

2009 ENGINE

Engine Mechanical (2GR-FE) - Avalon

ENGINE

ON-VEHICLE INSPECTION

1. INSPECT VALVE LASH ADJUSTER NOISE

- a. Rev up the engine several times. Check that the engine does not emit unusual noises.

If unusual noises occur, warm up the engine and idle it for over 30 minutes. Then repeat this procedure.

HINT:

If any defects or problems are found during the inspection above, perform lash adjuster inspection (See INSPECTION).

2. INSPECT IGNITION TIMING

- a. Warm up the engine.
- b. Turn the ignition switch off.
- c. When using the Techstream:

Check the ignition timing.

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch on.
3. Turn the tester on.
4. Enter DATA LIST MODE with the Techstream.

Ignition timing: 8 to 12° BTDC at idle

HINT:

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

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

NOTE: When checking the ignition timing, the transmission should be in the neutral position.

- d. When not using the Techstream:

Check the ignition timing.

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

SST 09843-18040

NOTE:

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

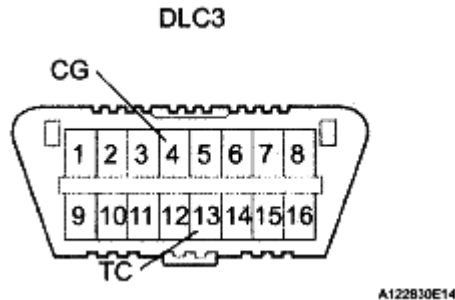


Fig. 1: Identifying DLC3 Connector Terminal CG And TC
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Remove the V-bank cover.
3. Pull out the red lead wire harness.
4. Connect the tester terminal of the timing light to the red lead wire as shown in the illustration.

NOTE: Use a timing light which detects the first signal.

5. Check the ignition timing at idle.

Ignition timing: 8 to 12° BTDC at idle

NOTE: When checking the ignition timing, the transmission should be in the neutral position.

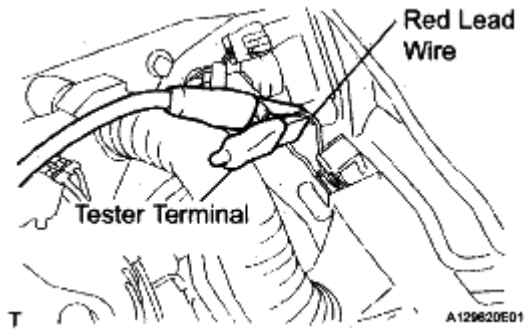


Fig. 2: Identifying Red Lead Wire And Tester Terminal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

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

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

Ignition timing: 5 to 15 BTDC at idle

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

3. INSPECT ENGINE IDLE SPEED

- a. Warm up the engine.
- b. When using the Techstream:

Check the idle speed.

1. Connect the Techstream to the DLC3.
2. Enter DATA LIST MODE with the Techstream.

Idle speed: 600 to 700 rpm

NOTE:

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

HINT:

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

c. When not using the Techstream:

Check the idle speed.

1. Using SST, connect tachometer test probe to terminal 9 (TAC) of the DLC3.

SST 09843-18030

2. Check the idle speed.

Idle speed: 600 to 700 rpm

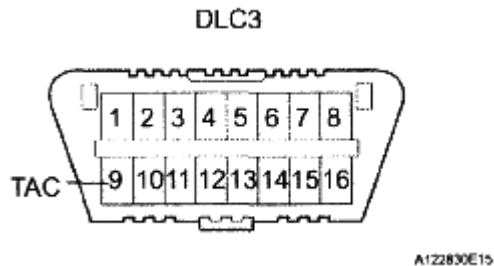


Fig. 3: Identifying DLC3 Connector Terminal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. INSPECT COMPRESSION

- a. Warm up and stop the engine.
- b. Disconnect the injector connectors.
- c. Remove the intake air surge tank (See **REMOVAL**).
- d. Remove the 6 ignition coils.
- e. Remove the 6 spark plugs.
- f. Check the cylinder compression pressure.
 1. Insert a compression gauge into the spark plug hole.
 2. While cranking the engine, measure the compression pressure.

Compression pressure: 1.3 MPa (13 kgf/cm² , 189 psi)

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

Difference between each cylinder: 0.1 MPa (1.0 kgf/cm² , 15 psi)

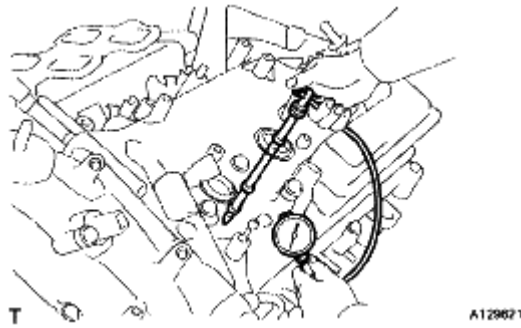


Fig. 4: Inserting Compression Gauge Into Spark Plug Hole
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE:

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

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

HINT:

- If adding oil increases the compression, 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.

5. INSPECT CO/HC

- a. Start the engine.
- b. Rev the engine at 2500 rpm for approximately 180 seconds.
- c. Insert CO/HC meter testing probe at least 40 cm (1.3 ft) into the tailpipe during idling.
- d. Check CO/HC concentration at idle and / or 2500 rpm.

HINT:

Check regulations and restrictions in your area when performing 2 mode CO/CH concentration testing (engine check at both idle speed and at 2500 rpm).

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

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

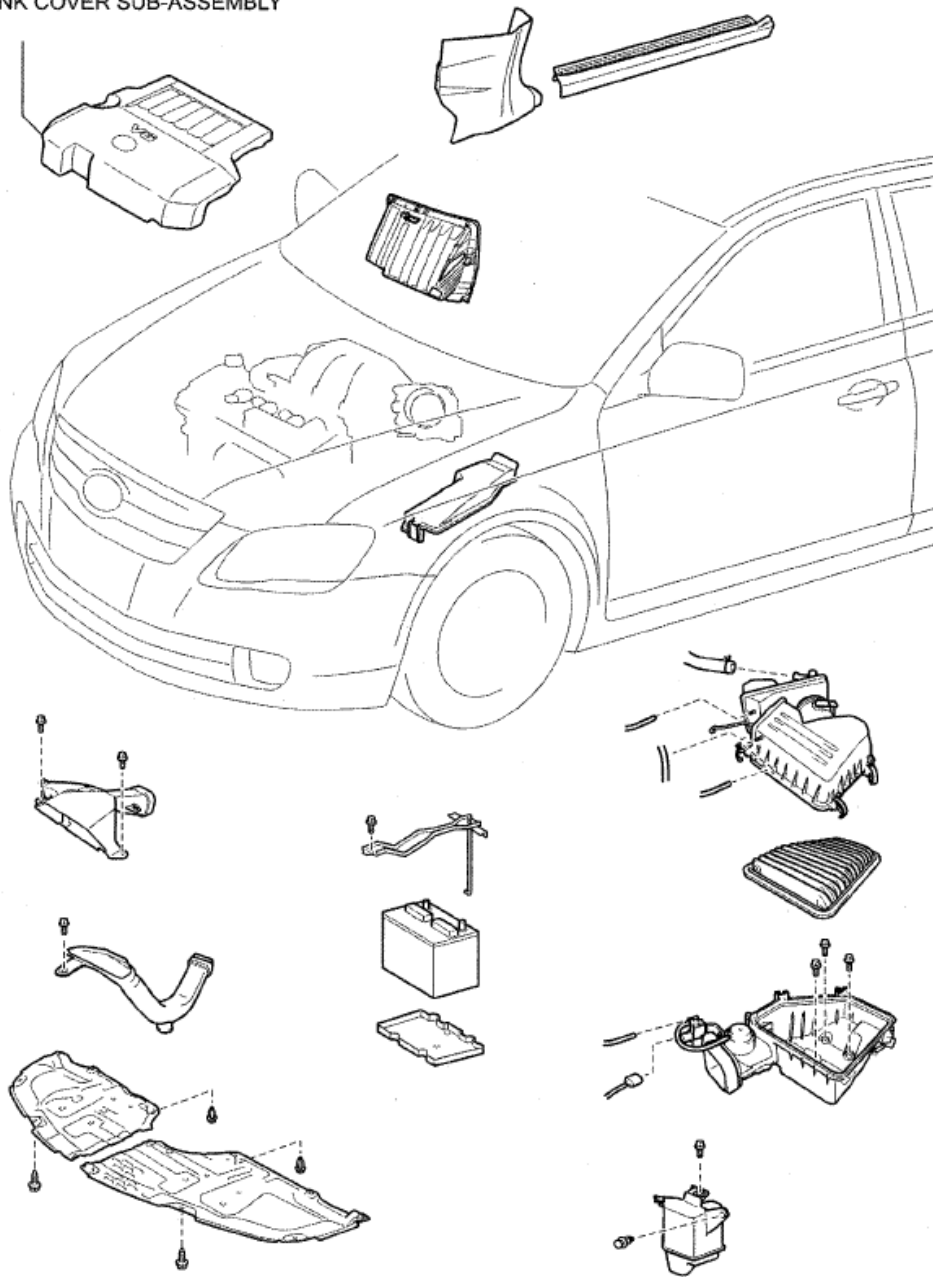
POSSIBLE CAUSES

CO	HC	Problems	Causes
Normal	High	Rough idle	1. Faulty ignitions: ○ Incorrect timing ○ Fouled, shorted or improperly gapped plugs 2. Incorrect valve clearance 3. Leaks in intake and exhaust valves 4. Leaks in cylinders
Low	High	Rough idle (fluctuating HC reading)	1. Vacuum leaks: ○ PCV 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 SFI system: ○ Faulty fuel pressure regulator ○ Defective ECT sensor ○ Defective MAF meter ○ Faulty ECM ○ Faulty injectors ○ Faulty throttle position sensor

DRIVE BELT

COMPONENTS

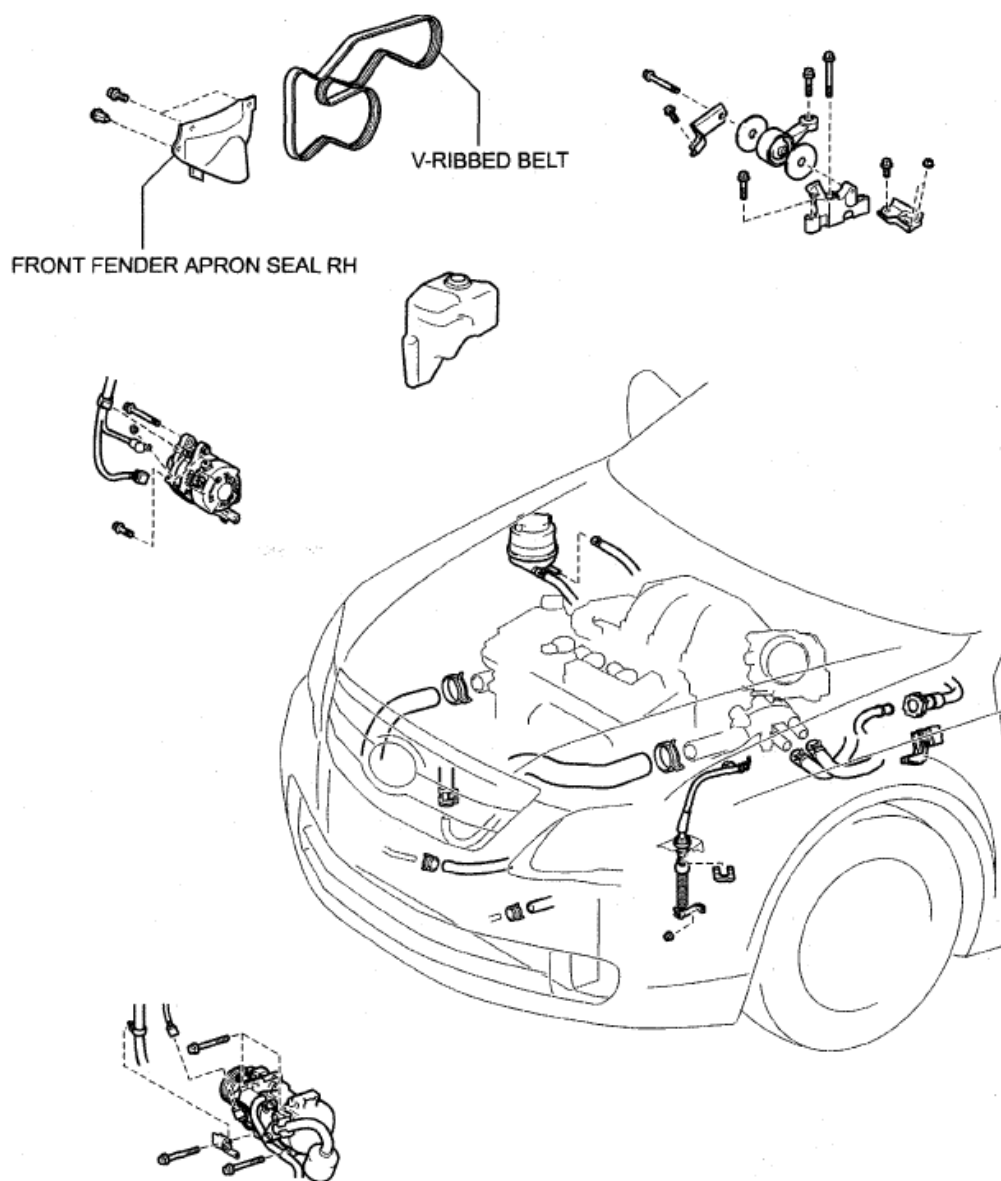
V-BANK COVER SUB-ASSEMBLY



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Fig. 5: Identifying Drive Belt Components (1 Of 2)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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Fig. 6: Identifying Drive Belt Components (2 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. REMOVE FRONT WHEEL RH
2. REMOVE FRONT FENDER APRON SEAL RH
3. REMOVE V-BANK COVER SUB-ASSEMBLY

4. REMOVE V-RIBBED BELT

- a. Using SST, release the belt tension by turning the belt tensioner counterclockwise, and remove the V-ribbed belt from the belt tensioner.

SST 09961-00950

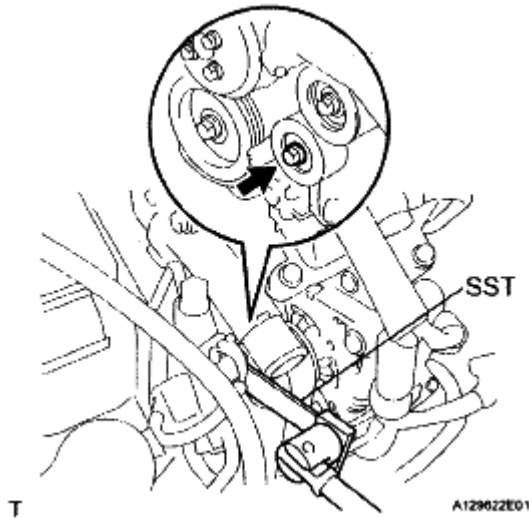


Fig. 7: Identifying SST

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

- b. While turning the belt tensioner counterclockwise, align with its holes, and then insert the 5 mm bi-hexagon wrench into the holes to fix the V-ribbed belt tensioner.

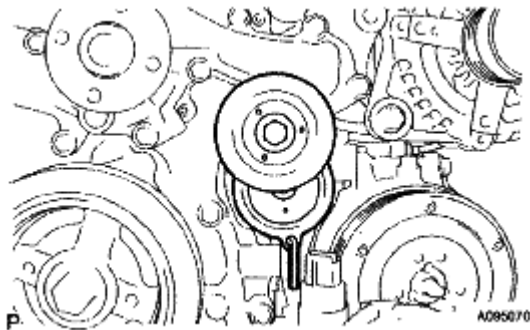


Fig. 8: Inserting Bi-Hexagon Wrench Into Holes

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

INSPECTION

1. INSPECT V-RIBBED BELT

- a. Visually check the V-ribbed belt for excessive wear, frayed cords, etc.

If any defect has been found, replace the V-ribbed belt.

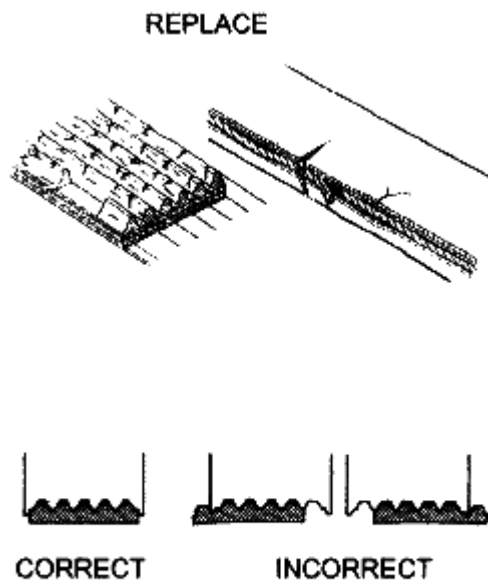
HINT:

Cracks on the rib side of a V-ribbed belt are considered acceptable.

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

HINT:

- After installing the V-ribbed belt, check that it fits properly in the ribbed grooves. Check to confirm that the belt has not slipped out of the grooves on the bottom of the crank pulley by hand.
- A "new belt" is a belt which has been used for less than 5 minutes with the engine running.
- A "used belt" is a belt which has been used for 5 minutes or more with the engine running.



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Fig. 9: Checking V-Ribbed Belt For Excessive Wear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- After installing a new belt, run the engine for approximately 5 minutes and then recheck the tension.

2. INSPECT V-RIBBED BELT TENSIONER ASSEMBLY

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

INSTALLATION

1. INSTALL V-RIBBED BELT

- a. Install the V-ribbed belt.
- b. Using SST, turn the belt tensioner counterclockwise, remove the bar.

SST 09961-00950

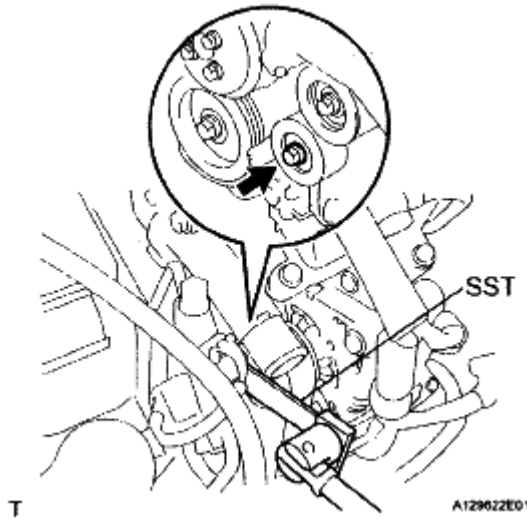


Fig. 10: Identifying SST

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

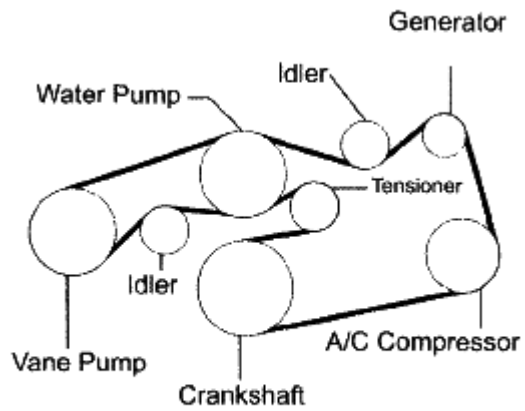
- c. If it is difficult to install the V-ribbed belt, perform the following procedure.
 1. Put the V-ribbed belt on everything except the tensioner pulley as shown in the illustration.
 2. While releasing the belt tension by turning the belt tensioner counterclockwise, put the V-ribbed belt on the tensioner pulley.

NOTE:

- Put the backside of the V-ribbed belt on the tensioner pulley and idler pulley.
- Check that the V-ribbed belt is properly set to each pulley.

2. INSTALL V-BANK COVER SUB-ASSEMBLY
3. INSTALL FRONT FENDER APRON SEAL RH
4. INSTALL FRONT WHEEL RH

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



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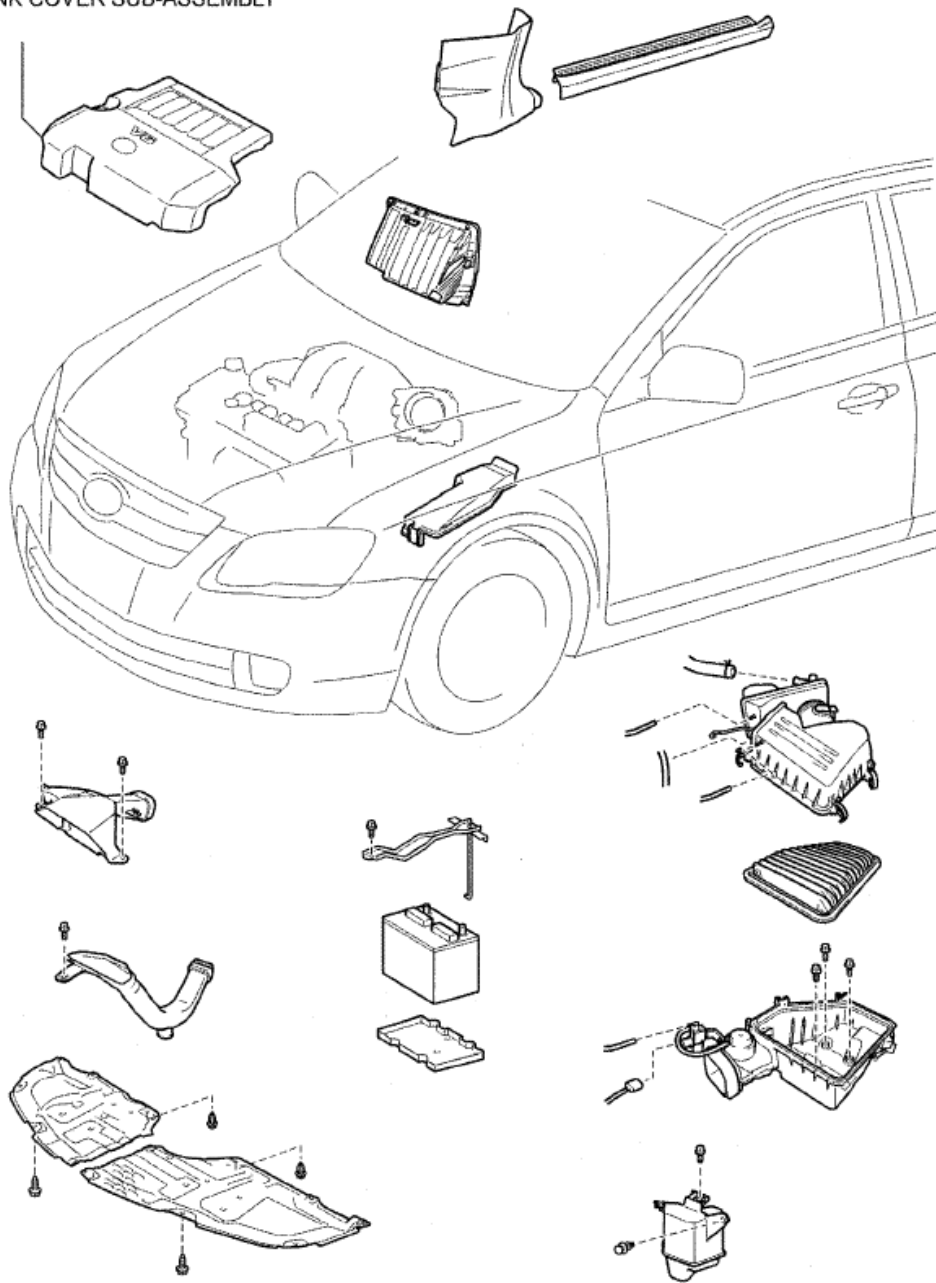
Fig. 11: View Of Drive Belt Routing

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

ENGINE FRONT OIL SEAL

COMPONENTS

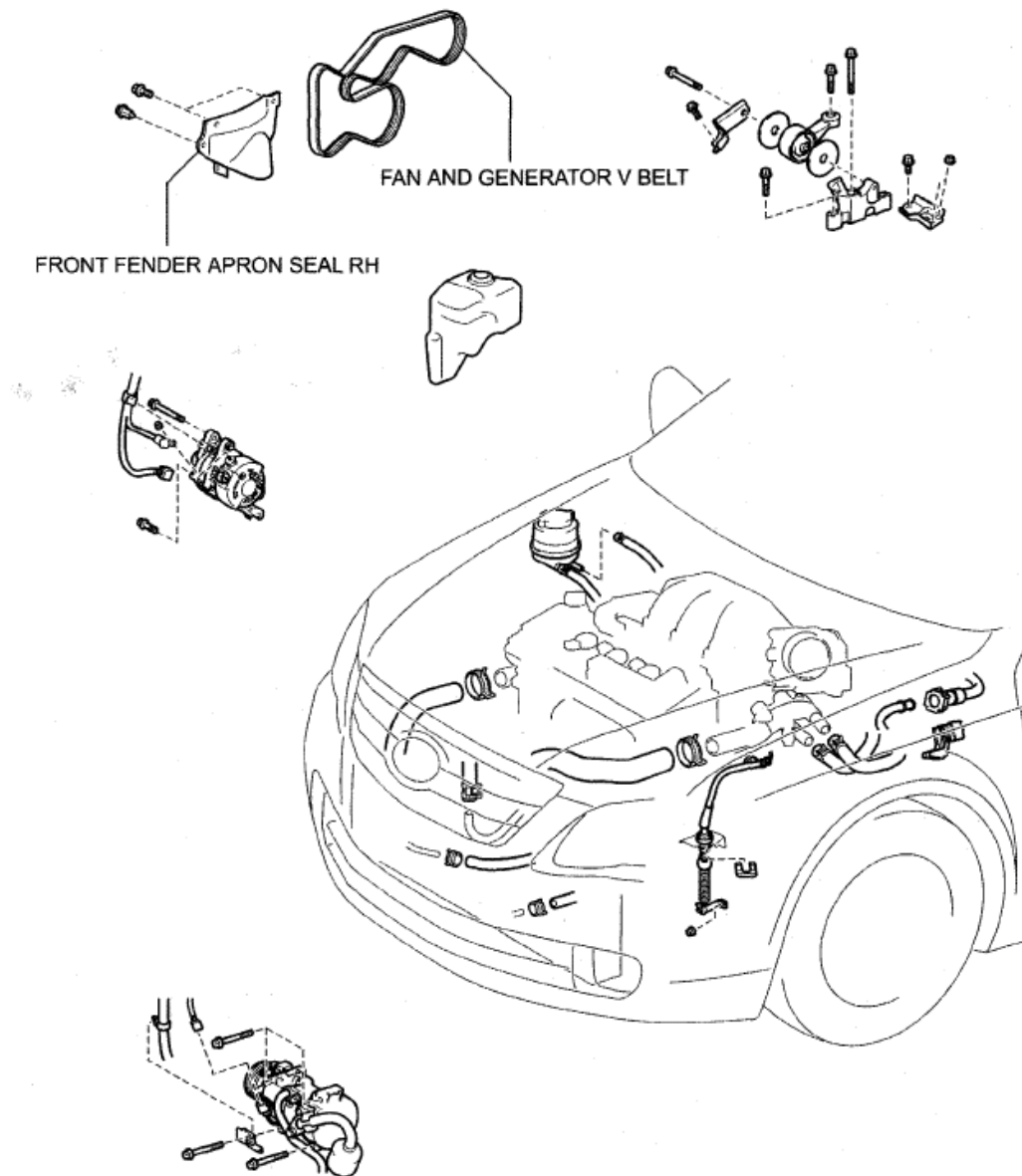
V-BANK COVER SUB-ASSEMBLY



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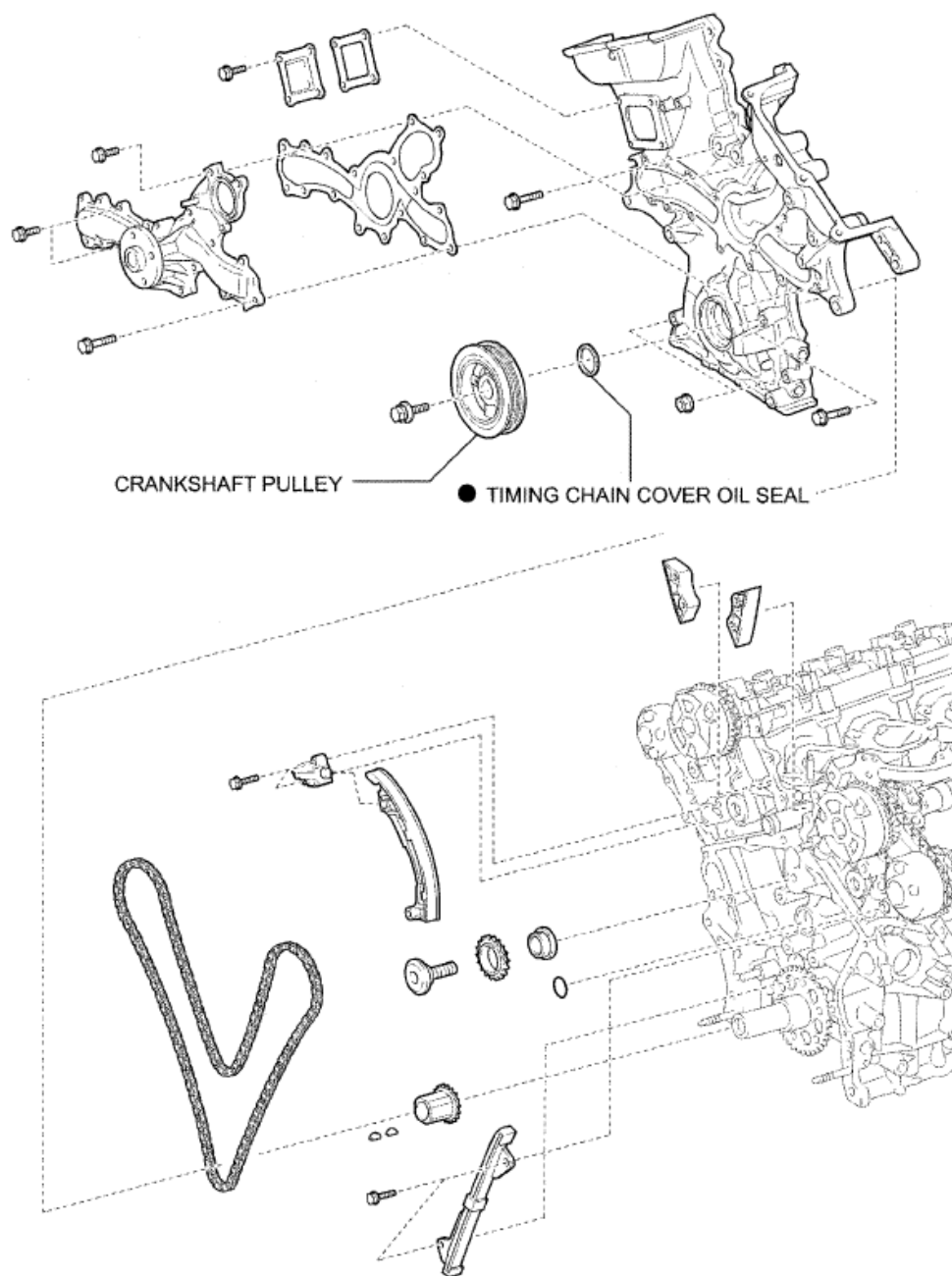
Fig. 12: Identifying Engine Front Oil Seal Components (1 Of 3) View Of Drive Belt And Pulley
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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Fig. 13: Identifying Engine Front Oil Seal Components (2 Of 3)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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Fig. 14: Identifying Engine Front Oil Seal Components (3 Of 3)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. REMOVE FRONT WHEEL RH
2. REMOVE FRONT FENDER APRON SEAL RH

3. **REMOVE V-BANK COVER SUB-ASSEMBLY**
4. **REMOVE FAN AND GENERATOR V BELT**

HINT:

Remove V-ribbed belt (See **REMOVAL**).

5. **REMOVE CRANKSHAFT PULLEY** (See **DISASSEMBLY**)
6. **REMOVE TIMING CHAIN COVER OIL SEAL**
 - a. Using a screwdriver, pry out the oil seal.

NOTE: Be careful not to damage the crankshaft. Tape the screwdriver tip before use.

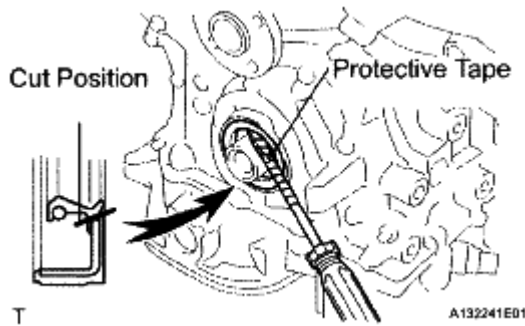


Fig. 15: Identifying Protective Tape Applying Area
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSTALLATION

1. **INSTALL TIMING CHAIN COVER OIL SEAL**
 - a. Apply MP grease to a new oil seal lip.
 - b. Using SST and a hammer, tap in the oil seal until its surface is flush with the timing chain cover edge.

SST 09316-60011 (09316-00011)

2. **INSTALL CRANKSHAFT PULLEY** (See **REASSEMBLY**)
3. **INSTALL FAN AND GENERATOR V BELT**

HINT:

Install the V-ribbed belt (See **INSTALLATION**).

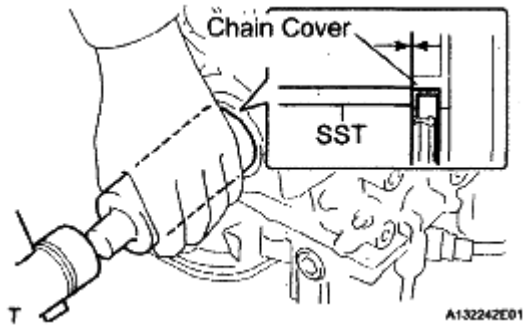


Fig. 16: Identifying Chain Cover

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

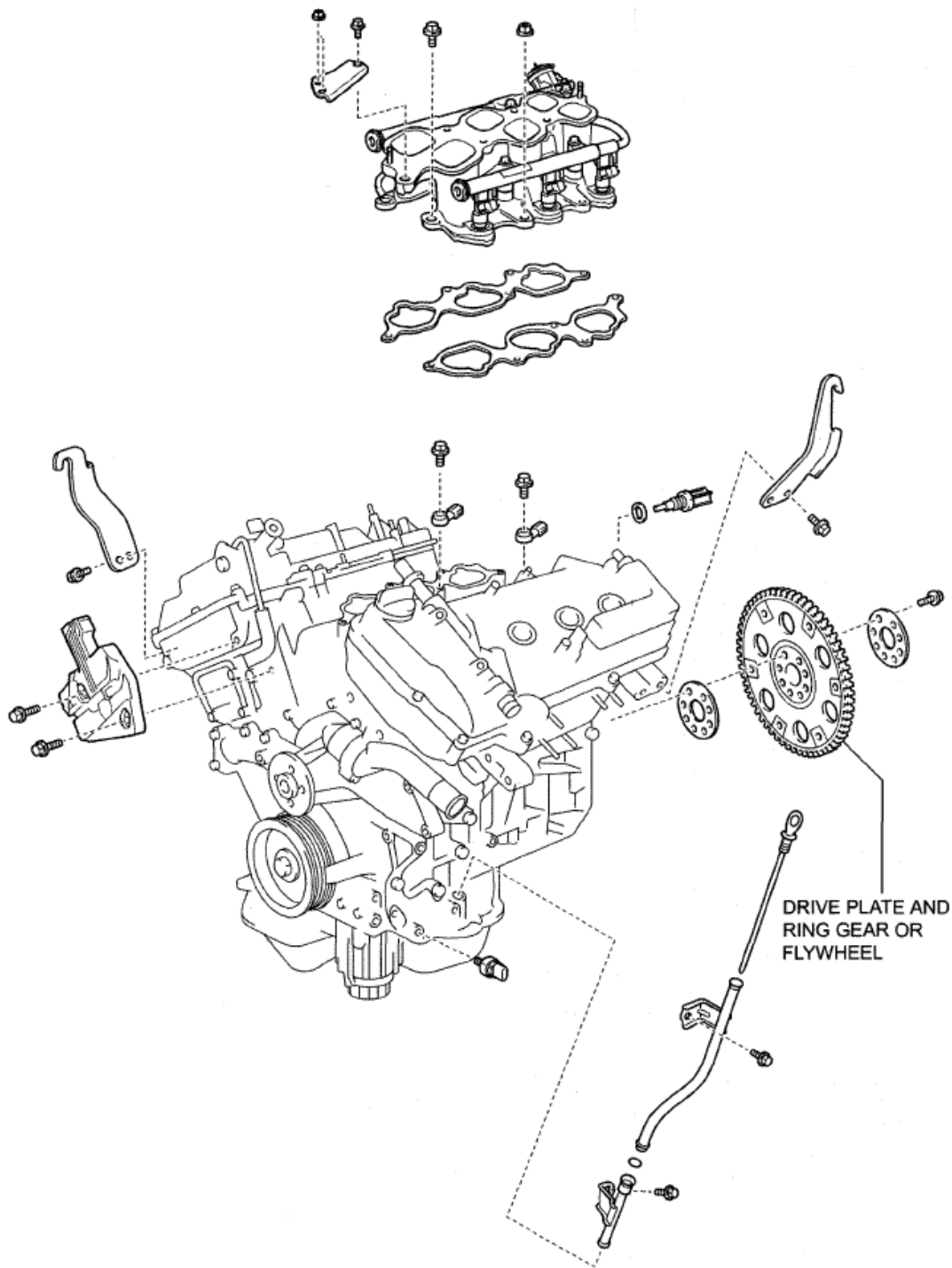
4. INSTALL V-BANK COVER SUB-ASSEMBLY
5. INSTALL FRONT WHEEL RH

ENGINE REAR OIL SEAL

COMPONENTS

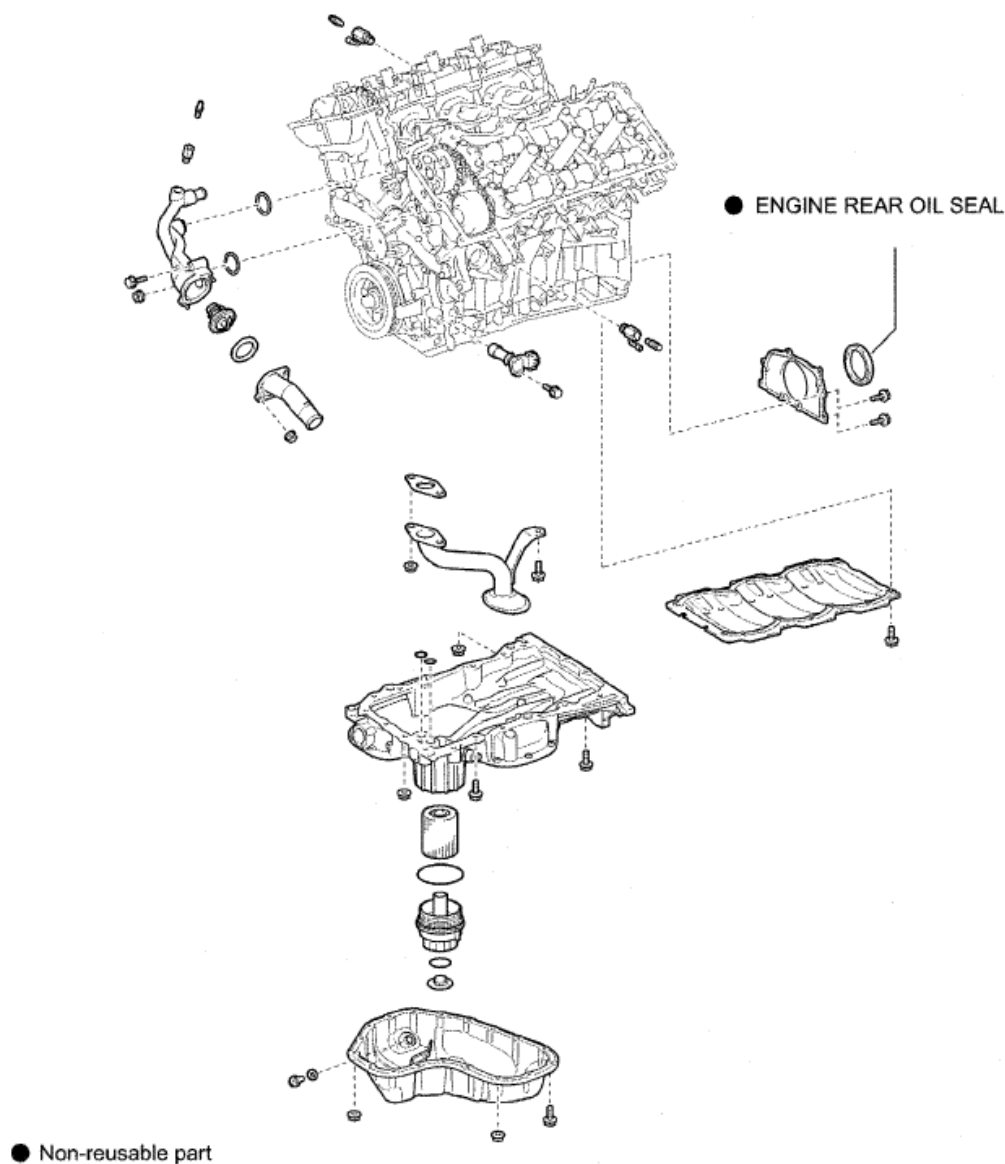


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Fig. 18: Identifying Engine Rear Oil Seal Components (2 Of 3)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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Fig. 19: Identifying Engine Rear Oil Seal Components (3 Of 3)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. REMOVE AUTOMATIC TRANSAXLE ASSEMBLY

See **REMOVAL**

2. REMOVE DRIVE PLATE AND RING GEAR OR FLYWHEEL

- a. Using SST, hold the crankshaft.

SST 09213-70011 (09213-70020), 09330-00021

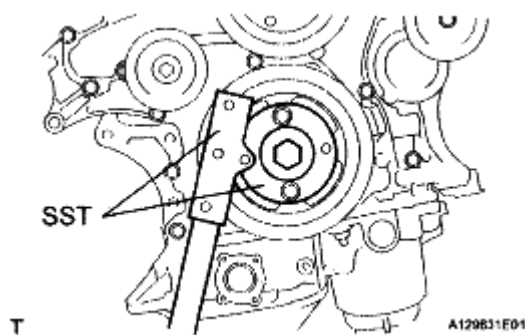


Fig. 20: Holding Crankshaft

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

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

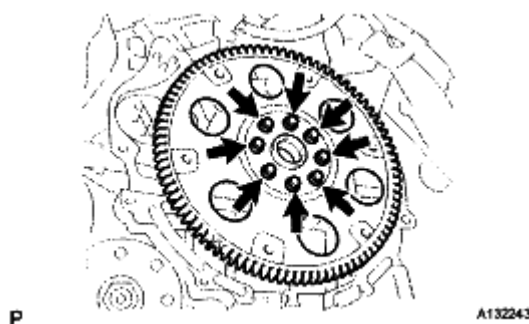


Fig. 21: Locating Front Spacer, Drive Plate And Rear Spacer Bolts

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

3. REMOVE ENGINE REAR OIL SEAL

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

NOTE: Be careful not to damage the crankshaft. Tape the screwdriver tip before use.

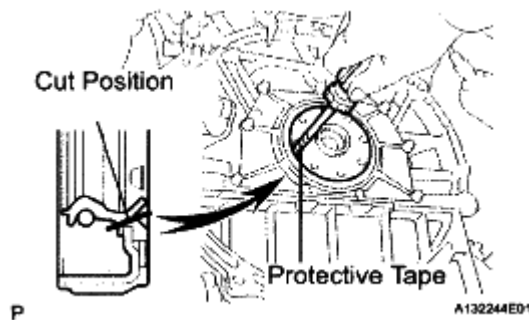


Fig. 22: Cutting Off Oil Seal Lip

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

INSTALLATION

1. INSTALL ENGINE REAR OIL SEAL

- Apply MP grease to a new oil seal lip.
- Using SST and a hammer, tap in the oil seal.

SST 09223-15030, 09950-70010 (09951-07150)

Oil seal tap in depth: -0.5 to 0.5 mm (-0.020 to 0.020 in.)

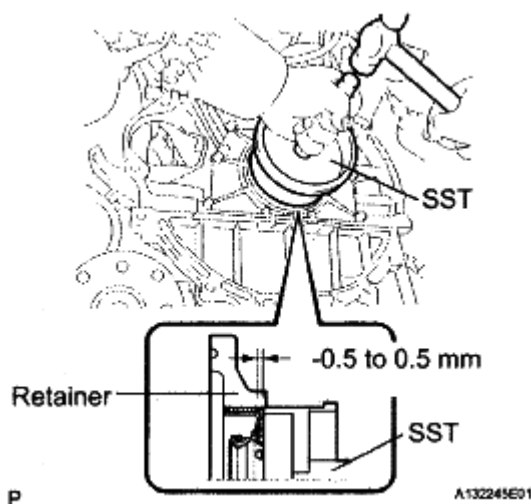


Fig. 23: Tapping In Oil Seal

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

2. INSTALL DRIVE PLATE AND RING GEAR OR FLYWHEEL

- Using SST, hold the crankshaft.

SST 09213-70011 (09213-70020), 09330-00021

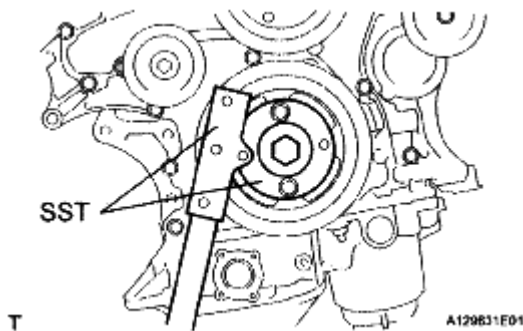


Fig. 24: Holding Crankshaft

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

- Apply adhesive to 2 or 3 threads of the mounting bolt end.

Adhesive: Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

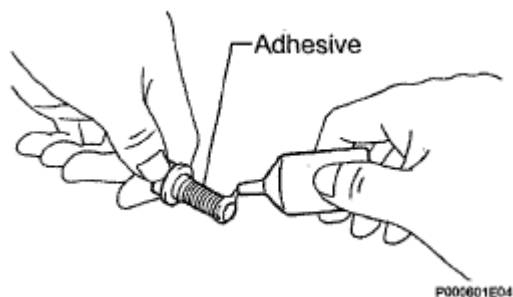


Fig. 25: Applying Adhesive To Threads Of Mounting Bolt End
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. Install the front spacer, drive plate and rear spacer on the crankshaft.
2. Install and tighten the 8 mounting bolts uniformly in several steps.

