

2009 ENGINE**Engine Mechanical - Camry Hybrid****ENGINE****INSPECTION****1. INSPECT COOLANT (for Engine)**

- a. Inspect the engine coolant (See ON-VEHICLE INSPECTION).

2. INSPECT ENGINE OIL

- a. Inspect the engine oil (See ON-VEHICLE INSPECTION).

3. INSPECT SPARK PLUGS

- a. Inspect the spark plugs (See ON-VEHICLE INSPECTION).

4. INSPECT AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY

- a. Remove the air cleaner filter element sub-assembly.
- b. Visually check that there is no dirt, blockage, and/or damage to the air cleaner filter element.

HINT:

- If there is any dirt or a blockage in the air cleaner filter element, clean it with compressed air.
- If any dirt or a blockage remains even after cleaning the air cleaner filter element with compressed air, replace it.

5. INSPECT IGNITION TIMING

- a. Set the vehicle to inspection mode (See INSPECTION MODE PROCEDURE).
- b. Warm up the engine.
- c. When using the Techstream:
 1. Connect the Techstream to the DLC3.
 2. Enter DATA LIST MODE on the Techstream.

Ignition timing: 5 to 25° BTDC at idle

NOTE:

- Turn all the electrical systems off.
- Inspect the engine idle speed with the cooling fan off.

HINT:

Refer to the Techstream operator's manual for help when selecting the DATA LIST.

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

SST 09843-18040

NOTE:

- Confirm the terminal numbers before connecting them. Connection with a wrong terminal can damage the engine.
- Turn off all electrical systems before connecting the terminals.
- Perform this inspection after the cooling fan motor is turned off.

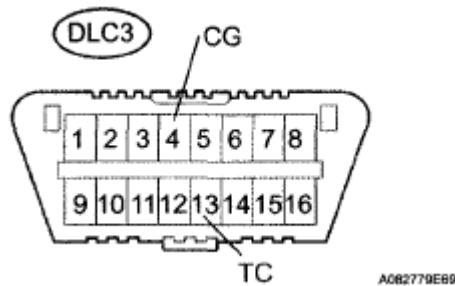


Fig. 1: Identifying DLC3 Connector Terminal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Remove the No. 1 engine cover.
3. Pull out the wire harness as shown in the illustration. Connect the clip of the timing light to the wire harness.

NOTE: Use a timing light which can detect the first signal.

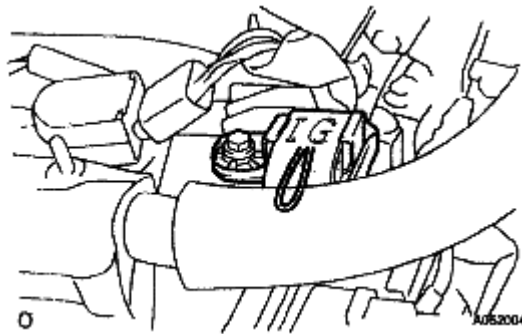


Fig. 2: Identifying Wire Harness
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. Check the ignition timing at idle.

Ignition timing: 5 to 25° BTDC at idle

NOTE: When checking the ignition timing, the transmission should be

in parking range.

HINT:

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

5. Disconnect terminals 13 (TC) and 4 (CG) of the DLC3.
6. Check the ignition timing at idle.

Ignition timing: 8 to 12° BTDC at idle

7. Confirm that the ignition timing moves to the advanced angle side when the engine rpm is increased.
8. Remove the timing light.

6. INSPECT ENGINE IDLE SPEED

- a. Set the vehicle to inspection mode (See **INSPECTION MODE PROCEDURE**).
- b. Warm up the engine.
- c. When using the Techstream:
 1. Connect the Techstream to the DLC3.

HINT:

Refer to the Techstream operator's manual for further details.

2. Enter DATA LIST MODE on the Techstream.

Idle speed: 850 to 950 rpm

NOTE:

- **When checking the idle speed, the transmission should be in parking range.**
- **Check the idle speed with the cooling fan off.**
- **Switch off all accessories and air conditioning before connecting the Techstream.**

- d. When not using the Techstream:
 1. Using SST, connect the tachometer tester probe to terminal 9 (TAC) of the DLC3.

SST 09843-18030

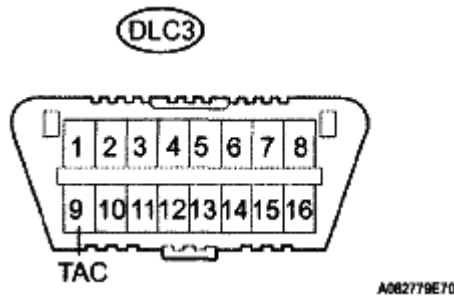


Fig. 3: Identifying DLC3 Connector Terminal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Check the idle speed.

Idle speed: 850 to 950 rpm

7. INSPECT COMPRESSION

- a. Set the vehicle to inspection mode (See INSPECTION MODE PROCEDURE).
- b. Warm up and stop the engine.
- c. Disconnect the injector connectors.
- d. Remove the ignition coils.

NOTE: If the ignition coil assembly connector is disconnected because a DTC is detected in inspection, always reconnect it.

- e. Remove the spark plugs.
- f. Check the cylinder compression pressure.
 1. Insert a compression gauge into the spark plug hole.

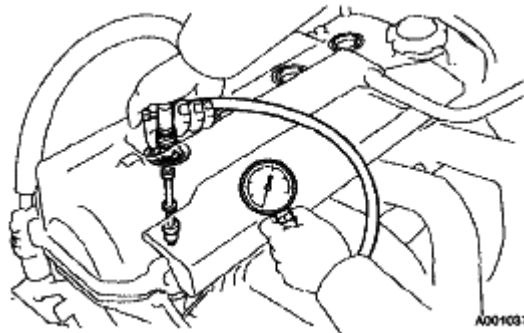


Fig. 4: Inspecting Cylinder Compression Pressure
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Connect the Techstream to the DLC3.

NOTE: Check the HV battery voltage in the data list to ensure that the

battery is fully charged.

3. Enter Active Test on the Techstream.
4. While cranking the engine, measure the compression pressure.

Compression pressure: 1.360 MPa (13.9 kgf/cm² , 198 psi)

Minimum pressure: 0.98 MPa (10 kgf/cm² , 142 psi)

Difference between each cylinder: 100 kPa (1.0 kgf/cm² , 14 psi)

NOTE:

- **Check the other cylinders' compression pressure in the same way.**
- **This measurement must be done as quickly as possible.**
- **After performing all the procedures, be sure to clear the DTCs stored in memory. Then, check that the normal system code is output.**

5. If the cylinder compression is low, pour a small amount of engine oil into the cylinder through the spark plug hole and inspect again.

HINT:

- If adding oil increases the compression, 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 in the gasket.

8. INSPECT CO/HC

- a. Set the vehicle to inspection mode (See **INSPECTION MODE PROCEDURE**).
- b. Start the engine.
- c. Run the engine at 2,500 rpm for approximately 180 seconds.
- d. Insert the CO/HC meter testing probe at least 40 cm (1.3 ft) into the tailpipe during idling.
- e. Immediately check CO/HC concentration at idle and at 2,500 rpm.

HINT:

- Complete the measurement within 3 minutes.
 - Check regulations and restrictions in your area when performing 2 mode CO/HC concentration testing (engine check at both idle speed and at 2,500 rpm).
- f. If the CO/HC concentration does not comply with regulations, troubleshoot in the order given below.
 1. Check A/F sensor operation (See **INSPECTION**).

2. Check heated oxygen sensor operation (See **INSPECTION**).
3. See the table below for possible causes, and then inspect and repair.

POSSIBLE CAUSES

CO	HC	Problems	Causes
Normal	High	Rough idle	<ol style="list-style-type: none"> 1. Faulty ignitions: <ul style="list-style-type: none"> ○ Incorrect timing ○ Fouled, shorted or improperly gapped plugs 2. Incorrect valve clearance 3. Leaky intake and exhaust valves 4. Leaky cylinders
Low	High	Rough idle (fluctuating HC reading)	<ol style="list-style-type: none"> 1. Vacuum leaks: <ul style="list-style-type: none"> ○ PCV hoses ○ Intake manifold ○ Throttle body ○ Brake booster line 2. Lean mixture causing misfire
High	High	Rough idle (black smoke from exhaust)	<ol style="list-style-type: none"> 1. Restricted air filter 2. Plugged PCV valve 3. Faulty SFI system: <ul style="list-style-type: none"> ○ Faulty pressure regulator ○ Defective engine coolant temperature sensor ○ Defective MAF meter ○ Faulty ECM ○ Faulty injectors ○ Faulty throttle position sensor

DRIVE BELT

COMPONENTS

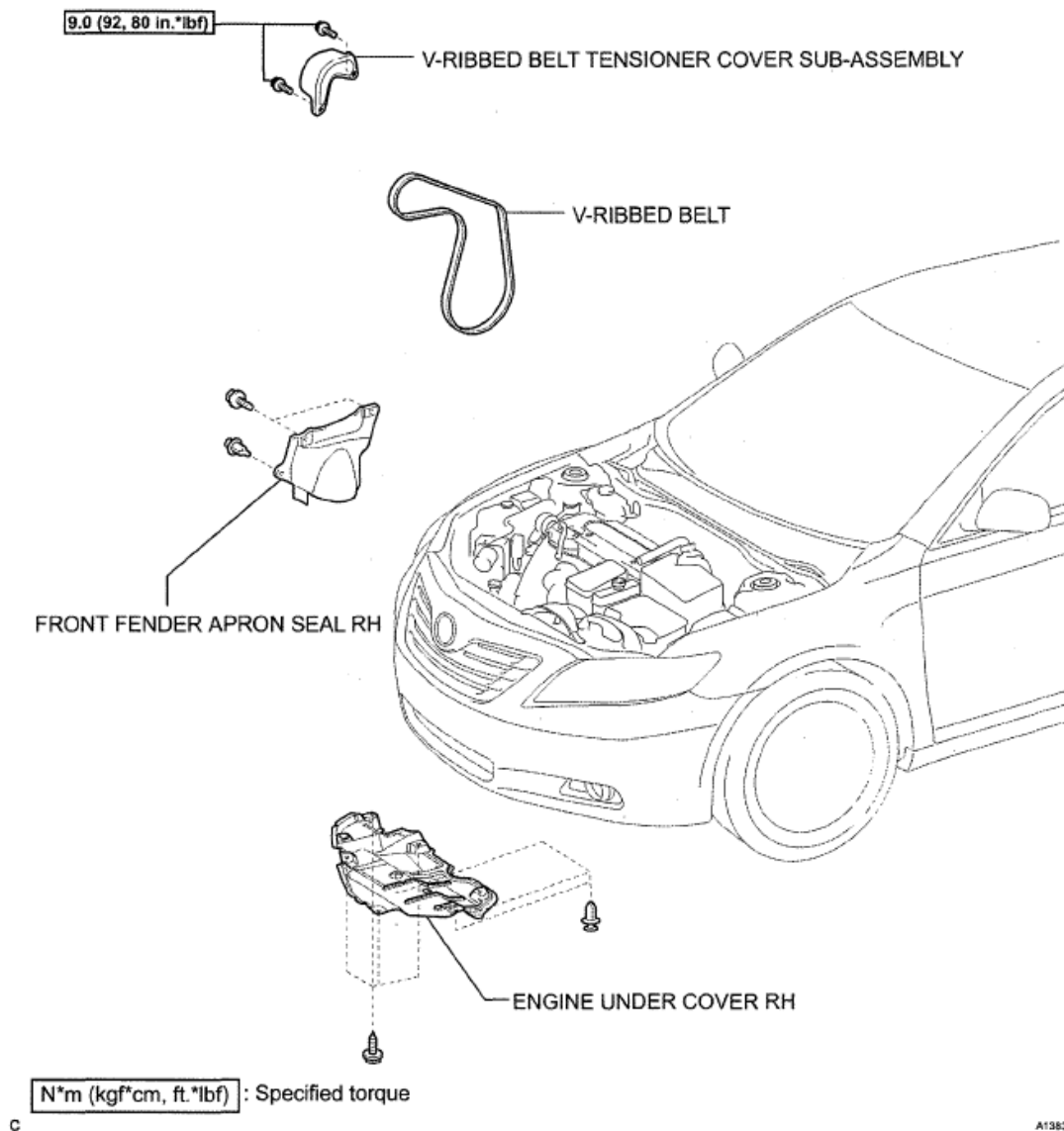


Fig. 5: Identifying Drive Belt Components With Torque Specification
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. **REMOVE FRONT WHEEL RH**
2. **REMOVE ENGINE UNDER COVER RH**
3. **REMOVE FRONT FENDER APRON SEAL RH**
4. **REMOVE V-RIBBED BELT TENSIONER COVER SUB-ASSEMBLY**
 - a. Remove the 2 bolts and V-ribbed belt tensioner cover.

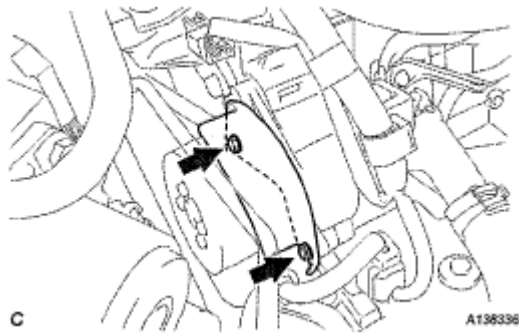


Fig. 6: Locating V-ribbed Belt Tensioner Cover And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. REMOVE V-RIBBED BELT

- a. Loosen the V-ribbed belt tensioner counterclockwise, then remove the V-ribbed belt.

NOTE:

- Be sure to connect the tools so that they are in line during use.
- When retracting the tensioner, turn it clockwise slowly. Do not apply force rapidly.
- After the tensioner is fully retracted, do not apply force more than necessary.

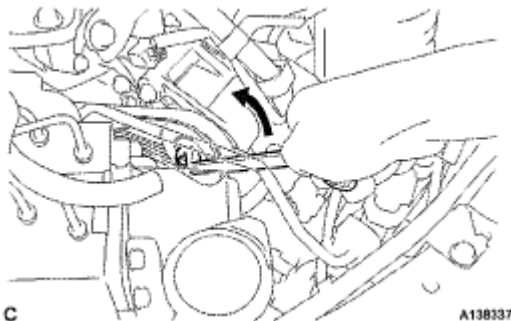


Fig. 7: Loosening V-ribbed Belt Tensioner Counterclockwise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION

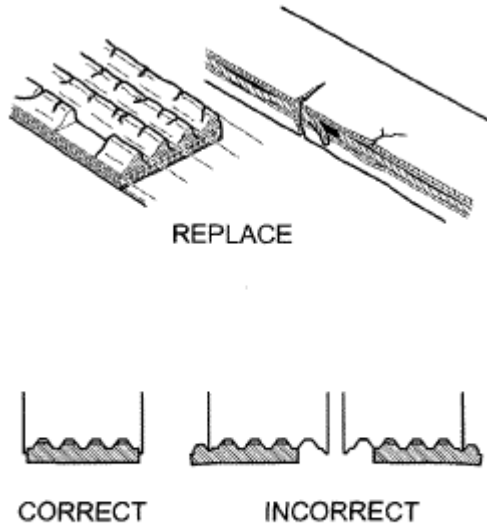
1. INSPECT V-RIBBED BELT

- a. Visually check the V-ribbed belt for excessive wear, frayed cords, etc. If any defect has been found, replace the V-ribbed belt.

HINT:

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

- A "new belt" is a belt which has been used for less than 5 minutes with the engine running.
- A "used belt" is a belt which has been used for 5 minutes or more with the engine running.



C

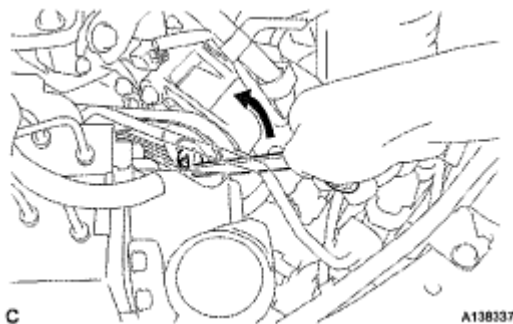
A139224E01

Fig. 8: Identifying V-Ribbed Belt Correct And Incorrect Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSTALLATION

1. INSTALL V-RIBBED BELT

- Loosen the V-ribbed belt tensioner arm counterclockwise, then install the V-ribbed belt.



C

A138337

Fig. 9: Identifying V-ribbed Belt Tensioner Arm Counterclockwise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- If it is difficult to install the V-ribbed belt, perform the following procedure:
 - Put the V-ribbed belt on every pulley except the tensioner pulley as shown in the illustration.

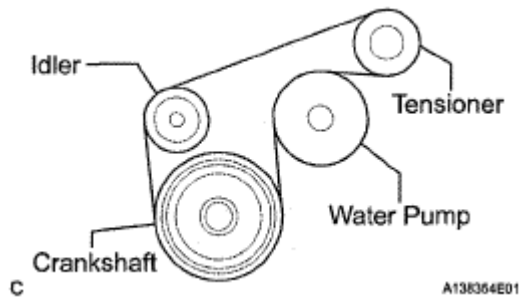


Fig. 10: Identifying V-Ribbed Belt Installation Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. While releasing the belt tension by turning the belt tensioner counterclockwise, put the V-ribbed belt on the tensioner pulley.

NOTE:

- Be sure to connect the tools so that they are in line during use.
- When retracting the tensioner, turn it clockwise slowly. Do not apply force rapidly.
- After the tensioner is fully retracted, do not apply force more than necessary.

3. After installing the V-ribbed belt, check that it fits properly in the ribbed grooves. Check to confirm that the belt has not slipped out of the grooves on the bottom of the crank pulley by hand.

2. INSTALL V-RIBBED BELT TENSIONER COVER SUB-ASSEMBLY

- a. Install the V-ribbed belt tensioner cover with the 2 bolts.

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

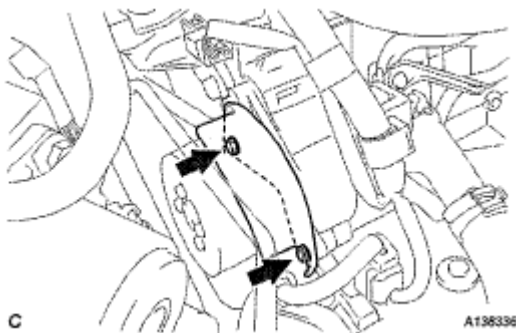


Fig. 11: Locating V-ribbed Belt Tensioner Cover And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. **INSTALL FRONT FENDER APRON SEAL RH**
4. **INSTALL ENGINE UNDER COVER RH**

5. INSTALL FRONT WHEEL RH

Torque: 103 N*m (1,050 kgf*cm, 76 ft.*lbf)

VALVE CLEARANCE

ADJUSTMENT

1. REMOVE FRONT WHEEL RH
2. REMOVE ENGINE UNDER COVER LH
3. REMOVE ENGINE UNDER COVER RH
4. REMOVE FRONT FENDER APRON SUB-ASSEMBLY RH
5. REMOVE NO. 1 ENGINE COVER SUB-ASSEMBLY (See REMOVAL)
6. REMOVE IGNITION COIL ASSEMBLY (See REMOVAL)
7. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY (See REMOVAL)
8. SET NO. 1 CYLINDER TO TDC/COMPRESSION
 - a. Turn the crankshaft pulley until its groove and the timing mark "0" of the timing chain cover are aligned.

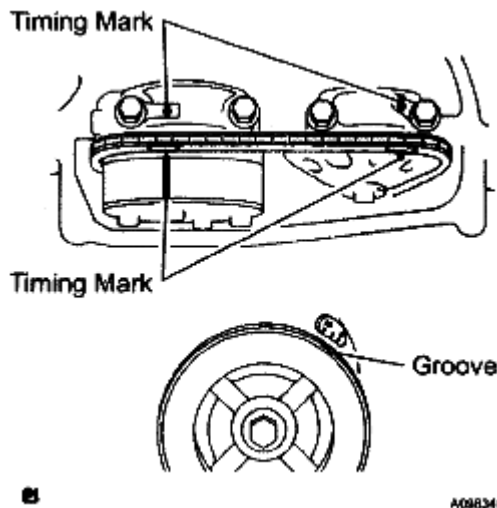


Fig. 12: Identifying Timing Mark Of Camshaft Timing Gear And Sprocket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Check that each timing mark of the camshaft timing gear and sprocket is aligned with each timing mark located on the No. 1 and No. 2 bearing caps as shown in the illustration. If not, turn the crankshaft by 1 revolution (360°) to align the timing marks as above.
9. CHECK VALVE CLEARANCE
 - a. Check only the valves indicated.
 1. Using a feeler gauge, measure the clearance between the valve lifter and camshaft.

Standard valve clearance (cold)

VALVE SPECIFICATION

Item	Standard Condition
Intake	0.19 to 0.29 mm (0.0075 to 0.0114 in.)
Exhaust	0.38 to 0.48 mm (0.0150 to 0.0189 in.)

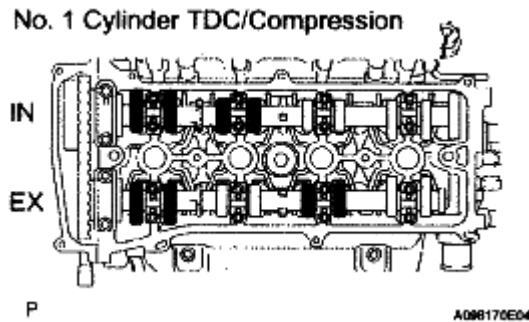


Fig. 13: Identifying Valve Clearance

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

2. Record any out-of-specification valve clearance measurements. They will be used later to determine the required replacement valve lifters.
- b. Turn the crankshaft 1 revolution (360°) and set the No. 4 cylinder to the TDC/compression.
- c. Check only the valves indicated.
 1. Using a feeler gauge, measure the clearance between the valve lifter and camshaft.

Standard valve clearance (cold)

VALVE SPECIFICATION

Item	Standard Condition
Intake	0.19 to 0.29 mm (0.0075 to 0.0114 in.)
Exhaust	0.38 to 0.48 mm (0.0150 to 0.0189 in.)

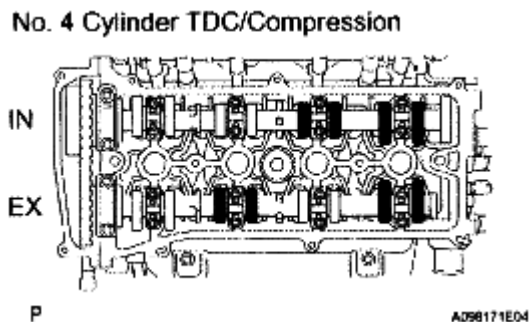


Fig. 14: Identifying Valve Clearance

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

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

10. ADJUST VALVE CLEARANCE

- a. Remove the No. 2 camshaft (see **REMOVAL**).
- b. Remove the camshaft (see **REMOVAL**).
- c. Remove the valve lifters.
- d. Using a micrometer, measure the thickness of the removed valve lifters.

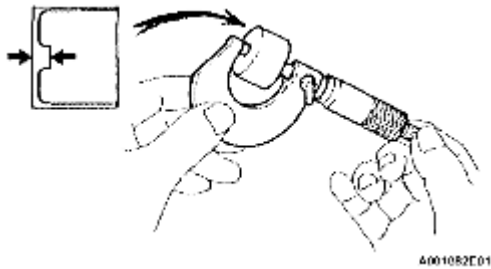


Fig. 15: Measuring Removed Lifter Thickness
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Calculate the thickness of a new lifter so that the valve clearance comes within the specified range.

New lifter thickness

LIFTER THICKNESS SPECIFICATION

Item	Specification
Intake	$A = B + (C - 0.24 \text{ mm (0.0095 in.)})$
Exhaust	$A = B + (C - 0.43 \text{ mm (0.0169 in.)})$

LIFTER THICKNESS SPECIFICATION

A	New lifter thickness
B	Used lifter thickness
C	Measured valve clearance

CALCULATION EXAMPLE (Intake):

1. Measured intake valve clearance = 0.40 mm (0.0158 in.)

(Measured - Specification = Excess clearance)

- a. $0.40 \text{ mm (0.0158 in.)} - 0.24 \text{ mm (0.0095 in.)} = 0.16 \text{ mm (0.0063 in.)}$

2. Measured used lifter thickness = 5.250 mm (0.2067 in.)

3. New lifter thickness = 5.410 mm (0.2130 in.)

(Excess clearance + Used lifter thickness = Ideal new lifter)

- a. $0.16 \text{ mm (0.0063 in.)} + 5.250 \text{ mm (0.2067 in.)} = 5.410 \text{ mm (0.2130 in.)}$
4. Closest new lifter = $5.420 \text{ mm (0.2134 in.)}$
- o Select No. 42 lifter
- f. Select a new lifter with a thickness as close as possible to the calculated values.

HINT:

- Lifters are available in 35 sizes in increments of $0.020 \text{ mm (0.0008 in.)}$, from $5.060 \text{ mm (0.1992 in.)}$ to $5.740 \text{ mm (0.2260 in.)}$.
- The identification number inside the valve lifters shows the value to 2 decimal places. (The illustration shows $5.420 \text{ mm (0.2134 in.)}$)

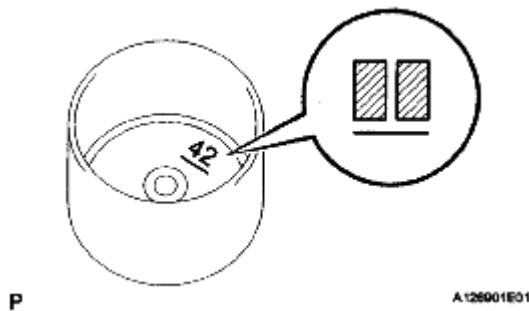


Fig. 16: Identifying Number Of Inside Valve Lifters
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Valve lifter selection chart (intake).

Measured clearance Installed lifter thickness	mm (in.)	
	mm (in.)	mm (in.)
5.060 (0.1992)	0.000 - 0.030 (0.0000 - 0.0012)	0.000 - 0.030 (0.0000 - 0.0012)
5.080 (0.2000)	0.031 - 0.050 (0.0012 - 0.0020)	0.031 - 0.050 (0.0012 - 0.0020)
5.100 (0.2008)	0.051 - 0.070 (0.0020 - 0.0028)	0.051 - 0.070 (0.0020 - 0.0028)
5.120 (0.2016)	0.071 - 0.090 (0.0028 - 0.0035)	0.071 - 0.090 (0.0028 - 0.0035)
5.140 (0.2024)	0.091 - 0.110 (0.0036 - 0.0043)	0.091 - 0.110 (0.0036 - 0.0043)
5.160 (0.2031)	0.111 - 0.130 (0.0044 - 0.0051)	0.111 - 0.130 (0.0044 - 0.0051)
5.180 (0.2039)	0.131 - 0.150 (0.0052 - 0.0059)	0.131 - 0.150 (0.0052 - 0.0059)
5.200 (0.2047)	0.151 - 0.170 (0.0059 - 0.0067)	0.151 - 0.170 (0.0059 - 0.0067)
5.210 (0.2051)	0.171 - 0.190 (0.0067 - 0.0074)	0.171 - 0.190 (0.0067 - 0.0074)
5.220 (0.2055)	0.190 - 0.210 (0.0075 - 0.0083)	0.190 - 0.210 (0.0075 - 0.0083)
5.230 (0.2059)	0.211 - 0.230 (0.0083 - 0.0091)	0.211 - 0.230 (0.0083 - 0.0091)
5.240 (0.2063)	0.231 - 0.250 (0.0091 - 0.0099)	0.231 - 0.250 (0.0091 - 0.0099)
5.250 (0.2067)	0.251 - 0.270 (0.0099 - 0.0107)	0.251 - 0.270 (0.0099 - 0.0107)
5.260 (0.2071)	0.271 - 0.290 (0.0107 - 0.0115)	0.271 - 0.290 (0.0107 - 0.0115)
5.270 (0.2075)	0.291 - 0.310 (0.0115 - 0.0123)	0.291 - 0.310 (0.0115 - 0.0123)
5.280 (0.2079)	0.311 - 0.330 (0.0123 - 0.0131)	0.311 - 0.330 (0.0123 - 0.0131)
5.290 (0.2083)	0.331 - 0.350 (0.0131 - 0.0139)	0.331 - 0.350 (0.0131 - 0.0139)
5.300 (0.2087)	0.351 - 0.370 (0.0139 - 0.0147)	0.351 - 0.370 (0.0139 - 0.0147)
5.310 (0.2091)	0.371 - 0.390 (0.0147 - 0.0155)	0.371 - 0.390 (0.0147 - 0.0155)
5.320 (0.2094)	0.391 - 0.410 (0.0155 - 0.0163)	0.391 - 0.410 (0.0155 - 0.0163)
5.330 (0.2098)	0.411 - 0.430 (0.0163 - 0.0171)	0.411 - 0.430 (0.0163 - 0.0171)
5.340 (0.2102)	0.431 - 0.450 (0.0171 - 0.0179)	0.431 - 0.450 (0.0171 - 0.0179)
5.350 (0.2106)	0.451 - 0.470 (0.0179 - 0.0187)	0.451 - 0.470 (0.0179 - 0.0187)
5.360 (0.2110)	0.471 - 0.490 (0.0187 - 0.0195)	0.471 - 0.490 (0.0187 - 0.0195)
5.370 (0.2114)	0.491 - 0.510 (0.0195 - 0.0203)	0.491 - 0.510 (0.0195 - 0.0203)
5.380 (0.2118)	0.511 - 0.530 (0.0203 - 0.0211)	0.511 - 0.530 (0.0203 - 0.0211)
5.390 (0.2122)	0.531 - 0.550 (0.0211 - 0.0219)	0.531 - 0.550 (0.0211 - 0.0219)
5.400 (0.2126)	0.551 - 0.570 (0.0219 - 0.0227)	0.551 - 0.570 (0.0219 - 0.0227)
5.410 (0.2130)	0.571 - 0.590 (0.0227 - 0.0235)	0.571 - 0.590 (0.0227 - 0.0235)
5.420 (0.2134)	0.591 - 0.610 (0.0235 - 0.0243)	0.591 - 0.610 (0.0235 - 0.0243)
5.430 (0.2138)	0.611 - 0.630 (0.0243 - 0.0251)	0.611 - 0.630 (0.0243 - 0.0251)
5.440 (0.2142)	0.631 - 0.650 (0.0251 - 0.0259)	0.631 - 0.650 (0.0251 - 0.0259)
5.450 (0.2146)	0.651 - 0.670 (0.0259 - 0.0267)	0.651 - 0.670 (0.0259 - 0.0267)
5.460 (0.2150)	0.671 - 0.690 (0.0267 - 0.0275)	0.671 - 0.690 (0.0267 - 0.0275)
5.470 (0.2154)	0.691 - 0.710 (0.0275 - 0.0283)	0.691 - 0.710 (0.0275 - 0.0283)
5.470 (0.2154)	0.711 - 0.730 (0.0283 - 0.0291)	0.711 - 0.730 (0.0283 - 0.0291)
5.480 (0.2157)	0.731 - 0.750 (0.0291 - 0.0299)	0.731 - 0.750 (0.0291 - 0.0299)
5.490 (0.2161)	0.751 - 0.770 (0.0299 - 0.0307)	0.751 - 0.770 (0.0299 - 0.0307)
5.500 (0.2165)	0.771 - 0.790 (0.0307 - 0.0315)	0.771 - 0.790 (0.0307 - 0.0315)
5.510 (0.2169)	0.791 - 0.810 (0.0315 - 0.0323)	0.791 - 0.810 (0.0315 - 0.0323)
5.520 (0.2173)	0.811 - 0.830 (0.0323 - 0.0331)	0.811 - 0.830 (0.0323 - 0.0331)
5.530 (0.2177)	0.831 - 0.850 (0.0331 - 0.0339)	0.831 - 0.850 (0.0331 - 0.0339)
5.540 (0.2181)	0.851 - 0.870 (0.0339 - 0.0347)	0.851 - 0.870 (0.0339 - 0.0347)
5.550 (0.2185)	0.871 - 0.890 (0.0347 - 0.0355)	0.871 - 0.890 (0.0347 - 0.0355)
5.560 (0.2189)	0.891 - 0.910 (0.0355 - 0.0363)	0.891 - 0.910 (0.0355 - 0.0363)
5.570 (0.2193)	0.911 - 0.930 (0.0363 - 0.0371)	0.911 - 0.930 (0.0363 - 0.0371)
5.580 (0.2197)	0.931 - 0.950 (0.0371 - 0.0379)	0.931 - 0.950 (0.0371 - 0.0379)
5.590 (0.2201)	0.951 - 0.970 (0.0379 - 0.0387)	0.951 - 0.970 (0.0379 - 0.0387)
5.600 (0.2205)	0.971 - 0.990 (0.0387 - 0.0395)	0.971 - 0.990 (0.0387 - 0.0395)
5.620 (0.2213)	0.991 - 1.010 (0.0395 - 0.0403)	0.991 - 1.010 (0.0395 - 0.0403)
5.640 (0.2220)	1.011 - 1.030 (0.0403 - 0.0411)	1.011 - 1.030 (0.0403 - 0.0411)
5.660 (0.2228)	1.031 - 1.050 (0.0411 - 0.0419)	1.031 - 1.050 (0.0411 - 0.0419)
5.680 (0.2236)	1.051 - 1.070 (0.0419 - 0.0427)	1.051 - 1.070 (0.0419 - 0.0427)
5.700 (0.2244)	1.071 - 1.090 (0.0427 - 0.0435)	1.071 - 1.090 (0.0427 - 0.0435)
5.720 (0.2252)	1.091 - 1.110 (0.0435 - 0.0443)	1.091 - 1.110 (0.0435 - 0.0443)
5.740 (0.2260)	1.111 - 1.130 (0.0443 - 0.0451)	1.111 - 1.130 (0.0443 - 0.0451)

6

A*26991E02

Fig. 17: Identifying Valve Lifter Selection Chart (Intake)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

New lifter thickness

LIFTER THICKNESS SPECIFICATION

Lifter No.	Thickness mm (in.)	Lifter No.	Thickness mm (in.)	Lifter No.	Thickness mm (in.)
06	5.060 (0.1992)	30	5.300 (0.2087)	54	5.540 (0.2181)
08	5.080 (0.2000)	32	5.320 (0.2094)	56	5.560 (0.2189)
10	5.100 (0.2008)	34	5.340 (0.2102)	58	5.580 (0.2197)

2009 Toyota Camry LE

2009 ENGINE Engine Mechanical - Camry Hybrid

12	5.120 (0.2016)	36	5.360 (0.2110)	60	5.600 (0.2205)
14	5.140 (0.2024)	38	5.380 (0.2118)	62	5.620 (0.2213)
16	5.160 (0.2031)	40	5.400 (0.2126)	64	5.640 (0.2220)
18	5.180 (0.2039)	42	5.420 (0.2134)	66	5.660 (0.2228)
20	5.200 (0.2047)	44	5.440 (0.2142)	68	5.680 (0.2236)
22	5.220 (0.2055)	46	5.460 (0.2150)	70	5.700 (0.2244)
24	5.240 (0.2063)	48	5.480 (0.2157)	72	5.720 (0.2252)
26	5.260 (0.2071)	50	5.500 (0.2165)	74	5.740 (0.2260)
28	5.280 (0.2079)	52	5.520 (0.2173)	-	-

Standard intake valve clearance (cold): 0.19 to 0.29 mm (0.0075 to 0.0114 in.)

EXAMPLE:

The 5.250 mm (0.2067 in.) lifter is installed, and the measured clearance is 0.400 mm (0.0157 in.).

Replace the 5.250 mm (0.2067 in.) lifter with a new No. 42 lifter.

- h. Valve lifter selection chart (exhaust).

2009 Toyota Camry LE

2009 ENGINE Engine Mechanical - Camry Hybrid

Measured clearance		mm (in.)		mm (in.)	
Installed lifter thickness	mm (in.)	mm (in.)		mm (in.)	
		mm (in.)		mm (in.)	
5.060 (0.1992)					
5.080 (0.2000)					
5.100 (0.2008)					
5.120 (0.2016)					
5.140 (0.2024)					
5.160 (0.2031)					
5.180 (0.2039)					
5.200 (0.2047)					
5.210 (0.2051)					
5.220 (0.2055)					
5.230 (0.2059)					
5.240 (0.2063)					
5.250 (0.2067)					
5.260 (0.2071)					
5.270 (0.2075)					
5.280 (0.2079)					
5.290 (0.2083)					
5.300 (0.2087)					
5.310 (0.2091)					
5.320 (0.2094)					
5.330 (0.2098)					
5.340 (0.2102)					
5.350 (0.2106)					
5.360 (0.2110)					
5.370 (0.2114)					
5.380 (0.2118)					
5.390 (0.2122)					
5.400 (0.2126)					
5.410 (0.2130)					
5.420 (0.2134)					
5.430 (0.2138)					
5.440 (0.2142)					
5.450 (0.2146)					
5.460 (0.2150)					
5.470 (0.2154)					
5.480 (0.2157)					
5.490 (0.2161)					
5.500 (0.2165)					
5.510 (0.2169)					
5.520 (0.2173)					
5.530 (0.2177)					
5.540 (0.2181)					
5.550 (0.2185)					
5.560 (0.2189)					
5.570 (0.2193)					
5.580 (0.2197)					
5.590 (0.2201)					
5.600 (0.2205)					
5.620 (0.2213)					
5.640 (0.2220)					
5.660 (0.2228)					
5.680 (0.2236)					
5.700 (0.2244)					
5.720 (0.2252)					
5.740 (0.2260)					

C

A143677E01

Fig. 18: Identifying Valve Lifter Selection Chart (Exhaust)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

New lifter thickness

LIFTER THICKNESS SPECIFICATION

Lifter No.	Thickness mm (in.)	Lifter No.	Thickness mm (in.)	Lifter No.	Thickness mm (in.)
06	5.060 (0.1992)	30	5.300 (0.2087)	54	5.540 (0.2181)
08	5.080 (0.2000)	32	5.320 (0.2094)	56	5.560 (0.2189)

2009 Toyota Camry LE

2009 ENGINE Engine Mechanical - Camry Hybrid

10	5.100 (0.2008)	34	5.340 (0.2102)	58	5.580 (0.2197)
12	5.120 (0.2016)	36	5.360 (0.2110)	60	5.600 (0.2205)
14	5.140 (0.2024)	38	5.380 (0.2118)	62	5.620 (0.2213)
16	5.160 (0.2031)	40	5.400 (0.2126)	64	5.640 (0.2220)
18	5.180 (0.2039)	42	5.420 (0.2134)	66	5.660 (0.2228)
20	5.200 (0.2047)	44	5.440 (0.2142)	68	5.680 (0.2236)
22	5.220 (0.2055)	46	5.460 (0.2150)	70	5.700 (0.2244)
24	5.240 (0.2063)	48	5.480 (0.2157)	72	5.720 (0.2252)
26	5.260 (0.2071)	50	5.500 (0.2165)	74	5.740 (0.2260)
28	5.280 (0.2079)	52	5.520 (0.2173)	-	-

Standard exhaust valve clearance (cold): 0.38 to 0.48 mm (0.0150 to 0.0189 in.)

EXAMPLE:

The 5.340 mm (0.2102 in.) lifter is installed, and the measured clearance is 0.510 mm (0.0201 in.).

Replace the 5.340 mm (0.2102 in.) lifter with a new No. 42 lifter.

- i. Install the selected valve lifter.

11. INSTALL CAMSHAFT

- a. Apply a light coat of engine oil to the journal portion of the camshaft.
- b. Install the timing chain onto the camshaft timing gear with the paint mark aligned with the timing mark on the camshaft timing gear as shown in the illustration.

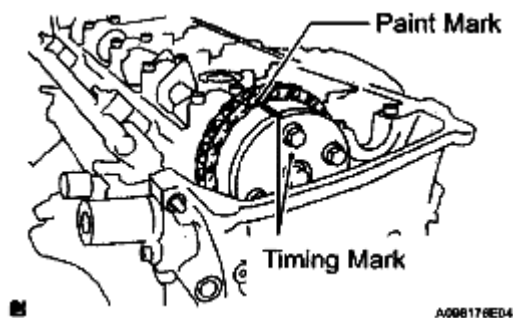


Fig. 19: Identifying Paint Mark, Timing Mark On Camshaft Timing Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Examine the front marks and numbers, and check that the order is as shown in the illustration. Then install the bearing caps into the cylinder head.

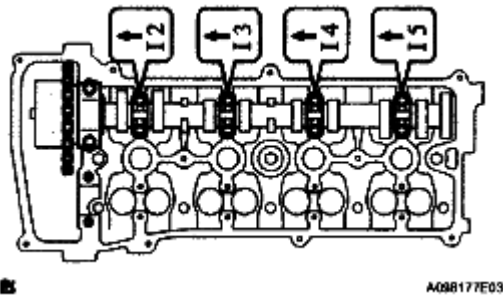


Fig. 20: Identifying Bearing Cap Numbers
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.
- e. Using several steps, uniformly tighten the 10 bearing cap bolts in the sequence shown in the illustration.

Torque: No. 1 bearing cap

30 N*m (301 kgf*cm, 22 ft.*lbf)

No. 3 bearing cap

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

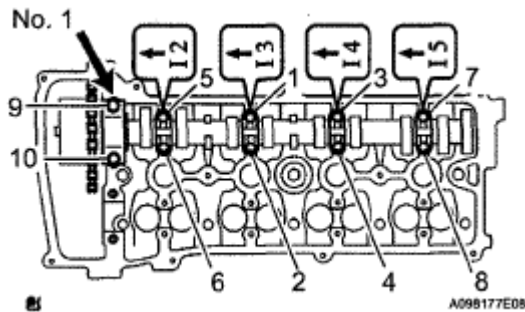


Fig. 21: Identifying Bearing Cap Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. INSTALL NO. 2 CAMSHAFT

- a. Apply a light coat of engine oil to the journal portion of the No. 2 camshaft.
- b. Put the No. 2 camshaft on the cylinder head with the paint mark of the chain aligned with the timing mark on the camshaft timing sprocket.

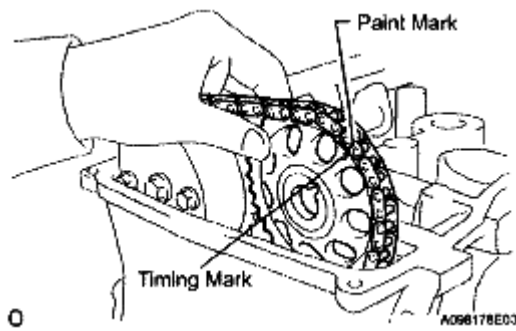


Fig. 22: View Of Aligning With Timing Mark On Camshaft Timing Sprocket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. While holding the No. 2 camshaft by hand, temporarily tighten the camshaft timing sprocket set bolt.

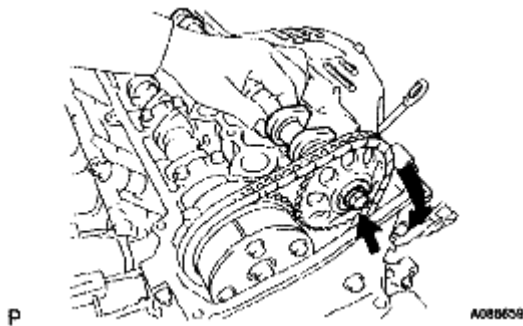


Fig. 23: Locating Camshaft Timing Sprocket Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Examine the front marks and numbers, and check that the order is as shown in the illustration. Then install the bearing caps onto the cylinder head.
- e. Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.

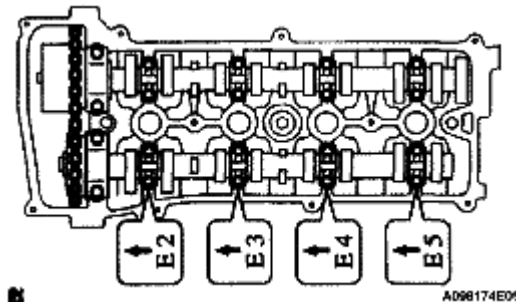


Fig. 24: Identifying Front Marks And Numbers Order
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Torque: No. 2 bearing cap

30 N*m (301 kgf*cm, 22 ft.*lbf)

No. 3 bearing cap

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

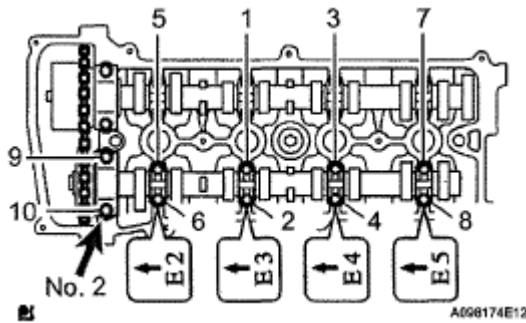


Fig. 25: Identifying Bearing Cap Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. While holding the camshaft with a wrench, tighten the camshaft timing sprocket set bolt.

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

NOTE: Be careful not to damage the valve lifter.

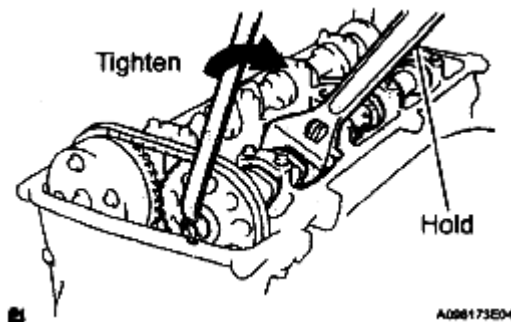


Fig. 26: Identifying Camshaft Timing Sprocket Set Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- h. Check that the paint marks on the chain are aligned with the timing marks on the camshaft timing gear and camshaft timing sprocket. Also, check that the crankshaft pulley groove is aligned with the timing mark "0" of the timing chain cover.

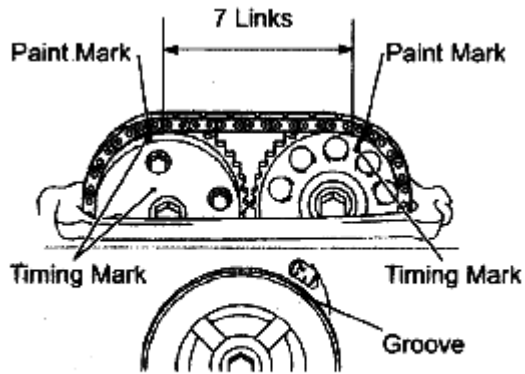


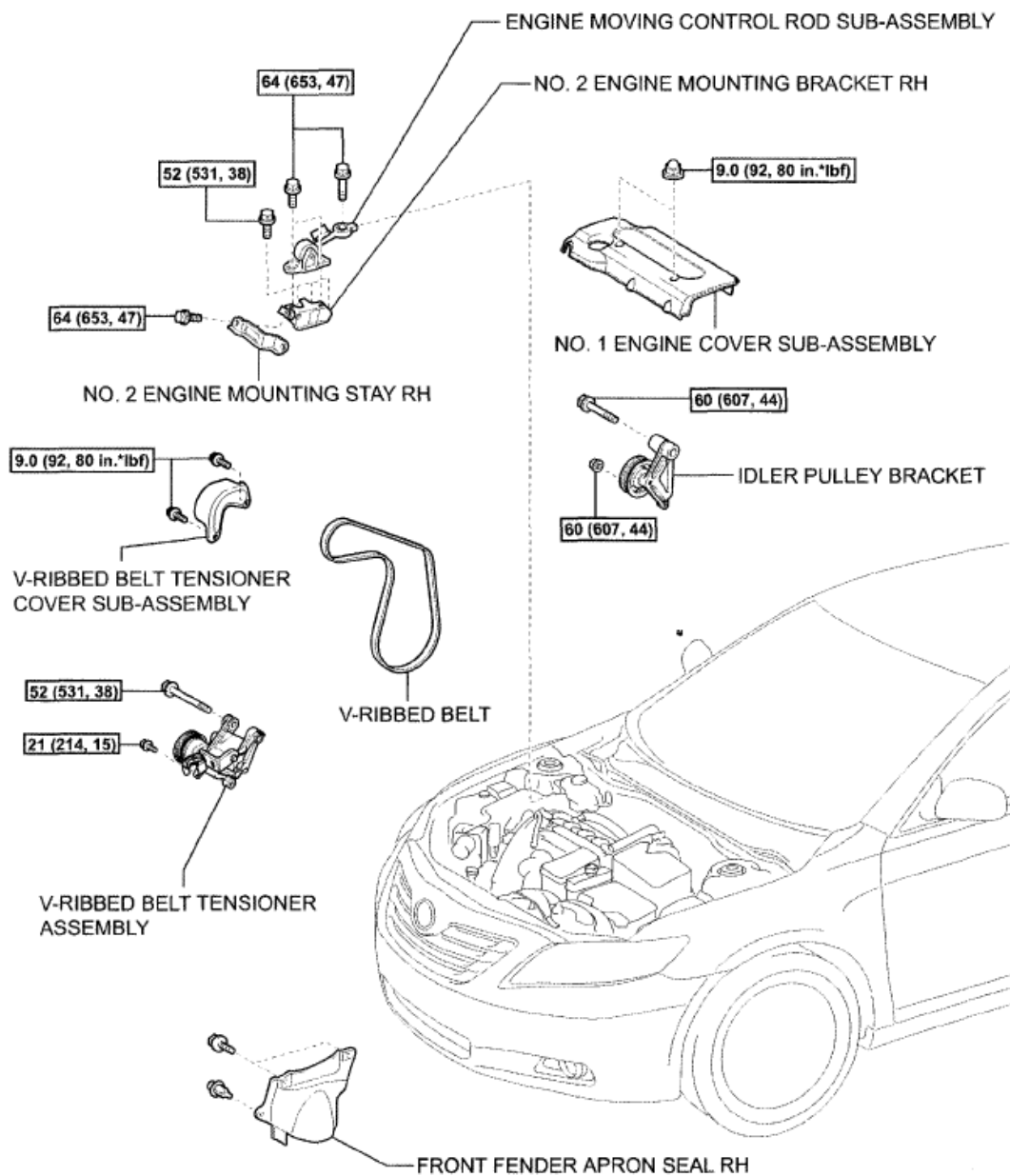
Fig. 27: Identifying Timing Marks On Camshaft Timing Gear And Camshaft Timing Sprocket

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

13. INSTALL NO. 1 CHAIN TENSIONER (See INSTALLATION)
14. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY (See INSTALLATION)
15. INSTALL IGNITION COIL ASSEMBLY (See INSTALLATION)
16. CHECK FOR ENGINE OIL LEAKS
17. INSTALL NO. 1 ENGINE COVER SUB-ASSEMBLY (See INSTALLATION)
18. INSTALL FRONT FENDER APRON RH
19. INSTALL ENGINE UNDER COVER LH
20. INSTALL ENGINE UNDER COVER RH
21. INSTALL FRONT WHEEL RH

TIMING CHAIN

COMPONENTS



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

A13R358E01

Fig. 28: Identifying Timing Chain Replacement Components With Torque Specifications (1 Of 4)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

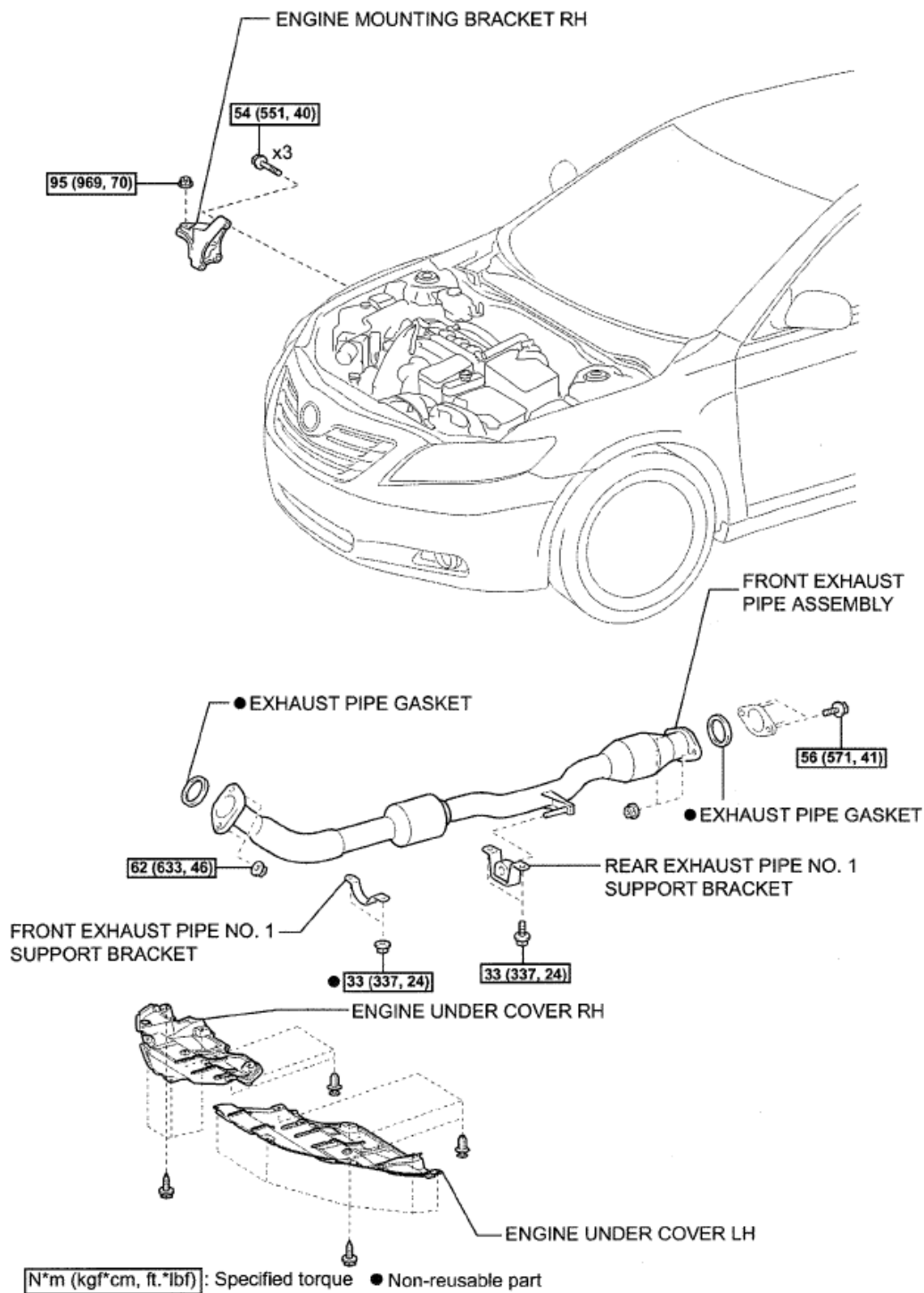
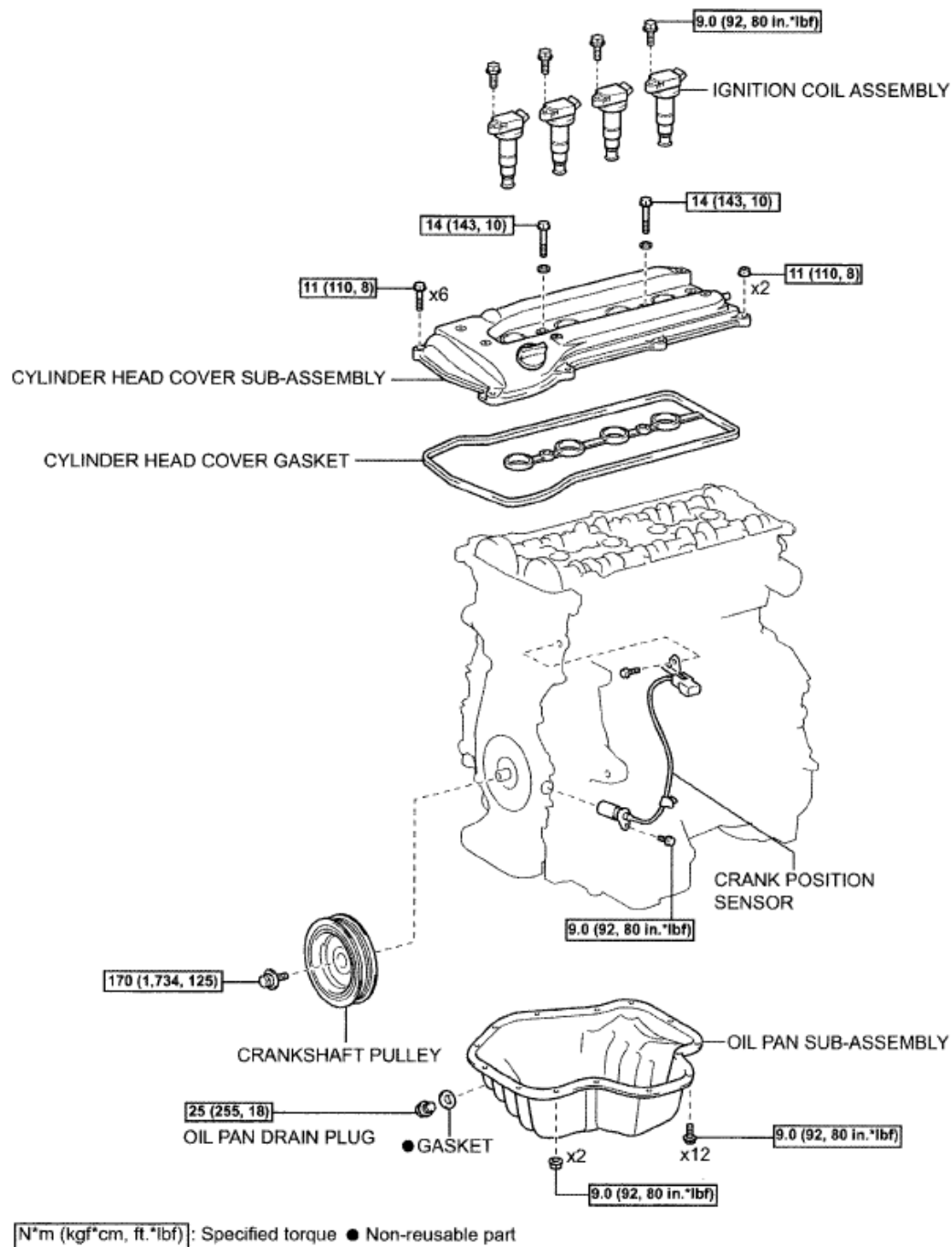
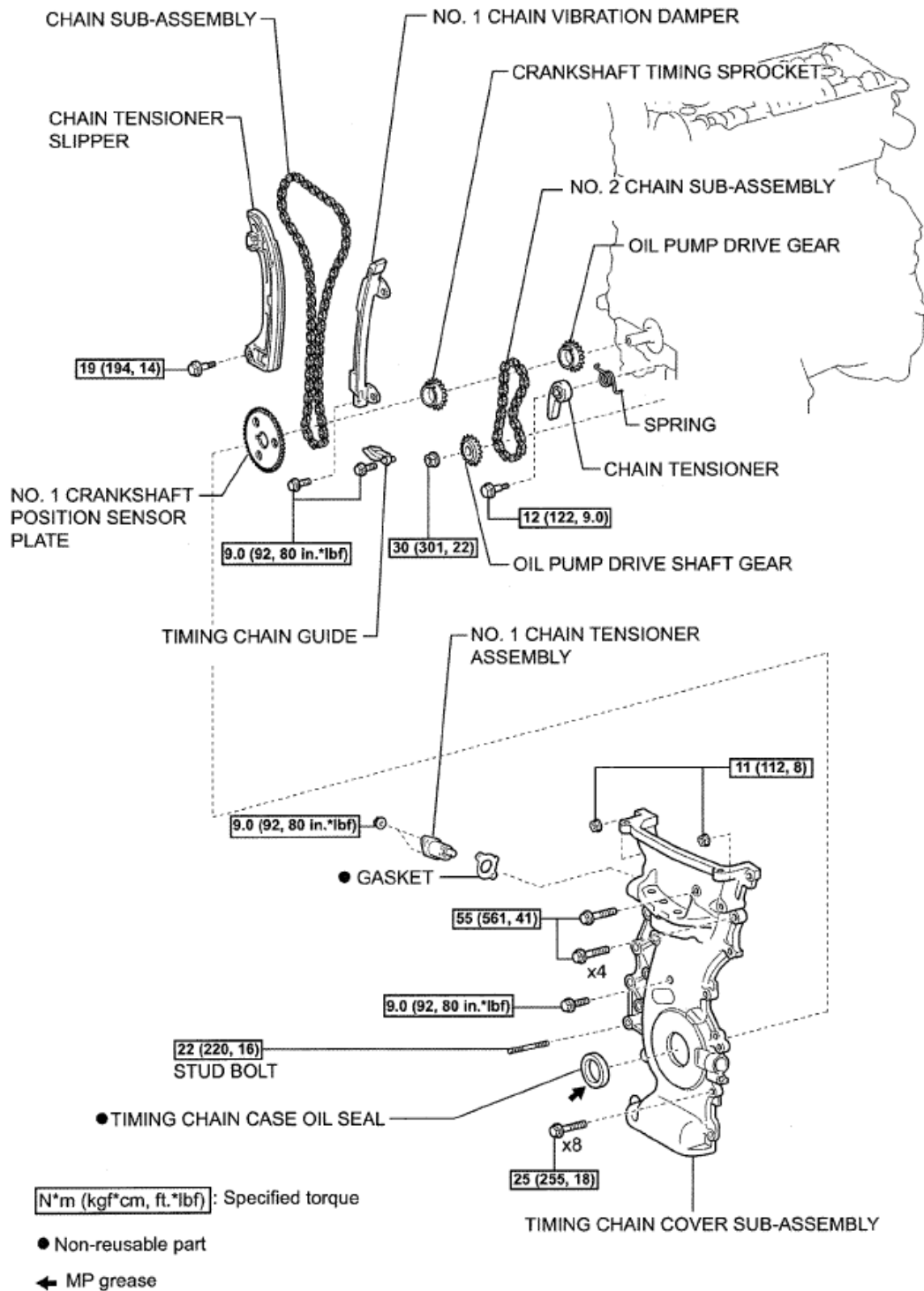


Fig. 29: Identifying Timing Chain Replacement Components With Torque Specifications (2 Of 4)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



A134922E02

Fig. 30: Identifying Timing Chain Replacement Components With Torque Specifications (3 Of 4)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



A136231E02

Fig. 31: Identifying Timing Chain Replacement Components With Torque Specifications (4 Of 4)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. REMOVE LUGGAGE TRIM SERVICE HOLE COVER

2. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL** (See **REMOVAL**)
3. **REMOVE NO. 1 ENGINE COVER SUB-ASSEMBLY** (See **REMOVAL**)
4. **REMOVE FRONT WHEEL RH**
5. **REMOVE ENGINE UNDER COVER LH**
6. **REMOVE ENGINE UNDER COVER RH**
7. **REMOVE FRONT FENDER APRON SEAL RH**
8. **DRAIN ENGINE OIL** (See **REPLACEMENT**)
9. **REMOVE FRONT EXHAUST PIPE ASSEMBLY**

HINT:

See **REMOVAL** .

10. **REMOVE NO. 2 ENGINE MOUNTING STAY RH** (See **REMOVAL**)
11. **REMOVE ENGINE MOVING CONTROL ROD SUB-ASSEMBLY** (See **REMOVAL**)
12. **REMOVE NO. 2 ENGINE MOUNTING BRACKET RH** (See **REMOVAL**)
13. **REMOVE V-RIBBED BELT TENSIONER COVER SUB-ASSEMBLY** (See **REMOVAL**)
14. **REMOVE V-RIBBED BELT** (See **REMOVAL**)
15. **REMOVE V-RIBBED BELT TENSIONER ASSEMBLY** (See **REMOVAL**)
16. **REMOVE IDLER PULLEY BRACKET** (See **REMOVAL**)
17. **REMOVE IGNITION COIL ASSEMBLY** (See **REMOVAL**)
18. **DISCONNECT VENTILATION HOSE**
19. **DISCONNECT NO. 2 VENTILATION HOSE**
20. **REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY**
 - a. Remove the 2 bolts and disconnect the 2 engine wires.

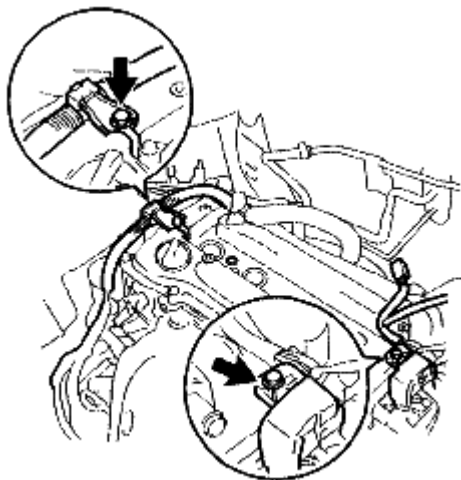


Fig. 32: Locating Engine Wires And Bolt

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

- b. Remove the 8 bolts, 2 nuts, and the cylinder head cover.

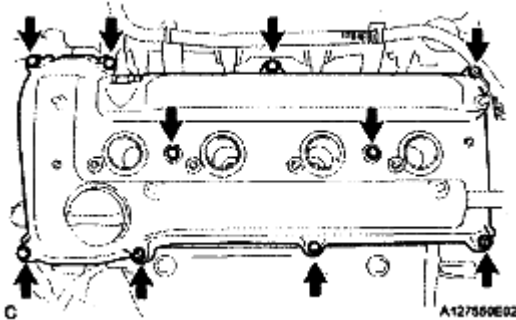


Fig. 33: Locating Cylinder Head Cover Bolts And Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

21. SET NO. 1 CYLINDER TO TDC/COMPRESSION (See VALVE CLEARANCE)
22. REMOVE CRANKSHAFT PULLEY (See REMOVAL)
23. REMOVE CRANK POSITION SENSOR (See REMOVAL)
24. REMOVE OIL PAN SUB-ASSEMBLY
 - a. Remove the 12 bolts and 2 nuts.

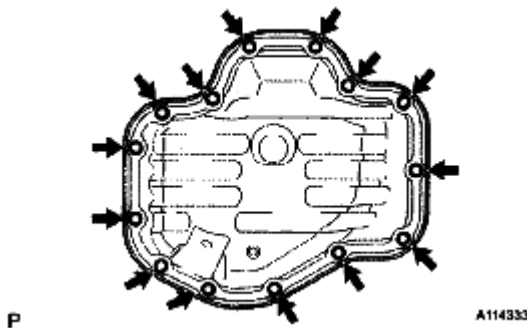
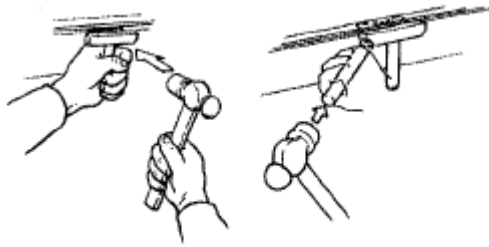


Fig. 34: Locating Oil Pan, Bolt And Nut Location
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Insert the blade of oil pan seal cutter between the crankcase and oil pan. Cut through the sealer and remove the oil pan.

NOTE: Be careful not to damage the contact surfaces of the crankcase, chain cover and oil pan.



A000019

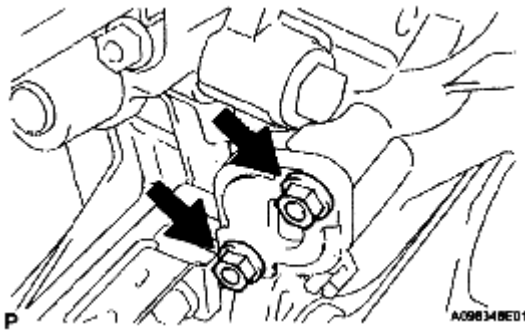
Fig. 35: View Of Cutting Sealer

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

25. REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY

- a. Remove the 2 nuts, tensioner and gasket.

