

**2009 ENGINE****Engine Mechanical (1GR-FE) - Tacoma****ENGINE****ON-VEHICLE INSPECTION**

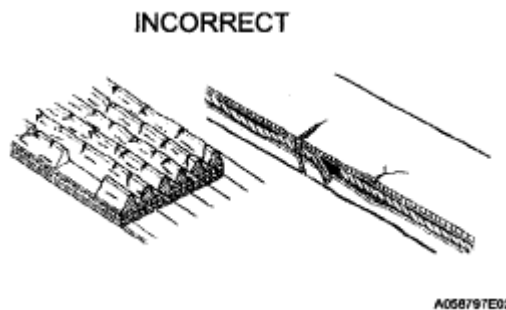
1. **INSPECT ENGINE COOLANT** (See ON-VEHICLE INSPECTION )
2. **INSPECT ENGINE OIL** (See SYSTEM DIAGRAM )
3. **INSPECT BATTERY** (See ON-VEHICLE INSPECTION )
4. **INSPECT AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY**
5. **INSPECT SPARK PLUG** (See ON-VEHICLE INSPECTION )
6. **INSPECT DRIVE BELT**
  - a. Visually check the driver belt for excessive wear, frayed cords, etc. If any defect is found, replace the drive belt.

**HINT:**

Cracks on the rib side of a drive belt are considered acceptable. If the drive belt has chunks missing from the ribs, it should be replaced.

**7. INSPECT IGNITION TIMING****NOTE:**

- Turn all electrical systems OFF.
- Operate the inspection when the cooling fan motor is turned OFF.



**Fig. 1: Identifying Drive Belt Incorrect Position**  
**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- a. Warm up the engine.
- b. When using the Techstream.
  1. Connect the Techstream to the DLC3.
  2. Enter the following menu items:

Select: Powertrain/Engine and ECT/Data List/IGN Advance.

3. Inspect the ignition timing during idling.

**Ignition timing:**

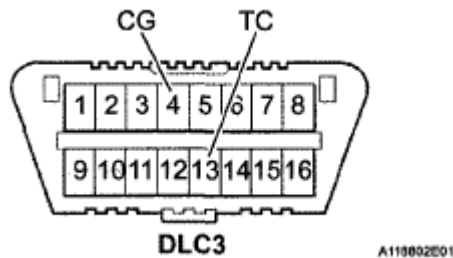
**7 to 24° BTDC @ idle (Transmission in neutral position)**

4. Check that the ignition timing advances immediately when the engine speed is increased.
- c. When not using Techstream.
1. Using SST, connect the terminals 13 (TC) and 4 (CG) of the DLC3.

**SST 09843-18040**

**NOTE:** Be sure not to connect the terminals wrongly. It causes breakage of the engine.

2. Remove the air cleaner.

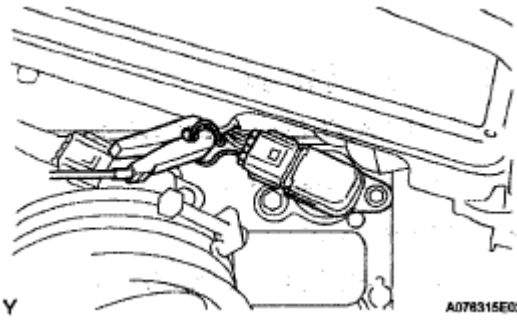


**Fig. 2: Identifying DLC3 Connector Terminal**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. Pull out the wire harness as shown in the illustration.
4. Connect the tester probe of a timing light to the wire of the ignition coil connector for No. 1 cylinder.

**NOTE:**

- Use a timing light that detects the first signal.
- After checking, be sure to wrap the wire harness with tape.



**Fig. 3: Identifying Wire Harness**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. Inspect the ignition timing during idling.

**Ignition timing:**

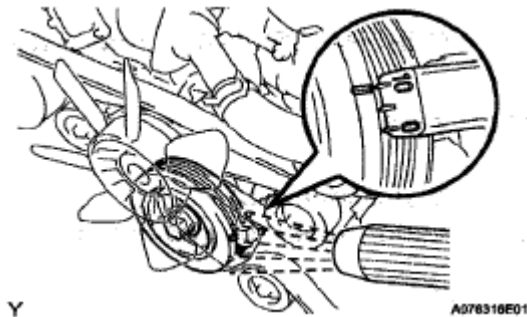
**8 to 12° BTDC @ idle (Transmission in neutral position)**

6. Remove the SST from the DLC3.
7. Inspect the ignition timing during idling.

**Ignition timing:**

**7 to 24° BTDC @ idle (Transmission in neutral position)**

8. Install the air cleaner.



**Fig. 4: Inspecting Ignition Timing**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**8. INSPECT ENGINE IDLING SPEED**

**NOTE:**

- Turn all the electrical systems OFF.
- Operate the inspection when the cooling fan motor is turned OFF.

- a. Warm up the engine.
- b. When using the Techstream:
  1. Connect the Techstream to the DLC3.
  2. Enter the following menu items:

Select: Powertrain/Engine and ECT/Data List/Engine Speed.

3. Inspect the engine idling speed.

**Idling speed:**

**650 to 750 rpm (Transmission in neutral position)**

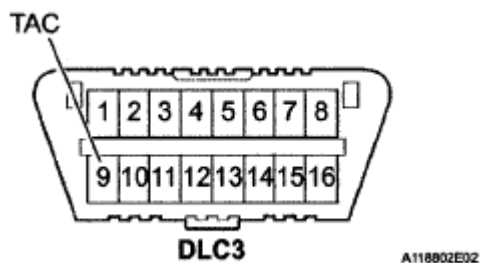
- c. When not using the Techstream:
  1. Using SST, connect the terminal 8 (TAC) of the DLC3.

**SST 09843-18030**

2. Race the engine speed at 2,500 rpm for approximately 90 seconds.
3. Inspect the engine idling speed.

**Idling speed:**

**650 to 750 rpm (Transmission in neutral position)**



**Fig. 5: Identifying DLC3 Connector Terminal**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 9. INSPECT COMPRESSION

- a. Warm up and stop the engine.
- b. Remove the circuit opening relay.
- c. Remove the V-bank cover.
- d. Remove the air cleaner assembly.
- e. Remove the ignition coils.
- f. Remove the spark plugs.
- g. Inspect the cylinder compression pressure.

1. Insert a compression gage into the spark plug hole.

**SST 09992-00500**

2. Fully open the throttle.
3. While cranking the engine, measure the compression pressure.

**Compression pressure:**

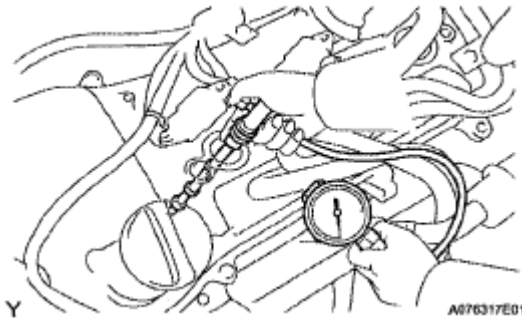
**1,300 kPa (13.3 kgf/cm<sup>2</sup> , 189 psi)**

**Minimum pressure:**

**1,000 kPa (10.2 kgf/cm<sup>2</sup> , 145 psi)**

**Difference between each cylinder:**

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



**Fig. 6: Inspecting Cylinder Compression Pressure**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:**

- Use a fully-charged battery so the engine speed can be increased to 250 rpm or more.
  - Inspect the other cylinders in the same way.
  - Measure the compression in as short a time as possible.
4. If the cylinder compression is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat steps (1) through (3) for cylinders with low compression.
    - If adding oil increases the compression, the piston rings and/or cylinder bore may be worn or damaged.
    - If pressure stays low, a valve may be stuck or seated improperly, or there may be leakage from the gasket.

# 10. INSPECT CO/HC

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

## HINT:

- Complete the measurement within 3 minutes.
  - When carrying out the 2 modes (idling and 2,500 rpm) test, the measurement orders are prescribed by the applicable local regulations.
- e. If the CO/HC concentration does not comply with regulations, troubleshoot in the order given below.
1. Check the heated oxygen sensor operation.

## TROUBLESHOOTING CHART

| CO     | HC   | Problems                                | Causes                                                                                                                                                                                                                                                                                                                       |
|--------|------|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Normal | High | Rough idling                            | <ol style="list-style-type: none"><li>1. Faulty ignition:<ul style="list-style-type: none"><li>○ Incorrect timing</li><li>○ Fouled, shorted or improperly gapped plugs</li></ul></li><li>2. Incorrect valve clearance</li><li>3. Leaky intake and exhaust valves</li><li>4. Leaky cylinders</li></ol>                        |
| Low    | High | Rough idling (Fluctuating HC reading)   | <ol style="list-style-type: none"><li>1. Vacuum leaks:<ul style="list-style-type: none"><li>○ PCV hoses</li><li>○ Intake manifold</li><li>○ Throttle body</li><li>○ IAC valve</li><li>○ Brake booster line</li></ul></li><li>2. Lean mixture causing misfire</li></ol>                                                       |
| High   | High | Rough idling (Black smoke from exhaust) | <ol style="list-style-type: none"><li>1. Restricted air filter</li><li>2. Plugged PCV valve</li><li>3. Faulty EFI systems:<ul style="list-style-type: none"><li>○ Faulty pressure regulator</li><li>○ Faulty engine coolant temperature sensor</li><li>○ Faulty mass air flow meter</li><li>○ Faulty ECM</li></ul></li></ol> |

- Faulty injectors
- Faulty throttle position sensor

## DRIVE BELT

### ON-VEHICLE INSPECTION

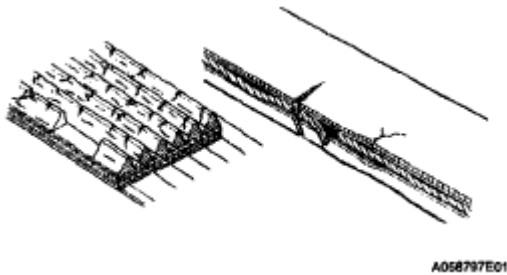
#### 1. INSPECT DRIVE BELT

- a. Visually check the drive belt for excessive wear frayed cords, etc. If any defect is found, replace the drive belt

HINT:

Cracks on the rib side of a drive belt are considered acceptable.

If the drive belt has chunks missing from the ribs, it should be replaced.



**Fig. 7: Identifying Drive Belt Cracks**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

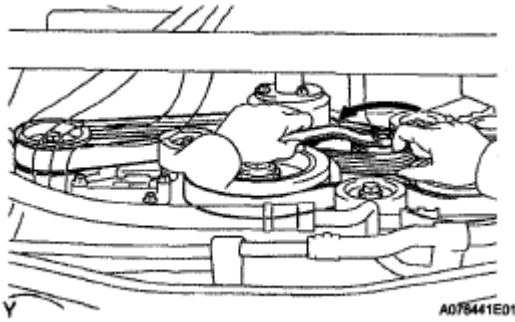
### REMOVAL

1. **REMOVE NO.1 ENGINE UNDER COVER SUB-ASSEMBLY (for Pre Runner and 4WD Type)**
  - a. Remove the 4 bolts, then remove the under cover No. 1.
2. **REMOVE FAN AND GENERATOR V BELT**
  - a. While releasing the belt tension by turning the belt tensioner counterclockwise, remove the V-ribbed belt from the belt tensioner.

### INSTALLATION

#### 1. INSPECT V-RIBBED BELT TENSIONER ASSEMBLY

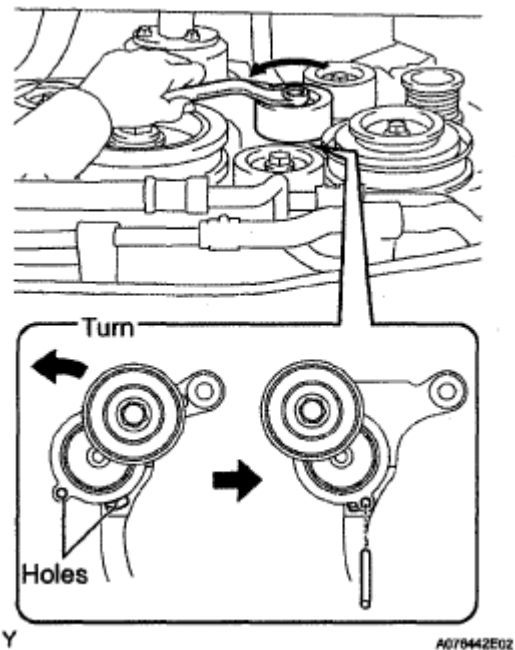
- a. Check that nothing gets caught in the tensioner by turning it clockwise and counterclockwise. If a malfunction exists, replace the tensioner.



**Fig. 8: Removing Fan And Generator V Belt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

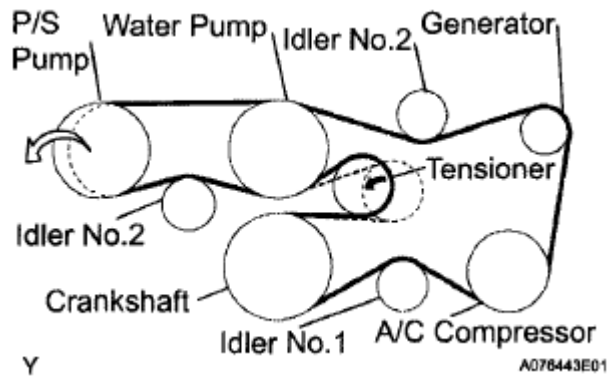
## 2. INSTALL FAN AND GENERATOR V BELT

- a. While turning the belt tensioner counterclockwise, align with its holes, and then insert a bar of 6 mm (0.24 in.) into the holes to fix the belt tensioner.
- b. Install the V-ribbed belt.
- c. While turning the belt tensioner counterclockwise, remove the bar.



**Fig. 9: Installing Fan And Generator V Belt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. If it is hard to install the V-ribbed belt, perform the following procedure.
  1. Put the V-ribbed belt on all parts except the P/S pump, as shown in the illustration.
  2. While releasing the belt tension by turning the belt tensioner counterclockwise, put the V-ribbed belt on the P/S pump.



**Fig. 10: Identifying Drive Belt And Components**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

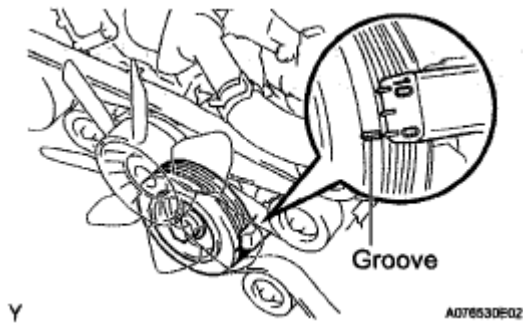
3. **INSTALL NO.1 ENGINE UNDER COVER SUB-ASSEMBLY (for Pre Runner and 4WD Type)**
  - a. Install the engine under cover with the 4 bolts.

**Torque: 29 N\*m (296 kgf\*cm, 21 ft.\*lbf)**

## VALVE CLEARANCE

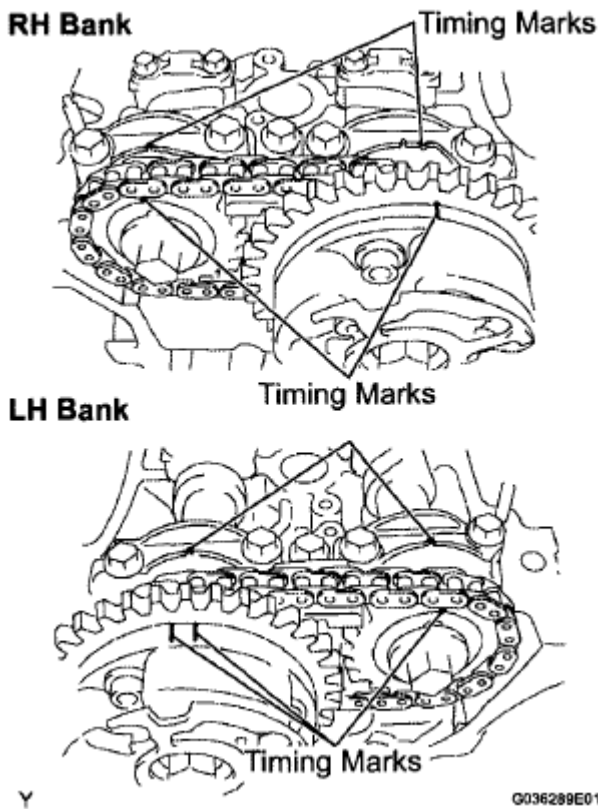
### ADJUSTMENT

1. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**
2. **DRAIN ENGINE COOLANT (See COOLANT )**
3. **REMOVE V-BANK COVER (See ON-VEHICLE INSPECTION )**
4. **REMOVE AIR CLEANER ASSEMBLY (See REMOVAL )**
5. **REMOVE INTAKE AIR SURGE TANK (See REMOVAL )**
6. **REMOVE IGNITION COIL ASSEMBLY (See IGNITION COIL )**
7. **REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY (See REMOVAL )**
8. **REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY LH (See REMOVAL )**
9. **SET NO.1 CYLINDER TO TDC/COMPRESSION**
  - a. Turn the crankshaft pulley until its groove and the timing mark "0" of the timing chain cover are aligned.



**Fig. 11: Identifying Crankshaft Pulley Groove**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Check that the timing marks of the camshaft timing gears are aligned with the timing marks of the bearing cap as shown in the illustration. If not, turn the crankshaft 1 complete revolution (360°) and align the timing marks above.



**Fig. 12: Identifying Timing Marks Of Camshaft Timing Gears**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

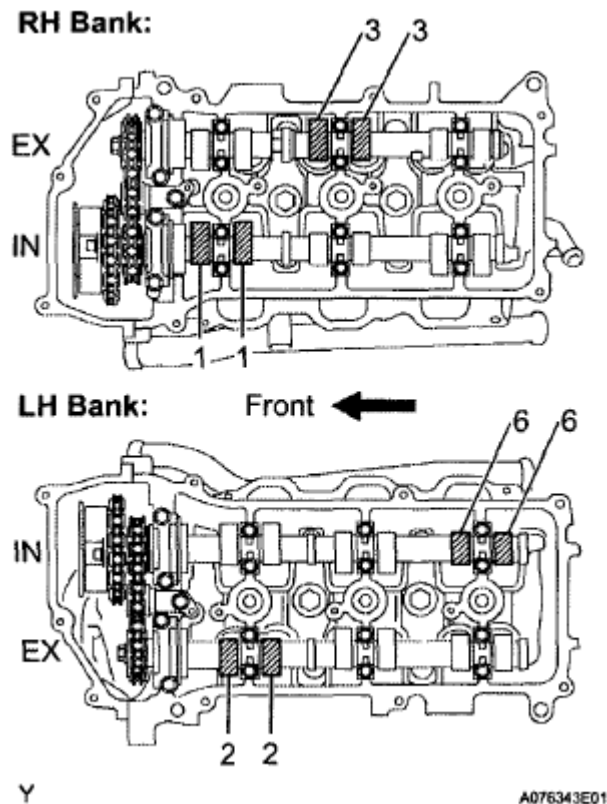
## 10. INSPECT VALVE CLEARANCE

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

**Valve clearance (Cold):**

**Intake 0.15 to 0.25 mm (0.006 to 0.010 in.) Exhaust 0.29 to 0.39 mm (0.011 to 0.015 in.)**

2. Record any out-of-specification valve clearance measurements. They will be used later to determine the required replacement valve lifter.



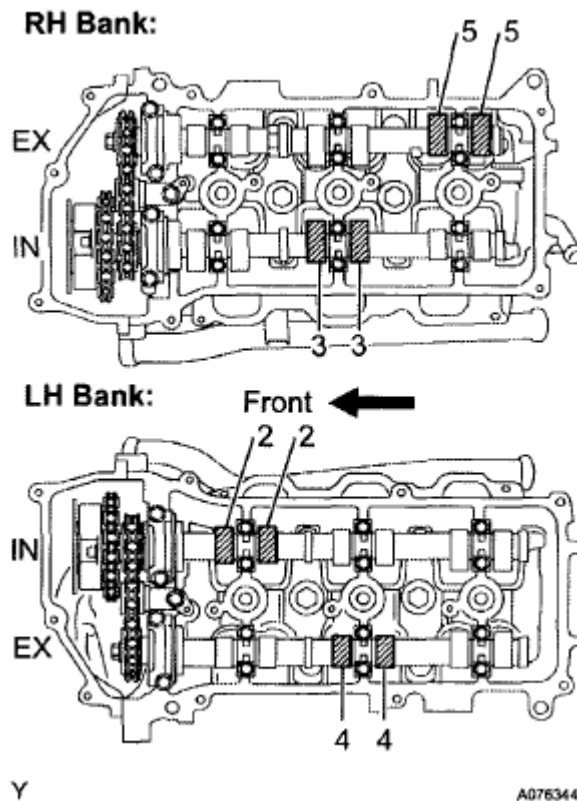
**Fig. 13: Identifying Valve Clearance Between Valve Lifter And Camshaft**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Turn the crankshaft 240° clockwise, and check the valves indicated in the illustration.
  1. Using a feeler gauge, measure the clearance between the valve lifter and camshaft.

**Valve clearance (Cold):**

**Intake 0.15 to 0.25 mm (0.006 to 0.010 in.) Exhaust 0.29 to 0.39 mm (0.011 to 0.015 in.)**

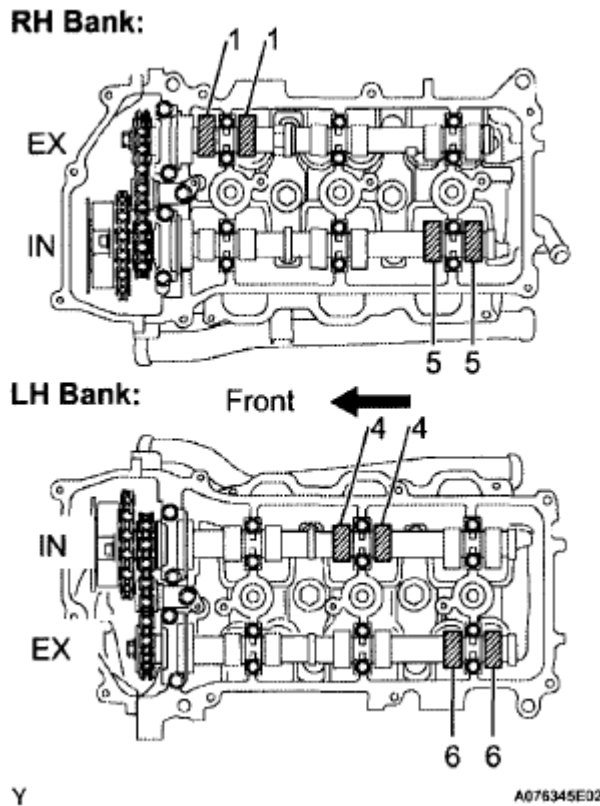
2. Record any out-of-specification valve clearance measurements. They will be used later to determine the required replacement valve lifter.



**Fig. 14: Identifying Valve Clearance Between Valve Lifter And Camshaft**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Turn the crankshaft 240° clockwise, and check the valves indicated in the illustration.
  1. Using a feeler gauge, measure the clearance between the valve lifter and camshaft.
  2. **Valve clearance (Cold): Intake 0.15 to 0.25 mm (0.006 to 0.010 in.) Exhaust 0.29 to 0.39 mm (0.011 to 0.015 in.)**

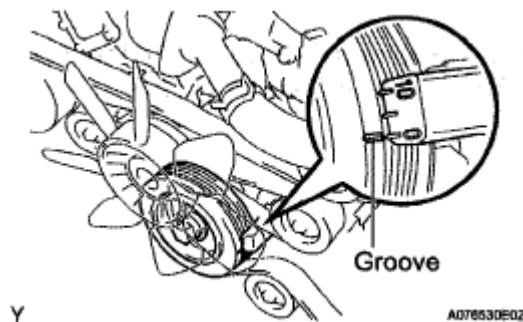
Record any out-of-specification valve clearance measurements. They will be used later to determine the required replacement valve lifter.



**Fig. 15: Identifying Valve Clearance Between Valve Lifter And Camshaft**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

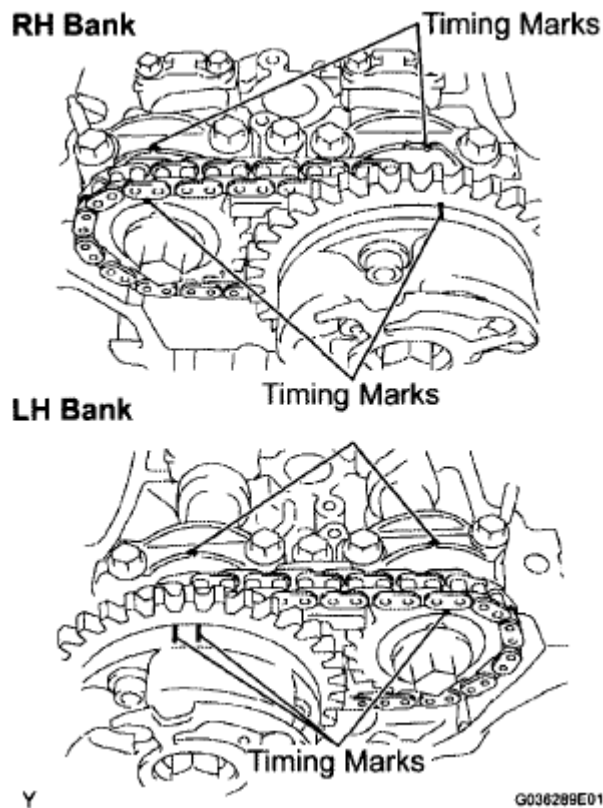
## 11. ADJUST VALVE CLEARANCE

- a. Set No. 1 cylinder to TDC/compression.
  1. Turn the crankshaft pulley until its groove and the timing mark "0" of the timing chain cover are aligned.



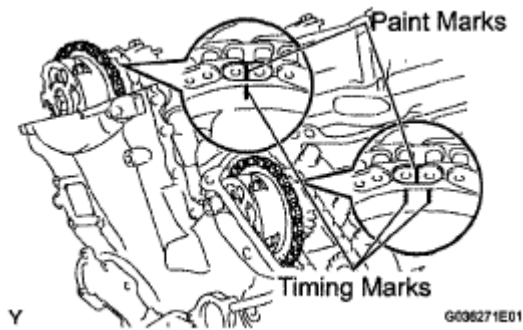
**Fig. 16: Identifying Crankshaft Pulley Groove**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Check that the timing marks of the camshaft timing gears are aligned with the timing marks of the bearing cap as shown in the illustration. If not, turn the crankshaft 1 complete revolution (360°) and align the timing marks as above.



**Fig. 17: Identifying Timing Marks Of Camshaft Timing Gears**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. Place paint marks on the No. 1 chain links corresponding to the timing marks of the camshaft timing gears.
  - b. Remove the chain tensioner assembly No. 1.
  - c. Remove the No. 2 camshaft.
  - d. Remove the chain tensioner assembly No. 2.
  - e. Remove the camshaft.
  - f. Remove the No. 4 camshaft sub-assembly.
  - g. Remove the chain tensioner assembly No. 3.
  - h. Remove the No. 3 camshaft sub-assembly.
  - i. Remove the valve lifters.



**Fig. 18: Identifying Paint Marks On No. 1 Chain Links**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- j. Determine the replacement valve lifter size according to the following formulas and charts:
1. Using a micrometer, measure the thickness of the removed lifter.
  2. Calculate the thickness of a new lifter so that the valve clearance comes within the specified value.

**T:**

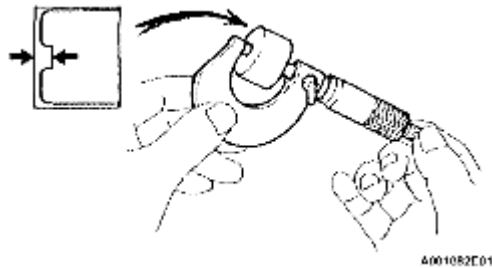
**Thickness of removed lifter**

**A:**

**Measured valve clearance**

**N:**

**Thickness of new lifter**



**Fig. 19: Measuring Thickness Of Removed Lifter**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Intake:**

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

**Exhaust:**

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

3. Select a new lifter with a thickness as close as possible to the calculated value.

HINT:

Lifters are available in 35 sizes in increments of 0.020 mm (0.0008 in.), from 5.060 mm (0.1992 in.) to 5.740 mm (0.2260 in.).

## 2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma



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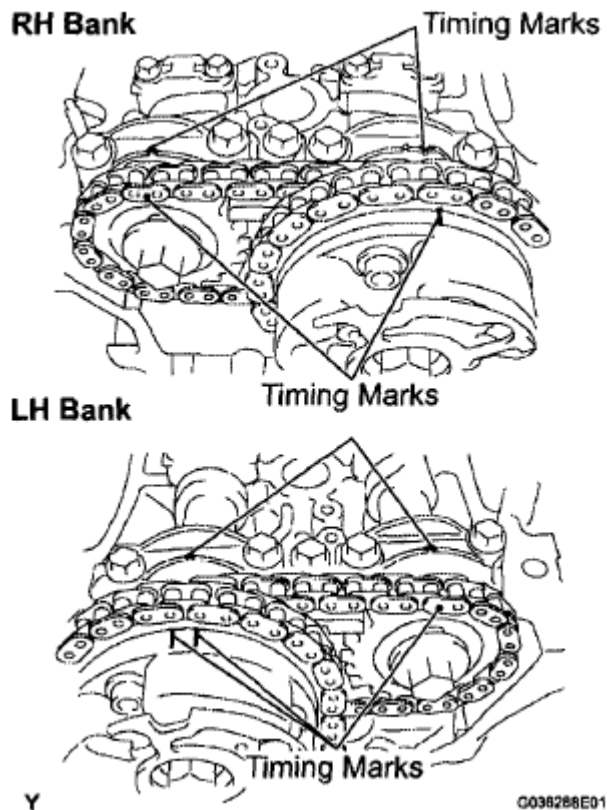
## 2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma

2

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- m. Install the No. 4 camshaft sub-assembly.
  - n. Install the camshaft.
  - o. Install the chain tensioner assembly No. 2.
  - p. Install the No. 2 camshaft.
  - q. Install the chain tensioner assembly No. 1.
    - 1. Check that the timing marks of the camshaft timing gears are aligned with the timing marks of the bearing cap as shown in the illustration.
12. **INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY LH** (See INSTALLATION )
13. **INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY** (See INSTALLATION )
14. **INSTALL IGNITION COIL ASSEMBLY**
- Torque: 10 N\*m (102 kgf\*cm, 7.4 ft.\*lbf)**
15. **INSTALL INTAKE AIR SURGE TANK** (See INSTALLATION )
16. **INSTALL AIR CLEANER ASSEMBLY** (See INSPECTION )
17. **ADD ENGINE COOLANT** (See COOLANT )
18. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**
19. **CHECK FOR ENGINE COOLANT LEAKAGE** (See REPLACEMENT )



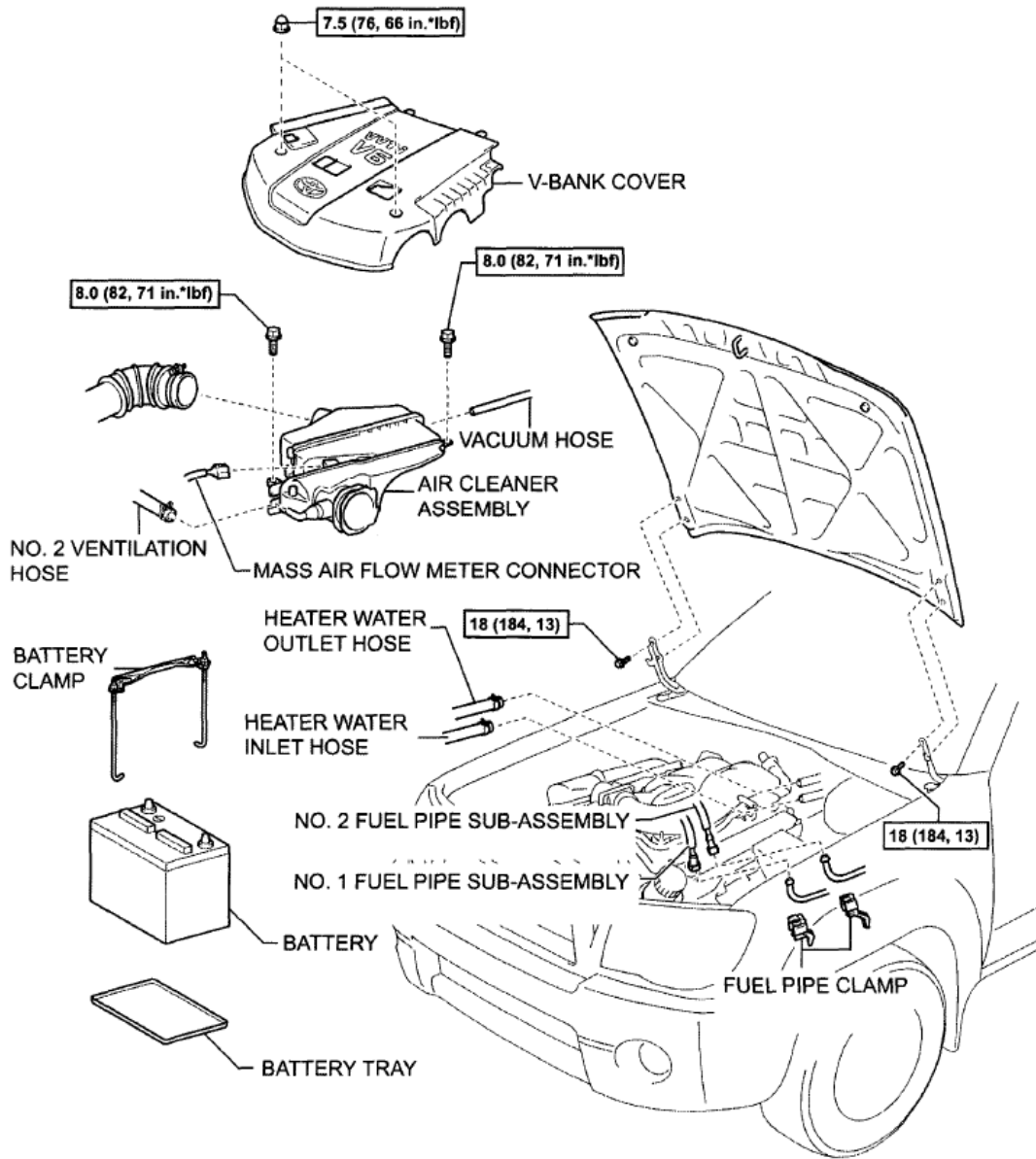
**Fig. 22: Identifying Timing Marks Of Camshaft Timing Gears**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**20. INSTALL V-BANK COVER**

- a. Install the V-bank cover with the 2 nuts.

**Torque: 7.5 N\*m (76 kgf\*cm, 66 in.\*lbf)**

**21. INSPECT IGNITION TIMING (See ON-VEHICLE INSPECTION )****TIMING CHAIN (FOR 2WD)****COMPONENTS**



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

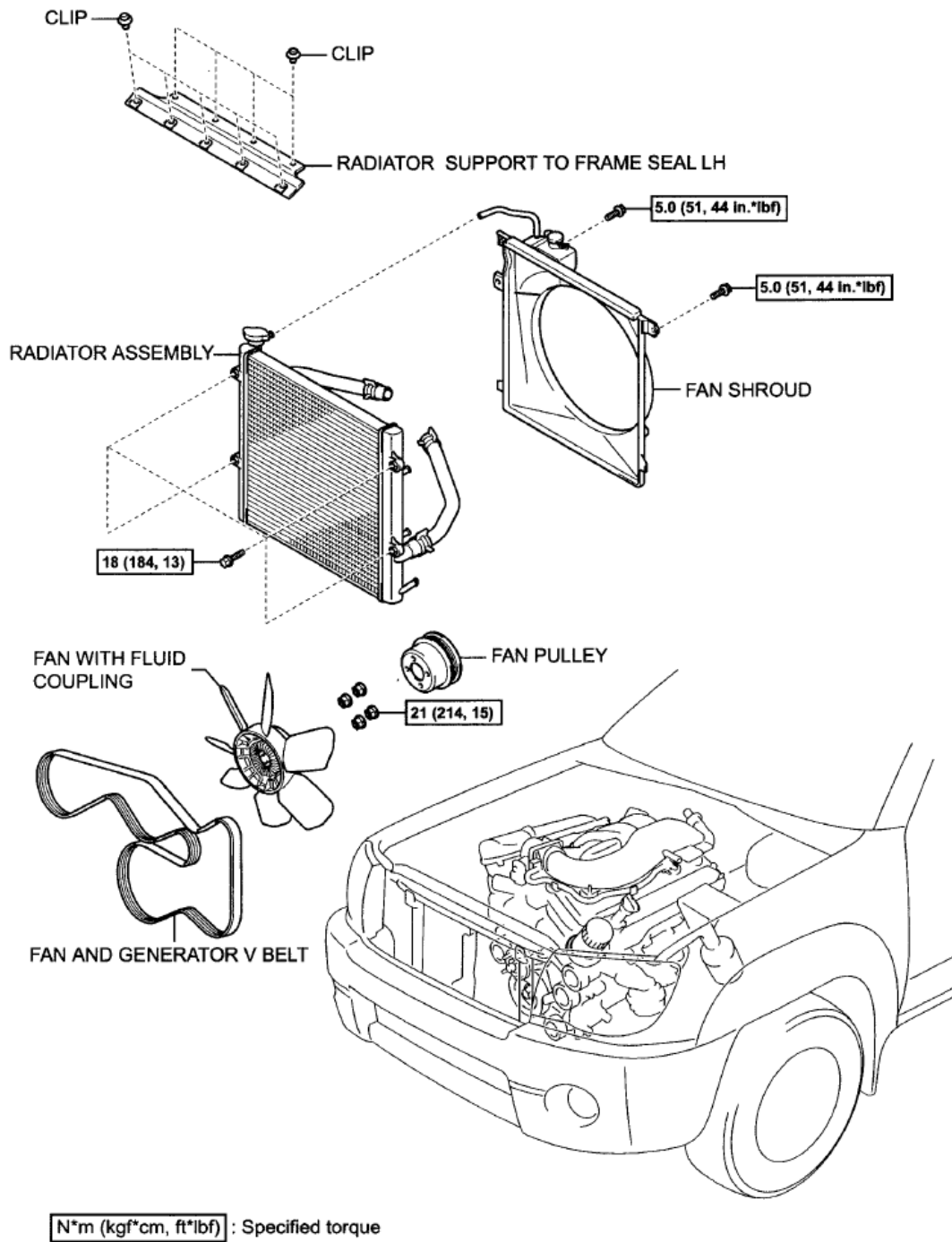
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**Fig. 23: Exploded View Of Timing Chain Components With Torque Specification (1 Of 10)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 2009 Toyota Tacoma

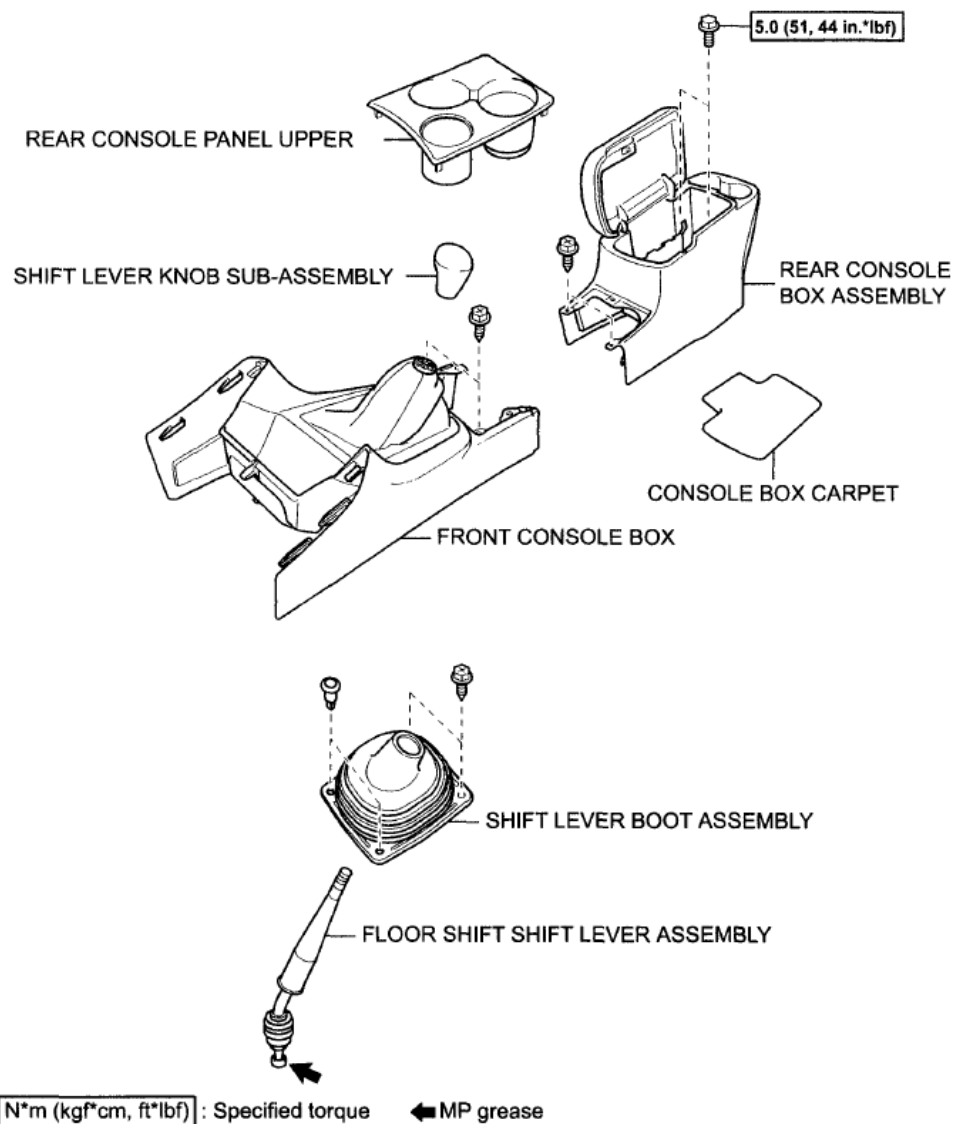
2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma



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**Fig. 24: Exploded View Of Timing Chain Components With Torque Specification (2 Of 10)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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**Fig. 25: Exploded View Of Timing Chain Components With Torque Specification (3 Of 10)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma

MANIFOLD STAY x3 40 (408, 30)

MANUAL TRANSMISSION CASE COVER

CLUTCH ACCUMULATOR ASSEMBLY

CLUTCH RELEASE CYLINDER TO FLEXIBLE HOSE TUBE

STARTER ASSEMBLY

NO. 2 MANIFOLD STAY 37 (377, 27) 72 (730, 53)

NO. 1 CLUTCH HOUSING COVER 15 (155, 11) 12 (120, 8.7)

FRONT EXHAUST PIPE ASSEMBLY

REAR NO. 1 ENGINE MOUNTING INSULATOR

EXHAUST PIPE STOPPER BRACKET

NO. 3 FRAME CROSSMEMBER SUB-ASSEMBLY

NO. 2 ENGINE UNDER COVER SUB-ASSEMBLY

PROPELLER WITH CENTER BEARING SHAFT ASSEMBLY

FRONT NO. 2 EXHAUST PIPE ASSEMBLY

● GASKET

48 (489, 35) x2

43 (438, 32) x3

65 (663, 48)

19 (194, 14) x2

40 (408, 30)

19 (189, 14) x4

40 (408, 30) x2

88 (899, 65) x2

62 (632, 46) x2

36 (369, 27) x2

30 (306, 22) x4

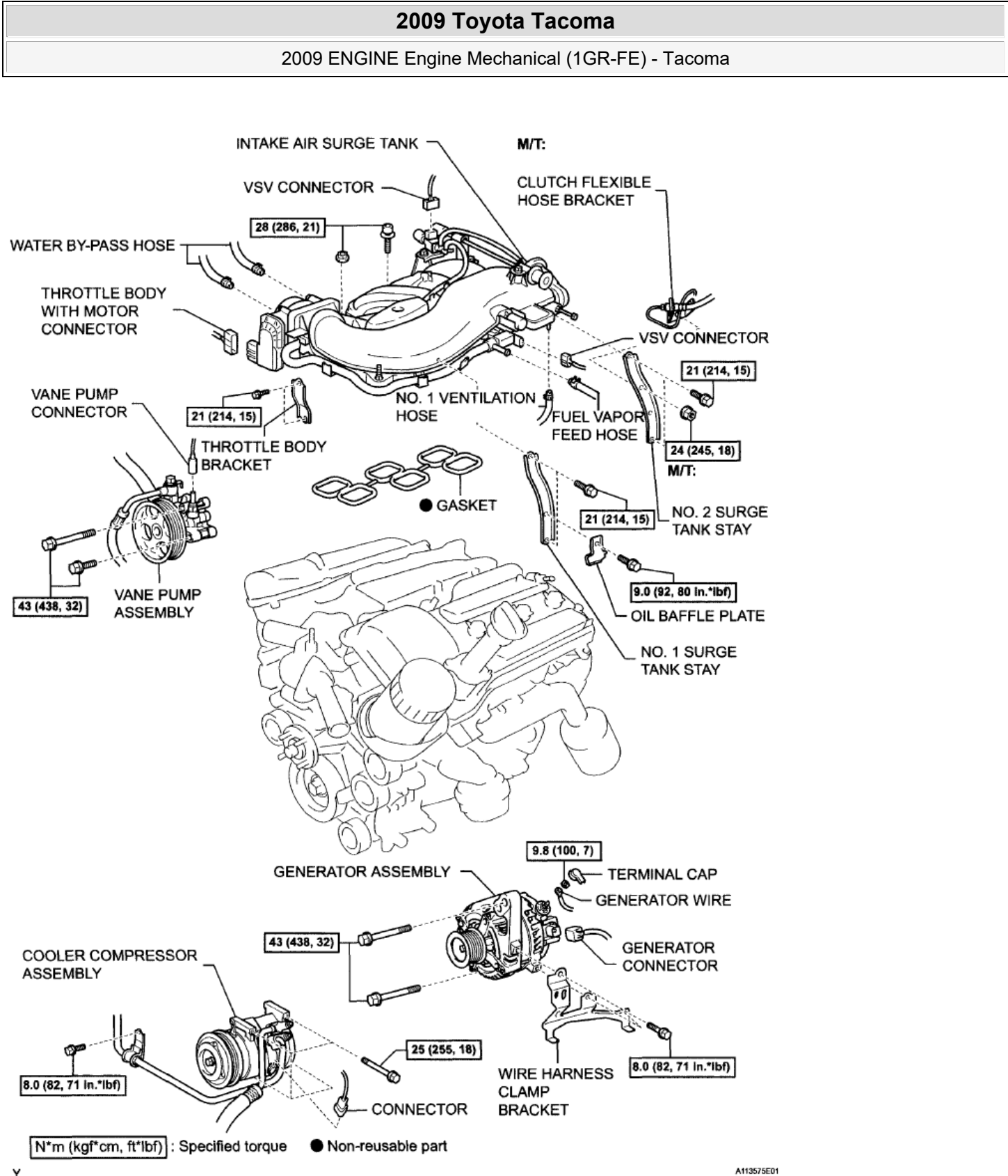
N\*m (kgf\*cm, ft\*lb) : Specified torque

● Non-reusable part

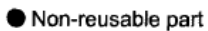
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| 2009 Toyota Tacoma                              |
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| 2009 Toyota Tacoma                              |
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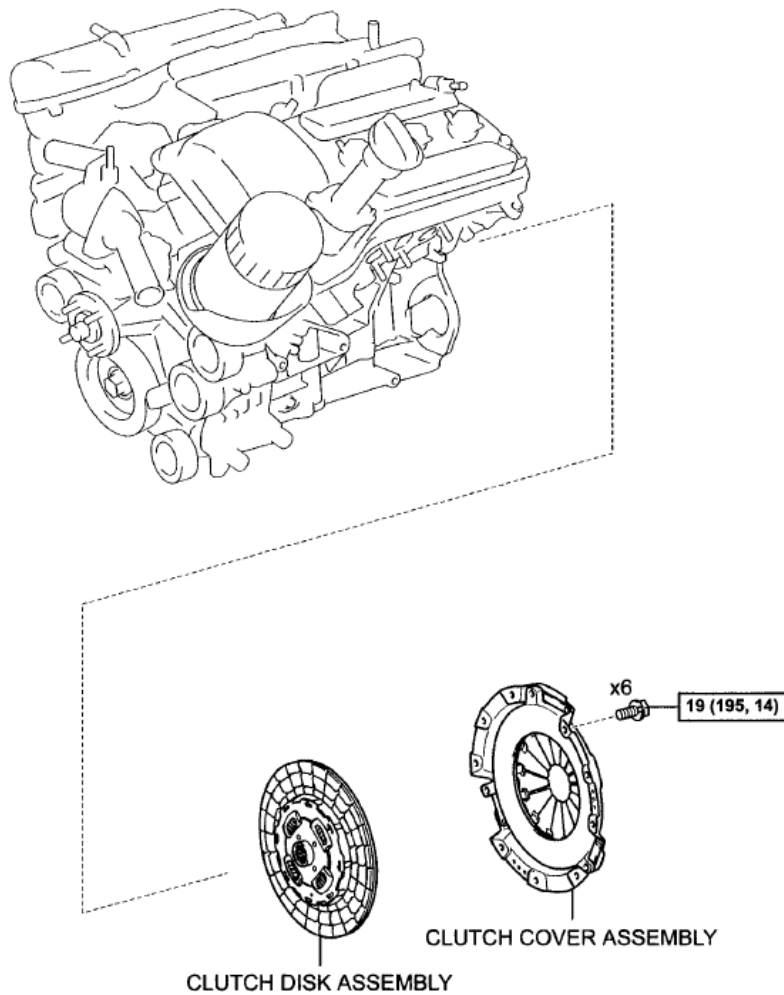


**Fig. 27: Exploded View Of Timing Chain Components With Torque Specification (5 Of 10)**  
**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**



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**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**



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

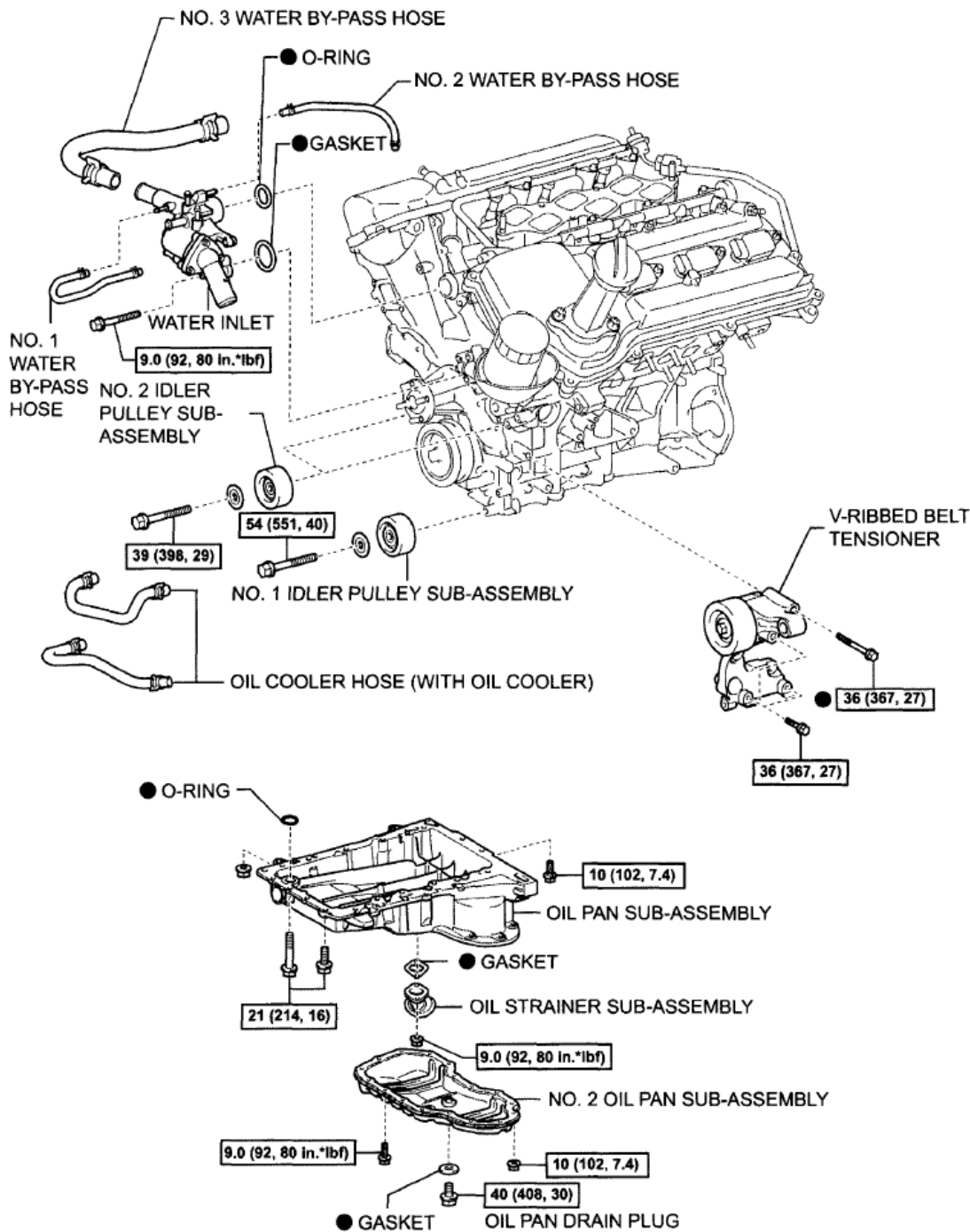
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**Fig. 29: Exploded View Of Timing Chain Components With Torque Specification (7 Of 10)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

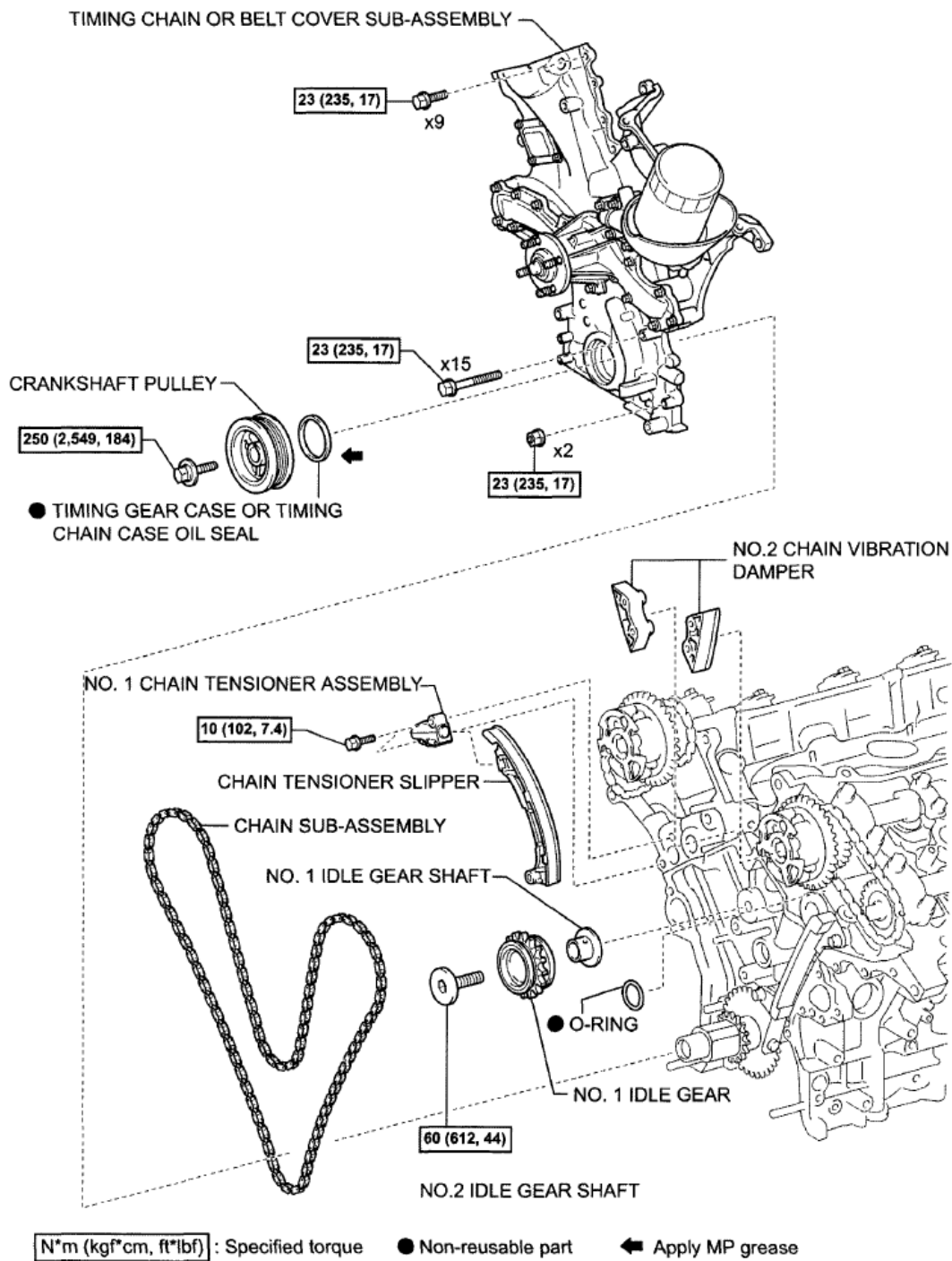
## 2009 Toyota Tacoma

2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma



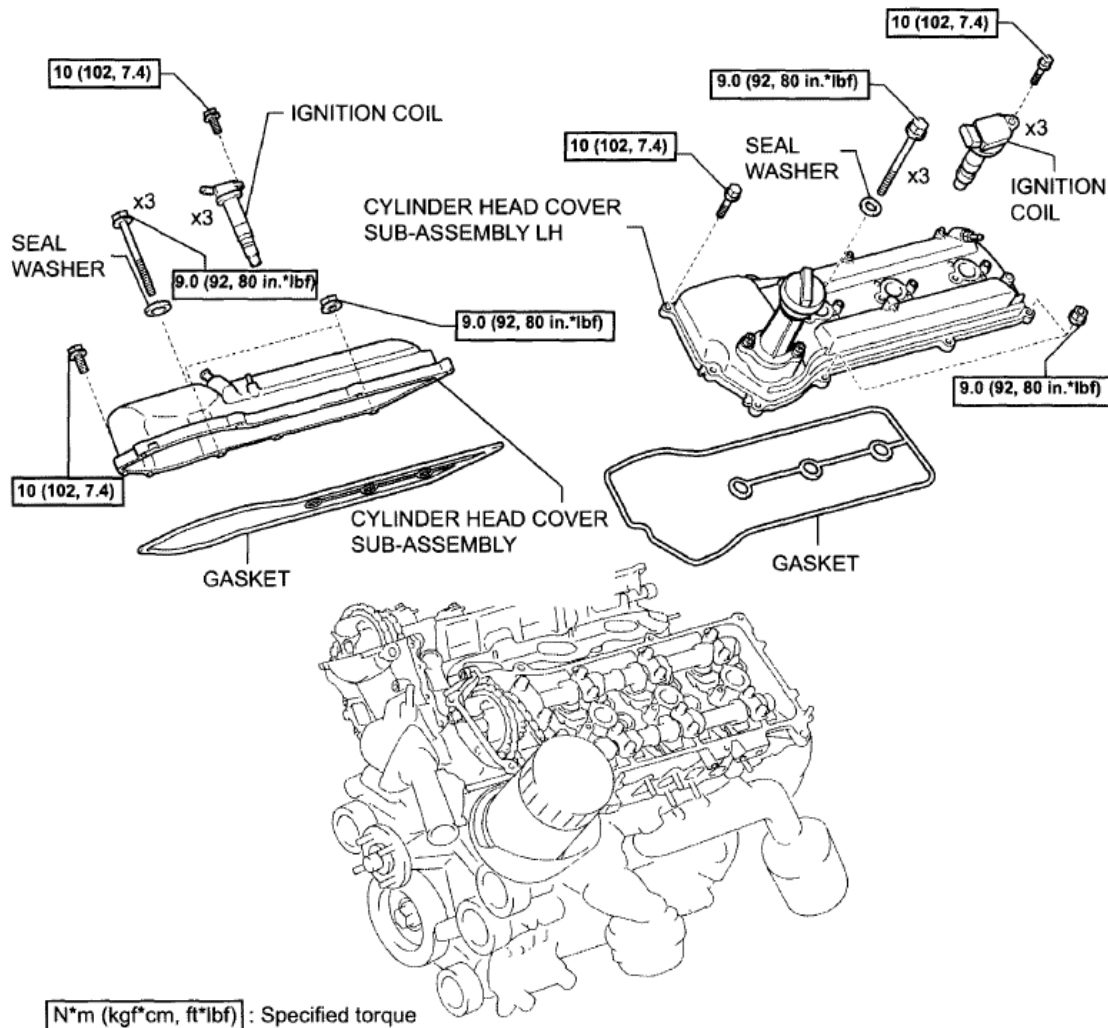
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**Fig. 30: Exploded View Of Timing Chain Components With Torque Specification (8 Of 10)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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**Fig. 31: Exploded View Of Timing Chain Components With Torque Specification (9 Of 10)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 32: Exploded View Of Timing Chain Components With Torque Specification (10 Of 10)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## REMOVAL

### 1. DISCHARGE FUEL SYSTEM PRESSURE

(See **FUEL SYSTEM**)

### 2. REMOVE BATTERY

### 3. DRAIN ENGINE COOLANT (See **COOLANT**)

### 4. DRAIN ENGINE OIL (See **OIL FILTER**)

### 5. REMOVE ENGINE ASSEMBLY

(See **REMOVAL**)

**6. REMOVE OIL LEVEL GAGE GUIDE**

- a. Remove the oil level gauge.
- b. Remove the bolt and pull out the oil level gauge guide.
- c. Remove the O-ring from the oil level gauge guide.

**7. REMOVE WATER INLET (See THERMOSTAT )**

**8. REMOVE V-RIBBED BELT TENSIONER ASSEMBLY (See REMOVAL )**

**9. REMOVE NO.2 IDLER PULLEY SUB-ASSEMBLY**

- a. Remove the 2 bolts, then remove the idler pulley No. 2.

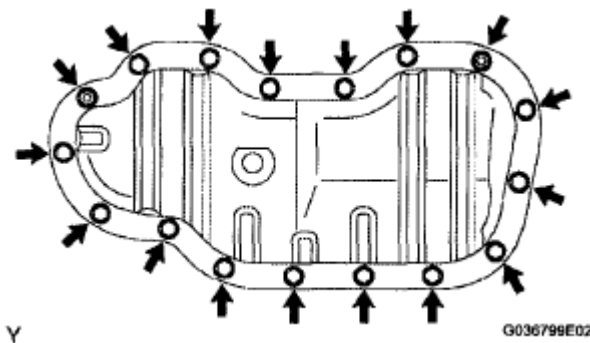
**10. REMOVE NO.1 IDLER PULLEY SUB-ASSEMBLY**

- a. Remove the bolt, then remove the idler pulley No. 1.

**11. REMOVE CRANKSHAFT PULLEY (See REMOVAL )**

**12. REMOVE NO.2 OIL PAN SUB-ASSEMBLY**

- a. Remove the 15 bolts and 2 nuts.



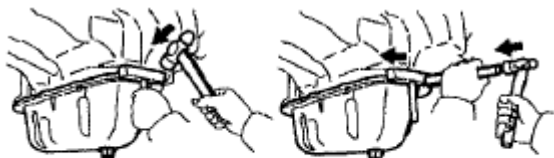
**Fig. 33: Locating No.2 Oil Pan Sub-Assembly**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Insert the blade of the oil pan seal cutter between the oil pan and oil pan No. 2, cut off applied sealer and remove the oil pan No. 2.

**NOTE:**

- Be careful not to damage the contact surfaces of the oil pan and oil pan No. 2

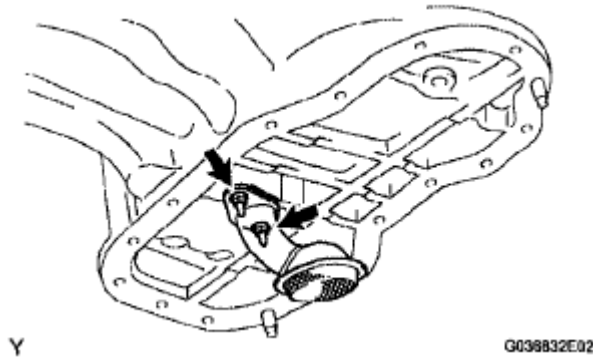


**Fig. 34: Removing Oil Pan No. 2**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### 13. REMOVE OIL STRAINER SUB-ASSEMBLY

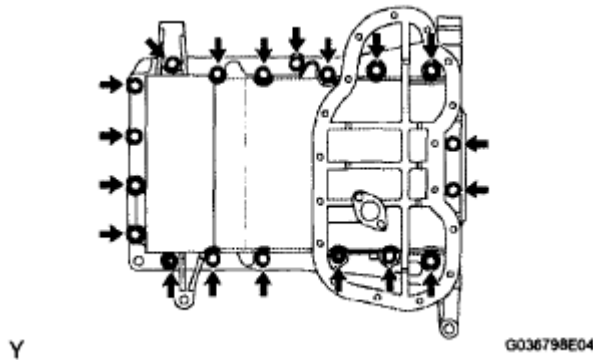
- a. Remove the 2 nuts, then remove the oil strainer and gasket.



**Fig. 35: Locating Oil Strainer And Nuts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### 14. REMOVE OIL PAN SUB-ASSEMBLY

- a. Remove the 17 bolts and 2 nuts.



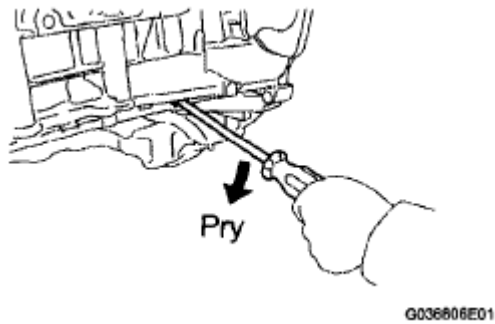
**Fig. 36: Locating Oil Pan Bolts And Nuts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

### 15. REMOVE INTAKE AIR SURGE TANK (See REMOVAL )

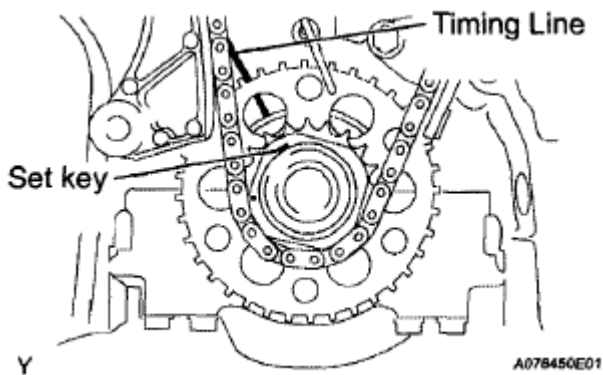
### 16. REMOVE IGNITION COIL ASSEMBLY (See IGNITION COIL )



**Fig. 37: Removing Oil Pan**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

17. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY (See REMOVAL )
18. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY LH (See REMOVAL )
19. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (See CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY )
20. REMOVE VVT SENSOR (See VVT SENSOR )
21. REMOVE TIMING CHAIN OR BELT COVER SUB-ASSEMBLY (See REMOVAL )
22. REMOVE TIMING GEAR CASE OR TIMING CHAIN CASE OIL SEAL (See REPLACEMENT )
23. SET NO.1 CYLINDER TO TDC/COMPRESSION
  - a. Using the crankshaft pulley set bolt, turn the crankshaft to align the crankshaft set key with the timing line of the cylinder block.



**Fig. 38: Identifying Crankshaft Pulley Timing Mark**

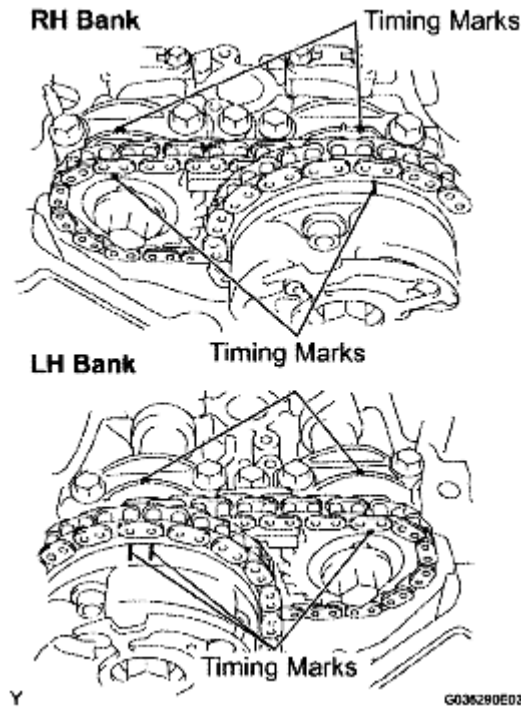
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Check that the timing marks of the camshaft timing gears are aligned with the timing marks of the bearing cap as shown in the illustration. If not, turn the crankshaft 1 complete revolution (360°) and align the timing marks as above.
24. REMOVE NO.1 CHAIN TENSIONER ASSEMBLY

**NOTE:**

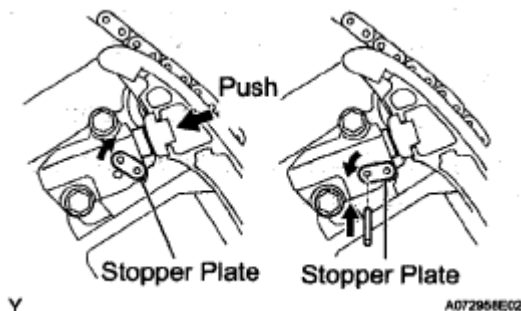
- Never rotate the crankshaft with the chain tensioner removed.

- When rotating the camshaft with the timing chain removed, rotate the crankshaft counterclockwise 40° from the TDC first.



**Fig. 39: Identifying Timing Marks Of Camshaft Timing Gears**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- While turning the stopper plate of the tensioner upward, push in the plunger of the chain tensioner as shown in the illustration.
- While turning the stopper plate of the tensioner down ward, insert a bar of 3.5 mm (0.138) into the holes in the stopper plate and tensioner to fix the stopper plate.
- Remove the 2 bolts, then remove the chain tensioner.



**Fig. 40: Pushing Plunger Of Chain Tensioner**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

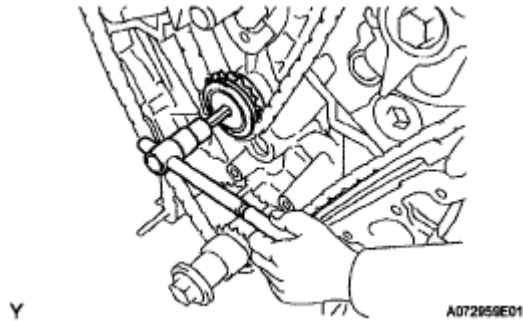
## 25. REMOVE CHAIN TENSIONER SLIPPER

**26. REMOVE IDLE SPROCKET ASSEMBLY**

- a. Using a 10 mm hexagon wrench, remove the idle gear shaft No. 2, idle gear No. 1 and idle gear shaft No. 1.

**27. REMOVE NO.2 CHAIN VIBRATION DAMPER**

- a. Remove the 2 chain vibration dampers No. 2.

**28. REMOVE CHAIN SUB-ASSEMBLY**

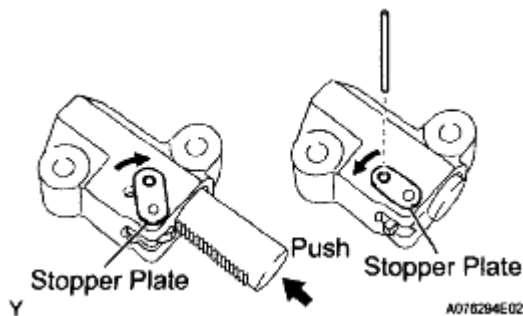
**Fig. 41: Removing Idle Sprocket Assembly**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**INSTALLATION****1. INSTALL CHAIN TENSIONER SLIPPER****2. INSTALL NO.1 CHAIN TENSIONER ASSEMBLY**

- a. While turning the stopper plate of the tensioner clockwise, push in the plunger of the tensioner as shown in the illustration.
- b. While turning the stopper plate of the tensioner counterclockwise, insert a bar of 35 mm (0.138 in.) into the holes in the stopper plate and tensioner to fix the stopper plate.
- c. Install the chain tensioner with the 2 bolts.

**Torque: 10 N\*m (102 kgf\*cm, 7.4 ft.\*lbf)**

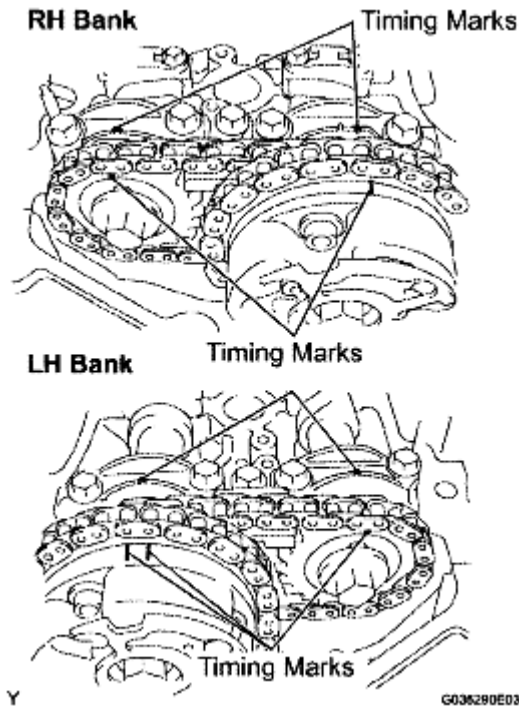


**Fig. 42: Pushing Plunger Of Tensioner**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

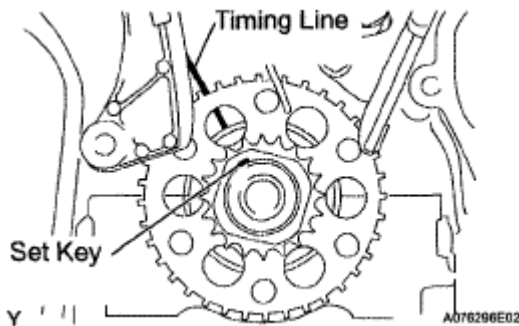
### 3. INSTALL CHAIN SUB-ASSEMBLY

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



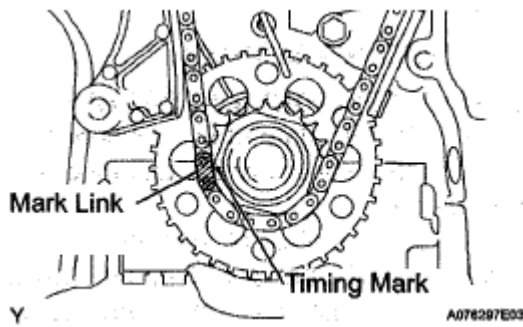
**Fig. 43: Identifying Timing Marks Of Camshaft Timing Gears**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Using the crankshaft pulley set bolt, turn the crankshaft to align the crankshaft set key with the timing line of the cylinder block.



**Fig. 44: Identifying Crankshaft Set Key With Timing Line**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Align the yellow mark link with the timing mark of the crankshaft timing link.



**Fig. 45: Aligning Timing Mark Of Crankshaft Timing Link**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

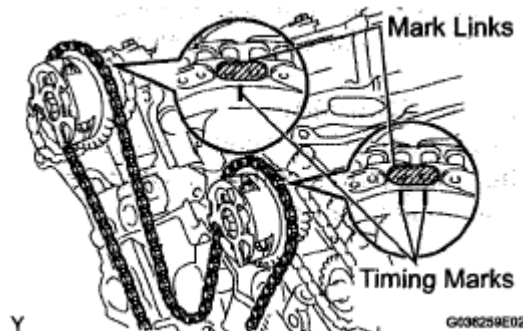
- c. Align the orange mark links with the timing marks of the camshaft timing gears, and install the chain.

**4. INSTALL NO.2 CHAIN VIBRATION DAMPER**

- a. Install the 2 chain vibration dampers No. 2.

**5. INSTALL IDLE SPROCKET ASSEMBLY**

- a. Apply a light coat of engine oil to rotating surface of the idle gear shaft No. 1.



**Fig. 46: Aligning Timing Marks Of Camshaft Timing Gears**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Temporarily install the idle gear shaft No. 1 together with idle gear shaft No. 2 while aligning the knock pin of the idle gear shaft No. 1 with the knock pin groove of the cylinder block.

**NOTE: Be careful of the idle gear direction.**

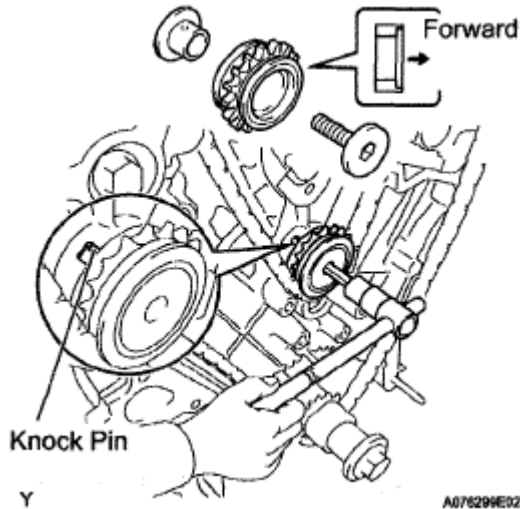
- c. Using 10 mm hexagon wrench, tighten the idle gear shaft No. 2.

**Torque: 60 N\*m (612 kgf\*cm, 44 ft.\*lbf)**

- d. Remove the bar from the chain tensioner.

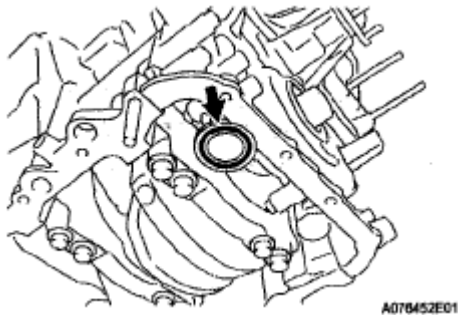
**6. INSTALL TIMING GEAR CASE OR TIMING CHAIN CASE OIL SEAL (See REPLACEMENT )**

7. INSTALL TIMING CHAIN OR BELT COVER SUB-ASSEMBLY (See INSTALLATION )
8. INSTALL VVT SENSOR (See VVT SENSOR )



**Fig. 47: Aligning Knock Pin Of Idle Gear Shaft No. 1**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (See INSPECTION )
10. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY LH (See INSTALLATION )
11. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY (See INSTALLATION )
12. INSTALL IGNITION COIL ASSEMBLY (See IGNITION COIL )
13. INSTALL INTAKE AIR SURGE TANK (See INSTALLATION )
14. INSTALL OIL PAN SUB-ASSEMBLY
  - a. Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the cylinder block, rear oil seal retainer and oil pan.
  - b. Install a new O-ring onto the oil pump.



**Fig. 48: Locating O-Ring Onto Oil Pump**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

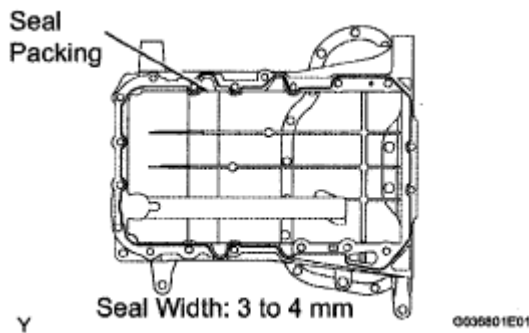
- c. Apply a continuous bead of the seal packing (diameter 3 to 4 mm (0.12 to 0.16 in.)) to the oil pan

as shown in the illustration.

**Seal packing:**

**Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent**

**NOTE:** Install the oil pan within 3 minutes of applying the seal packing. Tighten the oil pan bolts and nuts within 15 minutes of installing the oil pan. Otherwise, the seal packing must be removed and reapplied.



**Fig. 49: Identifying Seal Packing To Oil Pan**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

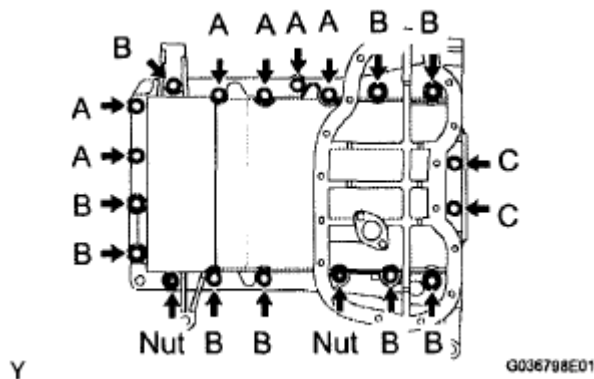
- d. Install the oil pan with the 17 bolts and 2 nuts, and tighten the bolts and nuts uniformly in several steps.

**Torque: 10 N\*m (102 kgf\*cm, 7.4 ft.\*lbf) for 10 mm (0.39 in.) head**

**21 N\*m (214 kgf\*cm, 16 ft.\*lbf) for 12 mm (0.47 in.) head**

**HINT:**

Each bolt length is as follows:



**Fig. 50: Locating Oil Pan Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### BOLT LENGTH SPECIFICATION

| Bolt | Length           |
|------|------------------|
| A    | 25 mm (0.98 in.) |
| B    | 45 mm (1.77 in.) |
| C    | 14 mm (0.55 in.) |

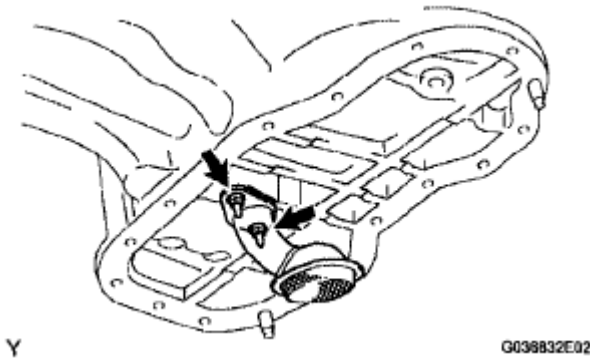
#### 15. INSTALL OIL STRAINER SUB-ASSEMBLY

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

**Torque: 9.0 N\*m (92 kgf\*cm, 80 in.\*lbf)**

#### 16. INSTALL NO.2 OIL PAN SUB-ASSEMBLY

- Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the oil pan and oil pan No. 2.



**Fig. 51: Locating Oil Strainer With Nuts**

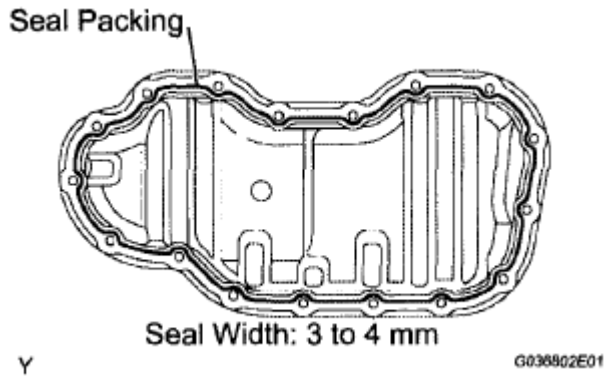
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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:**

**Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent**

**NOTE:** Install the oil pan No. 2 within 3 minutes of applying the seal packing. Tighten the oil pan No. 2 bolts and nut within 15 minutes of installing the oil pan. Otherwise, the seal packing must be removed and reapplied.

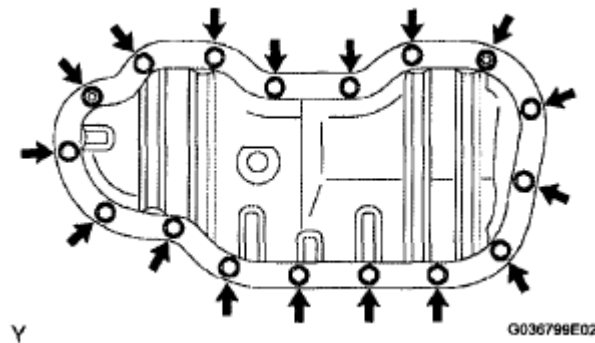


**Fig. 52: Identifying Oil Pan Seal Packing Area**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

**Torque: 9.0 N\*m (92 kgf\*cm, 80 in.\*lbf) for bolts 10 N\*m (102 kgf\*cm, 7.4 ft.\*lbf) for nuts**



**Fig. 53: Locating No.2 Oil Pan Sub-Assembly**

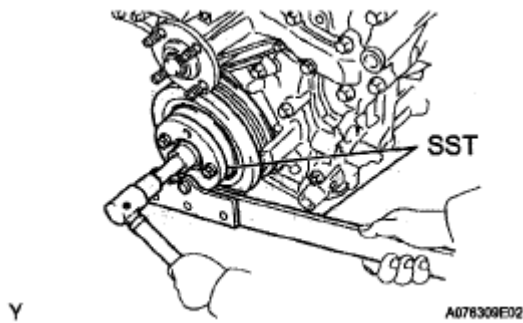
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 17. INSTALL CRANKSHAFT PULLEY

- a. Using SST, install the pulley set bolt.

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

**Torque: 250 N\*m (2,549 kgf\*cm, 184 ft.\*lbf)**



**Fig. 54: Installing Crankshaft Pulley**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

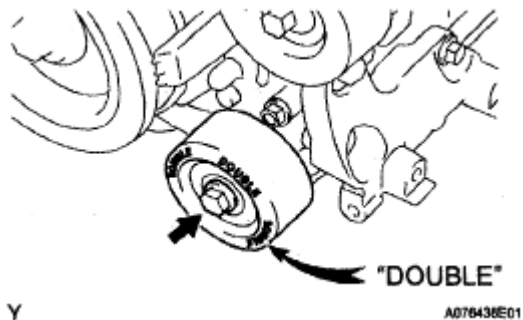
**18. INSTALL NO.1 IDLER PULLEY SUB-ASSEMBLY**

- a. Install the idler pulley with the bolt.

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

HINT:

DOUBLE is marked on the idler pulley No. 1 to distinguish it from the idler pulley No. 2.



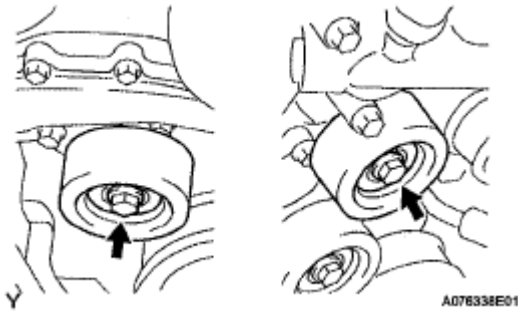
**Fig. 55: Locating Idler Pulley With Bolt**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**19. INSTALL NO.2 IDLER PULLEY SUB-ASSEMBLY**

- a. Install the 2 idler pulleys with the 2 bolts.

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



**Fig. 56: Locating Idler Pulleys With Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 20. INSTALL V-RIBBED BELT TENSIONER ASSEMBLY

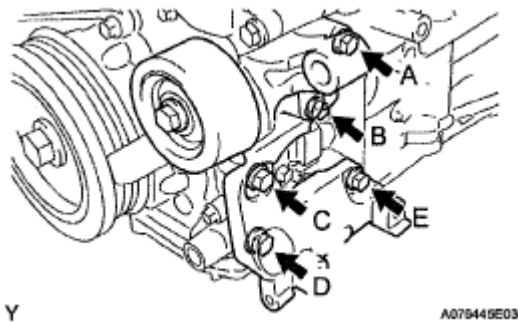
**NOTE:** A bolt in position A is not reusable.

**HINT:**

Each bolt length is as follows:

### BOLT LENGTH SPECIFICATION

| Position      | Length           |
|---------------|------------------|
| A             | 70 mm (2.76 in.) |
| B, C, D and E | 33 mm (1.30 in.) |



**Fig. 57: Locating V-Ribbed Belt Tensioner Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Use a new bolt in position A.
- Finger-tighten the bolts in positions A and E and install the bracket.
- Tighten the bolts in positions A and E.

**Torque: 36 N\*m (267 kgf\*cm, 27 ft.\*lbf)**

- Tighten the bolts in positions B, C and D.

**Torque: 36 N\*m (267 kgf\*cm, 27 ft.\*lbf)**

**21. INSTALL WATER INLET (See INSTALLATION )**

**22. INSTALL OIL LEVEL GAGE GUIDE**

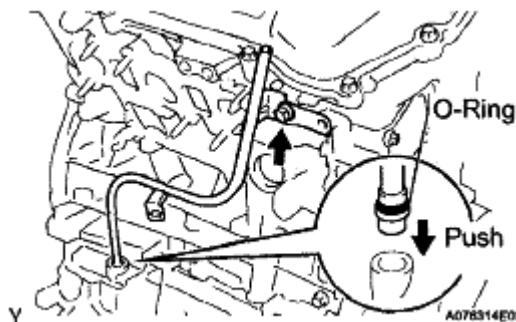
- a. Install a new O-ring onto the oil level gauge guide.
- b. Apply a light coat of engine oil to the O-ring.
- c. Push the oil level gauge guide end into the guide hole of the oil pan.
- d. Install the oil level gauge guide with the bolt.

**Torque: 9.0 N\*m (92 kgf\*cm, 80 in.\*lbf)**

- e. Install the oil level gauge guide.

**23. INSTALL ENGINE ASSEMBLY**

(See INSTALLATION )



**Fig. 58: Locating Oil Level Gauge Guide**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**24. INSTALL BATTERY**

**25. ADD ENGINE COOLANT (See COOLANT )**

**26. ADD ENGINE OIL (See INSTALLATION )**

**27. CHECK FOR ENGINE COOLANT LEAKAGE (See REPLACEMENT )**

**28. CHECK FOR ENGINE OIL LEAKAGE**

**29. CHECK FOR FUEL LEAKAGE**

**30. CHECK FOR EXHAUST GAS LEAKAGE**

**31. INSPECT IGNITION TIMING (See ON-VEHICLE INSPECTION )**

**32. INSPECT ENGINE IDLING SPEED (See ON-VEHICLE INSPECTION )**

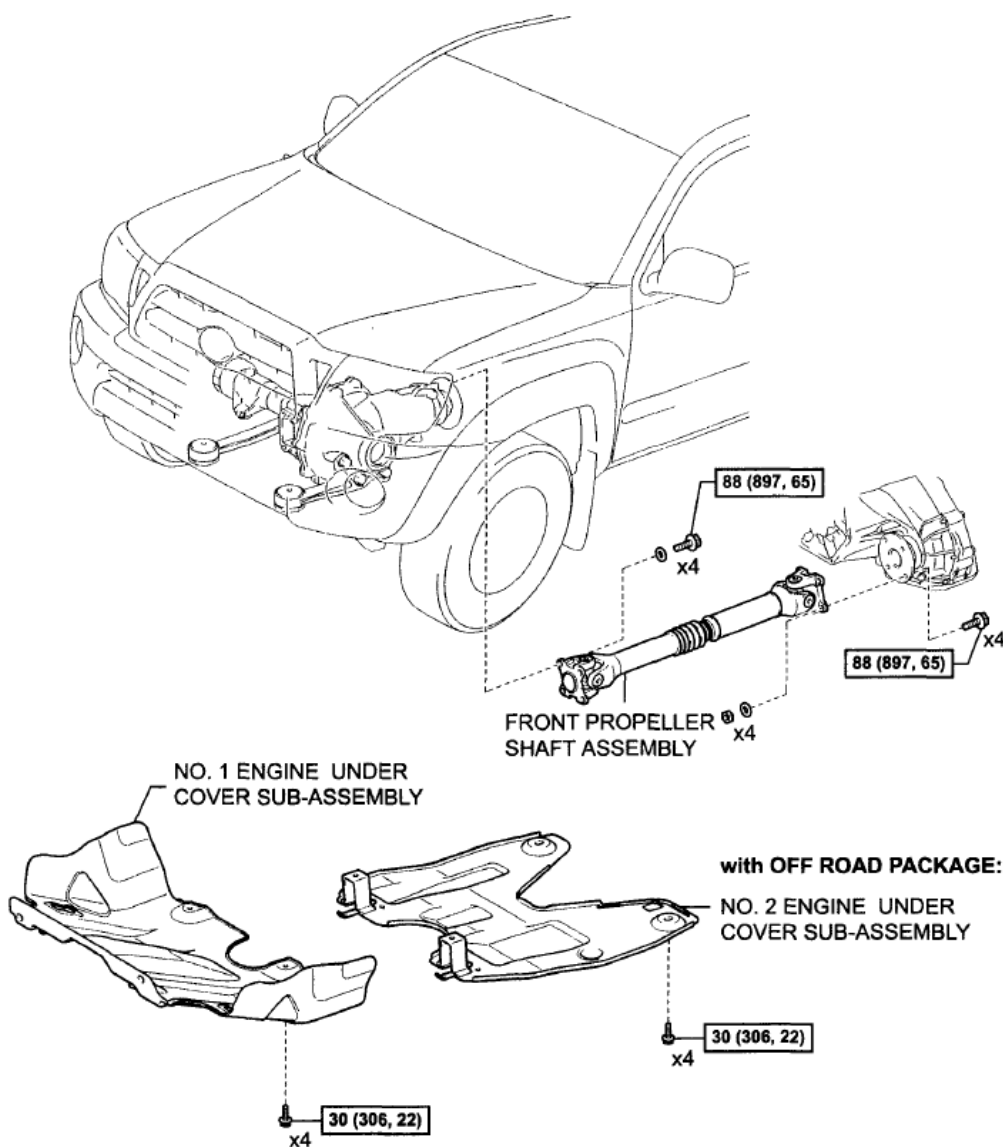
**33. INSPECT CO/HC (See ON-VEHICLE INSPECTION )**

## **TIMING CHAIN (FOR 4WD AND PRE-RUNNER)**

### **COMPONENTS**

## 2009 Toyota Tacoma

2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma



N\*m (kgf\*cm, ft\*lb) : Specified torque

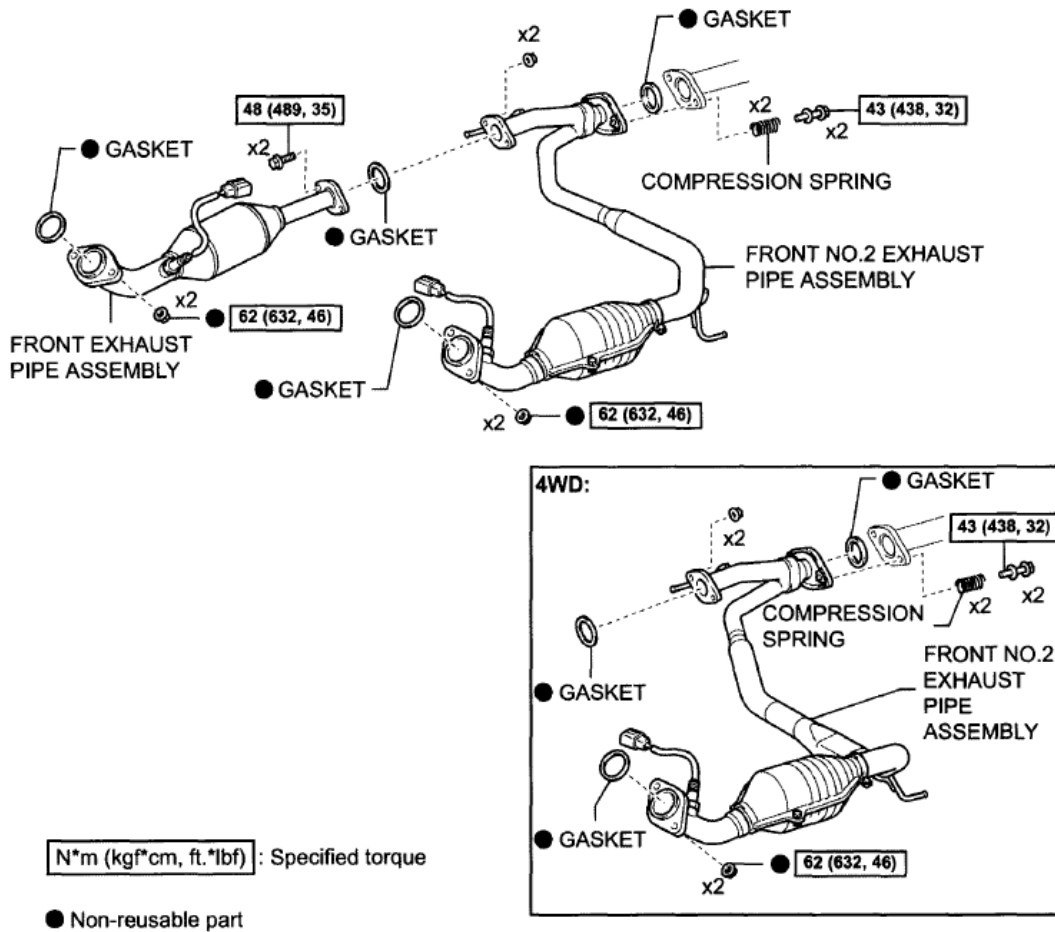
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**Fig. 59: Exploded View Of Timing Chain Components With Torque Specification (1 Of 12)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 2009 Toyota Tacoma

2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma



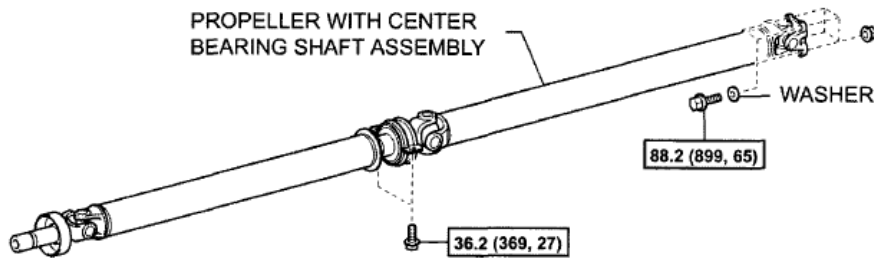
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**Fig. 60: Exploded View Of Timing Chain Components With Torque Specification (2 Of 12)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 2009 Toyota Tacoma

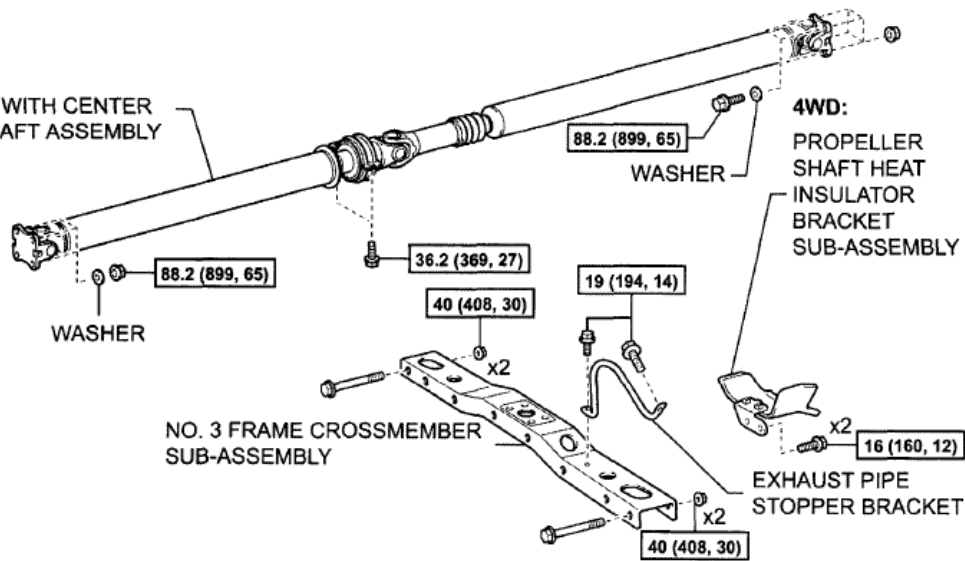
2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma

**PRE RUNNER:**



**4WD:**

PROPELLER WITH CENTER BEARING SHAFT ASSEMBLY



**N\*m (kgf\*cm, ft\*lb)** : Specified torque

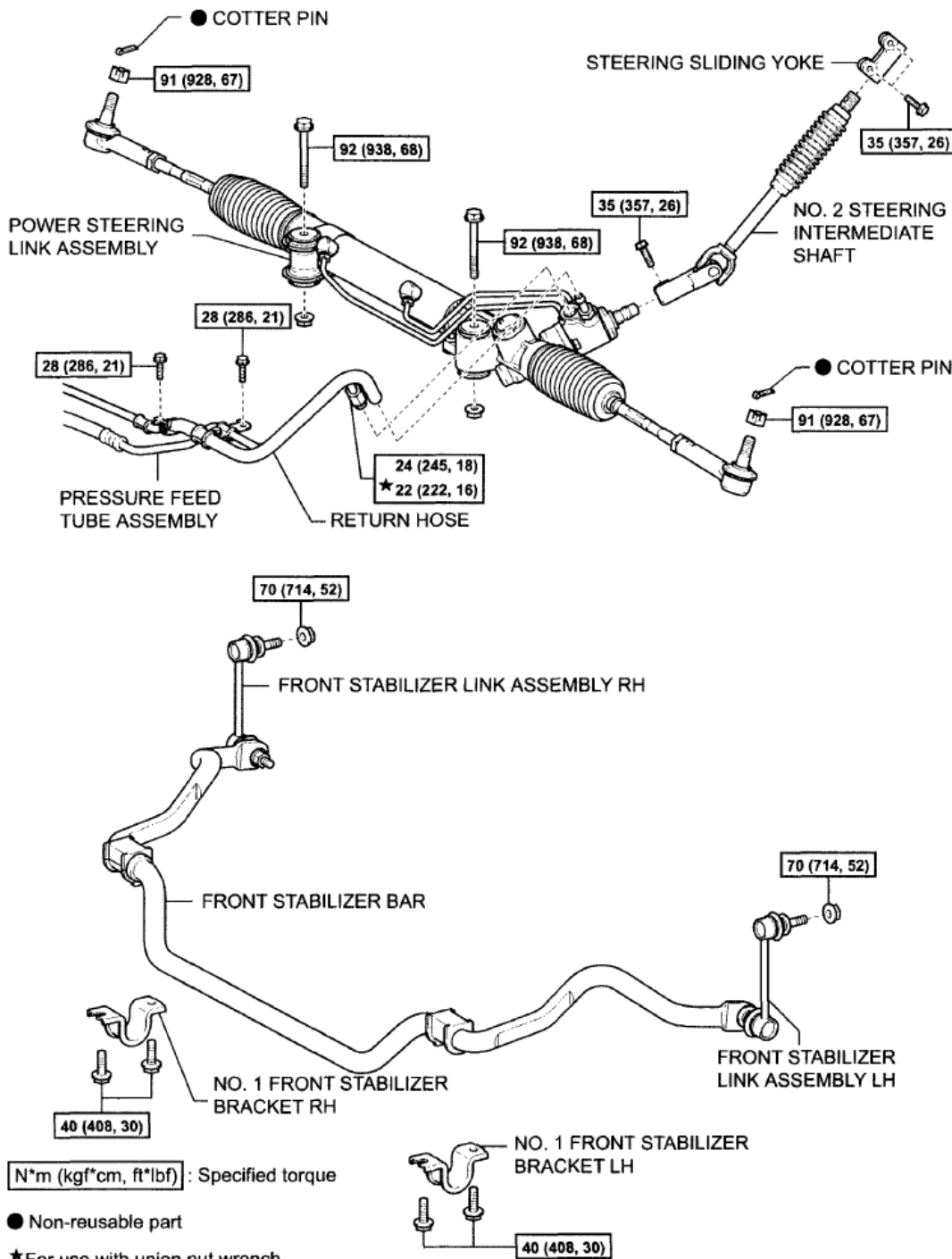
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**Fig. 61: Exploded View Of Timing Chain Components With Torque Specification (3 Of 12)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

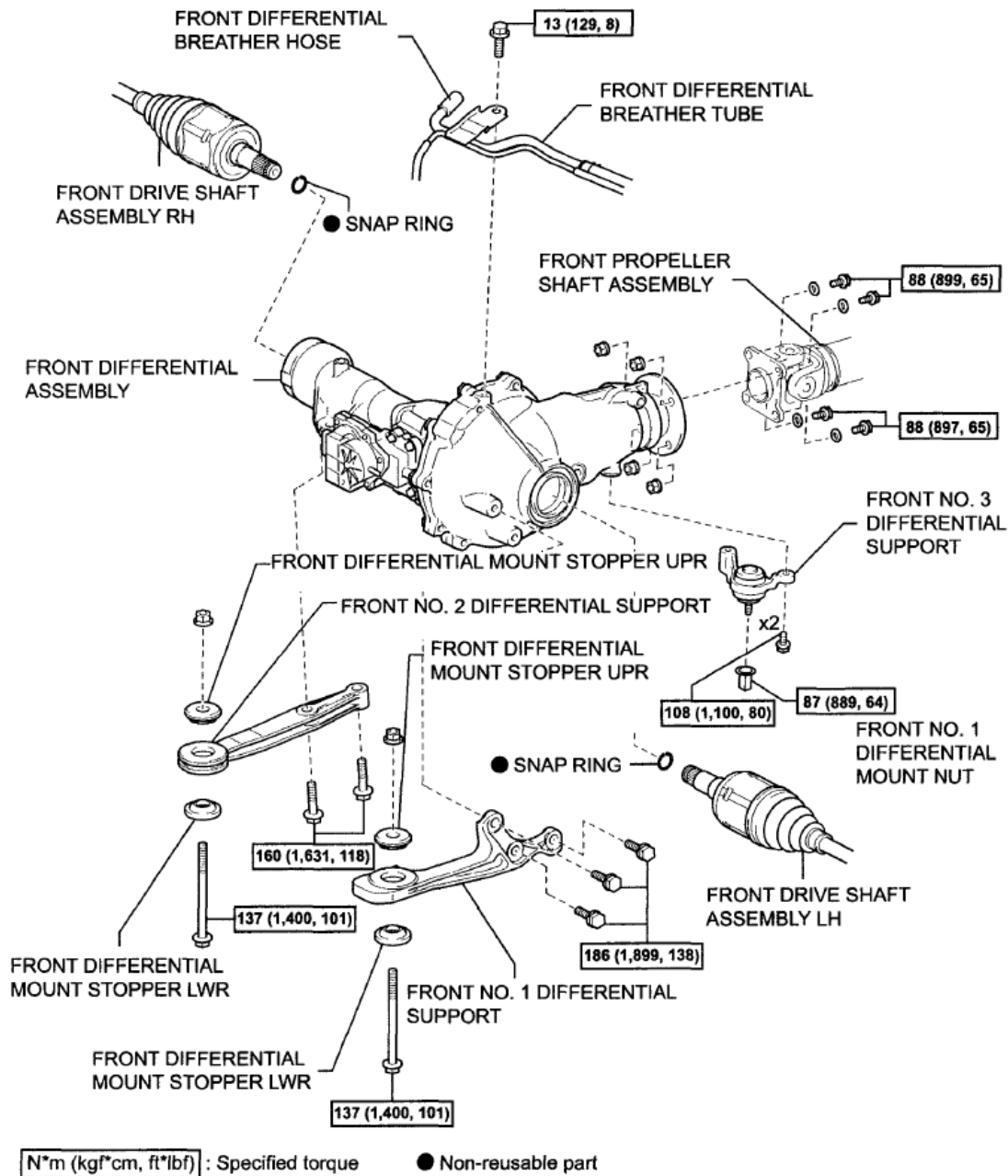
## 2009 Toyota Tacoma

2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma



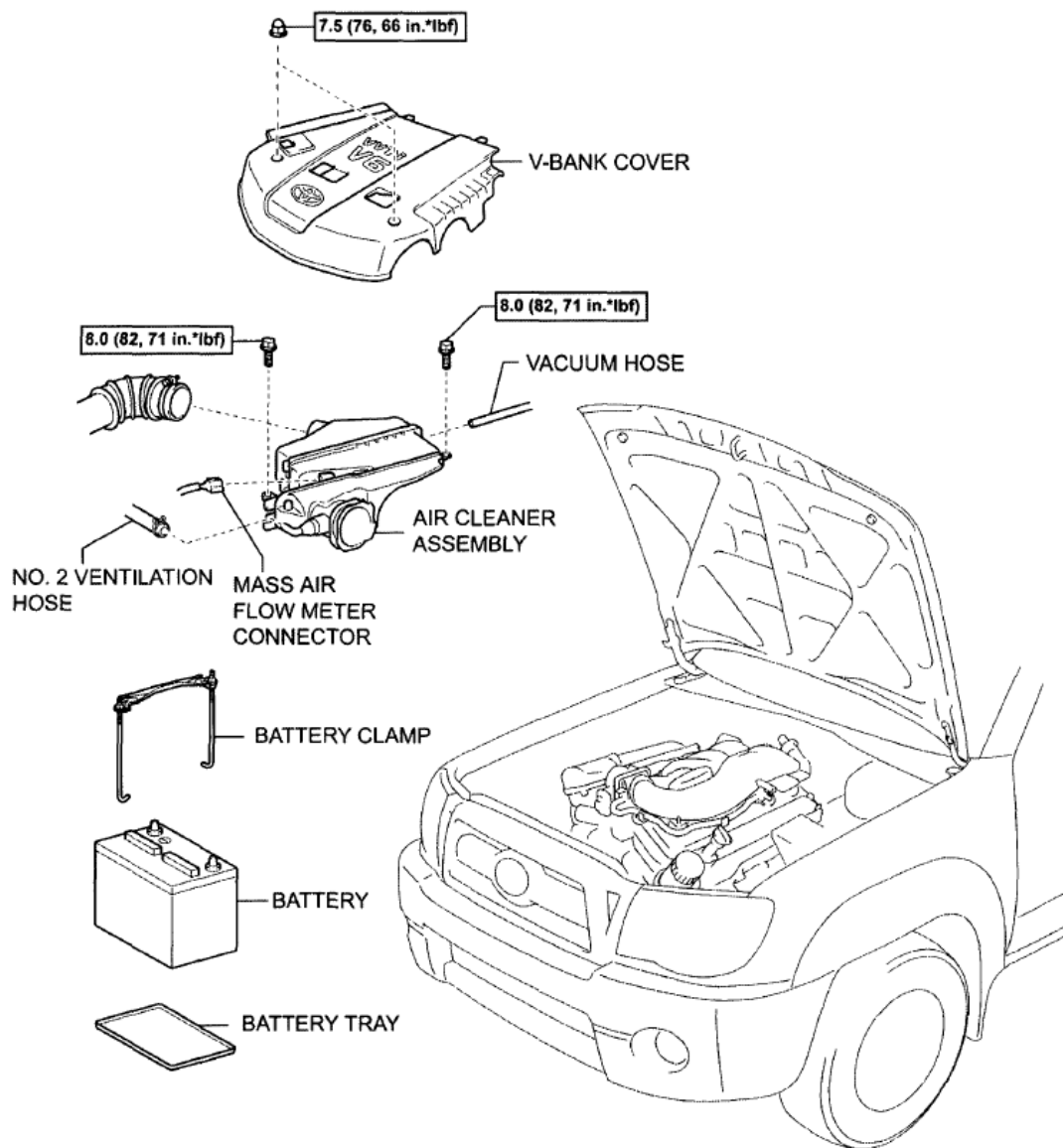
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**Fig. 62: Exploded View Of Timing Chain Components With Torque Specification (4 Of 12)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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**Fig. 63: Exploded View Of Timing Chain Components With Torque Specification (5 Of 12)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

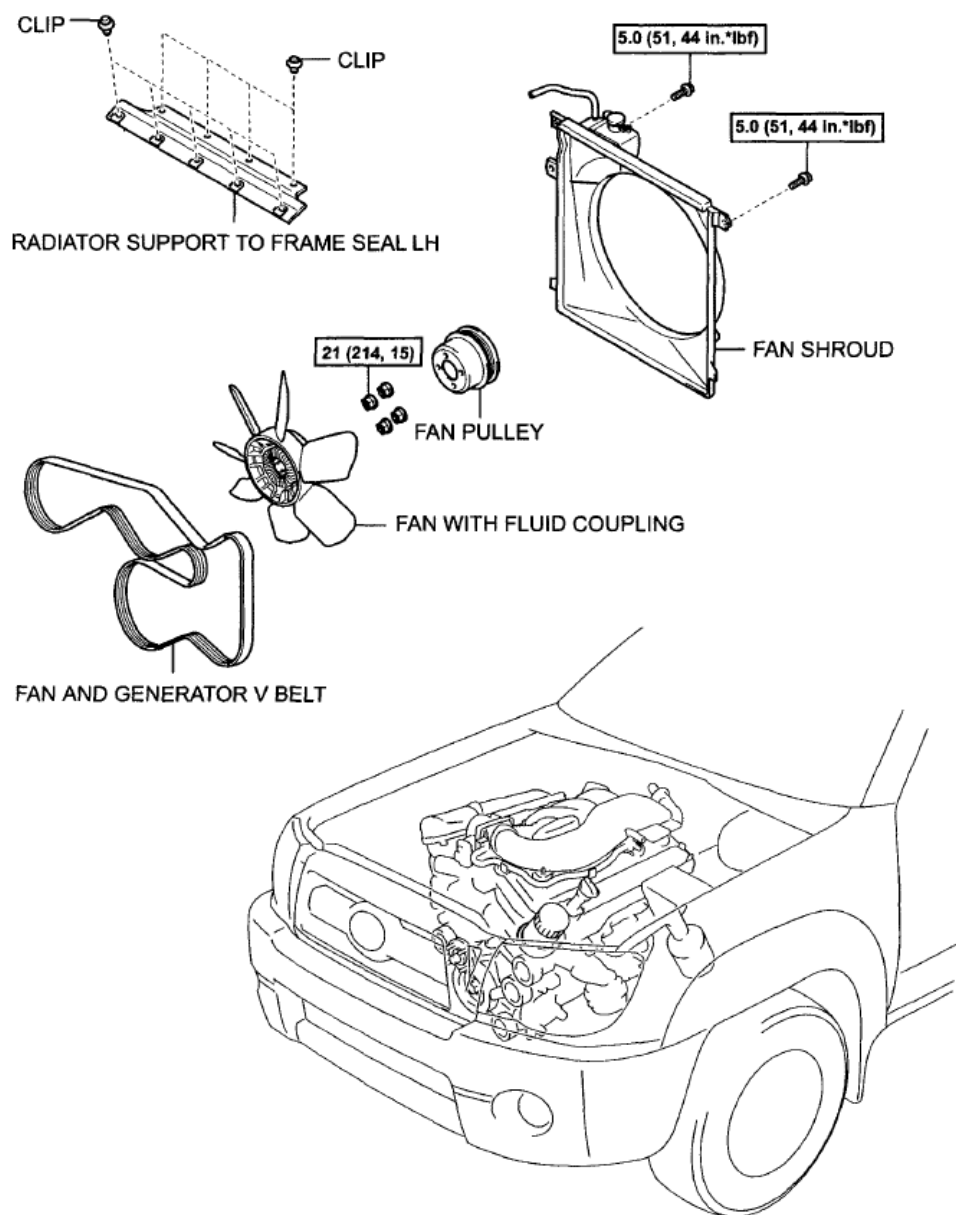


N\*m (kgf\*cm, ft\*lbf) : Specified torque

Y

A113568E02

**Fig. 64: Exploded View Of Timing Chain Components With Torque Specification (6 Of 12)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

