

2009 ENGINE**Engine Mechanical (2AZ-FE) - Corolla Matrix****ENGINE****ON-VEHICLE INSPECTION****1. INSPECT ENGINE COOLANT**

- a. Inspect the engine coolant (See COOLING SYSTEM).

2. INSPECT ENGINE OIL

- a. Inspect the engine oil (See LUBRICATION SYSTEM).

3. INSPECT BATTERY

- a. Inspect the battery (See ON-VEHICLE INSPECTION).

4. INSPECT AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY

- a. Remove the air cleaner cap sub-assembly (See REMOVAL).
- b. Remove the air filter element.
- c. Visually check that the air filter is not excessively damaged or oily.

If necessary, replace the air filter.

5. INSPECT SPARK PLUG (See ON-VEHICLE INSPECTION)**6. INSPECT V-RIBBED BELT (See ON-VEHICLE INSPECTION)****7. INSPECT IGNITION TIMING****NOTE:**

- Turn all the electrical systems and the A/C off.
- When checking the ignition timing, move the shift lever to neutral.

- a. Warm up and stop the engine.

- b. When using the Techstream:

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON.
3. Turn the Techstream on.
4. Enter the following menus: Power Train / Engine and ECT / Data List / IGN Advance.
5. Start the engine.
6. According to the display on the Techstream, read the Data List.

Standard ignition timing:

5 to 15° BTDC at idle

7. Check that the ignition timing advances immediately when the engine speed is increased.
8. Turn the ignition switch off.
9. Disconnect the Techstream from the DLC3.
- c. When not using the Techstream:
 1. Remove the No. 1 engine cover sub-assembly (See **REMOVAL**).
 2. Open the ignition cover located to the right of the No. 4 ignition coil.
 3. Pull the wire harness out from the IG cover.
 4. (4)Connect the timing light to the wire harness.

NOTE: Use a timing light that detects the primary signal.

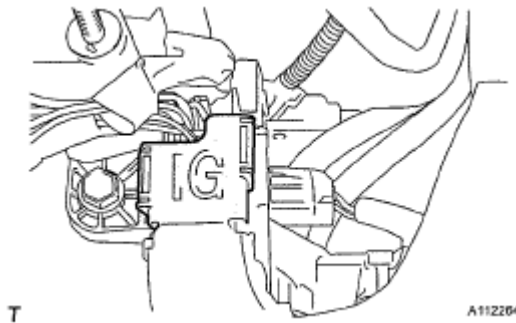


Fig. 1: Identifying Ignition Cover

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5. Using SST, connect terminals 13 (TC) and 4 (CG) of the DLC3.

SST 09843-18040

6. Allow the engine to idle and check the ignition timing.

Standard ignition timing:

8 to 12° BTDC at idle

HINT:

Run the engine at 1000 to 1300 rpm for 5 seconds, then check that the engine speed returns to idle speed.

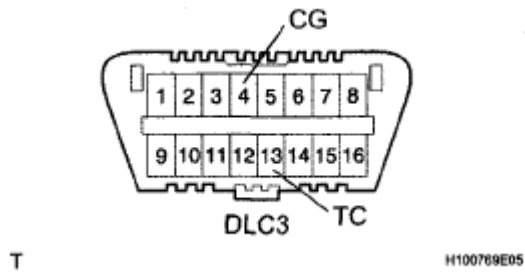


Fig. 2: Identifying Terminals (TC) And (CG) Of DLC3
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. Disconnect SST from terminals 13 (TC) and 4 (CG) of the DLC3.
8. Allow the engine to idle and check the ignition timing.

Standard ignition timing:

5 to 15° BTDC at idle

9. Check that the ignition timing advances immediately when the engine speed is increased.
10. Turn the ignition switch off.
11. Remove the timing light.
12. Close the IG cover.
13. Install the No. 1 engine cover sub-assembly (See **INSTALLATION**).

8. INSPECT ENGINE IDLE SPEED

NOTE:

- Turn all the electrical systems and the A/C off.
- When checking the idle speed, move the shift lever to P or neutral.

- a. Warm up and stop the engine.
- b. When using the Techstream:
 1. Connect the Techstream to the DLC3.
 2. Turn the ignition switch to ON.
 3. Turn the Techstream on.
 4. Enter the following menus: Power Train / Engine and ECT / Data List / Engine Speed.
 5. Start the engine.
 6. According to the display on the Techstream, read the Data List.

Standard idle speed:

600 to 700 rpm

7. Turn the ignition switch off.

8. Disconnect the Techstream from the DLC3.
- c. When not using the Techstream:
 1. Turn off all the accessories and air conditioning.
 2. Move the shift lever to P or neutral.
 3. Connect SST to terminal 9 (TAC) of the DLC3, and then connect a tachometer to SST.

SST 09843-18030

4. Start the engine.
5. Check the idle speed with the cooling fan off.

Standard idle speed:**600 to 700 rpm**

6. Turn the ignition switch off.
7. Remove the tachometer and disconnect SST from the DLC3.

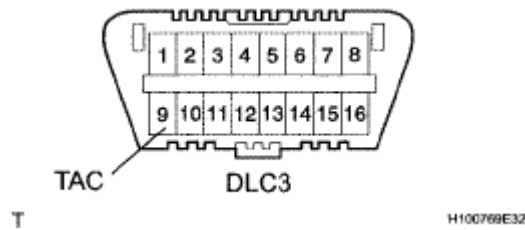


Fig. 3: Identifying Terminal (TAC) Of DLC3
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. INSPECT COMPRESSION

- a. Warm up and stop the engine.
- b. Remove the 4 ignition coils and spark plugs (See **REMOVAL**).
- c. Disconnect the 4 fuel injector connectors.
- d. Set SST and a compression gauge.

SST 09992-00500

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

Standard compression pressure:**1300 kPa (13.3 kgf/cm² , 189 psi)**

Minimum compression pressure:

1000 kPa (10.0 kgf/cm² , 145 psi)

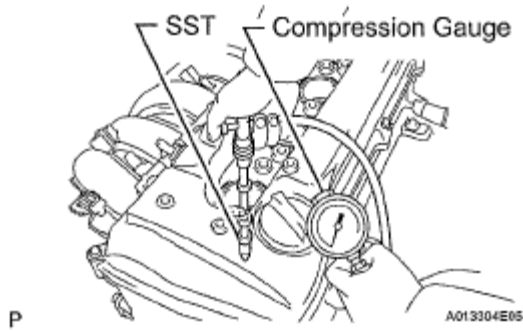


Fig. 4: Inserting Compression Gauge Into Spark Plug Hole
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard difference between each cylinder:

100 kPa (1.0 kgf/cm² , 15 psi) or less

NOTE:

- **Always use a fully-charged battery to obtain an engine speed of 250 rpm or more.**
- **Check the other cylinders in the same way.**
- **This measurement must be done as quickly as possible.**

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.

h. Connect the 4 fuel injector connectors.

i. Install the 4 spark plugs and ignition coils (See **INSTALLATION**).

10. INSPECT CO/HC

HINT:

This check determines whether or not the idle CO/HC complies with local regulations.

- a. Start and warm up the engine.

2009 Toyota Matrix

2009 ENGINE Engine Mechanical (2AZ-FE) - Corolla Matrix

- b. Run the engine at 2500 rpm for approximately 180 seconds.
- c. Insert the CO/HC meter testing probe at least 40 cm (1.3 ft.) into the tailpipe while idling.
- d. Inspect the CO/HC concentration during idle and when the engine is running at 2500 rpm.

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

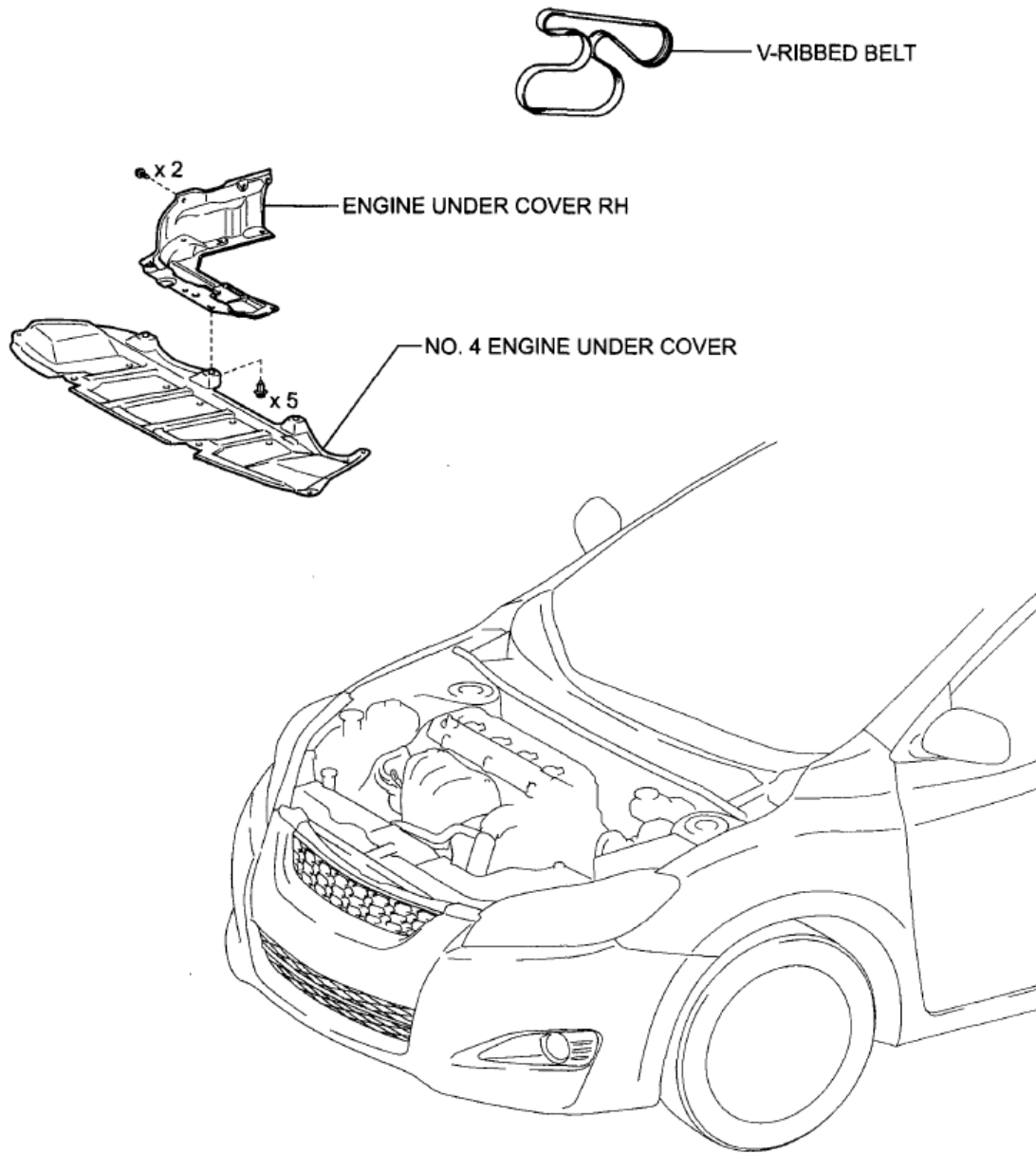
1. Check the A/F sensor and heated oxygen sensor operation.
2. See the table below for possible causes, then inspect the applicable parts and repair them if necessary.

TROUBLESHOOTING CHART

CO	HC	Problem	Possible Cause
Normal	High	Rough idle	1. Faulty ignition: ○ Incorrect timing ○ Plugs are contaminated, shorted, or gaps are defective 2. Incorrect valve clearance 3. Leaks in intake and exhaust valves 4. Leaks in cylinders
Low	High	Rough idle (Fluctuating HC reading)	1. Vacuum leakage: ○ Ventilation hoses ○ Intake manifold ○ Throttle body ○ Brake booster line 2. Lean mixture causing misfire
High	High	Rough idle (Black smoke from exhaust)	1. Restricted air filter 2. Plugged PCV valve 3. Faulty EFI system: ○ Faulty pressure regulator ○ Faulty engine coolant temperature sensor ○ Faulty mass air flow meter ○ Faulty ECM ○ Faulty injectors ○ Faulty throttle body

DRIVE BELT

COMPONENTS



A187490E01

Fig. 5: Identifying Drive Belt Components

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

ON-VEHICLE INSPECTION

1. CHECK V-RIBBED BELT

- Check the belt for wear, cracks or other signs of damage.

If any of the following defects is found, replace the V-ribbed belt.

- The belt is cracked.

- The belt is worn out to the extent that the cords are exposed.
- The belt has chunks missing from the ribs.

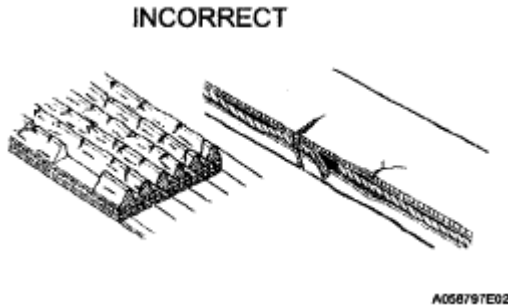


Fig. 6: Identifying V-Ribbed Belt Incorrect Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Check that the belt fits properly in the ribbed grooves.

HINT:

Check by hand to confirm that the belt has not slipped out of the groove on the bottom to the pulley. If it has slipped out, replace the V-ribbed belt. Install a new V-ribbed belt correctly.



A057787E03

Fig. 7: Identifying V-Ribbed Belt Correct And Incorrect Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. **REMOVE ENGINE UNDER COVER RH**
2. **REMOVE V-RIBBED BELT**
 - a. Using SST, slowly turn the V-ribbed belt tensioner clockwise.

SST 09216-42010 (09216-04010)

- b. Remove the V-ribbed belt from each pulley and slowly return the tensioner.

NOTE:

- **Make sure that SST and other tools are set to the tensioner securely.**
- **When compressing the V-ribbed belt tensioner, slowly turn the**

tensioner.

- Be careful not to pinch your fingers between the parts.

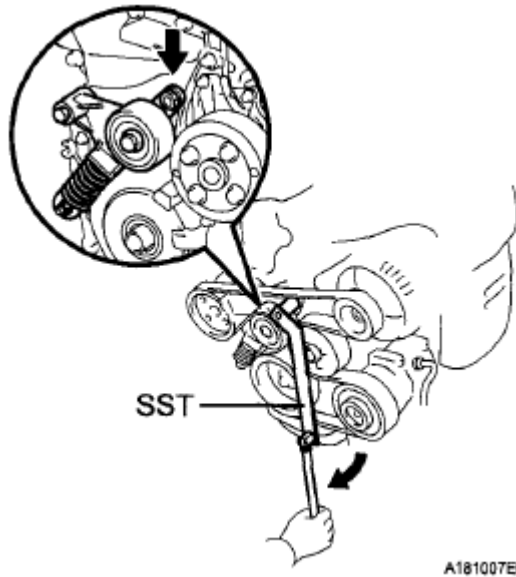


Fig. 8: Turning V-Ribbed Belt Tensioner
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSTALLATION

1. INSTALL V-RIBBED BELT

HINT:

The illustration shows the V-ribbed belt layout.

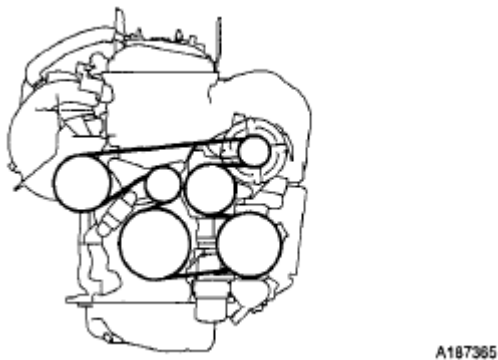


Fig. 9: Identifying V-Ribbed Belt Layout
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Using SST, slowly turn the V-ribbed belt tensioner clockwise and install the V-ribbed belt.

SST 09216-42010 (09216-04010)

NOTE:

- Make sure that SST and other tools are set to the tensioner securely.
- When compressing the V-ribbed belt tensioner, slowly turn the tensioner.

2. INSTALL ENGINE UNDER COVER RH

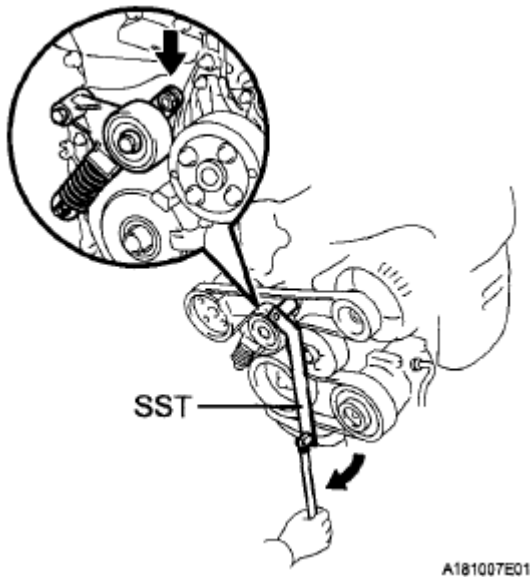


Fig. 10: Turning V-Ribbed Belt Tensioner
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

VALVE CLEARANCE

ADJUSTMENT

1. REMOVE ENGINE UNDER COVER RH
2. REMOVE NO. 1 ENGINE COVER SUB-ASSEMBLY (See REMOVAL)
3. REMOVE IGNITION COIL ASSEMBLY (See REMOVAL)
4. REMOVE SPARK PLUG (See REMOVAL)
5. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY (See REMOVAL)
6. SET NO. 1 CYLINDER TO TDC/COMPRESSION (See REMOVAL)
7. CHECK VALVE CLEARANCE
 - a. Check only the valves indicated in the illustration.
 1. Using a feeler gauge, measure the clearance between the valve lifter and camshaft.

Standard Valve Clearance (Cold)

VALVE CLEARANCE SPECIFICATION

Item	Specified Condition
Intake	0.19 to 0.29 mm (0.00748 to 0.0114 in.)
Exhaust	0.38 to 0.48 mm (0.0150 to 0.0189 in.)

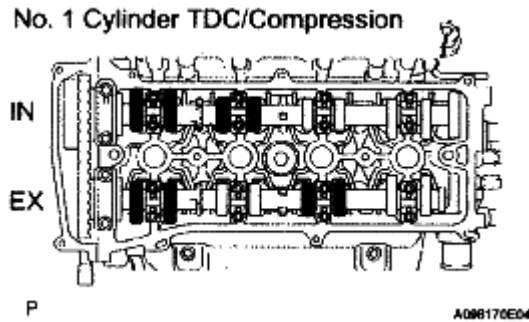


Fig. 11: Measuring Clearance Between Valve Lifter And Camshaft (No.1 Cylinder)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Standard Valve Clearance (Cold)

VALVE CLEARANCE SPECIFICATION

Item	Specified Condition
Intake	0.19 to 0.29 mm (0.00748 to 0.0114 in.)
Exhaust	0.38 to 0.48 mm (0.0150 to 0.0189 in.)

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

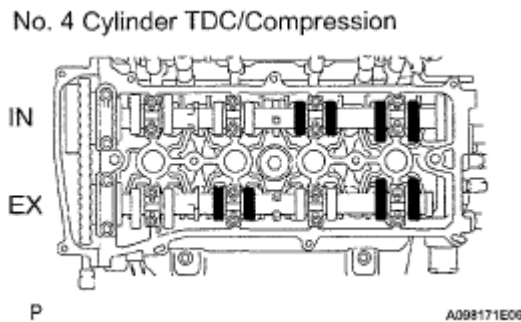


Fig. 12: Measuring Clearance Between Valve Lifter And Camshaft (No.4 Cylinder)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. ADJUST VALVE CLEARANCE

- Set the No. 1 cylinder to TDC/compression (See **REMOVAL**).
- Remove the No. 1 chain tensioner (See **REMOVAL**).
- Loosen the camshaft timing gear or sprocket (See **REMOVAL**).
- Remove the No. 2 camshaft (See **REMOVAL**).
- Remove the camshaft (See **REMOVAL**).
- Remove the valve lifters.
- Using a micrometer, measure the thickness of the removed valve lifters.
- 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	$A = B + (C - 0.24 \text{ mm (0.00945 in.)})$
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

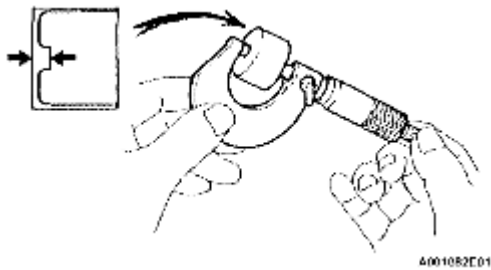


Fig. 13: Measuring Thickness Of Removed Valve Lifters
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

CALCULATION EXAMPLE (Intake):

- Measured intake valve clearance = 0.40 mm (0.0157 in.)

(Measured - Specification = Excess clearance)

- $(a) 0.40 \text{ mm (0.0157 in.)} - 0.24 \text{ mm (0.00945 in.)} = 0.16 \text{ mm (0.00630 in.)}$
- Measured used lifter thickness = 5.250 mm (0.2067 in.)
- New lifter thickness = 5.410 mm (0.2130 in.) (Excess clearance + Used lifter thickness = Ideal new lifter)

- a. $(a)0.16 \text{ mm (0.00630 in.)} + 5.250 \text{ mm (0.2067 in.)} = 5.410 \text{ mm (0.2130 in.)}$
4. Closest new lifter = 5.420 mm (0.2134 in.) - Select No. 42 lifter
- i. 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 mm (0.000787 in.), from 5.060 to 5.740 mm (0.1992 to 0.2260 in.).
- The identification number inside the valve lifters shows the value to 2 decimal places. The illustration shows 5.420 mm (0.2134 in.).

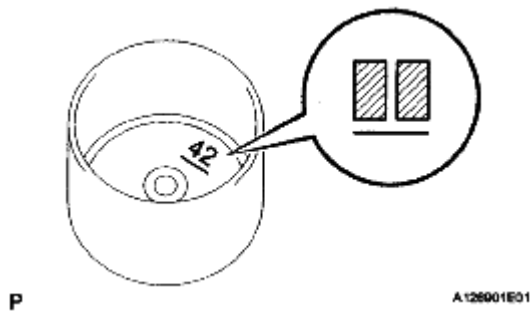


Fig. 14: Identifying Number 42 Valve Lifter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- j. Valve lifter selection chart (intake).

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2009 ENGINE Engine Mechanical (2AZ-FE) - Corolla Matrix

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)
5.480 (0.2157)	0.711 - 0.730 (0.0283 - 0.0291)	0.711 - 0.730 (0.0283 - 0.0291)
5.490 (0.2161)	0.731 - 0.750 (0.0291 - 0.0299)	0.731 - 0.750 (0.0291 - 0.0299)
5.500 (0.2165)	0.751 - 0.770 (0.0299 - 0.0307)	0.751 - 0.770 (0.0299 - 0.0307)
5.510 (0.2169)	0.771 - 0.790 (0.0307 - 0.0315)	0.771 - 0.790 (0.0307 - 0.0315)
5.520 (0.2173)	0.791 - 0.810 (0.0315 - 0.0323)	0.791 - 0.810 (0.0315 - 0.0323)
5.530 (0.2177)	0.811 - 0.830 (0.0323 - 0.0331)	0.811 - 0.830 (0.0323 - 0.0331)
5.540 (0.2181)	0.831 - 0.850 (0.0331 - 0.0339)	0.831 - 0.850 (0.0331 - 0.0339)
5.550 (0.2185)	0.851 - 0.870 (0.0339 - 0.0347)	0.851 - 0.870 (0.0339 - 0.0347)
5.560 (0.2189)	0.871 - 0.890 (0.0347 - 0.0355)	0.871 - 0.890 (0.0347 - 0.0355)
5.570 (0.2193)	0.891 - 0.910 (0.0355 - 0.0363)	0.891 - 0.910 (0.0355 - 0.0363)
5.580 (0.2197)	0.911 - 0.930 (0.0363 - 0.0371)	0.911 - 0.930 (0.0363 - 0.0371)
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 (0.2262)		
5.740 (0.2260)		

6

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Fig. 15: 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 Matrix

2009 ENGINE Engine Mechanical (2AZ-FE) - Corolla Matrix

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 (0.00748 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.

- k. Valve lifter selection chart (exhaust).

2009 ENGINE Engine Mechanical (2AZ-FE) - Corolla Matrix

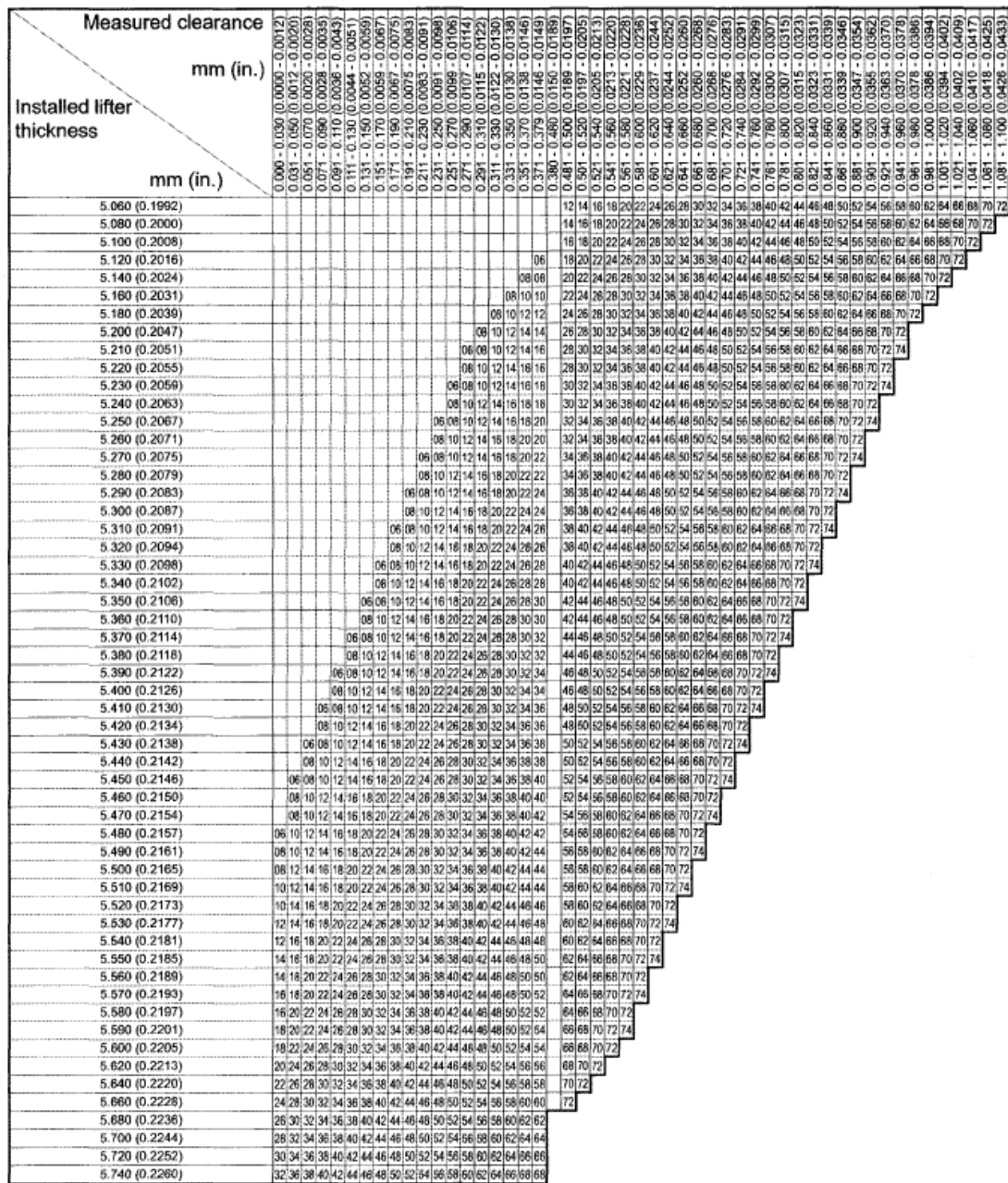


Fig. 16: Valve Lifter Selection Chart (Exhaust)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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 Matrix

2009 ENGINE Engine Mechanical (2AZ-FE) - Corolla Matrix

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.

- l. Install the selected valve lifter.
- m. Install the camshaft (See **INSTALLATION**).
- n. Install the No. 2 camshaft (See **INSTALLATION**).
- o. Install the No. 1 chain tensioner (See **INSTALLATION**).
9. **INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY** (See **INSTALLATION**)
10. **INSTALL SPARK PLUG** (See **INSTALLATION**)
11. **INSTALL IGNITION COIL ASSEMBLY** (See **INSTALLATION**)
12. **INSPECT FOR OIL LEAK**
13. **INSPECT IGNITION TIMING** (See **ENGINE**)
14. **INSTALL NO. 1 ENGINE COVER SUB-ASSEMBLY** (See **INSTALLATION**)
15. **INSTALL ENGINE UNDER COVER RH**

CAMSHAFT

COMPONENTS

2009 Toyota Matrix

2009 ENGINE Engine Mechanical (2AZ-FE) - Corolla Matrix

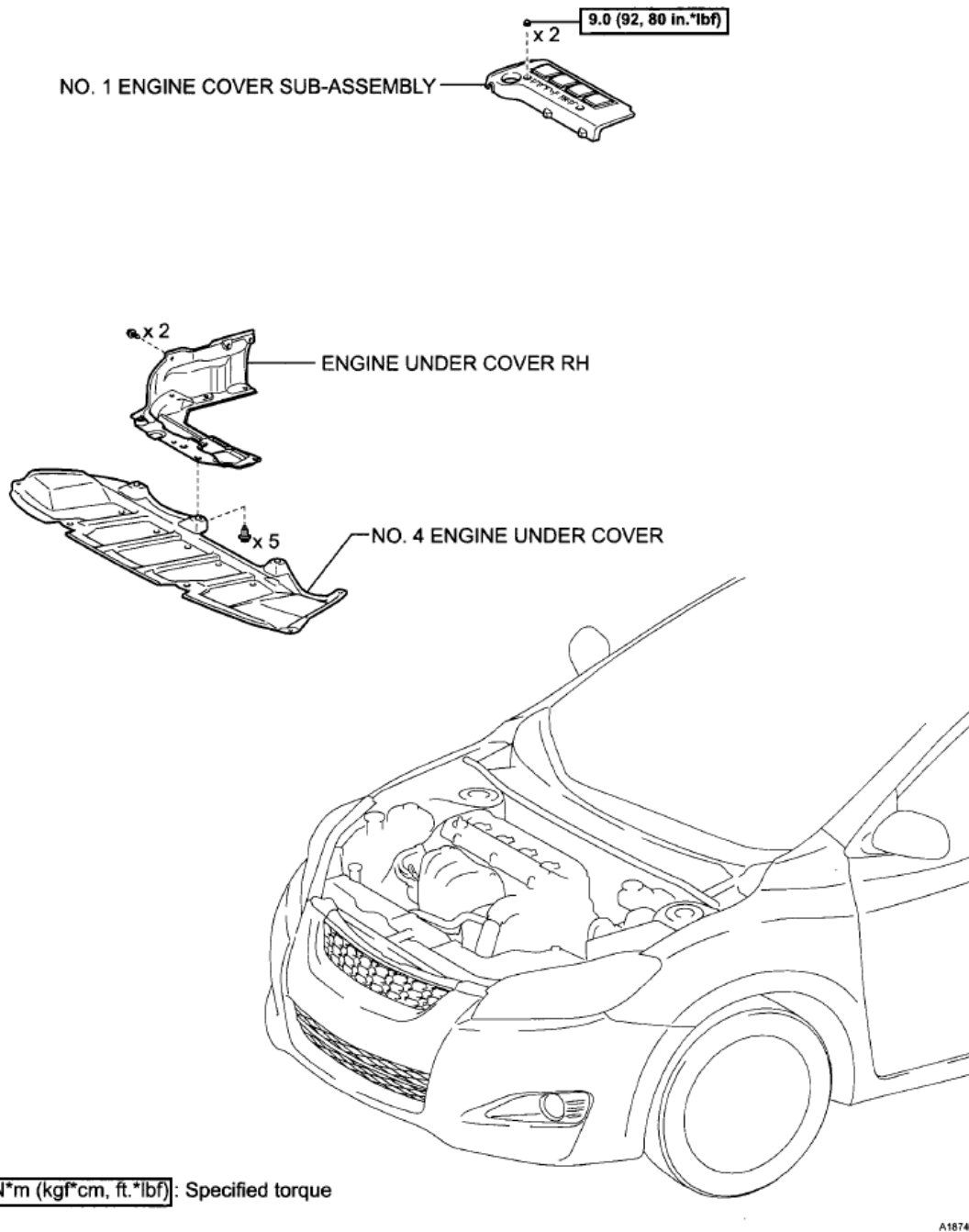
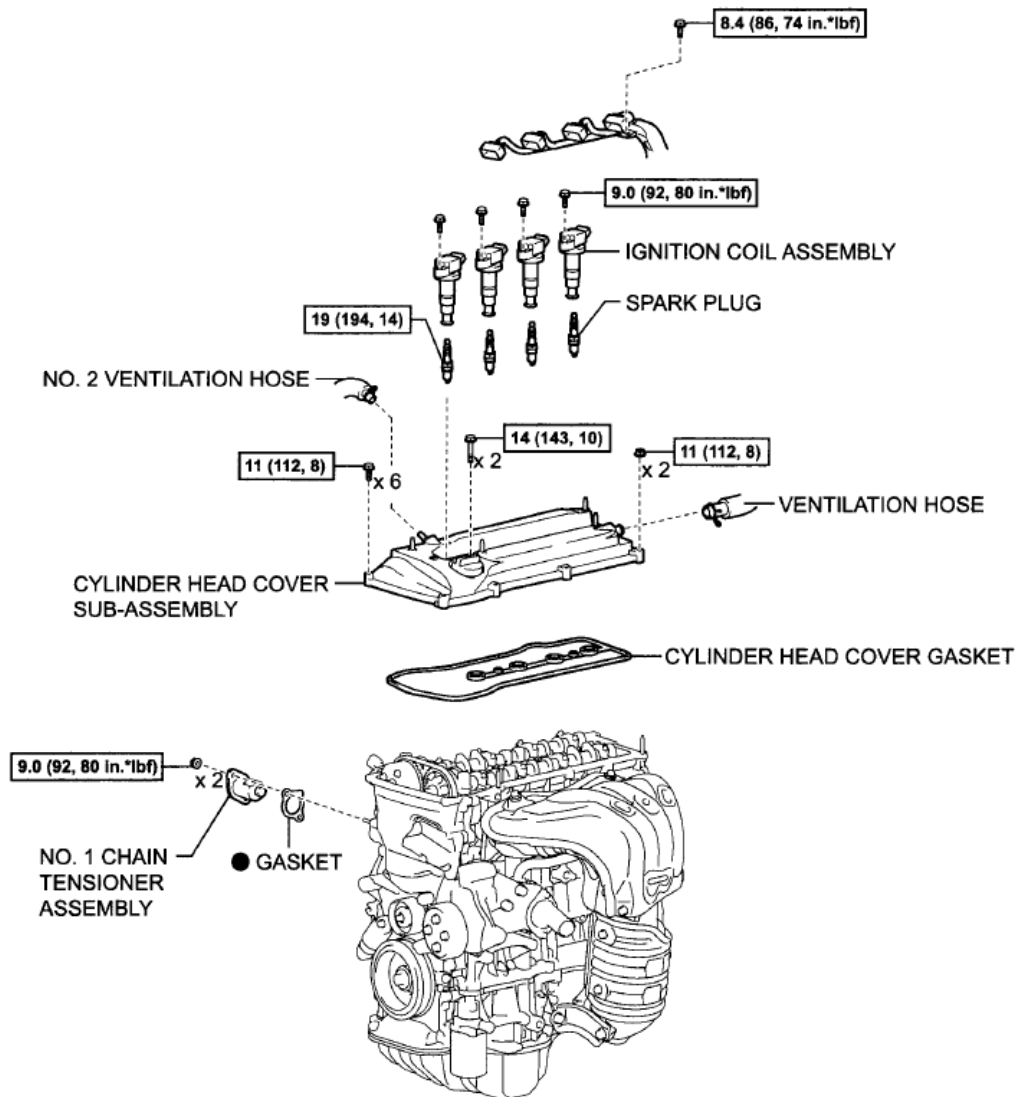


Fig. 17: Identifying Camshaft Components With Torque Specifications (1 Of 3)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



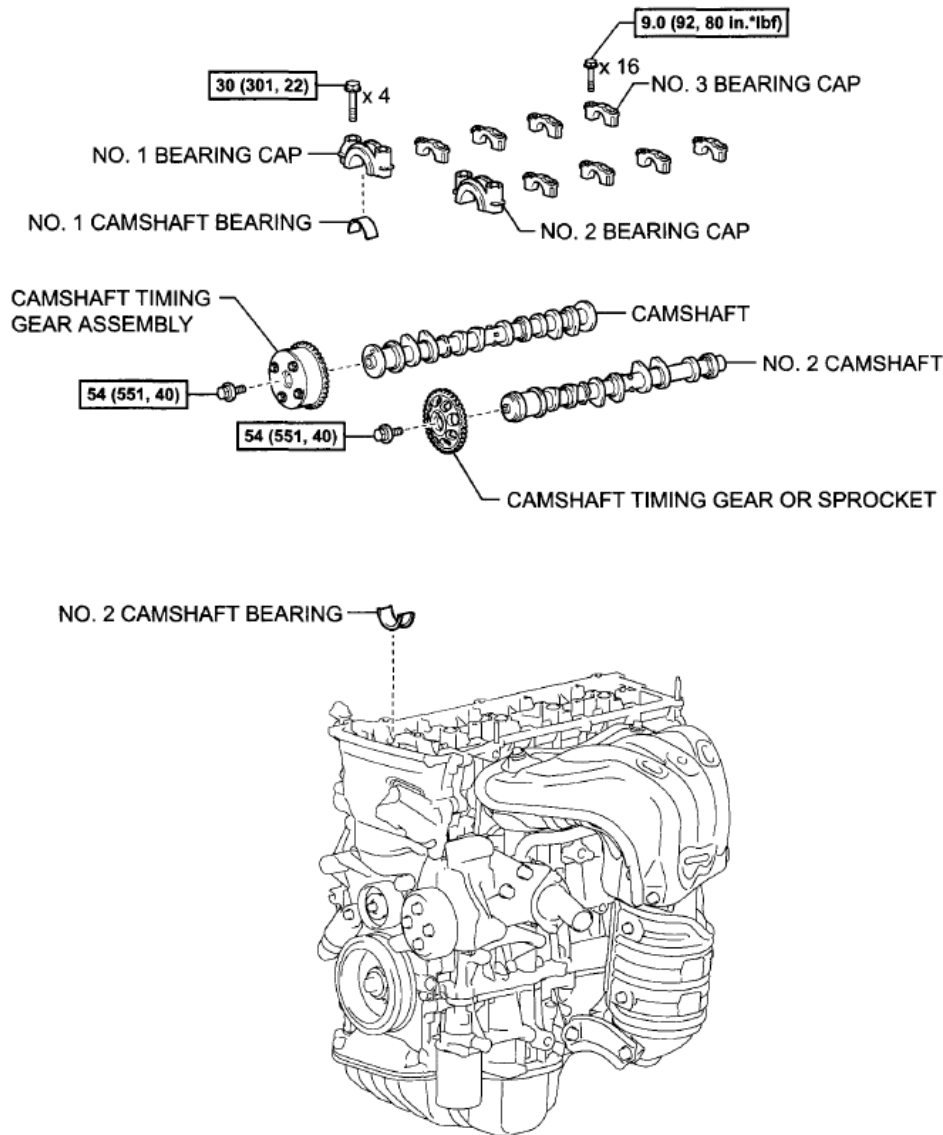
[N*m (kgf*cm, ft.*lbf)]: Specified torque

● Non-reusable part

P

A158824E02

Fig. 18: Identifying Camshaft Components With Torque Specifications (2 Of 3)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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

P

A156828E02

Fig. 19: Identifying Camshaft Components With Torque Specifications (3 Of 3)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. **REMOVE ENGINE UNDER COVER RH**
2. **REMOVE NO. 1 ENGINE COVER SUB-ASSEMBLY** (See **REMOVAL**)
3. **REMOVE IGNITION COIL ASSEMBLY** (See **REMOVAL**)
4. **REMOVE SPARK PLUG** (See **REMOVAL**)
5. **REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY**

- a. Remove the 2 ventilation hoses from the cylinder head cover sub-assembly.

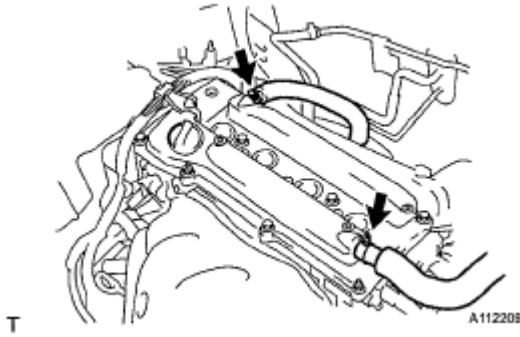


Fig. 20: Locating Ventilation Hoses

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

- b. Remove the 2 bolts and separate the 2 wire harness brackets.

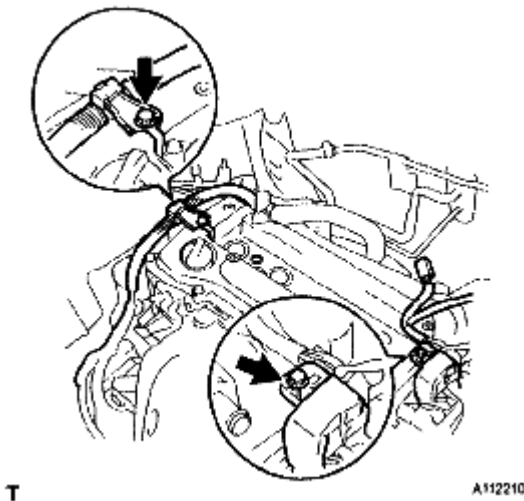


Fig. 21: Locating Wire Harness Brackets Bolts

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

- c. Remove the 8 bolts and 2 nuts, then remove the cylinder head cover sub-assembly and gasket.

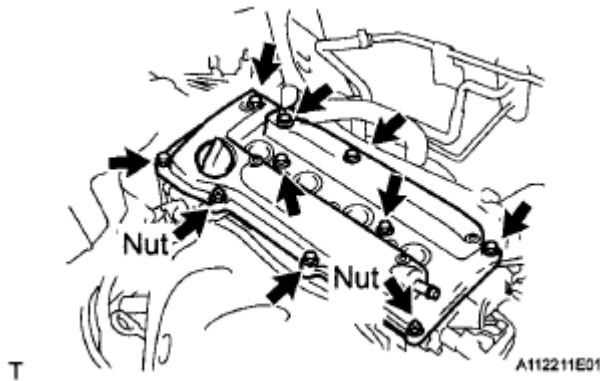


Fig. 22: Locating Cylinder Head Cover Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. SET NO. 1 CYLINDER TO TDC/COMPRESSION

- Turn the crankshaft pulley until the groove and the timing mark "0" on the timing chain cover are aligned.
- Check that each timing mark on 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 pulley 1 revolution (360°) to align the timing marks as illustrated.

- Place paint marks on the chain in alignment with the timing marks on the camshaft timing gear and camshaft timing sprocket.

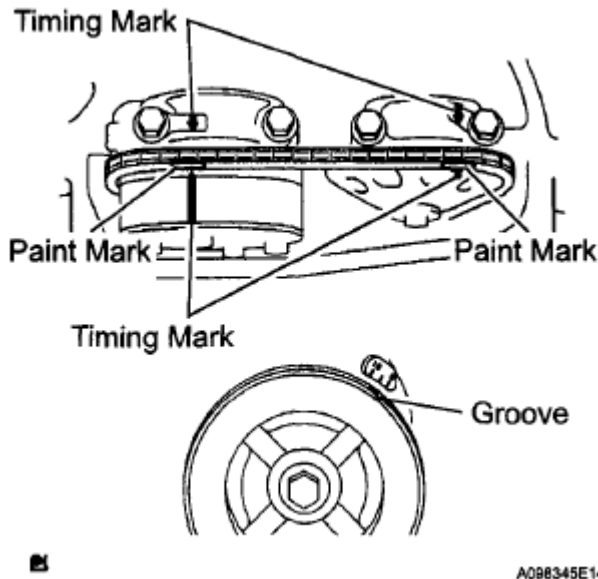


Fig. 23: Identifying Timing Mark On Camshaft Timing Gear And Sprocket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY (See REMOVAL)

8. LOOSEN CAMSHAFT TIMING GEAR OR SPROCKET

- a. While holding the No. 2 camshaft with a wrench, loosen the No. 2 camshaft timing set bolt.

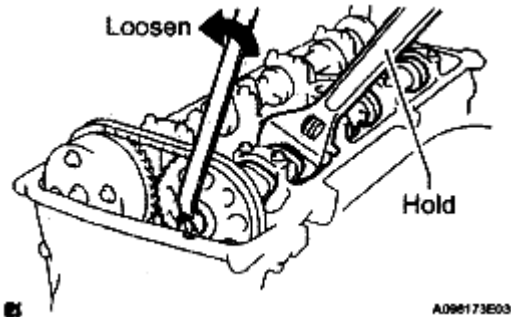


Fig. 24: Loosening Camshaft Timing Set Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. REMOVE NO. 2 CAMSHAFT

- a. Using several steps, uniformly loosen and remove the 10 bearing cap bolts in the sequence shown in the illustration.
- b. Remove the 5 bearing caps.

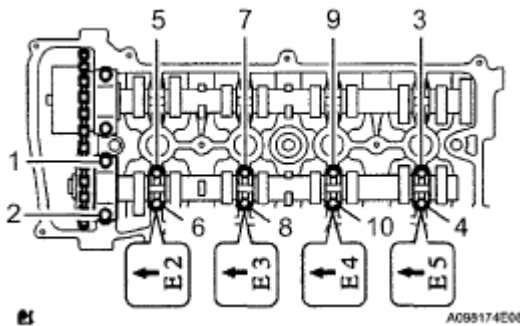


Fig. 25: Identifying Bearing Cap Bolts Removing Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. While holding the No. 2 camshaft by hand, remove the camshaft timing sprocket set bolt.
- d. Remove the camshaft timing sprocket from the No. 2 camshaft with the timing chain placed around the sprocket.
- e. Remove the camshaft timing sprocket from the timing chain.

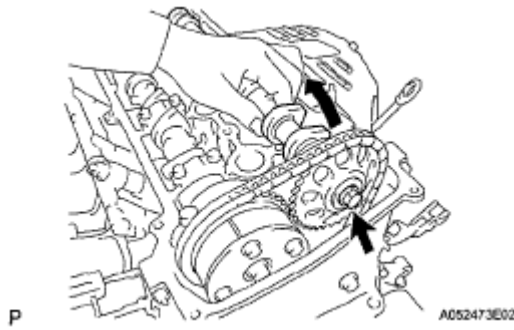


Fig. 26: Removing Camshaft Timing Sprocket From Timing Chain
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. REMOVE CAMSHAFT

- a. In several steps, uniformly loosen and remove the 10 bearing cap bolts in the sequence shown in the illustration.
- b. Remove the 5 bearing caps.
- c. Remove the camshaft and camshaft timing gear assembly while holding the timing chain by hand.

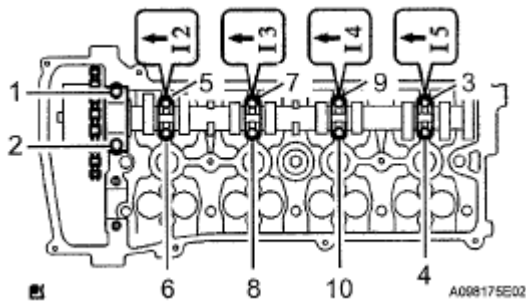


Fig. 27: Identifying Bearing Cap Bolts Removing Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Support the timing chain with a string to prevent it from slipping off the crankshaft sprocket as shown in the illustration.

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

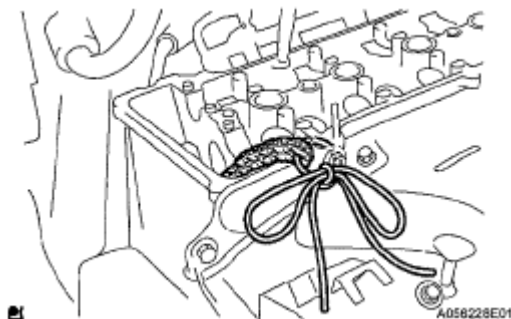


Fig. 28: Supporting Timing Chain With String
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. REMOVE CAMSHAFT TIMING GEAR ASSEMBLY

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

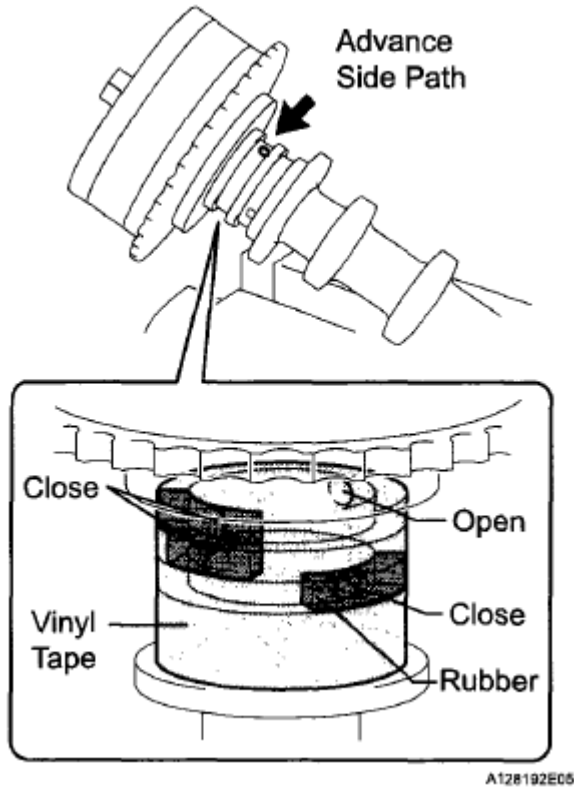


Fig. 29: Clamping Camshaft In Vise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Apply air pressure of 150 kPa (1.5 kgf/cm², 22 psi) to the opened oil path, then turn the camshaft timing gear assembly to the advance direction (counterclockwise) by hand.

CAUTION: Cover the paths with a piece of cloth to avoid oil splashes.

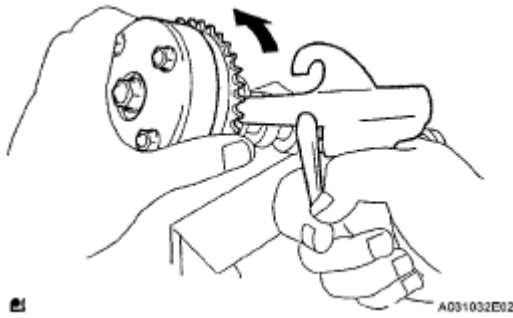


Fig. 30: Applying Air Pressure Of Opened Oil Path
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

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

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

NOTE:

- Be sure not to remove the other 4 bolts.
- When reusing the camshaft timing gear, release the straight pin lock first, then install the gear.

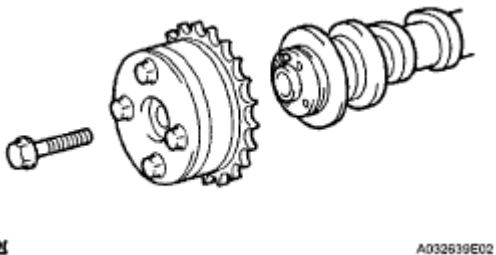


Fig. 31: Identifying Camshaft Timing Gear And Flange Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION

1. INSPECT CAMSHAFT TIMING GEAR ASSEMBLY

- a. Install the camshaft timing gear assembly (See **INSTALLATION**).
- b. Clamp the camshaft in a vise, and make sure that the camshaft timing gear assembly does not rotate.
- c. Cover all the oil paths with vinyl tape except the advance side path shown in the illustration.

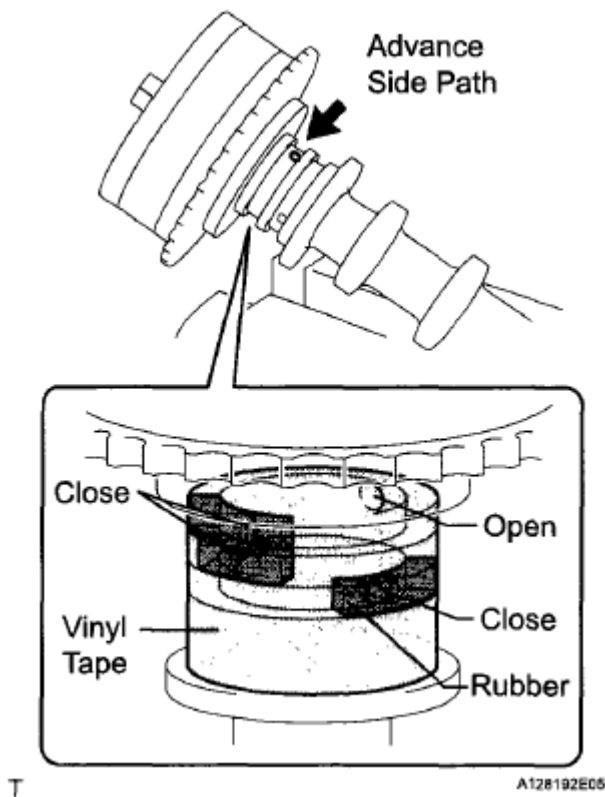


Fig. 32: Clamping Camshaft In Vise

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

- d. Apply air pressure of 150 kPa (1.5 kgf/cm² , 22 psi) to the opened oil path.

CAUTION: Cover the paths with a piece of cloth to avoid oil splashes.

- e. Check that the camshaft timing gear revolves in the advance direction (counterclockwise) by hand.

HINT:

Depending on the air pressure, the camshaft timing gear may turn to the advance side without applying force by hand. Also, if enough air pressure cannot be applied because of air leakage from the path, releasing the lock pin may be difficult.

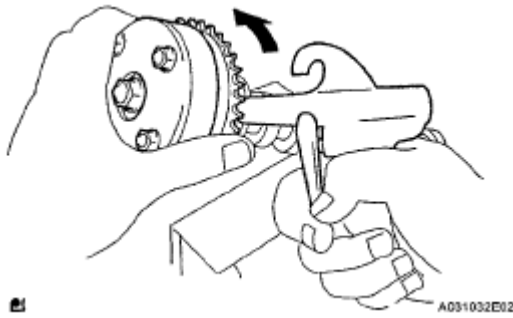


Fig. 33: Applying Air Pressure Of Opened Oil Path
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Check for smooth rotation.
 1. Turn the camshaft timing gear within its movable range (21°) 2 or 3 times, but do not turn it to the most retarded position. Make sure that the gear turns smoothly.

NOTE: Do not use air pressure to perform the smooth rotation check.

- g. Check the lock in the most retarded position.
 1. Confirm that the camshaft timing gear is locked at the most retarded position.
- h. Remove the camshaft timing gear assembly (See **REMOVAL**).

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.

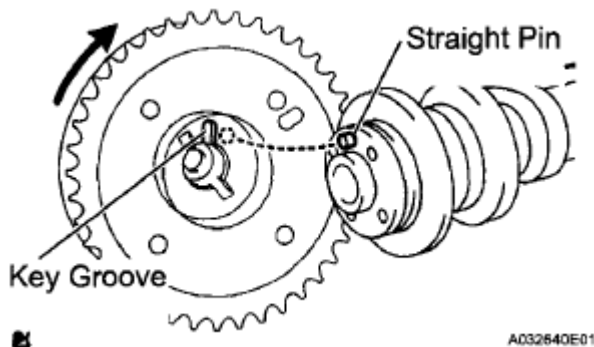


Fig. 34: Aligning Straight Pin And Key Groove
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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 direction (clockwise).

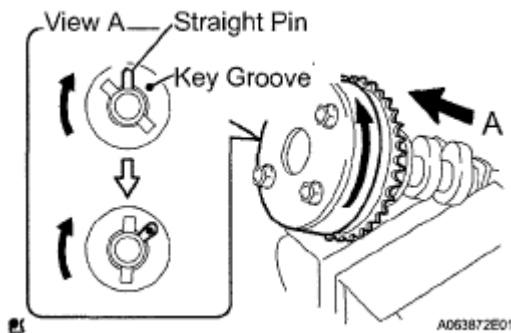


Fig. 35: Turning Camshaft Timing Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Check that there is no clearance between the timing gear and camshaft flange.

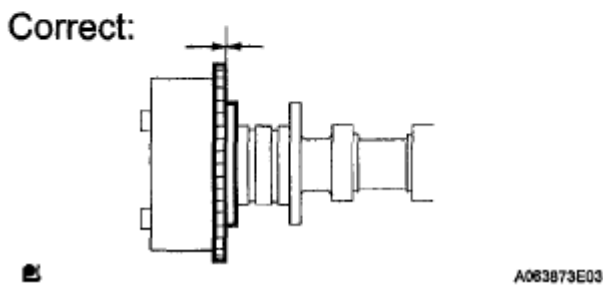
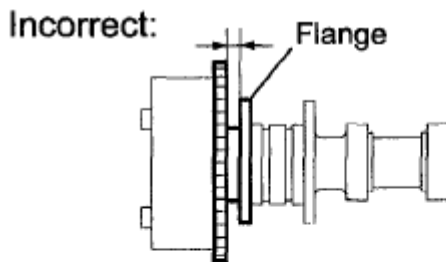


Fig. 36: Identifying Clearance Between Timing Gear And Camshaft Flange
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Tighten the flange bolt with the camshaft timing gear assembly secured in place.

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

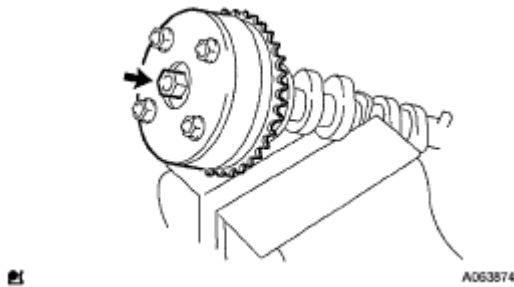


Fig. 37: Locating Flange Bolt

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

- e. Check that the camshaft timing gear assembly can move to the retard direction (clockwise) 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.

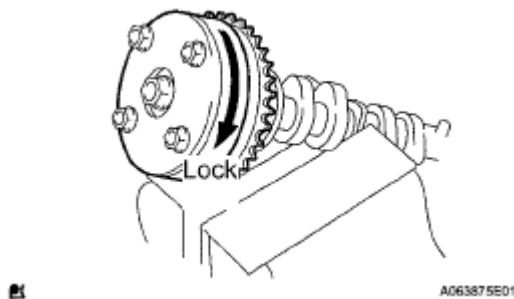


Fig. 38: Checking Camshaft Timing Gear Assembly

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

- 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.

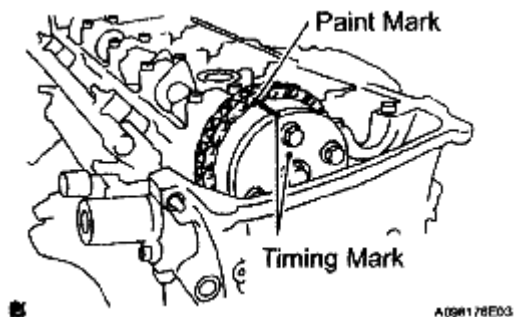


Fig. 39: Identifying Timing Mark On Camshaft Timing Gear

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.

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

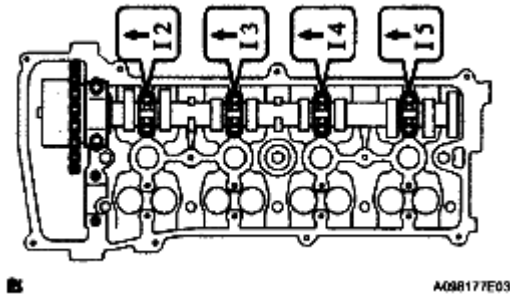


Fig. 40: Identifying Bearing Caps Illustration Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Torque: No. 1 bearing

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

No. 3 bearing

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

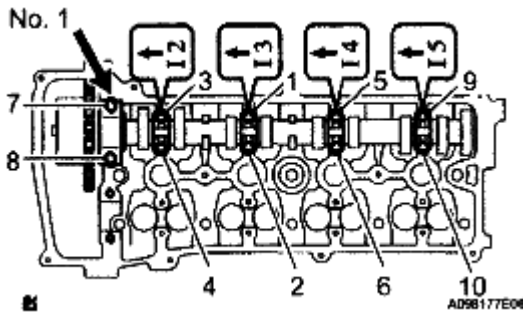


Fig. 41: Identifying Bearing Cap Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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 on the chain aligned with the timing mark on the camshaft timing sprocket.

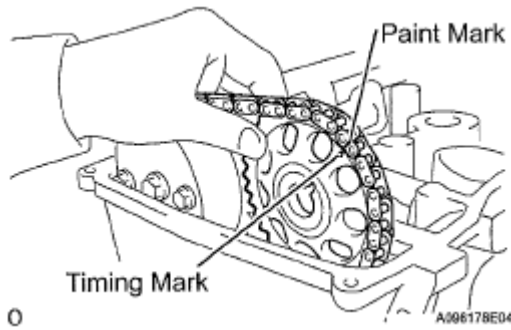


Fig. 42: Identifying Timing Mark On Camshaft Timing Sprocket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

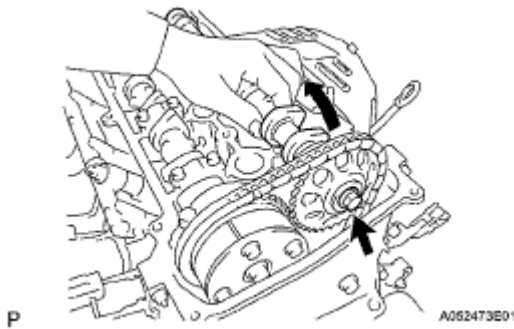


Fig. 43: Tightening Camshaft Timing Sprocket Set Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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.

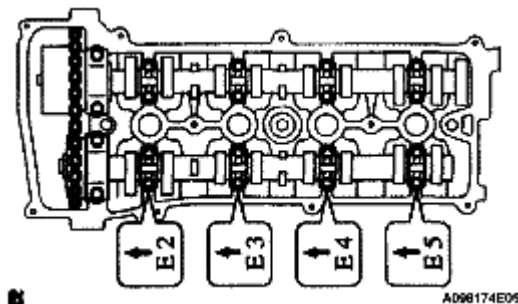


Fig. 44: Identifying Bearing Caps Illustration Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

illustration.

Torque: No. 2 bearing

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

No. 3 bearing

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

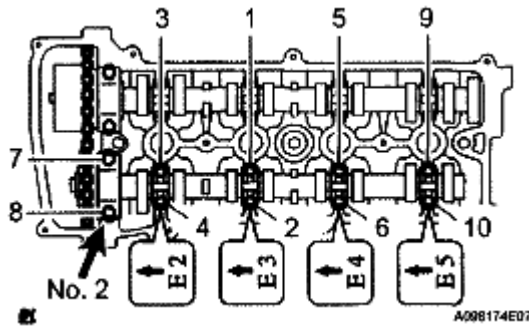


Fig. 45: Identifying Bearing Cap Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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.

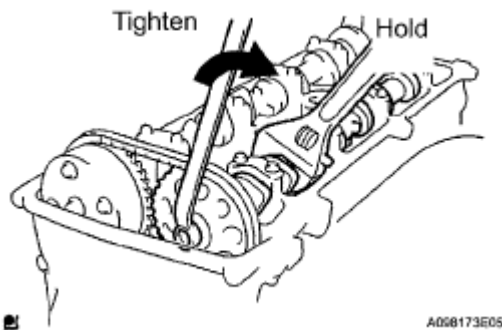
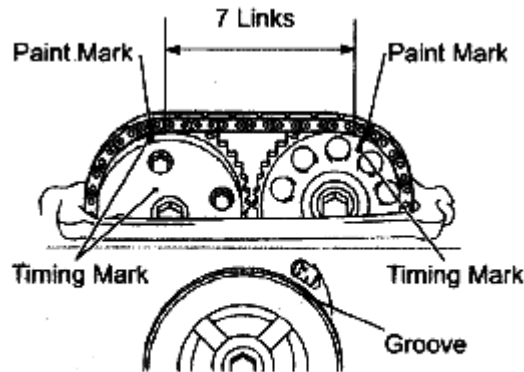


Fig. 46: Tightening Camshaft Timing Sprocket Set Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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" on the timing mark chain cover.

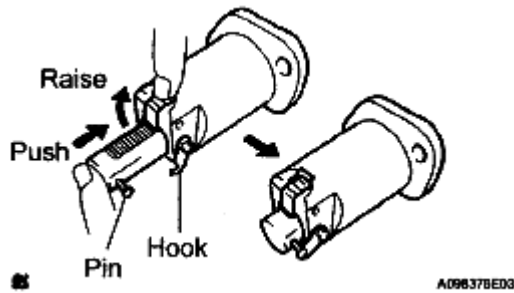


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Fig. 47: Aligning Timing Marks On Camshaft Timing Gear And Camshaft Timing Sprocket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY

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



A096378E03

Fig. 48: Releasing Ratchet Pawl
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: When installing the chain tensioner, set the hook again if the hook releases the plunger.

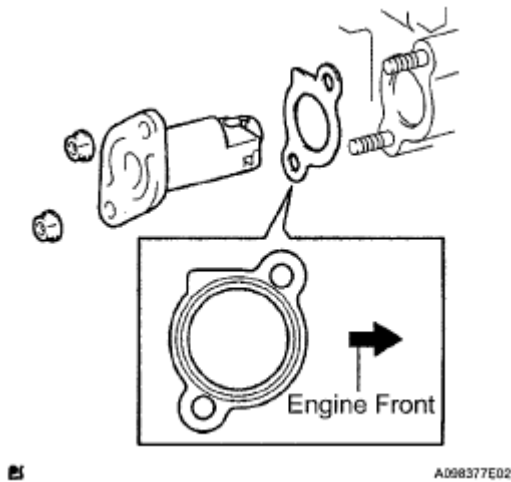


Fig. 49: Identifying Gasket And Chain Tensioner With Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

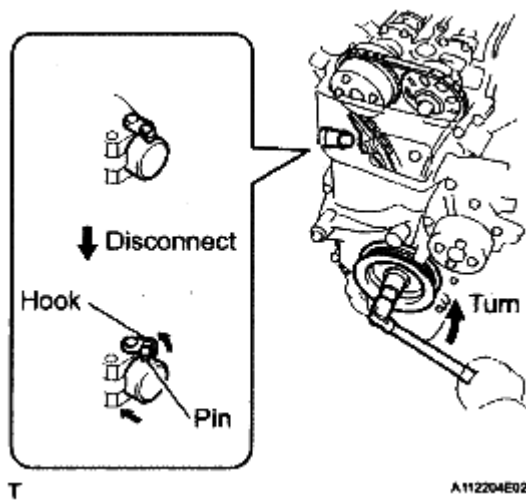


Fig. 50: Disconnecting Hook From Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Turn the crankshaft clockwise, then check that the plunger is extended.

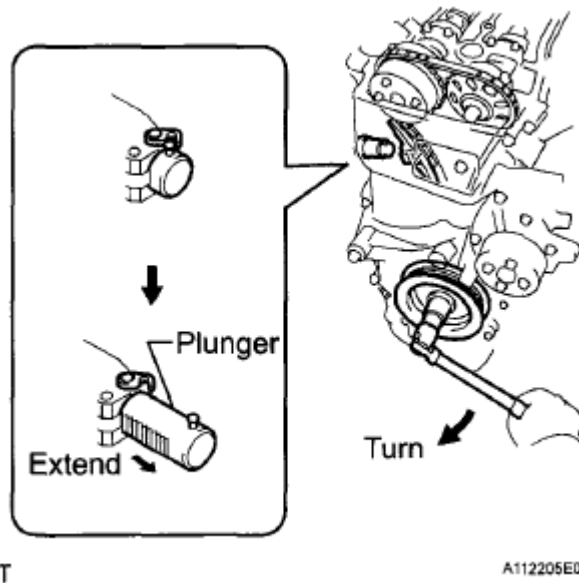


Fig. 51: Checking Plunger Extension

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

5. SET NO. 1 CYLINDER TO TDC/COMPRESSION (See REMOVAL)
6. CHECK VALVE CLEARANCE (See VALVE CLEARANCE)
7. ADJUST VALVE CLEARANCE (See VALVE CLEARANCE)
8. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY
 - a. Remove any old packing material from the contact surface.
 - 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 oil pan within 3 minutes of applying seal packing.
- Do not add engine oil for at least 2 hours after installing the oil pan.