Torque: 83 N*m (850 kgf*cm, 61 ft.*lbf)

3. INSTALL AUTOMATIC TRANSAXLE ASSEMBLY

See **INSTALLATION**

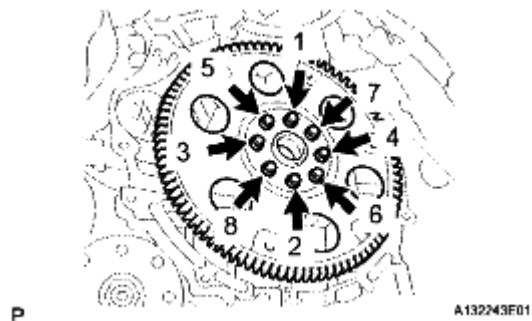
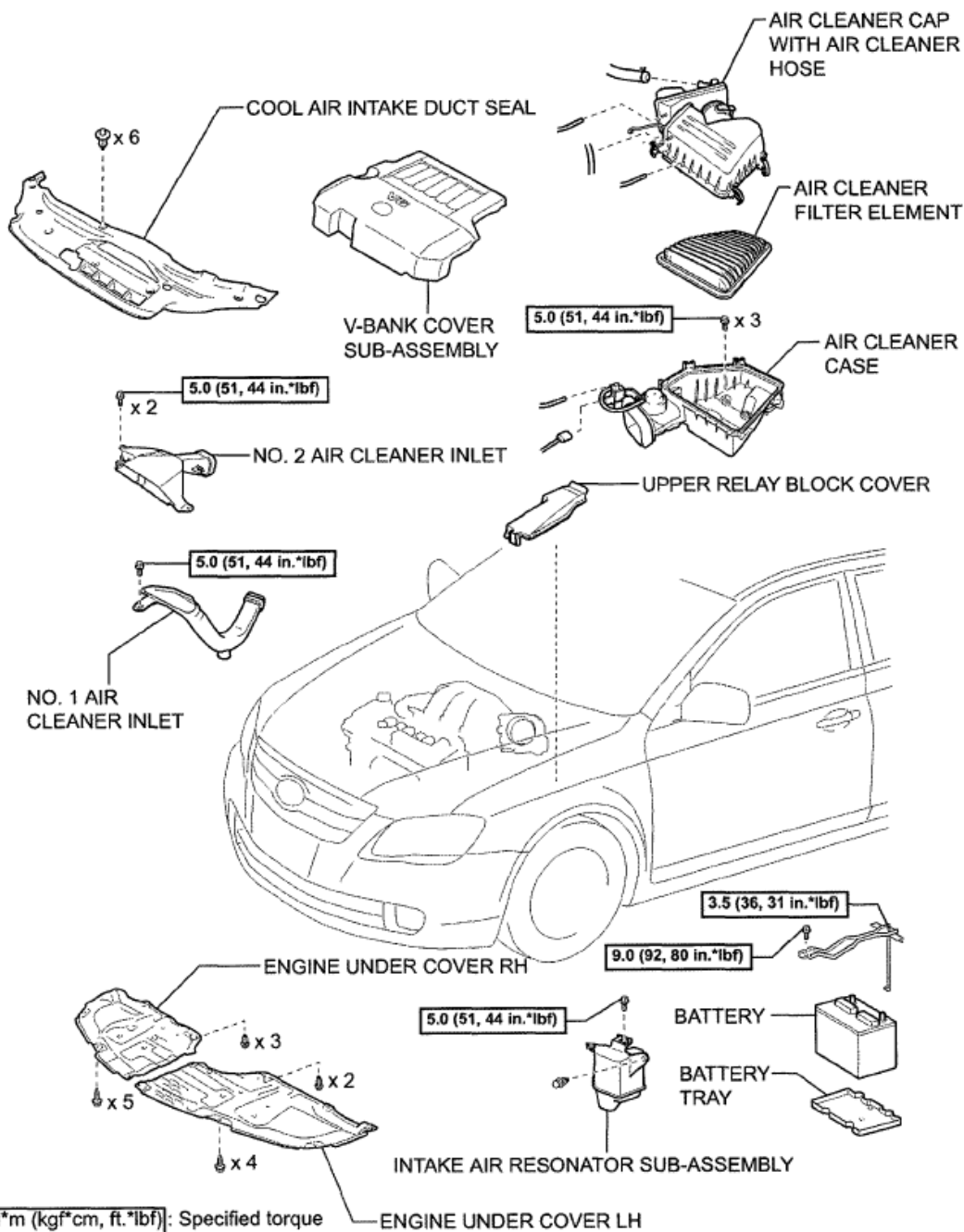


Fig. 26: Locating Mounting Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

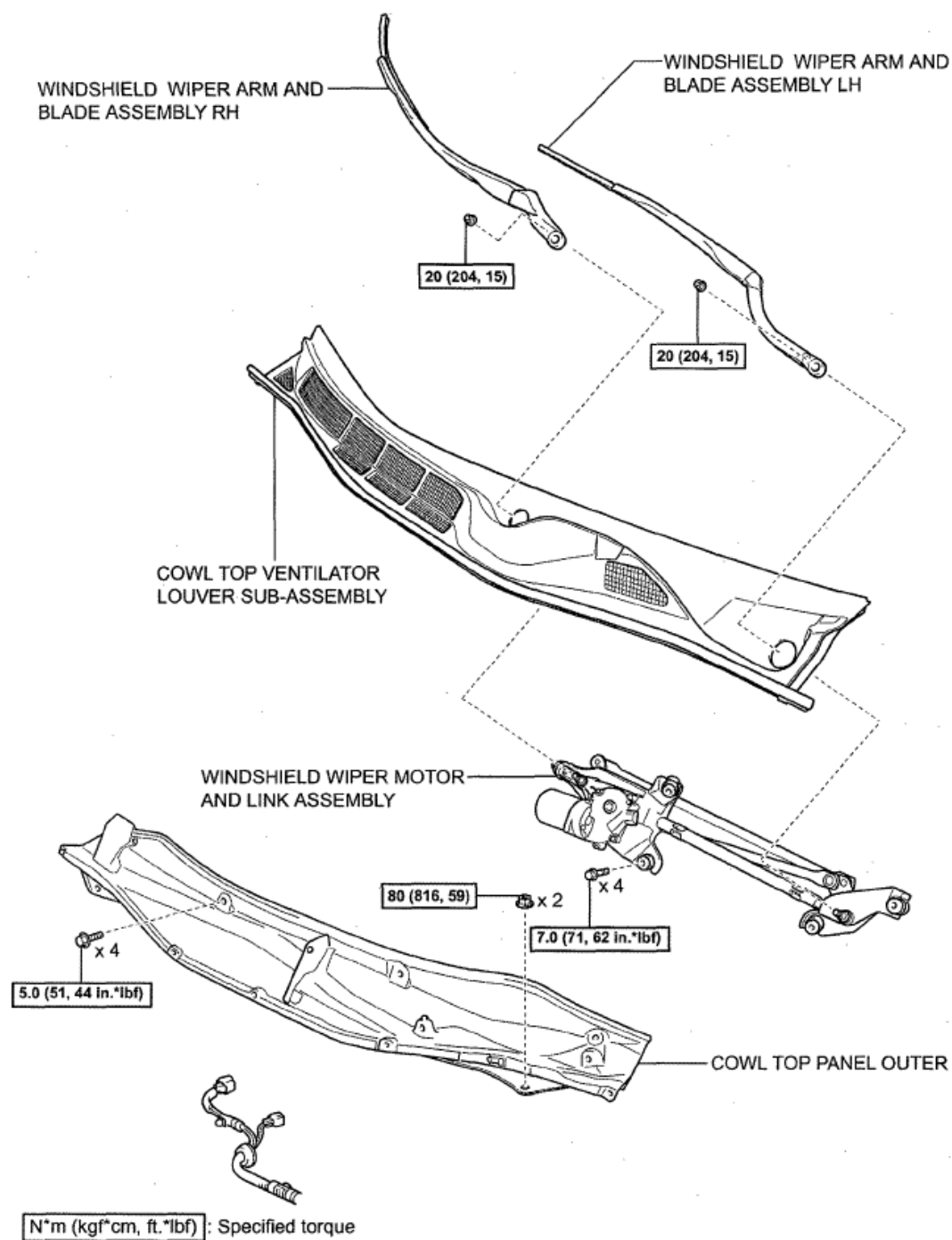
ENGINE ASSEMBLY

COMPONENTS



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Fig. 27: Identifying Engine Assembly Components With Torque Specification (1 Of 9)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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Fig. 28: Identifying Engine Assembly Components With Torque Specification (2 Of 9)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

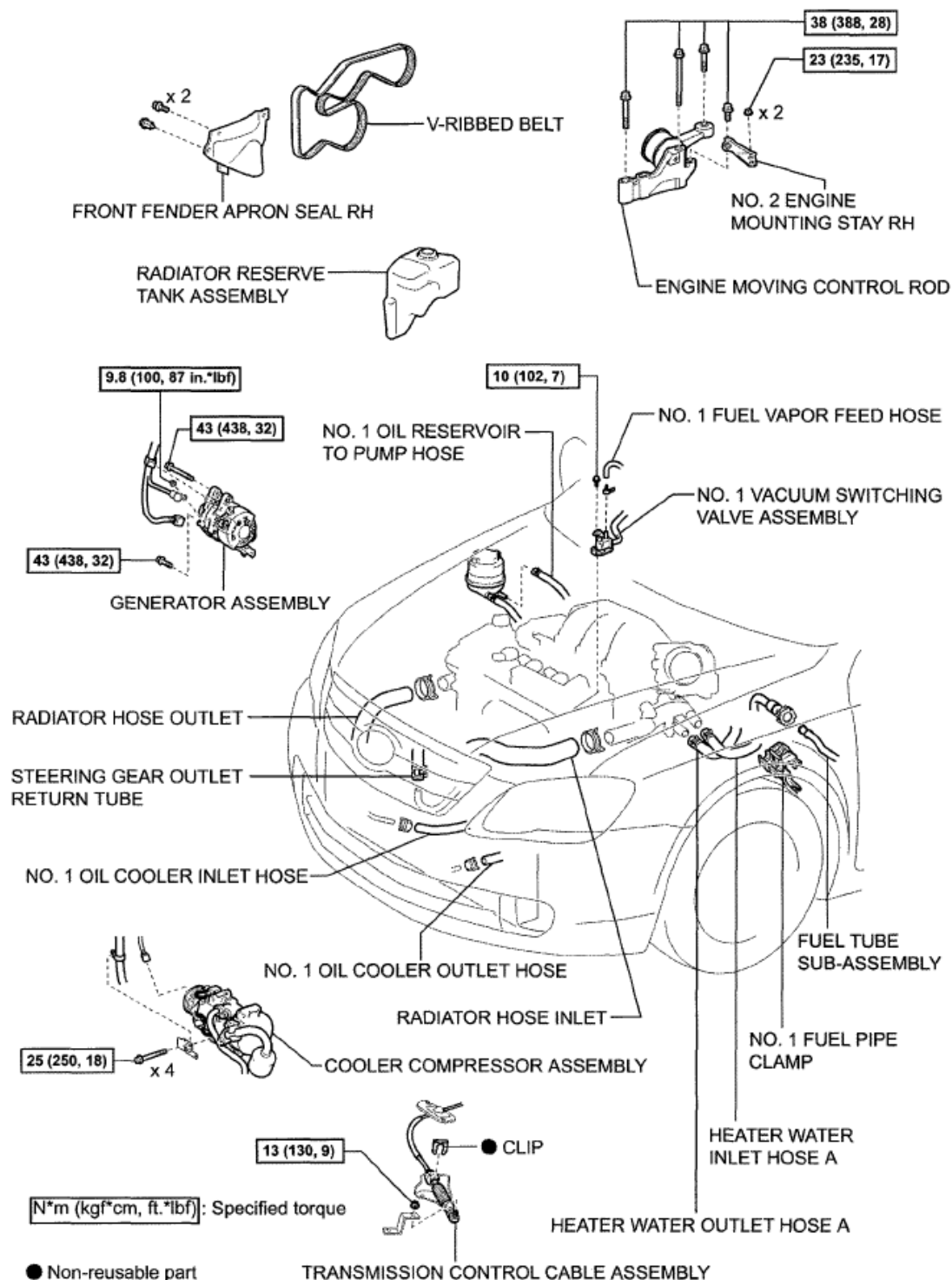
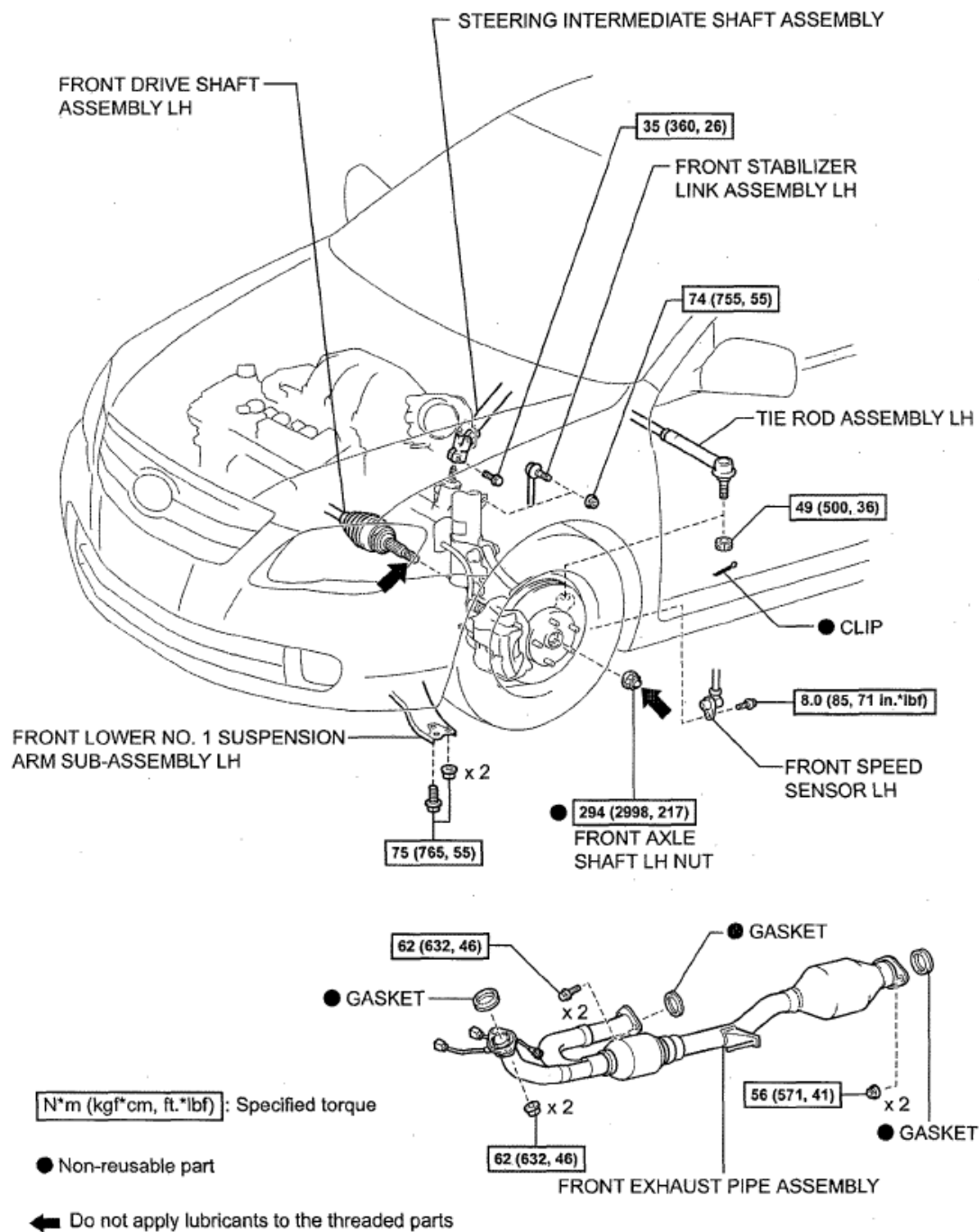


Fig. 29: Identifying Engine Assembly Components With Torque Specification (3 Of 9)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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Fig. 30: Identifying Engine Assembly Components With Torque Specification (4 Of 9)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

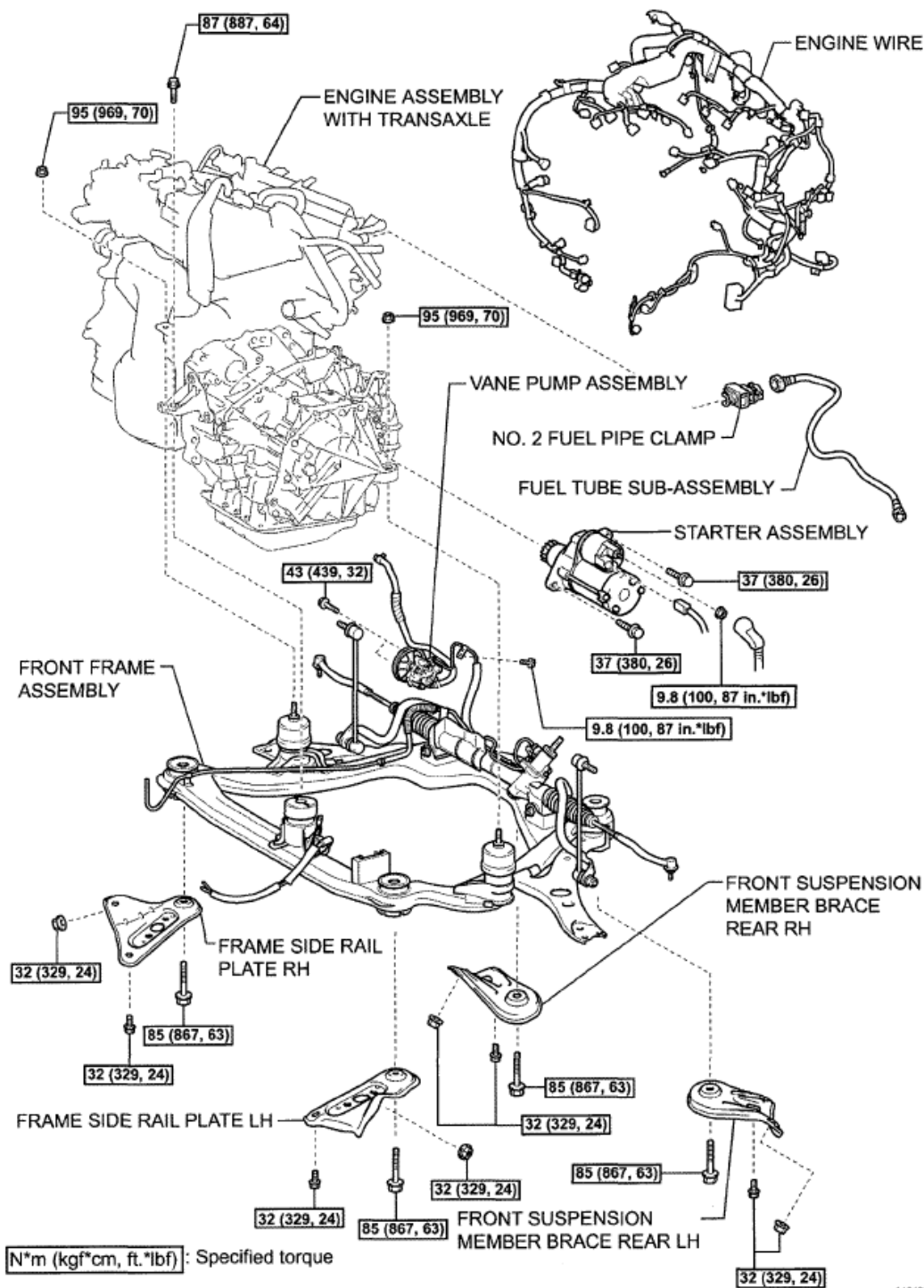
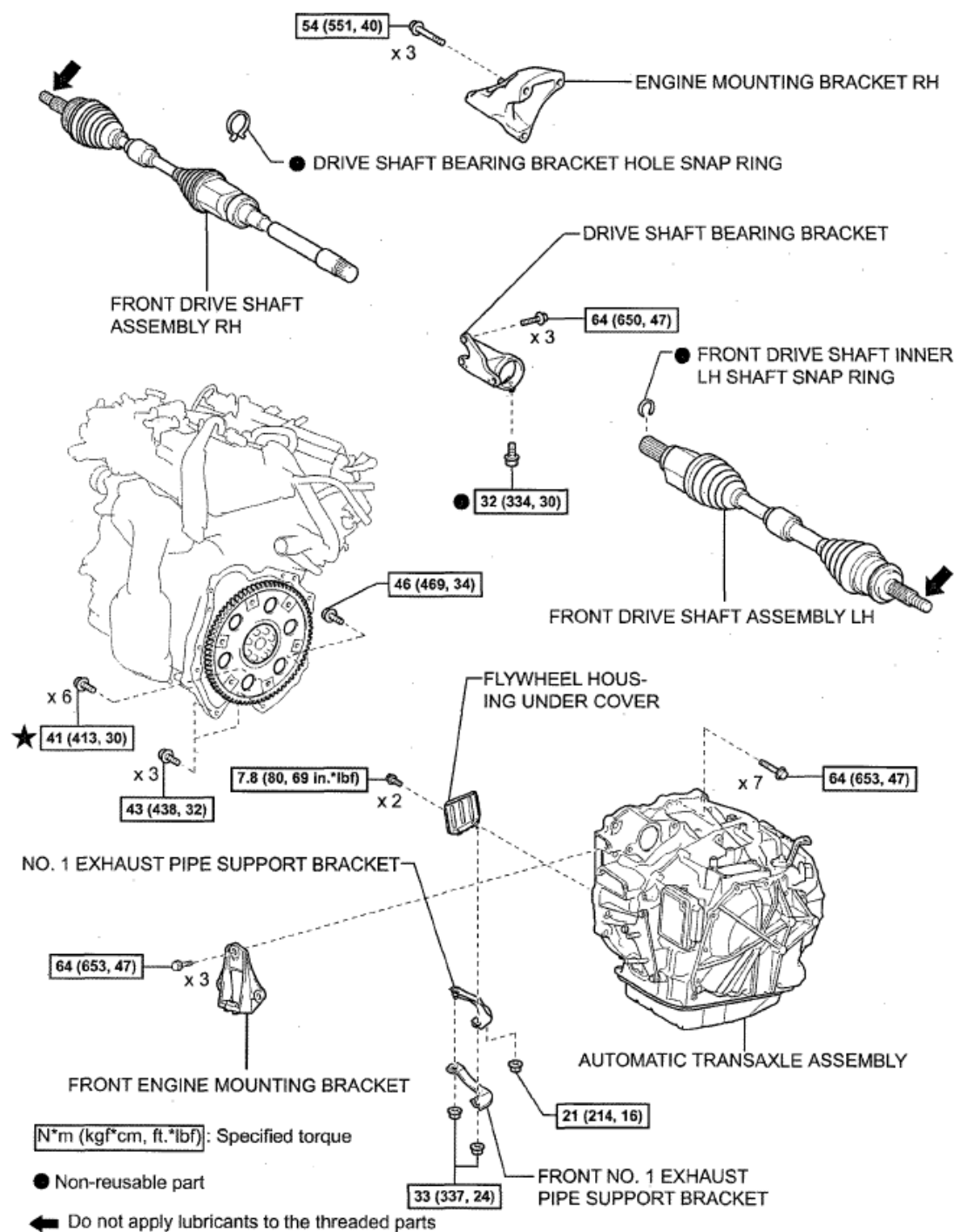
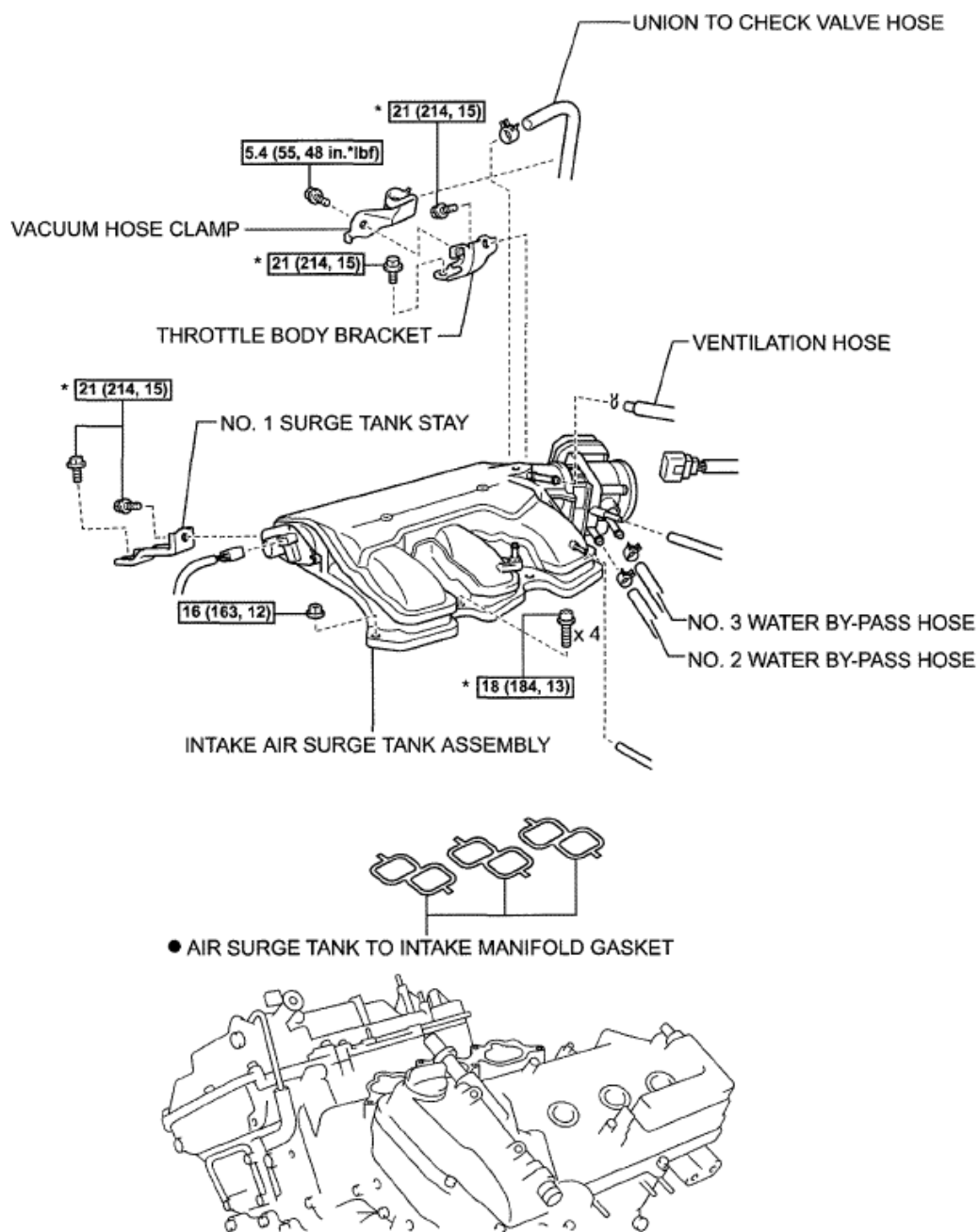


Fig. 31: Identifying Engine Assembly Components With Torque Specification (5 Of 9)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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Fig. 32: Identifying Engine Assembly Components With Torque Specification 6 Of 9)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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

● Non-reusable part

* DO NOT apply oil

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Fig. 33: Identifying Engine Assembly Components With Torque Specification (7 Of 9)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

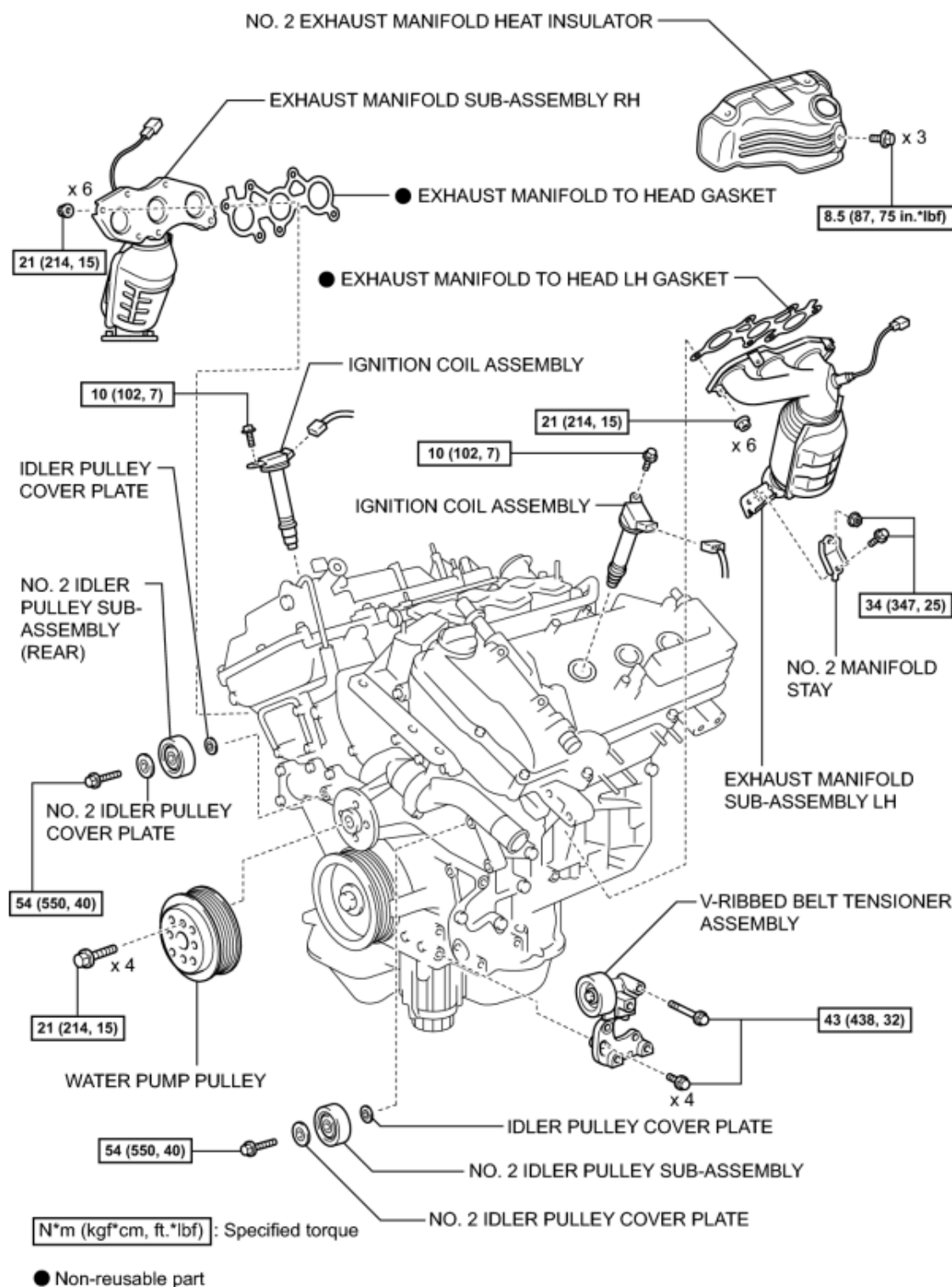
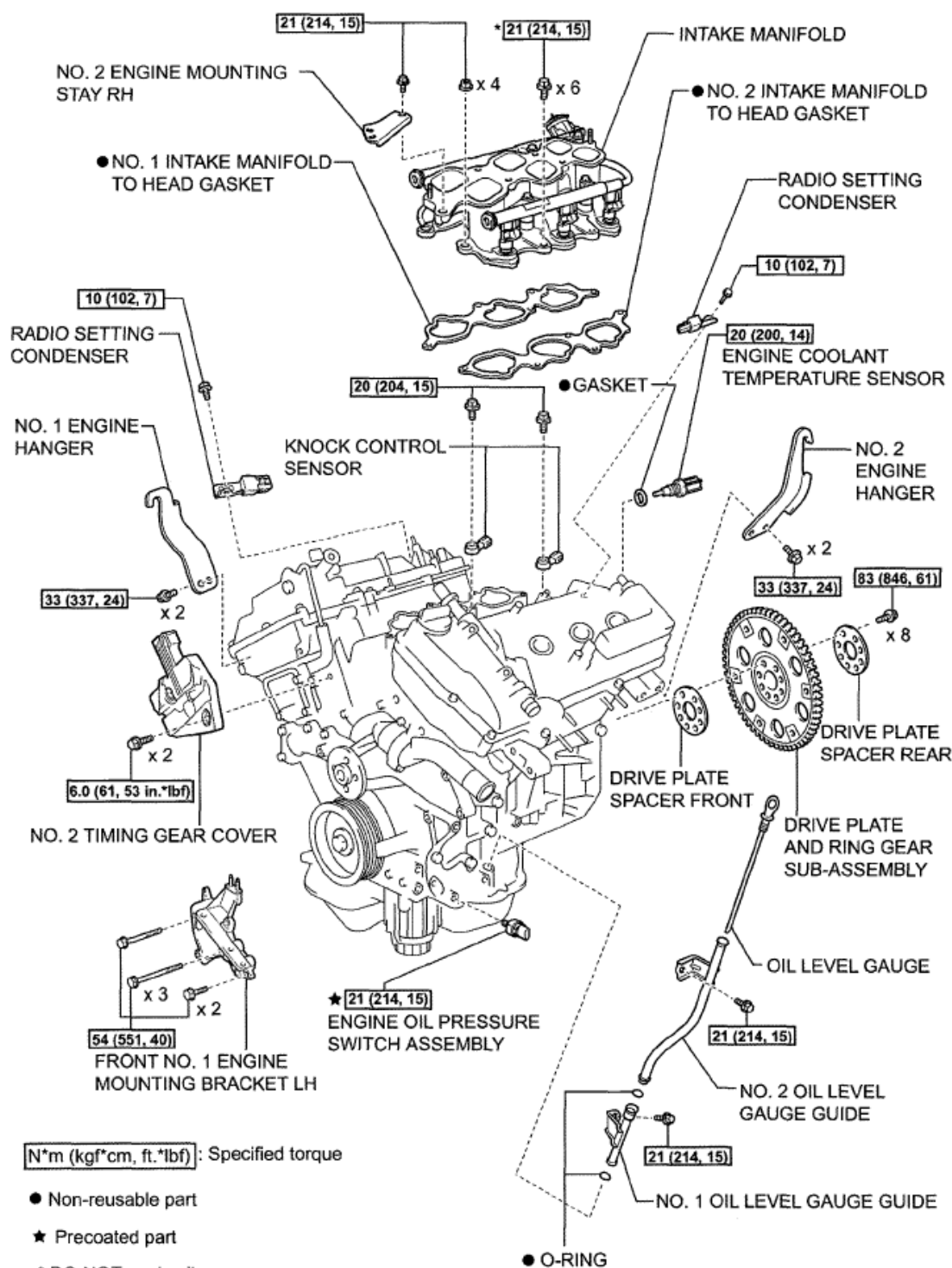


Fig. 34: Identifying Engine Assembly Components With Torque Specification (8 Of 9)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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Fig. 35: Identifying Engine Assembly Components With Torque Specification (9 Of 8)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. DISCHARGE FUEL SYSTEM PRESSURE

See **PRECAUTION**

- 2. REMOVE FRONT WHEELS**
- 3. REMOVE ENGINE UNDER COVER RH**
- 4. REMOVE ENGINE UNDER COVER LH**
- 5. REMOVE FRONT FENDER APRON SEAL RH**
- 6. DRAIN ENGINE OIL**
- 7. DRAIN ENGINE COOLANT (See REPLACEMENT)**
- 8. DRAIN AUTOMATIC TRANSAXLE FLUID (See REMOVAL)**
- 9. REMOVE WINDSHIELD WIPER ARM AND BLADE ASSEMBLY LH (See REMOVAL)**
- 10. REMOVE WINDSHIELD WIPER ARM AND BLADE ASSEMBLY RH (See REMOVAL)**
- 11. REMOVE COWL TOP VENTILATOR LOUVER SUB-ASSEMBLY (See REMOVAL)**
- 12. REMOVE WINDSHIELD WIPER MOTOR AND LINK ASSEMBLY (See REMOVAL)**
- 13. REMOVE COWL TOP PANEL OUTER (See REMOVAL)**
- 14. REMOVE BATTERY**
- 15. REMOVE COOL AIR INTAKE DUCT SEAL**
 - a. Remove the 6 clips and intake duct seal.
- 16. REMOVE V-BANK COVER SUB-ASSEMBLY (See REMOVAL)**
- 17. REMOVE V-RIBBED BELT (See REMOVAL)**
- 18. REMOVE RADIATOR RESERVE TANK ASSEMBLY**

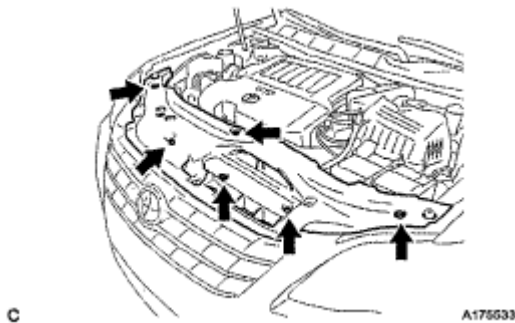


Fig. 36: Locating Intake Duct Seal Clips

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

- 19. REMOVE NO. 2 ENGINE MOUNTING STAY RH**
 - a. Remove the bolt, 2 nuts and No. 2 engine mounting stay RH.



Fig. 37: Locating Engine Mounting Stay Bolt And Nut RH
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

20. REMOVE ENGINE MOVING CONTROL ROD

- a. Remove the 4 bolts and engine moving control rod.

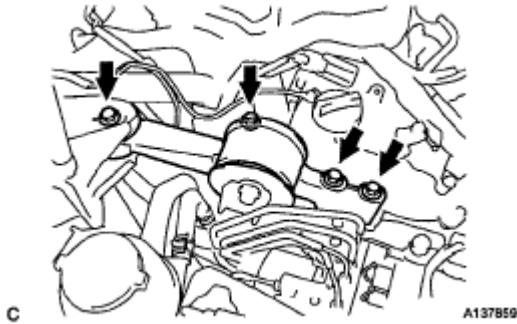


Fig. 38: Locating Engine Moving Control Rod Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

21. REMOVE NO. 2 AIR CLEANER INLET

- a. Disconnect the clamp and 2 vacuum hoses.
- b. Remove the 2 bolts and No. 2 air cleaner inlet.

22. REMOVE AIR CLEANER CAP WITH AIR CLEANER HOSE (See REMOVAL)

23. REMOVE AIR CLEANER CASE

- a. Remove the air cleaner filter element from the air cleaner case.

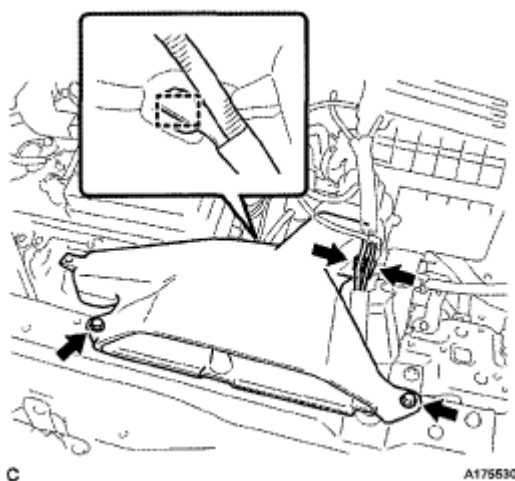


Fig. 39: Locating Air Cleaner Filter Element From Air Cleaner Case And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Disconnect the connector, vacuum hose, and hose clamp.
- c. Remove the 3 bolts and air cleaner case.

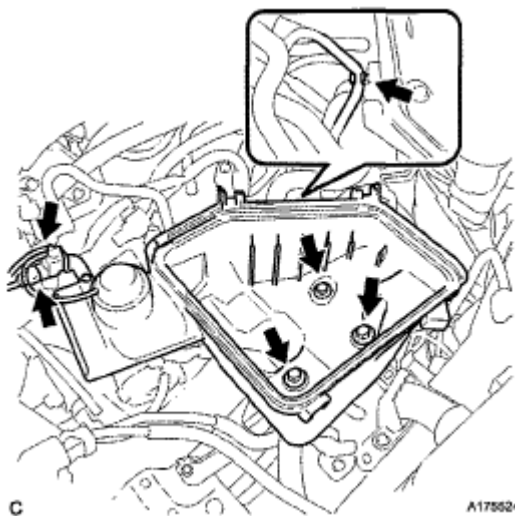


Fig. 40: Locating Air Cleaner Case Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

24. REMOVE NO. 1 AIR CLEANER INLET

- a. Remove the bolt and No. 1 air cleaner inlet.

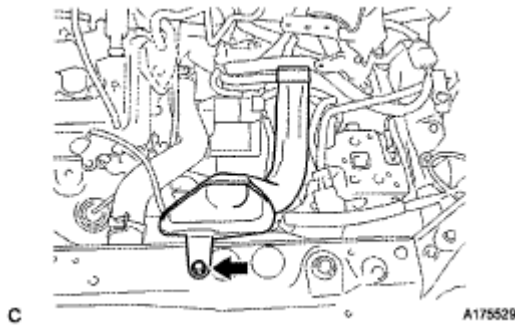


Fig. 41: Locating No.1 Air Cleaner Inlet
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

25. REMOVE INTAKE AIR RESONATOR SUB-ASSEMBLY

- a. Disconnect the wire harness clamp.
- b. Remove the clip, bolt and intake air resonator.

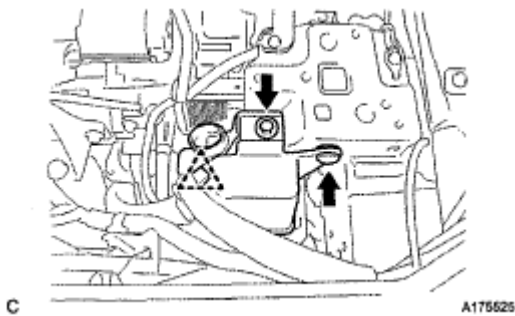


Fig. 42: Locating Intake Air Resonator Clip And Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

26. REMOVE NO. 1 FUEL VAPOR FEED HOSE

- a. Remove the clamp and disconnect the No. 1 fuel vapor feed hose.

27. REMOVE INTAKE AIR SURGE TANK ASSEMBLY (See REMOVAL)

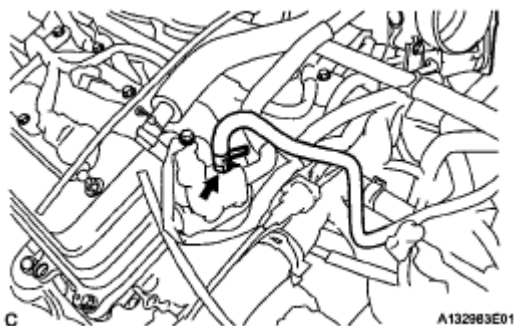


Fig. 43: Locating No. 1 Fuel Vapor Feed Hose Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

28. SEPARATE FUEL TUBE SUB-ASSEMBLY

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

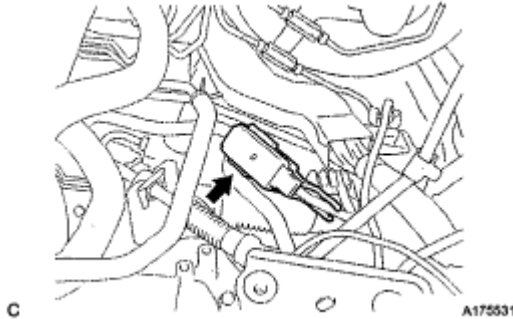


Fig. 44: Locating No. 1 Fuel Pipe Clamp Claw
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

NOTE:

- Check for contamination in the pipe and around the connector. Clean if necessary and then disconnect the connector.
- Disconnect the connector by hand.
- Do not bend, kink or twist the nylon tube.
- If the pipe and connector are stuck together, push and pull on the connector to release them.
- Put the pipe and connector ends in vinyl bags to prevent damage and contamination.

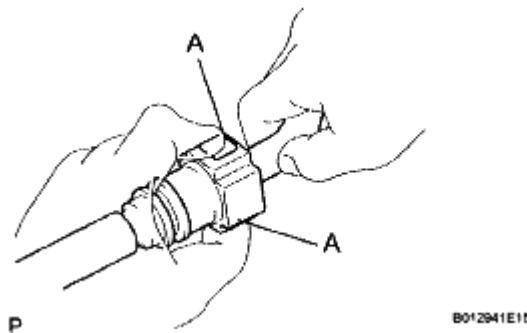


Fig. 45: Disconnecting Connector From Tube
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

29. REMOVE RADIATOR HOSE INLET

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

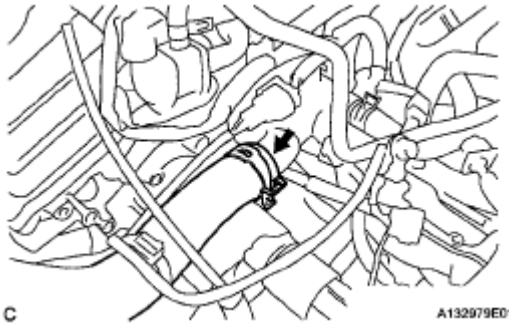


Fig. 46: Locating Radiator Hose Inlet Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

30. **REMOVE RADIATOR HOSE OUTLET**
 - a. Remove the clamp and disconnect the radiator hose outlet.
31. **DISCONNECT NO. 1 OIL COOLER INLET HOSE** (See **REMOVAL**)
32. **DISCONNECT NO. 1 OIL COOLER OUTLET HOSE** (See **REMOVAL**)

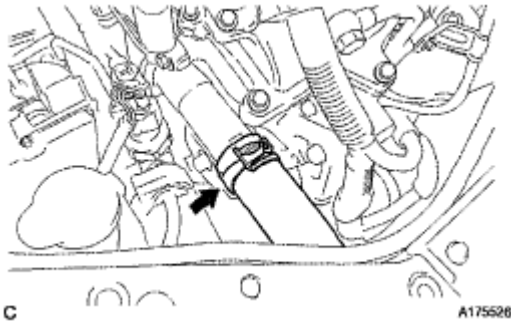


Fig. 47: Locating Radiator Hose Outlet Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

33. **DISCONNECT HEATER WATER INLET HOSE A**
 - a. Disconnect the heater water inlet hose.
34. **DISCONNECT HEATER WATER OUTLET HOSE A**
 - a. Disconnect the heater water outlet hose.
35. **REMOVE ECM** (See **REMOVAL**)
36. **REMOVE STARTER ASSEMBLY** (See **REMOVAL**)
37. **REMOVE UPPER RELAY BLOCK COVER**

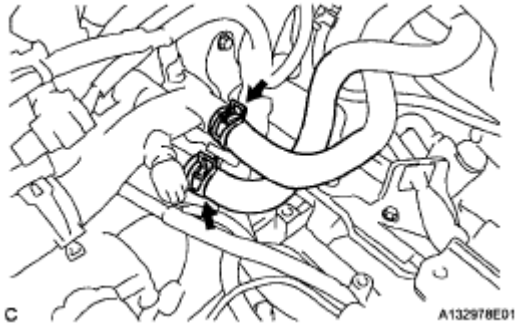


Fig. 48: Locating Heater Water Outlet Hose
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

38. DISCONNECT ENGINE WIRE

- a. Disconnect the engine wire from the engine room junction block.
 1. Remove the nut and separate the wire harness.
 2. Using a screwdriver, release the engine room junction block. Pull the engine room junction block upward.
 3. Disconnect the 2 engine wire connectors.

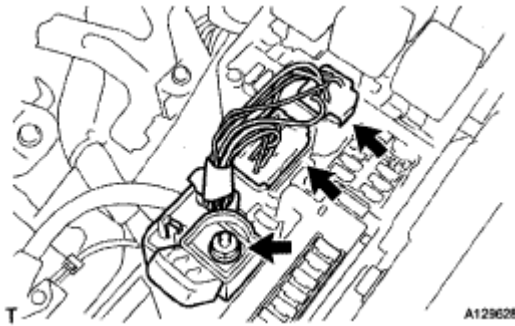


Fig. 49: Locating Engine Wire Connectors
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Disconnect the engine wire connector and 3 clamps.
- c. Remove the 2 bolts and disconnect the 2 ground cables.

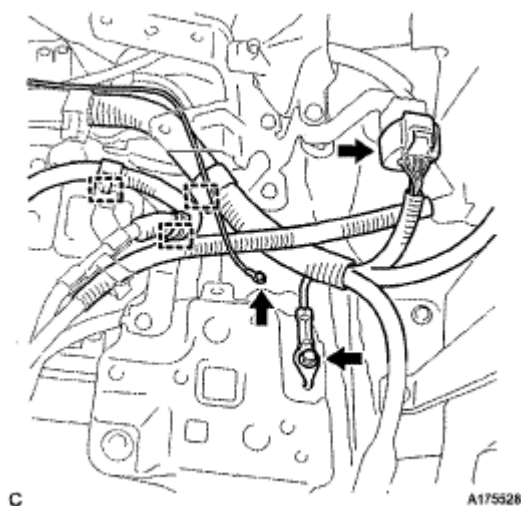


Fig. 50: Locating Ground Cables Bolts

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

- d. Remove the bolt and disconnect the ground cable from the wire bracket.
- e. Disconnect the engine wire clamp.
- f. Remove the 2 bolts and ground cable from the cylinder head.
- 39. **SEPARATE WIRE HARNESS** (See REMOVAL)
- 40. **DISCONNECT CONNECTOR** (See REMOVAL)
- 41. **DISCONNECT TRANSMISSION CONTROL CABLE ASSEMBLY** (See REMOVAL)

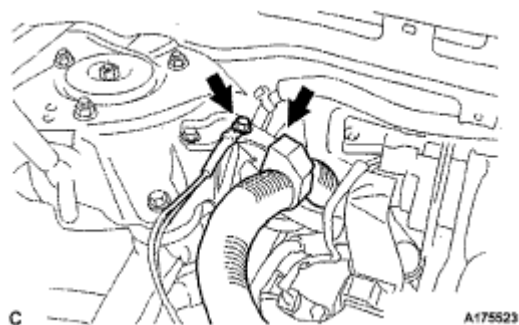


Fig. 51: Locating Ground Cable Bracket Bolts

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

- 42. **DISCONNECT NO. 1 OIL RESERVOIR TO PUMP HOSE**
 - a. Disconnect the No. 1 oil reservoir to pump hose.

