

2008 ENGINE**Engine Mechanical (1GR-FE) - Hilux****ENGINE****ON-VEHICLE INSPECTION****1. INSPECT ENGINE COOLANT**

HINT:

(See ON-VEHICLE INSPECTION)

2. INSPECT ENGINE OIL

HINT:

(See ON-VEHICLE INSPECTION)

3. INSPECT BATTERY

HINT:

(See ON-VEHICLE INSPECTION)

4. INSPECT AIR CLEANER FILTER ELEMENT SUBASSEMBLY**5. INSPECT DRIVE BELT****6. INSPECT IGNITION TIMING****NOTE:**

- Turn all 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. Warm up the engine.
 2. Connect Techstream to the DLC3.
 3. Turn the tester ON.
 4. Enter the following menus:

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

5. Inspect the ignition timing during idling.

Ignition timing:

7 to 24°C BTDC during idling (Transmission in neutral position)

6. Check that the ignition timing advances immediately when the engine speed is increased.
- c. When not using Techstream.
 1. Warm up the engine.
 2. 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.

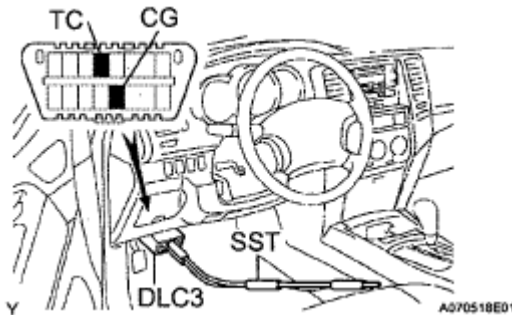


Fig. 1: Identifying DLC3 Terminals 13 (TC) And 4 (CG)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. Remove the air cleaner cap sub-assembly.
4. Pull out the wire harness as shown in the illustration.

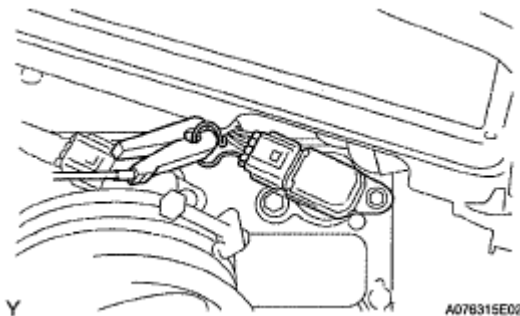


Fig. 2: Identifying Wire Harness
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. 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.

6. Inspect the ignition timing during idling.

Ignition timing:

8 to 12°CA BTDC during idling (Transmission in neutral position)

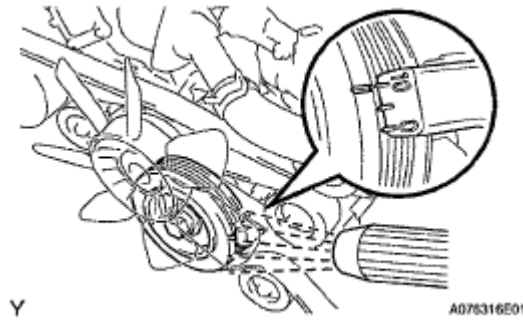


Fig. 3: Identifying Ignition Timing During Idling
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Ignition timing:

7 to 24°CA BTDC during idling (Transmission in neutral position)

9. Disconnect the timing light from the engine.
10. Install the air cleaner cap sub-assembly.

7. INSPECT ENGINE IDLING SPEED**NOTE:**

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

- a. When using the Techstream:

1. Warm up the engine.
2. Connect Techstream to the DLC3.
3. Turn the tester ON.
4. Enter the following menus:

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

5. Inspect the engine idling speed.

Idling speed:

650 to 750 rpm (Transmission in neutral position)

- b. When not using the Techstream:

1. Using SST, connect the terminal 8 (TAC) of the DLC3.

SST 09843-18030

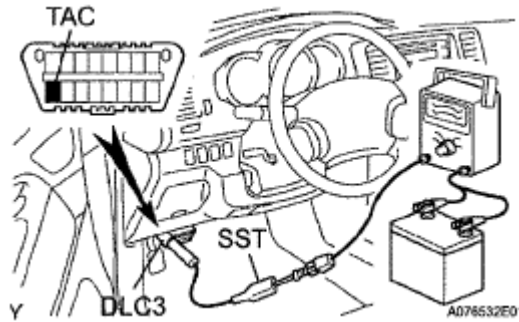


Fig. 4: Identifying DLC3 Terminal 8 (TAC)

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

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)

8. INSPECT COMPRESSION

- a. Warm up and stop the engine.
- b. Remove the V-bank cover.
- c. Remove the air cleaner assembly.
- d. Remove the intake air surge tank (See **REMOVAL**).
- e. Remove the 6 ignition coils.
- f. Remove the 6 spark plugs.
- g. Disconnect the 6 injector connectors.
- h. Inspect the cylinder compression pressure.
 1. Insert a compression gage into the spark plug hole (Procedure "A").

SST 09992-00500

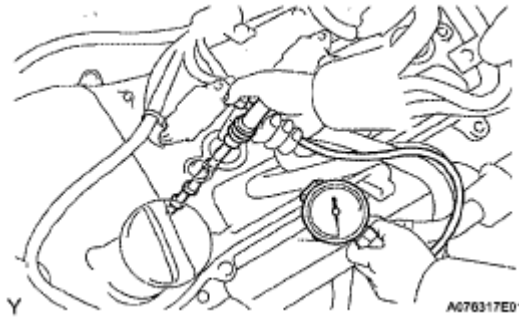


Fig. 5: Identifying Compression Gage Into Spark Plug Hole
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Fully open the throttle (Procedure "B").
3. While cranking the engine, measure the compression pressure (Procedure "C").

Compression pressure:

1,300 kPa (13.3 kgf/cm² , 189 psi)

Minimum pressure:

1,000 kPa (10.2 kgf/cm² , 145 psi)

Difference between each cylinder:

100 kPa (1.0 kgf/cm² , 15 psi)

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. Repeat procedures "A" through "C" for each cylinder.
5. If the cylinder compression is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat procedures "A" through "C" 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.
- i. Connect the 6 injector connectors.
- j. Install the 6 spark plugs.
- k. Install the 6 ignition coils.

- l. Install the intake air surge tank (See **INSTALLATION**).
- m. Install the air cleaner assembly.
- n. Install the V-bank cover.

9. INSPECT CO/HC

HINT:

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

- 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.

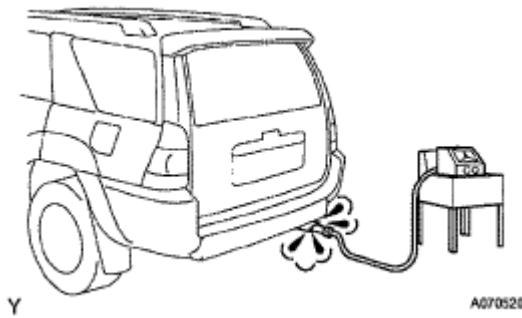


Fig. 6: Inserting CO/HC Meter Testing Probe Into Tailpipe During Idling
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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 A/F sensor and heated oxygen sensor operation.
 2. See the table below for possible causes, then inspect and correct the applicable causes if necessary.

CO/HC SYMPTOM REFERENCE CHART

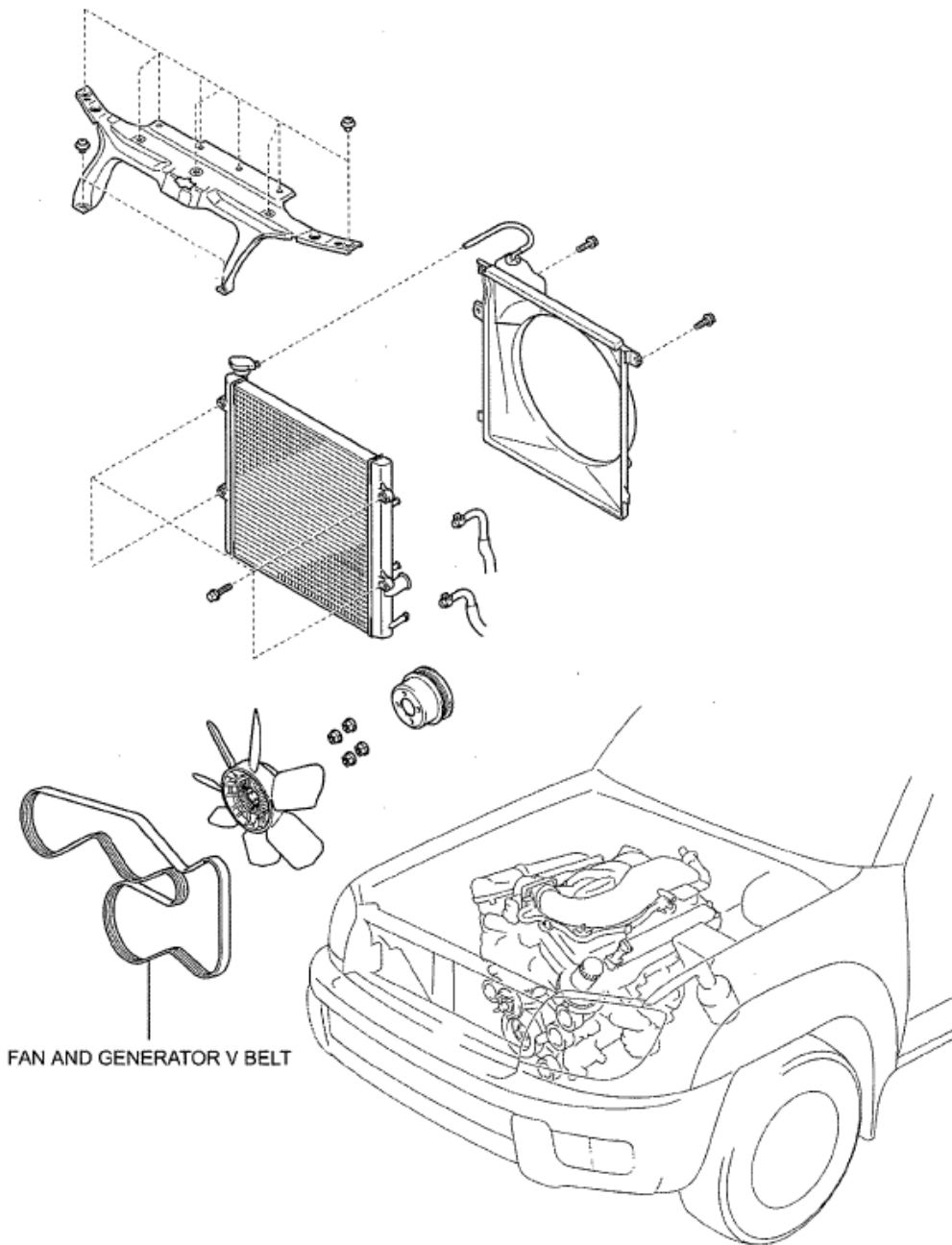
CO	HC	Symptom	Causes
			1. Faulty ignition: ○ Incorrect timing ○ Fouled, shorted or improperly

2008 Toyota Hilux 1GR-FE

2008 ENGINE Engine Mechanical (1GR-FE) - Hilux

Normal	High	Rough idling	- gapped plugs 2. Incorrect valve clearance 3. Leaky intake and exhaust valves 4. Leaky cylinders
Low	High	Rough idling (Fluctuating HC reading)	1. Vacuum leaks: - o PCV hoses - o Intake manifold - o Throttle body 2. Lean mixture causing misfire
High	High	Rough idling (Black smoke from exhaust)	1. Restricted air filter 2. Faulty EFI systems: - o Faulty pressure regulator - o Faulty engine coolant temperature sensor - o Faulty mass air flow meter - o Faulty ECM - o Faulty injectors - o Faulty throttle position sensor

DRIVE BELT**COMPONENTS**



A119787E03

Fig. 7: Identifying Drive Belt Components
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ON-VEHICLE INSPECTION

1. INSPECT DRIVE BELT

- 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.

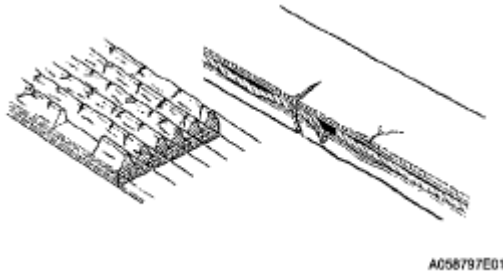


Fig. 8: Inspecting Drive Belt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL**1. REMOVE NO. 1 ENGINE UNDER COVER SUBASSEMBLY**

- a. Remove the 4 bolts, then remove the No. 1 engine under cover sub-assembly.

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.

INSPECTION**1. INSPECT V-RIBBED BELT TENSIONER ASSEMBLY**

- a. Check that nothing gets caught in the tensioner by turning it clockwise and counterclockwise.

If a normal exists, replace the tensioner.

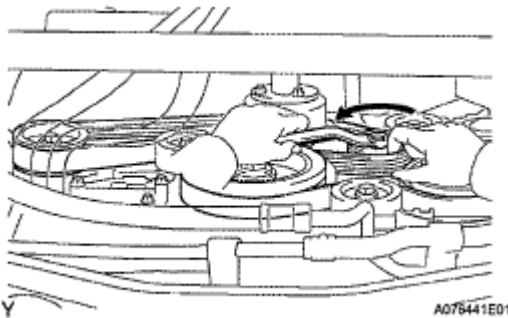


Fig. 9: Identifying V-Ribbed Belt Tensioner Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSTALLATION

1. INSTALL FAN AND GENERATOR V BELT

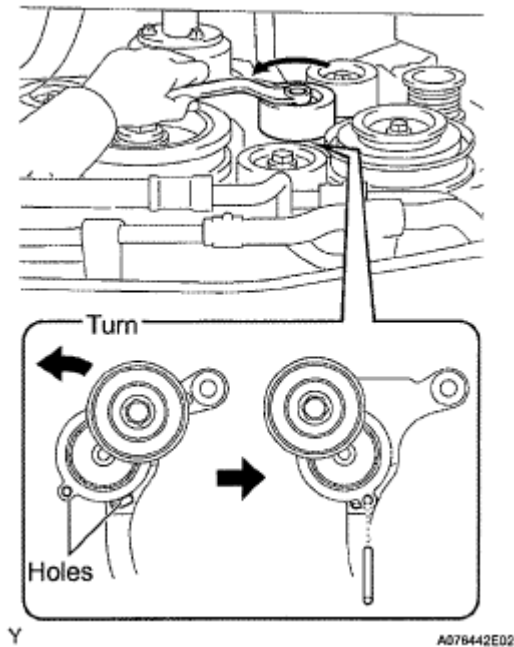


Fig. 10: Identifying Fan And Generator V Belt

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

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

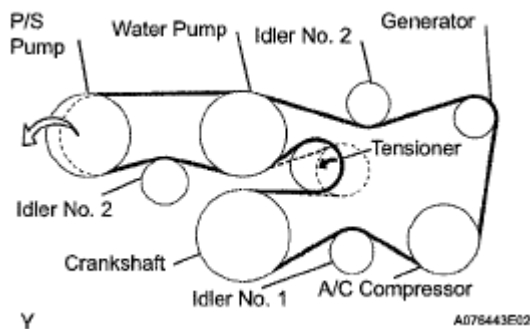


Fig. 11: Identifying V-Ribbed Belt Procedure

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

2. INSTALL NO. 1 ENGINE UNDER COVER SUBASSEMBLY

- a. Install the No. 1 engine under cover with the 4 bolts.

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

VALVE CLEARANCE**ADJUSTMENT**

1. **DRAIN ENGINE COOLANT** (See REPLACEMENT)
2. **REMOVE V-BANK COVER** (See REMOVAL)
3. **DISCONNECT NO. 2 VENTILATION HOSE**
4. **REMOVE AIR CLEANER ASSEMBLY** (See REMOVAL)
5. **REMOVE INTAKE AIR SURGE TANK** (See REMOVAL)
6. **REMOVE IGNITION COIL ASSEMBLY**
7. **REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY** (See DISASSEMBLY)
8. **REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY LH** (See DISASSEMBLY)
9. **SET NO. 1 CYLINDER TO TDC / COMPRESSION**
 - a. Turn the crankshaft pulley, and align the notch with the timing mark "0" of the timing chain cover.

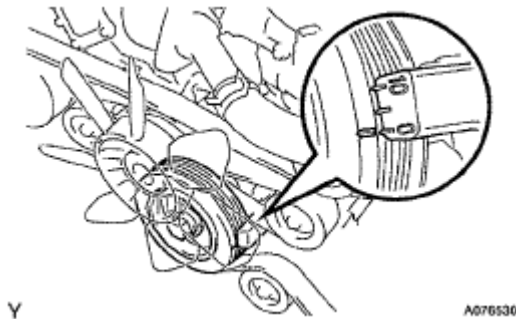


Fig. 12: Aligning Notch With Timing Mark
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

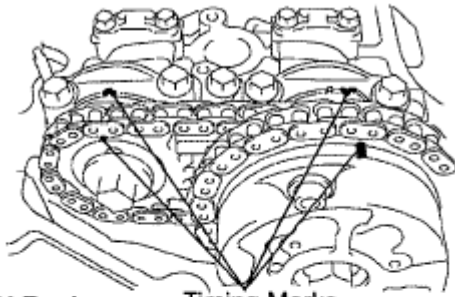
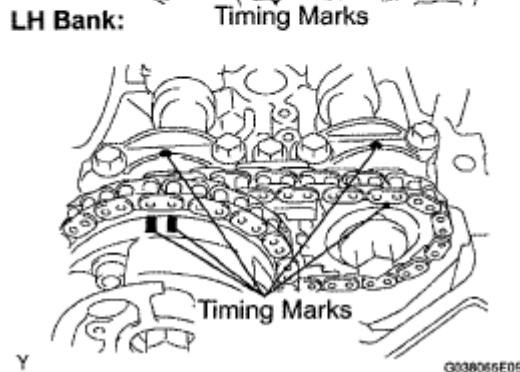
RH Bank:**LH Bank:**

Fig. 13: Aligning Timing Marks Of Camshaft Timing Gears And Bearing Caps
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.)

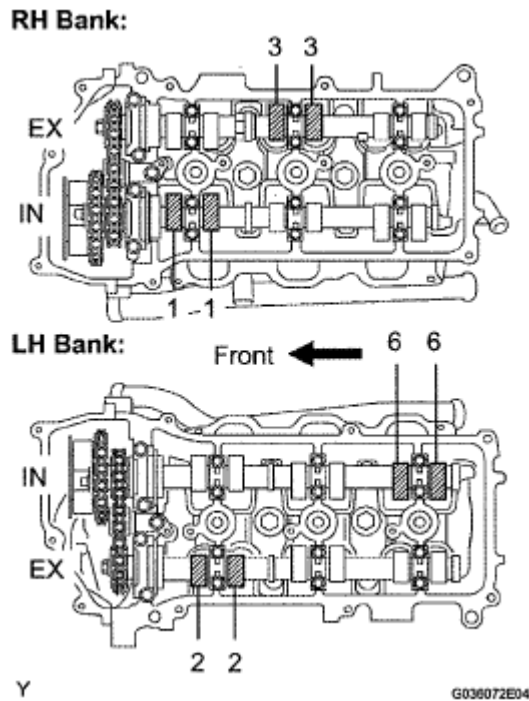


Fig. 14: Measuring Clearance Between Valve Lifter And Camshaft
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Record the out-of-specification valve clearance measurements. They will be used later to determine the required replacement valve lifter.
- b. Turn the crankshaft 2/3 of a revolution (240°), 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.)

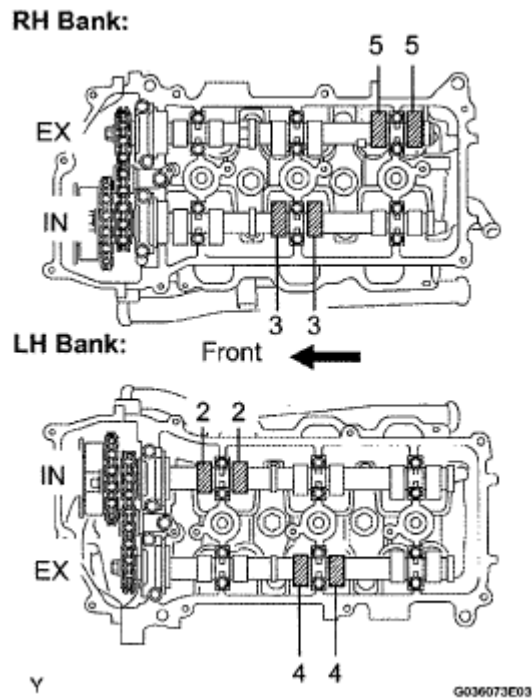


Fig. 15: Measuring Clearance Between Valve Lifter And Camshaft
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Record the out-of-specification valve clearance measurements. They will be used later to determine the required replacement valve lifter.
- c. Turn the crankshaft 2/3 of a revolution (240°), 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.)

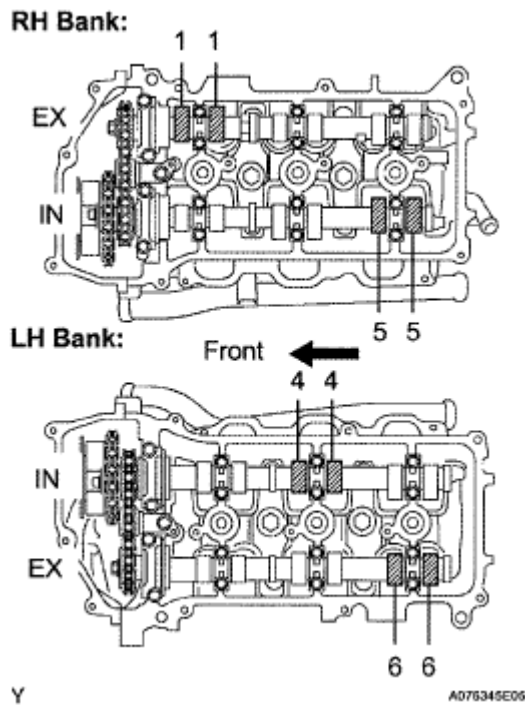


Fig. 16: Measuring Clearance Between Valve Lifter And Camshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

11. ADJUST VALVE CLEARANCE

- a. Set the No. 1 cylinder to the TDC /compression.
 1. Turn the crankshaft pulley, and align the notch with the timing mark "0" of the timing chain cover.

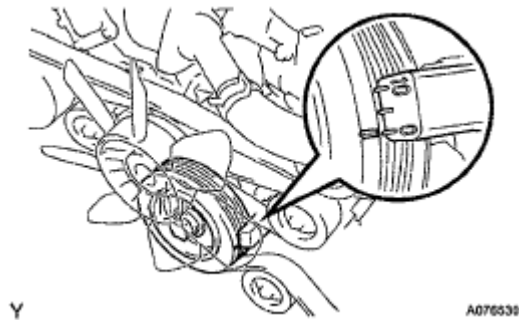
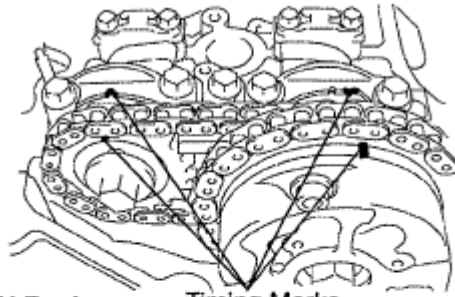


Fig. 17: Aligning Notch With Timing Mark
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

RH Bank:



LH Bank:

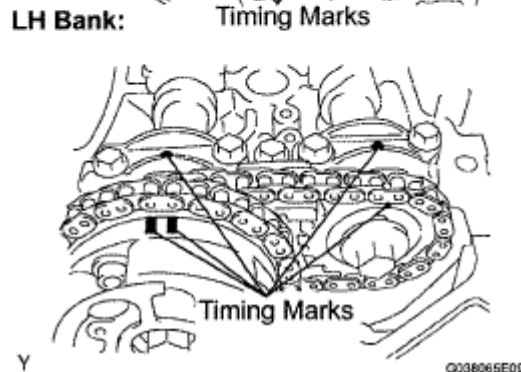


Fig. 18: Aligning Timing Marks Of Camshaft Timing Gears And Bearing Caps
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. Place paint marks on the No. 1 chain links that correspond with the timing marks of the camshaft timing gears.

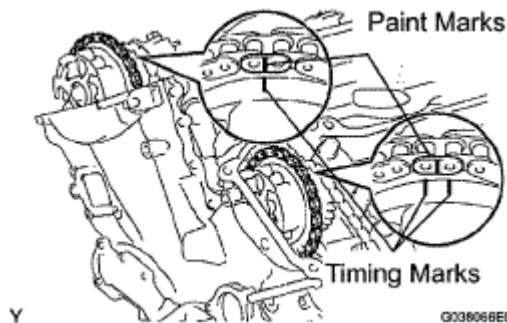


Fig. 19: Identifying Paint Marks And Timing Marks Of Camshaft Timing Gears
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the No. 1 chain tensioner assembly.

NOTE:

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

1. Remove the 4 bolts, timing chain cover plate and gasket.

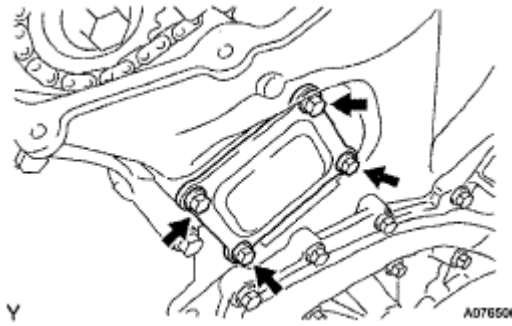


Fig. 20: Identifying Timing Chain Cover Plate Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. While rotating the stopper plate of the tensioner clockwise, push in the plunger of the chain tensioner as shown in the illustration.

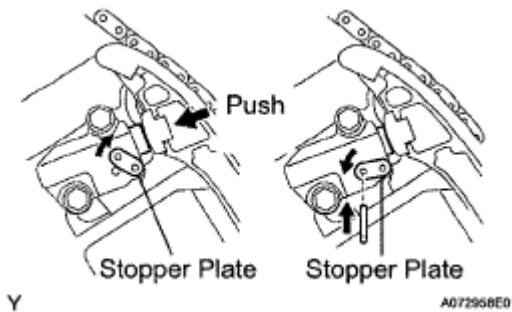


Fig. 21: Identifying Stopper Plate
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. While rotating the stopper plate of the tensioner counterclockwise, insert a bar of $\varnothing 3.5$ mm (0.138 in.) into the holes on the stopper plate and tensioner to fix the stopper plate.
 4. Remove the 2 bolts and chain tensioner.
- c. Remove the No. 2 camshaft.

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

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

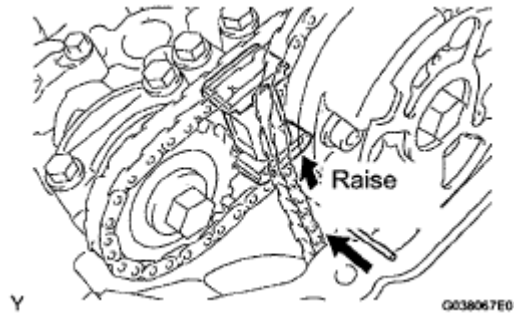


Fig. 22: Identifying Pin Into Hole

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

2. 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.

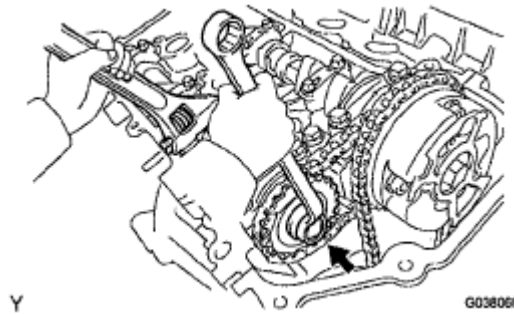


Fig. 23: Identifying Camshaft Timing Gear Set Bolt

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

3. Separate the camshaft timing gear from the No. 2 camshaft.
4. Rotate the camshaft counterclockwise using a wrench so that the cam lobes of No. 1 cylinder face upward as shown in the illustration.

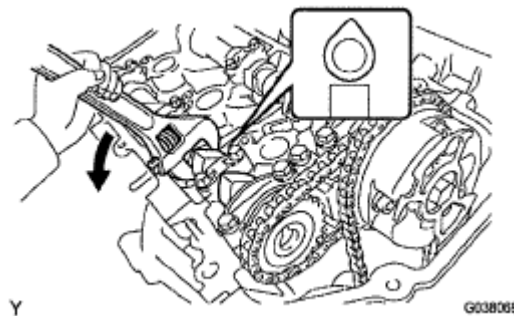


Fig. 24: Identifying No. 1 Cylinder Face

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

5. Using several steps, loosen and remove the 8 bearing cap bolts uniformly in the sequence as shown in the illustration.

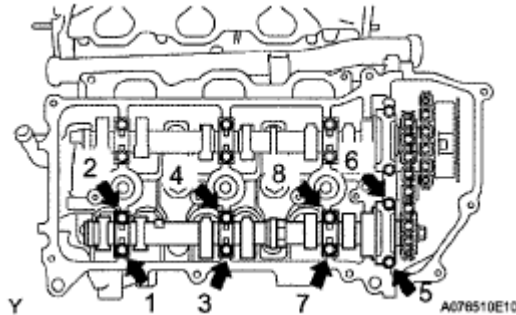


Fig. 25: Identifying Camshaft Bearing Caps Bolts Loosening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. Remove the 4 bearing caps and No. 2 camshaft.
- d. Remove the No. 2 chain tensioner assembly.
 1. Remove the No. 2 chain tensioner bolt, and then remove the No. 2 chain tensioner and camshaft timing gear.

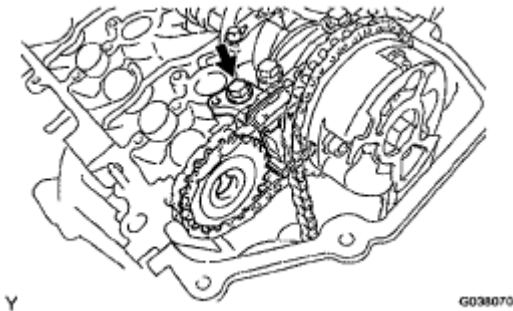


Fig. 26: Identifying No. 2 Chain Tensioner Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Remove the camshaft.

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

1. 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.

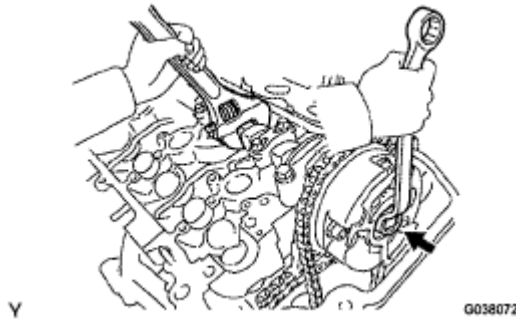


Fig. 27: Identifying Camshaft Timing Gear Set Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

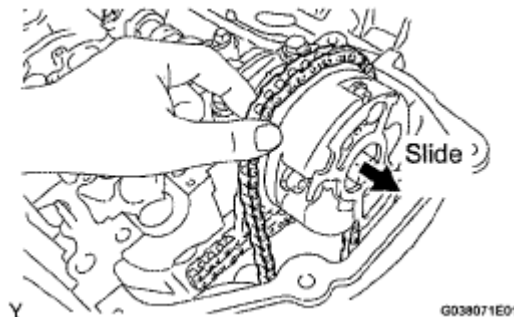


Fig. 28: Identifying Camshaft Timing Gear And No. 1 Chain
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

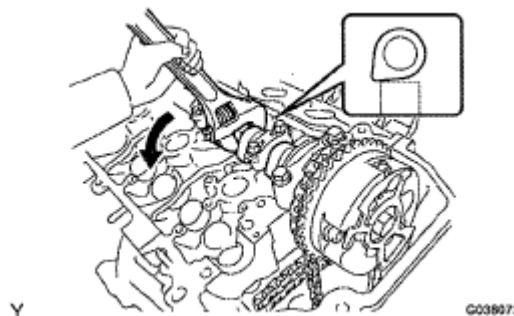


Fig. 29: Rotating No. 1 Camshaft Counterclockwise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. Using several steps, loosen and remove the 8 bearing cap bolts uniformly in the sequence as shown in the illustration.

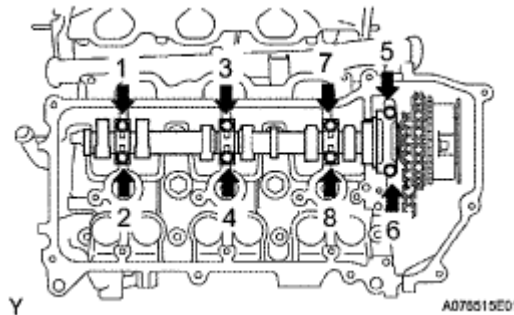


Fig. 30: Identifying Bearing Cap Bolts Loosening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. Remove the 4 bearing caps.
6. Remove the camshaft timing gear set bolt with the No. 1 camshaft lifted up, and then remove the No. 1 camshaft and camshaft timing gear with No. 2 chain.

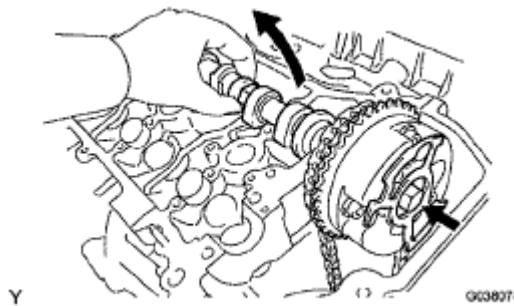


Fig. 31: Identifying Camshaft Timing Gear Set Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. 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.

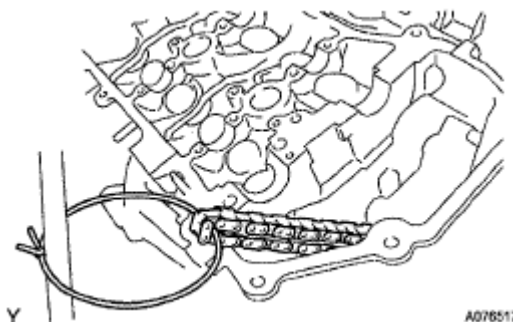


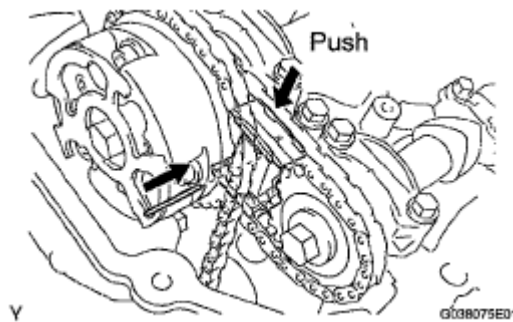
Fig. 32: Identifying No. 1 Chain With String

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

- f. Remove the No. 4 camshaft sub-assembly.

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

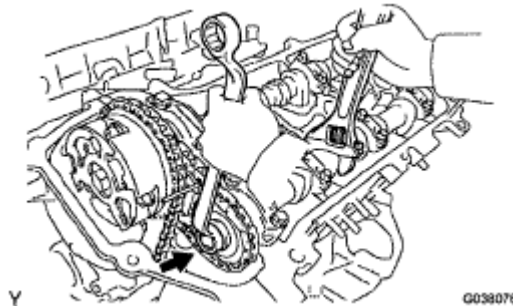
1. While pushing down the No. 3 chain tensioner, insert a pin of $\varnothing 1.0$ mm (0.039 in.) into the hole to fix it.

**Fig. 33: Identifying No. 3 Chain Tensioner**

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

2. 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.

**Fig. 34: Identifying Camshaft Timing Gear Set Bolt**

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

3. Separate the camshaft timing gear from the No. 4 camshaft.

4. Using several steps, loosen and remove the 8 bearing cap bolts uniformly in the sequence as shown in the illustration.

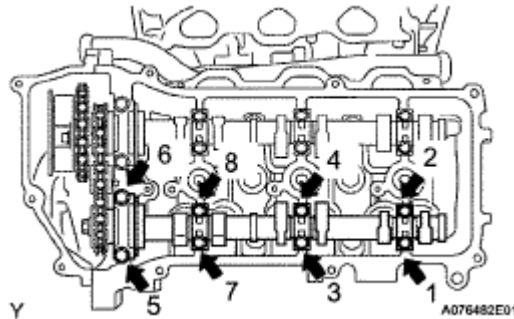


Fig. 35: Removing Bearing Cap Bolts In Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. Remove the 4 bearing caps and No. 4 camshaft.
- g. Remove the No. 3 chain tensioner assembly.
 1. Remove the No. 3 chain tensioner bolt, and then remove the No. 3 chain tensioner and camshaft timing gear.

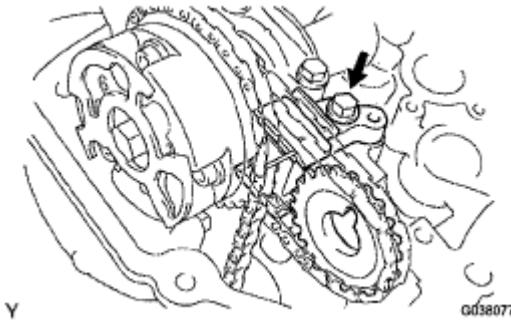


Fig. 36: Identifying No. 3 Chain Tensioner Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- h. Remove the No. 3 camshaft sub-assembly.

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

1. Using several steps, loosen and remove the 8 bearing cap bolts uniformly in the sequence as shown in the illustration.

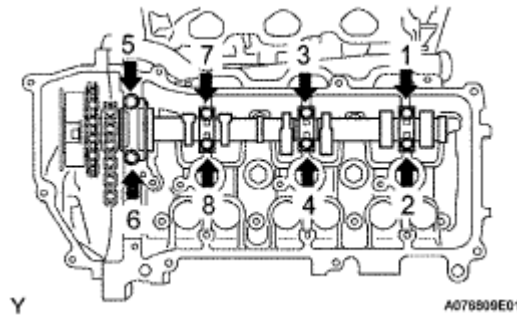


Fig. 37: Identifying Bearing Cap Bolts In Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Remove the 4 bearing caps.
3. Hold the No. 1 chain, and remove the No. 3 camshaft, camshaft timing gear and No. 2 chain.

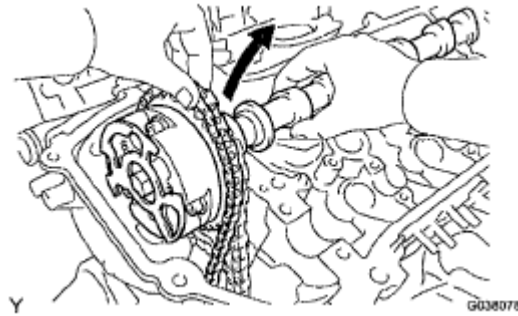


Fig. 38: Identifying No. 3 Camshaft, Camshaft Timing Gear And No. 2 Chain
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. 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.

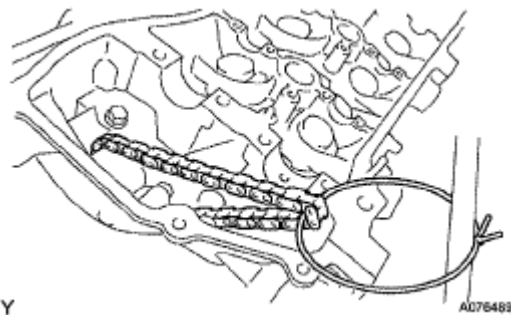


Fig. 39: Identifying No. 1 Chain With String
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- i. Remove the valve lifters.

- j. Determine the size of the valve lifter to be installed according to the following formulas or charts.
- Using a micrometer, measure the thickness of the removed lifter.

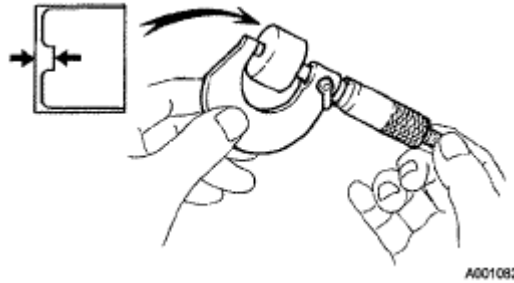


Fig. 40: Measuring Thickness Of Lifter

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

- 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

Intake:

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

Exhaust:

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

- 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.).

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Valve Lifter Selection Chart (Intake)

		Measured clearance mm (in.)	Removed lifter thickness mm (in.)
		0.000 - 0.020 (0.000 - 0.008)	0.000 - 0.020 (0.000 - 0.008)
		0.021 - 0.040 (0.008 - 0.016)	0.021 - 0.040 (0.008 - 0.016)
		0.041 - 0.060 (0.016 - 0.024)	0.041 - 0.060 (0.016 - 0.024)
		0.061 - 0.080 (0.024 - 0.032)	0.061 - 0.080 (0.024 - 0.032)
		0.081 - 0.100 (0.032 - 0.040)	0.081 - 0.100 (0.032 - 0.040)
		0.101 - 0.120 (0.040 - 0.048)	0.101 - 0.120 (0.040 - 0.048)
		0.121 - 0.140 (0.048 - 0.056)	0.121 - 0.140 (0.048 - 0.056)
		0.141 - 0.160 (0.056 - 0.064)	0.141 - 0.160 (0.056 - 0.064)
72706866646260585654525048464442403836343230282624222018161412	0.251 - 0.270 (0.099 - 0.106)	0.251 - 0.270 (0.099 - 0.106)	5.050 (0.1992)
72706866646260585654525048464442403836343230282624222018161412	0.271 - 0.290 (0.107 - 0.114)	0.271 - 0.290 (0.107 - 0.114)	5.080 (0.2000)
72706866646260585654525048464442403836343230282624222018161412	0.291 - 0.310 (0.115 - 0.122)	0.291 - 0.310 (0.115 - 0.122)	5.100 (0.2008)
72706866646260585654525048464442403836343230282624222018161412	0.311 - 0.330 (0.122 - 0.130)	0.311 - 0.330 (0.122 - 0.130)	5.120 (0.2016)
72706866646260585654525048464442403836343230282624222018161412	0.331 - 0.350 (0.130 - 0.138)	0.331 - 0.350 (0.130 - 0.138)	5.140 (0.2024)
72706866646260585654525048464442403836343230282624222018161412	0.351 - 0.370 (0.138 - 0.146)	0.351 - 0.370 (0.138 - 0.146)	5.160 (0.2031)
72706866646260585654525048464442403836343230282624222018161412	0.371 - 0.390 (0.146 - 0.154)	0.371 - 0.390 (0.146 - 0.154)	5.180 (0.2039)
72706866646260585654525048464442403836343230282624222018161412	0.391 - 0.410 (0.154 - 0.161)	0.391 - 0.410 (0.154 - 0.161)	5.200 (0.2047)
72706866646260585654525048464442403836343230282624222018161412	0.411 - 0.430 (0.162 - 0.169)	0.411 - 0.430 (0.162 - 0.169)	5.210 (0.2051)
72706866646260585654525048464442403836343230282624222018161412	0.431 - 0.450 (0.170 - 0.177)	0.431 - 0.450 (0.170 - 0.177)	5.220 (0.2055)
72706866646260585654525048464442403836343230282624222018161412	0.451 - 0.470 (0.178 - 0.185)	0.451 - 0.470 (0.178 - 0.185)	5.230 (0.2059)
72706866646260585654525048464442403836343230282624222018161412	0.471 - 0.490 (0.186 - 0.193)	0.471 - 0.490 (0.186 - 0.193)	5.240 (0.2063)
72706866646260585654525048464442403836343230282624222018161412	0.491 - 0.510 (0.194 - 0.201)	0.491 - 0.510 (0.194 - 0.201)	5.250 (0.2067)
72706866646260585654525048464442403836343230282624222018161412	0.511 - 0.530 (0.202 - 0.209)	0.511 - 0.530 (0.202 - 0.209)	5.260 (0.2071)
72706866646260585654525048464442403836343230282624222018161412	0.531 - 0.550 (0.210 - 0.217)	0.531 - 0.550 (0.210 - 0.217)	5.270 (0.2075)
72706866646260585654525048464442403836343230282624222018161412	0.551 - 0.570 (0.218 - 0.225)	0.551 - 0.570 (0.218 - 0.225)	5.280 (0.2079)
72706866646260585654525048464442403836343230282624222018161412	0.571 - 0.590 (0.226 - 0.233)	0.571 - 0.590 (0.226 - 0.233)	5.290 (0.2083)
72706866646260585654525048464442403836343230282624222018161412	0.591 - 0.610 (0.234 - 0.241)	0.591 - 0.610 (0.234 - 0.241)	5.300 (0.2087)
72706866646260585654525048464442403836343230282624222018161412	0.611 - 0.630 (0.242 - 0.249)	0.611 - 0.630 (0.242 - 0.249)	5.310 (0.2091)
72706866646260585654525048464442403836343230282624222018161412	0.631 - 0.650 (0.250 - 0.257)	0.631 - 0.650 (0.250 - 0.257)	5.320 (0.2094)
72706866646260585654525048464442403836343230282624222018161412	0.651 - 0.670 (0.258 - 0.265)	0.651 - 0.670 (0.258 - 0.265)	5.330 (0.2098)
72706866646260585654525048464442403836343230282624222018161412	0.671 - 0.690 (0.266 - 0.273)	0.671 - 0.690 (0.266 - 0.273)	5.340 (0.2102)
72706866646260585654525048464442403836343230282624222018161412	0.691 - 0.710 (0.274 - 0.281)	0.691 - 0.710 (0.274 - 0.281)	5.350 (0.2106)
72706866646260585654525048464442403836343230282624222018161412	0.711 - 0.730 (0.282 - 0.289)	0.711 - 0.730 (0.282 - 0.289)	5.360 (0.2110)
72706866646260585654525048464442403836343230282624222018161412	0.731 - 0.750 (0.290 - 0.297)	0.731 - 0.750 (0.290 - 0.297)	5.370 (0.2114)
72706866646260585654525048464442403836343230282624222018161412	0.751 - 0.770 (0.300 - 0.307)	0.751 - 0.770 (0.300 - 0.307)	5.380 (0.2118)
72706866646260585654525048464442403836343230282624222018161412	0.771 - 0.790 (0.308 - 0.315)	0.771 - 0.790 (0.308 - 0.315)	5.390 (0.2122)
72706866646260585654525048464442403836343230282624222018161412	0.791 - 0.810 (0.316 - 0.323)	0.791 - 0.810 (0.316 - 0.323)	5.400 (0.2126)
72706866646260585654525048464442403836343230282624222018161412	0.811 - 0.830 (0.324 - 0.331)	0.811 - 0.830 (0.324 - 0.331)	5.410 (0.2130)
72706866646260585654525048464442403836343230282624222018161412	0.831 - 0.850 (0.332 - 0.339)	0.831 - 0.850 (0.332 - 0.339)	5.420 (0.2134)
72706866646260585654525048464442403836343230282624222018161412	0.851 - 0.870 (0.340 - 0.347)	0.851 - 0.870 (0.340 - 0.347)	5.430 (0.2138)
72706866646260585654525048464442403836343230282624222018161412	0.871 - 0.890 (0.348 - 0.355)	0.871 - 0.890 (0.348 - 0.355)	5.440 (0.2142)
72706866646260585654525048464442403836343230282624222018161412	0.891 - 0.910 (0.356 - 0.363)	0.891 - 0.910 (0.356 - 0.363)	5.450 (0.2146)
72706866646260585654525048464442403836343230282624222018161412	0.911 - 0.930 (0.364 - 0.371)	0.911 - 0.930 (0.364 - 0.371)	5.460 (0.2150)
72706866646260585654525048464442403836343230282624222018161412	0.931 - 0.950 (0.372 - 0.379)	0.931 - 0.950 (0.372 - 0.379)	5.470 (0.2154)
72706866646260585654525048464442403836343230282624222018161412	0.951 - 0.970 (0.380 - 0.387)	0.951 - 0.970 (0.380 - 0.387)	5.480 (0.2157)
72706866646260585654525048464442403836343230282624222018161412	0.971 - 0.990 (0.390 - 0.397)	0.971 - 0.990 (0.390 - 0.397)	5.490 (0.2161)
72706866646260585654525048464442403836343230282624222018161412	0.991 - 1.010 (0.400 - 0.407)	0.991 - 1.010 (0.400 - 0.407)	5.500 (0.2165)
72706866646260585654525048464442403836343230282624222018161412	1.011 - 1.030 (0.410 - 0.417)	1.011 - 1.030 (0.410 - 0.417)	5.510 (0.2169)
72706866646260585654525048464442403836343230282624222018161412	1.031 - 1.050 (0.420 - 0.427)	1.031 - 1.050 (0.420 - 0.427)	5.520 (0.2173)
72706866646260585654525048464442403836343230282624222018161412	1.051 - 1.070 (0.430 - 0.437)	1.051 - 1.070 (0.430 - 0.437)	5.530 (0.2177)
72706866646260585654525048464442403836343230282624222018161412	1.071 - 1.090 (0.440 - 0.447)	1.071 - 1.090 (0.440 - 0.447)	5.540 (0.2181)
72706866646260585654525048464442403836343230282624222018161412	1.091 - 1.110 (0.450 - 0.457)	1.091 - 1.110 (0.450 - 0.457)	5.550 (0.2185)
72706866646260585654525048464442403836343230282624222018161412	1.111 - 1.130 (0.460 - 0.467)	1.111 - 1.130 (0.460 - 0.467)	5.560 (0.2189)
72706866646260585654525048464442403836343230282624222018161412	1.131 - 1.150 (0.470 - 0.477)	1.131 - 1.150 (0.470 - 0.477)	5.570 (0.2193)
72706866646260585654525048464442403836343230282624222018161412	1.151 - 1.170 (0.480 - 0.487)	1.151 - 1.170 (0.480 - 0.487)	5.580 (0.2197)
72706866646260585654525048464442403836343230282624222018161412	1.171 - 1.190 (0.490 - 0.497)	1.171 - 1.190 (0.490 - 0.497)	5.590 (0.2201)
72706866646260585654525048464442403836343230282624222018161412	1.191 - 1.210 (0.500 - 0.507)	1.191 - 1.210 (0.500 - 0.507)	5.600 (0.2205)
72706866646260585654525048464442403836343230282624222018161412	1.211 - 1.230 (0.510 - 0.517)	1.211 - 1.230 (0.510 - 0.517)	5.620 (0.2213)
72706866646260585654525048464442403836343230282624222018161412	1.231 - 1.250 (0.520 - 0.527)	1.231 - 1.250 (0.520 - 0.527)	5.640 (0.2220)
72706866646260585654525048464442403836343230282624222018161412	1.251 - 1.270 (0.530 - 0.537)	1.251 - 1.270 (0.530 - 0.537)	5.660 (0.2228)
72706866646260585654525048464442403836343230282624222018161412	1.271 - 1.290 (0.540 - 0.547)	1.271 - 1.290 (0.540 - 0.547)	5.680 (0.2236)
72706866646260585654525048464442403836343230282624222018161412	1.291 - 1.310 (0.550 - 0.557)	1.291 - 1.310 (0.550 - 0.557)	5.700 (0.2244)
72706866646260585654525048464442403836343230282624222018161412	1.311 - 1.330 (0.560 - 0.567)	1.311 - 1.330 (0.560 - 0.567)	5.720 (0.2252)
72706866646260585654525048464442403836343230282624222018161412	1.331 - 1.350 (0.570 - 0.577)	1.331 - 1.350 (0.570 - 0.577)	5.740 (0.2260)

C

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Fig. 41: Valve Lifter Selection Chart (Intake)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2008 ENGINE Engine Mechanical (1GR-FE) - Hilux

[illegible]

A134419E01

k. Install the No. 3 camshaft sub-assembly.

NOTE: As the thrust clearance of the camshaft is small, the camshaft must

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

1. Align the mark link (yellow) with the timing mark (2-dot mark) of the camshaft timing gear as shown in the illustration.

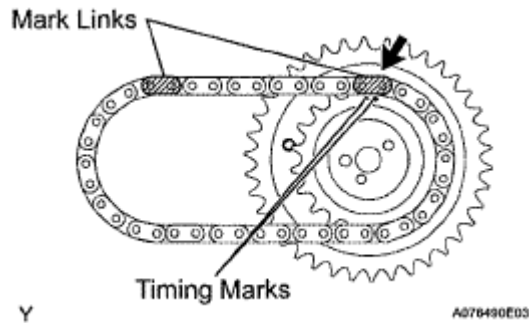


Fig. 43: Aligning Mark Link With Timing Mark
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Apply new engine oil to the thrust portions and journals of the camshafts.
3. Temporarily put the No. 1 chain on the No. 2 chain of the camshaft timing gear.

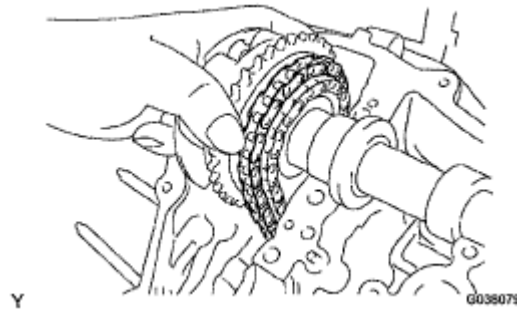


Fig. 44: Identifying No. 1 Chain On No. 2 Chain Of Camshaft Timing Gear
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. 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.

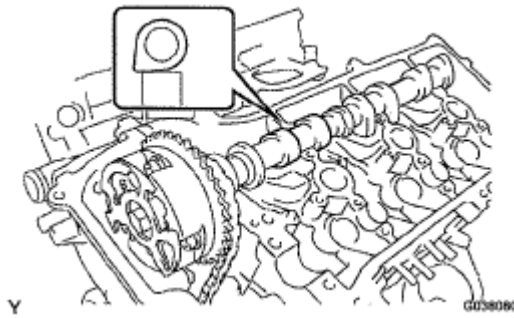


Fig. 45: Identifying No. 3 Camshaft Onto LH Cylinder Head With Cam Lobes
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. Install the 4 bearing caps in their proper locations.

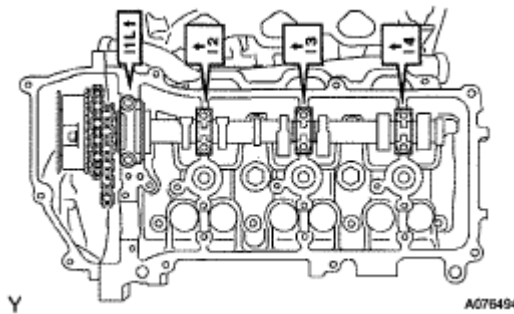


Fig. 46: Identifying Bearing Caps Proper Locations
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. Apply a light coat of engine oil to the threads of the bearing cap bolts.
7. Install the 8 bearing cap bolts. Using several steps, tighten the bolts uniformly in the sequence as shown in the illustration.

Torque:

For 10 mm (0.39 in.) head

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

For 12 mm (0.47 in.) head

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

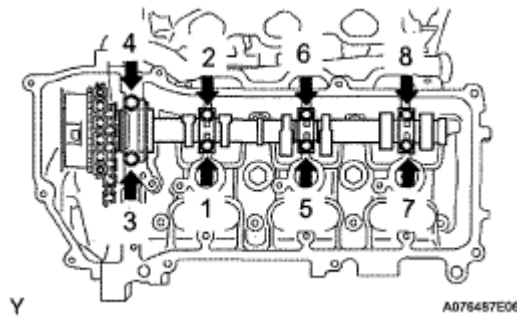


Fig. 47: Tightening Sequence Of Bearing Cap Bolts In Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. Set the paint mark of the No. 1 chain between the timing marks of the camshaft timing gear.

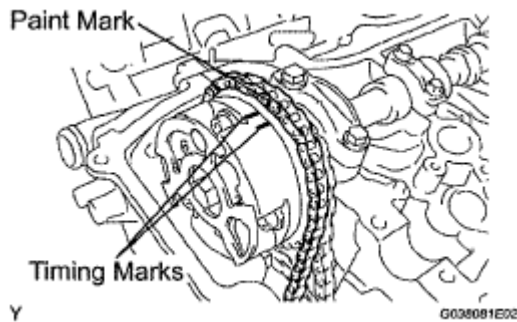


Fig. 48: Identifying Paint Mark Of No. 1 Chain Between Timing Marks Of Camshaft Timing Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. Install the No. 3 chain tensioner assembly.
 1. While pushing in the tensioner, insert a pin of $\phi 1.0$ mm (0.039 in.) into the hole to fix it.

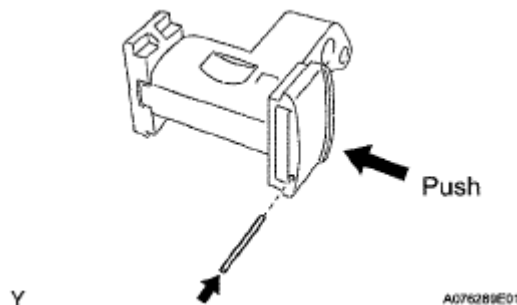


Fig. 49: Inserting Pin Into Hole
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

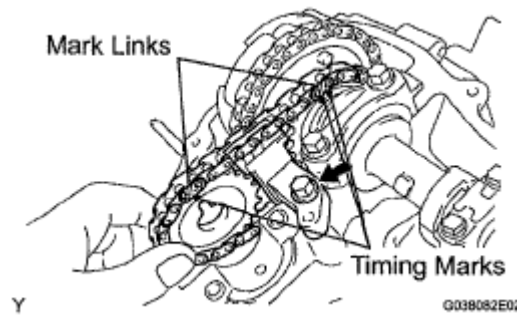


Fig. 50: Aligning Marks Links (Yellow) With Timing Marks (1-Dot Mark And 2-Dot Mark)

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

3. Tighten the No. 3 chain tensioner bolt.

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

- m. Install the No. 4 camshaft sub-assembly.

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

1. Align the knock pin hole on the camshaft timing gear with the knock pin of the No. 4 camshaft, and insert the No. 4 camshaft into the camshaft timing gear.
2. Temporarily install the camshaft timing gear set bolt.

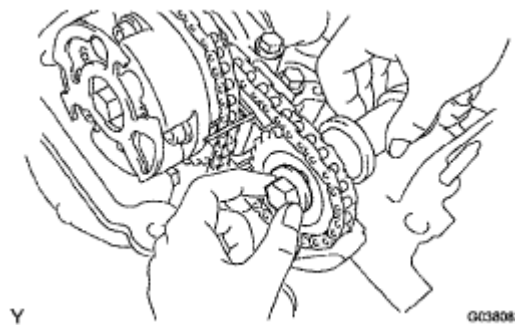


Fig. 51: Identifying Camshaft Timing Gear Set Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. Install the 4 bearing caps in their proper locations.

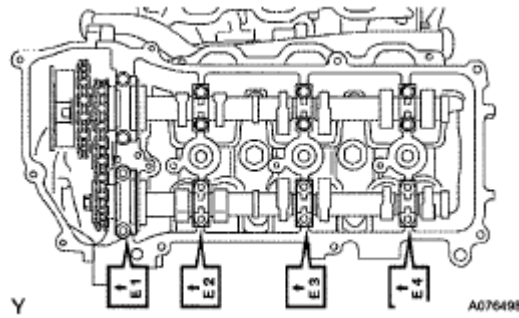


Fig. 52: Identifying Bearing Caps Proper Locations
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.
5. Install the 8 bearing cap bolts. Using several steps, tighten the bolts uniformly in the sequence as shown in the illustration.

Torque:

For 10mm (0.39 in.) head

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

For 12 mm (0.47 in.) head

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

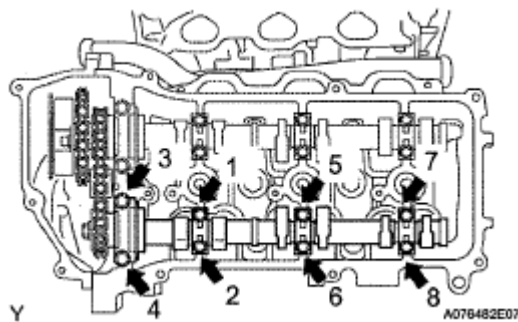


Fig. 53: Identifying Tightening Sequence Of Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. 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)

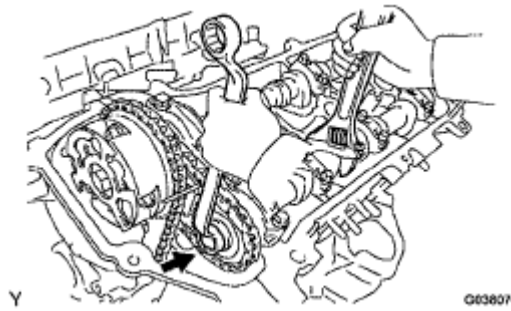


Fig. 54: Identifying Camshaft Timing Gear Set Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. Remove the pin from the No. 3 chain tensioner.
- n. Install the camshaft.

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

1. Align the mark link (yellow) with the timing mark (1-dot mark) of the camshaft timing gear as shown in the illustration.

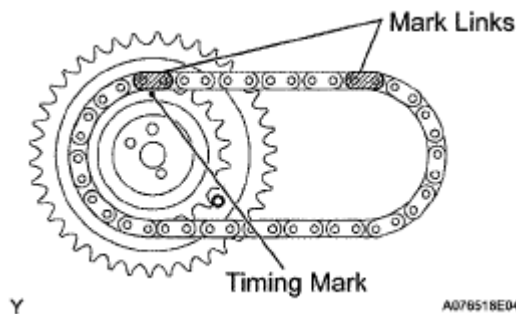


Fig. 55: Identifying Mark Link With Timing Mark Of Camshaft Timing Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Apply new engine oil to the thrust portions and journals of the camshafts.
3. Temporarily put the No. 1 chain on the No. 2 chain of the camshaft timing gear.

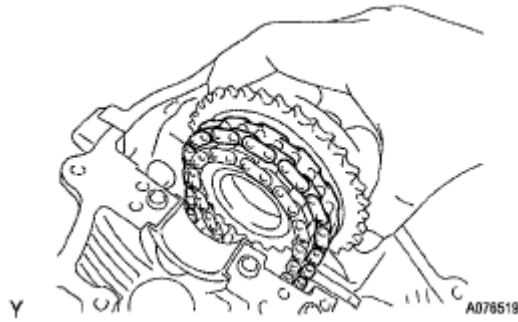


Fig. 56: Identifying No. 1 Chain On No. 2 Chain Of Camshaft Timing Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. 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.

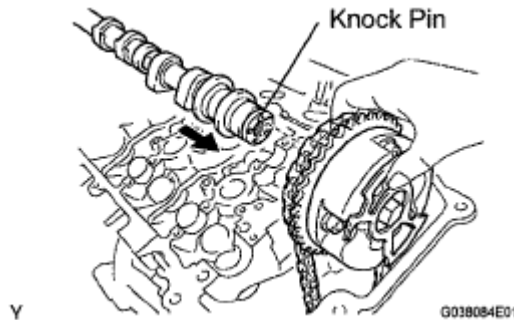


Fig. 57: Identifying Knock Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. Temporarily install the camshaft timing gear set bolt.
6. Set 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.

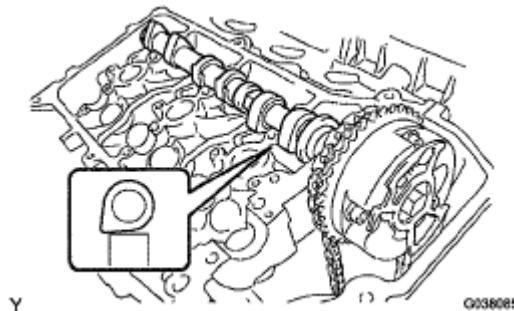


Fig. 58: Identifying No. 1 Camshaft Onto RH Cylinder Head With Cam Lobes
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. Install the 4 bearing caps in their proper locations.

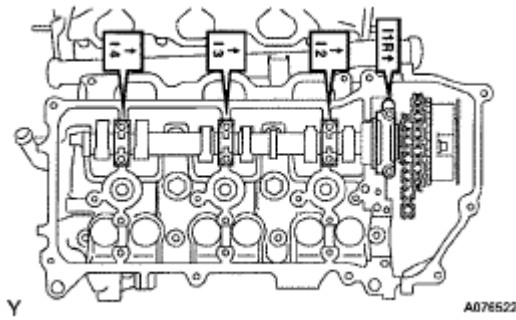


Fig. 59: Identifying Bearing Caps Proper Locations
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.
9. Install the 8 bearing cap bolts. Using several steps, tighten the bolts uniformly in the sequence as shown in the illustration.

Torque:

For 10 mm (0.39 in.) head

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

For 12 mm (0.47 in.) head

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

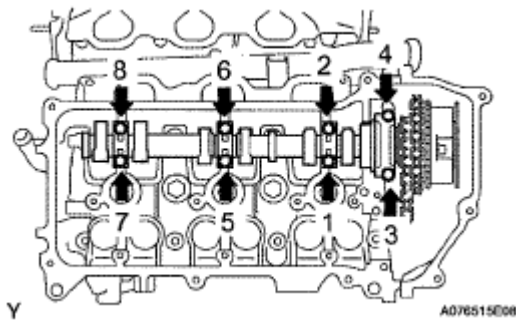


Fig. 60: Identifying Tightening Sequence Of Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. Rotate the No. 1 camshaft clockwise using the hexagonal portion of the No. 1 camshaft so that the timing mark of the camshaft timing gear is aligned with the timing mark of the camshaft bearing cap.

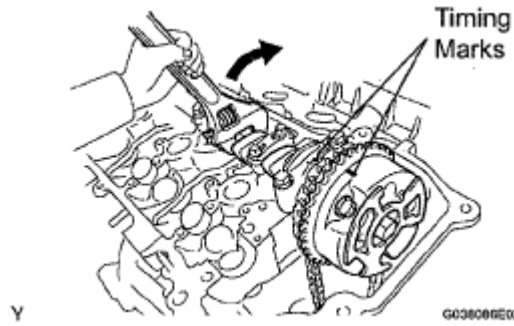


Fig. 61: Identifying Timing Mark Of Camshaft Timing Gear
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

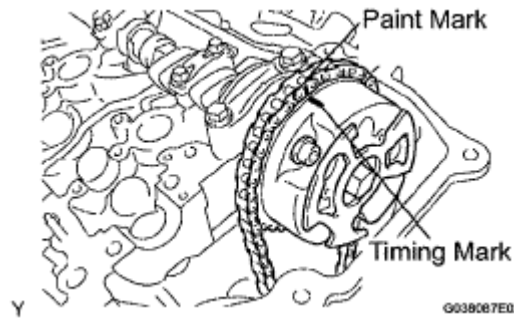


Fig. 62: Identifying Paint Mark Of No. 1 Chain With Timing Mark Of Camshaft Timing Gear
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. 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)

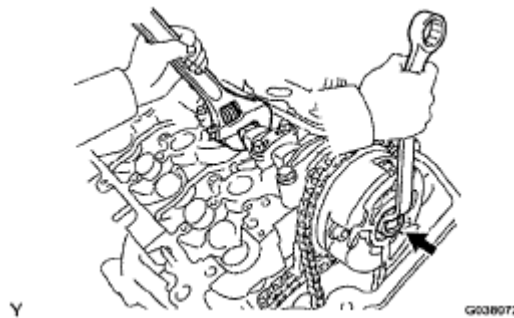


Fig. 63: Identifying Camshaft Timing Gear Set Bolt
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- o. Install the No. 2 chain tensioner assembly.

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

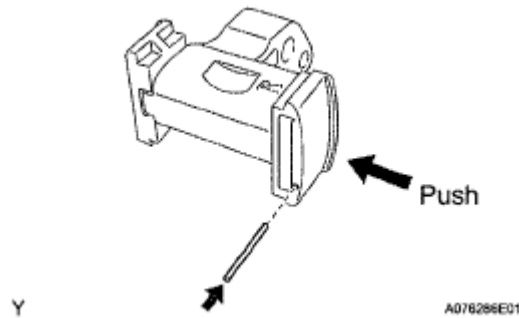


Fig. 64: Identifying Tensioner

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

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

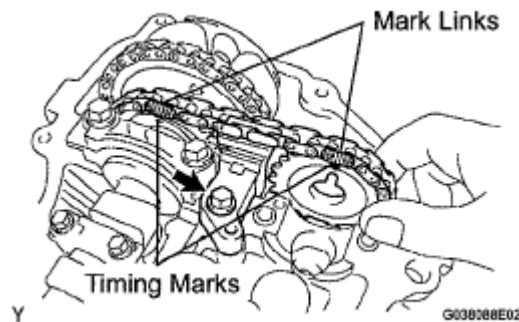


Fig. 65: Identifying Timing Mark Of Camshaft Bearing Cap

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

3. Tighten the No. 2 chain tensioner bolt.

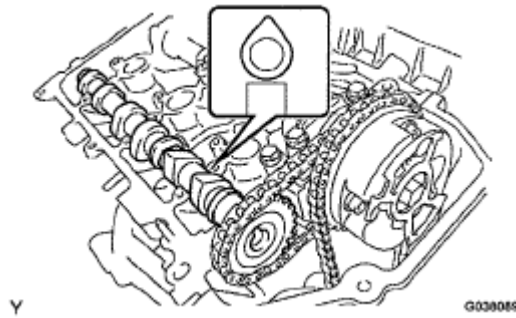
Torque: 19 N*m (194 kgf*cm, 14 ft.*lbf)

- p. Install the No. 2 camshaft.

NOTE:

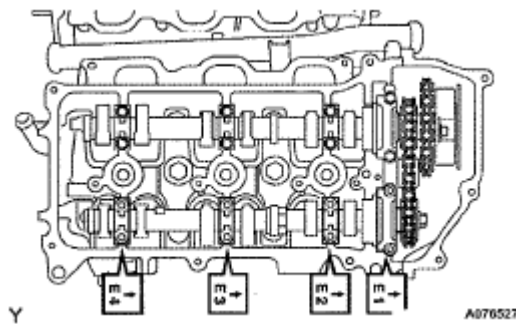
As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head which receives the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following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

1. Set 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. 66: Identifying Cam Lobes Position**

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

2. Install the 4 bearing caps in their proper locations.

**Fig. 67: Identifying Bearing Caps Proper Locations**

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

3. Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.
4. Install the 8 bearing cap bolts. Using several steps, tighten the bolts uniformly in the sequence as shown in the illustration.

Torque:

For 10 mm (0.39 in.) head

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

For 12 mm (0.47 in.) head

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

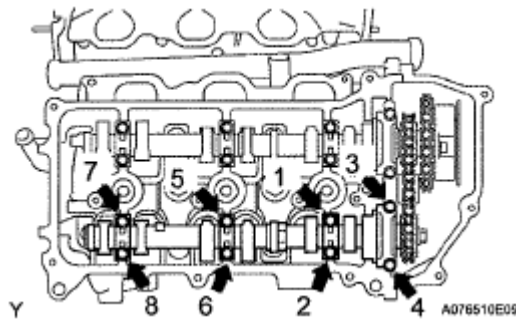


Fig. 68: Identifying Tightening Sequence Of Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. 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.

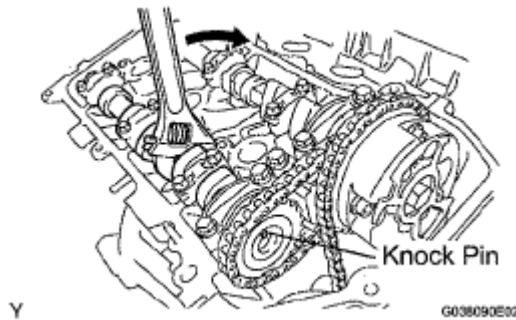


Fig. 69: Identifying Knock Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. 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)

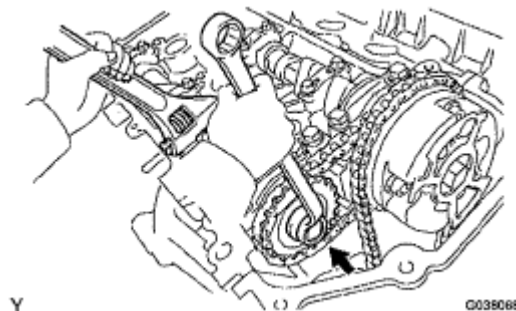


Fig. 70: Identifying Camshaft Timing Gear Set Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. Remove the pin from the No. 2 chain tensioner.

q. Install the No. 1 chain tensioner assembly.

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

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

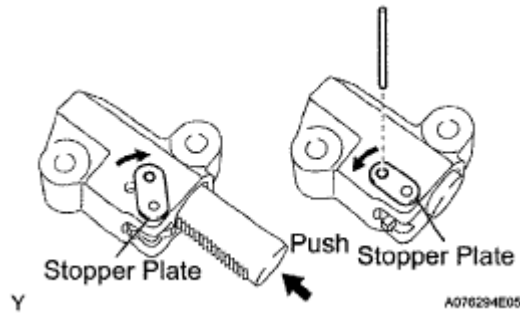


Fig. 71: Identifying Stopper Plate Of Tensioner
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. Remove the bar from the chain tensioner.
5. 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)

6. Turn the crankshaft pulley 2 complete revolutions slowly, and align the notch with the timing mark "0" of the timing chain cover.

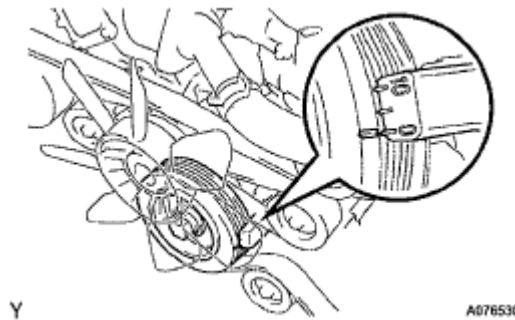
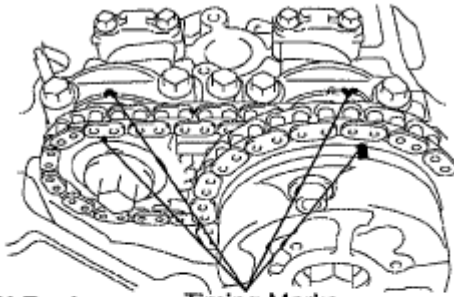


Fig. 72: Aligning Notch With Timing Mark
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

RH Bank:



LH Bank:

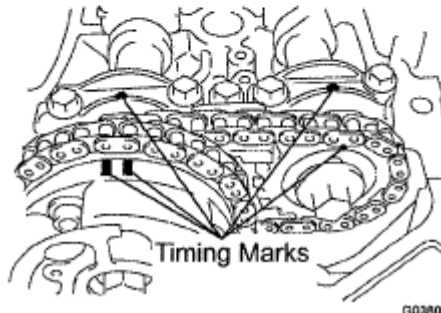


Fig. 73: Aligning Timing Marks Of Camshaft Timing Gears And Bearing Caps
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY LH (See REASSEMBLY)
13. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY (See REASSEMBLY)
14. INSTALL IGNITION COIL ASSEMBLY

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

15. INSTALL INTAKE AIR SURGE TANK (See INSTALLATION)
16. INSTALL AIR CLEANER ASSEMBLY (See INSTALLATION)
17. CONNECT NO. 2 VENTILATION HOSE
18. ADD ENGINE COOLANT (See REPLACEMENT)
19. CHECK FOR ENGINE COOLANT LEAKS (See REPLACEMENT)
20. INSTALL V-BANK COVER

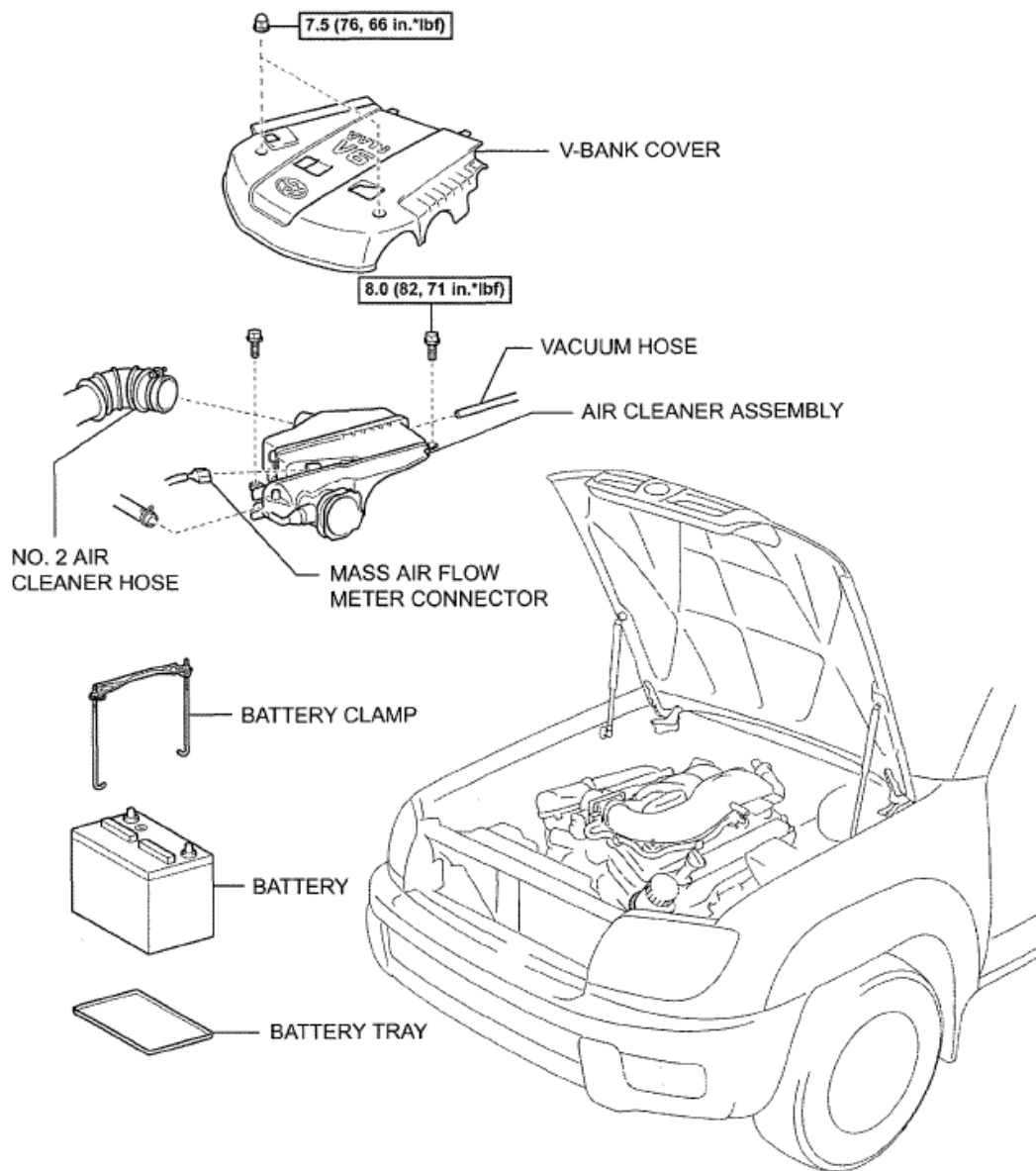
- a. Install the V-bank cover with the 2 nuts.