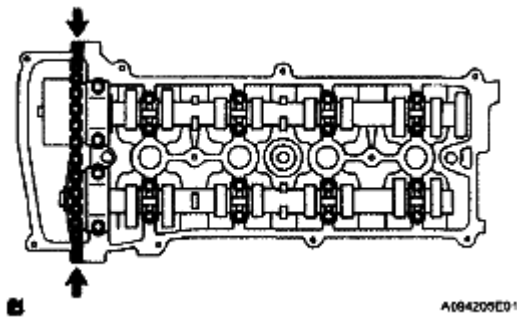


Fig. 52: Identifying Seal Packing Applying Area

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

- c. Install the cylinder head cover gasket and sub-assembly 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)

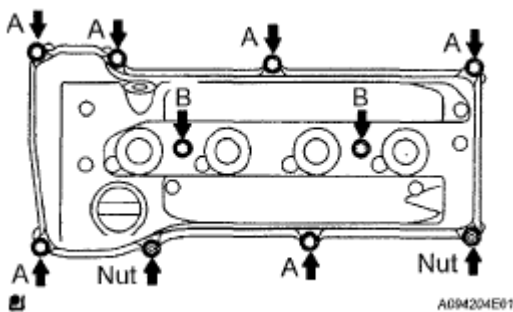


Fig. 53: Locating Cylinder Head Cover Bolts

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

- d. Install the 2 engine wire harness brackets with the 2 bolts.

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

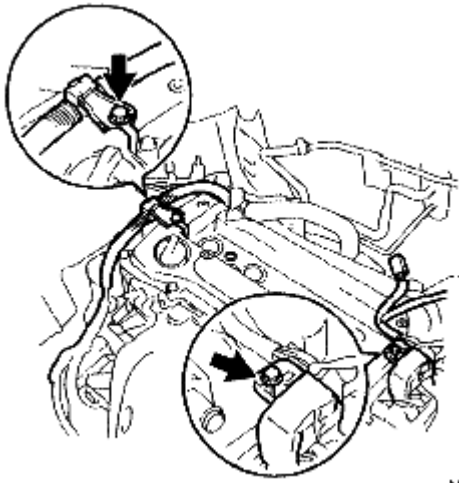


Fig. 54: Locating Wire Harness Brackets Bolts

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

- e. Connect the 2 ventilation hoses to the cylinder head cover.

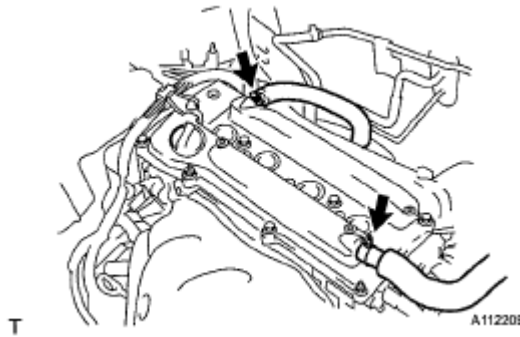


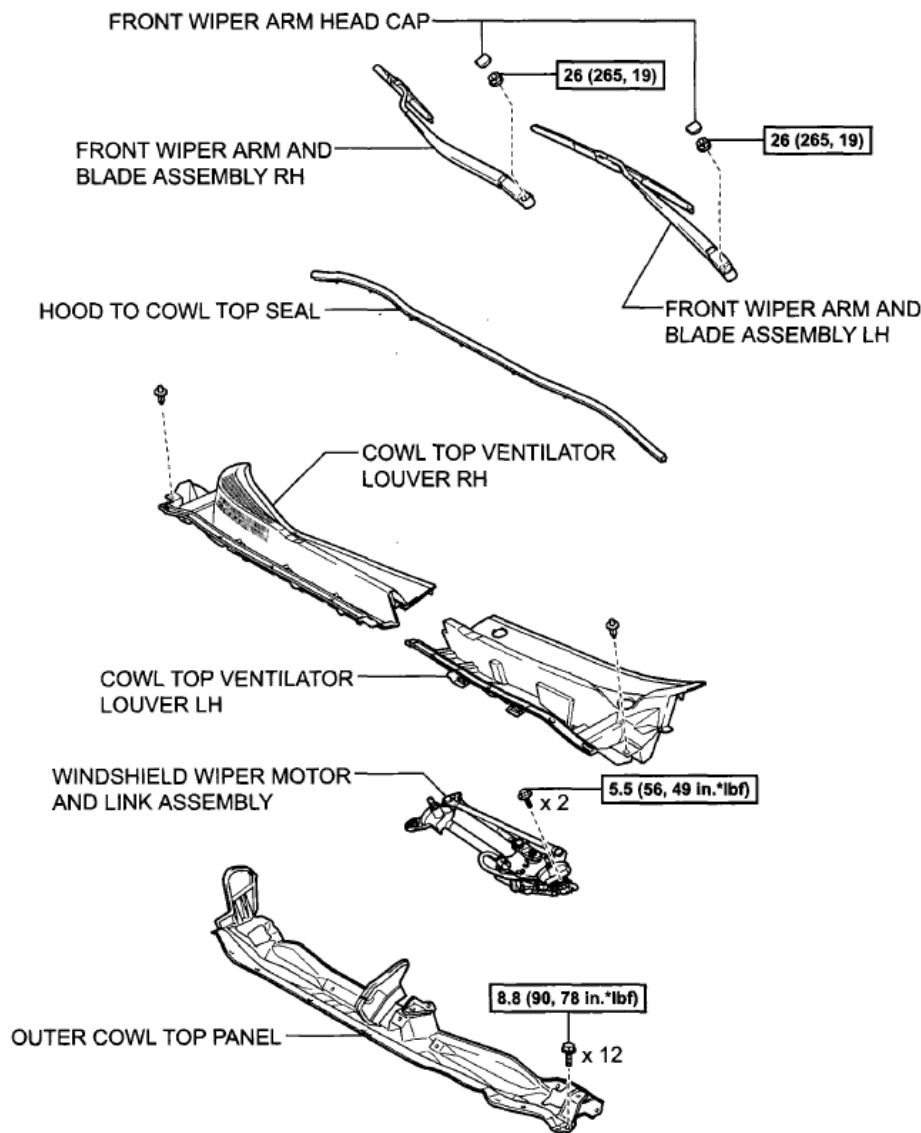
Fig. 55: Locating Ventilation Hoses

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

- 9. INSTALL SPARK PLUG (See INSTALLATION)
- 10. INSTALL IGNITION COIL ASSEMBLY (See INSTALLATION)
- 11. INSPECT FOR OIL LEAK
- 12. INSPECT IGNITION TIMING (See ENGINE)
- 13. INSTALL NO. 1 ENGINE COVER SUB-ASSEMBLY (See INSTALLATION)
- 14. INSTALL ENGINE UNDER COVER RH

CYLINDER HEAD GASKET

COMPONENTS



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

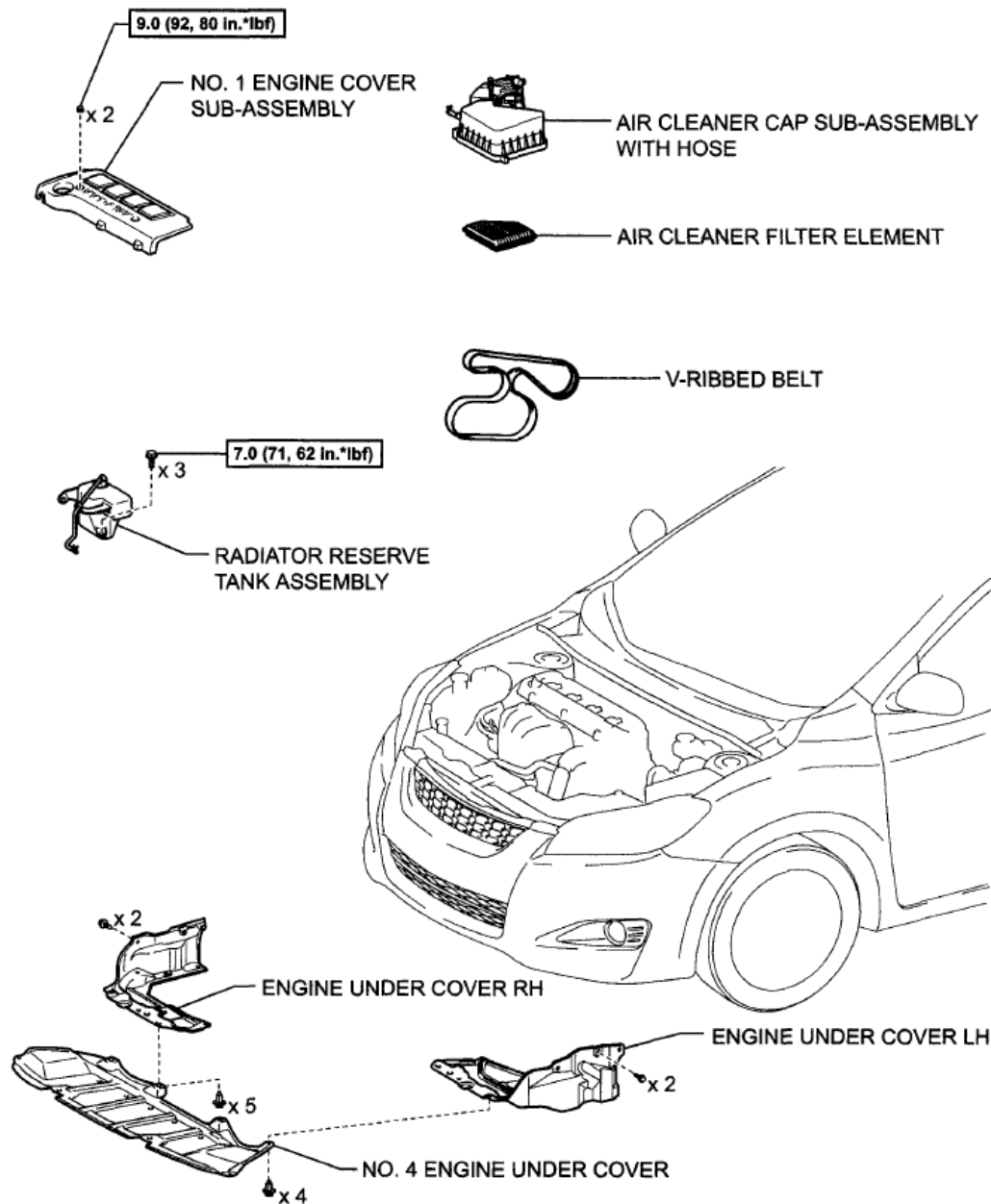
P

C176478E01

Fig. 56: Identifying Cylinder Head Gasket Components With Torque Specifications (1 Of 13)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2009 Toyota Matrix

2009 ENGINE Engine Mechanical (2AZ-FE) - Corolla Matrix



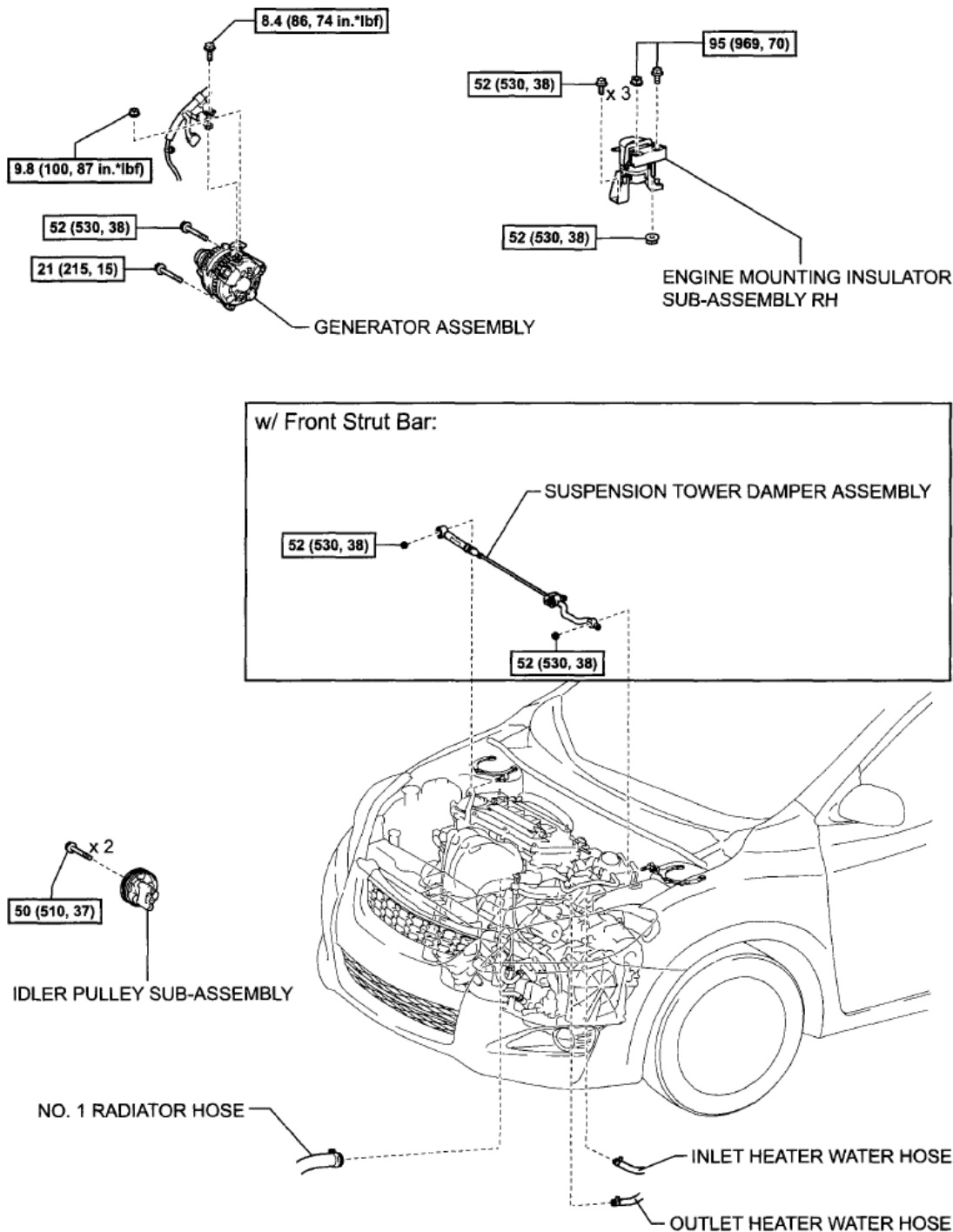
[N*m (kgf*cm, ft.*lbf)]: Specified torque

A187492E01

Fig. 57: Identifying Cylinder Head Gasket Components With Torque Specifications (2 Of 13)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2009 Toyota Matrix

2009 ENGINE Engine Mechanical (2AZ-FE) - Corolla Matrix



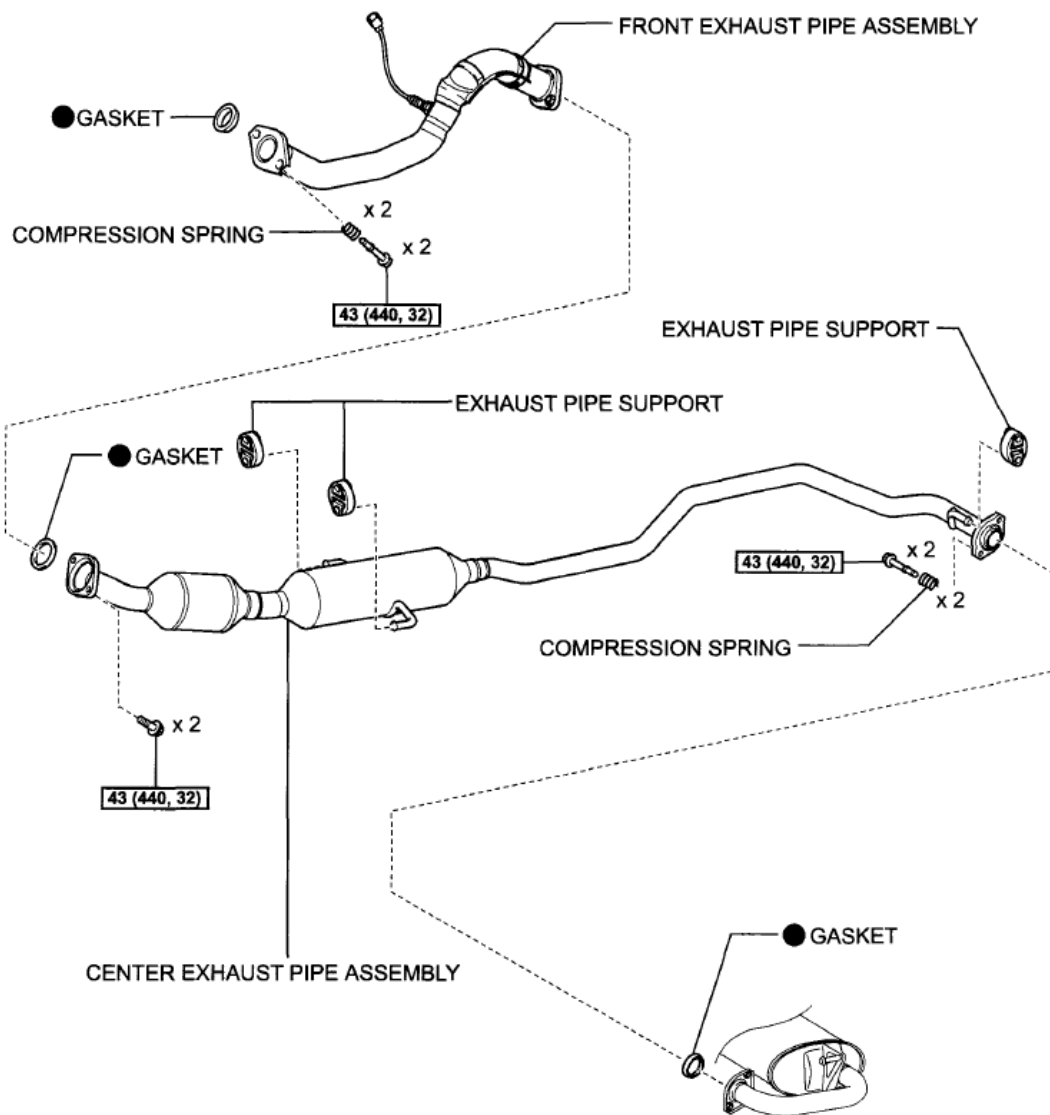
N*m (kgf*cm, ft.*lbf): Specified torque

C

A187403E01

Fig. 58: Identifying Cylinder Head Gasket Components With Torque Specifications (3 Of 13)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

for 2WD (Double Wishbone Type Suspension):



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

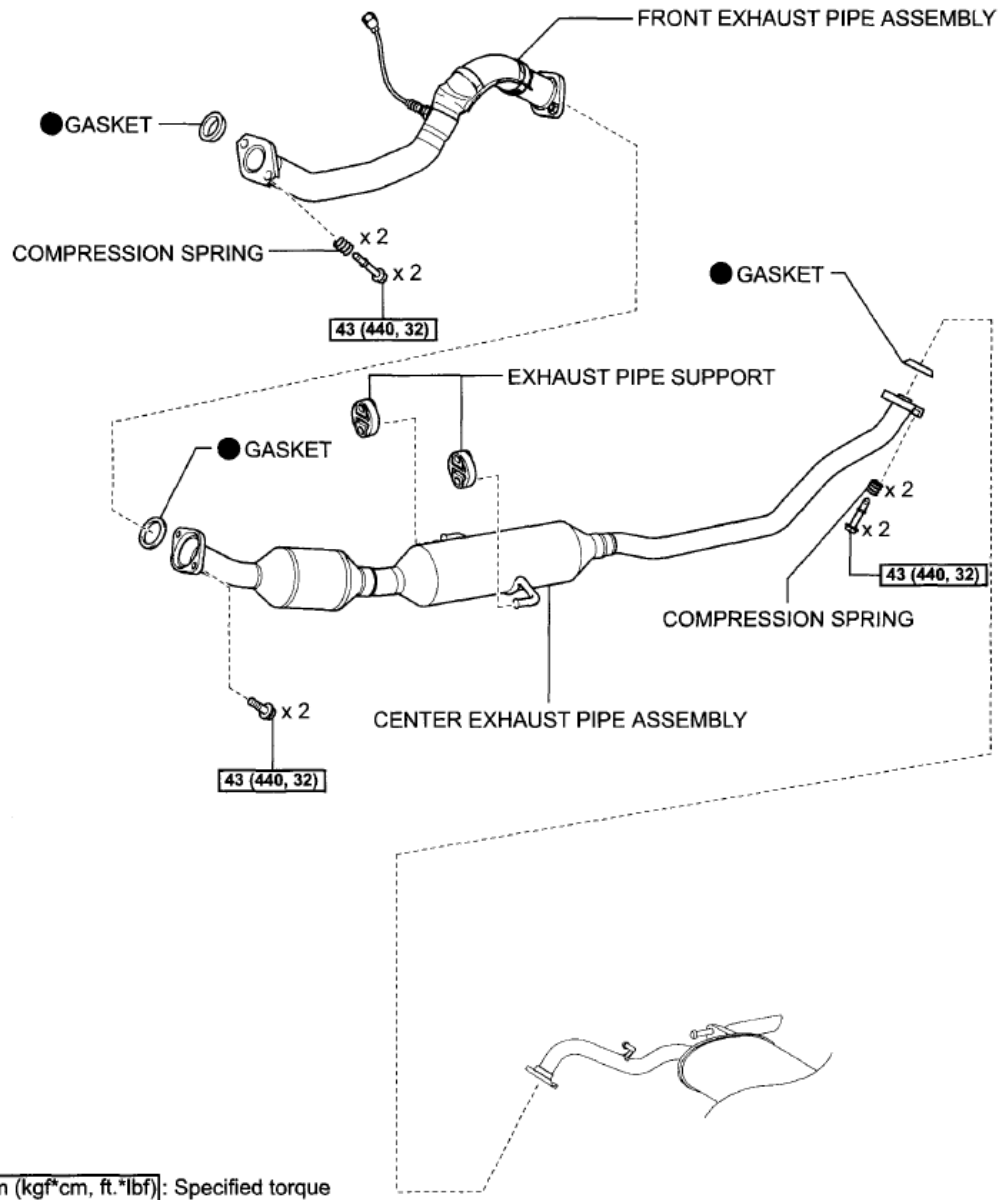
● Non-reusable part

C

A182438E04

Fig. 59: Identifying Cylinder Head Gasket Components With Torque Specifications (4 Of 13)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

for 2WD (Torsion Beam Type Suspension):

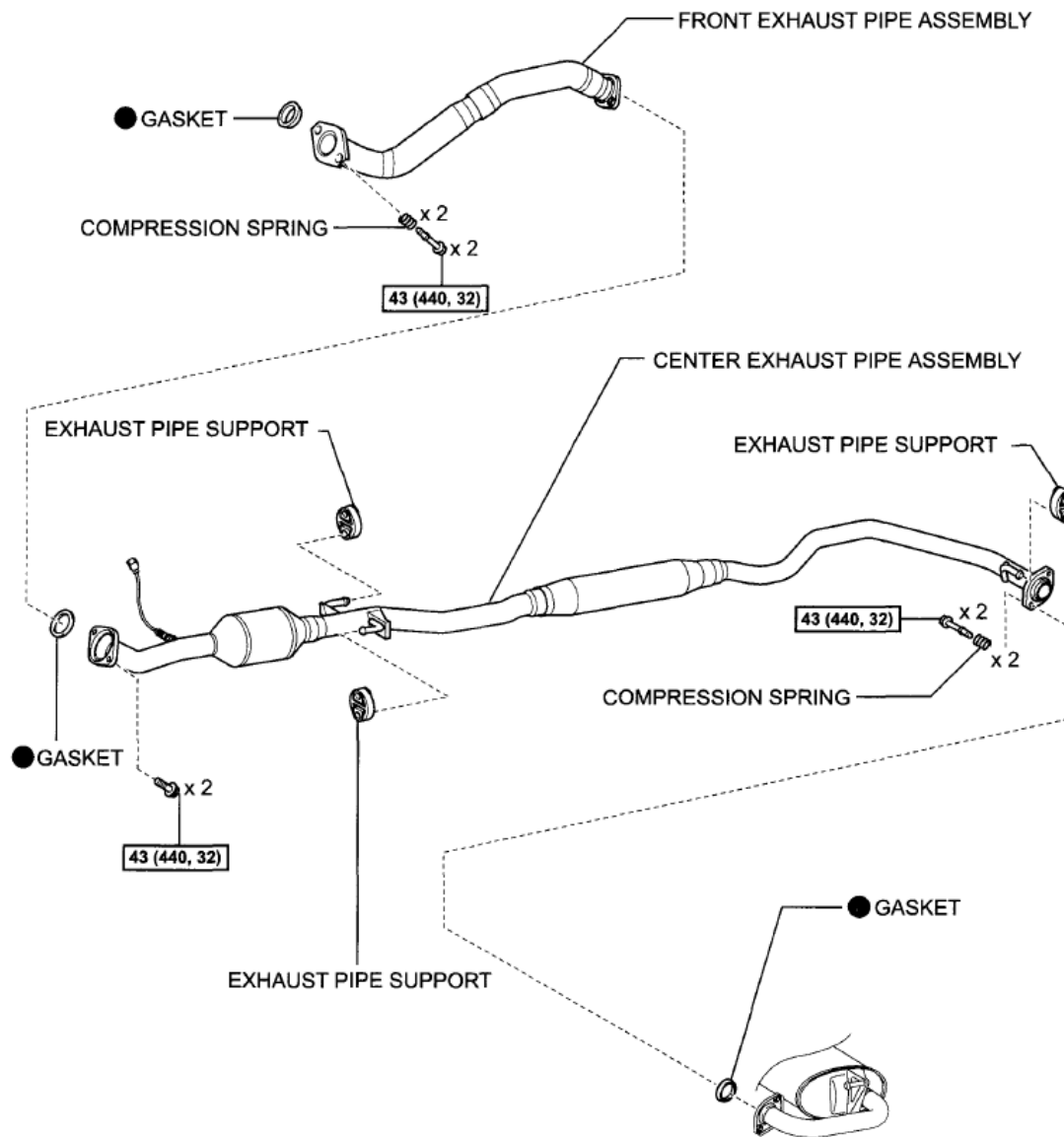


C

A182436E04

Fig. 60: Identifying Cylinder Head Gasket Components With Torque Specifications (5 Of 13)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

for 4WD:



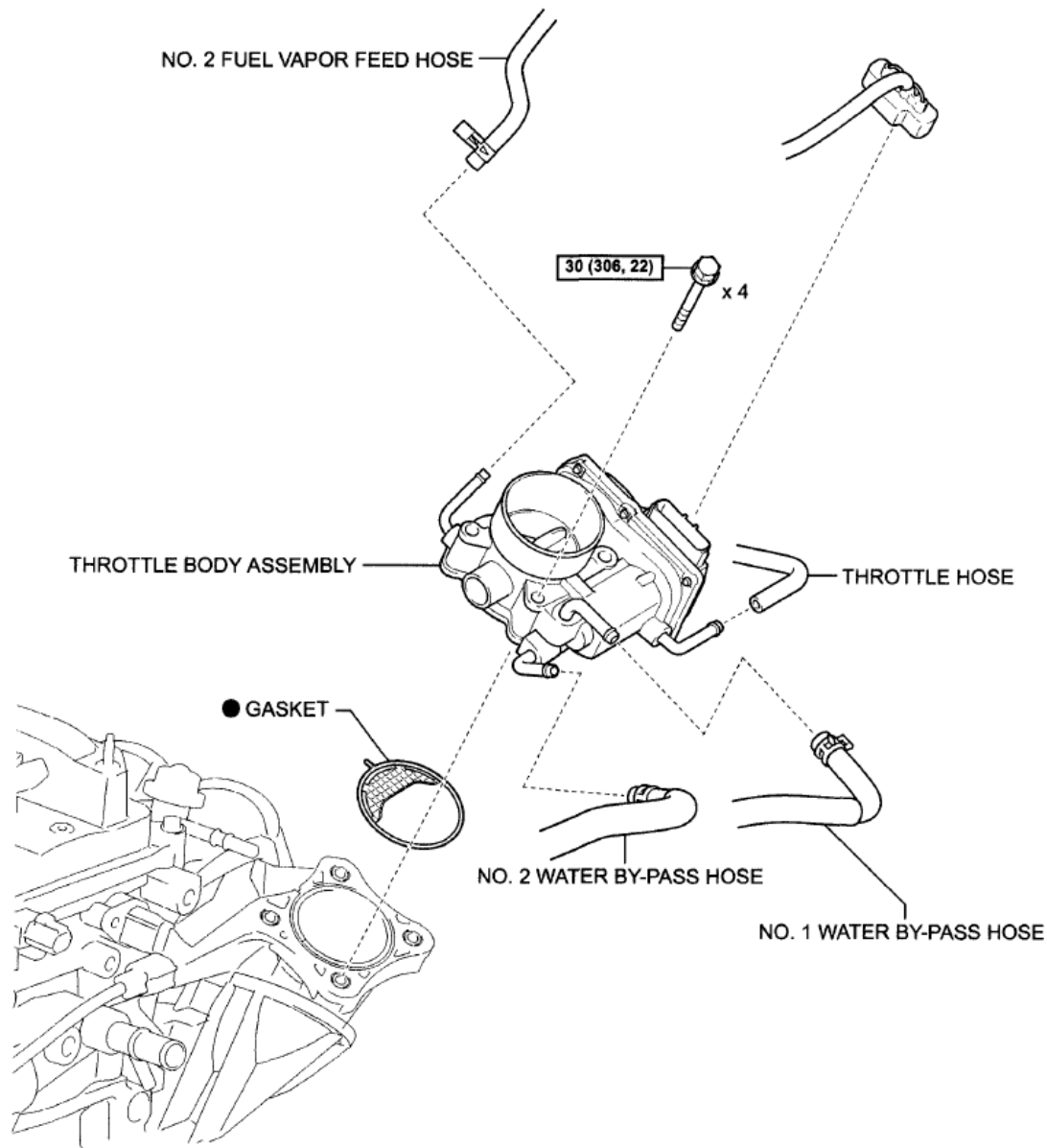
N*m (kgf*cm, ft.*lbf): Specified torque

● Non-reusable part

C

A182440ED4

Fig. 61: Identifying Cylinder Head Gasket Components With Torque Specifications (6 Of 13)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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

● Non-reusable part

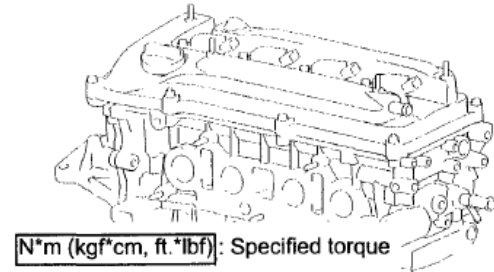
P

A167200E03

Fig. 62: Identifying Cylinder Head Gasket Components With Torque Specifications (7 Of 13)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2009 Toyota Matrix	
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2009 ENGINE Engine Mechanical (2AZ-FE) - Corolla Matrix



- Non-reusable part

Fig. 63: Identifying Cylinder Head Gasket Components With Torque Specifications (8 Of 13)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

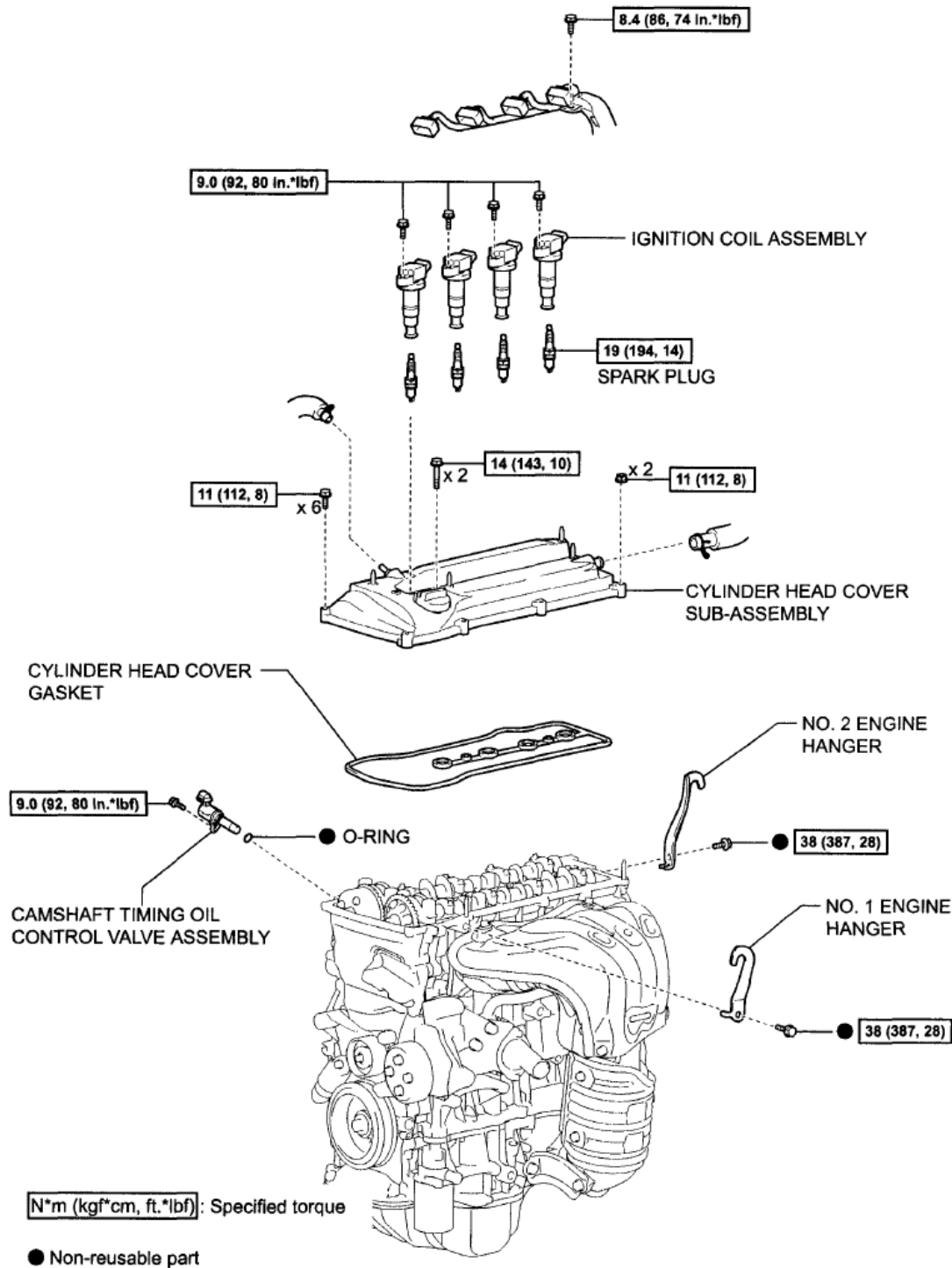
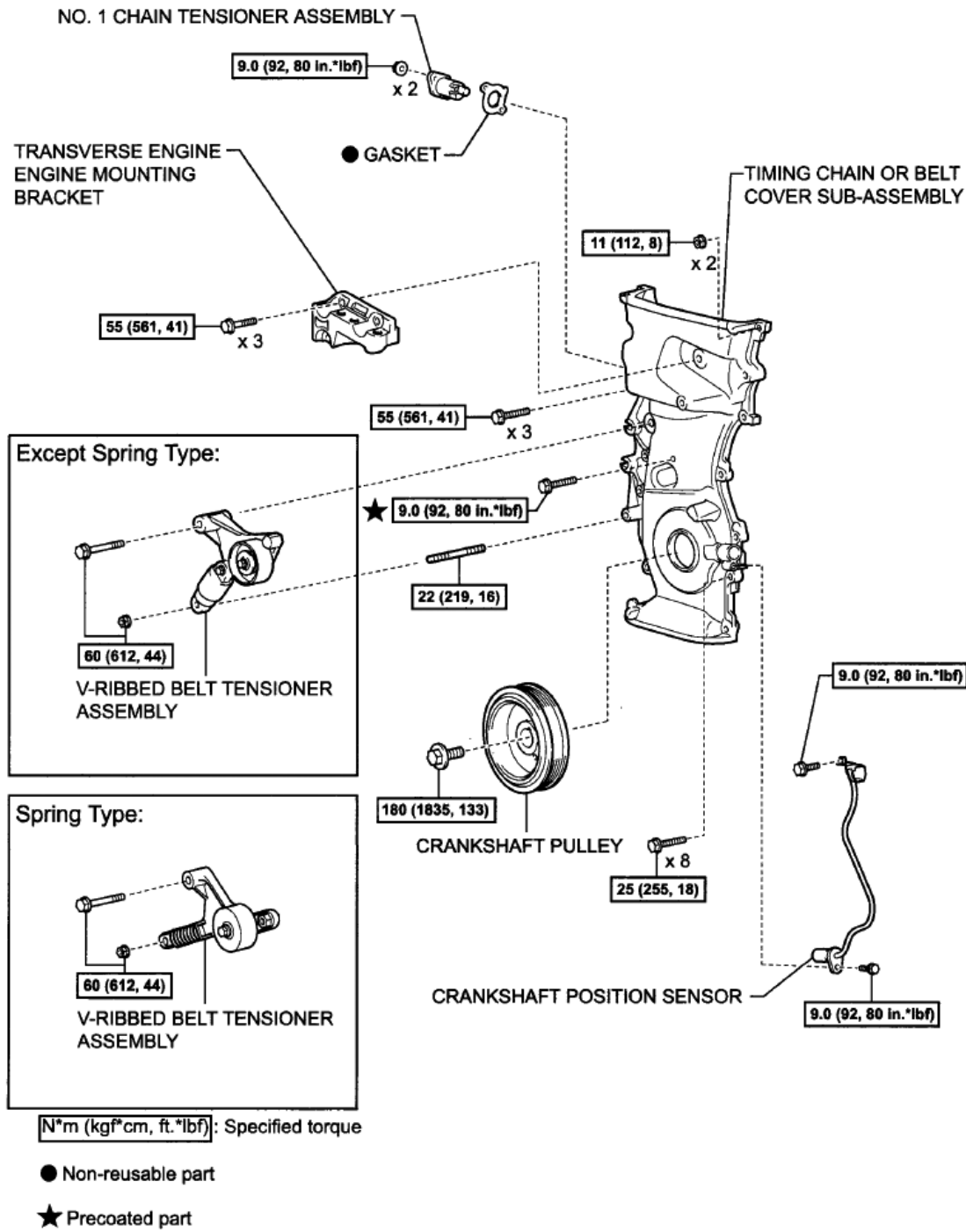


Fig. 64: Identifying Cylinder Head Gasket Components With Torque Specifications (9 Of 13)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2009 Toyota Matrix

2009 ENGINE Engine Mechanical (2AZ-FE) - Corolla Matrix

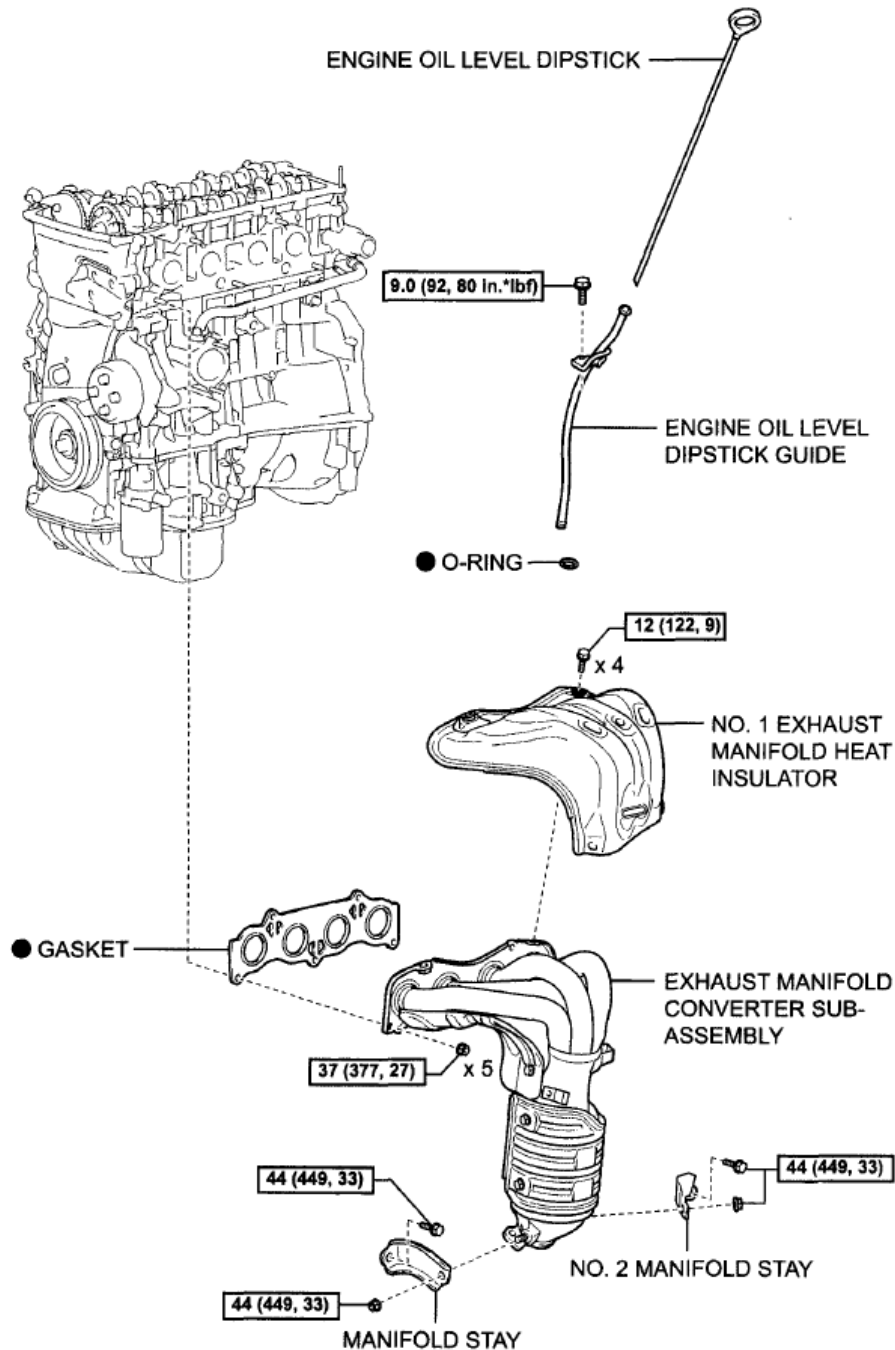


A180992E03

Fig. 65: Identifying Cylinder Head Gasket Components With Torque Specifications (10 Of 13)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2009 Toyota Matrix

2009 ENGINE Engine Mechanical (2AZ-FE) - Corolla Matrix

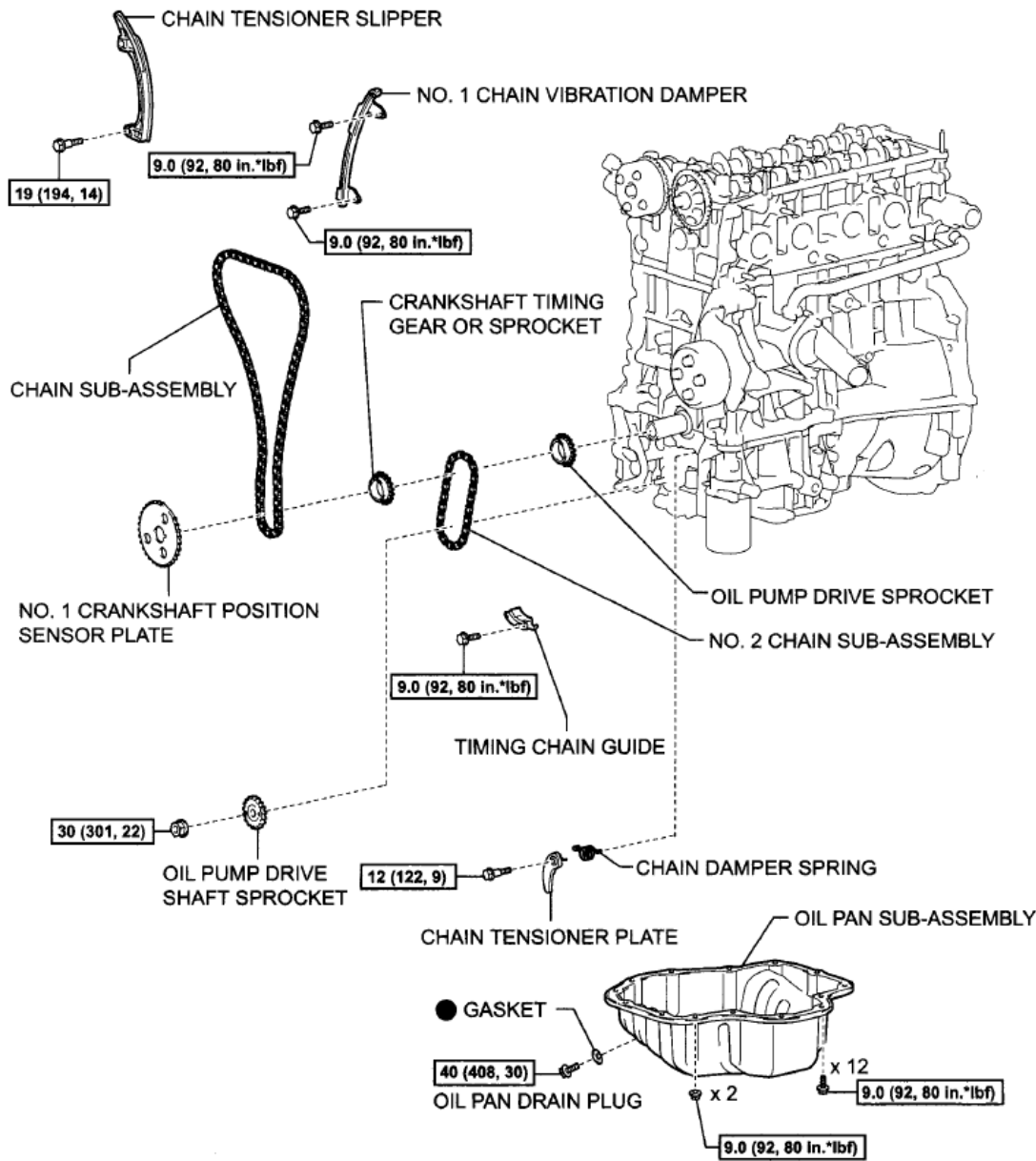


N*m (kgf*cm, ft.*lbf): Specified torque

● Non-reusable part

A158892E02

Fig. 66: Identifying Cylinder Head Gasket Components With Torque Specifications (11 Of 13)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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

● Non-reusable part

P

A156891E02

Fig. 67: Identifying Cylinder Head Gasket Components With Torque Specifications (12 Of 13)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2009 ENGINE Engine Mechanical (2AZ-FE) - Corolla Matrix



1. **DISCHARGE FUEL SYSTEM PRESSURE** (See **REMOVAL**)
2. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**

3. **REMOVE FRONT WIPER ARM HEAD CAP** (See REMOVAL)
4. **REMOVE FRONT WIPER ARM AND BLADE ASSEMBLY LH** (See REMOVAL)
5. **REMOVE FRONT WIPER ARM AND BLADE ASSEMBLY RH** (See REMOVAL)
6. **REMOVE HOOD TO COWL TOP SEAL** (See REMOVAL)
7. **REMOVE COWL TOP VENTILATOR LOUVER RH** (See REMOVAL)
8. **REMOVE COWL TOP VENTILATOR LOUVER LH** (See REMOVAL)
9. **REMOVE WINDSHIELD WIPER MOTOR AND LINK ASSEMBLY** (See REMOVAL)
10. **REMOVE OUTER COWL TOP PANEL** (See REMOVAL)
11. **REMOVE SUSPENSION TOWER DAMPER ASSEMBLY (w/ Front Strut Bar)** (See REMOVAL)
12. **REMOVE FRONT WHEEL RH**
13. **REMOVE ENGINE UNDER COVER LH**
14. **REMOVE ENGINE UNDER COVER RH**
15. **REMOVE NO. 1 ENGINE COVER SUB-ASSEMBLY** (See REMOVAL)
16. **DRAIN ENGINE COOLANT** (See COOLANT)
17. **DRAIN ENGINE OIL** (See REPLACEMENT)
18. **REMOVE CENTER EXHAUST PIPE ASSEMBLY (for 2WD)** (See REMOVAL)
19. **REMOVE CENTER EXHAUST PIPE ASSEMBLY (for 4WD)** (See REMOVAL)
20. **REMOVE FRONT EXHAUST PIPE ASSEMBLY** (See REMOVAL)
21. **REMOVE V-RIBBED BELT** (See REMOVAL)
22. **REMOVE GENERATOR ASSEMBLY** (See REMOVAL)
23. **SEPARATE RADIATOR RESERVE TANK ASSEMBLY** (See REMOVAL)
24. **REMOVE AIR CLEANER CAP SUB-ASSEMBLY WITH HOSE** (See REMOVAL)
25. **REMOVE THROTTLE BODY ASSEMBLY** (See REMOVAL)
26. **REMOVE IGNITION COIL ASSEMBLY** (See REMOVAL)
27. **REMOVE SPARK PLUG** (See REMOVAL)
28. **REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY** (See REMOVAL)
29. **REMOVE ENGINE OIL LEVEL DIPSTICK**
30. **REMOVE ENGINE OIL LEVEL DIPSTICK GUIDE**
 - a. Remove the bolt and engine oil level dipstick guide.

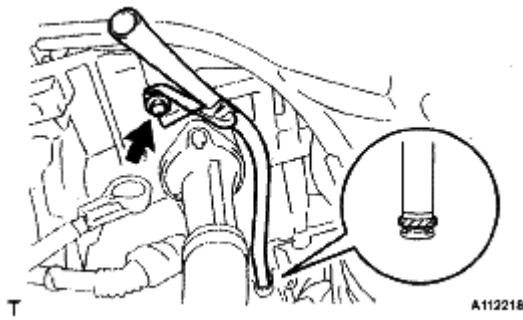


Fig. 69: Locating Engine Oil Level Dipstick Guide Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the O-ring from the engine oil level dipstick guide.
- 31. **DISCONNECT FUEL MAIN TUBE** (See **REMOVAL**)
- 32. **REMOVE FUEL DELIVERY PIPE SUB-ASSEMBLY** (See **REMOVAL**)
- 33. **REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY** (See **REMOVAL**)
- 34. **REMOVE INTAKE MANIFOLD** (See **REMOVAL**)
- 35. **REMOVE NO. 1 INTAKE MANIFOLD INSULATOR** (See **REMOVAL**)
- 36. **REMOVE MANIFOLD STAY** (See **REMOVAL**)
- 37. **REMOVE NO. 2 MANIFOLD STAY** (See **REMOVAL**)
- 38. **REMOVE NO. 1 EXHAUST MANIFOLD HEAT INSULATOR** (See **REMOVAL**)
- 39. **REMOVE EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY**
 - a. Disconnect the air-fuel ratio sensor connector.

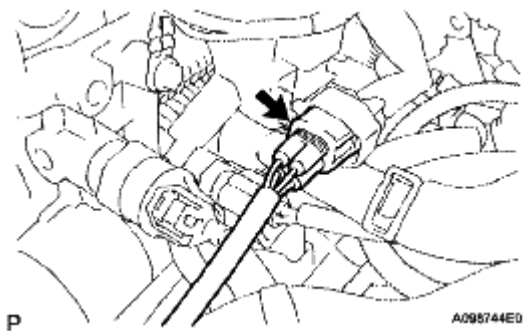


Fig. 70: Locating Air-Fuel Ratio Sensor Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

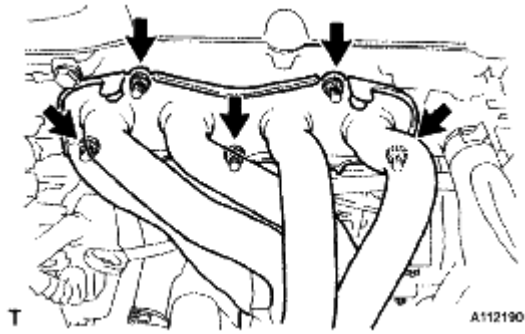


Fig. 71: Locating Exhaust Manifold Converter Sub-Assembly Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

40. REMOVE ENGINE MOUNTING INSULATOR SUB-ASSEMBLY RH

- a. Place a wooden block between a floor jack and the engine, then support the engine using the floor jack.

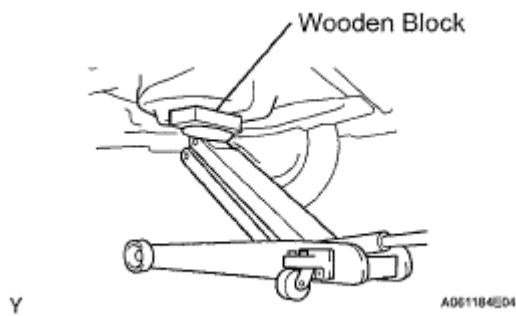


Fig. 72: Supporting Engine With Floor Jack
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the 4 bolts and 2 nuts, then remove the engine mounting insulator sub-assembly RH.

NOTE: Do not apply excessive force to the return tube when removing the engine mounting insulator sub-assembly RH.

HINT:

Keep clearance by lowering the engine using the floor jack when removing the front engine mounting insulator.

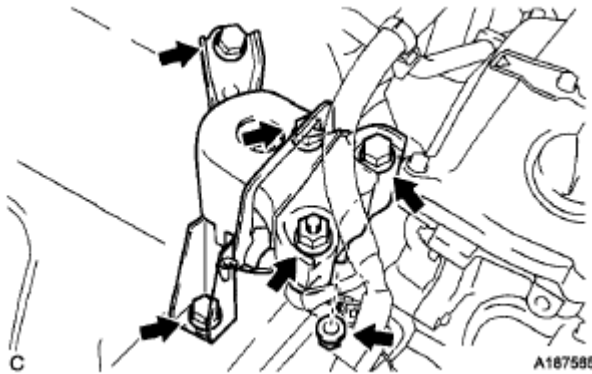


Fig. 73: Locating Front Engine Mounting Insulator Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

41. REMOVE IDLER PULLEY SUB-ASSEMBLY

- a. Loosen the 2 bolts and remove the idler pulley sub-assembly with the 2 bolts.

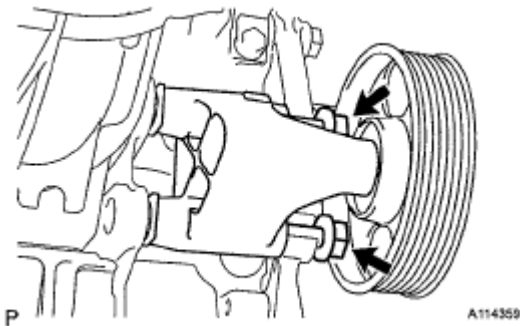


Fig. 74: Locating Idler Pulley Sub-Assembly With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

42. REMOVE OIL PAN SUB-ASSEMBLY

- a. Install the No. 1 and No. 2 engine hangers with new bolts.

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

Part No .

TORQUE SPECIFICATION

Item	Part No.
No. 1 engine hanger	12281-28010
No. 2 engine hanger	12282-28010
Bolt	91512-B1020 or 91552-81020

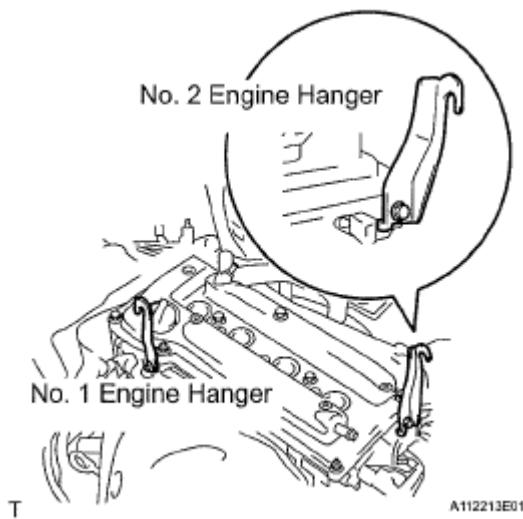


Fig. 75: Identifying No. 1 And No. 2 Engine Hangers With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Attach the sling device to the engine hangers and chain block.
- c. Remove the 12 bolts and 2 nuts.

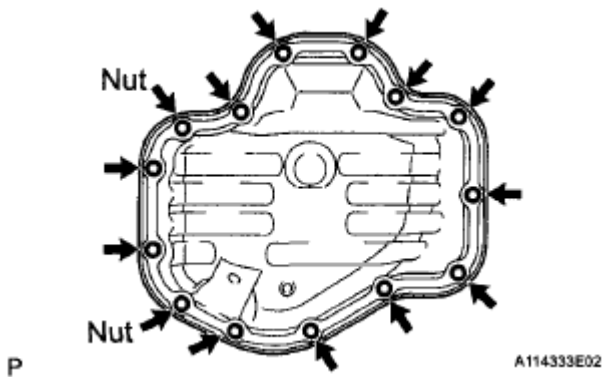
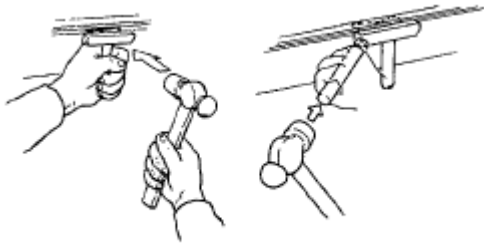


Fig. 76: Locating Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Insert the blade of an oil pan seal cutter between the crankcase, chain cover and oil pan, then cut through the applied sealer and remove the oil pan.

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



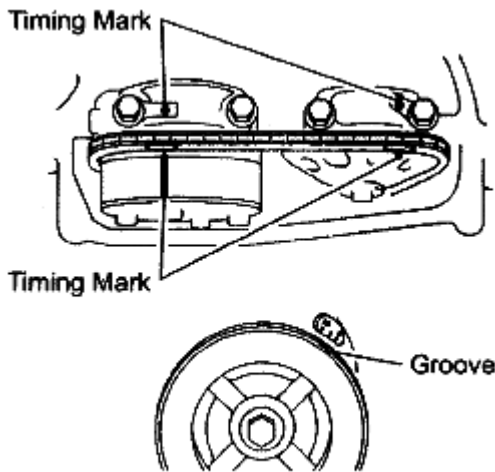
A000018E09

Fig. 77: Inserting Blade Of Oil Pan Seal Cutter Between Crankcase
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

43. SET NO. 1 CYLINDER TO TDC/COMPRESSION

- a. Turn the crankshaft pulley until the groove and the timing mark "0" on the timing chain cover are aligned.
- b. Check that each timing mark on the camshaft timing gear and sprocket is aligned with the timing marks located on the No. 1 and No. 2 bearing caps as shown in the illustration.

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



A08346E09

Fig. 78: Identifying Timing Mark On Camshaft Timing Gear And Sprocket
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

44. REMOVE CRANKSHAFT PULLEY (See REMOVAL)

45. REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY

- a. Remove the 2 nuts, No. 1 chain tensioner assembly and gasket.

NOTE: Do not turn the crankshaft without the No. 1 chain tensioner assembly.

46. REMOVE V-RIBBED BELT TENSIONER ASSEMBLY

- a. Lift the engine upward.

NOTE: Do not lift the engine more than necessary.

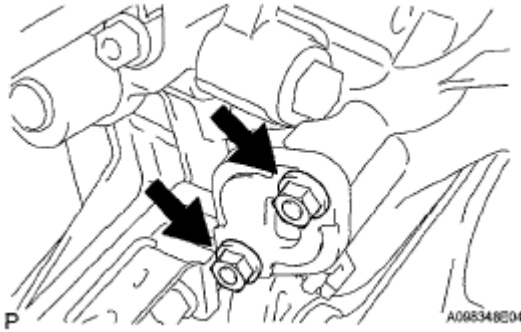


Fig. 79: Locating No. 1 Chain Tensioner Assembly Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the bolt, nut and V-ribbed belt tensioner assembly.
47. **REMOVE CRANKSHAFT POSITION SENSOR** (See **REMOVAL**)
 48. **REMOVE TIMING CHAIN OR BELT COVER SUB-ASSEMBLY** (See **REMOVAL**)

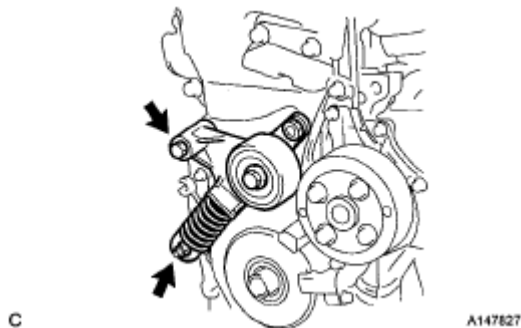


Fig. 80: Locating V-Ribbed Belt Tensioner Assembly And Bolt With Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

49. **REMOVE NO. 1 CRANKSHAFT POSITION SENSOR PLATE**
 - a. Remove the No. 1 crankshaft position sensor plate.

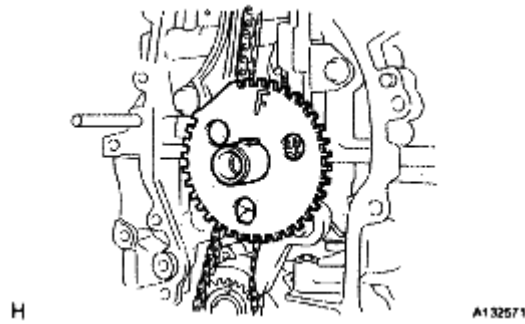


Fig. 81: Identifying No. 1 Crankshaft Position Sensor Plate
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

50. REMOVE TIMING CHAIN GUIDE

- a. Remove the bolt and timing chain guide.

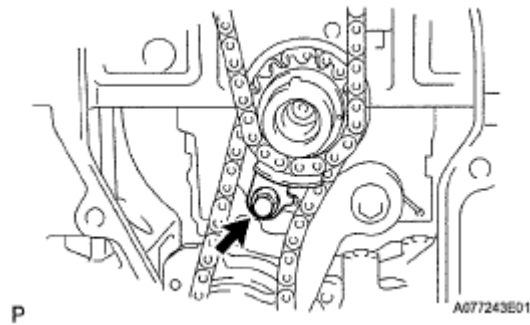


Fig. 82: Locating Timing Chain Guide And Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

51. REMOVE CHAIN TENSIONER SLIPPER

- a. Remove the bolt and chain tensioner slipper.

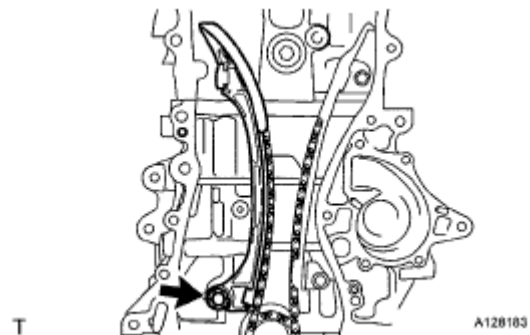


Fig. 83: Identifying Chain Tensioner Slipper And Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

52. REMOVE NO. 1 CHAIN VIBRATION DAMPER

- a. Remove the 2 bolts and No. 1 chain vibration damper.

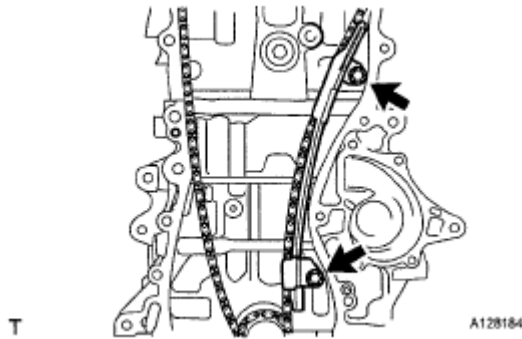


Fig. 84: Identifying No. 1 Chain Vibration Damper And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

53. REMOVE CHAIN SUB-ASSEMBLY

54. REMOVE CRANKSHAFT TIMING GEAR OR SPROCKET

- a. Remove the crankshaft timing gear or sprocket from the crankshaft.

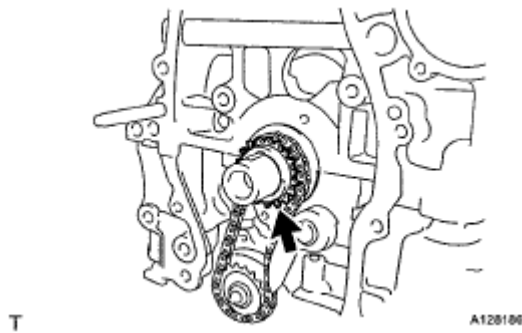


Fig. 85: Locating Crankshaft Timing Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

55. REMOVE NO. 2 CHAIN SUB-ASSEMBLY

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

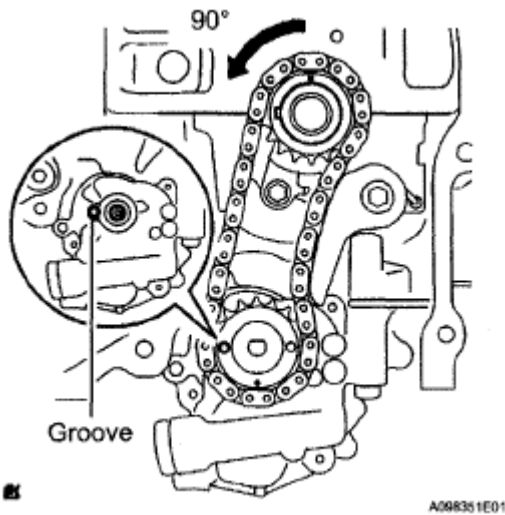


Fig. 86: Aligning Adjusting Hole On Oil Pump Drive Shaft Sprocket With Groove On Oil Pump

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

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

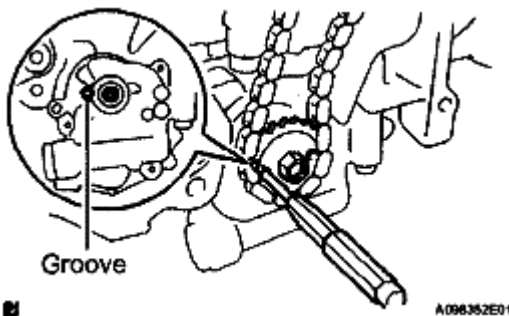


Fig. 87: Identifying Adjusting Hole On Oil Pump Drive Shaft Gear To Lock Gear In Position

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

- c. Remove the bolt, chain tensioner plate and spring.
 - d. Remove the oil pump drive sprocket, oil pump drive shaft sprocket and No. 2 chain.
56. **DISCONNECT NO. 1 RADIATOR HOSE** (See **REMOVAL**)
 57. **DISCONNECT OUTLET HEATER WATER HOSE** (See **REMOVAL**)
 58. **DISCONNECT INLET HEATER WATER HOSE** (See **REMOVAL**)

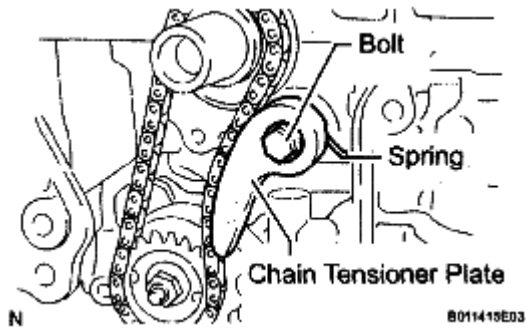


Fig. 88: Identifying Bolt, Chain Tensioner Plate And Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

59. DISCONNECT ENGINE WIRE

- a. Disconnect the radio setting condenser connector.
- 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 ground cable.

60. REMOVE NO. 2 CAMSHAFT (See **DISASSEMBLY**)

61. REMOVE CAMSHAFT (See **DISASSEMBLY**)

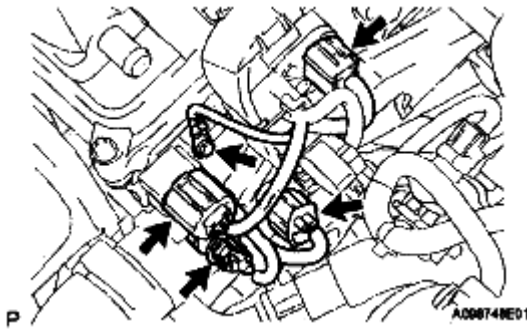


Fig. 89: Locating Camshaft Position Sensor Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

62. REMOVE NO. 1 CAMSHAFT BEARING (See **DISASSEMBLY**)

63. REMOVE NO. 2 CAMSHAFT BEARING (See **DISASSEMBLY**)

64. REMOVE CYLINDER HEAD SUB-ASSEMBLY

- a. In 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.