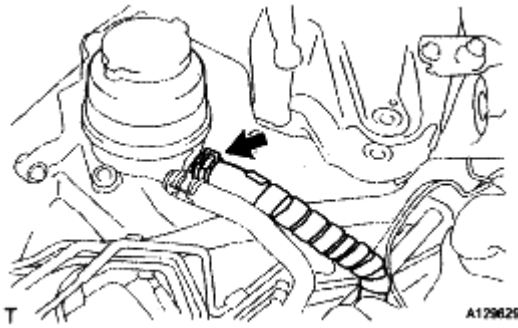


Fig. 52: Locating No. 1 Oil Reservoir To Pump Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

43. **DISCONNECT STEERING GEAR OUTLET RETURN TUBE**
 - a. Disconnect the steering gear outlet return tube.
44. **REMOVE FRONT NO. 1 EXHAUST PIPE SUPPORT BRACKET** (See **REMOVAL**)
45. **REMOVE FRONT EXHAUST PIPE ASSEMBLY** (See **REMOVAL**)
46. **SEPARATE FRONT STABILIZER LINK ASSEMBLY LH** (See **REMOVAL**)

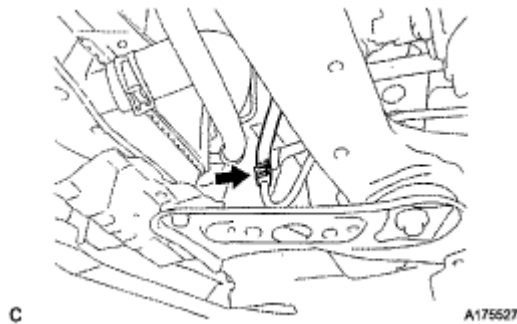


Fig. 53: Locating Steering Gear Outlet Return Tube
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

47. **SEPARATE FRONT STABILIZER LINK ASSEMBLY RH**

HINT:

Use the same procedures described for the LH side.

48. **REMOVE FRONT AXLE SHAFT LH NUT** (See **REMOVAL**)
49. **REMOVE FRONT AXLE SHAFT RH NUT**

HINT:

Use the same procedures described for the LH side.

50. **SEPARATE FRONT SPEED SENSOR LH** (See **REMOVAL**)

51. SEPARATE FRONT SPEED SENSOR RH

HINT:

Use the same procedures described for the LH side.

52. SEPARATE TIE ROD ASSEMBLY LH (See REMOVAL)**53. SEPARATE TIE ROD ASSEMBLY RH**

HINT:

Use the same procedures described for the LH side.

54. DISCONNECT FRONT LOWER NO. 1 SUSPENSION ARM SUB-ASSEMBLY LH (See REMOVAL)**55. DISCONNECT FRONT LOWER NO. 1 SUSPENSION ARM SUB-ASSEMBLY RH**

HINT:

Use the same procedures described for the LH side.

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

HINT:

Use the same procedures described for the LH side.

58. REMOVE NO. 1 EXHAUST PIPE SUPPORT BRACKET

- a. Remove the nut and No. 1 exhaust pipe support bracket.

59. REMOVE FLYWHEEL HOUSING UNDER COVER (See REMOVAL)**60. REMOVE DRIVE PLATE AND TORQUE CONVERTER CLUTCH SETTING BOLT (See REMOVAL)****61. DISCONNECT STEERING INTERMEDIATE SHAFT ASSEMBLY (See REMOVAL)****62. REMOVE GENERATOR ASSEMBLY (See REMOVAL)****63. SEPARATE COOLER COMPRESSOR ASSEMBLY**

- a. Remove the 2 connector clamps.
- b. Remove the 4 bolts and separate the compressor.

HINT:

Hang up the compressor and hoses instead of detaching them.

64. REMOVE ENGINE ASSEMBLY WITH TRANSAXLE

- a. Set the engine lifter.

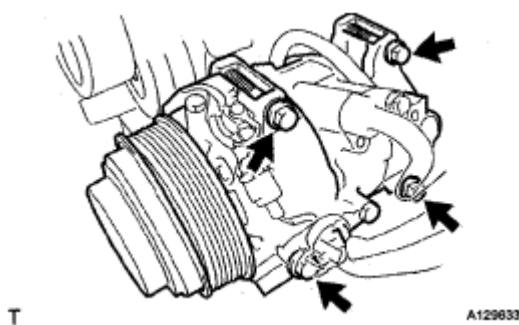


Fig. 54: Locating Cooler Compressor Assembly Bolts

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

- b. Remove the 4 bolts, 2 nuts, frame side rail plates RH and LH.
- c. Remove the 4 bolts, 2 nuts, front suspension member brace rears RH and LH.
- d. Operate the engine lifter, and then remove the engine assembly from the vehicle.

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

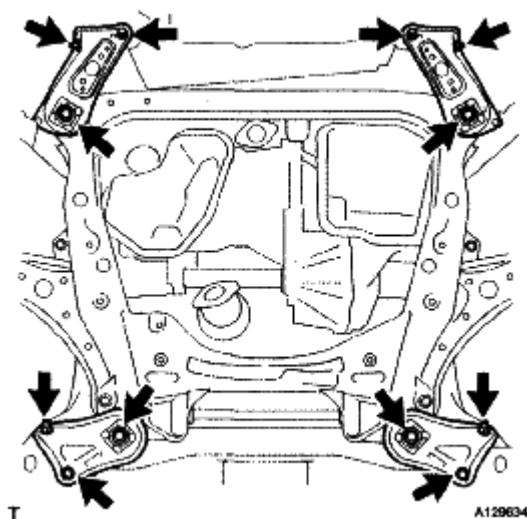


Fig. 55: Locating Frame Side Rail Plates RH And LH Bolts And Nuts

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

- e. Install the 2 engine hangers with the 4 bolts as shown in the illustration.

Part NO.:

No. 1 engine hanger 12281-31120

No. 2 engine hanger 12282-31100

Bolts 90119-A0117

Torque: 33 N*m (337 kgf*cm, 24 ft.*lbf)

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

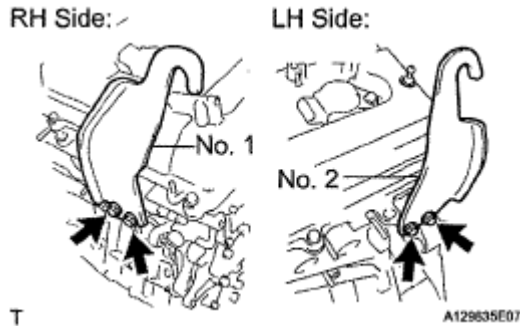


Fig. 56: Locating Engine Hangers With Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

65. REMOVE VANE PUMP ASSEMBLY

- a. Remove the pressure feed tube clamp bolt.
- b. Remove the 2 bolts and vane pump.

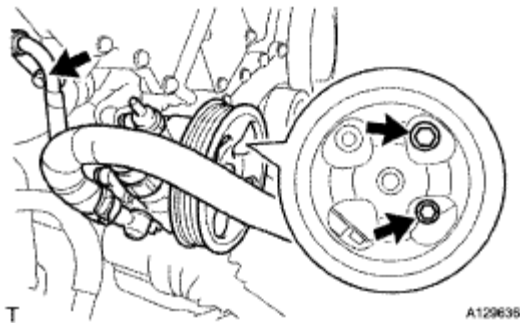


Fig. 57: Locating Frame Side Rail Plates RH And LH Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

66. REMOVE FRONT FRAME ASSEMBLY

- a. Disconnect the connector and clamp.

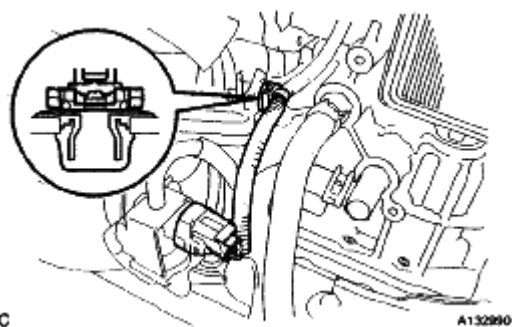


Fig. 58: Identifying Connector And Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Disengage the 2 clamps.

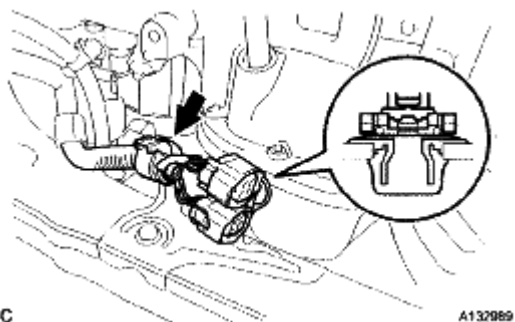


Fig. 59: Locating Clamps
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Remove the 2 nuts and disconnect the engine mounting insulators RH and LH.

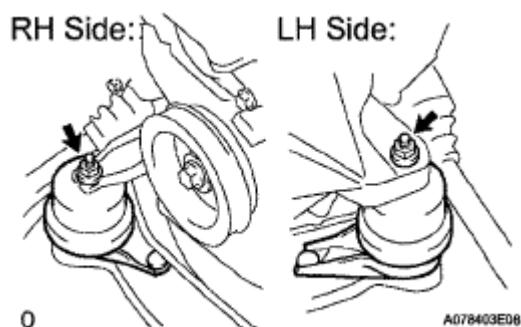


Fig. 60: Locating Engine Mounting Insulators Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Remove the bolt and disconnect the front engine mounting insulator.
67. **REMOVE FRONT DRIVE SHAFT ASSEMBLY LH** (See **REMOVAL**)
 68. **REMOVE FRONT DRIVE SHAFT ASSEMBLY RH** (See **REMOVAL**)
 69. **REMOVE ENGINE WIRE**

70. **REMOVE AUTOMATIC TRANSAXLE ASSEMBLY** (See **REMOVAL**)

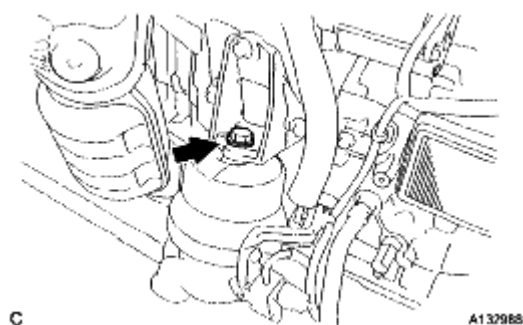


Fig. 61: Locating Front Engine Mounting Insulator Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

71. **REMOVE DRIVE PLATE AND RING GEAR SUB-ASSEMBLY** (See **REMOVAL**)

72. **INSTALL ENGINE STAND**

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

73. **REMOVE IGNITION COIL ASSEMBLY**

- a. Remove the 6 bolts and 6 ignition coils.

74. **REMOVE NO. 2 ENGINE MOUNTING STAY RH**

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

75. **REMOVE INTAKE MANIFOLD**

- a. Uniformly loosen and remove the 6 bolts and 4 nuts.
- b. Remove the intake manifold and 2 gaskets.

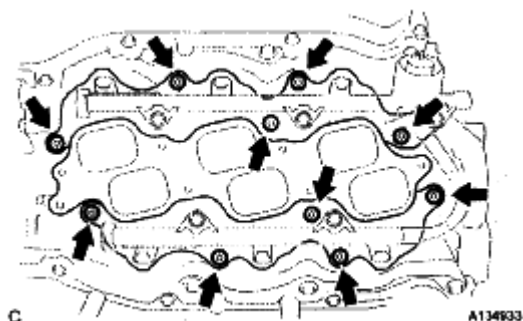


Fig. 62: Locating Intake Manifold Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

76. **REMOVE EXHAUST MANIFOLD SUB-ASSEMBLY RH**

- a. Uniformly loosen and remove the 6 nuts.
- b. Remove the manifold and gasket.

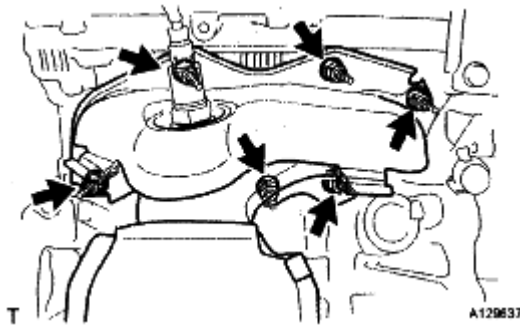


Fig. 63: Locating Exhaust Manifold Sub-Assembly Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

77. REMOVE OIL LEVEL GAUGE GUIDE SUB-ASSEMBLY

- a. Remove the oil level gauge.
- b. Remove the 2 bolts, No. 1 oil level gauge guide and No. 2 oil level gauge guide.
- c. Remove the 2 O-rings from the oil level gauge guides.

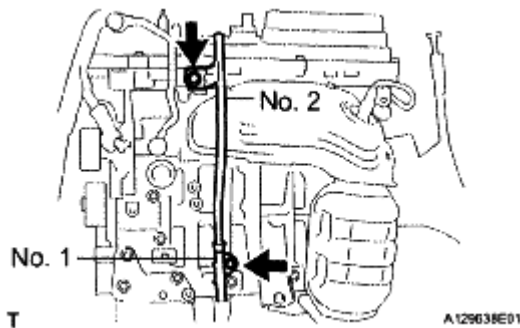


Fig. 64: Locating No. 1 Oil Level Gauge Guide And No. 2 Oil Level Gauge Guide Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

78. REMOVE NO. 2 MANIFOLD STAY

- a. Remove the bolt, nut and No. 2 manifold stay.

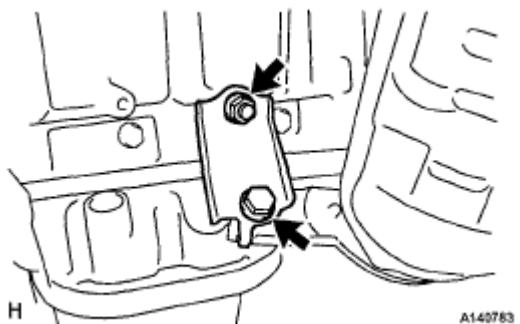


Fig. 65: Locating No. 2 Manifold Stay Bolt And Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

79. REMOVE NO. 2 EXHAUST MANIFOLD HEAT INSULATOR

- a. Remove the 3 bolts and No. 2 exhaust manifold heat insulator.

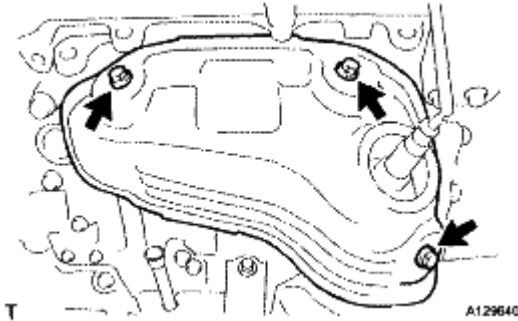


Fig. 66: Locating No. 2 Exhaust Manifold Heat Insulator With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

80. REMOVE EXHAUST MANIFOLD SUB-ASSEMBLY LH

- a. Uniformly loosen and remove the 6 nuts.
- b. Remove the manifold and gasket.

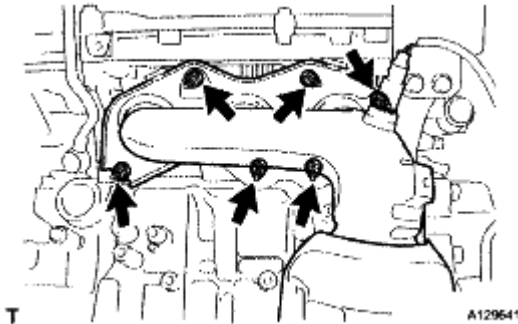


Fig. 67: Locating Exhaust Manifold Sub-Assembly LH Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

81. REMOVE ENGINE MOUNTING BRACKET RH

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

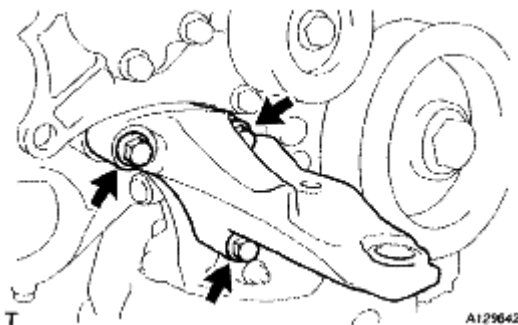


Fig. 68: Locating Engine Mounting Bracket RH Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

82. REMOVE DRIVE SHAFT BEARING BRACKET

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

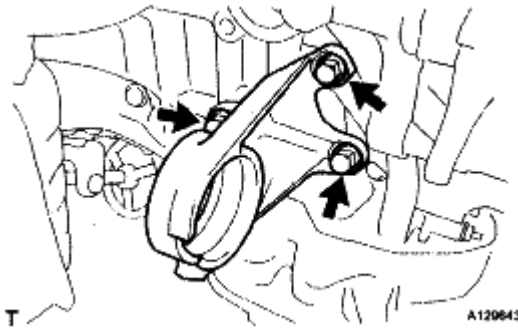


Fig. 69: Locating Drive Shaft Bearing Bracket Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

83. REMOVE V-RIBBED BELT TENSIONER ASSEMBLY

- a. Remove the 5 bolts and V-ribbed belt tensioner assembly.

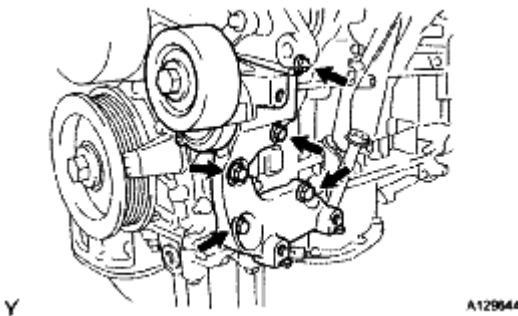


Fig. 70: Locating Ribbed Belt Tensioner Assembly Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

84. REMOVE NO. 2 TIMING GEAR COVER

- a. Remove the 2 bolts and No. 2 timing gear cover.

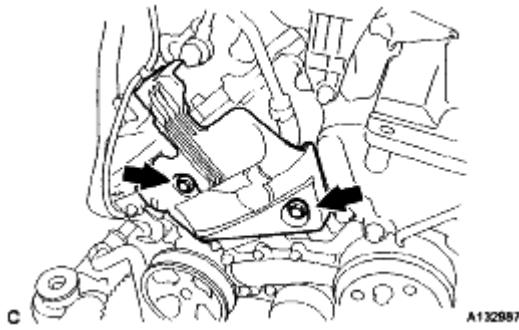


Fig. 71: Locating No. 2 Timing Gear Cover Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

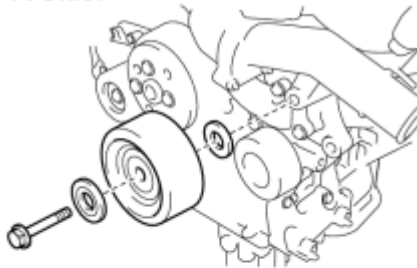
85. REMOVE NO. 2 IDLER PULLEY SUB-ASSEMBLY

- a. Remove the bolt, 2 plates and No. 2 idler pulley sub-assembly.

HINT:

Plate diameter: Idler pulley cover plate: 33.6 mm (1.32 in.) No. 2 idler pulley cover plate: 37.8 mm (1.49 in.)

FR Side:



RR Side:



Fig. 72: Locating No. 2 Idler Pulley Sub-Assembly Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

86. REMOVE WATER PUMP PULLEY (See REMOVAL)

87. REMOVE FRONT NO. 1 ENGINE MOUNTING BRACKET LH

- a. Remove the 6 bolts and front No. 1 engine mounting bracket LH.

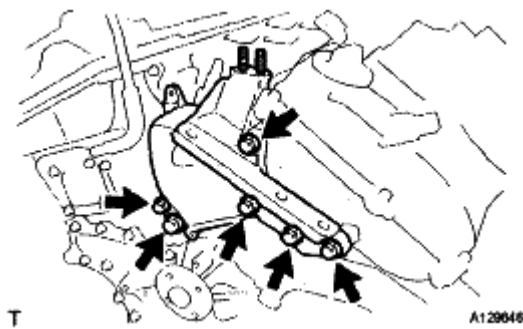


Fig. 73: Locating Front No. 1 Engine Mounting Bracket LH. Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

88. REMOVE RADIO SETTING CONDENSER

- a. Remove the 2 bolts and 2 radio setting condensers.

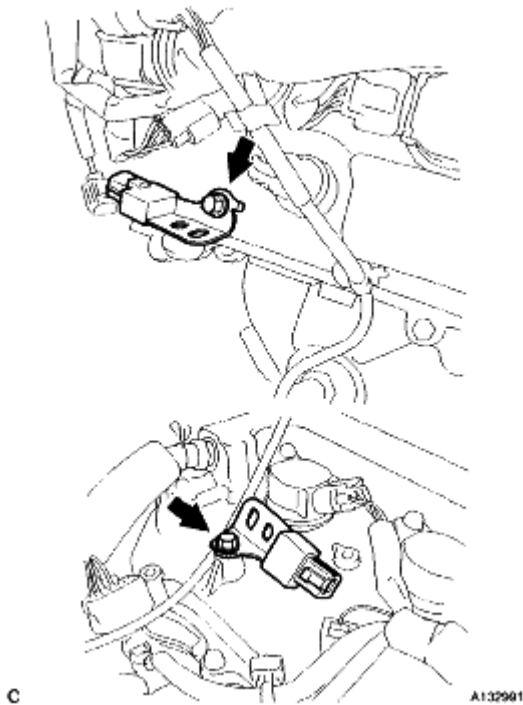


Fig. 74: Locating Radio Setting Condensers And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

89. REMOVE NO. 1 VACUUM SWITCHING VALVE ASSEMBLY

- a. Remove the bolt and No. 1 vacuum switching valve.

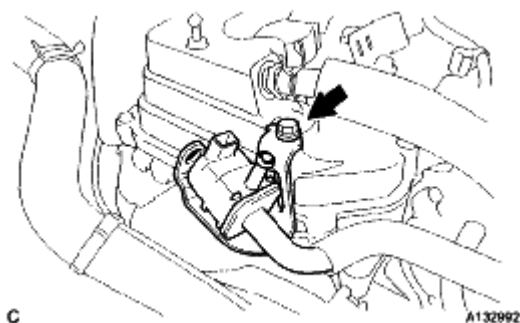


Fig. 75: Locating No. 1 Vacuum Switching Valve Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

90. REMOVE ENGINE OIL PRESSURE SWITCH ASSEMBLY

- a. Using a 24 mm deep socket wrench, remove the engine oil pressure switch assembly.

91. REMOVE KNOCK CONTROL SENSOR (See REMOVAL)

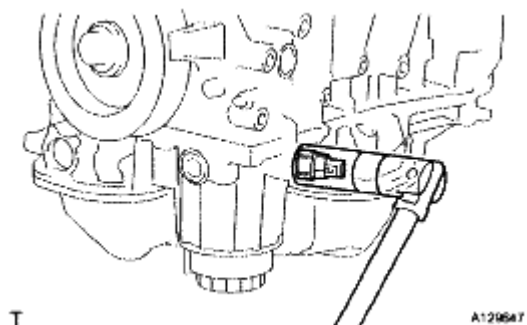


Fig. 76: Removing/Installing Engine Oil Pressure Switch Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

92. REMOVE ENGINE COOLANT TEMPERATURE SENSOR

- a. Using a 19 mm deep socket wrench, remove the engine coolant temperature sensor and gasket.

93. REPLACE PARTIAL ENGINE ASSEMBLY

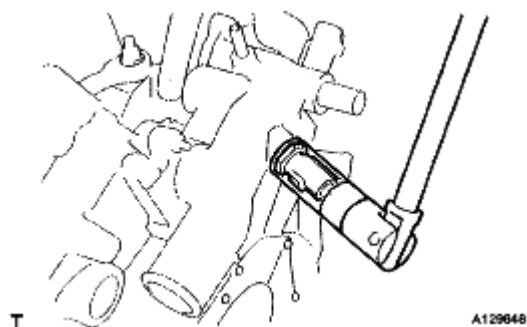


Fig. 77: Removing/Installing Engine Coolant Temperature Sensor
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSTALLATION

1. INSTALL ENGINE COOLANT TEMPERATURE SENSOR

- Using a 19 mm deep socket wrench, install the engine coolant temperature sensor and a new gasket.

Torque: 20 N*m (200 kgf*cm, 14 ft.*lbf)

2. INSTALL KNOCK CONTROL SENSOR (See INSTALLATION)

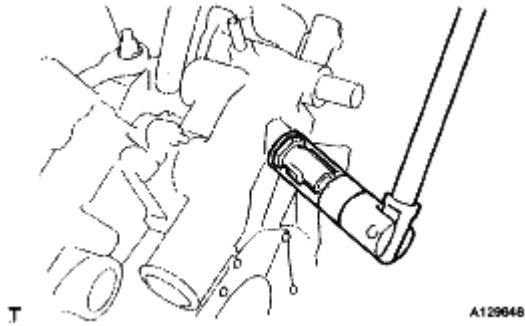


Fig. 78: Removing/Installing Engine Coolant Temperature Sensor
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. INSTALL ENGINE OIL PRESSURE SWITCH ASSEMBLY

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

Adhesive: Toyota Genuine Adhesive 1344, Three Bond 1344 or equivalent

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

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

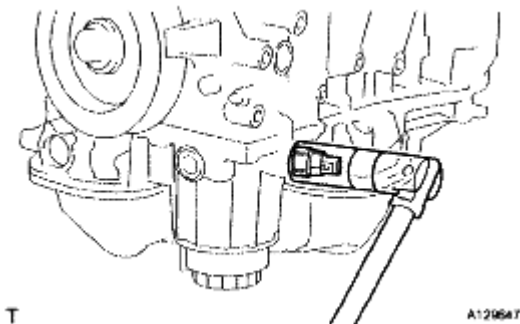


Fig. 79: Removing/Installing Engine Oil Pressure Switch Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. INSTALL NO. 1 VACUUM SWITCHING VALVE ASSEMBLY

- a. Install the No. 1 vacuum switching valve with the bolt.

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

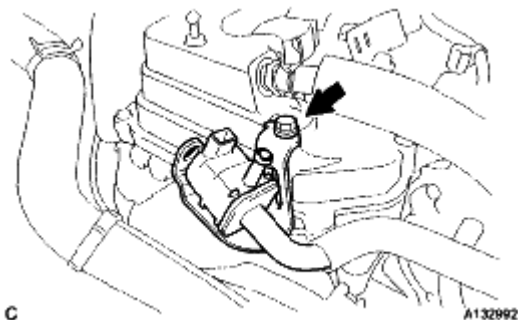


Fig. 80: Locating No. 1 Vacuum Switching Valve Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. INSTALL RADIO SETTING CONDENSER

- a. Install the 2 radio setting condensers with the 2 bolts.

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

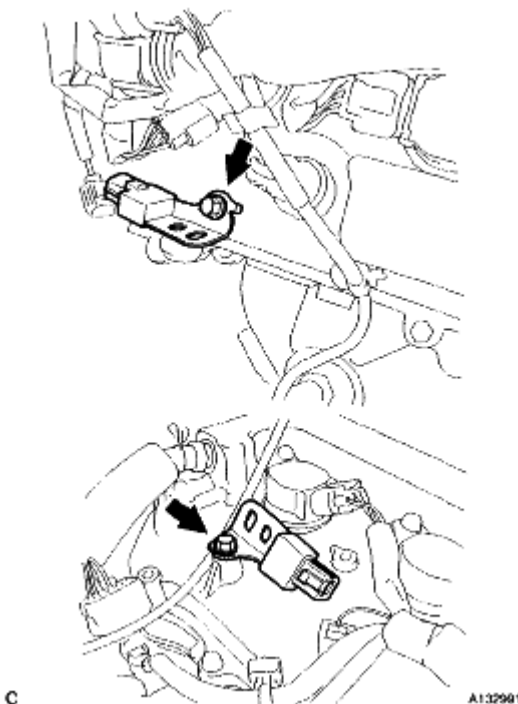


Fig. 81: Locating Radio Setting Condensers And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. INSTALL FRONT NO. 1 ENGINE MOUNTING BRACKET LH

- a. Install the front No. 1 engine mounting bracket LH with the 6 bolts.

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

7. INSTALL WATER PUMP PULLEY (See INSTALLATION)

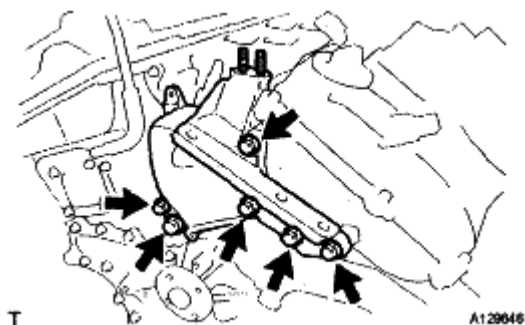


Fig. 82: Locating Front No. 1 Engine Mounting Bracket LH. Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. INSTALL NO. 2 IDLER PULLEY SUB-ASSEMBLY

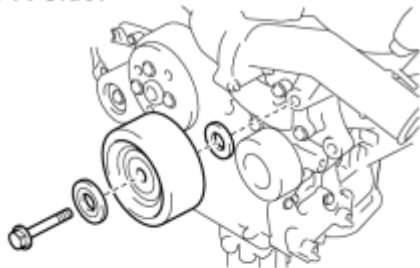
- a. Install the bolt, 2 plates and No. 2 idler pulley sub-assembly.

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

HINT:

Plate diameter: Idler pulley cover plate: 33.6 mm (1.32 in.) No. 2 idler pulley cover plate: 37.8 mm (1.49 in.)

FR Side:



RR Side:



Fig. 83: Locating No. 2 Idler Pulley Sub-Assembly Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. INSTALL NO. 2 TIMING GEAR COVER

- a. Install the No. 2 timing gear cover with the 2 bolts.

Torque: 6.0 N*m (61 kgf*cm, 53 in.*lbf)

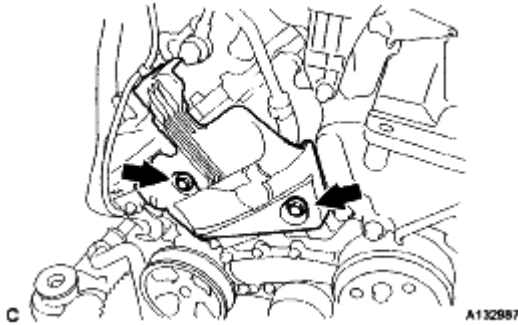


Fig. 84: Locating No. 2 Timing Gear Cover Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. INSTALL V-RIBBED BELT TENSIONER ASSEMBLY

- a. Temporarily install the V-ribbed belt tensioner with the 5 bolts.

HINT:

Each bolt length is as follows:

- A. 70 mm (2.76 in.)
 - B. 33 mm (1.30 in.)
- b. Install the V-ribbed belt tensioner by tightening bolt 1 and bolt 2 in the order shown in the illustration.

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

- c. Tighten the other bolts.

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

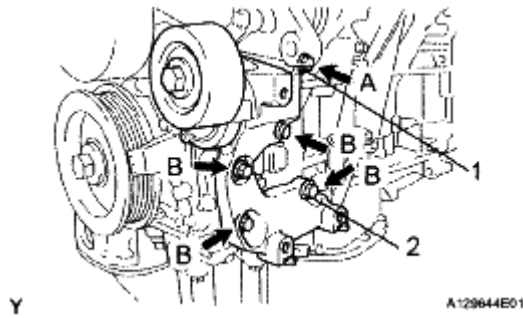


Fig. 85: Identifying V-Ribbed Belt Tensioner Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. INSTALL DRIVE SHAFT BEARING BRACKET

- a. Install the drive shaft bearing bracket with the 3 bolts.

Torque: 64 N*m (650 kgf*cm, 47 ft.*lbf)

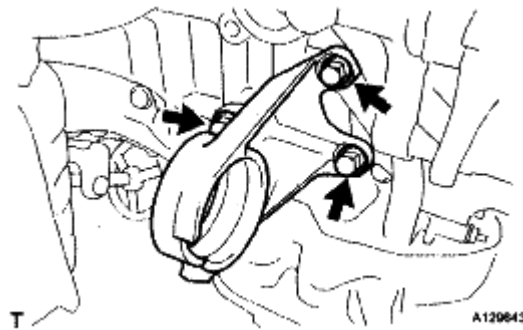


Fig. 86: Locating Drive Shaft Bearing Bracket With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. INSTALL ENGINE MOUNTING BRACKET RH

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

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

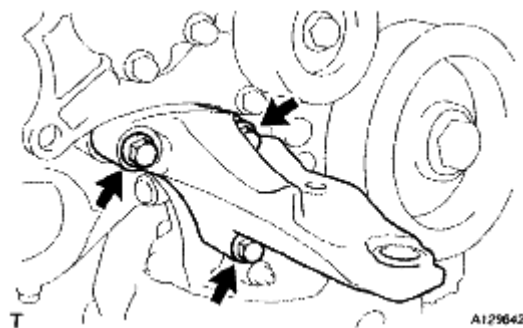


Fig. 87: Locating Engine Mounting Bracket RH With Bolts

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

13. INSTALL EXHAUST MANIFOLD SUB-ASSEMBLY LH

- a. Install a new gasket as shown in the illustration.

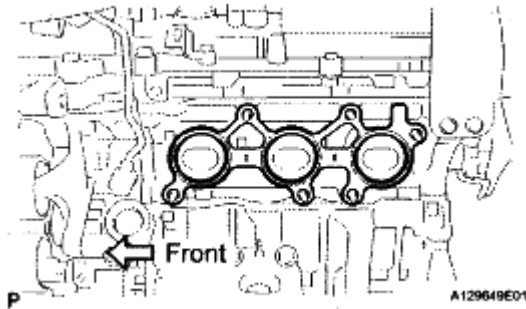


Fig. 88: Identifying Exhaust Manifold Sub-Assembly LH Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the exhaust manifold sub-assembly LH with the 6 nuts.

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

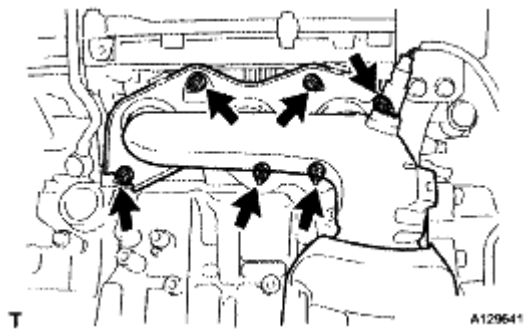


Fig. 89: Locating Exhaust Manifold Sub-Assembly LH With Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. INSTALL NO. 2 EXHAUST MANIFOLD HEAT INSULATOR

- a. Install the No. 2 exhaust manifold heat insulator with the 3 bolts.

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

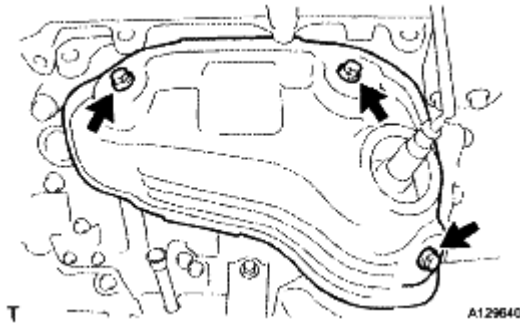


Fig. 90: Locating No. 2 Exhaust Manifold Heat Insulator With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

15. INSTALL NO. 2 MANIFOLD STAY

- a. Install the No. 2 manifold stay with the bolt and nut.

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

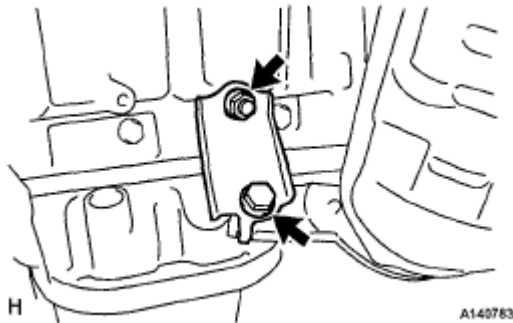


Fig. 91: Locating No. 2 Manifold Stay With Bolt And Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

16. INSTALL OIL LEVEL GAUGE GUIDE SUB-ASSEMBLY

- a. Install 2 new O-rings to the oil level gauge guides.
- b. Apply a light coat of engine oil to the O-rings.
- c. Push in the oil level gauge guide end into the guide hole.
- d. Install the No. 1 oil level gauge guide with the bolt.

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

- e. Install the No. 2 oil level gauge guide with the bolt.

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

- f. Install the oil level gauge.

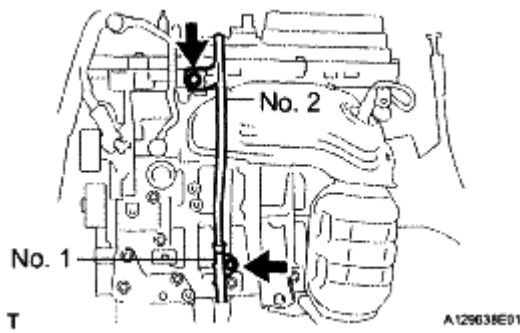


Fig. 92: Locating No. 1 Oil Level Gauge Guide And No. 2 Oil Level Gauge Guide Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

17. INSTALL EXHAUST MANIFOLD SUB-ASSEMBLY RH

- a. Install a new gasket as shown in the illustration.

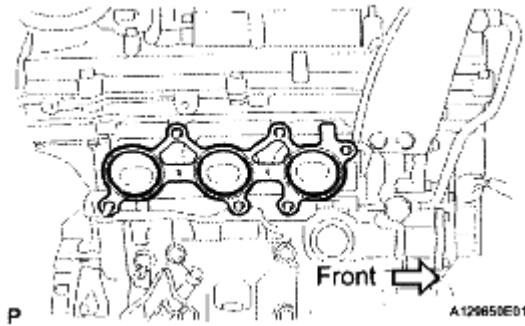


Fig. 93: Identifying Exhaust Manifold Sub-Assembly RH Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the exhaust manifold sub-assembly RH with the 6 nuts.

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

18. INSTALL INTAKE MANIFOLD

NOTE: DO NOT apply oil to the bolts listed below:

TIGHTENING PARTS REFERENCE CHART

Tightening Parts
Intake Manifold and Cylinder Head Sub-assembly RH
Intake Manifold and Cylinder Head Sub-assembly LH

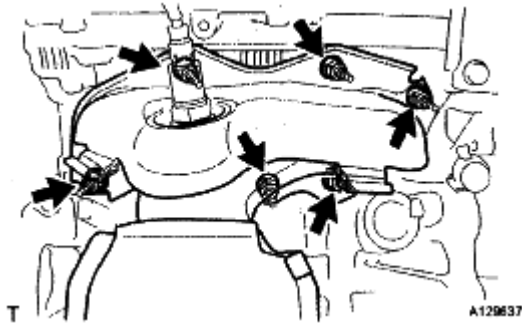


Fig. 94: Locating Exhaust Manifold Sub-Assembly Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

NOTE:

- Align the port holes of the gaskets and cylinder heads.
- Make sure that the gaskets are installed in the correct direction.

- b. Set the intake manifold on the cylinder heads.
- c. Install and tighten the 6 bolts and 4 nuts uniformly in several steps.

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

19. INSTALL NO. 2 ENGINE MOUNTING STAY RH

- a. Install the No. 2 engine mounting stay RH with the bolt.

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

20. INSTALL IGNITION COIL ASSEMBLY

- a. Install the 6 ignition coil assemblies with the 6 bolts.

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

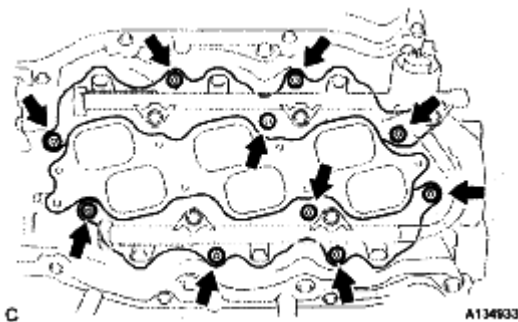


Fig. 95: Locating Ignition Coil Assemblies With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

21. REMOVE ENGINE STAND
22. INSTALL DRIVE PLATE AND RING GEAR SUB-ASSEMBLY (See INSTALLATION)
23. INSTALL AUTOMATIC TRANSAXLE ASSEMBLY (See INSTALLATION)
24. CONNECT CONNECTOR (See INSTALLATION)
25. INSTALL WIRE HARNESS (See INSTALLATION)
26. INSTALL ENGINE WIRE
27. INSTALL FRONT DRIVE SHAFT ASSEMBLY RH (See INSTALLATION)
28. INSTALL FRONT DRIVE SHAFT ASSEMBLY LH (See INSTALLATION)
29. INSTALL FRONT FRAME ASSEMBLY
 - a. Install the engine mounting insulators RH and LH with the 2 nuts.

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

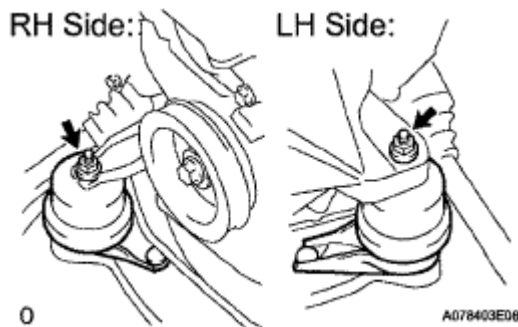


Fig. 96: Locating Engine Mounting Insulators Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the front engine mounting insulator with the bolt.

Torque: 87 N*m (887 kgf*cm, 64 ft.*lbf)

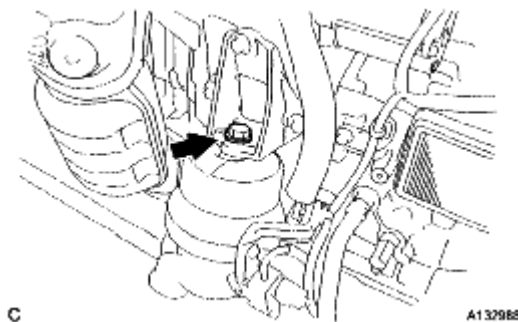


Fig. 97: Locating Front Engine Mounting Insulator Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Connect the 2 clamps.

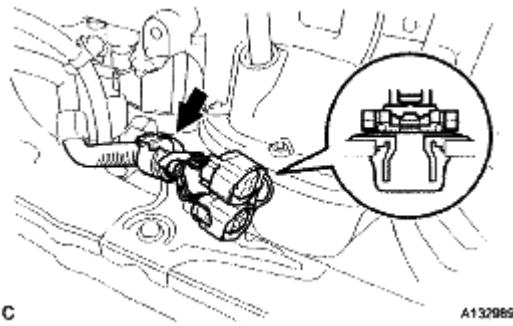


Fig. 98: Locating Clamps

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

- d. Connect the connector and clamp.

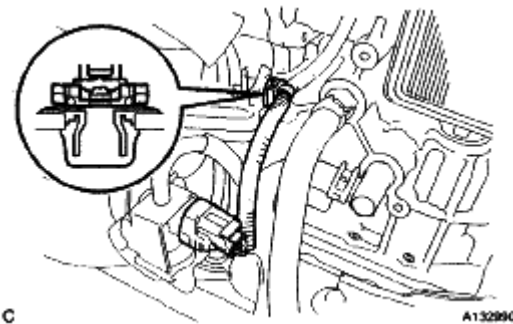


Fig. 99: Identifying Connector And Clamp

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

30. INSTALL VANE PUMP ASSEMBLY

- a. Install the vane pump with the 2 bolts.

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

- b. Install the pressure feed tube clamp bolt.

Torque: 9.8 N*m (100 kgf*cm, 87 in.*lbf)

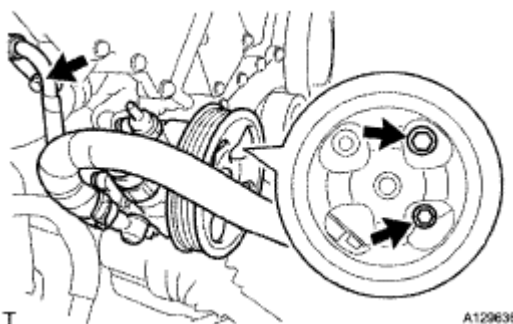


Fig. 100: Locating Frame Side Rail Plates RH And LH Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

31. INSTALL ENGINE ASSEMBLY WITH TRANSAXLE

- a. Set the engine assembly with transaxle on the engine lifter.
- b. Install the engine assembly to the vehicle.
- c. Install the frame side rail plates RH and LH with the 4 bolts and 2 nuts.

Torque: A

85 N*m (867 kgf*cm, 63 ft.*lbf)

B

32 N*m (329 kgf*cm, 24 ft.*lbf)

- d. Install the front suspension member brace rears RH and LH with the 4 bolts and 2 nuts.

Torque: C

85 N*m (867 kgf*cm, 63 ft.*lbf)

D

32 N*m (329 kgf*cm, 24 ft.*lbf)

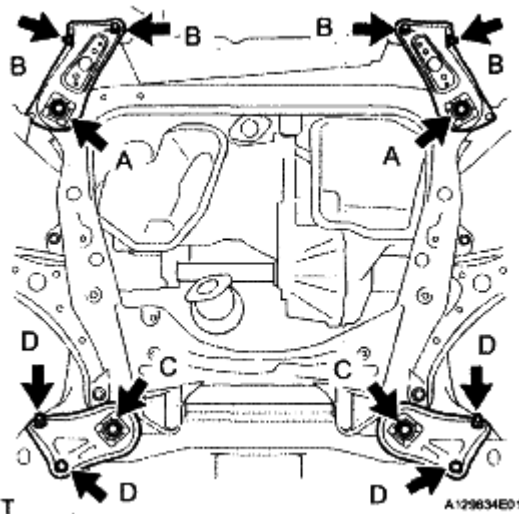


Fig. 101: Locating Frame Side Rail Plates Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

32. INSTALL COOLER COMPRESSOR ASSEMBLY

- a. Temporarily install the cooler compressor with the 4 bolts.

- b. Install the compressor with the 4 bolts by tightening the bolts in the order shown in the illustration.

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

- c. Install the 2 connector clamps.

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

34. **INSTALL STEERING INTERMEDIATE SHAFT ASSEMBLY** (See INSTALLATION)

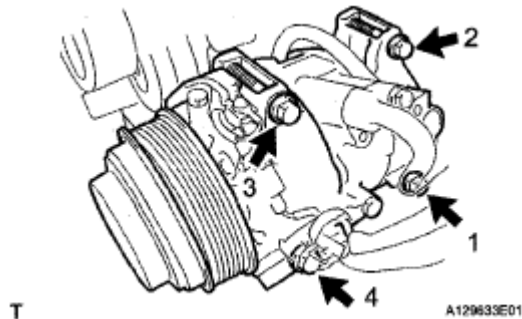


Fig. 102: Locating Compressor Bolts

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

35. **INSTALL DRIVE PLATE AND TORQUE CONVERTER CLUTCH SETTING BOLT** (See INSTALLATION)

36. **INSTALL FLYWHEEL HOUSING UNDER COVER** (See INSTALLATION)

37. **INSTALL NO. 1 EXHAUST PIPE SUPPORT BRACKET**

- a. Install the No. 1 exhaust pipe support bracket with the nut.

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

38. **INSTALL FRONT AXLE ASSEMBLY LH** (See INSTALLATION)

39. **INSTALL FRONT AXLE ASSEMBLY RH**

HINT:

Use the same procedures described for the LH side.

