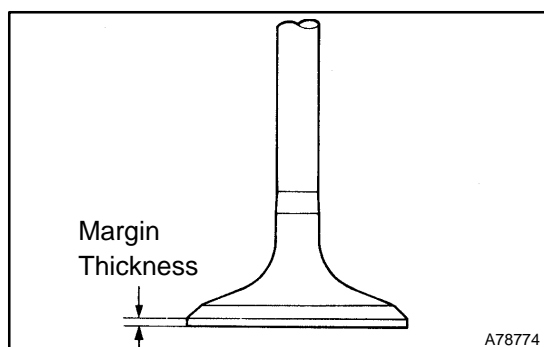


## 12. INSPECT EXHAUST VALVE

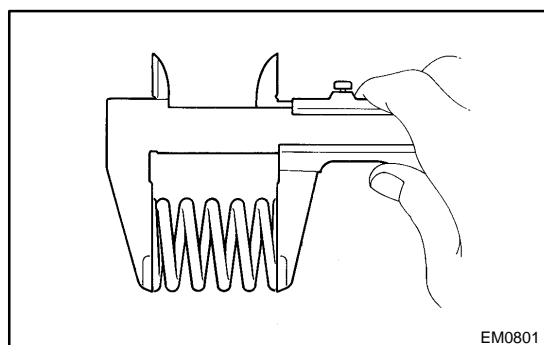
- (a) Check the valve overall length.  
**Standard overall length: 95.40 mm (3.7559 in.)**  
**Minimum overall length: 94.90 mm (3.7362 in.)**



- (b) Using a micrometer, measure the diameter of the valve stem.  
**Valve stem diameter:**  
**5.465 to 5.480 mm (0.2152 to 0.2157 in.)**

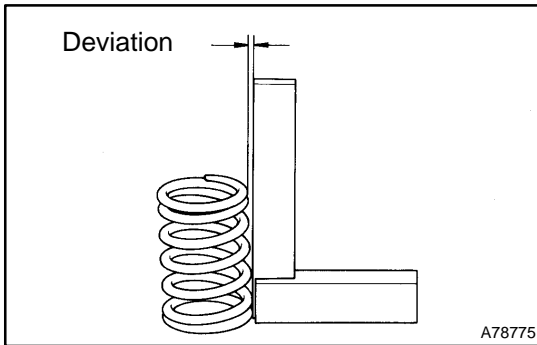


- (c) Check the valve head margin thickness.  
**Standard margin thickness: 1.0 mm (0.039 in.)**  
**Minimum margin thickness: 0.5 mm (0.020 in.)**

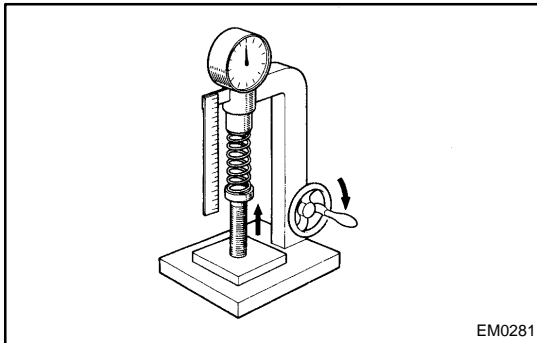


## 13. INSPECT INNER COMPRESSION SPRING

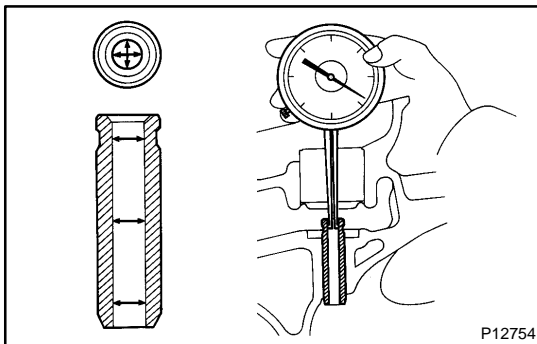
- (a) Using vernier calipers, measure the free length of the valve spring.  
**Free length: 45.50 mm (1.7913 in.)**



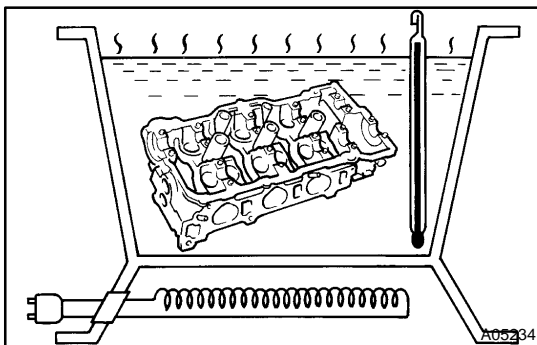
- (b) Using a steel square, measure the deviation of the valve spring.  
**Maximum deviation: 2.0 mm (0.079 in.)**



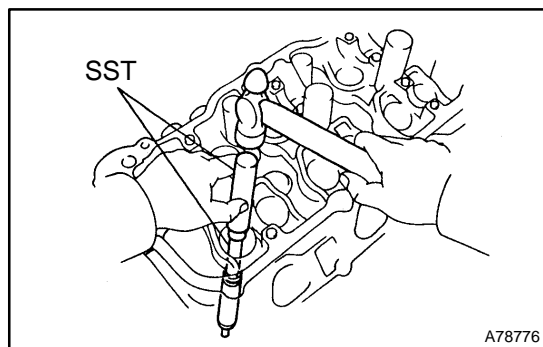
- (c) Using a spring tester, measure the tension of the valve spring at the specified installed length.  
**Installed tension:**  
**186 to 206 N (19.0 to 21.0 kgf, 41.9 to 46.3 lbf)**  
**at 33.8 mm (1.331 in.)**  
 If the installed tension is not as specified, replace the valve spring.



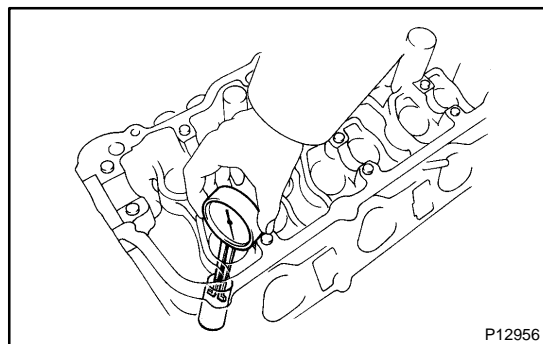
- 14. INSPECT VALVE GUIDE BUSHING OIL CLEARANCE**  
 (a) Using a caliper gauge, measure the inside diameter of the guide bushing.  
**Bushing inside diameter:**  
**5.510 to 5.530 mm (0.2169 to 0.2177 in.)**  
 (b) Subtract the valve stem diameter measurement from the guide bushing inside diameter measurement.  
**Standard oil clearance:**  
**Intake 0.025 to 0.060 mm (0.0010 to 0.0024 in.)**  
**Exhaust 0.030 to 0.065 mm (0.0012 to 0.0026 in.)**  
**Maximum oil clearance:**  
**Intake 0.08 mm (0.0031 in.)**  
**Exhaust 0.10 mm (0.0039 in.)**



- 15. REMOVE VALVE GUIDE BUSHING**  
 (a) Heat the cylinder head to 80 to 100 °C (176 to 212 °F).



- (b) Using SST and a hammer, tap out the guide bushing.  
 SST 09201-10000, 09201-01055, 09950-70010  
 (09951-07100)



## 16. INSTALL VALVE GUIDE BUSHING

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

**Diameter: 10.295 to 10.313 mm (0.4053 to 0.4060 in.)**

If the bushing bore diameter of the cylinder head is greater than 10.313 mm (0.4060 in.), machine the bushing bore to the dimension of 10.345 to 10.363 mm (0.4073 to 0.4080 in.)

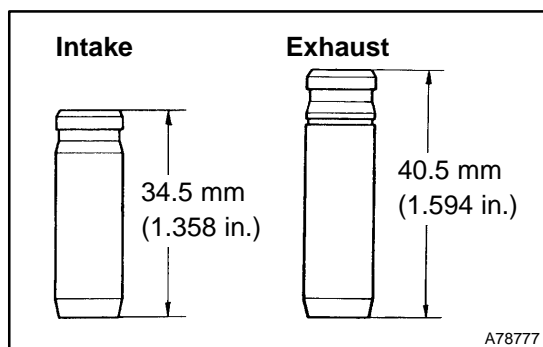
HINT:

### Bushing diameter

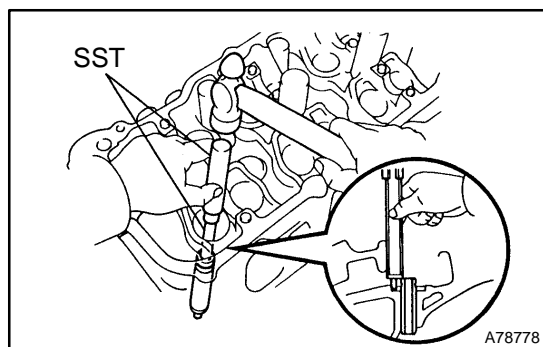
STD	10.333 to 10.344 mm (0.4068 to 0.4072 in.)
O/S	10.383 to 10.394 mm (0.4088 to 0.4092 in.)

### Bushing length

Intake	34.5 mm (1.358 in.)
Exhaust	40.5 mm (1.594 in.)



- (b) Heat the cylinder head to 80 to 100 °C (176 to 212 °F)



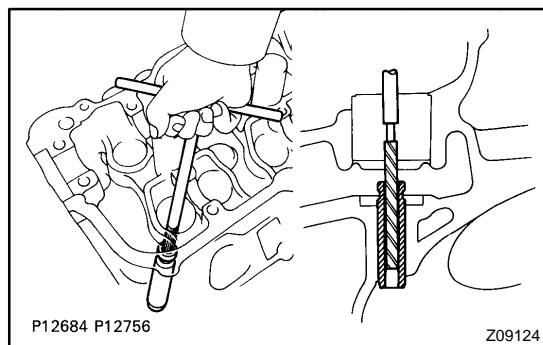
- (c) Using SST and a hammer, tap in a new guide bushing to the specified protrusion height.

SST 09201-10000, 09201-01055, 09950-70010  
 (09951-07100)

### Protrusion height:

**Intake: 11.1 to 11.5 mm (0.437 to 0.453 in.)**

**Exhaust: 8.9 to 9.3 mm (0.350 to 0.366 in.)**



- (d) Using a sharp 5.5 mm reamer, ream the guide bushing to obtain the standard specified clearance between the guide bushing and the valve stem.

### Standard oil clearance:

**Intake 0.025 to 0.060 mm (0.0010 to 0.0024 in.)**

**Exhaust 0.030 to 0.065 mm (0.0012 to 0.0026 in.)**

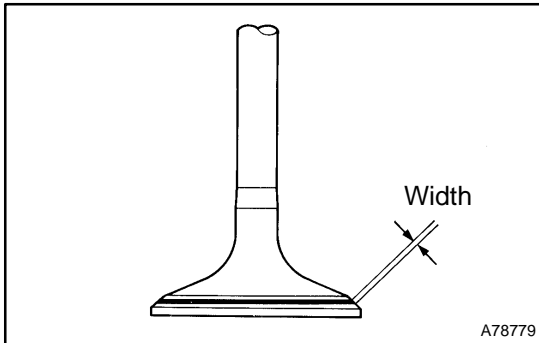


**17. INSPECT VALVE SEATS**

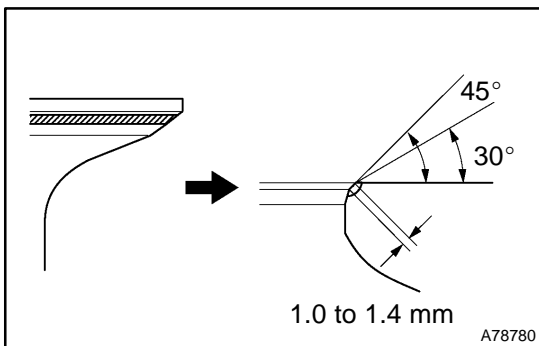
- (a) Apply a light coat of prussian blue (or white lead) to the valve face.
- (b) Lightly press the valve against the seat.

**NOTICE:**

**Do not rotate the valve.**

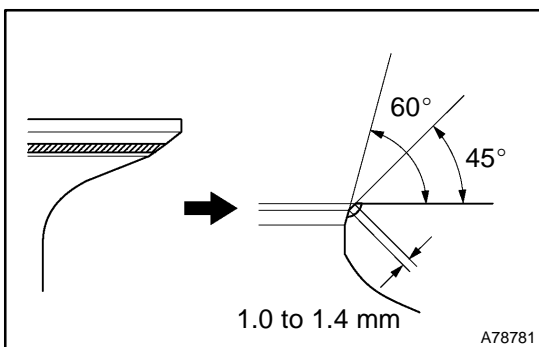


- (c) Check the valve face and seat according to the following procedure.
  - (1) If blue appears 360° around the face, the valve is concentric. If not, replace the valve.
  - (2) If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
  - (3) Check that the seat contact is in the middle of the valve face with the width between 1.0 to 1.4 mm (0.039 to 0.055 in.).

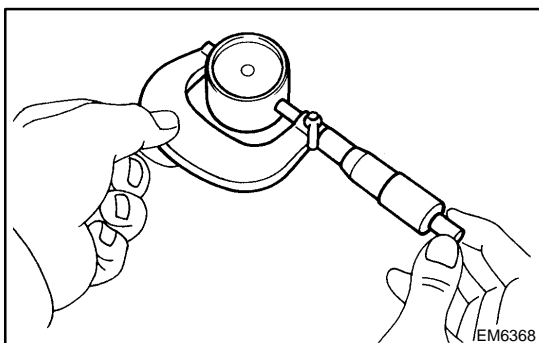
**18. REPAIR VALVE SEATS****NOTICE:**

**Releasing the seat-cutter pressure gradually helps to make smoother valve seat faces.**

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



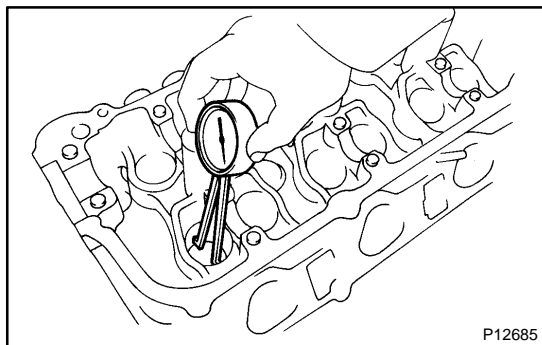
- (b) If the seating is too low on the valve face, use 60° and 45° cutters to correct the seat.
- (c) Hand-lap the valve and valve seat with an abrasive compound.
- (d) Recheck the valve seating position.

**19. INSPECT VALVE LIFTER**

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

**Lifter diameter:**

**30.966 to 30.976 mm (1.2191 to 1.2195 in.)**

**20. INSPECT VALVE LIFTER OIL CLEARANCE**

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

**Lifter bore diameter:**

**31.009 to 31.025 mm (1.2208 to 1.2215 in.)**

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

**Standard oil clearance:**

**0.033 to 0.059 mm (0.0013 to 0.0023 in.)**

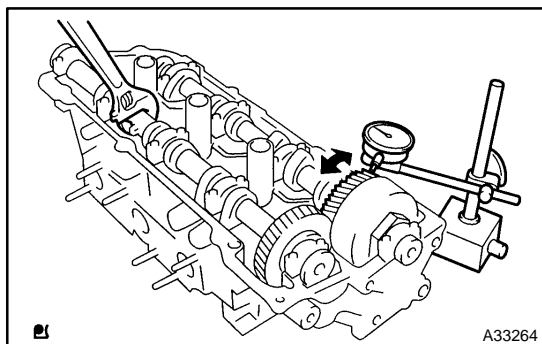
**Maximum oil clearance: 0.07 mm (0.0028 in.)**

**21. INSPECT CAMSHAFT GEAR BACKLASH**

- (a) Install camshaft timing gear assembly.  
(b) Install the camshafts to the cylinder head.

**NOTICE:**

- **Install without valves and sub-gear.**
- **Install with its timing mark matched.**



- (c) Set the dial indicator to the teeth of the intake camshaft at a right angle (90°).

- (d) Measure the backlash of the camshaft timing gear at least 4 positions.

**Standard backlash:**

**0.020 to 0.200 mm (0.0008 to 0.0079 in.)**

**Maximum backlash: 0.30 mm (0.0118 in.)**

**22. INSPECT CAMSHAFT THRUST CLEARANCE**

- (a) Install the camshafts.

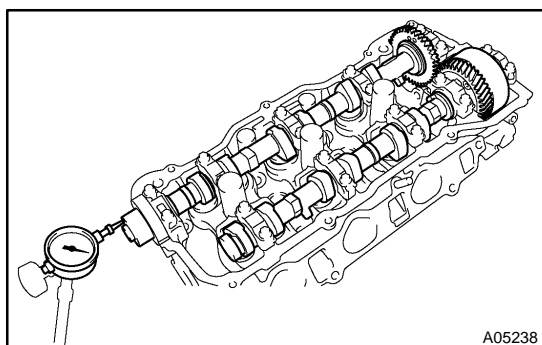
- (b) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

**Standard thrust clearance:**

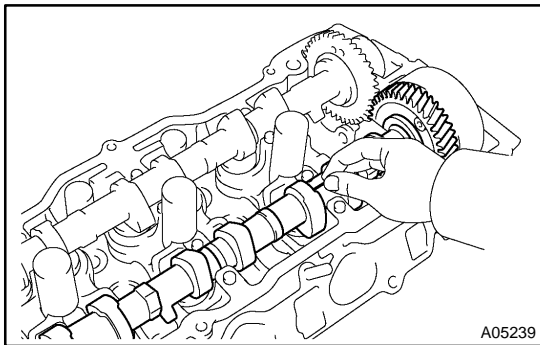
**0.040 to 0.090 mm (0.0016 to 0.0035 in.)**

**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 together.

**23. INSPECT CAMSHAFT OIL CLEARANCE**

- (a) Clean the bearing caps and camshaft journals.  
(b) Place the camshafts on the cylinder head.



(c) Lay a strip of plastigage across each of the camshaft journal.

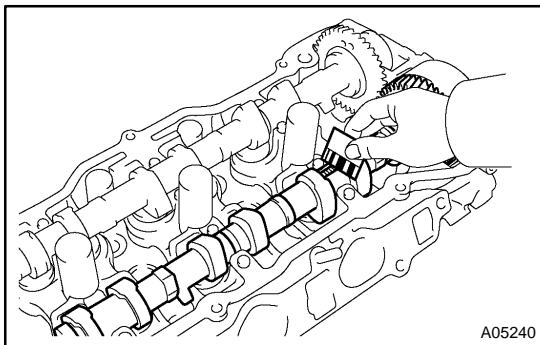
(d) Install the bearing caps.

**Torque: 16 N·m (163 kgf·cm, 12 ft·lbf)**

**NOTICE:**

**Do not turn the camshaft.**

(e) Remove the bearing caps.



(f) Measure the plastigage at its widest point.

**Standard oil clearance:**

**Intake #4, #5 journals**

**0.025 to 0.057 mm (0.0010 to 0.0022 in.)**

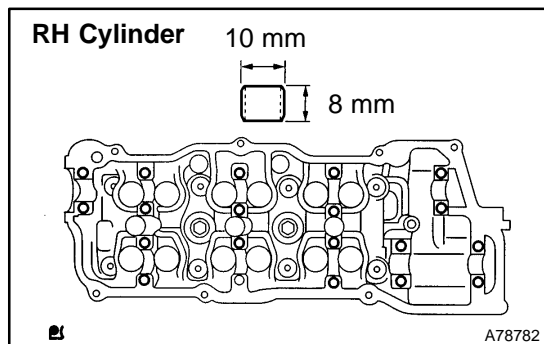
**Other journals 0.025 to 0.062 mm (0.0010 to 0.0024 in.)**

**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 together.

**NOTICE:**

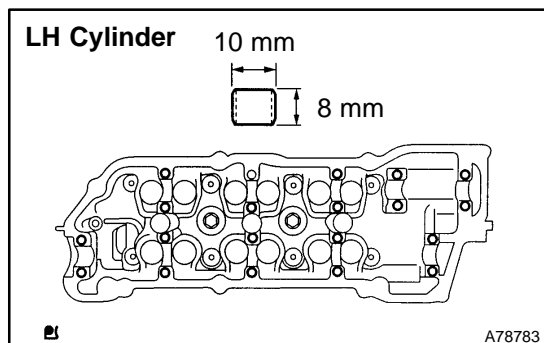
**Completely remove the plastigage.**



**24. INSTALL RING W/HEAD PIN (RH CYLINDER)**

(a) Using a plastic-faced hammer, tap in a new ring pin to the specified protrusion height.

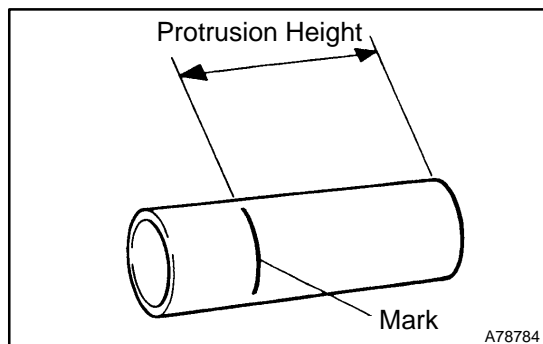
**Protrusion height: 3 mm (0.12 in.)**



**25. INSTALL RING PIN (LH CYLINDER)**

(a) Using a plastic-faced hammer, tap in a new ring pin to the specified protrusion height.

**Protrusion height: 3 mm (0.12 in.)**



## 26. INSTALL SPARK PLUG TUBE

- (a) Using paint, mark the standard position from the edge.

**Standard protrusion height:**

**42.4 to 43.4 mm (1.669 to 1.709 in.)**

### HINT:

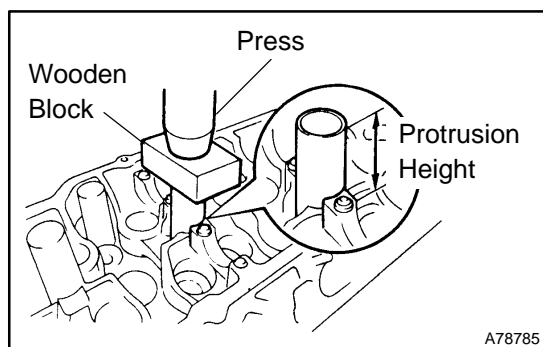
Use either end of the spark plug tube.

- (b) Apply adhesive to the spark plug tube where it will be pressed into the cylinder head.

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

### NOTICE:

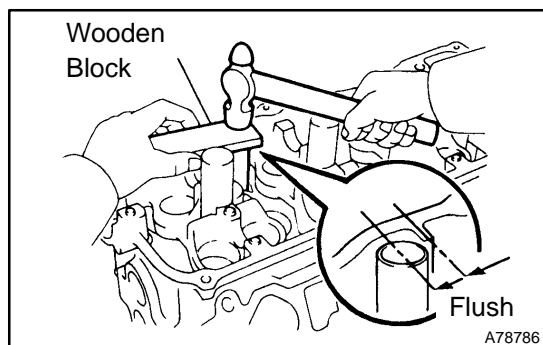
- Install the spark plug tube within 3 minutes after applying adhesive.
- Do not deform the spark plug tube.
- Do not expose the seal to coolant within an hour after installing.



- (c) Using a press and wooden block, install the spark plug tube to the required protrusion height.

### NOTICE:

**Be careful not to drip the adhesive.**

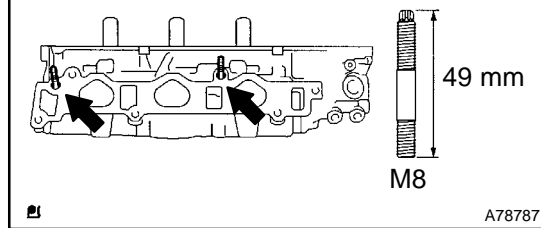


## 27. INSTALL PCV PIPE (RH CYLINDER)

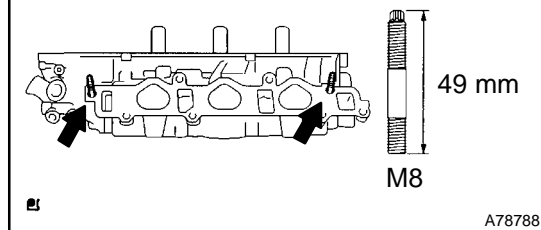
- (a) Using a wooden block and hammer, tap in 2 new PCV pipes until its top edge is flush with the cylinder head edge.

### NOTICE:

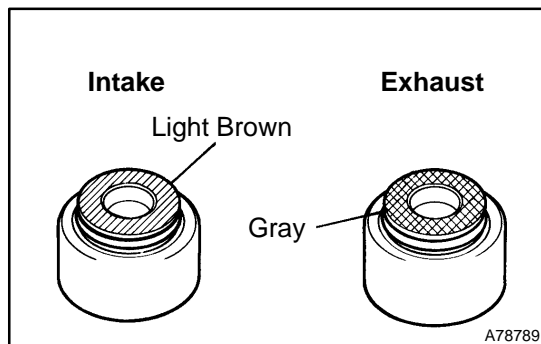
**Be careful not to damage the cylinder head edge.**

**RH Cylinder****28. INSTALL STUD BOLT**

- (a) Install the stud bolts on the intake side.  
**Torque: 7.5 N·m (76 kgf·cm, 66 in·lbf)**

**LH Cylinder****29. INSTALL STUD BOLT**

- (a) Install the stud bolts on the exhaust side.  
**Torque: 15 N·m (153 kgf·cm, 11 ft·lbf)**

**30. INSTALL VALVE STEM OIL O SEAL OR RING**

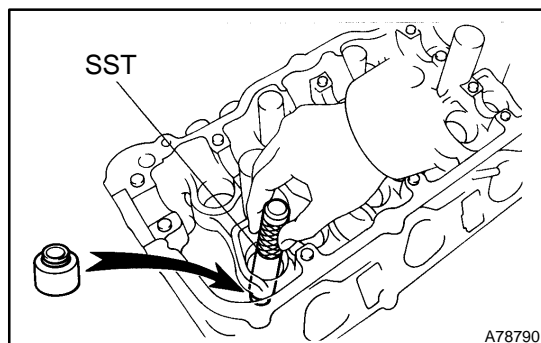
- (a) Apply a light coat of engine oil on the valve stem.

**NOTICE:**

**Pay much attention assembling the oil seal for intake and exhaust. Assembling the wrong one may cause a failure.**

**HINT:**

The intake valve oil seal is light brown and the exhaust valve oil seal is gray.

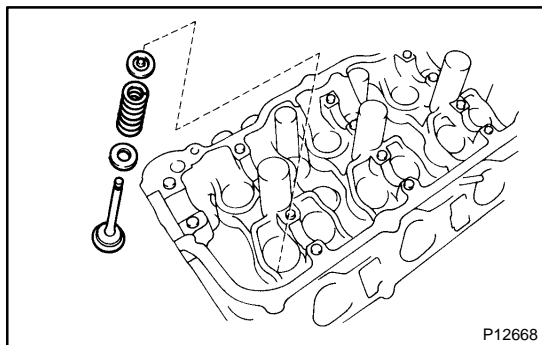


- (b) Using SST, push in a new oil seal.

SST 09201-41020

**NOTICE:**

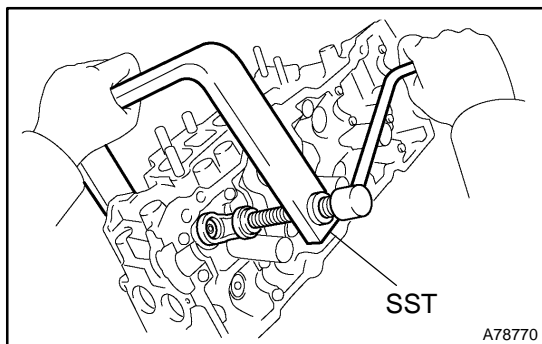
**Failure to use SST will cause the seal to be damaged or improperly seated.**

**31. INSTALL INTAKE VALVE**

- (a) Install the valve, spring seat, valve spring, and spring retainer.

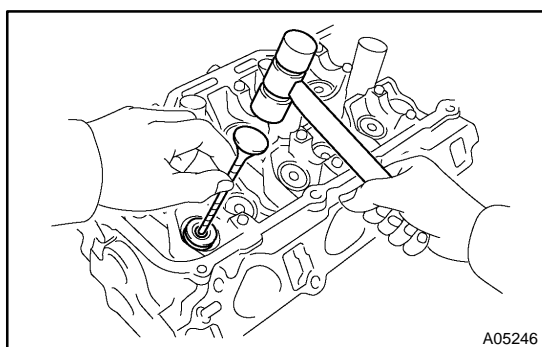
**NOTICE:**

**Install the same part in the same combination to the original locations.**



- (b) Using SST, compress the valve spring and place the 2 keepers around the valve stem.

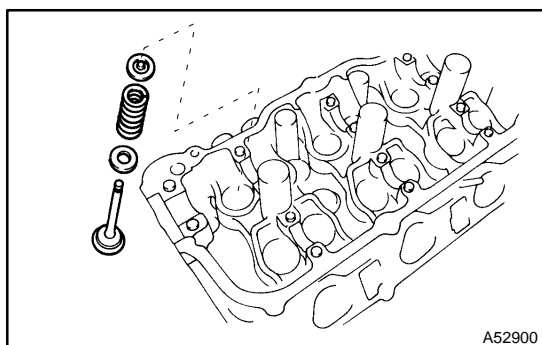
SST 09202-70020 (09202-00010)



- (c) Using a plastic-faced hammer and a discarded valve (the tip is wrapped with tape), lightly tap the installed valve to fitting into place.

**NOTICE:**

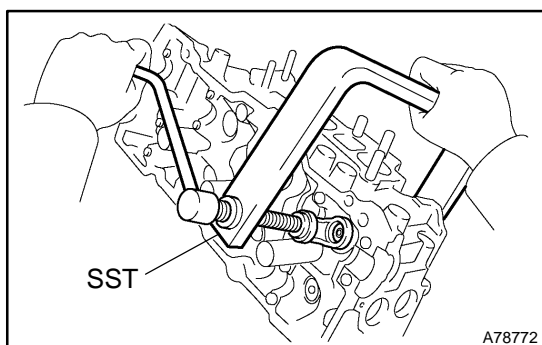
**Be careful not to damage the installed valve stem tip.**

**32. INSTALL EXHAUST VALVE**

- (a) Install the valve, spring seat, valve spring, and spring retainer.

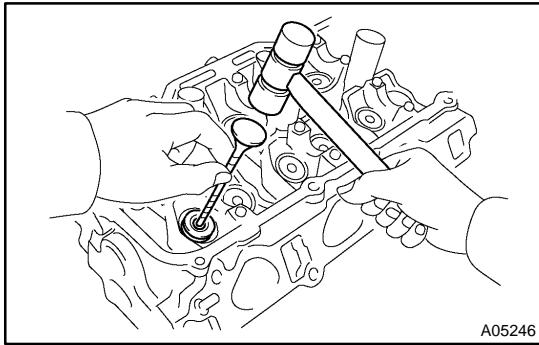
**NOTICE:**

**Install the same parts in the same combination to the original locations.**



- (b) Using SST, compress the valve spring and place the 2 keepers around the valve stem.

SST 09202-70020 (09202-00010)



- (c) Using a plastic-faced hammer and a discarded valve (the tip is wrapped with tape), lightly tap the installed valve to fitting into place.

**NOTICE:**

**Be careful not to damage the installed valve stem tip.**

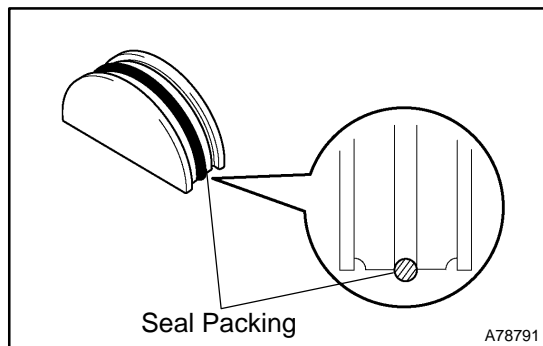
**33. INSTALL VALVE LIFTER**

- (a) Apply a light coat of engine oil on the valve lifter.

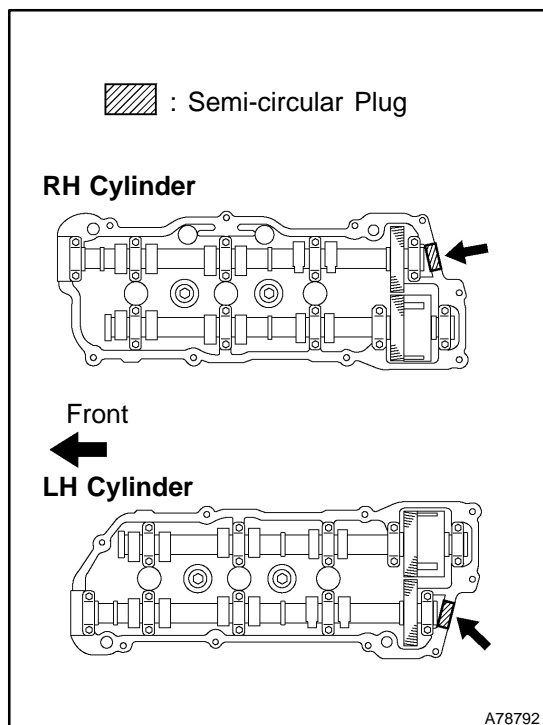
**NOTICE:**

**Install the same part in the same combination to the original locations.**

- (b) Install the valve lifter.  
(c) Check that the valve lifter rotates smoothly by hand.

**34. INSTALL SEMICIRCULAR PLUG**

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



- (c) Install the 2 semi-circular plugs to the cylinder heads.

**NOTICE:**

- Install the plugs flush with the top of the cylinder head.
- Install the semi-circular plugs within 3 minutes after applying seal packing.
- Do not expose the seal to engine oil within 2 hours after installing.

**35. INSTALL W/HEAD STRAIGHT SCREW PLUG NO.1 (RH CYLINDER)**

- (a) Using a 10mm socket hexagon wrench, install 2 new gaskets and the 2 screw plugs.

**Torque: 44 N·m (449 kgf·cm, 32 ft·lbf)**

**36. INSTALL W/HEAD STRAIGHT SCREW PLUG NO.2 (LH CYLINDER)**

- (a) Using a 10mm socket hexagon wrench, install 2 new gaskets and the 2 screw plugs.

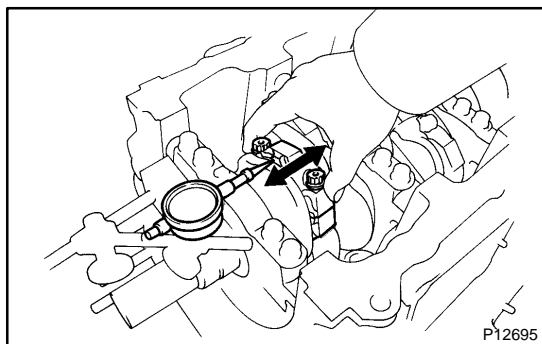
**Torque: 44 N·m (449 kgf·cm, 32 ft·lbf)**



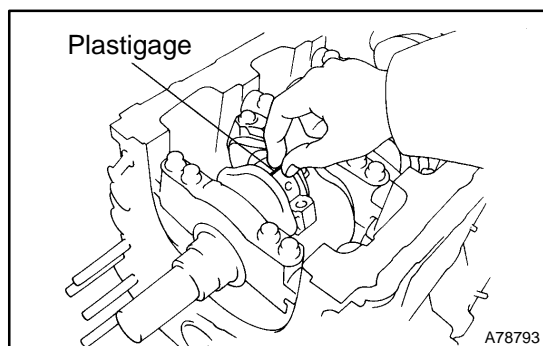
## OVERHAUL

1. **REMOVE CYLINDER BLOCK WATER DRAIN COCK SUB-ASSY**
2. **REMOVE WATER SEAL PLATE**
3. **REMOVE CYLINDER BLOCK W/HEAD STRAIGHT SCREW NO.1 PLUG**
  - (a) Using a 10 mm socket hexagon wrench, remove the screw plug.
4. **REMOVE CYLINDER BLOCK W/HEAD STRAIGHT SCREW NO.2 PLUG**
  - (a) Using a 10 mm socket hexagon wrench, remove the screw plug.
5. **REMOVE CYLINDER BLOCK W/HEAD STRAIGHT SCREW NO.3 PLUG**
  - (a) Using a 10 mm socket hexagon wrench, remove the screw plug.

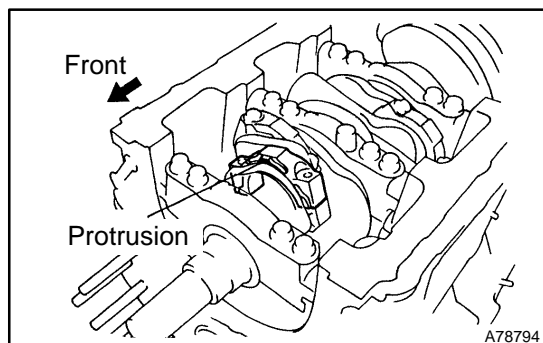
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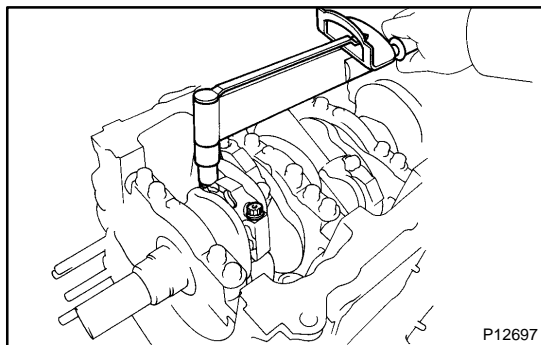
6. **INSPECT CONNECTING ROD THRUST CLEARANCE**
  - (a) Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.  
**Standard thrust clearance:**  
**0.15 to 0.30 mm (0.0059 to 0.0118 in.)**  
**Maximum thrust clearance: 0.35 mm (0.0138 in.)**
7. **INSPECT CONNECTING ROD OIL CLEARANCE**
  - (a) Check the matchmarks on the connecting rod and the cap are aligned to ensure correct reassembly.
  - (b) Remove the 2 connecting rod cap bolts.
  - (c) Clean the crank pin, the bearing and the connecting rod.
  - (d) Check the crank pin and the bearing for pitting and scratches.



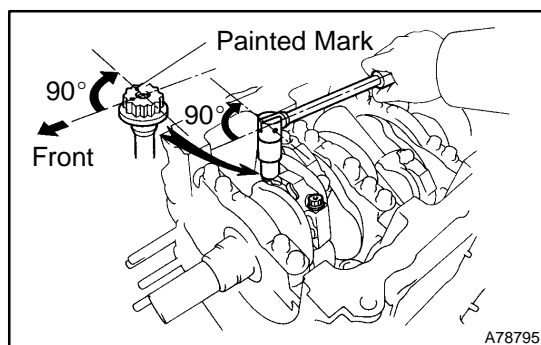
- (e) Lay a strip of plastigage across the crank pin.



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



- (h) Tighten the bolts in several steps by the specified torque.  
**Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)**

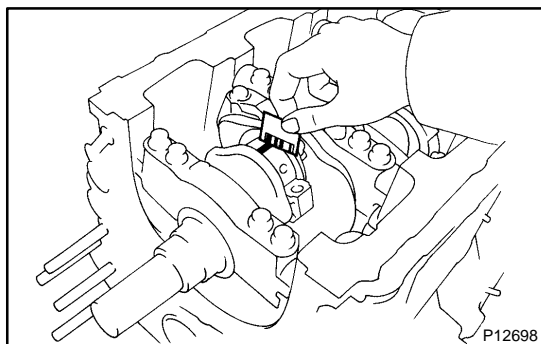


- (i) Mark the front side of the each connecting cap bolt with paint.  
(j) Retighten the cap bolts by 90° as shown in the illustration.

**NOTICE:**

**Do not turn the crankshaft.**

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



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

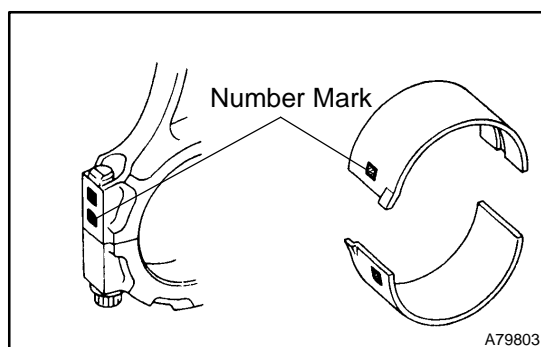
**Standard oil clearance:**

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

**Maximum oil clearance: 0.08 mm (0.0031 in.)**

**NOTICE:**

**Completely remove the plastigage.**

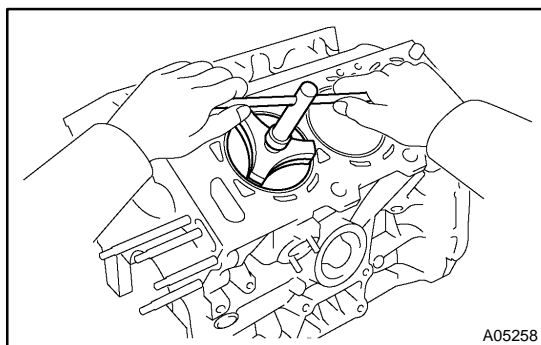


If replacing the bearing, replace it with one having the same number as marked on the connecting rod. There are 4 sizes of standard bearings, marked "1", "2", "3" and "4" accordingly.

**HINT:**

Standard bearing center wall thickness

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

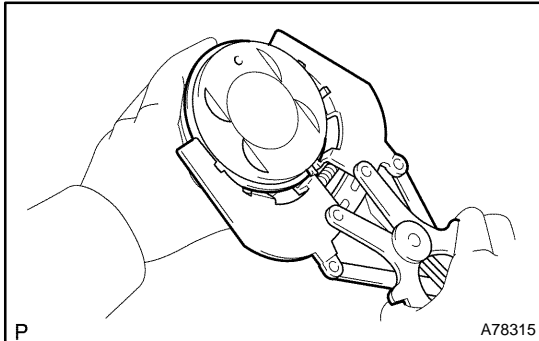
**8. REMOVE PISTON SUB-ASSY W/CONNECTING ROD**

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

**HINT:**

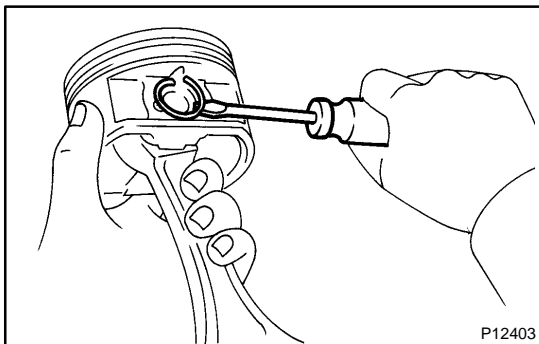
- Keep the bearings, the connecting rod and the cap together.
- Arrange the piston and the connecting rod assemblies in correct order.

## 9. REMOVE CONNECTING ROD BEARING



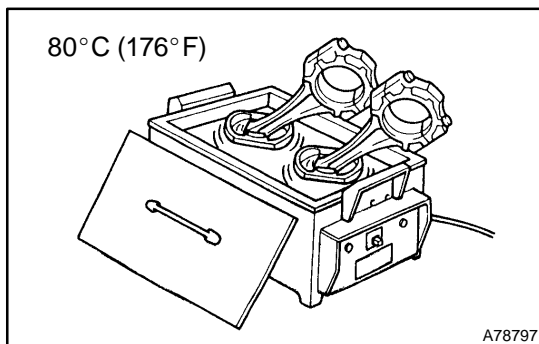
## 10. REMOVE PISTON RING SET

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



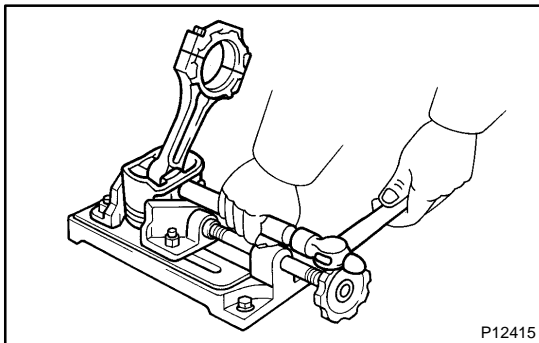
## 11. REMOVE PISTON PIN HOLE SNAP RING

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



## 12. REMOVE W/PIN PISTON SUB-ASSY

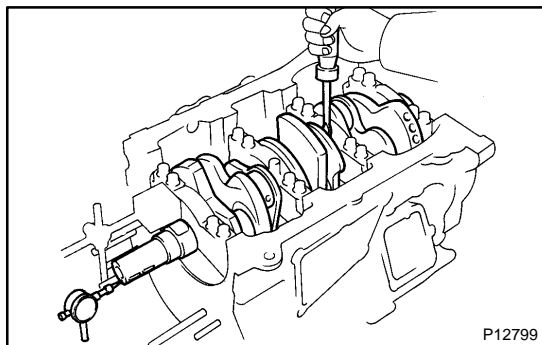
- (a) Gradually heat the piston to approx. 80°C (176°F).



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

### HINT:

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



### 13. INSPECT CRANKSHAFT THRUST CLEARANCE

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

**Standard thrust clearance:**

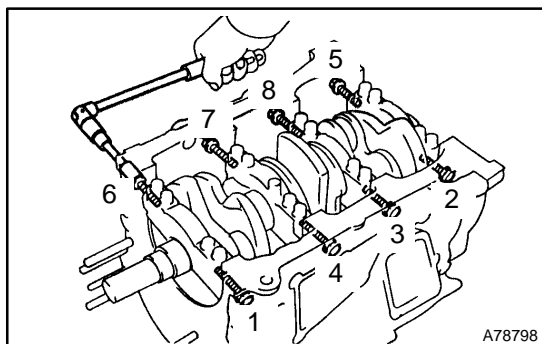
**0.04 to 0.24 mm (0.0016 to 0.0094 in.)**

**Maximum thrust clearance: 0.30 mm (0.0118 in.)**

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

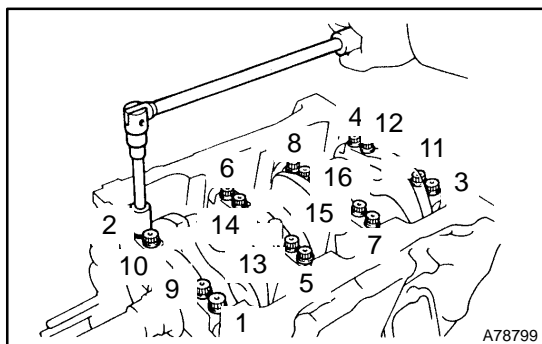
**HINT:**

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

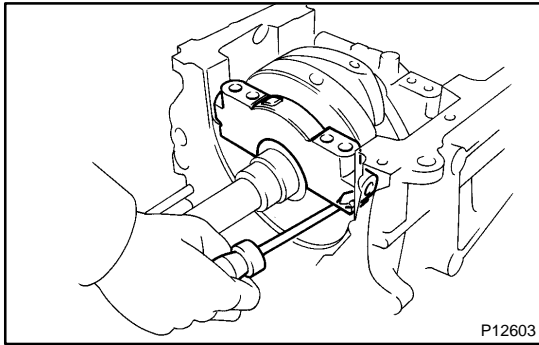


### 14. REMOVE CRANKSHAFT

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



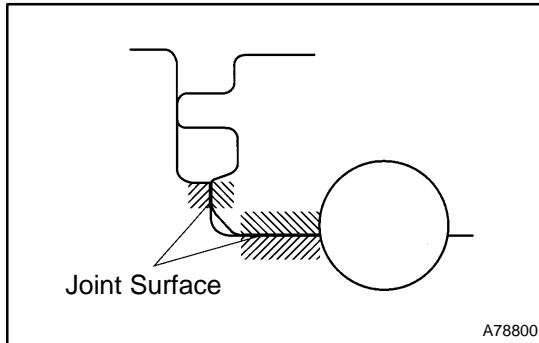
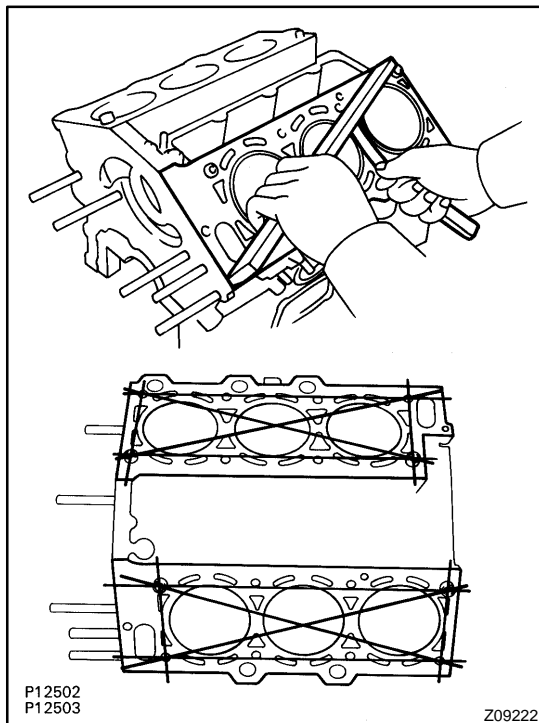
- (b) Using several steps, loosen and remove the 16 main bearing cap bolts uniformly in the sequence shown in the illustration.



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

**NOTICE:**

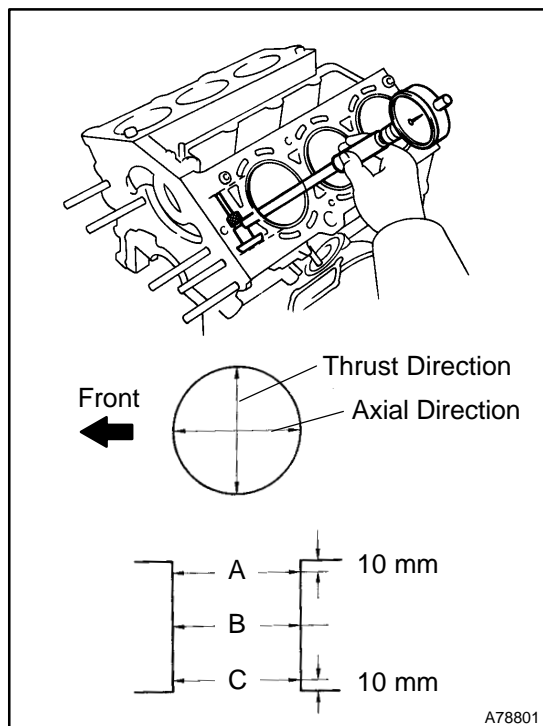
- Carefully pry out the main bearing cap by alternating lifting a little at a time on each end the cap.
- Be careful not to damage the joint surface of the cylinder block and the main bearing cap.