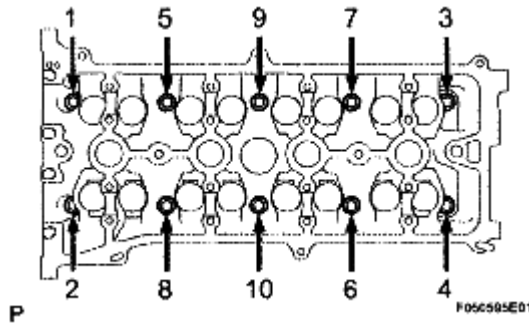


Fig. 90: Identifying Cylinder Head Bolts Removing Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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.

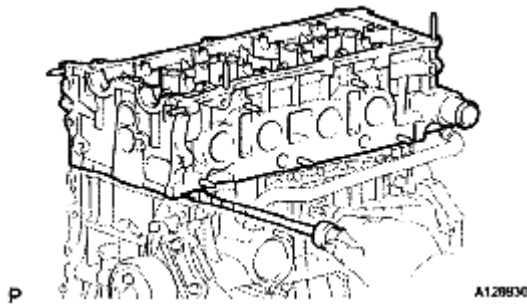


Fig. 91: Prying Between Cylinder Head And Cylinder Block
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

65. REMOVE CYLINDER HEAD GASKET

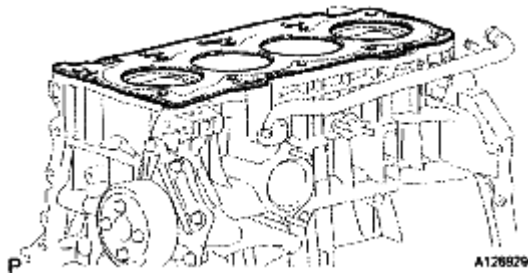


Fig. 92: Identifying Cylinder Head Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSTALLATION

1. INSTALL CYLINDER HEAD GASKET

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

NOTE:

- Remove any oil from the contact surface.
- Be careful of the installation direction.

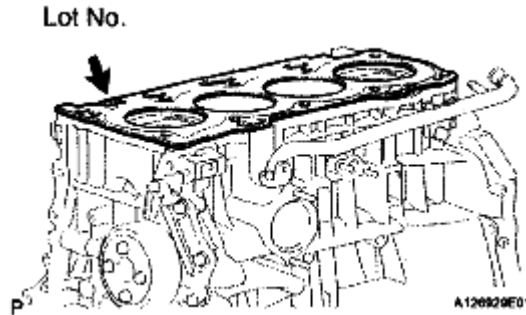


Fig. 93: Identifying Cylinder Head Gasket Installation Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. INSTALL CYLINDER HEAD SUB-ASSEMBLY

- a. Place the cylinder head on the cylinder head gasket.

NOTE:

Place the cylinder head gently in order to avoid damaging the cylinder head gasket.

- b. Install the cylinder head bolts.

NOTE:

The cylinder head bolts are tightened in 2 successive steps.

1. Apply a light coat of engine oil to the threads and under the heads of the cylinder head set bolts.
2. 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)

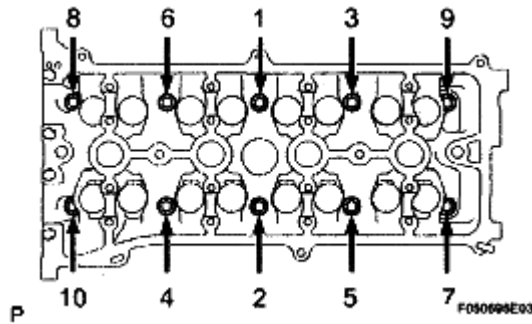


Fig. 94: Identifying Cylinder Head Set Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Mark the front of the cylinder head bolts with paint.
- d. Further tighten the cylinder head bolts 90° as shown in the illustration.
- e. Check that the paint mark is now at a 90° angle to the front.

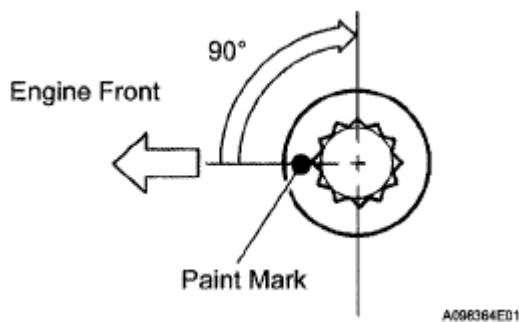


Fig. 95: Identifying Cylinder Head Bolts Tightening Angle
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. **INSTALL NO. 1 CAMSHAFT BEARING** (See REASSEMBLY)
4. **INSTALL NO. 2 CAMSHAFT BEARING** (See REASSEMBLY)
5. **INSTALL CAMSHAFT** (See REASSEMBLY)
6. **INSTALL NO. 2 CAMSHAFT** (See REASSEMBLY)
7. **CONNECT INLET HEATER WATER HOSE** (See INSTALLATION)
8. **CONNECT OUTLET HEATER WATER HOSE** (See INSTALLATION)
9. **CONNECT NO. 1 RADIATOR HOSE** (See INSTALLATION)
10. **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.
- c. Connect the engine coolant temperature sensor connector.
- d. Connect the engine oil pressure switch connector.

- e. Connect the radio setting condenser connector.
- f. Connect the inlet heater water hose.

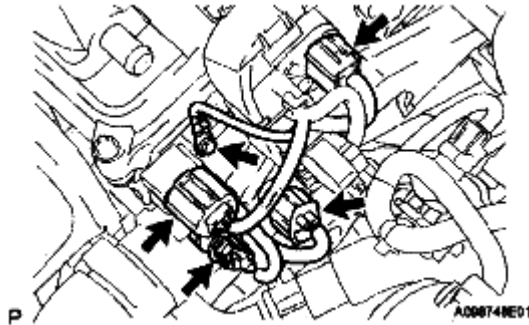


Fig. 96: Locating Camshaft Position Sensor Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. INSTALL NO. 2 CHAIN SUB-ASSEMBLY

- a. Set the crankshaft key in the position as shown in the illustration.

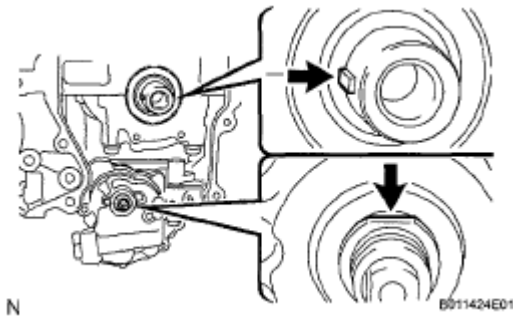


Fig. 97: Identifying Crankshaft Key Illustration Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Turn the cutout of the drive shaft so that it faces upward.
- 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 placed on the gears.
- e. Temporarily tighten the oil pump drive shaft sprocket with the nut.

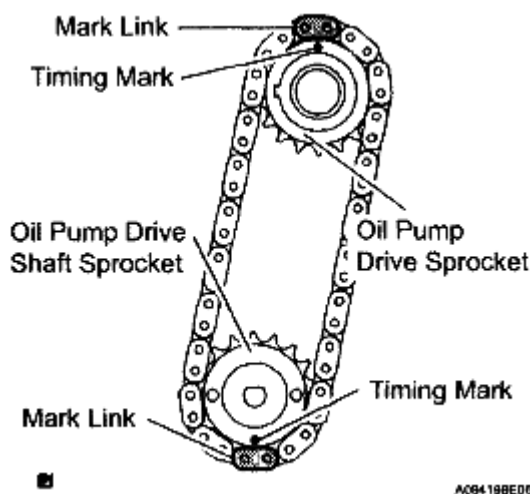


Fig. 98: Identifying Timing Marks On Timing Chain
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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)

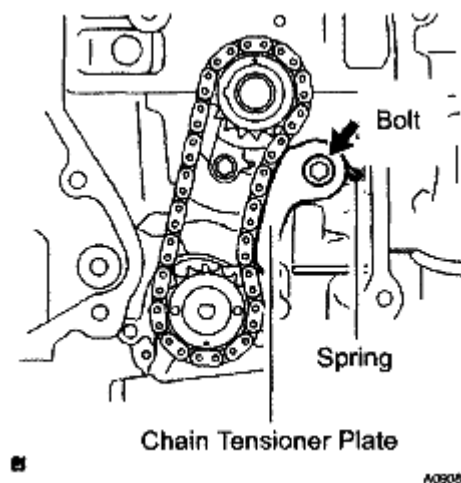


Fig. 99: Locating Chain Tensioner Plate With Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Align the adjusting hole on the oil pump drive shaft sprocket with the groove on the oil pump.
- h. Insert a bar of 4 mm in diameter into the adjusting hole on 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)

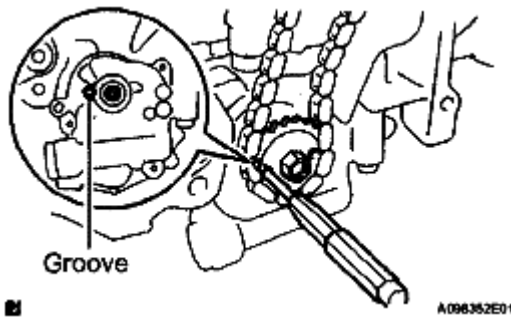


Fig. 100: Identifying Adjusting Hole On Oil Pump Drive Shaft Gear To Lock Gear In Position

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

12. INSTALL CRANKSHAFT TIMING GEAR OR SPROCKET

- Install the crankshaft timing gear or sprocket to the crankshaft.

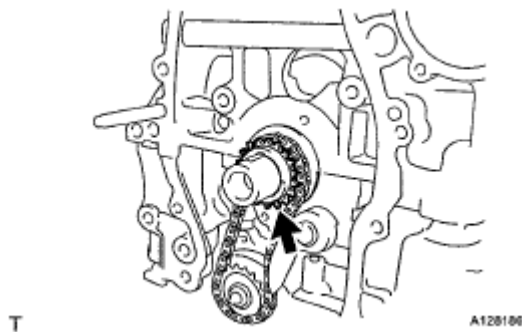


Fig. 101: Locating Crankshaft Timing Gear

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

13. INSTALL NO. 1 CHAIN VIBRATION DAMPER

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

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

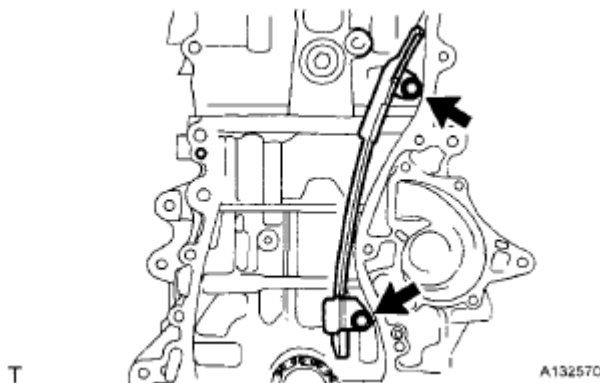


Fig. 102: Locating No. 1 Chain Vibration Damper With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. 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 on the camshaft timing gear with the timing marks located on the No. 1 and No. 2 bearing caps as shown in the illustration.

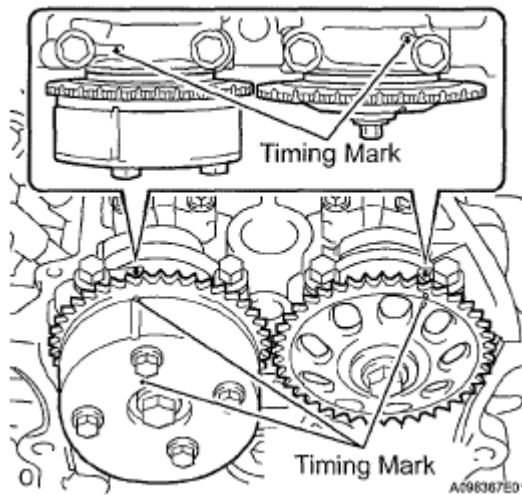


Fig. 103: Identifying Timing Marks On Camshaft Timing Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Using the crankshaft pulley bolt, turn the crankshaft to position the key on the crankshaft upward.

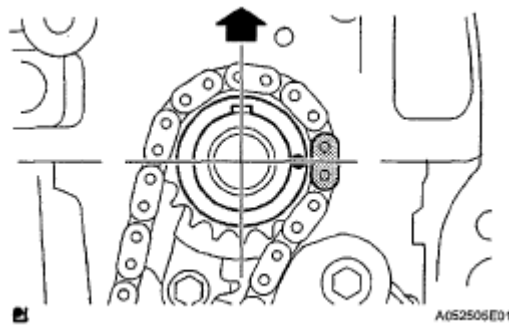


Fig. 104: Identifying Crankshaft Upward Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

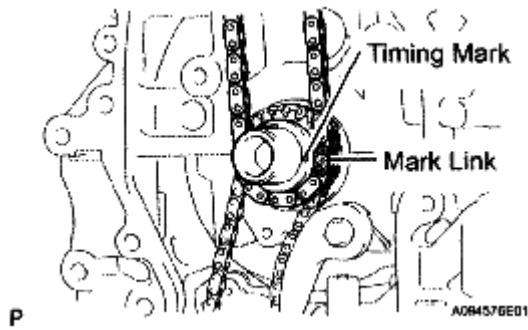


Fig. 105: Aligning Timing Mark On Crankshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

SST 09309-37010

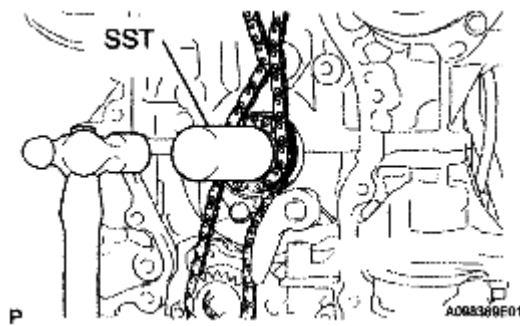


Fig. 106: Tapping Crankshaft Timing Sprocket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Align the gold or yellow links with the timing marks located on the camshaft timing gear and sprocket, then install the chain.

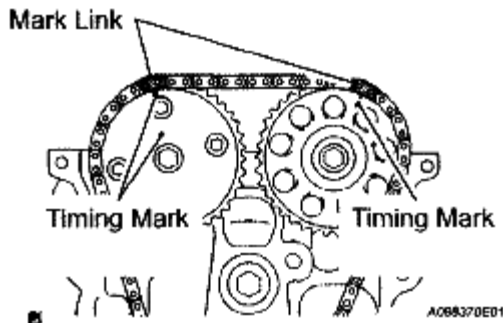


Fig. 107: Identifying Timing Marks Location
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

15. INSTALL CHAIN TENSIONER SLIPPER

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

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

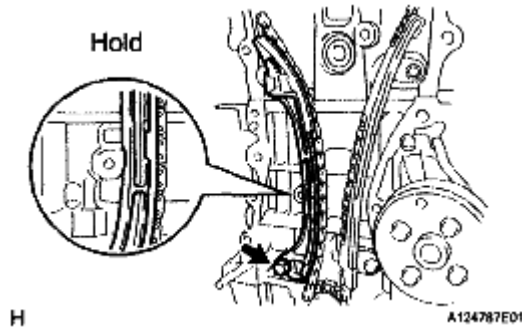


Fig. 108: Locating Chain Tensioner Slipper With Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

16. INSTALL TIMING CHAIN GUIDE

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

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

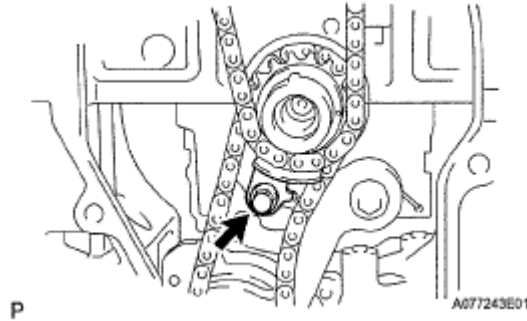


Fig. 109: Locating Timing Chain Guide And Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

17. INSTALL NO. 1 CRANKSHAFT POSITION SENSOR PLATE

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

18. INSTALL TIMING CHAIN OR BELT COVER SUB-ASSEMBLY (See INSTALLATION)

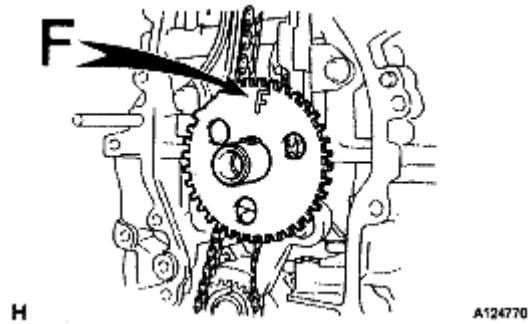


Fig. 110: Identifying Sensor Plate With "F" Mark Facing Forward Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

19. INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY

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

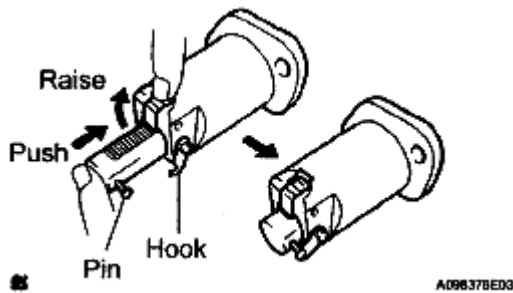


Fig. 111: Releasing Ratchet Pawl
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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: When installing the chain tensioner, set the hook again if the hook releases the plunger.

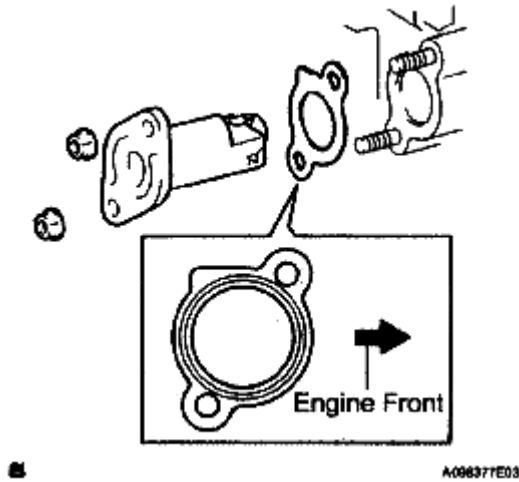


Fig. 112: Identifying Chain Tensioner With Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

20. INSTALL V-RIBBED BELT TENSIONER ASSEMBLY

- a. Except spring type V-ribbed belt tensioner:
 1. Install the V-ribbed belt tensioner assembly with the bolt and nut.

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

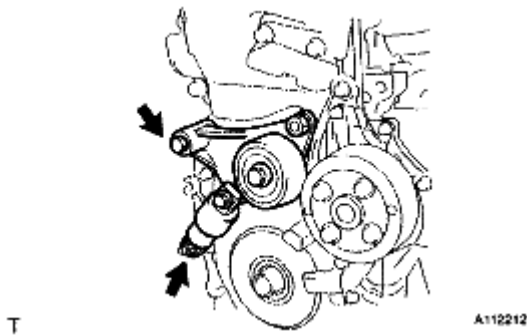


Fig. 113: Locating V-Ribbed Belt Tensioner Assembly With Bolt And Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Spring type V-ribbed belt tensioner:
 1. Install the V-ribbed belt tensioner to the engine by first tightening the bolt and then tightening the nut.

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

NOTE: When replacing the V-ribbed belt tensioner with a new one, do not pull out the pin.

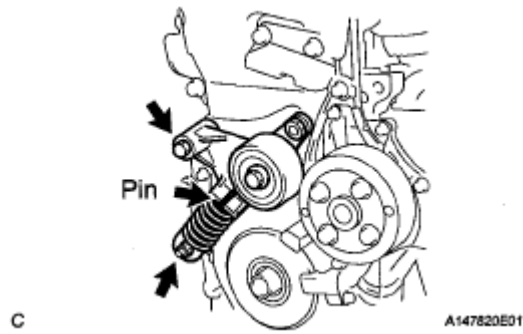


Fig. 114: Locating V-Ribbed Belt Tensioner With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

21. INSTALL CRANKSHAFT PULLEY

- a. Using SST, secure the pulley in place and tighten the bolt.

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

Torque: 180 N*m (1835 kgf*cm, 133 ft.*lbf)

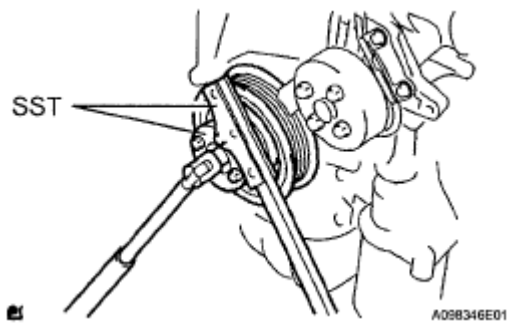


Fig. 115: Tightening Crankshaft Pulley Bolts With SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Turn the crankshaft counterclockwise, then disconnect the hook from the pin.

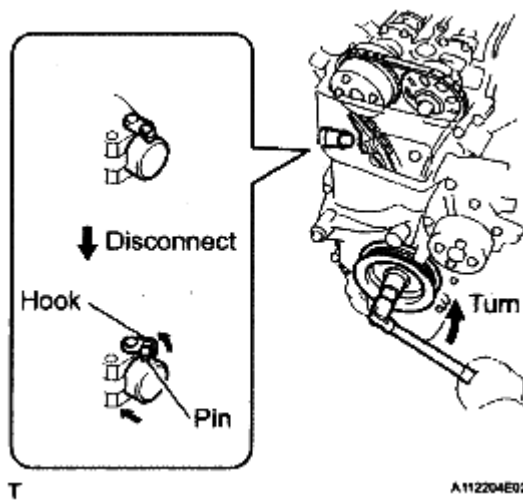


Fig. 116: Disconnecting Hook From Pin

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

- c. Turn the crankshaft clockwise, then check that the plunger is extended.

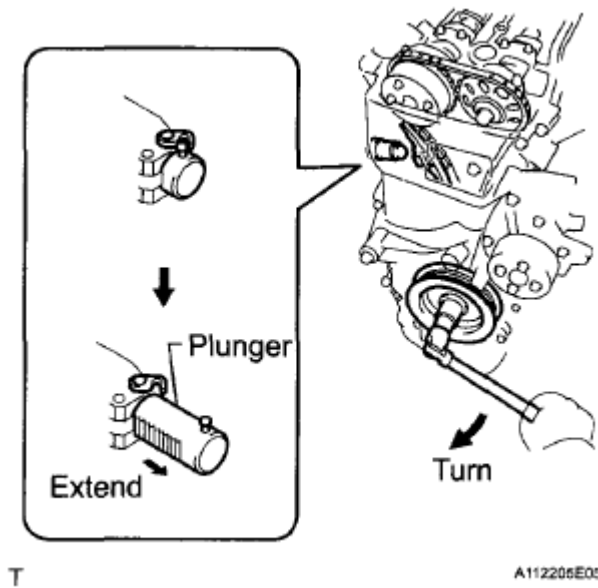


Fig. 117: Checking Plunger Extension

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

22. INSTALL OIL PAN SUB-ASSEMBLY

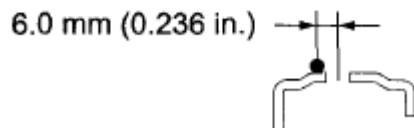
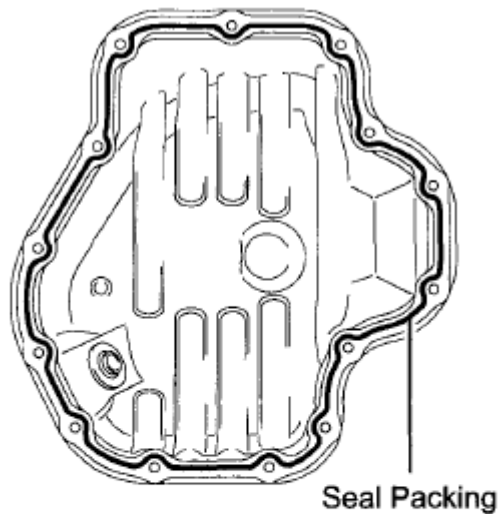
- a. Remove any old packing material and be careful not to drop any oil on the contact surfaces of the cylinder block and oil pan.
- b. Apply a continuous bead of seal packing (Diameter 4.0 to 4.5 mm (0.158 to 0.177 in.)) as shown in the illustration.

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 of applying seal packing.
- Do not add engine oil for at least 2 hours after installing the oil pan.

- c. Install the oil pan onto the cylinder block.



Seal Diameter: 4.0 to 4.5 mm

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Fig. 118: Identifying Seal Packing Applying Area
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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)

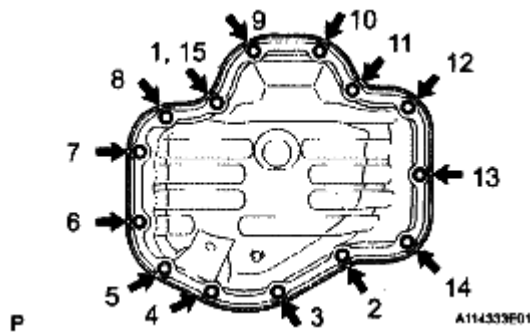


Fig. 119: Identifying Oil Pan Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

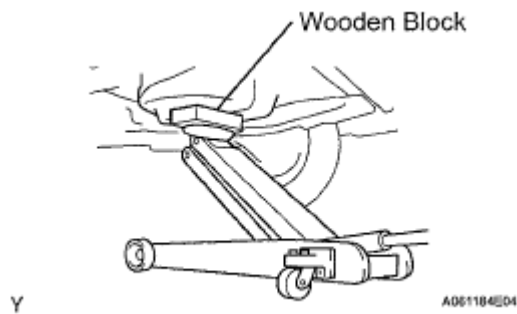


Fig. 120: Placing Wooden Block Between Floor Jack And Engine
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Place a wooden block between a floor jack and the engine, then support the engine using the floor jack.
- f. Remove the chain block and sling device.
- g. Remove the 2 bolts and engine hangers.

23. INSTALL CRANKSHAFT POSITION SENSOR (See INSTALLATION)

24. INSTALL IDLER PULLEY SUB-ASSEMBLY

- a. Install the idler pulley sub-assembly with the 2 bolts.

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

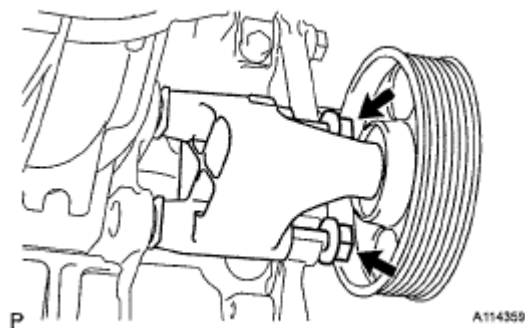


Fig. 121: Locating Idler Pulley Sub-Assembly With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

25. INSTALL ENGINE MOUNTING INSULATOR SUB-ASSEMBLY RH

- a. Install the engine mounting insulator sub-assembly RH with the 4 bolts and 2 nuts.

Torque: Bolt A

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

Bolt B

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

Nut A

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

Nut B

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

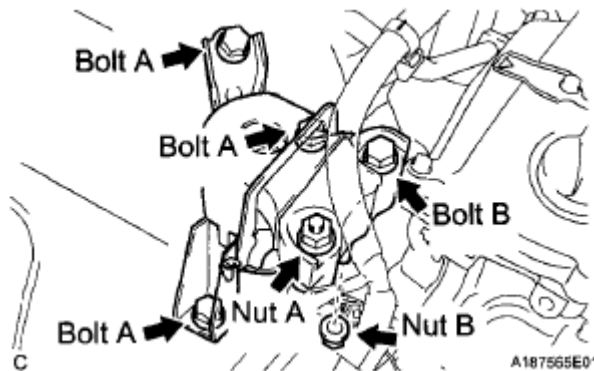


Fig. 122: Locating Engine Mounting Insulator Sub-Assembly RH With Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

26. INSTALL EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY

- a. Install a new gasket onto the cylinder head sub-assembly.
b. Temporarily tighten the exhaust manifold converter sub-assembly with the 5 nuts.
c. Tighten the 5 nuts in the sequence shown in the illustration.

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

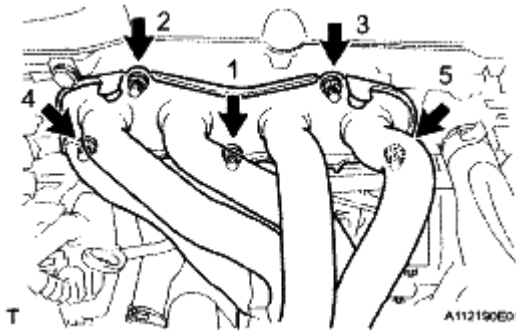


Fig. 123: Identifying Exhaust Manifold Converter Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Connect the air fuel ratio sensor connector.

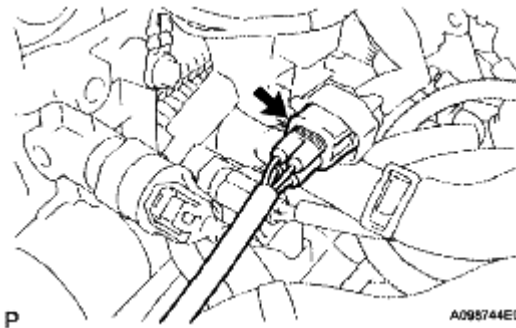


Fig. 124: Locating Air Fuel Ratio Sensor Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

27. INSTALL NO. 1 EXHAUST MANIFOLD HEAT INSULATOR (See INSTALLATION)
28. INSTALL NO. 2 MANIFOLD STAY (See INSTALLATION)
29. INSTALL MANIFOLD STAY (See INSTALLATION)
30. INSTALL NO. 1 INTAKE MANIFOLD INSULATOR (See INSTALLATION)
31. INSTALL INTAKE MANIFOLD (See INSTALLATION)
32. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (See INSTALLATION)
33. INSTALL FUEL DELIVERY PIPE SUB-ASSEMBLY (See INSTALLATION)
34. CONNECT FUEL MAIN TUBE (See INSTALLATION)
35. INSTALL ENGINE OIL LEVEL DIPSTICK GUIDE
 - a. Apply a light coat of engine oil to a new O-ring and install it onto the engine oil level dipstick guide.
 - b. Install the engine oil level dipstick guide with the bolt.

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

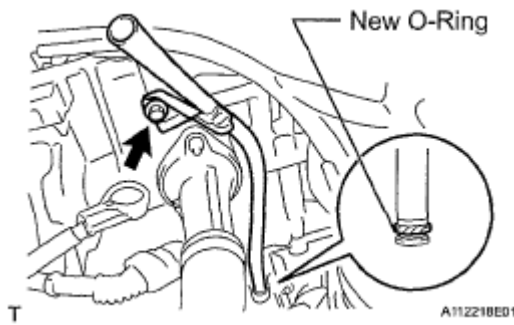


Fig. 125: Locating Engine Oil Level Dipstick Guide And O-Ring With Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

36. INSTALL ENGINE OIL LEVEL DIPSTICK
 37. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY (See INSTALLATION)
 38. INSTALL SPARK PLUG (See INSTALLATION)
 39. INSTALL IGNITION COIL ASSEMBLY (See INSTALLATION)
 40. INSTALL THROTTLE BODY ASSEMBLY (See INSTALLATION)
 41. INSTALL AIR CLEANER CAP SUB-ASSEMBLY WITH HOSE (See INSTALLATION)
 42. INSTALL RADIATOR RESERVE TANK ASSEMBLY (See INSTALLATION)
 43. INSTALL GENERATOR ASSEMBLY (See INSTALLATION)
 44. INSTALL V-RIBBED BELT
 - a. When a tensioner except spring type V-ribbed belt tensioner is used or the spring type V-ribbed belt tensioner is reused:
 1. Install the V-ribbed belt (See INSTALLATION).
 - b. When the spring type V-ribbed belt tensioner is replaced:
 1. Using SST, slowly turn the V-ribbed belt tensioner clockwise.

SST 09216-42010 (09216-04010)
 2. Pull out the pin with the V-ribbed belt tensioner being compressed in a clockwise direction.
 3. Slowly return the V-ribbed belt tensioner.
- NOTE:**
- Make sure that SST and other tools are set to the tensioner securely.
 - When compressing the V-ribbed belt tensioner, slowly turn the tensioner.
4. Install the V-ribbed belt (See INSTALLATION).

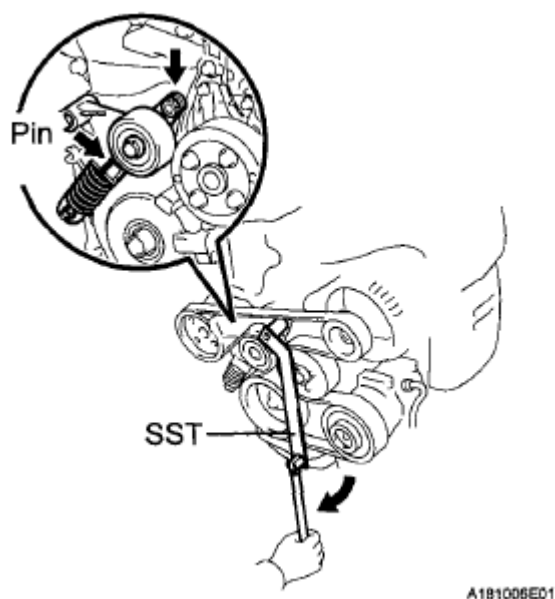


Fig. 126: Turning V-Ribbed Belt Tensioner
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

45. **INSTALL FRONT EXHAUST PIPE ASSEMBLY** (See INSTALLATION)
46. **INSTALL CENTER EXHAUST PIPE ASSEMBLY (for 2WD)** (See INSTALLATION)
47. **INSTALL CENTER EXHAUST PIPE ASSEMBLY (for 4WD)** (See INSTALLATION)
48. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**

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

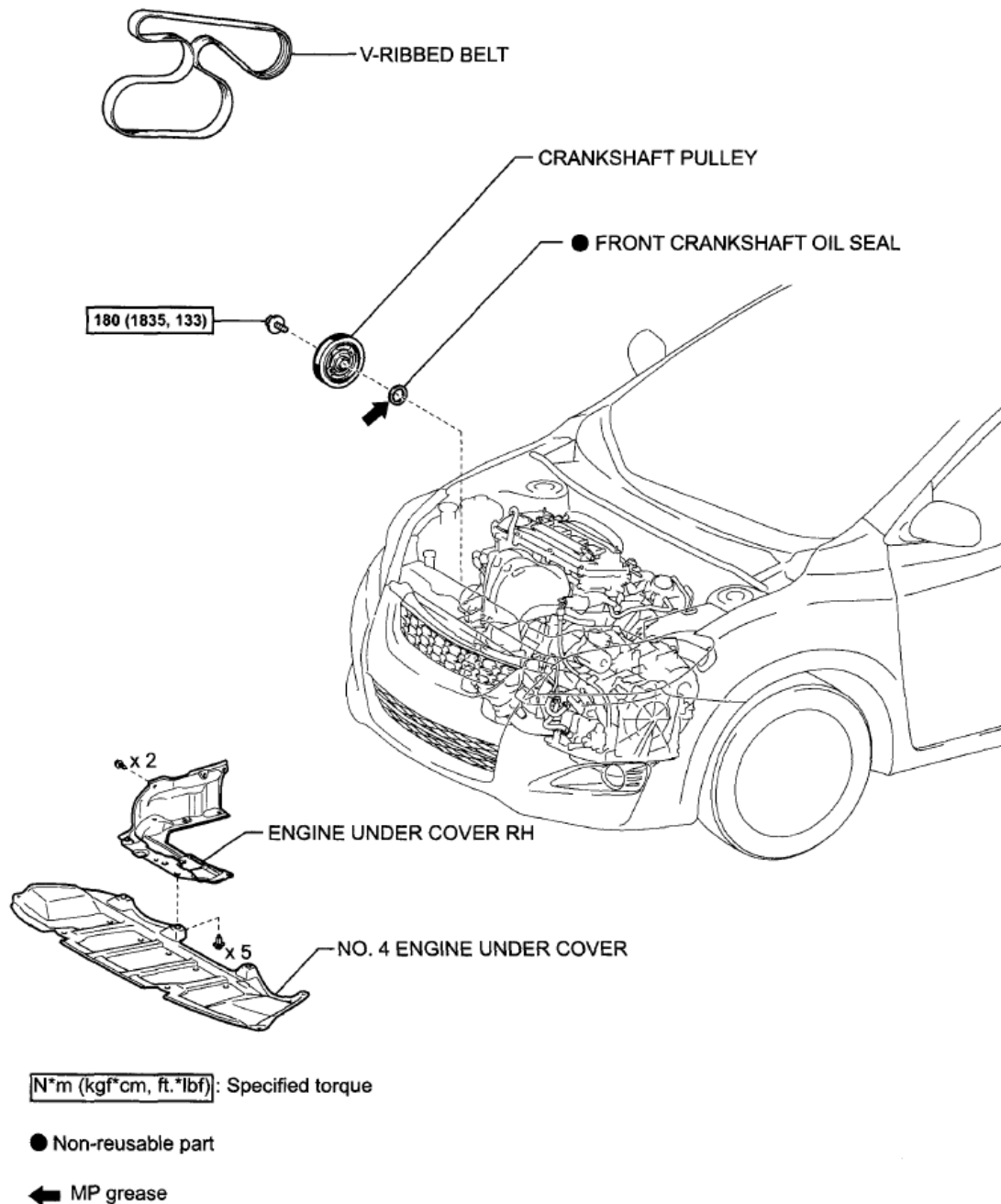
49. **ADD ENGINE OIL** (See REPLACEMENT)
50. **ADD ENGINE COOLANT** (See COOLANT)
51. **INSPECT FOR FUEL LEAK** (See ON-VEHICLE INSPECTION)
52. **INSPECT FOR COOLANT LEAK** (See COOLING SYSTEM)
53. **INSPECT FOR OIL LEAK**
54. **INSPECT FOR EXHAUST GAS LEAK**
55. **INSPECT IGNITION TIMING** (See ENGINE)
56. **INSPECT ENGINE IDLING SPEED** (See ON-VEHICLE INSPECTION)
57. **INSPECT COMPRESSION** (See ON-VEHICLE INSPECTION)
58. **INSPECT CO/HC** (See ON-VEHICLE INSPECTION)
59. **INSTALL SUSPENSION TOWER DAMPER ASSEMBLY (w/ Front Strut Bar)** (See INSTALLATION)
60. **INSTALL OUTER COWL TOP PANEL** (See INSTALLATION)
61. **INSTALL WINDSHIELD WIPER MOTOR AND LINK ASSEMBLY** (See INSTALLATION)
62. **INSTALL COWL TOP VENTILATOR LOUVER LH** (See INSTALLATION)

- 63. **INSTALL COWL TOP VENTILATOR LOUVER RH** (See INSTALLATION)
- 64. **INSTALL HOOD TO COWL TOP SEAL** (See INSTALLATION)
- 65. **INSTALL FRONT WIPER ARM AND BLADE ASSEMBLY RH** (See INSTALLATION)
- 66. **INSTALL FRONT WIPER ARM AND BLADE ASSEMBLY LH** (See INSTALLATION)
- 67. **INSTALL FRONT WIPER ARM HEAD CAP** (See INSTALLATION)
- 68. **INSTALL NO. 1 ENGINE COVER SUB-ASSEMBLY** (See INSTALLATION)
- 69. **INSTALL ENGINE UNDER COVER LH**
- 70. **INSTALL ENGINE UNDER COVER RH**
- 71. **INSTALL FRONT WHEEL RH**

Torque: 103 N*m (1050 kgf*cm, 76 ft.*lbf)

FRONT CRANKSHAFT OIL SEAL

COMPONENTS



A167494E01

Fig. 127: Identifying Front Crankshaft Oil Seal Components With Torque Specifications
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. REMOVE FRONT WHEEL RH
2. REMOVE ENGINE UNDER COVER RH
3. REMOVE V-RIBBED BELT (See REMOVAL)

4. REMOVE CRANKSHAFT PULLEY

- a. Using SST, hold the crankshaft pulley in place and loosen the pulley bolt.

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

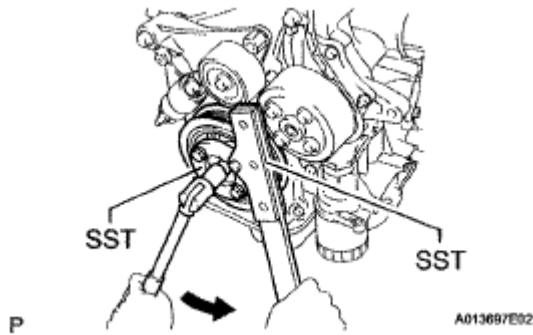


Fig. 128: Holding Crankshaft Pulley With SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using SST, remove the crankshaft 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.

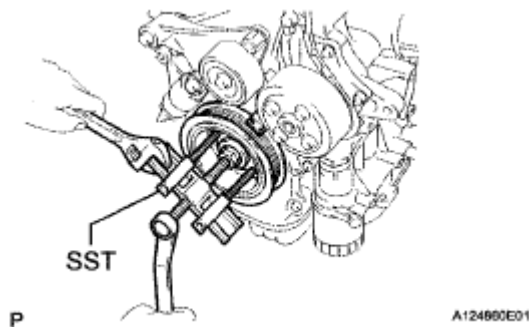


Fig. 129: Removing Crankshaft Pulley With SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. REMOVE FRONT CRANKSHAFT OIL SEAL

- a. Using a knife, cut off the lip of the oil seal.
- b. Using a screwdriver, pry out the oil seal.

NOTE: Do not damage the surfaces of the oil seal press fit hole and crankshaft.

HINT:

Tape the screwdriver tip before use.

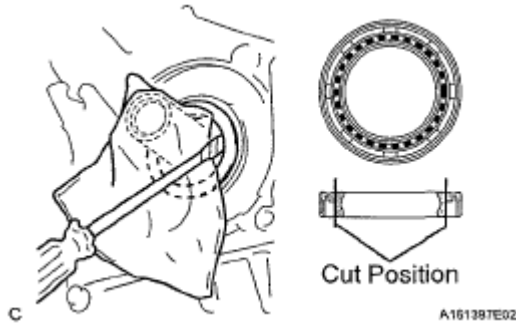


Fig. 130: Prying Out Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSTALLATION

1. INSTALL FRONT CRANKSHAFT OIL SEAL

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

SST 09223-22010

NOTE:

- Keep the lip free from foreign matter.
- Do not tap on the oil seal at an angle.

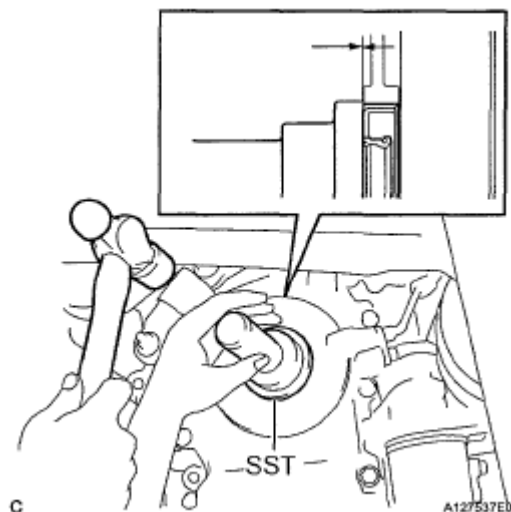


Fig. 131: Tapping Front Crankshaft Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. INSTALL CRANKSHAFT PULLEY

- a. While holding the crankshaft pulley in place with SST, tighten the bolt.

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

Torque: 180 N*m (1835 kgf*cm, 133 ft.*lbf)

3. **INSTALL V-RIBBED BELT** (See **REMOVAL**)
4. **INSPECT FOR OIL LEAK**
5. **INSTALL ENGINE UNDER COVER RH**
6. **INSTALL FRONT WHEEL RH**

Torque: 103 N*m (1050 kgf*cm, 76 ft.*lbf)

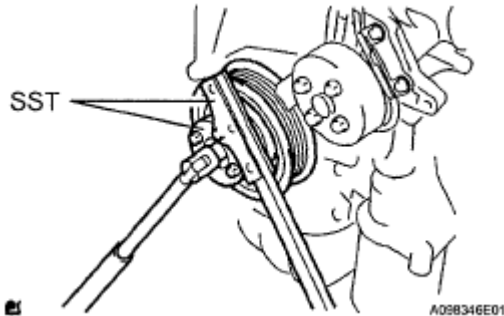
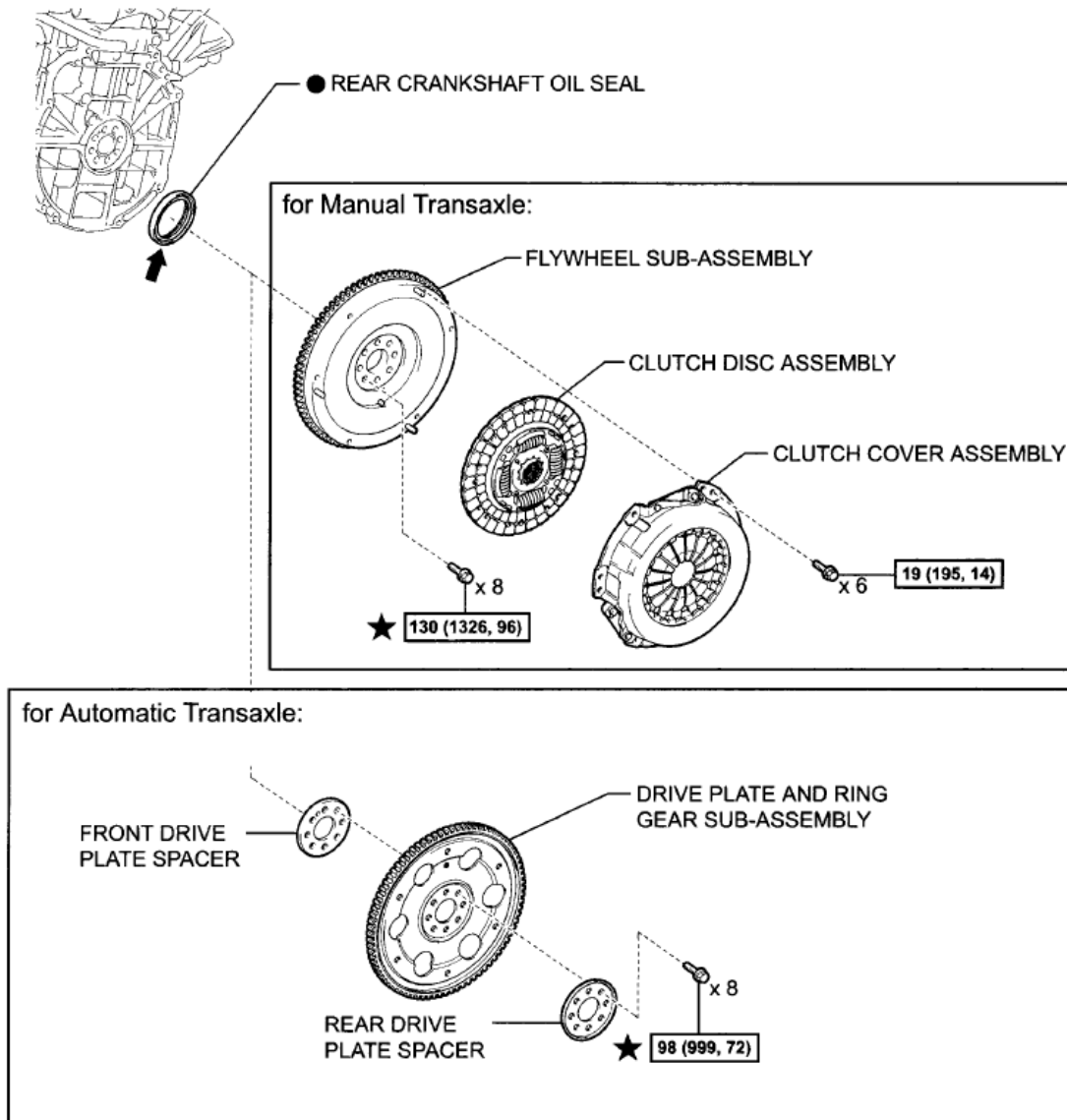


Fig. 132: Tightening Crankshaft Pulley Bolts With SST

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

REAR CRANKSHAFT OIL SEAL**COMPONENTS**



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

● Non-reusable part

← MP grease

★ Precoated part

A180994E01

Fig. 133: Identifying Rear Crankshaft Oil Seal Components With Torque Specifications
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. REMOVE AUTOMATIC TRANSAXLE ASSEMBLY (for Automatic Transaxle)

HINT:

- See **REMOVAL** for U250E.
- See **REMOVAL** for U140F.

2. REMOVE MANUAL TRANSAXLE ASSEMBLY (for Manual Transaxle)

HINT:

See **REMOVAL** for E351.

3. REMOVE CLUTCH COVER ASSEMBLY (for Manual Transaxle)

HINT:

See **REMOVAL** for E351.

4. REMOVE CLUTCH DISC ASSEMBLY (for Manual Transaxle)

HINT:

See **REMOVAL** for E351.

5. REMOVE DRIVE PLATE AND RING GEAR SUB-ASSEMBLY (for Automatic Transaxle)

- a. Using SST, hold the crankshaft.

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

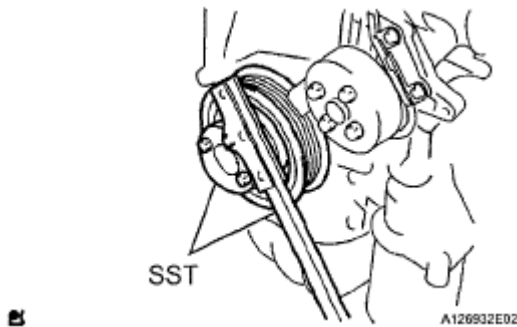


Fig. 134: Holding Crankshaft

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

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

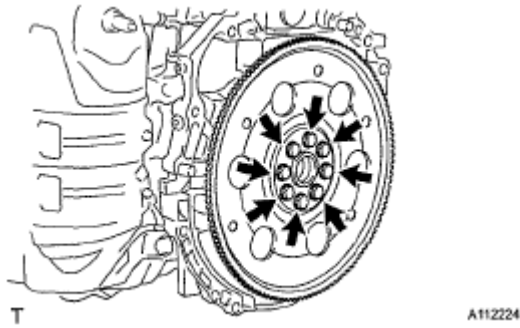


Fig. 135: Locating Drive Plate Bolts

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

6. REMOVE FLYWHEEL SUB-ASSEMBLY (for Manual Transaxle)

- a. Using SST, hold the crankshaft.

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

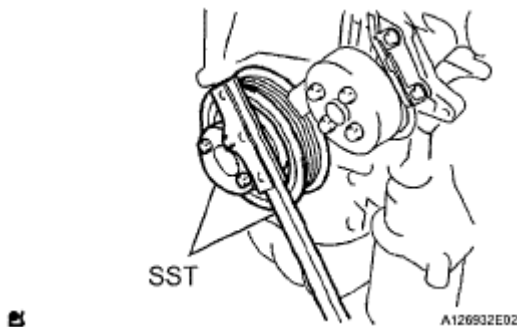


Fig. 136: Holding Crankshaft

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

- b. Remove the 8 bolts and flywheel.

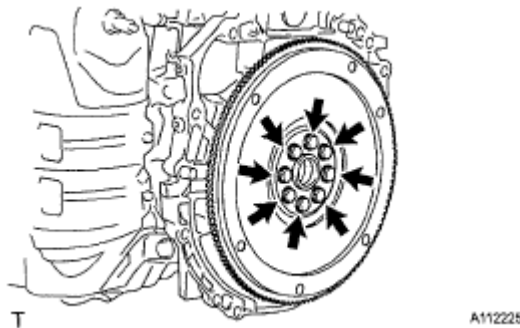


Fig. 137: Locating Flywheel Bolts

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

7. REMOVE REAR CRANKSHAFT OIL SEAL

- a. Using a knife, cut off the lip of the oil seal.
- b. Using a screwdriver, pry out the oil seal.

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

HINT:

Tape the screwdriver tip before use.

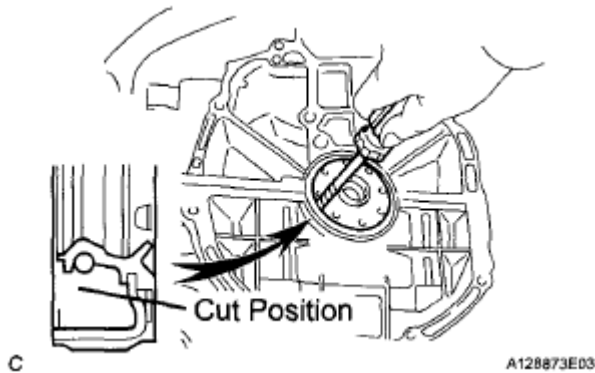


Fig. 138: Prying Out Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSTALLATION

1. INSTALL REAR CRANKSHAFT OIL SEAL

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

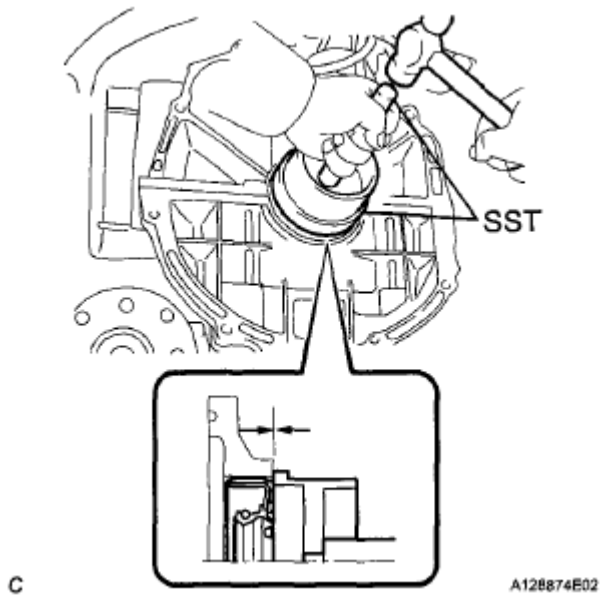
SST 09223-15030, 09950-70010 (09951 -07100)

NOTE:

- Keep the lip free from foreign matter.
- Do not tap on the oil seal at an angle.

2. INSTALL DRIVE PLATE AND RING GEAR SUB-ASSEMBLY (for Automatic Transaxle)

- a. Clean the 8 bolts and 8 bolt holes.

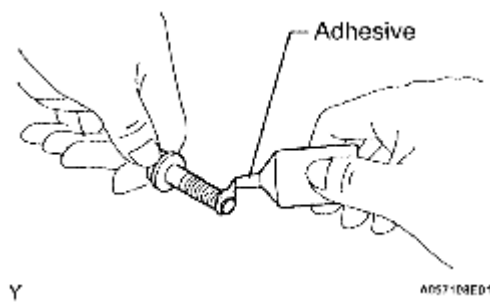
**Fig. 139: Tapping Rear Crankshaft Oil Seal**

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

- b. Apply adhesive to 2 or 3 threads of the 8 bolts.

Adhesive:

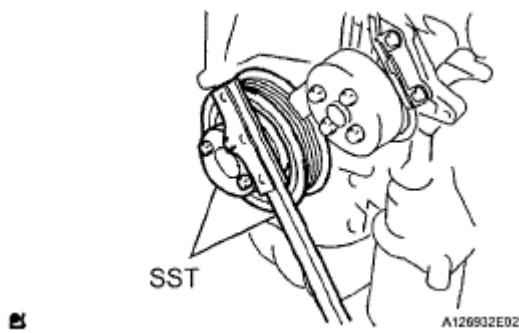
Toyota Genuine Adhesive 1344, Three Bond 1344 or equivalent

**Fig. 140: Applying Adhesive To Threads Of Bolts**

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

- c. Using SST, hold the crankshaft.

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

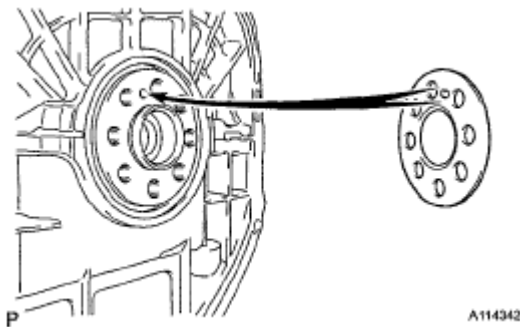
**Fig. 141: Holding Crankshaft**

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

- d. Install the front drive plate spacer.

HINT:

Align the pin of the front spacer with the pin hole of the crankshaft.

**Fig. 142: Aligning Pin Of Front Spacer With Pin Hole Of Crankshaft**

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

- e. Install the drive plate and rear drive plate spacer onto the crankshaft.

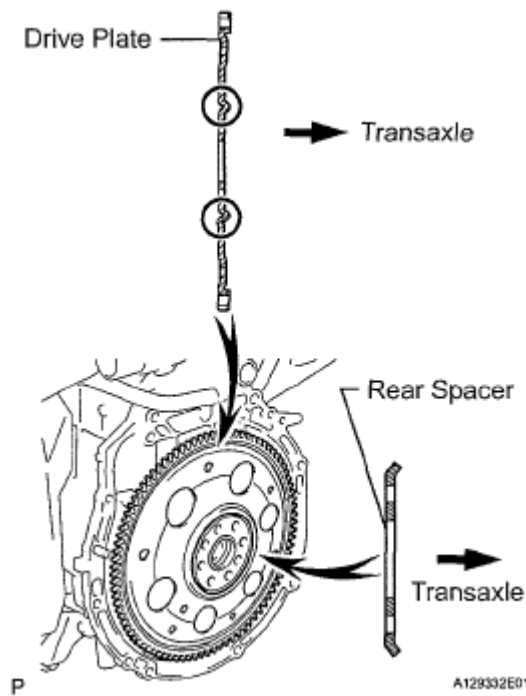


Fig. 143: Installing Drive Plate And Rear Drive Plate Spacer Onto Crankshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. In several steps, uniformly install and tighten the 8 bolts in the sequence shown in the illustration.

Torque: 98 N*m (999 kgf*cm, 72 ft.*lbf)

3. INSTALL FLYWHEEL SUB-ASSEMBLY (for Manual Transaxle)

- a. Clean the 8 bolts and 8 bolt holes.

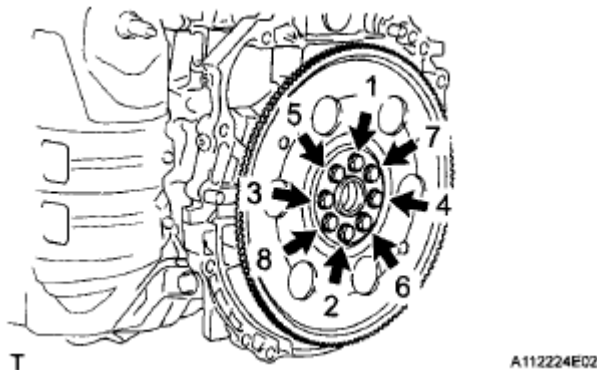


Fig. 144: Identifying Flywheel Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Apply adhesive to the end 2 or 3 threads of the 8 bolts.

Adhesive:

Toyota Genuine Adhesive 1344, Three Bond 1344 or equivalent

- c. Using SST, hold the crankshaft.

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

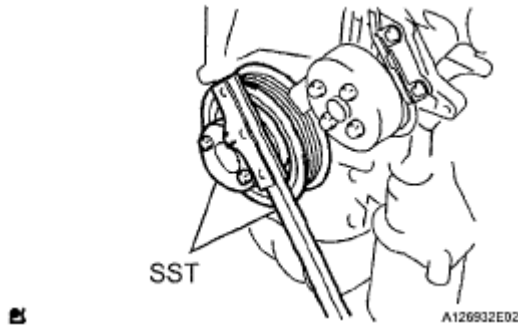


Fig. 145: Holding Crankshaft

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

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

Torque: 130 N*m (1326 kgf*cm, 96 ft.*lbf)

4. INSTALL CLUTCH DISC ASSEMBLY (for Manual Transaxle)

HINT:

See **INSTALLATION** for E351.

5. INSTALL CLUTCH COVER ASSEMBLY (for Manual Transaxle)

HINT:

See **INSTALLATION** for E351.

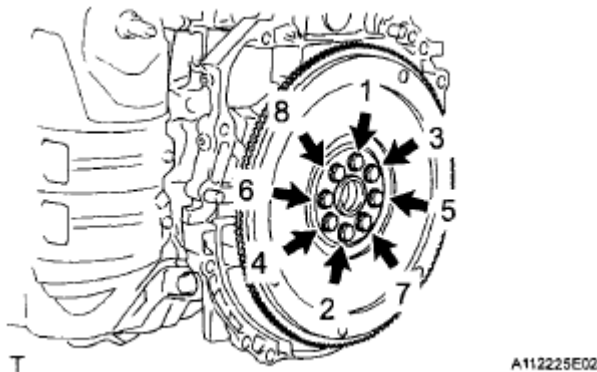


Fig. 146: Identifying Flywheel Bolts Tightening Sequence

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

6. INSTALL AUTOMATIC TRANSAXLE ASSEMBLY (for Automatic Transaxle)

HINT:

- See **INSTALLATION** for U250E.
- See **INSTALLATION** for U140F.

7. INSTALL MANUAL TRANSAXLE ASSEMBLY (for Manual Transaxle)

HINT:

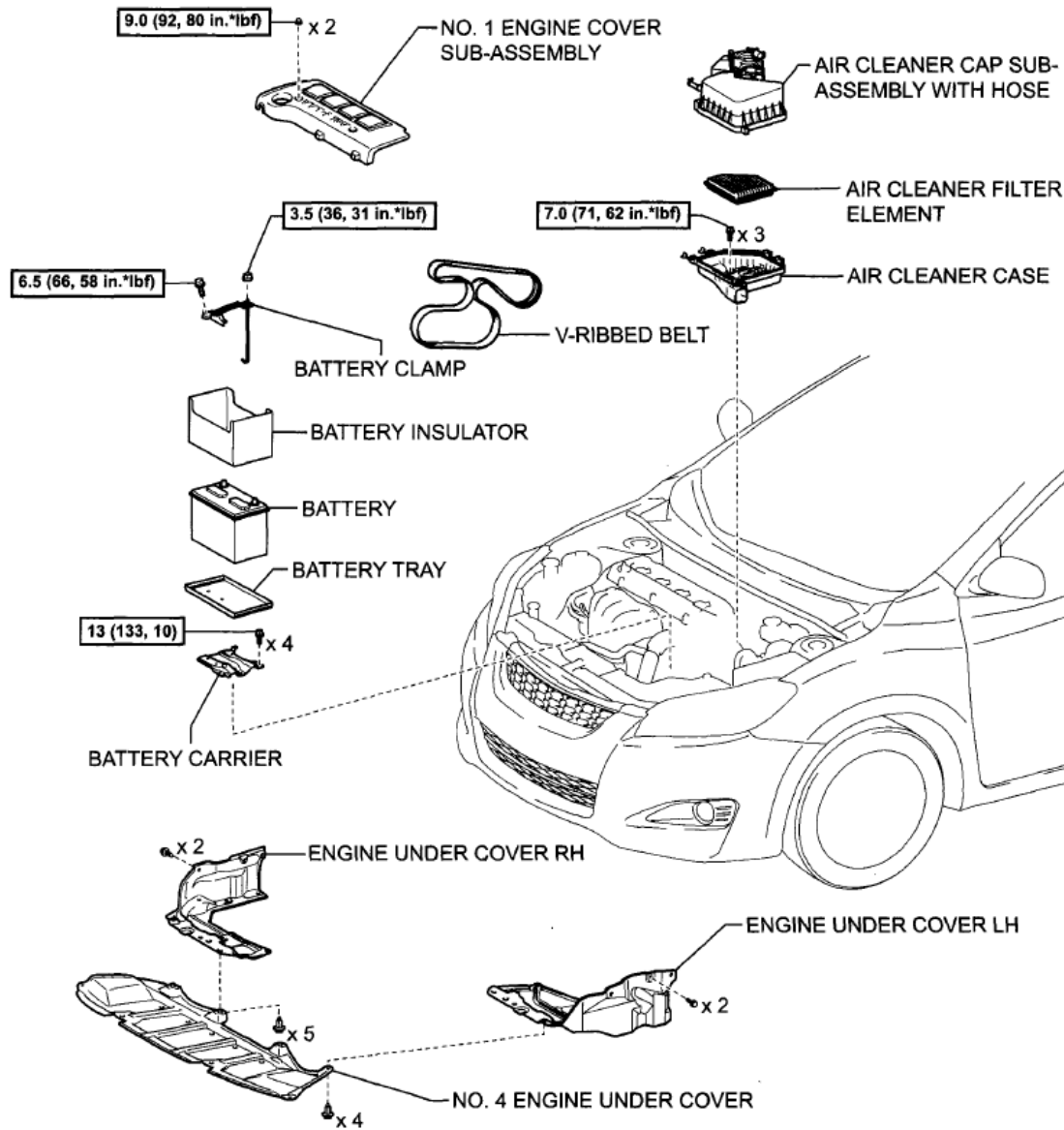
See **INSTALLATION** for E351.