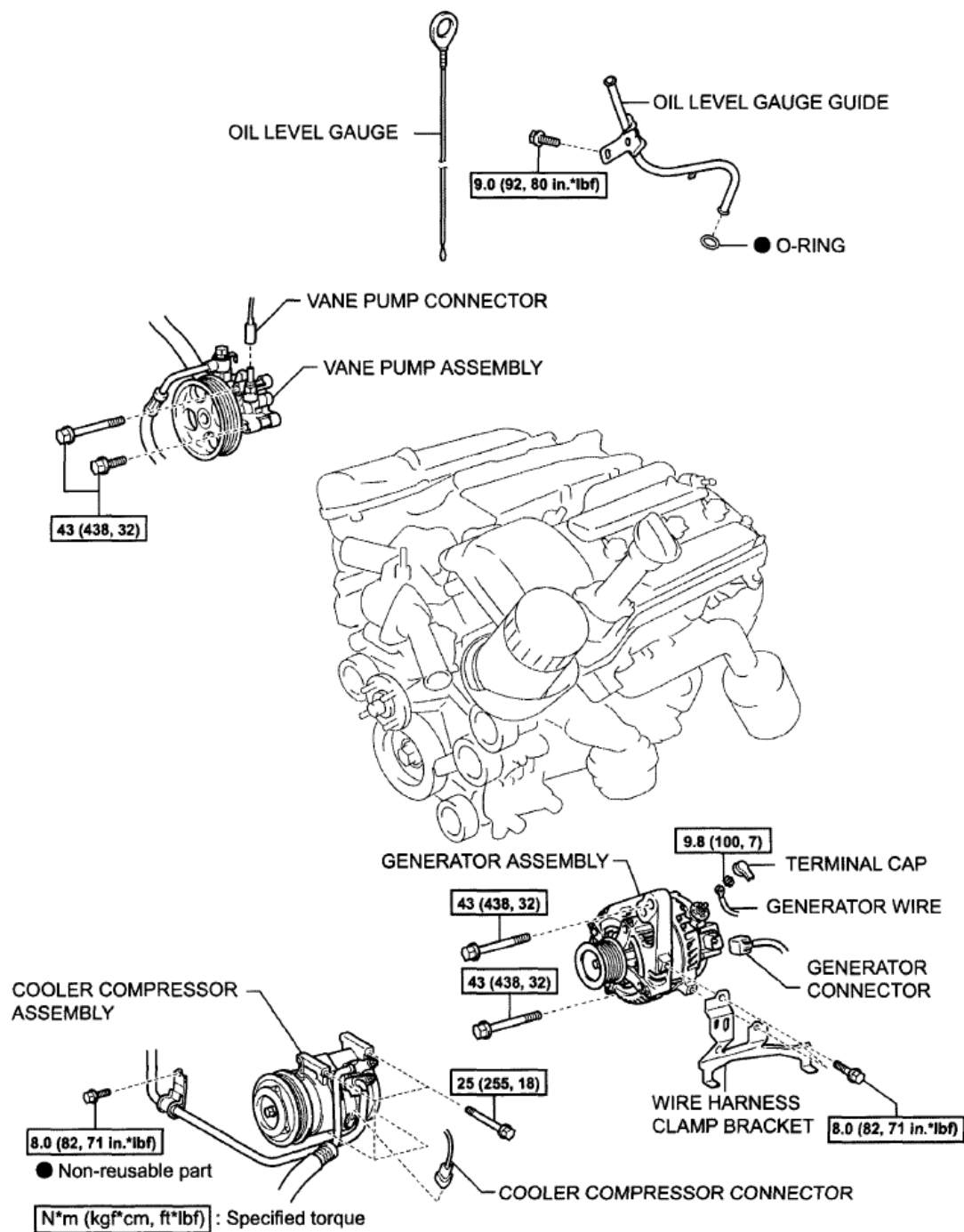


N\*m (kgf\*cm, ft\*lbf) : Specified torque

Y

A113567E01

**Fig. 65: Exploded View Of Timing Chain Components With Torque Specification (7 Of 12)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

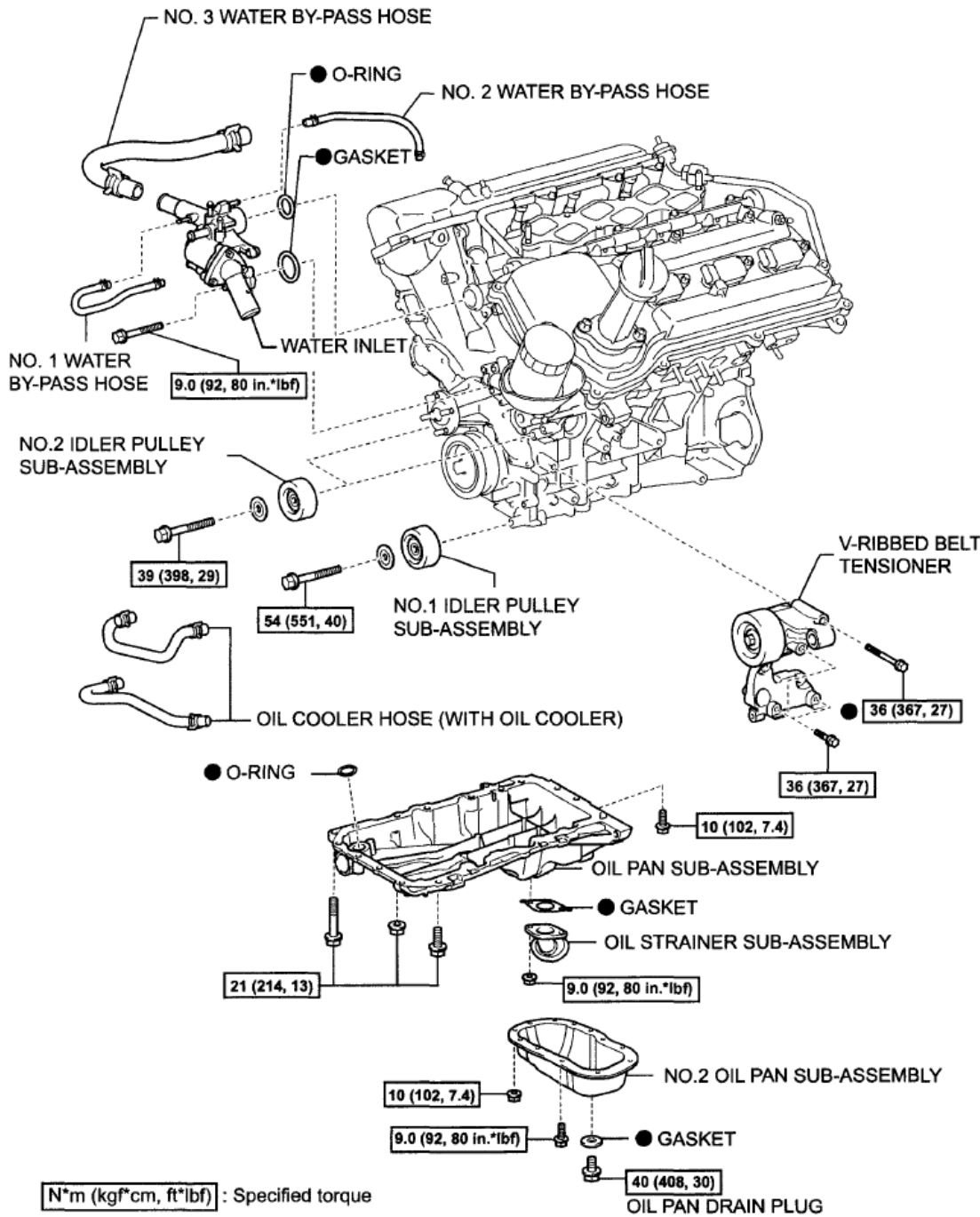


A113548E02

**Fig. 66: Exploded View Of Timing Chain Components With Torque Specification (8 Of 12)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 2009 Toyota Tacoma

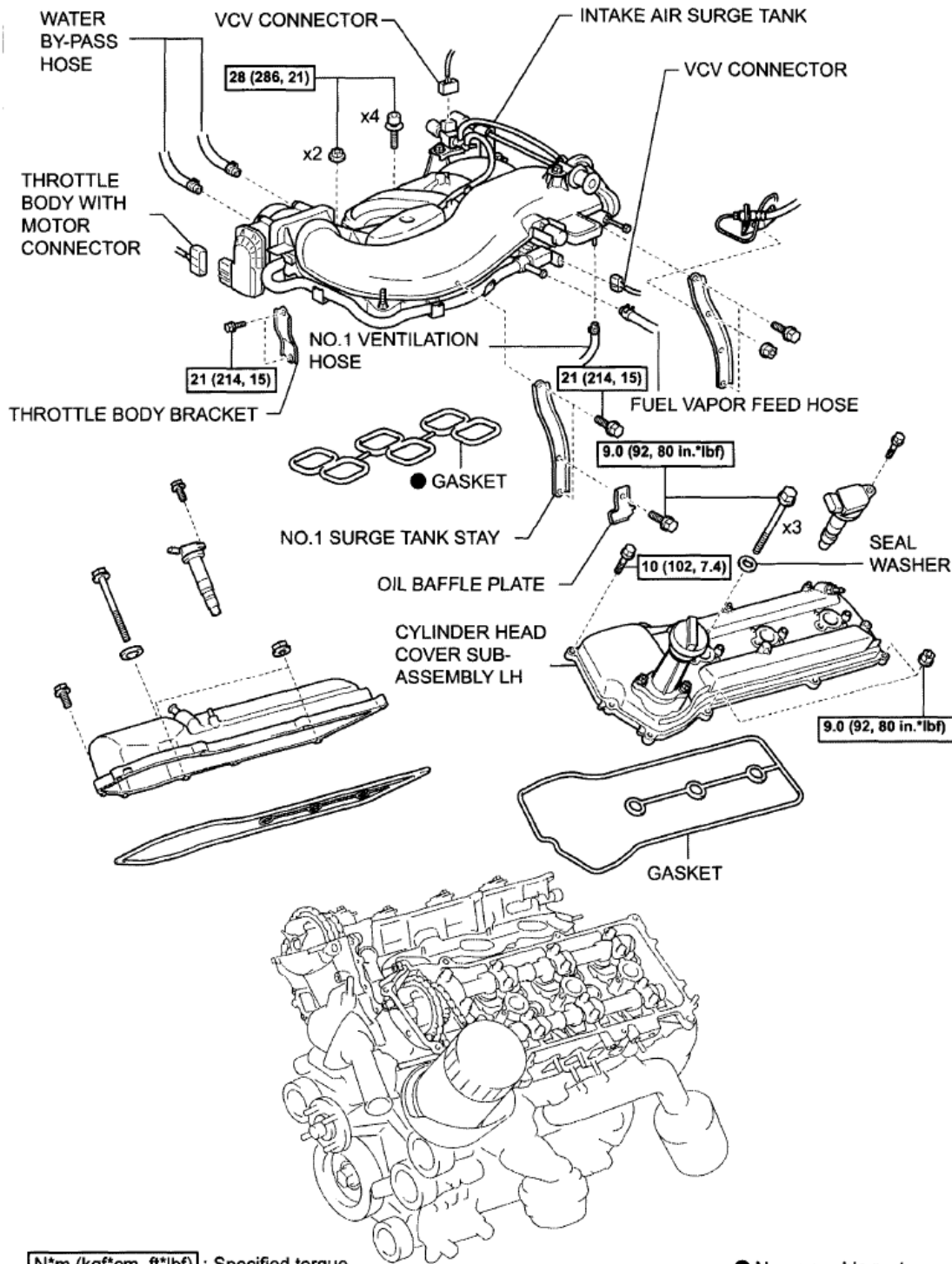
2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma



Y

A113549E01

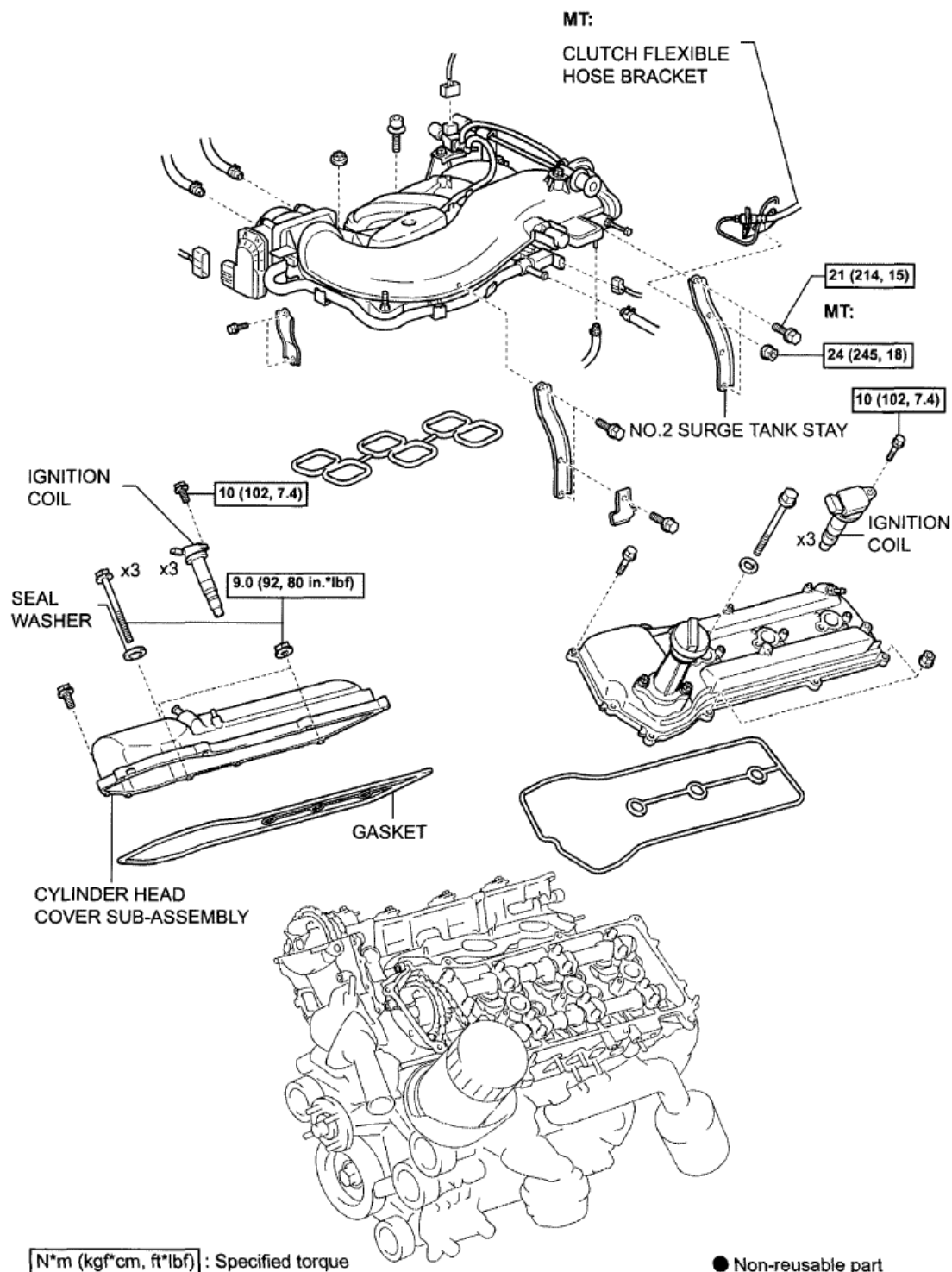
**Fig. 67: Exploded View Of Timing Chain Components With Torque Specification (9 Of 12)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



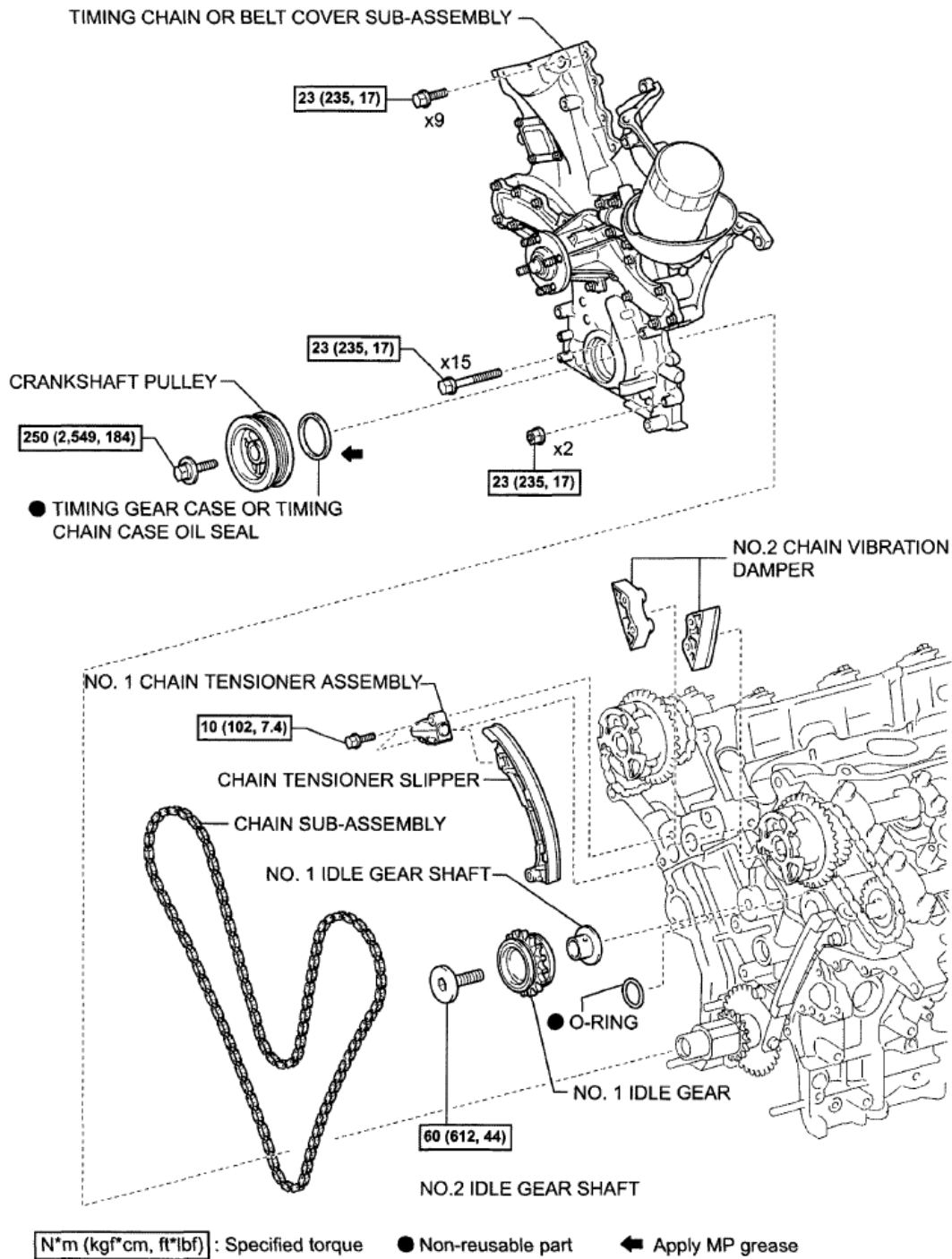
**Fig. 68: Exploded View Of Timing Chain Components With Torque Specification (10 Of 12)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 2009 Toyota Tacoma

2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma



**Fig. 69: Exploded View Of Timing Chain Components With Torque Specification (11 Of 12)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 70: Exploded View Of Timing Chain Components With Torque Specification (12 Of 12)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## REMOVAL

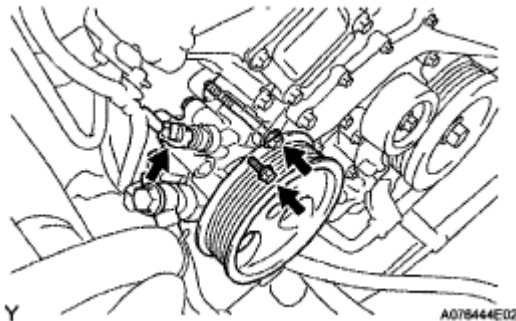
1. REMOVE BATTERY
2. DRAIN ENGINE COOLANT (See COOLANT )

3. **DRAIN ENGINE OIL** (See INSTALLATION )
4. **REMOVE POWER STEERING LINK ASSEMBLY**  
  
(See REMOVAL )
5. **REMOVE FRONT DIFFERENTIAL CARRIER ASSEMBLY (for 4WD)**  
  
(See DISASSEMBLY )
6. **REMOVE V-BANK COVER** (See ON-VEHICLE INSPECTION )
7. **REMOVE RADIATOR SUPPORT TO FRAME SEAL LH** (See REMOVAL )
8. **REMOVE FAN SHROUD** (See REMOVAL )
9. **REMOVE AIR CLEANER ASSEMBLY** (See REMOVAL )
10. **REMOVE OIL LEVEL GAGE GUIDE**
  - a. Remove the oil level gauge.
  - b. Remove the bolt and pull out the oil level gauge guide.
  - c. Remove the O-ring from the oil level gauge guide.
11. **REMOVE WATER INLET** (See THERMOSTAT )
12. **SEPARATE VANE PUMP ASSEMBLY**
  - a. Disconnect the power steering pressure switch connector.
  - b. Remove the 2 bolts, then separate the vane pump.

**NOTE:**        **Do not hit the pulley with other parts when separating the vane pump.**

**HINT:**

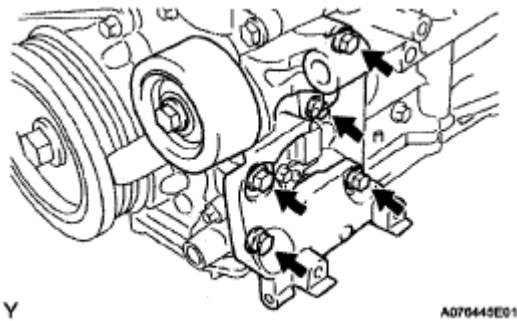
The vane pump is suspended securely.



**Fig. 71: Locating Vane Pump Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

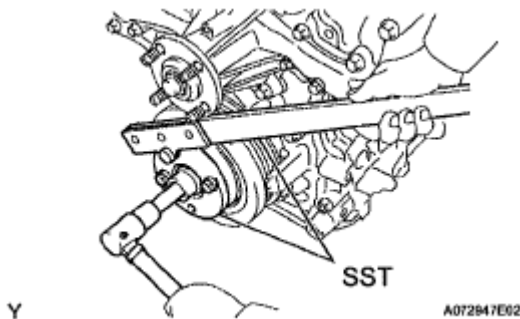
13. **REMOVE GENERATOR ASSEMBLY** (See REMOVAL )

14. **SEPARATE COOLER COMPRESSOR ASSEMBLY** (See **CRANKSHAFT POSITION SENSOR** )
15. **REMOVE V-RIBBED BELT TENSIONER ASSEMBLY**
  - a. Remove the 5 bolts, then remove the V-ribbed belt tensioner.
16. **REMOVE NO.2 IDLER PULLEY SUB-ASSEMBLY**
  - a. Remove the 2 bolts, then remove the idler pulley No. 2.
17. **REMOVE NO.1 IDLER PULLEY SUB-ASSEMBLY**
  - a. Remove the bolt, then remove the idler pulley No. 1.



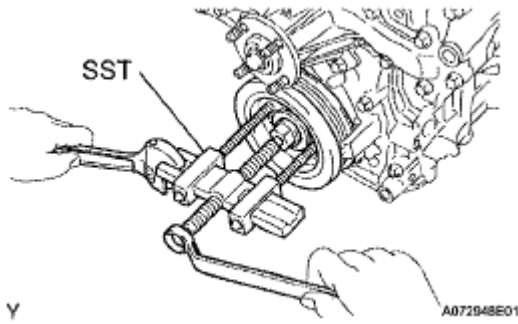
**Fig. 72: Locating V-Ribbed Belt Tensioner Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

18. **REMOVE CRANKSHAFT PULLEY**
    - a. Using SST, hold the crankshaft pulley and loosen the pulley set bolt.
- SST 09213-54015 (91651-60855), 09330-00021**



**Fig. 73: Loosening Pulley Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

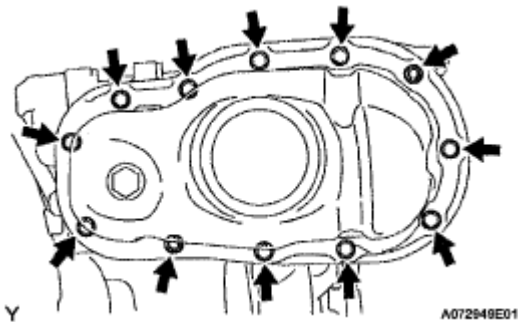
- b. Using the pulley set bolt and SST, remove the crankshaft pulley.
- SST 09950-50013 (09951-05010, 09952-05010, 09953-05020, 09954-05031)**



**Fig. 74: Removing Crankshaft Pulley**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**19. REMOVE NO.2 OIL PAN SUB-ASSEMBLY**

- a. Remove the 10 bolts and 2 nuts.

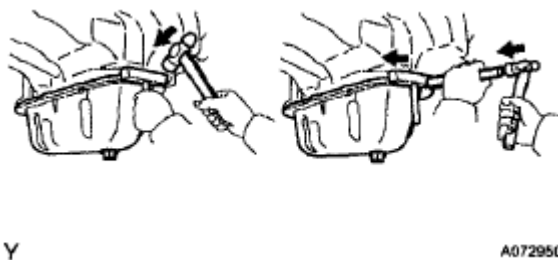


**Fig. 75: Removing No.2 Oil Pan Sub-Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Insert the blade of the oil pan seal cutter between the oil pan and oil pan No. 2, cut off applied sealer and remove the oil pan No. 2.

**NOTE:**

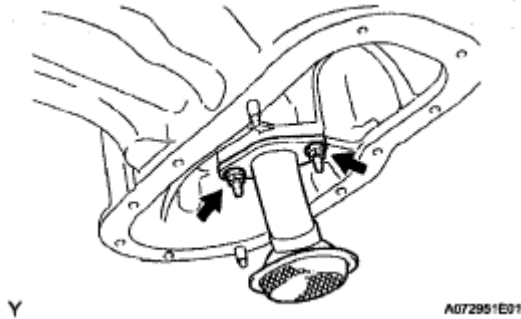
- Be careful not to damage the contact surfaces of the oil pan and oil pan No. 2.
- Be careful not to damage the oil pan No. 2 flange.



**Fig. 76: Removing Oil Pan No. 2**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 20. REMOVE OIL STRAINER SUB-ASSEMBLY

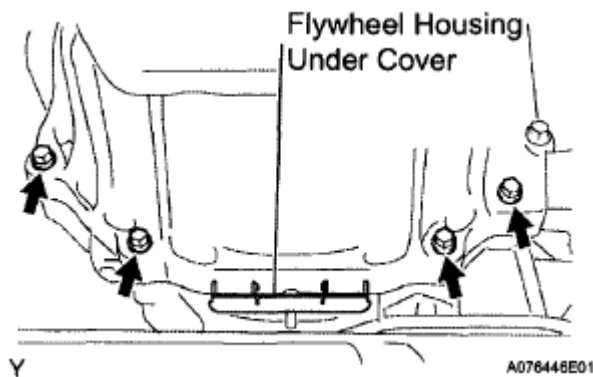
- a. Remove the 2 nuts, then remove the oil strainer and gasket.



**Fig. 77: Locating Oil Strainer Sub-Assembly Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

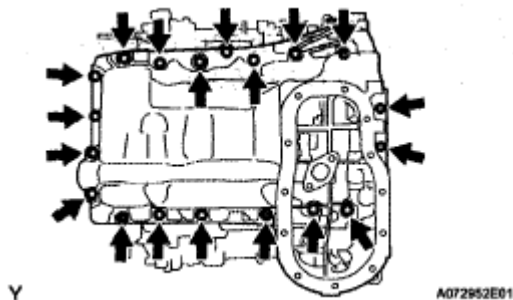
## 21. REMOVE OIL PAN SUB-ASSEMBLY

- a. Remove the 4 housing bolts.
- b. Remove the flywheel housing under cover.



**Fig. 78: Locating Flywheel Housing Under Cover Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Remove the 17 bolts and 2 nuts.

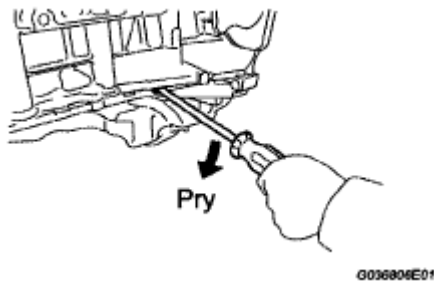


**Fig. 79: Locating Flywheel Housing Under Cover Bolts And Nuts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

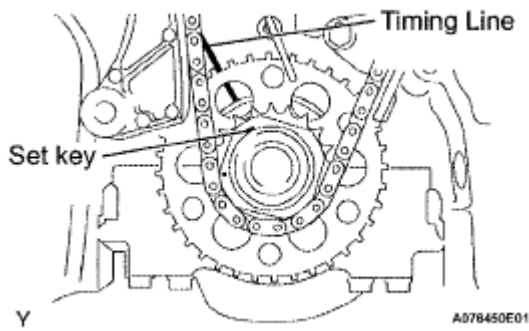
**NOTE:** Be careful not to damage the contact surfaces of the cylinder block and oil pan.

- e. Remove the O-ring from the oil pump.



**Fig. 80: Prying Between Oil Pan And Cylinder Block**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

22. REMOVE INTAKE AIR SURGE TANK (See REMOVAL )
23. REMOVE IGNITION COIL ASSEMBLY (See IGNITION COIL )
24. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY (See REMOVAL )
25. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY LH (See REMOVAL )
26. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (See CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY )
27. REMOVE VVT SENSOR (See VVT SENSOR )
28. REMOVE TIMING CHAIN OR BELT COVER SUB-ASSEMBLY (See REMOVAL )
29. REMOVE TIMING GEAR CASE OR TIMING CHAIN CASE OIL SEAL (See REPLACEMENT )
30. SET NO.1 COMPRESSION TO TDC/COMPRESSION
  - a. Using the crankshaft pulley set bolt, turn the crankshaft to align the crankshaft set key with the timing line of the cylinder block.



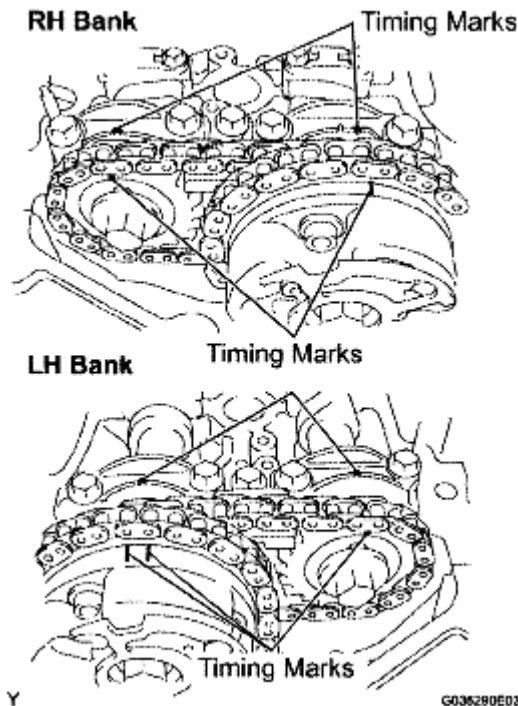
**Fig. 81: Aligning Crankshaft Set Key With Timing Line**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Check that the timing marks of the camshaft timing gears are aligned with the timing marks of the bearing cap as shown in the illustration. If not, turn the crankshaft 1 complete revolution (360°) and align the timing marks as above.

### 31. REMOVE NO.1 CHAIN TENSIONER ASSEMBLY

**NOTE:**

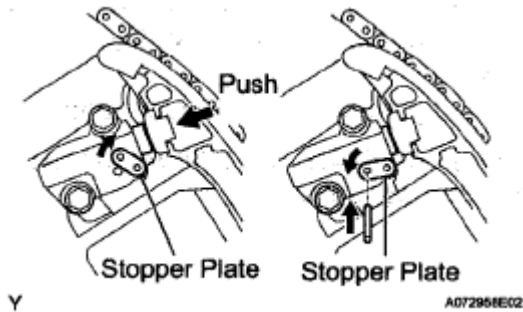
- Never rotate the crankshaft with the chain tensioner removed.
- When rotating the camshaft with the timing chain removed, rotate the crankshaft counterclockwise 40° from the TDC first.



**Fig. 82: Identifying Timing Marks Of Camshaft Timing Gears**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. While turning the stopper plate of the tensioner upward, push in the plunger of the chain tensioner

- as shown in the illustration.
- While turning the stopper plate of the tensioner down ward, insert a bar of 3.5 mm (0.138) into the holes in the stopper plate and tensioner to fix the stopper plate.
  - Remove the 2 bolts, then remove the chain tensioner.



**Fig. 83: Pushing Plunger Of Chain Tensioner**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**32. REMOVE CHAIN TENSIONER SLIPPER**

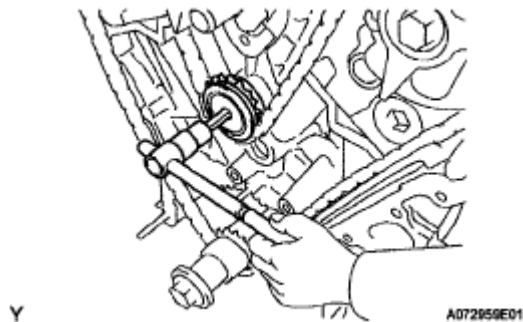
**33. REMOVE IDLE SPROCKET ASSEMBLY**

- Using a 10 mm hexagon wrench, remove the idle gear shaft No. 2, idle gear No. 1 and idle gear shaft No. 1.

**34. REMOVE NO.2 CHAIN VIBRATION DAMPER**

- Remove the 2 chain vibration dampers No. 2.

**35. REMOVE CHAIN SUB-ASSEMBLY**



**Fig. 84: Removing Idle Sprocket Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**INSTALLATION**

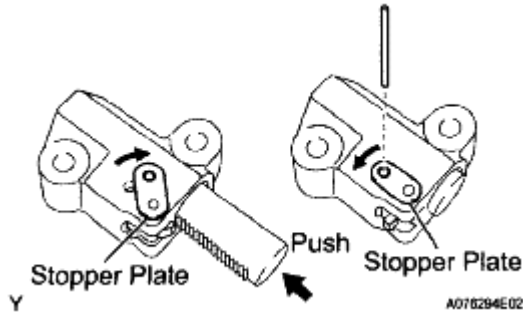
**1. INSTALL CHAIN TENSIONER SLIPPER**

**2. INSTALL NO.1 CHAIN TENSIONER ASSEMBLY**

- While turning the stopper plate of the tensioner clockwise, push in the plunger of the tensioner as shown in the illustration.

- b. While turning the stopper plate of the tensioner counterclockwise, insert a bar of 35 mm (0.138 in.) into the holes in the stopper plate and tensioner to fix the stopper plate.
- c. Install the chain tensioner with the 2 bolts.

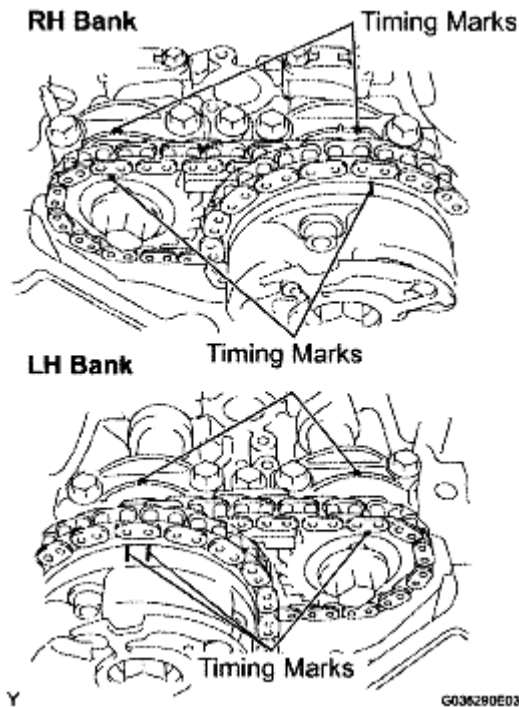
**Torque: 10 N\*m (102 kgf\*cm, 7.4 ft.\*lbf)**



**Fig. 85: Pushing Plunger Of Tensioner**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

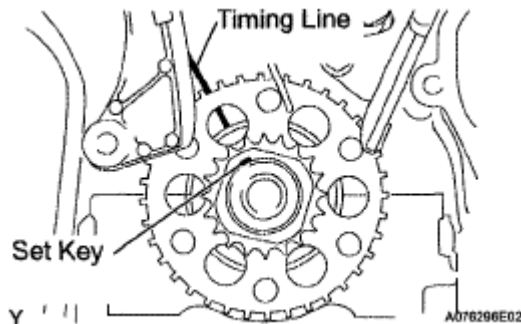
### 3. INSTALL CHAIN SUB-ASSEMBLY

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



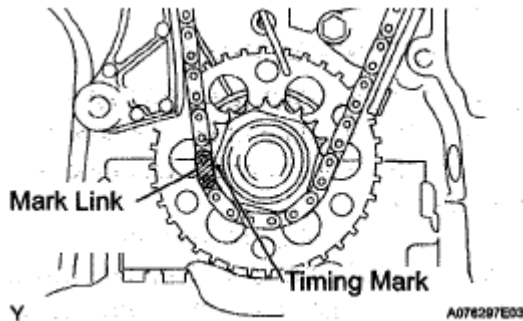
**Fig. 86: Identifying Timing Marks Of Camshaft Timing Gears**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Using the crankshaft pulley set bolt, turn the crankshaft to align the crankshaft set key with the timing line of the cylinder block.



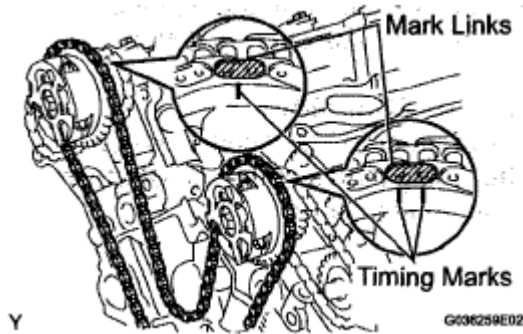
**Fig. 87: Identifying Crankshaft Set Key With Timing Line**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Align the yellow mark link with the timing mark of the crankshaft timing link.



**Fig. 88: Aligning Timing Mark Of Crankshaft Timing Link**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Align the orange mark links with the timing marks of the camshaft timing gears, and install the chain.
4. **INSTALL NO.2 CHAIN VIBRATION DAMPER**
    - a. Install the 2 chain vibration dampers No. 2.
  5. **INSTALL IDLE SPROCKET ASSEMBLY**
    - a. Apply a light coat of engine oil to rotating surface of the idle gear shaft No. 1.



**Fig. 89: Aligning Timing Marks Of Camshaft Timing Gears**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Temporarily install the idle gear shaft No. 1 together with the idle gear shaft No. 2 while aligning the knock pin of the idle gear shaft No. 1 with the knock pin groove of the cylinder block.

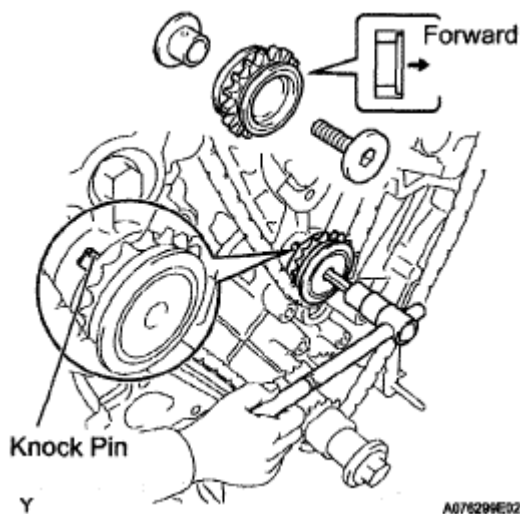
**NOTE:** Be careful of the idle gear direction.

- c. Using 10 mm hexagon wrench, tighten the idle gear shaft No. 2.

**Torque: 60 N\*m (612 kgf\*cm, 44 ft.\*lbf)**

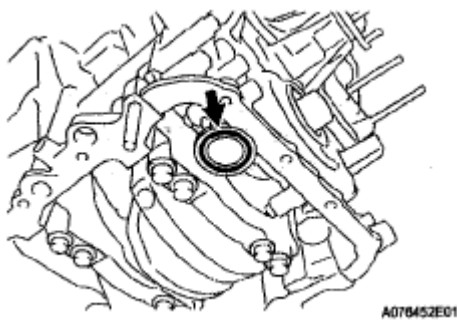
- d. Remove the bar from the chain tensioner.

6. **INSTALL TIMING GEAR CASE OR TIMING CHAIN CASE OIL SEAL** (See **REPLACEMENT** )
7. **INSTALL TIMING CHAIN OR BELT COVER SUB-ASSEMBLY** (See **INSTALLATION** )
8. **INSTALL VVT SENSOR** (See **VVT SENSOR** )



**Fig. 90: Aligning Knock Pin Of Idle Gear Shaft No. 1**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. **INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY** (See INSPECTION )
10. **INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY LH** (See INSTALLATION )
11. **INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY** (See INSTALLATION )
12. **INSTALL IGNITION COIL ASSEMBLY** (See IGNITION COIL )
13. **INSTALL INTAKE AIR SURGE TANK** (See INSTALLATION )
14. **INSTALL OIL PAN SUB-ASSEMBLY**
  - a. Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the cylinder block, rear oil seal retainer and oil pan.
  - b. Install a new O-ring onto the oil pump.



**Fig. 91: Locating O-Ring Onto Oil Pump**

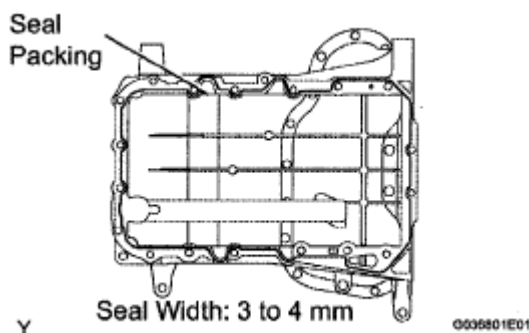
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Apply a continuous bead of seal packing (diameter 3 to 4 mm (0.12 to 0.16 in.)) to the oil pan as shown in the illustration.

**Seal packing:**

**Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent**

**NOTE:** Install the oil pan within 3 minutes of applying the seal packing. Tighten the oil pan bolts and nuts within 15 minutes of installing the oil pan. Otherwise, the seal packing must be removed and reapplied.



**Fig. 92: Identifying Seal Packing To Oil Pan**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Install the oil pan with the 17 bolts and 2 nuts, and tighten the bolts and nuts uniformly in several steps.

**Torque: 10 N\*m (102 kgf\*cm, 7.4 ft.\*lbf) for 10 mm (0.39 in.) head**

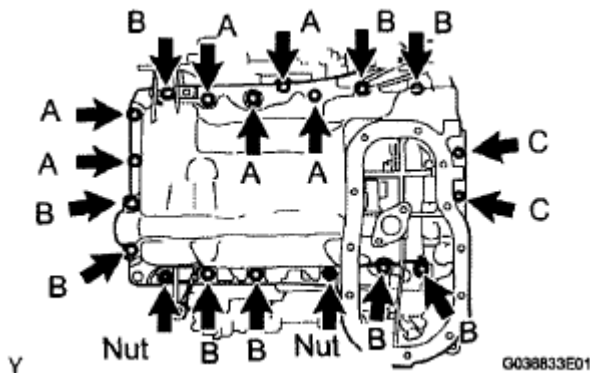
**21 N\*m (214 kgf\*cm, 16 ft.\*lbf) for 12 mm (0.47 in.) head**

HINT:

Each bolt length is as follows:

**BOLT LENGTH SPECIFICATION**

| Bolt | Length           |
|------|------------------|
| A    | 25 mm (0.98 in.) |
| B    | 45 mm (1.77 in.) |
| C    | 14 mm (0.55 in.) |



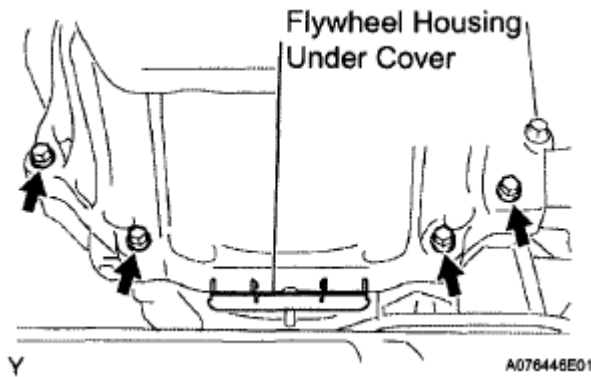
**Fig. 93: Locating Oil Pan Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Install the 4 housing bolts.

**Torque: 37 N\*m (377 kgf\*cm, 27 ft.\*lbf)**

- f. Install the flywheel housing under cover.



**Fig. 94: Locating Flywheel Housing Under Cover Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

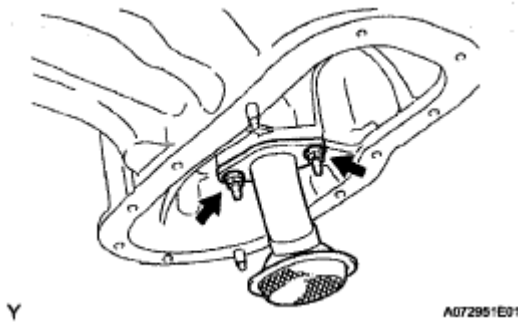
**15. INSTALL OIL STRAINER SUB-ASSEMBLY**

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

**Torque: 9.0 N\*m (92 kgf\*cm, 80 in.\*lbf)**

**16. INSTALL NO.2 OIL PAN SUB-ASSEMBLY**

- a. Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the oil pan and oil pan No. 2.



**Fig. 95: Locating Oil Strainer Sub-Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

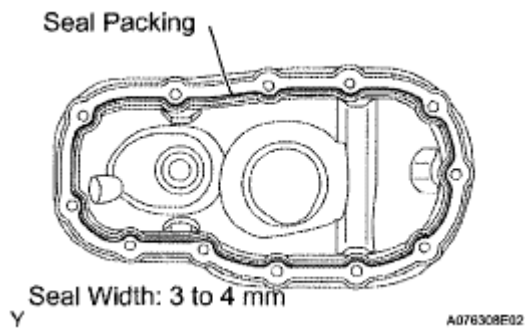
- b. Apply a continuous bead of seal packing (diameter 3 to 4 mm (0.12 to 0.16 in.)) as shown in the illustration.

**Seal packing:**

**Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent**

**NOTE:** Install the oil pan No. 2 within 3 minutes of applying the seal packing. Tighten the oil pan No. 2 bolts and nuts within 15 minutes of installing the oil pan No. 2. Otherwise, the seal packing must be

**removed and reapplied.**

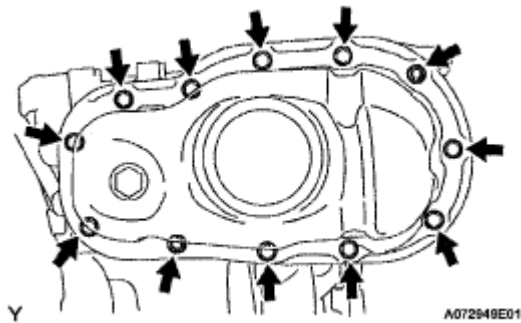


**Fig. 96: Identifying Seal Packing Of Oil Pan**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the oil pan No. 2 with the 10 bolts and 2 nuts. Tighten the bolts and nuts uniformly in several steps.

**Torque: 9.0 N\*m (92 kgf\*cm, 80 in.\*lbf) for bolts 10 N\*m (102 kgf\*cm, 7.4 in.\*lbf) for nut**



**Fig. 97: Removing No.2 Oil Pan Sub-Assembly**

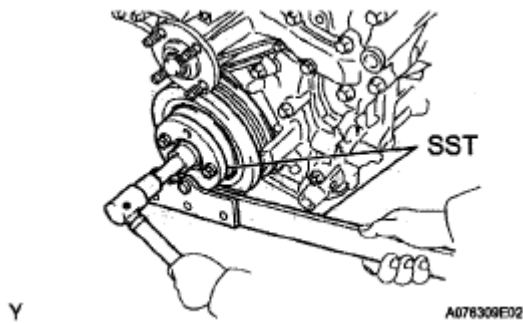
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## **17. INSTALL CRANKSHAFT PULLEY**

- a. Using SST, install the pulley set bolt.

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

**Torque: 250 N\*m (2,549 kgf\*cm, 184 ft.\*lbf)**



**Fig. 98: Installing Crankshaft Pulley**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

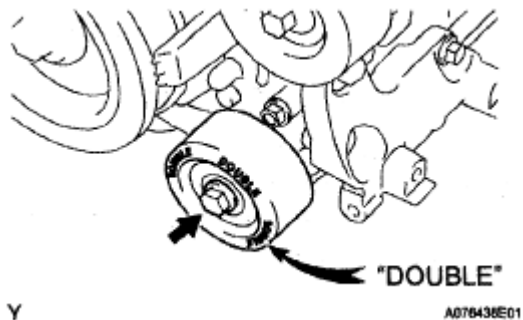
**18. INSTALL NO.1 IDLER PULLEY SUB-ASSEMBLY**

- a. Install the idler pulley with the bolt.

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

HINT:

DOUBLE is marked on the idler pulley No. 1 to distinguish it from the idler pulley No. 2.



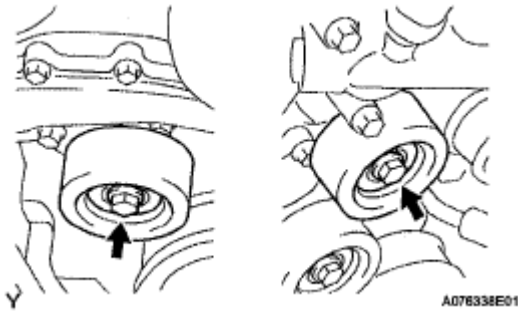
**Fig. 99: Locating Idler Pulley With Bolt**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**19. INSTALL NO.2 IDLER PULLEY SUB-ASSEMBLY**

- a. Install the 2 idler pulleys with the 2 bolts.

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



**Fig. 100: Locating Idler Pulleys With Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 20. INSTALL V-RIBBED BELT TENSIONER ASSEMBLY

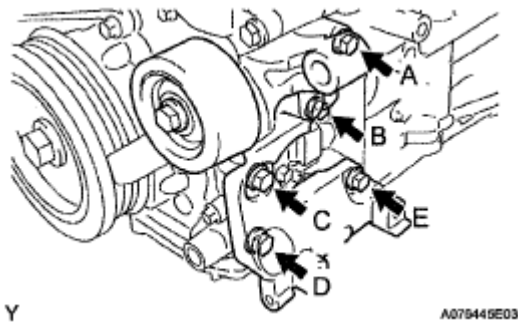
**NOTE:** A bolt in position A is not reusable.

**HINT:**

Each bolt length is as follows:

### BOLT LENGTH SPECIFICATION

| Position      | Length           |
|---------------|------------------|
| A             | 70 mm (2.76 in.) |
| B, C, D and E | 33 mm (1.30 in.) |



**Fig. 101: Locating V-Ribbed Belt Tensioner Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Use a new bolt in position A.
- Finger-tighten the bolts in positions A and E and install the bracket.
- Tighten the bolts in positions A and E.

**Torque: 36 N\*m (267 kgf\*cm, 27 ft.\*lbf)**

- Tighten the bolts in positions B, C and D.

**Torque: 36 N\*m (267 kgf\*cm, 27 ft.\*lbf)**

21. **INSTALL COOLER COMPRESSOR ASSEMBLY** (See INSTALLATION )

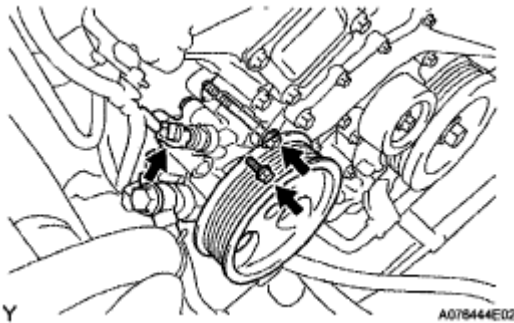
22. **INSTALL GENERATOR ASSEMBLY** (See INSTALLATION )

23. **INSTALL VANE PUMP ASSEMBLY**

- a. Install the vane pump with the 2 bolts.
- b. Connect the power steering pressure switch connector.

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

**NOTE:** Do not hit the pulley with other parts when installing the vane pump.



**Fig. 102: Locating Vane Pump Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Connect the power steering pressure switch connector.

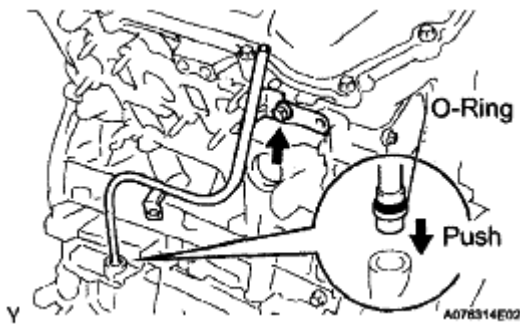
24. **INSTALL WATER INLET** (See INSTALLATION )

25. **INSTALL OIL LEVEL GAGE GUIDE**

- a. Install a new O-ring onto the oil level gauge guide.
- b. Apply a light coat of engine oil to the O-ring.
- c. Push the oil level gauge guide end into the guide hole of the oil pan.
- d. Install the oil level gauge guide with the bolt.

**Torque: 9.0 N\*m (92 kgf\*cm, 80 in.\*lbf)**

- e. Install the oil level gauge guide.

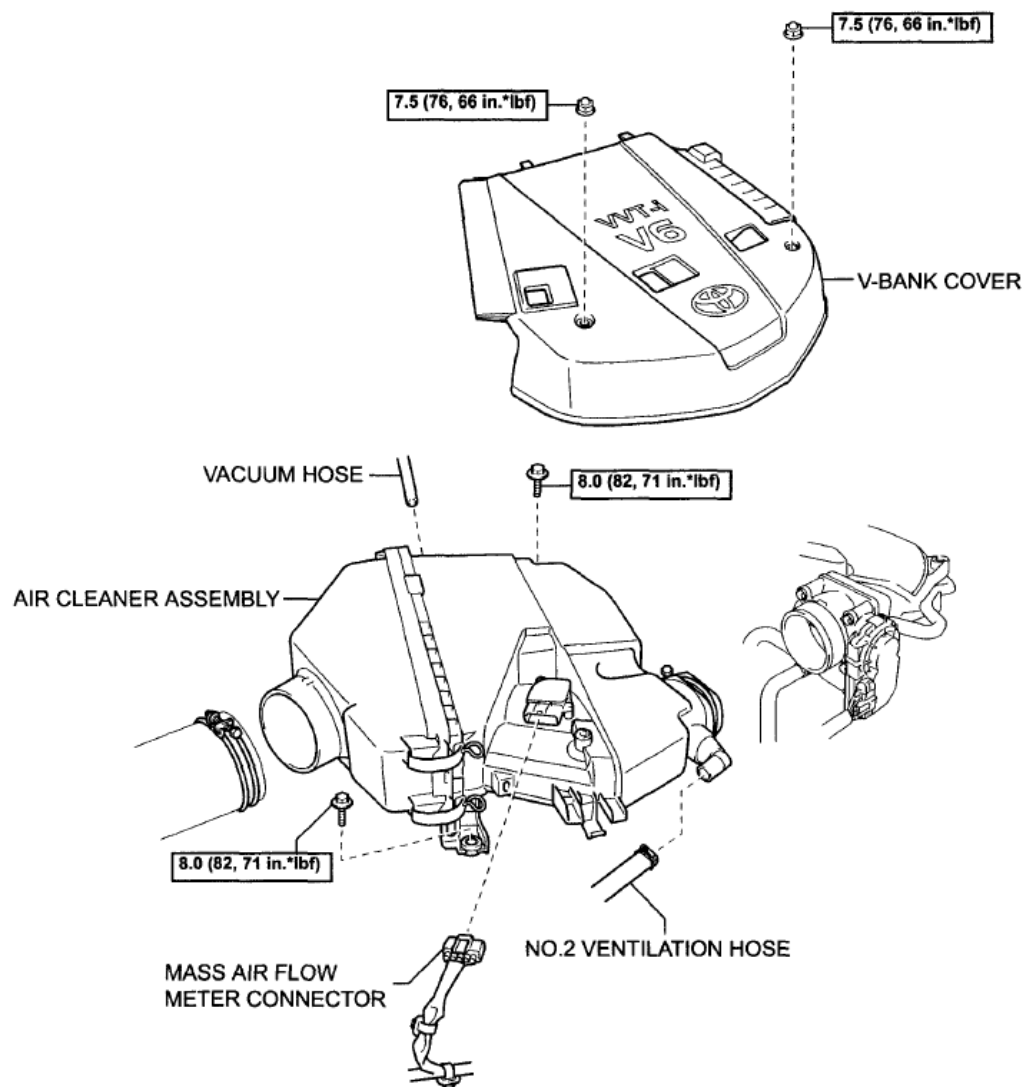


**Fig. 103: Locating Oil Level Gauge Guide**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

26. **INSTALL AIR CLEANER ASSEMBLY** (See INSPECTION )
27. **INSTALL FAN SHROUD** (See INSTALLATION )
28. **INSTALL RADIATOR SUPPORT TO FRAME SEAL LH**
29. **INSTALL FRONT DIFFERENTIAL CARRIER ASSEMBLY (for 4WD)**  
  
(See INSTALLATION )
30. **INSTALL POWER STEERING LINK ASSEMBLY**  
  
(See INSTALLATION )
31. **INSTALL BATTERY**
32. **ADD ENGINE OIL** (See INSTALLATION )
33. **ADD ENGINE COOLANT** (See COOLANT )
34. **ADD DIFFERENTIAL OIL (for 4WD)**
35. **INSPECT DIFFERENTIAL OIL (for 4WD)** (See DIFFERENTIAL OIL )
36. **ADD POWER STEERING FLUID**
37. **BLEED POWER STEERING FLUID** (See ON-VEHICLE INSPECTION )
38. **CHECK FOR ENGINE OIL LEAKAGE**
39. **CHECK FOR ENGINE COOLANT LEAKAGE** (See REPLACEMENT )
40. **CHECK FOR POWER STEERING FLUID LEAKAGE**
41. **INSPECT AND ADJUST FRONT WHEEL ALIGNMENT**  
  
(See FRONT WHEEL ALIGNMENT (FOR 4WD AND PRE-RUNNER) )
42. **INSTALL V-BANK COVER** (See INSPECTION )
43. **INSPECT IGNITION TIMING** (See ON-VEHICLE INSPECTION )

## **CAMSHAFT (FOR BANK 1)**

### **COMPONENTS**



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

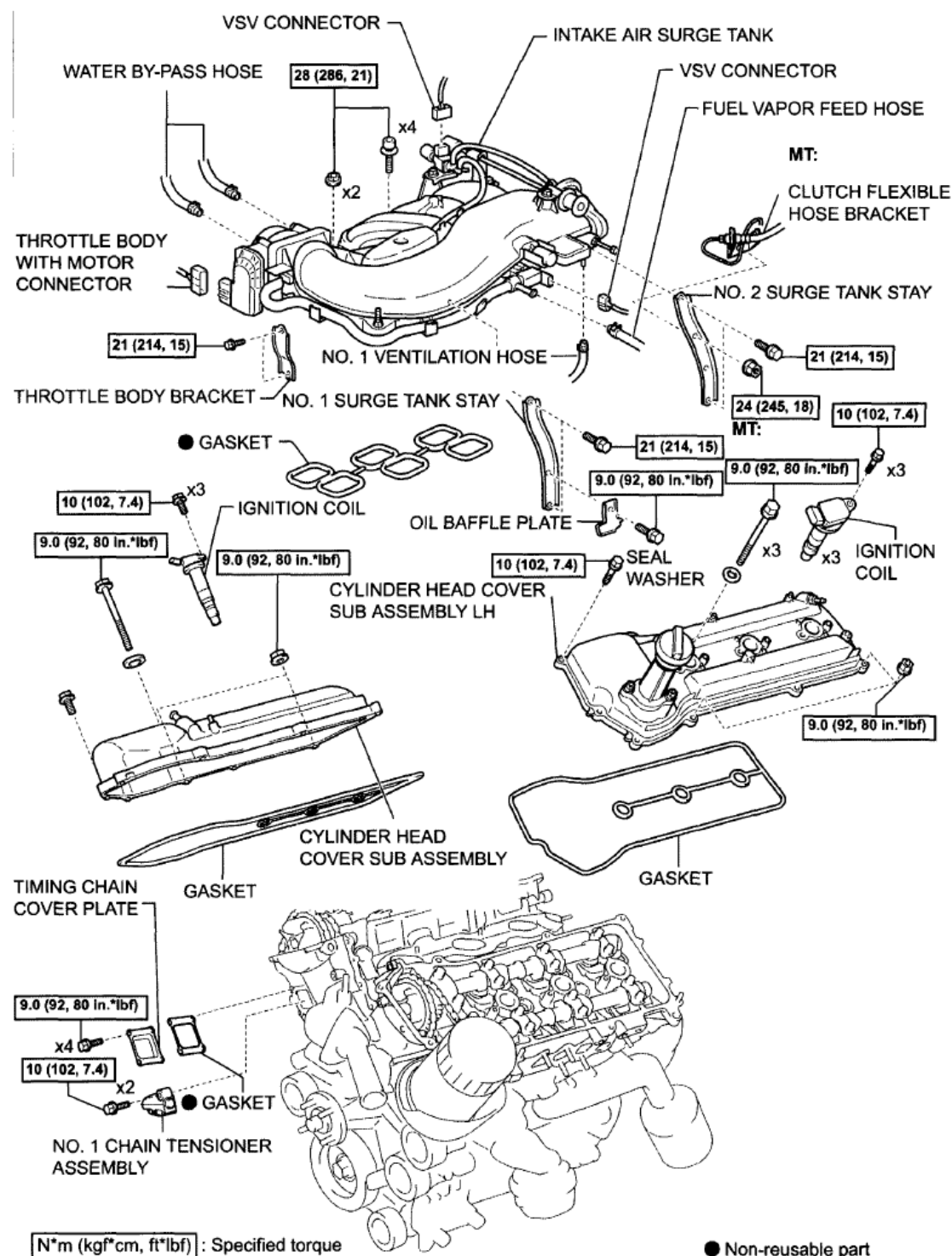
Y

A113544E01

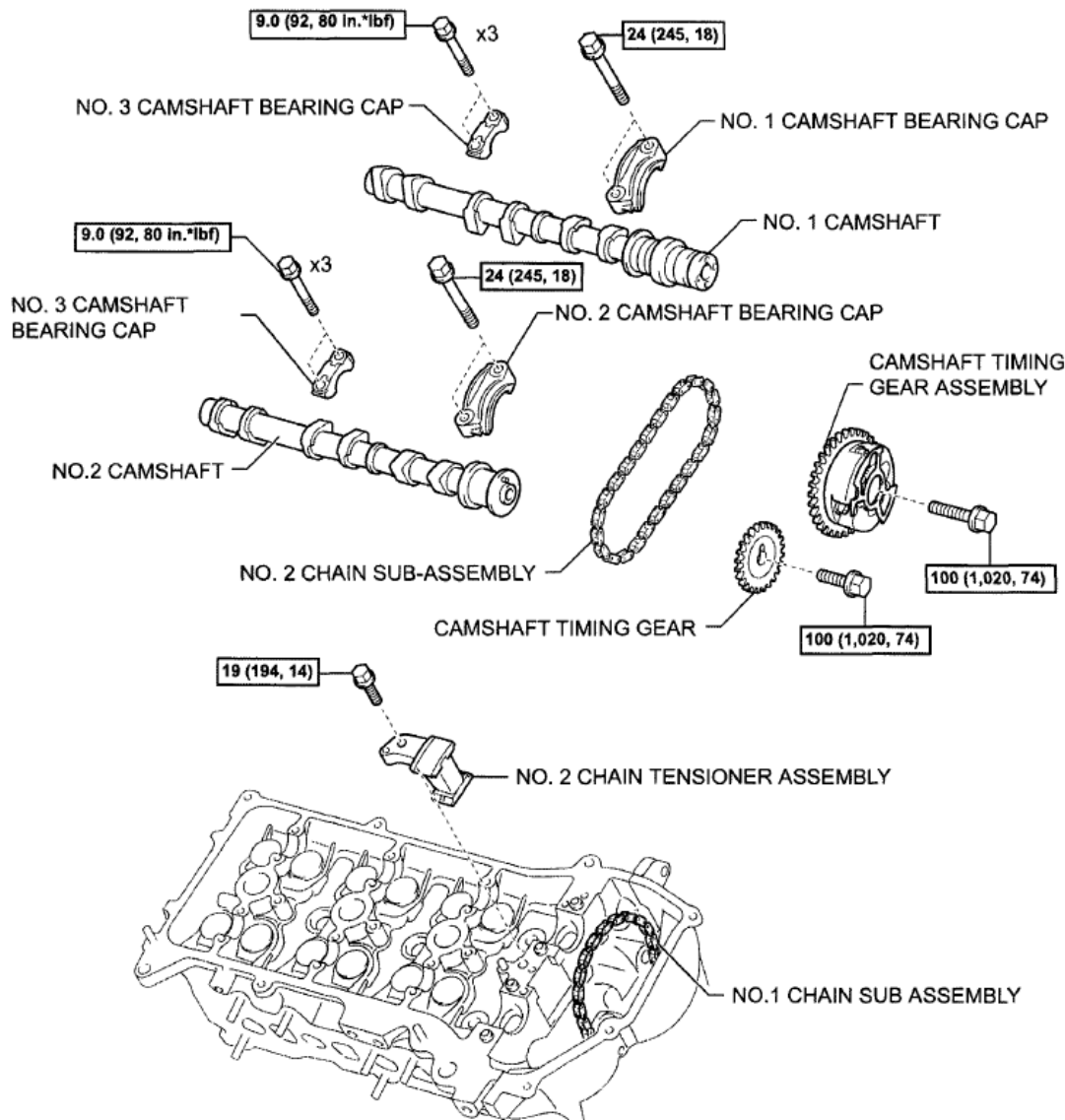
**Fig. 104: Exploded View Of Camshaft Components With Torque Specification (1 Of 3)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

| 2009 Toyota Tacoma                              |
|-------------------------------------------------|
| 2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma |

| 2009 Toyota Tacoma                              |
|-------------------------------------------------|
| 2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma |



**Fig. 105: Exploded View Of Camshaft Components With Torque Specification (2 Of 3)**  
**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**



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

A113592E02

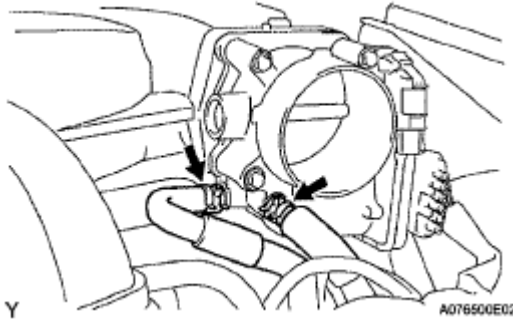
**Fig. 106: Exploded View Of Camshaft Components With Torque Specification (3 Of 3)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## REMOVAL

1. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**
2. **DRAIN ENGINE COOLANT** (See COOLANT )
3. **REMOVE V-BANK COVER** (See ON-VEHICLE INSPECTION )
4. **REMOVE AIR CLEANER ASSEMBLY** (See REMOVAL )

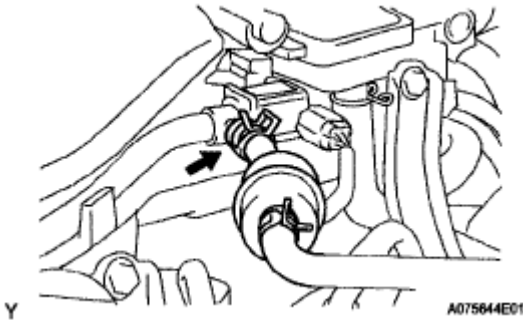
**5. REMOVE INTAKE AIR SURGE TANK**

- a. Disconnect the 2 water by-pass hoses.



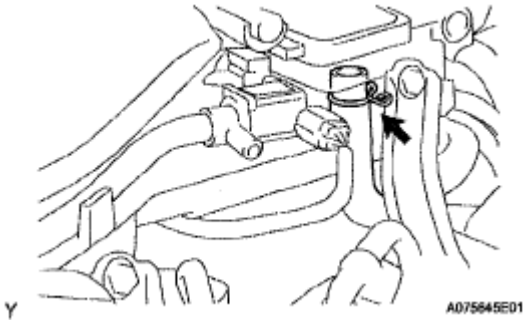
**Fig. 107: Locating Water By-Pass Hoses**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Disconnect the fuel vapor feed hose.



**Fig. 108: Locating Fuel Vapor Feed Hose**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

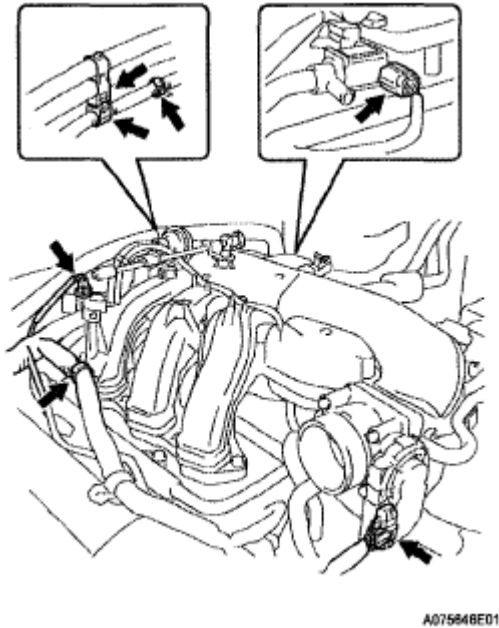
- c. Disconnect the ventilation hose.



**Fig. 109: Locating Ventilation Hose**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Disconnect the 2 VSV connectors.

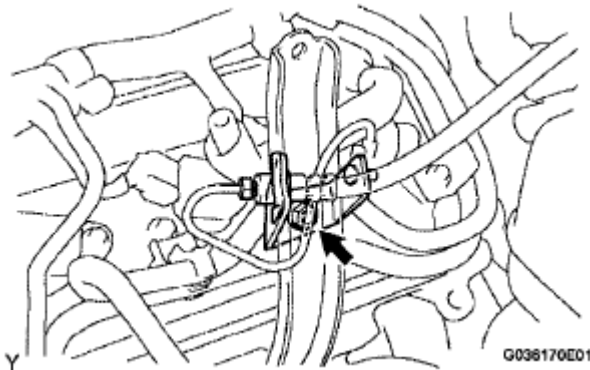
- e. Disconnect the throttle body with motor connector.
- f. Separate the 3 wire harness clamps and hose clamp.



**Fig. 110: Locating VSV Connectors**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

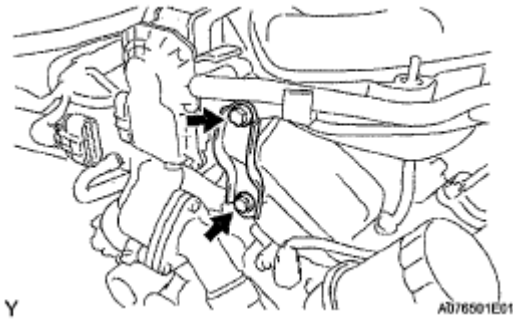
- g. Remove the nut, then separate the clutch flexible hose bracket from the surge tank stay (with Manual Transmission).



**Fig. 111: Locating Clutch Flexible Hose Bracket**

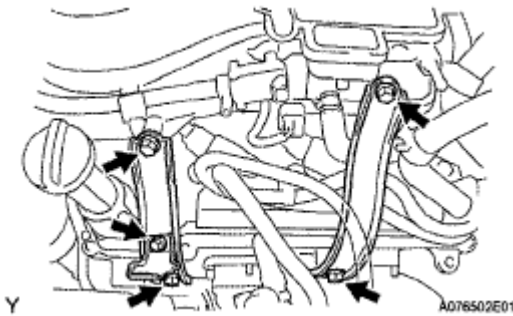
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- h. Remove the 2 bolts and throttle body bracket.



**Fig. 112: Locating Throttle Body Bracket And Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- i. Remove the bolt and oil baffle plate.
- j. Remove the 4 bolts and 2 surge tank stays.

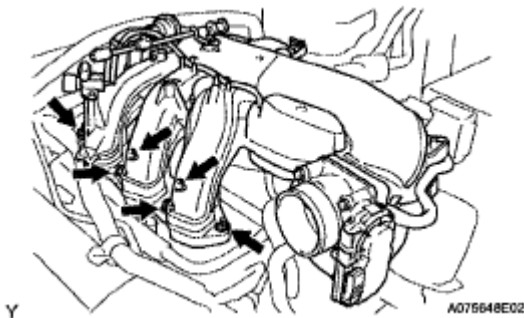


**Fig. 113: Locating Oil Baffle Plate Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- k. Remove the 2 nuts.
- l. Using a socket hexagon wrench 8, remove the 4 bolts, intake air surge tank and gasket.

#### **6. REMOVE IGNITION COIL ASSEMBLY**

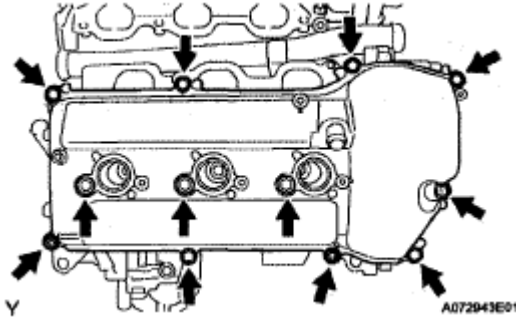
- a. Disconnect the 3 connectors.
- b. Remove the 3 bolts, then remove the 3 ignition coils.



**Fig. 114: Locating Ignition Coil Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**7. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY**

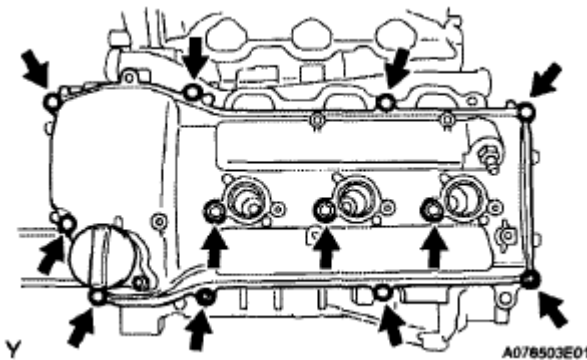
- a. Remove the 10 bolts, 3 seal washers, 2 nuts, cylinder head cover and gasket.



**Fig. 115: Locating Cylinder Head Cover Bolts And Seal Washer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**8. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY LH**

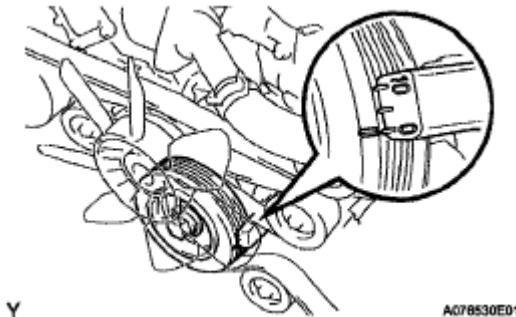
- a. Remove the 10 bolts, 3 seal washers, 2 nuts, cylinder head cover and gasket.



**Fig. 116: Locating Cylinder Head Cover Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**9. SET NO.1 CYLINDER TO TDC/COMPRESSION**

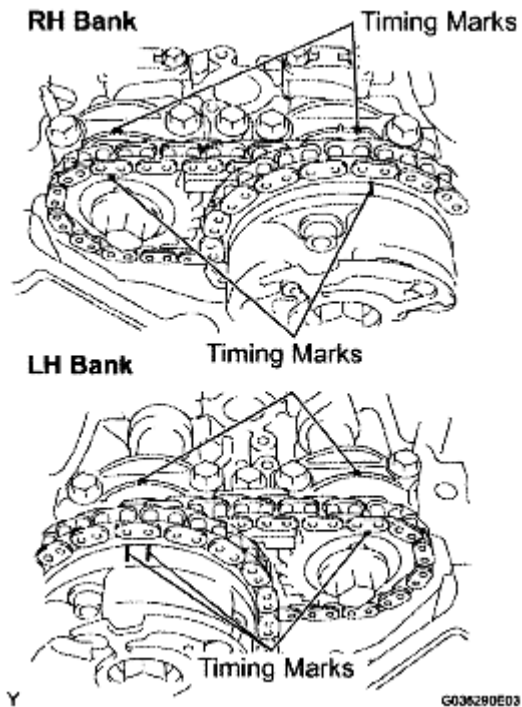
- a. Turn the crankshaft pulley until its groove and the timing mark "0" of the timing chain cover are aligned.



**Fig. 117: Identifying Timing Chain Cover Mark**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Check that the timing marks of the camshaft timing gears are aligned with the timing marks of the bearing cap as shown in the illustration. If not, turn the crankshaft 1 complete revolution (360°) and align the timing marks above.



**Fig. 118: Identifying Timing Marks Of Camshaft Timing Gears**

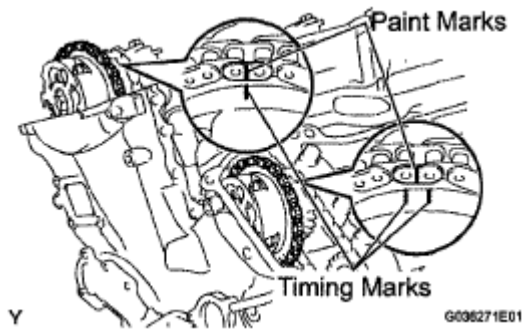
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Place paint marks on the No. 1 chain links corresponding to the timing marks of the camshaft timing gears.

#### 10. REMOVE NO.1 CHAIN TENSIONER ASSEMBLY

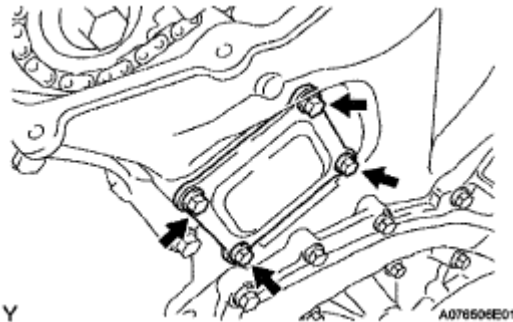
**NOTE:**

- Never rotate the crankshaft with the chain tensioner removed.
- When rotating the camshaft with the timing chain removed, rotate the crankshaft counterclockwise 40° from the TDC first.



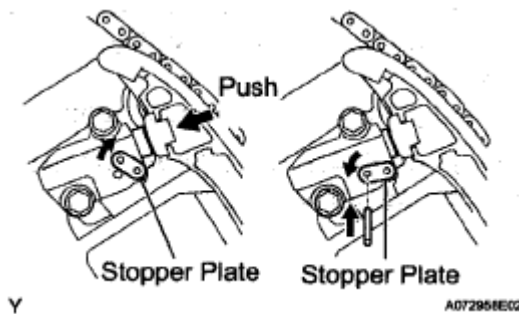
**Fig. 119: Identifying Paint Marks On No. 1 Chain Links**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Remove the 4 bolts, then remove the timing chain cover plate and gasket.



**Fig. 120: Locating Timing Chain Cover Plate Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. While turning the stopper plate of the tensioner upward, push in the plunger of the chain tensioner as shown in the illustration.
- c. While turning the stopper plate of the tensioner downward, insert a bar of 3.5 mm (0.138 in.) into the holes in the stopper plate and tensioner to fix the stopper plate.
- d. Remove the 2 bolts, then remove the chain tensioner.

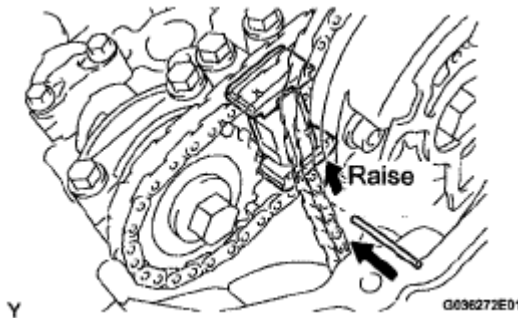


**Fig. 121: Pushing Plunger Of Chain Tensioner**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 11. REMOVE NO.2 CAMSHAFT

**NOTE:** Keep the camshaft level while it is being removed. The camshaft thrust clearance is very small and failing to keep it level could crack or damage the cylinder head journal surface, which receives the thrust. This could subsequently lead the camshaft to seize or break. Perform the following steps to avoid such problems.

- a. While raising the chain tensioner No. 2, insert a pin of 1.0 mm (0.039 in.) into the hole to fix it.

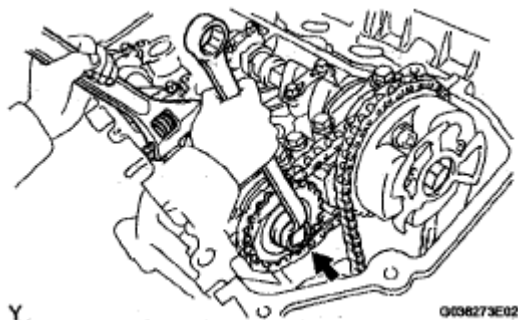


**Fig. 122: Raising Chain Tensioner No. 2**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Hold the hexagonal portion of the No. 2 camshaft with a wrench, and remove the camshaft timing gear set bolt.

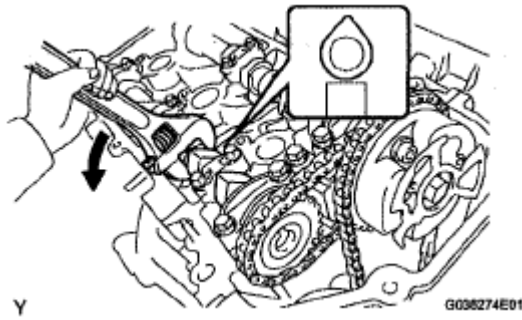
**NOTE:** Be careful not to damage the cylinder head and valve lifter with the wrench.

- c. Separate the camshaft timing gear from the No. 2 camshaft.



**Fig. 123: Removing Camshaft Timing Gear Set Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

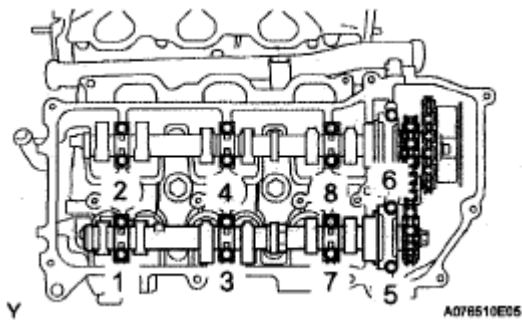
- d. Rotate the camshaft counterclockwise using the wrench so that the cam lobes of No. 1 cylinder face upward as shown in the illustration.



**Fig. 124: Rotating Camshaft**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Using several steps, uniformly loosen and remove the 8 bearing cap bolts in the sequence shown in the illustration.
- f. Remove the 4 bearing caps and No. 2 camshaft.



**Fig. 125: Identifying Bearing Cap Bolts Loosen Sequence**

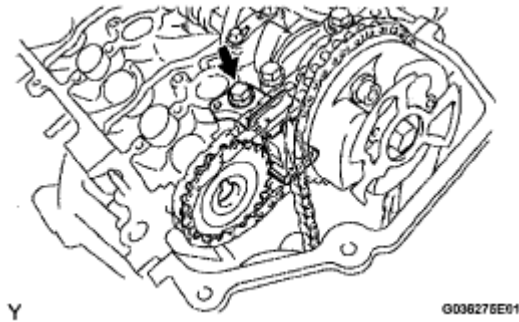
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 12. REMOVE NO.2 CHAIN TENSIONER ASSEMBLY

- a. Remove the chain tensioner No. 2 bolt, then remove the chain tensioner No. 2 and camshaft timing gear.

## 13. REMOVE CAMSHAFT

**NOTE:** Keep the camshaft level while it is being removed. The camshaft thrust clearance is very small and failing to keep it level could crack or damage the cylinder head journal surface, which receives the thrust. This could subsequently lead the camshaft to seize or break. Perform the following steps to avoid such problems.

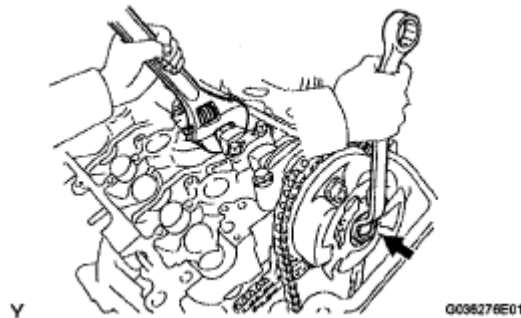


**Fig. 126: Locating Chain Tensioner No. 2 Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Hold the hexagonal portion of the No. 1 camshaft with a wrench, and loosen the camshaft timing gear set bolt.

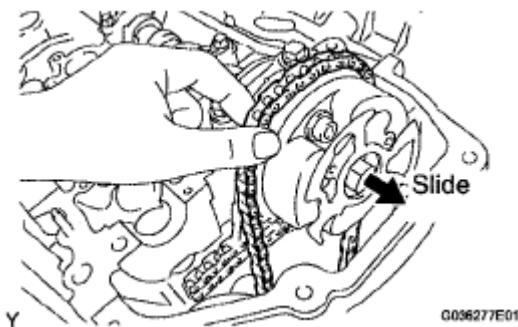
**NOTE:**

- Be careful not to damage the cylinder head and valve lifter with the wrench.
- Do not disassemble the camshaft timing gear assembly.



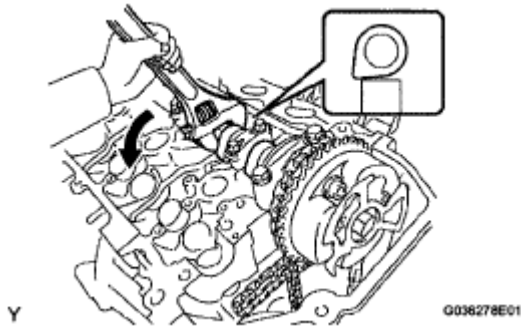
**Fig. 127: Holding Hexagonal Portion Of No. 1 Camshaft**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Slide the camshaft timing gear and separate the No. 1 chain from the camshaft timing gear.



**Fig. 128: Sliding Camshaft Timing Gear**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

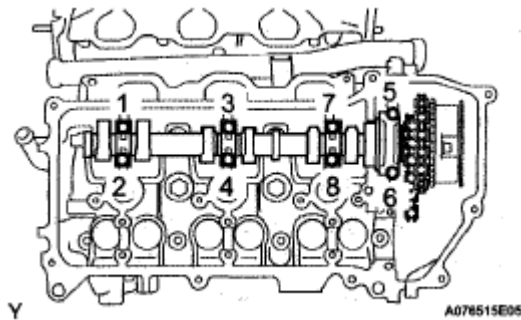
- c. Rotate the No. 1 camshaft counterclockwise using the wrench so that the cam lobes of No. 1 cylinder face downward as shown in the illustration.



**Fig. 129: Rotating No. 1 Camshaft**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

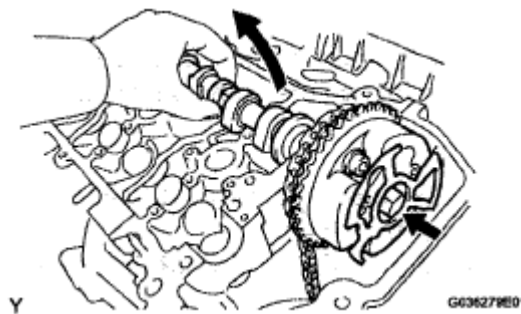
- d. Using several steps, loosen and remove the 8 bearing cap bolts in the sequence shown in the illustration.
- e. Remove the 4 bearing caps.



**Fig. 130: Identifying Bearing Cap Bolts Loosen Sequence**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Remove the camshaft timing gear set bolt with the No. 1 camshaft lifted up, then remove the No. 1 camshaft and camshaft timing gear with No. 2 chain.

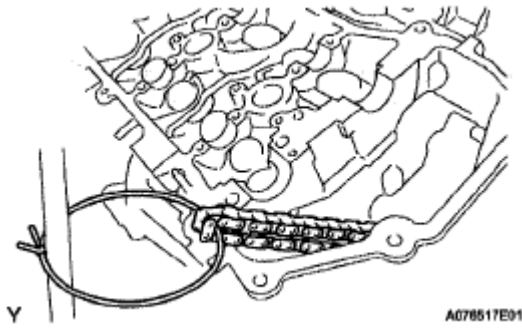


**Fig. 131: Removing Camshaft Timing Gear Set Bolt**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Tie the No. 1 chain with a string as shown in the illustration.

**NOTE:** Be careful not to drop anything inside the timing chain cover.



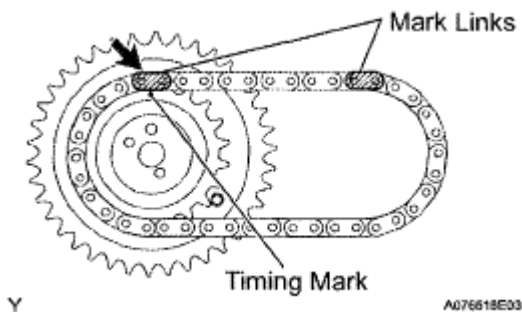
**Fig. 132: Tying No. 1 Chain With String**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## INSTALLATION

### 1. INSTALL CAMSHAFT

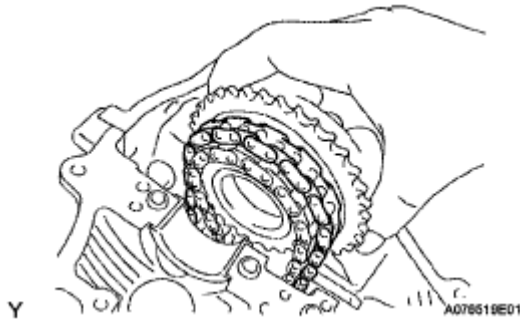
**NOTE:** Keep the camshaft level while it is being removed. The camshaft thrust clearance is very small and failing to keep it level could crack or damage the cylinder head journal surface, which receives the thrust. This could subsequently lead the camshaft to seize or break. Perform the following steps to avoid such problems.

- Align the yellow mark link with the timing mark (1 dot mark) of the camshaft timing gear as shown in the illustration.
- Apply new engine oil to the thrust portion and journal of the camshafts.



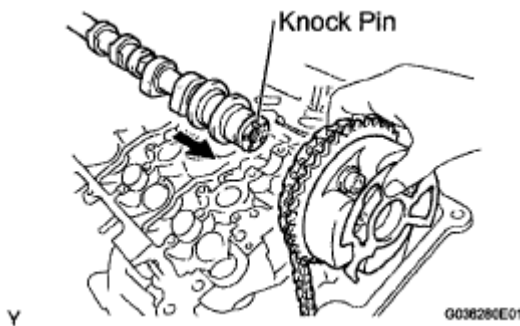
**Fig. 133: Aligning Timing Mark Of Camshaft Timing Gear**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Temporarily install the No. 1 chain onto the No. 2 chain of the camshaft timing gear.

**Fig. 134: Installing No. 1 Chain**

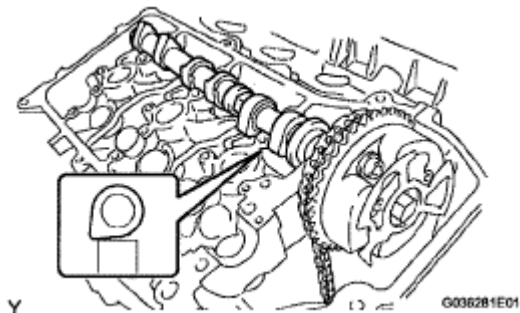
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Align the knock pin hole of the camshaft timing gear with the knock pin of the No. 1 camshaft, and insert the No. 1 camshaft into the camshaft timing gear.
- e. Temporarily install the camshaft timing gear set bolt.

**Fig. 135: Aligning Knock Pin Hole Of Camshaft Timing Gear**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

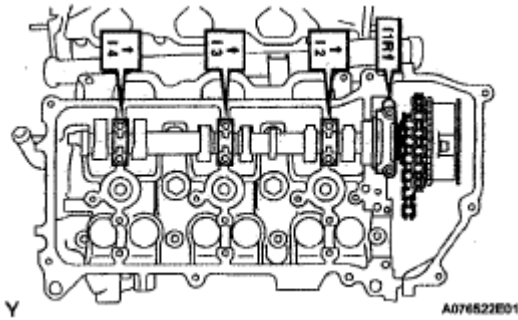
- f. Install the No. 1 camshaft onto the RH cylinder head with the cam lobes of the No. 1 cylinder facing downward as shown in the illustration.

**Fig. 136: Identifying No. 1 Camshaft Onto RH Cylinder Head**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Install the 4 bearing caps in the proper locations as shown.

- h. Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.



**Fig. 137: Identifying Bearing Caps**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

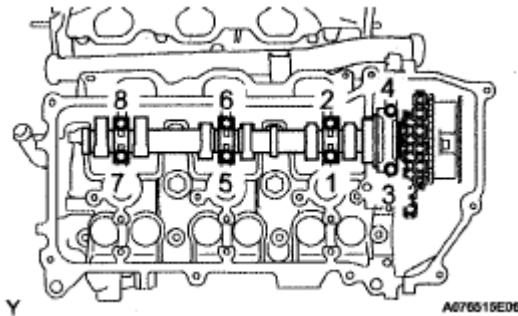
- i. Using several steps, uniformly install and tighten the 8 bearing cap bolts in the sequence shown in the illustration.

**Torque: 9.0 N\*m (92 kgf\*cm, 80 in.\*lbf) for 10**

**mm (0.39 in.) head**

**24 N\*m (245 kgf\*cm, 18 ft.\*lbf) for 12**

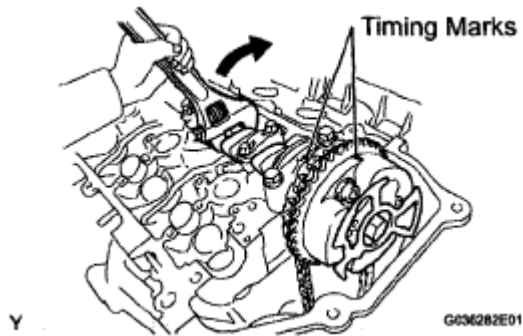
**mm (0.47 in.) head**



**Fig. 138: Identifying Bearing Caps Bolts Tighten Sequence**

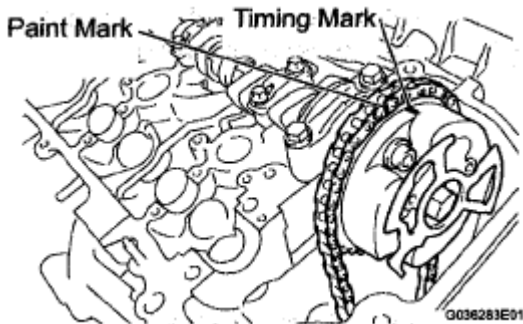
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- j. Rotate the No. 1 camshaft clockwise using a wrench so that the timing mark of the camshaft timing gear is aligned with the timing mark of the camshaft bearing cap.

**Fig. 139: Rotating No. 1 Camshaft**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

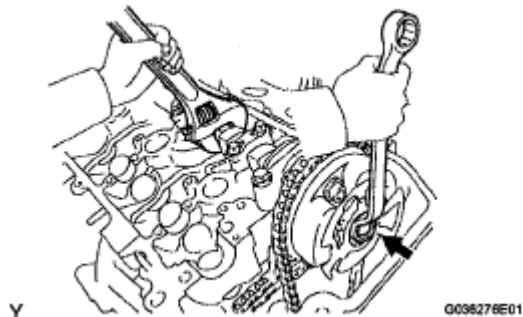
- k. Align the paint mark of the No. 1 chain with the timing mark of the camshaft timing gear.

**Fig. 140: Aligning Paint Mark Of No. 1 Chain**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- l. Hold the hexagonal portion of the No. 1 camshaft with a wrench, and tighten the camshaft timing gear set bolt.

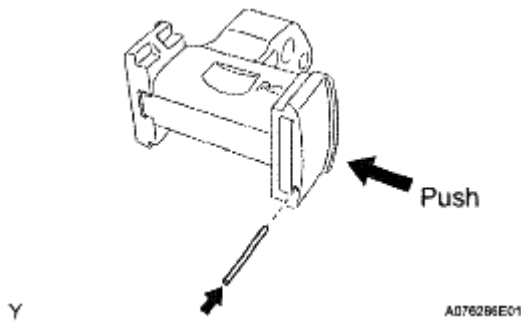
**Torque: 100 N\*m (1,020 kgf\*cm, 74 ft.\*lbf)**

**Fig. 141: Tightening Camshaft Timing Gear Set Bolt**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 2. INSTALL NO.2 CHAIN TENSIONER ASSEMBLY

- a. While pushing in the tensioner, insert a pin of 1.0 mm (0.039 in.) into the hole to fix it.

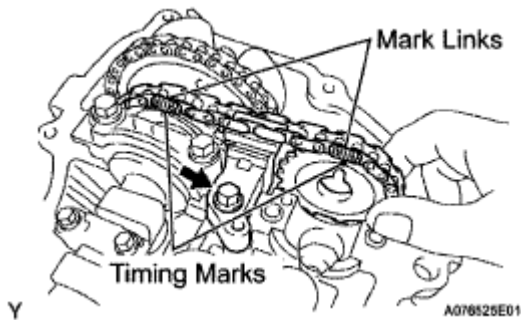


**Fig. 142: Pushing Tensioner**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Temporarily install the camshaft timing gear and chain tensioner No. 2 and align the yellow mark links with the timing marks (1 dot mark) of the camshaft timing gears.
- c. Tighten the chain tensioner No. 2 bolt.

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



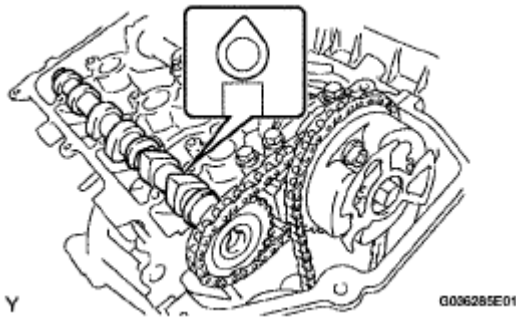
**Fig. 143: Identifying Camshaft Timing Gear And Chain Tensioner No. 2**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### 3. INSTALL NO.2 CAMSHAFT

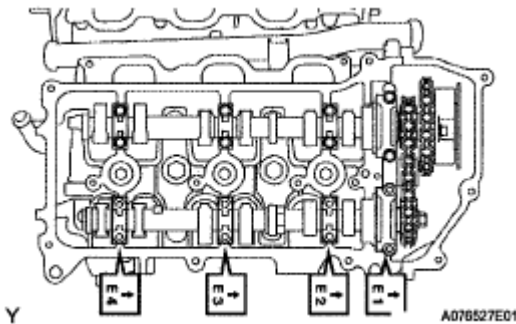
**NOTE:** Keep the camshaft level while it is being removed. The camshaft thrust clearance is very small and failing to keep it level could crack or damage the cylinder head journal surface, which receives the thrust. This could subsequently lead the camshaft to seize or break. Perform the following steps to avoid such problems.

- a. Install the No. 2 camshaft onto the RH cylinder head with the cam lobes of No. 1 cylinder facing upward as shown in the illustration.



**Fig. 144: Identifying Cam Lobes Of No. 1 Cylinder**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the 4 bearing caps in the proper locations as shown.
- c. Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.



**Fig. 145: Identifying Bearing Caps In Proper Locations**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

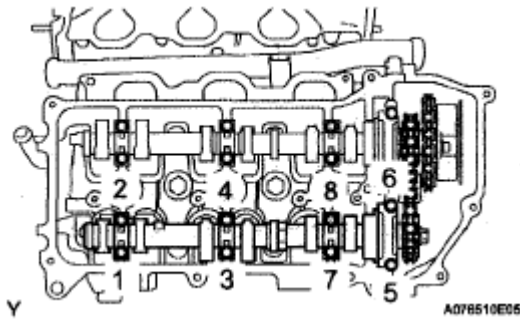
- d. Using several steps, uniformly install and tighten the 8 bearing cap bolts in the sequence shown in the illustration.

**Torque: 9.0 N\*m (92 kgf\*cm, 80 in.\*lbf) for 10**

**mm (0.39 in.) head**

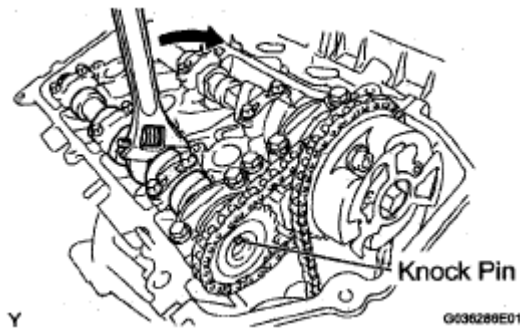
**24 N\*m (245 kgf\*cm, 18 ft.\*lbf) for 12**

**mm (0.47 in.) head**



**Fig. 146: Identifying Bearing Cap Bolts Tighten Sequence**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Rotate the No. 2 camshaft clockwise using a wrench so that the knock pin of the No. 2 camshaft is aligned with the knock pin hole of the camshaft timing gear.

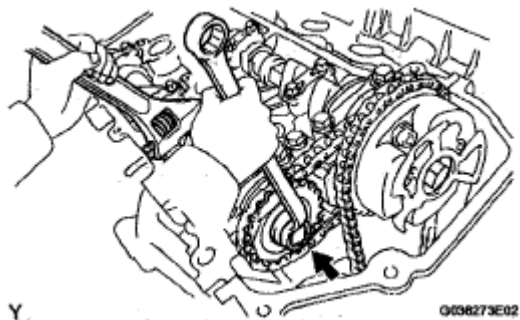


**Fig. 147: Rotating No. 2 Camshaft**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Hold the hexagonal portion of the No. 2 camshaft with a wrench, and install the camshaft timing gear set bolt.

**Torque: 100 N\*m (1,020 kgf\*cm, 74 ft.\*lbf)**

- g. Remove the pin from the chain tensioner No. 2.

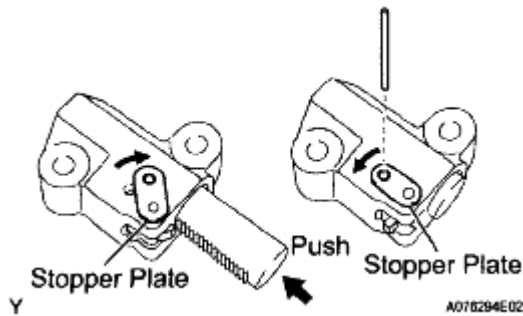


**Fig. 148: Removing Camshaft Timing Gear Set Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### 4. INSTALL NO.1 CHAIN TENSIONER ASSEMBLY

- While turning the stopper plate of the tensioner clockwise, push in the plunger of the tensioner as shown in the illustration.
- While turning the stopper plate of the tensioner counterclockwise, insert a bar of 3.5 mm (0.138 in.) into the holes in the stopper plate and tensioner to fix the stopper plate.
- Install the chain tensioner with the 2 bolts.

**Torque: 10 N\*m (102 kgf\*cm, 7.4 ft.\*lbf)**

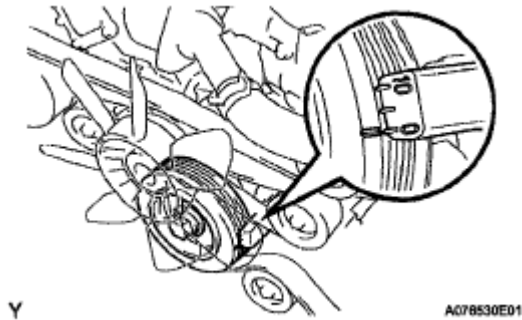


**Fig. 149: Pushing Plunger Of Tensioner**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Remove the bar from the chain tensioner.
- Install a new gasket and the timing chain cover plate with the 4 bolts.

**Torque: 9.0 N\*m (92 kgf\*cm, 80 in.\*lbf)**

- Turn the crankshaft pulley 2 complete revolutions slowly until its groove and the timing mark "0" of the timing chain cover are aligned.

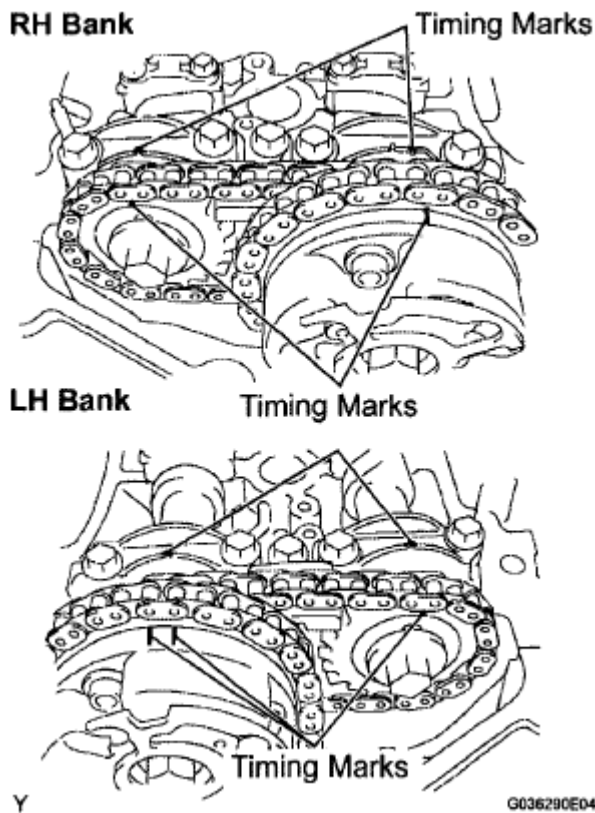


**Fig. 150: Identifying Timing Chain Cover Mark**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Check that the timing marks of the camshaft timing gears are aligned with the timing marks of the bearing cap as shown in the illustration.

#### 5. SET CYLINDER TO TDC/COMPRESSION (See ADJUSTMENT)

6. **INSPECT VALVE CLEARANCE** (See ADJUSTMENT )
7. **ADJUST VALVE CLEARANCE** (See ADJUSTMENT )
8. **INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY LH**
  - a. Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the cylinder head, timing chain cover and cylinder head cover.

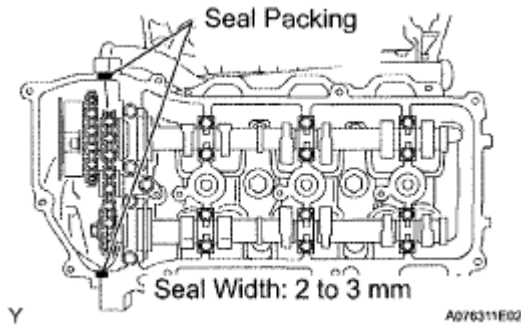


**Fig. 151: Identifying Timing Marks Of Camshaft Timing Gears**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the cylinder head cover within 3 minutes of applying seal packing. Tighten the cylinder head cover bolts and nuts within 15 minutes of installing the cylinder head cover. Otherwise, the seal packing must be removed and reapplied.

**Seal packing:**

**Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent**



**Fig. 152: Identifying Cylinder Head Cover Seal Packing**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

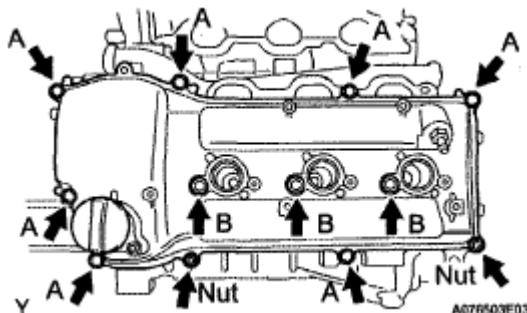
**NOTE:** Install the cylinder head cover within 3 minutes after applying the seal packing. After installing it, cylinder head cover bolts and nuts must be tightened within 15 minutes. Otherwise the seal packing must be removed and reapplied.

- c. Install the seal washers onto the bolts.
- d. Install the cylinder head cover with the 10 bolts and 2 nuts. Tighten the bolts and nuts uniformly in several steps.

**Torque: 10 N\*m (102 kgf\*cm, 7.4 ft.\*lbf) for bolt A**

**9.0 N\*m (92 kgf\*cm, 80 in.\*lbf) for bolt B**

**9.0 N\*m (92 kgf\*cm, 80 in.\*lbf) for nut**



**Fig. 153: Locating Cylinder Head Cover With Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**HINT:**

Each bolt length is as follows.

**BOLT LENGTH SPECIFICATION**

| Bolt | Length |
|------|--------|
|------|--------|

|   |                  |
|---|------------------|
| A | 25 mm (0.98 in.) |
| B | 60 mm (2.36 in.) |

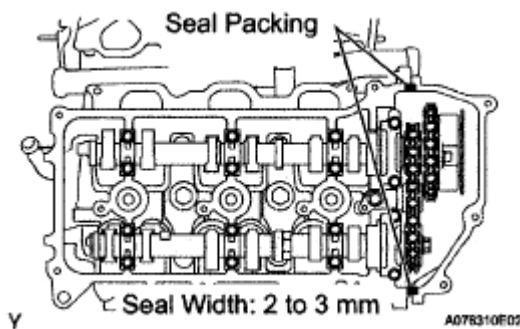
## 9. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY

- Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the cylinder head, timing chain cover and cylinder head cover.
- Apply a continuous bead of seal packing (diameter 2 to 3 mm (0.08 to 0.12 in.)) to the cylinder head and timing chain cover as shown in the illustration.

### Seal packing:

Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent

**NOTE:** Install the cylinder head cover within 3 minutes of applying the seal packing. Tighten the cylinder head cover bolts and nuts within 15 minutes of installing the cylinder head cover. Otherwise, the seal packing must be removed and reapplied.



**Fig. 154: Identifying Seal Packing Of Cylinder Head**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

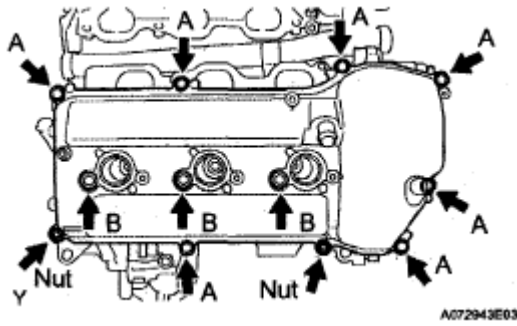
- Install the seal washers onto the bolts.
- Install the cylinder head cover with the 10 bolts and 2 nuts. Tighten the bolts and nuts uniformly in several steps.

**Torque: 10 N\*m (102 kgf\*cm, 7.4 ft.\*lbf) for bolt A**

**9.0 N\*m (92 kgf\*cm, 80 in.\*lbf) for bolt B**

**9.0 N\*m (92 kgf\*cm, 80 in.\*lbf) for nut**

**HINT:**



**Fig. 155: Locating Cylinder Head Cover Bolts**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Each bolt length is as follows.

#### BOLT LENGTH SPECIFICATION

| Bolt | Length           |
|------|------------------|
| A    | 25 mm (0.98 in.) |
| B    | 60 mm (2.36 in.) |

#### 10. INSTALL IGNITION COIL ASSEMBLY

- Install the 3 ignition coils with the 3 bolts.

**Torque: 10 N\*m (102 kgf\*cm, 7.4 ft.\*lbf) for bolt A**

- Connect the 3 connectors.

#### 11. INSTALL INTAKE AIR SURGE TANK

- Install a new gasket onto the intake air surge tank.
- Using the socket hexagon wrench 8, install the intake air surge tank with the 4 bolts.

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

- Install the 2 intake air surge tank nuts.

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

- Install the 2 surge tank stays with the 4 bolts.

**Torque: 21 N\*m (214 kgf\*cm, 15 ft.\*lbf)**

- Install the oil baffle plate with the bolt.

**Torque: 9.0 N\*m (92 kgf\*cm, 80 in.\*lbf)**

- Install the throttle body bracket with the 2 bolts.

**Torque: 21 N\*m (214 kgf\*cm, 15 ft.\*lbf)**

- g. Install the clutch flexible hose bracket with the nut (w/ Manual Transmission).

**Torque: 24 N\*m (245 kgf\*cm, 18 ft.\*lbf)**

- h. Install the 3 wire harness clamps and hose clamp.
  - i. Connect the throttle body w/ motor connector.
  - j. Connect the 2 VSV connectors.
  - k. Connect the ventilation hose.
  - l. Connect the fuel vapor feed hose.
  - m. Connect the 2 water by-pass hoses.
12. **INSTALL AIR CLEANER ASSEMBLY** (See INSPECTION )
13. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**

**Torque: 3.9 N\*m (40 kgf\*cm, 35 in.\*lbf)**

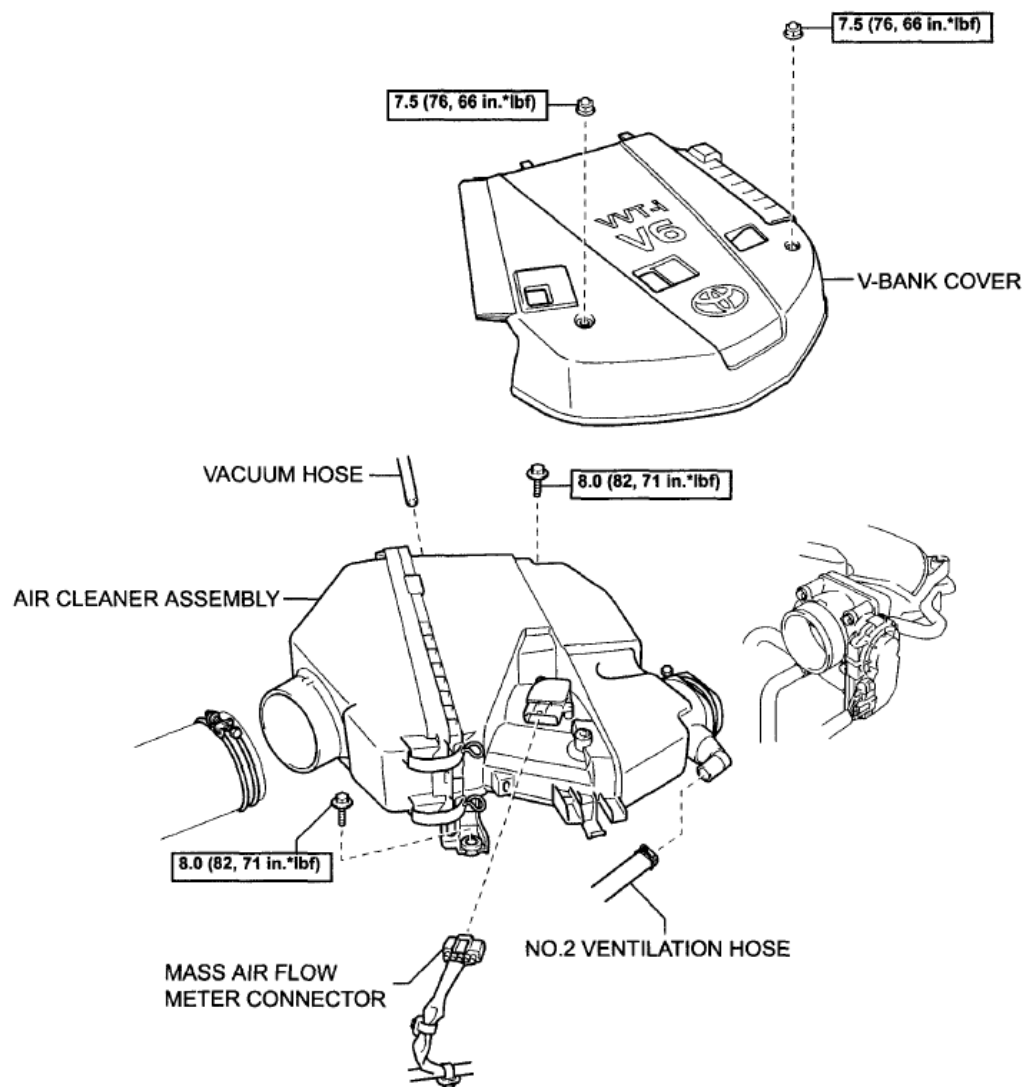
14. **ADD ENGINE COOLANT** (See COOLANT )
15. **CHECK FOR ENGINE COOLANT LEAKAGE** (See REPLACEMENT )
16. **INSTALL V-BANK COVER**
- a. Install the V-bank cover with the 2 nuts.