**15. REMOVE CRANKSHAFT THRUST WASHER SET****16. REMOVE CRANKSHAFT BEARING****17. INSPECT CYLINDER BLOCK FOR FLATNESS**

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

**Maximum warpage: 0.05 mm (0.0020 in.)**

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

**18. INSPECT CYLINDER BORE**

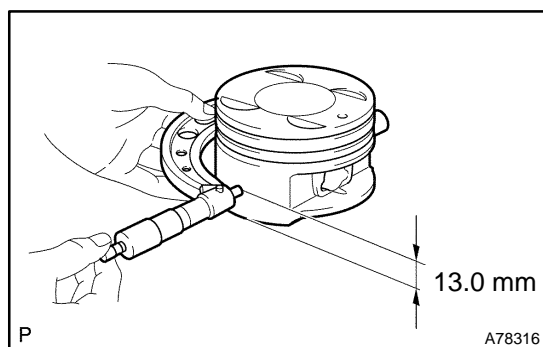
- (a) Using a cylinder gauge, measure the cylinder bore diameter at positions A, B and C in the thrust and axial directions.

**Standard diameter:**

**92.000 to 92.012 mm (3.6220 to 3.6225 in.)**

**Maximum diameter: 92.080 mm (3.6252 in.)**

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

**19. INSPECT W/PIN PISTON SUB-ASSY**

- (a) Using a micrometer, measure a diameter of the piston. When you measure the diameter, attach the micrometer to a location where 13.0 mm (0.512 in.) above from the piston bottom and meets at the right angles to the piston pin hole.

**Piston diameter:**

**91.953 to 91.967 mm (3.6202 to 3.6207 in.)**

**20. INSPECT PISTON OIL CLEARANCE**

- (a) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

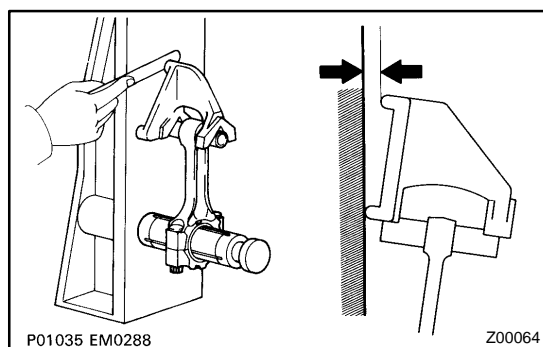
**Standard oil clearance: 0.033 to 0.059 mm (0.0013 to 0.0023 in.)**

**Maximum oil clearance: 0.13 mm (0.0051 in.)**

If the oil clearance is greater than maximum, replace all the 6 pistons. If necessary, replace the cylinder block.

**21. INSPECT CONNECTING ROD SUB-ASSY**

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

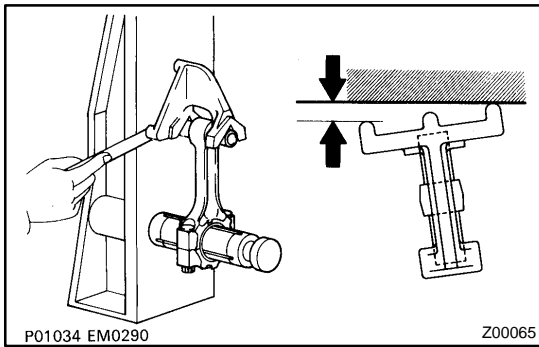


- (1) Check for misalignment.

**Maximum misalignment:**

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

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

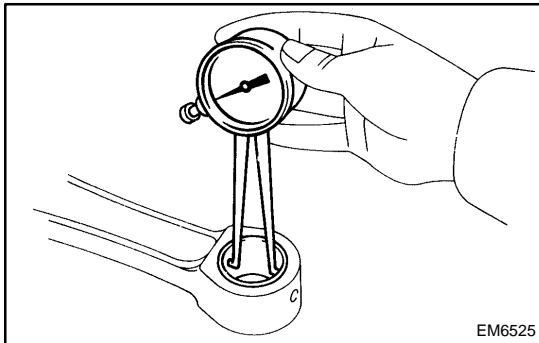


(2) Check for twist.

**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.

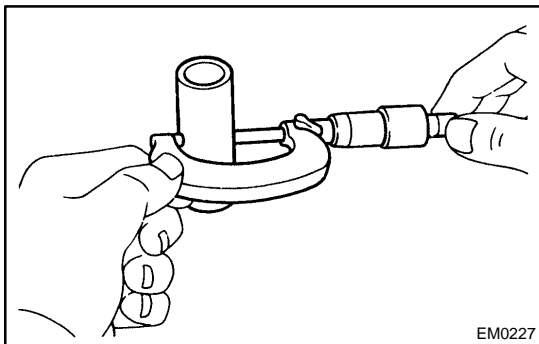


## 22. INSPECT PISTON PIN OIL CLEARANCE

(a) Using a caliper gauge, measure the inside diameter of the connecting rod bushing.

**Bushing inside diameter:**

**22.005 to 22.014 mm (0.8663 to 0.8667 in.)**



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

**Piston pin diameter:**

**21.997 to 22.006 mm (0.8660 to 0.8664 in.)**

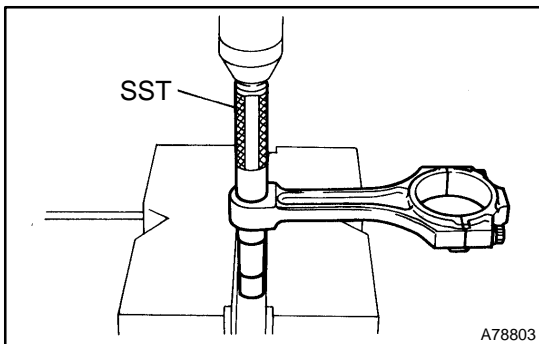
(c) Subtract the piston pin diameter measurement from the bushing inside diameter measurement.

**Standard oil clearance:**

**0.005 to 0.011 mm (0.0002 to 0.0004 in.)**

**Maximum oil clearance: 0.05 mm (0.0020 in.)**

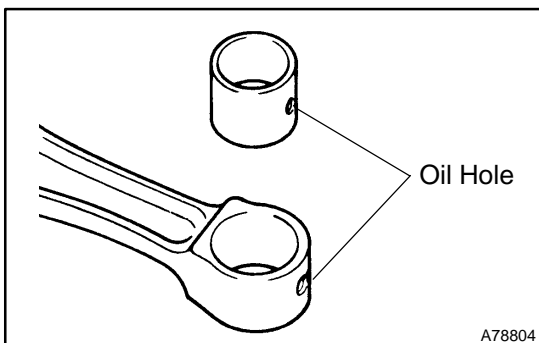
If the oil clearance is greater than maximum, replace the bushing. If necessary, replace the piston and the piston pin together.



## 23. REMOVE CONNECTING ROD SMALL END BUSH

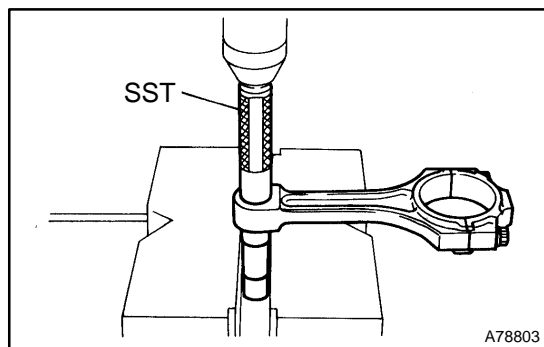
(a) Using SST and a press, press out the bushing.

SST 09222-30010

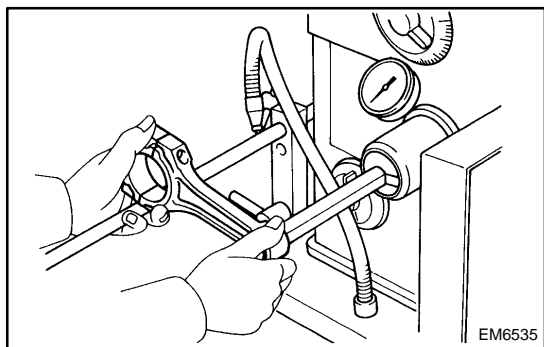


## 24. INSTALL CONNECTING ROD SMALL END BUSH

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



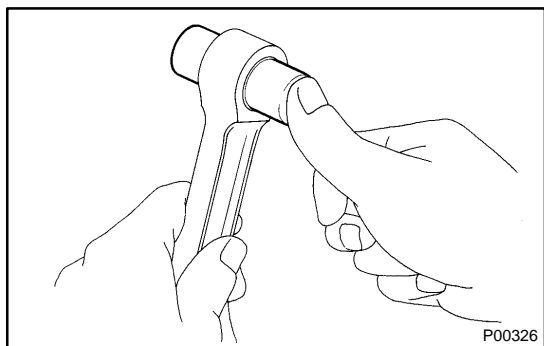
- (b) Using SST and a press, press in the bushing.  
SST 09222-30010



- (c) Using a pin hole grinder, hone the bushing to obtain the standard specified clearance between the bushing and the piston pin.

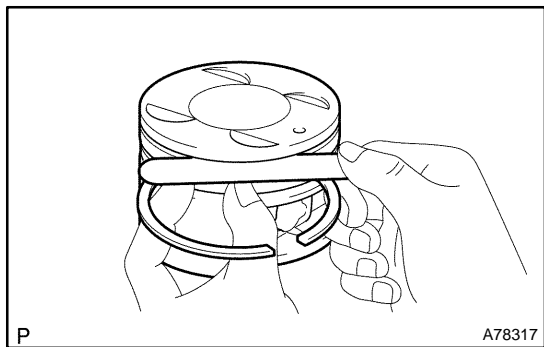
**Standard oil clearance:**

**0.005 to 0.011 mm (0.0002 to 0.0004 in.)**



**HINT:**

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



**25. INSPECT RING GROOVE CLEARANCE**

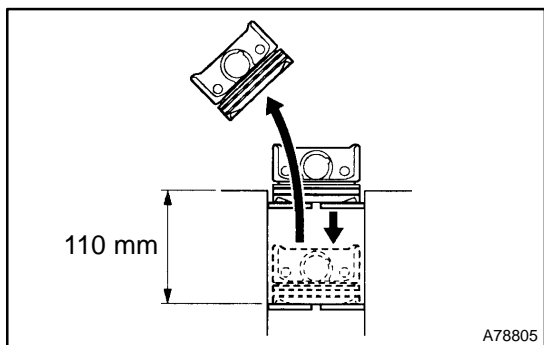
- (a) Using a feeler gauge, measure the clearance between new piston ring and the wall of the ring groove.

**Ring groove clearance:**

**No.1 0.03 to 0.08 mm (0.0012 to 0.0031 in.)**

**No.2 0.02 to 0.06 mm (0.0008 to 0.0024 in.)**

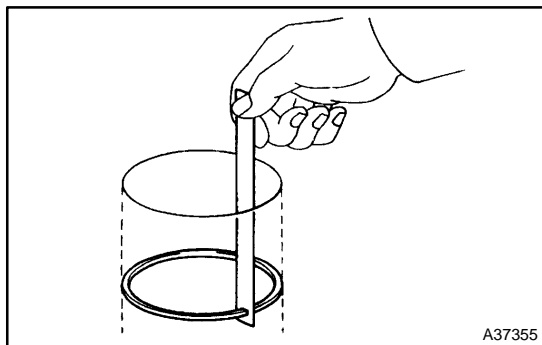
**Oil 0.03 to 0.11 mm (0.0012 to 0.0043 in.)**



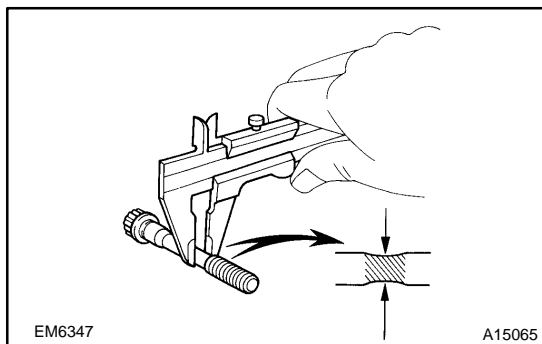
**26. INSPECT PISTON RING END GAP**

- (a) Using a piston, push the piston ring a little beyond the bottom of the ring travel, 110 mm (4.33 in.) from the top of the cylinder block.



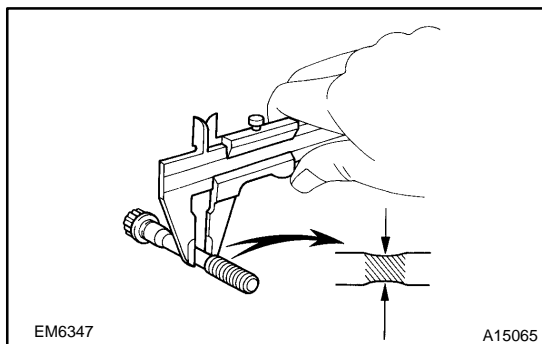


- (b) Using a feeler gauge, measure the end gap.  
**Standard end gap:**  
**No. 1 0.30 to 0.40 mm (0.0118 to 0.0157 in.)**  
**No. 2 0.50 to 0.60 mm (0.0197 to 0.0236 in.)**  
**Oil (Side rail) 0.15 to 0.40 mm (0.0059 to 0.0157 in.)**  
**Maximum end gap:**  
**No. 1 0.95 mm (0.0374 in.)**  
**No. 2 1.05 mm (0.0413 in.)**  
**Oil (Side rail) 1.00 mm (0.0394 in.)**



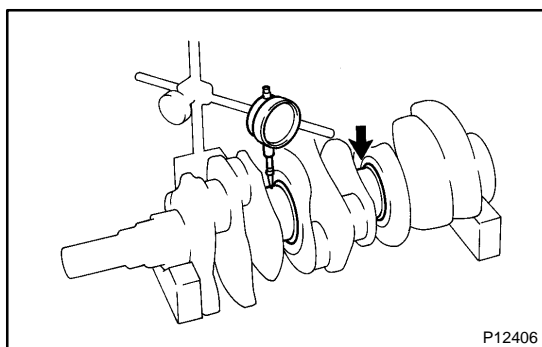
## 27. INSPECT CONNECTING ROD BOLT

- (a) Using vernier calipers, measure the tension portion diameter of the bolt.  
**Standard diameter: 7.2 to 7.3 mm (0.283 to 0.287 in.)**  
**Minimum diameter: 7.0 mm (0.276 in.)**  
 If the diameter is less than minimum, replace the bolt.



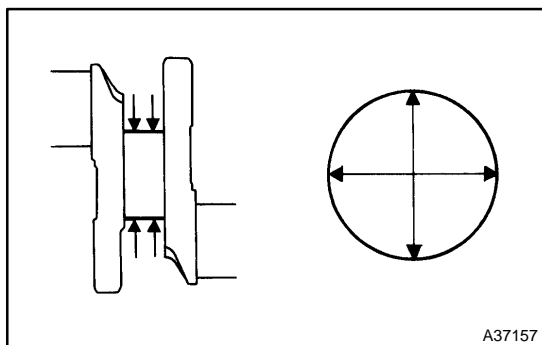
## 28. INSPECT CRANKSHAFT BEARING CAP SET BOLT

- (a) Using vernier calipers, measure the tension portion diameter of the bolt.  
**Standard diameter:**  
**7.5 to 7.6 mm (0.295 to 0.299 in.)**  
**Minimum diameter: 7.2 mm (0.283 in.)**  
 If the diameter is less than minimum, replace the bolt.

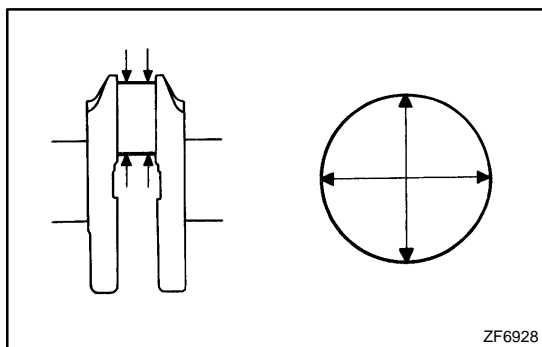


## 29. INSPECT CRANKSHAFT

- (a) Using a dial indicator and V-blocks, measure the runout as shown in the illustration.  
**Maximum circle runout: 0.06 mm (0.0024 in.)**



- (b) Using a micrometer, measure the diameter of each main journal.  
**Diameter: 60.988 to 61.000 mm (2.4011 to 2.4016 in.)**  
 (c) Check each main journal for taper and out-of-round as shown.  
**Maximum taper and out-of-round:**  
**0.02 mm (0.0008 in.)**

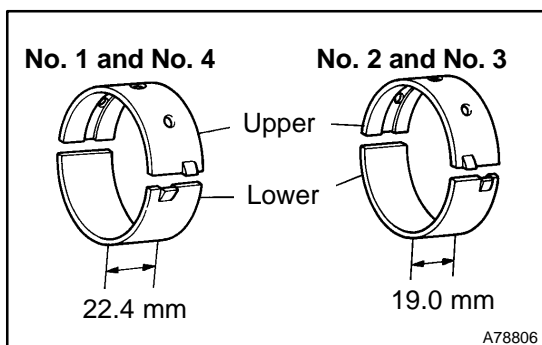


- (d) Using a micrometer, measure the diameter of each crank pin.

**Diameter: 52.992 to 53.000 mm (2.0863 to 2.0866 in.)**

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

**Maximum taper and out-of-round:  
0.02 mm (0.0008 in.)**

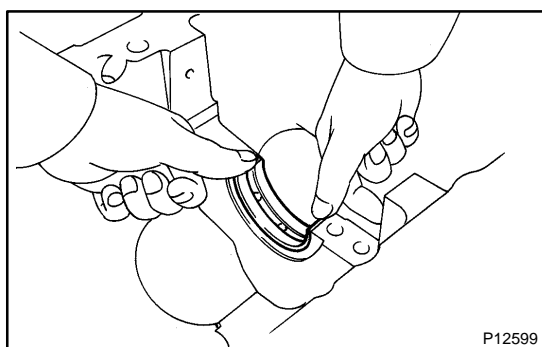


### 30. INSPECT CRANKSHAFT OIL CLEARANCE

#### HINT:

Main bearings come in widths of 22.4 mm (0.882 in.) and 19.0 mm (0.748 in.). Install the 22.4mm (0.882 in.) bearings in the No. 1 and No. 4 cylinder block journal positions with the main bearing cap. Install the 19.0 mm (0.748 in.) bearings in the No. 2 and No. 3 positions.

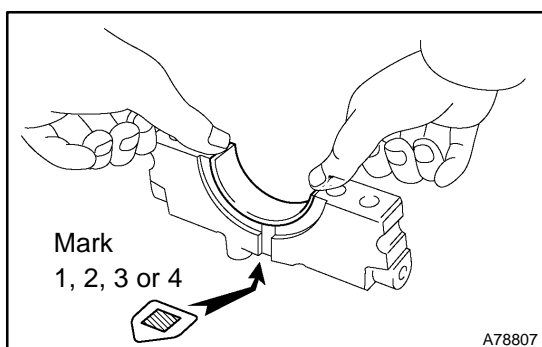
- (a) Clean each main journal and bearing.



- (b) Align the bearing key with the keyway of the cylinder block, and push in the 4 upper bearings.

#### NOTICE:

**Do not apply engine oil to the bearing and its contact surface.**



- (c) Align the bearing key with the keyway of the main bearing cap, and push in the 4 lower bearings.

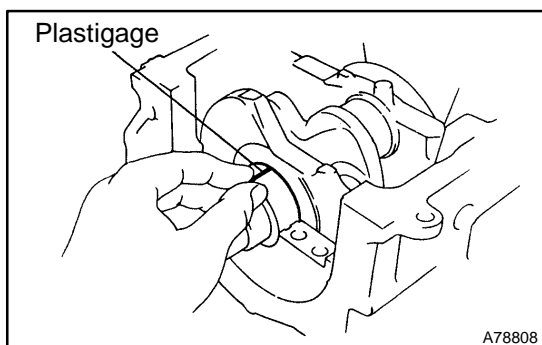
#### NOTICE:

**Do not apply engine oil to the bearing and its contact surface.**

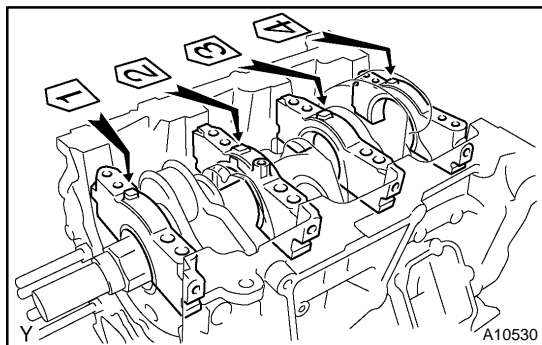
#### HINT:

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

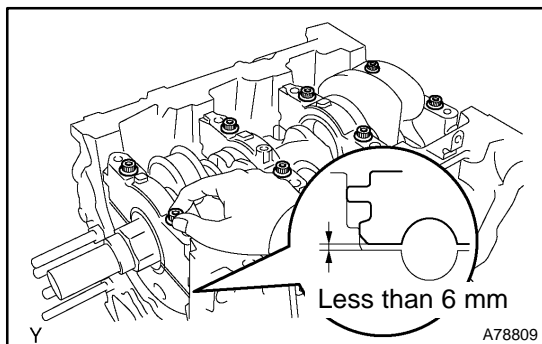
- (d) Place the crankshaft on the cylinder block.



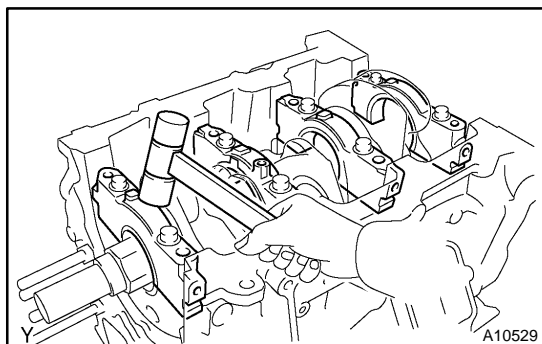
- (e) Lay a strip of plastigage across each journal.



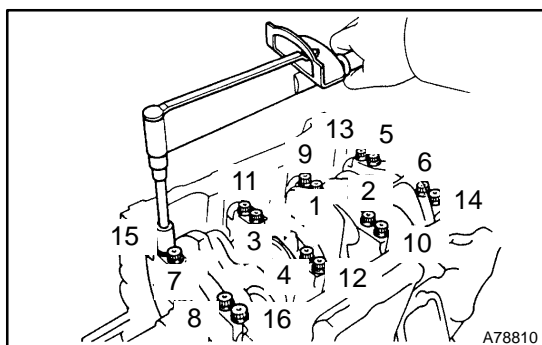
- (f) Examine the front marks and numbers and install the bearing caps on the cylinder block.
- (g) Apply a light coat of engine oil on the threads of the bearing cap bolts.
- (h) Temporarily install the 8 main bearing cap bolts to the inside positions.



- (i) Install the main bearing cap by hand, using the inner bolt as a guide. Stop the main bearing cap is about 6 mm (0.23 in.) away from mating with the block.

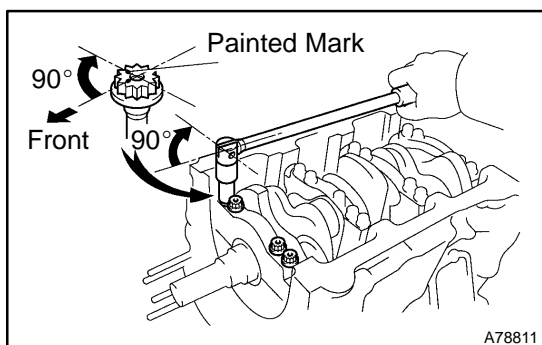


- (j) Using a plastic-faced hammer, lightly tap the bearing cap to ensure a proper fit.
- (k) Apply a light coat of engine oil on the threads of the main bearing cap bolts.



- (l) Using several steps, install and tighten the 16 main bearing cap bolts uniformly in the sequence shown in the illustration.

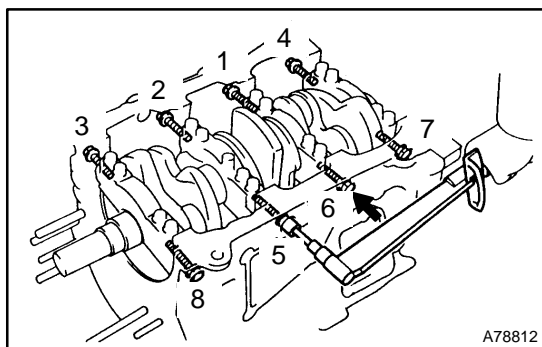
**Torque: 22 N·m (224 kgf·cm, 16 ft·lbf)**



- (m) Mark the front side of the bearing cap bolts with paint.
- (n) Retighten the bearing cap bolts by 90° in the same sequence shown as step (l).
- (o) Check that the painted mark is now at a 90° angle to the front.

**NOTICE:**

**Do not turn the crankshaft.**



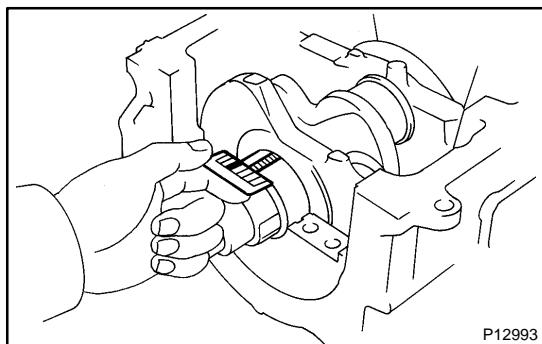
- (p) Using several steps, install and tighten the 8 main bearing cap bolts uniformly in the sequence shown in the illustration.

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

**HINT:**

Use the short bolt for the marked position (arrow)

- (q) Remove the main bearing caps.



- (r) Measure the plastigage at its widest point.

**Standard oil clearance:**

**No. 1 and No. 2 journals**

**0.014 to 0.031 mm (0.0006 to 0.0012 in.)**

**No. 3 and No. 4 journals**

**0.028 to 0.041 mm (0.0011 to 0.0016 in.)**

**Maximum clearance:**

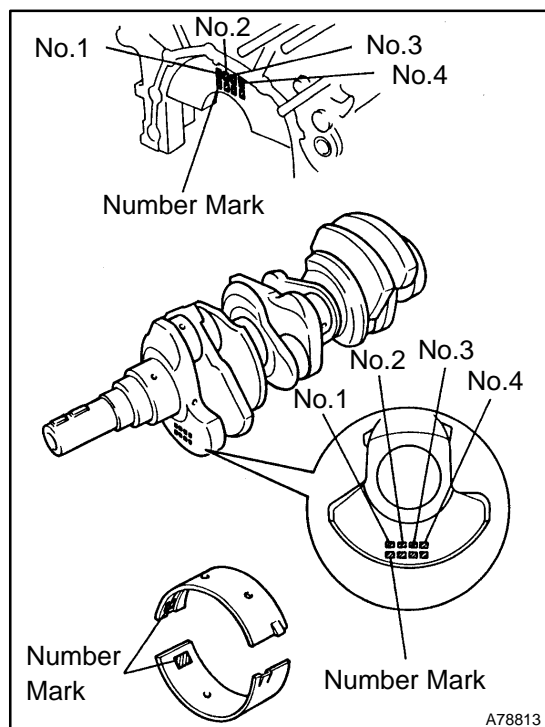
**No. 1 and No. 2 journals 0.05 mm (0.0020 in.)**

**No. 3 and No. 4 journals 0.06 mm (0.0024 in.)**

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

**NOTICE:**

**Completely remove the plastigage.**



- (s) If replacing a 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. The No. 1 and No. 2 journal bearing come in sizes, marked "3", "4", "5", "6" and "7". The No.3 and No. 4 journal bearings come in 5 standard bearing sizes, marked "1", "2", "3", "4" and "5".

#### No. 1 and No. 2 journal bearings

Cylinder block (A) + Crankshaft (B) =	0 to 5	6 to 11	12 to 17	18 to 23	24 to 28
Use Bearing	"3"	"4"	"5"	"6"	"7"

**HINT:**

**EXAMPLE**

Cylinder block "06" (A) + Crankshaft "08" (B)

=Total number 14 (Use bearing "5")

**No. 3 and No. 4 journal bearings**

Cylinder block (A) + Crankshaft (B) =	0 to 5	6 to 11	12 to 17	18 to 23	24 to 28
Use Bearing	"1"	"2"	"3"	"4"	"5"

HINT:

EXAMPLE

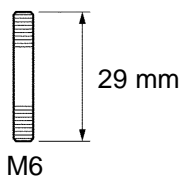
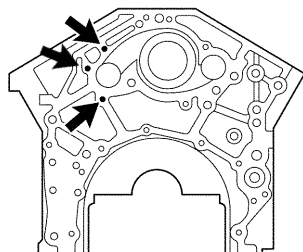
Cylinder block "06" (A) + Crankshaft "08" (B)

=Total number 14 (Use bearing "3")

Item	Mark	mm (in.)
Cylinder block main journal bore diameter (A)	"00"	66.000 (2.5984)
	"01"	66.001 (2.5985)
	"02"	66.002 (2.5985)
	"03"	66.003 (2.5985)
	"04"	66.004 (2.5986)
	"05"	66.005 (2.5986)
	"06"	66.006 (2.5987)
	"07"	66.007 (2.5987)
	"08"	66.008 (2.5987)
	"09"	66.009 (2.5988)
	"10"	66.010 (2.5988)
	"11"	66.011 (2.5989)
	"12"	66.012 (2.5989)
	"13"	66.013 (2.5989)
	"14"	66.014 (2.5990)
	"15"	66.015 (2.5990)
	"16"	66.016 (2.5990)
Crankshaft main journal diameter (B)	"00"	61.000 (2.4016)
	"01"	60.999 (2.4015)
	"02"	60.998 (2.4015)
	"03"	60.997 (2.4015)
	"04"	60.996 (2.4014)
	"05"	60.995 (2.4014)
	"06"	60.994 (2.4013)
	"07"	60.993 (2.4012)
	"08"	60.992 (2.4012)
	"09"	60.991 (2.4012)
	"10"	60.990 (2.4012)
	"11"	60.989 (2.4011)
	"12"	60.988 (2.4011)
Standard bearing center wall thickness	"1"	2.486 to 2.489 (0.0979 to 0.0980)
	"2"	2.489 to 2.492 (0.0980 to 0.0981)
	"3"	2.492 to 2.495 (0.0981 to 0.0982)
	"4"	2.495 to 2.498 (0.0982 to 0.0983)
	"5"	2.498 to 2.501 (0.0983 to 0.0985)
	"6"	2.501 to 2.504 (0.0985 to 0.0986)
	"7"	2.504 to 2.507 (0.0986 to 0.0987)

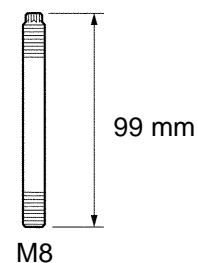
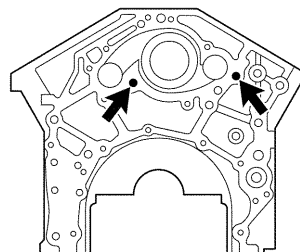
## 31. INSTALL STUD BOLT

Front Side



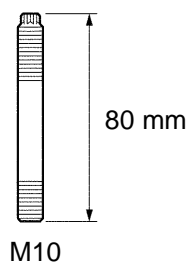
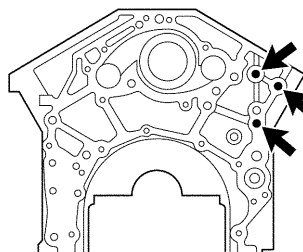
Torque: 6.0 N·m (60 kgf·cm, 53 in.-lbf)

Front Side



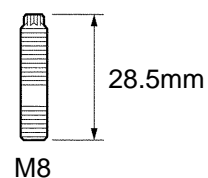
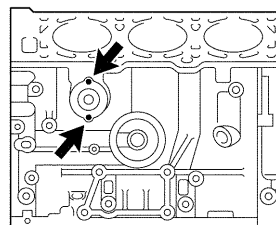
Torque: 15 N·m (145 kgf·cm, 11 ft-lbf)

Front Side



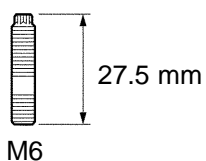
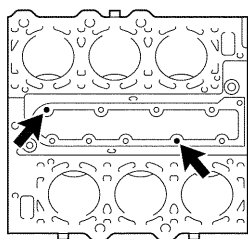
Torque: 21 N·m (220 kgf·cm, 15 ft-lbf)

Left Side



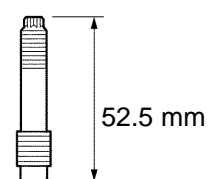
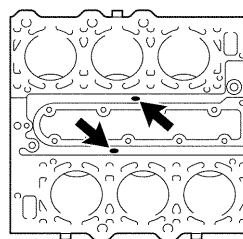
Torque: 7.0 N·m (70 kgf·cm, 62 in.-lbf)

Upper Side



Torque: 4.0 N·m (40 kgf·cm, 35 in.-lbf)

Upper Side



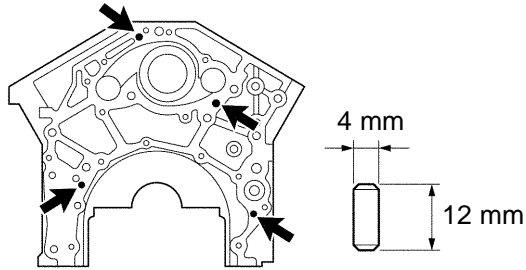
Torque: 12 N·m (122 kgf·cm, 9 ft-lbf)

P

A78318

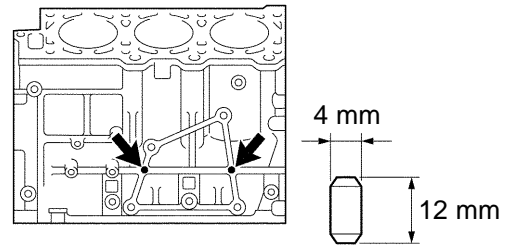
## 32. INSTALL STRAIGHT PIN

Front Side



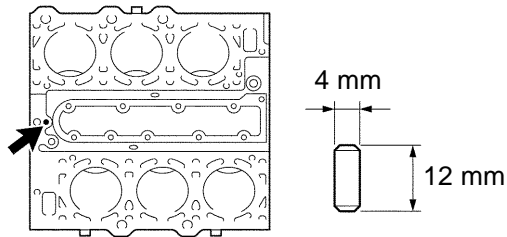
Protrusion Height: 6 mm

Right Side (FF)



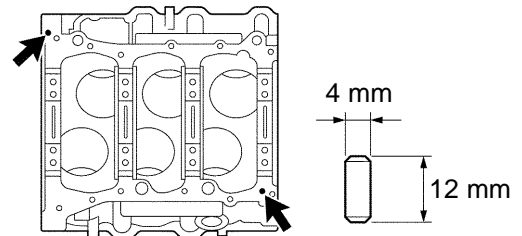
Protrusion Height: 6 mm

Upper Side



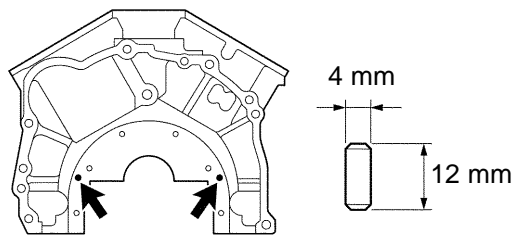
Protrusion Height: 6 mm

Lower Side



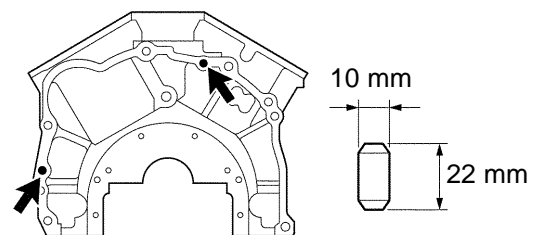
Protrusion Height: 6 mm

Back Side



Protrusion Height: 6 mm

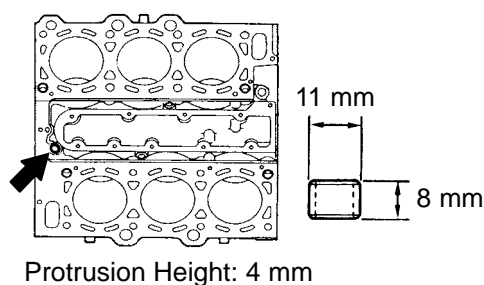
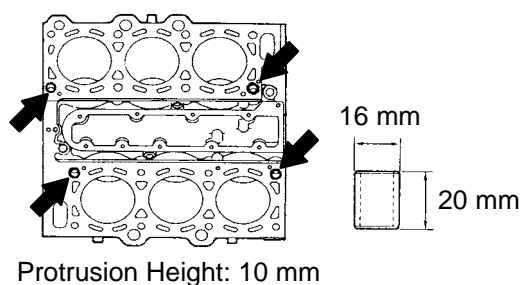
Back Side



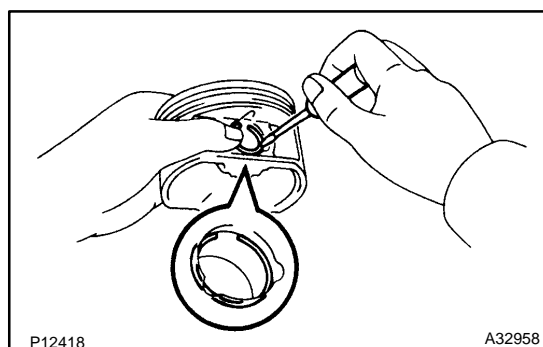
Protrusion Height: 11 mm

P

A78319

**33. INSTALL RING PIN****Upper Side**

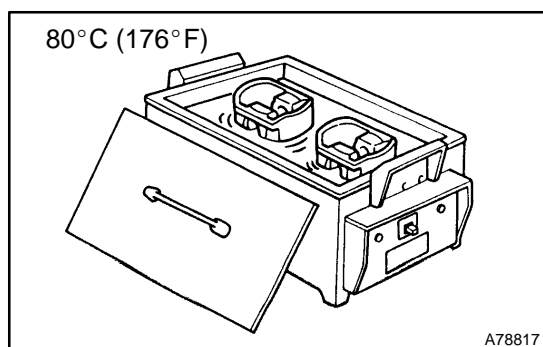
A78816

**34. INSTALL PISTON PIN HOLE SNAP RING**

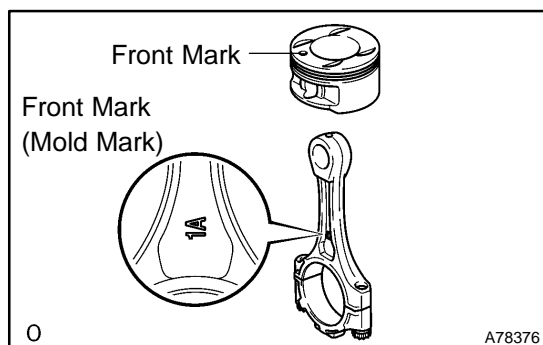
- (a) Using a small screwdriver, install a new snap ring at one end of the piston pin hole.

**HINT:**

Be sure that end gap of the snap ring is not aligned with the pin hole cutout portion of the piston.

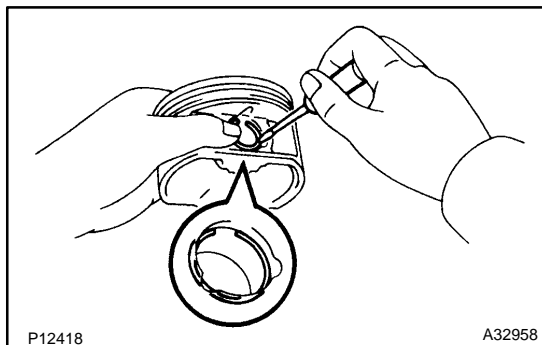
**35. INSTALL W/PIN PISTON SUB-ASSY**

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



- (b) Coat the piston pin with engine oil.
- (c) Align the front marks of the piston and connecting rod, and push in the piston pin with thumb until the pin contacts the snap ring.

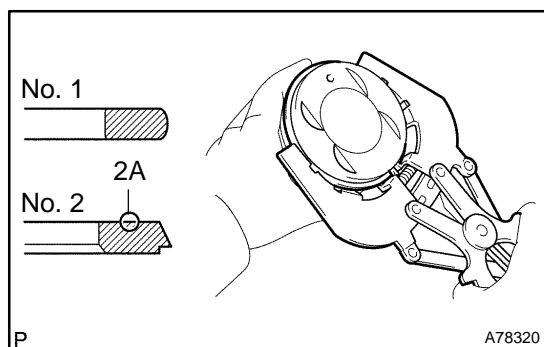


**36. INSTALL PISTON PIN HOLE SNAP RING**

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

**HINT:**

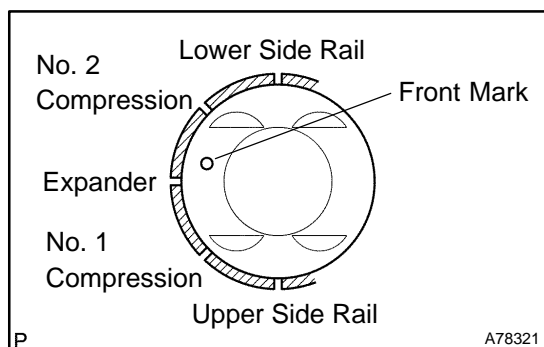
Be sure that end of gap of the snap ring is not aligned with the pin hole cutout portion of the piston.

**37. INSTALL PISTON RING SET**

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

**HINT:**

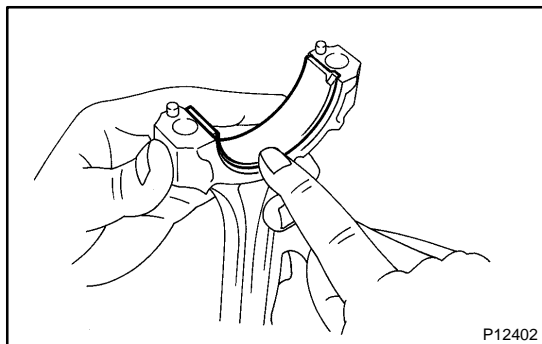
The compression ring No. 2 is installed with the code mark "2A" faced upward as shown in the illustration.



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

**NOTICE:**

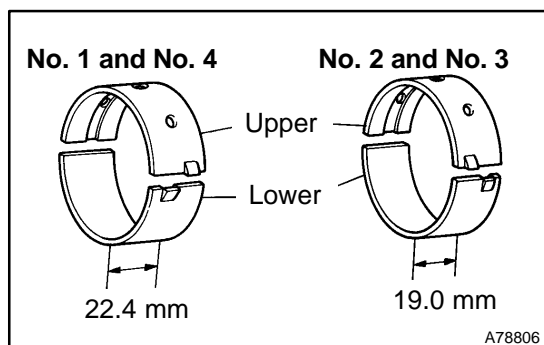
**Do not align the ring ends.**

**38. INSTALL CONNECTING ROD BEARING**

- (a) Align the key of the bearing with the keyway of the connecting rod or connecting cap.

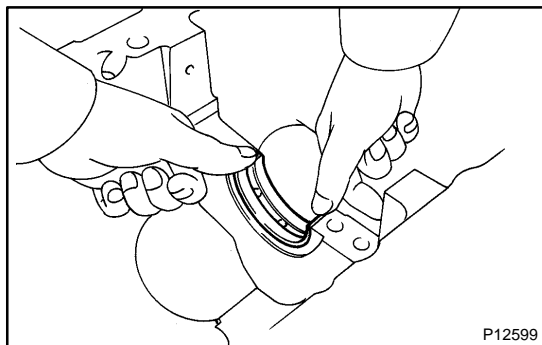
**NOTICE:**

**Clean the backside of the bearing and the bearing surface of the connecting rod. The surface should be free of dust and oils.**

**39. INSTALL CRANKSHAFT BEARING****HINT:**

Main bearings come in widths of 22.4 mm (0.882 in.) and 19.0 mm (0.748 in.). Install the 22.4mm (0.882 in.) bearings in the No. 1 and No. 4 cylinder block journal positions with the main bearing cap. Install the 19.0 mm (0.748 in.) bearings in the No. 2 and No. 3 positions.

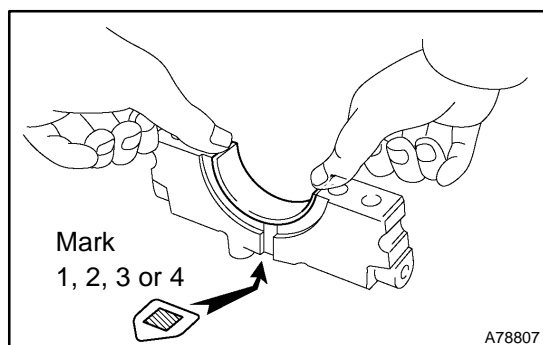
- (a) Clean each main journal and the bearing.



- (b) Align the key of the bearing with the keyway of the cylinder block, and push in the 4 upper bearings.

**NOTICE:**

**Do not apply engine oil to the bearing and its contact surface.**



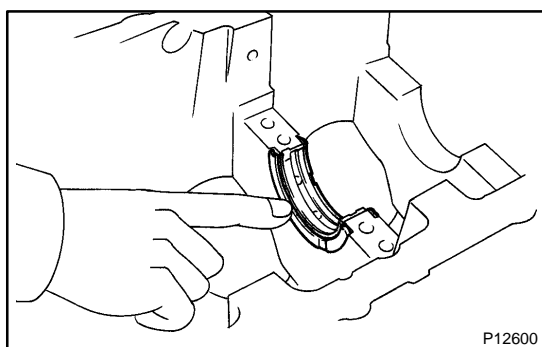
- (c) Align the key of the bearing with the keyway of the main bearing cap, and push in the 4 lower bearings.

**NOTICE:**

**Do not apply engine oil to the bearing and its contact surface.**

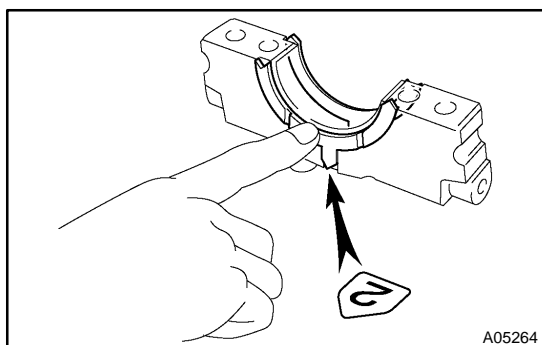
**HINT:**

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



**40. INSTALL CRANKSHAFT THRUST WASHER SET**

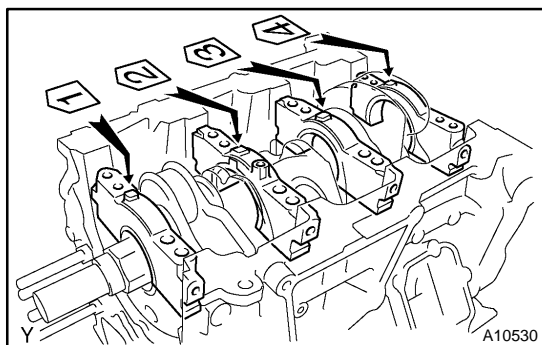
- (a) Install the 2 thrust washers under the No. 2 journal position of the cylinder block with the oil grooves facing outward.



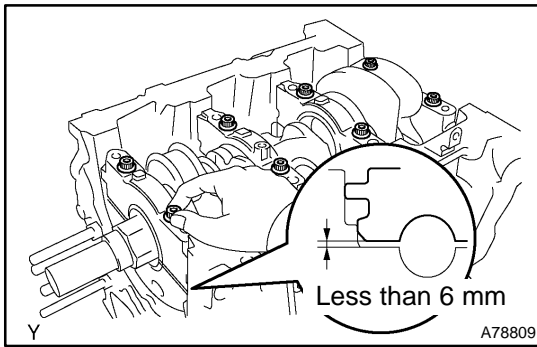
- (b) Install the 2 thrust washers on the No. 2 bearing cap with the grooves facing outward.

**41. INSTALL CRANKSHAFT**

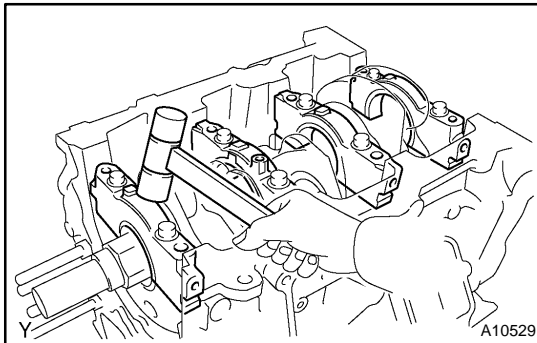
- (a) Apply engine oil to upper bearing and install the crankshaft on the cylinder block.



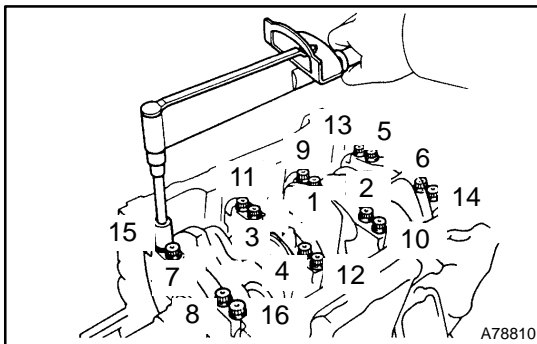
- (b) Examine the front marks and numbers and install the bearing caps on the cylinder block.
- (c) Apply a light coat of engine oil on the threads of bearing cap bolts.
- (d) Temporarily install the 8 main bearing cap bolts to the inside positions.



- (e) Install the main bearing cap by hand, using the inner bolt as a guide. Stop the main bearing cap is about 6 mm (0.23 in.) away from mating with the block.

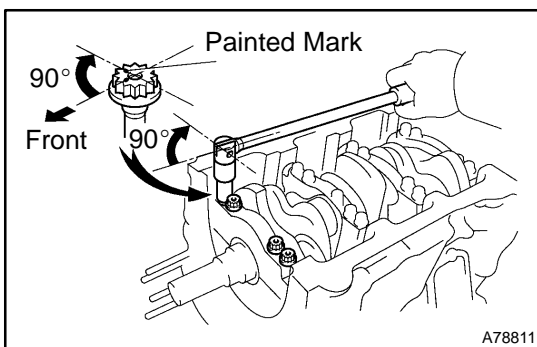


- (f) Using a plastic-faced hammer, lightly tap the bearing cap to ensure a proper fit.  
(g) Apply a light coat of engine oil on the threads of the main bearing cap bolts.