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

21. INSPECT IGNITION TIMING (See ON-VEHICLE INSPECTION)

TIMING CHAIN

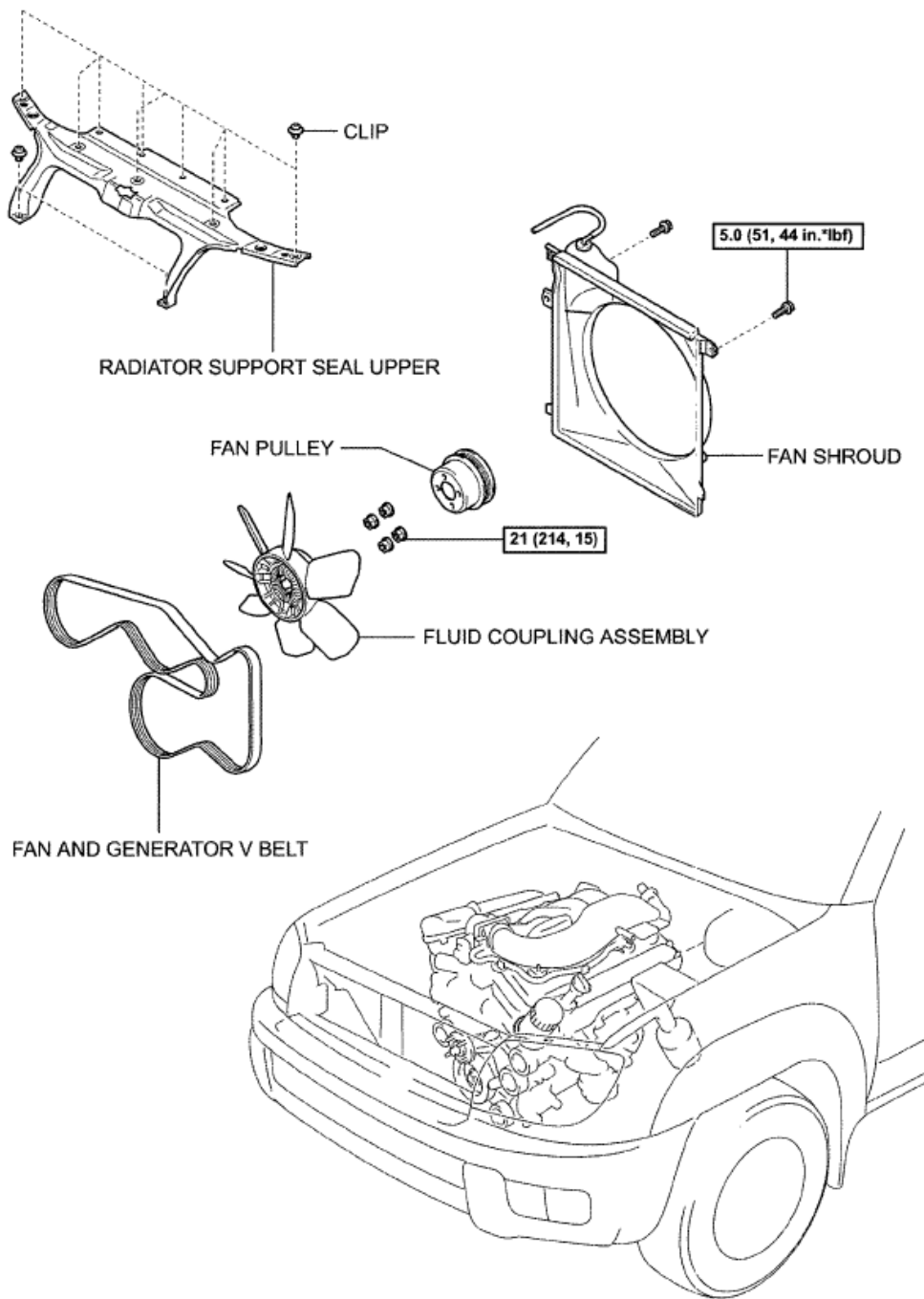
COMPONENTS



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

A137116E01

Fig. 74: Identifying Engine Timing Replacement Components With Torque Specifications (1 Of 7)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

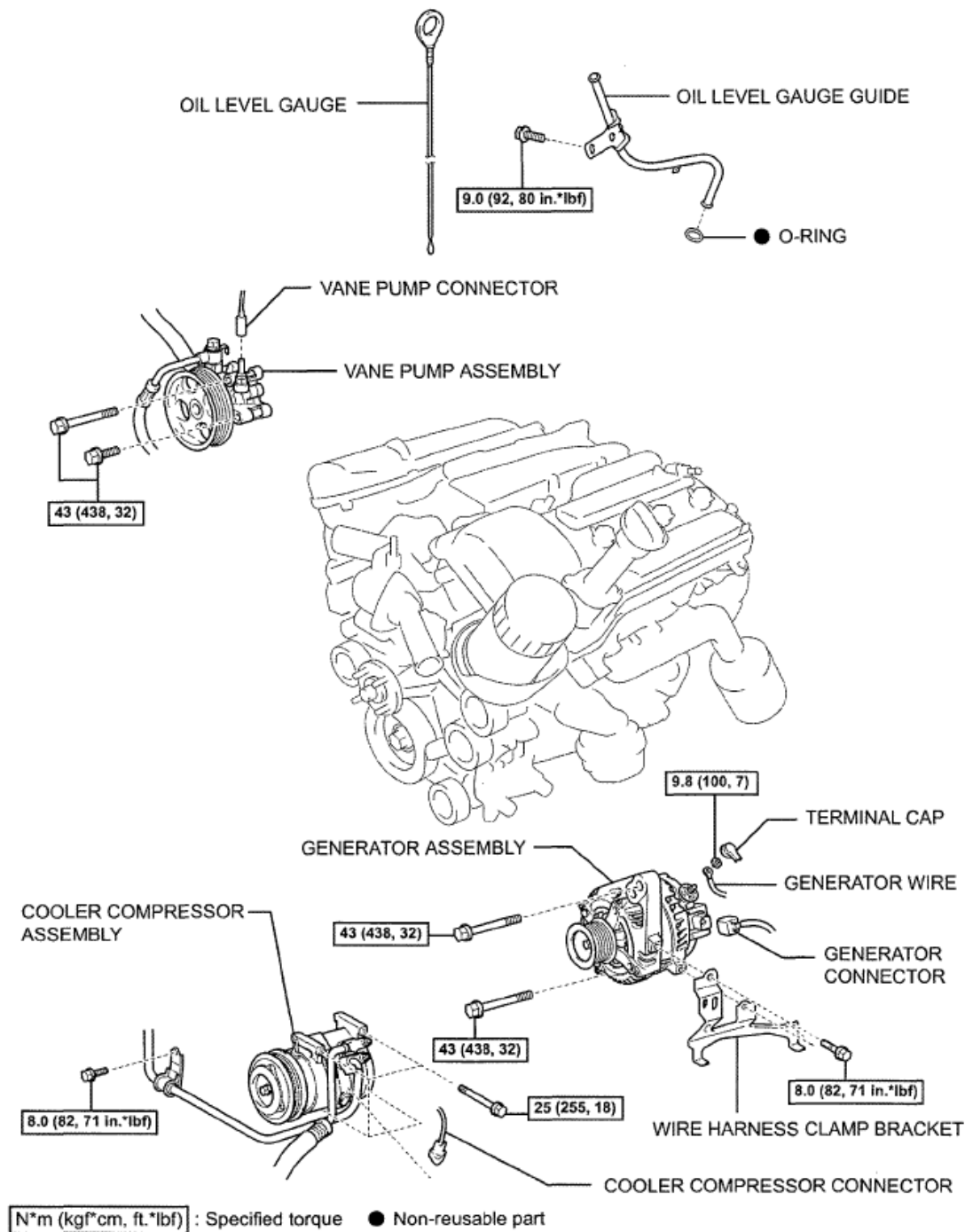


N*m (kgf*cm, ft.*lbf) : Specified torque

Y

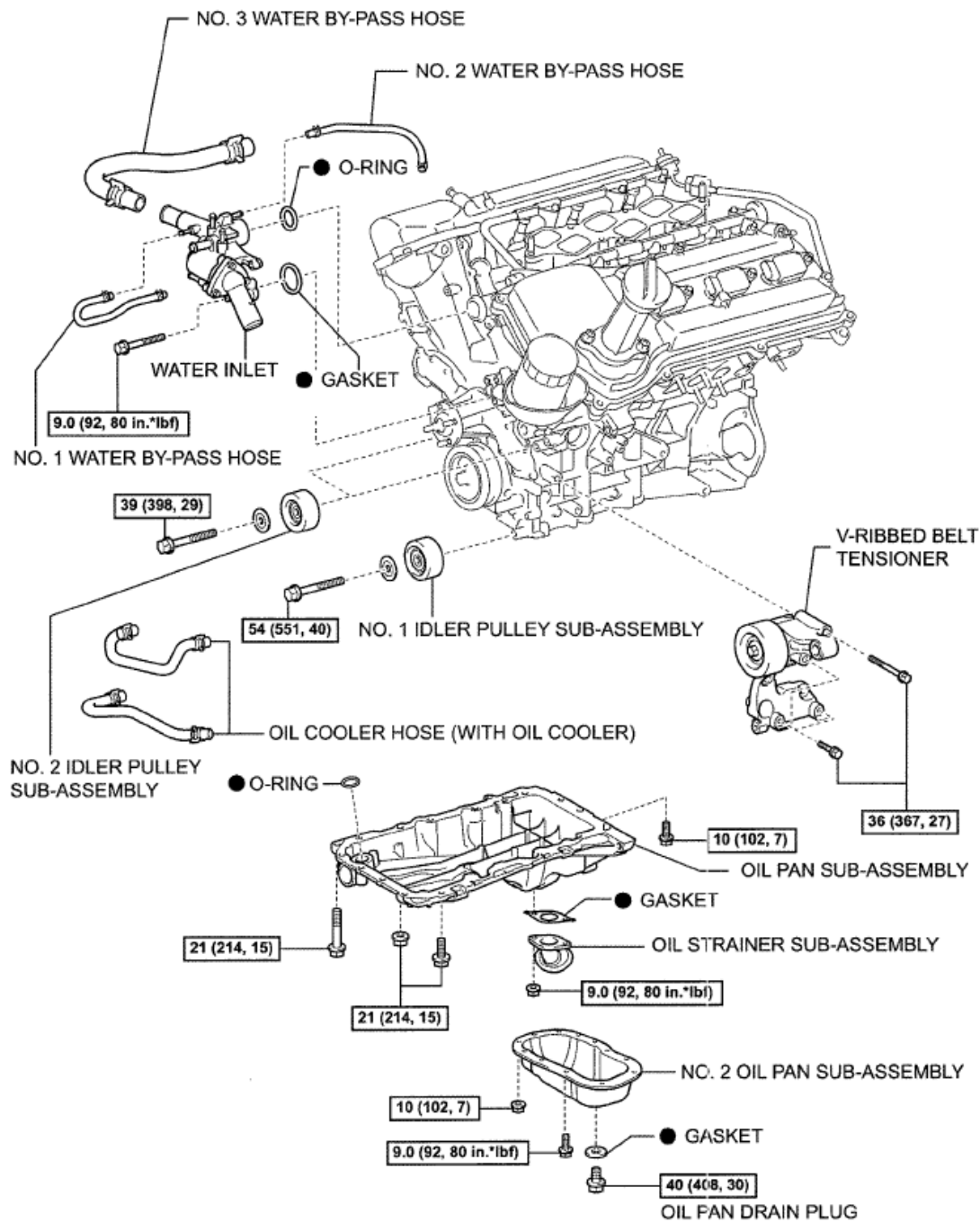
A137117E03

Fig. 75: Identifying Engine Timing Replacement Components With Torque Specifications (2 Of 7)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



A11979E01

Fig. 76: Identifying Engine Timing Replacement Components With Torque Specifications (3 Of 7)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

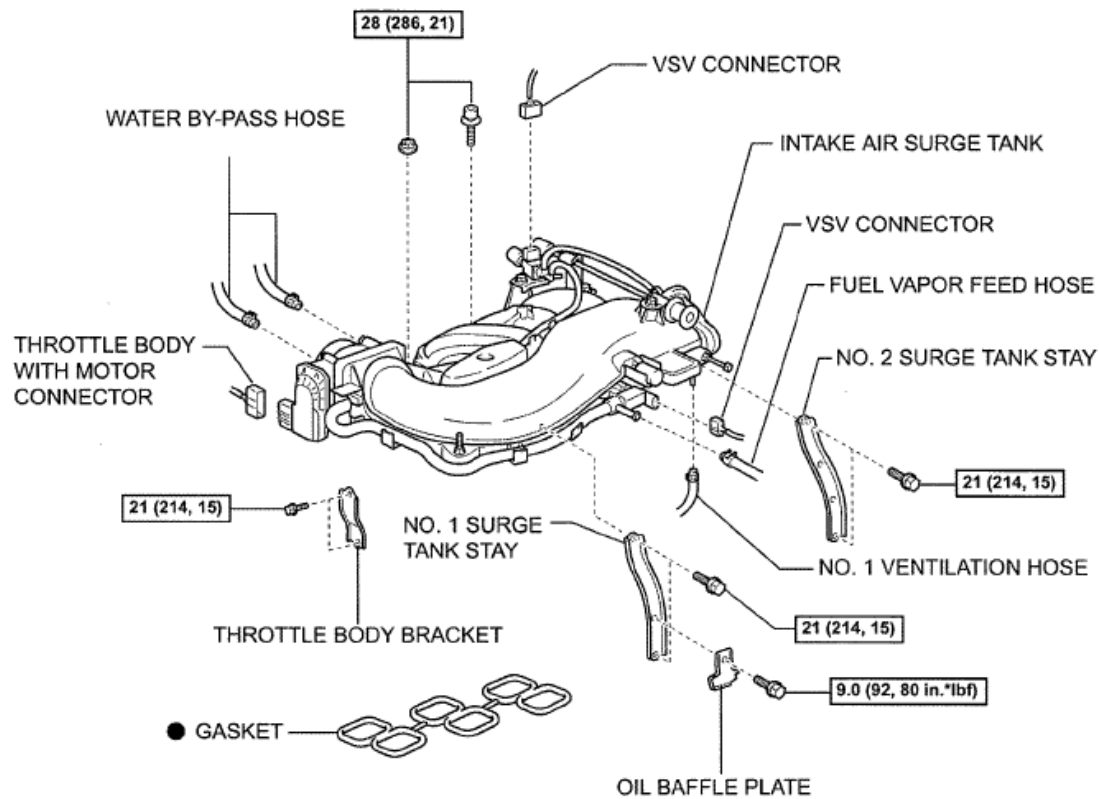


N*m (kgf*cm, ft.*lbf) : Specified torque

● Non-reusable part

A119800E02

Fig. 77: Identifying Engine Timing Replacement Components With Torque Specifications (4 Of 7)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

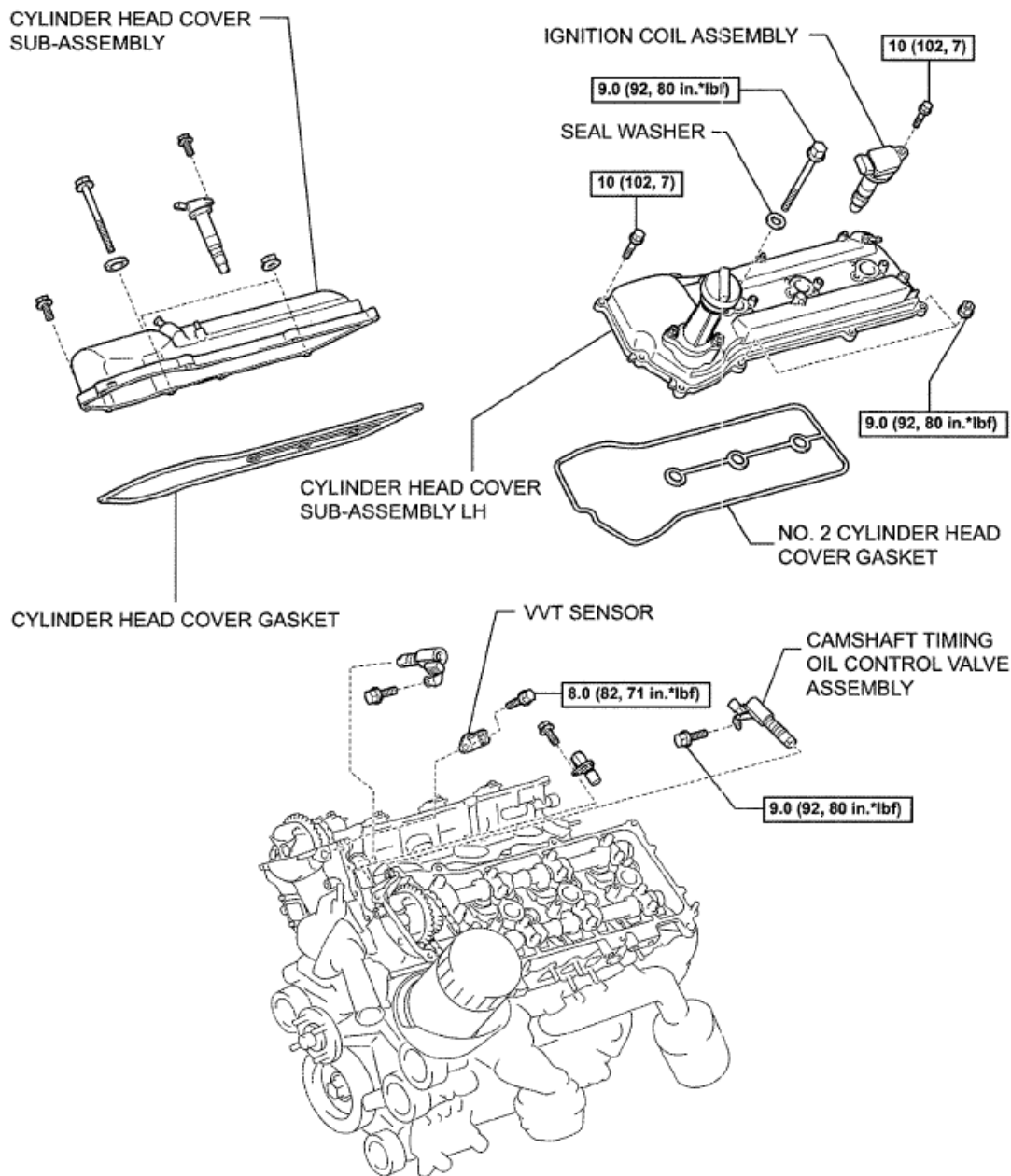


N*m (kgf*cm, ft.*lbf) : Specified torque

● Non-reusable part

A119844E03

Fig. 78: Identifying Engine Timing Replacement Components With Torque Specifications (5 Of 7)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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

A119940E03

Fig. 79: Identifying Engine Timing Replacement Components With Torque Specifications (6 Of 7)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

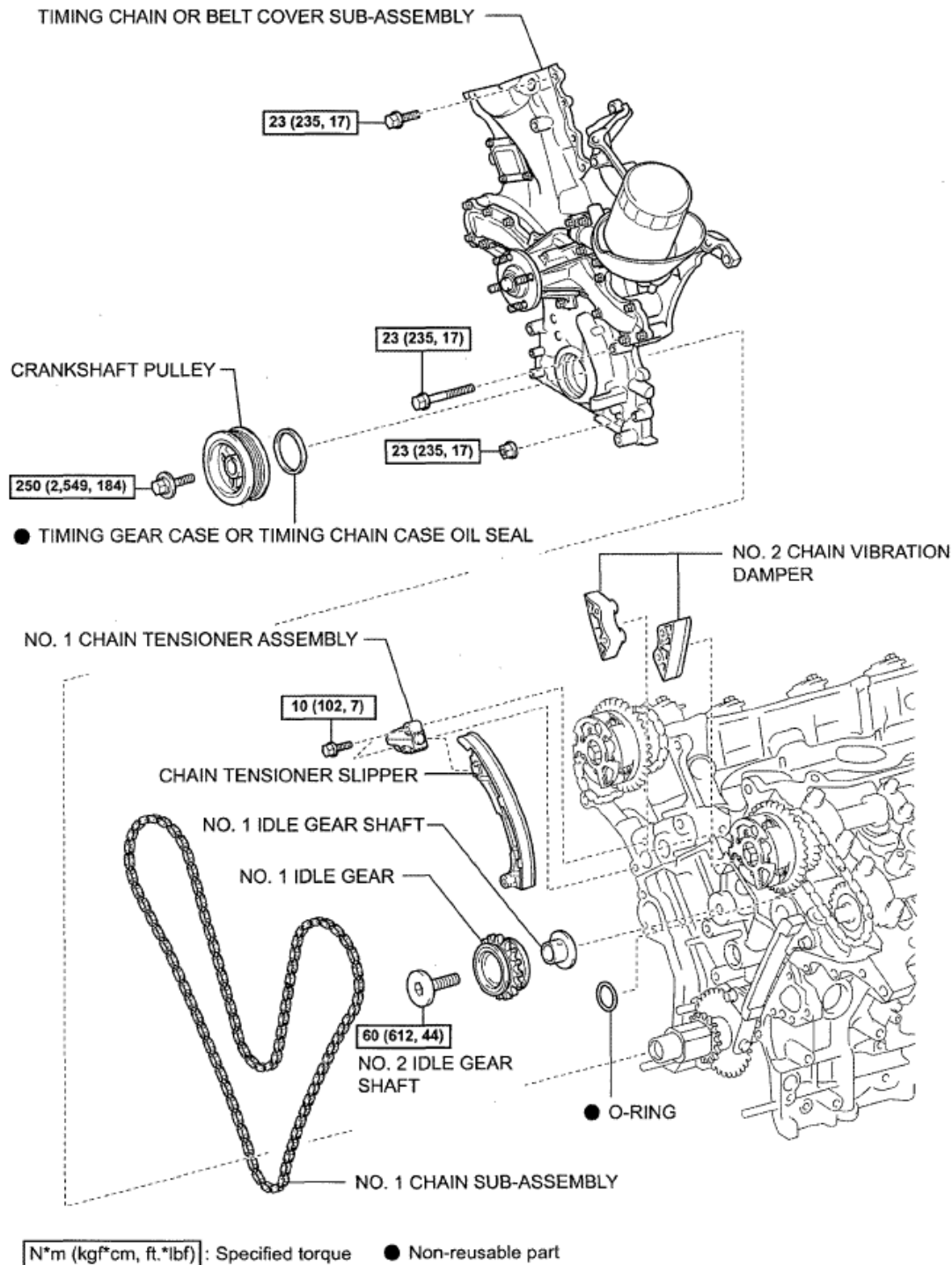


Fig. 80: Identifying Engine Timing Replacement Components With Torque Specifications (1 Of 7)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. REMOVE POWER STEERING LINK ASSEMBLY

HINT:

(See **REMOVAL**)

2. REMOVE DIFFERENTIAL CARRIER ASSEMBLY FRONT (for 4WD)

HINT:

(See **REMOVAL**)

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

4. DRAIN ENGINE OIL (See **REMOVAL)**

5. REMOVE BATTERY

6. REMOVE V-BANK COVER (See **REMOVAL)**

7. REMOVE RADIATOR SUPPORT SEAL UPPER

- a. Remove the 11 clips and radiator support seal upper.

8. LOOSEN FLUID COUPLING ASSEMBLY (See **REMOVAL)**

9. REMOVE FAN AND GENERATOR V BELT (See **REMOVAL)**

10. REMOVE FLUID COUPLING ASSEMBLY (See **REMOVAL)**

11. DISCONNECT NO. 2 VENTILATION HOSE

12. REMOVE AIR CLEANER ASSEMBLY (See **REMOVAL)**

13. REMOVE OIL LEVEL GAUGE 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.

14. REMOVE WATER INLET

15. SEPARATE VANE PUMP ASSEMBLY

- a. Disconnect the P/S oil pressure switch connector.
- b. Remove the 2 bolts, and separate the vane pump.

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

HINT:

The vane pump is suspended securely.

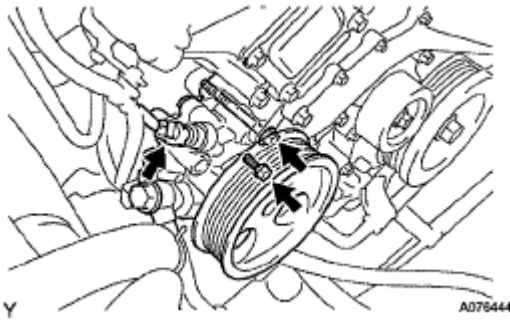


Fig. 81: Identifying Vane Pump Assembly Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

16. **REMOVE GENERATOR ASSEMBLY** (See DISASSEMBLY)
17. **SEPARATE COOLER COMPRESSOR ASSEMBLY** (See REMOVAL)
18. **REMOVE V-RIBBED BELT TENSIONER ASSEMBLY**
 - a. Remove the 5 bolts and V-ribbed belt tensioner.

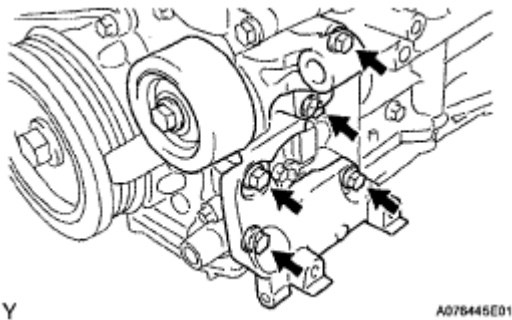


Fig. 82: Identifying V-Ribbed Belt Tensioner Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

19. **REMOVE NO. 2 IDLER PULLEY SUB-ASSEMBLY**
 - a. Remove the 2 bolts and 2 idler pulleys.
20. **REMOVE NO. 1 IDLER PULLEY SUB-ASSEMBLY**
 - a. Remove the bolt and idler pulley.
21. **REMOVE CRANKSHAFT PULLEY**
 - a. Using SST, hold the crankshaft pulley and loosen the pulley set bolt.

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

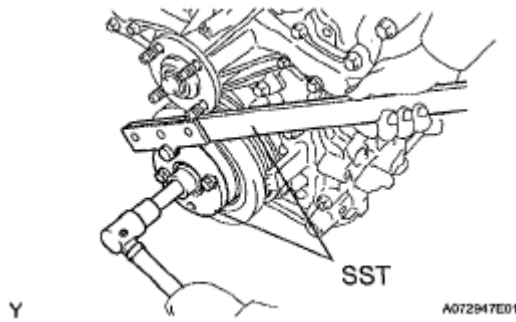


Fig. 83: Identifying Pulley Set Bolt Using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using the pulley set bolt and SST, remove the crankshaft pulley.

SST 09950-50013 (09951-05010, 09952-05010, 09953-05020, 09954-05031)

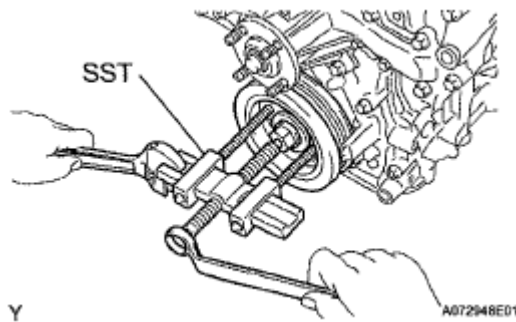


Fig. 84: Identifying Crankshaft Pulley Using Pulley Set Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

22. REMOVE NO. 2 OIL PAN SUB-ASSEMBLY

- a. Remove the 10 bolts and 2 nuts.

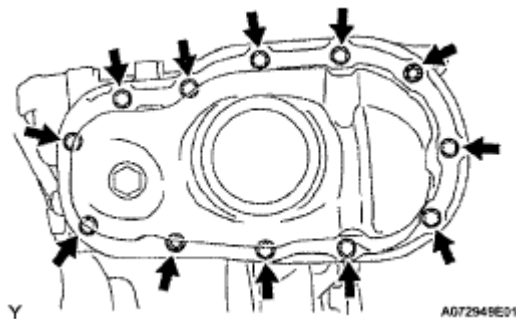
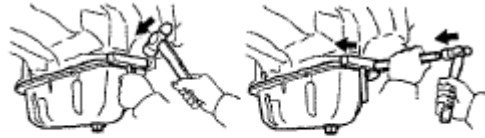


Fig. 85: Identifying Oil Pan No. 2 With 10 Bolts And 2 Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

NOTE:

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



Y

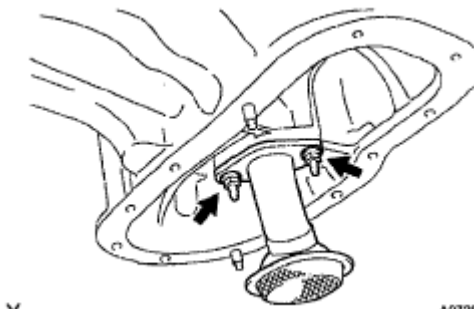
A072950E04

Fig. 86: Identifying Blade Of Oil Pan Seal Cutter Between Oil Pan And No. 2 Oil Pan

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

23. REMOVE OIL STRAINER SUB-ASSEMBLY

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



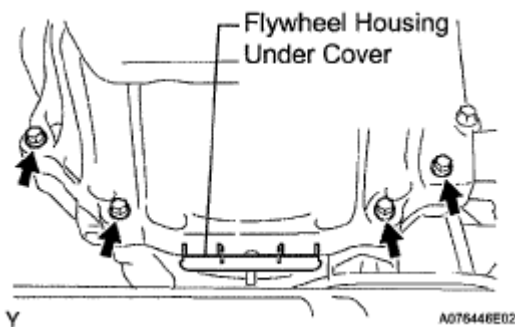
Y

A072951E01

Fig. 87: Identifying Oil Strainer Sub-Assembly Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

24. REMOVE OIL PAN SUB-ASSEMBLY

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



Y

A076446E02

Fig. 88: Identifying Oil Pan Sub-Assembly Housing Bolts

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

- c. Remove the 17 bolts and 2 nuts.

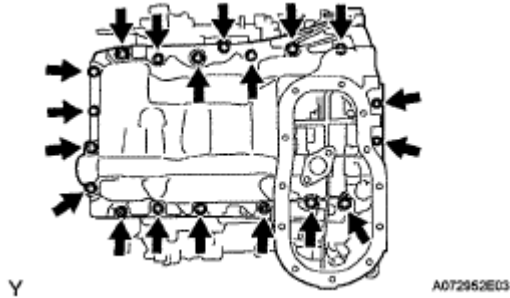


Fig. 89: Identifying Bolts And Nuts

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 as shown in the illustration.

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

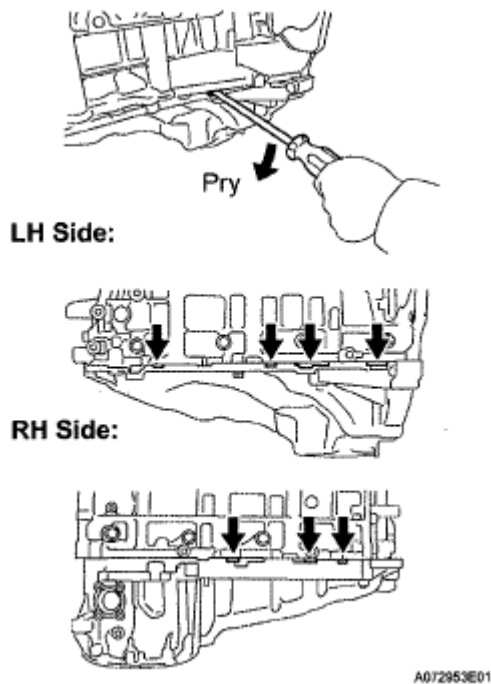


Fig. 90: Identifying Oil Pan By Prying

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

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

25. REMOVE INTAKE AIR SURGE TANK (See REMOVAL)

26. **REMOVE IGNITION COIL ASSEMBLY**
27. **REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY (See DISASSEMBLY)**
28. **REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY LH (See DISASSEMBLY)**
29. **REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY**
 - a. Disconnect the 2 oil control valve connectors.
 - b. Remove the 2 bolts and 2 camshaft timing oil control valves.
30. **REMOVE VVT SENSOR (See REMOVAL)**
31. **REMOVE TIMING CHAIN OR BELT COVER SUBASSEMBLY (See DISASSEMBLY)**
32. **REMOVE TIMING GEAR CASE OR TIMING CHAIN CASE OIL SEAL**
33. **SET NO. 1 CYLINDER TO TDC / COMPRESSION**
 - a. Install the crankshaft pulley set bolt, and turn the crankshaft to align the crankshaft set key with the timing line of the cylinder block.

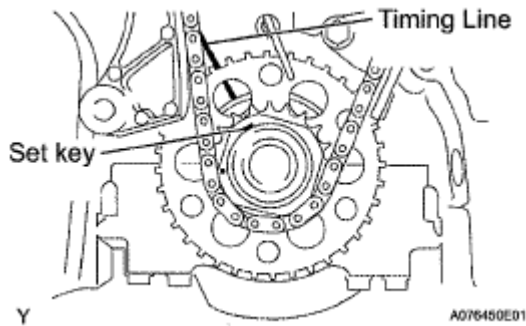
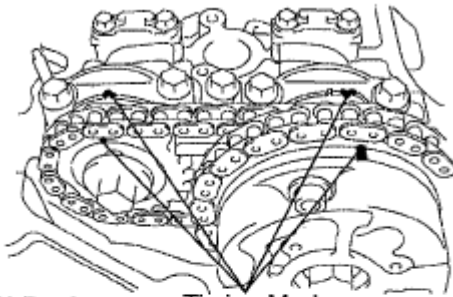


Fig. 91: Identifying Crankshaft Set Key With Timing Line Of Cylinder Block
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

RH Bank:



LH Bank:

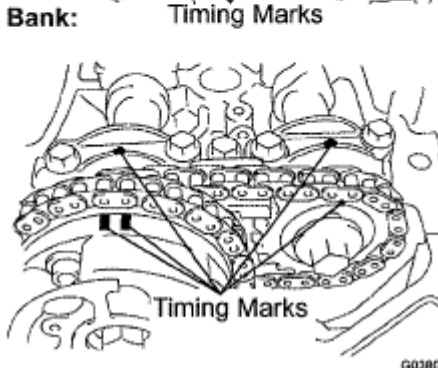


Fig. 92: Aligning Timing Marks Of Camshaft Timing Gears And Bearing Caps
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

34. 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.
- a. While turning the stopper plate of the tensioner clockwise, push in the plunger of the chain tensioner as shown in the illustration.

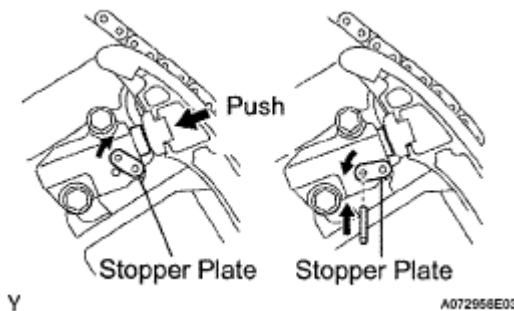


Fig. 93: Identifying Stopper Plate Of Tensioner
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. While turning the stopper plate of the tensioner counterclockwise, insert a bar of $\varnothing 3.5$ mm (0.138 in.) into the holes on the stopper plate and tensioner to fix the stopper plate.

- c. Remove the 2 bolts and chain tensioner.

35. REMOVE CHAIN TENSIONER SLIPPER

36. REMOVE NO. 1 IDLE GEAR SHAFT

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

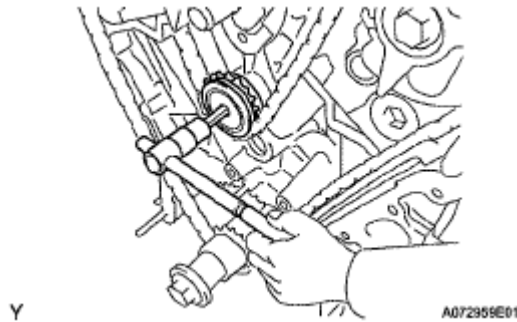


Fig. 94: Identifying Idle Gear Shaft
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

37. REMOVE NO. 2 CHAIN VIBRATION DAMPER

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

38. REMOVE CHAIN SUB-ASSEMBLY

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 $\varnothing 3.5$ mm (0.138 in.) into the holes on 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 ft.*lbf)

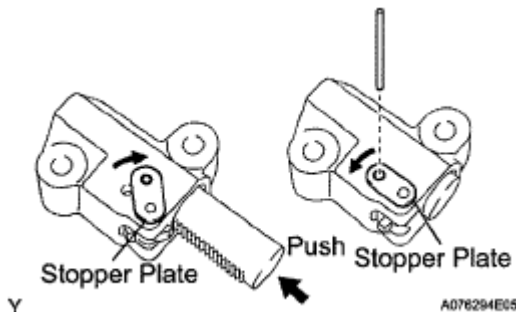
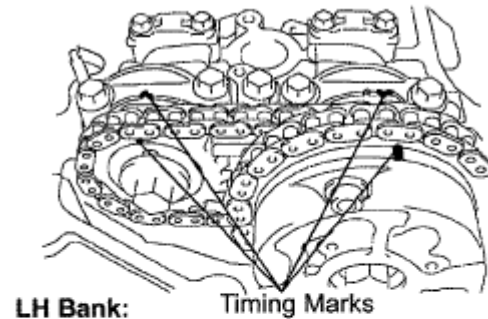
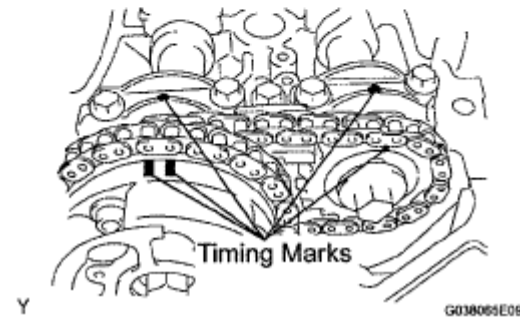


Fig. 95: Identifying Stopper Plate Of Tensioner

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

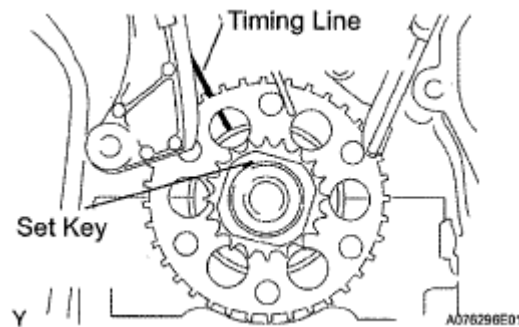
3. INSTALL CHAIN SUB-ASSEMBLY

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

RH Bank:**LH Bank:****Fig. 96: Aligning Timing Marks Of Camshaft Timing Gears And Bearing Caps**

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

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

**Fig. 97: Identifying Crankshaft Set Key With Timing Line Of Cylinder Block**

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

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

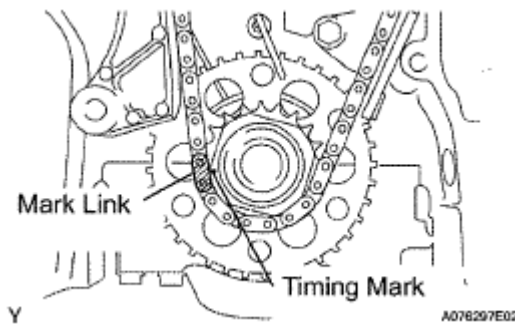


Fig. 98: Identifying Mark Link With Timing Mark Of Crankshaft Timing Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

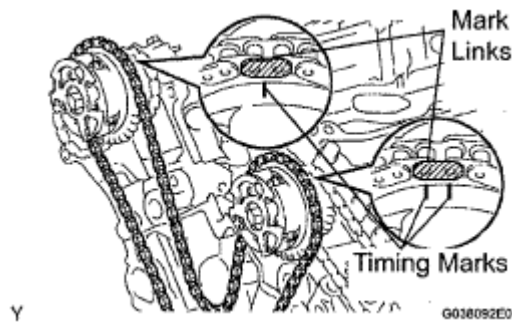


Fig. 99: Identifying Mark Links With Timing Marks Of Camshaft Timing Gears
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. INSTALL NO. 2 CHAIN VIBRATION DAMPER

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

5. INSTALL NO. 1 IDLE GEAR SHAFT

- a. Apply a light coat of engine oil to the rotating surface of the No. 1 idle gear shaft.
- b. Temporarily install the No. 1 idle gear shaft and No. 1 idle gear with the No. 2 idle gear shaft while aligning the knock pin of the No. 1 idle gear shaft 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 No. 2 idle gear shaft.

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 REASSEMBLY)

7. INSTALL TIMING CHAIN OR BELT COVER SUBASSEMBLY (See REASSEMBLY)

8. INSTALL VVT SENSOR (See INSTALLATION)

9. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

- a. Insert the camshaft timing oil control valves to each cylinder head, and tighten the 2 bolts.

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

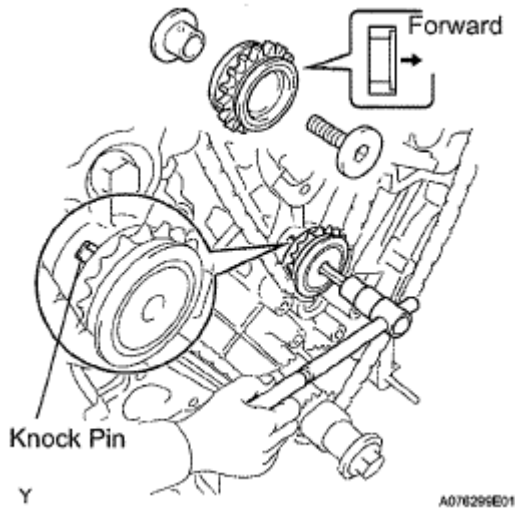


Fig. 100: Identifying No. 2 Idle Gear Shaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY LH (See REASSEMBLY)
11. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY (See REASSEMBLY)
12. INSTALL IGNITION COIL ASSEMBLY

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

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 to the oil pump.

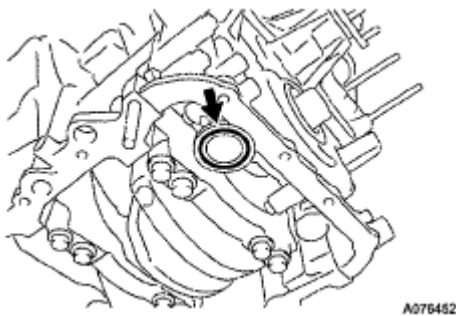


Fig. 101: Identifying O-Ring

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 after applying seal packing. After installing it, the oil pan bolts and nuts must be tightened within 15 minutes. Otherwise the seal packing must be removed and reapplied.

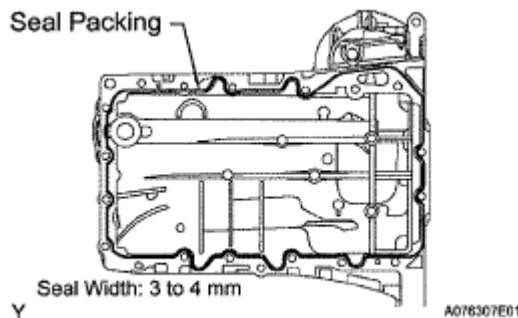


Fig. 102: Identifying Area For Applying Bead Of Seal Packing To Oil Pan

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

- d. Install the oil pan with the 17 bolts and 2 nuts.

Tighten the bolts and nuts uniformly in several steps.

Torque:

For bolt A

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

For bolt B

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

For bolt C

10 N*m (102 kgf*cm, 7 ft.*lbf)

For nut

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

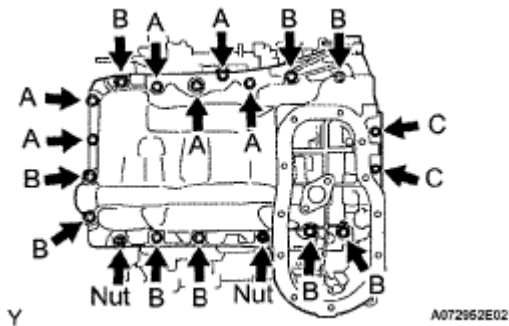


Fig. 103: Identifying Pan Sub-Assembly Housing Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

Each bolt length is as follows:

A: 25 mm (0.98 in.)

B: 45 mm (1.77 in.)

C: 14 mm (0.55 in.)

- e. Install the 4 housing bolts.

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

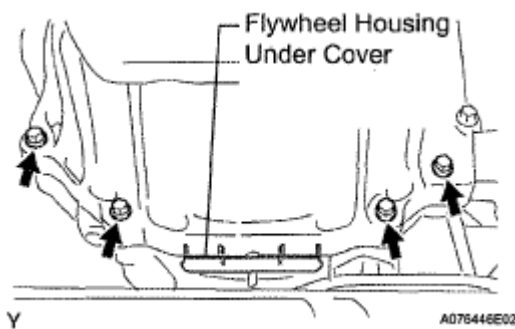


Fig. 104: Identifying Oil Pan Sub-Assembly Housing Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Install the flywheel housing under cover.

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)

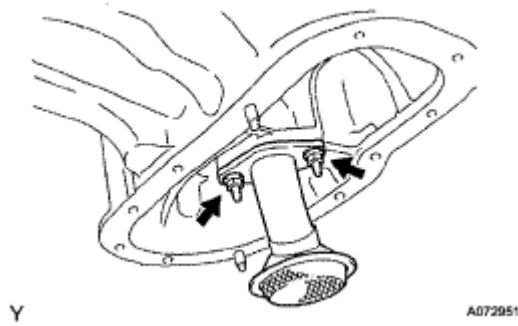


Fig. 105: Identifying Oil Strainer Sub-Assembly Nuts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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 No. 2 oil pan.
- 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 No. 2 oil pan within 3 minutes after applying seal packing. After installing it, the No. 2 oil pan bolts and nuts must be tightened within 15 minutes. Otherwise the seal packing must be removed and reapplied.

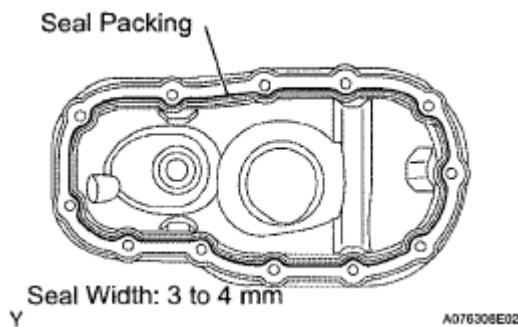


Fig. 106: Identifying Area For Applying Bead Of Seal Packing To Oil Pan
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

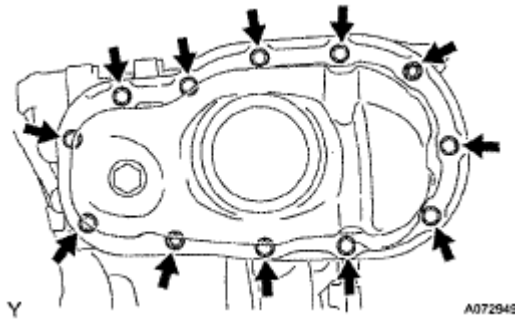


Fig. 107: Identifying Oil Pan Sub-Assembly Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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)

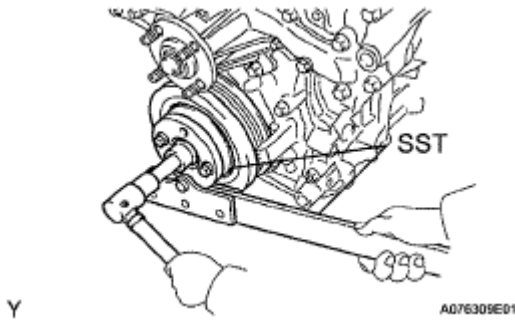


Fig. 108: Identifying Pulley Set Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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 No. 1 idler pulley to distinguish it from the No. 2 idler pulley.

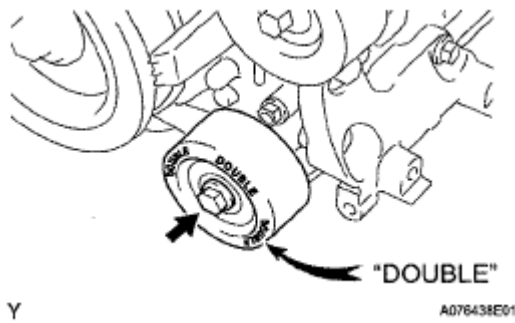


Fig. 109: Identifying Idler Pulley With Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

19. INSTALL NO. 2 IDLER PULLEY SUB-ASSEMBLY

- Install the 2 idler pulleys with the 2 bolts.

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

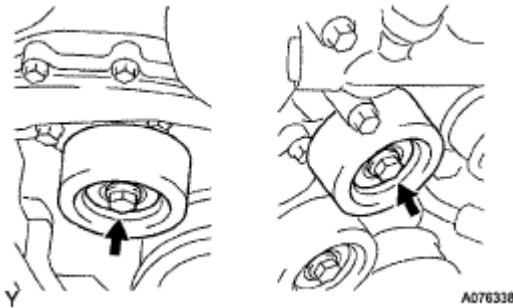


Fig. 110: Identifying Idler Pulleys Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

20. INSTALL V-RIBBED BELT TENSIONER ASSEMBLY

- Temporarily install the V-ribbed belt tensioner with the 5 bolts.
- Install the V-ribbed belt tensioner by tightening the bolt 1 and bolt 2 in the order shown in the illustration.

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

- Tighten the other bolts.

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

HINT:

Each bolt length is as; follows:

A: 70 mm (2.76 in.)

B: 33 mm (1.30 in.)

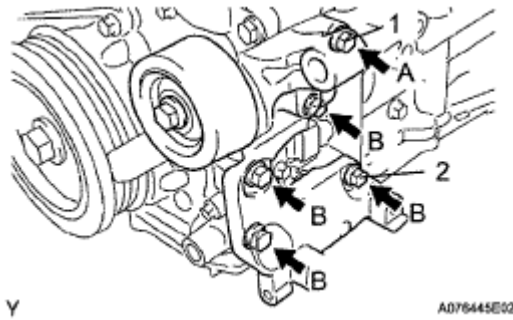


Fig. 111: Identifying V-Ribbed Belt Tensioner Assembly Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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.

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

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

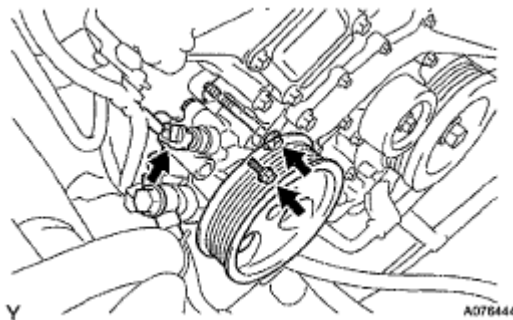


Fig. 112: Identifying Vane Pump Assembly Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Connect the P/S oil pressure switch connector.
24. **INSTALL WATER INLET** (See INSTALLATION)
25. **INSTALL OIL LEVEL GAUGE GUIDE**
 - a. Install a new O-ring to the oil level gauge guide.
 - b. Apply a light coat of engine oil to the O-ring.
 - c. Push in 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.

26. **INSTALL AIR CLEANER ASSEMBLY** (See INSTALLATION)
27. **CONNECT NO. 2 VENTILATION HOSE**
28. **INSTALL FLUID COUPLING ASSEMBLY** (See INSTALLATION)
29. **INSTALL FAN AND GENERATOR V BELT** (See REMOVAL)
30. **FULLY TIGHTEN FLUID COUPLING ASSEMBLY** (See INSTALLATION)
31. **INSTALL RADIATOR SUPPORT SEAL UPPER**
32. **INSTALL BATTERY**
33. **INSTALL DIFFERENTIAL CARRIER ASSEMBLY FRONT**

HINT:

(See INSTALLATION)

34. **INSTALL POWER STEERING LINK ASSEMBLY**

HINT:

(See INSTALLATION)

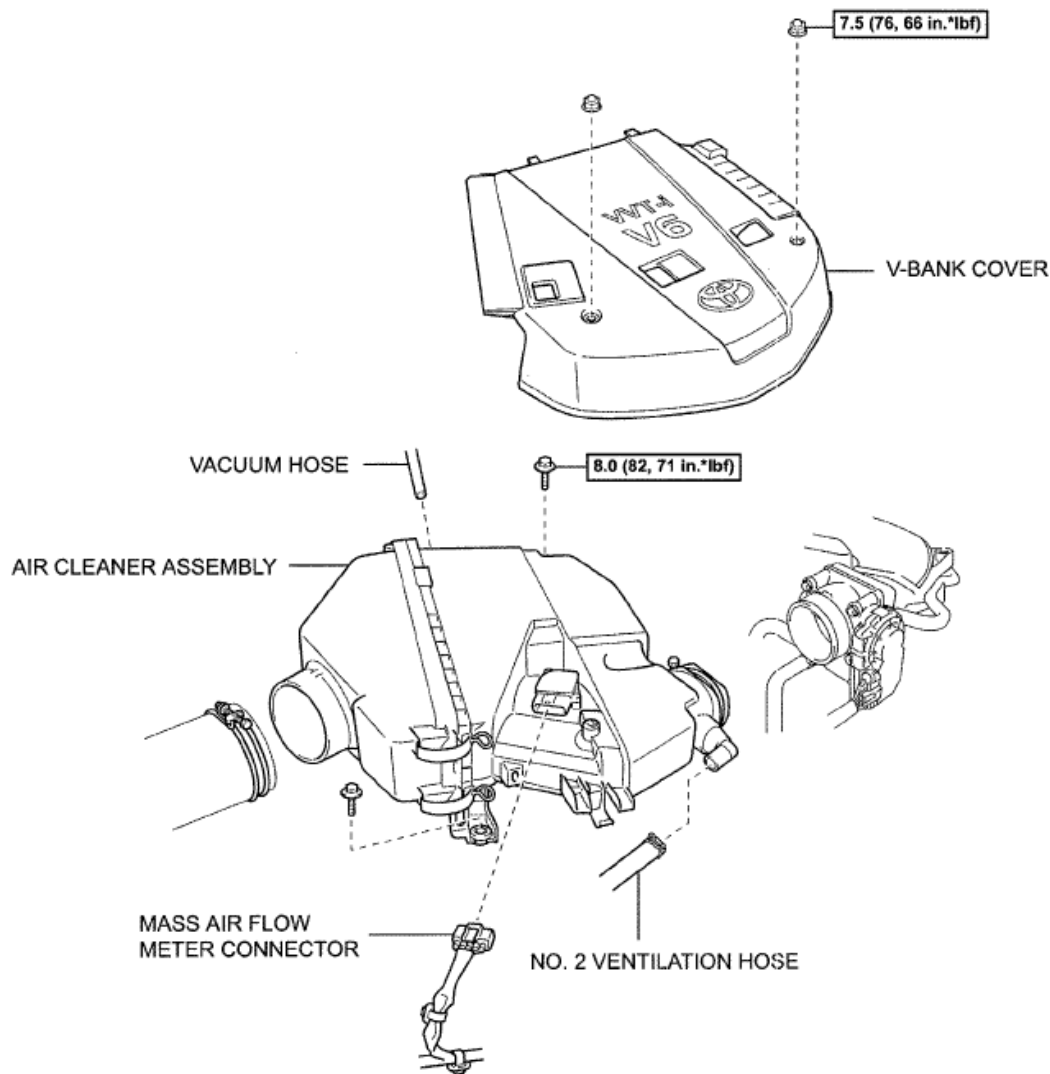
35. **ADD ENGINE OIL** (See INSTALLATION)
36. **ADD ENGINE COOLANT** (See REPLACEMENT)
37. **CHECK FOR ENGINE OIL LEAKS**
38. **CHECK FOR ENGINE COOLANT LEAKS** (See REPLACEMENT)
39. **INSTALL V-BANK COVER**
 - a. Install the V-bank cover with the 2 nuts.

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

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

CAMSHAFT (FOR BANK 1)

COMPONENTS

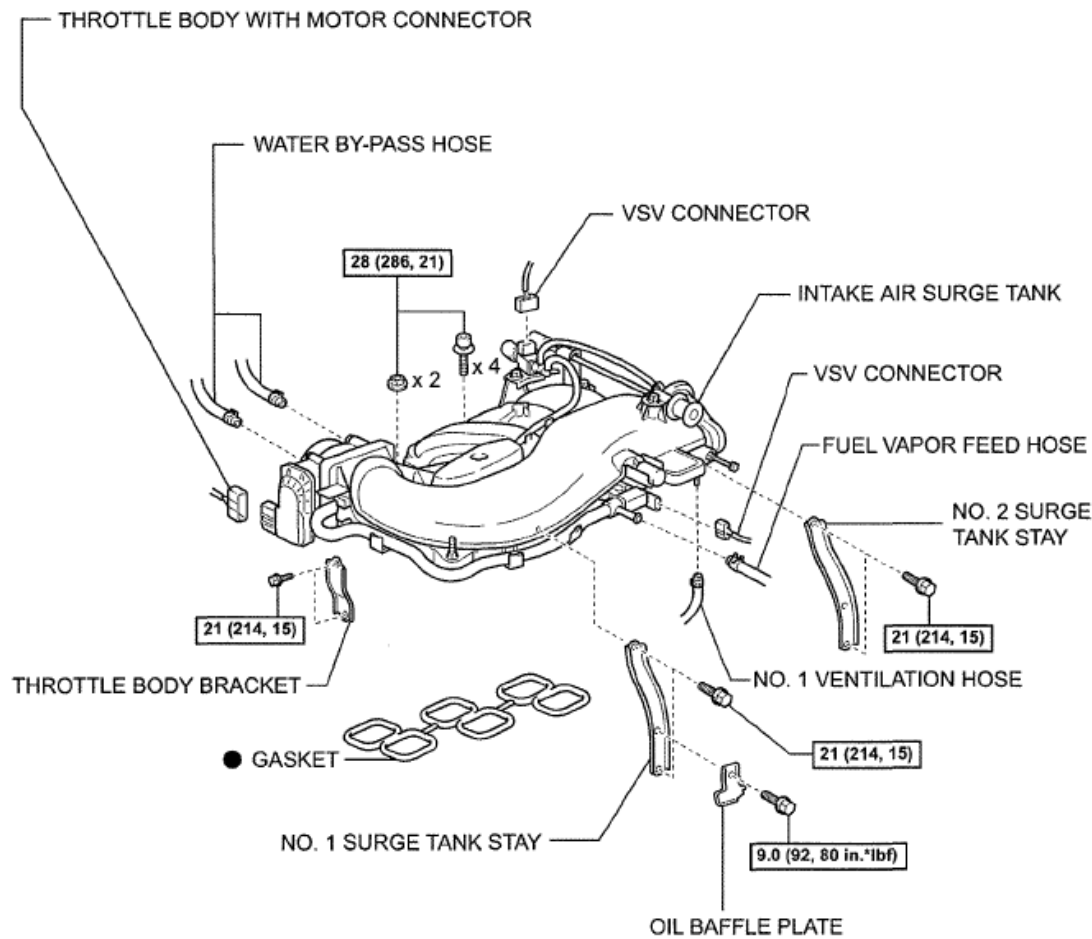


N*m (kgf*cm, ft.*lbf) : Specified torque

Y

A119778E01

Fig. 113: Identifying Camshaft Replacement Components With Torque Specifications (1 Of 4)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



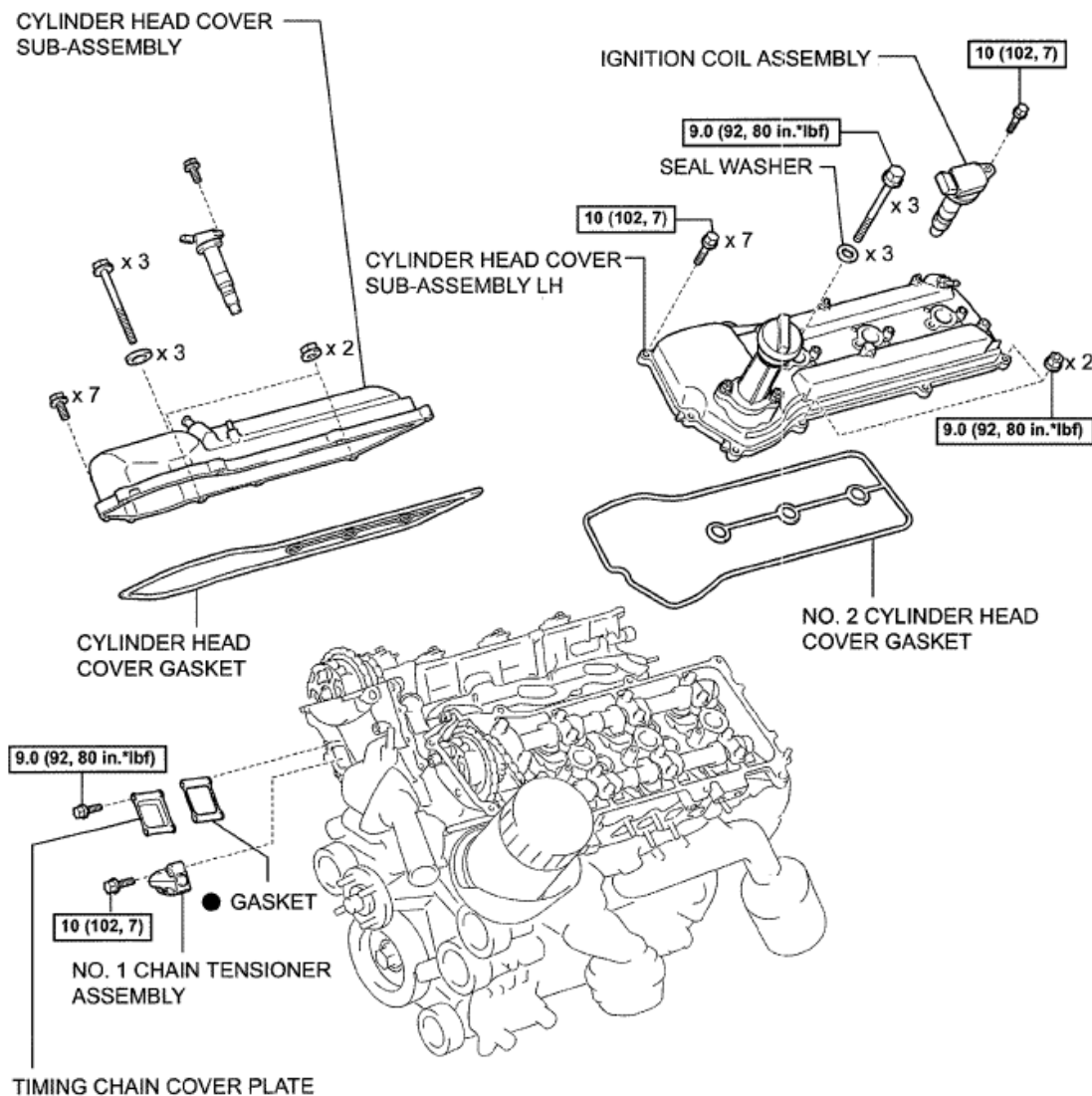
N*m (kgf*cm, ft.*lbf) : Specified torque

● Non-reusable part

Y

A119602E04

Fig. 114: Identifying Camshaft Replacement Components With Torque Specifications (2 Of 4)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

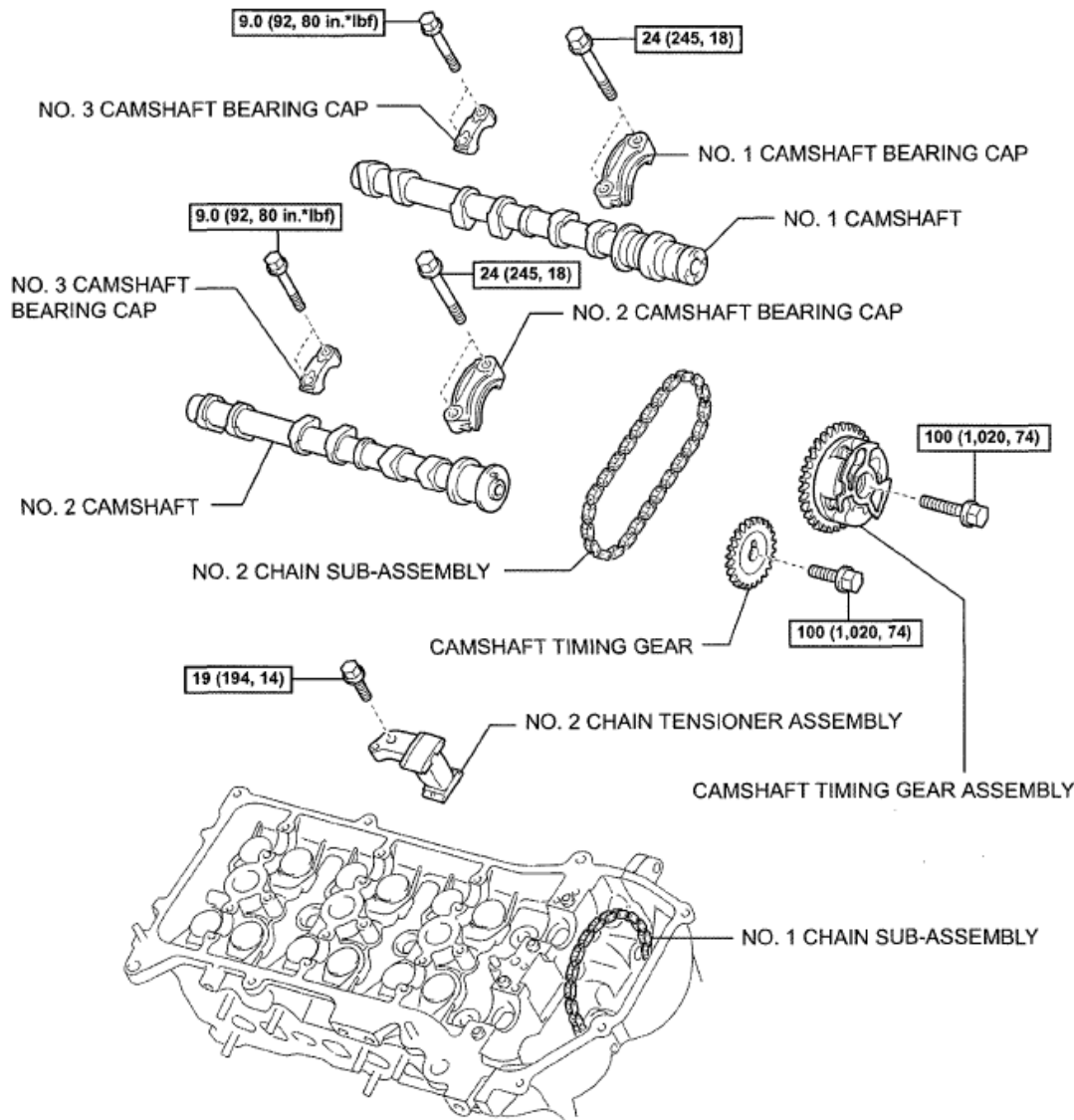


N*m (kgf*cm, ft.*lbf) : Specified torque

● Non-reusable part

A119925E05

Fig. 115: Identifying Camshaft Replacement Components With Torque Specifications (3 Of 4)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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

Y

A112803E04

Fig. 116: Identifying Camshaft Replacement Components With Torque Specifications (4 Of 4)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. **DRAIN ENGINE COOLANT** (See **REPLACEMENT**)
2. **REMOVE V-BANK COVER** (See **REMOVAL**)
3. **DISCONNECT NO. 2 VENTILATION HOSE**
4. **REMOVE AIR CLEANER ASSEMBLY** (See **REMOVAL**)

5. REMOVE INTAKE AIR SURGE TANK

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

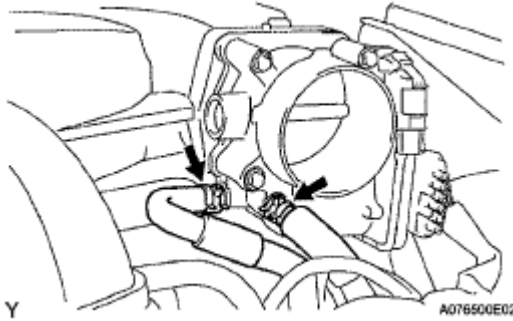


Fig. 117: Identifying Water By-Pass Hoses
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Disconnect the fuel vapor feed hose.

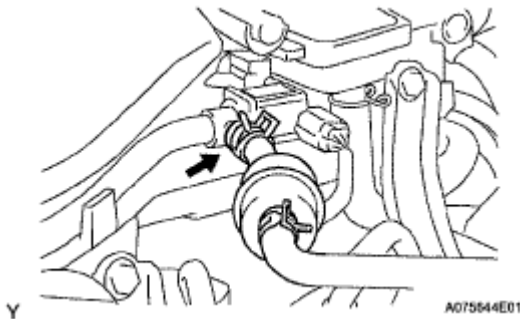


Fig. 118: Identifying Fuel Vapor Feed Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Disconnect the ventilation hose.

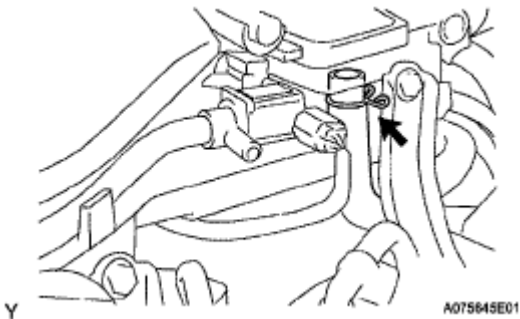
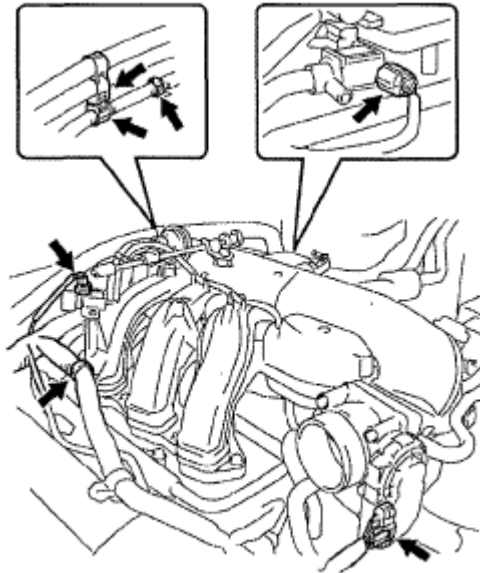


Fig. 119: Identifying Ventilation Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Disconnect the 2 VSV connectors.

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

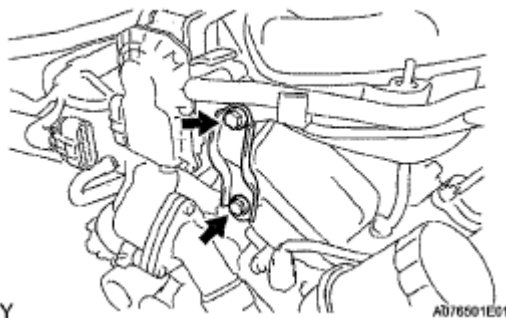


Y

A075646E01

Fig. 120: Identifying Wire Harness Clamps And Hose Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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



Y

A076501E01

Fig. 121: Identifying Throttle Body Bracket Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

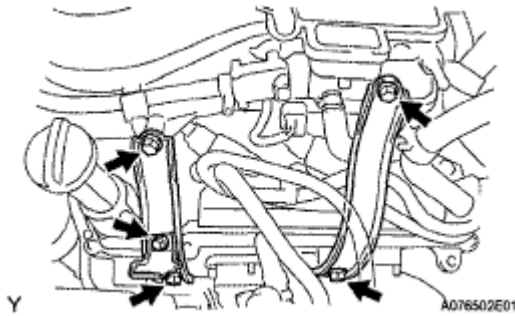


Fig. 122: Identifying Bolts And Surge Tank Stays
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

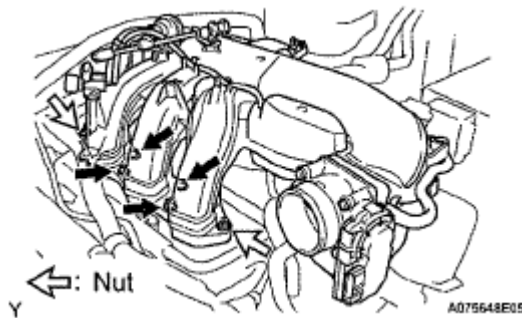


Fig. 123: Identifying Bolts, Intake Air Surge Tank And Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 6. REMOVE IGNITION COIL ASSEMBLY
- 7. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY
 - a. Remove the 10 bolts, 3 seal washers, 2 nuts, cylinder head cover and gasket.

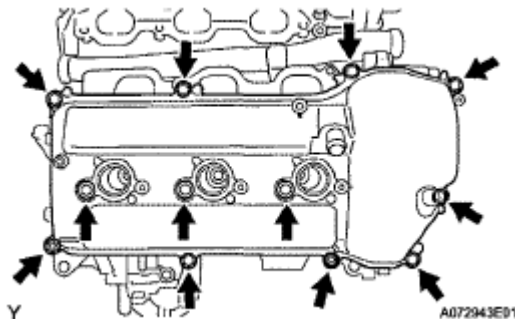


Fig. 124: Identifying Cylinder Head Cover Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 8. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY LH

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

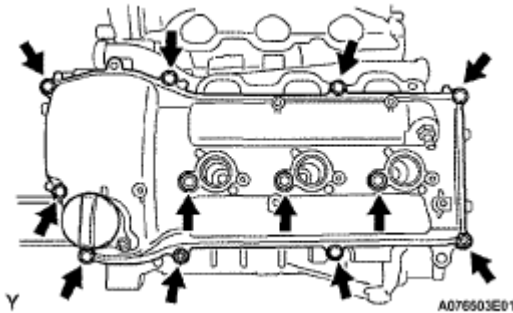


Fig. 125: Identifying Cylinder Head Cover Sub-Assembly Bolt And Nuts (LH)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. SET NO. 1 CYLINDER TO TDC / COMPRESSION

- a. Turn the crankshaft pulley, and align the notch with the timing mark "0" of the timing chain cover.

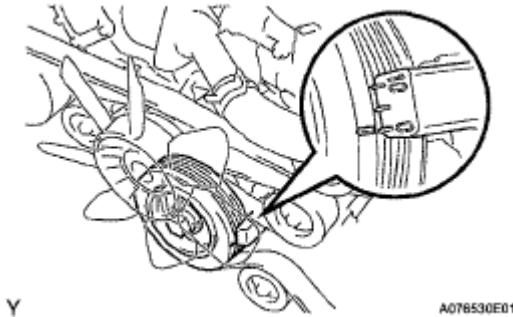
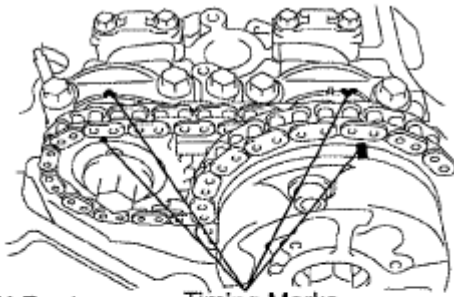


Fig. 126: Aligning Notch With Timing Mark
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

RH Bank:



LH Bank:

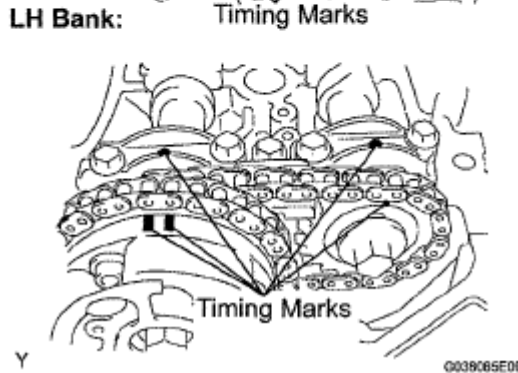


Fig. 127: Aligning Timing Marks Of Camshaft Timing Gears And Bearing Caps
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Place paint marks on the No. 1 chain links that correspond with the timing marks of the camshaft timing gears.

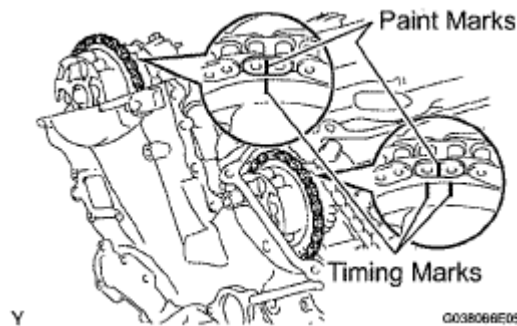


Fig. 128: Identifying Timing Marks Of Camshaft Timing Gears
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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 TDC first.

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

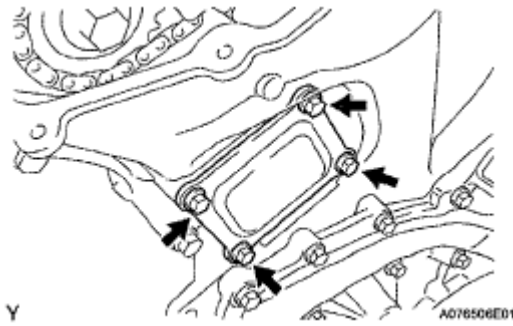


Fig. 129: Identifying Timing Chain Cover Plate Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

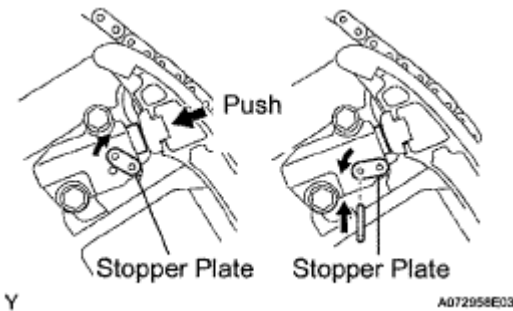


Fig. 130: Identifying Stopper Plate Of Tensioner
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. While turning the stopper plate of the tensioner counterclockwise, insert a bar of $\varnothing 3.5$ mm (0.138 in.) into the holes on the stopper plate and tensioner to fix the stopper plate in place.
- d. Remove the 2 bolts and chain tensioner.

11. REMOVE NO. 2 CAMSHAFT

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

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

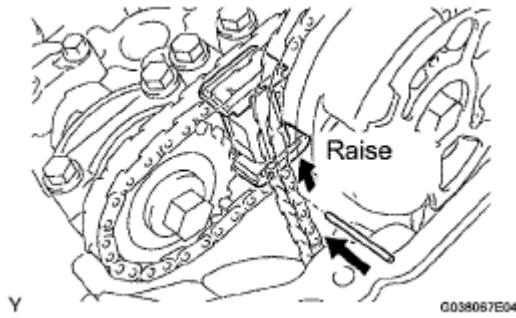


Fig. 131: Inserting Pin Into Hole

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.

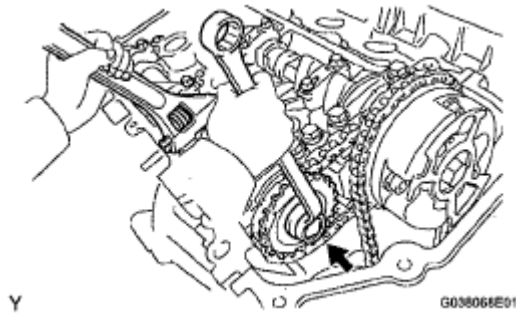


Fig. 132: Identifying Camshaft Timing Gear Set Bolt

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

- c. Separate the camshaft timing gear from the No. 2 camshaft.
- d. Rotate the camshaft counterclockwise using a wrench so that the cam lobes of the No. 1 cylinder face upward as shown in the illustration.

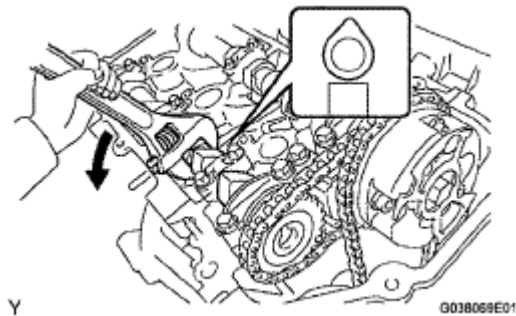


Fig. 133: Identifying Camshaft Counterclockwise

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

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

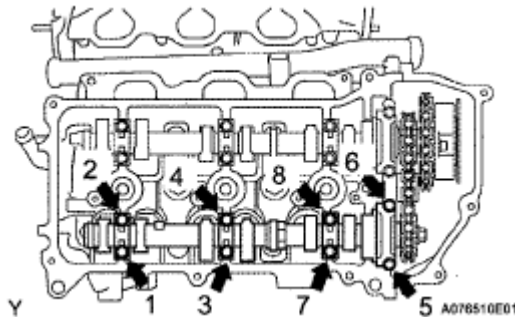


Fig. 134: Identifying Loosening Sequence Of Bearing Cap Bolts (Bank 1)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Remove the 4 bearing caps and No. 2 camshaft.