NOTE: Do not turn the crankshaft without the chain tensioner.



A090348E01

Fig. 36: Locating No. 1 Chain Tensioner Assembly Nuts

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

26. INSTALL ENGINE HANGERS

- a. Install the No. 1 engine hanger and No. 2 engine hanger with the bolts as shown in the illustration.
Parts No.:

ENGINE HANGERS PARTS NUMBER

No. 1 engine hanger	12281-28010
No. 2 engine hanger	12282-28010
Bolt	91512-61020

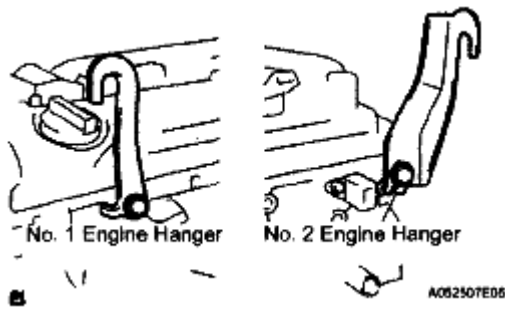


Fig. 37: Identifying Engine Hanger Bolts

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

Torque: 38 N*m (387 kgf*cm, 28 ft.*lbf)

- b. Attach the sling device to the engine hangers and chain block.

27. REMOVE ENGINE MOUNTING INSULATOR

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

CAUTION: Do not attempt to hang the engine by hooking the chain to any other part.

- b. Remove the bolt and disconnect the engine mounting insulator FR.

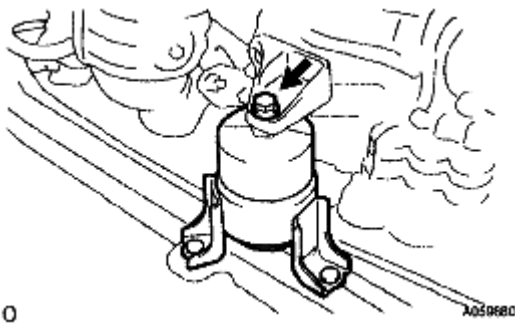


Fig. 38: Locating Engine Mounting Insulator FR With Bolt

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

- c. Remove the 4 nuts from the engine mounting insulator RH.

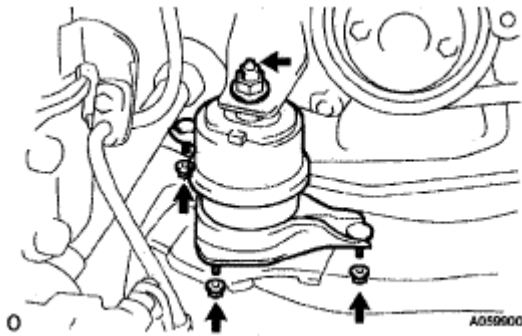


Fig. 39: Locating Engine Mounting Insulator RH Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Raise the engine and remove the engine mounting insulator RH.
- 28. **REMOVE ENGINE MOUNTING BRACKET RH**
 - a. Remove the 3 bolts and engine mounting bracket RH.

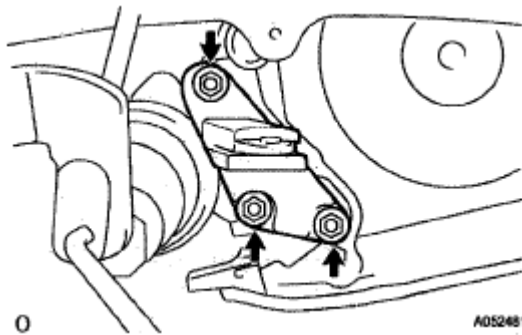


Fig. 40: Locating Engine Mounting Bracket With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 29. **REMOVE TIMING CHAIN COVER SUB-ASSEMBLY** (See **REMOVAL**)
- 30. **REMOVE TIMING CHAIN CASE OIL SEAL** (See **REMOVAL**)
- 31. **REMOVE NO. 1 CRANKSHAFT POSITION SENSOR PLATE**
 - a. Remove the crankshaft position sensor plate.

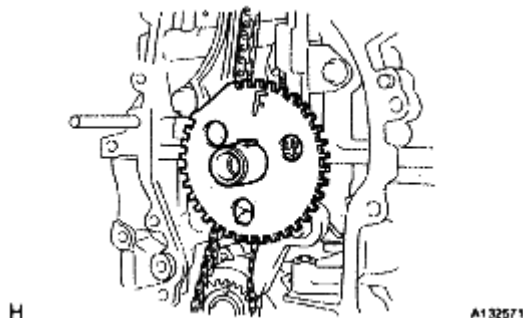


Fig. 41: Identifying Crankshaft Position Sensor Plate

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

32. REMOVE CHAIN TENSIONER SLIPPER

- a. Remove the bolt and chain tensioner slipper.

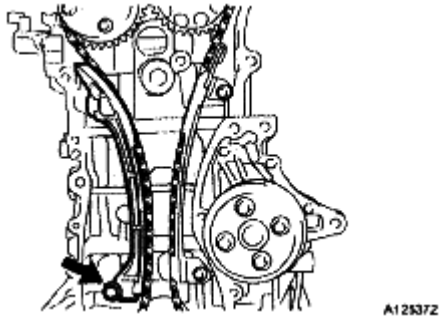


Fig. 42: Locating Chain Tensioner Slipper And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

33. REMOVE NO. 1 CHAIN VIBRATION DAMPER

- a. Remove the 2 bolts and chain vibration damper.

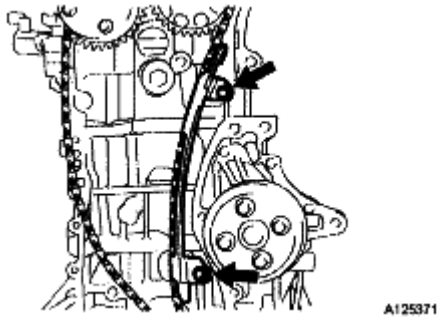


Fig. 43: Locating Chain Vibration Damper And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

34. REMOVE TIMING CHAIN GUIDE

- a. Remove the bolt and timing chain guide.

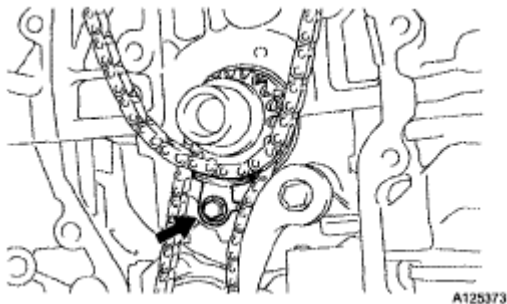


Fig. 44: Locating Timing Chain Guide And Bolt

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

35. REMOVE CHAIN SUB-ASSEMBLY

- a. Remove the chain sub-assembly.

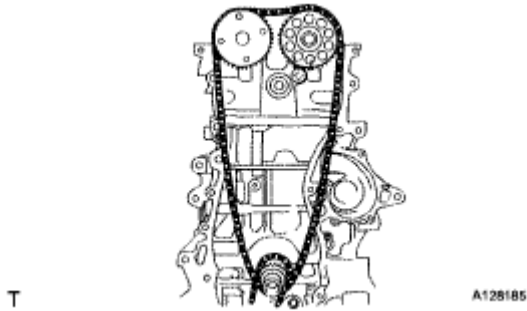


Fig. 45: Identifying Chain Sub-Assembly

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

36. REMOVE CRANKSHAFT TIMING SPROCKET

- a. Remove the crankshaft timing sprocket.

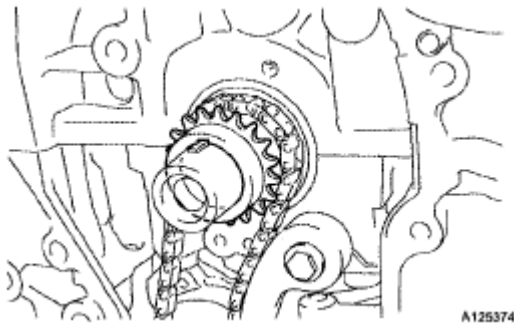


Fig. 46: Identifying Crankshaft Timing Sprocket

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

37. REMOVE NO. 2 CHAIN SUB-ASSEMBLY

- a. Turn the crankshaft 90° counterclockwise to align the adjusting hole of the oil pump drive shaft gear with the groove of the oil pump.

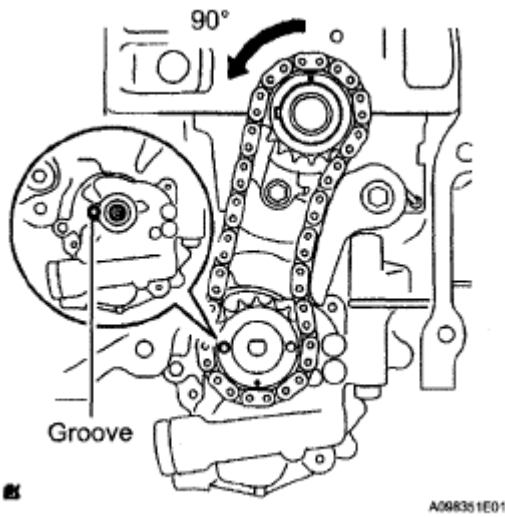


Fig. 47: Identifying Crankshaft 90° Counterclockwise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Insert a 4 mm diameter bar into the adjusting hole of the oil pump drive shaft gear to lock the gear in position, and then remove the nut.

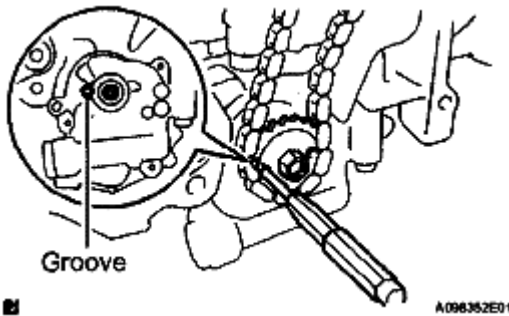


Fig. 48: View Of Diameter Bar Into Adjusting Hole
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Remove the bolt, chain tensioner plate and spring.

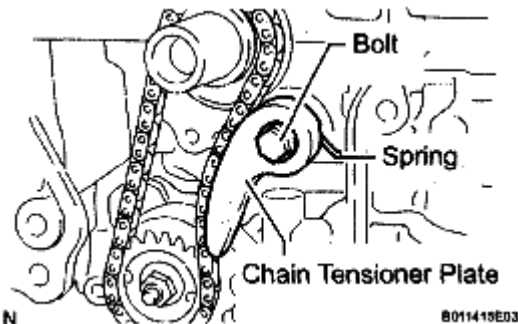


Fig. 49: Identifying Bolt, Chain Tensioner Plate And Spring

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

- d. Remove the chain tensioner, oil pump drive gear and chain.

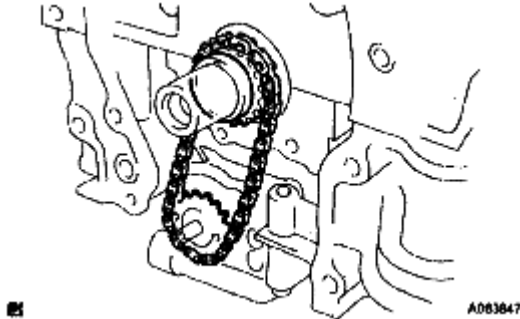


Fig. 50: Identifying Chain Tensioner, Oil Pump Driven Sprocket And Chain
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION

1. INSPECT CHAIN SUB-ASSEMBLY (See INSPECTION)
2. INSPECT NO. 2 CHAIN SUB-ASSEMBLY (See INSPECTION)
3. INSPECT OIL PUMP DRIVE GEAR (See INSPECTION)
4. INSPECT OIL PUMP DRIVE SHAFT GEAR (See INSPECTION)
5. INSPECT CHAIN TENSIONER SLIPPER (See INSPECTION)
6. INSPECT NO. 1 CHAIN VIBRATION DAMPER (See INSPECTION)
7. INSPECT CHAIN TENSIONER PLATE (See INSPECTION)
8. INSPECT NO. 1 CHAIN TENSIONER (See INSPECTION)

INSTALLATION

1. INSTALL NO. 2 CHAIN SUB-ASSEMBLY
 - a. Set the crankshaft key into the left horizontal position.
 - b. Turn the drive shaft so that the cutout faces upward.

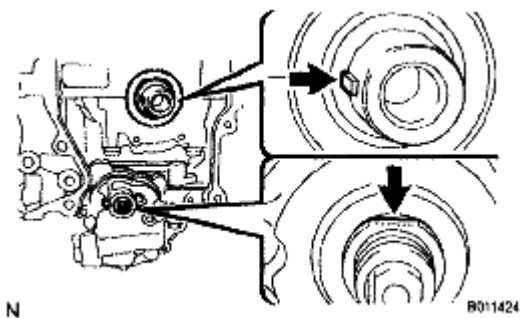


Fig. 51: Locating No.2 Chain Sub-Assembly

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

- c. Align the yellow mark links with the timing marks of each gear as shown in the illustration.
- d. Install the sprockets onto the crankshaft and oil pump shaft with the chain on the gears.
- e. Temporarily tighten the oil pump drive shaft gear with the nut.

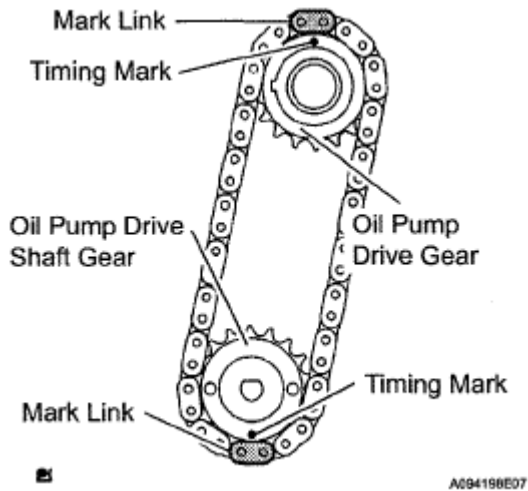


Fig. 52: Identifying Mark Links, Timing Marks With Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Insert the damper spring into the adjusting hole, and then install the chain tensioner plate with the bolt.

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

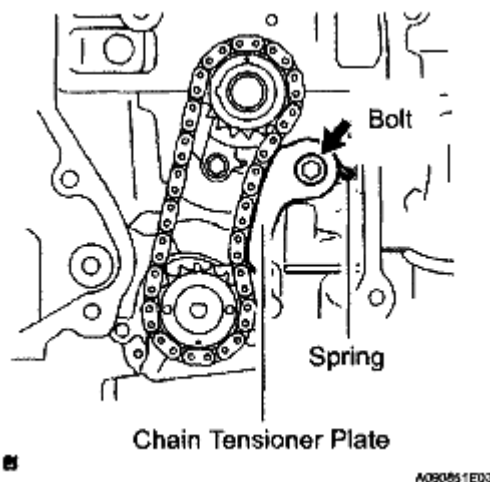


Fig. 53: Locating Chain Tensioner Plate With Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Align the adjusting hole of the oil pump drive shaft gear with the groove of the oil pump.

- h. Insert a 4 mm diameter bar into the adjusting hole of the oil pump drive shaft gear to lock the gear in position, and then tighten the nut.

Torque: 30 N*m (301 kgf*cm, 22 ft.*lbf)

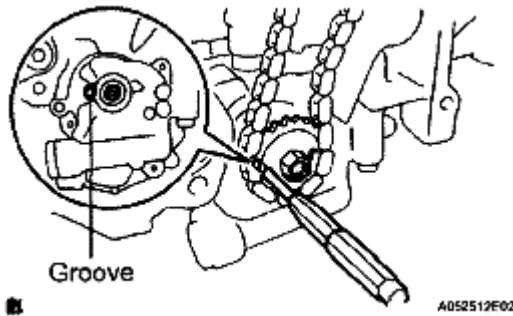


Fig. 54: Identifying Adjusting Hole Of Oil Pump Drive Shaft Gear With Groove Of Oil Pump
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- i. Rotate the crankshaft clockwise 90°, and position the crankshaft key to face up as shown in the illustration.

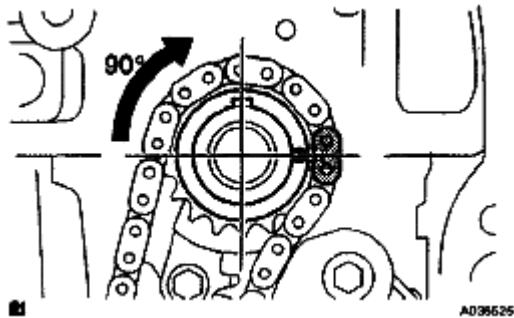


Fig. 55: View Of Rotating Crankshaft Clockwise 90°.
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. INSTALL CRANKSHAFT TIMING SPROCKET

- a. Install the crankshaft timing sprocket.

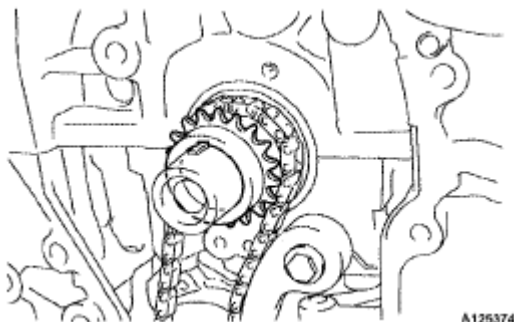


Fig. 56: Identifying Crankshaft Timing Sprocket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. INSTALL NO. 1 CHAIN VIBRATION DAMPER

- a. Install the chain vibration damper with the 2 bolts.

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

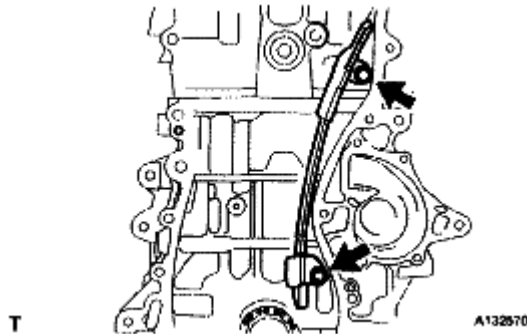


Fig. 57: Locating Chain Vibration Damper With Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. INSTALL CHAIN SUB-ASSEMBLY

- a. Set the No. 1 cylinder to TDC/compression.
1. Turn the camshafts with a wrench (using the hexagonal lobe) to align the timing marks of the camshaft timing gear with each timing mark located on the No. 1 and No. 2 bearing caps as shown in the illustration.

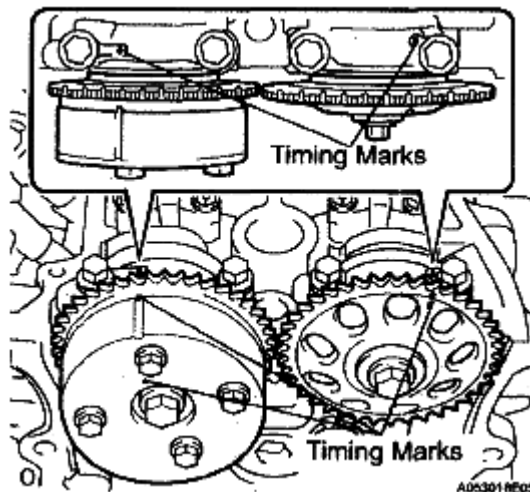


Fig. 58: Identifying Timing Mark On Camshaft Timing Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Using the crankshaft pulley bolt, turn the crankshaft to position the crankshaft key to face up as shown in the illustration.

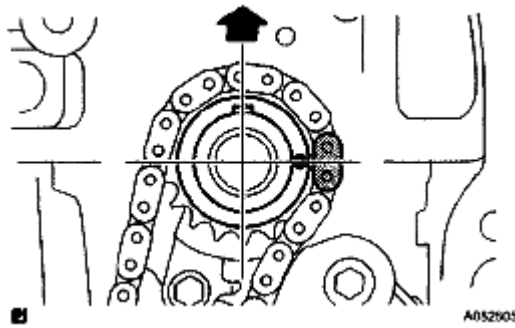


Fig. 59: View Of Setting Key On Crankshaft Upward
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the chain onto the crankshaft timing sprocket with the gold or pink mark link aligned with the timing mark on the crankshaft.

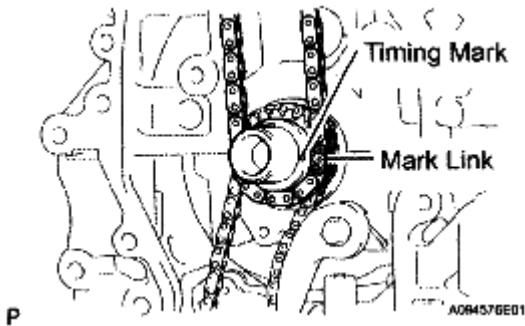


Fig. 60: View Of Aligning Timing Mark On Crankshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using SST and a hammer, tap in the crankshaft timing sprocket.

SST 09309-37010

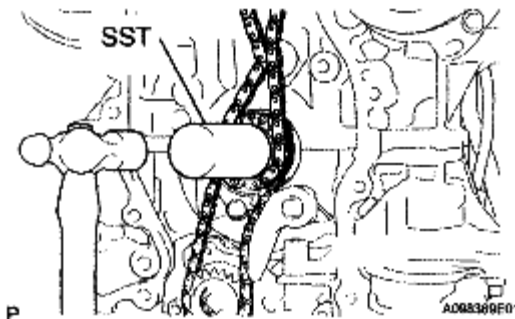


Fig. 61: View Of Tapping Crankshaft Timing Sprocket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Align the gold or yellow mark link with each timing mark located on the camshaft timing gear and

sprocket, then install the chain.

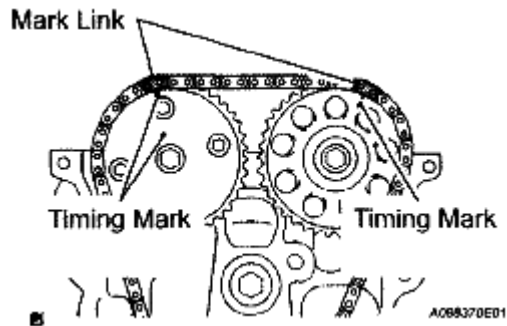


Fig. 62: Identifying Mark Link And Timing Mark
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. INSTALL CHAIN TENSIONER SLIPPER

- a. Install the chain tensioner slipper with the bolt.

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

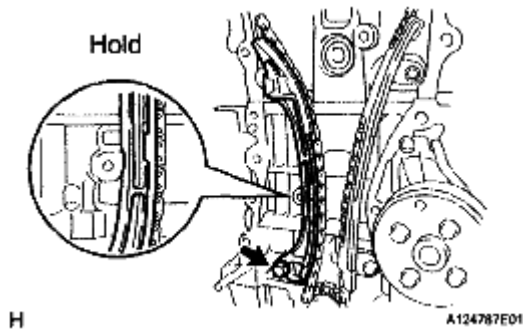


Fig. 63: Locating Chain Tensioner Slipper
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. INSTALL TIMING CHAIN GUIDE

- a. Install the timing chain guide with the bolt.

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

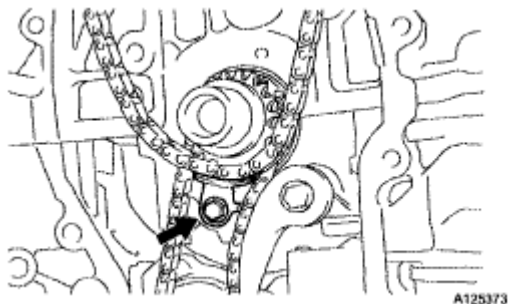


Fig. 64: Locating Timing Chain Guide And Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. INSTALL NO. 1 CRANKSHAFT POSITION SENSOR PLATE

- a. Install the sensor plate with the "F" mark facing forward.

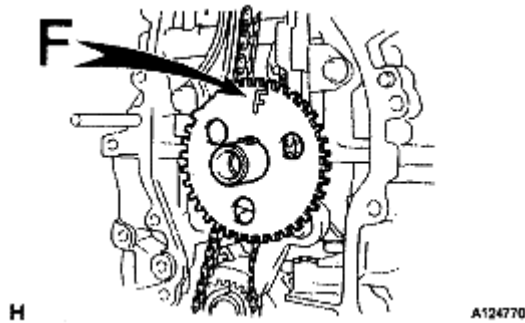


Fig. 65: Locating Crankshaft Position Sensor Plate With Mark
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. **INSTALL TIMING CHAIN CASE OIL SEAL** (See INSTALLATION)
9. **INSTALL TIMING CHAIN COVER SUB-ASSEMBLY** (See INSTALLATION)
10. **INSTALL ENGINE MOUNTING BRACKET RH**
 - a. Install the engine mounting bracket RH with the 3 bolts.

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

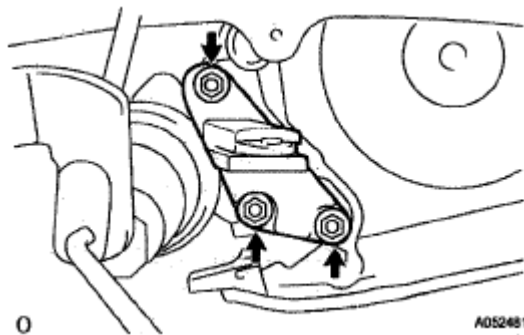


Fig. 66: Locating Engine Mounting Bracket With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. INSTALL ENGINE MOUNTING INSULATOR

- a. Raise the engine and install the engine mounting insulator RH.
- b. Install the engine mounting insulator RH with the 4 nuts.

Torque: Nut A

95 N*m (969 kgf*cm, 70 ft.*lbf)

Nut B

87 N*m (888 kgf*cm, 64 ft.*lbf)

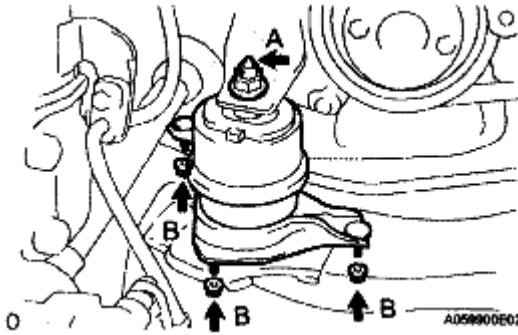


Fig. 67: Locating Engine Mounting Insulator RH With Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the engine mounting insulator FR with the bolt.

Torque: 87 N*m (888 kgf*cm, 64 ft.*lbf)

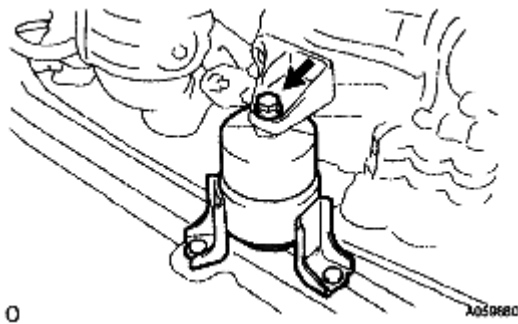


Fig. 68: Locating Engine Mounting Insulator FR With Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. INSTALL OIL PAN SUB-ASSEMBLY

- a. Remove any old packing material and be careful not to drop any oil on the contact surfaces of the cylinder block and oil pan.

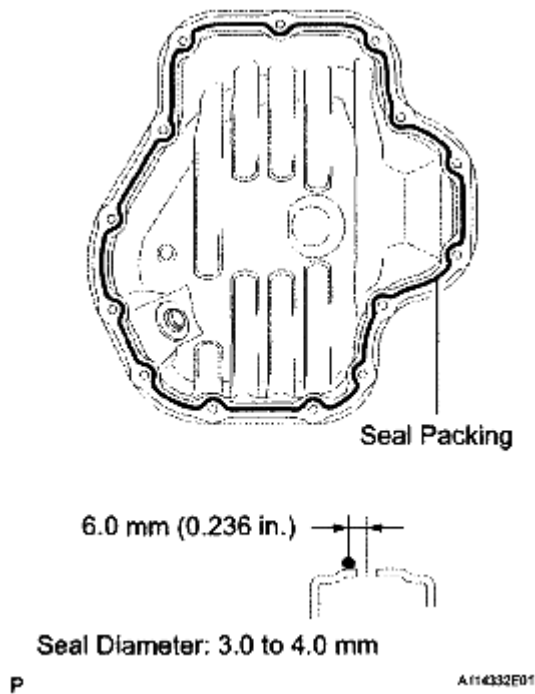


Fig. 69: Identifying Oil Pan Sub-Assembly Seal Packing Area
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Apply a continuous bead of seal packing (Diameter 3.0 to 4.0 mm (0.118 to 0.157 in.)) as shown in the illustration.

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

NOTE:

- Remove any oil from the contact surfaces.
- Install the oil pan within 3 minutes after applying seal packing.
- Do not start the engine for at least 2 hours after installing the oil pan.

- c. Install the oil pan to the cylinder block.
- d. Uniformly tighten the 12 bolts and 2 nuts in the sequence shown in the illustration.

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

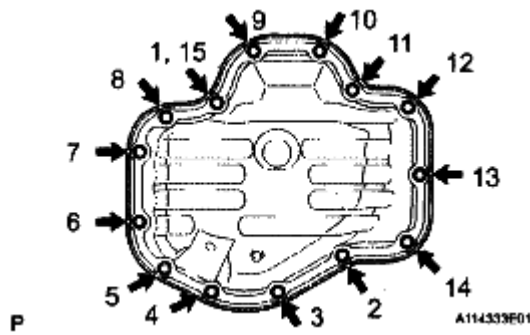


Fig. 70: Locating Oil Pan Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. INSTALL CRANK POSITION SENSOR (See INSTALLATION)

14. INSTALL CRANKSHAFT PULLEY (See INSTALLATION)

15. INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY

- a. Release the ratchet pawl, then fully push in the plunger and hook the hook to the pin so that the plunger is in the position shown in the illustration.

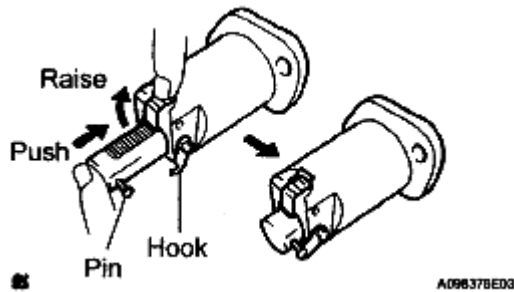


Fig. 71: Identifying Plunger Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install a new gasket and the chain tensioner with the 2 nuts.

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

NOTE: If the hook releases the plunger while the chain tensioner is being installed, set the hook again.

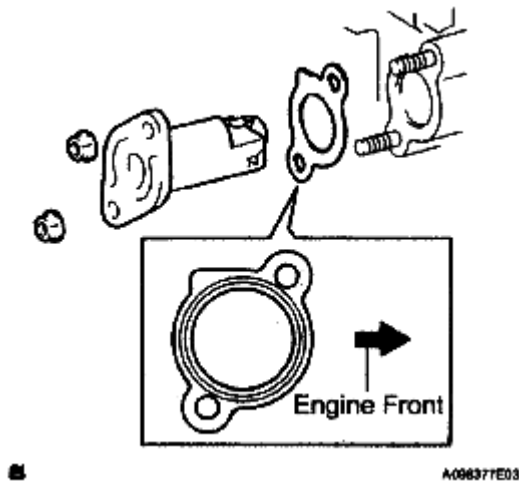


Fig. 72: Identifying Gasket

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

- c. Turn the crankshaft counterclockwise, then disconnect the plunger knock pin from the hook.

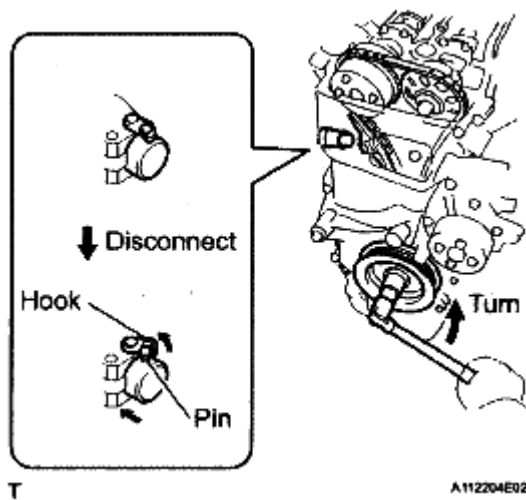


Fig. 73: Identifying Plunger Knock Pin From Hook

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

- d. Turn the crankshaft clockwise, then check that the plunger is extended.
16. **INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY**
 - a. Remove any old packing material from the contact surface.

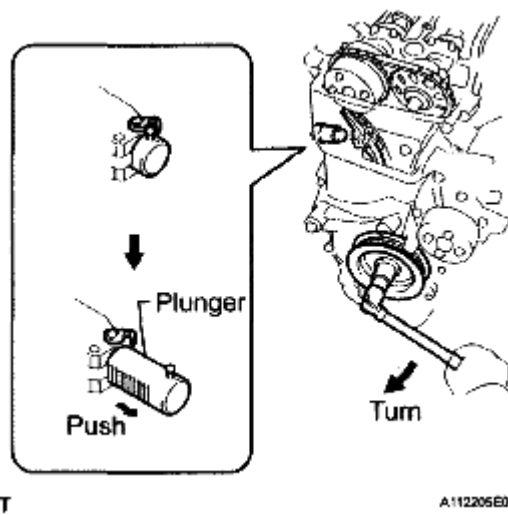


Fig. 74: View Of Turning Crankshaft Clockwise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Apply seal packing to the 2 locations shown in the illustration.

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

NOTE:

- Remove any oil from the contact surface.
- Install the cylinder head cover within 3 minutes of applying seal packing.
- Do not add engine oil for at least 2 hours after installing the cylinder head cover.

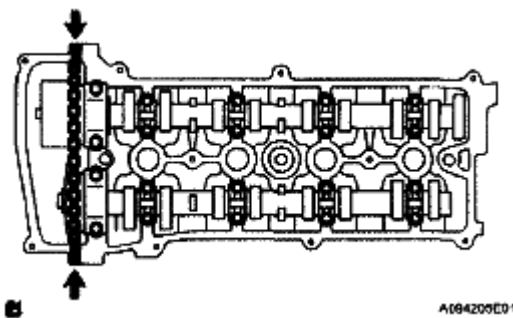


Fig. 75: Locating Seal Packing Locations
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the cylinder head cover with the 8 bolts and 2 nuts.

Torque: Bolt A

11 N*m (112 kgf*cm, 8 ft.*lbf)

Bolt B

14 N*m (143 kgf*cm, 10 ft.*lbf)

Nut

11 N*m (112 kgf*cm, 8 ft.*lbf)

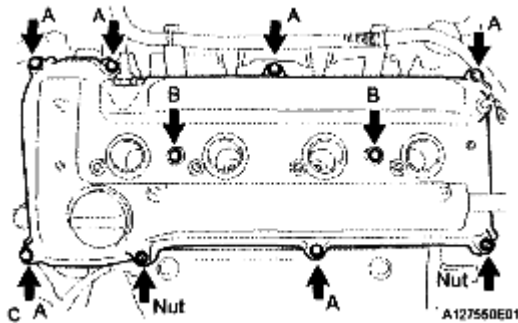


Fig. 76: Locating Cylinder Head Cover With Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Install the 2 engine wires with the 2 bolts.

Torque: 8.4 N*m (86 kgf*cm, 74 in.*lbf)

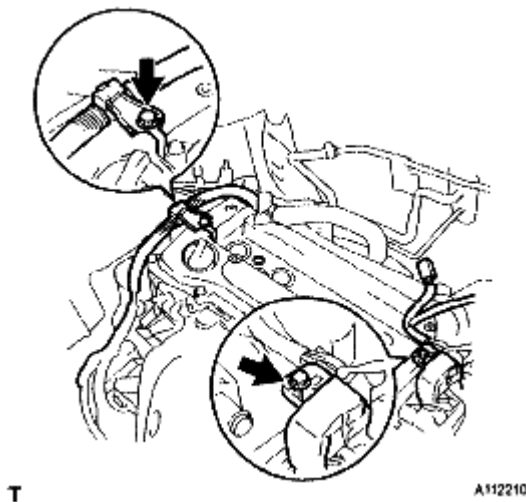


Fig. 77: Locating Engine Wires With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

17. INSTALL NO. 2 VENTILATION HOSE

18. INSTALL VENTILATION HOSE

19. INSTALL IGNITION COIL ASSEMBLY

- a. Install the 4 ignition coils with the 4 bolts.

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

- 20. **INSTALL IDLER PULLEY BRACKET** (See INSTALLATION)
- 21. **INSTALL V-RIBBED BELT TENSIONER ASSEMBLY** (See INSTALLATION)
- 22. **INSTALL V-RIBBED BELT** (See INSTALLATION)
- 23. **INSTALL V-RIBBED BELT TENSIONER COVER SUB-ASSEMBLY** (See INSTALLATION)
- 24. **INSTALL NO. 2 ENGINE MOUNTING BRACKET RH** (See INSTALLATION)
- 25. **INSTALL ENGINE MOVING CONTROL ROD SUB-ASSEMBLY** (See INSTALLATION)
- 26. **INSTALL NO. 2 ENGINE MOUNTING STAY RH** (See INSTALLATION)
- 27. **INSTALL FRONT EXHAUST PIPE ASSEMBLY**

HINT:

See INSTALLATION .

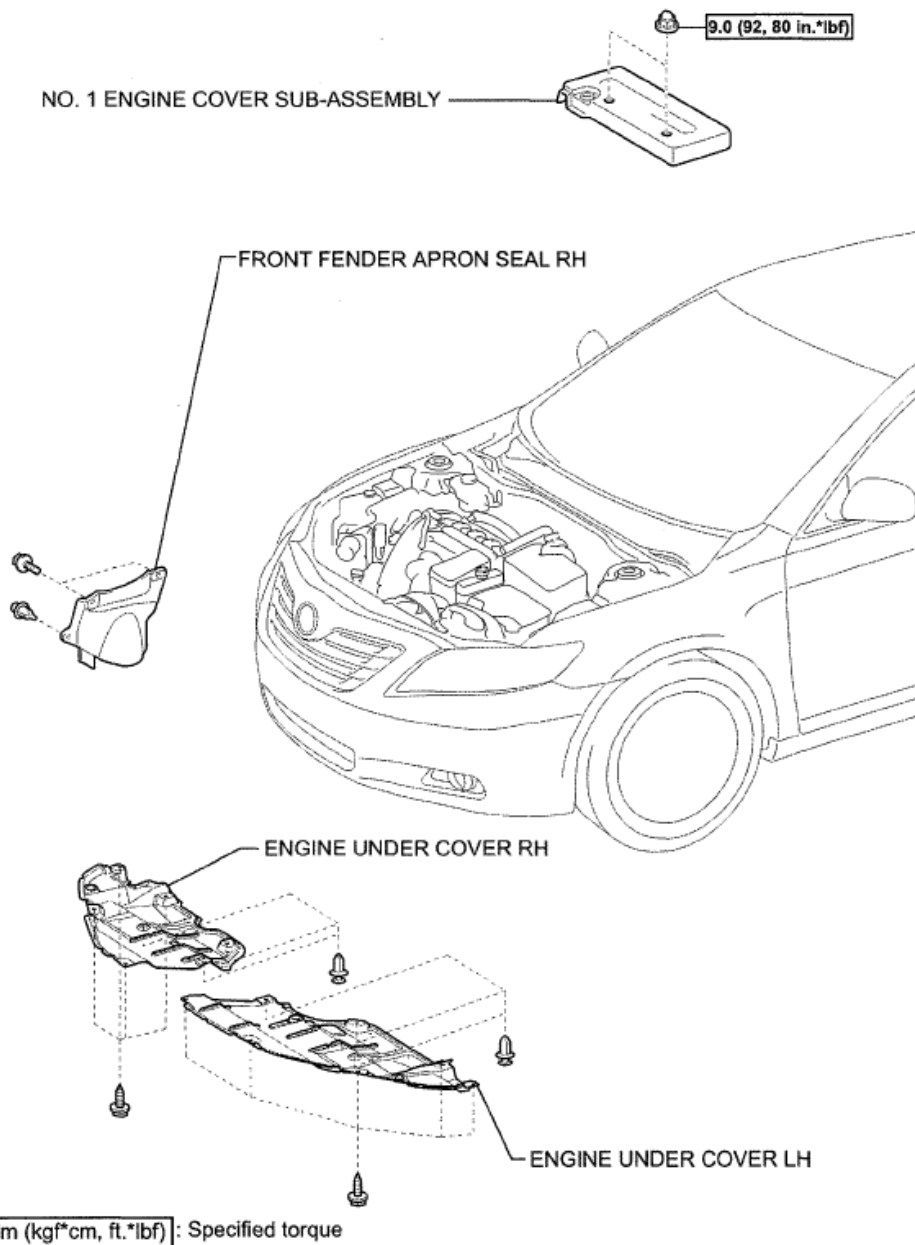
- 28. **ADD ENGINE OIL**
- 29. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL** (See INSTALLATION)
- 30. **INSTALL LUGGAGE TRIM SERVICE HOLE COVER**
- 31. **CHECK FOR ENGINE OIL LEAKS**
- 32. **CHECK FOR EXHAUST GAS LEAKS**
- 33. **CHECK IGNITION TIMING** (See ENGINE)
- 34. **INSTALL FRONT FENDER APRON SEAL RH**
- 35. **INSTALL ENGINE UNDER COVER LH**
- 36. **INSTALL ENGINE UNDER COVER RH**
- 37. **INSTALL FRONT WHEEL RH**
- 38. **INSTALL NO. 1 ENGINE COVER SUB-ASSEMBLY** (See INSTALLATION)
- 39. **PERFORM INITIALIZATION**
 - a. Perform initialization procedure (See INITIALIZATION).

HINT:

Some vehicle systems require initialization after reconnecting the cable to the negative battery terminal.

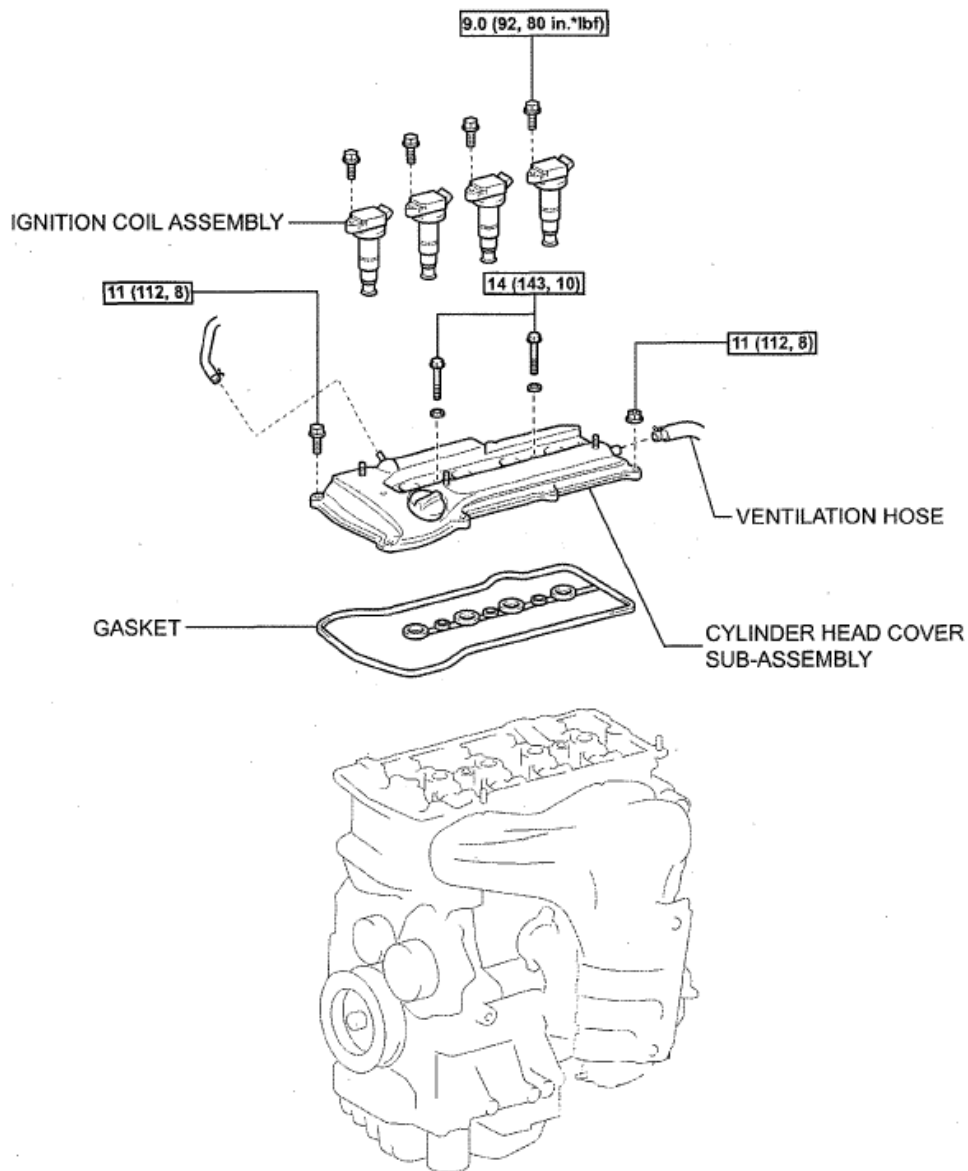
CAMSHAFT

COMPONENTS



A139232E01

Fig. 78: Identifying Camshaft Replacement Components With Torque Specification (1 Of 3)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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

c

A139233E01

Fig. 79: Identifying Camshaft Replacement Components With Torque Specifications (2 Of 3)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

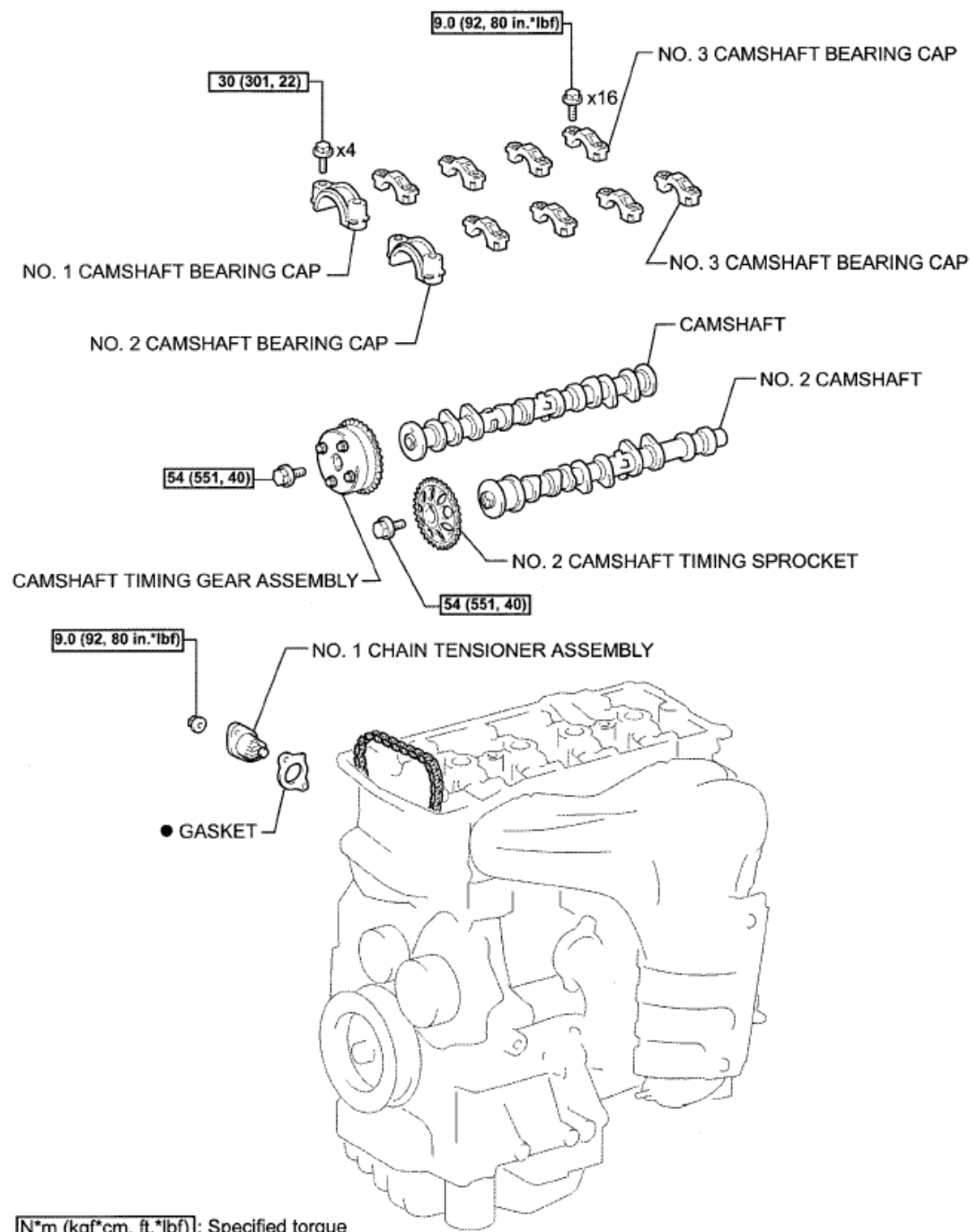


Fig. 80: Identifying Camshaft Components With Torque Specifications (3 Of 3)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. REMOVE FRONT WHEEL RH

2. REMOVE ENGINE UNDER COVER LH
3. REMOVE ENGINE UNDER COVER RH
4. REMOVE FRONT FENDER APRON SEAL RH
5. REMOVE NO. 1 ENGINE COVER SUB-ASSEMBLY (See REMOVAL)
6. REMOVE IGNITION COIL ASSEMBLY (See REMOVAL)
7. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY (See REMOVAL)
8. SET NO. 1 CYLINDER TO TDC/COMPRESSION (See VALVE CLEARANCE)
9. REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY (See REMOVAL)
10. REMOVE NO. 2 CAMSHAFT
 - a. While holding the camshaft with a wrench, loosen the camshaft timing set bolt.

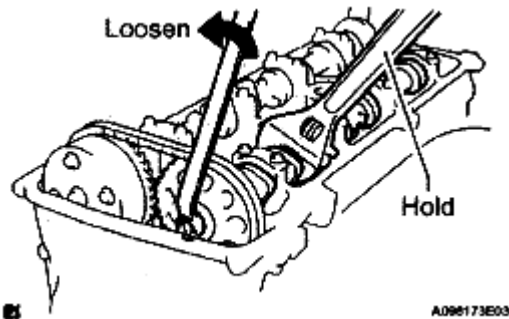


Fig. 81: View Of Loosening Camshaft Timing Set Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using several steps, uniformly loosen and remove the 10 bearing cap bolts in the sequence shown in the illustration.

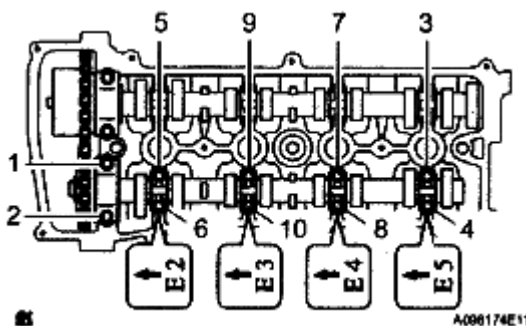


Fig. 82: Identifying Bearing Cap Bolts Loosening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Remove the 5 bearing caps.
- d. While holding the No. 2 camshaft by hand, remove the camshaft timing sprocket set bolt.

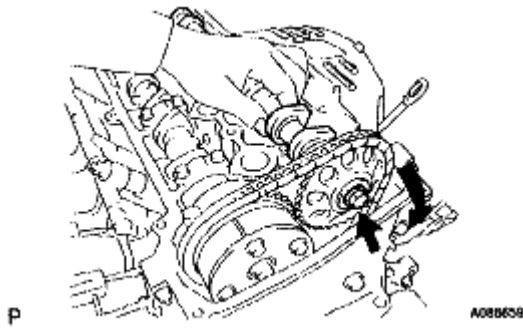


Fig. 83: Locating Camshaft Timing Sprocket Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Remove the camshaft timing sprocket from the No. 2 camshaft with the timing chain on the sprocket.
- f. Remove the camshaft timing sprocket from the timing chain.

11. REMOVE CAMSHAFT

- a. Using several steps, uniformly loosen and remove the 10 bearing cap bolts in the sequence shown in the illustration.

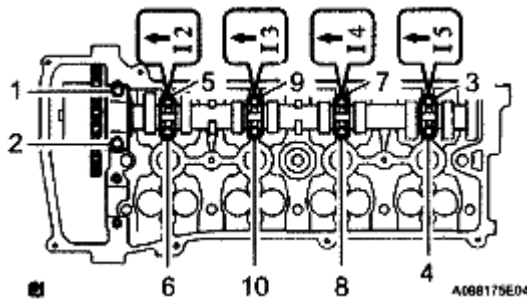


Fig. 84: Identifying Bearing Cap Bolts Loosening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the 5 bearing caps.
- c. Remove the camshaft and camshaft timing gear while holding the timing chain by hand.
- d. Tie the timing chain with a string as shown in the illustration.

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

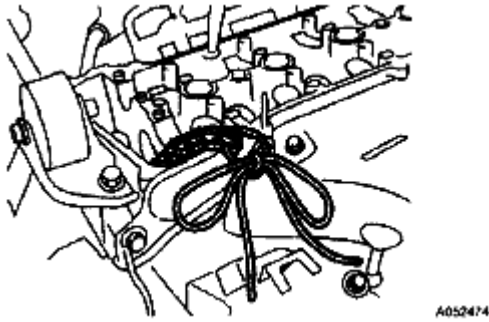


Fig. 85: View Of Tying Timing Chain With String
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. REMOVE CAMSHAFT TIMING GEAR ASSEMBLY

- a. Clamp the camshaft in a vise, and make sure that the camshaft timing gear does not rotate.
- b. Cover all the oil ports except the advance side port shown in the illustration with electrical tape.

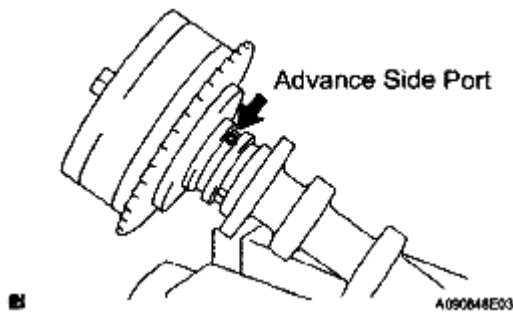


Fig. 86: Locating Advance Side Port
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Apply air pressure of 100 kPa (1.0 kgf/cm², 14 psi) to the oil path, then turn the camshaft timing gear in the advance direction (counterclockwise) by hand.

CAUTION: Cover the paths with a shop rag or piece of cloth to keep oil from splashing.

HINT:

Depending on the air pressure, the camshaft timing gear will turn to the advance angle side without applying force by hand. Also, if the pressure is difficult to apply because of air leakage from the port, the lock may be difficult to release.

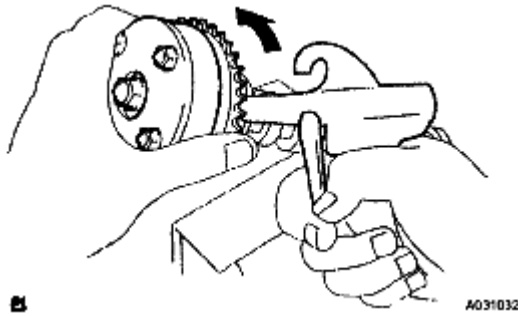


Fig. 87: View Of Applying Air Pressure To Port On Advanced Angle Side
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Remove the flange bolt of the camshaft timing gear.

NOTE:

- Be sure not to remove the other 4 bolts.
- If planning to reuse the gear, be sure to release the straight pin lock before installing the gear.

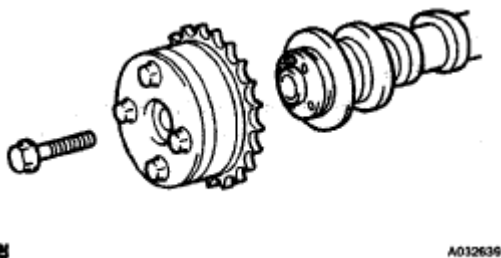


Fig. 88: Identifying Fringe Bolt From Camshaft Timing Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION

1. INSPECT CAMSHAFT TIMING GEAR ASSEMBLY

- a. Check the lock of the camshaft timing gear.
 1. Clamp the camshaft in a vise, and confirm that the camshaft timing gear is locked.

NOTE: Be careful not to damage the camshaft.

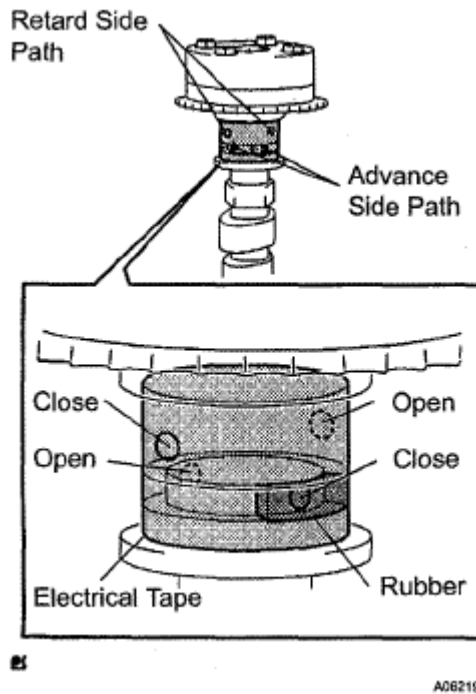


Fig. 89: Identifying Camshaft Timing Gear Assembly Lock
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Release the lock pin.

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

HINT:

The 2 advance side paths are provided in the groove of the camshaft. Plug one of the paths with a rubber piece.

2. Prick a hole in the tape placed on the advance side, prick a hole in the tape placed on the retard side path, on the opposite side to that of the advance side path, as shown in the illustration.
3. Apply approximately 200 kPa (2.0 kgf/cm², 28 psi) of air pressure to the two broken paths.

CAUTION: Cover the paths with a piece of cloth when applying pressure to keep oil from splashing.

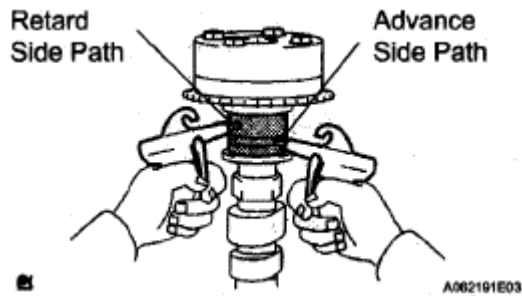


Fig. 90: View Of Applying Air Pressure Retard And Advance Side Path
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. Check that the camshaft timing gear revolves in the advance direction when reducing the air pressure of the retard side path.

OK: Gear rotates in the advance direction.

HINT:

This operation releases the lock pin for the most retarded position.

5. When the camshaft timing gear reaches the most advanced position, remove the air gun from the retard side path and advance side path, in that order.

NOTE: Do not remove the air gun from the advance side path first. The gear may abruptly shift in the retard direction and break the lock pin.

- c. Check for smooth rotation.

1. Rotate the camshaft timing gear within its movable range several times, but do not turn it to the most retarded position. Check that the gear rotates smoothly.

OK: Gear rotates smoothly.

NOTE: Do not use an air gun to check for smooth operation.

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

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

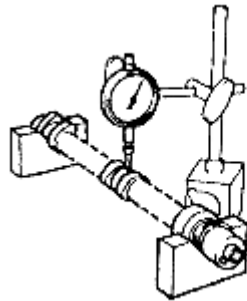
2. INSPECT CAMSHAFT

- a. Inspect the camshaft for runout.

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

Maximum circle runout: 0.03 mm (0.0012 in.)

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



EM01628C01

Fig. 91: Inspecting Camshaft Runout

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

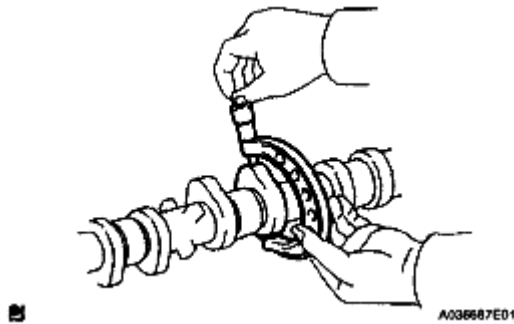
b. Inspect the cam lobes.

1. Using a micrometer, measure the cam lobe height.

Standard cam lobe height: 44.516 to 44.616 mm (1.7526 to 1.7565 in.)

Minimum cam lobe height: 44.406 mm (1.7483 in.)

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



A0386B7E01

Fig. 92: Inspecting Cam Lobes

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

c. Inspect the camshaft journals.

1. Using a micrometer, measure the journal diameter.

Standard journal diameter

JOURNAL POSITION SPECIFIED CONDITION

Journal Position	Specified Condition
No. 1	35.971 to 35.985 mm (1.4162 to 1.4167 in.)
Other	22.959 to 22.975 mm (0.9039 to 0.9045 in.)

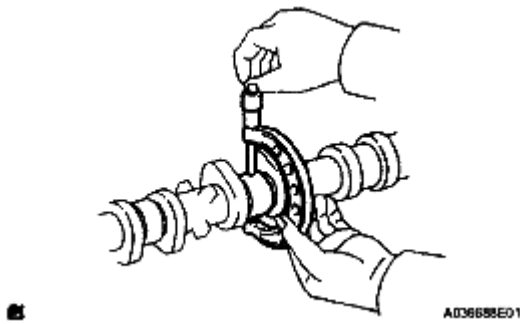


Fig. 93: Inspecting Camshaft Journals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

3. INSPECT NO. 2 CAMSHAFT

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

Maximum circle runout: 0.03 mm (0.0012 in.)

If the circle runout is greater than the maximum, replace the No. 2 camshaft.

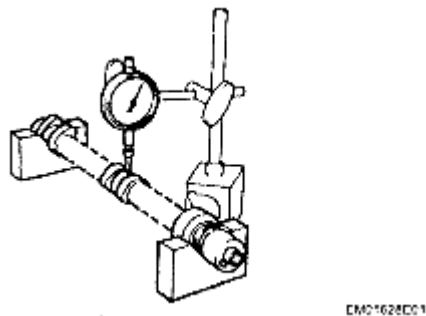


Fig. 94: Inspecting Camshaft Runout
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Standard cam lobe height: 45.983 to 46.083 mm (1.8104 to 1.8143 in.)

Minimum cam lobe height: 45.873 mm (1.8060 in.)

If the cam lobe height is less than the minimum, replace the No. 2 camshaft.

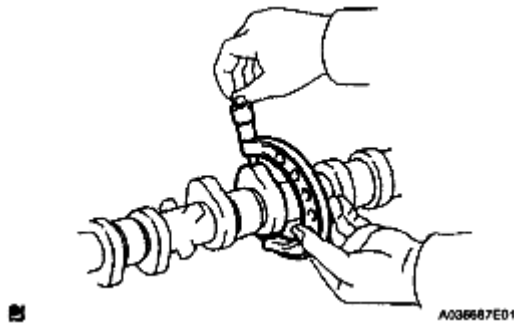


Fig. 95: Inspecting Cam Lobes

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

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

Standard journal diameter

JOURNAL POSITION SPECIFIED CONDITION

Journal Position	Specified Condition
No.1	35.971 to 35.985 mm (1.4162 to 1.4167 in.)
Other	22.959 to 22.975 mm (0.9039 to 0.9045 in.)

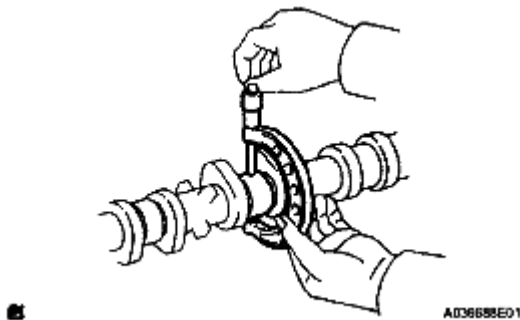


Fig. 96: Inspecting Camshaft Journals

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

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

INSTALLATION

1. INSTALL CAMSHAFT TIMING GEAR ASSEMBLY

- a. Put the camshaft timing gear and camshaft together with the straight pin and key groove misaligned, as shown in the illustration.
- b. Turn the camshaft timing gear as shown in the illustration while pushing it gently against the camshaft. Push further at the position where the pin fits into the groove.

NOTE: Be sure not to turn the camshaft timing gear to the retard angle side (the right angle).

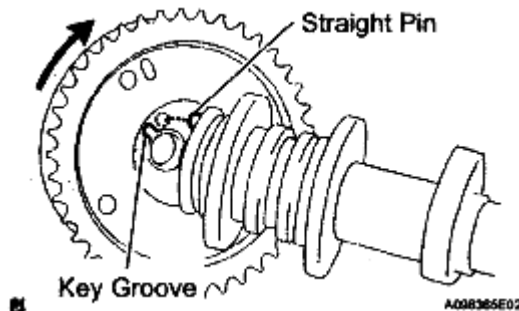


Fig. 97: Identifying Camshaft Timing Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Check that there is no clearance between the gear and camshaft.
- d. Tighten the flange bolt with the camshaft timing gear fixed in place.

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

- e. Check that the camshaft timing gear can move to the retard angle side (the right direction) and is locked in the most retarded position.

2. INSTALL CAMSHAFT

- a. Apply a light coat of engine oil to the journal portion of the camshaft.
- b. Install the timing chain onto the camshaft timing gear with the paint mark aligned with the timing mark in the camshaft timing gear as shown in the illustration.

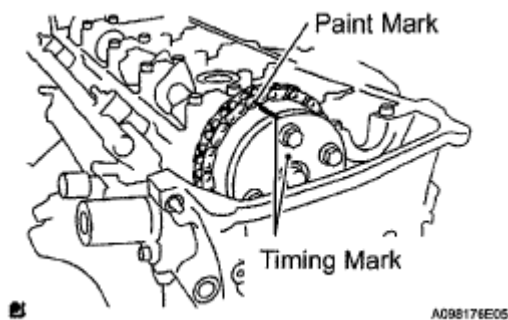


Fig. 98: Identifying Paint Mark Aligned With Timing Mark In Camshaft Timing Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Examine the front marks and numbers, and check that the order is as shown in the illustration. Then install the bearing caps into the cylinder head.

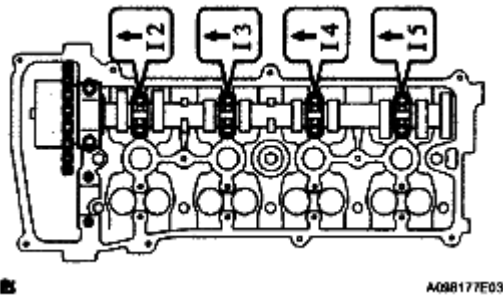


Fig. 99: Identifying Bearing Cap Numbers

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

- d. Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.
- e. Using several steps, uniformly tighten the 10 bearing cap bolts in the sequence shown in the illustration.