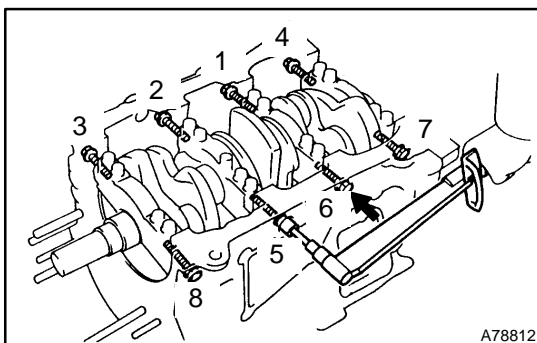


- (h) Using several steps, install and tighten the 16 main bearing cap bolts uniformly in the sequence shown in the illustration.

**Torque: 22 N·m (224 kgf·cm, 16 ft·lbf)**



- (i) Mark the front side of the bearing cap bolts with paint.  
(j) Retighten the bearing cap bolts by 90° in the same sequence shown as step (h).  
(k) Check that the painted mark is now at a 90° angle to the front.  
(l) Check that the crankshaft turns smoothly.

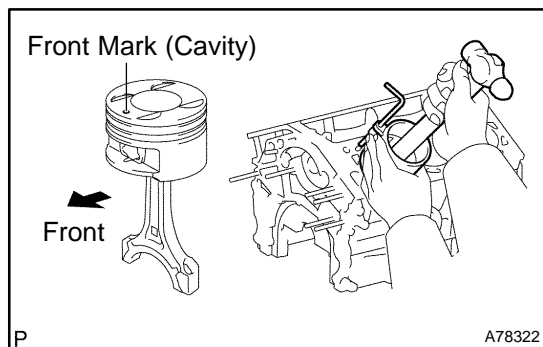


- (m) Using several steps, install and tighten the 8 main bearing cap bolts uniformly in the sequence shown in the illustration.

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

**HINT:**

Use the short bolt for the marked position (arrow)

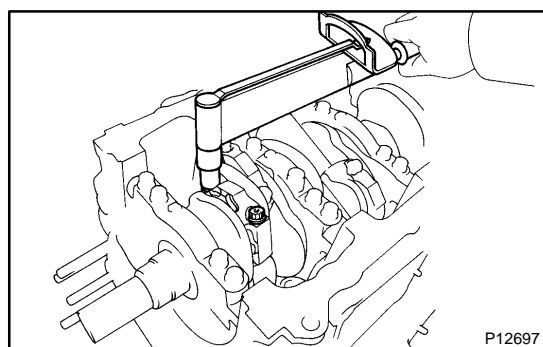
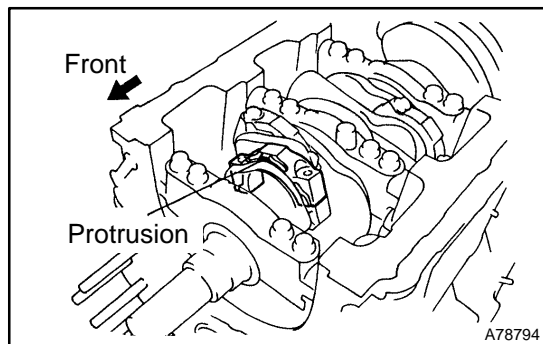
**42. INSTALL PISTON SUB-ASSY W/CONNECTING ROD**

- Apply engine oil to the cylinder walls, the pistons, and the surfaces of connecting rod bearings.
- Check the position of the piston ring ends.
- 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.

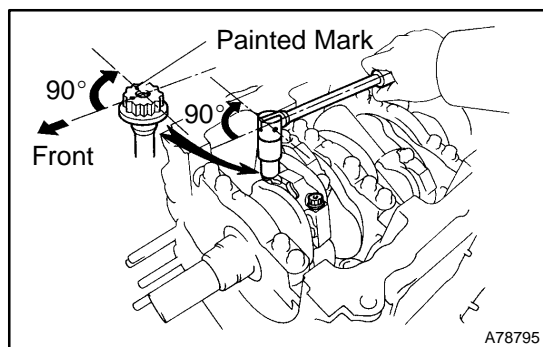
**NOTICE:**

**Match the numbered connecting rod cap with the connecting rod.**

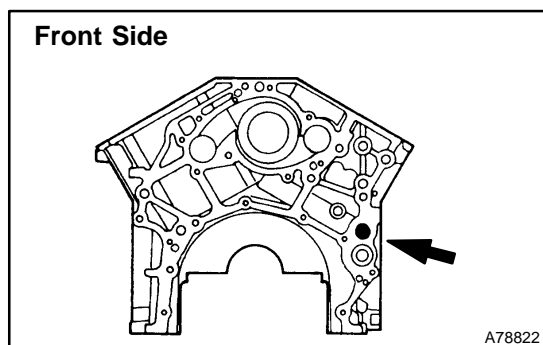
- Check that the protrusion of the connecting rod cap is facing in the correct direction.
- Apply a light coat of engine oil on the threads of the connecting rod cap bolts.



- Tighten the bolts in several steps by the specified torque.  
**Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)**

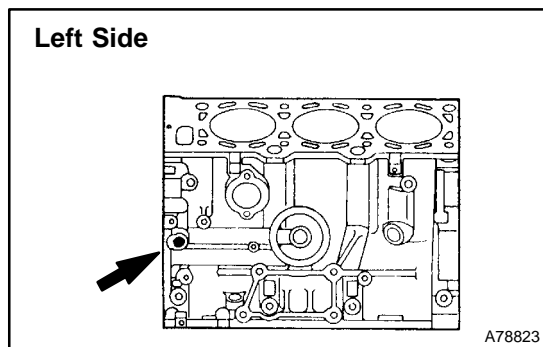


- Mark the front side of the each connecting cap bolt with paint.
- Retighten the cap bolts by 90° as shown in the illustration.
- Check that the crankshaft turns smoothly.

**43. INSTALL CYLINDER BLOCK W/HEAD STRAIGHT SCREW NO.1 PLUG**

- Using a 10 mm hexagon wrench, install a new gasket and the screw plug.

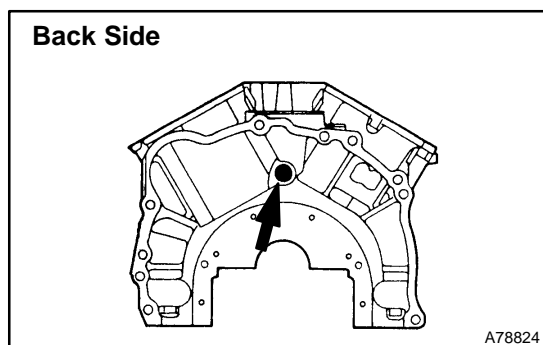
**Torque: 30 N·m (306 kgf·cm, 22 ft·lbf)**



#### 44. INSTALL CYLINDER BLOCK W/HEAD STRAIGHT SCREW NO.2 PLUG

- (a) Using a 10 mm hexagon wrench, install a new gasket and the screw plug.

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



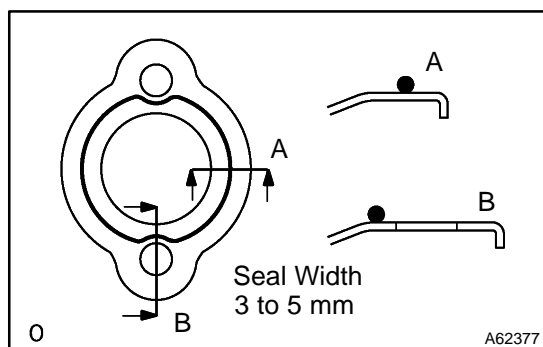
#### 45. INSTALL CYLINDER BLOCK W/HEAD STRAIGHT SCREW NO.3 PLUG

- (a) Using a 10 mm hexagon wrench, install a new gasket and the screw plug.

**Torque: 50 N·m (510 kgf·cm, 37 ft·lbf)**

#### 46. INSTALL WATER SEAL PLATE

- (a) Remove any old seal packing from the contact surface.

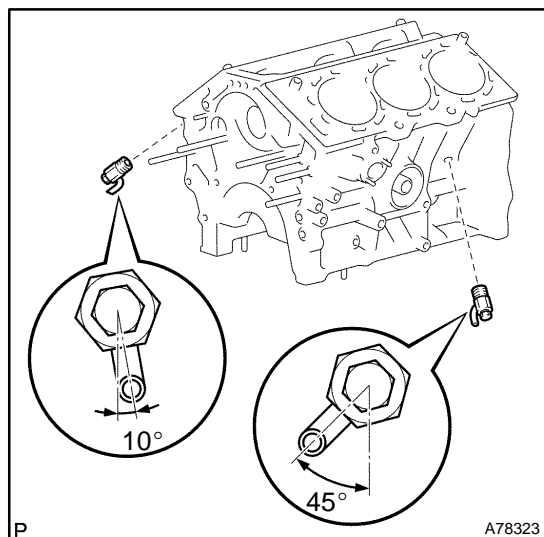


- (b) Apply a continuous bead of seal packing (Diameter 3 to 5 mm (0.12 to 0.20 in.)) as shown in the illustration.

**Seal packing: Part No. 08826-00100 or equivalent**

#### NOTICE:

- Remove any oil from the contact surface.
  - Install the seal plate within 3 minutes after applying seal packing.
  - Do not expose the seal to engine oil within 2 hours after installing.
- (c) Install the seal plate with the 2 nuts.
- Torque: 18 N·m (184 kgf·cm, 13 ft·lbf)**
- #### 47. INSTALL CYLINDER BLOCK WATER DRAIN COCK SUB-ASSY
- (a) Apply adhesive to 2 or 3 threads of the drain cock end.
- Adhesive: Part No. 08833-00070, THREE BOND 1324 or equivalent**



- (b) After applying the specified torque, rotate the drain cock clockwise as shown in the illustration.

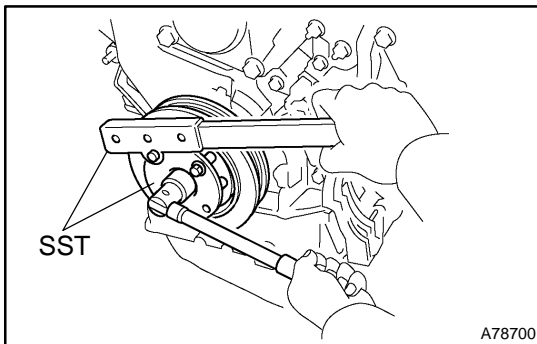
**Torque: 39 N·m (398 kgf·cm, 29 ft·lbf)**

**NOTICE:**

- Install the drain cock within 3 minutes after applying adhesive.
- Do not expose the seal to coolant within an hour after installing.
- Do not rotate the drain cock more than 1 revolution (360°) after tightening the drain cock with the specified torque.
- Do not loosen the drain cock after setting it correctly.

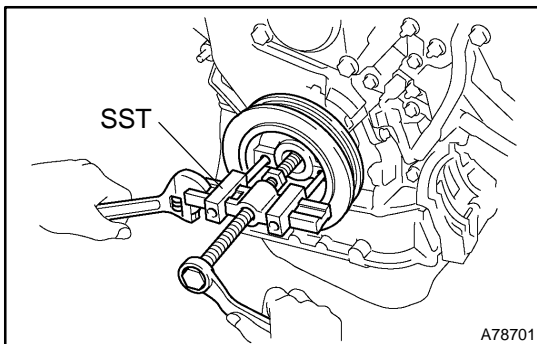
## OVERHAUL

1. REMOVE SPARK PLUG
2. REMOVE OIL FILLER CAP SUB-ASSY
3. REMOVE OIL FILLER CAP GASKET
4. REMOVE CYLINDER HEAD COVER SUB-ASSY LH
5. REMOVE CYLINDER HEAD COVER GASKET NO.2
6. REMOVE CYLINDER HEAD COVER SUB-ASSY
7. REMOVE CYLINDER HEAD COVER GASKET
8. REMOVE VENTILATION VALVE SUB-ASSY
9. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSY
  - (a) Remove both camshaft oil control valves.
  - (b) Remove the O-ring from each camshaft oil control valve.
10. REMOVE VVT SENSOR
11. REMOVE OIL LEVEL GAGE SUB-ASSY
12. REMOVE OIL LEVEL GAGE GUIDE



### 13. REMOVE CRANKSHAFT PULLEY

- (a) Using SST, loosen the pulley bolt.  
SST 09213-54015 (91651-60855), 09330-00021

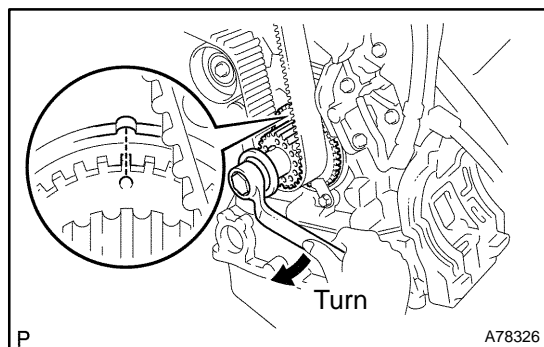


- (b) Using SST and the pulley bolt, remove the pulley.  
SST 09950-50013 (09951-05010, 09952-05010, 09953-05020, 09954-05031)

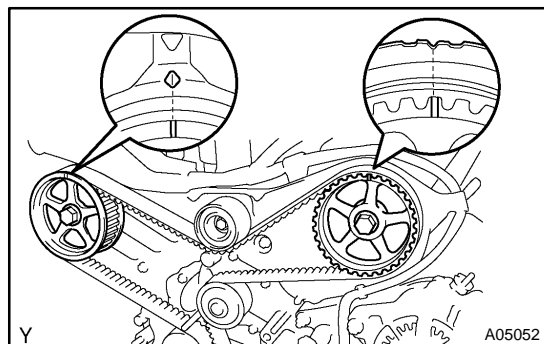
### NOTICE:

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

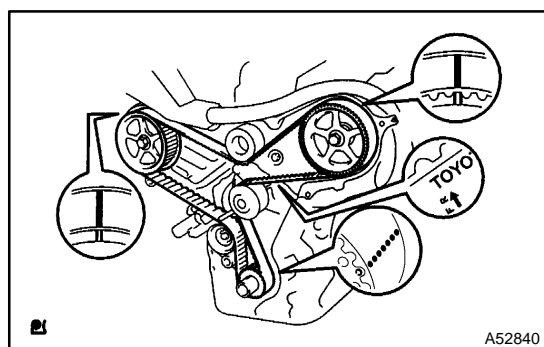
14. REMOVE TIMING BELT NO.1 COVER
15. REMOVE TIMING BELT NO.2 COVER
16. REMOVE ENGINE MOUNTING BRACKET RH
17. REMOVE TIMING BELT GUIDE NO.2

**18. REMOVE TIMING BELT**

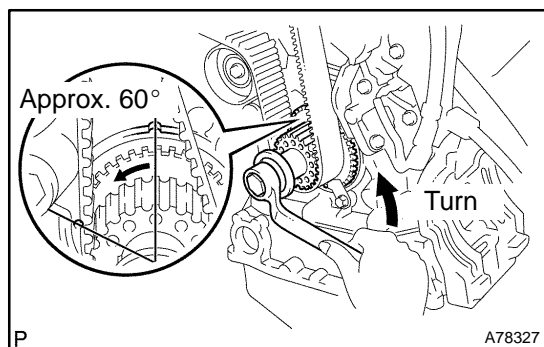
- (a) Set No. 1 cylinder to TDC/compression.
- (1) Temporarily install the crankshaft pulley bolt and the washer to the crankshaft.
  - (2) Turn the crankshaft clockwise, and align the timing marks of the crankshaft timing pulley and the oil pump body.



- (3) Check that timing marks of the camshaft timing pulleys and No. 3 timing belt cover are aligned.
- If not, turn the crankshaft 1 revolution (360°).
- (4) Remove the crankshaft pulley bolt.



- (b) If re-using the timing belt, check that there are 3 installation marks on the timing belt as shown in the illustration.
- (1) If the installation marks have disappeared, put new installation marks on the timing belt before removing.



- (c) Set No. 1 cylinder to approx. 60° BTDC/ compression.
- (1) Turn the crankshaft counterclockwise by approx. 60°.

**NOTICE:**

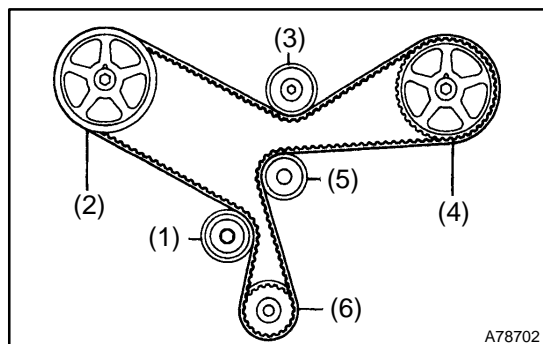
If the timing belt is disengaged, having the crankshaft pulley at the wrong angle can cause the piston head and valve head to come into contact with each other when you remove the camshaft timing pulley and camshaft, causing damage. So always set the crankshaft pulley at the correct angle.

- (d) Remove the timing belt tensioner.

**NOTICE:**

Do not install the tensioner as it removed.





(e) Remove the timing belt in this order.

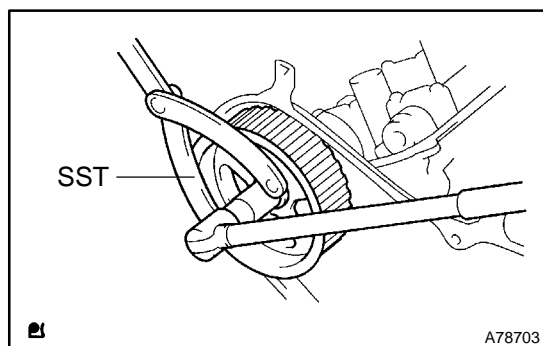
1st	No. 1 idler pulley
2nd	RH camshaft timing pulley
3rd	No. 2 idler pulley
4th	LH camshaft timing pulley
5th	Water pump pulley
6th	Crankshaft timing pulley

## 19. REMOVE TIMING BELT IDLER SUB-ASSY NO.1

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

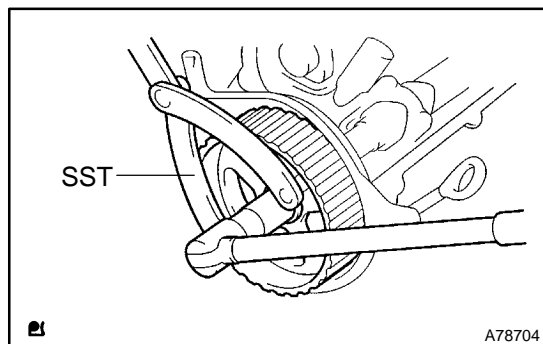
## 20. REMOVE TIMING BELT IDLER SUB-ASSY NO.2

## 21. REMOVE CRANKSHAFT POSITION SENSOR



## 22. REMOVE CAMSHAFT TIMING PULLEY

(a) Using SST, remove the bolt and the RH timing pulley.  
SST 09960-10010 (09962-01000, 09963-01000)



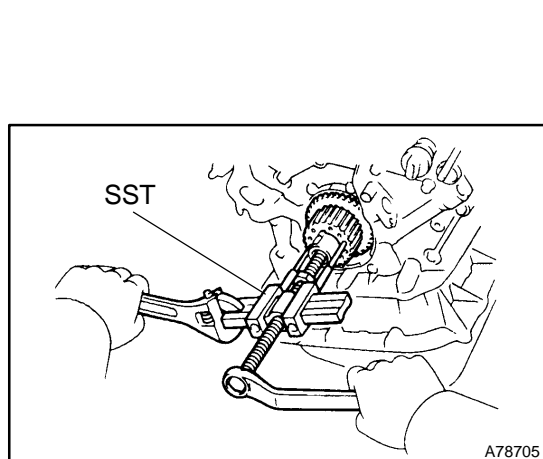
(b) Using SST, remove the bolt and the LH timing pulley.  
SST 09960-10010 (09962-01000, 09963-01000)

### HINT:

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

## 23. REMOVE TIMING BELT NO.3 COVER

## 24. REMOVE TIMING BELT IDLER BRACKET



## 25. REMOVE CRANKSHAFT TIMING PULLEY

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

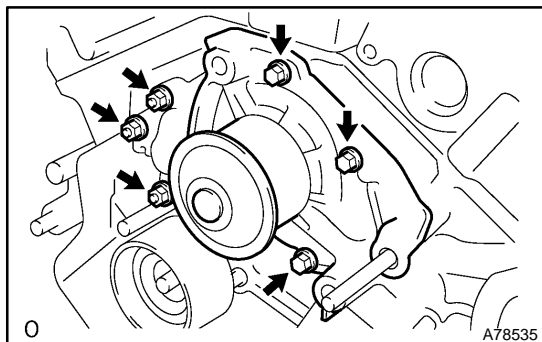
(b) Install the pulley bolt to the crankshaft.

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

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

### NOTICE:

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



## 26. REMOVE WATER PUMP ASSY

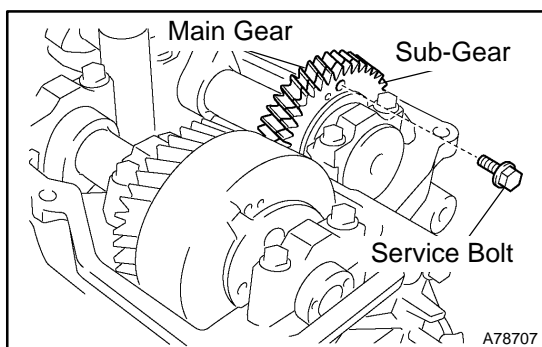
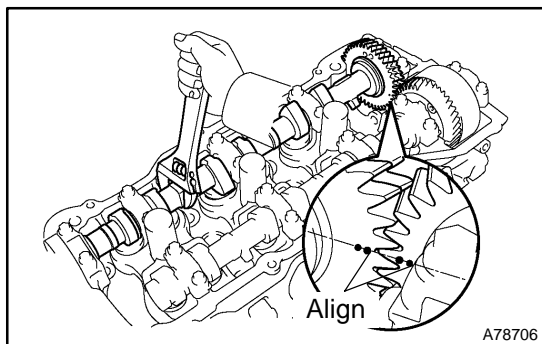
- (a) Remove the 3 bolts, the 3 nuts, the water pump and the gasket.

## 27. REMOVE CAMSHAFT

### NOTICE:

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

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



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

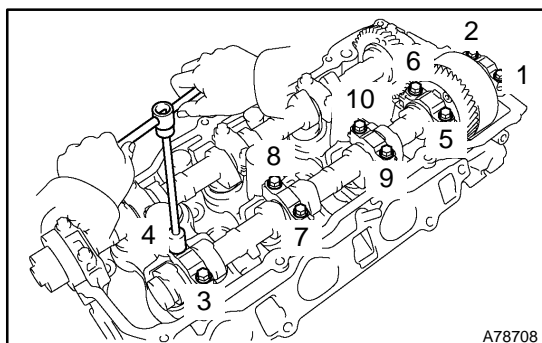
**Torque: 5.4 N·m (55 kgf·cm, 48 in.-lbf)**

### Recommended service bolt

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

### HINT:

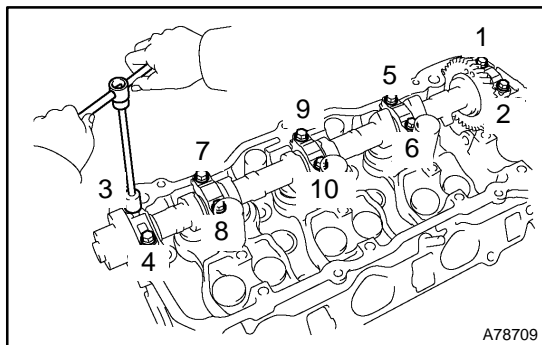
When removing the camshaft, make certain that the torsional spring force of the sub-gear has been eliminated by installation of the service bolt.



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

### NOTICE:

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



## 28. REMOVE NO.2 CAMSHAFT

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

### NOTICE:

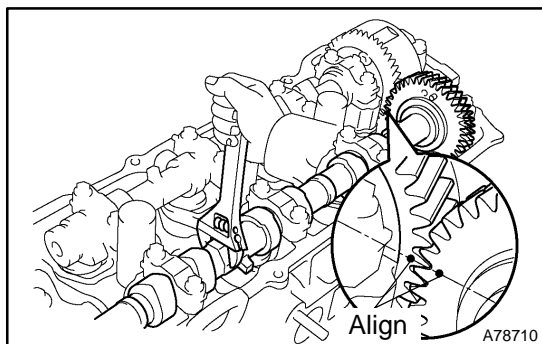
- Do not pry out the camshaft.
- Be careful not to damage the portion of the cylinder head receiving the shaft thrust.

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

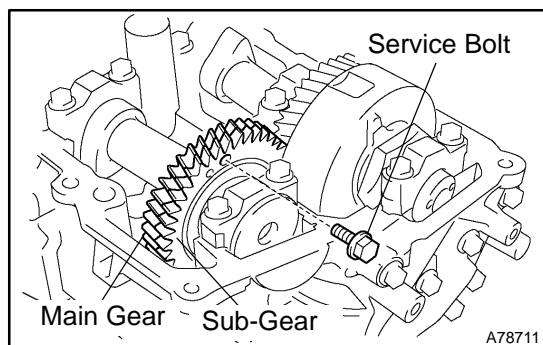
## 29. REMOVE NO.3 CAMSHAFT SUB-ASSY

### NOTICE:

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



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



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

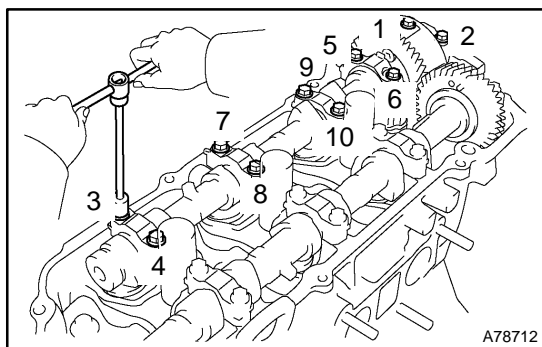
**Torque: 5.4 N·m (55 kgf·cm, 48 in.-lbf)**

### Recommended service bolt

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

### HINT:

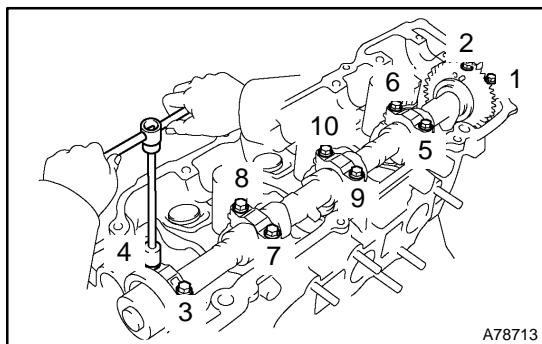
When removing the camshaft, make certain that the torsional spring force of the sub-gear has been eliminated by installation of the service bolt.



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

**NOTICE:**

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

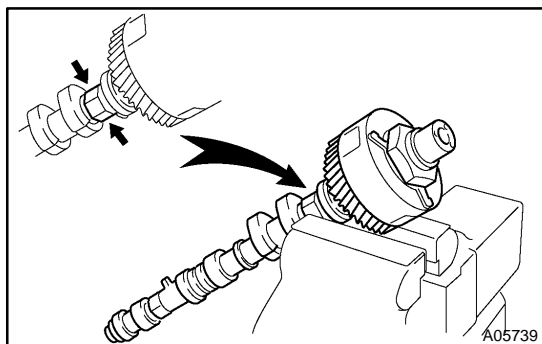
**30. REMOVE NO.4 CAMSHAFT SUB-ASSY**

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

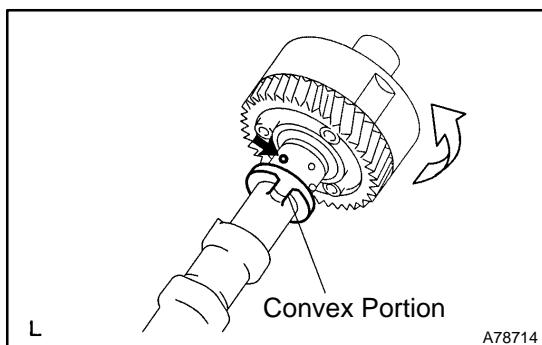
**NOTICE:**

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

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

**31. INSPECT CAMSHAFT TIMING GEAR ASSY**

- (a) Clamp the camshaft in a vise on the hexagonal lobe.  
(b) Check that VVT-i will not turn.



- (c) Cover all the oil ports except the port on the advance angle side (nearest to the convex portion) shown in the illustration with vinyl tape.  
(d) Using the air gun, apply about 100 kPa (1 kgf/cm<sup>2</sup>, 14 psi) of air pressure to the port on the advance side shown in the illustration.

**NOTICE:**

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

**HINT:**

Perform this in order to release the lock pin for the maximum delay angle lock.

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

**Standard: Must turn**

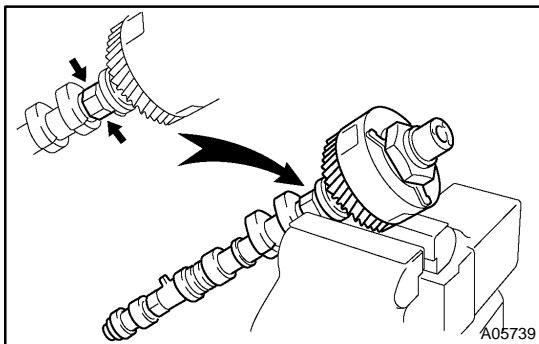
**HINT:**

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

- (f) Check that the VVT-i moves freely within about 30° range. Avoid moving the VVT-i unit to the maximum delay angle position as the lock-pin will re-engage.

**Standard: Smooth movable range is about 30°**

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



### 32. REMOVE CAMSHAFT TIMING GEAR ASSY

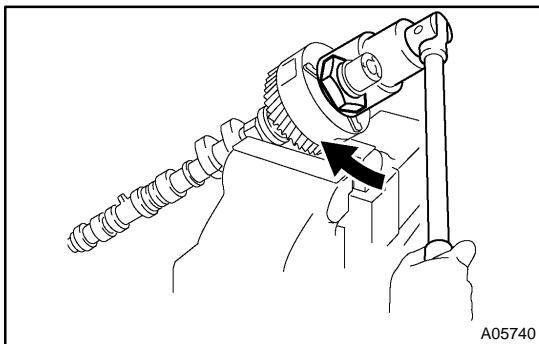
**NOTICE:**

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

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

**NOTICE:**

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



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

**NOTICE:**

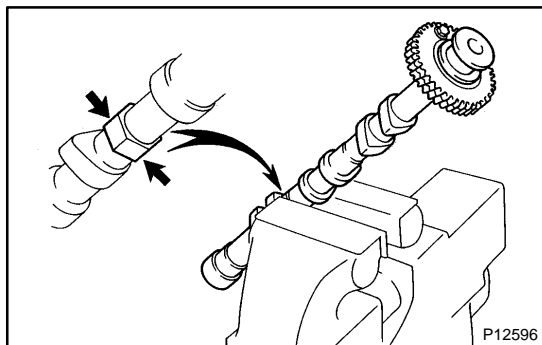
- **Remove it with the lock-pin engaged and locked at the maximum delay angle position.**
- **The lock nut has LH threads.**
- **Never use any tool other than the socket wrench. Other tools will deform the cam angle rotor.**

- (c) Remove the camshaft VVT-i.

**NOTICE:**

**Never remove the 3 bolts on the gear.**

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

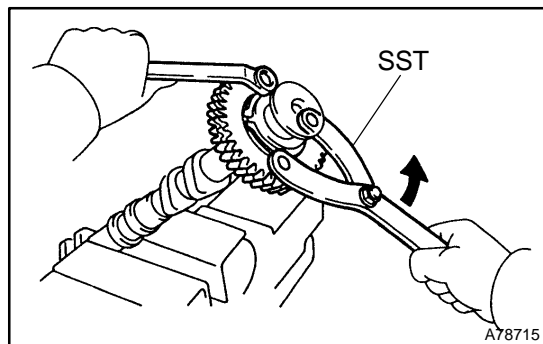


### 33. REMOVE CAMSHAFT SUB GEAR

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

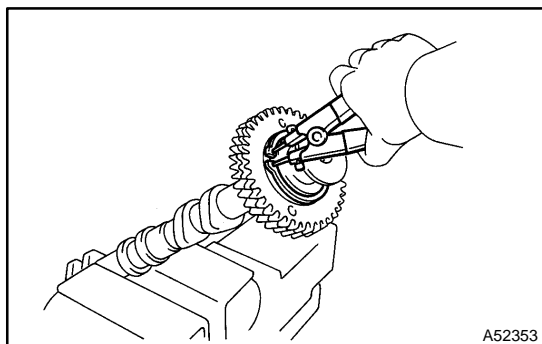
**NOTICE:**

Be careful not to damage the camshaft.



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

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



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

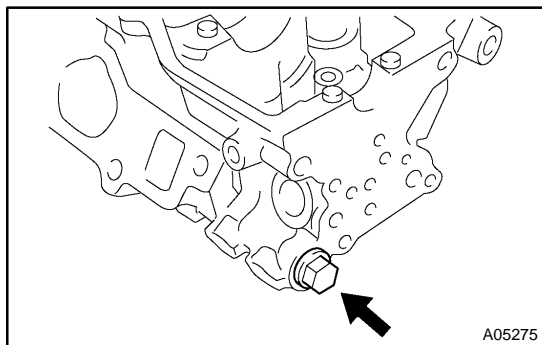
- (d) Remove the wave washer, the camshaft sub-gear and the camshaft gear bolt washer.

**HINT:**

Arrange the camshaft sub-gears and gear bolt washers (RH and LH sides) so that they can be returned to the original location when re-assembling.

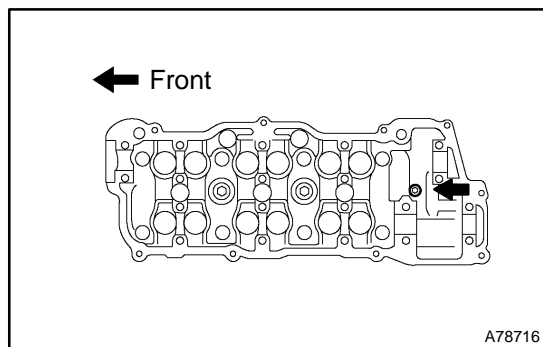
### 34. REMOVE ENGINE HANGER NO.2

### 35. REMOVE CYLINDER HEAD COVER REAR

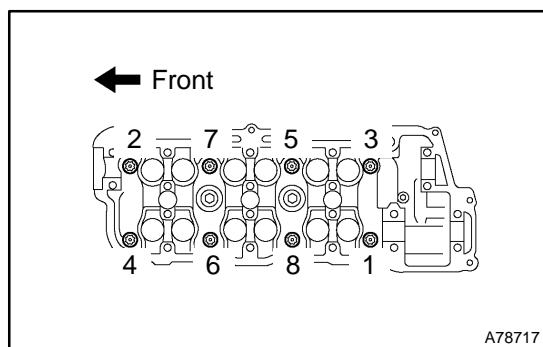


### 36. REMOVE OIL CONTROL VALVE FILTER

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

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

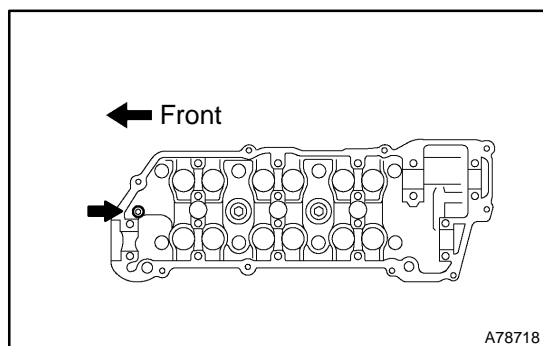
- (a) Using an 8 mm hexagon wrench, remove the hexagon bolt.



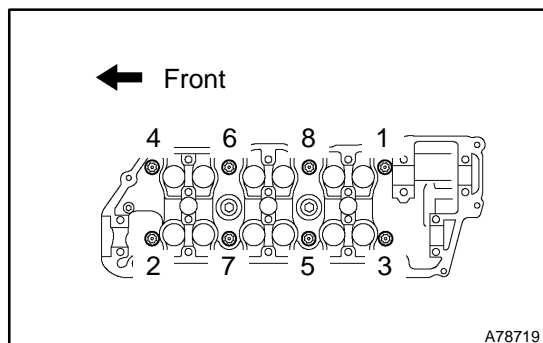
- (b) Using several steps, loosen the 8 cylinder head bolts uniformly in the sequence shown in the illustration. Remove the 8 cylinder head bolts and the plate washers.

**NOTICE:**

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

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

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

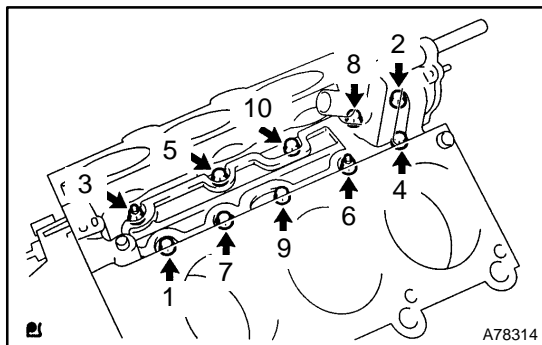


- (b) Using several steps, loosen the 8 cylinder head bolts uniformly in the sequence shown in the illustration. Remove the 8 cylinder head bolts and the plate washers.

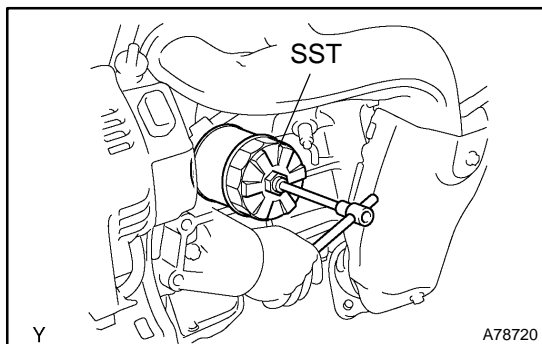
**NOTICE:**

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

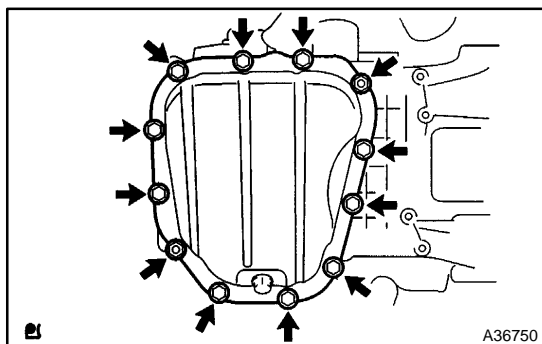
**40. REMOVE CYLINDER HEAD GASKET NO.2**

**41. REMOVE WATER INLET HOUSING**

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

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

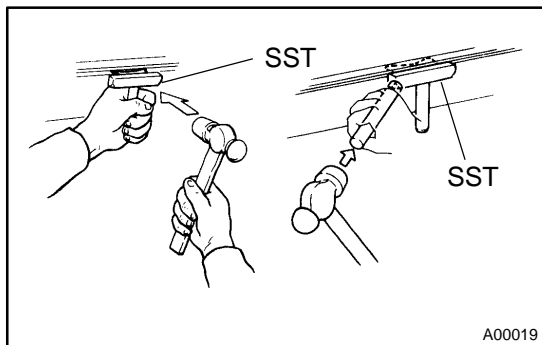
- (a) Using SST, remove the oil filter.  
SST 09228-07501
- (b) Using a 12 mm socket hexagon wrench, remove the oil filter union.

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

- (a) Remove the 10 bolts and the 2 nuts.
- (b) Insert the blade of SST between oil pan No. 1 and oil pan No. 2, cut off the sealer and remove the oil pan No. 2.  
SST 09032-00100

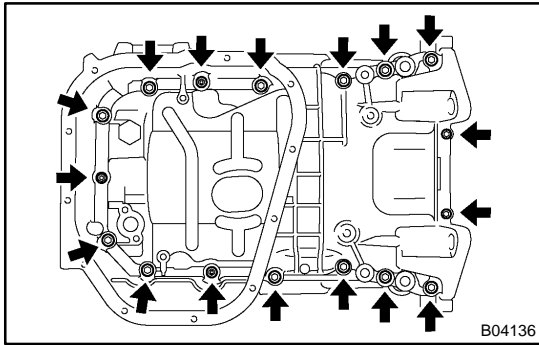
**NOTICE:**

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

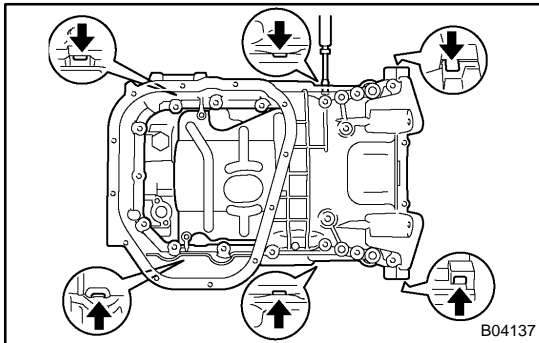
**45. REMOVE OIL STRAINER SUB-ASSY**

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



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

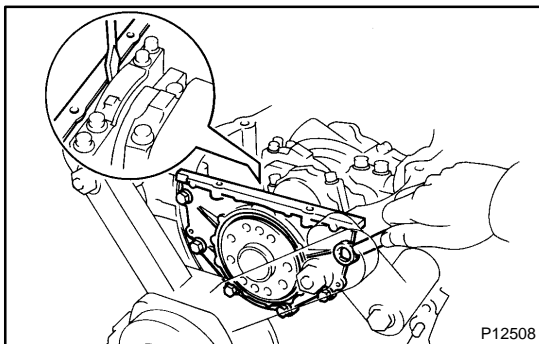
- (a) Loosen and remove the 15 bolts and the 2 nuts uniformly.



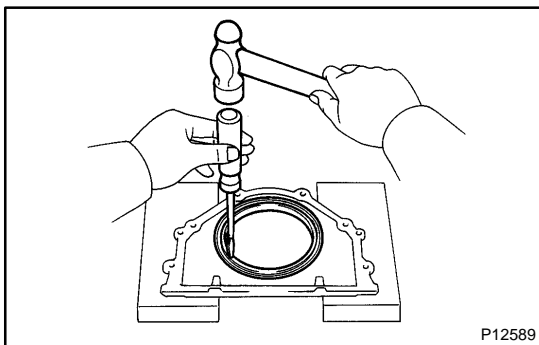
- (b) Using a screwdriver, remove the oil pan by prying between the cylinder block and the oil pan.

**NOTICE:**

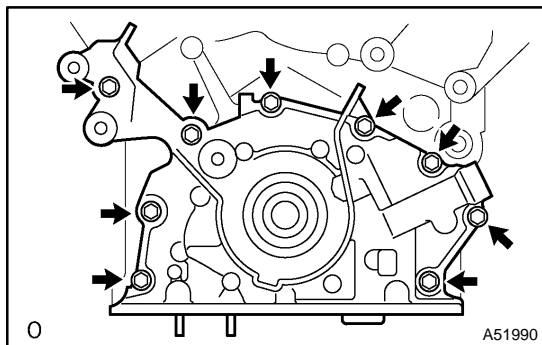
**Be careful not to damage the contact surfaces of the oil pan and cylinder block.**

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

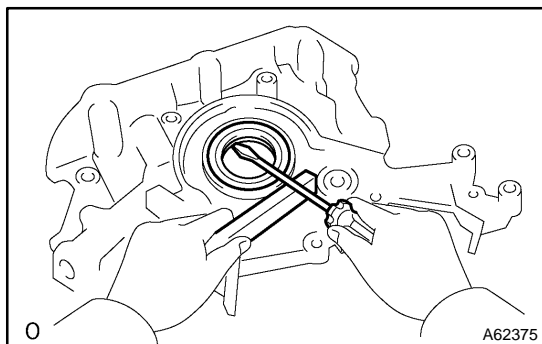
- (a) Remove the 6 bolts.
- (b) Using a screwdriver, remove the oil seal retainer by prying between the oil seal retainer and the main bearing cap.

**49. REMOVE ENGINE REAR OIL SEAL**

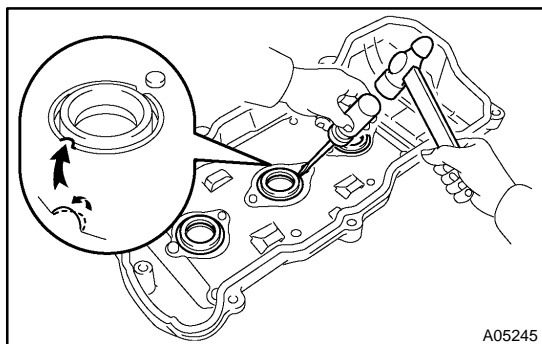
- (a) Using a screwdriver and a hammer, tap out the oil seal.

**50. REMOVE OIL PUMP ASSY**

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

**51. REMOVE OIL PUMP SEAL**

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

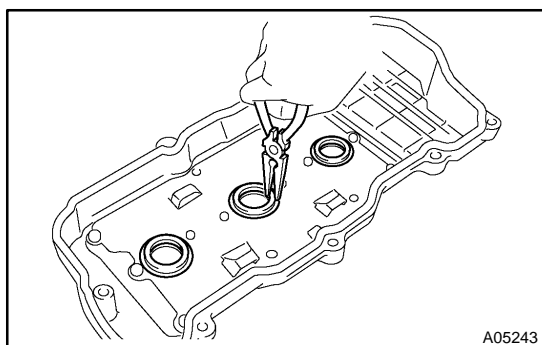
**52. REMOVE SPARK PLUG TUBE GASKET**

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

**NOTICE:**

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

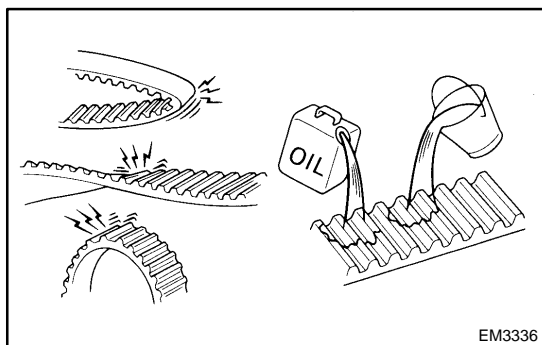
- (b) Using a screwdriver and a hammer, tap out the gasket.



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

**NOTICE:**

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

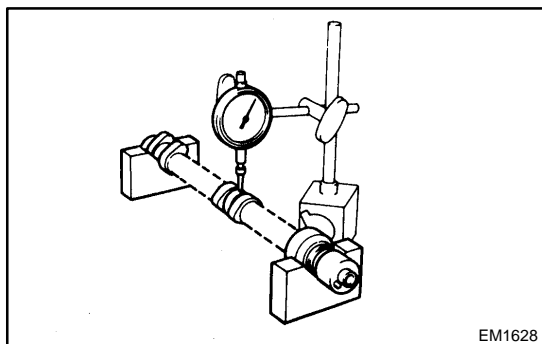
**53. INSPECT TIMING BELT****NOTICE:**

- 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 mounting bolt of the camshaft timing pulley.

Check the belt for any defects, as shown in the illustrations. Also check these points below.

- (a) If there is premature parting,
  - Check for proper installation.
  - Check the timing cover gasket for damage and proper installation.
- (b) If the belt teeth are cracked or damaged, check to see if either camshaft is locked.
- (c) 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.
- (d) If there is wear or damage on only one side of the belt, check the belt guide and the alignment of each pulley.
- (e) If there is noticeable wear on the belt teeth,
  - Check timing cover for damage.
  - Check gasket has been installed correctly.
  - Check for foreign object on the pulley teeth.

If there is any doubt about the belt condition, replace the timing belt.



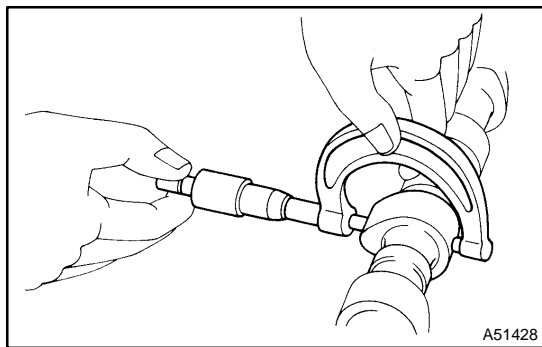
EM1628

#### 54. INSPECT CAMSHAFT

- (a) Inspect camshaft for runout.
  - (1) Place the camshaft on V-blocks.
  - (2) Using a dial indicator, measure the runout at the center journal.

**Maximum circle runout: 0.06 mm (0.0024 in.)**

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



A51428

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

**Standard cam lobe height:**

**Intake 43.132 to 43.232 mm (1.6981 to 1.7020 in.)**

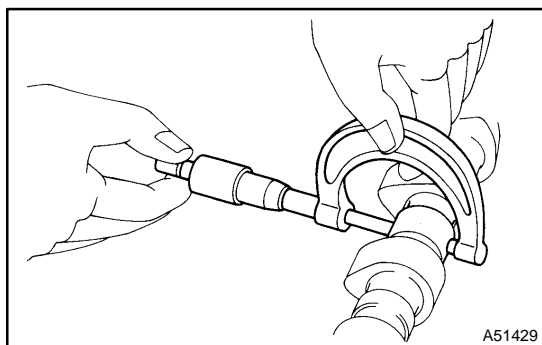
**Exhaust 43.010 to 43.110 mm (1.6933 to 1.6972 in.)**

**Minimum cam lobe height:**

**Intake 42.98 mm (1.6921 in.)**

**Exhaust 42.86 mm (1.6874 in.)**

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



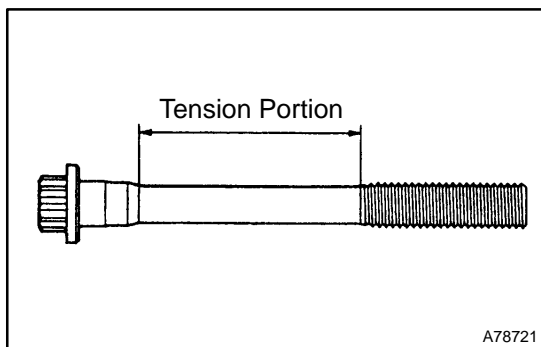
A51429

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

**Journal diameter:**

**26.959 to 26.975 mm (1.0614 to 1.0620 in.)**

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

**55. INSPECT CYLINDER HEAD SET BOLT**

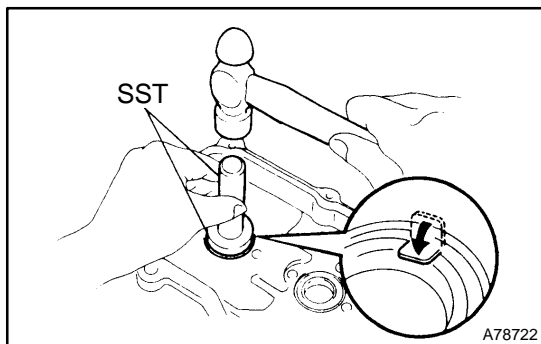
- (a) Using vernier calipers, measure the tension portion diameter of the bolt.