**Torque: 7.5 N\*m (76 kgf\*cm, 66 in.\*lbf)**

17. **INSPECT IGNITION TIMING** (See ON-VEHICLE INSPECTION )

## **CAMSHAFT (FOR BANK 2)**

### **COMPONENTS**



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

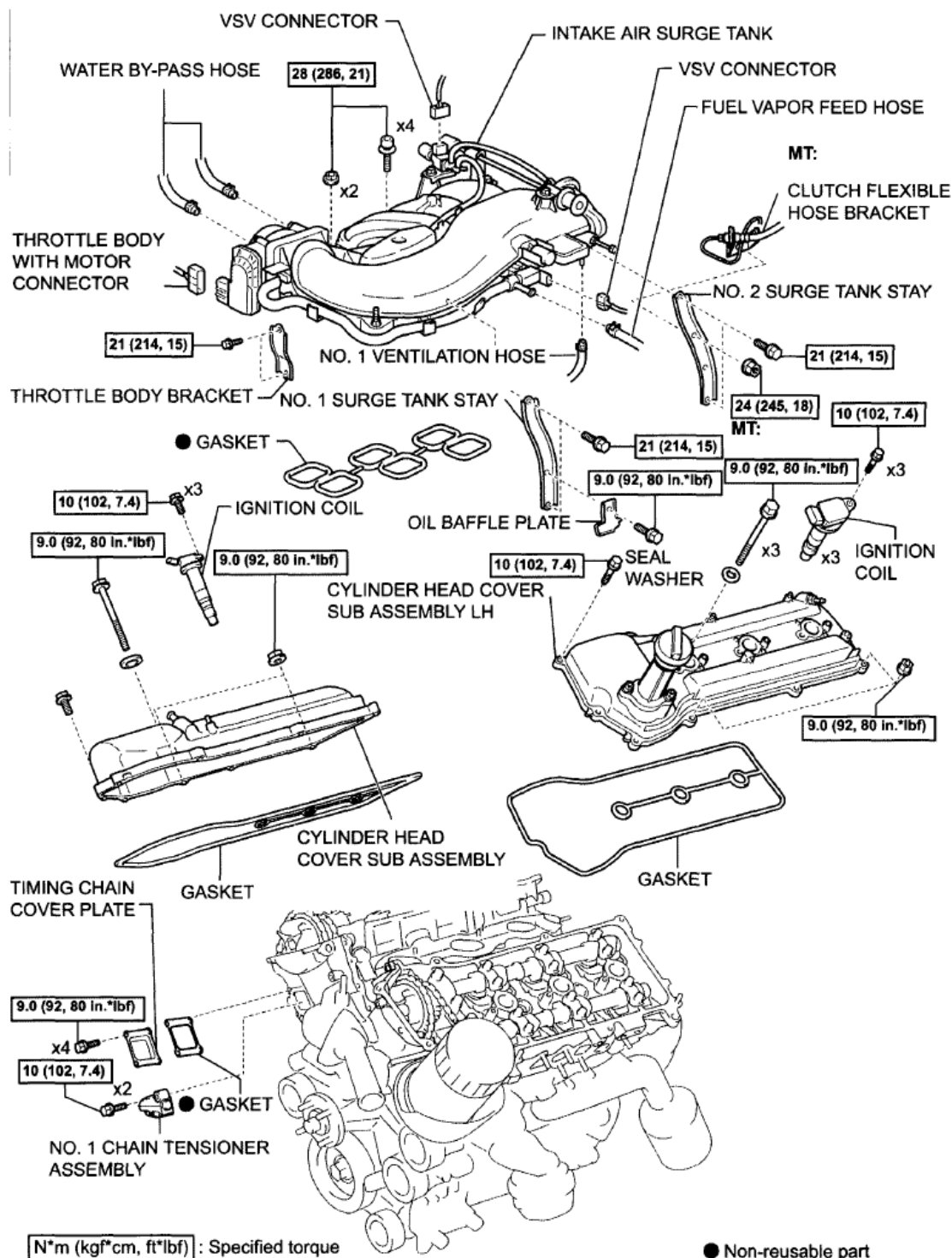
Y

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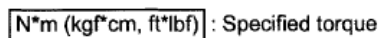
**Fig. 156: Exploded View Of Camshaft Components With Torque Specification (1 Of 3)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

| 2009 Toyota Tacoma                              |
|-------------------------------------------------|
| 2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma |

| 2009 Toyota Tacoma                              |
|-------------------------------------------------|
| 2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma |



**Fig. 157: Exploded View Of Camshaft Components With Torque Specification (2 Of 3)**  
**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**



A113593E01

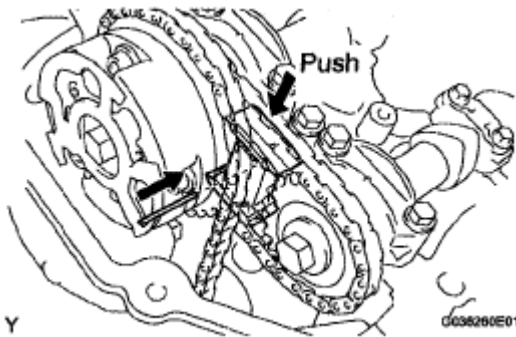
## REMOVAL

1. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**
2. **DRAIN ENGINE COOLANT** (See **COOLANT** )

3. **REMOVE V-BANK COVER** (See ON-VEHICLE INSPECTION )
4. **REMOVE AIR CLEANER ASSEMBLY** (See REMOVAL )
5. **REMOVE INTAKE AIR SURGE TANK** (See REMOVAL )
6. **REMOVE IGNITION COIL ASSEMBLY** (See IGNITION COIL )
7. **REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY** (See REMOVAL )
8. **REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY LH** (See REMOVAL )
9. **SET NO.1 CYLINDER TO TDC/COMPRESSION** (See REMOVAL )
10. **REMOVE NO.1 CHAIN TENSIONER ASSEMBLY** (See REMOVAL )
11. **REMOVE NO.4 CAMSHAFT SUB-ASSEMBLY**

**NOTE:** Keep the camshaft level while it is being removed. The camshaft thrust clearance is very small and failing to keep it level could crack or damage the cylinder head journal surface, which receives the thrust. This could subsequently lead the camshaft to seize or break. Perform the following steps to avoid such problems.

- a. While pushing down the chain tensioner No. 3, insert a pin of 1.0 mm (0.039 in.) into the hole to fix it.

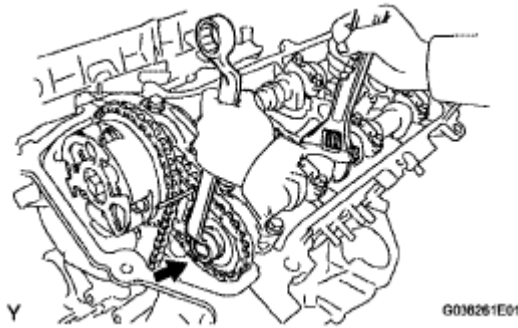


**Fig. 159: Pushing Chain Tensioner No. 3**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Hold the hexagonal portion of the No. 4 camshaft with a wrench, and remove the camshaft timing gear set bolt.

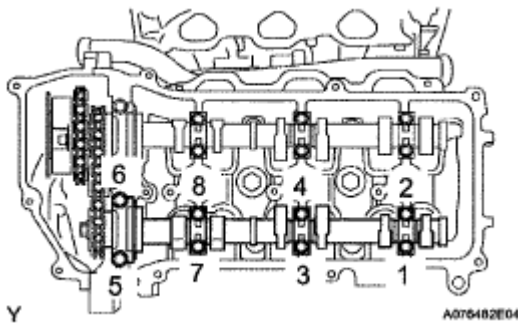
**NOTE:** Be careful not to damage the cylinder head and valve lifter with the wrench.

- c. Separate the camshaft timing gear from the No. 4 camshaft.



**Fig. 160: Removing Camshaft Timing Gear Set Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Using several steps, uniformly loosen and remove the 8 bearing cap bolts in the sequence shown in the illustration.
- e. Remove the 4 bearing caps and No. 4 camshaft.



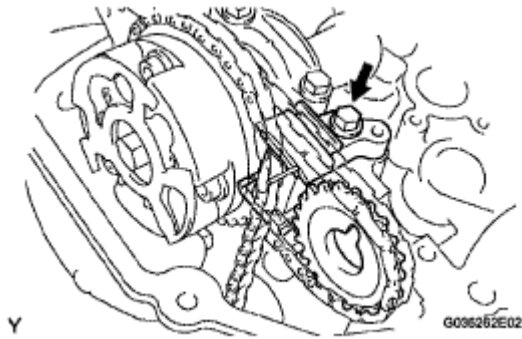
**Fig. 161: Identifying Bearing Cap Bolt Loosen Sequence**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 12. REMOVE NO.3 CHAIN TENSIONER ASSEMBLY

- a. Remove the chain tensioner No. 3 bolt, then remove the chain tensioner No. 3 and camshaft timing gear.

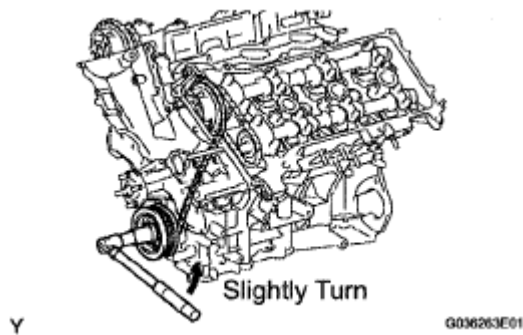
## 13. REMOVE NO.3 CAMSHAFT SUB-ASSEMBLY

**NOTE:** Keep the camshaft level while it is being removed. The camshaft thrust clearance is very small and failing to keep it level could crack or damage the cylinder head journal surface, which receives the thrust. This could subsequently lead the camshaft to seize or break. Perform the following steps to avoid such problems.



**Fig. 162: Locating Chain Tensioner No. 3 Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Release the chain tension between the camshaft timing gear (LH bank) and crankshaft timing gear by turning the crankshaft pulley counterclockwise slightly.

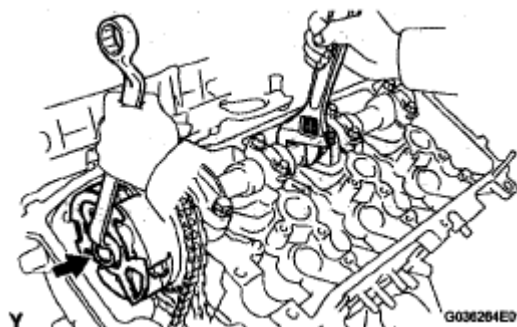


**Fig. 163: Turning Crankshaft Pulley**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Hold the hexagonal portion of the No. 3 camshaft with a wrench, then loosen the camshaft timing gear set bolt.

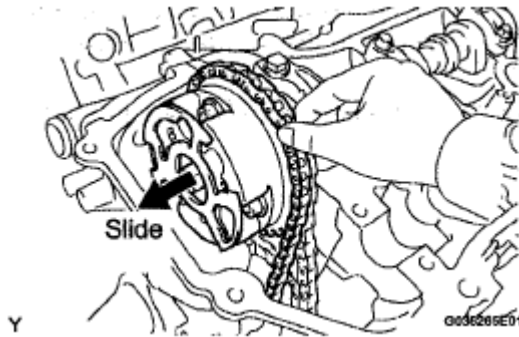
**NOTE:**

- Be careful not to damage the cylinder head and valve lifter with the wrench.
- Do not disassemble the camshaft timing gear assembly.



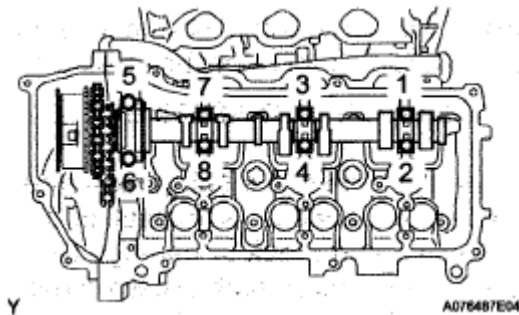
**Fig. 164: Loosening Camshaft Timing Gear Set Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Slide the camshaft timing gear and separate the No. 1 chain from the camshaft timing gear.



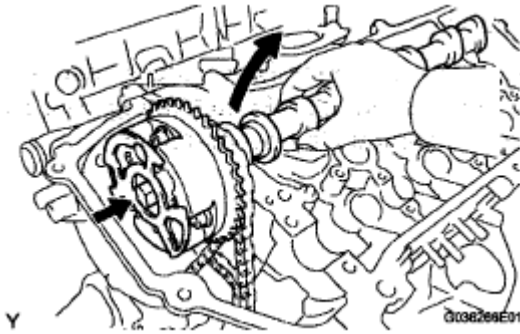
**Fig. 165: Sliding Camshaft Timing Gear**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Using several steps, uniformly loosen and remove the 8 bearing cap bolts in the sequence shown in the illustration.
- e. Remove the 4 bearing caps.



**Fig. 166: Identifying Bearing Cap Bolts Loosen Sequence**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

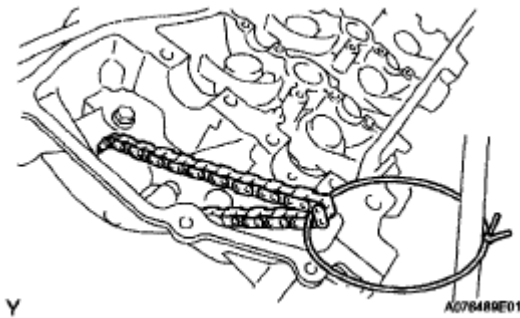
- f. Remove the camshaft timing gear set bolt with the No. 3 camshaft lifted up, then remove the No. 3 camshaft and camshaft timing gear w/ No. 2 chain.

**Fig. 167: Removing Camshaft Timing Gear**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Tie the No. 1 chain with a string as shown in the illustration.

**NOTE:** Be careful not to drop anything inside the timing chain cover.

**Fig. 168: Tying No. 1 Chain With String**

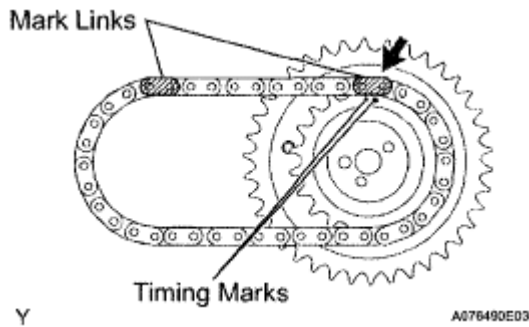
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## INSTALLATION

### 1. INSTALL NO.3 CAMSHAFT SUB-ASSEMBLY

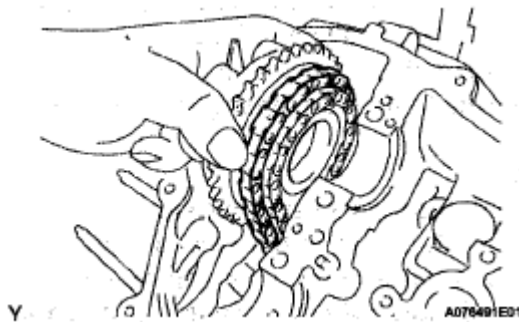
**NOTE:** Keep the camshaft level while it is being removed. The camshaft thrust clearance is very small and failing to keep it level could crack or damage the cylinder head journal surface, which receives the thrust. This could subsequently lead the camshaft to seize or break. Perform the following steps to avoid such problems.

- Align the yellow mark link with the timing mark (2 dot marks) of the camshaft timing gear as shown in the illustration.
- Apply new engine oil to the thrust portion and journal of the camshafts.



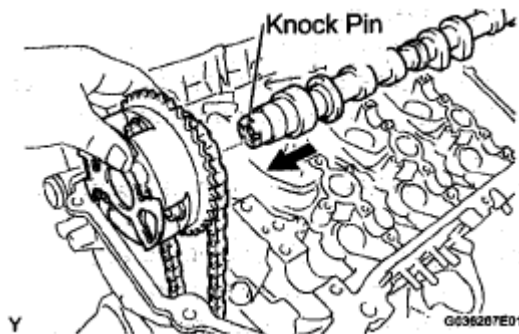
**Fig. 169: Identifying Timing Mark Of Camshaft Timing Gear**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Temporarily put the No. 1 chain on the No. 2 chain of the camshaft timing gear.



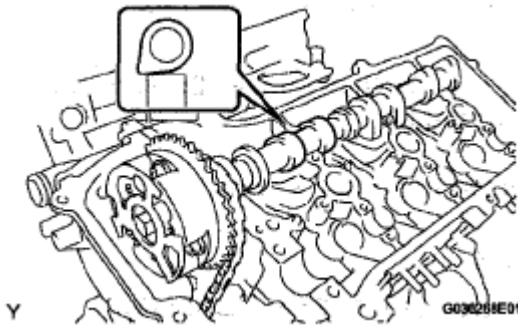
**Fig. 170: Putting No. 1 Chain On No. 2 Chain**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Align the knock pin hole in the camshaft timing gear with the knock pin of the No. 3 camshaft, and insert the No. 3 camshaft into the camshaft timing gear.
- e. Temporarily install the camshaft timing gear set bolt.



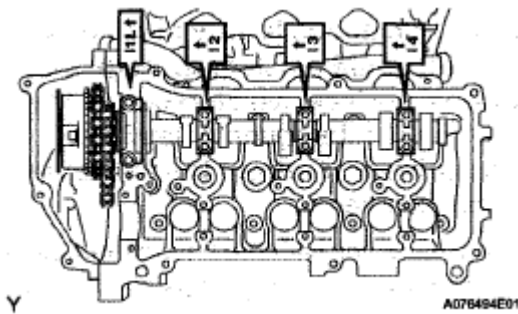
**Fig. 171: Aligning Knock Pin Hole In Camshaft Timing Gear**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Set the No. 3 camshaft onto the LH cylinder head with the cam lobes of the No. 2 cylinder facing downward as shown in the illustration.



**Fig. 172: Setting No. 3 Camshaft Onto Cylinder Head**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Install the 4 bearing caps in the proper locations as shown.
- h. Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.



**Fig. 173: Identifying Bearing Caps In Proper Locations**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

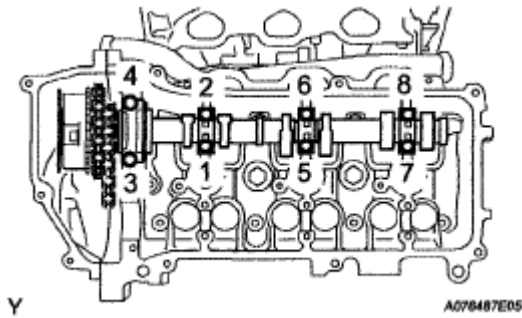
- i. Using several steps, uniformly install and tighten the 8 bearing cap bolts in the sequence shown in the illustration.

**Torque: 9.0 N\*m (92 kgf\*cm, 80 in.\*lbf) for 10**

**mm (0.39 in.) head**

**24 N\*m (245 kgf\*cm, 18 ft.\*lbf) for 12**

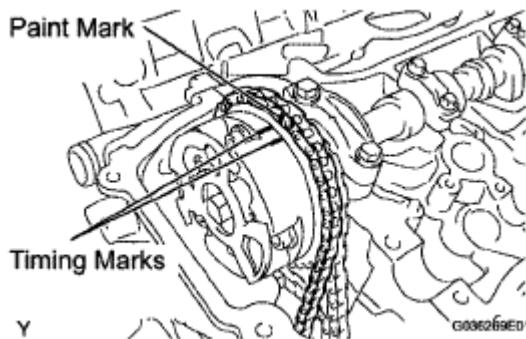
**mm (0.47 in.) head**



**Fig. 174: Identifying Bearing Cap Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- j. Align the paint mark of the No. 1 chain with the timing marks of the camshaft timing gear.

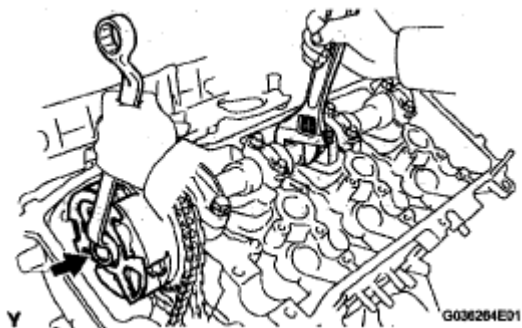


**Fig. 175: Identifying Timing Marks Of Camshaft Timing Gear**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- k. Hold the hexagonal portion of the No. 3 camshaft with a wrench, and tighten the camshaft timing gear set bolt.

**Torque: 100 N\*m (1,020 kgf\*cm, 74 ft.\*lbf)**

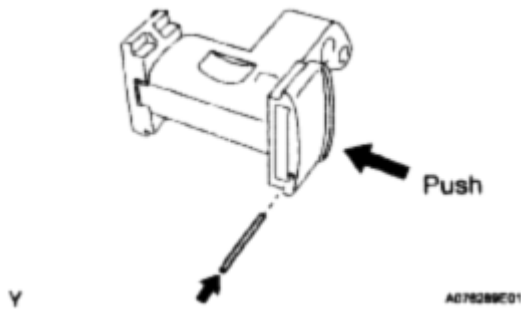


**Fig. 176: Loosening Camshaft Timing Gear Set Bolt**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 2. INSTALL NO.3 CHAIN TENSIONER ASSEMBLY

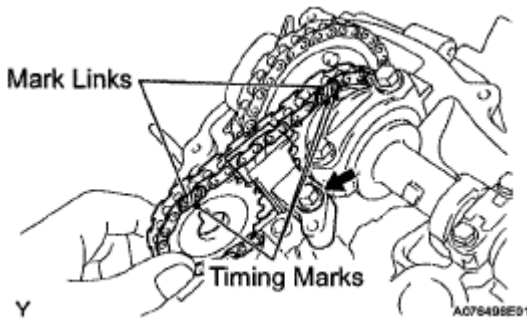
- a. While pushing in the tensioner, insert a pin of 1.0 mm (0.039 in.) into the hole to hold it.



**Fig. 177: Pushing No.3 Chain Tensioner Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Temporarily install the camshaft timing gear and chain tensioner No. 3 and align the yellow mark links with the timing marks (1 dot mark and 2 dot marks) of the camshaft timing gears.
- c. Tighten the chain tensioner No. 3 bolt.

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

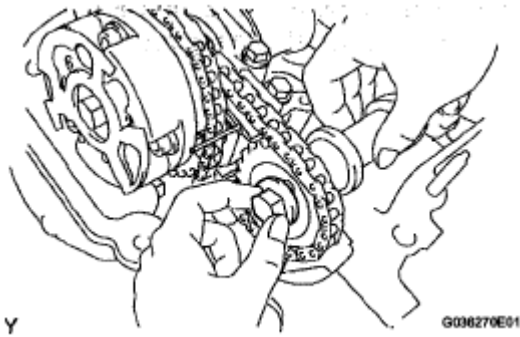


**Fig. 178: Identifying Timing Marks Of Camshaft Timing Gears**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### 3. INSTALL N0.4 CAMSHAFT SUB-ASSEMBLY

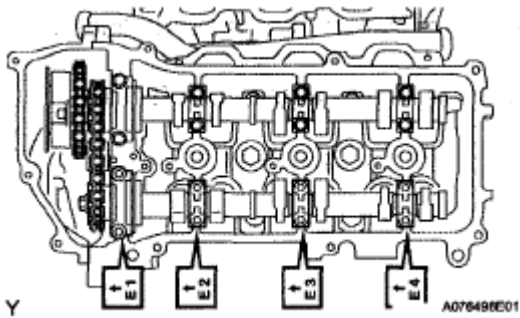
**NOTE:** Keep the camshaft level while it is being removed. The camshaft thrust clearance is very small and failing to keep it level could crack or damage the cylinder head journal surface, which receives the thrust. This could subsequently lead the camshaft to seize or break. Perform the following steps to avoid such problems.

- a. Align the knock pin hole in the camshaft timing gear with the knock pin of the No. 4 camshaft, and insert the No. 4 camshaft into the camshaft timing gear.
- b. Temporarily install the camshaft timing gear set bolt.



**Fig. 179: Aligning Knock Pin Hole In Camshaft Timing Gear**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the 4 bearing caps in the proper locations as shown.
- d. Apply a light coat of engine oil to the threads of the bearing cap bolts.



**Fig. 180: Identifying Bearing Caps In Proper Locations**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

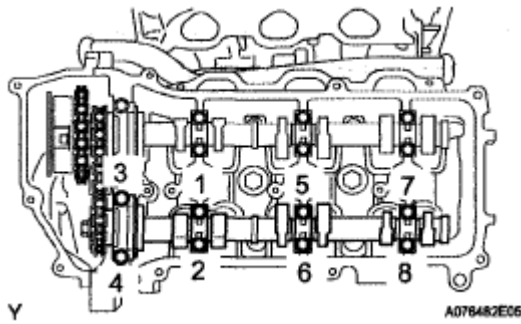
- e. Using several steps, uniformly install and tighten the 8 bearing cap bolts in the sequence shown in the illustration.

**Torque: 9.0 N\*m (92 kgf\*cm, 80 in.\*lbf) for 10**

**mm (0.39 in.) head**

**24 N\*m (245 kgf\*cm, 18 ft.\*lbf) for 12**

**mm (0.47 in.) head**

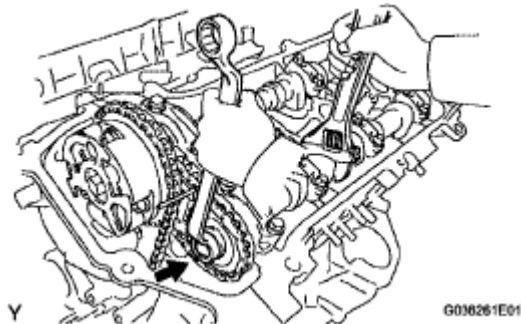


**Fig. 181: Identifying Bearing Caps Bolt Tighten Sequence**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Hold the hexagonal portion of the No. 4 camshaft with a wrench, and tighten the camshaft timing gear set bolt.

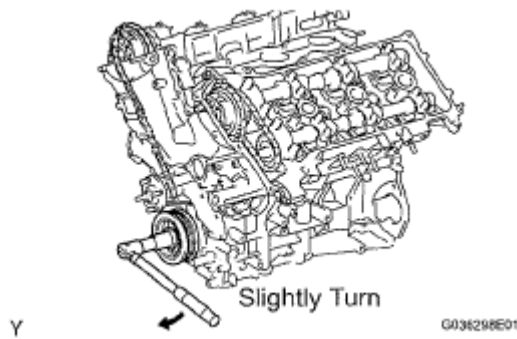
**Torque: 100 N\*m (1,020 kgf\*cm, 74 ft.\*lbf)**

- g. Remove the pin from the chain tensioner No. 3.



**Fig. 182: Removing Camshaft Timing Gear Set Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- h. Release the chain tension between the camshaft timing gear (RH bank) and crankshaft timing gear by turning the crankshaft pulley clockwise slightly.
4. **INSTALL NO.1 CHAIN TENSIONER ASSEMBLY** (See INSTALLATION )
5. **SET NO.1 CYLINDER TO TDC/COMPRESSION** (See REMOVAL )
6. **INSPECT VALVE CLEARANCE** (See ADJUSTMENT )



**Fig. 183: Releasing Chain Tension Between Camshaft Timing Gear**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. **ADJUST VALVE CLEARANCE** (See ADJUSTMENT )
8. **INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY LH** (See INSTALLATION )
9. **INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY** (See INSTALLATION )
10. **INSTALL IGNITION COIL ASSEMBLY**

**Torque: 10 N\*m (102 kgf\*cm, 7.4 ft.\*lbf)**

11. **INSTALL INTAKE AIR SURGE TANK** (See INSTALLATION )
12. **INSTALL AIR CLEANER ASSEMBLY** (See INSPECTION )
13. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**

**Torque: 3.9 N\*m (40 kgf\*cm, 35 in.\*lbf)**

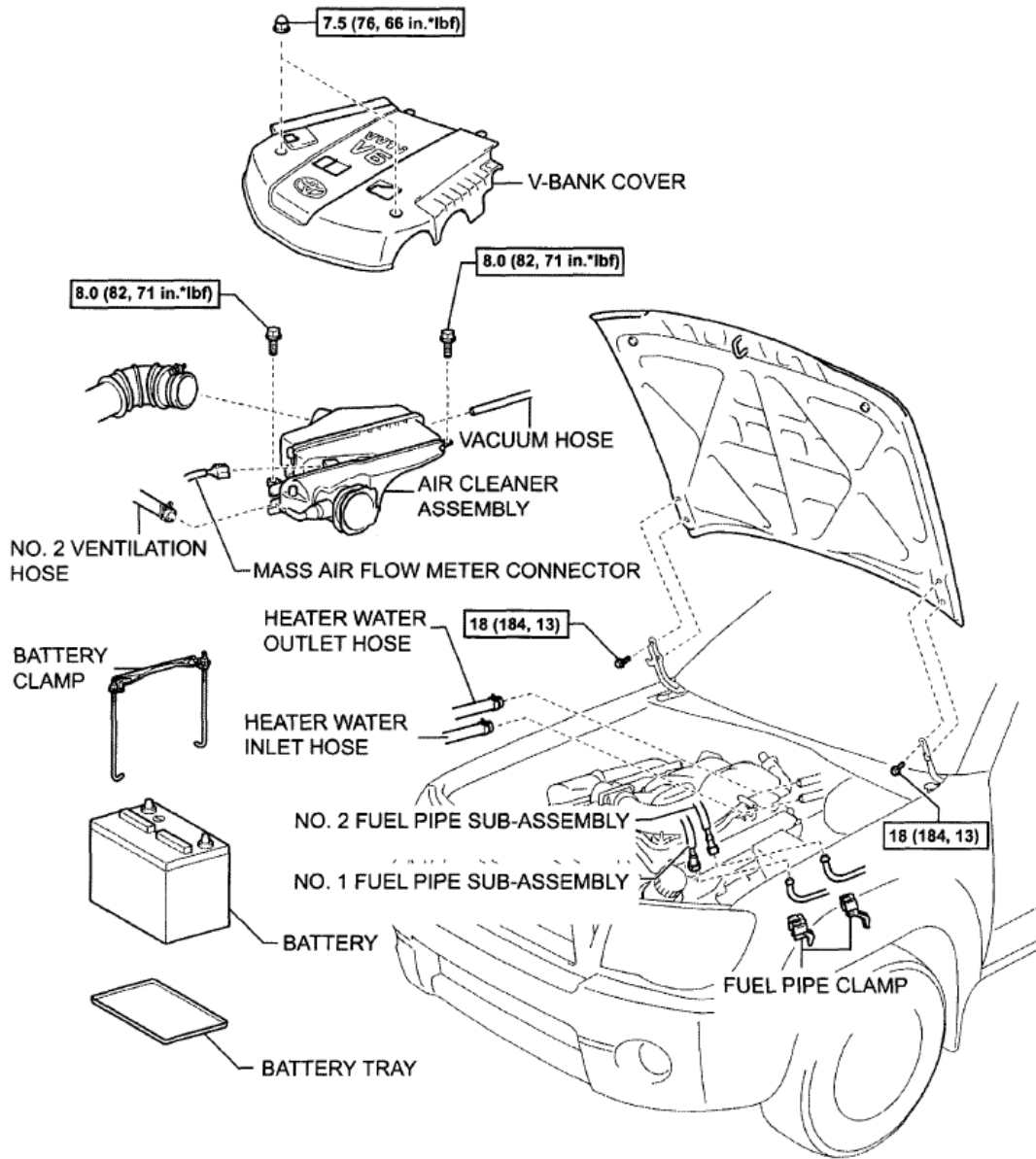
14. **ADD ENGINE COOLANT** (See COOLANT )
15. **CHECK FOR ENGINE COOLANT LEAKAGE** (See REPLACEMENT )
16. **INSTALL V-BANK COVER**
  - a. Install the V-bank cover with the 2 nuts.

**Torque: 7.5 N\*m (76 kgf\*cm, 66 in.\*lbf)**

17. **INSPECT IGNITION TIMING** (See ON-VEHICLE INSPECTION )

## **CYLINDER HEAD (FOR BANK 1 2WD)**

### **COMPONENTS**

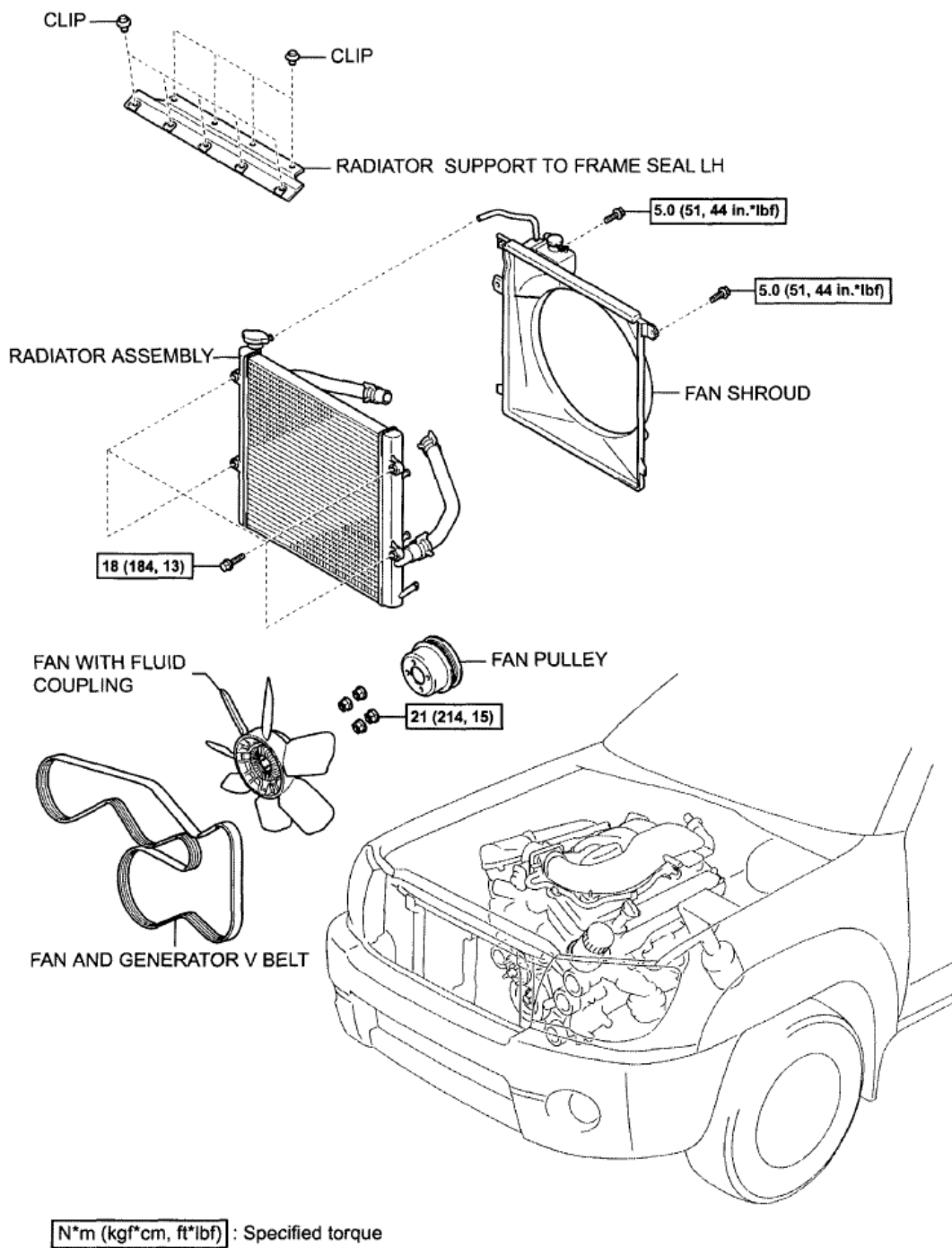


N\*m (kgf\*cm, ft\*lbf) : Specified torque

Y

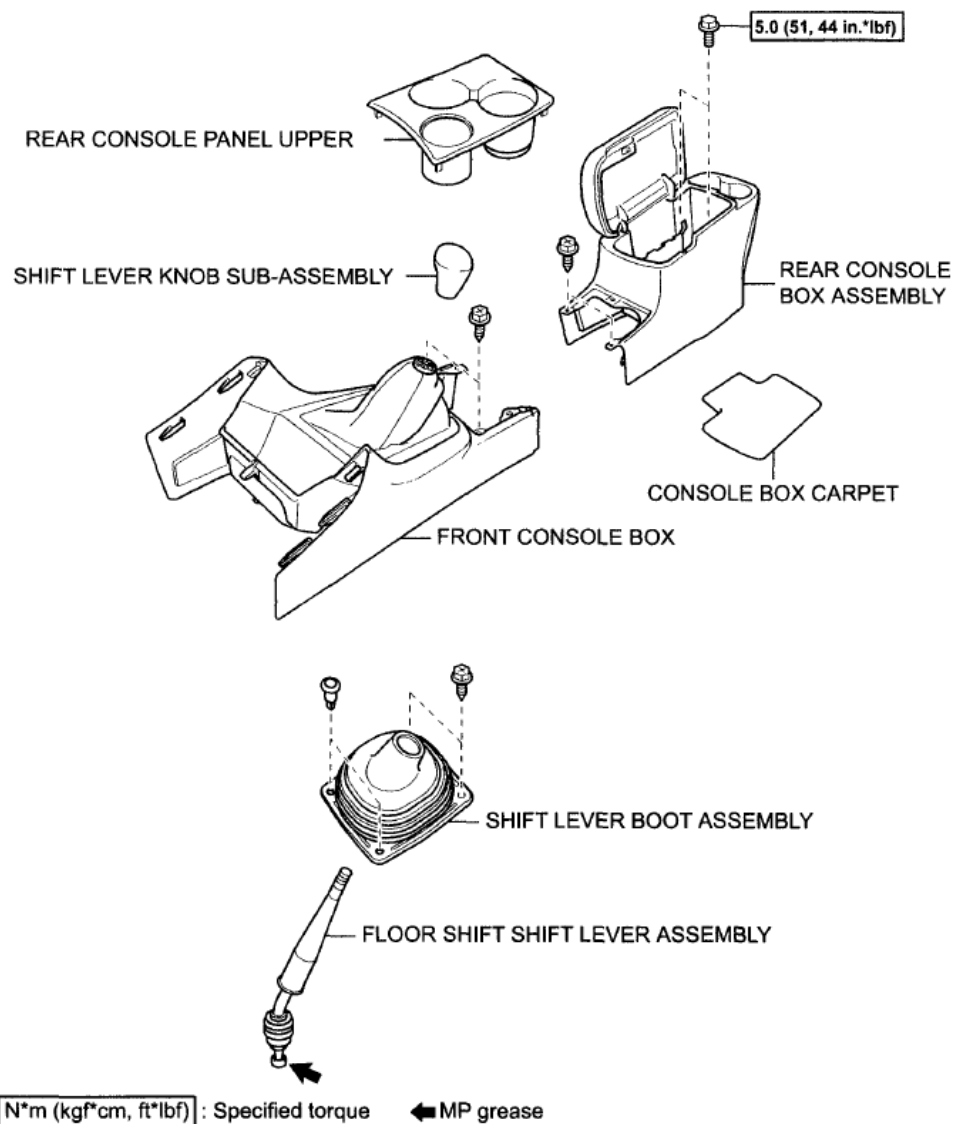
A113576E02

**Fig. 184: Exploded View Of Cylinder Head Components With Torque Specification (1 Of 12)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



A113566E01

**Fig. 185: Exploded View Of Cylinder Head Components With Torque Specification (2 Of 12)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



Y

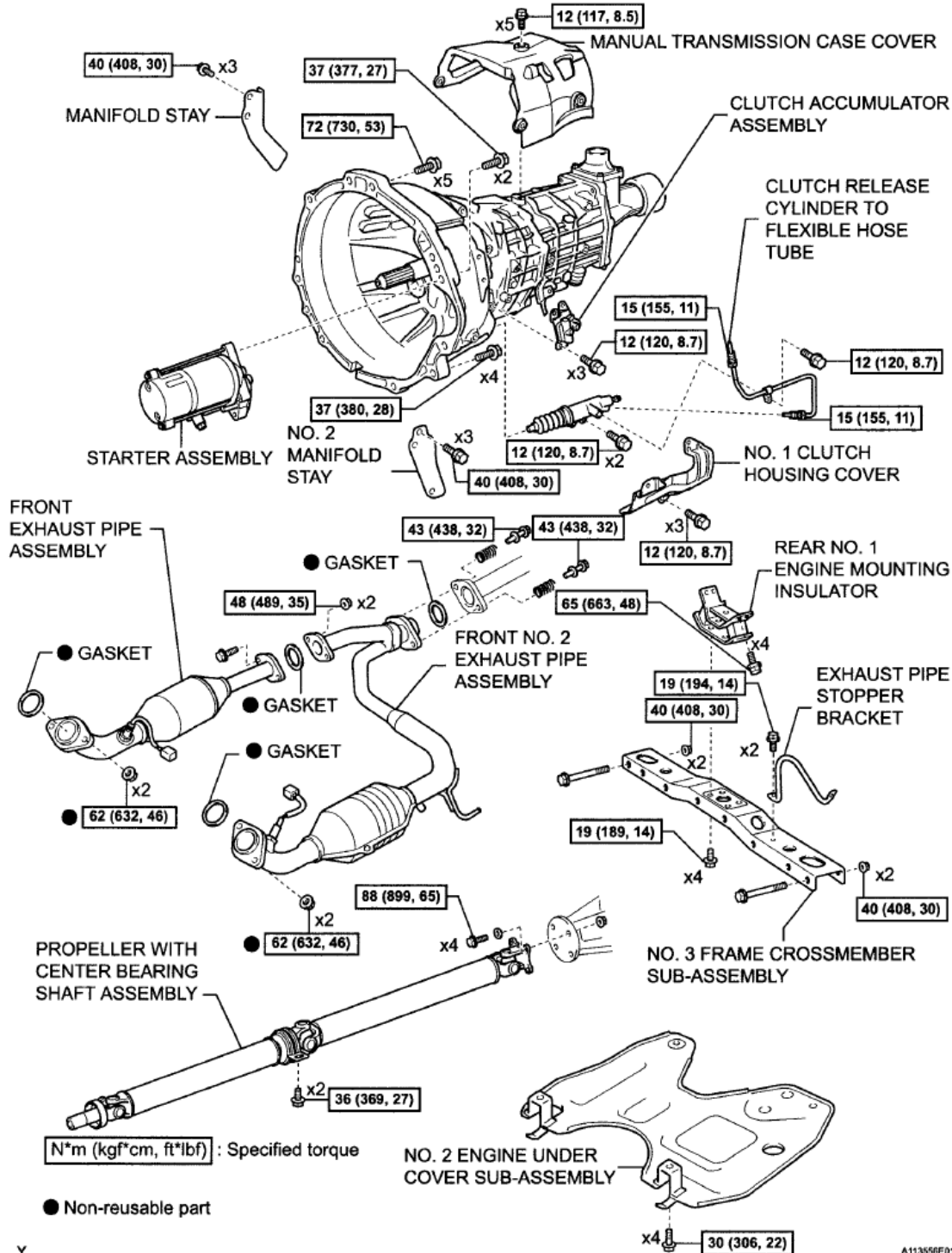
A113553E01

**Fig. 186: Exploded View Of Cylinder Head Components With Torque Specification (3 Of 12)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 2009 Toyota Tacoma

2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma

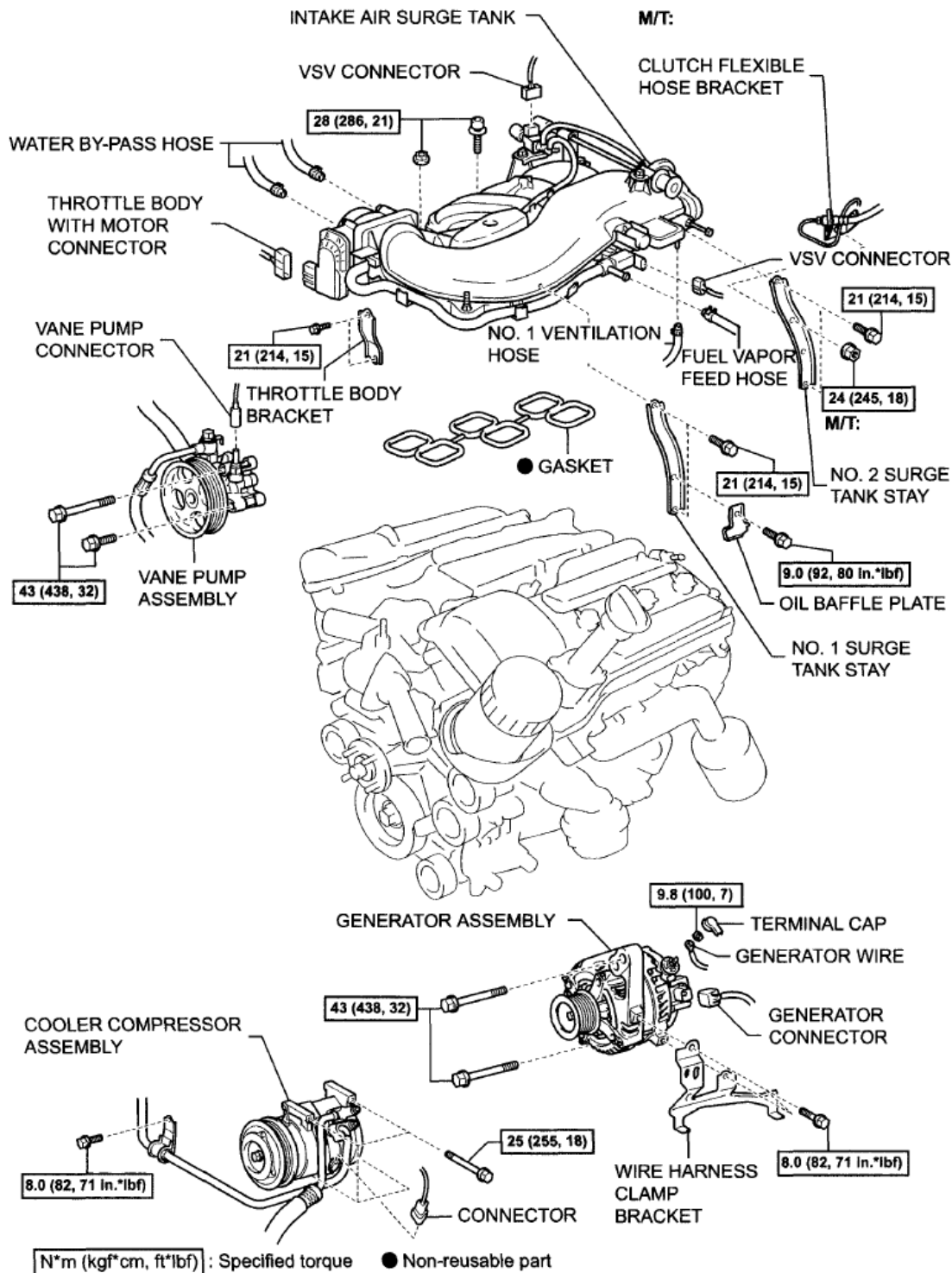
### 2WD AND PRE RUNNER, MANUAL TRANSMISSION:



**Fig. 187: Exploded View Of Cylinder Head Components With Torque Specification (4 Of 12)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

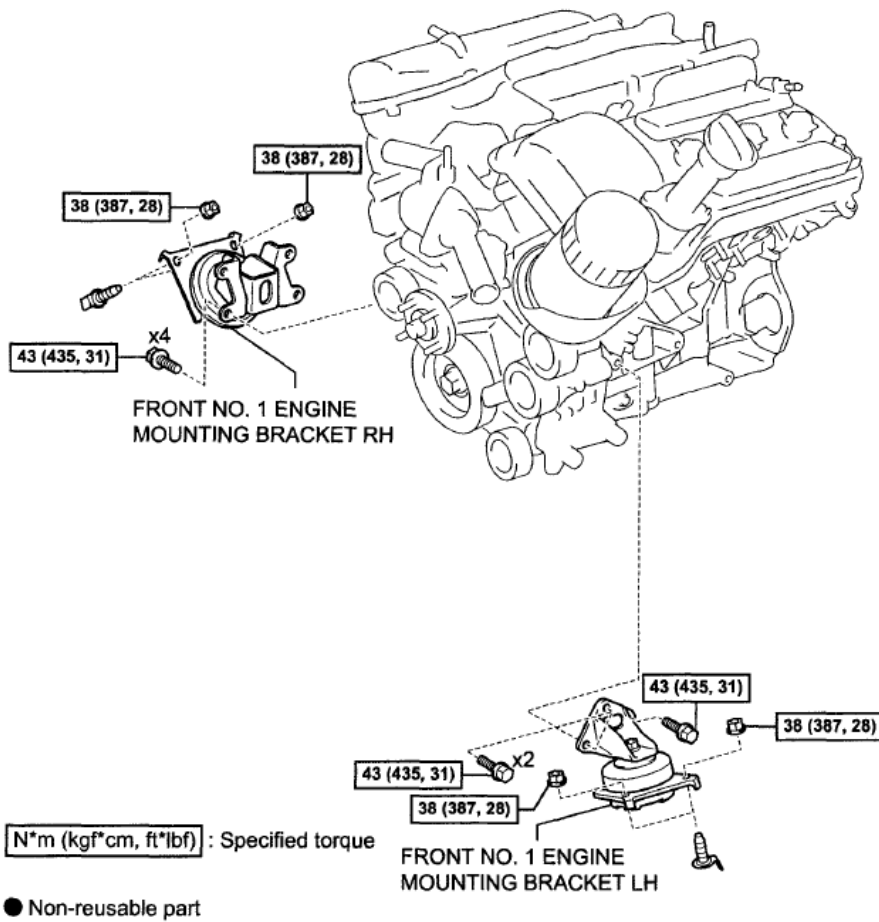
# 2009 Toyota Tacoma

2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma



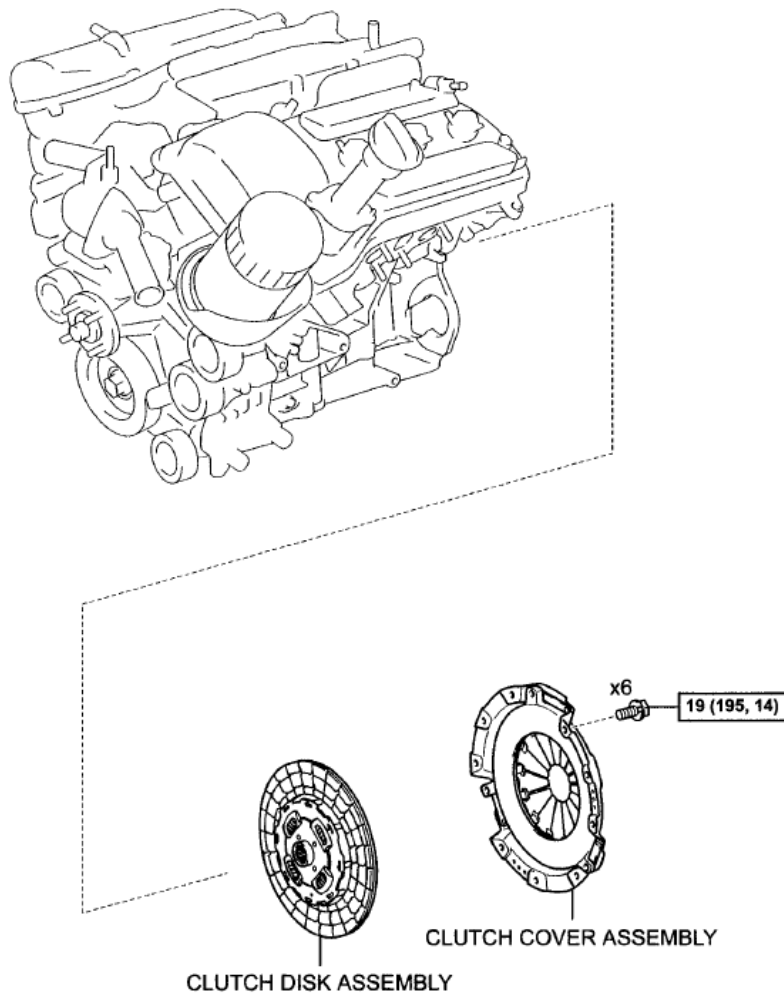
A113575E01

**Fig. 188: Exploded View Of Cylinder Head Components With Torque Specification (5 Of 12)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



A113584E01

**Fig. 189: Exploded View Of Cylinder Head Components With Torque Specification (6 Of 12)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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

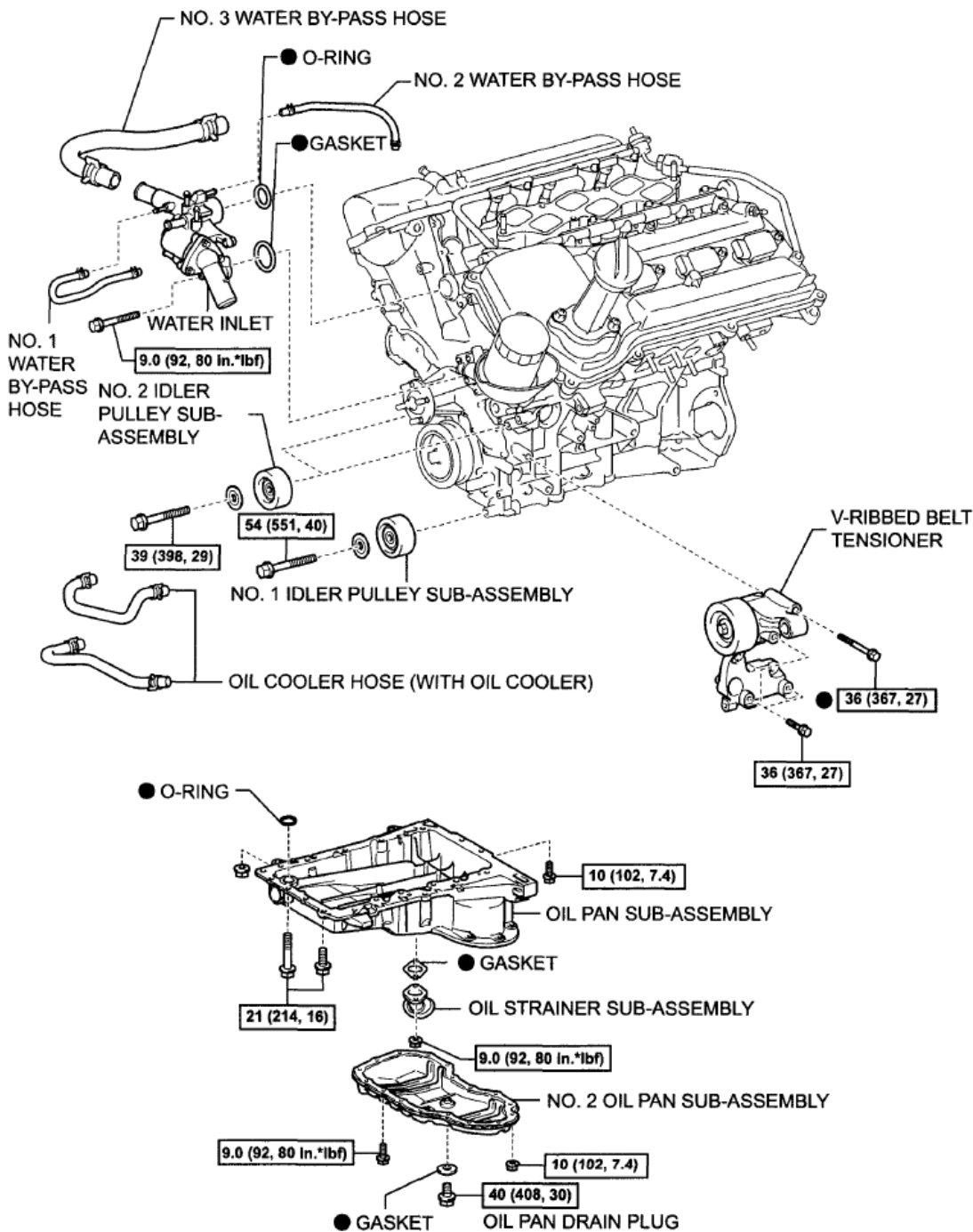
Y

A113585E01

**Fig. 190: Exploded View Of Cylinder Head Components With Torque Specification (7 Of 12)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 2009 Toyota Tacoma

2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma



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

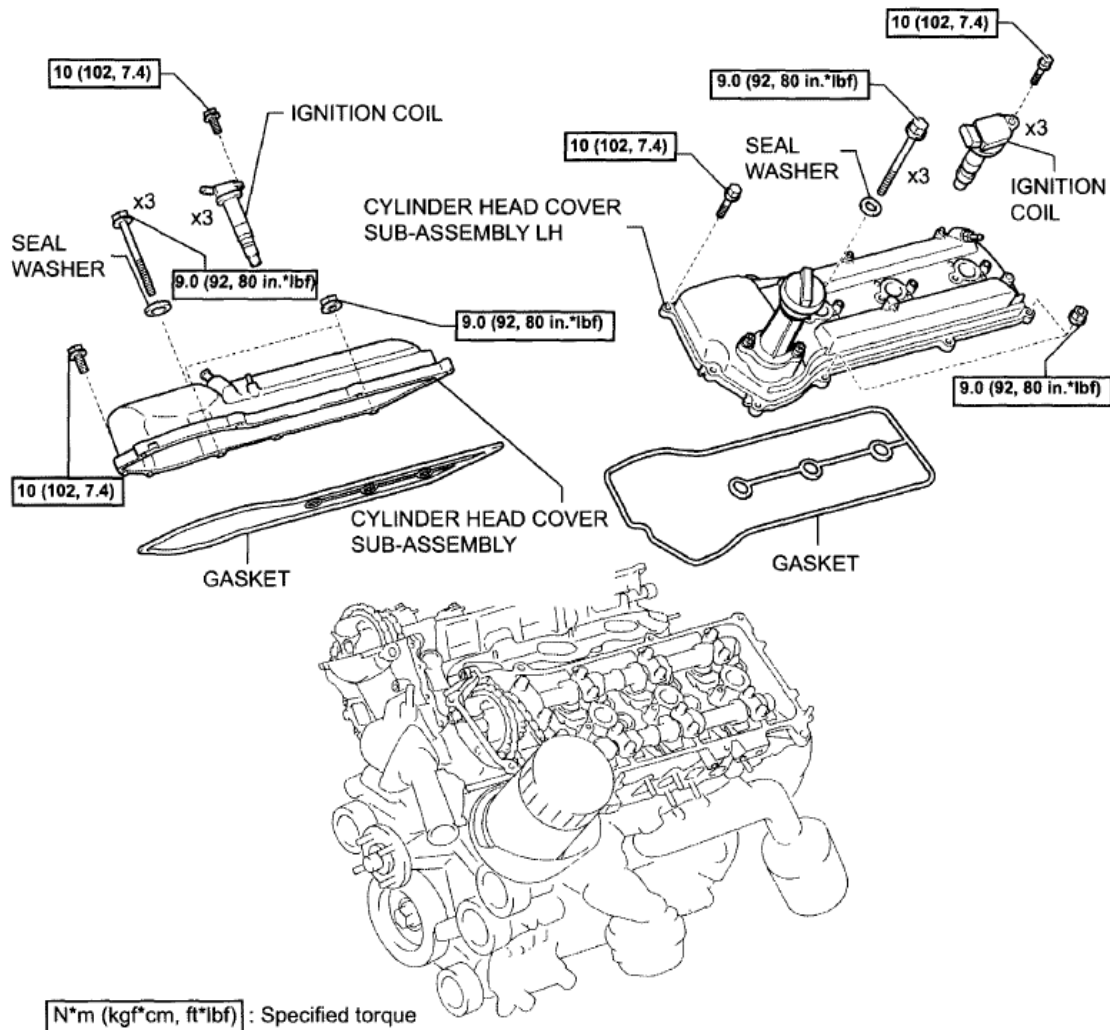
● Non-reusable part

A113568E01

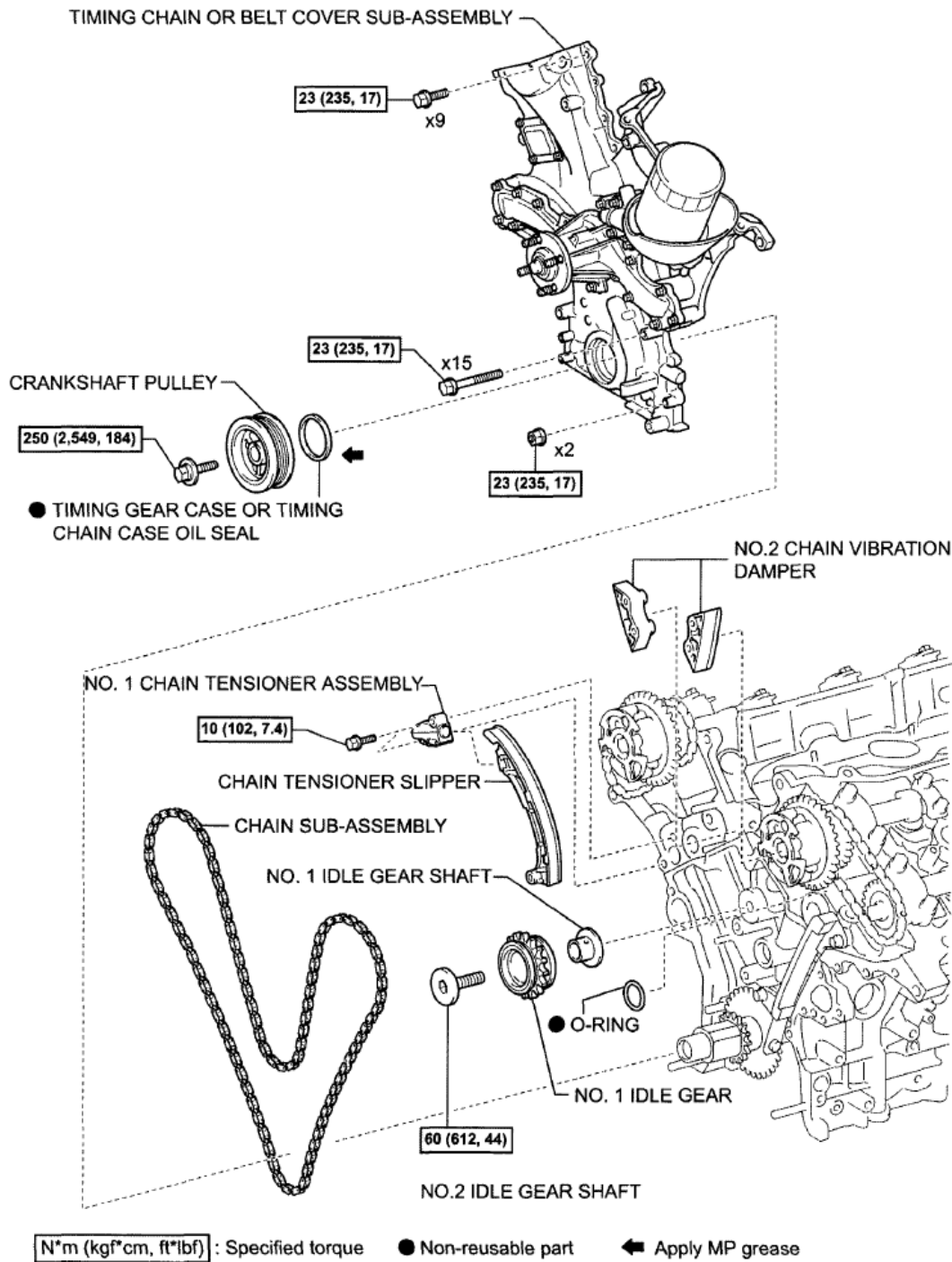
**Fig. 191: Exploded View Of Cylinder Head Components With Torque Specification (8 Of 12)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 2009 Toyota Tacoma

2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma



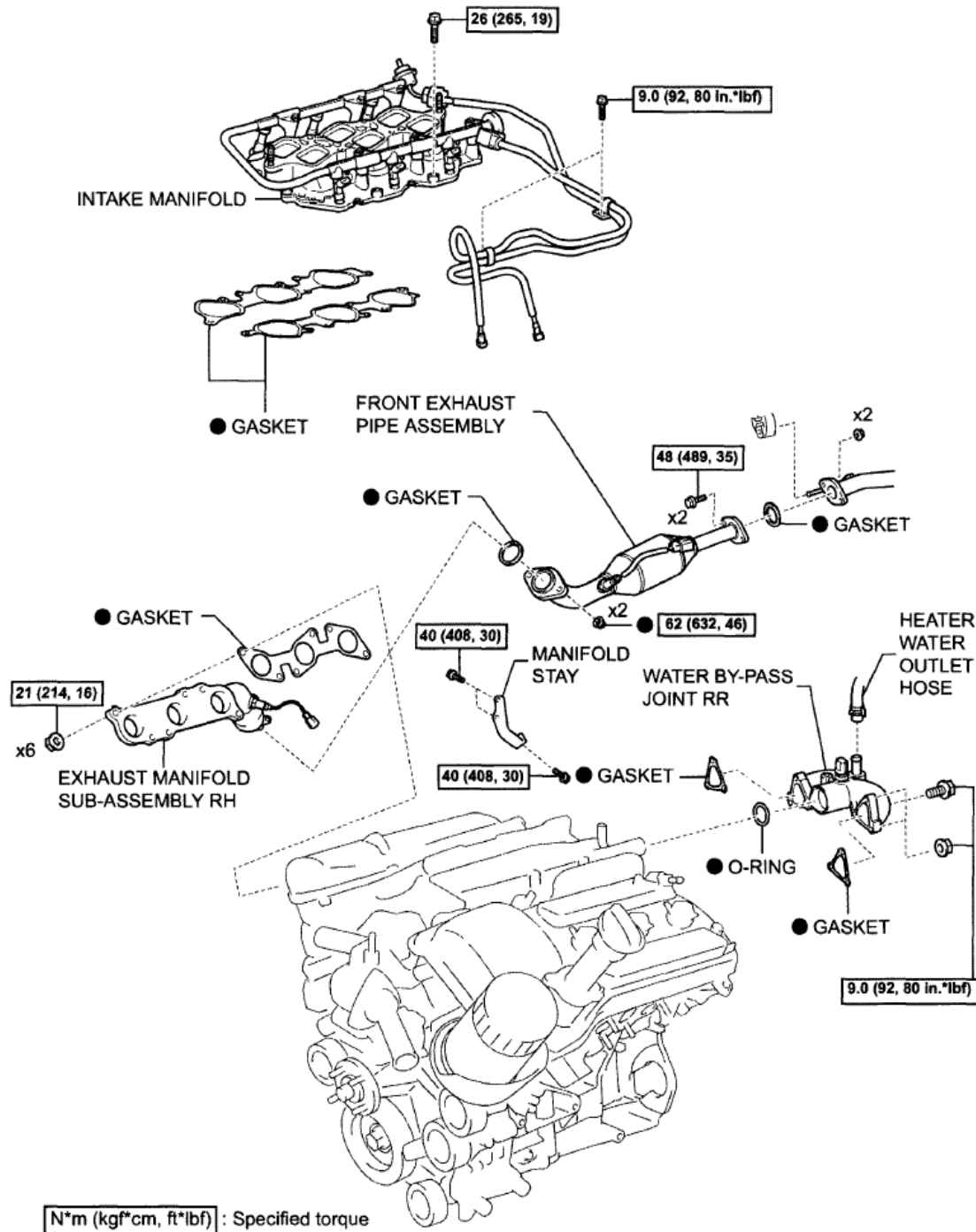
**Fig. 192: Exploded View Of Cylinder Head Components With Torque Specification (9 Of 12)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



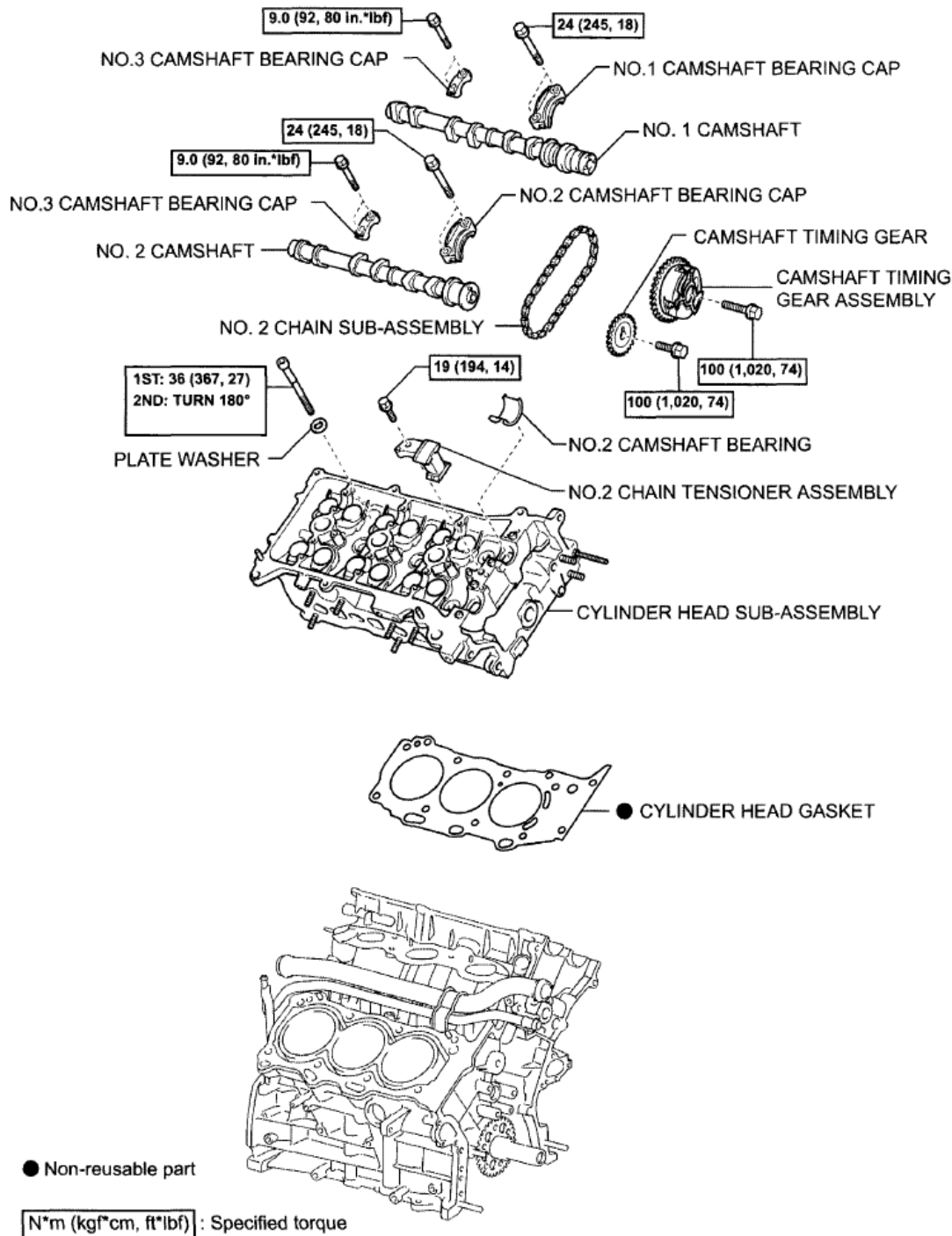
**Fig. 193: Exploded View Of Cylinder Head Components With Torque Specification (10 Of 12)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 2009 Toyota Tacoma

2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma



**Fig. 194: Exploded View Of Cylinder Head Components With Torque Specification (11 Of 12)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 195: Exploded View Of Cylinder Head Components With Torque Specification (12 Of 12)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## REMOVAL

### 1. DISCHARGE FUEL SYSTEM PRESSURE

(See **FUEL SYSTEM** )

2. **REMOVE BATTERY**
3. **DRAIN ENGINE COOLANT** (See **COOLANT** )
4. **DRAIN ENGINE OIL** (See **OIL FILTER** )
5. **REMOVE ENGINE ASSEMBLY**

(See **REMOVAL** )

6. **REMOVE TIMING CHAIN OR BELT COVER SUB-ASSEMBLY**

(See **REMOVAL** )

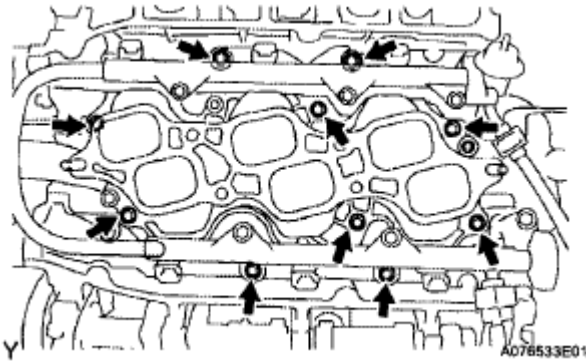
7. **REMOVE CHAIN SUB-ASSEMBLY**

(See **REMOVAL** )

8. **REMOVE NO.1 COOL AIR INLET**
  - a. Remove the 2 bolts, then remove the cool air inlet.
9. **REMOVE FRONT EXHAUST PIPE ASSEMBLY**

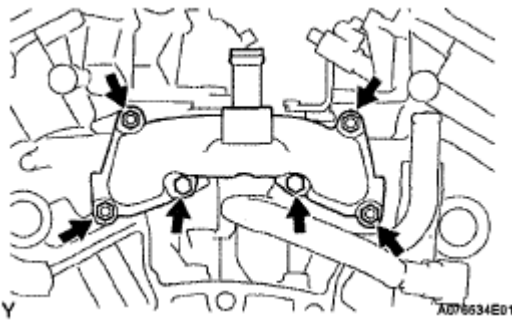
(See **INSTALLATION** )

10. **REMOVE MANIFOLD STAY**
  - a. Remove the 3 bolts, then remove the exhaust manifold stay.
11. **REMOVE EXHAUST MANIFOLD SUB-ASSEMBLY RH**
  - a. Disconnect the air fuel ratio sensor connector.
  - b. Remove the 6 nuts, then remove the exhaust manifold and gasket.
12. **DISCONNECT NO.1 FUEL PIPE SUB-ASSEMBLY** (See **REMOVAL** )
13. **DISCONNECT NO.2 FUEL PIPE SUB-ASSEMBLY** (See **REMOVAL** )
14. **REMOVE INTAKE MANIFOLD**
  - a. Disconnect the 6 fuel injector connectors.
  - b. Remove the 10 bolts, then remove the intake manifold and gasket.
15. **REMOVE WATER BY-PASS JOINT RR**
  - a. Disconnect the engine coolant temperature sensor connector.
  - b. Disconnect the heater hose.

**Fig. 196: Locating Intake Manifold Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

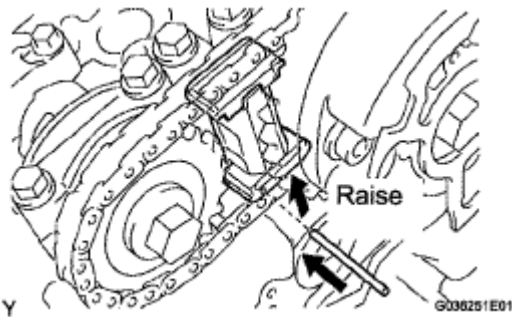
- c. Remove the 2 bolts and 4 nuts, then remove the water by-pass joint RR and 2 gaskets.
- d. Remove the O-ring from the water outlet hose.

**Fig. 197: Locating Water Outlet Hose Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### **16. REMOVE CAMSHAFT TIMING GEARS AND NO.2 CHAIN (for Bank 1)**

- a. While raising the chain tensioner No. 2, insert a pin of 1.0 mm (0.039 in.) into the hole to fix it.

**Fig. 198: Raising Chain Tensioner No. 2**

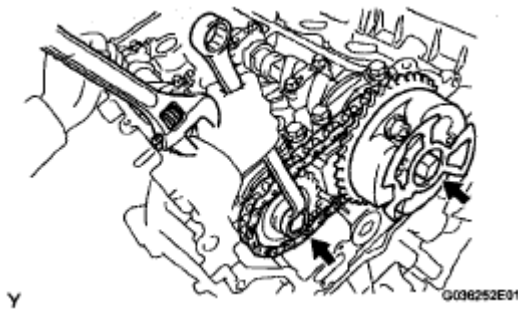
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Hold the hexagonal portion of the camshaft with a wrench.

**NOTE:** Be careful not to damage the cylinder head and valve lifter with the wrench.

- c. Remove the 2 bolts, then remove the camshaft timing gear, camshaft timing gear assembly and timing chain No. 2.

**NOTE:** Do not disassemble the camshaft timing gear assembly.



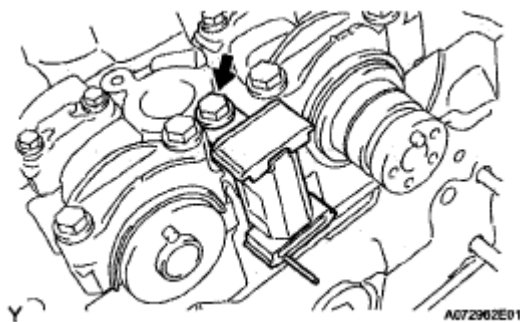
**Fig. 199: Holding Camshaft Using Wrench**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### 17. REMOVE NO.2 CHAIN TENSIONER ASSEMBLY

- a. Remove the bolt, then remove the chain tensioner No. 2.

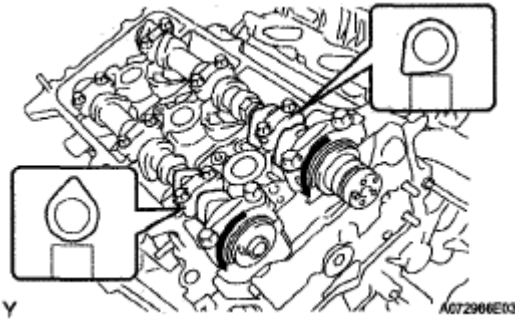
#### 18. REMOVE CAMSHAFTS

**NOTE:** Keep the camshaft level while it is being removed. The camshaft thrust clearance is very small and failing to keep it level could crack or damage the cylinder head journal surface, which receives the thrust. This could subsequently lead the camshaft to seize or break. Perform the following steps to avoid such problems.



**Fig. 200: Locating Chain Tensioner No. 2 With Bolt**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

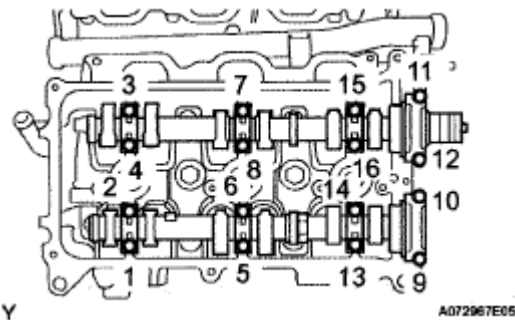
- a. Rotate the camshafts counterclockwise using a wrench so that the cam lobes of No. 1 cylinder face in the directions shown in the illustration.



**Fig. 201: Rotating Camshafts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using several steps, loosen and remove the 16 bearing cap bolts uniformly in the sequence shown in the illustration.
  - c. Remove the 8 bearing caps and 2 camshafts.
19. **REMOVE NO.2 CAMSHAFT BEARING**
  20. **REMOVE CYLINDER HEAD SUB-ASSEMBLY**
    - a. Remove the 2 bolts and separate the 2 ground cables.



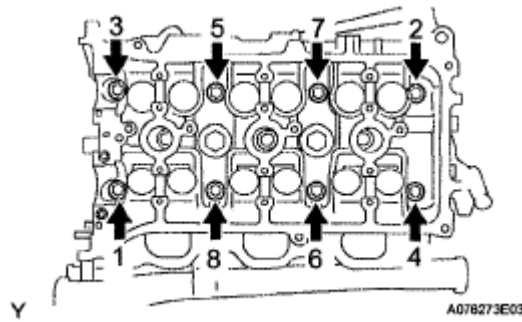
**Fig. 202: Identifying Bearing Cap Bolts Loosen Sequence (Bank 1 2WD)**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using several steps, uniformly loosen the 8 cylinder head bolts on the cylinder head with a 10 mm bi-hexagon wrench in the sequence shown in the illustration. Remove the 8 cylinder head bolts and 8 plate washers.

**NOTE:**

- Be careful not to drop the plate washers into the cylinder head.
- Cylinder head warpage or cracking could result from removing the bolts in the wrong order.



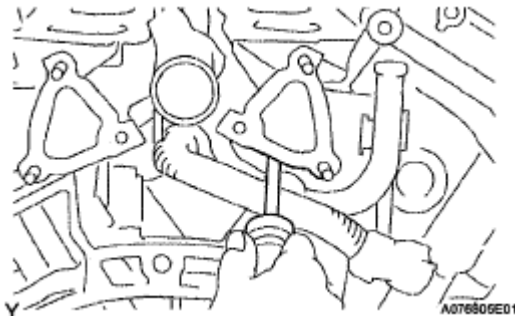
**Fig. 203: Locating Cylinder Head Bolt Loosen Sequence (Bank 1 2WD)**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Lift the cylinder head from the dowels on the cylinder block, and place the cylinder head on wooden blocks on a bench.

**NOTE:** Be careful not to drop the plate washers into the cylinder head.

If the cylinder head is difficult to remove, pry between the cylinder head and cylinder block with a screwdriver.



**Fig. 204: Lifting Cylinder Head**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 21. REMOVE CYLINDER HEAD GASKET

### INSPECTION

#### 1. INSPECT CYLINDER HEAD SET BOLT

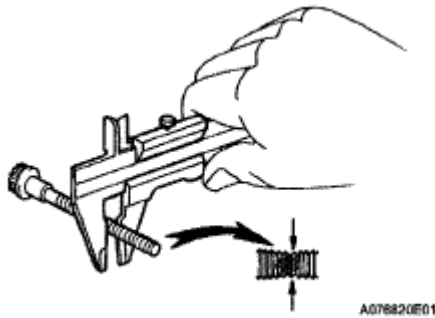
- a. Using vernier calipers, measure the outside diameter of the bolt thread.

**Standard outside diameter:**

**10.85 to 11.00 mm (0.4272 to 0.4331 in.)**

**Minimum outside diameter:**

**10.7 mm (0.421 in.)**



**Fig. 205: Inspecting Cylinder Head Set Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## INSTALLATION

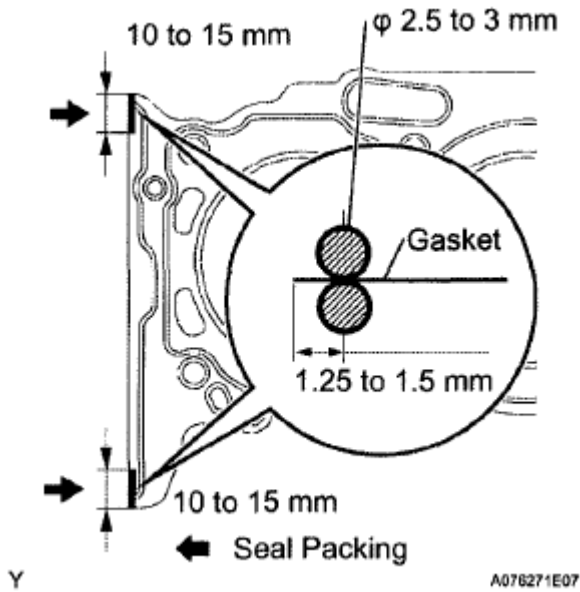
### 1. INSTALL CYLINDER HEAD GASKET

- a. Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the cylinder head and cylinder block.
- b. Apply a continuous bead of seal packing (diameter 2.5 to 3 mm (0.098 to 0.118 in.)) to a new cylinder head gasket as shown in the illustration.

#### Seal packing:

**Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent**

**NOTE:** Install the cylinder head within 3 minutes of applying the seal packing. Tighten the cylinder head bolts within 15 minutes of installing the cylinder head. Otherwise, the seal packing must be removed and reapplied.

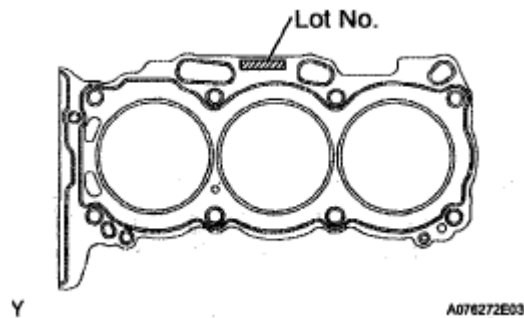


**Fig. 206: Identifying Cylinder Head Of Seal Packing**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Place the cylinder head gasket on the cylinder block surface with the Lot No. stamp upward.

**NOTE:**

- Be careful of the installation direction.
- Place the cylinder head carefully in order not to damage the gasket with the bottom part of the head.



**Fig. 207: Identifying Cylinder Block Surface With Lot No. Stamp**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**2. INSTALL CYLINDER HEAD SUB-ASSEMBLY**

- a. Place the cylinder head on the cylinder head gasket.
- b. Install the 8 cylinder head bolts.

**HINT:**

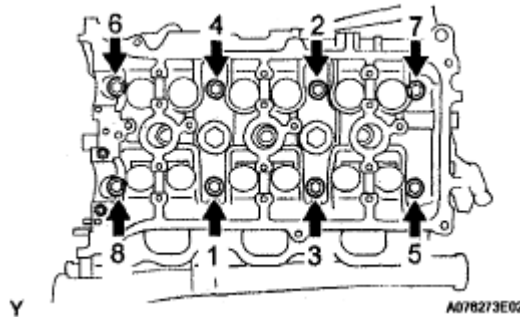
- The cylinder head bolts are tightened in 2 successive steps (steps (3) and (5)).

- If any cylinder head bolts are broken or deformed, replace them.
- 1. Apply a light coat of engine oil to the threads of the cylinder head bolts.
- 2. Install the plate washer onto the cylinder head bolt.
- 3. Using several steps, tighten each bolt uniformly with a 10 mm bi-hexagon wrench in the sequence shown in the illustration.

**Torque: 36 N\*m (367 kgf\*cm, 27 ft.\*lbf)**

If any cylinder head bolts do not meet the torque specification, replace them.

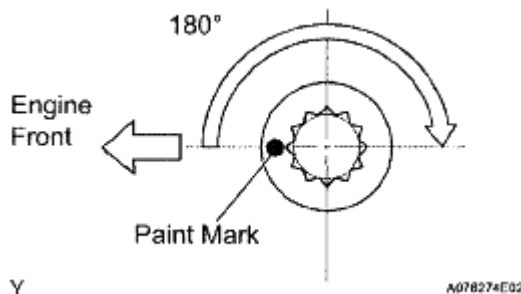
**NOTE: Do not drop the washers into the cylinder head.**



**Fig. 208: Identifying Cylinder Head Bolt Tightening Sequence (Bank 1 2WD)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 4. Mark the front side of each cylinder head bolt with paint.
- 5. Retighten the cylinder head bolts 180° as shown.
- 6. Check that the painted marks are now at 180° from the engine front.
- c. Install the ground cables with the 2 bolts.

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



**Fig. 209: Identifying Front Mark Of Cylinder Head Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

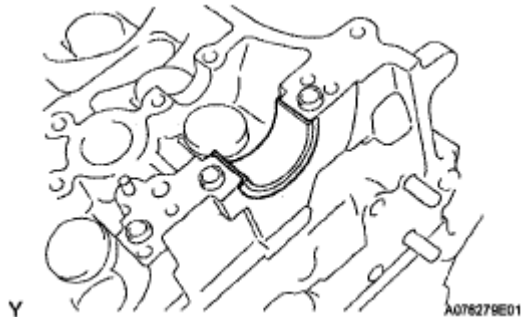
### 3. INSTALL NO.2 CAMSHAFT BEARING

- a. Install the camshaft bearing No. 2 onto the cylinder head.

**NOTE:** Clean the installation planes of the back side of the bearing and cylinder head and keep them free of oils and fats.

#### 4. INSTALL CAMSHAFTS

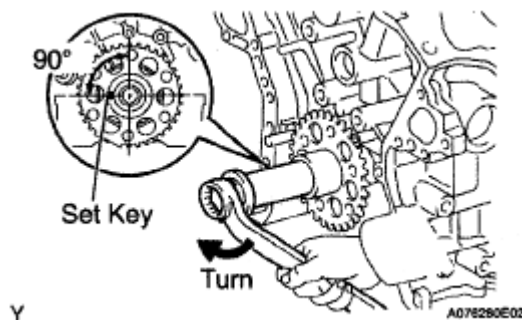
**NOTE:** Keep the camshaft level while it is being removed. The camshaft thrust clearance is very small and failing to keep it level could crack or damage the cylinder head journal surface, which receives the thrust. This could subsequently lead the camshaft to seize or break. Perform the following steps to avoid such problems.



**Fig. 210: Identifying No.2 Camshaft Bearing**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Set the crankshaft position.
1. Using the crankshaft pulley set bolt, turn the crankshaft, and set the crankshaft set key in the left horizontal position.

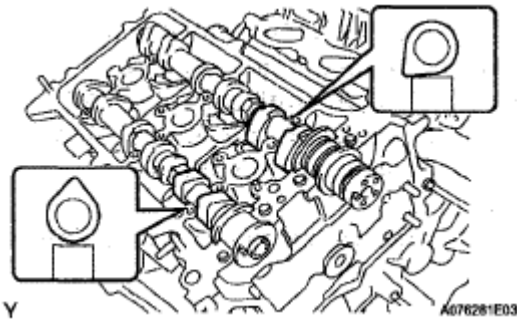
**NOTE:** Installing the crankshaft at the wrong angle could cause the piston head and valve head to come into contact with each other when installing the camshaft. This could cause damage, so always set the crankshaft at the correct angle.



**Fig. 211: Setting Crankshaft Position**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

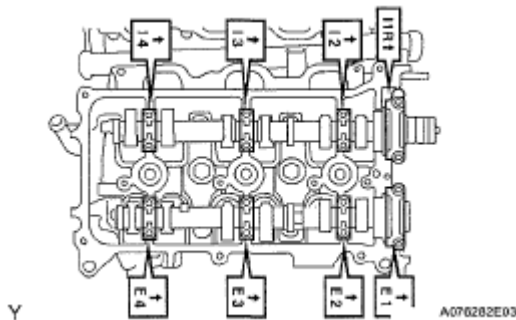
- b. Apply new engine oil to the thrust portion and journal of the camshafts.
- c. Place the 2 camshafts onto the cylinder head with the cam lobes of No. 1 cylinder facing in the directions shown in the illustration.



**Fig. 212: Identifying Bearing Cap Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Install the 8 bearing caps in the proper locations as shown.
- e. Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.



**Fig. 213: Identifying Bearing Cap Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

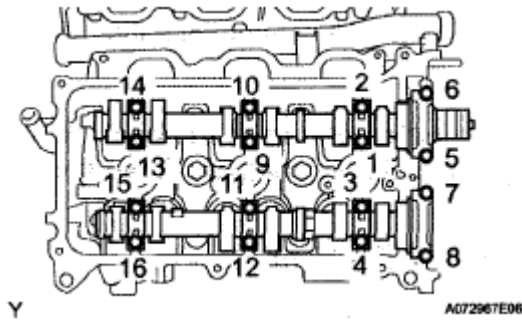
- f. Using several steps, uniformly install and tighten the 16 bearing cap bolts in the sequence shown in the illustration.

**Torque: 9.0 N\*m (92 kgf\*cm, 80 in.\*lbf) for 10**

**mm (0.39 in.) head**

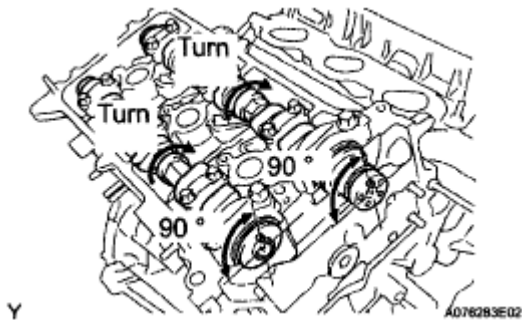
**24 N\*m (245 kgf\*cm, 18 ft.\*lbf) for 12**

**mm (0.47 in.) head**



**Fig. 214: Identifying Bearing Cap Bolts Tighten Sequence (Bank 1 2WD)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

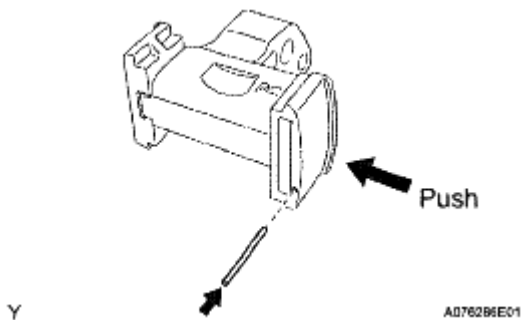
- g. Turn the camshafts clockwise until each camshaft knock pin comes to a position 90° to the cylinder head.



**Fig. 215: Turning Camshafts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 5. INSTALL NO.2 CHAIN TENSIONER ASSEMBLY

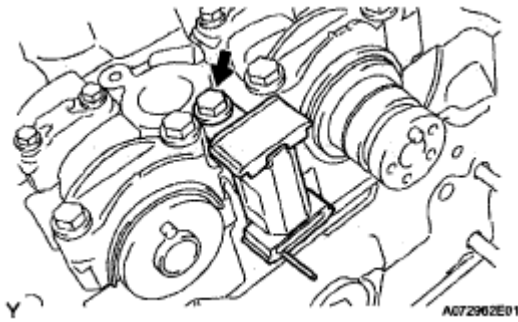
- a. While pushing in the tensioner, insert a pin of 1.0 mm (0.039 in.) into the hole to fix it.



**Fig. 216: Pushing Tensioner**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the chain tensioner No. 2 with the bolt.

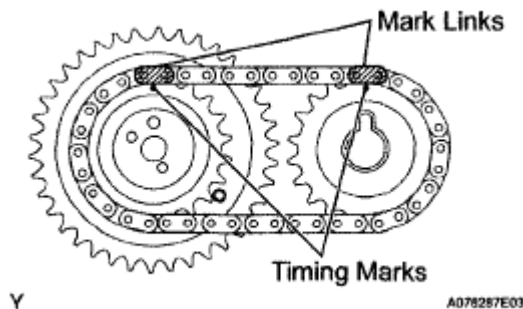
**Torque: 19 N\*m (194 kgf\*cm, 14 ft.\*lbf)**



**Fig. 217: Locating Chain Tensioner No. 2 With Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 6. INSTALL CAMSHAFT TIMING GEARS AND N0.2 CHAIN (for Bank 1)

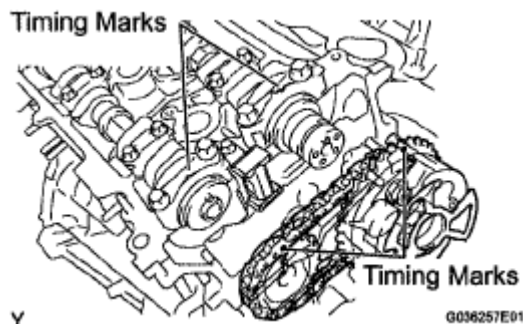
- a. Align the yellow mark links with the timing marks (1 dot mark) of camshaft timing gears as shown in the illustration.



**Fig. 218: Identifying Timing Marks Of Camshaft Timing Gears**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Align the timing marks on the camshaft timing gears with the timing marks on the bearing caps, and install the camshaft timing gears with the chain onto the RH camshafts.
- c. Temporarily install the 2 camshaft timing gear bolts.

**NOTE:** Do not push camshaft timing gear assembly onto the camshaft forcibly when installing it.

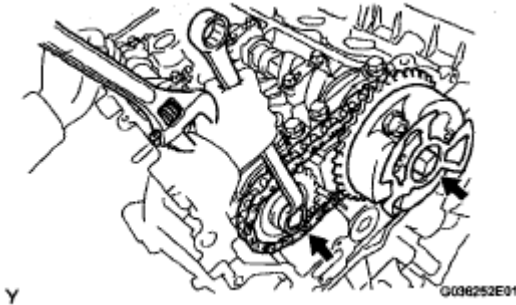


**Fig. 219: Identifying Timing Marks On Camshaft Timing Gears**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Hold the hexagonal portion of the camshaft with a wrench, and tighten the 2 bolts.

**Torque: 100 N\*m (1,020 kgf\*cm, 74 ft.\*lbf)**

- e. Remove the pin from the tensioner No. 2.



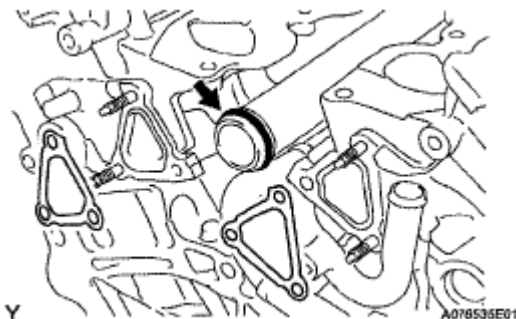
**Fig. 220: Holding Camshaft Using Wrench**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### **7. INSTALL WATER BY-PASS JOINT RR**

- a. Install a new O-ring onto the water outlet pipe.
- b. Apply soapy water to the O-ring.
- c. Install 2 new gaskets and water by-pass joint rear with the 2 bolts and 4 nuts.

**Torque: 9.0 N\*m (92 kgf\*cm, 80 in.\*lbf)**

- d. Connect the heater hose.
- e. Connect the engine coolant temperature sensor connector.



**Fig. 221: Locating O-Ring Onto Water Outlet Pipe**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### **8. INSTALL INTAKE MANIFOLD**

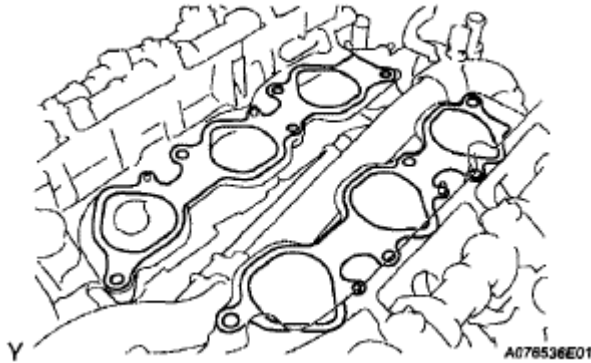
- a. Set a new gasket on each cylinder head.

**NOTE:**

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

- b. Set the intake manifold on the cylinder heads.
- c. Install and tighten the 10 bolts uniformly in several steps.

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



**Fig. 222: Identifying Intake Manifold**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Connect the 6 fuel injector connectors.

**9. INSTALL EXHAUST MANIFOLD SUB-ASSEMBLY RH**

- a. Set a new gasket to the RH cylinder head with the oval shape facing forward.

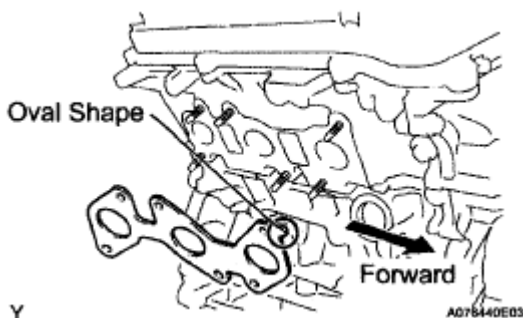
**NOTE:**

**Be careful of the installation direction.**

- b. Install the exhaust manifold with the 6 nuts. Tighten the nuts uniformly in several steps.

**Torque: 21 N\*m (214 kgf\*cm, 16 ft.\*lbf)**

- c. Connect the air fuel ratio sensor connector.



**Fig. 223: Installing Exhaust Manifold Sub-Assembly**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**10. INSTALL MANIFOLD STAY**

- a. Install the manifold stay with the 3 bolts.

**Torque: 40 N\*m (408 kgf\*cm, 30 ft.\*lbf)**

**11. INSTALL FRONT EXHAUST PIPE ASSEMBLY**

(See INSTALLATION )

**12. INSTALL NO.1 COOL AIR INLET**

- a. Install the cool air inlet with the 2 bolts.

**Torque: 12 N\*m (122 kgf\*cm, 9.0 ft.\*lbf)**

**13. INSTALL CHAIN TENSIONER SLIPPER**

**14. INSTALL NO.1 CHAIN TENSIONER ASSEMBLY (See INSTALLATION )**

**15. INSTALL CHAIN SUB-ASSEMBLY**

(See INSTALLATION )

**16. INSTALL TIMING CHAIN OR BELT COVER SUB-ASSEMBLY**

(See REASSEMBLY )

**17. INSTALL ENGINE ASSEMBLY**

(See INSTALLATION )

**18. INSTALL BATTERY**

**19. ADD ENGINE COOLANT (See COOLANT )**

**20. ADD ENGINE OIL (See INSTALLATION )**

**21. CHECK FOR ENGINE COOLANT LEAKAGE (See REPLACEMENT )**

**22. CHECK FOR ENGINE OIL LEAKAGE**

**23. CHECK FOR FUEL LEAKAGE**

**24. CHECK FOR EXHAUST GAS LEAKAGE**

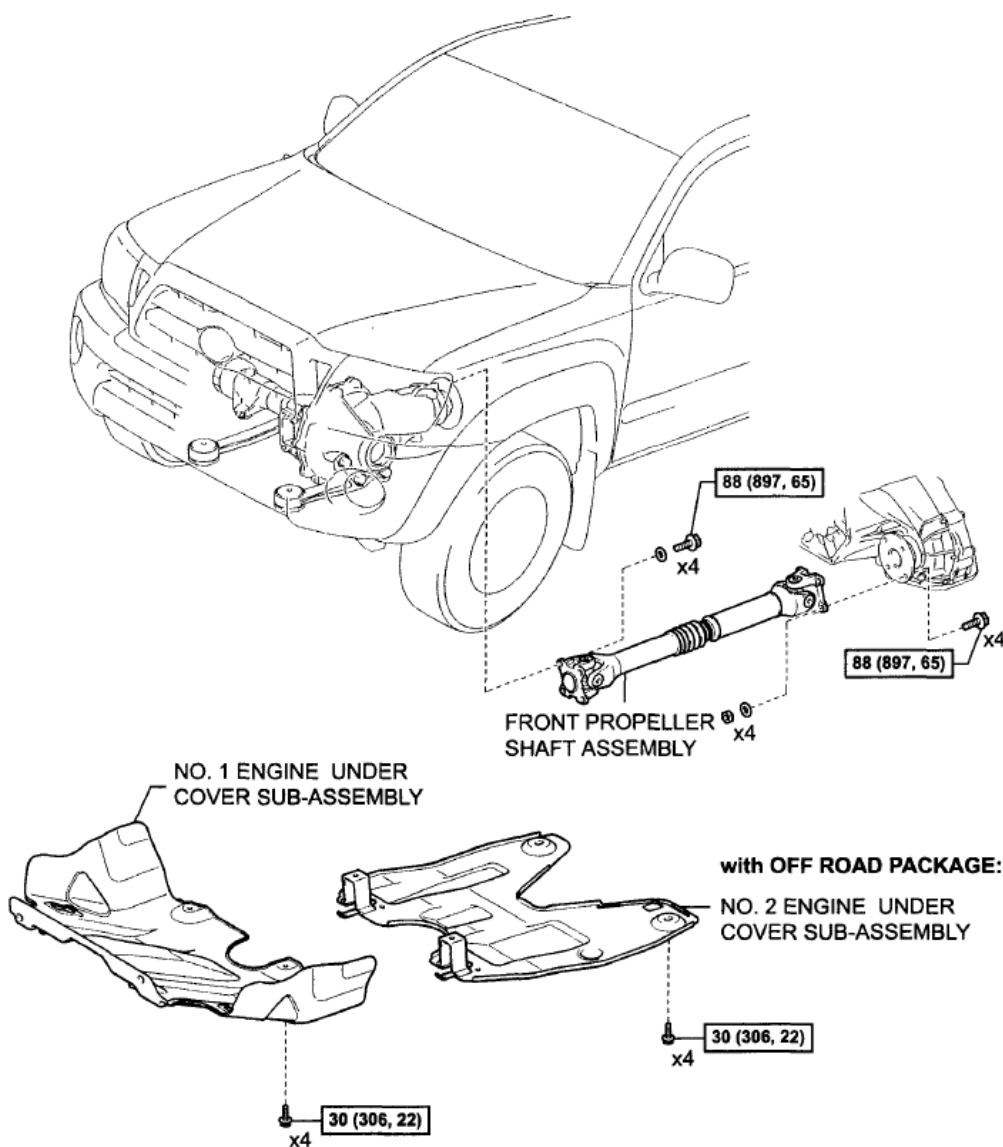
**25. INSPECT IGNITION TIMING (See ON-VEHICLE INSPECTION )**

**26. INSPECT ENGINE IDLING SPEED (See ON-VEHICLE INSPECTION )**

**27. INSPECT CO/HC (See ON-VEHICLE INSPECTION )**

**CYLINDER HEAD (FOR BANK 1 4WD AND PRE-RUNNER)**

**COMPONENTS**



**N\*m (kgf\*cm, ft\*lb)** : Specified torque

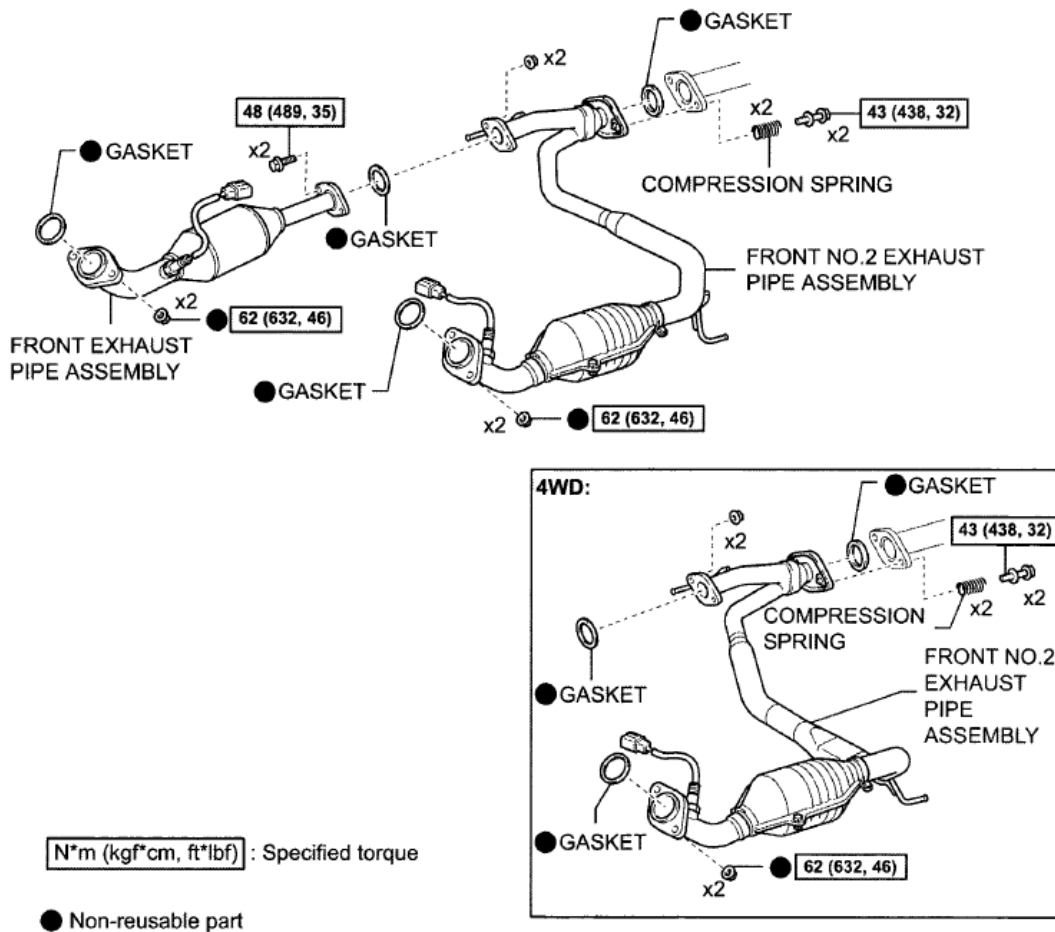
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**Fig. 224: Exploded View Of Cylinder Head Components With Torque Specification (1 Of 14)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 2009 Toyota Tacoma

2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma



Y

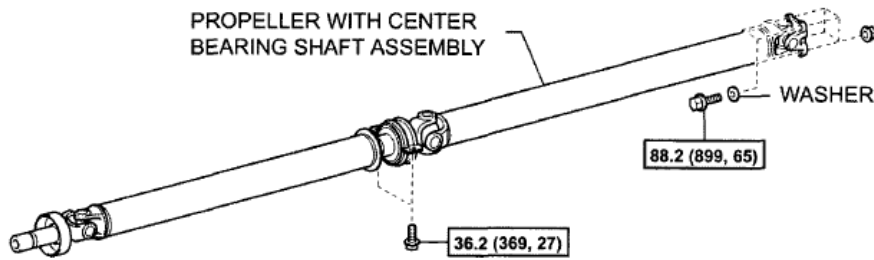
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**Fig. 225: Exploded View Of Cylinder Head Components With Torque Specification (2 Of 14)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 2009 Toyota Tacoma

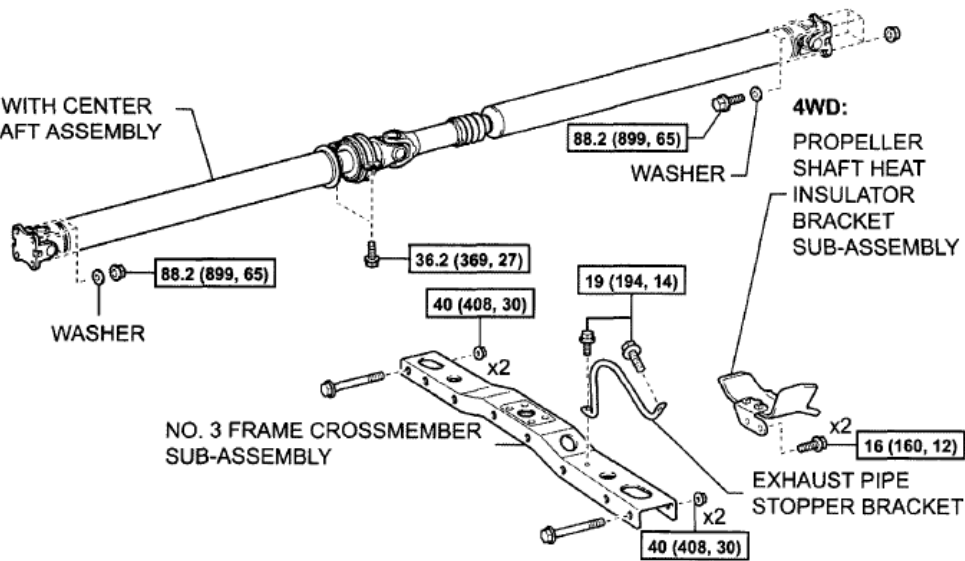
2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma

### PRE RUNNER:



### 4WD:

PROPELLER WITH CENTER BEARING SHAFT ASSEMBLY



N\*m (kgf\*cm, ft\*lb) : Specified torque

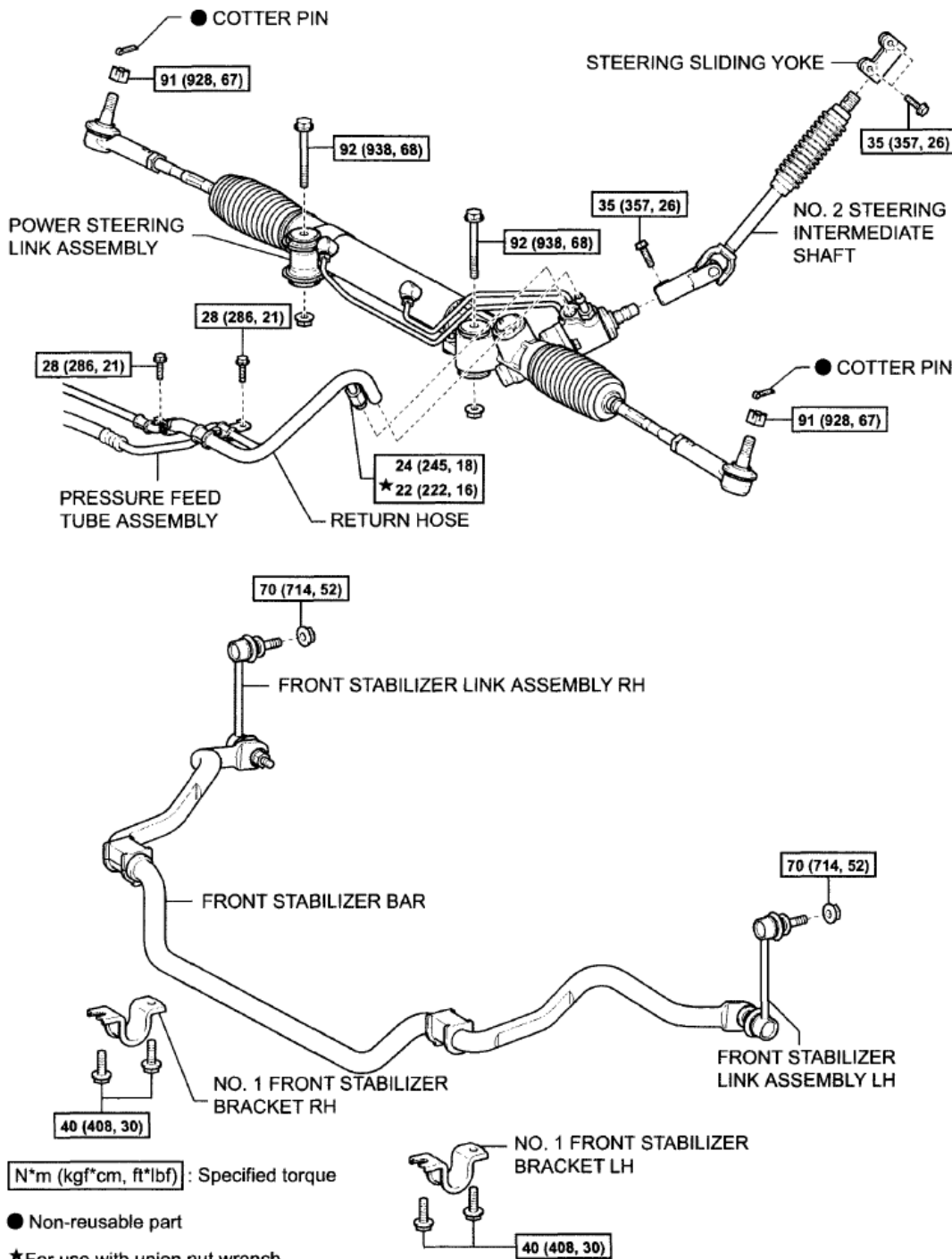
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**Fig. 226: Exploded View Of Cylinder Head Components With Torque Specification (3 Of 14)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

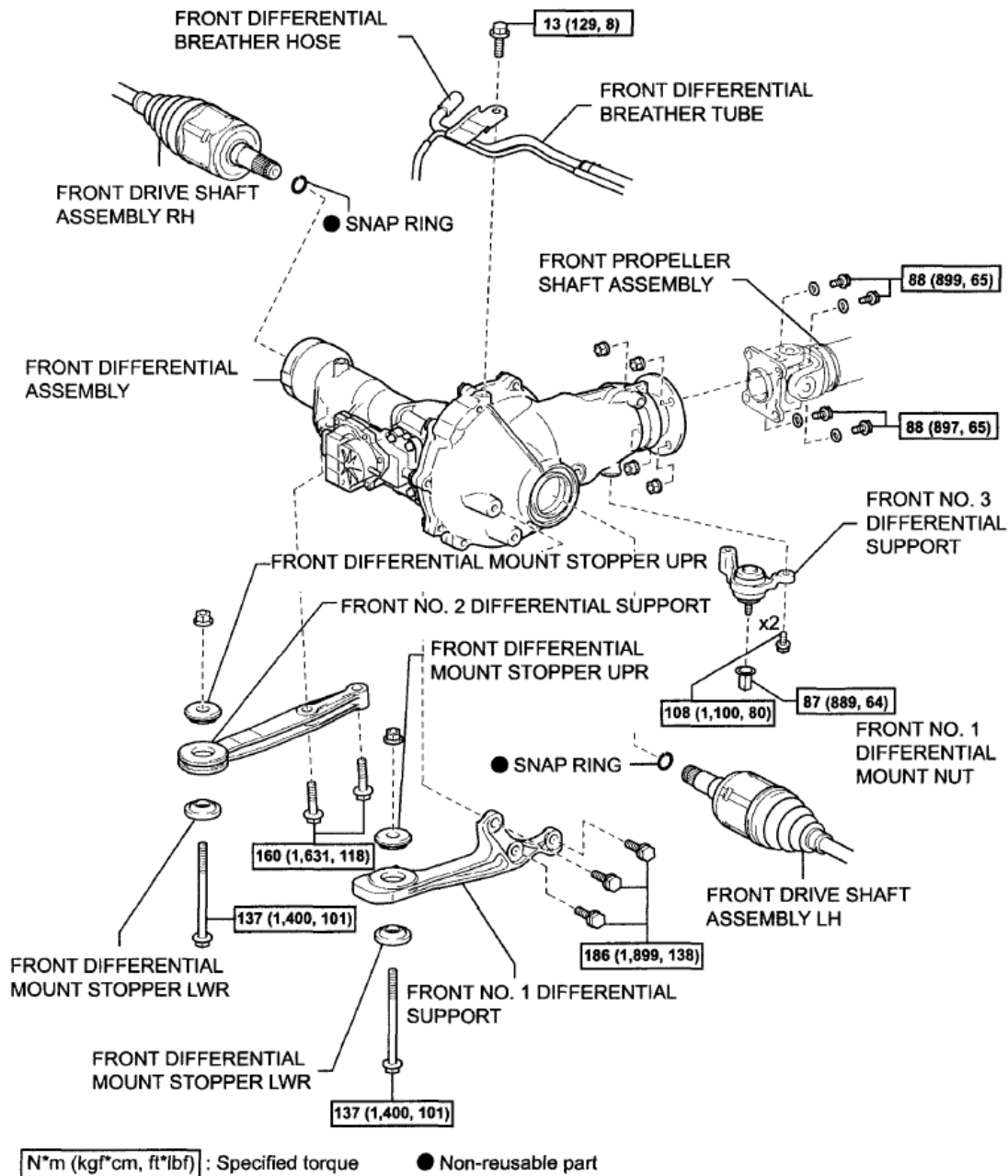
## 2009 Toyota Tacoma

2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma



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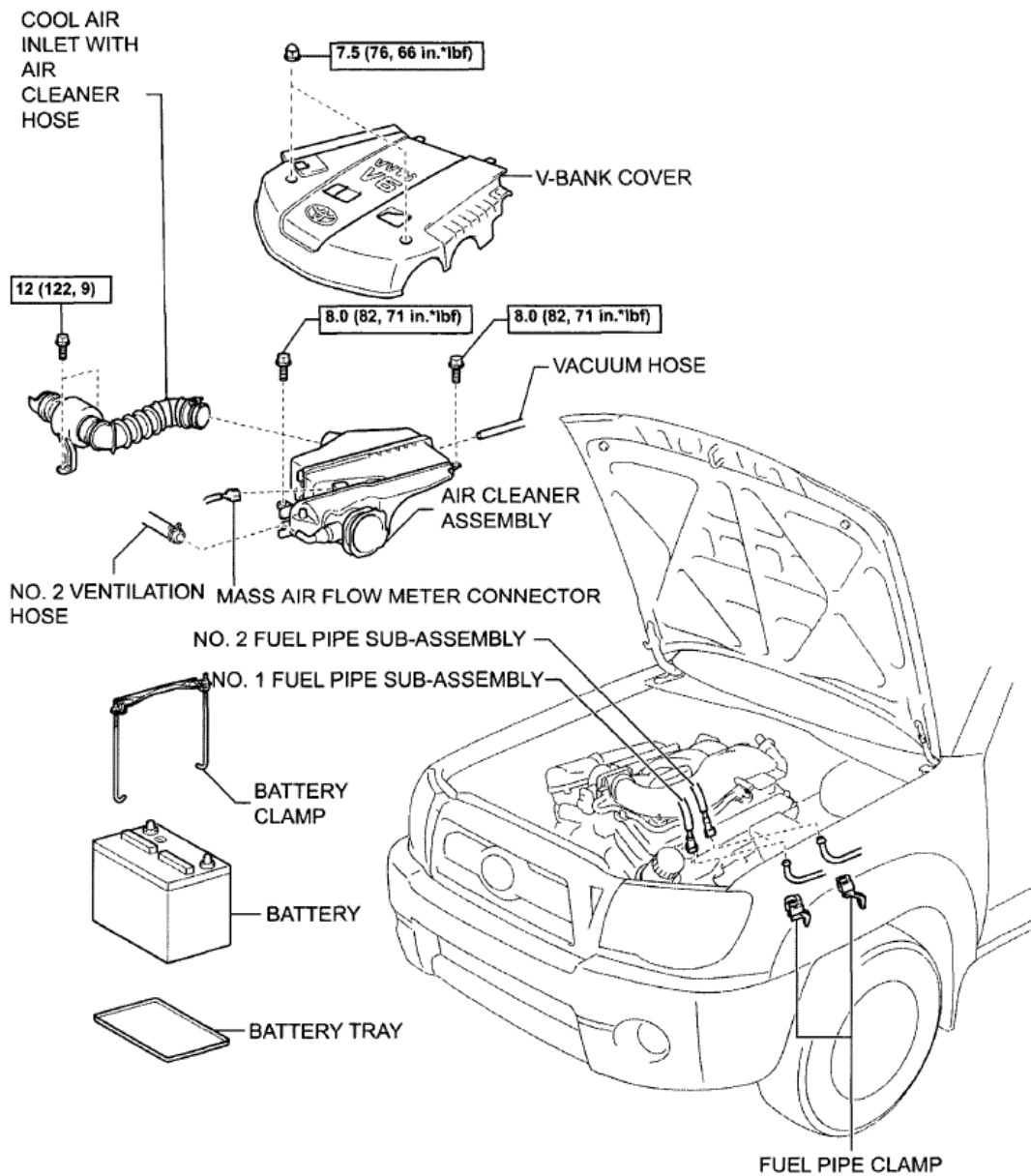
**Fig. 227: Exploded View Of Cylinder Head Components With Torque Specification (4 Of 14)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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**Fig. 228: Exploded View Of Cylinder Head Components With Torque Specification (5 Of 14)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