12. REMOVE NO. 2 CHAIN TENSIONER ASSEMBLY

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

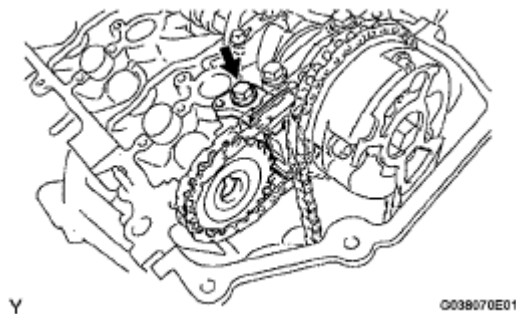


Fig. 135: Identifying Chain Tensioner Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. REMOVE NO. 1 CAMSHAFT

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

- a. 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.

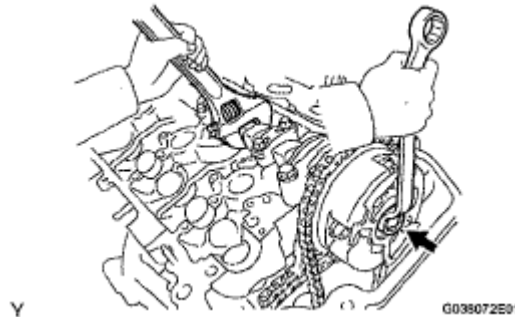


Fig. 136: Identifying Camshaft Timing Gear Set Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

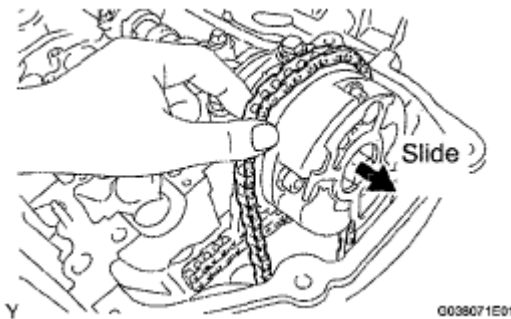


Fig. 137: Identifying Camshaft Timing Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

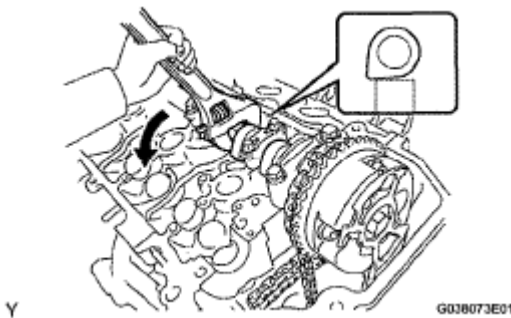


Fig. 138: Rotating No. 1 Camshaft Counterclockwise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

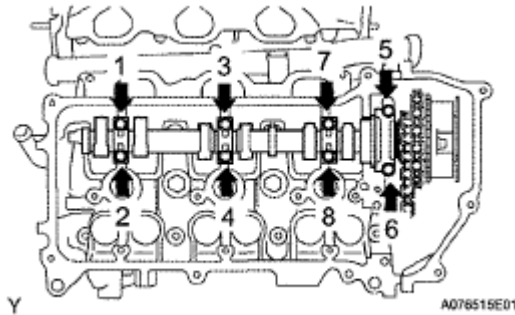


Fig. 139: Identifying Loosening Sequence Of Bearing Cap Bolts (Bank 1)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Remove the 4 bearing caps.
f. Remove the camshaft timing gear set bolt with the No. 1 camshaft lifted up, and then remove the No. 1 camshaft and camshaft timing gear with the No. 2 chain.

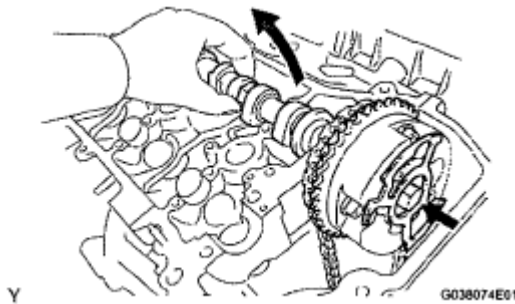


Fig. 140: Identifying Camshaft And Camshaft Timing Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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.

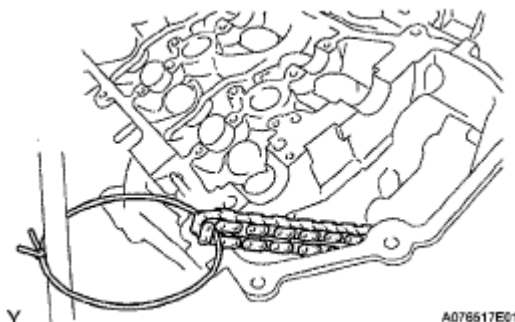


Fig. 141: Tying Chain Using String

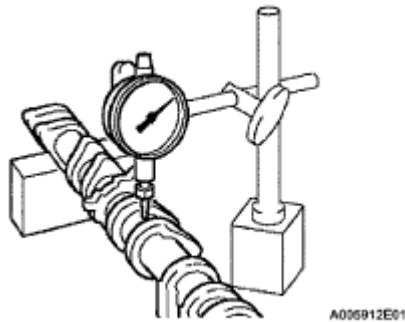
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION**1. INSPECT CAMSHAFTS**

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

Maximum runout: 0.06 mm (0.0024 in.)

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

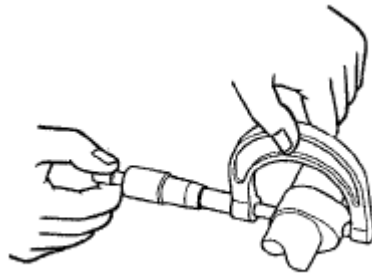
**Fig. 142: Identifying Camshafts Runout**

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

- 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.



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Fig. 143: Identifying Cam Lobe Height Using Micrometer
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

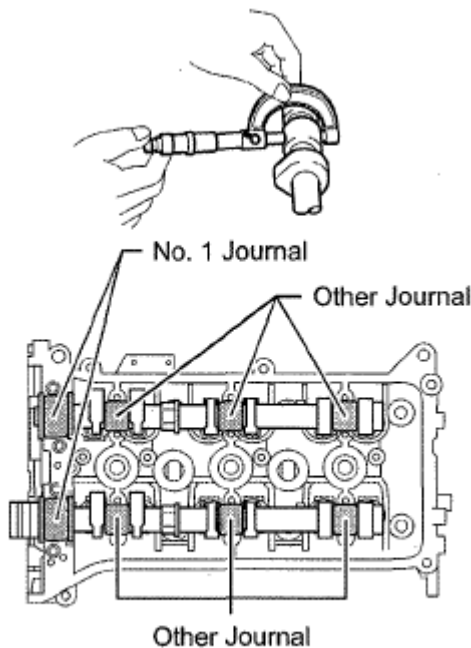
c. Inspect the camshaft journals.

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.



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A175406E01

Fig. 144: Identifying Journal Diameter
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. INSPECT CAMSHAFT TIMING GEAR ASSEMBLY

- a. Fix the intake camshaft in place with a vise.

NOTE: Be careful not to damage the camshaft.

- 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)

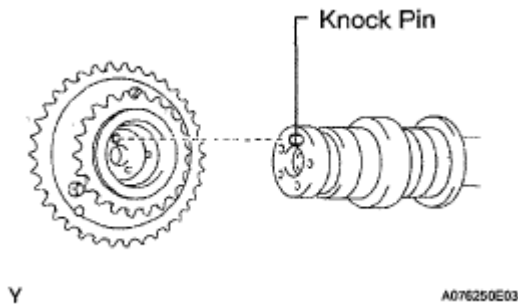


Fig. 145: Identifying Knock Pin

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

- c. Confirm that the camshaft timing gear assembly is locked.
- d. Release the lock pin.
1. Cover the 4 oil paths of the cam journal with masking tape as shown in the illustration.

HINT:

One of the 2 grooves on the cam journal is for retard side paths (upper) and the other is for advance side paths (lower). Each groove has 2 oil paths. Plug one of the oil paths for each groove with rubber pieces before wrapping the cam journal with tape.

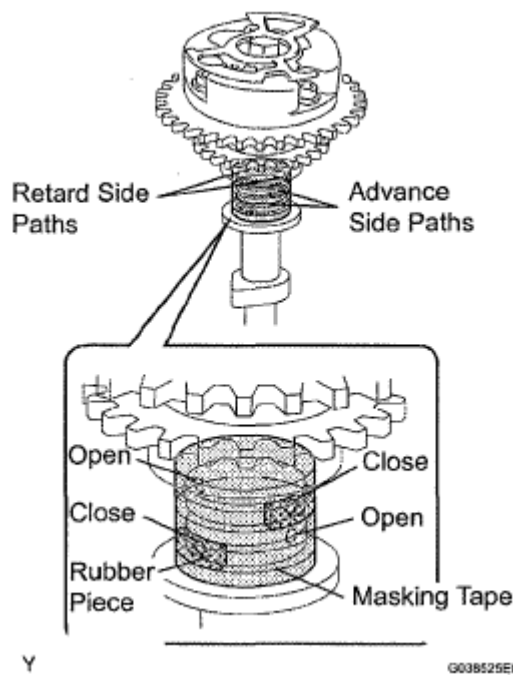


Fig. 146: Identifying Oil Paths Of Cam Journal With Masking Tape
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Prick a hole in the tape placed on the advance side path. Prick a hole in the retard side path on the opposite side of that advance side path, as shown in the illustration.
3. Apply about 200 kPa (2.0 kgf/cm², 29 psi) of air pressure to the two broken paths (the advance side path and the retard side path).

NOTE: Cover the paths with a cloth to avoid oil splashing.

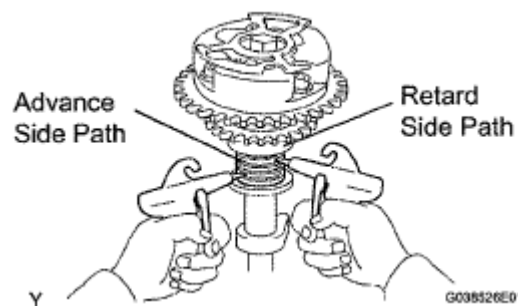


Fig. 147: Identifying Air Pressure To Broken Paths
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. Confirm that the camshaft timing gear assembly rotates in the advance direction when reducing the air pressure applied to the retard path.

HINT:

When the lock pin is released, the camshaft timing gear rotates in the advance direction.

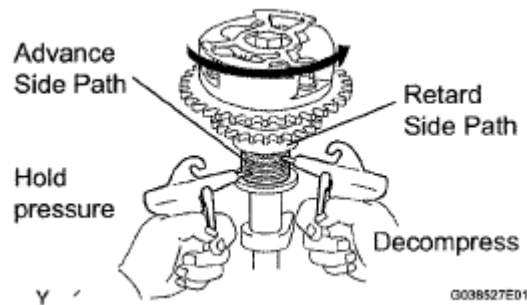


Fig. 148: Identifying Air Pressure To Broken Paths
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. When the camshaft timing gear comes to the most advanced position, release the air pressure from the retard side path, and then release the air pressure from the advance side path.

NOTE: The camshaft timing gear assembly occasionally shifts to the retard side abruptly if air compression of the advanced side path is released first. This often results in the breakage of the lock pin.

- e. Check for smooth revolution.

1. Except the position where the lock pin meets at the most retarded angle, turn the camshaft timing gear assembly back and forth and check the movable range and that there is no disturbance.

Standard: Movable smoothly in the range of about 31°

NOTE: Be sure to perform this check by hand, instead of with air pressure.

- f. Check the lock in the most retarded position.

1. Confirm that the camshaft timing gear assembly is locked at the most retarded position.

- g. Remove the set bolt and camshaft timing gear assembly.

NOTE: Be sure not to remove the other 3 bolts.

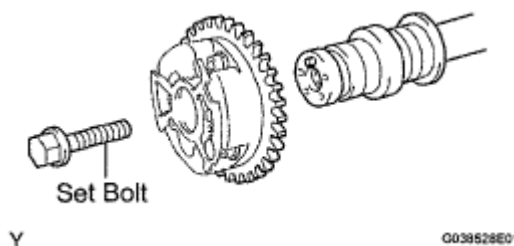


Fig. 149: Identifying Set Bolt And Camshaft Timing Gear Assembly
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. INSPECT CAMSHAFT OIL CLEARANCE (See REASSEMBLY)
4. INSPECT CAMSHAFT THRUST CLEARANCE (See REASSEMBLY)

INSTALLATION

1. INSTALL NO. 1 CAMSHAFT

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

- a. Align the mark link (yellow) with the timing mark (1-dot mark) of the camshaft timing gear as shown in the illustration.

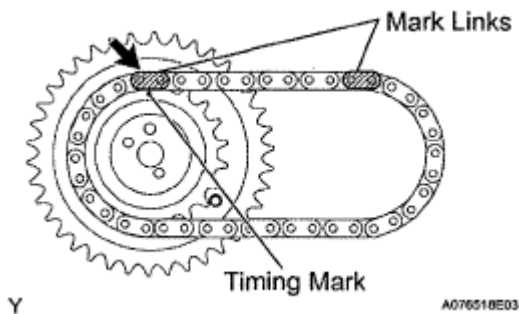


Fig. 150: Identifying Mark Link With Timing Mark
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Apply new engine oil to the thrust portions and journals of the camshafts.
- c. Temporarily put the No. 1 chain on the No. 2 chain of the camshaft timing gear.

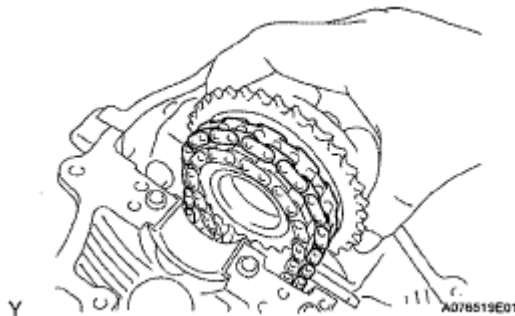


Fig. 151: Identifying No. 1 Chain Onto No. 2 Chain Of Camshaft Timing Gear
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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.

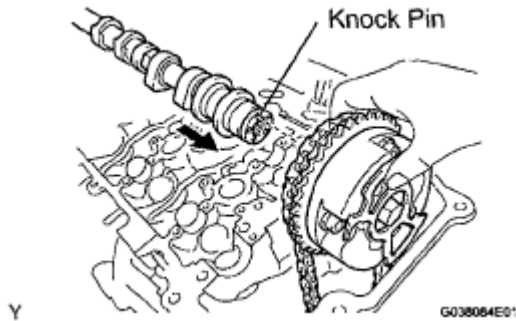


Fig. 152: Identifying Knock Pin Hole Of Camshaft Timing Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Temporarily install the camshaft timing gear set bolt.
f. Set the No. 1 camshaft onto the cylinder head RH with the cam lobes of the No. 1 cylinder facing downward as shown in the illustration.

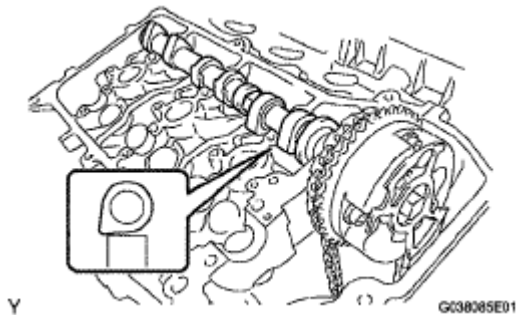


Fig. 153: Identifying No. 1 Camshaft Onto RH Cylinder Head With Cam Lobes
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Install the 4 bearing caps in their proper locations.

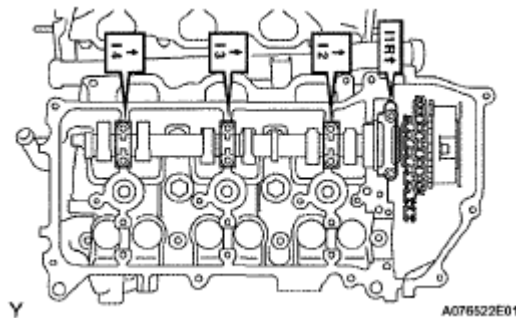


Fig. 154: Identifying Bearing Caps Locations
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- h. Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.
- i. Using several steps, install the 8 bearing cap bolts uniformly in the sequence shown in the illustration.

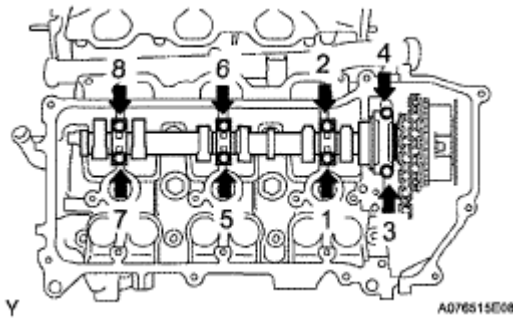
Torque:**For 10 mm (0.39 in.) head****9.0 N*m (92 kgf*cm, 80 in.*lbf)****For 12 mm (0.47 in.) head****24 N*m (245 kgf*cm, 18 ft.*lbf)**

Fig. 155: Identifying Tightening Sequence Of Bearing Cap Bolts (Bank 1)
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.

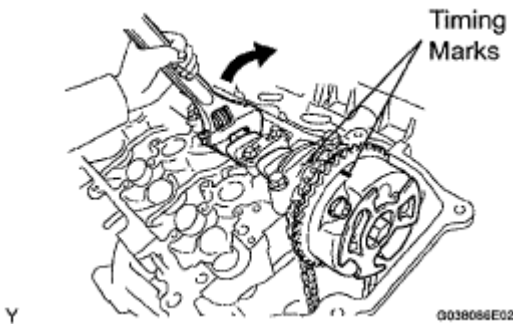


Fig. 156: Identifying No. 1 Camshaft Clockwise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

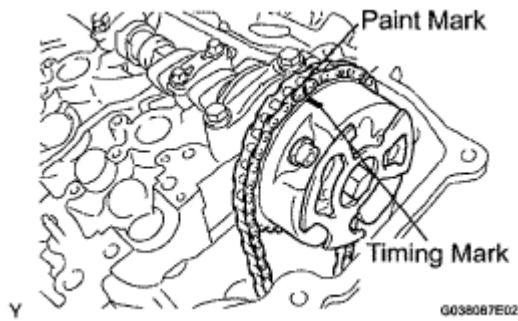


Fig. 157: Identifying Paint Mark Of No. 1 Chain With Timing Mark Of Camshaft Timing Gear

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

1. 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)

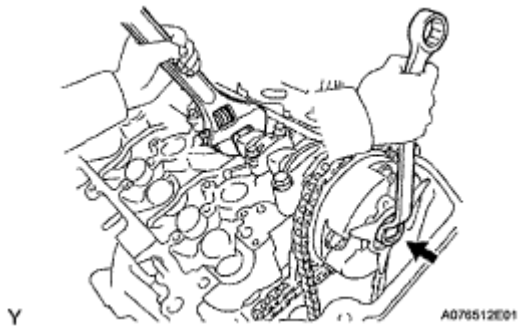


Fig. 158: Identifying Camshaft Timing Gear Set Bolt

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 $\phi 1.0$ mm (0.039 in.) into the hole to fix it in place.

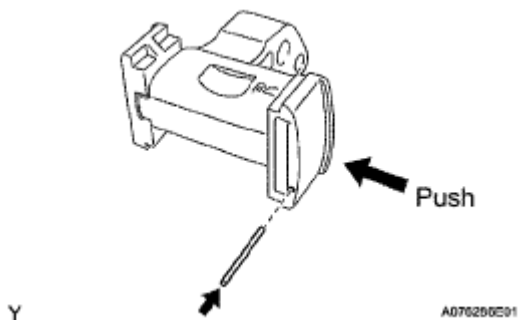


Fig. 159: Inserting Pin Into Hole

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

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

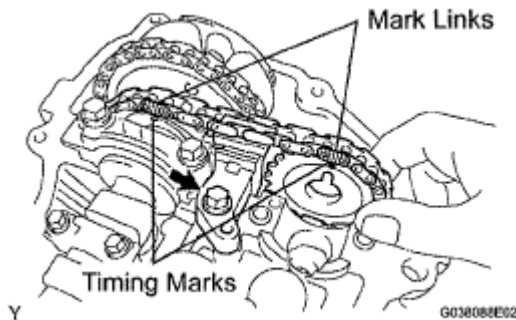


Fig. 160: Identifying Timing Mark Of Camshaft Bearing Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Tighten the No. 2 chain tensioner bolt.

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

3. INSTALL NO. 2 CAMSHAFT

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

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

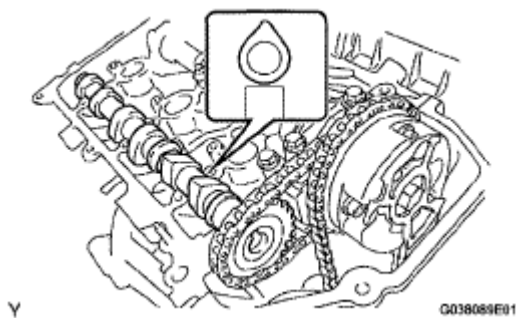


Fig. 161: Identifying Cam Lobes Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the 4 bearing caps in their proper locations.

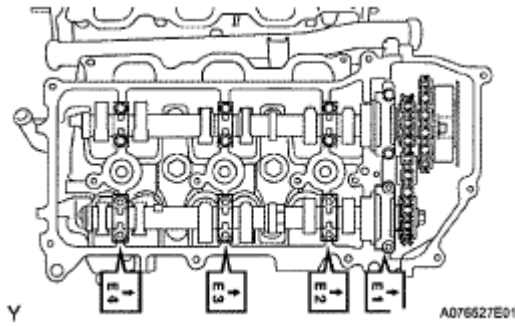


Fig. 162: Identifying Bearing Caps Locations

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

- c. Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.
- d. Using several steps, install the 8 bearing cap bolts uniformly in the sequence shown in the illustration.

Torque:

For 10 mm (0.39 in.) head

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

For 12 mm (0.47 in.) head

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

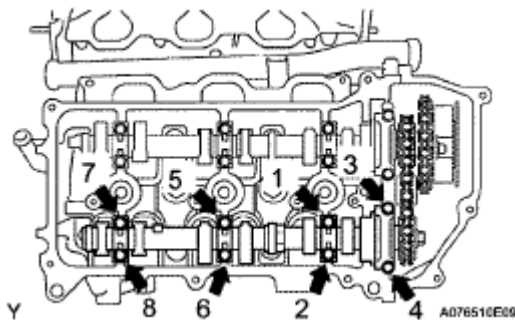


Fig. 163: Identifying Tightening Sequence Of Bearing Cap Bolts (Bank 1)

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.

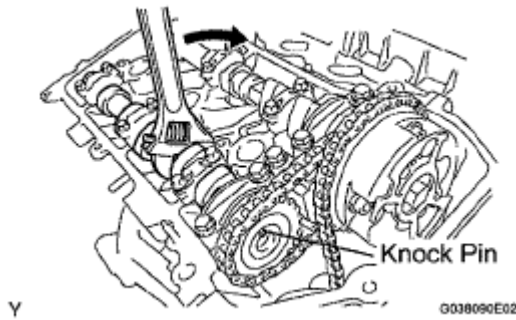


Fig. 164: Identifying Knock Pin

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)

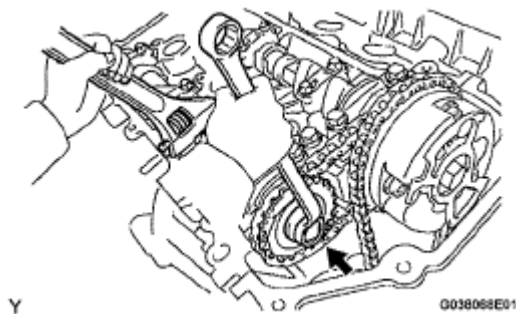


Fig. 165: Identifying Camshaft Timing Gear Set Bolt

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

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

4. 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.

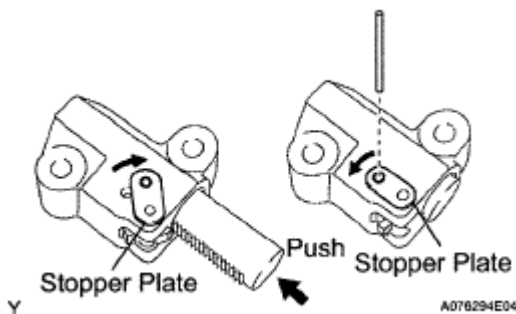


Fig. 166: Identifying Stopper Plate

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

- b. While turning the stopper plate of the tensioner counterclockwise, insert a bar of $\varnothing 3.5$ mm (0.138 in.) into the holes on the stopper plate and tensioner to fix the stopper plate in place.
- c. Install the chain tensioner with the 2 bolts.

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

- d. Remove the bar from the chain tensioner.
- e. 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)

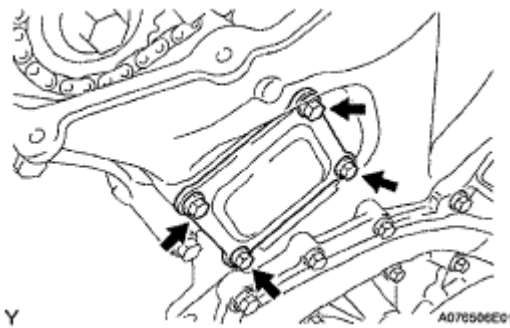


Fig. 167: Identifying Timing Chain Cover Plate Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Turn the crankshaft pulley 2 complete revolutions slowly, and align the notch with the timing mark "0" of the timing chain cover.

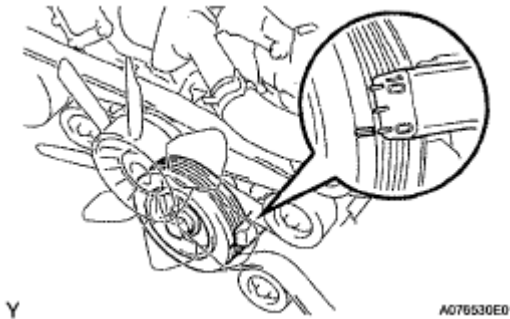
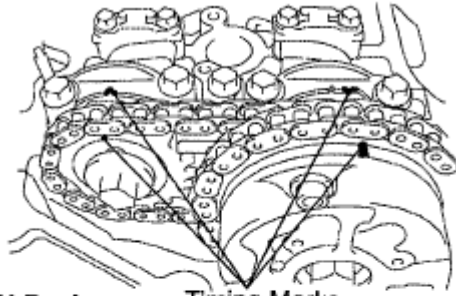


Fig. 168: Aligning Notch With Timing Mark
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Check that the timing marks of the camshaft timing gears are aligned with the timing marks of the bearing caps as shown in the illustration.
5. **SET NO. 1 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.

RH Bank:



LH Bank:

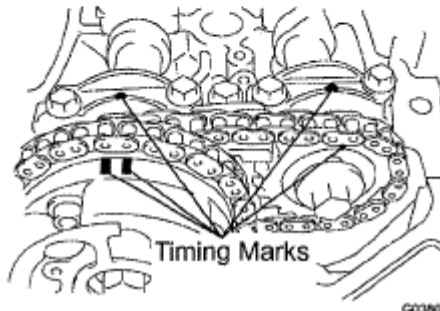


Fig. 169: Aligning Timing Marks Of Camshaft Timing Gears And Bearing Caps
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Apply 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

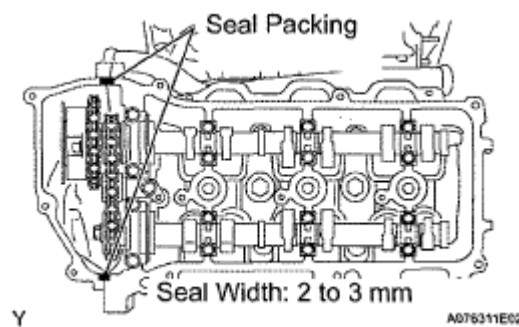


Fig. 170: Identifying Seal Packing Applying Area Of Cylinder Head
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE: Install the cylinder head cover within 3 minutes after applying seal packing. After installing it, the 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 to 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:

For bolt A

10 N*m (102 kgf*cm, 7 ft.*lbf)

For bolt B

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

Nut

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

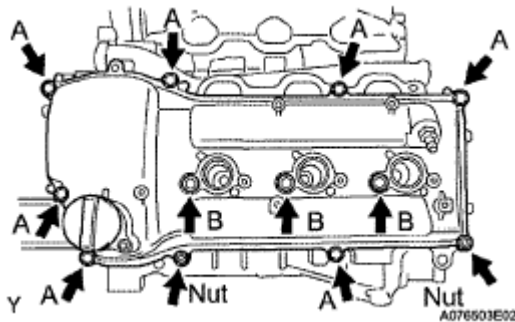


Fig. 171: Identifying Cylinder Head Cover Bolts

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

9. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY

- 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.
- b. Apply 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 after applying seal packing. After installing it, the cylinder head cover bolts and nuts must be tightened within 15 minutes. Otherwise the seal packing must be removed and reapplied.

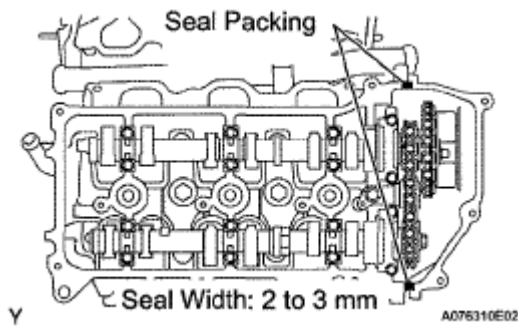


Fig. 172: Identifying Seal Packing Applying Area Of Cylinder Head
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the seal washers to 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:

For bolt A

10 N*m (102 kgf*cm, 7 ft.*lbf)

For bolt B

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

Nut

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

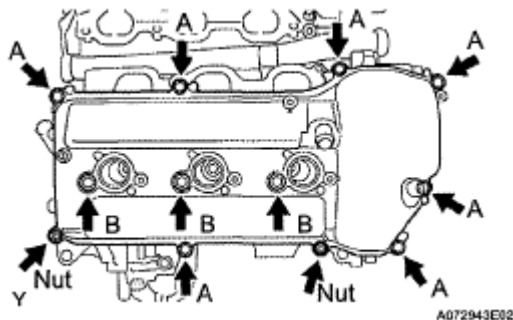


Fig. 173: Identifying Cylinder Head Cover Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. INSTALL IGNITION COIL ASSEMBLY

- a. Install the 3 ignition coils with the 3 bolts.

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

- b. Connect the 3 connectors to the 3 ignition coils.

11. INSTALL INTAKE AIR SURGE TANK

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

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

- c. Install the 2 intake air surge tank nuts.

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

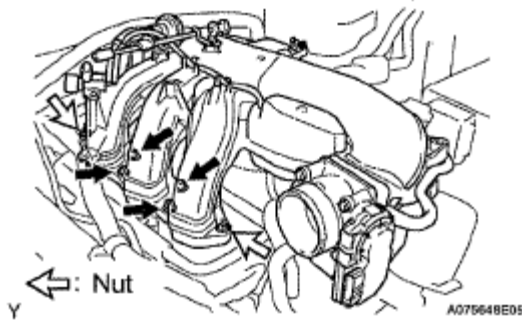


Fig. 174: Identifying Intake Air Surge Tank Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Install the 3 wire harness clamps and hose clamp.
- e. Connect the throttle body with motor connector.
- f. Connect the 2 VSV connectors.
- g. Install the 2 surge tank stays with the 4 bolts.

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

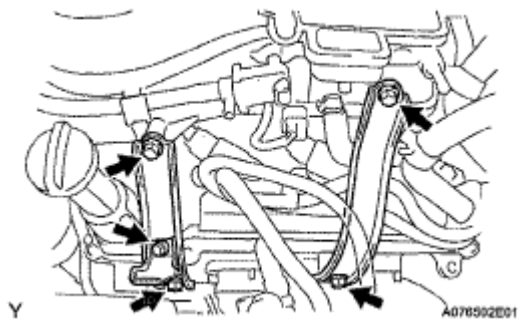


Fig. 175: Identifying Surge Tank Stays Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- h. Install the oil baffle plate with the bolt.

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

- i. Install the throttle body bracket with the 2 bolts.

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

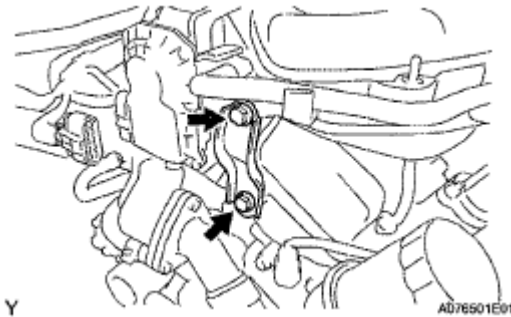


Fig. 176: Identifying Throttle Body Bracket Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- j. Connect the ventilation hose.

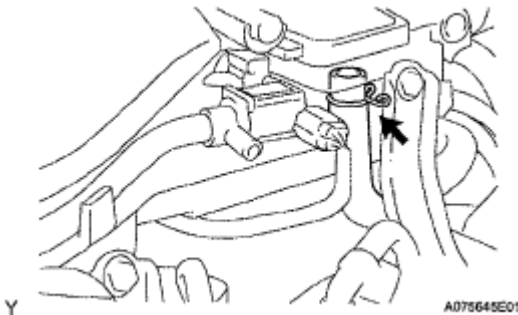


Fig. 177: Identifying Ventilation Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- k. Connect the fuel vapor feed hose.

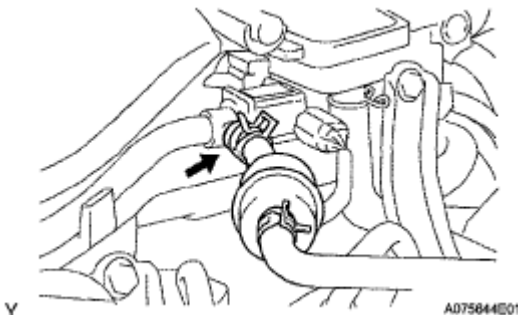


Fig. 178: Identifying Fuel Vapor Feed Hose

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

1. Connect the 2 water by-pass hoses.

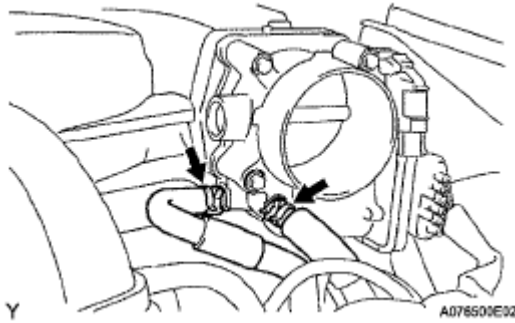


Fig. 179: Identifying Water By-Pass Hoses

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

12. INSTALL AIR CLEANER ASSEMBLY (See INSTALLATION)
13. CONNECT NO. 2 VENTILATION HOSE

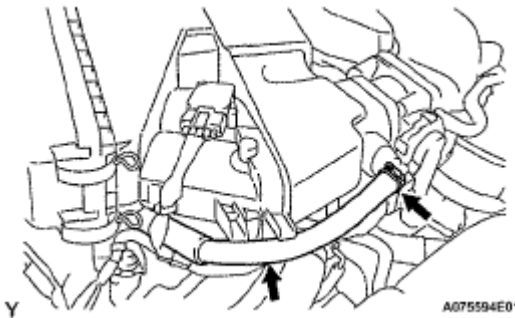


Fig. 180: Identifying Ventilation Hose

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

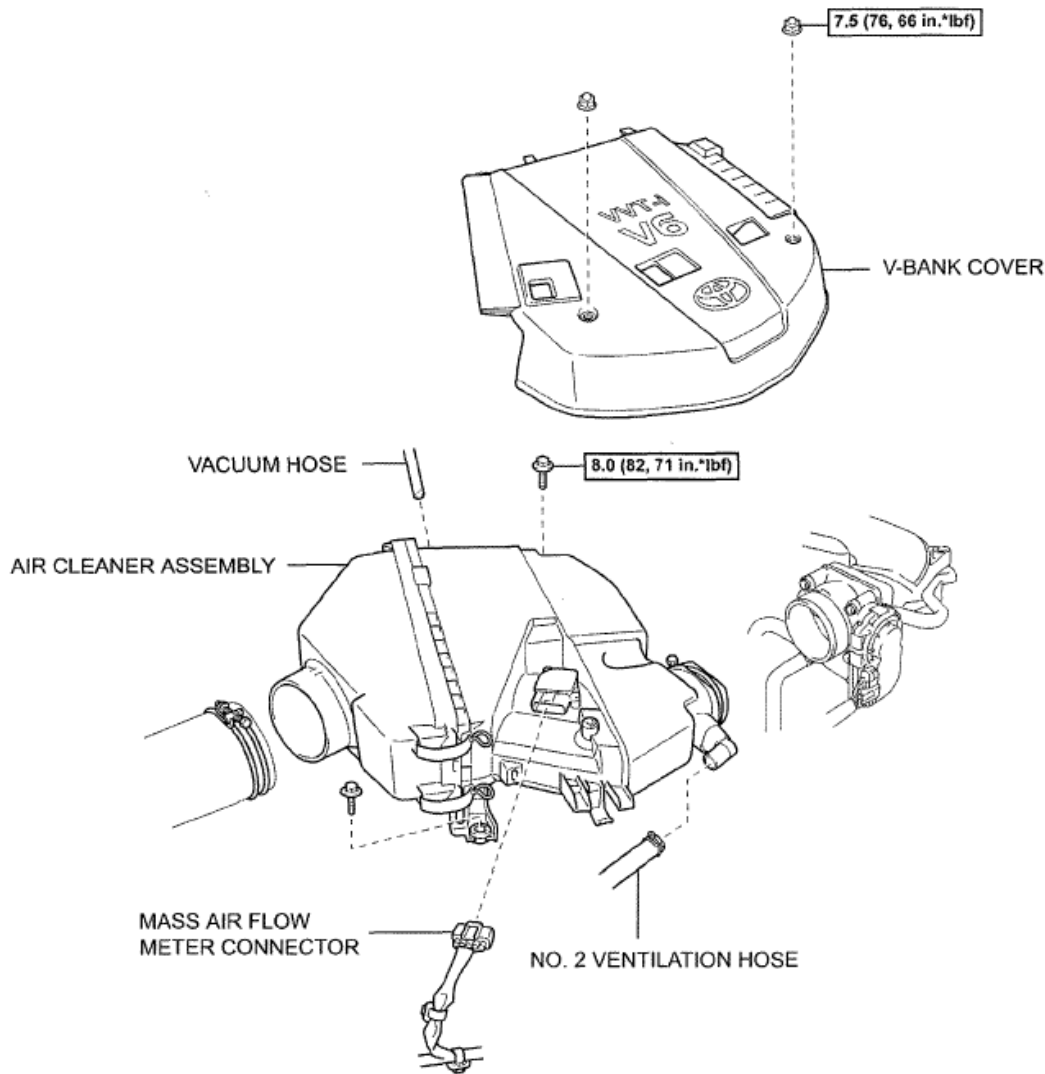
14. ADD ENGINE COOLANT (See REPLACEMENT)
15. CHECK FOR ENGINE COOLANT LEAKAGE (See REPLACEMENT)
16. INSTALL V-BANK COVER
 - a. Install the V-bank cover with the 2 nuts.

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

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

CAMSHAFT (FOR BANK 2)

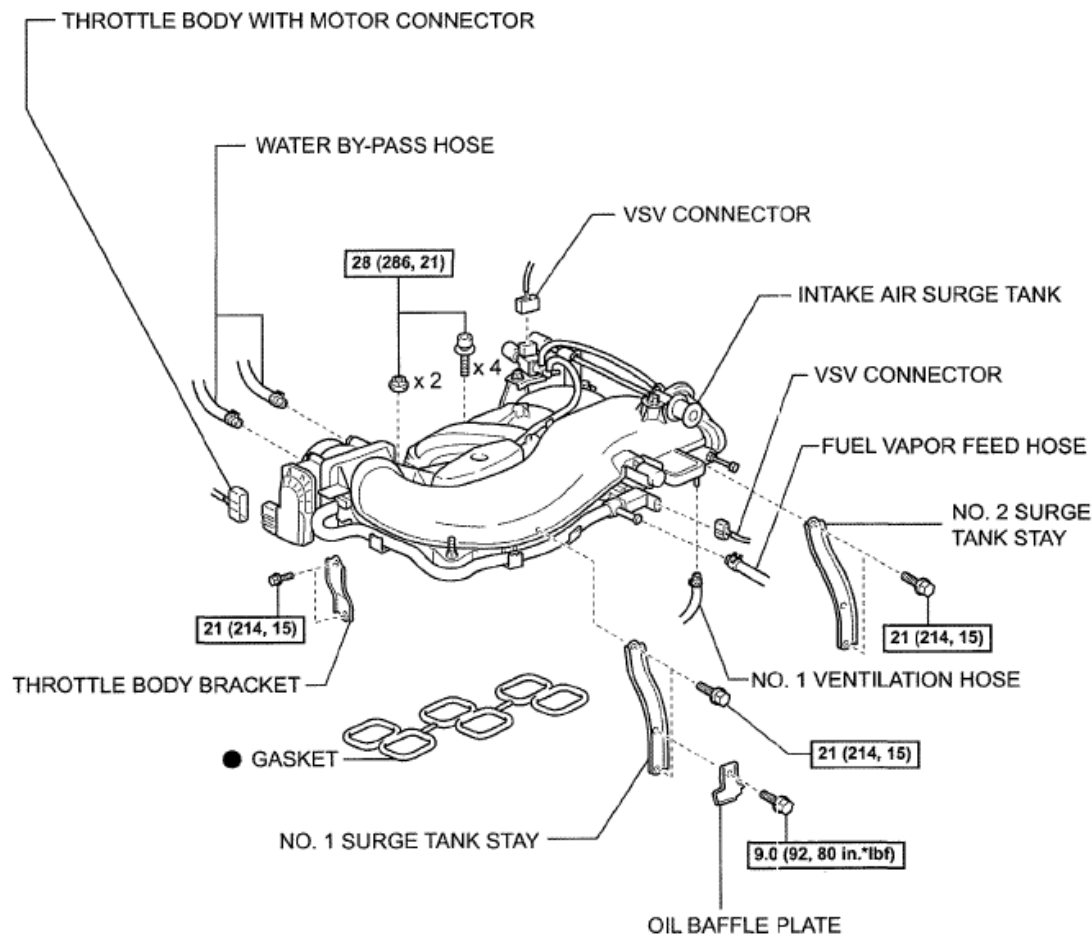
COMPONENTS



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

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Fig. 181: Identifying Camshaft Replacement Components With Torque Specifications (1 Of 4)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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

● Non-reusable part

A119B02E04

Fig. 182: Identifying Replacement Camshaft Components With Torque Specifications (2 Of 4)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

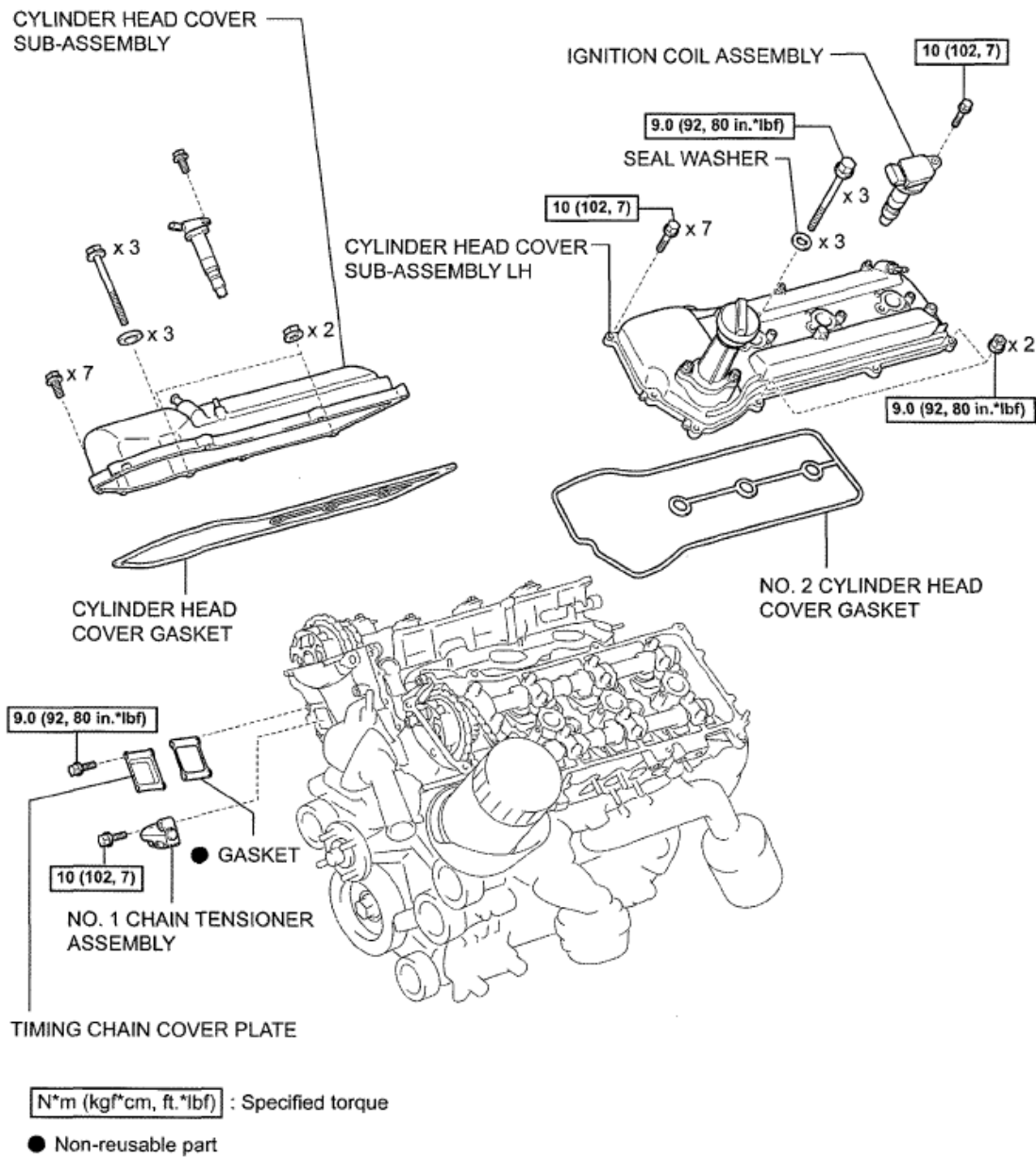
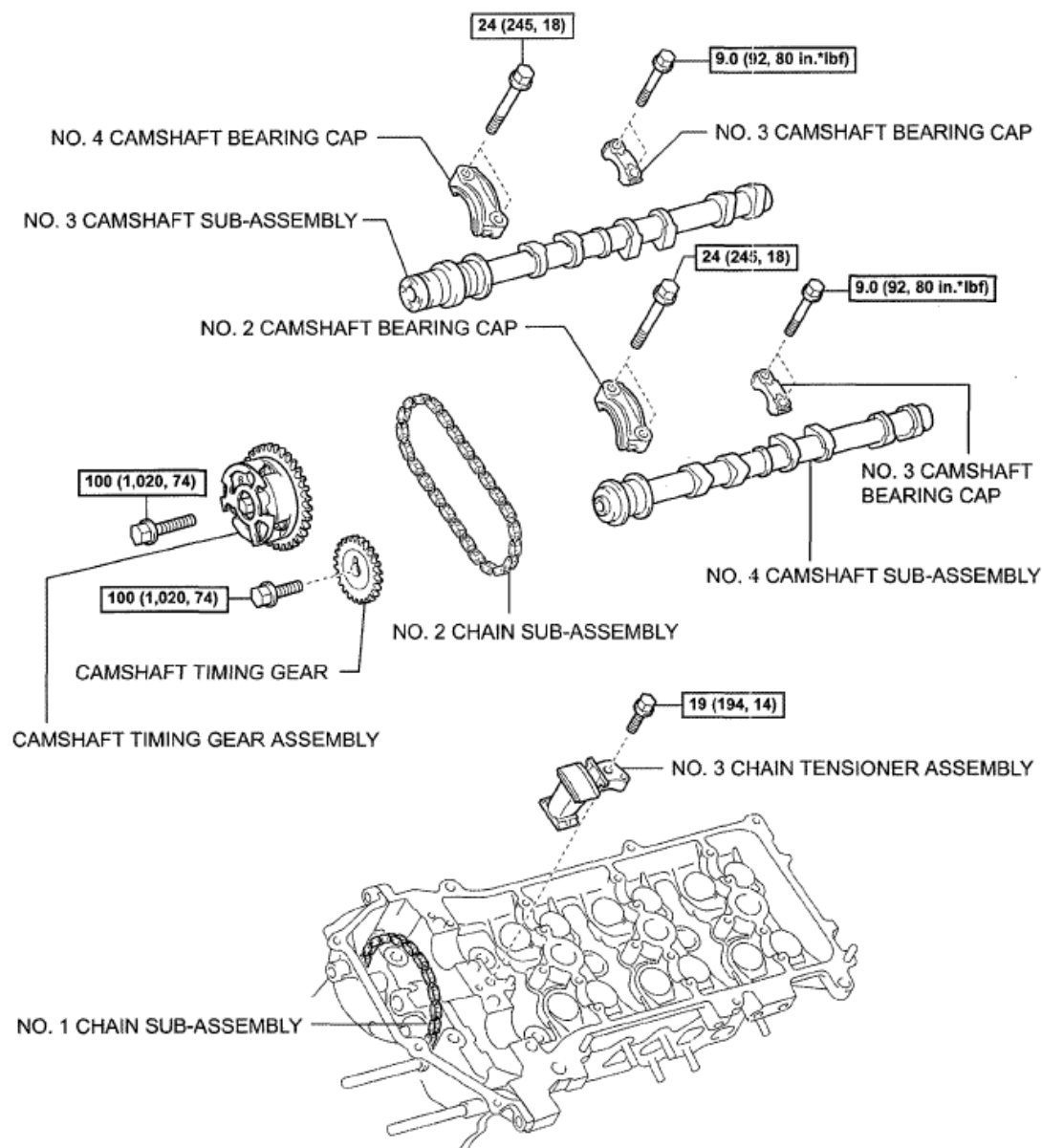


Fig. 183: Identifying Camshaft Replacement Components With Torque Specifications (3 Of 4)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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

A119804E04

Fig. 184: Identifying Camshaft Replacement Components With Torque Specifications (4 Of 4)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. **DRAIN ENGINE COOLANT** (See **REPLACEMENT**)
2. **REMOVE V-BANK COVER** (See **REMOVAL**)
3. **DISCONNECT NO. 2 VENTILATION HOSE**

4. REMOVE AIR CLEANER ASSEMBLY (See REMOVAL)
5. REMOVE INTAKE AIR SURGE TANK (See REMOVAL)
6. REMOVE IGNITION COIL ASSEMBLY
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: As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head which receives the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.

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

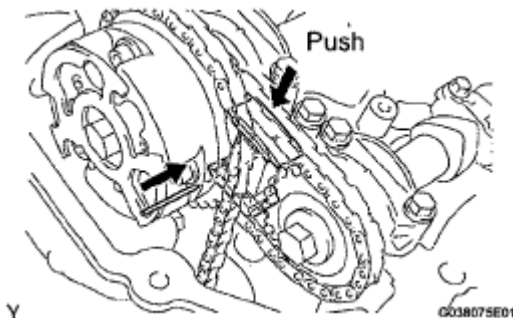


Fig. 185: Inserting Pin Into Hole

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.

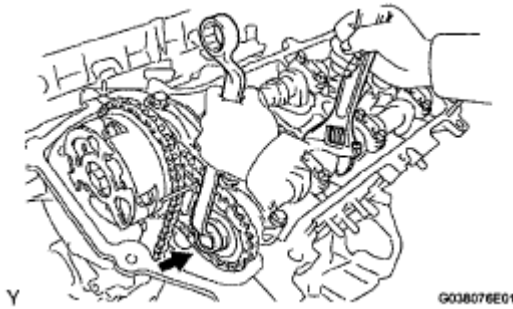


Fig. 186: Identifying Camshaft Timing Gear Set Bolt
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Separate the camshaft timing gear from the No. 4 camshaft.
- d. Using several steps, loosen and remove the 8 bearing cap bolts uniformly in the sequence shown in the illustration.

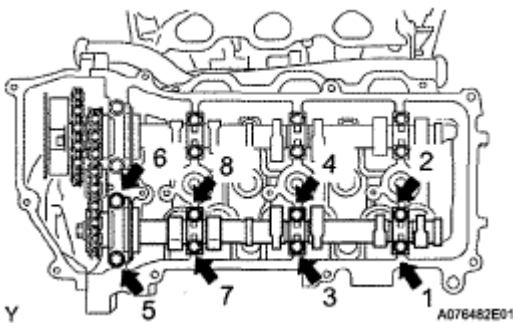


Fig. 187: Removing Bearing Cap Bolts In Sequence (Bank 2)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Remove the 4 bearing caps and No. 4 camshaft.
12. **REMOVE NO. 3 CHAIN TENSIONER ASSEMBLY**
 - a. Remove the No. 3 chain tensioner bolt, and then remove the No. 3 chain tensioner and camshaft timing gear.
13. **REMOVE NO. 3 CAMSHAFT SUB-ASSEMBLY**

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

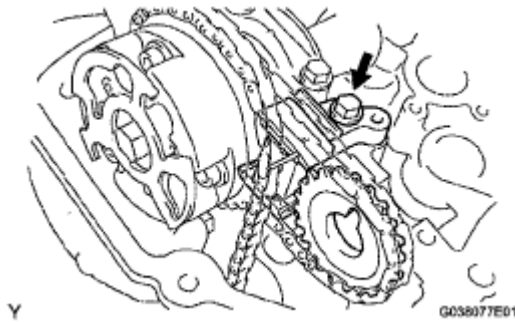


Fig. 188: Identifying Chain Tensioner Bolt
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

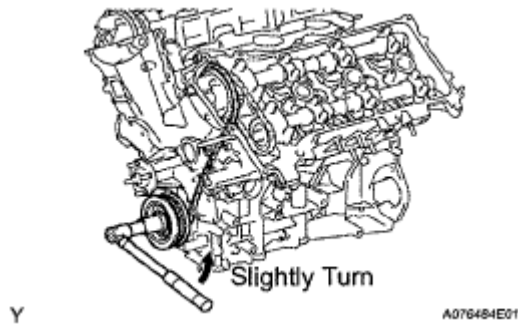


Fig. 189: Identifying Crankshaft Pulley
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Hold the hexagonal portion of the No. 3 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.

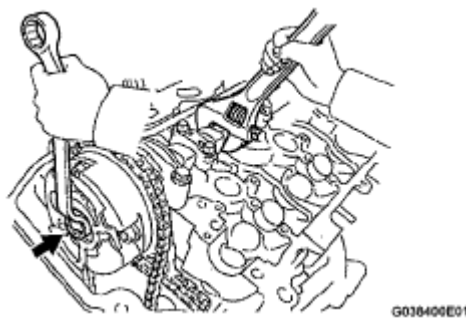


Fig. 190: Identifying Camshaft Timing Gear Set Bolt

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.

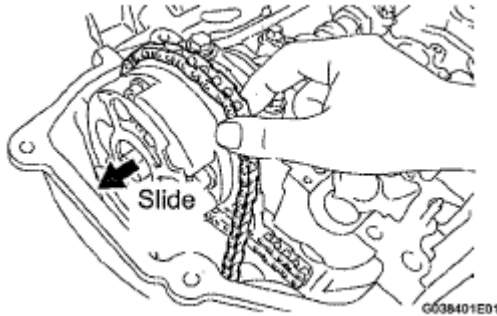


Fig. 191: Identifying Camshaft Timing Gear

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

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

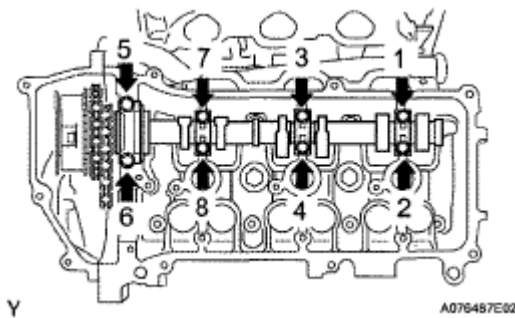


Fig. 192: Removing Sequence Of Bearing Cap Bolts (Bank 2)

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

- e. Remove the 4 bearing caps.
f. Remove the camshaft timing gear set bolt with the No. 3 camshaft lifted up, and then remove the No. 3 camshaft and camshaft timing gear with the No. 2 chain.

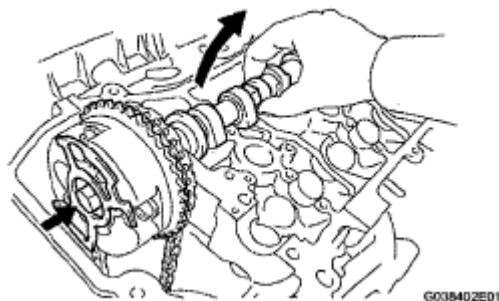


Fig. 193: Identifying Camshaft And Camshaft Timing Gear

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.

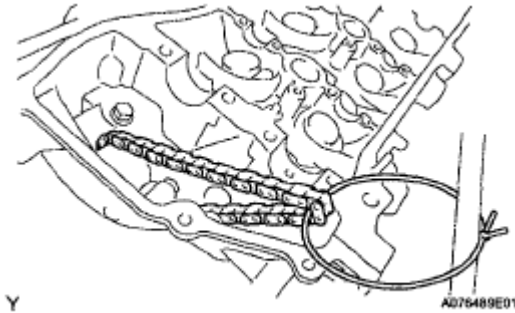


Fig. 194: Tying Chain Using String
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION

1. INSPECT CAMSHAFTS

- a. Inspect the camshaft runout.

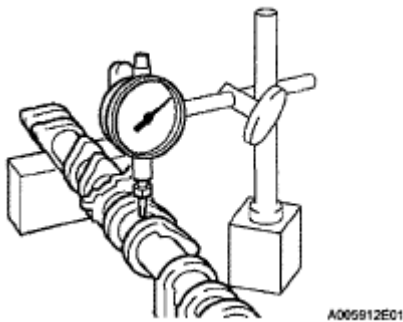


Fig. 195: Identifying Camshafts Runout
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

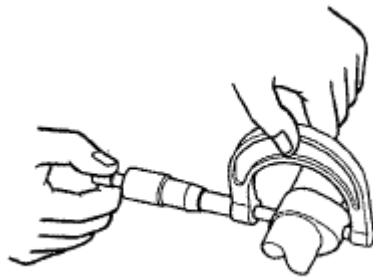
Maximum runout: 0.06 mm (0.0024 in.)

If the 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.



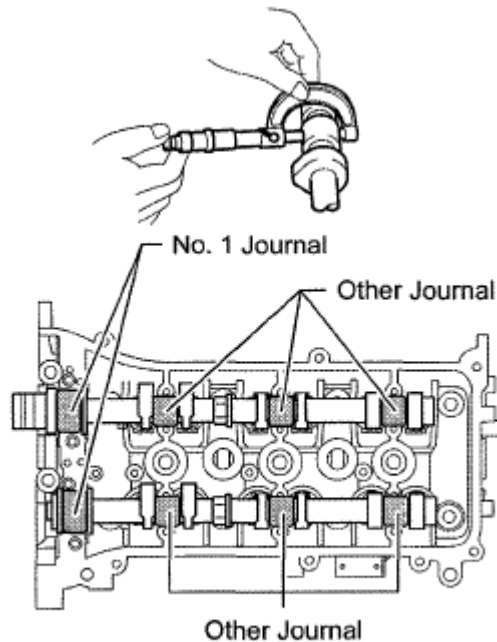
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Fig. 196: Identifying Cam Lobe Height Using Micrometer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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.



T

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Fig. 197: Identifying Journal Diameter

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

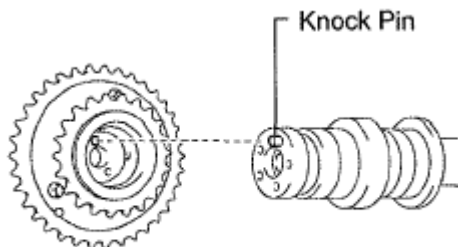
2. INSPECT CAMSHAFT TIMING GEAR ASSEMBLY

- Fix the intake camshaft in place with a vise.

NOTE: Be careful not to damage the camshaft.

- 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)



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Fig. 198: Identifying Knock Pin

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

- Confirm that the camshaft timing gear assembly is locked.

d. Release the lock pin.

1. Cover the 4 oil paths of the cam journal with masking tape as shown in the illustration.

HINT:

One of the 2 grooves on the cam journal is for retard side paths (upper) and the other is for advance side paths (lower). Each groove has 2 oil paths. Plug one of the oil paths for each groove with rubber pieces before wrapping the cam journal with tape.

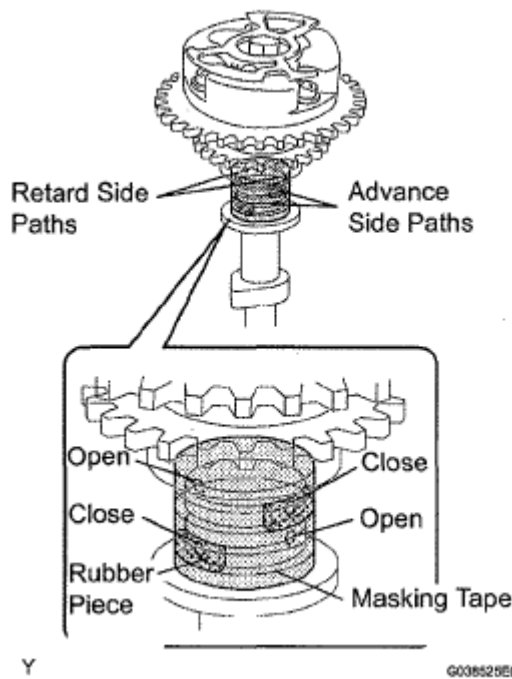


Fig. 199: Identifying Oil Paths Of Cam Journal With Masking Tape
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Prick a hole in the tape placed on the advance side path. Prick a hole in the retard side path on the opposite side of that advance side path, as shown in the illustration.
3. Apply about 200 kPa (2.0 kgf/cm², 29 psi) of air pressure to the two broken paths (the advance side path and the retard side path).

NOTE: Cover the paths with a cloth to avoid oil splashing.

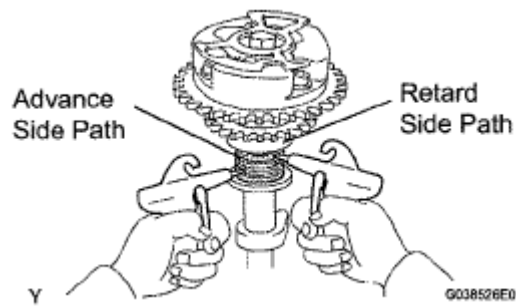


Fig. 200: Identifying Air Pressure To Broken Paths
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. Confirm that the camshaft timing gear assembly rotates in the advance direction when reducing the air pressure applied to the retard path.

HINT:

When the lock pin is released, the camshaft timing gear rotates in the advance direction.

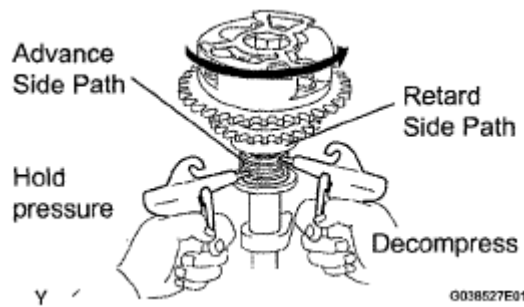


Fig. 201: Identifying Air Pressure To Broken Paths
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. When the camshaft timing gear comes to the most advanced position, release the air pressure from the retard side path, and then release the air pressure from the advance side path.

NOTE: The camshaft timing gear assembly occasionally shifts to the retard side abruptly if air compression of the advanced side path is released first. This often results in the breakage of the lock pin.

e. Check for smooth revolution.

1. Except the position where the lock pin meets at the most retarded angle, turn the camshaft timing gear assembly back and forth and check the movable range and that there is no disturbance.

Standard: Movable smoothly in the range of about 31°

NOTE: Be sure to perform this check by hand, instead of with air pressure.

- f. Check the lock in the most retarded position.
 1. Confirm that the camshaft timing gear assembly is locked at the most retarded position.
- g. Remove the set bolt and camshaft timing gear assembly.

NOTE: Be sure not to remove the other 3 bolts.

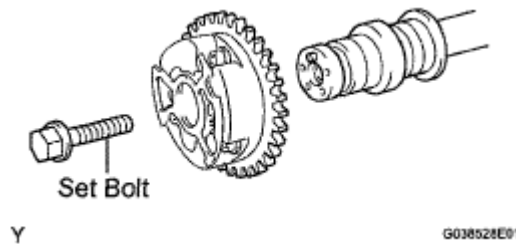


Fig. 202: Identifying Set Bolt And Camshaft Timing Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. INSPECT CAMSHAFT OIL CLEARANCE (See REASSEMBLY)
4. INSPECT CAMSHAFT THRUST CLEARANCE (See REASSEMBLY)

INSTALLATION

1. INSTALL NO. 3 CAMSHAFT SUB-ASSEMBLY

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

- a. Align the mark link (yellow) with the timing mark (2-dot mark) of the camshaft timing gear as shown in the illustration.

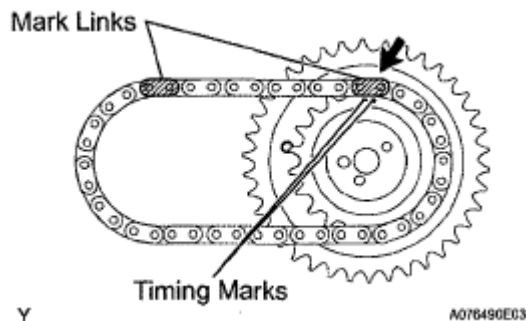


Fig. 203: Identifying Mark Link With Timing Mark Of Camshaft Timing Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Apply new engine oil to the thrust portions and journals of the camshafts.
- c. Temporarily put the No. 1 chain on the No. 2 chain of the camshaft timing gear.

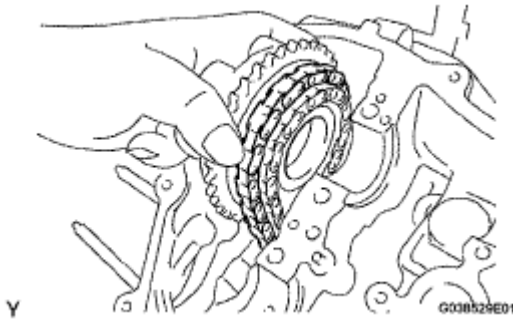


Fig. 204: Identifying No. 1 Chain On No. 2 Chain Of Camshaft Timing Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Align the knock pin hole of the camshaft timing gear with the knock pin of the No. 3 camshaft, and insert the No. 3 camshaft into the camshaft timing gear.

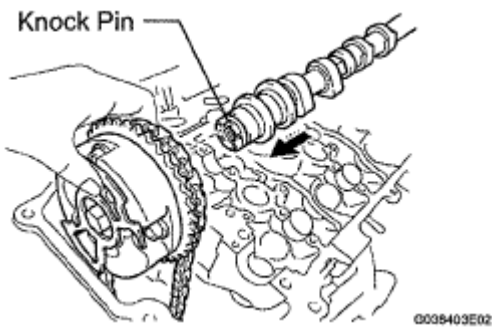


Fig. 205: Identifying Knock Pin Hole Of Camshaft Timing Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Temporarily install the camshaft timing gear set bolt.
- f. Set the No. 3 camshaft onto the cylinder head LH with the cam lobes of the No. 2 cylinder facing downward as shown in the illustration.

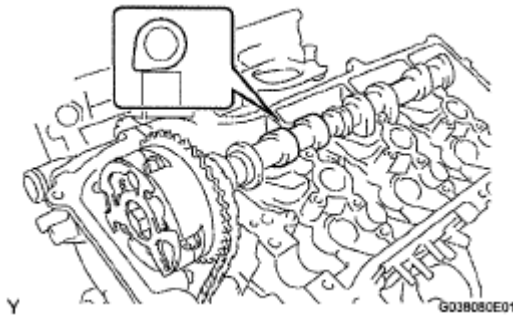


Fig. 206: Identifying No. 3 Camshaft Onto LH Cylinder Head With Cam Lobes
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Install the 4 bearing caps in their proper locations.

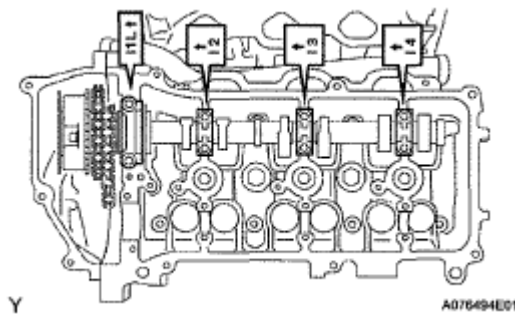


Fig. 207: Identifying Bearing Caps Locations
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- h. Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.
i. Using several steps, install the 8 bearing cap bolts uniformly in the sequence shown in the illustration.

Torque:

For 10 mm (0.39 in.) head

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

For 12 mm (0.47 in.) head

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

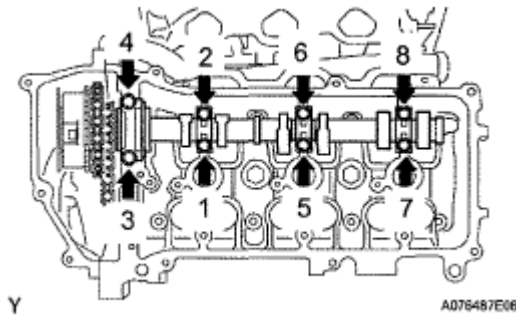


Fig. 208: Tightening Bearing Cap Bolts In Sequence (Bank 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- j. Set the paint mark of the No. 1 chain between the timing marks of the camshaft timing gear.

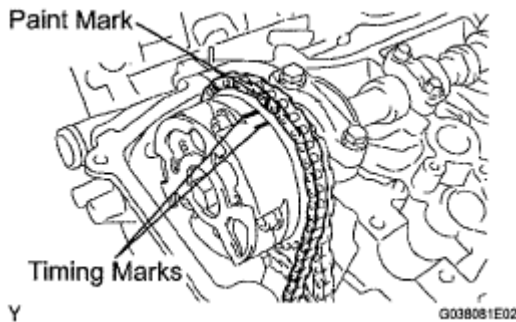


Fig. 209: Identifying Paint Mark Of Chain Between Timing Marks Of Camshaft Timing Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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)

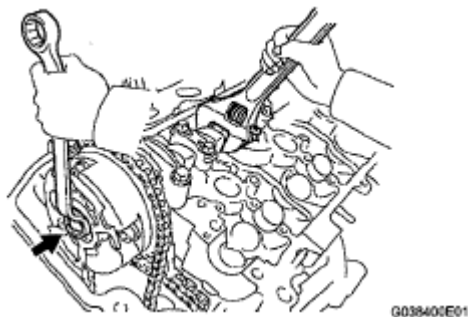
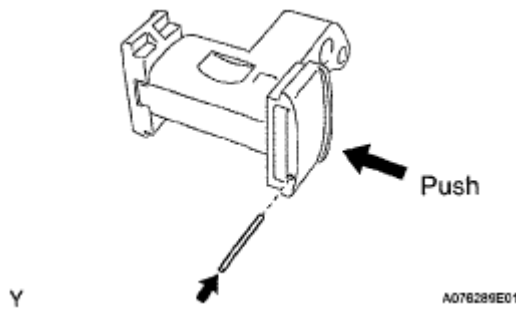


Fig. 210: Identifying Camshaft Timing Gear Set Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

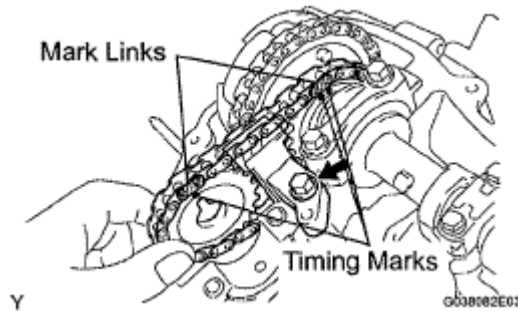
2. INSTALL NO. 3 CHAIN TENSIONER ASSEMBLY

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

**Fig. 211: Inserting Pin Into Hole**

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

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

**Fig. 212: Identifying Mark Links With Timing Marks Of Camshaft Timing Gears**

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

- c. Tighten the No. 3 chain tensioner bolt.

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

3. INSTALL NO. 4 CAMSHAFT SUB-ASSEMBLY

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

- a. Align the knock pin hole of 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.

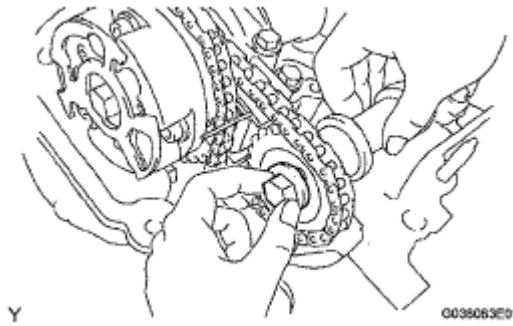


Fig. 213: Identifying Camshaft Timing Gear Set Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the 4 bearing caps in their proper locations.

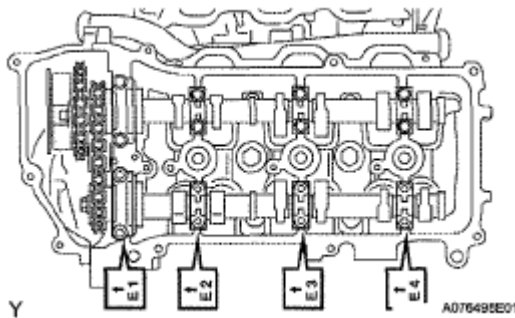


Fig. 214: Identifying Bearing Caps Locations
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Apply a light coat of engine oil to the threads of the bearing cap bolts.
- e. Using several steps, install the 8 bearing cap bolts uniformly in the sequence shown in the illustration.

Torque:

For 10 mm (0.39 in.) head

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

For 12 mm (0.47 in.) head

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

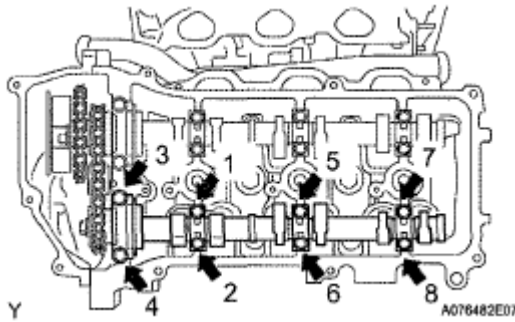


Fig. 215: Tightening Sequence Of Bearing Cap Bolts (Bank 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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)

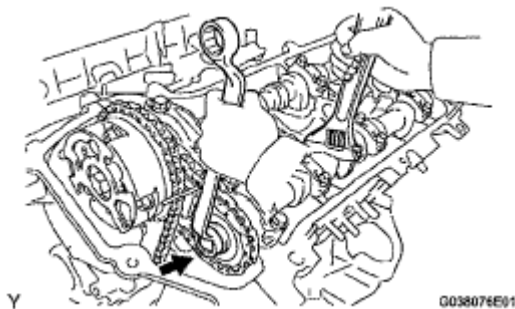


Fig. 216: Identifying Camshaft Timing Gear Set Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Remove the pin from the No. 3 chain tensioner
- h. Release the chain tension between the camshaft timing gear (RH bank) and crankshaft timing gear by turning the crankshaft pulley clockwise slightly.