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

41. **INSTALL FRONT LOWER NO. 1 SUSPENSION ARM SUB-ASSEMBLY RH**

HINT:

Use the same procedures described for the LH side.

42. **INSTALL TIE ROD ASSEMBLY LH** (See INSTALLATION)

43. INSTALL TIE ROD ASSEMBLY RH

HINT:

Use the same procedures described for the LH side.

44. INSTALL FRONT SPEED SENSOR LH (See INSTALLATION)**45. INSTALL FRONT SPEED SENSOR RH**

HINT:

Use the same procedures described for the LH side.

46. INSTALL FRONT AXLE SHAFT LH NUT (See INSTALLATION)**47. INSTALL FRONT AXLE SHAFT RH NUT**

HINT:

Use the same procedures described for the LH side.

48. INSTALL FRONT STABILIZER LINK ASSEMBLY LH (See INSTALLATION)**49. INSTALL FRONT STABILIZER LINK ASSEMBLY RH**

HINT:

Use the same procedures described for the LH side.

50. INSTALL FRONT EXHAUST PIPE ASSEMBLY (See INSTALLATION)**51. INSTALL FRONT NO. 1 EXHAUST PIPE SUPPORT BRACKET (See INSTALLATION)****52. CONNECT STEERING GEAR OUTLET RETURN TUBE**

- a. Connect the steering gear outlet return tube.

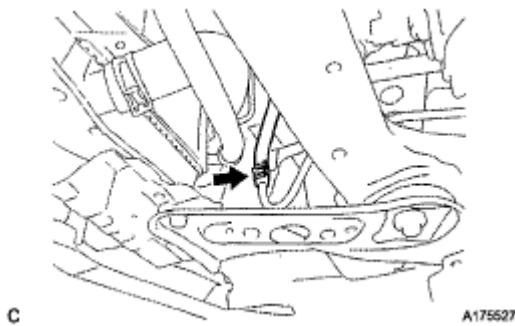


Fig. 103: Locating Steering Gear Outlet Return Tube
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

53. CONNECT NO. 1 OIL RESERVOIR TO PUMP HOSE

- a. Connect the No. 1 oil reservoir to pump hose.

54. CONNECT TRANSMISSION CONTROL CABLE ASSEMBLY (See INSTALLATION)**55. CONNECT ENGINE WIRE**

- a. Install the ground cable to the cylinder head with the 2 bolts.

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

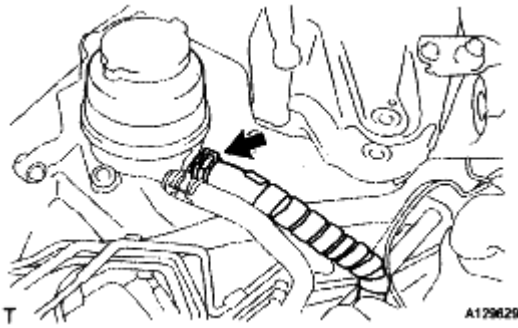


Fig. 104: Locating No. 1 Oil Reservoir To Pump Hose

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

- b. Connect the engine wire clamp.
- c. Install the ground cable with the bolt to the wire bracket.

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

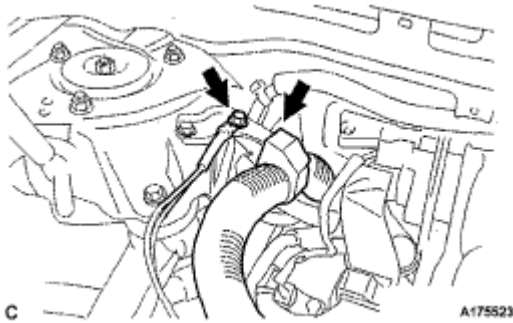


Fig. 105: Locating Ground Cable Bracket Bolts

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

- d. Install the 2 ground cables with the 2 bolts.

Torque: Bolt A

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

Bolt B

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

- e. Connect the engine wire connector and 3 clamps.

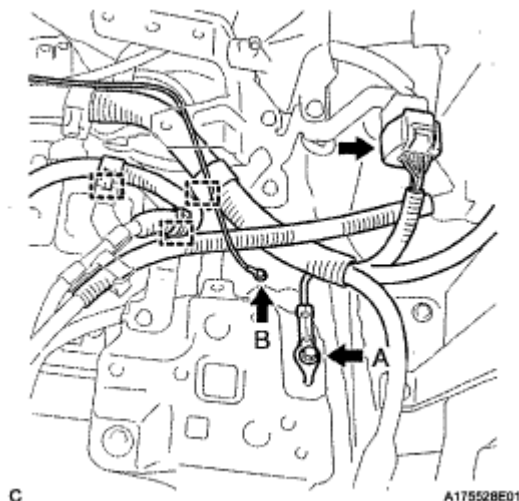


Fig. 106: Locating Ground Cables With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Connect the wire to the engine room junction block. Then, install it with the nut and 2 connectors.

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

56. **INSTALL UPPER RELAY BLOCK COVER**
57. **INSTALL STARTER ASSEMBLY** (See INSTALLATION)
58. **INSTALL ECM** (See INSTALLATION)

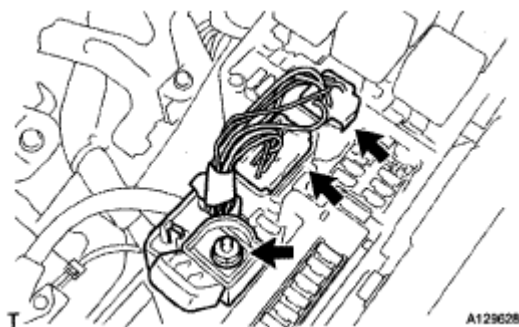


Fig. 107: Locating Engine Room Junction Block
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

59. **CONNECT HEATER WATER OUTLET HOSE A**
 - a. Connect the heater water outlet hose.
60. **CONNECT HEATER WATER INLET HOSE A**

- a. Connect the heater water inlet hose,
61. **CONNECT NO. 1 OIL COOLER OUTLET HOSE** (See INSTALLATION)
62. **CONNECT NO. 1 OIL COOLER INLET HOSE** (See INSTALLATION)

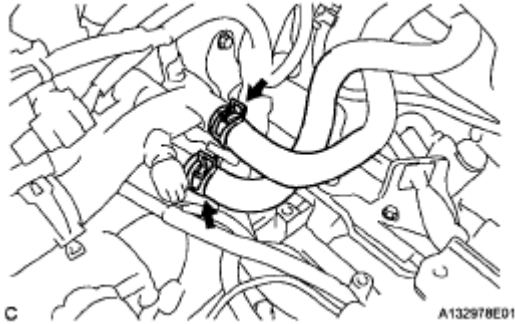


Fig. 108: Locating Heater Water Inlet Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

63. **INSTALL RADIATOR HOSE OUTLET**
- a. Install the clamp and connect the radiator hose outlet.

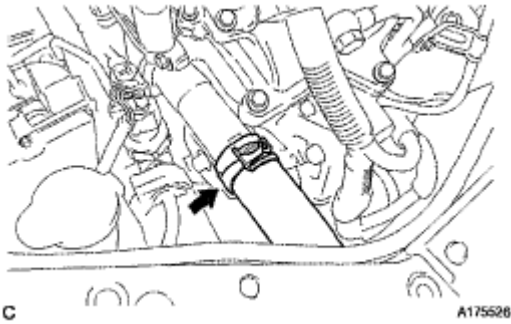


Fig. 109: Locating Radiator Hose Outlet Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

64. **INSTALL RADIATOR HOSE INLET**
- a. Install the clamp and connect the radiator hose inlet.

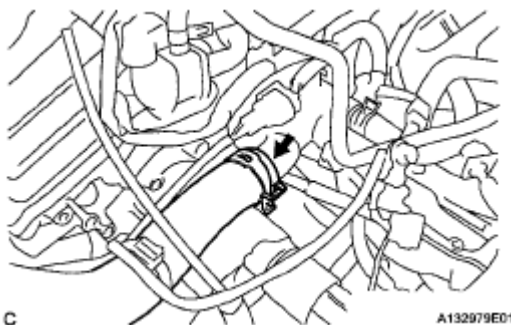


Fig. 110: Locating Radiator Hose Inlet Clamp

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

65. CONNECT FUEL TUBE SUB-ASSEMBLY

- a. Push in the fuel tube connector to the fuel pipe until the connector makes a "click" sound.

NOTE:

- Check for damage or contamination on the connected part of the pipe.
- Check if the pipe and the connector are securely connected by trying to pull them apart.

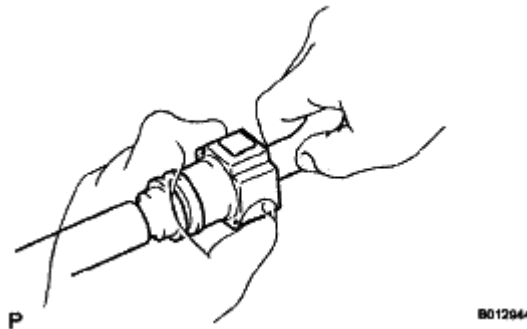


Fig. 111: Pushing Fuel Tube Connector To Fuel Pipe

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

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

66. INSTALL INTAKE AIR SURGE TANK ASSEMBLY (See INSTALLATION)

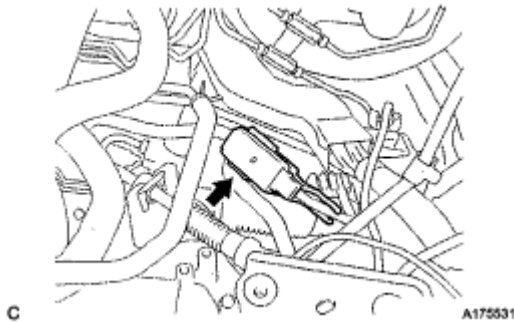


Fig. 112: Locating No. 1 Fuel Pipe Clamp

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

67. INSTALL NO. 1 FUEL VAPOR FEED HOSE

- a. Install the clamp and connect the No. 1 fuel vapor feed hose.

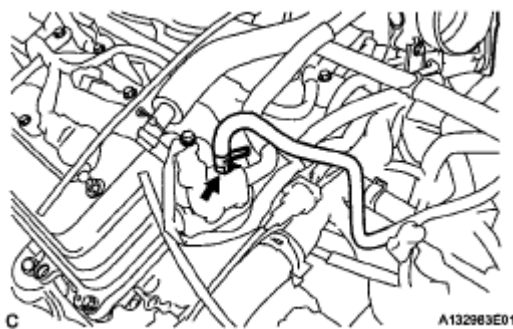


Fig. 113: Locating No. 1 Fuel Vapor Feed Hose Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

68. INSTALL INTAKE AIR RESONATOR SUB-ASSEMBLY

- a. Install the intake air resonator with the bolt and clip.

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

- b. Connect the wire harness clamp.

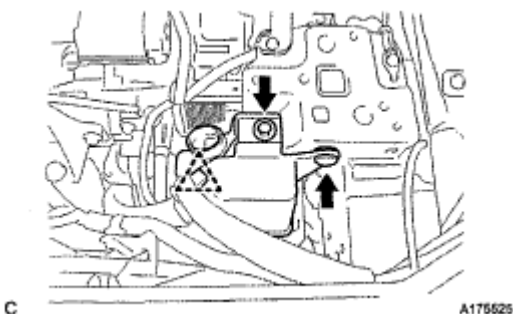


Fig. 114: Locating Intake Air Resonator Clip And Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

69. INSTALL NO. 1 AIR CLEANER INLET

- a. Install the No. 1 air cleaner inlet with the bolt.

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

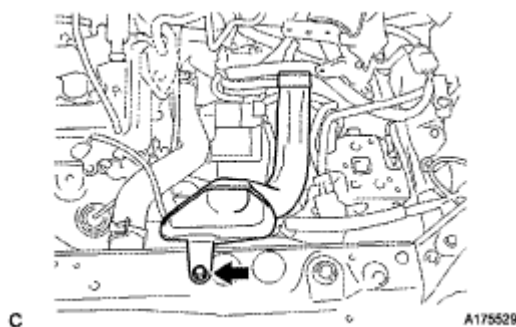


Fig. 115: Locating No. 1 Air Cleaner Inlet With Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

70. INSTALL AIR CLEANER CASE

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

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

- b. Connect the connector, vacuum hose, and hose clamp.
- c. Install the air cleaner filter element to the air cleaner case.

71. INSTALL AIR CLEANER CAP WITH AIR CLEANER HOSE (See INSTALLATION)

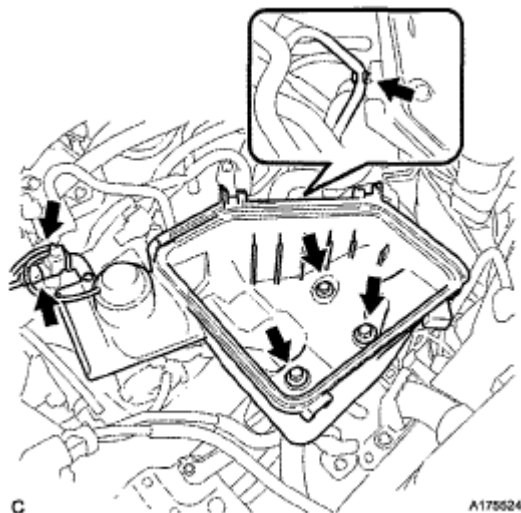


Fig. 116: Locating Air Cleaner Case Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

72. INSTALL NO. 2 AIR CLEANER INLET

- a. Install the No. 2 air cleaner inlet with the 2 bolts.

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

- b. Connect the clamp and 2 vacuum hoses.

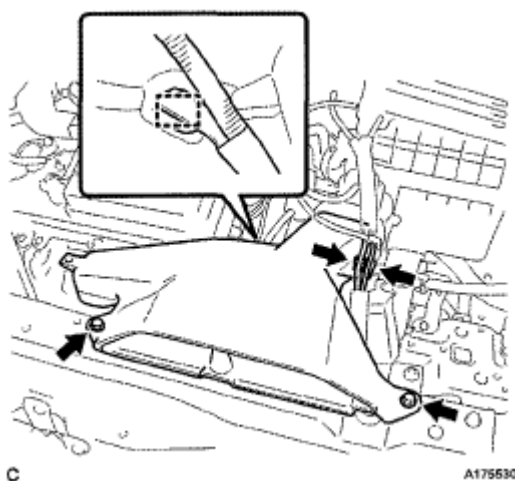


Fig. 117: Locating No. 2 Air Cleaner Inlet With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

73. CONNECT VACUUM HOSES

Vacuum Hose Routing Diagram:

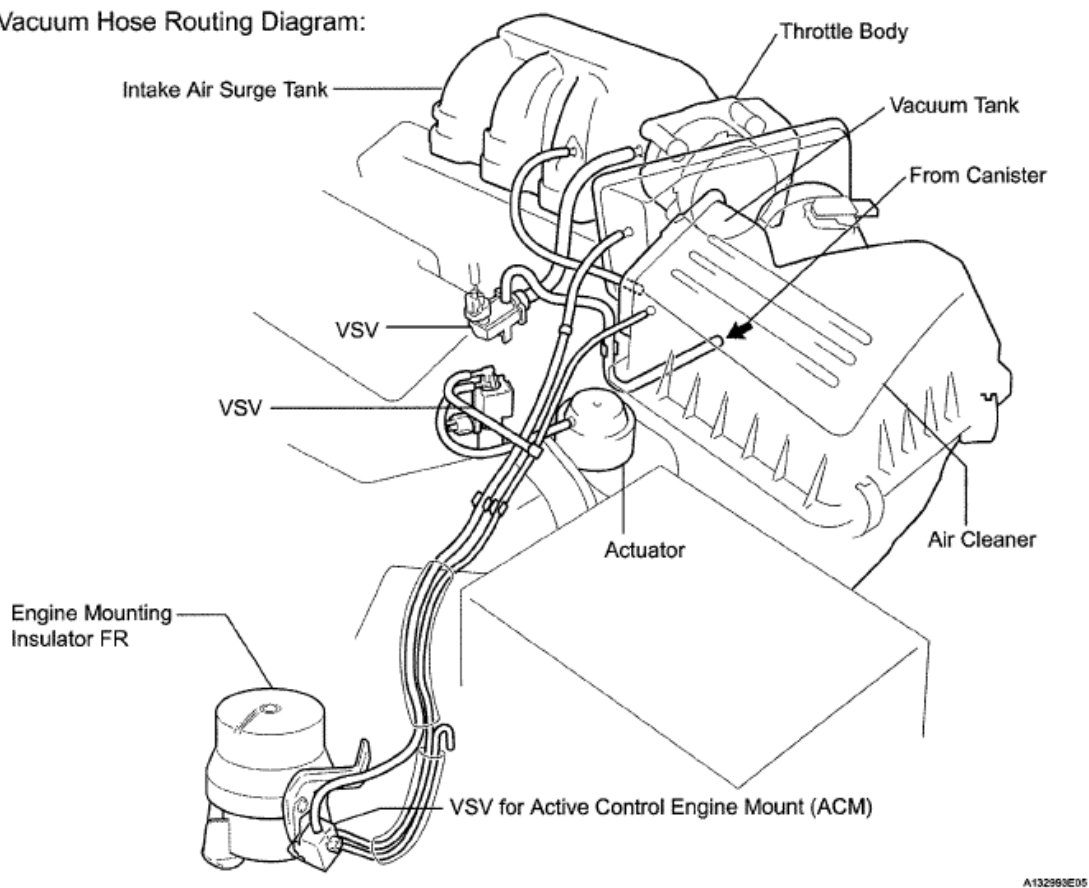


Fig. 118: Vacuum Hoses Routing Diagram
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

74. INSTALL ENGINE MOVING CONTROL ROD

- Temporarily install the engine moving control rod with the 4 bolts.
- First install the bolts A, and then the remaining bolt B.

Torque: 38 N*m (388 kgf*cm, 28 ft.*lbf)

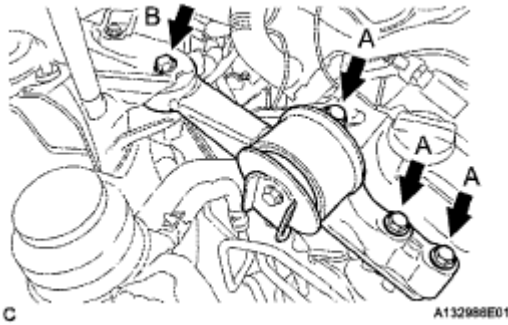


Fig. 119: Locating Engine Moving Control Rod With Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

75. INSTALL NO. 2 ENGINE MOUNTING STAY RH

- Temporarily install the No. 2 engine mounting stay RH with the bolt.

Torque: 38 N*m (388 kgf*cm, 28 ft.*lbf)

- Tighten the 2 nuts.

Torque: 23 N*m (235 kgf*cm, 17 ft.*lbf)

76. INSTALL RADIATOR RESERVE TANK ASSEMBLY

77. INSTALL V-RIBBED BELT (See INSTALLATION)

78. INSTALL BATTERY

NOTE: When disconnecting the cable, some systems need to be initialized after the cable is reconnected (See INITIALIZATION).



Fig. 120: Locating No. 2 Engine Mounting Stay RH With Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 79. INSTALL COWL TOP PANEL OUTER (See INSTALLATION)
- 80. INSTALL WINDSHIELD WIPER MOTOR AND LINK ASSEMBLY (See INSTALLATION)
- 81. INSTALL COWL TOP VENTILATOR LOUVER SUB-ASSEMBLY (See INSTALLATION)
- 82. INSTALL WINDSHIELD WIPER ARM AND BLADE ASSEMBLY RH (See INSTALLATION)
- 83. INSTALL WINDSHIELD WIPER ARM AND BLADE ASSEMBLY LH (See INSTALLATION)
- 84. INSTALL FRONT WHEELS

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

- 85. ADD ENGINE OIL (See REPLACEMENT)
- 86. ADD ENGINE COOLANT (See REPLACEMENT)
- 87. ADD AUTOMATIC TRANSAXLE FLUID (See INSTALLATION)
- 88. ADD POWER STEERING FLUID
- 89. BLEED POWER STEERING SYSTEM (See INSTALLATION)
- 90. INSPECT FOR FUEL LEAK (See ON-VEHICLE INSPECTION)
- 91. INSPECT FOR OIL LEAK
- 92. INSPECT FOR ENGINE COOLANT LEAK (See REPLACEMENT)
- 93. INSPECT FOR EXHAUST GAS LEAK
- 94. INSPECT SHIFT LEVER POSITION (See ADJUSTMENT)
- 95. ADJUST SHIFT LEVER POSITION (See ADJUSTMENT)
- 96. INSPECT AND ADJUST FRONT WHEEL ALIGNMENT

HINT:

Adjust the front wheel alignment (See ADJUSTMENT).

- 97. INSPECT IGNITION TIMING (See ON-VEHICLE INSPECTION)
- 98. INSPECT ENGINE IDLE SPEED (See ON-VEHICLE INSPECTION)
- 99. INSPECT CO/HC (See ON-VEHICLE INSPECTION)
- 100. INSTALL V-BANK COVER SUB-ASSEMBLY (See INSTALLATION)
- 101. INSTALL COOL AIR INTAKE DUCT SEAL
 - a. Install the intake duct seal with the 6 clips.
- 102. CHECK ABS SPEED SENSOR SIGNAL
 - a. Check the ABS speed sensor signal (See TEST MODE PROCEDURE).

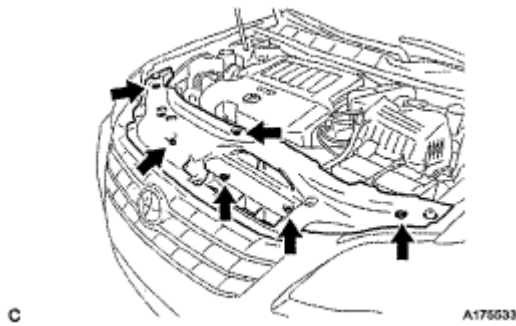


Fig. 121: Locating Intake Duct Seal Clips
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ENGINE UNIT

COMPONENTS

NOTE: Bank 1 may also be known as RH side.
 Bank 2 may also be known as LH side.

CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

18 (184, 13) x 3
SPARK PLUG

● SEAL WASHER

21 (214, 15)

CYLINDER HEAD COVER SUB-ASSEMBLY

10 (102, 7)

● O-RING

10 (102, 7)

● O-RING

10 (102, 7)

CAMSHAFT POSITION SENSOR

10 (102, 7) x 9

CAMSHAFT POSITION SENSOR

● CYLINDER HEAD COVER GASKET

● GASKET

OIL PIPE

● GASKET

65 (663, 48)

10 (102, 7)

OIL CONTROL VALVE FILTER RH

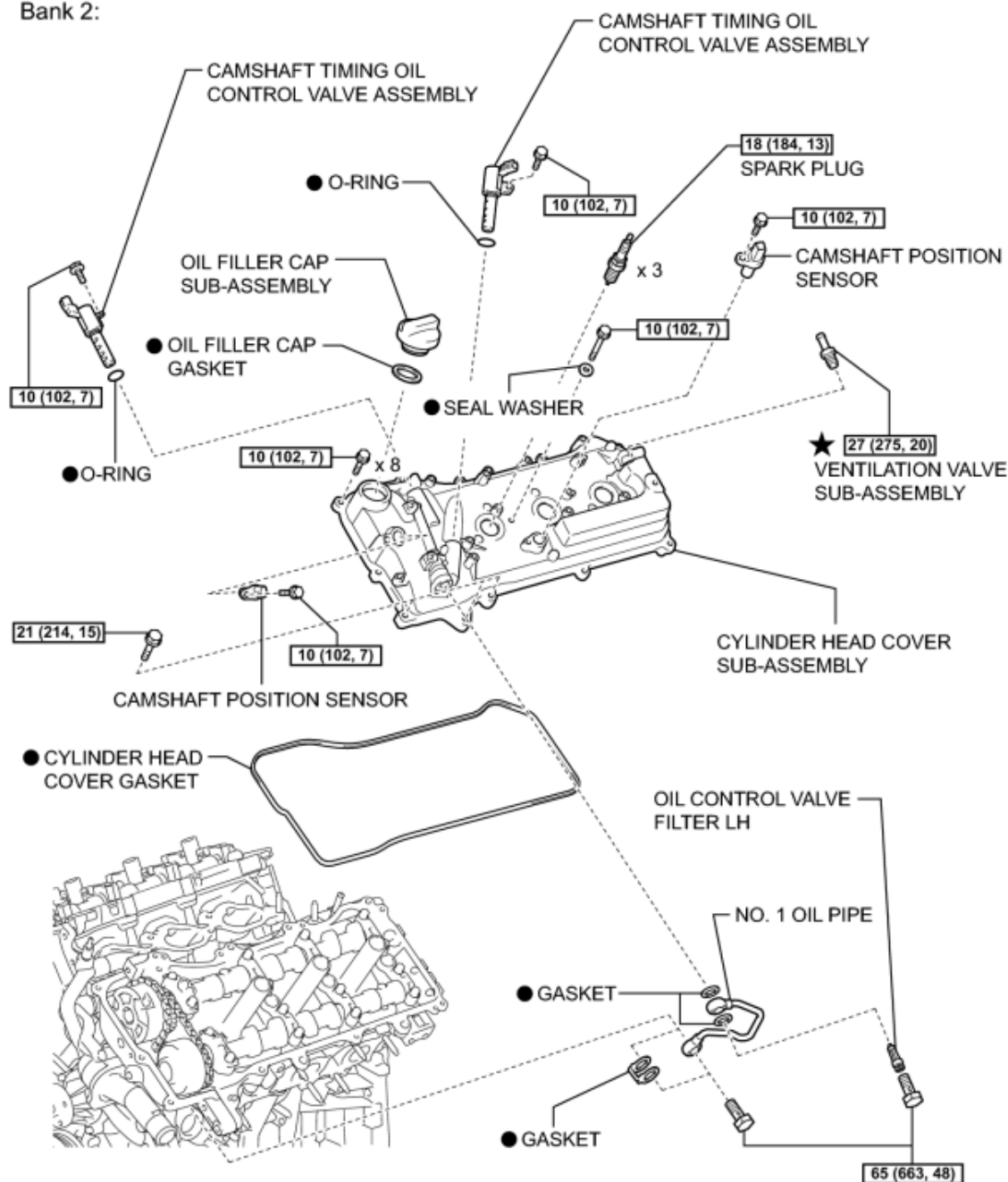
65 (663, 48)

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

● Non-reusable part

Fig. 122: Identifying Engine Unit Components With Torque Specifications (1 Of 10)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Bank 2:



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

● Non-reusable part

★ Precoated part

Fig. 123: Identifying Engine Unit Components With Torque Specifications (2 Of 10)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

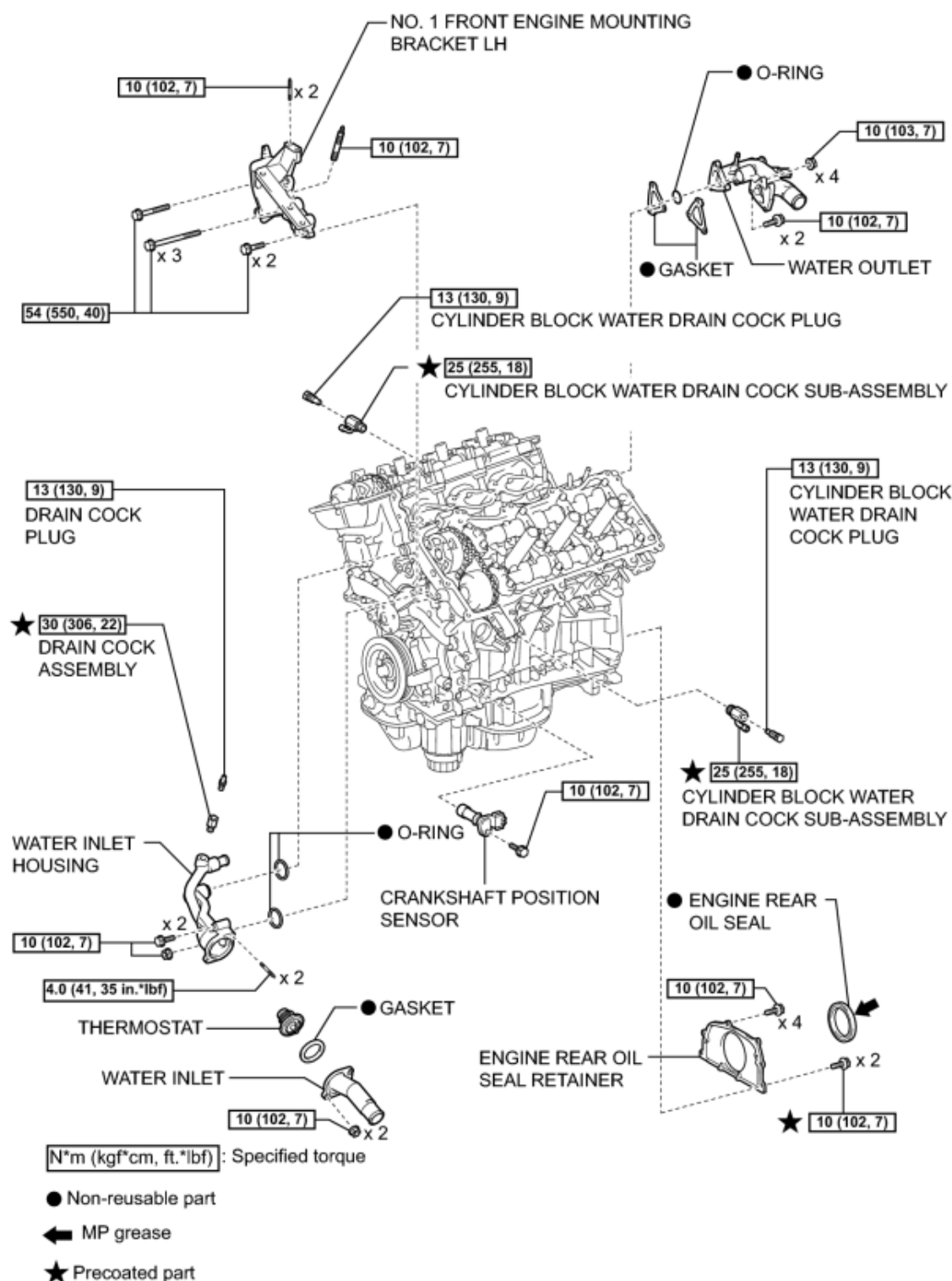


Fig. 124: Identifying Engine Unit Components With Torque Specifications (3 Of 10)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

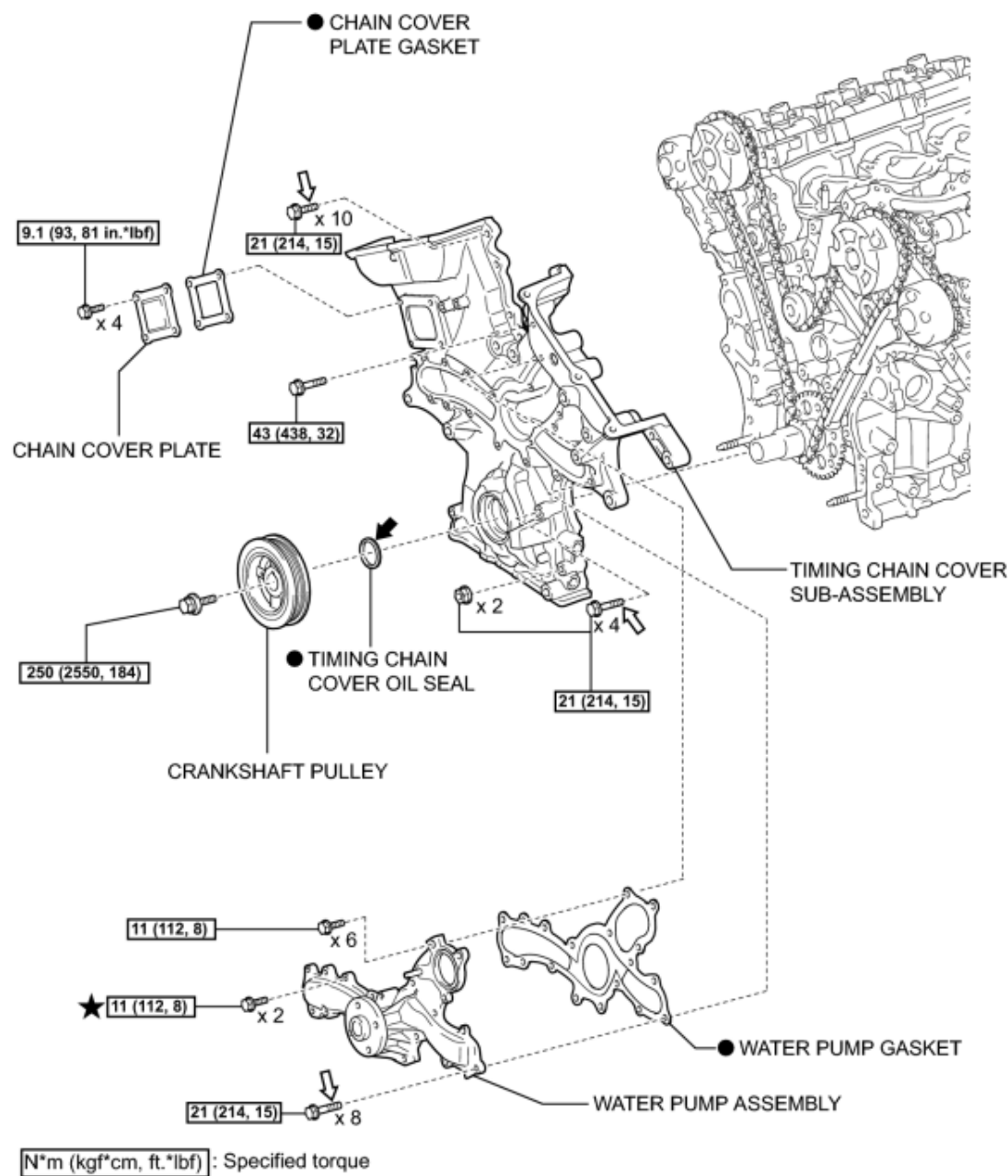
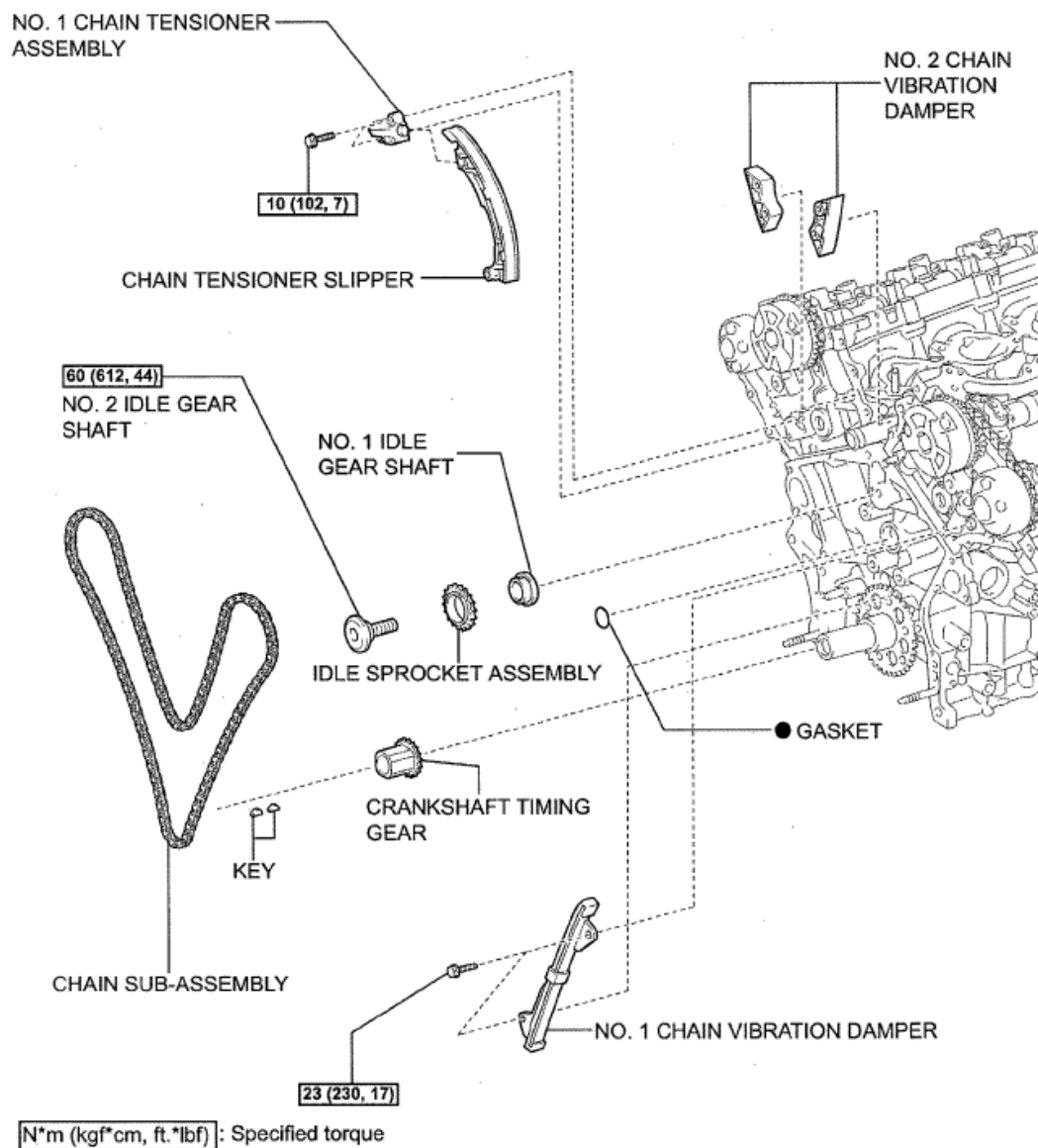


Fig. 125: Identifying Engine Unit Components With Torque Specifications (4 Of 10)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



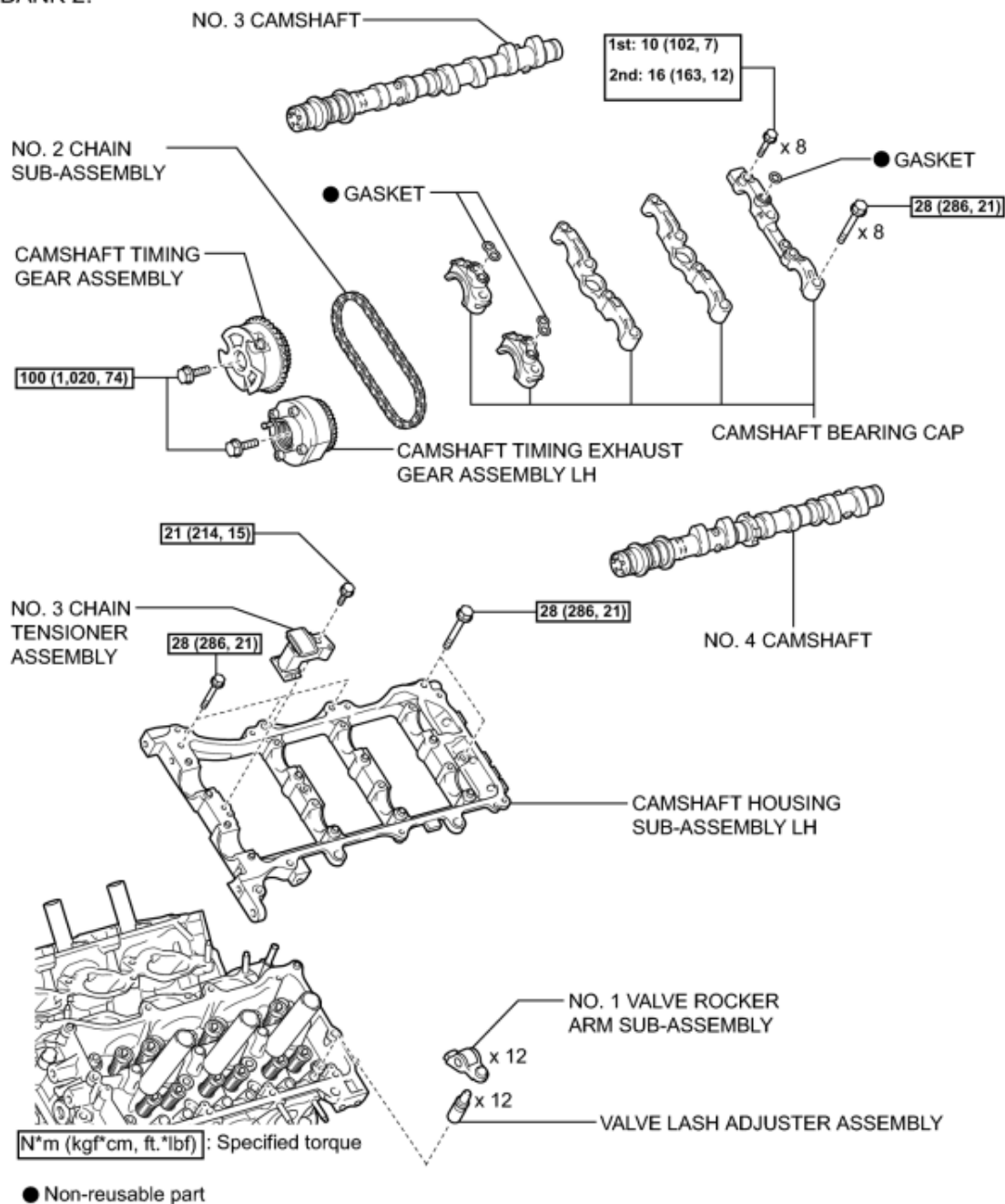
A132498E07

Fig. 126: Identifying Engine Unit Components With Torque Specifications (5 Of 10)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



domingo, 8 de diciembre de 2019 11:58:24 p. m.

BANK 2:



P

Fig. 128: Identifying Engine Unit Components With Torque Specifications (7 Of 10)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

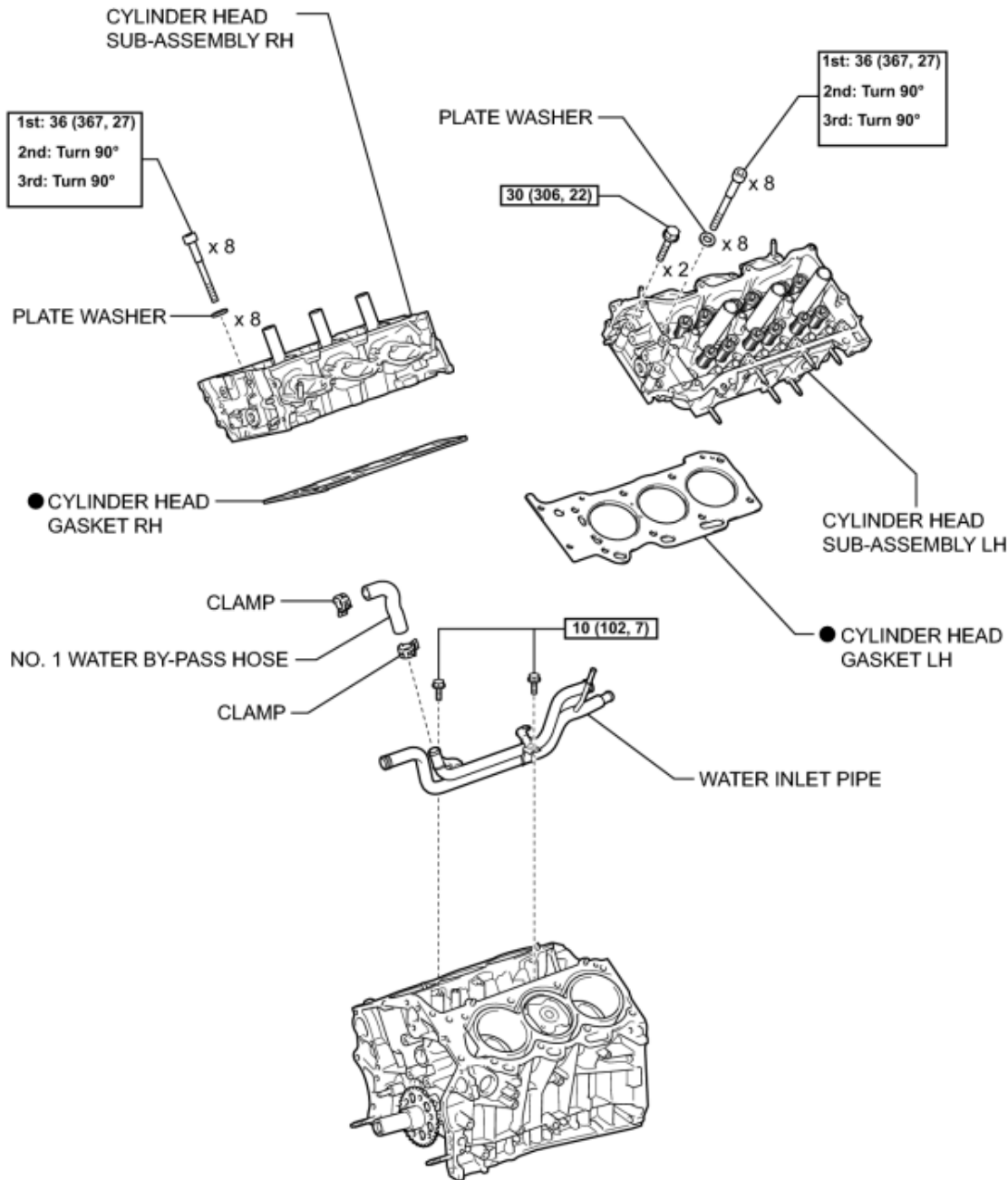
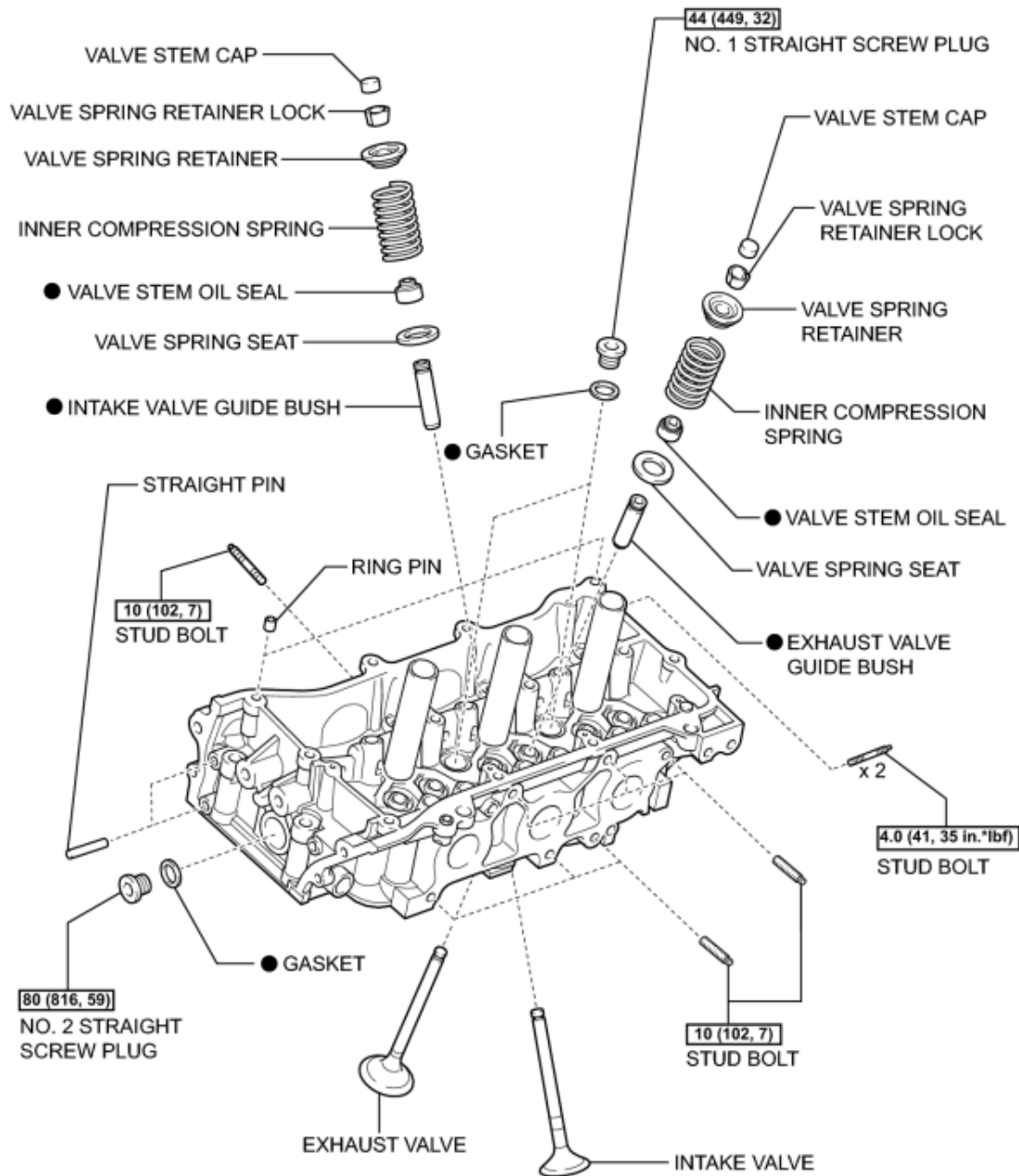


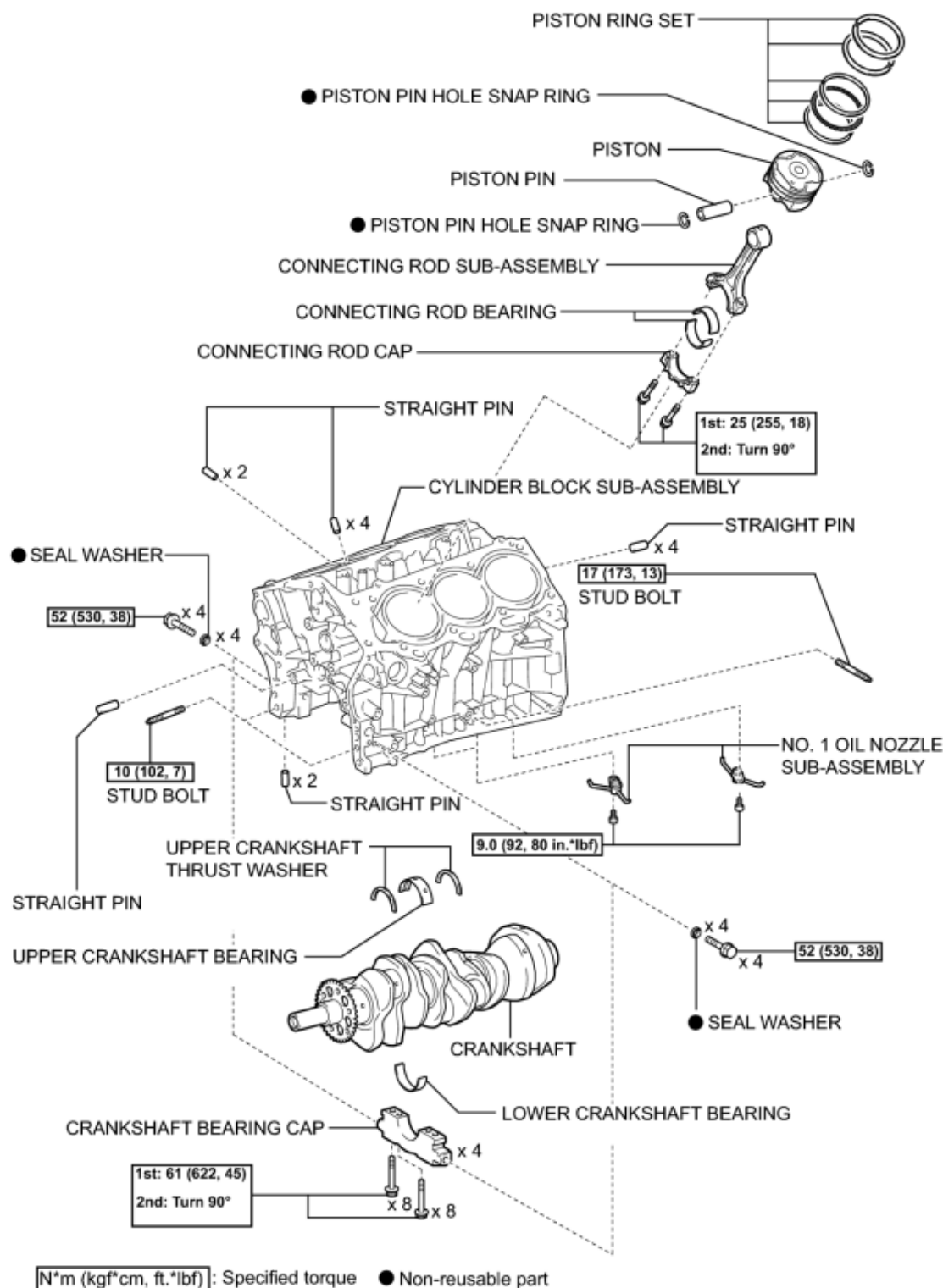
Fig. 129: Identifying Engine Unit Components With Torque Specifications (8 Of 10)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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

P

Fig. 130: Identifying Engine Unit Components With Torque Specifications (9 Of 10)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



P

Fig. 131: Identifying Engine Unit Components With Torque Specifications (10 Of 10)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DISASSEMBLY

NOTE: Bank 1 may also be known as RH side.