Torque: No. 1 bearing cap

30 N*m (301 kgf*cm, 22 ft.*lbf)

No. 3 bearing cap

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

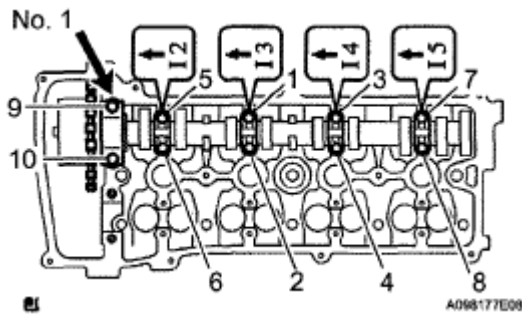


Fig. 100: Identifying Bearing Cap Bolts Tightening Sequence

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

3. INSTALL NO. 2 CAMSHAFT

- a. Apply a light coat of engine oil to the journal portion of the No. 2 camshaft.
- b. Put the No. 2 camshaft on the cylinder head with the paint mark of the chain aligned with the timing mark on the camshaft timing sprocket.

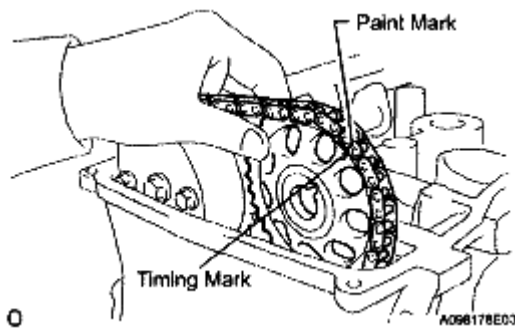


Fig. 101: View Of Aligning Timing Mark On Camshaft Timing Sprocket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. While holding the No. 2 camshaft by hand, temporarily tighten the camshaft timing sprocket set bolt.

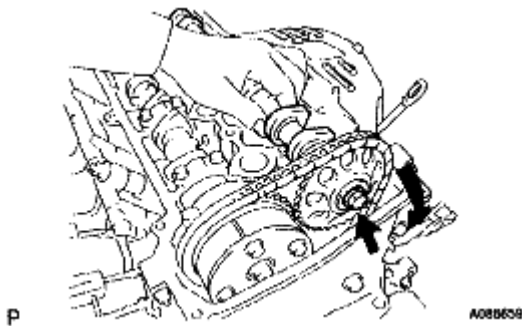


Fig. 102: Locating Camshaft Timing Sprocket Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Examine the front marks and numbers, and check that the order is as shown in the illustration. Then install the bearing caps onto the cylinder head.

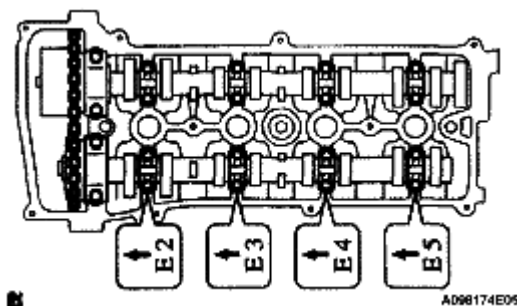


Fig. 103: Identifying Front Marks And Numbers Order
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.
- f. Using several steps, uniformly tighten the 10 bearing cap bolts in the sequence shown in the illustration.

Torque: No. 2 bearing cap

30 N*m (301 kgf*cm, 22 ft.*lbf)

No. 3 bearing cap

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

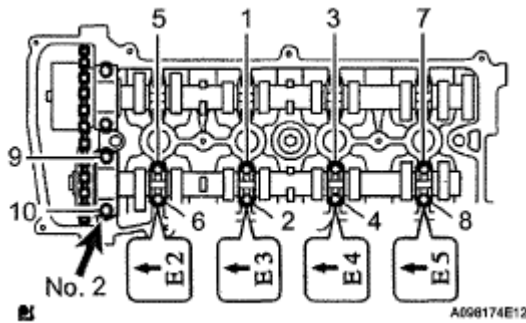


Fig. 104: Identifying Bearing Cap Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. While holding the camshaft with a wrench, tighten the camshaft timing sprocket set bolt.

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

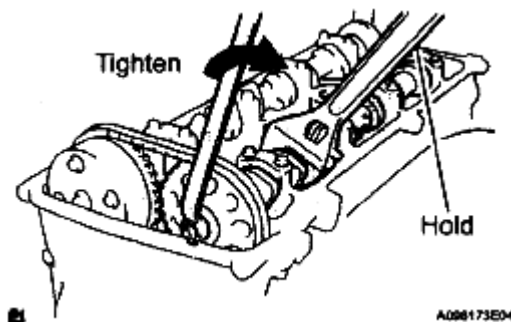


Fig. 105: Identifying Camshaft Timing Sprocket Set Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- h. Check that the paint marks on the chain are aligned with the timing marks on the camshaft timing gear and camshaft timing sprocket. Also, check that the crankshaft pulley groove is aligned with the timing mark "0" of the timing chain cover.

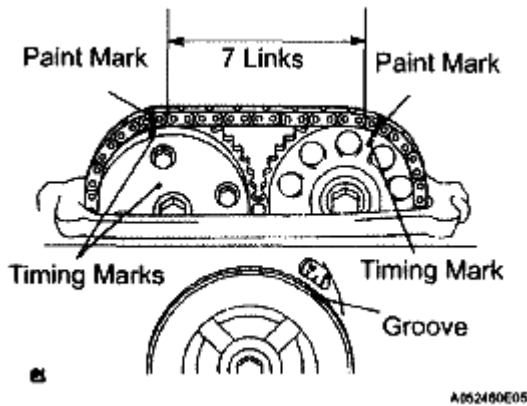


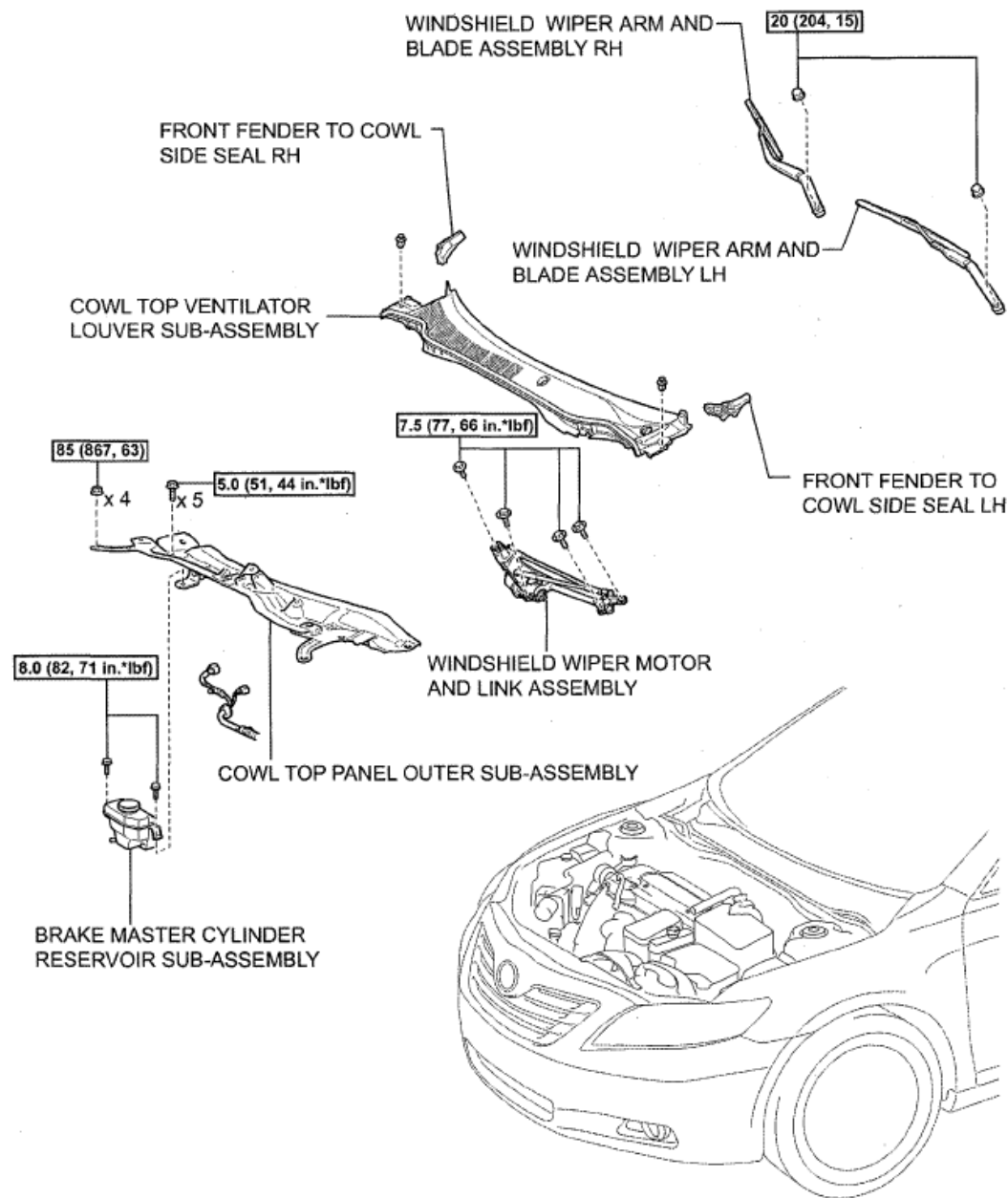
Fig. 106: Identifying Paint Marks, Timing Marks On Camshaft Timing Gear And Camshaft Timing Sprocket

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

4. INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY (See INSTALLATION)
5. CHECK VALVE CLEARANCE
6. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY (See INSTALLATION)
7. INSTALL IGNITION COIL ASSEMBLY (See INSTALLATION)
8. INSTALL NO. 1 ENGINE COVER SUB-ASSEMBLY (See INSTALLATION)
9. INSTALL FRONT FENDER APRON SEAL RH
10. INSTALL ENGINE UNDER COVER LH
11. INSTALL ENGINE UNDER COVER RH
12. INSTALL FRONT WHEEL RH
13. CHECK FOR ENGINE OIL LEAKS

CYLINDER HEAD

COMPONENTS

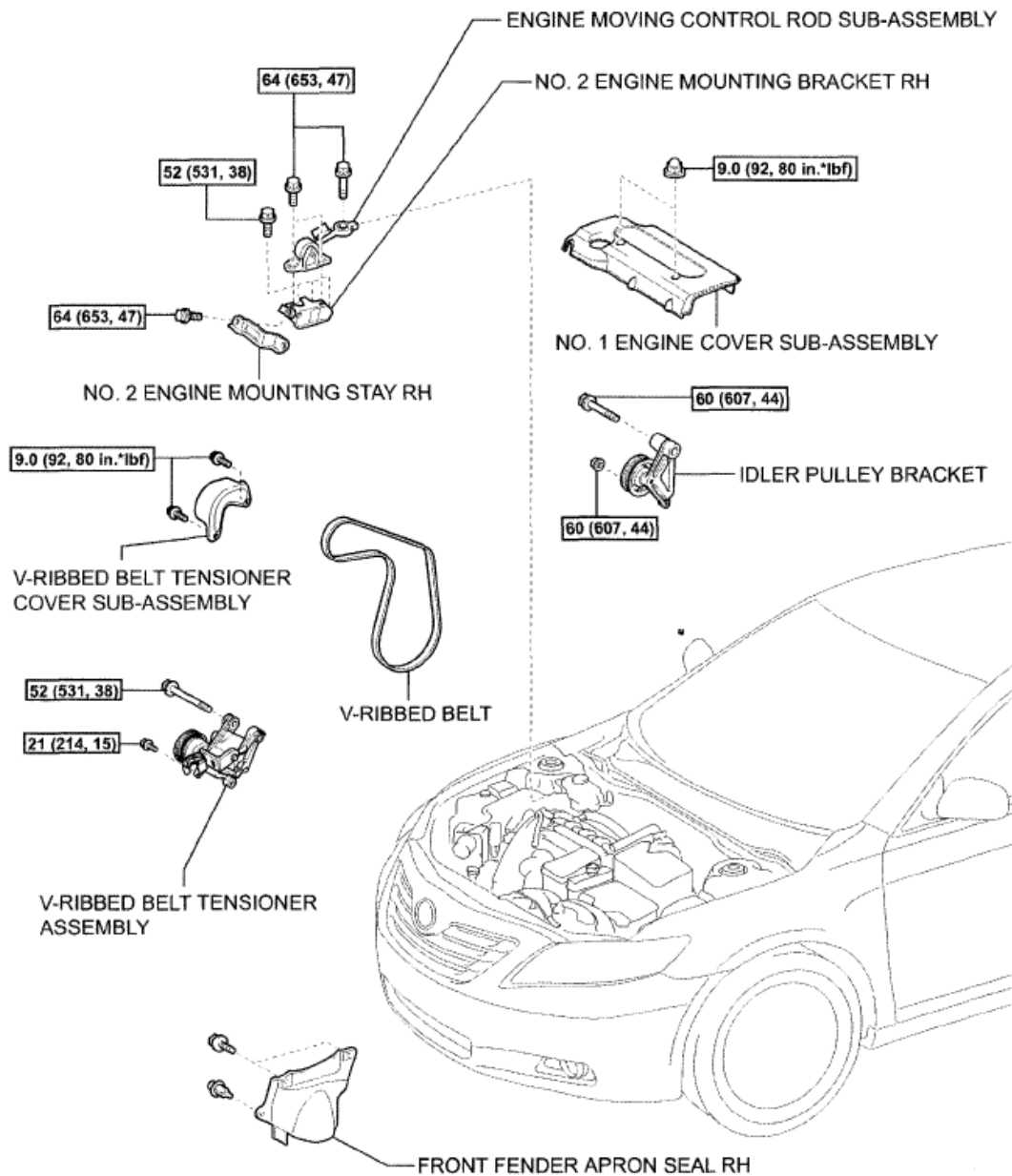


N*m (kgf*cm, ft.*lbf): Specified torque

C

A129008E04

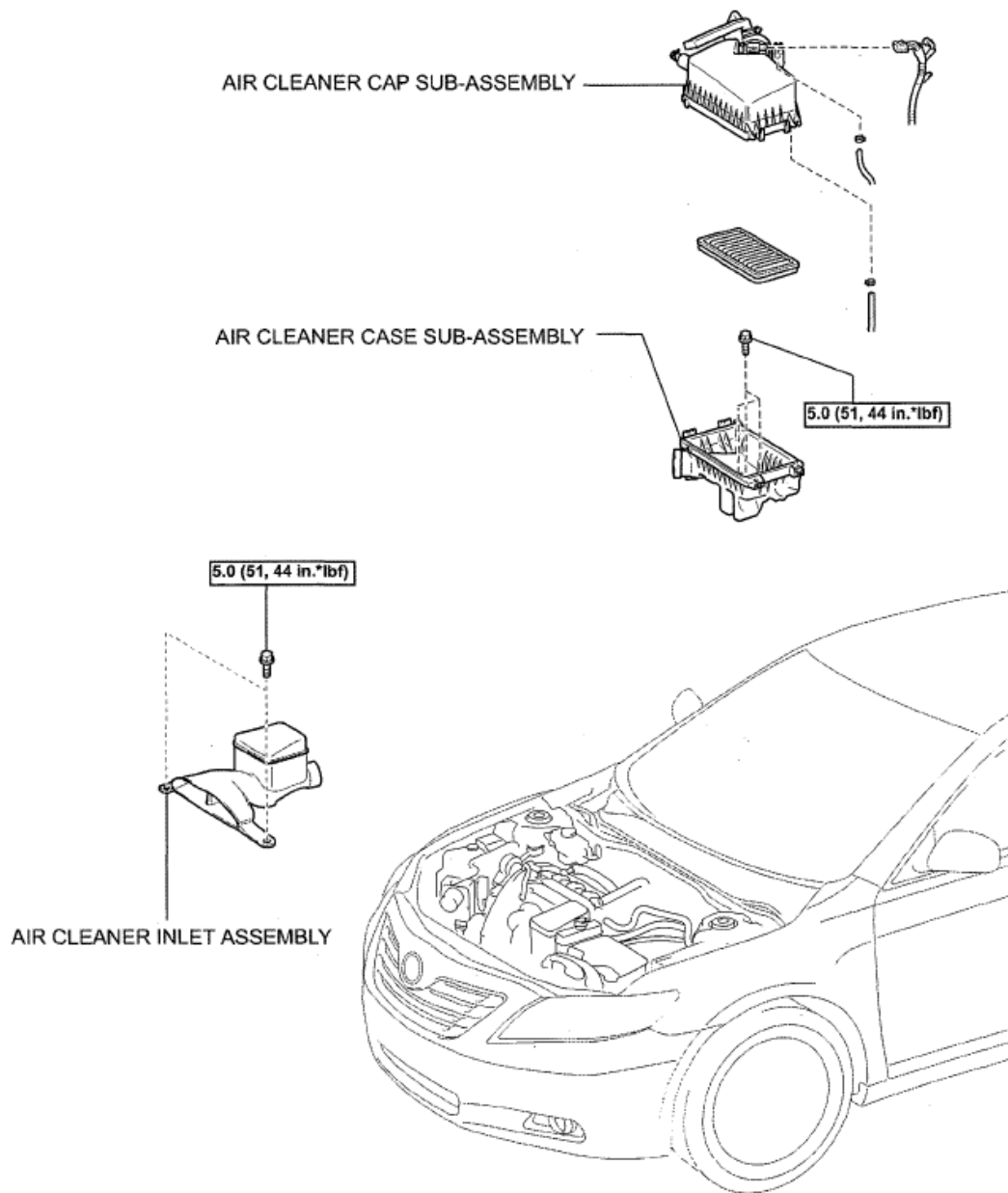
Fig. 107: Identifying Cylinder Head Replacement Components With Torque Specifications (1 Of 7)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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

A13R358E01

Fig. 108: Identifying Cylinder Head Replacement Components With Torque Specifications (2 Of 7)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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

c

A139235E01

Fig. 109: Identifying Cylinder Head Replacement Components With Torque Specifications (3 Of 7)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

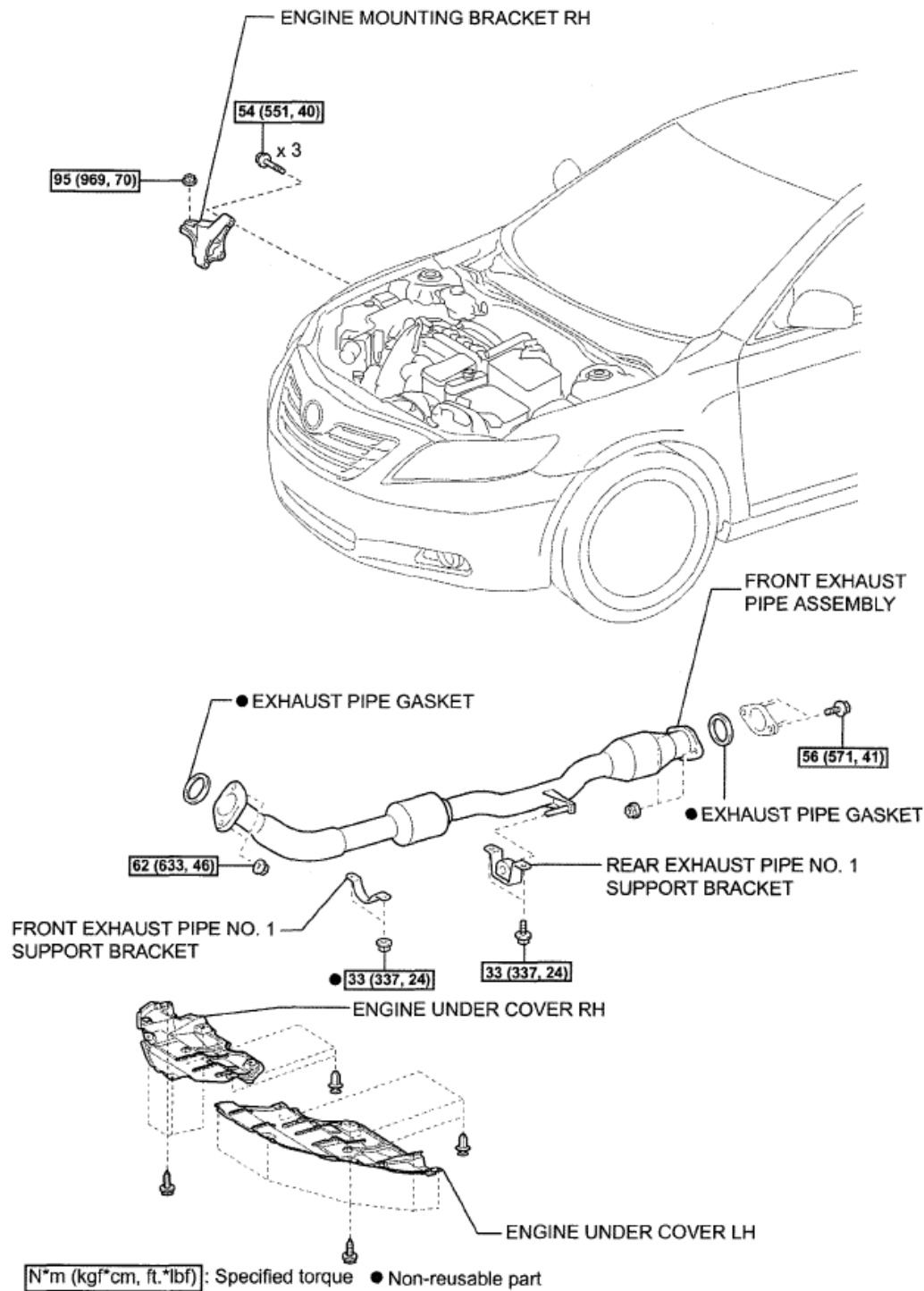


Fig. 110: Identifying Cylinder Head Replacement Components With Torque Specifications (4 Of 7)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2009 Toyota Camry LE

2009 ENGINE Engine Mechanical - Camry Hybrid

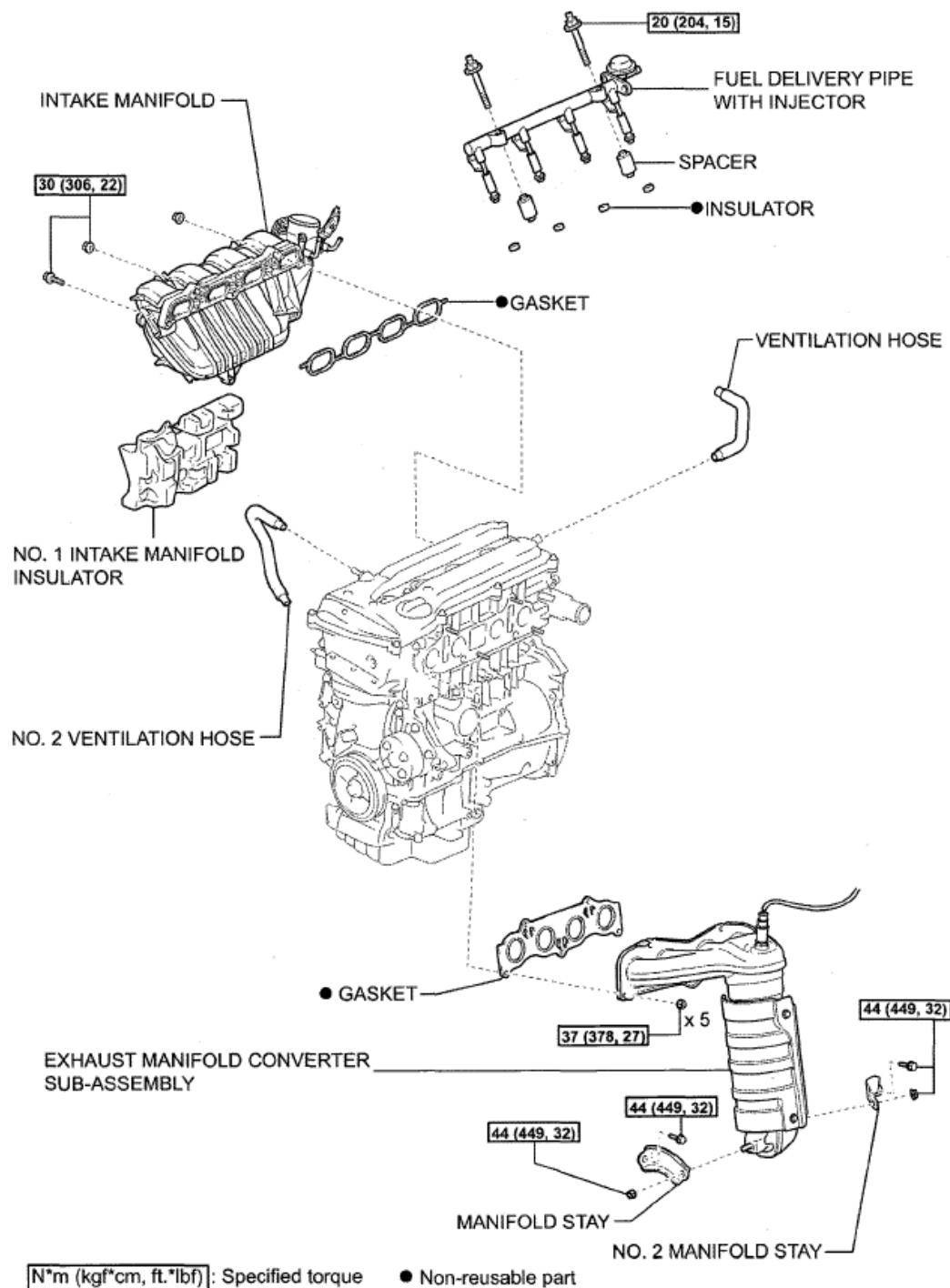
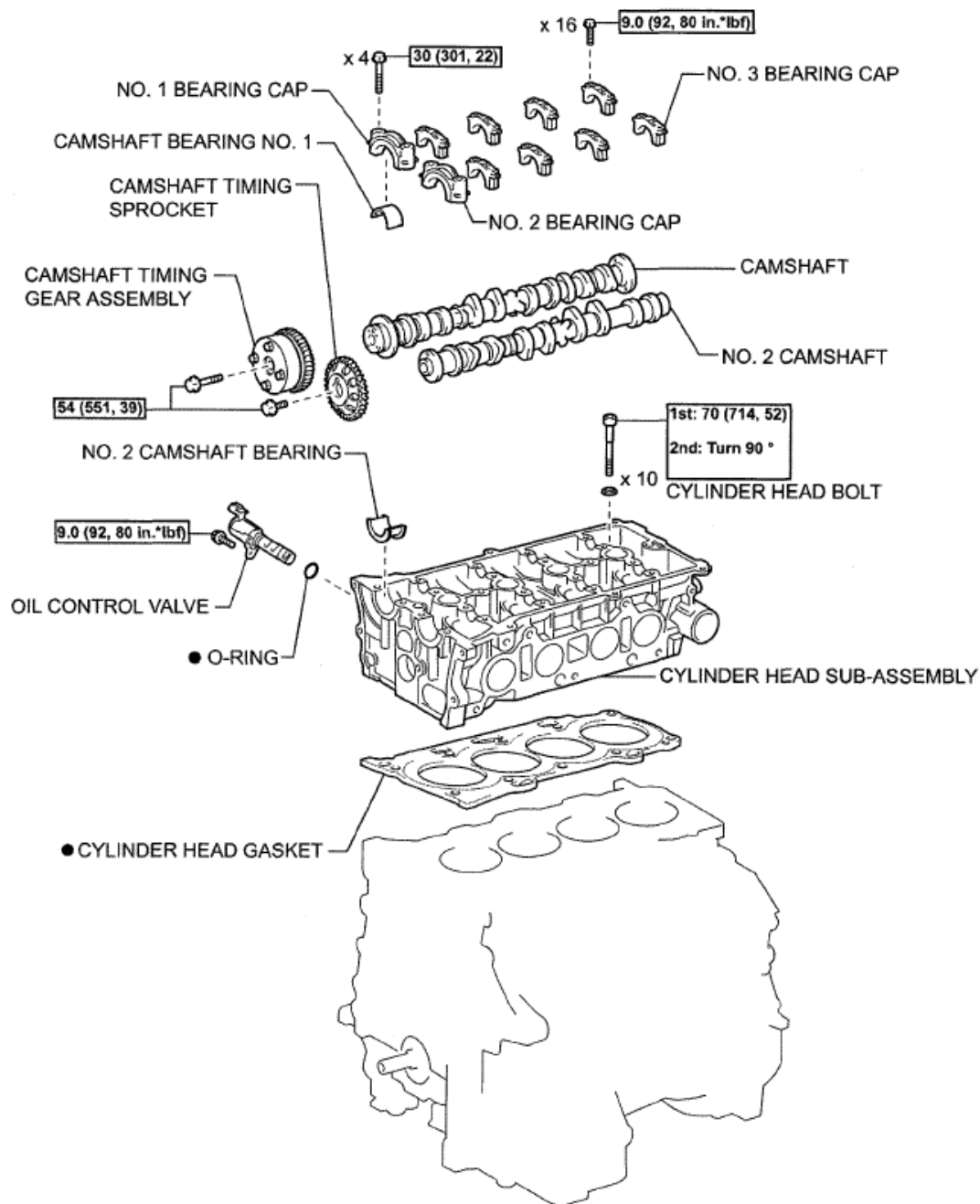


Fig. 111: Identifying Cylinder Head Replacement Components With Torque Specifications (5 Of 7)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

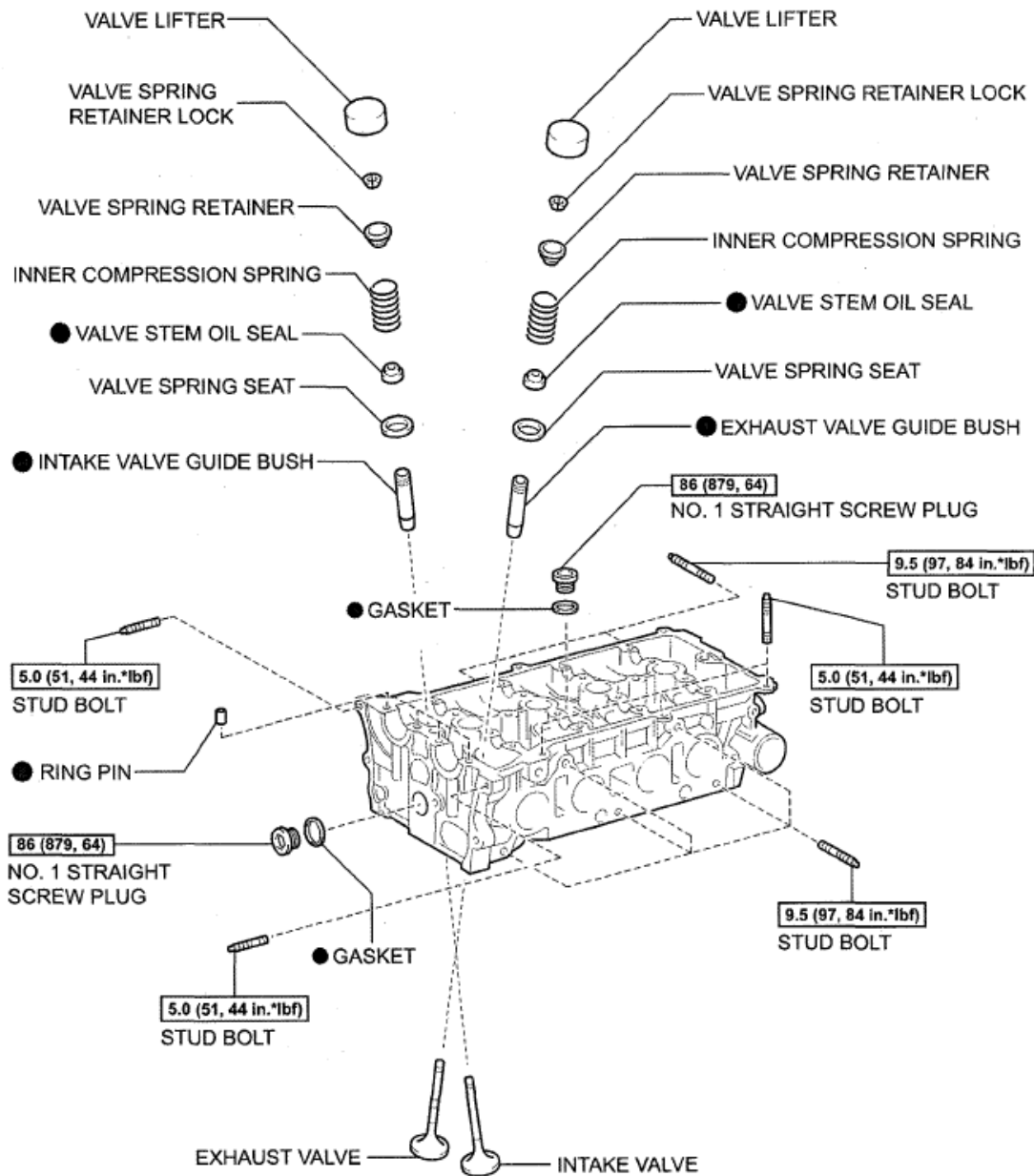


N*m (kgf*cm, ft.*lbf): Specified torque

● Non-reusable part

A134951E06

Fig. 112: Identifying Cylinder Head Components With Torque Specifications (6 Of 7)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



N*m (kgf*cm, ft.*lbf) : Specified torque ● Non-reusable part

A136083E02

Fig. 113: Identifying Cylinder Head Replacement Components With Torque Specifications (7 Of 7)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. DISCHARGE FUEL SYSTEM PRESSURE

HINT:

See **FUEL SYSTEM** .

2. **REMOVE LUGGAGE TRIM SERVICE HOLE COVER**
3. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL (See REMOVAL)**
4. **REMOVE ENGINE UNDER COVER LH**
5. **REMOVE ENGINE UNDER COVER RH**
6. **REMOVE FRONT FENDER APRON SEAL RH**
7. **REMOVE NO. 1 ENGINE COVER SUB-ASSEMBLY (See REMOVAL)**
8. **DRAIN COOLANT (for Engine) (See COOLANT (FOR ENGINE))**
9. **DRAIN ENGINE OIL (See REPLACEMENT)**
10. **REMOVE FRONT WIPER ARM AND BLADE ASSEMBLY LH (See REMOVAL)**
11. **REMOVE FRONT WIPER ARM AND BLADE ASSEMBLY RH (See REMOVAL)**
12. **REMOVE FRONT FENDER TO COWL SIDE SEAL LH (See REMOVAL)**
13. **REMOVE FRONT FENDER TO COWL SIDE SEAL RH (See REMOVAL)**
14. **REMOVE COWL TOP VENTILATOR LOUVER SUB-ASSEMBLY (See REMOVAL)**
15. **REMOVE WINDSHIELD WIPER MOTOR AND LINK ASSEMBLY (See REMOVAL)**
16. **SEPARATE BRAKE MASTER CYLINDER RESERVOIR SUB-ASSEMBLY**
17. **REMOVE COWL TOP PANEL OUTER SUB-ASSEMBLY (See REMOVAL)**
18. **REMOVE AIR CLEANER INLET ASSEMBLY (See REMOVAL)**
19. **REMOVE AIR CLEANER CAP SUB-ASSEMBLY (See REMOVAL)**
20. **REMOVE AIR CLEANER CASE SUB-ASSEMBLY (See REMOVAL)**
21. **REMOVE THROTTLE BODY ASSEMBLY (See REMOVAL)**
22. **DISCONNECT FUEL TUBE SUB-ASSEMBLY (See REMOVAL)**
23. **REMOVE FUEL DELIVERY PIPE WITH INJECTOR (See REMOVAL)**
24. **REMOVE INTAKE MANIFOLD (See REMOVAL)**
25. **REMOVE NO. 1 INTAKE MANIFOLD INSULATOR (See REMOVAL)**
26. **REMOVE FRONT EXHAUST PIPE ASSEMBLY**

HINT:

See **REMOVAL** .

27. **REMOVE NO. 2 ENGINE MOUNTING STAY RH (See REMOVAL)**
28. **REMOVE ENGINE MOVING CONTROL ROD SUB-ASSEMBLY (See REMOVAL)**
29. **REMOVE NO. 2 ENGINE MOUNTING BRACKET RH (See REMOVAL)**
30. **REMOVE V-RIBBED BELT TENSIONER COVER SUB-ASSEMBLY (See REMOVAL)**
31. **REMOVE V-RIBBED BELT (See REMOVAL)**
32. **REMOVE OIL LEVEL GAUGE SUB-ASSEMBLY**

33. **REMOVE OIL LEVEL GAUGE GUIDE** (See **REMOVAL**)
34. **REMOVE MANIFOLD STAY** (See **REMOVAL**)
35. **REMOVE NO. 2 MANIFOLD STAY** (See **REMOVAL**)
36. **REMOVE EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY** (See **REMOVAL**)
37. **REMOVE CHAIN SUB-ASSEMBLY**

HINT:

See **REMOVAL**.

38. REMOVE NO. 2 CAMSHAFT

- a. Using several steps, uniformly loosen and remove the 10 bearing cap bolts in the sequence shown in the illustration.

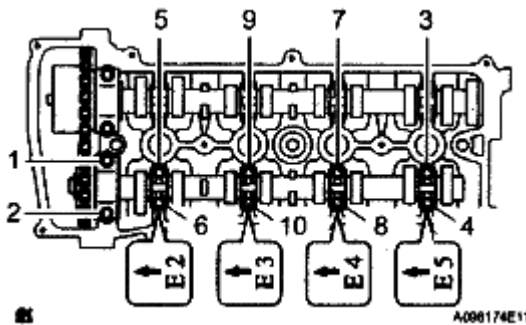


Fig. 114: Identifying Bearing Cap Bolts Loosening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the 5 bearing caps and No. 2 camshaft.

39. REMOVE CAMSHAFT

- a. Using several steps, uniformly loosen and remove the 10 bearing cap bolts in the sequence shown in the illustration.

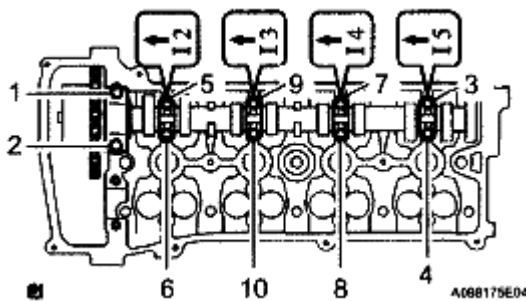


Fig. 115: Identifying Bearing Cap Bolts Loosening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the 5 bearing caps and camshaft.

40. **REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY** (See **REMOVAL**)
41. **DISCONNECT RADIATOR HOSE INLET** (See **REMOVAL**)
42. **DISCONNECT ENGINE WIRE**
 - a. Disconnect the radio setting condenser connector.

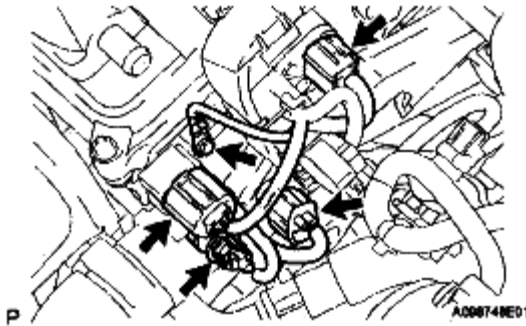


Fig. 116: Locating Radio Setting Condenser Sensor Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Disconnect the engine oil pressure switch connector.
 - c. Disconnect the engine coolant temperature sensor connector.
 - d. Disconnect the camshaft position sensor connector.
 - e. Remove the bolt and disconnect the ground cable.
43. **REMOVE NO. 2 CAMSHAFT BEARING**
 - a. Remove the No. 2 camshaft bearing.

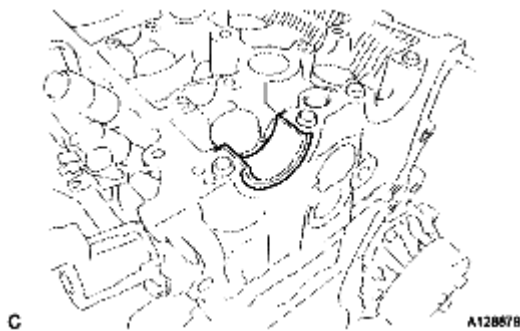


Fig. 117: Identifying Camshaft Bearing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

44. **REMOVE CYLINDER HEAD SUB-ASSEMBLY**
 - a. Using several steps, uniformly loosen and remove the 10 cylinder head bolts and 10 plate washers with a 10 mm bi-hexagon wrench in the sequence shown in the illustration.

NOTE: **Head warpage or cracking could result from removing the bolts in the wrong order.**

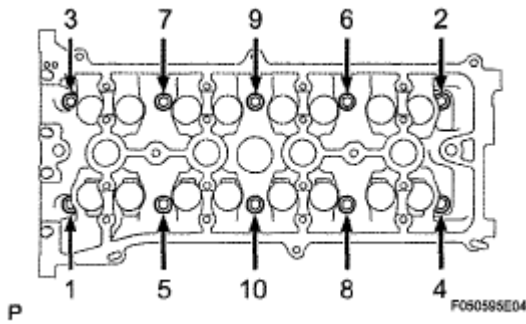


Fig. 118: Identifying Cylinder Head Bolts Loosening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a screwdriver with its tip wrapped with tape, pry between the cylinder head and cylinder block, and remove the cylinder head.

NOTE: Be careful not to damage the contact surfaces between the cylinder head and cylinder block.

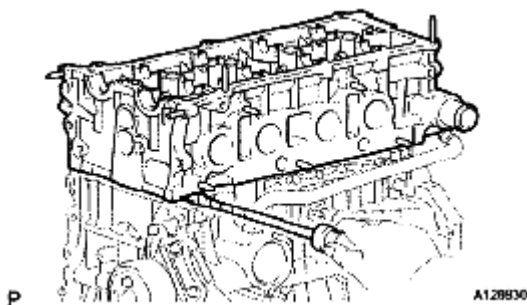


Fig. 119: Identifying Cylinder Head
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

45. REMOVE CYLINDER HEAD GASKET

- a. Remove the cylinder head gasket.

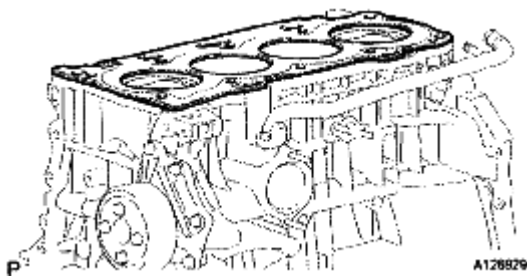


Fig. 120: Identifying Cylinder Head Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DISASSEMBLY

1. REMOVE VALVE LIFTER

- a. Remove the valve lifters.

HINT:

Arrange the valve lifters in the same order as removed.

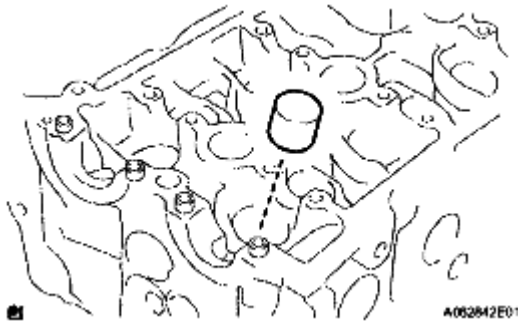


Fig. 121: Identifying Valve Lifters

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

2. REMOVE INTAKE VALVE

- a. Using SST and wooden blocks, compress and remove the valve retainer locks.

SST 09202-70020 (09202-00010)

- b. Remove the retainer, valve spring and valve.

HINT:

Arrange the removed parts in the same order as removed.

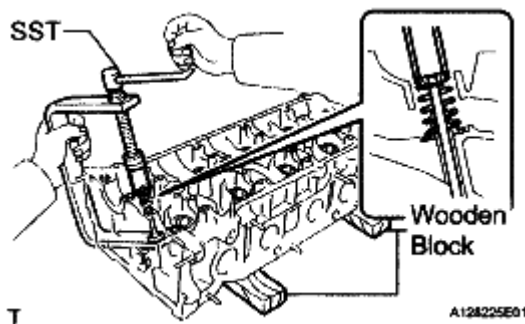


Fig. 122: Identifying Intake Valve

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

3. REMOVE EXHAUST VALVE

- a. Using SST and wooden blocks, compress and remove the valve retainer locks.

SST 09202-70020(09202-00010)

- b. Remove the retainer, valve spring and valve.

HINT:

Arrange the removed parts in the same order as removed.

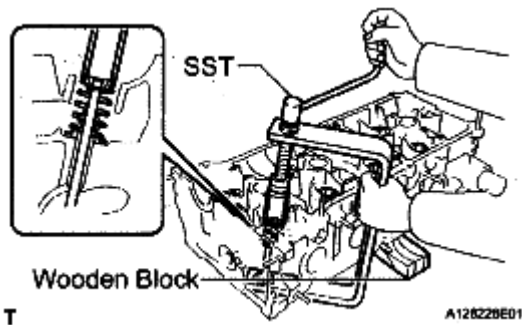


Fig. 123: Identifying Exhaust Valve

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

4. REMOVE VALVE STEM OIL SEAL

- a. Using needle-nose pliers, remove the oil seals.

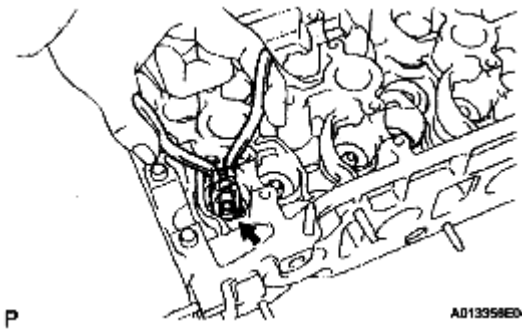


Fig. 124: Identifying Valve Stem Oil Seal

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

5. REMOVE VALVE SPRING SEAT

- a. Using compressed air and a magnetic pick-up tool, remove the valve spring seats by blowing air onto them.

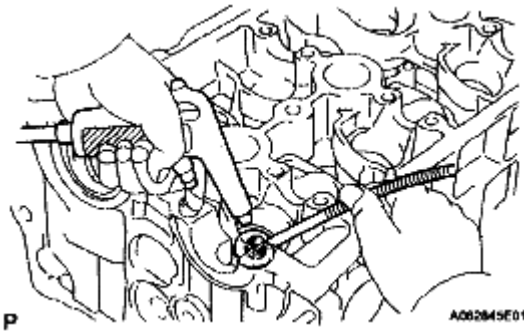


Fig. 125: Identifying Valve Spring Seat

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

6. REMOVE NO. 1 STRAIGHT SCREW PLUG

- a. Using a 14 mm straight hexagon wrench, remove the 2 screw plugs and 2 gaskets.

NOTE: If water leaks from any of the straight screw plugs or if any of them are corroded, replace it.

7. REMOVE STUD BOLT

8. REMOVE RING PIN

9. REMOVE INTAKE VALVE GUIDE BUSH

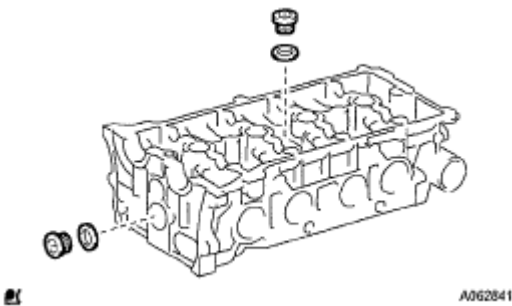


Fig. 126: Identifying Screw Plugs And Gaskets

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

- a. Heat the cylinder head to 80 to 100°C (176 to 212°F).
- b. Place the cylinder head on wooden blocks.
- c. Using SST and a hammer, tap out the guide bush.

SST 09201-10000 (09201-01050), 09950-70010 (09951-07100)

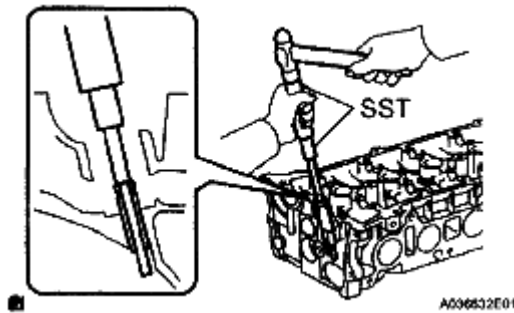


Fig. 127: View Of Taping Out Guide Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. REMOVE EXHAUST VALVE GUIDE BUSH

- Heat the cylinder head to 80 to 100°C (176 to 212°F).
- Place the cylinder head on wooden blocks.
- Using SST and a hammer, tap out the guide bush.

SST 09201-10000 (09201-01050), 09950-70010 (09951-07100)

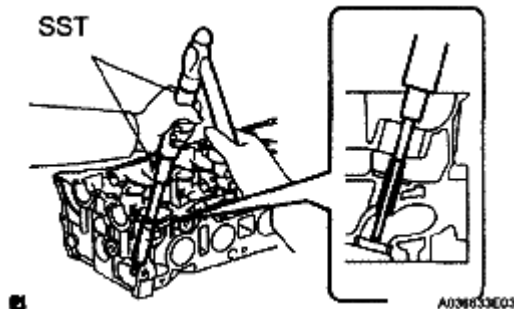


Fig. 128: View Of Taping Guide Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION

1. INSPECT CYLINDER HEAD FOR WARPAGE

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

Maximum warpage

ITEM SPECIFIED CONDITION CHART

Item	Specified Condition
Cylinder block side	0.05 mm (0.0020 in.)
Intake manifold side	0.08 mm (0.0031 in.)
Exhaust manifold side	0.08 mm (0.0031 in.)

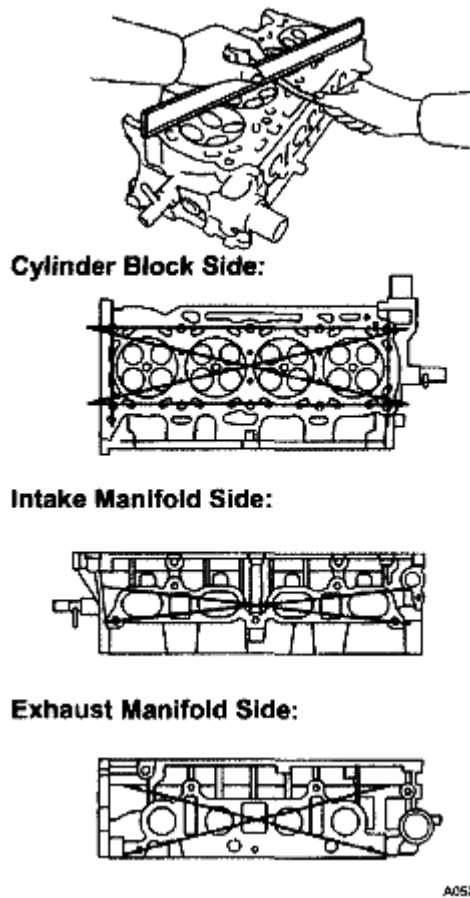


Fig. 129: Identifying Surface Contacting Cylinder Block
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

2. INSPECT CYLINDER HEAD FOR CRACKS

- Using a dye penetrant, check the intake ports, exhaust ports and cylinder surface for cracks. If cracked, replace the cylinder head.

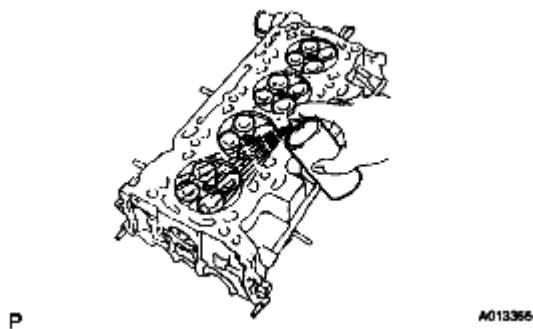


Fig. 130: Checking Intake Ports, Exhaust Ports And Cylinder Surface Cracks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. INSPECT VALVE SEATS

- a. Apply a light coat of Prussian blue to the valve face.
- b. Lightly press the valve face against the valve seat.
- c. Check the valve face and valve seat according to the following procedure:
 1. If Prussian blue appears 360° around the valve face, the valve face is concentric. If not, replace the valve.
 2. If Prussian blue appears 360° around the valve seat, the guide and valve face are concentric. If not, resurface the valve seat.
 3. Check that the valve seat contacts in the middle of the valve face with the valve seat width between 1.0 and 1.4 mm (Intake side (0.039 to 0.055 in.)).

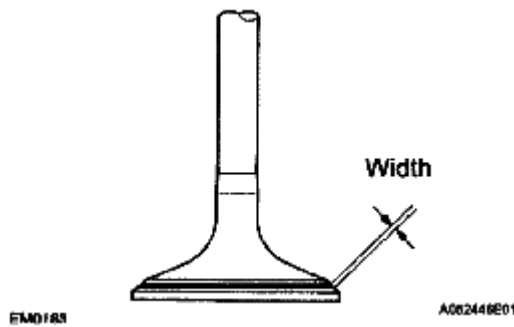


Fig. 131: Checking Valve Seats

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

4. Check that the valve seat contact is in the middle of the valve face with the valve seat width between 1.2 and 1.6 mm (Exhaust side (0.047 to 0.063 in.)).

4. REPAIR VALVE SEATS

NOTE:

- Repair the seat while checking the seating position.
- Keep the lip free from foreign matter.

- a. Using a 45° cutter, resurface the valve seat so that the valve seat width is more than the specification.

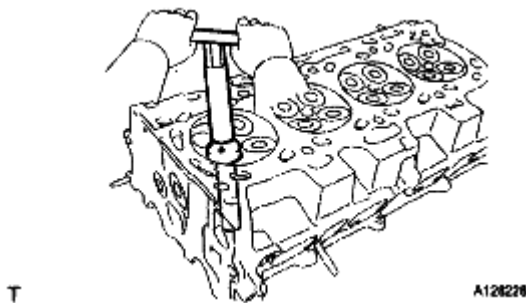


Fig. 132: View Of Resurfacing Valve Seats

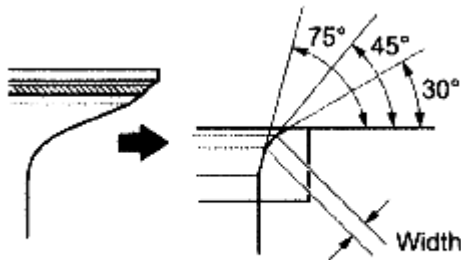
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using 30° and 75° cutters, correct the valve seat so that the valve contacts the entire circumference of the seat. The contact should be in the center of the valve seat, and the valve seat width should be maintained within the specified range around the entire circumference of the seat.

Valve seat width

ITEM SPECIFIED CONDITION CHART

Item	Specified Condition
Intake Side	1.0 to 1.4 mm (0.039 to 0.055 in.)
Exhaust Side	1.2 to 1.6 mm (0.047 to 0.063 in.)



T

A128227E01

Fig. 133: Identifying Valves Seats Angle

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

- c. Handrub the valve and valve seat with an abrasive compound.
- d. Check the valve seating position.

5. INSPECT CAMSHAFT THRUST CLEARANCE

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

Standard thrust clearance

ITEM SPECIFIED CONDITION CHART

Item	Specified Condition
Intake	0.040 to 0.095 mm (0.0016 to 0.0037 in.)
Exhaust	0.080 to 0.135 mm (0.0032 to 0.0053 in.)

Maximum thrust clearance

ITEM SPECIFIED CONDITION CHART

Item	Specified Condition
Intake	0.110 mm (0.0043 in.)
Exhaust	0.150 mm (0.0059 in.)

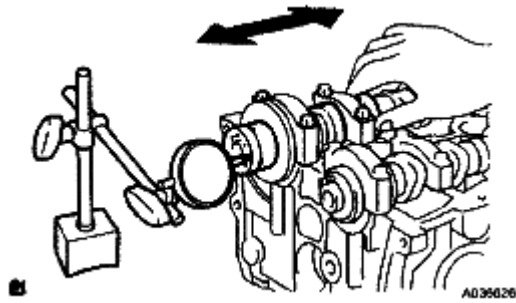


Fig. 134: Identifying Camshaft Thrust Clearance
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the thrust clearance is greater than the maximum, replace the cylinder head. If the thrust surface is damaged, replace the camshaft.

6. INSPECT CAMSHAFT OIL CLEARANCE

- a. Clean the bearing caps and camshaft journals.
- b. Place the camshafts on the cylinder head.
- c. Lay a strip of Plastigage across each of the camshaft journals.

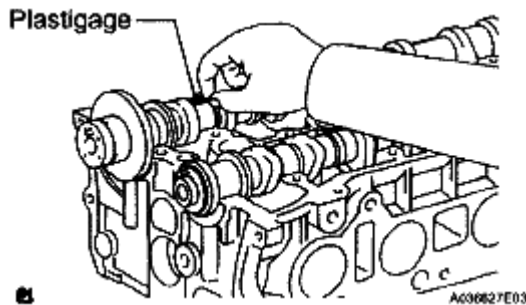


Fig. 135: View Of Laying Strip Of Plastigage On Camshaft Journals
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Install the bearing caps (See **INSTALLATION**).

NOTE: Do not turn the camshaft.

- e. Remove the bearing caps (See **REMOVAL**).
- f. Measure the Plastigage at its widest point.

Standard oil clearance

BEARING CENTER WALL THICKNESS SPECIFICATION

Item	Specified Condition
Camshaft No. 1 journal bearing mark 1	0.007 to 0.038 mm (0.0003 to 0.0015 in.)
Camshaft No. 1 journal bearing mark 2	0.008 to 0.038 mm (0.0003 to 0.0015 in.)

Camshaft No. 1 journal bearing mark 3	0.008 to 0.038 mm (0.0003 to 0.0015 in.)
Other camshaft journals	0.025 to 0.062 mm (0.0010 to 0.0024 in.)
No. 2 camshaft No. 1 journal	0.015 to 0.054 mm (0.0006 to 0.0021 in.)
No. 2 camshaft other journals	0.025 to 0.062 mm (0.0010 to 0.0024 in.)

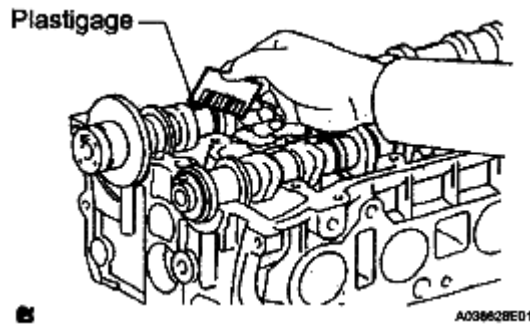


Fig. 136: View Of Measuring Plastigage On Widest Point
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Maximum oil clearance

ITEM SPECIFIED CONDITION CHART

Item	Specified Condition
Intake	0.070 mm (0.0028 in.)
Exhaust	0.100 mm (0.0039 in.)

NOTE: Completely remove the Plastigage after the inspection.

- If the oil clearance is greater than the maximum, replace the camshaft. If necessary, replace the cylinder head.
 - If the oil clearance on the camshaft No. 1 journal is greater than the maximum, choose a new bearing and install it.
1. Check the number mark shown in the illustration.

Cylinder head journal bore diameter

ITEM SPECIFIED CONDITION CHART

Mark 1	Mark 2	Mark 3
40.000 to 40.008 mm (1.5748 to 1.5752 in.)	40.009 to 40.017 mm (1.5752 to 1.5755 in.)	40.018 to 40.025 mm (1.5755 to 1.5758 in.)

Standard bearing center wall thickness

STANDARD BEARING CENTER WALL THICKNESS SPECIFICATION

Mark 1	Mark 2	Mark 3

2.000 to 2.004 mm (0.0787 to 0.0789 in.)	2.005 to 2.008 mm (0.0789 to 0.0791 in.)	2.009 to 2.012 mm (0.0791 to 0.0792 in.)
--	--	--

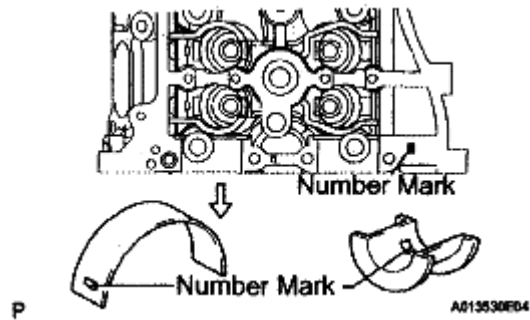


Fig. 137: Identifying Bearing Cap Number Mark
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Camshaft journal diameter

CAMSHAFT JOURNAL DIAMETER SPECIFICATION

Mark 1	Mark 2	Mark 3
35.971 to 35.985 mm (1.4162 to 1.4167 in.)	35.971 to 35.985 mm (1.4162 to 1.4167 in.)	35.971 to 35.985 mm (1.4162 to 1.4167 in.)

7. INSPECT INNER COMPRESSION SPRING

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

Free length: 47.43 mm (1.867 in.)

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

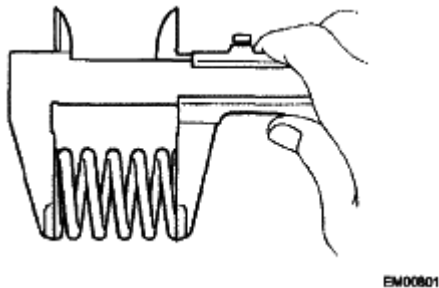


Fig. 138: Measuring Free Length Of Valve Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Using steel squares, measure the deviation of the valve spring.

Maximum deviation: 1.6 mm (0.063 in.)

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

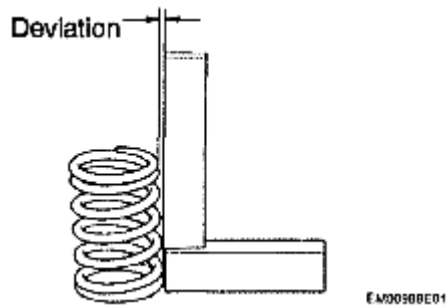


Fig. 139: Identifying Valve Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. INSPECT INTAKE VALVE

- a. Using a gasket scraper, scrape off any carbon on the valve head.

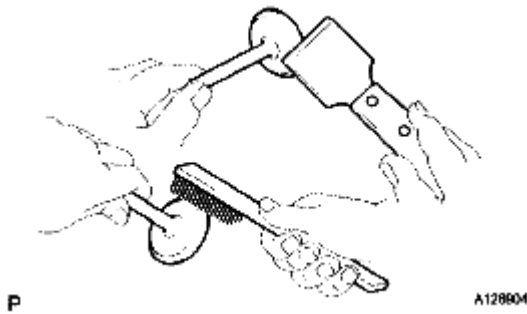


Fig. 140: View Of Cleaning Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using vernier calipers, measure the overall length of the valve.

Standard overall length: 101.71 mm (4.0043 in.)

Minimum overall length: 101.21 mm (3.9846 in.)

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

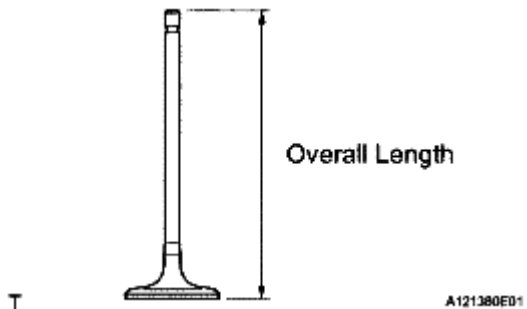


Fig. 141: Identifying Valve's Overall Length

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

- c. Using a micrometer, measure the diameter of the valve stem.

Valve stem diameter: 5.470 to 5.485 mm (0.2154 to 0.2159 in.)

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

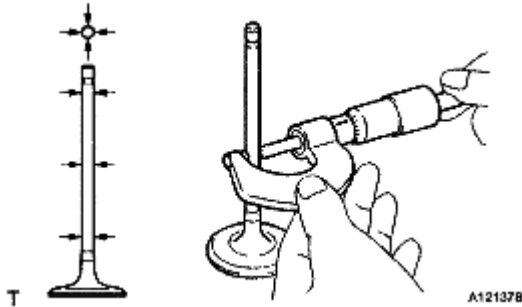


Fig. 142: Checking Diameter Of Valve Stem

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

- d. Using vernier calipers, measure the valve head margin thickness.

Standard margin thickness: 1.05 to 1.45 mm (0.0413 to 0.0571 in.)

Minimum margin thickness: 0.50 mm (0.0197 in.)

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

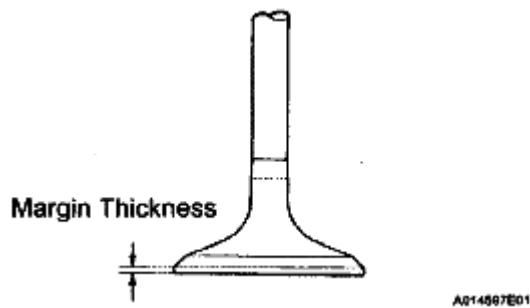


Fig. 143: Identifying Valve Head Margin Thickness

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

9. INSPECT EXHAUST VALVE

- a. Using a gasket scraper, scrape off any carbon on the valve head.

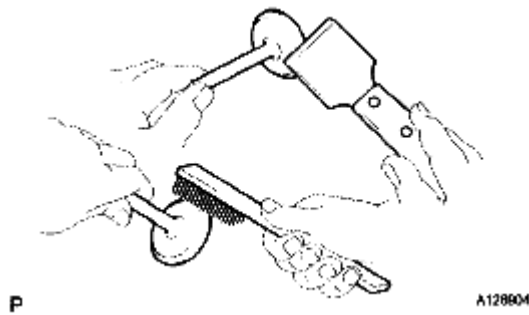


Fig. 144: View Of Cleaning Valve

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

- b. Using a wire brush, thoroughly clean the valve.
- c. Using vernier calipers, measure the overall length of the valve.

Standard overall length: 101.15 mm (3.9823 in.)

Minimum overall length: 100.70 mm (3.9646 in.)

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

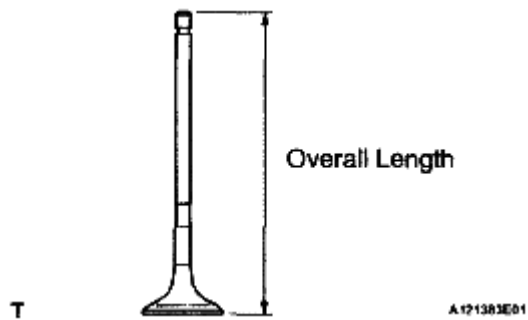


Fig. 145: Identifying Valve Overall Length

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

- d. Using a micrometer, measure the diameter of the valve stem.

Valve stem diameter: 5.465 to 5.480 mm (0.2152 to 0.2157 in.)

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

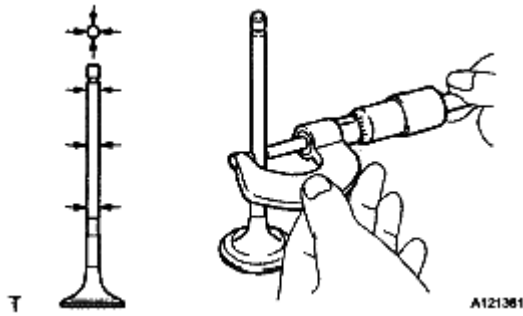


Fig. 146: View Of Measuring Diameter Of Valve Stem
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Using vernier calipers, measure the valve head margin thickness.

Standard margin thickness: 1.20 to 1.60 mm (0.0472 to 0.0630 in.)

Minimum margin thickness: 0.50 mm (0.0197 in.)