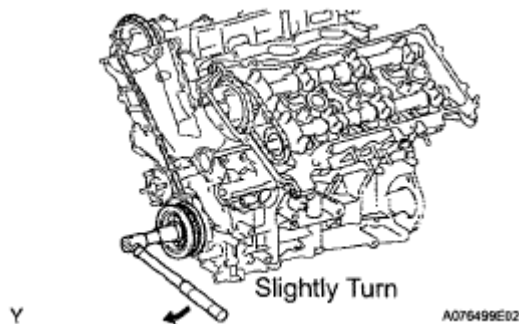
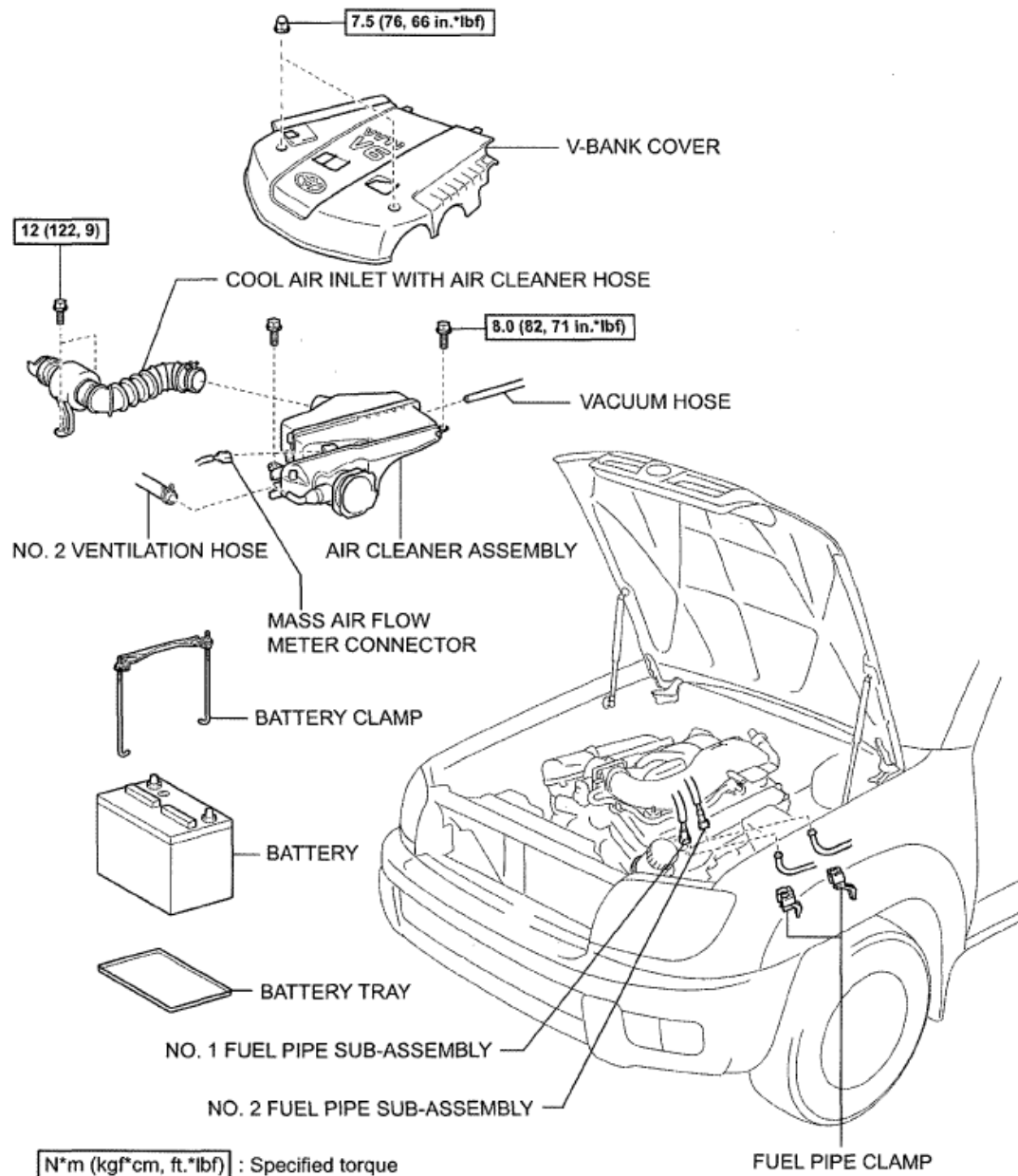


Fig. 217: Identifying Crankshaft Pulley
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. **INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY** (See INSTALLATION)
5. **SET NO. 1 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** (See INSTALLATION)
9. **INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY** (See INSTALLATION)
10. **INSTALL IGNITION COIL ASSEMBLY** (See INSTALLATION)
11. **INSTALL INTAKE AIR SURGE TANK** (See INSTALLATION)
12. **INSTALL AIR CLEANER ASSEMBLY** (See INSTALLATION)
13. **CONNECT NO. 2 VENTILATION HOSE**
14. **ADD ENGINE COOLANT** (See REMOVAL)
15. **CHECK FOR ENGINE COOLANT LEAKAGE** (See REMOVAL)
16. **INSTALL V-BANK COVER** (See INSTALLATION)
17. **INSPECT IGNITION TIMING** (See ON-VEHICLE INSPECTION)

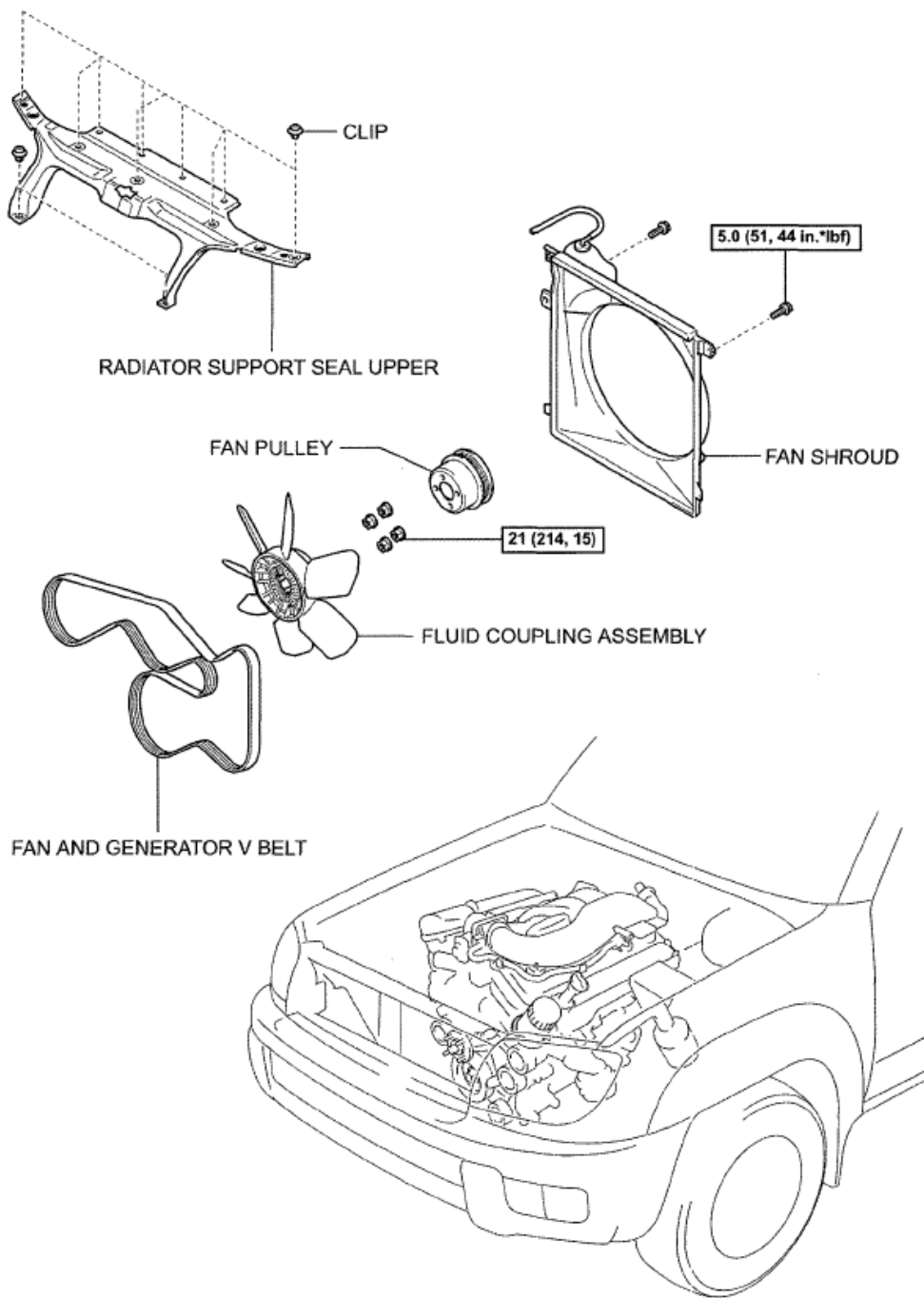
CYLINDER HEAD

COMPONENTS



A119806E02

Fig. 218: Identifying Engine Assembly Replacement Components With Torque Specifications (1 Of 11)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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

Y

A137117E09

Fig. 219: Identifying Engine Assembly Replacement Components With Torque Specifications (2 Of 11)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

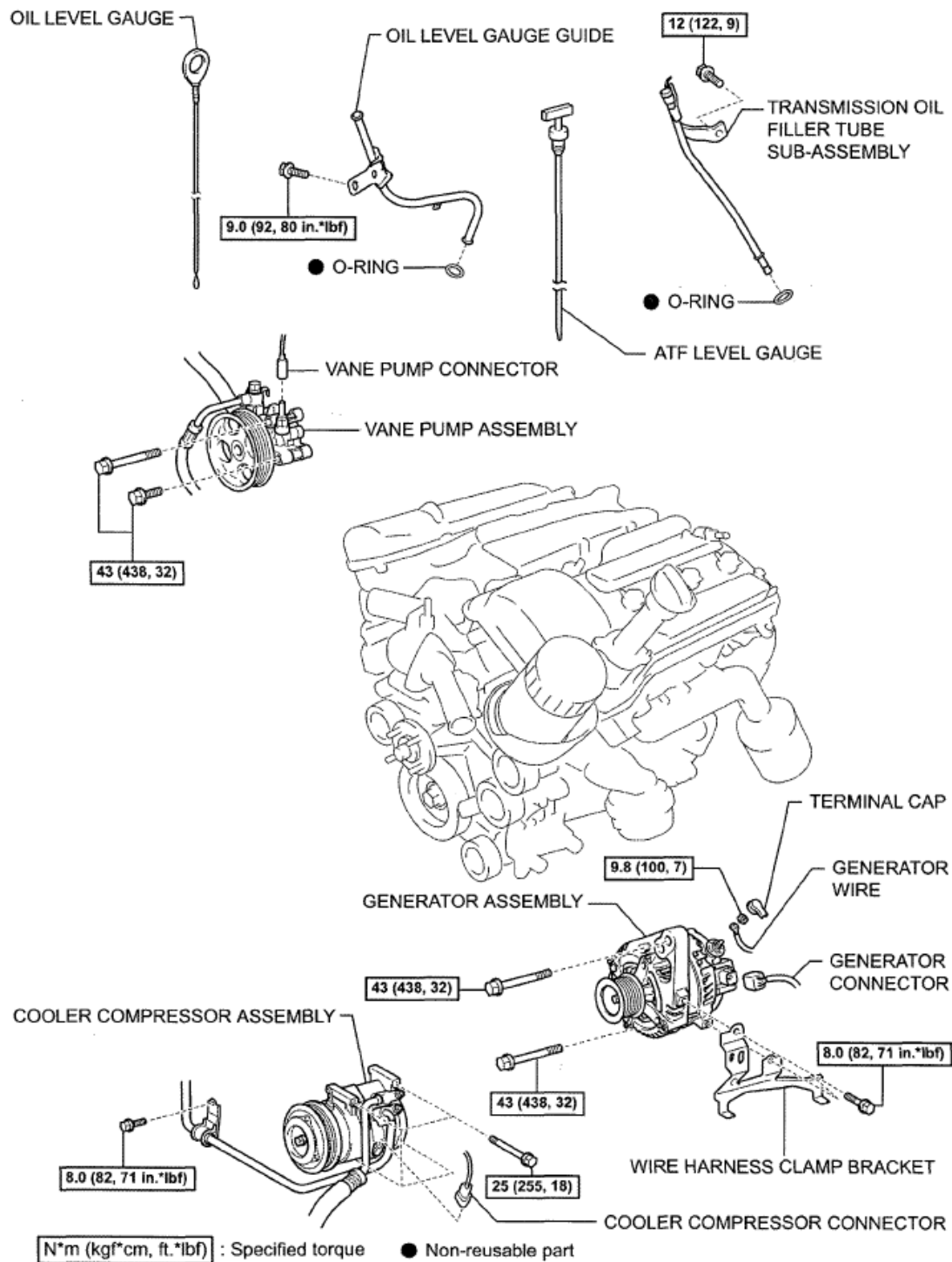
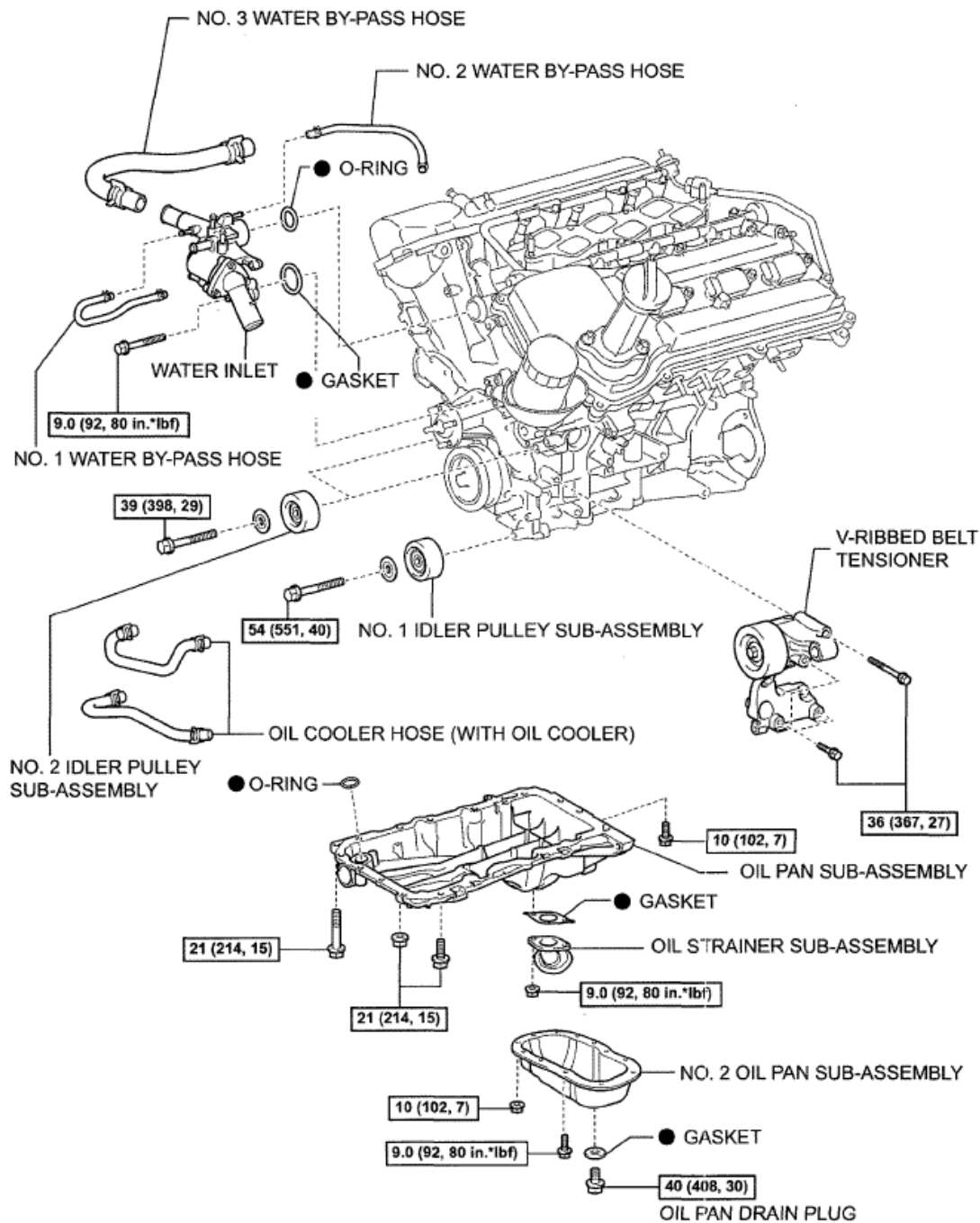


Fig. 220: Identifying Engine Assembly Replacement Components With Torque Specifications (3 Of 11)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

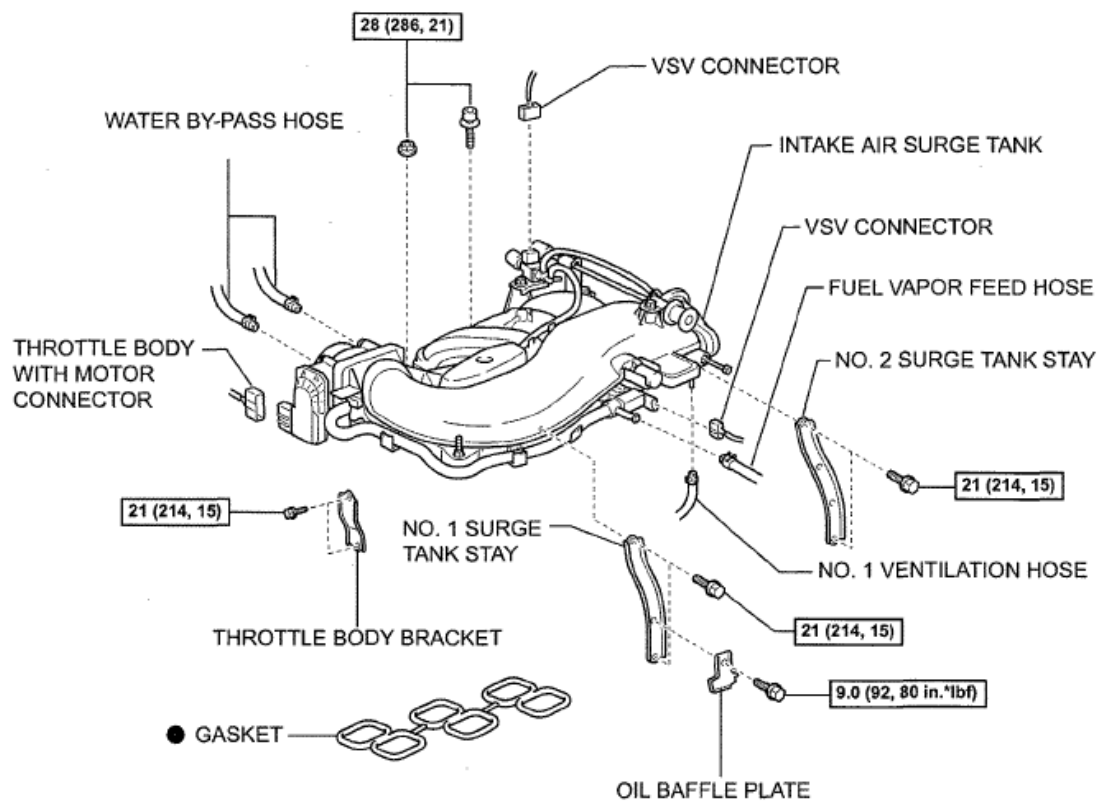


N*m (kgf*cm, ft.*lbf) : Specified torque

● Non-reusable part

A119800E02

Fig. 221: Identifying Engine Assembly Replacement Components With Torque Specifications (4 Of 11)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

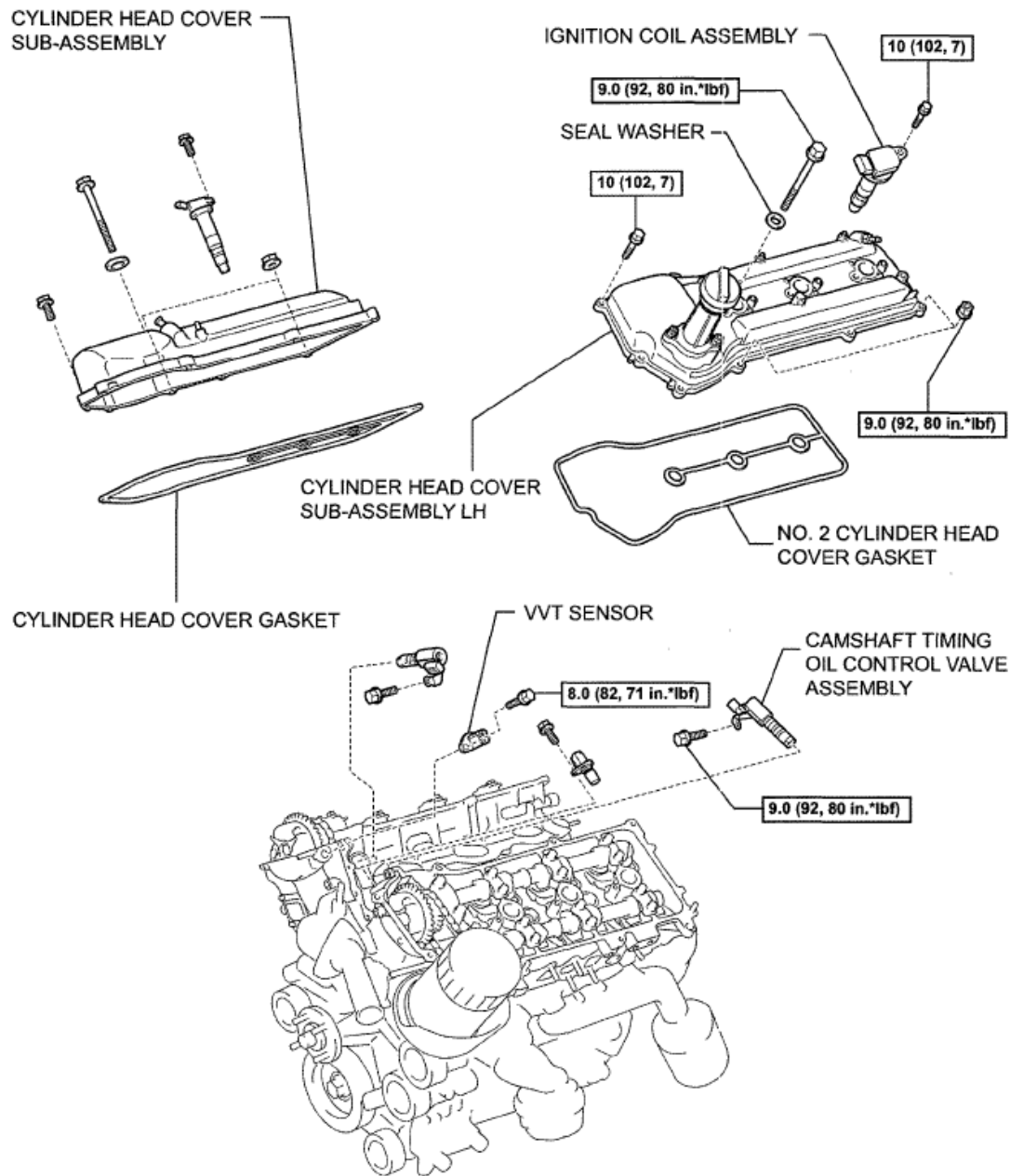


N*m (kgf*cm, ft.*lbf) : Specified torque

● Non-reusable part

A115844E03

Fig. 222: Identifying Engine Assembly Replacement Components With Torque Specifications (5 Of 11)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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

A119948E03

Fig. 223: Identifying Engine Assembly Replacement Components With Torque Specifications (6 Of 11)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

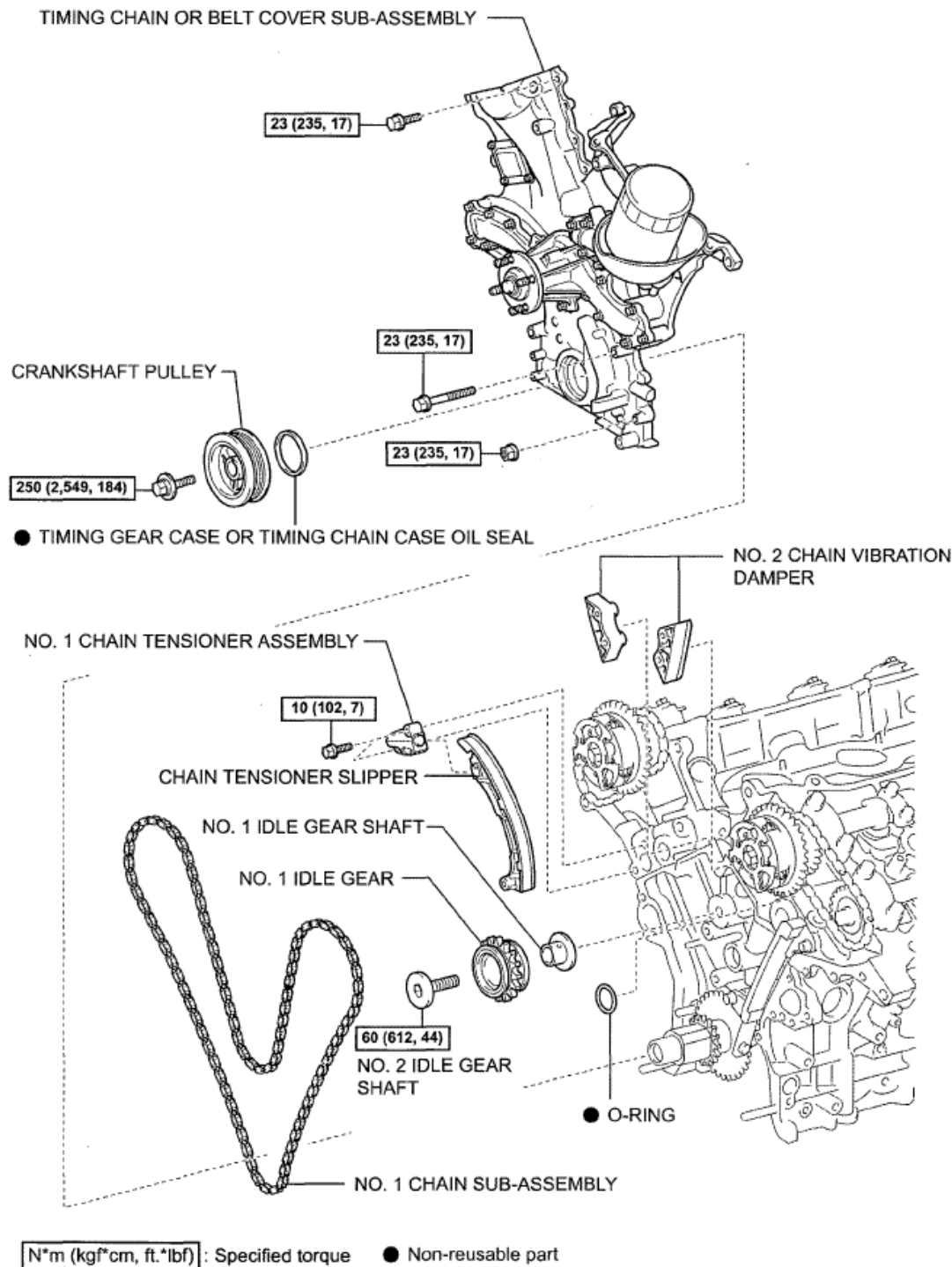


Fig. 224: Identifying Engine Assembly Replacement Components With Torque Specifications (7 Of 11)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

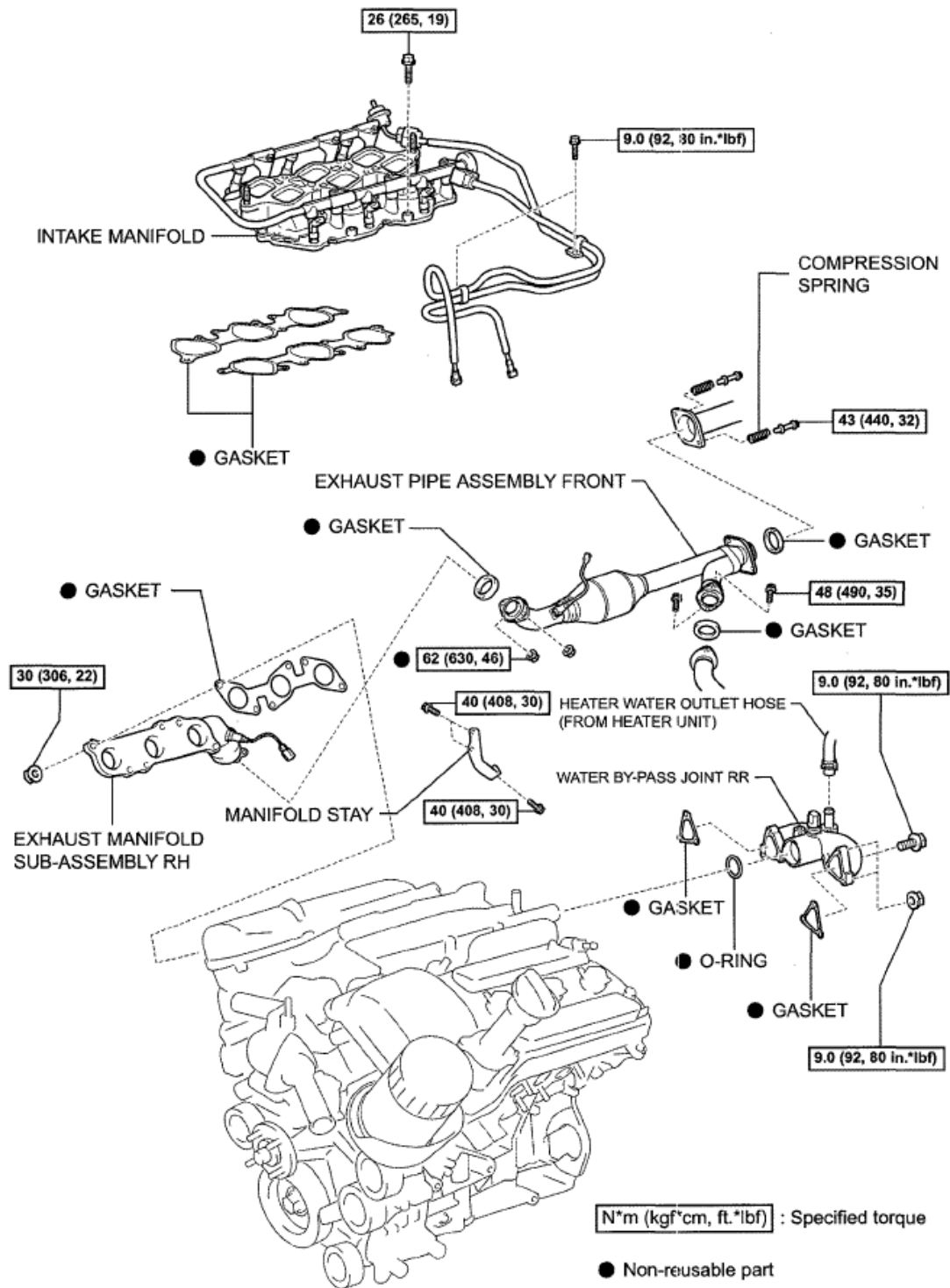


Fig. 225: Identifying Engine Assembly Replacement Components With Torque Specifications (8 Of 11)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

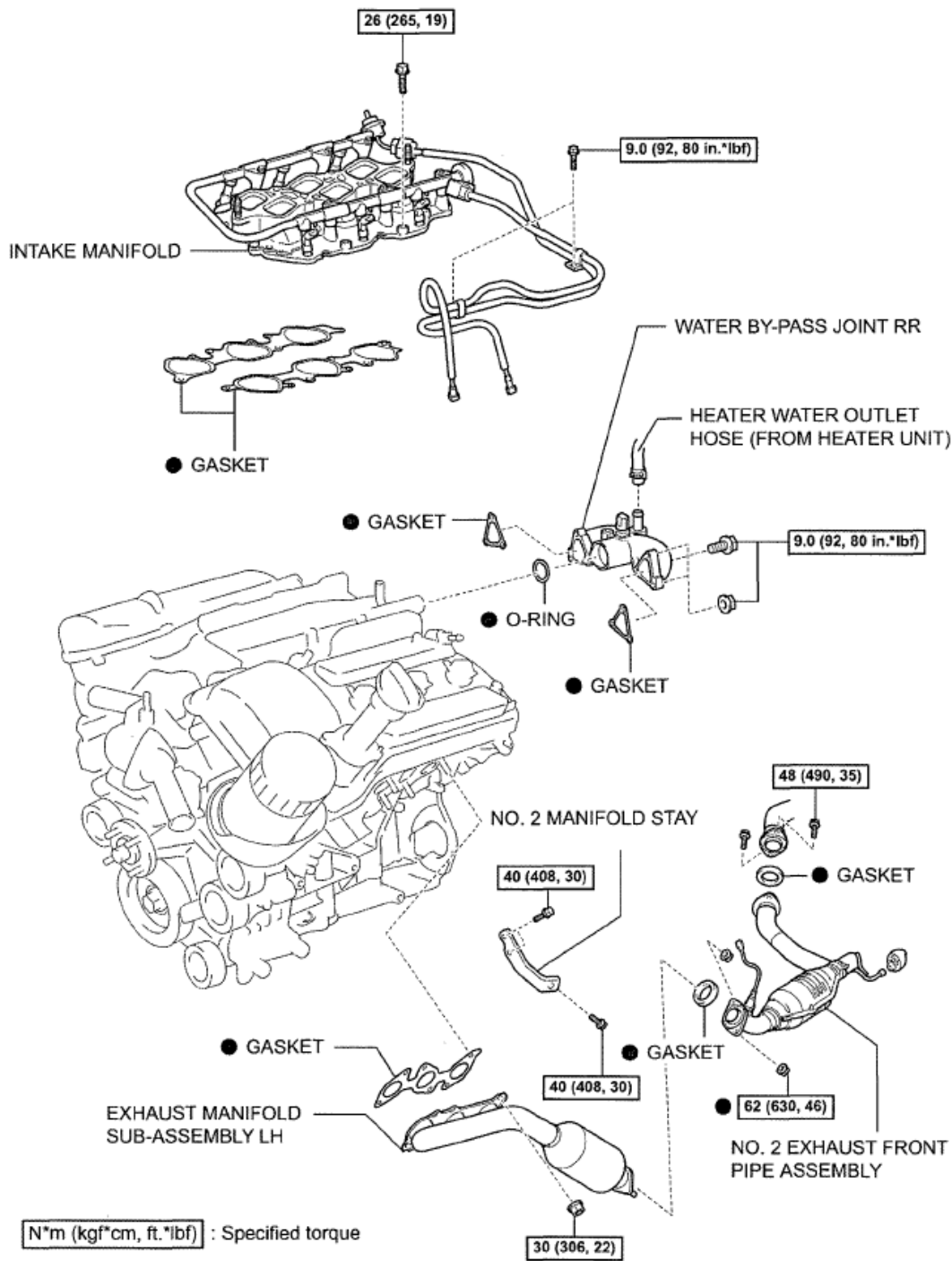
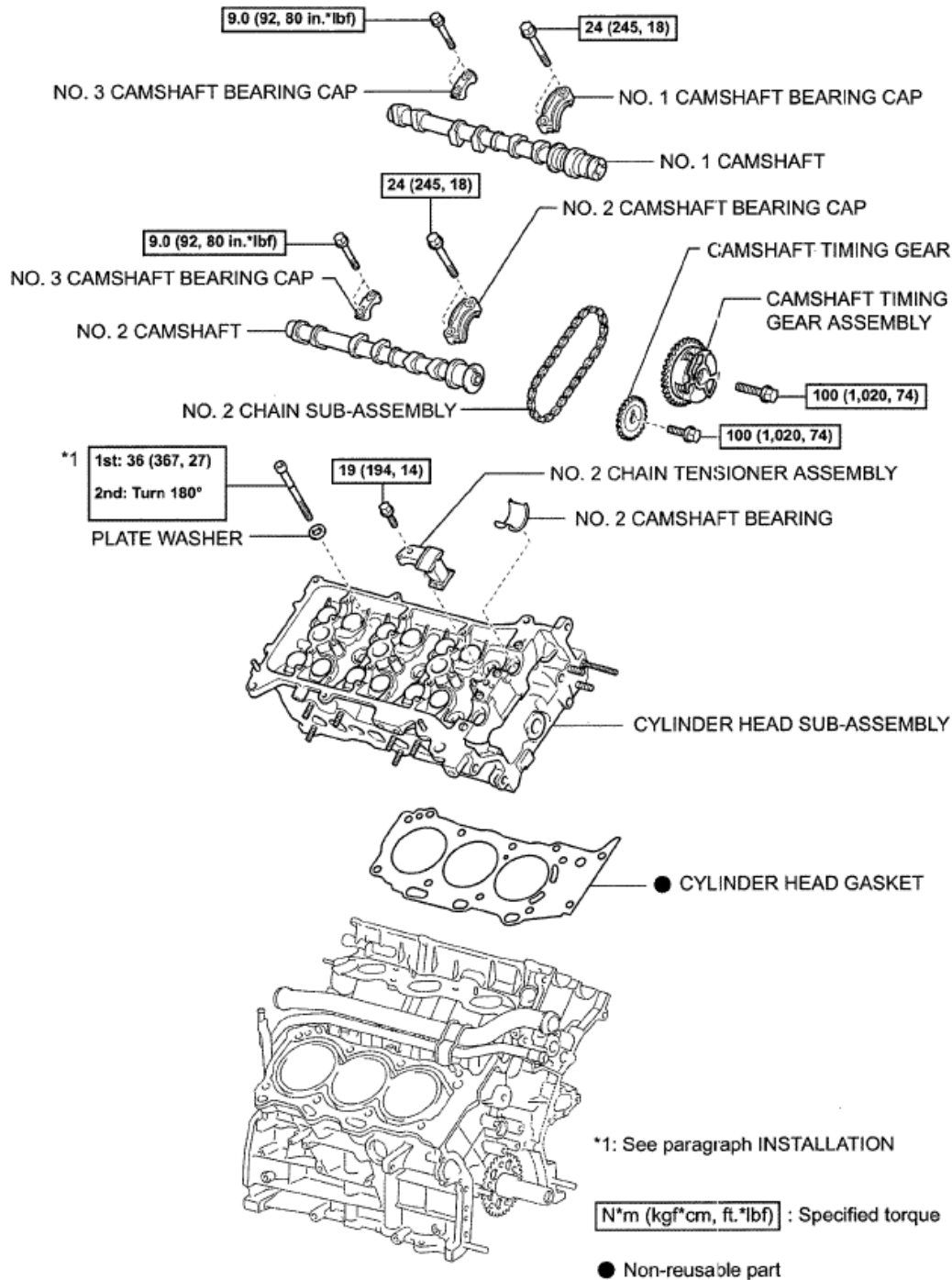


Fig. 226: Identifying Engine Assembly Replacement Components With Torque Specifications (9 Of 11)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Bank 1:



A119805E02

Fig. 227: Identifying Engine Assembly Replacement Components With Torque Specifications (10 Of 11)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Bank 2:

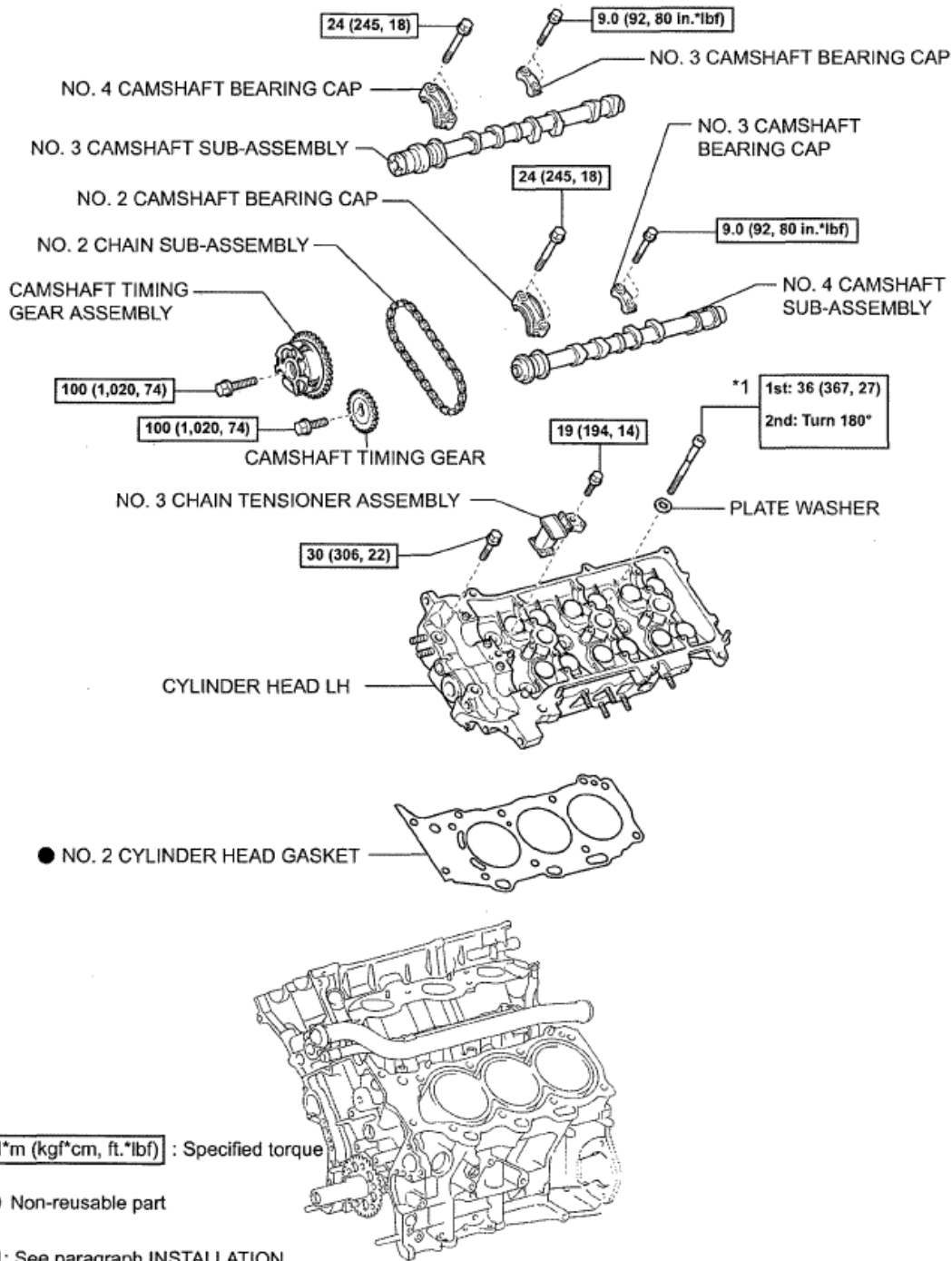


Fig. 228: Identifying Engine Assembly Replacement Components With Torque Specifications (11 Of 11)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. **DISCHARGE FUEL SYSTEM PRESSURE** (See **REMOVAL**)
2. **DRAIN ENGINE COOLANT** (See **REMOVAL**)
3. **DRAIN ENGINE OIL** (See **REMOVAL**)
4. **REMOVE CHAIN SUB-ASSEMBLY**

HINT:

(See **REMOVAL**)

5. **REMOVE NO. 1 COOL AIR INLET**
 - a. Remove the 2 bolts and cool air inlet with air cleaner hose.
6. **REMOVE TRANSMISSION OIL FILLER TUBE SUB-ASSEMBLY**
 - a. Remove the ATF level gauge.
 - b. Remove the bolt and pull out the oil filler tube.
 - c. Remove the O-ring from the oil filler tube.
7. **REMOVE EXHAUST PIPE ASSEMBLY FRONT**

HINT:

(See **REMOVAL**)

8. **REMOVE MANIFOLD STAY**
 - a. Remove the 3 bolts and manifold stay.
9. **REMOVE EXHAUST MANIFOLD SUB-ASSEMBLY RH**
 - a. Disconnect the A/F sensor connector.
 - b. Remove the 6 nuts, exhaust manifold and gasket.
10. **REMOVE NO. 2 EXHAUST FRONT PIPE ASSEMBLY** (See **REMOVAL**)
11. **REMOVE NO. 2 MANIFOLD STAY**
 - a. Remove the 3 bolts and No. 2 manifold stay.
12. **REMOVE EXHAUST MANIFOLD SUB-ASSEMBLY LH**
 - a. Disconnect the A/F sensor connector.
 - b. Remove the 6 nuts, 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, intake manifold and 2 gaskets.

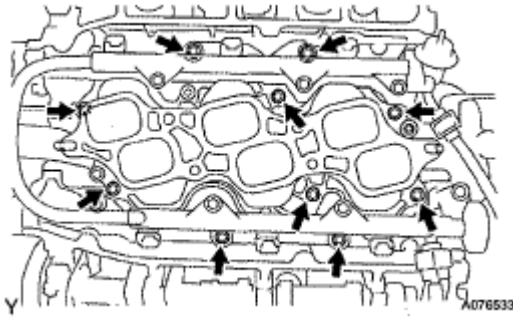


Fig. 229: Identifying Intake Manifold Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

16. REMOVE WATER BY-PASS JOINT RR

- a. Disconnect the engine coolant temperature sensor connector.
- b. Disconnect the heater hose.
- c. Remove the 2 bolts, 4 nuts, water by-pass joint RR and 2 gaskets.
- d. Remove the O-ring from the water outlet pipe.

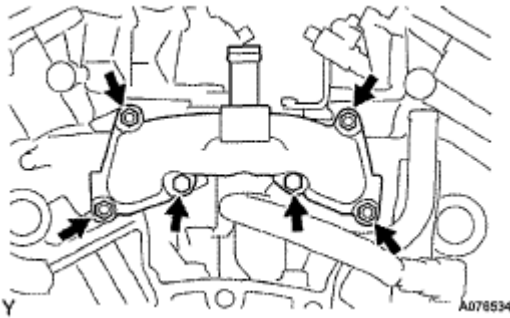


Fig. 230: Identifying Water By-Pass Joint Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

17. REMOVE CAMSHAFT TIMING GEARS AND NO. 2 CHAIN (for Bank 1)

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

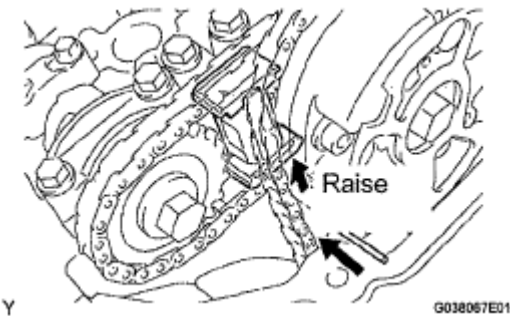


Fig. 231: Identifying Chain Tensioner
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Hold the hexagonal portion of the camshaft with a wrench, and remove the 2 bolts, camshaft timing gear, camshaft timing gear assembly and No. 2 timing chain.

NOTE:

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

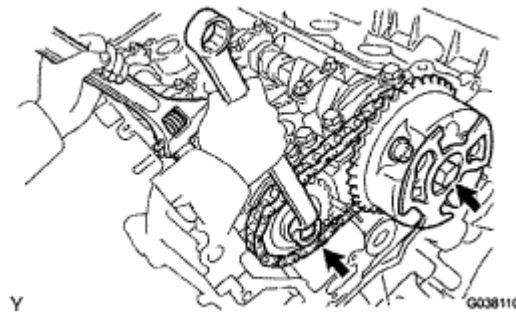


Fig. 232: Identifying Camshaft Timing Gear Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

18. REMOVE NO. 2 CHAIN TENSIONER ASSEMBLY

- a. Remove the bolt and No. 2 chain tensioner.

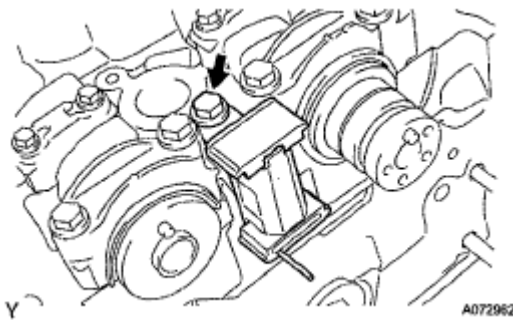


Fig. 233: Identifying No. 2 Chain Tensioner Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

19. REMOVE CAMSHAFTS (for Bank 1)

NOTE:

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

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

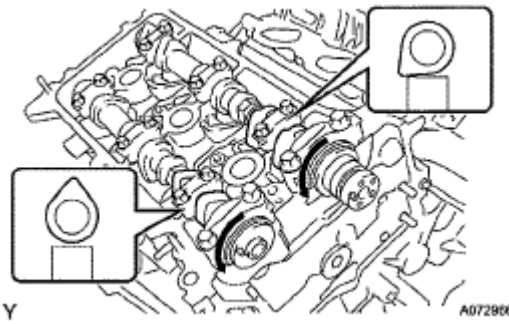


Fig. 234: Identifying Camshafts Counterclockwise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

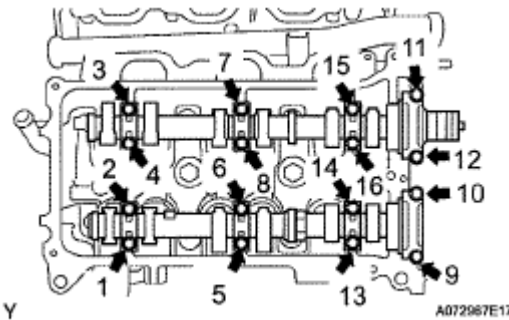


Fig. 235: Identifying Removal Sequence Of Bearing Cap Bolts (Bank 1)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Remove the 8 bearing caps and 2 camshafts.
20. **REMOVE NO. 2 CAMSHAFT BEARING**
21. **REMOVE NO. 1 CHAIN VIBRATION DAMPER**
 - a. Remove the 2 bolts and No. 1 chain vibration damper.
22. **REMOVE CAMSHAFT TIMING GEARS AND NO. 2 CHAIN (for Bank 2)**
 - a. While pushing down the No. 3 chain tensioner, insert a pin of $\phi 1.0$ mm (0.039 in.) into the hole to fix it.

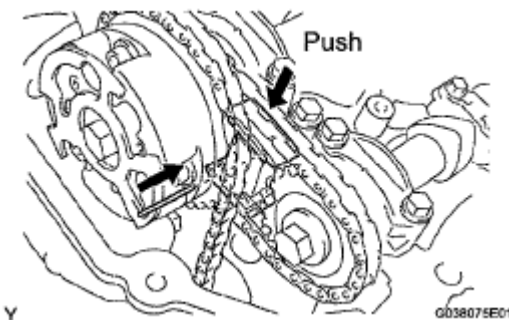


Fig. 236: Identifying No. 3 Chain Tensioner

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 No. 2 timing chain.

NOTE:

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

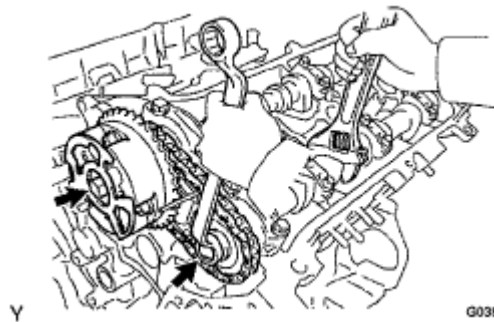


Fig. 237: Identifying Camshaft Timing Gear Assembly Bolts

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

23. REMOVE NO. 3 CHAIN TENSIONER ASSEMBLY

- a. Remove the bolt and No. 3 chain tensioner.

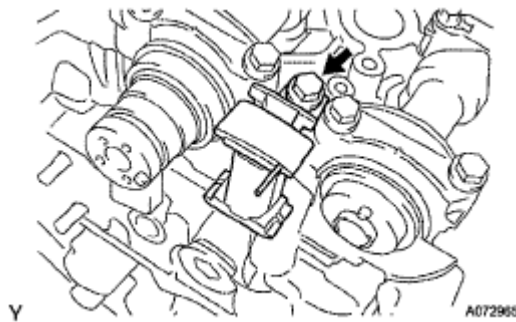


Fig. 238: Identifying Chain Tensioner Bolt

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

24. REMOVE CAMSHAFTS (for Bank 2)

NOTE:

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

- a. Using several steps, loosen and remove the 16 bearing cap bolts uniformly in the sequence as shown in the illustration.

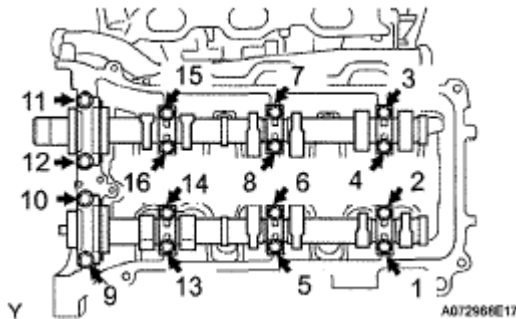


Fig. 239: Identifying Removal Sequence Of Bearing Cap Bolts (Bank 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the 8 bearing caps and 2 camshafts.

25. REMOVE CYLINDER HEAD SUB-ASSEMBLY

- a. Remove the 2 bolts and separate the 2 ground cables.
- 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 as shown in the illustration. Remove the 8 cylinder head bolts and plate washers.

NOTE:

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

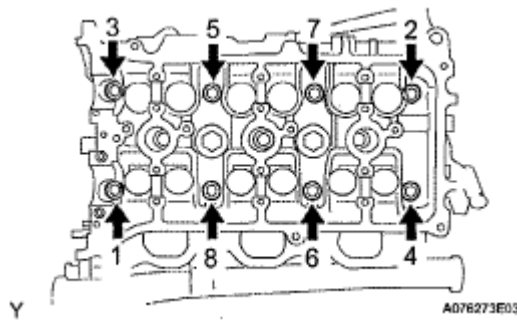


Fig. 240: Identifying Loosening Sequence Of Cylinder Head Bolts (RH)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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 damage the contact surfaces of the cylinder head

and cylinder block.

HINT:

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

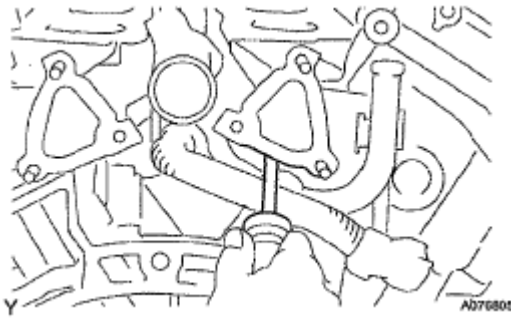


Fig. 241: Identifying Cylinder Head From Dowels On Cylinder Block
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

26. REMOVE CYLINDER HEAD GASKET

27. REMOVE CYLINDER HEAD LH

- a. Remove the bolt and separate the ground cable.
- b. Using several steps, remove the 2 cylinder head bolts on the cylinder head in the sequence as shown in the illustration.

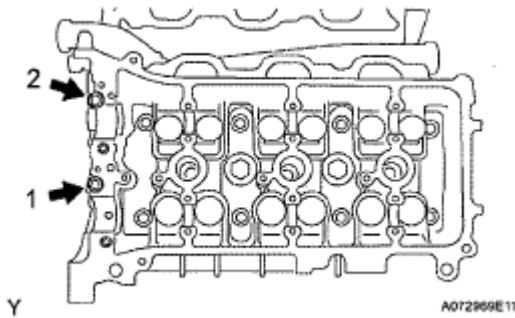


Fig. 242: Identifying Removal Sequence Of Cylinder Head Bolts (LH)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

NOTE:

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

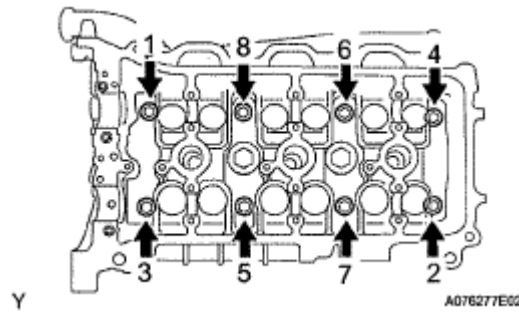


Fig. 243: Identifying Loosening Sequence Of Cylinder Head Bolts (LH)

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 damage the contact surfaces of the cylinder head and cylinder block.

HINT:

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

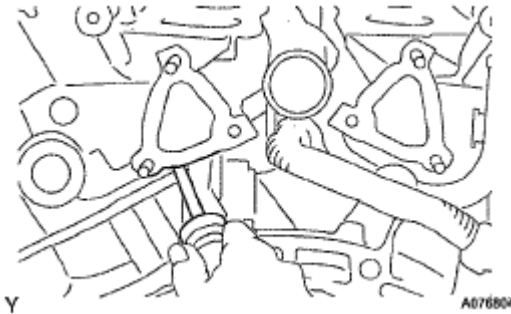


Fig. 244: Identifying Cylinder Head From Dowels On Cylinder Block

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

28. REMOVE NO. 2 CYLINDER HEAD GASKET

INSPECTION

1. INSPECT CYLINDER HEAD SET BOLT

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

Standard outside diameter: 10.85 to 11.00 mm (0.4272 to 0.4331 in.)

Minimum outside diameter: 10.7 mm (0.421 in.)

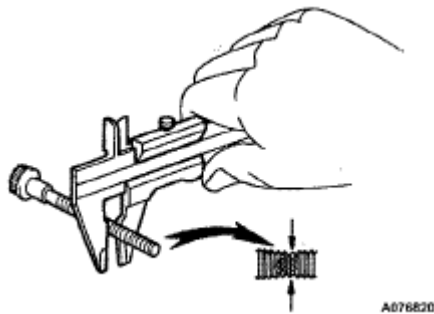


Fig. 245: Identifying Outside Thread Diameter Of Cylinder Head Set Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSTALLATION

1. INSTALL NO. 2 CYLINDER HEAD GASKET

- 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.
- Apply 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 after applying seal packing. After installing it, the cylinder head bolts must be tightened within 15 minutes. Otherwise the seal packing must be removed and reapplied.

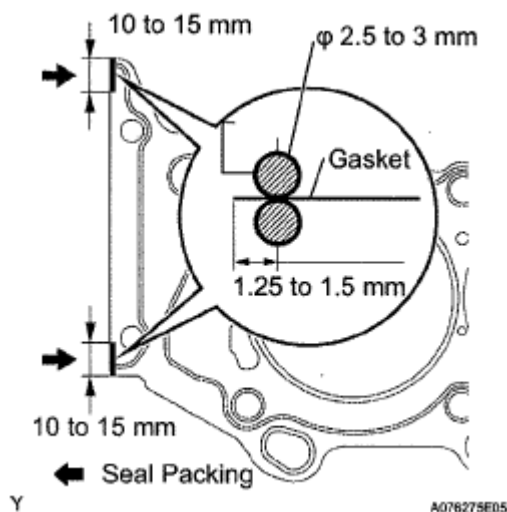


Fig. 246: Identifying Cylinder Head Gasket Dimension
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Place the cylinder head gasket on the cylinder block surface with the Lot No. stamp upper side facing 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.

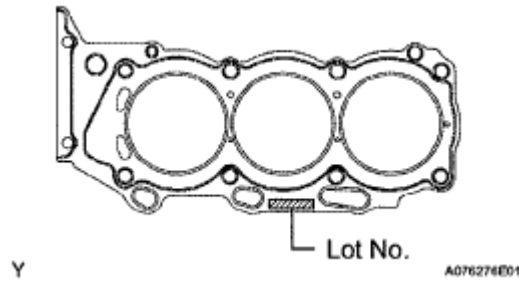


Fig. 247: Identifying Cylinder Head Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. INSTALL CYLINDER HEAD LH

- 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 (Procedures "A" and "B").
 - If any cylinder head bolt is 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 to the cylinder head bolt.
 3. Using several steps, tighten each bolt uniformly with a 10 mm bi-hexagon wrench in the sequence as shown in the illustration (Procedure "A").

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

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

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

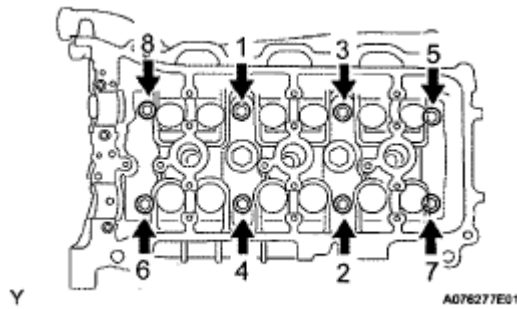


Fig. 248: Identifying Tightening Sequence Of Cylinder Head Bolts (LH)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. Mark the front side of each cylinder head bolt with paint.
5. Retighten the cylinder head bolts 180° as shown (Procedure "B").
6. Check that the painted marks are now at 180° opposite to the engine front.

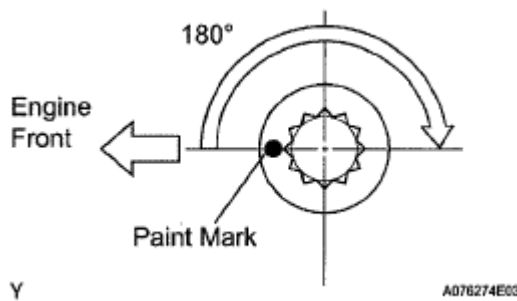


Fig. 249: Identifying Paint Mark On Cylinder Head Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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, install and tighten the 2 cylinder head bolts uniformly in the sequence as shown in the illustration.

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

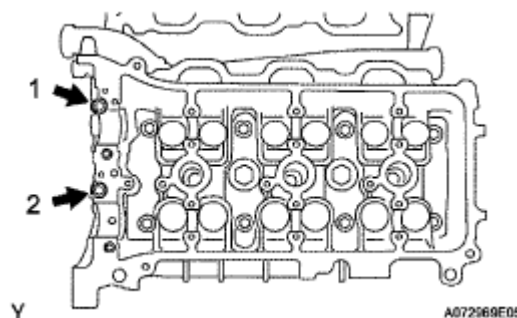


Fig. 250: Identifying Tightening Sequence Of Cylinder Head Bolts (LH)

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

- d. Install the ground cable with the bolt.

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

3. INSTALL CYLINDER HEAD GASKET

- 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.
- Apply 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 after applying seal packing. After installing it, the cylinder head bolts must be tightened within 15 minutes. Otherwise the seal packing must be removed and reapplied.

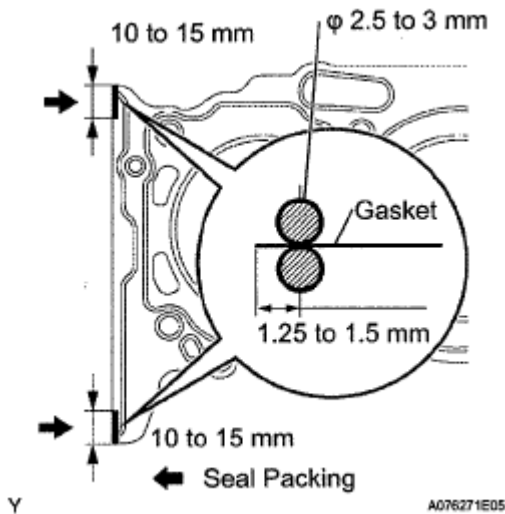


Fig. 251: Identifying Seal Packing Dimension

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 upper side facing 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.

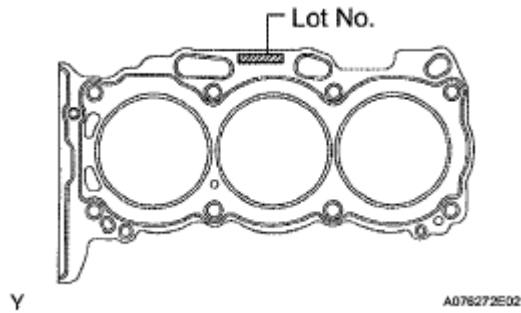


Fig. 252: Identifying Cylinder Head Gasket

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

4. 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 (Procedures "A" and "B").
 - If any cylinder head bolt is 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 to the cylinder head bolt.
 3. Using several steps, tighten each bolt uniformly with a 10 mm bi-hexagon wrench in the sequence as shown in the illustration (Procedure "A").

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

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

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

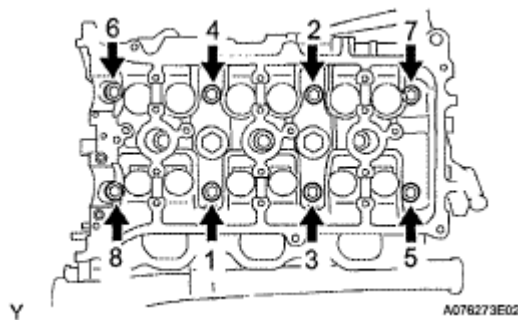


Fig. 253: Identifying Tightening Sequence Of Cylinder Head Bolts (RH)

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

4. Mark the front side of each cylinder head bolt with paint.

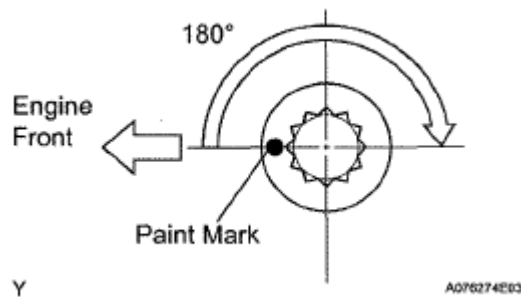


Fig. 254: Identifying Paint Mark On Cylinder Head Bolt
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. Retighten the cylinder head bolts 180° as shown (Procedure "B").
6. Check that the painted marks are now at 180° opposite to the engine front.
- c. Install the ground cables with the 2 bolts.

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

5. INSTALL CAMSHAFTS (for Bank 2)

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

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

NOTE: Setting the crankshaft at a wrong angle can cause the piston head and valve head to come into contact with each other when you install the camshaft, causing damage. So always set the crankshaft at the correct angle.

- b. Apply new engine oil to the thrust portions and journals of the camshafts.

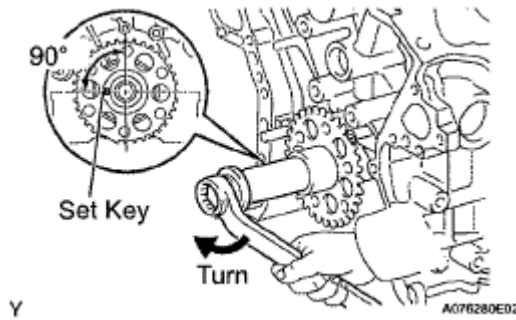


Fig. 255: Identifying Crankshaft

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

- c. Place the 2 camshafts onto the cylinder head with the cam lobes of No. 2 cylinder facing each correct direction as shown in the illustration.

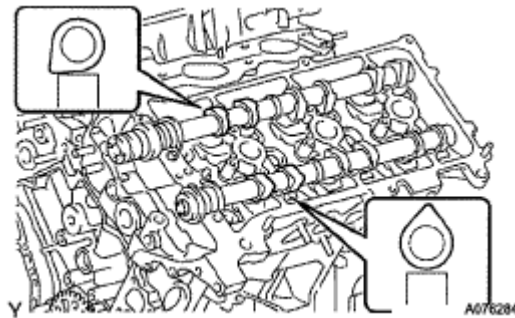


Fig. 256: Identifying Cam Lobes Position

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

- d. Install the 8 bearing caps in their proper locations.

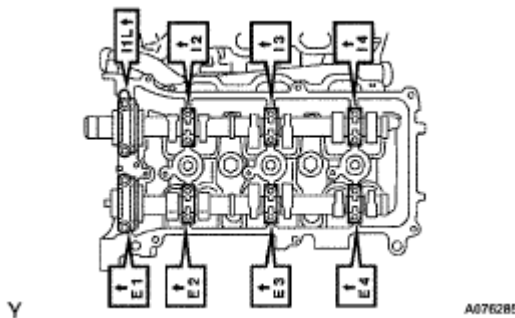


Fig. 257: Identifying Bearing Caps Locations

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

- e. Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.
- f. Using several steps, install and tighten the 16 bearing cap bolts uniformly in the sequence as shown in the illustration.

Torque:

For 10 mm (0.39 in.) head

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

For 12 mm (0.47 in.) head

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

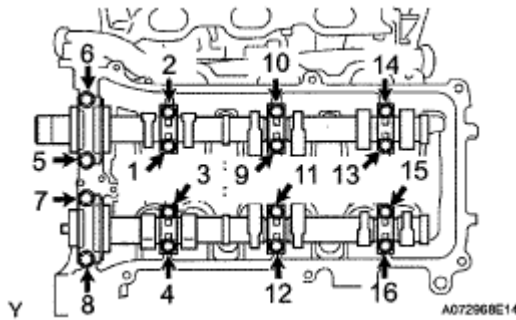


Fig. 258: Identifying Tightening Sequence Of Bearing Cap Bolts (Bank 2)

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

6. INSTALL NO. 3 CHAIN TENSIONER ASSEMBLY

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

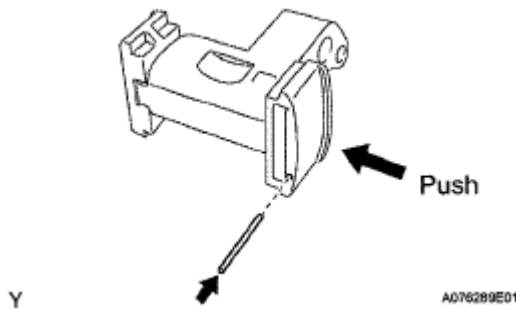


Fig. 259: Inserting Pin Into Hole

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

- b. Install the No. 3 chain tensioner with the bolt.

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

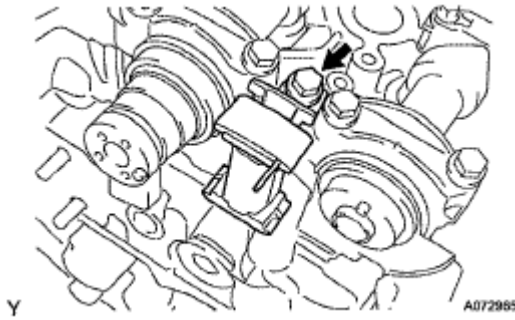


Fig. 260: Locating Chain Tensioner Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. INSTALL CAMSHAFT TIMING GEARS AND NO. 2 CHAIN (for Bank 2)

- a. Align the mark links (yellow) with the timing marks (1-dot mark and 2-dot mark) of the camshaft timing gears as shown in the illustration.

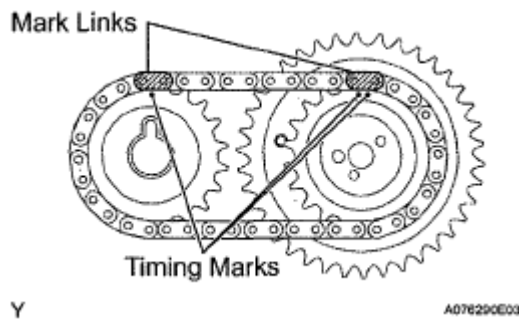


Fig. 261: Identifying Mark Links With Timing Marks Of Camshaft Timing Gears
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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 to the LH camshafts.

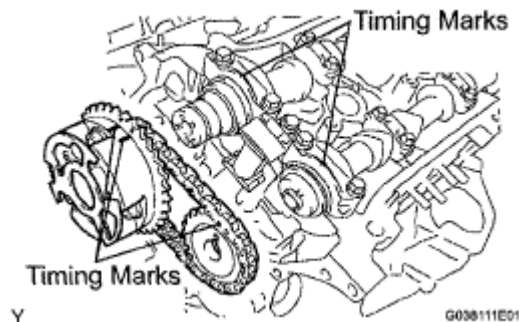


Fig. 262: Identifying Timing Marks On Camshaft Timing Gears
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Temporarily install the 2 camshaft timing gear bolts.

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

- 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)

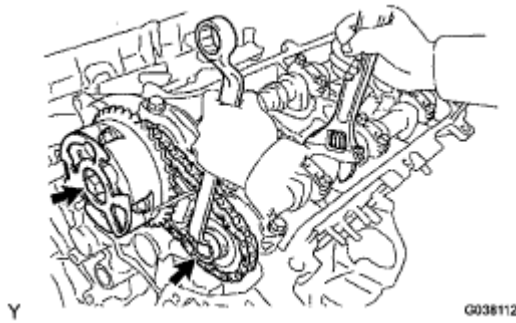


Fig. 263: Identifying Camshaft Timing Gear Assembly Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Remove the pin from the No. 3 tensioner.

8. INSTALL NO. 1 CHAIN VIBRATION DAMPER

- a. Install the No. 1 chain vibration damper with the 2 bolts.

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

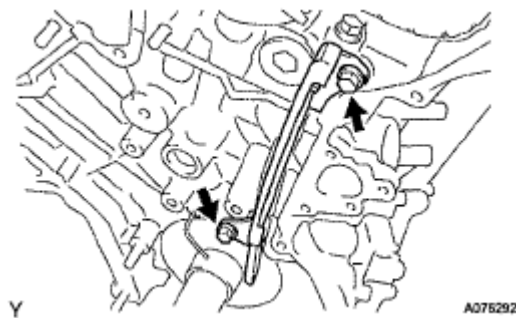


Fig. 264: Identifying Chain Vibration Damper Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. INSTALL NO. 2 CAMSHAFT BEARING

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

NOTE: Clean the backside of the bearing and the contact surface of the cylinder head and prevent oil from adhering to them.



Fig. 265: Identifying Camshaft Bearing

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

10. INSTALL CAMSHAFTS (for Bank 1)

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

a. Set the crankshaft position.

1. Using the crankshaft pulley set bolt, turn the crankshaft, and set the crankshaft set key into the left horizontal position.

NOTE: Having the crankshaft at the wrong angle can cause the piston head and valve head to come into contact with each other when you install the camshaft, causing damage. So always set the crankshaft at the correct angle.

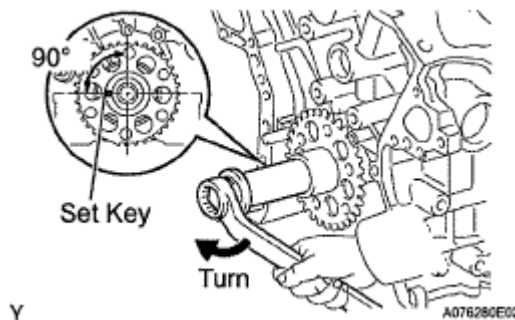


Fig. 266: Identifying Crankshaft

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

- b. Apply new engine oil to the thrust portions and journals of the camshafts.
- c. Place the 2 camshafts onto the cylinder head with the cam lobes of No. 1 cylinder facing each direction as shown in the illustration.

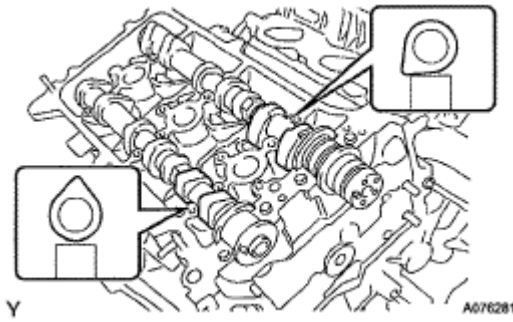


Fig. 267: Identifying Camshafts Lobe Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Install the 8 bearing caps in their proper locations.

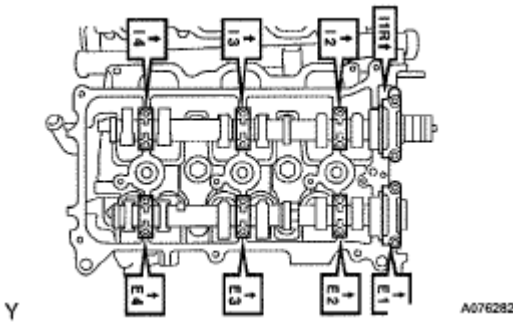


Fig. 268: Identifying Bearing Caps Locations
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.
f. Using several steps, install and tighten the 16 bearing cap bolts uniformly in the sequence as shown in the illustration.

Torque:

For 10 mm (0.39 in.) head

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

For 12 mm (0.47 in.) head

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

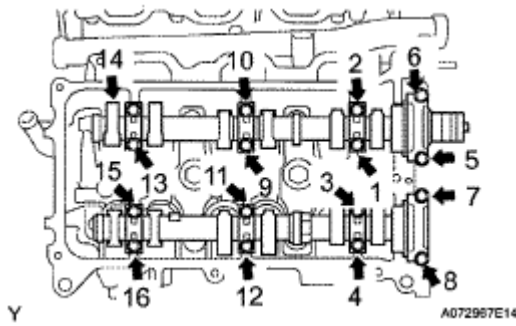


Fig. 269: Tightening Sequence Of Bearing Cap Bolts (Bank 1)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

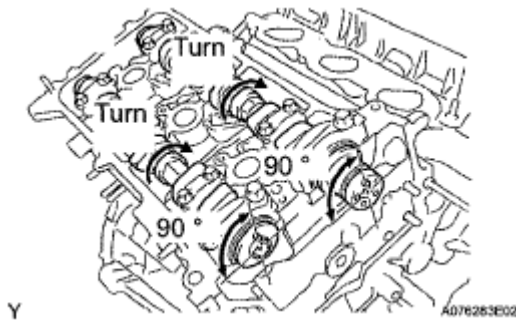


Fig. 270: Identifying Camshafts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. INSTALL NO. 2 CHAIN TENSIONER ASSEMBLY

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

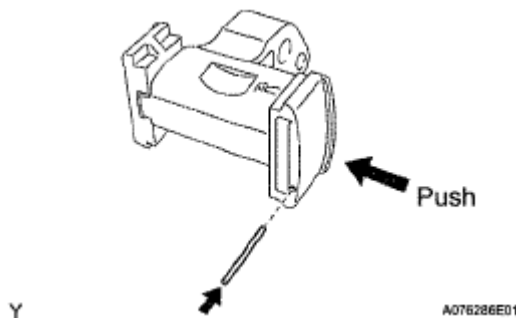


Fig. 271: Inserting Pin Into Hole
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

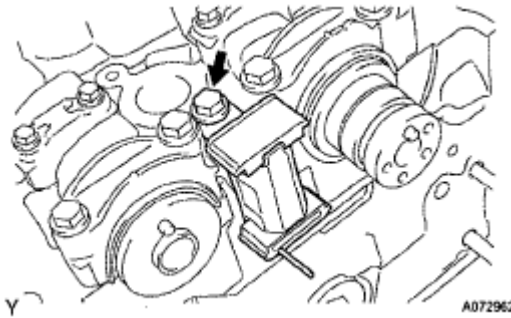


Fig. 272: Identifying Chain Tensioner Bolt
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. INSTALL CAMSHAFT TIMING GEARS AND NO. 2 CHAIN (for Bank 1)

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

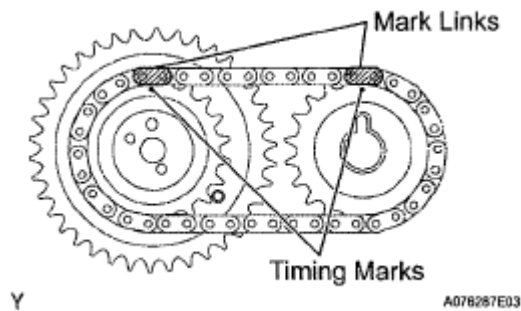


Fig. 273: Identifying Mark Links (Yellow) With Timing Marks Of Camshaft Timing Gears
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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 to the RH camshafts.

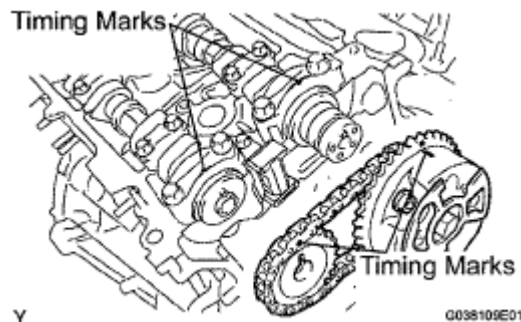


Fig. 274: Identifying Timing Marks On Camshaft Timing Gears
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Temporarily install the 2 camshaft timing gear bolts.

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

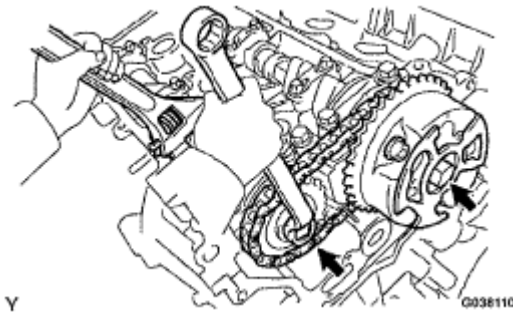


Fig. 275: Identifying Camshaft Timing Gear Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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 No. 2 tensioner.

13. INSTALL WATER BY-PASS JOINT RR

- a. Install a new O-ring to the water outlet pipe.

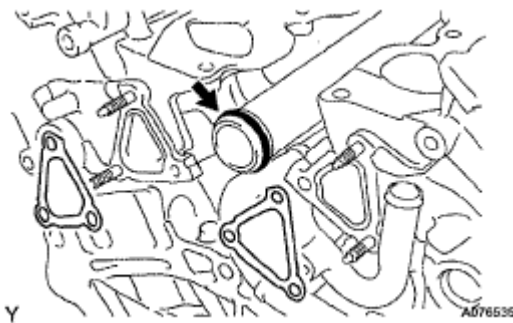


Fig. 276: Identifying O-Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Apply soapy water to the O-ring.
- c. Install 2 new gaskets and water by-pass joint RR 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.

14. 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.

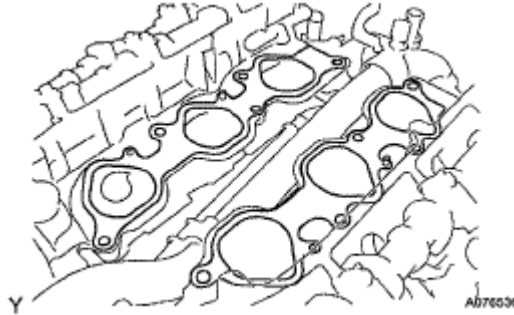


Fig. 277: Identifying Intake Manifold Gasket
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

- Connect the 6 fuel injector connectors.

- CONNECT NO. 2 FUEL PIPE SUB-ASSEMBLY (See INSTALLATION)
- CONNECT NO. 1 FUEL PIPE SUB-ASSEMBLY (See INSTALLATION)
- INSTALL EXHAUST MANIFOLD SUB-ASSEMBLY LH

- Set a new gasket to the LH cylinder head with the oval shape facing backward.

NOTE:

Be careful of the installation direction.

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

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

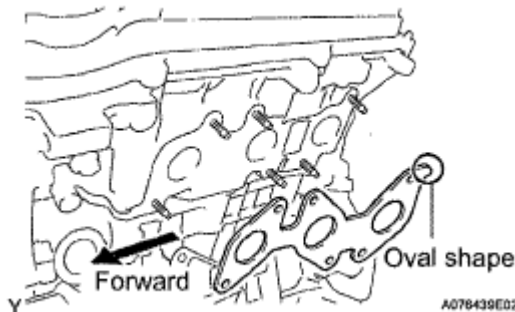


Fig. 278: Identifying Exhaust Manifold Gasket
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Connect the A/F sensor connector.

18. **INSTALL NO. 2 MANIFOLD STAY**

- a. Install the No. 2 manifold stay with the 3 bolts.

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

19. **INSTALL NO. 2 EXHAUST FRONT PIPE ASSEMBLY (See INSTALLATION)**

20. **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.

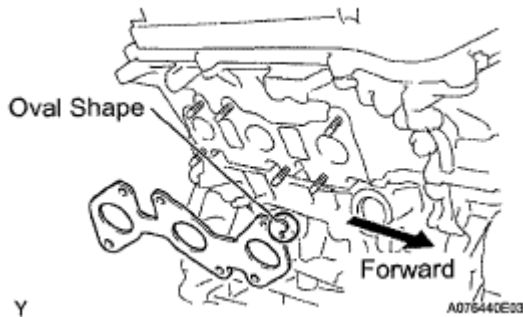


Fig. 279: Identifying Exhaust Manifold Gasket
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

- c. Connect the A/F sensor connector.