ENGINE ASSEMBLY

COMPONENTS

2009 Toyota Matrix

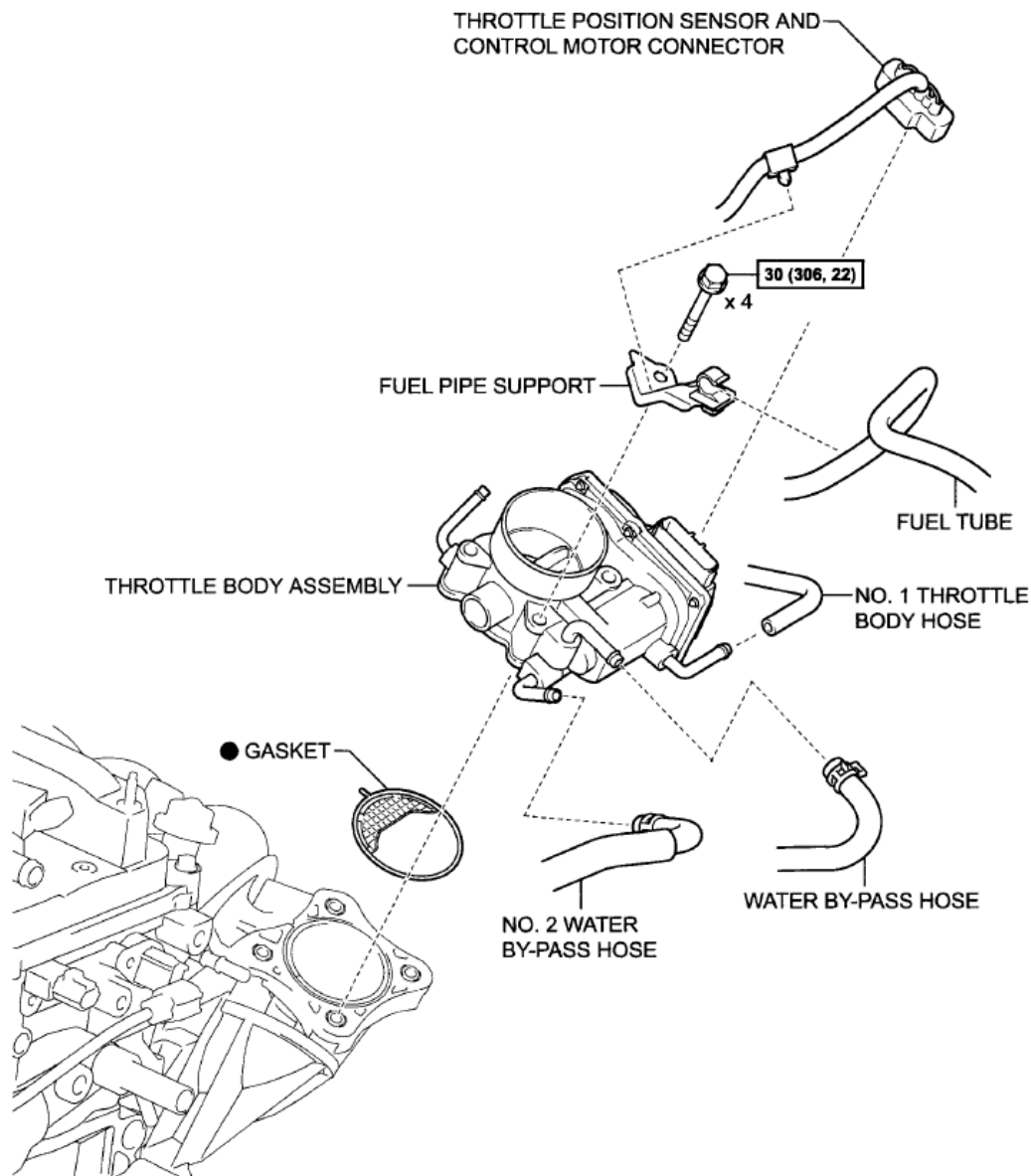
2009 ENGINE Engine Mechanical (2AZ-FE) - Corolla Matrix



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

A187496E01

Fig. 147: Identifying Engine Assembly Components With Torque Specifications (1 Of 14)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

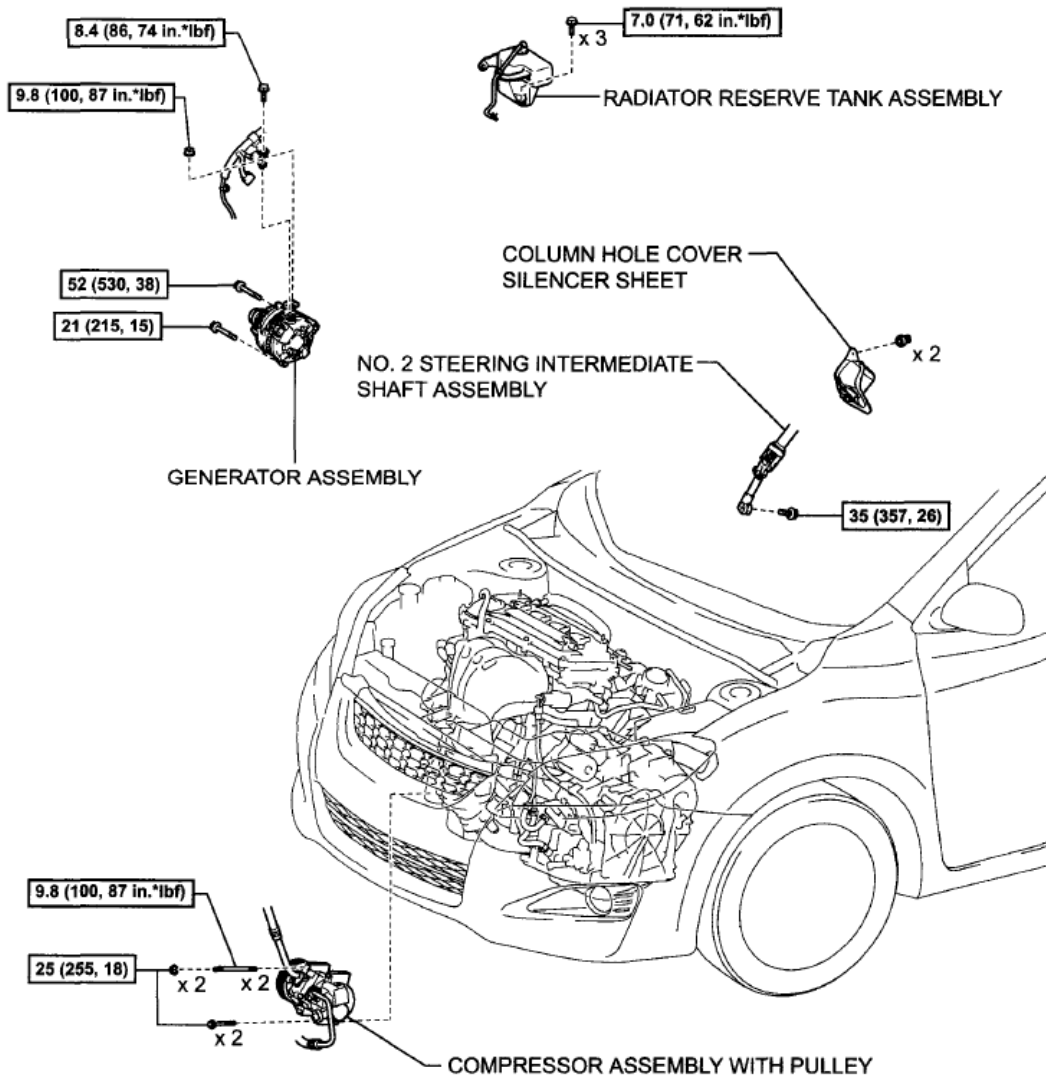


A124403E12

Fig. 148: Identifying Engine Assembly Components With Torque Specifications (2 Of 14)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2009 Toyota Matrix

2009 ENGINE Engine Mechanical (2AZ-FE) - Corolla Matrix



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

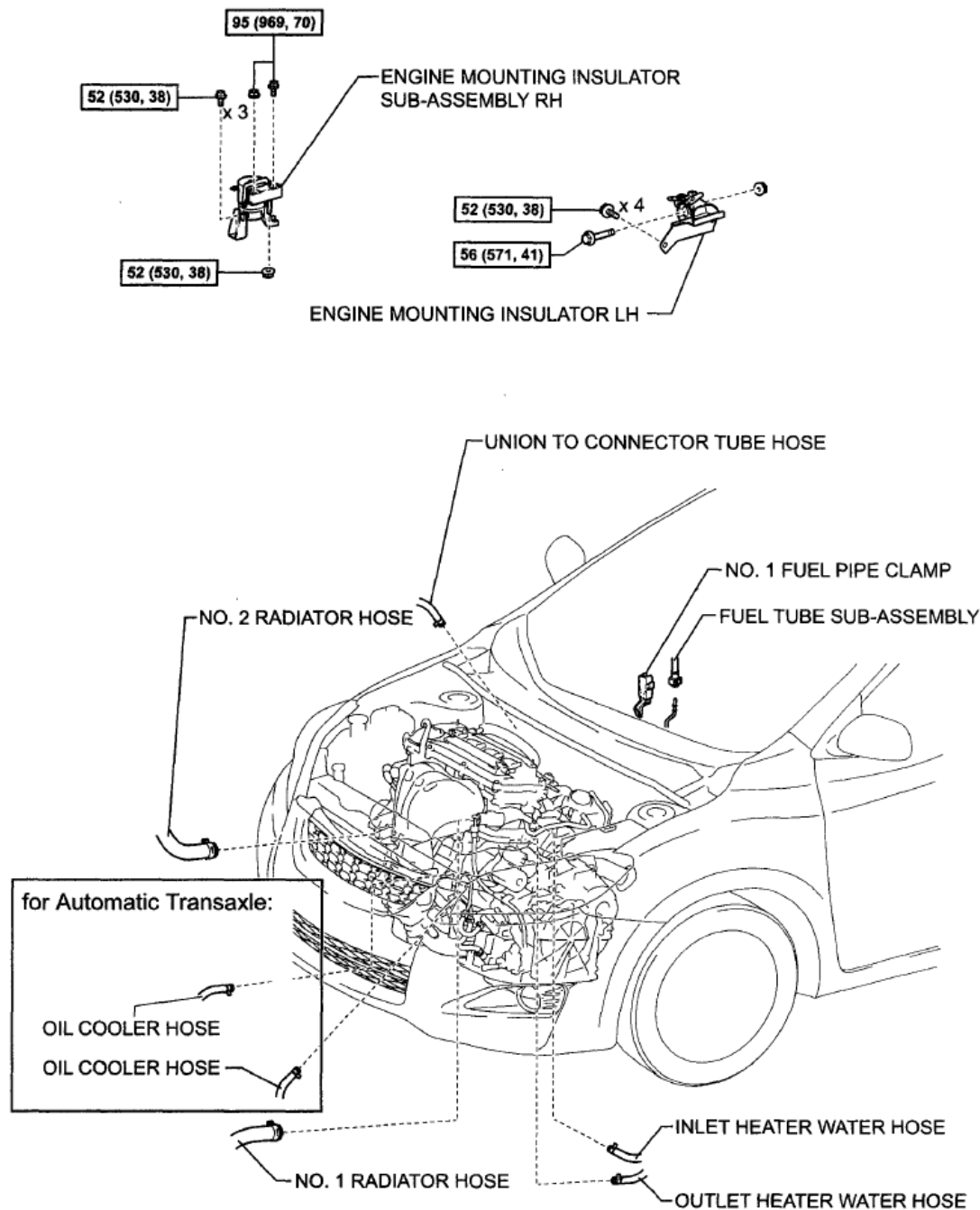
C

A187498E01

Fig. 149: Identifying Engine Assembly Components With Torque Specifications (3 Of 14)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2009 Toyota Matrix

2009 ENGINE Engine Mechanical (2AZ-FE) - Corolla Matrix



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

C

A187407E01

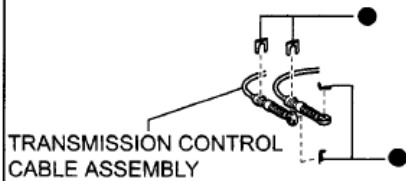
Fig. 150: Identifying Engine Assembly Components With Torque Specifications (4 Of 14)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2009 Toyota Matrix

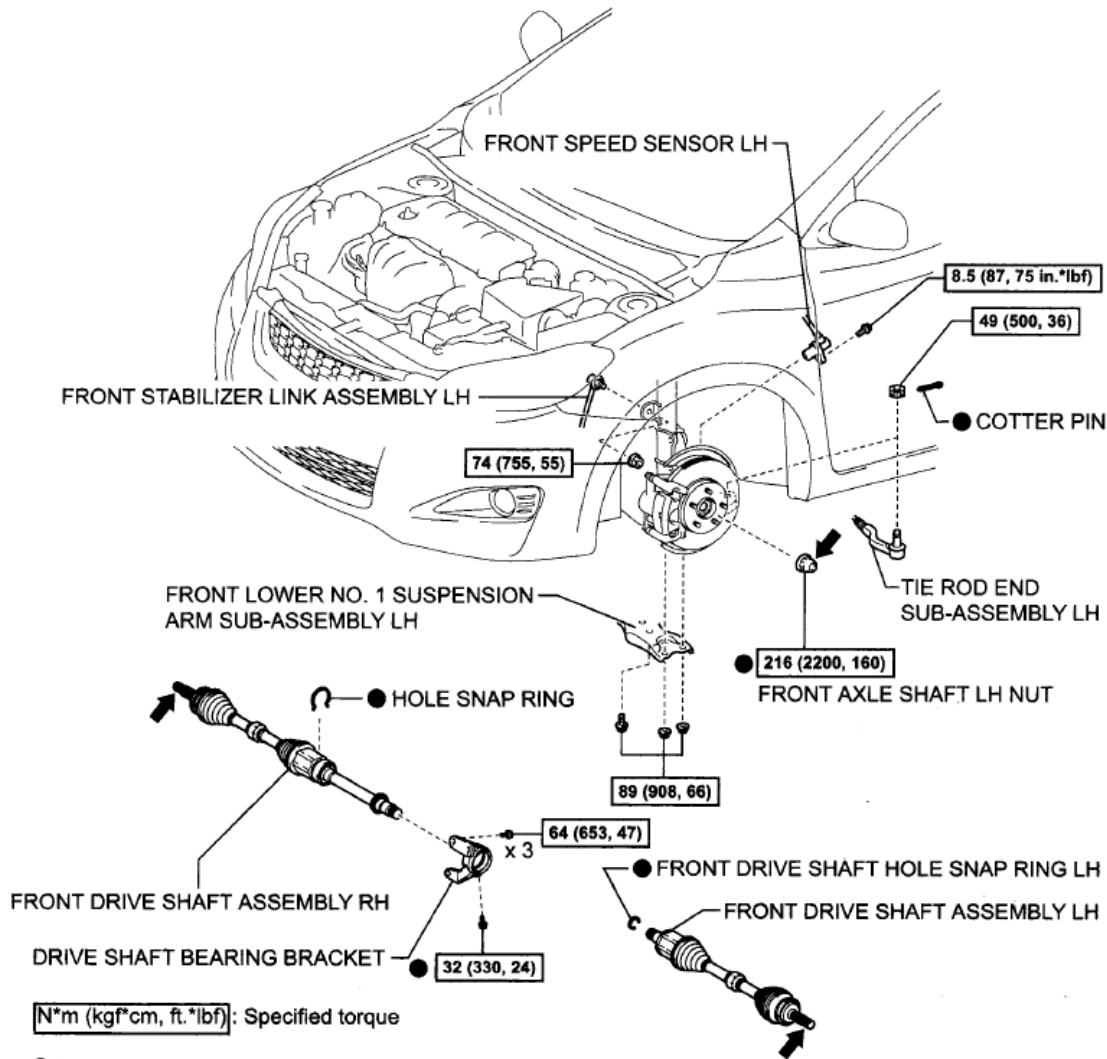
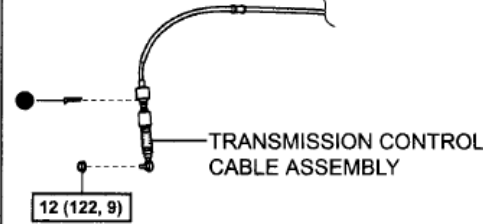
2009 ENGINE Engine Mechanical (2AZ-FE) - Corolla Matrix

for 2WD:

for Manual Transaxle:



for Automatic Transaxle:



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

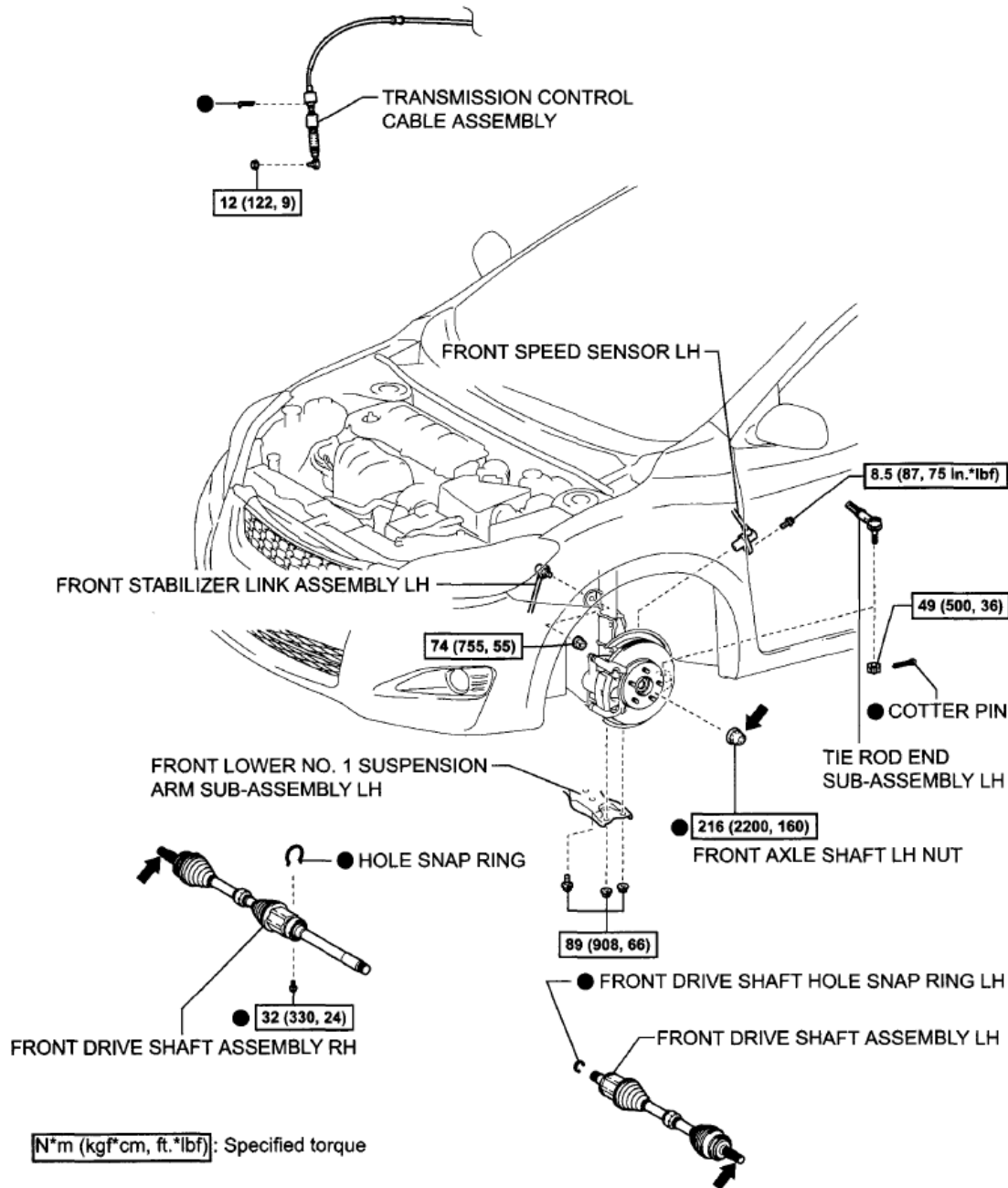
● Non-reusable part

← Do not apply lubricants to the threaded parts

A187498E01

Fig. 151: Identifying Engine Assembly Components With Torque Specifications (5 Of 14)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

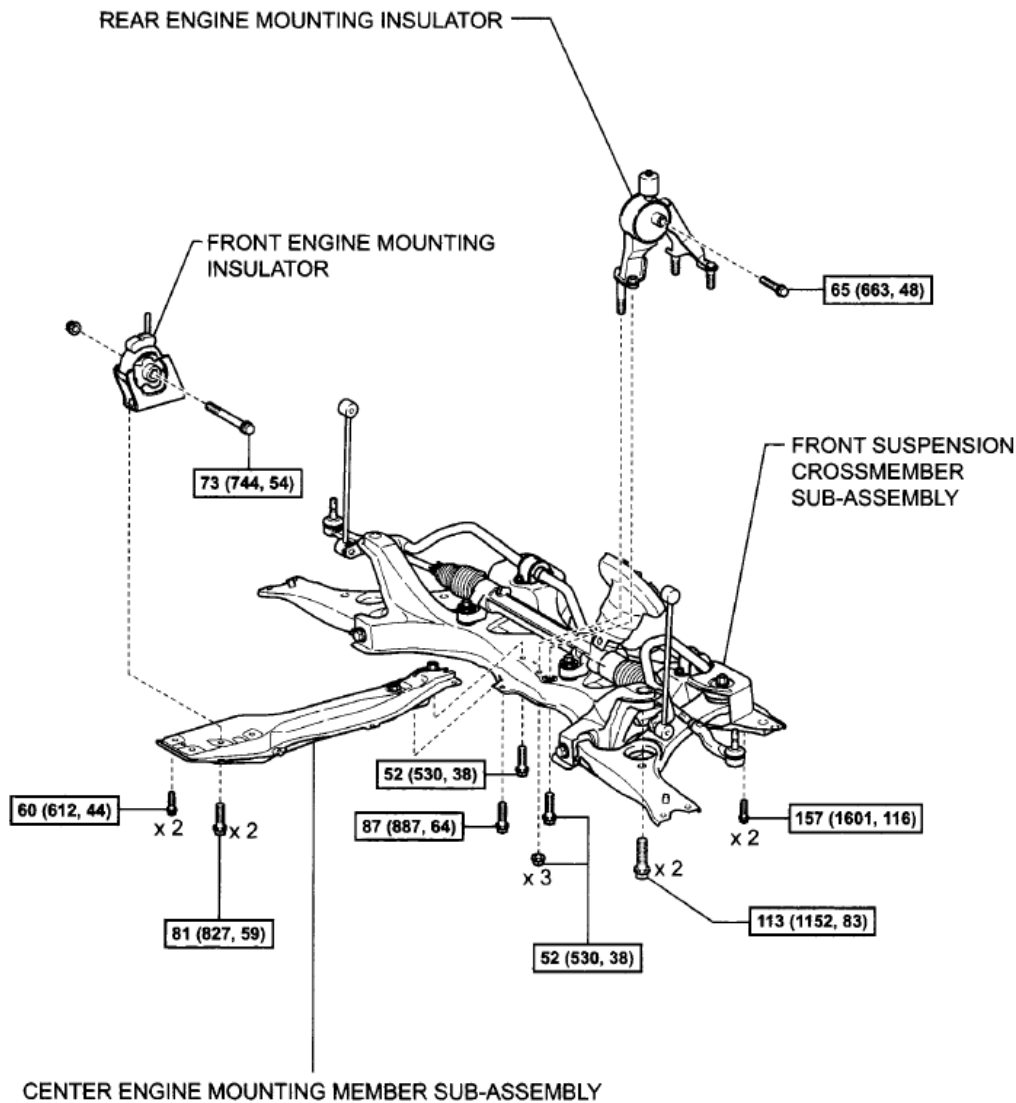
for 4WD:



A187499E01

Fig. 152: Identifying Engine Assembly Components With Torque Specifications (6 Of 14)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

for 2WD:



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

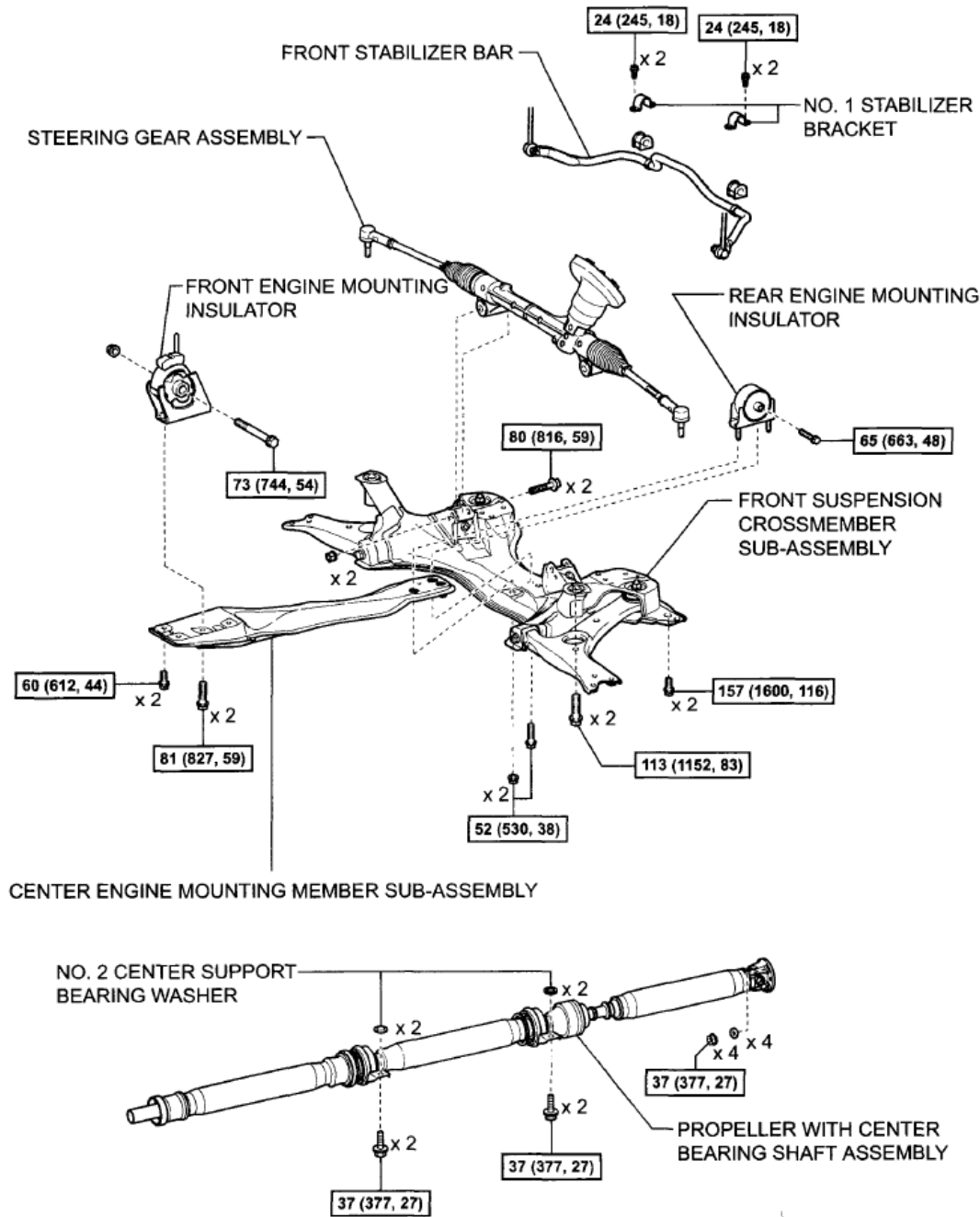
C162662E03

Fig. 153: Identifying Engine Assembly Components With Torque Specifications (7 Of 14)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2009 Toyota Matrix

2009 ENGINE Engine Mechanical (2AZ-FE) - Corolla Matrix

for 4WD:

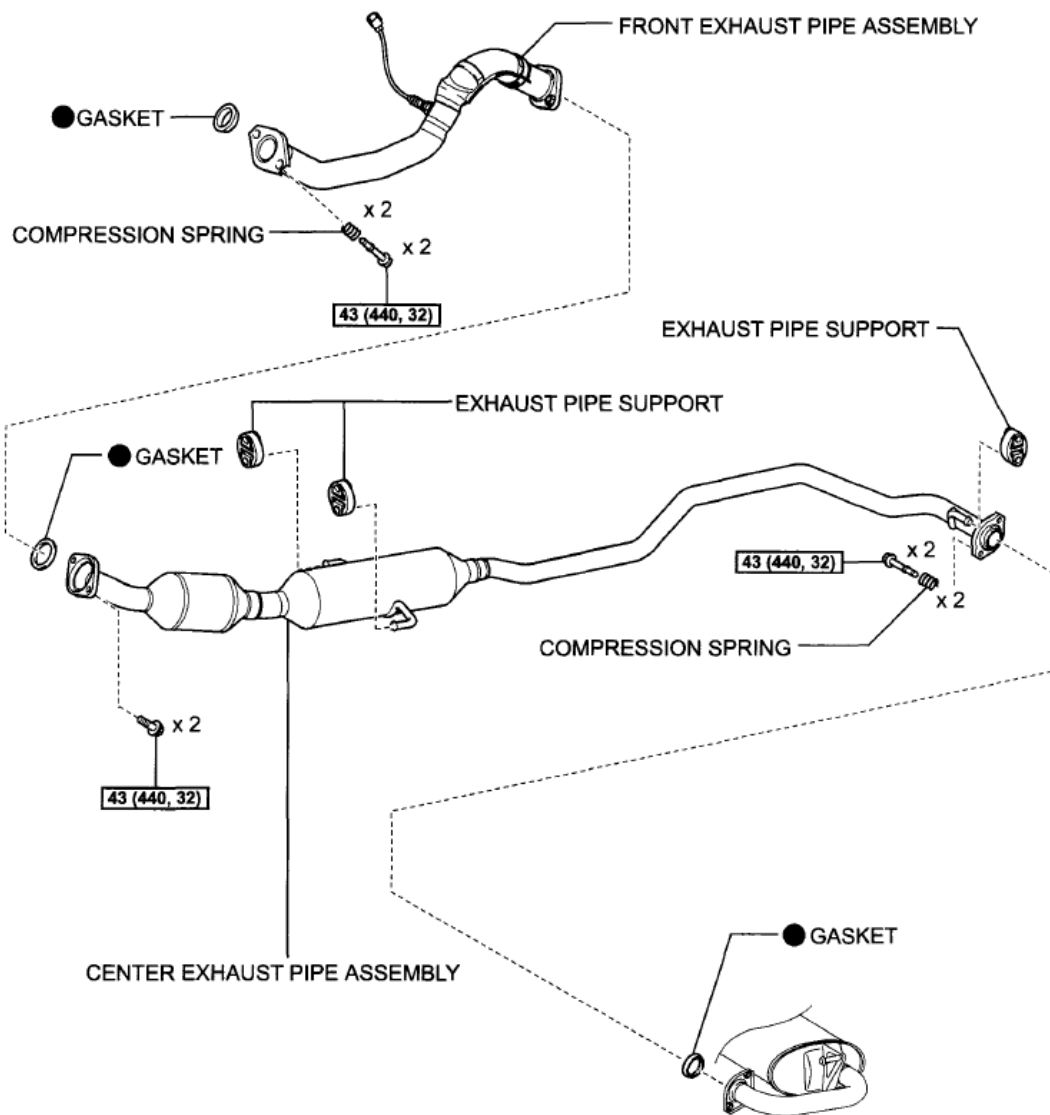


[N*m (kgf*cm, ft.*lbf)]: Specified torque

A109991E01

Fig. 154: Identifying Engine Assembly Components With Torque Specifications (8 Of 14)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

for 2WD (Double Wishbone Type Suspension):



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

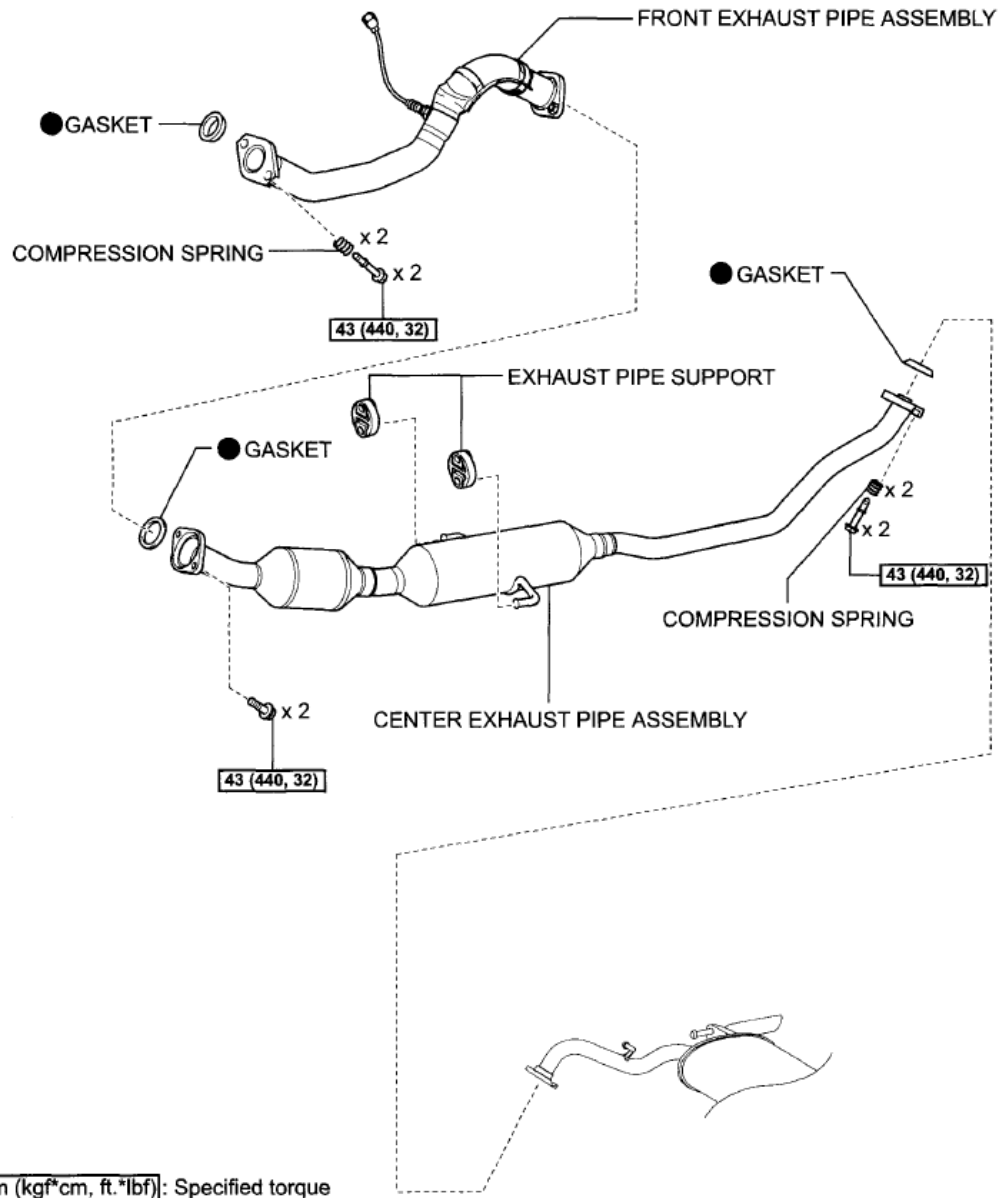
● Non-reusable part

C

A182438E04

Fig. 155: Identifying Engine Assembly Components With Torque Specifications (9 Of 14)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

for 2WD (Torsion Beam Type Suspension):

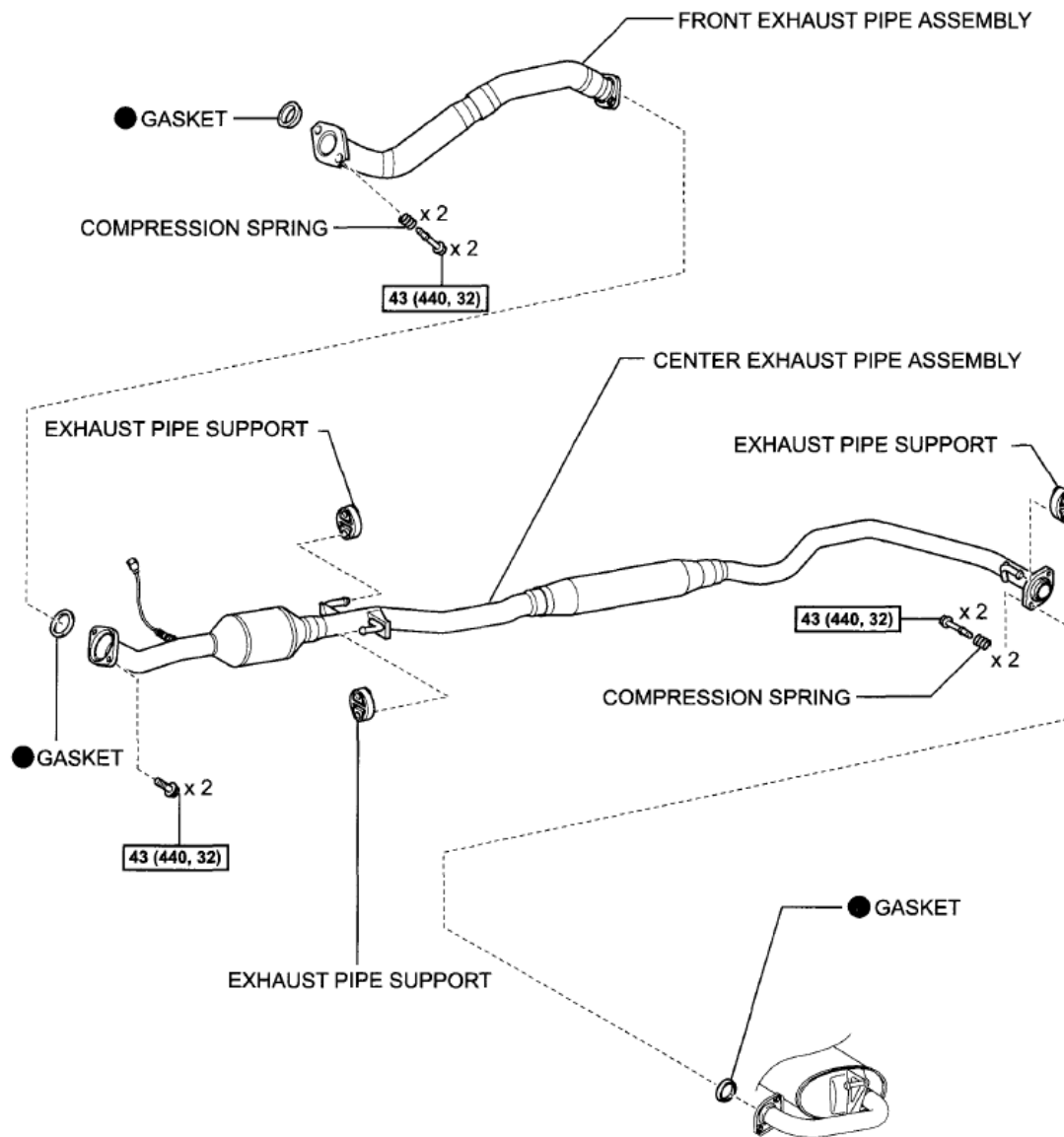


C

A182436E04

Fig. 156: Identifying Engine Assembly Components With Torque Specifications (10 Of 14)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

for 4WD:



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

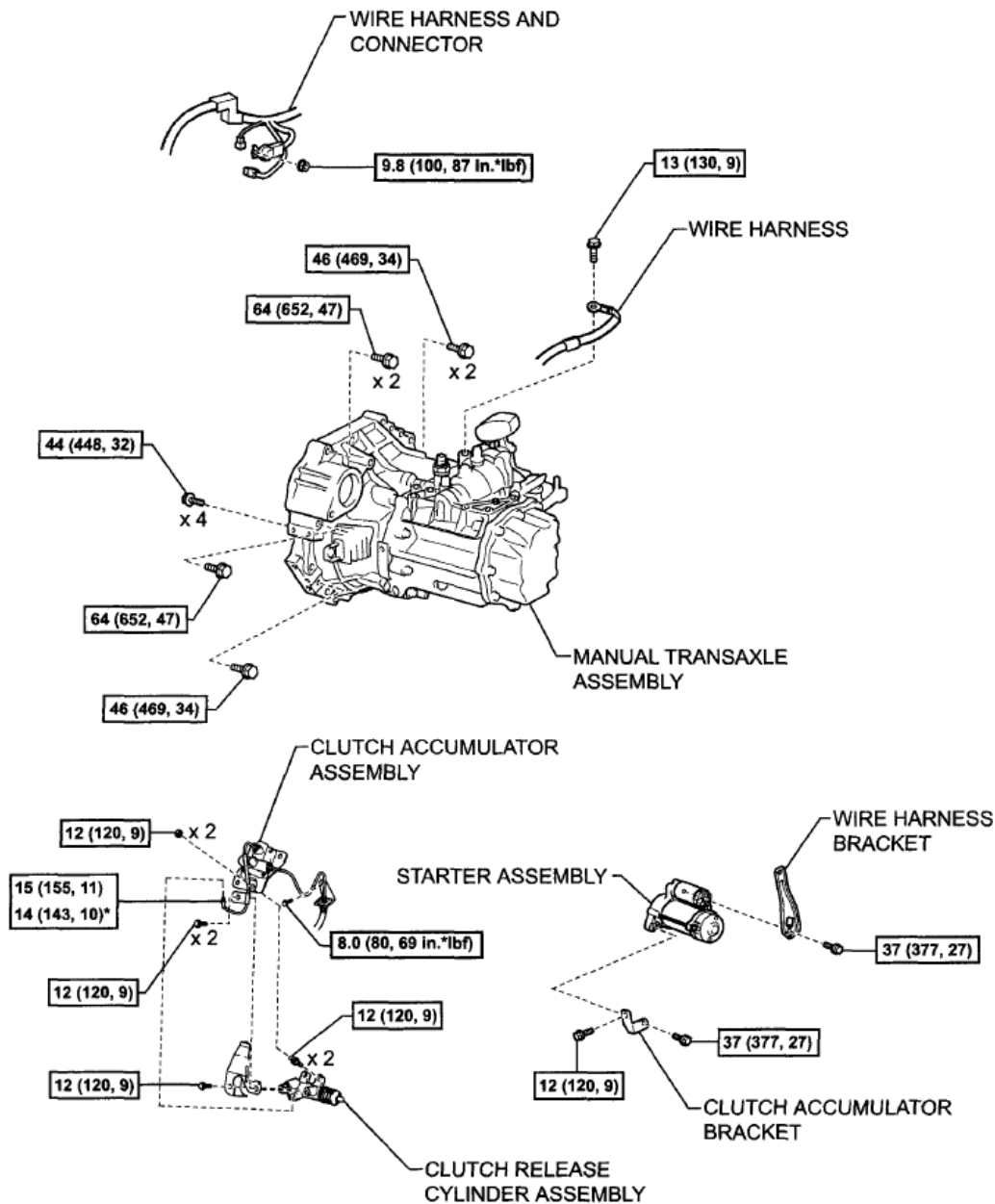
● Non-reusable part

C

A182440ED4

Fig. 157: Identifying Engine Assembly Components With Torque Specifications (11 Of 14)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

for E351 Manual Transaxle:



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

* For use with a union nut wrench

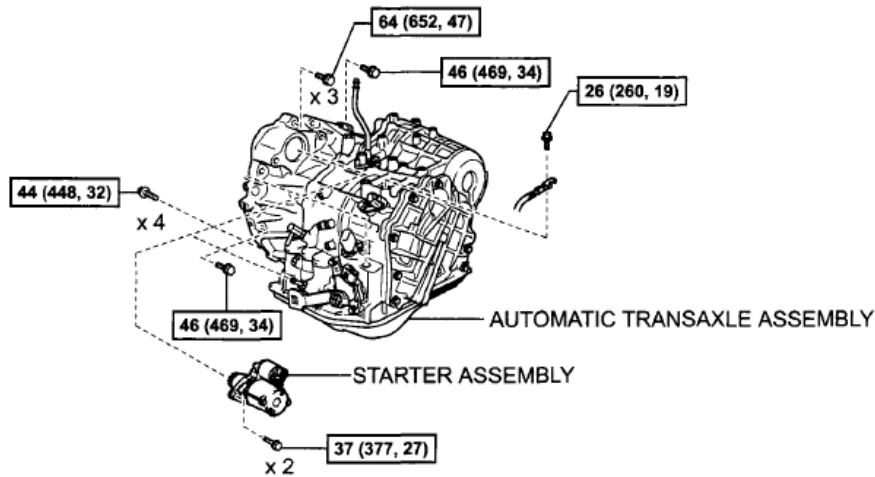
A181000E02

Fig. 158: Identifying Engine Assembly Components With Torque Specifications (12 Of 14)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

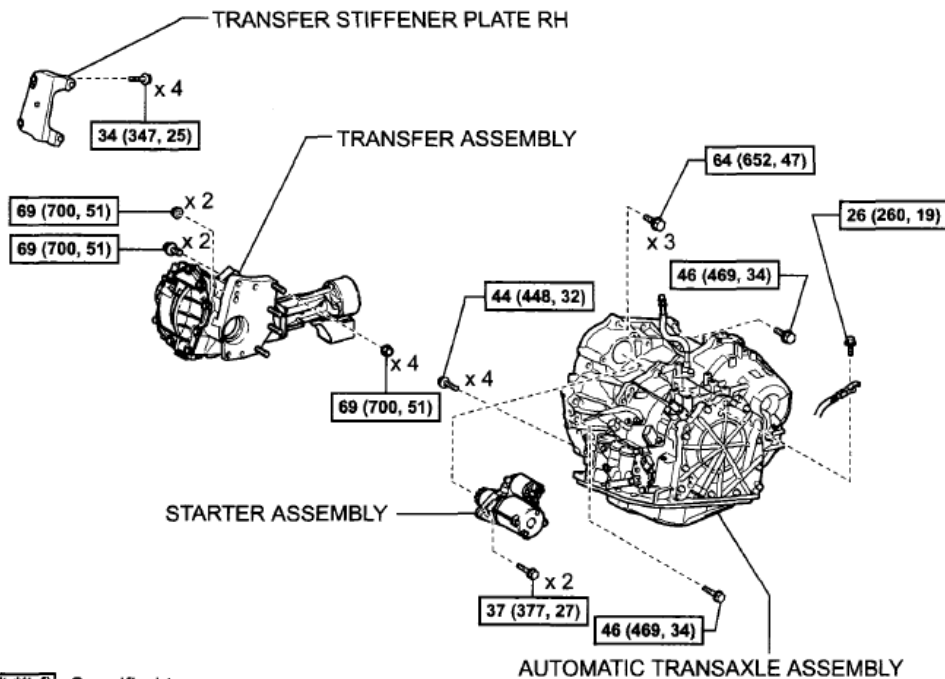
2009 Toyota Matrix

2009 ENGINE Engine Mechanical (2AZ-FE) - Corolla Matrix

for U250E Automatic Transaxle:



for U140F Automatic Transaxle:

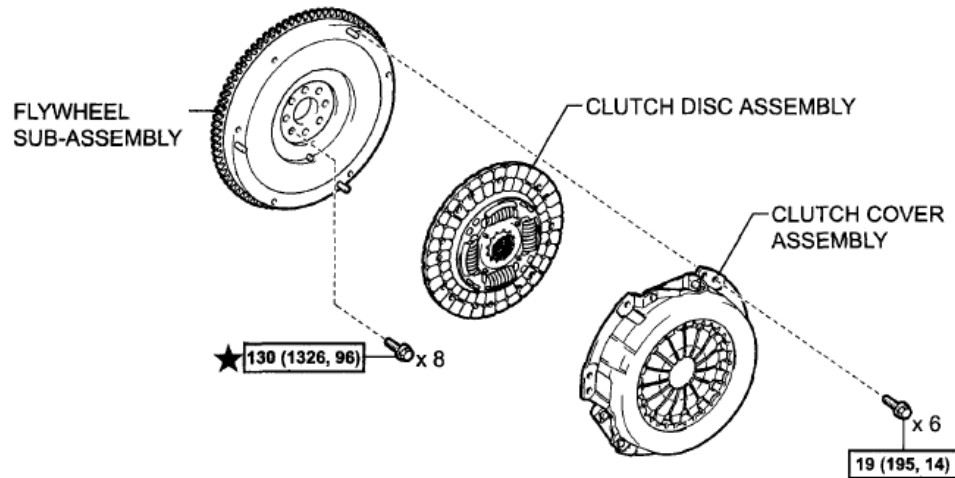


N*m (kgf*cm, ft.*lbf): Specified torque

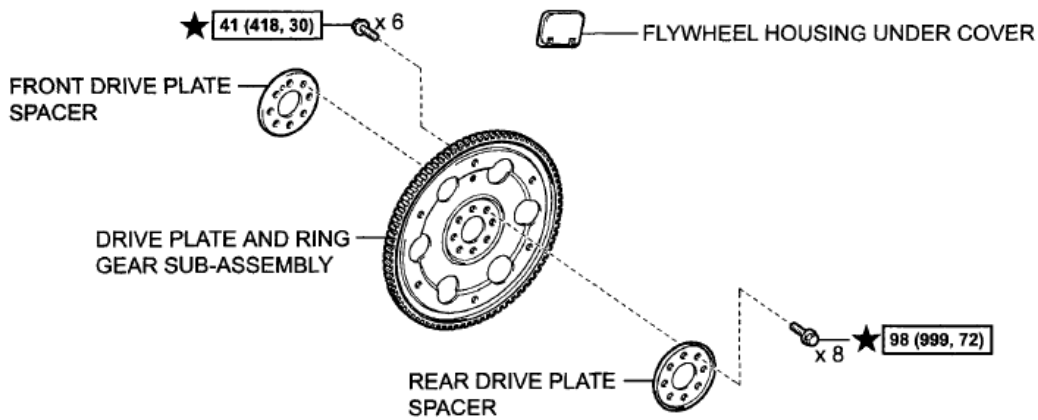
A181001E01

Fig. 159: Identifying Engine Assembly Components With Torque Specifications (13 Of 14)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

for Manual Transaxle:



for Automatic Transaxle:



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

★ Precoated part

A181002E01

Fig. 160: Identifying Engine Assembly Components With Torque Specifications (14 Of 14)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. **DISCHARGE FUEL SYSTEM PRESSURE** (See **FUEL SYSTEM**)

2. **ALIGN FRONT WHEELS FACING STRAIGHT AHEAD**
3. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**
4. **REMOVE FRONT WHEELS**
5. **REMOVE ENGINE UNDER COVER LH**
6. **REMOVE ENGINE UNDER COVER RH**
7. **DRAIN ENGINE COOLANT** (See COOLANT)
8. **DRAIN AUTOMATIC TRANSAXLE FLUID** (for Automatic Transaxle)

HINT:

- See REMOVAL REMOVAL for U250E.
- See REMOVAL for U140F.

9. **DRAIN MANUAL TRANSAXLE OIL** (for Manual Transaxle)

HINT:

See MANUAL TRANSAXLE OIL for E351.

10. **DRAIN TRANSFER OIL (for 4WD)** (See REPLACEMENT)
11. **REMOVE NO. 1 ENGINE COVER SUB-ASSEMBLY**
 - a. Remove the 2 nuts and No. 1 engine cover sub-assembly.

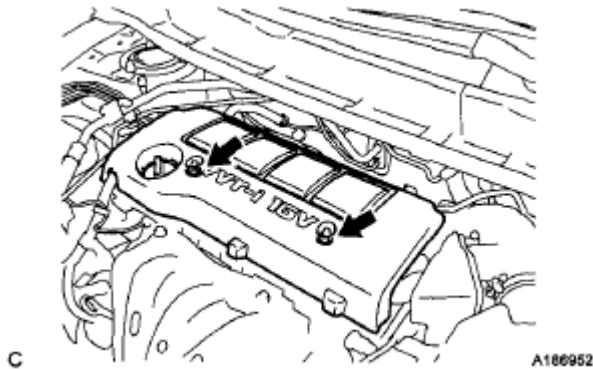


Fig. 161: Locating No. 1 Engine Cover Sub-Assembly And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. **SEPARATE RADIATOR RESERVE TANK ASSEMBLY**
 - a. Remove the 3 bolts and separate the radiator reserve tank assembly.

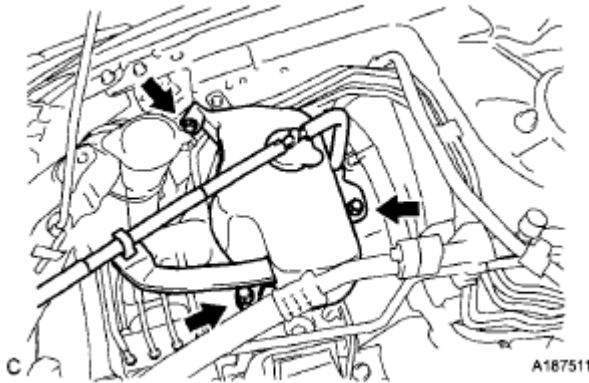


Fig. 162: Locating Radiator Reserve Tank Assembly And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. **REMOVE AIR CLEANER CAP SUB-ASSEMBLY WITH HOSE** (See **REMOVAL**)
14. **REMOVE AIR CLEANER CASE**
 - a. Remove the air cleaner filter element.
 - b. Disconnect the clamp of the engine wire.
 - c. Remove the 3 bolts and air cleaner case.

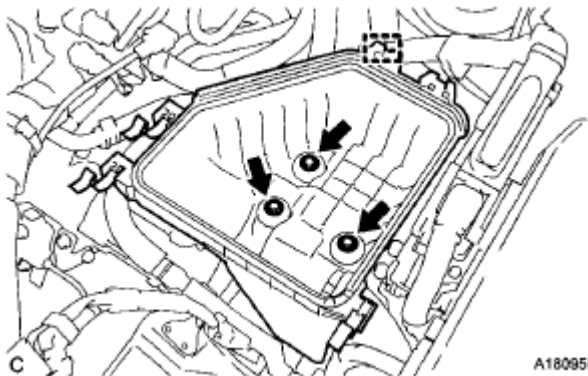


Fig. 163: Locating Air Cleaner Case And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

15. **REMOVE BATTERY**
 - a. Remove the bolt, nut and battery clamp.

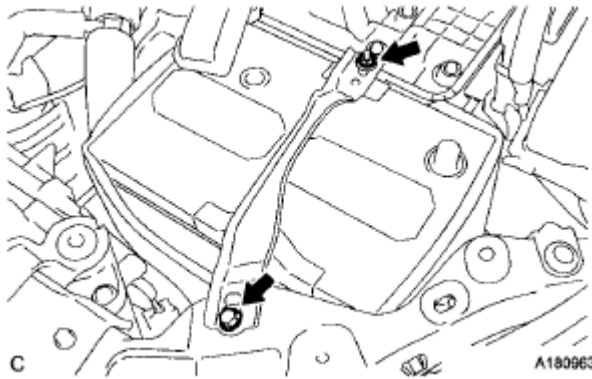


Fig. 164: Locating Battery Clamp And Bolt With Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the battery and battery insulator.

16. REMOVE BATTERY CARRIER

- a. Remove the battery tray.
- b. Separate the 2 wire harness clamps from the battery carrier.
- c. Remove the 4 bolts and battery carrier.

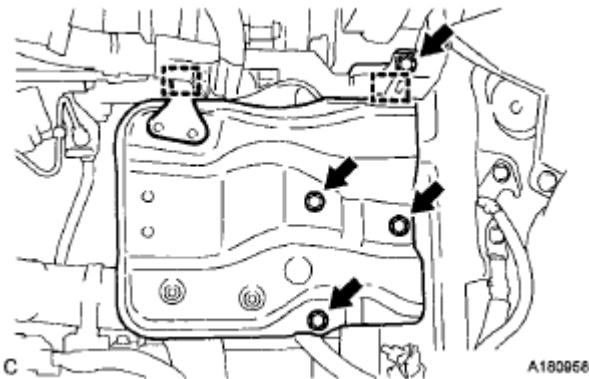
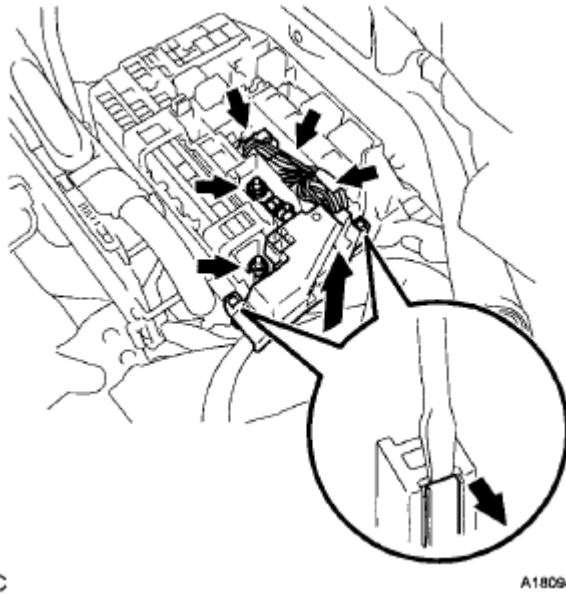


Fig. 165: Identifying Wire Harness Clamps And Battery Carrier Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

17. SEPARATE WIRE HARNESS

- a. Disconnect the 3 connectors from the engine room relay block.
- b. Remove the 2 nuts and disconnect the wire harnesses from the engine room relay block.
- c. Using a screwdriver, unlock the 2 claws.
- d. Pull the engine room relay block upward.



C

A18094B

Fig. 166: Pulling Engine Room Relay Block Upward
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Pull up the lever and disconnect the ECM connector.
- f. Disconnect the clamp.

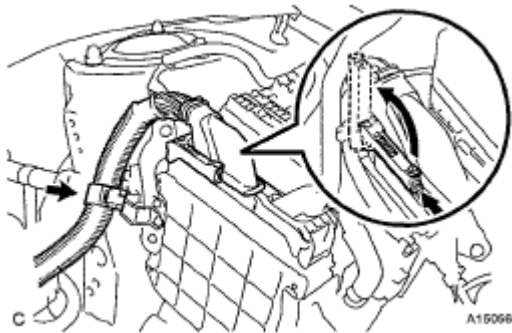


Fig. 167: Disconnecting ECM Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Remove the bolt and disconnect the ground cable and clamp (for Manual Transaxle).

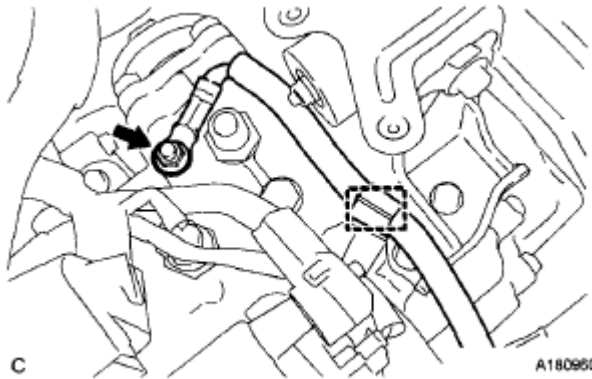


Fig. 168: Locating Ground Cable And Clamp (Manual Transaxle)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- h. Remove the bolt and disconnect the ground cable and clamp (for Automatic Transaxle).
- 18. **REMOVE THROTTLE BODY ASSEMBLY** (See **REMOVAL**)
- 19. **REMOVE V-RIBBED BELT** (See **REMOVAL**)
- 20. **REMOVE GENERATOR ASSEMBLY** (See **REMOVAL**)
- 21. **SEPARATE COMPRESSOR ASSEMBLY WITH PULLEY**
 - a. Disconnect the connector.
 - b. Remove the 2 bolts and 2 nuts.

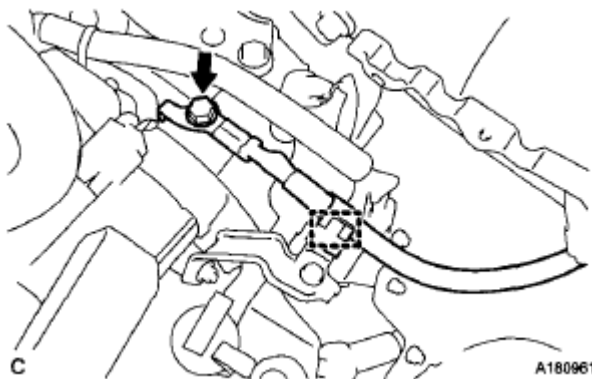


Fig. 169: Locating Ground Cable And Clamp (Automatic Transaxle)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

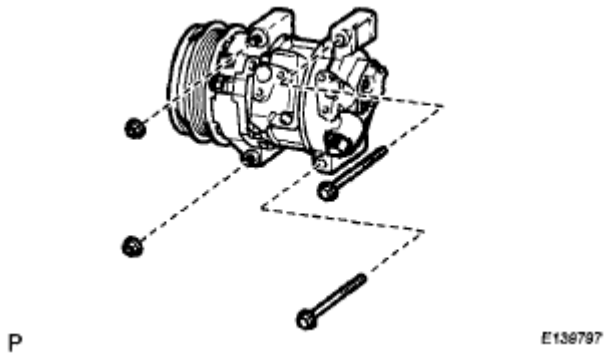


Fig. 170: Identifying Compressor Assembly Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using a "TORX" socket wrench (E8), remove the 2 stud bolts and compressor with pulley assembly.

HINT:

Secure the compressor and hoses off to the side instead of discharging the A/C system.

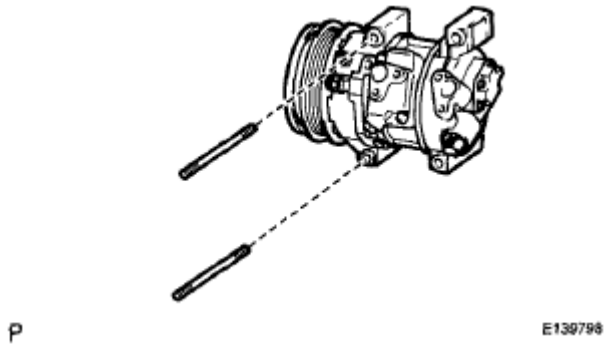


Fig. 171: Identifying Compressor Stud Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

22. DISCONNECT NO. 2 RADIATOR HOSE

- a. Disconnect the No. 2 radiator hose from the water inlet.

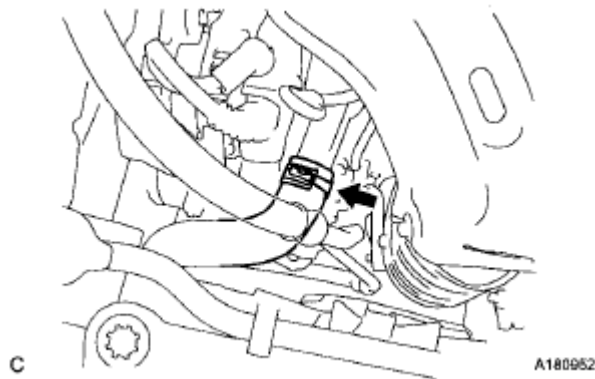


Fig. 172: Locating No. 2 Radiator Hose Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

23. DISCONNECT NO. 1 RADIATOR HOSE

- a. Disconnect the No. 1 radiator hose from the cylinder head.

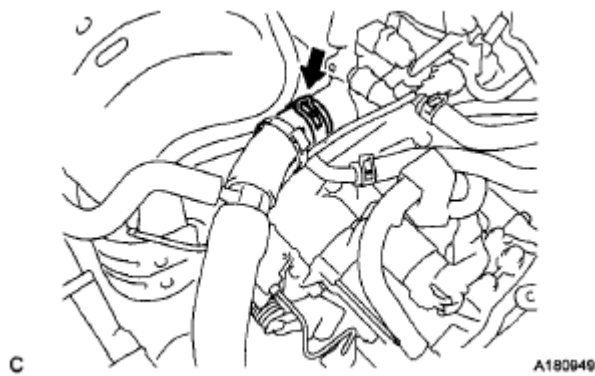


Fig. 173: Locating No. 1 Radiator Hose Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

24. DISCONNECT OIL COOLER HOSE (for Automatic Transaxle)

- a. Disconnect the 2 oil cooler hoses.

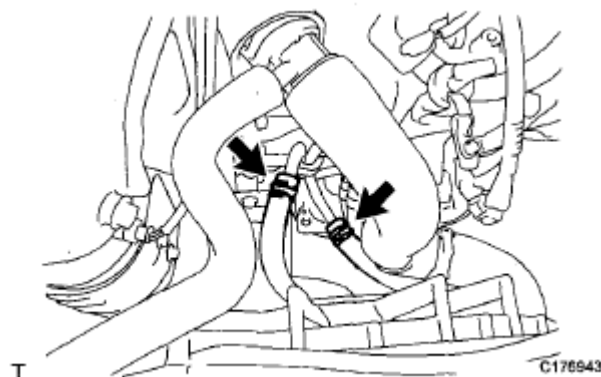
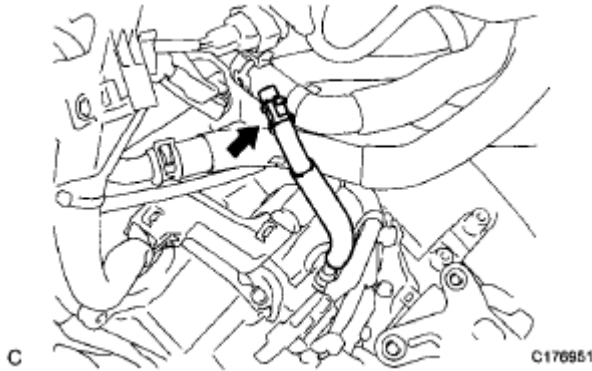


Fig. 174: Locating Oil Cooler Hose Clamp (Automatic Transaxle)

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

25. DISCONNECT BREATHER HOSE (for Automatic Transaxle)

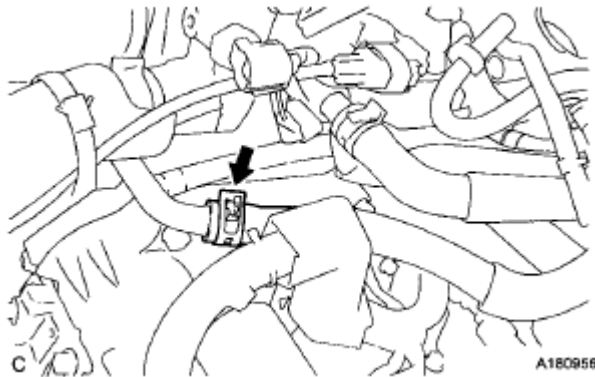
- a. Disconnect the breather hose.

**Fig. 175: Locating Breather Hose Clamp (Automatic Transaxle)**

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

26. DISCONNECT OUTLET HEATER WATER HOSE

- a. Disconnect the outlet heater water hose.

**Fig. 176: Locating Outlet Heater Water Hose**

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

27. DISCONNECT INLET HEATER WATER HOSE

- a. Disconnect the inlet heater water hose.

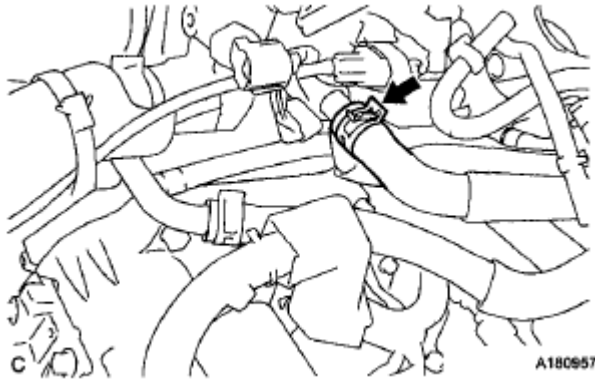


Fig. 177: Locating Inlet Heater Water Hose Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

28. REMOVE FUEL TUBE SUB-ASSEMBLY

- a. Release the claw and remove the No. 1 fuel pipe clamp.

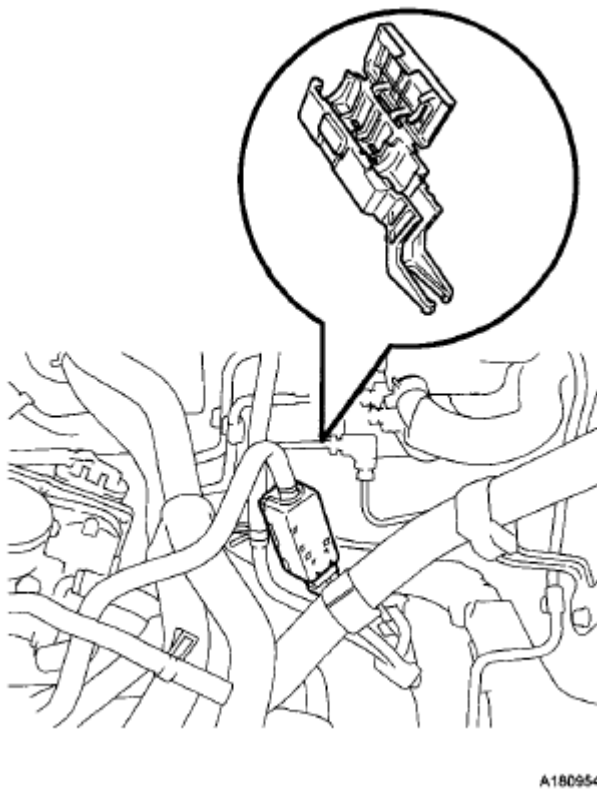


Fig. 178: Identifying No. 1 Fuel Pipe Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Pinch the retainer as illustrated, then pull the fuel tube connector out of the pipe.

NOTE:

- Remove any dirt or foreign matter from the fuel tube connector

before performing this work.

- Do not allow any scratches or foreign matter on the parts when disconnecting, as the fuel tube connector has O-rings that seal the pipe.
- Perform this work by hand. Do not use any tools.
- Do not forcibly bend, kink or twist the nylon tube.
- Protect the disconnected parts by covering them with vinyl bags after disconnecting the fuel tube.
- If the fuel tube connector and pipe are stuck, push and pull to release them.

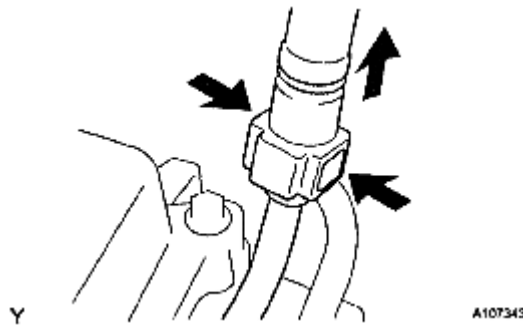


Fig. 179: Pulling Fuel Tube Connector Out Of Pipe
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

29. DISCONNECT UNION TO CONNECTOR TUBE HOSE

- a. Disconnect the union to connector tube hose.

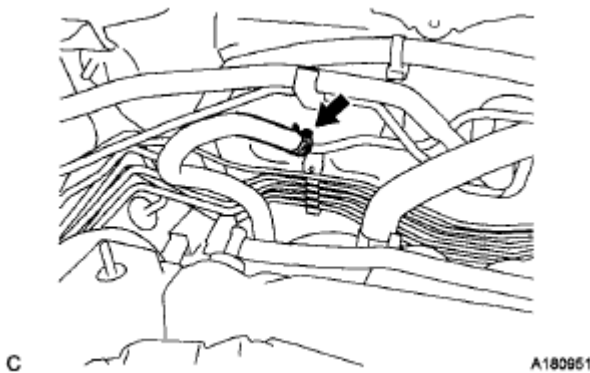


Fig. 180: Locating Connector Tube Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

30. SEPARATE CLUTCH RELEASE CYLINDER ASSEMBLY (for Manual Transaxle)

HINT:

See **REMOVAL** for E351.

31. SEPARATE TRANSMISSION CONTROL CABLE ASSEMBLY (for Automatic Transaxle)

a. U250E Automatic Transaxle:

1. Remove the nut and disconnect the control cable assembly from the control shaft lever.
2. Remove the clip and disconnect the transmission control cable assembly from the control cable bracket.