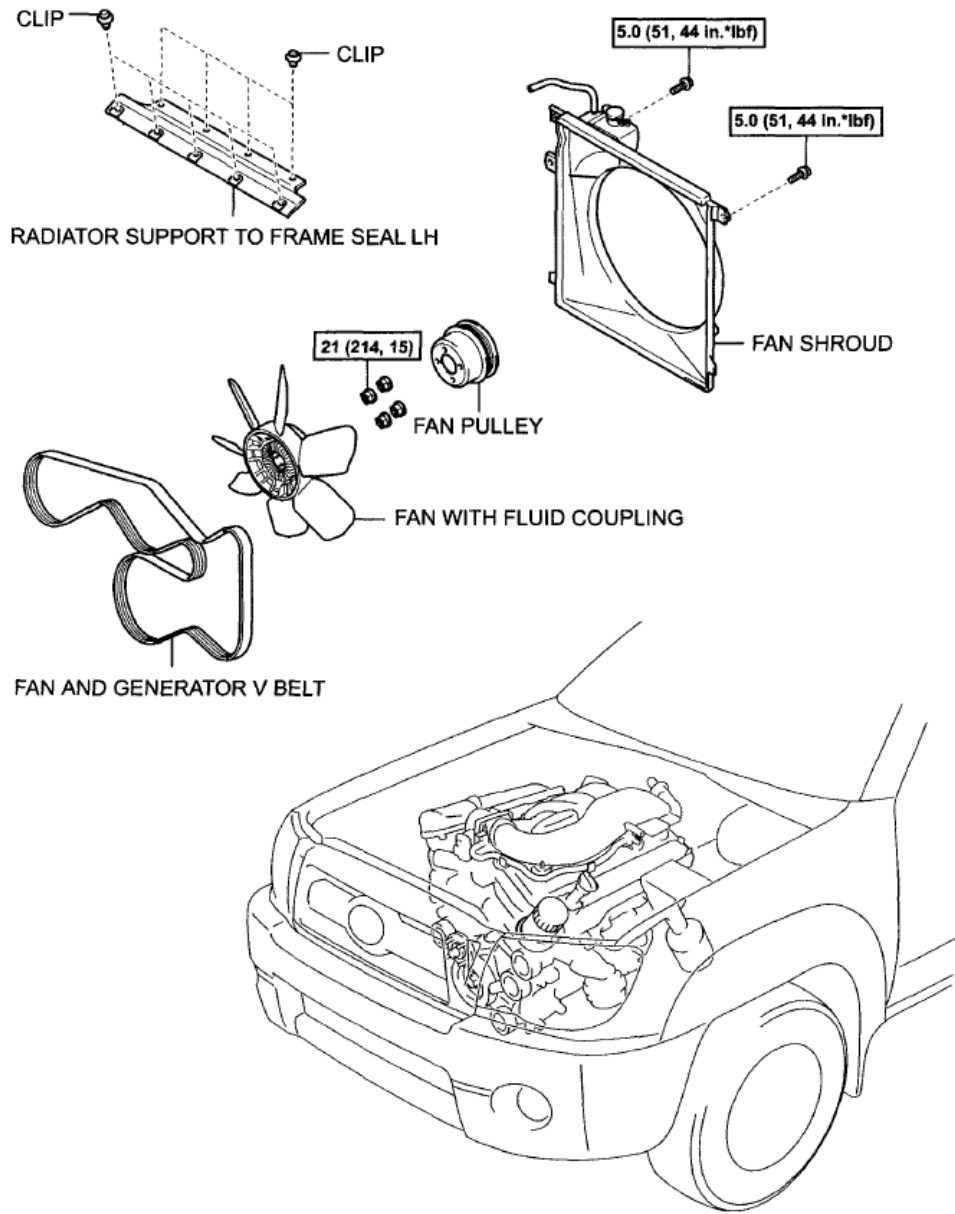


N\*m (kgf\*cm, ft\*lbf) : Specified torque

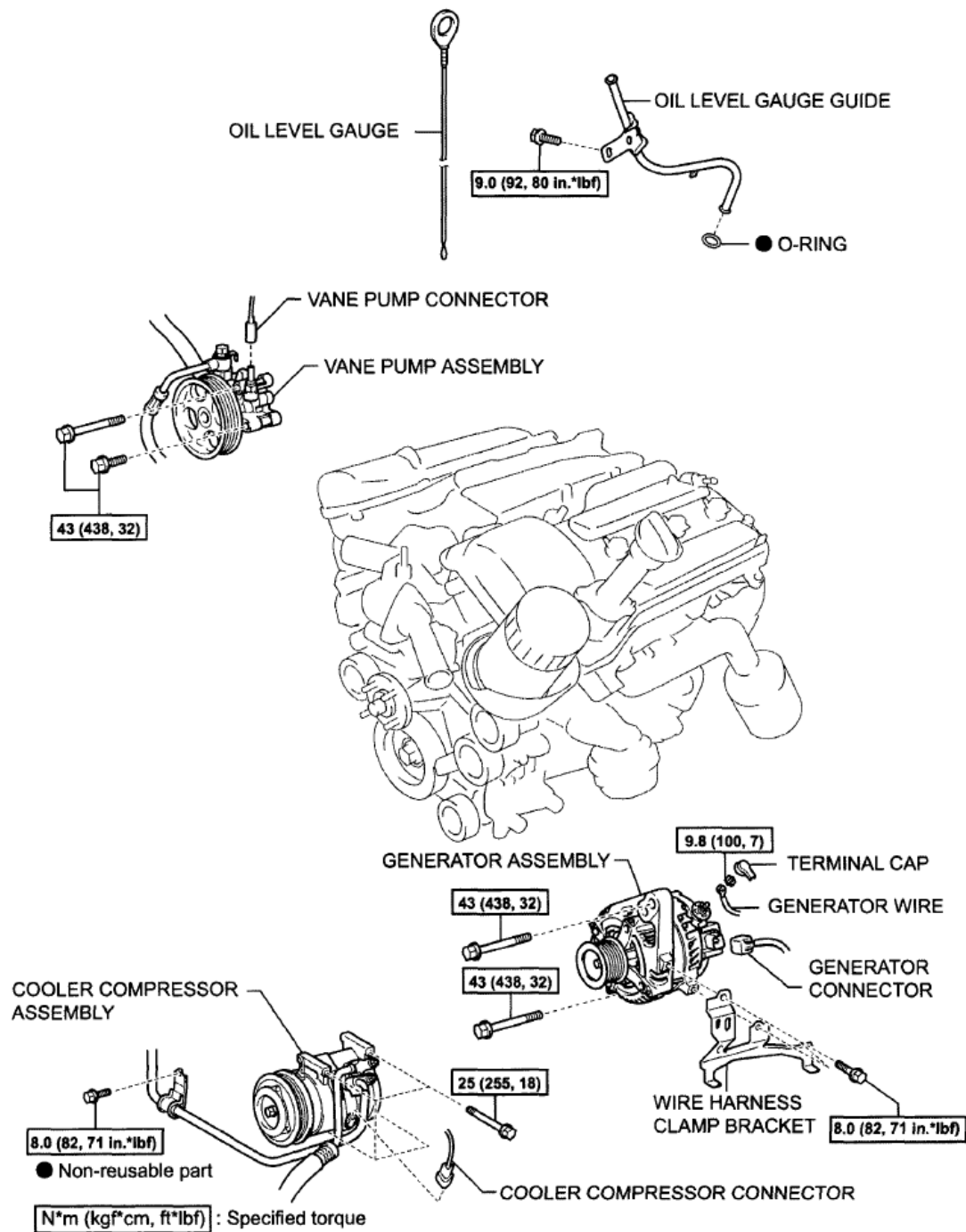
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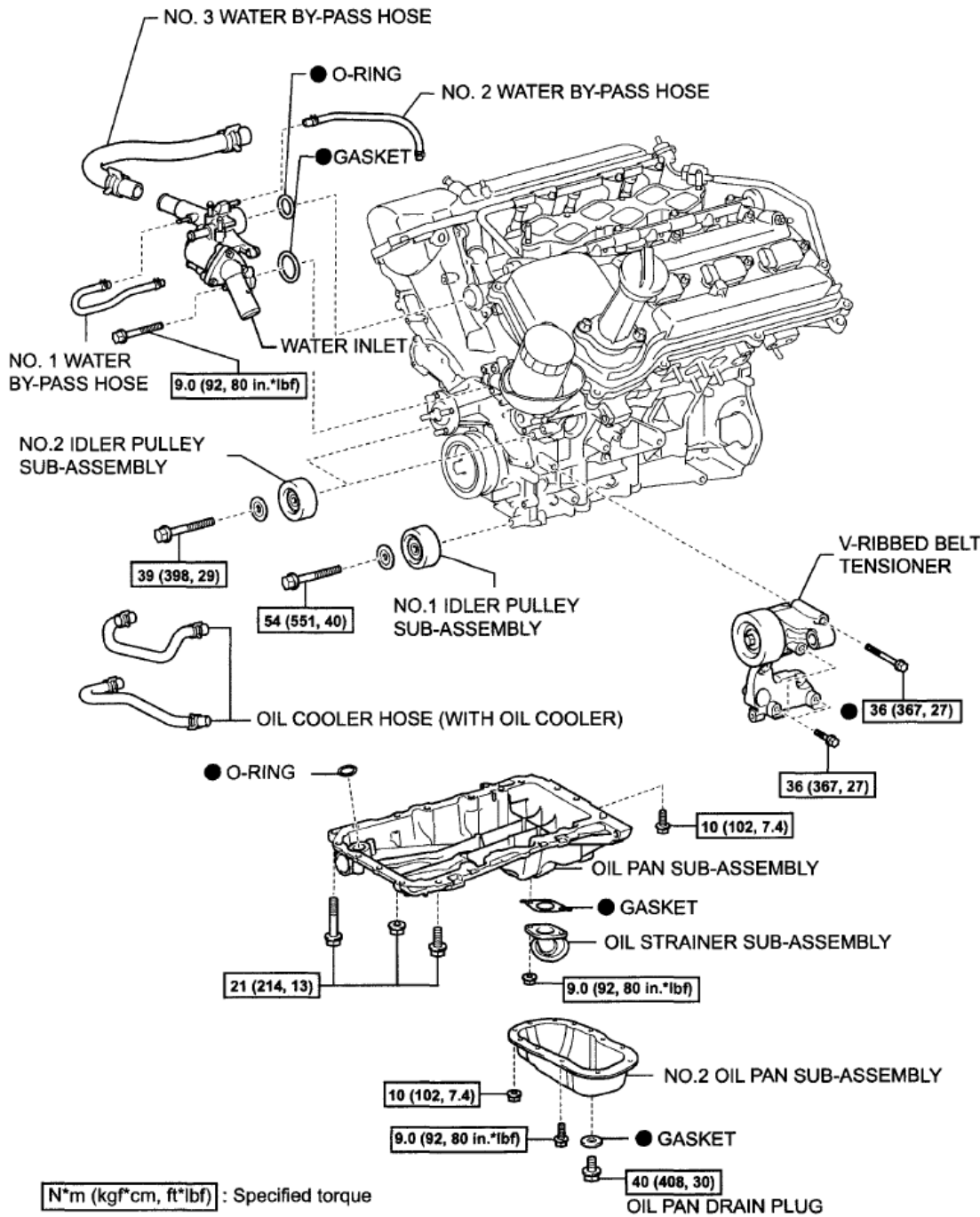
**Fig. 229: Exploded View Of Cylinder Head Components With Torque Specification (6 Of 14)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 230: Exploded View Of Cylinder Head Components With Torque Specification (7 Of 14)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 231: Exploded View Of Cylinder Head Components With Torque Specification (8 Of 14)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



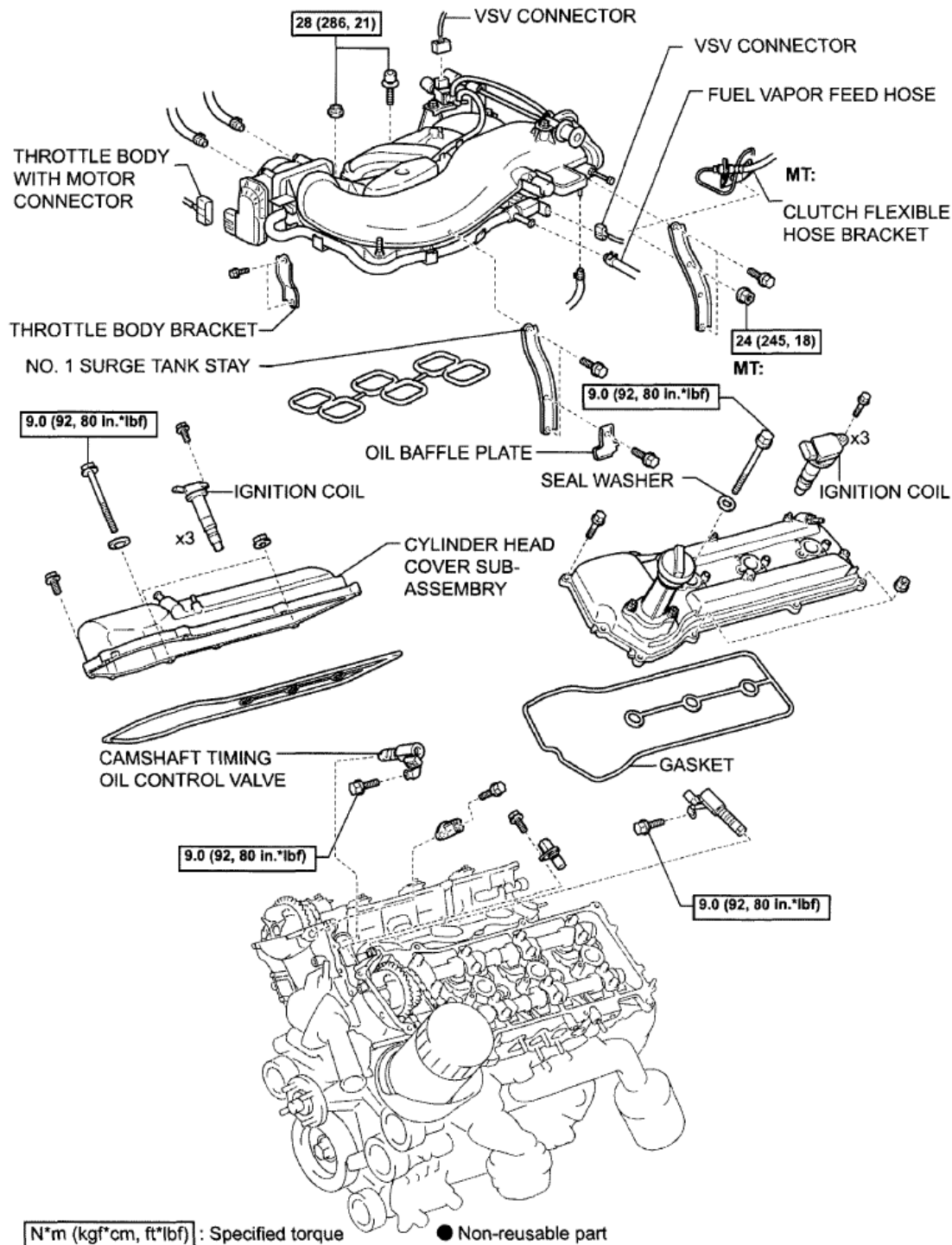
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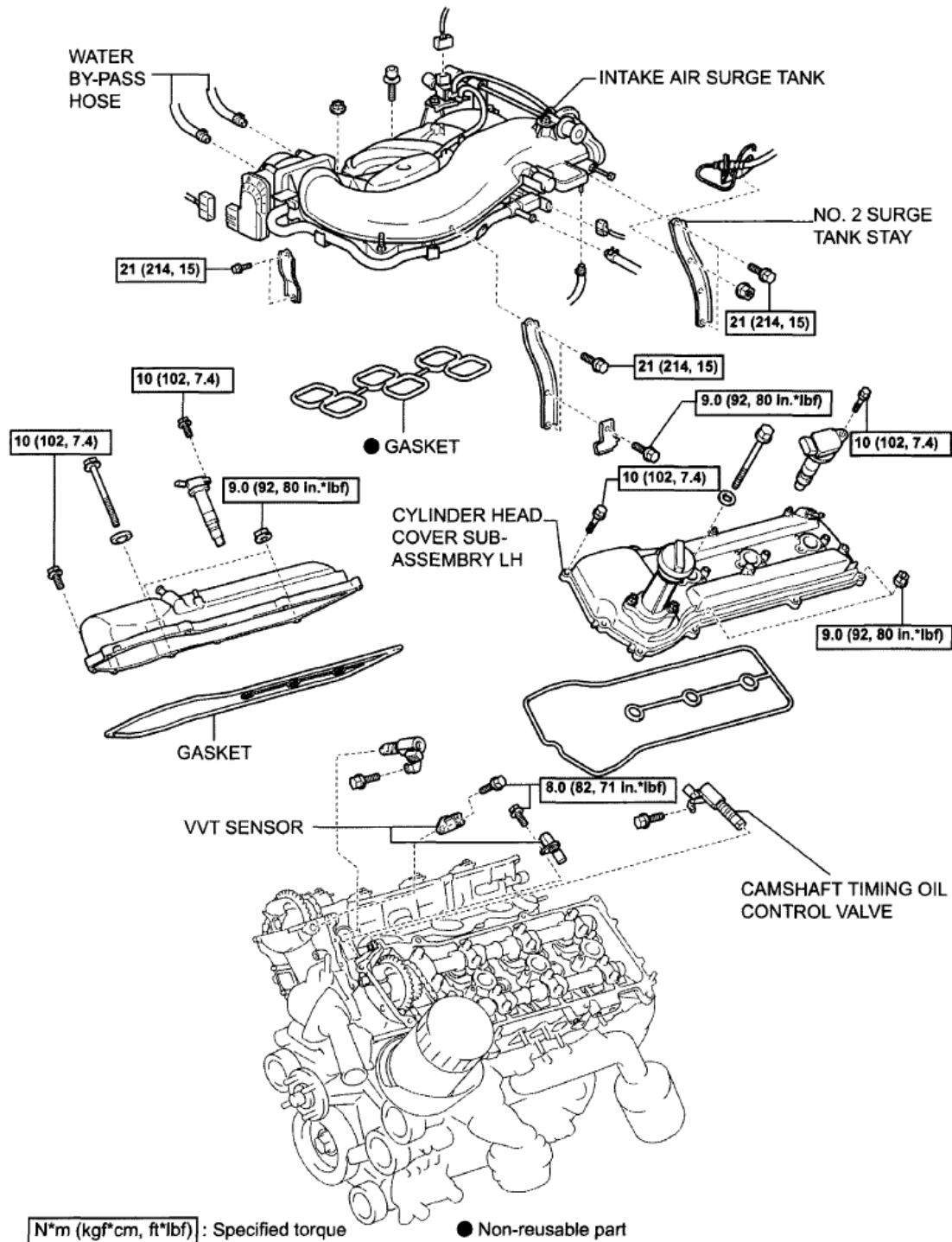
**Fig. 232: Exploded View Of Cylinder Head Components With Torque Specification (9 Of 14)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 2009 Toyota Tacoma

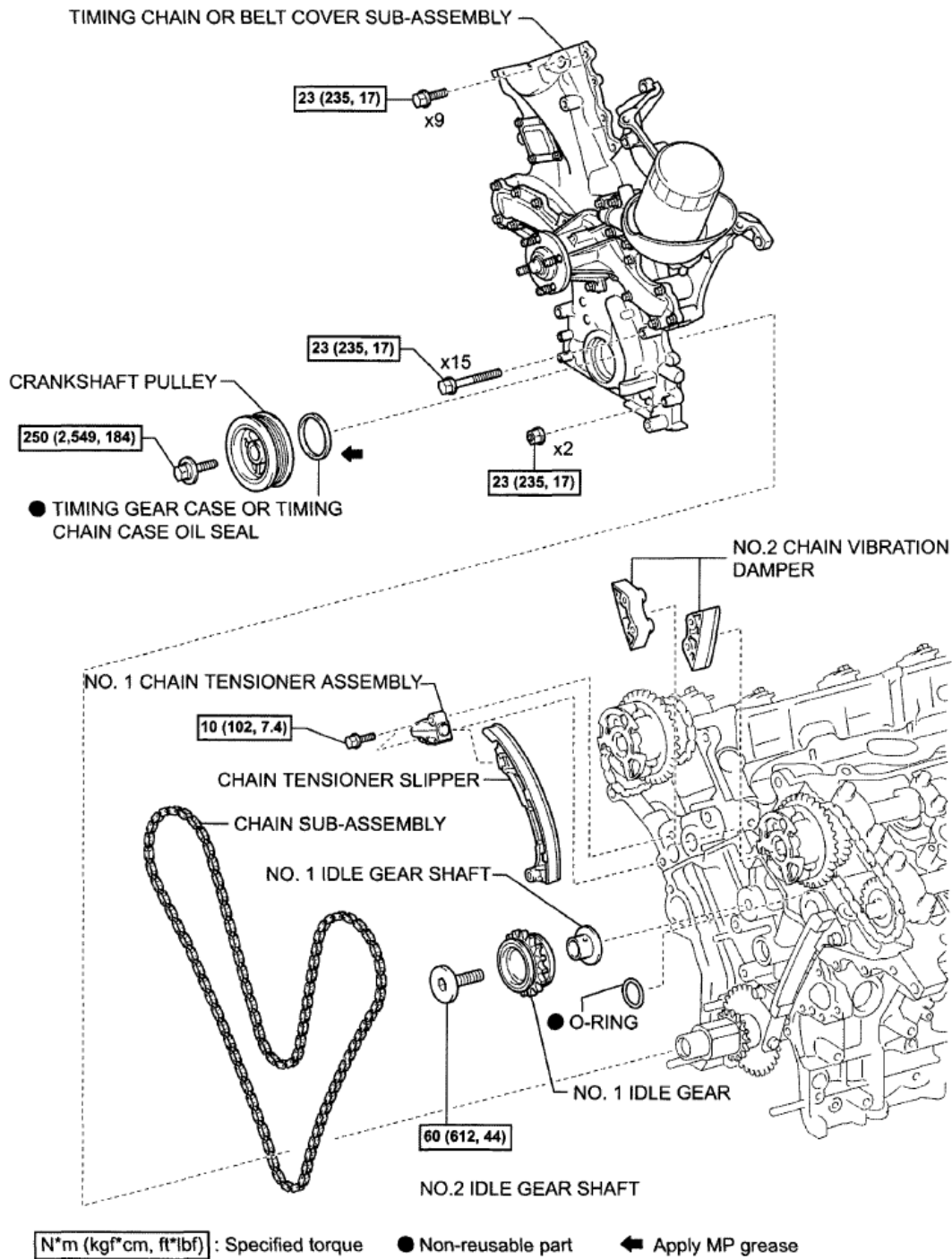
2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma



**Fig. 233: Exploded View Of Cylinder Head Components With Torque Specification (10 Of 14)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 234: Exploded View Of Cylinder Head Components With Torque Specification (11 Of 14)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

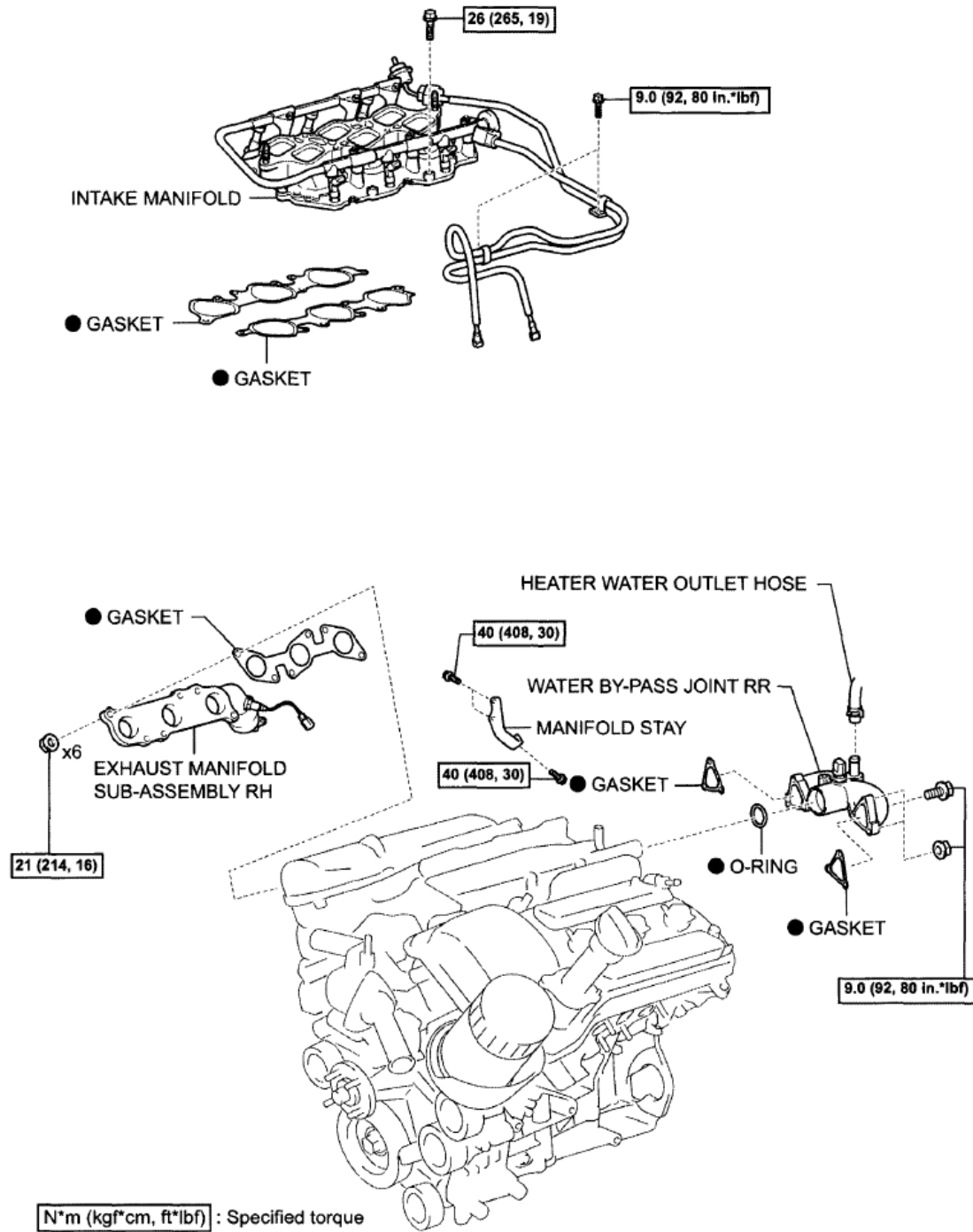


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**Fig. 235: Exploded View Of Cylinder Head Components With Torque Specification (12 Of 14)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

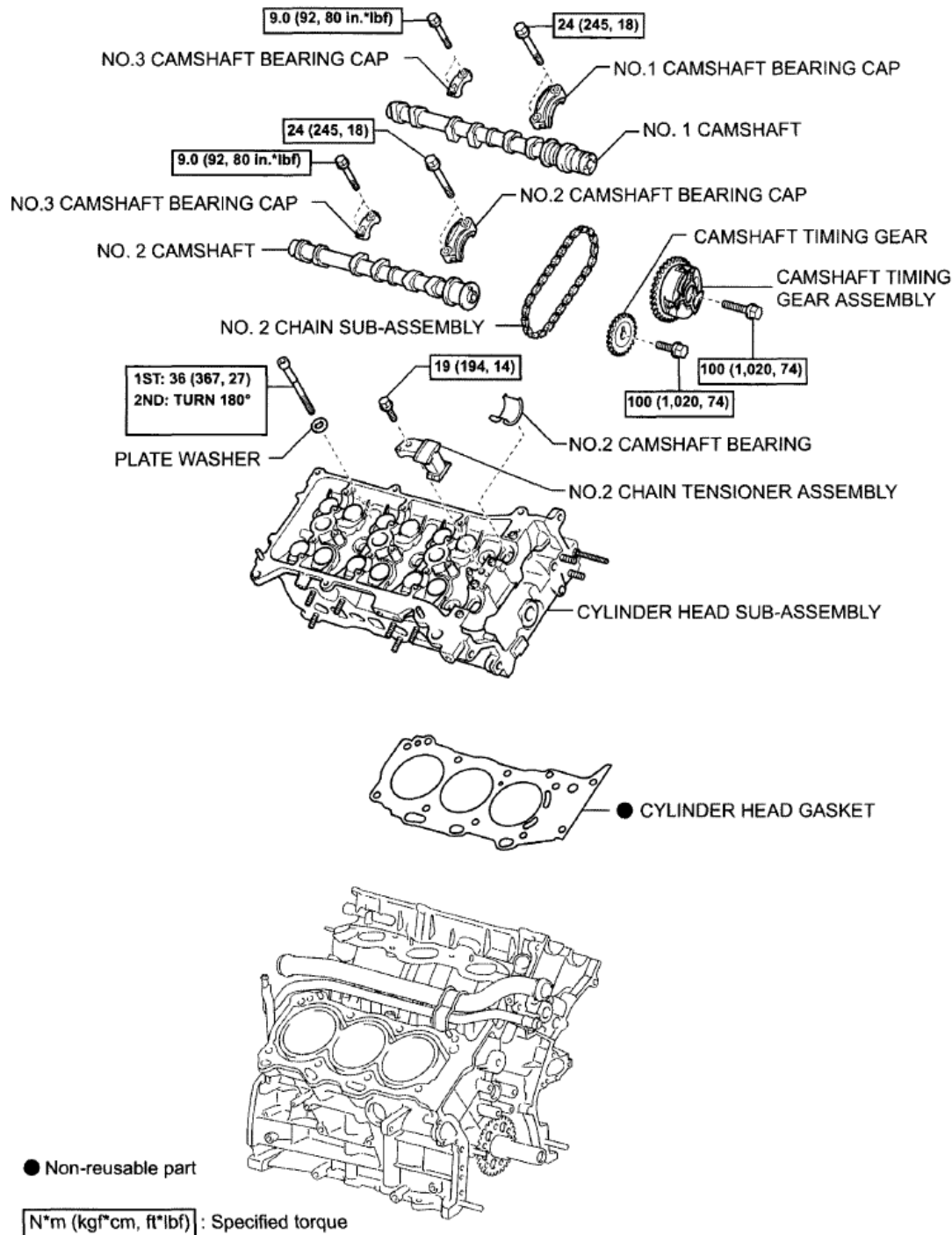
## 2009 Toyota Tacoma

2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma



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**Fig. 236: Exploded View Of Cylinder Head Components With Torque Specification (13 Of 14)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 237: Exploded View Of Cylinder Head Components With Torque Specification (14 Of 14)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## REMOVAL

### 1. DISCHARGE FUEL SYSTEM PRESSURE

(See **FUEL SYSTEM** )

2. **REMOVE BATTERY**
3. **DRAIN ENGINE COOLANT** (See **COOLANT** )
4. **DRAIN ENGINE OIL** (See **OIL FILTER** )
5. **REMOVE POWER STEERING LINK ASSEMBLY**

(See **REMOVAL** )

6. **REMOVE FRONT DIFFERENTIAL CARRIER ASSEMBLY (for 4WD)**

(See **DISASSEMBLY** )

7. **REMOVE TIMING CHAIN OR BELT COVER SUB-ASSEMBLY**

(See **REMOVAL** )

8. **REMOVE CHAIN SUB-ASSEMBLY**

(See **REMOVAL** )

9. **REMOVE NO.1 COOL AIR INLET**

- a. Remove the 2 bolts, then remove the cool air inlet.

10. **REMOVE FRONT EXHAUST PIPE ASSEMBLY**

(See **INSTALLATION** )

11. **REMOVE MANIFOLD STAY**

- a. Remove the 3 bolts, then remove the exhaust manifold stay.

12. **REMOVE EXHAUST MANIFOLD SUB-ASSEMBLY**

- a. Disconnect the air fuel ratio sensor connector.
- b. Remove the 6 nuts, then remove the exhaust manifold and gasket.

13. **DISCONNECT NO.1 FUEL PIPE SUB-ASSEMBLY** (See **REMOVAL** )

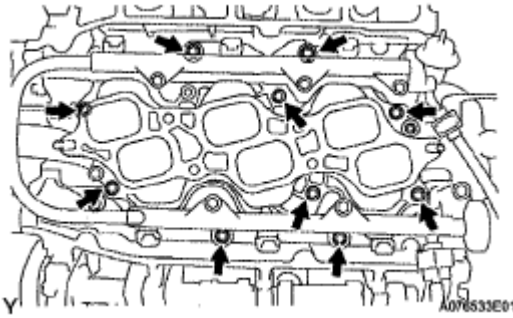
14. **DISCONNECT NO.2 FUEL PIPE SUB-ASSEMBLY** (See **REMOVAL** )

15. **REMOVE INTAKE MANIFOLD**

- a. Disconnect the 6 fuel injector connectors.
- b. Remove the 10 bolts, then remove the intake manifold and gasket.

16. **REMOVE WATER BY-PASS JOINT RR**

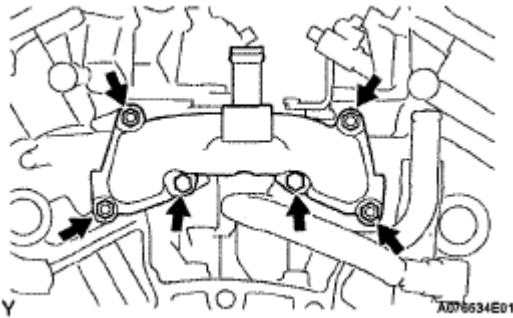
- a. Disconnect the engine coolant temperature sensor connector.
- b. Disconnect the heater hose.



**Fig. 238: Locating Water By-Pass Joint Bolt**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Remove the 2 bolts and 4 nuts, then remove the water by-pass joint RR and 2 gaskets.
- d. Remove the O-ring from the water outlet hose.

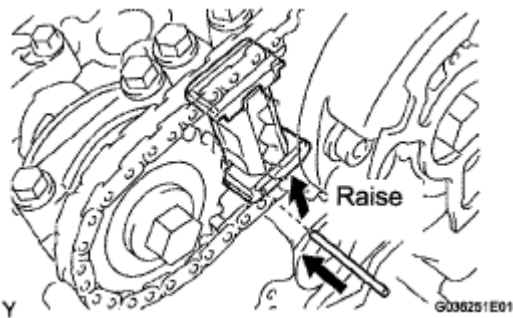


**Fig. 239: Locating Water Outlet Hose Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**17. REMOVE CAMSHAFT TIMING GEARS AND NO.2 CHAIN (for Bank 1)**

- a. While raising the chain tensioner No. 2, insert a pin of 1.0 mm (0.039 in.) into the hole to fix it.



**Fig. 240: Raising Chain Tensioner No. 2**

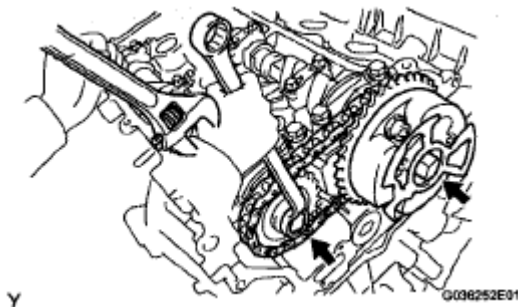
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Hold the hexagonal portion of the camshaft with a wrench.

**NOTE:** Be careful not to damage the cylinder head and valve lifter with the wrench.

- c. Remove the 2 bolts, then remove the camshaft timing gear, camshaft timing gear assembly and timing chain No. 2.

**NOTE:** Do not disassemble the camshaft timing gear assembly.



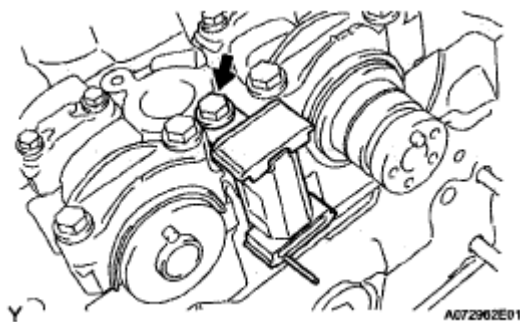
**Fig. 241: Holding Camshaft Using Wrench**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### 18. REMOVE NO.2 CHAIN TENSIONER ASSEMBLY

- a. Remove the bolt, then remove the chain tensioner No. 2.

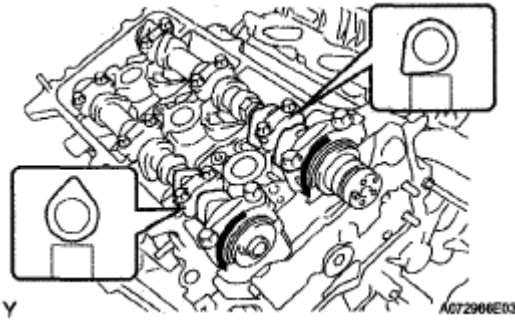
#### 19. REMOVE CAMSHAFTS

**NOTE:** Keep the camshaft level while it is being removed. The camshaft thrust clearance is very small and failing to keep it level could crack or damage the cylinder head journal surface, which receives the thrust. This could subsequently lead the camshaft to seize or break. Perform the following steps to avoid such problems.



**Fig. 242: Locating Chain Tensioner No. 2 With Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Rotate the camshafts counterclockwise using a wrench so that the cam lobes of No. 1 cylinder face in the directions shown in the illustration.



**Fig. 243: Rotating Camshafts**

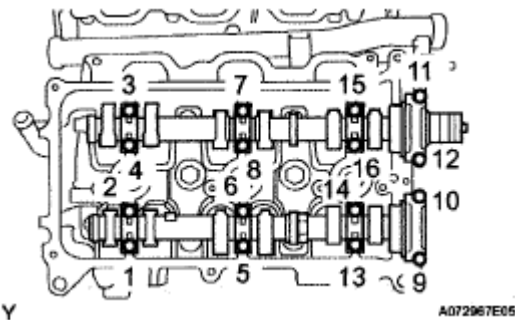
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using several steps, loosen and remove the 16 bearing cap bolts uniformly in the sequence shown in the illustration.
- c. Remove the 8 bearing caps and 2 camshafts.

**20. REMOVE NO.2 CAMSHAFT BEARING**

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

- a. Remove the 2 bolts and separate the 2 ground cables.



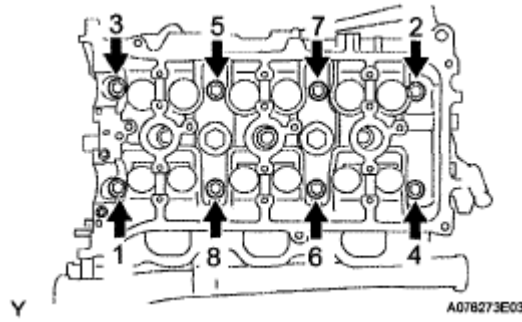
**Fig. 244: Identifying Bearing Cap Bolts Loosen Sequence (Bank 1 4WD And Pre-Runner)**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using several steps, loosen the 8 cylinder head bolts on the cylinder head uniformly with a 10 mm bi-hexagon wrench in the sequence shown in the illustration. Remove the 8 cylinder head bolts and 8 plate washers.

**NOTE:**

- Be careful not to drop the plate washers into the cylinder head.
- Cylinder head warpage or cracking could result from removing the bolts in the wrong order.

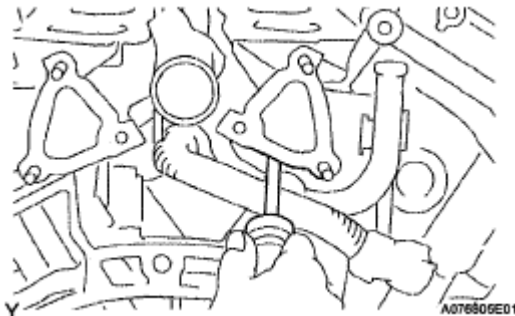


**Fig. 245: Locating Cylinder Head Bolt Loosen Sequence (Bank 1 4WD And Pre-Runner)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Lift the cylinder head from the dowels on the cylinder block, and place the cylinder head on wooden blocks on a bench.

**NOTE:** Be careful not to drop the plate washers into the cylinder head.

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



**Fig. 246: Lifting Cylinder Head**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 22. REMOVE CYLINDER HEAD GASKET

### INSPECTION

#### 1. INSPECT CYLINDER HEAD SET BOLT

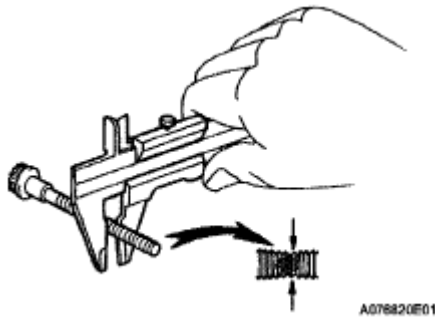
- a. Using a vernier caliper, measure the outside diameter of the bolt thread.

**Standard outside diameter:**

**10.85 to 11.00 mm (0.4272 to 0.4331 in.)**

**Minimum outside diameter:**

**10.7 mm (0.421 in.)**



**Fig. 247: Inspecting Cylinder Head Set Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## INSTALLATION

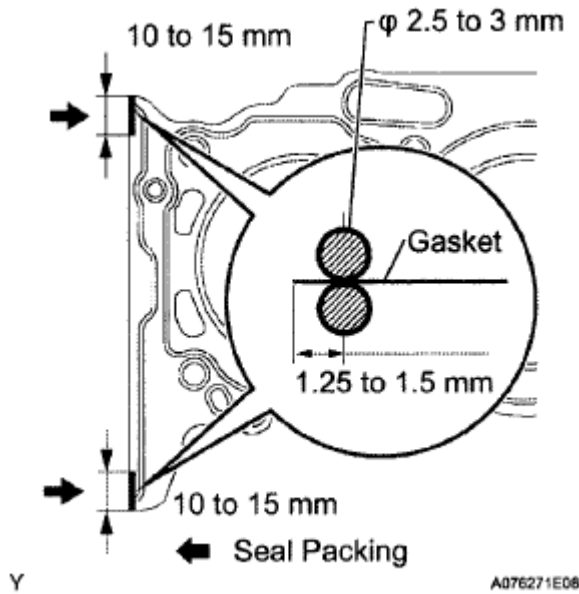
### 1. INSTALL CYLINDER HEAD GASKET

- a. Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the cylinder head and cylinder block.
- b. Apply a continuous bead of the seal packing (diameter 2.5 to 3 mm (0.098 to 0.118 in.)) to a new cylinder head gasket as shown in the illustration.

#### Seal packing:

**Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent**

**NOTE:** Install the cylinder head within 3 minutes of applying seal packing. Tighten the cylinder head bolts within 15 minutes of installing the cylinder head. Otherwise, the seal packing must be removed and reapplied.



**Fig. 248: Identifying Cylinder Head Gasket**

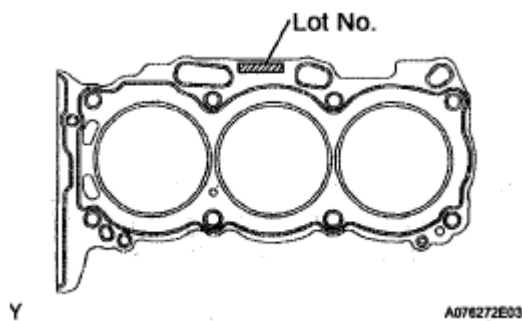
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Place the cylinder head gasket on the cylinder block surface with the Lot No. stamp upward.

**NOTE:**

- Be careful of the installation direction.
- Place the cylinder head carefully in order not to damage the gasket with the bottom part of the head.

**2. INSTALL CYLINDER HEAD SUB-ASSEMBLY**



**Fig. 249: Identifying Cylinder Block Surface With Lot No. Stamp**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Place the cylinder head on the cylinder head gasket.
- b. Install the 8 cylinder head bolts.

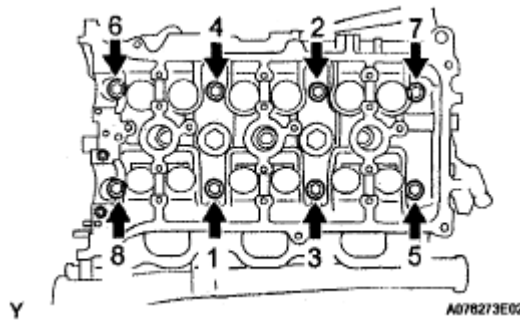
**HINT:**

- The cylinder head bolts are tightened in 2 successive steps (steps (3) and (5)).
  - If any cylinder head bolts are broken or deformed, replace them.
1. Apply a light coat of engine oil to the threads of the cylinder head bolts.
  2. Install the plate washer onto the cylinder head bolt.
  3. Using several steps, tighten each bolt uniformly with a 10 mm bi-hexagon wrench in the sequence shown in the illustration.

**Torque: 36 N\*m (367 kgf\*cm, 27 ft.\*lbf)**

If any cylinder head bolts do not meet the torque specification, replace them.

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

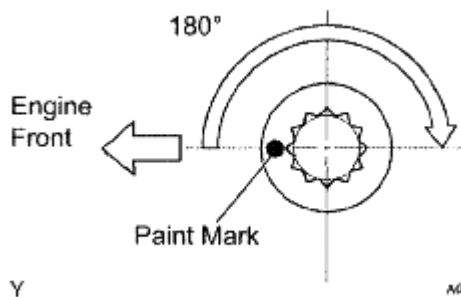


**Fig. 250: Identifying Cylinder Head Bolt Tightening Sequence (Bank 1 4WD And Pre-Runner)**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. Mark the front side of each cylinder head bolt with paint.
  5. Retighten the cylinder head bolts 180° as shown.
  6. Check that the painted marks are now at 180° from the engine front.
- c. Install the ground cables with the 2 bolts.

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



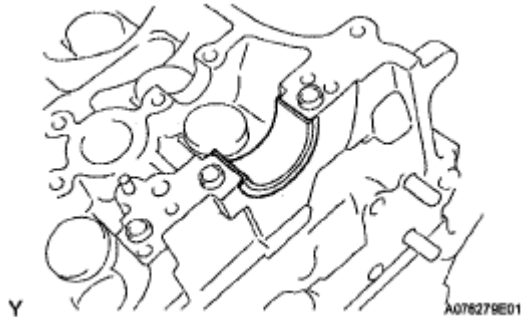
**Fig. 251: Identifying Front Mark Of Cylinder Head Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### 3. INSTALL NO.2 CAMSHAFT BEARING

- a. Install the camshaft bearing No. 2 onto the cylinder head.

**NOTE:** Clean the installation planes of the back side of the bearing and cylinder head and keep them free of oils and fats.

### 4. INSTALL CAMSHAFTS

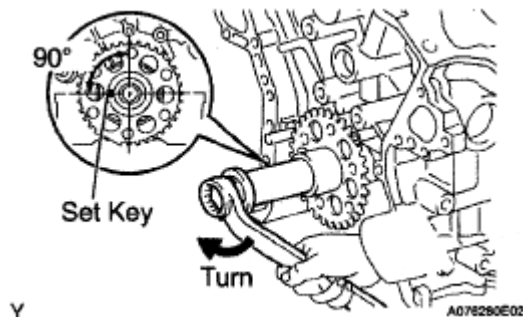


**Fig. 252: Identifying No.2 Camshaft Bearing**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** Keep the camshaft level while it is being removed. The camshaft thrust clearance is very small and failing to keep it level could crack or damage the cylinder head journal surface, which receives the thrust. This could subsequently lead the camshaft to seize or break. Perform the following steps to avoid such problems.

- a. Set the crankshaft position.
  1. Using the crankshaft pulley set bolt, turn the crankshaft, and set the crankshaft set key in the left horizontal position.

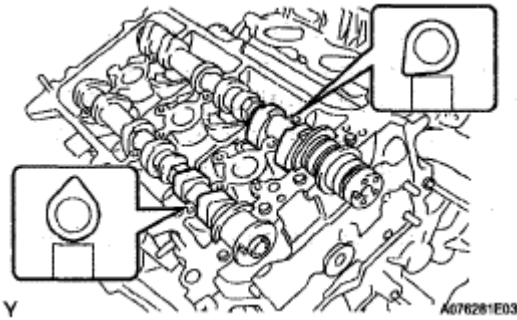
**NOTE:** Installing the crankshaft at the wrong angle could cause the piston head and valve head to come into contact with each other when installing the camshaft. This could cause damage, so always set the crankshaft at the correct angle.



**Fig. 253: Setting Crankshaft Position**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

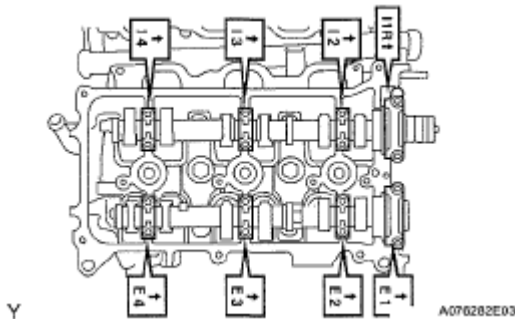
- b. Apply new engine oil to the thrust portion and journal of the camshafts.
- c. Place the 2 camshafts onto the cylinder head with the cam lobes of No. 1 cylinder facing in the directions shown in the illustration.



**Fig. 254: Identifying Bearing Cap Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Install the 8 bearing caps in the proper locations as shown.
- e. Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.



**Fig. 255: Identifying Bearing Cap Bolts Tighten Sequence (Bank 1 4WD And Pre-Runner)**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

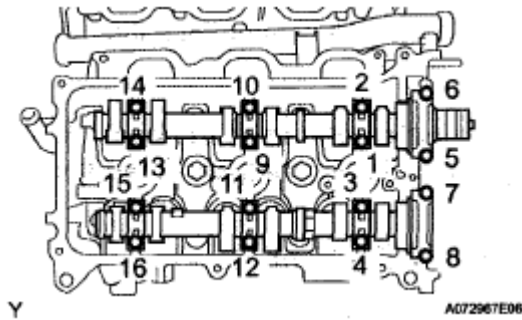
- f. Using several steps, uniformly install and tighten the 16 bearing cap bolts in the sequence shown in the illustration.

**Torque: 9.0 N\*m (92 kgf\*cm, 80 in.\*lbf) for 10**

**mm (0.39 in.) head**

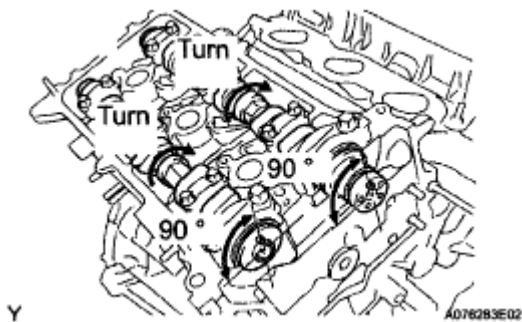
**24 N\*m (245 kgf\*cm, 18 ft.\*lbf) for 12**

**mm (0.47 in.) head**



**Fig. 256: Identifying Bearing Cap Bolts Tighten Sequence (Bank 1 4WD And Pre-Runner)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

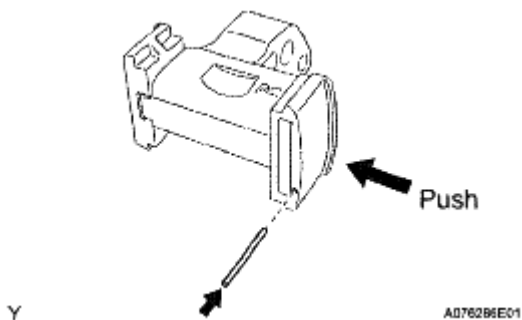
- g. Turn the camshafts clockwise until the knock pin comes to a position 90° to the cylinder head.



**Fig. 257: Turning Camshafts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 5. INSTALL NO.2 CHAIN TENSIONER ASSEMBLY

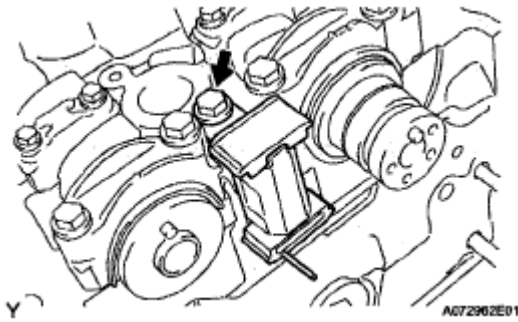
- a. While pushing in the tensioner, insert a pin of 1.0 mm (0.039 in.) into the hole to fix it.



**Fig. 258: Pushing Tensioner**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the chain tensioner No. 2 with the bolt.

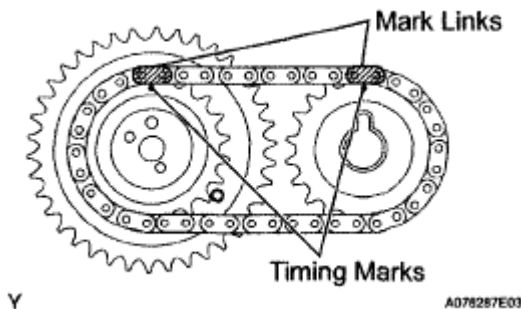
**Torque: 19 N\*m (194 kgf\*cm, 14 ft.\*lbf)**



**Fig. 259: Locating Chain Tensioner No. 2 With Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 6. INSTALL CAMSHAFT TIMING GEARS AND N0.2 CHAIN (for Bank 1)

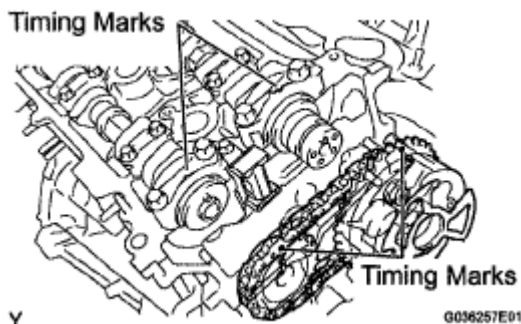
- a. Align the yellow mark links with the timing marks (1 dot mark) of camshaft timing gears as shown in the illustration.



**Fig. 260: Identifying Timing Marks Of Camshaft Timing Gears**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Align the timing marks on the camshaft timing gears with the timing marks on the bearing caps, and install the camshaft timing gears with the chain onto the RH camshafts.
- c. Temporarily install the 2 camshaft timing gear bolts.

**NOTE:** Do not push the camshaft timing gear assembly onto the camshaft forcibly when installing it.

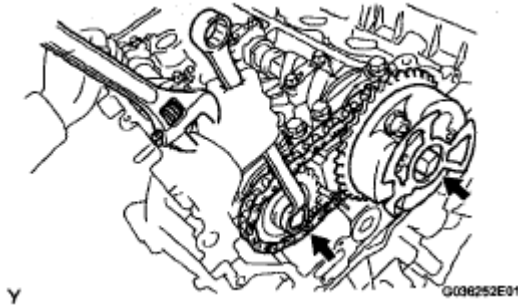


**Fig. 261: Identifying Timing Marks On Camshaft Timing Gears**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Hold the hexagonal portion of the camshaft with a wrench, and tighten the 2 bolts.

**Torque: 100 N\*m (1,020 kgf\*cm, 74 ft.\*lbf)**

- e. Remove the pin from the tensioner No. 2.



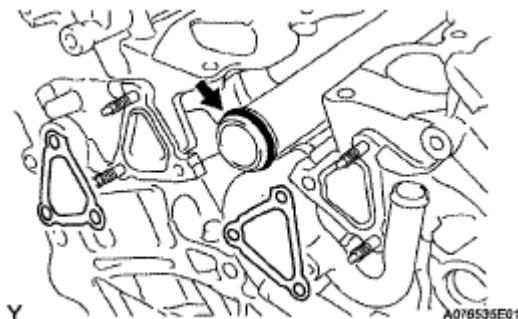
**Fig. 262: Holding Camshaft Using Wrench**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### **7. INSTALL WATER BY-PASS JOINT RR**

- a. Install a new O-ring onto the water outlet pipe.
- b. Apply soapy water to the O-ring.
- c. Install 2 new gaskets and water by-pass joint rear with the 2 bolts and 4 nuts.

**Torque: 9.0 N\*m (92 kgf\*cm, 80 in.\*lbf)**

- d. Connect the heater hose.
- e. Connect the engine coolant temperature sensor connector.



**Fig. 263: Locating O-Ring Onto Water Outlet Pipe**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### **8. INSTALL INTAKE MANIFOLD**

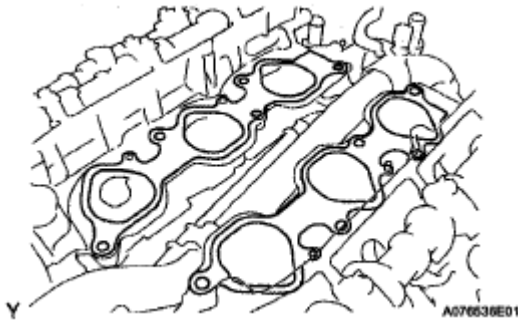
- a. Set a new gasket on each cylinder head.

**NOTE:**

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

- b. Set the intake manifold on the cylinder heads.
- c. Install and tighten the 10 bolts uniformly in several steps.

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



**Fig. 264: Identifying Gasket On Cylinder Head**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Connect the 6 fuel injector connectors.

**9. CONNECT N0.2 FUEL PIPE SUB-ASSEMBLY**

**10. CONNECT NO.1 FUEL PIPE SUB-ASSEMBLY (See INSTALLATION )**

**11. INSTALL EXHAUST MANIFOLD SUB-ASSEMBLY RH**

- a. Set a new gasket to the RH cylinder head with the oval shape facing forward.

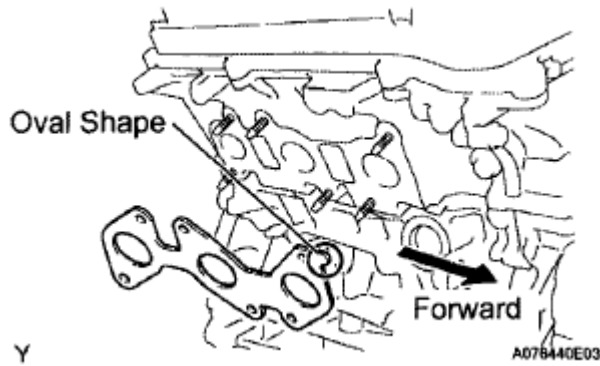
**NOTE:**

**Be careful of the installation direction.**

- b. Install the exhaust manifold with the 6 nuts. Tighten the nuts uniformly in several steps.

**Torque: 21 N\*m (214 kgf\*cm, 16 ft.\*lbf)**

- c. Connect the air fuel ratio sensor connector.



**Fig. 265: Installing Exhaust Manifold Sub-Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**12. INSTALL MANIFOLD STAY**

- a. Install the manifold stay with the 3 bolts.

**Torque: 40 N\*m (408 kgf\*cm, 30 ft.\*lbf)**

**13. INSTALL FRONT EXHAUST PIPE ASSEMBLY**

(See **INSTALLATION** )

**14. INSTALL NO.1 COOL AIR INLET**

- a. Install the cool air inlet with the 2 bolts.

**Torque: 12 N\*m (122 kgf\*cm, 9.0 ft.\*lbf)**

**15. INSTALL CHAIN TENSIONER SLIPPER**

**16. INSTALL NO.1 CHAIN TENSIONER ASSEMBLY (See **INSTALLATION** )**

**17. INSTALL CHAIN SUB-ASSEMBLY**

(See **INSTALLATION** )

**18. INSTALL TIMING CHAIN OR BELT COVER SUB-ASSEMBLY**

(See **REASSEMBLY** )

**19. INSTALL FRONT DIFFERENTIAL CARRIER ASSEMBLY (for 4WD)**

(See **INSTALLATION** )

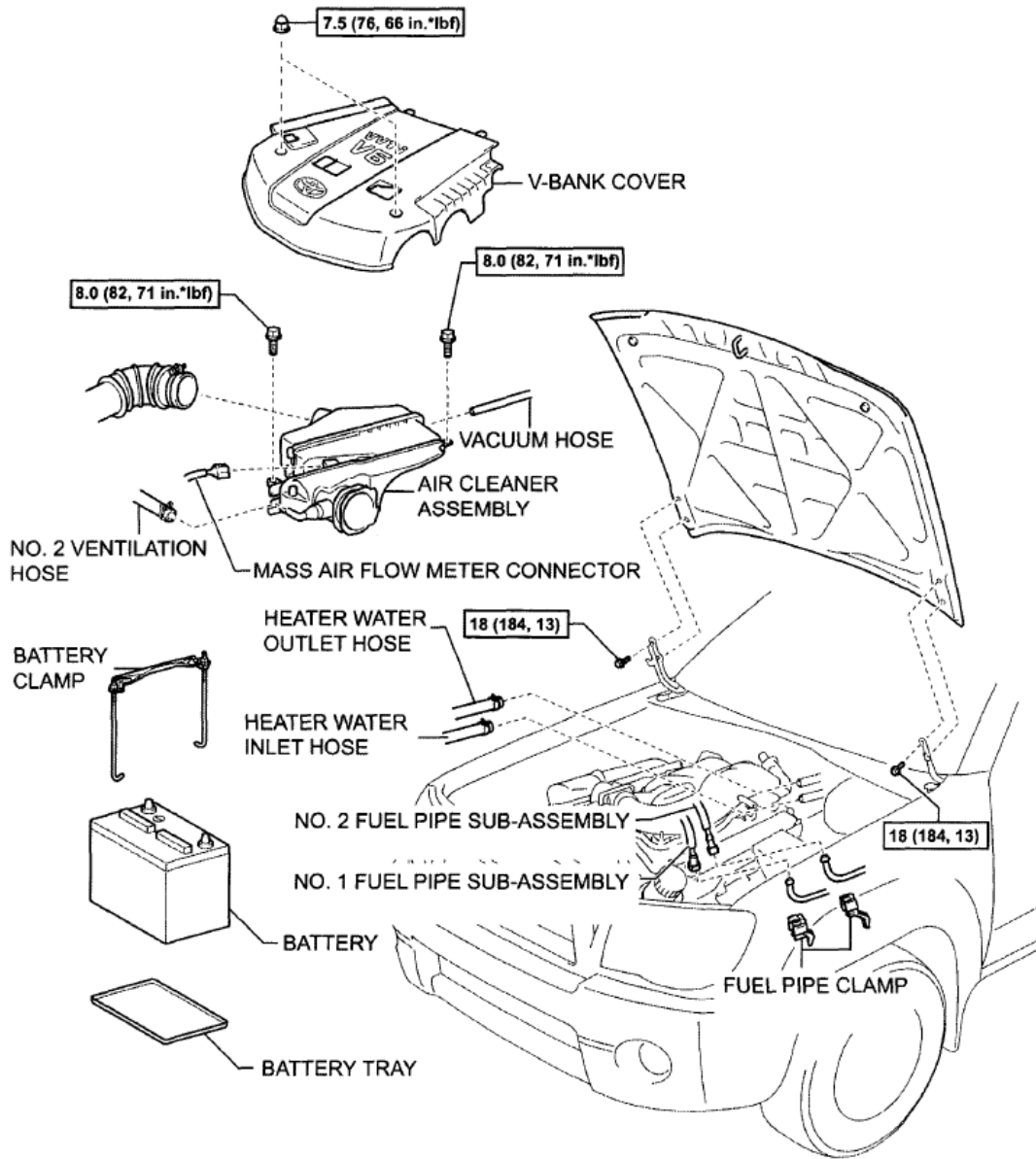
**20. INSTALL POWER STEERING LINK ASSEMBLY**

(See **INSTALLATION** )

- 21. **INSTALL BATTERY**
- 22. **ADD ENGINE OIL** (See INSTALLATION )
- 23. **ADD ENGINE COOLANT** (See COOLANT )
- 24. **ADD DIFFERENTIAL OIL (for 4WD)**
- 25. **INSPECT DIFFERENTIAL OIL (for 4WD)** (See DIFFERENTIAL OIL )
- 26. **ADD POWER STEERING FLUID**
- 27. **BLEED POWER STEERING FLUID** (See ON-VEHICLE INSPECTION )
- 28. **CHECK FOR ENGINE OIL LEAKAGE**
- 29. **CHECK FOR ENGINE COOLANT LEAKAGE** (See REPLACEMENT )
- 30. **CHECK FOR FUEL LEAKAGE**
- 31. **CHECK FOR EXHAUST GAS LEAKAGE**
- 32. **CHECK FOR POWER STEERING FLUID LEAKAGE**
- 33. **INSPECT AND ADJUST FRONT WHEEL ALIGNMENT**  
  
(See FRONT WHEEL ALIGNMENT (FOR 4WD AND PRE-RUNNER) )
- 34. **INSPECT IGNITION TIMING** (See ON-VEHICLE INSPECTION )
- 35. **INSPECT ENGINE IDLING SPEED** (See ON-VEHICLE INSPECTION )
- 36. **INSPECT CO/HC** (See ON-VEHICLE INSPECTION )
- 37. **REMOVE COMPRESSION** (See ON-VEHICLE INSPECTION )

## **CYLINDER HEAD (FOR BANK 2 2WD)**

### **COMPONENTS**

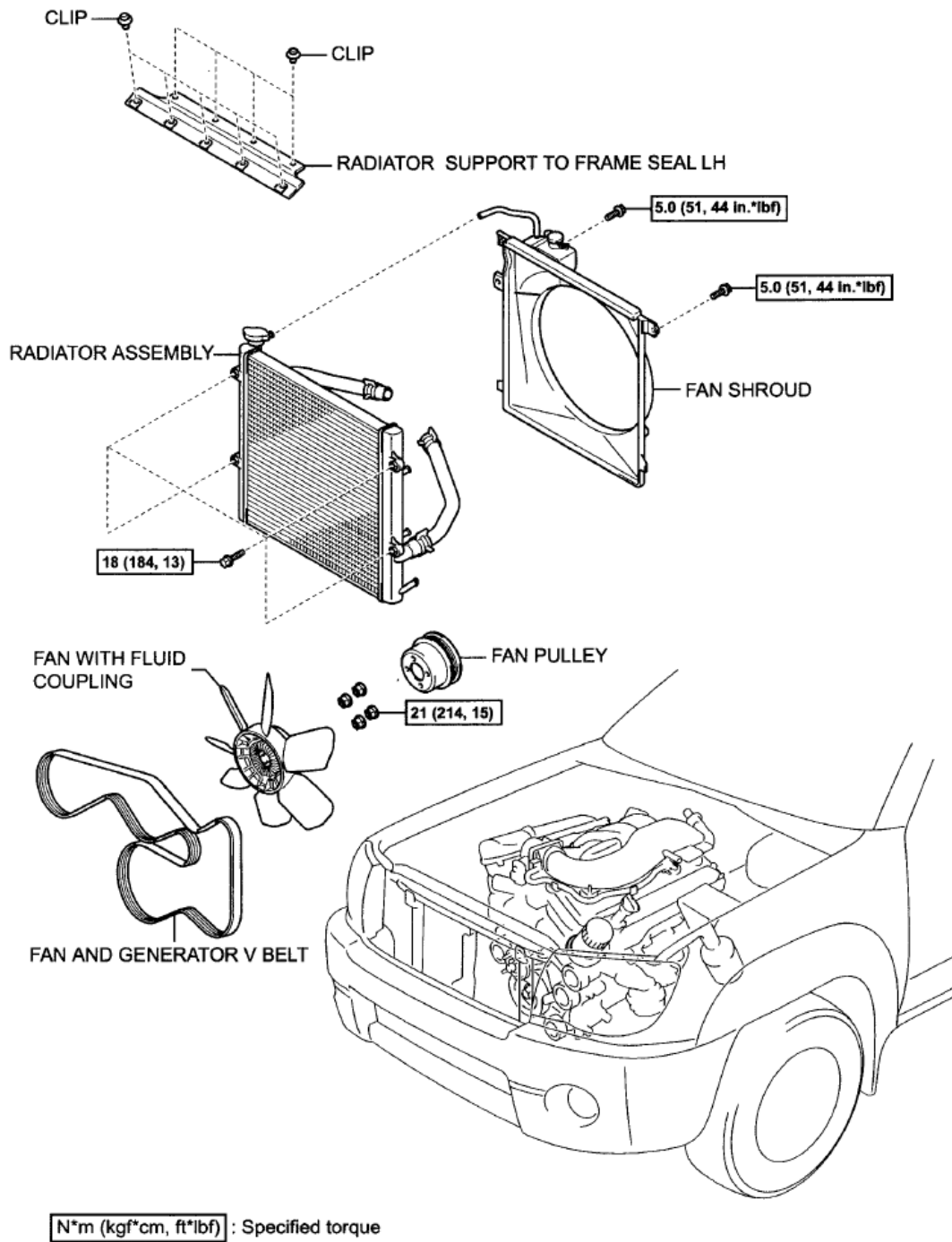


N\*m (kgf\*cm, ft\*lbf) : Specified torque

Y

A113576E02

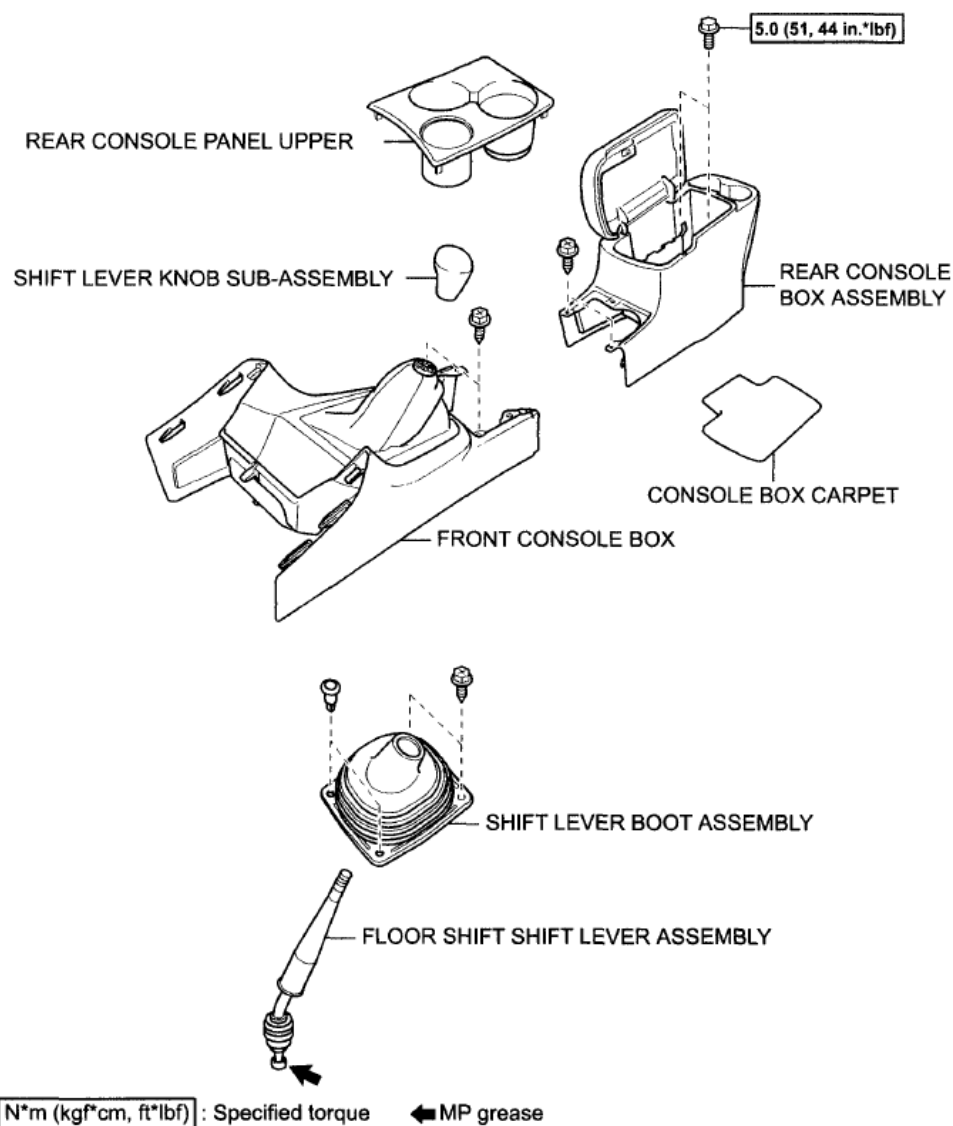
**Fig. 266: Exploded View Of Cylinder Head Components With Torque Specification (1 Of 12)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



Y

A113586E01

**Fig. 267: Exploded View Of Cylinder Head Components With Torque Specification (2 Of 12)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



Y

A113553E01

**Fig. 268: Exploded View Of Cylinder Head Components With Torque Specification (3 Of 12)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

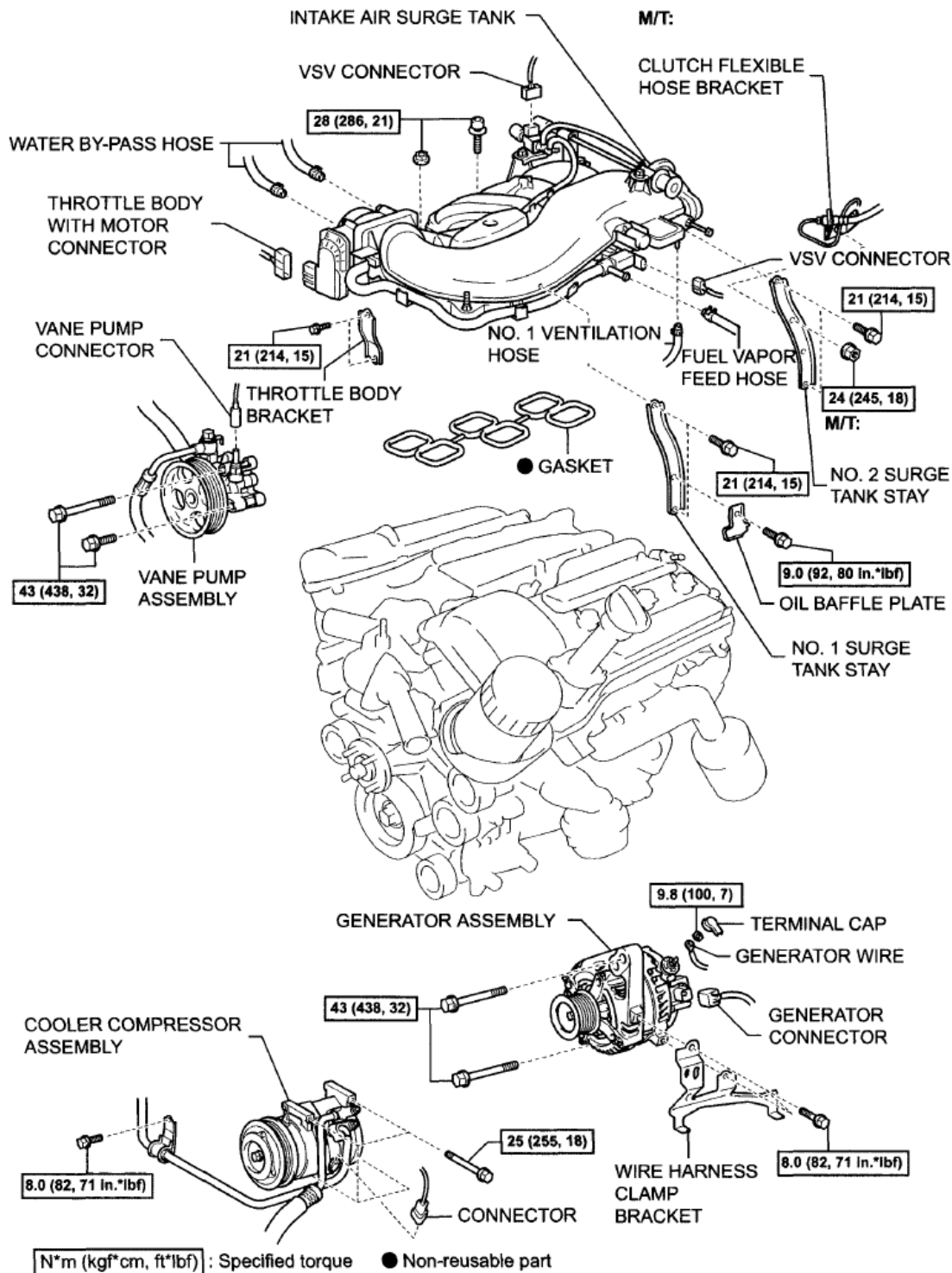
## 2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma

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domingo, 8 de diciembre de 2019 10:57:18 p. m.

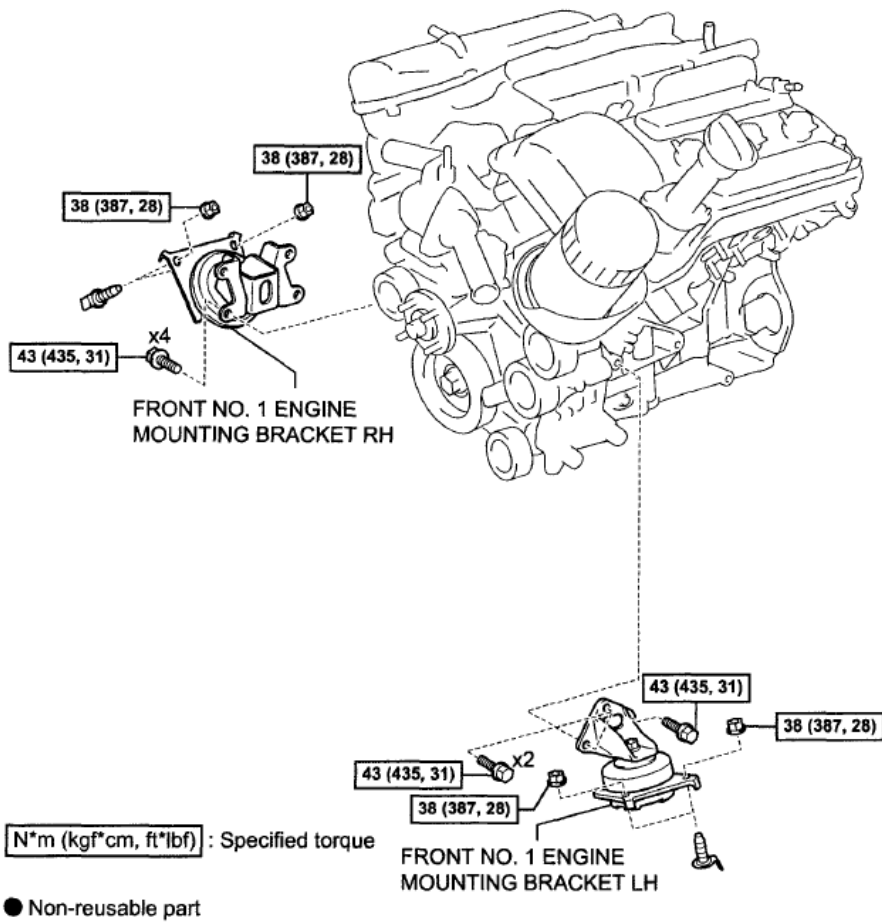
## 2009 Toyota Tacoma

2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma



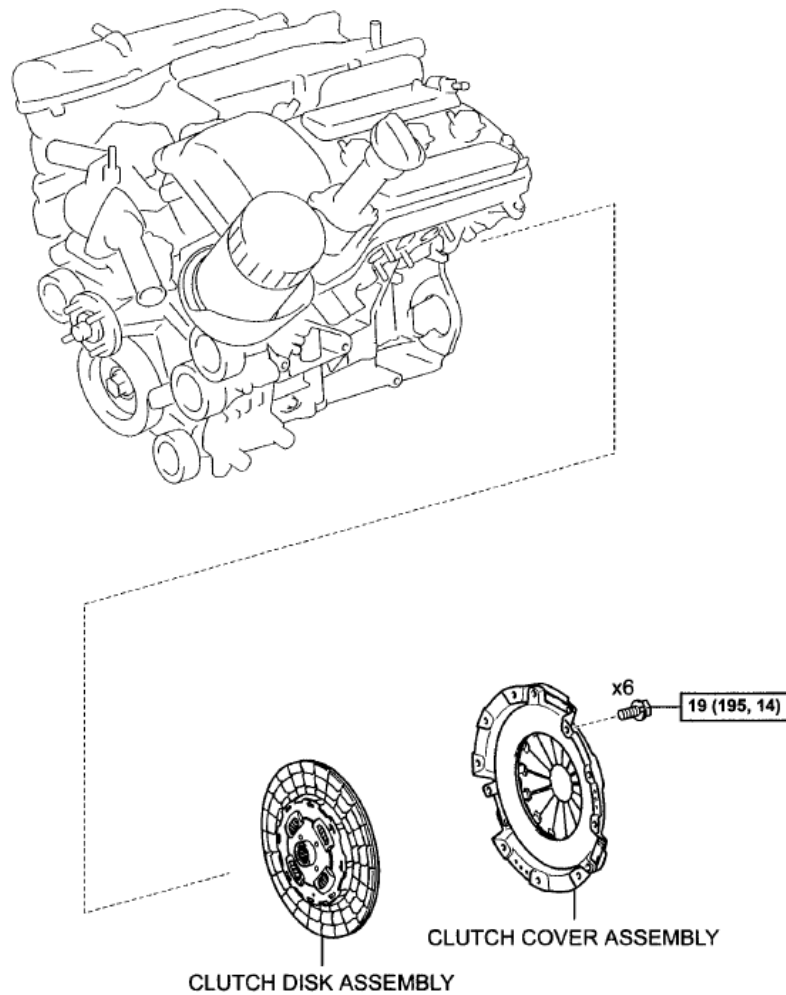
A113575E01

**Fig. 270: Exploded View Of Cylinder Head Components With Torque Specification (5 Of 12)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



A113584E01

**Fig. 271: Exploded View Of Cylinder Head Components With Torque Specification (6 Of 12)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

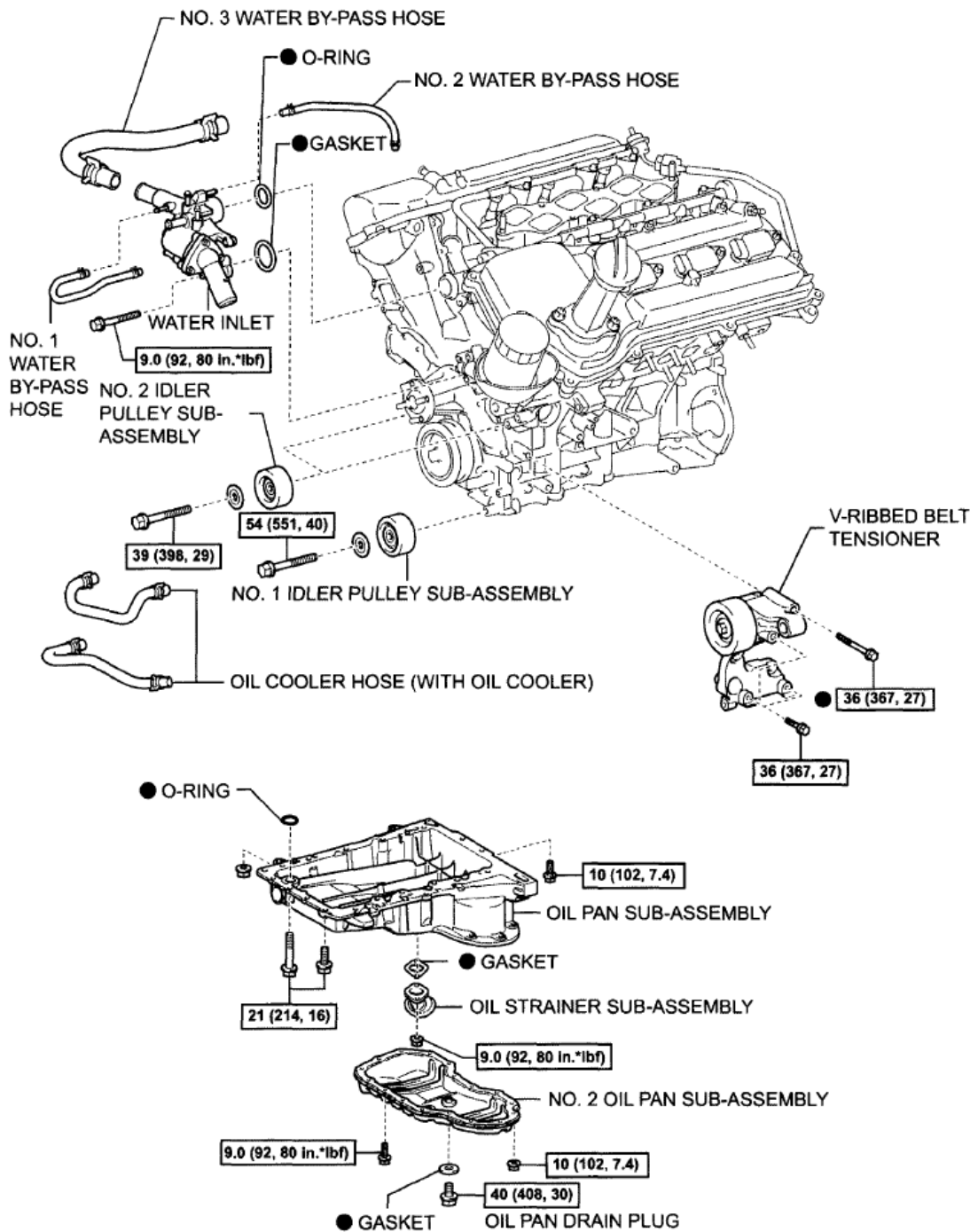


N\*m (kgf\*cm, ft\*lb) : Specified torque

Y

A113585E01

**Fig. 272: Exploded View Of Cylinder Head Components With Torque Specification (7 Of 12)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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

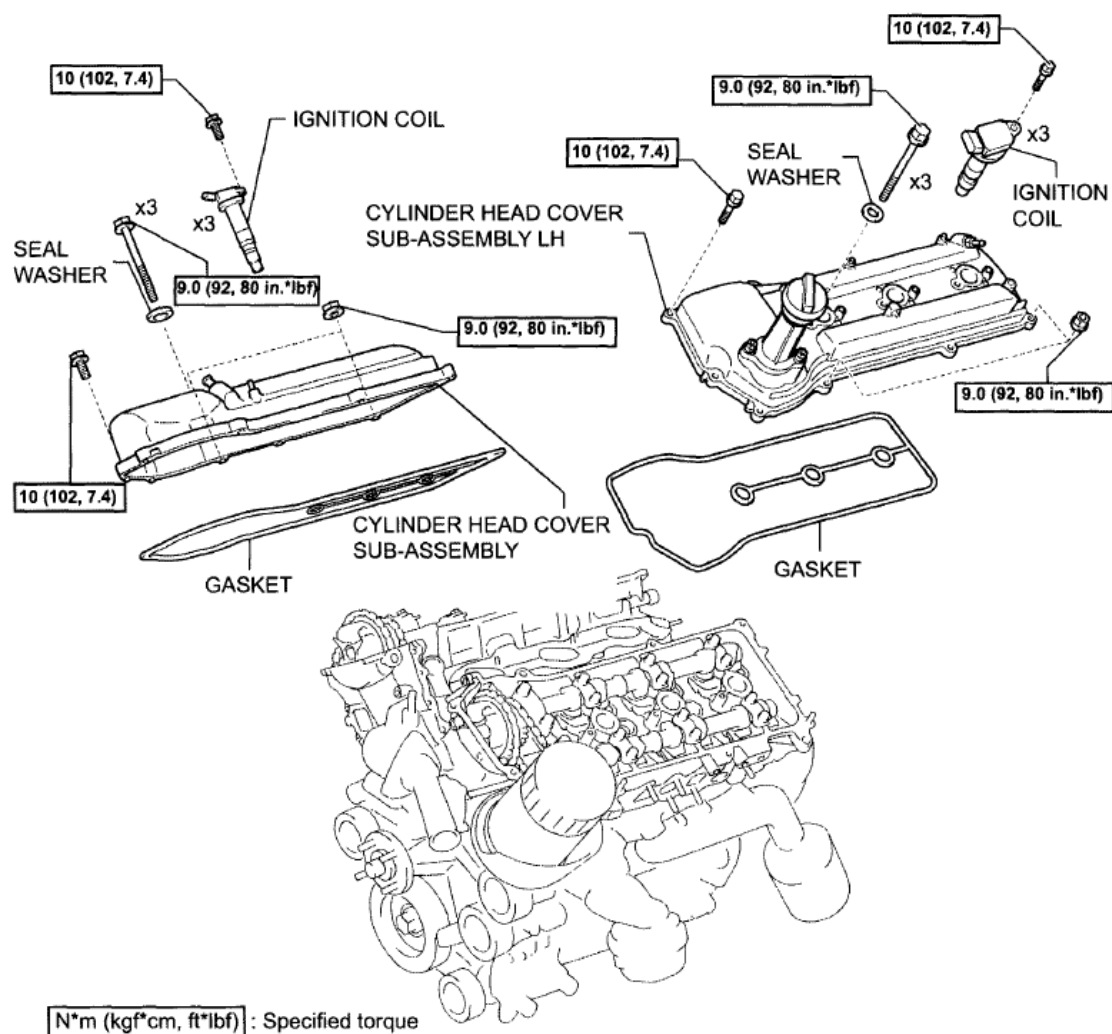
● Non-reusable part

A113588E01

**Fig. 273: Exploded View Of Cylinder Head Components With Torque Specification (8 Of 12)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

| 2009 Toyota Tacoma                              |
|-------------------------------------------------|
| 2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma |

2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma

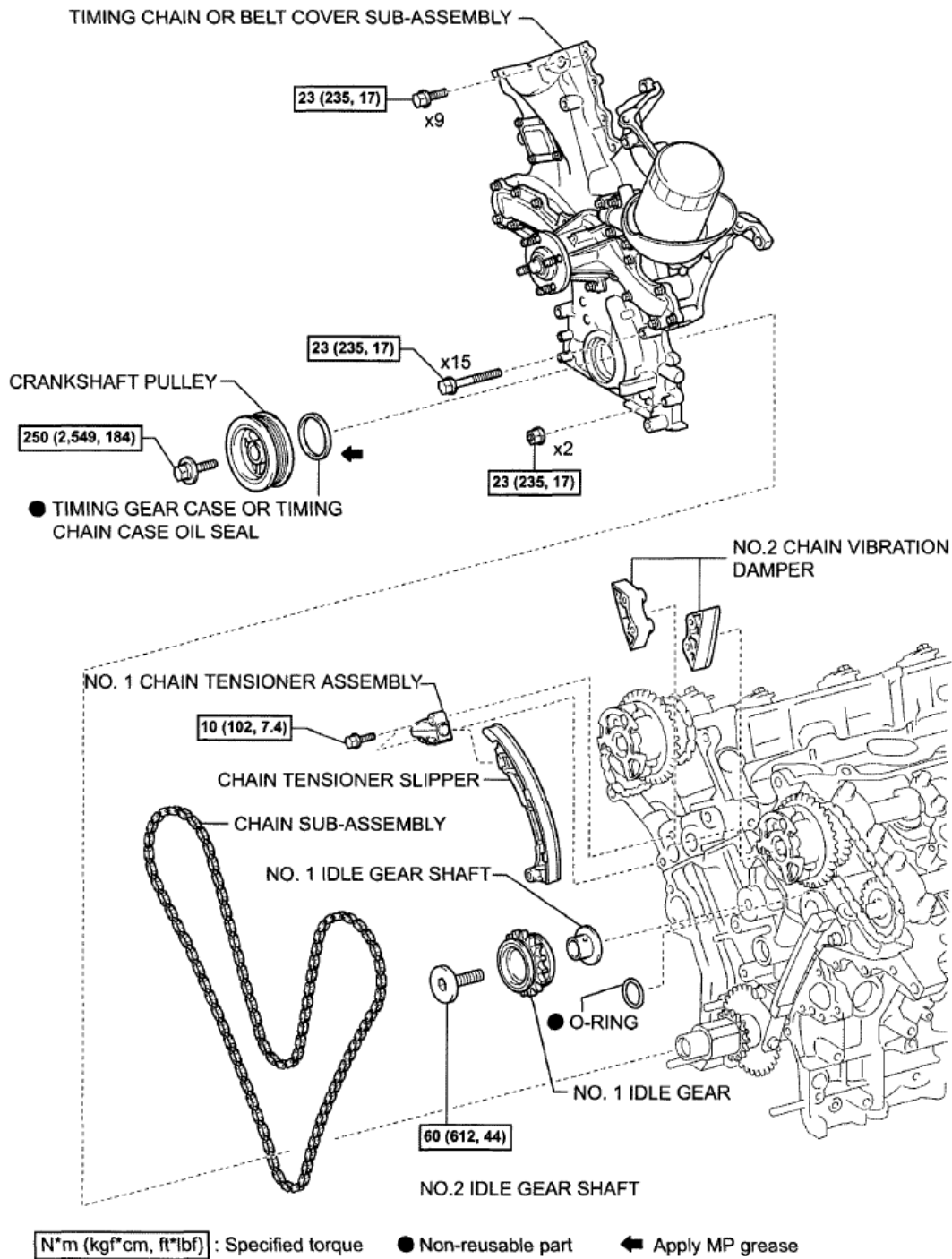


- Non-reusable part

Y

A113588E01

**Fig. 274: Exploded View Of Cylinder Head Components With Torque Specification (9 Of 12)**  
**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

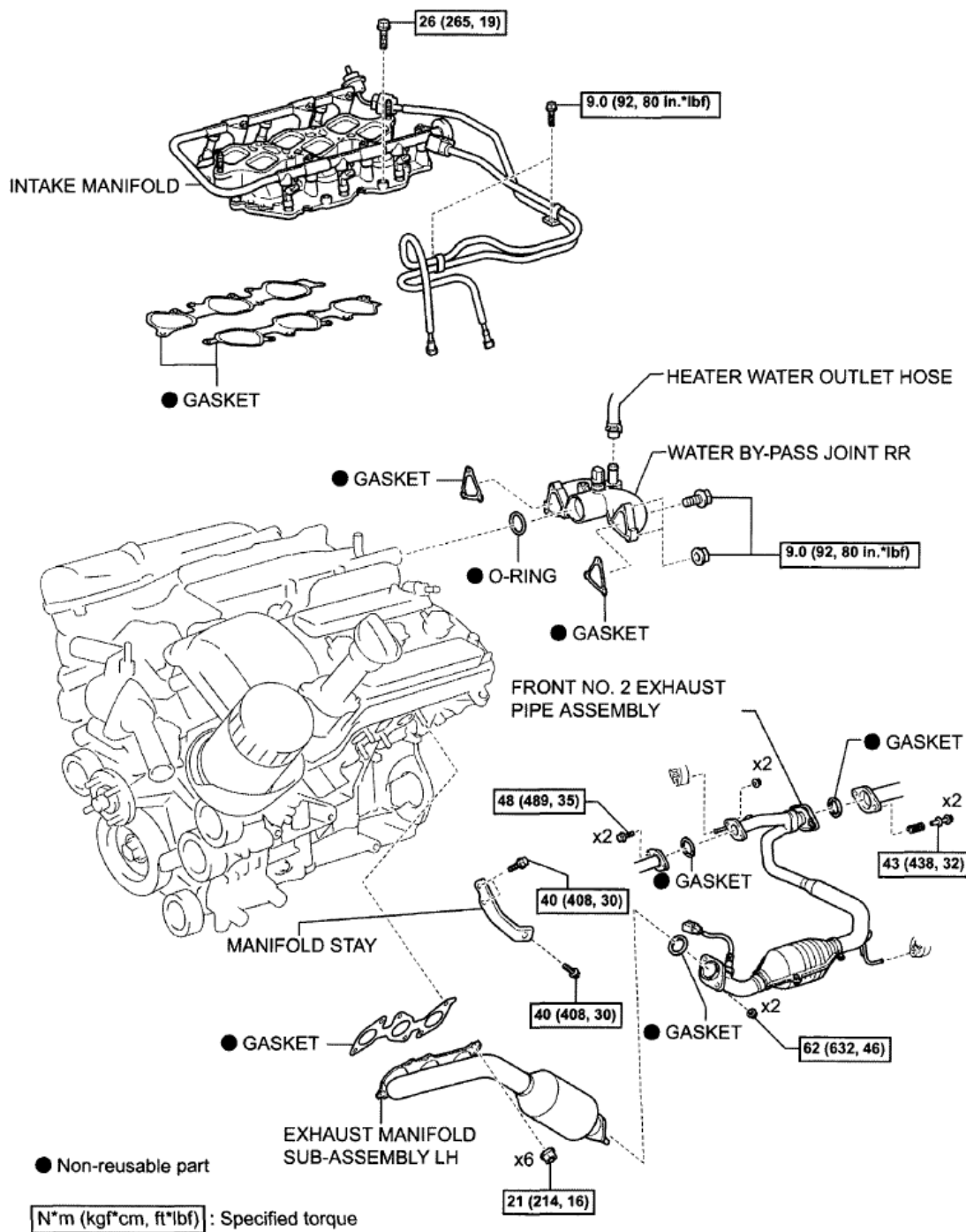


A113591E01

**Fig. 275: Exploded View Of Cylinder Head Components With Torque Specification (10 Of 12)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

| 2009 Toyota Tacoma                              |
|-------------------------------------------------|
| 2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma |

| 2009 Toyota Tacoma                              |
|-------------------------------------------------|
| 2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma |

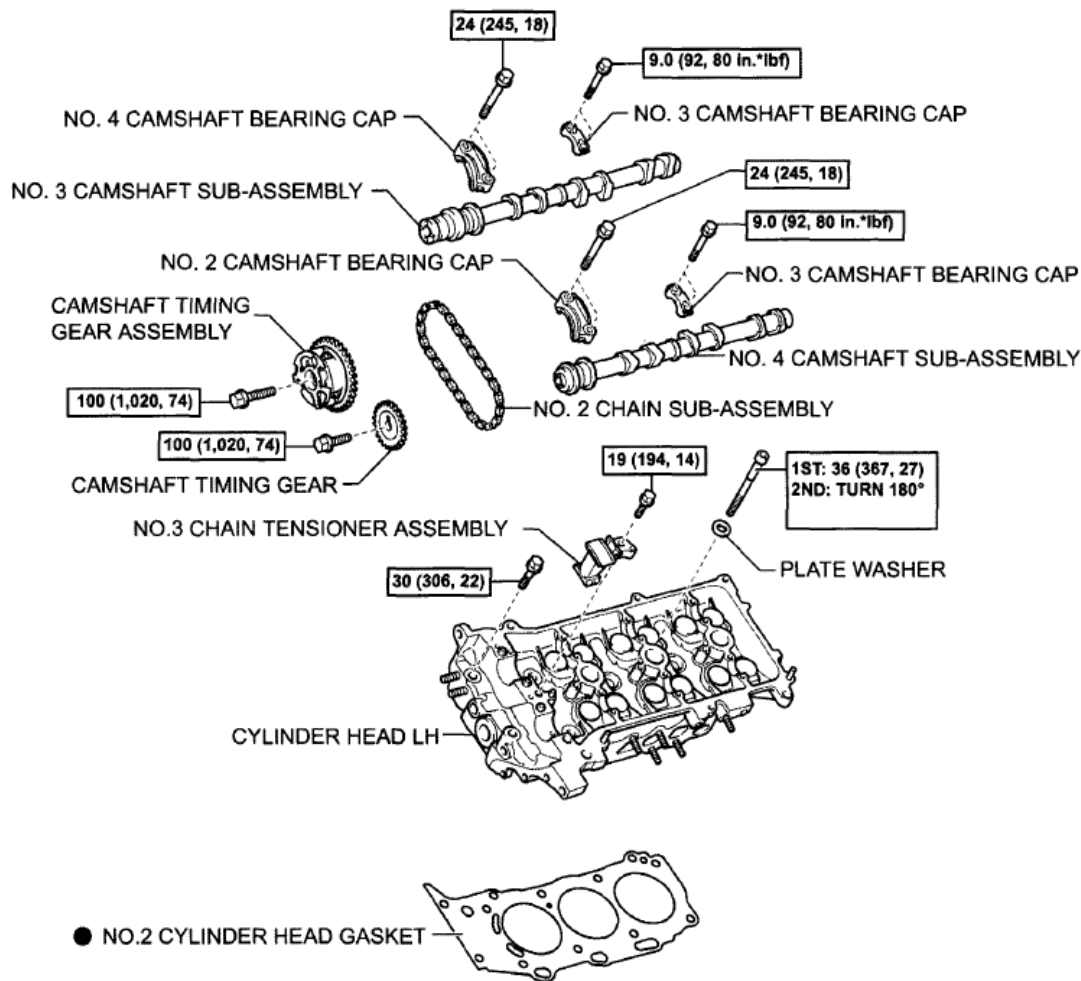


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**Fig. 276: Exploded View Of Cylinder Head Components With Torque Specification (11 Of 12)**  
**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

## 2009 Toyota Tacoma

2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma



● Non-reusable part

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

A113595E01

**Fig. 277: Exploded View Of Cylinder Head Components With Torque Specification (12 Of 12)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### REMOVAL

#### 1. DISCHARGE FUEL SYSTEM PRESSURE

(See **FUEL SYSTEM** )

2. **DRAIN ENGINE COOLANT** (See **COOLANT** )

3. **DRAIN ENGINE OIL** (See **OIL FILTER** )

4. **REMOVE ENGINE ASSEMBLY**

(See **REMOVAL** )

5. **REMOVE TIMING CHAIN OR BELT COVER SUB-ASSEMBLY**

(See **REMOVAL** )

6. **REMOVE CHAIN SUB-ASSEMBLY**

(See **REMOVAL** )

7. **REMOVE NO.1 COOL AIR INLET**

- a. Remove the 2 bolts, then remove the cool air inlet.

8. **REMOVE FRONT NO.2 EXHAUST PIPE ASSEMBLY**

(See **INSTALLATION** )

9. **REMOVE MANIFOLD STAY**

- a. Remove the 3 bolts, then remove the exhaust manifold stay.

10. **REMOVE EXHAUST MANIFOLD SUB-ASSEMBLY LH**

- a. Disconnect the air fuel ratio sensor connector.
- b. Remove the 6 nuts, then remove the exhaust manifold and gasket.

11. **REMOVE INTAKE MANIFOLD** (See **REMOVAL** )

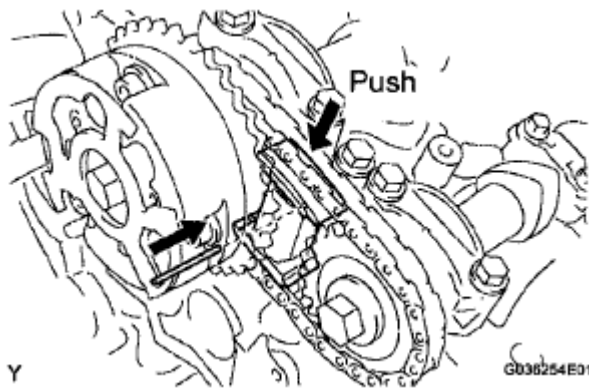
12. **REMOVE WATER BY-PASS JOINT RR** (See **REMOVAL** )

13. **REMOVE NO.1 CHAIN VIBRATION DAMPER**

- a. Remove the 2 bolts, then remove the chain vibration damper No. 1.

14. **REMOVE CAMSHAFT TIMING GEARS AND NO.2 CHAIN (for Bank 2)**

- a. While pushing down the chain tensioner No. 2, insert a pin of 10. mm (0.039 in.) into the hole to fix it.



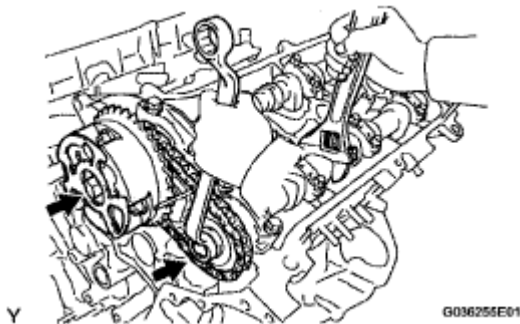
**Fig. 278: Removing Camshaft Timing Gears And No.2 Chain**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Hold the hexagonal portion of the camshaft with a wrench.

**NOTE:** Be careful not to damage the cylinder head and valve lifter with the wrench.

- c. Remove the 2 bolts, then remove the camshaft timing gear, camshaft timing gear assembly and timing chain No. 2.

**NOTE:** Do not disassemble the camshaft timing gear assembly.



**Fig. 279: Holding Camshaft Using Wrench**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

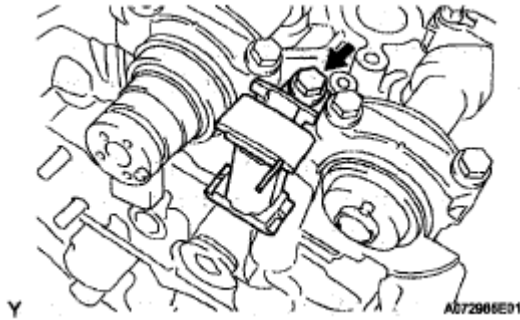
#### 15. REMOVE NO.2 CHAIN TENSIONER ASSEMBLY

- a. Remove the bolt, then remove the chain tensioner No. 3.

#### 16. REMOVE CAMSHAFTS

**NOTE:** Keep the camshaft level while it is being removed. The camshaft thrust clearance is very small and failing to keep it level could crack or damage the cylinder head journal surface, which receives the thrust. This could subsequently lead the camshaft to seize or break. Perform the following

steps to avoid such problems.

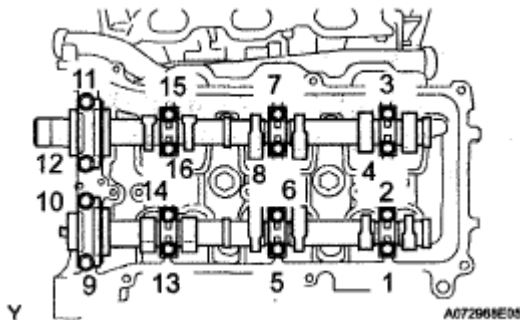


**Fig. 280: Locating Chain Tensioner No. 3 Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Using several steps, uniformly loosen and remove the 16 bearing cap bolts in the sequence shown in the illustration.
- b. Remove the 8 bearing caps and 2 camshafts.

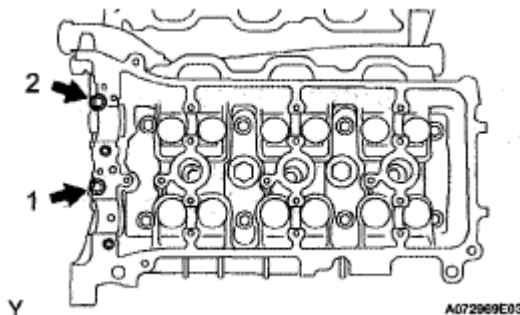
**17. REMOVE CYLINDER HEAD LH**

- a. Remove the bolt, then separate the ground cable.



**Fig. 281: Identifying Bearing Cap Bolts Loosen Sequence (Bank 2 2WD)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using several steps, remove the 2 cylinder head bolts on the cylinder head in the sequence shown in the illustration.



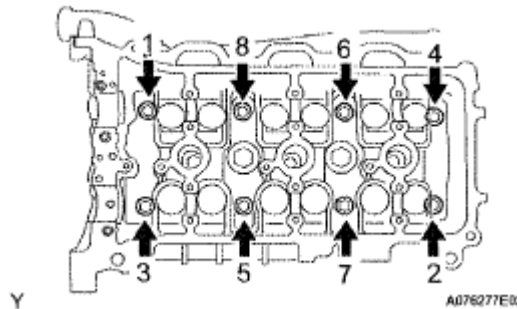
**Fig. 282: Locating Cylinder Head Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using several steps, uniformly loosen the 8 cylinder head bolts on the cylinder head with a 10 mm bi-hexagon wrench in the sequence shown in the illustration. Remove the 8 cylinder head bolts and 8 plate washers.

**NOTE:**

- Be careful not to drop the plate washers into the cylinder head.
- Cylinder head warpage or cracking could result from removing the bolts in the wrong order.



**Fig. 283: Locating Cylinder Head Bolt Tighten Sequence (Bank 2 2WD)**

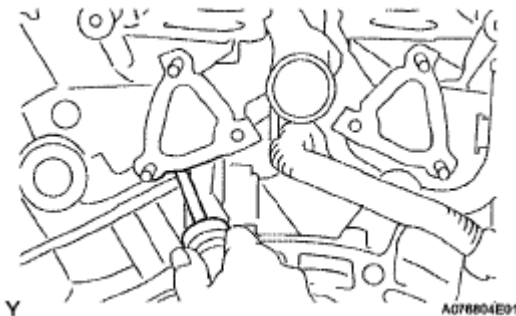
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Lift the cylinder head from the dowels on the cylinder block, and place the cylinder head on wooden blocks on a bench.

**NOTE:**

**Be careful not to drop the plate washers into the cylinder head.**

If the cylinder head is difficult to remove, pry between the cylinder head and cylinder block with a screwdriver.



**Fig. 284: Lifting Cylinder Head On Cylinder Block**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

**INSPECTION****1. INSPECT CYLINDER HEAD SET BOLT**

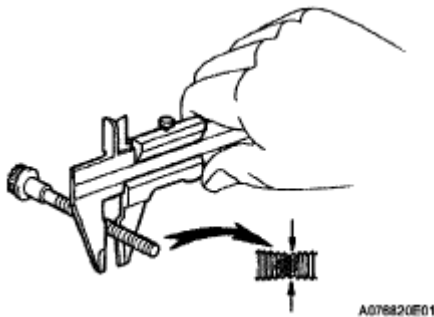
- a. Using vernier calipers, measure the outside diameter of the bolt thread.

**Standard outside diameter:**

**10.85 to 11.00 mm (0.4272 to 0.4331 in.)**

**Minimum outside diameter:**

**10.7 mm (0.421 in.)**



**Fig. 285: Inspecting Cylinder Head Set Bolt**  
**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

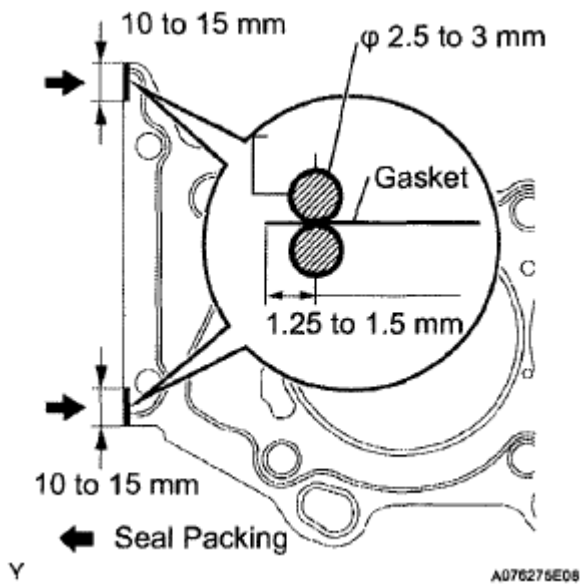
**INSTALLATION****1. INSTALL NO.2 CYLINDER HEAD GASKET**

- a. Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surface of the cylinder head and cylinder block.
- b. Apply a continuous bead of seal packing (diameter 2.5 to 3.0 mm (0.098 to 0.118 in.)) to a new cylinder head gasket as shown in the illustration.

**Seal packing:**

**Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent**

**NOTE:**      **Install the cylinder head within 3 minutes of applying the seal packing. Tighten the cylinder head bolts within 15 minutes of installing the cylinder head. Otherwise, the seal packing must be removed and reapplied.**



**Fig. 286: Identifying No.2 Cylinder Head Gasket Dimension**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

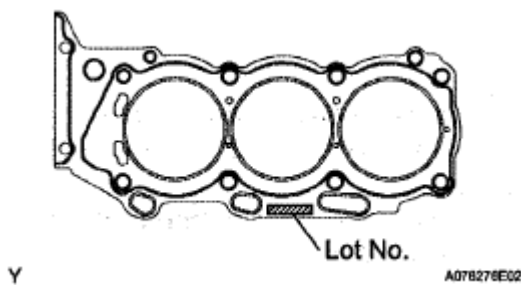
- c. Place the cylinder head gasket on the cylinder block surface with the Lot No. stamp upward.

**NOTE:**

- Be careful of the installation direction.
- Place the cylinder head carefully in order not to damage the gasket with the bottom part of the head.

**2. INSTALL CYLINDER HEAD LH**

- a. Place the cylinder head on the cylinder head gasket.
- b. Install the 8 cylinder head bolts.



**Fig. 287: Identifying Cylinder Head Gasket**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**HINT:**

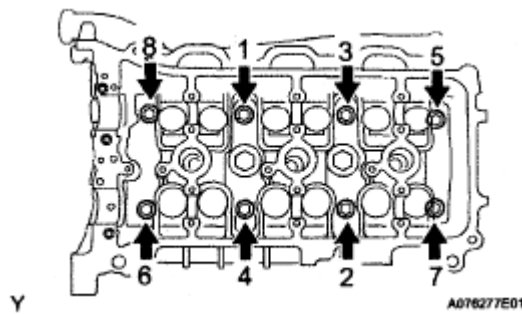
- The cylinder head bolts are tightened in 2 successive steps (steps (3) and (5)).
- If any cylinder head bolts are broken or deformed, replace them.

1. Apply a light coat of engine oil to the threads of the cylinder head bolts.
2. Install the plate washer onto the cylinder head bolt.
3. Using several steps, tighten each bolt uniformly with a 10 mm bi-hexagon wrench in the sequence shown in the illustration.

**Torque: 36 N\*m (367 kgf\*cm, 27 ft.\*lbf)**

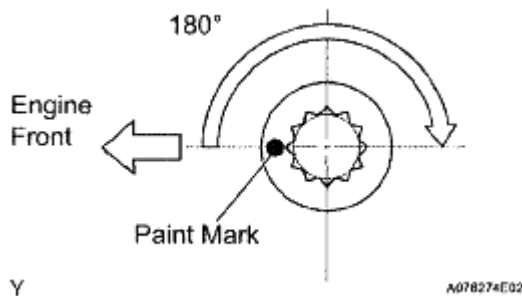
If any cylinder head bolts do not meet the torque specification, replace them.

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



**Fig. 288: Identifying Cylinder Head Bolt Tighten Sequence (Bank 2 2WD)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

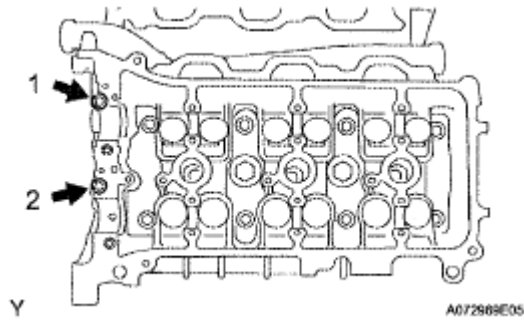
4. Mark the front side of each cylinder head bolt with paint.
5. Retighten the cylinder head bolts 180° as shown.
6. Check that the painted marks are now at 180° from the engine front.



**Fig. 289: Identifying Front Mark Of Cylinder Head Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the 2 cylinder head bolts.
  1. Apply a light coat of engine oil to the threads of the cylinder head bolts.
  2. Using several steps, uniformly install and tighten the 2 cylinder head bolts in the sequence shown in the illustration.

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



**Fig. 290: Locating Cylinder Head Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Install the ground cables with the 2 bolts.

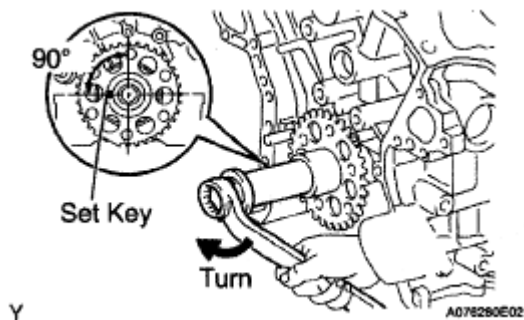
**Torque: 8.0 N\*m (82 kgf\*cm, 71 in.\*lbf)**

### 3. INSTALL CAMSHAFTS

**NOTE:** Keep the camshaft level while it is being removed. The camshaft thrust clearance is very small and failing to keep it level could crack or damage the cylinder head journal surface, which receives the thrust. This could subsequently lead the camshaft to seize or break. Perform the following steps to avoid such problems.