21. **INSTALL MANIFOLD STAY**

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

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

22. **INSTALL EXHAUST PIPE ASSEMBLY FRONT (See INSTALLATION)**

23. **INSTALL TRANSMISSION OIL FILLER TUBE SUB-ASSEMBLY**

- a. Coat a new O-ring with ATF, and install it to the oil filler tube.
- b. Push in the oil filler tube end into the oil pan lower tube.
- c. Install the oil filler tube with the bolt.

Torque: 12 N*m (122 kgf*cm, 9 ft.*lbf)

- d. Install the ATF level gauge.

24. INSTALL NO. 1 COOL AIR INLET

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

Torque: 12 N*m (122 kgf*cm, 9 ft.*lbf)

25. INSTALL CHAIN SUB-ASSEMBLY

HINT:

(See INSTALLATION)

26. ADD ENGINE OIL (See INSTALLATION)

27. ADD ENGINE COOLANT (See REPLACEMENT)

28. CHECK FOR ENGINE OIL LEAKAGE

29. CHECK FOR ENGINE COOLANT LEAKAGE (See REPLACEMENT)

30. CHECK FOR FUEL LEAKAGE

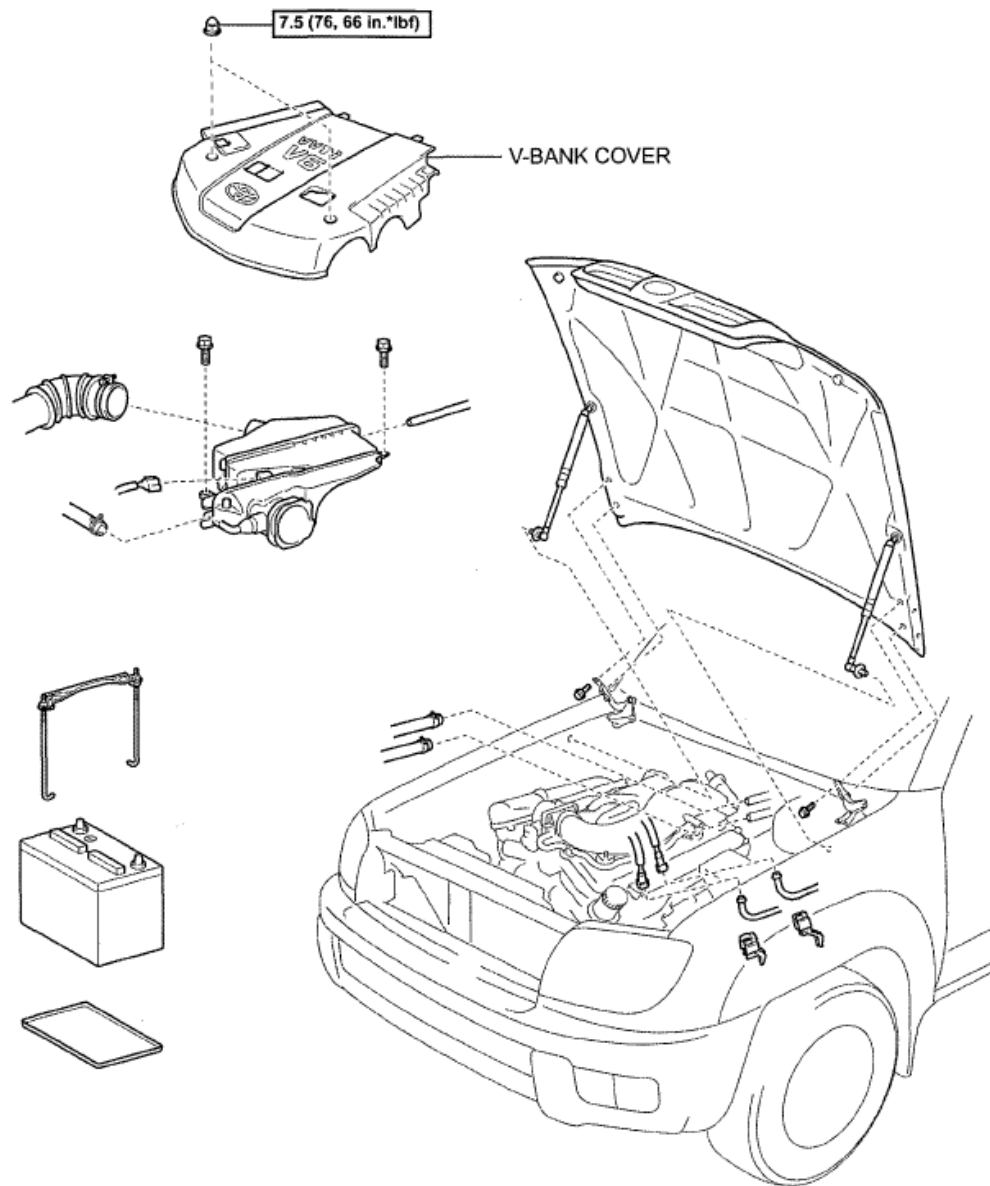
31. CHECK FOR EXHAUST GAS LEAKAGE

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

33. INSPECT COMPRESSION (See ON-VEHICLE INSPECTION)

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

ENGINE FRONT OIL SEAL**COMPONENTS**

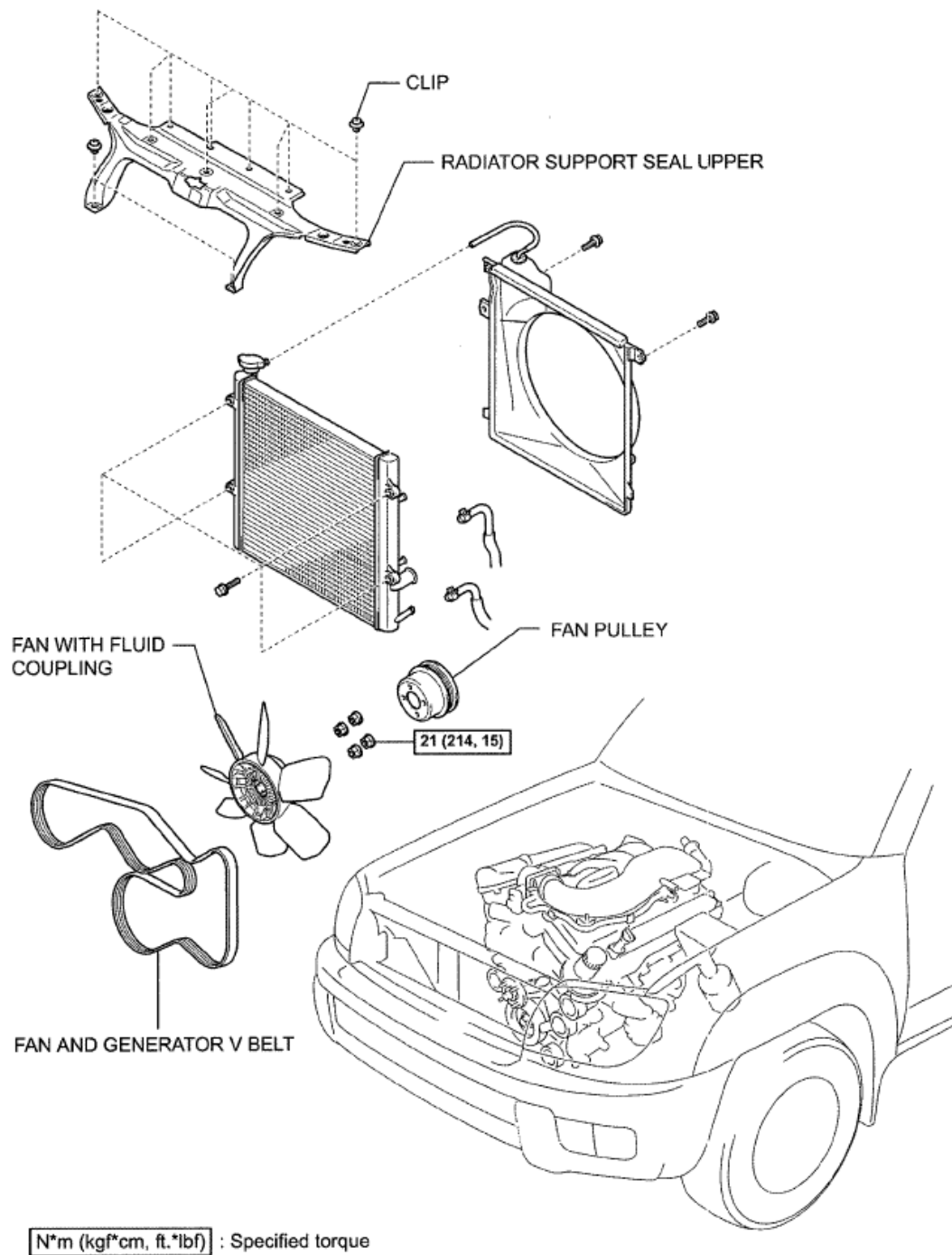


N*m (kgf*cm, ft.*lbf) : Specified torque

Y

A11978E04

Fig. 280: Identifying Engine Front Oil Seal Replacement Components With Torque Specification (1 Of 3)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



A119787ED4

Fig. 281: Identifying Engine Front Oil Seal Replacement Components With Torque Specification (2 Of 3)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

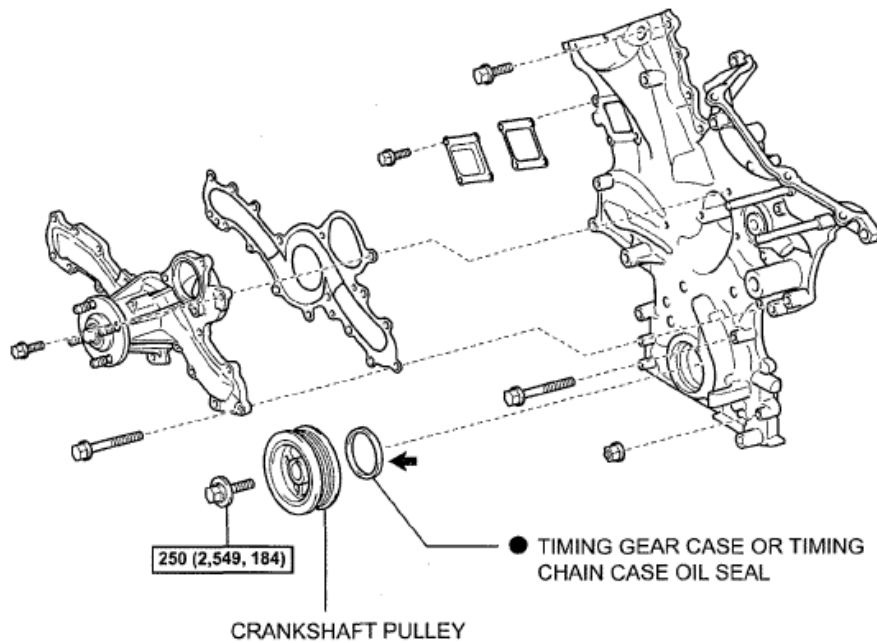


Fig. 282: Identifying Engine Front Oil Seal Replacement Components With Torque Specification (3 Of 3)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**
2. **REMOVE V-BANK COVER (See REMOVAL)**
3. **REMOVE RADIATOR SUPPORT SEAL UPPER**
 - a. Remove the 11 clips and radiator support seal upper.
4. **REMOVE NO. 1 ENGINE UNDER COVER SUB-ASSEMBLY**
 - a. Remove the 4 bolts and engine under cover.
5. **LOOSEN FAN WITH FLUID COUPLING (See REMOVAL)**
6. **REMOVE FAN AND GENERATOR V BELT (See REMOVAL)**
7. **REMOVE FAN WITH FLUID COUPLING (See REMOVAL)**
8. **REMOVE CRANKSHAFT PULLEY**

HINT:

(See **REMOVAL**)

SST 09213-54015 (91651-60855), 09330-00021, 09950-50013 (09951-05010, 09952-05010, 09953-05020, 09954-05031)

9. 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 the tip of the screwdriver with tape.

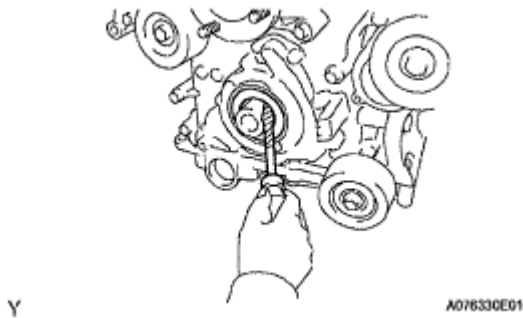


Fig. 283: Identifying Timing Chain Case Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSTALLATION

1. INSTALL TIMING GEAR CASE OR TIMING CHAIN CASE OIL SEAL

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

SST 09226-10010

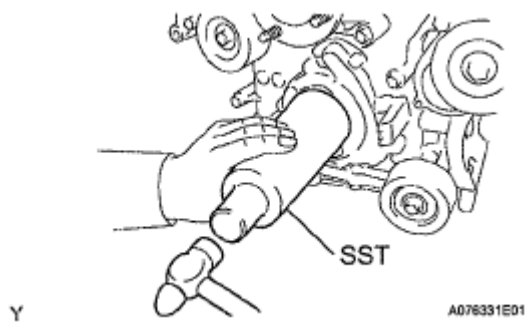


Fig. 284: Identifying Timing Chain Case Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. INSTALL CRANKSHAFT PULLEY

HINT:

(See **INSTALLATION**)

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

3. **INSTALL FAN WITH FLUID COUPLING** (See **INSTALLATION**)
4. **INSTALL FAN AND GENERATOR V BELT** (See **REMOVAL**)
5. **FULLY TIGHTEN FAN WITH FLUID COUPLING** (See **INSTALLATION**)
6. **INSTALL RADIATOR SUPPORT SEAL UPPER**
7. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**
 - a. Connect the cable to the negative battery terminal.

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

8. **CHECK FOR ENGINE OIL LEAKAGE**
9. **INSTALL NO. 1 ENGINE UNDER COVER SUB-ASSEMBLY**
 - a. Install the engine under cover with the 4 bolts.

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

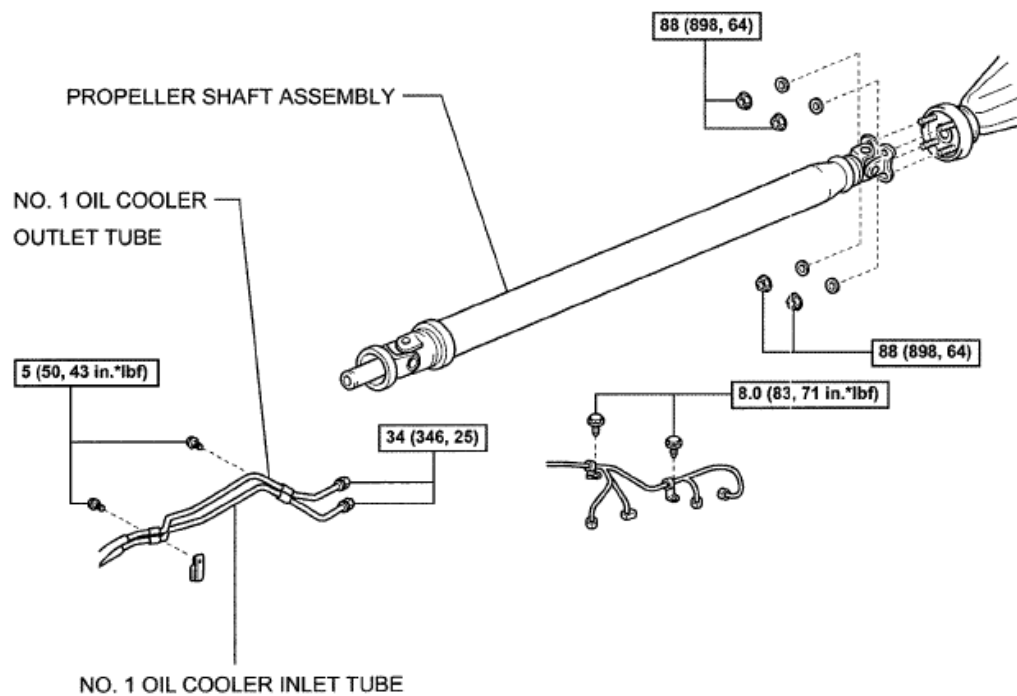
10. **INSTALL V-BANK COVER**
 - a. Install the V-bank cover with the 2 nuts.

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

ENGINE REAR OIL SEAL

COMPONENTS

2WD:

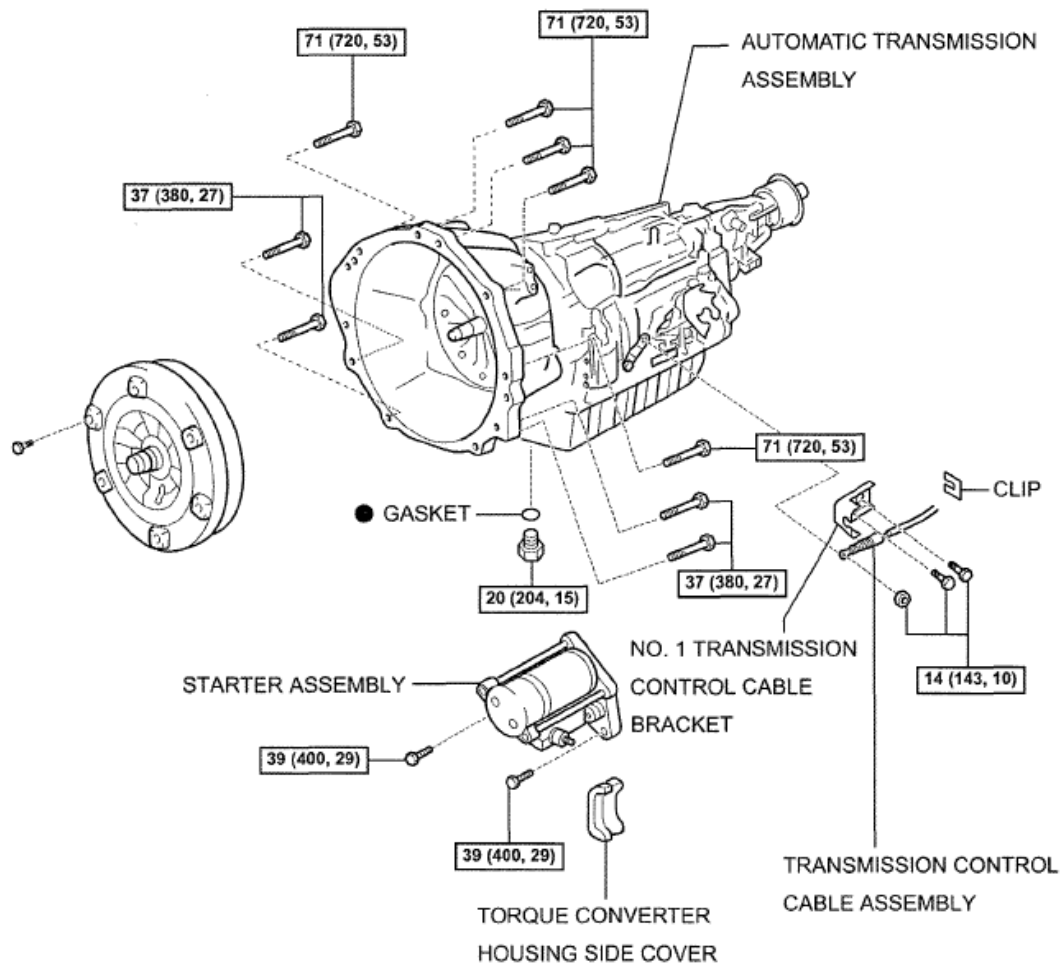


N*m (kgf*cm, ft.*lbf) : Specified torque

C

C119718E03

Fig. 285: Identifying Engine Rear Oil Seal Replacement Components With Torque Specifications (1 Of 6)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



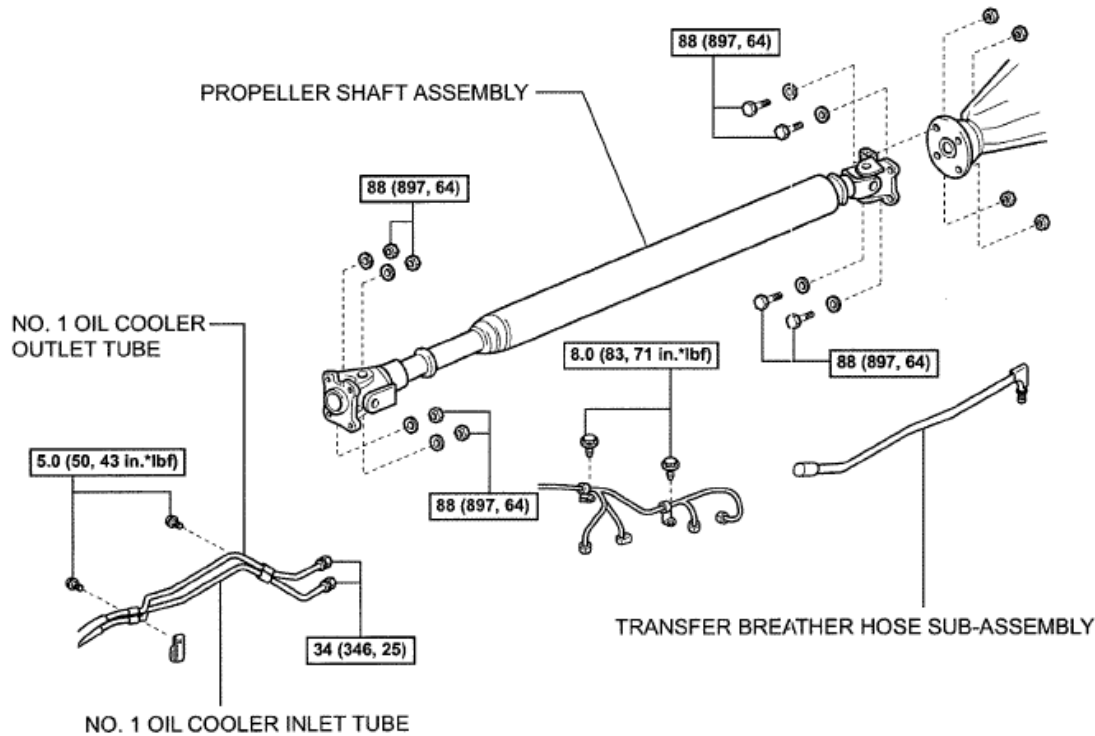
N*m (kgf*cm, ft.*lbf) : Specified torque

● Non-reusable part

C119719E06

Fig. 286: Identifying Engine Rear Oil Seal Replacement Components With Torque Specifications (2 Of 6)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4WD:

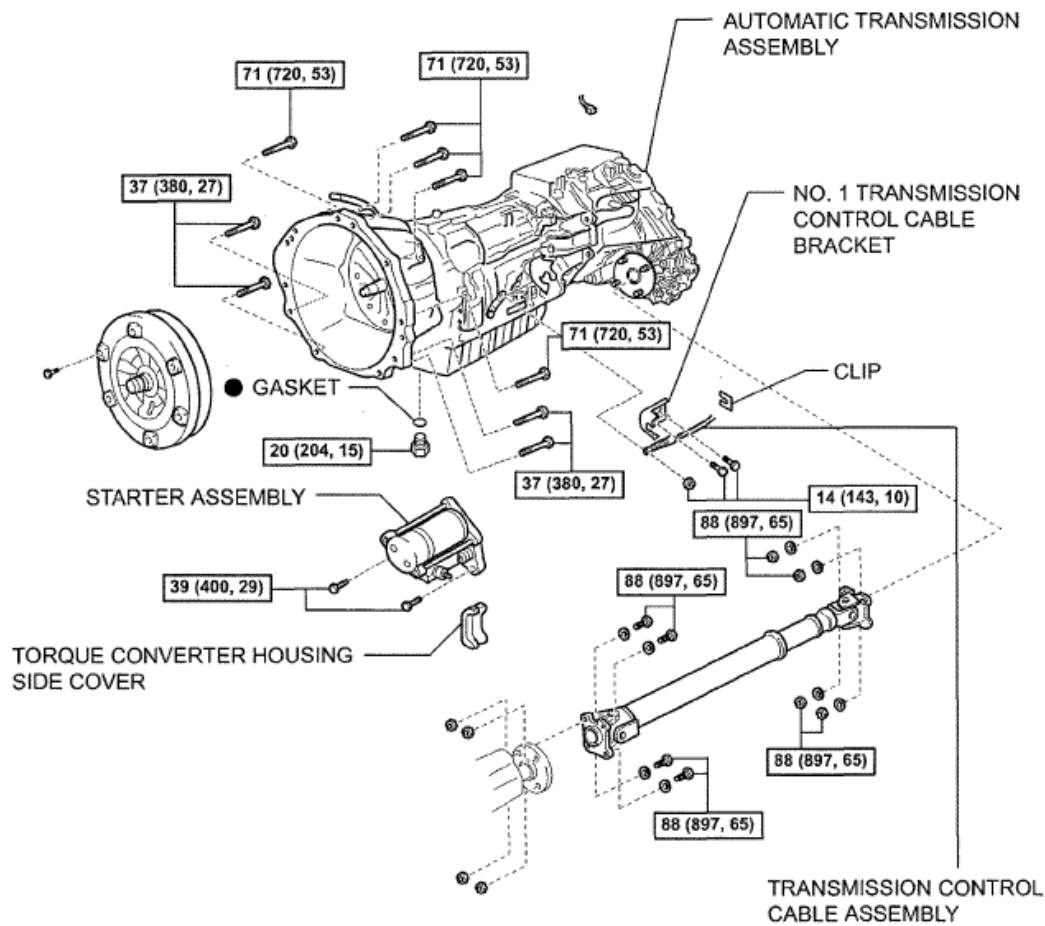


N*m (kgf*cm, ft.*lbf) : Specified torque

c

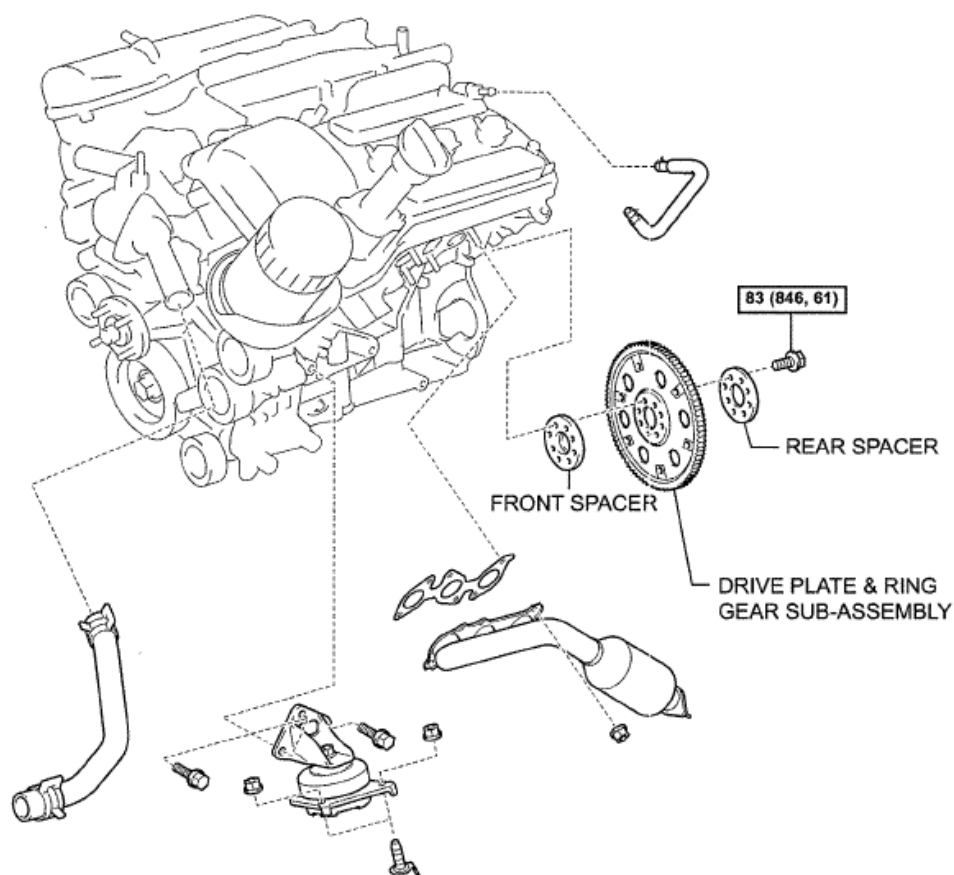
C119724E01

Fig. 287: Identifying Engine Rear Oil Seal Replacement Components With Torque Specifications (3 Of 6)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



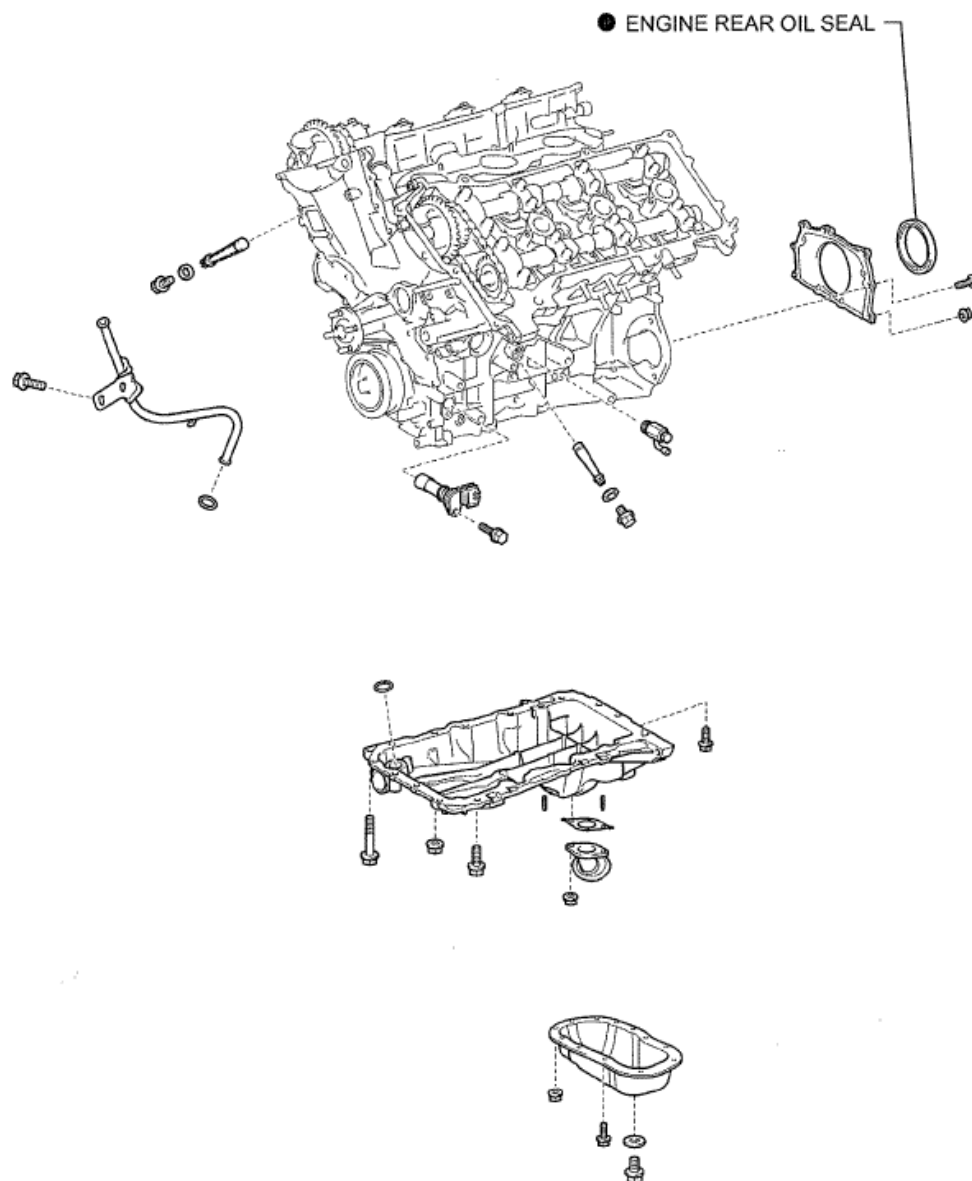
C119725E01

Fig. 288: Identifying Engine Rear Oil Seal Replacement Components With Torque Specifications (4 Of 6)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



A119923E01

Fig. 289: Identifying Engine Rear Oil Seal Replacement Components With Torque Specification (5 Of 6)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



A119792E02

Fig. 290: Identifying Engine Rear Oil Seal Replacement Components (6 Of 6)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. REMOVE AUTOMATIC TRANSMISSION ASSEMBLY (for 2WD)

HINT:

(See **REMOVAL**)

2. REMOVE AUTOMATIC TRANSMISSION ASSEMBLY (for 4WD)

HINT:

(See **REMOVAL**)

3. REMOVE DRIVE PLATE & RING GEAR SUB-ASSEMBLY

- a. Using SST, hold the crankshaft.

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

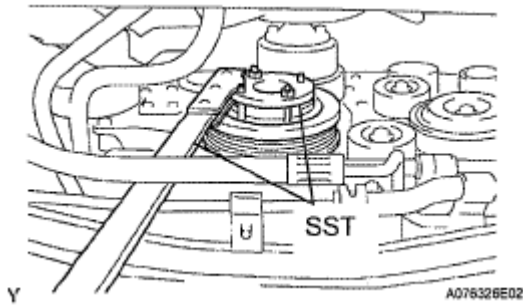


Fig. 291: Identifying Crankshaft Using SST

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

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

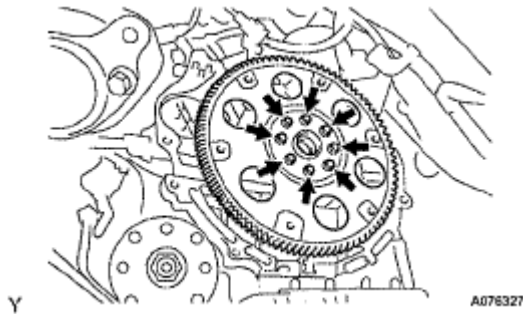


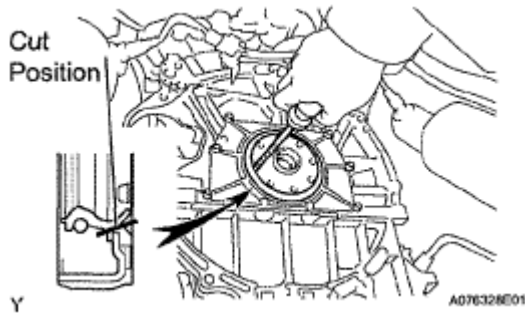
Fig. 292: Identifying Drive Plate Bolts

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

4. REMOVE ENGINE REAR 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. Tape the screwdriver tip.

**Fig. 293: Identifying Engine Rear Oil Seal**

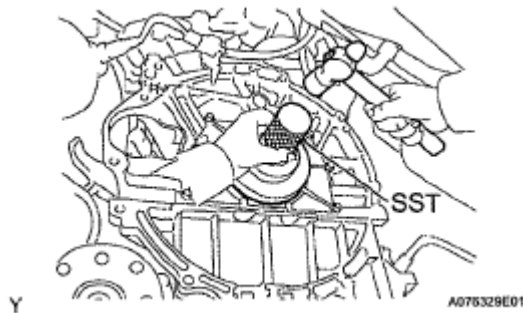
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSTALLATION

1. INSTALL ENGINE REAR OIL SEAL

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

SST 09223-78010

**Fig. 294: Identifying Engine Rear Oil Seal**

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

2. INSTALL DRIVE PLATE & RING GEAR SUB-ASSEMBLY

- a. Using SST, hold the crankshaft.

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

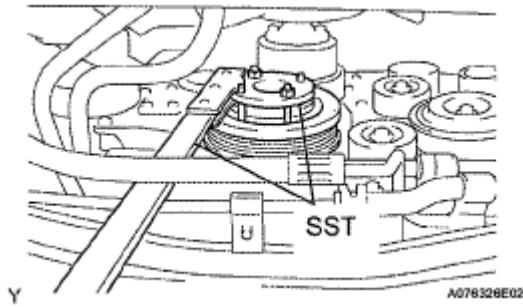


Fig. 295: Identifying Crankshaft

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

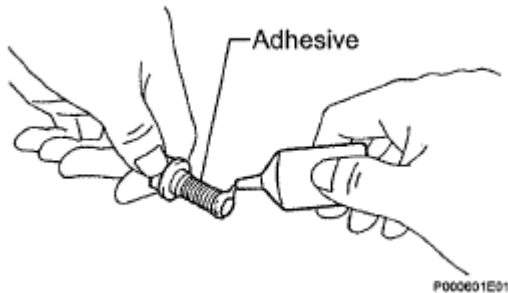


Fig. 296: Identifying Adhesive To Threads Of Mounting Bolt End

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

- c. Install the front spacer, drive plate and rear spacer on the crankshaft.
- d. Using several steps, install and tighten the 8 mounting bolts uniformly in the sequence as shown in the illustration.

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

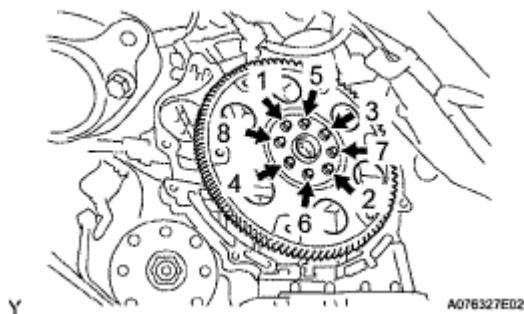


Fig. 297: Identifying Tightening Sequence Of Drive Plate Bolts

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

3. INSTALL AUTOMATIC TRANSMISSION ASSEMBLY (for 2WD)

HINT:

(See INSTALLATION)

4. INSTALL AUTOMATIC TRANSMISSION ASSEMBLY (for 4WD)

HINT:

(See INSTALLATION)

5. CHECK FOR ENGINE OIL LEAKAGE**ENGINE ASSEMBLY****COMPONENTS**

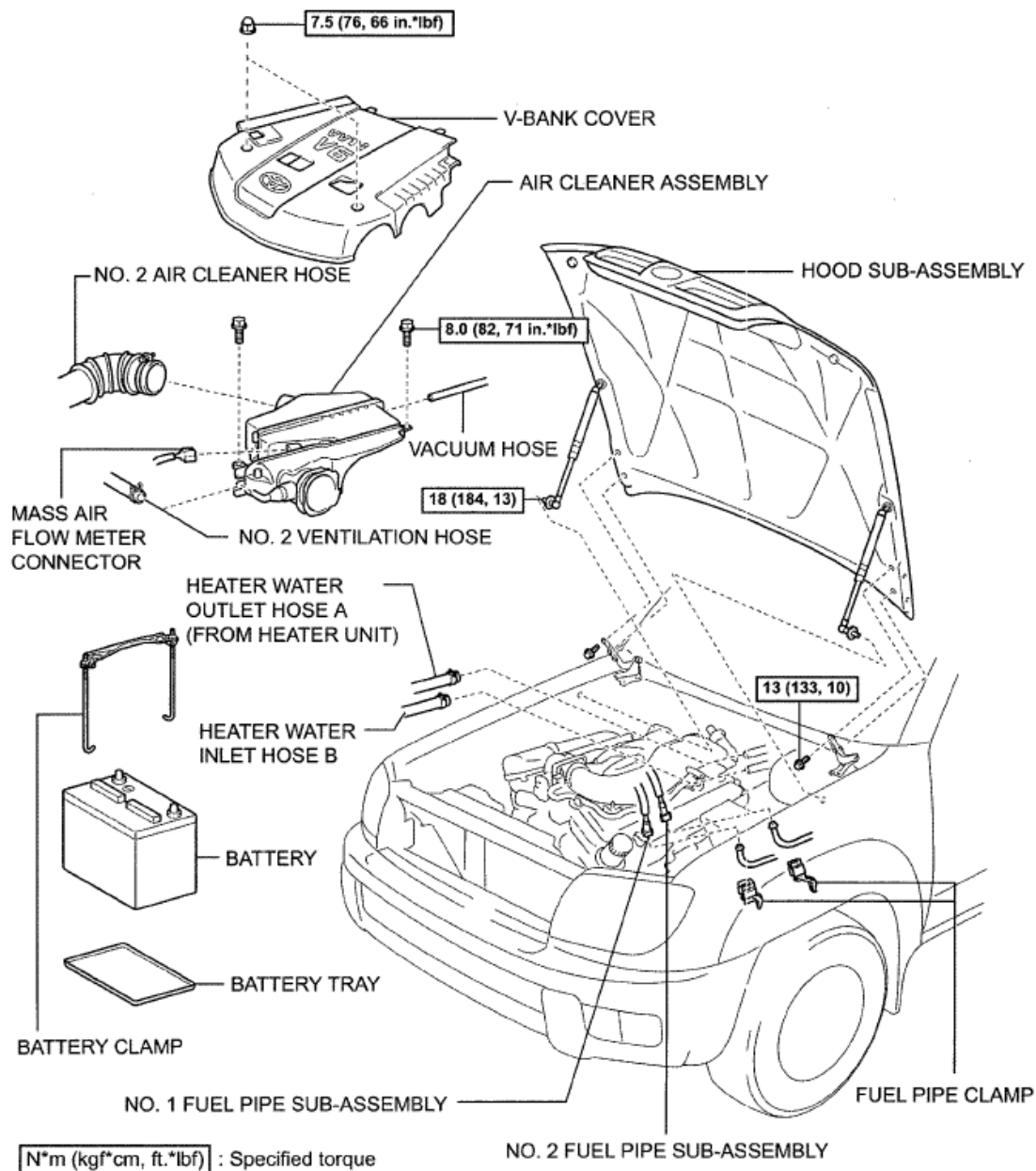
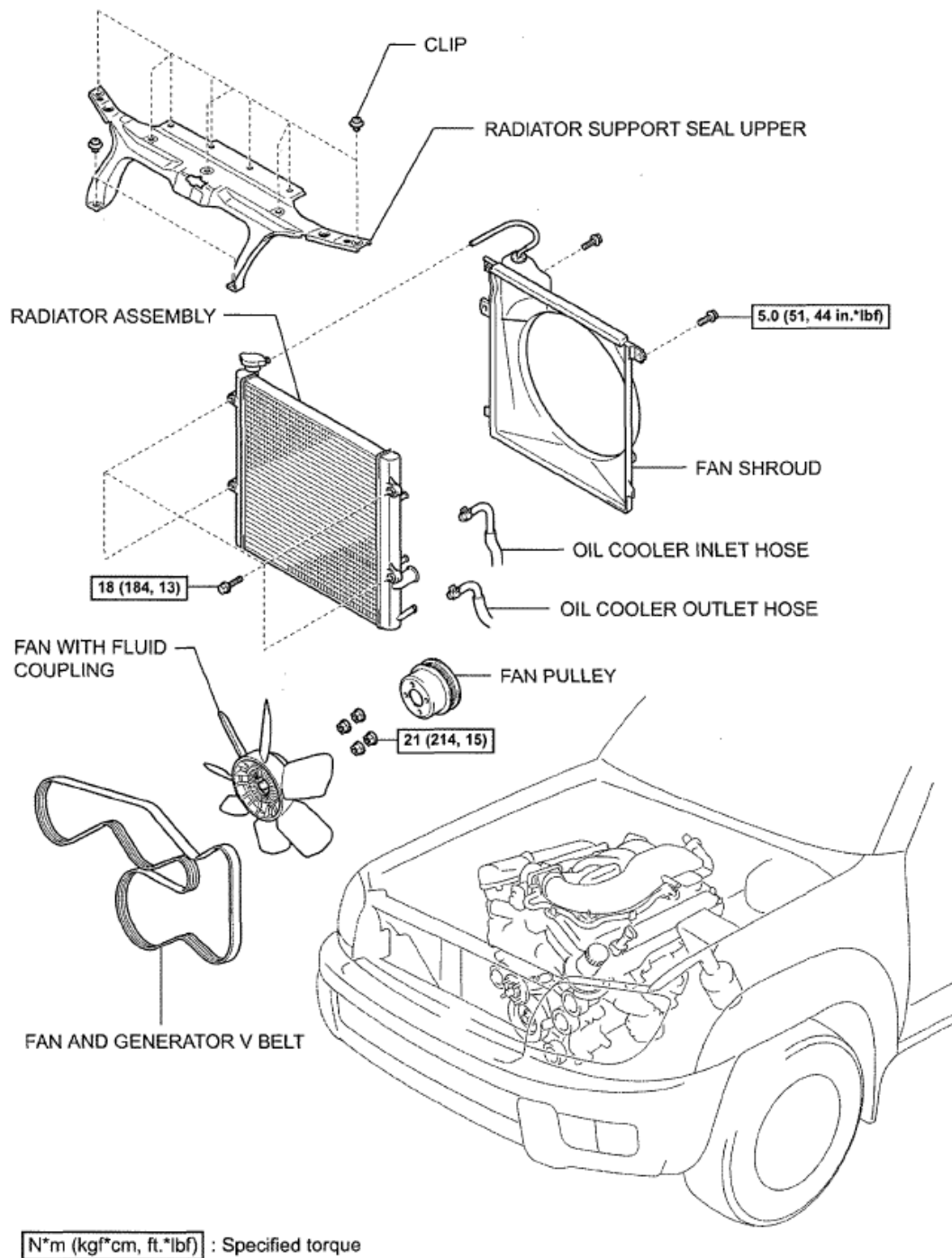
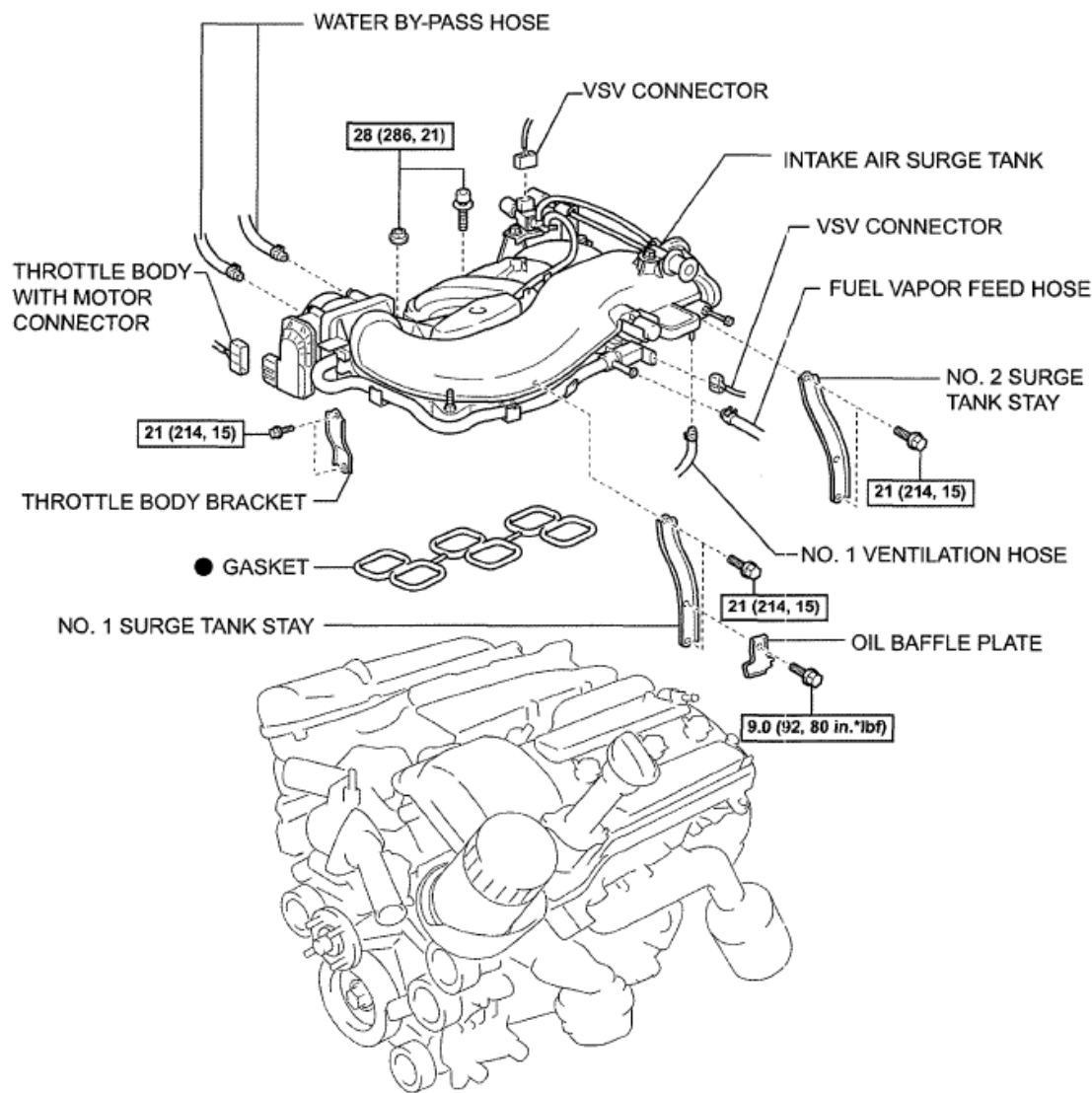


Fig. 298: Identifying Engine Assembly Replacement Components With Torque Specifications (1 Of 8)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



A119787E05

Fig. 299: Identifying Engine Assembly Replacement Components With Torque Specifications (2 Of 8)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

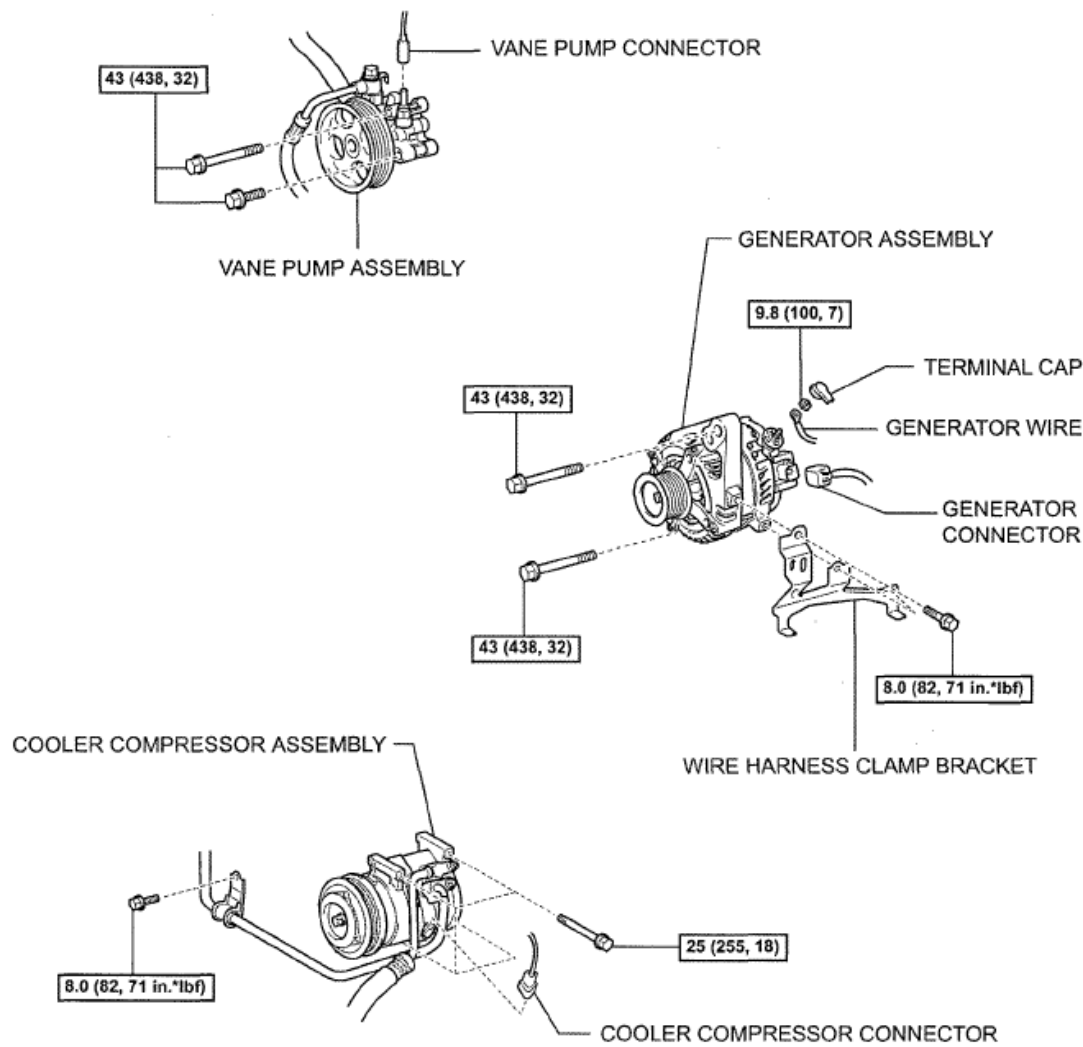


N*m (kgf*cm, ft.*lbf) : Specified torque

● Non-reusable part

A119788E02

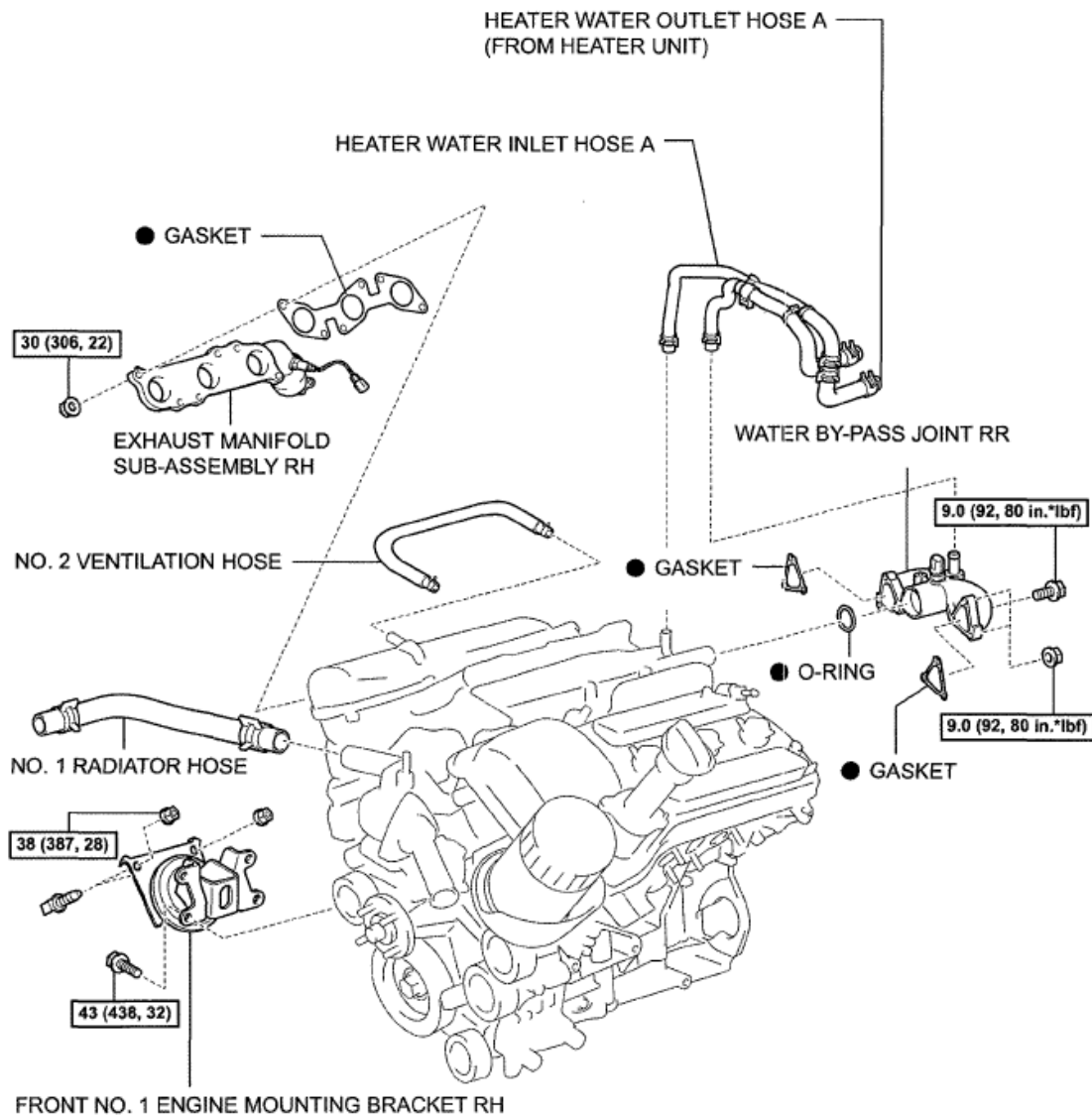
Fig. 300: Identifying Engine Assembly Replacement Components With Torque Specifications (3 Of 8)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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

A119918E06

Fig. 301: Identifying Engine Assembly Replacement Components With Torque Specifications (4 Of 8)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

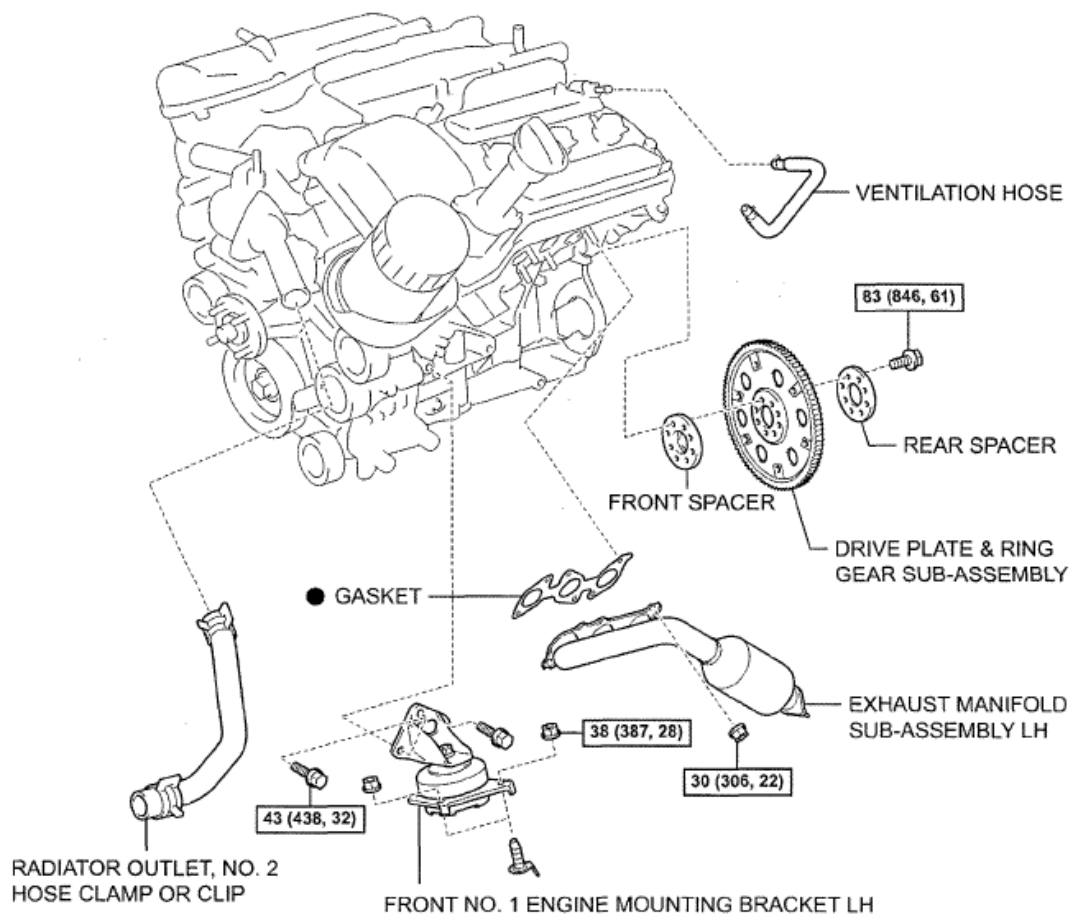


N*m (kg*cm, ft.*lbf) : Specified torque

● Non-reusable part

A119798E01

Fig. 302: Identifying Engine Assembly Replacement Components With Torque Specifications (5 Of 8)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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

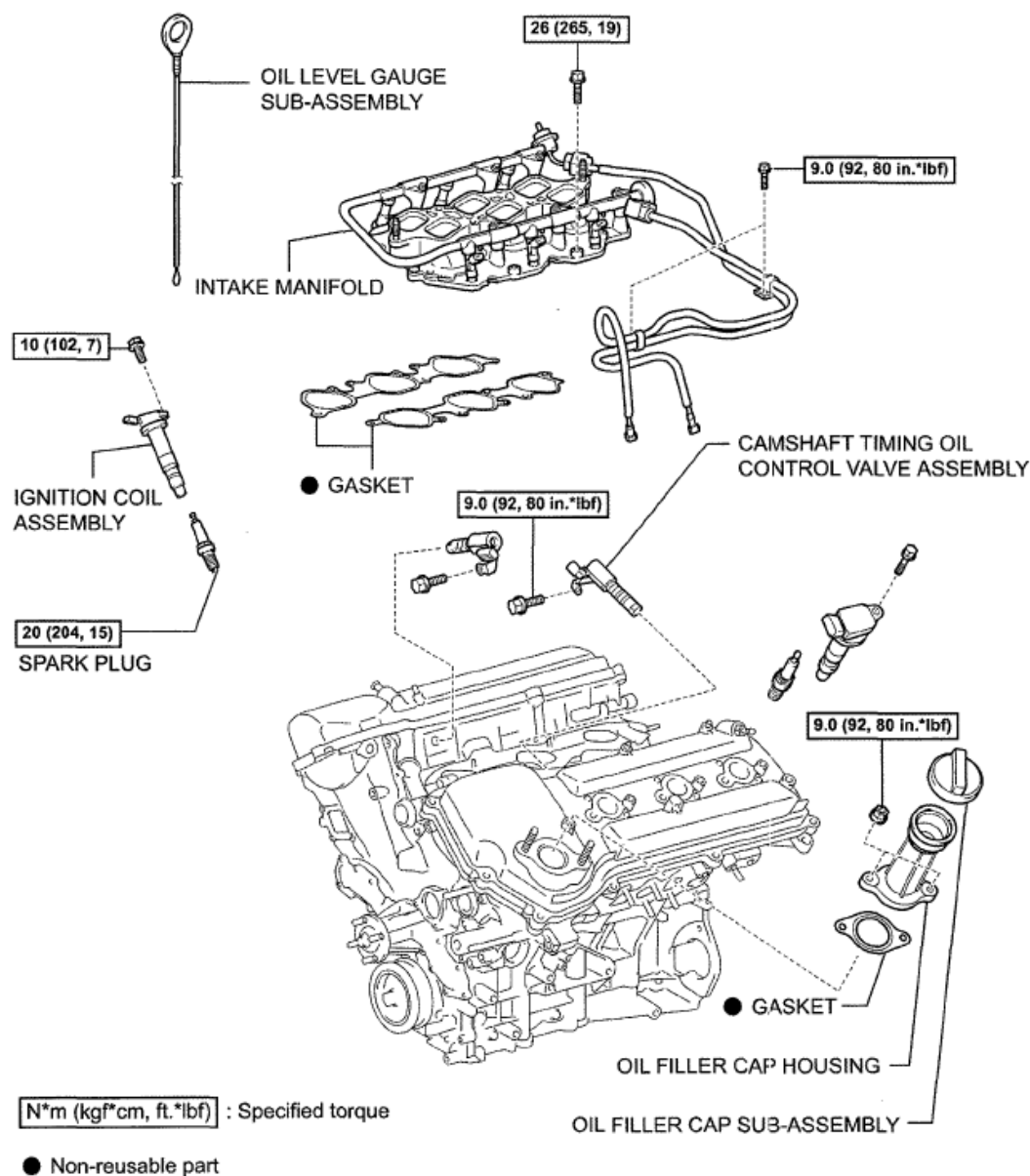
● Non-reusable part

A119923E02

Fig. 303: Identifying Engine Assembly Replacement Components With Torque Specifications (6 Of 8)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2008 Toyota Hilux 1GR-FE

2008 ENGINE Engine Mechanical (1GR-FE) - Hilux



A119790E01

Fig. 304: Identifying Engine Assembly Replacement Components With Torque Specifications (7 Of 8)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

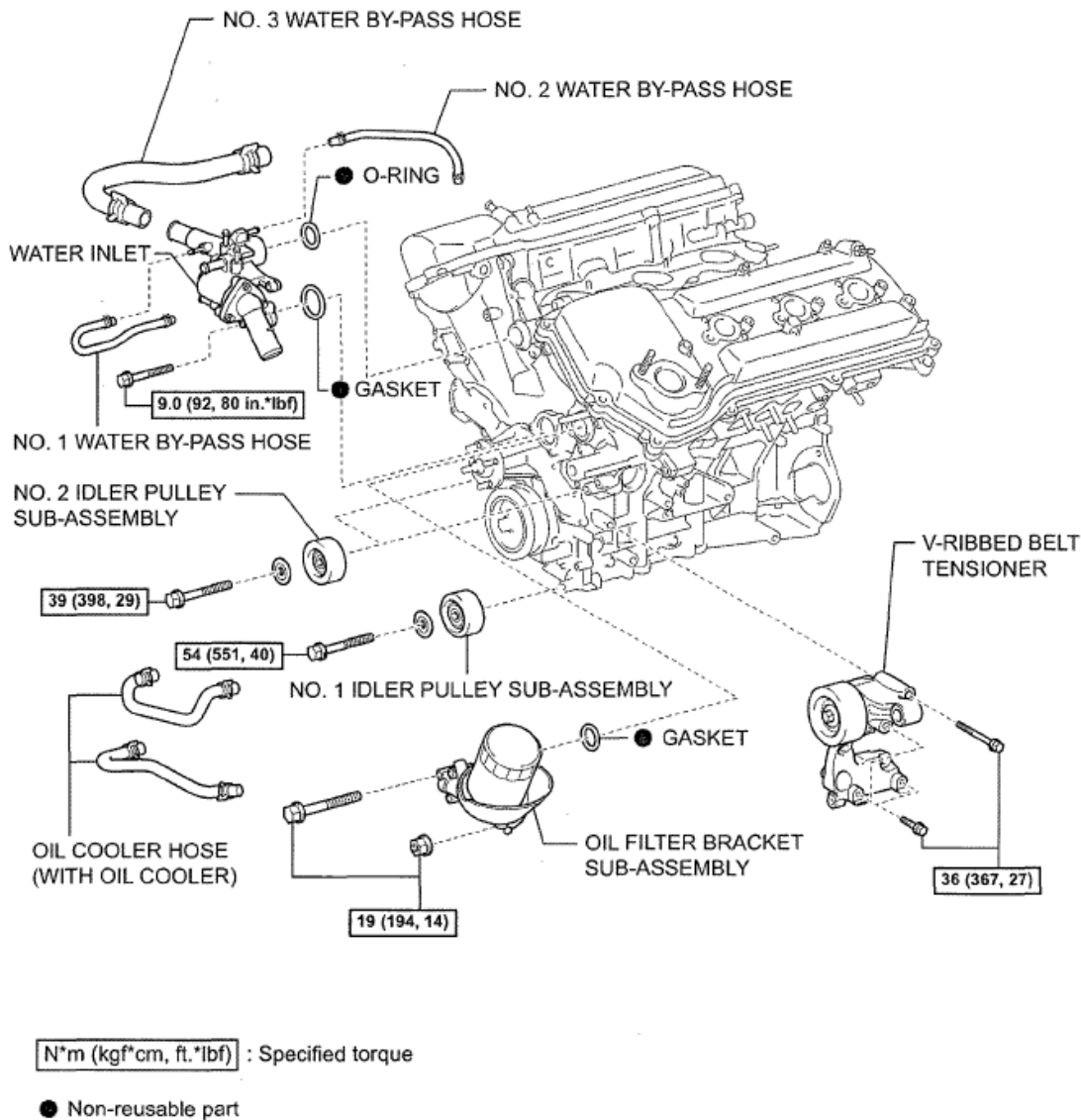


Fig. 305: Identifying Engine Assembly Replacement Components With Torque Specifications (8 Of 8)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. **DISCHARGE FUEL SYSTEM PRESSURE** (See **REMOVAL**)
2. **REMOVE AUTOMATIC TRANSMISSION ASSEMBLY** (for 2WD)

HINT:

(See **REMOVAL**)

3. **REMOVE AUTOMATIC TRANSMISSION ASSEMBLY** (for 4WD)

HINT:

(See **REMOVAL**)

4. **DRAIN ENGINE COOLANT** (See **REPLACEMENT**)
5. **DRAIN ENGINE OIL** (See **REMOVAL**)
6. **REMOVE BATTERY**
7. **REMOVE HOOD SUB-ASSEMBLY**
 - a. Disconnect the windshield washer hose.
 - b. Separate the 2 hood supports.
 - c. Remove the 4 bolts and hood.
8. **REMOVE V-BANK COVER** (See **REMOVAL**)
9. **REMOVE NO. 2 VENTILATION HOSE**
10. **REMOVE AIR CLEANER ASSEMBLY** (See **REMOVAL**)
11. **REMOVE RADIATOR SUPPORT SEAL UPPER**
 - a. Remove the 11 clips and radiator support seal upper.
12. **REMOVE RADIATOR ASSEMBLY** (See **REMOVAL**)
13. **REMOVE FAN SHROUD**
 - a. Unfasten the hose clamp, and disconnect the 2 oil cooler hoses from the fan shroud.
 - b. Remove the fan shroud.
14. **LOOSEN FAN WITH FLUID COUPLING** (See **REMOVAL**)
15. **REMOVE FAN AND GENERATOR V BELT** (See **REMOVAL**)
16. **REMOVE FAN WITH FLUID COUPLING**
 - a. Remove the 4 bolts and fan with fluid coupling.
17. **REMOVE FAN PULLEY**
18. **SEPARATE VANE PUMP ASSEMBLY** (See **REMOVAL**)
19. **REMOVE GENERATOR ASSEMBLY** (See **DISASSEMBLY**)
20. **SEPARATE COOLER COMPRESSOR** (See **REMOVAL**)
21. **DISCONNECT NO. 1 FUEL PIPE SUB-ASSEMBLY** (See **REMOVAL**)
22. **DISCONNECT NO. 2 FUEL PIPE SUB-ASSEMBLY** (See **REMOVAL**)
23. **DISCONNECT HEATER WATER INLET HOSE B**
24. **DISCONNECT HEATER WATER OUTLET HOSE A (FROM HEATER UNIT)**
25. **REMOVE INTAKE AIR SURGE TANK** (See **REMOVAL**)
26. **SEPARATE ENGINE WIRE**
 - a. Remove the front door scuff plate RH (See **REMOVAL**).
 - b. Remove the cowl side trim board RH (See **REMOVAL**).
 - c. Remove the glove compartment door (See **REMOVAL**).
 - d. Disconnect each connector for the ECM, four wheel drive control ECU (4WD only) and instrument panel wire before pulling out the engine wire into the engine room.

- e. Disconnect the front differential connector.

27. SEPARATE NO. 2 ENGINE WIRE

- a. Disconnect the ground cable from the cylinder block.

28. 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: 91671-10825

Torque: 33 N*m (336 kgf*cm, 24 ft.*lbf)

- b. Attach the engine sling device and hang the engine with the chain block.

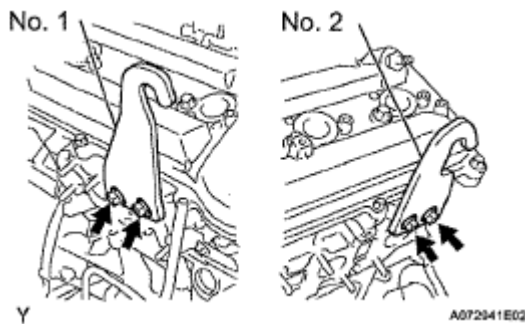


Fig. 306: Identifying Engine Hangers Bolts

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.

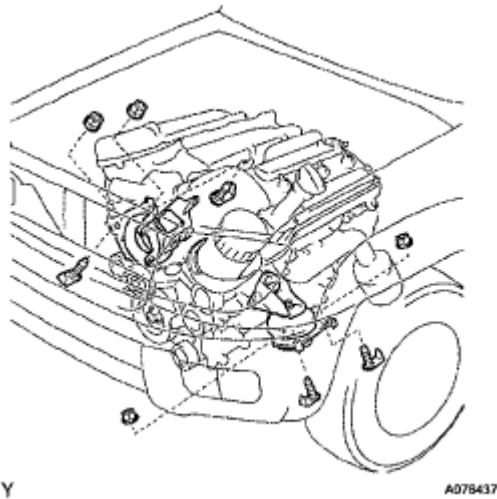


Fig. 307: Identifying Engine Mounting Brackets Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Lift the engine out of the vehicle carefully.

NOTE: Make sure the engine is clear of all wiring and hoses.

- e. Place the engine onto a working bench.

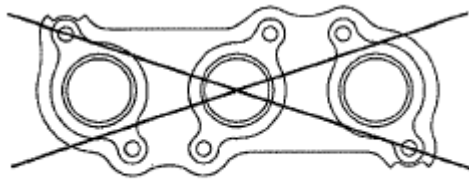
29. **REMOVE DRIVE PLATE & RING GEAR SUB-ASSEMBLY** (See REMOVAL)
30. **REMOVE ENGINE WIRE**
31. **REMOVE NO. 1 RADIATOR HOSE**
32. **REMOVE RADIATOR OUTLET, NO. 2 HOSE CLAMP OR CLIP**
33. **REMOVE HEATER WATER INLET HOSE A**
34. **REMOVE HEATER WATER OUTLET HOSE A (FROM HEATER UNIT)**
35. **REMOVE VENTILATION HOSE**
36. **REMOVE NO. 2 VENTILATION HOSE**
37. **REMOVE EXHAUST MANIFOLD SUB-ASSEMBLY RH**
 - a. Remove the 6 nuts, exhaust manifold and gasket.
38. **REMOVE EXHAUST MANIFOLD SUB-ASSEMBLY LH**
 - a. Remove the 6 nuts, exhaust manifold and gasket.
39. **INSPECT EXHAUST MANIFOLD FOR FLATNESS**
 - a. Using a precision straight edge and feeler gauge, measure the warpage of the contact surface of the cylinder head.

Maximum warpage: 0.7 mm (0.028 in.)

If warpage is greater than the maximum, replace the exhaust manifold.

HINT:

Maximum warpage of each installation surface: 0.3 mm (0.012 in.)



Y

A076808

Fig. 308: Identifying Exhaust Manifold For Flatness
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

40. **REMOVE FRONT NO. 1 ENGINE MOUNTING BRACKET RH**
 - a. Remove the 4 bolts and engine mounting bracket with engine mounting insulator.
41. **REMOVE FRONT NO. 1 ENGINE MOUNTING BRACKET LH**
 - a. Remove the 3 bolts and engine mounting bracket with engine mounting insulator.
42. **REMOVE NO. 2 IDLER PULLEY SUB-ASSEMBLY**
 - a. Remove the 2 bolts and 2 idler pulleys.
43. **REMOVE NO. 1 IDLER PULLEY SUB-ASSEMBLY**
 - a. Remove the bolt and idler pulley.
44. **REMOVE V-RIBBED BELT TENSIONER ASSEMBLY (See REMOVAL)**
45. **REMOVE WATER INLET (See REMOVAL)**
46. **REMOVE OIL FILTER BRACKET SUB-ASSEMBLY**
 - a. Remove the 3 bolts, 2 nuts, oil filter bracket and gasket.
47. **REMOVE INTAKE MANIFOLD (See REMOVAL)**
48. **INSPECT INTAKE MANIFOLD FOR FLATNESS**
 - a. Using a precision straight edge and feeler gauge, measure the warpage of the contact surface of the cylinder head and intake air surge tank.

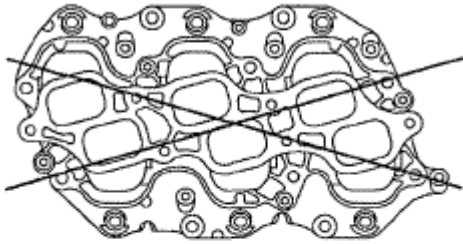
Maximum warpage:

Intake air surge tank side: 0.8 mm (0.031 in.)

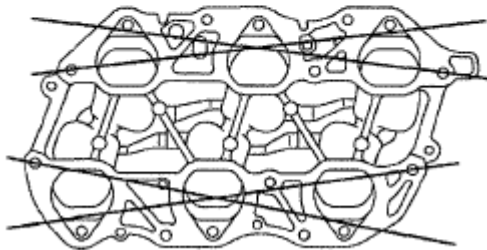
Cylinder head side: 0.2 mm (0.008 in.)

If warpage is greater than the maximum, replace the intake manifold.

Intake Air Surge Tank Side



Cylinder Head Side



Y

A076807E02

Fig. 309: Identifying Intake Manifold For Flatness
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

49. **REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY**
 - a. Remove the 2 bolts and 2 camshaft timing oil control valves.
50. **REMOVE WATER BY-PASS JOINT RR (See REMOVAL)**
51. **REMOVE OIL FILLER CAP SUB-ASSEMBLY**
52. **REMOVE OIL FILLER CAP HOUSING**
 - a. Remove the 2 nuts, oil filler cap housing and gasket.
53. **REMOVE IGNITION COIL ASSEMBLY**
54. **REMOVE SPARK PLUG**
55. **REMOVE OIL LEVEL GAUGE SUB-ASSEMBLY**
56. **REMOVE PARTIAL ENGINE ASSEMBLY**

INSTALLATION

1. **INSTALL OIL LEVEL GAUGE SUB-ASSEMBLY**
2. **INSTALL SPARK PLUG**

Torque: 20 N*m (204 kgf*cm, 15 ft.*lbf)

3. **INSTALL IGNITION COIL ASSEMBLY**

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

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**

- a. Insert the camshaft timing oil control valves to each cylinder head, and tighten the 2 bolts.

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

8. INSTALL INTAKE MANIFOLD (See INSTALLATION)**9. INSTALL OIL FILTER BRACKET SUB-ASSEMBLY**

- a. Install a new gasket and oil filter bracket with the 3 bolts and 2 nuts.

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

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 with engine mounting insulator with the 3 bolts.

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

15. INSTALL FRONT NO. 1 ENGINE MOUNTING BRACKET RH

- a. Install the engine mounting bracket with engine mounting insulator with the 4 bolts.

Torque: 43 N*m (438 kgf*cm, 32 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 OUTLET HOSE A (FROM HEATER UNIT)****21. INSTALL HEATER WATER INLET HOSE A****22. INSTALL RADIATOR OUTLET, NO. 2 HOSE CLAMP OR CLIP****23. INSTALL NO. 1 RADIATOR HOSE****24. INSTALL ENGINE WIRE****25. INSTALL DRIVE PLATE & RING GEAR SUB-ASSEMBLY (See INSTALLATION)**

26. INSTALL ENGINE ASSEMBLY

- a. Attach the engine sling device and hang the engine with the chain block.
- b. Lower the engine into the engine room carefully.
- c. Attach the engine mounting brackets to the frame brackets.
- d. Install the engine mounting brackets to the frame brackets with the 4 bolts and 4 nuts.

Torque: 38 N*m (387 kgf*cm, 28 ft.*lbf)

- e. Remove the 4 bolts and 2 engine hangers.

27. INSTALL NO. 2 ENGINE WIRE

- a. Install the ground cable to the cylinder block.