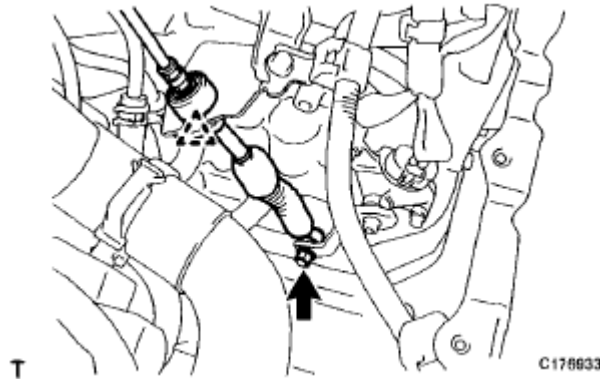


Fig. 181: Locating Transmission Control Cable Assembly And Nut (Automatic Transaxle)

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

3. Disconnect the control cable assembly from the control cable bracket.

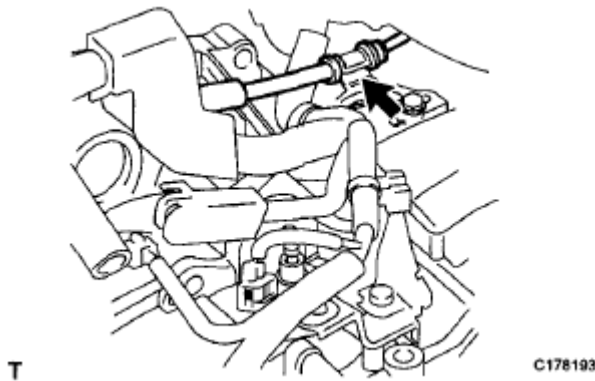


Fig. 182: Locating Control Cable Bracket

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

b. U140F Automatic Transaxle:

1. Remove the nut and disconnect the control cable assembly from the control shaft lever.
2. Remove the clip and disconnect the transmission control cable assembly from the control cable bracket.



Fig. 183: Locating Control Cable Assembly Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. Disconnect the control cable assembly from the control cable bracket.

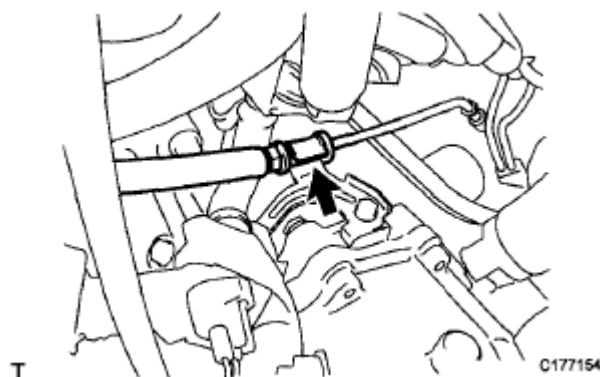


Fig. 184: Locating Control Cable Bracket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

32. **SEPARATE TRANSMISSION CONTROL CABLE ASSEMBLY (for Manual Transaxle)**
 - a. Remove the 2 clips and disconnect the 2 transmission control cables from the control cable bracket*1.
 - b. Remove the 2 clips and disconnect the 2 transmission control cables from the transaxle*2.

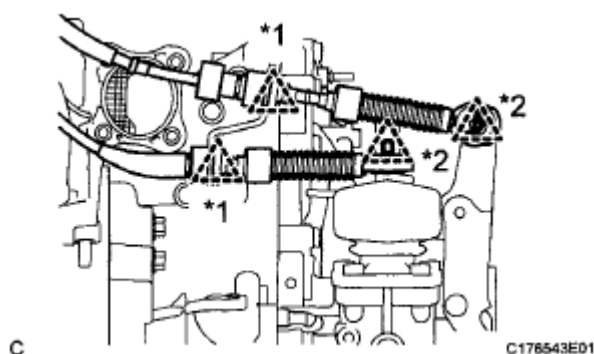


Fig. 185: Identifying Control Cable Bracket

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

33. **SECURE STEERING WHEEL** (See **REMOVAL**)
34. **REMOVE COLUMN HOLE COVER SILENCER SHEET** (See **REMOVAL**)
35. **SEPARATE NO. 2 STEERING INTERMEDIATE SHAFT ASSEMBLY**

HINT:

- See **REMOVAL** for 2WD.
- See **REMOVAL** for 4WD.

36. **SEPARATE NO. 1 STEERING COLUMN HOLE COVER SUB-ASSEMBLY** (See **REMOVAL**)
37. **REMOVE CENTER EXHAUST PIPE ASSEMBLY** (See **REMOVAL**)
38. **REMOVE FRONT EXHAUST PIPE ASSEMBLY** (See **REMOVAL**)
39. **REMOVE PROPELLER WITH CENTER BEARING SHAFT ASSEMBLY (for 4WD)** (See **REMOVAL**)
40. **REMOVE FRONT AXLE SHAFT LH NUT** (See **REMOVAL**)
41. **REMOVE FRONT AXLE SHAFT RH NUT**

HINT:

Perform the same procedure for the LH side.

42. **SEPARATE FRONT SPEED SENSOR LH** (See **REMOVAL**)
43. **SEPARATE FRONT SPEED SENSOR RH**

HINT:

Perform the same procedure for the LH side.

44. **SEPARATE TIE ROD END SUB-ASSEMBLY LH**

HINT:

- See **REMOVAL** for 2WD.
- See **REMOVAL** for 4WD.

45. **SEPARATE TIE ROD END SUB-ASSEMBLY RH**

HINT:

Perform the same procedure for the LH side.

46. **SEPARATE FRONT STABILIZER LINK ASSEMBLY LH** (See **REMOVAL**)
47. **SEPARATE FRONT STABILIZER LINK ASSEMBLY RH**

HINT:

Perform the same procedure for the LH side.

48. **SEPARATE FRONT LOWER NO. 1 SUSPENSION ARM SUB-ASSEMBLY LH** (See **REMOVAL**)
49. **SEPARATE FRONT LOWER NO. 1 SUSPENSION ARM SUB-ASSEMBLY RH**

HINT:

Perform the same procedure for the LH side.

50. **SEPARATE STEERING KNUCKLE WITH AXLE HUB LH**
 - a. Put matchmarks on the drive shaft and axle hub.

NOTE: **Do not punch the marks.**

- b. Using a plastic-faced hammer, disconnect the front axle assembly LH.

NOTE:

- **Be careful not to damage the boot or speed sensor rotor.**
- **Do not excessively push out the drive shaft from the axle assembly.**

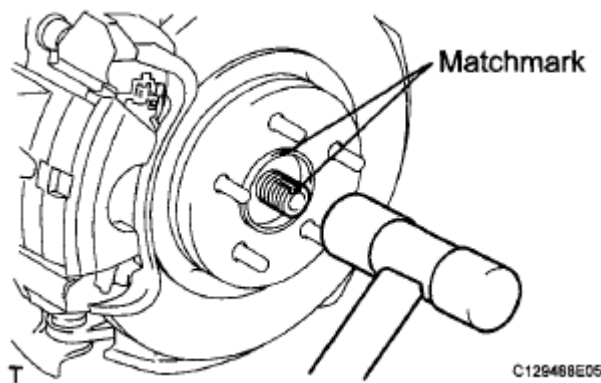


Fig. 186: Putting Matchmarks On Drive Shaft And Axle Hub
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

51. **SEPARATE STEERING KNUCKLE WITH AXLE HUB RH**

HINT:

Perform the same procedure for the LH side.

52. **REMOVE FRONT DRIVE SHAFT ASSEMBLY LH** (See **REMOVAL**)
53. **REMOVE FRONT DRIVE SHAFT HOLE SNAP RING LH** (See **REMOVAL**)

54. **REMOVE FRONT DRIVE SHAFT ASSEMBLY RH (for 2WD) (See REMOVAL)**
55. **REMOVE FRONT DRIVE SHAFT ASSEMBLY RH (for 4WD) (See REMOVAL)**
56. **SEPARATE DRIVE PLATE AND TORQUE CONVERTER CLUTCH SETTING BOLT (for Automatic Transaxle)**

HINT:

- See REMOVAL for U250E.
- See REMOVAL for U140F.

57. **REMOVE FRONT SUSPENSION CROSSMEMBER SUB-ASSEMBLY**

HINT:

- See REMOVAL for 2WD.
- See REMOVAL for 4WD.

58. **REMOVE CENTER ENGINE MOUNTING MEMBER SUB-ASSEMBLY**

HINT:

- See INSTALLATION for 2WD.
- See INSTALLATION for 4WD.

59. **REMOVE ENGINE ASSEMBLY WITH TRANSAXLE**

- a. Set the engine assembly with transaxle on the engine lifter.

NOTE: Place the engine on wooden blocks or equivalent so that the engine is level.

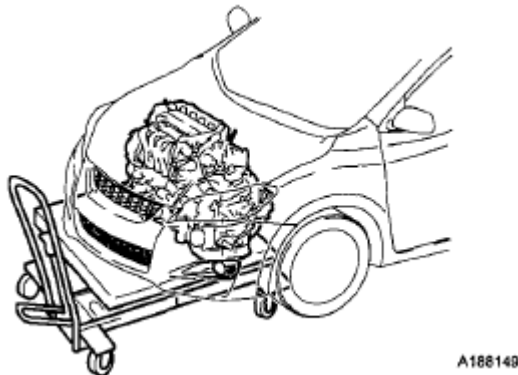


Fig. 187: Identifying Engine Assembly With Transaxle On Engine Lifter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the bolt and 2 nuts, and separate the engine mounting insulator RH.

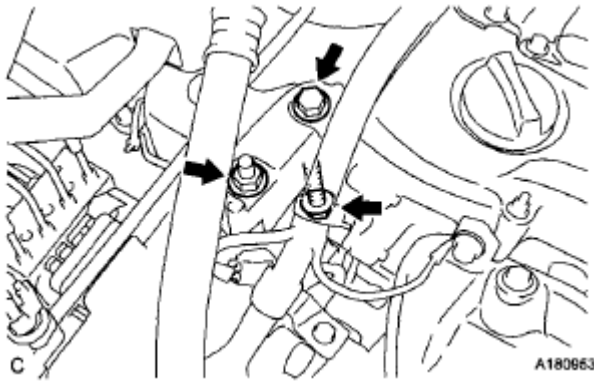


Fig. 188: Locating Engine Mounting Insulator RH Bolt And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Remove the through bolt and nut, and separate the engine mounting insulator LH.
- d. Carefully remove the engine with transaxle from the vehicle.

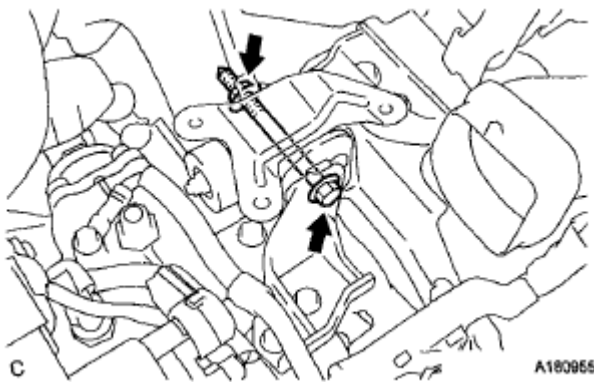


Fig. 189: Locating Engine Mounting Insulator LH Bolt And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

60. INSTALL ENGINE HANGERS

- a. Install the No. 1 and No. 2 engine hangers with new bolts as shown in the illustration.

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

TORQUE SPECIFICATION

Item	Part No.
No. 1 engine hanger	12281-28010
No. 2 engine hanger	12282-28010
Bolt	91512-B1020 or 91552-81020

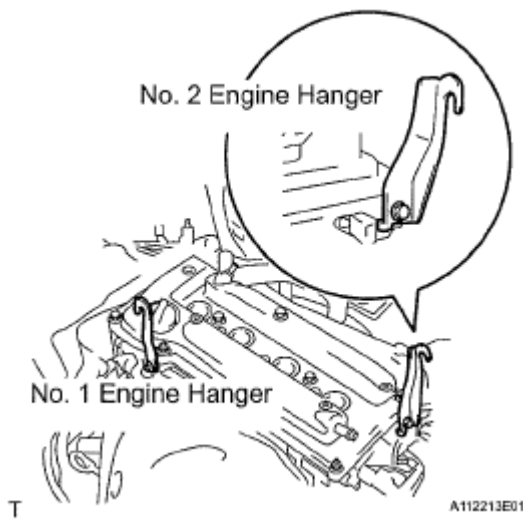


Fig. 190: Identifying No. 1 And No. 2 Engine Hangers With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using an engine sling device and a chain block, suspend the engine assembly with transaxle.

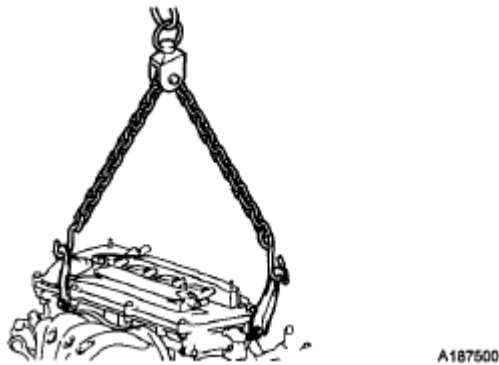


Fig. 191: Lifting Engine Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

61. REMOVE FRONT ENGINE MOUNTING INSULATOR

- a. Remove the through bolt and nut, and separate the front engine mounting insulator.

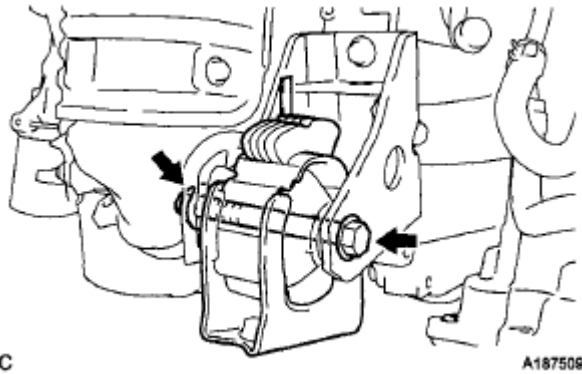


Fig. 192: Locating Front Engine Mounting Insulator Bolt And Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

62. **REMOVE REAR ENGINE MOUNTING INSULATOR (for 2WD)**
- Remove the through bolt and separate the rear engine mounting insulator.

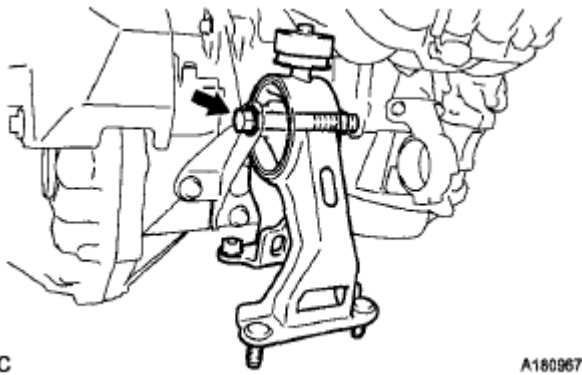


Fig. 193: Locating Rear Engine Mounting Insulator And Bolt (2WD)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

63. **REMOVE REAR ENGINE MOUNTING INSULATOR (for 4WD)**
- Remove the through bolt and separate the rear engine mounting insulator.

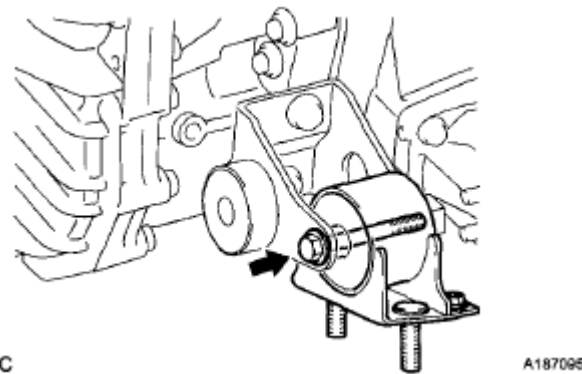


Fig. 194: Locating Rear Engine Mounting Insulator Bolt (4WD)

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

64. REMOVE ENGINE MOUNTING INSULATOR LH

- a. Remove the 4 bolts and engine mounting insulator LH.

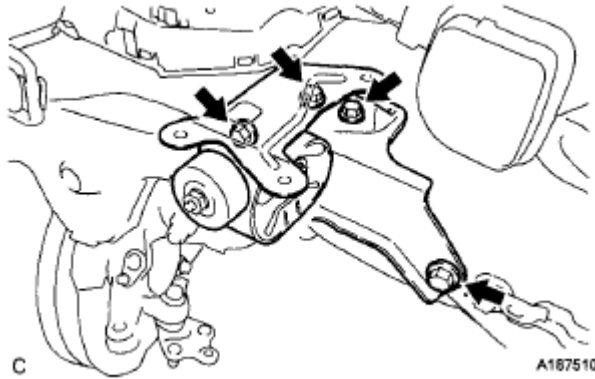


Fig. 195: Locating Engine Mounting Insulator LH And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

65. REMOVE ENGINE MOUNTING INSULATOR SUB-ASSEMBLY RH

- a. Remove the 3 bolts and engine mounting insulator sub-assembly RH.

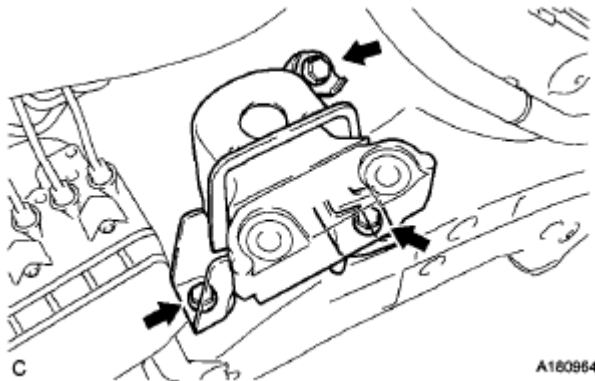


Fig. 196: Locating Engine Mounting Insulator Sub-Assembly RH And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

66. REMOVE DRIVE SHAFT BEARING BRACKET (for 2WD)

- a. Remove the 3 bolts and bracket.

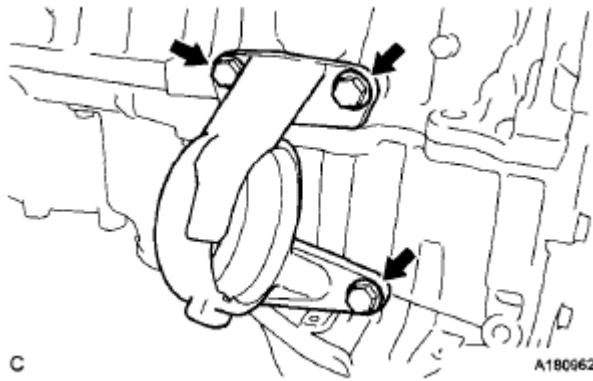


Fig. 197: Locating Drive Shaft Bearing Bracket And Bolts (2WD)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

67. **REMOVE STARTER ASSEMBLY (for Automatic Transaxle) (See DISASSEMBLY)**
68. **REMOVE STARTER ASSEMBLY (for Manual Transaxle) (See REMOVAL)**
69. **REMOVE MANUAL TRANSAXLE ASSEMBLY (for Manual Transaxle)**

HINT:

See REMOVAL for E351.

70. **REMOVE AUTOMATIC TRANSAXLE ASSEMBLY (for Automatic Transaxle)**

HINT:

- See REMOVAL for U250E.
- See REMOVAL for U140F.

71. **REMOVE CLUTCH COVER ASSEMBLY (for Manual Transaxle)**

HINT:

See REMOVAL INSPECTION for E351.

72. **REMOVE CLUTCH DISC ASSEMBLY (for Manual Transaxle)**

HINT:

See REMOVAL for E351.

73. **REMOVE FLYWHEEL SUB-ASSEMBLY (for Manual Transaxle) (See REMOVAL)**
74. **REMOVE DRIVE PLATE AND RING GEAR SUB-ASSEMBLY (for Automatic Transaxle) (See REMOVAL)**
75. **REMOVE ENGINE WIRE**

INSTALLATION

1. **INSTALL ENGINE WIRE**
2. **INSTALL DRIVE PLATE AND RING GEAR SUB-ASSEMBLY (for Automatic Transaxle) (See INSTALLATION)**
3. **INSTALL FLYWHEEL SUB-ASSEMBLY (for Manual Transaxle) (See INSTALLATION)**
4. **INSTALL CLUTCH DISC ASSEMBLY (for Manual Transaxle)**

HINT:

See INSTALLATION for E351.

5. **INSTALL CLUTCH COVER ASSEMBLY (for Manual Transaxle)**

HINT:

See INSTALLATION for E351.

6. **INSTALL AUTOMATIC TRANSAXLE ASSEMBLY (for Automatic Transaxle)**

HINT:

- See INSTALLATION for U250E.
- See INSTALLATION for U140F.

7. **INSTALL MANUAL TRANSAXLE ASSEMBLY (for Manual Transaxle)**

HINT:

See INSTALLATION for E351.

8. **INSTALL STARTER ASSEMBLY (for Manual Transaxle) (See INSTALLATION)**
9. **INSTALL STARTER ASSEMBLY (for Automatic Transaxle) (See INSTALLATION)**
10. **INSTALL DRIVE SHAFT BEARING BRACKET (for 2WD)**
 - a. Install the drive shaft bearing bracket with the 3 bolts.

Torque: 64 N*m (653 kgf*cm, 47 ft.*lbf)

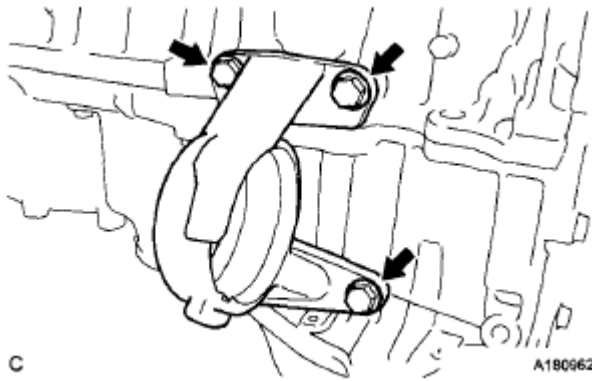


Fig. 198: Locating Drive Shaft Bearing Bracket And Bolts (2WD)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. TEMPORARILY TIGHTEN FRONT ENGINE MOUNTING INSULATOR

- a. Temporarily install the front engine mounting insulator with the nut and through bolt.

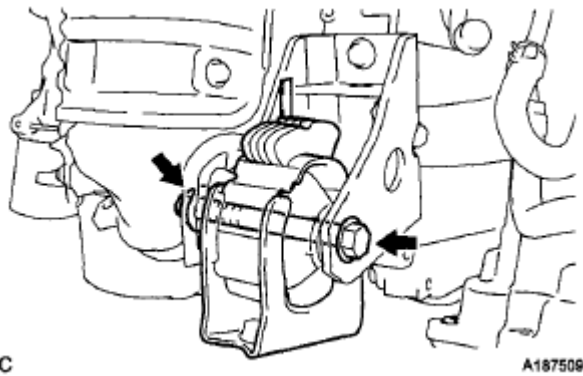


Fig. 199: Locating Front Engine Mounting Insulator Bolt And Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. TEMPORARILY TIGHTEN REAR ENGINE MOUNTING INSULATOR (for 2WD)

- a. Temporarily install the rear engine mounting insulator to the engine mounting bracket with the through bolt.

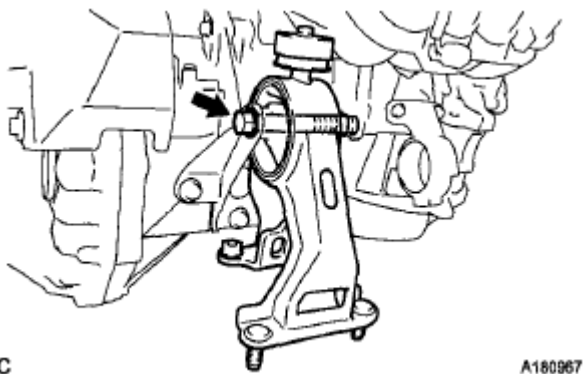
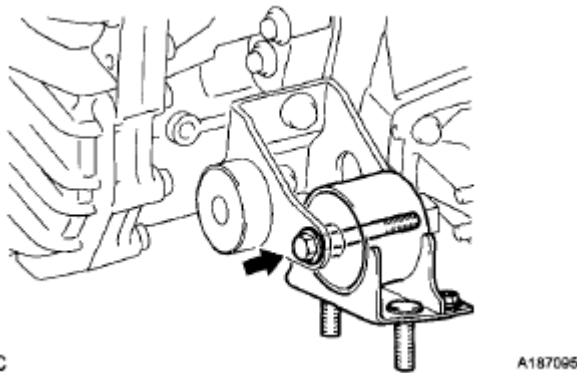


Fig. 200: Locating Rear Engine Mounting Insulator And Bolt (2WD)

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

13. TEMPORARILY TIGHTEN REAR ENGINE MOUNTING INSULATOR (for 4WD)

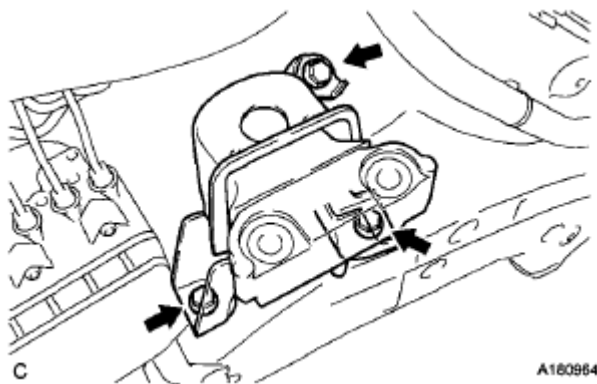
- a. Temporarily install the rear engine mounting insulator to the engine mounting bracket with the through bolt.

**Fig. 201: Locating Rear Engine Mounting Insulator Bolt (4WD)**

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

14. INSTALL ENGINE MOUNTING INSULATOR SUB-ASSEMBLY RH

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

Torque: 52 N*m (530 kgf*cm, 38 ft.*lbf)**Fig. 202: Locating Engine Mounting Insulator Sub-Assembly RH And Bolts**

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

15. INSTALL ENGINE MOUNTING INSULATOR LH

- a. Temporarily install the engine mounting insulator LH with the 4 bolts.
- b. Tighten the 4 bolts.

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

HINT:

Perform this procedure only when replacement of the engine mounting insulator is necessary.

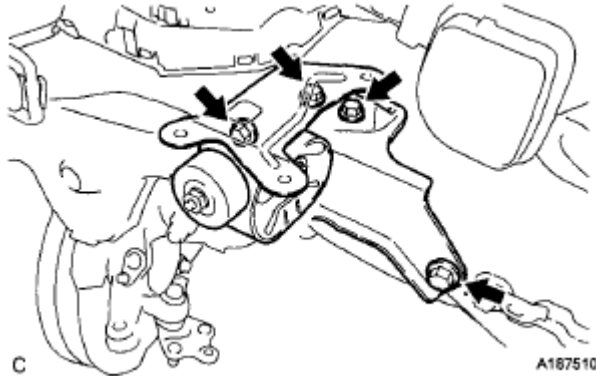


Fig. 203: Locating Engine Mounting Insulator LH And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

16. INSTALL ENGINE ASSEMBLY WITH TRANSAXLE

- a. Set the engine assembly with transaxle on the engine lifter.

NOTE: Place the engine on wooden blocks or equivalent so that the engine is level.

- b. Remove the 2 bolts and 2 engine hangers.

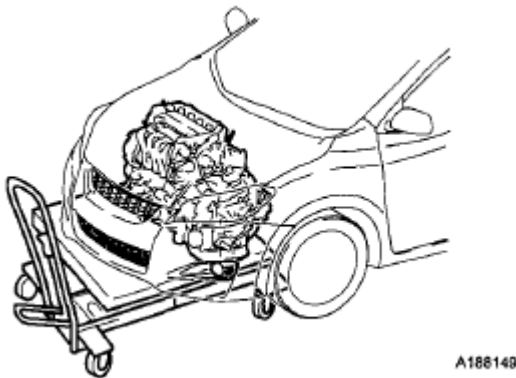


Fig. 204: Identifying Engine Assembly With Transaxle On Engine Lifter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Operate the engine lifter and lift the engine assembly with transaxle to the position where the engine mounting insulators RH and LH can be installed.

CAUTION: Do not raise the engine more than necessary. If the engine is raised excessively, the vehicle may also be lifted up.

NOTE:

- Make sure that the engine is clear of all wiring and hoses.
- While raising the engine into the vehicle, do not allow it to contact the vehicle.

- d. Install the engine mounting insulator RH with the bolt and 2 nuts.

Torque: Nut A

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

Nut B

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

Bolt

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

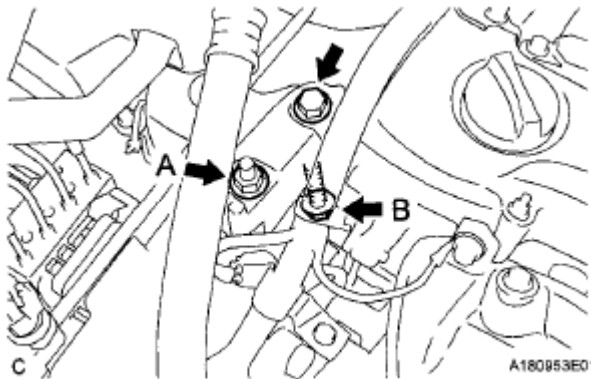


Fig. 205: Locating Engine Mounting Insulator RH With Bolt And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Install the engine mounting insulator LH with the through bolt and nut.

Torque: 56 N*m (571 kgf*cm, 41 ft.*lbf)

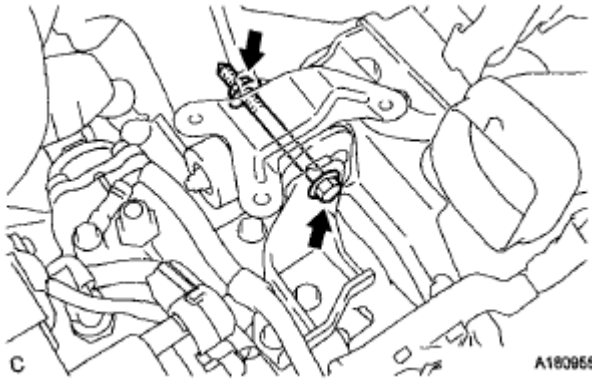


Fig. 206: Locating Engine Mounting Insulator LH With Bolt And Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

17. TEMPORARILY INSTALL CENTER ENGINE MOUNTING MEMBER SUB-ASSEMBLY

HINT:

- See **INSTALLATION** for 2WD.
- See **INSTALLATION** for 4WD.

18. INSTALL FRONT SUSPENSION CROSSMEMBER SUB-ASSEMBLY

HINT:

- See **INSTALLATION** for 2WD.
- See **INSTALLATION** for 4WD.

19. FULLY TIGHTEN CENTER ENGINE MOUNTING MEMBER SUB-ASSEMBLY

HINT:

- See **INSTALLATION** for 2WD.
- See **INSTALLATION** for 4WD.

20. FULLY TIGHTEN FRONT ENGINE MOUNTING INSULATOR

- a. Fully tighten the front engine mounting insulator with the nut and through bolt.

Torque: 73 N*m (744 kgf*cm, 54 ft.*lbf)

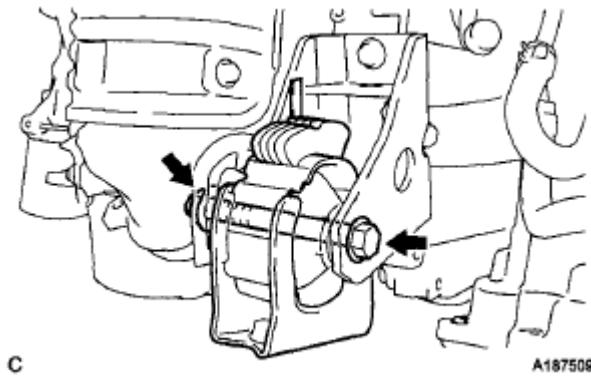


Fig. 207: Locating Front Engine Mounting Insulator Bolt And Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

21. FULLY TIGHTEN REAR ENGINE MOUNTING INSULATOR (for 2WD)

- a. Fully tighten the rear engine mounting insulator to the engine mounting bracket with the through bolt.

Torque: 65 N*m (663 kgf*cm, 48 ft.*lbf)

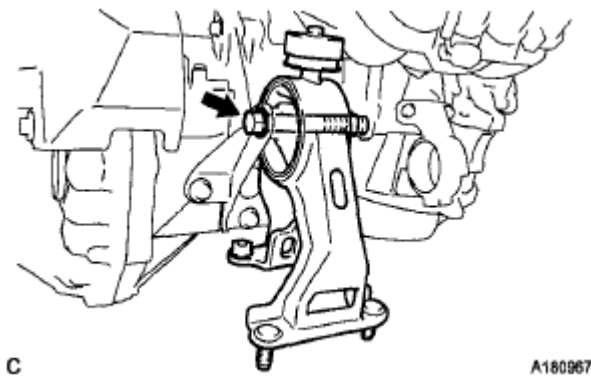


Fig. 208: Locating Rear Engine Mounting Insulator And Bolt (2WD)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

22. FULLY TIGHTEN REAR ENGINE MOUNTING INSULATOR (for 4WD)

- a. Fully tighten the rear engine mounting insulator to the engine mounting bracket with the through bolt.

Torque: 65 N*m (663 kgf*cm, 48 ft.*lbf)

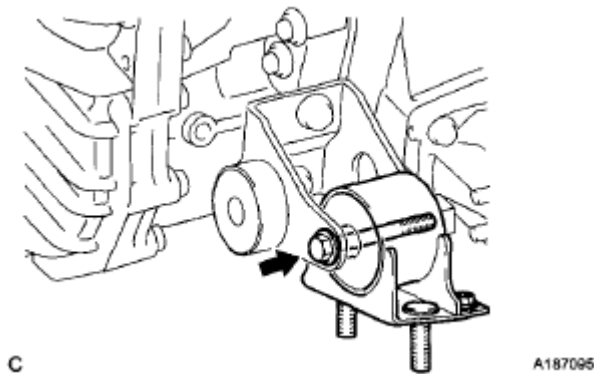


Fig. 209: Locating Rear Engine Mounting Insulator Bolt (4WD)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

23. INSTALL DRIVE PLATE AND TORQUE CONVERTER CLUTCH SETTING BOLT (for Automatic Transaxle)

HINT:

- See **INSTALLATION** for U250E.
- See **INSTALLATION** for U140F.

24. INSTALL FRONT DRIVE SHAFT HOLE SNAP RING LH (See **INSTALLATION)**

25. INSTALL FRONT DRIVE SHAFT ASSEMBLY LH (See **INSTALLATION)**

26. INSTALL FRONT DRIVE SHAFT ASSEMBLY RH

HINT:

- See **INSTALLATION** for 2WD.
- See **INSTALLATION** for 4WD.

27. INSTALL STEERING KNUCKLE WITH AXLE HUB LH

- a. Align the matchmarks and connect the front drive shaft assembly to the front axle assembly LH.

28. INSTALL STEERING KNUCKLE WITH AXLE HUB RH

HINT:

Perform the same procedure for the LH side.

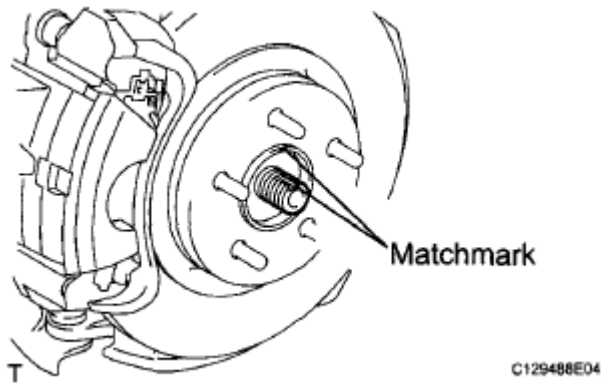


Fig. 210: Identifying Matchmarks Location

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

29. **INSTALL FRONT LOWER NO. 1 SUSPENSION ARM SUB-ASSEMBLY LH (See INSTALLATION)**
30. **INSTALL FRONT LOWER NO. 1 SUSPENSION ARM SUB-ASSEMBLY RH**

HINT:

Perform the same procedure for the LH side.

31. **INSTALL FRONT STABILIZER LINK ASSEMBLY LH (See INSTALLATION)**
32. **INSTALL FRONT STABILIZER LINK ASSEMBLY RH**

HINT:

Perform the same procedure for the LH side.

33. **INSTALL TIE ROD END SUB-ASSEMBLY LH**

HINT:

- See INSTALLATION for 2WD.
- See INSTALLATION for 4WD.

34. **INSTALL TIE ROD END SUB-ASSEMBLY RH**

HINT:

Perform the same procedure for the LH side.

35. **INSTALL FRONT SPEED SENSOR LH (See INSTALLATION)**
36. **INSTALL FRONT SPEED SENSOR RH**

HINT:

Perform the same procedure for the LH side.

- 37. **INSTALL FRONT AXLE SHAFT LH NUT** (See INSTALLATION)
- 38. **INSTALL FRONT AXLE SHAFT RH NUT**

HINT:

Perform the same procedure for the LH side.

- 39. **TEMPORARILY INSTALL PROPELLER WITH CENTER BEARING SHAFT ASSEMBLY (for 4WD)** (See INSTALLATION)
- 40. **FULLY TIGHTEN PROPELLER WITH CENTER BEARING SHAFT ASSEMBLY (for 4WD)** (See INSTALLATION)
- 41. **INSTALL FRONT EXHAUST PIPE ASSEMBLY** (See INSTALLATION)
- 42. **INSTALL CENTER EXHAUST PIPE ASSEMBLY** (See INSTALLATION)
- 43. **INSTALL NO. 1 STEERING COLUMN HOLE COVER SUB-ASSEMBLY** (See INSTALLATION)
- 44. **INSTALL NO. 2 STEERING INTERMEDIATE SHAFT ASSEMBLY**

HINT:

- See INSTALLATION for 2WD.
- See INSTALLATION for 4WD.
- 45. **INSTALL COLUMN HOLE COVER SILENCER SHEET** (See INSTALLATION)
- 46. **INSTALL TRANSMISSION CONTROL CABLE ASSEMBLY (for Automatic Transaxle)**
 - a. U250E Automatic Transaxle:
 - 1. Connect the transmission control cable to the control cable bracket.

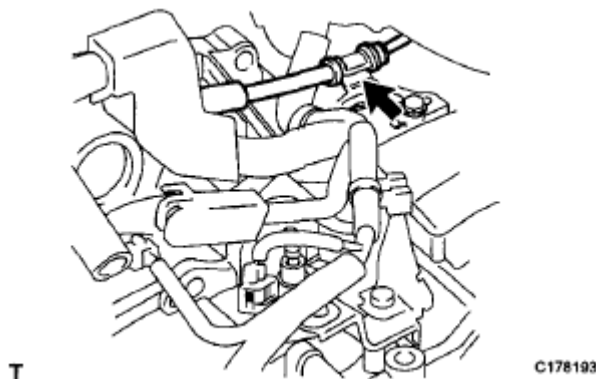


Fig. 211: Locating Control Cable Bracket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 2. Connect the transmission control cable to the bracket with a new clip.
- 3. Connect the transmission control cable assembly to the control shaft lever with the nut.

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

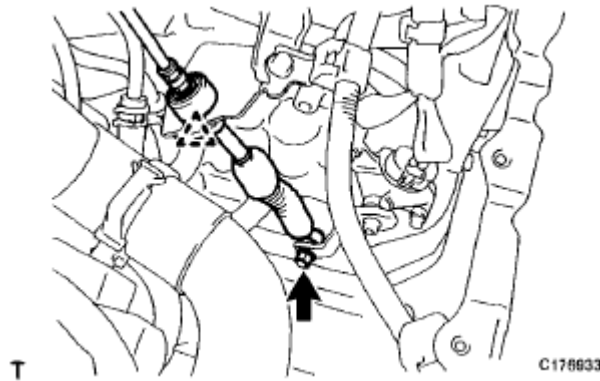


Fig. 212: Locating Transmission Control Cable Assembly And Nut (Automatic Transaxle)

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

b. U140F Automatic Transaxle:

1. Connect the transmission control cable to the control cable bracket.

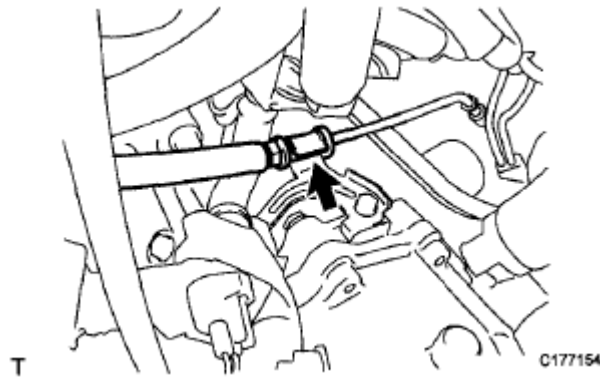
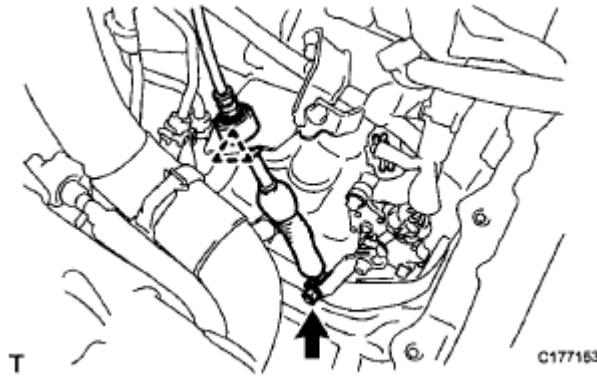


Fig. 213: Locating Control Cable Bracket

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

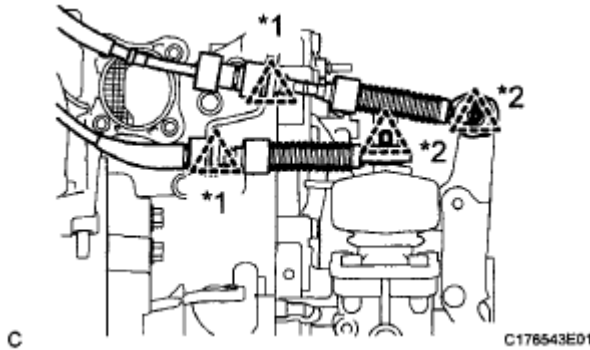
2. Connect the transmission control cable to the bracket with a new clip.
3. Connect the transmission control cable assembly to the control shaft lever with the nut.

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

**Fig. 214: Locating Control Cable Assembly Nuts**

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

47. **INSTALL TRANSMISSION CONTROL CABLE ASSEMBLY (for Manual Transaxle)**
- Install the 2 transmission control cables to the control cable bracket with 2 new clips*1.
 - Install the 2 transmission control cables to the transaxle with 2 new clips*2.

**Fig. 215: Identifying Control Cable Bracket**

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

48. **INSTALL CLUTCH RELEASE CYLINDER ASSEMBLY (for Manual Transaxle)**

HINT:

See **REASSEMBLY** for E351.

49. **CONNECT UNION TO CONNECTOR TUBE HOSE**

- Connect the union to connector tube hose.

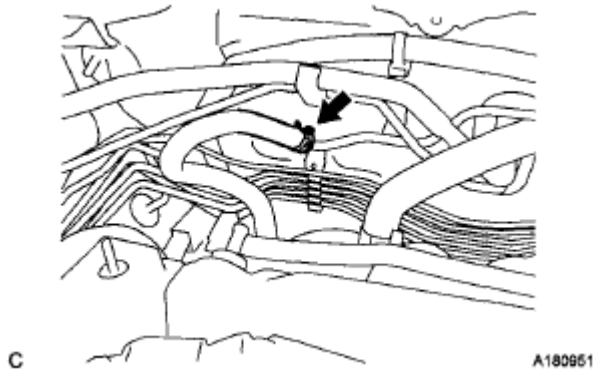


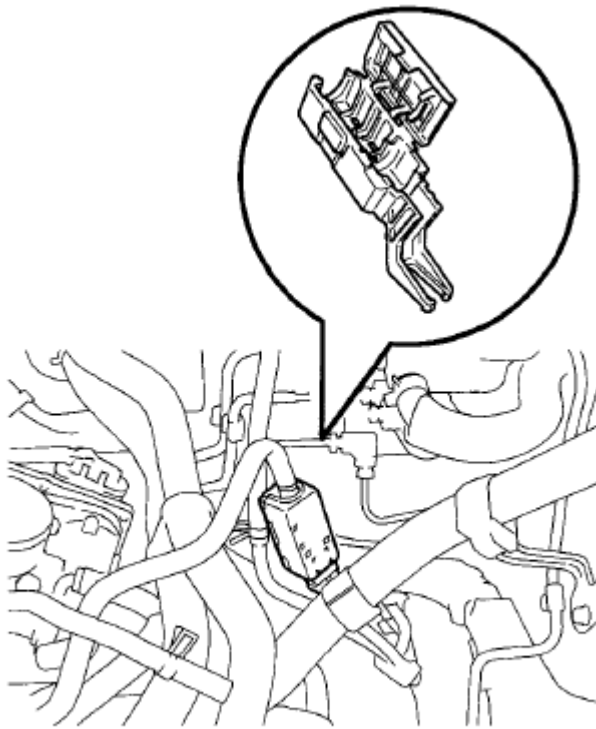
Fig. 216: Locating Connector Tube Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

50. INSTALL FUEL TUBE SUB-ASSEMBLY

- a. Connect the fuel tube connector and fuel pipe.

CAUTION: Align the fuel tube connector with the pipe, then push the fuel tube connector in until the retainer makes a "click" sound. If the connection is tight, apply a small amount of engine oil to the tip of the pipe. After connecting, pull the pipe and connector to make sure that they are securely connected.

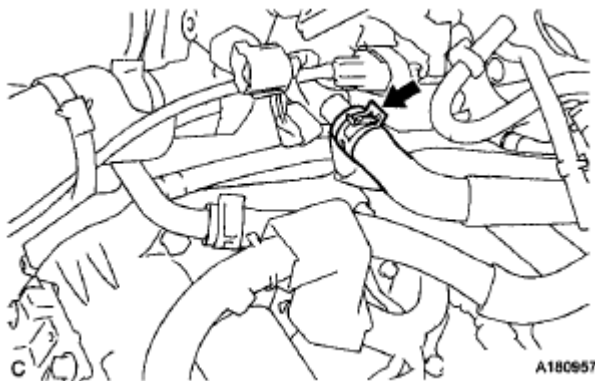
- b. Engage the claw and install the No. 1 fuel pipe clamp.



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Fig. 217: Identifying No. 1 Fuel Pipe Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

51. **CONNECT INLET HEATER WATER HOSE**
- Connect the inlet heater water hose with the clamp.



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Fig. 218: Locating Inlet Heater Water Hose Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

52. **CONNECT OUTLET HEATER WATER HOSE**
- Connect the outlet heater water hose with the clamp.

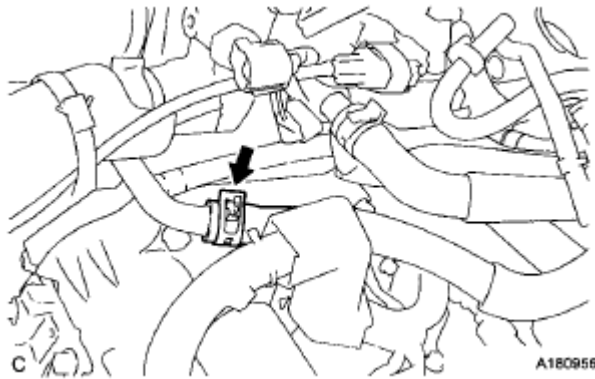


Fig. 219: Locating Outlet Heater Water Hose

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

53. INSTALL BREATHER HOSE (for Automatic Transaxle)

- a. Install the breather hose.

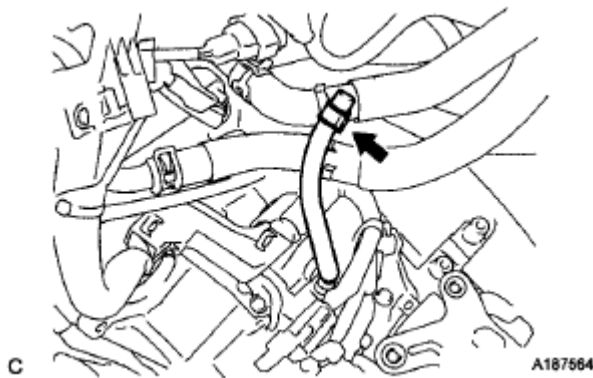


Fig. 220: Locating Breather Hose Clamp (Automatic Transaxle)

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

54. CONNECT OIL COOLER HOSE (for Automatic Transaxle)

- a. Connect the 2 oil cooler hoses with the clamps.

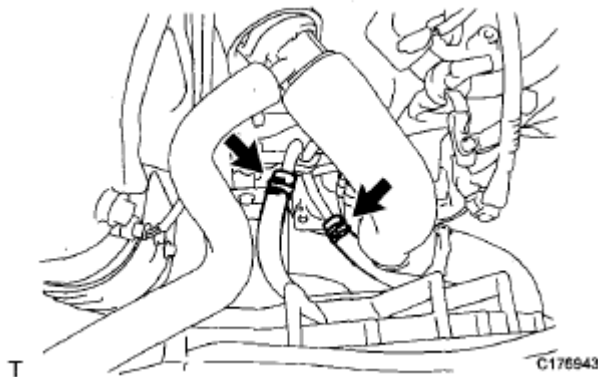
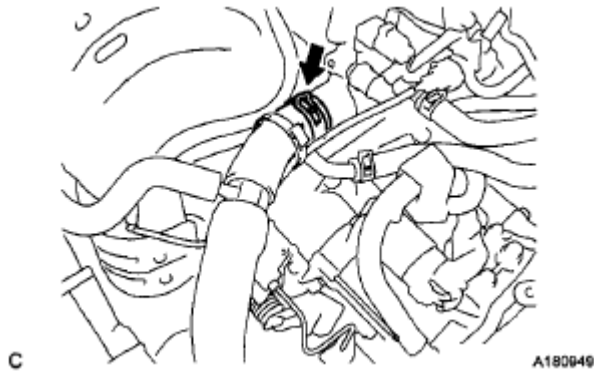


Fig. 221: Locating Oil Cooler Hose Clamp (Automatic Transaxle)

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

55. INSTALL NO. 1 RADIATOR HOSE

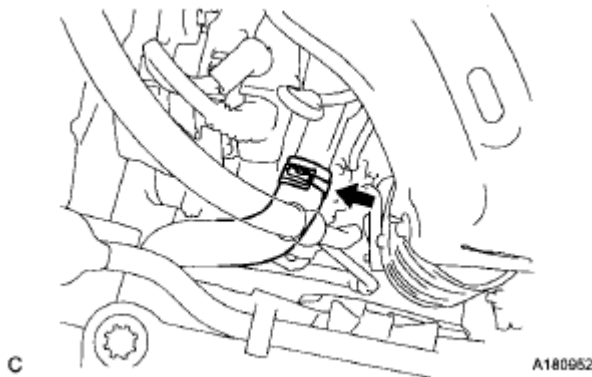
- a. Connect the No. 1 radiator hose with the clamp.

**Fig. 222: Locating No. 1 Radiator Hose Clamp**

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

56. INSTALL NO. 2 RADIATOR HOSE

- a. Connect the No. 2 radiator hose with the clamp.

**Fig. 223: Locating No. 2 Radiator Hose Clamp**

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

57. INSTALL COMPRESSOR ASSEMBLY WITH PULLEY (See INSTALLATION)**58. INSTALL GENERATOR ASSEMBLY (See INSTALLATION)****59. INSTALL V-RIBBED BELT (See INSTALLATION)****60. INSTALL THROTTLE BODY ASSEMBLY (See INSTALLATION)****61. INSTALL WIRE HARNESS**

- a. Install the ground cable to the transmission with the bolt and clamp (for Manual Transaxle).

Torque: 13 N*m (130 kgf*cm, 10 ft.*lbf)

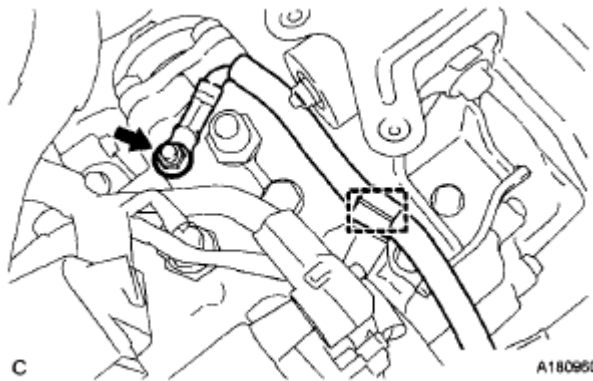


Fig. 224: Locating Ground Cable And Clamp (Manual Transaxle)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the ground wire to the transmission with the bolt and clamp (for Automatic Transaxle).

Torque: 26 N*m (260 kgf*cm, 19 ft.*lbf)

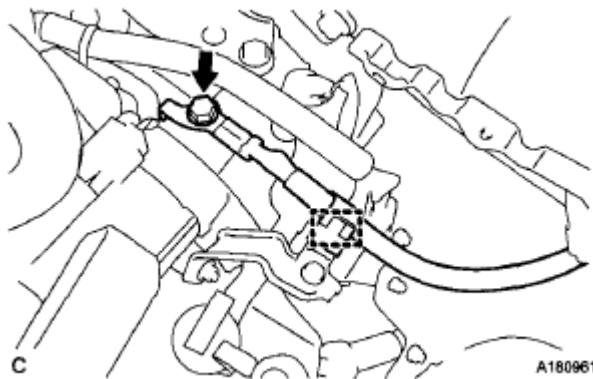


Fig. 225: Locating Ground Cable And Clamp (Automatic Transaxle)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the wire harness with the 2 nuts.

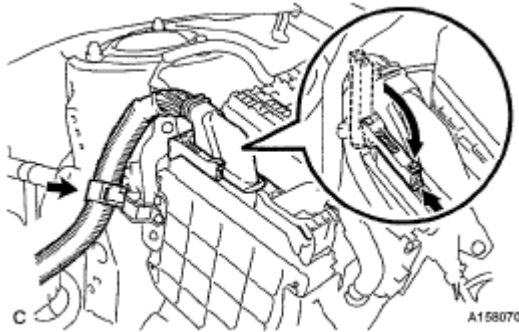
Torque: 8.4 N*m (85 kgf*cm, 74 in.*lbf)

- d. Connect the 3 connectors.

**Fig. 226: Locating Wire Harness With Nuts**

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

- e. Connect the connector to the ECM with the clamp and lock lever.

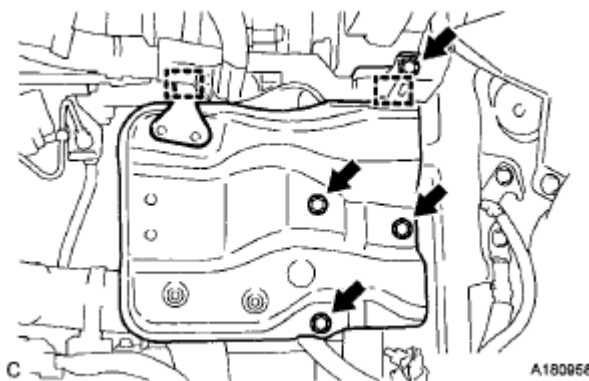
**Fig. 227: Connecting Connector To ECM With Clamp And Lock Lever**

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

62. INSTALL BATTERY CARRIER

- a. Install the battery carrier with the 4 bolts.

Torque: 13 N*m (133 kgf*cm, 10 ft.*lbf)

**Fig. 228: Identifying Wire Harness Clamps And Battery Carrier Bolts**

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

- b. Connect the 2 wire harness clamps.

63. INSTALL BATTERY

- a. Install the battery tray, battery and battery insulator.
- b. Install the battery clamp with the bolt and nut.

Torque: Bolt

6.5 N*m (66 kgf*cm, 58 in.*lbf)

Nut

3.5 N*m (36 kgf*cm, 31 in.*lbf)

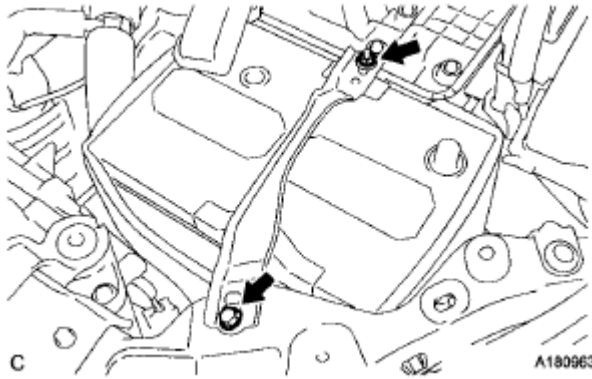


Fig. 229: Locating Battery Clamp And Bolt With Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

64. INSTALL AIR CLEANER CASE

- a. Install the air cleaner case with the 3 bolts.

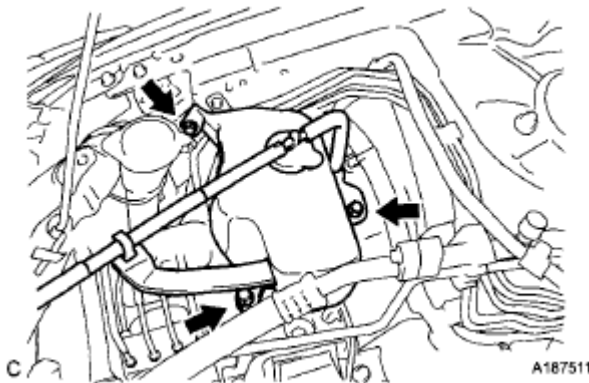
Torque: 7.0 N*m (71 kgf*cm, 62 in.*lbf)



Fig. 230: Locating Air Cleaner Case And Bolts

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

- b. Install the engine wire clamp to the air cleaner case.
 - c. Install the air cleaner filter element.
65. **INSTALL AIR CLEANER CAP SUB-ASSEMBLY WITH HOSE** (See **INSTALLATION**)
66. **INSTALL RADIATOR RESERVE TANK ASSEMBLY**
- a. Install the radiator reserve tank assembly with the 3 bolts.

Torque: 7.0 N*m (71 kgf*cm, 62 in.*lbf)**Fig. 231: Locating Radiator Reserve Tank Assembly And Bolts**

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

67. **ADD MANUAL TRANSAXLE OIL** (for Manual Transaxle)

HINT:

See **MANUAL TRANSAXLE OIL** for E351.

68. **INSPECT MANUAL TRANSAXLE OIL** (for Manual Transaxle)

HINT:

See **MANUAL TRANSAXLE OIL** for E351.

69. **ADD AUTOMATIC TRANSAXLE FLUID** (for Automatic Transaxle)

HINT:

- See **AUTOMATIC TRANSAXLE FLUID** for U250E.
- See **AUTOMATIC TRANSAXLE FLUID** for U140F.

70. **INSPECT AUTOMATIC TRANSAXLE FLUID** (for Automatic Transaxle)

HINT:

- See **AUTOMATIC TRANSAXLE FLUID** for U250E.
- See **AUTOMATIC TRANSAXLE FLUID** for U140F.

71. **ADD TRANSFER OIL (for 4WD)**
72. **INSPECT TRANSFER OIL (for 4WD) (See **TRANSFER OIL**)**
73. **ADJUST TRANSFER OIL (See **TRANSFER OIL**)**
74. **INSPECT SHIFT LEVER POSITION (for Automatic Transaxle)**

HINT:

- See **ON-VEHICLE INSPECTION** for U250E.
- See **ON-VEHICLE INSPECTION** for U140F.

75. **ADJUST SHIFT LEVER POSITION (for Automatic Transaxle)**

HINT:

- See **ADJUSTMENT** for U250E.
- See **ADJUSTMENT** for U140F.

76. **ADD ENGINE COOLANT (See **COOLANT**)**
77. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**

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

78. **WARM UP ENGINE**
79. **FILL BRAKE FLUID RESERVOIR (for Manual Transaxle)**

HINT:

See **INSTALLATION** for E351.

80. **BLEED CLUTCH LINE (for Manual Transaxle)**

HINT:

See **INSTALLATION** for E351.

81. **INSPECT FLUID LEVEL (for Manual Transaxle)**

HINT:

See **INSTALLATION** for E351.

82. **INSPECT FOR FUEL LEAK (See **ON-VEHICLE INSPECTION**)**

83. **INSPECT FOR COOLANT LEAK** (See COOLING SYSTEM)
84. **INSPECT FOR OIL LEAK**
85. **INSPECT FOR EXHAUST GAS LEAK**
86. **INSTALL ENGINE UNDER COVER LH**
87. **INSTALL ENGINE UNDER COVER RH**
88. **INSTALL FRONT WHEELS**

Torque: 103 N*m (1050 kgf*cm, 76 ft.*lbf)

89. **INSPECT IGNITION TIMING** (See ENGINE)
90. **INSPECT ENGINE IDLING SPEED** (See ON-VEHICLE INSPECTION)
91. **INSPECT CO/HC** (See ON-VEHICLE INSPECTION)
92. **ADJUST FRONT WHEEL ALIGNMENT**

HINT:

See FRONT WHEEL ALIGNMENT .

93. **INSTALL NO. 1 ENGINE COVER SUB-ASSEMBLY**
 - a. Install the No. 1 engine cover sub-assembly with the 2 nuts.
94. **CHECK ABS SPEED SENSOR SIGNAL**

HINT:

- See TEST MODE PROCEDURE for w/o VSC.
- See TEST MODE PROCEDURE for w/ VSC.