- a. Set the crankshaft position.
  1. Using the crankshaft pulley set bolt, turn the crankshaft, and set the crankshaft set key in the left horizontal position.

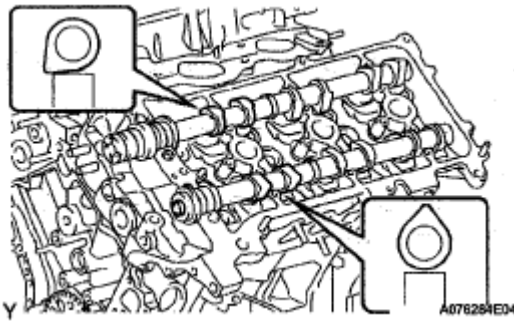
**NOTE:** Installing the crankshaft at the wrong angle could cause the piston head and valve head to come into contact with each other when installing the camshaft. This could cause damage, so always set the crankshaft at the correct angle.



**Fig. 291: Setting Crankshaft Position**

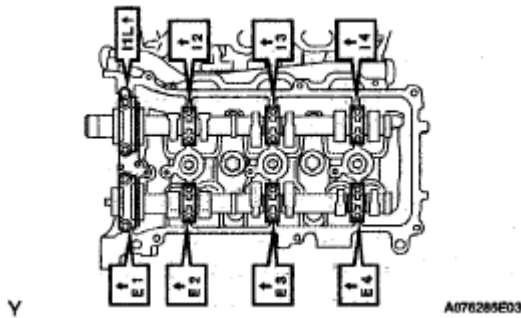
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Apply new engine oil to the thrust portion and journal of the camshafts.
- c. Place the 2 camshafts onto the cylinder head with the cam lobes of No. 1 cylinder facing in the directions as shown in the illustration.



**Fig. 292: Identifying Camshafts Onto Cylinder Head**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Install the 8 bearing caps in the proper locations as shown.
- e. Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.



**Fig. 293: Identifying Bearing Caps In Proper Locations**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

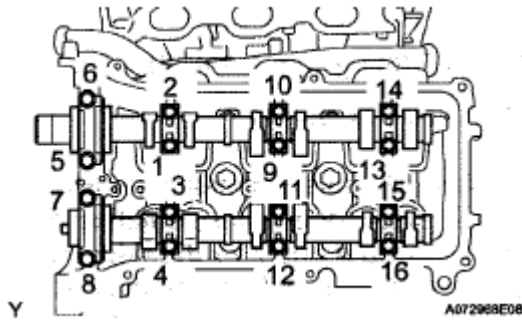
- f. Using several steps, uniformly install and tighten the 16 bearing cap bolts in the sequence shown in the illustration.

**Torque: 9.0 N\*m (92 kgf\*cm, 80 in.\*lbf) for 10**

**mm (0.39 in.) head**

**24 N\*m (245 kgf\*cm, 18 ft.\*lbf) for 12**

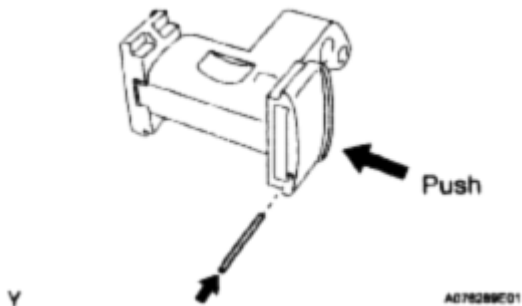
**mm (0.47 in.) head**



**Fig. 294: Identifying Bearing Cap Bolts Tighten Sequence (Bank 2 2WD)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### 4. INSTALL NO.2 CHAIN TENSIONER ASSEMBLY

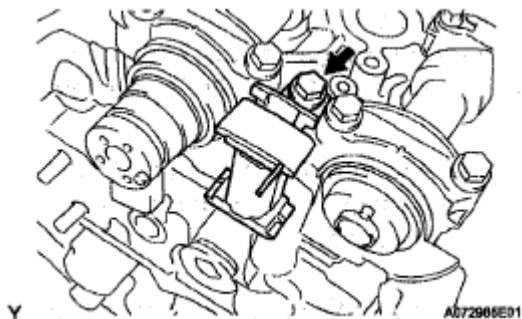
- a. While pushing in the tensioner, insert a pin of 1.0 mm (0.039 in.) into the hole to fix it.



**Fig. 295: Pushing No.3 Chain Tensioner Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the chain tensioner No. 2 with the bolt.

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

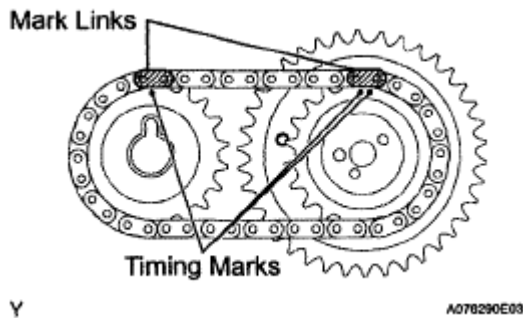


**Fig. 296: Locating Chain Tensioner No. 3 Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### 5. INSTALL CAMSHAFT TIMING GEARS AND NO.2 CHAIN (for Bank 2)

- a. Align the yellow mark links with the timing marks (1 dot mark and 2 dot marks) of camshaft timing

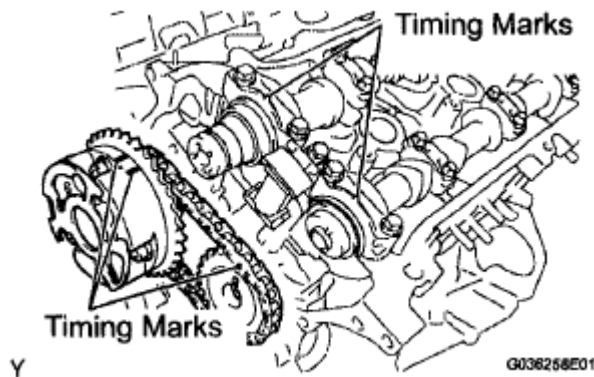
gears as shown in the illustration.



**Fig. 297: Identifying Timing Marks Of Camshaft Timing Gears**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Align the timing marks on the camshaft timing gears with the timing marks on the bearing caps, and install the camshaft timing gears with the chain onto the LH camshafts.
- c. Temporarily install the 2 camshaft timing gear bolts.

**NOTE:** Do not push camshaft timing gear assembly onto the camshaft forcibly when installing it.

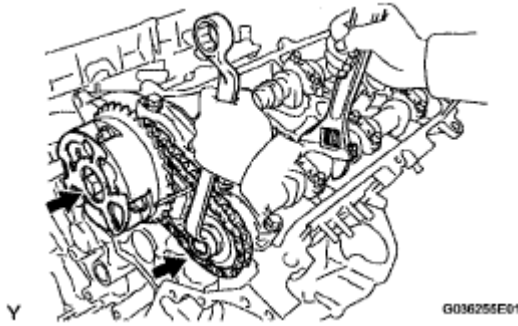


**Fig. 298: Identifying Timing Marks On Camshaft Timing Gears**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Hold the hexagonal portion of the camshaft with a wrench, and tighten the 2 bolts.

**Torque: 100 N\*m (1,020 kgf\*cm, 74 ft.\*lbf)**

- e. Remove the pin from the tensioner No. 2.



**Fig. 299: Holding Camshaft Using Wrench**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

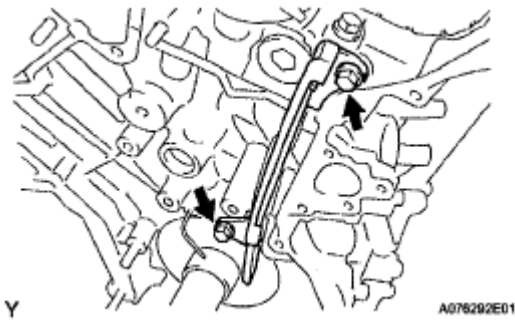
**6. INSTALL NO.1 CHAIN VIBRATION DAMPER**

- a. Install the chain vibration damper with the 2 bolts.

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

**7. INSTALL WATER BY-PASS JOINT RR (See INSTALLATION )**

**8. INSTALL INTAKE MANIFOLD (See INSTALLATION )**



**Fig. 300: Tightening Camshaft Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**9. INSTALL EXHAUST MANIFOLD SUB-ASSEMBLY LH**

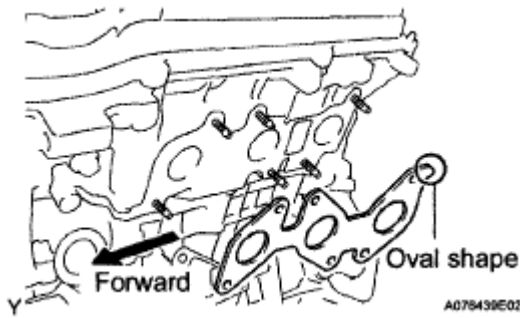
- a. Set a new gasket to the LH cylinder head with the oval shape facing forward.

**NOTE: Be careful of the installation direction.**

- b. Install the exhaust manifold with the 6 nuts. Tighten the nuts uniformly in several steps.

**Torque: 21 N\*m (214 kgf\*cm, 16 ft.\*lbf)**

- c. Connect the air fuel ratio sensor connector.



**Fig. 301: Installing Exhaust Manifold Sub-Assembly LH**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**10. INSTALL MANIFOLD STAY**

- a. Install the manifold stay with the 3 bolts.

**Torque: 40 N\*m (408 kgf\*cm, 30 ft.\*lbf)**

**11. INSTALL NO.2 EXHAUST FRONT PIPE ASSEMBLY**

(See **INSTALLATION** )

**12. INSTALL NO.1 COOL AIR INLET**

- a. Install the cool air inlet with the 2 bolts.

**Torque: 12 N\*m (122 kgf\*cm, 9.0 ft.\*lbf)**

**13. INSTALL CHAIN TENSIONER SLIPPER**

**14. INSTALL NO.1 CHAIN TENSIONER ASSEMBLY (See **INSTALLATION** )**

**15. INSTALL CHAIN SUB-ASSEMBLY**

(See **INSTALLATION** )

**16. INSTALL TIMING CHAIN OR BELT COVER SUB-ASSEMBLY**

(See **REASSEMBLY** )

**17. INSTALL ENGINE ASSEMBLY**

(See **INSTALLATION** )

**18. INSTALL BATTERY**

**19. ADD ENGINE COOLANT (See **COOLANT** )**

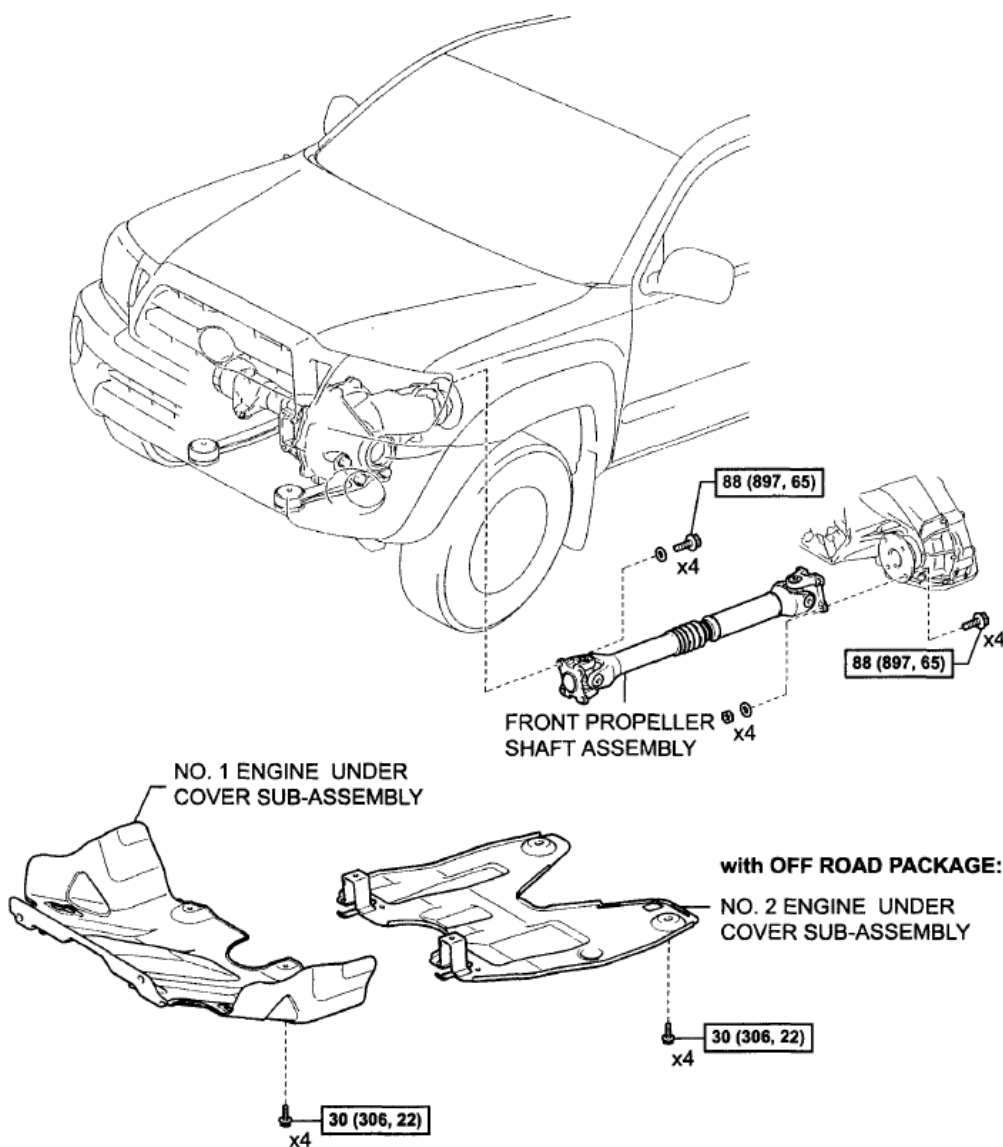
**20. ADD ENGINE OIL (See **INSTALLATION** )**

**21. CHECK FOR ENGINE COOLANT LEAKAGE (See **REPLACEMENT** )**

- 22. **CHECK FOR ENGINE OIL LEAKAGE**
- 23. **CHECK FOR FUEL LEAKAGE**
- 24. **CHECK FOR EXHAUST GAS LEAKAGE**
- 25. **INSPECT IGNITION TIMING (See ON-VEHICLE INSPECTION )**
- 26. **INSPECT ENGINE IDLING SPEED (See ON-VEHICLE INSPECTION )**
- 27. **INSPECT CO/HC (See ON-VEHICLE INSPECTION )**
- 28. **INSPECT COMPRESSION (See ON-VEHICLE INSPECTION )**

## **CYLINDER HEAD (FOR BANK 2 4WD AND PRE-RUNNER)**

### **COMPONENTS**



**N\*m (kgf\*cm, ft\*lb)** : Specified torque

P

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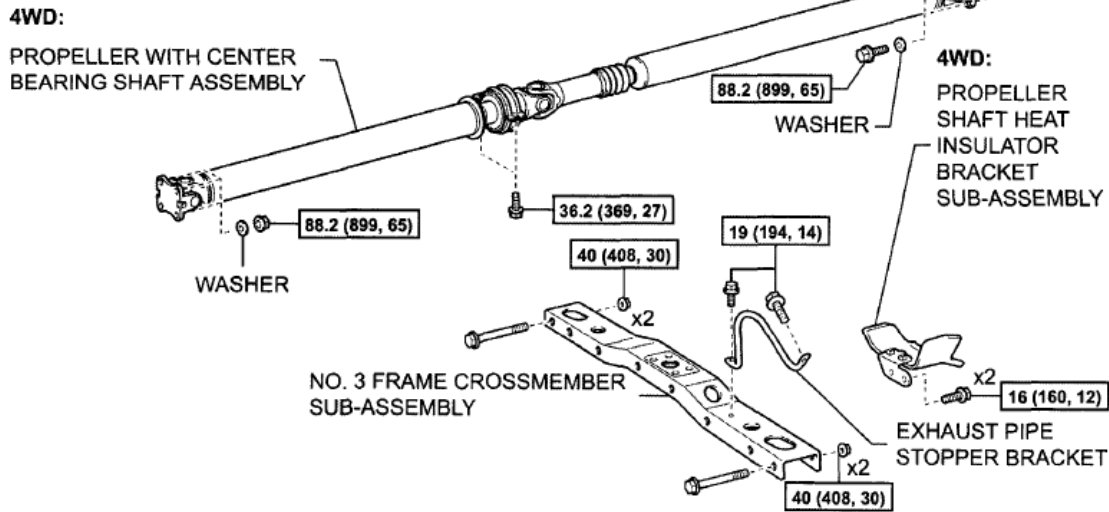
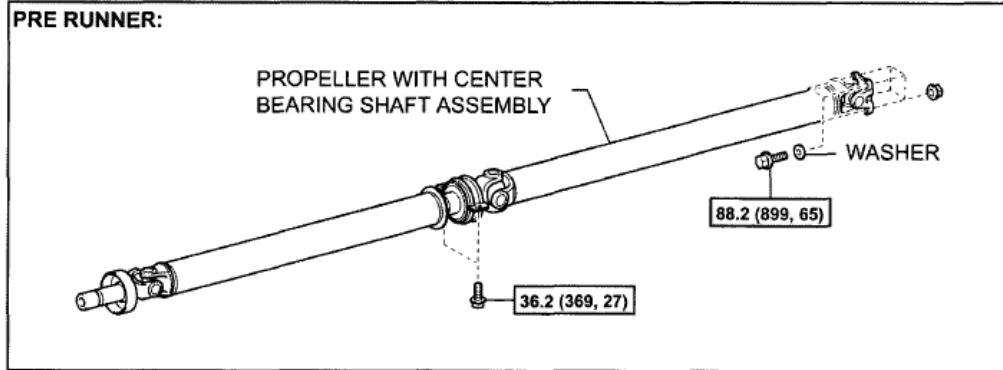
**Fig. 302: Exploded View Of Cylinder Head Components With Torque Specification (1 Of 14)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 2009 Toyota Tacoma

## 2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma



**Fig. 303: Exploded View Of Cylinder Head Components With Torque Specification (2 Of 14)**  
**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**



N\*m (kgf\*cm, ft\*lb) : Specified torque

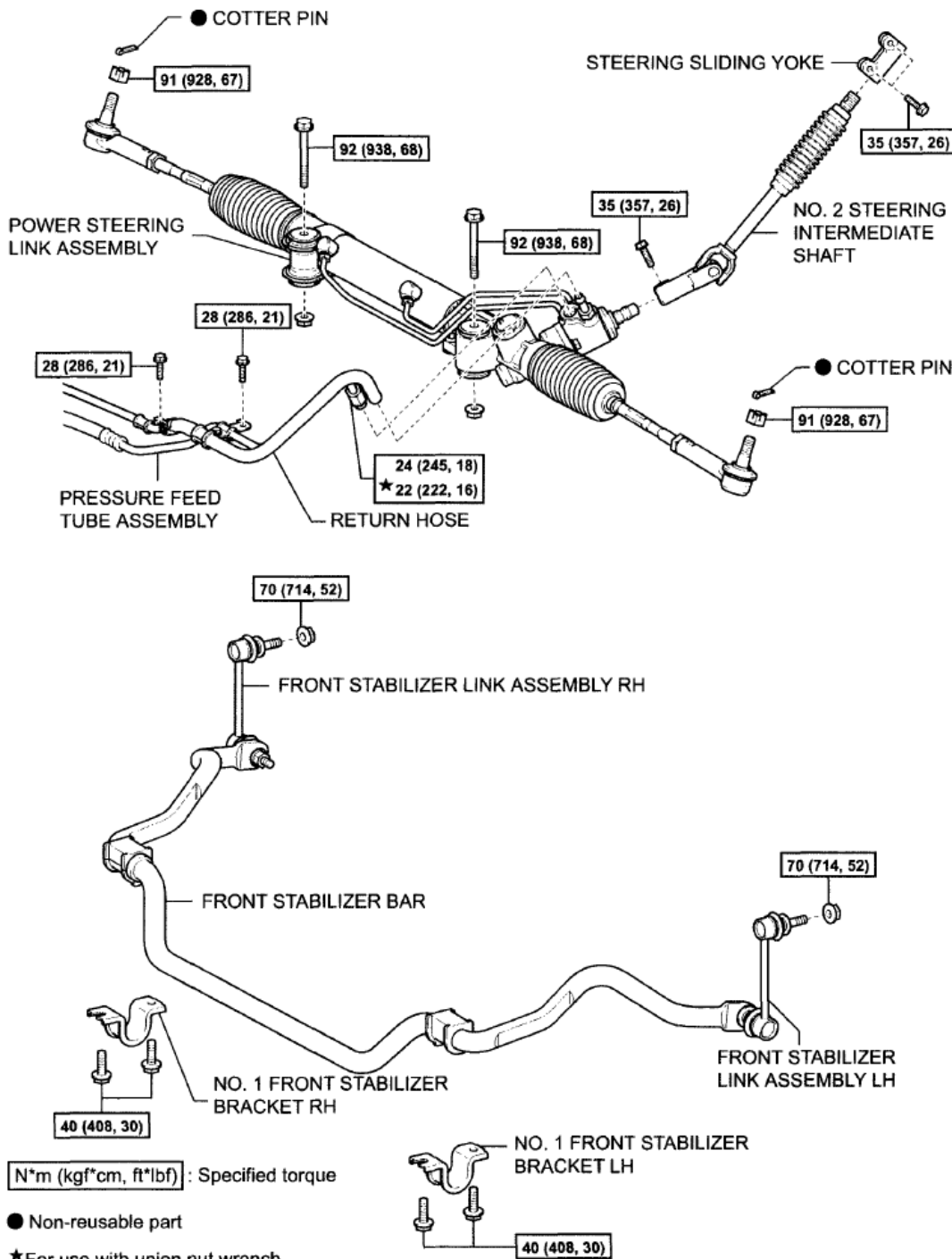
Y

A113600E01

**Fig. 304: Exploded View Of Cylinder Head Components With Torque Specification (3 Of 14)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

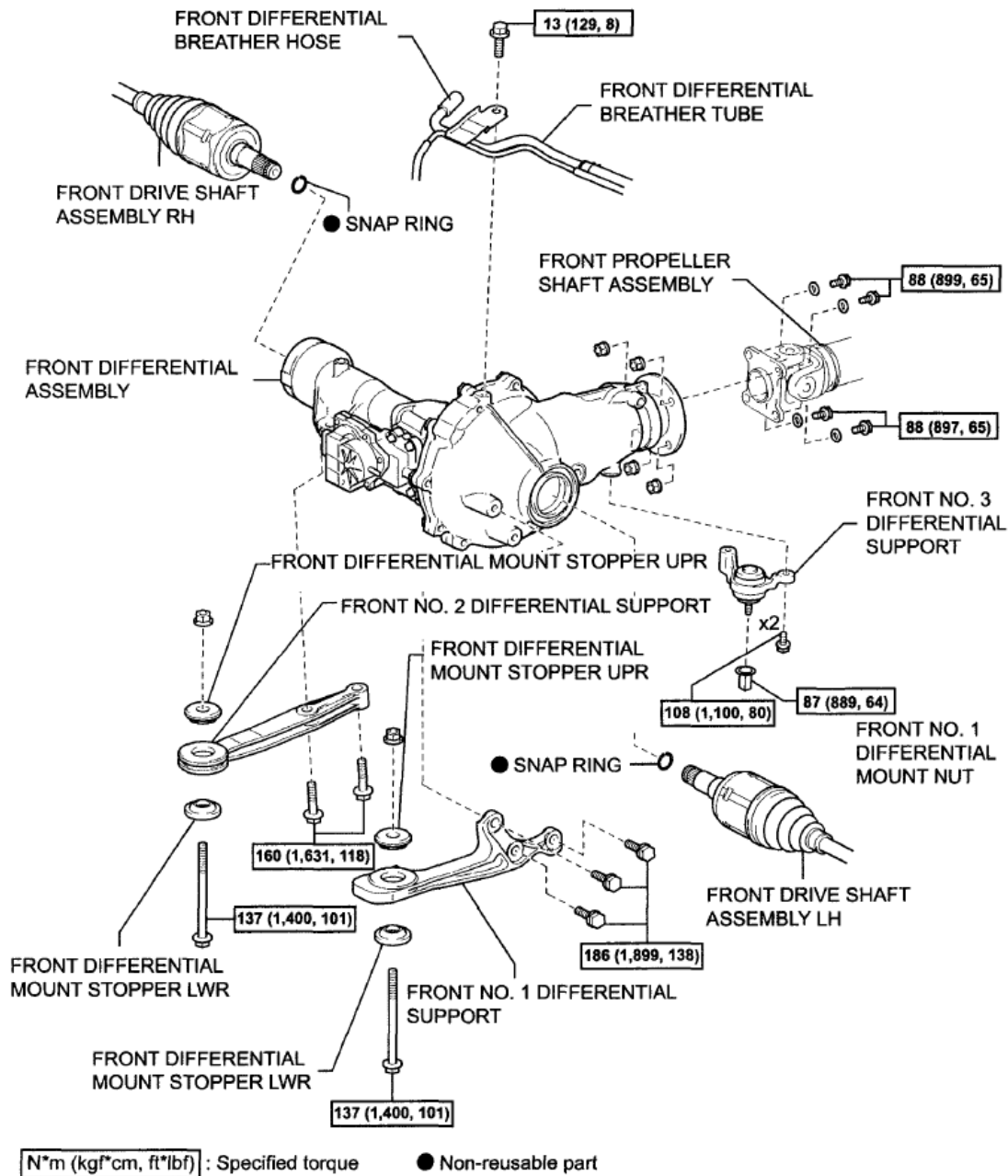
## 2009 Toyota Tacoma

2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma



A113601E02

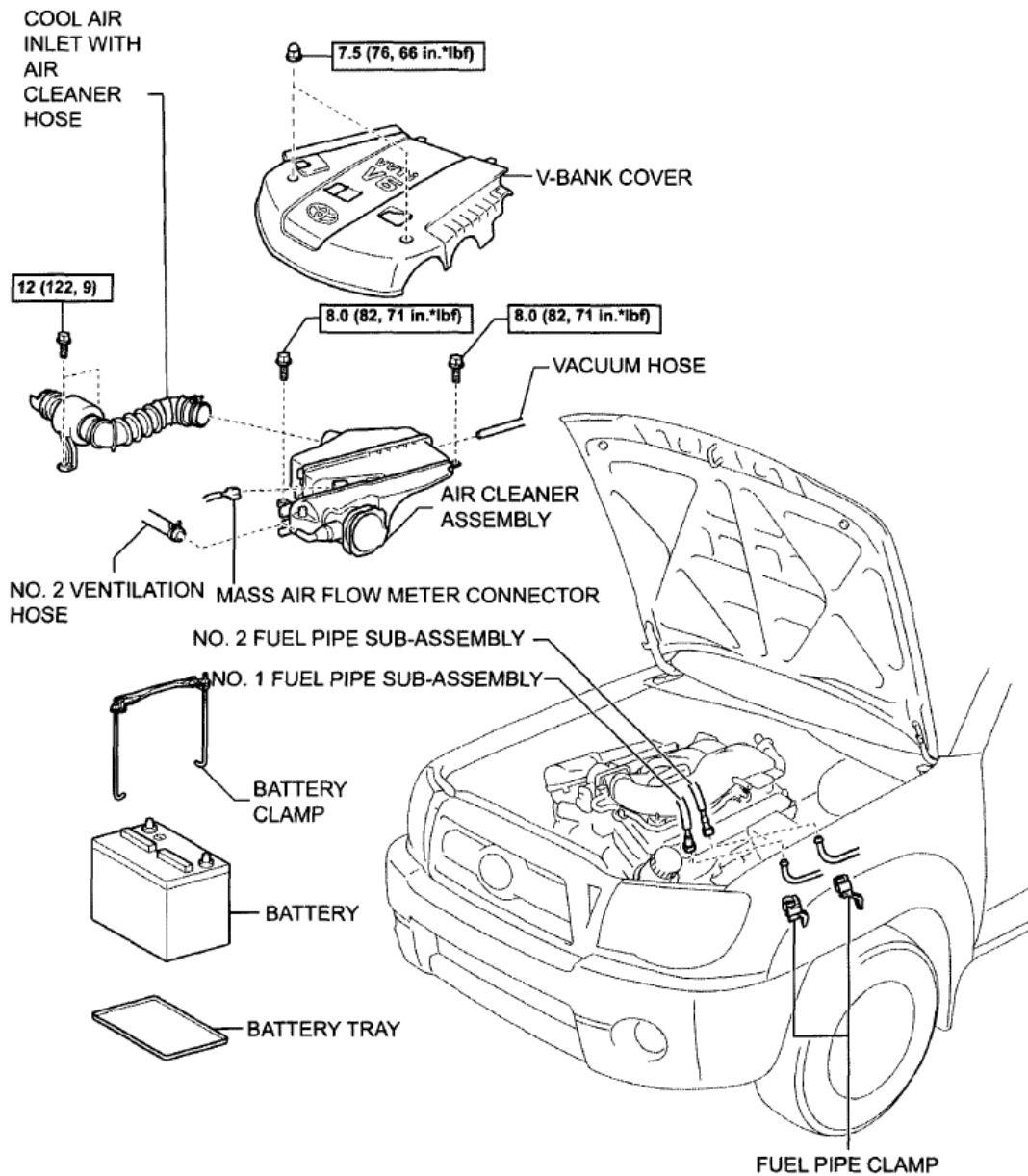
**Fig. 305: Exploded View Of Cylinder Head Components With Torque Specification (4 Of 14)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



P

A113508E01

**Fig. 306: Exploded View Of Cylinder Head Components With Torque Specification (5 Of 14)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

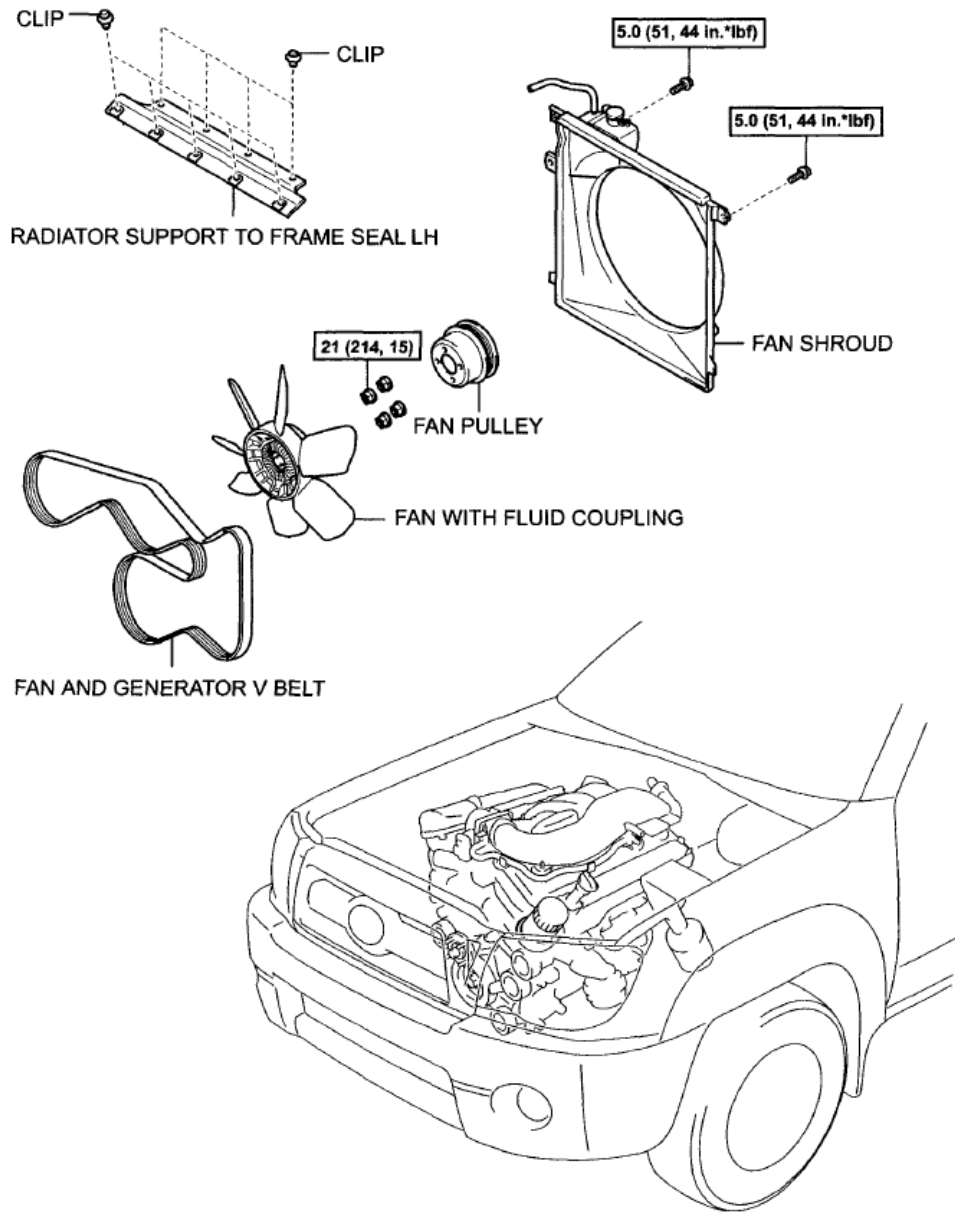


N\*m (kgf\*cm, ft\*lbf) : Specified torque

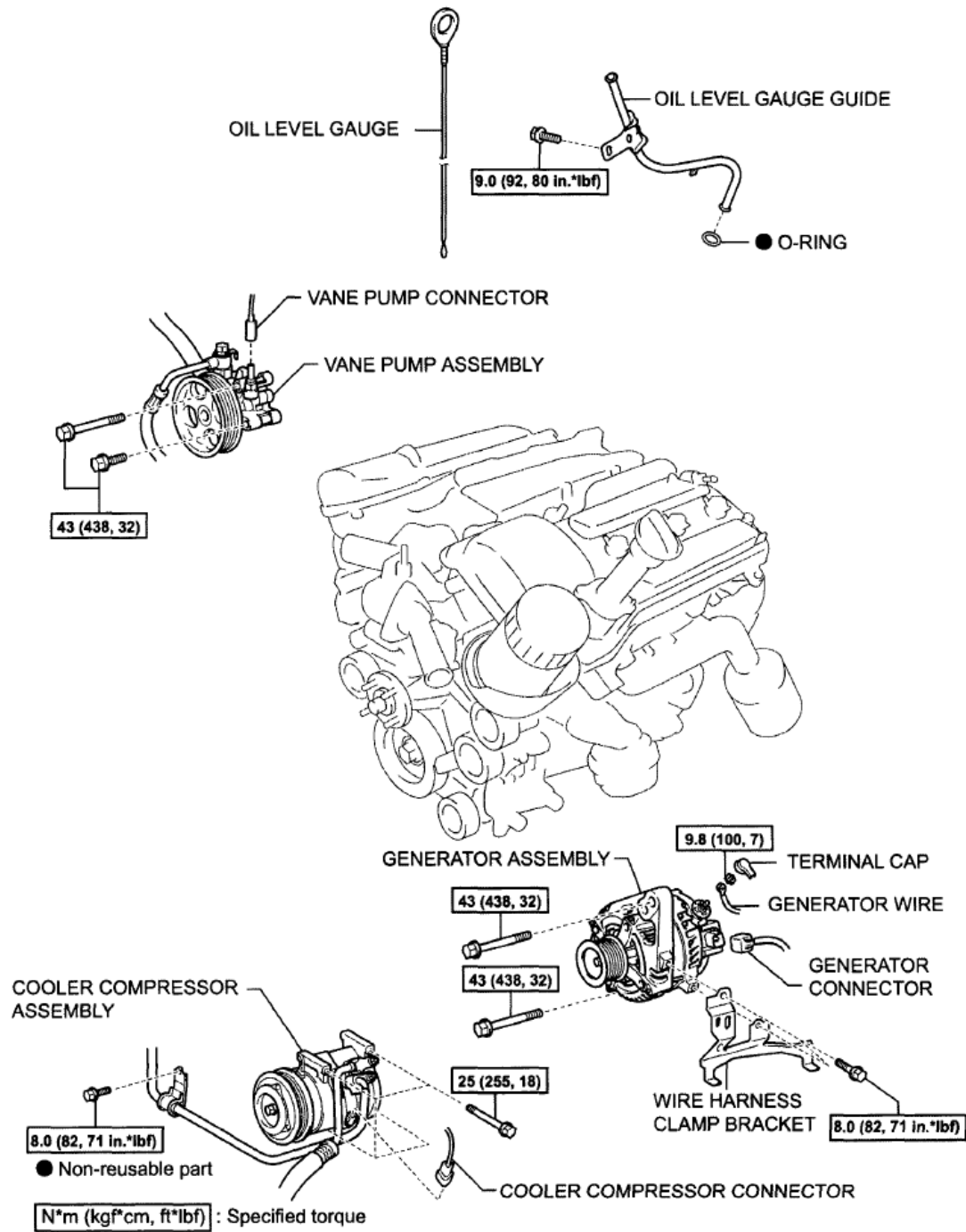
Y

A113589E01

**Fig. 307: Exploded View Of Cylinder Head Components With Torque Specification (6 Of 14)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

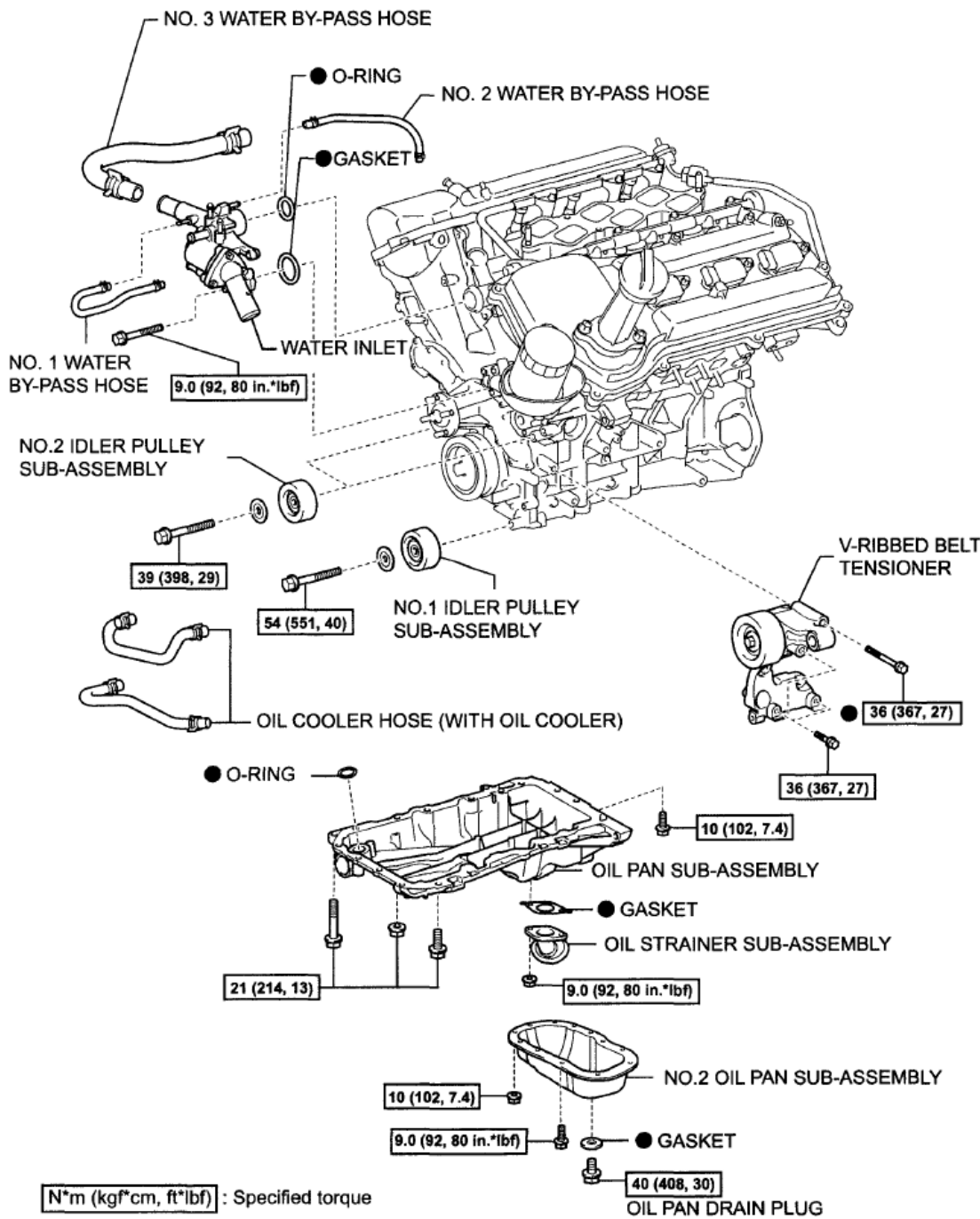


**Fig. 308: Exploded View Of Cylinder Head Components With Torque Specification (7 Of 14)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



A113548E02

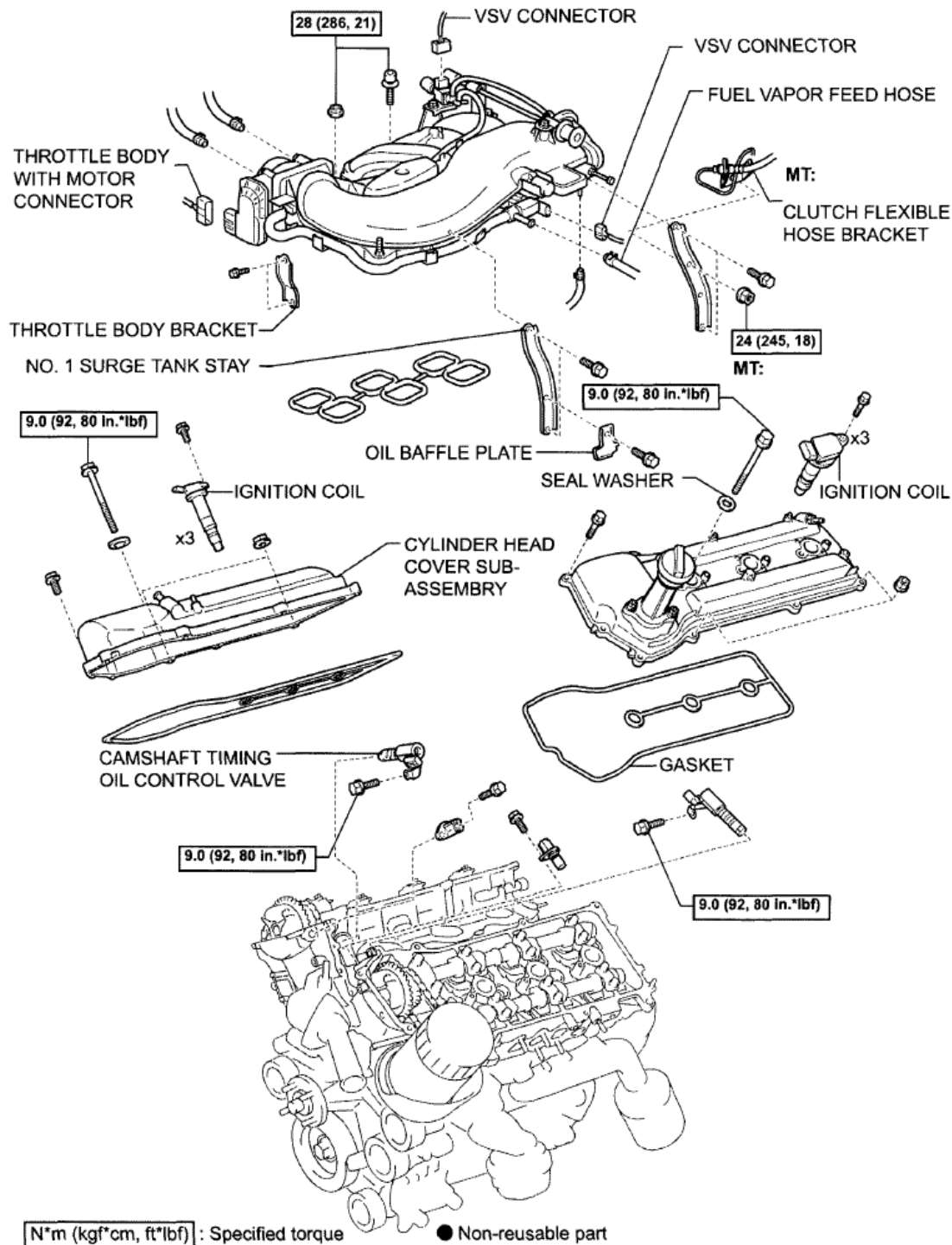
**Fig. 309: Exploded View Of Cylinder Head Components With Torque Specification (8 Of 14)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



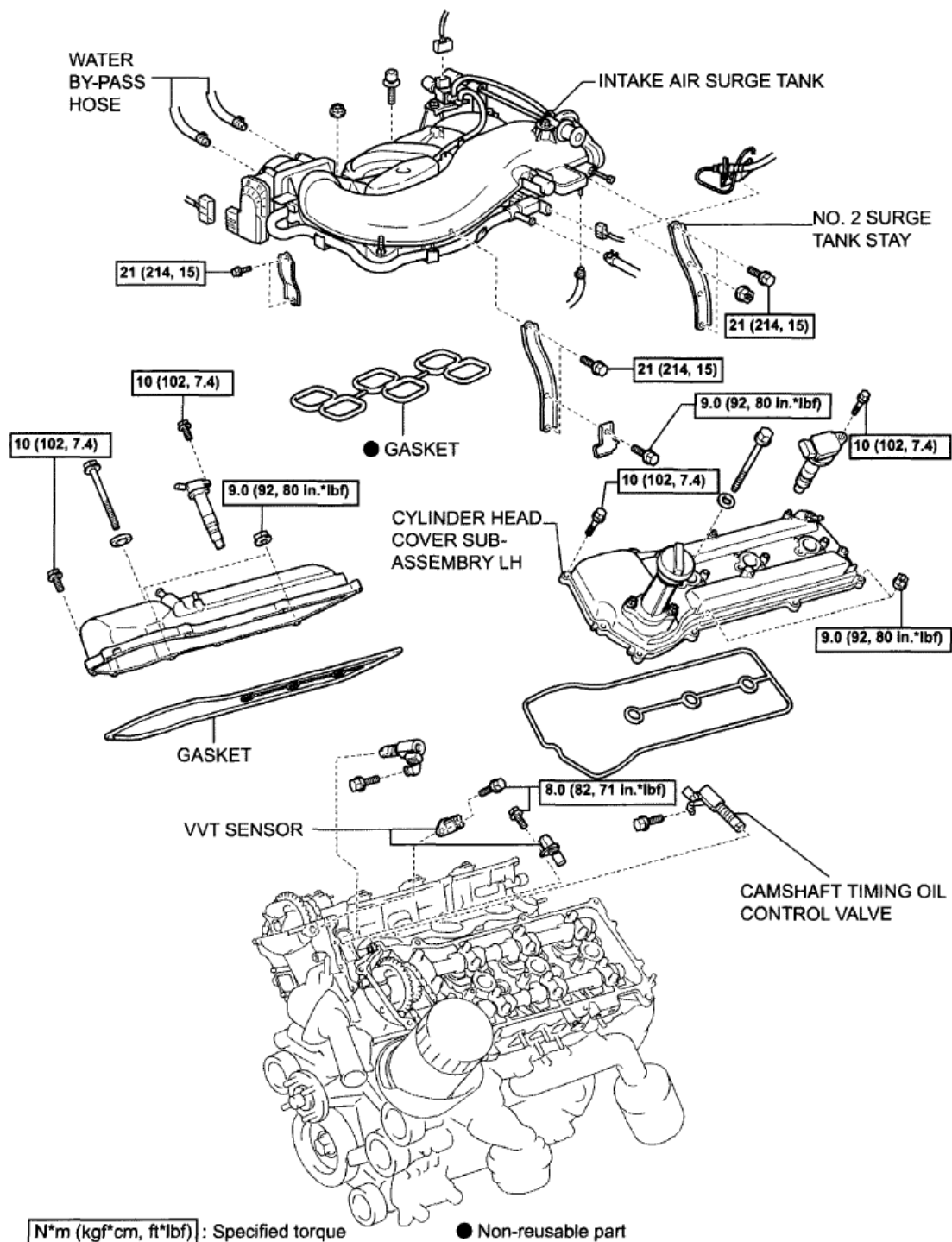
Y

A113549E01

**Fig. 310: Exploded View Of Cylinder Head Components With Torque Specification (9 Of 14)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

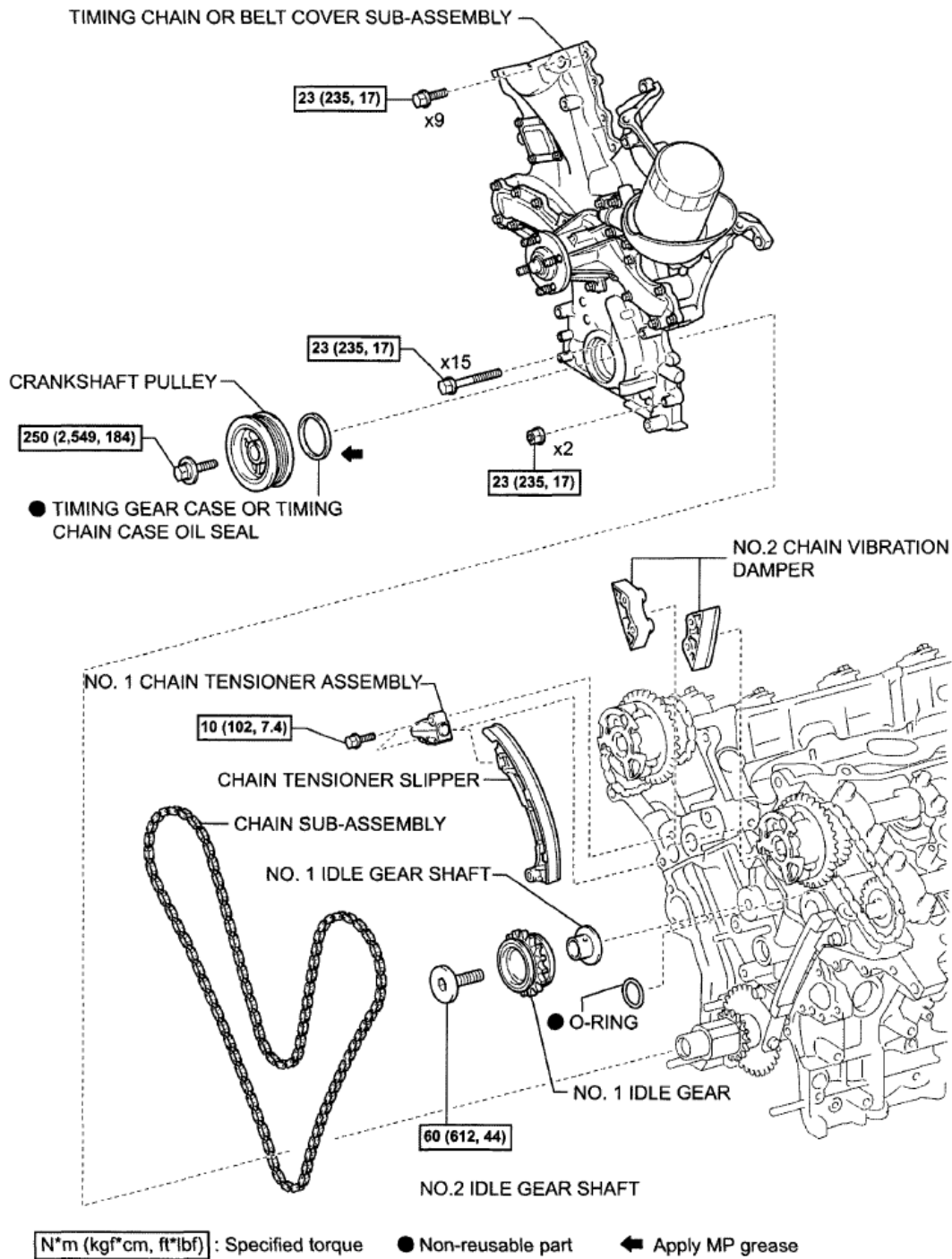


**Fig. 311: Exploded View Of Cylinder Head Components With Torque Specification (10 Of 14)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

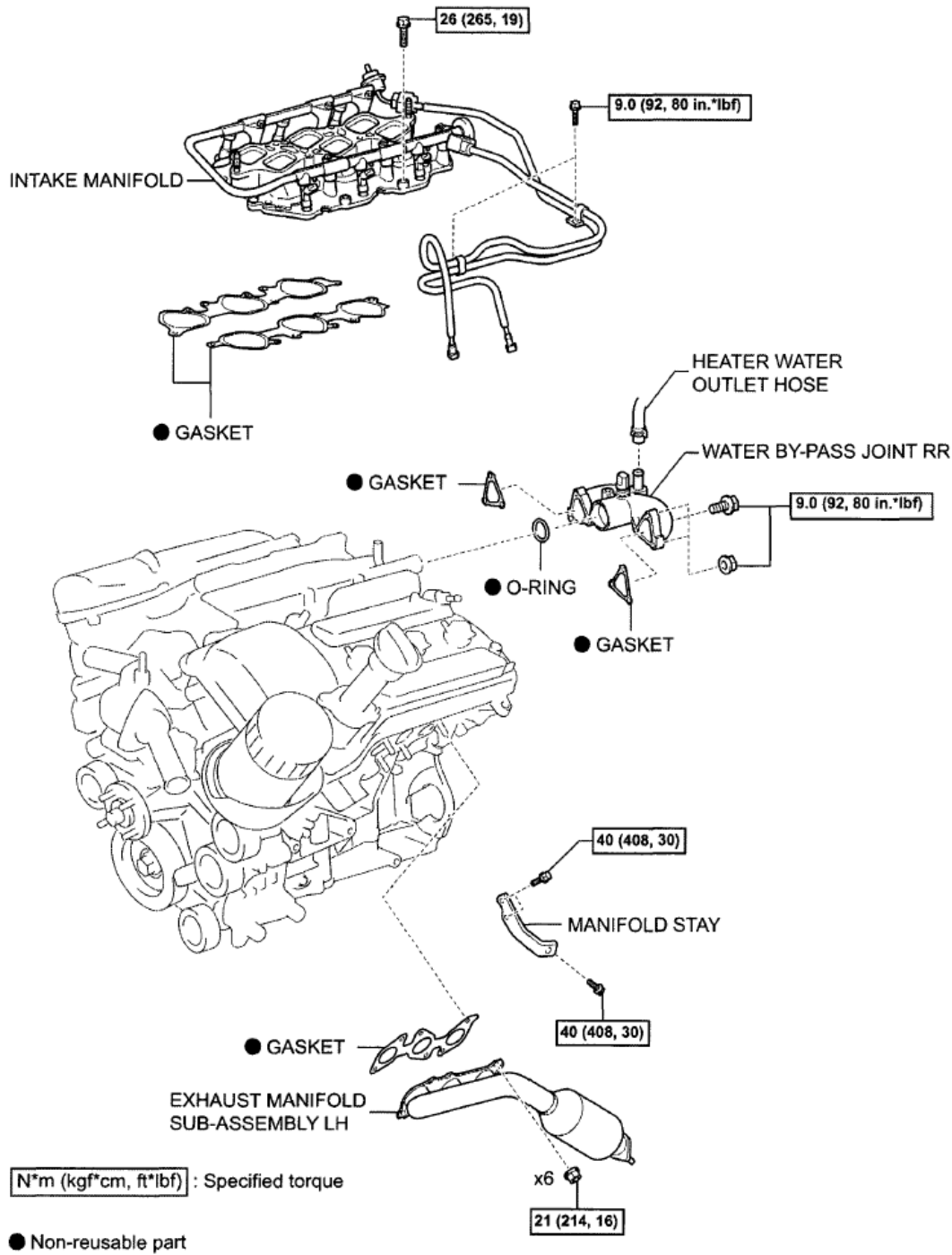


A113570E02

**Fig. 312: Exploded View Of Cylinder Head Components With Torque Specification (11 Of 14)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 313: Exploded View Of Cylinder Head Components With Torque Specification (12 Of 14)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

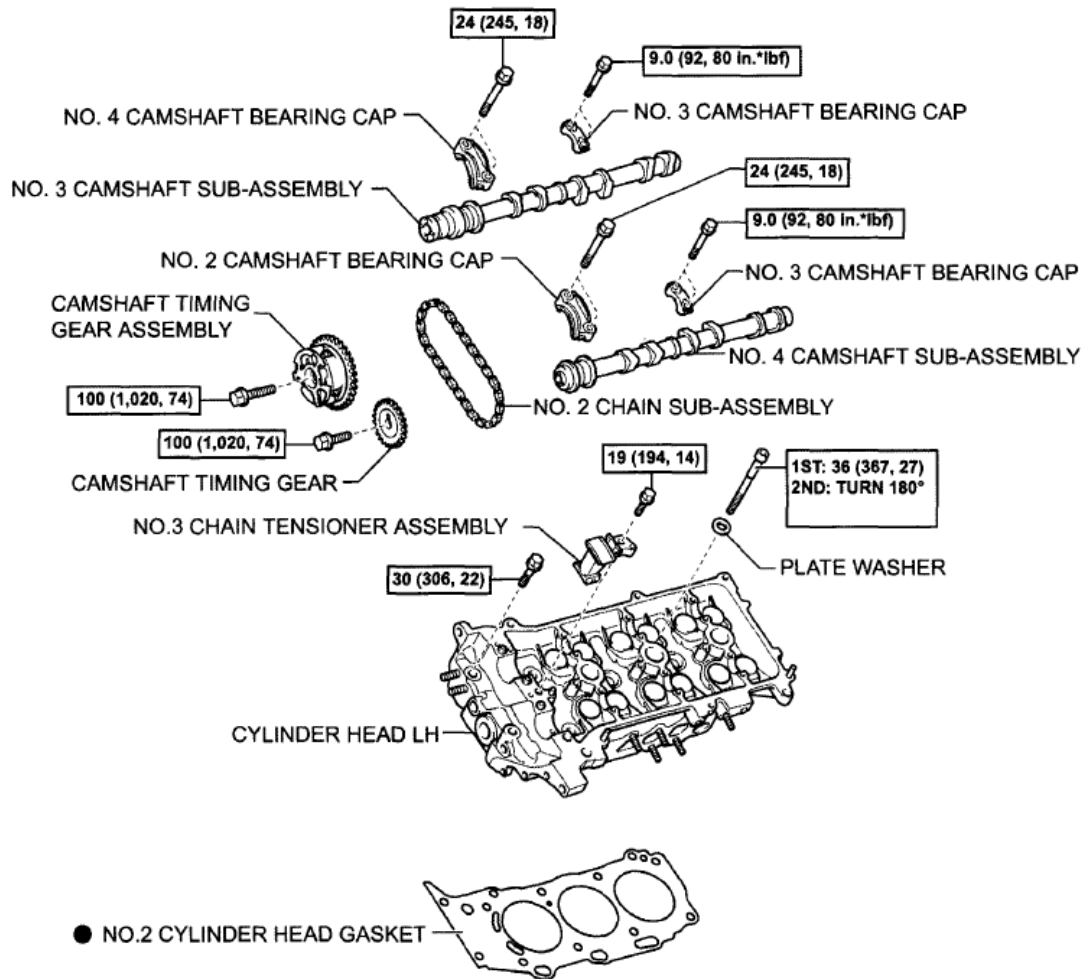


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**Fig. 314: Exploded View Of Cylinder Head Components With Torque Specification (13 Of 14)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 2009 Toyota Tacoma

2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma



● Non-reusable part

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

A113595E01

**Fig. 315: Exploded View Of Cylinder Head Components With Torque Specification (14 Of 14)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### REMOVAL

#### 1. DISCHARGE FUEL SYSTEM PRESSURE

(See **FUEL SYSTEM** )

2. **REMOVE BATTERY**
3. **DRAIN ENGINE COOLANT** (See **COOLANT** )
4. **DRAIN ENGINE OIL** (See **OIL FILTER** )
5. **REMOVE POWER STEERING LINK ASSEMBLY**

(See **REMOVAL** )

6. **REMOVE FRONT DIFFERENTIAL CARRIER ASSEMBLY (for 4WD)**

(See **DISASSEMBLY** )

7. **REMOVE TIMING CHAIN OR BELT COVER SUB-ASSEMBLY**

(See **REMOVAL** )

8. **REMOVE CHAIN SUB-ASSEMBLY**

(See **REMOVAL** )

9. **REMOVE NO.1 COOL AIR INLET**

- a. Remove the 2 bolts, then remove the cool air inlet.

10. **REMOVE FRONT NO.2 EXHAUST PIPE ASSEMBLY**

(See **INSTALLATION** )

11. **REMOVE MANIFOLD STAY**

- a. Remove the 3 bolts, then remove the exhaust manifold stay.

12. **REMOVE EXHAUST MANIFOLD SUB-ASSEMBLY LH**

- a. Disconnect the air fuel ratio sensor connector.
- b. Remove the 6 nuts, then remove the exhaust manifold and gasket.

13. **DISCONNECT NO.1 FUEL PIPE SUB-ASSEMBLY** (See **REMOVAL** )

14. **DISCONNECT NO.2 FUEL PIPE SUB-ASSEMBLY** (See **REMOVAL** )

15. **REMOVE INTAKE MANIFOLD** (See **REMOVAL** )

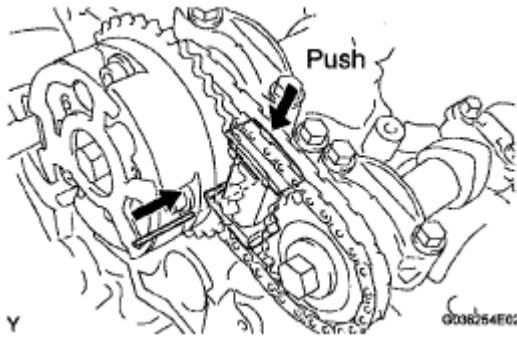
16. **REMOVE WATER BY-PASS JOINT RR** (See **REMOVAL** )

17. **REMOVE NO.1 CHAIN VIBRATION DAMPER**

- a. Remove the 2 bolts, then remove the chain vibration damper No. 1.

18. **REMOVE CAMSHAFT TIMING GEARS AND NO.2 CHAIN (for Bank 2)**

- a. While pushing down the chain tensioner No. 2, insert a pin of 10 mm (0.039 in.) into the hole to fix it.



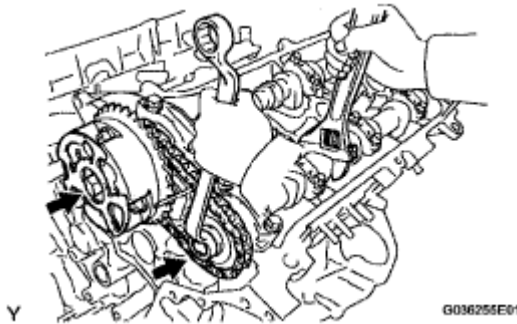
**Fig. 316: Removing Camshaft Timing Gears And N0.2 Chain**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Hold the hexagonal portion of the camshaft with a wrench.

**NOTE:** Be careful not to damage the cylinder head and valve lifter with the wrench.

- c. Remove the 2 bolts, then remove the camshaft timing gear, camshaft timing gear assembly and timing chain No. 2.

**NOTE:** Do not disassemble the camshaft timing gear assembly.



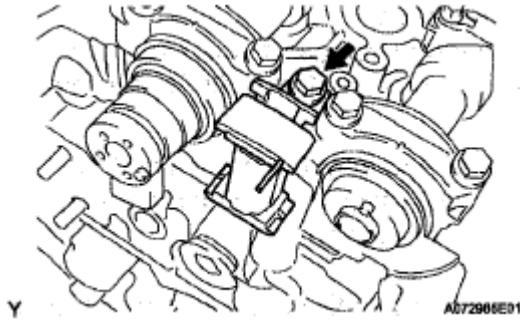
**Fig. 317: Holding Camshaft Using Wrench**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### 19. REMOVE NO.2 CHAIN TENSIONER ASSEMBLY

- a. Remove the bolt, then remove the chain tensioner No. 3.

#### 20. REMOVE CAMSHAFTS

**NOTE:** Keep the camshaft level while it is being removed. The camshaft thrust clearance is very small and failing to keep it level could crack or damage the cylinder head journal surface, which receives the thrust. This could subsequently lead the camshaft to seize or break. Perform the following steps to avoid such problems.

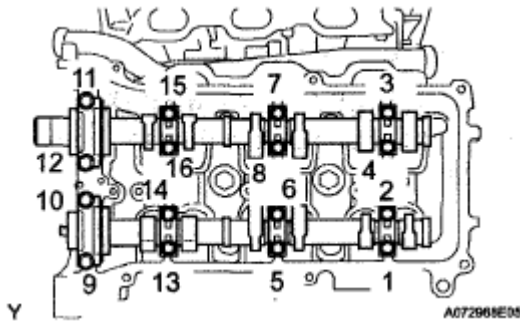


**Fig. 318: Locating Chain Tensioner No. 3 Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Using several steps, loosen and remove the 16 bearing cap bolts uniformly in the sequence shown in the illustration.
- b. Remove the 8 bearing caps and 2 camshafts.

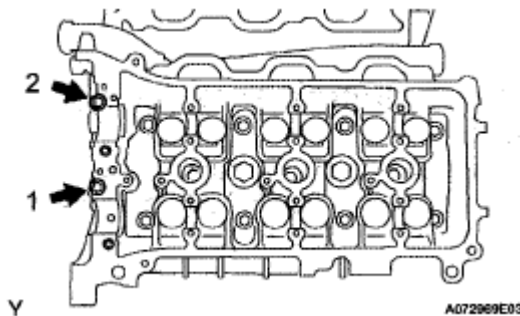
**21. REMOVE CYLINDER HEAD LH**

- a. Remove the bolt, then separate the ground cable.



**Fig. 319: Identifying Bearing Cap Bolts Loosen Sequence (Bank 2 4WD And Pre-Runner)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using several steps, remove the 2 cylinder head bolts on the cylinder head in the sequence shown in the illustration.

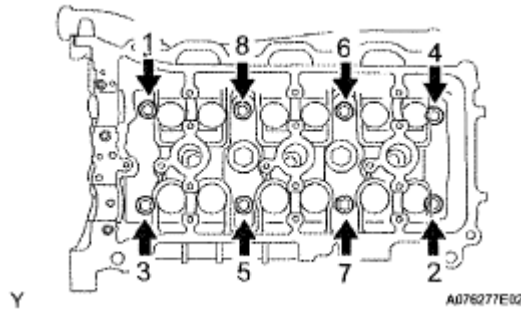


**Fig. 320: Locating Cylinder Head Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using several steps, uniformly loosen the 8 cylinder head bolts on the cylinder head with a 10 mm bi-hexagon wrench in the sequence shown in the illustration. Remove the 8 cylinder head bolts and 8 plate washers.

**NOTE:**

- Be careful not to drop the plate washers into the cylinder head.
- Cylinder head warpage or cracking could result from removing the bolts in the wrong order.



**Fig. 321: Locating Cylinder Head Bolt Tighten Sequence (Bank 2 4WD And Pre-Runner)**

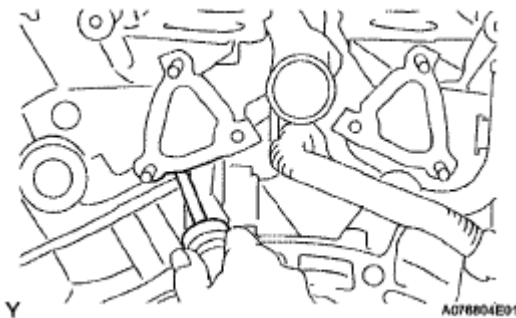
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Lift the cylinder head from the dowels on the cylinder block, and place the cylinder head on wooden blocks on a bench.

**NOTE:**

**Be careful not to drop the plate washers into the cylinder head.**

If the cylinder head is difficult to remove, pry between the cylinder head and cylinder block with a screwdriver.



**Fig. 322: Lifting Cylinder Head On Cylinder Block**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 22. REMOVE NO.2 CYLINDER HEAD GASKET

### INSPECTION

**1. INSPECT CYLINDER HEAD SET BOLT**

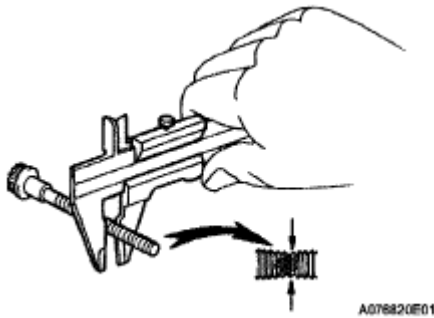
- a. Using vernier calipers, measure the outside diameter of the bolt thread.

**Standard outside diameter:**

**10.85 to 11.00 mm (0.4272 to 0.4331 in.)**

**Minimum outside diameter:**

**10.7 mm (0.421 in.)**



**Fig. 323: Inspecting Cylinder Head Set Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

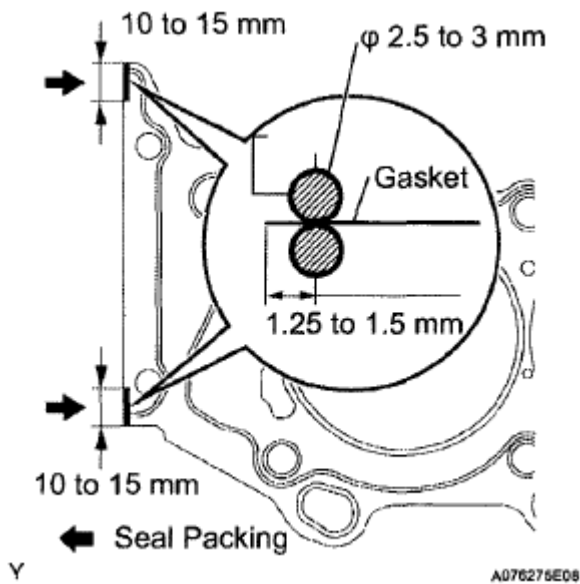
**INSTALLATION****1. INSTALL NO.2 CYLINDER HEAD GASKET**

- a. Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surface of the cylinder head and cylinder block.
- b. Apply a continuous bead of seal packing (diameter 2.5 to 3.0 mm (0.098 to 0.118 in.)) to a new cylinder head gasket as shown in the illustration.

**Seal packing:**

**Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent**

**NOTE:**      **Install the cylinder head within 3 minutes of applying the seal packing. Tighten the cylinder head bolts within 15 minutes of installing the cylinder head. Otherwise, the seal packing must be removed and reapplied.**



**Fig. 324: Identifying No.2 Cylinder Head Gasket Dimension**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

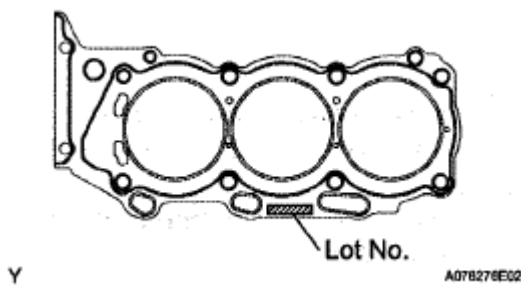
- c. Place the cylinder head gasket on the cylinder block surface with the Lot No. stamp upward.

**NOTE:**

- Be careful of the installation direction.
- Place the cylinder head carefully in order not to damage the gasket with the bottom part of the head.

**2. INSTALL CYLINDER HEAD LH**

- a. Place the cylinder head on the cylinder head gasket.
- b. Install the 8 cylinder head bolts.



**Fig. 325: Identifying Cylinder Head Gasket**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**HINT:**

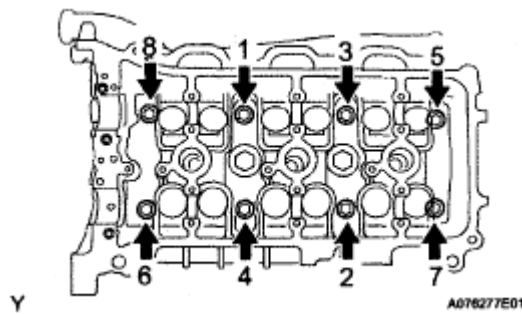
- The cylinder head bolts are tightened in 2 successive steps (steps (3) and (5)).
- If any cylinder head bolts are broken or deformed, replace it.

1. Apply a light coat of engine oil to the threads of the cylinder head bolts.
2. Install the plate washer onto the cylinder head bolt.
3. Using several steps, uniformly tighten each bolt with a 10 mm bi-hexagon wrench in the sequence shown in the illustration.

**Torque: 36 N\*m (367 kgf\*cm, 27 ft.\*lbf)**

If any cylinder head bolts do not meet the torque specification, replace them.

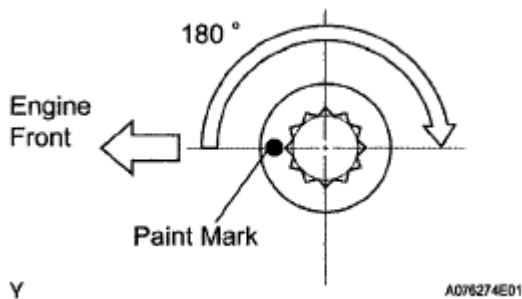
**NOTE:** Do not drop the washers into the cylinder head.



**Fig. 326: Identifying Cylinder Head Bolt Tighten Sequence (Bank 2 4WD And Pre-Runner)**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. Mark the front side of each cylinder head bolt with paint.
5. Retighten the cylinder head bolts 180° as shown.
6. Check that the painted marks are now at 180° from the engine front.



**Fig. 327: Tightening Cylinder Head Bolt**

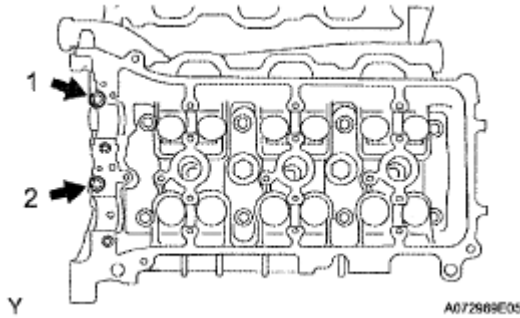
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the 2 cylinder head bolts.
  1. Apply a light coat of engine oil to the threads of the cylinder head bolts.
  2. Using several steps, uniformly install and tighten the 2 cylinder head bolts in the sequence as shown in the illustration.

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

- d. Install the ground cables with the 2 bolts.

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



**Fig. 328: Locating Cylinder Head Bolts**

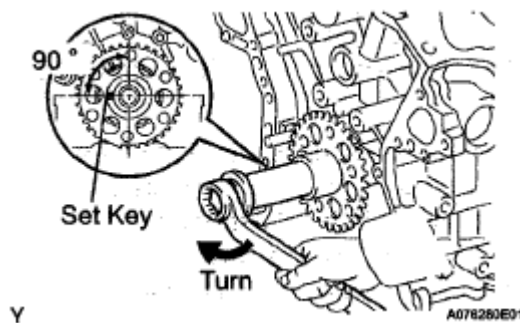
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### 3. INSTALL CAMSHAFTS

**NOTE:** Keep the camshaft level while it is being removed. The camshaft thrust clearance is very small and failing to keep it level could crack or damage the cylinder head journal surface, which receives the thrust. This could subsequently lead the camshaft to seize or break. Perform the following steps to avoid such problems.

- a. Set the crankshaft position.
  1. Using the crankshaft pulley set bolt, turn the crankshaft, and set the crankshaft set key in the left horizontal position.

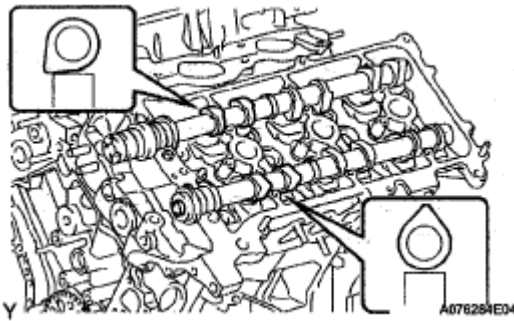
**NOTE:** Installing the crankshaft at the wrong angle could cause the piston head and valve head to come into contact with each other when installing the camshaft. This could cause damage, so always set the crankshaft at the correct angle.



**Fig. 329: Setting Crankshaft Pulley Bolt**

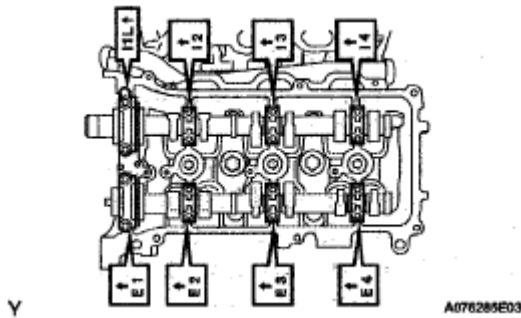
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Apply new engine oil to the thrust portion and journal of the camshafts.
- c. Place the 2 camshafts onto the cylinder head with the cam lobes of No. 1 cylinder facing in the directions shown in the illustration.



**Fig. 330: Identifying Camshafts Onto Cylinder Head**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Install the 8 bearing caps in the proper locations as shown.
- e. Apply a light coat of engine oil to the threads and under the leads of the bearing cap bolts.



**Fig. 331: Identifying Bearing Caps In Proper Locations**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

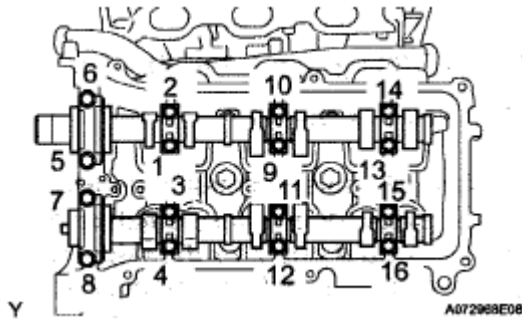
- f. Using several steps, uniformly install and tighten the 16 bearing cap bolts in the sequence as shown in the illustration.

**Torque: 9.0 N\*m (92 kgf\*cm, 80 in.\*lbf) for 10**

**mm (0.39 in.) head**

**24 N\*m (245 kgf\*cm, 18 ft.\*lbf) for 12**

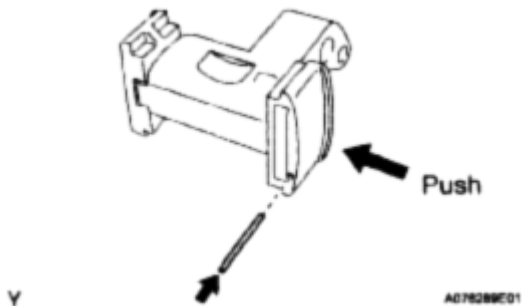
**mm (0.47 in.) head**



**Fig. 332: Identifying Bearing Cap Bolts Tighten Sequence (Bank 2 4WD And Pre-Runner)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### 4. INSTALL NO.2 CHAIN TENSIONER ASSEMBLY

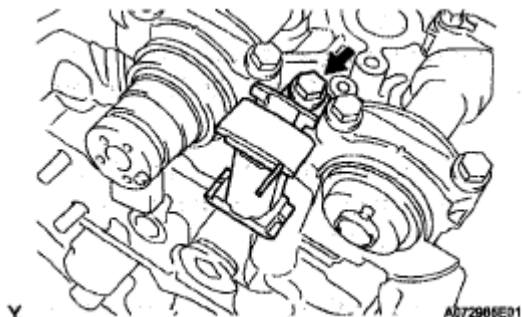
- a. While pushing in the tensioner, insert a pin of 1.0 mm (0.039 in.) into the hole to fix it.



**Fig. 333: Pushing No.3 Chain Tensioner Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the chain tensioner No. 2 with the bolt.

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

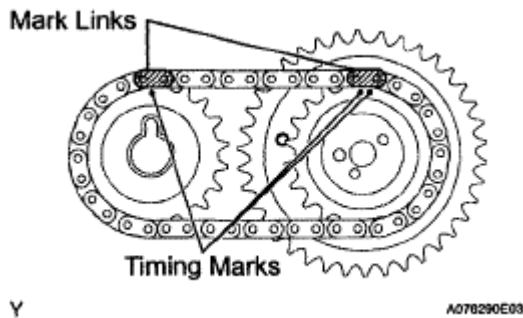


**Fig. 334: Locating Chain Tensioner No. 3 Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### 5. INSTALL CAMSHAFT TIMING GEARS AND NO.2 CHAIN (for Bank 2)

- a. Align the yellow mark links with the timing marks (1 dot mark and 2 dot marks) of camshaft timing

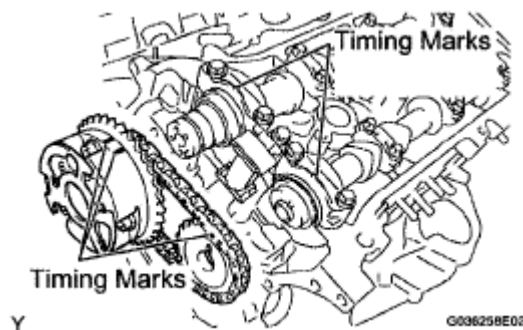
gears as shown in the illustration.



**Fig. 335: Identifying Timing Marks Of Camshaft Timing Gears**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Align the timing marks on the camshaft timing gears with the timing marks on the bearing caps, and install the camshaft timing gears with the chain onto the LH camshafts.
- c. Temporarily install the 2 camshaft timing gear bolts.

**NOTE:** Do not push camshaft timing gear assembly onto the camshaft forcibly when installing it.

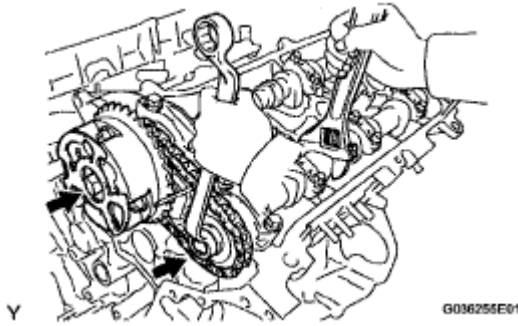


**Fig. 336: Aligning Timing Marks On Camshaft Timing Gears**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Hold the hexagonal portion of the camshaft with a wrench, and tighten the 2 bolts.

**Torque: 100 N\*m (1,020 kgf\*cm, 74 ft.\*lbf)**

- e. Remove the pin from the tensioner No. 2.



**Fig. 337: Holding Camshaft Using Wrench**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

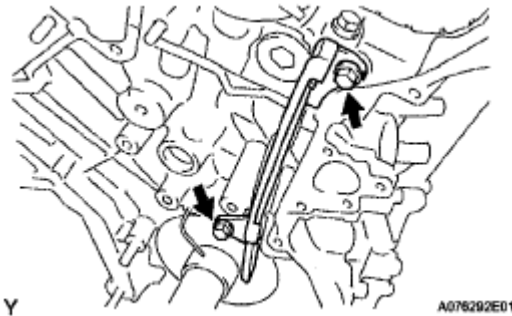
**6. INSTALL NO.1 CHAIN VIBRATION DAMPER**

- a. Install the chain vibration damper with the 2 bolts.

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

**7. INSTALL WATER BY-PASS JOINT RR (See INSTALLATION )**

**8. INSTALL INTAKE MANIFOLD (See INSTALLATION )**



**Fig. 338: Tightening Camshaft Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**9. CONNECT NO.2 FUEL PIPE SUB-ASSEMBLY**

**10. CONNECT NO.1 FUEL PIPE SUB-ASSEMBLY (See INSTALLATION )**

**11. INSTALL EXHAUST MANIFOLD SUB-ASSEMBLY LH**

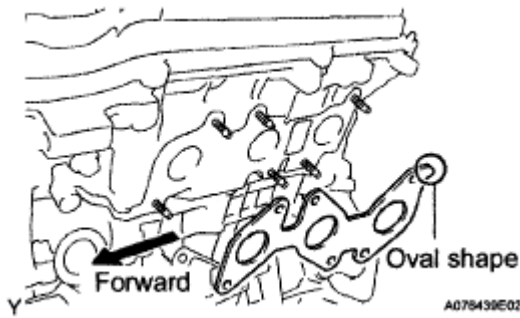
- a. Set a new gasket to the LH cylinder head with the oval shape facing forward.

**NOTE: Be careful of the installation direction.**

- b. Install the exhaust manifold with the 6 nuts. Tighten the nuts uniformly in several steps.

**Torque: 21 N\*m (214 kgf\*cm, 16 ft.\*lbf)**

- c. Connect the air fuel ratio sensor connector.



**Fig. 339: Installing Exhaust Manifold Sub-Assembly LH**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**12. INSTALL MANIFOLD STAY**

- a. Install the manifold stay with the 3 bolts.

**Torque: 40 N\*m (408 kgf\*cm, 30 ft.\*lbf)**

**13. INSTALL NO.2 EXHAUST PIPE ASSEMBLY**

(See **INSTALLATION** )

**14. INSTALL NO.1 COOL AIR INLET**

- a. Install the cool air inlet with the 2 bolts.

**Torque: 12 N\*m (122 kgf\*cm, 9.0 ft.\*lbf)**

**15. INSTALL CHAIN TENSIONER SLIPPER**

**16. INSTALL NO.1 CHAIN TENSIONER ASSEMBLY (See **INSTALLATION** )**

**17. INSTALL CHAIN SUB-ASSEMBLY**

(See **INSTALLATION** )

**18. INSTALL TIMING CHAIN OR BELT COVER SUB-ASSEMBLY**

(See **REASSEMBLY** )

**19. INSTALL DIFFERENTIAL CARRIER ASSEMBLY FRONT (for 4WD)**

(See **INSTALLATION** )

**20. INSTALL POWER STEERING LINK ASSEMBLY**

(See **INSTALLATION** )

**21. INSTALL BATTERY**

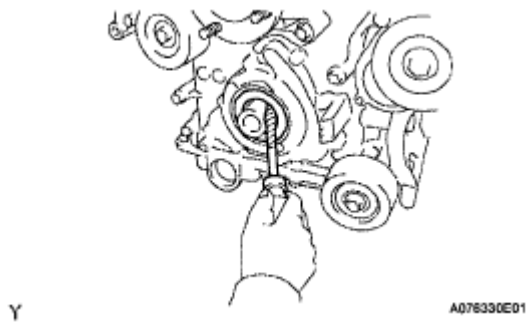
22. **ADD ENGINE OIL** (See INSTALLATION )
23. **ADD ENGINE COOLANT** (See COOLANT )
24. **ADD DIFFERENTIAL OIL** (for 4WD)
25. **INSPECT DIFFERENTIAL OIL** (for 4WD) (See DIFFERENTIAL OIL )
26. **ADD POWER STEERING FLUID**
27. **BLEED POWER STEERING FLUID** (See ON-VEHICLE INSPECTION )
28. **CHECK FOR ENGINE OIL LEAKAGE**
29. **CHECK FOR ENGINE COOLANT LEAKAGE** (See REPLACEMENT )
30. **CHECK FOR FUEL LEAKAGE**
31. **CHECK FOR EXHAUST GAS LEAKAGE**
32. **CHECK FOR POWER STEERING FLUID LEAKAGE**
33. **INSPECT AND ADJUST FRONT WHEEL ALIGNMENT**  
  
(See FRONT WHEEL ALIGNMENT (FOR 4WD AND PRE-RUNNER) )
34. **INSPECT IGNITION TIMING** (See ON-VEHICLE INSPECTION )
35. **INSPECT ENGINE IDLING SPEED** (See ON-VEHICLE INSPECTION )
36. **INSPECT CO/HC** (See ON-VEHICLE INSPECTION )
37. **INSPECT COMPRESSION** (See ON-VEHICLE INSPECTION )

## **ENGINE FRONT OIL SEAL**

### **REMOVAL**

1. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**
2. **REMOVE V-BANK COVER** (See ON-VEHICLE INSPECTION )
3. **REMOVE RADIATOR SUPPORT TO FRAME SEAL LH** (See REMOVAL )
4. **REMOVE NO.1 ENGINE UNDER COVER SUB-ASSEMBLY** (for 4WD and Pre Runner Drive Type)
  - a. Remove the 4 bolts and engine under cover.
5. **REMOVE FAN SHROUD** (See REMOVAL )
6. **REMOVE CRANKSHAFT PULLEY** (See REMOVAL )
7. **REMOVE TIMING GEAR CASE OR TIMING CHAIN CASE OIL SEAL**
  - a. Using a screwdriver, pry out the oil seal.

**NOTE:**        **Be careful not to damage the crankshaft. Wrap a tip of the screwdriver with tape.**

**Fig. 340: Prying Oil Seal**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

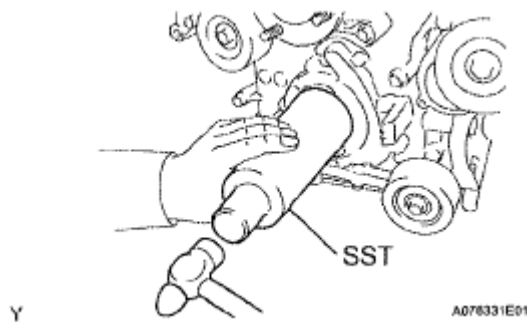
## INSTALLATION

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

- Apply MP grease to a new oil seal lip.
- Using SST and a hammer, tap in the oil seal until its surface is flush with the timing chain cover edge.

**SST 09226-10010**

### 2. INSTALL CRANKSHAFT PULLEY (See INSTALLATION )

**Fig. 341: Installing Timing Gear Case Or Timing Chain Case Oil Seal**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. INSTALL FAN SHROUD (See INSTALLATION )
4. INSTALL RADIATOR SUPPORT TO FRAME SEAL LH
5. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL

**Torque: 3.9 N\*m (40 kgf\*cm, 35 in.\*lbf)**

6. CHECK FOR ENGINE OIL LEAKAGE
7. INSTALL ENGINE UNDER COVER SUB-ASSEMBLY (for 4WD and Pre Runner Drive Type)
  - Install the engine under cover with the 4 bolts.

**Torque: 29 N\*m (296 kgf\*cm, 21 ft.\*lbf)**

## 8. INSTALL V-BANK COVER

- a. Install the V-bank cover with the 2 nuts.

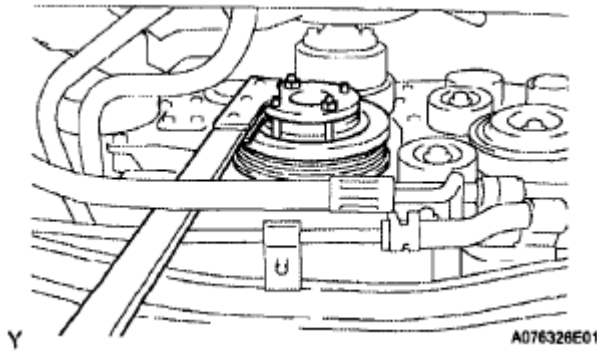
**Torque: 7.5 N\*m (76 kgf\*cm, 66 in.\*lbf)**

# ENGINE REAR OIL SEAL

## REMOVAL

1. **REMOVE TRANSMISSION ASSEMBLY** (See **REMOVAL** )
2. **REMOVE FLYWHEEL SUB-ASSEMBLY (for Manual Transmission)**
  - a. Using SST, hold the crankshaft.

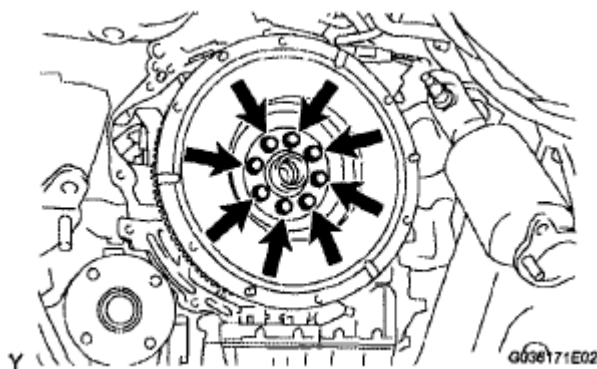
**SST 09213-54015 (91651 -60855), 09330-00021**



**Fig. 342: Holding Crankshaft**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the 8 bolts, then remove the flywheel and 2 spacers.



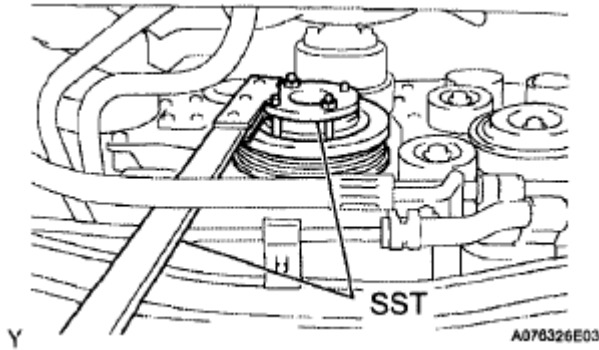
**Fig. 343: Locating Flywheel Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**3. REMOVE DRIVE PLATE & RING GEAR SUB-ASSEMBLY (for Automatic Transmission)**

- a. Using SST, hold the crankshaft.

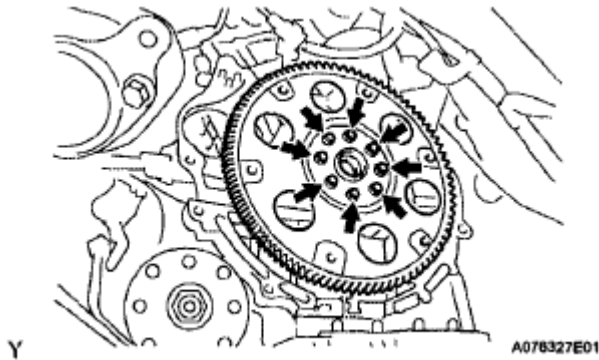
**SST 09213-54015 (91651-60855), 09330-00021**



**Fig. 344: Holding Crankshaft**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the 8 bolts, then remove the drive plate and 2 spacers.



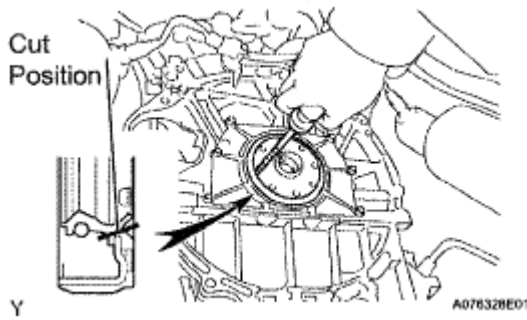
**Fig. 345: Locating Drive Plate Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**4. REMOVE REAR ENGINE OIL SEAL**

- a. Using a knife, cut off the oil seal lip.
- b. Using a screwdriver, pry out the oil seal.

**NOTE:** Be careful not to damage the crankshaft. Wrap the screwdriver tip with tape.



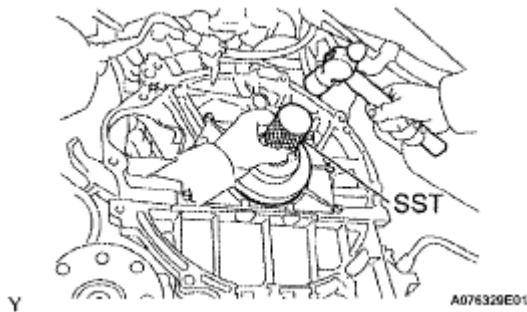
**Fig. 346: Removing Rear Engine Oil Seal**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## INSTALLATION

### 1. INSTALL REAR ENGINE OIL SEAL

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

**SST 09223-78010**

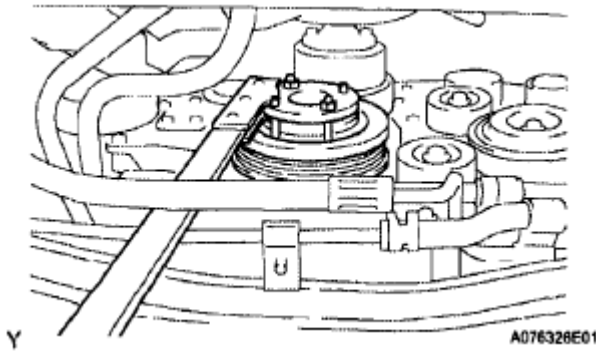


**Fig. 347: Installing Rear Engine Oil Seal**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### 2. INSTALL FLYWHEEL SUB-ASSEMBLY (for Manual Transmission)

- Using SST, hold the crankshaft.

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

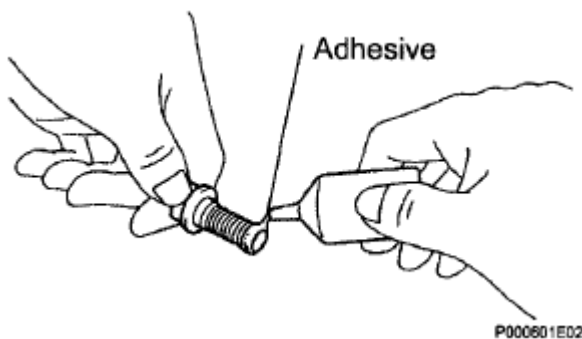
**Fig. 348: Holding Crankshaft**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Apply adhesive to 2 or 3 threads of the mounting bolt end.

**Adhesive:**

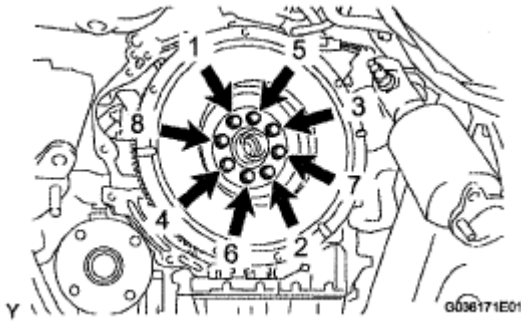
**Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent**

**Fig. 349: Applying Adhesive To 2 Or 3 Threads Of Mounting Bolt End**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the flywheel and 2 spacers onto the crankshaft.
- d. Using several steps, uniformly install and tighten the 8 mounting bolts in the sequence shown in the illustration.

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

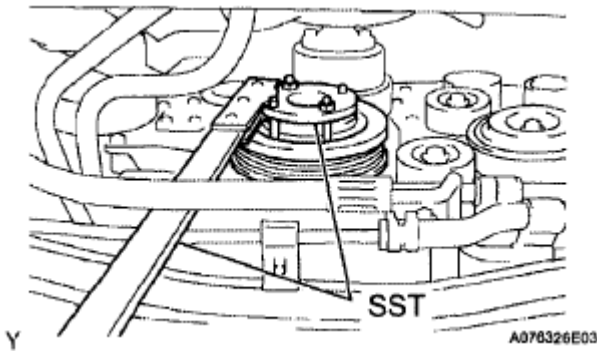
**Fig. 350: Locating Flywheel Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**3. INSTALL DRIVE PLATE & RING GEAR SUB-ASSEMBLY (for Automatic Transmission)**

- a. Using SST, hold the crankshaft.

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

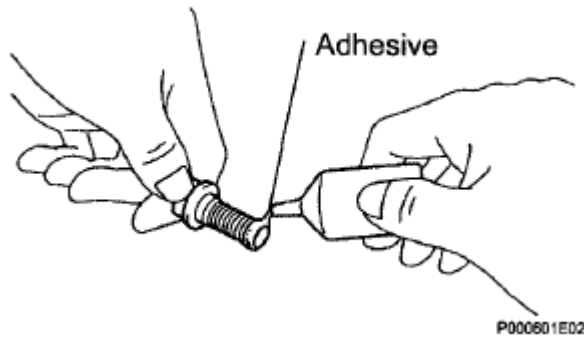
**Fig. 351: Holding Crankshaft**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Apply adhesive to 2 or 3 threads of the mounting bolt end.

**Adhesive:**

**Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent**

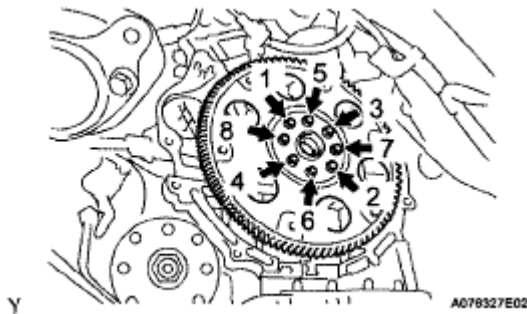


**Fig. 352: Applying Adhesive To 2 Or 3 Threads Of Mounting Bolt End**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the drive plate and 2 spacers onto the crankshaft.
- d. Using several steps, uniformly install and tighten the 8 mounting bolts in the sequence shown in the illustration.