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

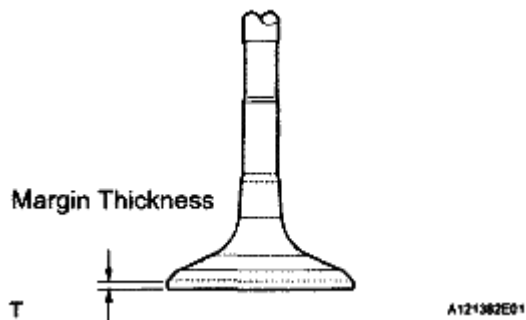


Fig. 147: Identifying Valve Head Margin Thickness
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. INSPECT INTAKE VALVE GUIDE BUSH

- a. Using a caliper gauge, measure the inside diameter of the guide bush.

Bushing inside diameter: 5.510 to 5.530 mm (0.2169 to 0.2177 in.)

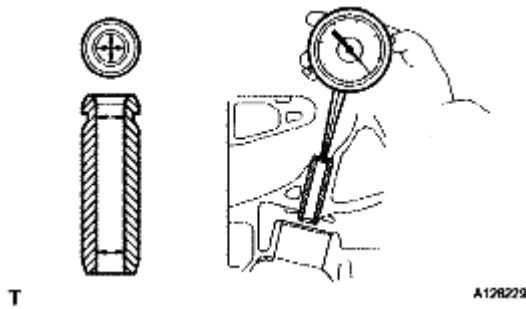


Fig. 148: Identifying Inside Diameter Of Guide Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Subtract the valve stem diameter measurement from the guide bush inside diameter measurement.

Standard oil clearance: 0.025 to 0.060 mm (0.0010 to 0.0024 in.)

Maximum oil clearance: 0.080 mm (0.0031 in.)

If the clearance is greater than the maximum, replace the valve and guide bush.

11. INSPECT EXHAUST VALVE GUIDE BUSH

- a. Using a caliper gauge, measure the inside diameter of the guide bush.

Bushing inside diameter: 5.510 to 5.530 mm (0.2169 to 0.2177 in.)

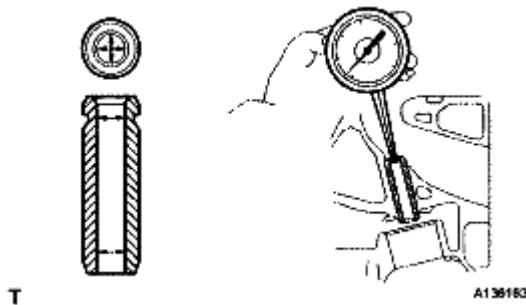


Fig. 149: Identifying Inside Diameter Of Guide Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Subtract the valve stem diameter measurement from the guide bushing inside diameter measurement.

Standard oil clearance: 0.030 to 0.065 mm (0.0012 to 0.0026 in.)

Maximum oil clearance: 0.100 mm (0.0039 in.)

If the clearance is greater than the maximum, replace the valve and guide bush.

12. INSPECT VALVE LIFTER

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

Lifter diameter: 30.966 to 30.976 mm (1.2191 to 1.2195 in.)

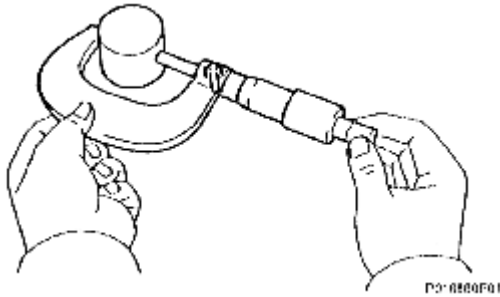


Fig. 150: Inspecting Valve Lifter

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

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

Standard lifter bore diameter: 31.009 to 31.025 mm (1.2208 to 1.2215 in.)

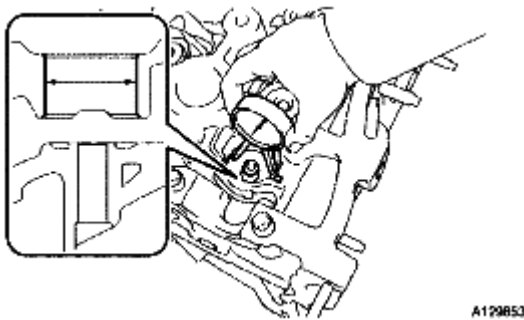


Fig. 151: Identifying Lifter Bore Diameter Of Cylinder Head

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

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

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

Maximum oil clearance: 0.070 mm (0.0028 in.)

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

13. INSPECT CYLINDER HEAD SET BOLT

- a. Using vernier calipers, measure the length of the cylinder head set bolt from the seat to the end.

Standard bolt length: 141.3 to 142.7 mm (5.563 to 5.618 in.)

Maximum bolt length: 144.2 mm (5.677 in.)

If the bolt length is greater than the maximum, replace the cylinder head set bolt.

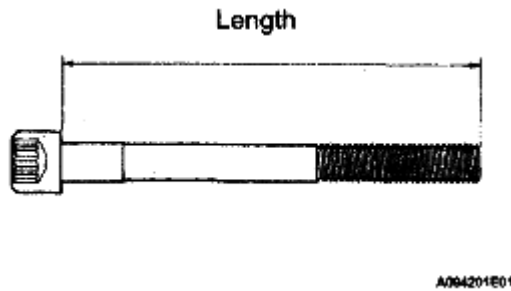


Fig. 152: Identifying Length Of Head Bolts From Seat To End
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REASSEMBLY

1. INSTALL INTAKE VALVE GUIDE BUSH

- Using a caliper gauge, measure the bush bore diameter of the cylinder head.

Cylinder bore diameter: 10.285 to 10.306 mm (0.4049 to 0.4057 in.)

Select a new guide bush (STD or O/S 0.05).

INTAKE VALVE GUIDE BUSH SPECIFICATION

Bush size	Bush bore diameter
STD	10.285 to 10.306 mm (0.4049 to 0.4057 in.)
O/S 0.05	10.335 to 10.356 mm (0.4069 to 0.4077 in.)

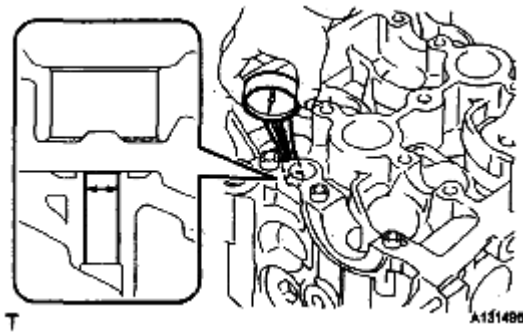


Fig. 153: Identifying Bush Bore Diameter Of Cylinder Head
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the bush bore diameter of the cylinder head is greater than 10.306 mm (0.4057 in.), machine the

bush bore to the dimension of 10.335 to 10.356 mm (0.4069 to 0.4077 in.) to install an O/S 0.05 valve guide bush. If the bush bore diameter of the cylinder head is greater than 10.356 mm (0.4077 in.), replace the cylinder head.

- b. Heat the cylinder head to 80 to 100°C (176 to 212°F).
- c. Place the cylinder head on wooden blocks.
- d. Using SST and a hammer, tap in a new guide bush to the specified protrusion height.

SST 09201-10000 (09201-01050), 09950-70010 (09951-07100)

Protrusion height: 9.6 to 10.0 mm (0.3779 to 0.3937 in.)

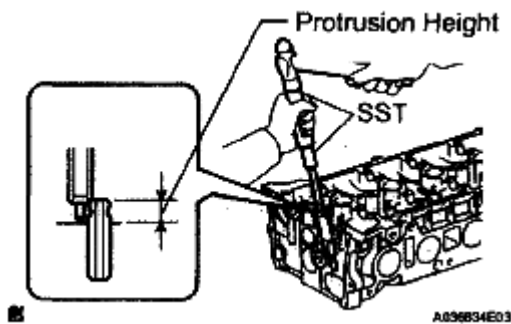


Fig. 154: View Of Tapping Guide Bush To Protrusion Height
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Using a sharp 5.5 mm reamer, ream the guide bush to obtain the standard specified clearance between the guide bush and valve stem.

Standard oil clearance: 0.025 to 0.060 mm (0.0010 to 0.0024 in.)

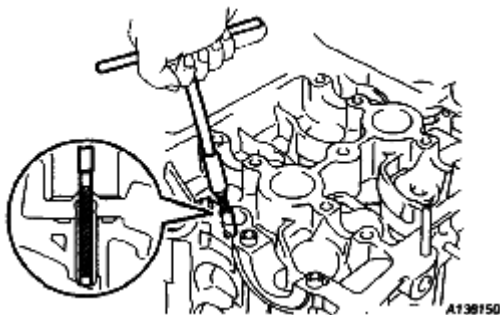


Fig. 155: View Of Reaming Guide Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. INSTALL EXHAUST VALVE GUIDE BUSH

- a. Using a caliper gauge, measure the bush bore diameter of the cylinder head.

Diameter: 10.285 to 10.306 mm (0.4049 to 0.4057 in.)

Select a new guide bush (STD or O/S 0.05).

EXHAUST VALVE GUIDE BUSH SPECIFICATION

Bush size	Bush bore diameter
STD	10.285 to 10.306 mm (0.4049 to 0.4057 in.)
O/S 0.05	10.335 to 10.356 mm (0.4069 to 0.4077 in.)

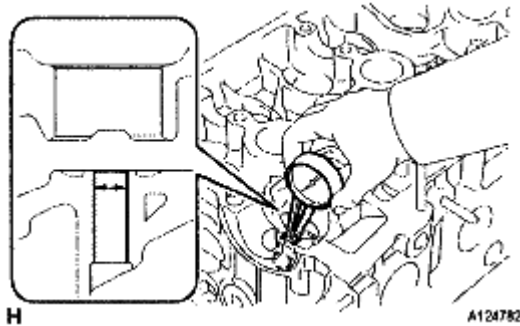


Fig. 156: Identifying Bush Bore Diameter Of Cylinder Head
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the bush bore diameter of the cylinder head is greater than 10.306 mm (0.4057 in.), machine the bush bore to the dimension of 10.335 to 10.356 mm (0.4069 to 0.4077 in.) to install an O/S 0.05 valve guide bush. If the bush bore diameter of the cylinder head is greater than 10.356 mm (0.4077 in.), replace the cylinder head.

- Heat the cylinder head to 80 to 100°C (176 to 212°F).
- Place the cylinder head on wooden blocks.
- Using SST and a hammer, tap in a new guide bush to the specified protrusion height.

SST 09201-10000 (09201-01050), 09950-70010 (09951-07100)

Protrusion height: 9.6 to 10.0 mm (0.3779 to 0.3937 in.)

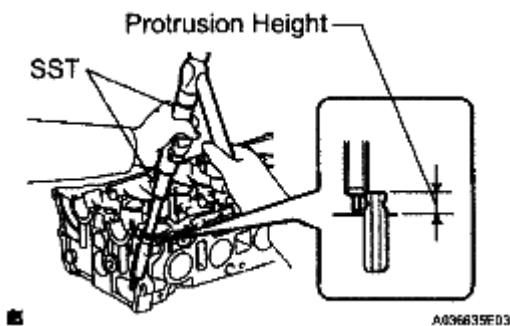


Fig. 157: Identifying Guide Bush To Specified Protrusion Height
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Using a sharp 5.5 mm reamer, ream the guide bush to obtain the standard specified clearance between the guide bush and valve stem.

Standard oil clearance: 0.030 to 0.065 mm (0.0012 to 0.0026 in.)

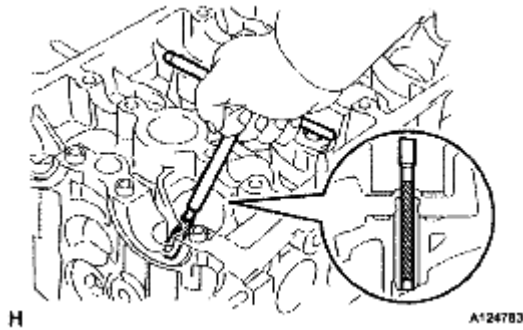


Fig. 158: View Of Reaming Valve Guide Bush

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

3. INSTALL RING PIN

- a. Using a plastic-faced hammer, tap in 4 new ring pins to the specified protrusion height.

Protrusion height: 3 mm (0.12 in.)

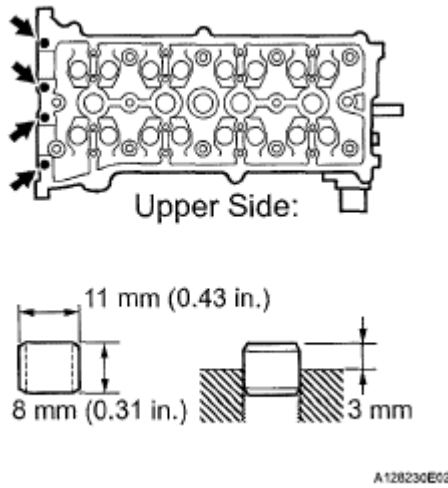


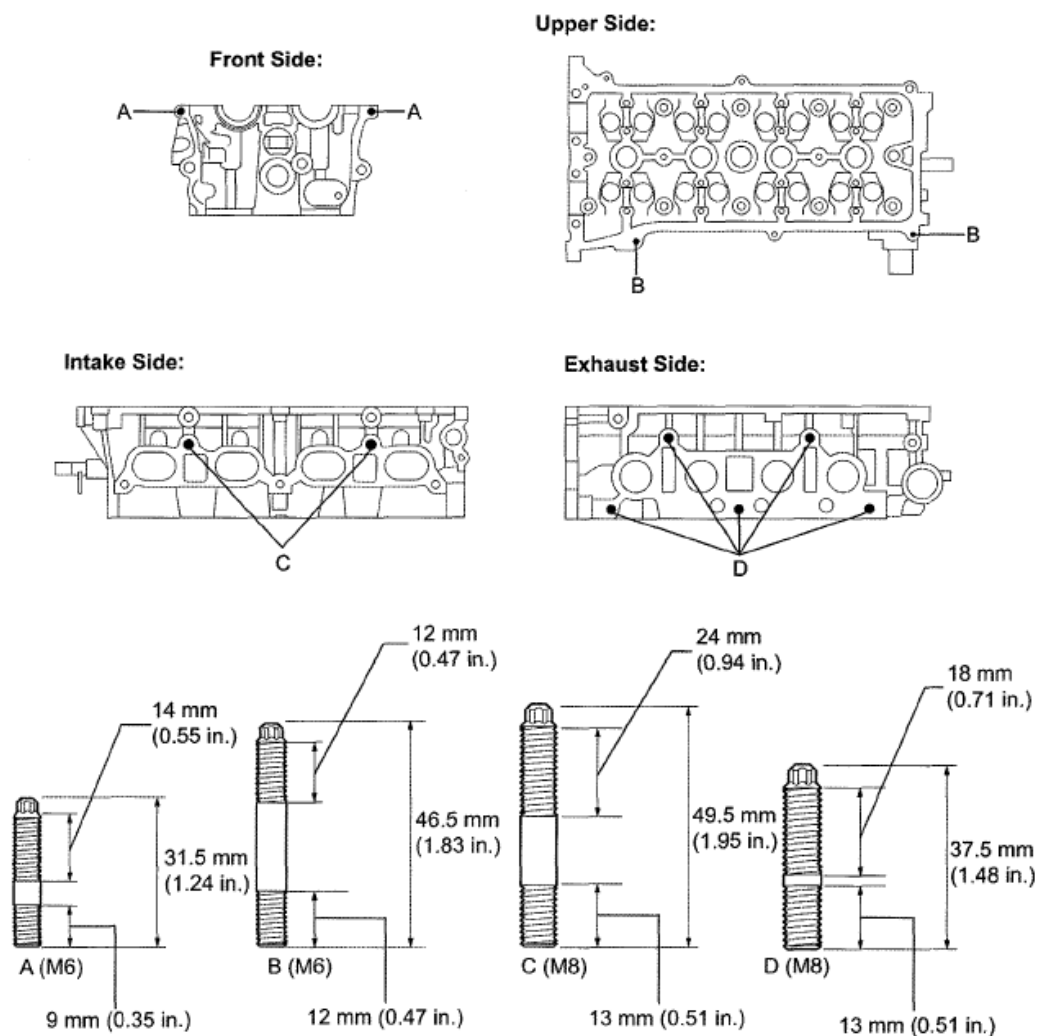
Fig. 159: Locating Ring Pins

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

4. INSTALL STUD BOLT

NOTE: If any stud bolt is deformed or the threads are damaged, replace it.

- a. Using E5 and E7 "TORX" sockets, install the stud bolts.



T

A128231E03

Fig. 160: Identifying Stud Bolts Dimensions
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Torque: Bolt A

5.0 N*m (51 kgf*cm, 44 in.*lbf)

Bolt B

5.0 N*m (51 kgf*cm, 44 in.*lbf)

Bolt C

9.5 N*m (97 kgf*cm, 84 in.*lbf)

Bolt D

9.5 N*m (97 kgf*cm, 84 in.*lbf)

5. INSTALL NO. 1 STRAIGHT SCREW PLUG

- a. Using a 14 mm straight hexagon wrench, install 2 new gaskets and the 2 straight screw plugs.

Torque: 86 N*m (879 kgf*cm, 64 ft.*lbf)

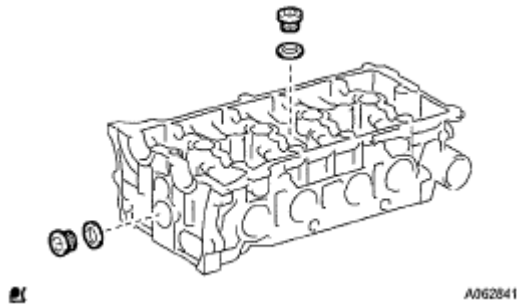


Fig. 161: Identifying Screw Plugs And Gaskets
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. INSTALL VALVE SPRING SEAT

- a. Install the valve spring seats to the cylinder head.



Fig. 162: Identifying Valve Spring Seat
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. INSTALL VALVE STEM OIL SEAL

- a. Apply a light coat of engine oil to new oil seals.

NOTE: Pay close attention when installing the intake and exhaust oil seals. For example, installing the intake oil seal into the exhaust side or installing the exhaust oil seal to the intake side can cause installation problems later.

HINT:

The intake valve oil seal is gray and the exhaust valve oil seal is black.

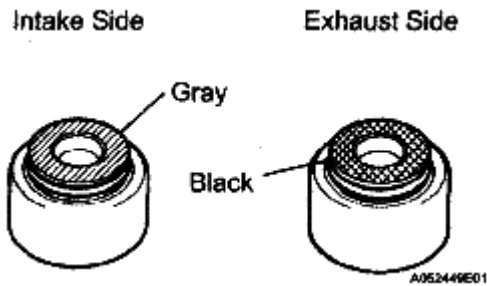


Fig. 163: Identifying Intake And Exhaust Valve Stem Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using SST, push in the oil seal.

SST 09201-41020

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

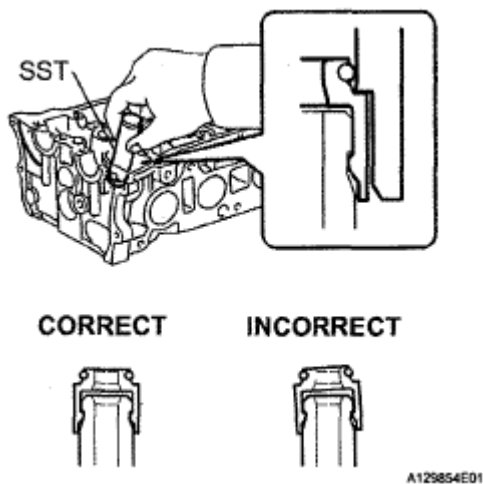


Fig. 164: View Of Pushing Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. INSTALL INTAKE VALVE

- a. Sufficiently apply engine oil to the tip area of the intake valve shown in the illustration.

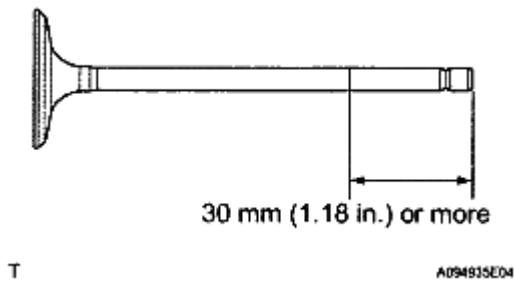


Fig. 165: Identifying Intake Valve Dimension

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

- b. Install the valve, compression spring and spring retainer to the cylinder head.

NOTE: Install the same parts in the same combination to the original locations.

- c. Using SST and wooden blocks, compress the spring and install the 2 retainer locks.

SST 09202-70020 (09202-00010)

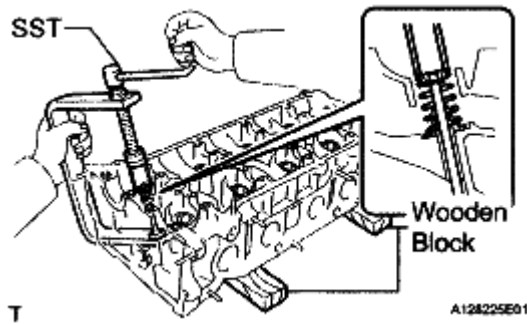


Fig. 166: View Of Compressing Spring With Retainer Locks

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

- d. Using a 5 mm pin punch and plastic hammer, lightly tap the valve stem tip to ensure a proper fit.

NOTE: Be careful not to damage the valve stem tip.

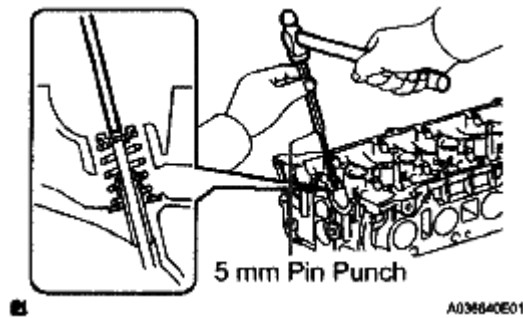


Fig. 167: View Of Tapping Valve Stem Tip

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

9. INSTALL EXHAUST VALVE

- Sufficiently apply engine oil to the tip area of the exhaust valve shown in the illustration.

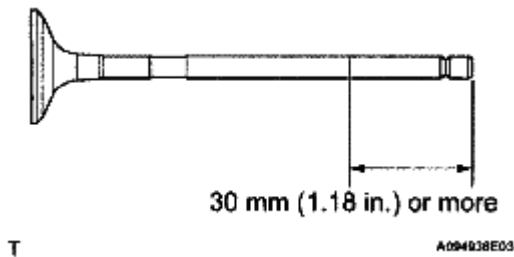


Fig. 168: Identifying Exhaust Valve Dimension

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

- Install the valve, compression spring and spring retainer to the cylinder head.

NOTE: Install the same parts in the same combination to the original locations.

- Using SST and wooden blocks, compress the spring and install the 2 retainer locks.

SST 09202-70020 (09202-00010)

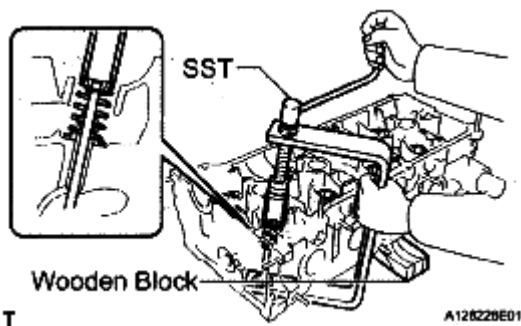


Fig. 169: View Of Compressing Spring

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

- d. Using a 5 mm pin punch and plastic hammer, lightly tap the valve stem tip to ensure a proper fit.

NOTE: Be careful not to damage the valve stem tip.

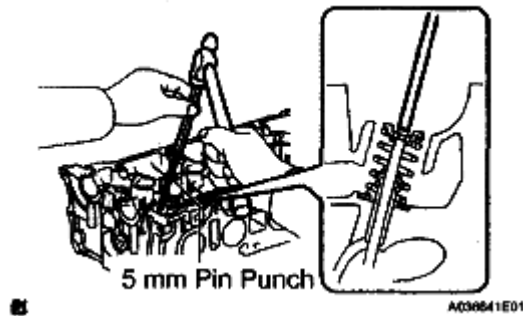


Fig. 170: View Of Tapping Valve Stem Tip

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

10. INSTALL VALVE LIFTER

- a. Apply a light coat of engine oil to the tip of each valve stem.
- b. Install the valve lifters.

NOTE: Install the valve lifters to their original places.

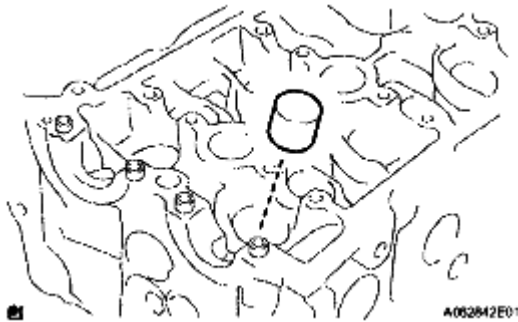


Fig. 171: Identifying Valve Lifters

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

INSTALLATION

1. INSTALL CYLINDER HEAD GASKET

- a. Place a new gasket on the cylinder block surface with the Lot No. stamp facing upward.

NOTE:

- Remove any oil from the contact surfaces.
- Make sure that the gasket is installed in the correct direction.

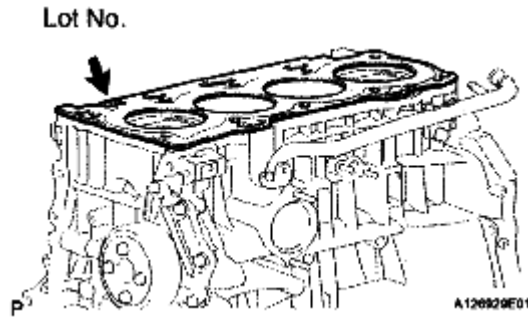


Fig. 172: Locating Cylinder Head Gasket

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

2. INSTALL CYLINDER HEAD SUB-ASSEMBLY

- a. Install the cylinder head on the cylinder block.

HINT:

The cylinder head bolts are tightened in 2 progressive steps.

- b. Apply a light coat of engine oil to the bolt threads and the area beneath the bolt heads that come in contact with the washers.
- c. Install the bolts and plate washers to the cylinder head.

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

- d. Using several steps, uniformly install and tighten the 10 cylinder head set bolts and plate washers with a 10 mm bi-hexagon wrench in the order shown in the illustration.

Torque: 70 N*m (714 kgf*cm, 52 ft.*lbf)

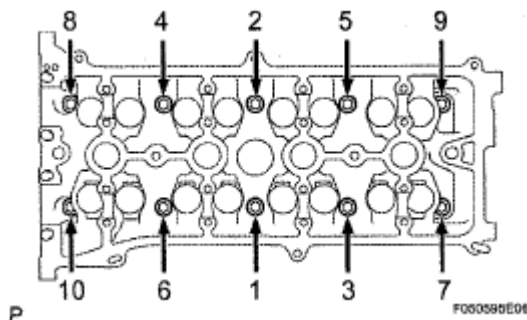


Fig. 173: Identifying Cylinder Head Set Bolts Tighten Sequence

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

- e. Mark the front side of the cylinder head bolts with paint.
- f. Retighten the cylinder head bolts 90° in the sequence shown in the illustration.

- g. Check that the paint mark is now at a 90° angle from the front.

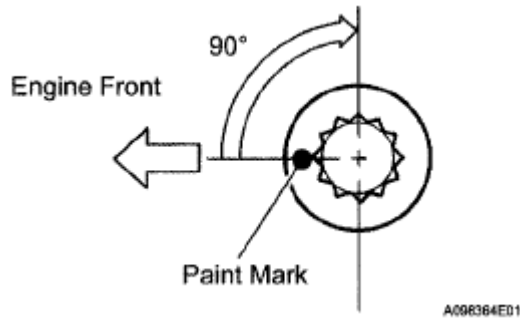


Fig. 174: Identifying Paint Mark On Cylinder Head Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. CONNECT ENGINE WIRE

- a. Connect the ground cable with the bolt.

Torque: 8.4 N*m (86 kgf*cm, 74 in.*lbf)

- b. Connect the camshaft position sensor connector.

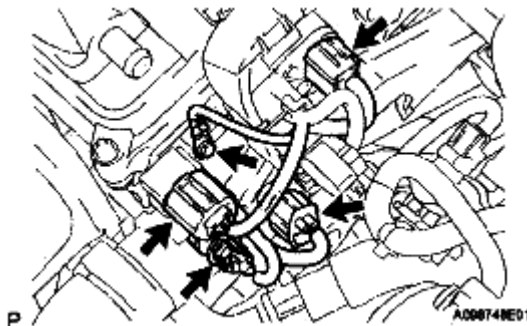


Fig. 175: Locating Camshaft Position Sensor Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Connect the engine coolant temperature sensor connector.
- d. Connect the engine oil pressure switch connector.
- e. Connect the radio setting condenser connector.

4. CONNECT RADIATOR HOSE INLET (See INSTALLATION)

5. INSTALL NO. 2 CAMSHAFT BEARING

- a. Install the No. 2 camshaft bearing.

6. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (See INSTALLATION)

7. INSTALL CAMSHAFTS

- a. Apply a light coat of engine oil to the journal portion of the camshaft.
- b. Place the 2 camshafts on the cylinder head with the No. 1 cam lobes facing the directions shown in

the illustration.

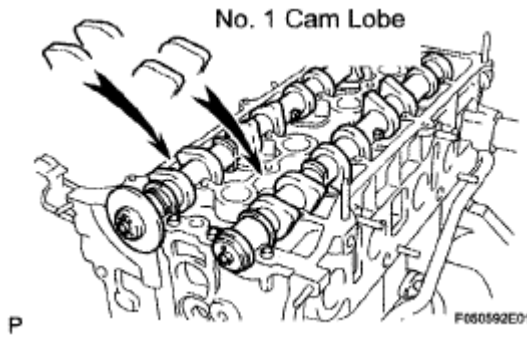


Fig. 176: Identifying Cam Lobes Facing Directions
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Examine the front marks and numbers, and check that the order is as shown in the illustration. Then install the bearing caps onto the cylinder head.
- d. Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.

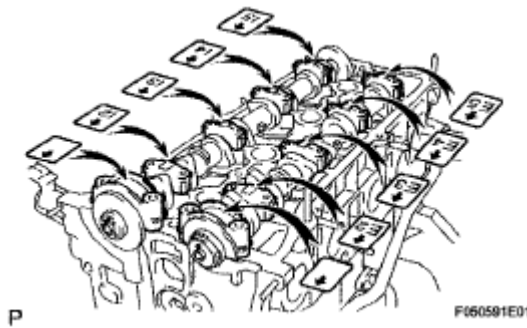


Fig. 177: Identifying Front Marks And Numbers Order
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Using several steps, uniformly tighten the 20 bearing cap bolts in the sequence shown in the illustration.

Torque: No. 1 and No. 2 bearing cap

30 N*m (301 kgf*cm, 22 ft.*lbf)

No. 3 bearing caps

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

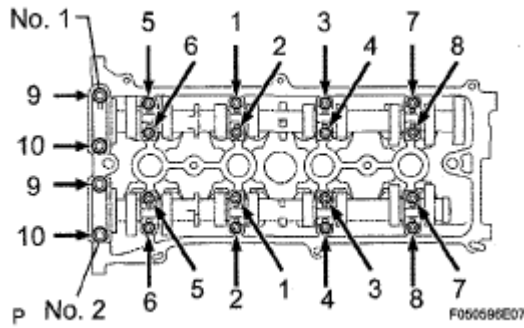


Fig. 178: Identifying Bearing Cap Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. INSTALL CHAIN SUB-ASSEMBLY

HINT:

See INSTALLATION.

9. INSTALL EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY (See INSTALLATION)
10. INSTALL NO. 2 MANIFOLD STAY (See INSTALLATION)
11. INSTALL MANIFOLD STAY (See INSTALLATION)
12. INSTALL OIL LEVEL GAUGE GUIDE (See INSTALLATION)
13. INSTALL OIL LEVEL GAUGE SUB-ASSEMBLY
14. INSTALL V-RIBBED BELT (See INSTALLATION)
15. INSTALL V-RIBBED BELT TENSIONER COVER SUB-ASSEMBLY (See INSTALLATION)
16. INSTALL NO. 2 ENGINE MOUNTING BRACKET RH (See INSTALLATION)
17. INSTALL ENGINE MOVING CONTROL ROD SUB-ASSEMBLY (See INSTALLATION)
18. INSTALL NO. 2 ENGINE MOUNTING STAY RH (See INSTALLATION)
19. INSTALL FRONT EXHAUST PIPE ASSEMBLY

HINT:

See INSTALLATION .

20. INSTALL NO. 1 INTAKE MANIFOLD INSULATOR (See INSTALLATION)
21. INSTALL INTAKE MANIFOLD (See INSTALLATION)
22. INSTALL FUEL DELIVERY PIPE WITH INJECTOR (See INSTALLATION)
23. CONNECT FUEL TUBE SUB-ASSEMBLY (See INSTALLATION)
24. INSTALL THROTTLE BODY ASSEMBLY (See INSTALLATION)
25. INSTALL AIR CLEANER CASE SUB-ASSEMBLY (See INSTALLATION)
26. INSTALL AIR CLEANER CAP SUB-ASSEMBLY (See INSTALLATION)
27. INSTALL AIR CLEANER INLET ASSEMBLY (See INSTALLATION)

28. **INSTALL COWL TOP PANEL OUTER SUB-ASSEMBLY** (See INSTALLATION)
29. **INSTALL BRAKE MASTER CYLINDER RESERVOIR SUB-ASSEMBLY**
30. **INSTALL WINDSHIELD WIPER MOTOR AND LINK ASSEMBLY** (See INSTALLATION)
31. **INSTALL COWL TOP VENTILATOR LOUVER SUB-ASSEMBLY** (See INSTALLATION)
32. **INSTALL FRONT FENDER TO COWL SIDE SEAL LH** (See INSTALLATION)
33. **INSTALL FRONT FENDER TO COWL SIDE SEAL RH** (See INSTALLATION)
34. **INSTALL FRONT WIPER ARM AND BLADE ASSEMBLY LH** (See INSTALLATION)
35. **INSTALL FRONT WIPER ARM AND BLADE ASSEMBLY RH** (See INSTALLATION)
36. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL** (See INSTALLATION)
37. **INSTALL LUGGAGE TRIM SERVICE HOLE COVER**
38. **ADD ENGINE OIL**
39. **INSPECT FOR FUEL LEAK** (See ON-VEHICLE INSPECTION)
40. **ADD COOLANT (for Engine)** (See COOLANT (FOR ENGINE))
41. **INSPECT FOR COOLANT LEAK (for Engine)** (See ON-VEHICLE INSPECTION)
42. **INSPECT FOR ENGINE OIL LEAK**
43. **INSPECT FOR EXHAUST GAS LEAK**
44. **INSPECT IGNITION TIMING** (See INSPECTION)
45. **INSPECT IDLE SPEED** (See INSPECTION)
46. **INSPECT COMPRESSION** (See INSPECTION)
47. **INSPECT CO/HC** (See INSPECTION)
48. **INSTALL NO. 1 ENGINE COVER SUB-ASSEMBLY** (See INSTALLATION)
49. **INSTALL FRONT FENDER APRON SEAL RH**
50. **INSTALL ENGINE UNDER COVER LH**
51. **INSTALL ENGINE UNDER COVER RH**
52. **INSTALL FRONT WHEEL RH** (See INSTALLATION)
53. **PERFORM INITIALIZATION**
 - a. Perform initialization procedure (See INITIALIZATION).

HINT:

Some vehicle systems require initialization after reconnecting the cable to the negative battery terminal.

ENGINE FRONT OIL SEAL

COMPONENTS

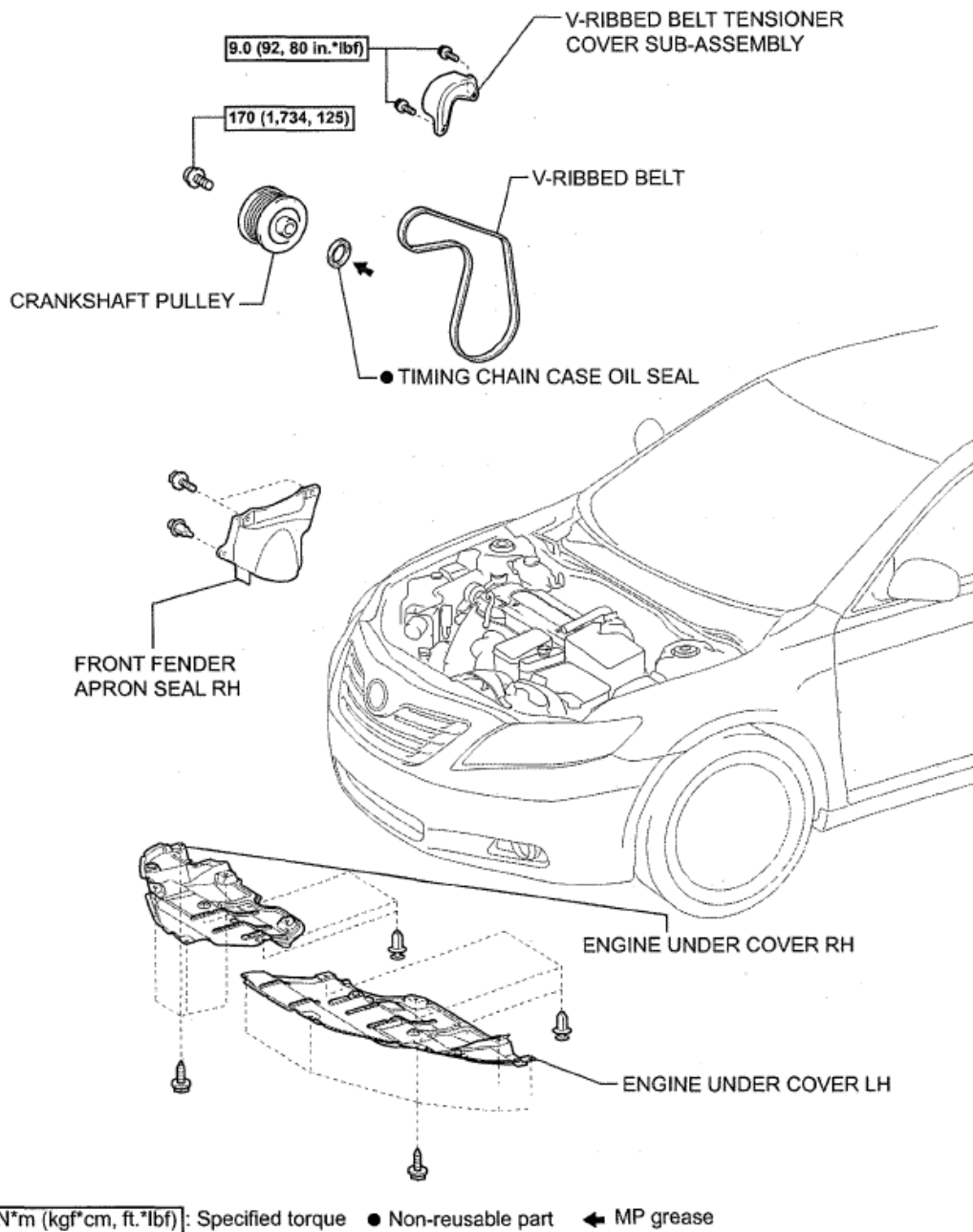


Fig. 179: Identifying Engine Front Oil Seal Replacement Components With Torque Specifications
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. REMOVE FRONT WHEEL RH
2. REMOVE FRONT FENDER APRON SEAL RH
3. REMOVE ENGINE UNDER COVER LH
4. REMOVE ENGINE UNDER COVER RH

5. **REMOVE V-RIBBED BELT TENSIONER COVER SUB-ASSEMBLY** (See **REMOVAL**)
6. **REMOVE V-RIBBED BELT** (See **REMOVAL**)
7. **REMOVE CRANKSHAFT PULLEY**
 - a. Using SST, fix the pulley in place and loosen the pulley bolt.

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

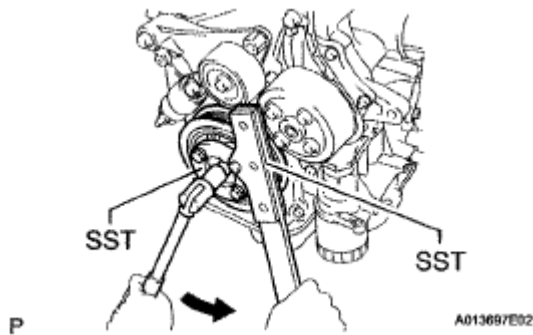


Fig. 180: View Of Loosening Pulley Bolt
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

SST 09950-50013 (09951-05010, 09952-05010, 09953-05020, 09954-05021), 09950-40011 (09957-04010)

HINT:

If necessary, remove the pulley and pulley bolt using SST.

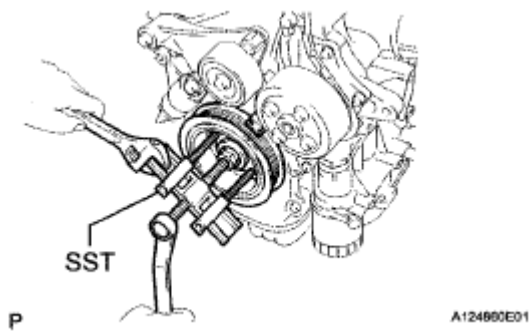


Fig. 181: Identifying Crankshaft Pulley And Pulley Bolt
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. **REMOVE TIMING CHAIN CASE OIL SEAL**
 - a. Using a knife, cut off the oil seal lip.
 - b. Using a screwdriver with the tip taped, pry out the oil seal.

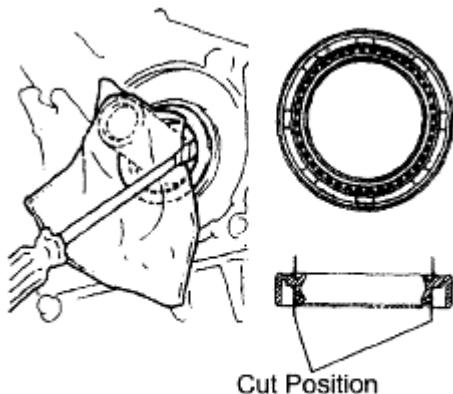
NOTE: After the removal, check the crankshaft for damage. If it is damaged, smooth the surface with 400-grit sandpaper.

INSTALLATION

1. INSTALL TIMING CHAIN CASE OIL SEAL

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

NOTE: Keep the lip free from foreign matter.



A112628E02

Fig. 182: View Of Prying Out Oil Seal

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

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

SST 09223-22010

NOTE: Wipe off extra grease from the crankshaft.

2. INSTALL CRANKSHAFT PULLEY

- a. Align the pulley set key with the key groove of the pulley.

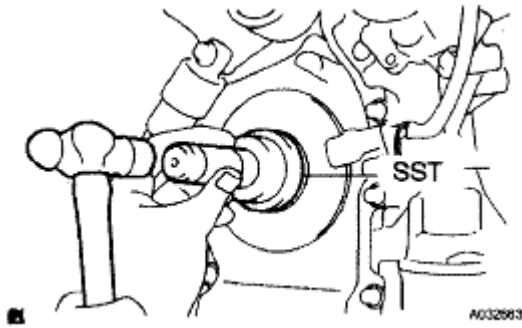


Fig. 183: Identifying Pulley Set Key

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

- b. Using SST, hold the pulley in place and tighten the bolt.

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

Torque: 170 N*m (1,734 kgf*cm, 125 ft.*lbf)

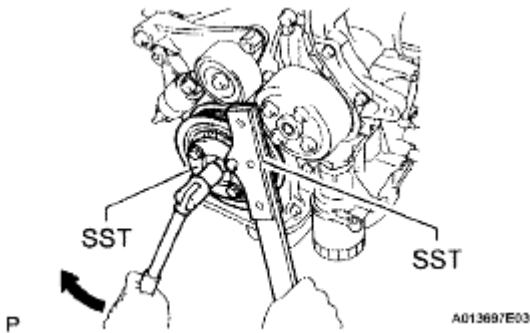


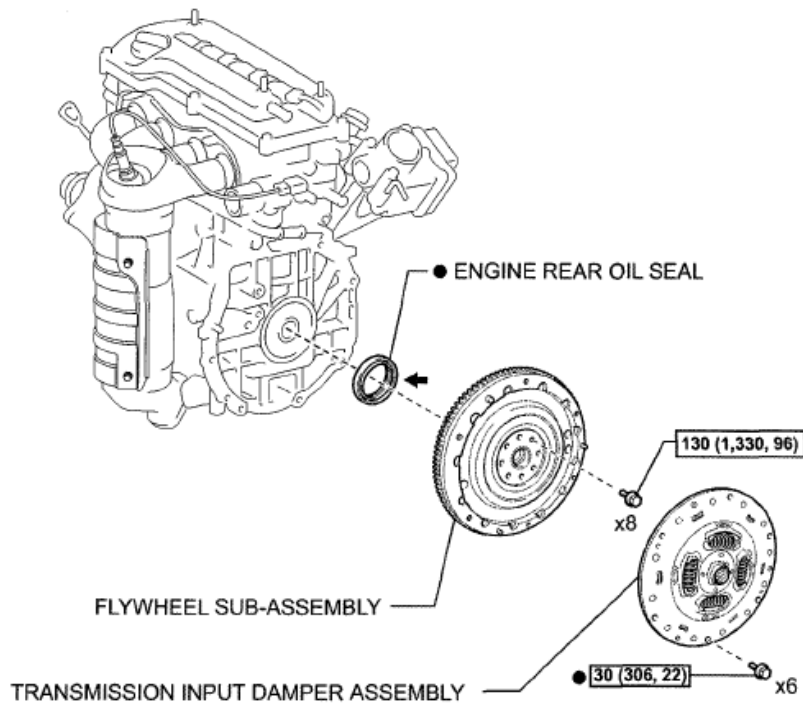
Fig. 184: Identifying Pulley Bolt With SST

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

3. **INSTALL V-RIBBED BELT** (See **INSTALLATION**)
4. **INSTALL V-RIBBED BELT TENSIONER COVER SUB-ASSEMBLY** (See **INSTALLATION**)
5. **INSTALL ENGINE UNDER COVER LH**
6. **INSTALL ENGINE UNDER COVER RH**
7. **INSTALL FRONT FENDER APRON SEAL RH**
8. **INSTALL FRONT WHEEL RH**
9. **CHECK FOR ENGINE OIL LEAKS**

ENGINE REAR OIL SEAL

COMPONENTS



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

● Non-reusable part

← MP grease

c

A138360E02

Fig. 185: Identifying Engine Rear Oil Seal Components With Torque Specifications
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. SEPARATE HYBRID VEHICLE TRANSAXLE ASSEMBLY

HINT:

See **REMOVAL** .

2. REMOVE TRANSMISSION INPUT DAMPER ASSEMBLY

- Using SST, hold the crankshaft.

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

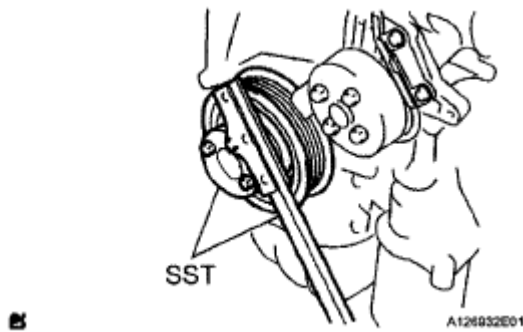


Fig. 186: Identifying Crankshaft

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

- b. Remove the 6 bolts and transmission input damper from the flywheel.

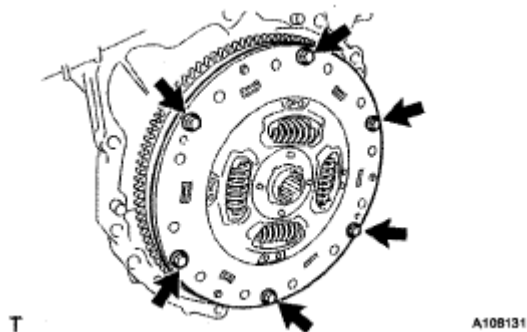


Fig. 187: Locating Transmission Input Damper And Bolts

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

3. REMOVE FLYWHEEL SUB-ASSEMBLY

- a. Using SST, hold the crankshaft.

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

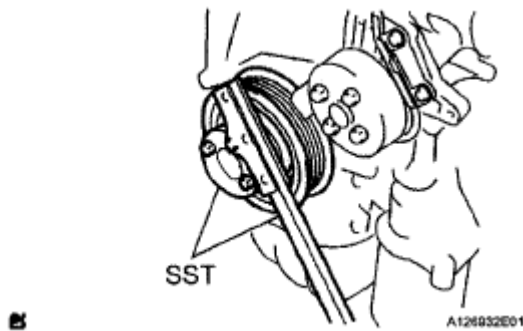


Fig. 188: Identifying Crankshaft

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

- b. Remove the 8 bolts and flywheel.

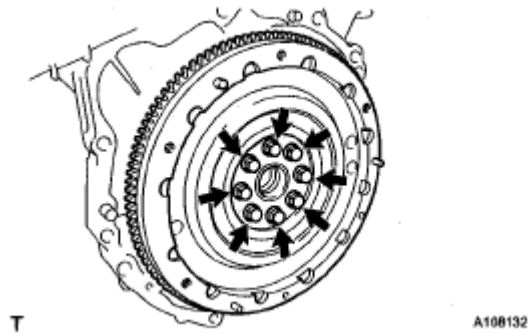


Fig. 189: Identifying 8 Bolts And Flywheel

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

4. REMOVE ENGINE REAR OIL SEAL

- a. Using a knife, cut through the oil seal lip.
- b. Using a screwdriver with its tip taped, pry out the oil seal.

NOTE: After the removal, check the crankshaft for damage. If it is damaged, smooth the surface with 400-grit sandpaper.

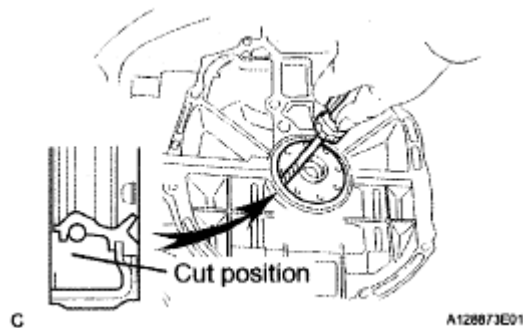


Fig. 190: Identifying Engine Rear Oil Seal

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.

NOTE: Keep the lip free from foreign matter.

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

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

NOTE: Wipe off extra grease from the crankshaft.

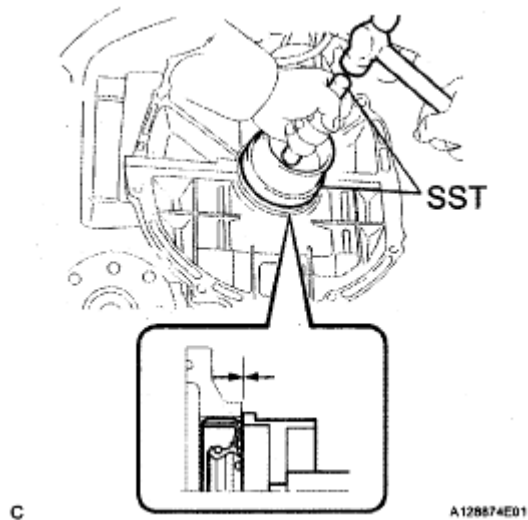


Fig. 191: Identifying Engine Rear Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. INSTALL FLYWHEEL SUB-ASSEMBLY

- a. Using SST, hold the crankshaft.

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

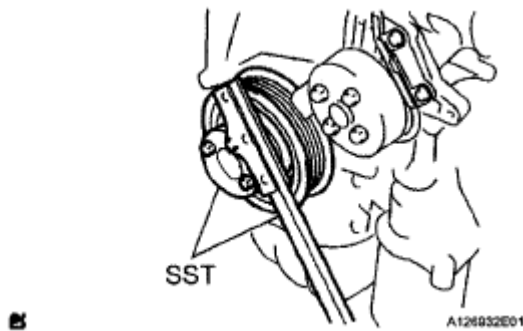


Fig. 192: Identifying Crankshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Clean the bolt and the bolt hole.
- c. Apply adhesive to 2 or 3 threads of the bolt end.

Adhesive: Part No. 08833-00070, Three Bond or equivalent

- d. Install the flywheel with the 8 bolts. Uniformly tighten the 8 bolts in the sequence shown in the illustration.

Torque: 130 N*m (1,330 kgf*cm, 96 ft.*lbf)

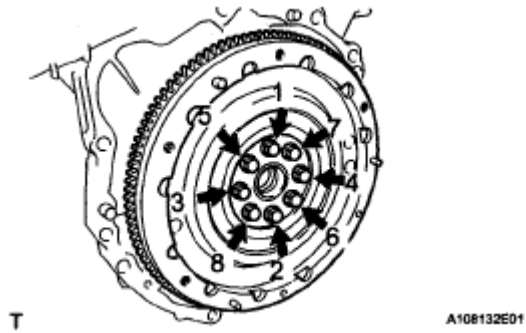


Fig. 193: Identifying 8 Bolts Uniformly In Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. INSTALL TRANSMISSION INPUT DAMPER ASSEMBLY

- a. Using SST, hold the crankshaft.

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

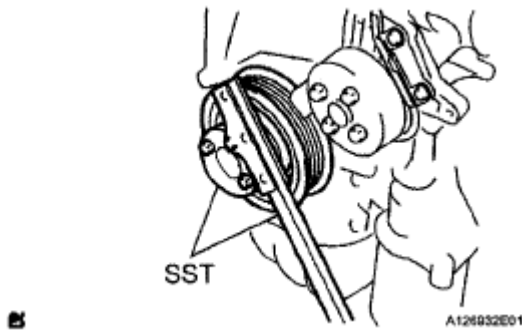


Fig. 194: Identifying Crankshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Clean the bolt hole.
c. Install new 6 bolts and transmission input damper.

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

HINT:

Take care not to insert the transmission input damper in the wrong direction.

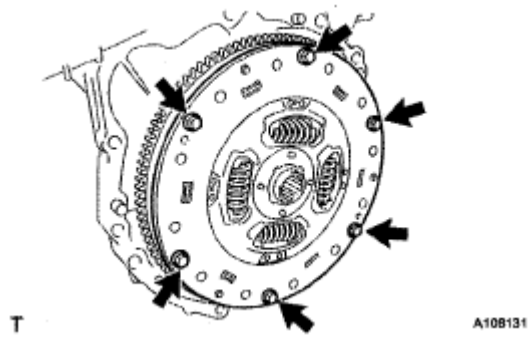


Fig. 195: Locating Transmission Input Damper And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

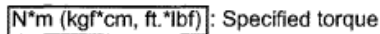
4. INSTALL HYBRID VEHICLE TRANSAXLE ASSEMBLY

HINT:

See INSTALLATION .

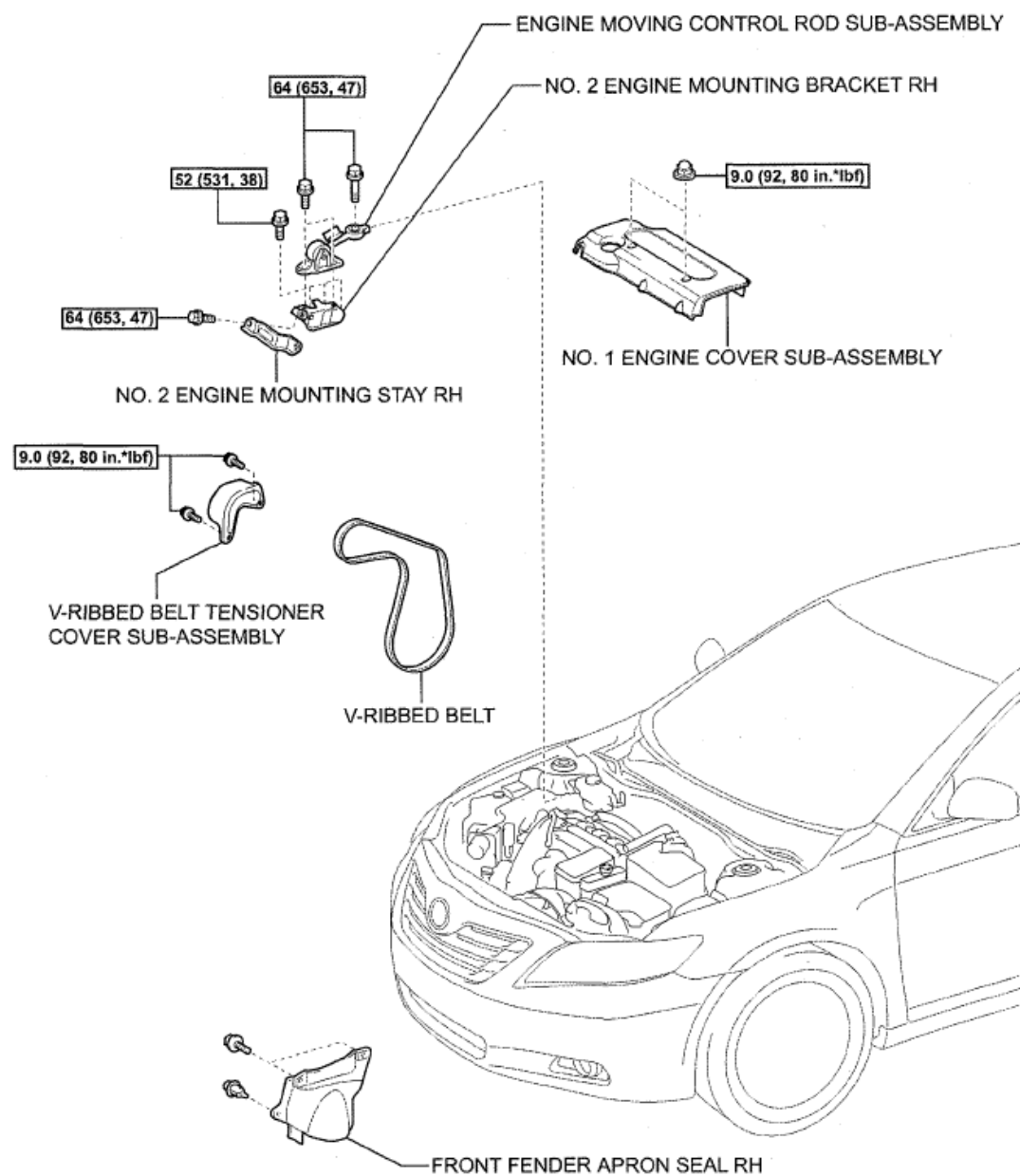
ENGINE ASSEMBLY

COMPONENTS



A129008E02

© 2011 Mitchell Repair Information Company, LLC.