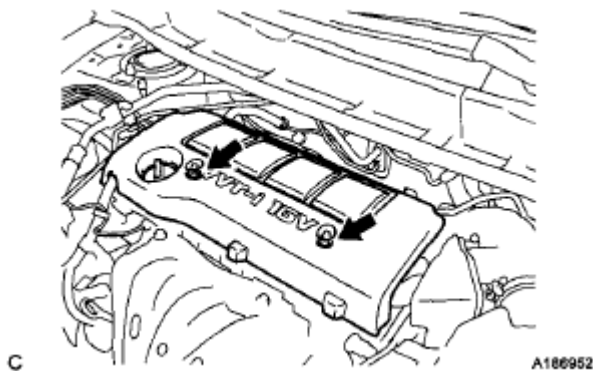


Fig. 232: Locating No. 1 Engine Cover Sub-Assembly And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ENGINE UNIT

COMPONENTS

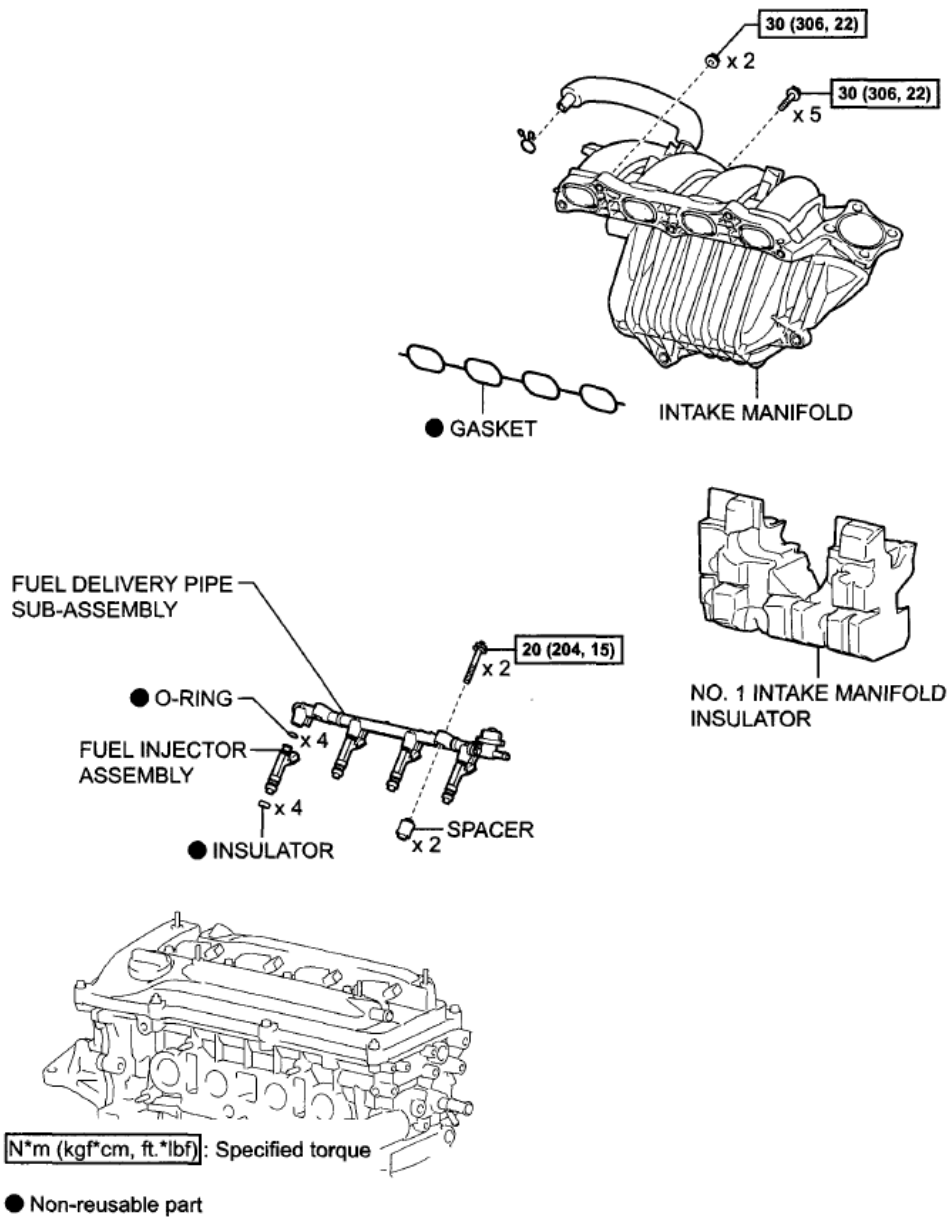
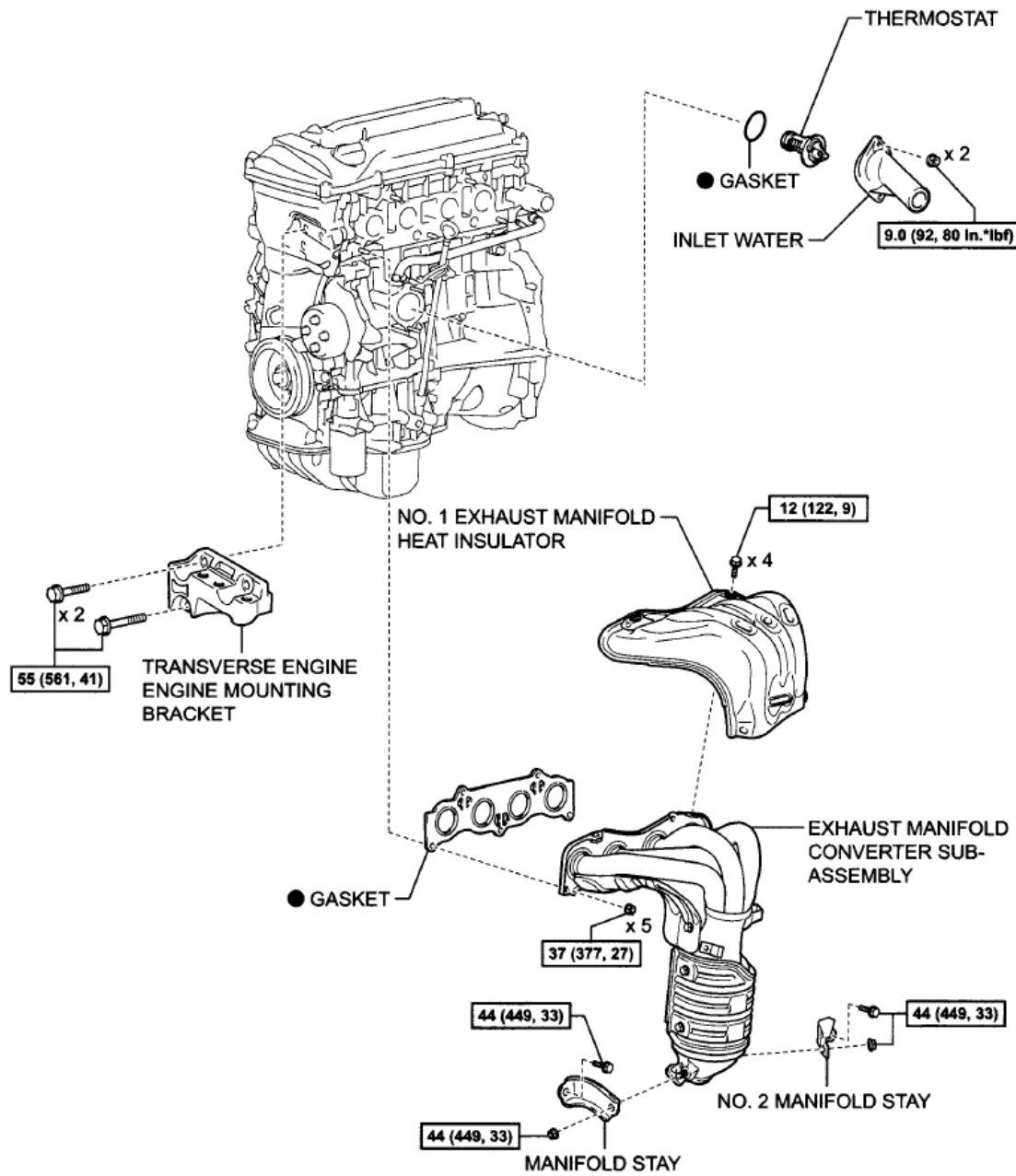


Fig. 233: Identifying Engine Unit Components With Torque Specifications (1 Of 7)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2009 Toyota Matrix

2009 ENGINE Engine Mechanical (2AZ-FE) - Corolla Matrix



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

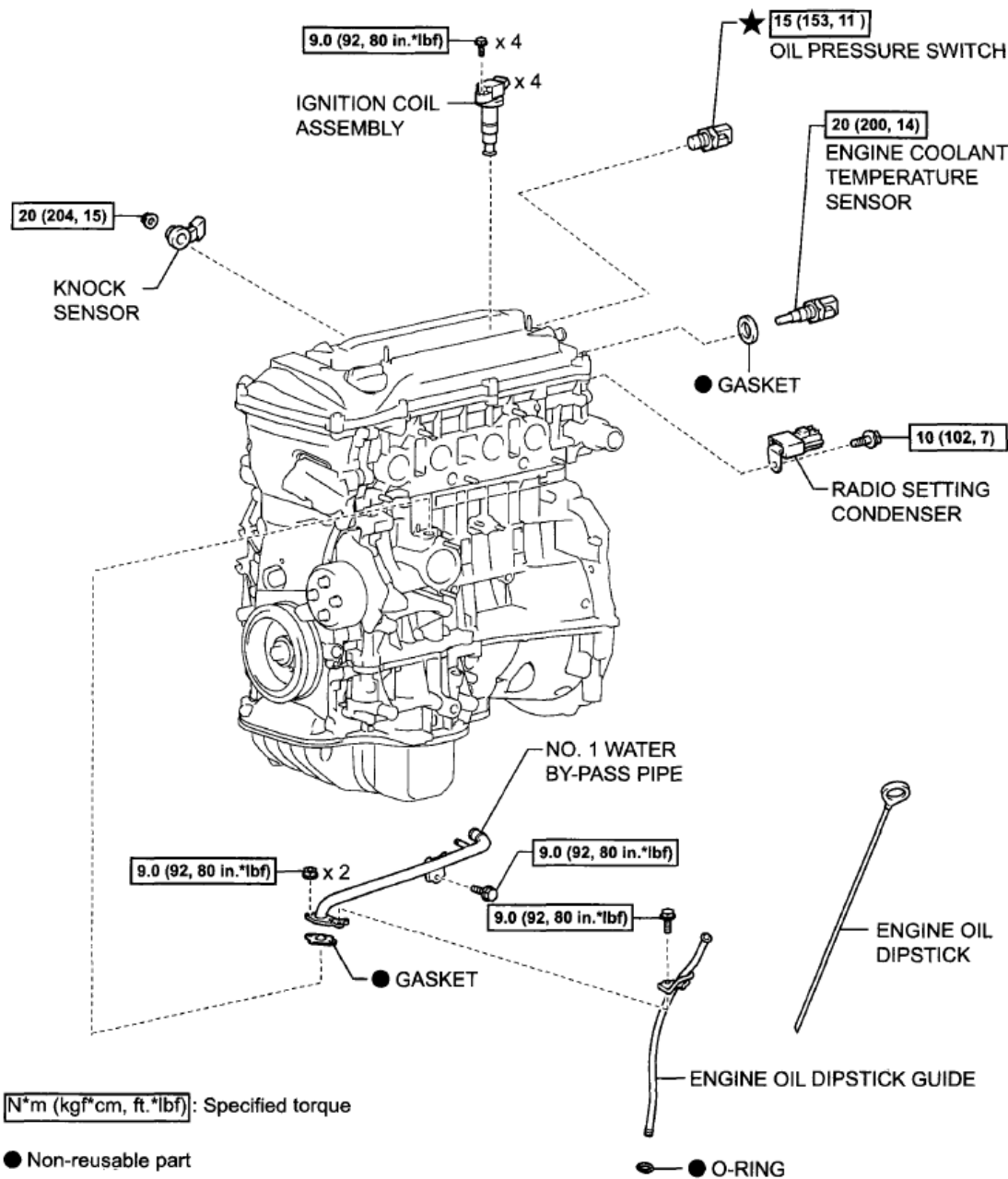
● Non-reusable part

A156853E03

Fig. 234: Identifying Engine Unit Components With Torque Specifications (2 Of 7)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2009 Toyota Matrix

2009 ENGINE Engine Mechanical (2AZ-FE) - Corolla Matrix



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Fig. 235: Identifying Engine Unit Components With Torque Specifications (3 Of 7)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2009 ENGINE Engine Mechanical (2AZ-FE) - Corolla Matrix



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

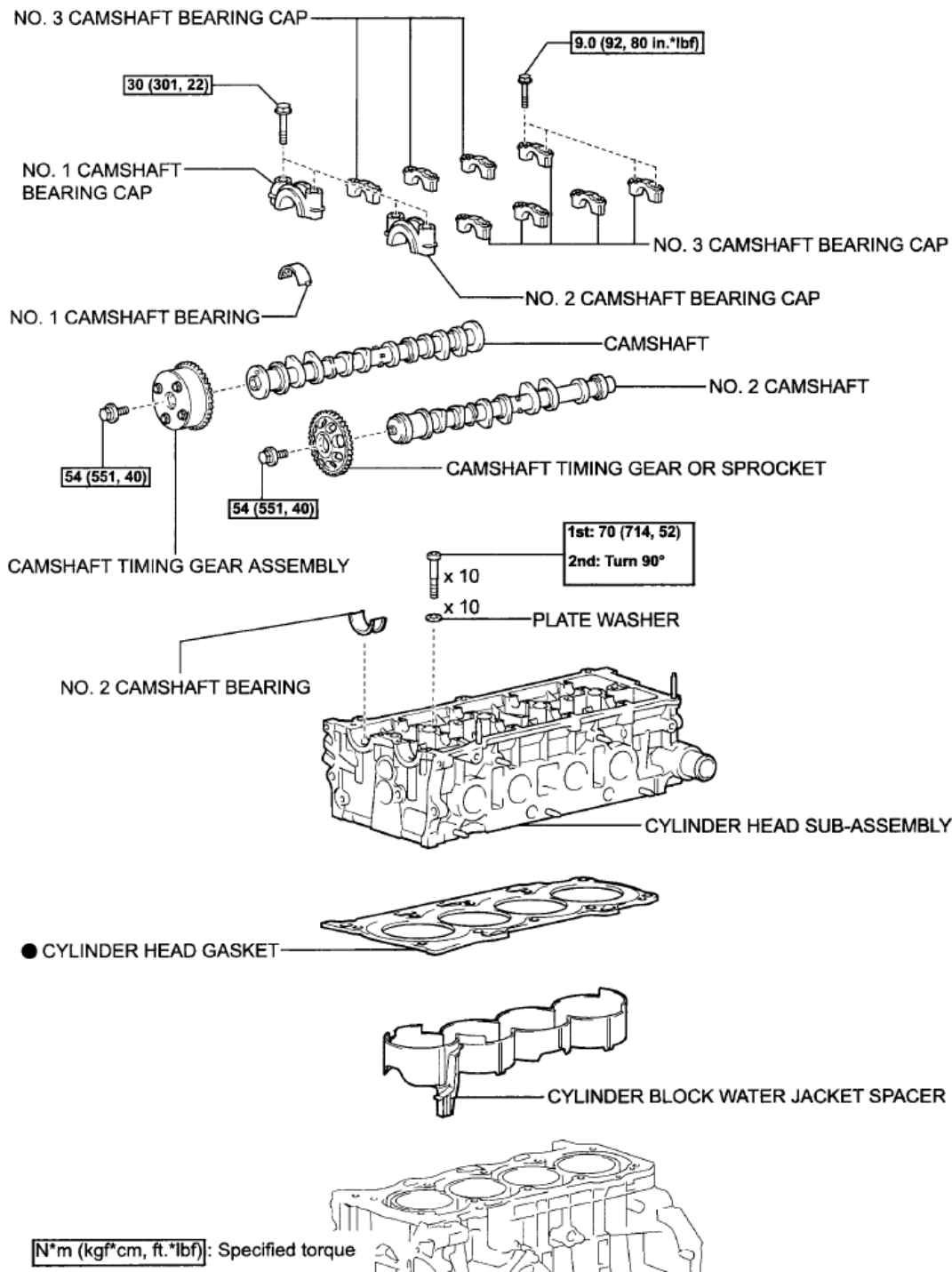
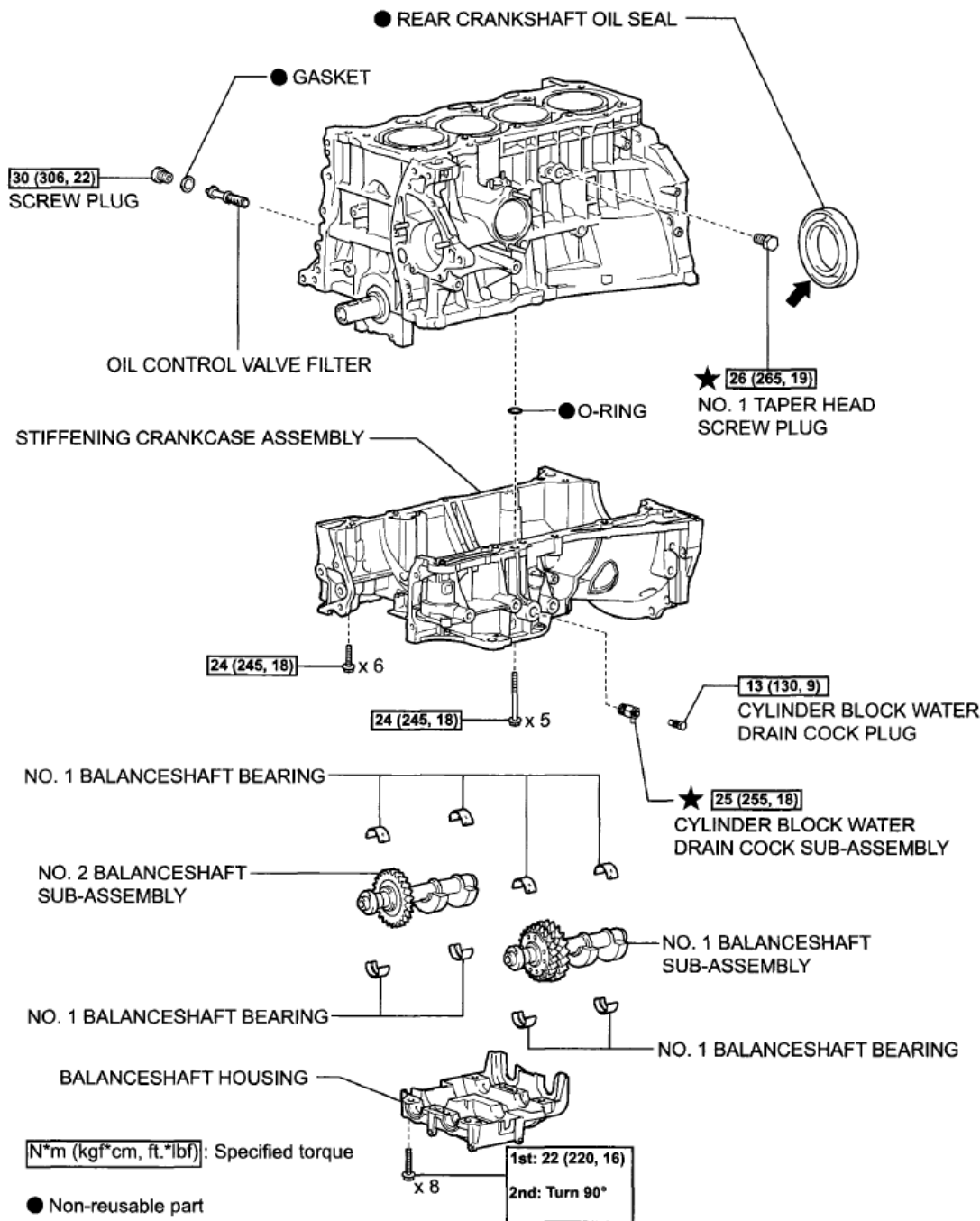


Fig. 238: Identifying Engine Unit Components With Torque Specifications (6 Of 7)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2009 Toyota Matrix

2009 ENGINE Engine Mechanical (2AZ-FE) - Corolla Matrix



A135395E15

Fig. 239: Identifying Engine Unit Components With Torque Specifications (7 Of 7)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. REMOVE FUEL DELIVERY PIPE SUB-ASSEMBLY (See REMOVAL)

2. **REMOVE FUEL INJECTOR ASSEMBLY** (See **REMOVAL**)
3. **REMOVE INTAKE MANIFOLD** (See **REMOVAL**)
4. **REMOVE NO. 1 INTAKE MANIFOLD INSULATOR**
 - a. Remove the No. 1 intake manifold insulator.

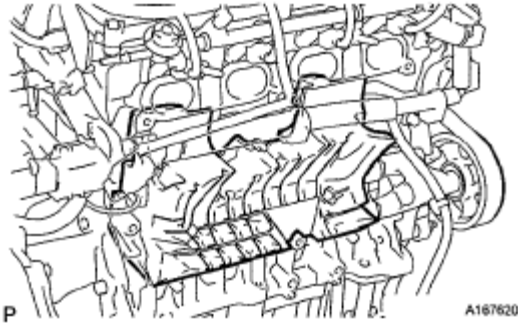


Fig. 240: Identifying No. 1 Intake Manifold Insulator
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. **REMOVE NO. 1 EXHAUST MANIFOLD HEAT INSULATOR** (See **REMOVAL**)
6. **REMOVE MANIFOLD STAY** (See **REMOVAL**)
7. **REMOVE NO. 2 MANIFOLD STAY** (See **REMOVAL**)
8. **REMOVE EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY** (See **REMOVAL**)
9. **REMOVE WATER INLET** (See **REMOVAL**)
10. **REMOVE THERMOSTAT** (See **REMOVAL**)
11. **REMOVE ENGINE OIL DIPSTICK**
12. **REMOVE ENGINE OIL DIPSTICK GUIDE** (See **REMOVAL**)
13. **REMOVE NO. 1 WATER BY-PASS PIPE**
 - a. Remove the bolt and 2 nuts, then remove the No. 1 water by-pass pipe.
 - b. Remove the gasket.
14. **REMOVE IGNITION COIL ASSEMBLY** (See **REMOVAL**)
15. **REMOVE KNOCK SENSOR** (See **REMOVAL**)
16. **REMOVE OIL PRESSURE SWITCH** (See **OIL PRESSURE SWITCH**)

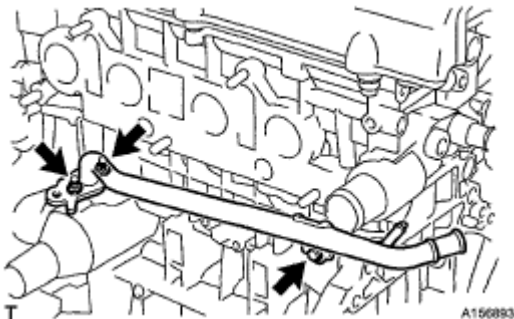
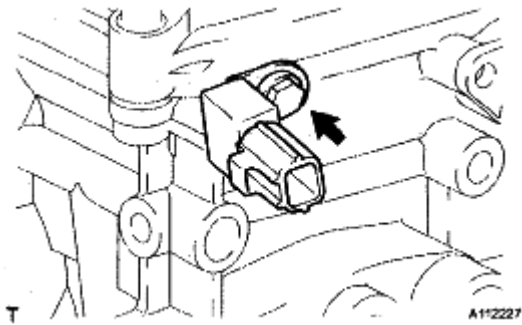


Fig. 241: Locating No. 1 Water By-Pass Pipe Nuts And Bolts

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

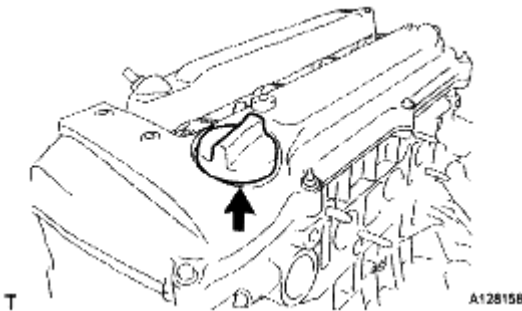
17. **REMOVE ENGINE COOLANT TEMPERATURE SENSOR** (See **REMOVAL**)
18. **REMOVE RADIO SETTING CONDENSER**
 - a. Remove the bolt and radio setting condenser.

**Fig. 242: Locating Radio Setting Condenser**

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

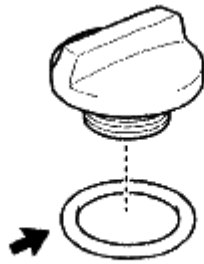
DISASSEMBLY

1. **REMOVE OIL FILLER CAP SUB-ASSEMBLY**
 - a. Remove the oil filler cap from the cylinder head cover.

**Fig. 243: 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 from the oil filler cap.



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Fig. 244: Locating Oil Filler Cap Gasket

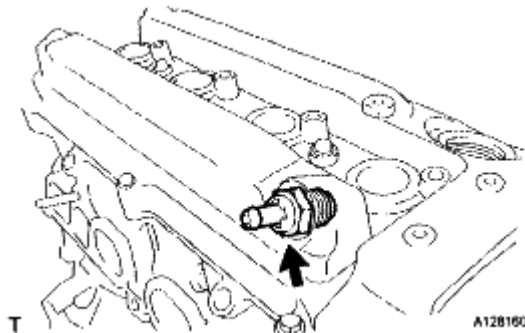
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. REMOVE VENTILATION VALVE SUB-ASSEMBLY

- a. Using a 22 mm deep socket wrench, remove the ventilation valve from the cylinder head cover.

4. REMOVE SPARK PLUG (See REMOVAL)

5. REMOVE OIL FILTER SUB-ASSEMBLY (See REPLACEMENT)



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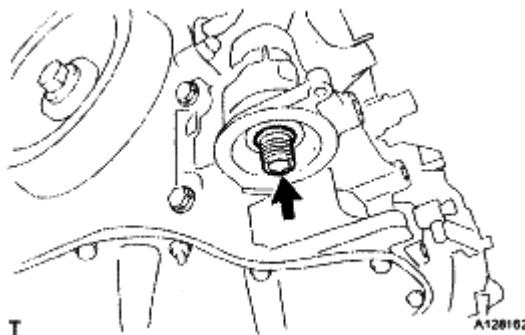
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Fig. 245: Locating Ventilation Valve

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

6. REMOVE OIL FILTER UNION

- a. Using a 12 mm socket hexagon wrench, remove the oil filter union.



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Fig. 246: Locating Oil Filter Union

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

7. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY

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

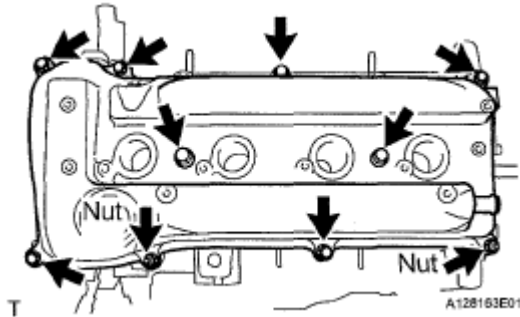


Fig. 247: Locating Cylinder Head Cover Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. REMOVE CYLINDER HEAD COVER GASKET

- a. Remove the cylinder head cover gasket from the cylinder head cover.

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

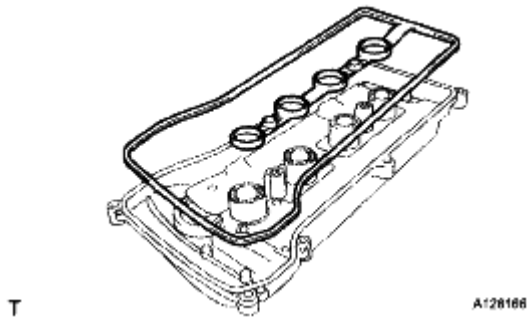


Fig. 248: Locating Cylinder Head Cover Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. REMOVE CRANKSHAFT POSITION SENSOR

- a. Remove the wire harness clamp.
- b. Separate the wire harness from the wire harness clamp bracket.

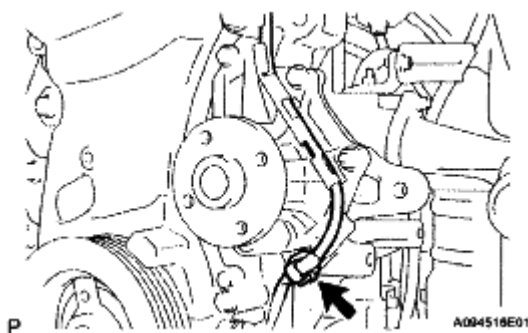


Fig. 249: Locating Crankshaft Position Sensor

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

- c. Remove the 2 bolts and sensor.

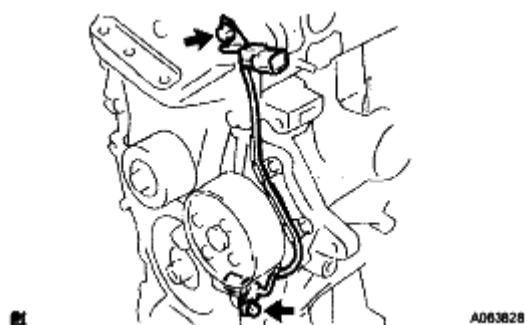


Fig. 250: Locating Crankshaft Position Sensor And Bolts

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

11. REMOVE CAMSHAFT POSITION SENSOR

- a. Remove the bolt and camshaft position sensor.

12. SET NO. 1 CYLINDER TO TDC/COMPRESSION (See REMOVAL)

13. REMOVE CRANKSHAFT PULLEY (See REMOVAL)

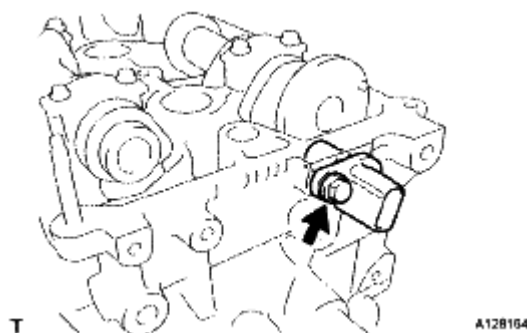


Fig. 251: Locating Camshaft Position Sensor And Bolts

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

14. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

- a. Remove the bolt and camshaft timing oil control valve from the cylinder head.

NOTE: The camshaft timing oil control valve may be damaged when loosening the cylinder head bolts if the oil control valve is not removed.

- b. Remove the O-ring from the camshaft timing oil control valve.

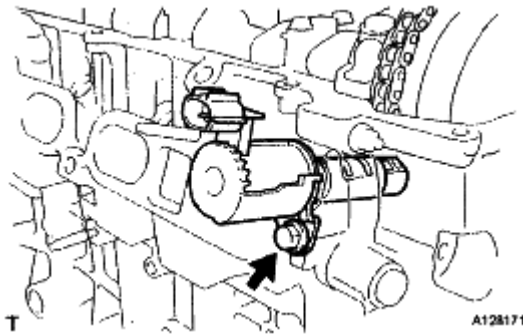


Fig. 252: Locating Camshaft Timing Oil Control Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

15. REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY (See REMOVAL)

16. REMOVE WATER PUMP PULLEY (See REMOVAL)

17. REMOVE WATER PUMP ASSEMBLY (See REMOVAL)

18. REMOVE OIL PAN DRAIN PLUG

- a. Remove the oil pan drain plug from the oil pan.



Fig. 253: Locating Oil Pan Drain Plug
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

19. REMOVE OIL PAN SUB-ASSEMBLY

- a. Remove the 12 bolts and 2 nuts.

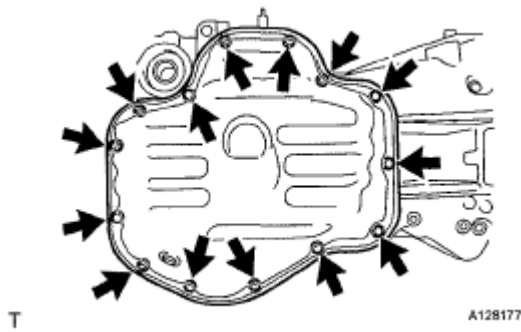


Fig. 254: Locating Oil Pan Bolts And Nuts

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

- b. Insert the blade of an oil pan seal cutter between the crankcase, chain cover and oil pan, then cut through the applied sealer and remove the oil pan.

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

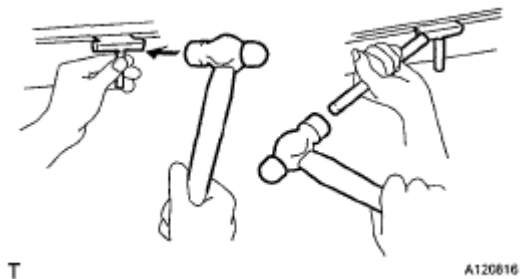


Fig. 255: Removing Oil Pan Seal With Cutter

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

20. REMOVE TIMING CHAIN OR BELT COVER SUB-ASSEMBLY (See REMOVAL)
21. REMOVE FRONT CRANKSHAFT OIL SEAL (See REMOVAL)
22. REMOVE NO. 1 CRANKSHAFT POSITION SENSOR PLATE (See REMOVAL)
23. REMOVE TIMING CHAIN GUIDE (See REMOVAL)
24. REMOVE CHAIN TENSIONER SLIPPER (See REMOVAL)
25. REMOVE NO. 1 CHAIN VIBRATION DAMPER (See REMOVAL)
26. REMOVE CHAIN SUB-ASSEMBLY
27. REMOVE CRANKSHAFT TIMING GEAR OR SPROCKET (See REMOVAL)
28. REMOVE NO. 2 CHAIN SUB-ASSEMBLY (See REMOVAL)
29. REMOVE KEYS
 - a. Remove the 2 pulley set keys from the crankshaft.

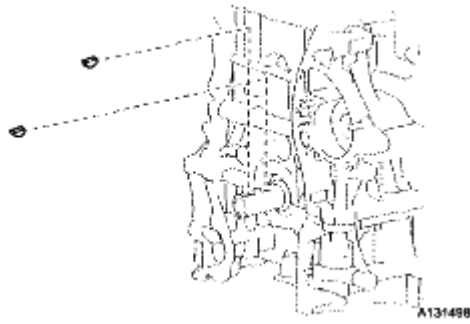


Fig. 256: Identifying Pulley Set Keys

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

30. REMOVE NO. 2 CAMSHAFT

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

NOTE: Uniformly loosen the bolts while keeping the camshaft level.

HINT:

Arrange the removed parts in the correct order.

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

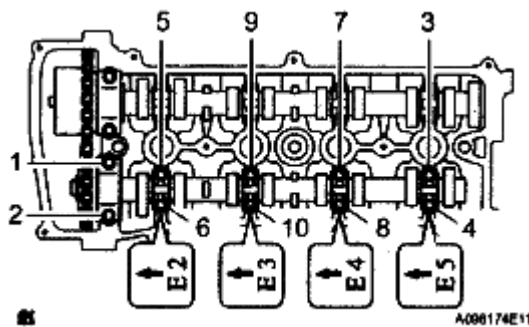


Fig. 257: Identifying No. 2 Camshaft Bearing Cap Bolts Removing Sequence

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

31. REMOVE CAMSHAFT

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

NOTE: Uniformly loosen the bolts while keeping the camshaft level.

HINT:

Arrange the removed parts in the correct order.

- b. Remove the 5 bearing caps.
- c. Remove the camshaft.

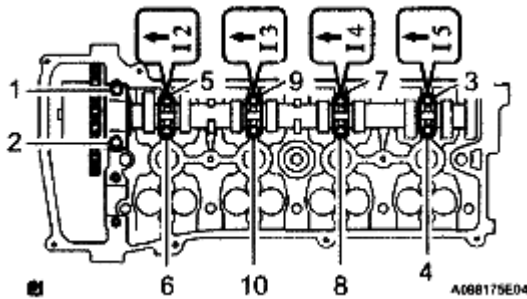


Fig. 258: Identifying Camshaft Bearing Cap Bolts Removing Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

32. REMOVE NO. 1 CAMSHAFT BEARING

- a. Remove the camshaft bearing from the No. 1 camshaft bearing cap.

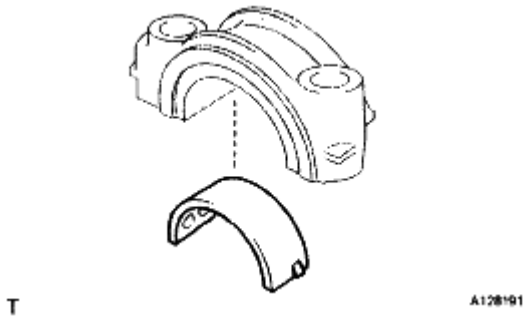


Fig. 259: Identifying No. 1 Camshaft Bearing Cap And Bearing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

33. REMOVE NO. 2 CAMSHAFT BEARING

- a. Remove the No. 2 camshaft bearing from the cylinder head.

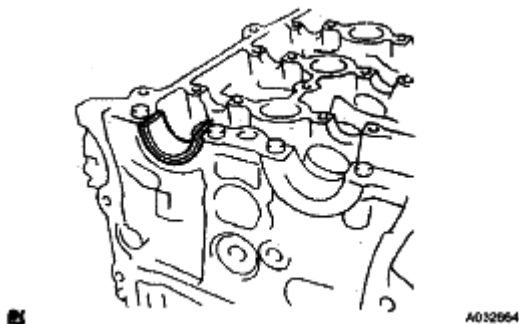


Fig. 260: Identifying No. 2 Camshaft Bearing

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

34. REMOVE CAMSHAFT TIMING GEAR OR SPROCKET

- a. Clamp the camshaft in a vise.

NOTE:

- Do not overtighten the vise.
- Do not damage the camshaft.

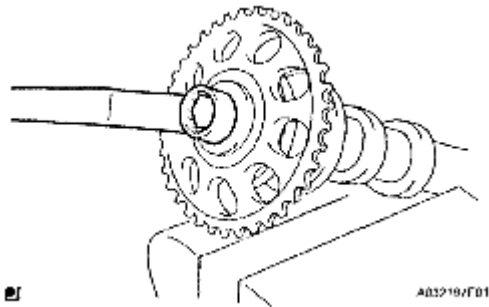


Fig. 261: Removing/Installing Camshaft Timing Gear With Vise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the bolt and camshaft timing gear or sprocket.

- 35. REMOVE CAMSHAFT TIMING GEAR ASSEMBLY (See REMOVAL)**
36. REMOVE CYLINDER HEAD SUB-ASSEMBLY (See REMOVAL)
37. REMOVE CYLINDER HEAD GASKET

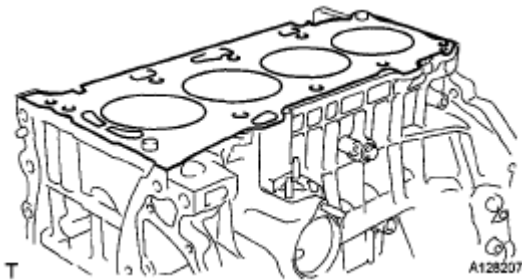


Fig. 262: Identifying Cylinder Head Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

38. REMOVE CYLINDER BLOCK WATER JACKET SPACER

- a. Using needle nose pliers, remove the cylinder block water jacket spacer from the water jacket.

NOTE:

Before turning the cylinder block upside down, make sure that the water jacket spacer is removed, as it will fall out.

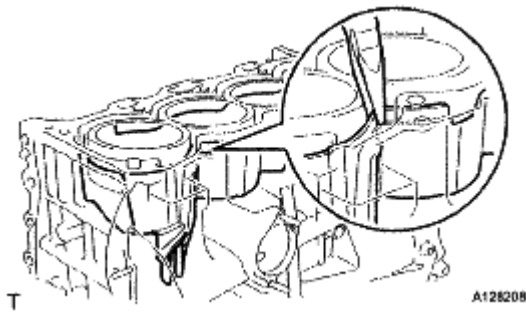


Fig. 263: Removing Cylinder Block Water Jacket Spacer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

39. 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 cock.

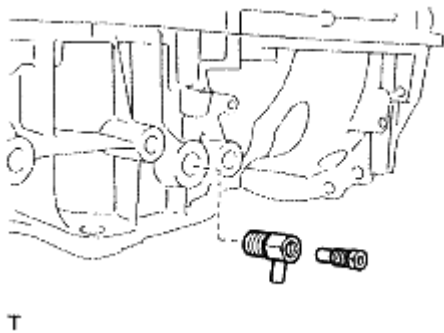


Fig. 264: Identifying Water Drain Cock
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

40. REMOVE OIL CONTROL VALVE FILTER

- a. Using an 8 mm socket hexagon wrench, remove the plug, gasket and oil control valve filter.

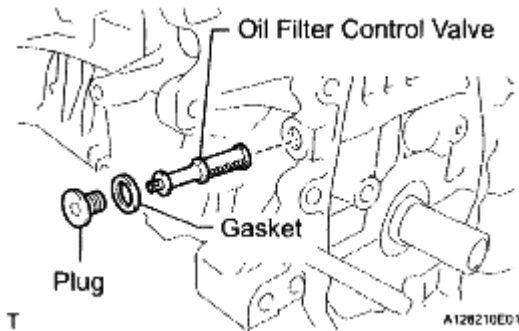


Fig. 265: Identifying Plug, Gasket And Oil Control Valve Filter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

41. REMOVE NO. 1 TAPER HEAD SCREW PLUG

- a. Remove the No. 1 taper head screw plug.

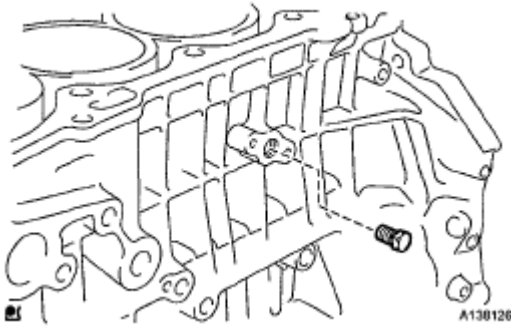


Fig. 266: Identifying No. 1 Taper Head Screw Plug
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

42. **REMOVE OIL PUMP ASSEMBLY** (See **DISASSEMBLY**)
43. **INSPECT BALANCESHAFT THRUST CLEARANCE** (See **INSPECTION**)
44. **INSPECT BALANCESHAFT OIL CLEARANCE** (See **INSPECTION**)
45. **REMOVE NO. 1 AND NO. 2 BALANCESHAFTS**
 - a. Remove the No. 1 and No. 2 balanceshafts.

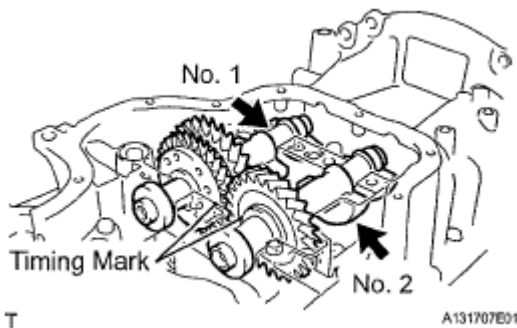
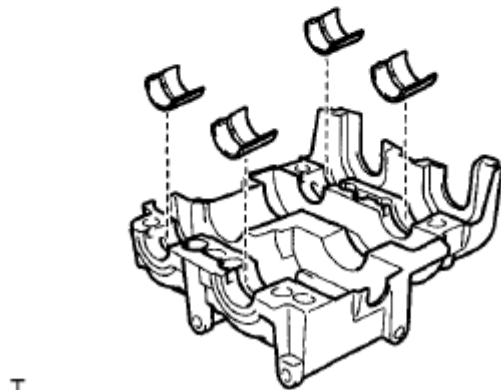
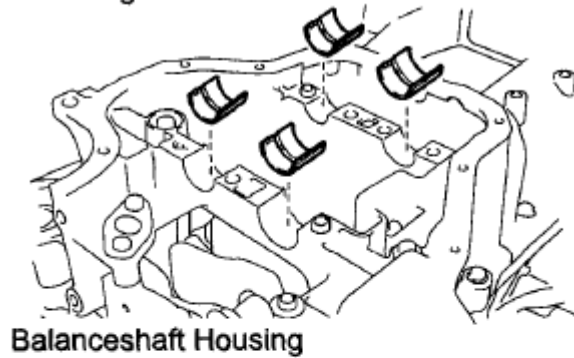


Fig. 267: Locating No. 1 And No. 2 Balanceshafts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

46. **REMOVE NO. 1 BALANCESHAFT BEARING**
 - a. Remove the 8 No. 1 balanceshaft bearings shown in the illustration.
47. **REMOVE REAR CRANKSHAFT OIL SEAL** (See **REMOVAL**)

Stiffening Crankcase



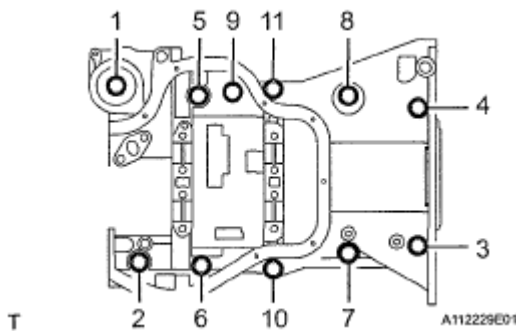
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Fig. 268: Removing/Installing No. 1 Balanceshaft Bearings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

48. REMOVE STIFFENING CRANKCASE ASSEMBLY

- a. Uniformly loosen and remove the 11 bolts in the sequence shown in the illustration.



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Fig. 269: Identifying Stiffening Crankcase Bolts Removing Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a screwdriver with its tip wrapped with protective tape, remove the crankcase by prying between the crankcase and cylinder block.

NOTE: Be careful not to damage the contact surfaces between the

crankcase and cylinder block.

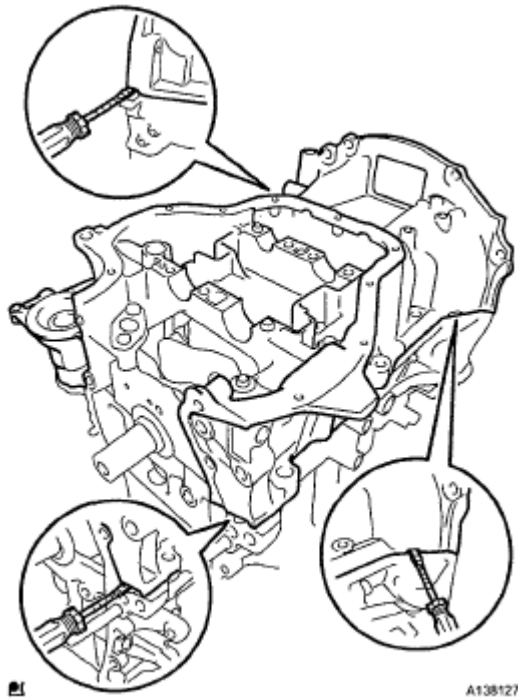


Fig. 270: Prying Between Crankcase And Cylinder Block
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Remove the O-ring from the cylinder block.

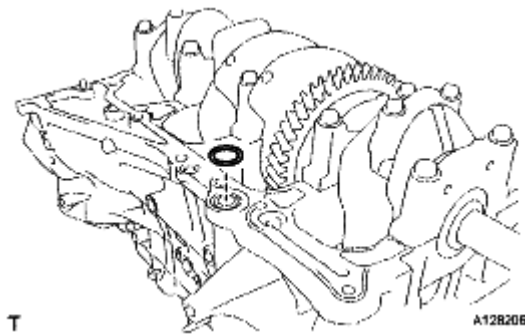


Fig. 271: Identifying O-Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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 balancershaft housing and bearings.
If necessary, replace the balancershaft.

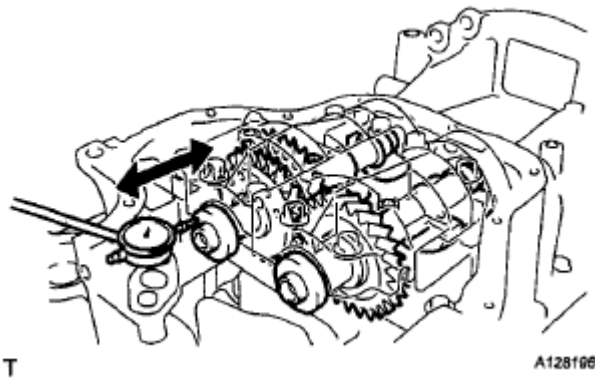


Fig. 272: Inspecting Balancershaft Thrust Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. INSPECT BALANCESHAFT OIL CLEARANCE

- a. Clean each bearing and journal.
- b. Check each bearing and journal for pitting and scratches.

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

- c. Place the No. 1 and No. 2 balancershafts onto the crankcase.
- d. Lay a strip of Plastigage across each journal.
- e. Install the balancershaft housing (See **REASSEMBLY**).

NOTE: **Do not turn the balancershafts.**

- f. Remove the balancershafts (See **DISASSEMBLY**).

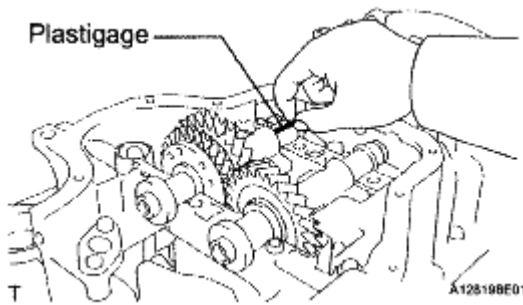


Fig. 273: Laying Strip Of Plastigage Across Each Journal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Measure the Plastigage at its widest point.

Standard oil clearance:

0.022 to 0.049 mm (0.0009 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 balancershaft.

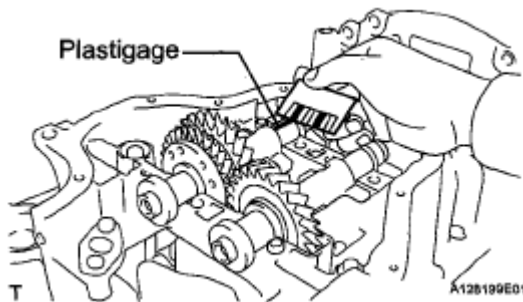


Fig. 274: Measuring Plastigage Widest Point
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- h. If replacing a bearing, select a new one with the same number.

Standard Balancershaft Housing Journal Bore Diameter

BALANCESHAFT HOUSING JOURNAL BORE DIAMETER SPECIFICATION

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

BEARING CENTER WALL THICKNESS SPECIFICATION

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:

22.985 to 23.000 mm (0.9049 to 0.9055 in.)

- i. Inspect the balancershaft housing bolts.
 1. Using a vernier caliper, measure the length of the bolts from the seat to the end.

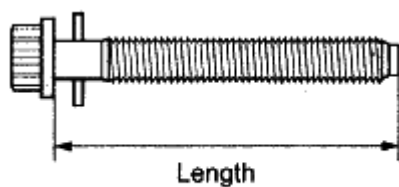
Standard bolt length:

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.



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Fig. 275: Measuring 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 a vernier caliper, 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 elongation is greater than the maximum, replace the chain.

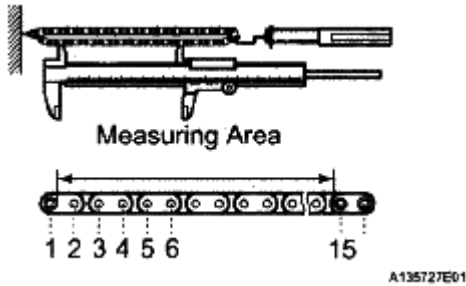


Fig. 276: Measuring Length Of Links
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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 a vernier caliper, 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 elongation is greater than the maximum, replace the No. 2 chain.

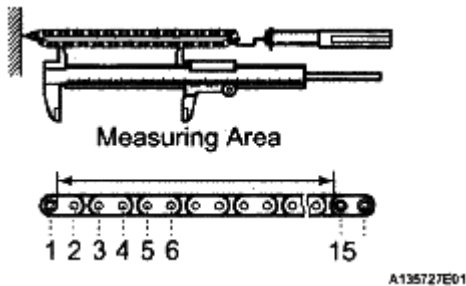


Fig. 277: Measuring Length Of Links
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. INSPECT OIL PUMP DRIVE GEAR

- Place the chain around the sprocket.
- Using a vernier caliper, measure the sprocket diameter with the chain placed around.

Minimum gear diameter (with chain):

48.2 mm (1.898 in.)

NOTE: The vernier caliper must be in contact with the chain rollers when measuring.

If the diameter is less than the minimum, replace the chain and sprocket.

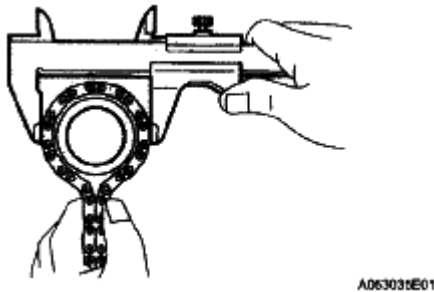


Fig. 278: Measuring Sprocket Diameter With Chain Placed Around
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. INSPECT OIL PUMP DRIVE SHAFT GEAR

- a. Place the chain around the sprocket.
- b. Using a vernier caliper, measure the sprocket diameter with the chain placed around.

Minimum gear diameter (with chain):

48.2 mm (1.898 in.)

NOTE: The vernier caliper must be in contact with the chain rollers when measuring.

If the diameter is less than the minimum, replace the chain and sprocket.

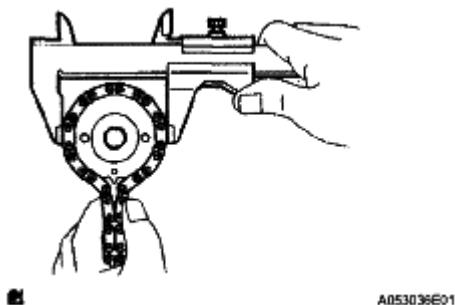


Fig. 279: Measuring Sprocket Diameter With Chain Placed Around
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. INSPECT CAMSHAFT TIMING GEAR ASSEMBLY

- a. Place the chain around the sprocket.
- b. Using a vernier caliper, measure the sprocket diameter with the chain placed around.

Minimum gear diameter (with chain):

97.3 mm (3.831 in.)

NOTE: **The vernier caliper must be in contact with the chain rollers when measuring.**

If the diameter is less than the minimum, replace the chain and sprocket.

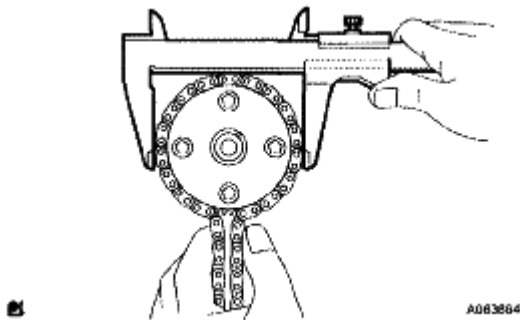


Fig. 280: Measuring Sprocket Diameter With Chain Placed Around
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. INSPECT CAMSHAFT TIMING GEAR OR SPROCKET

- a. Place the chain around the sprocket.
- b. Using a vernier caliper, measure the sprocket diameter with the chain placed around.

Minimum gear diameter (with chain):

97.3 mm (3.831 in.)

NOTE: **The vernier caliper must be in contact with the chain rollers when measuring.**

If the diameter is less than the minimum, replace the chain and sprocket.

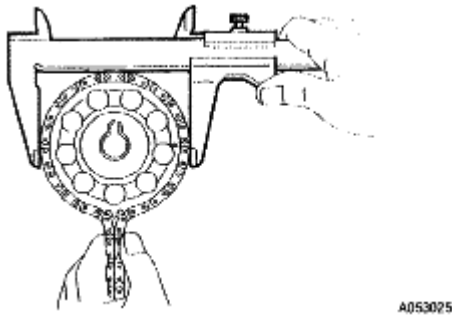


Fig. 281: Measuring Sprocket Diameter With Chain Placed Around
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. INSPECT CRANKSHAFT TIMING GEAR OR SPROCKET

- a. Place the chain around the timing sprocket.
- b. Using a vernier caliper, measure the timing gear diameter with the chain placed around.

Minimum gear diameter (with chain):

51.6 mm (2.031 in.)

NOTE: The vernier caliper must be in contact with the chain rollers when measuring.

If the gear diameter is less than the minimum, replace the chain sub-assembly and crankshaft timing sprocket.

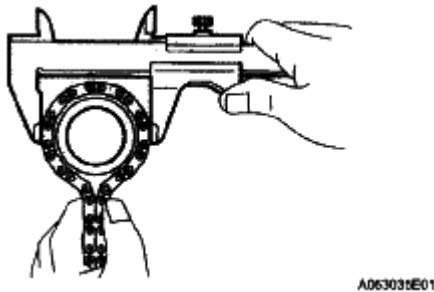


Fig. 282: Measuring Sprocket Diameter With Chain Placed Around
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. INSPECT CHAIN TENSIONER SLIPPER

- a. Using a vernier caliper, 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.

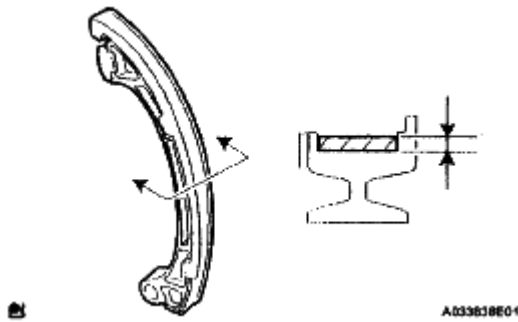


Fig. 283: Measuring Tensioner Slipper Wear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. INSPECT NO. 1 CHAIN VIBRATION DAMPER

- a. Using a vernier caliper, 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.

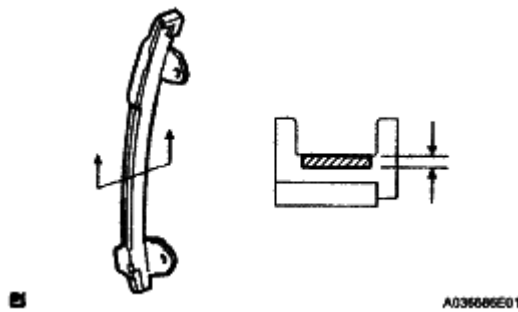


Fig. 284: Measuring Vibration Damper Wear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. INSPECT CHAIN TENSIONER PLATE

- a. Using a vernier caliper, measure the chain tensioner plate wear.

Maximum wear:

0.5 mm (0.020 in.)

If the wear is greater than the maximum, replace the chain tensioner plate.

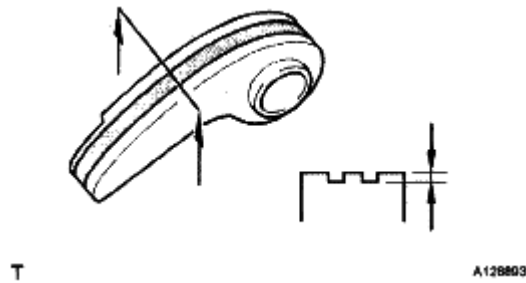


Fig. 285: Measuring Chain Tensioner Plate Wear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. INSPECT NO. 1 CHAIN TENSIONER ASSEMBLY

- Check that the plunger moves smoothly when the ratchet pawl is raised with your finger.
- 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.

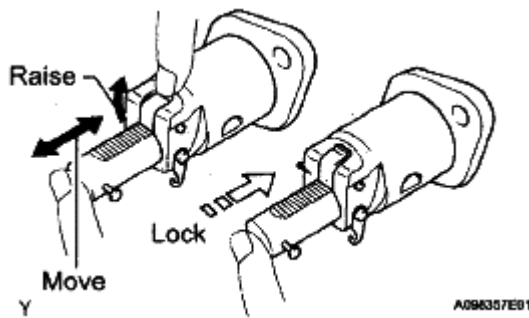


Fig. 286: Checking Plunger Moves Smoothly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. INSPECT CAMSHAFT

- Inspect the camshaft for runout.
 - Place the camshaft on V-blocks.
 - 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.

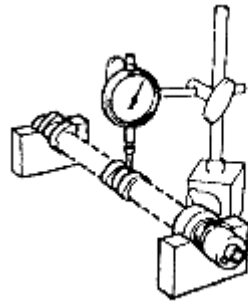


Fig. 287: Measuring Circle Runout At Center Journal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Standard cam lobe height:

47.306 to 47.406 mm (1.8624 to 1.8664 in.)

Minimum cam lobe height:

47.196 mm (1.8581 in.)

If any of the cam lobe heights are less than the minimum, replace the camshaft.

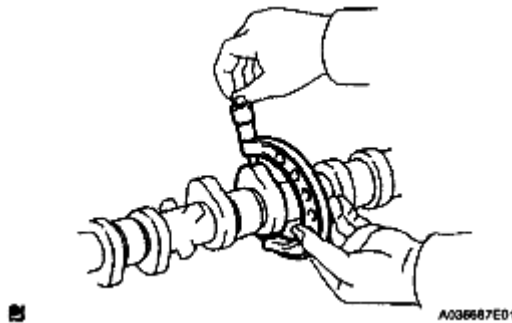


Fig. 288: Measuring Cam Lobe Heights
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Standard Journal Diameter

JOURNAL DIAMETER SPECIFICATION

Journal Position	Specified Condition
No. 1	35.971 to 35.985 mm (1.4162 to 1.4167 in.)

Others	22.959 to 22.975 mm (0.9039 to 0.9045 in.)
--------	--

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

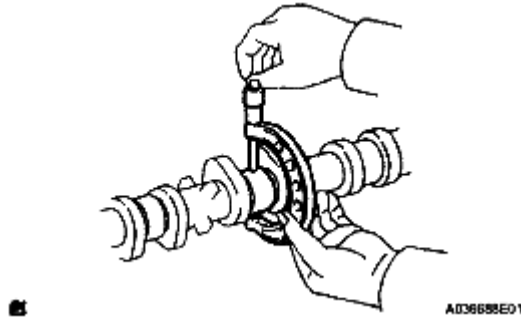


Fig. 289: Measuring Journal Diameter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

15. 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.

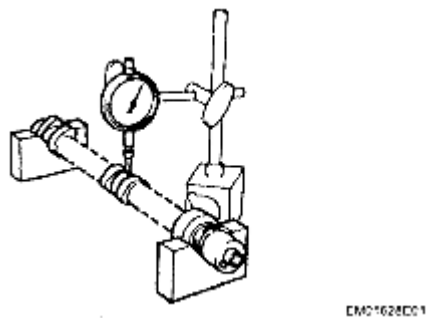


Fig. 290: Measuring Circle Runout At Center Journal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Standard cam lobe height:

46.063 to 46.163 mm (1.8135 to 1.8174 in.)

Minimum cam lobe height:

45.953 mm (1.8092 in.)

If any of the cam lobe heights are less than the minimum, replace the No. 2 camshaft.

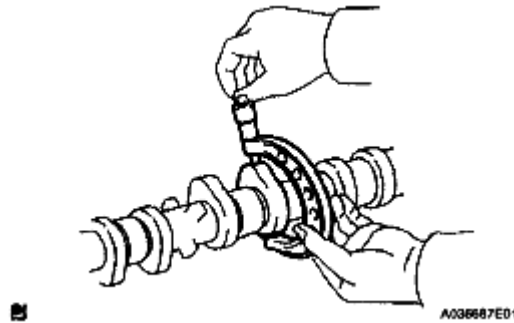


Fig. 291: Measuring Cam Lobe Heights

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 DIAMETER SPECIFICATION

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

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

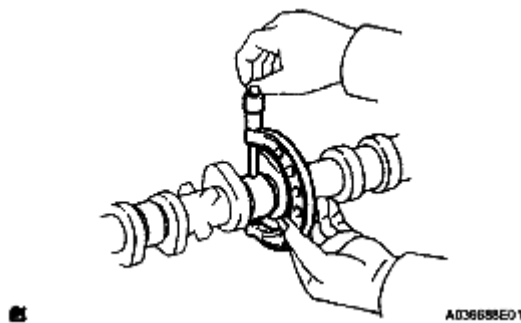


Fig. 292: Measuring Journal Diameter

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

REASSEMBLY

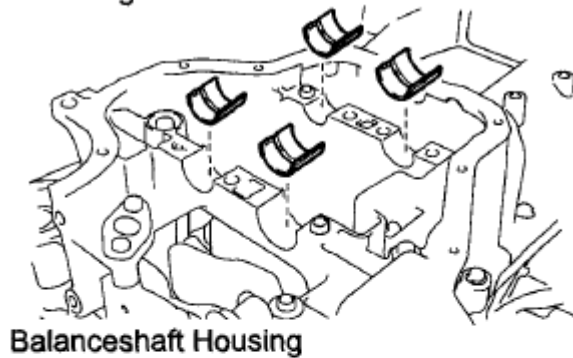
1. INSTALL NO. 1 BALANCESHAFT BEARING

- a. Align the bearing claw with the claw groove, and push in the 8 bearings.

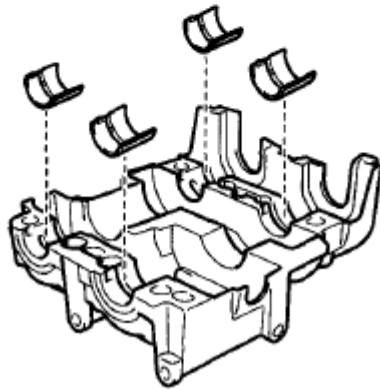
NOTE: Do not apply engine oil to the contact surfaces of the balanceshaft bearing and balanceshaft housing.

- b. Apply a light coat of the engine oil to the bearings.

Stiffening Crankcase



Balanceshaft Housing



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A128204E04

Fig. 293: Removing/Installing No. 1 Balanceshaft Bearings

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

2. INSTALL NO. 1 AND NO. 2 BALANCESHAFTS

- 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.

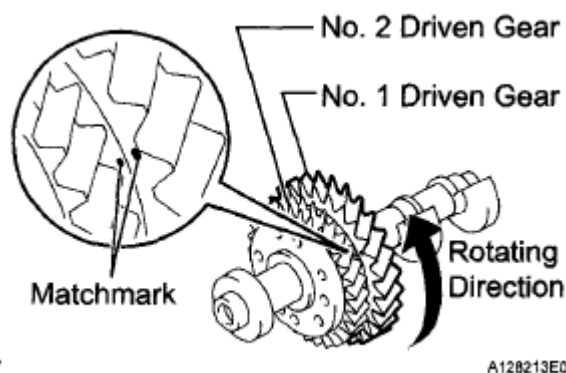


Fig. 294: Aligning Matchmarks On No. 1 And No. 2 Driven Gears
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Confirm that the alignment marks on the No. 1 and No. 2 balancshafts are aligned.

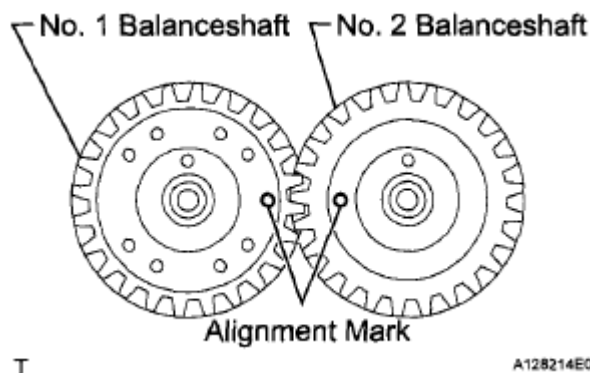
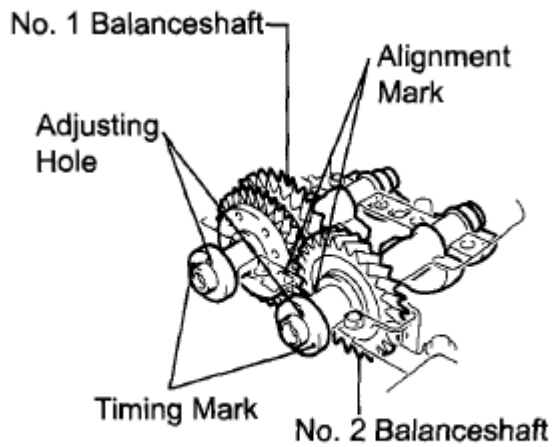


Fig. 295: Aligning Marks On No. 1 And No. 2 Balancshafts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Align the alignment marks on the No. 1 and No. 2 balancshafts as shown in the illustration.
- d. Place the No. 1 and No. 2 balancshafts onto the crankcase.
- e. Apply a light coat of engine oil to the threads and under the heads of the bolts.



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Fig. 296: Aligning Marks On No. 1 And No. 2 Balancershafts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Torque: 22 N*m (220 kgf*cm, 16 ft.*lbf)

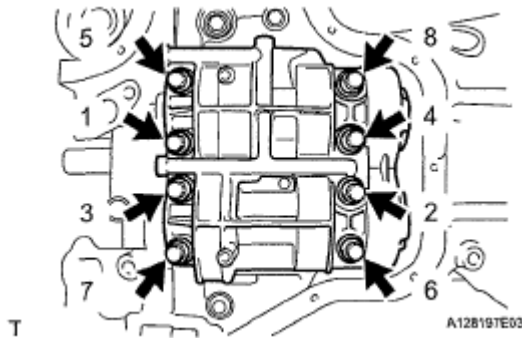


Fig. 297: Tightening Bolts Sequence
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Mark the front of the bolts with paint.

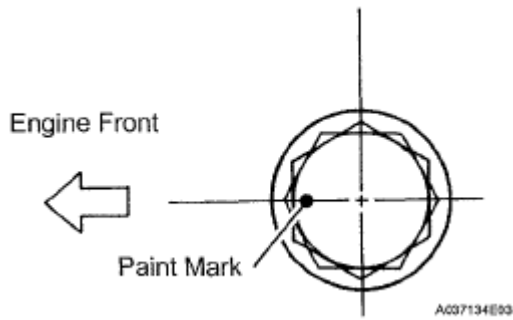


Fig. 298: [Identifying Paint Mark On Bolt]
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- h. Further tighten the bolts 90° as shown in the illustration.
- i. Check that the paint mark is now at a 90° angle to the front.

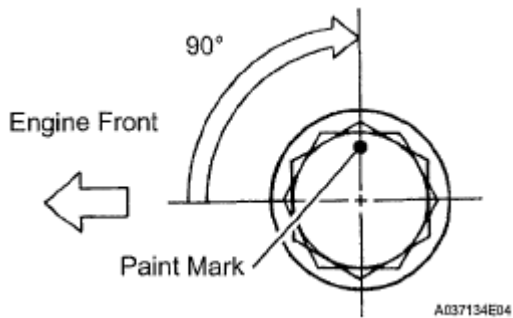


Fig. 299: Identifying Bolt Tightening Angle
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. INSTALL STIFFENING CRANKCASE ASSEMBLY

- a. Place a new O-ring on the cylinder block as shown in the illustration.

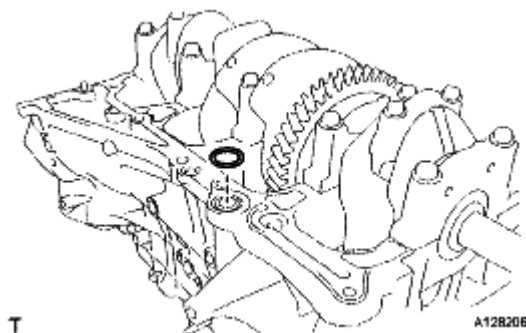


Fig. 300: Identifying O-Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. With the No. 1 crank pin of the crankshaft placed at the TDC position, install the No. 1 and No. 2 balanceshafts and align the adjusting holes as shown in the illustration.

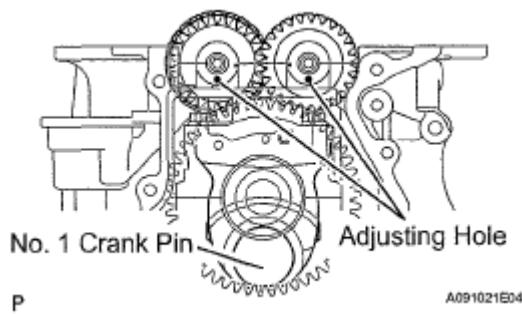


Fig. 301: Aligning Adjusting Holes

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

- c. Apply a continuous bead of seal packing (Diameter 2.5 to 3.0 mm (0.098 to 0.118 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 crankcase within 3 minutes of applying seal packing.
- Do not add engine oil for at least 2 hours after installing the crankcase.

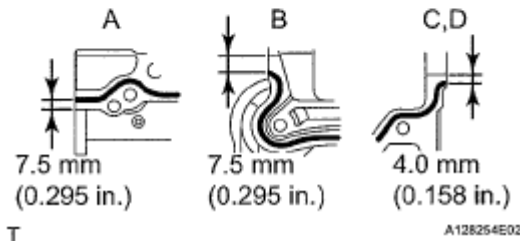
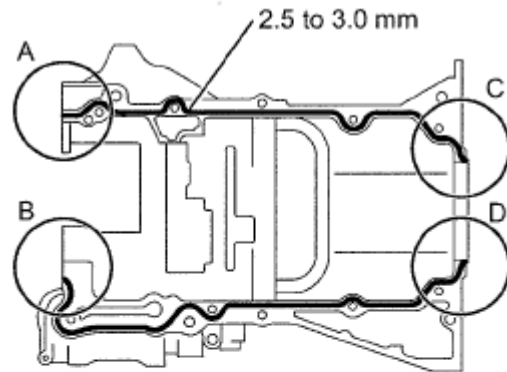


Fig. 302: Identifying Seal Packing Applying Area

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

- d. Temporarily install the crankcase with the 11 bolts.

BOLT LENGTH SPECIFICATION

Item	Bolt Length
A	125 mm (4.92 in.)
B	45 mm (1.77 in.)

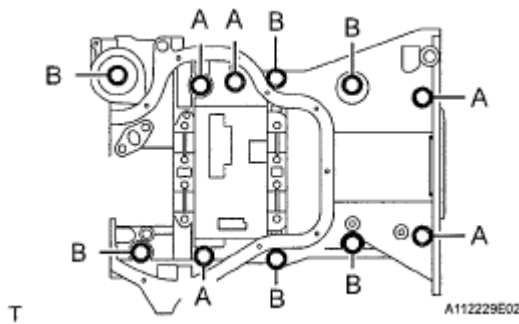


Fig. 303: Identifying Crankcase With Bolts

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

- e. Uniformly tighten the bolts.

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

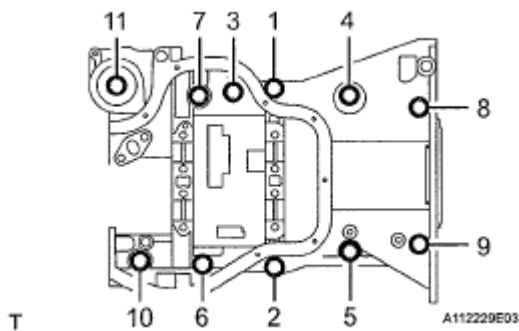


Fig. 304: Identifying Crankcase Bolts Tightening Sequence

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

- f. Confirm that the timing marks on the balanceshafts are aligned when the key groove is placed at the TDC position, as shown in the illustration.

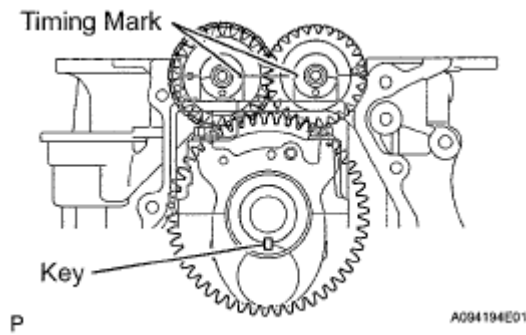


Fig. 305: Identifying Timing Mark Location
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. INSTALL OIL PUMP ASSEMBLY (See INSTALLATION)
5. INSTALL REAR CRANKSHAFT OIL SEAL (See INSTALLATION)
6. INSTALL NO. 1 TAPER HEAD SCREW PLUG
 - a. Apply adhesive to 2 or 3 threads of the plug, and install it.

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

Adhesive:

Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

NOTE:

- Install the plug within 3 minutes of applying adhesive.
- Do not add coolant for at least an hour after installing the plug.

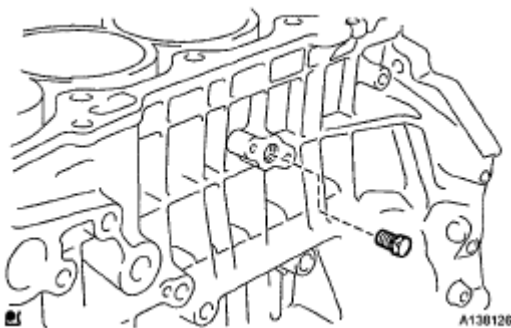


Fig. 306: Identifying No. 1 Taper Head Screw Plug
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. INSTALL OIL CONTROL VALVE FILTER
 - a. Check that there are no foreign objects on the mesh part of the oil control valve filter.
 - b. Using an 8 mm socket hexagon wrench, install a new gasket and the oil control valve filter with the plug.