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

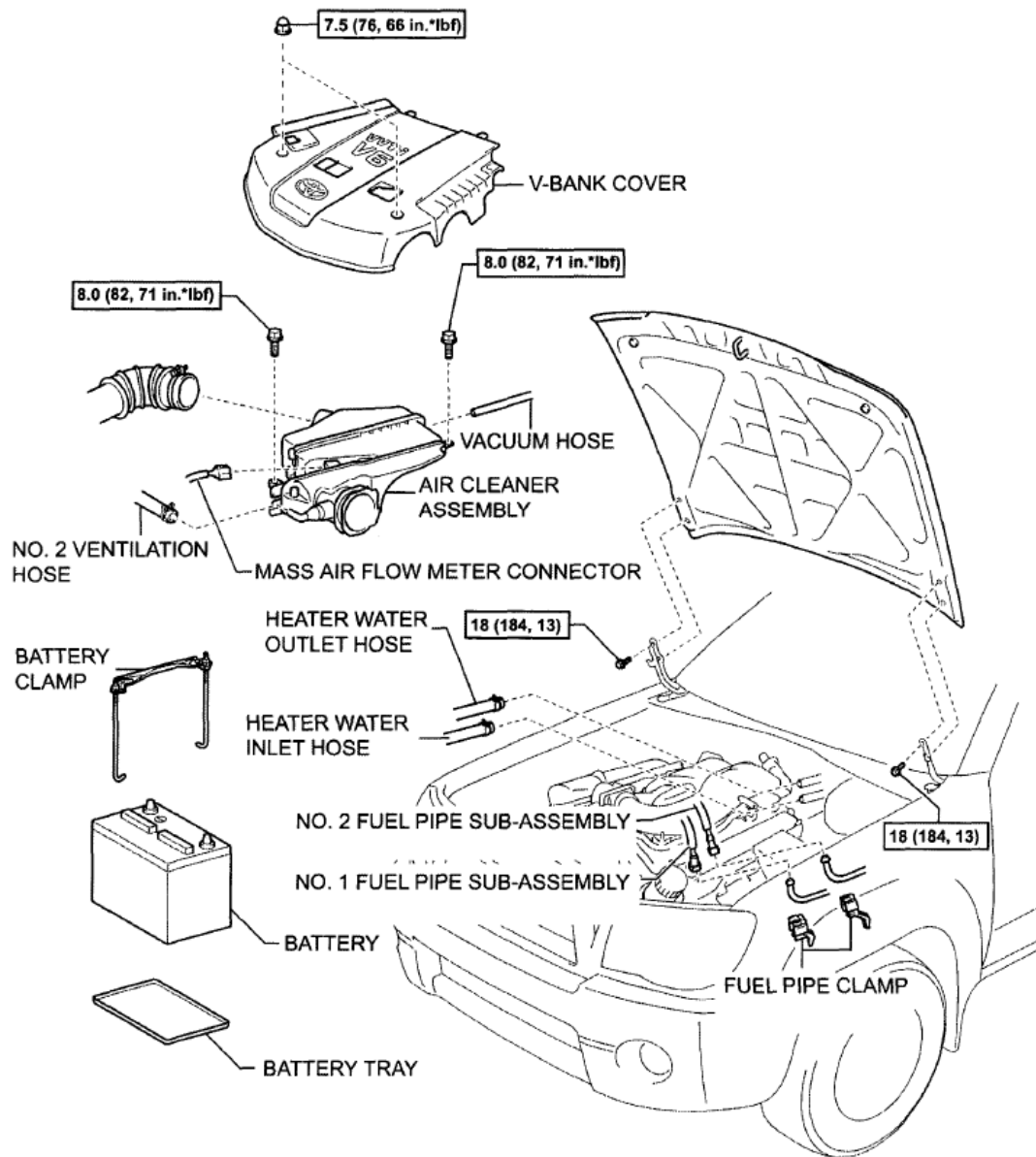
**4. INSTALL TRANSMISSION ASSEMBLY (See INSTALLATION )**



**Fig. 353: Locating Drive Plate Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## **ENGINE ASSEMBLY**

### **COMPONENTS**



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

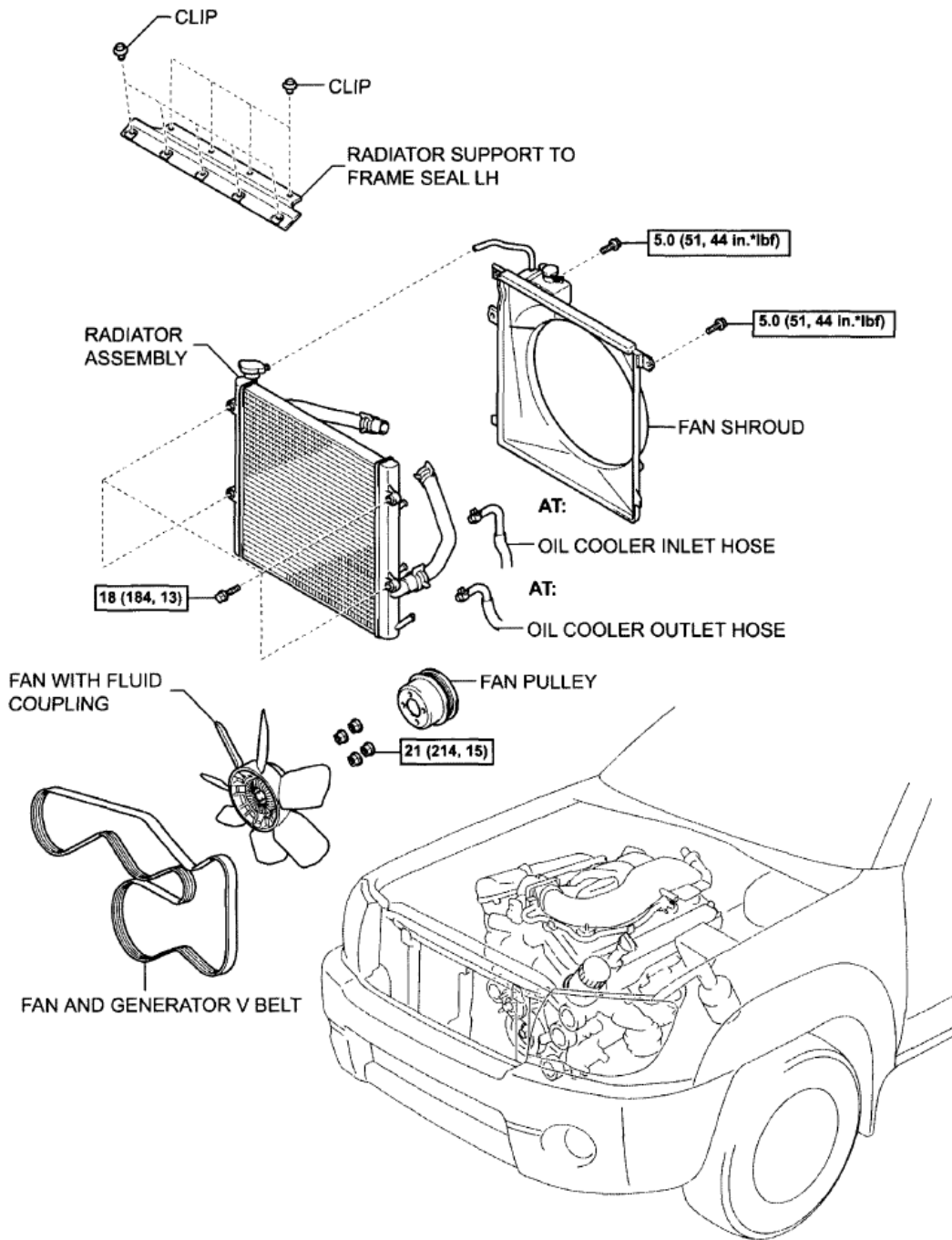
Y

A113576E02

**Fig. 354: Exploded View Of Engine Assembly Components With Torque Specification (1 Of 16)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

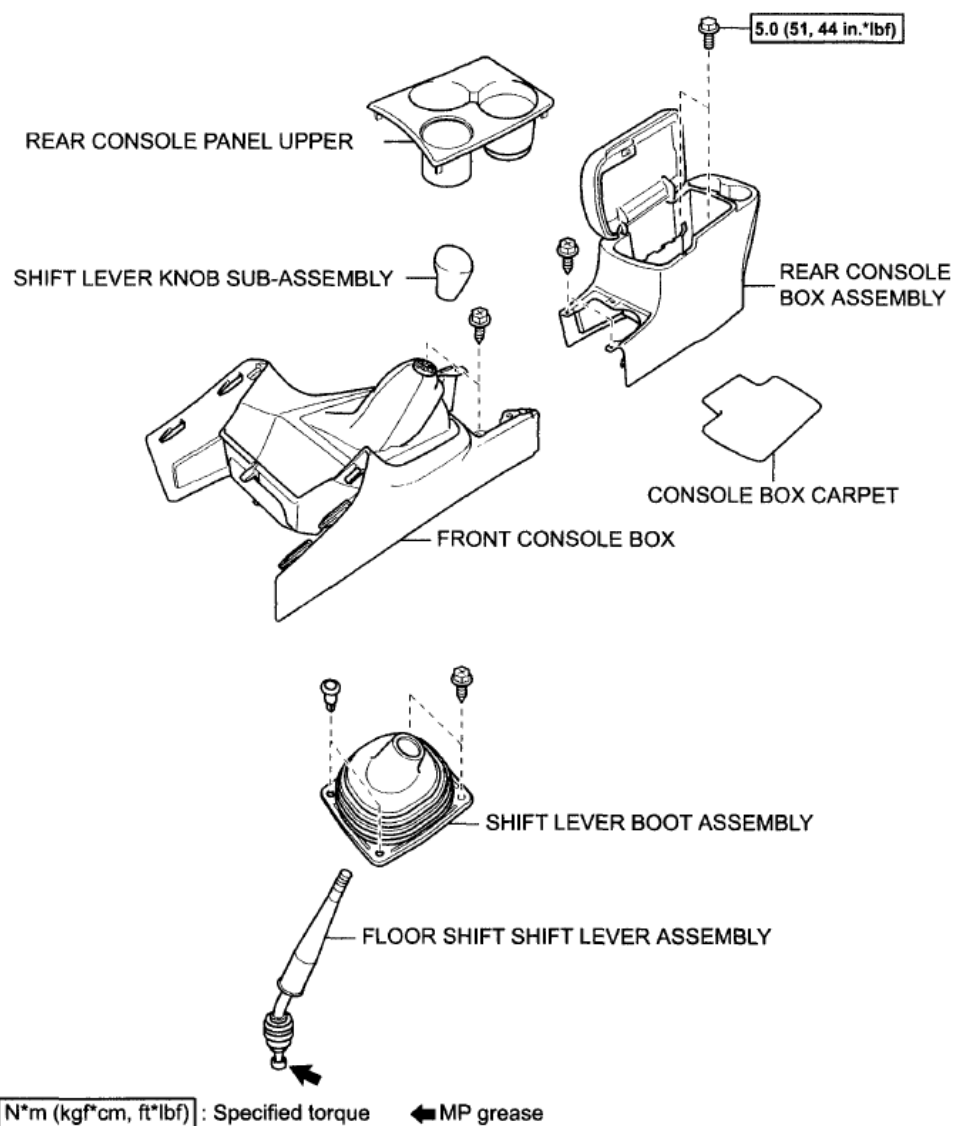
## 2009 Toyota Tacoma

2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma



A112677E01

**Fig. 355: Exploded View Of Engine Assembly Components With Torque Specification (2 Of 16)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



Y

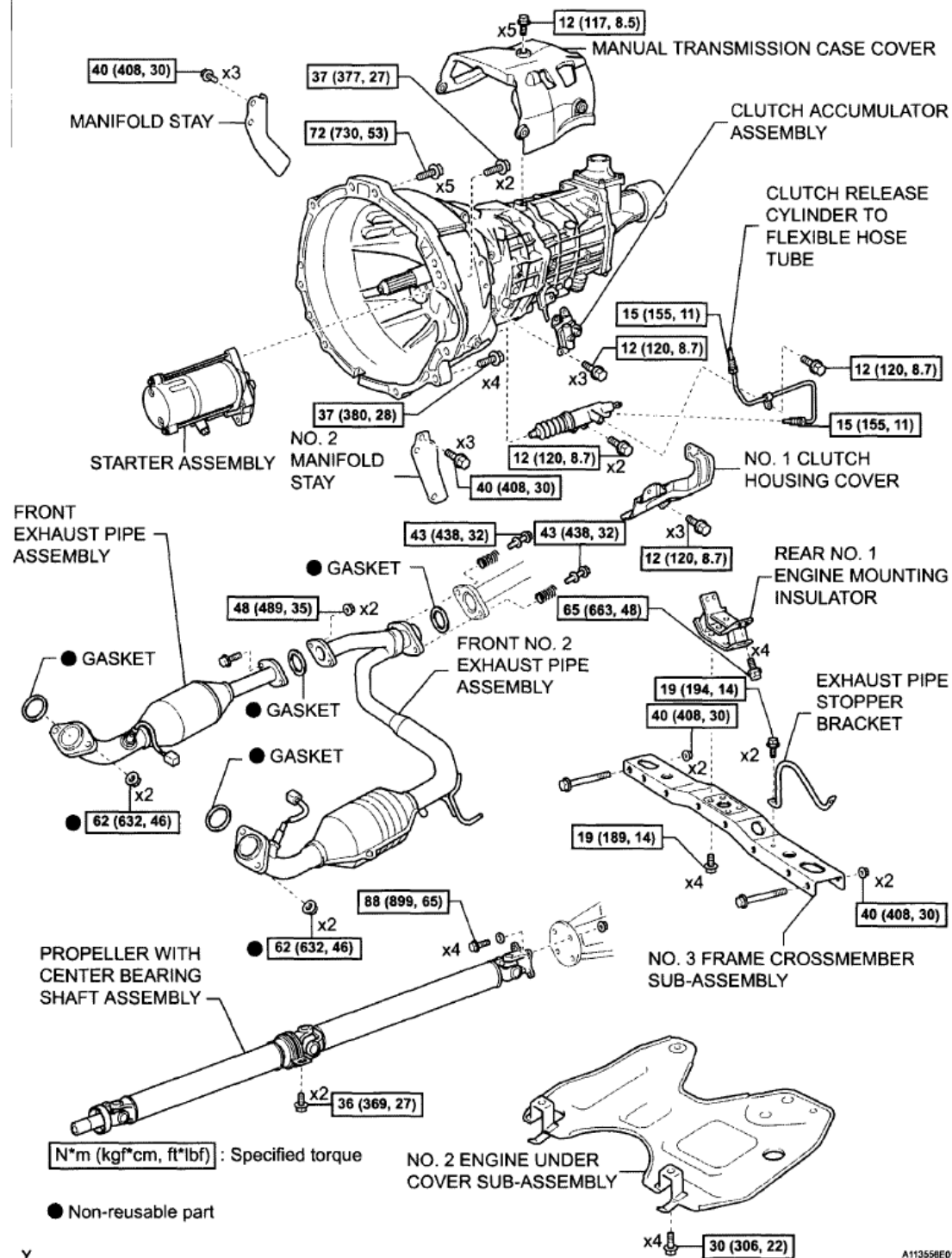
A113553E01

**Fig. 356: Exploded View Of Engine Assembly Components With Torque Specification (3 Of 16)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

| 2009 Toyota Tacoma                              |
|-------------------------------------------------|
| 2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma |

| 2009 Toyota Tacoma                              |
|-------------------------------------------------|
| 2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma |

**2WD AND PRE RUNNER, MANUAL TRANSMISSION:**

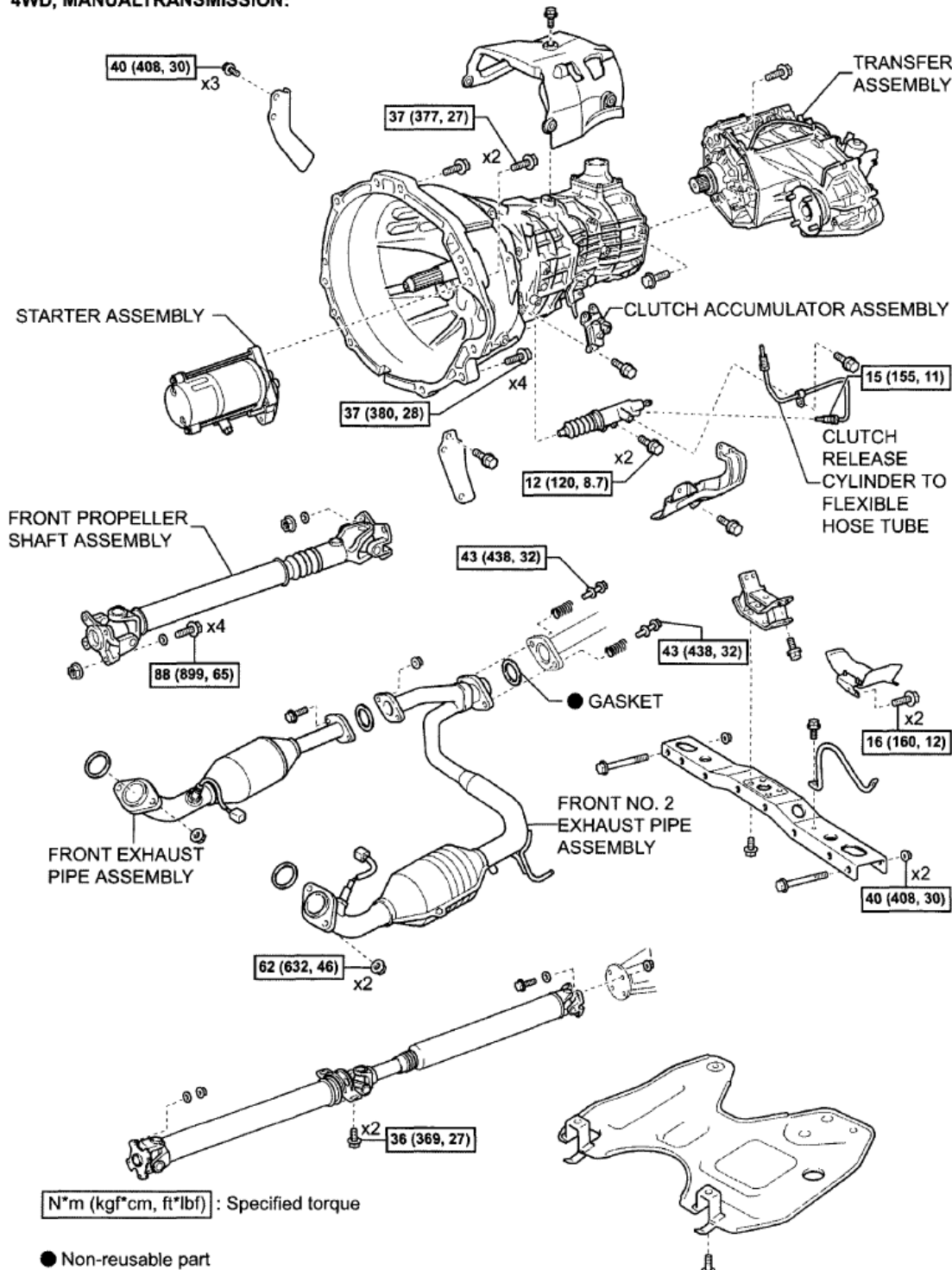


**Fig. 357: Exploded View Of Engine Assembly Components With Torque Specification (4 Of 16)**  
**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

## 2009 Toyota Tacoma

2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma

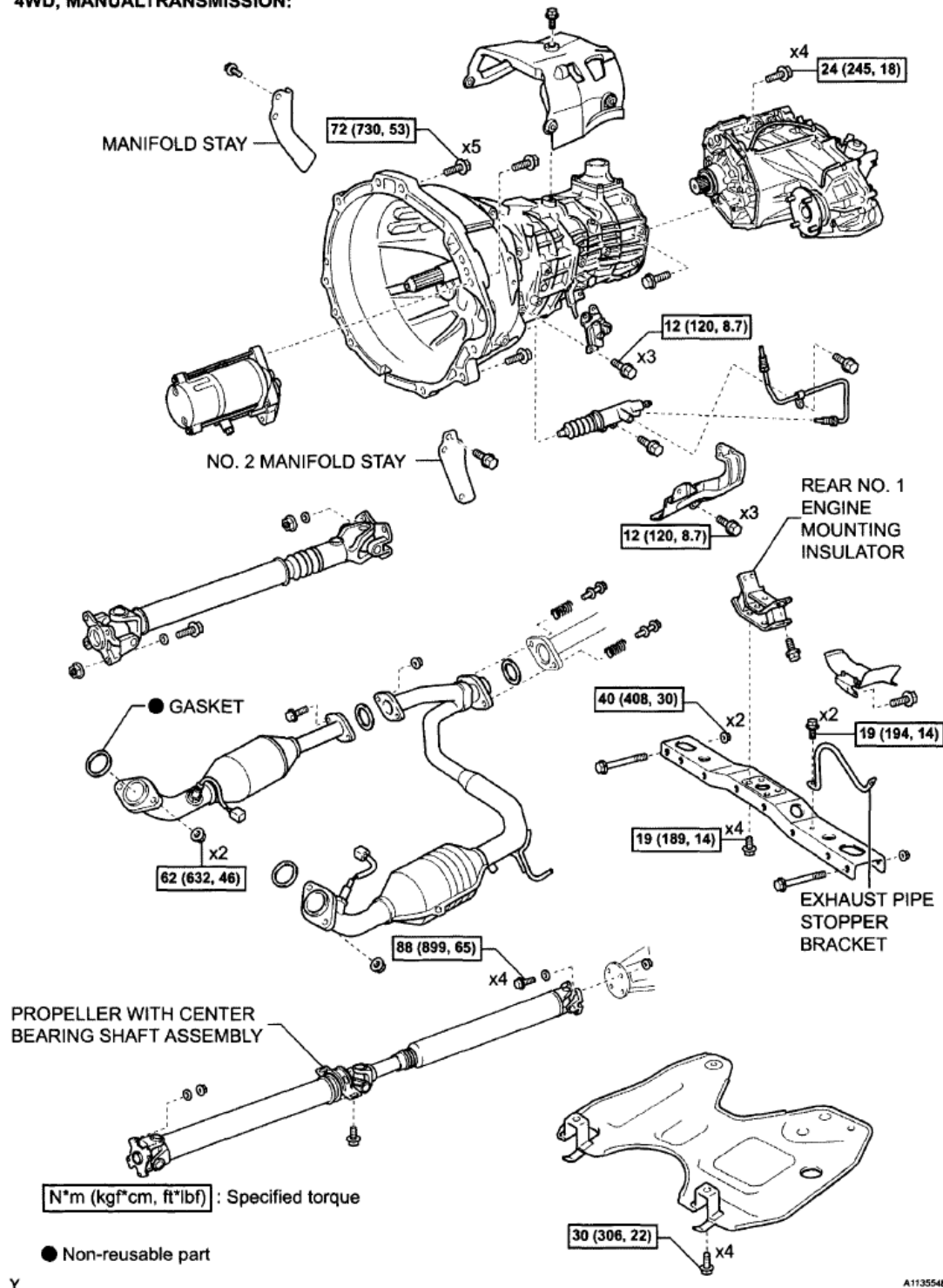
### 4WD, MANUAL TRANSMISSION:



A113554E01

**Fig. 358: Exploded View Of Engine Assembly Components With Torque Specification (5 Of 16)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4WD, MANUALTRANSMISSION:

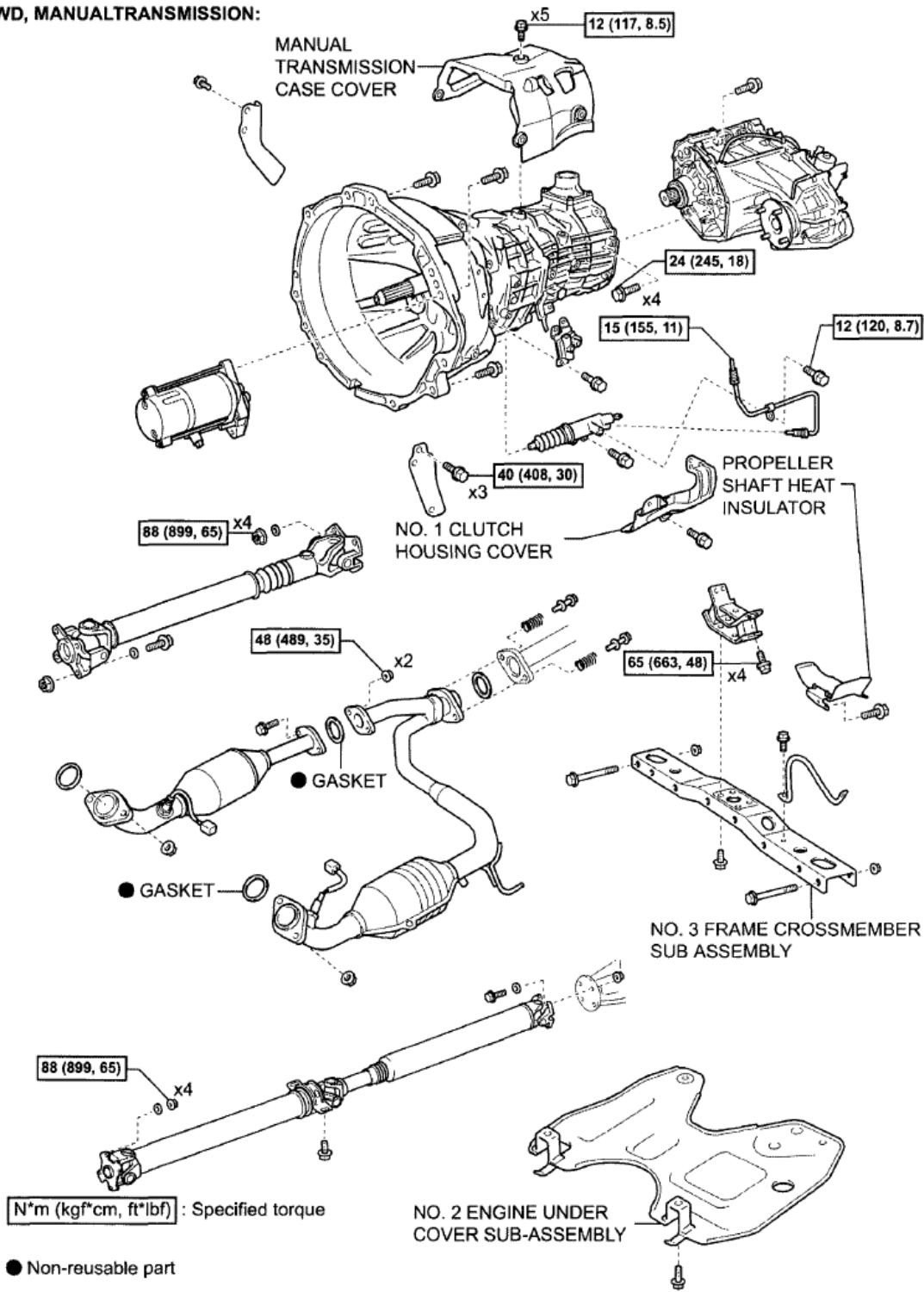


**Fig. 359: Exploded View Of Engine Assembly Components With Torque Specification (6 Of 16)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 2009 Toyota Tacoma

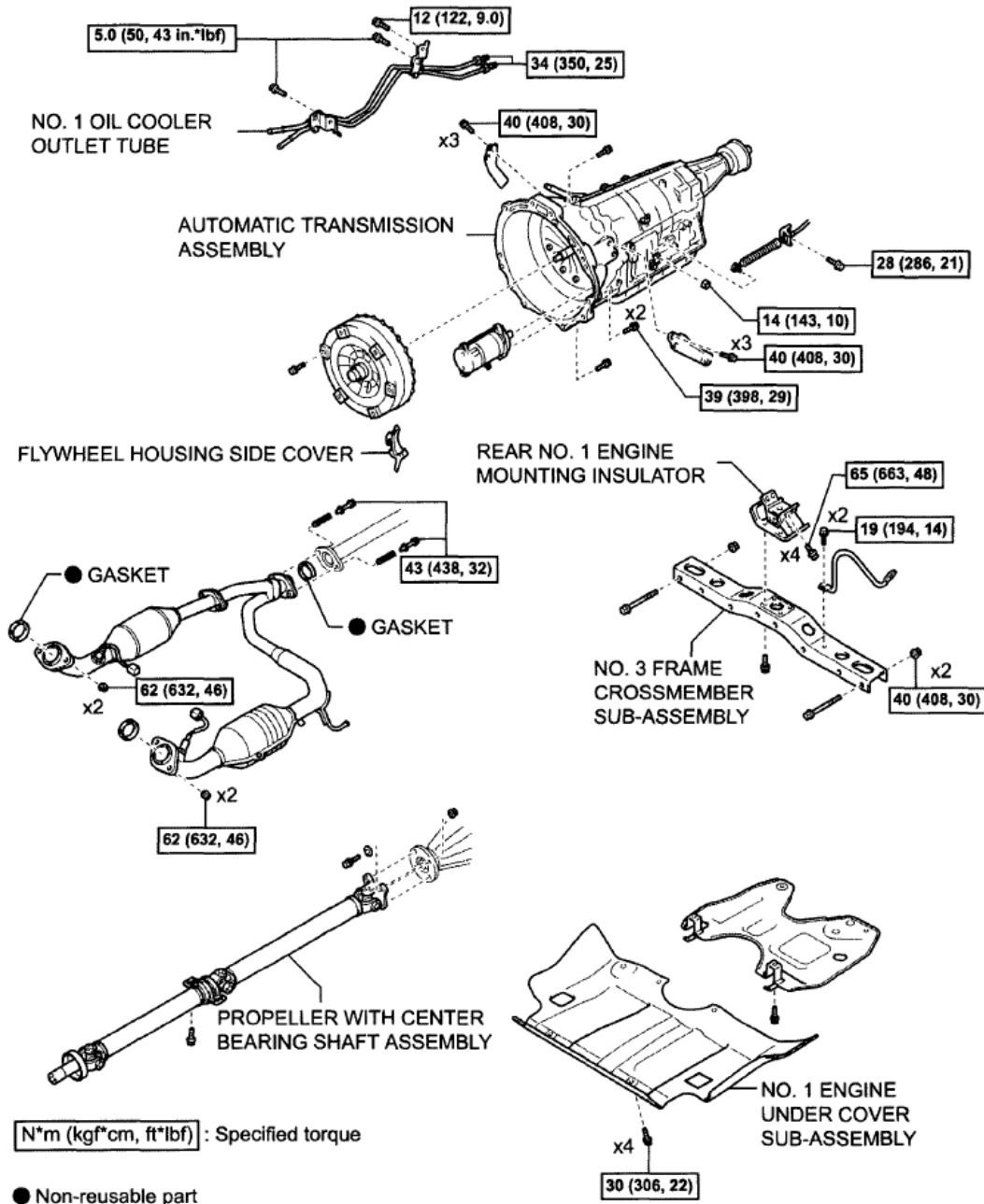
2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma

### 4WD, MANUAL TRANSMISSION:



**Fig. 360: Exploded View Of Engine Assembly Components With Torque Specification (7 Of 16)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

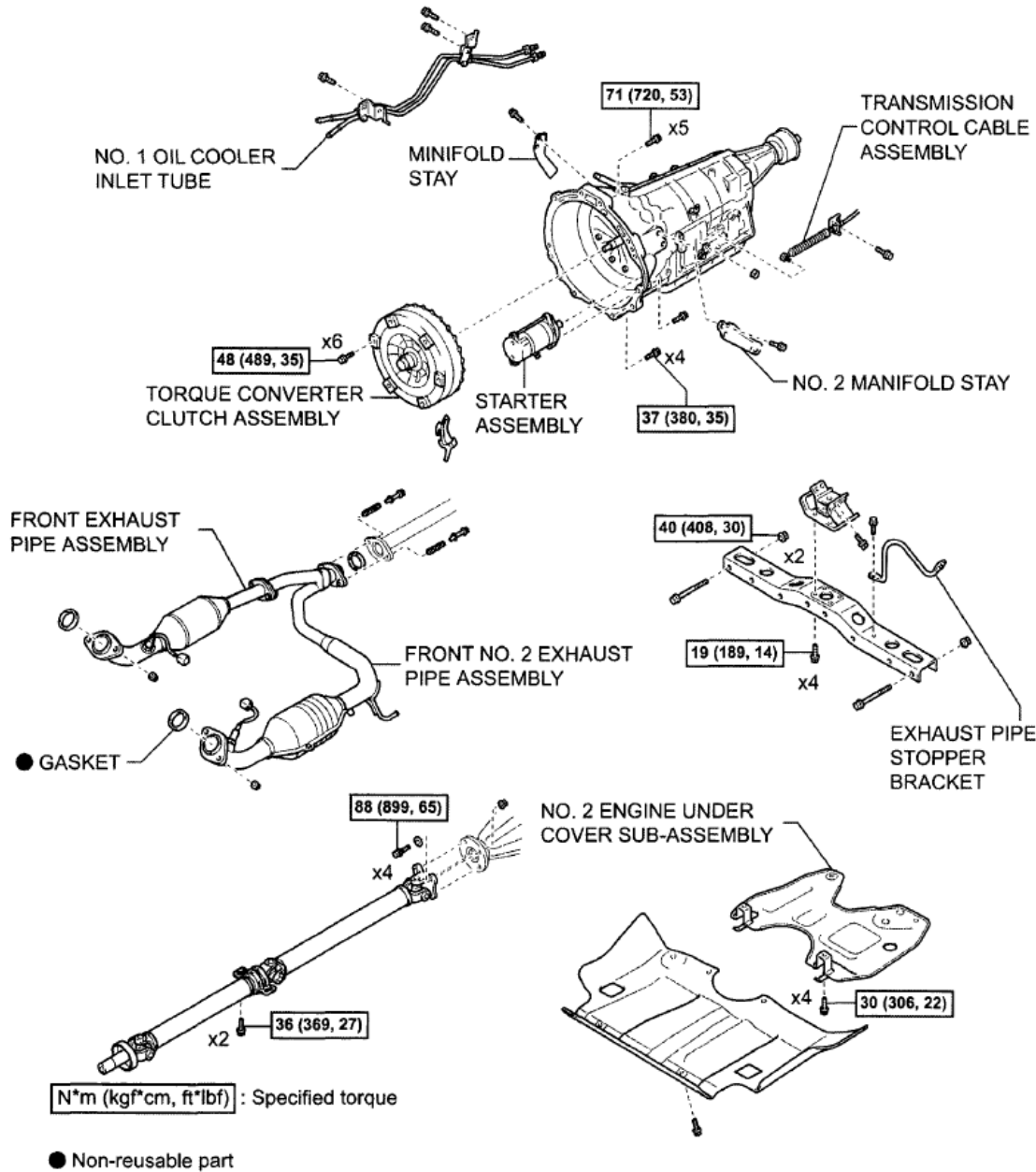
2WD AND PRE RUNNER, AUTOMATIC TRANSMISSION:



A113551E01

**Fig. 361: Exploded View Of Engine Assembly Components With Torque Specification (8 Of 16)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2WD AND PRE RUNNER, AUTOMATIC TRANSMISSION:



Y

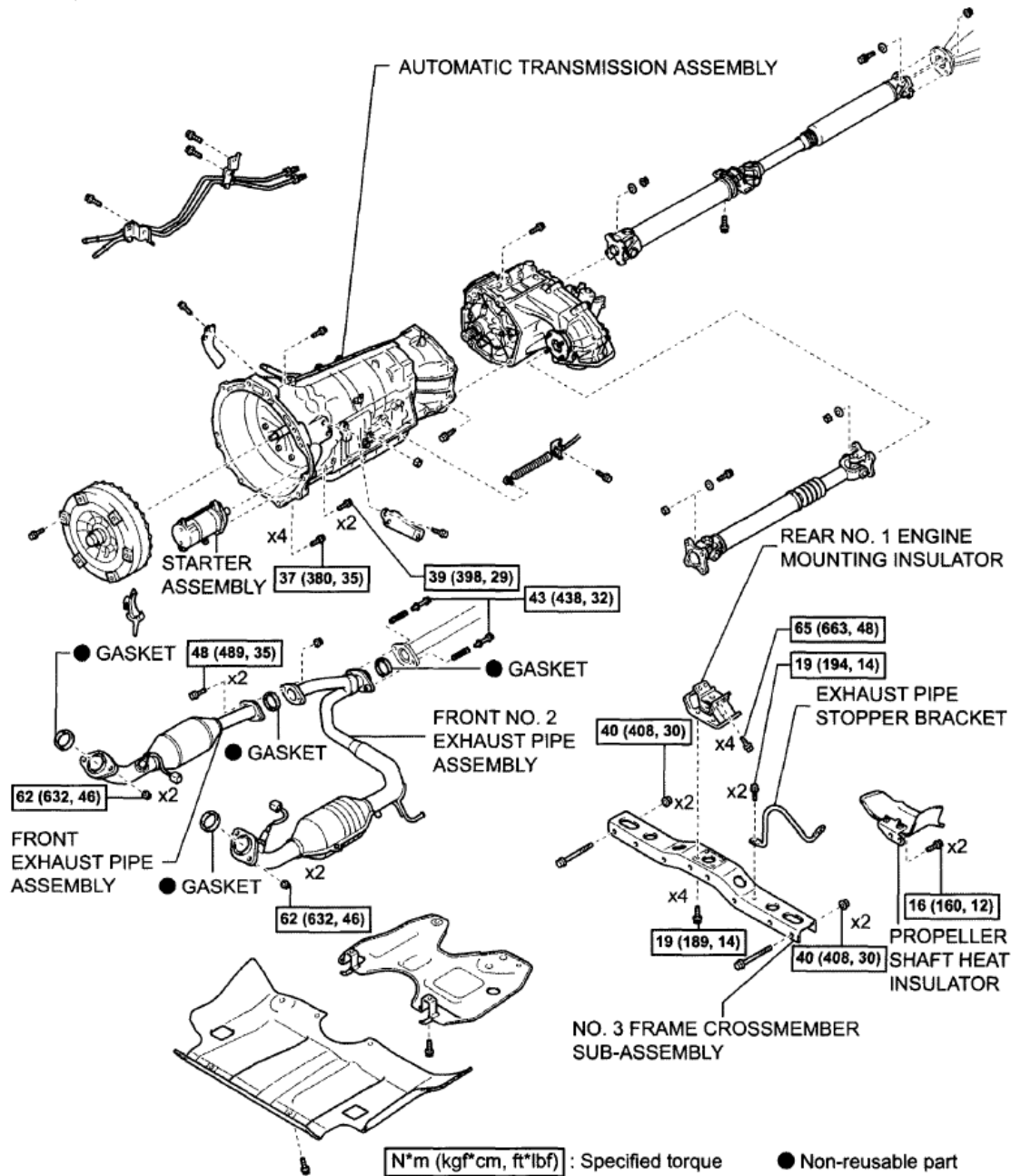
A113551E02

**Fig. 362: Exploded View Of Engine Assembly Components With Torque Specification (9 Of 16)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 2009 Toyota Tacoma

2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma

4WD, MANUALTRANSMISSION:

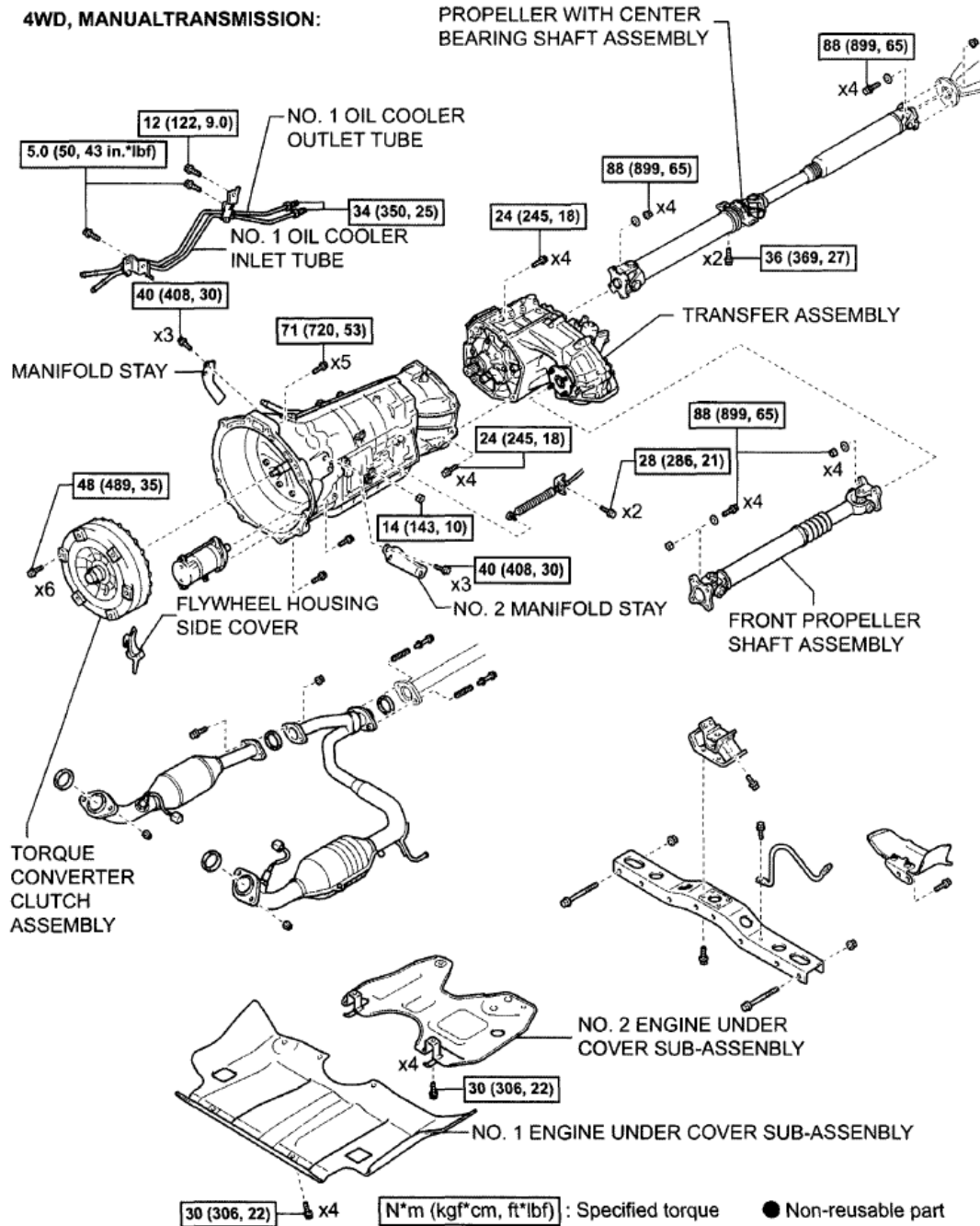


A113555E01

**Fig. 363: Exploded View Of Engine Assembly Components With Torque Specification (10 Of 16)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 2009 Toyota Tacoma

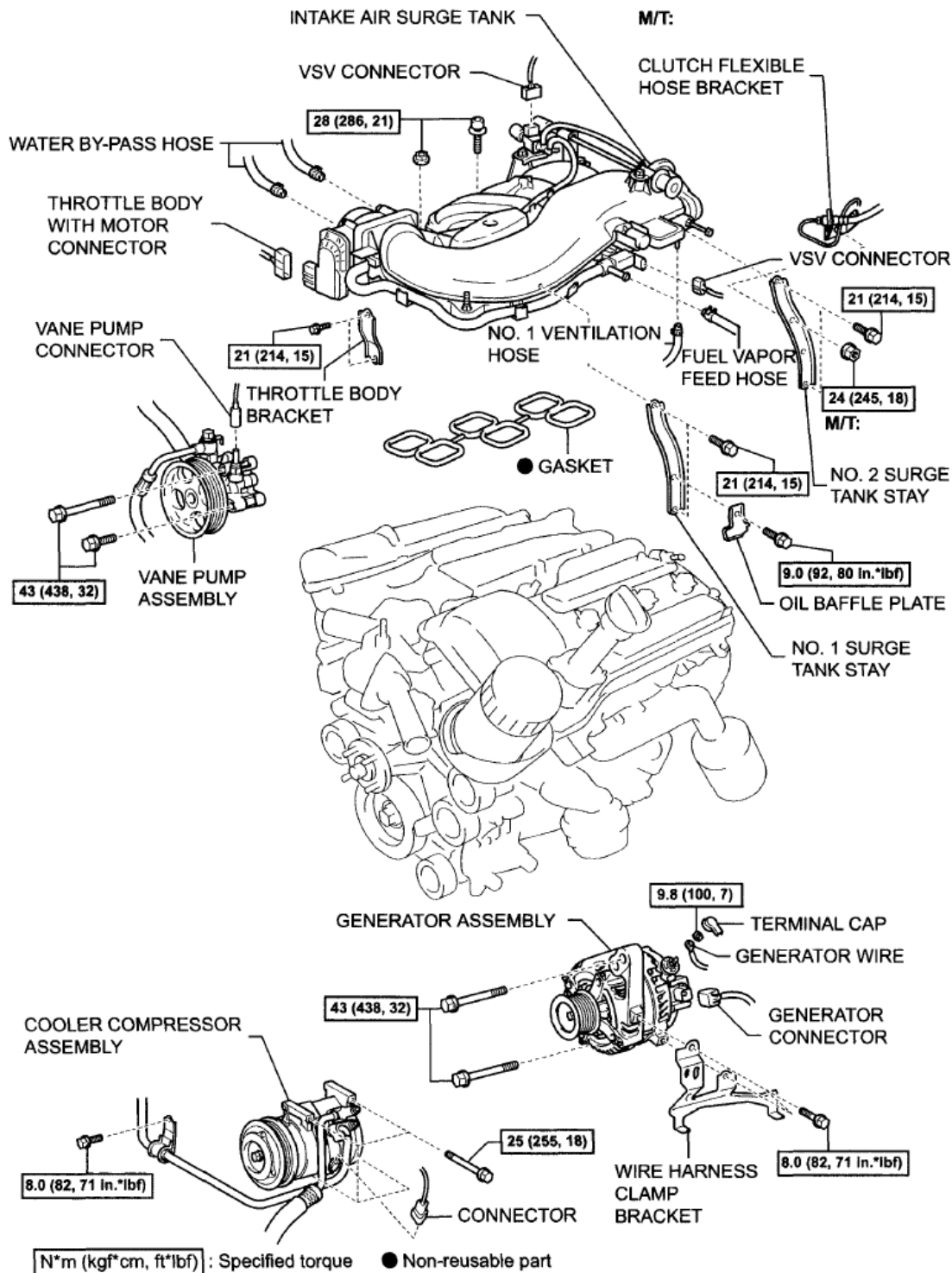
2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma



**Fig. 364: Exploded View Of Engine Assembly Components With Torque Specification (11 Of 16)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 2009 Toyota Tacoma

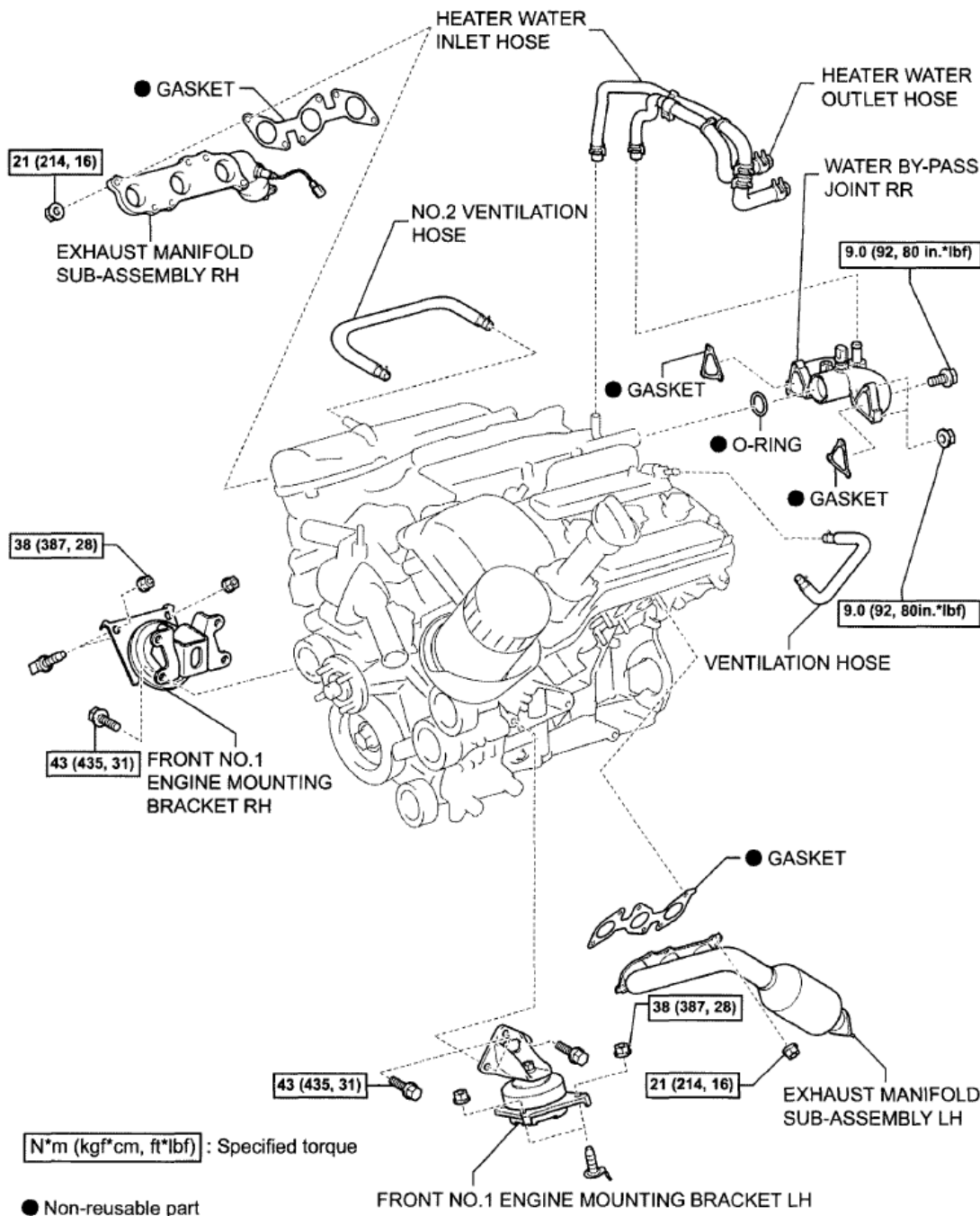
2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma



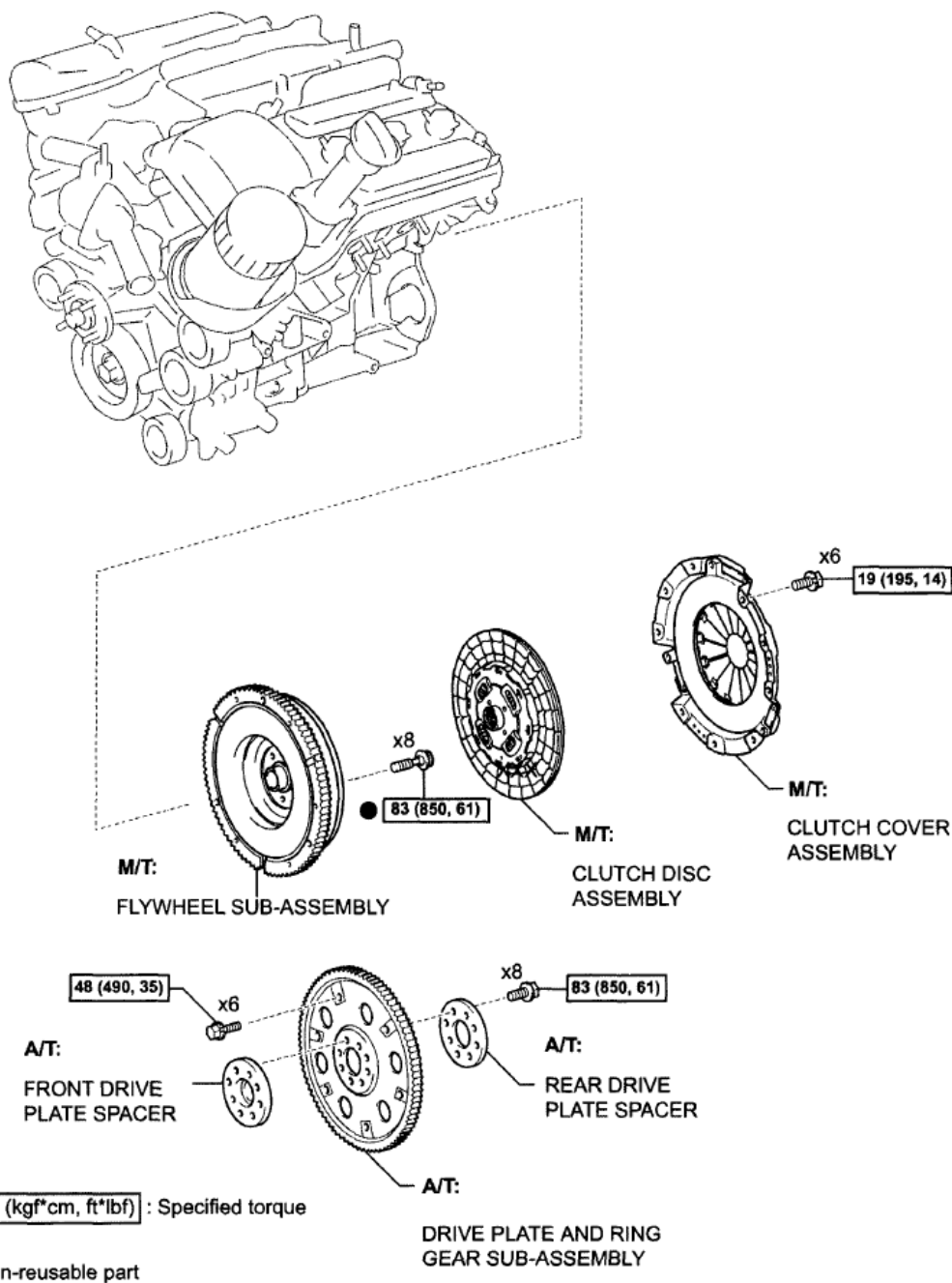
**Fig. 365: Exploded View Of Engine Assembly Components With Torque Specification (12 Of 16)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 2009 Toyota Tacoma

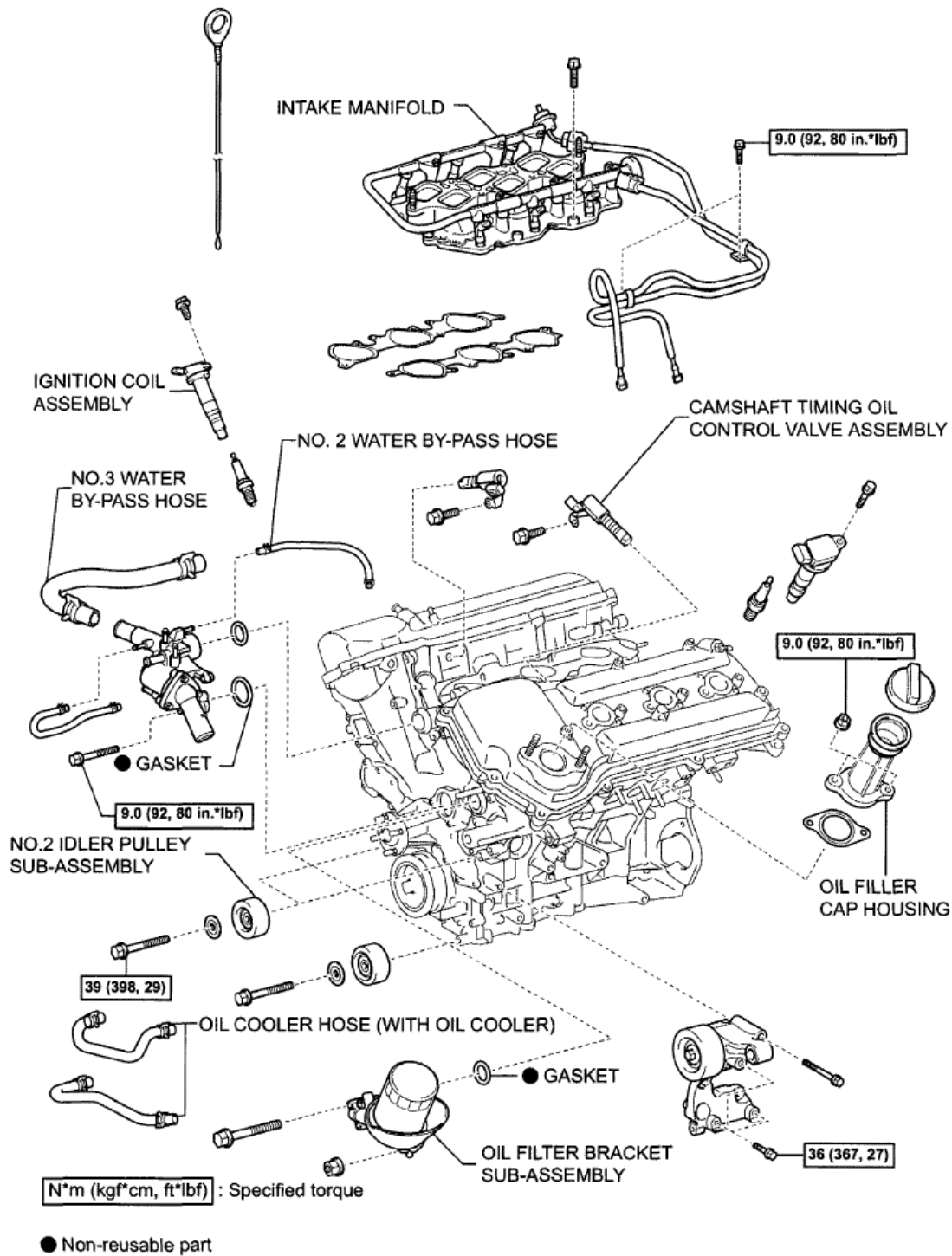
2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma



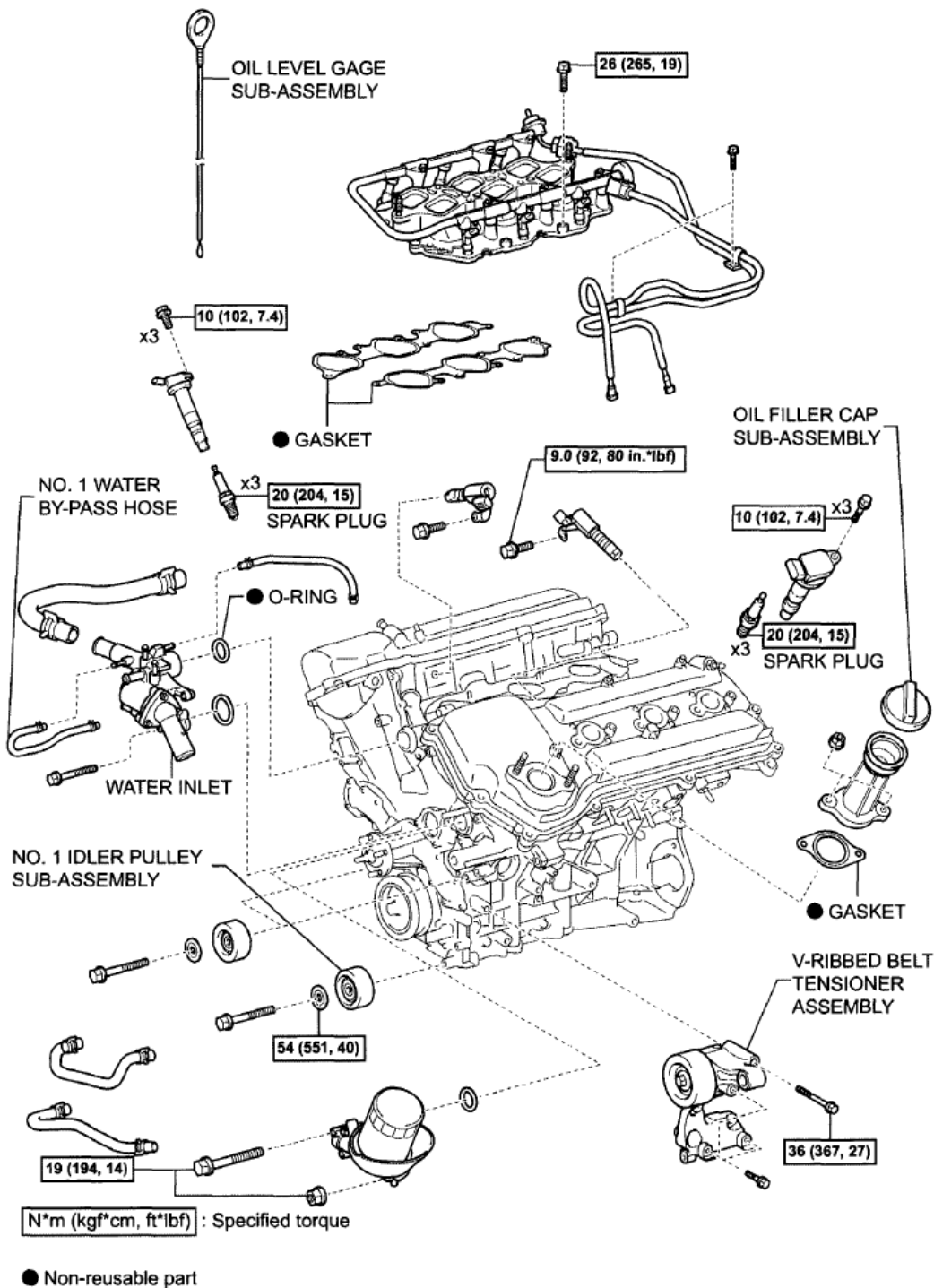
**Fig. 366: Exploded View Of Engine Assembly Components With Torque Specification (13 Of 16)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 367: Exploded View Of Engine Assembly Components With Torque Specification (14 Of 16)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 368: Exploded View Of Engine Assembly Components With Torque Specification (15 Of 16)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 369: Exploded View Of Engine Assembly Components With Torque Specification (16 Of 16)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## REMOVAL

**1. DISCHARGE FUEL SYSTEM PRESSURE**

(See **FUEL SYSTEM** )

**2. REMOVE BATTERY****3. DRAIN ENGINE COOLANT (See **COOLANT** )****4. DRAIN ENGINE OIL (See **OIL FILTER** )****5. REMOVE HOOD SUB-ASSEMBLY**

- a. Disconnect the windshield washer hose.
- b. Separate the 2 hood supports.
- c. Remove the 4 bolts, then remove the hood.

**6. REMOVE RADIATOR SUPPORT TO FRAME SEAL LH (See **REMOVAL** )****7. REMOVE FAN SHROUD (See **REMOVAL** )****8. REMOVE RADIATOR ASSEMBLY (See **REMOVAL** )****9. REMOVE V-BANK COVER (See **ON-VEHICLE INSPECTION** )****10. REMOVE TRANSMISSION ASSEMBLY**

HINT:

Refer to the table below when removing transmission.

**TRANSMISSION REFERENCE**

| Transmission           | Drive Type | Refer to              |
|------------------------|------------|-----------------------|
| Manual Transmission    | 2WD        | <b><u>REMOVAL</u></b> |
| Manual Transmission    | 4WD        | <b><u>REMOVAL</u></b> |
| Automatic Transmission | 2WD        | <b><u>REMOVAL</u></b> |
| Automatic Transmission | 4WD        | <b><u>REMOVAL</u></b> |

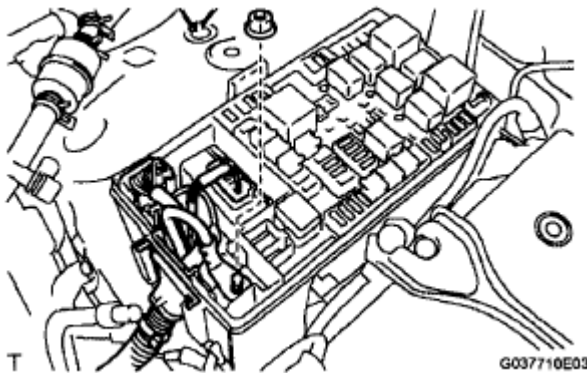
**11. REMOVE CLUTCH COVER ASSEMBLY (for Manual Transmission)****TRANSMISSION REFERENCE**

| Transmission | Refer to                              |
|--------------|---------------------------------------|
| RA60         | <b><u>CLUTCH UNIT (FOR RA60)</u></b>  |
| RA60F        | <b><u>CLUTCH UNIT (FOR RA60F)</u></b> |

**12. REMOVE CLUTCH DISC ASSEMBLY (for Manual Transmission)****TRANSMISSION REFERENCE**

| Transmission | Refer to                              |
|--------------|---------------------------------------|
| RA60         | <b><u>CLUTCH UNIT (FOR RA60)</u></b>  |
| RA60F        | <b><u>CLUTCH UNIT (FOR RA60F)</u></b> |

13. **REMOVE FAN PULLEY**
14. **REMOVE VANE PUMP ASSEMBLY** (See REMOVAL )
15. **REMOVE GENERATOR ASSEMBLY** (See REMOVAL )
16. **SEPARATE COOLER COMPRESSOR ASSEMBLY** (See CRANKSHAFT POSITION SENSOR )
17. **DISCONNECT NO.1 FUEL PIPE SUB-ASSEMBLY** (See REMOVAL )
18. **DISCONNECT NO.2 FUEL PIPE SUB-ASSEMBLY** (See REMOVAL )
19. **DISCONNECT HEATER WATER INLET HOSE**
20. **DISCONNECT HEATER WATER OUTLET HOSE**
21. **REMOVE INTAKE AIR SURGE TANK** (See REMOVAL )
22. **SEPARATE ENGINE WIRE**
  - a. Remove the glove compartment door.
  - b. Remove the instrument panel finish panel sub-assembly lower RH.
  - c. Disconnect the 5 connectors from the ECM.
  - d. Disconnect the 2 connectors from four wheel drive ECU (4WD only).
  - e. Pull the wire harness into the engine room.
  - f. Disconnect the front differential connector (4WD only).
  - g. Disconnect the 3 connectors from the engine room relay block.
  - h. Remove the nut, then separate the engine wire from the engine room relay block.
23. **SEPARATE NO.2 ENGINE WIRE**
  - a. Disconnect the ground cable from the cylinder block.



**Fig. 370: Identifying Engine Room Relay Block**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

24. **REMOVE ENGINE ASSEMBLY**
  - a. Install the 2 engine hangers with the 4 bolts as shown in the illustration.

**Part No:**

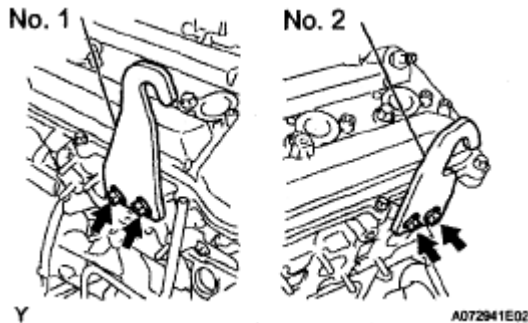
**Engine hanger No. 1 12281-31070**

**Engine hanger No. 2 12282-31050**

**Bolt 90119-08177**

**Torque: 33 N\*m (336 kgf\*cm, 24 ft.\*lbf)**

- b. Attach the engine sling device and hang the engine with the chain block.

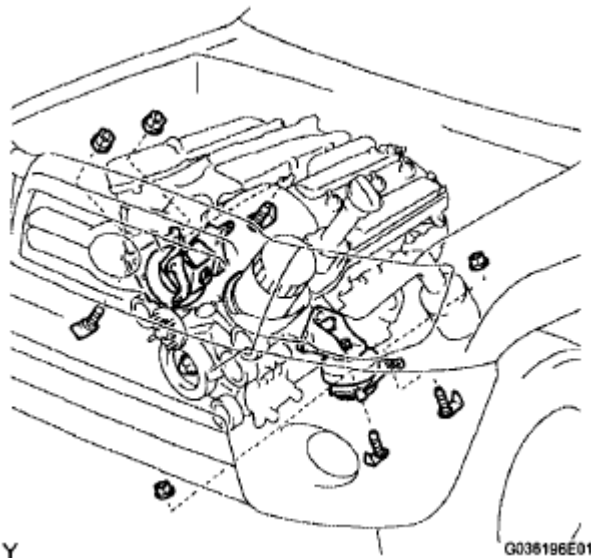


**Fig. 371: Locating Engine Hangers Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Remove the 4 bolts and 4 nuts, and separate the engine mounting brackets from the frame brackets.  
d. Lift the engine out of the vehicle carefully.

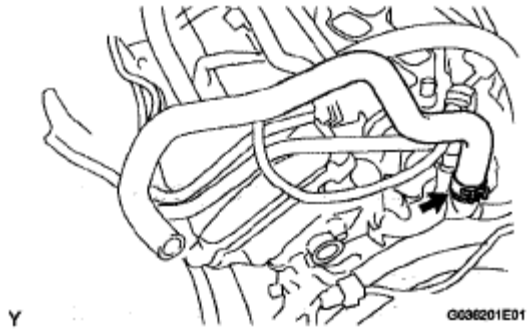
**NOTE:**        **Make sure that the engine is clear of all wiring and hoses.**

- e. Place the engine onto a working bench.



**Fig. 372: Identifying Engine Mounting Brackets And Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

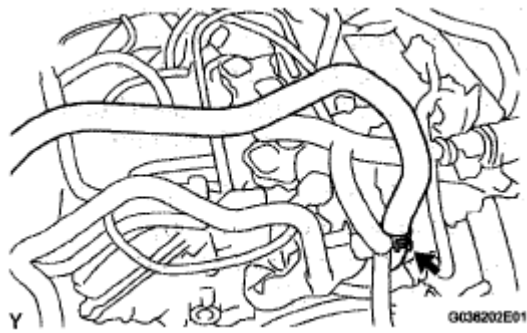
25. **REMOVE FLYWHEEL SUB-ASSEMBLY (for Manual Transmission) (See REMOVAL )**
26. **REMOVE DRIVE PLATE & RING GEAR SUB-ASSEMBLY (for Automatic Transmission) (See REMOVAL )**
27. **REMOVE HEATER WATER INLET HOSE**



**Fig. 373: Locating Heater Water Inlet Hose**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

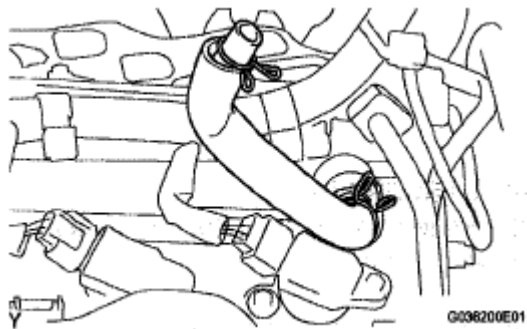
28. **REMOVE HEATER WATER OUTLET HOSE**



**Fig. 374: Locating Heater Water Outlet Hose**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

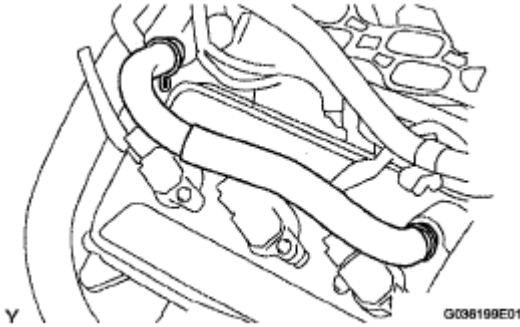
29. **REMOVE VENTILATION HOSE**



**Fig. 375: Locating Ventilation Hose**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

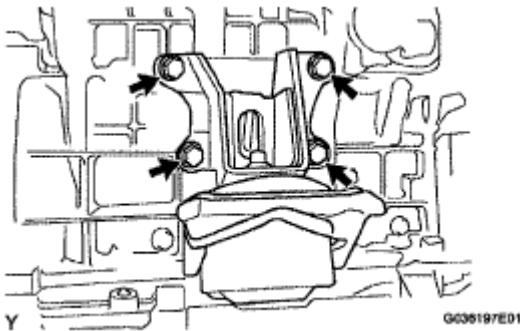
30. **REMOVE NO.2 VENTILATION HOSE**
31. **REMOVE EXHAUST MANIFOLD SUB-ASSEMBLY RH**
  - a. Remove the 6 nuts, exhaust manifold and gasket.
32. **REMOVE EXHAUST MANIFOLD SUB-ASSEMBLY LH**
  - a. Remove the 6 nuts, exhaust manifold and gasket.



**Fig. 376: Locating No.2 Ventilation Hose**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

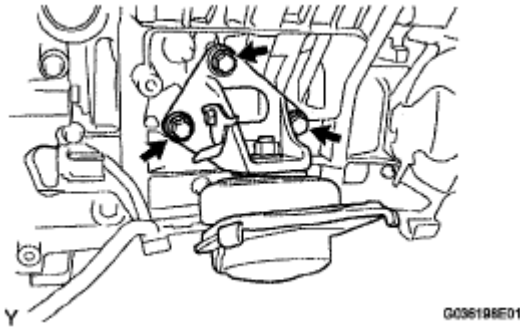
33. **REMOVE FRONT NO.1 ENGINE MOUNTING BRACKET RH**
  - a. Remove the 4 bolts, then remove the engine mounting bracket RH.



**Fig. 377: Locating Engine Mounting Bracket Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

34. **REMOVE FRONT NO.1 ENGINE MOUNTING BRACKET LH**
  - a. Remove the 3 bolts, then remove the engine mounting bracket LH.
35. **REMOVE NO.2 IDLER PULLEY SUB-ASSEMBLY**
  - a. Remove the 2 bolts, then remove the 2 idler pulleys.
36. **REMOVE NO.1 IDLER PULLEY SUB-ASSEMBLY**
  - a. Remove the bolt, then remove the idler pulley.



**Fig. 378: Locating Front No.1 Engine Mounting Bracket Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

37. **REMOVE V-RIBBED BELT TENSIONER ASSEMBLY** (See REMOVAL )
38. **REMOVE WATER INLET** (See THERMOSTAT )
39. **REMOVE OIL FILTER BRACKET SUB-ASSEMBLY**
  - a. Remove the 3 bolts and 2 nuts, then remove the oil filter bracket and gasket.
40. **REMOVE INTAKE MANIFOLD** (See REMOVAL )
41. **REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY** (See CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY )
42. **REMOVE WATER BY-PASS JOINT RR** (See REMOVAL )
43. **REMOVE OIL FILTER CAP SUB-ASSEMBLY**
44. **REMOVE OIL FILLER CAP HOUSING**
  - a. Remove the 2 nuts, oil filler cap housing and gasket.
45. **REMOVE IGNITION COIL ASSEMBLY** (See IGNITION COIL )
46. **REMOVE SPARK PLUG**
47. **REMOVE OIL LEVEL GAGE SUB-ASSEMBLY**

## INSPECTION

### 1. INSPECT INTAKE MANIFOLD FOR WARPAGE

- a. Using a precision straight edge and feeler gauge, measure the warpage of the contact surfaces of the cylinder head and intake air surge tank.

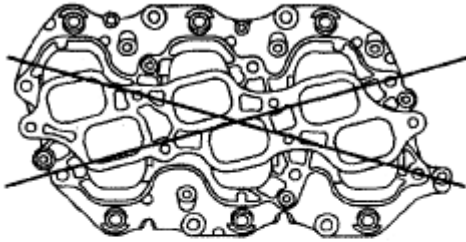
**Maximum warpage:**

**0.8 mm (0.031 in.) for Intake air surge tank side**

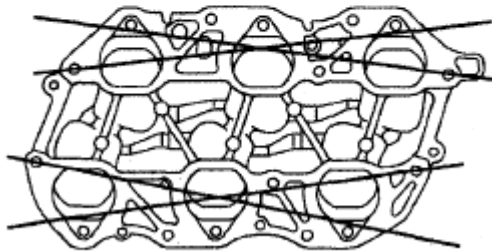
**0.2 mm (0.008 in.) for Cylinder head side**

If warpage is greater than the maximum, replace the intake manifold.

Intake Air Surge Tank Side



Cylinder Head Side



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A076807E02

**Fig. 379: Identifying Warpage Of Contact Surfaces Of Cylinder Head And Intake Air Surge Tank**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 2. INSPECT EXHAUST MANIFOLD FOR WARPAGE

- Using a precision straight edge and feeler gauge, measure the warpage of the top surface of the cylinder head.

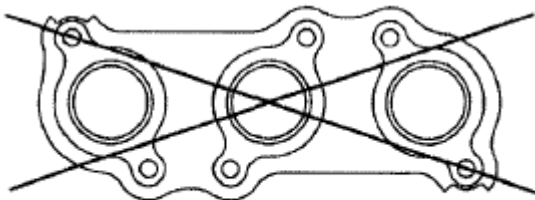
**Maximum warpage:**

**0.7 mm (0.028 in.)**

If warpage is greater than maximum, replace the exhaust manifold.

**HINT:**

Maximum warpage of each installation surface: 0.3 mm (0.012 in.)



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A076808E01

**Fig. 380: Inspecting Exhaust Manifold For Warpage**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**INSTALLATION**

1. **INSTALL OIL LEVEL GAGE SUB-ASSEMBLY**
2. **INSTALL SPARK PLUG**

**Torque: 20 N\*m (204 kgf\*cm, 15 ft.\*lbf)**

3. **INSTALL IGNITION COIL ASSEMBLY (See IGNITION COIL )**
4. **INSTALL OIL FILLER CAP HOUSING**

- a. Install a new gasket and oil filler cap housing with the 2 nuts.

**Torque: 9.0 N\*m (92 kgf\*cm, 80 in.\*lbf)**

5. **INSTALL OIL FILLER CAP SUB-ASSEMBLY**
6. **INSTALL WATER BY-PASS JOINT RR (See INSTALLATION )**
7. **INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (See INSPECTION )**
8. **INSTALL INTAKE MANIFOLD (See INSTALLATION )**
9. **INSTALL OIL FILTER BRACKET SUB-ASSEMBLY**
  - a. Install a new gasket and oil filler bracket with the 3 bolts and 2 nuts.
10. **INSTALL WATER INLET (See INSTALLATION )**
11. **INSTALL V-RIBBED BELT TENSIONER ASSEMBLY (See INSTALLATION )**
12. **INSTALL NO.1 IDLER PULLEY SUB-ASSEMBLY (See INSTALLATION )**
13. **INSTALL NO.2 IDLER PULLEY SUB-ASSEMBLY (See INSTALLATION )**
14. **INSTALL FRONT NO.1 ENGINE MOUNTING BRACKET LH**
  - a. Install the engine mounting bracket w/ engine mounting insulator with the 3 bolts.

**Torque: 43 N\*m (435 kgf\*cm, 31 ft.\*lbf)**

15. **INSTALL FRONT NO.1 ENGINE MOUNTING BRACKET RH**
  - a. Install the engine mounting bracket w/ engine mounting insulator with the 4 bolts.

**Torque: 43 N\*m (435 kgf\*cm, 31 ft.\*lbf)**

16. **INSTALL EXHAUST MANIFOLD SUB-ASSEMBLY LH (See INSTALLATION )**
17. **INSTALL EXHAUST MANIFOLD SUB-ASSEMBLY RH (See INSTALLATION )**
18. **INSTALL NO.2 VENTILATION HOSE**
19. **INSTALL VENTILATION HOSE**
20. **INSTALL HEATER WATER INLET HOSE**
21. **INSTALL HEATER WATER OUTLET HOSE**

22. **INSTALL FLYWHEEL SUB-ASSEMBLY (for Manual Transmission)** (See INSTALLATION )
23. **INSTALL DRIVE PLATE & RING GEAR SUB-ASSEMBLY (for Automatic Transmission)** (See INSTALLATION )
24. **INSTALL ENGINE ASSEMBLY**
- Attach the engine sling device and hang the engine with the chain block.
  - Lower the engine into the engine compartment carefully.
  - Attach the engine mounting brackets to the frame brackets.
  - Install the engine mounting brackets onto the frame brackets with the 4 bolts and 4 nuts.

**Torque: 38 N\*m (387 kgf\*cm, 28 ft.\*lbf)**

- Remove the 4 bolts and 2 engine hangers.
25. **INSTALL NO.2 ENGINE WIRE**
- Install the ground cable to the cylinder block.

**Torque: 13 N\*m (133 kgf\*cm, 9 ft.\*lbf)**

26. **INSTALL ENGINE WIRE**
- Connect the 3 connectors to the engine room relay box.
  - Install the nut, then install the engine wire into the engine room relay block.
  - Connect the front differential connector (4WD only).
  - Insert the engine wire into the vehicle room, and install the grommet.
  - Connect the 2 connectors to the four wheel ECU (4WD only).
  - Connect the 5 connectors to the ECM.
  - Install the instrument panel finish panel sub-assembly lower RH.
  - Install the glove compartment door.
27. **INSTALL INTAKE AIR SURGE TANK** (See INSTALLATION )
28. **CONNECT HEATER WATER INLET HOSE**
29. **CONNECT HEATER WATER OUTLET HOSE**
30. **CONNECT NO.2 FUEL PIPE SUB-ASSEMBLY**
31. **CONNECT NO.1 FUEL PIPE SUB-ASSEMBLY** (See INSTALLATION )
32. **INSTALL COOLER COMPRESSOR ASSEMBLY** (See INSTALLATION )
33. **INSTALL GENERATOR ASSEMBLY** (See INSTALLATION )
34. **INSTALL VANE PUMP ASSEMBLY** (See INSTALLATION )
35. **INSTALL FAN PULLEY**
36. **INSTALL CLUTCH DISC ASSEMBLY (for Manual Transmission)**

**TRANSMISSION REFERENCE**

| Transmission | Refer to            |
|--------------|---------------------|
| RA60         | <u>INSTALLATION</u> |

**RA60F INSTALLATION****37. INSTALL CLUTCH COVER ASSEMBLY (for Manual Transmission)****TRANSMISSION REFERENCE**

| <b>Transmission</b> | <b>Refer to</b>            |
|---------------------|----------------------------|
| RA60                | <b><u>INSTALLATION</u></b> |
| RA60F               | <b><u>INSTALLATION</u></b> |

**38. INSTALL TRANSMISSION ASSEMBLY**

HINT:

Refer to the table below when installing transmission.

**TRANSMISSION REFERENCE**

| <b>Transmission</b>    | <b>Drive Type</b> | <b>Refer to</b>            |
|------------------------|-------------------|----------------------------|
| Manual Transmission    | 2WD               | <b><u>INSTALLATION</u></b> |
| Manual Transmission    | 4WD               | <b><u>REMOVAL</u></b>      |
| Automatic Transmission | 2WD               | <b><u>INSTALLATION</u></b> |
| Automatic Transmission | 4WD               | <b><u>INSTALLATION</u></b> |

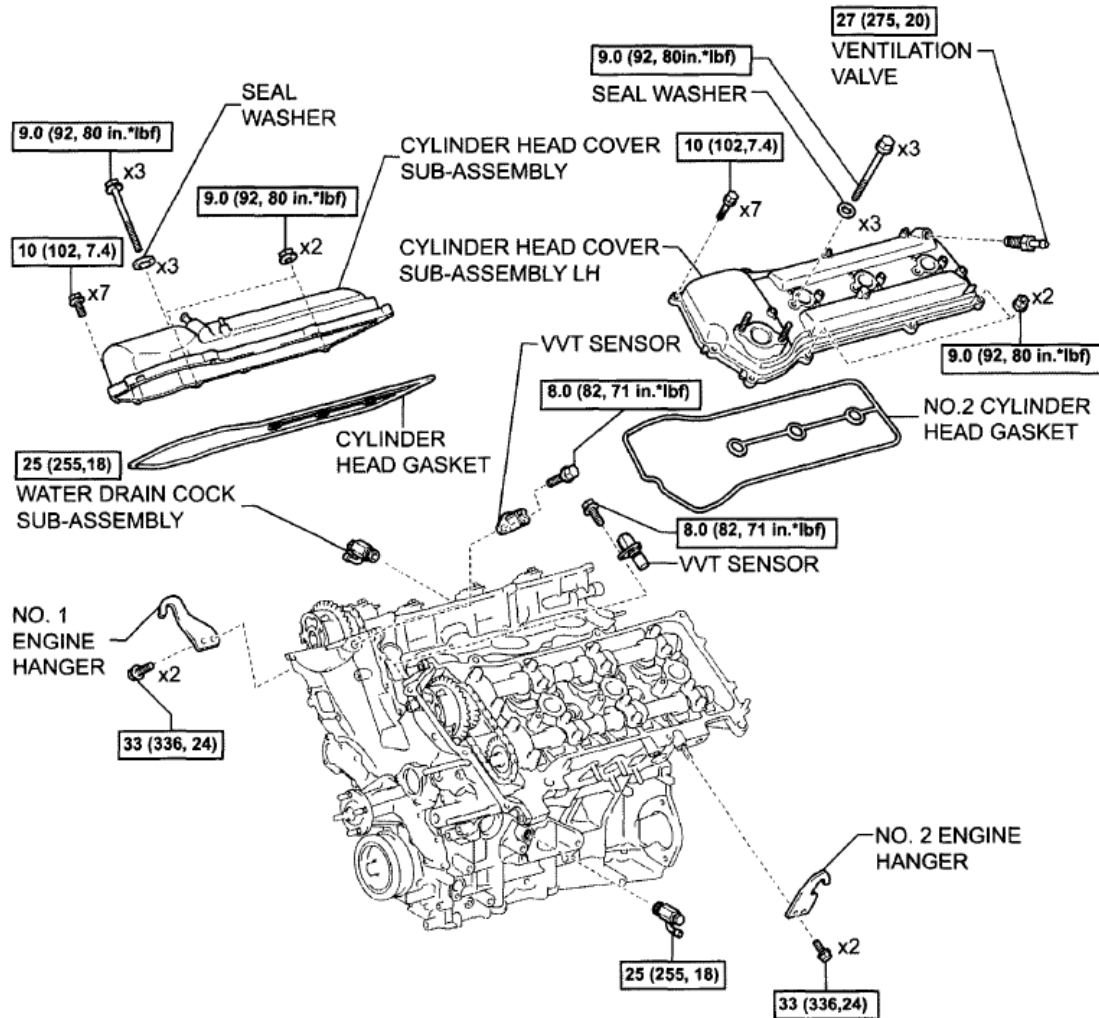
**39. INSTALL RADIATOR ASSEMBLY (See INSTALLATION )****40. INSTALL FAN SHROUD (See INSTALLATION )****41. INSTALL RADIATOR SUPPORT TO FRAME SEAL LH****42. INSTALL HOOD SUB-ASSEMBLY**

(See REASSEMBLY )

**43. INSTALL BATTERY****44. ADD ENGINE COOLANT (See COOLANT )****45. ADD ENGINE OIL (See INSTALLATION )****46. PERFORM INITIALIZATION****47. CHECK FOR ENGINE COOLANT LEAKAGE (See REPLACEMENT )****48. CHECK FOR ENGINE OIL LEAKAGE****49. CHECK FOR FUEL LEAKAGE****50. CHECK FOR EXHAUST GAS LEAKAGE****51. INSTALL V-BANK COVER (See INSPECTION )****52. INSPECT IGNITION TIMING (See ON-VEHICLE INSPECTION )****53. INSPECT ENGINE IDLING SPEED (See ON-VEHICLE INSPECTION )****54. INSPECT CO/HC (See ON-VEHICLE INSPECTION )**

## ENGINE UNIT

### COMPONENTS



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

● Non-reusable part

Y

A113608E01

**Fig. 381: Identifying Engine Unit Components With Torque Specification (1 Of 8)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

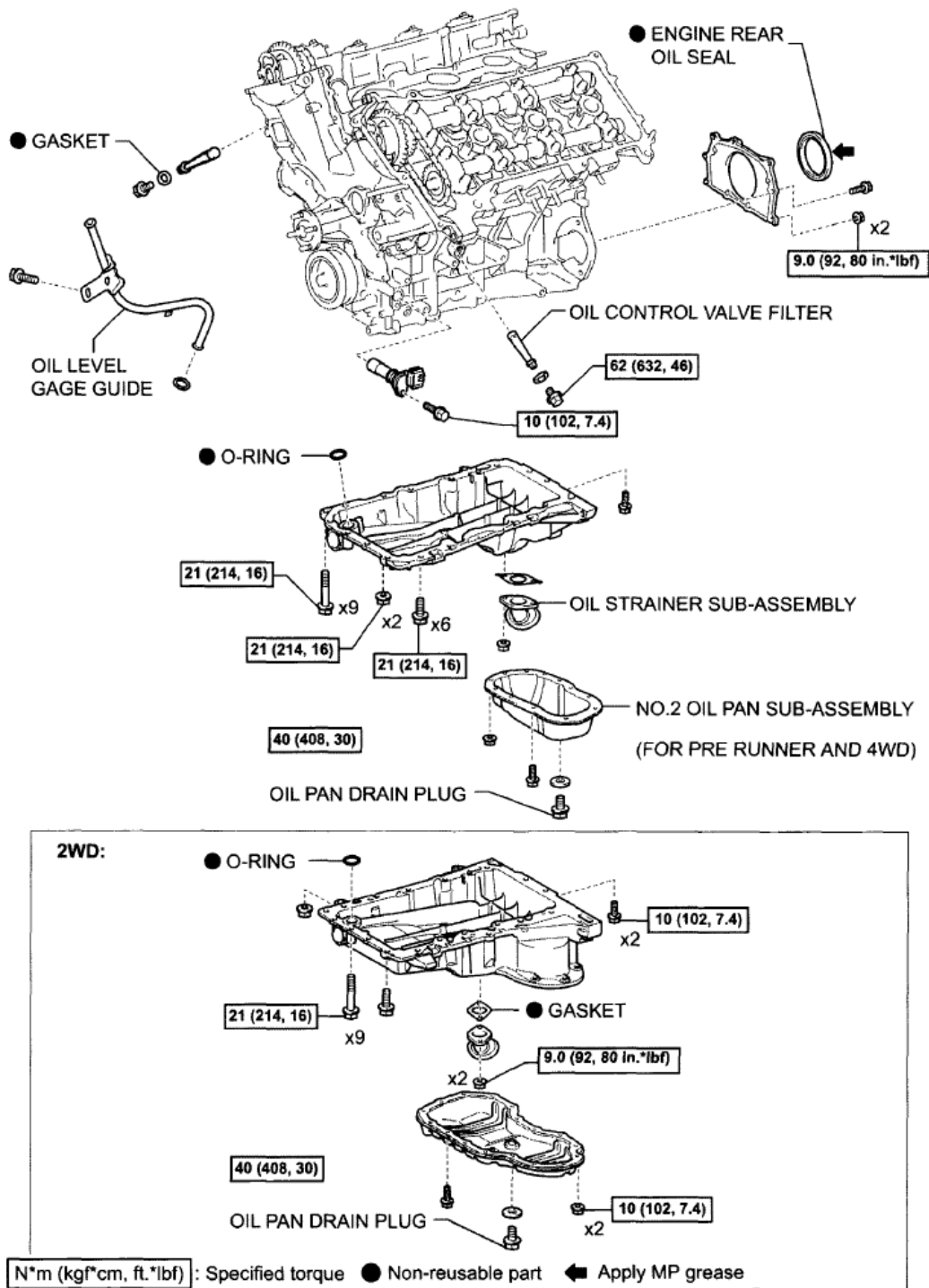
| 2009 Toyota Tacoma |
|--------------------|
|--------------------|

2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma



## 2009 Toyota Tacoma

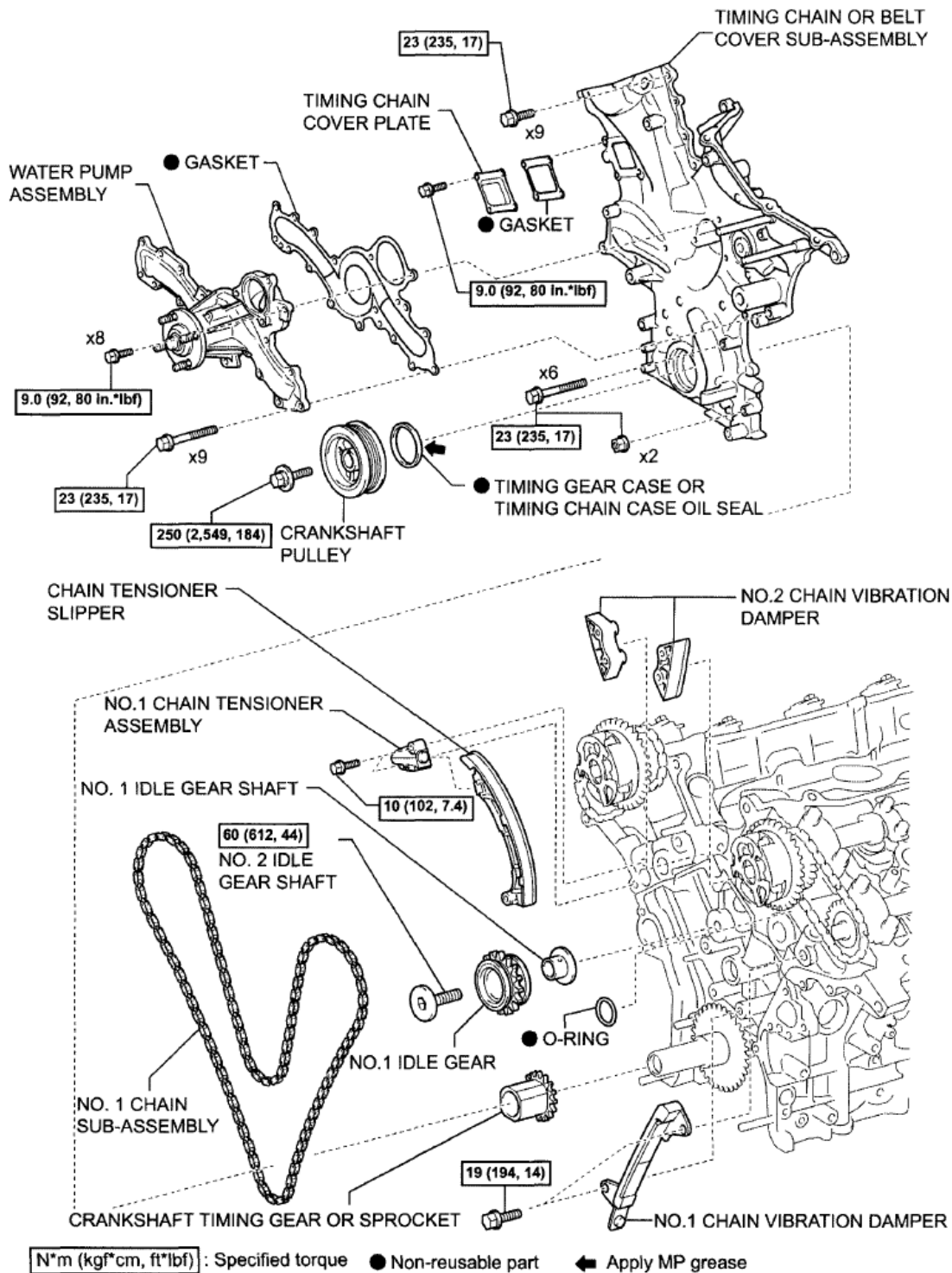
2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma



**Fig. 383: Identifying Engine Unit Components With Torque Specification (3 Of 8)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 2009 Toyota Tacoma

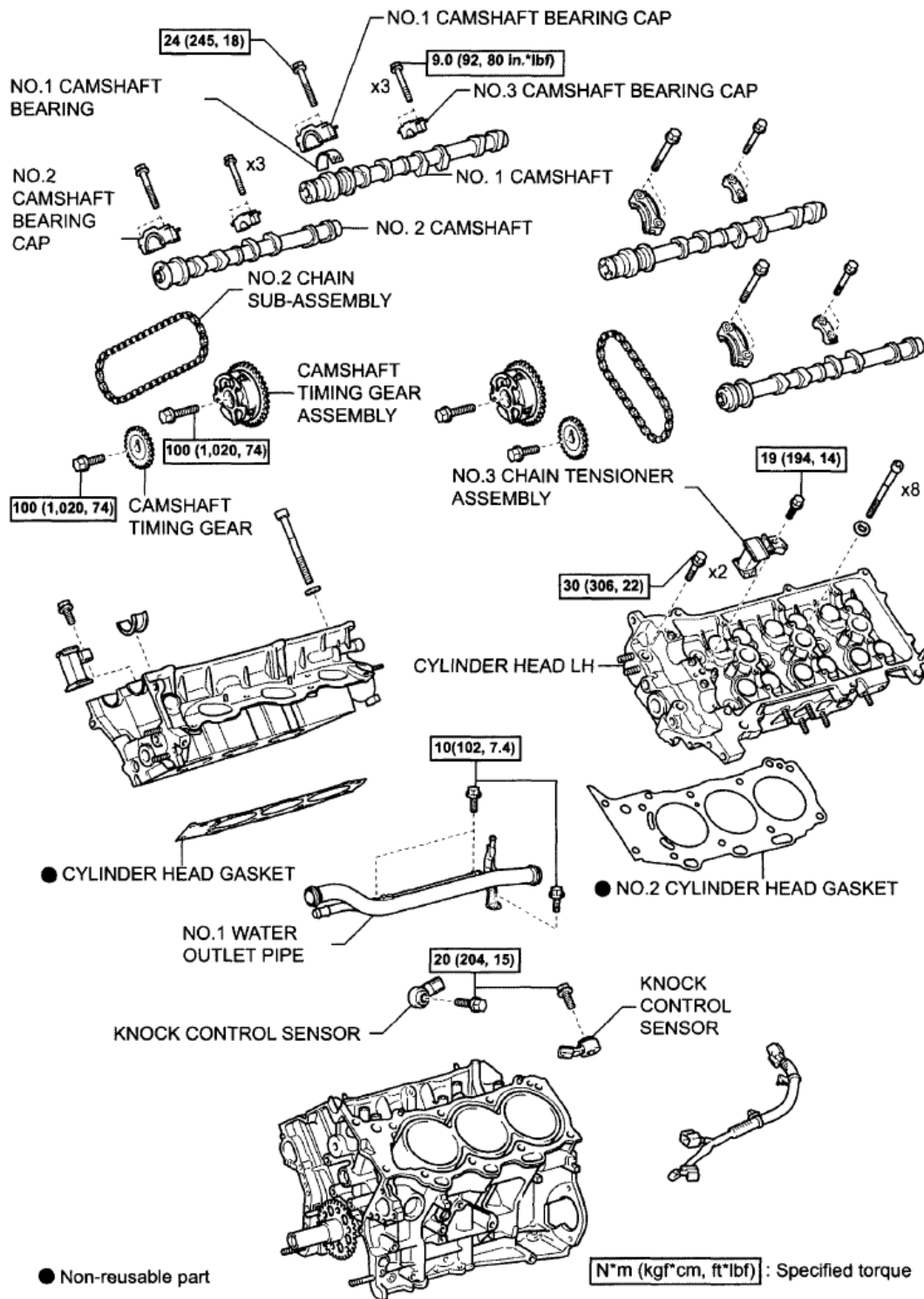
2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma



**Fig. 384: Identifying Engine Unit Components With Torque Specification (4 Of 8)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 2009 Toyota Tacoma

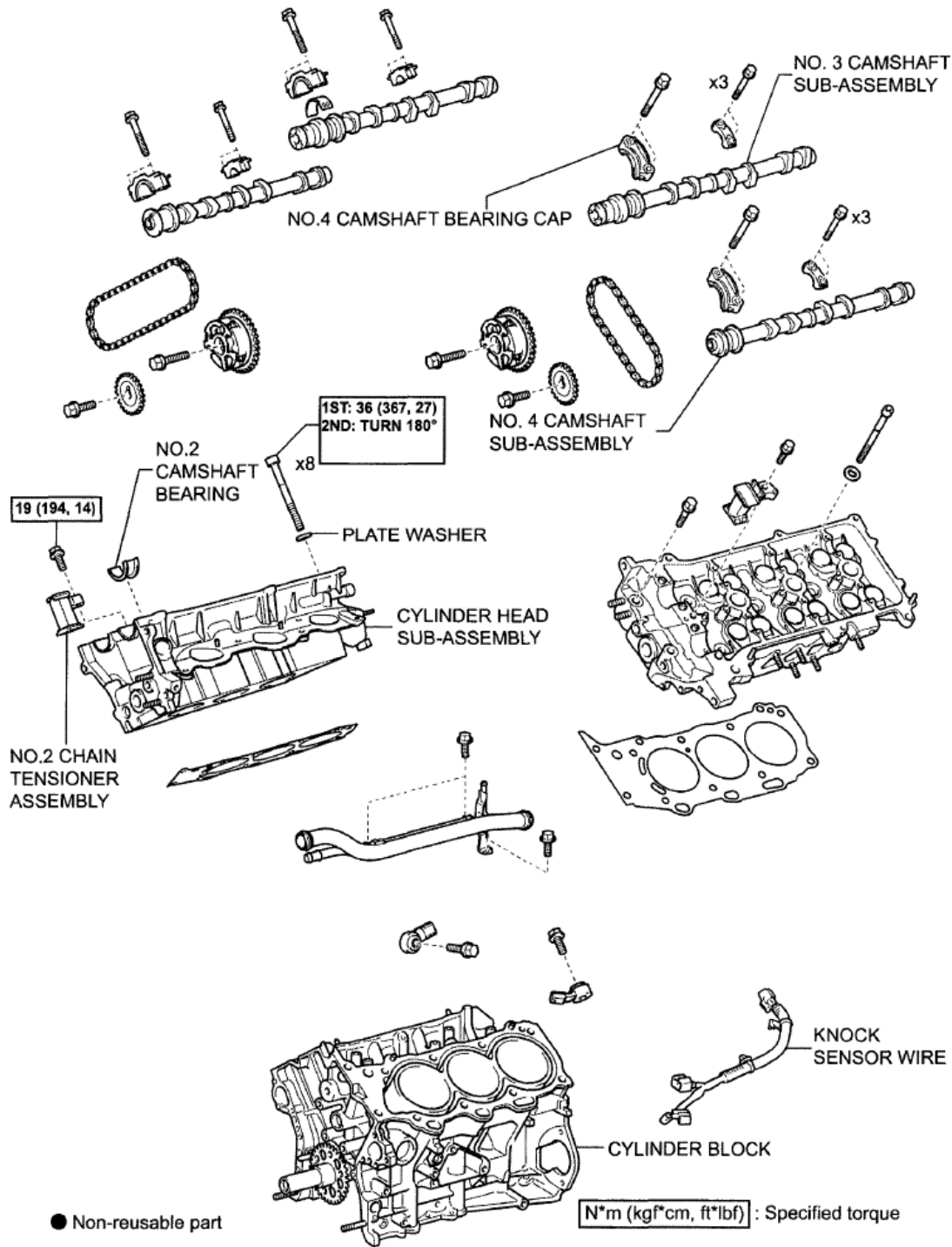
2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma



**Fig. 385: Identifying Engine Unit Components With Torque Specification (5 Of 8)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 2009 Toyota Tacoma

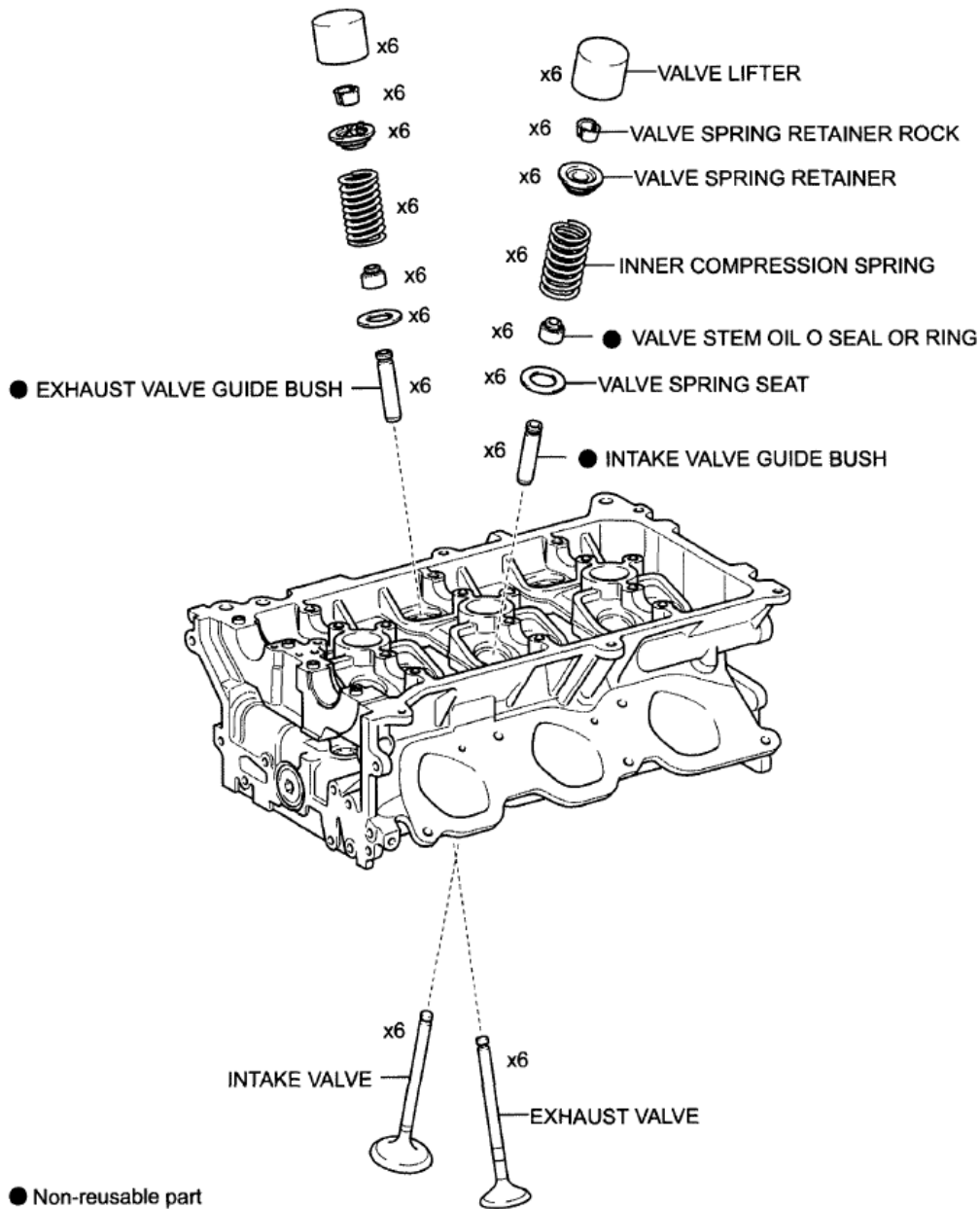
2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma



**Fig. 386: Identifying Engine Unit Components With Torque Specification (6 Of 8)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

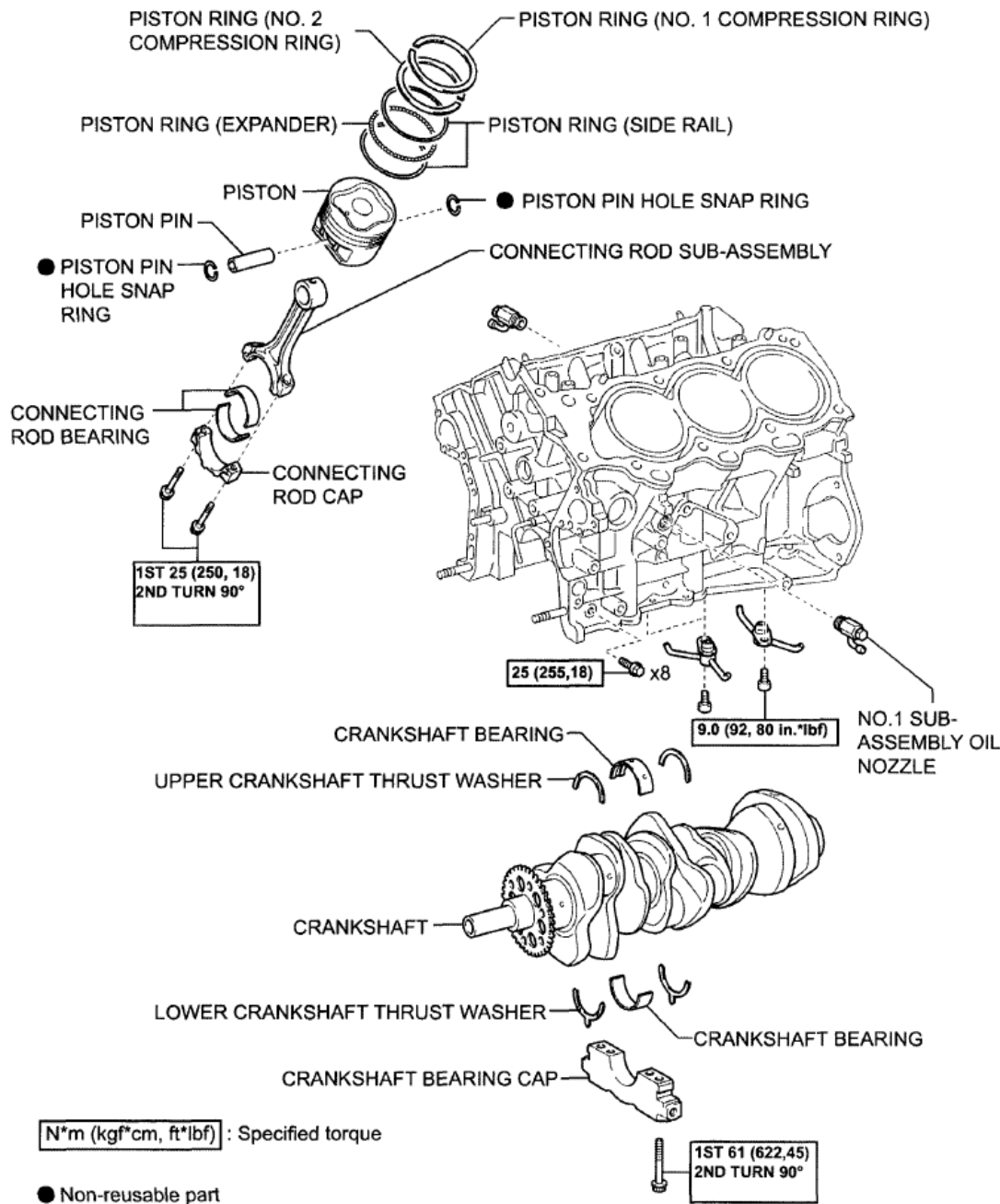
## 2009 Toyota Tacoma

2009 ENGINE Engine Mechanical (1GR-FE) - Tacoma



A113543E02

**Fig. 387: Identifying Engine Unit Components With Torque Specification (7 Of 8)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 388: Identifying Engine Unit Components With Torque Specification (8 Of 8)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## DISASSEMBLY

### HINT:

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

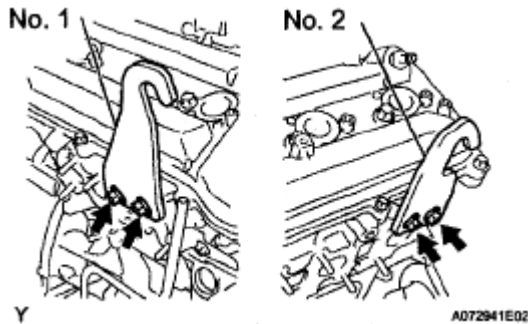
- Replace all gaskets, O-rings and oil seals with new parts.

**1. REMOVE ENGINE HANGERS**

- a. Remove the 2 bolts and engine hanger No. 1.
- b. Remove the 2 bolts and engine hanger No. 2.

**2. REMOVE OIL LEVEL GAGE GUIDE**

- a. Remove the bolt, then pull out the oil level gauge guide.
- b. Remove the O-ring from the oil level gauge guide.



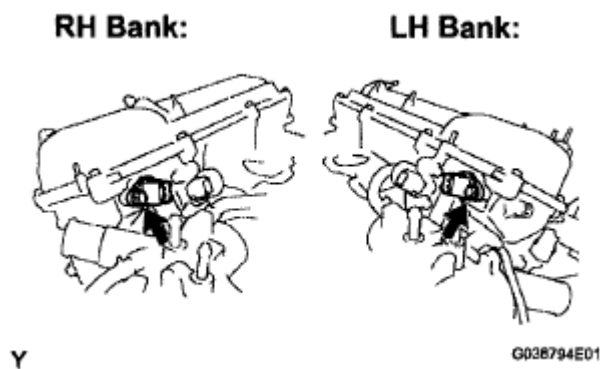
**Fig. 389: Locating Engine Hanger No. 1 Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**3. REMOVE CYLINDER BLOCK WATER DRAIN COCK SUB-ASSEMBLY**

- a. Remove the 2 water drain cocks.

**4. REMOVE VVT SENSOR**

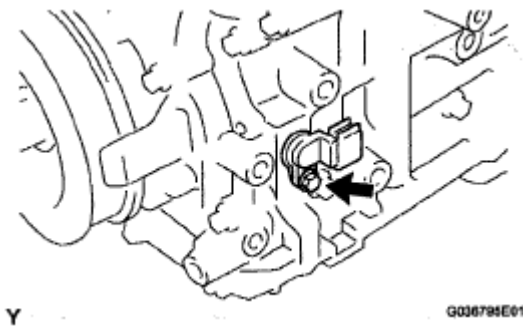
- a. Remove the 2 bolts, then remove the 2 VVT sensors.



**Fig. 390: Locating VVT Sensors Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**5. REMOVE CRANKSHAFT POSITION SENSOR**

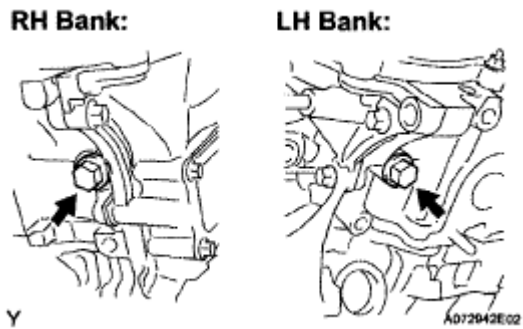
- a. Remove the bolt, then remove the crankshaft position sensor.



**Fig. 391: Locating Crankshaft Position Sensor Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 6. REMOVE OIL CONTROL VALVE FILTER

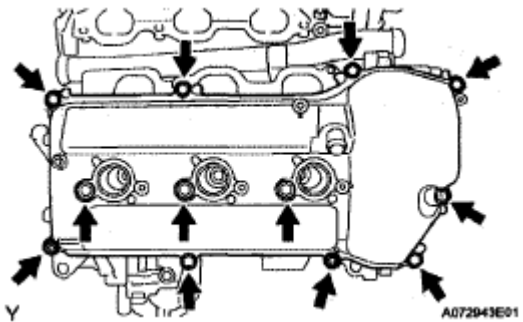
- Remove the plug and filter, then remove the gasket from each cylinder head.



**Fig. 392: Locating Oil Control Valve Filter Plug**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 7. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY

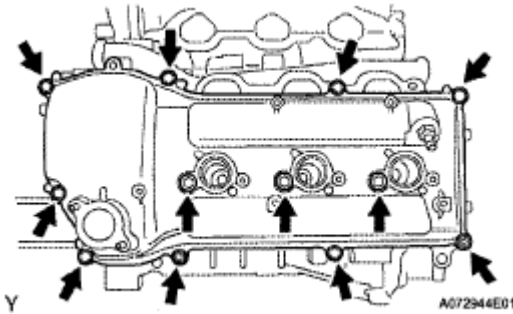
- Remove the 10 bolts, 3 seal washers and 2 nuts, then remove the cylinder head cover.
- Remove the gasket from the cylinder head cover.



**Fig. 393: Locating Cylinder Head Cover Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 8. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY LH

- a. Remove the 10 bolts, 3 seal washers and 2 nuts, then remove the cylinder head cover.
- b. Remove the gasket from the cylinder head cover.
- c. Remove the ventilation valve from the cylinder head cover.

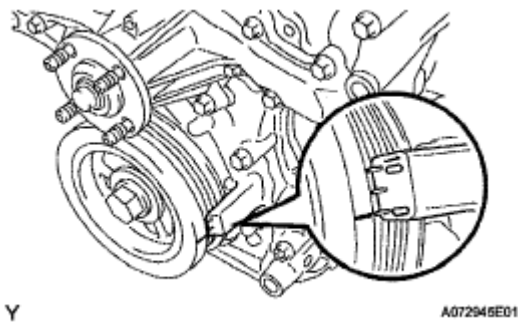


**Fig. 394: Locating Cylinder Head Cover Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 9. REMOVE CRANKSHAFT PULLEY

- a. Turn the crankshaft pulley until its groove and the timing mark "0" of the timing chain cover are aligned.

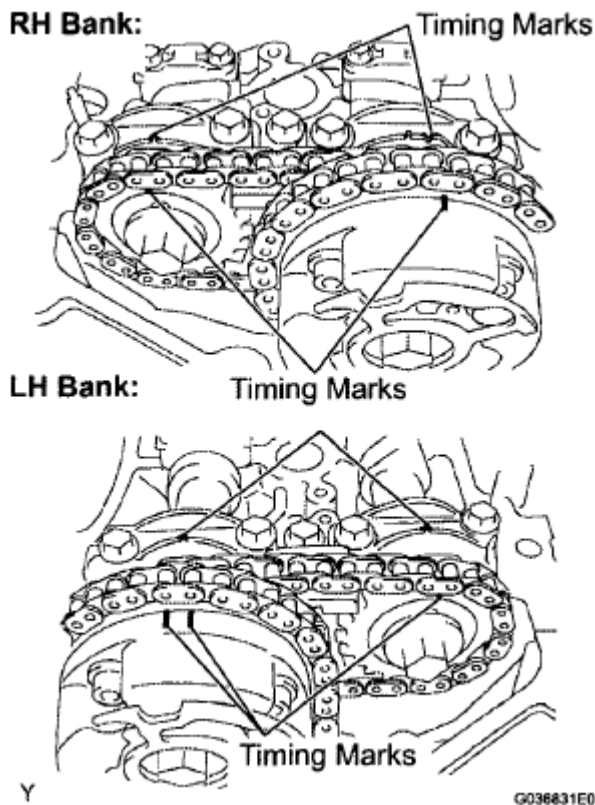


**Fig. 395: Identifying Timing Mark Of Timing Chain Cover**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Check that each timing mark of the camshaft timing gears is aligned with each timing mark located on the No. 1 and No. 2 bearing caps as shown in the illustration.

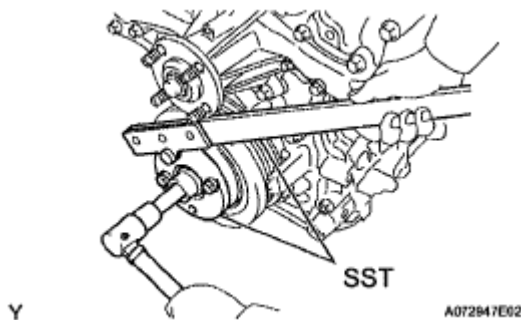
If not, turn the crankshaft 1 complete revolution (360°) and align the timing marks as above.



**Fig. 396: Identifying Timing Mark Of Camshaft Timing Gears**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using SST, fix the pulley and loosen the pulley bolt.

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



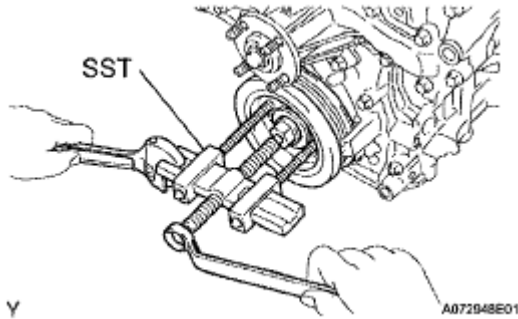
**Fig. 397: Loosening Pulley Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

**SST 09950-50013 (09951 -05010, 09952-05010, 09953-05020, 09954-05031)**

**10. REMOVE OIL PAN DRAIN PLUG**

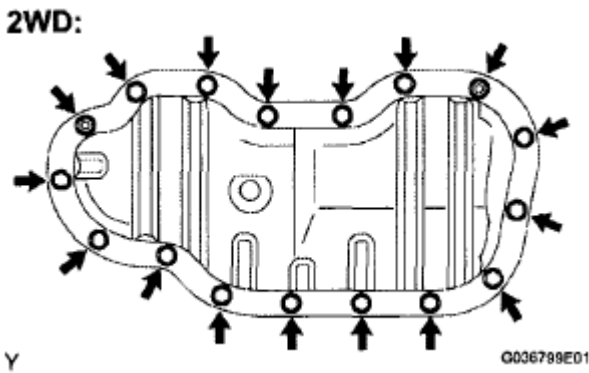
- a. Remove the drain plug and gasket.



**Fig. 398: Removing Crankshaft Pulley**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**11. REMOVE NO.2 OIL PAN SUB-ASSEMBLY**

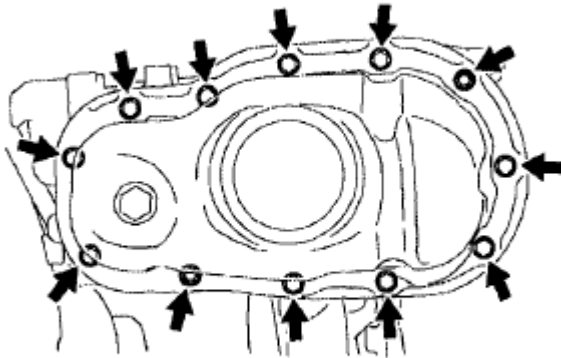
- a. Remove the 15 bolts and 2 nuts (for 2WD).



**Fig. 399: Locating No.2 Oil Pan Sub-Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the 10 bolts and 2 nuts (for Pre Runner and 4WD).

**Pre Runner and 4WD:**



A118006E01

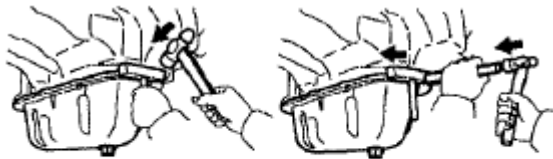
**Fig. 400: Locating Oil Pan Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Insert the blade of the oil pan seal cutter between the oil pan and oil pan No. 2, then cut off applied sealer and remove the oil pan No. 2.

**NOTE:**

- Be careful not to damage the contact surface of the oil pan and oil pan No. 2.
- Be careful not to damage the oil pan No. 2 flange.



Y

A072950E03

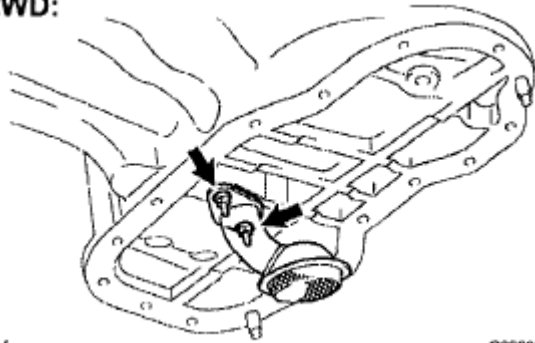
**Fig. 401: Removing Oil Pan No. 2**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

2WD:



Y

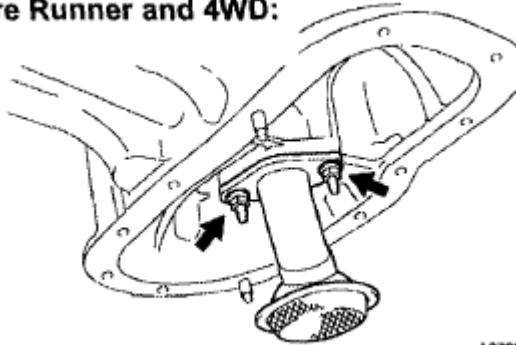
G036832E01

**Fig. 402: Locating Oil Strainer Nuts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the 2 nuts, then remove the oil strainer and gasket (for Pre Runner and 4WD).

Pre Runner and 4WD:



Y

A072951E02

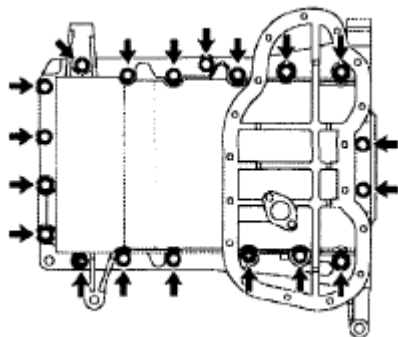
**Fig. 403: Locating Oil Strainer Nuts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### 13. REMOVE OIL PAN SUB-ASSEMBLY

- a. Remove the 17 bolts and 2 nuts (for 2WD).

2WD:



Y

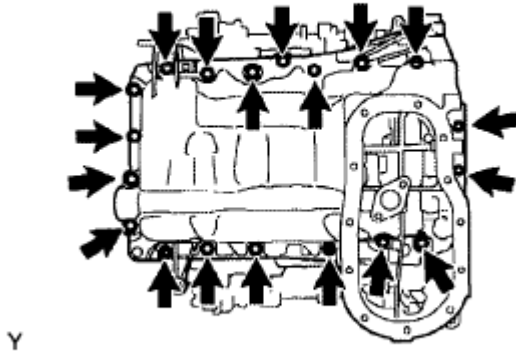
G036799E02

**Fig. 404: Locating Oil Pan Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the 17 bolts and 2 nuts (for Pre Runner and 4WD).

**Pre Runner and 4WD:**



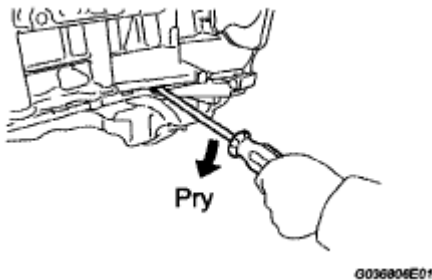
A122289E01

**Fig. 405: Locating Engine Unit Bolts And Nuts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using a screwdriver, remove the oil pan by prying between the oil pan and cylinder block in the sequence shown.

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

- d. Remove the O-ring from the oil pump.

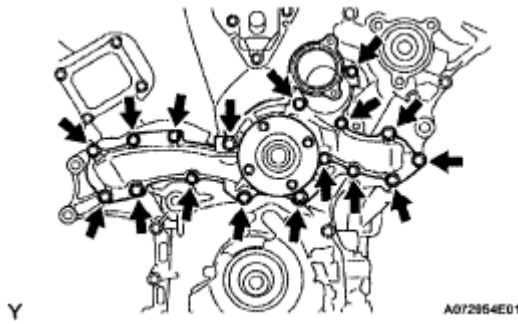


G036804E01

**Fig. 406: Prying Between Oil Pan And Cylinder Block**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### 14. REMOVE WATER PUMP ASSEMBLY

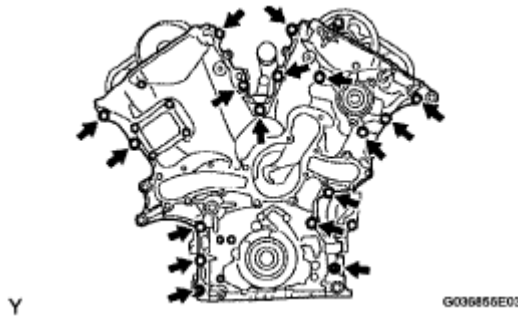
- a. Remove the 17 bolts, then remove the water pump and gasket.



**Fig. 407: Locating Water Pump Assembly Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**15. REMOVE TIMING CHAIN OR BELT COVER SUB-ASSEMBLY**

- a. Remove the 15 bolts and 2 nuts.



**Fig. 408: Locating Timing Chain Cover Bolts And Nuts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

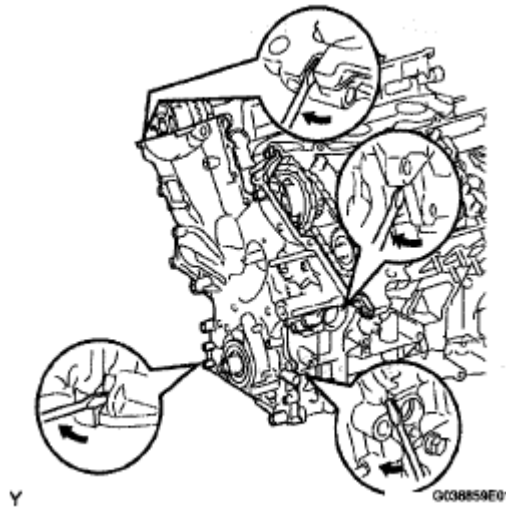
- b. Remove the timing chain cover by prying between the timing chain cover, cylinder head and cylinder block with a screwdriver.

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

- c. Remove the O-ring from the LH cylinder head.

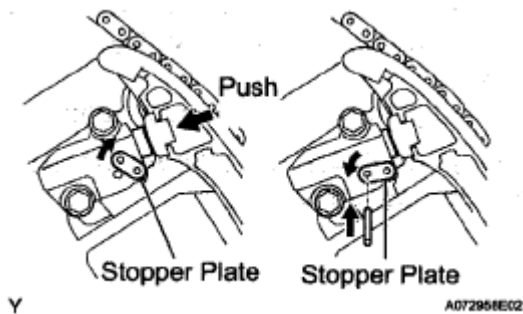
**16. REMOVE NO.1 CHAIN TENSIONER ASSEMBLY**

- NOTE:**
- Never rotate the crankshaft with the chain tensioner removed.
  - When rotating the camshaft with the timing chain removed, rotate the crankshaft counterclockwise 40° from the TDC first.



**Fig. 409: Removing Timing Chain Cover**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. While turning the stopper plate of the tensioner upward, push in the plunger of the chain tensioner as shown in the illustration.
- b. While turning the stopper plate of the tensioner downward, insert a bar of 3.5 mm (0.138 in.) into the holes in the stopper plate and tensioner to fix the stopper plate.
- c. Remove the 2 bolts, then remove the chain tensioner.

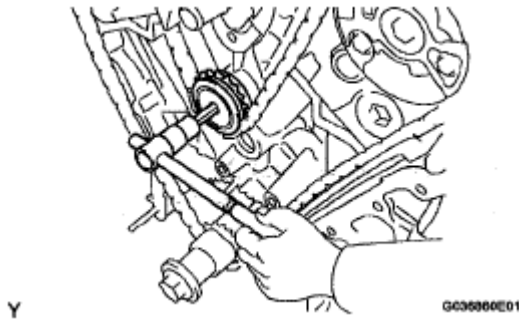


**Fig. 410: Pushing Plunger Of Chain Tensioner**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**17. REMOVE CHAIN TENSIONER SLIPPER**

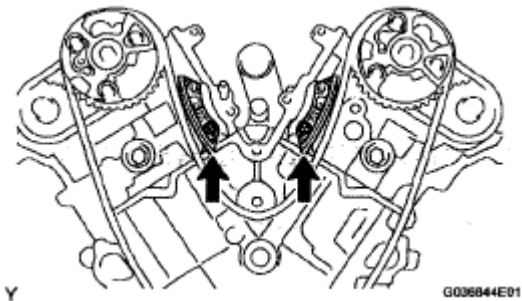
**18. REMOVE IDLE SPROCKET ASSEMBLY**

- a. Using a 10 mm hexagon wrench, remove the idle gear shaft No. 2, idle gear No. 1 and idle gear shaft No. 1.



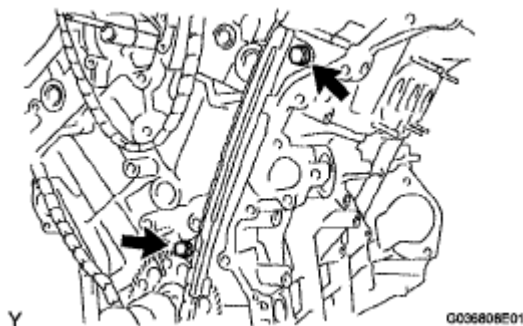
**Fig. 411: Removing Idle Sprocket Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

19. **REMOVE NO.2 CHAIN VIBRATION DAMPER**
  - a. Remove the 2 chain vibration dampers No. 2.
20. **REMOVE CHAIN SUB-ASSEMBLY**
21. **REMOVE CRANKSHAFT TIMING GEAR OR SPROCKET**



**Fig. 412: Locating Chain Vibration Dampers No. 2**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

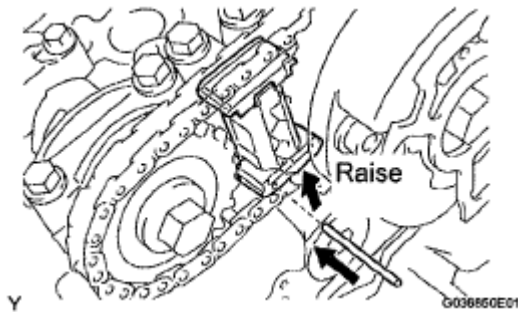
22. **REMOVE NO.1 CHAIN VIBRATION DAMPER**
  - a. Remove the 2 bolts, then remove the chain vibration damper No. 1.



**Fig. 413: Locating Chain Vibration Damper No. 1 And Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### 23. REMOVE CAMSHAFT TIMING GEARS AND NO.2 CHAIN (for Bank 1)

- a. While raising the chain tensioner No. 2 upward, insert a pin of 1.0 mm (0.039 in.) into the hole to fix it.



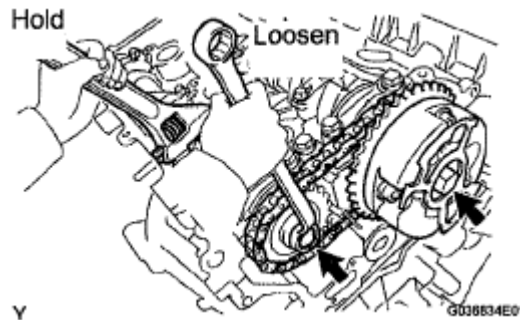
**Fig. 414: Raising Chain Tensioner No. 2**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Hold the hexagonal portion of the camshaft with a wrench, and remove the 2 bolts, camshaft timing gear, camshaft timing gear assembly and timing chain No. 2.

**NOTE:**

- Be careful not to damage the cylinder head and valve lifter with the wrench.
- Do not disassemble the camshaft timing gear assembly.