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

A139237E01

Fig. 197: Identifying Engine Assembly Repalcement Components With Torque Specifications (2 Of 9)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

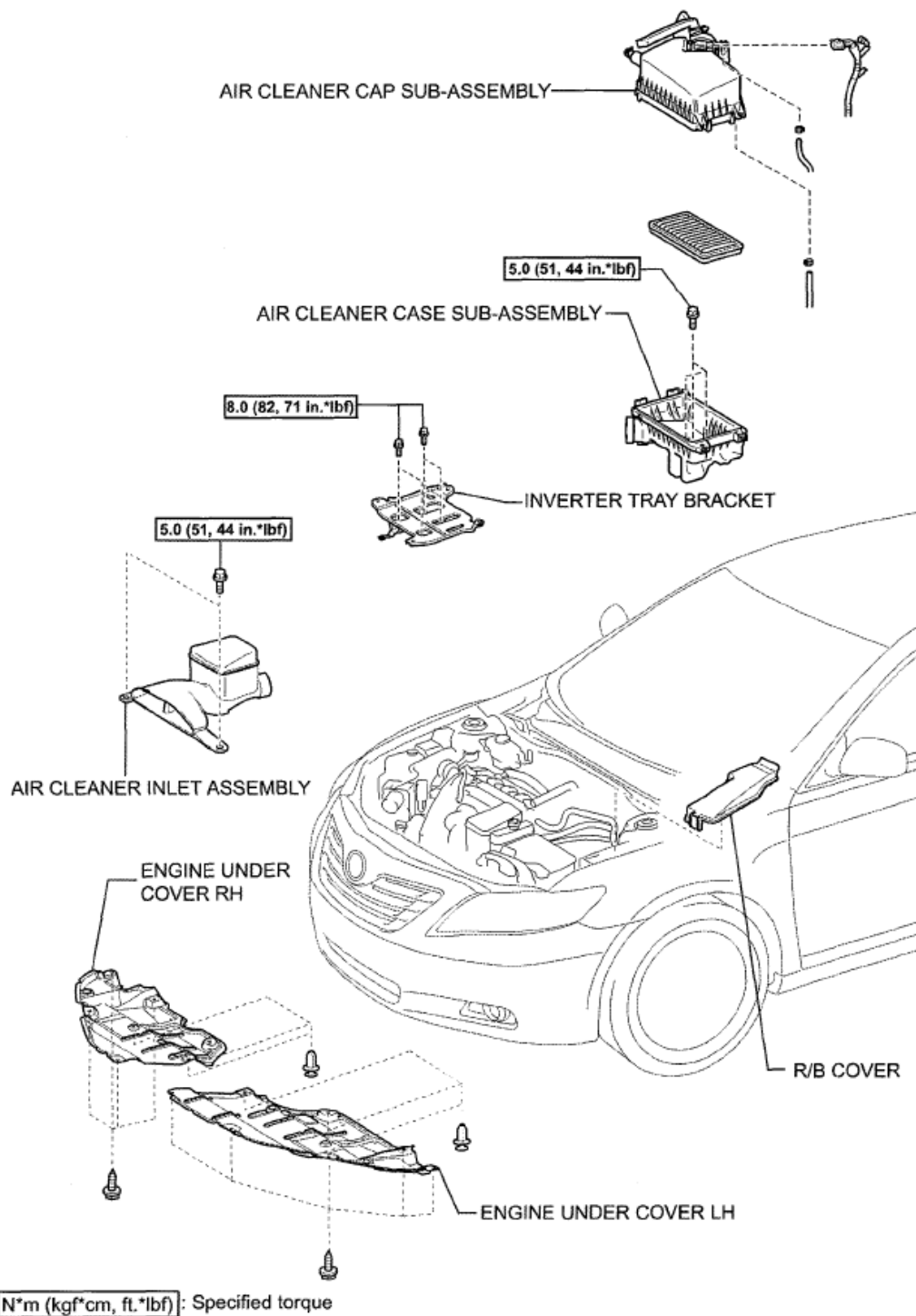
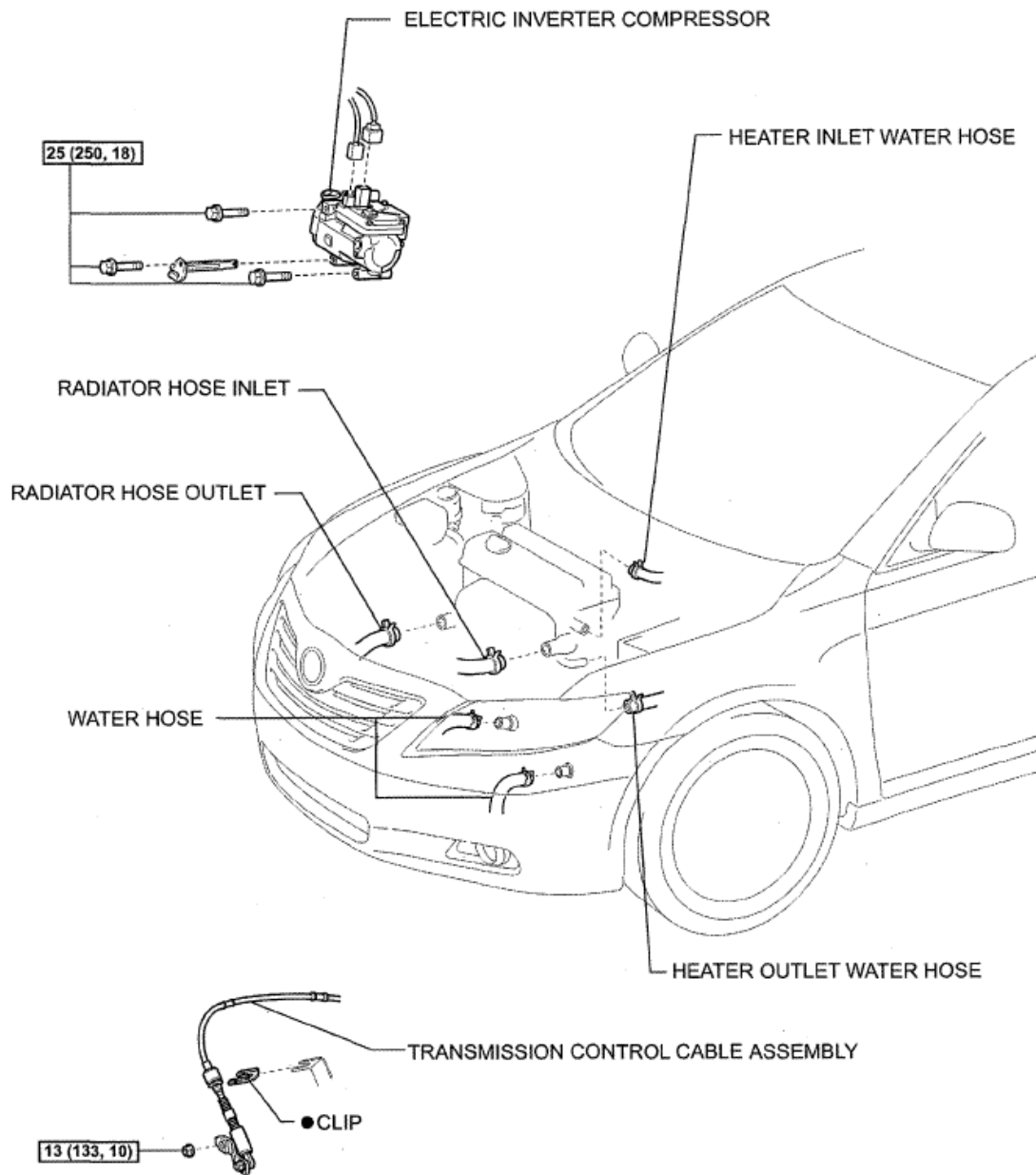


Fig. 198: Identifying Engine Assembly Replacement Components With Torque Specifications (3 Of 9)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2009 Toyota Camry LE

2009 ENGINE Engine Mechanical - Camry Hybrid



[N*m (kgf*cm, ft.*lbf)]: Specified torque ● Non-reusable part

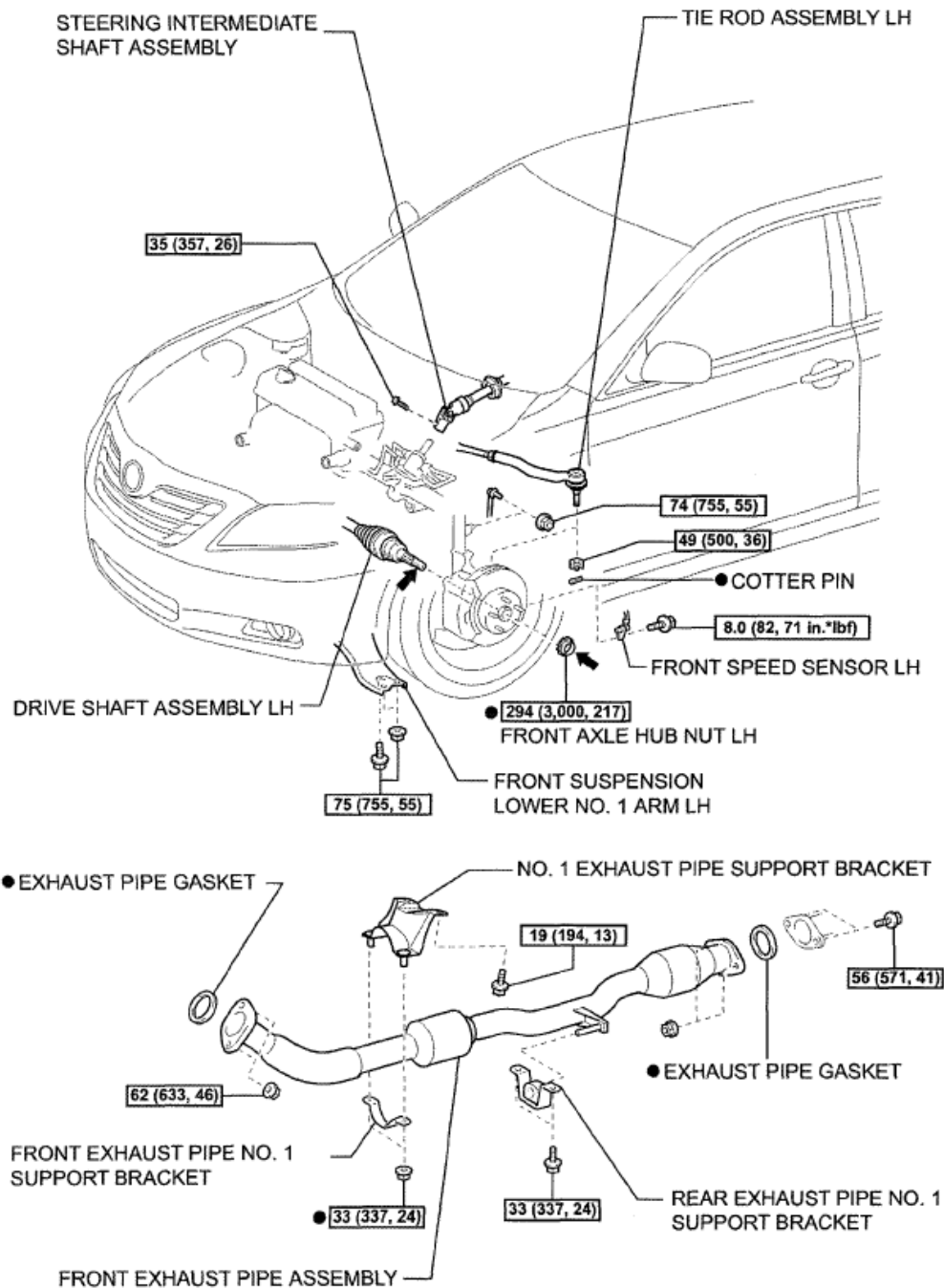
A138362ED1

c

Fig. 199: Identifying Engine Assembly Replacement Components With Torque Specifications (4 Of 9)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2009 Toyota Camry LE

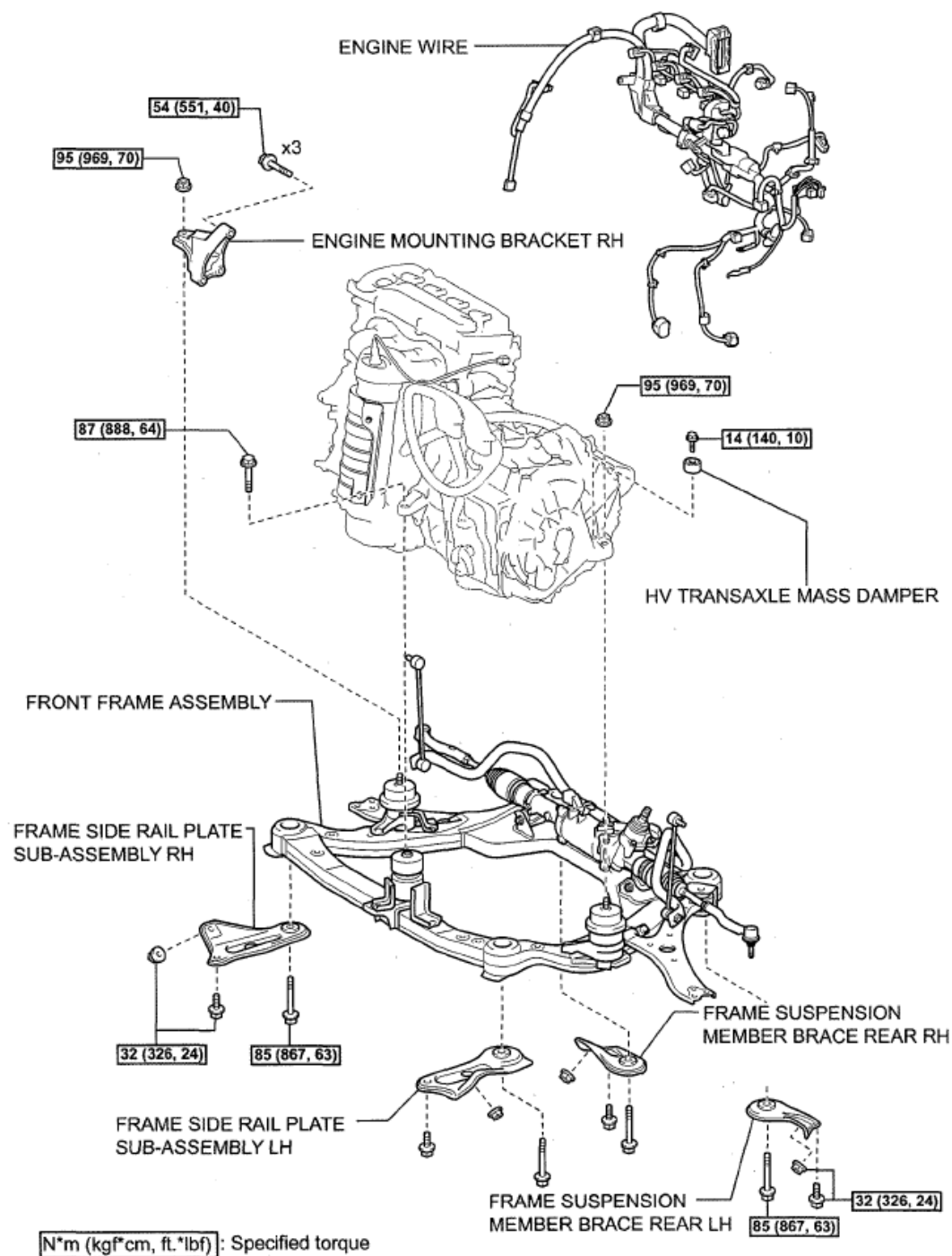
2009 ENGINE Engine Mechanical - Camry Hybrid



[N*m (kgf*cm, ft.*lbf)]: Specified torque ● Non-reusable part ← Do not apply lubricants threaded parts

A134917E04

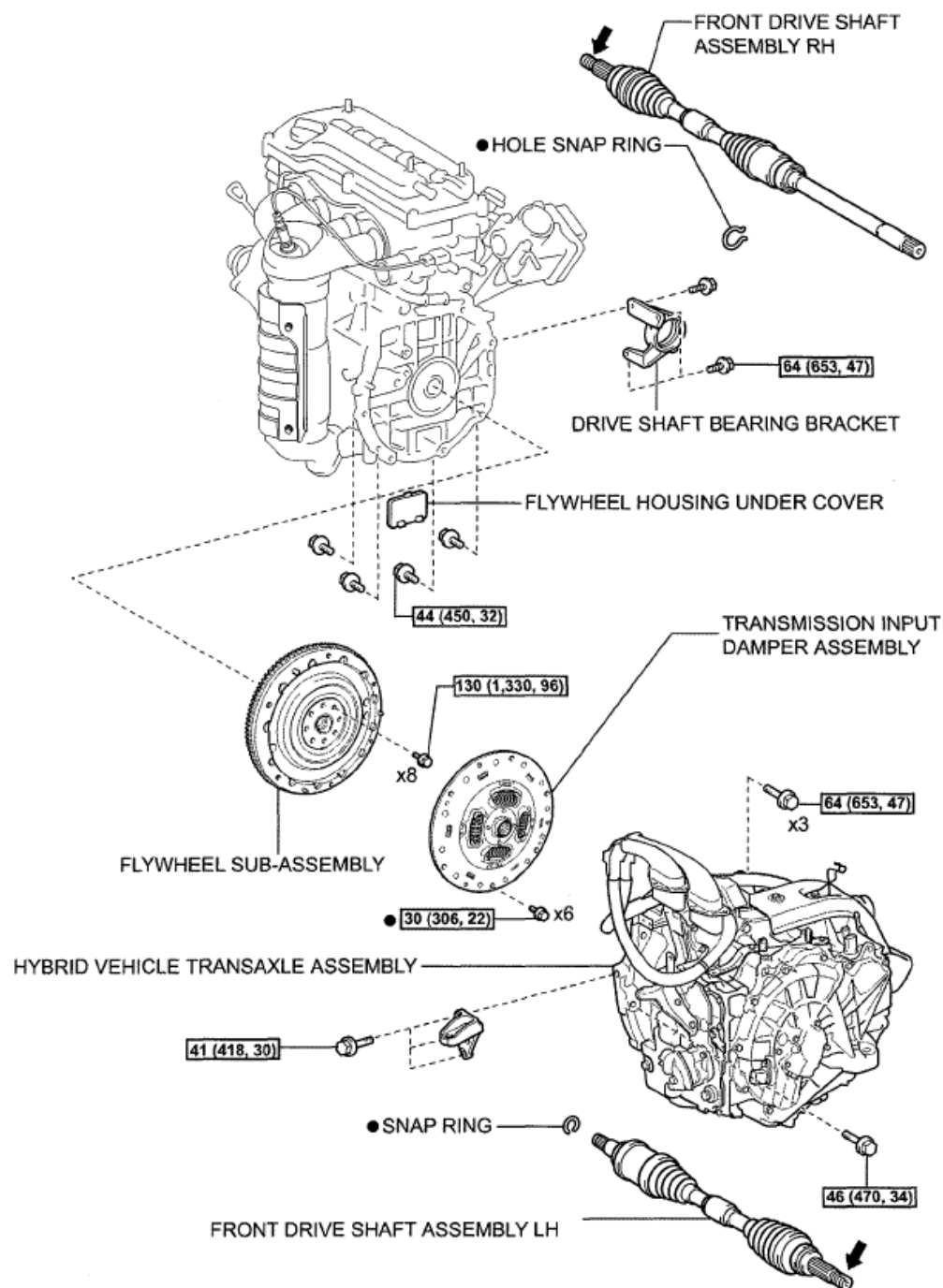
Fig. 200: Identifying Engine Assembly Replacement Components With Torque Specifications (5 Of 9)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



C

A138363E01

Fig. 201: Identifying Engine Assembly Replacement Components With Torque Specifications (6 Of 9)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



N*m (kgf*cm, ft.*lbf) : Specified torque • Non-reusable part ◀ Do not apply lubricants threaded parts

A138364E02

Fig. 202: Identifying Engine Assembly Replacement Components With Torque Specifications (7 Of 9)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2009 Toyota Camry LE

2009 ENGINE Engine Mechanical - Camry Hybrid

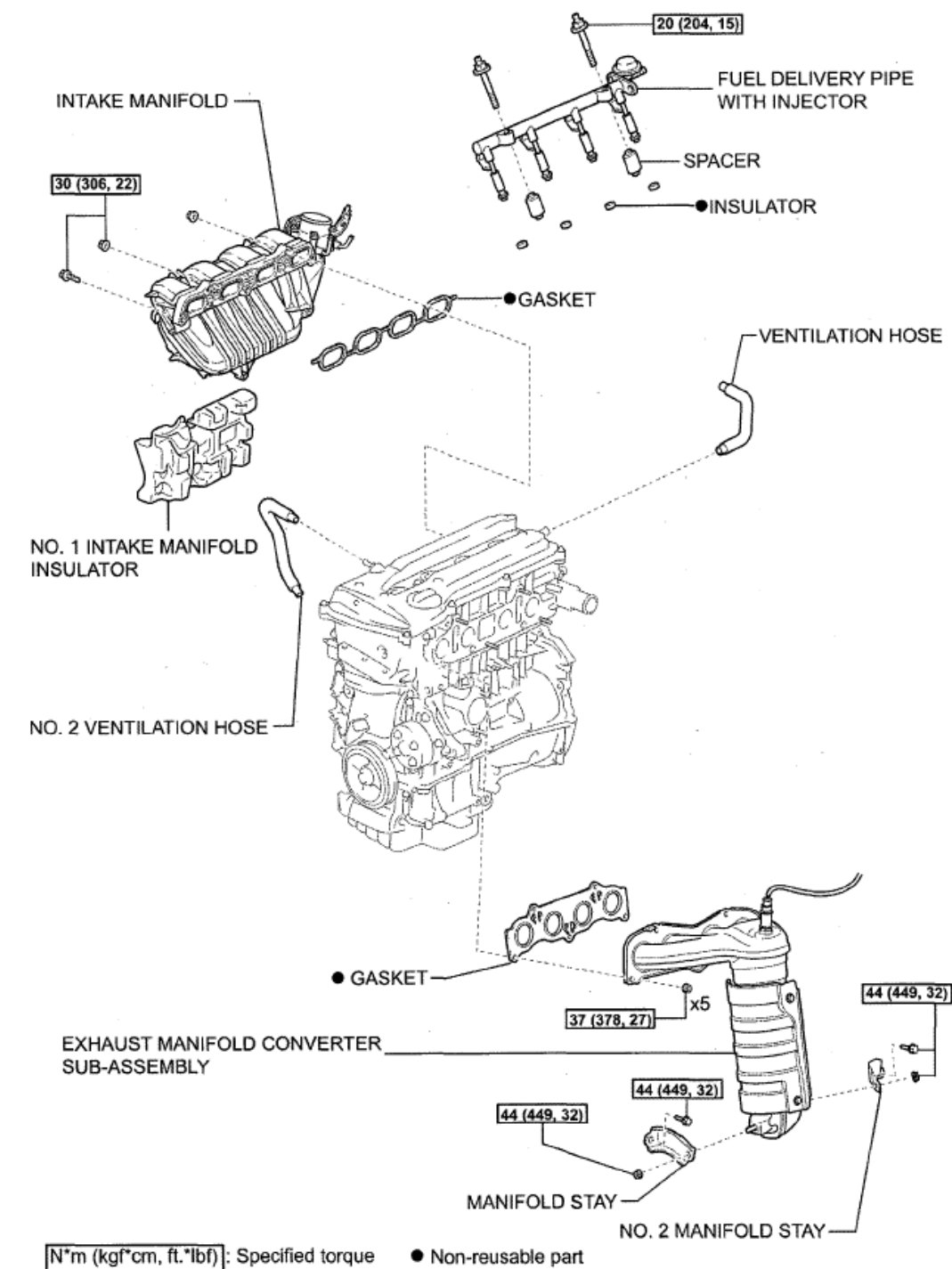


Fig. 203: Identifying Engine Assembly Replacement Components With Torque Specifications (8 Of 9)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2009 Toyota Camry LE

2009 ENGINE Engine Mechanical - Camry Hybrid

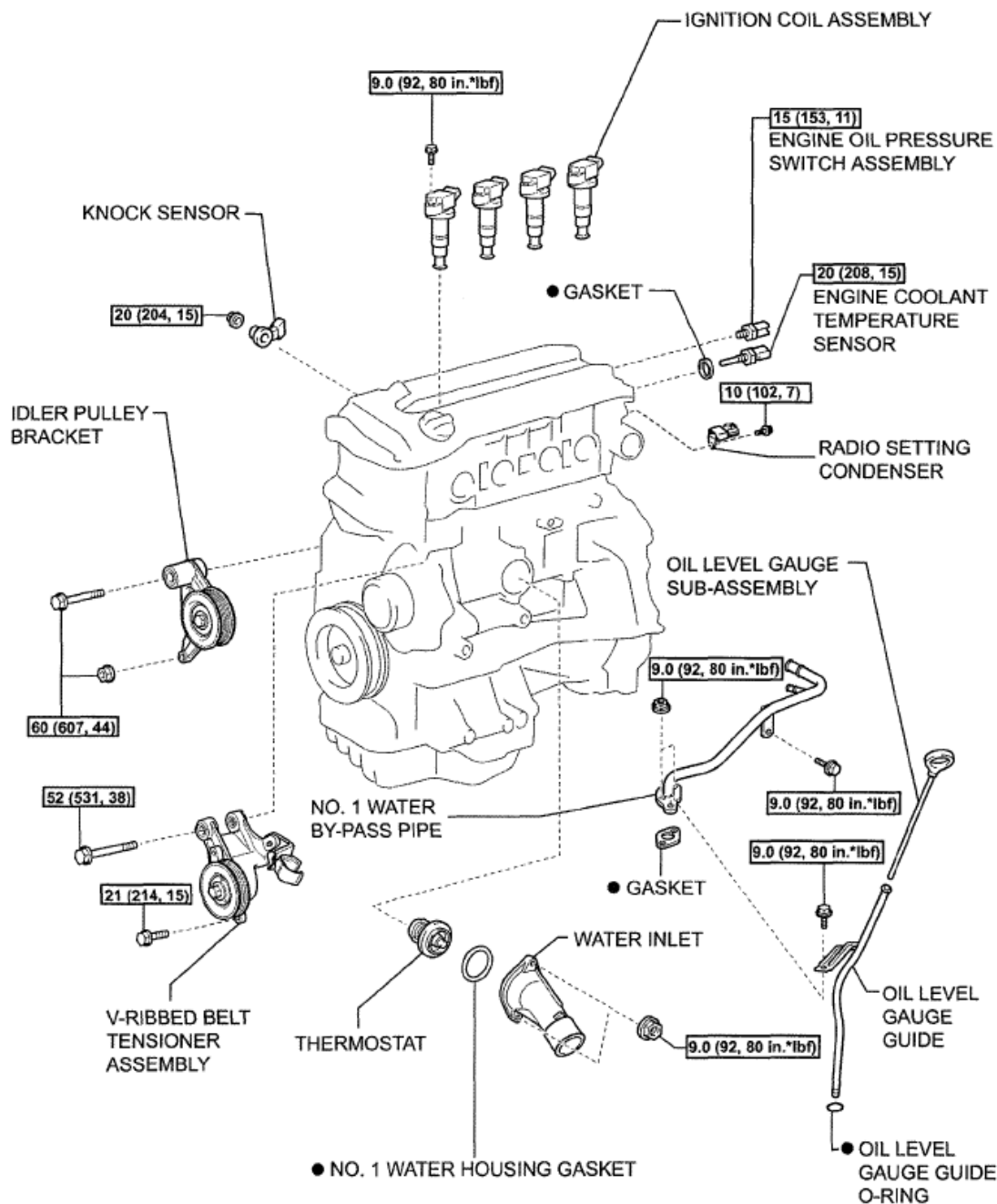


Fig. 204: Identifying Engine Assembly Replacement Components With Torque Specifications (9 Of 9)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. PRECAUTION

HINT:

See **PRECAUTION** .

2. **REMOVE LUGGAGE TRIM SERVICE HOLE COVER**
3. **DISCHARGE FUEL SYSTEM PRESSURE**

HINT:

See **FUEL SYSTEM** .

4. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL** (See **REMOVAL**)
5. **REMOVE SERVICE PLUG GRIP** (See **REMOVAL**)
6. **PLACE FRONT WHEELS FACING STRAIGHT AHEAD**
7. **REMOVE FRONT WHEELS**
8. **REMOVE ENGINE UNDER COVER LH**
9. **REMOVE ENGINE UNDER COVER RH**
10. **REMOVE FRONT FENDER APRON SEAL RH**
11. **DRAIN ENGINE OIL** (See **REPLACEMENT**)
12. **DRAIN COOLANT (for Engine)** (See **COOLANT (FOR ENGINE)**)
13. **DRAIN COOLANT (for Inverter)** (See **REPLACEMENT**)
14. **DRAIN HYBRID TRANSAXLE FLUID** (See **HYBRID TRANSAXLE FLUID**)
15. **REMOVE FRONT WIPER ARM AND BLADE ASSEMBLY LH** (See **REMOVAL**)
16. **REMOVE FRONT WIPER ARM AND BLADE ASSEMBLY RH** (See **REMOVAL**)
17. **REMOVE FRONT FENDER TO COWL SIDE SEAL LH** (See **REMOVAL**)
18. **REMOVE FRONT FENDER TO COWL SIDE SEAL RH** (See **REMOVAL**)
19. **REMOVE COWL TOP VENTILATOR LOUVER SUB-ASSEMBLY** (See **REMOVAL**)
20. **REMOVE WINDSHIELD WIPER MOTOR AND LINK ASSEMBLY** (See **REMOVAL**)
21. **SEPARATE BRAKE MASTER CYLINDER RESERVOIR SUB-ASSEMBLY**
22. **REMOVE COWL TOP PANEL OUTER SUB-ASSEMBLY** (See **REMOVAL**)
23. **REMOVE NO. 1 ENGINE COVER SUB-ASSEMBLY**
 - a. Remove the 2 nuts and cover.

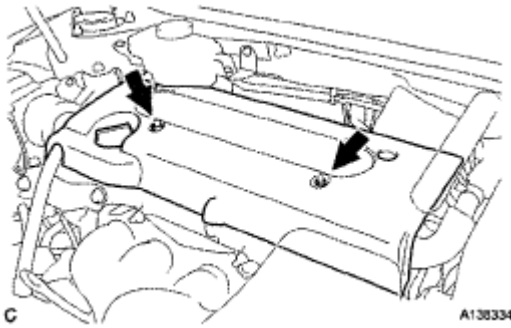


Fig. 205: Locating No. 1 Engine Cover Sub-Assembly Cover And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

24. **REMOVE V-RIBBED BELT TENSIONER COVER SUB-ASSEMBLY** (See **REMOVAL**)
25. **REMOVE V-RIBBED BELT** (See **REMOVAL**)
26. **REMOVE AIR CLEANER INLET ASSEMBLY**
 - a. Remove the 2 bolts, clamp and air cleaner inlet.

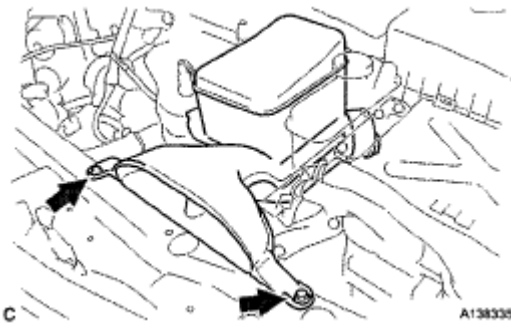


Fig. 206: Locating Clamp, Air Cleaner Inlet And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

27. **REMOVE AIR CLEANER CAP SUB-ASSEMBLY** (See **REMOVAL**)
28. **REMOVE AIR CLEANER CASE SUB-ASSEMBLY**
 - a. Disconnect the hose clamp.
 - b. Remove the 3 bolts and air cleaner case.

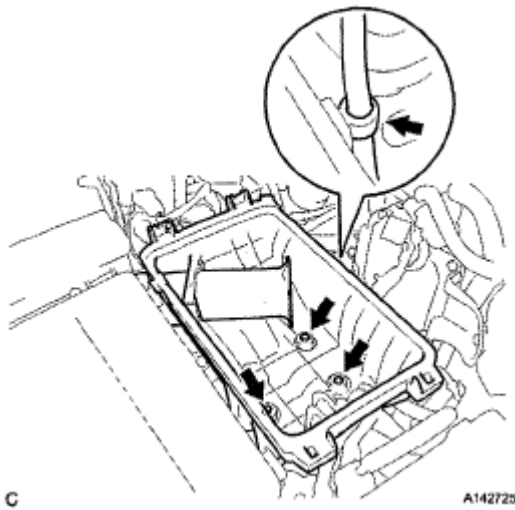


Fig. 207: Locating Air Cleaner Case And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

29. REMOVE INVERTER WITH CONVERTER ASSEMBLY

HINT:

See **REMOVAL** .

30. SEPARATE WATER WITH MOTOR AND BRACKET PUMP ASSEMBLY (See **REMOVAL)**

31. REMOVE INVERTER TRAY BRACKET

- a. Remove the 4 bolts and inverter tray bracket.

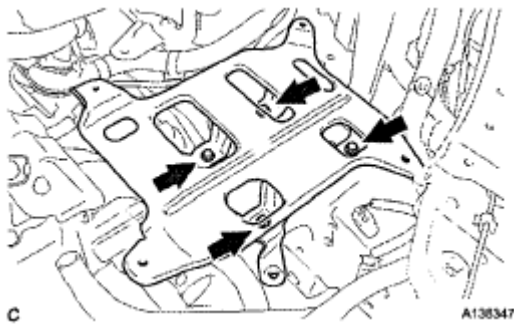


Fig. 208: Locating Inverter Tray Bracket And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

32. REMOVE NO. 2 ENGINE MOUNTING STAY RH

- a. Remove the 2 bolts and No. 2 engine mounting stay RH.

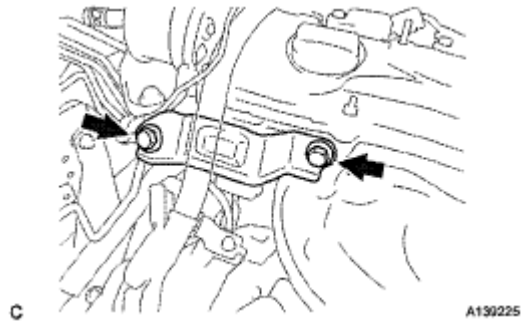


Fig. 209: Locating Engine Mounting Stay RH And Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

33. REMOVE ENGINE MOVING CONTROL ROD SUB-ASSEMBLY

- a. Remove the 3 bolts and the engine moving control rod with bracket.

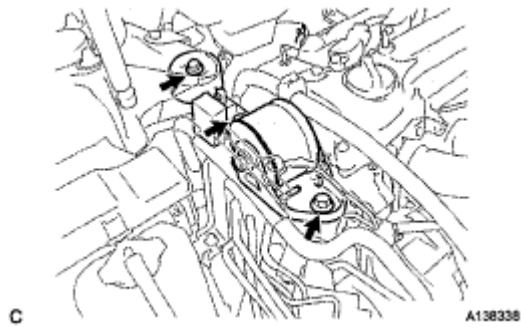


Fig. 210: Locating Engine Moving Control Rod With Bracket And Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

34. REMOVE NO. 2 ENGINE MOUNTING BRACKET RH

- a. Remove the bolt and disconnect the ground cable.
- b. Remove the 3 bolts and No. 2 engine mounting bracket RH.

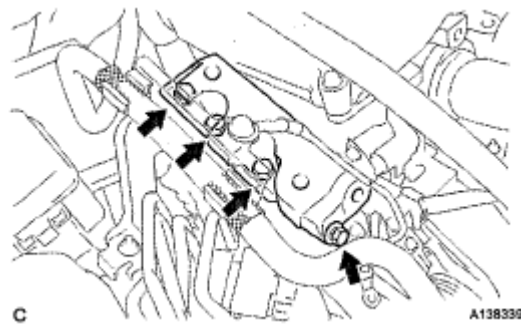


Fig. 211: Locating Engine Mounting Bracket RH And Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

35. DISCONNECT RADIATOR HOSE INLET

- a. Remove the clamp and disconnect the radiator hose inlet.

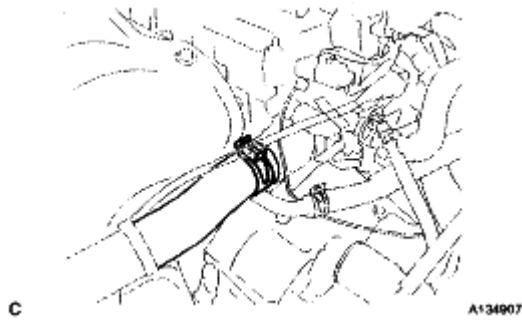


Fig. 212: Identifying Radiator Hose Inlet And Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

36. DISCONNECT RADIATOR HOSE OUTLET

- a. Remove the clamp and disconnect the radiator hose outlet.



Fig. 213: Identifying Radiator Hose Outlet And Clamps
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

37. DISCONNECT WATER HOSE

- a. Remove the 2 clamps and disconnect the 2 water hoses.

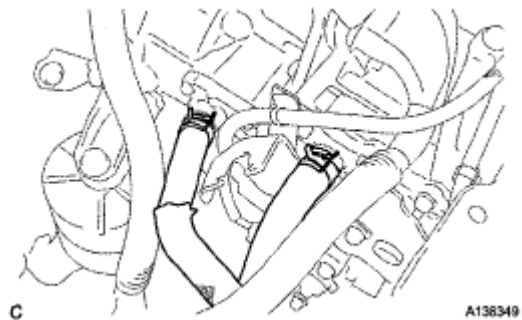


Fig. 214: Identifying Water Hoses And Clamps
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

38. DISCONNECT HEATER INLET WATER HOSE

- a. Disconnect the heater inlet water hose.

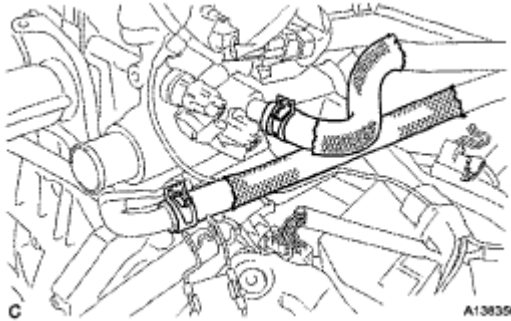


Fig. 215: Identifying Heater Outlet/Inlet Water Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

39. DISCONNECT HEATER OUTLET WATER HOSE

- a. Disconnect the heater outlet water hose.

40. REMOVE HYBRID VEHICLE CONTROL ECU (See REMOVAL)**41. REMOVE POWER STEERING ECU ASSEMBLY (See REMOVAL)****42. DISCONNECT ENGINE WIRE**

- a. Disconnect the engine wire from the engine room relay block.
 1. Remove the nut and separate the wire harness.
 2. Using a screwdriver, unlock the engine room R/ B. Pull the engine room R/B upward.

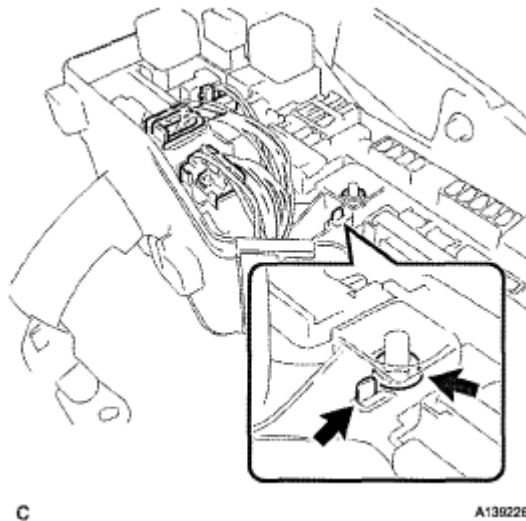


Fig. 216: Locating Engine Wire And Engine Room Relay Block
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. Disconnect the clamps and engine wire connectors.

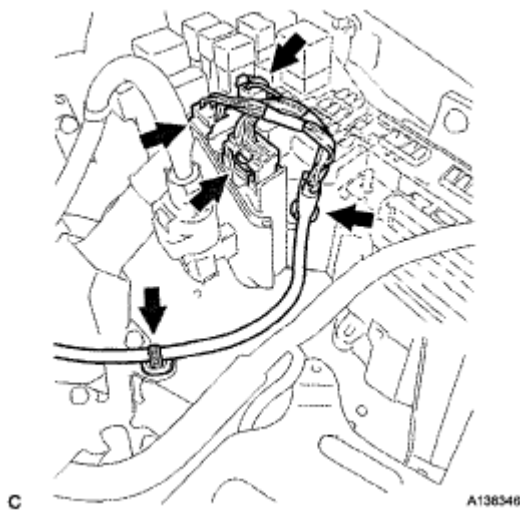


Fig. 217: Locating Clamps And Engine Wire Connectors
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the 2 bolts and clamp from the body.

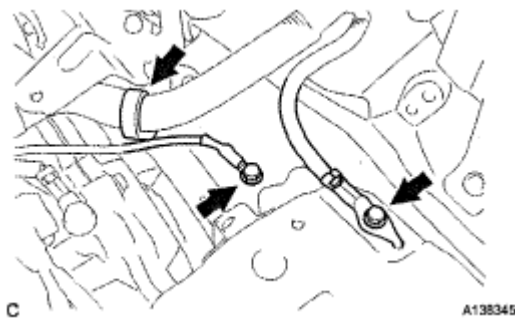


Fig. 218: Locating Clamp And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Remove the clamp from the bracket.

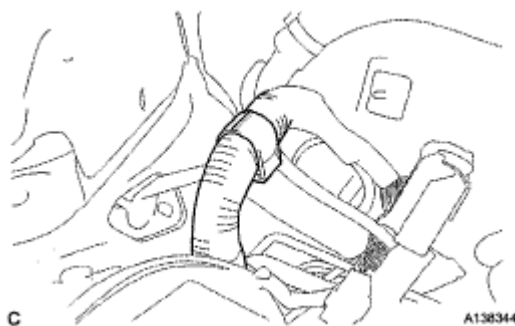


Fig. 219: Identifying Clamp And Bracket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Release the lock lever of the connector as shown in the illustration.

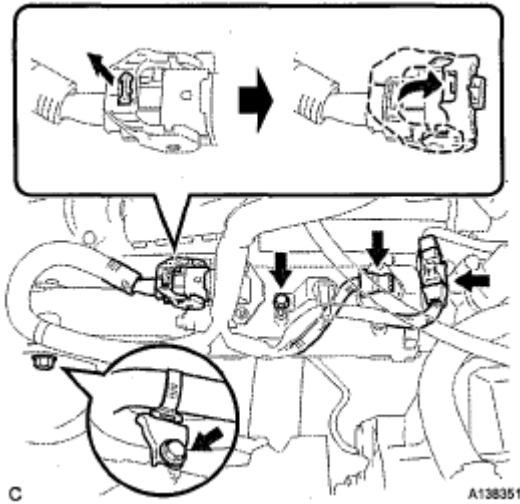


Fig. 220: Identifying Lock Lever Of Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Disconnect the 3 connectors from the power steering link assembly.
f. Remove the 2 bolts and power steering wire from the power steering link assembly.
43. **DISCONNECT TRANSMISSION CONTROL CABLE ASSEMBLY**
- a. Remove the clip and nut, and separate the control lever.

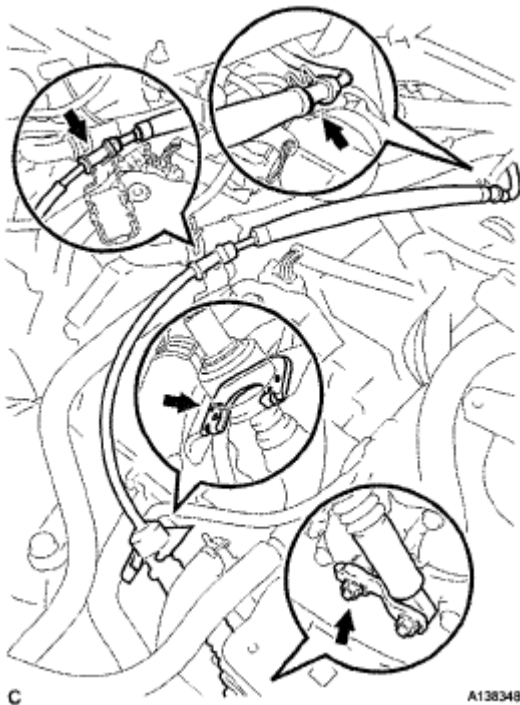


Fig. 221: Locating Control Lever, Clip And Nuts

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

- b. Disconnect the cable from the clamp.

44. DISCONNECT FUEL TUBE SUB-ASSEMBLY

- a. Remove the No. 1 fuel pipe clamp.

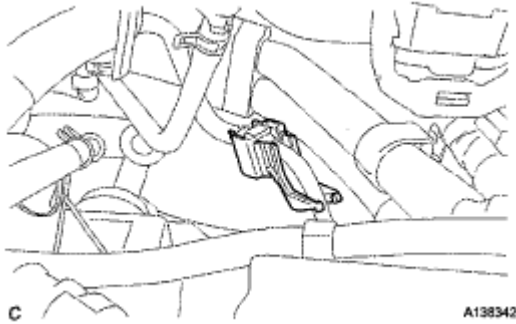


Fig. 222: Identifying Fuel Pipe Clamp

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

- b. Disconnect the connector from the tube while pinching part A with your fingers as shown in the illustration.

NOTE:

- Check for contamination in the pipe and around the connector. Clean if necessary and then disconnect the connector.
- Disconnect the connector by hand.
- Do not bend, fold or rotate the nylon tube.
- If the pipe and connector are stuck together, push and pull the connector until it becomes free.
- Put the pipe and connector ends in vinyl bags to prevent damage and contamination.

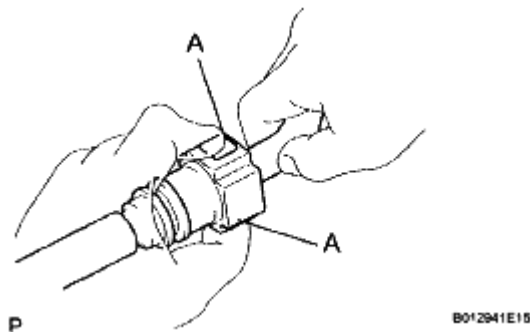


Fig. 223: Identifying Connector From Tube

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

45. SEPARATE ELECTRIC INVERTER COMPRESSOR

- a. Release the green-colored lock.

CAUTION: Wear insulated gloves when performing the procedures.

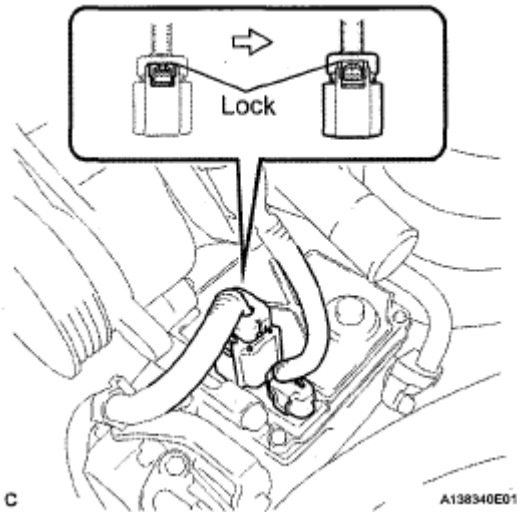


Fig. 224: Identifying Green-Colored Lock

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

- b. Disconnect the 2 connectors.

NOTE: Insulate the connector by sealing it with tape.

- c. Disconnect the No.4 engine wire clamps.

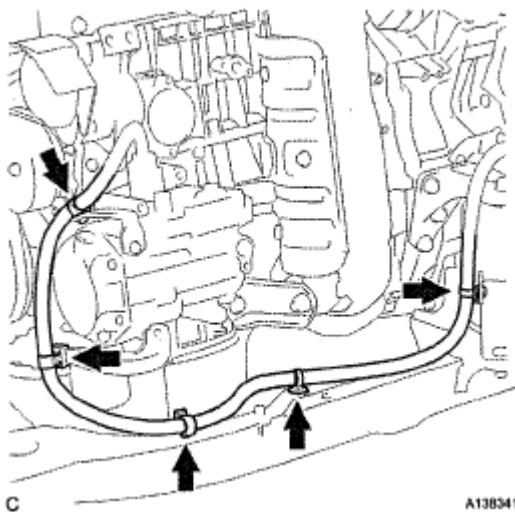


Fig. 225: Locating Engine Wire Clamps

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

- d. Remove the 3 bolts and separate the compressor.

HINT:

Hang up the hoses instead of detaching them.

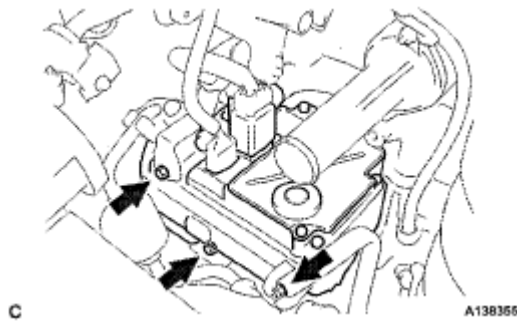


Fig. 226: Locating Compressor And Bolts

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

46. REMOVE FRONT EXHAUST PIPE ASSEMBLY

HINT:

See **REMOVAL** .

47. REMOVE FRONT AXLE HUB NUT LH (See **REMOVAL)**

48. REMOVE FRONT AXLE HUB NUT RH

HINT:

Use the same procedures described for the LH side.

49. REMOVE FRONT STABILIZER LINK ASSEMBLY LH (See **REMOVAL)**

50. REMOVE FRONT STABILIZER LINK ASSEMBLY RH

HINT:

Use the same procedures described for the LH side.

51. REMOVE FRONT SPEED SENSOR LH (See **REMOVAL)**

52. REMOVE FRONT SPEED SENSOR RH

HINT:

Use the same procedures described for the LH side.

53. **DISCONNECT TIE ROD ASSEMBLY LH** (See REMOVAL)

54. **DISCONNECT TIE ROD ASSEMBLY RH**

HINT:

Use the same procedures described for the LH side.

55. **DISCONNECT FRONT SUSPENSION LOWER NO. 1 ARM LH** (See REMOVAL)

56. **DISCONNECT FRONT SUSPENSION LOWER NO. 1 ARM RH**

HINT:

Use the same procedures described for the LH side.

57. **SEPARATE FRONT AXLE ASSEMBLY LH** (See REMOVAL)

58. **SEPARATE FRONT AXLE ASSEMBLY RH**

HINT:

Use the same procedures described for the LH side.

59. **REMOVE NO. 1 EXHAUST PIPE SUPPORT BRACKET**

a. Remove the 2 bolts and No. 1 exhaust pipe support bracket.

60. **SEPARATE STEERING INTERMEDIATE SHAFT ASSEMBLY** (See REMOVAL)

61. **REMOVE ENGINE ASSEMBLY WITH TRANSAXLE**

a. Set the engine lifter.

b. Remove the 4 bolts, 2 nuts and frame side rail plate RH and LH.

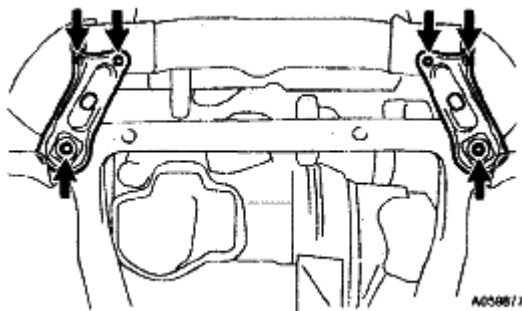


Fig. 227: Locating RH/LH Frame Side Rail Plate Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Remove the 4 bolts, 2 nuts and front suspension member brace rear RH and LH.

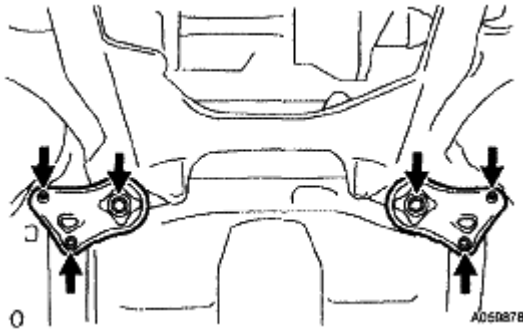


Fig. 228: Locating Front Suspension Member Brace Rear Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Carefully remove the engine assembly from the vehicle.
- e. Install the 2 engine hangers as shown in the illustration.

Parts No.:

ENGINE HANGERS PARTS NUMBER

Parts	Parts No.
No. 1 engine hanger	12281-28010
No. 2 engine hanger	12282-28010
Bolt	91512-61020

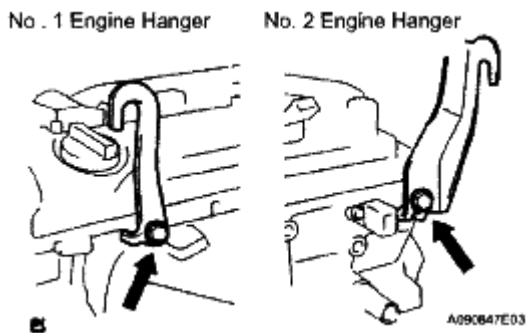


Fig. 229: Locating Engine Hangers
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Torque: 38 N*m (387 kgf*cm, 28 ft.*lbf)

- f. Using a chain block and an engine sling device, hang the engine assembly.
- 62. REMOVE HV TRANSAXLE MASS DAMPER**
- a. Remove the bolt and transaxle mass damper.

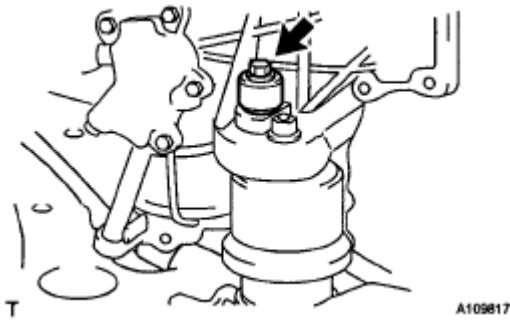


Fig. 230: Locating Transaxle Mass Damper Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

63. REMOVE FRONT FRAME ASSEMBLY

- a. Remove the 2 nuts and separate the engine mounting insulators RH and LH.

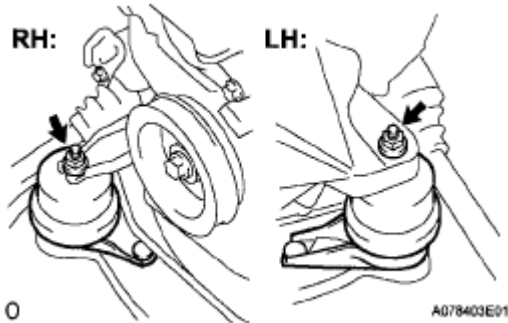


Fig. 231: Locating Front Frame Assembly Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the bolt from the engine mounting insulator FR.

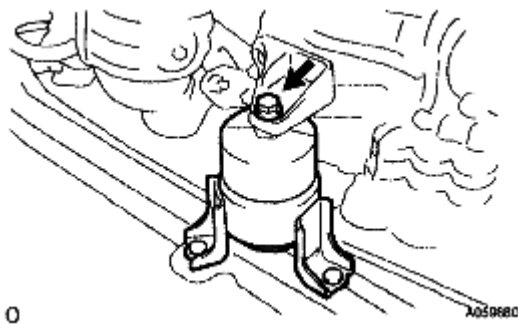


Fig. 232: Locating Engine Mounting Insulator FR With Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Raise the engine assembly and separate the front frame.

64. REMOVE FRONT DRIVE SHAFT ASSEMBLY LH (See REMOVAL)

65. REMOVE FRONT DRIVE SHAFT ASSEMBLY RH (See DISASSEMBLY)

66. REMOVE ENGINE WIRE**67. SEPARATE HYBRID VEHICLE TRANSAXLE ASSEMBLY**

HINT:

See **REMOVAL** .

68. REMOVE TRANSMISSION INPUT DAMPER ASSEMBLY (See **REMOVAL)****69. REMOVE FLYWHEEL SUB-ASSEMBLY (See **REMOVAL**)****70. INSTALL ENGINE STAND**

- a. Fix the engine onto an engine stand with the bolts.

71. REMOVE FUEL DELIVERY PIPE WITH INJECTOR (See **REMOVAL)****72. REMOVE INTAKE MANIFOLD**

- a. Remove the 5 bolts, 2 nuts, and intake manifold.

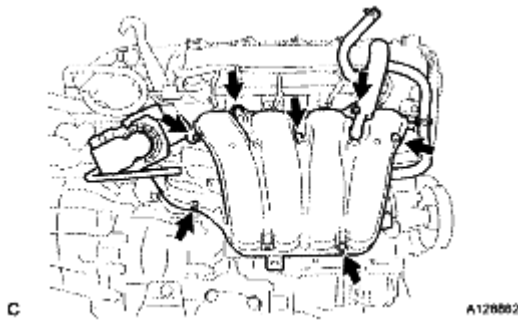


Fig. 233: Locating Intake Manifold, Bolts And Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the gasket from the intake manifold.

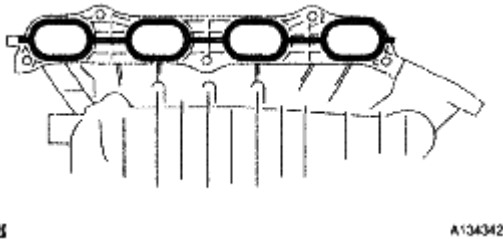
73. REMOVE NO. 2 VENTILATION HOSE

Fig. 234: Identifying Intake Manifold Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

74. REMOVE NO. 1 INTAKE MANIFOLD INSULATOR

- a. Remove the No. 1 intake manifold insulator from the cylinder block.

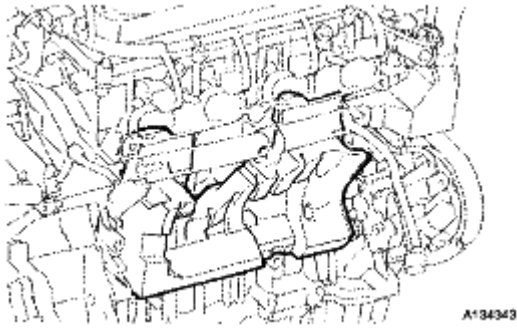


Fig. 235: Identifying Intake Manifold Insulator And Cylinder Block
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

75. REMOVE DRIVE SHAFT BEARING BRACKET

- a. Remove the 3 bolts and drive shaft bearing bracket.

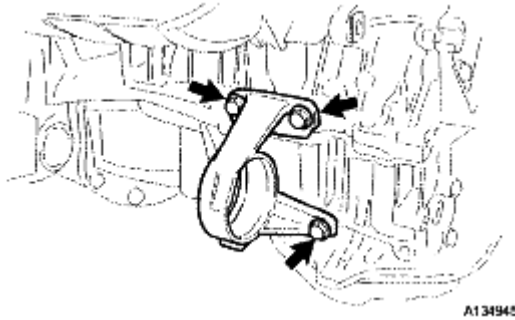


Fig. 236: Locating Drive Shaft Bearing Bracket And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

76. REMOVE OIL LEVEL GAUGE SUB-ASSEMBLY

77. REMOVE OIL LEVEL GAUGE GUIDE

- a. Remove the bolt and oil level gauge guide.

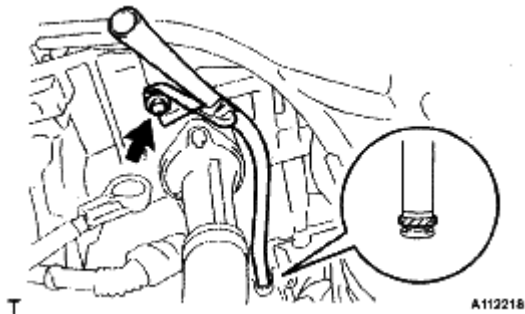


Fig. 237: Locating Oil Level Gauge Guide
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the O-ring from the oil level gauge guide.

78. REMOVE MANIFOLD STAY

- a. Remove the bolt, nut and stay.

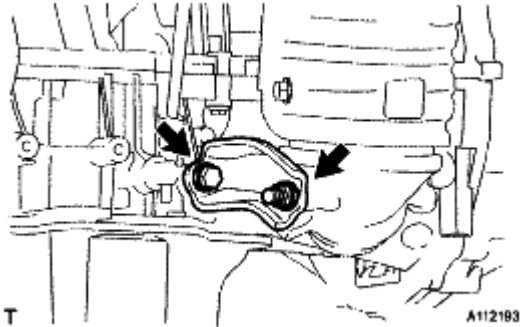


Fig. 238: Locating Manifold Stay With Bolt And Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

79. REMOVE NO. 2 MANIFOLD STAY

- a. Remove the bolt, nut and stay.

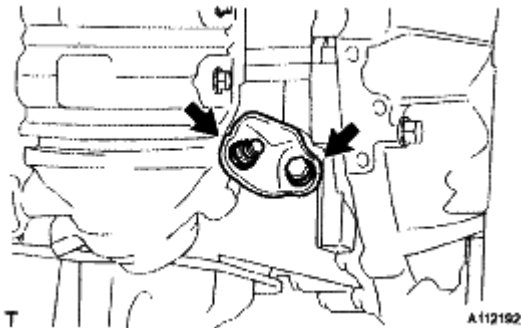


Fig. 239: Locating Stay With Bolt And Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

80. REMOVE EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY

- a. Disconnect the air-fuel ratio sensor connector.

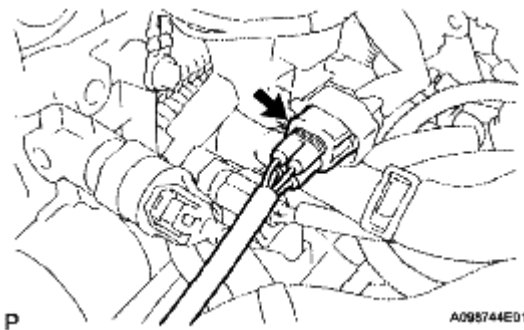


Fig. 240: Locating Air-Fuel Ratio Sensor Connector

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

- b. Remove the 5 nuts, manifold converter and gasket.

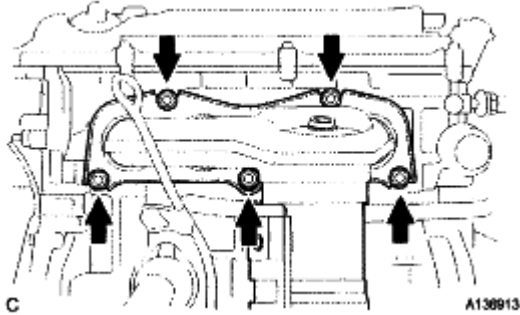


Fig. 241: Locating Manifold Converter And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

81. REMOVE WATER INLET (See REMOVAL)
82. REMOVE THERMOSTAT (See REMOVAL)
83. REMOVE NO. 1 WATER BY-PASS PIPE
 - a. Remove the bolt, 2 nuts and No. 1 water by-pass pipe with the gasket.

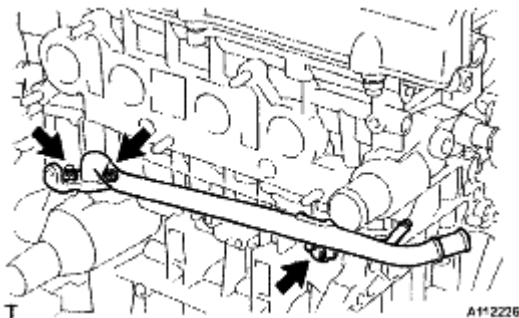


Fig. 242: Locating Exhaust Manifold Converter Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

84. REMOVE IDLER PULLEY BRACKET
 - a. Loosen the 2 bolts and remove the idler pulley bracket from the engine.

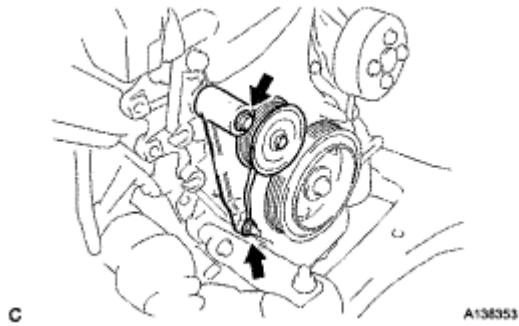


Fig. 243: Locating Idler Pulley Bracket Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

85. REMOVE ENGINE MOUNTING BRACKET RH

- a. Remove the 3 bolts and engine mounting bracket RH.

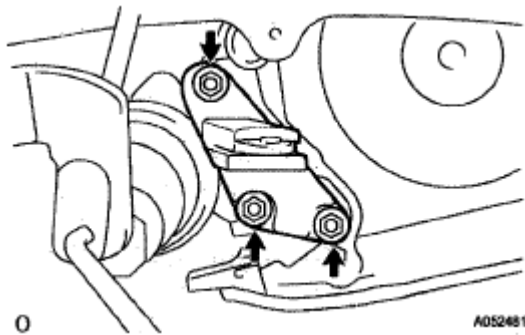


Fig. 244: Locating Engine Mounting Bracket With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

86. REMOVE V-RIBBED BELT TENSIONER ASSEMBLY

- a. Remove the 2 bolts and belt tensioner.

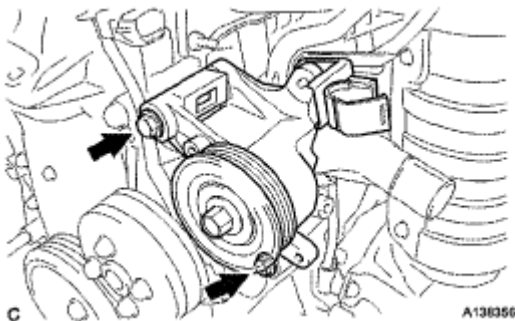


Fig. 245: Locating Belt Tensioner And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

87. REMOVE IGNITION COIL ASSEMBLY

- a. Remove the 4 bolts and 4 ignition coils.
- 88. **REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY** (See **REMOVAL**)
- 89. **REMOVE KNOCK SENSOR**
 - a. Disconnect the sensor connector.
 - b. Remove the nut and sensor.
- 90. **REMOVE RADIO SETTING CONDENSER**
 - a. Remove the bolt and radio setting condenser.

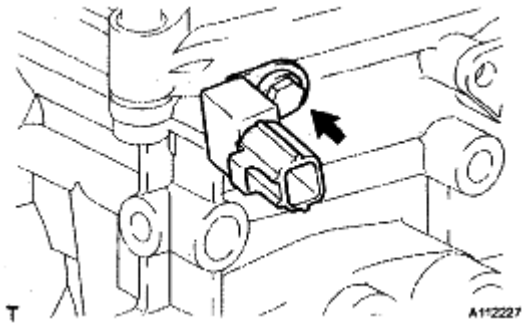


Fig. 246: Locating Radio Setting Condenser And Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 91. **REMOVE ENGINE OIL PRESSURE SWITCH ASSEMBLY**
 - a. Using a 24 mm deep socket wrench, remove the engine oil pressure switch assembly.

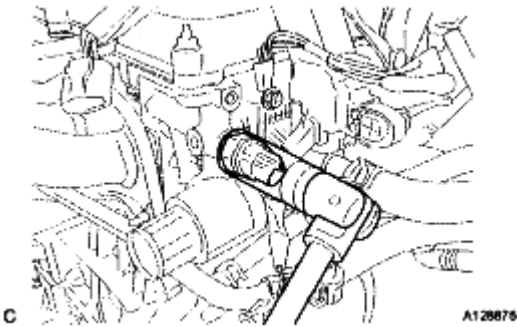


Fig. 247: Identifying Engine Oil Pressure Switch Assembly
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 92. **REMOVE ENGINE COOLANT TEMPERATURE SENSOR**
 - a. Using SST, remove the sensor and gasket.

SST 09817-33190

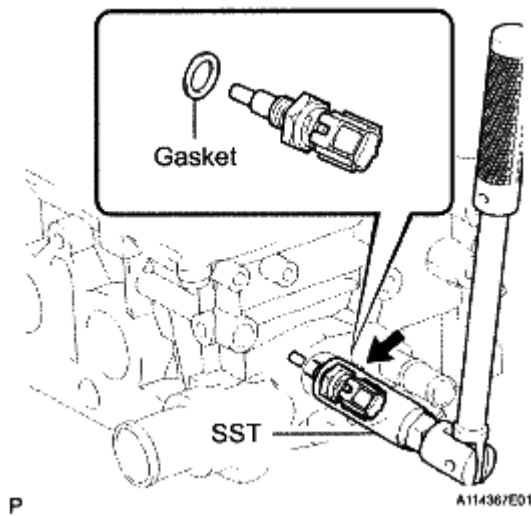


Fig. 248: Locating Gasket And ECT Sensor
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION

1. INSPECT INTAKE MANIFOLD

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

Maximum warpage: 0.20 mm (0.0079 in.)

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

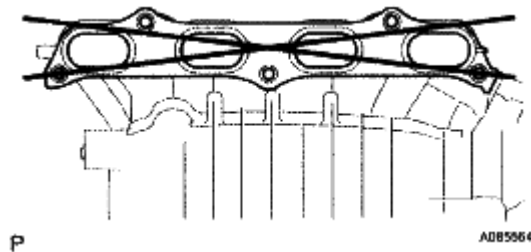


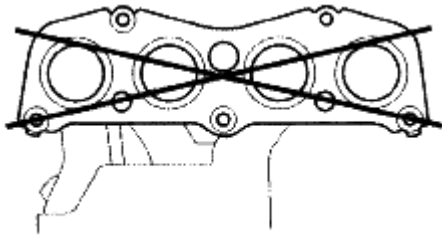
Fig. 249: Identifying Surface Contacting Cylinder Head
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. INSPECT EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY

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

Maximum warpage: 0.70 mm (0.0276 in.)

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



H

A124780

Fig. 250: Inspecting Exhaust Manifold

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

INSTALLATION

1. INSTALL ENGINE COOLANT TEMPERATURE SENSOR

- Using SST, install a new gasket and the ECT sensor.

SST 09817-33190

Torque: 20 N*m (208 kgf*cm, 15 ft.*lbf)

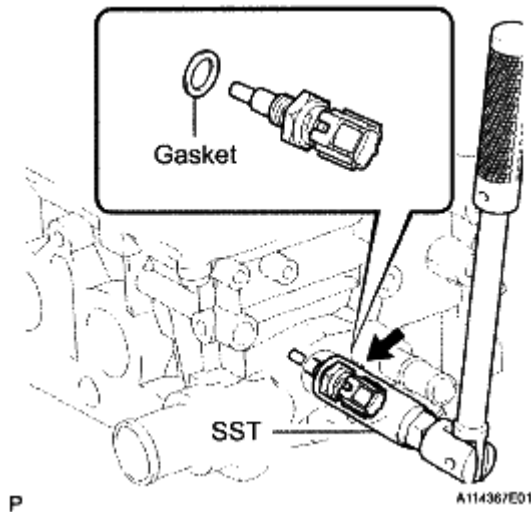


Fig. 251: Locating Gasket And ECT Sensor

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

2. INSTALL ENGINE OIL PRESSURE SWITCH ASSEMBLY

- Clean the threads of the oil pressure switch. Apply adhesive to 2 or 3 threads of the oil pressure switch.

Adhesive: Part No. 08833-00080 THREE BOND 1344 or equivalent

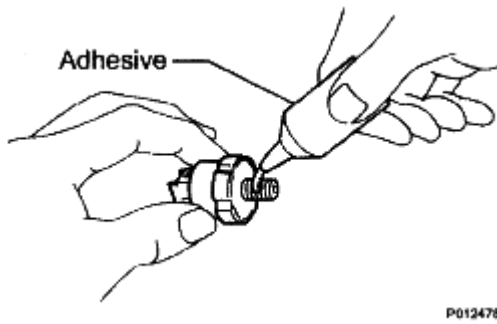


Fig. 252: Identifying Adhesive To Threads Of Oil Pressure Switch
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a 24 mm deep socket wrench, install the oil pressure switch.

Torque: 15 N*m (153 kgf*cm, 11 ft.*lbf)

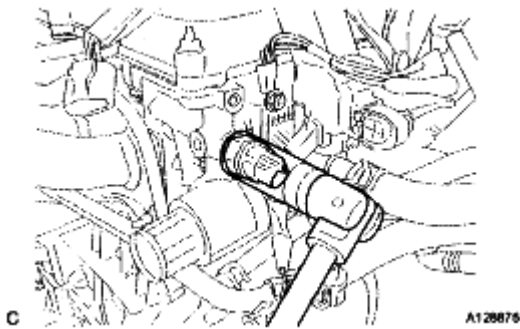


Fig. 253: Identifying Engine Oil Pressure Switch Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. INSTALL RADIO SETTING CONDENSER

- a. Install the condenser with the bolt.

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

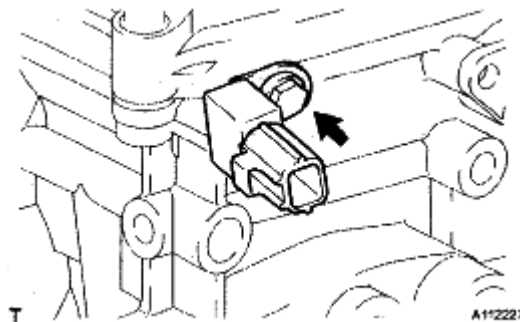


Fig. 254: Locating Radio Setting Condenser And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. INSTALL KNOCK SENSOR

- a. Install the sensor with the nut as shown in the illustration.

Torque: 20 N*m (204 kgf*cm, 15 ft.*lbf)

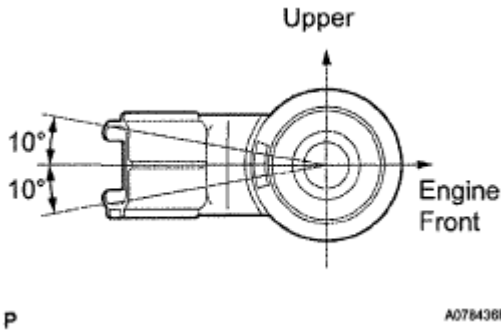


Fig. 255: Identifying Knock Sensor Installation Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (See INSTALLATION)

6. INSTALL IGNITION COIL ASSEMBLY

- a. Install the 4 ignition coils with the 4 bolts.

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

7. INSTALL V-RIBBED BELT TENSIONER ASSEMBLY

- a. Install the V-ribbed belt tensioner with the 2 bolts.

Torque: Bolt A

52 N*m (530 kgf*cm, 38 ft.*lbf)

Bolt B

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

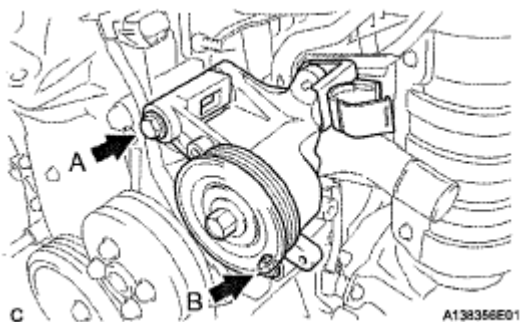


Fig. 256: Locating V-Ribbed Belt Tensioner With Bolts

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

8. INSTALL ENGINE MOUNTING BRACKET RH

- a. Install the engine mounting bracket RH with the 3 bolts.

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

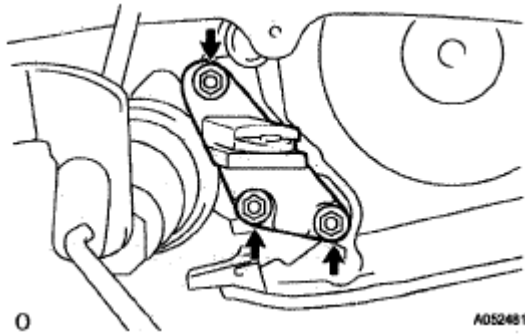


Fig. 257: Locating Engine Mounting Bracket With Bolts

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

9. INSTALL IDLER PULLEY BRACKET

- a. Install the idler pulley bracket to the engine with the 2 bolts.