Bank 2 may also be known as LH side.

CAUTION: For additional information on timing chain/gear removal guidelines, installation and camshaft timing gear alignment, see 2GR-FE VALVE TIMING PROCEDURE .

1. REMOVE OIL FILLER CAP SUB-ASSEMBLY

- a. Remove the oil filler cap sub-assembly.

2. REMOVE SPARK PLUG

3. REMOVE OIL PAN DRAIN PLUG

- a. Remove the drain plug and gasket.

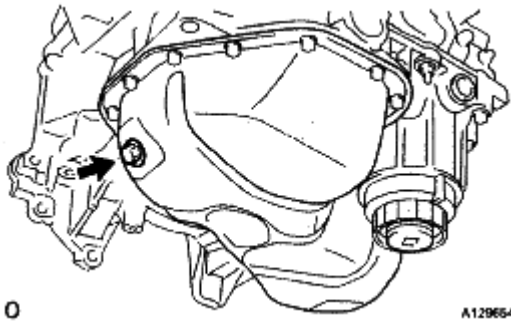


Fig. 132: Locating Drain Plug And Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. REMOVE VENTILATION VALVE SUB-ASSEMBLY

- a. Remove the ventilation valve sub-assembly.

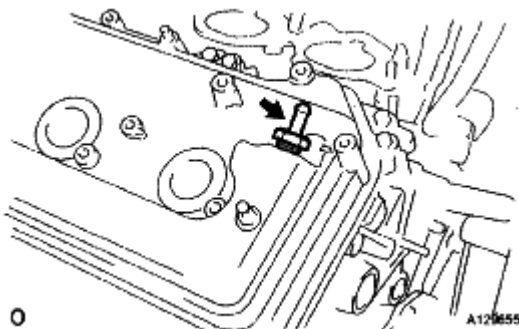
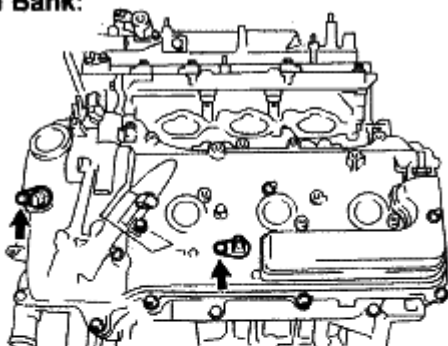


Fig. 133: Locating Ventilation Valve Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

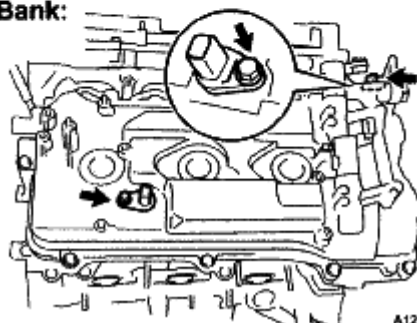
5. REMOVE CAMSHAFT POSITION SENSOR

- a. Remove the 4 bolts and 4 camshaft position sensors.

LH Bank:



RH Bank:



0

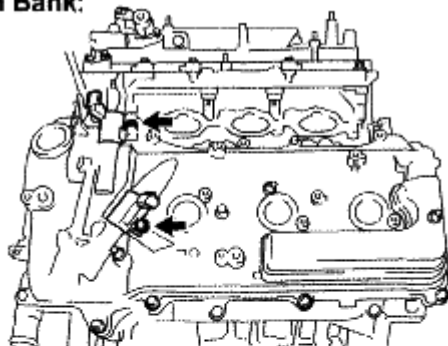
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Fig. 134: Locating Camshaft Position Sensors Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

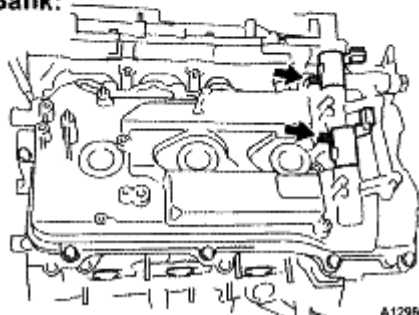
6. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

- a. Remove the 4 bolts and 4 camshaft timing oil control valves.

LH Bank:



RH Bank:



0

A129662E01

Fig. 135: Locating Camshaft Timing Oil Control Valves Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. REMOVE CRANK POSITION SENSOR

- a. Remove the bolt and crankshaft position sensor.

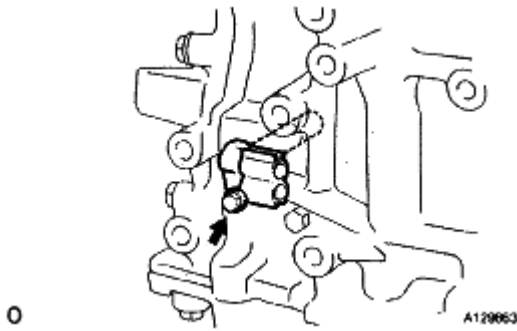


Fig. 136: Locating Crankshaft Position Sensor Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. REMOVE OIL PIPE NO. 1

- a. Remove the 2 oil pipe unions and oil pipe No. 1.
- b. Remove the oil control valve filter LH and gaskets.

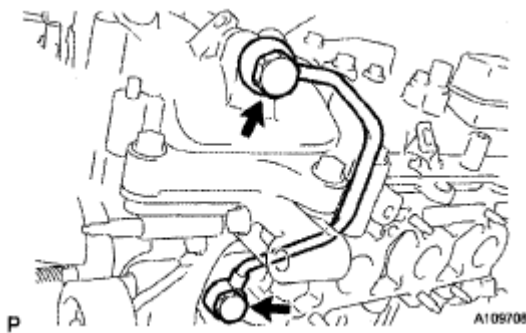


Fig. 137: Locating Oil Pipe Unions And Oil Pipe No. 1
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. REMOVE OIL PIPE

- a. Remove the bolt.
- b. Remove the 2 oil pipe unions and oil pipe.
- c. Remove the oil control valve filter RH and gaskets.

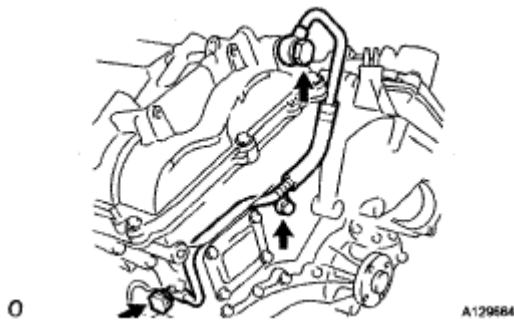


Fig. 138: Locating Oil Pipe Unions And Oil Pipe Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. REMOVE CYLINDER BLOCK WATER DRAIN COCK SUB-ASSEMBLY

- a. Remove the water drain cocks from the cylinder block.
- b. Remove the water drain cock plugs from the water drain cocks.

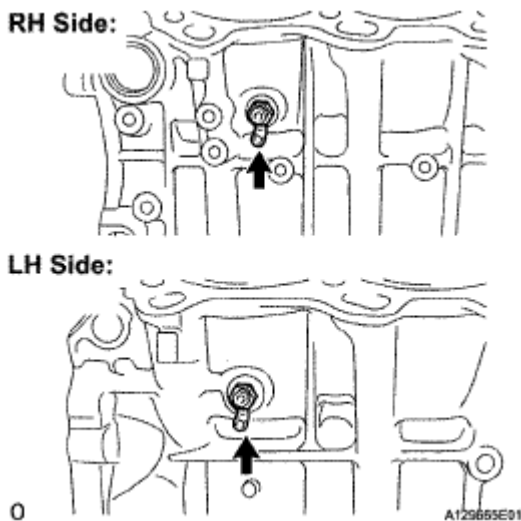


Fig. 139: Locating Water Drain Cock Plugs From Water Drain Cocks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. REMOVE OIL FILTER ELEMENT

- a. Remove the drain plug.

NOTE: Do not remove the O-ring.

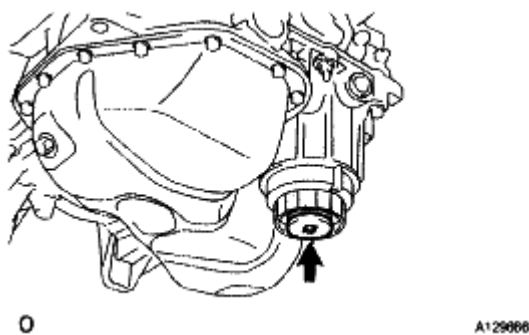


Fig. 140: Locating Drain Plug

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

- b. Connect the hose to the pipe.
- c. Insert the pipe with the hose into the oil filter cap.
- d. Make sure that the oil is completely drained and remove the pipe and O-ring.

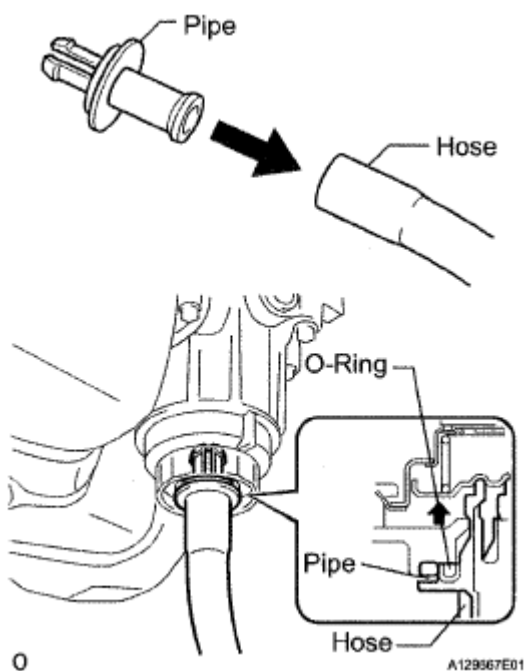


Fig. 141: Connecting Hose To Pipe

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

- e. Using SST, remove the oil filter cap.

SST 09228-06501

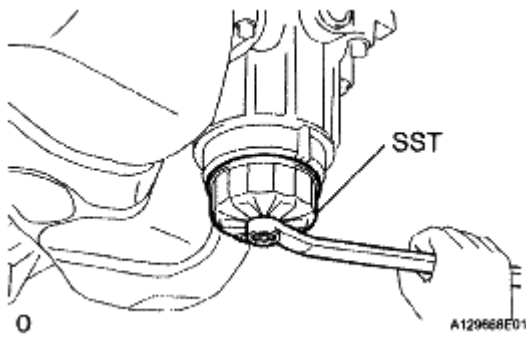


Fig. 142: Removing Oil Filter Cap

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

- f. Remove the oil filter element and O-ring from the oil filter cap.

NOTE: Do not use any tools when removing the O-ring to prevent the O-ring groove from being damaged.

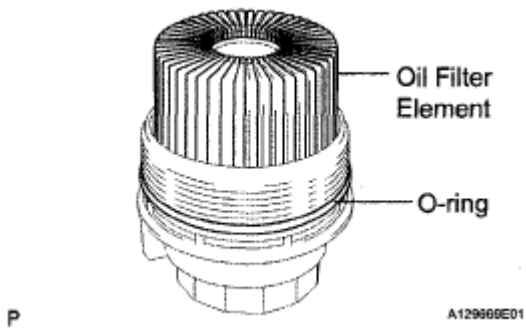


Fig. 143: Identifying Oil Filter Element And O-Ring

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

12. REMOVE CRANKSHAFT PULLEY

- a. Using SST, loosen the crankshaft pulley bolt.

SST 09213-70011 (09213-70020), 09330-00021

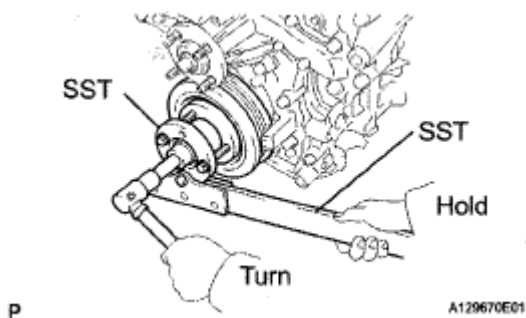


Fig. 144: Loosening Crankshaft Pulley Bolt

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

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

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

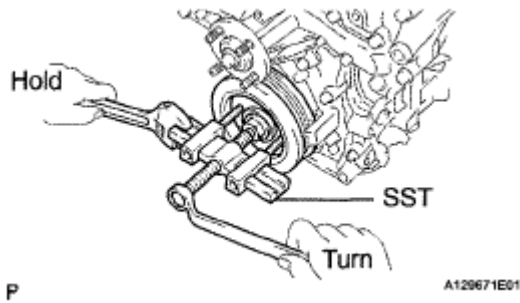


Fig. 145: Removing Crankshaft Pulley Bolt And Crankshaft Pulley
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. REMOVE ENGINE MOUNTING BRACKET FRONT NO. 1 LH

- a. Remove the 6 bolts, and engine mounting bracket front No. 1 LH.

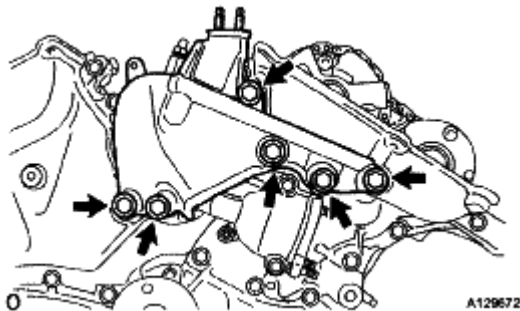


Fig. 146: Locating Engine Mounting Bracket Front No. 1 Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. REMOVE WATER INLET HOUSING

- a. Remove the 2 nuts, water inlet and thermostat.
- b. Remove the gasket.
- c. Remove the drain cock plug.
- d. Remove the drain cock.

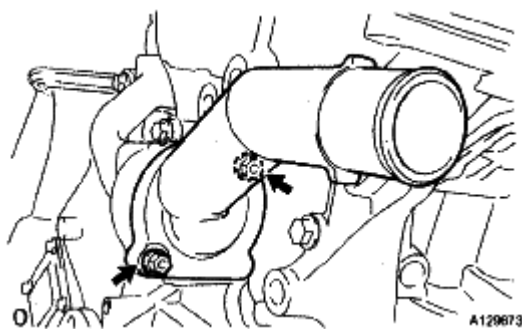


Fig. 147: Locating Water Inlet Housing Nuts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Remove the 2 bolts, nut, and water inlet housing.

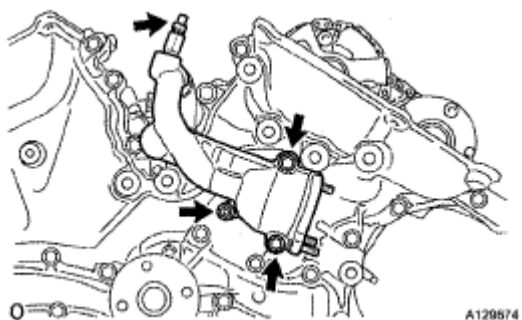


Fig. 148: Locating Water Inlet Housing Bolts And Nuts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Remove the 2 O-rings.

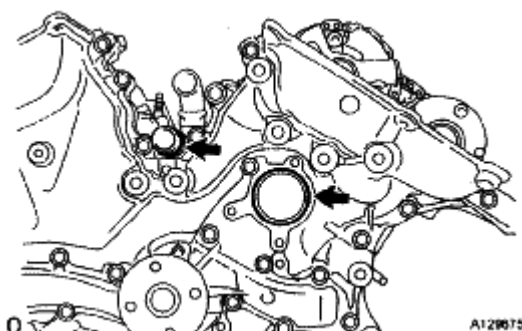


Fig. 149: Locating O-Rings
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

15. REMOVE WATER OUTLET

- a. Remove the 2 bolts, 4 nuts, and water outlet.

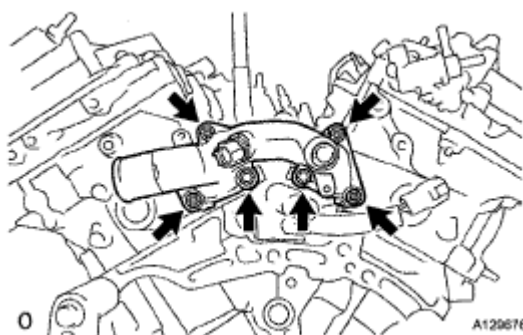


Fig. 150: Locating Water Outlet Bolts And Nuts

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

- b. Remove the 2 gaskets and O-ring.

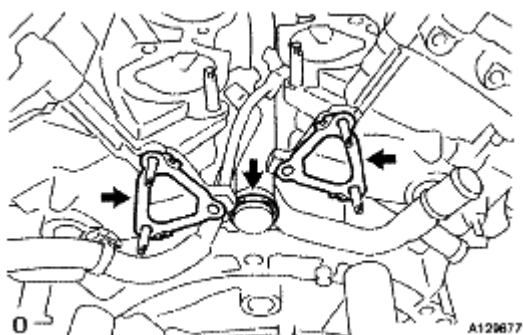


Fig. 151: Locating Gaskets And O-Ring

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

16. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY LH

- a. Remove the 12 bolts, head cover and gasket.

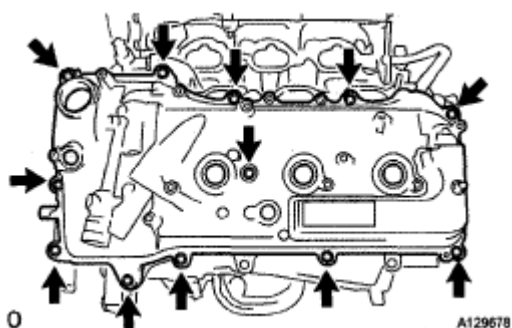


Fig. 152: Locating Head Cover And Gasket And Bolts

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

17. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY

- a. Remove the 12 bolts, head cover and gasket.

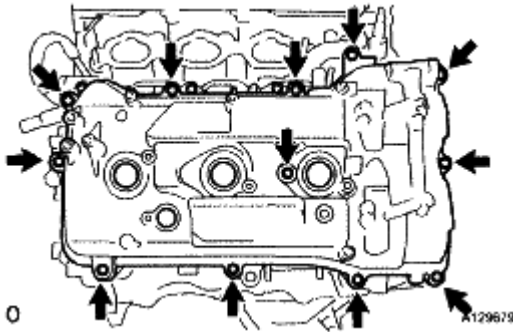


Fig. 153: Locating Head Cover And Gasket Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

18. REMOVE OIL PAN SUB-ASSEMBLY NO. 2

- a. Remove the 16 bolts and 2 nuts.

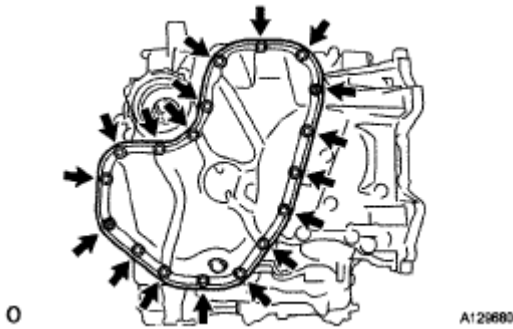


Fig. 154: Locating Oil Pan Sub-Assembly No. 2 Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Insert the blade of SST between the oil pans. Cut through the applied sealer and remove the oil pan sub-assembly No. 2.

SST 09032-00100

NOTE: Be careful not to damage the contact surfaces of the oil pans.

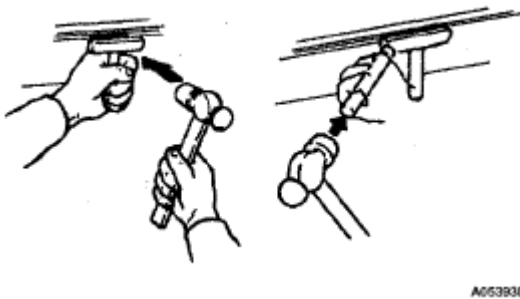


Fig. 155: Inserting Blade Of SST Between Oil Pans

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

19. REMOVE OIL STRAINER SUB-ASSEMBLY

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

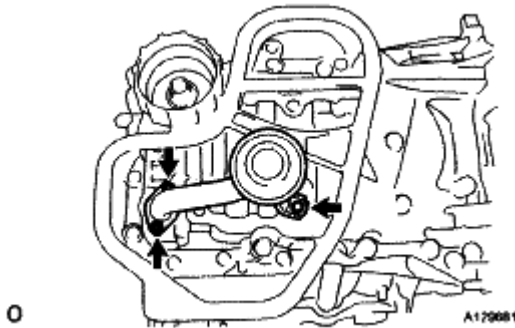


Fig. 156: Locating Oil Strainer Sub-Assembly Bolts And Nuts

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

20. REMOVE OIL PAN SUB-ASSEMBLY

- a. Remove the 16 bolts and 2 nuts.

HINT:

Be sure to clean the bolts and stud bolts and check the threads for cracks or other damage.

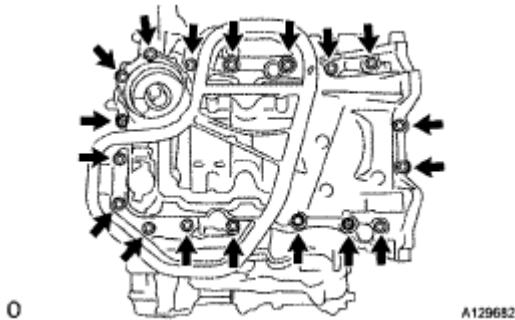


Fig. 157: Locating Oil Pan Sub-Assembly Bolts And Nuts

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

- b. Remove the oil pan by prying between the oil pan and cylinder block with a screwdriver.

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

HINT:

Tape the screwdriver tip before use.

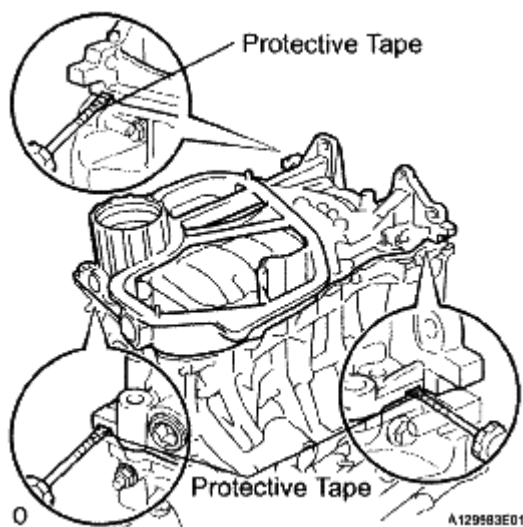


Fig. 158: Identifying Protective Tape Applying Area
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Remove the 2 O-rings.

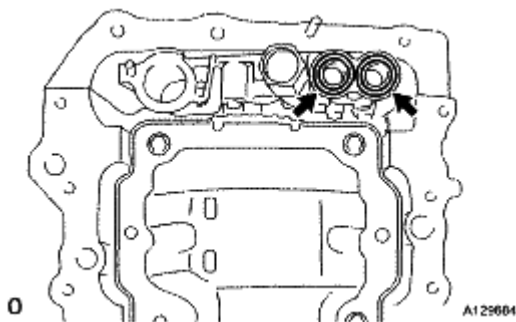


Fig. 159: Locating O-Rings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

21. REMOVE OIL PAN BAFFLE PLATE NO.1

- a. Remove the 7 bolts and oil pan baffle plate.

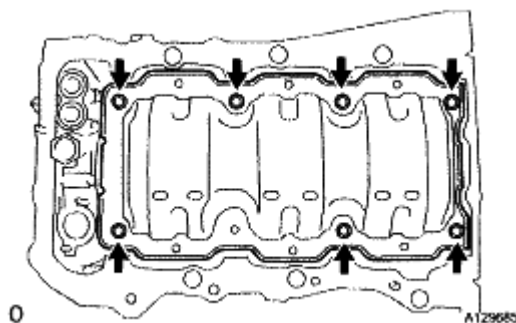


Fig. 160: Locating Oil Pan Baffle Plate Bolts

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

22. REMOVE ENGINE REAR OIL SEAL

- a. Remove the 6 bolts.

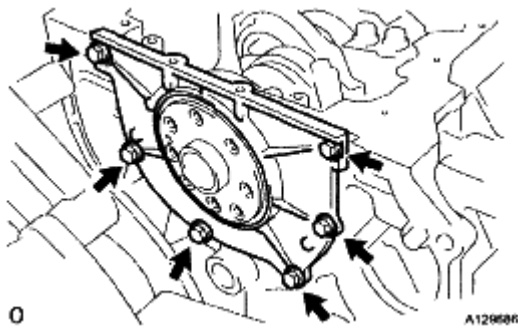


Fig. 161: Locating Engine Rear Oil Seal Bolts

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

- b. Using a screwdriver, pry out the oil seal retainer.

HINT:

Tape the screwdriver tip before use.

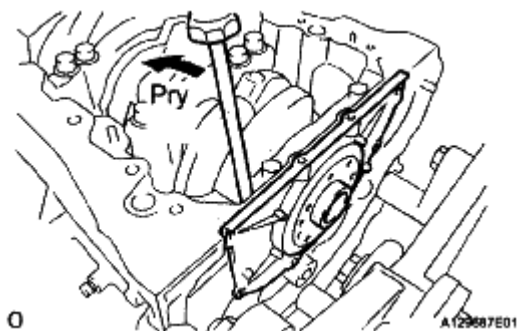


Fig. 162: Prying Out Oil Seal Retainer

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

23. REMOVE WATER PUMP ASSEMBLY

- a. Remove the 16 bolts, water pump and gasket.

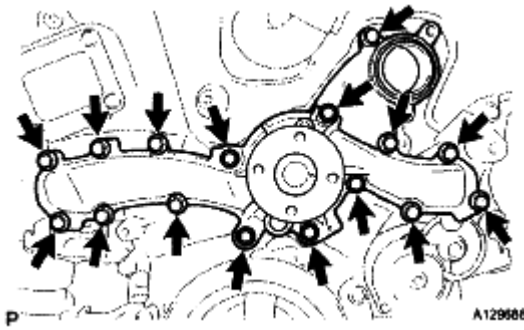


Fig. 163: Locating Water Pump And Gasket Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

24. REMOVE TIMING CHAIN COVER SUB-ASSEMBLY

- a. Remove the 15 bolts and 2 nuts as shown in the illustration.



Fig. 164: Locating Timing Chain Cover Sub-Assembly Bolts And Nuts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the timing chain cover by prying between the timing chain cover and cylinder head or cylinder block with a screwdriver.

NOTE: Be careful not to damage the contact surfaces of the cylinder head, cylinder block and chain cover.

HINT:

Tape the screwdriver tip before use.

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

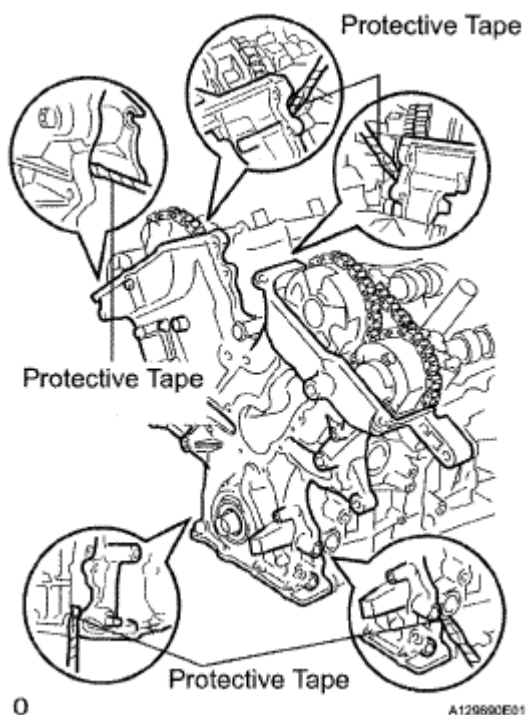


Fig. 165: Locating Chain Cover Plate And Gasket Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Remove the gasket.

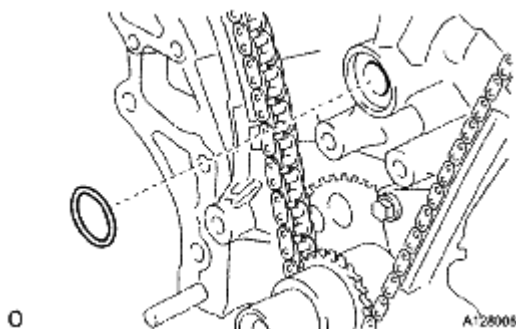


Fig. 166: Identifying Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

25. SET NO. 1 CYLINDER TO TDC / COMPRESSION

CAUTION: For additional information on timing chain/gear removal guidelines, installation and camshaft timing gear alignment, see 2GR-FE VALVE TIMING PROCEDURE .

- a. Temporarily tighten the pulley set bolt.
- b. Set the timing mark on the crank angle sensor plate to the RH block bore center line (TDC /

compression).

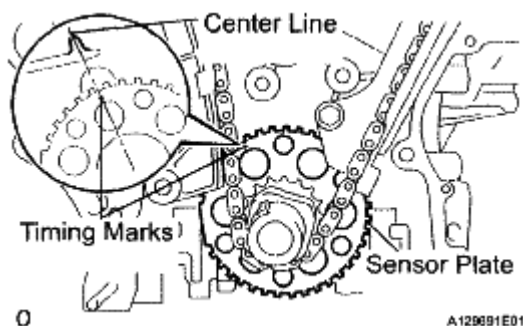


Fig. 167: Identifying Timing Mark On Crank Angle Sensor Plate
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

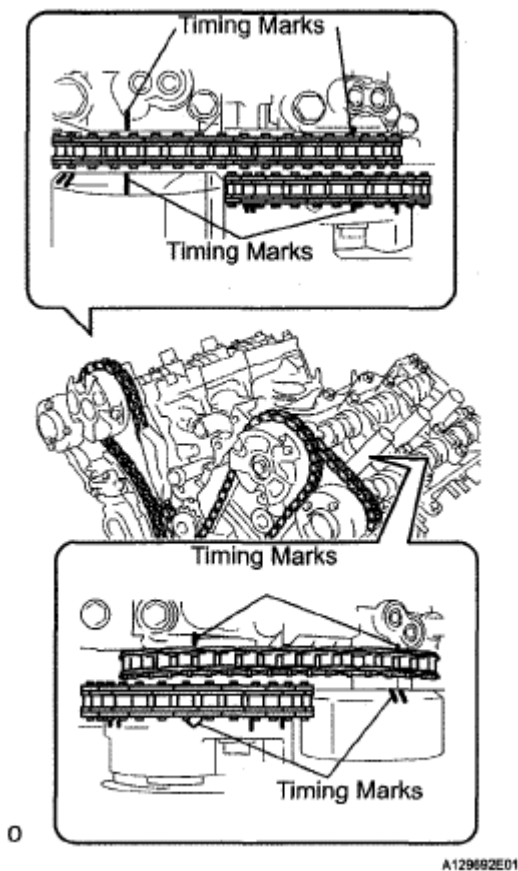


Fig. 168: Identifying Timing Marks Of Camshaft Timing Gears
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

26. REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY

- Move the stopper plate upward to release the lock, and push the plunger deep into the tensioner.
- Move the stopper plate downward to set the lock, and insert a hexagon wrench into the stopper plate's hole.
- Remove the 2 bolts and chain tensioner.

27. REMOVE CHAIN TENSIONER SLIPPER

- Remove the chain tensioner slipper.

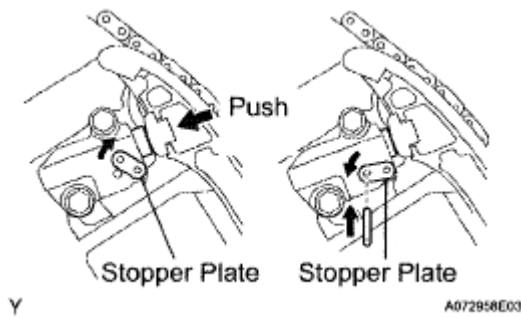


Fig. 169: Identifying Chain Tensioner Slipper

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

28. REMOVE CHAIN SUB-ASSEMBLY

- Turn the crankshaft counterclockwise 10° to loosen the chain of the crankshaft timing gear.
- Remove the chain from the crank timing gear and place it on the crankshaft.

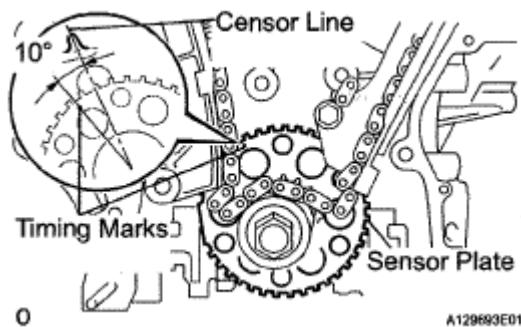


Fig. 170: Identifying Chain Sub-Assembly

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

- Turn the camshaft timing gear assembly on the RH bank clockwise (approximately 60°) and set it as shown in the illustration. Be sure to loosen the chain between the center banks.
- Remove the chain.

RH Side:

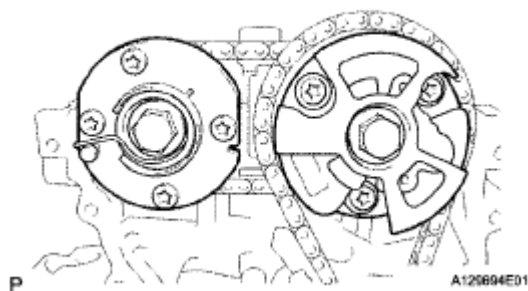


Fig. 171: Identifying Chain Sub-Assembly
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

29. REMOVE IDLE SPROCKET ASSEMBLY

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

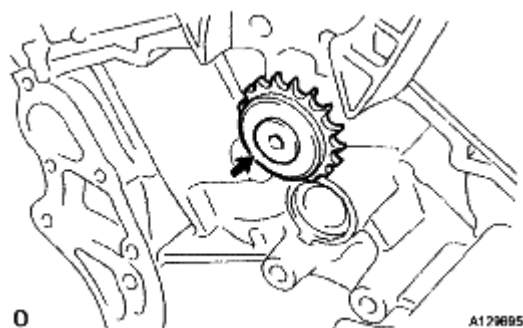


Fig. 172: Locating Idle Sprocket Assembly
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

30. REMOVE NO. 1 CHAIN VIBRATION DAMPER

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

31. REMOVE NO. 2 CHAIN VIBRATION DAMPER

- a. Remove the 2 chain vibration dampers.

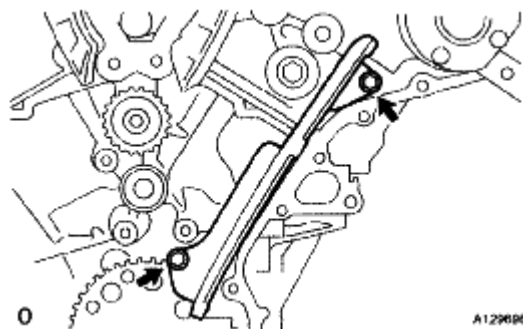


Fig. 173: Locating Chain Vibration Dampers

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

32. REMOVE CRANKSHAFT TIMING GEAR

- a. Remove the pulley set bolt.
- b. Remove the crankshaft timing gear from the crankshaft.
- c. Remove the 2 pulley set keys from the crankshaft.

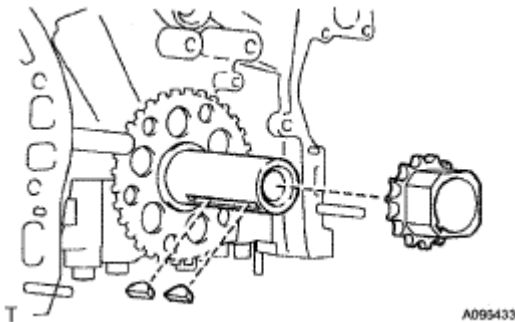


Fig. 174: Identifying Crankshaft Timing Gear

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

33. REMOVE CAMSHAFT TIMING GEARS AND NO. 2 CHAIN (for RH BANK)

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

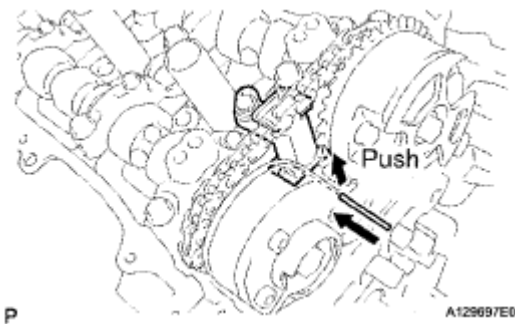


Fig. 175: Inserting Pin Into Hole

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

- b. Hold the hexagonal portion of the camshaft with a wrench, and remove the 2 bolts and 2 camshaft timing gears.

NOTE:

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

- c. Remove the No. 2 chain.

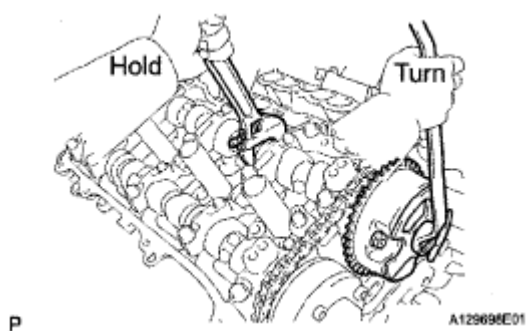


Fig. 176: Holding Hexagonal Portion Of Camshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

34. REMOVE NO. 2 CHAIN TENSIONER ASSEMBLY

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

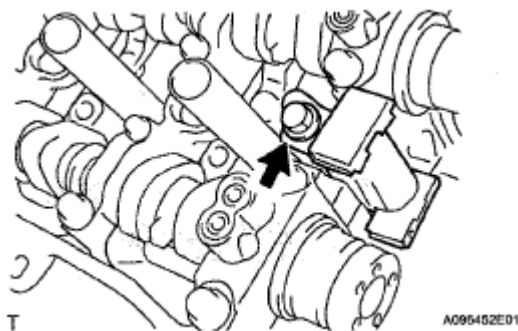


Fig. 177: Locating Chain Tensioner No. 2 Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

35. REMOVE CAMSHAFT BEARING CAP

- a. Remove the 3 gaskets.

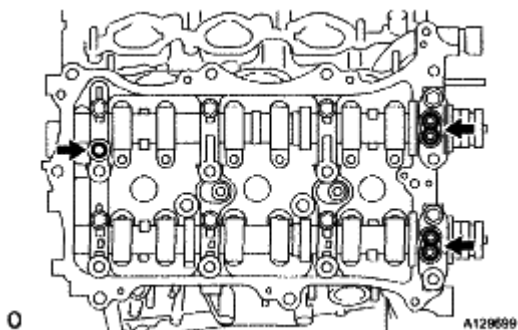


Fig. 178: Locating Camshaft Bearing Cap Gaskets
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Make sure that the knock pin of the camshaft is positioned as shown in the illustration.

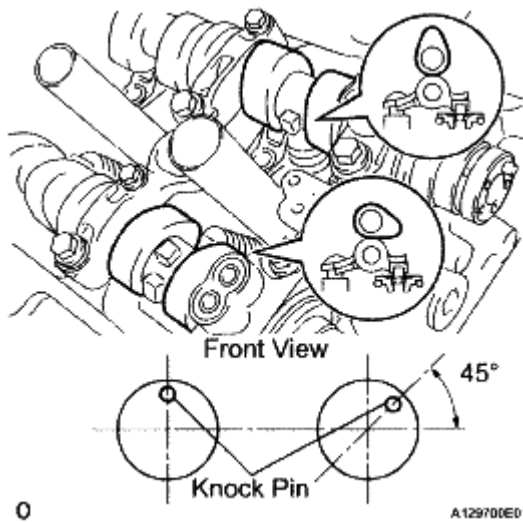


Fig. 179: Identifying Camshaft Positioned
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Uniformly loosen and remove the 8 bearing cap bolts in the sequence shown in the illustration.

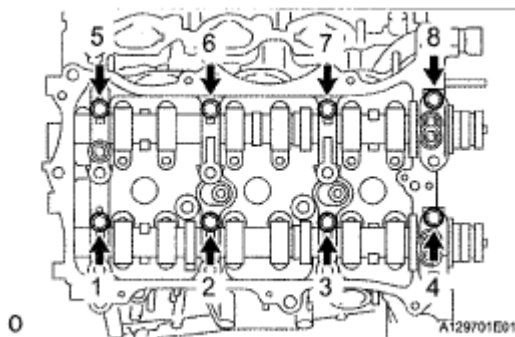


Fig. 180: Identifying Loosening Sequence Of Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Uniformly loosen and remove the 12 bearing cap bolts in the sequence shown in the illustration.

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

- e. Remove the 5 bearing caps.

36. REMOVE CAMSHAFT

- a. Remove the camshaft.

37. REMOVE NO. 2 CAMSHAFT

- a. Remove the No. 2 camshaft.

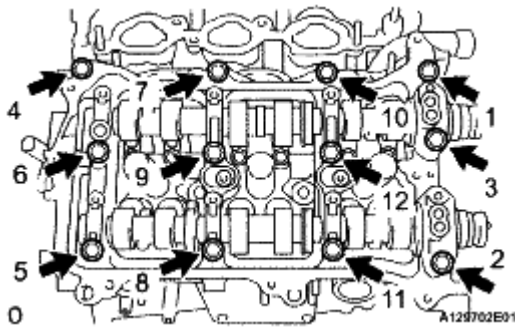


Fig. 181: Identifying Loosening Sequence Of Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

38. REMOVE CAMSHAFT HOUSING SUB-ASSEMBLY RH

- a. Remove the camshaft housing sub-assembly RH by prying between the cylinder head and camshaft housing sub-assembly RH with a screwdriver.

NOTE: Be careful not to damage the contact surfaces of the cylinder head and camshaft housing.

HINT:

Tape the screwdriver tip before use.

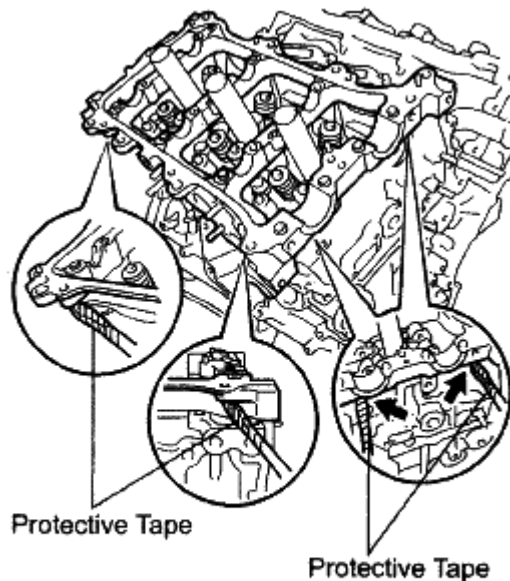


Fig. 182: Identifying Protective Tape Applying Area
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

39. REMOVE CAMSHAFT TIMING GEARS AND NO. 2 CHAIN (for LH BANK)

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

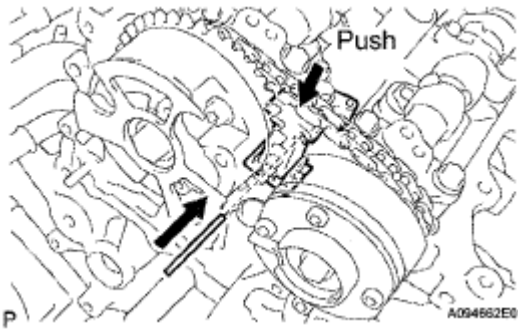


Fig. 183: Inserting Pin Into Hole

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

- b. Hold the hexagonal portion of the camshaft with a wrench, and remove the 2 bolts and 2 camshaft timing gears.