**Standard outside diameter:**

**8.95 to 9.05 mm (0.3524 to 0.3563 in.)**

**Minimum outside diameter: 8.75 mm (0.3445 in.)**

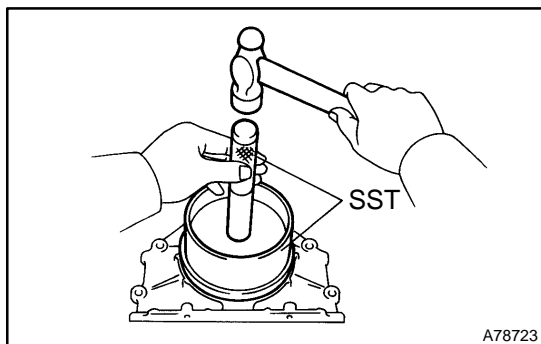
If the diameter is less than minimum, replace the bolt.

**56. INSTALL SPARK PLUG TUBE GASKET**

- (a) 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 (09951-00430), 09950-70010 (09951-07100)

- (b) Return the ventilation plate tab to its original position.  
 (c) Apply a light coat of MP grease to the gasket lip.

**57. INSTALL ENGINE REAR OIL SEAL**

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

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

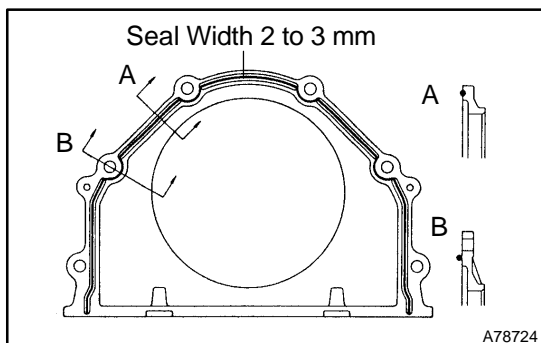
**NOTICE:**

- **Be careful not to tap the oil seal at an angle.**
- **Keep the lip free of foreign objects.**

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

**58. INSTALL ENGINE REAR OIL SEAL RETAINER**

- (a) Remove any old packing material from the contact surface.



- (b) Apply a continuous bead of seal packing (Diameter 2 to 3 mm (0.08 to 0.12 in.)) as shown in the illustration.

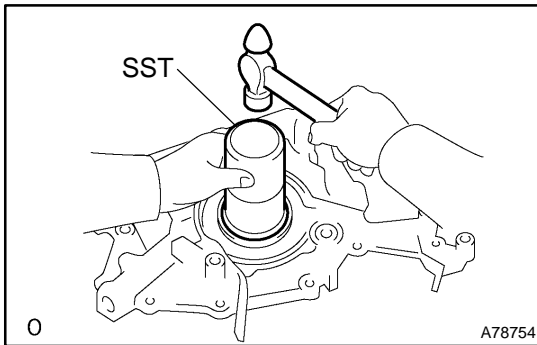
**Seal packing: Part No. 08826-00080 or equivalent**

**NOTICE:**

- **Remove any oil from the contact surface.**
- **Install the oil seal retainer within 3 minutes after applying seal packing.**
- **Do not expose the seal to engine oil within 2 hours after installing.**

- (c) Install the oil seal retainer with the 6 bolts. Tighten the bolt uniformly in several steps.

**Torque: 8.0 N·m (82 kgf·cm, 71 in·lbf)**

**59. INSTALL OIL PUMP SEAL**

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

SST 09223-00010

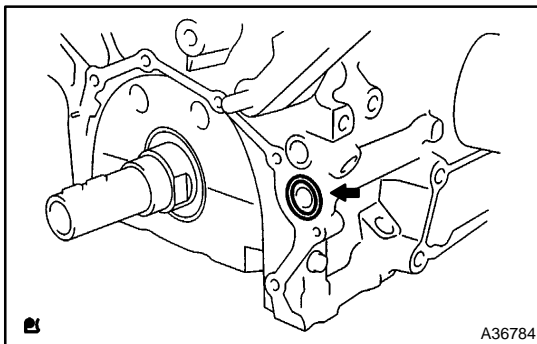
**NOTICE:**

- Be careful not to tap the oil seal at an angle.
- Keep the lip free of foreign objects.

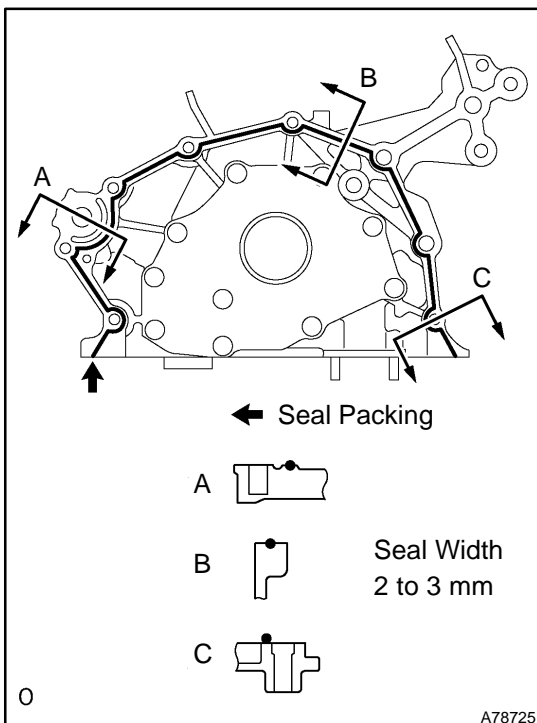
- (b) Apply MP grease to the oil seal lip.

**60. INSTALL OIL PUMP ASSY**

- (a) Remove any old packing material from the contact surface.



- (b) Apply a light coat of engine oil to a new O-ring and place it on the cylinder block.

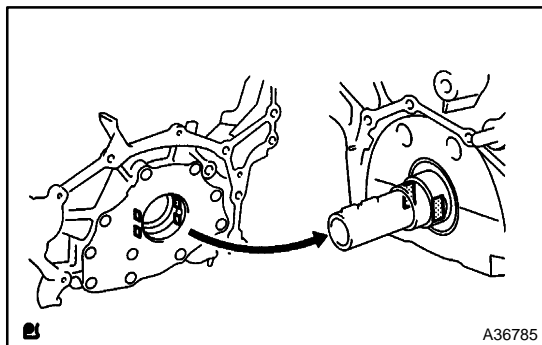


- (c) Apply a continuous bead of seal packing (Diameter 2 to 3 mm (0.08 to 0.12 in.)) as shown in the illustration.

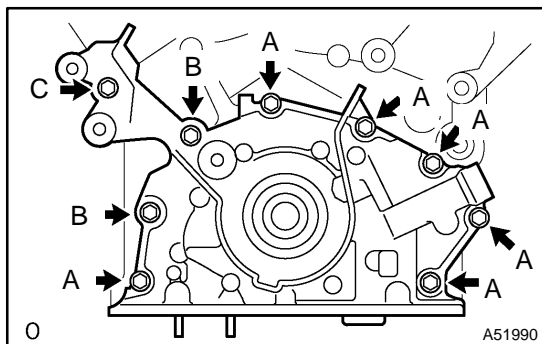
**Seal packing: Part No. 08826-00080 or equivalent**

**NOTICE:**

- Remove any oil from contact surface.
- Apply seal packing to the inner side of the bolt holes.
- Install the oil pump within 3 minutes after applying seal packing.
- Do not expose the seal to engine oil within 2 hours after installing.



- (d) Align the key of the oil pump drive gear with the keyway located on the crankshaft, and slide the oil pump into place.



- (e) Install the oil pump with the 9 bolts. Tighten the bolts uniformly in several steps.

**Torque:**

**Bolt A 8.0 N·m (82 kgf·cm, 71 in.-lbf)**

**Bolt B 20 N·m (199 kgf·cm, 14 ft·lbf)**

**Bolt C 43 N·m (439 kgf·cm, 32 ft·lbf)**

# 61. INSTALL CRANKSHAFT POSITION SENSOR

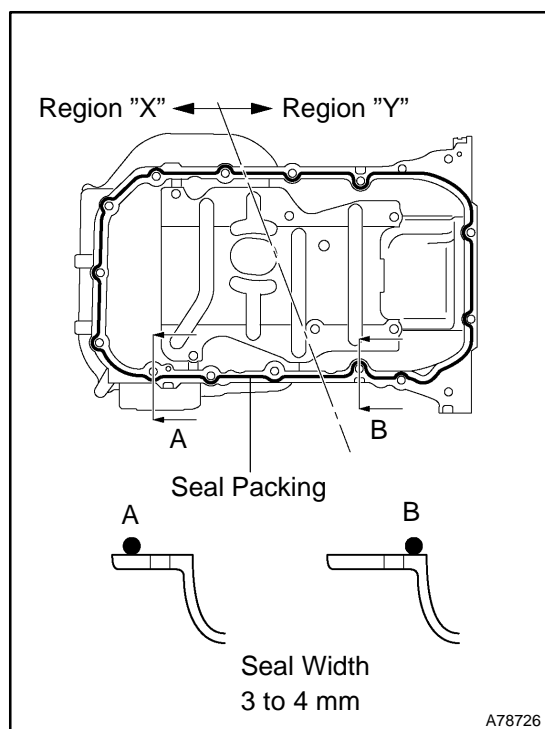
**Torque: 8.0 N·m (80 kgf·cm, 71 in.-lbf)**

# 62. INSTALL OIL PAN BAFFLE PLATE

**Torque: 8.0 N·m (82 kgf·cm, 71 in.-lbf)**

# 63. INSTALL OIL PAN SUB-ASSY

- (a) Remove any old seal packing from the contact surface.



- (b) Apply a continuous bead of seal packing (Diameter 3 to 4 mm (0.12 to 0.16 in.)) as shown in the illustration.

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

**NOTICE:**

- Remove any oil from the contact surface.
- Apply seal packing to the outer side of the bolt holes in the region "X".
- Apply seal packing to the inner side of the bolt holes in the region "Y".
- Install the oil pan within 3 minutes after applying seal packing.
- Do not expose the seal to engine oil within 2 hours after installing.

- (c) Install the oil pan No. 1 with the 15 bolts and the 2 nuts. Tighten the bolts uniformly in several steps.

**Torque:**

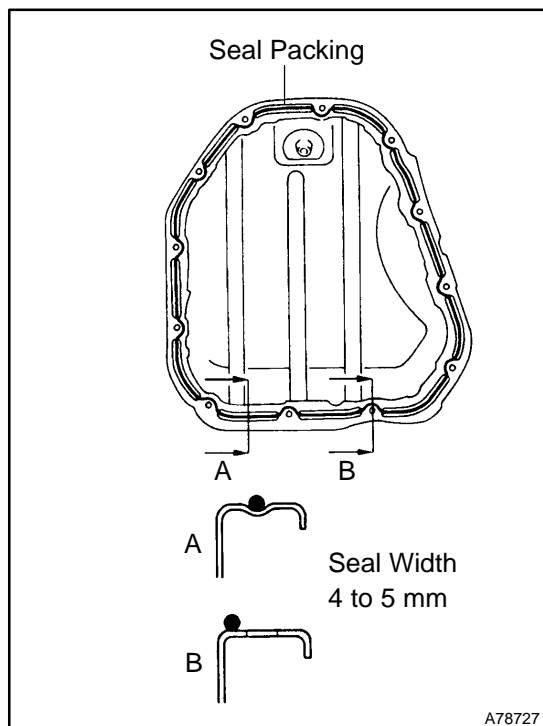
**10 mm head 8.0 N·m (82 kgf·cm, 71 in.-lbf)**

**12 mm head 20 N·m (199 kgf·cm, 14 ft·lbf)**

**64. INSTALL OIL STRAINER SUB-ASSY**

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

**Torque: 8.0 N·m (82 kgf·cm, 71 in.-lbf)**

**65. INSTALL OIL PAN SUB-ASSY NO.2**

- (a) Remove any old seal packing from the contact surface.  
 (b) Apply a continuous bead of seal packing (Diameter 4 to 5 mm (0.16 to 0.20 in.)) as shown in the illustration.

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

**NOTICE:**

- Remove any oil from the contact surface.
  - Apply seal packing to the inner side of the bolt holes.
  - Install the oil pan within 3 minutes after applying seal packing.
  - Do not expose the seal to engine oil within 2 hours after installing.
- (c) Install the oil pan No. 2 with the 10 bolts and the 2 nuts.  
**Torque: 8.0 N·m (82 kgf·cm, 71 in.-lbf)**

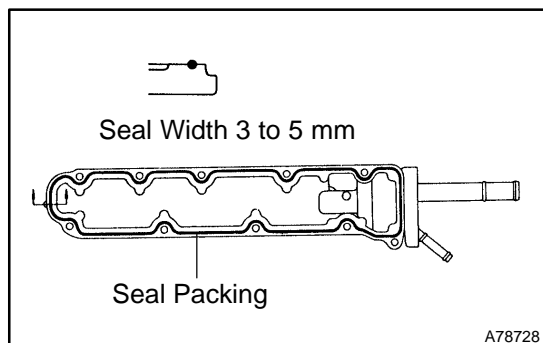
**66. INSTALL OIL PAN DRAIN PLUG**

- (a) Install the drain plug with a new gasket.

**Torque: 45 N·m (459 kgf·cm, 33 ft·lbf)**

**67. INSTALL WATER INLET HOUSING**

- (a) Remove any old packing material from the contact surface.

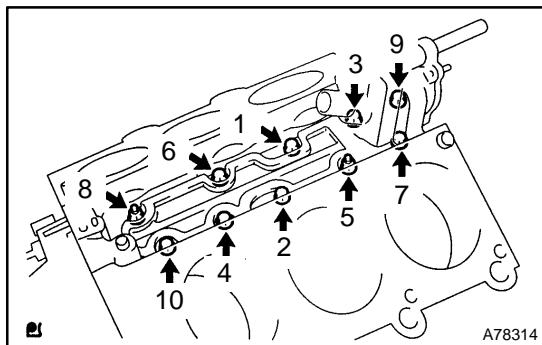


- (b) Apply a continuous bead of seal packing (Diameter 3 to 5 mm (0.12 to 0.20 in.)) as shown in the illustration.

**Seal packing: Part No. 08826-00100 or equivalent**

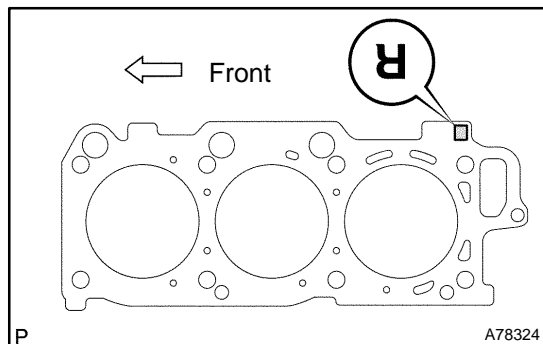
**NOTICE:**

- Remove any oil from the contact surface.
- Install the water inlet housing within 3 minutes after applying seal packing.
- Do not expose the seal to coolant within 2 hours after installing.



- (c) Install the water inlet housing with the 8 bolts and the 2 nuts. Using several steps, tighten the bolts and the nuts uniformly in the sequence shown in the illustration.

**Torque: 8.0 N·m (82 kgf·cm, 71 in.-lbf)**



#### 68. INSTALL CYLINDER HEAD GASKET

- (a) Place a new cylinder head gasket on the cylinder block with the R mark upward.

##### NOTICE:

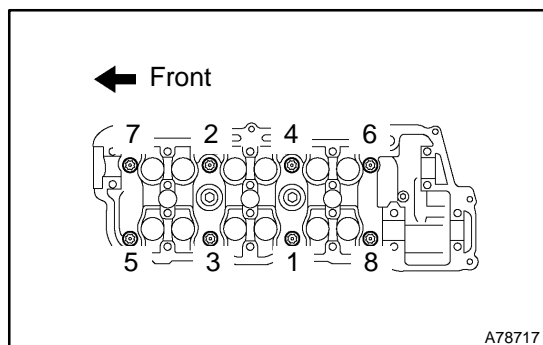
- Remove any oil from the contact surface.
- Be careful of the installing orientation.
- Place the cylinder head on the gasket carefully in order not to damage the gasket at the bottom part of the head.

#### 69. INSTALL CYLINDER HEAD SUB-ASSY

##### NOTICE:

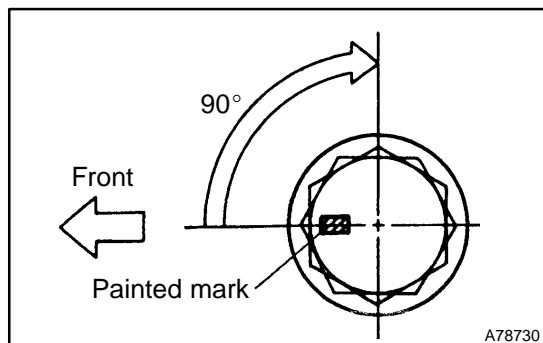
The cylinder head bolts are tightened in 2 successive steps.

- (a) Apply a light coat of engine oil on the threads of the cylinder head bolts.
- (b) Install the plate washers to the cylinder head bolts.



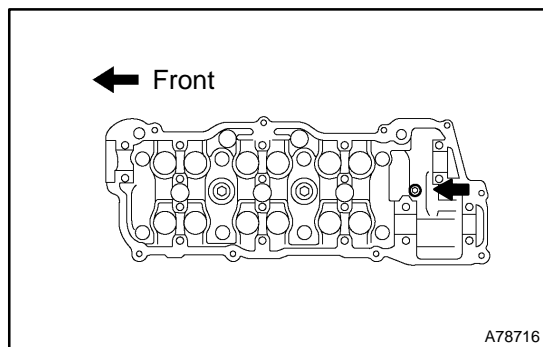
- (c) Using several steps, install and tighten the 8 cylinder head bolts uniformly in the sequence shown in the illustration.

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



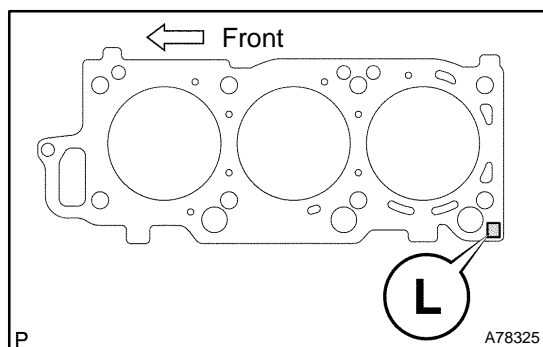
- (d) Mark the front side of each cylinder head bolt head with paint as shown in the illustration.
- (e) Retighten the cylinder head bolts by 90° in the same sequence as step (c).
- (f) Check that the painted mark is now at a 90° angle to the front.





- (g) Using an 8 mm socket hexagon wrench, install the hexagon bolt.

**Torque: 19 N·m (189 kgf·cm, 14 ft·lbf)**



## 70. INSTALL CYLINDER HEAD GASKET NO.2

- (a) Place a new cylinder head gasket on the cylinder block with the L mark upward.

### NOTICE:

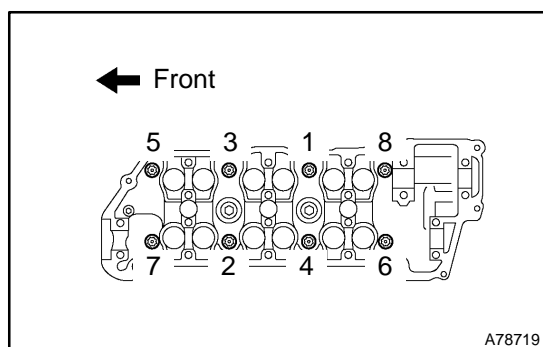
- Remove any oil from the contact surface.
- Be careful of the installing orientation.
- Place the cylinder head on the gasket carefully in order not to damage the gasket at the bottom part of the head.

## 71. INSTALL CYLINDER HEAD LH

### NOTICE:

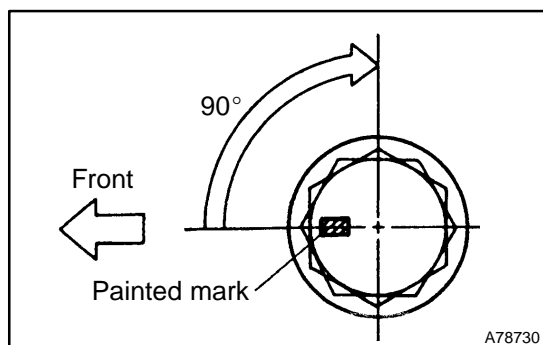
The cylinder head bolts are tightened in 2 successive steps.

- (a) Apply a light coat of engine oil on the threads of the cylinder head bolts.
- (b) Install the plate washers to the cylinder head bolts.

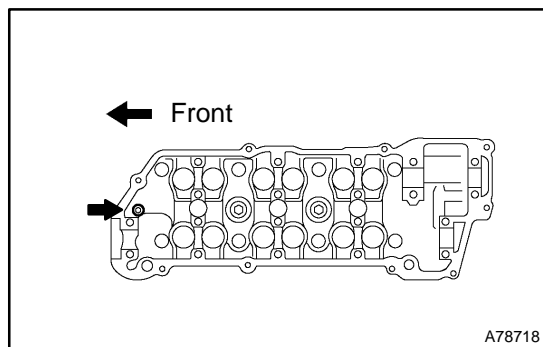


- (c) Using several steps, install and tighten the 8 cylinder head bolts uniformly in the sequence shown in the illustration.

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

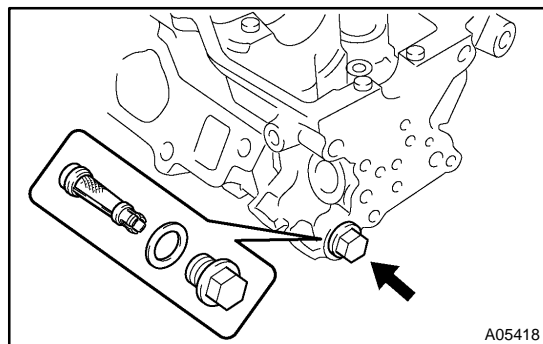


- (d) Mark the front side of each cylinder head bolt head with paint as shown in the illustration.
- (e) Retighten the cylinder head bolts by 90° in the same sequence as step (c).
- (f) Check that the painted mark is now at a 90° angle to the front.



- (g) Using an 8 mm socket hexagon wrench, install the hexagon bolt.

**Torque: 19 N·m (189 kgf·cm, 14 ft·lbf)**



## 72. INSTALL OIL CONTROL VALVE FILTER

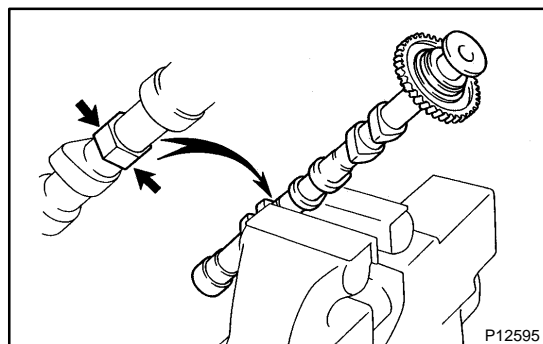
- (a) Check that no foreign object is on the mesh part of the filter.  
 (b) Assemble the valve filter and the plug.  
 (c) Install the plug with a new gasket.

**Torque: 45 N·m (459 kgf·cm, 33 ft·lbf)**

## 73. INSTALL CYLINDER HEAD COVER REAR

- (a) Install the rear cover and a new gasket.

**Torque: 10 N·m (102 kgf·cm, 7 ft·lbf)**

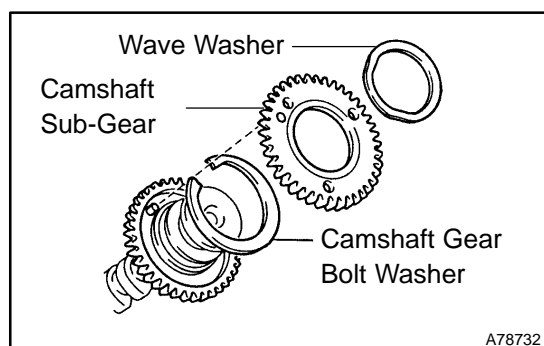


## 74. INSTALL CAMSHAFT SUB GEAR

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

### NOTICE:

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

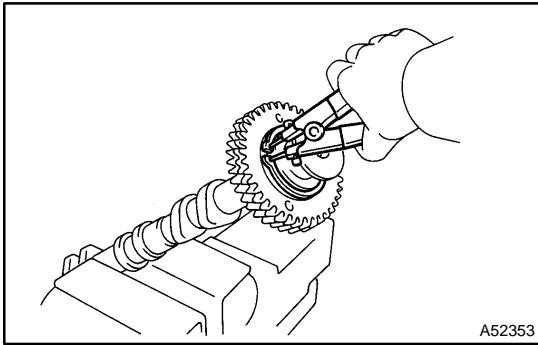


- (b) Install the camshaft gear bolt washer and the camshaft sub-gear.

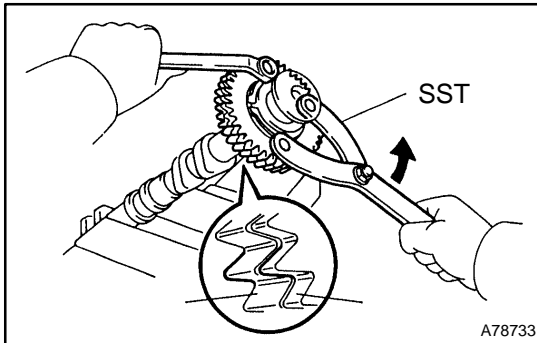
### HINT:

Attach the pins on the gears to the gear bolt washer ends.

- (c) Install the wave washer.



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



- (e) 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)
- (f) Align the gear teeth of the main gear and sub-gear and tighten the service bolt.

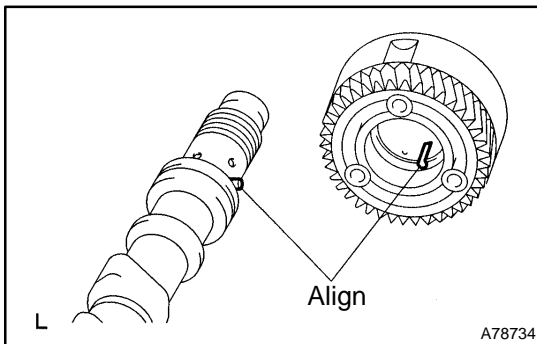
**Torque: 5.4 N·m (55 kgf·cm, 48 in.-lbf)**

**NOTICE:**

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

**HINT:**

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



**75. INSTALL CAMSHAFT TIMING GEAR ASSY**

- (a) Align the alignment pin with the alignment pin groove and install VVT-i on the camshaft.

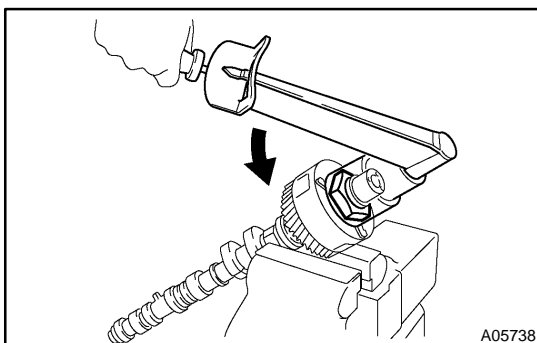
**NOTICE:**

**Install it with the lock-pin engaged and locked at the maximum delay angle position.**

- (b) Apply engine oil on the nut, the mounting surface of VVT-i and the screw threads.

**NOTICE:**

- **Be sure to apply the oil, otherwise the specified torque cannot be obtained.**
- **New nuts must be used when replacing VVT-i unit.**



- (c) Using a 46 mm socket wrench, install and tighten a lock nut by turning it counterclockwise.

**Torque: 150 N·m (1,530 kgf·cm, 111 ft.-lbf)**

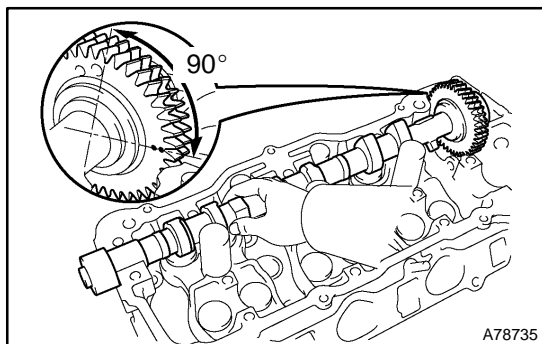
**NOTICE:**

- **The lock nut has LH threads.**
- **Never use any tool other than the socket wrench. Other tools will deform the cam angle rotor.**

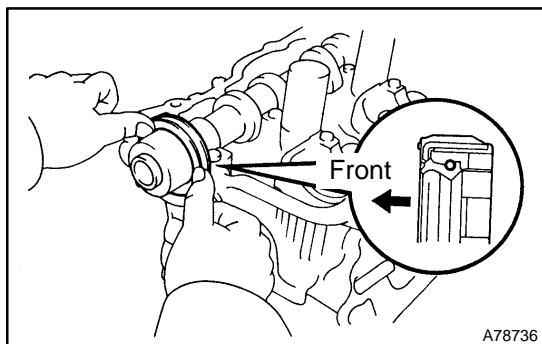
**76. INSTALL NO.2 CAMSHAFT****NOTICE:**

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

- (a) Apply new engine oil to the thrust portion and journal of the camshaft.



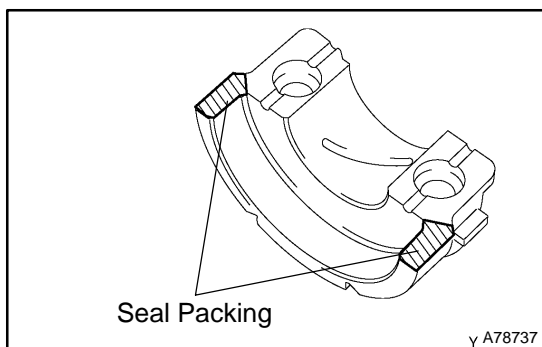
- (b) Place the No. 2 camshaft at a 90° angle of the timing mark (2 dot marks) on the cylinder head.
- (c) Apply MP grease to a new oil seal lip.



- (d) Install the oil seal to the camshaft.

**NOTICE:**

- **Do not turn over the oil seal lip.**
  - **Insert the oil seal until it stops.**
- (e) Remove any old packing material from the contact surface.

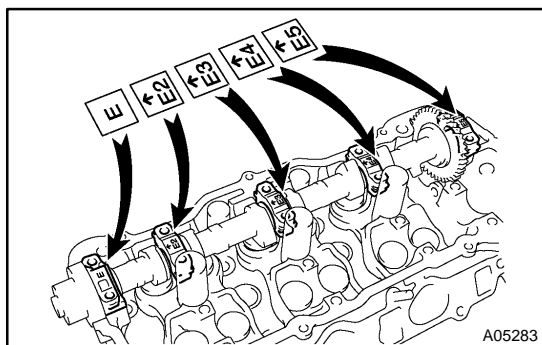


- (f) Apply seal packing to the No. 1 bearing cap as shown in the illustration.

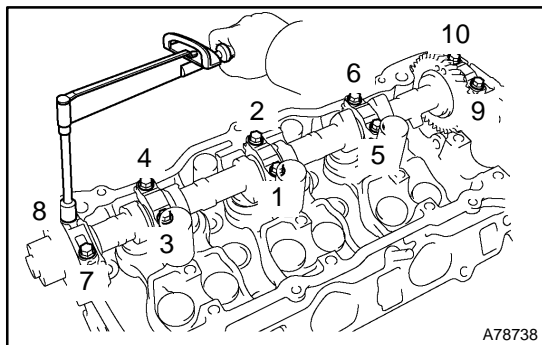
**Seal packing: Part No. 08826-00080 or equivalent**

**NOTICE:**

- **Install the No. 1 bearing cap within 5 minutes after applying seal packing.**
- **Do not expose the seal to engine oil within 2 hours after installing.**



- (g) Install the 5 bearing caps in their proper locations.
- (h) Apply a light coat of engine oil on the threads of the bearing cap bolts.



- (i) Using several steps, tighten the 10 bearing cap bolts uniformly in the sequence shown in the illustration.

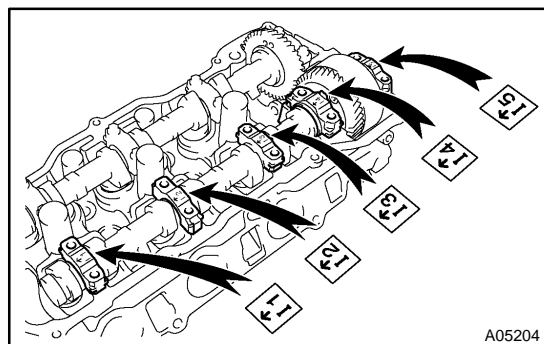
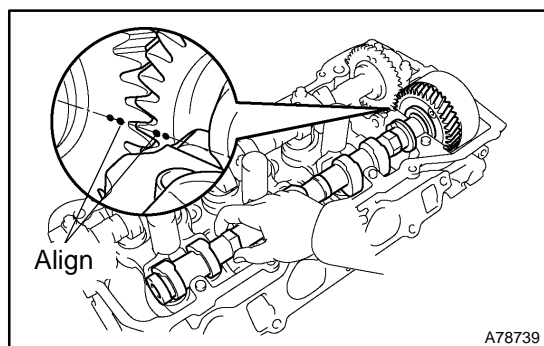
**Torque: 16 N·m (163 kgf·cm, 12 ft·lbf)**

## 77. INSTALL CAMSHAFT

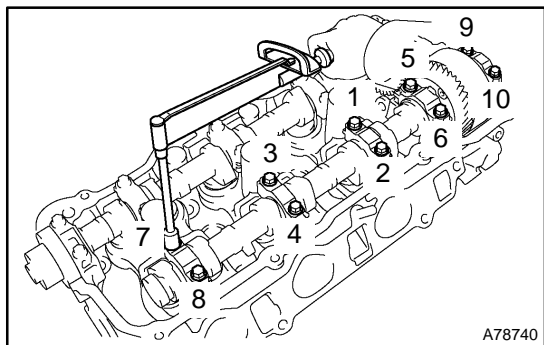
### NOTICE:

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

- (a) Apply new engine oil to the thrust portion and journal of the camshaft.
- (b) Align the timing marks (2 dot marks) of the camshaft drive with the driven gears.
- (c) Place the camshaft on the cylinder head.



- (d) Install the 5 bearing caps in their proper locations.
- (e) Apply a light coat of engine oil on the threads of the bearing cap bolts.



- (f) Using several steps, tighten the 10 bearing cap bolts uniformly in the sequence shown in the illustration.

**Torque: 16 N·m (163 kgf·cm, 12 ft·lbf)**

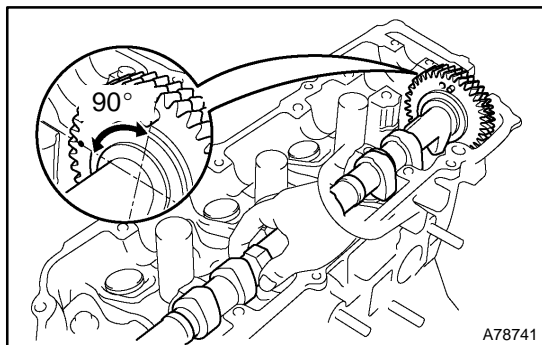
- (g) Remove the service bolt.

## 78. INSTALL NO.4 CAMSHAFT SUB-ASSY

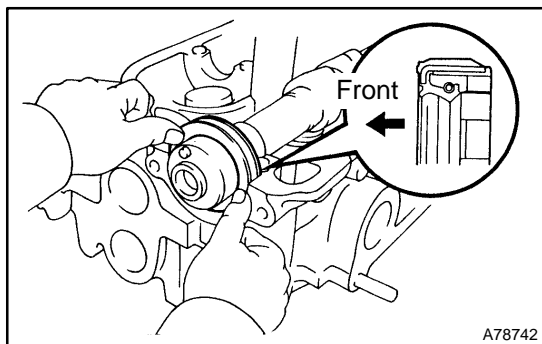
### NOTICE:

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

- (a) Apply new engine oil to the thrust portion and journal of the camshaft.



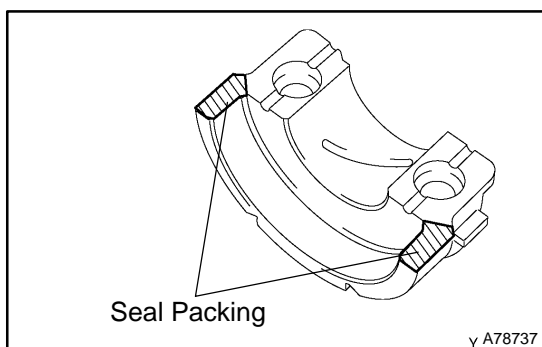
- (b) Place the No. 4 camshaft at a 90° angle of timing mark (1 dot marks) on the cylinder head.
- (c) Apply MP grease to a new oil seal lip.



- (d) Install the oil seal to the camshaft.

**NOTICE:**

- **Do not turn over the oil seal lip.**
- **Insert the oil seal until it stops.**
- (e) Remove any old packing material from the contact surface.

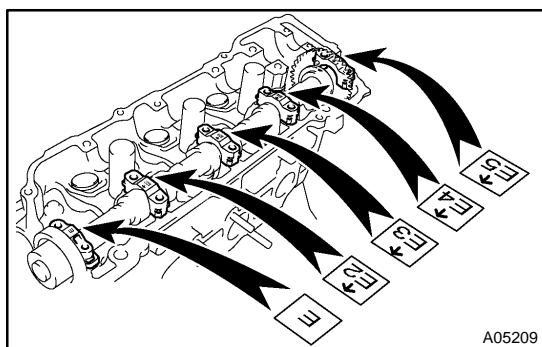


- (f) Apply seal packing to the No. 1 bearing cap as shown in the illustration.

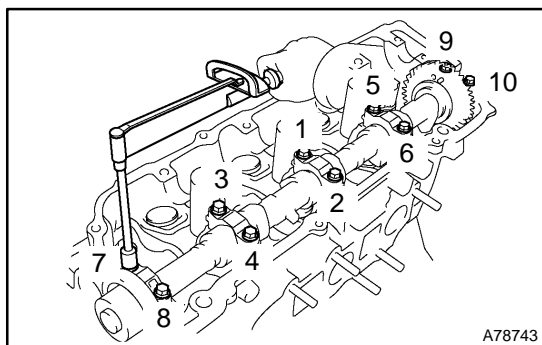
**Seal packing: Part No. 08826-00080 or equivalent**

**NOTICE:**

- **Install the No. 1 bearing cap within 5 minutes after applying seal packing.**
- **Do not expose the seal to engine oil within 2 hours after installing.**



- (g) Install the 5 bearing caps in their proper locations.
- (h) Apply a light coat of engine oil on the threads of the bearing cap bolts.



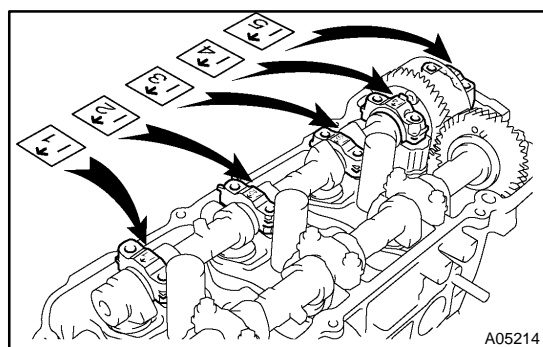
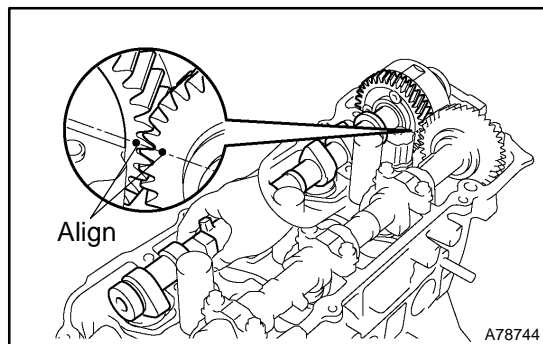
- (i) Using several steps, tighten the 10 bearing cap bolts uniformly in the sequence shown in the illustration.

**Torque: 16 N·m (163 kgf·cm, 12 ft·lbf)**

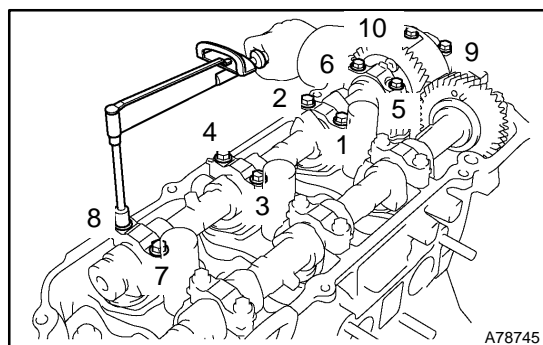
**79. INSTALL NO.3 CAMSHAFT SUB-ASSY****NOTICE:**

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

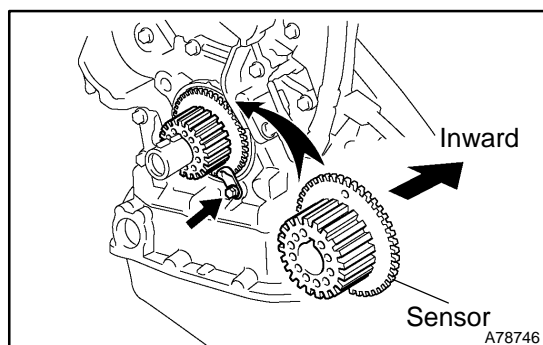
- (a) Apply new engine oil to the thrust portion and journal of the camshaft.
- (b) Align the timing marks (1 dot marks) of the camshaft drive with the driven gears. Place the camshaft on the cylinder head.



- (c) Install the 5 bearing caps in their proper locations.
- (d) Apply a light coat of engine oil on the threads of the bearing cap bolts.



- (e) Using several steps, tighten the 10 bearing cap bolts uniformly in the sequence shown in the illustration.  
**Torque: 16 N·m (163 kgf·cm, 12 ft·lbf)**
- (f) Remove the service bolt.

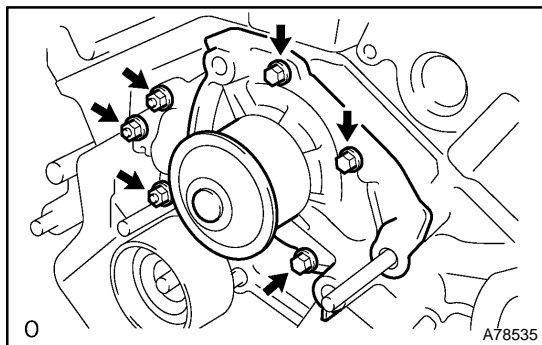
**80. INSTALL CRANKSHAFT TIMING PULLEY**

- (a) Align the keyway of the timing pulley with the key located on the crankshaft and slide the timing pulley into place.

**NOTICE:**

**Do not scratch the sensor area of the crankshaft timing pulley.**

- (b) Install the timing belt plate with the bolt.  
**Torque: 8.0 N·m (82 kgf·cm, 71 in·lbf)**

**81. INSTALL WATER PUMP ASSY**

- (a) Install a new gasket and the water pump with the 3 bolts and the 3 nuts.

**Torque: 8.0 N·m (82 kgf·cm, 71 in·lbf)**

**82. INSTALL OIL LEVEL GAGE GUIDE**

- (a) Apply a light coat of engine oil to a new O-ring and install it to the level gage guide.  
 (b) Install the level gage guide.

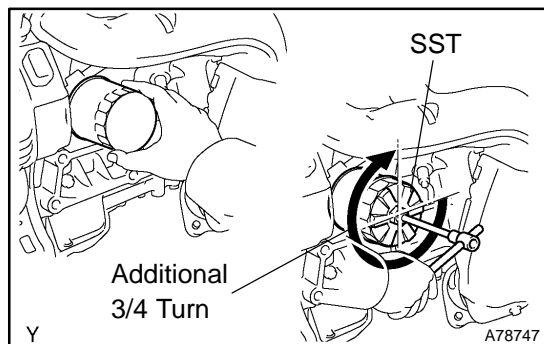
**Torque: 8.0 N·m (82 kgf·cm, 71 in·lbf)**

**83. INSTALL OIL FILTER SUB-ASSY**

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

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

- (b) Check and clean the oil filter installation surface.  
 (c) Apply clean engine oil to the gasket of a new oil filter.  
 (d) Lightly screw the oil filter into place, and tighten it until the gasket contacts the seat.



- (e) Using SST, tighten it an additional 3/4 turn.  
 SST 09228-07501

**84. INSTALL TIMING BELT IDLER BRACKET**

**Torque: 28 N·m (286 kgf·cm, 21 ft·lbf)**

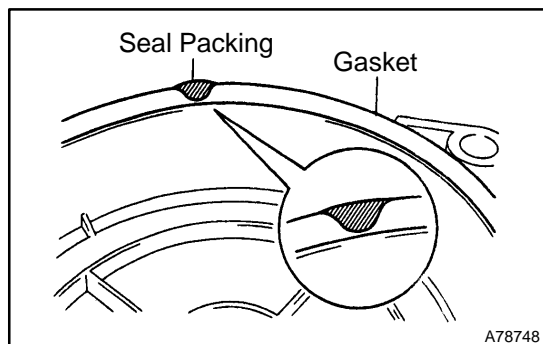
**85. INSTALL TIMING BELT NO.3 COVER**

- (a) Visually check for cracks and breaks in the gasket of the timing belt cover.

**HINT:**

If there is a trace that water is entering at the visual check, repair it with seal packing when the crack length is within 2 to 3 cm (0.79 to 1.18 in.). Replace the gasket when the crack length is 3 to 4 cm (1.18 to 1.57 in.) and more.





- (b) When repairing the timing belt cover gasket, follow the procedure below.

- (1) Repair the cracks and breaks by applying the seal packing to the damaged area.

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

**NOTICE:**

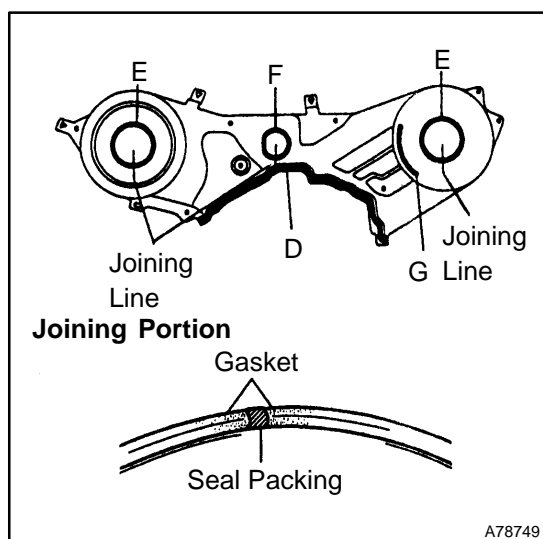
**When applying the seal packing, apply it as wide and high as the gasket.**

- (c) When replacing the timing belt cover gasket is needed to replace, follow the procedure below.

- (1) Using a screwdriver and gasket scraper, remove the remaining gasket.

**NOTICE:**

**Be careful not to damage the timing belt cover.**



- (2) Remove the backing paper from a new gasket, and affix the gasket along the groove of the timing belt cover as shown in the illustration.

**NOTICE:**

- **Affix the gasket in the center of the groove.**
- **At the corners, try to keep the gasket thickness uniform.**

**HINT:**

Gasket	D	E	F	G
Length	335 mm (13.19 in.)	180 mm (7.09 in.)	133 mm (5.24 in.)	72 mm (2.83 in.)

- (3) If there is a gap on the joint of the gasket, apply seal packing to close the gap.

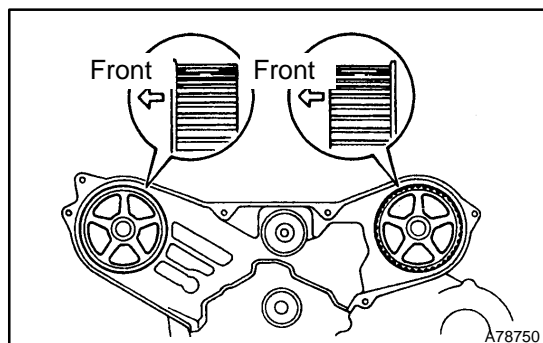
**Seal packing: Part No. 08826-00080 or equivalent**

**NOTICE:**

**When applying the seal packing, apply it as wide and high as the gasket.**

- (d) Install the timing belt cover with the 6 bolts.

**Torque: 8.5 N·m (87 kgf·cm, 76 in.-lbf)**

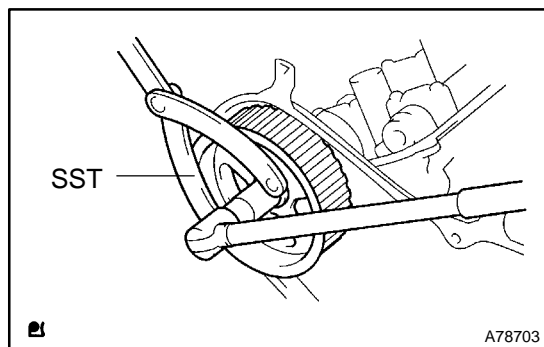


## 86. INSTALL CAMSHAFT TIMING PULLEY

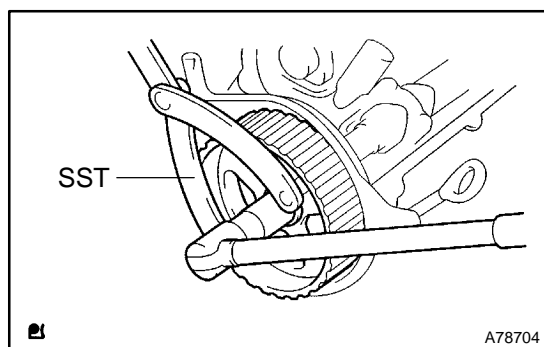
- (a) Pay attention to the orientation of the belt guide, install the camshaft timing pulley with the belt guide properly oriented and tighten the bolt temporarily.

**HINT:**

- Face the belt guide of the RH timing pulley toward front of the engine.
- Face the belt guide of the LH timing pulley toward rear of the engine.