Torque: 60 N*m (607 kgf*cm, 44 ft.*lbf)

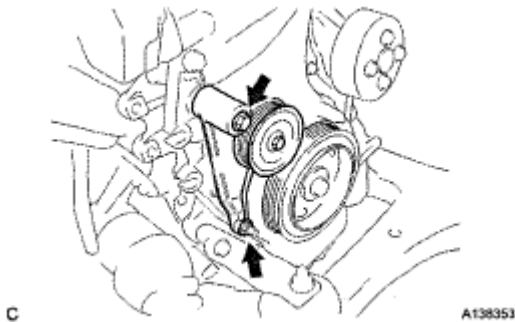


Fig. 258: Locating Idler Pulley Bracket With Bolts

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

10. INSTALL NO. 1 WATER BY-PASS PIPE

- a. Install a new gasket and the pipe with the bolt and 2 nuts.

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

11. INSTALL THERMOSTAT (See INSTALLATION)

12. INSTALL WATER INLET (See INSTALLATION)

13. INSTALL EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY

- a. Install a new gasket onto the cylinder head.

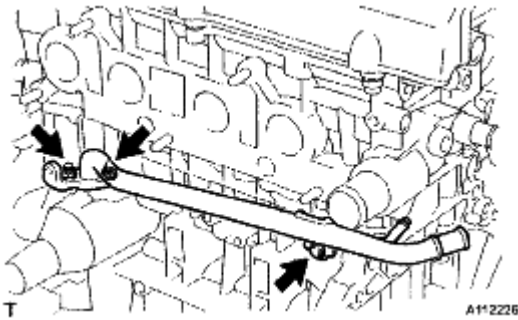


Fig. 259: Locating Exhaust Manifold Converter Sub-Assembly Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Temporarily tighten the exhaust manifold converter with the 5 nuts.
- c. Tighten the 5 nuts in the sequence shown in the illustration.

Torque: 37 N*m (378 kgf*cm, 27 ft.*lbf)

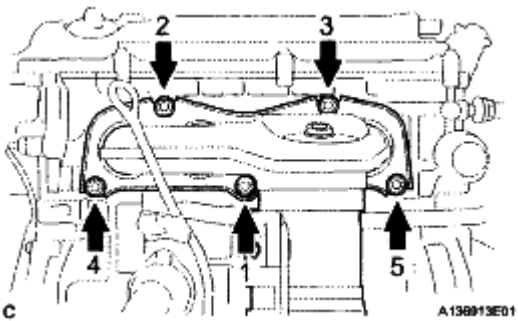


Fig. 260: Locating Exhaust Manifold Bolt Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Connect the air-fuel ratio sensor connector.

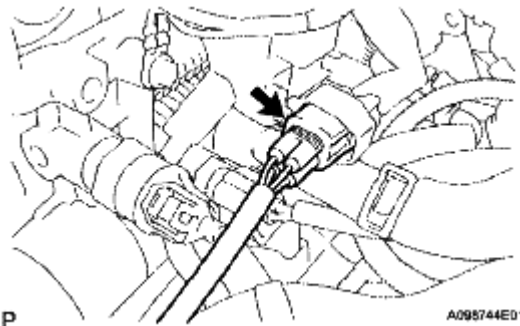


Fig. 261: Locating Air-Fuel Ratio Sensor Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. INSTALL NO. 2 MANIFOLD STAY

- a. Install the stay with the bolt and nut.

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

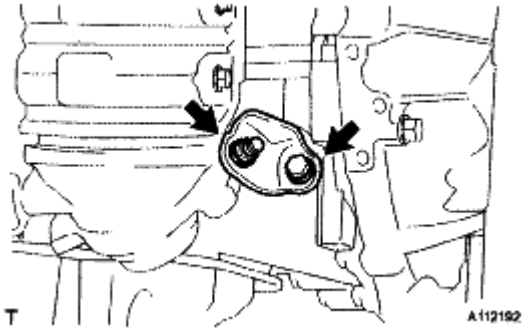


Fig. 262: Locating Stay With Bolt And Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

15. INSTALL MANIFOLD STAY

- a. Install the stay with the bolt and nut.

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

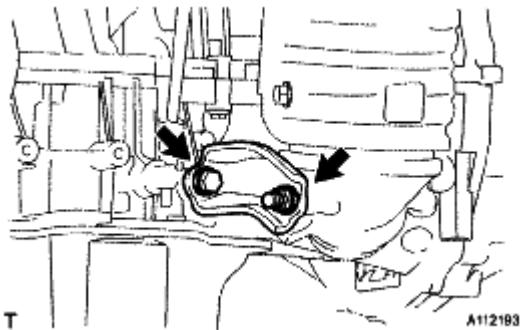


Fig. 263: Locating Manifold Stay With Bolt And Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

16. INSTALL OIL LEVEL GAUGE GUIDE

- a. Apply a light coat of engine oil to a new O-ring and install it to the guide.
- b. Install the oil level gauge guide with the bolt.

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

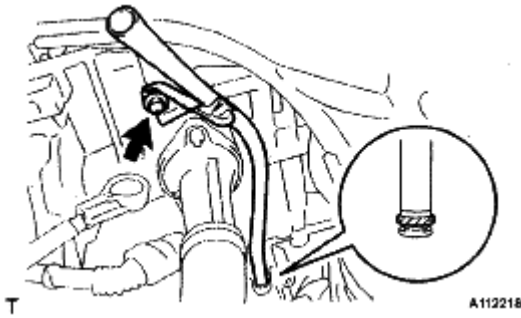


Fig. 264: Locating Oil Level Gauge Guide With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

17. INSTALL OIL LEVEL GAUGE SUB-ASSEMBLY
18. INSTALL DRIVE SHAFT BEARING BRACKET
 - a. Install the bracket with the 3 bolts.

Torque: 64 N*m (653 kgf*cm, 47 ft.*lbf)

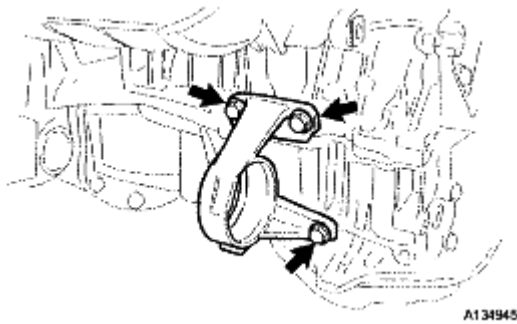


Fig. 265: Locating Drive Shaft Bearing Bracket And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

19. INSTALL NO. 1 INTAKE MANIFOLD INSULATOR
 - a. Install the No. 1 intake manifold insulator onto the cylinder block.

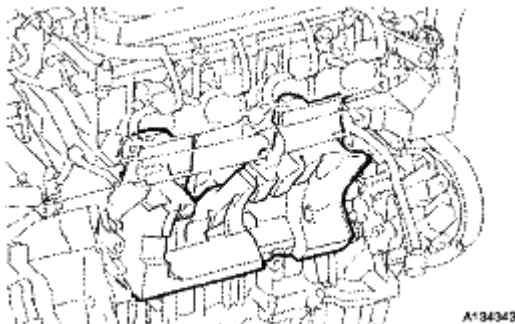


Fig. 266: Identifying Intake Manifold Insulator And Cylinder Block
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

20. INSTALL NO. 2 VENTILATION HOSE**21. INSTALL INTAKE MANIFOLD**

- a. Install a new gasket into the intake manifold.

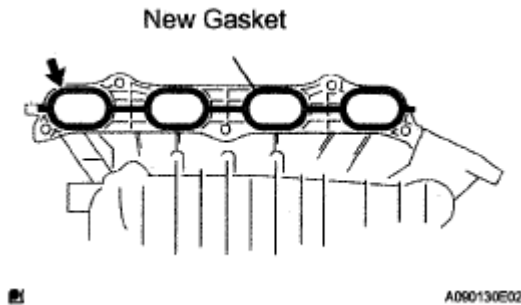


Fig. 267: Locating Intake Manifold Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the intake manifold with the 5 bolts and 2 nuts.

Torque: 30 N*m (305 kgf*cm, 22 ft.*lbf)

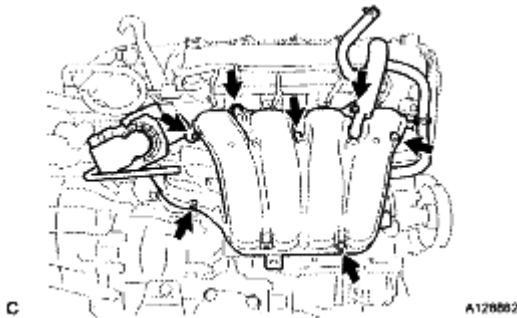


Fig. 268: Locating Intake Manifold, Bolts And Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

22. **INSTALL FUEL DELIVERY PIPE WITH INJECTOR** (See INSTALLATION)
23. **REMOVE ENGINE STAND**
24. **INSTALL FLYWHEEL SUB-ASSEMBLY** (See INSTALLATION)
25. **INSTALL TRANSMISSION INPUT DAMPER ASSEMBLY** (See INSTALLATION)
26. **INSTALL HYBRID VEHICLE TRANSAXLE ASSEMBLY**

HINT:

See INSTALLATION .

27. **INSTALL ENGINE WIRE**
28. **INSTALL FRONT DRIVE SHAFT ASSEMBLY LH** (See INSTALLATION)

29. INSTALL FRONT DRIVE SHAFT ASSEMBLY RH (See INSTALLATION)**30. INSTALL FRONT FRAME ASSEMBLY**

- a. Install the engine mounting insulators RH and LH with the 2 nuts.

Torque: 95 N*m (969 kgf*cm, 70 ft.*lbf)

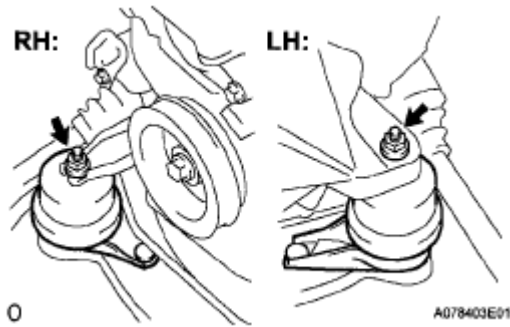


Fig. 269: Locating Front Frame Assembly Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the engine mounting insulator FR with the bolt.

Torque: 87 N*m (888 kgf*cm, 64 ft.*lbf)

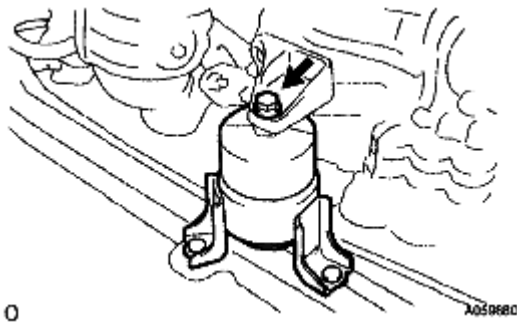


Fig. 270: Locating Engine Mounting Insulator FR With Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

31. INSTALL HV TRANSAXLE MASS DAMPER

- a. Install the bolt and transaxle mass damper.

Torque: 14 N*m (140 kgf*cm, 10 ft.*lbf)

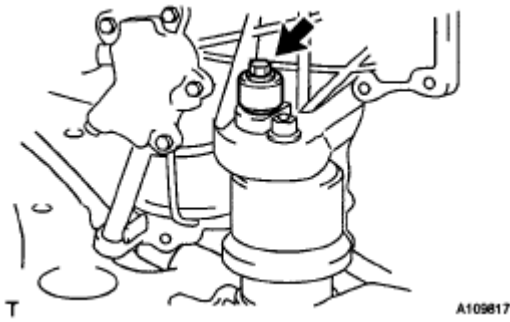


Fig. 271: Locating Transaxle Mass Damper Bolt
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

32. INSTALL ENGINE ASSEMBLY WITH TRANSAXLE

- a. Set the engine assembly with transaxle on the engine lifter.
- b. Install the engine assembly to the vehicle.
- c. Install the frame side plate LH and RH with the 4 bolts and 2 nuts.

Torque: Bolt A

85 N*m (867 kgf*cm, 63 ft.*lbf)

Bolt B and nut

32 N*m (326 kgf*cm, 24 ft.*lbf)

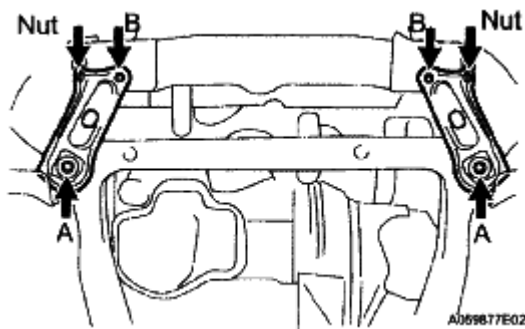


Fig. 272: Locating Engine Assembly, Nuts And Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Install the front suspension member brace rear RH and LH with the 4 bolts and 2 nuts.

Torque: Bolt C

85 N*m (867 kgf*cm, 63 ft.*lbf)

Bolt D and nut

32 N*m (326 kgf*cm, 24 ft.*lbf)

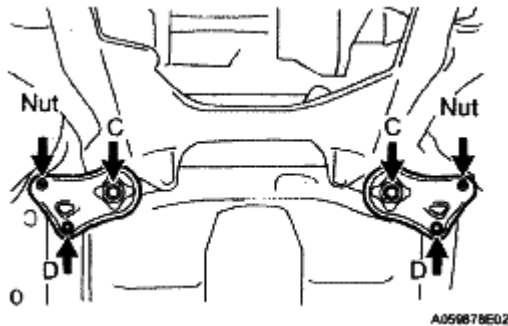


Fig. 273: Locating Front Suspension Member Brace Rear Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

33. **INSTALL STEERING INTERMEDIATE SHAFT ASSEMBLY** (See INSTALLATION)
34. **INSTALL NO. 1 EXHAUST PIPE SUPPORT BRACKET**
 - a. Install the No. 1 exhaust pipe support bracket with the 2 bolts.

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

35. **INSTALL FRONT AXLE ASSEMBLY LH** (See INSTALLATION)
36. **INSTALL FRONT AXLE ASSEMBLY RH**

HINT:

Use the same procedures described for the LH side.

37. **INSTALL FRONT SUSPENSION LOWER NO. 1 ARM LH** (See INSTALLATION)
38. **INSTALL FRONT SUSPENSION LOWER NO. 1 ARM RH**

HINT:

Use the same procedures described for the LH side.

39. **INSTALL TIE ROD ASSEMBLY LH** (See INSTALLATION)
40. **INSTALL TIE ROD ASSEMBLY RH**

HINT:

Use the same procedures described for the LH side.

41. **INSTALL FRONT SPEED SENSOR LH** (See INSTALLATION)
42. **INSTALL FRONT SPEED SENSOR RH**

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

43. INSTALL FRONT STABILIZER LINK ASSEMBLY LH (See INSTALLATION)**44. INSTALL FRONT STABILIZER LINK ASSEMBLY RH**

HINT:

Use the same procedures described for the LH side.

45. INSTALL FRONT AXLE HUB NUT LH (See INSTALLATION)**46. INSTALL FRONT AXLE HUB NUT RH**

HINT:

Use the same procedures described for the LH side.

47. INSTALL FRONT EXHAUST PIPE ASSEMBLY

HINT:

See INSTALLATION .

48. INSTALL COMPRESSOR AND MAGNETIC CLUTCH

- a. Temporarily install the compressor with the 3 bolts.
- b. Install the compressor with the 3 bolts by tightening the bolts in the order shown in the illustration.

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

NOTE: **Tighten the bolts in the order shown in the illustration to install the compressor.**

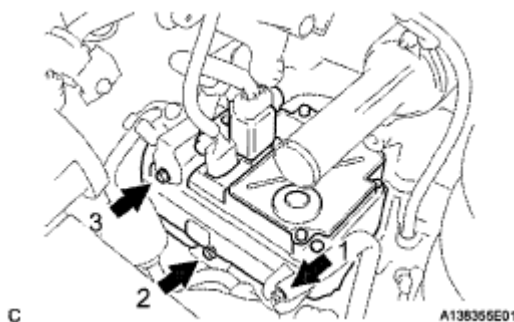
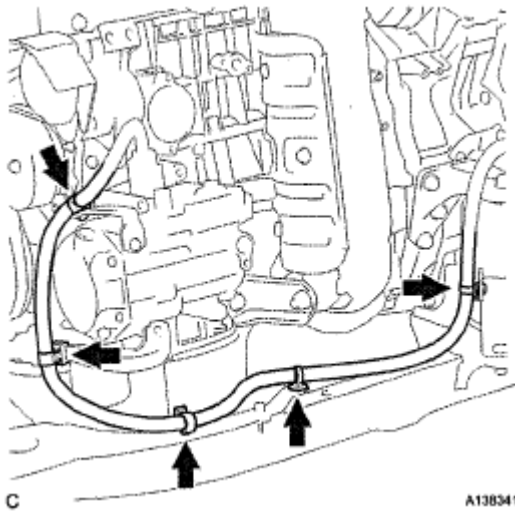


Fig. 274: Locating Compressor With Bolts

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

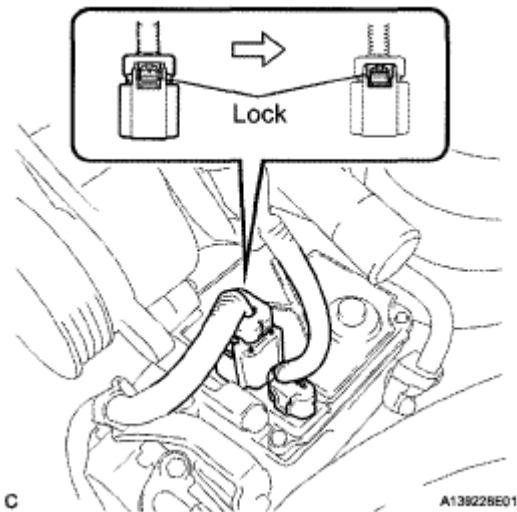
- c. Connect the No. 4 engine wire clamps.

CAUTION: Wear insulated gloves when performing the procedures.

**Fig. 275: Locating Engine Wire Clamps**

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

- d. Connect the 2 connectors.
- e. Lock the green-colored lock.

**Fig. 276: Identifying Green-Colored Lock**

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

49. CONNECT FUEL TUBE SUB-ASSEMBLY

- a. Push in the fuel tube connector to the fuel pipe until the connector makes a "click" sound.

NOTE:

- Check for damage or contamination on the connected part of the pipe.

- Check if the pipe and the connector are securely connected by trying to pull them apart.

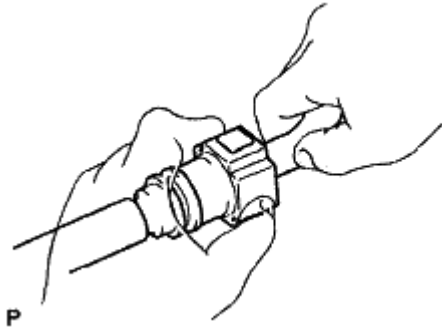


Fig. 277: Identifying Fuel Tube Connector To Fuel Pipe
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the No. 1 fuel pipe clamp.

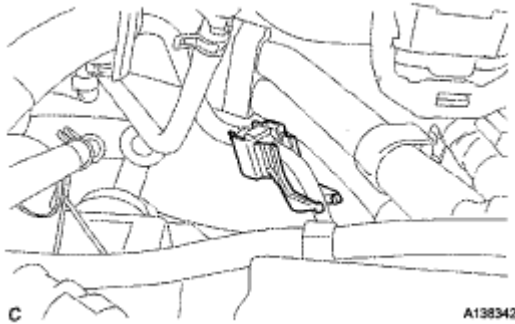


Fig. 278: Identifying Fuel Pipe Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

50. INSTALL TRANSMISSION CONTROL CABLE ASSEMBLY

- a. Install a new clip and nut, and connect the control lever.

Torque: 13 N*m (130 kgf*cm, 9 ft.*lbf)

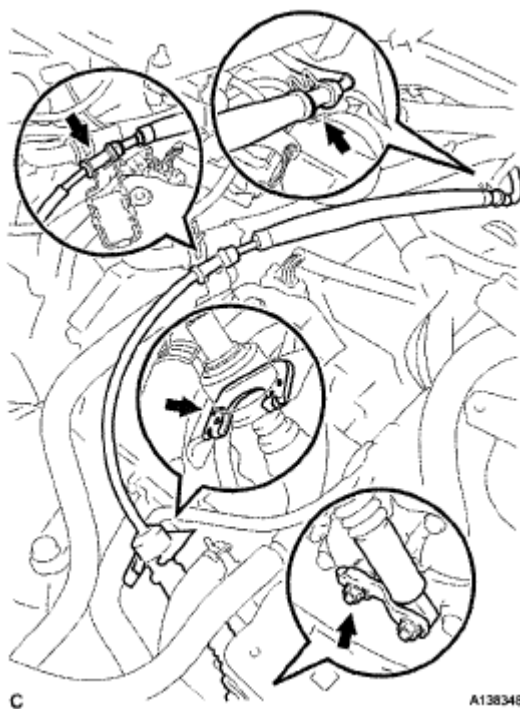


Fig. 279: Locating Control Lever, Clip And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Connect the cable to the 2 clamps.

51. CONNECT ENGINE WIRE

- a. Install the 2 bolts and power steering wire to the power steering link assembly.

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

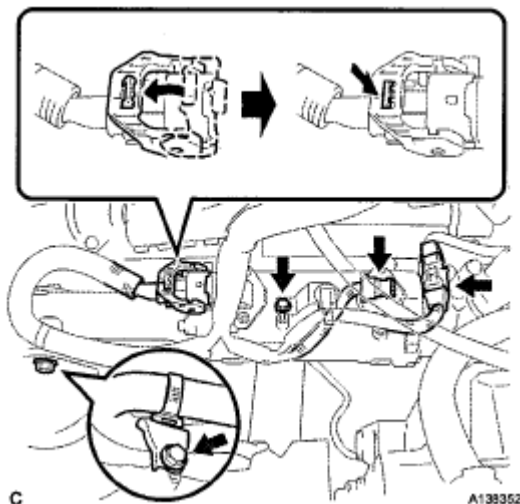


Fig. 280: Identifying Bolts And Power Steering Wire To Power Steering Link Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Connect the 3 wire harness connectors to the power steering link assembly and securely lock the connector.
- c. Connect the clamp to the bracket.

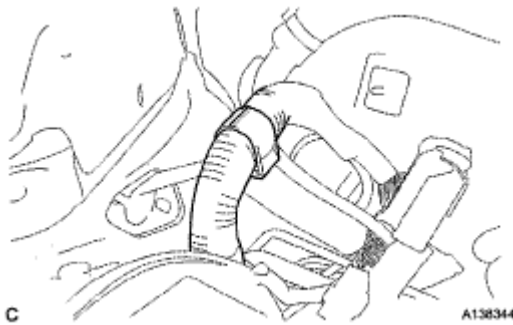


Fig. 281: Identifying Clamp And Bracket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Install the 2 bolts and clamp to the body.

Torque: 8.4 N*m (85 kgf*cm, 74 in.*lbf)

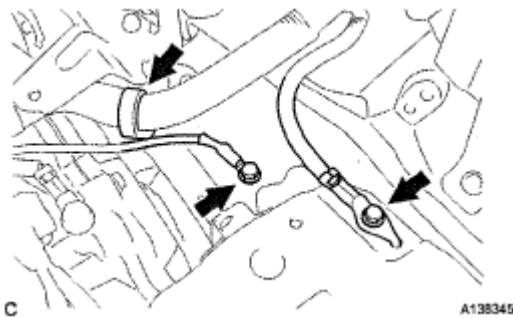


Fig. 282: Locating Clamp And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Connect the 3 connectors and 2 clamps to the engine room junction block.

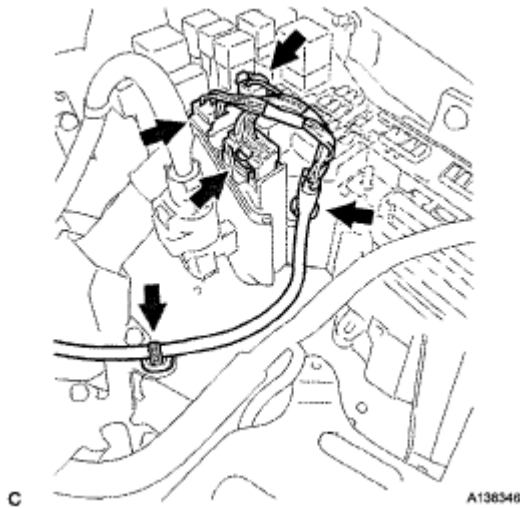


Fig. 283: Locating Clamps And Connectors Of Engine Wire Connectors
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Connect the wire to the engine room junction block. Then, install it with the nut and 3 connectors.

Torque: 8.4 N*m (85 kgf*cm, 74 in.*lbf)

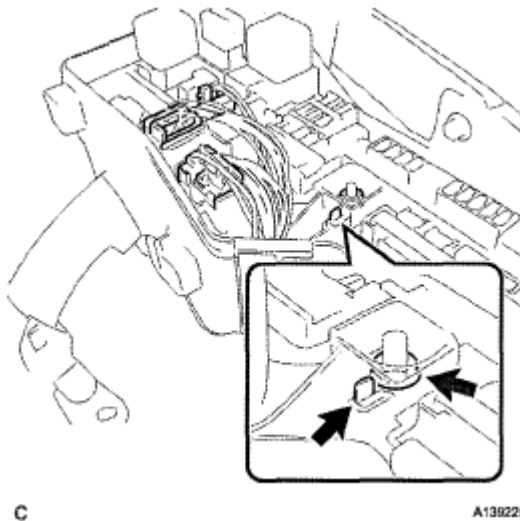


Fig. 284: Locating Engine Wire And Engine Room Relay Block
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

52. **INSTALL POWER STEERING ECU ASSEMBLY** (See **INSTALLATION**)
53. **INSTALL HYBRID VEHICLE CONTROL ECU** (See **INSTALLATION**)
54. **CONNECT HEATER INLET WATER HOSE**
a. Connect the heater inlet water hose.

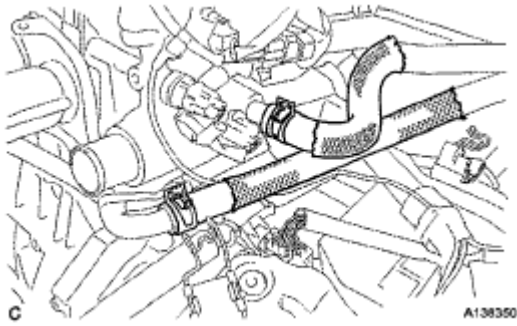


Fig. 285: Identifying Heater Outlet/Inlet Water Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

55. **CONNECT HEATER OUTLET WATER HOSE**
 - a. Connect the heater outlet water hose.
56. **CONNECT WATER HOSE**
 - a. Install the 2 clamps and connect the 2 water hoses.

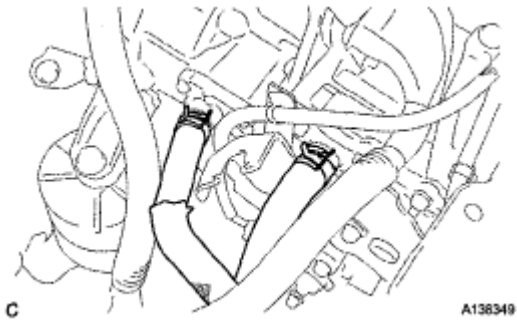


Fig. 286: Identifying Water Hoses And Clamps
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

57. **CONNECT RADIATOR HOSE INLET**
 - a. Install the clamp and connect the radiator hose inlet.

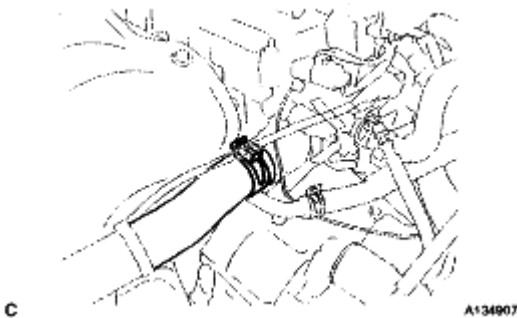


Fig. 287: Identifying Radiator Hose Inlet And Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

58. CONNECT RADIATOR HOSE OUTLET

- a. Install the clamp and connect the radiator hose outlet.



Fig. 288: Identifying Radiator Hose Outlet And Clamps
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

59. INSTALL NO. 2 ENGINE MOUNTING BRACKET RH

- a. Install the 3 bolts and No. 2 engine mounting bracket RH.

Torque: 52 N*m (531 kgf*cm, 38 ft.*lbf)

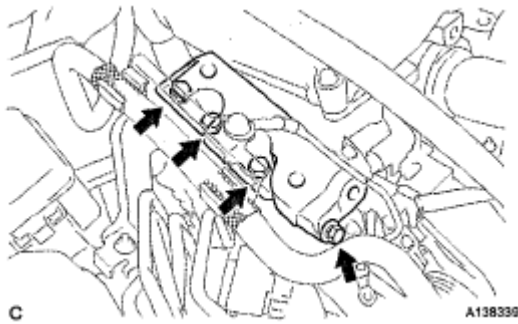


Fig. 289: Locating Engine Mounting Bracket RH And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the ground cable with the bolt.

Torque: 8.4 N*m (85 kgf*cm, 74 in.*lbf)

60. INSTALL ENGINE MOVING CONTROL ROD SUB-ASSEMBLY

- a. Install the engine moving control rod by tightening the 3 bolts in the order shown in the illustration.

Torque: 64 N*m (653 kgf*cm, 47 ft.*lbf)

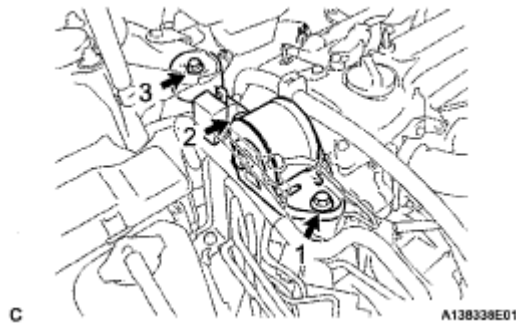


Fig. 290: Locating Engine Moving Control Rod Bolts With Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

61. INSTALL NO. 2 ENGINE MOUNTING STAY RH

- a. Install the No. 2 engine mounting stay RH with the 2 bolts.

Torque: 64 N*m (653 kgf*cm, 47 ft.*lbf)

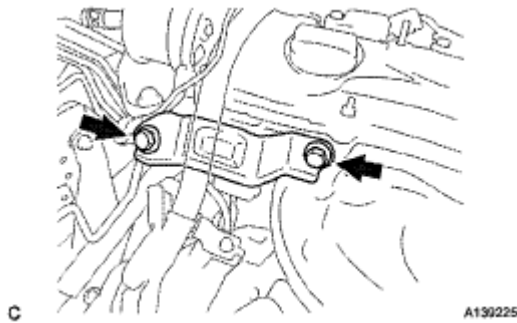


Fig. 291: Locating Engine Mounting Stay RH And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

62. INSTALL WATER WITH MOTOR AND BRACKET PUMP ASSEMBLY (See INSTALLATION)

63. INSTALL INVERTER TRAY BRACKET

- a. Install the inverter tray bracket with the 4 bolts.

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

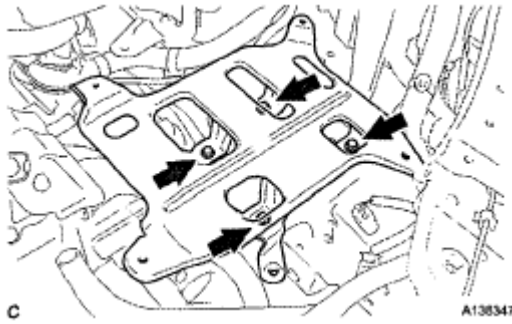


Fig. 292: Locating Inverter Tray Bracket And Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

64. INSTALL INVERTER WITH CONVERTER ASSEMBLY

HINT:

See INSTALLATION .

65. INSTALL AIR CLEANER CASE SUB-ASSEMBLY

- a. Install the air cleaner case with the 3 bolts.

Torque: 5.0 N*m (51 kgf*cm, 44 in.*lbf)

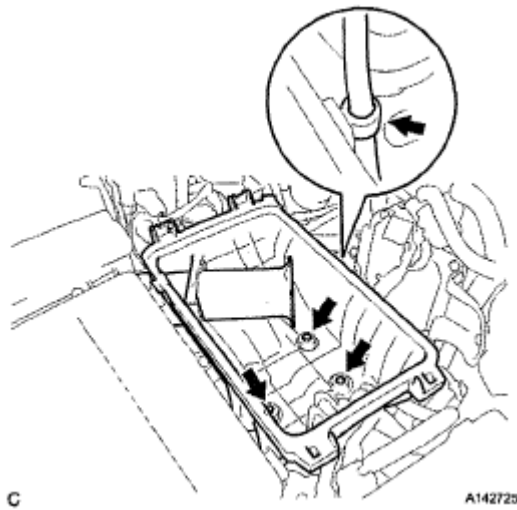


Fig. 293: Locating Air Cleaner Case And Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Connect the hose clamp.

66. INSTALL AIR CLEANER CAP SUB-ASSEMBLY (See INSTALLATION)

67. INSTALL AIR CLEANER INLET ASSEMBLY

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

Torque: 5.0 N*m (51 kgf*cm, 44 in.*lbf)

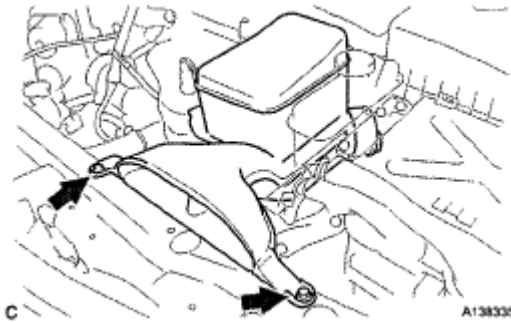


Fig. 294: Locating Clamp, Air Cleaner Inlet And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

68. **INSTALL V-RIBBED BELT** (See INSTALLATION)
69. **INSTALL V-RIBBED BELT TENSIONER COVER SUB-ASSEMBLY** (See INSTALLATION)
70. **INSTALL COWL TOP PANEL OUTER SUB-ASSEMBLY** (See INSTALLATION)
71. **INSTALL BRAKE MASTER CYLINDER RESERVOIR SUB-ASSEMBLY**
72. **INSTALL WINDSHIELD WIPER MOTOR AND LINK ASSEMBLY** (See INSTALLATION)
73. **INSTALL COWL TOP VENTILATOR LOUVER SUB-ASSEMBLY** (See INSTALLATION)
74. **INSTALL FRONT FENDER TO COWL SIDE SEAL LH** (See INSTALLATION)
75. **INSTALL FRONT FENDER TO COWL SIDE SEAL RH** (See INSTALLATION)
76. **INSTALL FRONT WIPER ARM AND BLADE ASSEMBLY LH** (See INSTALLATION)
77. **INSTALL FRONT WIPER ARM AND BLADE ASSEMBLY RH** (See INSTALLATION)
78. **INSTALL FRONT WHEEL**

Torque: 103 N*m (1,050 kgf*cm, 76 ft.*lbf)

79. **ADD ENGINE OIL**
80. **INSTALL SERVICE PLUG GRIP** (See INSTALLATION)
81. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**

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

82. **INSTALL LUGGAGE TRIM SERVICE HOLE COVER**
83. **ADD COOLANT (for Engine)** (See COOLANT (FOR ENGINE))
84. **ADD COOLANT (for Inverter)** (See REPLACEMENT)
85. **ADD AND INSPECT HYBRID TRANSAXLE FLUID** (See HYBRID TRANSAXLE FLUID)
86. **CHECK FOR FUEL LEAKS** (See ON-VEHICLE INSPECTION)
87. **CHECK FOR ENGINE OIL LEAKS**
88. **CHECK FOR COOLANT LEAKS (for Engine)** (See ON-VEHICLE INSPECTION)

- 89. **CHECK FOR COOLANT LEAKS (for Inverter)** (See COOLANT (FOR INVERTER))
- 90. **CHECK FOR EXHAUST GAS LEAKS**
- 91. **CHECK SHIFT LEVER POSITION** (See ADJUSTMENT)
- 92. **ADJUST FRONT WHEEL ALIGNMENT**

HINT:

See ADJUSTMENT .

- 93. **CHECK IGNITION TIMING** (See ENGINE)
- 94. **CHECK ENGINE IDLE SPEED** (See INSPECTION)
- 95. **INSPECT CO/HC** (See INSPECTION)
- 96. **INSTALL FRONT FENDER APRON SEAL RH**
- 97. **INSTALL ENGINE UNDER COVER LH**
- 98. **INSTALL ENGINE UNDER COVER RH**
- 99. **INSTALL NO. 1 ENGINE COVER SUB-ASSEMBLY**
 - a. Install the No. 1 engine cover with the 2 nuts.

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

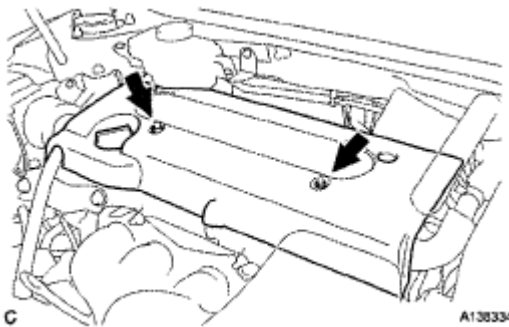


Fig. 295: Locating No. 1 Engine Cover Sub-Assembly Cover And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 100. **CHECK ABS SPEED SENSOR SIGNAL**

HINT:

See TEST MODE PROCEDURE .

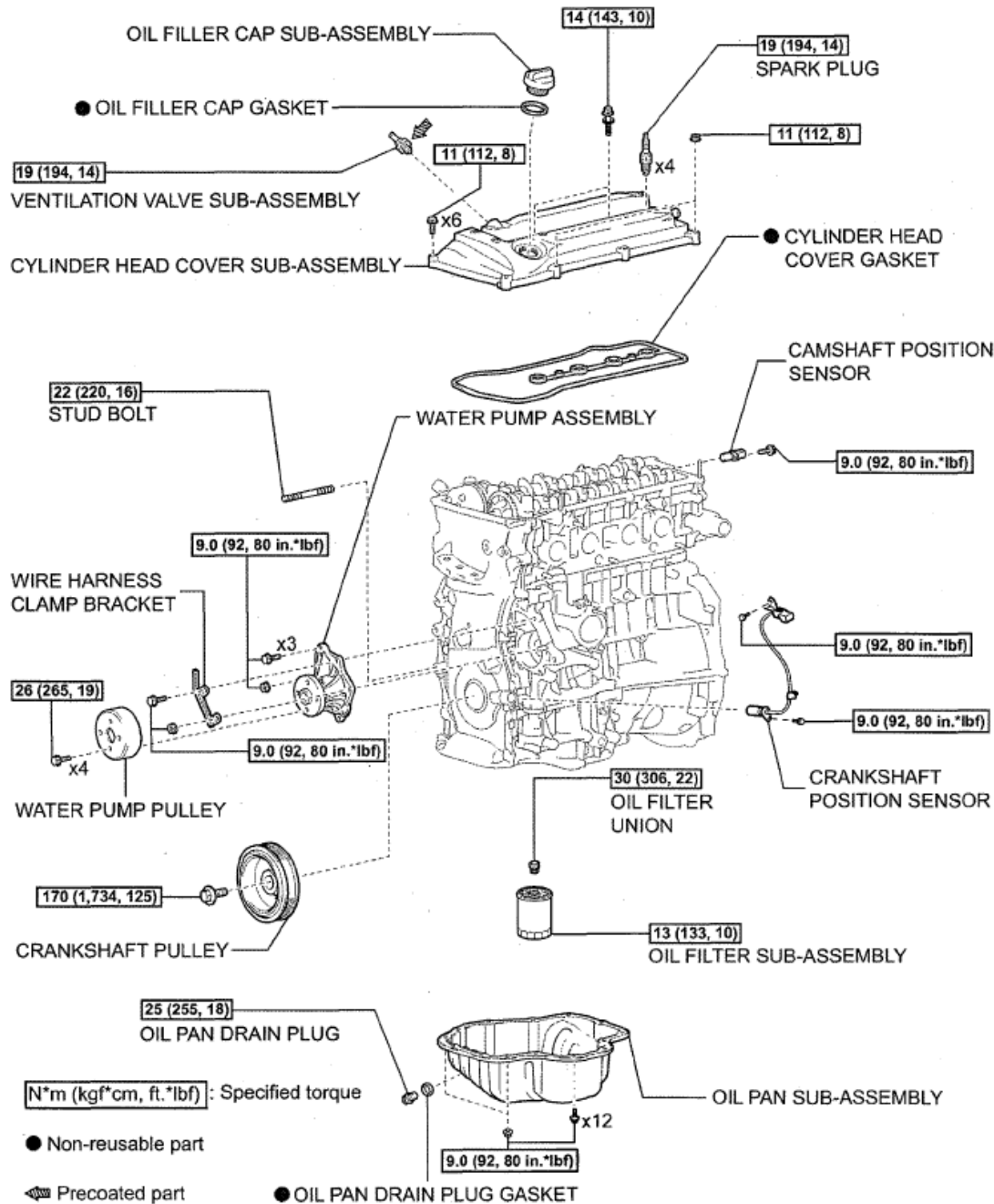
- 101. **PERFORM INITIALIZATION**
 - a. Perform initialization procedure (See INITIALIZATION).

HINT:

Some vehicle systems require initialization after reconnecting the cable to the negative battery terminal.

ENGINE UNIT

COMPONENTS



A139238E01

Fig. 296: Identifying Engine Unit Replacement Components With Torque Specifications (1 Of 5)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

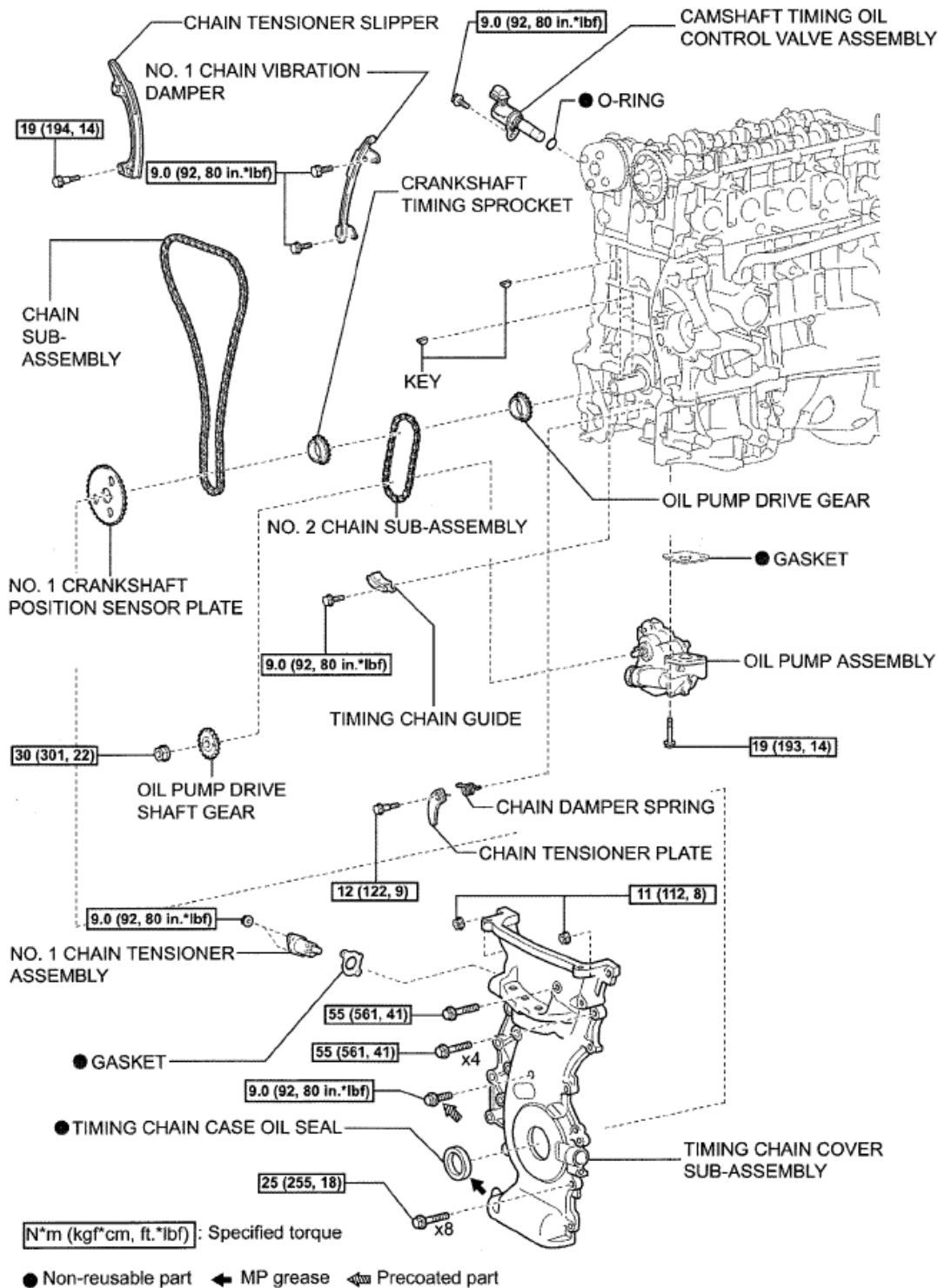


Fig. 297: Identifying Engine Unit Replacement Components With Torque Specifications (2 Of 5)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

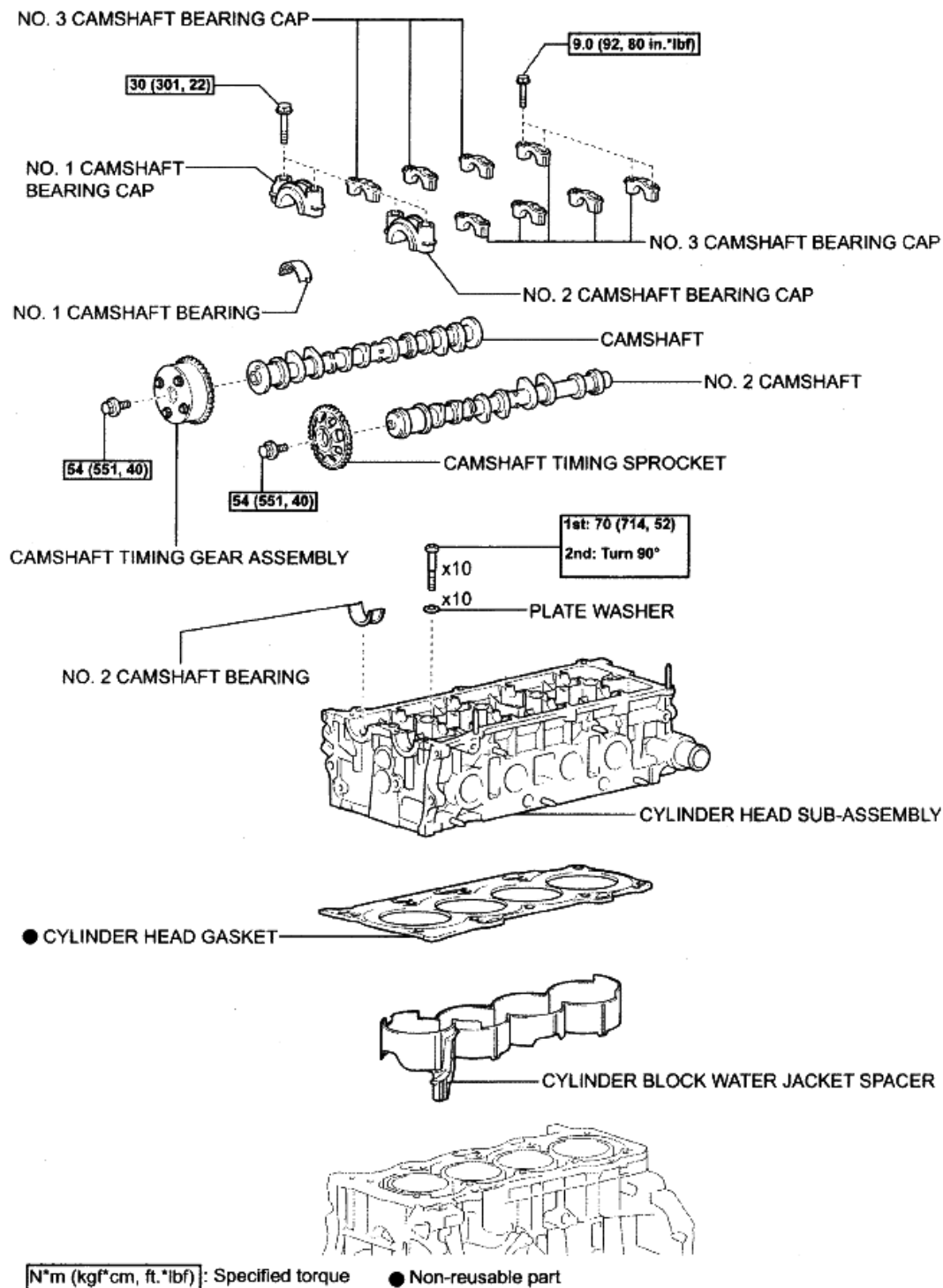
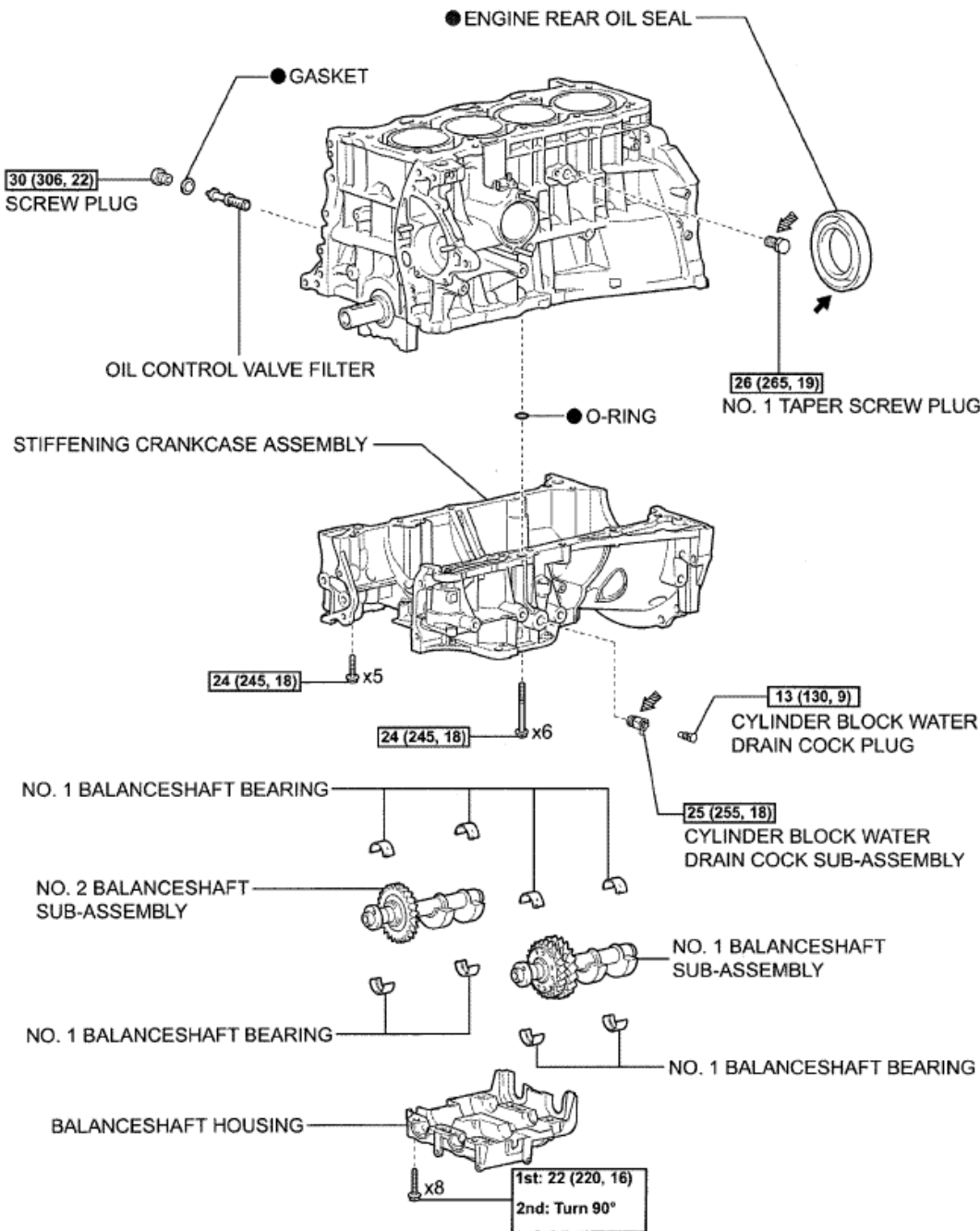


Fig. 298: Identifying Engine Unit Replacement Components With Torque Specifications (3 To 5)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2009 Toyota Camry LE

2009 ENGINE Engine Mechanical - Camry Hybrid

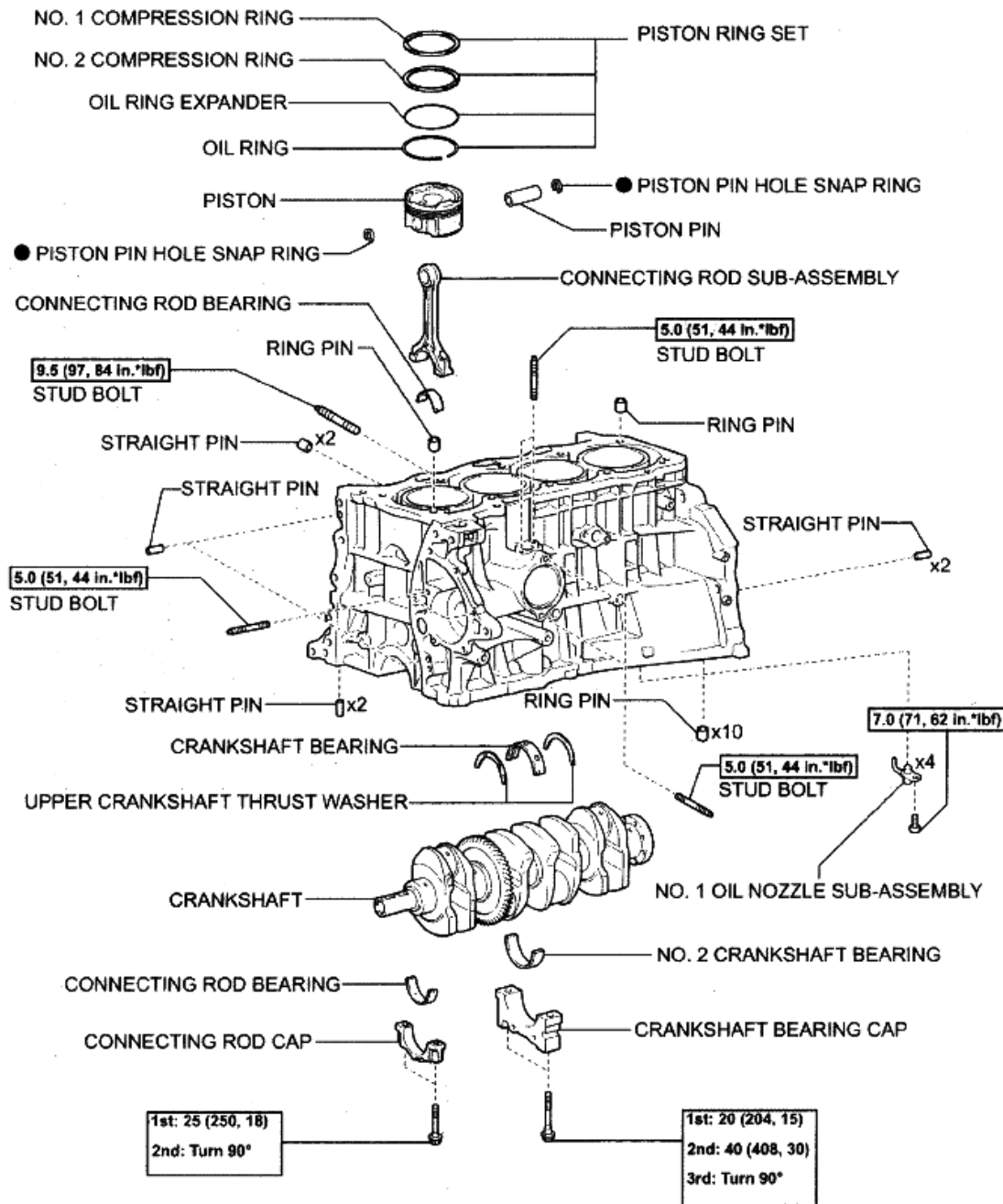


[N*m (kgf*cm, ft.*lbf)]: Specified torque

● Non-reusable part ← MP grease ← Precoated part

A135395E06

Fig. 299: Identifying Engine Unit Replacement Components With Torque Specifications (4 To 5)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



[N*m (kgf*cm, ft.*lbf)]: Specified torque ● Non-reusable part

A138396F01

Fig. 300: Identifying Engine Unit Replacement Components With Torque Specification (5 To 5)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DISASSEMBLY

1. REMOVE OIL FILLER CAP SUB-ASSEMBLY

- Remove the oil filler cap.

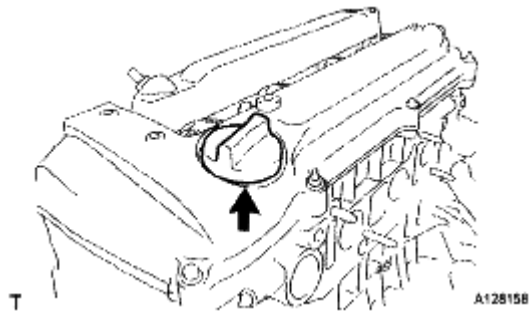


Fig. 301: Locating Oil Filler Cap

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

2. REMOVE OIL FILLER CAP GASKET

- a. Remove the oil filler cap gasket.

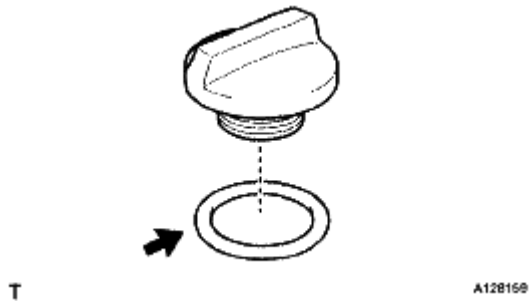


Fig. 302: Locating Gasket To Cap

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

3. REMOVE VENTILATION VALVE SUB-ASSEMBLY

- a. Remove the ventilation valve.

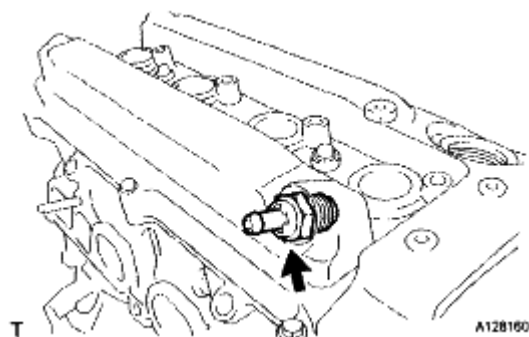


Fig. 303: Locating Ventilation Valve

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

4. REMOVE SPARK PLUG

- a. Remove the spark plugs.

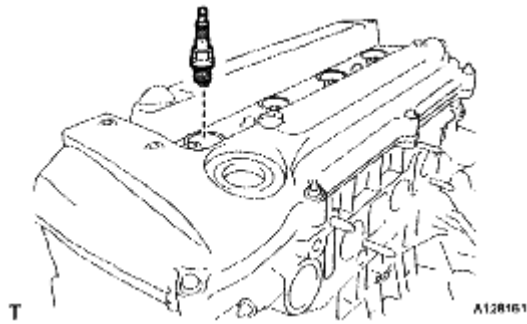


Fig. 304: Identifying Spark Plugs

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

5. REMOVE OIL FILTER SUB-ASSEMBLY

- a. Using SST, remove the oil filter.

SST 09228-06501

HINT:

Place a container for oil to be drained before removing the oil filter.

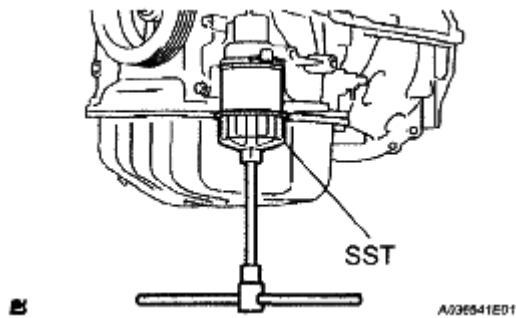


Fig. 305: Identifying Oil Filter With SST

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

6. REMOVE OIL FILTER UNION

- a. Using a 12 mm hexagon wrench, remove the union.

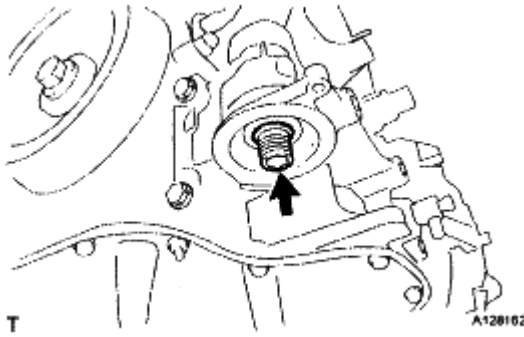


Fig. 306: Locating Oil Filter Union

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

7. **REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY** (See **REMOVAL**)
8. **REMOVE CYLINDER HEAD COVER GASKET**
 - a. Remove the cylinder head cover gasket.

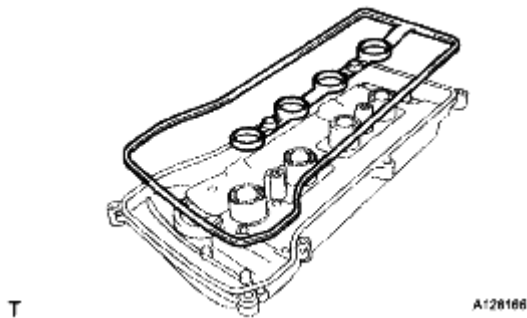


Fig. 307: Identifying Cylinder Head Cover Gasket

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

9. **REMOVE CRANKSHAFT POSITION SENSOR**
 - a. Remove the wire harness clamp.
 - b. Separate the wire harness from the wire harness clamp bracket.

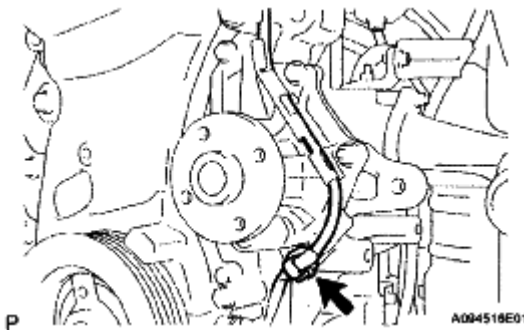


Fig. 308: Locating Clamp Of Crankshaft Position Sensor From Water Pump

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

- c. Remove the 2 bolts and sensor.

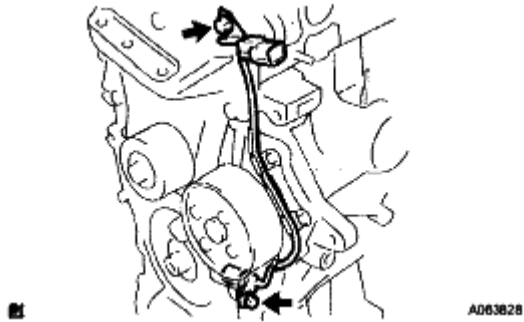


Fig. 309: Locating Sensor And Bolts

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

10. REMOVE CAMSHAFT POSITION SENSOR

- a. Remove the bolt and sensor.

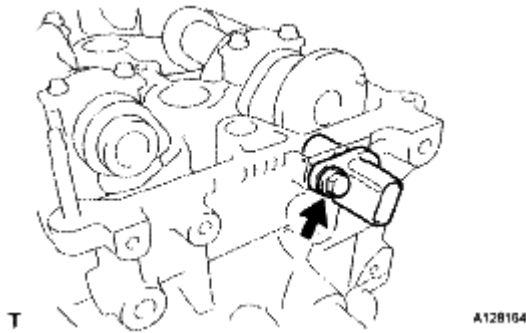


Fig. 310: Locating Sensor And Bolts

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

11. REMOVE CRANKSHAFT PULLEY (See REMOVAL)
12. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (See REMOVAL)
13. REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY (See REMOVAL)
14. REMOVE WATER PUMP PULLEY (See REMOVAL)
15. REMOVE WATER PUMP ASSEMBLY (See REMOVAL)
16. REMOVE OIL PAN DRAIN PLUG
 - a. Remove the oil pan drain plug and gasket.

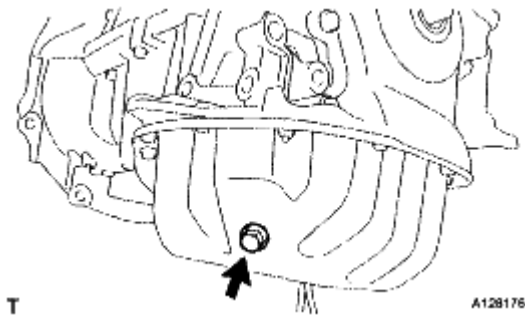


Fig. 311: Locating Oil Pan Drain Plug

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

17. REMOVE OIL PAN SUB-ASSEMBLY (See REMOVAL)
18. REMOVE TIMING CHAIN COVER SUB-ASSEMBLY (See REMOVAL)
19. REMOVE TIMING CHAIN CASE OIL SEAL
 - a. Using a screwdriver and hammer, remove the oil seal.

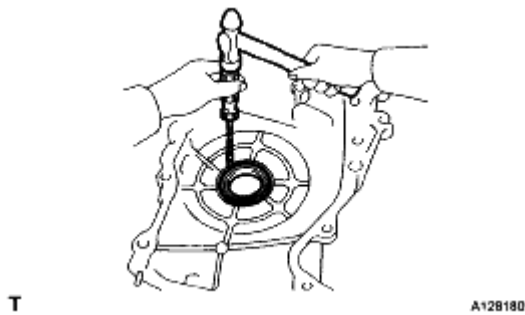


Fig. 312: Identifying Timing Chain Case Oil Seal

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

20. REMOVE NO. 1 CRANKSHAFT POSITION SENSOR PLATE (See REMOVAL)
21. REMOVE TIMING CHAIN GUIDE (See REMOVAL)
22. REMOVE CHAIN TENSIONER SLIPPER (See REMOVAL)
23. REMOVE NO. 1 CHAIN VIBRATION DAMPER (See REMOVAL)
24. REMOVE CHAIN SUB-ASSEMBLY (See REMOVAL)
25. REMOVE CRANKSHAFT TIMING SPROCKET (See REMOVAL)
26. REMOVE NO. 2 CHAIN SUB-ASSEMBLY (See REMOVAL)
27. REMOVE KEYS
 - a. Remove the 2 pulley set keys from the crankshaft.

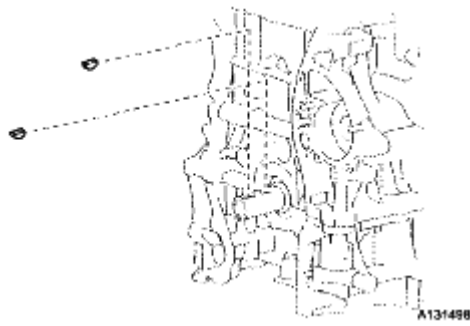


Fig. 313: Identifying Pulley Set Keys And Crankshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

28. REMOVE NO. 2 CAMSHAFT

- a. Using several steps, uniformly loosen and remove the 10 bearing cap bolts in the sequence shown in the illustration.