NOTE:

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

- c. Remove the No. 2 chain.

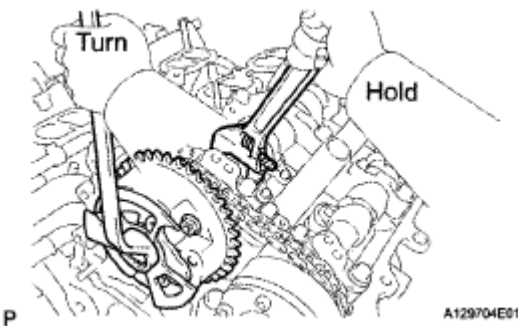


Fig. 184: Holding Hexagonal Portion Of Camshaft

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

40. REMOVE NO. 3 CHAIN TENSIONER ASSEMBLY

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

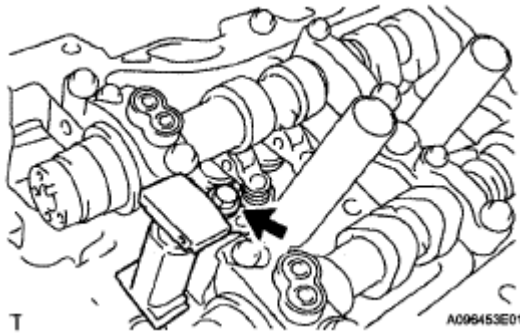


Fig. 185: Locating Chain Tensioner No. 3 Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

41. REMOVE CAMSHAFT BEARING CAP

- a. Remove the 3 gaskets.

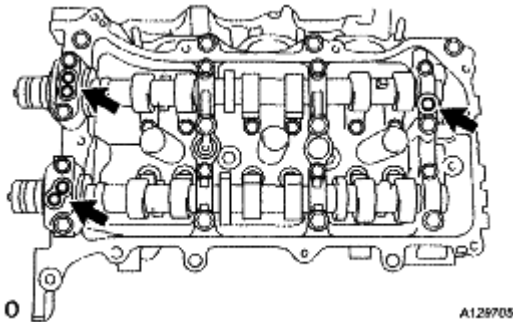


Fig. 186: Locating Camshaft Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Make sure that the knock pin of the camshaft is positioned as shown in the illustration.

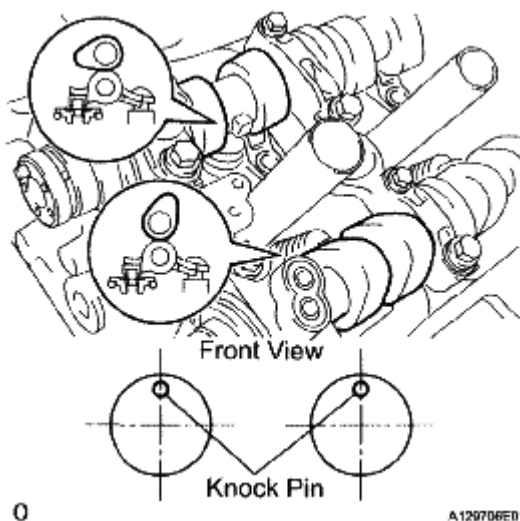


Fig. 187: Identifying Camshaft Position

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

- c. Uniformly loosen and remove the 8 bearing cap bolts in the sequence shown in the illustration.

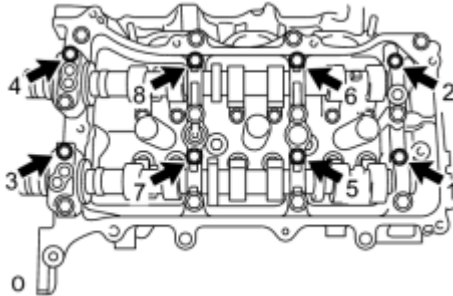


Fig. 188: Identifying Loosening Sequence Of Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Uniformly loosen and remove the 13 bearing cap bolts in the sequence shown in the illustration.

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

- e. Remove the 5 bearing caps.

42. REMOVE NO. 4 CAMSHAFT

- a. Remove the No. 4 camshaft.

43. REMOVE NO. 3 CAMSHAFT

- a. Remove the No. 3 camshaft.

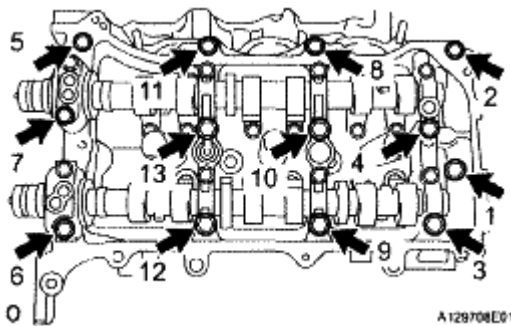


Fig. 189: Identifying Loosening Sequence Of Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

44. REMOVE CAMSHAFT HOUSING SUB-ASSEMBLY LH

- a. Remove the camshaft housing sub-assembly LH by prying between the cylinder head and camshaft housing sub-assembly LH with a screwdriver.

NOTE: Be careful not to damage the contact surfaces of the cylinder head and camshaft housing.

HINT:

Tape the screwdriver tip before use.

45. REMOVE NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY

- a. Remove the 24 valve rocker arms.

HINT:

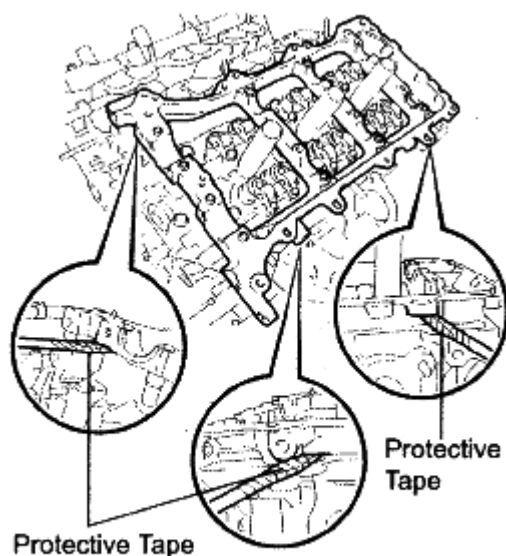
Arrange the removed parts in the correct order.

46. REMOVE VALVE LASH ADJUSTER ASSEMBLY

- a. Remove the 24 valve lash adjusters from the cylinder head.

HINT:

Arrange the removed parts in the correct order.



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Fig. 190: Identifying Protective Tape Applying Area
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

47. REMOVE CYLINDER HEAD LH

- a. Uniformly loosen and remove the 2 bolts in the sequence shown in the illustration.

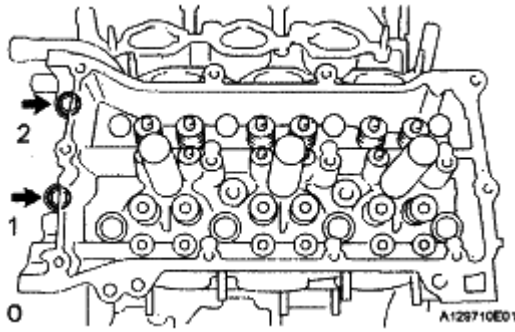


Fig. 191: Identifying Loosening Sequence Of Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

NOTE:

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

HINT:

Be sure to keep the removed parts separate for each installation position.

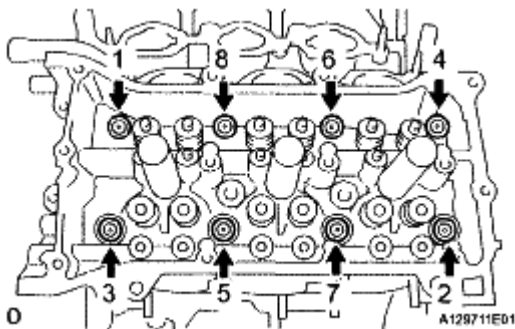


Fig. 192: Identifying Loosening Sequence Of Cylinder Head Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Remove the cylinder head and gasket.

48. REMOVE CYLINDER HEAD SUB-ASSEMBLY

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

NOTE:

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

HINT:

Be sure to keep the removed parts separate for each installation position.

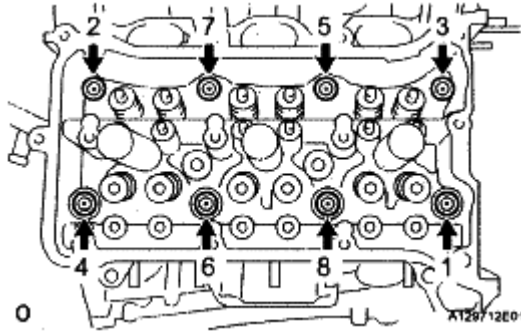


Fig. 193: Identifying Cylinder Head Sub-Assembly Bolts Loosening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the cylinder head and gasket.
- 49. **REMOVE WATER INLET PIPE**
 - a. Separate the knock sensor wire.
 - b. Remove the 2 bolts and water outlet pipe.
 - c. Separate the water by-pass hose No. 1.
- 50. **REMOVE VALVE STEM CAP**
 - a. Remove the valve stem caps from the cylinder head.

HINT:

Arrange the removed parts in the correct order.

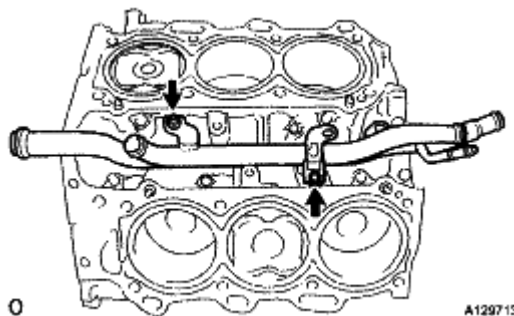


Fig. 194: Locating Water Outlet Pipe Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 51. **REMOVE INTAKE VALVE**
 - a. Using SST and wooden blocks, compress the compression spring and remove the valve retainer locks.

SST 09202-70020 (09202-00010)

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

HINT:

Arrange the removed parts in the correct order.

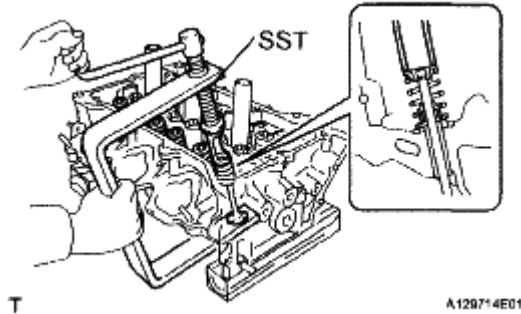


Fig. 195: Compressing Compression Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

52. REMOVE EXHAUST VALVE

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

SST 09202-70020(09202-00010)

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

HINT:

Arrange the removed parts in the correct order.

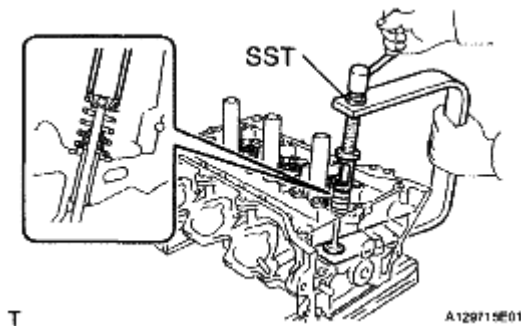


Fig. 196: Compressing Compression Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

53. REMOVE VALVE STEM OIL SEAL

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

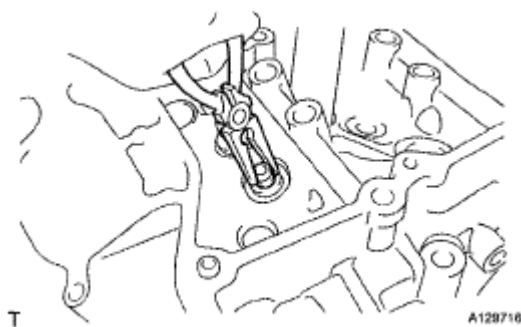


Fig. 197: Removing Oil Seals

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

54. REMOVE VALVE SPRING SEAT

- a. Using compressed air and a magnetic finger, remove the valve spring seat by blowing air onto it.

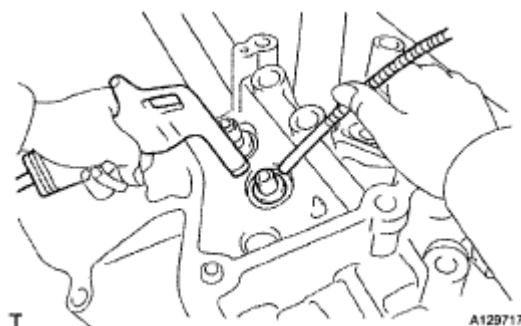


Fig. 198: Removing Valve Spring Seat By Blowing Air

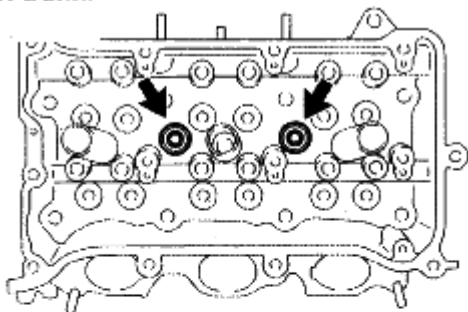
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

55. REMOVE WITH HEAD STRAIGHT SCREW PLUG NO. 1

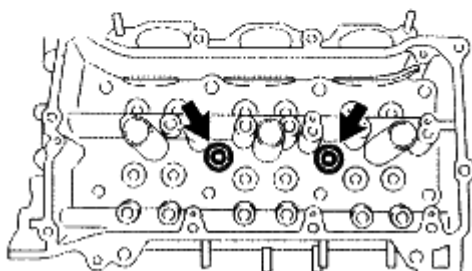
- a. Using a 10 mm hexagon wrench, remove the 4 screw plugs and 4 gaskets.

NOTE: If water leaks from the w/ head straight screw plug No. 1 or the plug is corroded, replace it.

RH Bank:



LH Bank:



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Fig. 199: Removing Screw Plugs And Gaskets

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

56. REMOVE WITH HEAD STRAIGHT SCREW PLUG NO. 2

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

NOTE: If water leaks from the w/ head straight screw plug No. 2 or the plug is corroded, replace it.

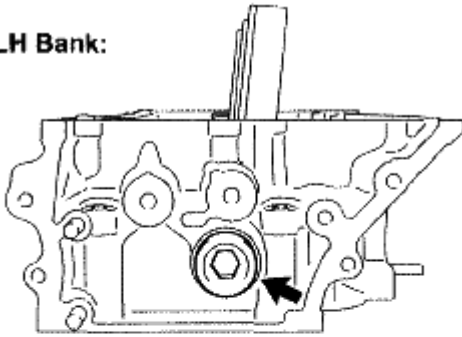
57. REMOVE RING PIN

NOTE: It is not necessary to remove the ring pin unless it is being replaced.

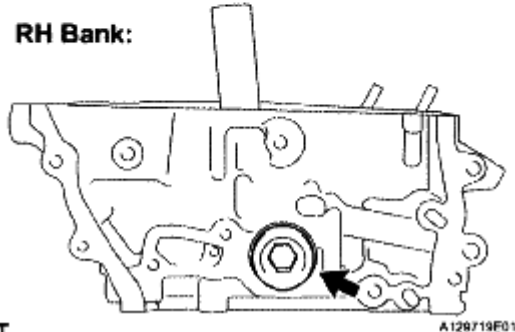
58. REMOVE STUD BOLT

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

LH Bank:



RH Bank:



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Fig. 200: Locating Screw Plugs

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

59. REMOVE STRAIGHT PIN

NOTE: If the straight pin is deformed or the threads are damaged, replace it.

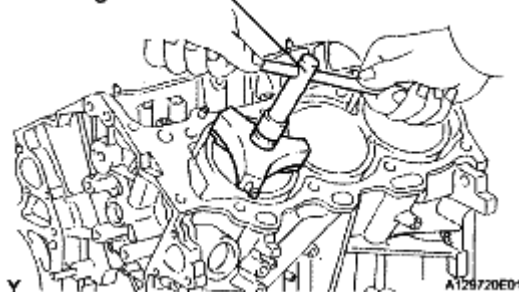
60. REMOVE PISTON SUB-ASSEMBLY WITH CONNECTING ROD

- Using a ridge reamer, remove all the carbon from the top of the cylinder.
- 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.

Ridge Reamer



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Fig. 201: Removing Carbon From Top Of Cylinder
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

61. REMOVE CONNECTING ROD BEARING

HINT:

Arrange the removed parts in the correct order.

62. REMOVE CRANKSHAFT

- a. Uniformly loosen and remove the 8 main bearing cap bolts and seal washers in the several steps and in the sequence shown in the illustration.

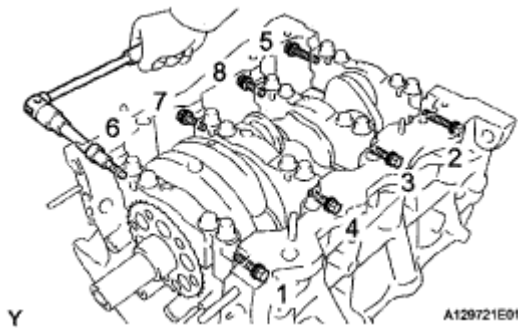


Fig. 202: Identifying Crankshaft Main Bearing Cap Bolts Loosening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Uniformly loosen the 16 bearing cap bolts in several steps in the sequence shown in the illustration.

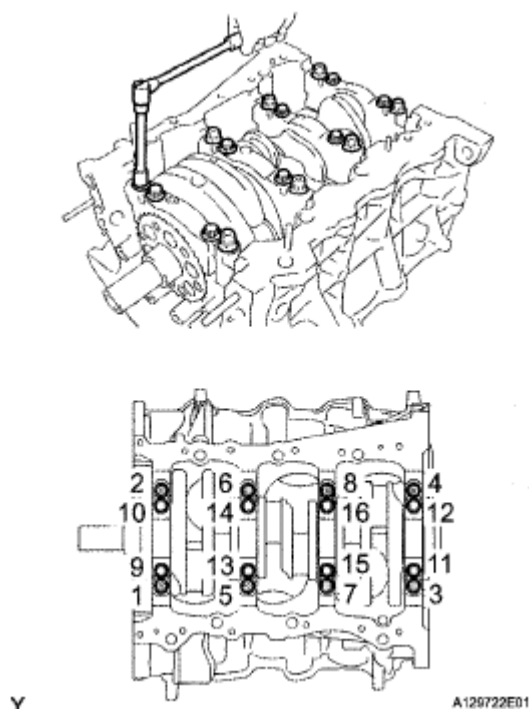


Fig. 203: Identifying Bearing Cap Bolts Loosening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

NOTE:

- Pull up the main cap little by little to the right and the left in turns.
- Be careful not to damage the joint surface of the cylinder block and the main bearing caps.

63. REMOVE CRANKSHAFT BEARING

HINT:

Arrange the removed parts in the correct order.

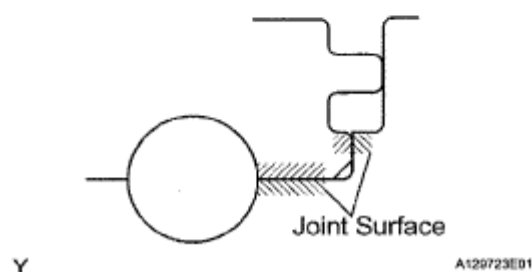
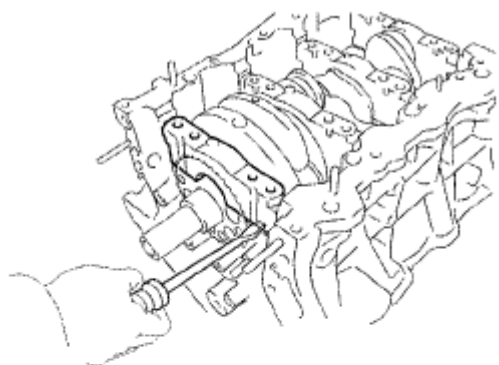


Fig. 204: Prying Out Main Bearing Caps
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

64. REMOVE CRANKSHAFT THRUST WASHER SET

- a. Remove the upper bearings and upper thrust washers from the cylinder block.

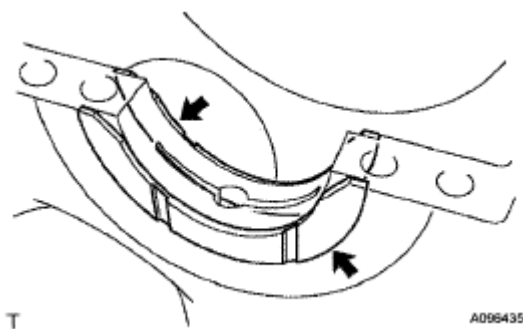


Fig. 205: Locating Upper Bearings And Upper Thrust Washers
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

65. REMOVE PISTON RING SET

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

HINT:

Arrange the piston rings in the correct order.

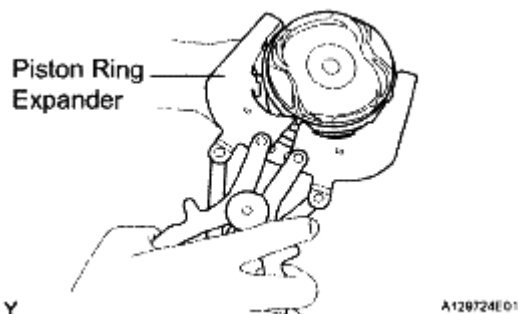


Fig. 206: Removing Side Rails

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

66. REMOVE PISTON SUB-ASSEMBLY WITH PIN

- a. Check the fitting condition between the piston and piston pin.
 1. Try to move the piston back and forth on the piston pin.

If any movement is felt, replace the piston and pin as a set.

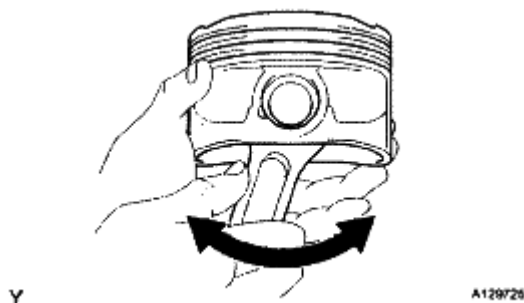


Fig. 207: Checking Fitting Condition Between Piston And Piston Pin

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

- b. Disconnect the connecting rod from the piston.
 1. Using a screwdriver, pry off the snap rings from the piston.

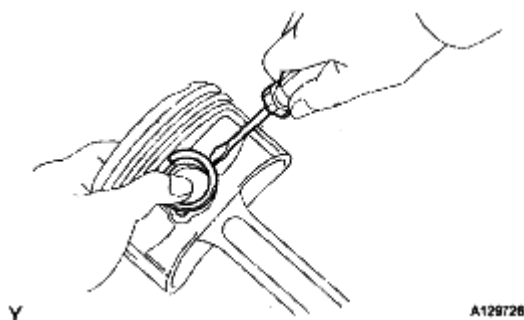


Fig. 208: Prying Off Snap Rings From Piston

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

2. Gradually heat the piston to approximately 80°C (176°F).

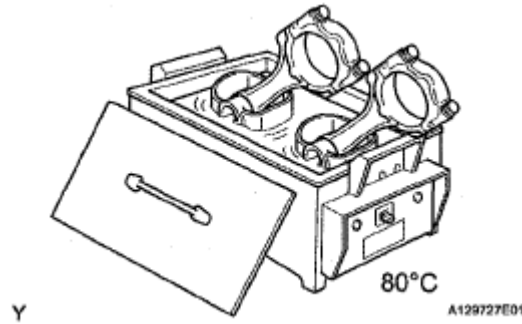


Fig. 209: Heating Piston

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

3. Using a brass bar and plastic hammer, lightly tap out the piston pin and remove the connecting rod.

HINT:

- The piston and pin are a matched set.
- Arrange the pistons, pins, rings, connecting rods and bearings in the correct order.

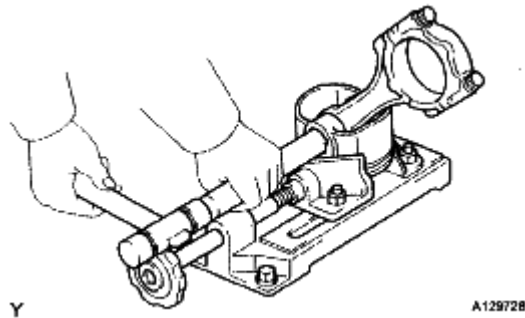


Fig. 210: Tapping Out Piston Pin

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

- c. Using a gasket scraper, remove the carbon from the piston top.

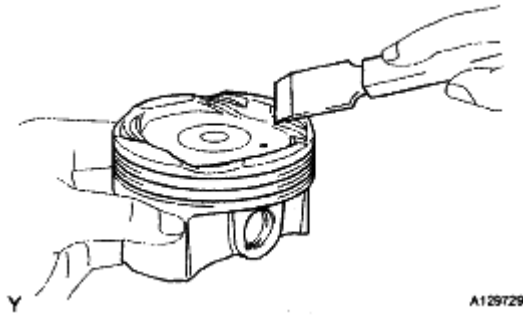


Fig. 211: Removing Carbon From Piston Top
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Using a groove cleaning tool or broken ring, clean the piston ring grooves.

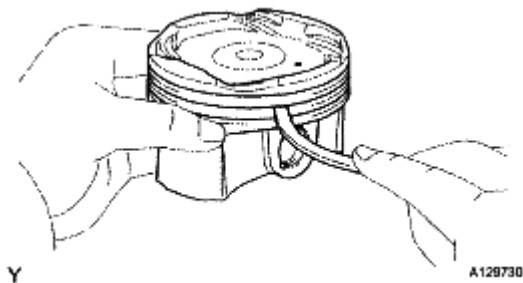


Fig. 212: Cleaning Piston Ring Grooves
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Using solvent and a brush, thoroughly clean the piston.

NOTE: Do not use a wire brush.

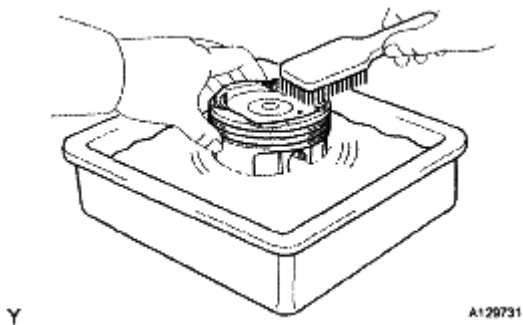


Fig. 213: Cleaning Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

67. REMOVE SUB-ASSEMBLY OIL NOZZLE NO. 1

- a. Using a 5 mm hexagon wrench, remove the 3 oil nozzles.
- b. Check the oil nozzles for damage or clogging. If necessary, replace the oil nozzle.

INSPECTION

NOTE: Bank 1 may also be known as RH side.

Bank 2 may also be known as LH side.

1. INSPECT VALVE LASH ADJUSTER ASSEMBLY

- NOTE:**
- Keep the lash adjuster free from dirt and foreign objects.
 - Only use clean engine oil.

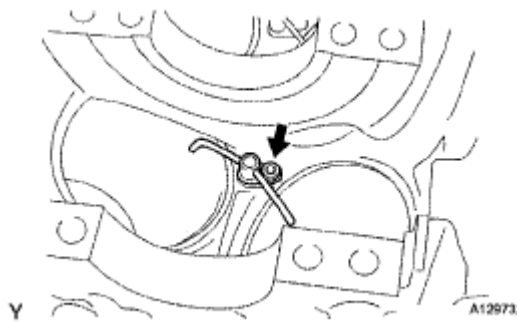


Fig. 214: Locating Oil Nozzles
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Place the lash adjuster into a container full of engine oil.
- Insert SST's tip into the lash adjuster's plunger and use the tip to press down on the check ball inside the plunger.

SST 09276-75010

- Squeeze SST and lash adjuster together to move the plunger up and down 5 to 6 times.
- Check the movement of the plunger and bleed the air.

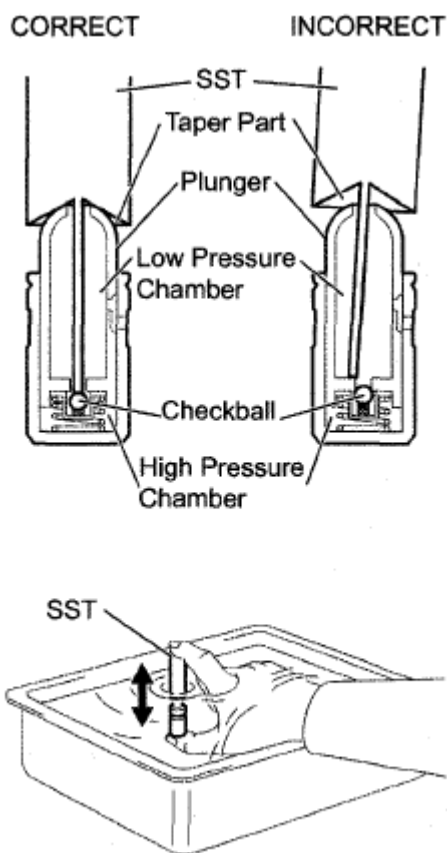
OK: Plunger moves up and down.

NOTE: When bleeding high-pressure air from the compression chamber, make sure that the tip of SST is actually pressing the checkball as shown in the illustration. If the checkball is not pressed, air will not bleed.

- After bleeding the air, remove SST. Then quickly and firmly press the plunger with a finger.

OK: Plunger is very difficult to move.

If the result is not as specified, replace the lash adjuster.



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Fig. 215: Inserting SST's Tip Into Lash Adjuster's Plunger
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. INSPECT CAMSHAFTS

- a. Inspect 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: 0.04 mm (0.0016 in.)

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

HINT:

Check the oil clearance after replacing the camshaft.

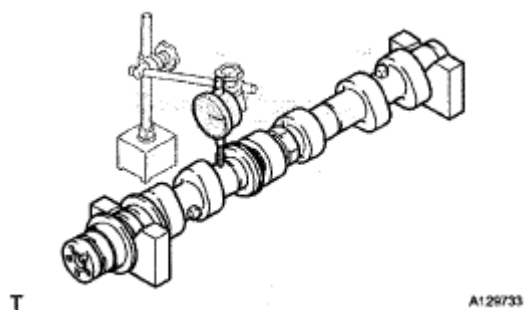


Fig. 216: Measuring Circle Runout At Center Journal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Standard cam lobe height

CAM LOBE HEIGHT SPECIFICATION

Item	Specification
Intake	44.316 to 44.416 mm (1.7447 to 1.7487 in.)
Exhaust	44.262 to 44.362 mm (1.7426 to 1.7465 in.)

Maximum cam lobe height

CAM LOBE HEIGHT SPECIFICATION

Item	Specification
Intake	44.166 mm (1.7388 in.)
Exhaust	44.112 mm (1.7367 in.)

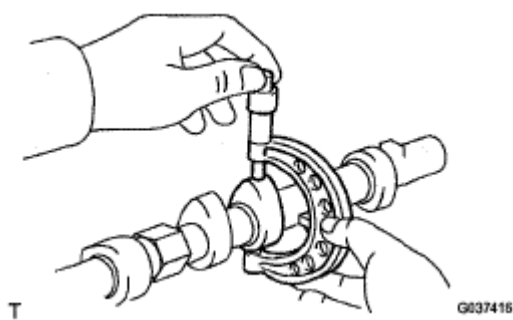


Fig. 217: Measuring Cam Lobe Height
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using a micrometer, measure the journal diameter.

Standard journal diameter

JOURNAL DIAMETER

Item	Specification
No. 1 journal	35.946 to 35.960 mm (1.4152 to 1.4157 in.)
Other journal	25.959 to 25.975 mm (1.0220 to 1.0226 in.)

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

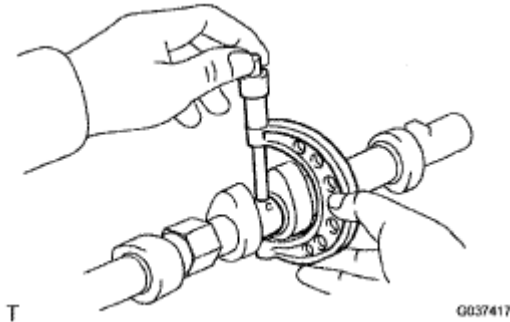


Fig. 218: Measuring Journal Diameter

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

3. INSPECT CAMSHAFT TIMING GEAR ASSEMBLY

- a. Clamp the camshaft in a vise.

NOTE: Be careful not to damage the camshaft in the vise.

- b. Put the camshaft timing gear and camshaft together by aligning the key groove and straight pin.
- c. Lightly press the gear against the camshaft, and turn the gear. Push further at the position where the pin enters the groove.

CAUTION: Be sure not to turn the camshaft timing gear in the retard direction (the right angle).

- d. Check that there is no clearance between the gear's fringe and the camshaft.

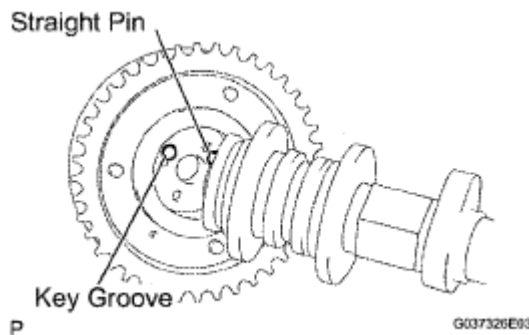


Fig. 219: Aligning Key Groove And Straight Pin

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

- e. Tighten the fringe bolt with the camshaft timing gear fixed.

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

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

NOTE: Be careful not to damage the camshaft.

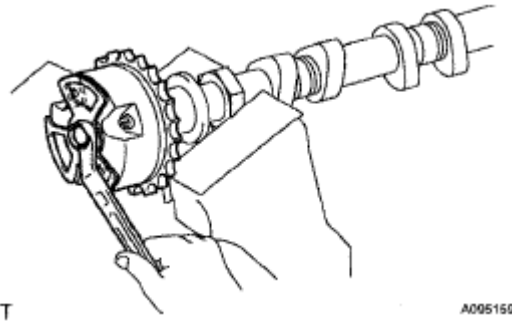


Fig. 220: Tightening Fringe Bolt With Camshaft Timing Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Release the lock pin.
1. Cover the 4 oil paths of the cam journal with vinyl tape as shown in the illustration.

HINT:

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

2. Break through the tape of the advance side path and the retard side path on the opposite side to the hole of the advance side path, as shown in the illustration.

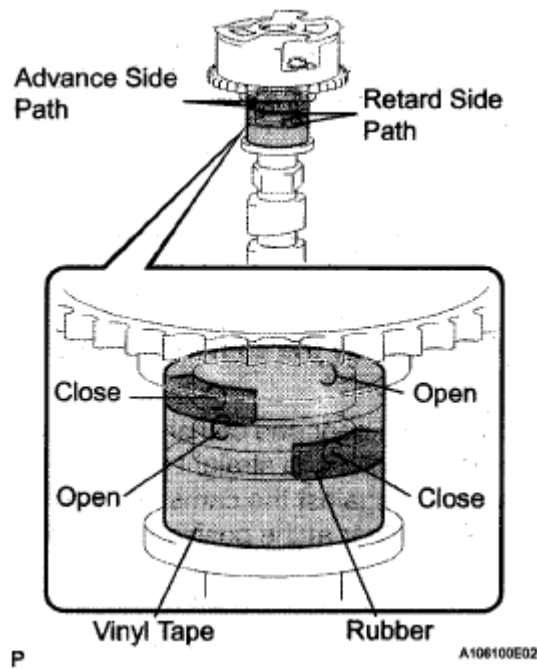


Fig. 221: Identifying Vinyl Tape Area

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

3. Apply approximately 200 kPa (2.0 kgf/cm², 28 psi) of air pressure to the two broken paths.

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

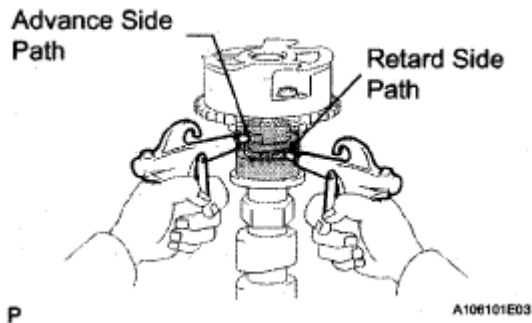


Fig. 222: Applying Air Pressure To Broken Paths

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

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

HINT:

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

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

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

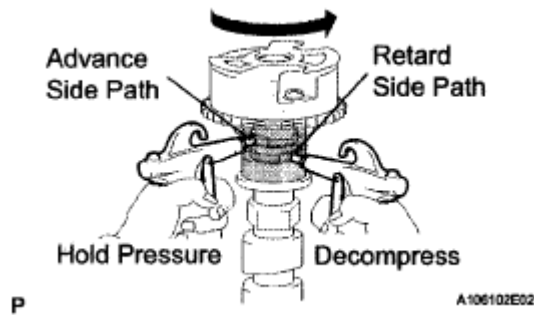


Fig. 223: Checking Camshaft Timing Gear Revolves In Advance Direction
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- h. 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.

CAUTION: Do not use air pressure to perform the smooth operation check.

- i. Check the lock in the most retarded position.
 1. Confirm that the camshaft timing gear is locked at the most retarded position.
- j. Remove the fringe bolt and camshaft timing gear.

NOTE:

- Be sure not to remove the other 3 bolts.
- If planning to reuse the gear, be sure to release the straight pin lock before installing the gear.

4. INSPECT CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY

- a. Clamp the camshaft in a vise.

NOTE: Be careful not to damage the camshaft in the vise.

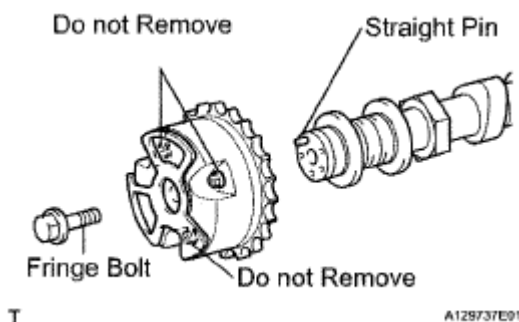


Fig. 224: Identifying Fringe Bolt

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

- b. Put the camshaft timing exhaust gear and camshaft together by aligning the key groove and straight pin.
- c. Lightly press the gear against the camshaft, and turn the gear. Push further at the position where the pin enters the groove.

CAUTION: Be sure not to turn the camshaft timing exhaust gear in the retard direction (the right angle).

- d. Check that there is no clearance between the gear's fringe and the camshaft.

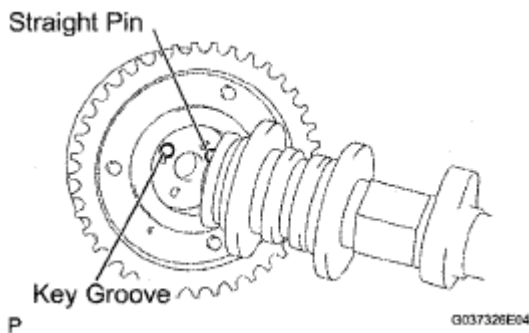


Fig. 225: Aligning Key Groove And Straight Pin

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

- e. Tighten the fringe bolt with the camshaft timing exhaust gear fixed.

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

- f. Check the camshaft timing exhaust gear lock.
 1. Make sure that the camshaft timing exhaust gear is locked.

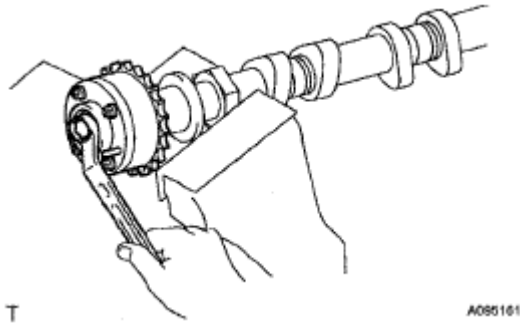


Fig. 226: Tightening Fringe Bolt With Camshaft Timing Exhaust Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

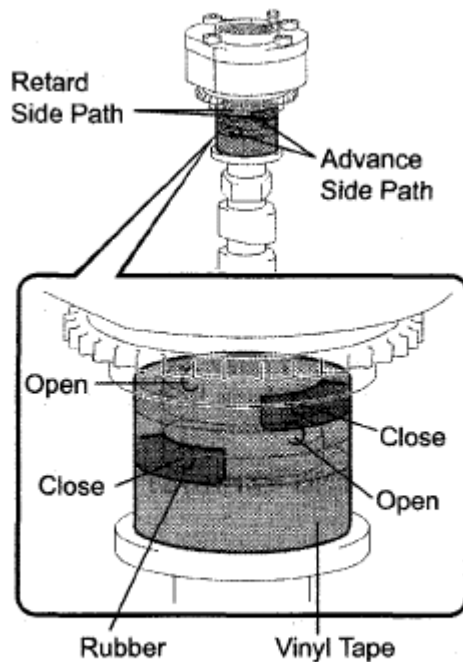
g. Release the lock pin.

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

HINT:

4 oil paths are provided in the groove. Plug 2 paths with rubber pieces.

2. Prick a hole in the tape placed on the advance side path. Prick a hole in the tape placed on the retard side path, on the opposite side to that of the advance side path, as shown in the illustration.



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Fig. 227: Identifying Vinyl Tape Area

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

3. Apply approximately 200 kPa (2.0 kgf/cm² , 28 psi) of air pressure to the two broken paths (the advance side path and the retard side path).

NOTE: Cover the paths with a shop rag or piece of cloth when applying pressure to keep oil from splashing.

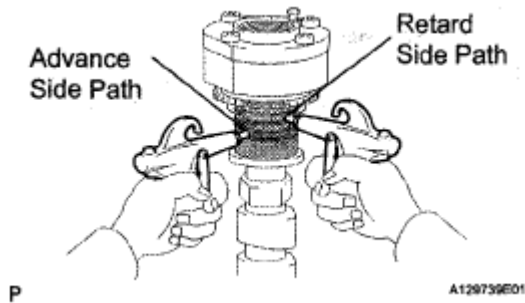


Fig. 228: Applying Air Pressure To Broken Paths
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. Make sure that the camshaft timing exhaust gear turns in the retard direction when reducing the air pressure applied to the advance side path.

HINT:

The lock pin is released and the camshaft timing exhaust gear turns in the retard direction.

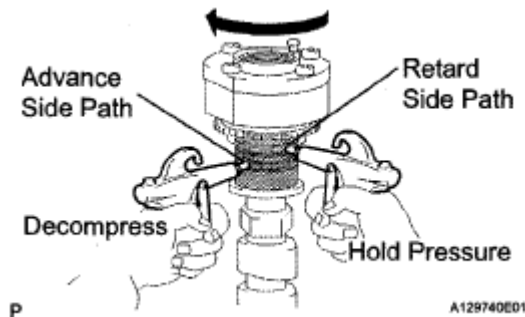


Fig. 229: Turning Camshaft Timing Exhaust Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

NOTE: Be sure to release the air pressure from the advance side path first. If the air pressure of the retard side path is released first,

the camshaft timing exhaust gear may abruptly shift in the advance direction and break the lock pin or other parts.

h. Check for smooth rotation.

1. Turn the camshaft timing exhaust gear within its movable range (18.5°) 2 or 3 times, but do not turn it to the most advanced position. Make sure that the gear turns smoothly.

NOTE: When the air pressure is released from the advance side path and then from the retard side path, the gear automatically returns to the most advanced position due to the advance assist spring operation and locks. Gradually release the air pressure from the retard side path before performing the smooth rotation check.

i. Check the lock at the most advanced position.

1. Make sure that the camshaft timing exhaust gear is locked at the most advanced position.

j. Remove the fringe bolt and camshaft timing exhaust gear.

NOTE:

- Be sure not to remove the other 3 bolts.
- If planning to reuse the gear, be sure to release the straight pin lock before installing the gear.

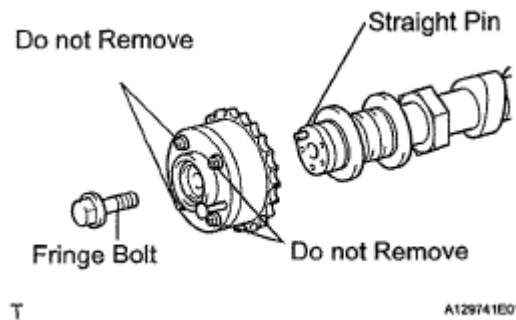


Fig. 230: Identifying Fringe Bolt And Camshaft Timing Exhaust Gear

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

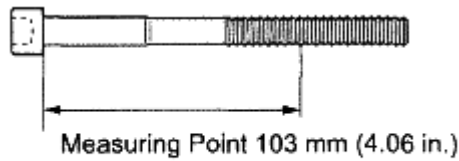
5. INSPECT CYLINDER HEAD SET BOLT

- a. Using vernier calipers, measure the minimum diameter of the elongated thread at the measuring point.

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

Minimum outside diameter: 10.70 mm (0.4213 in.)

Measuring point: 103 mm (4.06 in.)



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Fig. 231: Measuring Cylinder Head Set Bolt Length
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

- If a visual check reveals no excessively thin areas, check the center of the bolt (see illustration) and find the area that has the lowest diameter.
- If the diameter is less than the minimum, replace the cylinder head bolt.

6. INSPECT CHAIN SUB-ASSEMBLY

- Pull the chain with a force of 147 N (15 kgf, 33 lbf) as shown in the illustration.
- Using vernier calipers, measure the length of 15 links.

Maximum chain elongation: 136.9 mm (5.390 in.)

If the elongation is greater than the maximum, replace the chain.

NOTE: Perform the same measurement by pulling at random in 3 or more places to obtain an average.

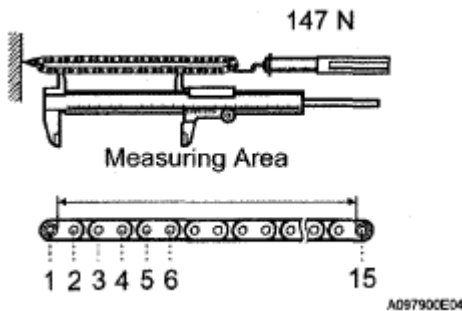


Fig. 232: Measuring Length Of Links
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. INSPECT NO. 2 CHAIN SUB-ASSEMBLY

- Pull the chain with a force of 147 N (15 kgf, 33 lbf) as shown in the illustration.
- Using vernier calipers, measure the length of 15 links.

Maximum chain elongation: 137.6 mm (5.417 in.)

If the elongation is greater than the maximum, replace the chain.

NOTE: Perform the same measurement by pulling at random in 3 or more places to obtain an average.

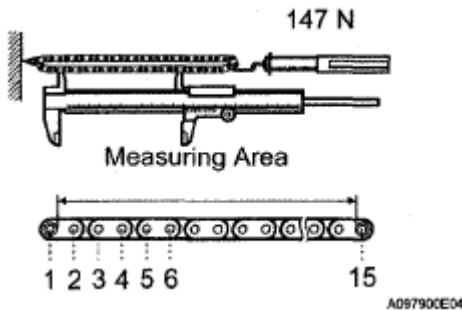


Fig. 233: Measuring Length Of Links

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

8. INSPECT CRANKSHAFT TIMING GEAR

- Wrap the chain around the sprocket.
- Using vernier calipers, measure the sprocket diameter with the chain.

Minimum sprocket diameter (with chain): 61.4 mm (2.417 in.)

HINT:

- The vernier calipers must contact the chain rollers for the measurement.
- If the diameter is less than the minimum, replace the chain and sprocket.