- (b) Using SST, tighten the RH pulley bolt.  
 SST 09960-10010 (09962-01000, 09963-01000)  
**Torque: 125 N·m (1,275 kgf·cm, 92 ft·lbf)**



- (c) Using SST, tighten the LH pulley bolt.  
 SST 09960-10010 (09962-01000, 09963-01000)  
**Torque: 125 N·m (1,275 kgf·cm, 92 ft·lbf)**

#### 87. INSTALL TIMING BELT IDLER SUB-ASSY NO.2

**Torque: 43 N·m (438 kgf·cm, 32 ft·lbf)**

#### 88. INSTALL TIMING BELT IDLER SUB-ASSY NO.1

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

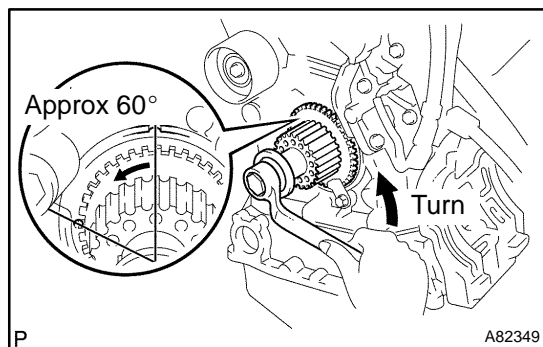
**Torque: 34 N·m (347 kgf·cm, 25 ft·lbf)**

#### 89. INSTALL TIMING BELT

- (a) Remove any oil or water on the pulleys, and keep them clean.

##### NOTICE:

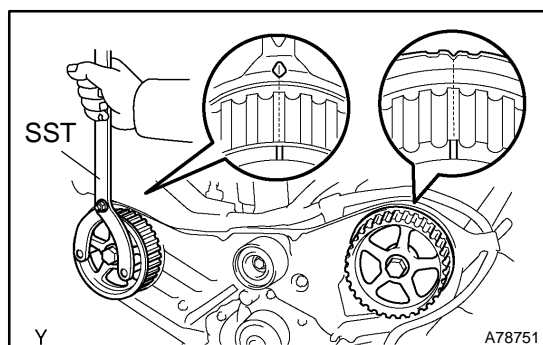
- **If there is a trace of water and/or oil on the timing belt repair the leakage and install a new timing belt.**
  - **Wipe only the pulleys; do not use any cleaning agent.**
- (b) Inspect the idler pulleys.
- (1) Check that the idler pulley turns smoothly.
  - (2) Visually check the seal portion of the idler pulley for oil leakage.
- (c) Inspect the water pump.
- (1) Turn the pulley, and check that water pump bearing moves smoothly and does not make noise.
  - (2) Visually check the drain hole for coolant leakage.
- (d) Temporarily install the crankshaft pulley bolt and the washer to the crankshaft.



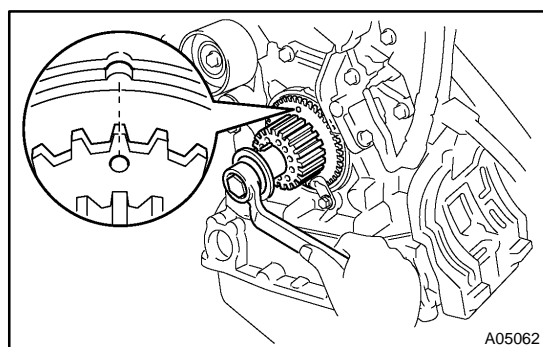
(e) Turn the crankshaft counterclockwise by approx. 60°.

**NOTICE:**

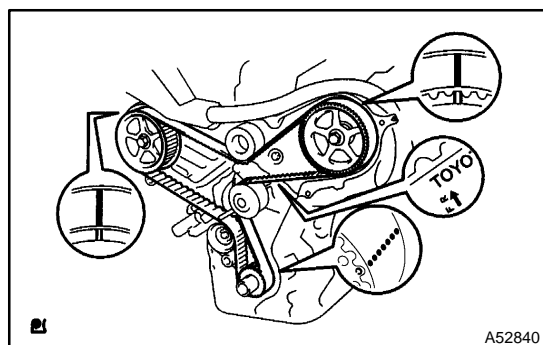
To prevent contacting the piston head and the valve head, set the crankshaft pulley at 60° BTDC/compression position.



(f) Using SST, turn the crankshaft pulley, and align the timing marks of the timing pulley and the No. 3 timing belt cover. SST 09960-10010 (09962-01000, 09963-01000)



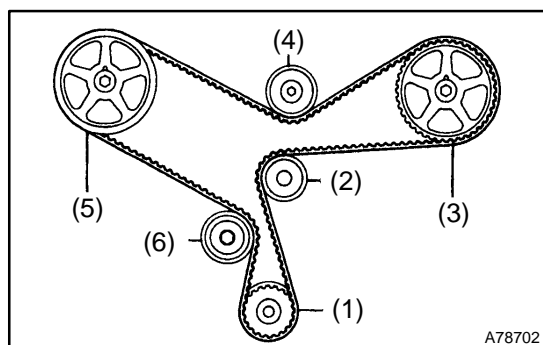
(g) Turn the crankshaft, and align the timing marks of the crankshaft timing pulley and the oil pump body.



(h) Face the front mark on the timing belt forward.

(i) Align the installation mark on the timing belt with the timing mark of the crankshaft timing pulley.

(j) Align the installation marks on the timing belt with the timing marks of the camshaft timing pulleys.

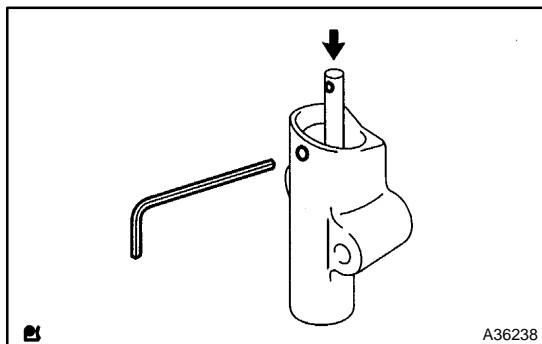


(k) Install the timing belt in this order.

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

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

- (a) Set the timing belt tensioner upright on the press.



- (b) Slowly press in the push rod.

**NOTICE:**

**Do not apply pressure more than 9.8 kN (1,000 kgf, 2,205 lbf) to the rod.**

- (c) Align the holes of the push rod and housing, pass a 1.5 mm hexagon wrench through the holes to keep the setting position of the push rod.
- (d) Release the press.
- (e) Temporarily install the tensioner with the 2 bolts. Alternately tighten the 2 bolts.

**Torque: 27 N·m (280 kgf·cm, 20 ft·lbf)**

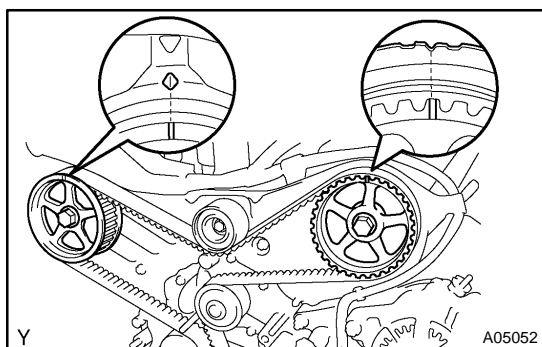
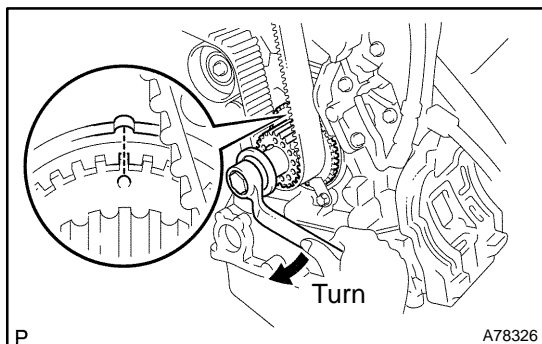
**NOTICE:**

**Be sure to tighten the bolts equally. Installing the tensioner at an angle may cause failure of its proper operation.**

- (f) Remove the 1.5 mm hexagon wrench from the tensioner.
- (g) Turn the crankshaft 2 revolutions slowly, and align the timing marks of the crankshaft timing pulley and the oil pump body.

**NOTICE:**

**Always turn the crankshaft clockwise.**



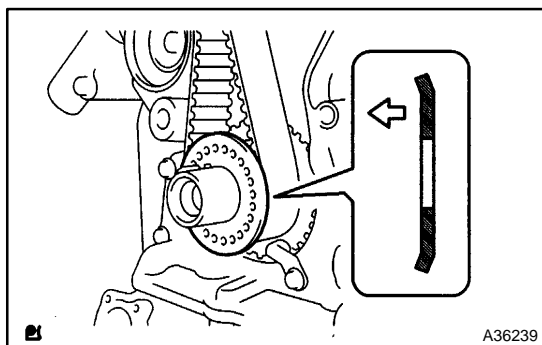
- (h) Check the timing marks of the RH and LH timing pulleys are aligned with the timing marks of the No. 3 timing belt cover as shown in the illustration.

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

- (i) Remove the crankshaft pulley bolt.

**91. INSTALL TIMING BELT GUIDE NO.2**

- (a) Install the timing belt guide, facing the cup side toward the engine front.



**92. INSTALL ENGINE MOUNTING BRACKET RH**

**Torque: 28 N·m (286 kgf·cm, 21 ft·lbf)**

**93. INSTALL TIMING BELT NO.2 COVER**

(a) Visually check for cracks and breaks in the gasket of the timing belt cover.

If there is a trace that water is entering at the visual check, replace the timing belt cover.

(b) Install the timing belt cover.

**Torque: 8.5 N·m (87 kgf·cm, 75 in·lbf)**

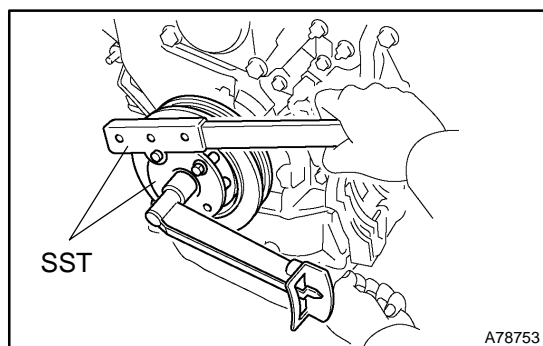
**94. INSTALL TIMING BELT NO.1 COVER**

(a) Visually check for cracks and breaks in the gasket of the timing belt cover.

If there is a trace that water is entering at the visual check, replace the timing belt cover.

(b) Install the timing belt cover.

**Torque: 8.5 N·m (87 kgf·cm, 75 in·lbf)**

**95. INSTALL CRANKSHAFT PULLEY**

(a) Align the keyway of the pulley with the key located on the crankshaft and slide the pulley into place.

(b) Using SST, install the pulley bolt.

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

**Torque: 220 N·m (2,250 kgf·cm, 162 ft·lbf)**

**96. INSTALL VVT SENSOR**

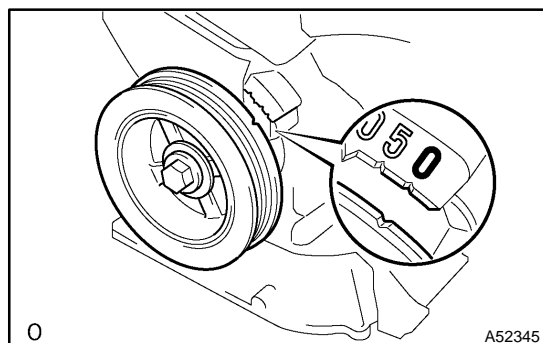
**Torque: 8.0 N·m (82 kgf·cm, 71 in·lbf)**

**97. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSY**

**Torque: 8.0 N·m (82 kgf·cm, 71 in·lbf)**

**98. INSTALL ENGINE HANGER NO.2**

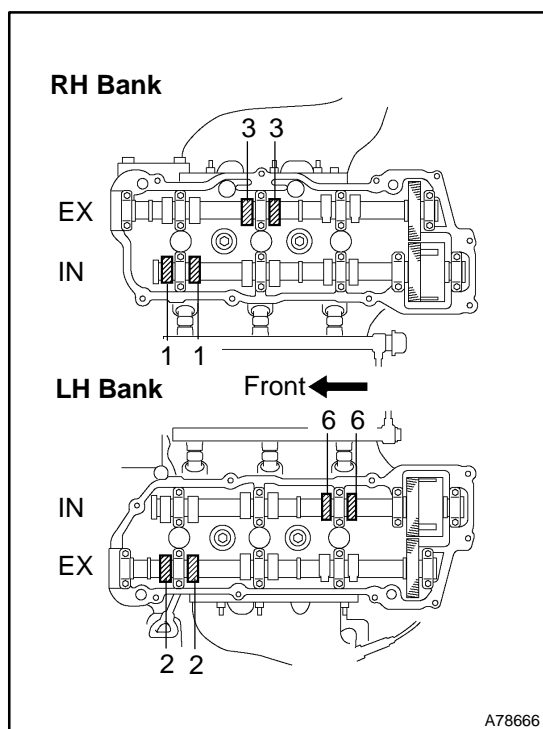
**Torque: 20 N·m (199 kgf·cm, 14 ft·lbf)**

**99. INSPECT VALVE CLEARANCE**

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

(b) Check that the valve lifters on the No. 1 (IN and EX) are both loose.

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



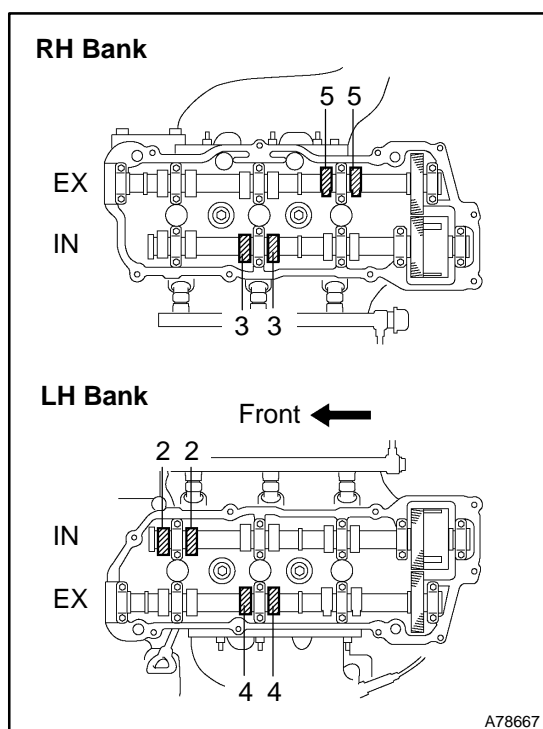
- (c) Check the valves indicated in the illustration on the left.
- (1) Using a feeler gauge, measure the clearance between the valve lifter and the camshaft.

**Valve clearance (Cold):**

**Intake 0.15 to 0.25 mm (0.006 to 0.010 in.)**

**Exhaust 0.25 to 0.35 mm (0.010 to 0.014 in.)**

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



- (d) Turn the crankshaft 2/3 of a revolution (240°), and check the valves indicated in the illustration on the left.

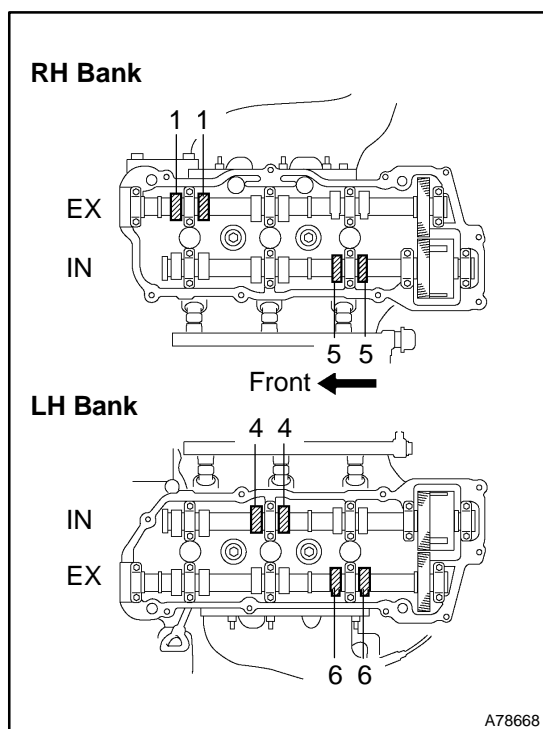
- (1) Using a feeler gauge, measure the clearance between the valve lifter and the camshaft.

**Valve clearance (Cold):**

**Intake 0.15 to 0.25 mm (0.006 to 0.010 in.)**

**Exhaust 0.25 to 0.35 mm (0.010 to 0.014 in.)**

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



- (e) Turn the crankshaft 2/3 of a revolution (240°), and check the valves indicated in the illustration on the left.

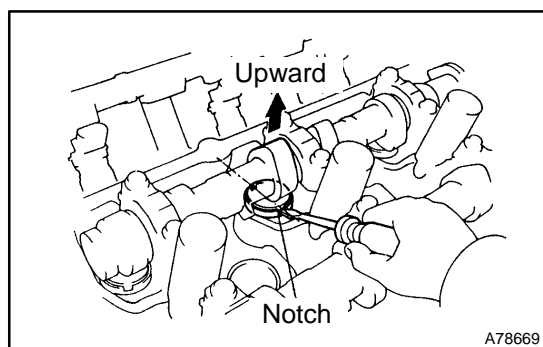
- (1) Using a feeler gauge, measure the clearance between the valve lifter and the camshaft.

**Valve clearance (Cold):**

**Intake 0.15 to 0.25 mm (0.006 to 0.010 in.)**

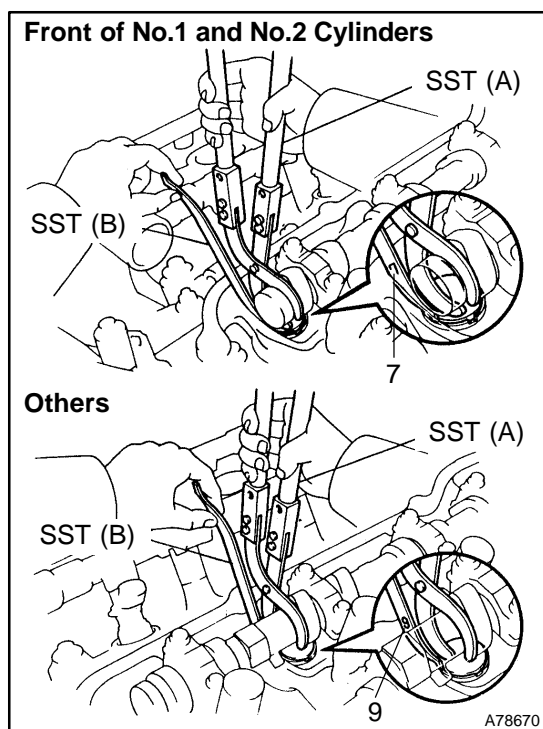
**Exhaust 0.25 to 0.35 mm (0.010 to 0.014 in.)**

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



**100. ADJUST VALVE CLEARANCE**

- (a) Turn the camshaft so that the cam lobe is facing upward.
- (b) Turn the valve lifter with a screwdriver so that the notches are perpendicular to the camshaft.



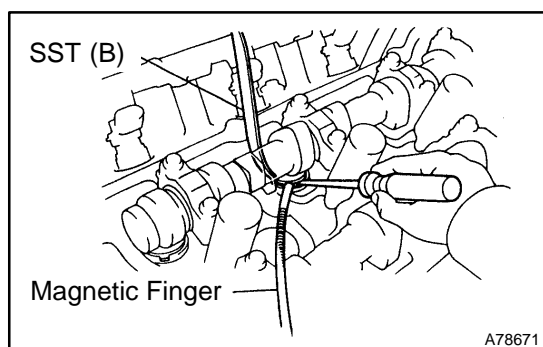
- (c) Using SST (A), press down the valve lifter and place SST (B) between the camshaft and valve lifter. Remove SST (A).

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

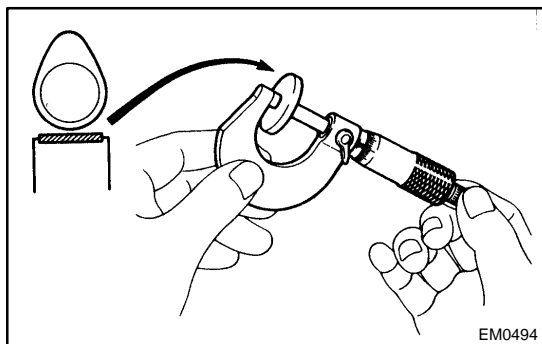
**HINT:**

- Apply SST (B) at a slight angle on the side marked with "9" or "7", at the position shown in the illustration.
- When SST (B) is inserted too deeply, it will get pinched by the shim. To prevent it from being stuck, insert it gently from the intake side, at a slight angle.

SST (A)	09248-05410
SST (B)	09248-05420



- (d) Using a small screwdriver and magnetic finger, remove the adjusting shim.



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

A	Thickness of new shim
B	Thickness of used shim
C	Measured valve clearance

**Specified value (Cold):**

**Intake  $A = B + (C - 0.20 \text{ mm (0.008 in.)})$**

**Exhaust  $A = B + (C - 0.30 \text{ mm (0.012 in.)})$**

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

**EXAMPLE: (Intake)**

Measure valve clearance = 0.45 mm (0.0177 in.)

$0.45 \text{ mm (0.0177 in.)} - 0.20 \text{ mm (0.0078 in.)} = 0.25 \text{ mm (0.0098 in.)}$

(Measured - Specification = Excess clearance)

Used shim measurement = 2.80 mm (0.1102 in.)

$0.25 \text{ mm (0.0098 in.)} + 2.80 \text{ mm (0.1102 in.)} = 3.05 \text{ mm (0.1201 in.)}$

(Excess clearance + Used shim = Ideal new shim)

Closest new shim = 3.05 mm (0.1201 in.) = Shim No. "12"

**HINT:**

- Shims are available in 17 sizes in increments of 0.05 mm (0.0020 in.), from 2.50 mm (0.0984 in.) to 3.30 mm (0.1299 in.).
- Refer to new shim thickness table on next 2 pages.



## 2005 SIENNA REPAIR MANUAL (RM1163U)

**Author :**

**Date :**

V00719

## Adjusting Shim Selection Chart (Exhaust)

Installed shim thickness mm (in.)		2.500 (0.0984)	2.520 (0.0992)	2.540 (0.1000)	2.560 (0.1004)	2.580 (0.1008)	2.600 (0.1016)	2.620 (0.1031)	2.640 (0.1039)	2.660 (0.1043)	2.680 (0.1047)	2.670 (0.1051)	2.680 (0.1055)	2.690 (0.1059)	2.700 (0.1063)	2.710 (0.1067)	2.720 (0.1071)	2.730 (0.1075)	2.740 (0.1079)	2.750 (0.1083)	2.760 (0.1087)	2.770 (0.1091)	2.780 (0.1094)	2.790 (0.1098)	2.800 (0.1102)	2.810 (0.1106)	2.820 (0.1110)	2.830 (0.1114)	2.840 (0.1118)	2.850 (0.1122)	2.860 (0.1126)	2.870 (0.1130)	2.880 (0.1134)	2.890 (0.1138)	2.900 (0.1142)	2.910 (0.1146)	2.920 (0.1150)	2.930 (0.1154)	2.940 (0.1157)	2.950 (0.1161)	2.960 (0.1165)	2.970 (0.1169)	2.980 (0.1173)	2.990 (0.1177)	3.000 (0.1181)	3.010 (0.1185)	3.020 (0.1189)	3.030 (0.1193)	3.040 (0.1197)	3.050 (0.1201)	3.060 (0.1205)	3.080 (0.1213)	3.100 (0.1220)	3.120 (0.1228)	3.140 (0.1236)	3.160 (0.1244)	3.180 (0.1252)	3.200 (0.1260)	3.220 (0.1268)	3.240 (0.1276)	3.260 (0.1283)	3.280 (0.1291)	3.300 (0.1299)
Measured clearance mm (in.)																																																															
0.000 – 0.020 (0.0000 – 0.0008)																																																															
0.021 – 0.040 (0.0008 – 0.0016)																																																															
0.041 – 0.060 (0.0016 – 0.0024)																																																															
0.061 – 0.080 (0.0024 – 0.0031)																																																															
0.081 – 0.100 (0.0032 – 0.0039)																																																															
0.101 – 0.120 (0.0040 – 0.0047)																																																															
0.121 – 0.140 (0.0048 – 0.0055)																																																															
0.141 – 0.160 (0.0056 – 0.0063)																																																															
0.161 – 0.180 (0.0063 – 0.0071)																																																															
0.181 – 0.200 (0.0071 – 0.0079)																																																															
0.201 – 0.220 (0.0079 – 0.0087)																																																															
0.221 – 0.240 (0.0087 – 0.0094)																																																															
0.241 – 0.249 (0.0095 – 0.0098)																																																															
0.250 – 0.350 (0.0098 – 0.0138)																																																															
0.351 – 0.360 (0.0138 – 0.0142)																																																															
0.361 – 0.380 (0.0142 – 0.0150)																																																															
0.381 – 0.400 (0.0150 – 0.0157)																																																															
0.401 – 0.420 (0.0158 – 0.0165)																																																															
0.421 – 0.440 (0.0166 – 0.0173)																																																															
0.441 – 0.460 (0.0174 – 0.0181)																																																															
0.461 – 0.480 (0.0181 – 0.0189)																																																															
0.481 – 0.500 (0.0189 – 0.0197)																																																															
0.501 – 0.520 (0.0197 – 0.0205)																																																															
0.521 – 0.540 (0.0205 – 0.0213)																																																															
0.541 – 0.560 (0.0213 – 0.0220)																																																															
0.561 – 0.580 (0.0221 – 0.0228)																																																															
0.581 – 0.600 (0.0229 – 0.0236)																																																															
0.601 – 0.620 (0.0237 – 0.0244)																																																															
0.621 – 0.640 (0.0244 – 0.0252)																																																															
0.641 – 0.660 (0.0252 – 0.0260)																																																															
0.661 – 0.680 (0.0260 – 0.0268)																																																															
0.681 – 0.700 (0.0268 – 0.0276)																																																															
0.701 – 0.720 (0.0276 – 0.0283)																																																															
0.721 – 0.740 (0.0284 – 0.0291)																																																															
0.741 – 0.760 (0.0292 – 0.0299)																																																															
0.761 – 0.780 (0.0300 – 0.0307)																																																															
0.781 – 0.800 (0.0307 – 0.0315)																																																															
0.801 – 0.820 (0.0315 – 0.0323)																																																															
0.821 – 0.840 (0.0323 – 0.0331)																																																															
0.841 – 0.860 (0.0331 – 0.0339)																																																															
0.861 – 0.880 (0.0339 – 0.0346)																																																															
0.881 – 0.900 (0.0347 – 0.0354)																																																															
0.901 – 0.920 (0.0355 – 0.0362)																																																															
0.921 – 0.940 (0.0363 – 0.0370)																																																															
0.941 – 0.960 (0.0370 – 0.0378)																																																															
0.961 – 0.980 (0.0378 – 0.0386)																																																															
0.981 – 1.000 (0.0386 – 0.0394)																																																															
1.001 – 1.020 (0.0394 – 0.0402)																																																															
1.021 – 1.040 (0.0402 – 0.0409)																																																															
1.041 – 1.060 (0.0410 – 0.0417)																																																															
1.061 – 1.080 (0.0418 – 0.0425)																																																															
1.081 – 1.100 (0.0426 – 0.0433)																																																															
1.101 – 1.120 (0.0433 – 0.0441)																																																															
1.121 – 1.140 (0.0441 – 0.0449)																																																															
1.141 – 1.150 (0.0449 – 0.0453)																																																															

Exhaust valve clearance (Cold):  
0.25 to 0.35 mm (0.010 to 0.014 in.)

EXAMPLE: The 2.800 mm (0.1102 in.) shim is installed, and the measured clearance is 0.450 mm (0.0177 in.).

Shim No.

Thickness

Shim No.

1

2.500 (0.0984)

10

2

2.550 (0.1004)

11

3

2.600 (0.1024)

12

4

2.650 (0.1043)

13

5

2.700 (0.1063)

14

6

2.750 (0.1083)

15

7

2.800 (0.1102)

16

8

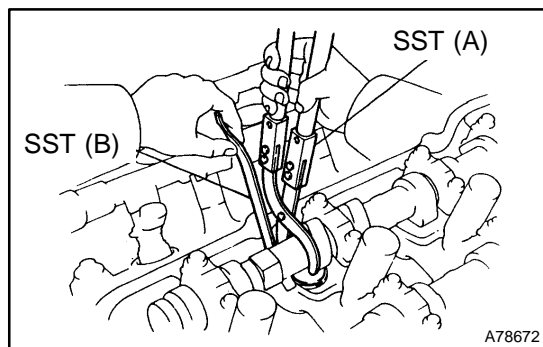
2.850 (0.1122)

17

9

2.900 (0.1142)

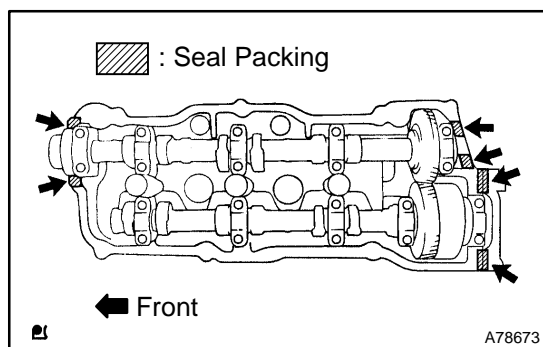
HINT: New shims have the thick



- (h) Place a new adjusting shim on the valve lifter, with imprinted numbers facing down.
- (i) Press down the valve lifter with SST (A), and remove SST (B).  
SST 09248-55040 (09248-05410, 09248-05420)
- (j) Recheck the valve clearance.

#### 101. INSTALL CYLINDER HEAD COVER SUB-ASSY

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



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

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

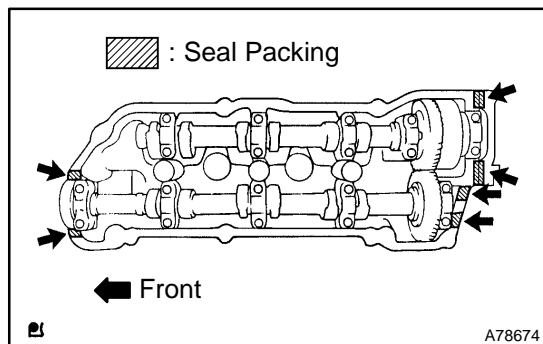
#### NOTICE:

- Remove any oil from the contact surface.
  - Install the cylinder head cover within 3 minutes after applying seal packing.
  - Do not start the engine within 2 hours after installing.
- (c) Install the cylinder head cover with the 9 bolts. Tighten the bolts uniformly in several steps.

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

#### 102. INSTALL CYLINDER HEAD COVER SUB-ASSY LH

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



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

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

#### NOTICE:

- Remove any oil from the contact surface.
  - Install the cylinder head cover within 3 minutes after applying seal packing.
  - Do not start the engine within 2 hours after installing.
- (c) Install the cylinder head cover with the 9 bolts. Tighten the bolts uniformly in several steps.

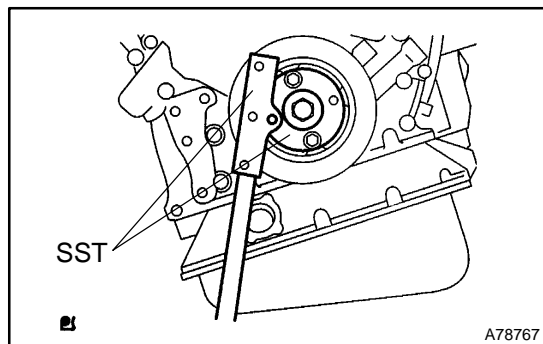
**Torque: 8.0 N·m (80 kgf·cm, 71 in.-lbf)**

#### 103. INSTALL SPARK PLUG

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

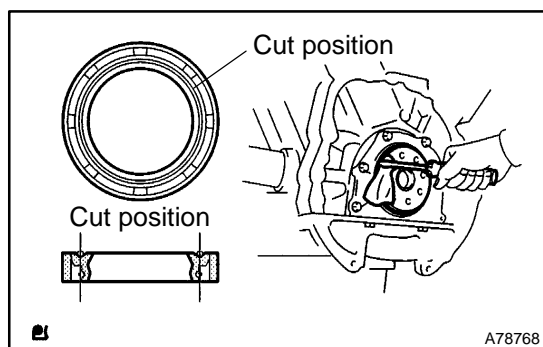
# ENGINE REAR OIL SEAL REPLACEMENT

1. REMOVE AUTOMATIC TRANSAXLE ASSY (2WD DRIVE TYPE) (See page 40-9 )
2. REMOVE AUTOMATIC TRANSMISSION W/TRANSFER (4WD DRIVE TYPE) (See page 40-9 )



## 3. REMOVE DRIVE PLATE & RING GEAR SUB-ASSY

- (a) Using SST, hold the crankshaft.  
SST 09213-54015 (91651-60855), 09330-00021
- (b) Remove the 8 bolts, the rear spacer, the drive plate and the front spacer.

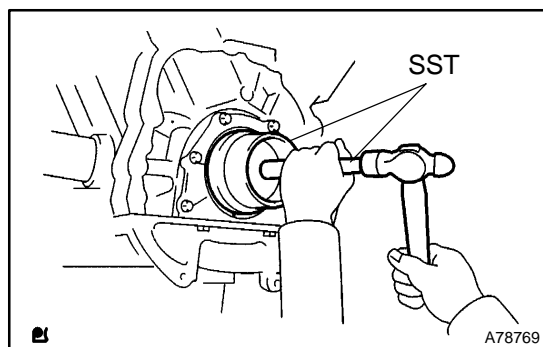


## 4. REMOVE ENGINE REAR OIL SEAL

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

### NOTICE:

After the removal, check if the crankshaft is not damaged. If it is damaged, smooth the surface with 400-grit sandpaper.



## 5. INSTALL ENGINE REAR OIL SEAL

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

### NOTICE:

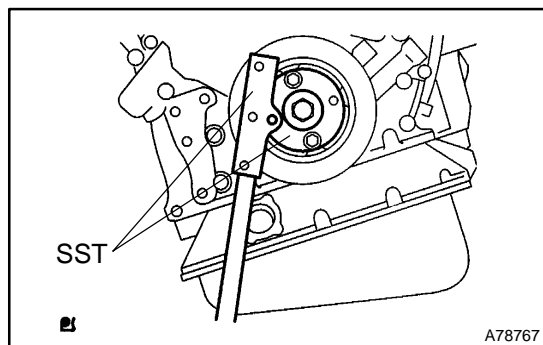
Keep the lip off foreign materials.

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

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

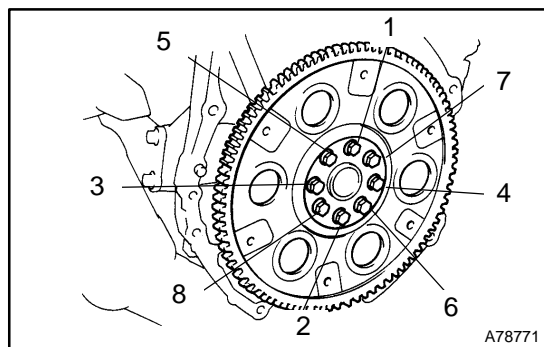
### NOTICE:

- Be careful not to tap the oil seal slantingly.
- Wipe off extra grease on the crankshaft.



## 6. INSTALL DRIVE PLATE & RING GEAR SUB-ASSY

- (a) Using SST, hold the crankshaft.  
SST 09213-54015 (91651-60855), 09330-00021
- (b) Clean the bolts and the bolt holes.
- (c) Apply adhesive to 2 or 3 threads of the bolts.  
**Adhesive: Part No. 08833-00070, THREE BOND 1324 or equivalent**
- (d) Install the front spacer, the drive plate and the rear spacer on the crankshaft.



- (e) Using several steps, install and tighten the 8 bolts uniformly in the sequence shown in the illustration.

**Torque: 83 N·m (846 kgf·cm, 61 ft·lbf)**

**NOTICE:**

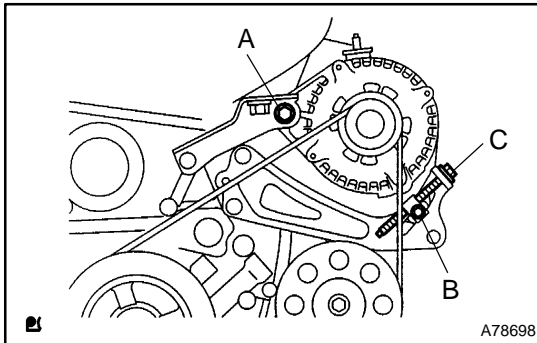
**Do not start the engine within an hour after installing.**

7. **INSTALL AUTOMATIC TRANSMISSION W/TRANSFER (4WD DRIVE TYPE) (See page 40-9 )**
8. **INSTALL AUTOMATIC TRANSAXLE ASSY (2WD DRIVE TYPE) (See page 40-9 )**

# DRIVE BELT REPLACEMENT

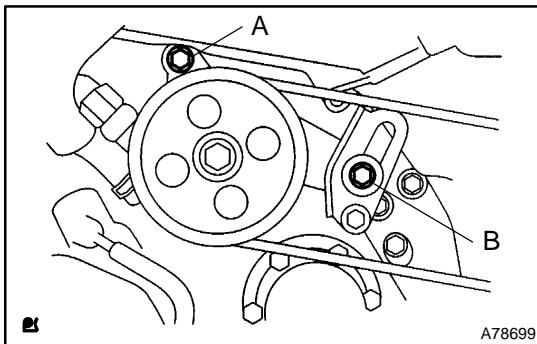
1405G-06

1. REMOVE FRONT WHEEL RH
2. REMOVE FRONT FENDER APRON SEAL RH



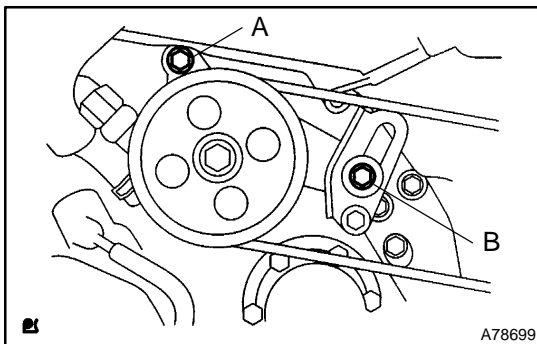
## 3. REMOVE V (COOLER COMPRESSOR TO CRANKSHAFT PULLEY) BELT NO.1

- (a) Loosen bolts A and B.
- (b) Loosen the adjusting bolt C, and remove the V-ribbed belt.



## 4. REMOVE VANE PUMP V BELT

- (a) Loosen bolts A and B, and remove the V-ribbed belt.



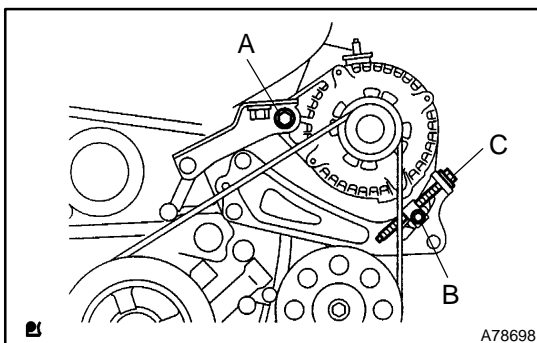
## 5. INSTALL VANE PUMP V BELT

- (a) Install the V-ribbed belt on each pulley.
- (b) Using a bar, adjust the V-ribbed belt tension and tighten bolt B.

**Torque: 44 N·m (449 kgf·cm, 32 ft·lbf)**

- (c) Tighten bolt A.

**Torque: 44 N·m (449 kgf·cm, 32 ft·lbf)**



## 6. INSTALL V (COOLER COMPRESSOR TO CRANKSHAFT PULLEY) BELT NO.1

- (a) Install the V-ribbed belt on each pulley.
- (b) Tighten the adjusting bolt C, and adjust the V-ribbed belt tension.
- (c) First tighten bolt A, then tighten bolt B.

**Torque:**

**Bolt A 58 N·m (591 kgf·cm, 43 ft·lbf)**

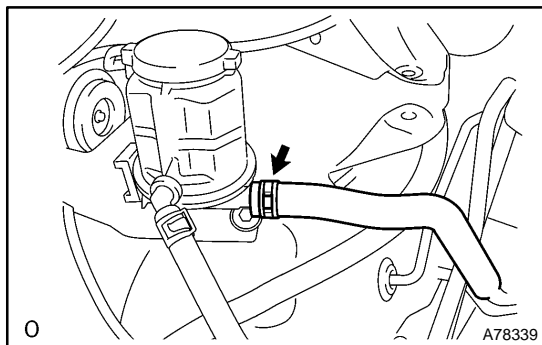
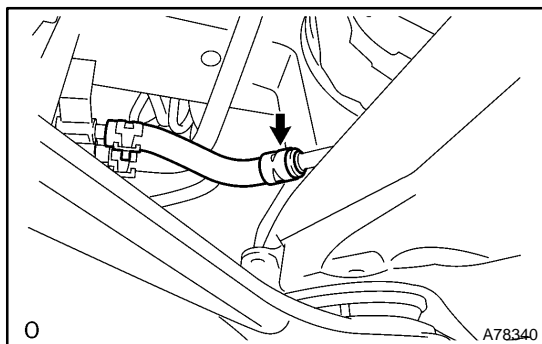
**Bolt B 18 N·m (184 kgf·cm, 13 ft·lbf)**

7. INSPECT DRIVE BELT DEFLECTION AND TENSION (REFERENCE) (See page [14-1](#) )
8. INSTALL FRONT WHEEL RH  
Torque: 103 N·m (1,050 kgf·cm, 76 ft·lbf)

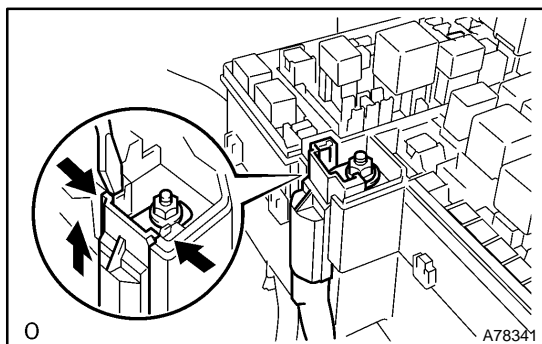
## REPLACEMENT

1. DISCHARGE FUEL SYSTEM PRESSURE (See page 11-1 )
2. REMOVE FRONT WHEELS
3. REMOVE ENGINE UNDER COVER NO.1
4. REMOVE FRONT FENDER LINER LH
5. REMOVE FRONT FENDER LINER RH
6. REMOVE FRONT FENDER APRON SEAL LH
7. REMOVE FRONT FENDER APRON SEAL RH
8. DRAIN COOLANT (See page 16-8 )
9. DRAIN ENGINE OIL (See page 17-23 )
10. DRAIN AUTOMATIC TRANSAXLE FLUID (See page 40-22 )
11. DRAIN TRANSFER OIL (4WD DRIVE TYPE)
12. REMOVE FRONT WIPER ARM HEAD CAP
13. REMOVE FR WIPER ARM RH (See page 66-8 )
14. REMOVE FR WIPER ARM LH (See page 66-8 )
15. REMOVE COWL TOP VENTILATOR LOUVER SUB-ASSY (See page 66-8 )
16. REMOVE WIPER LINK ASSY (See page 66-8 )
17. REMOVE COWL TOP TO COWL BRACE INNER NO.1 (See page 11-13 )
18. REMOVE COWL TOP PANEL SUB-ASSY OUTER FRONT (See page 11-13 )
19. REMOVE V-BANK COVER SUB-ASSY (See page 14-7 )
20. REMOVE BATTERY
21. REMOVE AIR CLEANER CAP SUB-ASSY (See page 19-5 )
22. REMOVE AIR CLEANER FILTER ELEMENT SUB-ASSY
23. REMOVE AIR CLEANER INLET NO.2 (See page 19-5 )
24. REMOVE AIR CLEANER CASE (See page 19-5 )
25. REMOVE AIR CLEANER BRACKET (See page 19-5 )
26. REMOVE AIR CLEANER INLET NO.1 (See page 19-5 )
27. REMOVE V (COOLER COMPRESSOR TO CRANKSHAFT PULLEY) BELT NO.1  
(See page 14-5 )
28. REMOVE GENERATOR ASSY (See page 19-19 )
29. REMOVE ENGINE MOVING CONTROL ROD (See page 14-84 )
30. REMOVE ENGINE MOUNTING STAY NO.2 RH (See page 14-84 )
31. REMOVE GENERATOR BRACKET NO.2 (See page 14-84 )
32. REMOVE GENERATOR BELT ADJUSTING BAR (See page 17-1 1)
33. SEPARATE COMPRESSOR AND MAGNETIC CLUTCH (See page 17-1 1)
34. SEPARATE TRANSMISSION CONTROL CABLE ASSY (See page 40-47 )
35. DISCONNECT UNION TO CHECK VALVE HOSE
36. DISCONNECT FUEL VAPOR FEED HOSE NO.1
37. DISCONNECT FUEL PIPE SUB-ASSY NO.1 (See page 11-1 )
38. DISCONNECT HEATER WATER INLET HOSE B
39. DISCONNECT HEATER WATER OUTLET HOSE B
40. DISCONNECT RADIATOR HOSE INLET
41. DISCONNECT RADIATOR HOSE OUTLET
42. DISCONNECT OIL COOLER INLET HOSE NO.1
43. DISCONNECT OIL COOLER OUTLET HOSE NO.1



**44. DISCONNECT OIL RESERVOIR TO PUMP HOSE NO.1****45. DISCONNECT STEERING GEAR OUTLET RETURN TUBE****46. REMOVE GLOVE COMPARTMENT DOOR ASSY****47. SEPARATE ENGINE WIRE**

(a) Disconnect the engine wire harness from the ECM and the junction block.



(b) Disconnect the engine wire harness from the engine room junction block.

(1) Remove the nut and separate the wire harness.

(2) Using a screwdriver, release the engine room junction block. Separate the engine wire by pulling it upward.

(c) Pull out the engine wire harness.

(d) Remove the body ground.

**48. REMOVE PROPELLER SHAFT (4WD DRIVE TYPE) (See page 30-6 )**

SST 09325-20010

**49. REMOVE EXHAUST PIPE ASSY CENTER (4WD DRIVE TYPE) (See page 15-6 )****50. REMOVE EXHAUST PIPE ASSY FRONT (2WD DRIVE TYPE) (See page 15-2 )****51. REMOVE EXHAUST PIPE ASSY FRONT (4WD DRIVE TYPE) (See page 15-6 )****52. SEPARATE FRONT STABILIZER LINK ASSY LH (See page 30-18 )****53. SEPARATE FRONT STABILIZER LINK ASSY RH**

HINT:

Perform the same procedure as above on the opposite side.

**54. REMOVE FRONT AXLE HUB LH NUT (See page 30-18 )**

SST 09930-00010

**55. REMOVE FRONT AXLE HUB RH NUT**

SST 09930-00010

HINT:

Perform the same procedure as above on the opposite side.

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**56. SEPARATE SPEED SENSOR FRONT LH (See page 30-18 )****57. SEPARATE SPEED SENSOR FRONT RH**

HINT:

Perform the same procedure as above on the opposite side.

**58. SEPARATE TIE ROD ASSY LH (See page 30-18 )**

SST 09628-6201 1

**59. SEPARATE TIE ROD ASSY RH**

SST 09628-6201 1

HINT:

Perform the same procedure as above on the opposite side.

**60. SEPARATE FRONT SUSPENSION ARM SUB-ASSY LOWER NO.1 LH (See page 30-18 )****61. SEPARATE FRONT SUSPENSION ARM SUB-ASSY LOWER NO.1 RH**

HINT:

Perform the same procedure as above on the opposite side.

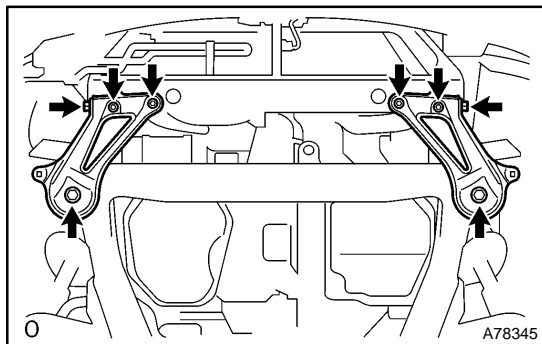
**62. SEPARATE FRONT AXLE ASSY LH (See page 30-18 )****63. SEPARATE FRONT AXLE ASSY RH**

HINT:

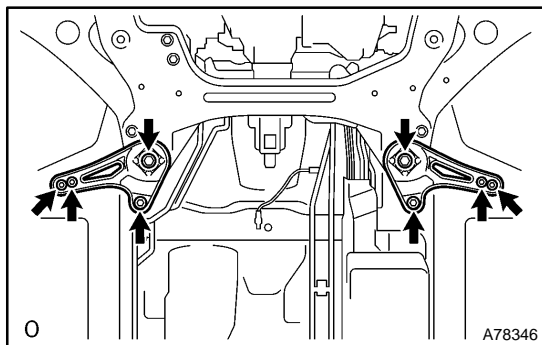
Perform the same procedure as above on the opposite side.

**64. SEPARATE STEERING INTERMEDIATE SHAFT ASSY (See page 51-19 )****65. REMOVE ENGINE ASSEMBLY WITH TRANSAXLE**

(a) Set the engine lifter.

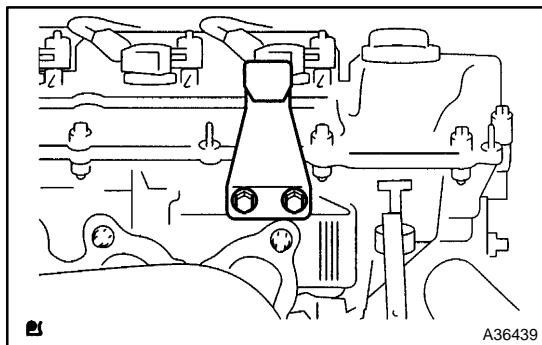


(b) Remove the 6 bolts, the 2 nuts, the frame side rail plate RH and LH.



(c) Remove the 6 bolts, the 2 nuts, the front suspension member brace rear RH and LH.

(d) Carefully remove the engine assembly from the vehicle.



- (e) Install the No. 2 engine hanger in correct direction (shown in the illustration).

**Part No.:**

**No. 2 engine hanger 12282-20020**

**Bolt 90080-11331**

**Torque: 20 N·m (199 kgf·cm, 14 ft·lbf)**

- (f) Attach the engine sling and hang the engine assembly with the chain block.