Torque: 13 N*m (133 kgf*cm, 9 ft.*lbf)

28. INSTALL ENGINE WIRE

- a. Connect the front differential connector.
- b. Insert the engine wire to the cabin space, and install the grommet.
- c. Connect each connector for the ECM, four wheel drive control ECU (4WD only) and instrument panel wire.
- d. Install the glove compartment door.
- e. Install the cowl side trim board RH.
- f. Install the front door scuff plate RH.

29. INSTALL INTAKE AIR SURGE TANK (See INSTALLATION)**30. CONNECT HEATER WATER OUTLET HOSE A (FROM HEATER UNIT)****31. CONNECT HEATER WATER INLET HOSE B****32. CONNECT NO. 2 FUEL PIPE SUB-ASSEMBLY (See INSTALLATION)****33. CONNECT NO. 1 FUEL PIPE SUB-ASSEMBLY (See INSTALLATION)****34. INSTALL COOLER COMPRESSOR (See INSTALLATION)****35. INSTALL GENERATOR ASSEMBLY (See INSTALLATION)****36. INSTALL VANE PUMP ASSEMBLY (See INSTALLATION)****37. INSTALL FAN PULLEY****38. INSTALL FAN WITH FLUID COUPLING**

- a. Temporarily install the fan with fluid coupling with the 4 nuts.

39. INSTALL FAN AND GENERATOR V BELT (See REMOVAL)**40. FULLY TIGHTEN FAN WITH FLUID COUPLING (See INSTALLATION)****41. INSTALL FAN SHROUD**

- a. Put the fan shroud into the engine room.
- b. Connect the 2 oil cooler hoses with the hose clamp.

42. INSTALL RADIATOR ASSEMBLY (See INSPECTION)

- 43. **INSTALL RADIATOR SUPPORT SEAL UPPER**
- 44. **INSTALL AIR CLEANER ASSEMBLY (See INSTALLATION)**
- 45. **CONNECT NO. 2 VENTILATION HOSE**
- 46. **INSTALL HOOD SUB-ASSEMBLY**
 - a. Install the hood with the 4 bolts.

Torque: 13 N*m (133 kgf*cm, 10 ft.*lbf)
 - b. Tighten the 2 hood supports.

Torque: 18 N*m (184 kgf*cm, 13 ft.*lbf)
 - c. Connect the windshield washer hose.
- 47. **ADJUST HOOD SUB-ASSEMBLY (See ADJUSTMENT)**
- 48. **INSTALL BATTERY**
- 49. **ADD ENGINE OIL (See INSTALLATION)**
- 50. **ADD ENGINE COOLANT (See REPLACEMENT)**
- 51. **INSTALL AUTOMATIC TRANSMISSION ASSEMBLY (for 2WD)**

HINT:

(See INSTALLATION)

- 52. **INSTALL AUTOMATIC TRANSMISSION ASSEMBLY (for 4WD)**

HINT:

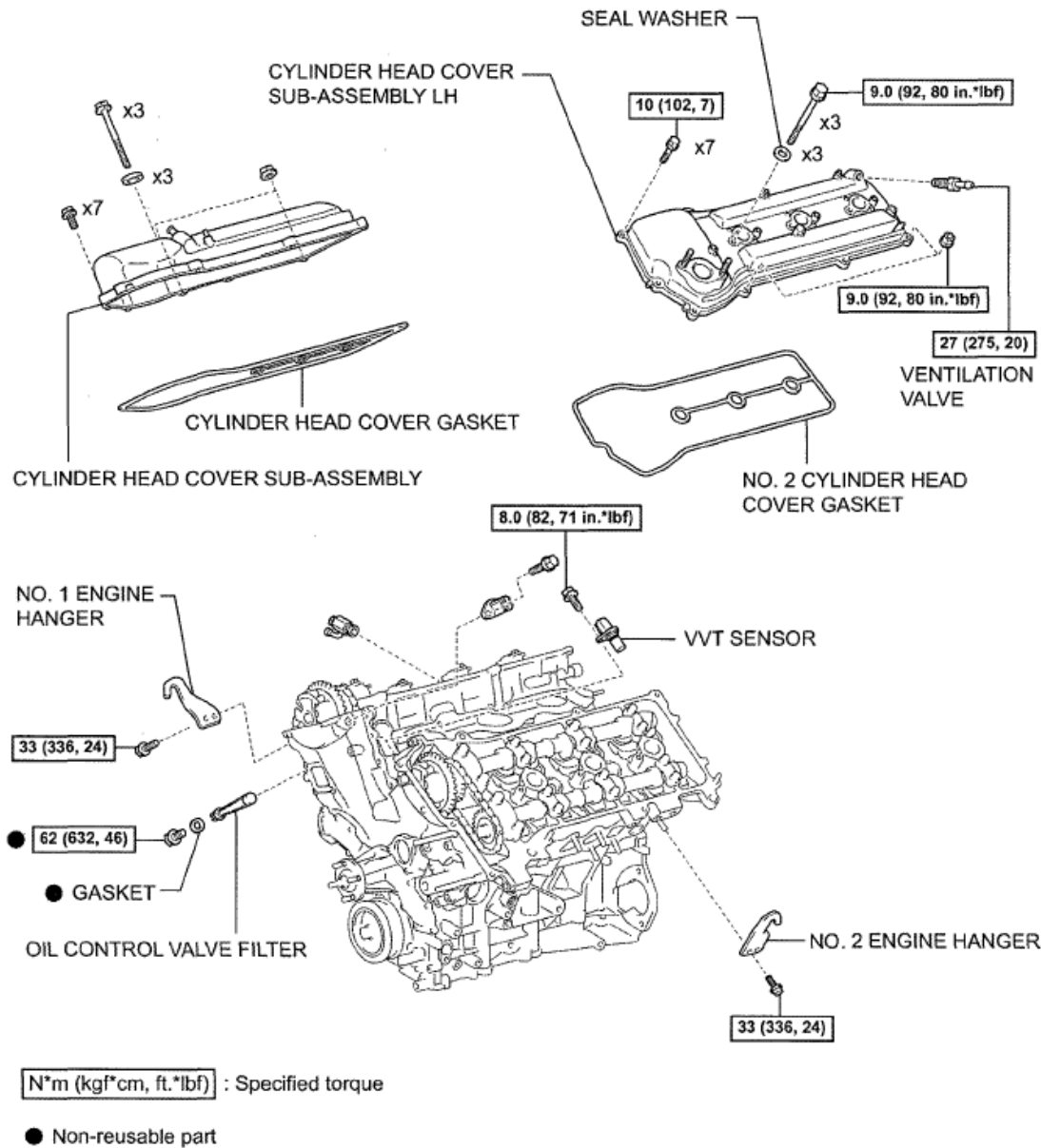
(See INSTALLATION)

- 53. **CHECK FOR ENGINE COOLANT LEAKAGE (See REPLACEMENT)**
- 54. **CHECK FOR FUEL LEAKAGE (See ON-VEHICLE INSPECTION)**
- 55. **CHECK FOR ENGINE OIL LEAKAGE**
- 56. **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)
- 57. **INSPECT IGNITION TIMING (See ON-VEHICLE INSPECTION)**
- 58. **INSPECT ENGINE IDLE SPEED (See ON-VEHICLE INSPECTION)**
- 59. **INSPECT CO/HC (See ON-VEHICLE INSPECTION)**

ENGINE UNIT

COMPONENTS

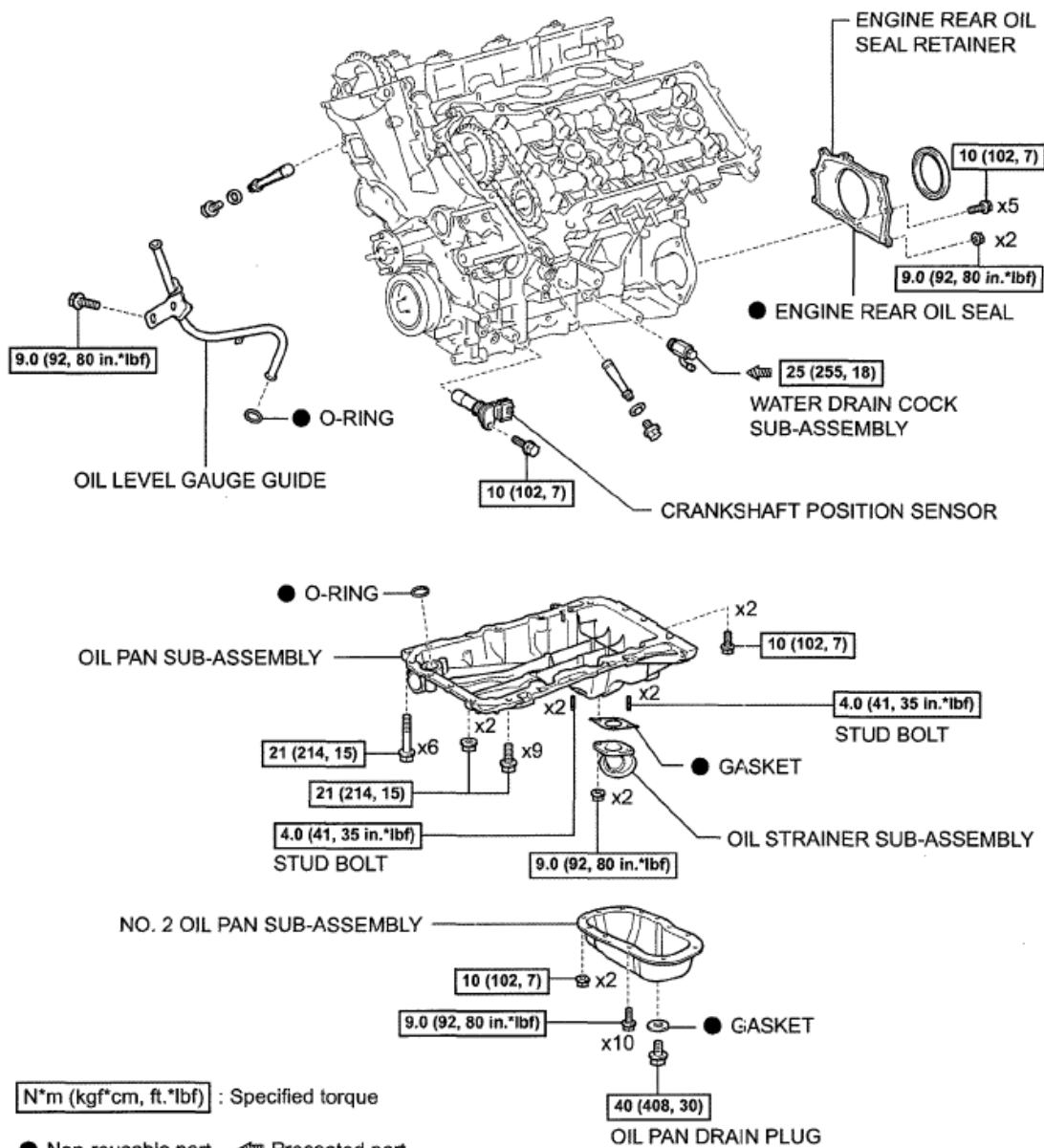


A119791E02

Fig. 310: Identifying Engine Unit Replacement Components With Torque Specifications (1 Of 8)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

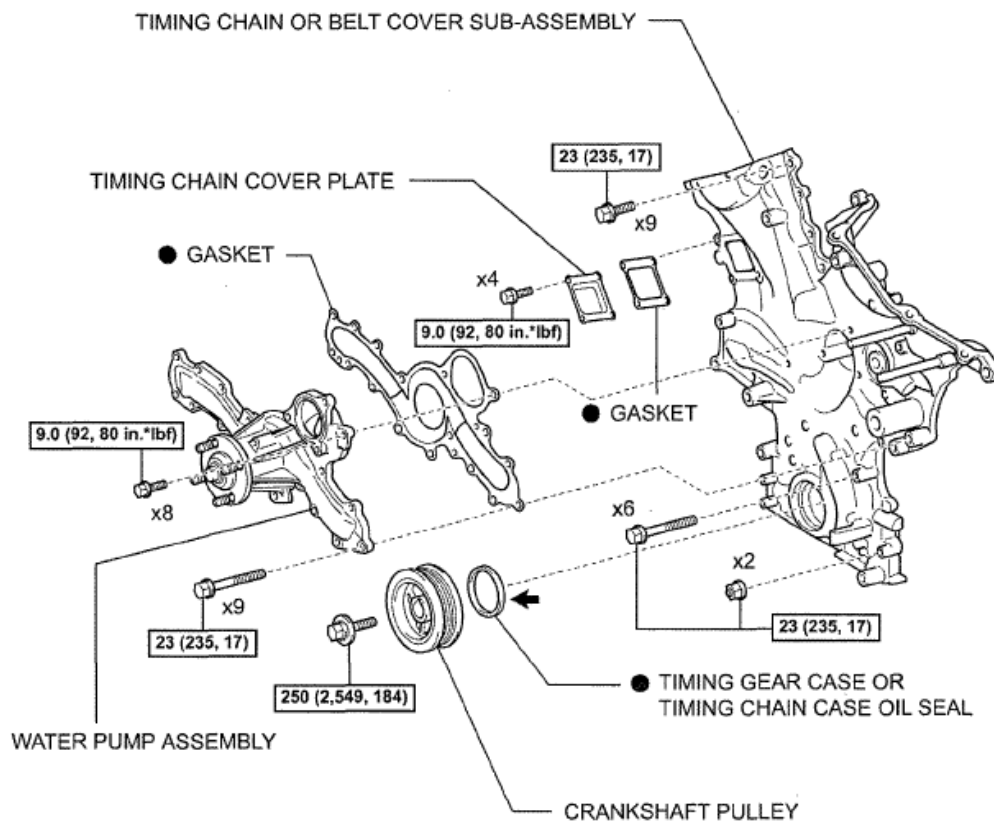
2008 Toyota Hilux 1GR-FE

2008 ENGINE Engine Mechanical (1GR-FE) - Hilux



A119792E03

Fig. 311: Identifying Engine Unit Replacement Components With Torque Specifications (2 Of 8)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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

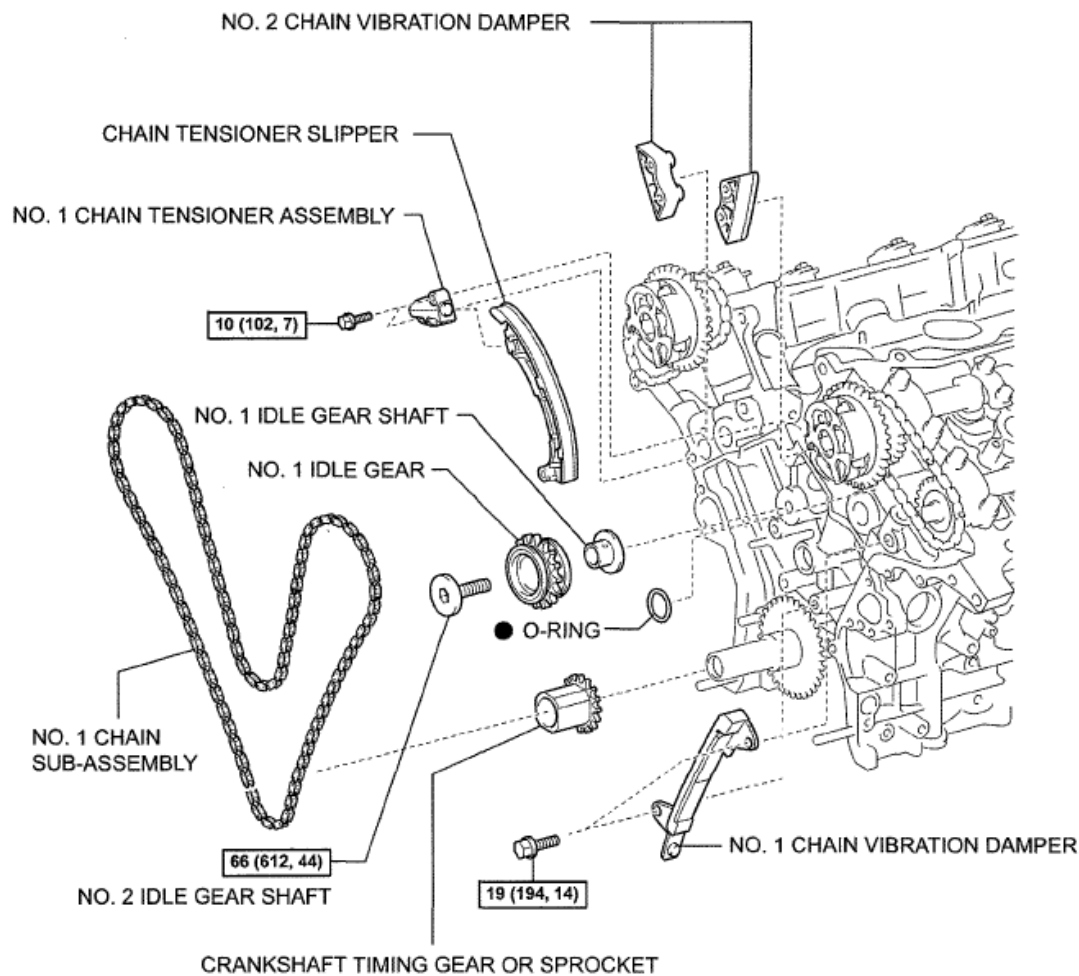
● Non-reusable part

← MP grease

Y

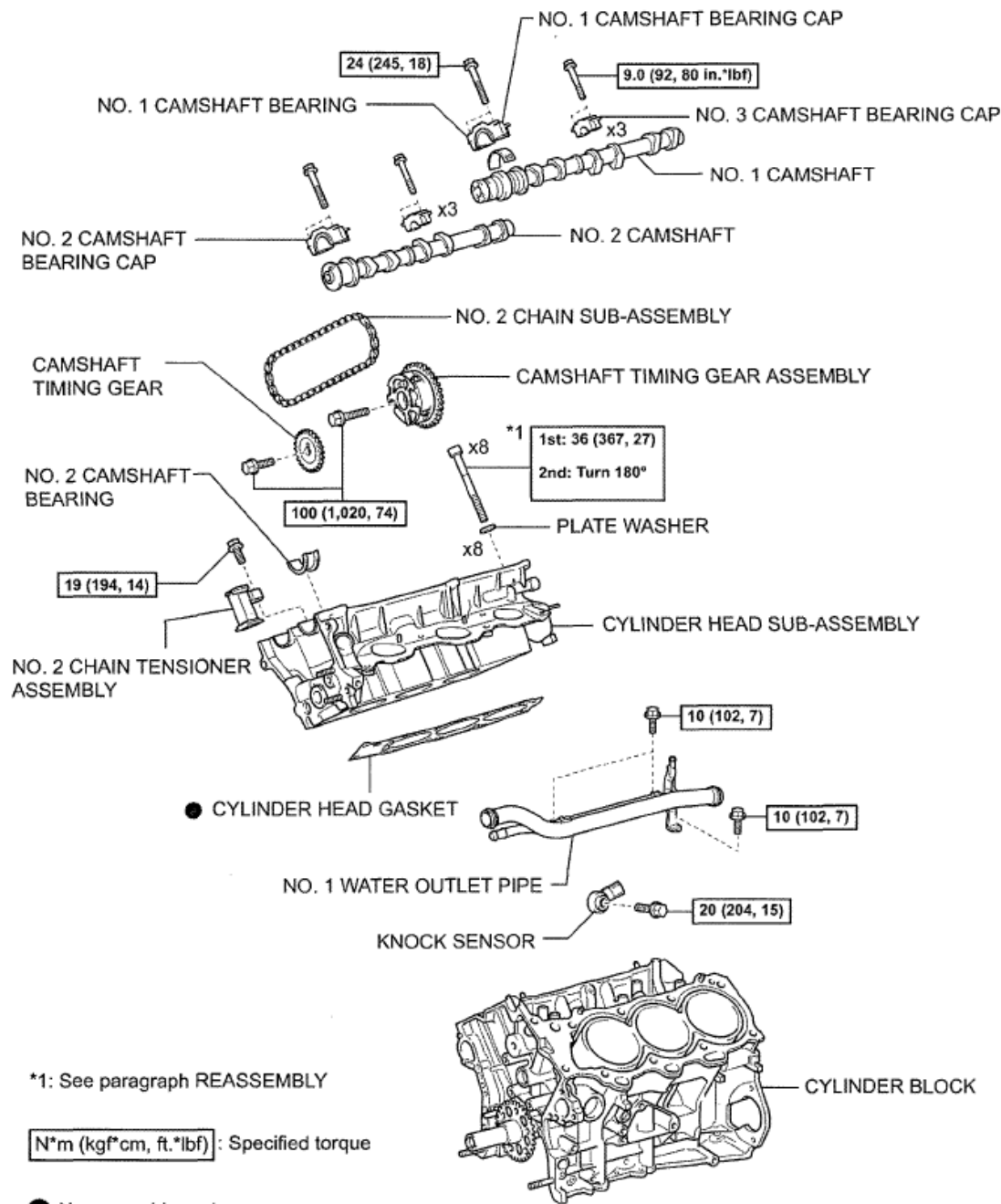
A119793E02

Fig. 312: Identifying Engine Unit Replacement Components With Torque Specifications (3 Of 8)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



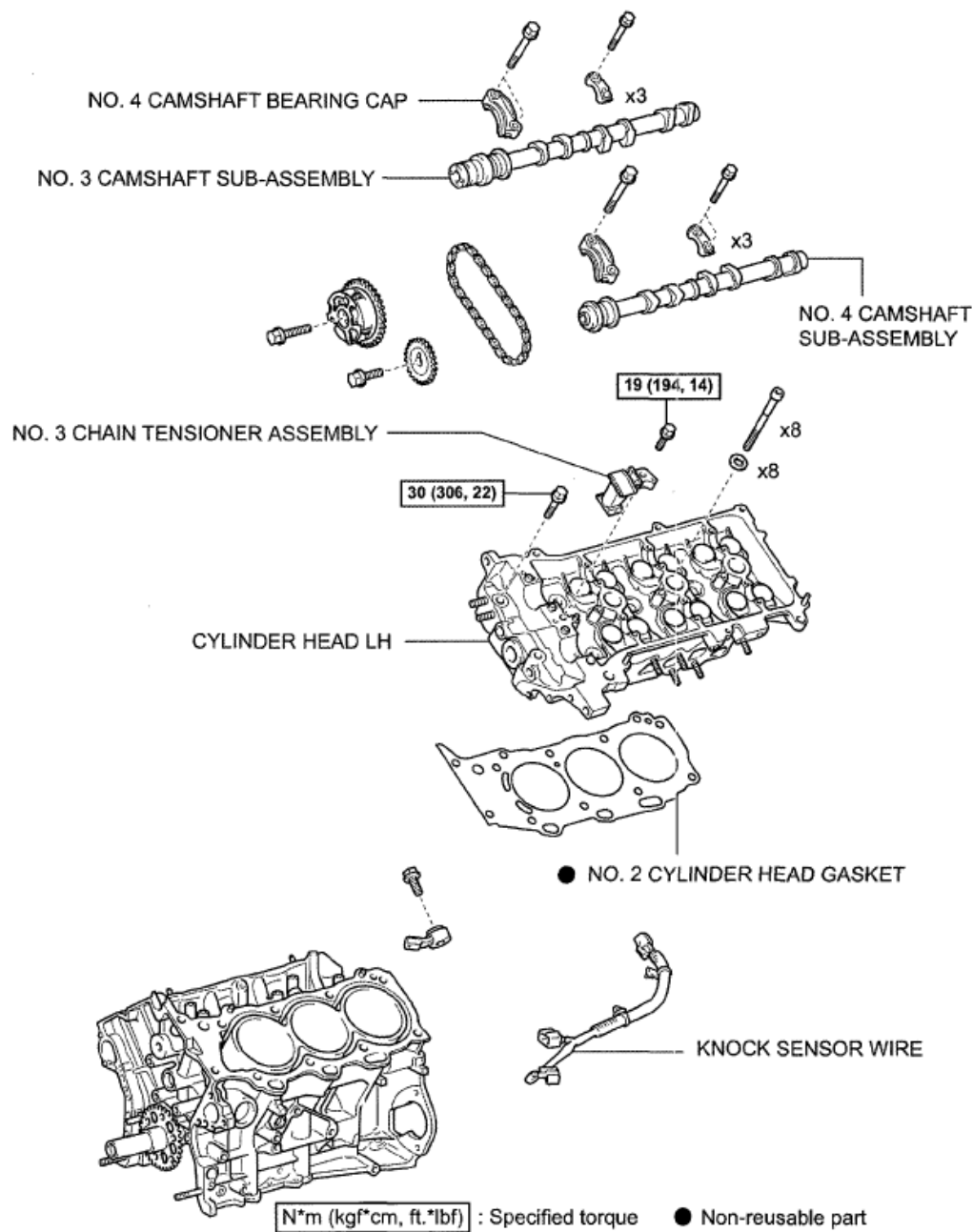
A119794E08

Fig. 313: Identifying Engine Unit Replacement Components With Torque Specifications (4 Of 8)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



A119795E04

Fig. 314: Identifying Engine Unit Replacement Components With Torque Specifications (5 Of 8)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



A119796E01

Fig. 315: Identifying Engine Unit Replacement Components With Torque Specifications (6 Of 8)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

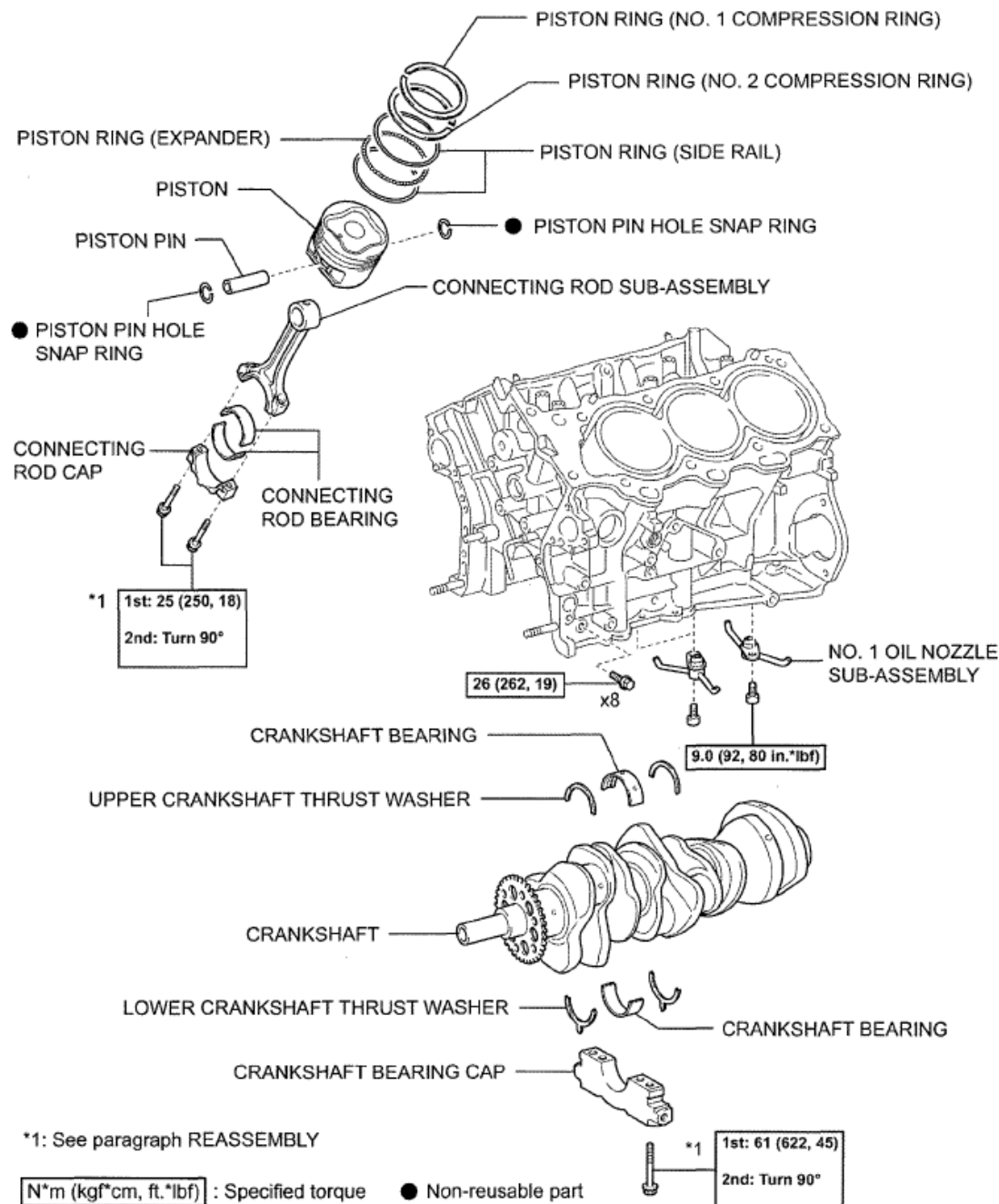


Fig. 316: Identifying Engine Unit Replacement Components With Torque Specifications (7 Of 8)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

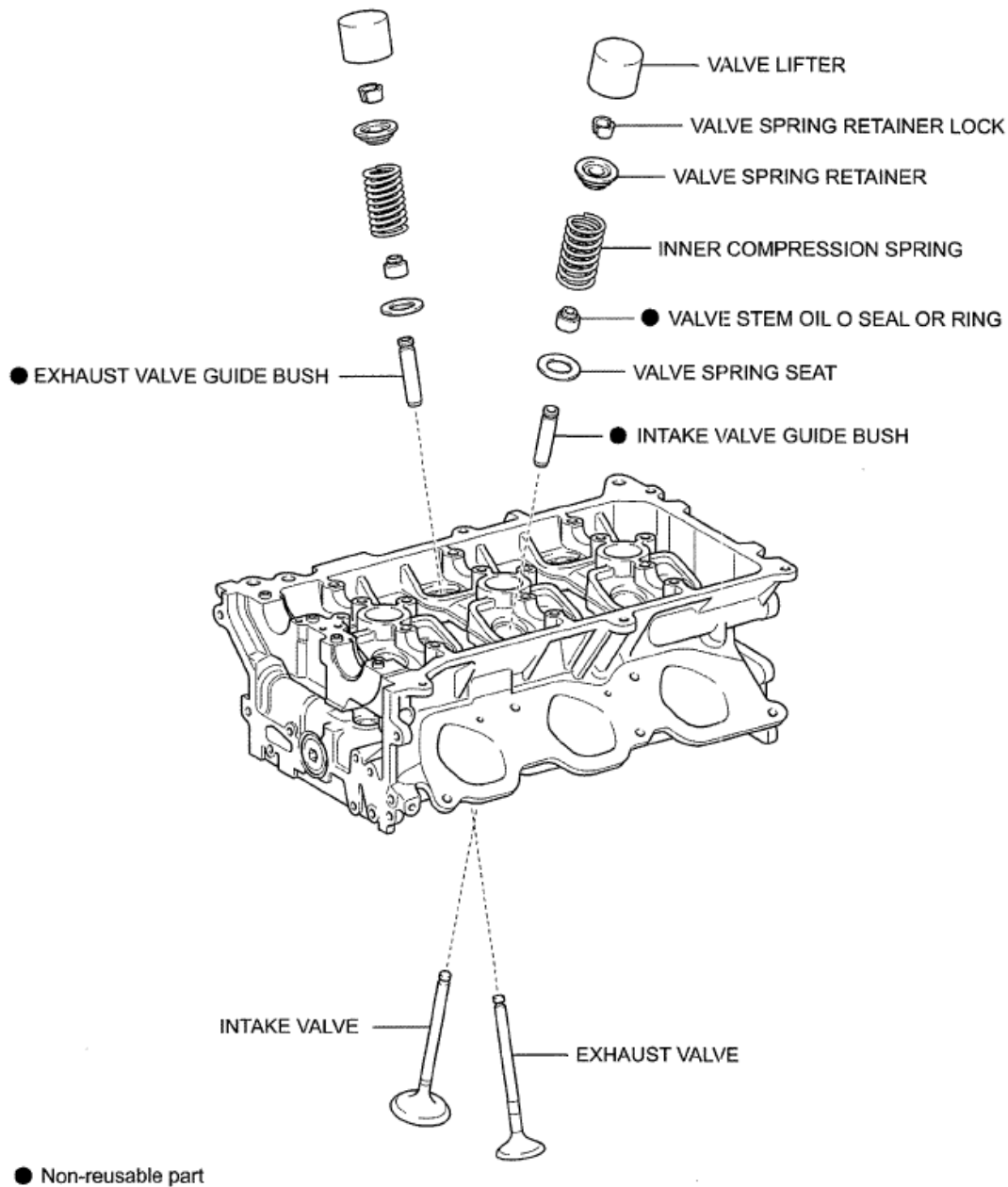


Fig. 317: Identifying Engine Unit Replacement Components (8 Of 8)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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 ones.

1. REMOVE NO. 1 ENGINE HANGER

- a. Remove the 2 bolts and No. 1 engine hanger.

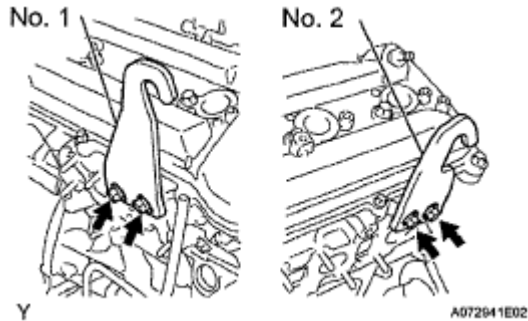


Fig. 318: Identifying Engine Hangers Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. REMOVE NO. 2 ENGINE HANGER

- a. Remove the 2 bolts and No. 2 engine hanger.

3. REMOVE OIL LEVEL GAUGE GUIDE

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

4. REMOVE CYLINDER BLOCK WATER DRAIN COCK SUB-ASSEMBLY

- a. Remove the 2 water drain cocks.

5. REMOVE VVT SENSOR

- a. Remove the 2 bolts and 2 VVT sensors.

6. REMOVE CRANKSHAFT POSITION SENSOR

- a. Remove the bolt and crankshaft position sensor.

7. REMOVE OIL CONTROL VALVE FILTER

- a. Remove the plug, filter and gasket from each cylinder head.

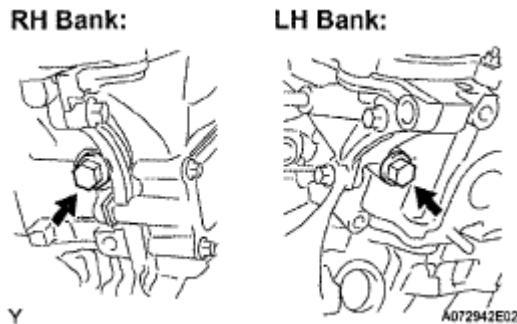


Fig. 319: Identifying Oil Control Valve Filter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY

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

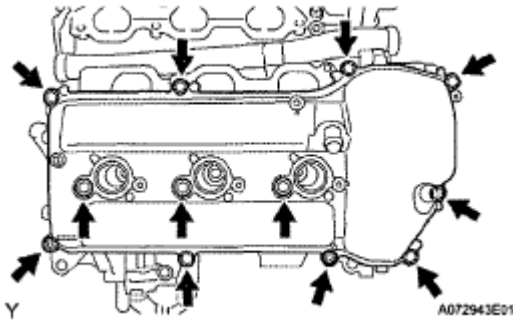


Fig. 320: Identifying Cylinder Head Cover Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY LH

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

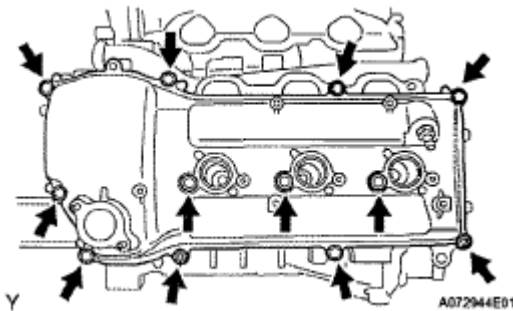


Fig. 321: Identifying Cylinder Head Cover Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the ventilation valve from the cylinder head cover.

10. REMOVE CRANKSHAFT PULLEY

- a. Turn the crankshaft pulley, and align the notch with the timing mark "0" of the timing chain cover.

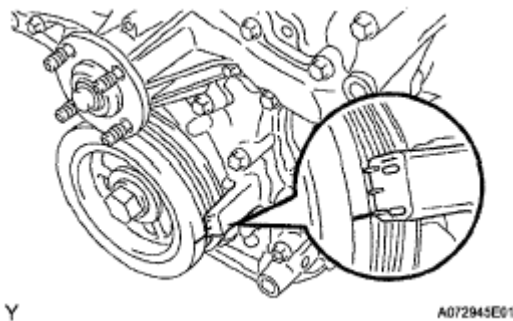
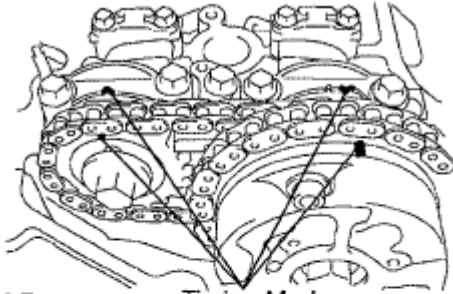


Fig. 322: Identifying Crankshaft Pulley Notch With Timing Mark 0 Of Timing Chain Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

RH Bank:



LH Bank:

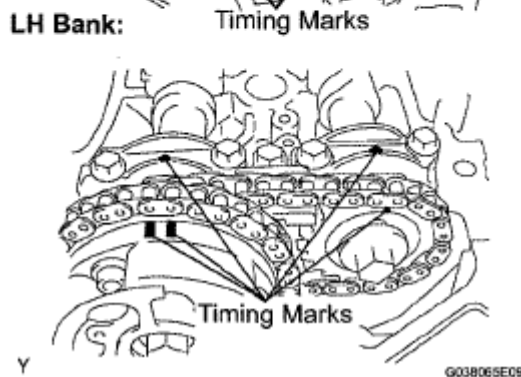


Fig. 323: Aligning Timing Marks Of Camshaft Timing Gears And Bearing Caps
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using SST, hold the crankshaft pulley and loosen the pulley set bolt.

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

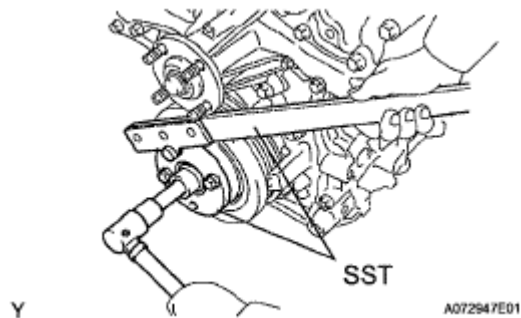


Fig. 324: Identifying Pulley Set Bolt Using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

SST 09950-50013 (09951-05010, 09952-05010, 09953-05020, 09954-05031)

11. REMOVE OIL PAN DRAIN PLUG

- a. Remove the drain plug and gasket.

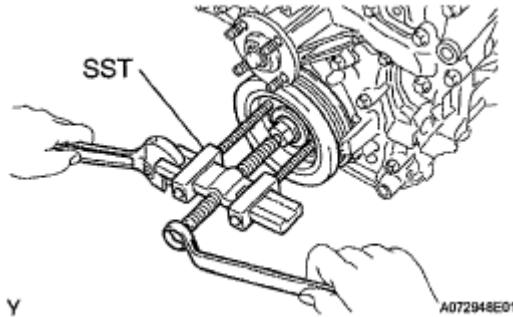


Fig. 325: Identifying Crankshaft Pulley
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. REMOVE NO. 2 OIL PAN SUB-ASSEMBLY

- a. Remove the 10 bolts and 2 nuts.

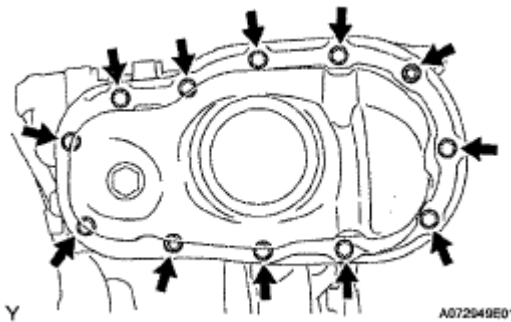


Fig. 326: Identifying Oil Pan Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

NOTE:

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

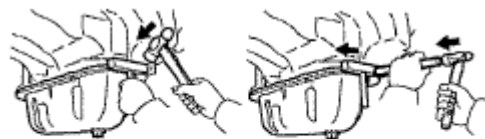


Fig. 327: Identifying Oil Pan
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. REMOVE OIL STRAINER SUB-ASSEMBLY

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

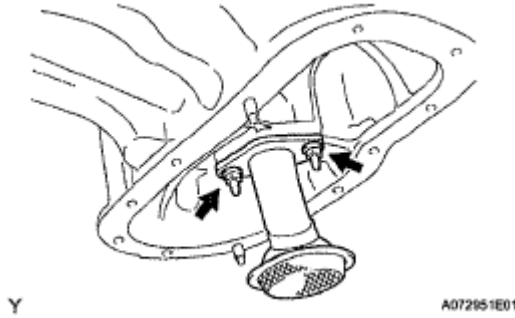


Fig. 328: Identifying Oil Strainer Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. REMOVE OIL PAN SUB-ASSEMBLY

- a. Remove the 17 bolts and 2 nuts.

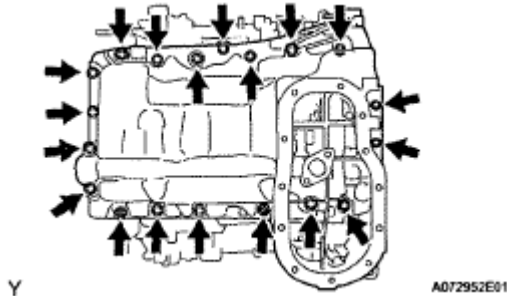


Fig. 329: Identifying Oil Pan Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the 4 stud bolts.
- c. Using a screwdriver, remove the oil pan by prying between the oil pan and cylinder block as shown in the illustration.

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

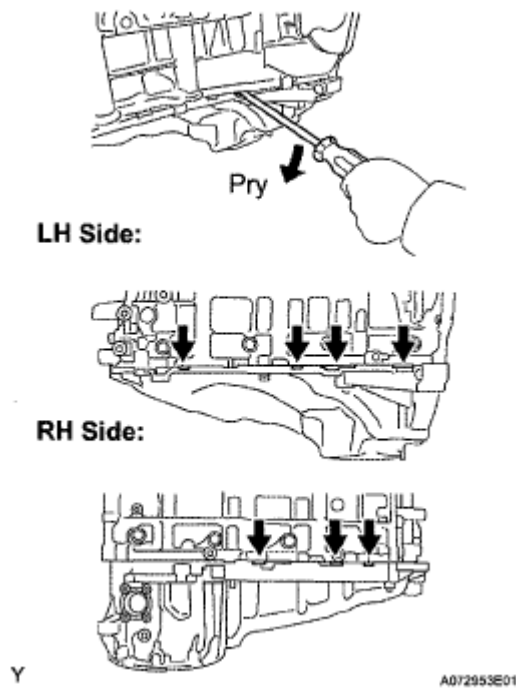


Fig. 330: Identifying Oil Pan

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

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

15. REMOVE WATER PUMP ASSEMBLY

- a. Remove the 17 bolts, water pump and gasket.

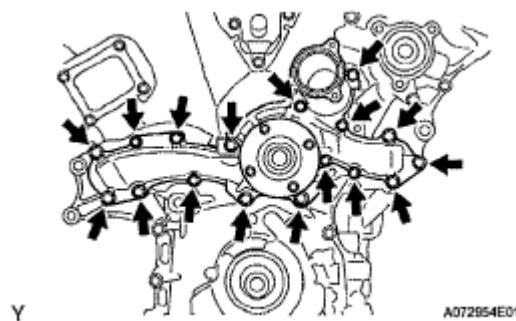


Fig. 331: Identifying Water Pump Bolts

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

16. REMOVE TIMING CHAIN OR BELT COVER SUB-ASSEMBLY

- a. Remove the 15 bolts and 2 nuts.

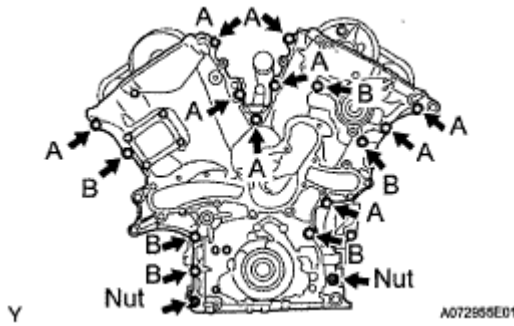


Fig. 332: Identifying Timing Chain Cover Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the timing chain cover by prying between the timing chain cover and cylinder head or cylinder block with a screwdriver.

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

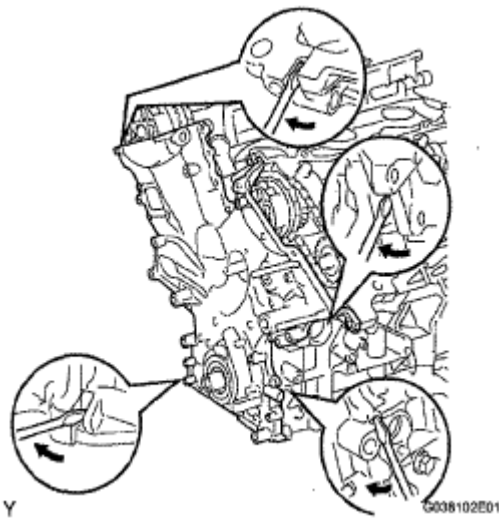


Fig. 333: Identifying Timing Chain Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Remove the O-ring from the LH cylinder head.
17. 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 oil pump assembly. Wrap the tip of the screwdriver with tape.

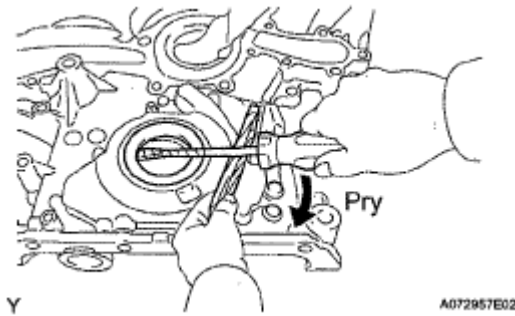


Fig. 334: Identifying Timing Chain Case Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

18. 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.
- a. While turning the stopper plate of the tensioner clockwise, push in the plunger of the chain tensioner as shown in the illustration.

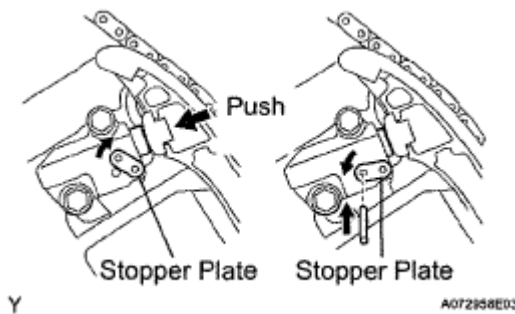


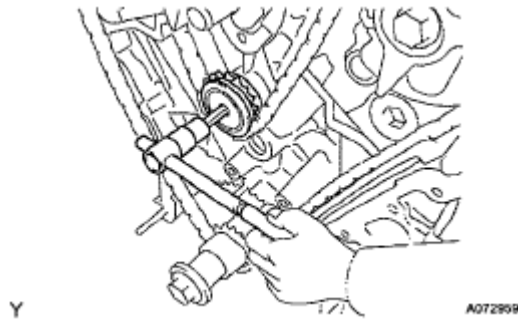
Fig. 335: Identifying Stopper Plate Of Tensioner
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. While turning the stopper plate of the tensioner counterclockwise, insert a bar of $\phi 3.5$ mm (0.138 in.) into the holes on the stopper plate and tensioner to fix the stopper plate.
- c. Remove the 2 bolts and chain tensioner.

19. REMOVE CHAIN TENSIONER SLIPPER

20. REMOVE NO. 1 IDLE GEAR SHAFT

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

**Fig. 336: Identifying Idle Gear Shaft**

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

21. REMOVE NO. 2 CHAIN VIBRATION DAMPER

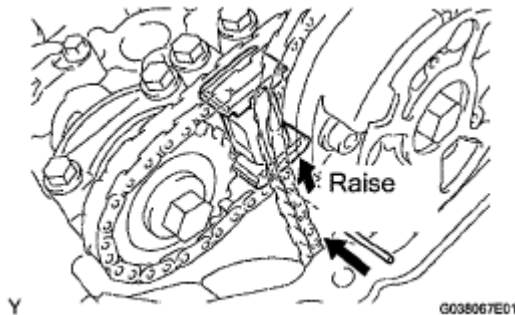
- a. Remove the 2 No. 2 chain vibration dampers.

22. REMOVE CHAIN SUB-ASSEMBLY**23. REMOVE CRANKSHAFT TIMING GEAR OR SPROCKET****24. REMOVE NO. 1 CHAIN VIBRATION DAMPER**

- a. Remove the 2 bolts and No. 1 chain vibration damper.

25. REMOVE CAMSHAFT TIMING GEARS AND NO. 2 CHAIN (for Bank 1)

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

**Fig. 337: Identifying No. 2 Chain Tensioner**

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 No. 2 timing chain.

NOTE:

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

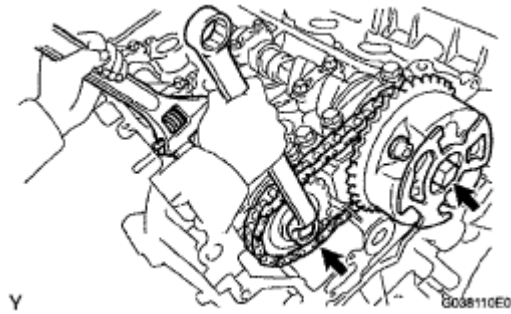


Fig. 338: Identifying Camshaft Timing Gear Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

26. REMOVE NO. 2 CHAIN TENSIONER ASSEMBLY

- a. Remove the bolt and No. 2 chain tensioner.

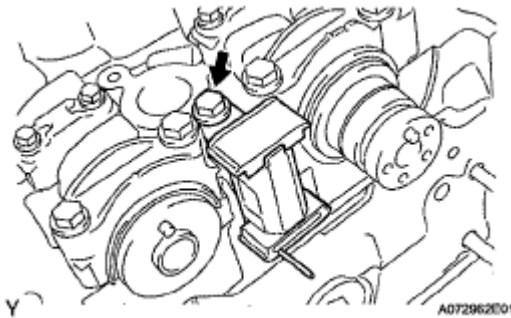


Fig. 339: Identifying Chain Tensioner Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

27. REMOVE CAMSHAFT TIMING GEARS AND NO. 2 CHAIN (for Bank 2)

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

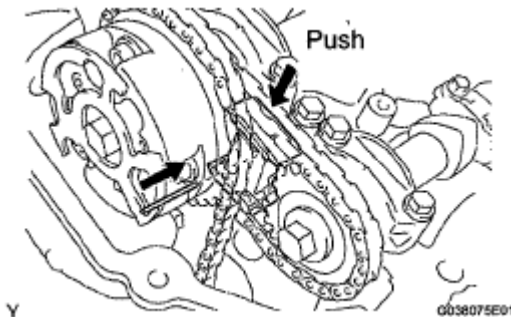


Fig. 340: Identifying No. 3 Chain Tensioner
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Hold the hexagonal portion of the camshaft with a wrench, and remove the 2 bolts, camshaft timing

gear, camshaft timing gear assembly and No. 2 timing chain.

NOTE:

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

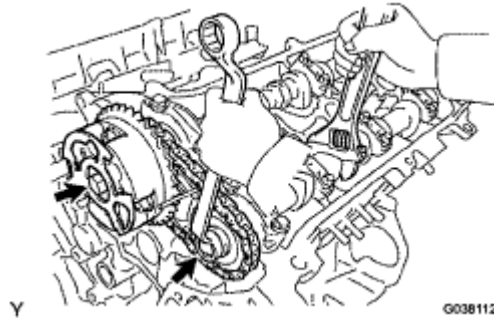


Fig. 341: Identifying Camshaft Timing Gear Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

28. REMOVE NO. 3 CHAIN TENSIONER ASSEMBLY

- a. Remove the bolt and No. 3 chain tensioner.

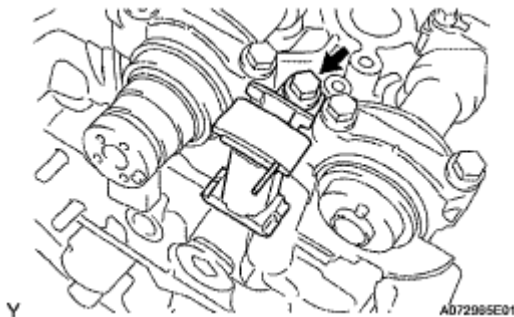


Fig. 342: Identifying Chain Tensioner Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

29. REMOVE CAMSHAFTS

NOTE:

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

- a. Remove the camshafts of the RH bank.
 1. Rotate the camshafts counterclockwise using a wrench so that the cam lobes of No. 1 cylinder face each direction as shown in the illustration.

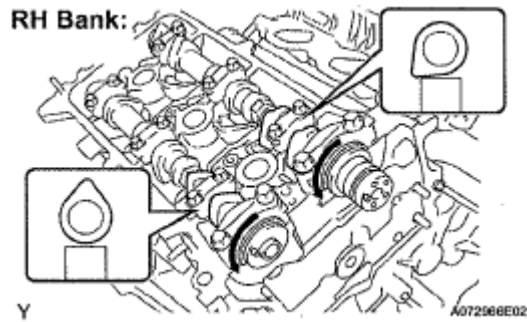


Fig. 343: Identifying Camshafts Counterclockwise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Using several steps, loosen and remove the 16 bearing cap bolts uniformly in the sequence as shown in the illustration.

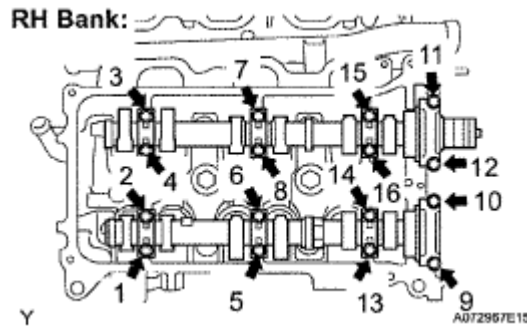


Fig. 344: Identifying Removal Sequence Of Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. Remove the 8 bearing caps and 2 camshafts.
- b. Remove the camshafts of the LH bank.
1. Using several steps, loosen and remove the 16 bearing cap bolts uniformly in the sequence as shown in the illustration.

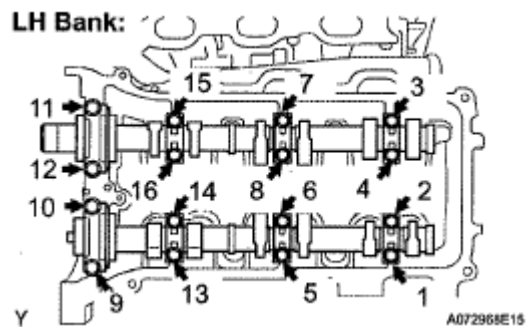


Fig. 345: Identifying Removal Sequence Of Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Remove the 8 bearing caps and 2 camshafts.
30. **REMOVE NO. 1 CAMSHAFT BEARING**
31. **REMOVE NO. 2 CAMSHAFT BEARING**
32. **REMOVE CYLINDER HEADS**
 - a. Using several steps, remove the 2 cylinder head bolts on the LH cylinder head in the sequence as shown in the illustration.

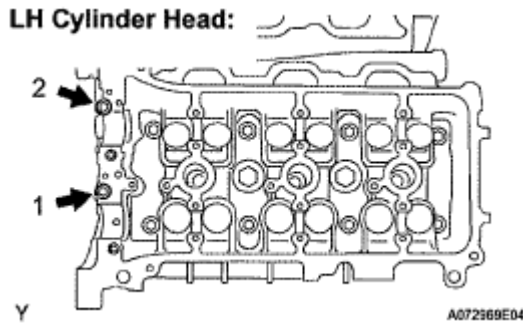


Fig. 346: Identifying Removal Sequence Of Cylinder Head Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using several steps, loosen the 8 cylinder head bolts on each cylinder head with a 10 mm bi-hexagon wrench in the sequence as shown in the illustration. Remove the 16 cylinder head bolts and plate washers.

NOTE:

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

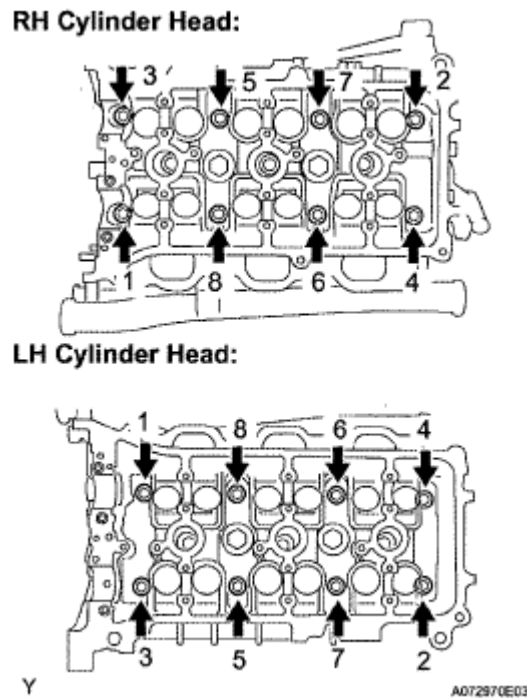


Fig. 347: Identifying Loosening Sequence Of Cylinder Head Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

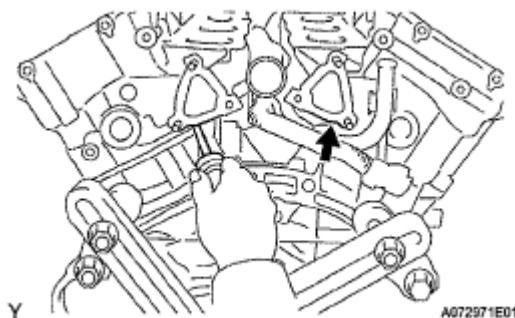


Fig. 348: Identifying Cylinder Head From Dowels On Cylinder Block
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Remove the RH and LH cylinder head gaskets.

33. REMOVE NO. 1 WATER OUTLET PIPE

- a. Separate the knock sensor wire.
- b. Remove the 3 bolts and water outlet pipe.

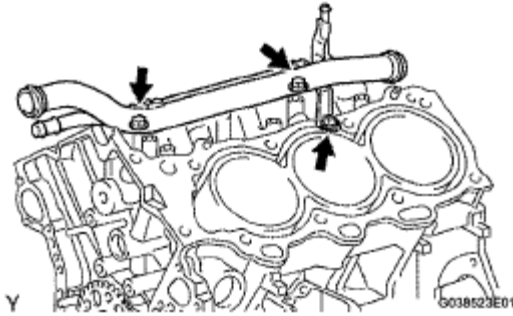


Fig. 349: Identifying Water Outlet Pipe Bolts

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

34. REMOVE KNOCK SENSOR

- a. Disconnect the knock sensor connectors.
- b. Remove the 2 bolts and 2 knock sensors.

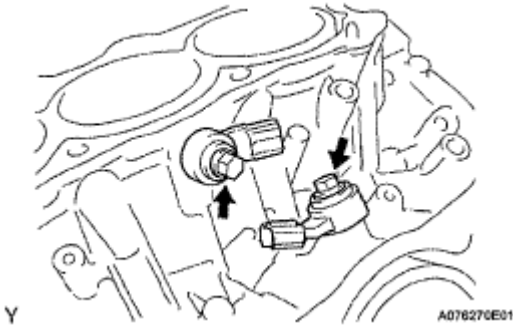


Fig. 350: Identifying Knock Sensor Bolts

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

35. REMOVE ENGINE REAR OIL SEAL RETAINER

- a. Remove the 5 bolts and 2 nuts.
- b. Using a screwdriver, remove the oil seal retainer by prying between the oil seal retainer and crankshaft bearing cap.

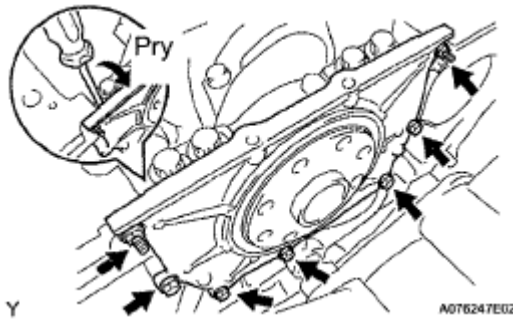


Fig. 351: Identifying Engine Rear Oil Seal Retainer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

36. REMOVE ENGINE REAR OIL SEAL

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

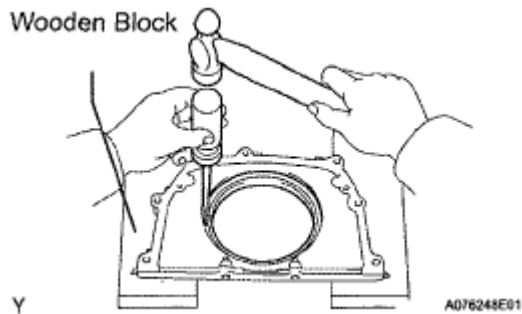


Fig. 352: Identifying Engine Rear Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

37. REMOVE VALVE LIFTER

HINT:

Arrange the valve lifter in the correct order.

38. REMOVE VALVE

HINT:

Arrange the valves, inner compression springs, valve spring retainers and valve spring retainer locks 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 locks.

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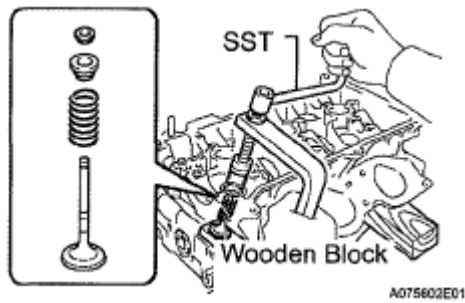


Fig. 353: Identifying Valve Spring Retainer Locks

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

- c. Remove the valve, inner compression spring, valve spring and valve spring retainer.

39. REMOVE VALVE SPRING SEAT

- a. Using compressed air and a magnetic finger, remove the valve spring seat by blowing air.



Fig. 354: Identifying Valve Spring Seat

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

40. REMOVE VALVE STEM OIL O SEAL OR RING

- a. Using needle-nose pliers, remove the valve stem oil seal.

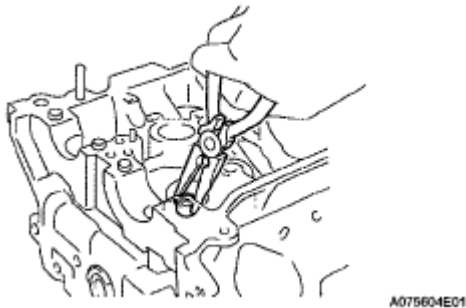


Fig. 355: Identifying Valve Stem Oil Seal

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

41. 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.)

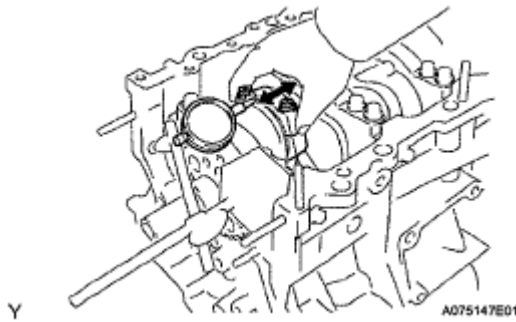


Fig. 356: Identifying Connecting Rod Thrust Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

42. INSPECT CONNECTING ROD OIL CLEARANCE

- a. Check the matchmarks on the connecting rod and cap are aligned to ensure correct reassembling.
- 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 pits and scratches.
- e. Lay a strip of Plastigage across the crank pin.

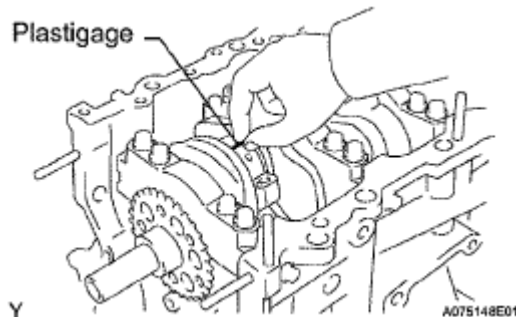


Fig. 357: Identifying Strip Of Plastigage Across Crank Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Check that the protrusion of the connecting rod cap is facing the correct direction.

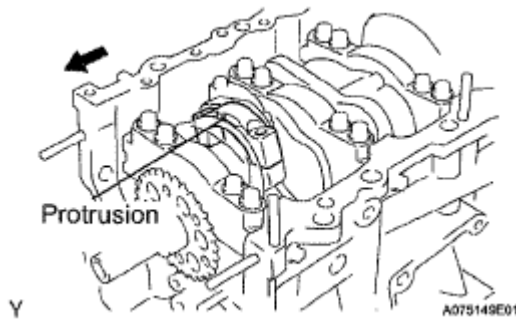


Fig. 358: Identifying Protrusion Of Connecting Rod Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Apply a light coat of engine oil to the threads of the connecting rod cap bolts.
- h. Tighten the bolts alternately with the specified torque.

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

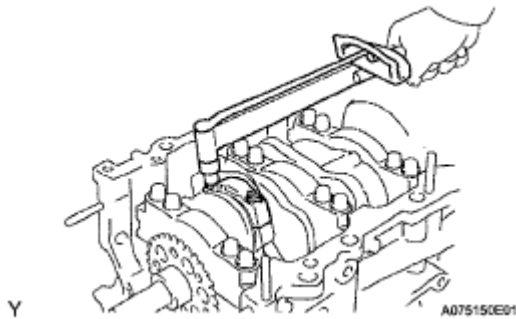


Fig. 359: Identifying Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

NOTE: Do not turn the crankshaft.

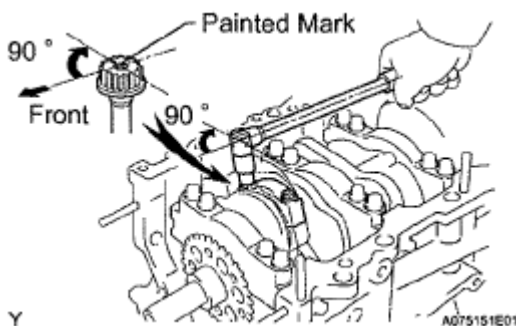


Fig. 360: Identifying Bearing Cap Bolts

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

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

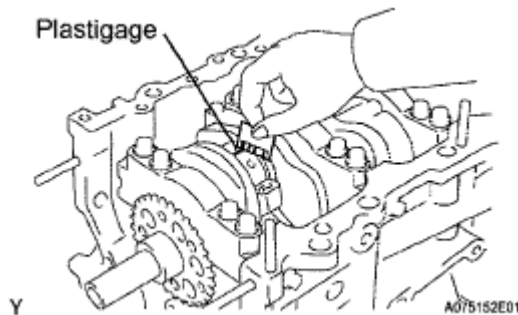


Fig. 361: Identifying Plastigage At Its Widest Point
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

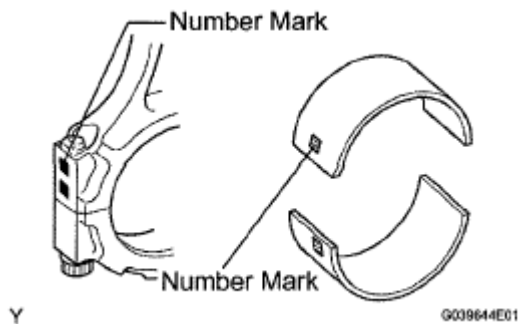


Fig. 362: Identifying Number Marked On Connecting Rod
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

Standard bearing center wall thickness

BEARING THICKNESS SPECIFICATION

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)

43. REMOVE PISTON SUB-ASSEMBLY WITH CONNECTING ROD

- a. Using a ridge reamer, remove all the carbon from the top of the cylinder.

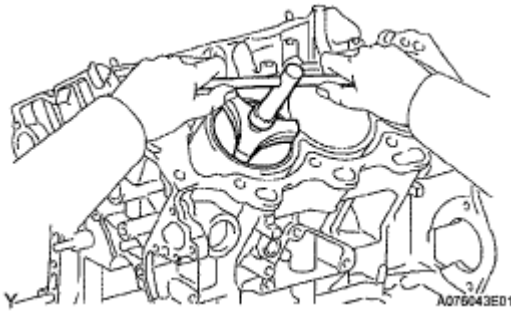


Fig. 363: Identifying Carbon From Top Of Cylinder Using Ridge Reamer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. 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 assemblies in the correct order.

44. REMOVE CONNECTING ROD BEARING**45. REMOVE PISTON RING SET**

- a. Using a piston ring expander, remove the 2 compression rings.

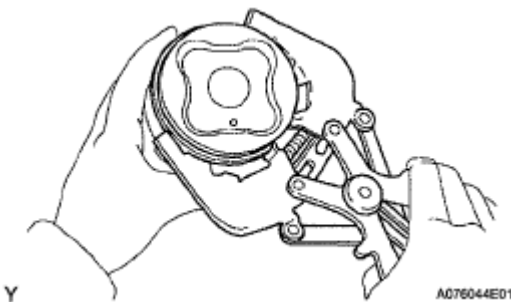


Fig. 364: Identifying Compression Rings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the 2 side rails and oil ring by hand.

46. REMOVE PISTON PIN HOLE SNAP RING

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

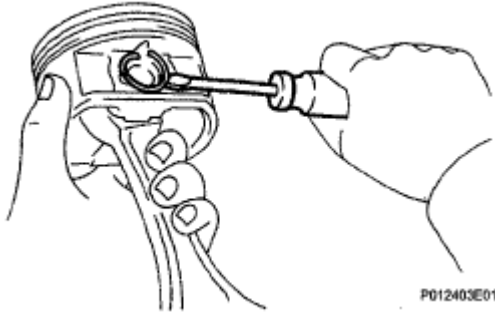


Fig. 365: Identifying Piston Pin Hole Snap Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

47. REMOVE WITH PIN PISTON SUB-ASSEMBLY

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

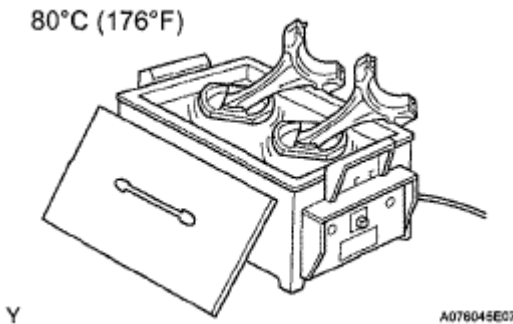


Fig. 366: Identifying Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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.

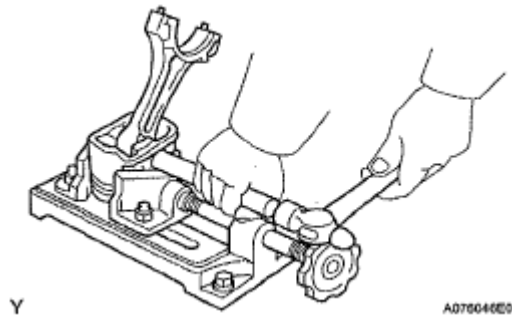


Fig. 367: Identifying Piston Pin And Connecting Rod
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

48. 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 a crankshaft.

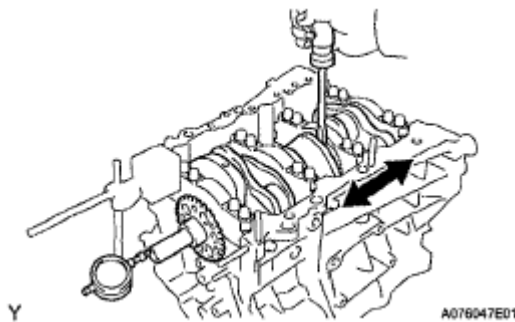


Fig. 368: Identifying Crankshaft Thrust Clearance
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

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

49. REMOVE CRANKSHAFT

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

the sequence as shown in the illustration.

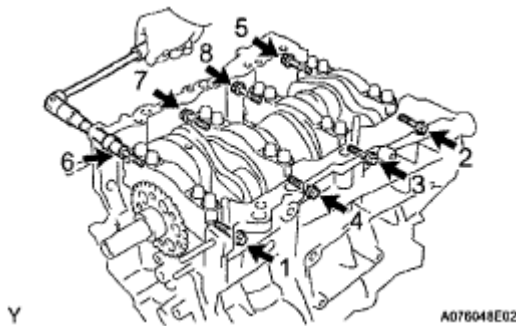


Fig. 369: Identifying Sequence Of Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

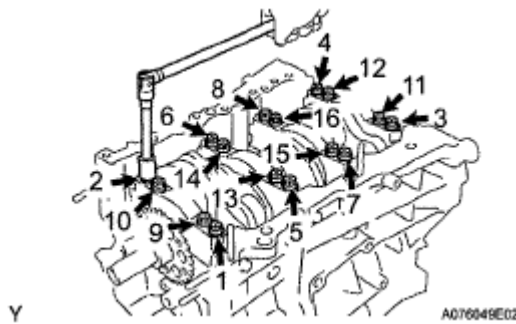


Fig. 370: Identifying Loosening Sequence Of Main Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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 while turning it little by little to the right and the left.
- Be careful not to damage the joint surfaces of the cylinder block and the main bearing cap.

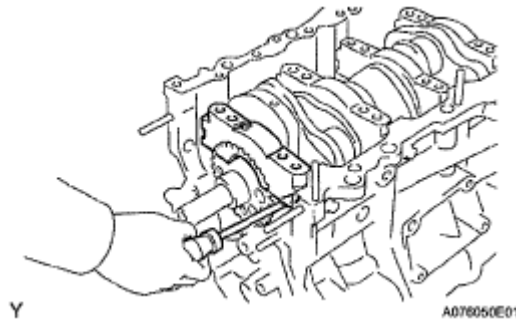


Fig. 371: Identifying Main Bearing Caps And Lower Bearings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 50. REMOVE CRANKSHAFT THRUST WASHER SET
- 51. REMOVE CRANKSHAFT BEARING
- 52. REMOVE NO. 1 OIL NOZZLE SUB-ASSEMBLY
 - a. Using a 5 mm socket hexagon wrench, remove the 3 oil nozzles.

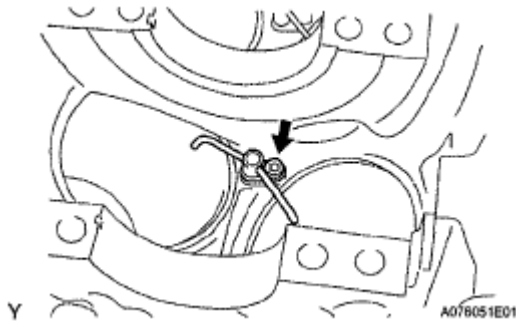


Fig. 372: Identifying Oil Nozzles
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION

1. INSPECT CAMSHAFTS

- a. Inspect the camshaft for runout.

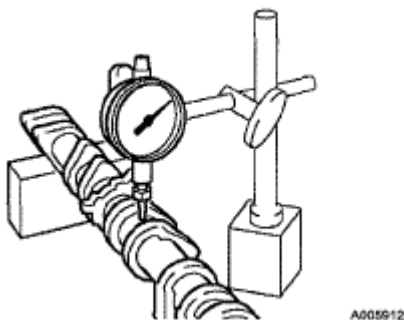


Fig. 373: Identifying Camshaft Runout

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

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

Maximum runout:

0.06 mm (0.0024 in.)

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

- b. Inspect the cam lobes.

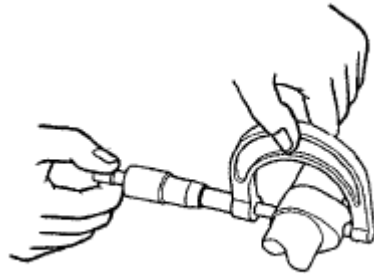
1. Using a micrometer, measure the cam lobe height.

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.)



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Fig. 374: Identifying Cam Lobe Height

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

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.

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.

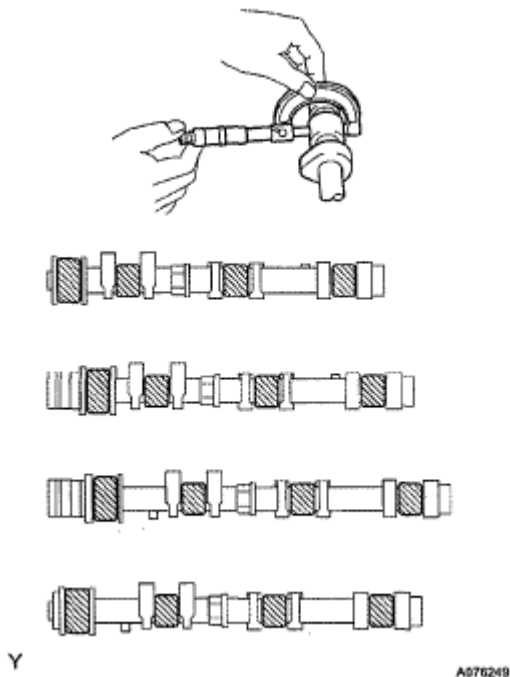


Fig. 375: Identifying Journal Diameter

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

2. INSPECT CAMSHAFT TIMING GEAR ASSEMBLY

- a. Fix the intake camshaft with a vise.

NOTE: Be careful not to damage the camshaft.

- 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)

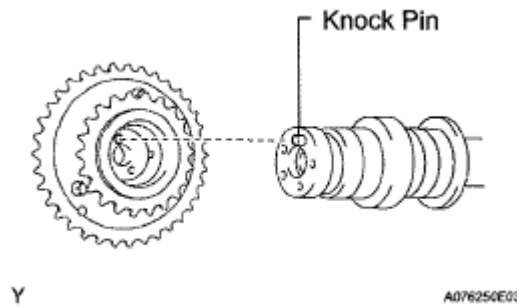


Fig. 376: Identifying Knock Pin

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

- c. Confirm the camshaft timing gear assembly is locked.
- d. Release the lock pin.
 - 1. Cover 4 oil paths of the cam journal with a masking tape as shown in the illustration.

HINT:

One of the 2 grooves on the cam journal is for retards (upper) and the other is for advances (lower). Each groove has 2 oil paths. Plug one of the oil paths for each groove with rubber pieces before wrapping the cam journal with tape.

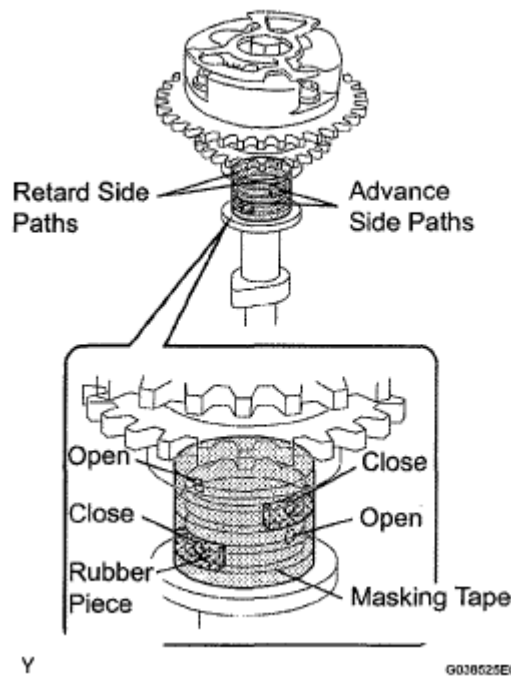


Fig. 377: Identifying Oil Paths Of Cam Journal With Masking Tape

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

- 2. Prick a hole in the tape placed on the advance side path. Prick a hole in the retard side path, on the opposite side to that of the advance side path, as shown in the illustration.

3. Apply about 200 kPa (2.0 kgf/cm²) of air pressure to the two broken paths (the advance side path and the retard side path).

NOTE: Cover the paths with a shop rag to avoid oil splashing.