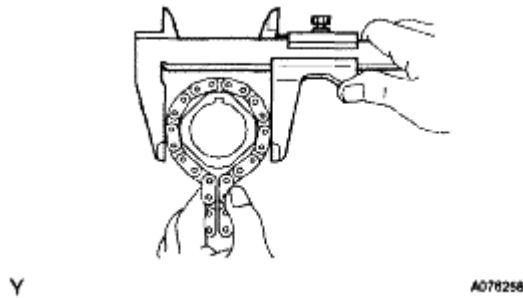


Fig. 234: Measuring Sprocket Diameter With Chain

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

9. INSPECT IDLE SPROCKET ASSEMBLY

- Wrap the chain around the sprocket.
- Using vernier calipers, measure the sprocket diameter with the chain.

Minimum sprocket diameter (with chain): 61.4 mm (2.417 in.)

HINT:

- The vernier calipers must contact the chain rollers for the measurement.
- If the diameter is less than the minimum, replace the chain and sprocket.

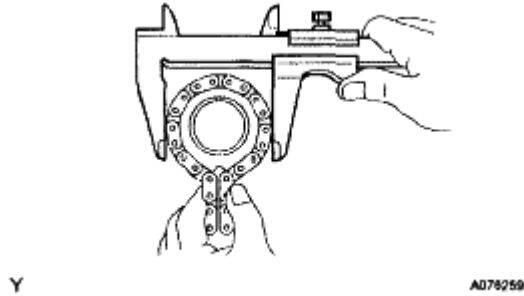


Fig. 235: Measuring Sprocket Diameter With Chain
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. INSPECT IDLE GEAR SHAFT OIL CLEARANCE

- a. Using a micrometer, measure the idle gear shaft diameter.

Idle gear shaft diameter: 30.000 to 30.013 mm (1.1811 to 1.1816 in.)

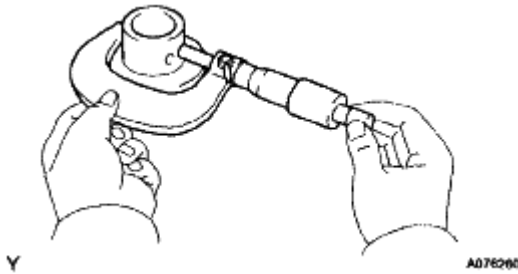


Fig. 236: Measuring Idle Gear Shaft Diameter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a caliper gauge, measure the inside diameter of the idle gear.

Idle gear inside diameter: 30.020 to 30.033 mm (1.1819 to 1.1824 in.)

- c. Subtract the idle gear shaft diameter measurement from the idle gear inside diameter measurement.

Standard oil clearance: 0.007 to 0.033 mm (0.0003 to 0.0013 in.)

Maximum oil clearance: 0.083 mm (0.0033 in.)

If the thrust oil clearance is greater than the maximum, replace the idle gear shaft and idle gear.

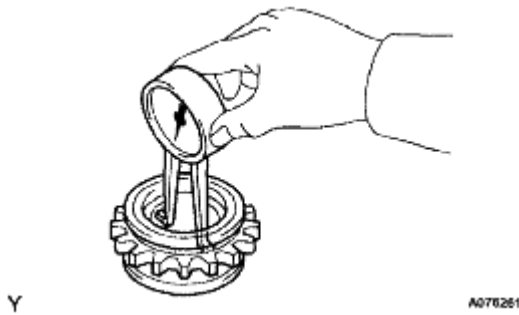


Fig. 237: Measuring Inside Diameter Of Idle Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. INSPECT NO. 1 CHAIN TENSIONER ASSEMBLY

- a. Move the stopper plate upward to release the lock. Push the plunger and check that it moves smoothly. If necessary, replace the chain tensioner assembly No. 1.

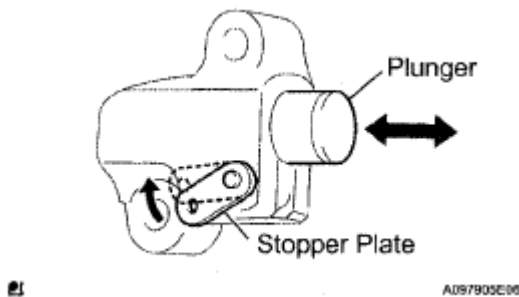


Fig. 238: Inspecting No. 1 Chain Tensioner Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. INSPECT NO. 2 CHAIN TENSIONER ASSEMBLY

- a. Check that the plunger moves smoothly.
- b. Measure the worn depth of the chain tensioner slipper.

Maximum depth: 0.9 mm (0.035 in.)

If the depth is greater than the maximum, replace the chain tensioner No. 2.

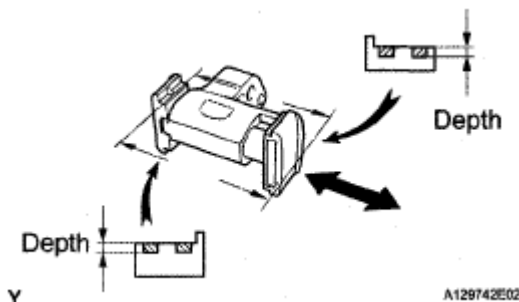


Fig. 239: Measuring Worn Depth Of Chain Tensioner Slipper
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. INSPECT NO. 3 CHAIN TENSIONER ASSEMBLY

- a. Check that the plunger moves smoothly.
- b. Measure the worn depth of the chain tensioner slipper.

Maximum depth: 0.9 mm (0.035 in.)

If the depth is greater than the maximum, replace the chain tensioner No. 3.

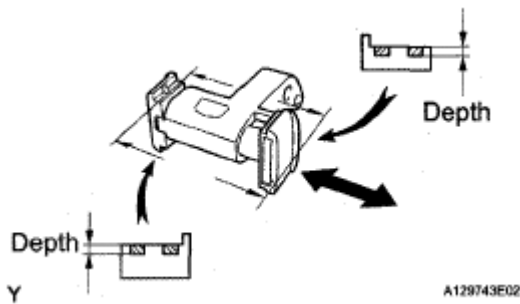


Fig. 240: Measuring Worn Depth Of Chain Tensioner Slipper
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. INSPECT CHAIN TENSIONER SLIPPER

- a. Measure the worn depth of the chain tensioner slipper.

Maximum depth: 1.0 mm (0.039 in.)

If the depth is greater than the maximum, replace the chain tensioner slipper.

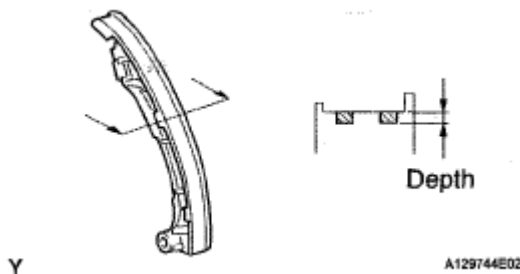


Fig. 241: Measuring Worn Depth Of Chain Tensioner Slipper
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

15. INSPECT NO. 1 CHAIN VIBRATION DAMPER

- a. Measure the worn depth of the chain vibration damper No. 1.

Maximum depth: 1.0 mm (0.039 in.)

If the depth is greater than the maximum, replace the chain vibration damper No. 1.

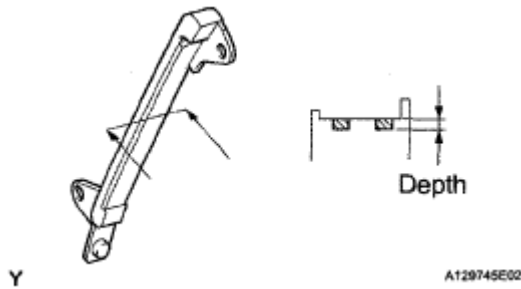


Fig. 242: Measuring Worn Depth Of Chain Vibration Damper No. 1
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

16. INSPECT NO. 2 CHAIN VIBRATION DAMPER

- Measure the worn depth of the chain vibration damper No. 2.

Maximum depth: 1.0 mm (0.039 in.)

If the depth is greater than the maximum, replace the chain vibration damper No. 2.

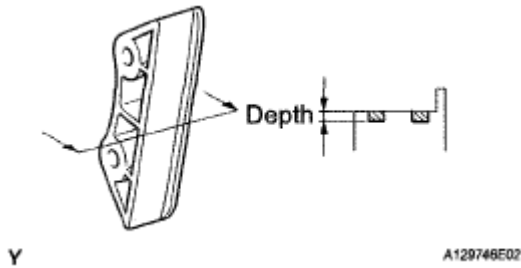


Fig. 243: Measuring Worn Depth Of Chain Vibration Damper No. 2
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

17. INSPECT CYLINDER HEAD SUB-ASSEMBLY

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

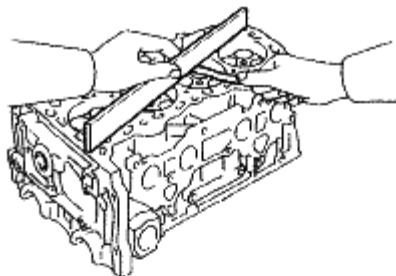
Standard warpage

WARPAGE SPECIFICATION

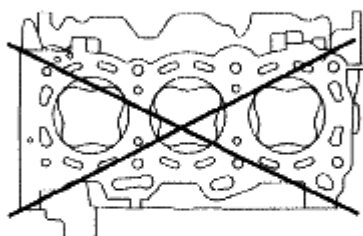
Item	Warpage
Cylinder head lower	0.05 mm (0.0020 in.)
Intake	0.08 mm (0.0031 in.)
Exhaust	0.08 mm (0.0031 in.)

Maximum warpage: 0.10 mm (0.0039 in.)

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



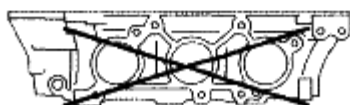
Cylinder head lower side:



Intake side:



Exhaust side:

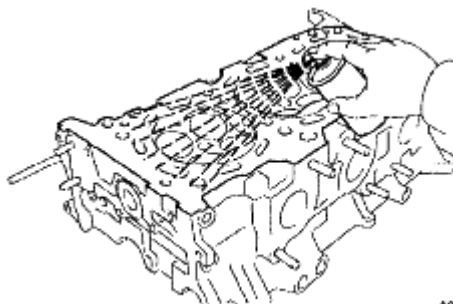


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Fig. 244: Measuring Warpage Of Contact Surface Of Cylinder Block And Manifolds
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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



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Fig. 245: Checking Intake Ports, Exhaust Ports And Cylinder Surface For Cracks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

18. INSPECT INTAKE VALVE

- a. 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.)

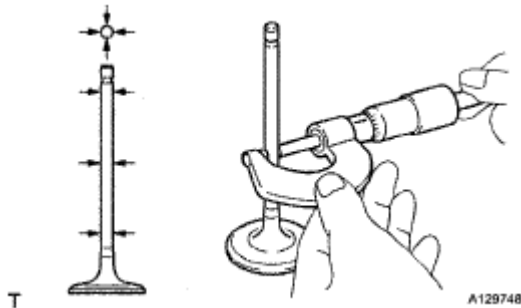


Fig. 246: Measuring Diameter Of Valve Stem
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Standard margin thickness: 1.0 mm (0.0394 in.)

Minimum margin thickness: 0.5 mm (0.0197 in.)

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

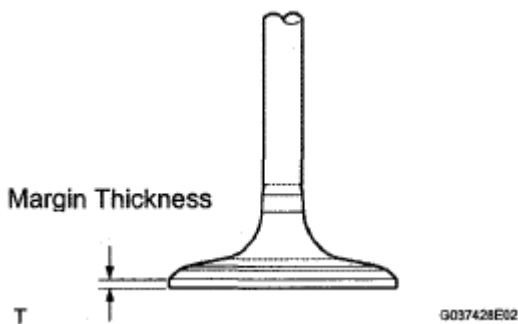


Fig. 247: Measuring Valve Head Margin Thickness
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using vernier calipers, measure the valve's overall length.

Standard overall length: 105.85 mm (4.1673 in.)

Minimum overall length: 105.35 mm (4.1476 in.)

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

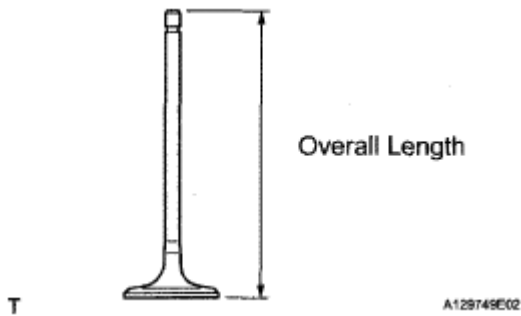


Fig. 248: Measuring Valve's Overall Length
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

19. INSPECT EXHAUST VALVE

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

Valve stem diameter: 5.465 to 5.480 mm (0.2151 to 0.2157 in.)

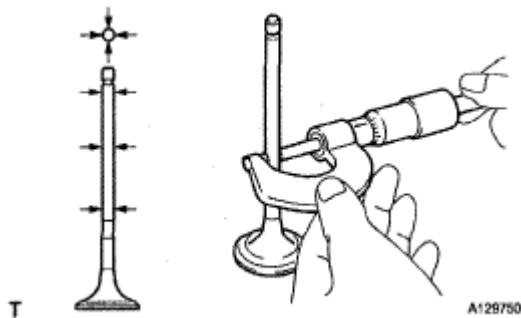


Fig. 249: Measuring Diameter Of Valve Stem
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Standard margin thickness: 1.0 mm (0.0394 in.)

Minimum margin thickness: 0.5 mm (0.0197 in.)

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

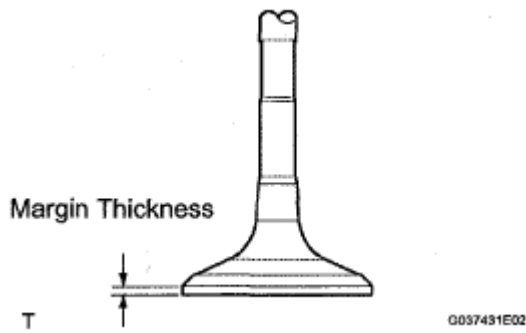


Fig. 250: Measuring Valve Head Margin Thickness
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using vernier calipers, measure the valve's overall length.

Standard overall length: 111.40 mm (4.3858 in.)

Minimum overall length: 109.90 mm (4.3268 in.)

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

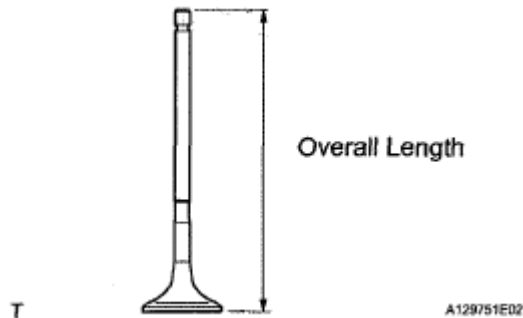


Fig. 251: Measuring Valve's Overall Length
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

20. INSPECT INTAKE 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 by using the following procedure.
 - 1. If prussian blue appears around the entire valve face, the valve face is concentric. If not, replace the valve.
 - 2. If prussian blue appears around the entire valve seat, the guide and valve face are concentric. If not, resurface the valve seat.
 - 3. Check that the valve seat contacts in the middle of the valve face with the width between 1.1 and 1.5 mm (0.043 and 0.059 in.).

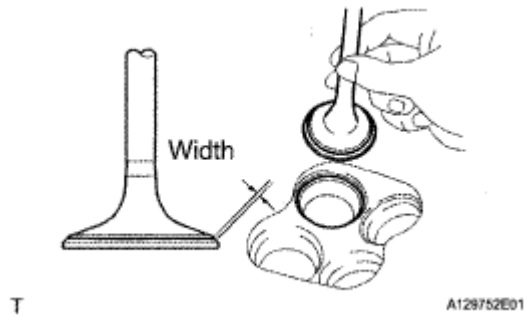


Fig. 252: Inspecting Intake Valve Seats
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

21. INSPECT EXHAUST 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 by using the following procedure.
 1. If prussian blue appears around the entire valve face, the valve face is concentric. If not, replace the valve.
 2. If prussian blue appears around the entire valve seat, the guide and valve face are concentric. If not, resurface the valve seat.
 3. Check that the valve seat contacts in the middle of the valve face with the width between 1.2 and 1.6 mm (0.047 and 0.063 in.).

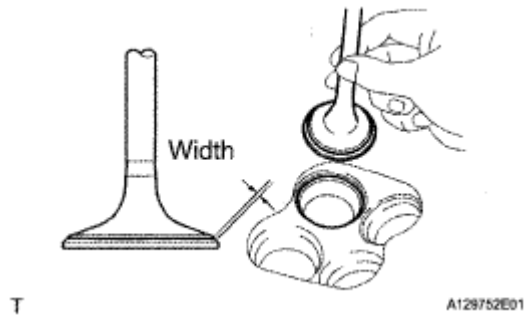


Fig. 253: Inspecting Exhaust Valve Seats
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

22. REPAIR INTAKE VALVE SEATS

NOTE: Keep the lip free from foreign matter.

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

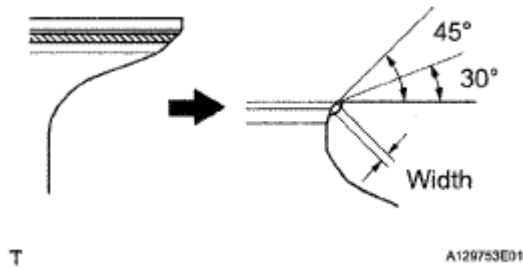


Fig. 254: Identifying Valve Face Angle

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

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

23. REPAIR EXHAUST VALVE SEATS

NOTE: Keep the lip free from foreign matter.

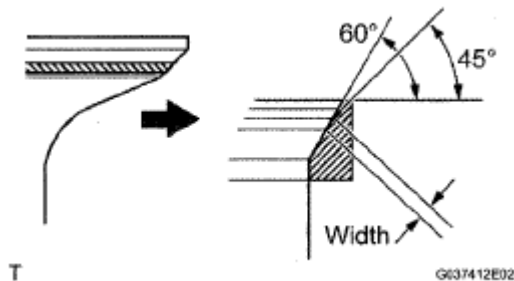


Fig. 255: Identifying Valve Seating Position Angle

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

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

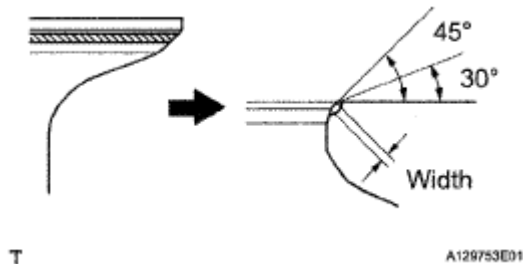


Fig. 256: Identifying Valve Face Angle

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

- b. If the seating is too low on the valve face, use 45° and 75° cutters to correct the seat.
- c. Handrub the valve and valve seat with an abrasive compound.

- d. Check the valve seating position.

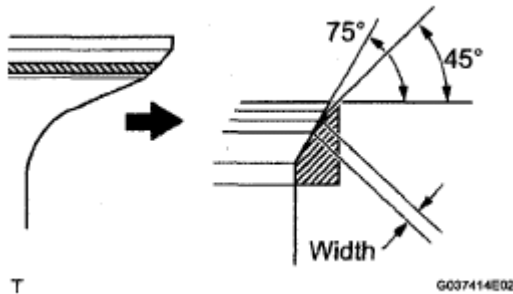


Fig. 257: Identifying Valve Seating Position Angle
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

24. INSPECT INNER COMPRESSION SPRING

- a. Using vernier calipers, measure the free length of the inner compression spring.

Free length: 45.91 mm (1.8075 in.)

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

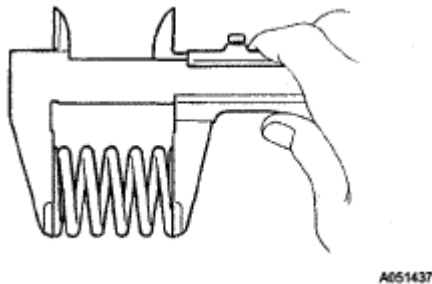


Fig. 258: Measuring Free Length Of Inner Compression Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a steel square, measure the deviation of the inner compression spring.

Maximum deviation: 1.0 mm (0.039 in.)

Maximum angle (reference): 2°

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

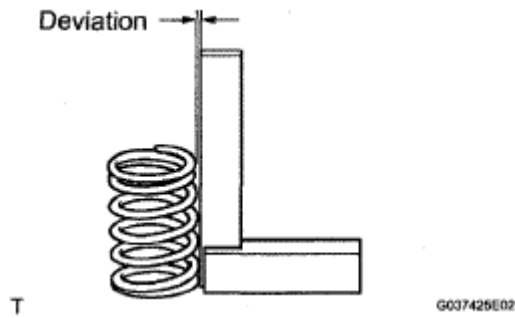


Fig. 259: Measuring Deviation Of Inner Compression Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

25. INSPECT VALVE GUIDE BUSH OIL CLEARANCE

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

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

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

Standard clearance

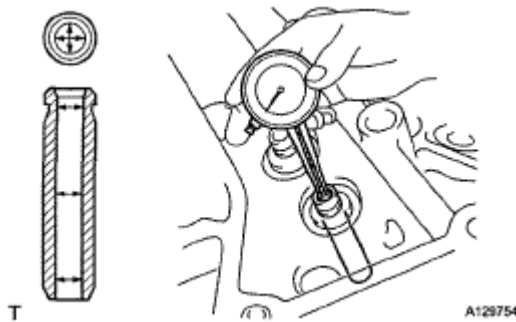


Fig. 260: Measuring Inside Diameter Of Guide Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

GUIDE BUSH SPECIFICATION

Item	Clearance
Intake	0.025 to 0.060 m (0.0010 to 0.0024 in.)
Exhaust	0.030 to 0.065 mm (0.0012 to 0.0026 in.)

Maximum oil clearance

OIL CLEARANCE CHART

Item	Clearance
Intake	0.08 mm (0.0032 in.)
Exhaust	0.10 mm (0.0039 in.)

HINT:

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

26. INSPECT CAMSHAFT THRUST CLEARANCE

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

Standard thrust clearance: 0.08 to 0.13 mm (0.0031 to 0.0051 in.)

Maximum thrust clearance: 0.15 mm (0.006 in.)

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

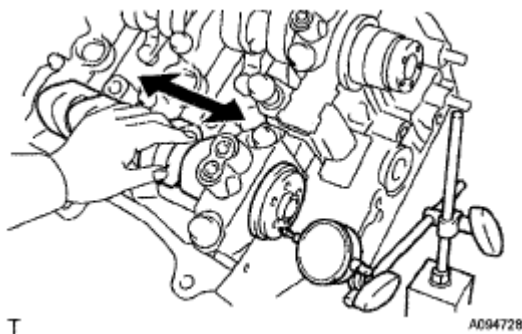


Fig. 261: Measuring Thrust Clearance While Moving Camshaft Back And Forth
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Standard thrust clearance: 0.08 to 0.13 mm (0.0031 to 0.0051 in.)

Maximum thrust clearance: 0.15 mm (0.006 in.)

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

27. INSPECT CAMSHAFT OIL CLEARANCE

- Clean the bearing caps, camshaft housing and camshaft journals.
- Place the camshafts on the camshaft housing.
- Lay a strip of Plastigage across each of the camshaft journals.
- Install the bearing caps (See **REASSEMBLY**).

NOTE: Do not turn the camshaft.

- e. Remove the bearing caps (See **DISASSEMBLY**).

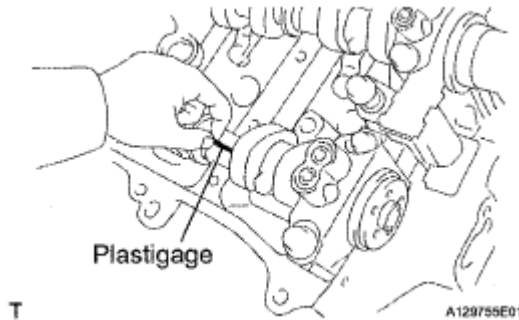


Fig. 262: Identifying Plastigage

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

- f. Measure the Plastigage at its widest point.

Standard oil clearance

OIL CLEARANCE CHART

Item	Oil Clearance
No. 1 journal	0.040 to 0.079 mm (0.0016 to 0.0031 in.)
Other journal	0.025 to 0.062 mm (0.00098 to 0.0024 in.)

Maximum oil clearance

OIL CLEARANCE CHART

Item	Oil Clearance
No. 1 journal	0.10 mm (0.0039 in.)
Other journal	0.09 mm (0.0035 in.)

If the oil clearance is greater than the maximum, replace the camshaft. If necessary, replace the camshaft housing.

- g. Clean the bearing caps, camshaft housing and camshaft journals.
h. Place the camshafts on the camshaft housing.

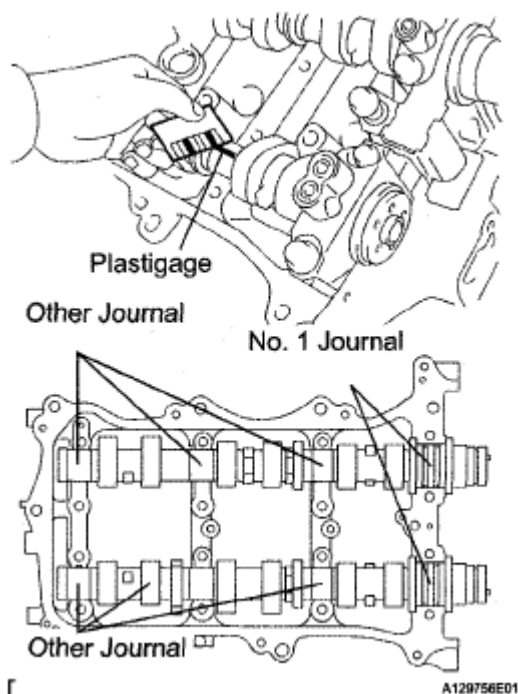


Fig. 263: Measuring Plastigage At Widest Point
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- i. Lay a strip of Plastigage across each of the camshaft journals.
- j. Install the bearing caps (See **REASSEMBLY**).

NOTE: Do not turn the camshaft.

- k. Remove the bearing caps (See **DISASSEMBLY**).

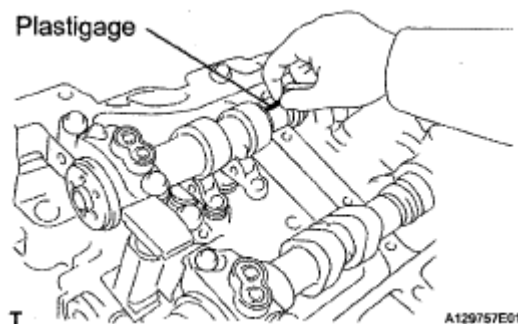


Fig. 264: Identifying Plastigage
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- l. Measure the Plastigage at its widest point.

Standard oil clearance

OIL CLEARANCE CHART

Item	Oil Clearance
No. 1 journal	0.040 to 0.079 mm (0.0016 to 0.0031 in.)
Other journal	0.025 to 0.062 mm (0.00098 to 0.0024 in.)

Maximum oil clearance**OIL CLEARANCE CHART**

Item	Oil Clearance
No. 1 journal	0.10 mm (0.0039 in.)
Other journal	0.09 mm (0.0035 in.)

If the oil clearance is greater than the maximum, replace the camshaft. If necessary, replace the camshaft housing.

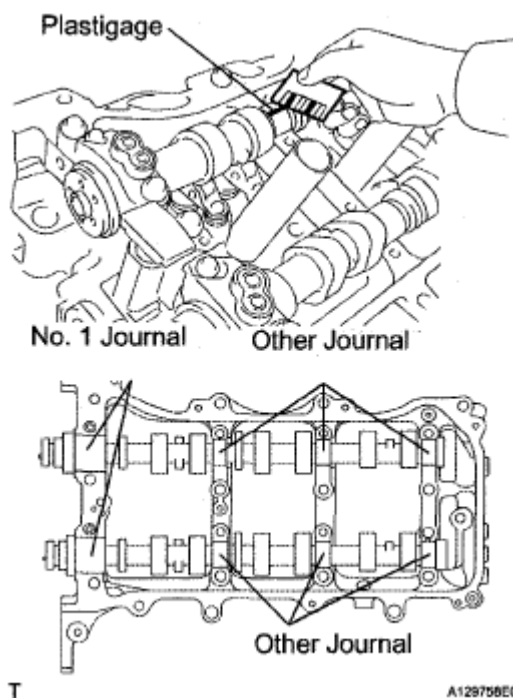


Fig. 265: Measuring Plastigage At Widest Point
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

28. INSPECT CONNECTING ROD THRUST CLEARANCE

- Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.

Standard thrust clearance: 0.15 to 0.40 mm (0.0059 to 0.0157 in.)

Maximum thrust clearance: 0.50 mm (0.020 in.)

If the thrust clearance is greater than the maximum, replace the connecting rod assemblies. If necessary, replace the crankshaft.



Fig. 266: Measuring Thrust Clearance While Moving Connecting Rod Back And Forth
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

29. INSPECT CONNECTING ROD OIL CLEARANCE

- Check that the matchmarks on the connecting rod and cap are aligned to ensure the correct reassembly (Procedure "A").

HINT:

The matchmarks on the connecting rods and caps are provided to ensure correct reassembly.

- Using SST, remove the 2 connecting rod cap bolts (Procedure "B").

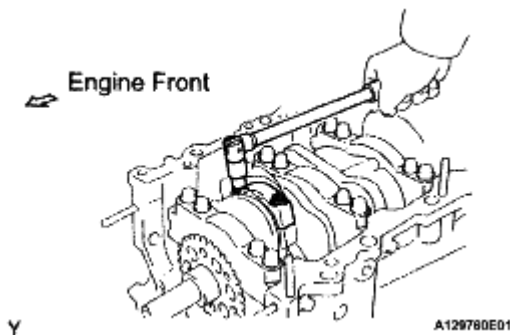


Fig. 267: Removing Connecting Rod Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Using the 2 removed connecting rod caps bolts, remove the connecting rod cap and lower bearing by wiggling the connecting rod cap right and left (Procedure "C").

HINT:

Keep the lower bearing inserted to the connecting rod cap.

- Clean the crank pin and bearing (Procedure "D").

- e. Check the crank pin and bearing for pitting and scratches (Procedure "E").

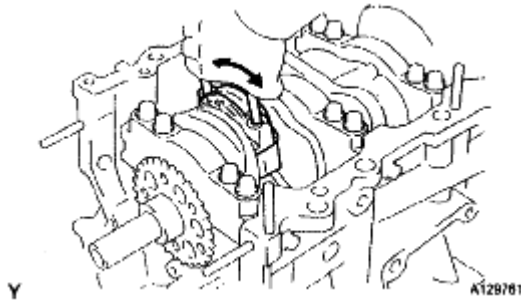


Fig. 268: Removing Connecting Rod Caps Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Lay a strip of Plastigage on the crank pin (Procedure "F").

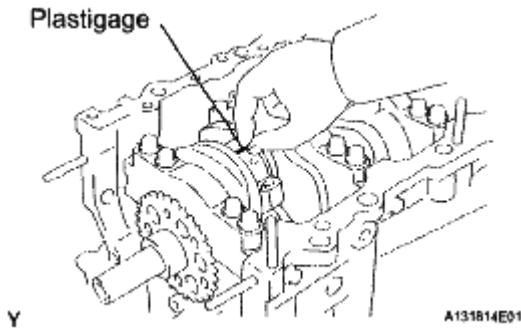


Fig. 269: Identifying Plastigage On Crank Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Check that the front mark of the connecting rod cap is facing forward (Procedure "G").

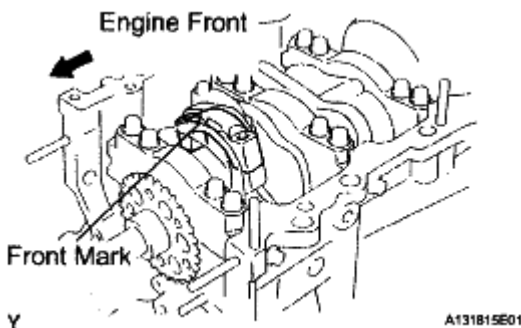


Fig. 270: Identifying Front Mark Of Connecting Rod Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- h. Using SST, install the connecting rod cap (Procedure "H").

NOTE: Do not turn the crankshaft.

- i. Remove the 2 bolts and connecting rod cap (see bprocedure "B" and c"C" above).

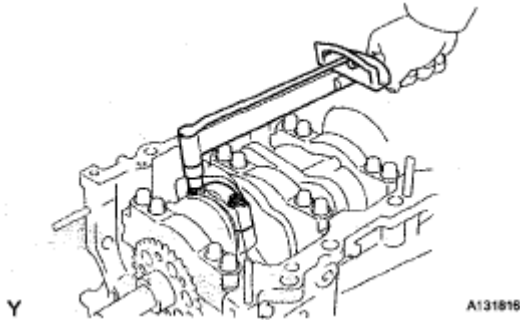


Fig. 271: Installing Connecting Rod Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- j. Measure the Plastigage at its widest point.

Standard oil clearance: 0.045 to 0.067 mm (0.0018 to 0.0026 in.)

Maximum oil clearance: 0.070 mm (0.0028 in.)

If the oil clearance is greater than the maximum, replace the connecting rod bearings. If necessary, replace 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 mark 1, 2, 3 or 4 on its surface.

Reference:

Connecting rod diameter

CONNECTING ROD DIAMETER SPECIFICATION

Mark	Diameter
1	56.000 to 56.006 mm (2.2047 to 2.2050 in.)
2	56.007 to 56.012 mm (2.2050 to 2.2052 in.)
3	56.013 to 56.018 mm (2.2052 to 2.2054 in.)
4	56.019 to 56.024 mm (2.2055 to 2.2057 in.)

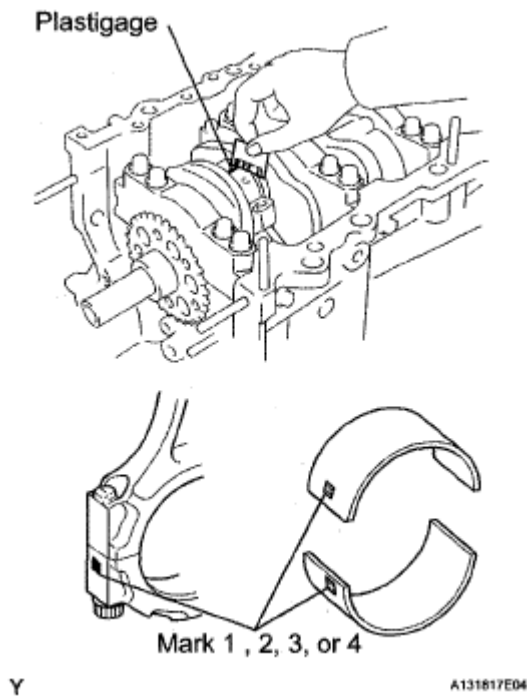


Fig. 272: Measuring Plastigage At Widest Point
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard bearing center wall thickness

BEARING CENTER WALL THICKNESS SPECIFICATION

Mark	Diameter
1	1.481 to 1.484 mm (0.0583 to 0.0584 in.)
2	1.484 to 1.487 mm (0.0584 to 0.0585 in.)
3	1.487 to 1.490 mm (0.0585 to 0.0587 in.)
4	1.490 to 1.493 mm (0.0587 to 0.0588 in.)

Crankshaft pin diameter: 52.992 to 53.000 mm (2.0863 to 2.0866 in.)

- k. Completely remove the Plastigage.

30. INSPECT CRANKSHAFT THRUST CLEARANCE

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

Standard thrust clearance: 0.04 to 0.24 mm (0.0016 to 0.0094 in.)

Maximum thrust clearance: 0.30 mm (0.0118 in.)

If the thrust clearance is greater than the maximum, replace the thrust washers as a set. If necessary, replace the crankshaft.

Thrust washer thickness: 2.43 to 2.48 mm (0.0957 to 0.0976 in.)

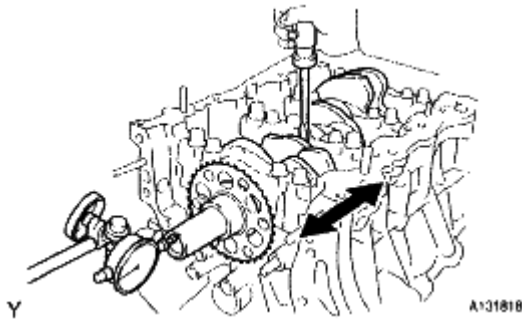


Fig. 273: Measuring Crankshaft Thrust Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

31. INSPECT CYLINDER BLOCK FOR WARPAGE

- a. Using a precision straight edge and feeler gauge, measure the warpage of the contact surface of the cylinder head gasket.

Maximum warpage: 0.07 mm (0.0028 in.)

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

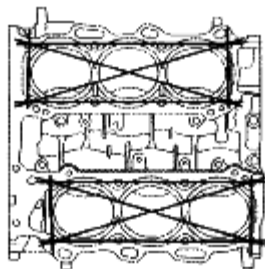
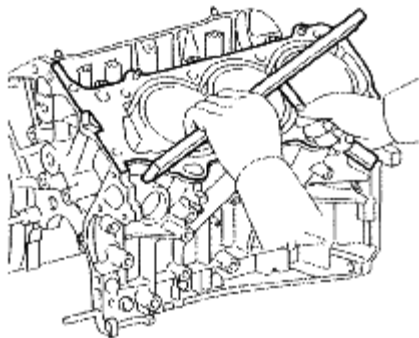


Fig. 274: Measuring Warpage Of Contact Surface Of Cylinder Head Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Visually check the cylinder for vertical scratches. If deep scratches are present, rebore all the 6

cylinders. If necessary, replace the cylinder block.

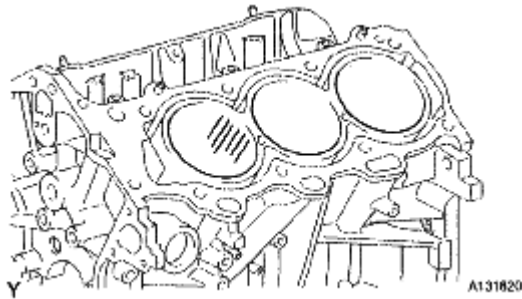


Fig. 275: Checking Cylinder For Vertical Scratches
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

32. INSPECT CYLINDER BORE

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

Standard diameter: 94.000 to 94.012 mm (3.7008 to 3.7013 in.)

Maximum diameter: 94.200 mm (3.7087 in.)

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

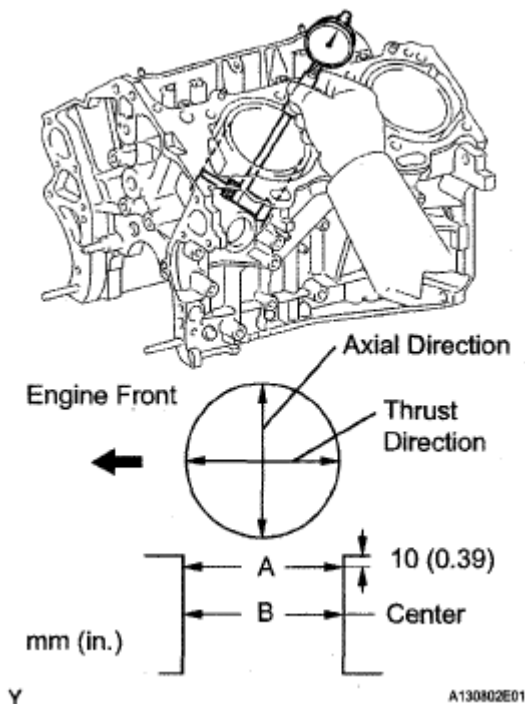


Fig. 276: Measuring Cylinder Bore Diameter At Positions A And B
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

33. INSPECT PISTON SUB-ASSEMBLY WITH PIN

- Using a micrometer, measure the piston diameter at right angles to the piston center line where the distance from the piston end as specified.

Distance: 9.8 mm (0.3858 in.)

Standard diameter: 93.960 to 93.980 mm (3.6992 to 3.7000 in.)

Maximum diameter: 93.830 mm (3.6941 in.)

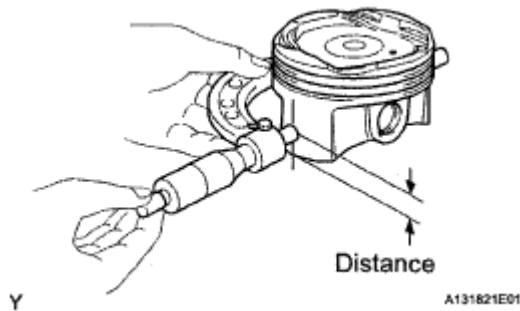


Fig. 277: Measuring Piston Diameter At Right Angles To Piston Center Line
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

34. INSPECT PISTON OIL CLEARANCE

- Measure the cylinder bore diameter in the thrust direction.
- Subtract the piston diameter measurement from the cylinder bore diameter measurement.

Standard oil clearance: 0.02 to 0.052 mm (0.0008 to 0.0020 in.)

Maximum oil clearance: 0.06 mm (0.0024 in.)

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

35. INSPECT RING GROOVE CLEARANCE

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

Ring groove clearance

RING GROOVE CLEARANCE SPECIFICATION

Item	Clearance
No. 1	0.020 to 0.070 mm (0.0008 to 0.0028 in.)
No. 2	0.020 to 0.060 mm (0.0008 to 0.0024 in.)
Oil	0.070 to 0.150 mm (0.0028 to 0.0059 in.)

If the clearance is not as specified, replace the piston.

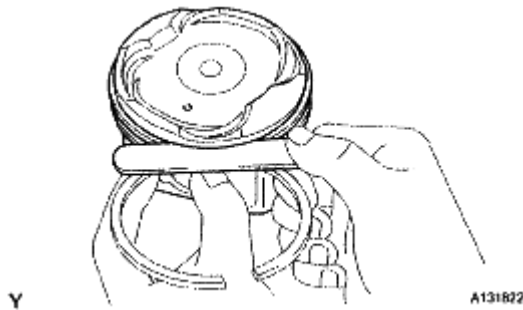


Fig. 278: Measuring Clearance Between Piston Ring And Wall Of Ring Groove
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

36. INSPECT PISTON RING END GAP

- Insert the piston ring into the cylinder bore.
- 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.

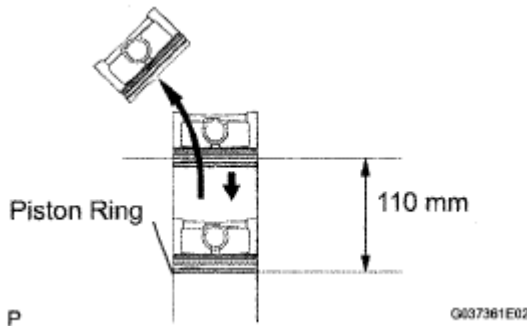


Fig. 279: Pushing Piston Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Using a feeler gauge, measure the end gap.

Standard end gap

END GAP SPECIFICATION

Item	End Gap
No. 1	0.25 to 0.35 mm (0.0098 to 0.0138 in.)
No. 2	0.50 to 0.60 mm (0.0197 to 0.0236 in.)
Oil	0.10 to 0.40 mm (0.0039 to 0.0157 in.)

Maximum end gap

END GAP SPECIFICATION

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Item	End Gap
No. 1	0.50 mm (0.0197 in.)
No. 2	0.85 mm (0.0335 in.)
Oil	0.60 mm (0.0236 in.)

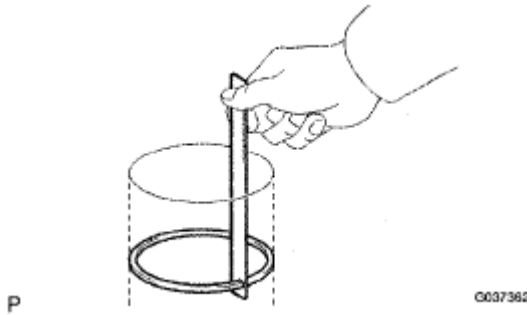


Fig. 280: Measuring End Gap

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

If the end gap is greater than the maximum, replace the piston ring. If the end gap is greater than the maximum, even with a new piston ring, replace the cylinder block.

37. INSPECT PISTON PIN OIL CLEARANCE

- Using a caliper gauge, measure the inside diameter of the piston pin hole.

Piston pin hole inside diameter

PISTON PIN HOLE INSIDE DIAMETER SPECIFICATION

Mark	Diameter
A	22.001 to 22.004 mm (0.8662 to 0.8663 in.)
B	22.004 to 22.007 mm (0.8663 to 0.8664 in.)
C	22.007 to 22.010 mm (0.8664 to 0.8665 in.)

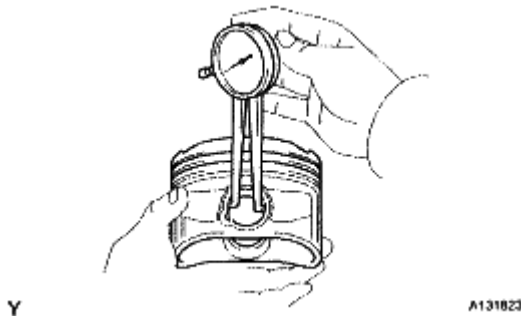


Fig. 281: Measuring Inside Diameter Of Piston Pin Hole

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

- Using a micrometer, measure the piston pin diameter.

Piston pin diameter

PISTON PIN DIAMETER SPECIFICATION

Mark	Diameter
A	21.997 to 22.000 mm (0.8660 to 0.8661 in.)
B	22.000 to 22.003 mm (0.8661 to 0.8663 in.)
C	22.003 to 22.006 mm (0.8663 to 0.8664 in.)

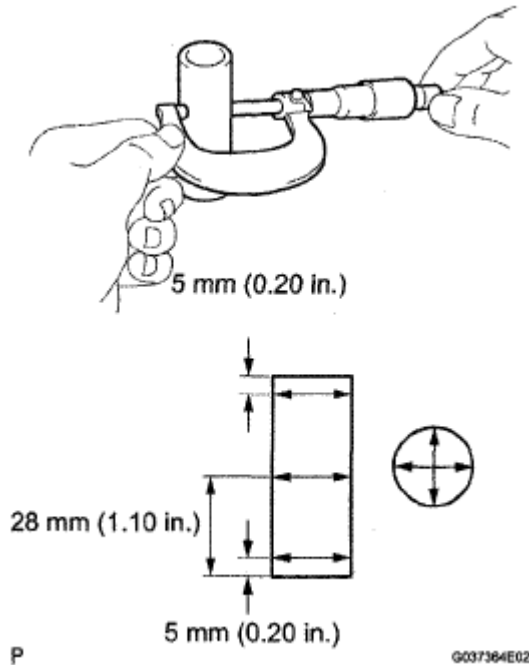


Fig. 282: Measuring Piston Pin Diameter

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

- Subtract the piston pin diameter measurement from the piston pin hole diameter measurement.

Standard oil clearance: 0.001 to 0.007 mm (0.00004 to 0.0003 in.)

Maximum oil clearance: 0.015 mm (0.0006 in.)

HINT:

If the oil clearance is greater than the maximum, replace the piston and piston pin as a set.

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

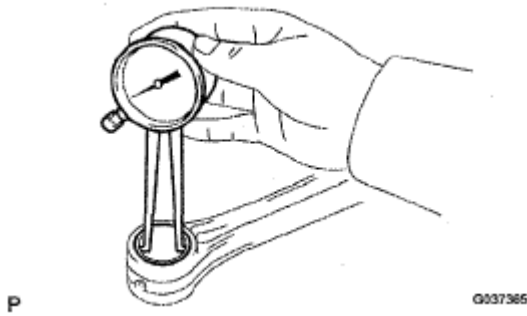


Fig. 283: Measuring Inside Diameter Of Connecting Rod Bushing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Bushing inside diameter

BUSHING INSIDE DIAMETER SPECIFICATION

Mark	Diameter
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.)

- e. Subtract the piston pin diameter measurement from the bushing inside diameter measurement.

Standard oil clearance: 0.005 to 0.011 mm (0.0002 to 0.0004 in.)

Maximum oil clearance: 0.03 mm (0.0012 in.)

HINT:

If the oil clearance is greater than the maximum, replace the bushing. If necessary, replace the connecting rod and piston pin as a set.