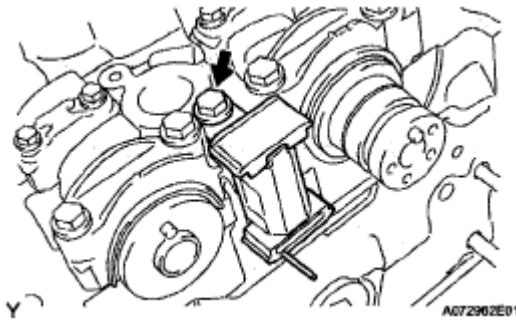


**Fig. 415: Removing Camshaft Timing Gear And Bolt**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### 24. REMOVE NO.2 CHAIN TENSIONER ASSEMBLY

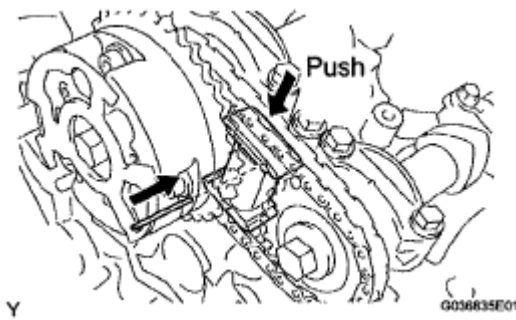
- a. Remove the bolt, then remove the chain tensioner No. 2.



**Fig. 416: Locating Chain Tensioner No. 2 With Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**25. REMOVE CAMSHAFT TIMING GEARS AND NO.2 CHAIN (for Bank 2)**

- a. While pushing down the chain tensioner No. 3, insert a pin of 1.0 mm (0.039 in.) into the hole to fix it.

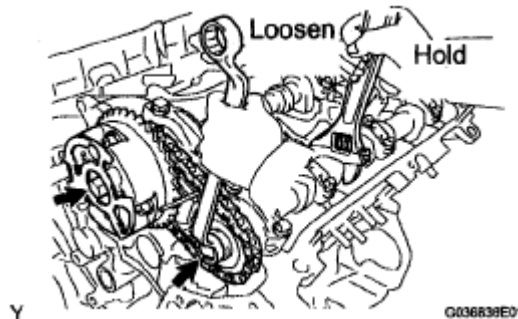


**Fig. 417: Pushing Chain Tensioner No. 3**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Hold the hexagonal portion of the camshaft with a wrench, and remove the 2 bolts, camshaft timing gear, camshaft timing gear assembly and timing chain No. 2.

**NOTE:**

- Be careful not to damage the cylinder head and valve lifter with the wrench.
- Do not disassemble the camshaft timing gear assembly.



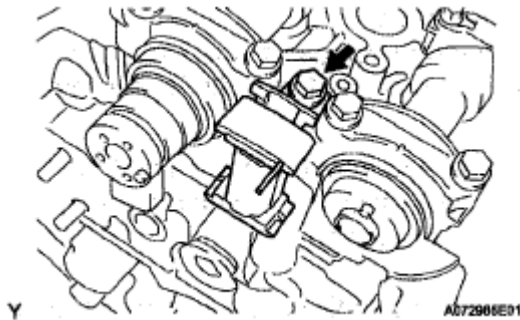
**Fig. 418: Removing Camshaft Timing Gear**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**26. REMOVE NO.3 CHAIN TENSIONER ASSEMBLY**

- a. Remove the bolt, then remove the chain tensioner No. 3.

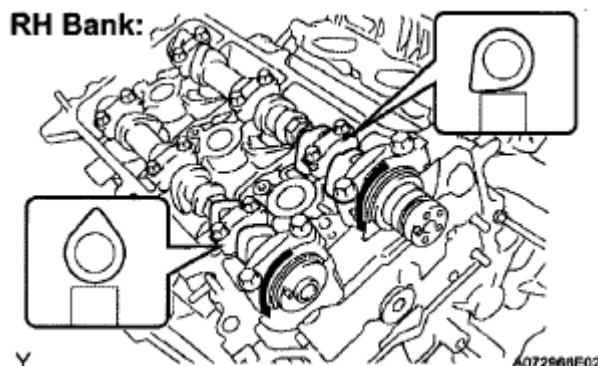
**27. REMOVE CAMSHAFTS**

**NOTE:** Keep the camshaft level while it is being removed. The camshaft thrust clearance is very small and failing to keep it level could crack or damage the cylinder head journal surface, which receives the thrust. This could subsequently lead the camshaft to seize or break. Perform the following steps to avoid such problems.



**Fig. 419: Locating Chain Tensioner No. 3 Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

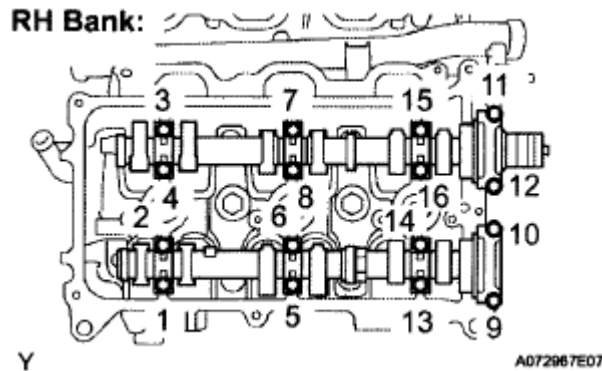
- a. Remove the camshafts of the RH bank.
  1. Rotate the camshafts counterclockwise using a wrench so that cam lobes of No. 1 cylinder face in the directions as shown in the illustration.



**Fig. 420: Rotating Camshafts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

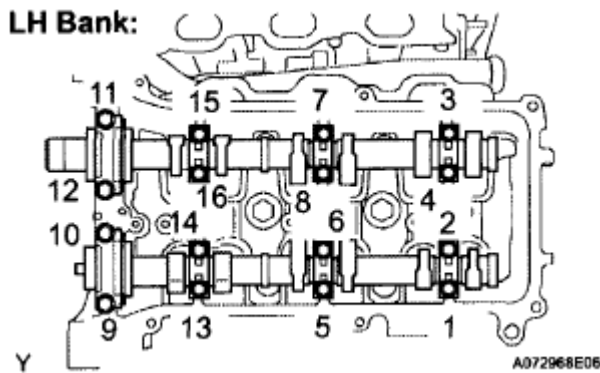
2. Using several steps, uniformly loosen and remove the 16 bearing cap bolts in the sequence shown in the illustration.

3. Remove the 8 bearing caps, then remove the 2 camshafts.



**Fig. 421: Identifying Bearing Cap Bolts Loosen Sequence**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

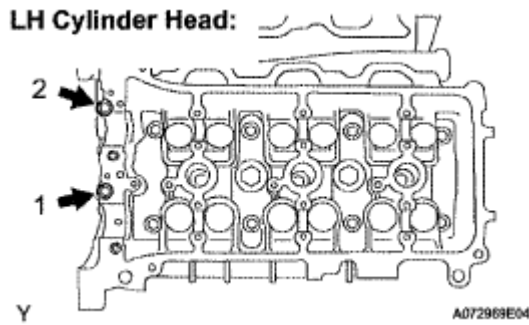
- b. Remove the camshafts of the LH bank.
  1. Using several steps, uniformly loosen and remove the 16 bearing cap bolts in the sequence shown in the illustration.
  2. Remove the 8 bearing caps, then remove the 2 camshafts.
- c. **REMOVE NO.1 CAMSHAFT BEARING**
- d. **REMOVE NO.2 CAMSHAFT BEARING**



**Fig. 422: Identifying Bearing Cap Bolts Loosen Sequence**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 28. REMOVE CYLINDER HEADS

- a. Using several steps, remove the 2 cylinder head bolts on the LH cylinder head in the sequence shown in the illustration.



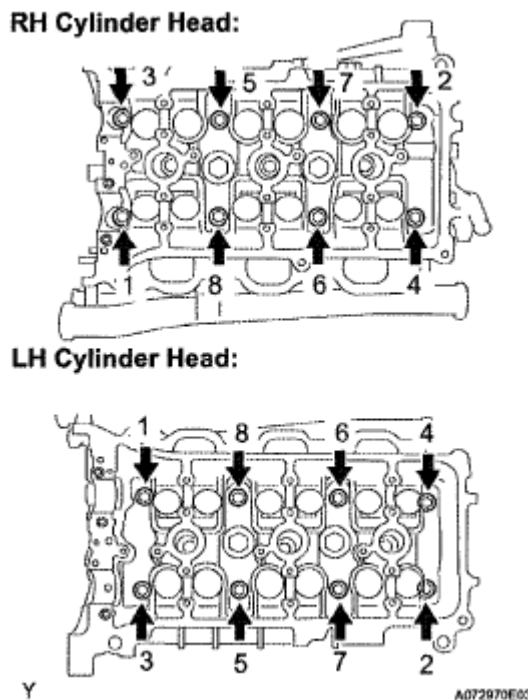
**Fig. 423: Locating Cylinder Head Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using several steps, loosen the 8 cylinder head bolts on each cylinder head with a 10 mm bi-hexagon wrench in the sequence shown in the illustration. Remove the 16 cylinder head bolts, then remove the plate washers.

**NOTE:**

- Be careful not to drop the plate washers into the cylinder head.
- Cylinder head warpage or cracking could result from removing the bolts in the wrong order.



**Fig. 424: Locating Cylinder Head Bolts Loosen Sequence**

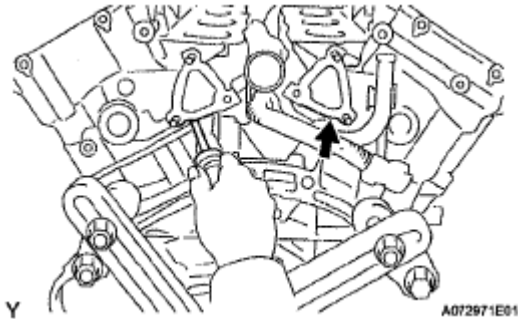
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

**HINT:**

If the cylinder head is difficult to remove, pry between the cylinder head and cylinder block with a screwdriver.



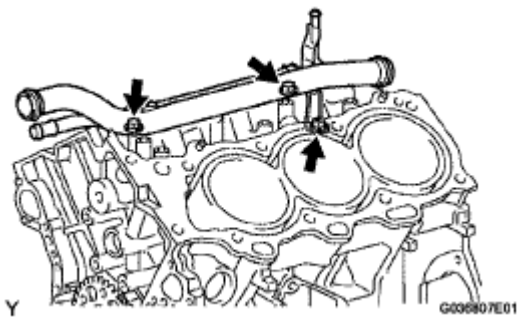
**Fig. 425: Lifting Cylinder Head**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Remove the RH and LH cylinder head gaskets.

**29. REMOVE NO.1 WATER OUTLET PIPE**

- a. Separate the knock sensor wire.
- b. Remove the 3 bolts, then remove the water outlet pipe.

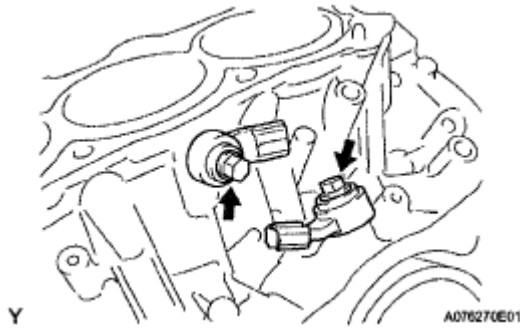


**Fig. 426: Locating Water Outlet Pipe Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**30. REMOVE KNOCK CONTROL SENSOR**

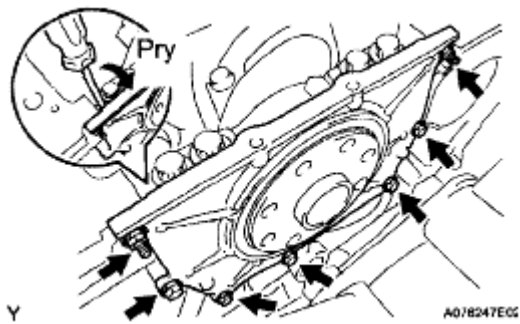
- a. Disconnect the knock sensor connectors.
- b. Remove the 2 bolts, then remove the 2 knock sensors.



**Fig. 427: Locating Knock Sensors Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### 31. REMOVE REAR ENGINE OIL SEAL RETAINER

- Remove the 5 bolts and 2 nuts.
- Using a screwdriver, remove the oil seal retainer by prying between the oil seal retainer and crankshaft bearing cap.

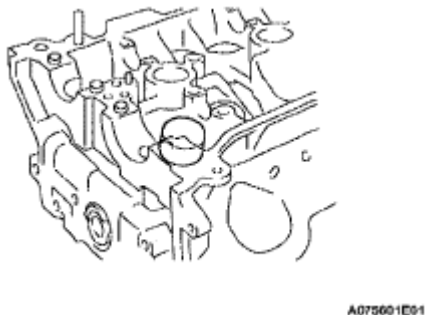


**Fig. 428: Locating Rear Engine Oil Seal Retainer Bolts And Nuts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### 32. REMOVE VALVE LIFTER

HINT:

Arrange the valve lifter in the correct order.



**Fig. 429: Identifying Valve Lifter**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**33. REMOVE VALVE**

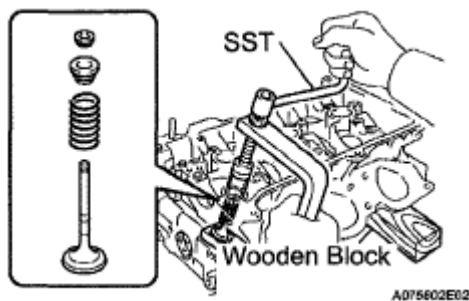
HINT:

Arrange the valves, inner compression springs, valve spring retainers and valve spring retainer rocks in the correct order.

- a. Place the cylinder head on a wooden block.
- b. Using SST, compress the inner compression spring and remove the 2 valve spring retainer rocks.

**SST 09202-70020 (09202-00010)**

- c. Remove the valve, inner compression spring and valve spring retainer.

**Fig. 430: Removing Valve**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**34. REMOVE VALVE SPRING SEAT**

- a. Using compressed air and a magnetic finger, remove the valve spring seat by blowing air.

**Fig. 431: Removing Valve Spring Seat**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**35. REMOVE VALVE STEM OIL O SEAL OR RING**

- a. Using needle-nose pliers, remove the valve stem oil seal.

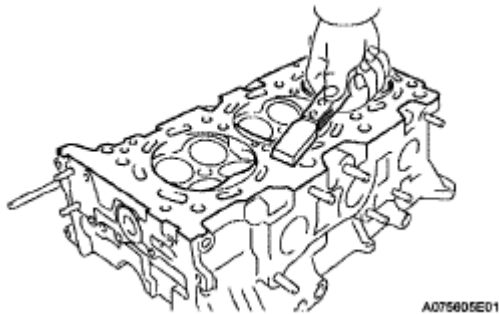


**Fig. 432: Removing Valve Stem Oil O Seal Or Ring**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### 36. CLEAN CYLINDER HEAD SUB-ASSEMBLY

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

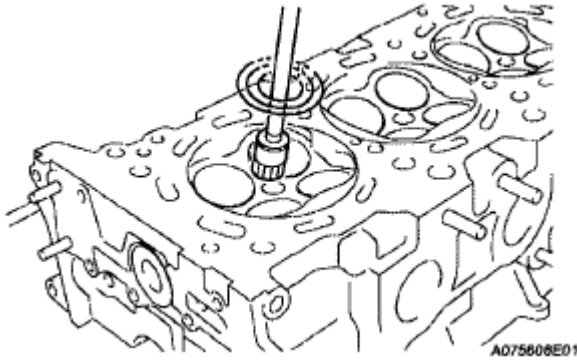
**NOTE:** Be careful not to scratch the cylinder block contact surface.



**Fig. 433: Cleaning Cylinder Head Sub-Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

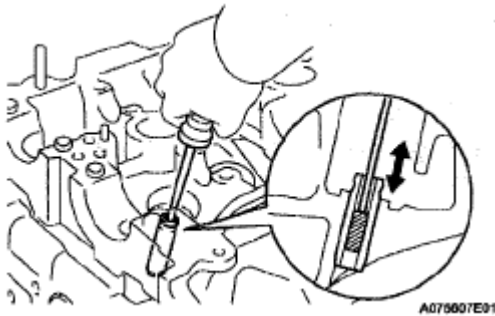
- b. Using a wire brush, remove all the carbon from the combustion chambers.

**NOTE:** Be careful not to scratch the combustion chambers.



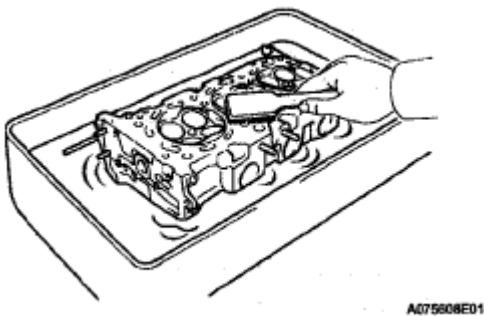
**Fig. 434: Removing Carbon From Combustion Chambers**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using a valve guide bushing brush and solvent, clean all the valve guide bushes.



**Fig. 435: Cleaning Valve Guide Bushes**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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



**Fig. 436: Cleaning Cylinder Head**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

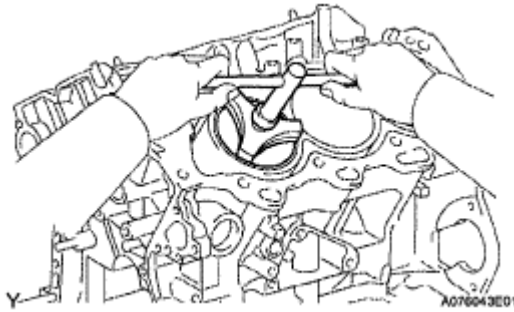
### **37. REMOVE WITH PISTON SUB-ASSEMBLY WITH CONNECTING ROD**

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

block.

HINT:

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

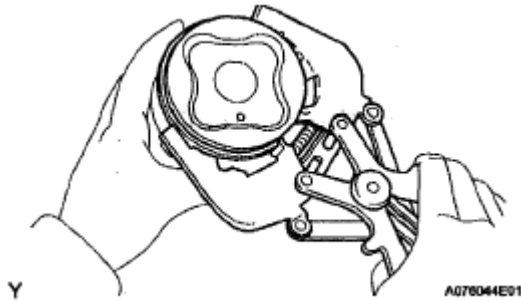


**Fig. 437: Removing Piston Sub-Assembly With Connecting Rod**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**38. REMOVE CONNECTING ROD BEARING**

**39. REMOVE PISTON RING SET**

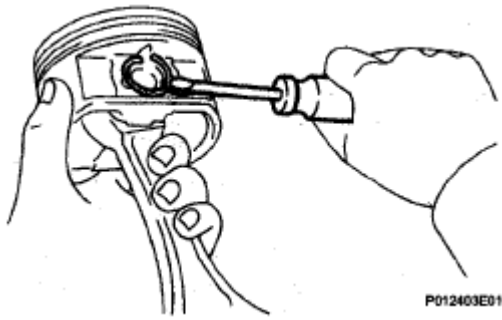
- Using a piston ring expander, remove the 2 compression rings.
- Remove the 2 side rails and oil ring by hand.



**Fig. 438: Removing Piston Ring Set**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**40. REMOVE HOLE SNAP RING**

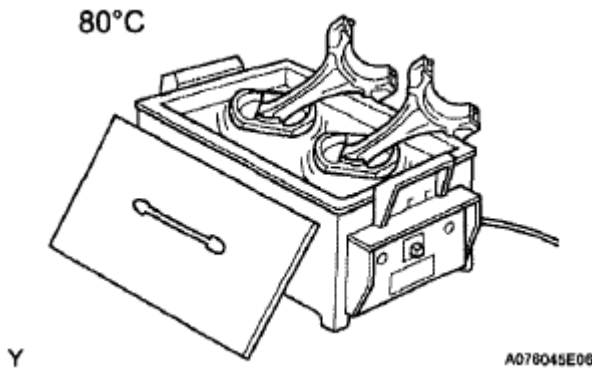
- Using a small screwdriver, pry out the 2 snap rings.

**Fig. 439: Removing Hole Snap Ring**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**41. REMOVE WITH PISTON SUB-ASSEMBLY**

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

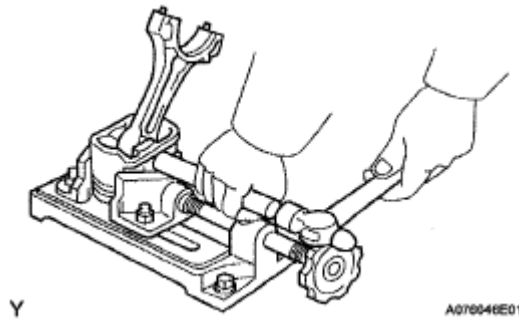
**Fig. 440: Heating Piston Sub-Assembly**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

**HINT:**

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



**Fig. 441: Tapping Piston Pin**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### 42. 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.)**

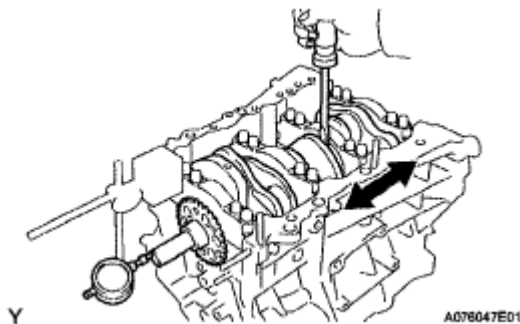
**Maximum thrust clearance:**

**0.30 mm (0.0118 in.)**

If the thrust clearance is greater than the maximum, replace the pair of the thrust washers or crankshaft.

**HINT:**

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



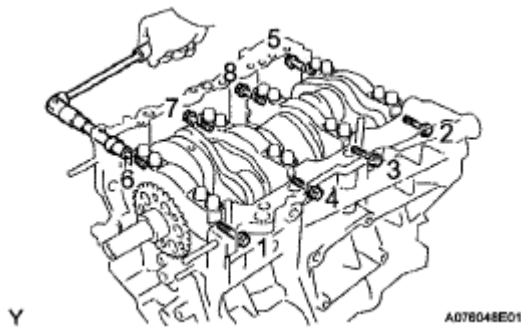
**Fig. 442: Inspecting Crankshaft Thrust Clearance**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### 43. REMOVE CRANKSHAFT

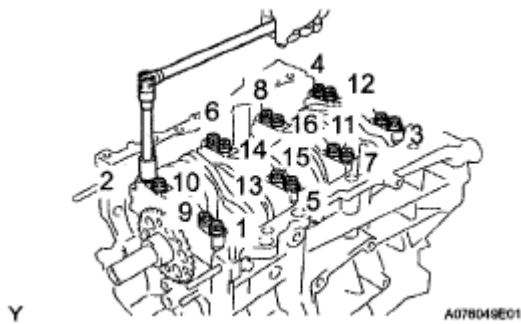
- a. Using several steps, uniformly loosen and remove the 8 main bearing cap bolts and seal washers in

the sequence shown in the illustration.



**Fig. 443: Identifying Main Bearing Cap Bolts Loosen Sequence**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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



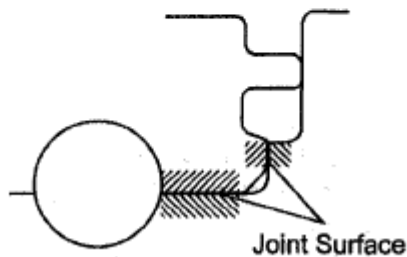
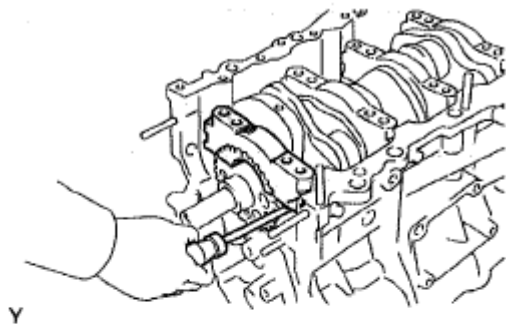
**Fig. 444: Identifying Main Bearing Cap Bolts Loosen Sequence**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

**NOTE:**

- Pull up the main bearing cap by turning it to the right and left little by little.
- Be careful not to damage the joint surfaces of the cylinder block and the main bearing cap.

44. REMOVE CRANKSHAFT THRUST WASHER SET
45. REMOVE CRANKSHAFT BEARING

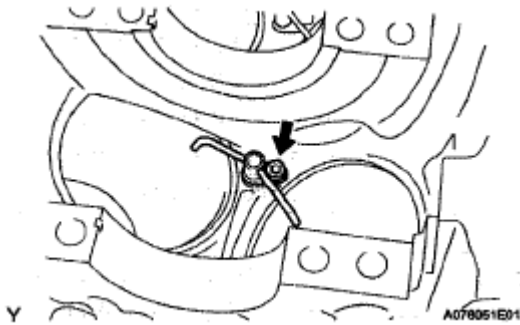


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**Fig. 445: Removing Main Bearing Caps And Lower Bearings**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**46. REMOVE NO.1 SUB-ASSEMBLY OIL NOZZLE**

- a. Using a 5 mm socket hexagon wrench, remove the 3 oil nozzles.

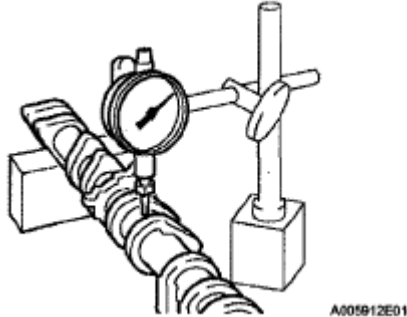


**Fig. 446: Locating Oil Nozzles**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**INSPECTION**

**1. INSPECT CAMSHAFTS**

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

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

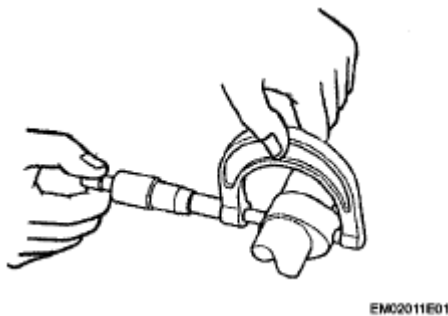
**Fig. 447: Inspecting Camshaft For Runout**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

**Standard cam lobe height:****Intake 44.168 to 44.268 mm (1.7389 to 1.7428 in.)****Exhaust 44.580 to 44.680 mm (1.7551 to 1.7591 in.)****Minimum cam lobe height:****Intake 44.018 mm (1.7330 in.)****Exhaust 44.430 mm (1.7492 in.)**

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



**Fig. 448: Inspecting Cam Lobes**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

**No. 1 journal diameter:**

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

**Other journal diameter:**

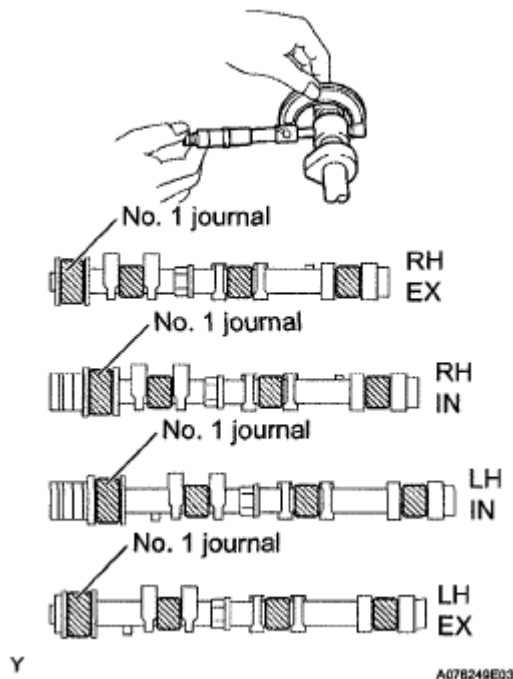
**22.959 to 22.975 mm (0.9039 to 0.9045 in.)**

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

## 2. INSPECT CAMSHAFT TIMING GEAR ASSEMBLY

- a. Fix the intake camshaft in a vise.

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

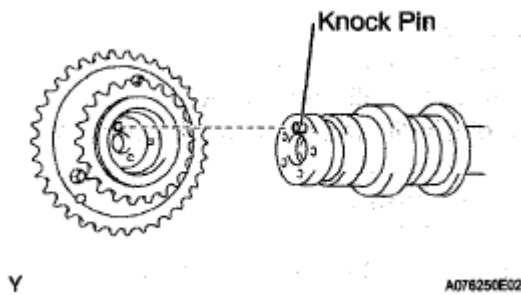


**Fig. 449: Inspecting Camshaft Timing Gear Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Align the knock pin hole in the camshaft timing gear assembly with the knock pin of the camshaft, and install the camshaft timing gear assembly with the bolt.

**Torque: 100 N\*m (1,020 kgf\*cm, 74 ft.\*lbf)**

- c. Confirm that the camshaft timing gear assembly is locked.



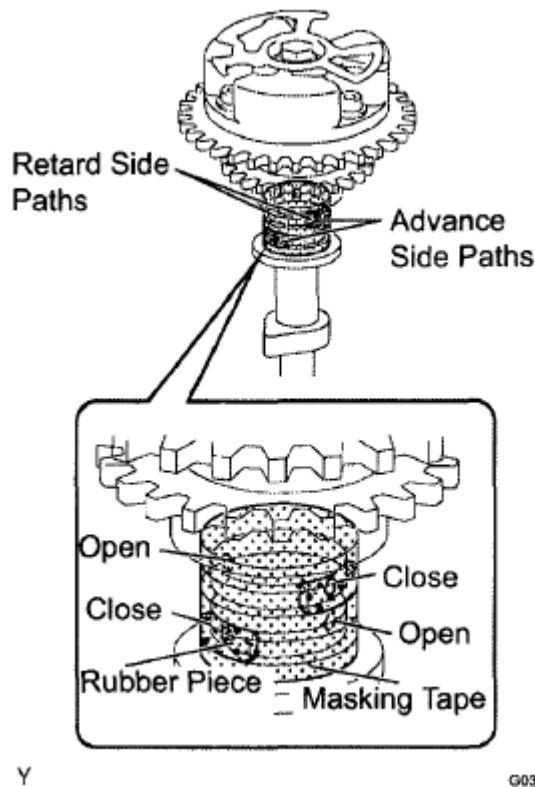
**Fig. 450: Aligning Knock Pin Hole In Camshaft Timing Gear Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Release that lock pin.
1. Cover 4 oil paths of cam journal with masking tape as shown in the illustration.

**HINT:**

One of the 2 grooves on the cam journal is for the retard side path (upper) and the other is for the advance side path (lower). Each groove has 2 oil paths. Plug one of the oil paths for each groove with a piece of rubber before wrapping the cam journal with tape.

2. Puncture the tape covering the advance oil path and retard oil path on the opposite side of the groove as shown in the illustration.

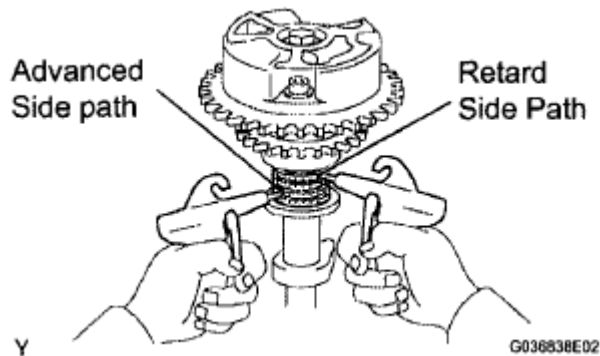


**Fig. 451: Releasing Lock Pin**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. Apply air pressure into two broken paths (the advance side path and the retard side path) of about 200 kPa (2.0 kgf/cm<sup>2</sup>).

**NOTE:** Cover the paths with a shop rag to avoid oil splashes.



**Fig. 452: Applying Air Pressure Into Broken Paths**

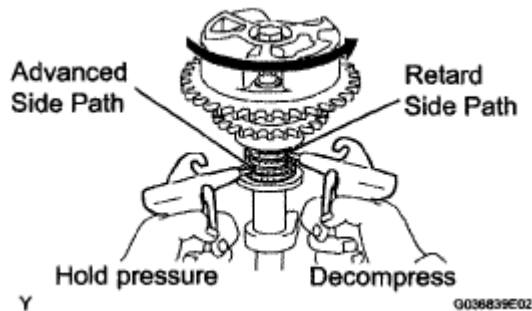
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. Confirm that the camshaft timing gear assembly rotates in the timing advance direction when reducing the air pressure on the timing retard path.

**HINT:**

When the lock pin is released, the camshaft timing gear rotates in the advance direction.

5. When the camshaft timing gear comes to the most advanced position, release the air pressure on the timing retard side path, and release that of the timing advance side path.



**Fig. 453: Applying Air Pressure On Timing Retard Path**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** Camshaft timing assembly gear occasionally shifts to the retard side abruptly if the air compression on the advanced side path is released first. This often causes the breakage of the lock pin.

- e. Check the smooth revolution.
  1. Rotate the camshaft timing gear several times within the movable range except for the most retarded position and check it rotates smoothly.

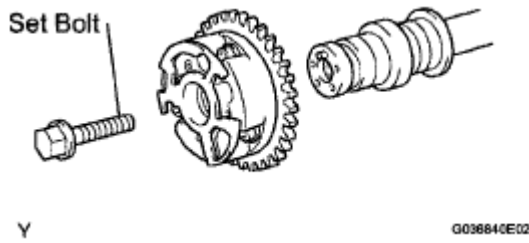
**Standard:**

Move smoothly in the range about 31°

**NOTE:** Be sure to perform this check by hand, instead of using air pressure.

- f. Check that the lock is in the most retarded position.
  1. Confirm that the camshaft timing gear assembly is locked in the most retarded position.
- g. Remove the set bolt, then remove the camshaft timing gear assembly.

**NOTE:** Be sure not to remove the other 3 bolts.

**Fig. 454: Identifying Set Bolt**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### 3. INSPECT CYLINDER HEAD SET BOLT

- a. Using vernier calipers, measure the outer diameter of the bolt thread.

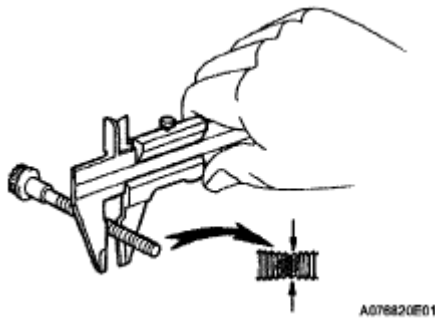
**Standard outer diameter:**

**10.85 to 11.00 mm (0.4272 to 0.4331 in.)**

**Minimum outer diameter:**

**10.7 mm (0.421 in.)**

If the cylinder head set bolt is less than the minimum, replace the bolt.

**Fig. 455: Inspecting Cylinder Head Set Bolt**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### 4. INSPECT CHAIN SUB-ASSEMBLY

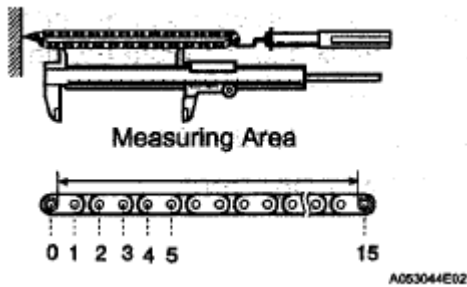
- a. Using a spring scale, apply 147 N (15.0 kgf, 33.1 lbf) to the chain and measure the length.

**Maximum chain length:**

**146.8 mm (5.780 in.)**

**NOTE: Measure the length at least 3 places and calculate the average length.**

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



**Fig. 456: Inspecting Chain Sub-Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### 5. INSPECT NO.2 CHAIN SUB-ASSEMBLY

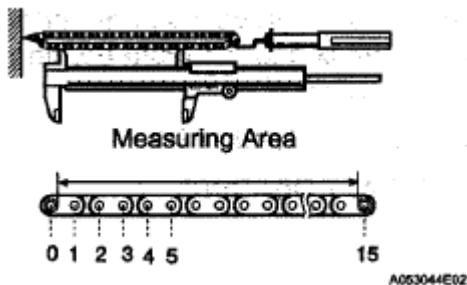
- a. Using a spring scale, apply 147 N (15.0 kgf, 33.1 lbf) to the chain and measure the length.

**Maximum chain length:**

146.8 mm (5.780 in.)

**NOTE:** Measure the length at least 3 places and calculate the average length.

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



**Fig. 457: Inspecting No.2 Chain Sub-Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### 6. INSPECT CAMSHAFT TIMING GEAR ASSEMBLY

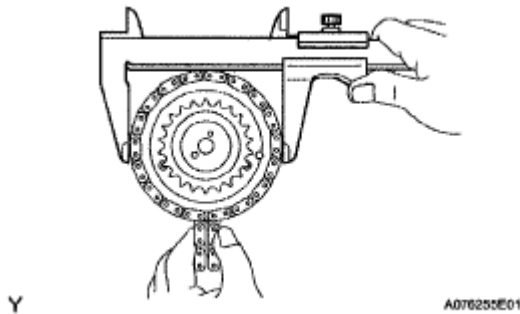
- a. Wrap the No. 1 chain around the larger gear of timing gear assembly.
- b. Using vernier caliper, measure the timing gear with the chain wrapped.

**Minimum gear diameter (with chain):**

115.5 mm (4.547 in.)

**NOTE:** Vernier caliper must be in contact with the chain rollers when measuring.

If the gear diameter is less than the minimum, replace the No. 1 chain and the camshaft timing gear assembly.



**Fig. 458: Inspecting Camshaft Timing Gear Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

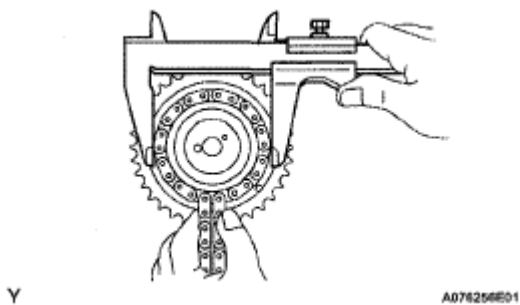
- c. Wrap the No. 2 chain around the smaller gear of timing gear assembly.
- d. Using vernier calipers, measure the timing gear with the chain wrapped.

**Minimum gear diameter (with chain):**

**73.1 mm (2.878 in.)**

**NOTE:** The vernier calipers must be in contact the chain rollers when measuring.

If the gear diameter is less than the minimum, replace the No. 2 chain and the camshaft timing gear assembly.



**Fig. 459: Measuring Timing Gear With Chain Wrapped**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 7. INSPECT CAMSHAFT TIMING GEAR OR SPROCKET

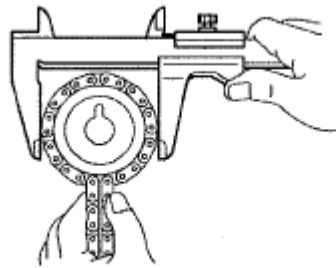
- a. Wrap the No. 2 chain around the timing gear.
- b. Using vernier calipers, measure the camshaft timing gear diameter with the chain wrapped.

**Minimum gear diameter (with chain):**

**73.1 mm (2.878 in.)**

**NOTE:**        **The vernier calipers must be in contact the chain rollers when measuring.**

If the gear diameter is less than the minimum, replace the No. 2 chain and camshaft timing gear.



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**Fig. 460: Inspecting Camshaft Timing Gear Or Sprocket**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### **8. INSPECT CRANKSHAFT TIMING GEAR OR SPROCKET**

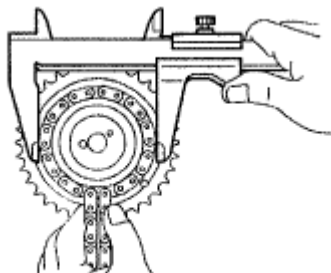
- a. Wrap the No. 1 chain around the timing gear.
- b. Using vernier calipers, measure the timing gear diameter with the chain wrapped.

**Minimum gear diameter (with chain):**

**61.0 mm (2.402 in.)**

**NOTE:**        **The vernier calipers must be in contact with the chain rollers when measuring.**

If the gear diameter is less than the minimum, replace the No. 1 chain and the crankshaft timing gear.



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**Fig. 461: Measuring Timing Gear Diameter With Chain Wrapped**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### **9. INSPECT IDLE SPROCKET ASSEMBLY**

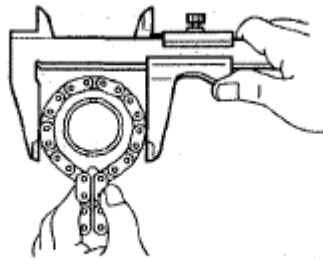
- a. Wrap the No. 1 chain around the idle sprocket.
- b. Using vernier caliper, measure the idle sprocket with the chain wrapped.

**Minimum gear diameter (with chain):**

**61.0 mm (2.402 in.)**

**NOTE:** The vernier caliper must be in contact with the chain rollers when measuring.

If the gear diameter is less than the minimum, replace the No. 1 chain and idle sprocket.



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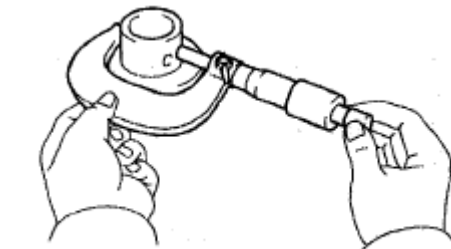
**Fig. 462: Measuring Idle Sprocket With Chain Wrapped**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### 10. INSPECT NO.1 IDLE GEAR SHAFT

- a. Using a micrometer, measure the idle gear shaft diameter.

**Idle gear shaft diameter:**

**22.987 to 23.000 mm (0.9050 to 0.9055 in.)**



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**Fig. 463: Measuring Idle Gear Shaft Diameter**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a caliper gauge, measure the internal diameter of the idle gear.

**Idle gear internal diameter:**

**23.02 to 23.03 mm (0.9063 to 0.9067 in.)**

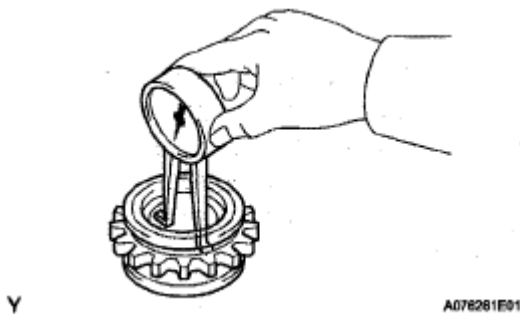
- c. Subtract the idle gear shaft diameter measurement from the idle gear internal diameter measurement.

**Standard oil clearance:**

**0.020 to 0.043 mm (0.0008 to 0.0017 in.)**

**Maximum oil clearance:**

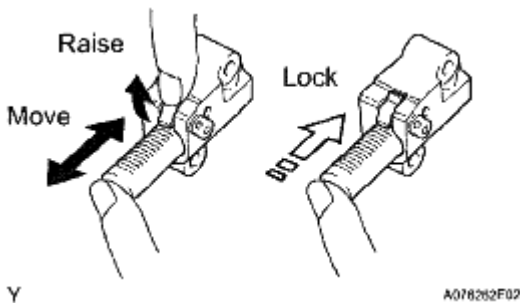
**0.093 mm (0.0037 in.)**



**Fig. 464: Measuring Internal Diameter Of Idle Gear**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### 11. INSPECT N0.1 CHAIN TENSIONER ASSEMBLY

- a. Check that the plunger moves smoothly when the ratchet pawl is raised with finger.
- b. Release the ratchet pawl, then check that the plunger is locked in place by the ratchet pawl and does not move when pushing it with finger.



**Fig. 465: Inspecting N0.1 Chain Tensioner Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

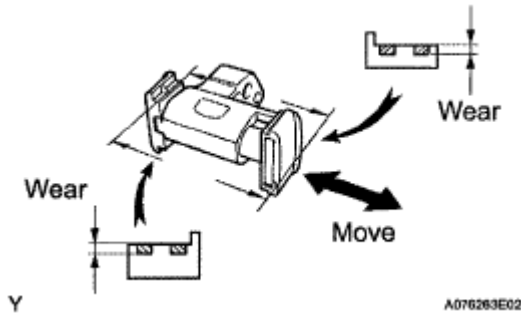
#### 12. INSPECT NO.2 CHAIN TENSIONER ASSEMBLY

- a. Check that the plunger moves smoothly.
- b. Measure the wear of the chain tensioner slipper.

**Maximum wear:**

**1.0 mm (0.039 in.)**

If the wear is greater than the maximum, replace the chain tensioner No. 2.



**Fig. 466: Inspecting No.2 Chain Tensioner Assembly**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

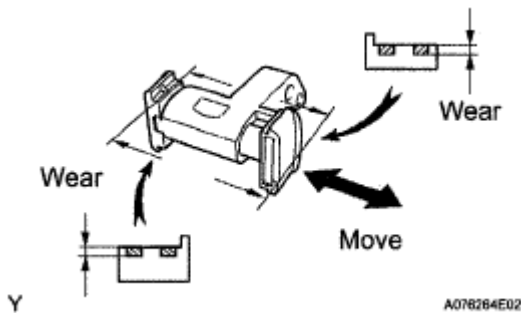
### 13. INSPECT NO.3 CHAIN TENSIONER ASSEMBLY

- a. Check that the plunger moves smoothly.
- b. Measure the wear of the chain tensioner slipper.

**Maximum wear:**

**1.0 mm (0.039 in.)**

If the wear is greater than the maximum, replace the chain tensioner No. 3.



**Fig. 467: Inspecting No.3 Chain Tensioner Assembly**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

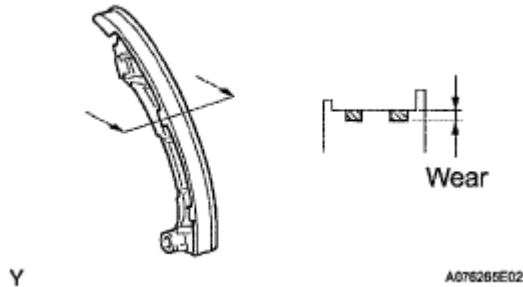
### 14. INSPECT CHAIN TENSIONER SLIPPER

- a. Measure the wear of the tensioner slipper.

**Maximum wear:**

**1.0 mm (0.039 in.)**

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



**Fig. 468: Inspecting Chain Tensioner Slipper**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

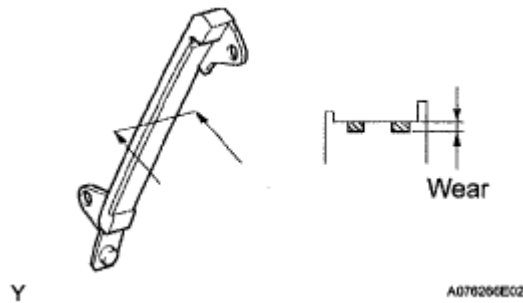
#### 15. INSPECT NO.1 CHAIN VIBRATION DAMPER

- a. Measure the wear of the vibration damper No. 1.

**Maximum wear:**

**1.0 mm (0.039 in.)**

If the thickness is greater than the maximum, replace the vibration damper No. 1.



**Fig. 469: Identifying Thickness Of No.1 Chain Vibration Damper**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

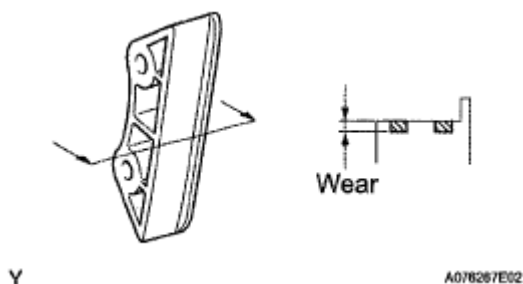
#### 16. INSPECT NO.2 CHAIN VIBRATION DAMPER

- a. Measure the wear of the vibration damper No. 2

**Maximum wear:**

**1.0 mm (0.039 in.)**

If the thickness is greater than the maximum, replace the vibration damper No. 2.



**Fig. 470: Identifying Thickness Of No.2 Chain Vibration Damper**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

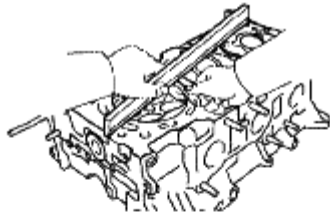
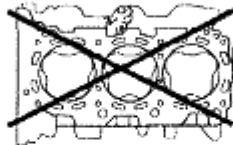
## 17. INSPECT CYLINDER HEAD SUB-ASSEMBLY

- a. Inspect the cylinder head for warpage.
  1. Using a precision straight edge and feeler gauge, measure the warpage on the cylinder block side and the intake and exhaust sides.

**Maximum warpage:**

**0.10 mm (0.0039 in.)**

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

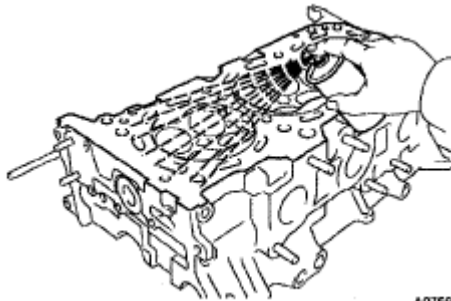
**Cylinder Block Side:****Intake Manifold Side:****Exhaust Manifold Side:**

Y

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**Fig. 471: Inspecting Cylinder Head For Warpage**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Inspect the cylinder head for crack.
  - 1. Using a dye penetrant, check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks. If cracked, replace the cylinder head.



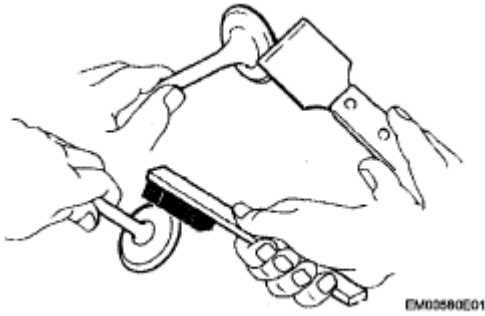
A075610E01

**Fig. 472: Inspecting Cylinder Head For Crack**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 18. CLEAN VALVE

- a. Using a gasket scraper, chip off any carbon from the valve head.

- b. Using a wire brush, thoroughly clean the valve.



**Fig. 473: Cleaning Valve**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

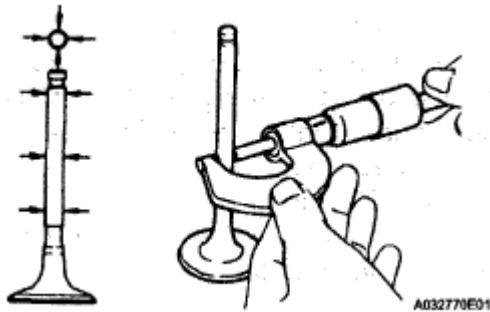
## 19. INSPECT VALVE

- a. Inspect valve stem diameter.
  1. Using a micrometer, measure the diameter of the valve stem.

### Valve stem diameter

#### VALVE STEM DIAMETER REFERENCE

|         |                                          |
|---------|------------------------------------------|
| Intake  | 5.470 to 5.485 mm (0.2154 to 0.2159 in.) |
| Exhaust | 5.465 to 5.480 mm (0.2152 to 0.2158 in.) |



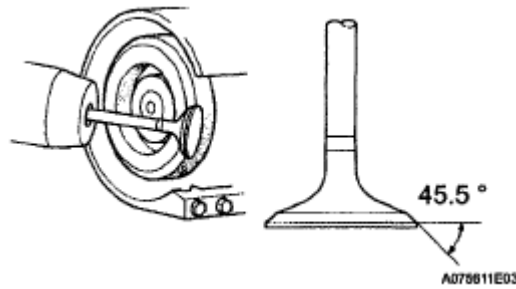
**Fig. 474: Inspecting Valve Stem Diameter**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Inspect valve face angle.
  1. Grind the valve enough to remove any pits and carbon.
  2. Check that the valve is ground to the correct valve face angle.

### Valve face angle:

**45.5°**



**Fig. 475: Inspecting Valve Face Angle**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Inspect valve head margin thickness.
  - 1. Using vernier calipers, check the valve head margin thickness.

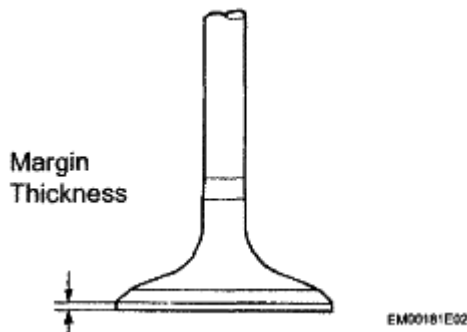
**Standard margin thickness:**

**1.0 mm (0.039 in.)**

**Minimum margin thickness:**

**0.5 mm (0.020 in.)**

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



**Fig. 476: Inspecting Valve Head Margin Thickness**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Inspect overall length.
  - 1. Using vernier calipers, check the overall length.

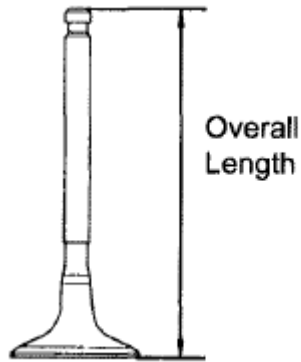
**Standard overall length**

**INTAKE AND EXHAUST LENGTH SPECIFICATION**

|         |                        |
|---------|------------------------|
| Intake  | 106.95 mm (4.2106 in.) |
| Exhaust | 105.80 mm (4.1654 in.) |

**Minimum overall length****MINIMUM OVERALL LENGTH REFERENCE**

|         |                        |
|---------|------------------------|
| Intake  | 106.70 mm (4.2008 in.) |
| Exhaust | 105.55 mm (4.1555 in.) |



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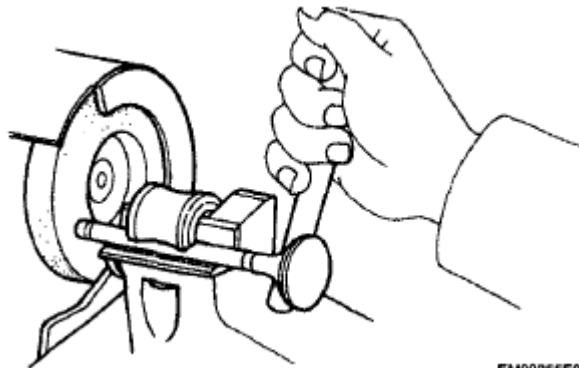
**Fig. 477: Identifying Valve Overall Length****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

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

- e. Inspect valve stem tip.
  - 1. Check the surface of the valve stem tip for wear.

**NOTE:** Do not grind to less than the minimum length.

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

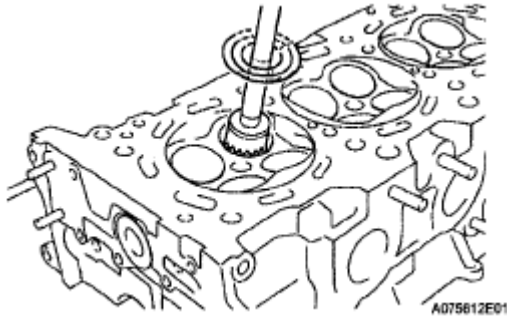


EM00255E01

**Fig. 478: Inspecting Valve Stem Tip****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.****20. CLEAN VALVE SEAT**

- a. Using a 45° carbide cutter, resurface the valve seats.

- b. Clean the valve seats.



**Fig. 479: Cleaning Valve Seat**

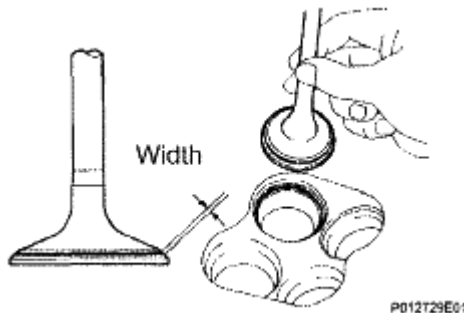
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 21. INSPECT VALVE SEAT

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

**NOTE:** Do not rotate the valve.

- c. Check the valve face and seat according to the following procedure.



**Fig. 480: Inspecting Valve Seat**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. If blue appears 360° around the face, the valve is concentric.

If not, replace the valve.

2. If the blue appears 360° around the valve seat, the guide and face are concentric.

If not, resurface the valve seat.

3. Check that the seat is in contact with the middle of the valve face with the following width.

**Standard width:**

**1.0 to 1.4 mm (0.039 to 0.055 in.)**

## **22. INSPECT INNER COMPRESSION SPRING**

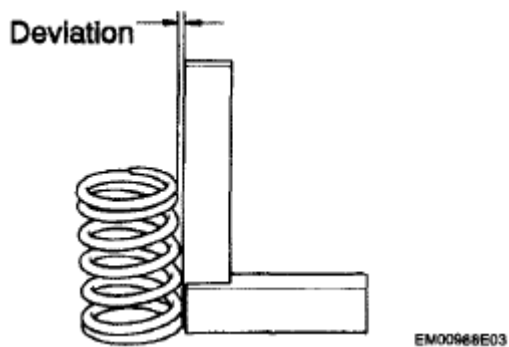
a. Inspect the deviation.

1. Using steel squares, measure the deviation of the inner compression spring.

**Maximum deviation:**

**2.0 mm (0.079 in.)**

If the deviation is greater than the maximum, replace the inner compression spring.



**Fig. 481: Inspecting Inner Compression Spring**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

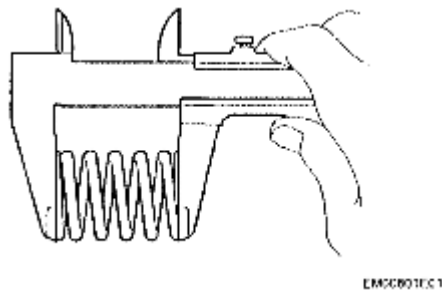
b. Inspect the free length.

1. Using vernier calipers, measure the free length of the inner compression spring.

**Free length:**

**47.80 mm (1.8819 in.)**

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



**Fig. 482: Inspecting Inner Compression Spring Free Length**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

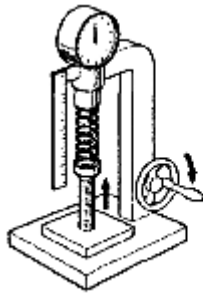
c. Inspect the tension.

1. Using a spring tester, measure the tension of the inner compression spring at the specified installed length.

**Installed tension:**

**186.2 to 205.8 N (19.0 to 21.0 kgf, 41.9 to 46.3 lbf) at 33.3 mm (1.311 in.)**

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



EN00281E01

**Fig. 483: Measuring Tension Of Inner Compression Spring**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

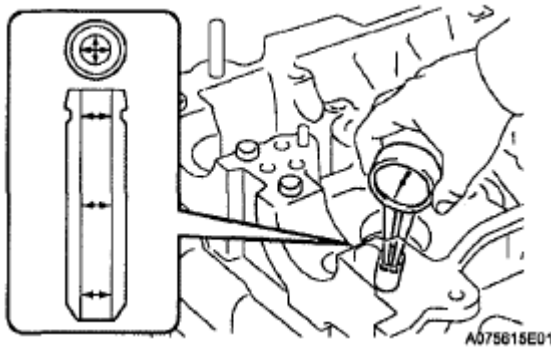
**23. INSPECT VALVE GUIDE BUSH OIL CLEARANCE**

- a. Using a caliper gauge, measure the internal diameter of the valve guide bush.

**inside diameter:**

**5.51 to 5.53 mm (0.2169 to 0.2177 in.)**

- b. Subtract the valve stem diameter measurement (Step 8) from the valve guide bush internal diameter measurement.



**Fig. 484: Measuring Internal Diameter Of Valve Guide Bush**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Standard oil clearance**

**OIL CLEARANCE REFERENCE**

|         |                                          |
|---------|------------------------------------------|
| 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**

**OIL CLEARANCE REFERENCE**

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

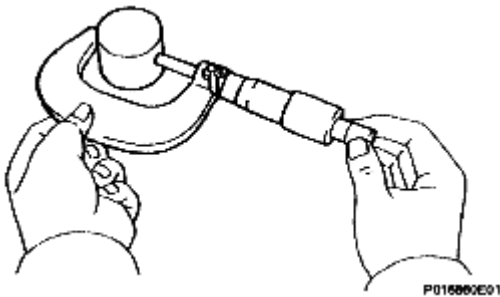
If the oil clearance is greater than the maximum, replace the valve and valve guide bush.

**24. INSPECT VALVE LIFTER**

- a. Using a micrometer, measure the valve lifter diameter.

**Valve lifter diameter:**

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



**Fig. 485: Measuring Valve Lifter Diameter**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**25. 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.)**

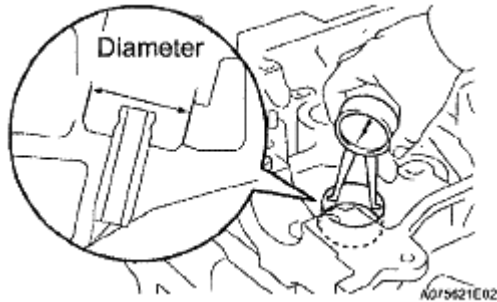
- b. Subtract the valve lifter diameter measurement (Step 16) from the lifter bore diameter measurement.

**Standard oil clearance:**

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

**Maximum oil clearance:**

**0.08 mm (0.0031 in.)**



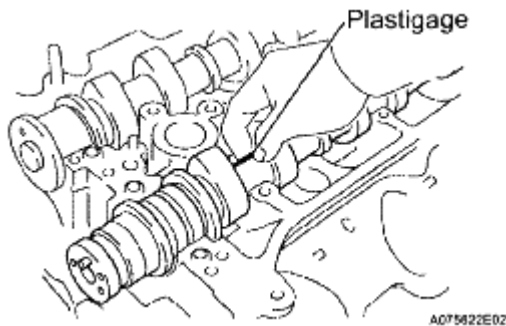
**Fig. 486: Inspecting Valve Lifter Oil Clearance**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the oil clearance is greater than the maximum, replace the valve lifter.

If necessary, replace the cylinder head.

## 26. INSPECT CAMSHAFT OIL CLEARANCE

- Clean the camshaft bearing caps, camshaft bearings and camshaft journals.
- Install the camshaft bearing (see INSTALLATION or INSTALLATION ).
- Place the camshaft on the cylinder head.
- Lay a strip of Plastigage across each camshaft journal.
- Install the camshaft bearing caps (see INSTALLATION or INSTALLATION ).



**Fig. 487: Inspecting Camshaft Oil Clearance**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** Do not turn the camshafts.

- Remove the camshaft bearing caps (see INSTALLATION or INSTALLATION ).
- Measure the Plastigage at its widest point.

### Standard oil clearance (Cylinder head RH)

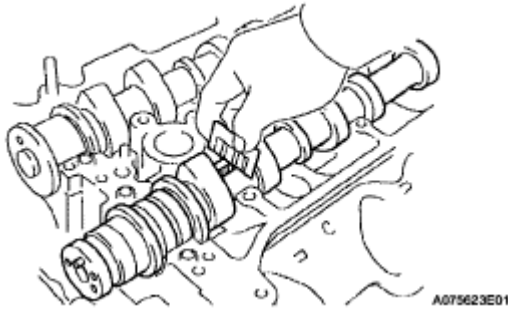
#### OIL CLEARANCE REFERENCE

|                 |                                          |
|-----------------|------------------------------------------|
| No. 1 (Intake)  | 0.008 to 0.038 mm (0.0003 to 0.0015 in.) |
| No. 1 (Exhaust) | 0.040 to 0.079 mm (0.0016 to 0.0031 in.) |
| Others          | 0.025 to 0.062 mm (0.0010 to 0.0024 in.) |

### Standard oil clearance (Cylinder head LH)

#### OIL CLEARANCE REFERENCE

|        |                                          |
|--------|------------------------------------------|
| No. 1  | 0.040 to 0.079 mm (0.0016 to 0.0031 in.) |
| Others | 0.025 to 0.062 mm (0.0010 to 0.0024 in.) |



**Fig. 488: Measuring Plastigage At Widest Point**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### Maximum oil clearance (Cylinder head RH)

#### OIL CLEARANCE REFERENCE

|                |                      |
|----------------|----------------------|
| No. 1 (Intake) | 0.07 mm (0.0028 in.) |
| Others         | 0.10 mm (0.0039 in.) |

### Maximum oil clearance (Cylinder head LH): 0.10 mm (0.0039 in.)

If the oil clearance is greater than the maximum, replace the camshaft bearings and/or camshafts. If necessary, replace the camshaft bearing caps and cylinder head together.

### Reference

#### OIL CLEARANCE REFERENCE

|                                                   |                                            |
|---------------------------------------------------|--------------------------------------------|
| Cylinder head journal bore diameter               | 40.009 to 40.017 mm (1.5752 to 1.5755 in.) |
| Camshaft bearing center wall thickness (Mark "2") | 2.004 to 2.008 mm (0.0789 to 0.0791 in.)   |
| Cylinder head journal bore diameter               | 40.009 to 40.017 mm (1.5752 to 1.5755 in.) |
| Camshaft journal diameter                         | 35.971 to 35.985 mm (1.4165 to 1.4167 in.) |

- h. Remove the Plastigage completely.
- i. Remove the camshafts.
- j. Remove the camshaft bearing.

**27. INSPECT CAMSHAFT THRUST CLEARANCE**

- a. Install the camshafts. (See **INSTALLATION** or **INSTALLATION** ).
- b. Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

**Standard thrust clearance:**

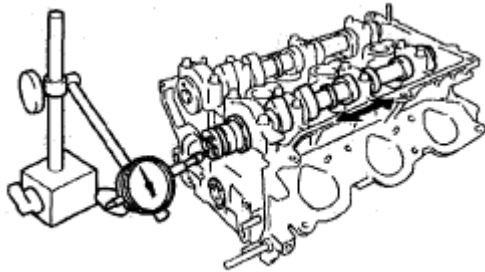
**0.04 to 0.09 mm (0.016 to 0.035 in.)**

**Maximum thrust clearance:**

**0.11 mm (0.0043 in.)**

If the thrust clearance is greater than the maximum, replace the camshafts.

If necessary, replace the camshaft bearing caps and cylinder head as a set.



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**Fig. 489: Inspecting Camshaft Thrust Clearance**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**28. INSPECT CONNECTING ROD THRUST CLEARANCE**

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

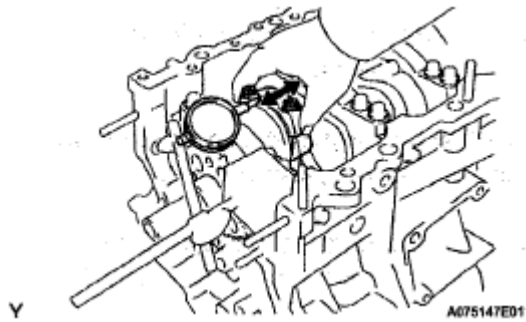
**Standard thrust clearance:**

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

**Maximum thrust clearance:**

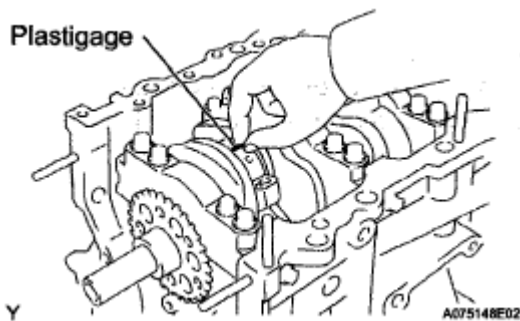
**0.35 mm (0.0138 in.)**

**29. INSPECT CONNECTING ROD OIL CLEARANCE**



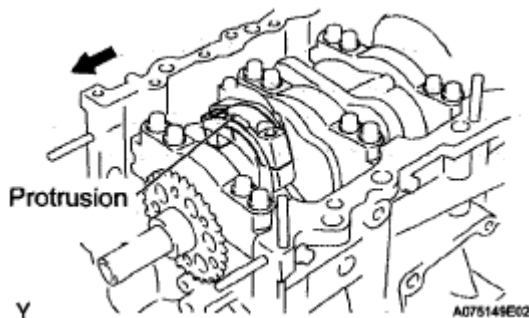
**Fig. 490: Inspecting Connecting Rod Thrust Clearance**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Check the matchmarks on the connecting rod and cap are aligned to ensure correct assembly.
- b. Remove the 2 connecting rod cap bolts.
- c. Clean the crank pin, bearing and connecting rod.
- d. Check the crank pin and bearing for any pits and scratches.
- e. Lay a strip of plastigage across the crank pin.



**Fig. 491: Laying Strip Of Plastigage**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

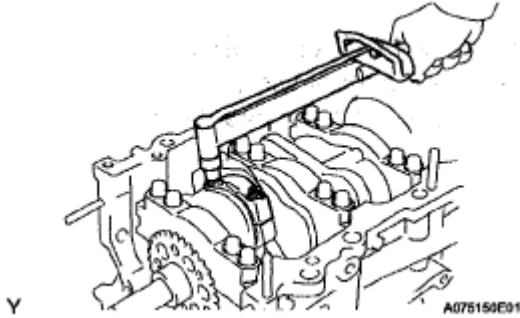
- f. Check that the protrusion of the connecting rod cap is facing in the correct direction.
- g. Apply a light coat of engine oil to the threads of the connecting rod cap bolts.



**Fig. 492: Identifying Protrusion Of Connecting Rod Cap**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- h. Tighten the bolts alternately to the specified torque.

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

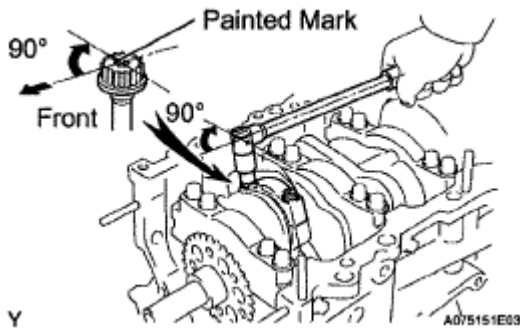


**Fig. 493: Tightening Connecting Rod Cap Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

**NOTE: Do not turn the crankshaft.**

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



**Fig. 494: Identifying Connecting Cap Bolt Mark Location**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- l. Measure the plastigage at its widest point.

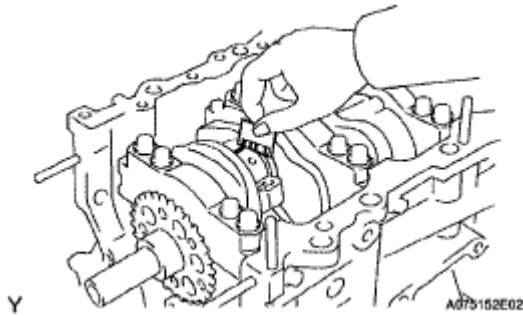
**Standard oil clearance:**

**0.026 to 0.046 mm (0.0010 to 0.0018 in.)**

**Maximum oil clearance:**

**0.066 mm (0.0025 in.)**

**NOTE:** Completely remove the plastigage.

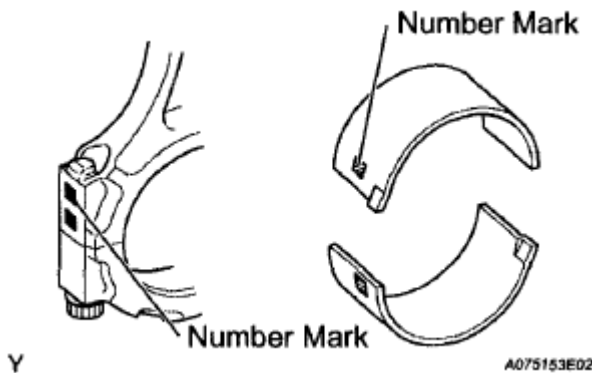


**Fig. 495: Measuring Plastigage Widest Point**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- m. When replacing the bearing, replace it with one with 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



**Fig. 496: Identifying Number Marked On Connecting Rod Bearing**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### CONNECTING ROD BEARING MARK REFERENCE

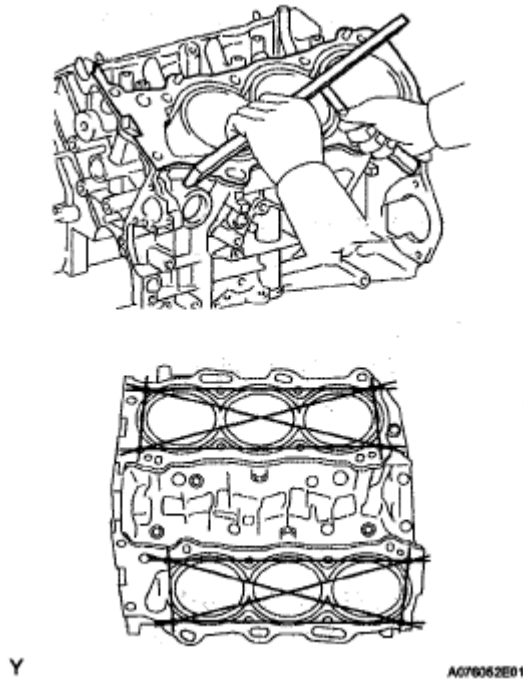
| Mark | mm (In.)                          |
|------|-----------------------------------|
| "1"  | 1.484 to 1.487 (0.0584 to 0.0585) |
| "2"  | 1.487 to 1.490 (0.0585 to 0.0587) |
| "3"  | 1.490 to 1.493 (0.0587 to 0.0588) |
| "4"  | 1.493 to 1.496 (0.0588 to 0.0589) |

### 30. CHECK CYLINDER BLOCK FOR WARPAGE

- a. Using a precision straight edge and feeler gauge, measure the warpage of the contact surface of the cylinder head gasket.

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

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



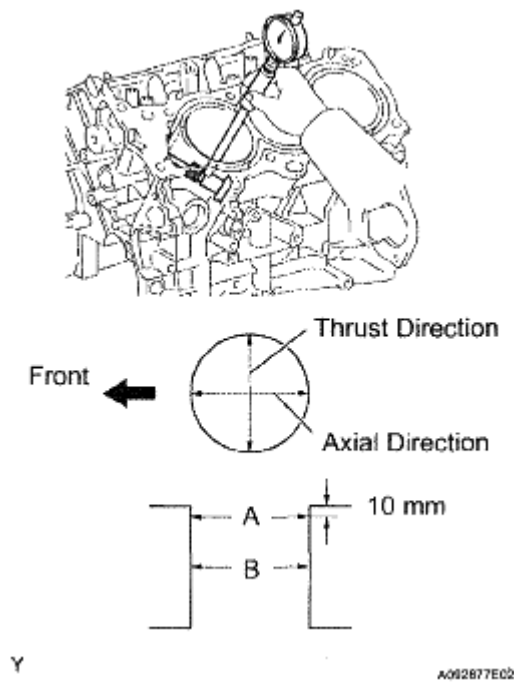
**Fig. 497: Measuring Warpage Contact Surface Of Cylinder Head Gasket**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**31. INSPECT CYLINDER BORE**

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

**Standard diameter:****94.000 to 94.012 mm (3.7008 to 3.7013 in.)****Maximum diameter:****94.132 mm (3.7060 in.)**

If the average diameter of 4 positions is greater than the maximum, replace the cylinder block.



**Fig. 498: Inspecting Cylinder Bore**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### 32. INSPECT WITH PISTON SUB-ASSEMBLY

- a. Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 27.7 mm (1.091 in.) from the piston head.

**Piston diameter:**

**93.910 to 93.940 mm (3.6972 to 3.6984 in.)**

### 33. INSPECT PISTON OIL CLEARANCE

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

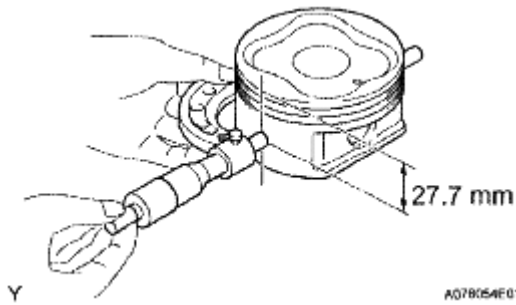
**Standard oil clearance:**

**0.060 to 0.102 mm (0.0031 to 0.0040 in.)**

**Maximum oil clearance:**

**0.13 mm (0.0051 in.)**

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



**Fig. 499: Inspecting Piston Oil Clearance**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

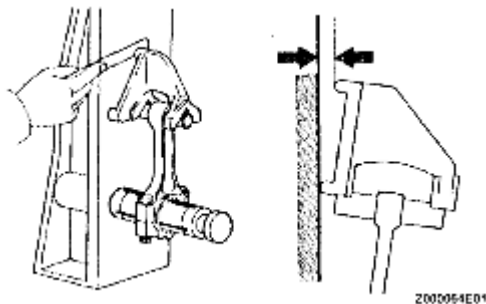
### 34. INSPECT CONNECTING ROD SUB-ASSEMBLY

- 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 the maximum, replace the connecting rod assembly.



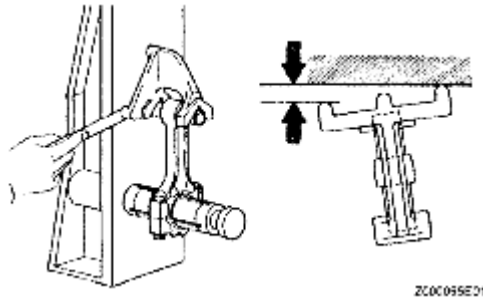
**Fig. 500: Inspecting Connecting Rod Sub-Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Check the twist.

**Maximum twist:**

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

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



**Fig. 501: Inspecting Connecting Rod (Twist)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

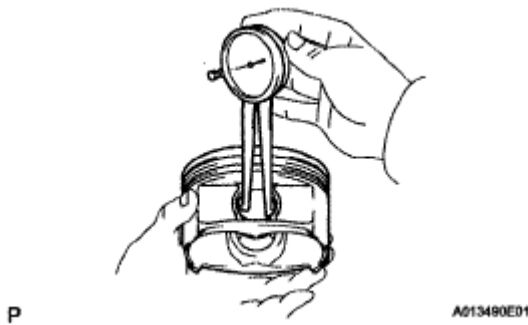
### 35. INSPECT PISTON PIN OIL CLEARANCE

- a. Using a caliper gauge, measure the internal diameter of the piston pin hole.

**Piston pin hole internal diameter:**

**22.001 to 22.010 mm (0.8662 to 0.8665 in.)**

**Piston pin hole inside diameter**



**Fig. 502: Inspecting Piston Pin Oil Clearance**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### MARK REFERENCE

| Mark | mm (in.)                            |
|------|-------------------------------------|
| A    | 22.001 to 22.004 (0.8662 to 0.8663) |
| B    | 22.005 to 22.007 (0.8663 to 0.8664) |
| C    | 22.008 to 22.010 (0.8665 to 0.8665) |

- b. Using a micrometer, measure the piston pin diameter.

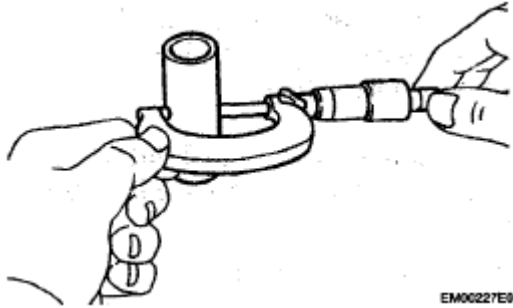
**Piston pin diameter:**

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

## Piston pin diameter

### PISTON PIN DIAMETER SPECIFICATION

| Mark | mm (in.)                            |
|------|-------------------------------------|
| A    | 21.997 to 22.000 (0.8660 to 0.8661) |
| B    | 22.001 to 22.003 (0.8661 to 0.8663) |
| C    | 22.004 to 22.006 (0.8663 to 0.8664) |



**Fig. 503: Measuring Piston Pin Diameter**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Using a caliper gauge, measure the internal diameter of the connecting rod bushing.

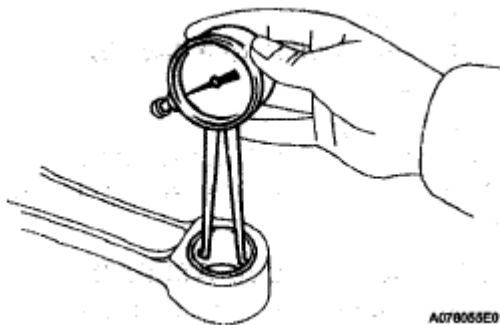
### Bushing internal diameter:

22.005 to 22.014 mm (0.8663 to 0.8667 in.)

### Bushing internal diameter

### BUSHING INTERNAL DIAMETER CHART

| Mark | mm (in.)                            |
|------|-------------------------------------|
| A    | 22.005 to 22.008 (0.8663 to 0.8665) |
| B    | 22.009 to 22.011 (0.8665 to 0.8666) |
| C    | 22.012 to 22.014 (0.8666 to 0.8667) |



**Fig. 504: Measuring Internal Diameter Of Connecting Rod Bushing**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Subtract the piston pin diameter measurement from the piston pin hole diameter measurement.

**Standard oil clearance:**

**0.001 to 0.007 mm (0.00004 to 0.00028 in.)**

**Maximum oil clearance:**

**0.040 mm (0.0016 in.)**

- e. If the oil clearance is greater than the maximum, replace the bushing. If necessary, replace the piston and piston pin together.  
f. Subtract the piston pin diameter measurement from the bushing inside diameter measurement.

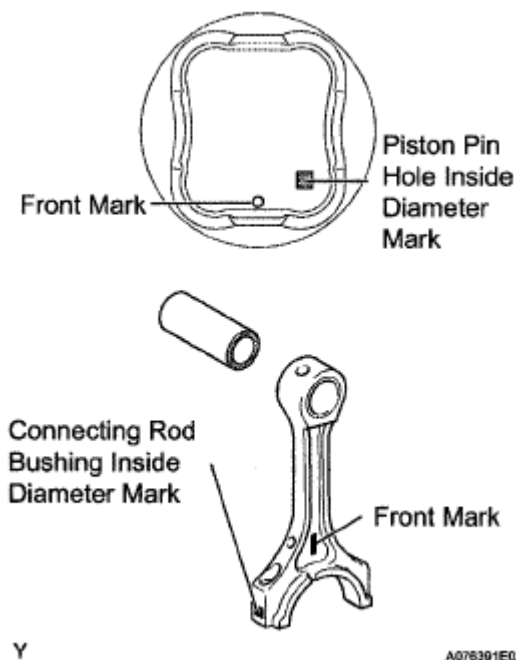
**Standard oil clearance:**

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

**Maximum oil clearance:**

**0.050 mm (0.0020 in.)**

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



**Fig. 505: Identifying Piston Pin Hole Inside Diameter Mark And Front Mark**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### 36. INSPECT RING GROOVE CLEARANCE

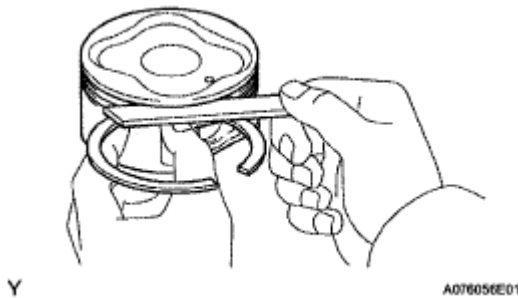
- a. Using a feeler gauge, measure the clearance between a new piston ring and the wall of the ring groove.

**Ring groove clearance:**

**No.1 0.02 to 0.07 mm (0.0008 to 0.0028 in.)**

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

**Oil 0.07 to 0.15 mm (0.0028 to 0.0060 in.)**

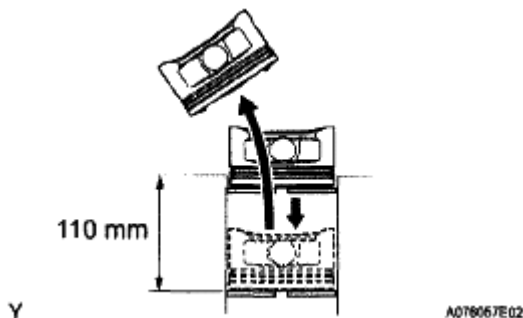


**Fig. 506: Inspecting Ring Groove Clearance**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### 37. 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.



**Fig. 507: Pushing Piston Ring Bottom Of Ring Travel**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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 0.40 to 0.50 mm (0.0157 to 0.0197 in.)**

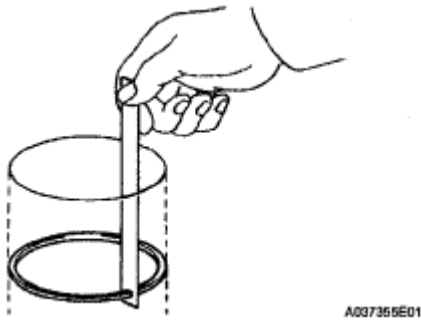
**Oil (Side rail) 0.10 to 0.40 mm (0.0039 to 0.0157 in.)**

**Maximum end gap:**

**No. 1 1.0 mm (0.039 in.)**

**No. 2 1.1 mm (0.043 in.)**

**Oil (Side rail) 1.0 mm (0.039 in.)**



**Fig. 508: Inspecting Piston Ring End Gap**

**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

### **38. INSPECT CONNECTING ROD BOLT**

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

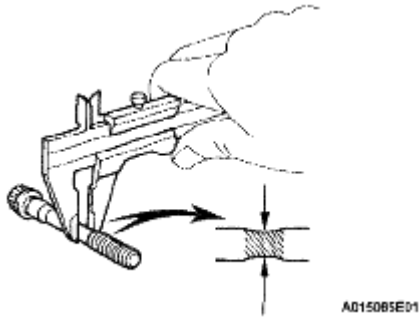
**Standard diameter:**

**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 the minimum, replace the bolt.



**Fig. 509: Inspecting Connecting Rod Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

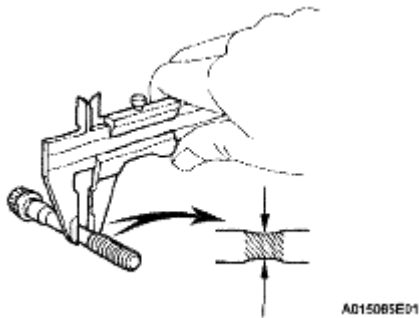
### 39. INSPECT CRANKSHAFT BEARING CAP SET BOLT

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

**Standard diameter:**

**10.0 to 10.2 mm (0.393 to 0.402 in.)**

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



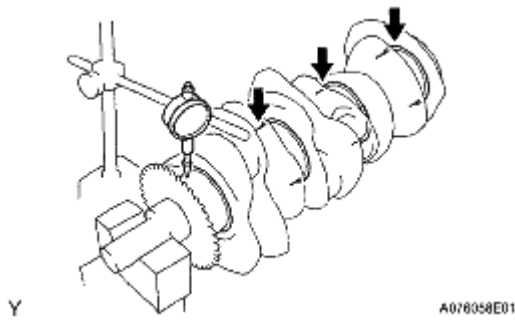
**Fig. 510: Inspecting Crankshaft Bearing Cap Set Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### 40. 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.)**



**Fig. 511: Measuring Crankshaft Runout**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a micrometer, measure the diameter of each main journal.

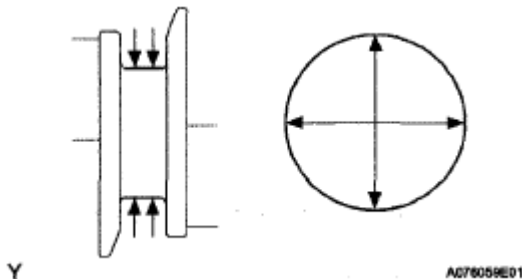
**Diameter:**

**71.988 to 72.000 mm (2.8342 to 2.8346 in.)**

- c. Check each main journal for taper and out-of-roundness as shown.

**Maximum taper and out-of-roundness:**

**0.02 mm (0.0008 in.)**



**Fig. 512: Measuring Diameter Of Main Journal**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

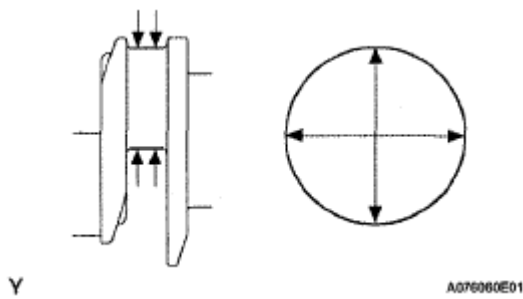
**Diameter:**

**55.992 to 56.000 mm (2.2044 to 2.2047 in.)**

- e. Check each crank pin for taper and out-of-roundness as shown.

**Maximum taper and out-of-roundness:**

**0.02 mm (0.0008 in.)**



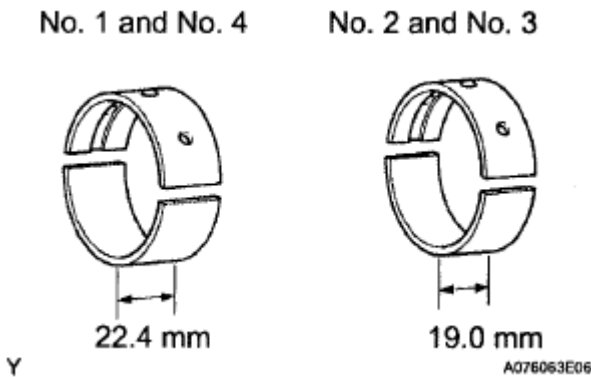
**Fig. 513: Measuring Diameter Of Crank Pin**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### 41. INSPECT CRANKSHAFT OIL CLEARANCE

HINT:

There are 2 types of main bearings with different widths (19.0 mm (0.748 in.) and 22.4 mm (0.882 in.)) for use in the inspection. Install the 22.4 mm (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.



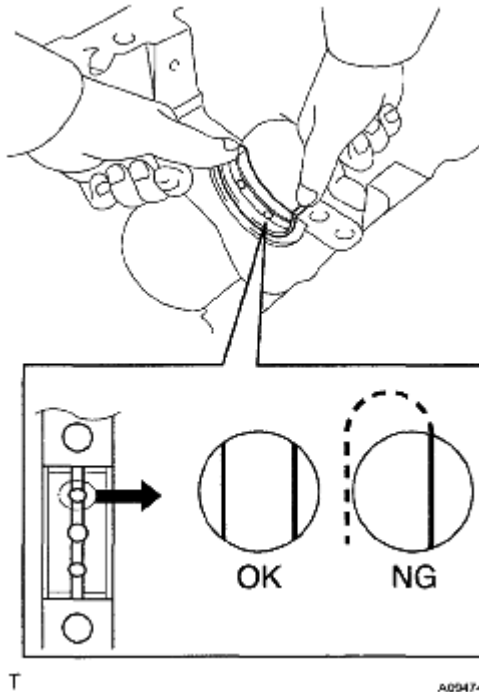
**Fig. 514: Inspecting Crankshaft Oil Clearance**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the 4 upper bearings.
  1. Install the upper bearing near the center of the cylinder block.

**NOTE:**

- The width of the No. 1 and No. 4 journal bearings is different from that of the No. 2 and No. 3 journal bearings. Therefore, confirm whether it is the correct journal bearing prior to installation.
- Do not apply engine oil to the bearing installation surfaces of the cylinder block and the back side of the bearings.

- Check that the oil groove on the cylinder block can be seen through the oil supply holes of the upper bearing.



**Fig. 515: Installing Upper Bearings**  
**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

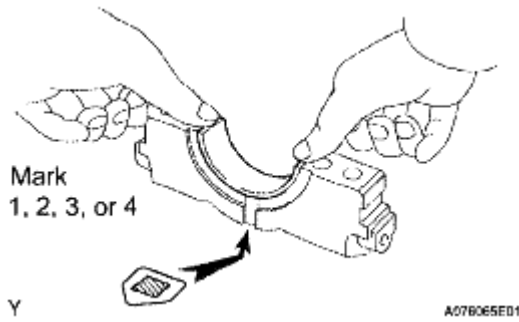
- c. Install the 4 lower bearings.
1. Install the lower bearing near the center of the cylinder block.

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

HINT:

A number marked on each main bearing cap indicates the installation position.

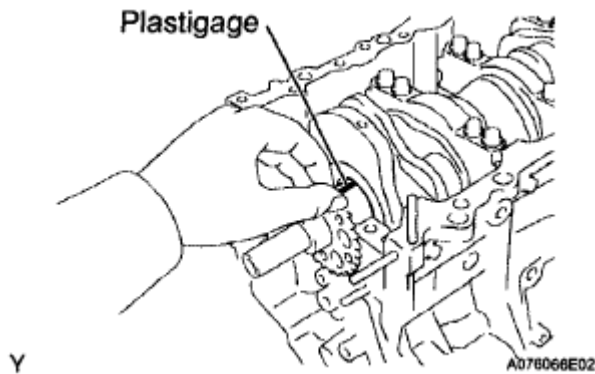
- d. Place the crankshaft on the cylinder block.



**Fig. 516: Installing Lower Bearings**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

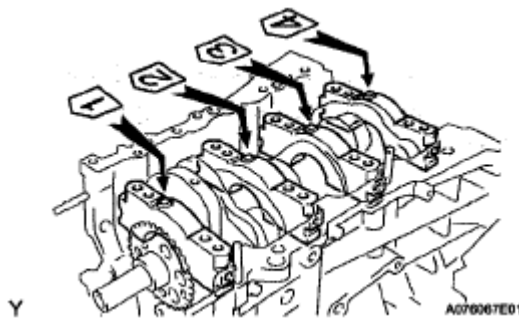
- e. Lay a strip of plastigage across each journal.



**Fig. 517: Laying Strip Of Plastigage**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

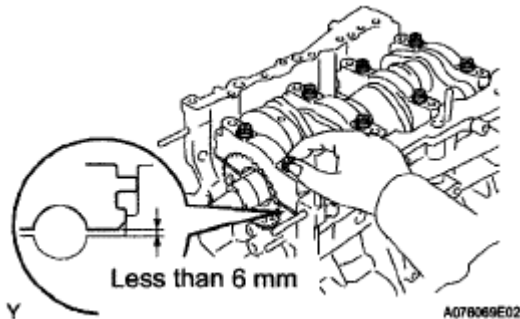
- f. Examine the front marks and numbers, check the sequence order is as shown and install the bearing caps onto the cylinder block.
- g. Apply a light coat of engine oil to the threads of bearing cap bolts.
- h. Temporarily install the 8 main bearing cap bolts in the inside positions.



**Fig. 518: Identifying Front Mark Of Bearing Caps Onto Cylinder Block**

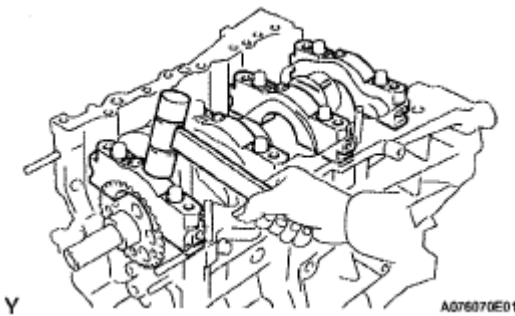
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- i. Install the main bearing caps. Tighten the 2 bolts for each bearing cap until the clearance between the bearing cap and the cylinder block is under 6 mm (0.23 in.).



**Fig. 519: Identifying Clearance Between Bearing Cap And Cylinder Block**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

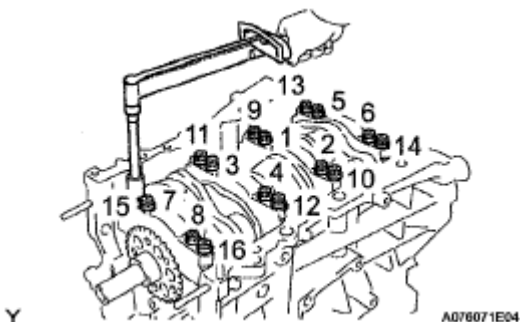
- j. Using a plastic-faced hammer, lightly tap the bearing cap to ensure a proper fit.
- k. Apply a light coat of engine oil to the threads of main bearing cap bolts.



**Fig. 520: Tapping Bearing Cap**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- l. Install the 16 main bearing cap bolts. Using several steps, tighten the bolts uniformly in the sequence shown in the illustration.

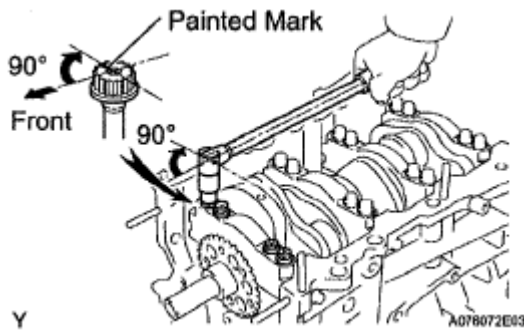
**Torque: 61 N\*m (622 kgf\*cm, 45 ft.\*lbf)**



**Fig. 521: Identifying Main Bearing Cap Bolts Tightening Sequence**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- m. Mark the front side of the bearing cap bolts with paint.
- n. Retighten the bearing cap bolts 90° in the sequence as shown.
- o. Check that the painted mark is now at a 90° angle from the front.

**NOTE: Do not turn the crankshaft.**

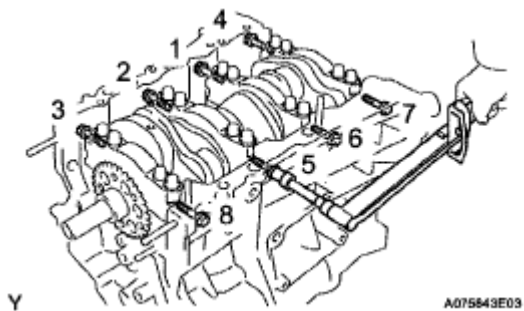


**Fig. 522: Identifying Front Side Of Bearing Cap Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- p. Install the 8 main bearing cap bolts. Using several steps, tighten the bolts uniformly in the sequence shown in the illustration.

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

- q. Remove the main bearing caps.



**Fig. 523: Identifying Main Bearing Caps Tighten Sequence**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- r. Measure the Plastigage at its widest point.

**Standard oil clearance:**

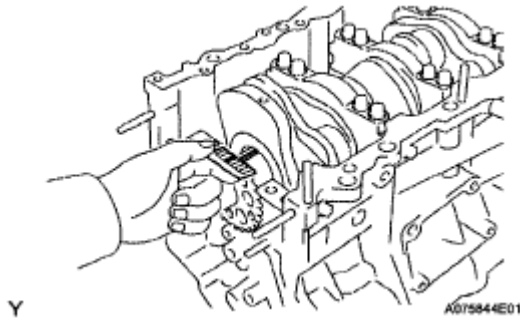
**0.018 to 0.030 mm (0.0007 to 0.0012 in.)**

**Maximum clearance:**

**0.046 mm (0.0018 in.)**

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

**NOTE:**        **Completely remove the plastigage.**



**Fig. 524: Measuring Plastigage Widest Point**  
**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- s. Replace the bearing with the same number. If the number of the bearing cannot be determined, select the correct bearing by adding together the numbers imprinted on the cylinder block and crankshaft, then refer to the table below for the appropriate bearing number. There are 5 size of standard bearings, marked "1", "2", "3", "4" and "5" accordingly.

**Journal bearing**

**JOURNAL BEARING REFERENCE**

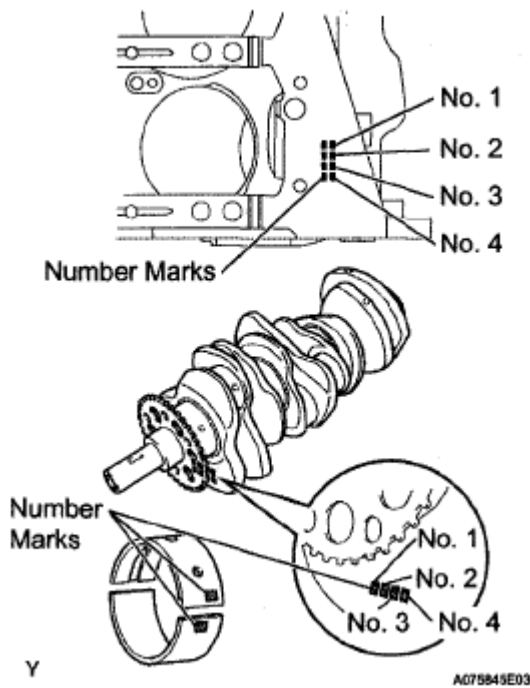
| Cylinder block (A) + Crankshaft | 0-5 | 6-11 | 12-17 | 18-23 | 24-28 |
|---------------------------------|-----|------|-------|-------|-------|
| Use Bearing                     | "1" | "2"  | "3"   | "4"   | "5"   |

HINT:

EXAMPLE

Cylinder block "11" (A) + Crankshaft "06" (B)

=Total number 17 (Use bearing "3")



**Fig. 525: Identifying Crankshaft Number Mark Location**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**ITEM MARK SPECIFICATION**

| Item                                          | Mark | mm (In.)                            |
|-----------------------------------------------|------|-------------------------------------|
| Cylinder block main journal bore diameter (A) | "00" | 77.000(3.0315)                      |
|                                               | "01" | 77.001 (3.0315)                     |
|                                               | "02" | 77.002 (3.0316)                     |
|                                               | "03" | 77.003 (3.0316)                     |
|                                               | "04" | 77.004 (3.0317)                     |
|                                               | "05" | 77.005 (3.0317)                     |
|                                               | "06" | 77.006 (3.0317)                     |
|                                               | "07" | 77.007 (3.0318)                     |
|                                               | "08" | 77.008 (3.0318)                     |
|                                               | "09" | 77.009 (3.0319)                     |
|                                               | "10" | 77.010 (3.0319)                     |
|                                               | "11" | 77.011 (3.0319)                     |
|                                               | "12" | 77.012 (3.0320)                     |
|                                               | "13" | 77.013 (3.0320)                     |
|                                               | "14" | 77.014 (3.0320)                     |
|                                               | "15" | 77.015 (3.0321)                     |
|                                               | "16" | 77.016 (3.0321)                     |
|                                               | "00" | 71.999 to 72.000 (2.8346 to 2.8346) |
|                                               | "01" | 71.998 to 71.999 (2.8346 to 2.8346) |
|                                               | "02" | 71.997 to 71.998 (2.8345 to 2.8346) |

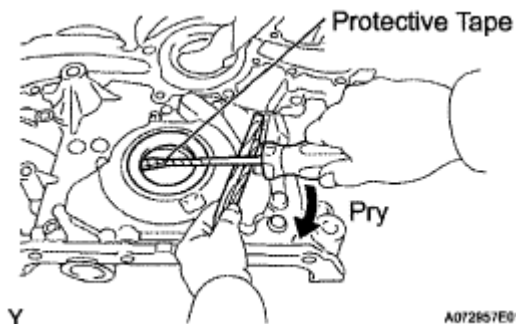
|                                        |      |                                     |
|----------------------------------------|------|-------------------------------------|
| Crankshaft main journal diameter (B)   | "03" | 71.996 to 71.997 (2.8345 to 2.8346) |
|                                        | "04" | 71.995 to 71.996 (2.8344 to 2.8345) |
|                                        | "05" | 71.994 to 71.995 (2.8344 to 2.8344) |
|                                        | "06" | 71.993 to 71.994 (2.8343 to 2.8344) |
|                                        | "07" | 71.992 to 71.993 (2.8343 to 2.8343) |
|                                        | "08" | 71.991 to 71.992 (2.8343 to 2.8343) |
|                                        | "09" | 71.990 to 71.991 (2.8343 to 2.8343) |
|                                        | "10" | 71.989 to 71.990 (2.8342 to 2.8343) |
| Standard bearing center wall thickness | "11" | 71.988 to 71.989 (2.8342 to 2.8342) |
|                                        | "1"  | 2.488 to 2.491 (0.0980 to 0.0981)   |
|                                        | "2"  | 2.491 to 2.494 (0.0981 to 0.0982)   |
|                                        | "3"  | 2.494 to 2.497 (0.0982 to 0.0983)   |
|                                        | "4"  | 2.497 to 2.500 (0.0982 to 0.0984)   |
|                                        | "5"  | 2.500 to 2.503 (0.0984 to 0.0985)   |

## REPLACEMENT

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

- Using a screwdriver, pry out the oil seal.

**NOTE:** Be careful not to damage the oil pump assembly. Wrap a tip of the screwdriver with tape.



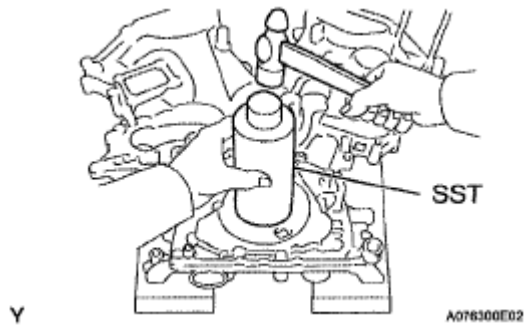
**Fig. 526: Removing Timing Gear Case Or Timing Chain Case Oil Seal**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

- Using SST and a hammer, tap in a new oil seal until its surface is flush with the timing chain cover edge.

**SST 09226-10010**

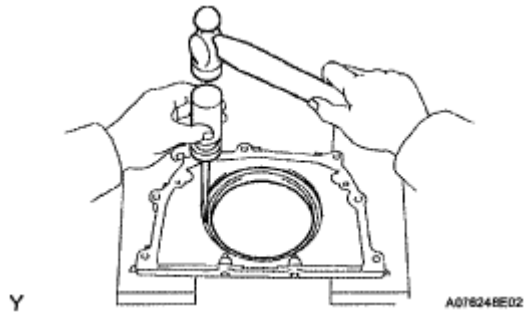
- Apply MP grease to the oil seal lip.



**Fig. 527: Installing Timing Gear Case Or Timing Chain Case Oil Seal**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### **3. REMOVE REAR ENGINE OIL SEAL**

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



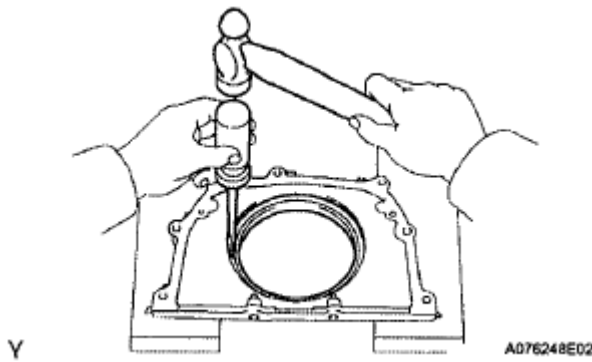
**Fig. 528: Removing Rear Engine Oil Seal**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### **4. INSTALL REAR ENGINE 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 09223-78010**

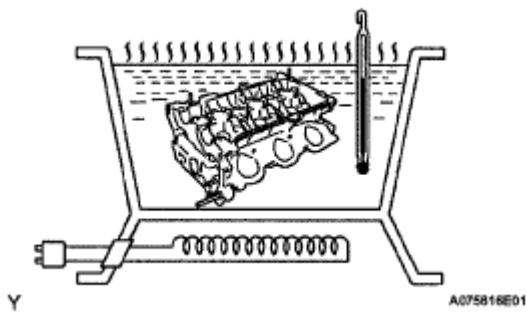
- b. Apply MP grease to the oil seal lip.



**Fig. 529: Installing Rear Engine Oil Seal**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 5. REMOVE VALVE GUIDE BUSH

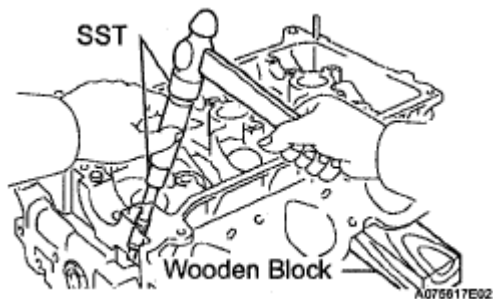
- a. Gradually heat the cylinder head to 80 to 100°C (176 to 212°F).



**Fig. 530: Heating Cylinder Head**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Place the cylinder head on a wooden block.
- c. Using SST, tap out the valve guide bush.

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



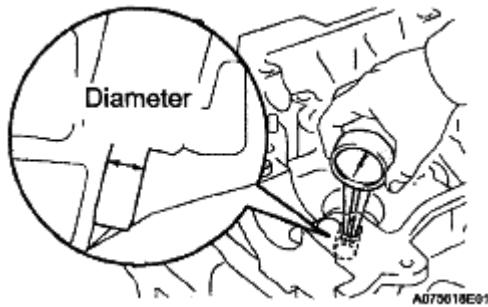
**Fig. 531: Placing Cylinder Head On Wooden Block**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 6. INSTALL VALVE GUIDE BUSH

- a. Using a caliper gauge, measure the bush bore diameter of the cylinder head.

**Bush bore diameter:**

**10.295 to 10.315 mm (0.4053 to 0.4061 in.)**



**Fig. 532: Installing Valve Guide Bush**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

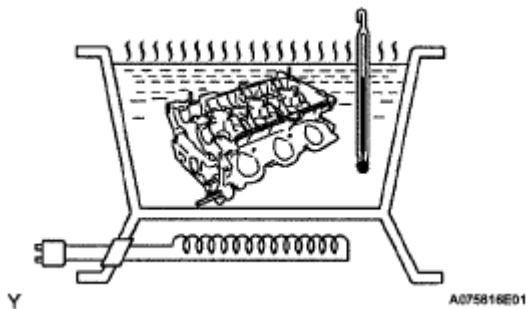
If the bush bore diameter of the cylinder head is greater than 10.315 mm (0.4061 in.), machine the bush bore to the dimension of 10.345 to 10.365 mm (0.4073 to 0.4081 in.).

**Valve guide bush diameter**

### VALVE GUIDE BUSH DIAMETER CHART

|          |                                            |
|----------|--------------------------------------------|
| STD      | 10.333 to 10.344 mm (0.4068 to 0.4072 in.) |
| O/S 0.05 | 10.383 to 10.394 mm (0.4088 to 0.4092 in.) |

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



**Fig. 533: Heating Cylinder Head**

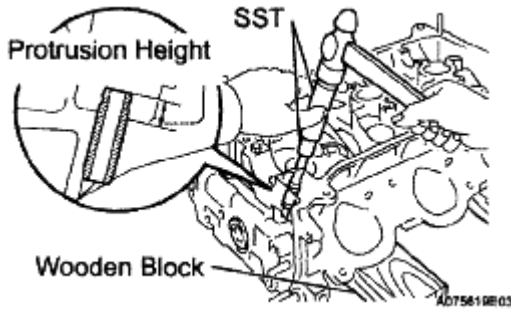
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Place the cylinder head on a wooden block.
- d. Using SST, tap in a new valve guide bush to the specified protrusion height.

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

Protrusion height:

9.3 to 9.7 mm (0.366 to 0.382 in.)



**Fig. 534: Tapping Valve Guide Bush**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Using a sharp 5.5 mm reamer, ream the valve guide bush to the standard specified clearance between the valve guide bush and valve stem.

Standard oil clearance:

**STANDARD OIL CLEARANCE REFERENCE**

|         |                                          |
|---------|------------------------------------------|
| 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.) |



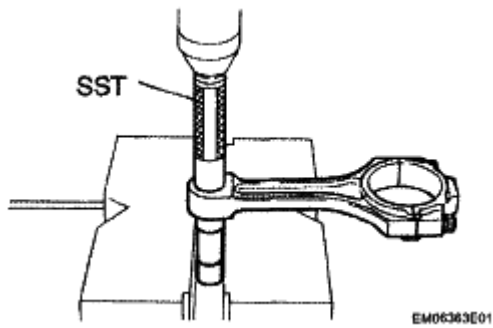
**Fig. 535: Reaming Valve Guide Bush**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**7. REMOVE CONNECTING ROD SMALL END BUSH**

- a. Using SST and a press, press out the bushing.

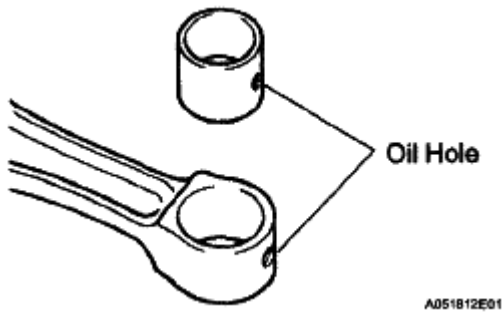
SST 09222-30010



**Fig. 536: Removing Connecting Rod Small End Bush**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**8. INSTALL CONNECTING ROD SMALL END BUSH**

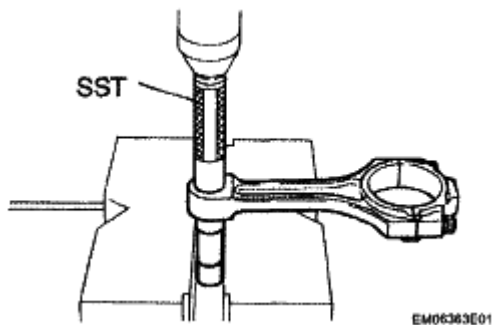
- a. Align the oil holes of a new bushing and the connecting rod.



**Fig. 537: Identifying Oil Hole**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using SST and a press, press in the bushing.

**SST 09222-30010**



**Fig. 538: Pressing Bushing**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

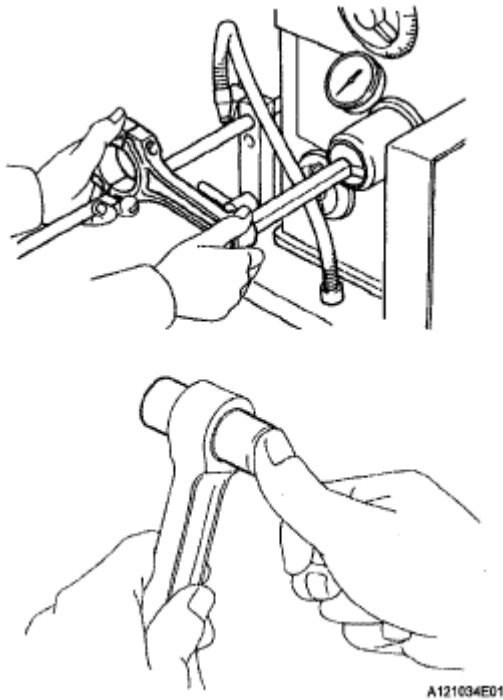
- c. Using a pin hole grinder, hone the bushing to the standard specified clearance between the bushing and piston pin.

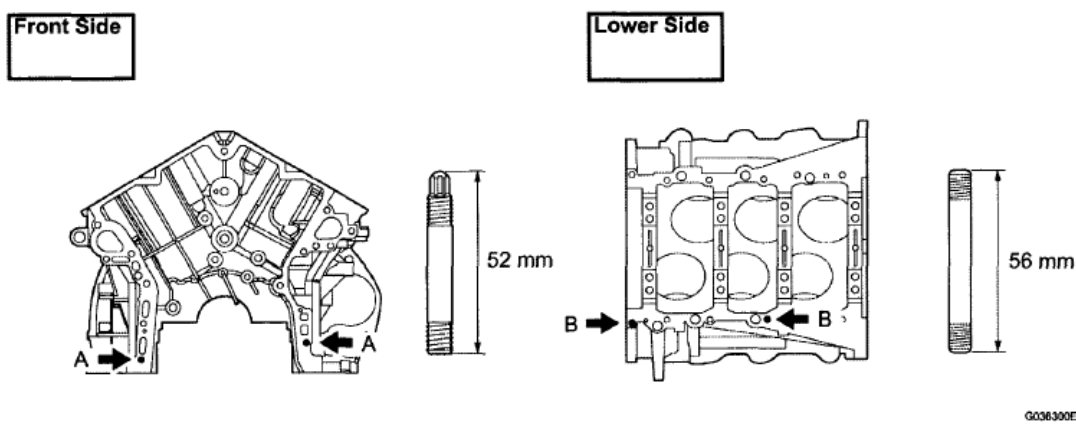
**Standard oil clearance:****0.005 to 0.011 mm (0.0002 to 0.0004 in.)****HINT:**

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

**REASSEMBLY****1. INSTALL STUD BOLT**

- a. Install the stud bolts as shown in the illustration.

**Torque: 11 N\*m (112 kgf\*cm, 8.1 ft.\*lbf) for stud bolt A****4.5 N\*m (46 kgf\*cm, 40 in.\*lbf) for stud bolt B****Fig. 539: Installing Stud Bolt****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**



**Fig. 540: Identifying Stud Bolt Dimension**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 2. INSTALL STRAIGHT PIN

- a. Using a plastic-faced hammer, tap into the new straight pin.