**66. REMOVE EXHAUST MANIFOLD HEAT INSULATOR NO.1**

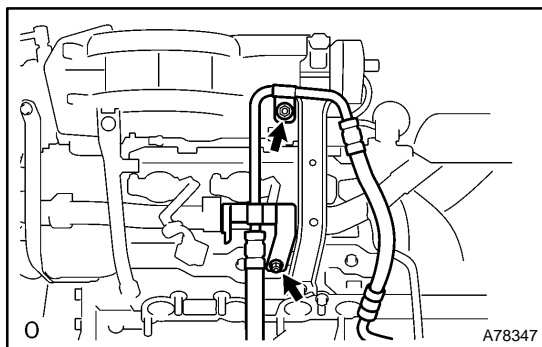
**67. REMOVE MANIFOLD STAY**

**68. REMOVE EXHAUST MANIFOLD SUB-ASSY RH (2WD DRIVE TYPE) (See page 14-129 )**

**69. REMOVE EXHAUST MANIFOLD CONVERTER SUB-ASSY (4WD DRIVE TYPE)**

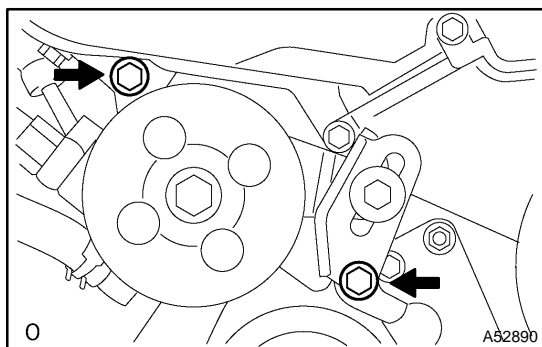
(See page 14-129 )

**70. REMOVE VANE PUMP V BELT (See page 14-5 )**



**71. REMOVE VANE PUMP ASSY**

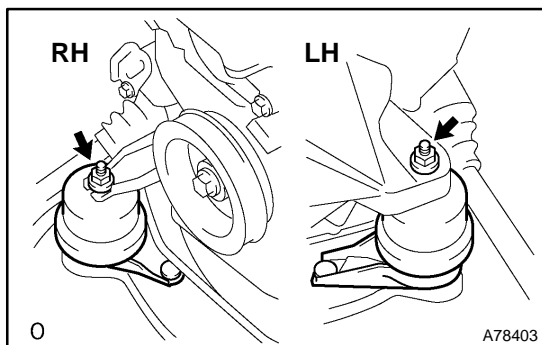
- (a) Remove the 2 nuts and disconnect the PS pressure tube.



- (b) Remove the 2 bolts and the vane pump.

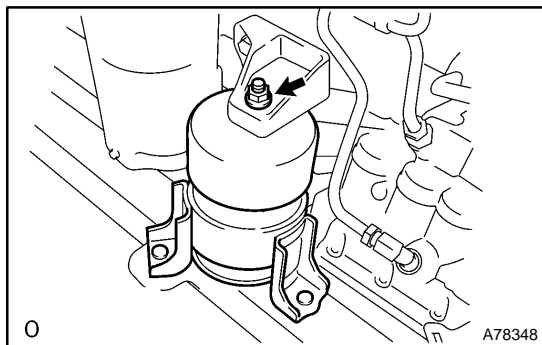
**72. REMOVE STABILIZER BAR FRONT (4WD DRIVE TYPE)**

**73. REMOVE RACK & PINION POWER STEERING GEAR ASSY (4WD DRIVE TYPE)**

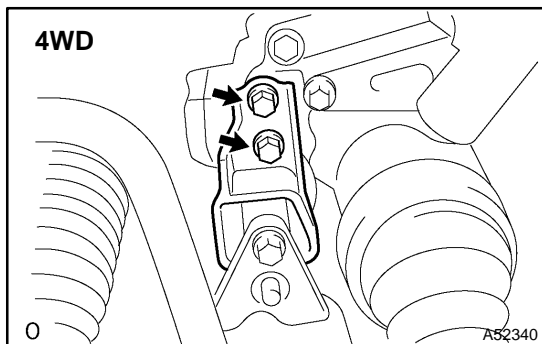


**74. REMOVE FRONT FRAME ASSY**

- (a) Remove the 2 nuts and separate engine mounting insulator RH and LH.

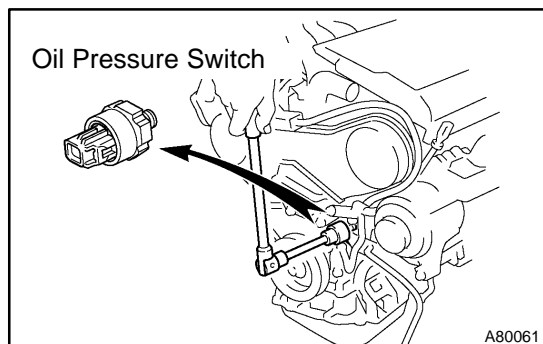


- (b) Remove the nut and separate the engine mounting insulator FR.



- (c) **4WD:**  
Remove the 2 bolts and separate the engine mounting insulator RR.

75. **REMOVE FRONT DRIVE SHAFT ASSY LH** (See page 30-18 )  
SST 09520-01010, 09520-24010 (09520-32040)
76. **REMOVE FRONT DRIVE SHAFT ASSY RH (2WD DRIVE TYPE)** (See page 30-18 )
77. **REMOVE FRONT DRIVE SHAFT ASSY RH (4WD DRIVE TYPE)** (See page 30-18 )
78. **REMOVE STARTER ASSY** (See page 19-5 )
79. **REMOVE ENGINE MOUNTING BRACKET FR** (See page 40-9 )
80. **REMOVE AUTOMATIC TRANSAXLE ASSY (2WD DRIVE TYPE)** (See page 40-9 )
81. **REMOVE TRANSFER STIFFENER PLATE RH (4WD DRIVE TYPE)** (See page 40-9 )
82. **REMOVE AUTOMATIC TRANSMISSION W/TRANSFER (4WD DRIVE TYPE)** (See page 40-9 )
83. **REMOVE DRIVE SHAFT BEARING BRACKET (2WD DRIVE TYPE)**
84. **REMOVE ENGINE MOUNTING BRACKET RR (4WD DRIVE TYPE)**
85. **REMOVE DRIVE PLATE & RING GEAR SUB-ASSY** (See page 14-154 )  
SST 09213-54015 (91651-60855), 09330-00021
86. **INSTALL ENGINE STAND**
87. **REMOVE ENGINE HANGER NO.2**
88. **REMOVE EMISSION CONTROL VALVE SET** (See page 14-7 )
89. **REMOVE INTAKE AIR SURGE TANK** (See page 14-7 )
90. **REMOVE INTAKE MANIFOLD** (See page 14-129 )
91. **REMOVE WATER OUTLET** (See page 14-129 )
92. **REMOVE IGNITION COIL ASSY**
93. **REMOVE MANIFOLD CONVERTER INSULATOR NO.3**
94. **REMOVE EXHAUST MANIFOLD HEAT INSULATOR NO.2**
95. **REMOVE MANIFOLD STAY NO.2**
96. **REMOVE EXHAUST MANIFOLD CONVERTER SUB-ASSY NO.2** (See page 14-146 )
97. **REMOVE ENGINE MOUNTING BRACKET RH**
98. **REMOVE PUMP BRACKET**
99. **REMOVE GENERATOR BRACKET NO.1**
100. **REMOVE COMPRESSOR MOUNTING BRACKET NO.1** (See page 17-1 1)
101. **REMOVE WATER INLET**
102. **REMOVE THERMOSTAT**

**103. REMOVE ENGINE OIL PRESSURE SWITCH ASSY**

- (a) Using a 27 mm deep socket wrench, remove the oil pressure switch.

**104. REMOVE KNOCK SENSOR (See page 10-13 )****105. REPLACE PARTIAL ENGINE ASSY****106. INSTALL KNOCK SENSOR (See page 10-13 )****107. INSTALL ENGINE OIL PRESSURE SWITCH ASSY**

- (a) Apply adhesive to 2 or 3 threads of the oil pressure switch.

**Adhesive:**

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

- (b) Using a 27 mm deep socket wrench, install the oil pressure switch.

**Torque: 15 N·m (153 kgf·cm, 11 ft·lbf)**

**108. INSTALL THERMOSTAT (See page 16-16 )****109. INSTALL WATER INLET (See page 16-16 )****110. INSTALL COMPRESSOR MOUNTING BRACKET NO.1 (See page 17-1 1)****111. INSTALL GENERATOR BRACKET NO.1**

**Torque: 58 N·m (591 kgf·cm, 43 ft·lbf)**

**112. INSTALL PUMP BRACKET**

**Torque: 32 N·m (326 kgf·cm, 24 ft·lbf)**

**113. INSTALL ENGINE MOUNTING BRACKET RH**

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

**114. INSTALL EXHAUST MANIFOLD CONVERTER SUB-ASSY NO.2 (See page 14-146 )****115. INSTALL MANIFOLD STAY NO.2**

**Torque: 49 N·m (500 kgf·cm, 36 ft·lbf)**

**116. INSTALL EXHAUST MANIFOLD HEAT INSULATOR NO.2 (See page 14-146 )****117. INSTALL MANIFOLD CONVERTER INSULATOR NO.3 (See page 14-146 )****118. INSTALL IGNITION COIL ASSY (See page 14-7 )****119. INSTALL WATER OUTLET (See page 14-129 )****120. INSTALL INTAKE MANIFOLD (See page 14-129 )****121. INSTALL INTAKE AIR SURGE TANK (See page 14-7 )****122. INSTALL EMISSION CONTROL VALVE SET (See page 14-7 )****123. INSTALL DRIVE PLATE & RING GEAR SUB-ASSY (See page 14-154 )**

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

**124. INSTALL DRIVE SHAFT BEARING BRACKET (2WD DRIVE TYPE)**

**Torque: 64 N·m (650 kgf·cm, 47 in·lbf)**

**125. INSTALL ENGINE MOUNTING BRACKET RR (4WD DRIVE TYPE)**

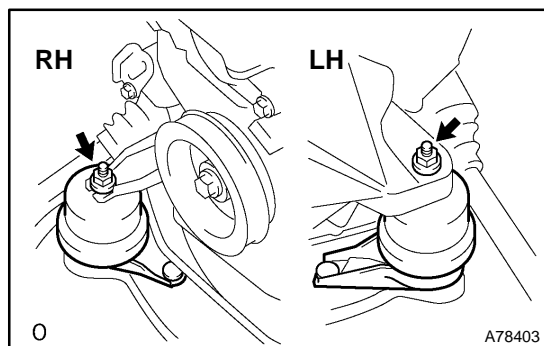
**Torque: 64 N·m (653 kgf·cm, 47 in·lbf)**

**126. INSTALL AUTOMATIC TRANSMISSION W/TRANSFER (4WD DRIVE TYPE) (See page 40-8 )****127. INSTALL TRANSFER STIFFENER PLATE RH (4WD DRIVE TYPE) (See page 40-8 )****128. INSTALL AUTOMATIC TRANSAXLE ASSY (2WD DRIVE TYPE) (See page 40-8 )****129. INSTALL ENGINE MOUNTING BRACKET FR (See page 40-8 )****130. INSTALL STARTER ASSY (See page 19-5 )**

**131. INSTALL FRONT DRIVE SHAFT ASSY LH (See page 30-18 )**

**132. INSTALL FRONT DRIVE SHAFT ASSY RH (2WD DRIVE TYPE) (See page 30-18 )**

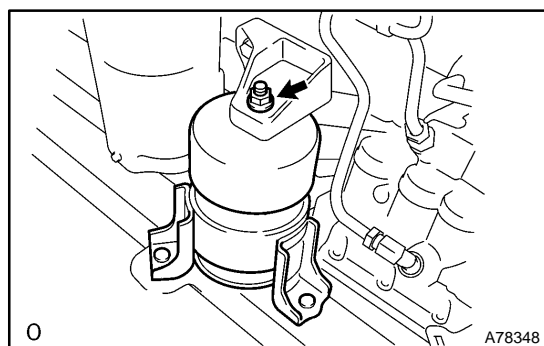
**133. INSTALL FRONT DRIVE SHAFT ASSY RH (4WD DRIVE TYPE) (See page 30-18 )**



**134. INSTALL FRONT FRAME ASSY**

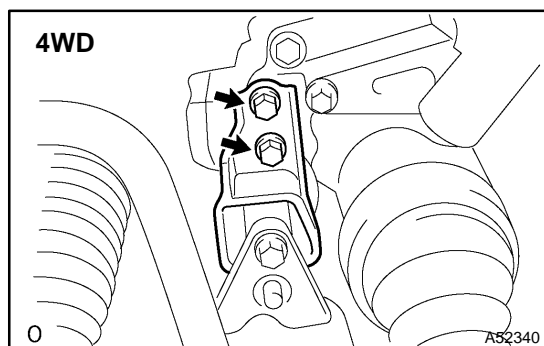
- (a) Install the engine mounting insulator RH and LH with the 2 nuts.

**Torque: 95 N·m (969 kgf·cm, 70 ft·lbf)**



- (b) Install the engine mounting insulator FR with the nut.

**Torque: 87 N·m (887 kgf·cm, 64 ft·lbf)**



- (c) **4WD:**

Install the engine mounting insulator RR with the 2 bolts.

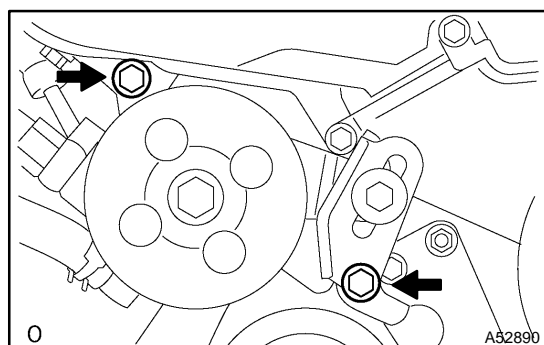
**Torque: 75 N·m (765 kgf·cm, 55 ft·lbf)**

**135. INSTALL RACK & PINION POWER STEERING GEAR ASSY (4WD DRIVE TYPE)**

**Torque: 70 N·m (714 kgf·cm, 52 ft·lbf)**

**136. INSTALL STABILIZER BAR FRONT (4WD DRIVE TYPE)**

**Torque: 17 N·m (173 kgf·cm, 13 ft·lbf)**



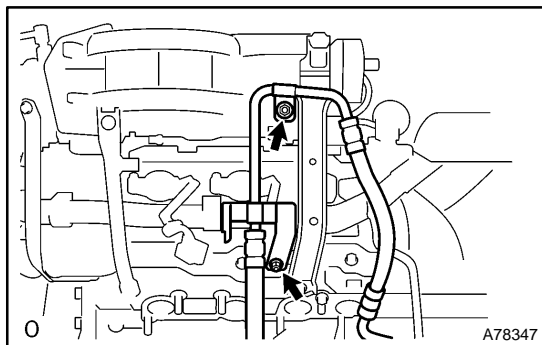
**137. INSTALL VANE PUMP ASSY**

- (a) Temporarily tighten the bolt.

- (b) Install the adjusting strut to the engine mounting bracket RH with the bolt.

**Torque: 44 N·m (449 kgf·cm, 32 ft·lbf)**





- (c) Connect the PS pressure tube with the 2 nuts.  
Torque: 7.8 N·m (80 kgf·cm, 69 in·lbf)

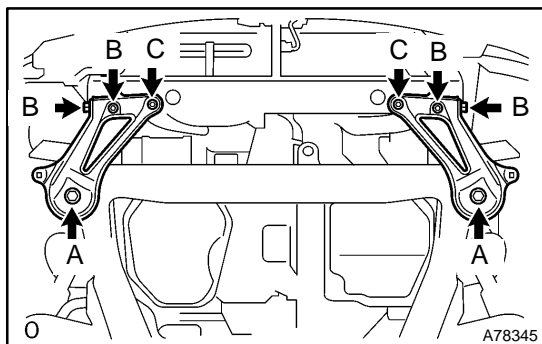
138. INSTALL VANE PUMP V BELT (See page 14-5 )

139. INSTALL EXHAUST MANIFOLD SUB-ASSY RH (2WD DRIVE TYPE) (See page 14-129 )

140. INSTALL EXHAUST MANIFOLD CONVERTER SUB-ASSY (4WD DRIVE TYPE)  
(See page 14-129 )

141. INSTALL MANIFOLD STAY (See page 14-129 )

142. INSTALL EXHAUST MANIFOLD HEAT INSULATOR NO.1 (See page 14-129 )



143. INSTALL ENGINE ASSEMBLY WITH TRANSAXLE

- (a) Set the engine assembly with transaxle on the engine lifter.  
(b) Install the engine assembly to the vehicle.  
(c) Install the frame side rail plate RH and LH with the 6 bolts and the 2 nuts.

**Torque:**

**Bolt A** 85 N·m (867 kgf·cm, 63 ft·lbf)

**Bolt B** 32N·m (329 kgf·cm, 24 ft·lbf)

**Nut C** 32N·m (329 kgf·cm, 24 ft·lbf)

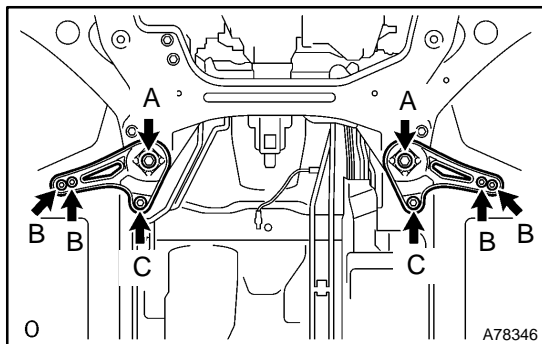
- (d) Install the front suspension member brace rear RH and LH with the 6 bolts and the 2 nuts.

**Torque:**

**Bolt A** 85 N·m (867 kgf·cm, 63 ft·lbf)

**Bolt B** 32N·m (329 kgf·cm, 24 ft·lbf)

**Nut C** 32N·m (329 kgf·cm, 24 ft·lbf)



144. INSTALL STEERING INTERMEDIATE SHAFT ASSY (See page 51-19 )

145. INSTALL FRONT AXLE ASSY LH (See page 30-18 )

146. INSTALL FRONT AXLE ASSY RH

HINT:

Perform the same procedure as above on the opposite side.

147. INSTALL FRONT SUSPENSION ARM SUB-ASSY LOWER NO.1 LH (See page 30-18 )

148. INSTALL FRONT SUSPENSION ARM SUB-ASSY LOWER NO.1 RH

HINT:

Perform the same procedure as above on the opposite side.

**149. INSTALL TIE ROD ASSY LH (See page 30-18 )**

**150. INSTALL TIE ROD ASSY RH**

**HINT:**

Perform the same procedure as above on the opposite side.

**151. INSTALL SPEED SENSOR FRONT LH (See page 30-18 )**

**152. INSTALL SPEED SENSOR FRONT RH**

**HINT:**

Perform the same procedure as above on the opposite side.

**153. INSTALL FRONT AXLE HUB LH NUT (See page 30-18 )**

**154. INSTALL FRONT AXLE HUB RH NUT**

**HINT:**

Perform the same procedure as above on the opposite side.

**155. INSTALL FRONT STABILIZER LINK ASSY LH (See page 30-18 )**

**156. INSTALL FRONT STABILIZER LINK ASSY RH**

**HINT:**

Perform the same procedure as above on the opposite side.

**157. INSTALL EXHAUST PIPE ASSY FRONT (2WD DRIVE TYPE) (See page 15-2 )**

**158. INSTALL EXHAUST PIPE ASSY FRONT (4WD DRIVE TYPE) (See page 15-6 )**

**159. INSTALL EXHAUST PIPE ASSY CENTER (4WD DRIVE TYPE) (See page 15-6 )**

**160. INSTALL PROPELLER SHAFT (4WD DRIVE TYPE) (See page 30-6 )**

**161. CONNECT FUEL PIPE SUB-ASSY NO.1 (See page 11-1 )**

**162. INSTALL TRANSMISSION CONTROL CABLE ASSY (See page 40-47 )**

**163. INSTALL COMPRESSOR AND MAGNETIC CLUTCH (See page 17-1 1)**

**164. INSTALL GENERATOR BELT ADJUSTING BAR (See page 17-1 1)**

**165. INSTALL GENERATOR BRACKET NO.2 (See page 14-84 )**

**166. INSTALL ENGINE MOUNTING STAY NO.2 RH (See page 14-84 )**

**167. INSTALL ENGINE MOVING CONTROL ROD (See page 14-84 )**

**168. INSTALL GENERATOR ASSY (See page 19-19 )**

**169. INSTALL V (COOLER COMPRESSOR TO CRANKSHAFT PULLEY) BELT NO.1  
(See page 14-5 )**

**170. INSPECT DRIVE BELT DEFLECTION AND TENSION (REFERENCE) (See page 14-1 )**

**171. INSTALL AIR CLEANER INLET NO.1 (See page 19-5 )**

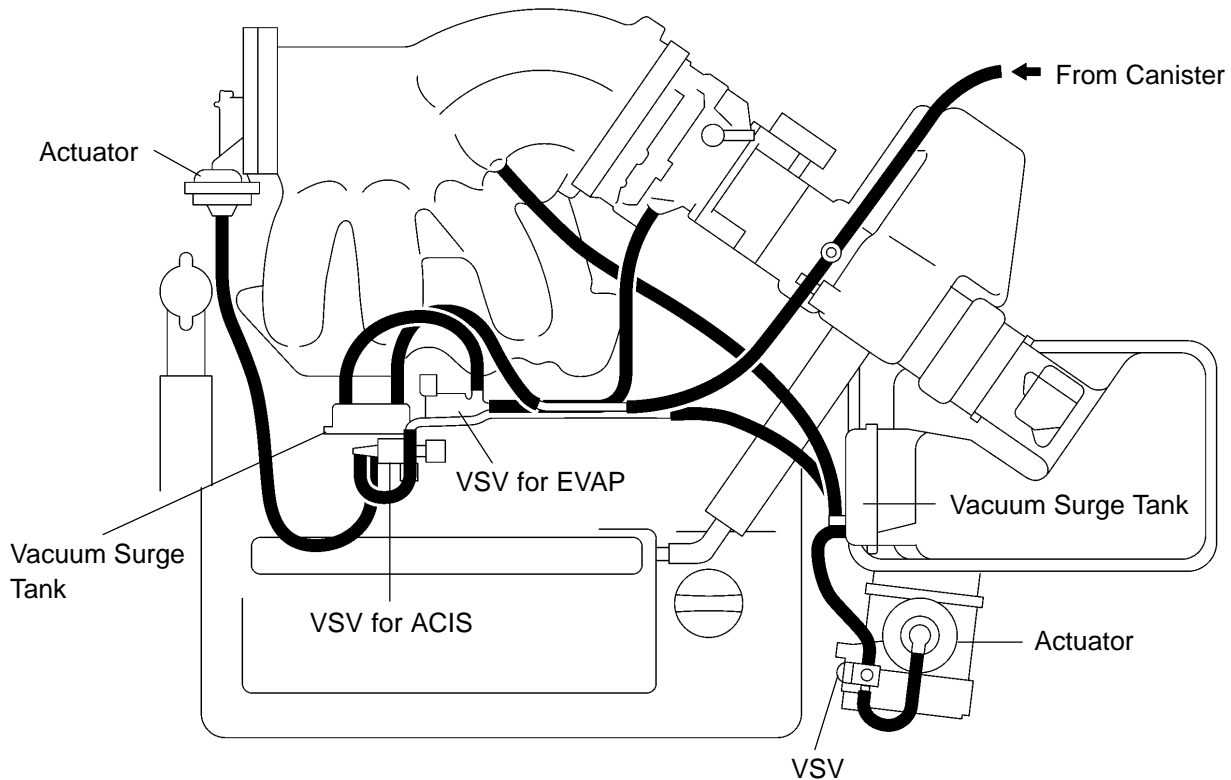
**172. INSTALL AIR CLEANER BRACKET (See page 19-5 )**

**173. INSTALL AIR CLEANER CASE (See page 19-5 )**

**174. INSTALL AIR CLEANER INLET NO.2 (See page 19-5 )**

**175. INSTALL AIR CLEANER CAP SUB-ASSY (See page 19-5 )**



**176. CONNECT VACUUM HOSE****Vacuum Hose Routing Diagram**

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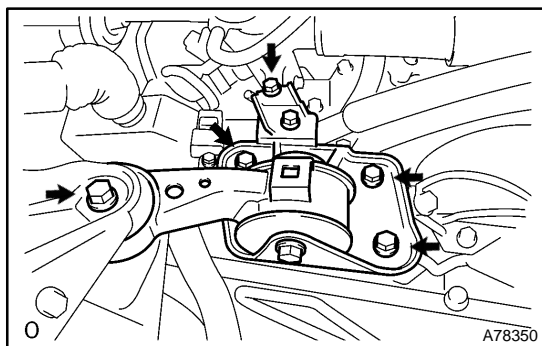
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- 177. INSTALL V-BANK COVER SUB-ASSY (See page 14-7 )
- 178. INSTALL COWL TOP PANEL SUB-ASSY OUTER FRONT (See page 11-13 )
- 179. INSTALL COWL TOP TO COWL BRACE INNER NO.1 (See page 11-13 )
- 180. INSTALL WIPER LINK ASSY (See page 66-8 )
- 181. INSTALL FR WIPER ARM LH (See page 66-8 )
- 182. INSTALL FR WIPER ARM RH (See page 66-8 )
- 183. INSTALL FRONT WHEELS (See page 14-5 )
- 184. ADD TRANSFER OIL (4WD DRIVE TYPE) (See page 31-4 )
- 185. INSPECT TRANSFER OIL (4WD DRIVE TYPE) (See page 31-4 )
- 186. ADD AUTOMATIC TRANSAXLE FLUID
- 187. ADD ENGINE OIL (See page 17-23 )
- 188. ADD COOLANT (See page 16-8 )
- 189. ADD POWER STEERING FLUID
- 190. BLEED POWER STEERING FLUID
- 191. INSPECT AUTOMATIC TRANSAXLE FLUID (See page 40-2 )
- 192. CHECK FOR ENGINE OIL LEAKS
- 193. CHECK FOR ENGINE COOLANT LEAKS (See page 16-8 )
- 194. CHECK POWER STEERING FLUID LEAKAGE
- 195. INSPECT FOR FUEL LEAKS

- 196. CHECK FOR EXHAUST GAS LEAKS
- 197. INSPECT AND ADJUST FRONT WHEEL ALIGNMENT (See page [26-7](#) )
- 198. INSPECT STEERING WHEEL CENTER POINT
- 199. INSPECT IGNITION TIMING (See page [14-1](#) )
  - SST 09843-18040
- 200. INSPECT ENGINE IDLE SPEED (See page [14-1](#) )
  - SST 09843-18040
- 201. INSPECT CO/HC (See page [14-1](#) )
- 202. CHECK ABS SPEED SENSOR SIGNAL (See page [05-386](#) )

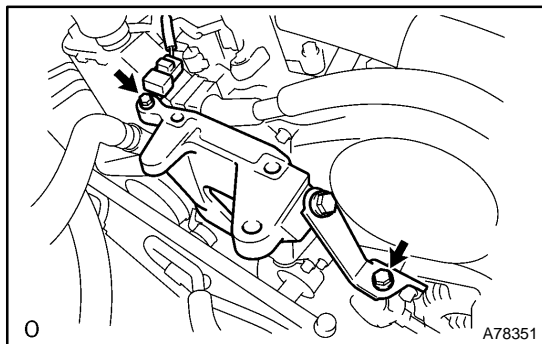
## REPLACEMENT

1. REMOVE FRONT WHEEL RH
2. REMOVE FRONT WIPER ARM HEAD CAP
3. REMOVE FR WIPER ARM RH (See page 66-8 )
4. REMOVE FR WIPER ARM LH (See page 66-8 )
5. REMOVE COWL TOP VENTILATOR LOUVER SUB-ASSY (See page 66-8 )
6. REMOVE WIPER LINK ASSY (See page 66-8 )
7. REMOVE COWL TOP TO COWL BRACE INNER NO.1 (See page 11-13 )
8. REMOVE COWL TOP PANEL SUB-ASSY OUTER FRONT (See page 11-13 )
9. REMOVE FRONT FENDER APRON SEAL RH
10. REMOVE V (COOLER COMPRESSOR TO CRANKSHAFT PULLEY) BELT NO.1 (See page 14-5 )
11. REMOVE VANE PUMP V BELT (See page 14-5 )



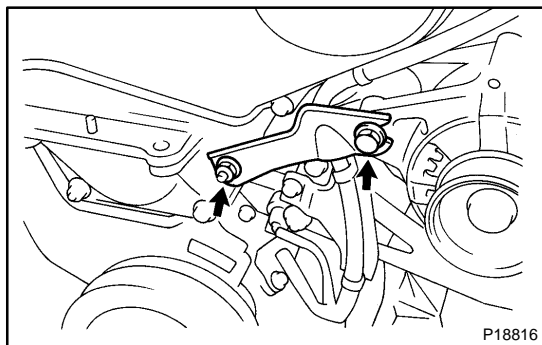
### 12. REMOVE ENGINE MOVING CONTROL ROD

- (a) Remove the 5 bolts, the engine moving control rod and the engine mounting stay.



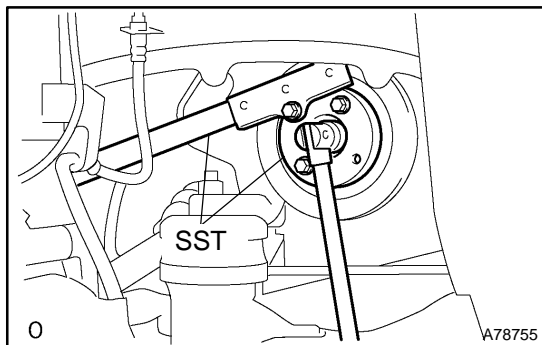
### 13. REMOVE ENGINE MOUNTING STAY NO.2 RH

- (a) Remove the bolt and the wire harness bracket.
- (b) Remove the bolt, the engine mounting stay No.2 and the engine mounting bracket No.2.

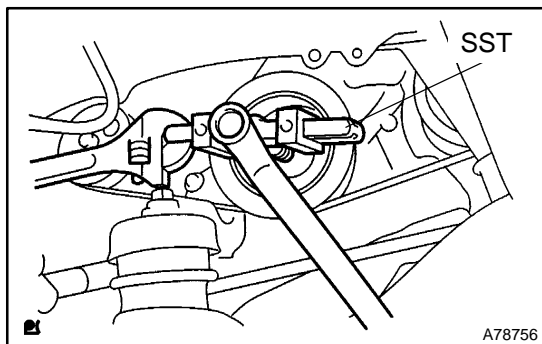


### 14. REMOVE GENERATOR BRACKET NO.2

- (a) Remove the nut and the generator bracket.

**15. REMOVE CRANKSHAFT PULLEY**

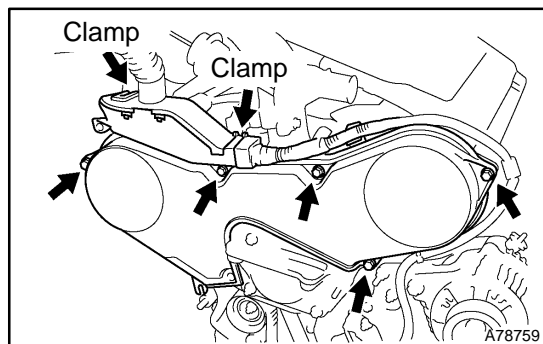
- (a) Using SST, loosen the pulley bolt.  
SST 09213-54015 (91651-60855), 09330-00021



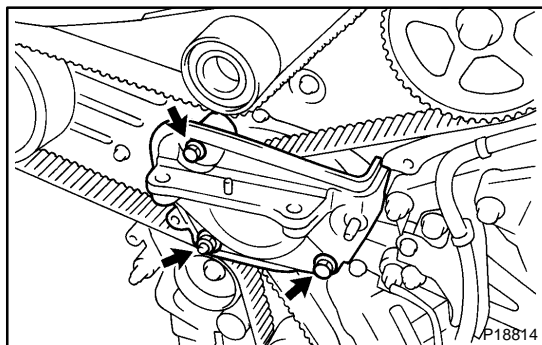
- (b) Using SST and the pulley bolt, remove the pulley.  
SST 09950-50013 (09951-05010, 09952-05010, 09953-05020, 09954-05031)

**NOTICE:**

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

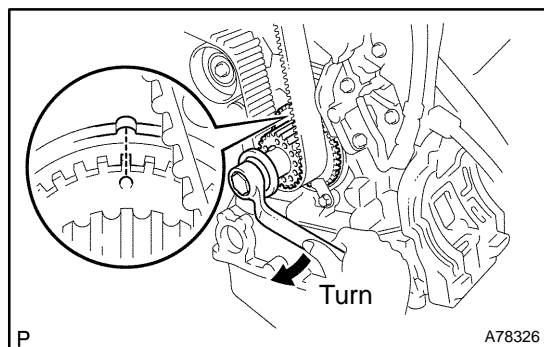
**16. REMOVE TIMING BELT NO.1 COVER****17. REMOVE TIMING BELT NO.2 COVER**

- (a) Disconnect the engine wire protector clamps from the timing belt No. 3 cover.  
(b) Remove the 5 bolts and the timing belt cover.

**18. REMOVE ENGINE MOUNTING BRACKET RH**

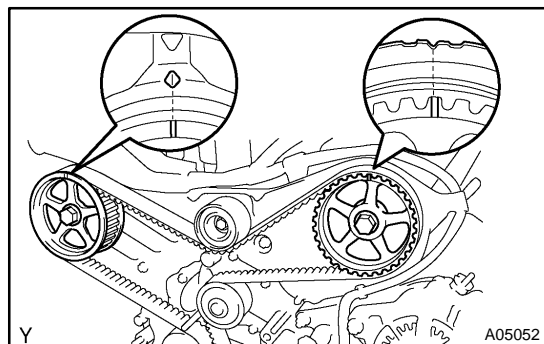
- (a) Remove the 2 bolts, the nut and the engine mounting bracket RH.

**19. REMOVE TIMING BELT GUIDE NO.2**

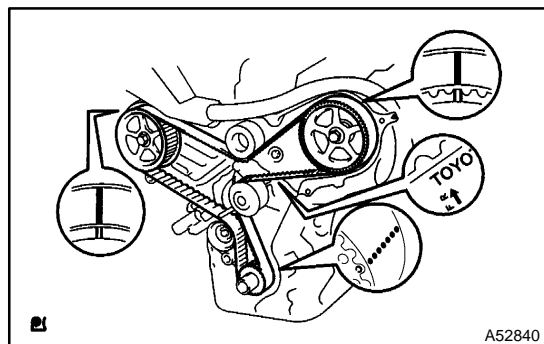


## 20. REMOVE TIMING BELT

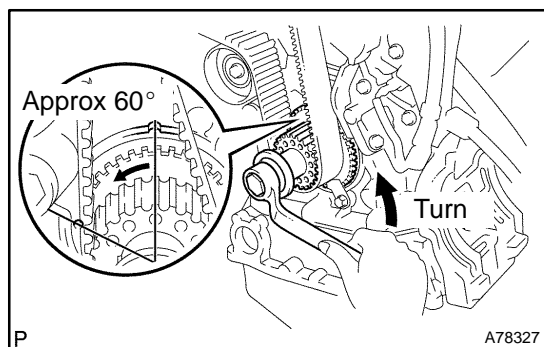
- (a) Set No. 1 cylinder to TDC/compression.
- (1) Temporarily install the crankshaft pulley bolt and the washer to the crankshaft.
  - (2) Turn the crankshaft clockwise, and align the timing marks of the crankshaft timing pulley and the oil pump body.



- (3) Check that timing marks of the camshaft timing pulleys and No. 3 timing belt cover are aligned.
- If not, turn the crankshaft 1 revolution (360°).
- (4) Remove the crankshaft pulley bolt.



- (b) If re-using the timing belt, check that there are 3 installation marks on the timing belt as shown in the illustration.
- (1) If the installation marks have disappeared, put new installation mark on the timing belt before removing.



- (c) Set No. 1 cylinder to approx. 60° BTDC/compression.
- (1) Turn the crankshaft counterclockwise by approx. 60°.

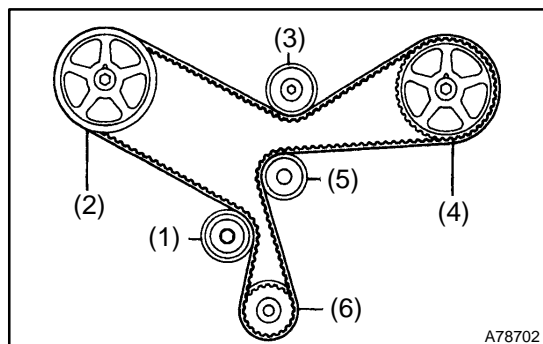
### NOTICE:

If the timing belt is disengaged, having the crankshaft pulley at the wrong angle can cause the piston head and valve head to come into contact with each other when you remove the camshaft timing pulley and camshaft, causing damage. So always set the crankshaft pulley at the correct angle.

- (d) Remove the timing belt tensioner.

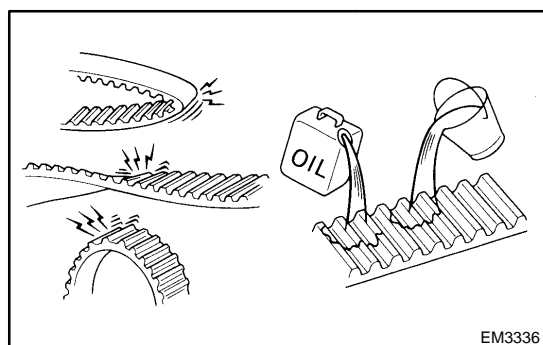
### NOTICE:

Do not install the tensioner as it removed.



(e) Remove the timing belt in this order.

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



## 21. 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 mounting bolt of the camshaft timing pulley.

Check the belt for any defects as shown in the illustrations. Also, check these points below.

- If there is 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.
  - Check gasket has been installed correctly.
  - Check for foreign object on the pulley teeth.

If there is any doubt about the belt condition, replace the timing belt.

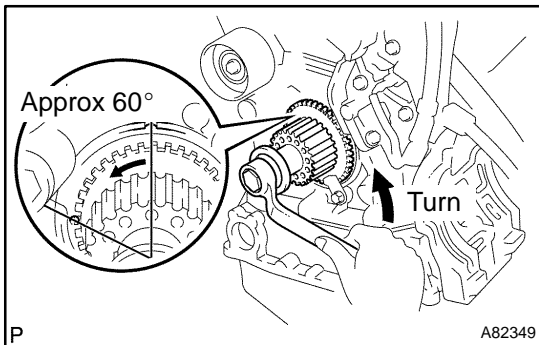
## 22. INSTALL TIMING BELT

- Remove any oil or water on the pulleys, and keep them clean.

### NOTICE:

- If there is a trace of water and/or oil on the timing belt, repair the leakage and install a new timing belt.
  - Wipe only the pulleys; do not use any cleaning agent.
- Inspect the idler pulleys.
    - Check that the idler pulley turns smoothly.
    - Visually check the seal portion of the idler pulley for oil leakage.

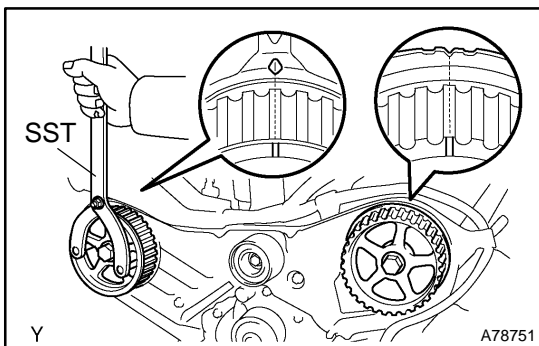
- (c) Inspect the water pump.
  - (1) Turn the pulley, and check that water pump bearing moves smoothly and does not make noise.
  - (2) Visually check the drain hole for coolant leakage.
- (d) Temporarily install the crankshaft pulley bolt and the washer to the crankshaft.



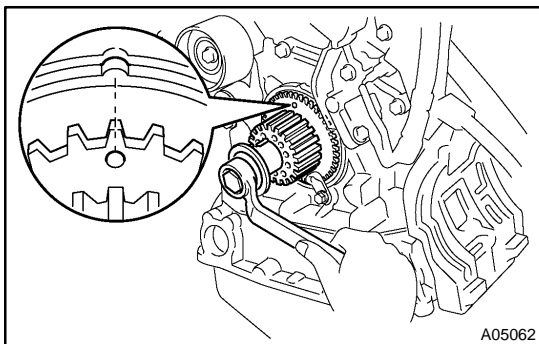
- (e) Turn the crankshaft counterclockwise by approx. 60°.

**NOTICE:**

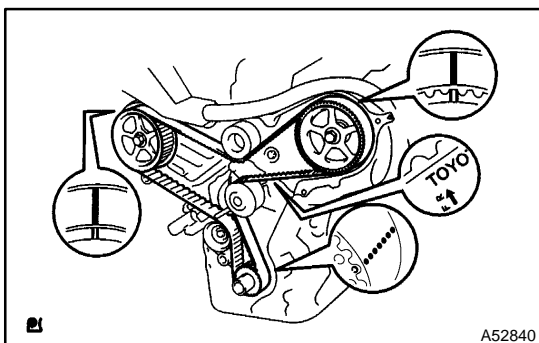
To prevent contacting the piston head and the valve head, set the crankshaft pulley at 60° BTDC/compression position.



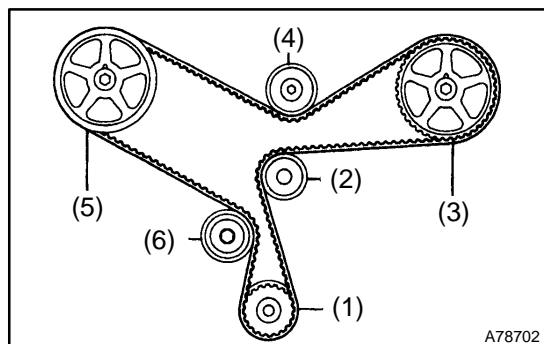
- (f) Using SST, turn the camshaft pulley, and align the timing marks of the timing pulley and the No. 3 timing belt cover. SST 09960-10010 (09962-01000, 09963-01000)



- (g) Turn the crankshaft, and align the timing marks of the crankshaft timing pulley and the oil pump body.



- (h) Face the front mark on the timing belt forward.
- (i) Align the installation mark on the timing belt with the timing mark of the crankshaft timing pulley.
- (j) Align the installation marks on the timing belt with the timing marks of the camshaft timing pulleys.

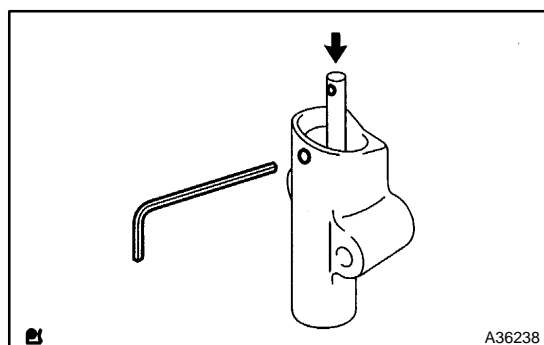


(k) Install the timing belt in this order.

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

## 23. INSTALL CHAIN TENSIONER ASSY NO.1

(a) Set the timing belt tensioner upright on the press.



(b) Slowly press in the push rod.

### NOTICE:

**Do not apply pressure more than 9.8 kN (1,000 kgf, 2,205 lbf) to the rod.**

(c) Align the holes of the push rod and housing, pass a 1.5 mm hexagon wrench through the holes to keep the setting position of the push rod.

(d) Release the press.

(e) Temporarily install the tensioner with the 2 bolts. Alternately tighten the 2 bolts.

**Torque: 27 N·m (280 kgf·cm, 20 ft·lbf)**

### NOTICE:

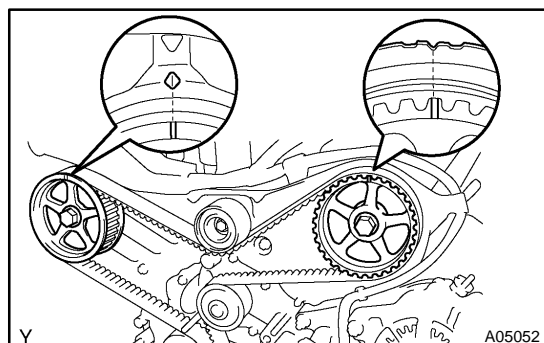
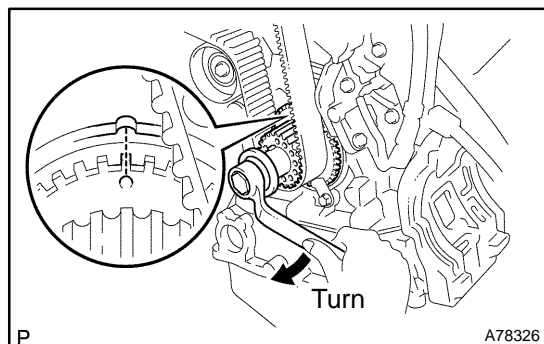
**Be sure to tighten the bolts equally. Installing the tensioner at an angle may cause failure of its proper operation.**

(f) Remove the 1.5 mm hexagon wrench from the tensioner.

(g) Turn the crankshaft 2 revolutions slowly and align the timing marks of the crankshaft timing pulley and the oil pump body.

### NOTICE:

**Always turn the crankshaft clockwise.**

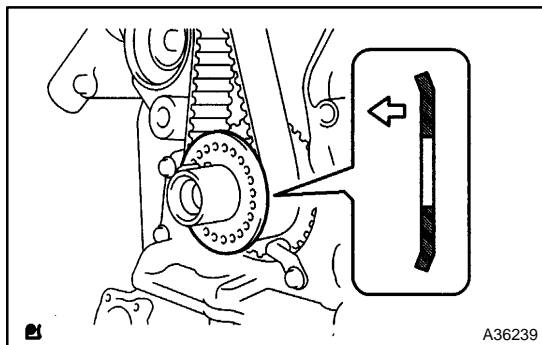


(h) Check the timing marks of the RH and LH timing pulleys are aligned with the timing marks of the No. 3 timing belt cover as shown in the illustration.

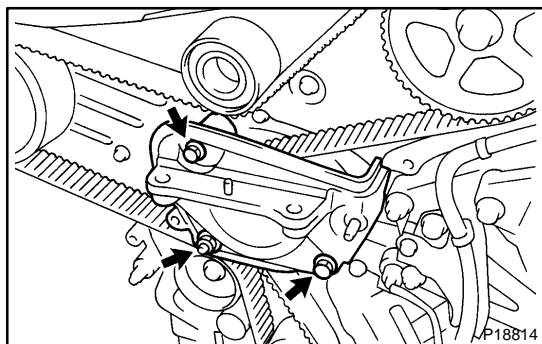
If the marks do not align, remove the timing belt and reinstall it.

(i) Remove the crankshaft pulley bolt.



**24. INSTALL TIMING BELT GUIDE NO.2**

- (a) Install the timing belt guide, facing the cup side toward the engine front.

**25. INSTALL ENGINE MOUNTING BRACKET RH**

- (a) Install the engine mounting bracket RH with the 2 bolts and the nut.

**Torque: 28 N·m (286 kgf·cm, 21 ft·lbf)**

**26. INSTALL TIMING BELT NO.2 COVER**

- (a) Visually check for cracks and breaks in the gasket of the timing belt cover.  
If there is a trace that water is entering at the visual check, replace the timing belt cover.
- (b) Install the timing belt cover.

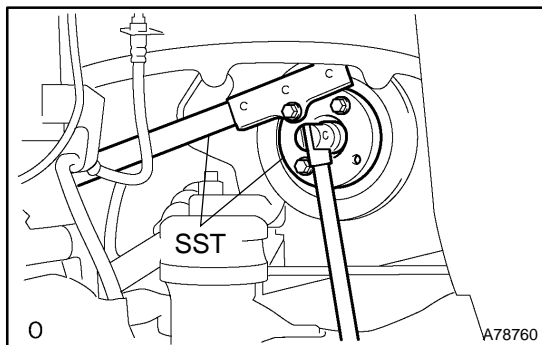
**Torque: 8.5 N·m (87 kgf·cm, 75 in·lbf)**

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

- (a) Visually check for cracks and breaks in the gasket of the timing belt cover.  
If there is a trace that water is entering at the visual check, replace the timing belt cover.
- (b) Install the timing belt cover.

**Torque: 8.5 N·m (87 kgf·cm, 75 in·lbf)**

- (c) Install the engine wire protector cover to the timing belt No. 3 cover.

**28. INSTALL CRANKSHAFT PULLEY**

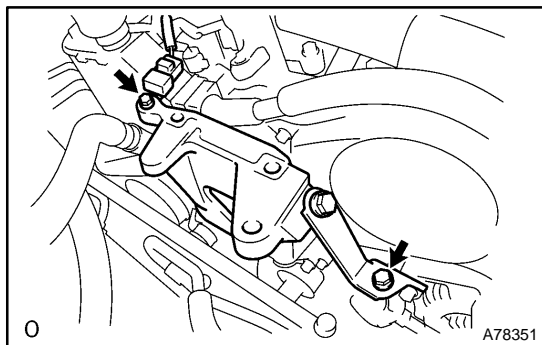
- (a) Align the keyway of the pulley with the key located on the crankshaft and slide the pulley into place.
- (b) Using SST, install the pulley bolt.

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

**Torque: 220 N·m (2250 kgf·cm, 162 ft·lbf)**

**29. INSTALL GENERATOR BRACKET NO.2**

**Torque: 28 N·m (286 kgf·cm, 21 ft·lbf)**

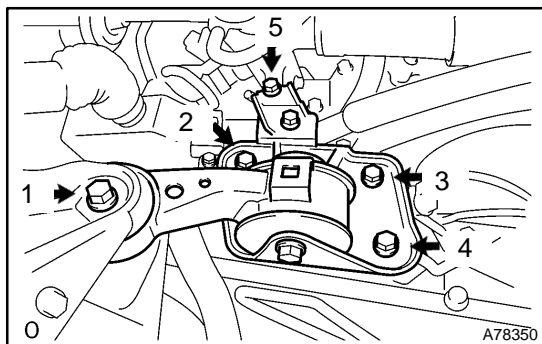
**30. INSTALL ENGINE MOUNTING STAY NO.2 RH**

- (a) Install the engine mounting stay No. 2 and the engine mounting bracket No. 2 with the bolt.

**Torque: 64 N·m (653 kgf·cm, 47 ft·lbf)**

- (b) Install the wire harness bracket with the bolt.

**Torque: 8.4 N·m (85 kgf·cm, 74 in·lbf)**

**31. INSTALL ENGINE MOVING CONTROL ROD**

- (a) Install the engine mounting control rod and the engine mounting stay with the 5 bolts. Using several steps, tighten the bolts in the sequence shown in the illustration.