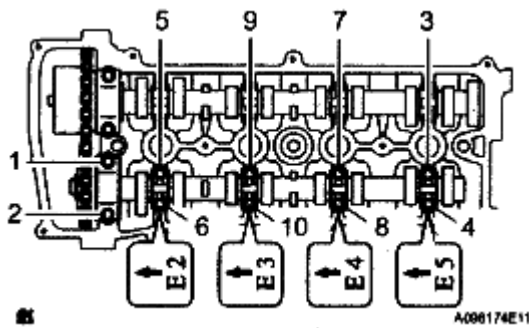


Fig. 314: Identifying Bearing Cap Bolts Loosening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the 5 bearing caps.

29. REMOVE CAMSHAFT

- a. Using several steps, uniformly loosen and remove the 10 bearing cap bolts in the sequence shown in the illustration.

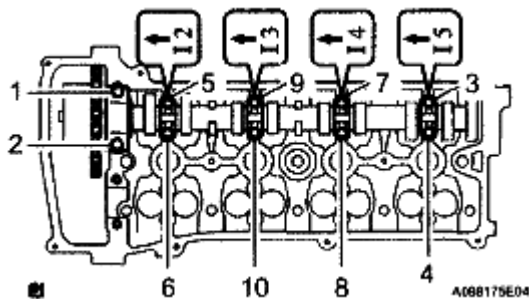


Fig. 315: Identifying Bearing Cap Bolts In Loosening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the 5 bearing caps.

30. REMOVE NO. 1 CAMSHAFT BEARING

Remove the No. 1 camshaft bearing.

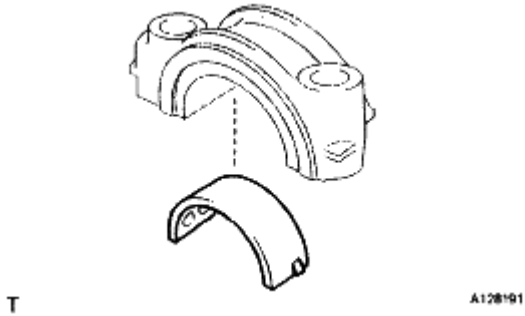


Fig. 316: Identifying Camshaft Bearing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

31. REMOVE NO. 2 CAMSHAFT BEARING

- a. Remove the No. 2 camshaft bearing.

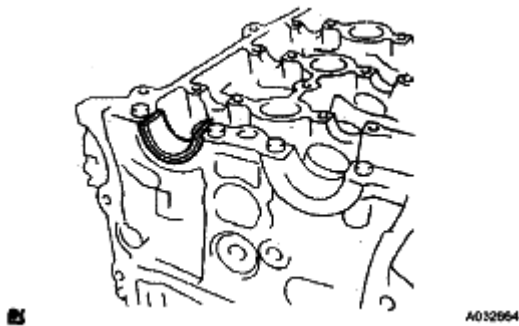


Fig. 317: Identifying Camshaft Bearing Location
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

32. REMOVE CAMSHAFT TIMING SPROCKET

- a. Clamp the camshaft in a vise.

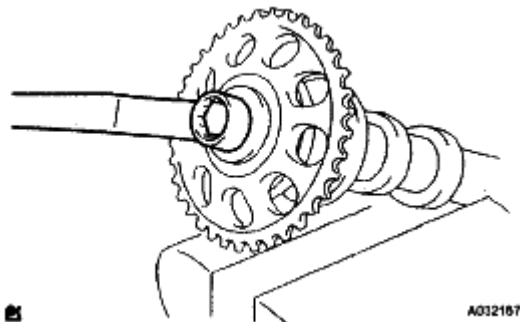


Fig. 318: Identifying Camshaft With Vise

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

- b. Remove the flange bolt of the camshaft timing sprocket.
- 33. **REMOVE CAMSHAFT TIMING GEAR ASSEMBLY** (See **REMOVAL**)
- 34. **REMOVE CYLINDER HEAD SUB-ASSEMBLY** (See **REMOVAL**)
- 35. **REMOVE CYLINDER HEAD GASKET** (See **REMOVAL**)
- 36. **REMOVE CYLINDER BLOCK WATER JACKET SPACER**
 - a. Using needle-nose pliers, remove the cylinder block water jacket spacer.

NOTE: Be sure to remove the water jacket spacer if the cylinder block is to be turned upside down.

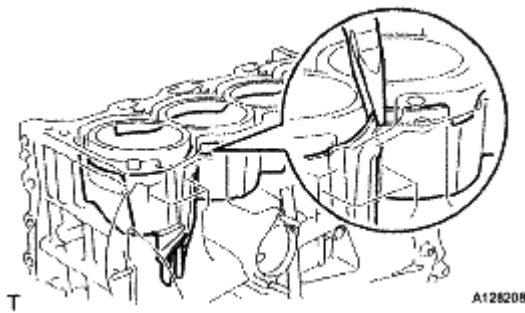


Fig. 319: Identifying Cylinder Block Water Jacket Spacer

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

- 37. **REMOVE CYLINDER BLOCK WATER DRAIN COCK SUB-ASSEMBLY**
 - a. Remove the water drain cock from the stiffening crankcase.
 - b. Remove the water drain cock plug from the water drain cocks.

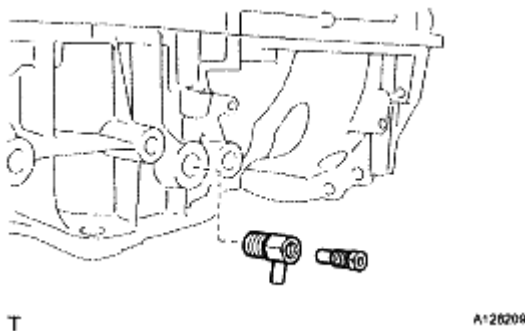


Fig. 320: Identifying Cylinder Block Water Drain Cock Sub-Assembly

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

- 38. **REMOVE OIL CONTROL VALVE FILTER**
 - a. Using an 8 mm socket hexagon wrench, remove the plug and filter.

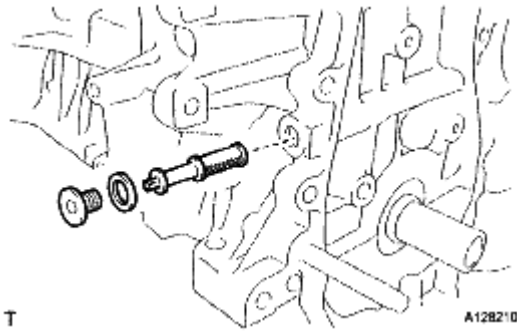


Fig. 321: Identifying Plug And Filter

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

39. REMOVE NO. 1 TAPER SCREW PLUG

- a. Remove the No. 1 taper screw plug.

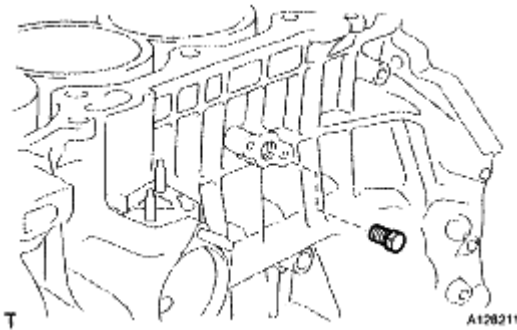


Fig. 322: Identifying Taper Screw Plug

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

40. REMOVE OIL PUMP ASSEMBLY

- a. Remove the 3 bolts, oil pump and gasket.

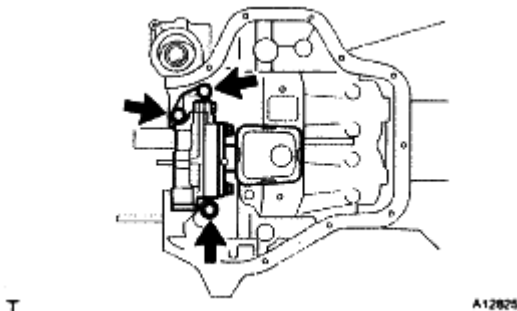


Fig. 323: Locating Oil Pump And Bolts

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

41. REMOVE NO. 1 AND NO. 2 BALANCE SHAFT SUB-ASSEMBLY

- a. Uniformly loosen and remove the 8 bolts in the sequence shown in the illustration.

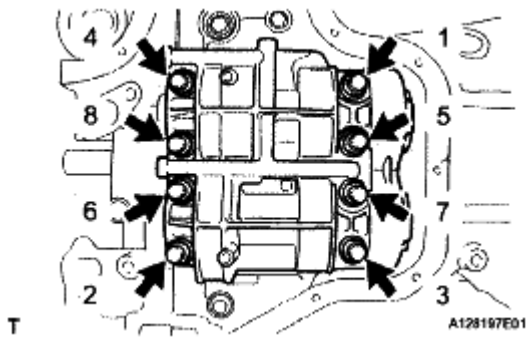


Fig. 324: Locating No. 1 And No. 2 Balanceshaft Sub-Assembly Bolts Loosening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the No. 1 and No. 2 balanceshafts.

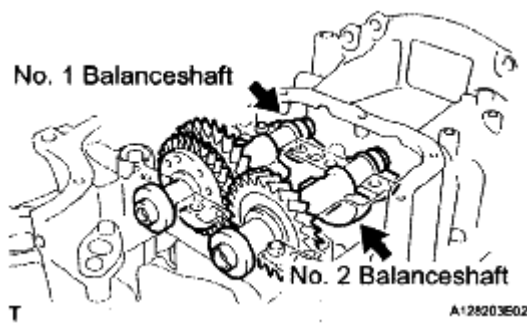
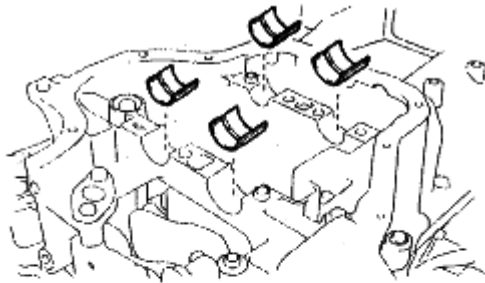


Fig. 325: Locating Balanceshafts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

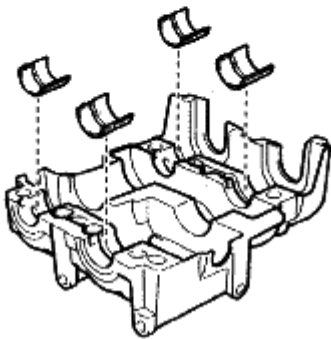
42. REMOVE NO. 1 BALANCESHAFT BEARING

- a. Remove the No. 1 balanceshaft bearings.

Stiffening Crankcase:



Balanceshaft Housing:



T

A12B204E02

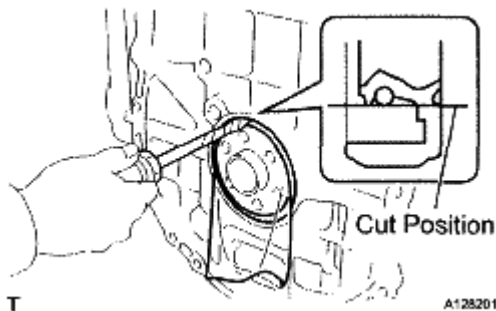
Fig. 326: Identifying Balanceshaft Bearings

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

43. REMOVE ENGINE REAR OIL SEAL

- a. Using a knife, cut off the oil seal lip.
- b. Using a screwdriver with its tip taped, pry out the oil seal.

NOTE: After removing the oil seal, check the crankshaft for damage. If it is damaged, smooth the surface with 400-grit sandpaper.



T

A12B201E01

Fig. 327: Identifying Engine Rear Oil Seal

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

44. REMOVE STIFFENING CRANKCASE ASSEMBLY

- a. Uniformly loosen and remove the 11 bolts in the sequence shown in the illustration.

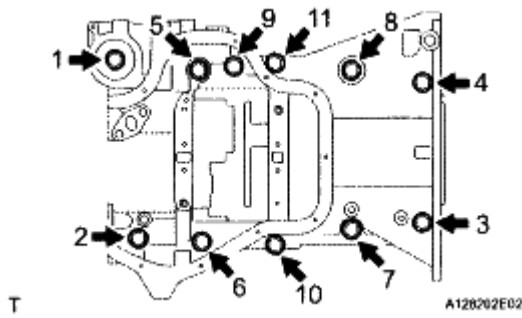


Fig. 328: Locating Stiffening Crankcase Bolt Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

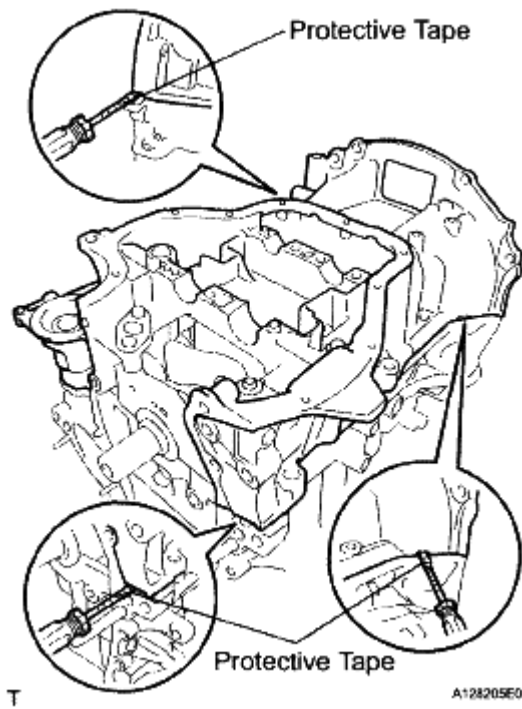


Fig. 329: Identifying Crankcase And Cylinder Block
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Remove the O-ring from the cylinder block.

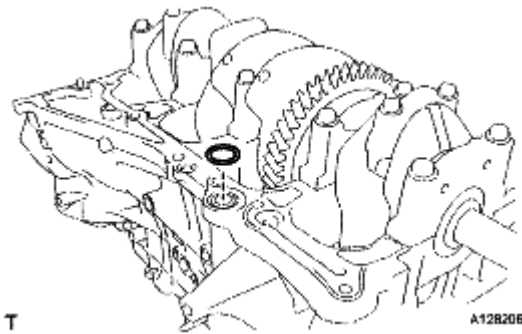


Fig. 330: Identifying O-Ring From Cylinder Block
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

45. REMOVE PISTON SUB-ASSEMBLY WITH CONNECTING ROD

- a. Using a ridge reamer, remove all the carbon from the top of the cylinder.

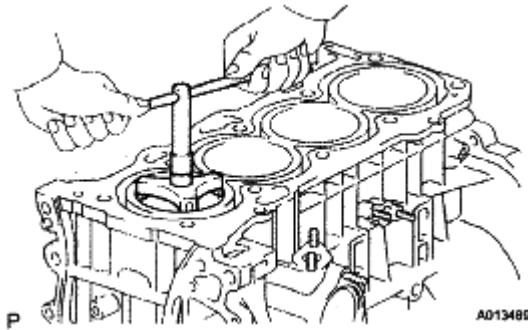


Fig. 331: Identifying Carbon From Top Of Cylinder
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Check that the matchmarks on the connecting rod and cap are aligned to ensure correct reassembly.

HINT:

The matchmarks on the connecting rods and caps are provided to ensure correct reassembly.

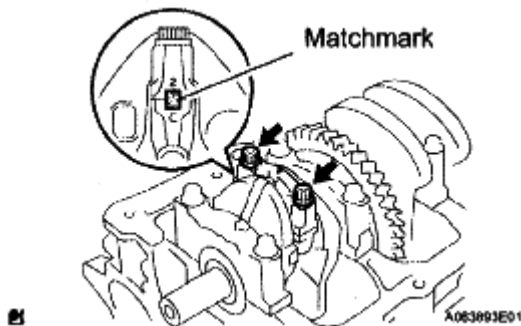


Fig. 332: Identifying Matchmark On Connecting Rod And Cap

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

- c. Using a 12 mm socket wrench, uniformly loosen the 2 bolts.
- d. Using the 2 removed connecting rod cap bolts, remove the connecting rod cap and lower bearing by wiggling the connecting rod cap right and left.

HINT:

Keep the lower bearing inserted in the connecting rod cap.

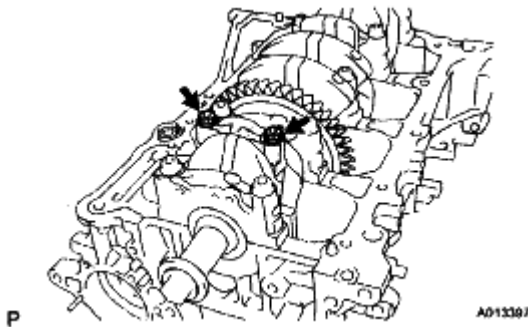


Fig. 333: Locating Connecting Rod Cap Bolts

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

- e. Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

HINT:

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

46. REMOVE CONNECTING ROD BEARING

- a. Remove the connecting rod bearings.

HINT:

Arrange the removed parts in the correct order.

47. REMOVE PISTON RING SET

- a. Using a piston ring expander, remove the 2 compression rings.

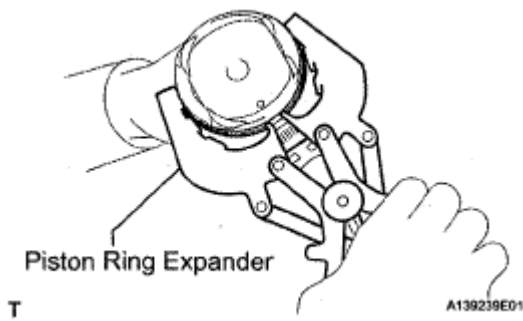


Fig. 334: View Of Piston Ring With Piston Ring Expander
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the oil ring rail and oil ring expander by hand.

HINT:

Arrange the removed parts in the correct order.

48. REMOVE PISTON PIN HOLE SNAP RING

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

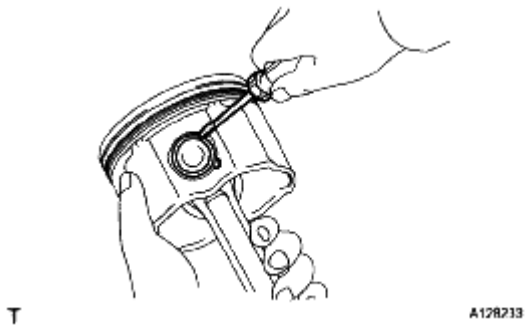


Fig. 335: View Of Piston Pin Hole Snap Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

49. REMOVE PISTON

- a. Gradually heat each piston to approximately 80 to 90°C(176 to 194°F).

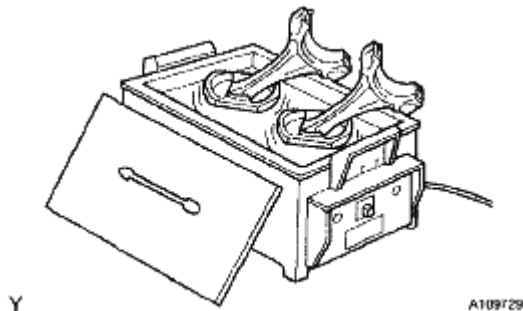


Fig. 336: View Of Heating Piston

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

- b. Using a plastic 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.

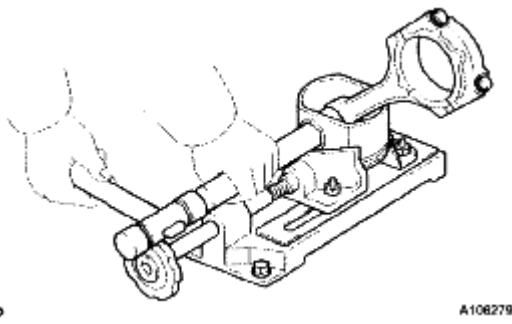


Fig. 337: Identifying Connecting Rod

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

50. REMOVE CRANKSHAFT

- a. Uniformly loosen and remove the 10 main bearing cap bolts in the sequence shown in the illustration.

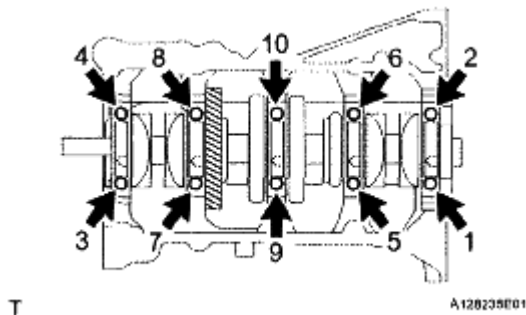


Fig. 338: Locating Main Bearing Cap Bolts Location

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

- b. Use 2 removed main bearing cap bolts to remove the 5 main bearing caps and 5 lower bearings.

NOTE: Insert the bolts into the caps in turn. Ease the cap out by gently pulling up and applying force toward the front and back sides of the cylinder block, as shown in the illustration. Take care not to damage the contact surfaces of the cap and cylinder block.

HINT:

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

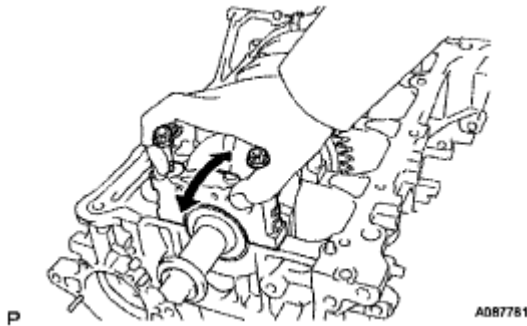


Fig. 339: Identifying Bearing Cap Bolts To Remove Main Bearing Caps And Lower Bearings.
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Lift out the crankshaft.

51. REMOVE UPPER CRANKSHAFT THRUST WASHER

- a. Remove the upper crankshaft thrust washers from the cylinder block.

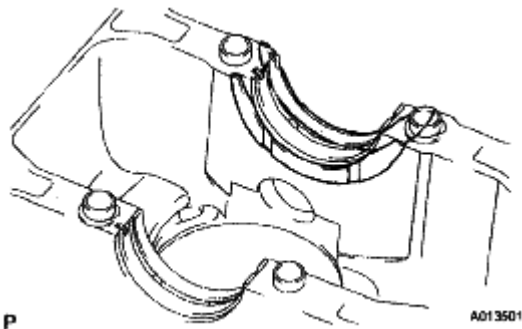


Fig. 340: Identifying Crankshaft Thrust Washer Upper
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

52. REMOVE CRANKSHAFT BEARING

- a. Remove the 5 upper main bearings from the cylinder block.

HINT:

Arrange the bearings in the correct order.

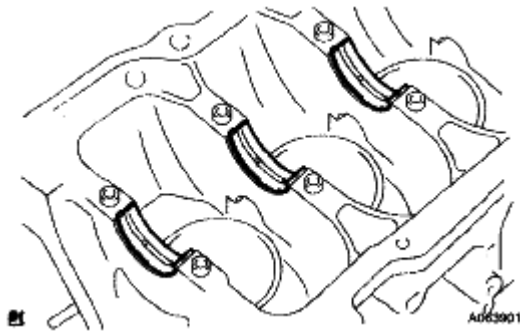


Fig. 341: Identifying Crankshaft Bearing Caps

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

53. REMOVE NO. 2 CRANKSHAFT BEARING

- a. Remove the 5 lower main bearings from the 5 main bearing caps.

HINT:

Arrange the bearings in the correct order.

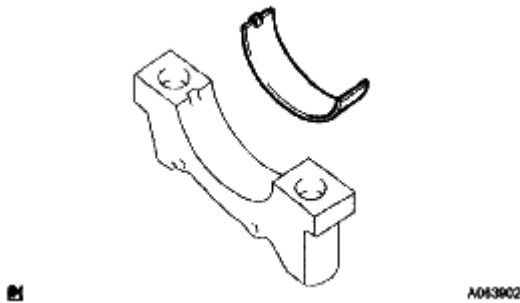


Fig. 342: Identifying Lower Main Bearings And Main Bearing Caps

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

54. REMOVE STUD BOLT

55. REMOVE NO. 1 OIL NOZZLE SUB-ASSEMBLY

- a. Using a 5 mm hexagon wrench, remove the bolts and oil nozzles.

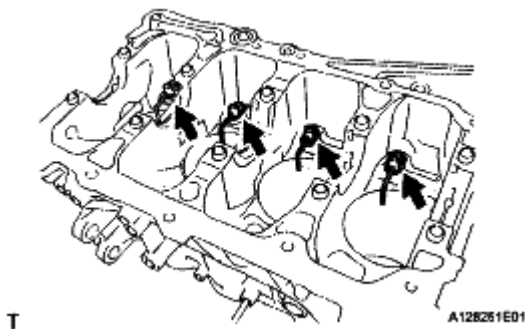


Fig. 343: Locating Oil Nozzles And Bolts

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

56. CLEAN CYLINDER BLOCK

NOTE: If the cylinder is washed at high temperatures, the cylinder liner will stick out beyond the cylinder block. Always wash the cylinder block at a temperature of 45°C (113°F) or less.

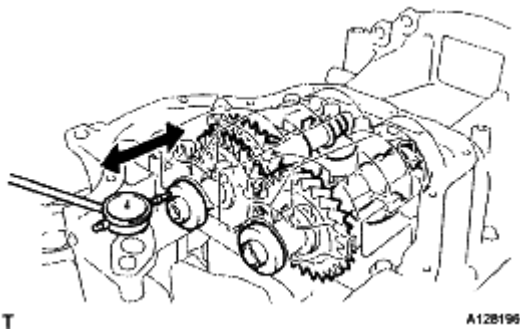
INSPECTION**1. INSPECT BALANCESHAFT THRUST CLEARANCE**

- Install the balanceshafts (See **REASSEMBLY**).
- Using a dial indicator, measure the thrust clearance while moving the balanceshaft back and forth.

Standard thrust clearance: 0.05 to 0.09 mm (0.0020 to 0.0035 in.)

Maximum thrust clearance: 0.09 mm (0.0035 in.)

If the thrust clearance is greater than the maximum, replace the balanceshaft housing and bearings. If necessary, replace the balanceshaft.

**Fig. 344: View Of Balance Shaft Thrust Clearance**

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

2. INSPECT BALANCESHAFT OIL CLEARANCE

- Clean each bearing and journal.
- Check each bearing and journal for pitting and scratches.

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

- Place the No. 1 and No. 2 balanceshafts onto the crankcase. (See **REASSEMBLY**)
- Lay a strip of Plastigage across each journal.

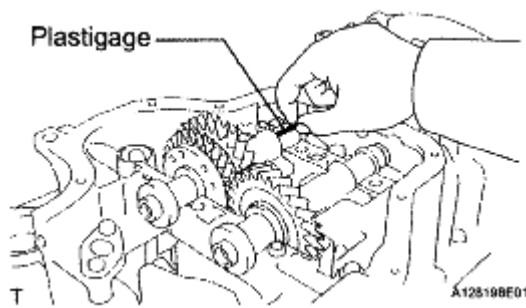


Fig. 345: Laying Strip Of Plastigage

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

- e. Install the balancer shaft housing (See **REASSEMBLY**).

NOTE: Do not turn the balancer shafts.

- f. Remove the balancer shafts (See **DISASSEMBLY**).

- g. Measure the Plastigage at its widest point.

Standard oil clearance: 0.004 to 0.049 mm (0.0002 to 0.0019 in.)

Maximum oil clearance: 0.049 mm (0.0019 in.)

NOTE: Remove the Plastigage completely after the measurement.

If the oil clearance is greater than the maximum, replace the bearing. If necessary, replace the balancer shaft.

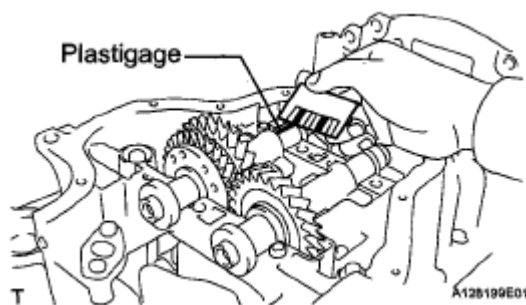


Fig. 346: View Of Measuring Plastigage On Widest Point

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

- h. If replacing a bearing, select a new one with the same number.

Standard balancer shaft housing journal bore diameter

ITEM SPECIFIED CONDITION CHART

--	--

Item	Specified Condition
Mark 1	26.000 to 26.006 mm (1.0236 to 1.0239 in.)
Mark 2	26.007 to 26.012 mm (1.0239 to 1.0241 in.)
Mark 3	26.013 to 26.018 mm (1.0241 to 1.0243 in.)

Standard bearing center wall thickness

ITEM SPECIFIED CONDITION CHART

Item	Specified Condition
Mark 1	1.486 to 1.489 mm (0.05850 to 0.05862 in.)
Mark 2	1.490 to 1.492 mm (0.05866 to 0.05874 in.)
Mark 3	1.493 to 1.495 mm (0.0588 to 0.0589 in.)

Standard balancershaft journal diameter

ITEM SPECIFIED CONDITION CHART

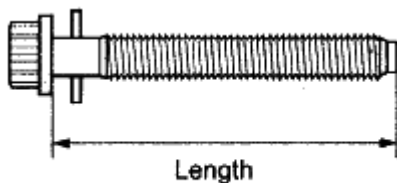
Item	Specified Condition
Mark 1	22.985 to 23.000 mm (0.9049 to 0.9055 in.)
Mark 2	22.985 to 23.000 mm (0.9049 to 0.9055 in.)
Mark 3	22.985 to 23.000 mm (0.9049 to 0.9055 in.)

- i. Inspect the balancershaft housing bolts.
 1. Using vernier calipers, measure the length of the bolts from the seat to the end.

Standard bolt length: 58.3 to 59.7 mm (2.295 to 2.350 in.)

Maximum bolt length: 60.3 mm (2.374 in.)

If the bolt length is greater than the maximum, replace the balancershaft housing bolt.



A131575E01

Fig. 347: Identifying Length Of Bolts From Seat To End
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. INSPECT CHAIN SUB-ASSEMBLY

- a. Pull the chain with a force of 140 N (14.3 kgf, 31.5 lbf) as shown in the illustration.
- b. Using vernier calipers, measure the length of 15 links.

Maximum chain elongation: 114.5 mm (4.508 in.)

NOTE: Perform the measurement at 3 random places. Use the average of the measurements.

If the average elongation is greater than the maximum, replace the chain.

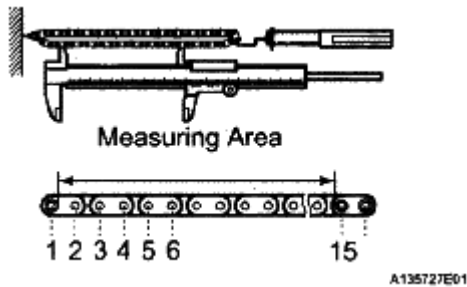


Fig. 348: Identifying Chain Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. INSPECT NO. 2 CHAIN SUB-ASSEMBLY

- Pull the chain with a force of 140 N (14.3 kgf, 31.5 lbf) as shown in the illustration.
- Using vernier calipers, measure the length of 15 links.

Maximum chain elongation: 102.2 mm (4.024 in.)

NOTE: Perform the measurement at 3 random places. Use the average of the measurements.

If the average elongation is greater than the maximum, replace the No. 2 chain.

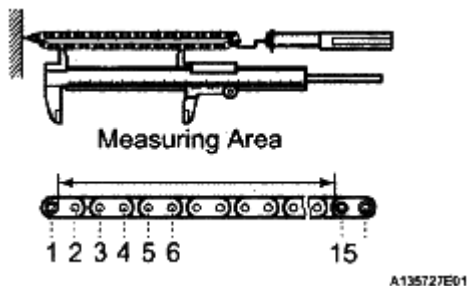


Fig. 349: Identifying Chain Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. INSPECT OIL PUMP DRIVE GEAR

- place the chain around the gear.
- Using vernier calipers, measure the diameter of the gear and chain.

Minimum gear diameter (with chain): 48.2 mm (1.898 in.)

NOTE: The vernier calipers must be in contact with the chain rollers when measuring.

If the diameter is less than the minimum, replace the chain and gear.

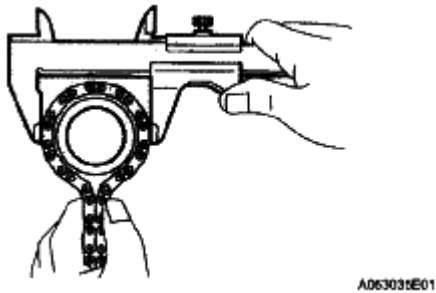


Fig. 350: Identifying Drive Gear Diameter With Chain
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. INSPECT OIL PUMP DRIVE SHAFT GEAR

- a. Place the chain around the gear.
- b. Using vernier calipers, measure the diameter of the gear and chain.

Minimum gear diameter (with chain): 48.2 mm (1.898 in.)

NOTE: The vernier calipers must be in contact with the chain rollers when measuring.

If the diameter is less than the minimum, replace the chain and gear.

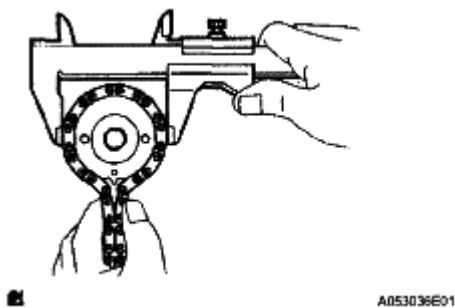


Fig. 351: Identifying Diameter Of Gear And Chain
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. INSPECT CAMSHAFT TIMING GEAR ASSEMBLY

- a. Place the chain around the timing gear.
- b. Using vernier calipers, measure the diameter the timing gear and chain.

Minimum gear diameter (with chain): 97.3 mm (3.831 in.)

NOTE: The vernier calipers must be in contact with the chain rollers when measuring.

If the diameter is less than the minimum, replace the chain and gear.

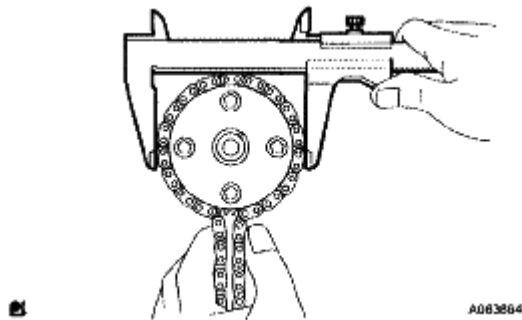


Fig. 352: Identifying Diameter Timing Gear And Chain
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. INSPECT CAMSHAFT TIMING SPROCKET

- a. Place the chain around the sprocket.
- b. Using vernier calipers, measure the diameter of the sprocket and chain.

Minimum sprocket diameter (with chain): 97.3 mm (3.831 in.)

NOTE: The vernier calipers must be in contact with the chain rollers when measuring.

If the diameter is less than the minimum, replace the chain and sprocket.

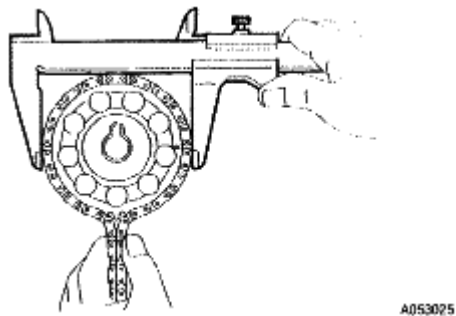


Fig. 353: Identifying Diameter Of Sprocket And Chain
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. INSPECT CRANKSHAFT TIMING GEAR

- a. Place the chain around the timing gear.

- b. Using vernier calipers, measure the diameter of the timing gear and chain.

Minimum gear diameter (with chain): 51.6 mm (2.031 in.)

NOTE: The vernier calipers must be in contact with the chain rollers when measuring.

If the gear diameter is less than the minimum, replace the chain sub-assembly and crankshaft timing gear.

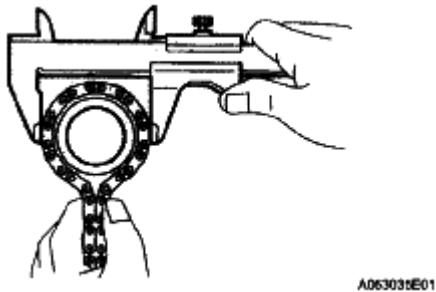


Fig. 354: Identifying Diameter Of Timing Gear And Chain
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. INSPECT CHAIN TENSIONER SLIPPER

- a. Using vernier calipers, measure the tensioner slipper wear.

Maximum wear: 1.0 mm (0.039 in.)

If the wear is greater than the maximum, replace the chain tensioner slipper.

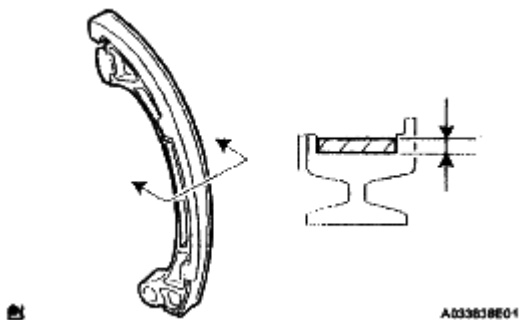


Fig. 355: View Of Chain Tensioner Slipper
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. INSPECT NO. 1 CHAIN VIBRATION DAMPER

- a. Using vernier calipers, measure the vibration damper wear.

Maximum wear: 1.0 mm (0.039 in.)

If the wear is greater than the maximum, replace the No. 1 chain vibration damper.

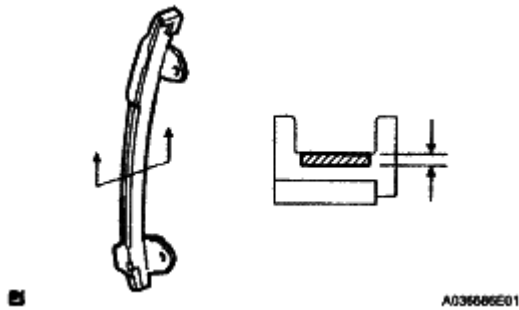


Fig. 356: View Of Chain Vibration Damper

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

12. INSPECT CHAIN TENSIONER PLATE

- a. Using vernier calipers, measure the vibration damper wear.

Maximum wear: 0.5 mm (0.020 in.)

If the wear is greater than the maximum, replace the chain tensioner plate.

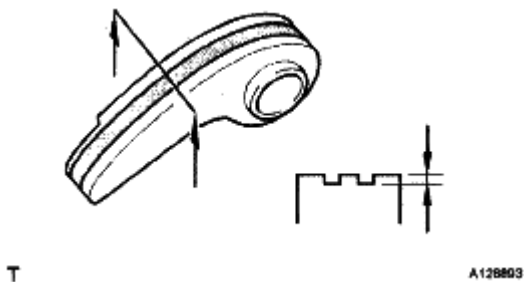


Fig. 357: View Of Vibration Damper Wear

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

13. INSPECT NO. 1 CHAIN TENSIONER

- a. Check that the plunger moves smoothly when the ratchet pawl is raised with your finger.

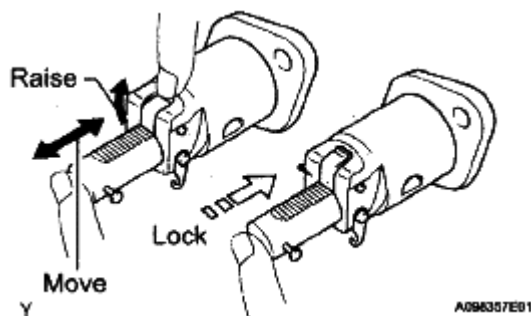


Fig. 358: View Of Plunger Movement

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

- b. Release the ratchet pawl, then check that the plunger is locked in place by the ratchet pawl and does not move when pushed with your finger.

14. INSPECT CONNECTING ROD THRUST CLEARANCE

- a. Install the connecting rod cap (See **REASSEMBLY**).
- b. Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.

Standard thrust clearance: 0.160 to 0.362 mm (0.0063 to 0.0143 in.)

Maximum thrust clearance: 0.362 mm (0.0143 in.)

If the thrust clearance is greater than the maximum, replace the connecting rod assemblies as necessary. If necessary, replace the crankshaft.

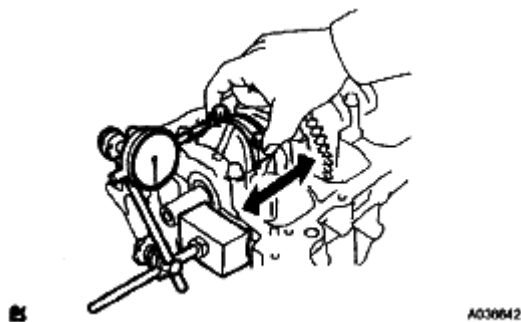


Fig. 359: View Of Thrust Clearance

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

15. INSPECT CONNECTING ROD OIL CLEARANCE

- a. Clean the crank pin and bearing.
- b. Check the crank pin and bearing for pitting and scratches.
- c. Lay a strip of Plastigage on the crank pin.

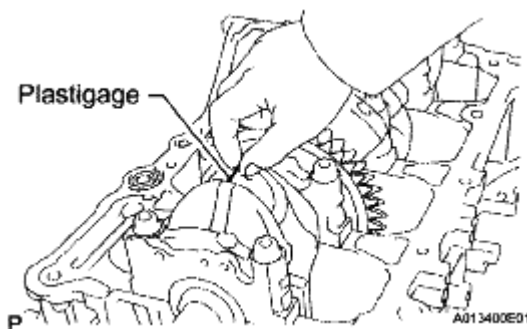


Fig. 360: Identifying Plastigage On Crank Pin

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

- d. Check that the front mark of the connecting rod cap is facing forward.
- e. Install the connecting rod cap (See **REASSEMBLY**).

NOTE: Do not turn the crankshaft.

- f. Remove the 2 bolts and connecting rod cap (See **DISASSEMBLY**).

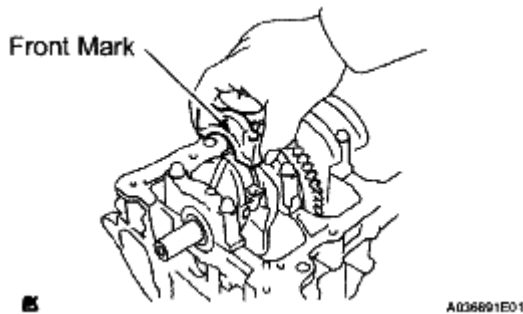


Fig. 361: Identifying Front Mark Of Connecting Rod Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Measure the Plastigage at its widest point.

Standard oil clearance: 0.032 to 0.063 mm (0.0013 to 0.0025 in.)

Maximum oil clearance: 0.063 mm (0.0025 in.)

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

NOTE: Completely remove the Plastigage after the measurement.

HINT:

If replacing a bearing, replace it with one that has the same number as its respective connecting rod cap. Each bearing's standard thickness is indicated by a 1, 2, or 3 mark on its surface.

Standard connecting rod large end bore diameter

MARK SPECIFIED CONDITION CHART

Mark	Specified Condition
Mark 1	51.000 to 51.007 mm (2.0079 to 2.0082 in.)
Mark 2	51.008 to 51.013 mm (2.0082 to 2.0084 in.)
Mark 3	51.014 to 51.020 mm (2.0084 to 2.0087 in.)

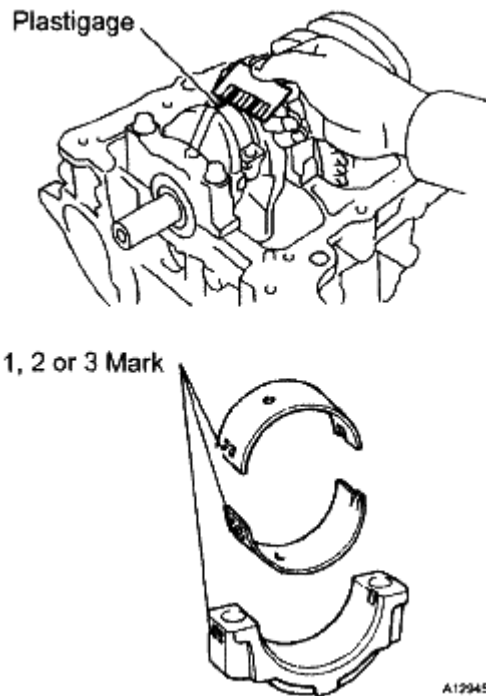


Fig. 362: View Of Plastigage With Widest Point
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard connecting rod bearing thickness

MARK SPECIFIED CONDITION CHART

Mark	Specified Condition
Mark 1	1.485 to 1.488 mm (0.0585 to 0.0586 in.)
Mark 2	1.489 to 1.491 mm (0.0586 to 0.0587 in.)
Mark 3	1.492 to 1.494 mm (0.0587 to 0.0588 in.)

Standard crankshaft pin diameter

MARK SPECIFIED CONDITION CHART

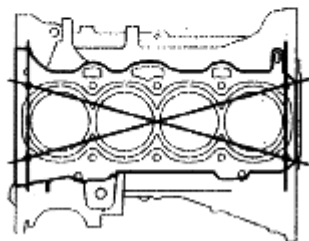
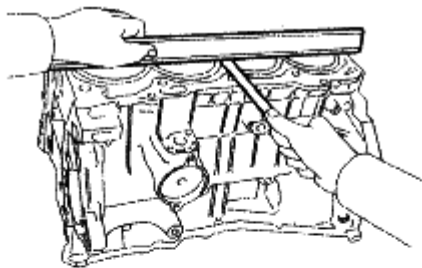
Mark	Specified Condition
Mark 1	47.990 to 48.000 (1.8894 to 1.8898 in.)
Mark 2	47.990 to 48.000 (1.8894 to 1.8898 in.)
Mark 3	47.990 to 48.000 (1.8894 to 1.8898 in.)

16. INSPECT CYLINDER BLOCK FOR WARPAGE

- Using a precision straightedge and feeler gauge, measure the warpage of the surface that is in contact with the cylinder head gasket.

Maximum warpage: 0.05 mm (0.0020 in.)

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



T

A112240

Fig. 363: Inspecting Cylinder Block For Warpage
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

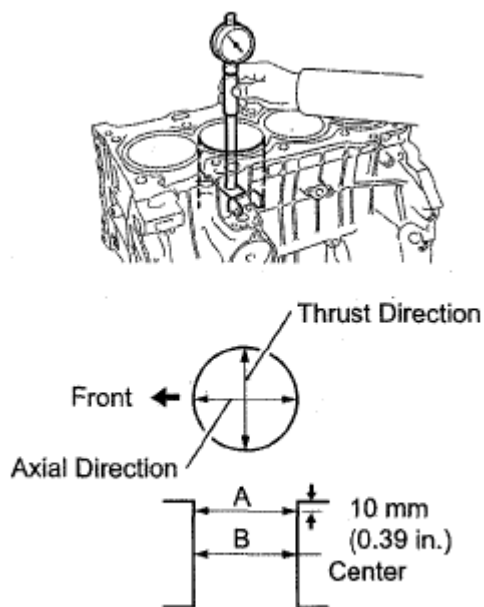
17. INSPECT CYLINDER BORE

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

Standard diameter: 88.500 to 88.513 mm (3.4843 to 3.4847 in.)

Maximum diameter: 88.633 mm (3.4894 in.)

If the average diameter of the 4 positions is greater than the maximum, replace the cylinder block.



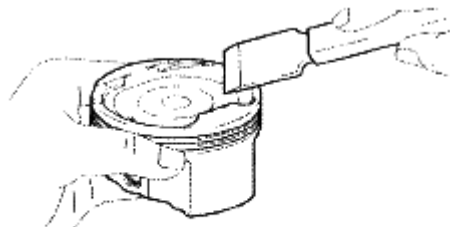
T

A112241E04

Fig. 364: View Of Cylinder Bore Diameter On Positions A And B
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

18. INSPECT PISTON

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

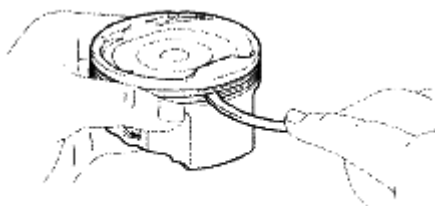


P

A126913

Fig. 365: Identifying Carbon From Piston Top
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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



P

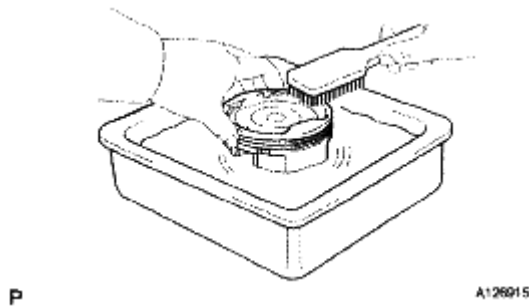
A126914

Fig. 366: Identifying Piston Ring Grooves

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

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

NOTE: Do not use a wire brush.

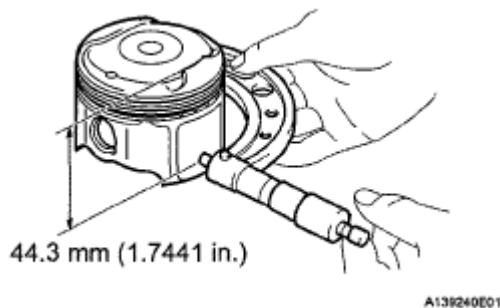
**Fig. 367: View Of Piston**

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

- d. Using a micrometer, measure the piston diameter at right angles to the piston pin hole, and at a point 44.3 mm (1.7441 in.) from the piston head.

Standard piston diameter: 88.469 to 88.479 mm (3.4830 to 3.4834 in.)

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

**Fig. 368: Identifying Piston Diameter On Right Angles**

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

19. INSPECT PISTON OIL CLEARANCE

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

Standard oil clearance: 0.021 to 0.044 mm (0.0008 to 0.0017 in.)

Maximum oil clearance: 0.10 mm (0.0039 in.)

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

cylinder block.

20. INSPECT RING GROOVE CLEARANCE

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

Standard ring groove clearance

ITEM SPECIFIED CONDITION CHART

Item	Specified Condition
No. 1 Ring	0.020 to 0.070 mm (0.0008 to 0.0028 in.)
No. 2 Ring	0.020 to 0.060 mm (0.0008 to 0.0024 in.)
Oil Ring	0.020 to 0.070 mm (0.0008 to 0.0028 in.)

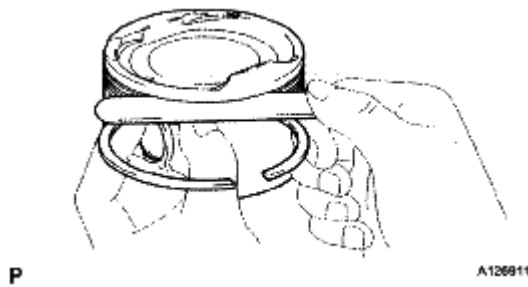


Fig. 369: View Of Clearance Between Piston Ring And Ring Groove
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

21. INSPECT PISTON RING END GAP

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

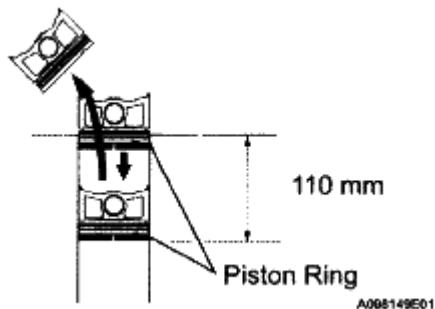


Fig. 370: Identifying Piston Ring End Gap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a feeler gauge, measure the end gap.

Standard end gap

ITEM SPECIFIED CONDITION CHART

Item	Specified Condition
No. 1 Ring	0.24 to 0.31 mm (0.0094 to 0.0122 in.)
No. 2 Ring	0.33 to 0.43 mm (0.0130 to 0.0169 in.)
Oil Ring	0.10 to 0.30 mm (0.0040 to 0.0119 in.)

Maximum end gap

ITEM SPECIFIED CONDITION CHART

Item	Specified Condition
No. 1 Ring	0.89 mm (0.0350 in.)
No. 2 Ring	1.37 mm (0.0539 in.)
Oil Ring	0.73 mm (0.0287 in.)

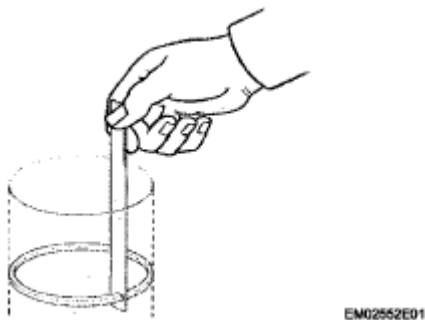


Fig. 371: View Of End Gap

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

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

22. INSPECT PISTON PIN OIL CLEARANCE

- Using a caliper gauge, measure the piston pin bore diameter.

Standard piston pin bore diameter: 22.001 to 22.010 mm (0.8662 to 0.8665 in.)

ITEM SPECIFIED CONDITION CHART

Item	Specified Condition
A	22.001 to 22.004 mm (0.8662 to 0.8663 in.)
B	22.005 to 22.007 mm (0.8663 to 0.8664 in.)
C	22.008 to 22.010 mm (0.8665 to 0.8665 in.)

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



T

A11Z243

Fig. 372: Identifying Piston Pin Oil Clearance

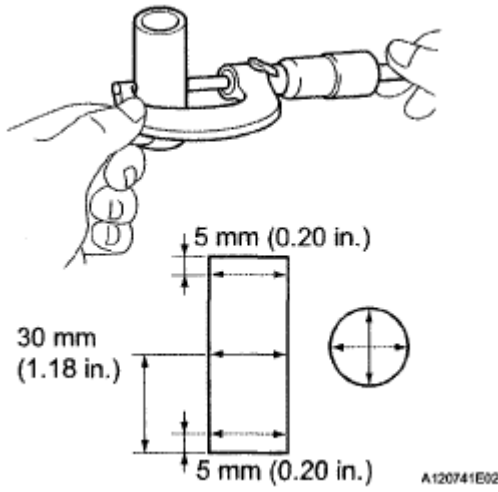
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a micrometer, measure the piston pin diameter.

Standard piston pin diameter: 21.997 to 22.006 mm (0.8660 to 0.8664 in.)

ITEM SPECIFIED CONDITION CHART

Item	Specified Condition
A	21.997 to 22.000 mm (0.8660 to 0.8661 in.)
B	22.001 to 22.003 mm (0.8662 to 0.8663 in.)
C	22.004 to 22.006 mm (0.8663 to 0.8664 in.)



T

A120741E02

Fig. 373: Identifying Piston Pin Diameter

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

If the diameter is not as specified, replace the piston pin.

- c. Using a caliper gauge, measure the connecting rod small end bore diameter.

Standard connecting rod small end bore diameter: 22.005 to 22.014 mm (0.8663 to 0.8667 in.)

ITEM SPECIFIED CONDITION CHART

Item	Specified Condition
A	22.005 to 22.008 mm (0.8663 to 0.8665 in.)
B	22.009 to 22.011 mm (0.8665 to 0.8666 in.)
C	22.012 to 22.014 mm (0.8666 to 0.8667 in.)

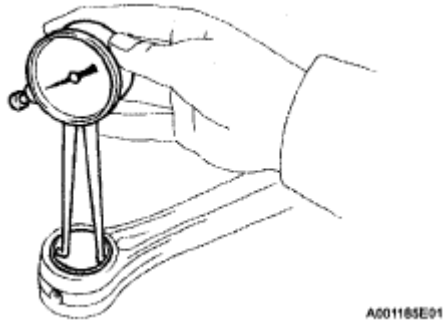


Fig. 374: Identifying Connecting Rod Small End Bore Diameter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

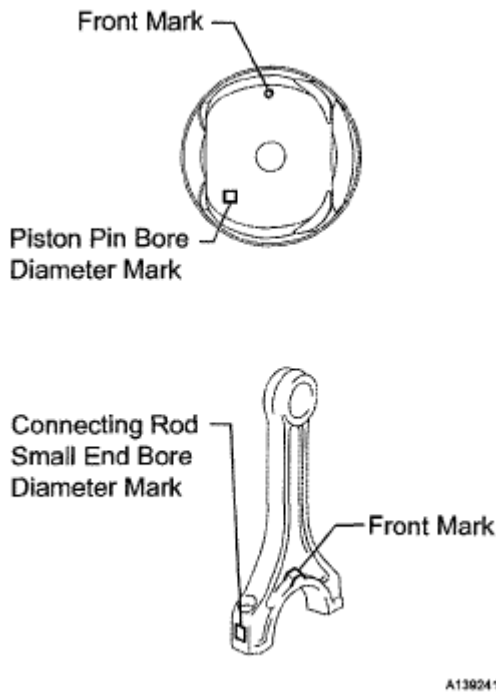
If the diameter is not as specified, replace the connecting rod.

- d. Subtract the piston pin diameter measurement from the piston pin bore diameter measurement.

Standard oil clearance: 0.001 to 0.007 mm (0.00004 to 0.0003 in.)

Maximum oil clearance: 0.010 mm (0.0004 in.)

If the oil clearance is greater than the maximum, replace the connecting rod. If necessary, replace the piston and piston pin as a set.



A139241E01

Fig. 375: Identifying Piston Pin Diameter From Connecting Rod Small End Bore
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Subtract the piston pin diameter measurement from the connecting rod small end bore diameter measurement.

Standard oil clearance: 0.005 to 0.011 mm (0.0002 to 0.0004 in.)

Maximum oil clearance: 0.011 mm (0.0004 in.)

If the oil clearance is greater than the maximum, replace the connecting rod. If necessary, replace the connecting rod and piston pin as a set.

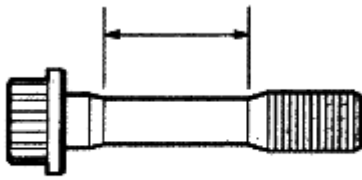
23. INSPECT CONNECTING ROD BOLT

- 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 connecting rod bolt.



A030851

Fig. 376: Identifying Connecting Rod Bolt Dimension

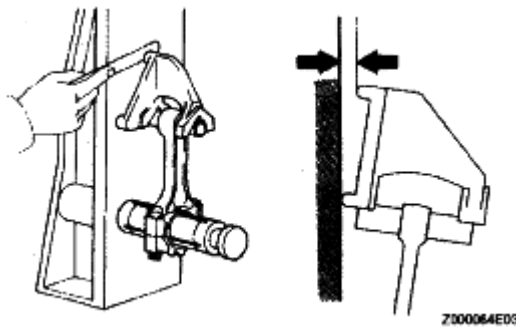
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

24. INSPECT CONNECTING ROD SUB-ASSEMBLY

- a. Using a connecting 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 the misalignment is greater than the maximum, replace the connecting rod.



Z000064E03

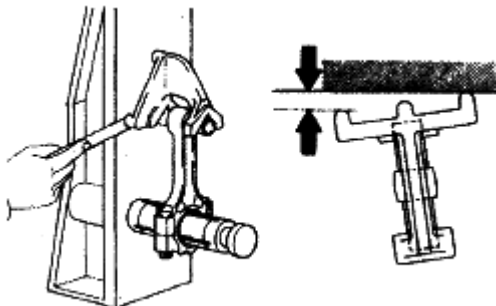
Fig. 377: View Of Connecting Rod Alignment

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

2. Check for twist.

Maximum twist: 0.15 mm (0.0059 in.) per 100 mm (3.94 in.)

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



Z000065E02

Fig. 378: Identifying Connecting Rod Twist

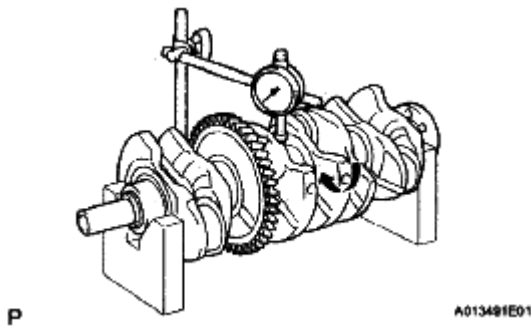
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

25. INSPECT CRANKSHAFT

- a. Using a dial indicator and V-blocks, measure the circle runout as shown in the illustration.

Maximum circle runout: 0.03 mm (0.0012 in.)

If the taper and distortion are greater than the maximum, replace the crankshaft.

**Fig. 379: View Of Crankshaft Runout**

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

- b. Using a micrometer, measure the diameter of each main journal.

Standard diameter: 54.988 to 55.000 mm (2.1649 to 2.1654 in.)

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

- c. Check each main journal for taper and distortion as shown in the illustration.

Maximum taper and distortion: 0.003 mm (0.0001 in.)

If the taper and distortion are greater than the maximum, replace the crankshaft.

Standard diameter (Reference)

MARK SPECIFIED CONDITION CHART

Mark	Specified Condition
0	54.999 to 55.000 mm (2.1653 to 2.1654 in.)
1	54.997 to 54.998 mm (2.1652 to 2.1653 in.)
2	54.995 to 54.996 mm (2.1652 to 2.1652 in.)
3	54.993 to 54.994 mm (2.1651 to 2.1651 in.)
4	54.991 to 54.992 mm (2.1650 to 2.1650 in.)
5	54.988 to 54.990 mm (2.1649 to 2.1650 in.)

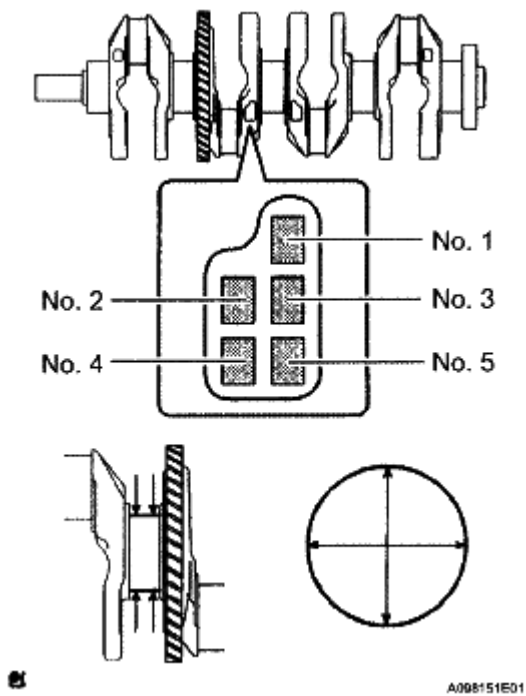


Fig. 380: Identifying Diameter Of Main Journal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Standard diameter: 47.990 to 48.000 mm (1.8894 to 1.8898 in.)

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

- e. Inspect each crank pin for taper and distortion as shown in the illustration.

Maximum taper and distortion: 0.003 mm (0.0001 in.)

If the taper and distortion are greater than the maximum, replace the crankshaft.

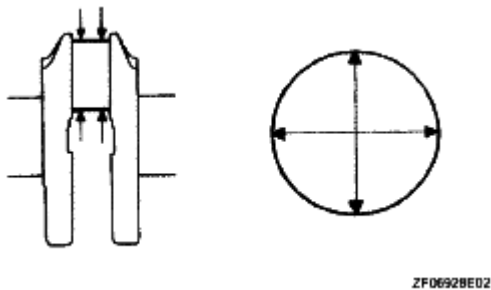


Fig. 381: View Of Diameter Of Crank Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

26. INSPECT CRANKSHAFT THRUST CLEARANCE

- a. Install the main bearing cap (See **REASSEMBLY**).
- b. 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 0.0095 in.)

Maximum thrust clearance: 0.30 mm (0.0118 in.)

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

HINT:

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

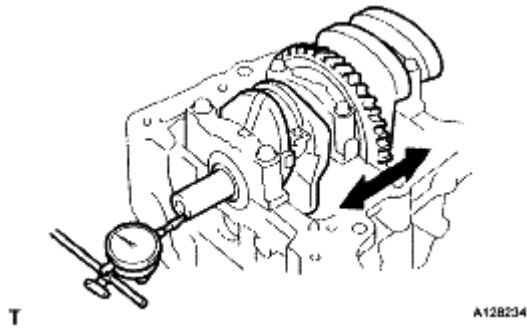


Fig. 382: Identifying Crankshaft Thrust Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

27. INSPECT CRANKSHAFT OIL CLEARANCE

- a. Check the crank journal and bearing for pitting and scratches.
- b. Install the crankshaft bearing (See **REASSEMBLY**).
- c. Place the crankshaft on the cylinder block.
- d. Lay a strip of Plastigage across each journal.

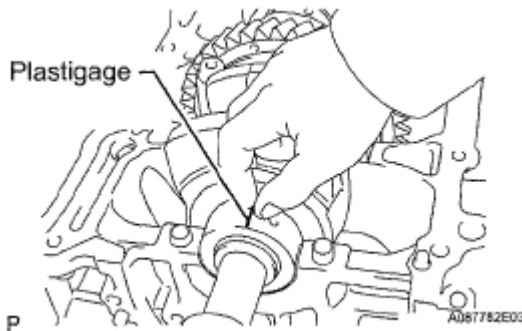


Fig. 383: Laying Strip Of Plastigage Across Journal

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

- e. Examine the front marks and numbers and install the bearing caps on the cylinder block.

HINT:

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

- f. Install the main bearing cap (See **REASSEMBLY**).

NOTE: Do not turn the crankshaft.

- g. Remove the main bearing caps (See **DISASSEMBLY**).
h. Measure the Plastigage at its widest point.

Standard oil clearance: 0.017 to 0.040 mm (0.0007 to 0.0016 in.)

Maximum oil clearance: 0.060 mm (0.0024 in.)

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

NOTE: Remove the Plastigage completely after the measurement.

HINT:

- If replacing a bearing, select a new one with the same number. If the number of the bearing cannot be determined, calculate the correct bearing number by adding together the numbers imprinted on the cylinder block and crankshaft. Then select a new bearing with the calculated number according to the chart below. There are 4 sizes of standard bearings, marked "1", "2", "3" and "4" accordingly.
- EXAMPLE: Cylinder block "3" + Crankshaft "5" = Total number 8 (Use bearing "3")

MARK SPECIFIED CONDITION CHART

Cylinder block + Crankshaft	0 to 2	3 to 5	6 to 8	9 to 11
Bearing to be used	"1"	"2"	"3"	"4"

Standard cylinder block journal bore diameter

MARK SPECIFIED CONDITION CHART

Mark	Specified Condition
0	59.000 to 59.002 mm (2.3228 to 2.3229 in.)
1	59.003 to 59.004 mm (2.3230 to 2.3230 in.)
2	59.005 to 59.006 mm (2.3230 to 2.3231 in.)
3	59.007 to 59.009 mm (2.3231 to 2.3232 in.)
4	59.010 to 59.011 mm (2.3232 to 2.3233 in.)

5	59.012 to 59.013 mm (2.3233 to 2.3234 in.)
6	59.014 to 59.016 mm (2.3234 to 2.3235 in.)