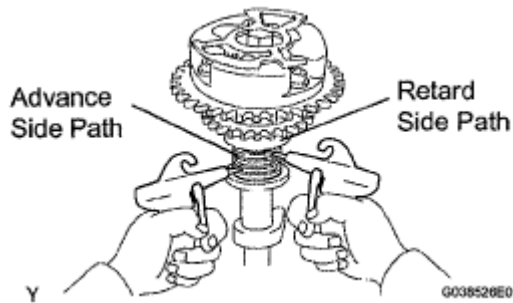


Fig. 378: Identifying Air Pressure To Broken Paths
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. Confirm that the camshaft timing gear assembly rotates in the advance direction when reducing the air pressure applied to the retard path.

HINT:

When the lock pin is released, the camshaft timing gear rotates in the advance direction.

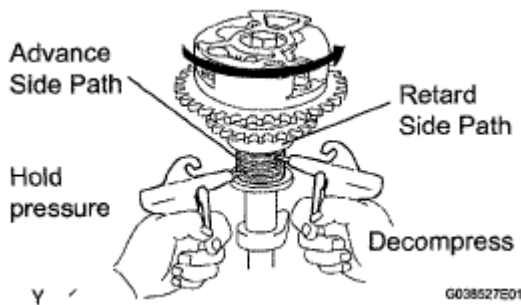


Fig. 379: Identifying Air Pressure To Broken Paths
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. When the camshaft timing gear comes to the most advanced position, release the air pressure from the retard side path, and then release the air pressure from the advance side path.

NOTE: The camshaft timing assembly gear occasionally shifts to the retard side abruptly, if air compression of the advanced side path is released first. It often results in the breakage of the lock pin.

- e. Check for smooth revolution.

1. Except the position where the lock pin meets at the most retard angle, turn the camshaft timing gear assembly back and forth and check the movable range and that there is no disturbance.

Standard:

Movable smoothly in the range about 31°

NOTE: Be sure to perform this check by hand, instead of air pressure.

- f. Check the lock in the most retarded position.
 1. Confirm that the camshaft timing gear assembly is locked at the most retarded position.
- g. Remove the set bolt and camshaft timing gear assembly.

NOTE: Be sure not to remove the other 3 bolts.

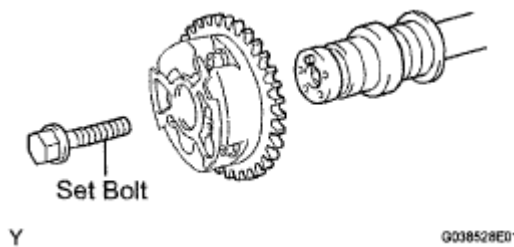


Fig. 380: Identifying Set Bolt And Camshaft Timing Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. INSPECT CYLINDER HEAD SET BOLT

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

Standard outside diameter:

10.85 to 11.00 mm (0.4272 to 0.4331 in.)

Minimum outside diameter:

10.7 mm (0.421 in.)

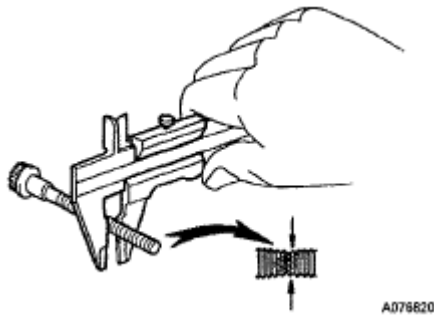


Fig. 381: Identifying Outside Thread Diameter Of Cylinder Head Set Bolt
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. INSPECT CHAIN SUB-ASSEMBLY

- a. Using a spring scale, pull the chain sub assembly with a force of 147 N (15.0 kgf, 33.1 lbf) and measure the length of the chain sub assembly by vernier calipers.

Maximum chain elongation:

146.8 mm (5.780 in.)

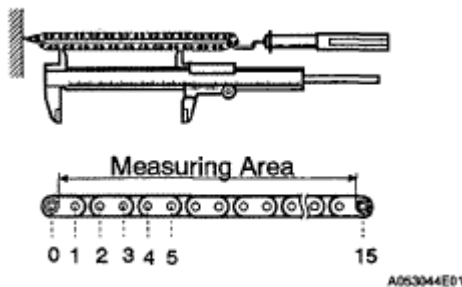


Fig. 382: Identifying Length Of Chain Sub Assembly By Vernier Calipers
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE: Perform the same measurements by pulling at random in 3 or more places to obtain an average length.

If the elongation is greater than the maximum, replace the chain.

5. INSPECT NO. 2 CHAIN SUB-ASSEMBLY

- a. Using a spring scale, pull the chain sub assembly with a force of 147 N (15.0 kgf, 33.1 lbf) and measure the length of the chain sub assembly by vernier calipers.

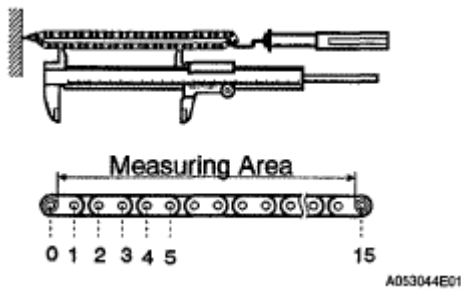


Fig. 383: Identifying Length Of Chain Sub Assembly By Vernier Calipers
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Maximum chain elongation:

146.8 mm (5.780 in.)

NOTE: Perform the same measurements by pulling at random in 3 or more places to obtain an average length.

If the elongation is greater than the maximum, replace the chain.

6. INSPECT CAMSHAFT TIMING GEAR ASSEMBLY

- a. Put the No. 1 chain on the larger gear of the camshaft timing gear assembly.
- b. Using vernier calipers, measure the timing gear with the chain.

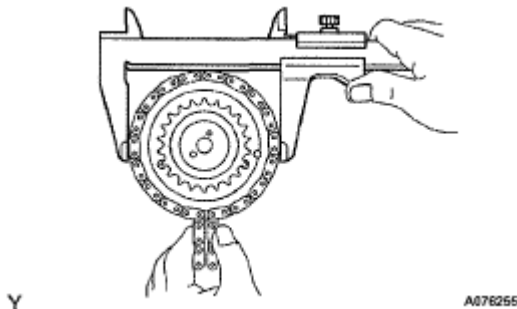


Fig. 384: Identifying Timing Gear Diameter
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Minimum gear diameter (with chain):

115.5 mm (4.547 in.)

NOTE: The vernier calipers must contact the chain rollers for the measuring. If the diameter is less than the minimum, replace the No. 1 chain and camshaft timing gear assembly.

- c. Put the No. 2 chain on the smaller gear of the camshaft timing gear assembly.
- d. Using vernier calipers, measure the timing gear with the chain.

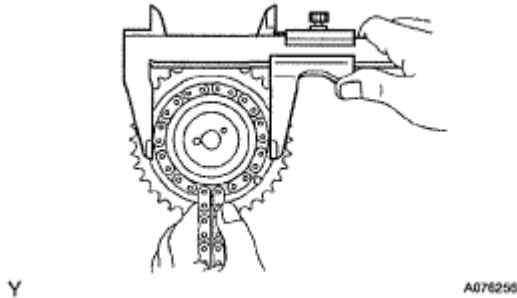


Fig. 385: Identifying Timing Gear Diameter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Minimum gear diameter (with chain):

73.1 mm (2.878 in.)

NOTE: The vernier calipers must contact the chain rollers for the measuring.

If the diameter is less than the minimum, replace the No. 2 chain and camshaft timing gear assembly.

7. INSPECT CAMSHAFT TIMING GEAR OR SPROCKET

- a. Put the No. 2 chain on the camshaft timing gear.
- b. Using vernier calipers, measure the camshaft timing gear diameter with the chain.

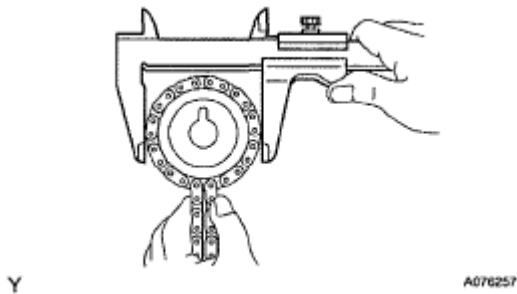


Fig. 386: Identifying Camshaft Timing Gear Diameter With Chain
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Minimum gear diameter (with chain):

73.1 mm (2.878 in.)

NOTE: The vernier calipers must contact the chain rollers for the measuring.

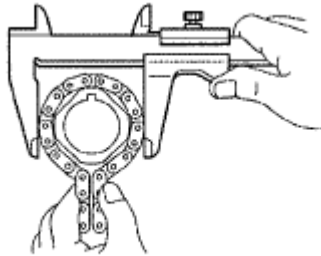
If the diameter is less than the minimum, replace the No. 2 chain and the camshaft timing gear.

8. INSPECT CRANKSHAFT TIMING GEAR OR SPROCKET

- a. Put the No. 1 chain on the crankshaft timing gear.
- b. Using vernier calipers, measure the crankshaft timing gear diameter with the chain.

Minimum gear diameter (with chain):

61.0 mm (2.402 in.)



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Fig. 387: Identifying Crankshaft Timing Gear Diameter With Chain
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE: The vernier calipers must contact the chain rollers for the measuring.

If the diameter is less than the minimum, replace the No. 1 chain and crankshaft timing gear.

9. INSPECT NO. 1 IDLE GEAR

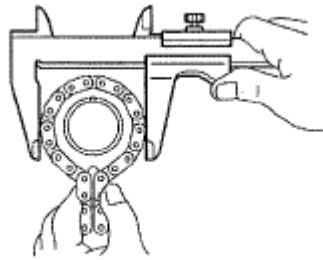
- a. Put the No. 1 chain on the idle gear.
- b. Using vernier calipers, measure the idle gear with the chain.

Minimum gear diameter (with chain):

61.0 mm (2.402 in.)

NOTE: The vernier calipers must contact the chain rollers for the measuring.

If the diameter is less than the minimum, replace the No. 1 chain and idle gear.



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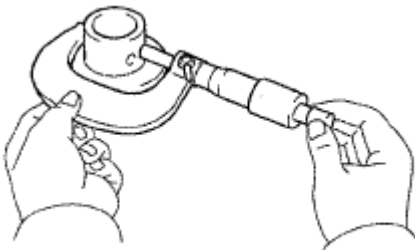
Fig. 388: Identifying Idle Gear Diameter With Chain
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. INSPECT IDLE GEAR SHAFT OIL CLEARANCE

- 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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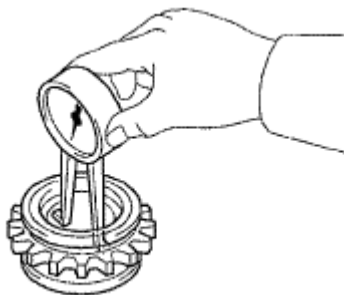
A076260

Fig. 389: Identifying Idle Gear Shaft Diameter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a caliper gauge, measure the inside diameter of the idle gear.

Idle gear inside diameter:

23.02 to 23.03 mm (0.9063 to 0.9067 in.)



Y

A076261

Fig. 390: Identifying Inside Diameter Of Idle Gear

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

- c. Subtract the idle gear shaft diameter measurement from the idle gear inside 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.)

11. INSPECT NO. 1 CHAIN TENSIONER ASSEMBLY

- a. Check that the plunger moves smoothly when the ratchet pawl is raised with your finger.
- b. Release the ratchet pawl and check that the plunger is locked in place by the ratchet pawl and does not move when pushing with your finger.

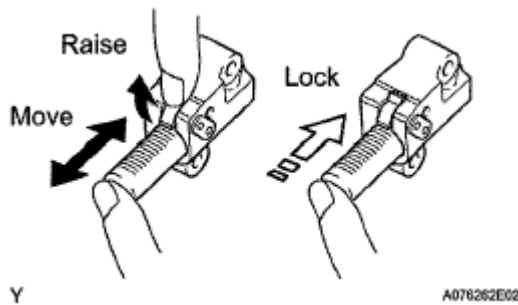


Fig. 391: Identifying No. 1 Chain Tensioner Assembly

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 worn depth of the chain tensioner slipper.

Maximum depth:

1.0 mm (0.039 in.)

If the depth is greater than the maximum, replace the No. 2 chain tensioner.

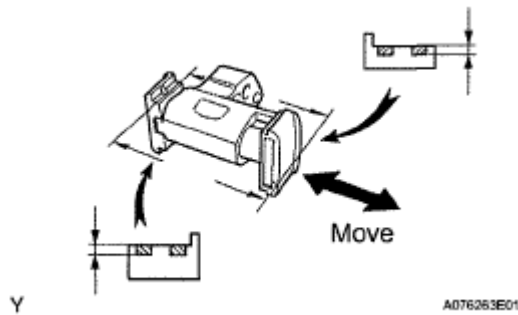


Fig. 392: Identifying No. 2 Chain Tensioner Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. INSPECT NO. 3 CHAIN TENSIONER ASSEMBLY

- Check that the plunger moves smoothly.
- Measure the worn depth of the chain tensioner slipper.

Maximum depth:

1.0 mm (0.039 in.)

If the depth is greater than the maximum, replace the No. 3 chain tensioner.

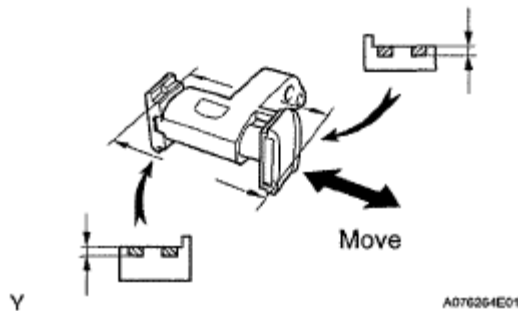


Fig. 393: Identifying No. 3 Chain Tensioner Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. INSPECT CHAIN TENSIONER SLIPPER

- Measure the worn depth of the chain tensioner slipper.

Maximum depth:

1.0 mm (0.039 in.)

If the depth is greater than the maximum, replace the chain tensioner slipper.

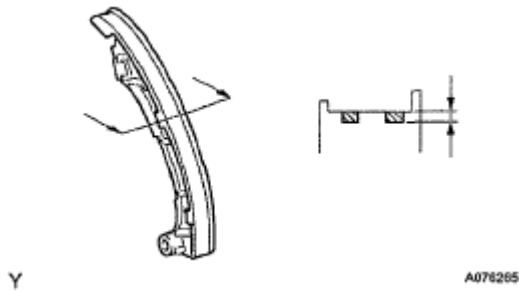


Fig. 394: Identifying Worn Depth Of Chain Tensioner Slipper
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

15. INSPECT NO. 1 CHAIN VIBRATION DAMPER

- a. Measure the worn depth of the No. 1 chain vibration damper.

Maximum depth:

1.0 mm (0.039 in.)

If the depth is greater than the maximum, replace the No. 1 chain vibration damper.

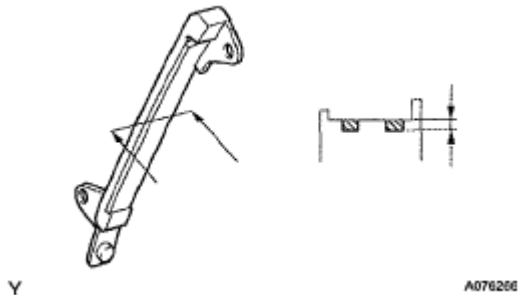


Fig. 395: Identifying Worn Depth Of No. 1 Chain Vibration Damper
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

16. INSPECT NO. 2 CHAIN VIBRATION DAMPER

- a. Measure the worn depth of the No. 2 chain vibration damper.

Maximum depth:

1.0 mm (0.039 in.)

If the depth is greater than the maximum, replace the No. 2 chain vibration damper.

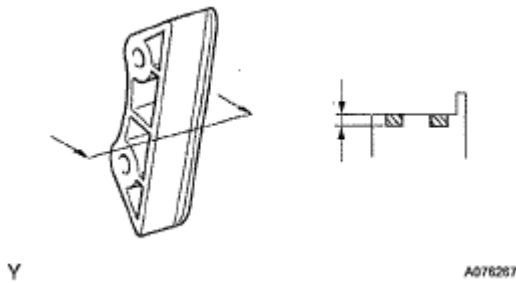


Fig. 396: Identifying Worn Depth Of No. 2 Chain Vibration Damper
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

17. 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.

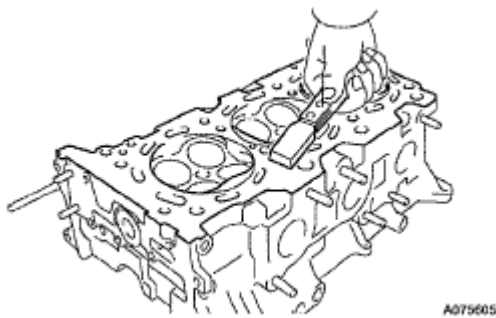


Fig. 397: Identifying Gasket Material From Cylinder Block Contact Surface
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

NOTE: Be careful not to scratch the combustion chambers.

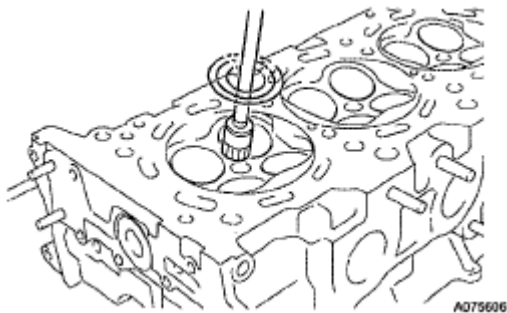


Fig. 398: Identifying Carbon From Combustion Chambers
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using a valve guide bushing brush and solvent, clean all the valve guide bushes.

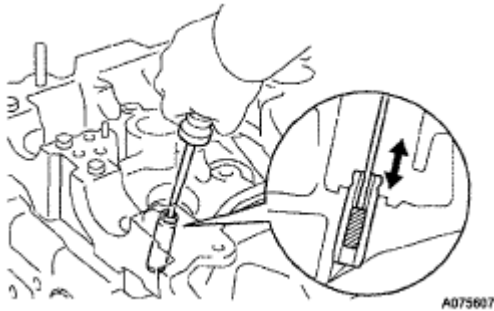


Fig. 399: Identifying Valve Guide Bushes

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

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

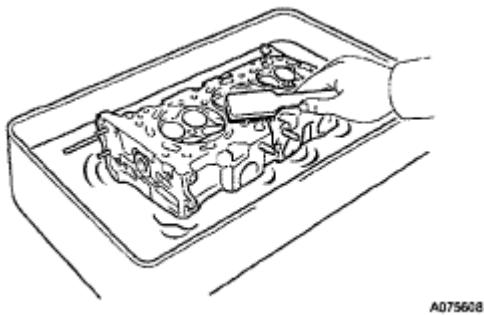


Fig. 400: Identifying Cylinder Head

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

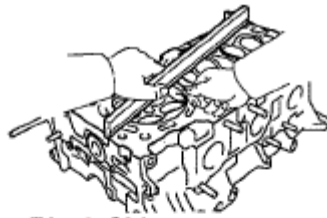
18. INSPECT CYLINDER HEAD SUB-ASSEMBLY

- a. Inspect warpage.
1. Using a precision straight edge and feeler gauge, measure the warpage of the contact surfaces of the cylinder block and manifolds.

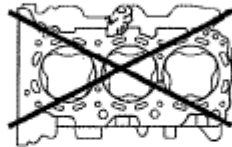
Maximum warpage:

0.10 mm (0.0039 in.)

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



Cylinder Block Side:



Intake Manifold Side:



Exhaust Manifold Side:



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Fig. 401: Identifying Warpage Of Contact Surfaces Of Cylinder Block And Manifolds
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Inspect cranks.

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.

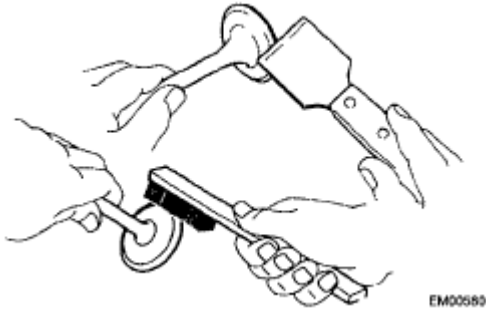


A075610

Fig. 402: Identifying Combustion Chamber, Intake Ports, Exhaust Ports And Cylinder Block Surface For Cracks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

19. 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. 403: Identifying Valves**

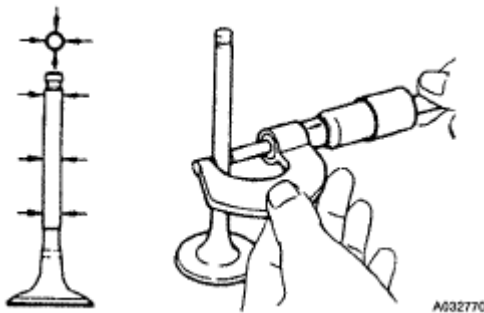
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

20. INSPECT VALVE

- a. Inspect the valve stem diameter.
 1. Using a micrometer, measure the diameter of the valve stem.

Valve stem diameter**VALVE STEM DIAMETER SPECIFICATION**

Intake	Exhaust
5.470 to 5.485 mm (0.2154 to 0.2159 in.)	5.465 to 5.480 mm (0.2152 to 0.2158 in.)

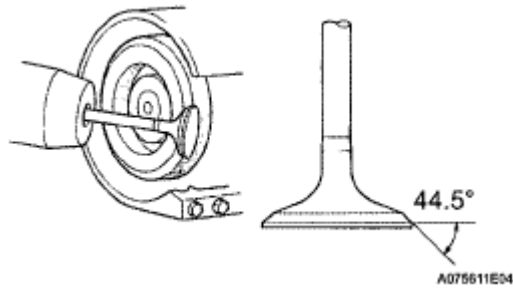
**Fig. 404: Identifying Diameter Of Valve Stem**

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

- b. Inspect the valve face angle.
 1. Grind the valve enough to remove pits and carbon.
 2. Check that the valve is ground to the correct valve face angle.

Valve face angle:

44.5°

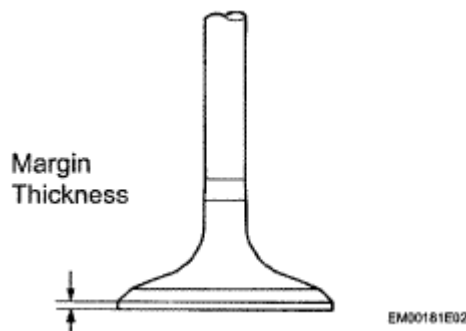
**Fig. 405: Identifying Valve Face Angle**

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

- c. Inspect the 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. 406: Identifying Valve Head Margin Thickness**

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

- d. Inspect the overall length.
1. Using vernier calipers, check the overall length.

Standard overall length**STANDARD VALVE LENGTH SPECIFICATION**

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Intake	Exhaust
106.95 mm (4.2106 in.)	105.80 mm (4.1654 in.)

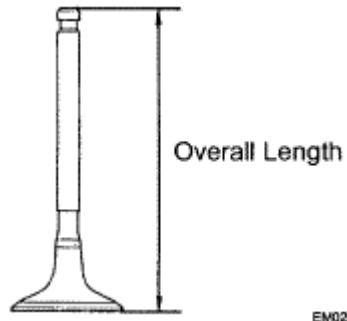


Fig. 407: Identifying Valve Overall Length
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Minimum overall length

MINIMUM VALVE LENGTH SPECIFICATION

Intake	Exhaust
106.40 mm (4.1890 in.)	105.30 mm (4.1457 in.)

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

- e. Inspect the valve stem tip.
 - 1. Check the surface of the valve stem tip for wear.

NOTE: Do not grind off more than the minimum length.

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

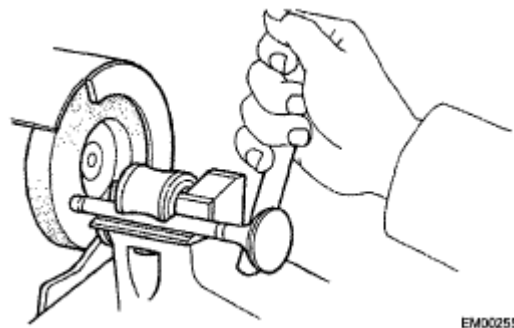


Fig. 408: Identifying Surface Of Valve Stem Tip For Wear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

21. CLEAN VALVE SEAT

- a. Using a 45° carbide cutter, resurface the valve seats.
- b. Clean the valve seats.

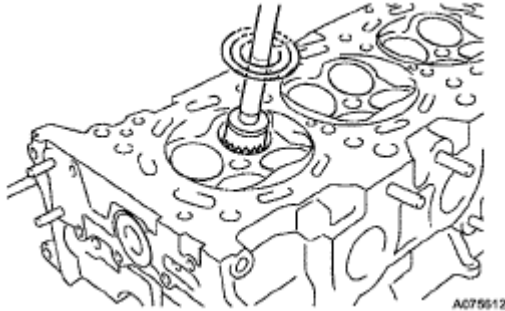


Fig. 409: Identifying Valve Seat
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

22. INSPECT VALVE SEAT

- a. Apply a light coat of prussian blue (or white lead) to the valve face.

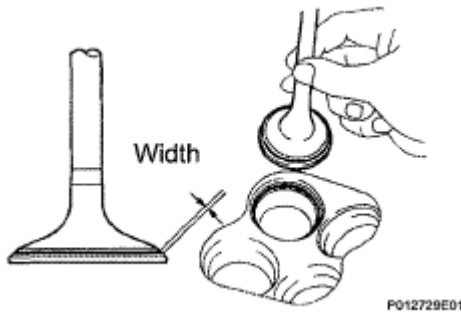


Fig. 410: Identifying Valve Face And Seat
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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.
 1. If prussian blue appears around the entire face, the valve is centered.

If not, replace the valve.

2. If prussian blue appears around the entire valve seat, the guide and face are centered. If not, resurface the valve seat.
3. Check that the seat contacts the middle of the valve face with the width below.

Standard width:

1.0 to 1.4 mm (0.039 to 0.055 in.)

23. REPAIR VALVE SEAT

NOTE: Take off a cutter gradually to make the intake valve seat smooth.

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

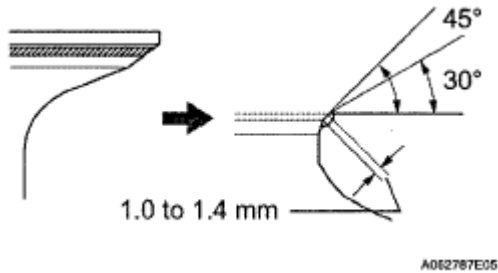


Fig. 411: Identifying Valve Seat Angle

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

- b. Intake side:

If the seating is too low to the valve face, use 60° and 45° cutters to correct the seat.

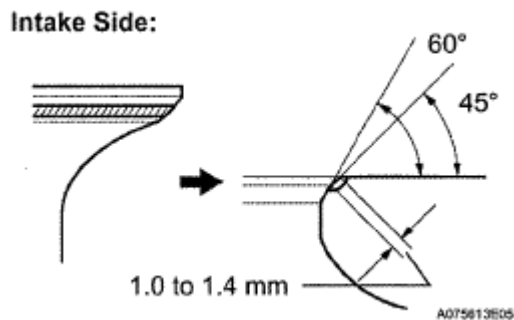
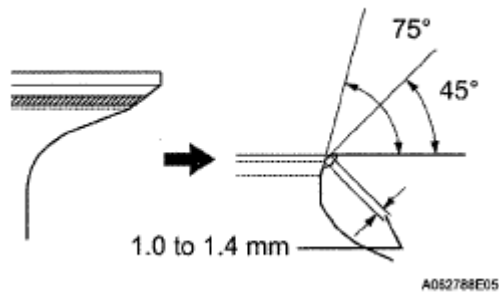


Fig. 412: Identifying Valve Seat Angle (Intake Side)

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

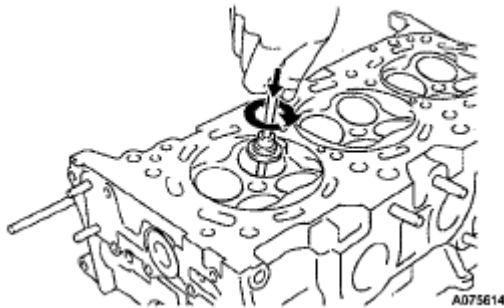
- c. Exhaust side:

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

Exhaust Side:**Fig. 413: Identifying Valve Seat Angle (Exhaust Side)**

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

- d. Handrub the valve and valve seat with an abrasive compound.
- e. After handrubbing, clean the valve and valve seat.

**Fig. 414: Identifying Valve And Valve Seat**

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

24. INSPECT INNER COMPRESSION SPRING

- a. Inspect squareness.
 - 1. Using a steel square, measure the squareness 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.

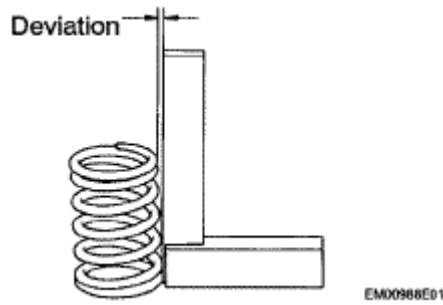


Fig. 415: Identifying Squareness Of Inner Compression Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Inspect 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.

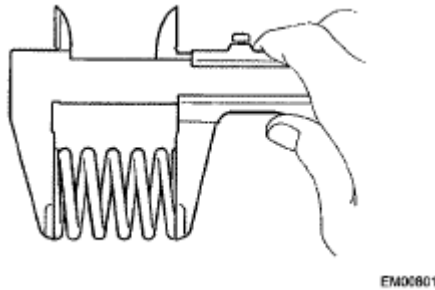


Fig. 416: Identifying Free Length Of Inner Compression Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

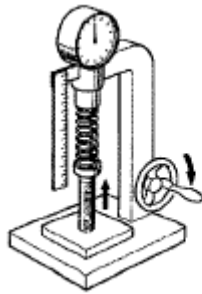
c. Inspect tension.

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.



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Fig. 417: Identifying Tension Of Inner Compression Spring
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

25. INSPECT VALVE GUIDE BUSH OIL CLEARANCE

- a. Using a caliper gauge, measure the inside diameter of the valve guide bush.

Inside diameter:

5.51 to 5.53 mm (0.2169 to 0.2177 in.)

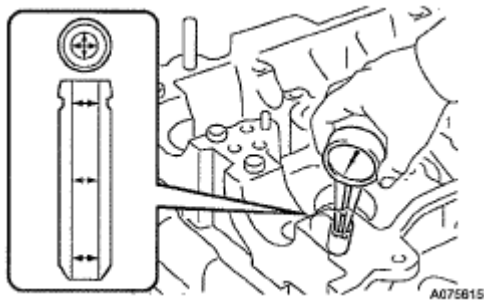


Fig. 418: Identifying Inside Diameter Of Valve Guide Bush
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Subtract the valve stem diameter measurement (Step 8) from the valve guide bush inside diameter measurement.

Standard overall length

VALVE LENGTH SPECIFICATION

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

Minimum overall length

VALVE LENGTH SPECIFICATION

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

If the oil clearance is greater than the maximum, replace the valve and valve guide bush.

26. REMOVE VALVE GUIDE BUSH

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

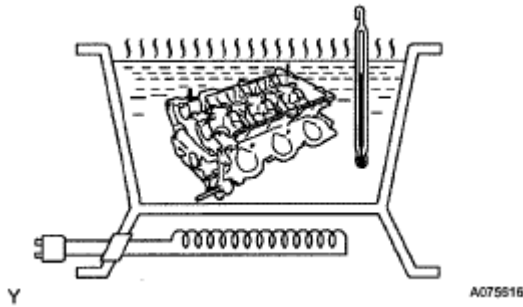


Fig. 419: Identifying Cylinder Head

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)

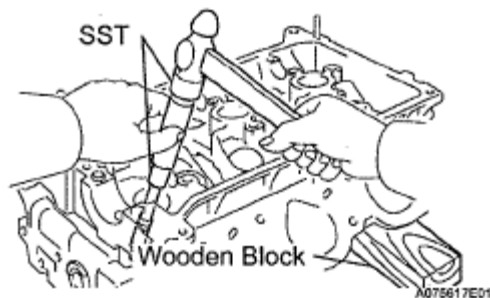


Fig. 420: Identifying Valve Guide Bush

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

27. 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.)

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.).

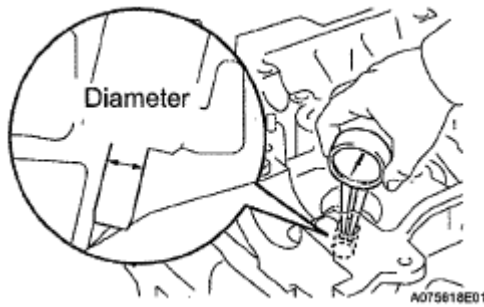


Fig. 421: Identifying Bush Bore Diameter Of Cylinder Head
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Valve guide bush diameter

VALVE GUIDE BUSH DIAMETER SPECIFICATION

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).

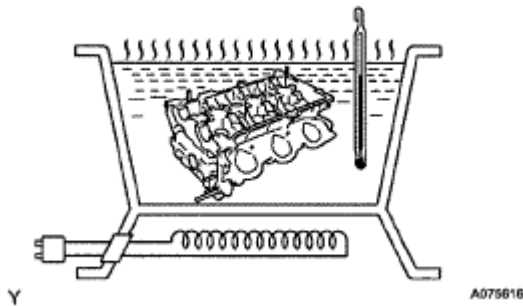


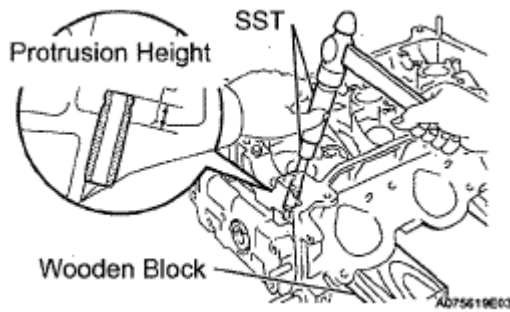
Fig. 422: Identifying Cylinder Head
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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. 423: Identifying Valve Guide Bush**

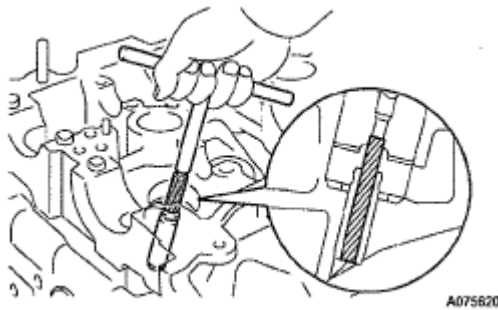
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Using a sharp 5.5 mm reamer, ream the valve guide bush to obtain the standard specified clearance between the valve guide bush and valve stem.

Standard overall length

STANDARD VALVE LENGTH SPECIFICATION

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

**Fig. 424: Identifying Valve Guide Bush**

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

28. 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.)

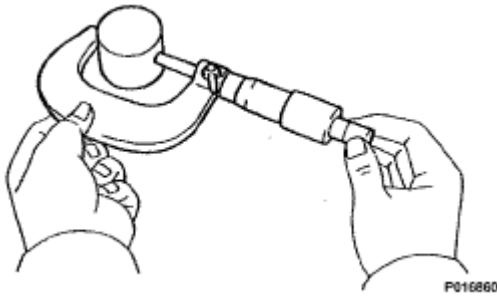


Fig. 425: Identifying Valve Lifter Diameter

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

29. 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.)

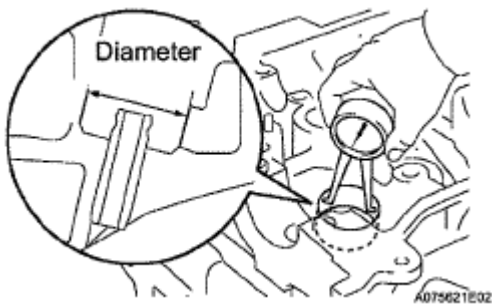


Fig. 426: Identifying Lifter Bore Diameter Of Cylinder Head

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

- 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.)

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

30. INSPECT CAMSHAFT OIL CLEARANCE

- a. Clean the camshaft bearing caps, camshaft bearings and camshaft journals.
- b. Install the camshaft bearing (See **REASSEMBLY**).
- c. Place the camshaft on the cylinder head.
- d. Lay a strip of Plastigage across each of the camshaft journals.

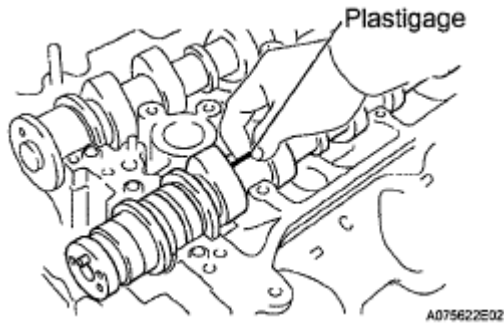


Fig. 427: Identifying Strip Of Plastigage Across Camshaft Journals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Install the camshaft bearing caps (See **REASSEMBLY**).

NOTE: Do not turn the camshafts.

- f. Remove the camshaft bearing caps (See **DISASSEMBLY**).
- g. Measure the Plastigage at its widest point.

Standard oil clearance (Cylinder head RH)

STANDARD OIL CLEARANCE (CYLINDER HEAD RH)

No. 1 (Intake)	No. 1 (Exhaust)	Others
0.008 to 0.038 mm (0.0003 to 0.0015 in.)	0.040 to 0.079 mm (0.0016 to 0.0031 in.)	0.025 to 0.062 mm (0.0010 to 0.0024 in.)

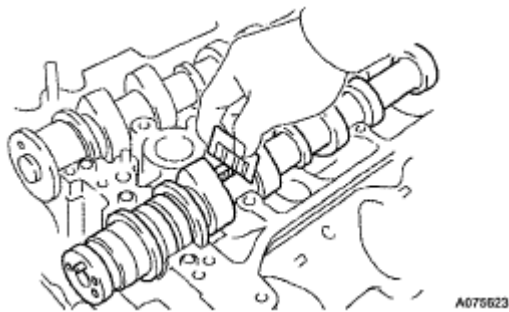


Fig. 428: Identifying Plastigage At Widest Point
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard oil clearance (Cylinder head LH)

STANDARD OIL CLEARANCE (CYLINDER HEAD LH)

No. 1	Others
0.040 to 0.079 mm (0.0016 to 0.0031 in.)	0.025 to 0.062 mm (0.0010 to 0.0024 in.)

Maximum oil clearance (Cylinder head RH)**MAXIMUM OIL CLEARANCE (CYLINDER HEAD RH)**

No. 1 (Intake)	Others
0.07 mm (0.0028 in.)	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 camshaft.

If necessary, replace the camshaft bearing caps and cylinder head together.

Reference:**CYLINDER HEAD JOURNAL BORE DIAMETER SPECIFICATION**

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.)
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.

31. INSPECT CAMSHAFT THRUST CLEARANCE

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

Standard thrust clearance:

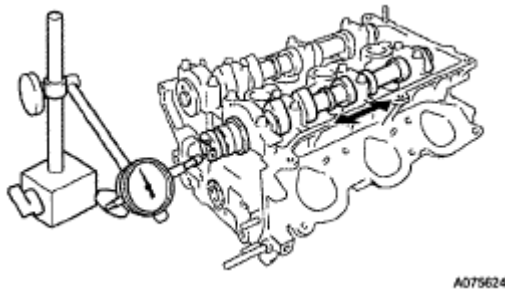
0.04 to 0.09 mm (0.0016 to 0.0035 in.)

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. 429: Identifying Camshaft Thrust Clearance
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

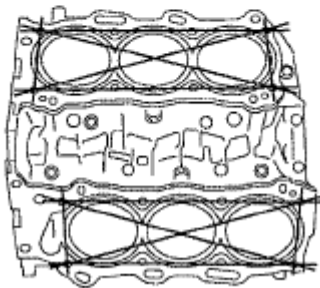
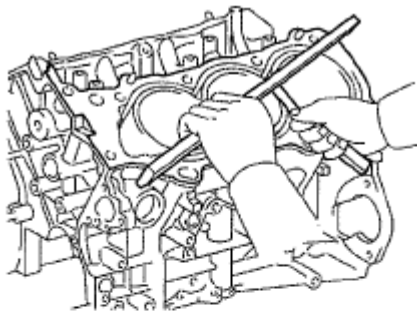
32. INSPECT CYLINDER BLOCK FOR FLATNESS

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



Y

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Fig. 430: Identifying Warpage Of Contact Surface Of Cylinder Head Gasket
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

33. 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.

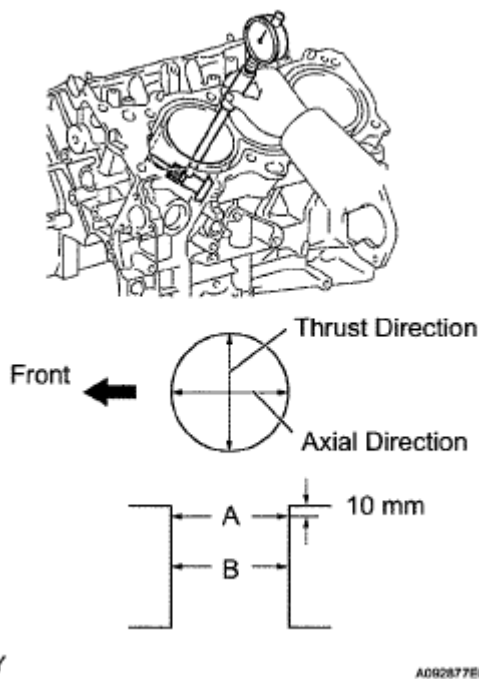


Fig. 431: Identifying Cylinder Bore Diameter

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

34. INSPECT WITH PIN 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 93.920 mm (3.6972 to 3.6976 in.)

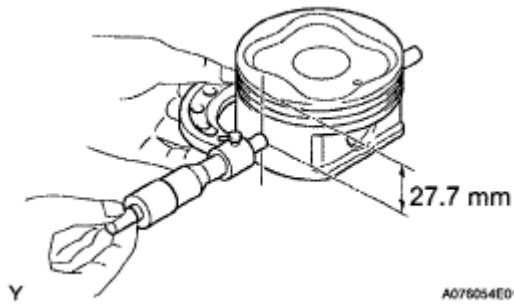


Fig. 432: Identifying Piston Diameter

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

35. INSPECT PISTON OIL CLEARANCE

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

Standard oil clearance:

0.080 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.

36. 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.

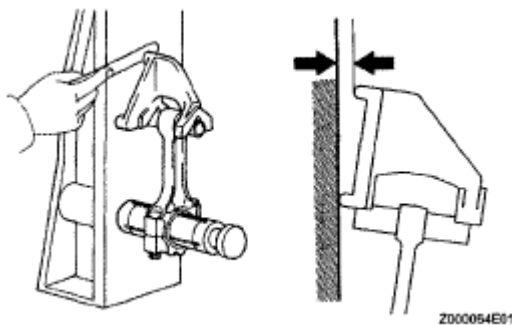


Fig. 433: Identifying Connecting Rod For Misalignment
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Check twist.

Maximum twist:

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

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

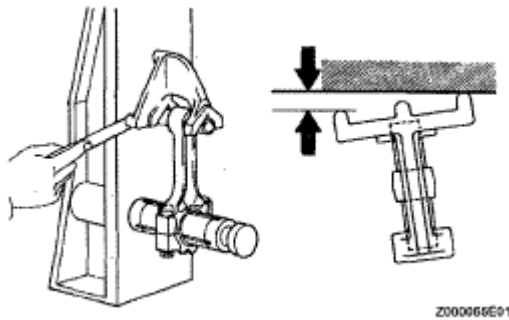


Fig. 434: Identifying Connecting Rod For Twist
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

37. INSPECT PISTON PIN OIL CLEARANCE

- a. Using a caliper gauge, measure the inside diameter of the piston pin hole.

Piston pin hole inside diameter:

22.001 to 22.010 mm (0.8662 to 0.8665 in.)

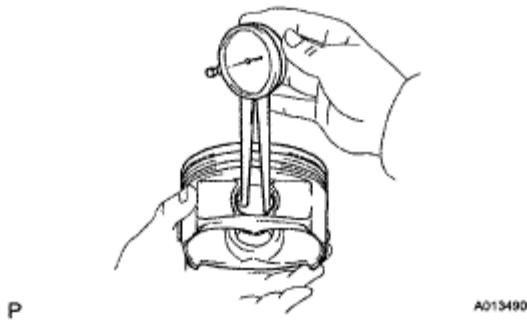


Fig. 435: Identifying Inside Diameter Of Piston Pin Hole
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

Piston pin hole inside diameter

PISTON PIN HOLE INSIDE DIAMETER SPECIFICATION

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.)

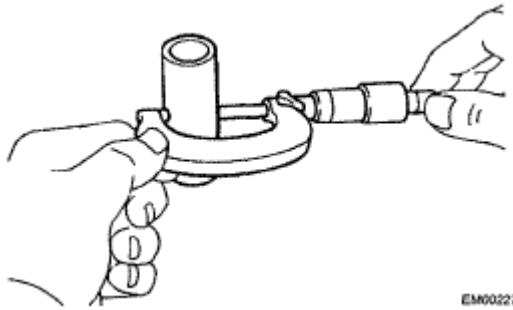


Fig. 436: Identifying Piston Pin Diameter

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

HINT:

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)

- c. Using a caliper gauge, measure the inside diameter of the connecting rod bushing.

Bushing inside diameter:

22.005 to 22.014 mm (0.8663 to 0.8667 in.)

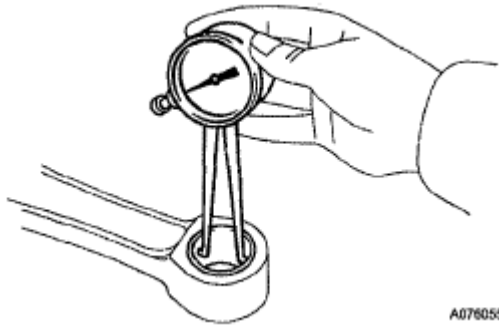


Fig. 437: Identifying Inside Diameter Of Connecting Rod Bushing
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

Bushing inside diameter

BUSHING INSIDE DIAMETER SPECIFICATION

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)

- 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.)

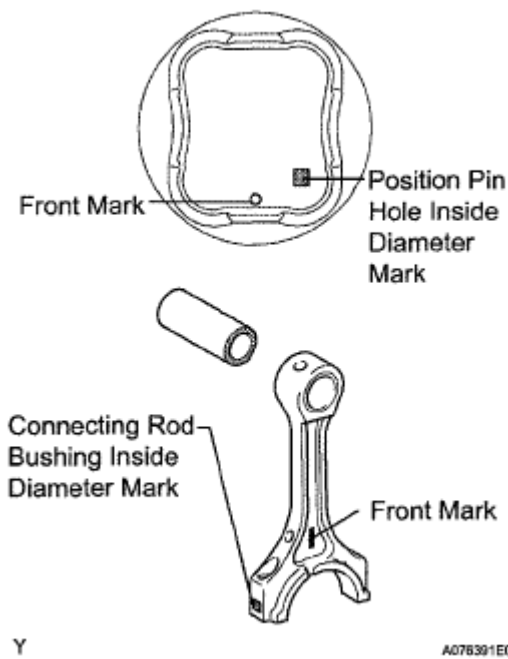


Fig. 438: Identifying Connecting Rod Bushing Inside Diameter Mark
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

38. REMOVE CONNECTING ROD SMALL END BUSH

- a. Using SST and a press, press out the bushing.

SST 09222-30010

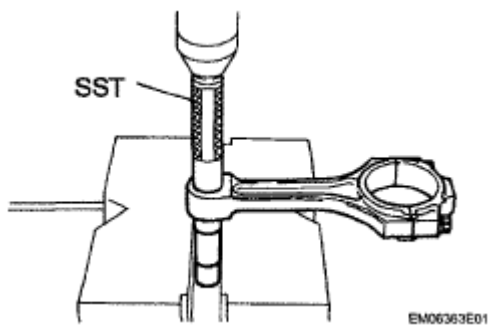
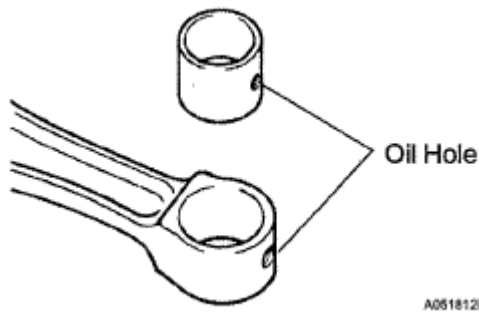


Fig. 439: Identifying Connecting Rod Small End Bush
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

39. INSTALL CONNECTING ROD SMALL END BUSH

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

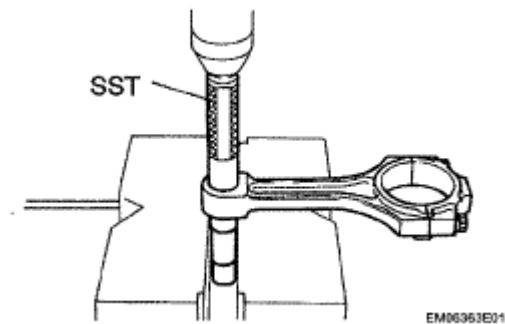


A051812E01

Fig. 440: Identifying Oil Hole Of Connecting Rod Small End Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using SST and a press, press in the bushing.

SST 09222-30010



EM06363E01

Fig. 441: Identifying Connecting Rod Small End Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using a pin hole grinder, hone the bushing to obtain 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 that the piston pin fits at a normal room temperature. Coat the piston pin with engine oil, and push it into the connecting rod with a thumb.

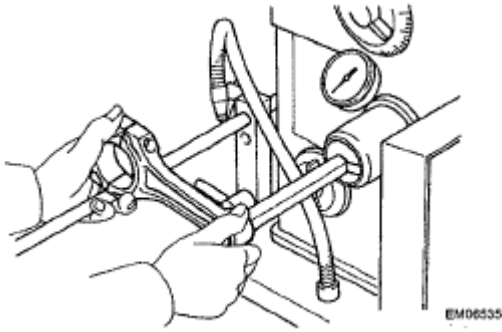


Fig. 442: Identifying Clearance Between Bushing And Piston Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

40. INSPECT RING GROOVE CLEARANCE

- a. Using a feeler gauge, measure the clearance between the 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.)

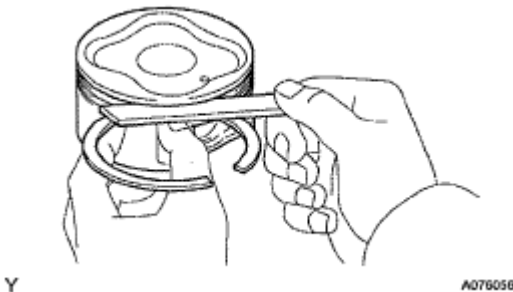


Fig. 443: Identifying Clearance Between Piston Ring And Wall Of Ring Groove
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

41. INSPECT PISTON RING END GAP

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

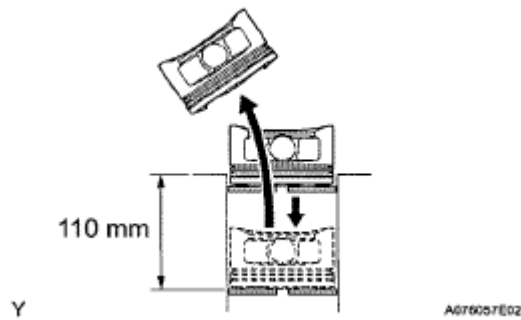


Fig. 444: Identifying Piston Ring

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.)

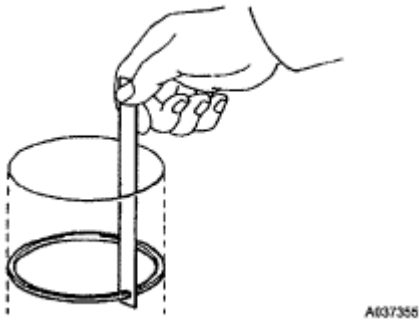


Fig. 445: Identifying Piston Ring End Gap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

42. 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.

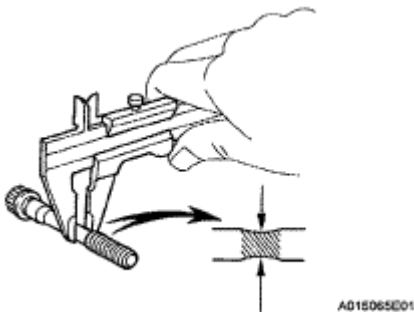


Fig. 446: Identifying Tension Portion Diameter Of Connecting Rod Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

43. 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.

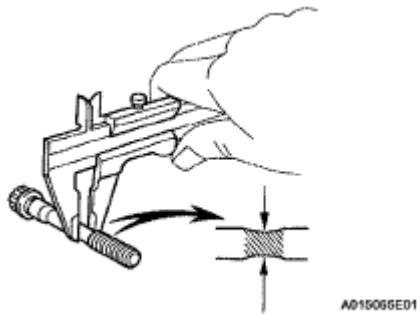


Fig. 447: Identifying Tension Portion Diameter Of Crankshaft Bearing Cap Set Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

44. INSPECT CRANKSHAFT

- Using a dial indicator and V-blocks, measure the runout as shown in the illustration.

Maximum circle runout:

0.06 mm (0.0024 in.)

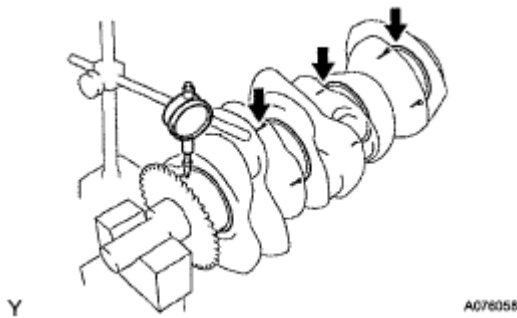


Fig. 448: Identifying Crankshaft Runout
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Using a micrometer, measure the diameter of each main journal.

Diameter:

71.988 to 72.000 mm (2.8342 to 2.8346 in.)

- Check each main journal for taper and out-of-round as shown.

Maximum taper and out-of-round:

0.02 mm (0.0008 in.)

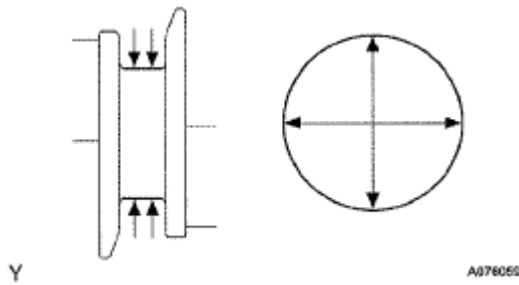


Fig. 449: Identifying Main Journal For Taper And Out-Of-Round
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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-round as shown.

Maximum taper and out-of-round:

0.02 mm (0.0008 in.)

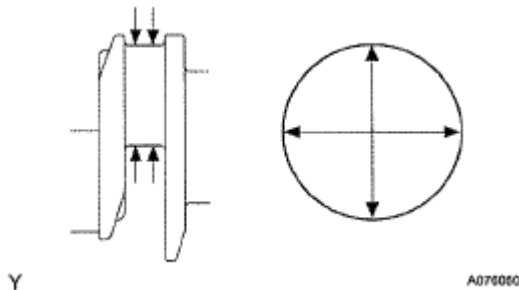


Fig. 450: Identifying Crank Pin For Taper And Out-Of-Round
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

45. INSPECT CRANKSHAFT OIL CLEARANCE

HINT:

Main bearings come in widths of 19.0 mm (0.748 in.) and 22.4 mm (0.882 in.). 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.

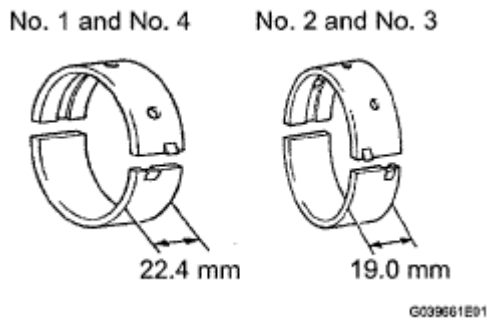


Fig. 451: Identifying Main Bearing Width

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

- b. Align the bearing claw with the claw groove of the cylinder block, and push in the 4 upper bearings.

NOTE: Do not apply engine oil to the bearing or its contact surface.

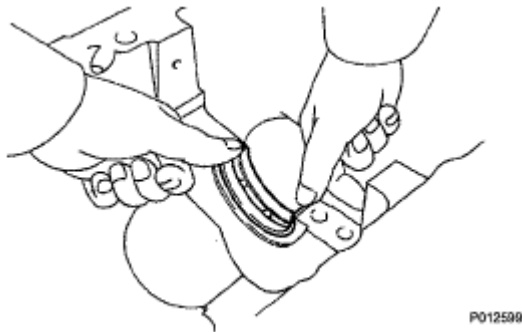


Fig. 452: Identifying Pushing In Upper Bearings

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

- c. Align the bearing claw with the claw groove of the main bearing cap, and push in the 4 bottom bearings.

NOTE: Do not apply engine oil to the bearing or its contact surface.

HINT:

A number marked on each main bearing cap indicates the installation position.

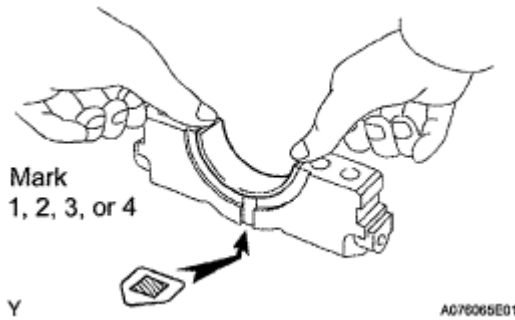


Fig. 453: Identifying Pushing In Lower Bearings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Place the crankshaft on the cylinder block.
- e. Lay a strip of Plastigage across each journal.

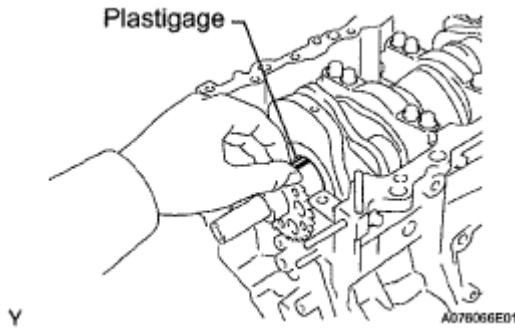


Fig. 454: Identifying Strip Of Plastigage Across Journal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Examine the front marks and numbers and install the bearing caps on the cylinder block.

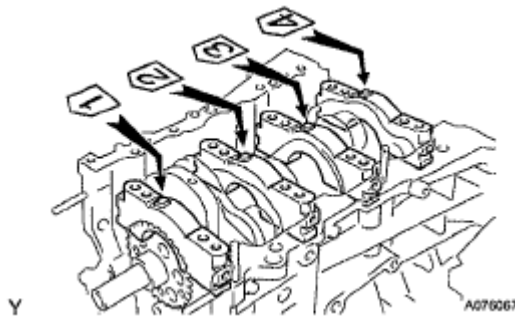


Fig. 455: Identifying Bearing Caps Front Marks And Numbers
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Apply a light coat of engine oil to the threads of the bearing cap bolts.
- h. Temporarily install the 8 main bearing cap bolts to the inside positions.
- i. Install the main bearing caps. Tighten the 2 bolts for each bearing cap until the clearance between

the bearing cap and the cylinder block becomes less than 6 mm (0.23 in.).

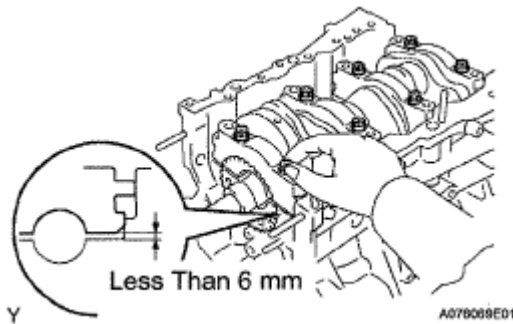


Fig. 456: Identifying Clearance Between Bearing Cap And Cylinder Block
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- j. Using a plastic-faced hammer, lightly tap the bearing cap to ensure a proper fit.

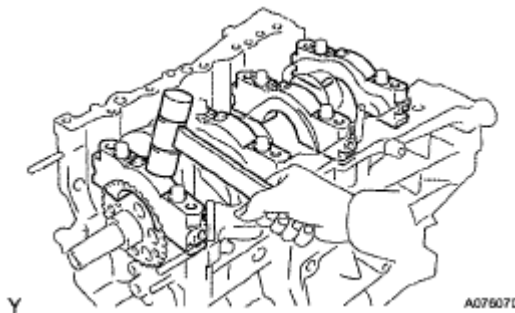


Fig. 457: Identifying Tapping Bearing Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- k. Apply a light coat of engine oil to the threads of the main bearing cap bolts.
- l. Install the 16 main bearing cap bolts. Using several steps, tighten the bolts uniformly in the sequence as shown in the illustration.

Torque: 61 N*m (622 kgf*cm, 45 ft.*lbf)

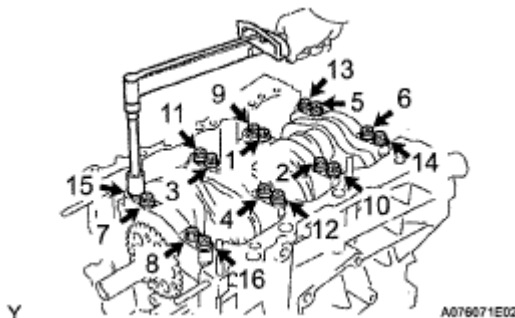


Fig. 458: Identifying Tightening Sequence Of Main Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- m. Mark the front side of the bearing cap bolts with paint.
- n. Retighten the bearing cap bolts 90° in the sequence as shown.

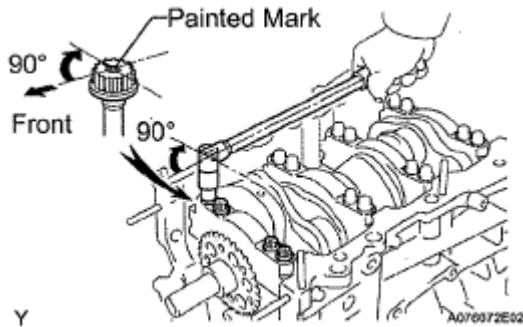


Fig. 459: Identifying Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- o. Check that the painted mark is now at a 90° angle to the front.

NOTE: Do not turn the crankshaft.

- p. Install the 8 main bearing cap bolts. Using several steps, tighten the bolts uniformly in the sequence as shown in the illustration.

Torque: 26 N*m (262 kgf*cm, 19 ft.*lbf)

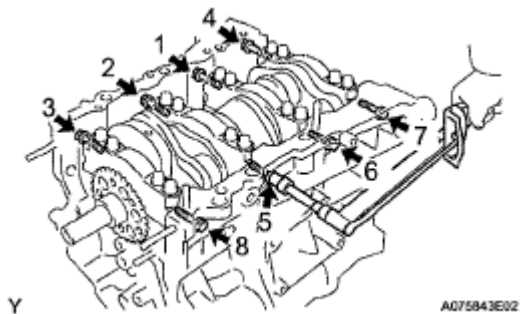


Fig. 460: Identifying Tightening Sequence Of Main Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- q. Remove the main bearing caps.
- 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.)

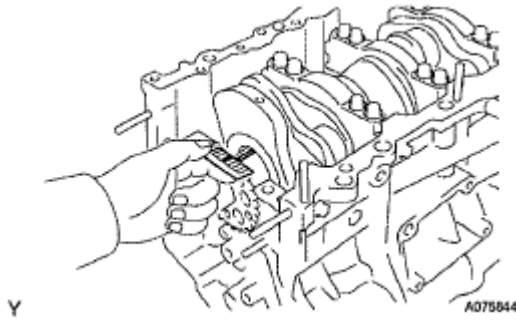


Fig. 461: Identifying Plastigage At Widest Point
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

NOTE: Completely remove the Plastigage.

- s. If replacing a bearing, replace it with one that has 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 appropriate bearing number. There are 5 sizes of standard bearings, marked "1", "2", "3", "4" and "5" accordingly.

Journal bearings

JOURNAL BEARINGS SPECIFICATION

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

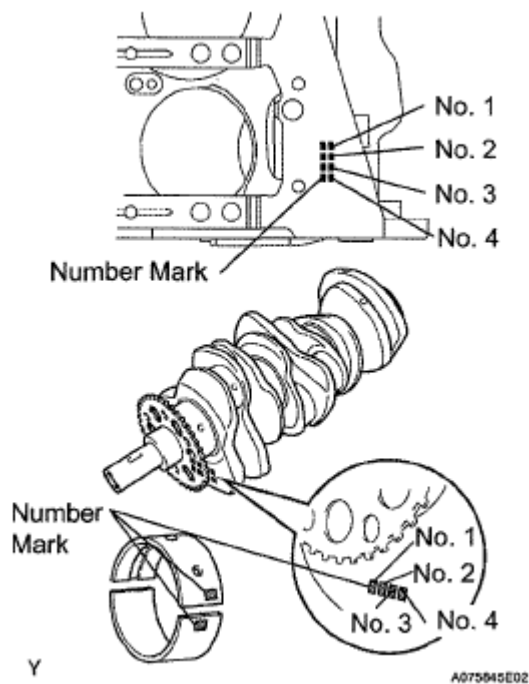


Fig. 462: Identifying Number Mark On Bearings
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

EXAMPLE

Cylinder block "11" (A) + Crankshaft "06" (B) = Total number 17 (Use bearing "3")

CYLINDER BLOCK MAIN JOURNAL BORE DIAMETER 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)
Crankshaft main journal diameter (B)	"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)
	"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)
	"11"	71.988 to 71.989 (2.8342 to 2.8342)
Standard bearing center wall thickness	"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)

REASSEMBLY

1. INSTALL STUD BOLT

- Install the stud bolts as shown in the illustration.

Torque:

For Stud bolt A

11 N*m (112 kgf*cm, 8.1 ft.*lbf)

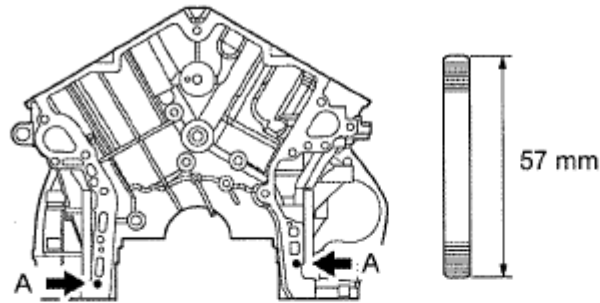
For stud bolt B

4.5 N*m (46 kgf*cm, 40 in.*lbf)

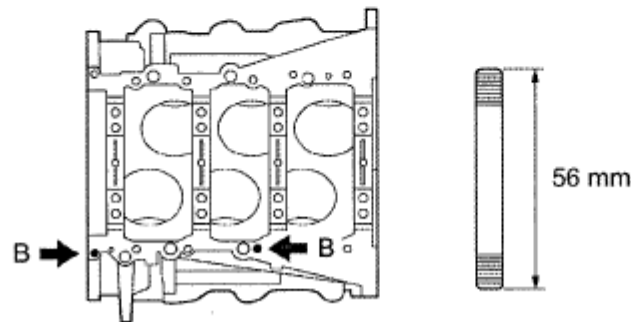
For stud bolt C

4.0 N*m (41 kgf*cm, 35 in.*lbf)

Front Side:



Lower Side:



G039645E01

Fig. 463: Identifying Stud Bolts Dimension
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. INSTALL STRAIGHT PIN

- a. Using a plastic-faced hammer, tap in the straight pin.

Standard protrusion:

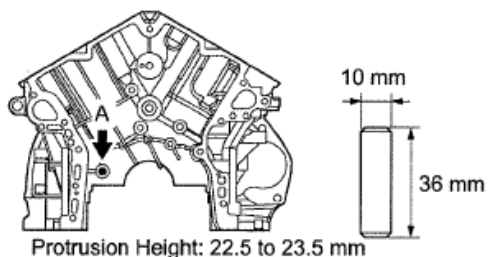
22.5 to 23.5 mm (0.886 to 0.925 in.) for pin A

10.5 to 11.5 mm (0.413 to 0.453 in.) for pin B

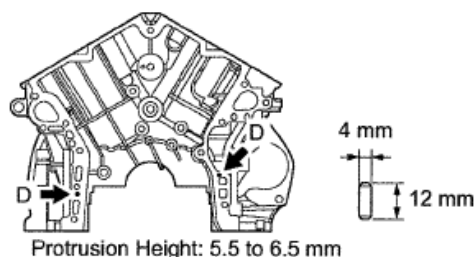
8.5 to 9.5 mm (0.335 to 0.374 in.) for pin C

5.5 to 6.5 mm (0.217 to 0.256 in.) for pin D

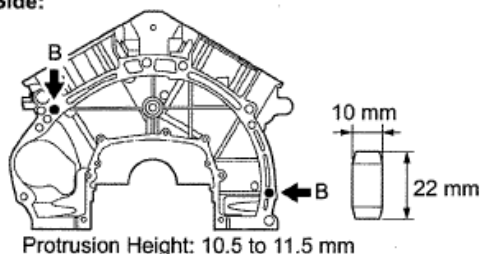
Front Side:



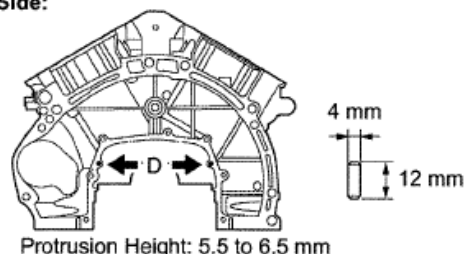
Front Side:



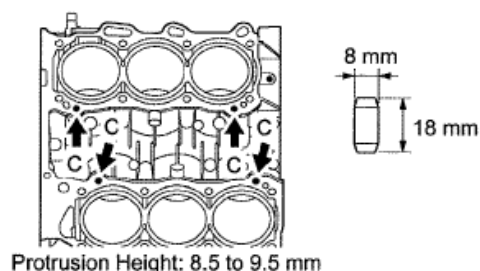
Rear Side:



Rear Side:



Upper Side:



Lower Side:

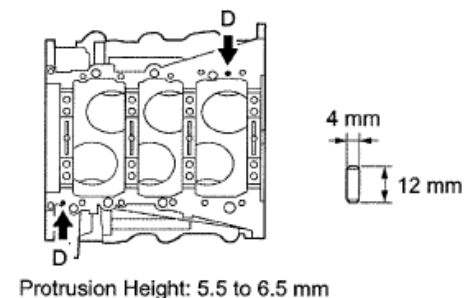


Fig. 464: Identifying Straight Pin Dimension

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

3. INSTALL TIGHT PLUG

- Apply adhesive around the tight plugs.

Adhesive:

Toyota Genuine Adhesive 1324, Three Bond 1324 or Equivalent

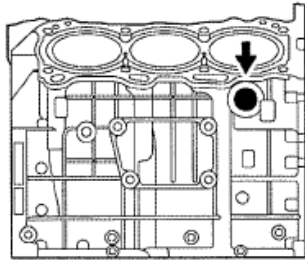
- Using SST, install the tight plugs as shown in the illustration.

SST 09950-60010 (09951-00350), 09950-70010 (09951-07150)

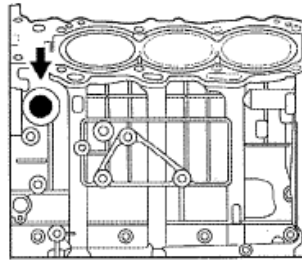
Standard depth:

0.2 to 1.2 mm (0.008 to 0.047 in.)

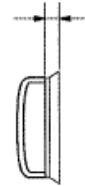
Right Side:



Left Side:



0.2 to 1.2 mm



Y

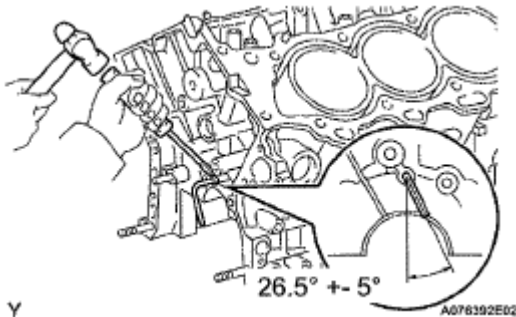
A076364E05

Fig. 465: Identifying Tight Plug Dimension

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

4. INSTALL OIL JET

- Using a screwdriver and hammer, tap in the oil jet.



Y

A076392E02

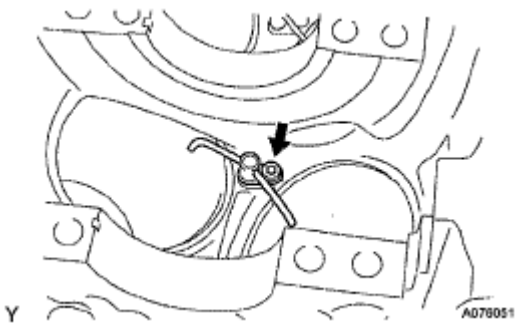
Fig. 466: Identifying Oil Jet

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

5. INSTALL NO. 1 OIL NOZZLE SUB-ASSEMBLY

- Using a 5 mm socket hexagon wrench, install the 3 oil nozzles.

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



Y

A076051

Fig. 467: Identifying Oil Nozzles

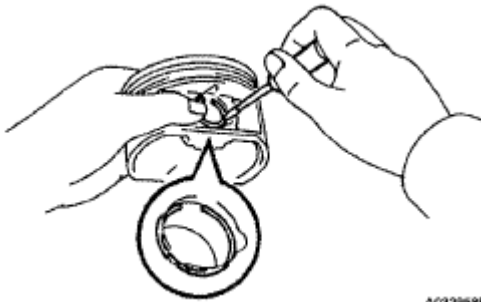
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. INSTALL PISTON PIN HOLE SNAP RING

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

HINT:

Check that an end gap of the snap ring is not overlapped to the pin hole cutout portion of the piston.



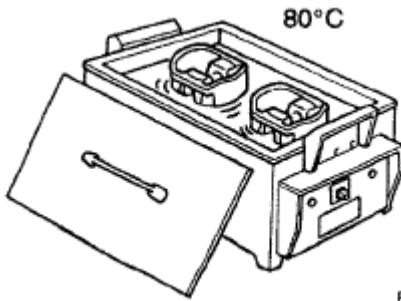
A032958E01

Fig. 468: Identifying Piston Pin 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).



P012417E06

Fig. 469: Identifying 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 a thumb.

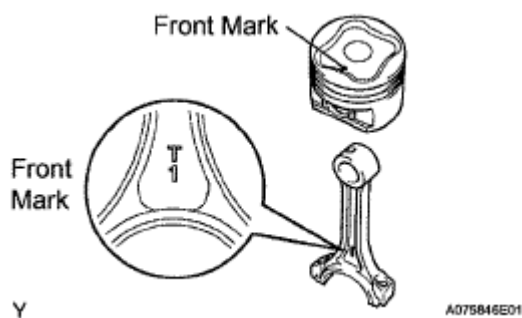


Fig. 470: Identifying Front Marks Of Piston And Connecting Rod
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. INSTALL PISTON PIN HOLE SNAP RING

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

HINT:

Be sure that an end gap of the snap ring is not overlapped to the pin hole cutout portion of the piston.

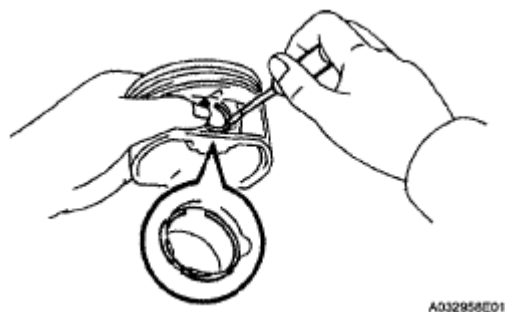


Fig. 471: Identifying Piston Pin Hole Snap Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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: Install the No. 2 compression ring with the painted mark facing upward.

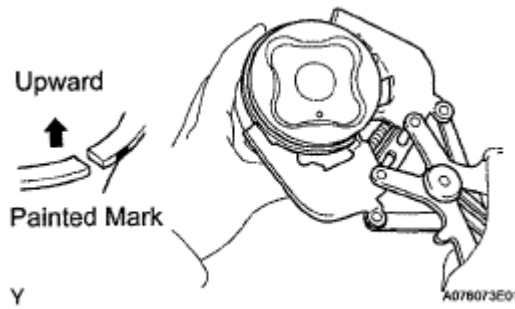


Fig. 472: Identifying Compression Rings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

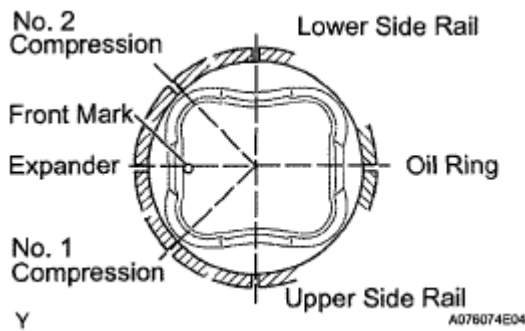


Fig. 473: Identifying Piston Ring Ends
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. INSTALL CONNECTING ROD BEARING

- a. Align the bearing claw with the groove of the connecting rod or connecting cap.

NOTE: Clean the backside of the bearing and the contact surface of the connecting rod and prevent oil from adhering to them.

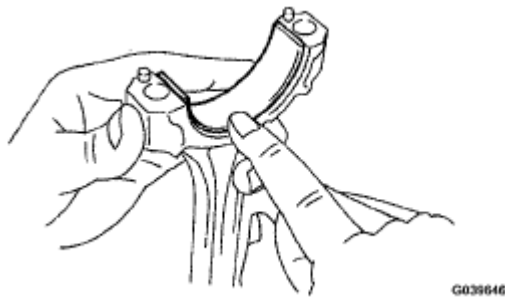


Fig. 474: Identifying Bearing Claw With Groove Of Connecting Rod
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. INSTALL CRANKSHAFT BEARING

HINT:

Main bearings come in widths of 19.0 mm (0.748 in.) and 22.4 mm (0.882 in.). 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.

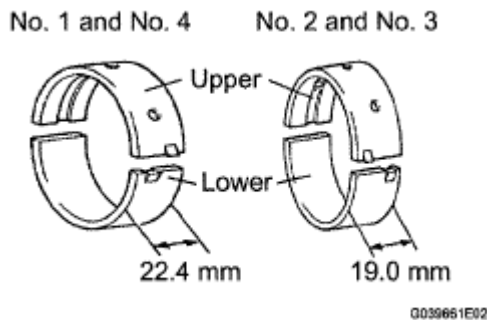


Fig. 475: Identifying Main Bearings Width

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

- b. Align the bearing claw with the claw groove of the cylinder block, and push in the 4 upper bearings.

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

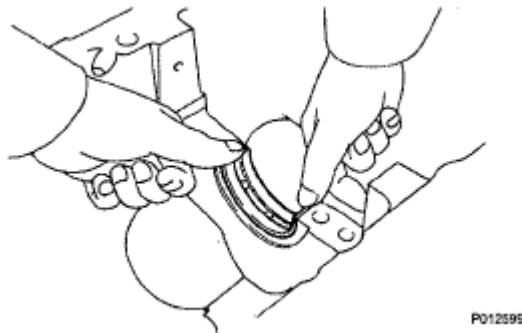


Fig. 476: Identifying Pushing In Upper Bearings

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

- c. Align the bearing claw with the claw groove of the main bearing cap, and push in the 4 lower bearings.

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

HINT:

The number marked on each main bearing cap indicates the installation position.