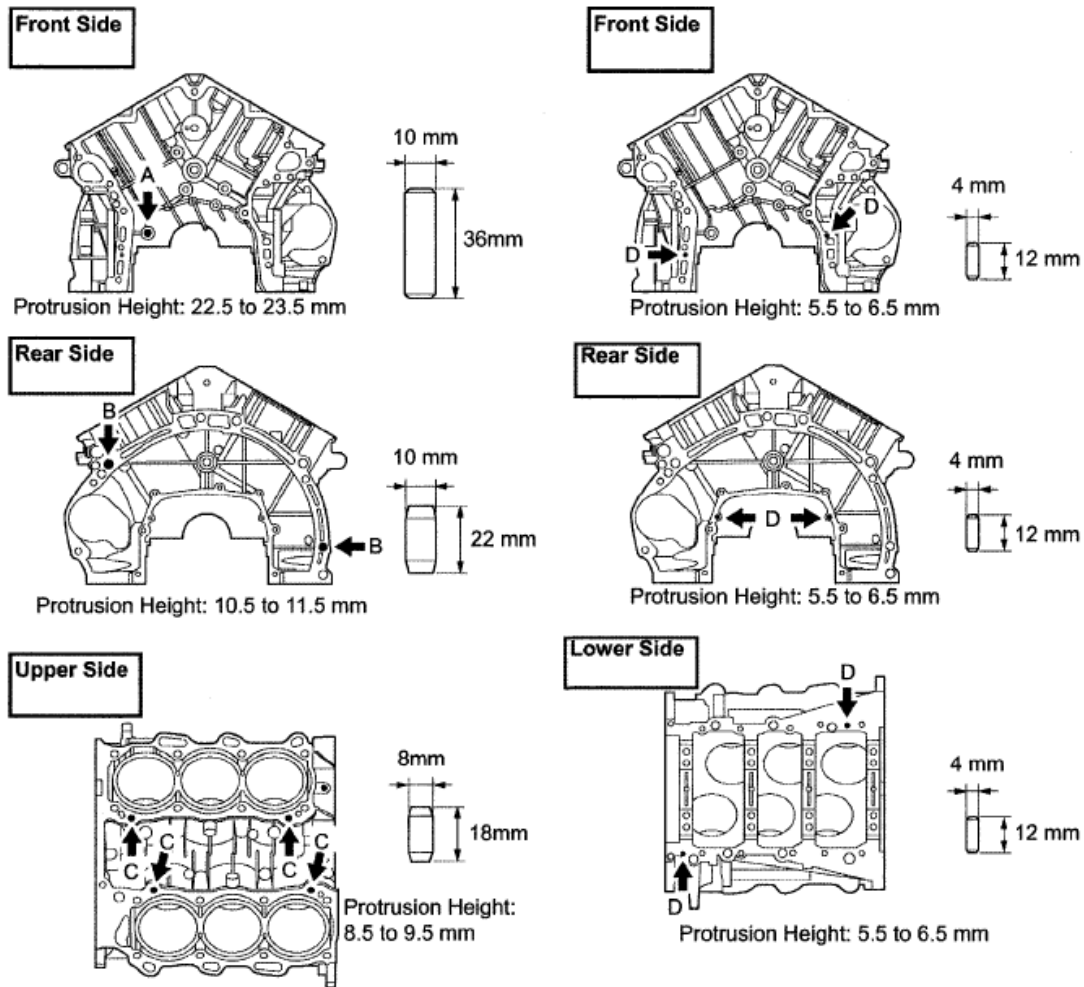
**Standard protrusion:**

**Pin A 22.5 to 23.5 mm (0.886 to 0.925 in.)**

**Pin B 10.5 to 11.5 mm (0.413 to 0.453 in.)**

**Pin C 8.5 to 9.5 mm (0.335 to 0.374 in.)**

**Pin D 5.5 to 6.5 mm (0.217 to 0.256 in.)**



Y

A075062E04

**Fig. 541: Identifying Stud Bolt Dimension (1 Of 2)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### 3. INSTALL TIGHT PLUG

- Apply adhesive around tight plugs.

**Adhesive:**

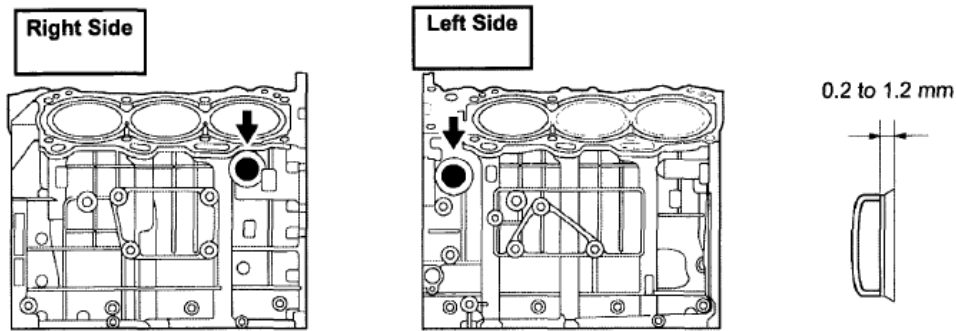
**Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent.**

- Using SST, install the tight plugs as shown in the illustration.

**SST 09550-60010 (09951 -00350), 09950-70010 (09951-07150)**

**Standard depth:**

**0.2 to 1.2 mm (0.008 to 0.047 in.)**



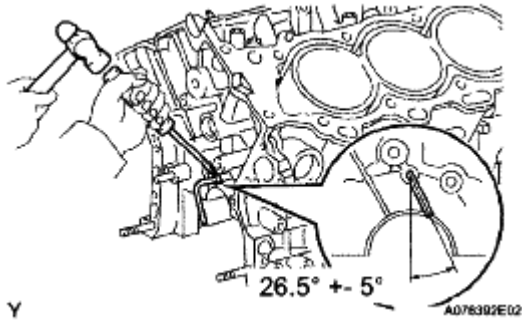
Y

A076064E04

**Fig. 542: Identifying Stud Bolt Dimension (2 Of 2)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### 4. INSTALL OIL JET

- Using a screw driver and hammer, tap in a oil jet.



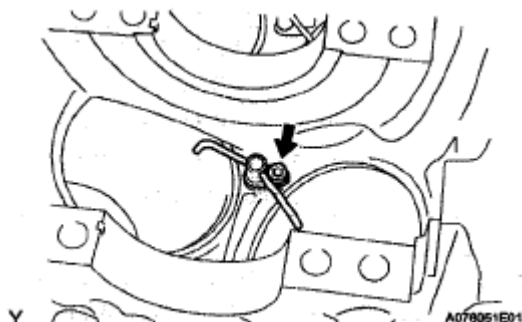
Y

**Fig. 543: Tapping Oil Jet**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### 5. INSTALL NO.1 SUB-ASSEMBLY OIL NOZZLE

- Using a 5 mm socket hexagon wrench, install the 3 oil nozzles.

**Torque: 9.0 N\*m (92 kgf\*cm, 80 in.\*lbf)**



Y

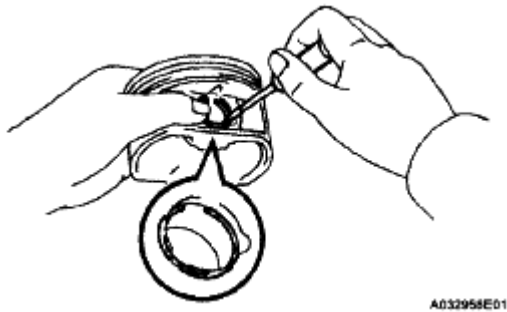
**Fig. 544: Locating No.1 Sub-Assembly Oil Nozzle**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 6. INSTALL HOLE SNAP RING

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

HINT:

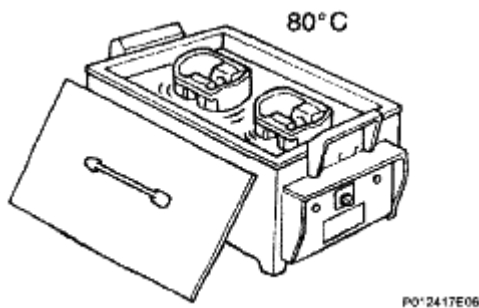
Check that an end gap of the snap ring is not overlapped with the pin hole cutout portion of the piston.



**Fig. 545: Installing Hole Snap Ring**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

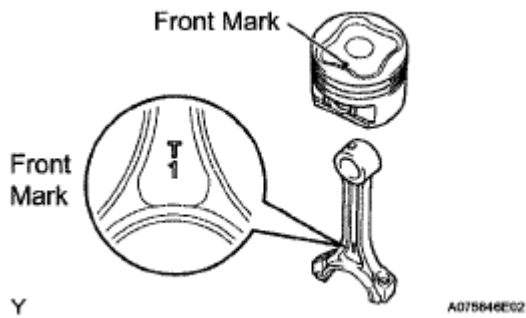
## 7. INSTALL WITH PIN PISTON SUB-ASSEMBLY

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



**Fig. 546: Heating Piston**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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.



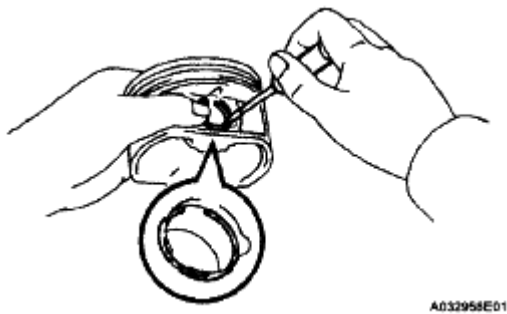
**Fig. 547: Aligning Front Marks Of Piston And Connecting Rod**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 8. INSTALL HOLE SNAP RING

- Using a small screwdriver, install a new snap ring onto the other side of the piston pin hole.

HINT:

Make sure that the gap in the snap ring does not overlap with the pin hole cutout portion of the piston.

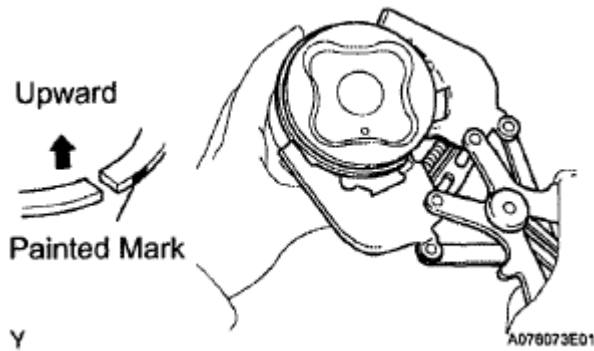


**Fig. 548: Installing Hole Snap Ring**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 9. INSTALL PISTON RING SET

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

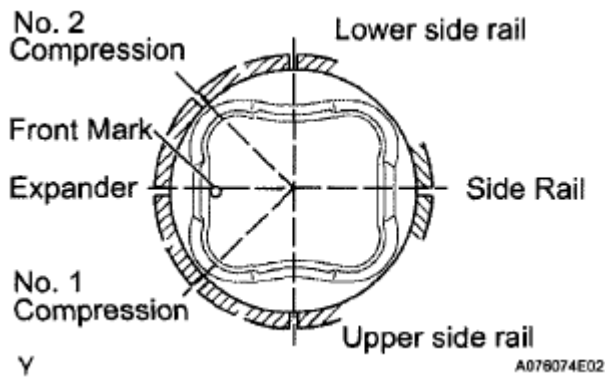
**NOTE:** Mark Install the compression ring No. 2 with the painted mark facing upward.



**Fig. 549: Installing Piston Ring Set**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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



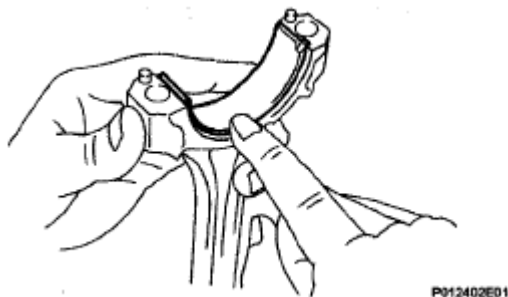
**Fig. 550: Identifying Piston Rings Front Mark, Expander And Side Rail**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 10. INSTALL CONNECTING ROD BEARING

- a. Align the bearing claw with the groove of the connecting rod or connecting cap.

**NOTE:** Clean the back side of the bearing and the bearing surface of the connecting rod and keep them free of oils and fats.



**Fig. 551: Aligning Bearing Claw With Groove Of Connecting Rod**

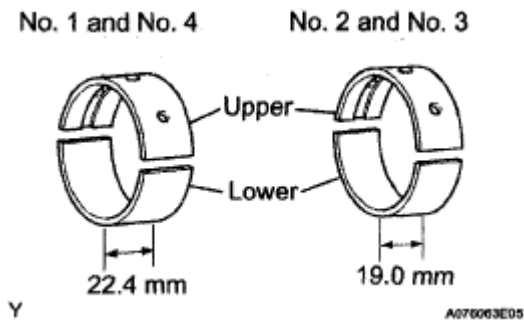
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 11. INSTALL CRANKSHAFT BEARING

### HINT:

There are 2 types of main bearings with different widths (19.0 mm (0.748 in.) and 22.4 mm (0.882 in.)) for use in the inspection. Install the 22.4 mm (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.



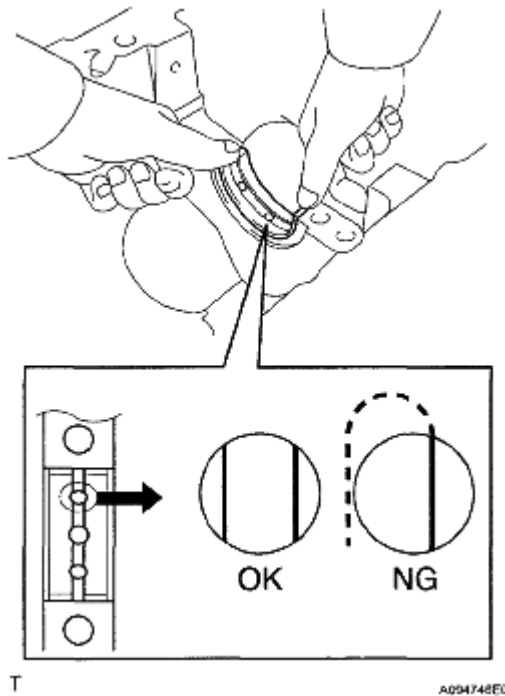
**Fig. 552: Identifying Crankshaft Bearing**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the 4 upper bearings.
  1. Install the upper bearings near the center of the cylinder block.

### NOTE:

- The width of the No. 1 and No. 4 journal bearings is different from that of the No. 2 and No. 3 journal bearings. Therefore, confirm whether it is the correct journal bearing prior to installation.
- Do not apply engine oil to the bearing installation surfaces of the cylinder block and the back side of the bearings.
- Check that the oil groove on the cylinder block can be seen through the oil supply holes of the upper bearing.



**Fig. 553: Installing Upper Bearings**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

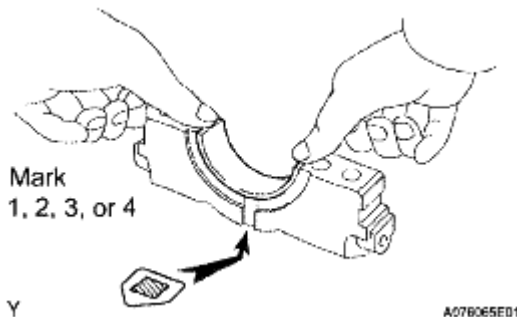
c. Install the 4 lower bearings.

1. Install the lower bearings near the center of the cylinder block.

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

**HINT:**

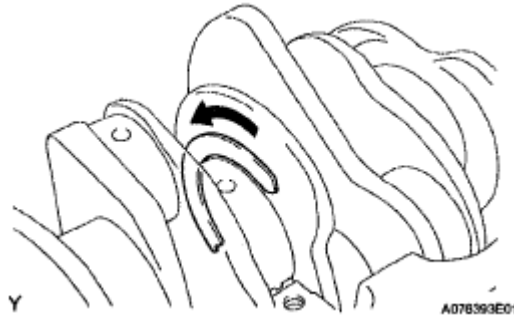
A number marked on each main bearing cap indicates the installation position.



**Fig. 554: Installing Lower Bearings**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

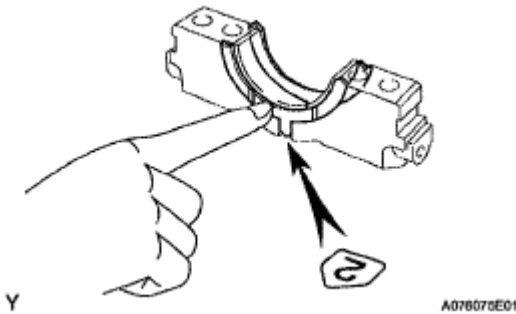
## 12. INSTALL CRANKSHAFT

- a. Apply engine oil to the upper bearing and install the crankshaft onto the cylinder block.
- b. Install the 2 upper thrust washers onto the No. 2 journal position of the cylinder block.
  1. Push the crankshaft toward the front (rear) side.
  2. Install the 2 upper thrust washers with the oil grooves facing outward.



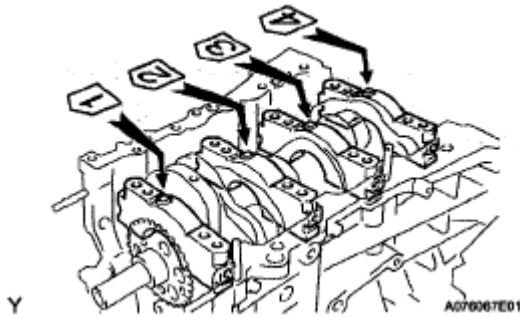
**Fig. 555: Installing Crankshaft Onto Cylinder Block**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the 2 lower thrust washers onto the No. 2 bearing cap with the grooves facing outward.



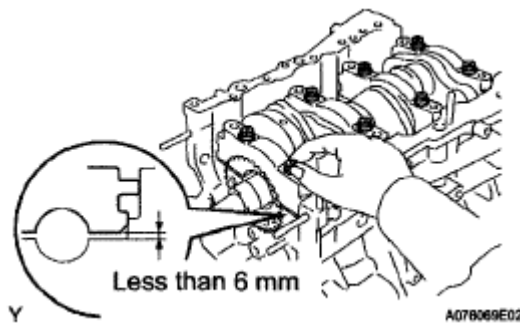
**Fig. 556: Installing Lower Thrust Washers Onto No. 2 Bearing Cap**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Examine the front marks and numbers, check the sequence number is as shown in the illustration and install the bearing caps on the cylinder block.
- e. Apply a light coat of engine oil to the threads of bearing cap bolts.
- f. Temporarily install the 8 main bearing cap bolts in the inside positions.



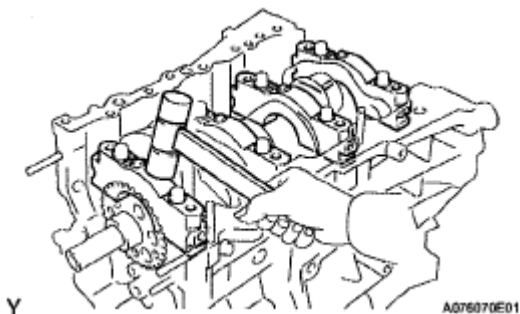
**Fig. 557: Identifying Front Mark Of Bearing Caps Onto Cylinder Block**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Install the main bearing caps. Tighten the 2 bolts for each bearing cap until the clearance between the bearing cap and the cylinder block is under 6 mm (0.23 in.).



**Fig. 558: Identifying Clearance Between Bearing Cap And Cylinder Block**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

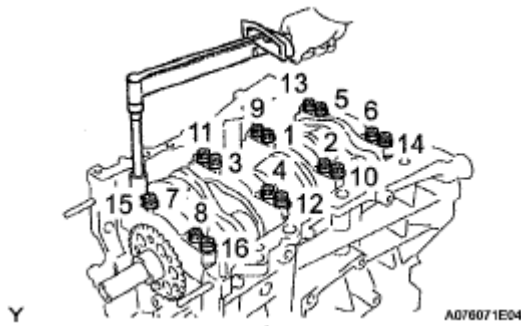
- h. Using a plastic-faced hammer, lightly tap the bearing cap to ensure a proper fit.
- i. Apply a light coat of engine oil to the threads of main bearing cap bolts.



**Fig. 559: Tapping Bearing Cap**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

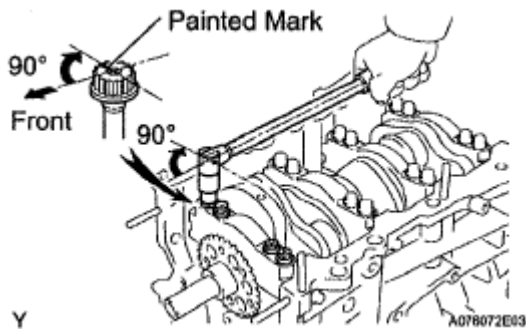
- j. Install the 16 main bearing cap bolts. Using several steps, tighten the bolts uniformly in the sequence shown in the illustration.

**Torque: 61 N\*m (622 kgf\*cm, 45 ft.\*lbf)**



**Fig. 560: Identifying Main Bearing Cap Bolts Tightening Sequence**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

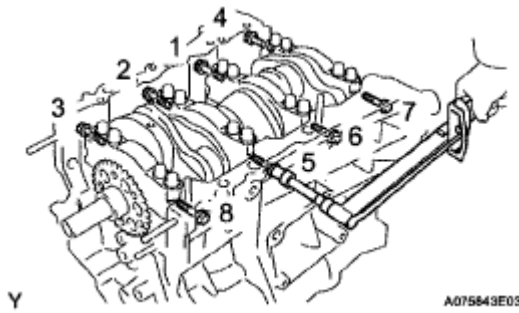
- k. Mark the front side of the bearing cap bolts with paint.
- l. Retighten the bearing cap bolts 90° in the sequence as shown.
- m. Check that the painted mark is now at a 90° angle from the front.
- n. Check that the crankshaft turns smoothly.



**Fig. 561: Identifying Front Side Of Bearing Cap Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- o. Using several steps, tighten the 8 main bearing cap bolts uniformly in the sequence shown in the illustration.

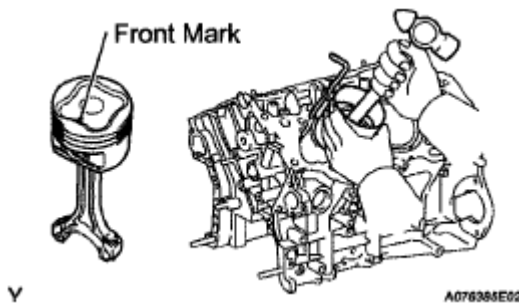
**Torque: 25 N\*m (255 kgf\*cm, 18 ft.\*lbf)**



**Fig. 562: Identifying Main Bearing Caps Tighten Sequence**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### 13. INSTALL PISTON SUB-ASSEMBLY WITH CONNECTIONG ROD

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

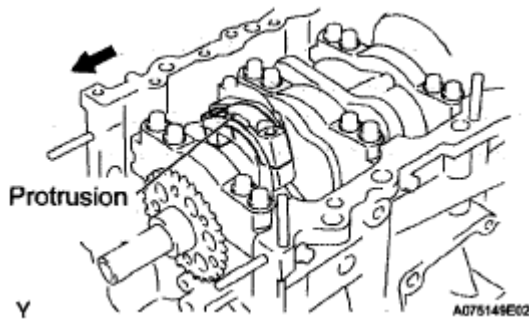


**Fig. 563: Installing Piston Sub-Assembly With Connecting Rod**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using a piston ring compressor, push the correct number piston and connecting rod into each cylinder with the front mark of the piston facing forward.

**NOTE:**

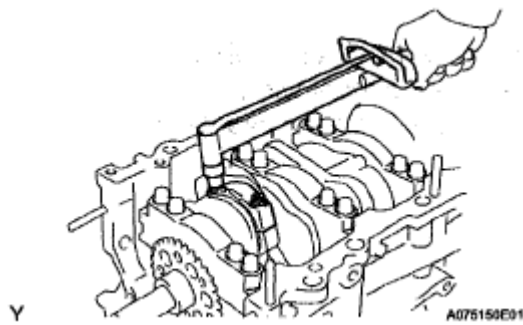
- Clean the back side of the bearing and the bearing surface of the connecting rod cap and keep them free of oils and fats.
  - Match the numbered connecting rod cap with the connecting rod.
- d. Check that the protrusion of the connecting rod cap is facing in the correct direction.
  - e. Apply a light coat of engine oil to the threads of the connecting rod cap bolts.



**Fig. 564: Identifying Protrusion Of Connecting Rod Cap**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Using SST, tighten the bolts alternately to the specified torque.

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



**Fig. 565: Tightening Connecting Rod Cap Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

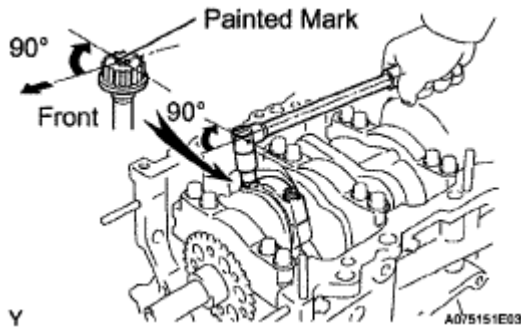
- g. Mark the front side of the each connecting cap bolt with paint.  
h. Retighten the cap bolts 90° as shown.  
i. Check that the crankshaft turns smoothly.

#### **14. INSTALL RING PIN**

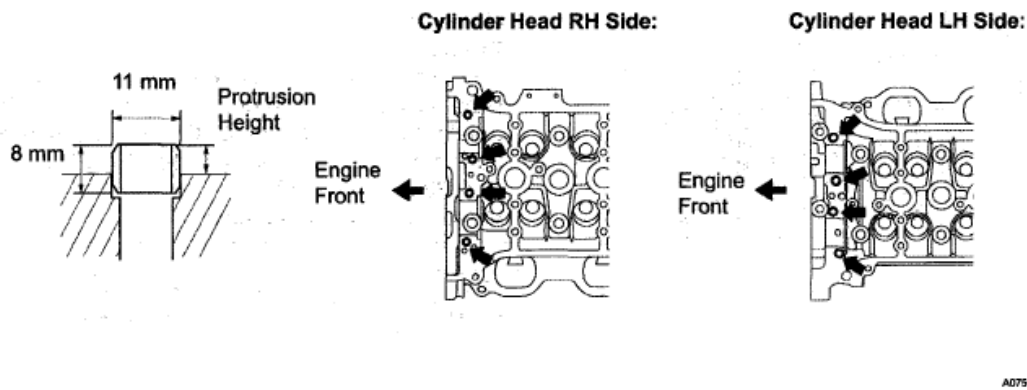
- a. Using a plastic-faced hammer, tap in the new ring pins to the specified protrusion height.

**Specified protrusion height:**

**2.7 to 3.3 mm (0.106 to 0.130 in.)**



**Fig. 566: Identifying Connecting Cap Bolt Mark Location**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 567: Identifying Cylinder Head Protrusion Height**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 15. INSTALL STRAIGHT PIN

- Using a plastic-faced hammer, tap in the new straight pins to the specified protrusion height.

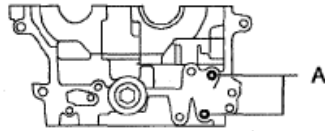
### Specified protrusion height

#### SPECIFIED PROTRUSION HEIGHT REFERENCE

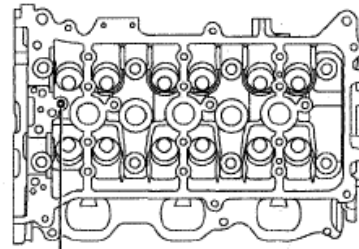
|   |                                      |
|---|--------------------------------------|
| A | 17.5 to 19.5 mm (0.689 to 0.768 In.) |
| B | 7.5 to 8.5 mm (0.295 to 0.335 In.)   |
| C | 7.0 to 9.0 mm (0.276 to 0.354 In.)   |

Cylinder Head RH Side:

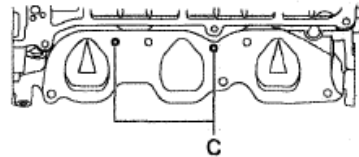
Front Side:



Upper Side:

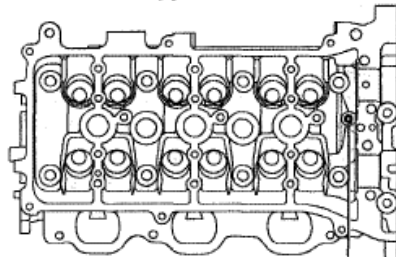


Intake Manifold Side:

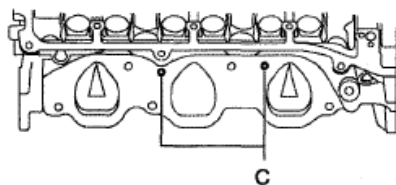


Cylinder Head LH Side:

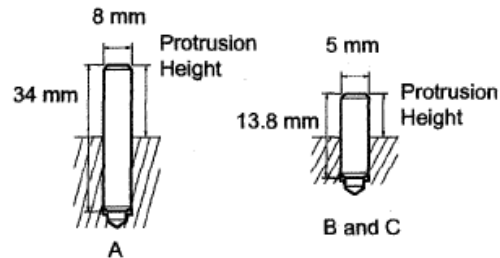
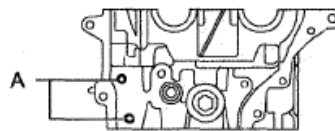
Upper Side:



Intake Manifold Side:



Front Side:



Y

A075627E04

**Fig. 568: Identifying Cylinder Head Protrusion Height**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 16. INSTALL STUD BOLT

- Using the torx socket wrenchs E5 and E7, install the stud bolts.

**Torque: 4.0 N\*m (41 kgf\*cm, 35 in.\*lbf) for stud**

**bolt A**

**9.0 N\*m (92 kgf\*cm, 80 in.\*lbf) for stud**

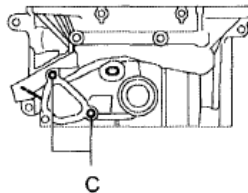
**bolt B**

4.0 N\*m (41 kgf\*cm, 35 in.\*lbf) for stud

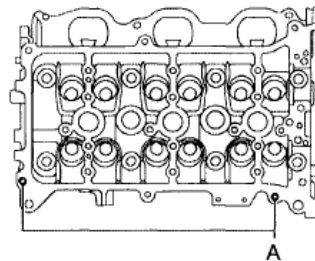
bolt C

Cylinder Head RH Side:

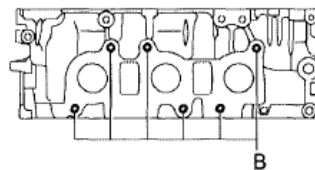
Rear Side:



Upper Side:

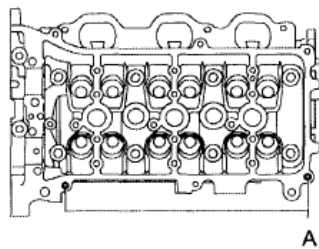


Exhaust Manifold Side:

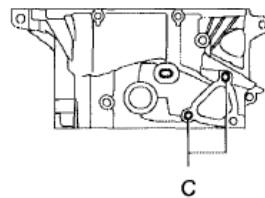


Cylinder Head LH Side:

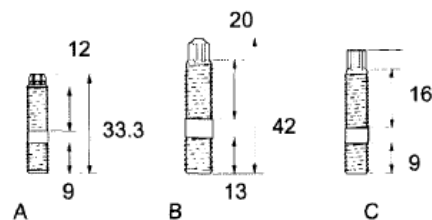
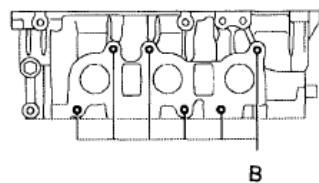
Upper Side:



Rear Side:



Exhaust Manifold Side:



Y

0036299E01

**Fig. 569: Identifying Cylinder Head Exhaust Manifold Side**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 17. INSTALL UNION

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

**Adhesive:**

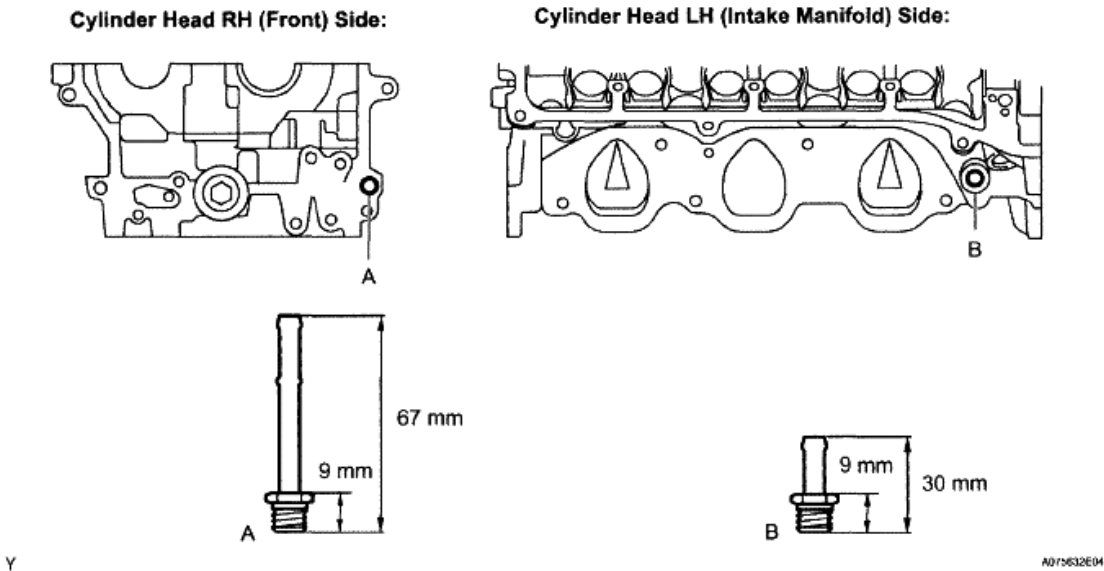
**Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent**

- b. Using a deep socket wrench 12, install the unions.

**Torque: 15 N\*m (150 kgf\*cm, 11 ft.\*lbf)**



**Fig. 570: Applying Adhesive To Threads Of Bolt End**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 571: Identifying Cylinder Head Bolt Dimension**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

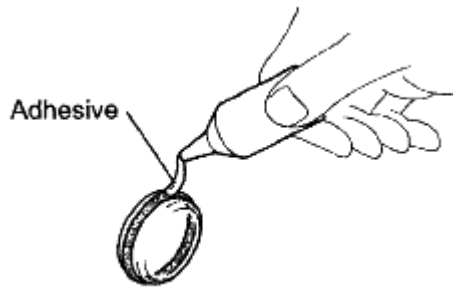
## 18. INSTALL TIGHT PLUG

- a. Apply adhesive around the tight plug.
- b. Using SST, tap in the tight plugs to the specified depth.

**SST 09950-60010 (09951 -00250), 09950-70010 (09951-07150)**

**Specified depth:**

**1.5 mm (0.059 in.)**

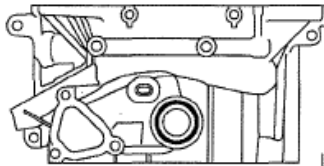


P

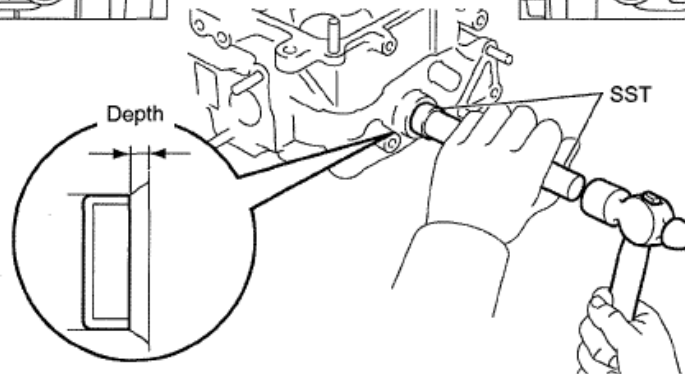
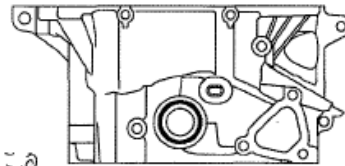
A058129E09

**Fig. 572: Applying Adhesive Around Tight Plug**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Cylinder Head RH (Rear) Side:



Cylinder Head LH (Rear) Side:



Y

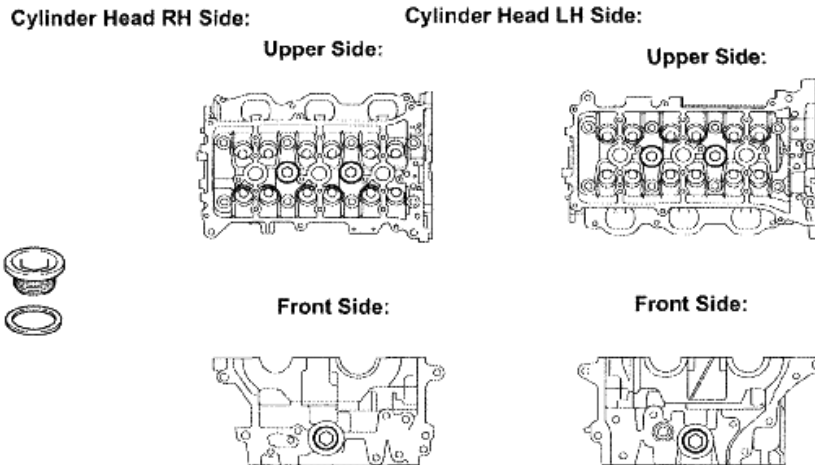
A075633E03

**Fig. 573: Tapping Tight Plugs**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 19. INSTALL WITH HEAD STRAIGHT SCREW PLUG

- Using a straight hexagon wrench 14, install a new gasket and straight screw plug.

**Torque: 80 N\*m (816 kgf\*cm, 59 ft.\*lbf)**



Y

A075634E03

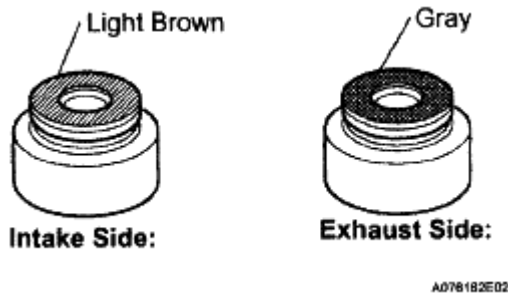
**Fig. 574: Identifying Cylinder Head Upper Side**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 20. INSTALL VALVE STEM OIL O SEAL OR RING

HINT:

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

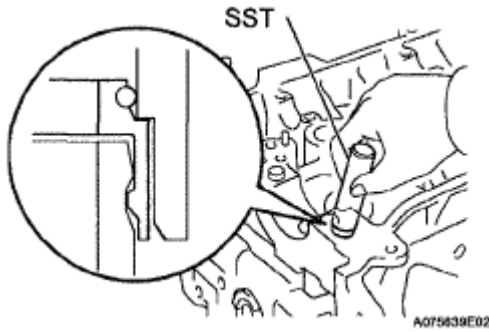
- Apply a light coat of engine oil to the valve guide bush.



**Fig. 575: Identifying Valve Stem Oil O Seal Or Ring**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

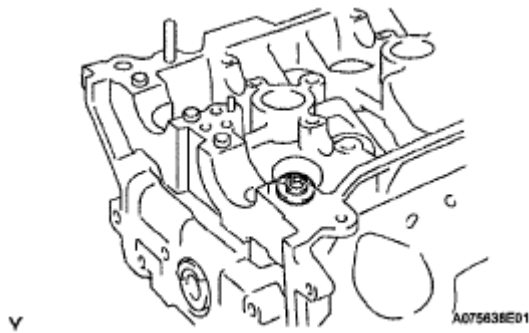
- Using SST, push in a new valve stem oil seal.

**SST 09201-41020**



**Fig. 576: Pushing Valve Stem Oil Seal**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

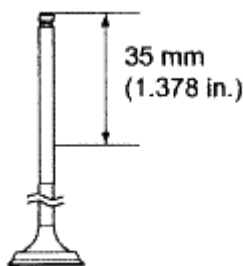
## 21. INSTALL VALVE SPRING SEAT



**Fig. 577: Installing Valve Spring Seat**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 22. INSTALL VALVE

- a. Apply the engine oil to the valve as shown in the illustration.

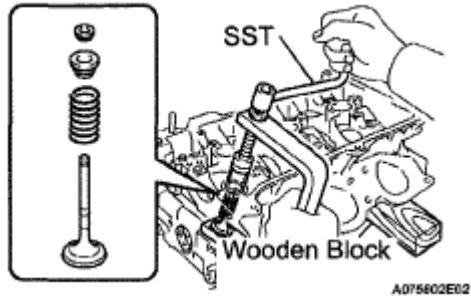


**Fig. 578: Identifying Valve Dimension**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Place the cylinder head on a wooden block.
- c. Install the valve, inner compression spring and valve spring retainer.
- d. Using SST, compress the inner compression spring and place the 2 valve spring retainer rocks

around the valve stem.

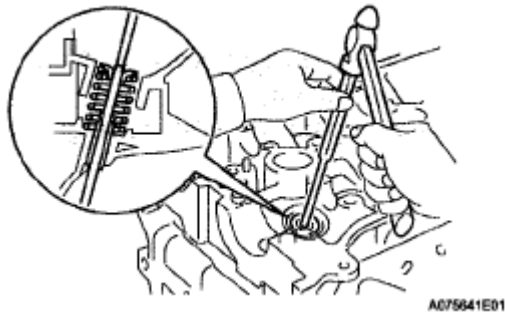
**SST 09202-70020 (09202-00010)**



**Fig. 579: Compressing Spring And Valve Spring Retainer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Using a pin punch 5, lightly tap the valve stem tip to ensure a proper fit.

**NOTE:** Be careful not to damage the valve stem tip.



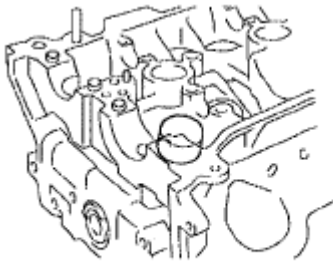
**Fig. 580: Tapping Valve Stem**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### **23. INSTALL VALVE LIFTER**

- a. Apply the engine oil to the valve stem end and valve lifter, and install the valve lifter onto the valve stem.
- b. Check that the valve lifter rotates smoothly by hand.

### **24. INSTALL REAR ENGINE OIL SEAL RETAINER**

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



A075601E01

**Fig. 581: Identifying Valve Lifter**

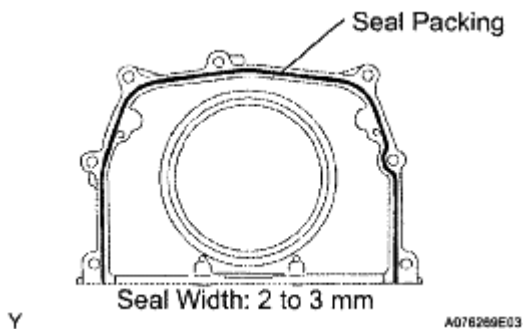
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

**Seal packing:****Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent**

**NOTE:** Parts must be assembled within 3 minutes of application. Otherwise, the seal packing must be removed and reapplied.

- c. Install the oil seal retainer with the 5 bolts and 2 nuts.

**Fig. 582: Applying Continuous Bead Of Seal Packing**

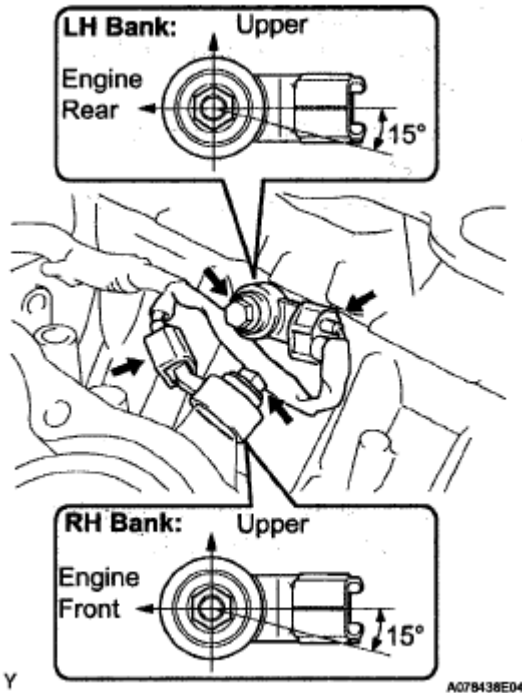
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Torque: 9.0 N\*m (92 kgf\*cm, 80 in.\*lbf)****10 N\*m (102 kgf\*cm, 7.4 ft.\*lbf)****25. INSTALL KNOCK CONTROL SENSOR**

- a. Install the 2 knock sensors with the 2 bolts as shown in the illustration.

**Torque: 20 N\*m (204 kgf\*cm, 15 ft.\*lbf)**

- b. Connect the knock sensor connectors.
- c. Connect the knock sensor wire.



**Fig. 583: Locating Knock Control Sensor**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

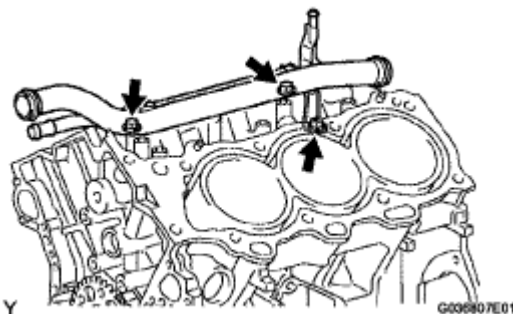
## 26. INSTALL NO.1 WATER OUTLET PIPE

- a. Install the water outlet pipe with the 3 bolts.

**Torque: 10 N\*m (102 kgf\*cm, 7.4 ft.\*lbf)**

## 27. INSTALL CYLINDER HEAD GASKET

- a. Remove any old packing material and be careful not to drop any oil on the contact surfaces of the cylinder head and cylinder block.



**Fig. 584: Locating No.1 Water Outlet Pipe**

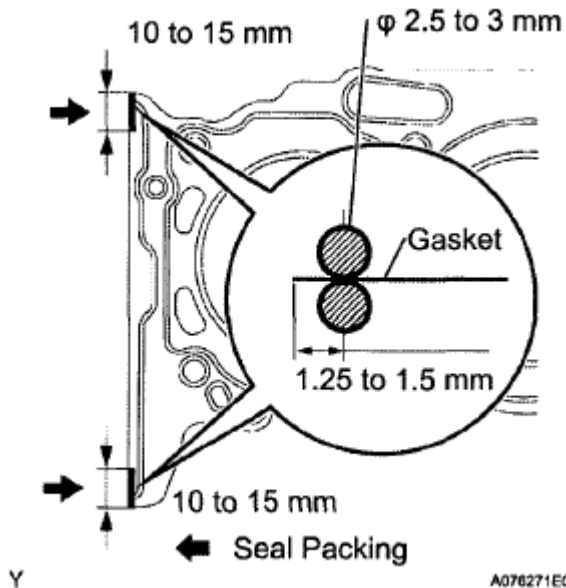
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Apply a continuous bead of seal packing (diameter 2.5 to 3 mm (0.098 to 0.118 in.)) to a new cylinder head gasket as shown in the illustration.

**Seal packing:**

**Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent**

**NOTE:** Install the cylinder head within 3 minutes of applying the seal packing. After installation, cylinder head bolts must be tightened within 15 minutes. Otherwise, the seal packing must be removed and reapplied.

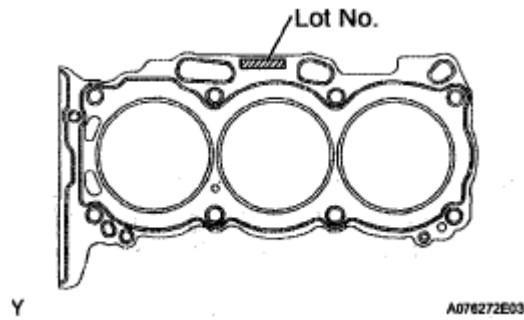


**Fig. 585: Applying Continuous Bead Of Seal Packing**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Place the cylinder head gasket on the cylinder block surface with the Lot No. stamp upward.

**NOTE:**

- Be careful of the installation direction.
- Place the cylinder head carefully in order not to damage the gasket with the bottom part of the head.



**Fig. 586: Identifying Cylinder Block Surface With Lot No. Stamp**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 28. INSTALL CYLINDER HEAD SUB-ASSEMBLY

- Place the RH cylinder head on the cylinder head gasket.
- Install the 8 cylinder head bolts.

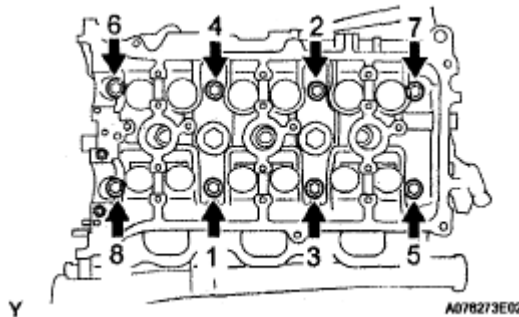
### HINT:

- The cylinder head bolts are tightened in 2 successive steps (steps (3) and (5)).
  - If any cylinder head bolts are broken or deformed, replace them.
- Apply a light coat of engine oil to the threads and under the heads of the cylinder head bolts.
  - Using several steps, uniformly install and tighten the 10 cylinder head bolts and plate washers with a bi-hexagon wrench 10 mm in the sequence shown in the illustration.

**Torque: 36 N\*m (367 kgf\*cm, 27 ft.\*lbf)**

If any cylinder head bolts do not meet the torque specification, replace them.

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



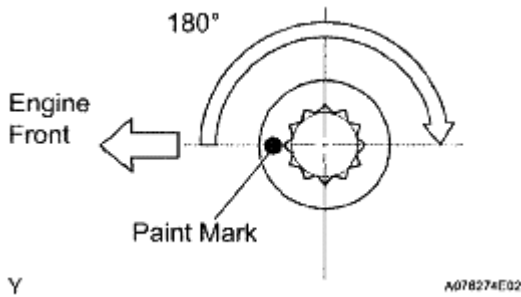
**Fig. 587: Locating Cylinder Head Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Mark the front of the cylinder head bolt with paint.

4. Retighten the cylinder head bolts by 180° as shown.
5. Check that the painted marks are now at 180° from the engine front.

## 29. INSTALL NO.2 CYLINDER HEAD GASKET

- a. Remove any old packing material and be careful not to drop any oil on the contact surfaces of the cylinder head and cylinder block.



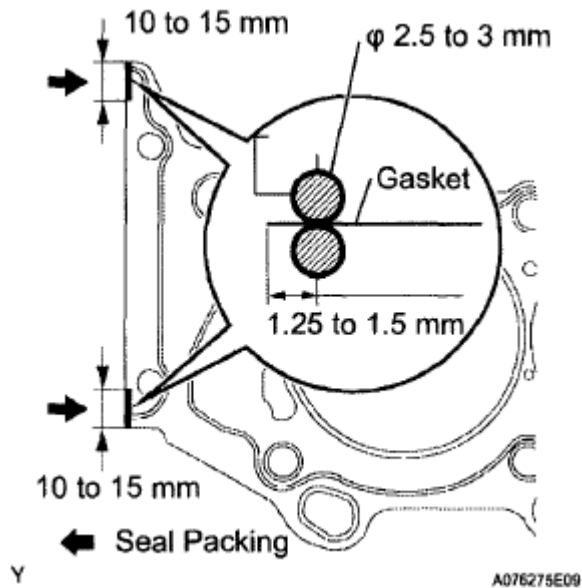
**Fig. 588: Identifying Front Mark Of Cylinder Head Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Apply a continuous bead of seal packing (Diameter 2.5 to 3 mm (0.098 to 0.118 in.)) to a new cylinder head gasket as shown in the illustration.

### Seal packing:

**Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent**

**NOTE:** Install the cylinder head within 3 minutes of applying the seal packing. After installation, cylinder head bolts must be tightened within 15 minutes. Otherwise, the seal packing must be removed and reapplied.

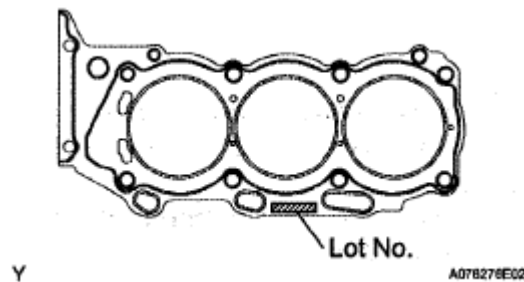


**Fig. 589: Applying Continuous Bead Of Seal Packing To Cylinder Head Gasket**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Place the cylinder head gasket on the cylinder block surface with the Lot No. stamp upward.

**NOTE:**

- Be careful of the installation direction.
- Place the cylinder head carefully in order not to damage the gasket with the bottom part of the head.



**Fig. 590: Identifying Cylinder Head Gasket**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### 30. INSTALL CYLINDER HEAD LH

- a. Place the LH cylinder head on the cylinder head gasket.
- b. Install the 8 cylinder head bolts.

**HINT:**

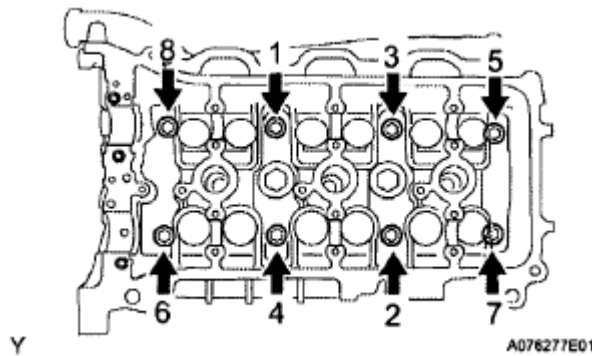
- The cylinder head bolts are tightened in 2 successive steps (steps (3) and (5)).
- If any cylinder head bolts are broken or deformed, replace them.

1. Apply a light coat of engine oil to the threads and under the heads of the cylinder head bolts.
2. Using several steps, uniformly install and tighten the 8 cylinder head bolts and plate washers with a bi-hexagon wrench 10 mm in the sequence shown in the illustration.

**Torque: 36 N\*m (367 kgf\*cm, 27 ft.\*lbf)**

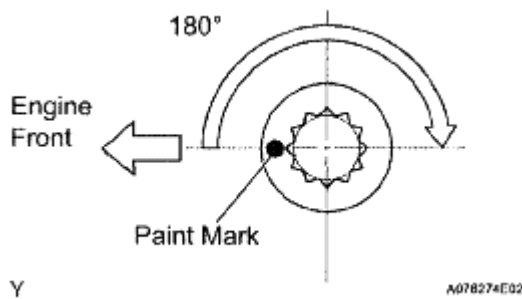
If any cylinder head bolts do not meet the torque specification, replace them.

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



**Fig. 591: Identifying Cylinder Head Bolt Tighten Sequence**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

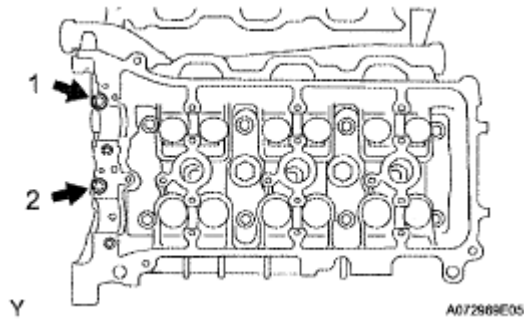
3. Mark the front of the cylinder head bolt with paint.
4. Retighten the cylinder head bolts by 180° as shown.
5. Check that the painted marks are now at 180° from the engine front.



**Fig. 592: Identifying Front Mark Of Cylinder Head Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the 2 cylinder head bolts.
  1. Apply a light coat of engine oil to the threads of the cylinder head bolts.
  2. Using several steps, uniformly install and tighten the 10 cylinder head bolts and plate washers with a bi-hexagon wrench 10 mm in the sequence shown in the illustration.

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



**Fig. 593: Locating Cylinder Head Bolts**

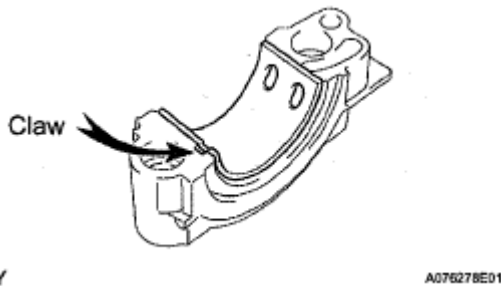
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### **31. INSTALL NO.1 CAMSHAFT BEARING**

- a. Align the bearing claw with the claw groove of the bearing cap, and push in the camshaft bearing.

**NOTE:**

- Install the bearing while aligning it with the oil hole in the bearing cap.
- Clean the back side of the bearing and the surface of the bearing cap and keep them free of oils and fats.



**Fig. 594: Locating No.1 Camshaft Bearing**

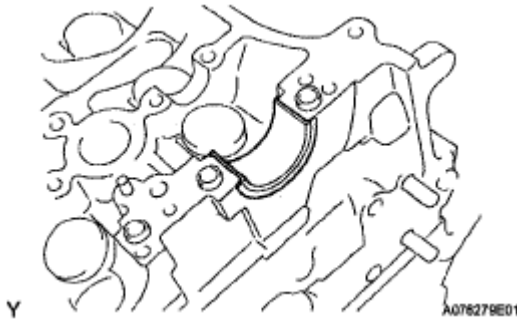
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### **32. INSTALL NO.2 CAMSHAFT BEARING**

- a. Install camshaft bearing No. 2 onto the cylinder head.

**NOTE:**

**Clean the back side of the bearing and the bearing surface of the cylinder head and keep them free of oils and fats.**



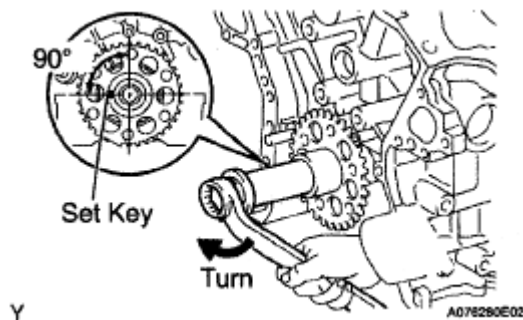
**Fig. 595: Identifying No.2 Camshaft Bearing**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### 33. INSTALL CAMSHAFTS

**NOTE:** Keep the camshaft level while it is being removed. The camshaft thrust clearance is very small and failing to keep it level could crack or damage the cylinder head journal surface, which receives the thrust. This could subsequently lead the camshaft to seize or break. Perform the following steps to avoid such problems.

- a. Set the crankshaft position.
  1. Using the crankshaft pulley set bolt, turn the crankshaft, and set the crankshaft set key in the left horizontal position as indicated.

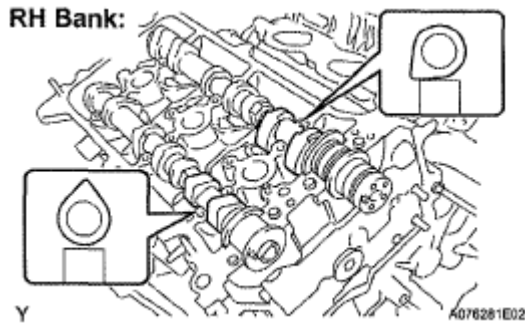
**NOTE:** Setting the crankshaft at the wrong angle could cause the piston head and valve head to come into contact with each other when the camshaft is installed. This could cause damage, so always set the camshaft at the correct angle.



**Fig. 596: Setting Crankshaft Position**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Apply new engine oil to the thrust portion and journal of the camshafts.
- c. Install the camshaft of the RH bank.
  1. Place the 2 camshafts on the RH cylinder head with the No. 1 cam lobes facing as shown the

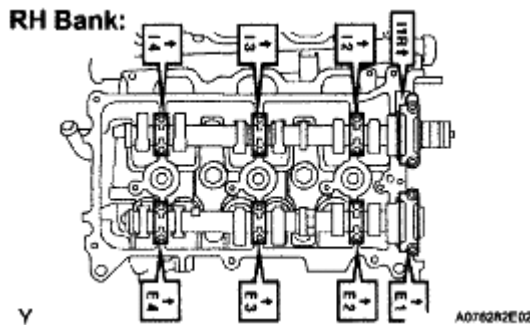
illustration.



**Fig. 597: Installing Camshaft Of RH Bank**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Install the 8 bearing caps in their correct locations.
3. Apply a light coat of engine oil to the threads of the bearing cap bolts.



**Fig. 598: Identifying Bearing Cap Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

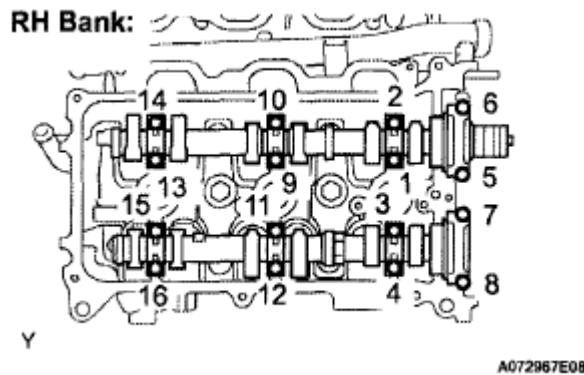
4. Using several steps, uniformly tighten the 16 bearing cap bolts in the sequence shown in the illustration.

**Torque: 9.0 N\*m (92 kgf\*cm, 80 in.\*lbf) for**

**10 mm (0.39 in.) head**

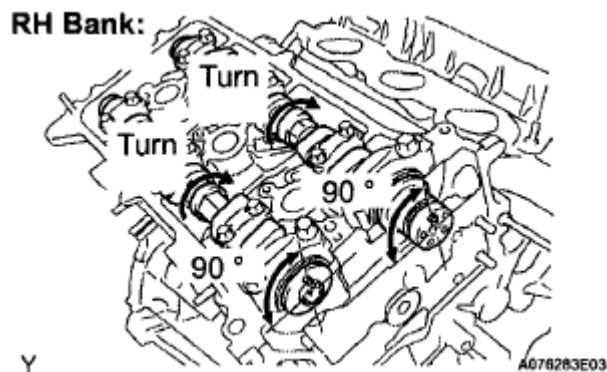
**24 N\*m (245 kgf\*cm, 18 ft.\*lbf) for**

**12 mm (0.47 in.) head**



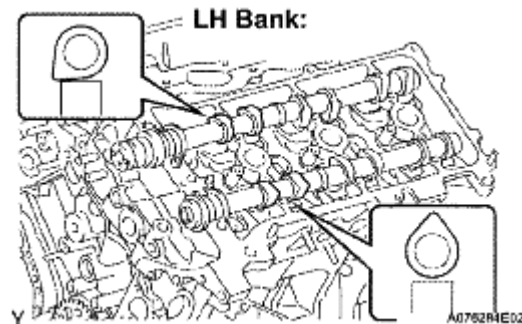
**Fig. 599: Identifying Bearing Cap Bolts Tighten Sequence**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. Using a wrench, turn the camshafts clockwise until each camshaft knock pin comes to a position 90° to the cylinder head.



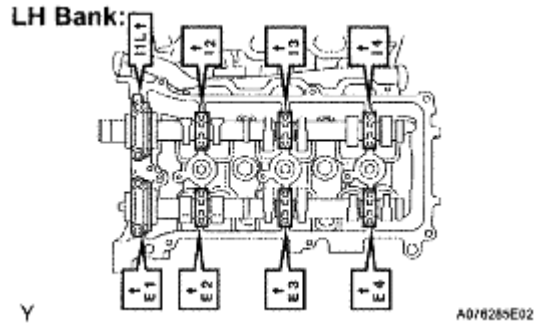
**Fig. 600: Turning Camshafts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Install the camshafts of the LH bank.
  1. Place the 2 camshafts on the LH cylinder head with the No.1 cam lobes facing as shown the illustration.



**Fig. 601: Installing Camshafts Of LH Bank**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Install the 8 bearing caps in the correct locations as shown.
3. Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.



**Fig. 602: Identifying Bearing Caps In Correct Locations**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

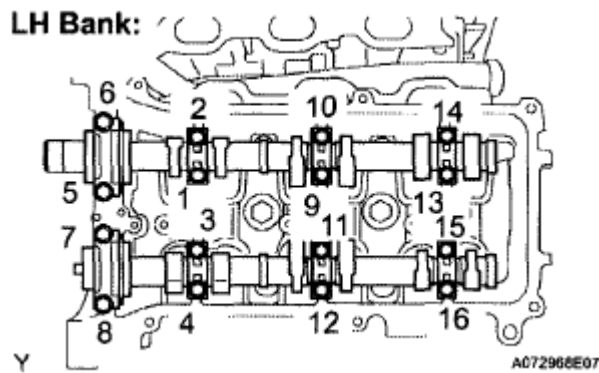
4. Using several steps, uniformly tighten the 16 bearing cap bolts in the sequence shown in the illustration.

**Torque: 9.0 N\*m (92 kgf\*cm, 80 in.\*lbf) for**

**10 mm (0.39 in.) head**

**24 N\*m (245 kgf\*cm, 18 ft.\*lbf) for**

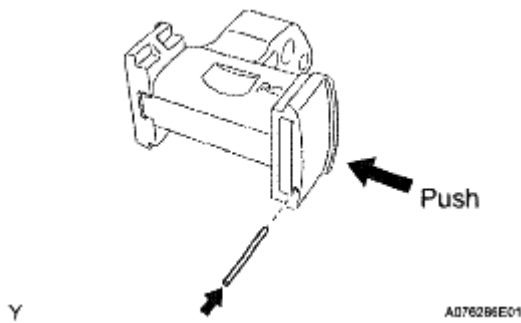
**12 mm (0.47 in.) head**



**Fig. 603: Identifying Bearing Caps Bolts Tighten Sequence**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### 34. INSTALL N0.2 CHAIN TENSIONER ASSEMBLY

- a. While pushing in the tensioner, insert a pin of 1.0 mm (0.039 in.) into the hole to fix it.

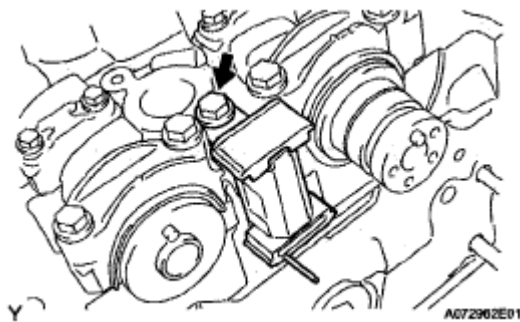


**Fig. 604: Pushing Tensioner**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the chain tensioner No. 2 with the bolt.

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

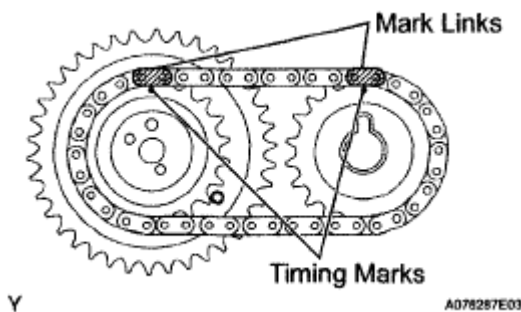


**Fig. 605: Locating Chain Tensioner No. 2 With Bolt**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### 35. INSTALL CAMSHAFT TIMING GEARS AND NO.2 CHAIN (for Bank 1)

- a. Align the yellow mark links with the timing marks (1 dot mark) of camshaft timing gears as shown in the illustration.



**Fig. 606: Identifying Timing Marks Of Camshaft Timing Gears**

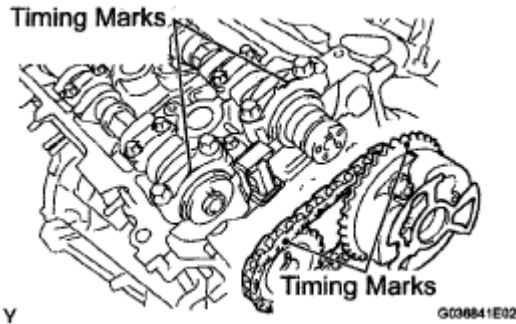
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Align the timing marks on the camshaft timing gears with the timing marks on the bearing caps,

and install the camshaft timing gears with the chain onto the RH camshafts.

- c. Temporarily install the 2 camshaft timing gear bolts.

**NOTE:** Do not push the camshaft timing gear assembly onto the camshaft forcibly when installing it.

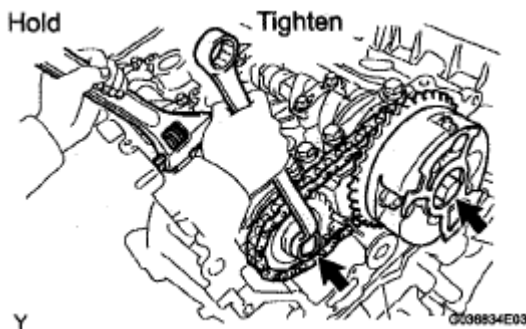


**Fig. 607: Identifying Timing Marks On Camshaft Timing Gears**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Hold the hexagonal portion of the camshaft with a wrench, and tighten the 2 bolts.

**Torque: 100 N\*m (1,020 kgf\*cm, 74 ft.\*lbf)**

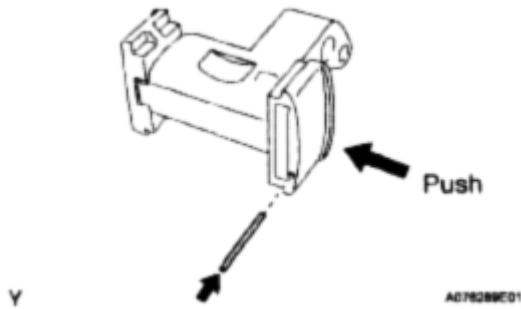
- e. Remove the pin from the chain tensioner No. 2.



**Fig. 608: Holding Hexagonal Portion Of Camshaft**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### 36. INSTALL N0.3 CHAIN TENSIONER ASSEMBLY

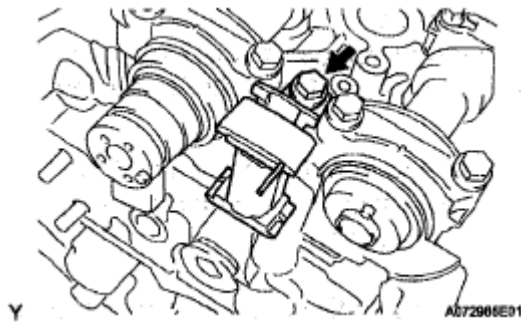
- a. While pushing in the tensioner, insert a pin of 1.0 mm (0.039 in.) into the hole to hold it.



**Fig. 609: Pushing No.3 Chain Tensioner Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the chain tensioner No. 3 with the bolt.

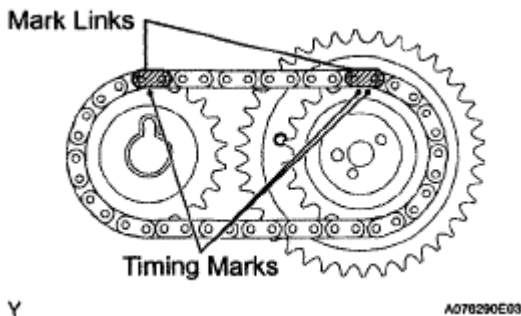
**Torque: 19 N\*m (194 kgf\*cm, 14 ft.\*lbf)**



**Fig. 610: Locating Chain Tensioner No. 3 Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### 37. INSTALL CAMSHAFT TIMING GEARS AND NO.2 CHAIN (for Bank 2)

- a. Align the yellow mark links with the timing marks (1 dot mark and 2 dot marks) on camshaft timing gears as shown in the illustration.



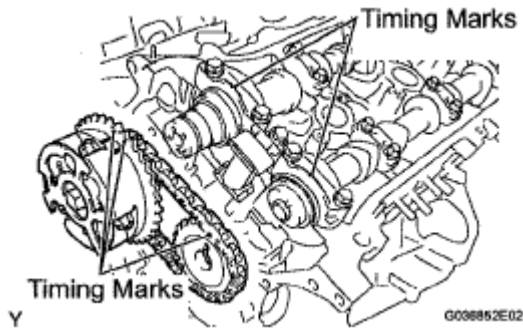
**Fig. 611: Identifying Timing Marks Of Camshaft Timing Gears**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Align the timing marks on the camshaft timing gears with the timing marks on the bearing caps,

and install the camshaft timing gears with the chain onto the LH camshafts.

- c. Temporarily install the 2 camshaft timing gear bolts.

**NOTE:** Do not push camshaft timing gear assembly onto the camshaft forcibly when installing it.

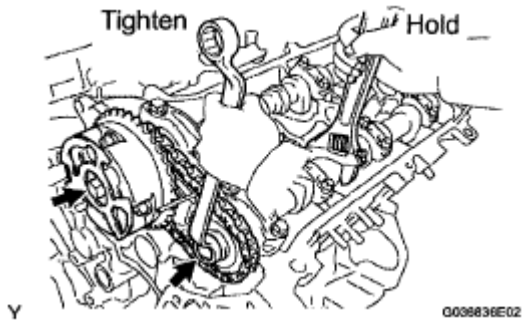


**Fig. 612: Identifying Timing Marks On Camshaft Timing Gears**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Hold the hexagonal portion of the camshaft with a wrench, and tighten the 2 bolts.

**Torque: 100 N\*m (1,020 kgf\*cm, 74 ft.\*lbf)**

- e. Remove the pin from the chain tensioner No. 3.

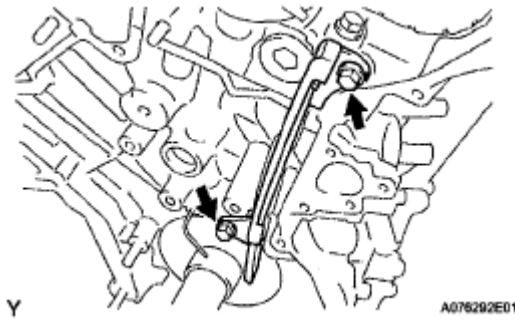


**Fig. 613: Holding Hexagonal Portion Of Camshaft**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### **38. INSTALL NO.1 CHAIN VIBRATION DAMPER**

- a. Install the chain vibration damper No. 1 with the 2 bolts.

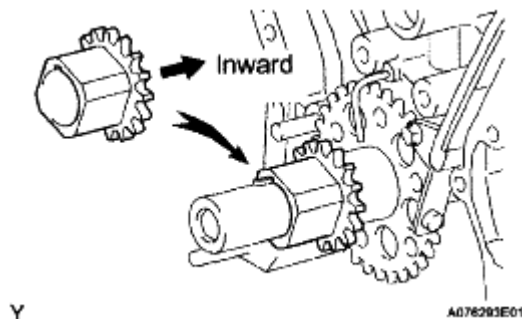
**Torque: 19 N\*m (194 kgf\*cm, 14 ft.\*lbf)**

**Fig. 614: Tightening Camshaft Bolt**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**39. INSTALL CRANKSHAFT TIMING GEAR OR SPROCKET**

- a. Align the timing gear set key with the key groove of the timing gear.
- b. Install the timing gear onto the crankshaft with the gear side facing inward.

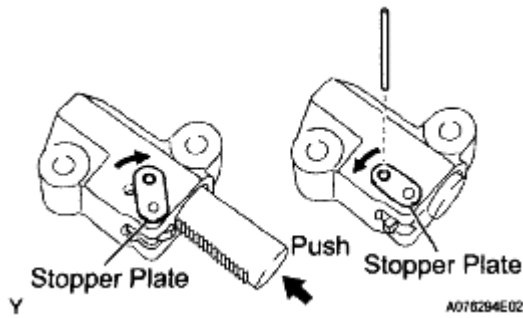
**40. INSTALL CHAIN TENSIONER SLIPPER****Fig. 615: Installing Crankshaft Timing Gear Or Sprocket**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**41. INSTALL NO.1 CHAIN TENSIONER ASSEMBLY**

- a. While turning the stopper plate of the tensioner clockwise, push in the plunger of the tensioner as shown in the illustration.
- b. While turning the stopper plate of the tensioner counterclockwise, insert a bar of 3.5 mm (0.138 in.) into the holes in the stopper plate and tensioner to fix the stopper plate.
- c. Install the chain tensioner with the 2 bolts.

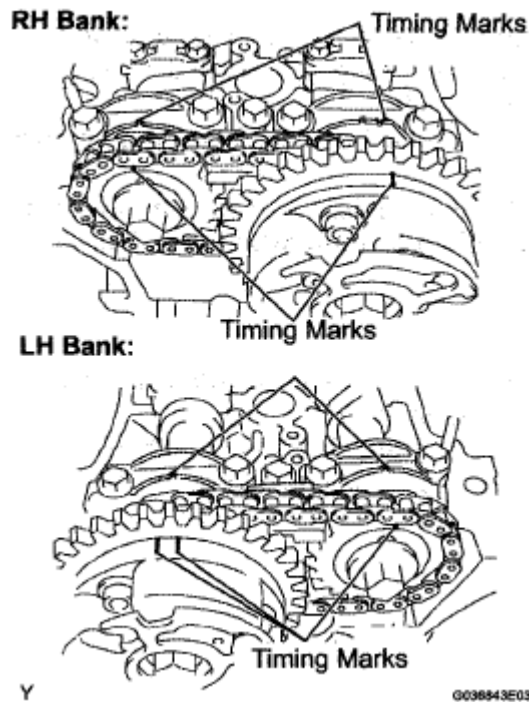
**Torque: 10 N\*m (102 kgf\*cm, 7.4 ft.\*lbf)**



**Fig. 616: Pushing Plunger Of Tensioner**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

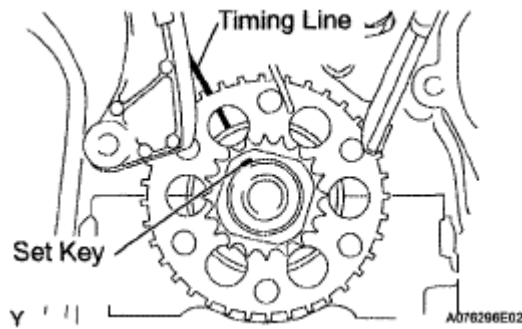
#### 42. INSTALL CHAIN SUB-ASSEMBLY

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



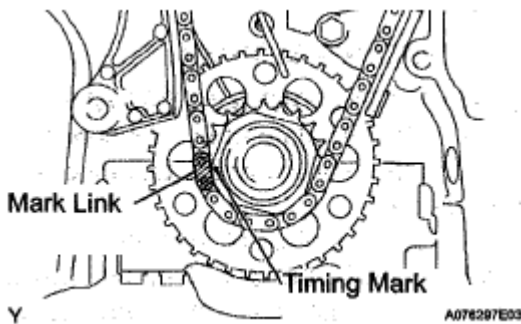
**Fig. 617: Identifying Timing Marks Of Camshaft Timing Gears And Bearing Caps**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Using the crankshaft pulley set bolt, turn the crankshaft to align the crankshaft set key with the timing line of the cylinder block.



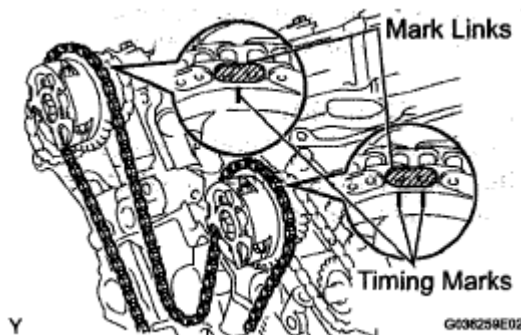
**Fig. 618: Identifying Crankshaft Set Key With Timing Line**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Align the yellow mark link with the timing mark of the crankshaft timing gear.



**Fig. 619: Aligning Timing Mark Of Crankshaft Timing Link**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Align the orange mark links with the timing marks of the camshaft timing gears, and install the chain.



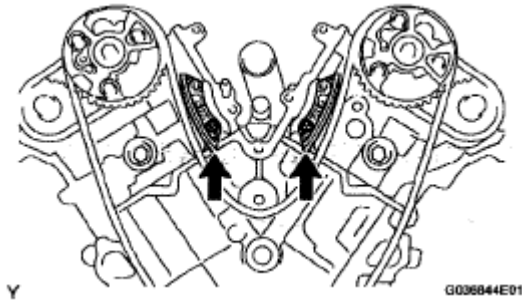
**Fig. 620: Aligning Timing Marks Of Camshaft Timing Gears**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### **43. INSTALL NO.2 CHAIN VIBRATION DAMPER**

- a. Install the 2 chain vibration dampers No. 2.

#### **44. INSTALL IDLE SPROCKET ASSEMBLY**

- a. Apply a light coat of engine oil to rotating surface of the idle gear shaft No. 1.



**Fig. 621: Locating Chain Vibration Dampers No. 2**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Temporarily install the idle gear shaft No. 1 together with the idle gear shaft No. 2 while aligning the knock pin of the idle gear shaft No. 1 with the knock pin groove of the cylinder block.

**NOTE:** Be careful of the idle gear direction.

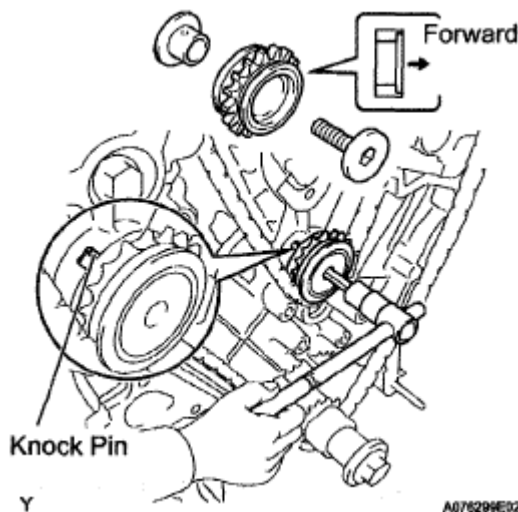
- c. Using a 10 mm hexagon wrench, tighten the idle gear shaft No. 2.

**Torque: 60 N\*m (612 kgf\*cm, 44 ft.\*lbf)**

- d. Remove the bar from the chain tensioner.

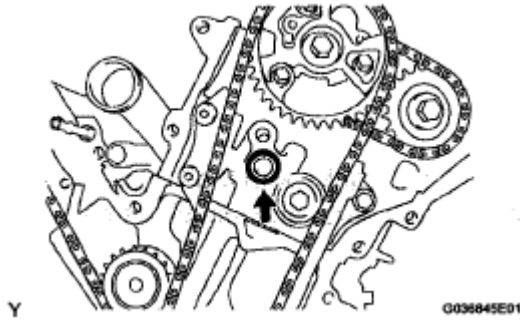
#### 45. INSTALL TIMING CHAIN OR BELT COVER SUB-ASSEMBLY

- a. Remove any old packing material and be careful not to drop any oil on the contact surfaces of the timing chain cover, cylinder head and cylinder block.



**Fig. 622: Aligning Knock Pin Of Idle Gear Shaft No. 1**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install a new O-ring onto the LH cylinder head as shown in the illustration.

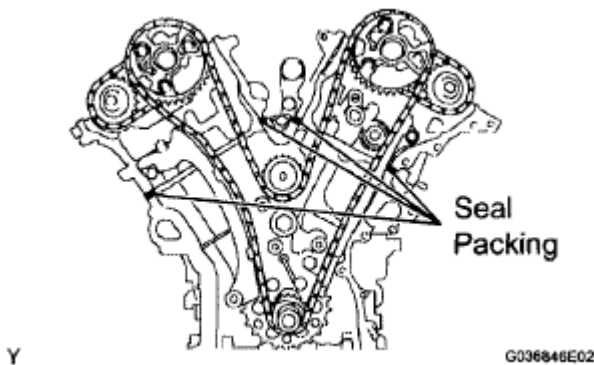


**Fig. 623: Locating O-ring Onto LH Cylinder Head**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

**Seal packing:**

**Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent**



**Fig. 624: Identifying Timing Chain Seal Packing Area**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Apply a continuous bead of seal packing (diameter 3 to 4 mm (0.12 to 0.16 in.)) to the timing chain cover as shown in the illustration.

**Seal packing:**

**Water pump part: Toyota Genuine Seal Packing 1282B, Three Bond 1282B or equivalent**

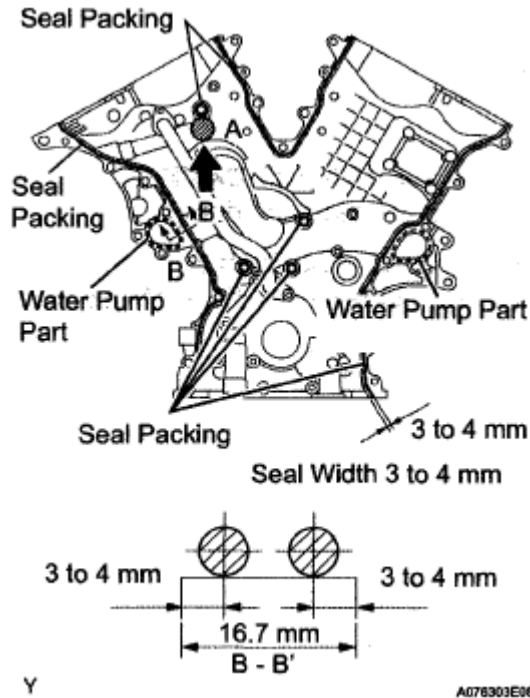
**Other part: Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent**

**NOTE:**

- Install the timing chain cover within 3 minutes of applying the

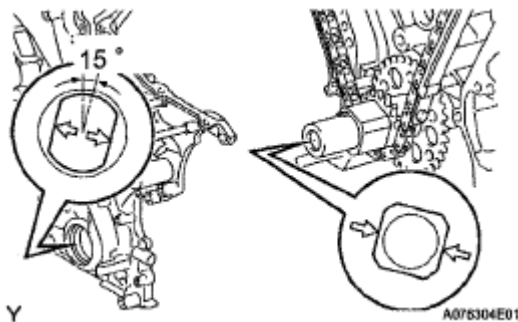
seal packing. After installation, the timing chain cover bolts and nuts must be tightened within 15 minutes. Otherwise, the seal packing must be removed and reapplied.

- Do not apply seal packing to A as shown in the illustration.



**Fig. 625: Applying Seal Packing To Timing Chain Cover**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Align the key way of the oil pump drive rotor with the rectangular portion of the crankshaft timing gear, and slide the timing chain cover into place.



**Fig. 626: Aligning Key Of Oil Pump Drive Rotor**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

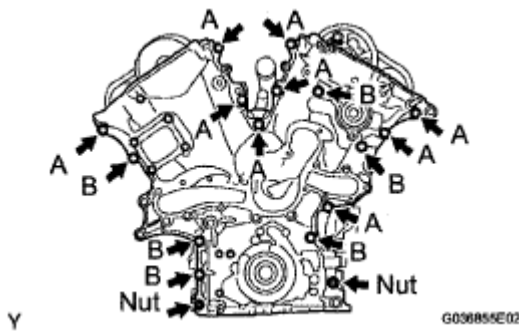
- Install the timing chain cover with the 15 bolts and 2 nuts. Tighten the bolts and nuts uniformly in several steps.

**Torque: 23 N\*m (235 kgf\*cm, 17 ft.\*lbf)**

**NOTE:**

- Take care not to wrap the chain and slipper beyond the timing chain cover seal line.
- After installing the timing chain cover, install the water pump within 15 minutes.

**HINT:**



**Fig. 627: Locating Timing Chain Cover Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Each bolt length is as follows:

**BOLT LENGTH SPECIFICATION**

| Bolt | length           |
|------|------------------|
| A    | 25 mm (0.98 in.) |
| B    | 55 mm (2.17 in.) |

**46. INSTALL WATER PUMP ASSEMBLY**

- a. Install a new gasket and the water pump with the 17 bolts.

**Torque: 9.0 N\*m (92 kgf\*cm, 80 in.\*lbf) for 10**

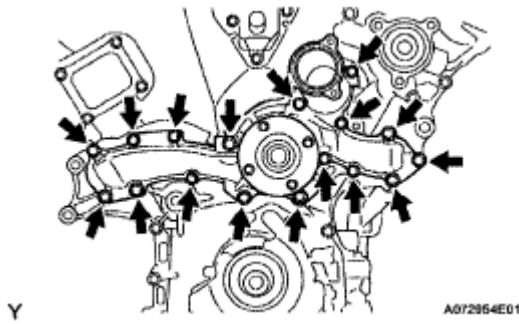
**mm (0.39 in.) head**

**23 N\*m (235 kgf\*cm, 17 ft.\*lbf) for 12**

**mm (0.47 in.) head**

**47. INSTALL OIL PAN SUB-ASSEMBLY**

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



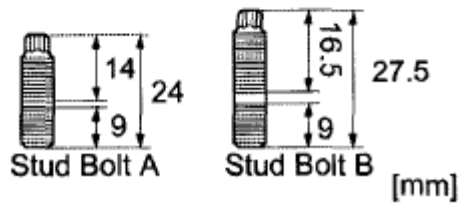
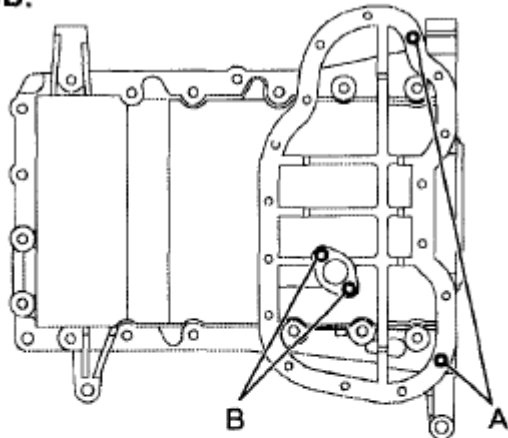
**Fig. 628: Locating Water Pump Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the 4 stud bolts (for 2WD).

**Torque: 4.0 N\*m (41 kgf\*cm, 35 in.\*lbf)**

**2WD:**



Y G036800E01

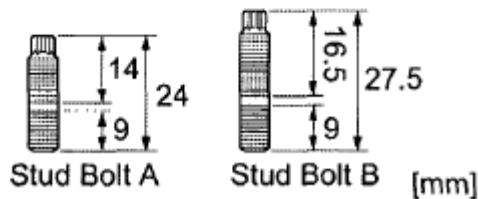
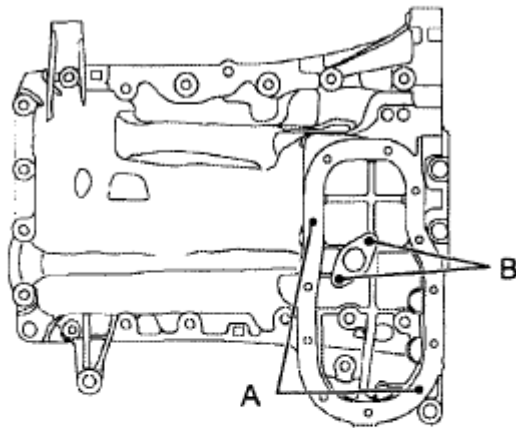
**Fig. 629: Identifying Stud Bolts Dimension**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the 4 stud bolts (for Pre Runner and 4WD).

**Torque: 4.0 N\*m (41 kgf\*cm, 35 in.\*lbf)**

**Pre Runner and 4WD:**

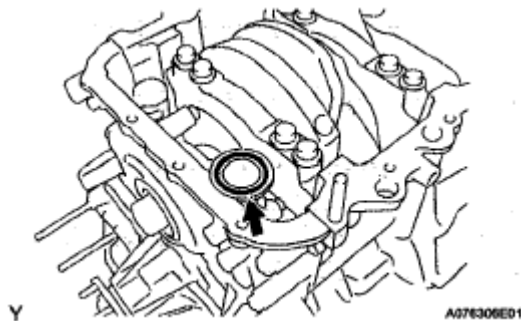


Y

G036648E01

**Fig. 630: Identifying Stud Bolts Dimension**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Install a new O-ring onto the oil pump.



Y

A076306E01

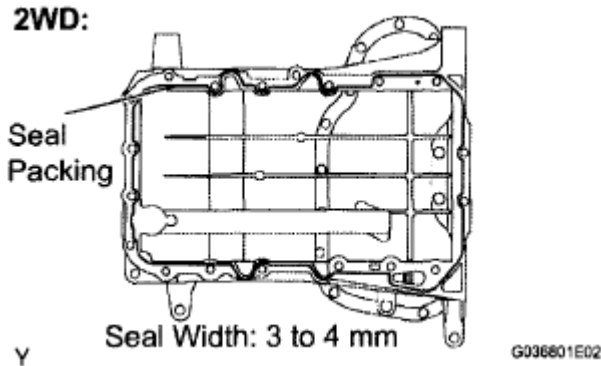
**Fig. 631: Locating O-ring Onto Oil Pump**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Apply a continuous bead of seal packing (diameter 3 to 4 mm (0.12 to 1.16 in.)) to the oil pan as shown in the illustration (for 2WD).

**Seal packing:**

**Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent**

**NOTE:** Install the oil pan within 3 minutes of applying the seal packing. After installation, the oil pan bolts and nuts must be tightened within 15 minutes. Otherwise, the seal packing must be removed and reapplied.



**Fig. 632: Applying Seal Packing To Oil Pan**

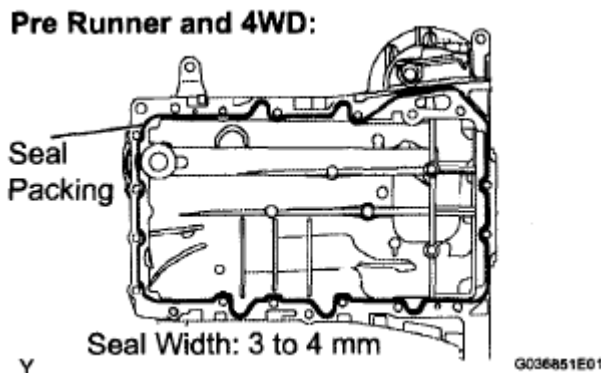
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Apply a continuous bead of the seal packing (diameter 3 to 4 mm (0.12 to 0.16 in.)) to the oil pan as shown in the illustration (for Pre Runner and 4WD).

**Seal packing:**

Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent

**NOTE:** Install the oil pan within 3 minutes of applying the seal packing. After installation, the oil pan bolts and nuts must be tightened within 15 minutes. Otherwise, the seal packing must be removed and reapplied.



**Fig. 633: Applying Seal Packing To Oil Pan**

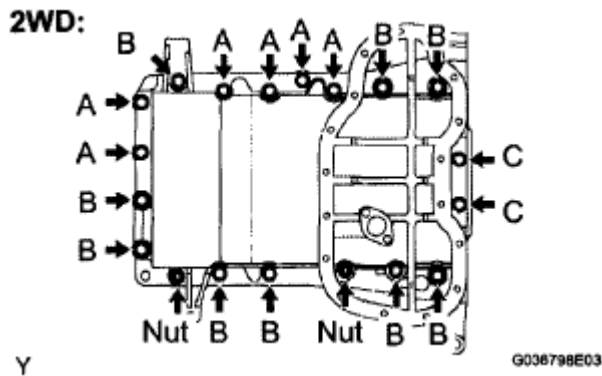
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Install the oil pan with the 17 bolts and 2 nuts. Tighten the bolts and nuts uniformly in several steps

(for 2WD).

**Torque: 10 N\*m (102 kgf\*cm, 7.4 ft.\*lbf) for 10 mm (0.39 in.) head**

**Torque: 21 N\*m (214 kgf\*cm, 16 ft.\*lbf) for 12 mm (0.47 in.) head**



**Fig. 634: Locating Oil Pan Bolts And Nuts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**HINT:**

Each bolt length is as follows:

**BOLT LENGTH SPECIFICATION**

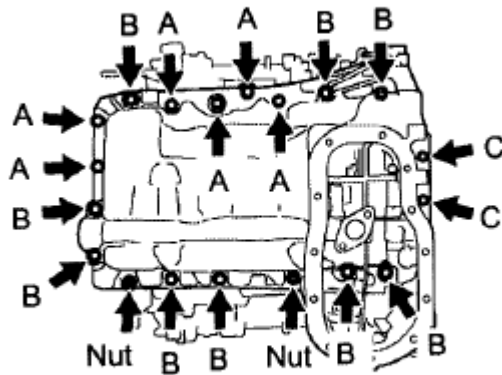
| Bolt | length           |
|------|------------------|
| A    | 25 mm (0.98 In.) |
| B    | 45 mm (1.77 in.) |
| C    | 14 mm (0.55 in.) |

- h. Install the oil pan with the 17 bolts and 2 nuts. Tighten the bolts and nuts uniformly in several steps (for Pre Runner and 4WD).

**Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf) for 10 mm (0.39 in.) head**

**21 N\*m (214 kgf\*cm, 16 ft.\*lbf) for 12 mm (0.47 in.) head**

**Pre Runner and 4WD:**



A116005E01

**Fig. 635: Locating Oil Pan Bolts And Nuts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**HINT:**

Each bolt length is as follows:

**BOLT LENGTH SPECIFICATION**

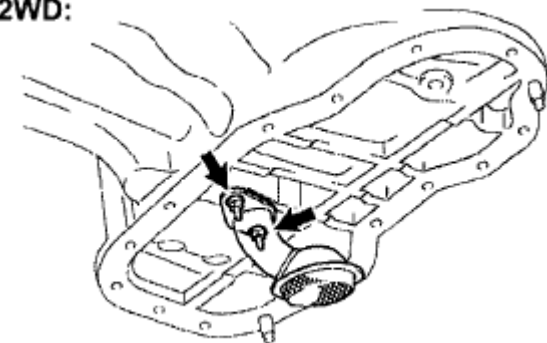
| Bolt | length           |
|------|------------------|
| A    | 25 mm (0.98 in.) |
| B    | 45 mm (1.77 in.) |
| C    | 14 mm (0.55 in.) |

**48. INSTALL OIL STRAINER SUB-ASSEMBLY**

- Install a new gasket, then install the oil strainer with the 2 nuts (for 2WD).

**Torque: 9.0 N\*m (92 kgf\*cm, 80 in.\*lbf)**

**2WD:**



G036832E01

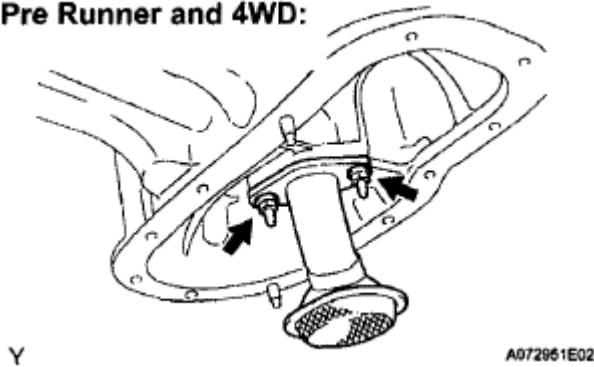
**Fig. 636: Locating Oil Strainer Nuts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install a new gasket, then install the oil strainer with the 2 nuts (for Pre Runner and 4WD).

**Torque: 9.0 N\*m (92 kgf\*cm, 80 in.\*lbf)****49. INSTALL NO.2 OIL PAN SUB-ASSEMBLY**

- a. Remove any old packing material and be careful not to drop any oil on the contact surfaces of the oil pan and oil pan No. 2.

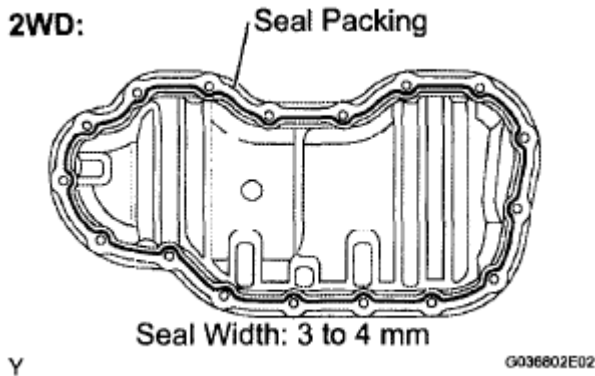
**Pre Runner and 4WD:****Fig. 637: Locating Oil Strainer Nuts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Apply a continuous bead of the seal packing (diameter 3 to 4 mm (0.12 to 0.16 in.)) as shown in the illustration (for 2WD).

**Seal packing:****Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent**

**NOTE:** Install the oil pan No. 2 within 3 minutes of applying the seal packing. After installation, oil pan No. 2 bolts and nuts must be tightened within 15 minutes. Otherwise, the seal packing must be removed and reapplied.



**Fig. 638: Identifying Oil Strainer Seal Packing**

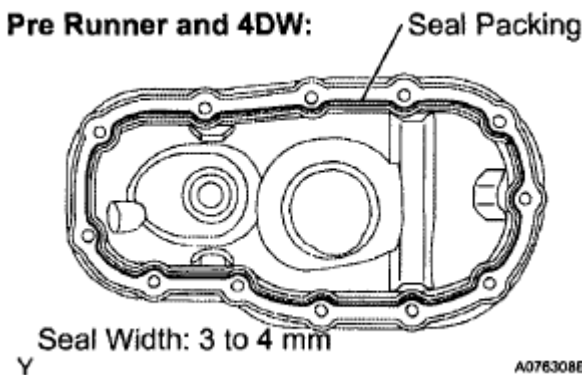
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Apply a continuous bead of seal packing (diameter 3 to 4 mm(0.12 to 0.16 in.)) as shown in the illustration (for Pre Runner and 4WD).

**Seal packing:**

**Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent**

**NOTE:** Install the oil pan No. 2 within 3 minutes of applying the seal packing. After installation, the oil pan No. 2 bolts and nuts must be tightened within 15 minutes. Otherwise, the seal packing must be removed and reapplied.

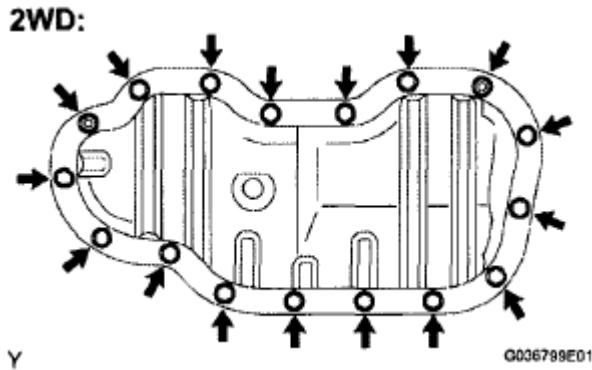


**Fig. 639: Identifying Oil Strainer Seal Packing**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

**Torque: 9.0 N\*m (92 kgf\*cm, 80 in.\*lbf) for bolts 10 N\*m (102 kgf\*cm, 7.4 ft.\*lbf) for nut**



**Fig. 640: Locating No.2 Oil Pan Sub-Assembly And Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Install the oil pan No. 2 with the 10 bolts and 2 nuts. Tighten the bolts and nuts uniformly in several steps (for Pre Runner and 4WD).

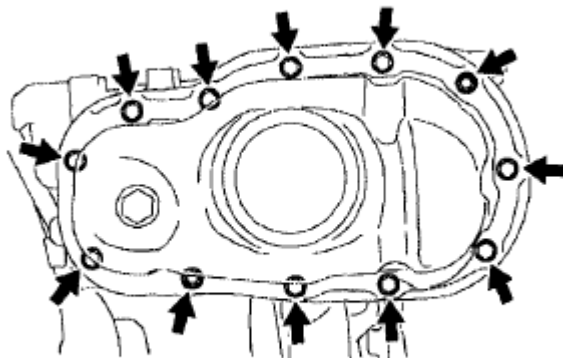
**Torque: 9.0 N\*m (92 kgf\*cm, 80 in.\*lbf) for bolts 10 N\*m (102 kgf\*cm, 7.4 ft.\*lbf)**

#### 50. INSTALL OIL PAN DRAIN PLUG

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

**Torque: 40 N\*m (408 kgf\*cm, 30 ft.\*lbf)**

**Pre Runner and 4WD:**



**Fig. 641: Locating Oil Pan No. 2 With Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

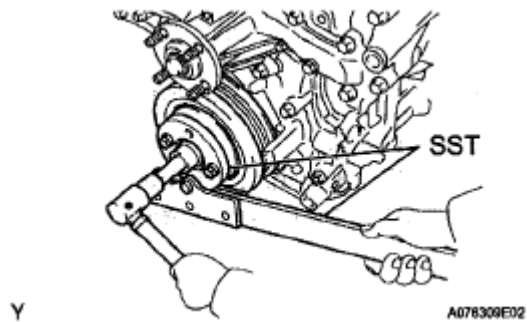
#### 51. INSTALL CRANKSHAFT PULLEY

- a. Using SST, fix the pulley and tighten the bolt.

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

**Torque: 250 N\*m (2,549 kgf\*cm, 185 ft.\*lbf)**

52. **SET NO.1 CYLINDER TO TDC/COMPRESSION**
53. **INSPECT VALVE CLEARANCE**
54. **ADJUST VALVE CLEARANCE**
55. **INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY**



**Fig. 642: Installing Crankshaft Pulley**

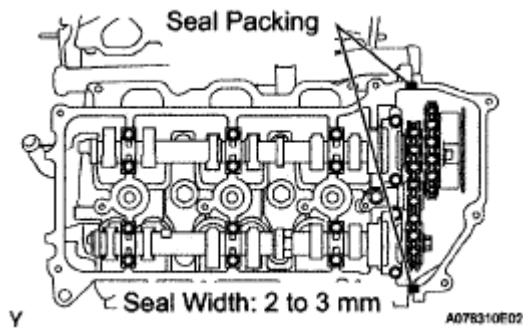
**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- a. Remove any old packing material and be careful not to drop any oil on the contact surfaces of the cylinder head, timing chain cover and cylinder head cover.
- b. Install the gasket onto the cylinder head cover.
- c. Apply a continuous bead of seal packing (diameter 2 to 3 mm (0.08 to 0.12 in.)) to the cylinder head and timing chain cover as shown in the illustration.

**Seal packing:**

**Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent**

**NOTE:** Install the cylinder head cover within 3 minutes of applying the seal packing. After installation, the cylinder head cover bolts and nuts must be tightened within 15 minutes. Otherwise the seal packing must be removed and reapplied.



**Fig. 643: Identifying Seal Packing Of Cylinder Head**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Install the seal washers onto the bolts.
- e. Install the cylinder head cover with the 10 bolts and 2 nuts. Tighten the bolts and nuts uniformly in several steps.

**Torque: 10 N\*m (102 kgf\*cm, 7.4 ft.\*lbf) for bolts**

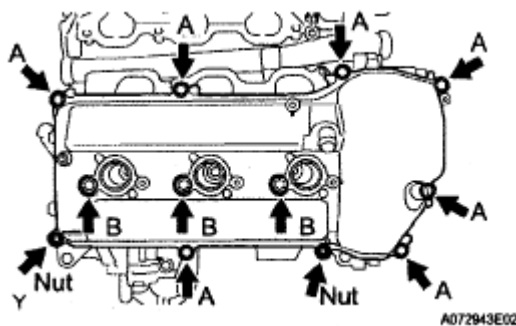
**A**

**9.0 N\*m (92 kgf\*cm, 80 in.\*lbf) for bolts**

**B**

**9.0 N\*m (92 kgf\*cm, 80 in.\*lbf) for nuts**

HINT:



**Fig. 644: Locating Cylinder Head Cover Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Each bolt length is as follows:**

**BOLT LENGTH SPECIFICATION**

| Bolt | length |
|------|--------|
| A    | 25 mm  |

|   |                  |
|---|------------------|
| B | 60 mm (2.36 in.) |
|---|------------------|

**56. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY LH**

- a. Remove any old packing material and be careful not to drop any oil on the contact surfaces of the cylinder head, timing chain cover and cylinder head cover.
- b. Apply adhesive to the threads of the ventilation valve.

**Adhesive:****Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent**

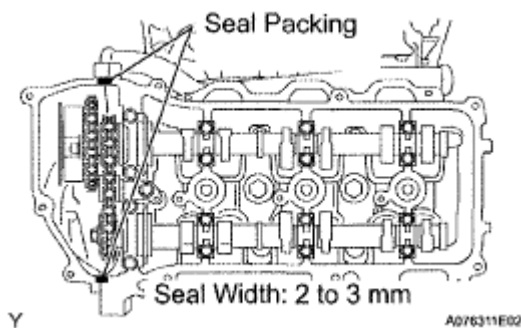
- c. Install the ventilation valve onto the cylinder head cover.

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

- d. Install the gasket onto the cylinder head cover.
- e. Apply a continuous bead of seal packing (diameter 2 to 3 mm (0.08 to 0.12 in.)) to the cylinder head and timing chain cover as shown in the illustration.

**Seal packing:****Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent**

**NOTE:** Install the cylinder head cover of 3 minutes of applying the seal packing. After installation, the cylinder head cover bolts and nuts must be tightened within 15 minutes. Otherwise, the seal packing must be removed and reapplied.



**Fig. 645: Identifying Cylinder Head Cover Seal Packing**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Install the seal washers onto the bolts.
- g. Install the cylinder head cover with the 10 bolts and 2 nuts. Tighten the bolts and nuts uniformly in several steps.

**Torque: 10 N\*m (102 kgf\*cm, 7.4 ft.\*lbf) for bolts**

**A**

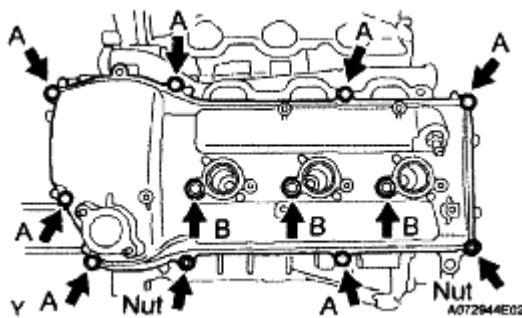
**9.0 N\*m (92 kgf\*cm, 80 in.\*lbf) for bolts**

**B**

**9.0 N\*m (92 kgf\*cm, 80 in.\*lbf) for nuts**

**HINT:**

Each bolt length is as follows:



**Fig. 646: Locating Cylinder Head Cover Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**BOLT LENGTH SPECIFICATION**

| Bolt | length           |
|------|------------------|
| A    | 25 mm (0.98 in.) |
| B    | 60 mm (2.36 in.) |

**57. INSTALL OIL CONTROL VALVE FILTER**

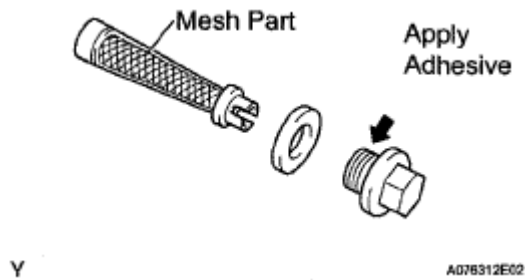
- Check that no foreign objects on the mesh part of the 2 filters.
- Install 2 new gaskets onto each new plug.
- Insert the filters into the plugs.
- Apply adhesive to 2 or 3 threads of the plugs.

**Adhesive:**

**Toyota Genuine Adhesive 1344, Three Bond 1344 or equivalent**

- Install the plugs onto each cylinder head.

**Torque: 62 N\*m (632 kgf\*cm, 46 ft.\*lbf)**

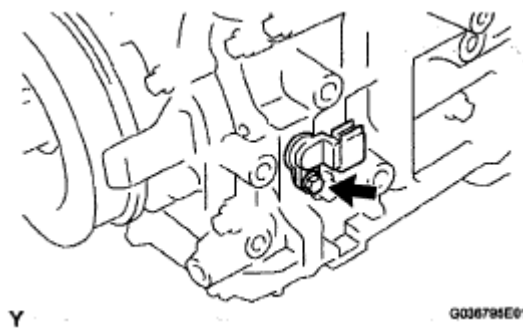


**Fig. 647: Identifying Oil Control Valve Filter**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### 58. INSTALL CRANKSHAFT POSITION SENSOR

- Install the crankshaft position sensor with the bolt.

**Torque: 10 N\*m (102 kgf\*cm, 7.4 ft.\*lbf)**

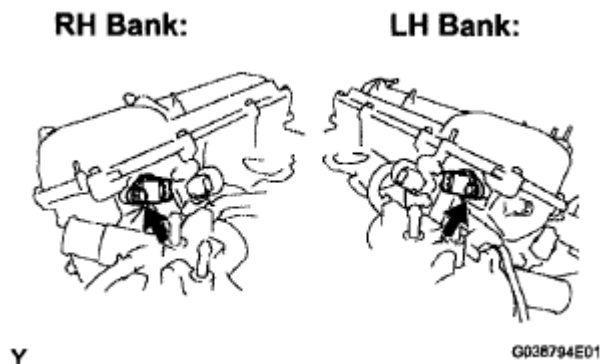


**Fig. 648: Locating Crankshaft Position Sensor Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### 59. INSTALL VVT SENSOR

- Apply a light coat of engine oil to the O-ring of each VVT sensor.
- Install the 2 VVT sensors with the 2 bolts.

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

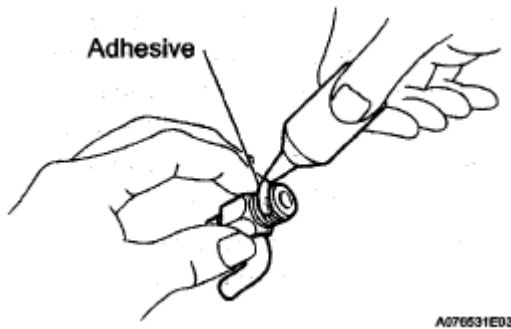


**Fig. 649: Locating VVT Sensors Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**60. INSTALL CYLINDER BLOCK WATER DRAIN COCK SUB-ASSEMBLY**

- a. Apply adhesive to 2 or 3 threads of the drain cocks end.

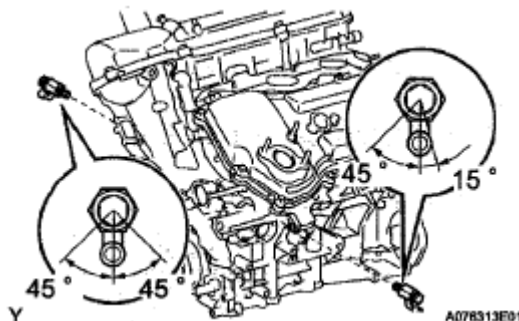
**Adhesive:****Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent****Fig. 650: Applying Adhesive Threads Of Drain Cocks End**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Tighten the drain cocks to the specified torque, and rotate them clockwise as shown in the illustration.

**Torque: 25 N\*m (255 kgf\*cm, 18 ft.\*lbf)****NOTE:**

- Do not rotate the drain cocks more than 1 complete revolution (360°) after tightening the drain cocks to the specified torque.
- Do not loosen the drain cocks after setting it correctly.

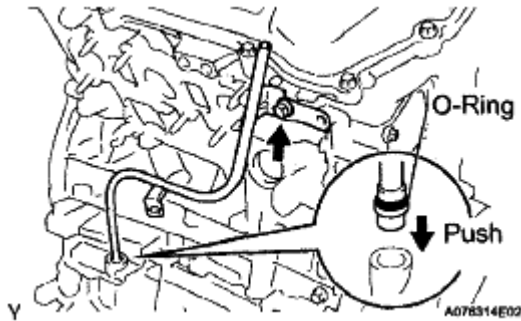
**Fig. 651: Identifying Drain Cocks Tighten Angle**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**61. INSTALL OIL LEVEL GAGE GUIDE**

- a. Install a new O-ring onto the oil level gauge guide.
- b. Apply a light coat of engine oil to the O-ring.
- c. Push the oil level gauge guide end into the guide hole of the oil pan.
- d. Install the oil level gauge guide with the bolt.

**Torque: 9.0 N\*m (92 kgf\*cm, 80 in.\*lbf)**



**Fig. 652: Locating Oil Level Gauge Guide**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

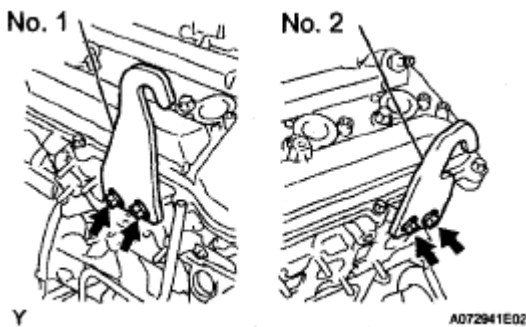
## 62. INSTALL ENGINE HANGERS

- a. Install the engine hanger with the 2 bolts.

**Torque: 33 N\*m (336 kgf\*cm, 24 ft.\*lbf)**

- b. Install the engine hanger with the 2 bolts.

**Torque: 33 N\*m (336 kgf\*cm, 24 ft.\*lbf)**



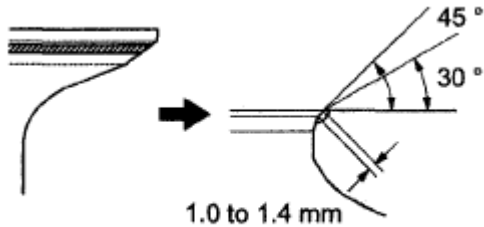
**Fig. 653: Locating Engine Hangers Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## REPAIR

### 1. REPAIR VALVE SEAT

**NOTE:** Use a cutter to gradually make the intake valve seat smoother.

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



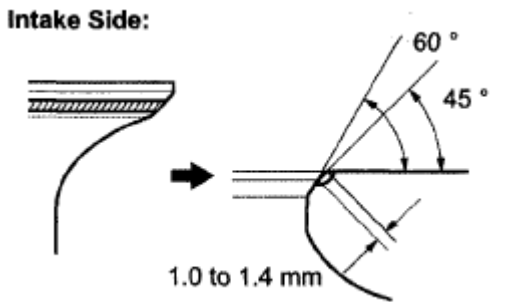
A062767E04

**Fig. 654: Identifying Valve Face Angle**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Intake side:

If the seating is too low on the valve face, use 60° and 45° cutters to correct the seat.



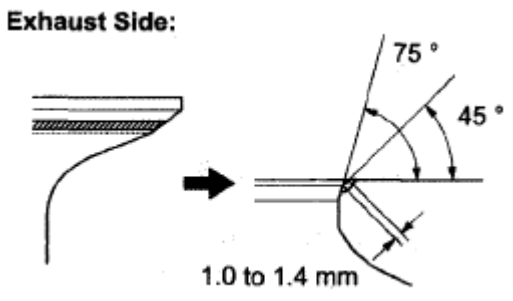
A075613E03

**Fig. 655: Identifying Valve Face Angle (Intake Side)**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Exhaust side:

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

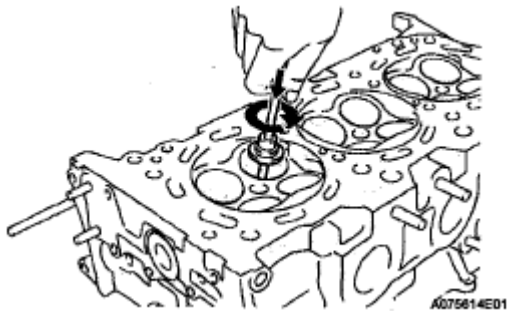


A062768E03

**Fig. 656: Identifying Valve Face Angle (Exhaust Side)**

**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- d. Lap the valve and valve seat with an abrasive compound by hand.
- e. After lapping, clean the valve and valve seat.



**Fig. 657: Lapping Valve And Valve Seat**

**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**