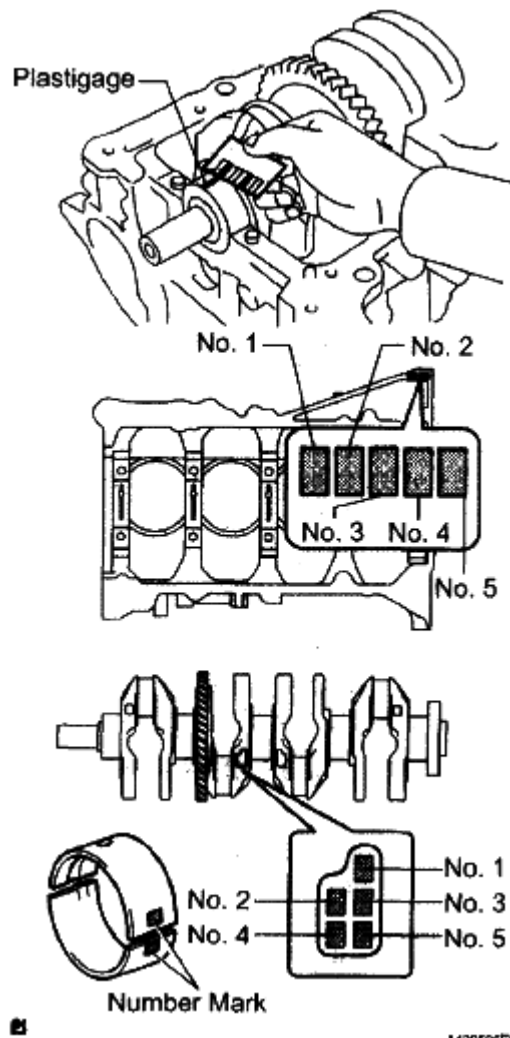


Fig. 384: Identifying Plastigage Widest Point
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard crankshaft journal diameter

MARK SPECIFIED CONDITION CHART

Mark	Specified Condition
0	54.999 to 55.000 mm (2.1653 to 2.1654 in.)
1	54.997 to 54.998 mm (2.1652 to 2.1653 in.)
2	54.995 to 54.996 mm (2.1652 to 2.1652 in.)
3	54.993 to 54.994 mm (2.1651 to 2.1651 in.)
4	54.991 to 54.992 mm (2.1650 to 2.1650 in.)
5	54.988 to 54.990 mm (2.1649 to 2.1650 in.)

Standard bearing center wall thickness

MARK SPECIFIED CONDITION CHART

Mark	Specified Condition
1	1.993 to 1.996 mm (0.0785 to 0.0786 in.)
2	1.997 to 1.999 mm (0.0786 to 0.0787 in.)
3	2.000 to 2.002 mm (0.0787 to 0.0788 in.)
4	2.003 to 2.005 mm (0.0789 to 0.0789 in.)

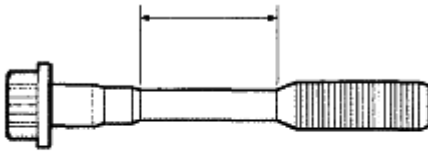
28. INSPECT CRANKSHAFT BEARING CAP SET BOLT

- Using vernier calipers, measure the tension portion diameter of the bolts.

Standard diameter: 7.3 to 7.5 mm (0.287 to 0.295 in.)

Minimum diameter: 7.2 mm (0.284 in.)

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



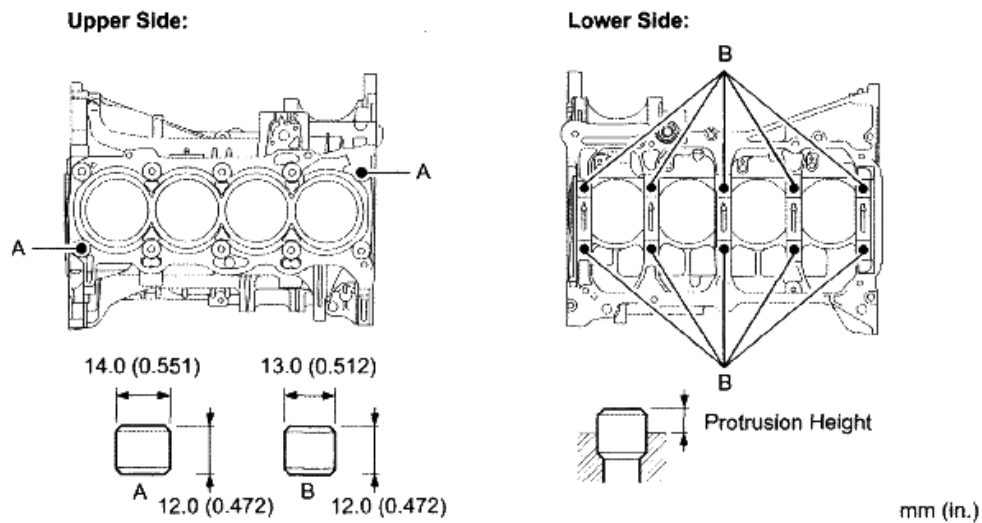
A0064556

Fig. 385: Identifying Bearing Cap Bolt Dimension
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REASSEMBLY

1. INSTALL RING PIN

- Using a plastic hammer, tap in the ring pin.



T

A112261E02

Fig. 386: Identifying Ring Pin Dimension

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

Standard protrusion

PROTRUSION SPECIFICATION CHART

Item	Protrusion
Pin A	6 mm (0.236 in.)
Pin B	5 mm (0.197 in.)

2. INSTALL STUD BOLT

- Install the stud bolts as shown in the illustration.

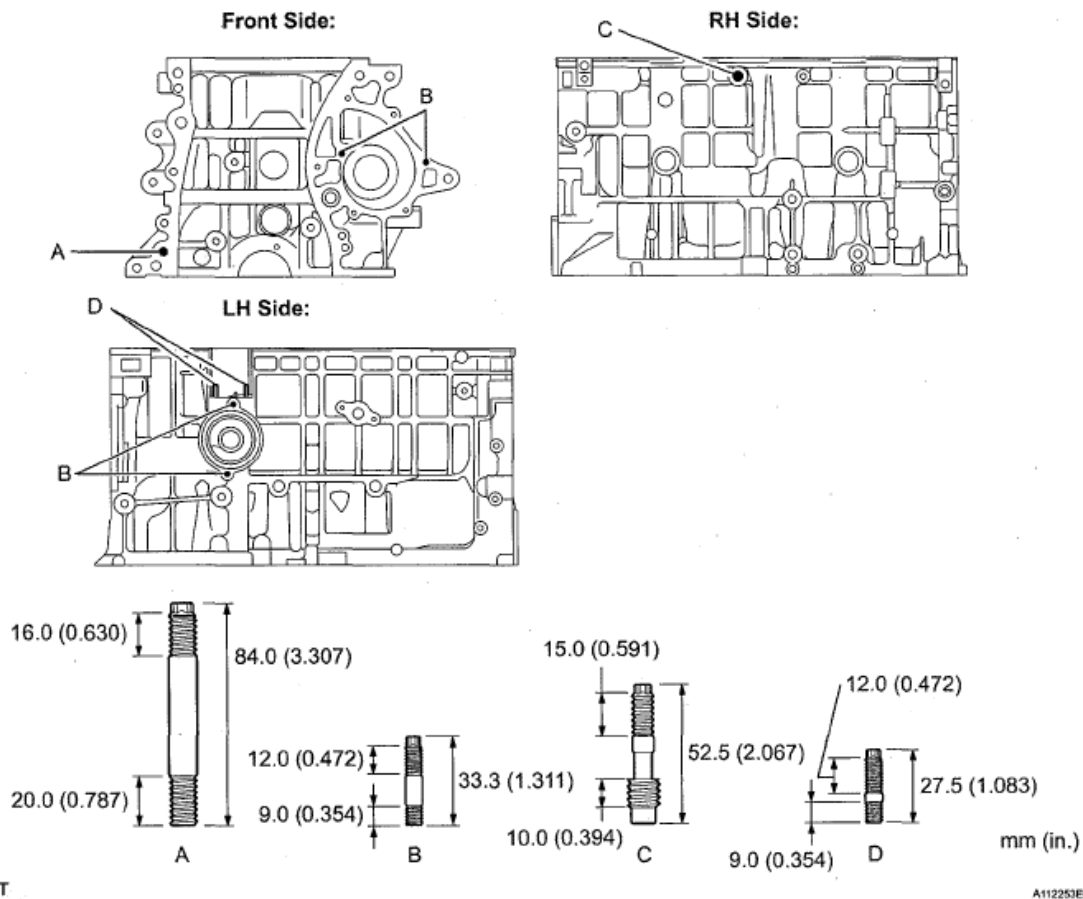


Fig. 387: Identifying Stud Bolt Dimension

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

Torque: Stud Bolt A

5.0 N*m (51 kgf*cm, 44 in.*lbf)

Stud Bolt B

22 N*m (220 kgf*cm, 16 ft.*lbf)

Stud Bolt C

9.5 N*m (97 kgf*cm, 84 in.*lbf)

Stud Bolt D

5.0 N*m (51 kgf*cm, 44 in.*lbf)

3. INSTALL STRAIGHT PIN

- Using a plastic hammer, tap in the straight pin.

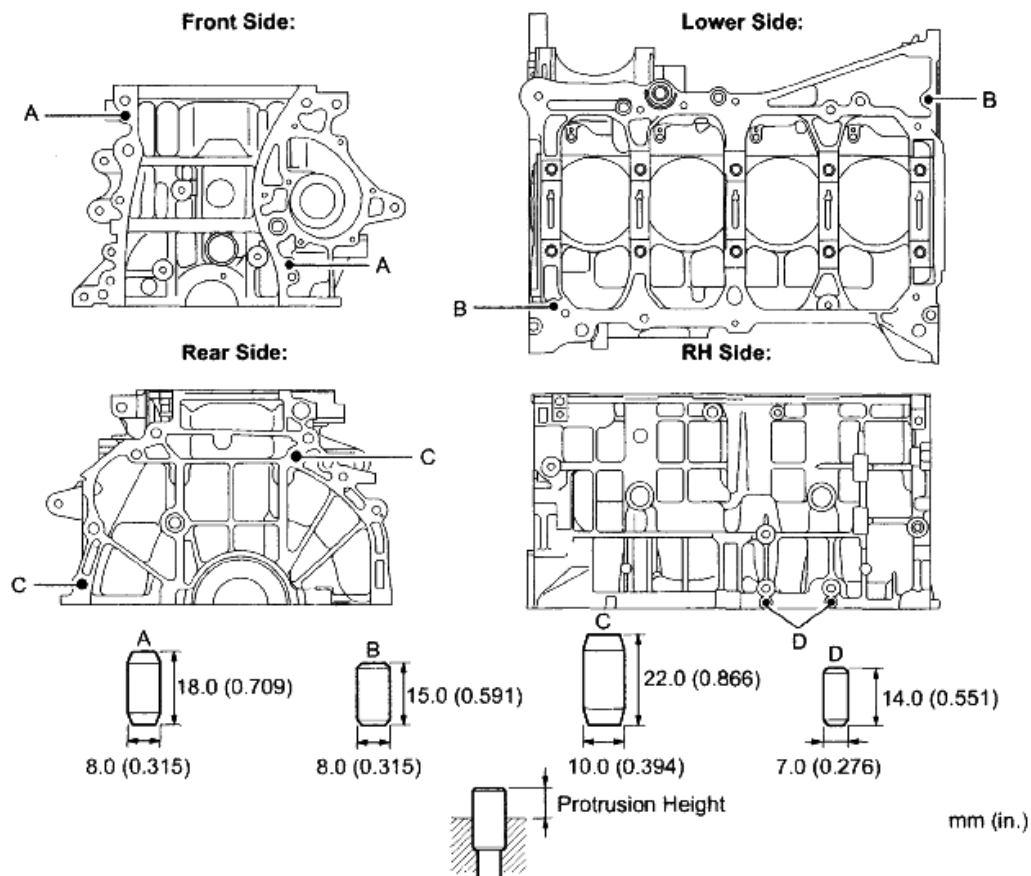


Fig. 388: Identifying Straight Pin Dimension
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard protrusion

PROTRUSION SPECIFICATION CHART

Item	Protrusion
Pin A	8 mm (0.315 in.)
Pin B	7.5 mm (0.295 in.)
Pin C	12 mm (0.472 in.)
Pin D	5 mm (0.197 in.)

4. INSTALL NO. 1 OIL NOZZLE SUB-ASSEMBLY

- Using a 5 mm hexagon wrench, install the oil nozzles with the bolts.

Torque: 7.0 N*m (71 kgf*cm, 62 in.*lbf)

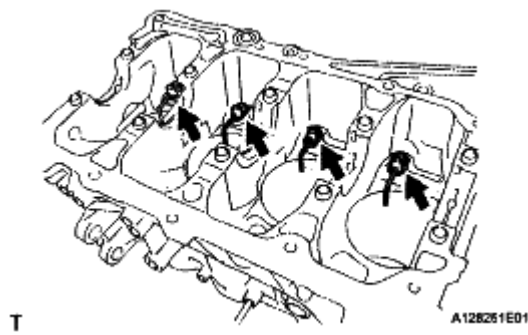


Fig. 389: View Of Oil Nozzles And Bolts

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

5. INSTALL PISTON

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

HINT:

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

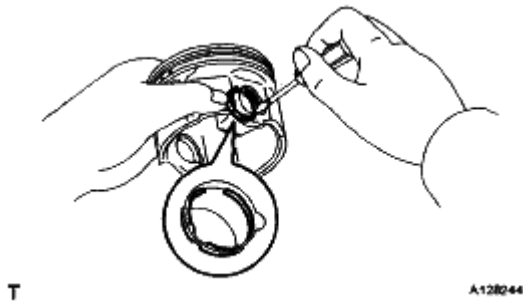


Fig. 390: Identifying Snap Ring

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

- b. Gradually heat the piston to approximately 80 to 90°C (176 to 194°F).
- c. Align the front marks of the piston and connecting rod, and push in the piston with your thumb.

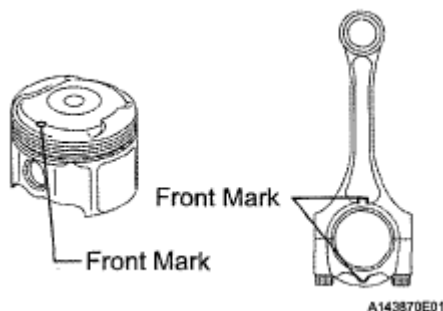


Fig. 391: Identifying Piston Mark And Connecting Rod Mark Location

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

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

HINT:

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

- e. Check the fitting condition between the piston and piston pin by trying to move the piston back and forth on the piston pin.

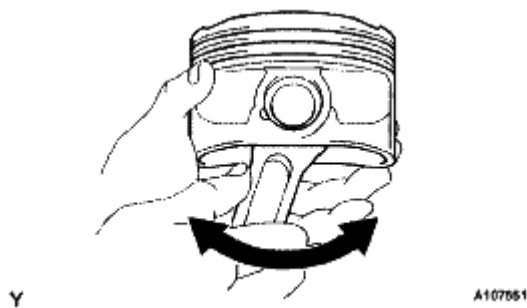


Fig. 392: View Of Fitting Condition Between Piston And Piston Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. INSTALL PISTON RING SET

- a. Install the oil ring expander and oil ring rail by hand.

NOTE:

- Install the expander and oil ring so that their ring ends are at opposite sides.
- Securely install the expander to the inner groove of the oil ring.

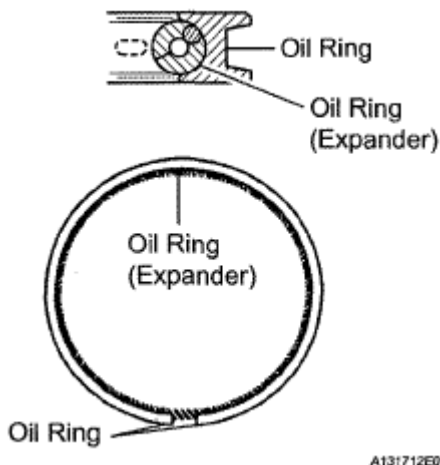


Fig. 393: Identifying Piston Oil Ring

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

- b. Using a piston ring expander, install the 2 compression rings so that the paint marks are positioned as shown in the illustration.

NOTE: Install the compression ring No. 2 with the code mark (2N) facing upward.

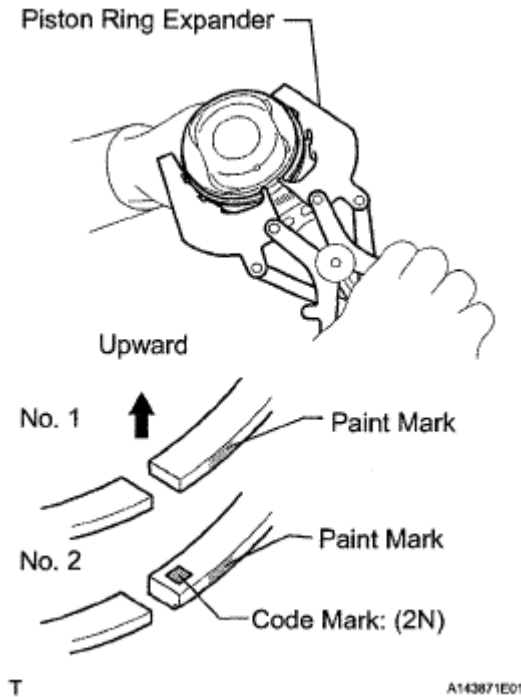


Fig. 394: View Of Piston Ring With Piston Ring Expander
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Position the piston rings so that the ring ends are as shown in the illustration.

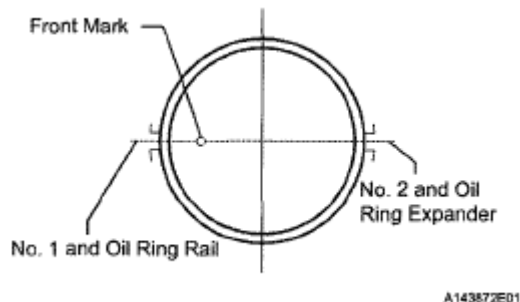


Fig. 395: Identifying Piston Rings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. INSTALL CRANKSHAFT BEARING

- a. Install the upper bearing with an oil groove on the cylinder block.

NOTE:

- Do not apply engine oil to the bearings and the contact surfaces.
- There is an identification mark on the crankshaft bearing No. 1 UPR only.

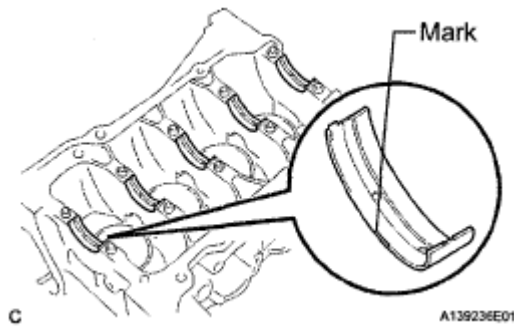


Fig. 396: Identifying Crankshaft Bearing Mark Location
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. INSTALL NO. 2 CRANKSHAFT BEARING

- a. Install the lower bearing onto the bearing cap.

NOTE:

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

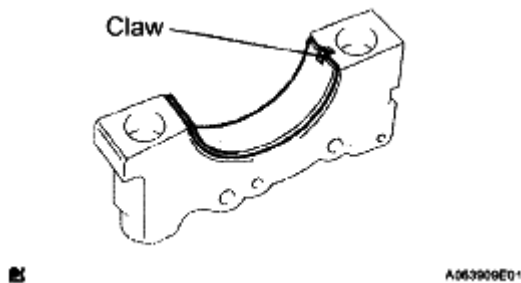


Fig. 397: Identifying Lower Bearing On Bearing Cap (Claw)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. INSTALL UPPER CRANKSHAFT THRUST WASHER

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

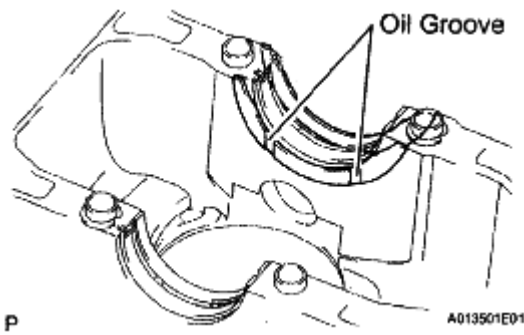


Fig. 398: Identifying Cylinder Block With Oil Grooves
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Apply engine oil to the crankshaft thrust washer.

10. INSTALL CRANKSHAFT

- a. Apply engine oil to the upper bearing and install the crankshaft on the cylinder block.
- b. Apply engine oil to the lower bearing.
- c. Examine the front marks and install the bearing caps on the cylinder block.

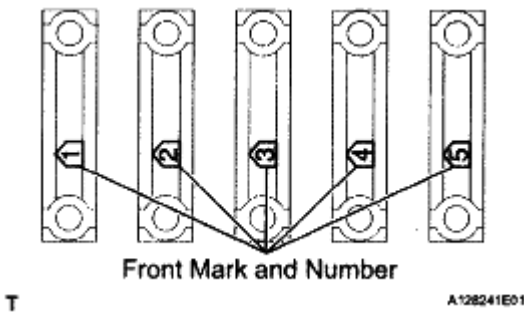


Fig. 399: Identifying Front Marks On Bearing Caps
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Apply a light coat of engine oil to the threads and under the bearing cap bolts.
- e. Install the crankshaft bearing cap bolts.

NOTE: The main bearing cap bolts are tightened in 2 progressive steps.

f. Step 1

- 1. Install and uniformly tighten the 10 main bearing cap bolts in the sequence shown in the illustration.

Torque: 20 N*m (204 kgf*cm, 15 ft.*lbf)

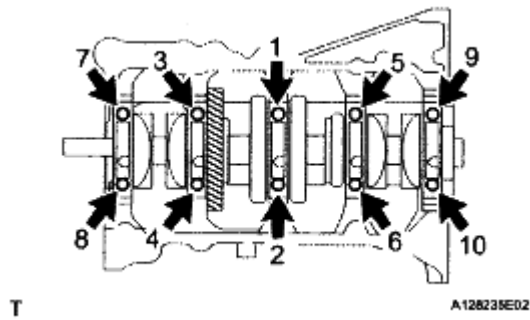


Fig. 400: Locating Main Bearing Cap Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Further tighten the 10 main bearing cap bolts in the sequence shown in the illustration.

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

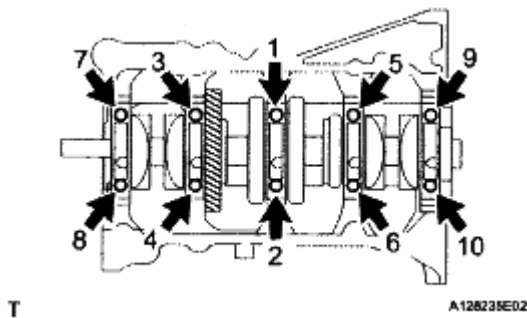


Fig. 401: Locating Main Bearing Cap Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Step 2

1. Mark the front of the bearing cap bolts with paint.

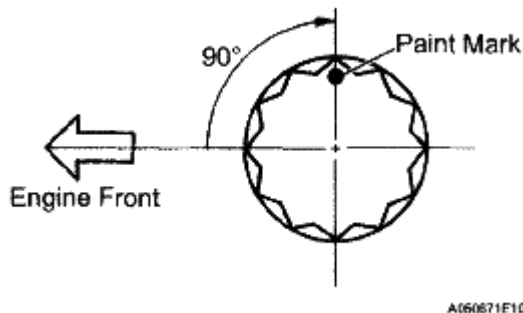


Fig. 402: Identifying Bearing Cap Bolts With Paint Mark
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Further tighten the bearing cap bolts by 90° in the numerical order shown in the previous illustration.

- h. Check that the paint mark is now at a 90° angle to the front.
- i. Check that the crankshaft turns smoothly.
- j. Check the crankshaft thrust clearance (See **INSPECTION**).

11. INSTALL CONNECTING ROD BEARING

- a. Align the bearing claw with the groove of the connecting rod or connecting cap.

NOTE: Do not apply engine oil to the bearings or the contact surfaces.

12. INSTALL PISTON SUB-ASSEMBLY WITH CONNECTING ROD

NOTE: The connecting rod cap bolts are tightened in 2 progressive steps.

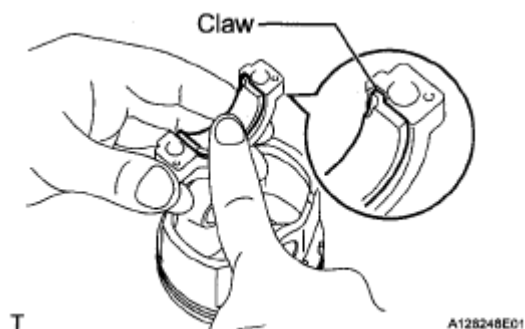


Fig. 403: View Of Piston Sub-Assembly With Connecting Rod
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

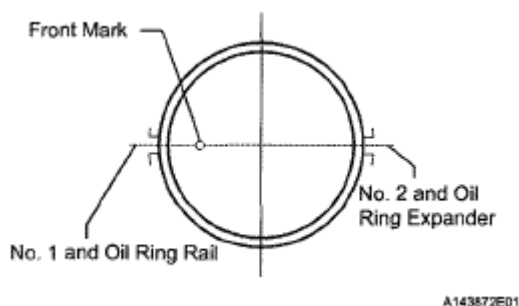


Fig. 404: View Of Piston Rings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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.

NOTE: Match the numbered connecting rod cap with the connecting rod.

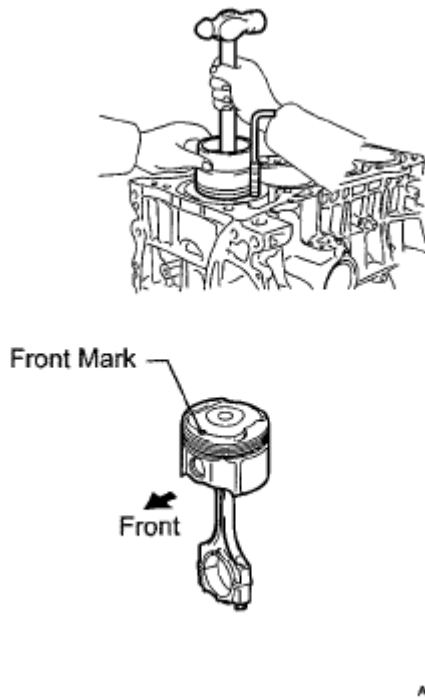


Fig. 405: View Of Piston And Connecting Rod Assemblies
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Check that the protrusion of the connecting rod cap is facing in the correct direction.

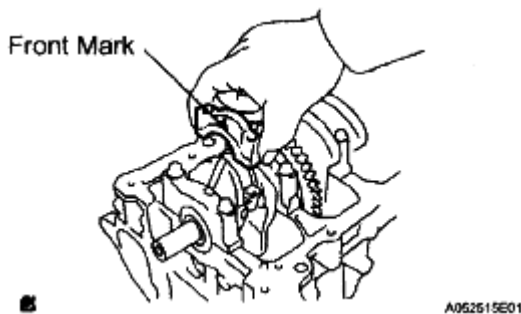


Fig. 406: Identifying Connecting Rod Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Apply a light coat of engine oil to the threads and under the heads of the connecting rod cap bolts.
f. Install the connecting cap bolts.

NOTE: The connecting cap bolts should be tightened in 2 progressive steps.

- g. step 1
1. Install and alternately tighten the bolts of the connecting rod cap in several steps.

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

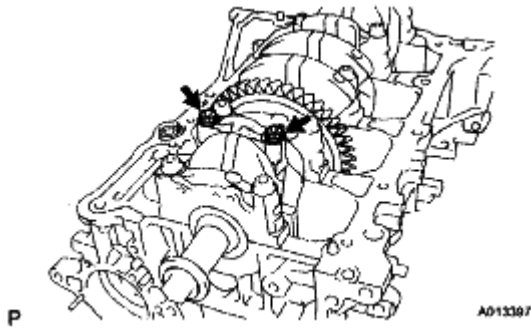


Fig. 407: Locating Connecting Rod Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

h. Step 2

1. Mark the front of the connecting rod cap bolts with paint.
2. Further tighten the cap bolts by 90° as shown in the illustration.

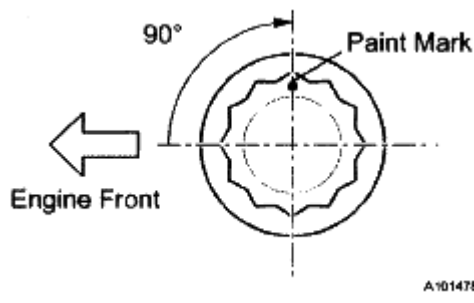


Fig. 408: Identifying Connecting Rod Bolts With Paint Mark
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

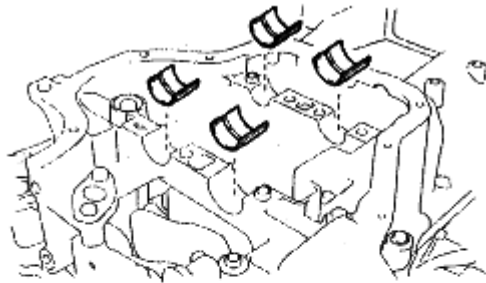
- i. Check that the crankshaft turns smoothly.
- j. Check the connecting rod thrust clearance (See **INSPECTION**).

13. INSTALL NO. 1 BALANCESHAFT BEARING

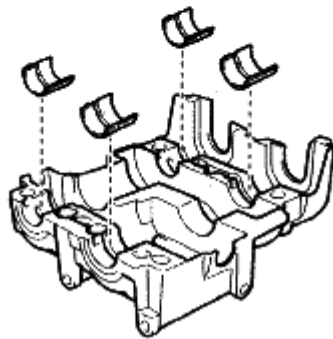
- a. Install the bearings in the crankcase and balanceshaft housing.

NOTE: Do not apply engine oil to the bearings and the contact surfaces.

Stiffening Crankcase:



Balanceshaft Housing:



T

A12B204E02

Fig. 409: Identifying Balanceshaft Bearings

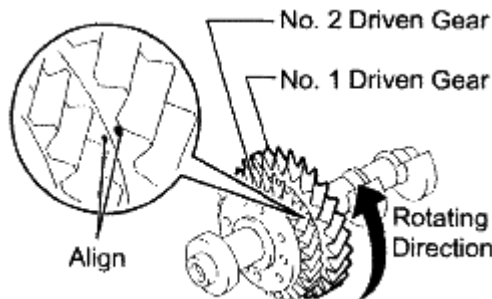
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Apply a light coat of engine oil to the bearings.

14. INSTALL NO. 1 AND NO. 2 BALANCESHAFT SUB-ASSEMBLY

- a. Rotate the No. 1 driven gear of the No. 1 balanceshaft in the rotating direction until it hits the stopper.

NOTE: Confirm that the matchmarks on the No. 1 and No. 2 driven gears are matched.



T

A12B213E01

Fig. 410: View Of Driven Gear Of Balanceshaft

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

- b. Align the timing marks of the No. 1 and No. 2 balanceshafts as shown in the illustration.

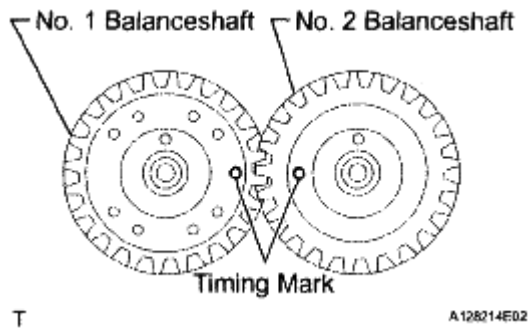


Fig. 411: View Of Timing Marks Of No. 1 And No. 2 Balancershafts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Place the No. 1 and No. 2 balancershafts on the crankcase.

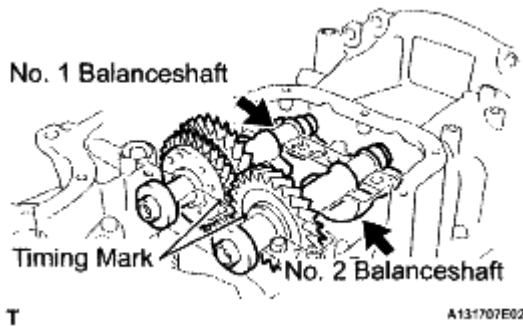


Fig. 412: Identifying Timing Mark On Balancer Shaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Apply a light coat of engine oil under the heads of the balancershaft housing bolts.
e. Install the balancershaft housing bolts.

NOTE: The balance shaft housing bolts are tightened in 2 progressive steps.

- f. Step 1
1. Install and uniformly tighten the 8 bolts in the sequence shown in the illustration.

Torque: 22 N*m (220 kgf*cm, 16 ft.*lbf)

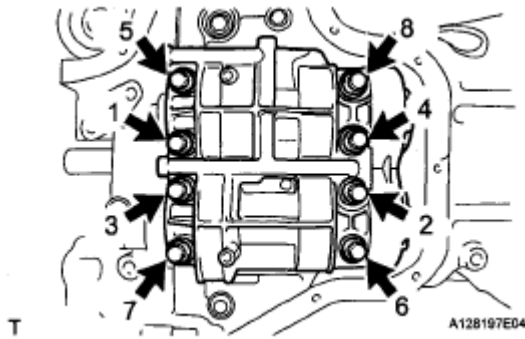


Fig. 413: Locating Tightening Sequence Of Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

g. Step 2

1. Mark the front side of each balanceshaft housing bolt head with paint.
2. Further tighten the bolts by 90° as shown in the illustration.
3. Check that the paint marks are now at a 90° angle to the front.

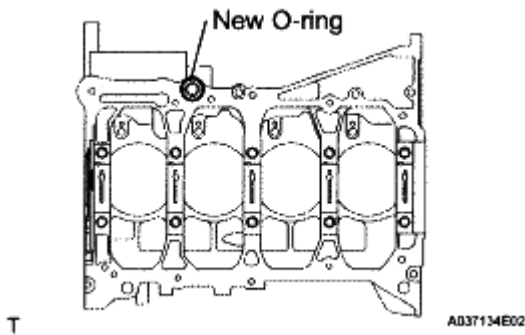


Fig. 414: Identifying O-Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

15. INSTALL STIFFENING CRANKCASE ASSEMBLY

- a. Place a new O-ring on the cylinder block, as shown in the illustration.

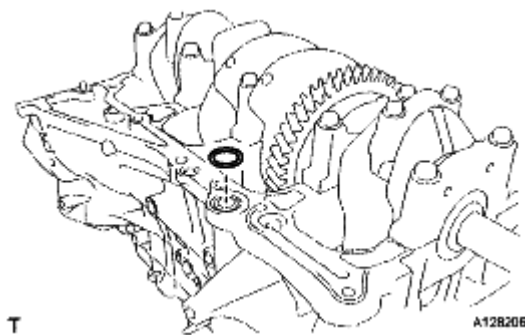


Fig. 415: Identifying O-Ring From Cylinder Block
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Temporarily tighten the pulley set bolt.
- c. Turn the crankshaft to set the crank pins of the No. 1 and No. 4 cylinders to the bottom.

HINT:

Make sure that the timing mark on the balancershaft drive gear is positioned as shown in the illustration.

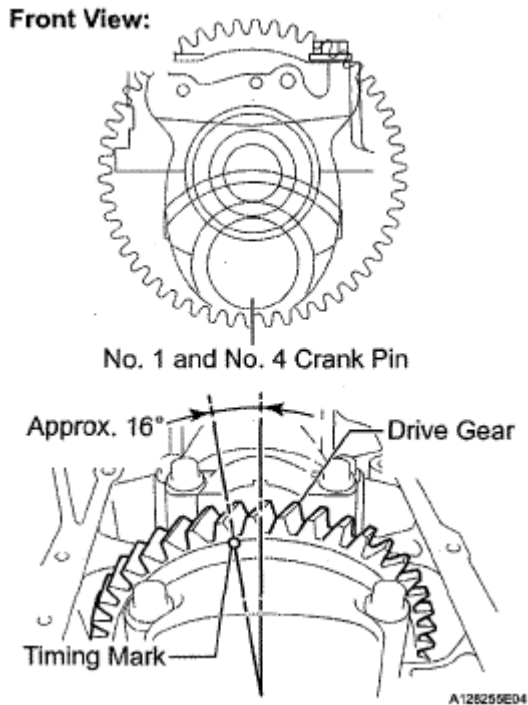


Fig. 416: Identifying Timing Mark On Balancershaft Drive Gear
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Apply seal packing in a continuous bead (diameter: 2.5 to 3.0 mm (0.098 to 0.118 in.)) to the places shown in the illustration.

Seal packing: Toyota Genuine Seal Packing Black, Three bond 1207B or equivalent

NOTE:

- Remove any oil from the contact surface.
- Install the crankcase within 3 minutes after applying seal packing.
- Do not start the engine for at least 2 hours after installing the stiffening crankcase.

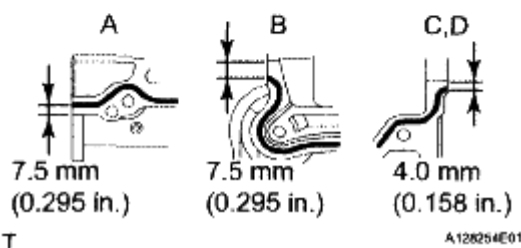
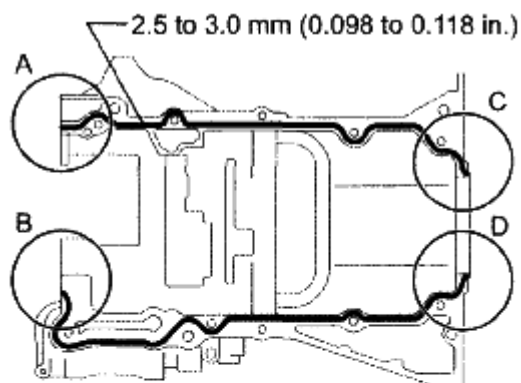


Fig. 417: Identifying Seal Packing In Bead

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

- e. Install the stiffening crankcase so that the reference holes on the balanceshafts are positioned as shown in the illustration.

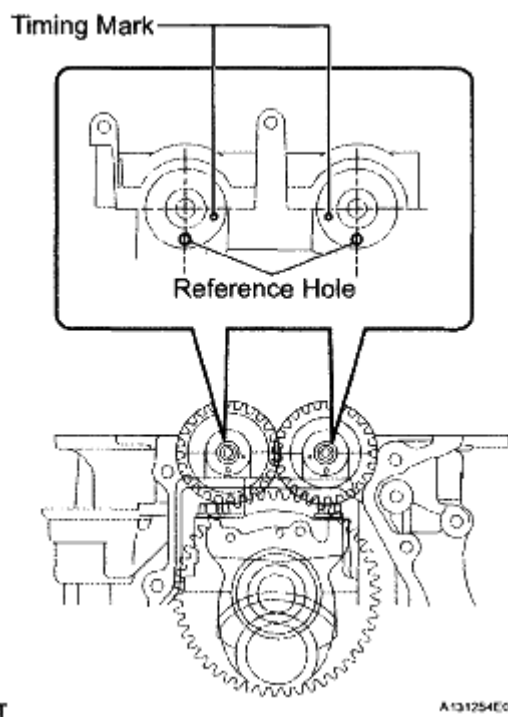


Fig. 418: Identifying Reference Holes On Balanceshafts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Temporarily install the crankcase with the 11 bolts.

Bolt length

BOLT LENGTH SPECIFICATION

Item	Length
Bolt A	122 mm (4.803 in.)
Bolt B	45 mm (1.772 in.)

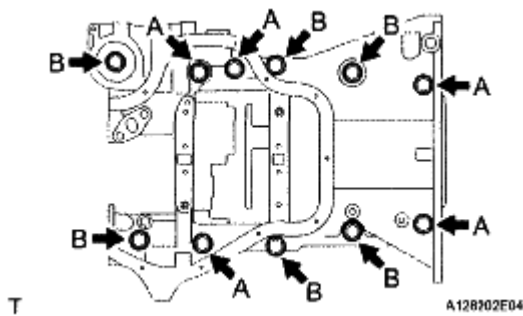


Fig. 419: View Of Crankcase With Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Uniformly tighten the 11 bolts in the sequence shown in the illustration.

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

- h. Wipe off any excess seal packing with a clean piece of cloth.

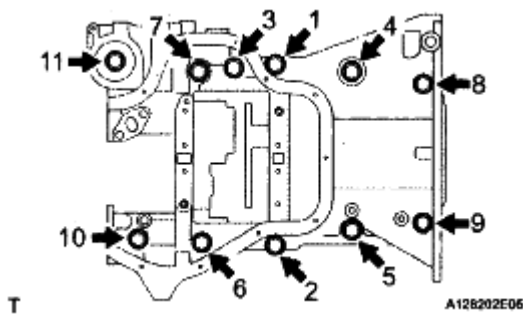


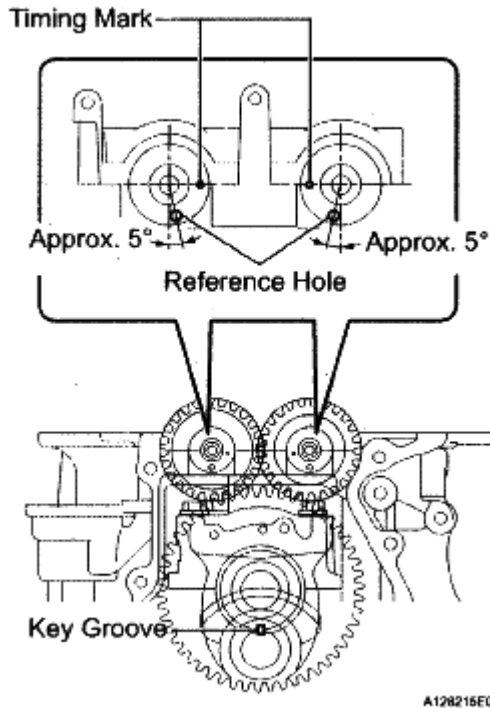
Fig. 420: Locating Crankcase Bolts Tightening Sequence
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- i. Turn the crankshaft again to set the key groove to the bottom. Make sure that the timing marks are aligned as shown in the illustration.

HINT:

A 'O' is stamped as a timing mark.

- j. Remove the pulley set bolt.



T

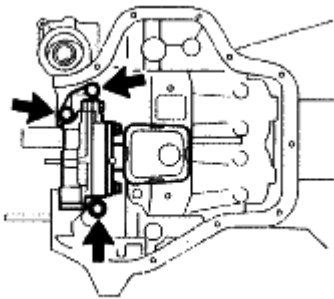
A128215E01

Fig. 421: Identifying Timing Mark And Reference Hole
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

16. INSTALL OIL PUMP ASSEMBLY

- a. Install a new gasket and oil pump with the 3 bolts.

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



T

A128253

Fig. 422: Locating Oil Pump And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

17. INSTALL ENGINE REAR OIL SEAL

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

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

NOTE: Keep the lip free from foreign materials.

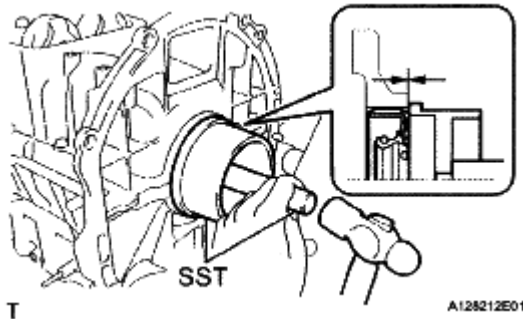


Fig. 423: View Of Taping Oil Seal

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

- b. Apply MP grease to a new oil seal lip.

NOTE: Wipe off extra grease on the crankshaft.

18. INSTALL NO. 1 TAPER SCREW PLUG

- a. Apply adhesive to 2 or 3 threads of the plug, and install the plug.

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

Adhesive: Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

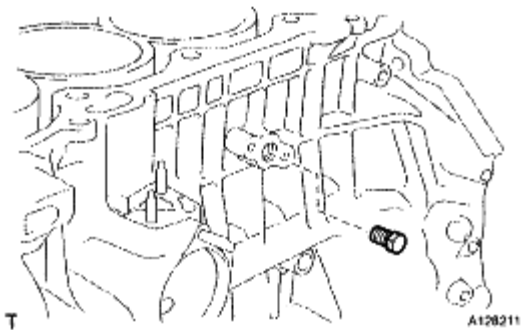


Fig. 424: Identifying Taper Screw Plug

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

19. INSTALL OIL CONTROL VALVE FILTER

- a. Check that no foreign matter is on the mesh part of the filter.
- b. Using an 8 mm socket hexagon wrench, install a new gasket and the oil control valve filter with the screw plug.

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

NOTE: Do not touch the mesh when installing the oil control valve filter.

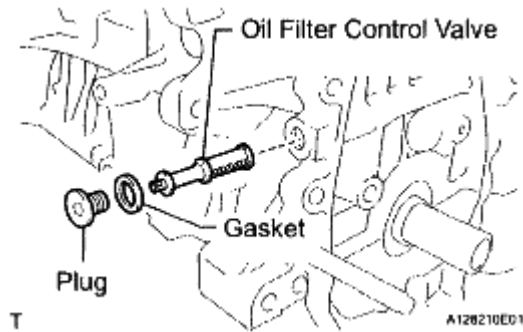


Fig. 425: Identifying Oil Control Valve Filter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

20. INSTALL CYLINDER BLOCK WATER DRAIN COCK SUB-ASSEMBLY

- a. Apply adhesive to the threads of the drain cock.

Adhesive: Toyota Genuine Adhesive 1344, Three Bond 1344 or equivalent

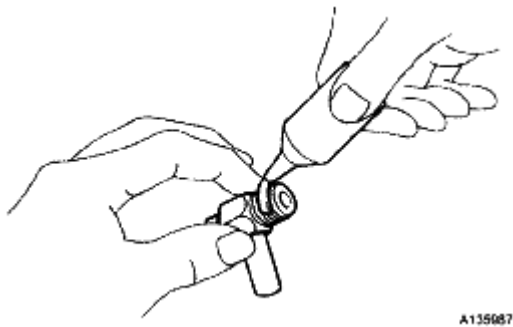


Fig. 426: View Of Adhesive On Drain Cock
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the water drain cock within the range shown in the illustration.

Torque: 25 N*m (255 kgf*cm, 18 ft.*lbf)

NOTE: Do not rotate the drain cock more than 1 revolution (360°) after tightening it to the specified torque.

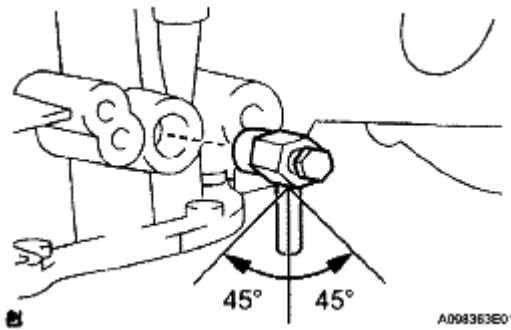


Fig. 427: Identifying Drain Cock

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

- c. Install the water drain cock plugs to the water drain cocks.

Torque: 13 N*m (130 kgf*cm, 9 ft.*lbf)

21. INSTALL CYLINDER BLOCK WATER JACKET SPACER

- a. Install the water jacket spacer as shown in the illustration.

HINT:

Be sure to face the slope to the front of the engine.

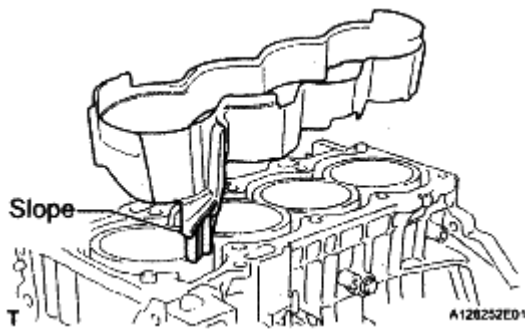


Fig. 428: Identifying Water Jacket Spacer

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

- 22. **INSTALL CYLINDER HEAD GASKET** (See INSTALLATION)
- 23. **INSTALL CYLINDER HEAD SUB-ASSEMBLY** (See INSTALLATION)
- 24. **INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY**
 - a. Apply a light coat of engine oil to a new O-ring, then install it onto the camshaft timing oil control valve.

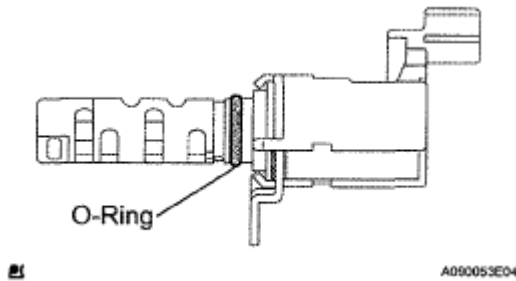


Fig. 429: Identifying O-Ring

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

- b. Install the camshaft timing oil control valve with the bolt.

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

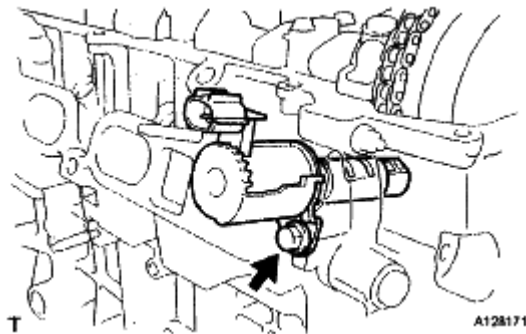


Fig. 430: Locating Camshaft Timing Oil Control Valve With Bolt

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

25. **INSTALL CAMSHAFT TIMING GEAR ASSEMBLY** (See **INSTALLATION**)
26. **INSTALL CAMSHAFT TIMING SPROCKET**
 - a. Clamp the camshaft in a vise.

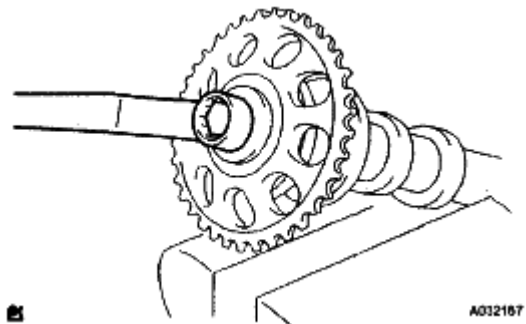


Fig. 431: View Of Camshaft With Vise

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

- b. Tighten the flange bolt with the camshaft timing sprocket fixed.

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

27. INSTALL NO. 1 CAMSHAFT BEARING

- a. Install the No. 1 camshaft bearing.

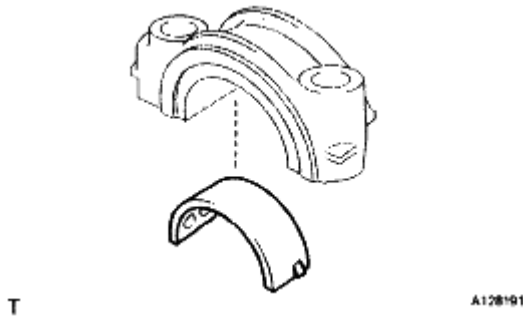


Fig. 432: Identifying Camshaft Bearing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

28. INSTALL NO. 2 CAMSHAFT BEARING (See INSTALLATION)

29. INSTALL CAMSHAFT

- a. Apply a light coat of engine oil to the journal portion of the camshaft.
- b. Examine the front marks and numbers, and check that the order is as shown in the illustration. Then install the bearing caps into the cylinder head.

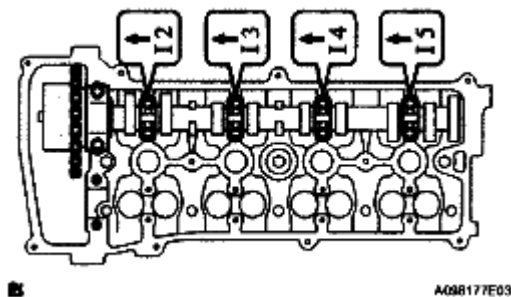


Fig. 433: Identifying Bearing Cap Numbers
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.
- d. Using several steps, uniformly tighten the 10 bearing cap bolts in the sequence shown in the illustration.

Torque: No. 1 bearing cap

30 N*m (301 kgf*cm, 22 ft.*lbf)

No. 3 bearing cap

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

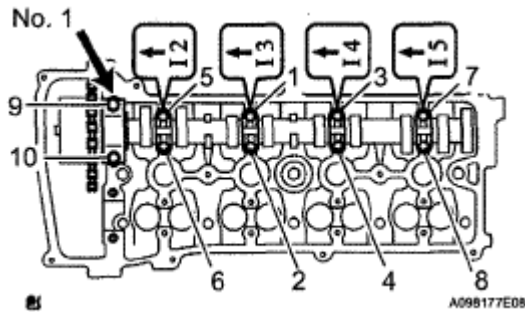


Fig. 434: Identifying Bearing Cap Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

30. INSTALL NO. 2 CAMSHAFT

- Apply a light coat of engine oil to the journal portion of the No. 2 camshaft.
- Examine the front marks and numbers, and check that the order is as shown in the illustration. Then install the bearing caps onto the cylinder head.

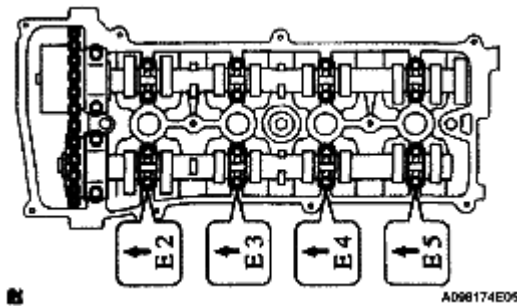


Fig. 435: Identifying Front Marks And Numbers Order
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.
- Using several steps, uniformly tighten the 10 bearing cap bolts in the sequence shown in the illustration.

Torque: No. 1 bearing cap

30 N*m (301 kgf*cm, 22 ft.*lbf)

No. 3 bearing cap

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

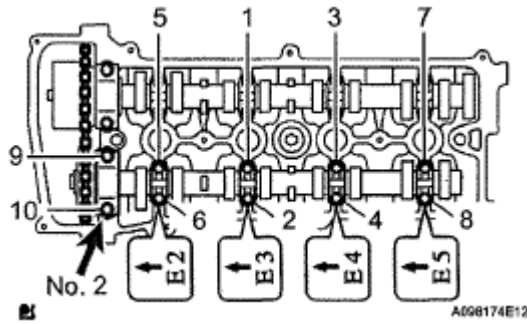


Fig. 436: Identifying Bearing Cap Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

31. INSTALL KEYS

- a. Install the 2 keys.

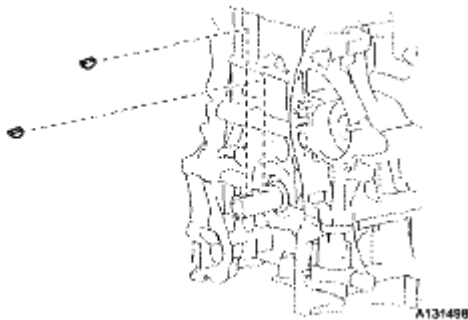


Fig. 437: Identifying Pulley Set Keys And Crankshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

32. **INSTALL NO. 2 CHAIN SUB-ASSEMBLY** (See INSTALLATION)
33. **INSTALL CRANKSHAFT TIMING SPROCKET** (See INSTALLATION)
34. **INSTALL NO. 1 CHAIN VIBRATION DAMPER** (See INSTALLATION)
35. **INSTALL CHAIN SUB-ASSEMBLY** (See INSTALLATION)
36. **INSTALL CHAIN TENSIONER SLIPPER** (See INSTALLATION)
37. **INSTALL TIMING CHAIN GUIDE** (See INSTALLATION)
38. **INSTALL NO. 1 CRANKSHAFT POSITION SENSOR PLATE** (See INSTALLATION)
39. **INSTALL TIMING CHAIN CASE OIL SEAL**

- a. Using SST, tap in a new oil seal until its surface is flush with the timing chain cover edge.

SST 09223-22010

- b. Apply a light coat of MP grease to the lip of the oil seal.

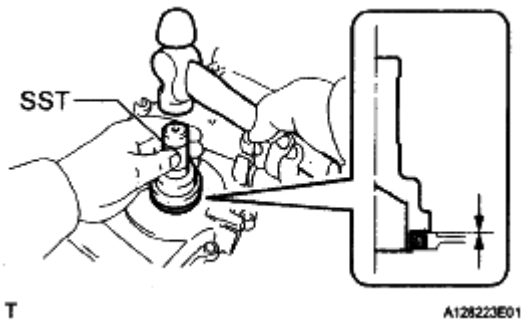


Fig. 438: View Of Timing Chain Case Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE:

- Keep the lip free from foreign matter.
- Do not tap on the oil seal at an angle.
- Make sure that the oil seal edge does not stick out of the timing chain case.

NOTE:

Keep the gap between the timing chain cover edge and the oil seal free of foreign matter.

40. INSTALL TIMING CHAIN COVER SUB-ASSEMBLY (See INSTALLATION)
41. INSTALL OIL PAN SUB-ASSEMBLY (See INSTALLATION)
42. INSTALL OIL PAN DRAIN PLUG

- a. Install a new gasket and oil pan drain plug.

Torque: 25 N*m (255 kgf*cm, 18 ft.*lbf)

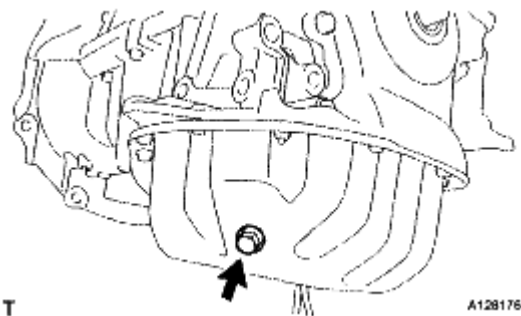


Fig. 439: Locating Oil Pan Drain Plug
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

43. INSTALL WATER PUMP ASSEMBLY (See INSTALLATION)
44. INSTALL WATER PUMP PULLEY (See INSTALLATION)
45. INSTALL CRANKSHAFT POSITION SENSOR
 - a. Apply a light coat of engine oil to the O-ring of the sensor.

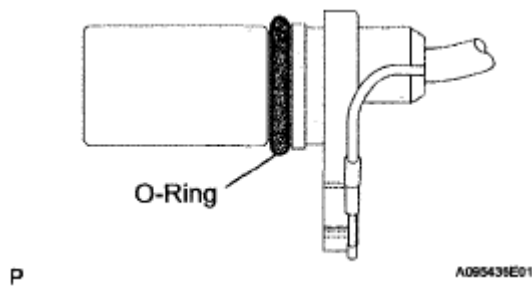


Fig. 440: Identifying Crankshaft Position Sensor O-Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Confirm that the wire harness of the sensor is placed as shown in the illustration.

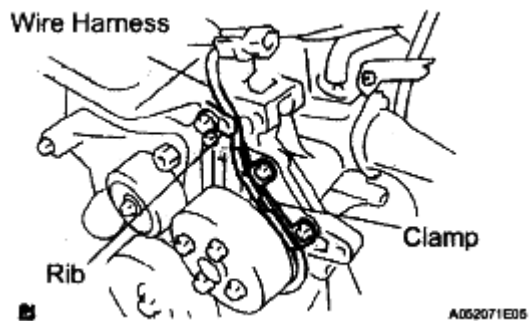


Fig. 441: Identifying Clamp And Wire Harness
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the sensor with the 2 bolts.

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

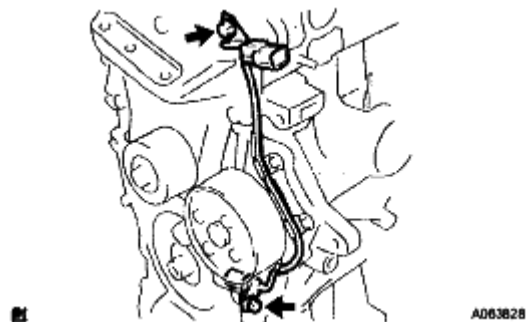


Fig. 442: Locating Sensor And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Install the clamp of the crankshaft position sensor onto the water pump.

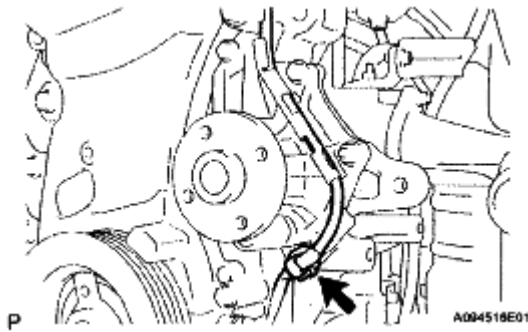


Fig. 443: Locating Clamp Of Crankshaft Position Sensor From Water Pump
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

46. INSTALL CRANKSHAFT PULLEY (See INSTALLATION)
47. INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY (See INSTALLATION)
48. INSPECT VALVE CLEARANCE
49. ADJUST VALVE CLEARANCE (See ADJUSTMENT)
50. INSTALL CAMSHAFT POSITION SENSOR
 - a. Apply a light coat of engine oil to the O-ring of the sensor.

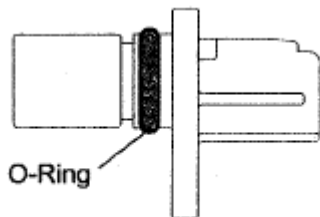


Fig. 444: Identifying Camshaft Position Sensor O-Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the sensor with the bolt.

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

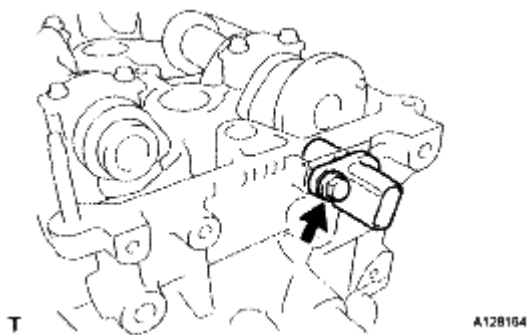


Fig. 445: Locating Sensor And Bolts

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

51. **INSTALL CYLINDER HEAD COVER GASKET**

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

NOTE: Remove any oil from the contact surface.

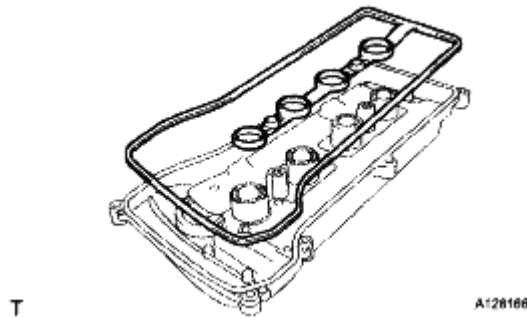


Fig. 446: Identifying Cylinder Head Cover Gasket
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

52. **INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY** (See INSTALLATION)

53. **INSTALL OIL FILTER UNION**

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

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

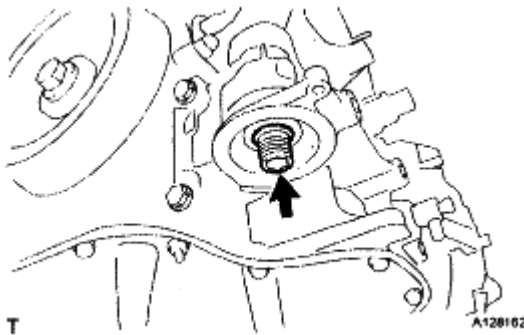
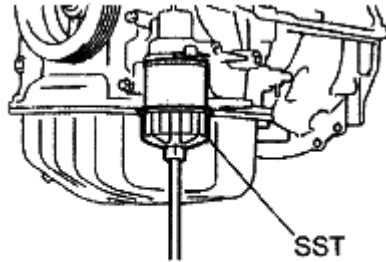


Fig. 447: Locating Oil Filter Union
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

54. **INSTALL OIL FILTER SUB-ASSEMBLY**

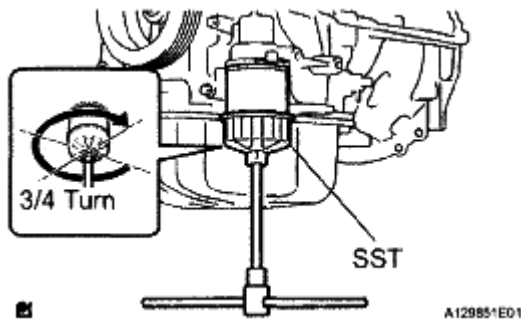
- a. Check and clean the oil filter installation surface.
- b. Apply clean engine oil to the gasket of a new oil filter.
- c. Lightly screw the oil filter into place, and tighten it until the gasket contacts the seat.
- d. When using a torque wrench:
 1. Using SST, tighten the oil filter.

SST 09228-06501**Torque: 13 N*m (133 kgf*cm, 10 ft.*lbf)**

A129850E01

Fig. 448: Identifying Oil Filter With SST**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- e. When not using a torque wrench:
 - 1. Using SST, tighten it an additional 3/4 turn.

SST 09228-06501**Fig. 449: Identifying Oil Filter With SST****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.****55. INSTALL SPARK PLUG**

- a. Install the spark plugs.

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

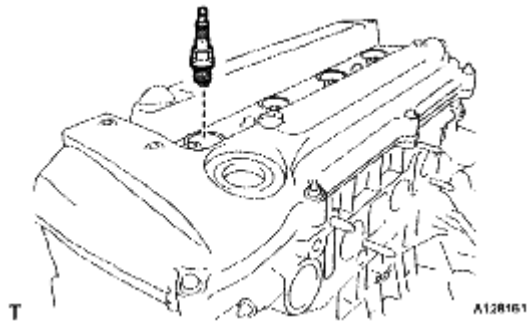


Fig. 450: Identifying Spark Plugs

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

56. INSTALL VENTILATION VALVE SUB-ASSEMBLY

- a. Apply adhesive to the threads of the ventilation valve.

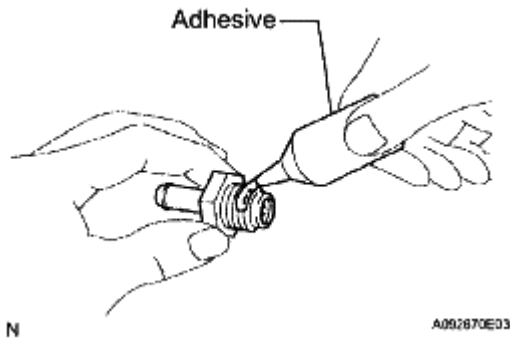


Fig. 451: View Of Adhesive To Threads Of Ventilation Valve

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

- b. Install the ventilation valve.

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

Adhesive: Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

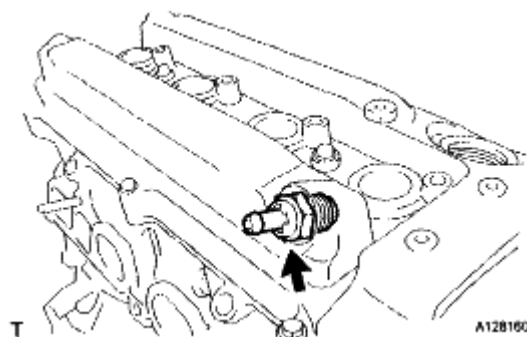
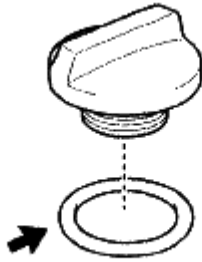


Fig. 452: Locating Ventilation Valve

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

57. INSTALL OIL FILLER CAP GASKET

- a. Install a new gasket to the cap.



T

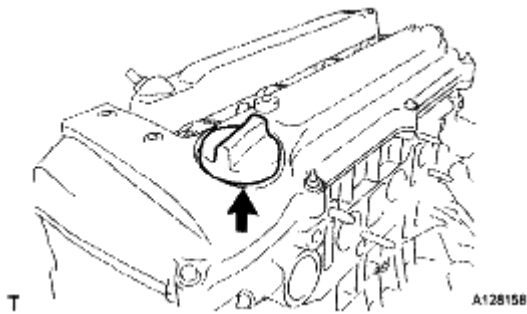
A128158

Fig. 453: Locating Oil Filler Cap Gasket

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

58. INSTALL OIL FILLER CAP SUB-ASSEMBLY

- a. Install the oil filler cap.



T

A128158

Fig. 454: Locating Oil Filler Cap

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