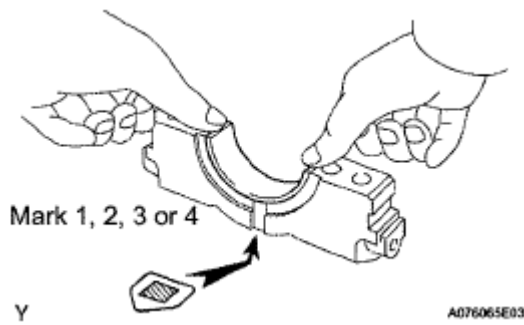


Fig. 477: Identifying Pushing In Lower Bearings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. INSTALL CRANKSHAFT

- a. Apply engine oil to the upper bearing and install the crankshaft on the cylinder block.
- b. Install the 2 upper thrust washers to 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.

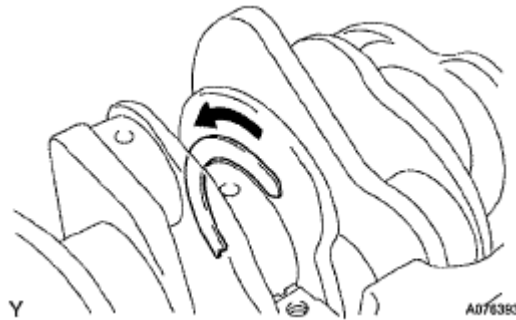


Fig. 478: Identifying Upper Thrust Washers
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the 2 lower thrust washers on the No. 2 bearing cap with the grooves facing outward.

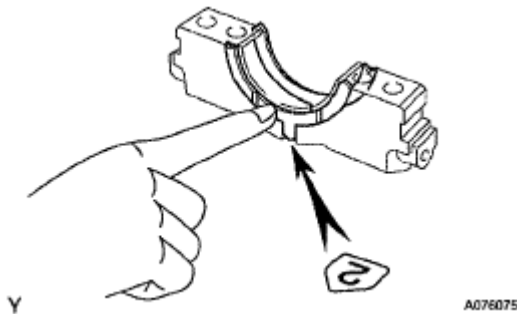


Fig. 479: Identifying Lower Thrust Washers
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Examine the front marks and numbers and install the bearing caps on the cylinder block.

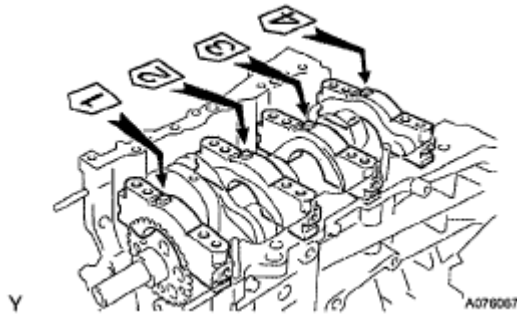


Fig. 480: Identifying Bearing Caps Front Marks And Numbers
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Apply a light coat of engine oil to the threads of the bearing cap bolts.
- f. Temporarily install the 8 main bearing cap bolts to the inside positions.
- 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 becomes less than 6 mm (0.23 in.).

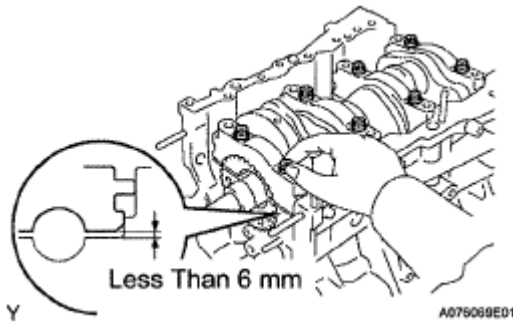


Fig. 481: Identifying Clearance Between Bearing Cap And Cylinder Block
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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 the main bearing cap bolts.

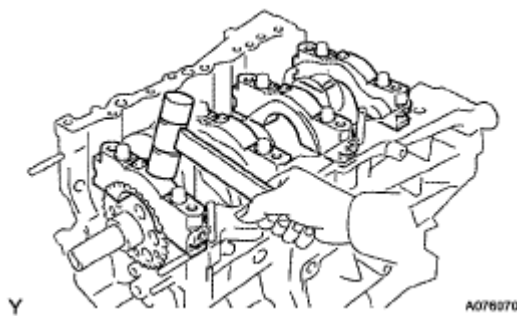


Fig. 482: Identifying Bearing Cap

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 as shown in the illustration.

Torque: 61 N*m (622 kgf*cm, 45 ft.*lbf)

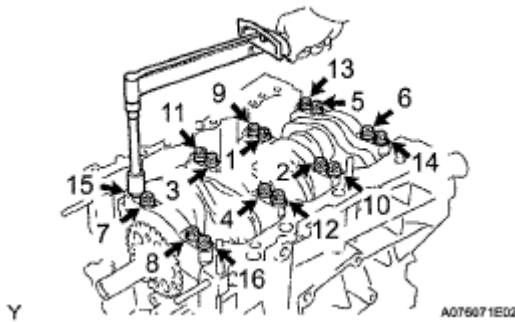


Fig. 483: Identifying Tightening Sequence Of Main Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- k. Mark the front side of the bearing cap bolts with paint.

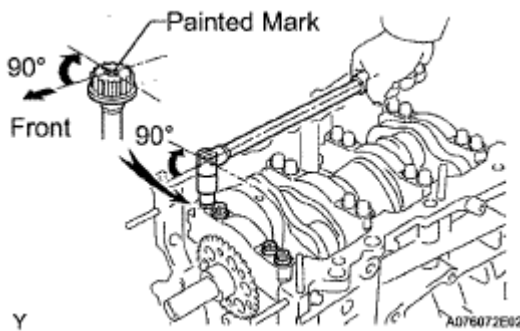


Fig. 484: Identifying Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- l. Retighten the bearing cap bolts 90° in the sequence as shown.
- m. Check that the painted mark is now at a 90° angle to the front.
- n. Check that the crankshaft turns smoothly.
- o. Using several steps, tighten the 8 main bearing cap bolts uniformly in the sequence as shown in the illustration.

Torque: 26 N*m (262 kgf*cm, 19 ft.*lbf)

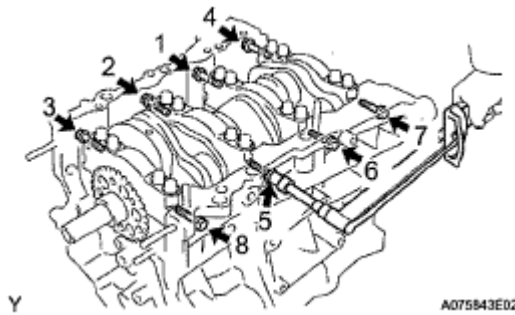


Fig. 485: Identifying Tightening Sequence Of Main Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. INSTALL PISTON SUB-ASSEMBLY WITH CONNECTING ROD

- a. Apply engine oil to the cylinder walls, the pistons, and the surfaces of the connecting rod bearings.
- b. Check the positions of the piston ring ends.
- c. Using a piston ring compressor, push the correctly numbered piston and connecting rod assemblies into each cylinder with the front mark of the piston facing forward.

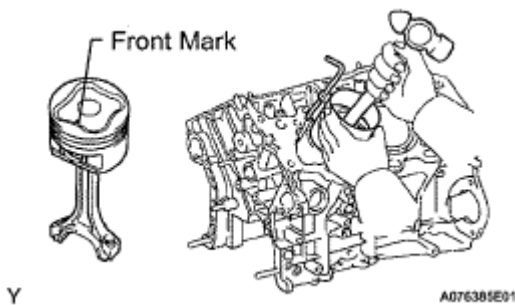


Fig. 486: Identifying Piston And Connecting Rod Assemblies Into Cylinder
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE:

- Clean the backside of the bearing and the contact surface of the connecting rod cap and prevent oil from adhering to them.
- Match the numbered connecting rod cap with the connecting rod.

- d. Check that the protrusion of the connecting rod cap is facing the correct direction.

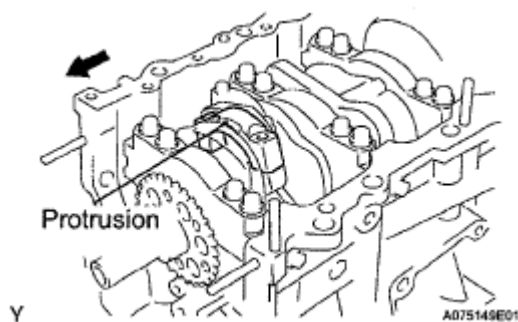


Fig. 487: Identifying Protrusion Of Connecting Rod Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Apply a light coat of engine oil to the threads of the connecting rod cap bolts.
- f. Tighten the bolts alternately with the specified torque.

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

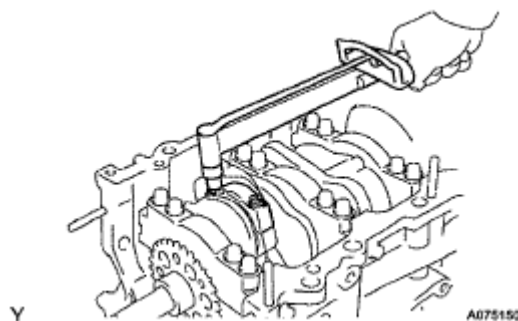


Fig. 488: Identifying Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Mark the front side of each connecting cap bolt with paint.
- h. Retighten the cap bolts 90° as shown.

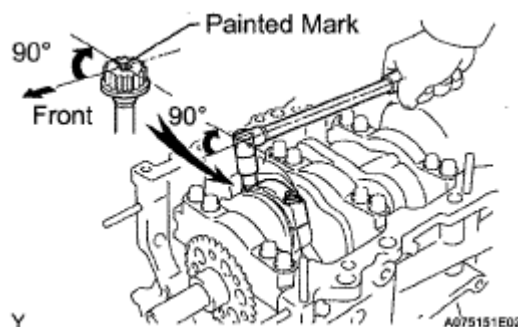


Fig. 489: Identifying Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

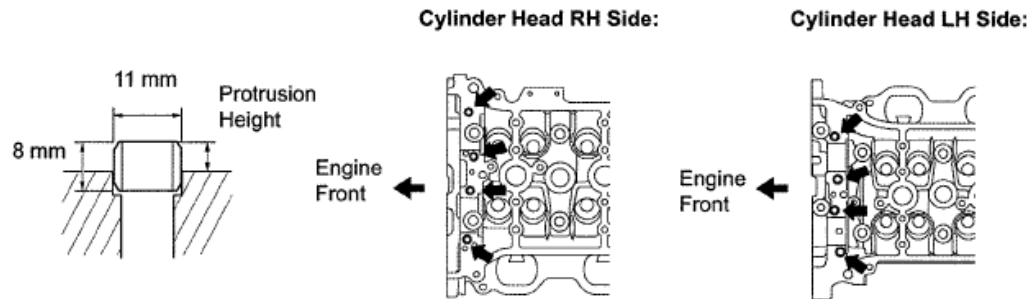
- i. Check that the crankshaft turns smoothly.

14. INSTALL RING PIN

- a. Using a plastic-faced hammer, tap in new ring pins until it reaches the specified protrusion height.

Specified protrusion height:

2.7 to 3.3 mm (0.106 to 0.130 in.)



Y

A075625E04

Fig. 490: Identifying Ring Pin Dimension

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

15. INSTALL STRAIGHT PIN

- a. Using a plastic-faced hammer, tap in new straight pins until it reaches the specified protrusion height.

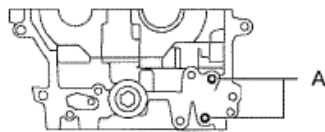
Specified protrusion height:

STRAIGHT PIN PROTRUSION HEIGHT SPECIFICATION

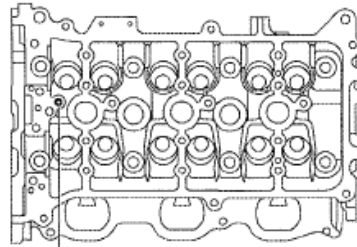
A	17.5 to 19.5 mm (0.689 to 0.768 in.)
B	7.5 to 8.5 mm (0.295 to 0.335 in.)
C	7.0 to 9.0 mm (0.276 to 0.354 in.)

Cylinder Head RH Side:

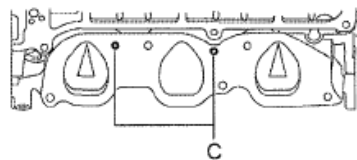
Front Side:



Upper Side:

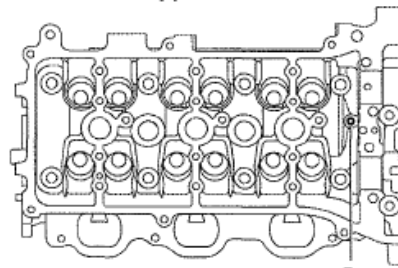


Intake Manifold Side:

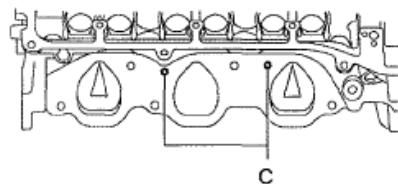


Cylinder Head LH Side:

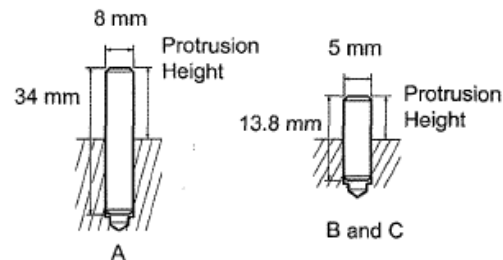
Upper Side:



Intake Manifold Side:



Front Side:



Y

A075627E04

Fig. 491: Identifying Straight Pin Dimension

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

16. INSTALL STUD BOLT

- Using the torx socket wrench E5 and E7, install the stud bolts.

Torque:

For stud bolt A

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

For stud bolt B

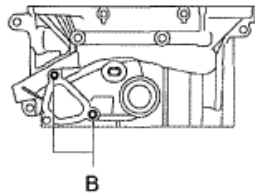
4.0 N*m (41 kgf*cm, 35 in.*lbf)

For stud bolt C

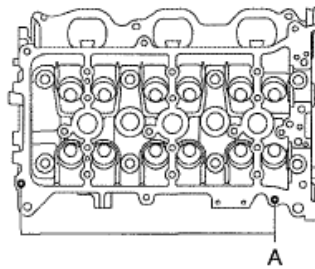
20 N*m (199 kgf*cm, 14 ft.*lbf)

Cylinder Head RH Side:

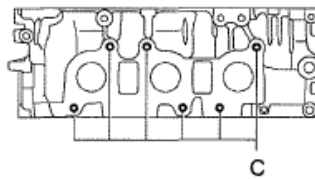
Rear Side:



Upper Side:

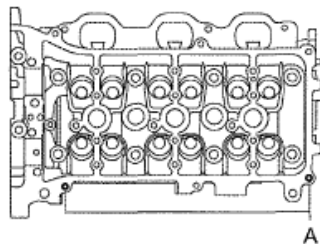


Exhaust Manifold Side:

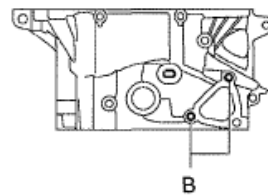


Cylinder Head LH Side:

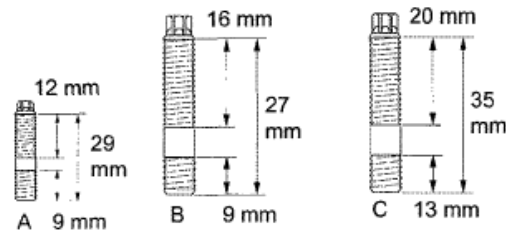
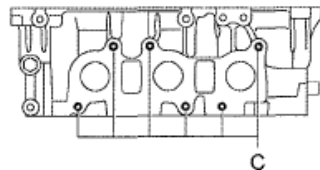
Upper Side:



Rear Side:



Exhaust Manifold Side:



G038605E01

Fig. 492: Identifying Stud Bolt Dimension
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 Adhesive 1324, Three Bond 1324 or Equivalent

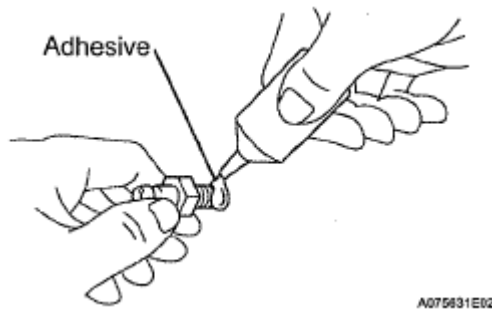


Fig. 493: Identifying Adhesive To Threads Of Bolt End
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a deep socket wrench 12, install the unions.

Torque: 15 N*m (150 kgf*cm, 11 ft.*lbf)

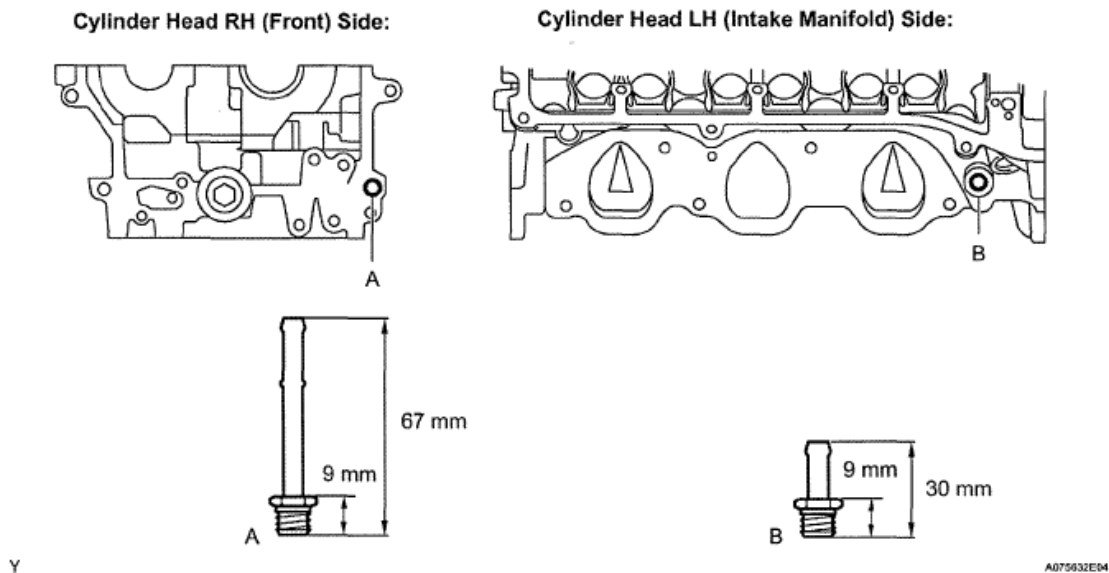
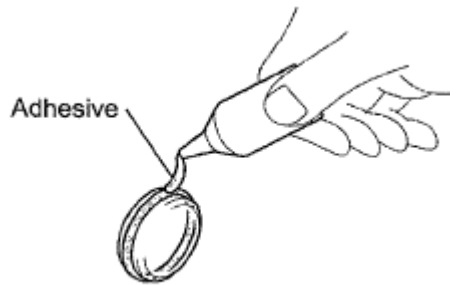


Fig. 494: Identifying Cylinder Head Bolt Dimension
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

18. INSTALL TIGHT PLUG

- a. Apply adhesive around the tight plug.



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A058129E09

Fig. 495: Identifying Adhesive Around Tight Plug
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

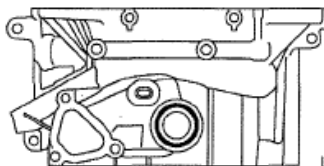
- b. Using SST, tap in the tight plugs to the specified depth.

SST 09950-60010 (09951-00250), 09950-70010 (09951-07150)

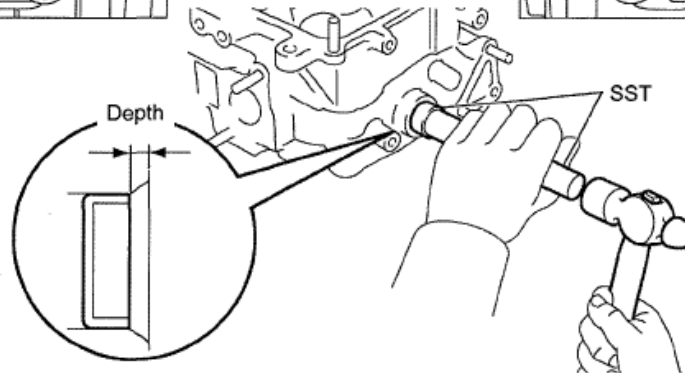
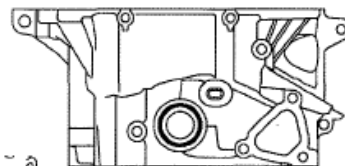
Specified depth:

1.5 mm (0.059 in.)

Cylinder Head RH (Rear) Side:



Cylinder Head LH (Rear) Side:



Y

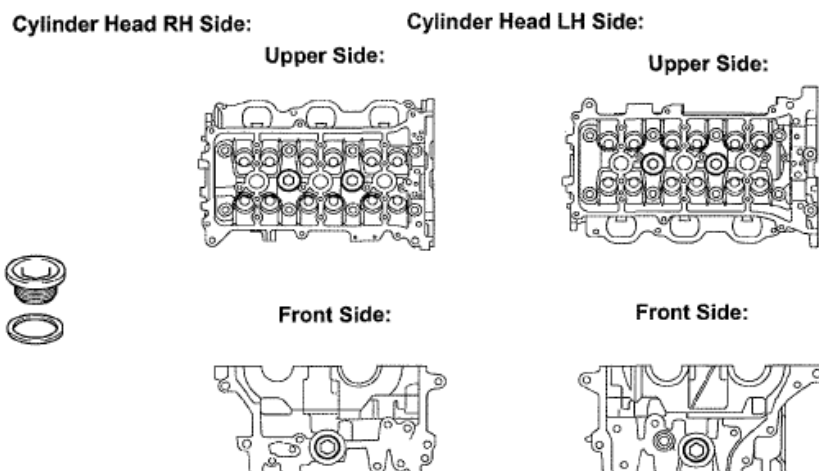
A075633E03

Fig. 496: Identifying Tight Plug
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

19. INSTALL WITH HEAD STRAIGHT SCREW PLUG

- a. 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

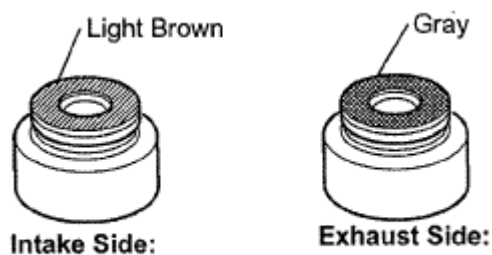
Fig. 497: Identifying Head Straight Screw Plug
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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.



A075162E02

Fig. 498: Identifying Valve Guide Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Using SST, push in a new valve stem oil seal.

SST 09201-41020

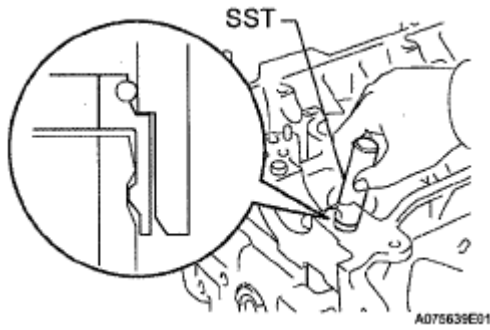


Fig. 499: Identifying Valve Stem Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

21. INSTALL VALVE SPRING SEAT

- Install the valve spring seat.

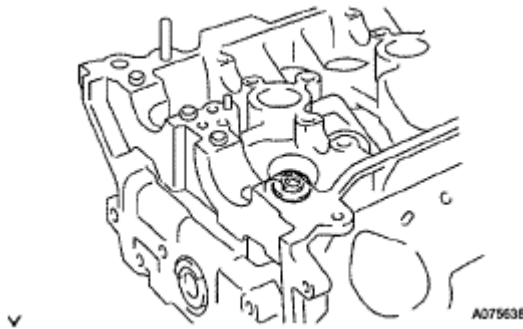


Fig. 500: Identifying Valve Spring Seat
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

22. INSTALL VALVE

- Apply engine oil to the valve as shown in the illustration.

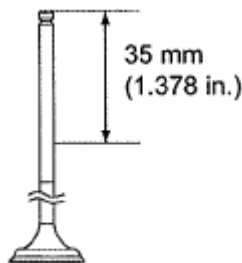


Fig. 501: Identifying Valve Stem Dimension
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Place the cylinder head on a wooden block.
- 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 locks around the valve stem.

SST 09202-70020 (09202-00010)

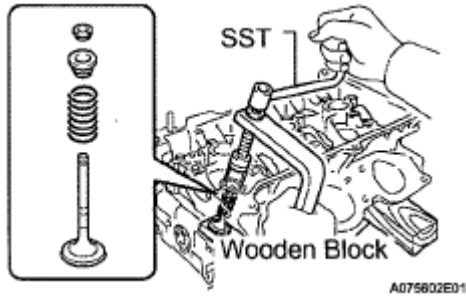


Fig. 502: Identifying Inner Compression Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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.

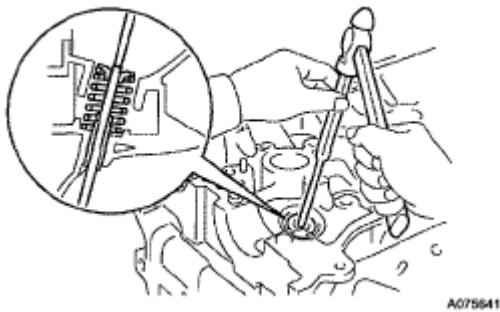


Fig. 503: Identifying Valve Stem Tip
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

23. INSTALL VALVE LIFTER

- a. Apply engine oil to the valve stem end and valve lifter, and install the valve lifter to the valve stem.

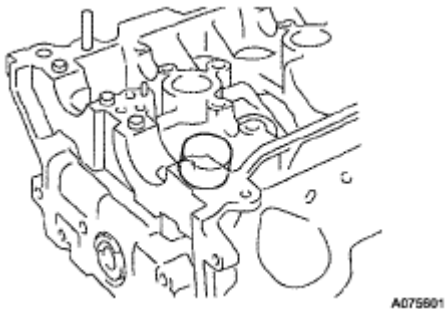


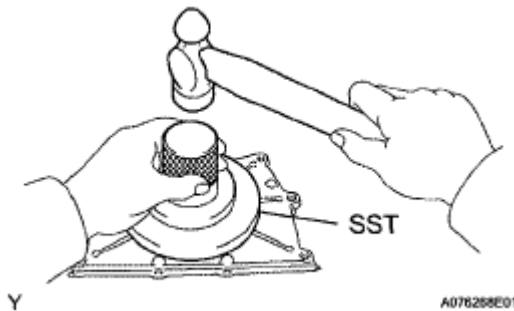
Fig. 504: Identifying Valve Lifter

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

- b. Check that the valve lifter rotates smoothly by hand.

24. INSTALL ENGINE REAR OIL SEAL

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

SST 09223-78010**Fig. 505: Identifying Engine Rear Oil Seal**

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

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

25. INSTALL ENGINE REAR OIL SEAL RETAINER

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

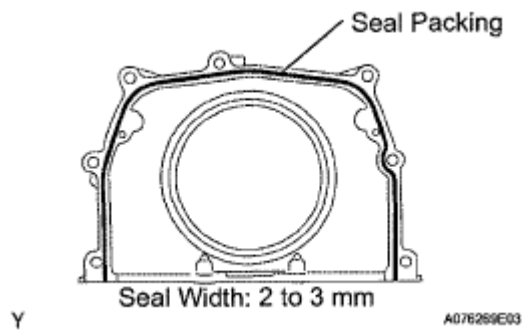


Fig. 506: Identifying Seal Packing Applying Area
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the oil seal retainer with the 5 bolts and 2 nuts.

Torque: For nut

For nut

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

For bolt

10 N*m (102 kgf*cm, 7 ft.*lbf)

26. INSTALL KNOCK 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)

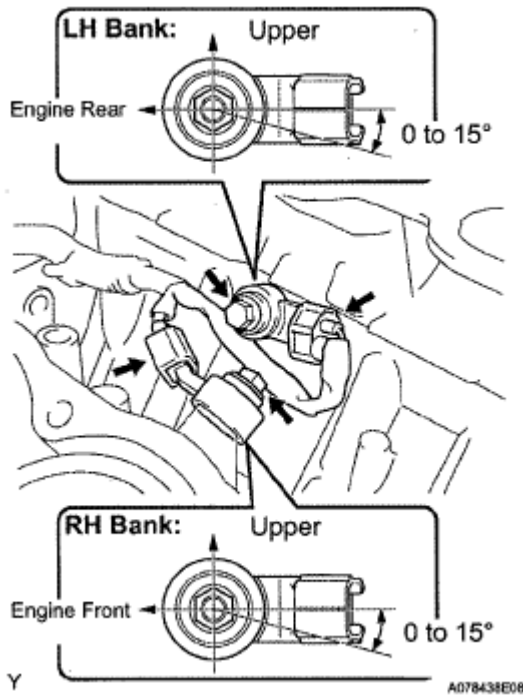


Fig. 507: Identifying Knock Sensors Bolts

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

- b. Connect the knock sensor connectors.

27. INSTALL NO. 1 WATER OUTLET PIPE

- a. Install the water outlet pipe with the 3 bolts.

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

28. 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.

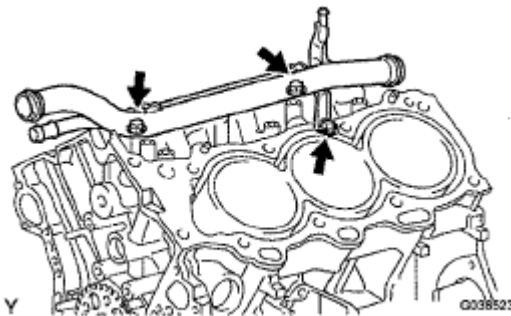


Fig. 508: Identifying Water Outlet Pipe Bolts

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

- b. Apply 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.

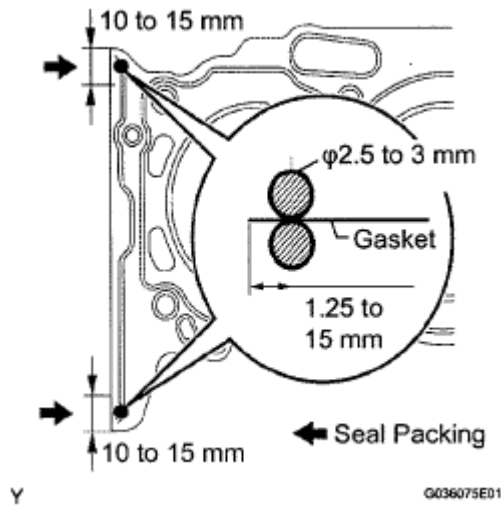


Fig. 509: Identifying Seal Packing Dimension

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

Seal packing:

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

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

- c. Place the cylinder head gasket on the cylinder block surface with the Lot No. stamp upper side facing 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.

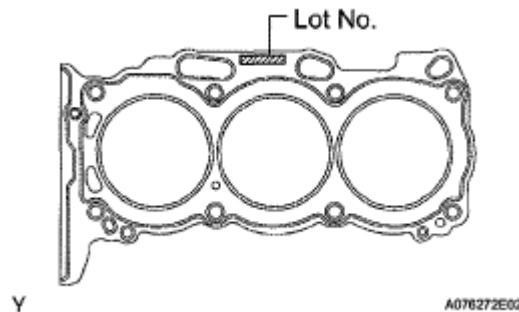


Fig. 510: Identifying Cylinder Head Gasket

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

29. INSTALL CYLINDER HEAD SUB-ASSEMBLY

- a. Place the RH cylinder head on the cylinder head gasket.
- b. Install the 8 cylinder head bolts and plate washers.

HINT:

- The cylinder head bolts are tightened in 2 successive steps (procedures "A" and "B").
 - If any cylinder head bolt is 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 to the cylinder head bolt.
 3. Using several steps, tighten each bolt with a 10 mm bi-hexagon wrench uniformly in the sequence as shown in the illustration (Procedure "A").

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

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

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

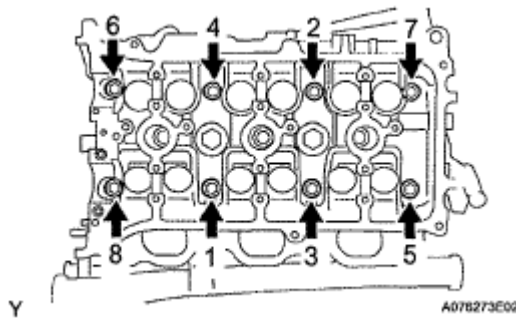


Fig. 511: Identifying Tightening Sequence Of Cylinder Head Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. Mark the front side of each cylinder head bolt with paint.
5. Retighten the cylinder head bolts by 180° as shown (Procedure "B").

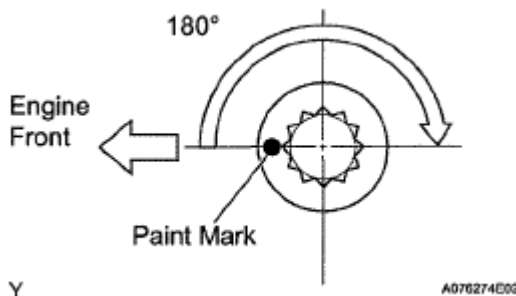


Fig. 512: Identifying Retightening Angle Of Cylinder Head Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. Check that the painted marks are now at 180° opposite to the engine front.

30. INSTALL NO. 2 CYLINDER HEAD GASKET

- 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.
- Apply 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 after applying seal packing. After installing it, the cylinder head bolts must be tightened within 15 minutes. Otherwise the seal packing must be removed and reapplied.

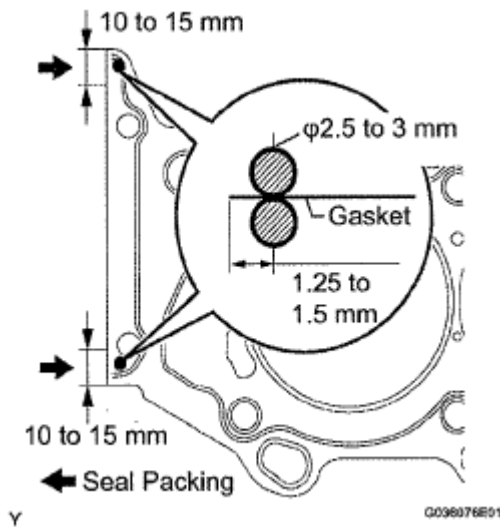


Fig. 513: Identifying Seal Packing Dimension
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Place the cylinder head gasket on the cylinder block surface with the Lot No. stamp upper side facing 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.

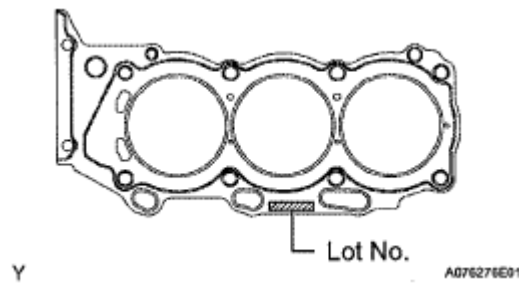


Fig. 514: Identifying Cylinder Head Gasket
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

31. INSTALL CYLINDER HEAD LH

- a. Place the LH cylinder head on the cylinder head gasket.
- b. Install the 8 cylinder head bolts and plate washers.

HINT:

- The cylinder head bolts are tightened in 2 successive steps (procedures "A" and "B").
 - If any cylinder head bolt is 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 to the cylinder head bolt.
 3. Using several steps, tighten each bolt with a 10 mm bi-hexagon wrench uniformly in the sequence as shown in the illustration (Procedure "A").

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

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

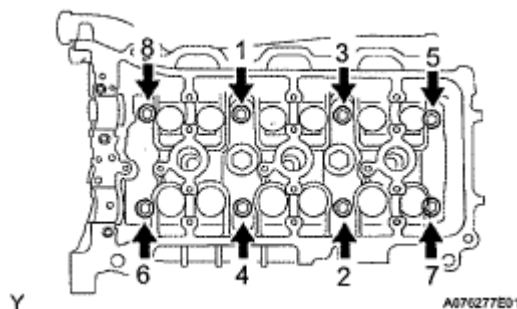


Fig. 515: Identifying Tightening Sequence Of Cylinder Head Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

4. Mark the front side of each cylinder head bolt with paint.

5. Retighten the cylinder head bolts by 180° as shown (Procedure "B").

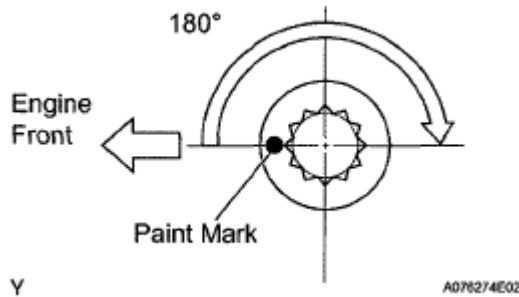


Fig. 516: Identifying Retightening Angle Of Cylinder Head Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. Check that the painted marks are now at 180° opposite to the engine front.
- c. Install the 2 cylinder head bolts.
 1. Apply a light coat of engine oil to the threads of the cylinder head bolts.
 2. Install the 2 cylinder head bolts. Using several steps, tighten the bolts uniformly in the sequence as shown in the illustration.

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

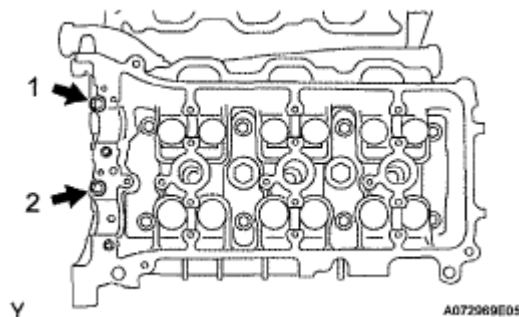


Fig. 517: Identifying Tightening Sequence Of Cylinder Head Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

32. 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 backside of the bearing and the contact surface of the bearing cap and prevent oil from adhering to them.

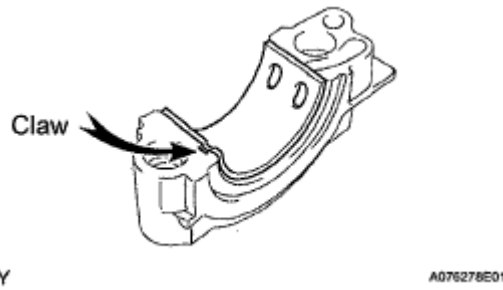


Fig. 518: Identifying Camshaft Bearing Claw
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

33. INSTALL NO. 2 CAMSHAFT BEARING

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

NOTE: Clean the backside of the bearing and the bearing surface of the cylinder head.

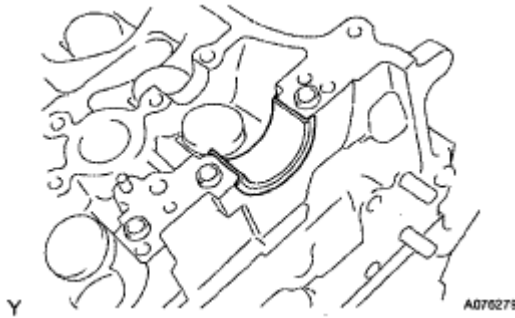


Fig. 519: Identifying No. 2 Camshaft Bearing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

34. INSTALL CAMSHAFTS

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

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

NOTE: Having the crankshaft at the wrong angle can cause the piston head and valve head to come into contact with each other when you install the camshaft, causing damage. So always set the

crankshaft at the correct angle.

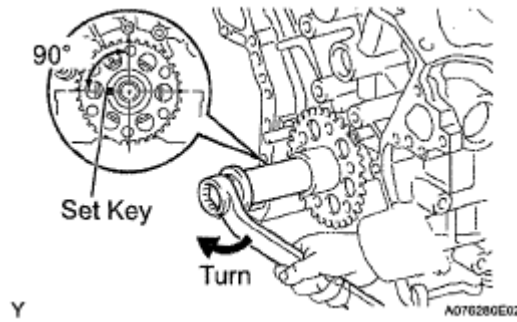


Fig. 520: Identifying Crankshaft

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 onto the RH cylinder head with the cam lobes of No. 1 cylinder facing each direction as shown in the illustration.

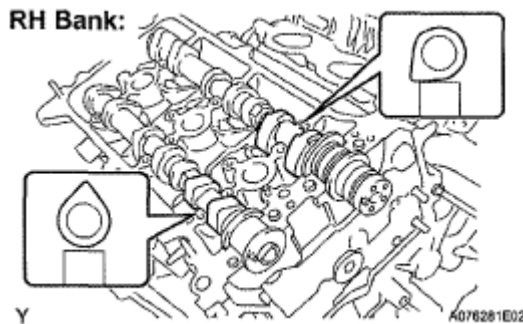


Fig. 521: Identifying Cam Lobes Position

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

2. Install the 8 bearing caps in their proper locations.

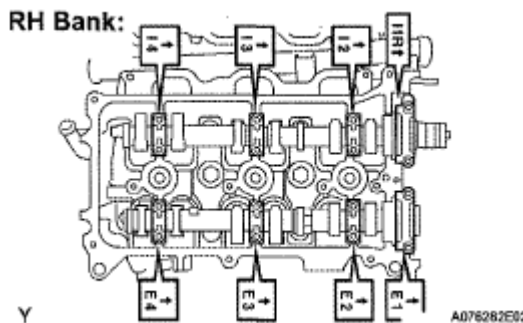


Fig. 522: Identifying Bearing Caps Locations

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

3. Apply a light coat of engine oil to the threads of the bearing cap bolts.
4. Install the 16 bearing cap bolts. Using several steps, tighten the bolts uniformly in the sequence as shown in the illustration.

Torque:

For 10 mm (0.39 in.) head

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

For 12 mm (0.47 in.) head

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

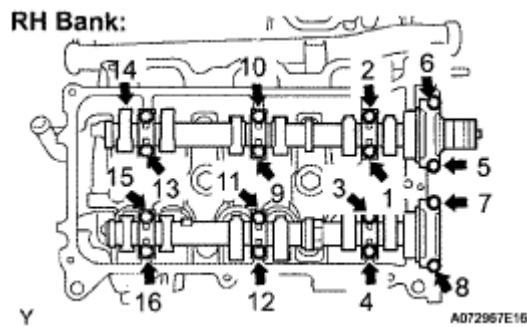


Fig. 523: Identifying Tightening Sequence Of Bearing Caps Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. Turn the camshafts clockwise with a wrench until the camshaft knock pin comes 90° position to the cylinder head.

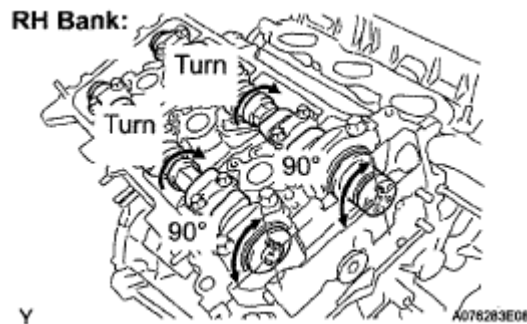


Fig. 524: Identifying Camshafts Clockwise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Install the camshafts of the LH bank.
 1. Place the 2 camshafts onto the LH cylinder head with the cam lobes of No. 2 cylinder facing as shown in the illustration.

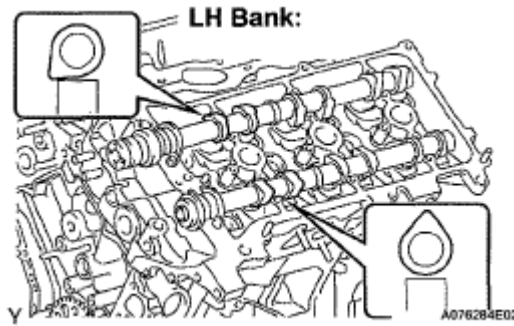


Fig. 525: Identifying Cam Lobes Position
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Install the 8 bearing caps in their proper locations.

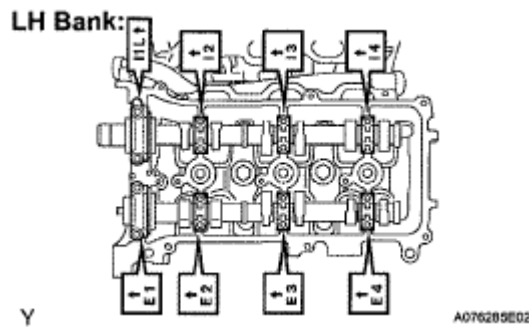


Fig. 526: Identifying Bearing Caps Locations
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.
4. Install the 16 bearing cap bolts. Using several steps, tighten the bolts uniformly in the sequence as shown in the illustration.

Torque:

For 10 mm (0.39 in.) head

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

For 12 mm (0.47 in.) head

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

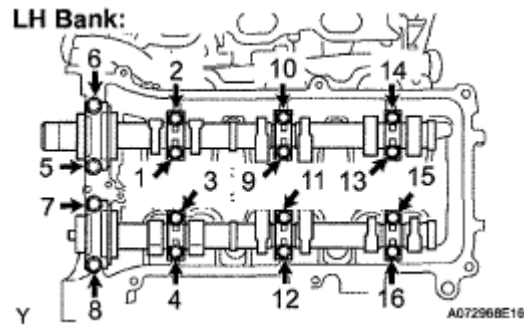


Fig. 527: Identifying Tightening Sequence Of Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

35. INSTALL NO. 2 CHAIN TENSIONER ASSEMBLY

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

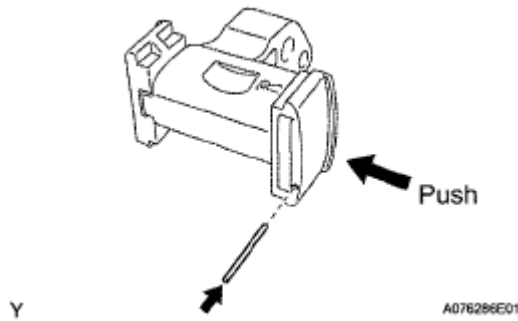


Fig. 528: Identifying Pushing In Tensioner
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

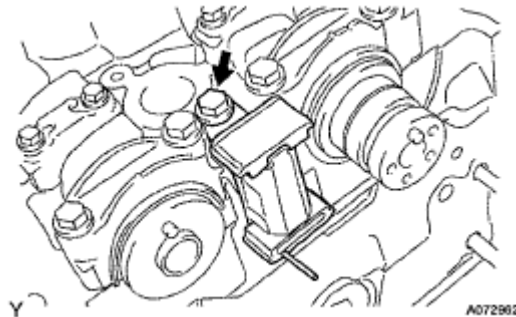


Fig. 529: Identifying No. 2 Chain Tensioner Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

36. INSTALL CAMSHAFT TIMING GEARS AND NO. 2 CHAIN (for Bank 1)

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

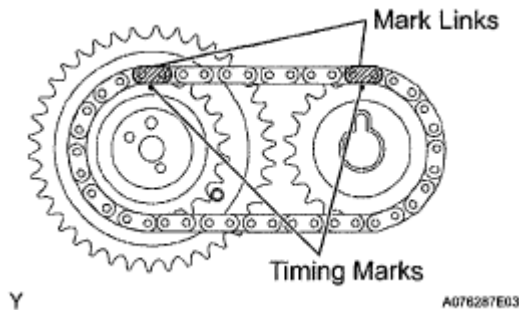


Fig. 530: Identifying Mark Links (Yellow) With Timing Marks Of Camshaft Timing Gears
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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 to the RH camshafts.
- c. Temporarily install the 2 camshaft timing gear bolts.

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

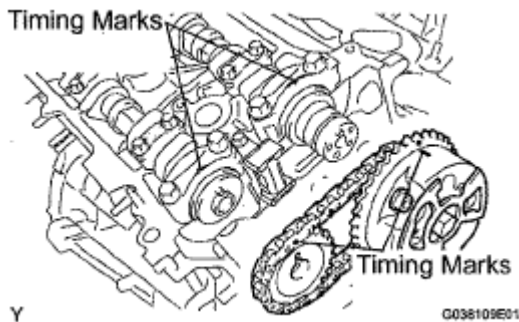


Fig. 531: Identifying Timing Marks On Camshaft Timing Gears
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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 No. 2 chain tensioner.

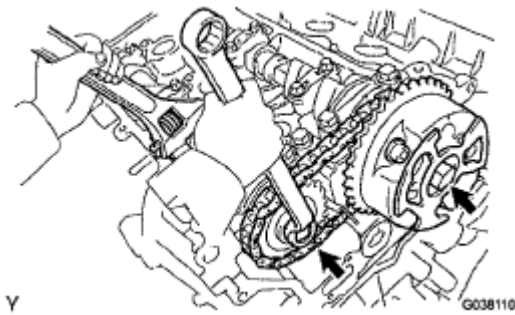


Fig. 532: Identifying Camshaft Timing Gear Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

37. INSTALL NO. 3 CHAIN TENSIONER ASSEMBLY

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

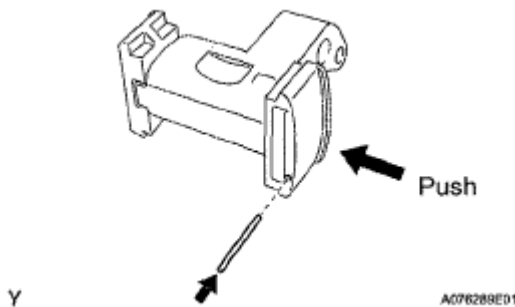


Fig. 533: Identifying Pushing In Tensioner
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the No. 3 chain tensioner with the bolt.

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

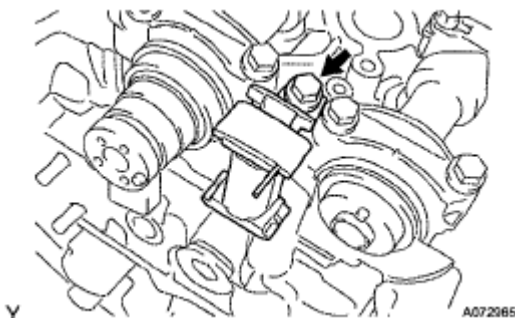


Fig. 534: Identifying Chain Tensioner Bolt
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

38. INSTALL CAMSHAFT TIMING GEARS AND NO. 2 CHAIN (for Bank 2)

- a. Align the mark links (yellow) with the timing marks (1-dot mark and 2-dot mark) of the camshaft

timing gears as shown in the illustration.

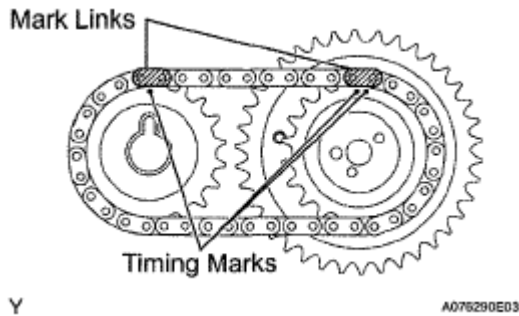


Fig. 535: Identifying Mark Links With Timing Marks Of Camshaft Timing Gears
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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 to the LH camshafts.

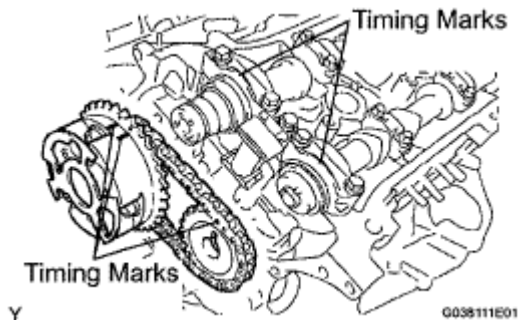


Fig. 536: Identifying Timing Marks On Camshaft Timing Gears
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Temporarily install the 2 camshaft timing gear bolts.

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

- 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)

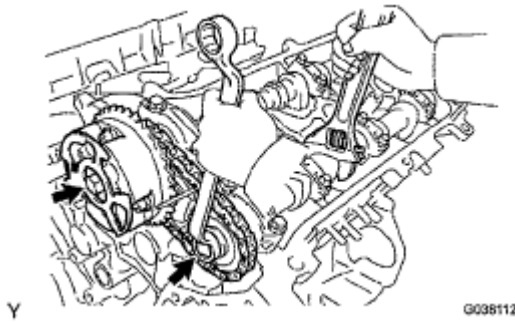


Fig. 537: Identifying Camshaft Timing Gears Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

39. INSTALL NO. 1 CHAIN VIBRATION DAMPER

- a. Install the No. 1 chain vibration damper with the 2 bolts.

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

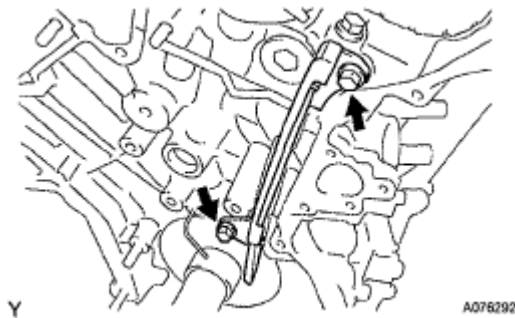


Fig. 538: Identifying Chain Vibration Damper Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

40. 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 facing inward as shown in the illustration.

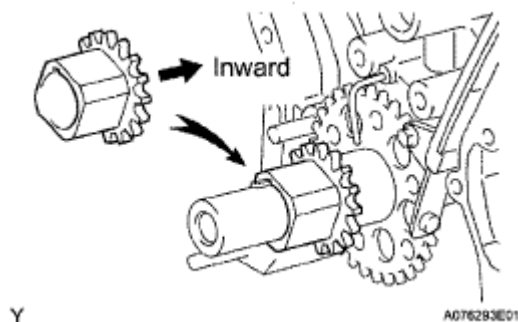


Fig. 539: Identifying Crankshaft Timing Gear Onto Crankshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

41. INSTALL CHAIN TENSIONER SLIPPER

42. 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.

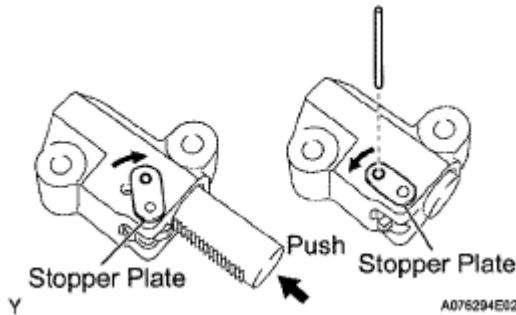


Fig. 540: Identifying Plunger Of Tensioner
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

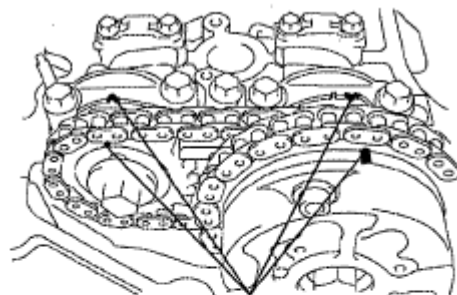
- b. While turning the stopper plate of the tensioner counterclockwise, insert a bar of $\varnothing 3.5$ mm (0.138 in.) into the holes on the stopper plate and tensioner to fix the stopper plate.
- c. Install the chain tensioner with the 2 bolts.

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

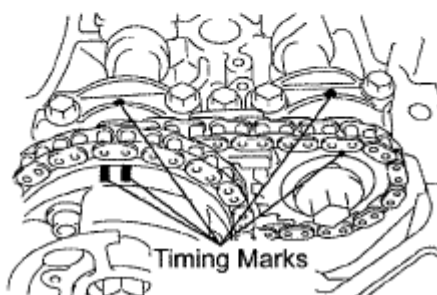
43. INSTALL CHAIN SUB-ASSEMBLY

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

RH Bank:



LH Bank:

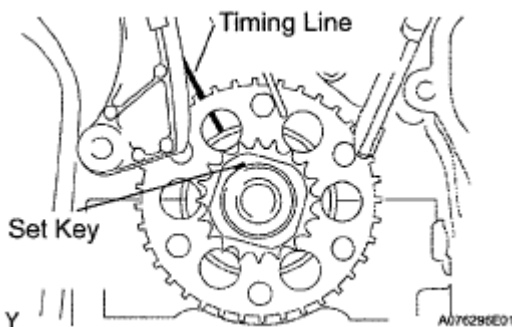


Y

G038065E09

Fig. 541: Aligning Timing Marks Of Camshaft Timing Gears And Bearing Caps
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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



Y

A076296E01

Fig. 542: Identifying Crankshaft Set Key With Timing Line Of Cylinder Block
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

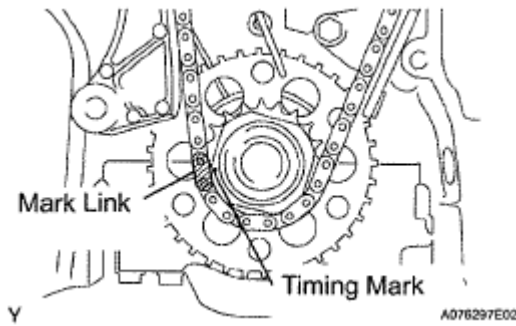


Fig. 543: Identifying Mark Link With Timing Mark Of Crankshaft Timing Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

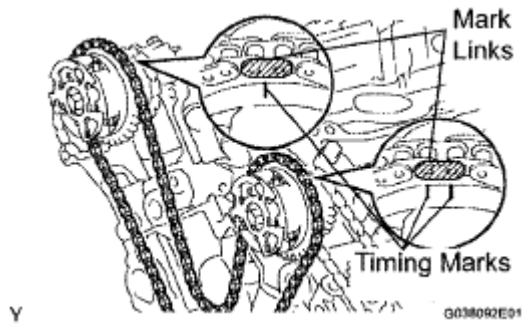


Fig. 544: Identifying Mark Links With Timing Marks Of Camshaft Timing Gears
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

44. INSTALL NO. 2 CHAIN VIBRATION DAMPER

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

45. INSTALL NO. 1 IDLE GEAR SHAFT

- a. Apply a light coat of engine oil to the rotating surface of the No. 1 idle gear shaft.
- b. Temporarily install the No. 1 idle gear shaft and No. 1 idle gear with the No. 2 idle gear shaft while aligning the knock pin of the No. 1 idle gear shaft with the knock pin groove of the cylinder block.

NOTE: Be careful of the idle gear direction.

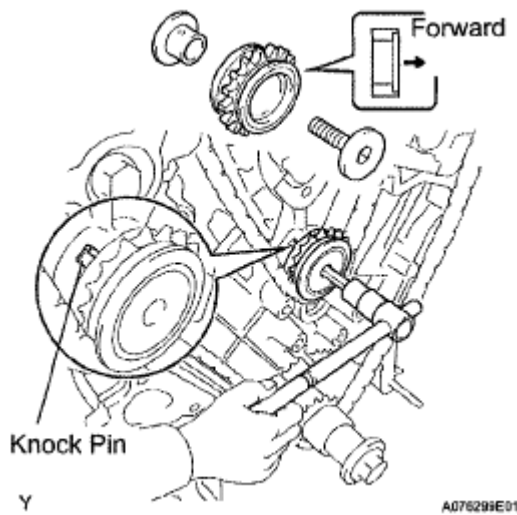


Fig. 545: Identifying Idle Gear Shaft

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

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

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

- d. Remove the bar from the chain tensioner.

46. INSTALL TIMING GEAR CASE OR TIMING CHAIN CASE OIL SEAL

- a. Using SST and a hammer, tap in a new oil seal until its surface is flush with the timing chain cover edge.

SST 09226-10010

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

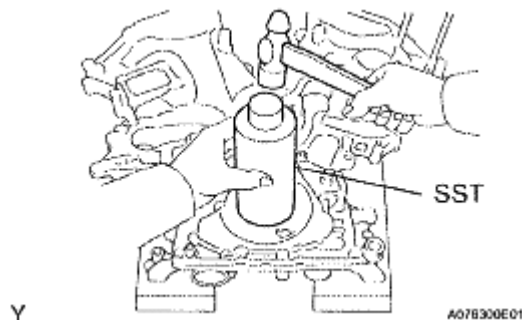


Fig. 546: Identifying Timing Chain Case Oil Seal

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

47. INSTALL TIMING CHAIN OR BELT COVER SUB-ASSEMBLY

- a. Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the timing chain cover, cylinder head and cylinder block.

- b. Install a new O-ring to the LH cylinder head as shown in the illustration.

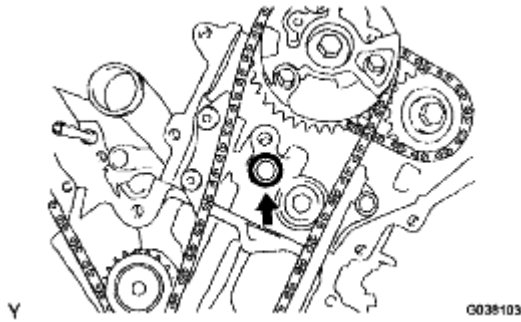


Fig. 547: Identifying O-Ring

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

- c. Apply a continuous bead of seal packing (diameter 3.0 to 4.0 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

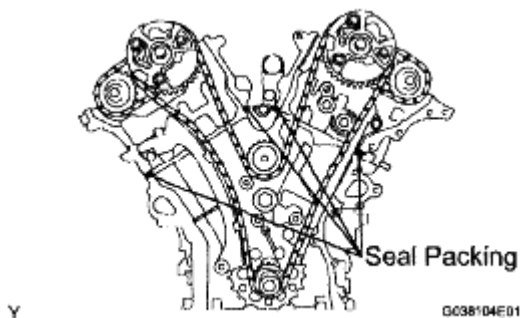


Fig. 548: Identifying Seal Packing

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

- d. Apply a continuous bead of seal packing (diameter 3.0 to 4.0 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 after applying

seal packing. After installing it, 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 the "A" as shown in the illustration.

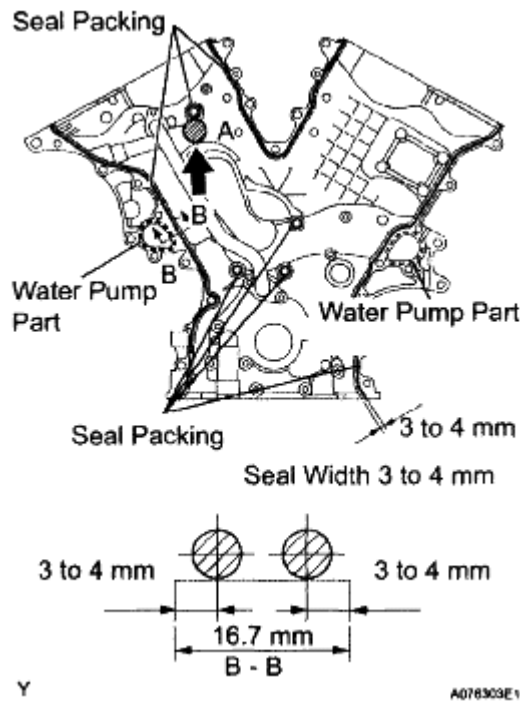


Fig. 549: Identifying Seal Packing Diameter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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.

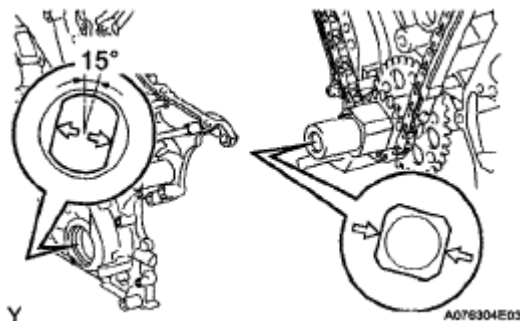


Fig. 550: Identifying Oil Pump Drive Rotor Key Way With Crankshaft Timing Gear Rectangular Portion

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

- f. 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)

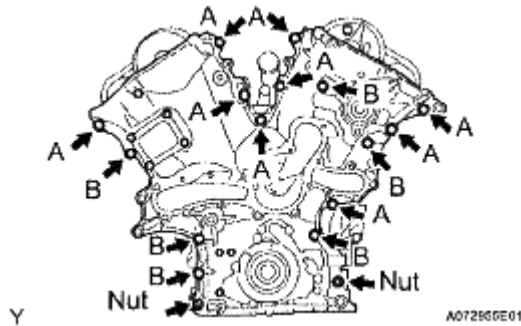


Fig. 551: Identifying Timing Chain Cover Bolts And Nuts

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

NOTE:

- Pay attention not to wrap the chain and slipper over the timing chain cover seal line.
- After installing the timing chain cover, install the water pump within 15 minutes.

HINT:

Each bolt length is as follows:

A: 25 mm (0.98 in.)

B: 55 mm (2.17 in.)

48. INSTALL WATER PUMP ASSEMBLY

- a. Install a new gasket and the water pump with the 17 bolts.

Torque:

For 10 mm (0.39 in.) head

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

For 12 mm (0.47 in.) head

23 N*m (235 kgf*cm, 17 ft.*lbf)

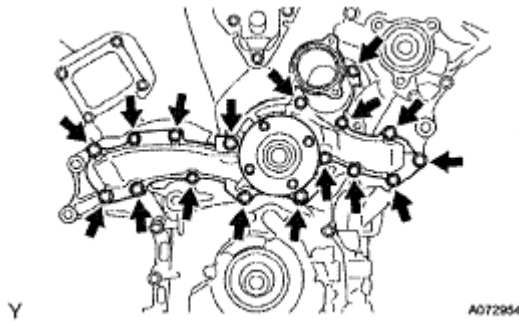


Fig. 552: Identifying Water Pump Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

49. INSTALL OIL PAN SUB-ASSEMBLY

- 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.
- Install the 4 stud bolts.

Torque: 4.0 N*m (41 kgf*cm, 35 in.*lbf)

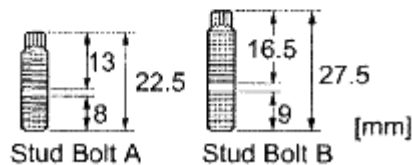
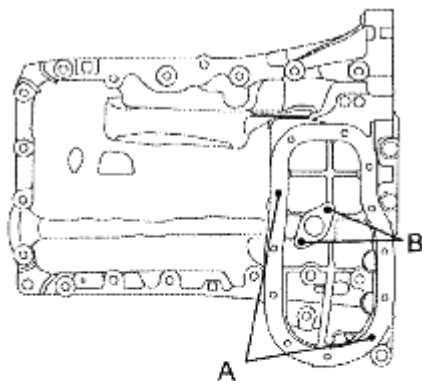


Fig. 553: Identifying Stud Bolts Dimension
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Install a new O-ring to the oil pump.

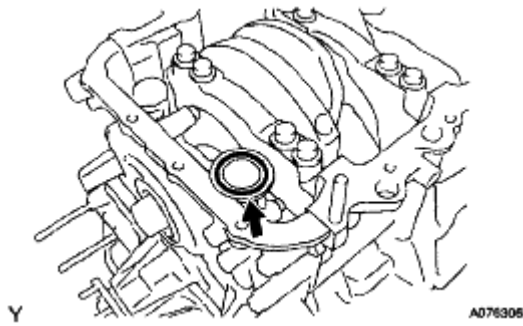


Fig. 554: Identifying O-Ring

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 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 after applying seal packing. After installing it, the oil pan bolts and nuts must be tightened within 15 minutes. Otherwise the seal packing must be removed and reapplied.

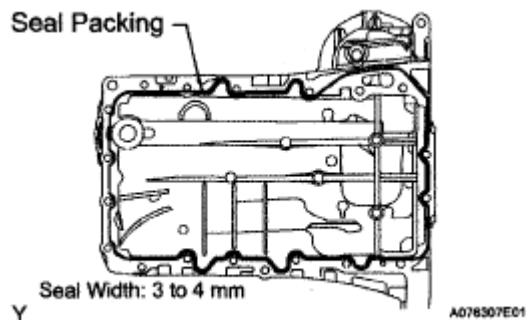


Fig. 555: Identifying Seal Packing Applying Area

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

- e. Install the oil pan with the 17 bolts and 2 nuts. Tighten the bolts and nuts uniformly in several steps.

Torque:

For bolt A

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

For bolt B

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

For bolt C

10 N*m (102 kgf*cm, 7 ft.*lbf)

For nut

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

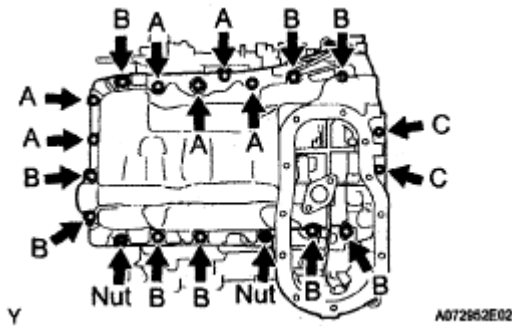


Fig. 556: Identifying Oil Pan Bolts And Nuts

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

HINT:

Each bolt length is as follows:

A: 25 mm (0.98 in.)

B: 45 mm (1.77 in.)

C: 14 mm (0.55 in.)

50. 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)

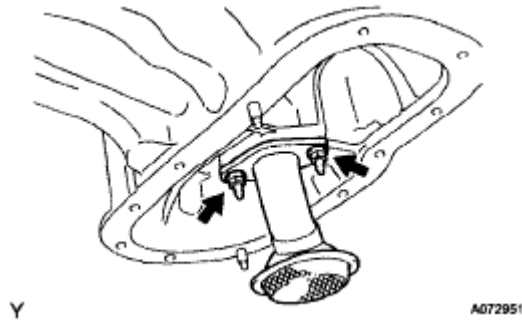


Fig. 557: Identifying Oil Strainer Nuts

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

51. 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 No. 2 oil pan.
- 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 No. 2 oil pan within 3 minutes after applying seal packing. After installing it, the No. 2 oil pan bolts and nuts must be tightened within 15 minutes. Otherwise the seal packing must be removed and reapplied.

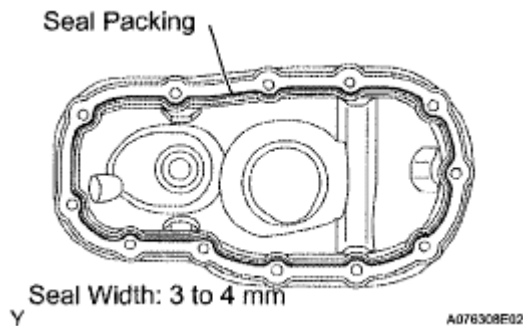


Fig. 558: Identifying Seal Packing Applying Area

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

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

Torque:

For bolt

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

For nut

10 N*m (102 kgf*cm, 7 ft.*lbf)

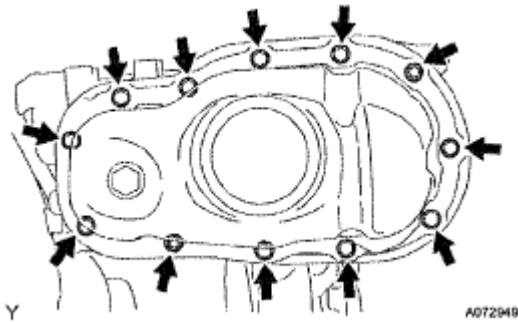


Fig. 559: Identifying Oil Pan Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

52. INSTALL OIL PAN DRAIN PLUG

- a. Install the drain plug and a new gasket.

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

53. 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)

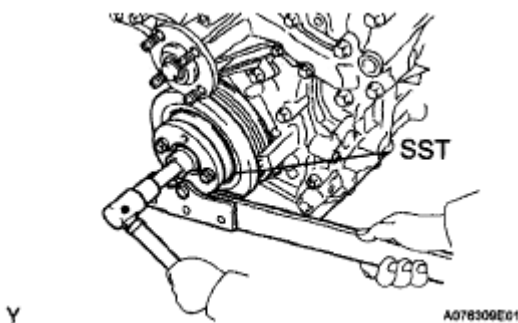


Fig. 560: Identifying Crankshaft Pulley Set Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

54. SET NO. 1 CYLINDER TO TDC / COMPRESSION (See ADJUSTMENT)

55. INSPECT VALVE CLEARANCE (See ADJUSTMENT)

56. **ADJUST VALVE CLEARANCE (See ADJUSTMENT)**57. **INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY**

- 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.
- b. 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 after applying seal packing. After installing it, the cylinder head cover bolts and nuts must be tightened within 15 minutes. Otherwise the seal packing must be removed and reapplied.

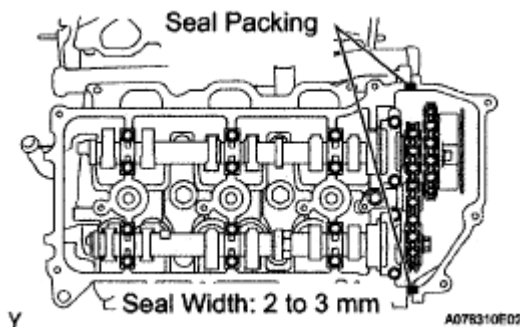


Fig. 561: Identifying Seal Packing Applying Area
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the gasket to the cylinder head cover.
- d. Install the seal washers to 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:

For bolt A

10 N*m (102 kgf*cm, 7 ft.*lbf)

For bolt B

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

For nut

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

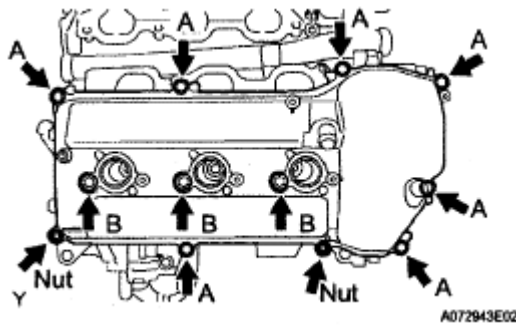


Fig. 562: Identifying Cylinder Head Cover Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

58. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY LH

- 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 adhesive to the threads of the ventilation valve.

Adhesive:

Toyota Genuine Adhesive 1324, Three Bond 1324 or Equivalent

- Install the ventilation valve to the cylinder head cover.

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

- 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.

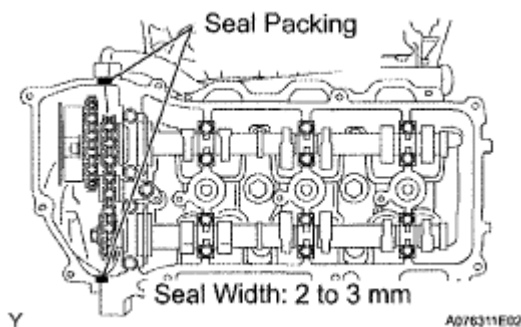


Fig. 563: Identifying Seal Packing Applying Area
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Seal packing:

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

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

- e. Install the gasket to the cylinder head cover.
- f. Install the seal washers to the bolts.
- g. Install the cylinder head cover with the 10 bolts and 2 nuts. Tighten the bolts and nuts uniformly in several steps.

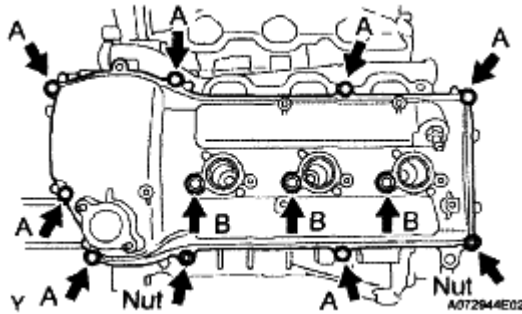


Fig. 564: Identifying Cylinder Head Cover Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Torque:

For bolt A

10 N*m (102 kgf*cm, 7 ft.*lbf)

For bolt B

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

For nut

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

59. INSTALL OIL CONTROL VALVE FILTER

- a. Check that no foreign objects are present on the mesh part of the 2 filters.
- b. Install 2 new gaskets to each new plug.
- c. Insert the filters to the plugs.
- d. Apply adhesive to 2 or 3 threads of the plugs.

Adhesive:

Toyota Genuine Adhesive 1344, Three Bond 1344 or Equivalent

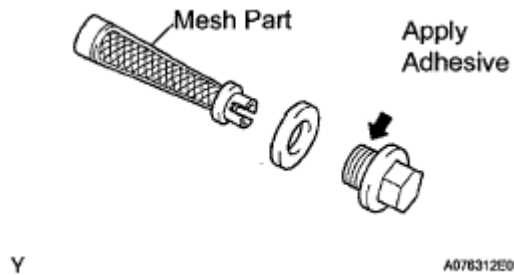


Fig. 565: Identifying Adhesive Applying Area
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Install the plugs to each cylinder head.

Torque: 62 N*m (632 kgf*cm, 46 ft.*lbf)

60. INSTALL CRANKSHAFT POSITION SENSOR

- a. Install the crankshaft position sensor with the bolt.

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

61. INSTALL WT SENSOR

- a. Apply a light coat of engine oil to the O-ring of each WT sensor.
- b. Install the 2 WT sensors with the 2 bolts.

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

62. INSTALL CYLINDER BLOCK WATER DRAIN COCK SUB-ASSEMBLY

- a. Apply adhesive to 2 or 3 threads of the drain cocks end.

Adhesive:

Toyota Genuine Adhesive 1324, Three Bond 1324 or Equivalent

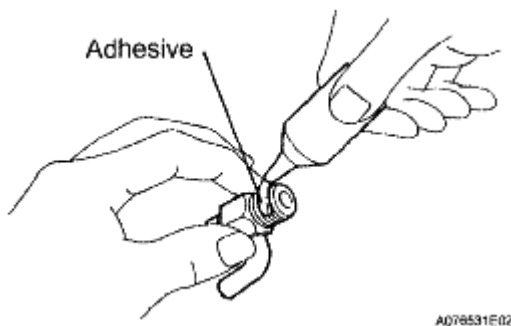


Fig. 566: Identifying Adhesive To Threads Of Drain Cocks End
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

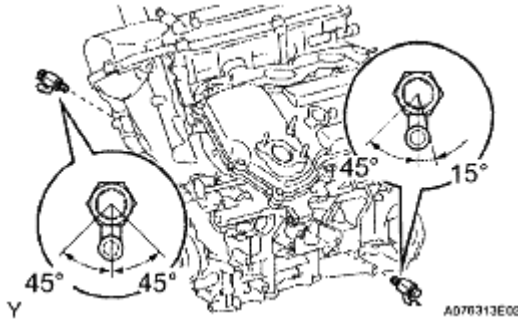


Fig. 567: Identifying Drain Cock Rotating Angle
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE:

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

63. INSTALL OIL LEVEL GAUGE GUIDE

- a. Install a new O-ring to the oil level gauge guide.

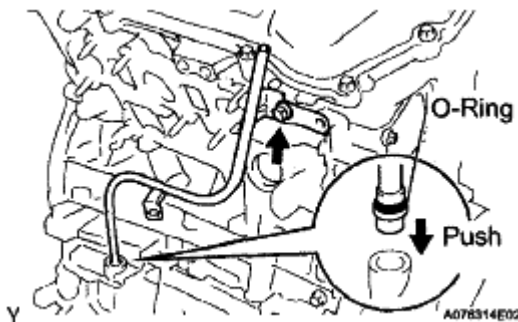


Fig. 568: Identifying Oil Level Gauge Guide
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Apply a light coat of engine oil to the O-ring.
- c. Push in 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)

64. INSTALL NO. 2 ENGINE HANGER

- a. Install the engine hanger with the 2 bolts.

Torque: 33 N*m (336 kgf*cm, 24 ft.*lbf)

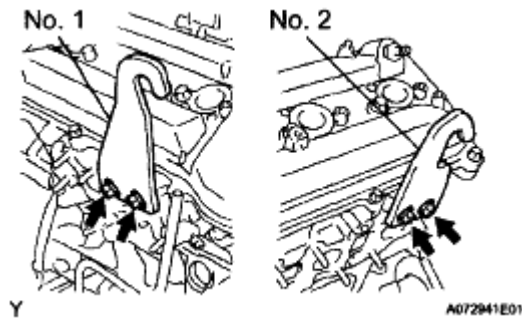


Fig. 569: Identifying Engine Hanger Bolts

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

65. INSTALL NO. 1 ENGINE HANGER

- a. Install the engine hanger with

Torque: 33 N*m (336 kgf*cm, 24 ft.*lbf)