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

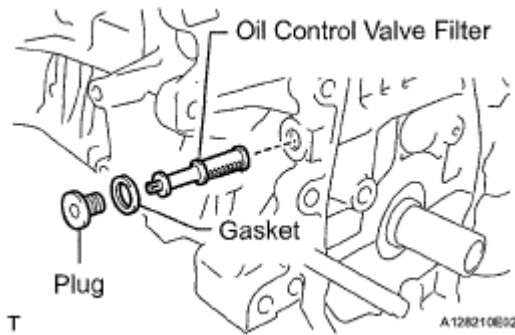


Fig. 307: Identifying Gasket And Oil Control Valve Filter With Plug
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. INSTALL CYLINDER BLOCK WATER DRAIN COCK SUB-ASSEMBLY

- a. Apply adhesive to 2 or 3 threads of the drain cock.

Adhesive:

Toyota Genuine Adhesive 1344, Three Bond 1344 or equivalent

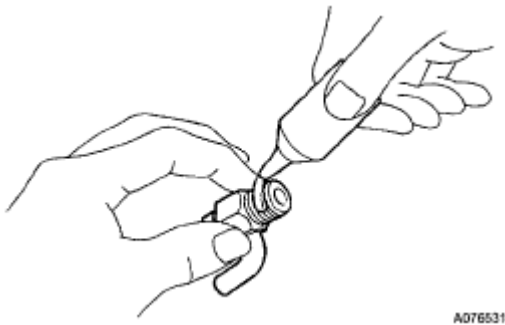


Fig. 308: Identifying Adhesive Applying Area To Drain Cock
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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 cocks more than 1 revolution (360°) after tightening the drain cock to the specified torque.

- c. Install the water drain cock plug to the water drain cock.

Torque: 13 N*m (130 kgf*cm, 9 ft.*lbf)

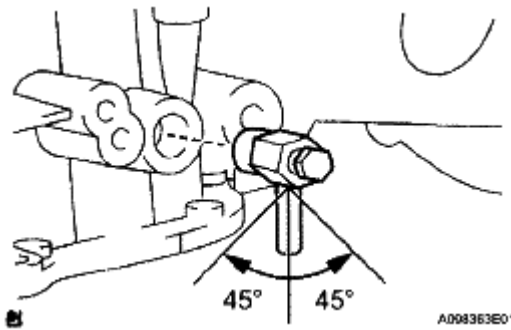


Fig. 309: Tightening Drain Cock To Specified Torque
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. 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.

10. INSTALL CYLINDER HEAD GASKET (See INSTALLATION)

11. INSTALL CYLINDER HEAD SUB-ASSEMBLY (See INSTALLATION)

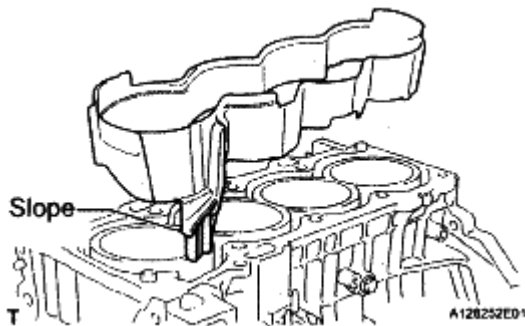


Fig. 310: Identifying Water Jacket Spacer In Illustration
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

- a. Apply a light coat of engine oil onto a new O-ring.
- b. Install the O-ring to the camshaft timing oil control valve.

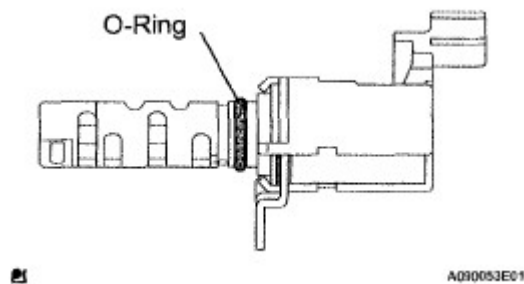


Fig. 311: Identifying Camshaft Timing Oil Control Valve O-Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the camshaft timing oil control valve with the bolt.

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

13. INSTALL CAMSHAFT TIMING GEAR ASSEMBLY (See INSTALLATION)

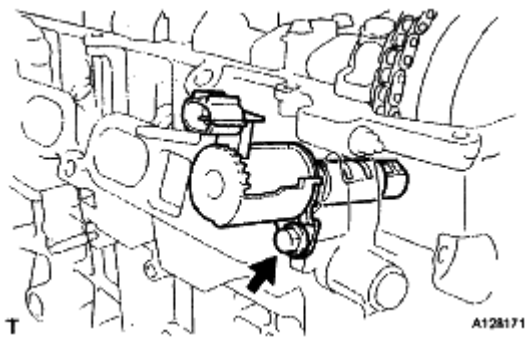


Fig. 312: Locating Camshaft Timing Oil Control Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. INSTALL CAMSHAFT TIMING GEAR OR SPROCKET

- a. Clamp the camshaft in a vise, then install the camshaft timing sprocket with the bolt.

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

15. INSTALL NO. 1 CAMSHAFT BEARING

- a. Clean the installation surfaces and the inner and outer surfaces of the bearing.

NOTE: **Keep the installation surfaces and the back surfaces of the bearing free of engine oil.**

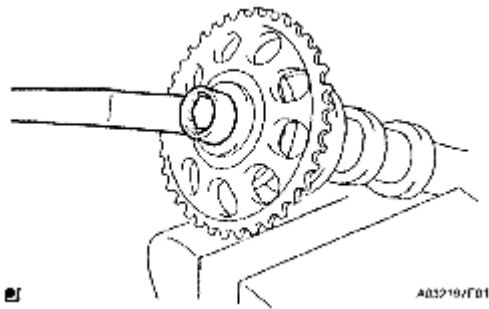


Fig. 313: Removing/Installing Camshaft Timing Gear With Vise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Align the claws and install the No. 1 camshaft bearing onto the No. 1 camshaft bearing cap.

16. INSTALL NO. 2 CAMSHAFT BEARING

- a. Clean the installation surfaces and the inner and outer surfaces of the bearing.

NOTE: Keep the installation surfaces and the back surfaces of the bearing free of engine oil.

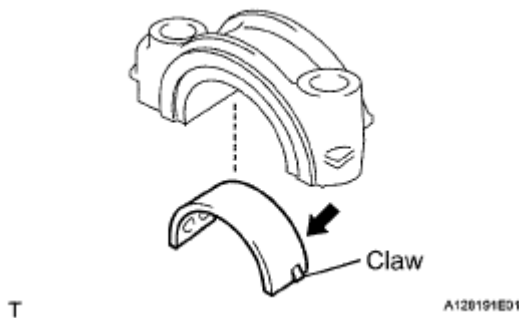


Fig. 314: Locating No. 2 Camshaft Bearing Claw
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

17. INSTALL CAMSHAFT

- a. Apply a light coat of engine oil to the journal portion.



Fig. 315: Identifying No. 2 Camshaft Bearing Installation Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

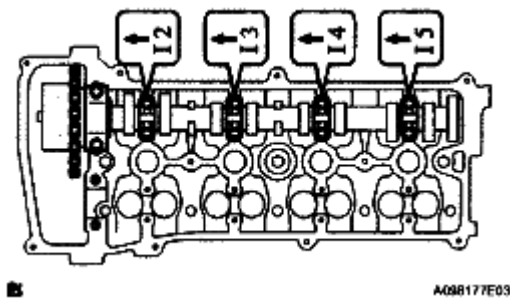


Fig. 316: Identifying Bearing Caps Installing Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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)

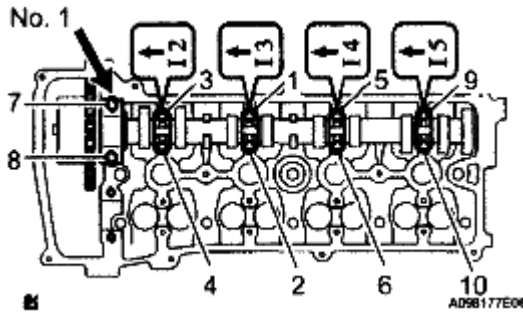


Fig. 317: Identifying Bearing Caps Bolts Tightening Sequence

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

18. 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.
- Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.

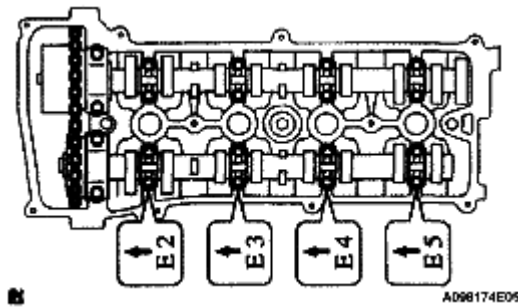


Fig. 318: Identifying No. 2 Camshaft Bearing Caps Installing Sequence

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

- 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)

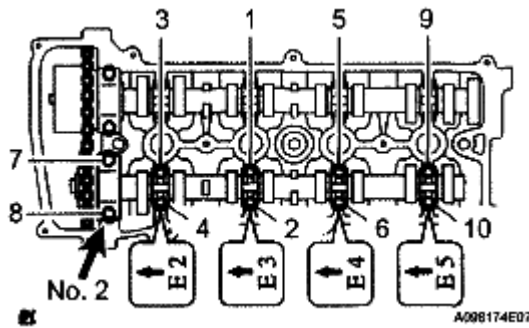


Fig. 319: Identifying No. 2 Camshaft Bearing Caps Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

19. INSTALL KEYS

- a. Install the 2 keys.

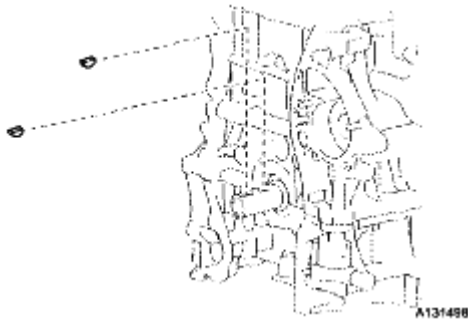


Fig. 320: Identifying Pulley Set Keys
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

20. INSTALL NO. 2 CHAIN SUB-ASSEMBLY (See INSTALLATION)
21. INSTALL CRANKSHAFT TIMING GEAR OR SPROCKET (See INSTALLATION)
22. INSTALL NO. 1 CHAIN VIBRATION DAMPER (See INSTALLATION)
23. INSTALL CHAIN SUB-ASSEMBLY (See INSTALLATION)
24. INSTALL CHAIN TENSIONER SLIPPER (See INSTALLATION)
25. INSTALL TIMING CHAIN GUIDE (See INSTALLATION)
26. INSTALL NO. 1 CRANKSHAFT POSITION SENSOR PLATE (See INSTALLATION)
27. INSTALL FRONT CRANKSHAFT OIL SEAL (See INSTALLATION)
28. INSTALL TIMING CHAIN OR BELT COVER SUB-ASSEMBLY (See INSTALLATION)
29. INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY (See INSTALLATION)
30. INSTALL V-RIBBED BELT TENSIONER ASSEMBLY (See INSTALLATION)
31. INSTALL CRANKSHAFT POSITION SENSOR
 - a. Apply a light coat of engine oil to the O-ring of the sensor.

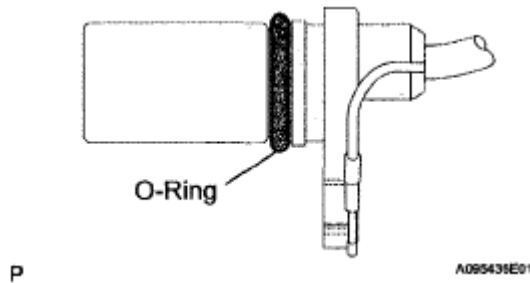


Fig. 321: Identifying Crankshaft Position Sensor O-Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Confirm that the wire harness of the sensor is placed as shown in the illustration.

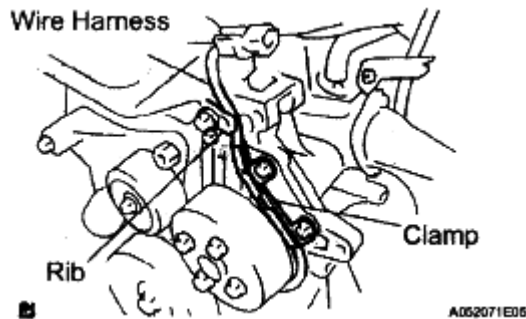


Fig. 322: Identifying Wire Harness With Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the sensor with the 2 bolts.

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

- d. Install the clamp of the crankshaft position sensor onto the water pump.

32. INSTALL OIL PAN SUB-ASSEMBLY (See INSTALLATION)

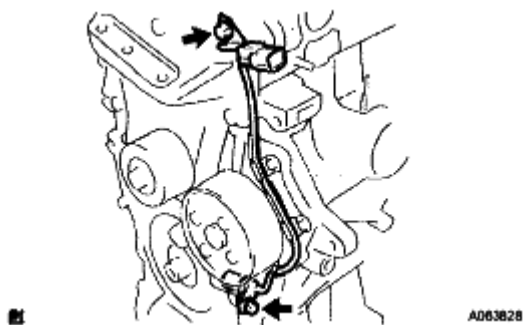


Fig. 323: Locating Crankshaft Position Sensor And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

33. INSTALL OIL PAN DRAIN PLUG

- a. Install the oil pan drain plug with a new gasket.

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

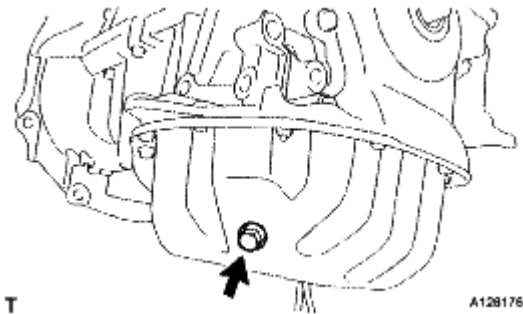


Fig. 324: Locating Oil Pan Drain Plug

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

34. **INSTALL WATER PUMP ASSEMBLY** (See INSTALLATION)
35. **INSTALL WATER PUMP PULLEY** (See INSTALLATION)
36. **INSTALL CRANKSHAFT PULLEY** (See INSTALLATION)
37. **INSPECT VALVE CLEARANCE** (See VALVE CLEARANCE)
38. **ADJUST VALVE CLEARANCE** (See VALVE CLEARANCE)
39. **INSTALL CAMSHAFT POSITION SENSOR**

- a. Apply a light coat of engine oil onto the O-ring of the sensor.

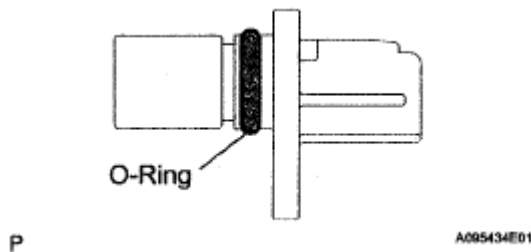


Fig. 325: Identifying Camshaft Position Sensor O-Ring

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

- b. Install the camshaft position sensor with the bolt.

Torque: 9 0 N*m (92 kgf*cm, 80 in.*lbf)

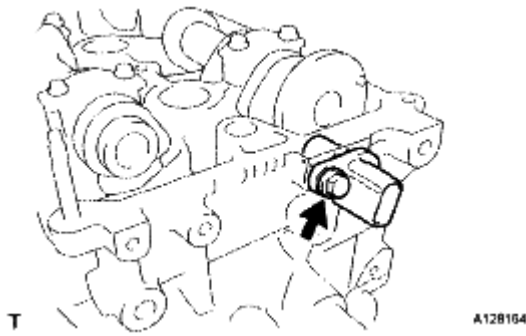


Fig. 326: Locating Camshaft Position Sensor And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

40. INSTALL CYLINDER HEAD COVER GASKET

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

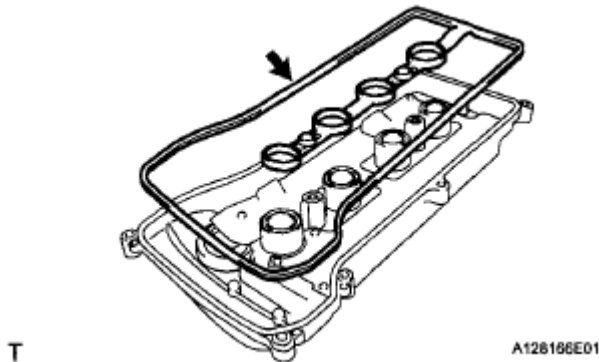


Fig. 327: Identifying Cylinder Head Cover Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

41. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY

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

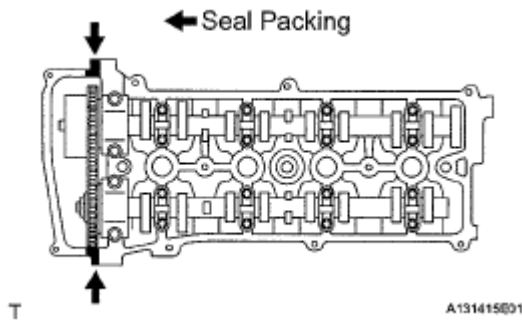


Fig. 328: Identifying Seal Packing Applying Area
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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)

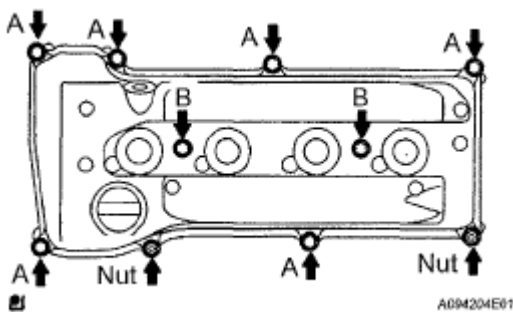


Fig. 329: Locating Cylinder Head Cover Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

42. INSTALL OIL FILTER UNION

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

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

43. INSTALL OIL FILTER SUB-ASSEMBLY (See REPLACEMENT)

44. INSTALL SPARK PLUG (See INSTALLATION)

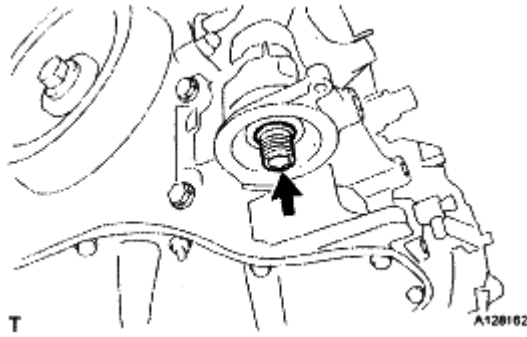


Fig. 330: Locating Oil Filter Union

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

45. INSTALL VENTILATION VALVE SUB-ASSEMBLY

- a. Apply adhesive to the threads of the ventilation valve.

Adhesive:

Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

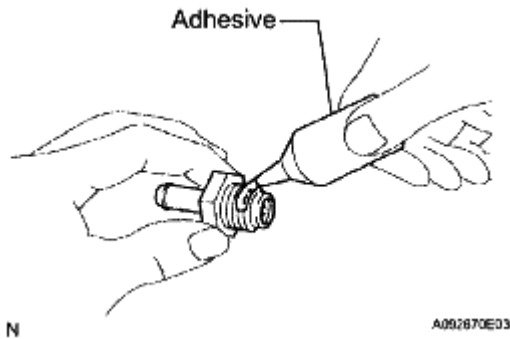
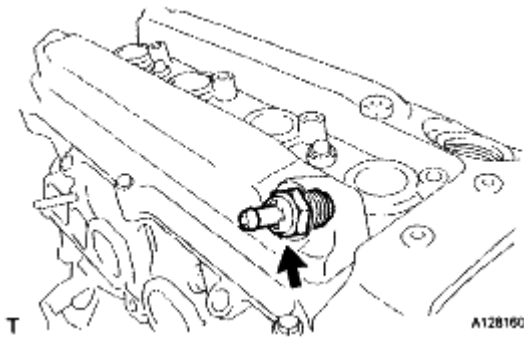


Fig. 331: Applying Adhesive To Threads Of Ventilation Valve

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

- b. Using a 22 mm deep socket wrench, install the ventilation valve onto the cylinder head cover.

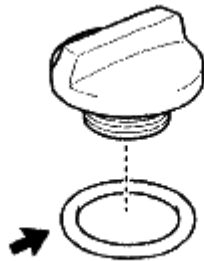
Torque: 19 N*m (194 kgf*cm, 14 ft.*lbf)

**Fig. 332: Locating Ventilation Valve**

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

46. INSTALL OIL FILLER CAP GASKET

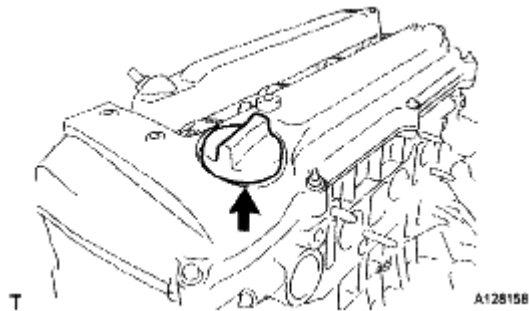
- a. Install the oil filler cap gasket onto the oil filler cap.

**Fig. 333: Locating Oil Filler Cap Gasket**

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

47. INSTALL OIL FILLER CAP SUB-ASSEMBLY

- a. Install the oil filler cap onto the cylinder head cover.

**Fig. 334: Locating Oil Filler Cap**

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

INSTALLATION**1. INSTALL RADIO SETTING CONDENSER**

- a. Install the condenser with the bolt.

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

2. **INSTALL ENGINE COOLANT TEMPERATURE SENSOR** (See INSPECTION)
3. **INSTALL OIL PRESSURE SWITCH** (See INSTALLATION)
4. **INSTALL KNOCK SENSOR** (See INSTALLATION)

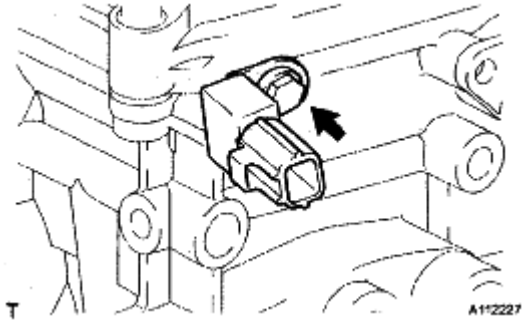


Fig. 335: Locating Radio Setting Condenser
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. **INSTALL IGNITION COIL ASSEMBLY** (See INSTALLATION)
6. **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)

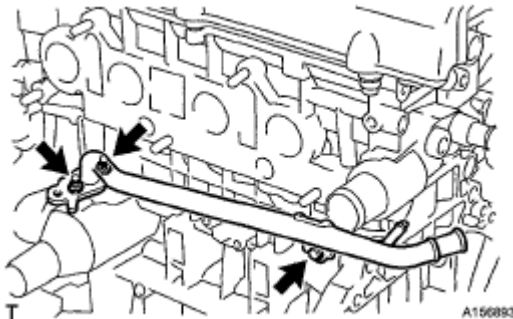


Fig. 336: Locating No. 1 Water By-Pass Pipe Nuts And Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. **INSTALL ENGINE OIL DIPSTICK GUIDE** (See INSTALLATION)
8. **INSTALL ENGINE OIL DIPSTICK**
9. **INSTALL THERMOSTAT** (See INSTALLATION)
10. **INSTALL WATER INLET** (See INSTALLATION)
11. **INSTALL EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY** (See INSTALLATION)

12. **INSTALL NO. 2 MANIFOLD STAY** (See INSTALLATION)
13. **INSTALL MANIFOLD STAY** (See INSTALLATION)
14. **INSTALL NO. 1 EXHAUST MANIFOLD HEAT INSULATOR** (See INSTALLATION)
15. **INSTALL NO. 1 INTAKE MANIFOLD INSULATOR**
 - a. Install the No. 1 intake manifold insulator onto the cylinder block.
16. **INSTALL INTAKE MANIFOLD** (See INSTALLATION)
17. **INSTALL FUEL INJECTOR ASSEMBLY** (See INSTALLATION)
18. **INSTALL FUEL DELIVERY PIPE SUB-ASSEMBLY** (See INSTALLATION)

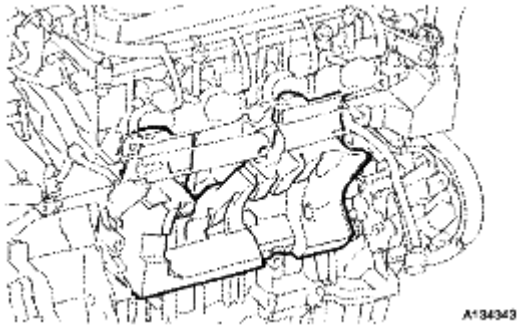


Fig. 337: Identifying No. 1 Intake Manifold Insulator
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

CYLINDER HEAD

COMPONENTS

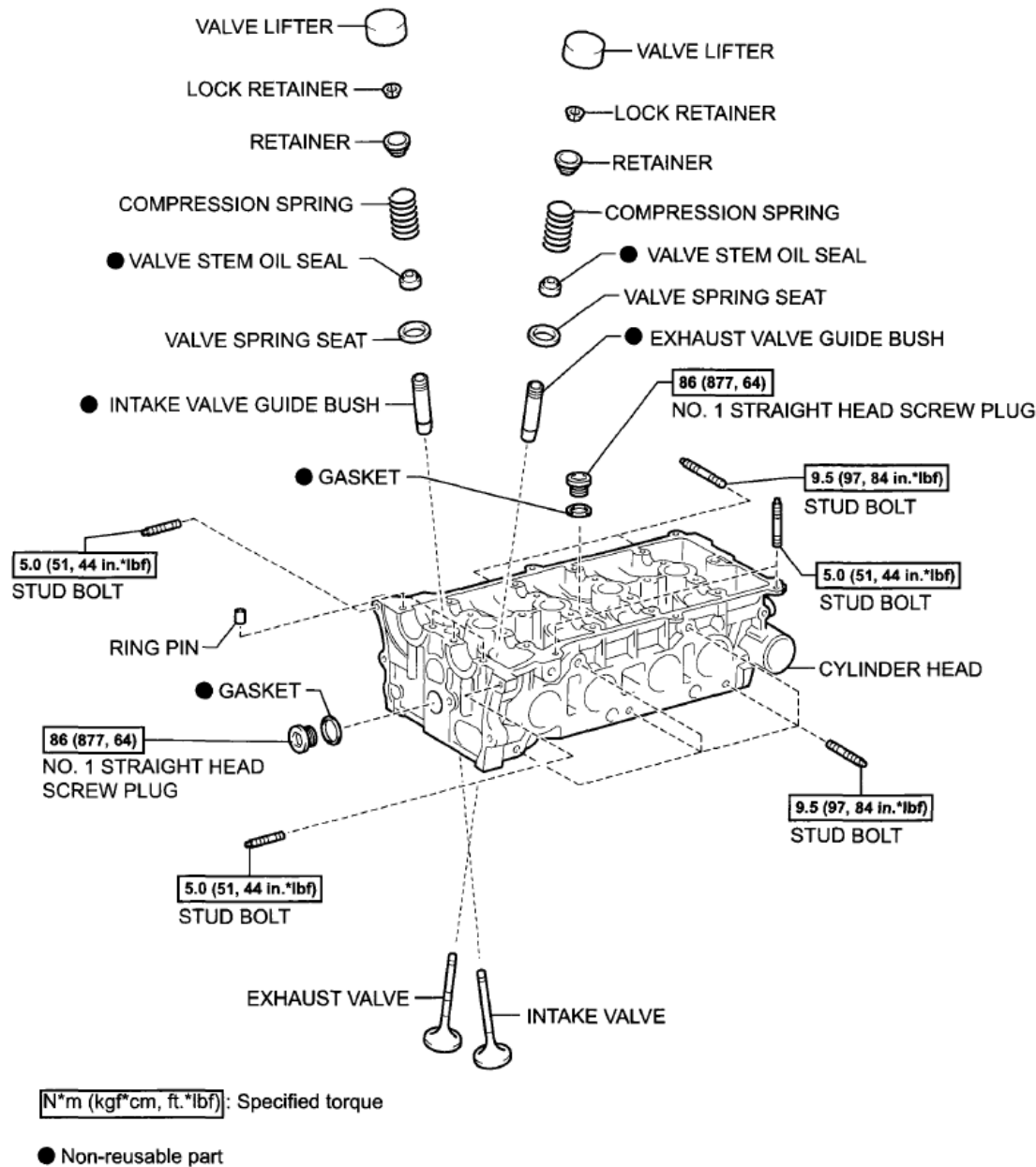


Fig. 338: Identifying Cylinder Head Components With Torque Specifications
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

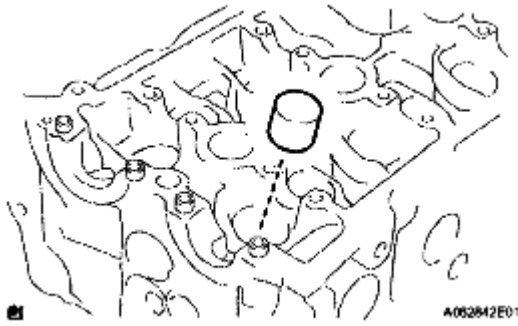
DISASSEMBLY

1. REMOVE VALVE LIFTER

- Remove the 16 valve lifters from the cylinder head.

HINT:

Arrange the valve lifters in the correct order.

**Fig. 339: Identifying Valve Lifters**

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

2. REMOVE INTAKE VALVE

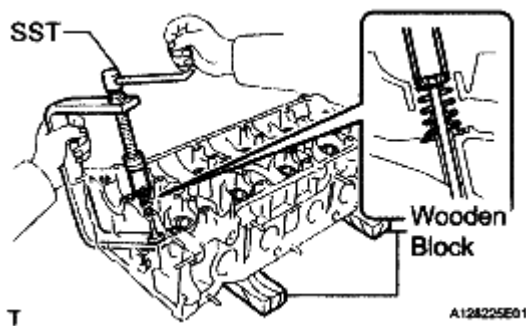
- a. Using SST and wooden blocks, remove the 16 retainer locks.

SST 09202-70020 (09202-00010)

- b. Remove the 8 retainers, compression springs and intake valves.

HINT:

Arrange the removed parts in the correct order.

**Fig. 340: Removing/Installing Springs And Intake Valves**

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

3. REMOVE EXHAUST VALVE

- a. Using SST and wooden blocks, remove the 16 retainer locks.

SST 09202-70020 (09202-00010)

- b. Remove the 8 retainers, compression springs and exhaust valves.

HINT:

Arrange the removed parts in the correct order.

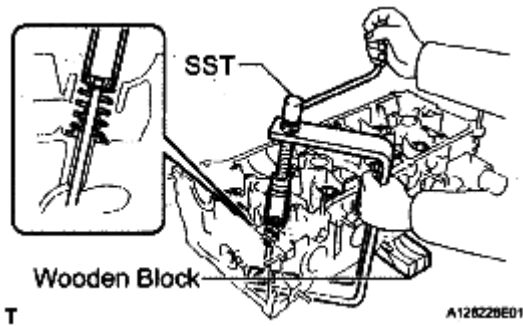


Fig. 341: Removing/Installing Springs And Retainer Locks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. REMOVE VALVE STEM OIL SEAL

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



Fig. 342: Removing 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.

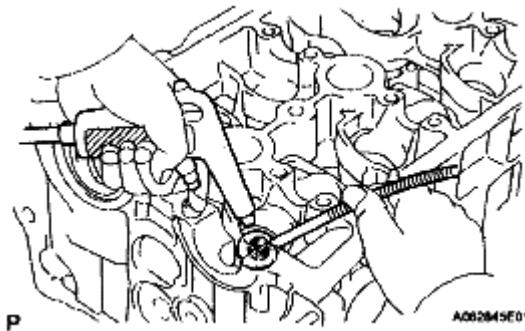


Fig. 343: Removing Valve Spring Seats
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. REMOVE NO. 1 STRAIGHT HEAD SCREW PLUG

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

NOTE: If water leaks from any straight screw plug or a plug is corroded, replace it.

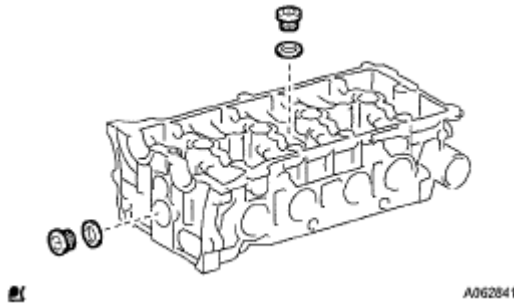


Fig. 344: Identifying Screw Plugs And Gaskets
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. REMOVE STUD BOLT
8. REMOVE RING PIN

INSPECTION

1. INSPECT CYLINDER HEAD FOR WARPAGE

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

Maximum Warpage

CYLINDER BLOCK SIDE SPECIFICATION

Item	Specified Condition
Cylinder block side	0.08 mm (0.00315 in.)
Intake manifold side	0.08 mm (0.00315 in.)
Exhaust manifold side	0.08 mm (0.00315 in.)

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

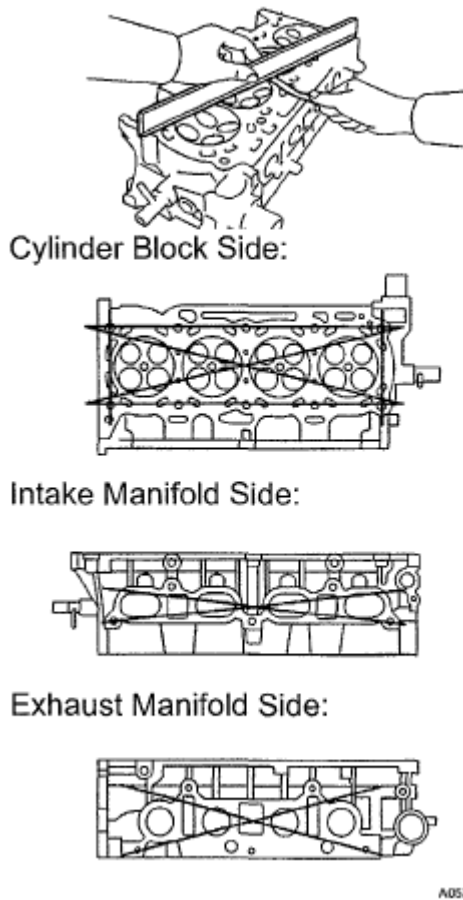


Fig. 345: Measuring Surface Contacting Cylinder Block And Manifolds For Warpage
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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.

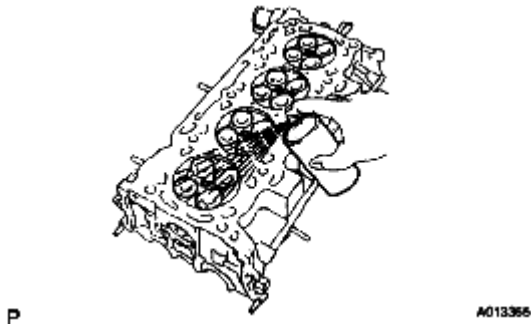


Fig. 346: Checking Intake Ports, Exhaust Ports And Cylinder Surface For Cracks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. 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

THRUST CLEARANCE SPECIFICATION

Item	Specified Condition
Intake	0.040 to 0.095 mm (0.00157 to 0.00374 in.)
Exhaust	0.090 to 0.145 mm (0.00354 to 0.00570 in.)

Maximum Thrust Clearance

THRUST CLEARANCE SPECIFICATION

Item	Specified Condition
Intake	0.110 mm (0.00433 in.)
Exhaust	0.150 mm (0.00591 in.)

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

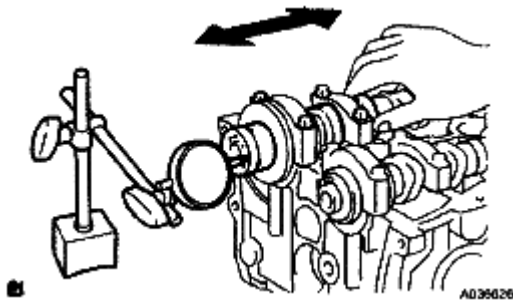


Fig. 347: Measuring Camshaft Thrust Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. 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.
- d. Install the bearing caps (See **INSTALLATION**).

NOTE: Do not turn the camshaft.

- e. Remove the bearing caps (See **REMOVAL**).

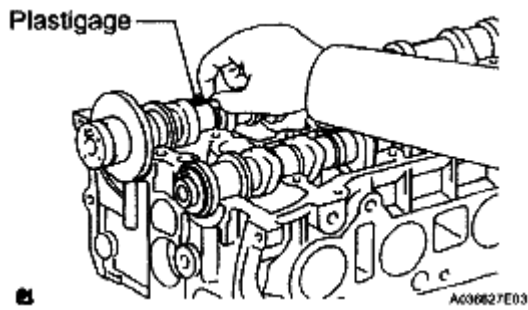


Fig. 348: Laying Strip Of Plastigage Across Each Of Camshaft Journals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Measure the Plastigage at its widest point.

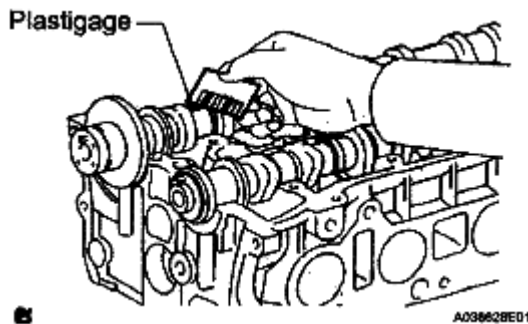


Fig. 349: Measuring Plastigage At Widest Point
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard Oil Clearance

OIL CLEARANCE SPECIFICATION

Item	Specified Condition
Camshaft No. 1 journal bearing mark 1	0.007 to 0.038 mm (0.000276 to 0.00150 in.)
Camshaft No. 1 journal bearing mark 2	0.008 to 0.038 mm (0.000315 to 0.00150 in.)
Camshaft No. 1 journal bearing mark 3	0.008 to 0.038 mm (0.000315 to 0.00150 in.)
Camshaft other journals	0.025 to 0.062 mm (0.000984 to 0.00244 in.)
No. 2 camshaft No. 1 journal	0.040 to 0.072 mm (0.00157 to 0.00283 in.)
No. 2 camshaft other journals	0.025 to 0.062 mm (0.000984 to 0.00244 in.)

Maximum Oil Clearance

OIL CLEARANCE SPECIFICATION

Item	Specified Condition
Intake	0.070 mm (0.00276 in.)
Exhaust	0.100 mm (0.00394 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

CYLINDER HEAD JOURNAL BORE DIAMETER SPECIFICATION

Mark 1	Mark 2	Mark 3
40.000 to 40.009 mm (1.5748 to 1.5752 in.)	40.010 to 40.017 mm (1.5752 to 1.5755 in.)	40.018 to 40.025 mm (1.5755 to 1.5758 in.)

Bearing Center Wall Thickness

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.)

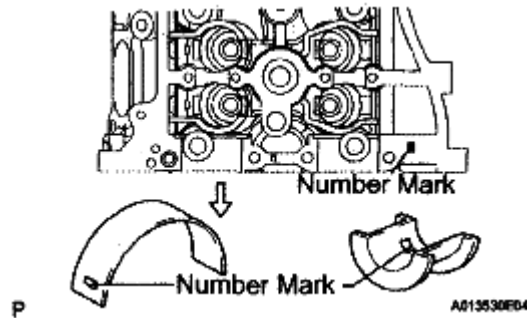


Fig. 350: Identifying Number Mark On Bearing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Camshaft journal diameter:

35.971 to 35.985 mm (1.4162 to 1.4167 in.)

5. INSPECT INNER COMPRESSION SPRING

- a. Using a vernier caliper, 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.

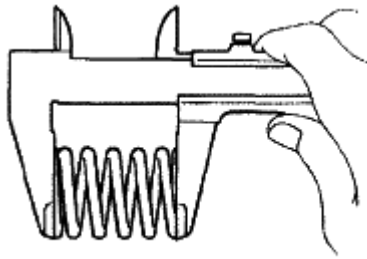


Fig. 351: Measuring Free Length Of Valve Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a steel set square, 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.

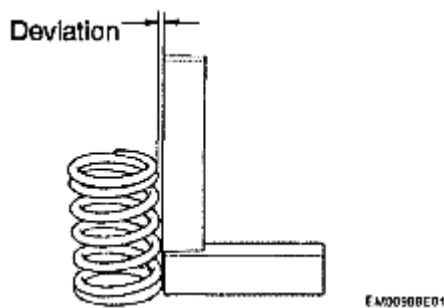


Fig. 352: Measuring Deviation Of Valve Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. INSPECT INTAKE VALVE

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

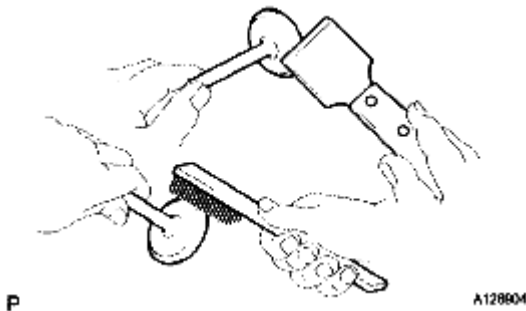


Fig. 353: Inspecting Intake Valve

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

- b. Using a vernier caliper, 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.

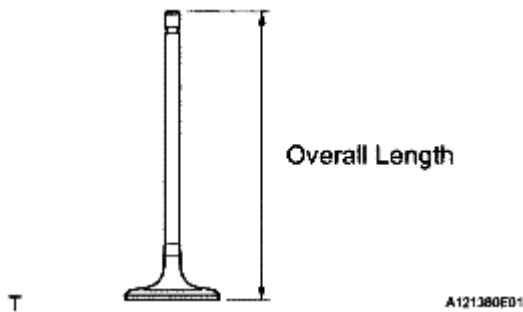


Fig. 354: Measuring Overall Length Of Valve

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 is not as specified, check the oil clearance.

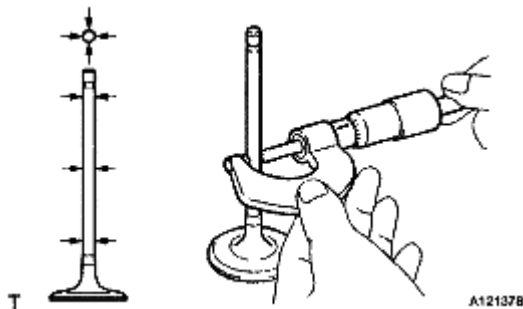


Fig. 355: Measuring Diameter Of Valve Stem

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

- d. Using a vernier caliper, 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.

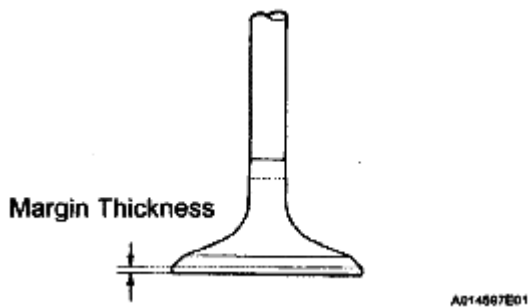


Fig. 356: Measuring Valve Head Margin Thickness
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. INSPECT EXHAUST VALVE

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

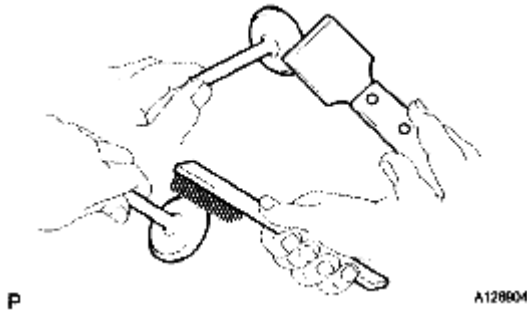


Fig. 357: Inspecting Intake Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a vernier caliper, 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.

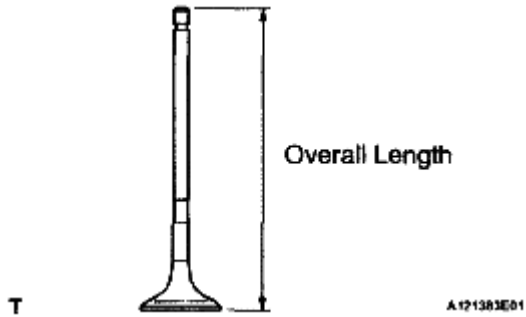


Fig. 358: Measuring Overall Length Of Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. 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 is not as specified, check the oil clearance.

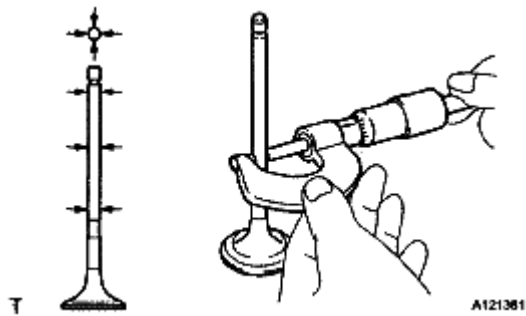


Fig. 359: Measuring Diameter Of Valve Stem
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Using a vernier caliper, 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.

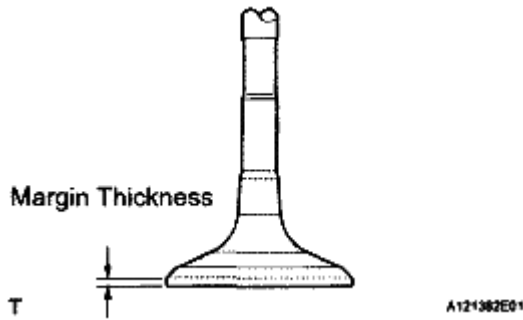


Fig. 360: Measuring Valve Head Margin Thickness
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. INSPECT INTAKE VALVE GUIDE BUSH

- 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.)

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

Standard oil clearance:

0.025 to 0.060 mm (0.0010 to 0.0024 in.)

Maximum oil clearance:

0.090 mm (0.0035 in.)

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

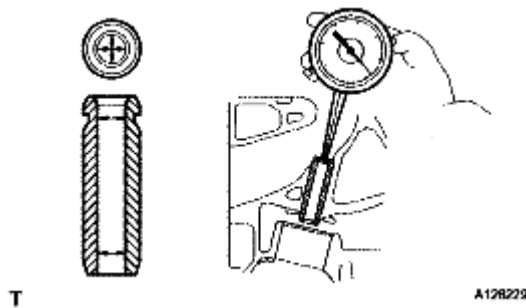


Fig. 361: Inspecting Intake Valve Guide Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. 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.)**

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

Standard oil clearance:**0.030 to 0.065 mm (0.0012 to 0.0026 in.)****Maximum oil clearance:****0.095 mm (0.0037 in.)**

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

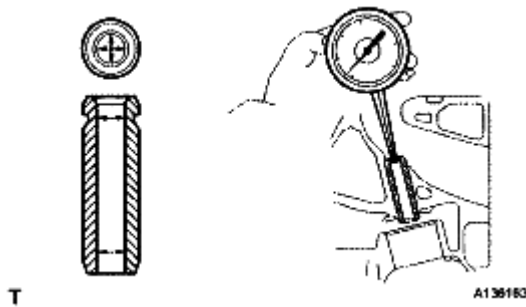


Fig. 362: Inspecting Exhaust Valve Guide Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. INSPECT VALVE LIFTER

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

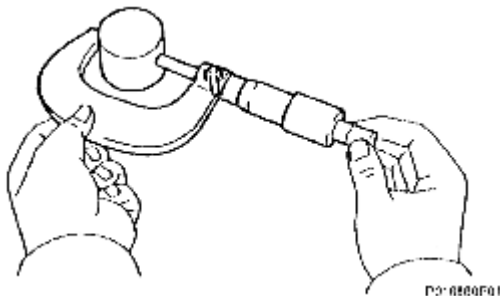
Lifter diameter:**30.966 to 30.976 mm (1.2191 to 1.2195 in.)**

Fig. 363: Measuring Lifter Diameter

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

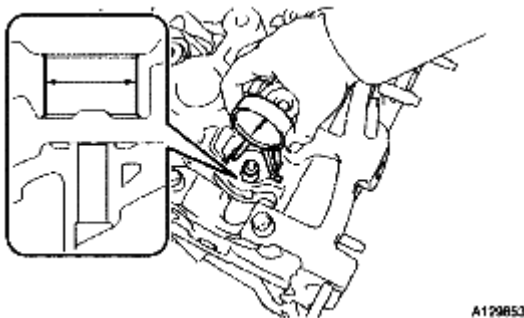
- b. Using a caliper gauge, measure the lifter bore diameter of the cylinder head.

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

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

Standard oil clearance:**0.033 to 0.059 mm (0.00130 to 0.00232 in.)****Maximum oil clearance:****0.079 mm (0.00311 in.)**

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

**Fig. 364: Measuring Lifter Bore Diameter Of Cylinder Head**

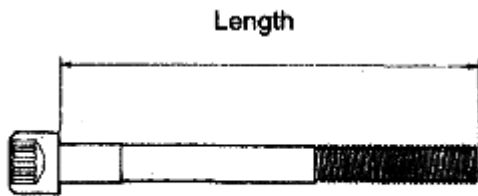
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. INSPECT CYLINDER HEAD SET BOLT

- a. Using a vernier caliper, measure the length of the head bolts 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.



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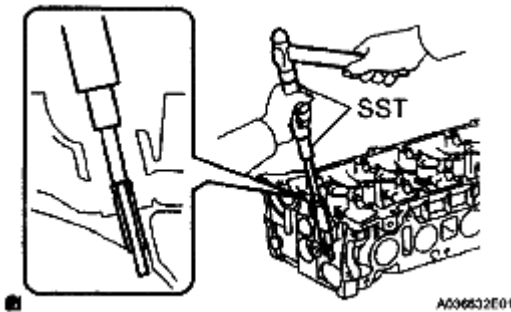
Fig. 365: Measuring Length Of Head Bolts From Seat To End
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REPLACEMENT

1. REMOVE INTAKE 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 09202-70020 (09202-00010)



A036532E01

Fig. 366: Removing Intake Valve Guide Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. 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 09202-70020(09202-00010)

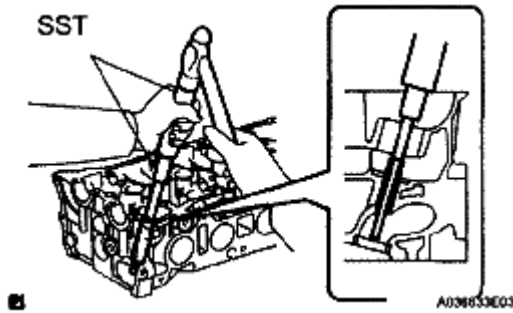


Fig. 367: Removing Exhaust Valve Guide Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. INSTALL INTAKE VALVE GUIDE BUSH

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

Cylinder head bush 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)

BUSH BORE DIAMETER SPECIFICATION

Bush Size	Bush Bore Diameter
Use STD	10.285 to 10.306 mm (0.4049 to 0.4057 in.)
Use O/S 0.05	10.335 to 10.356 mm (0.4069 to 0.4077 in.)

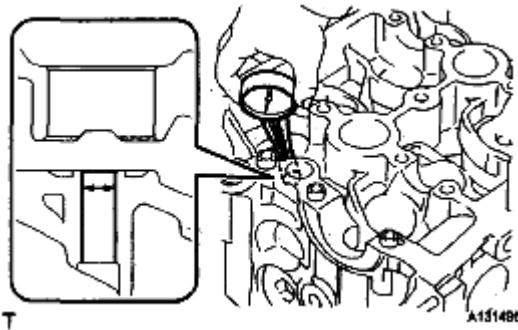


Fig. 368: Measuring Bush Bore Diameter Of Cylinder Head
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the cylinder head bush bore diameter is greater than 10.306 mm (0.4057 in.), machine the bush bore to a dimension of 10.335 to 10.356 mm (0.4069 to 0.4077 in.) and 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. (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.)

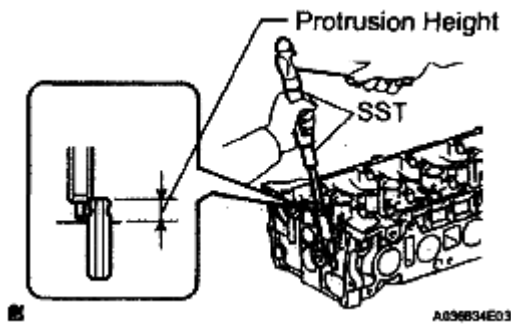


Fig. 369: Tapping Guide Bush To Specified Protrusion Height
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Standard oil clearance:

0.025 to 0.060 mm (0.0010 to 0.0024 in.)

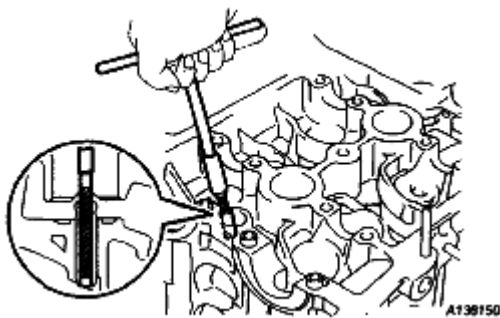


Fig. 370: Reaming Guide Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. INSTALL EXHAUST VALVE GUIDE BUSH

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

Cylinder head bush 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)

BUSH BORE DIAMETER SPECIFICATION

Bush Size	Bush Bore Diameter
Use STD	10.285 to 10.306 mm (0.4049 to 0.4057 in.)
Use O/S 0.05	10.335 to 10.356 mm (0.4069 to 0.4077 in.)

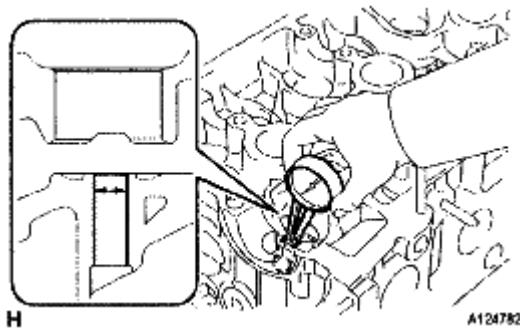


Fig. 371: Measuring Bush Bore Diameter Of Cylinder Head
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the cylinder head bush bore diameter is greater than 10.306 mm (0.4057 in.), machine the bush bore to a dimension of 10.335 to 10.356 mm (0.4069 to 0.4077 in.) and 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.)

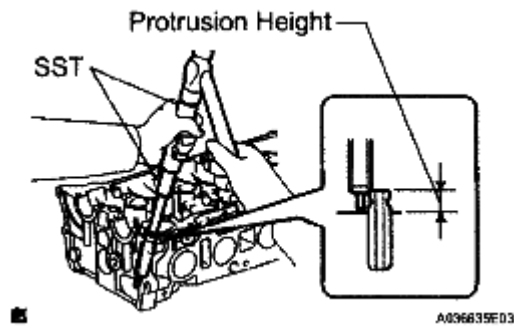


Fig. 372: Tapping Guide Bush To Specified Protrusion Height
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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 (0.00118 to 0.00256 in.)

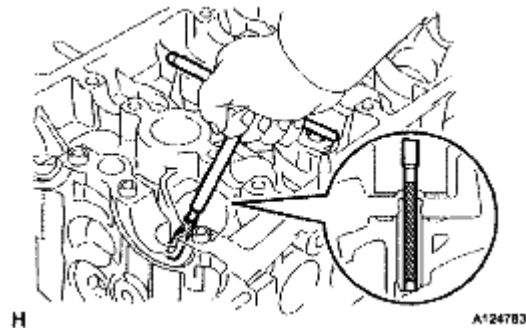


Fig. 373: Reaming Guide Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REASSEMBLY

1. INSTALL RING PIN

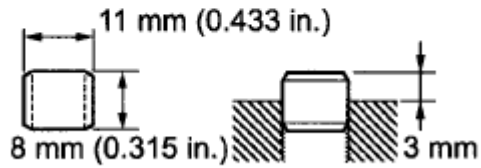
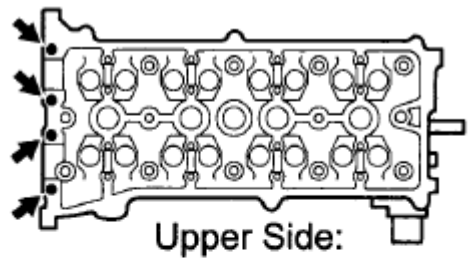
- a. Using a plastic-faced hammer, tap in a new ring pin to the specified protrusion height.

Protrusion height:

3 mm (0.118 in.)

2. INSTALL STUD BOLT

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



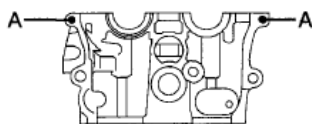
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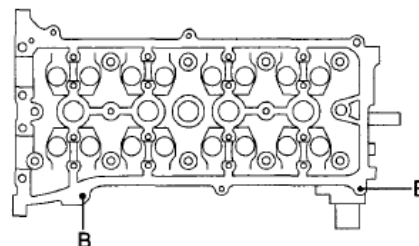
Fig. 374: Identifying Ring Pin Height
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

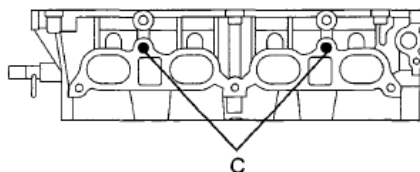
Front Side:



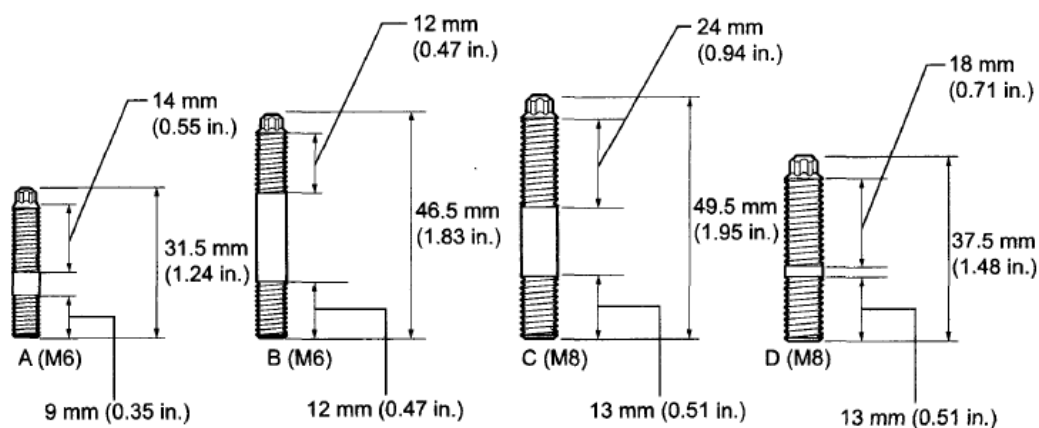
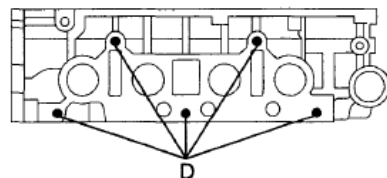
Upper Side:



Intake Side:



Exhaust Side:



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Fig. 375: Identifying Stud Bolts Height

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)

3. INSTALL NO. 1 STRAIGHT HEAD SCREW PLUG

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

Torque: 86 N*m (877 kgf*cm, 64 ft.*lbf)

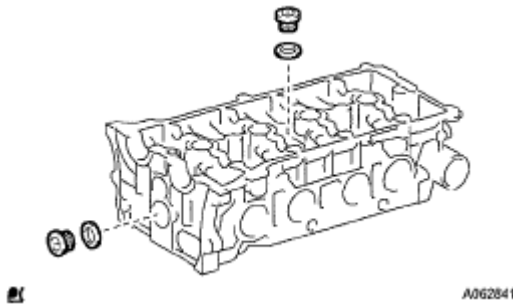


Fig. 376: Identifying Screw Plugs And Gaskets

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

4. INSTALL VALVE SPRING SEAT

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

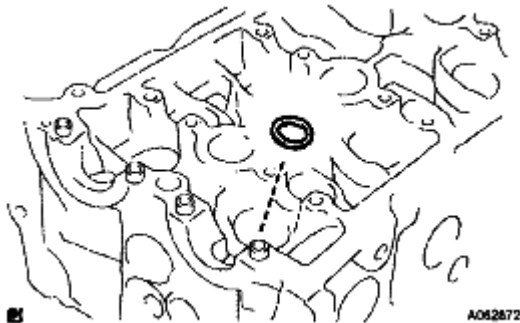


Fig. 377: Identifying Valve Spring Seats

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

5. INSTALL VALVE STEM OIL SEAL

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

NOTE: Pay close attention when installing the intake and exhaust oil seals. Installing the intake oil seal into the exhaust side or installing the exhaust oil seal into the intake side may cause installation problems later.

HINT:

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

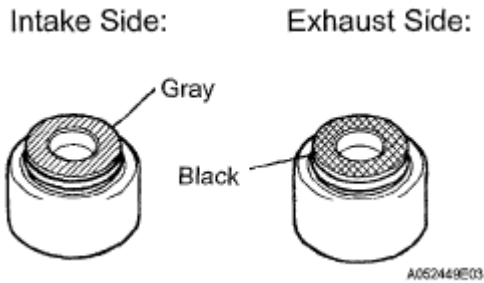


Fig. 378: Identifying Intake And Exhaust Oil Seals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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.

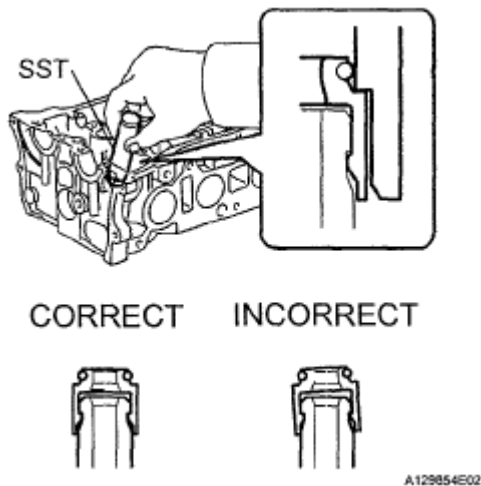


Fig. 379: Identifying Oil Seal Correct And Incorrect Installation Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. INSTALL INTAKE VALVE

- a. Apply a sufficient coat of engine oil to the tip area of the intake valve shown in the illustration.
- 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.

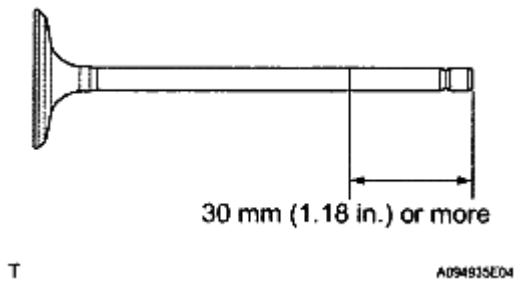


Fig. 380: Identifying Tip Area Of Intake Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

SST 09202-70020(09202-00010)

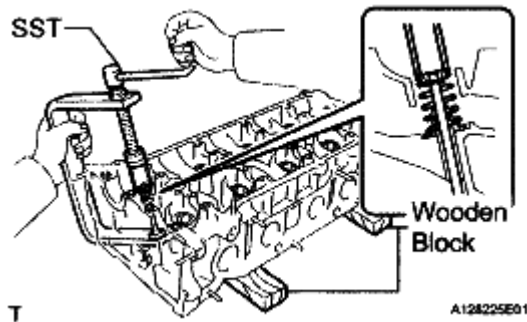


Fig. 381: Removing/Installing Springs And Intake Valves
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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.

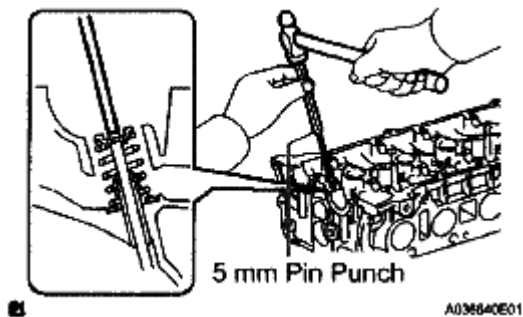


Fig. 382: Tapping Valve Stem
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. INSTALL EXHAUST VALVE

- a. Apply a sufficient coat of engine oil to the tip area of the intake valve shown in the illustration.
- 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.

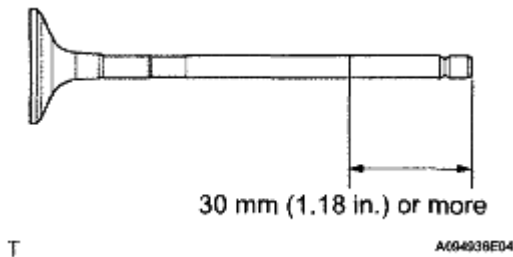


Fig. 383: Identifying Tip Area Of Exhaust Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

SST 09202-70020 (09202-00010)

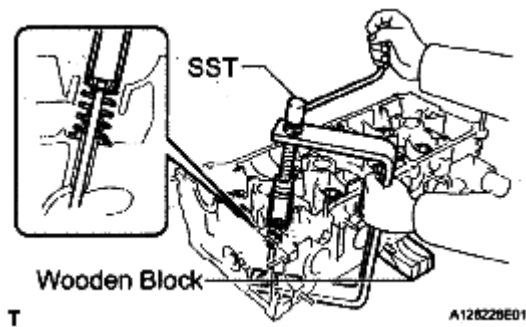


Fig. 384: Removing/Installing Springs And Retainer Locks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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.

8. INSTALL VALVE LIFTER

- a. Apply a light coat of engine oil to the valve lifters.

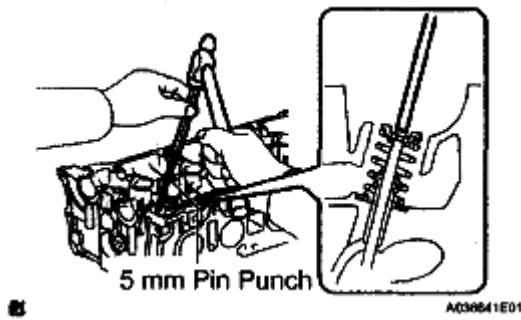


Fig. 385: Tapping Valve Stem

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

- b. Assemble the valve lifters and the tip of each valve stem.

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

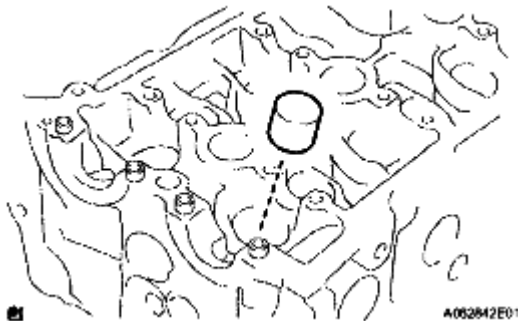


Fig. 386: Identifying Valve Lifters

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

REPAIR

1. 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 entire valve face, the valve face is concentric. If not, replace the valve.
 2. If prussian blue appears 360° around the entire valve seat, the guide and valve face are concentric. If not, resurface the valve seat.
 3. Check that the valve seat contact is in the middle of the valve seat width is between 1.0 and 1.4 mm (intake side (0.039 and 0.055 in.)).
 4. Check that the valve face width is between 1.2 and 1.6 mm (Exhaust side (0.047 and 0.063 in.)).

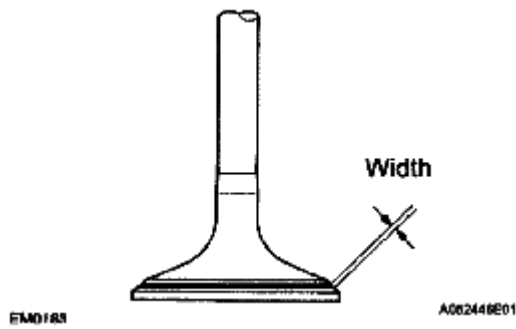


Fig. 387: Inspecting Valve Seat
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. 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.

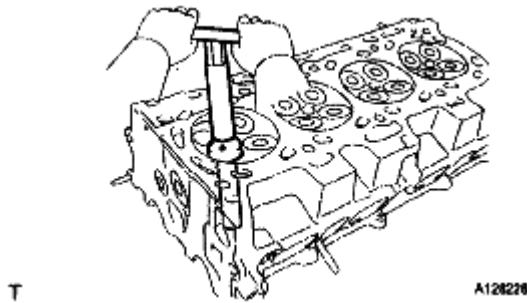


Fig. 388: Reaming Valve Seat
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using 30° to 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

VALVE SEAT WIDTH 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.)