**Torque:**

**12 mm head 23 N·m (235 kgf·cm, 17 ft·lbf)**

**14 mm head 64 N·m (653 kgf·cm, 47 ft·lbf)**

**32. INSTALL VANE PUMP V BELT (See page 14-5 )**

**33. INSTALL V (COOLER COMPRESSOR TO CRANKSHAFT PULLEY) BELT NO.1 (See page 14-5 )**

**34. INSPECT DRIVE BELT DEFLECTION AND TENSION (REFERENCE) (See page 14-1 )**

**35. INSTALL COWL TOP PANEL SUB-ASSY OUTER FRONT (See page 11-13 )**

**36. INSTALL COWL TOP TO COWL BRACE INNER NO.1 (See page 11-13 )**

**37. INSTALL WIPER LINK ASSY (See page 66-8 )**

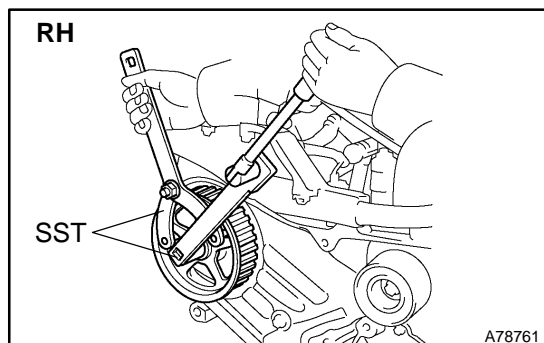
**38. INSTALL FR WIPER ARM LH (See page 66-8 )**

**39. INSTALL FR WIPER ARM RH (See page 66-8 )**

**40. INSTALL FRONT WHEEL RH (See page 14-5 )**

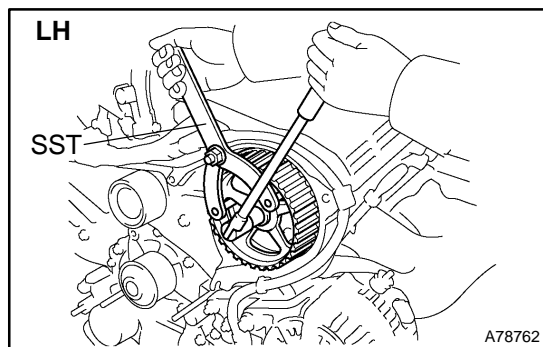
## REPLACEMENT

1. DRAIN COOLANT (See page 16-8 )
2. REMOVE FRONT WHEEL RH
3. REMOVE FRONT WIPER ARM HEAD CAP
4. REMOVE FR WIPER ARM RH (See page 66-8 )
5. REMOVE FR WIPER ARM LH (See page 66-8 )
6. REMOVE COWL TOP VENTILATOR LOUVER SUB-ASSY (See page 66-8 )
7. REMOVE WIPER LINK ASSY (See page 66-8 )
8. REMOVE COWL TOP TO COWL BRACE INNER NO.1 (See page 11-13 )
9. REMOVE COWL TOP PANEL SUB-ASSY OUTER FRONT (See page 11-13 )
10. REMOVE V-BANK COVER SUB-ASSY (See page 14-7 )
11. REMOVE AIR CLEANER CAP SUB-ASSY (See page 10-7 )
12. REMOVE EMISSION CONTROL VALVE SET (See page 14-7 )
13. REMOVE INTAKE AIR SURGE TANK (See page 14-7 )
14. REMOVE IGNITION COIL ASSY
15. REMOVE CYLINDER HEAD COVER SUB-ASSY (See page 14-7 )
16. REMOVE FRONT FENDER APRON SEAL RH
17. REMOVE V (COOLER COMPRESSOR TO CRANKSHAFT PULLEY) BELT NO.1 (See page 14-5 )
18. REMOVE VANE PUMP V BELT (See page 14-5 )
19. REMOVE ENGINE MOVING CONTROL ROD (See page 14-84 )
20. REMOVE ENGINE MOUNTING STAY NO.2 RH (See page 14-84 )
21. REMOVE GENERATOR BRACKET NO.2 (See page 14-84 )
22. REMOVE CRANKSHAFT PULLEY (See page 14-84 )  
SST 09213-54015 (91651-60855), 09330-00021, 09950-50013 (09951-05010, 09952-05010, 09953-05020, 09954-05031)
23. REMOVE TIMING BELT NO.1 COVER
24. REMOVE TIMING BELT NO.2 COVER (See page 14-84 )
25. REMOVE ENGINE MOUNTING BRACKET RH (See page 14-84 )
26. REMOVE TIMING BELT GUIDE NO.2
27. REMOVE TIMING BELT (See page 14-84 )
28. REMOVE TIMING BELT IDLER SUB-ASSY NO.2



### 29. REMOVE CAMSHAFT TIMING PULLEY

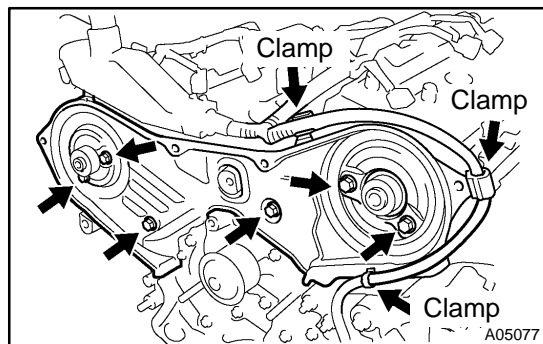
- (a) Using SST, remove the bolt and the RH timing pulley.  
SST 09960-10010 (09962-01000, 09963-01000), 09249-63010



- (b) Using SST, remove the LH timing pulley.  
SST 09960-10010 (09962-01000, 09963-01000)

**HINT:**

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



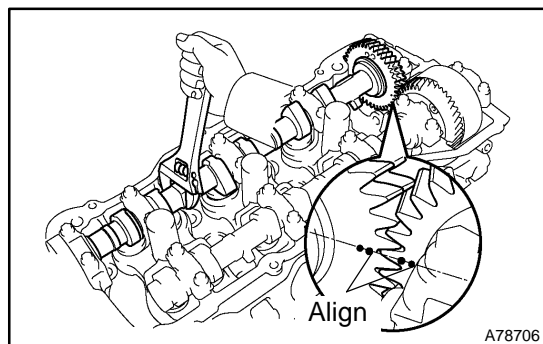
**30. REMOVE TIMING BELT NO.3 COVER**

- (a) Disconnect the 3 engine wire harness clamps from the timing belt No.3 cover.  
(b) Remove the 6 bolts and the timing belt cover.

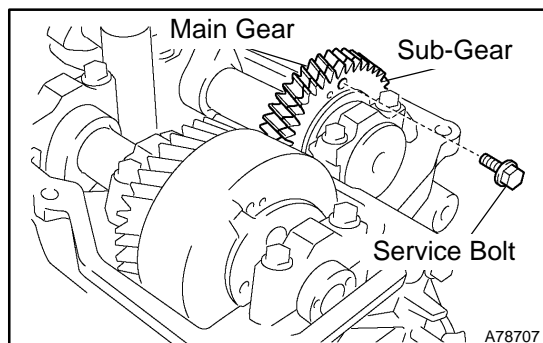
**31. REMOVE CAMSHAFT**

**NOTICE:**

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



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



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

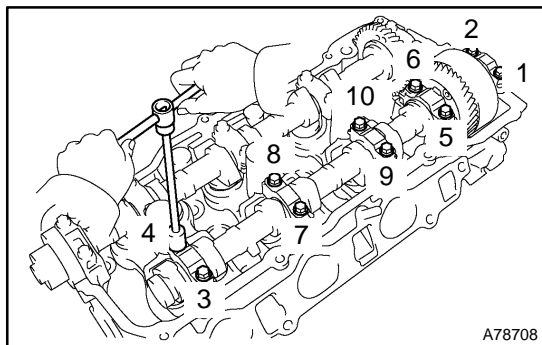
**Torque: 5.4 N·m (55 kgf·cm, 48 in.·lbf)**

**Recommended service bolt**

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

**HINT:**

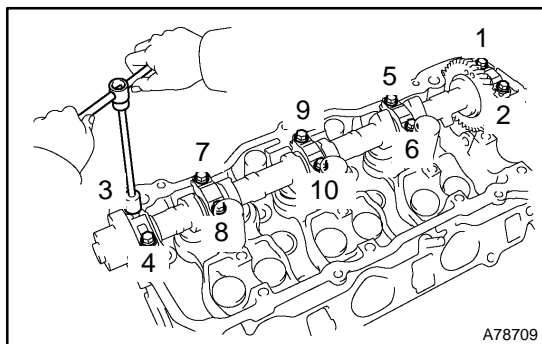
When removing the camshaft, make certain that the torsional spring force of the sub-gear has been eliminated by installation of the service bolt.



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

**NOTICE:**

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

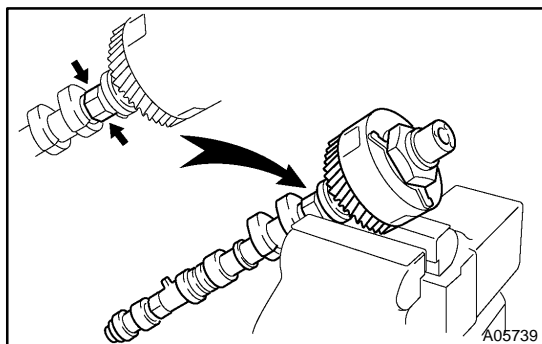
**32. REMOVE NO.2 CAMSHAFT**

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

**NOTICE:**

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

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

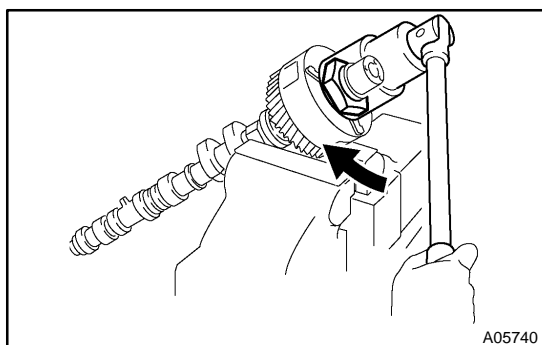
**33. REMOVE CAMSHAFT TIMING GEAR ASSY****NOTICE:**

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

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

**NOTICE:**

Be careful not to damage the camshaft.



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

**NOTICE:**

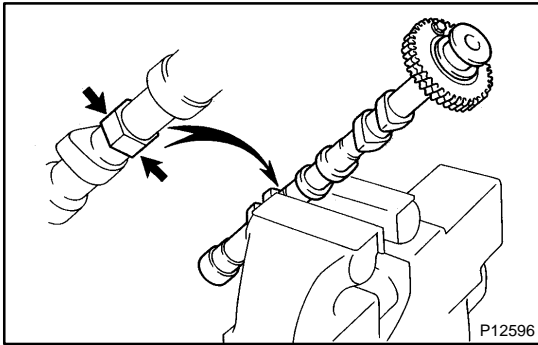
- Remove it with the lock-pin engaged and locked at the maximum delay angle position.
- The lock nut has LH threads.
- Never use any tool other than the socket wrench. Other tools will deform the cam angle rotor.

- (c) Remove the camshaft VVT-i.

**NOTICE:**

Never remove the 3 bolts on the gear.

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

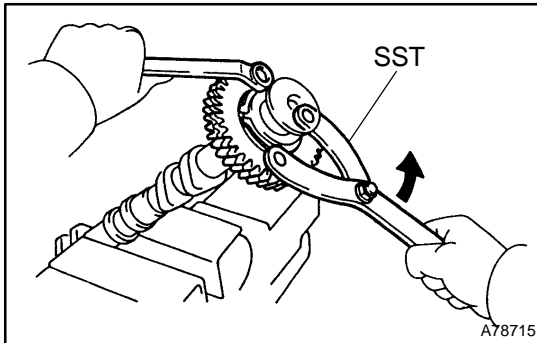


### 34. REMOVE CAMSHAFT SUB GEAR

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

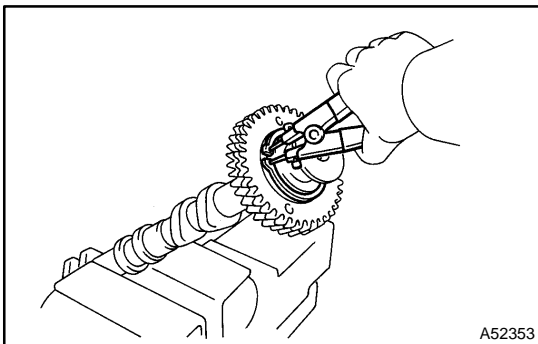
**NOTICE:**

Be careful not to damage the camshaft.



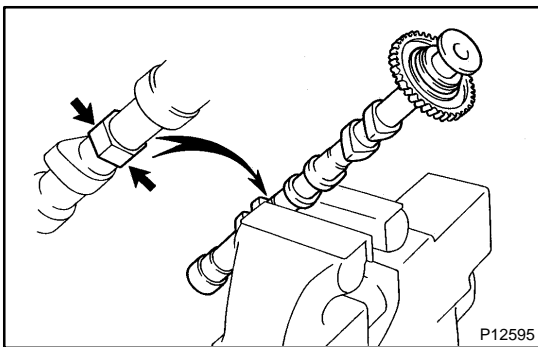
- (b) Using SST, turn the sub-gear counterclockwise, and remove the service bolt.

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



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

- (d) Remove the wave washer, the camshaft sub-gear and the camshaft gear bolt washer.

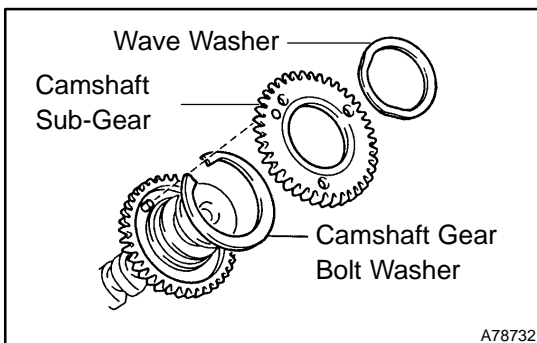


### 35. INSTALL CAMSHAFT SUB GEAR

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

**NOTICE:**

Be careful not to damage the camshaft.

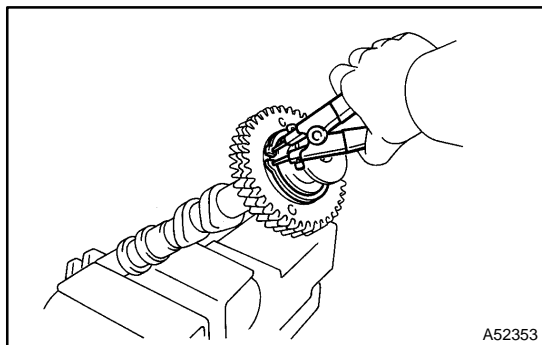


- (b) Install the camshaft gear bolt washer and the camshaft sub-gear.

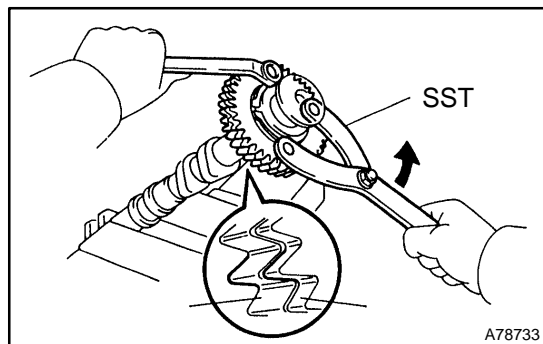
**HINT:**

Attach the pins on the gears to the gear bolt washer ends.

- (c) Install the wave washer.



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



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

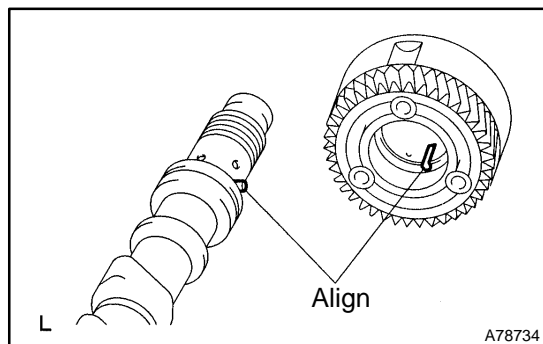
**Torque: 5.4 N·m (55 kgf·cm, 48 in.-lbf)**

**NOTICE:**

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

**HINT:**

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



**36. INSTALL CAMSHAFT TIMING GEAR ASSY**

- (a) Align the alignment pin with the alignment pin groove and install VVT-i on the camshaft.

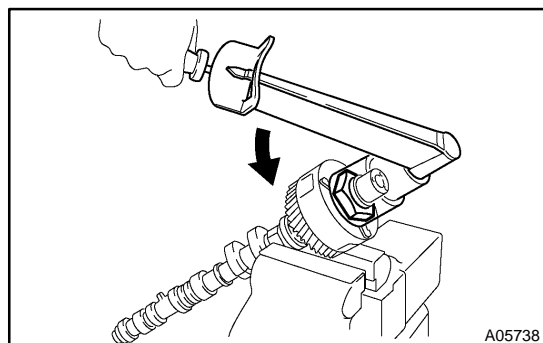
**NOTICE:**

**Install it with the lock-pin engaged and locked at the maximum delay angle position.**

- (b) Apply engine oil on the nut, the mounting surface of VVT-i and the screw threads.

**NOTICE:**

- **Be sure to apply the oil, otherwise the specified torque cannot be obtained.**
- **New nut must be used when replacing VVT-i unit.**



- (c) Using a 46 mm socket wrench, install and tighten a lock nut by turning it counterclockwise.

**Torque: 150 N·m (1,530 kgf·cm, 111 ft.-lbf)**

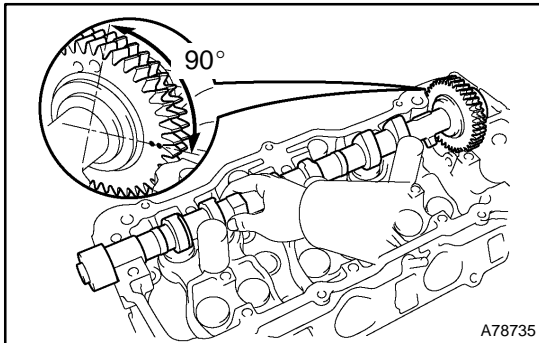
**NOTICE:**

- **The lock nut has LH threads.**
- **Never use any tool other than the socket wrench. Other tools will deform the cam angle rotor.**

**37. INSTALL NO.2 CAMSHAFT****NOTICE:**

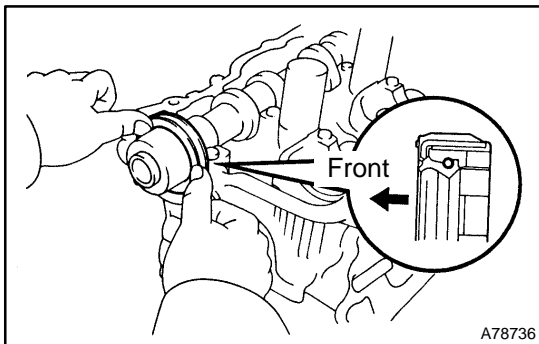
Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, damage to the cylinder head or to the camshaft may result. To avoid this, the following steps should be carried out.

- (a) Apply new engine oil to the thrust portion and journal of the camshaft.



- (b) Place the No. 2 camshaft at a 90° angle of the timing mark (2 dot marks) on the cylinder head.

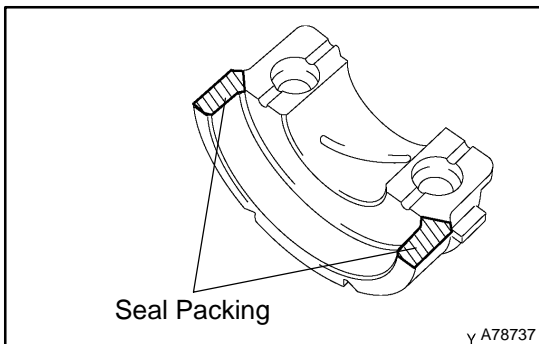
- (c) Apply MP grease to a new oil seal lip.



- (d) Install the oil seal to the camshaft.

**NOTICE:**

- **Do not turn over the oil seal lip.**
  - **Insert the oil seal until it stops.**
- (e) Remove any old packing material from the contact surface.

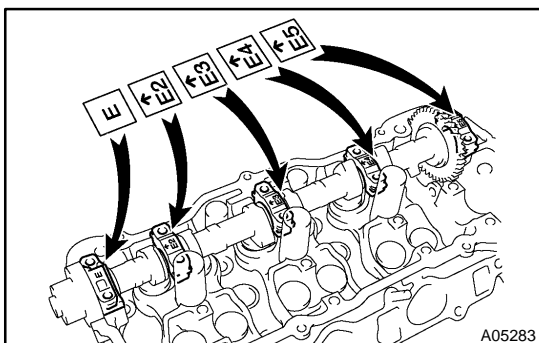


- (f) Apply seal packing to the No. 1 bearing cap as shown in the illustration.

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

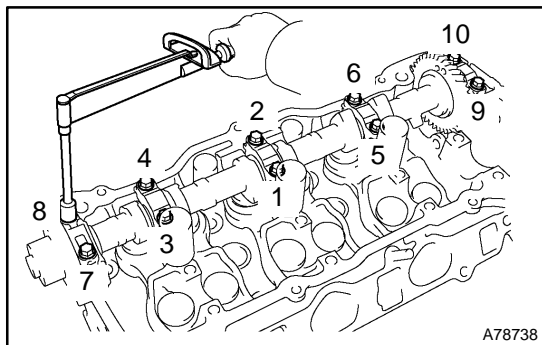
**NOTICE:**

- **Install the No. 1 bearing cap within 5 minutes after applying seal packing.**
- **Do not expose the seal to engine oil within 2 hours after installing.**



- (g) Install the 5 bearing caps in their proper locations.
- (h) Apply a light coat of engine oil on the threads of the bearing cap bolts.





- (i) Using several steps, tighten the 10 bearing cap bolts uniformly in the sequence shown in the illustration.

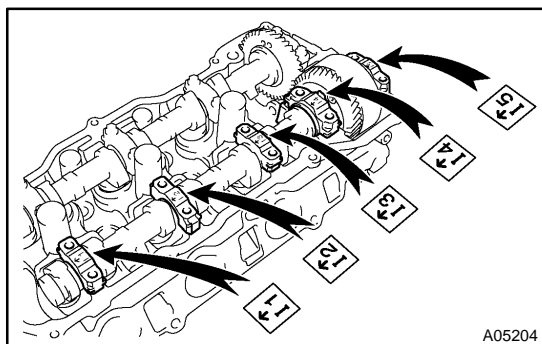
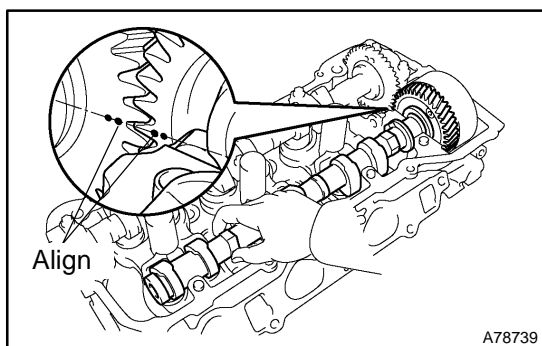
**Torque: 16 N·m (163 kgf·cm, 12 ft·lbf)**

### 38. INSTALL CAMSHAFT

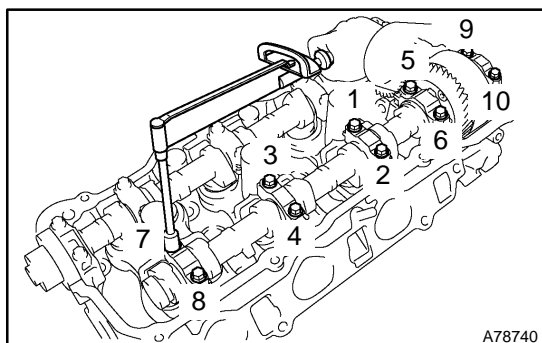
#### NOTICE:

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

- (a) Apply new engine oil to the thrust portion and journal of the camshaft.
- (b) Align the timing marks (2 dot marks) of the camshaft drive with the driven gears.
- (c) Place the camshaft on the cylinder head.



- (d) Install the 5 bearing caps in their proper locations.
- (e) Apply a light coat of engine oil on the threads of the bearing cap bolts.



- (f) Using several steps, tighten the 10 bearing cap bolts uniformly in the sequence shown in the illustration.

**Torque: 16 N·m (163 kgf·cm, 12 ft·lbf)**

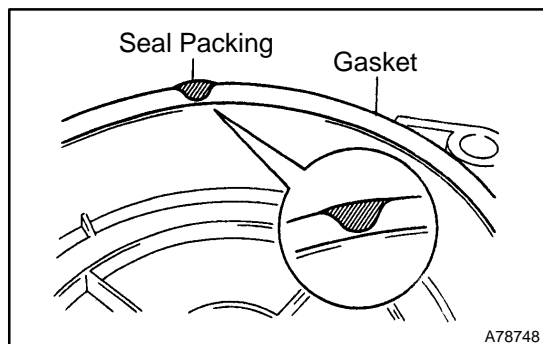
- (g) Remove the service bolt.

### 39. INSTALL TIMING BELT NO.3 COVER

- (a) Visually check for cracks and breaks in the gasket of the timing belt cover.

#### HINT:

If there is a trace that water is entering at the visual check, repair it with seal packing when the crack length is within 2 to 3 cm (0.79 to 1.18 in.). Replace the gasket when the crack length is 3 to 4 cm (1.18 to 1.57 in.) and more.



(b) When the timing belt cover gasket is needed to replace, follow the procedure below.

- (1) Repair the cracks and breaks by applying the seal packing to the damaged area.

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

**NOTICE:**

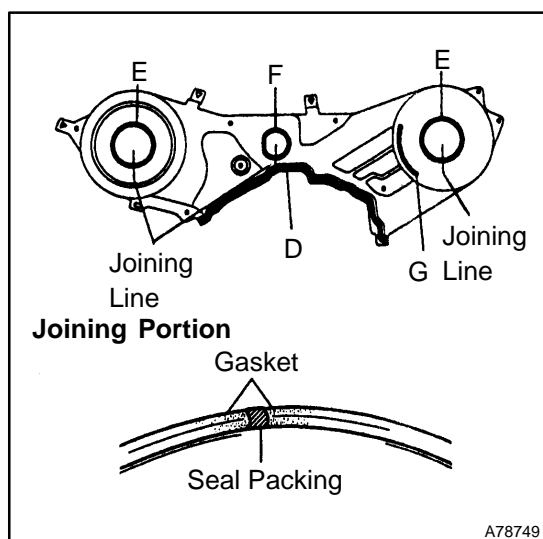
**When applying the seal packing, apply it as wide and high as the gasket.**

(c) When the timing belt cover gasket is needed to replace, follow the procedure below.

- (1) Using a screwdriver and a gasket scraper, remove the remaining gasket.

**NOTICE:**

**Be careful not to damage the timing belt cover.**



- (2) Remove the backing paper from a new gasket, and affix the gasket along the groove of the timing belt cover as shown in the illustration.

**NOTICE:**

- **Affix the gasket in the center of the groove.**
- **At the corners, try to keep the gasket thickness uniform.**

**HINT:**

Gasket	D	E	F	G
Length	335 mm (13.19 in.)	180 mm (7.09 in.)	133 mm (5.24 in.)	72 mm (2.83 in.)

- (3) If there is a gap on the joint of the gasket, apply seal packing to close the gap.

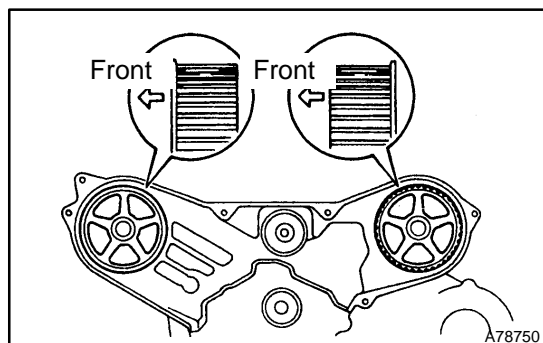
**Seal packing: Part No. 08826-00080 or equivalent**

**NOTICE:**

**When applying the seal packing, apply it as wide and high as the gasket.**

(d) Install the timing belt cover with the 6 bolts.

**Torque: 8.5 N·m (87 kgf·cm, 76 in.-lbf)**

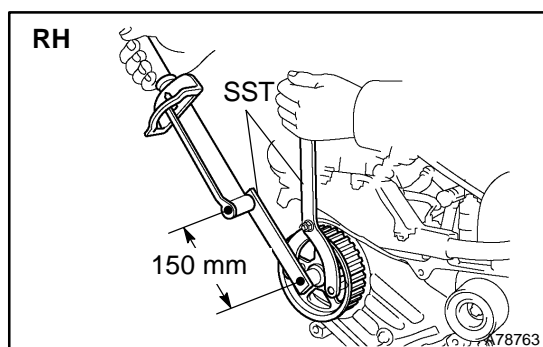


#### 40. INSTALL CAMSHAFT TIMING PULLEY

- (a) Pay attention to the orientation of the belt guide, install the camshaft timing pulley with the belt guide properly oriented and tighten the bolt temporarily.

**HINT:**

- Face the belt guide of the RH timing pulley toward front of the engine.
- Face the belt guide of the LH timing pulley toward rear of the engine.



- (b) Using SST, tighten the RH pulley bolt.  
SST 09960-10010 (09962-01000, 09963-01000),  
09249-63010

Torque: 125 N·m (1,275 kgf·cm, 92 ft·lbf)

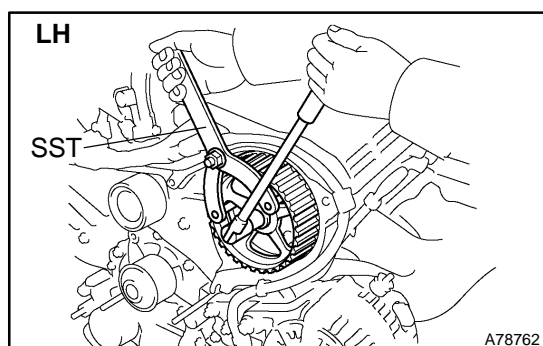
**NOTICE:**

The torque indicated above is used without SST on extension tool. If you are using extension tools, find the reading of the torque wrench by the formula.

(See page 01-5 )

Extended length:

SST (09249-63010) 150mm (5.91 in.)



- (c) Using SST, tighten the LH pulley bolt.  
SST 09960-10010 (09962-01000, 09963-01000)  
Torque: 125 N·m (1275 kgf·cm, 92 ft·lbf)

**41. INSTALL TIMING BELT IDLER SUB-ASSY NO.2**

Torque: 43 N·m (438 kgf·cm, 32 ft·lbf)

**42. INSPECT TIMING BELT (See page 14-84 )**

**43. INSTALL TIMING BELT (See page 14-84 )**

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

**44. INSTALL CHAIN TENSIONER ASSY NO.1 (See page 14-84 )**

**45. INSTALL TIMING BELT GUIDE NO.2 (See page 14-84 )**

**46. INSTALL ENGINE MOUNTING BRACKET RH (See page 14-84 )**

**47. INSTALL TIMING BELT NO.2 COVER (See page 14-84 )**

**48. INSTALL TIMING BELT NO.1 COVER (See page 14-84 )**

**49. INSTALL CRANKSHAFT PULLEY (See page 14-84 )**

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

**50. INSTALL GENERATOR BRACKET NO.2 (See page 14-84 )**

**51. INSTALL ENGINE MOUNTING STAY NO.2 RH (See page 14-84 )**

**52. INSTALL ENGINE MOVING CONTROL ROD (See page 14-84 )**

**53. INSPECT VALVE CLEARANCE (See page 14-7 )**

**54. ADJUST VALVE CLEARANCE (See page 14-7 )**

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

**55. INSTALL VANE PUMP V BELT (See page 14-5 )**

**56. INSTALL V (COOLER COMPRESSOR TO CRANKSHAFT PULLEY) BELT NO.1  
(See page 14-5 )**

**57. INSPECT DRIVE BELT DEFLECTION AND TENSION (REFERENCE) (See page 14-1 )**

**58. INSTALL CYLINDER HEAD COVER SUB-ASSY (See page 14-7 )**

**59. INSTALL IGNITION COIL ASSY (See page 14-7 )**

**60. INSTALL INTAKE AIR SURGE TANK (See page 14-7 )**

61. INSTALL EMISSION CONTROL VALVE SET (See page [14-7](#) )
62. INSTALL AIR CLEANER CAP SUB-ASSY (See page [10-7](#) )
63. CONNECT VACUUM HOSE (See page [14-33](#) )
64. INSTALL V-BANK COVER SUB-ASSY (See page [14-7](#) )
65. INSTALL COWL TOP PANEL SUB-ASSY OUTER FRONT (See page [11-13](#) )
66. INSTALL COWL TOP TO COWL BRACE INNER NO.1 (See page [11-13](#) )
67. INSTALL WIPER LINK ASSY (See page [66-8](#) )
68. INSTALL FR WIPER ARM LH (See page [66-8](#) )
69. INSTALL FR WIPER ARM RH (See page [66-8](#) )
70. INSTALL FRONT WHEEL RH (See page [14-5](#) )
71. ADD COOLANT (See page [16-8](#) )
72. CHECK FOR ENGINE COOLANT LEAKS (See page [16-8](#) )

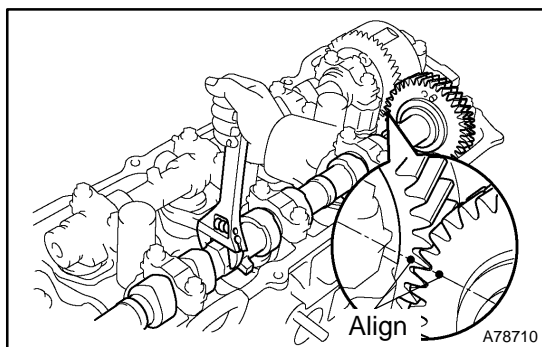
## REPLACEMENT

1. DRAIN COOLANT (See page 16-8 )
2. REMOVE FRONT WHEEL RH
3. REMOVE FRONT WIPER ARM HEAD CAP
4. REMOVE FR WIPER ARM RH (See page 66-8 )
5. REMOVE FR WIPER ARM LH (See page 66-8 )
6. REMOVE COWL TOP VENTILATOR LOUVER SUB-ASSY (See page 66-8 )
7. REMOVE WIPER LINK ASSY (See page 66-8 )
8. REMOVE COWL TOP TO COWL BRACE INNER NO.1 (See page 11-13 )
9. REMOVE COWL TOP PANEL SUB-ASSY OUTER FRONT (See page 11-13 )
10. REMOVE V-BANK COVER SUB-ASSY (See page 14-7 )
11. REMOVE RADIATOR HOSE INLET
12. REMOVE IGNITION COIL ASSY
13. REMOVE CYLINDER HEAD COVER SUB-ASSY LH (See page 14-7 )
14. REMOVE FRONT FENDER APRON SEAL RH
15. REMOVE V (COOLER COMPRESSOR TO CRANKSHAFT PULLEY) BELT NO.1  
(See page 14-5 )
16. REMOVE VANE PUMP V BELT (See page 14-5 )
17. REMOVE ENGINE MOVING CONTROL ROD (See page 14-84 )
18. REMOVE ENGINE MOUNTING STAY NO.2 RH (See page 14-84 )
19. REMOVE GENERATOR BRACKET NO.2 (See page 14-84 )
20. REMOVE CRANKSHAFT PULLEY (See page 14-84 )  
SST 09213-54015 (91651-60855), 09330-00021, 09950-50013 (09951-05010, 09952-05010,  
09953-05020, 09954-05031)
21. REMOVE TIMING BELT NO.1 COVER
22. REMOVE TIMING BELT NO.2 COVER (See page 14-84 )
23. REMOVE ENGINE MOUNTING BRACKET RH (See page 14-84 )
24. REMOVE TIMING BELT GUIDE NO.2
25. REMOVE TIMING BELT (See page 14-84 )
26. REMOVE TIMING BELT IDLER SUB-ASSY NO.2
27. REMOVE CAMSHAFT TIMING PULLEY (See page 14-99 )  
SST 09960-10010 (09962-01000, 09963-01000), 09249-63010
28. REMOVE TIMING BELT NO.3 COVER (See page 14-99 )

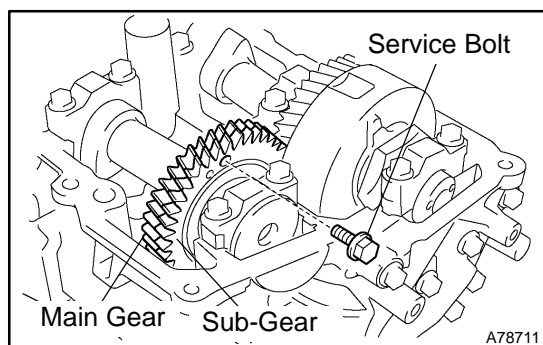
### 29. REMOVE NO.3 CAMSHAFT SUB-ASSY

#### NOTICE:

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



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



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

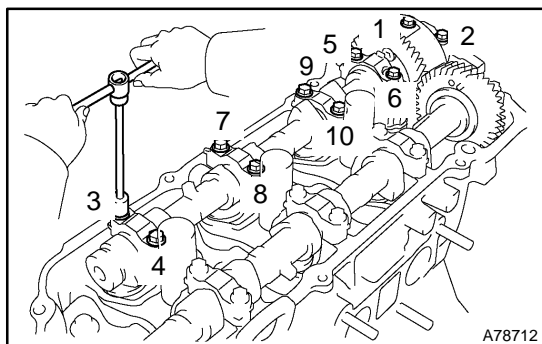
**Torque: 5.4 N·m (55 kgf·cm, 48 in.-lbf)**

#### Recommended service bolt

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

#### HINT:

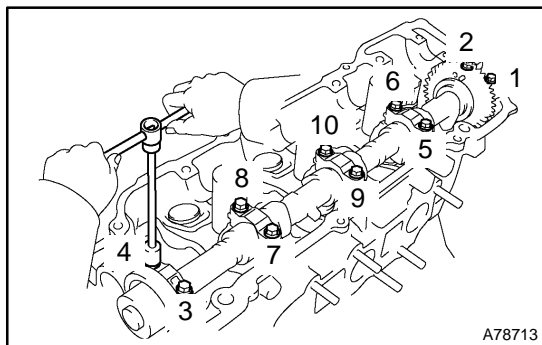
When removing the camshaft, make certain that the torsional spring force of the sub-gear has been eliminated by installation of the service bolt.



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

#### NOTICE:

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



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

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

#### NOTICE:

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

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

#### 31. REMOVE CAMSHAFT TIMING GEAR ASSY (See page 14-99 )

#### 32. REMOVE CAMSHAFT SUB GEAR (See page 14-99 )

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

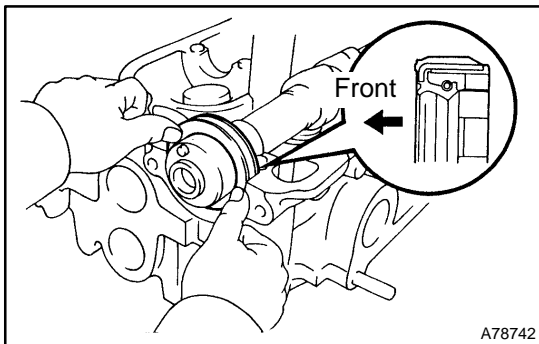
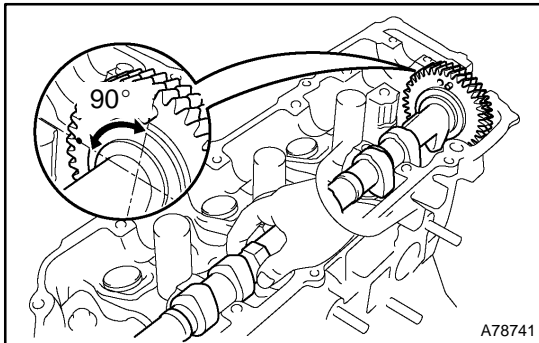
#### 33. INSTALL CAMSHAFT SUB GEAR (See page 14-99 )

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

**34. INSTALL CAMSHAFT TIMING GEAR ASSY (See page 14-99 )****35. INSTALL NO.4 CAMSHAFT SUB-ASSY****NOTICE:**

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

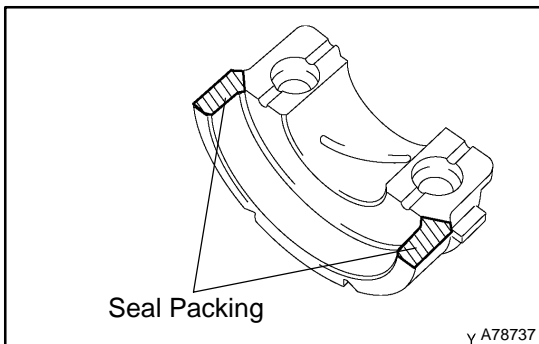
- Apply new engine oil to the thrust portion and journal of the camshaft.
- Place the No. 4 camshaft at a 90° angle of timing mark (1 dot marks) on the cylinder head.
- Apply MP grease to a new oil seal lip.



- Install the oil seal to the camshaft.

**NOTICE:**

- Do not turn over the oil seal lip.
  - Insert the oil seal until it stops.
- Remove any old packing material from the contact surface.

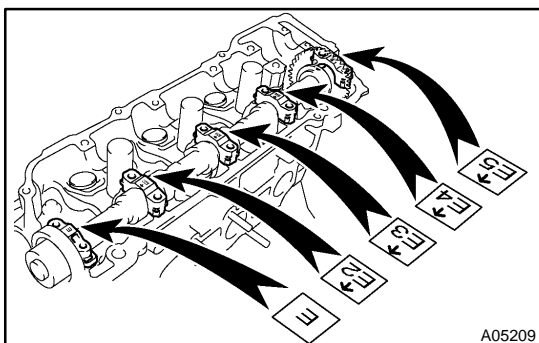


- Apply seal packing to the No. 1 bearing cap as shown in the illustration.

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

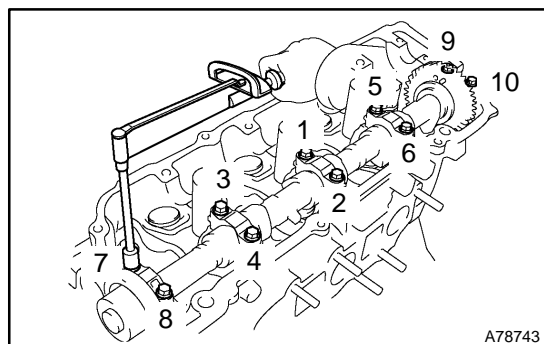
**NOTICE:**

- Install the No. 1 bearing cap within 5 minutes after applying seal packing.
- Do not expose the seal to engine oil within 2 hours after installing.



- Install the 5 bearing caps in their proper locations.
- Apply a light coat of engine oil on the threads of the bearing cap bolts.





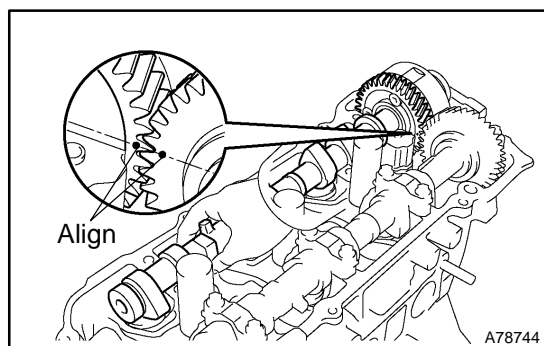
- (i) Using several steps, install and tighten the 10 bearing cap bolts uniformly in the sequence shown in the illustration.  
**Torque: 16 N·m (163 kgf·cm, 12 ft·lbf)**

### 36. INSTALL NO.3 CAMSHAFT SUB-ASSY

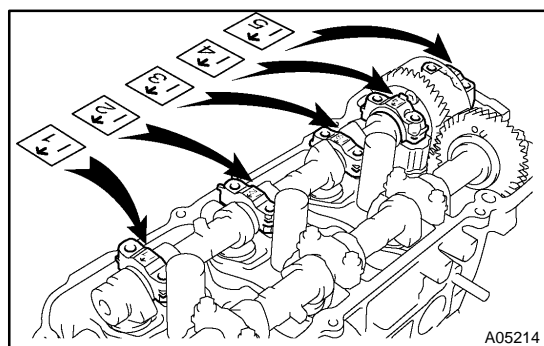
#### NOTICE:

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

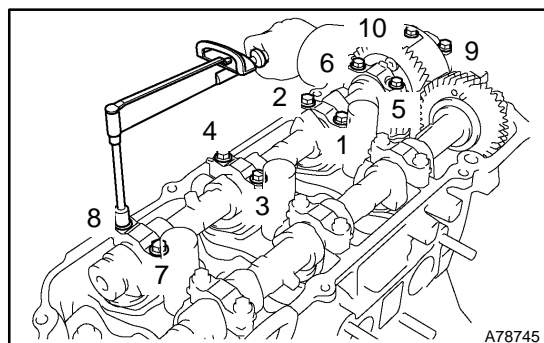
- (a) Apply new engine oil to the thrust portion and journal of the camshaft.



- (b) Align the timing marks (1 dot marks) of the camshaft drive with the driven gears. Place the camshaft on the cylinder head.



- (c) Install the 5 bearing caps in their proper locations.  
(d) Apply a light coat of engine oil on the threads of the bearing cap bolts.



- (e) Using several steps, install and tighten the 10 bearing cap bolts uniformly in the sequence shown in the illustration.  
**Torque: 16 N·m (163 kgf·cm, 12 ft·lbf)**  
(f) Remove the service bolt.

### 37. INSTALL TIMING BELT NO.3 COVER (See page 14-99 )

### 38. INSTALL CAMSHAFT TIMING PULLEY (See page 14-99 )

SST 09960-10010 (09962-01000, 09963-01000), 09249-63010

### 39. INSTALL TIMING BELT IDLER SUB-ASSY NO.2 (See page 14-99 )

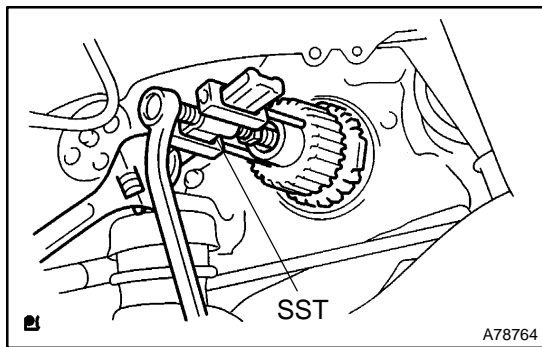
### 40. INSPECT TIMING BELT (See page 14-84 )



41. **INSTALL TIMING BELT (See page 14-84 )**  
SST 09960-10010 (09962-01000, 09963-01000)
42. **INSTALL CHAIN TENSIONER ASSY NO.1 (See page 14-84 )**
43. **INSTALL TIMING BELT GUIDE NO.2 (See page 14-84 )**
44. **INSTALL ENGINE MOUNTING BRACKET RH (See page 14-84 )**
45. **INSTALL TIMING BELT NO.2 COVER (See page 14-84 )**
46. **INSTALL TIMING BELT NO.1 COVER (See page 14-84 )**
47. **INSTALL CRANKSHAFT PULLEY (See page 14-84 )**  
SST 09213-54015 (91651-60855), 09330-00021
48. **INSTALL GENERATOR BRACKET NO.2 (See page 14-84 )**
49. **INSTALL ENGINE MOUNTING STAY NO.2 RH (See page 14-84 )**
50. **INSTALL ENGINE MOVING CONTROL ROD (See page 14-84 )**
51. **INSPECT VALVE CLEARANCE (See page 14-7 )**
52. **ADJUST VALVE CLEARANCE (See page 14-7 )**  
SST 09248-55040 (09248-05410, 09248-05420)
53. **INSTALL VANE PUMP V BELT (See page 14-5 )**
54. **INSTALL V (COOLER COMPRESSOR TO CRANKSHAFT PULLEY) BELT NO.1 (See page 14-5 )**
55. **INSPECT DRIVE BELT DEFLECTION AND TENSION (REFERENCE) (See page 14-1 )**
56. **INSTALL CYLINDER HEAD COVER SUB-ASSY LH (See page 14-7 )**
57. **INSTALL IGNITION COIL ASSY (See page 14-7 )**
58. **INSTALL V-BANK COVER SUB-ASSY (See page 14-7 )**
59. **INSTALL COWL TOP PANEL SUB-ASSY OUTER FRONT (See page 11-13 )**
60. **INSTALL COWL TOP TO COWL BRACE INNER NO.1 (See page 11-13 )**
61. **INSTALL WIPER LINK ASSY (See page 66-8 )**
62. **INSTALL FR WIPER ARM LH (See page 66-8 )**
63. **INSTALL FR WIPER ARM RH (See page 66-8 )**
64. **INSTALL FRONT WHEEL RH (See page 14-5 )**
65. **ADD COOLANT (See page 16-8 )**
66. **CHECK FOR ENGINE COOLANT LEAKS (See page 16-8 )**

# OIL PUMP SEAL REPLACEMENT

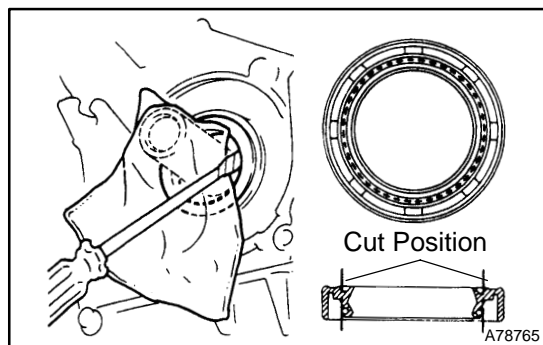
1. REMOVE FRONT WHEEL RH
2. REMOVE FRONT WIPER ARM HEAD CAP
3. REMOVE FR WIPER ARM RH (See page 66-8 )
4. REMOVE FR WIPER ARM LH (See page 66-8 )
5. REMOVE COWL TOP VENTILATOR LOUVER SUB-ASSY (See page 66-8 )
6. REMOVE WIPER LINK ASSY (See page 66-8 )
7. REMOVE COWL TOP TO COWL BRACE INNER NO.1 (See page 11-13 )
8. REMOVE COWL TOP PANEL SUB-ASSY OUTER FRONT (See page 11-13 )
9. REMOVE FRONT FENDER APRON SEAL RH
10. REMOVE V (COOLER COMPRESSOR TO CRANKSHAFT PULLEY) BELT NO.1 (See page 14-5 )
11. REMOVE VANE PUMP V BELT (See page 14-5 )
12. REMOVE ENGINE MOVING CONTROL ROD (See page 14-84 )
13. REMOVE ENGINE MOUNTING STAY NO.2 RH (See page 14-84 )
14. REMOVE GENERATOR BRACKET NO.2 (See page 14-84 )
15. REMOVE CRANKSHAFT PULLEY (See page 14-84 )  
SST 09213-54015 (91651-60855), 09330-00021, 09950-50013 (09951-05010, 09952-05010, 09953-05020, 09954-05031)
16. REMOVE TIMING BELT NO.1 COVER
17. REMOVE TIMING BELT NO.2 COVER (See page 14-84 )
18. REMOVE ENGINE MOUNTING BRACKET RH (See page 14-84 )
19. REMOVE TIMING BELT GUIDE NO.2
20. REMOVE TIMING BELT (See page 14-84 )
21. REMOVE CRANKSHAFT TIMING PULLEY
  - (a) Remove the bolt and the timing belt plate.