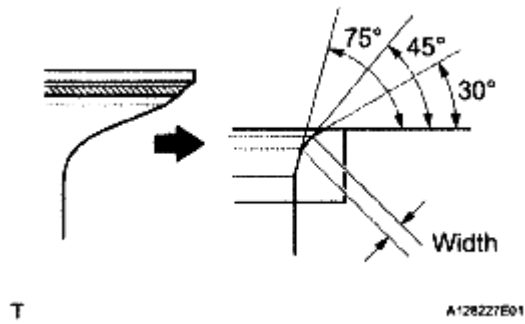


Fig. 389: Checking Valve Seating Position

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

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

CYLINDER BLOCK

COMPONENTS

2009 Toyota Matrix
2009 ENGINE Engine Mechanical (2AZ-FE) - Corolla Matrix

2009 Toyota Matrix
2009 ENGINE Engine Mechanical (2AZ-FE) - Corolla Matrix

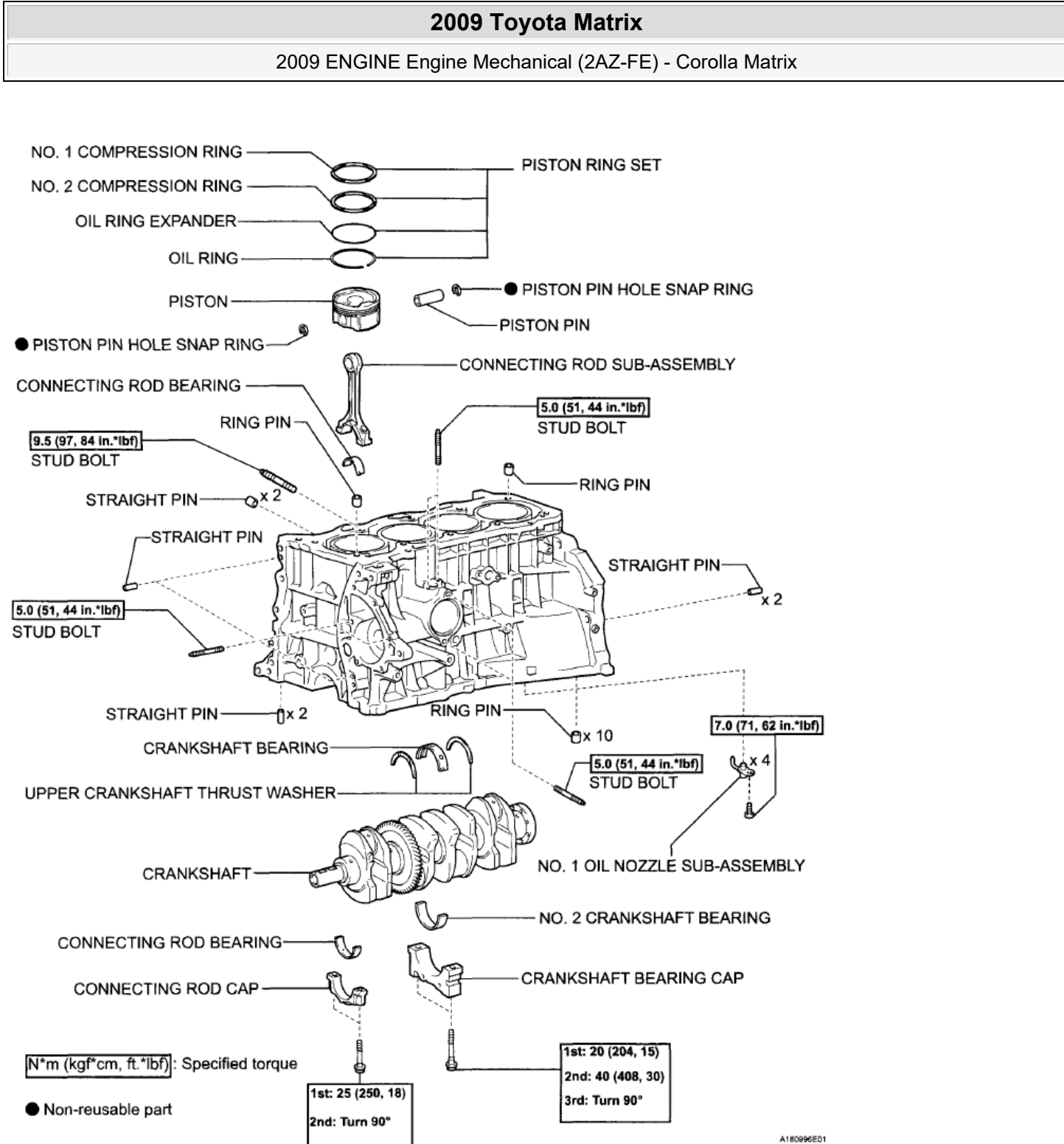


Fig. 390: Identifying Cylinder Block Components With Torque Specifications
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DISASSEMBLY

1. **INSPECT CONNECTING ROD THRUST CLEARANCE** (See **INSPECTION**)
2. **INSPECT CONNECTING ROD OIL CLEARANCE** (See **INSPECTION**)
3. **REMOVE PISTON SUB-ASSEMBLY WITH CONNECTING ROD**

- a. Check that the matchmarks on the connecting rod and cap are aligned to ensure the correct reassembly.

HINT:

The matchmarks on the connecting rods and caps are provided for ensuring the correct reassembly.

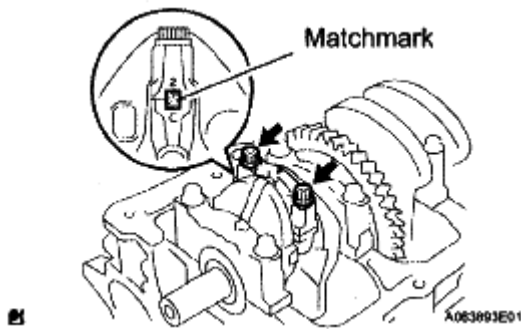


Fig. 391: Aligning Matchmarks Between Connecting Rods And Caps
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a 12 mm socket wrench, uniformly loosen and remove the 2 bolts.
- c. Using the 2 removed connecting rod cap bolts, remove the connecting rod cap and lower bearing by wiggling the connecting rod cap right and left.

HINT:

Keep the lower bearing inserted in the connecting rod cap.

- d. 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.

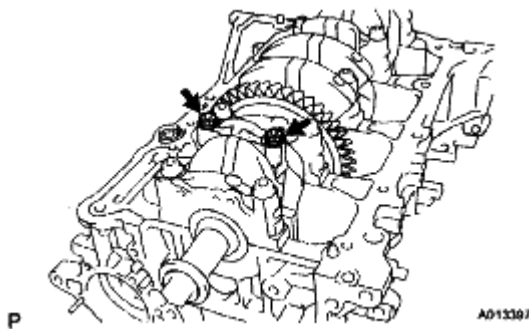


Fig. 392: Identifying Connecting Rods Caps Bolts

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

4. REMOVE CONNECTING ROD BEARING

- a. Remove the connecting rod bearings.

HINT:

Arrange the removed parts in the correct order.

5. REMOVE PISTON RING SET

- a. Using a piston ring expander, remove the 2 compression rings.
- b. Remove the oil ring rail and oil ring expander by hand.

HINT:

Arrange the removed parts in the correct order.

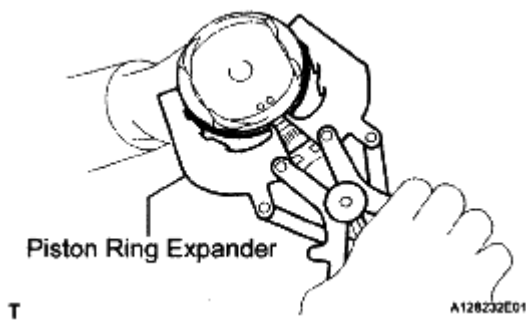


Fig. 393: Removing Piston Ring Set

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

6. REMOVE PISTON PIN HOLE SNAP RING

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

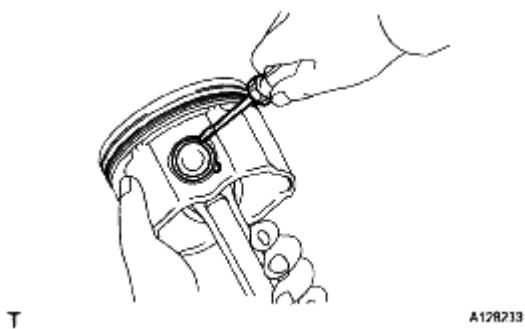


Fig. 394: Prying Out Snap Rings

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

7. REMOVE PISTON

- a. Gradually heat the piston to between 80 and 90°C (176 and 194°F).

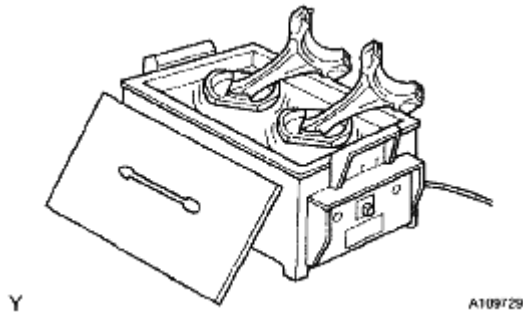


Fig. 395: Heating Piston To Between 80 And 90°C
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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, pin, rings, connecting rods and bearings in the correct order.

8. INSPECT CRANKSHAFT THRUST CLEARANCE (See INSPECTION)

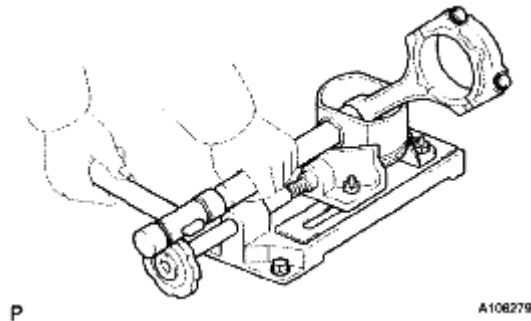


Fig. 396: Tapping Out Piston Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. REMOVE CRANKSHAFT

- a. Uniformly loosen and remove the 10 main bearing cap bolts in the sequence shown in the illustration.

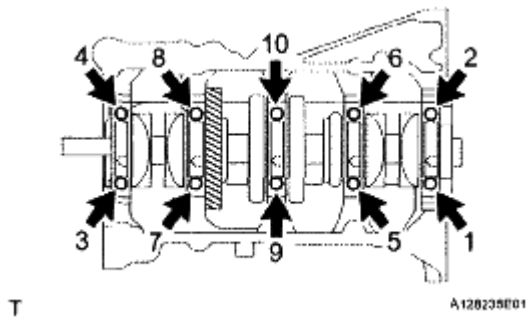


Fig. 397: Locating Main Bearing Cap Bolts

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

- b. Using 2 removed main bearing cap bolts, remove the 5 main bearing caps and 5 lower bearings.

NOTE: Insert the bolts into one of the caps. Ease the cap out by gently pulling up and applying force toward the front and back side of the cylinder block, as shown in the illustration. Take care not to damage the contact surfaces of the cap and cylinder block.

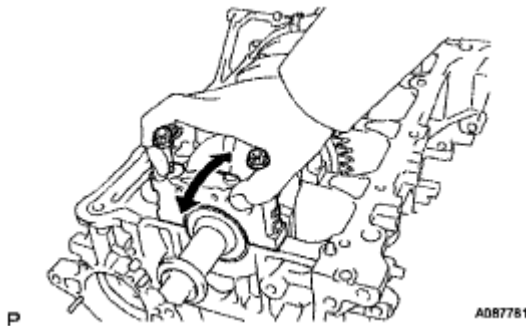


Fig. 398: Removing Main Bearing Cap Bolts

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

HINT:

- Keep each lower bearing and main bearing cap as a set.
- Arrange the sets of the main bearing caps and lower bearings in the correct order.

- c. Lift out the crankshaft.

10. REMOVE UPPER CRANKSHAFT THRUST WASHER

- a. Remove the upper crankshaft thrust washers from the cylinder block.

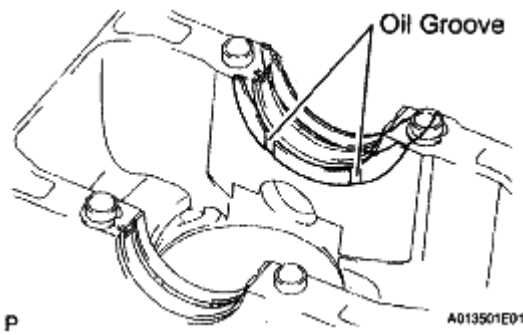


Fig. 399: Identifying Oil Groove

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

11. REMOVE CRANKSHAFT BEARING

- a. Remove the 5 crankshaft bearings from the cylinder block.

HINT:

Arrange the removed parts in the correct order.

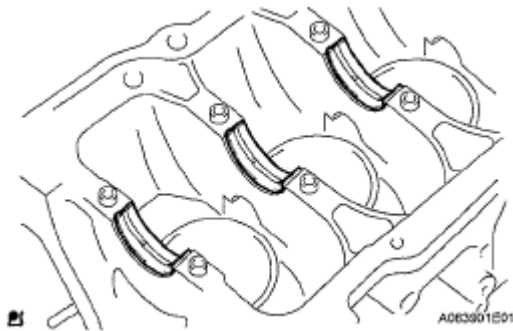


Fig. 400: Identifying Crankshaft Bearings

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

12. REMOVE NO. 2 CRANKSHAFT BEARING

- a. Remove the 5 No. 2 crankshaft bearings from the 5 main bearing caps.

HINT:

Arrange the removed parts in the correct order.

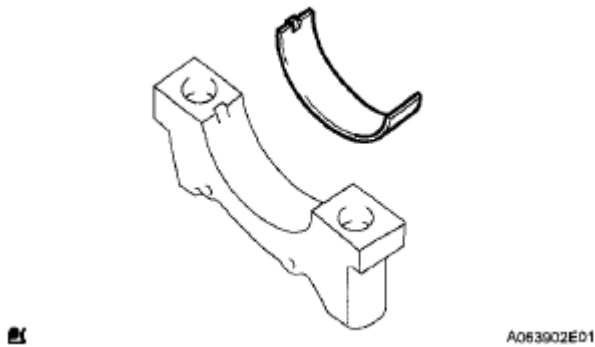


Fig. 401: Identifying No. 2 Crankshaft Bearings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. REMOVE NO. 1 OIL NOZZLE SUB-ASSEMBLY

- a. Using a 5 mm hexagon wrench, remove the bolts and oil nozzles.

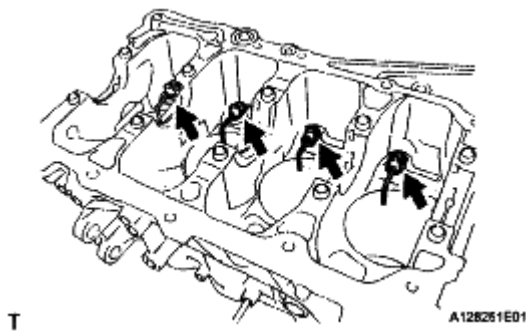


Fig. 402: Locating Oil Nozzles With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. REMOVE STUD BOLT

15. REMOVE RING PIN

16. REMOVE STRAIGHT PIN

INSPECTION

1. 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 (0.00630 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. 403: Measuring Connecting Rod Thrust Clearance
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. 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.

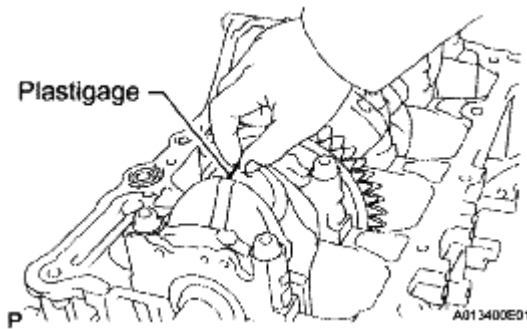


Fig. 404: Laying Strip Of Plastigage On Crank Pin
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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**).

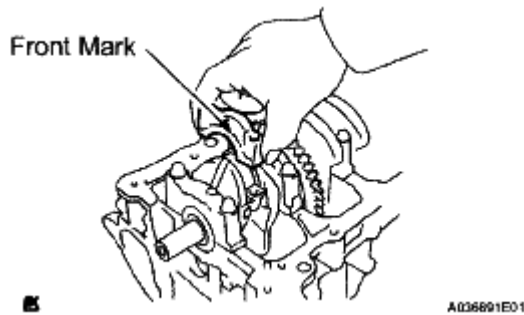


Fig. 405: Identifying Connecting Rod Cap Installation Position
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Measure the Plastigage at its widest point.

Standard oil clearance:

0.024 to 0.048 mm (0.000945 to 0.00189 in.)

Maximum oil clearance:

0.063 mm (0.00248 in.)

NOTE: Completely remove the Plastigage after the measurement.

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

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

CONNECTING ROD LARGE END BORE DIAMETER SPECIFICATION

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.)

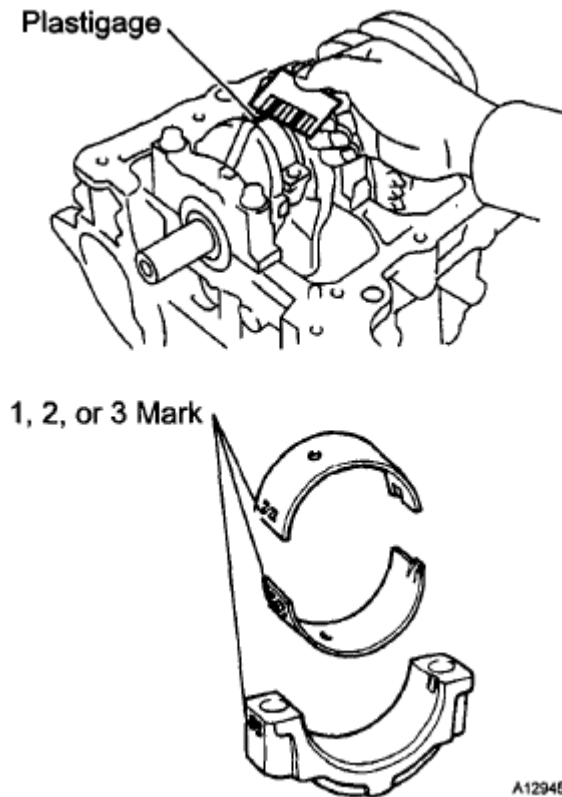


Fig. 406: Measuring Plastigage At Widest Point
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard Connecting Rod Bearing Thickness

CONNECTING ROD BEARING THICKNESS SPECIFICATION

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:

47.990 to 48.000 (1.8894 to 1.8898 in.)

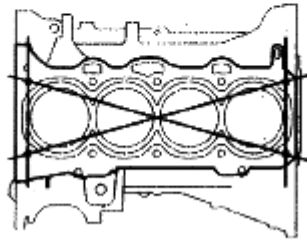
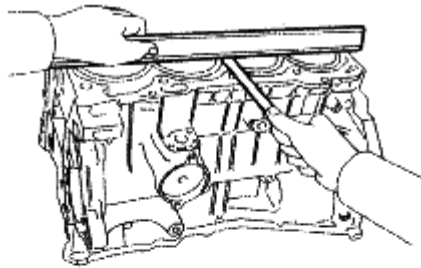
3. INSPECT CYLINDER BLOCK FOR WARPAGE

- Using a precision straightedge and feeler gauge, measure the warpage of the surface that contacts the cylinder head gasket.

Maximum warpage:

0.05 mm (0.00197 in.)

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

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Fig. 407: Measuring Warpage Of Surface Contacts Cylinder Head Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. INSPECT CYLINDER BORE

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

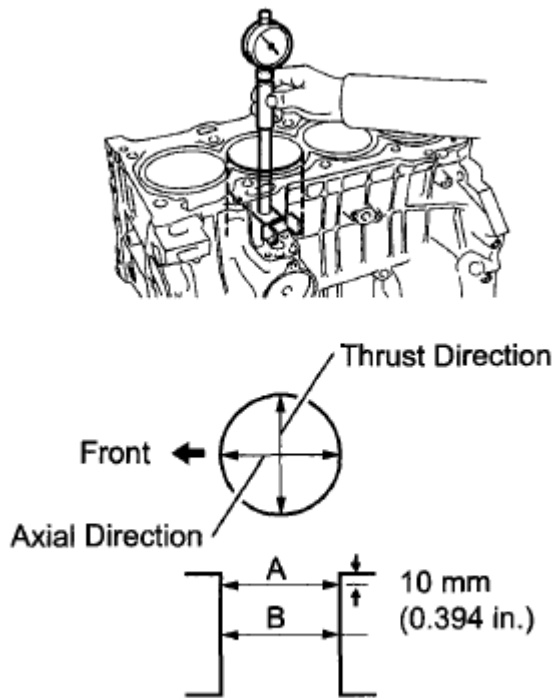
Standard diameter:

88.500 to 88.513 mm (3.4843 to 3.4847 in.)

Maximum diameter:

88.613 mm (3.4887 in.)

If the average diameter of the 4 positions is greater than the maximum, replace the cylinder block.



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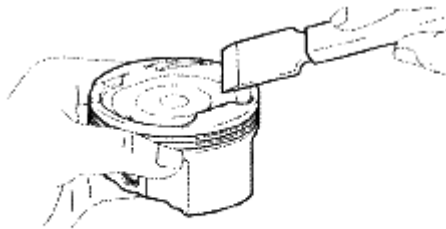
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Fig. 408: Measuring Cylinder Bore Diameter Positions A And B
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. INSPECT PISTON

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

NOTE: Do not damage the piston.

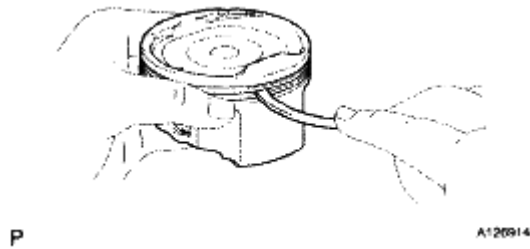


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Fig. 409: Removing Carbon From Top Of Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

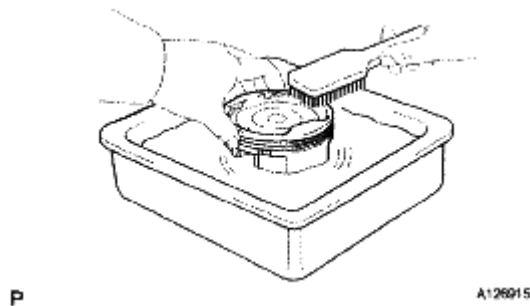
- Using a groove cleaning tool or a broken ring, clean the piston ring grooves.

**Fig. 410: Cleaning 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. 411: Cleaning 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 the piston 44.4 mm (1.748 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.

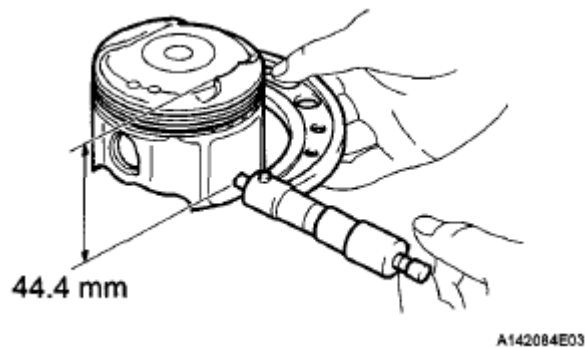


Fig. 412: Measuring Piston Diameter

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

6. 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 (0.000827 to 0.00173 in.)****Maximum oil clearance:****0.10 mm (0.00394 in.)**

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

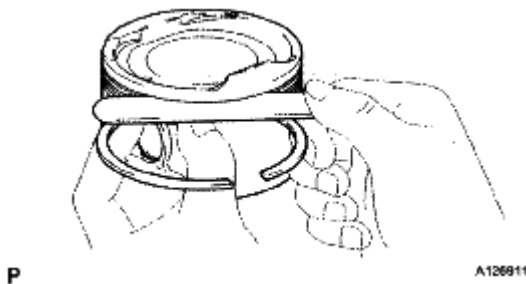
7. INSPECT RING GROOVE CLEARANCE

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

Standard Ring Groove Clearance**RING GROOVE CLEARANCE SPECIFICATION**

Item	Specified Condition
No. 1 Ring	0.020 to 0.070 mm (0.000787 to 0.00276 in.)
No. 2 Ring	0.020 to 0.060 mm (0.000787 to 0.00236 in.)
Oil Ring	0.020 to 0.070 mm (0.000787 to 0.00276 in.)

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

**Fig. 413: Measuring Clearance Between Piston Ring And Wall Of Ring Groove**

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

8. 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.

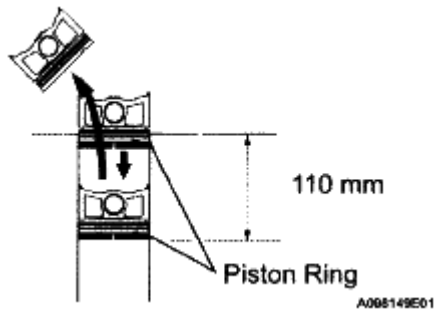


Fig. 414: Inspecting Piston Ring End Gap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a feeler gauge, measure the end gap.

Standard End Gap

PISTON RING END GAP SPECIFICATION

Item	Specified Condition
No. 1 Ring	0.24 to 0.31 mm (0.00945 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 (0.00394 to 0.0118 in.)

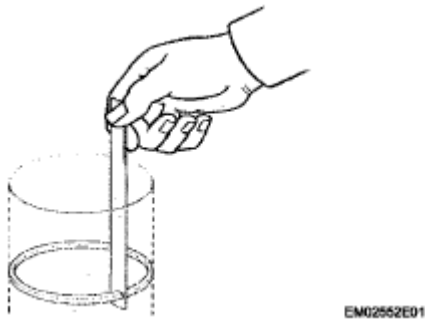


Fig. 415: Measuring End Gap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Maximum End Gap

PISTON RING END GAP SPECIFICATION

Item	Specified Condition
No. 1 Ring	0.31 mm (0.0122 in.)
No. 2 Ring	0.43 mm (0.0169 in.)
Oil Ring	0.30 mm (0.0118 in.)

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

9. INSPECT PISTON PIN OIL CLEARANCE

- a. 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.)

PISTON PIN BORE DIAMETER SPECIFICATION

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.)



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Fig. 416: Measuring Piston Pin Bore Diameter

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

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

- 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.)

PISTON PIN DIAMETER SPECIFICATION

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.)

If the diameter is not as specified, replace the piston pin.

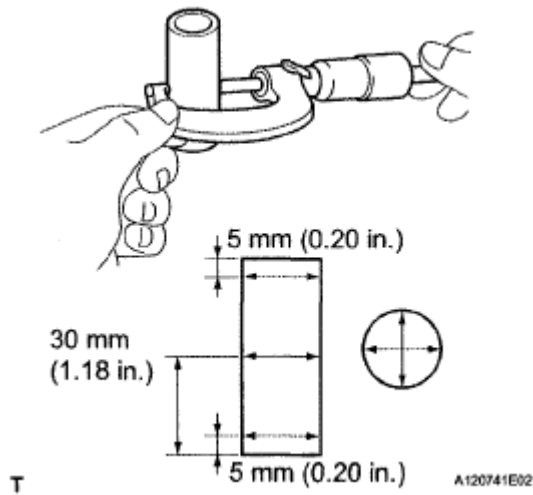


Fig. 417: Measuring Piston Pin Diameter

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

- 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.)

CONNECTING ROD SMALL END BORE DIAMETER SPECIFICATION

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.)

If the diameter is not as specified, replace the connecting rod.

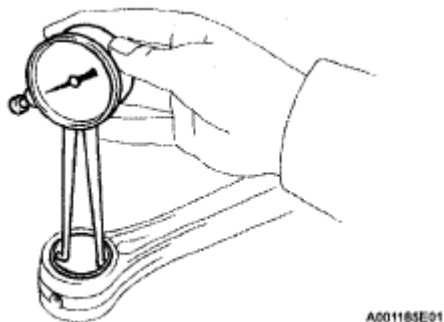


Fig. 418: Measuring Connecting Rod Small End Bore Diameter

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

- 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.)****HINT:**

Two different engine models manufactured at different factories are available for this vehicle. Referring to the Introduction section, check the engine serial number. Confirm the factory at which the engine was manufactured according to the following table.

ENGINE SERIAL NUMBER REFERENCE

Engine Serial Number	Factory
1 #####	TMC made
2 #####	TMC made
7 #####	except TMC made
8 #####	except TMC made

If the oil clearance is greater than the maximum, replace the connecting rod. If necessary, replace the piston and piston pin as a set.

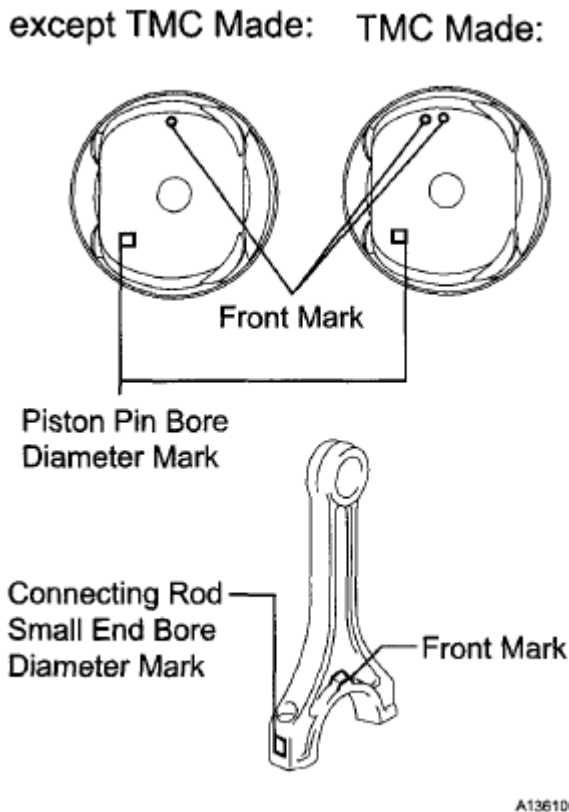


Fig. 419: [Identifying Piston Pin Bore Diameter]

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.

10. INSPECT CONNECTING ROD BOLT

- a. Using a vernier caliper, 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.

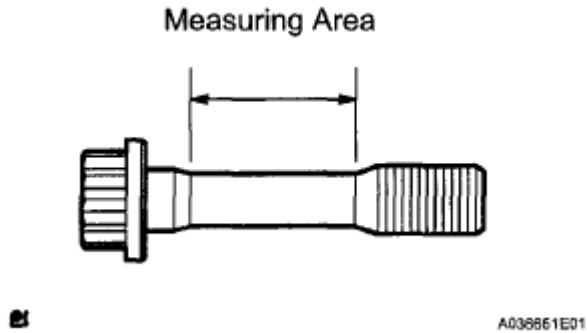


Fig. 420: Measuring Tension Portion Diameter Of Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. 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.

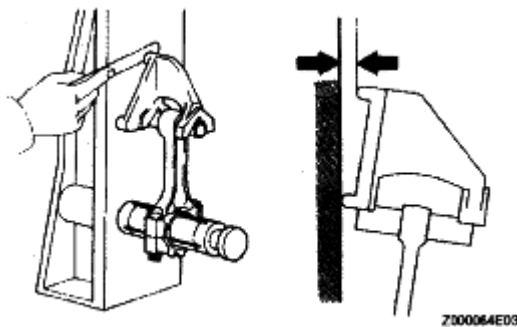


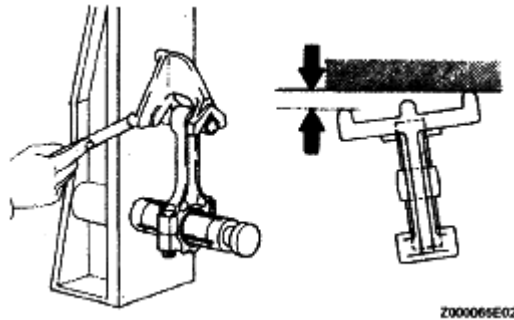
Fig. 421: Checking Connecting Rod Alignment
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Check for twist.

Maximum twist:

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

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



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Fig. 422: Checking Connecting Rod Twist
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

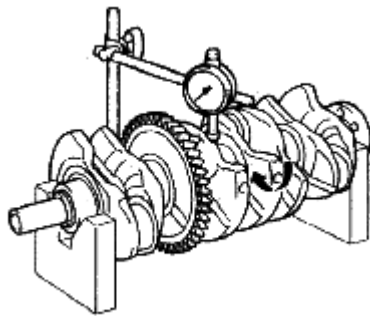
12. INSPECT CRANKSHAFT

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



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Fig. 423: Measuring Crankshaft Circle Runout
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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.

- 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)

DIAMETER REFERENCE

Mark	Specified Condition
0	54.999 to 55.000 mm (2.16531 to 2.16535 in.)
1	54.997 to 54.998 mm (2.16523 to 2.16527 in.)
2	54.995 to 54.996 mm (2.16515 to 2.16519 in.)
3	54.993 to 54.994 mm (2.16507 to 2.16511 in.)
4	54.991 to 54.992 mm (2.16500 to 2.16503 in.)
5	54.988 to 54.990 mm (2.1649 to 2.1650 in.)

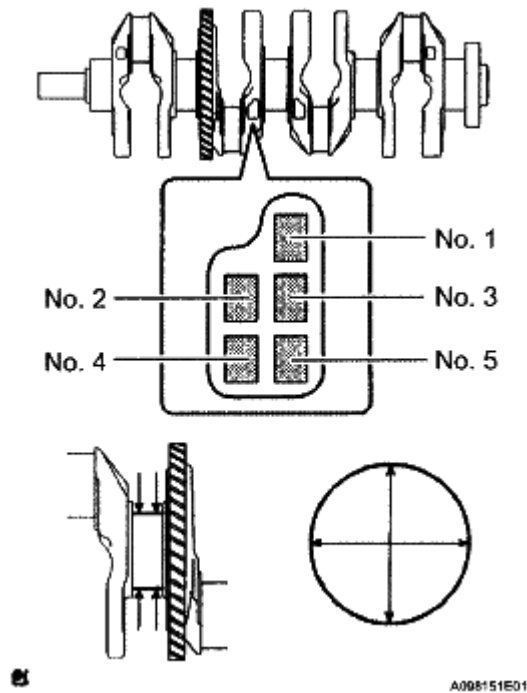


Fig. 424: Measuring Diameter Of Each Main Journal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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 (0.000118 in.)

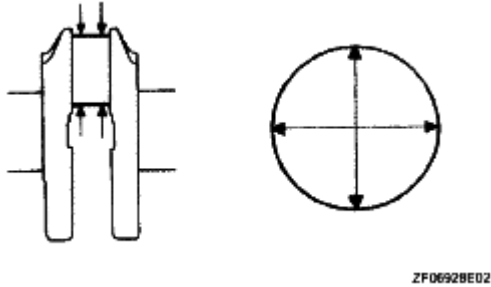


Fig. 425: Measuring Diameter Of Each Crank Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the taper and distortion are greater than the maximum, replace the crankshaft.

13. 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 (0.00157 to 0.00945 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.).

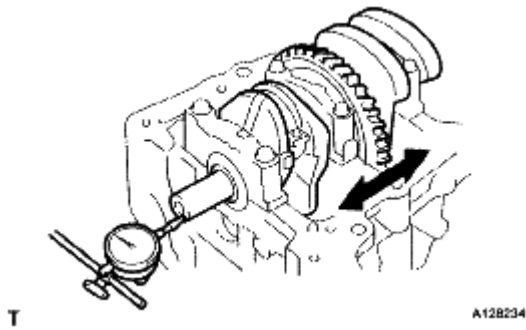


Fig. 426: Inspecting Crankshaft Thrust Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. 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.
- 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 caps (See **REASSEMBLY**).

NOTE: Do not turn the crankshaft.

- g. Remove the main bearing caps (See **DISASSEMBLY**).

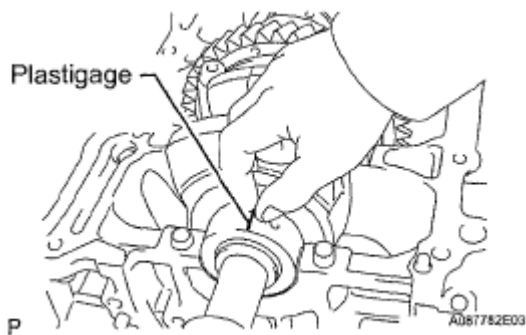


Fig. 427: Laying Strip Of Plastigage Across Each Journal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- h. Measure the Plastigage at its widest point.

2009 Toyota Matrix

2009 ENGINE Engine Mechanical (2AZ-FE) - Corolla Matrix

Standard oil clearance:

0.017 to 0.040 mm (0.000669 to 0.00157 in.)

Maximum oil clearance:

0.060 mm (0.00236 in.)

NOTE: Remove the Plastigage completely after the measurement.

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

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. 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")

NUMBER REFERENCE

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

CYLINDER BLOCK JOURNAL BORE DIAMETER SPECIFICATION

Mark	Specified Condition
0	59.000 to 59.002 mm (2.32283 to 2.32291 in.)
1	59.003 to 59.004 mm (2.32295 to 2.32299 in.)
2	59.005 to 59.006 mm (2.32303 to 2.32307 in.)
3	59.007 to 59.009 mm (2.32311 to 2.32318 in.)
4	59.010 to 59.011 mm (2.32322 to 2.32326 in.)
5	59.012 to 59.013 mm (2.32330 to 2.32334 in.)
6	59.014 to 59.016 mm (2.32338 to 2.32346 in.)

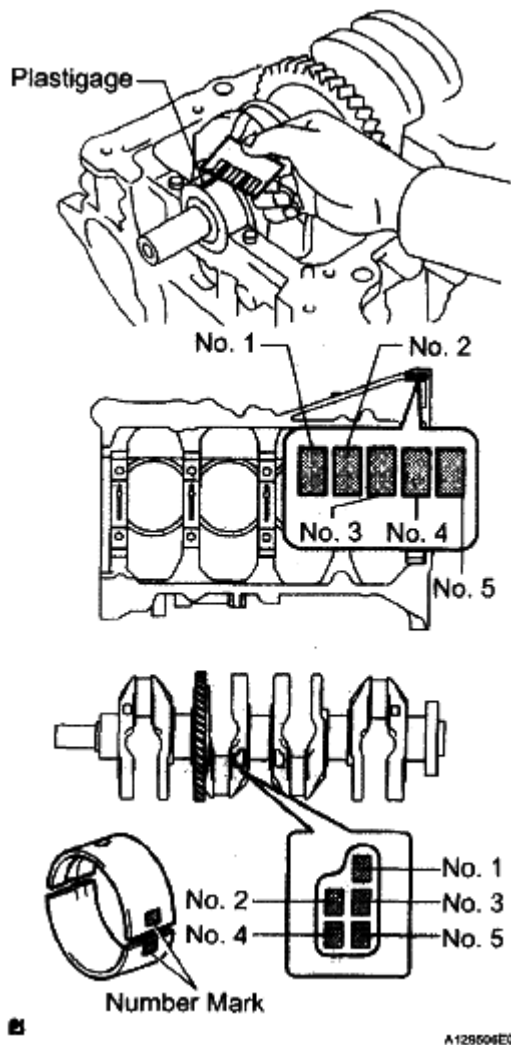


Fig. 428: Measuring Plastigage At Widest Point
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard Crankshaft Journal Diameter

CRANKSHAFT JOURNAL DIAMETER SPECIFICATION

Mark	Specified Condition
0	54.999 to 55.000 mm (2.16531 to 2.16535 in.)
1	54.997 to 54.998 mm (2.16523 to 2.16527 in.)
2	54.995 to 54.996 mm (2.16515 to 2.16519 in.)
3	54.993 to 54.994 mm (2.16507 to 2.16511 in.)
4	54.991 to 54.992 mm (2.16500 to 2.16504 in.)
5	54.988 to 54.990 mm (2.16488 to 2.16496 in.)

Standard Bearing Center Wall Thickness

BEARING CENTER WALL THICKNESS SPECIFICATION

Mark	Specified Condition
1	1.993 to 1.996 mm (0.078464 to 0.078583 in.)
2	1.997 to 1.999 mm (0.078622 to 0.078701 in.)
3	2.000 to 2.002 mm (0.078740 to 0.078819 in.)
4	2.003 to 2.005 mm (0.078858 to 0.078937 in.)

15. INSPECT CRANKSHAFT BEARING CAP SET RING PIN

- a. Using a vernier caliper, measure the tension portion diameter of the bolts.

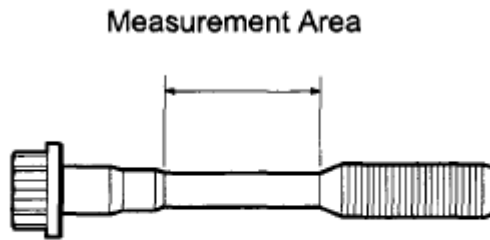
Standard diameter:

7.5 to 7.6 mm (0.295 to 0.299 in.)

Minimum diameter:

7.5 mm (0.295 in.)

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

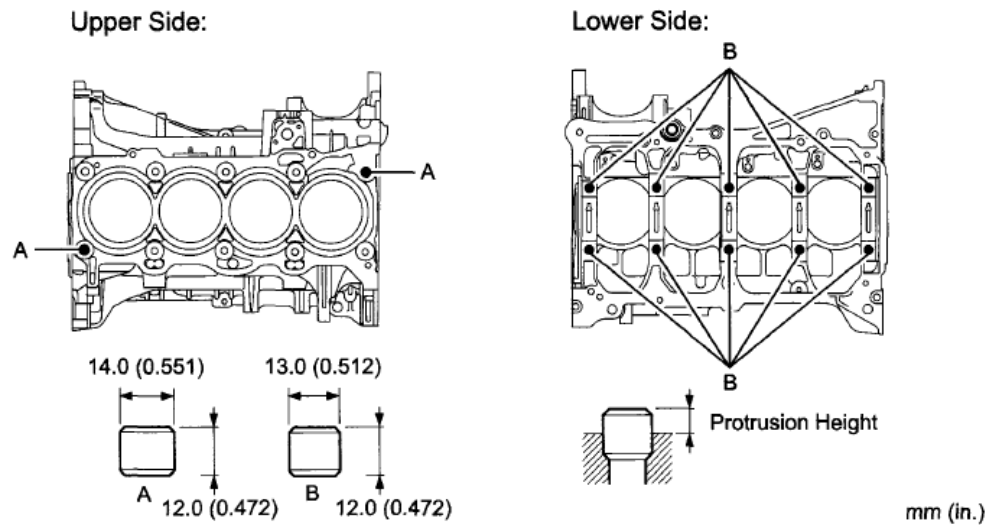


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Fig. 429: Measuring Tension Portion Diameter Of Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REASSEMBLY**1. INSTALL RING PIN**

- a. Using a plastic hammer, tap in the ring pins.



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Fig. 430: Identifying Ring Pin Height

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

Standard Protrusion

RING PIN HEIGHT REFERENCE

Item	Protrusion
A	6 mm (0.236 in.)
B	5 mm (0.197 in.)

2. INSTALL STUD BOLT

- Install the stud bolts as shown in the illustration.

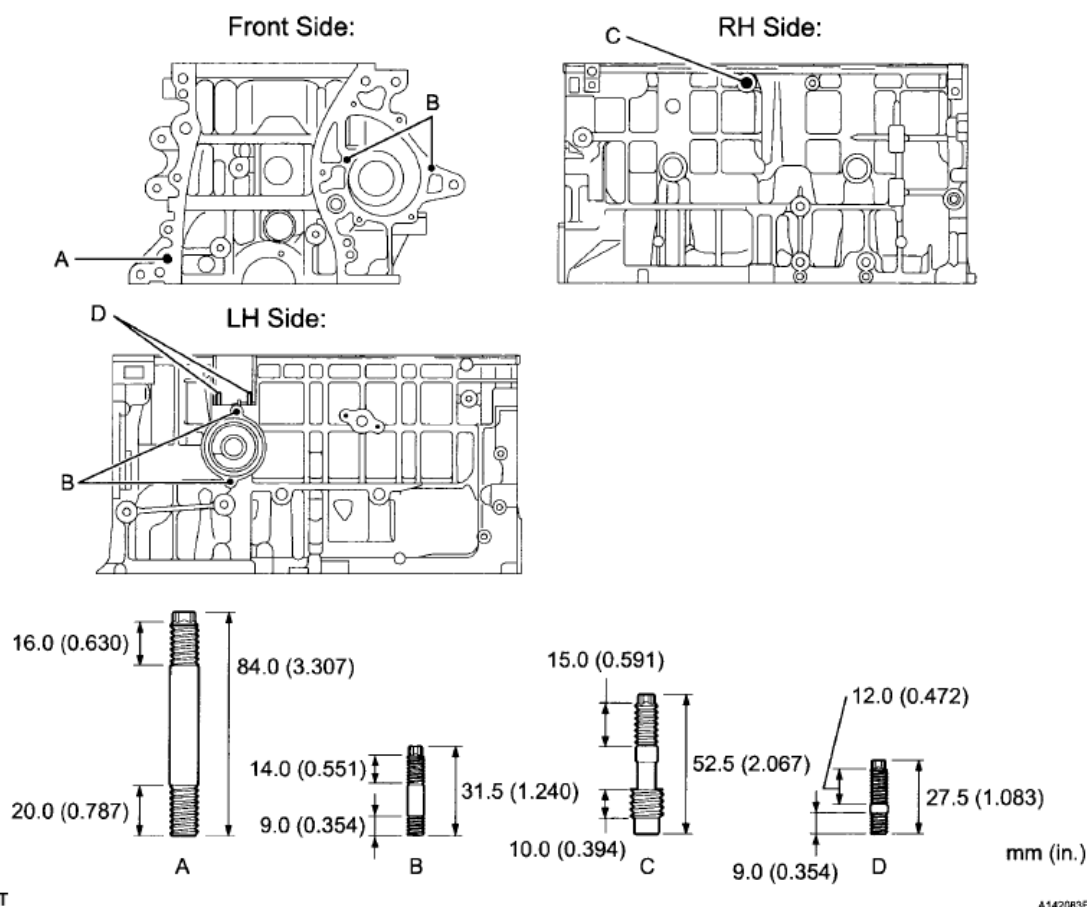


Fig. 431: Identifying Stud Bolts Height

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

Torque: Stud Bolt A

22 N*m (220 kgf*cm, 16 ft.*lbf)

Stud Bolt B

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

Stud Bolt C

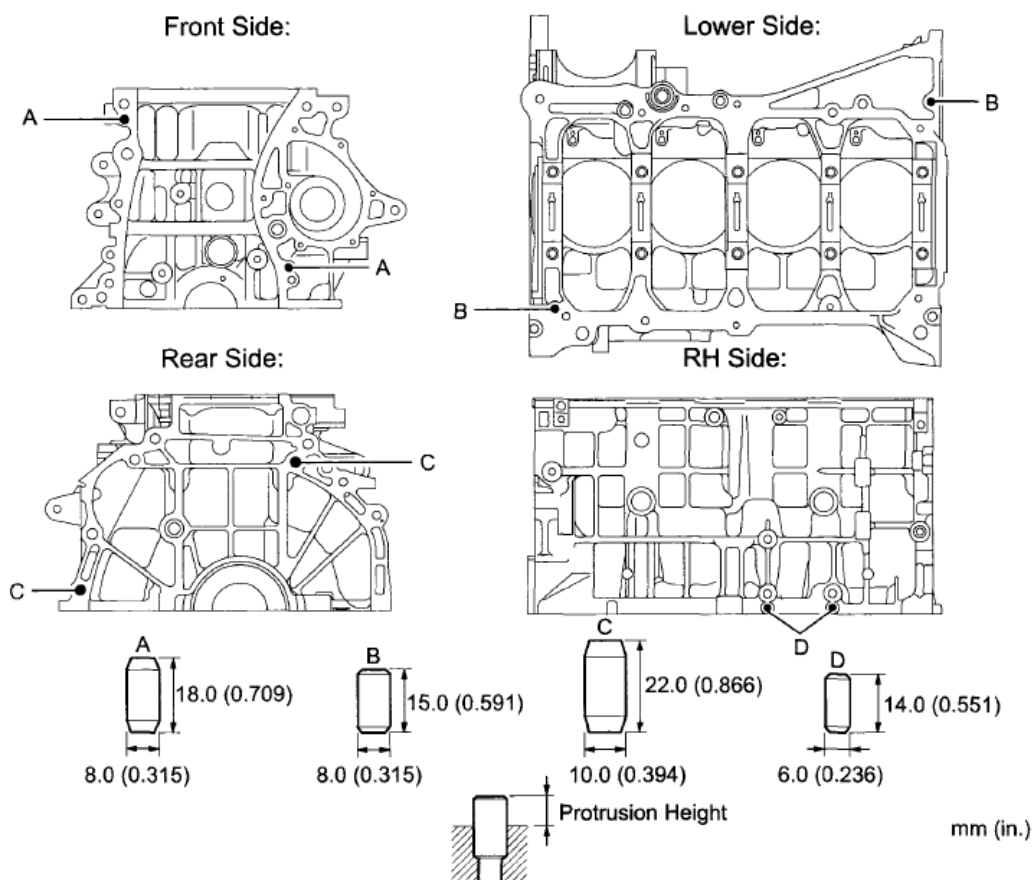
9.5 N*m (97 kgf*cm, 84 in.*lbf)

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 pins.



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Fig. 432: Identifying Straight Pin Height
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard Protrusion

STRAIGHT PIN HEIGHT REFERENCE

Item	Protrusion
A	8 mm (0.315 in.)
B	7.5 mm (0.295 in.)
C	12 mm (0.472 in.)
D	5 mm (0.197 in.)

4. **INSPECT CRANKSHAFT OIL CLEARANCE** (See **INSPECTION**)
5. **INSTALL NO. 1 OIL NOZZLE SUB-ASSEMBLY**
 - a. Using a 5 mm hexagon wrench, install the oil nozzles with the bolts.

Torque: 7.0 N*m (71 kgf*cm, 62 in.*lbf)

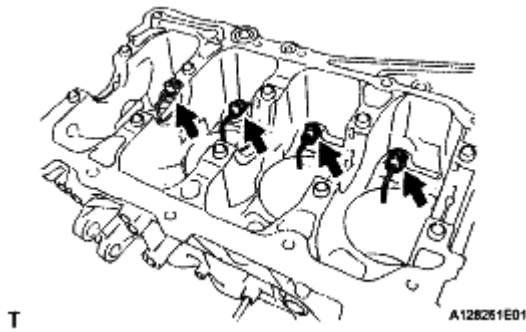


Fig. 433: Locating Oil Nozzles With Bolts

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

6. INSTALL PISTON

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

HINT:

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

- Gradually heat the piston to approximately 80 to 90°C (176 to 194°F).

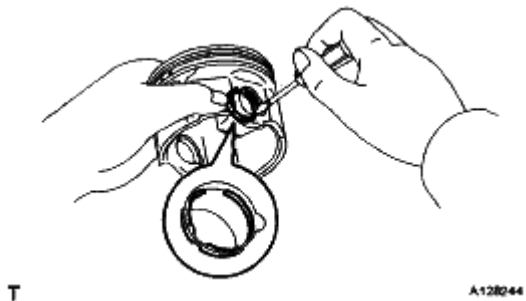


Fig. 434: Installing Snap Ring Of Piston Pin Hole

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

- Align the front marks on the piston and connecting rod, and push in the piston with a thumb.

HINT:

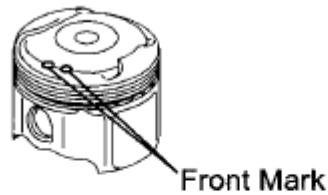
Two different engine models manufactured at different factories are available for this vehicle. Referring to the Introduction section, check the engine serial number. Confirm the factory at which the engine was manufactured according to the following table.

ENGINE SERIAL NUMBER REFERENCE

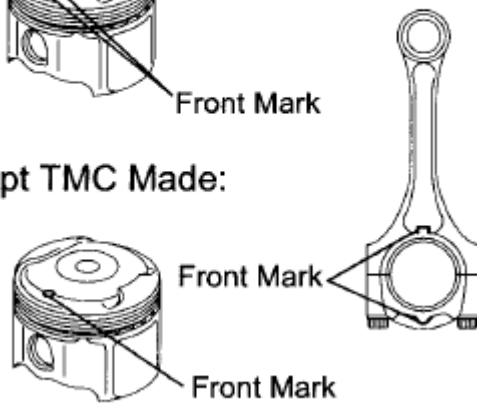
Engine Serial Number	Factory
1 #####	TMC made
2 #####	TMC made

7 #####	except TMC made
8 #####	except TMC made

TMC Made:



except TMC Made:



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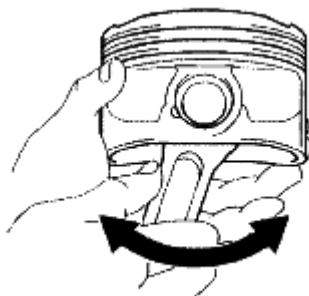
Fig. 435: Aligning Front Marks On Piston And Connecting Rod
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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 on the snap ring is not aligned with the pin hole cutout 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.



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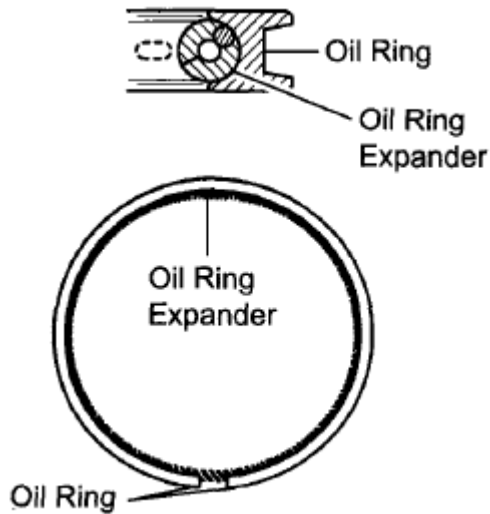
Fig. 436: Checking Fitting Condition Between Piston And Piston Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. 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 into the inner groove of the oil ring.



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Fig. 437: Identifying Piston Ring Set

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

- 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 No. 2 compression ring with the code mark (2N or 2A) facing upward.

HINT:

Supply part compression springs (No. 1 and No. 2) do not have paint marks.

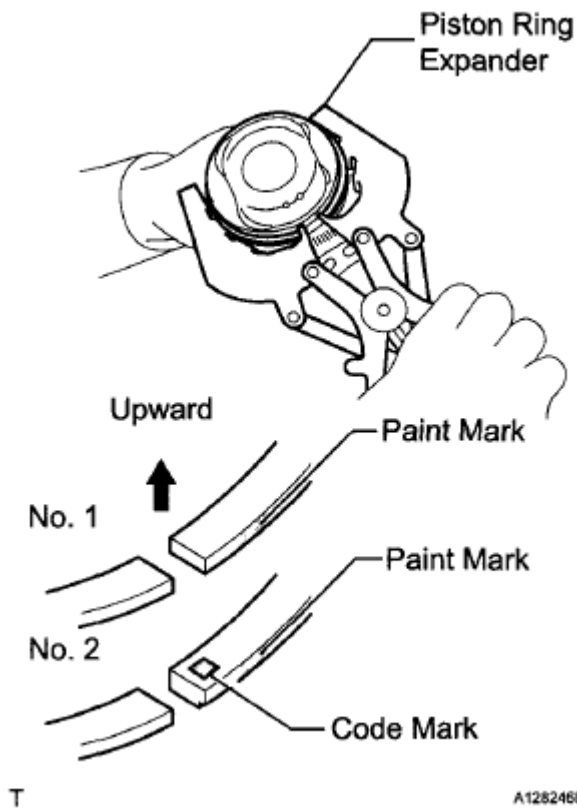


Fig. 438: Identifying Piston Ring Proper Installation Position
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Position the piston rings so that the ring ends are as shown in the illustration.

HINT:

Two different engine models manufactured at different factories are available for this vehicle. Referring to the Introduction section, check the engine serial number. Confirm the factory at which the engine was manufactured according to the following table.

ENGINE SERIAL NUMBER REFERENCE

Engine Serial Number	Factory
1 #####	TMC made
2 #####	TMC made
7 #####	except TMC made
8 #####	except TMC made

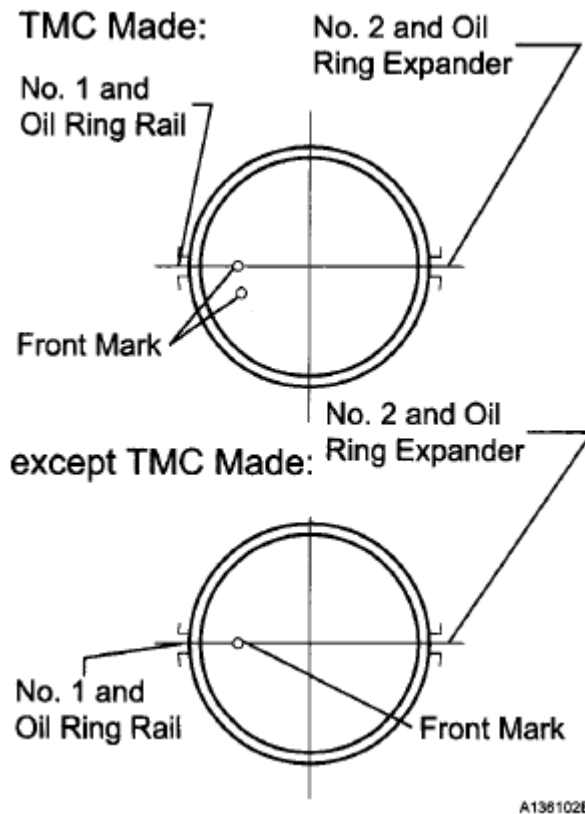


Fig. 439: Positioning Piston Rings

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

8. INSTALL CRANKSHAFT BEARING

- Install the upper bearing with an oil groove on the cylinder block.

NOTE: Do not apply engine oil to the bearing inner surface or bearing cap contact surfaces.

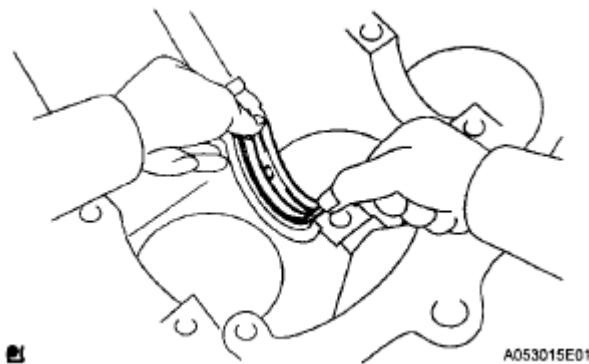


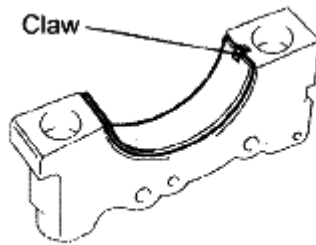
Fig. 440: Installing Upper Bearing With Oil Groove On Cylinder Block

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

9. INSTALL NO. 2 CRANKSHAFT BEARING

- a. Install the No. 2 crankshaft bearing on 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 oils.



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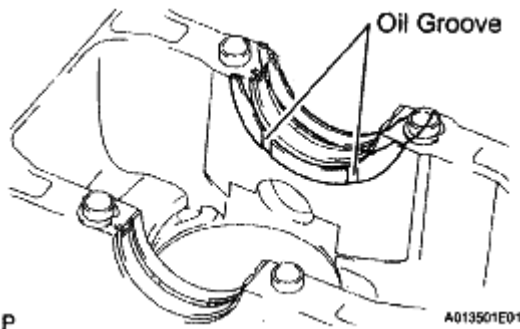
Fig. 441: Identifying No. 2 Crankshaft Bearing Claw
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. 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.

NOTE: Make sure to install the proper thrust washers.

- b. Apply engine oil to the crankshaft thrust washers.



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Fig. 442: Installing Upper Crankshaft Thrust Washer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. INSTALL CRANKSHAFT

- a. Apply engine oil to the upper bearings and place the crankshaft on the cylinder block.
- b. Apply engine oil to the lower bearings.
- c. Examine the front marks and install the bearing caps on the cylinder block.
- 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.

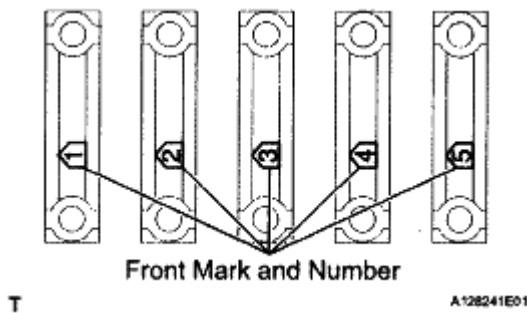


Fig. 443: Identifying Main Bearing Cap Installation Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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)

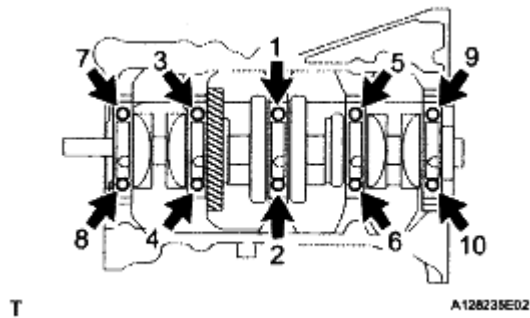


Fig. 444: Identifying Main Bearing Cap Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Retighten the 10 main bearing cap bolts in the sequence shown in the illustration.

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

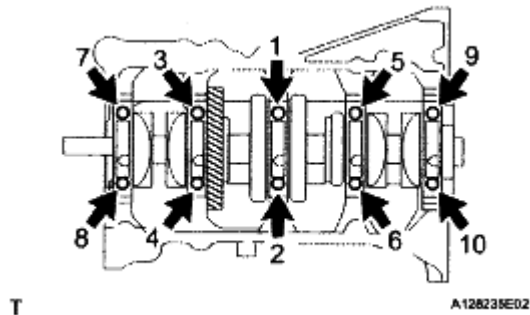


Fig. 445: Identifying Main Bearing Cap Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Step 2
 - 1. Mark the front of the bearing cap bolts with paint.
 - 2. Retighten the bearing cap bolts 90° in the numerical order shown in the 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**).

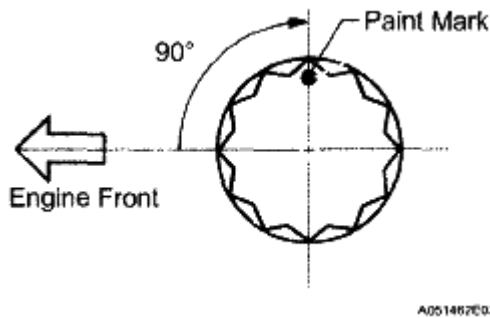


Fig. 446: Identifying Bearing Cap Bolts Tightening Angle
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. INSTALL CONNECTING ROD BEARING

- a. Align the bearing claw with the groove on the connecting rod or connecting cap.

NOTE: Do not apply engine oil to the bearing inner surface or connecting rod contact surface.

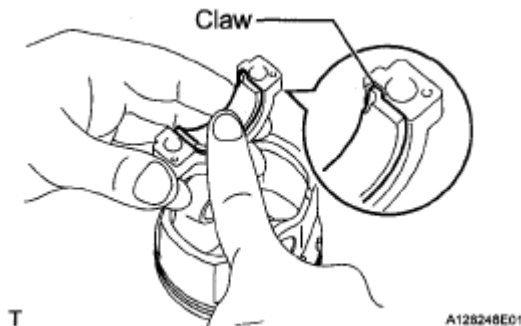


Fig. 447: Aligning Bearing Claw With Groove On Connecting Rod
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. INSTALL PISTON SUB-ASSEMBLY WITH CONNECTING ROD

NOTE: The connecting rod cap bolts are tightened in 2 progressive steps.

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

HINT:

Two different engine models manufactured at different factories are available for this vehicle. Referring to the Introduction section, check the engine serial number. Confirm the factory at which the engine was manufactured according to the following table.

ENGINE SERIAL NUMBER REFERENCE

Engine Serial Number	Factory
1 #####	TMC made
2 #####	TMC made
7 #####	except TMC made
8 #####	except TMC made

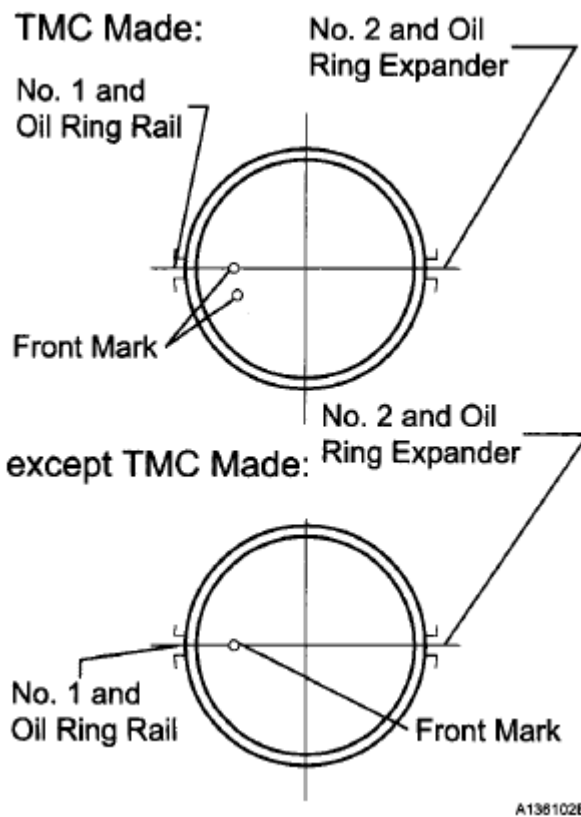


Fig. 448: Positioning Piston Rings

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.

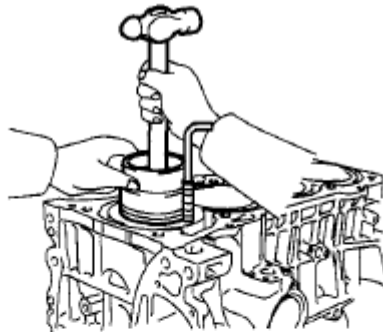
NOTE: Match the numbered connecting rod cap with the connecting rod.

HINT:

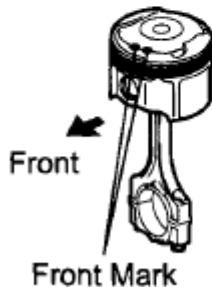
Two different engine models manufactured at different factories are available for this vehicle. Referring to the Introduction section, check the engine serial number. Confirm the factory at which the engine was manufactured according to the following table.

ENGINE SERIAL NUMBER REFERENCE

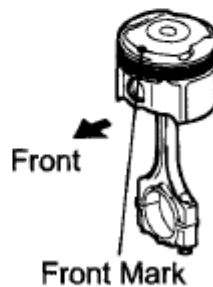
Engine Serial Number	Factory
1 #####	TMC made
2 #####	TMC made
7 #####	except TMC made
8 #####	except TMC made



TMC Made:



except TMC Made:



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Fig. 449: Pushing Correctly Numbered Piston And Connecting Rod Assemblies
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

NOTE: The connecting cap bolts should be tightened in 2 progressive steps.

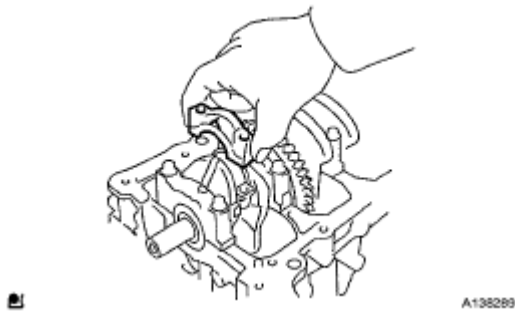


Fig. 450: Identifying Connecting Rod Cap Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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)

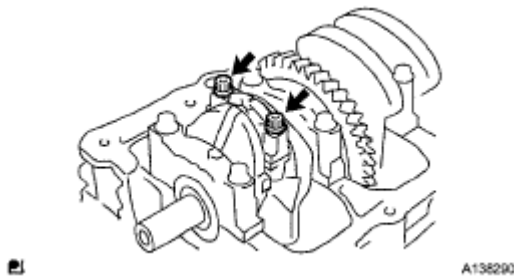
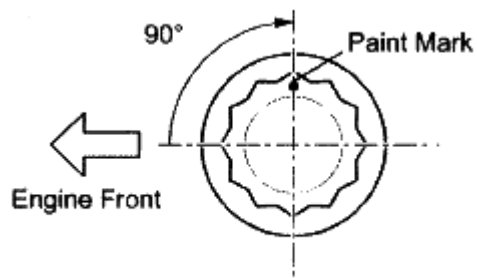


Fig. 451: Locating Connecting Rod Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

h. Step 2

1. Mark the front of the connecting rod cap bolts with paint.
 2. Retighten the cap bolts 90° as shown in the illustration.
- i. Check that the crankshaft turns smoothly.
 - j. Check the connecting rod thrust clearance (See **INSPECTION**).



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Fig. 452: Identifying Connecting Rod Cap Bolts Tightening Angle
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.