- (b) Install the pulley bolt to the crankshaft.
- (c) Using SST, remove the crankshaft timing pulley.  
SST 09950-50013 (09951-05010, 09952-05010, 09953-05020, 09954-05011)

## NOTICE:

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



## 22. REMOVE OIL PUMP SEAL

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

## NOTICE:

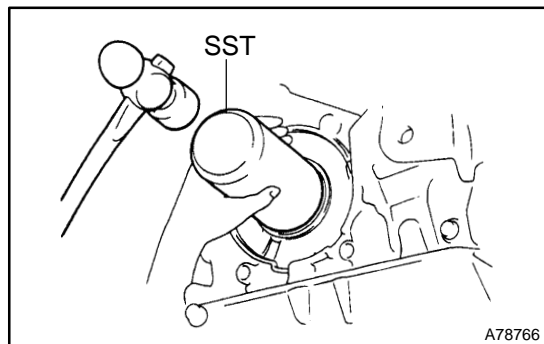
After the removal, check the crankshaft for damage. If it is damaged, smooth the surface with 400-grit sandpaper.

**23. INSTALL OIL PUMP SEAL**

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

**NOTICE:**

**Keep the lip free of foreign objects.**

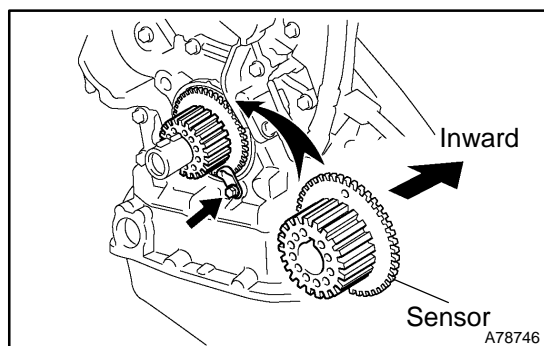


- (b) Using SST and a hammer, tap in a new oil seal until its surface is flush with the oil pump edge.

SST 09223-00010

**NOTICE:**

- **Be careful not to tap the oil seal at an angle.**
- **Wipe off extra grease on the crankshaft.**

**24. INSTALL CRANKSHAFT TIMING PULLEY**

- (a) Align the keyway of the pulley with the key located on the crankshaft and slide the pulley into place.

**NOTICE:**

**Do not scratch the sensor area of the crankshaft timing pulley.**

- (b) Install the timing belt plate with the bolt.

**Torque: 8.0 N·m (82 kgf·cm, 71 in.-lbf)**

**25. INSPECT TIMING BELT (See page 14-84 )****26. INSTALL TIMING BELT (See page 14-84 )**

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

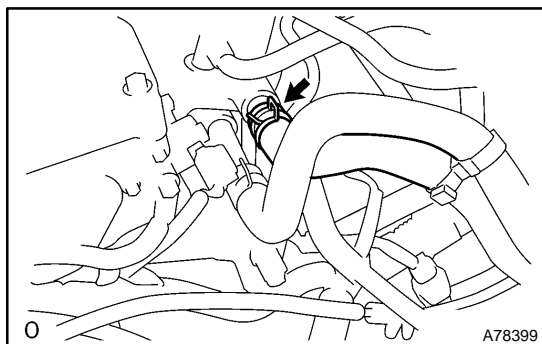
**27. INSTALL CHAIN TENSIONER ASSY NO.1 (See page 14-84 )****28. INSTALL TIMING BELT GUIDE NO.2 (See page 14-84 )****29. INSTALL ENGINE MOUNTING BRACKET RH (See page 14-84 )****30. INSTALL TIMING BELT NO.2 COVER (See page 14-84 )****31. INSTALL TIMING BELT NO.1 COVER (See page 14-84 )****32. INSTALL CRANKSHAFT PULLEY (See page 14-84 )**

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

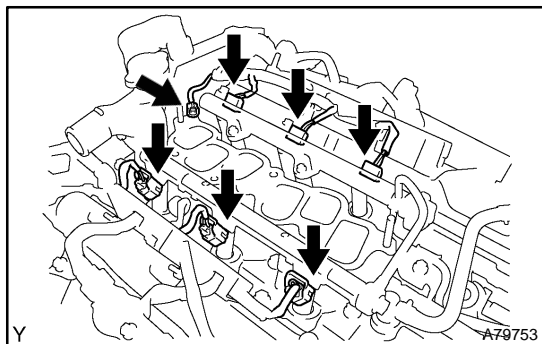
**33. INSTALL GENERATOR BRACKET NO.2 (See page 14-84 )****34. INSTALL ENGINE MOUNTING STAY NO.2 RH (See page 14-84 )****35. INSTALL ENGINE MOVING CONTROL ROD (See page 14-84 )****36. INSTALL VANE PUMP V BELT (See page 14-5 )****37. INSTALL V (COOLER COMPRESSOR TO CRANKSHAFT PULLEY) BELT NO.1 (See page 14-5 )****38. INSPECT DRIVE BELT DEFLECTION AND TENSION (REFERENCE) (See page 14-1 )****39. INSTALL COWL TOP PANEL SUB-ASSY OUTER FRONT (See page 11-13 )****40. INSTALL COWL TOP TO COWL BRACE INNER NO.1 (See page 11-13 )****41. INSTALL WIPER LINK ASSY (See page 66-8 )****42. INSTALL FR WIPER ARM LH (See page 66-8 )****43. INSTALL FR WIPER ARM RH (See page 66-8 )****44. INSTALL FRONT WHEEL RH (See page 14-5 )****45. CHECK FOR ENGINE OIL LEAKS**

## REPLACEMENT

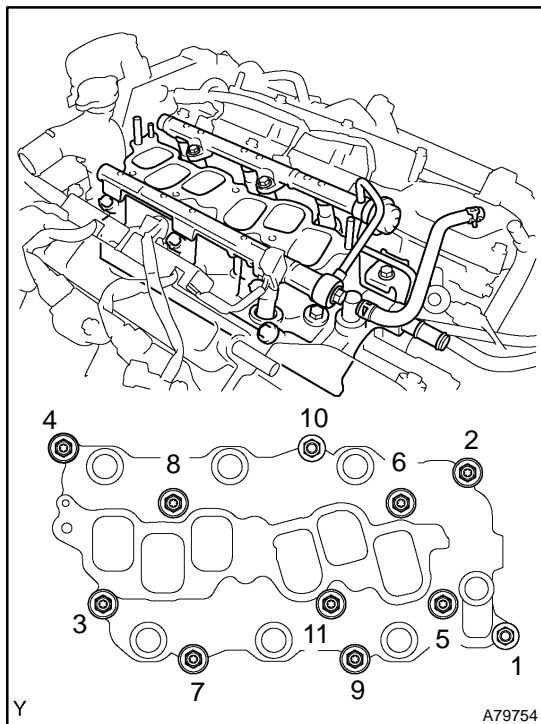
1. DISCHARGE FUEL SYSTEM PRESSURE (See page 11-1 )
2. DRAIN COOLANT (See page 16-8 )
3. DRAIN ENGINE OIL (See page 17-23 )
4. REMOVE FRONT WHEEL RH
5. REMOVE FRONT WIPER ARM HEAD CAP
6. REMOVE FR WIPER ARM RH (See page 66-8 )
7. REMOVE FR WIPER ARM LH (See page 66-8 )
8. REMOVE COWL TOP VENTILATOR LOUVER SUB-ASSY (See page 66-8 )
9. REMOVE WIPER LINK ASSY (See page 66-8 )
10. REMOVE COWL TOP TO COWL BRACE INNER NO.1 (See page 11-13 )
11. REMOVE COWL TOP PANEL SUB-ASSY OUTER FRONT (See page 11-13 )
12. REMOVE V-BANK COVER SUB-ASSY (See page 14-7 )
13. REMOVE AIR CLEANER CAP SUB-ASSY (See page 10-7 )
14. REMOVE EMISSION CONTROL VALVE SET (See page 14-7 )
15. REMOVE INTAKE AIR SURGE TANK (See page 14-7 )
16. DISCONNECT FUEL PIPE SUB-ASSY NO.1 (See page 11-1 )



17. DISCONNECT HEATER WATER INLET HOSE B



18. REMOVE INTAKE MANIFOLD
  - (a) Remove the nut and the ground cable.
  - (b) Disconnect the 6 fuel injector connectors.

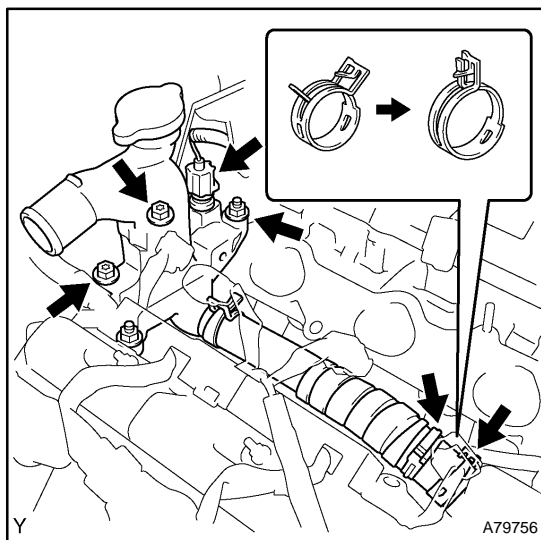


- (c) In order to remove the intake manifold, using several steps, remove the 9 bolts and the 2 nuts in the sequence shown in the illustration.

## 19. DISCONNECT RADIATOR HOSE INLET

## 20. REMOVE WATER OUTLET

- (a) Disconnect the radiator reserve tank hose.



- (b) Disconnect the engine coolant temperature sensor connector.  
 (c) Remove the clamp.  
 (d) Remove the 2 bolts, the 2 nuts and the 2 washers.  
 (e) Lock the hose clamp as shown in the illustration and remove the water outlet together with the water by-pass hose No. 1.  
 (f) Remove the 2 gaskets from the 2 cylinder heads.

## 21. REMOVE FRONT FENDER APRON SEAL RH

## 22. REMOVE V (COOLER COMPRESSOR TO CRANKSHAFT PULLEY) BELT NO.1 (See page 14-5 )

## 23. REMOVE VANE PUMP V BELT (See page 14-5 )

## 24. REMOVE ENGINE MOVING CONTROL ROD (See page 14-84 )

## 25. REMOVE ENGINE MOUNTING STAY NO.2 RH (See page 14-84 )

## 26. REMOVE GENERATOR BRACKET NO.2 (See page 14-84 )

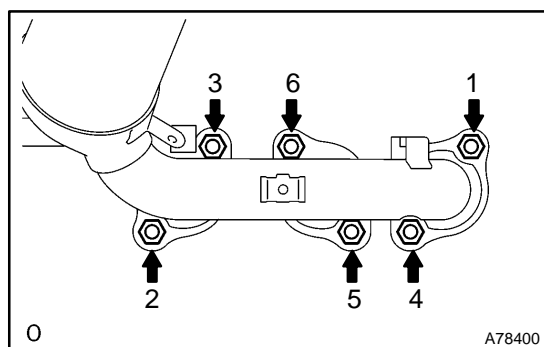
## 27. REMOVE CRANKSHAFT PULLEY (See page 14-84 )

SST 09213-54015 (91651-60855), 09330-00021, 09950-50013 (09951-05010, 09952-05010, 09953-05020, 09954-05031)

28. REMOVE TIMING BELT NO.1 COVER
29. REMOVE TIMING BELT NO.2 COVER (See page 14-84 )
30. REMOVE ENGINE MOUNTING BRACKET RH (See page 14-84 )
31. REMOVE TIMING BELT GUIDE NO.2
32. REMOVE TIMING BELT (See page 14-84 )
33. REMOVE TIMING BELT IDLER SUB-ASSY NO.2
34. REMOVE CAMSHAFT TIMING PULLEY (See page 14-99 )  
SST 09960-10010 (09962-01000, 09963-01000), 09249-63010
35. REMOVE TIMING BELT NO.3 COVER (See page 14-99 )
36. SEPARATE VANE PUMP ASSY (See page 14-33 )
37. REMOVE PROPELLER SHAFT (4WD DRIVE TYPE) (See page 30-6 )  
SST 09325-20010
38. REMOVE EXHAUST PIPE ASSY FRONT (2WD DRIVE TYPE) (See page 15-2 )
39. REMOVE EXHAUST PIPE ASSY CENTER (4WD DRIVE TYPE) (See page 15-6 )
40. REMOVE EXHAUST MANIFOLD HEAT INSULATOR NO.1
41. REMOVE MANIFOLD STAY

#### 42. REMOVE EXHAUST MANIFOLD SUB-ASSY RH (2WD DRIVE TYPE)

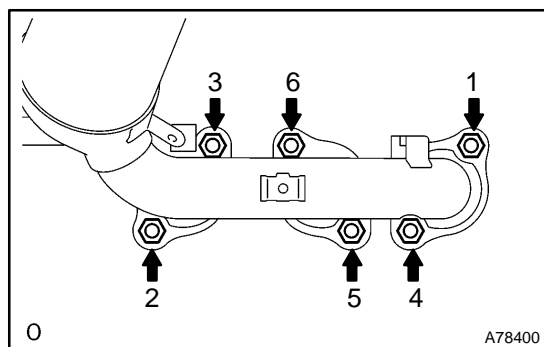
- (a) Disconnect the heated oxygen sensor connector.
- (b) Using several steps, loosen and remove the 6 nuts in the sequence shown in the illustration.



- (c) Remove the exhaust manifold RH and the gasket from the cylinder head RH.

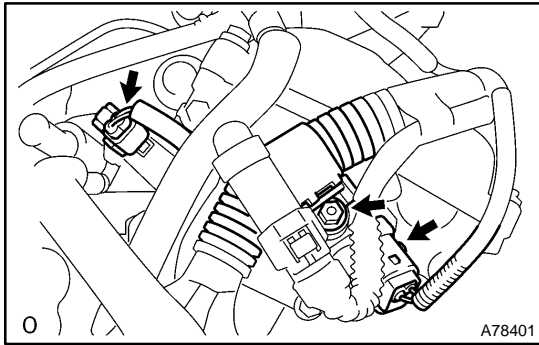
#### 43. REMOVE EXHAUST MANIFOLD CONVERTER SUB-ASSY (4WD DRIVE TYPE)

- (a) Disconnect the heated oxygen sensor connector.

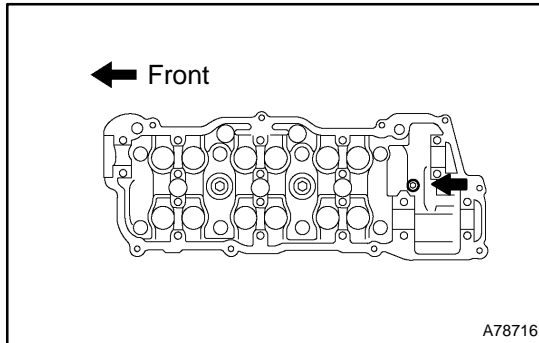


- (b) Using several steps, loosen and remove the 6 nuts in the sequence shown in the illustration.
- (c) Remove the exhaust manifold RH and the gasket from the cylinder head RH.

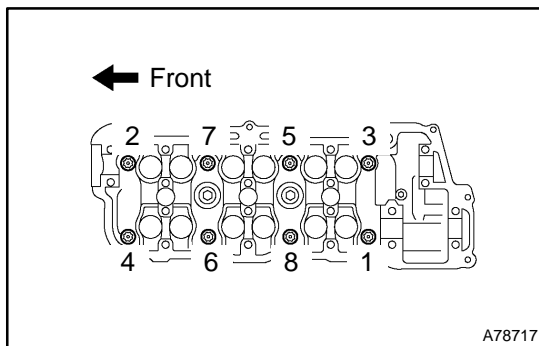
44. REMOVE IGNITION COIL ASSY
45. REMOVE CYLINDER HEAD COVER SUB-ASSY (See page 14-7 )
46. REMOVE CAMSHAFT (See page 14-99 )
47. REMOVE NO.2 CAMSHAFT (See page 14-99 )

**48. REMOVE CYLINDER HEAD SUB-ASSY**

- (a) Disconnect the VVT sensor connector.
- (b) Disconnect the camshaft timing oil control valve connector.
- (c) Remove the nut and disconnect the engine wire harness clamp.



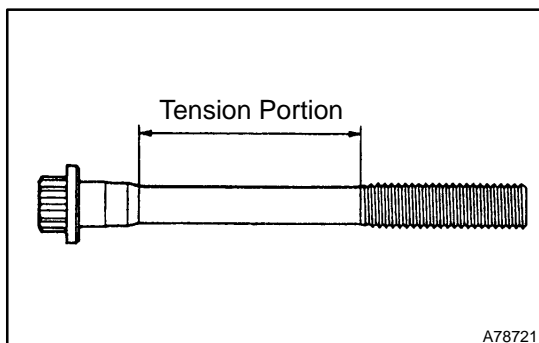
- (d) Using an 8 mm hexagon wrench, remove the hexagon bolt.



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

**NOTICE:**

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

**49. REMOVE CYLINDER HEAD GASKET****50. INSPECT CYLINDER HEAD SET BOLT**

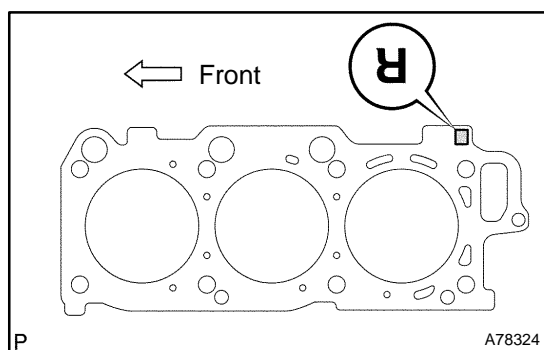
- (a) Using vernier calipers, measure the tension portion diameter of the bolt.

**Standard outside diameter:**

**8.95 to 9.05 mm (0.3524 to 0.3563 in.)**

**Minimum outside diameter: 8.75 mm (0.3445 in.)**

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



### 51. INSTALL CYLINDER HEAD GASKET

- (a) Place a new cylinder head gasket on the cylinder block with the R mark upward.

#### NOTICE:

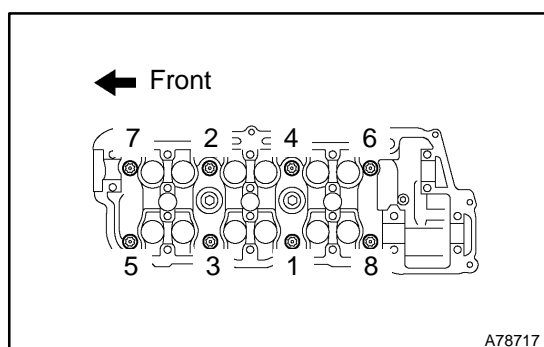
- Remove any oil from the contact surface.
- Be careful of the installing orientation.
- Place the cylinder head on the gasket carefully in order not to damage the gasket at the bottom part of the head.

### 52. INSTALL CYLINDER HEAD SUB-ASSY

#### NOTICE:

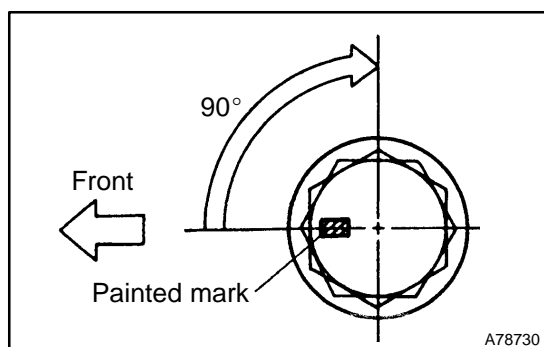
The cylinder head bolts are tightened in 2 successive steps.

- (a) Apply a light coat of engine oil on the threads of the cylinder head bolts.
- (b) Install the plate washers to the cylinder head bolts.

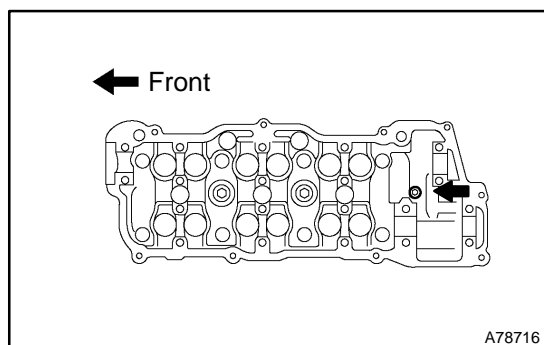


- (c) Using several steps, install and tighten the 8 cylinder head bolts uniformly in the sequence shown in the illustration.

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



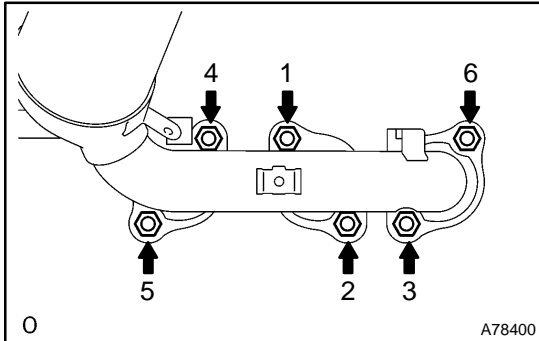
- (d) Mark the front side of each cylinder head bolt head with paint as shown in the illustration.
- (e) Retighten the cylinder head bolts by 90° in the same sequence as step (c).
- (f) Check that the painted mark is now at a 90° angle to the front.



- (g) Using an 8 mm socket hexagon wrench, install the hexagon bolt.
- Torque: 19 N·m (189 kgf·cm, 14 ft·lbf)**
- (h) Connect the engine wire harness clamp with the nut.
- Torque: 8.4 N·m (85 kgf·cm, 74 in·lbf)**



53. INSTALL NO.2 CAMSHAFT (See page 14-99 )
54. INSTALL CAMSHAFT (See page 14-99 )
55. INSTALL CYLINDER HEAD COVER SUB-ASSY (See page 14-7 )
56. INSTALL IGNITION COIL ASSY (See page 14-7 )

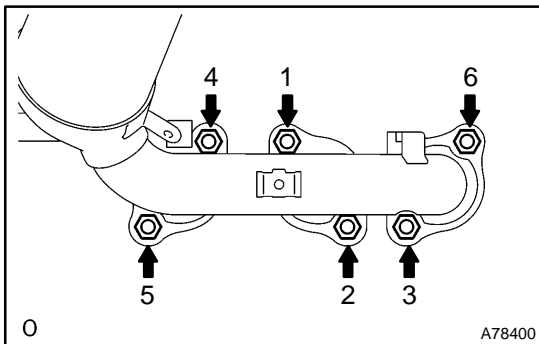


#### 57. INSTALL EXHAUST MANIFOLD SUB-ASSY RH (2WD DRIVE TYPE)

- (a) Install a new gasket and the exhaust manifold RH with the 6 nuts. Using several steps, tighten the nuts uniformly in the sequence shown in the illustration.

**Torque: 49 N·m (500 kgf·cm, 36 ft·lbf)**

- (b) Retighten nut 1 and 2 shown in the illustration.



#### 58. INSTALL EXHAUST MANIFOLD CONVERTER SUB-ASSY (4WD DRIVE TYPE)

- (a) Install a new gasket and the exhaust manifold RH with the 6 nuts. Using several steps, tighten the nuts uniformly in the sequence shown in the illustration.

**Torque: 49 N·m (500 kgf·cm, 36 ft·lbf)**

- (b) Retighten nut 1 and 2 shown in the illustration.

#### 59. INSTALL MANIFOLD STAY

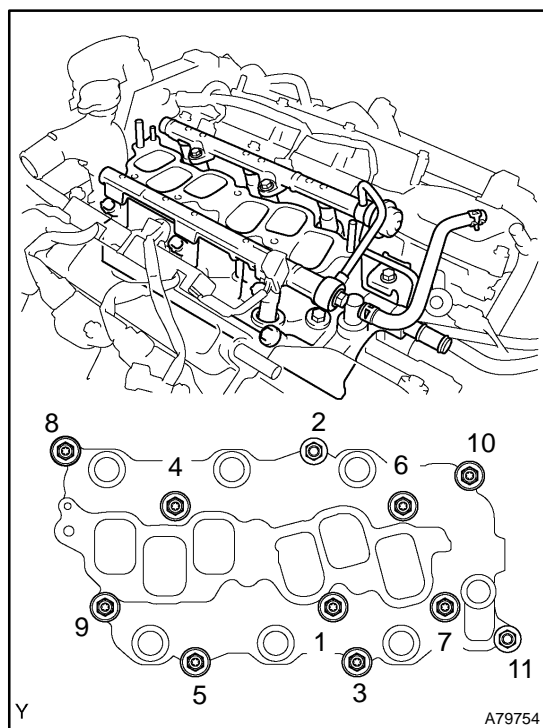
**Torque: 34 N·m (347 kgf·cm, 25 ft·lbf)**

#### 60. INSTALL EXHAUST MANIFOLD HEAT INSULATOR NO.1

**Torque: 8.5 N·m (87 kgf·cm, 75 in·lbf)**

61. INSTALL EXHAUST PIPE ASSY FRONT (2WD DRIVE TYPE) (See page 15-2 )
62. INSTALL EXHAUST PIPE ASSY CENTER (4WD DRIVE TYPE) (See page 15-6 )
63. INSTALL PROPELLER SHAFT (4WD DRIVE TYPE) (See page 30-6 )
64. INSTALL VANE PUMP ASSY (See page 14-33 )
65. INSTALL TIMING BELT NO.3 COVER (See page 14-99 )
66. INSTALL CAMSHAFT TIMING PULLEY (See page 14-99 )  
SST 09960-10010 (09962-01000, 09963-01000), 09249-63010
67. INSTALL TIMING BELT IDLER SUB-ASSY NO.2 (See page 14-99 )
68. INSPECT TIMING BELT (See page 14-84 )
69. INSTALL TIMING BELT (See page 14-84 )  
SST 09960-10010 (09962-01000, 09963-01000)
70. INSTALL CHAIN TENSIONER ASSY NO.1 (See page 14-84 )
71. INSTALL TIMING BELT GUIDE NO.2 (See page 14-84 )
72. INSTALL ENGINE MOUNTING BRACKET RH (See page 14-84 )
73. INSTALL TIMING BELT NO.2 COVER (See page 14-84 )
74. INSTALL TIMING BELT NO.1 COVER (See page 14-84 )
75. INSTALL CRANKSHAFT PULLEY (See page 14-84 )  
SST 09213-54015 (91651-60855), 09330-00021
76. INSTALL GENERATOR BRACKET NO.2 (See page 14-84 )
77. INSTALL ENGINE MOUNTING STAY NO.2 RH (See page 14-84 )
78. INSTALL ENGINE MOVING CONTROL ROD (See page 14-84 )

79. **INSTALL VANE PUMP V BELT** (See page 14-5 )
80. **INSTALL V (COOLER COMPRESSOR TO CRANKSHAFT PULLEY) BELT NO.1**  
(See page 14-5 )
81. **INSPECT DRIVE BELT DEFLECTION AND TENSION (REFERENCE)** (See page 14-1 )
82. **INSTALL WATER OUTLET**
  - (a) Install 2 new gaskets to the 2 cylinder heads.
  - (b) Install the water outlet together with the water by-pass hose No. 1 and unlock the hose clamp.
  - (c) Tighten the 2 bolts, the 2 nuts and the 2 washers.  
**Torque: 15 N·m (153 kgf·cm, 11 ft·lbf)**
  - (d) Install the clamp.
  - (e) Connect the engine coolant temperature sensor connector.
  - (f) Connect the radiator reserve tank hose.
  - (g) Connect the radiator hose inlet.



### 83. **INSTALL INTAKE MANIFOLD**

- (a) Install the intake manifold with the 9 bolts and the 2 nuts. Using several steps, tighten the bolts and the nuts uniformly in the sequence shown in the illustration.
- (b) Retighten the 2 bolts and 2 nuts of the water outlet.  
**Torque: 15 N·m (153 kgf·cm, 11 ft·lbf)**
- (c) Retighten the water outlet mounting bolts and nuts.  
**Torque: 15 N·m (153 kgf·cm, 11 ft·lbf)**
- (d) Install the ground cable with the nut.  
**Torque: 8.4 N·m (86 kgf·cm, 74 in·lbf)**
- (e) Connect the heater water inlet hose B.

84. **CONNECT FUEL PIPE SUB-ASSY NO.1** (See page 11-1 )
85. **INSTALL INTAKE AIR SURGE TANK** (See page 14-7 )
86. **INSTALL EMISSION CONTROL VALVE SET** (See page 14-7 )
87. **INSTALL AIR CLEANER CAP SUB-ASSY** (See page 10-7 )
88. **CONNECT VACUUM HOSE** (See page 14-33 )
89. **INSTALL V-BANK COVER SUB-ASSY** (See page 14-7 )
90. **INSTALL COWL TOP PANEL SUB-ASSY OUTER FRONT** (See page 11-13 )
91. **INSTALL COWL TOP TO COWL BRACE INNER NO.1** (See page 11-13 )
92. **INSTALL WIPER LINK ASSY** (See page 66-8 )
93. **INSTALL FR WIPER ARM LH** (See page 66-8 )
94. **INSTALL FR WIPER ARM RH** (See page 66-8 )
95. **INSTALL FRONT WHEEL RH** (See page 14-5 )
96. **ADD ENGINE OIL** (See page 17-23 )
97. **ADD COOLANT** (See page 16-8 )
98. **CHECK FOR ENGINE OIL LEAKS**

**99. CHECK FOR ENGINE COOLANT LEAKS (See page 16-8 )**

**100. INSPECT FOR FUEL LEAKS**

**101. CHECK FOR EXHAUST GAS LEAKS**

**102. INSPECT IGNITION TIMING (See page 14-1 )**

SST 09843-18040

**103. INSPECT ENGINE IDLE SPEED (See page 14-1 )**

SST 09843-18040

**104. INSPECT COMPRESSION (See page 14-1 )**

SST 09992-00500

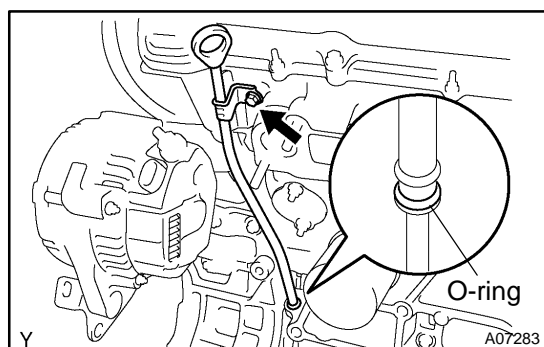
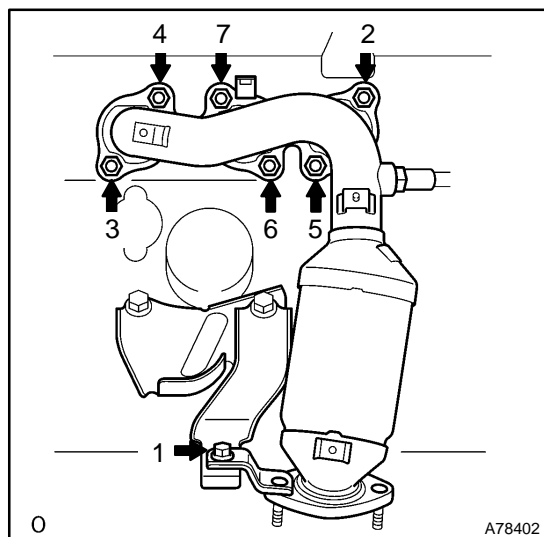
**105. INSPECT CO/HC (See page 14-1 )**

## REPLACEMENT

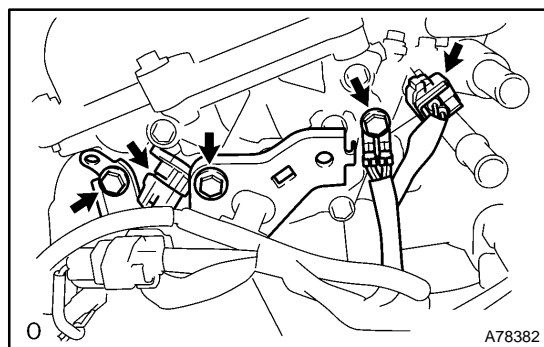
1. DISCHARGE FUEL SYSTEM PRESSURE (See page 11-1 )
2. DRAIN COOLANT (See page 16-8 )
3. DRAIN ENGINE OIL (See page 17-23 )
4. REMOVE FRONT WHEEL RH
5. REMOVE FRONT WIPER ARM HEAD CAP
6. REMOVE FR WIPER ARM RH (See page 66-8 )
7. REMOVE FR WIPER ARM LH (See page 66-8 )
8. REMOVE COWL TOP VENTILATOR LOUVER SUB-ASSY (See page 66-8 )
9. REMOVE WIPER LINK ASSY (See page 66-8 )
10. REMOVE COWL TOP TO COWL BRACE INNER NO.1 (See page 11-13 )
11. REMOVE COWL TOP PANEL SUB-ASSY OUTER FRONT (See page 11-13 )
12. REMOVE V-BANK COVER SUB-ASSY (See page 14-7 )
13. REMOVE AIR CLEANER CAP SUB-ASSY (See page 19-5 )
14. REMOVE AIR CLEANER FILTER ELEMENT SUB-ASSY
15. REMOVE AIR CLEANER INLET NO.2 (See page 19-5 )
16. REMOVE AIR CLEANER CASE (See page 19-5 )
17. REMOVE EMISSION CONTROL VALVE SET (See page 14-7 )
18. REMOVE INTAKE AIR SURGE TANK (See page 14-7 )
19. DISCONNECT FUEL PIPE SUB-ASSY NO.1 (See page 11-1 )
20. DISCONNECT HEATER WATER INLET HOSE B (See page 14-129 )
21. REMOVE INTAKE MANIFOLD (See page 14-129 )
22. REMOVE RADIATOR HOSE INLET
23. REMOVE WATER OUTLET (See page 14-129 )
24. REMOVE FRONT FENDER APRON SEAL RH
25. REMOVE V (COOLER COMPRESSOR TO CRANKSHAFT PULLEY) BELT NO.1  
(See page 14-5 )
26. REMOVE VANE PUMP V BELT (See page 14-5 )
27. REMOVE ENGINE MOVING CONTROL ROD (See page 14-84 )
28. REMOVE ENGINE MOUNTING STAY NO.2 RH (See page 14-84 )
29. REMOVE GENERATOR BRACKET NO.2 (See page 14-84 )
30. REMOVE CRANKSHAFT PULLEY (See page 14-84 )  
SST 09213-54015 (91651-60855), 09330-00021, 09950-50013 (09951-05010, 09952-05010,  
09953-05020, 09954-05031)
31. REMOVE TIMING BELT NO.1 COVER
32. REMOVE TIMING BELT NO.2 COVER (See page 14-84 )
33. REMOVE ENGINE MOUNTING BRACKET RH (See page 14-84 )
34. REMOVE TIMING BELT GUIDE NO.2
35. REMOVE TIMING BELT (See page 14-84 )
36. REMOVE TIMING BELT IDLER SUB-ASSY NO.2
37. REMOVE CAMSHAFT TIMING PULLEY (See page 14-99 )  
SST 09960-10010 (09962-01000, 09963-01000), 09249-63010
38. REMOVE TIMING BELT NO.3 COVER (See page 14-99 )
39. SEPARATE EXHAUST PIPE ASSY FRONT
  - (a) Remove the 2 nuts and separate the front pipe from the exhaust manifold converter No. 2.
  - (b) Remove the gasket from the front pipe.
40. REMOVE MANIFOLD CONVERTER INSULATOR NO.3
41. REMOVE EXHAUST MANIFOLD HEAT INSULATOR NO.2

**42. REMOVE EXHAUST MANIFOLD CONVERTER SUB-ASSY NO.2**

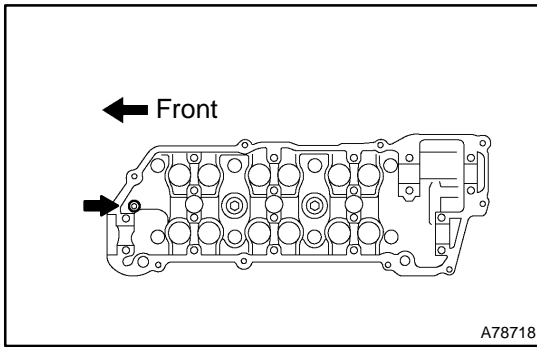
- (a) Disconnect the heated oxygen sensor connector.
- (b) Using several steps, loosen and remove the 6 nuts and the bolt in the sequence shown in the illustration.
- (c) Remove the exhaust manifold converter No. 2 and the gasket from the cylinder head LH.

**43. REMOVE OIL LEVEL GAGE GUIDE**

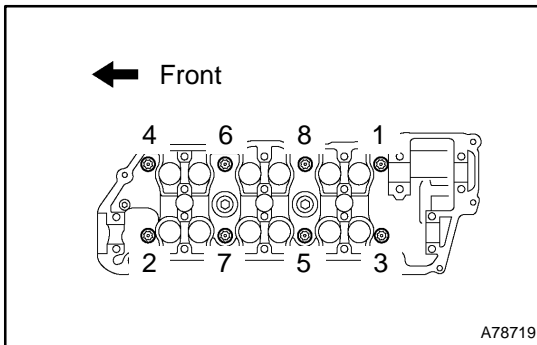
- (a) Remove the bolt which is used to secure the oil level gage guide from the cylinder head LH.
- (b) Pull out the oil level gage guide and the oil level gage together from the oil pan.
- (c) Remove the O-ring from the oil level gage guide.

**44. REMOVE IGNITION COIL ASSY****45. REMOVE CYLINDER HEAD COVER SUB-ASSY LH (See page 14-7 )****46. REMOVE NO.3 CAMSHAFT SUB-ASSY (See page 14-1 14)****47. REMOVE NO.4 CAMSHAFT SUB-ASSY (See page 14-1 14)****48. REMOVE CYLINDER HEAD LH**

- (a) Disconnect the VVT sensor connector.
- (b) Disconnect the camshaft timing oil control valve connector.
- (c) Remove the bolt and disconnect the ground cable.
- (d) Remove the bolt and the wire harness clamp bracket.
- (e) Remove the bolt and separate the water inlet.



- (f) Using an 8 mm hexagon wrench, remove the hexagon bolt.



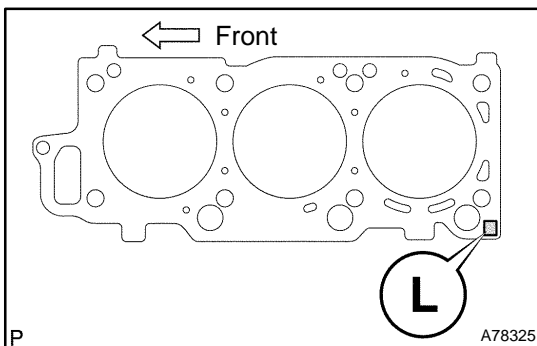
- (g) Using several steps, loosen the 8 cylinder head bolts uniformly in the sequence shown in the illustration. Remove the 8 cylinder head bolts and the plate washers.

**NOTICE:**

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

**49. REMOVE CYLINDER HEAD GASKET NO.2**

**50. INSPECT CYLINDER HEAD SET BOLT (See page 14-129 )**



**51. INSTALL CYLINDER HEAD GASKET NO.2**

- (a) Place a new cylinder head gasket on the cylinder block with the L mark upward.

**NOTICE:**

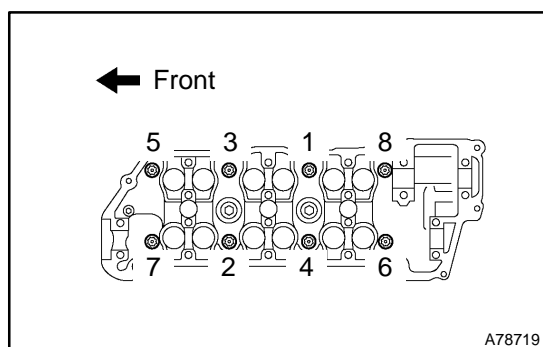
- Remove any oil from the contact surface.
- Be careful of the installing orientation.
- Place the cylinder head on the gasket carefully in order not to damage the gasket at the bottom part of the head.

**52. INSTALL CYLINDER HEAD LH**

**NOTICE:**

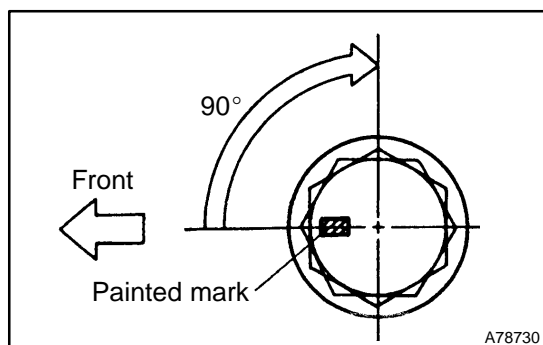
The cylinder head bolts are tightened in 2 successive steps.

- (a) Apply a light coat of engine oil on the threads of the cylinder head bolts.
- (b) Install the plate washer to the cylinder head bolt.

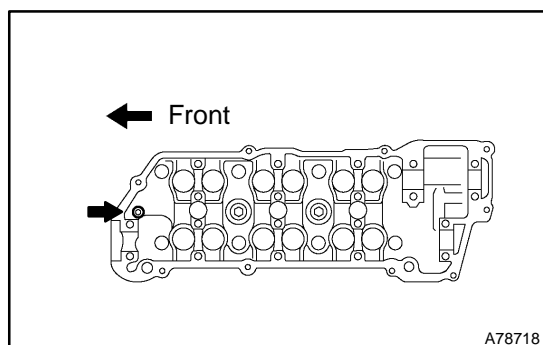


- (c) Using several steps, install and tighten the 8 cylinder head bolts uniformly in the sequence shown in the illustration.

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

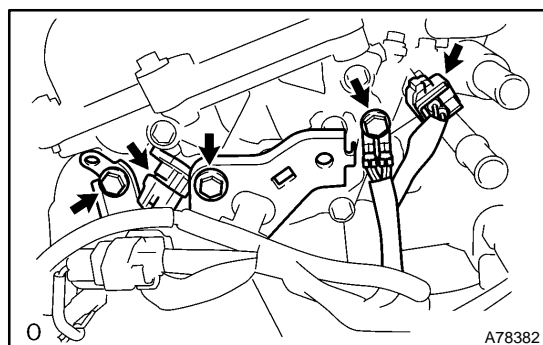


- (d) Mark the front side of each cylinder head bolt head with paint as shown in the illustration.
- (e) Retighten the cylinder head bolts by 90° in the same sequence as step (c).
- (f) Check that the painted mark is now at a 90° angle to the front.



- (g) Using an 8 mm socket hexagon wrench, install the hexagon bolt.

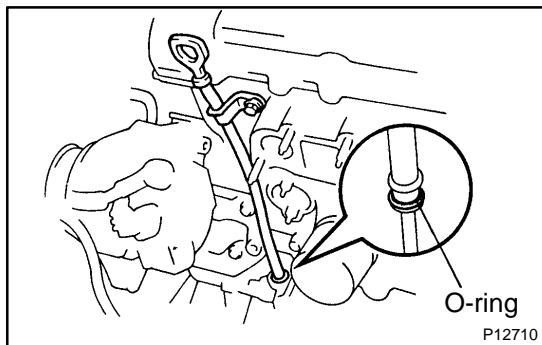
**Torque: 19 N·m (189 kgf·cm, 14 ft·lbf)**



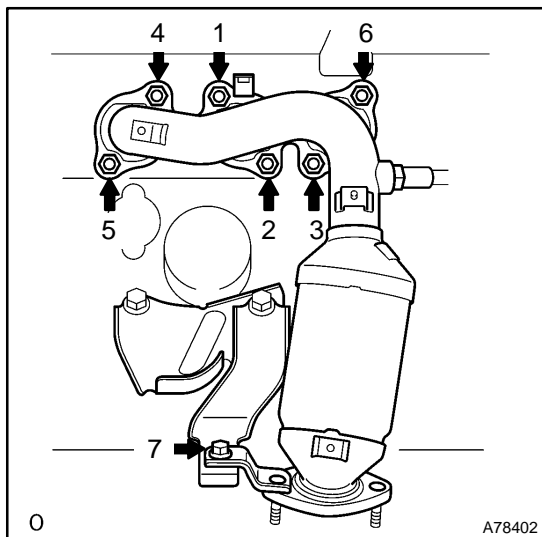
- (h) Install the bolt holding the water inlet to the cylinder head.  
**Torque: 20 N·m (199 kgf·cm, 14 ft·lbf)**
- (i) Install the wire harness clamp bracket with the bolt.  
**Torque: 5.4 N·m (55 kgf·cm, 48 in·lbf)**
- (j) Connect the ground cable with the bolt.  
**Torque: 5.4 N·m (55 kgf·cm, 48 in·lbf)**

53. INSTALL NO.4 CAMSHAFT SUB-ASSY (See page 14-1 14)
54. INSTALL NO.3 CAMSHAFT SUB-ASSY (See page 14-1 14)
55. INSTALL CYLINDER HEAD COVER SUB-ASSY LH (See page 14-7 )
56. INSTALL IGNITION COIL ASSY (See page 14-7 )



**57. INSTALL OIL LEVEL GAGE GUIDE**

- (a) Install a new O-ring to the oil level gauge guide.
- (b) Apply soapy water to the O-ring.
- (c) Push in the oil level gauge guide end into the guide hole of the oil pan No.1.
- (d) Install the oil level gauge guide with the bolt.
- Torque: 8.0 N·m (82 kgf·cm, 71 in.-lbf)**
- (e) Install the oil level gauge.

**58. INSTALL EXHAUST MANIFOLD CONVERTER SUB-ASSY NO.2**

- (a) Install a new gasket and the exhaust manifold converter No.2 with the 6 nuts and bolt. Using several steps, tighten the nuts uniformly in the sequence shown in the illustration.
- Torque: 49 N·m (500 kgf·cm, 36 ft.-lbf)**
- (b) Retighten nut 1 and 2 shown in the illustration.

**59. INSTALL EXHAUST MANIFOLD HEAT INSULATOR NO.2**

**Torque: 8.5 N·m (87 kgf·cm, 75 in.-lbf)**

**60. INSTALL MANIFOLD CONVERTER INSULATOR NO.3**

**Torque: 8.5 N·m (87 kgf·cm, 75 in.-lbf)**

**61. INSTALL EXHAUST PIPE ASSY FRONT**

- (a) Install a new gasket and front pipe to the exhaust manifold converter No.2 with 2 new nuts.

**Torque: 62 N·m (632 kgf·cm, 46 ft.-lbf)**

**62. INSTALL TIMING BELT NO.3 COVER (See page 14-99 )****63. INSTALL CAMSHAFT TIMING PULLEY (See page 14-99 )**

SST 09960-10010 (09962-01000, 09963-01000), 09249-63010

**64. INSTALL TIMING BELT IDLER SUB-ASSY NO.2 (See page 14-99 )****65. INSPECT TIMING BELT (See page 14-84 )****66. INSTALL TIMING BELT (See page 14-84 )**

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

**67. INSTALL CHAIN TENSIONER ASSY NO.1 (See page 14-84 )****68. INSTALL TIMING BELT GUIDE NO.2 (See page 14-84 )****69. INSTALL ENGINE MOUNTING BRACKET RH (See page 14-84 )****70. INSTALL TIMING BELT NO.2 COVER (See page 14-84 )****71. INSTALL TIMING BELT NO.1 COVER (See page 14-84 )****72. INSTALL CRANKSHAFT PULLEY (See page 14-84 )**

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

**73. INSTALL GENERATOR BRACKET NO.2 (See page 14-84 )****74. INSTALL ENGINE MOUNTING STAY NO.2 RH (See page 14-84 )****75. INSTALL ENGINE MOVING CONTROL ROD (See page 14-84 )****76. INSTALL VANE PUMP V BELT (See page 14-5 )**



77. **INSTALL V (COOLER COMPRESSOR TO CRANKSHAFT PULLEY) BELT NO.1**  
(See page [14-5](#))
78. **INSPECT DRIVE BELT DEFLECTION AND TENSION (REFERENCE)** (See page [14-1](#))
79. **INSTALL WATER OUTLET** (See page [14-129](#))
80. **INSTALL INTAKE MANIFOLD** (See page [14-129](#))
81. **CONNECT FUEL PIPE SUB-ASSY NO.1** (See page [11-1](#))
82. **INSTALL INTAKE AIR SURGE TANK** (See page [14-7](#))
83. **INSTALL EMISSION CONTROL VALVE SET** (See page [14-7](#))
84. **INSTALL AIR CLEANER CASE** (See page [19-5](#))
85. **INSTALL AIR CLEANER INLET NO.2** (See page [19-5](#))
86. **INSTALL AIR CLEANER CAP SUB-ASSY** (See page [19-5](#))
87. **CONNECT VACUUM HOSE** (See page [14-33](#))
88. **INSTALL V-BANK COVER SUB-ASSY** (See page [14-7](#))
89. **INSTALL COWL TOP PANEL SUB-ASSY OUTER FRONT** (See page [11-13](#))
90. **INSTALL COWL TOP TO COWL BRACE INNER NO.1** (See page [11-13](#))
91. **INSTALL WIPER LINK ASSY** (See page [66-8](#))
92. **INSTALL FR WIPER ARM LH** (See page [66-8](#))
93. **INSTALL FR WIPER ARM RH** (See page [66-8](#))
94. **INSTALL FRONT WHEEL RH** (See page [14-5](#))
95. **ADD ENGINE OIL** (See page [17-23](#))
96. **ADD COOLANT** (See page [16-8](#))
97. **CHECK FOR ENGINE OIL LEAKS**
98. **CHECK FOR ENGINE COOLANT LEAKS** (See page [16-8](#))
99. **INSPECT FOR FUEL LEAKS**
100. **CHECK FOR EXHAUST GAS LEAKS**
101. **INSPECT IGNITION TIMING** (See page [14-1](#))  
SST 09843-18040
102. **INSPECT ENGINE IDLE SPEED** (See page [14-1](#))  
SST 09843-18040
103. **INSPECT COMPRESSION** (See page [14-1](#))  
SST 09992-00500
104. **INSPECT CO/HC** (See page [14-1](#))