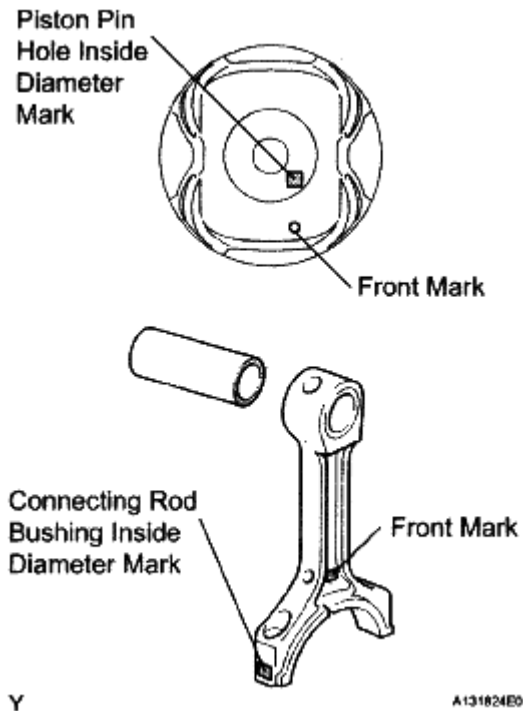


Fig. 284: Identifying Piston Pin Hole Inside Diameter Mark
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

38. INSPECT CONNECTING ROD

- a. Using a rod aligner and feeler gauge, check the connecting rod alignment.
 1. Check for out-of-alignment.

Maximum out-of-alignment: 0.05 mm (0.0020 in.) per 100 mm (3.94 in.)

If the out-of-alignment is greater than the maximum, replace the connecting rod assembly.

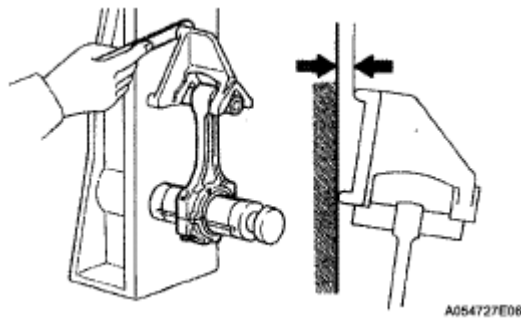


Fig. 285: Checking Connecting Rod Alignment
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Check for twist.

Maximum twist: 0.15 mm (0.0059 in.) per 100 mm (3.94 in.)

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

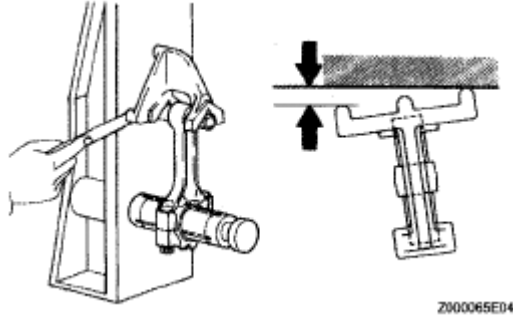


Fig. 286: Checking Connecting Rod Twist
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

39. REMOVE CONNECTING ROD SMALL END BUSH

- a. Using SST and a press, press out the bush.

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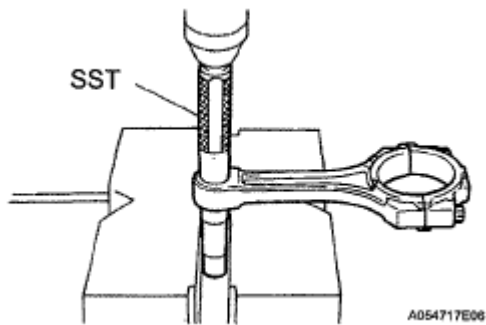


Fig. 287: Pressing Out Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

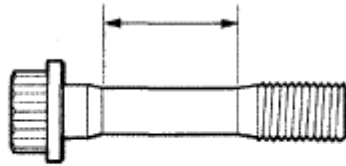
40. INSPECT CONNECTING ROD BOLT

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

Standard diameter: 7.2 to 7.3 mm (0.283 to 0.287 in.)

Minimum diameter: 7.0 mm (0.276 in.)

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



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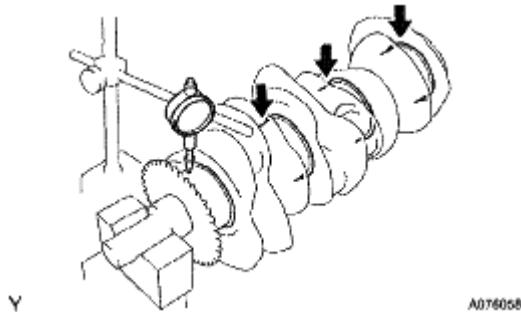
Fig. 288: Measuring Tension Portion Diameter Of Bolt
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

41. INSPECT CRANKSHAFT

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

Maximum circle runout: 0.06 mm (0.0024 in.)

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



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Fig. 289: Measuring Circle Runout At Center Journal
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Inspect the main journals.
 1. Using a micrometer, measure the diameter of each main journal.

Standard journal diameter: 60.988 to 61.00 mm (2.4011 to 2.4016 in.)

If the diameter is not as specified, check the oil clearance. If necessary, replace the crankshaft.

2. Check each main journal for taper and out-of-round as shown in the illustration.

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

If the taper and out-of-round is greater than the maximum, replace the crankshaft.

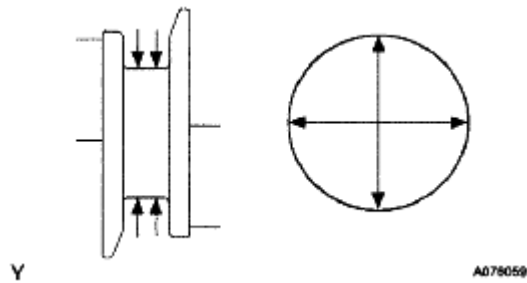


Fig. 290: Measuring Diameter Of Main Journal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Inspect the crank pin.

1. Using a micrometer, measure the diameter of each crank pin.

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

If the diameter is not as specified, check the oil clearance. If necessary, replace the crankshaft.

2. Check each crank pin for taper and out-of-round as shown in the illustration.

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

If the taper and out-of-round is greater than the maximum, replace the crankshaft.

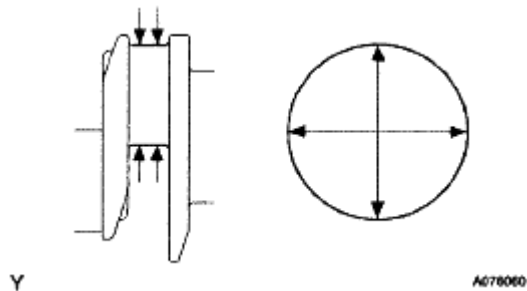


Fig. 291: Measuring Diameter Of Crank Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

42. INSPECT CRANKSHAFT OIL CLEARANCE

NOTE: Main bearings come in widths of 18.0 mm (0.709 in.) and 21.0 mm (0.827 in.). Install the 21.0 mm (0.827 in.) bearings in the No. 1 and No. 4 cylinder block journal positions with the main bearing cap. Install the 18.0 mm (0.709 in.) bearings in the No. 2 and No. 3 positions.

- a. Clean the main journal and the both surfaces of the bearing.

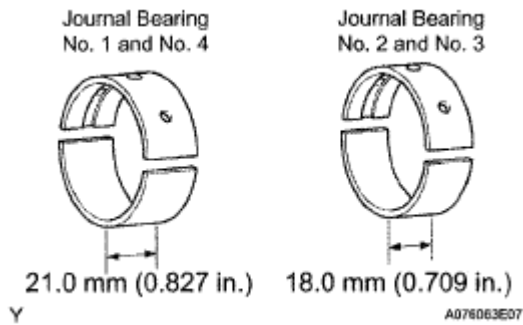


Fig. 292: Identifying Main Journal Bearing Dimension
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Install the upper bearing.

1. Install the upper bearing to the cylinder block as shown in the illustration.

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

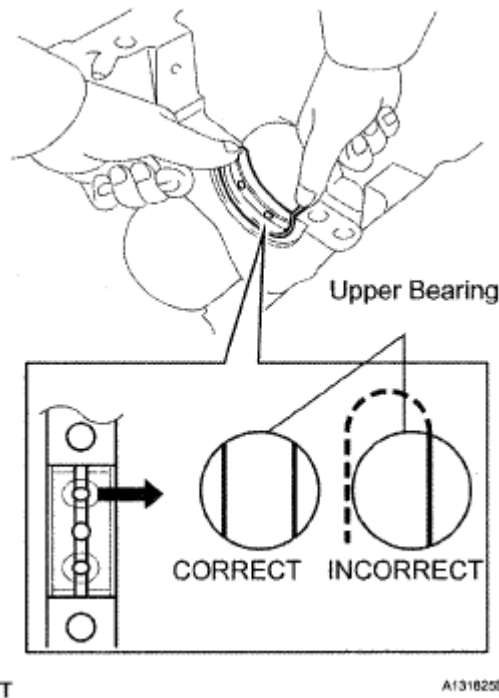


Fig. 293: Installing Upper Bearing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Install the lower bearing.

1. Install the lower bearing to the bearing cap.
2. Using vernier calipers, measure the distance between the bearing cap's edge and the lower bearing's edge.

Dimension (A - B): 0.7 mm (0.0276 in.) or less

NOTE: Do not apply engine oil to the bearing's contact area and underside.

- d. Place the crankshaft on the cylinder block.

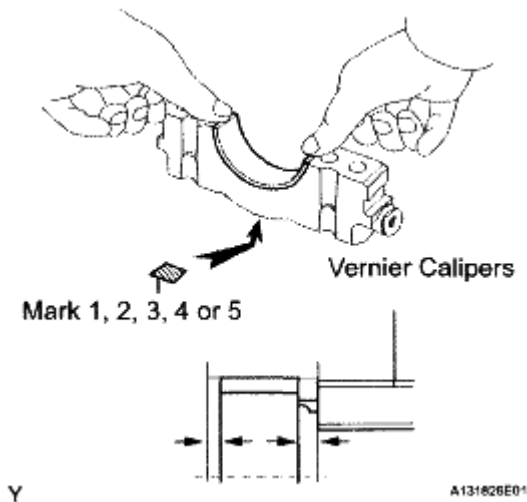


Fig. 294: Installing Lower Bearing To Bearing Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Lay a strip of Plastigage across each journal.
- f. Examine the front marks and numbers and install the bearing caps on the cylinder block.

HINT:

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

- g. Apply a light coat of engine oil to the threads and under the head of bearing cap bolts.
- h. Temporarily install the 8 main bearing cap bolts to the inside positions.

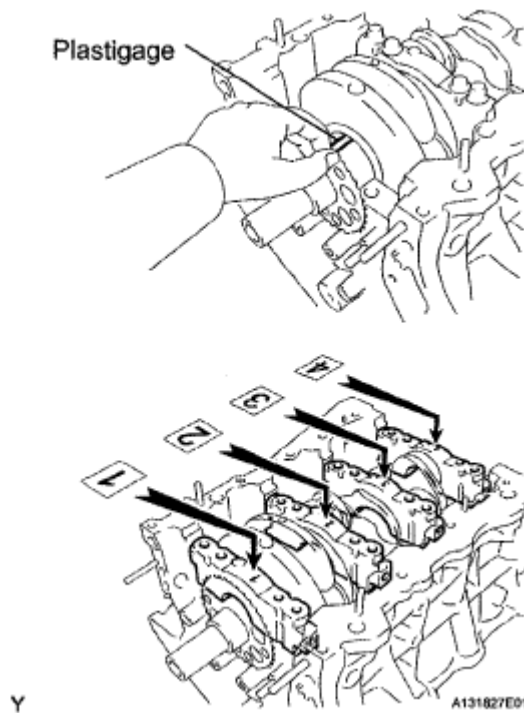


Fig. 295: Identifying Plastigage

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

- i. Insert the main bearing cap with your hand until the clearance between the main bearing cap and the cylinder block is less than 6 mm (0.23 in.) by marking the 2 internal bearing cap bolts as a guide.

Bolt length: 100 to 102 mm (3.94 to 4.02 in.)

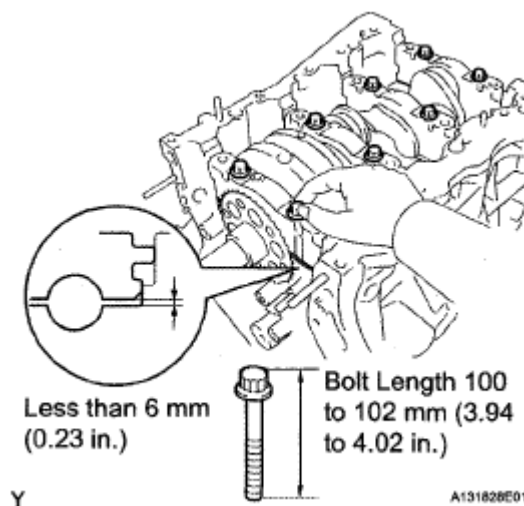


Fig. 296: Checking Clearance Between Main Bearing Cap And Cylinder Block

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

- j. Using a plastic hammer, lightly tap the bearing cap to ensure a proper fit.
- k. Apply a light coat of engine oil to the threads and under the head of the 8 main bearing cap bolts.

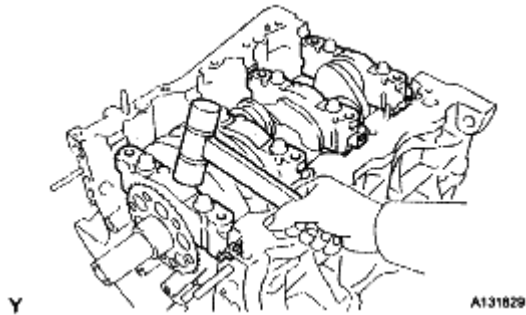


Fig. 297: Tapping Bearing Cap
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- l. Install the 8 main bearing cap bolts to the outside positions.

Bolt length: 105.5 to 107.5 mm (4.15 to 4.23 in.)

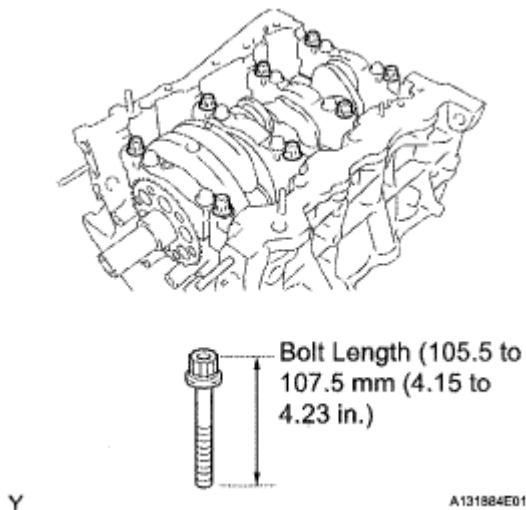


Fig. 298: Identifying Bolt Length
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- m. Install and uniformly tighten the 16 main bearing cap bolts in several steps and in the sequence shown in the illustration.

Torque: 61 N*m (622 kgf*cm, 45 ft.*lbf)

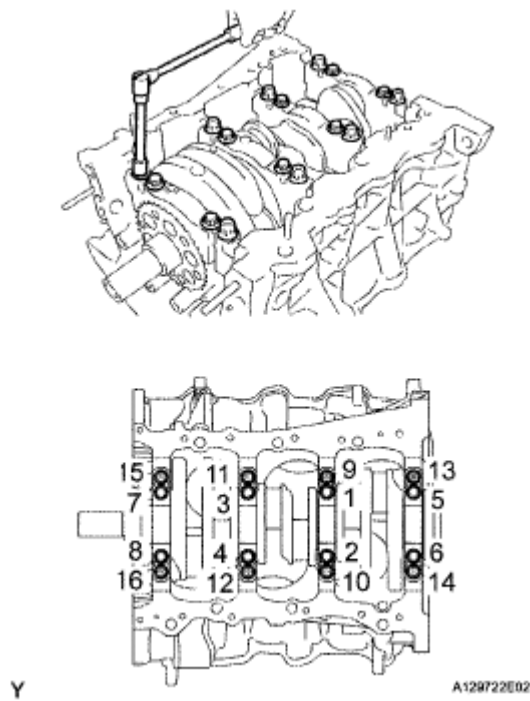


Fig. 299: Tightening Main Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- n. Mark the front side of the bearing cap bolts with paint.
- o. Tighten the bearing cap bolts another 90° in the sequence shown.
- p. Check that the painted mark is now at a 90° angle to the front.

NOTE: Do not turn the crankshaft.

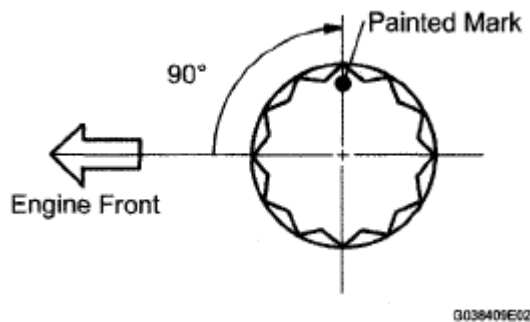


Fig. 300: Identifying Paint Mark On Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- q. Install and uniformly tighten the 8 main bearing cap bolts in several steps and in the sequence shown in the illustration.

Torque: 52 N*m (525 kgf*cm, 38 ft.*lbf)

HINT:

- Bolt (A) length: 45 mm (1.77 in.)
 - Except bolt (A) length: 30 mm (1.18 in.)
- r. Remove the main bearing caps.

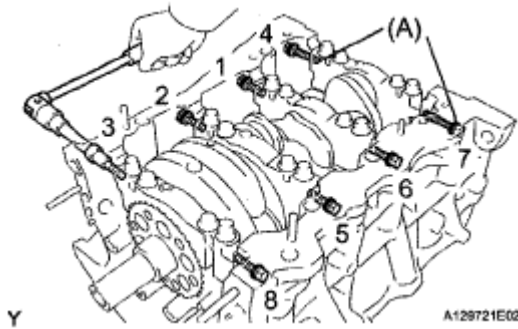


Fig. 301: Identifying Bearing Cap Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- s. Measure the Plastigage at its widest point.

Standard oil clearance: 0.026 to 0.047 mm (0.0010 to 0.0019 in.)

Maximum clearance: 0.050 mm (0.0020 in.)

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

NOTE: Completely remove the Plastigage.

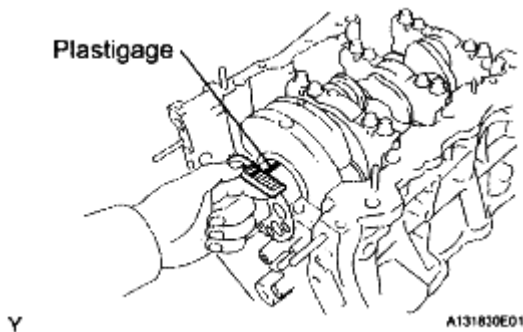


Fig. 302: Measuring Plastigage At Widest Point
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- t. If replacing a bearing, replace it with one having the same number. If the number of the bearing cannot be determined, select the correct bearing by adding together the numbers imprinted on the cylinder block and crankshaft, then refer to the table below for the appropriate bearing number.

There are 5 sizes of standard bearings, marked "1", "2", "3", "4" and "5" accordingly.

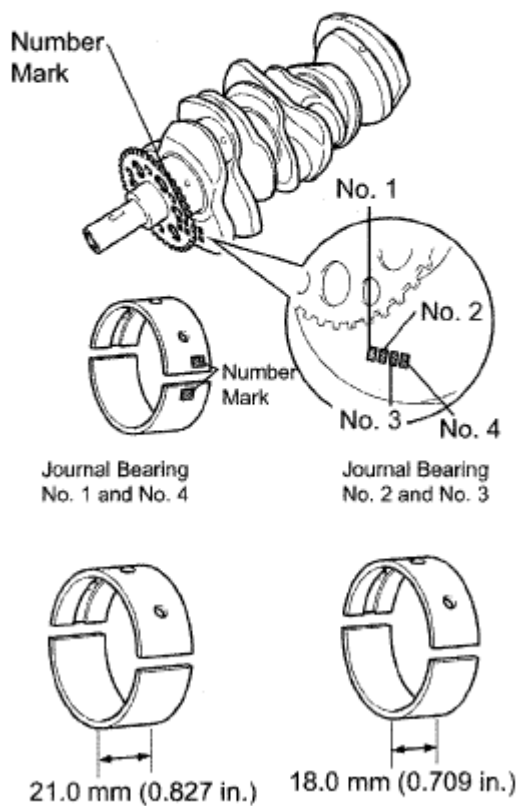
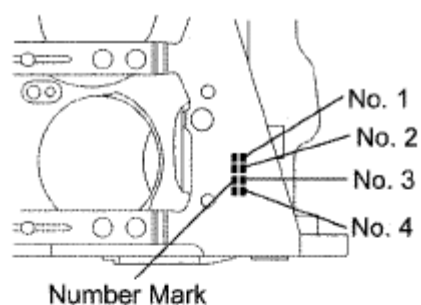
Journal bearings:

JOURNAL BEARINGS SPECIFICATION

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

HINT:

EXAMPLE: Cylinder block "11" + Crankshaft "06" = Total number 17 (Use bearing "3")



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Fig. 303: Identifying Number Mark On Crankshaft Bearing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Crankshaft main journal diameter

CRANKSHAFT MAIN JOURNAL DIAMETER SPECIFICATION

Mark	Diameter
"00"	60.999 to 61.000 mm (2.4015 to 2.4016 in.)
"01"	60.998 to 60.999 mm (2.4015 to 2.4015 in.)
	60.997 to 60.998 mm (2.4015 to 2.4015 in.)
"03"	60.996 to 60.997 mm (2.4014 to 2.4015 in.)
"04"	60.995 to 60.996 mm (2.4014 to 2.4014 in.)
"05"	60.994 to 60.995 mm (2.4013 to 2.4014 in.)
"06"	60.993 to 60.994 mm (2.4013 to 2.4013 in.)
"07"	60.992 to 60.993 mm (2.4013 to 2.4013 in.)
"08"	60.991 to 60.992 mm (2.4012 to 2.4013 in.)
"09"	60.990 to 60.991 mm (2.4012 to 2.4012 in.)
"10"	60.989 to 60.990 mm (2.4011 to 2.4012 in.)
"11"	60.988 to 60.989 mm (2.4011 to 2.4011 in.)

Standard upper bearing center wall thickness (No. 1 and No. 4 journals)

UPPER BEARING CENTER WALL THICKNESS SPECIFICATION

Mark	Diameter
"1"	2.500 to 2.503 mm (0.0984 to 0.0985 in.)
"2"	2.503 to 2.506 mm (0.0985 to 0.0987 in.)
"3"	2.506 to 2.509 mm (0.0987 to 0.0988 in.)
"4"	2.509 to 2.512 mm (0.0988 to 0.0989 in.)
"5"	2.512 to 2.515 mm (0.0989 to 0.0990 in.)

Standard lower bearing center wall thickness (No. 1 and No. 4 journals)

LOWER BEARING CENTER WALL THICKNESS SPECIFICATION

Mark	Diameter
"1"	2.478 to 2.481 mm (0.0976 to 0.0977 in.)
"2"	2.481 to 2.484 mm (0.0977 to 0.0978 in.)
"3"	2.484 to 2.487 mm (0.0978 to 0.0979 in.)
"4"	2.487 to 2.490 mm (0.0979 to 0.0980 in.)
"5"	2.490 to 2.493 mm (0.0980 to 0.0981 in.)

Standard upper bearing center thickness (No. 2 and No. 3 journals)

UPPER BEARING CENTER THICKNESS SPECIFICATION

Mark	Diameter
------	----------

Mark	Diameter
"1"	2.478 to 2.481 mm (0.0976 to 0.0977 in.)
"2"	2.481 to 2.484 mm (0.0977 to 0.0978 in.)
"3"	2.484 to 2.487 mm (0.0978 to 0.0979 in.)
"4"	2.487 to 2.490 mm (0.0979 to 0.0980 in.)
"5"	2.490 to 2.493 mm (0.0980 to 0.0981 in.)

Standard lower bearing center thickness (No. 2 and No. 3 journals)

LOWER BEARING CENTER THICKNESS SPECIFICATION

Mark	Diameter
"1"	2.500 to 2.503 mm (0.0984 to 0.0985 in.)
"2"	2.503 to 2.506 mm (0.0985 to 0.0987 in.)
"3"	2.506 to 2.509 mm (0.0987 to 0.0988 in.)
"4"	2.509 to 2.512 mm (0.0988 to 0.0989 in.)
"5"	2.512 to 2.515 mm (0.0989 to 0.0990 in.)

43. INSPECT CRANKSHAFT BEARING CAP SET BOLT

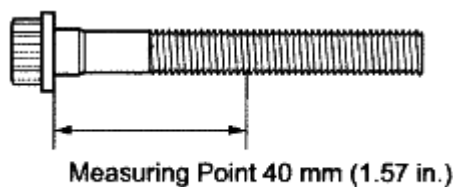
- a. Using vernier calipers, measure the minimum diameter of the compressed thread at the measuring point.

Standard diameter: 10.5 to 11.0 mm (0.4134 to 0.4331 in.)

Minimum diameter: 10.7 mm (0.4213 in.)

Measuring point: 40 mm (1.57 in.)

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



A125160E02

Fig. 304: Measuring Minimum Diameter Of Compressed Thread At Measuring Point
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REPLACEMENT

NOTE: Bank 1 may also be known as RH side.

Bank 2 may also be known as LH side.

1. REMOVE SPARK PLUG TUBE GASKET

- a. Pry up the claws of the ventilation baffle plate.

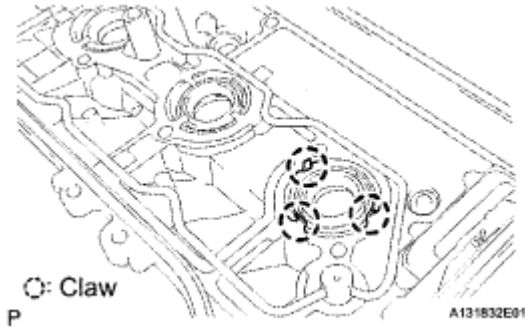


Fig. 305: Identifying Claws Of Ventilation Baffle Plate
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a screwdriver with its tip taped and a hammer, tap out the 3 spark plug tube gaskets.

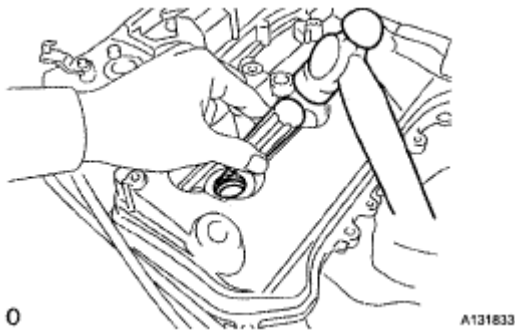


Fig. 306: Tapping Out Spark Plug Tube Gaskets
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. REMOVE ENGINE REAR OIL SEAL

- a. Place the oil seal retainer on wooden blocks.
- b. Using a screwdriver and a hammer, tap out the oil seal.

HINT:

Tape the screwdriver tip before use.

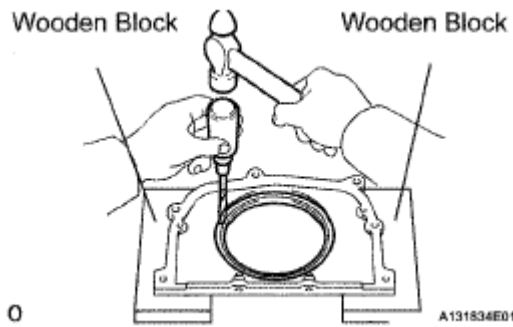


Fig. 307: Tapping Out Oil Seal

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

3. REMOVE TIMING CHAIN COVER OIL SEAL

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

HINT:

Tape the screwdriver tip before use.

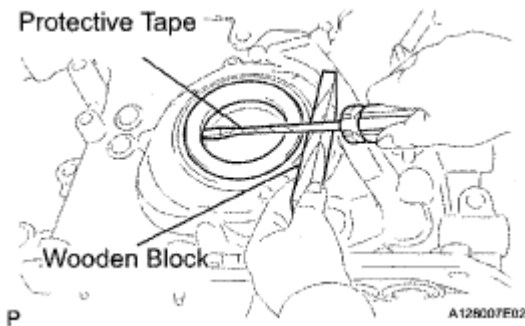


Fig. 308: Prying Out Oil Seal

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

4. INSTALL TIMING CHAIN COVER OIL SEAL

- a. Using SST, tap in a new oil seal until its surface is flush with the timing gear case edge.

SST 09316-60011 (09316-00011)

NOTE:

- Keep the lip free from foreign matter.
- Do not tap on the oil seal at an angle.
- Make sure that the oil seal edge does not stick out of the timing chain case.

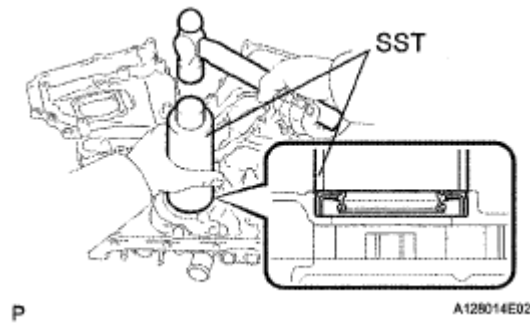


Fig. 309: Tapping Oil Seal

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

5. INSTALL ENGINE REAR OIL SEAL

- Place the oil seal retainer on wooden blocks.
- Using SST, tap in a new oil seal until its surface is flush with the oil seal retainer edge.

SST 09223-15030

NOTE:

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

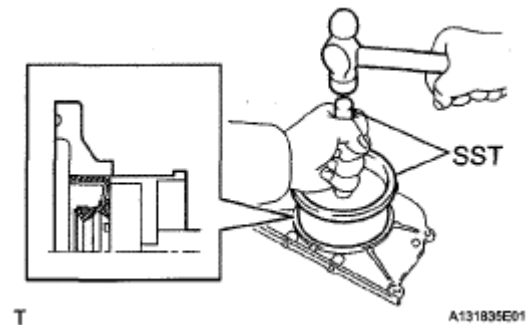


Fig. 310: Tapping Oil Seal

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

6. INSTALL SPARK PLUG TUBE GASKET

- Using a 32 mm socket wrench, tap in 6 new spark plug tube gaskets to the head covers.

NOTE:

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

- Return the claw of the ventilation baffle plate to its original position.

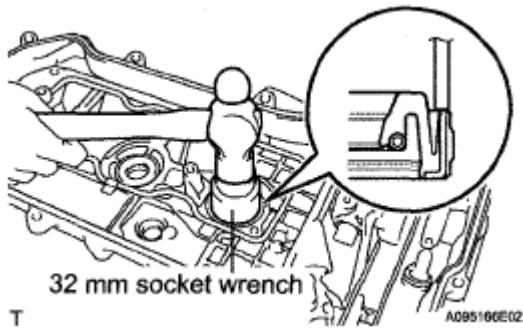


Fig. 311: Tapping Spark Plug Tube Gaskets To Head Covers
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. 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 09201-10000 (09201-01050), 09950-70010 (09951-07100)

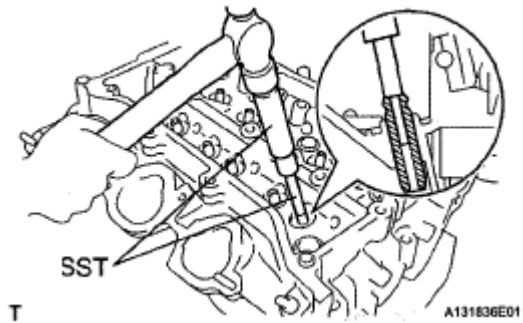
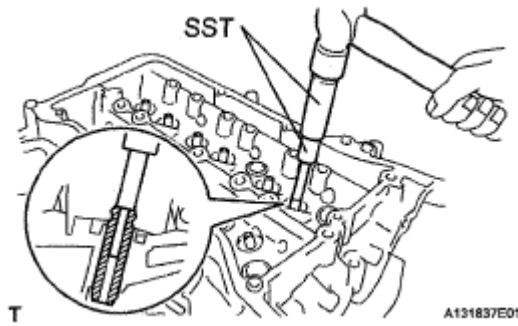


Fig. 312: Tapping Out Guide Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. REMOVE EXHAUST VALVE GUIDE BUSH

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

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

**Fig. 313: Tapping Out Guide Bush**

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

9. INSTALL INTAKE VALVE GUIDE BUSH

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

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

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

GUIDE BUSH 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. 314: Measuring Bush Bore Diameter Of Cylinder Head**

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

If the bush bore diameter of the cylinder head is greater than 10.306 mm (0.4057 in.), machine the bush bore to the dimension of 10.335 to 10.356 mm (0.4069 to 0.4077 in.) to install a 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.

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

- d. Place the cylinder head on wooden blocks.
- e. Using SST, tap in a new valve guide bush to the specified protrusion height.

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

Protrusion height: 9.30 to 9.70 mm (0.3661 to 0.3819 in.)

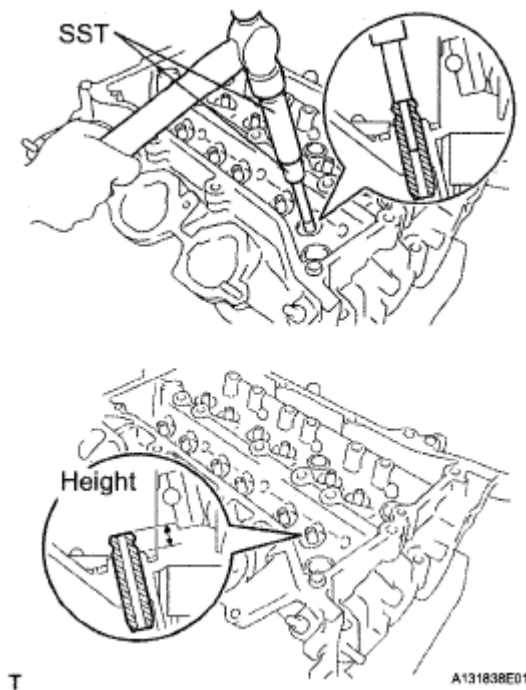


Fig. 315: Tapping Valve Guide Bush To Specified Protrusion Height
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Using a sharp 5.5 mm reamer, ream the valve guide bush to obtain the standard specified clearance.

Standard oil clearance: 0.025 to 0.060 mm (0.0010 to 0.0023 in.)

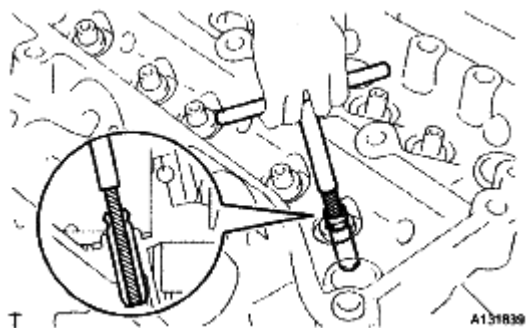


Fig. 316: Reaming Valve Guide Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. INSTALL EXHAUST VALVE GUIDE BUSH

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

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

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

GUIDE BUSH 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. 317: Measuring Bush Bore Diameter Of Cylinder Head
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the bush bore diameter of the cylinder head is greater than 10.306 mm (0.4057 in.), machine the bush bore to the dimension of 10.335 to 10.356 mm (0.4069 to 0.4077 in.) to install a 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.

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

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

Protrusion height: 9.30 to 9.70 mm (0.3661 to 0.3819 in.)

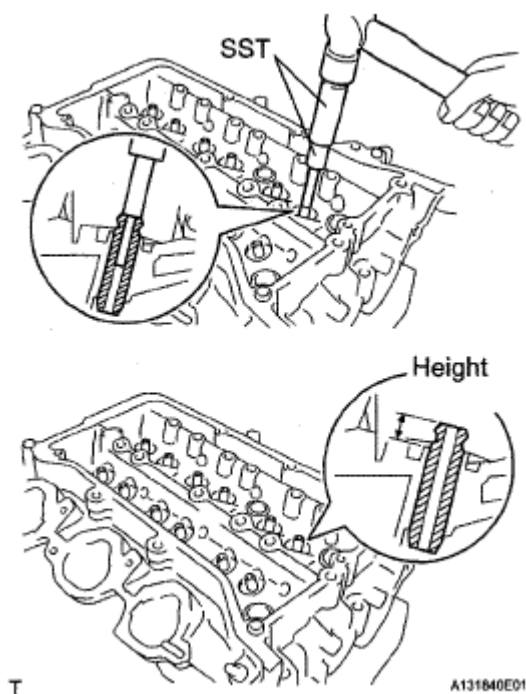


Fig. 318: Tapping Valve Guide Bush

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

- f. Using a sharp 5.5 mm reamer, ream the valve guide bushing to obtain the standard specified clearance.

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

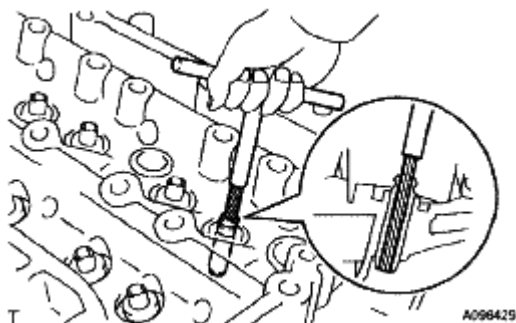


Fig. 319: Reaming Valve Guide Bushing

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

11. INSTALL CONNECTING ROD SMALL END BUSH

- a. Align the oil holes of a new bush and the connecting rod.

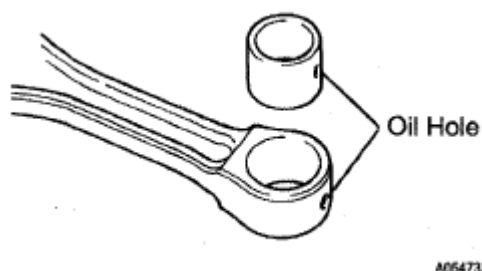


Fig. 320: Aligning Oil Holes Of Bush And Connecting Rod
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using SST and a press, press in the bush.

SST 09222-30010

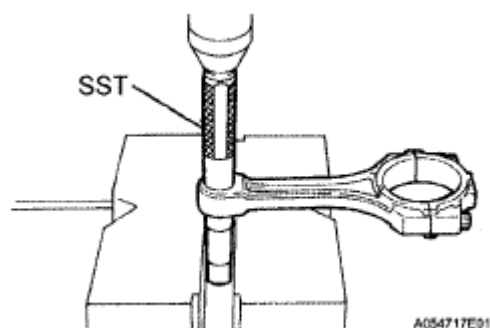


Fig. 321: Pressing Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using a pin hole grinder, hone the bush to obtain the standard clearance between the bush and piston pin.

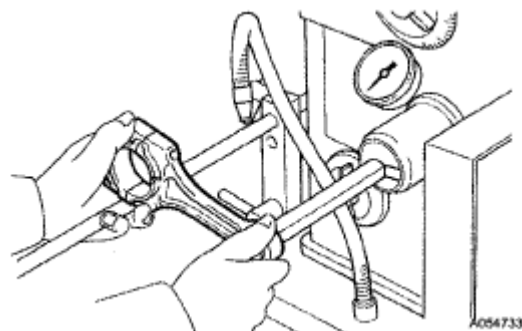


Fig. 322: Honing Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Check that the piston pin fits at normal room temperature.
1. Coat the piston pin with engine oil, and push it into the connecting rod with your thumb.

REASSEMBLY

CAUTION: For additional information on timing chain/gear removal guidelines, installation and camshaft timing gear alignment, see 2GR-FE VALVE TIMING PROCEDURE .

NOTE: Bank 1 may also be known as RH side.

Bank 2 may also be known as LH side.

1. INSTALL TIGHT PLUG

NOTE: If water leaks from the tight plug or the plug corrodes, replace it.

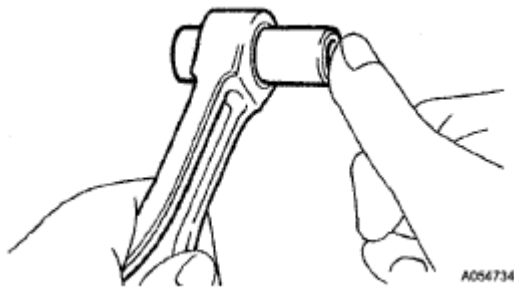


Fig. 323: Checking Piston Pin Fitting
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Apply adhesive around the tight plugs.

Adhesive: Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

- b. Using SST, tap in the tight plugs.

SST 09950-60010 (09951-00340), 09950-70010 (09951-07100)

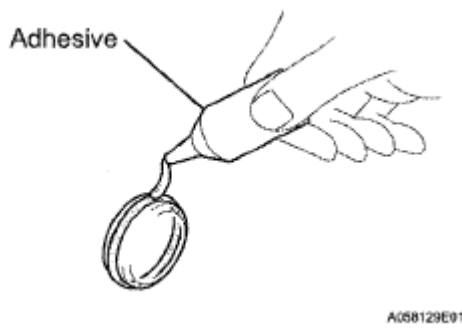
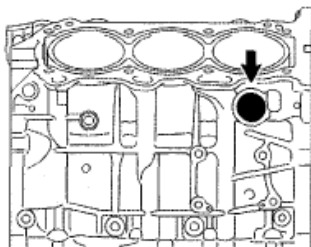
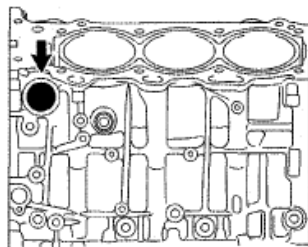


Fig. 324: Applying Adhesive Around Tight Plugs
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

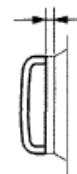
RH Side:



LH Side:



0.2 to 1.2 mm
(0.007 to 0.047 in.)



Y

A131041E01

Fig. 325: Locating Tight Plug Area

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

2. INSTALL STRAIGHT PIN

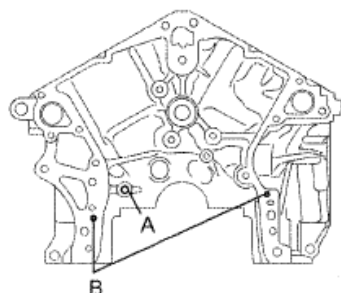
- Using a plastic hammer, tap in new straight pins to the cylinder block.

Standard protrusion

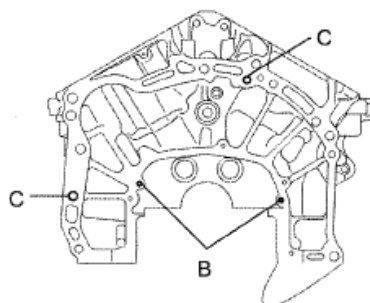
PROTRUSION SPECIFICATION

Item	Protrusion
Pin A	23 mm (0.906 in.)
Pin B	6 mm (0.236 in.)
Pin C	11 mm (0.433 in.)
Pin D	9 mm (0.354 in.)

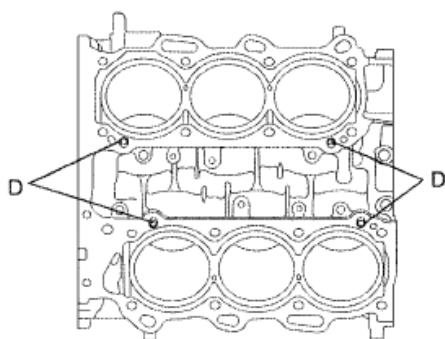
Cylinder Block Front Side:



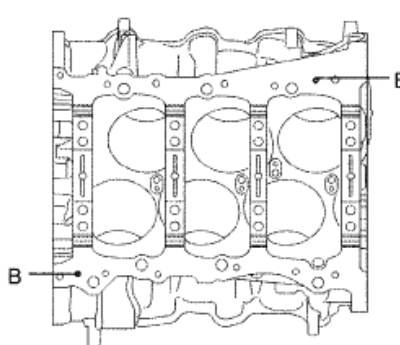
Cylinder Block Rear Side:



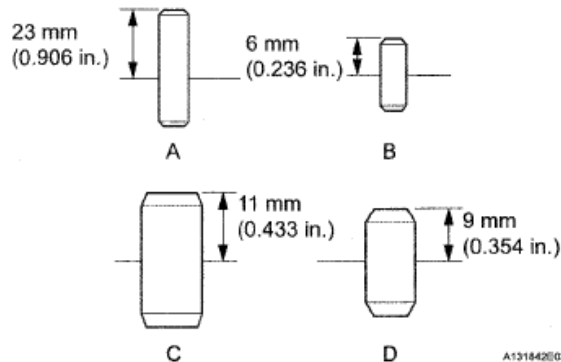
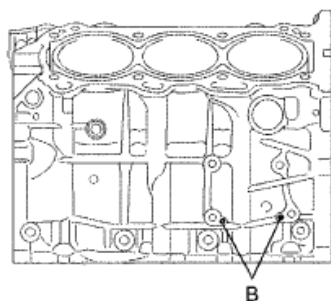
Cylinder Block Upper Side:



Cylinder Block Lower Side:



Cylinder Block RH Side:



A131842E03

Fig. 326: Identifying Straight Pins Dimension In Cylinder Block
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. INSTALL STUD BOLT

- Using E8 and E10 "TORX" sockets wrench, install the stud bolt.

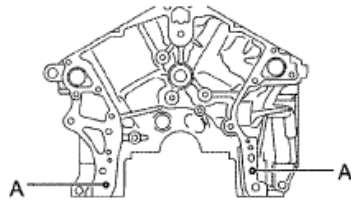
Torque: A bolt

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

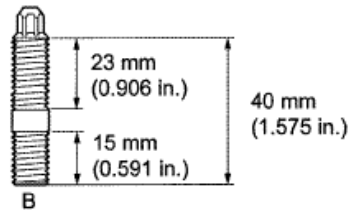
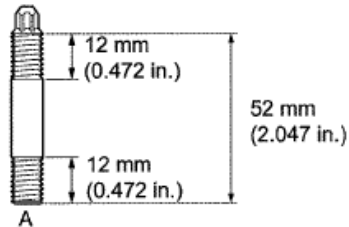
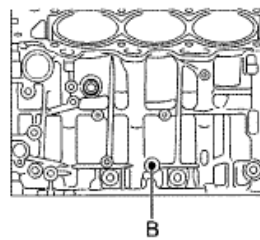
B bolt

17 N*m (173 kgf*cm, 13 ft.*lbf)

Front Cylinder Block Side:



Cylinder Block LH Side:



Y

A134958E02

Fig. 327: Identifying Stud Bolt Dimension

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

4. INSTALL SUB-ASSEMBLY OIL NOZZLE NO. 1

- Using a 5 mm hexagon wrench, install the 3 oil nozzles with the bolts.

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

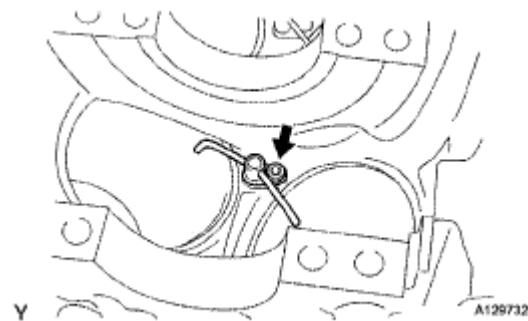


Fig. 328: Locating Oil Nozzles

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

5. INSTALL PISTON SUB-ASSEMBLY WITH PIN

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

HINT:

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

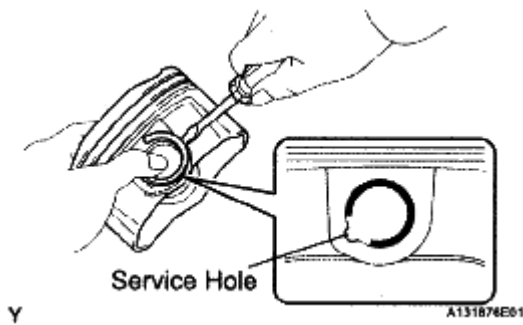


Fig. 329: Installing Snap Ring At One End Of Piston Pin Hole
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Gradually heat the piston to approximately 80°C (176°F).

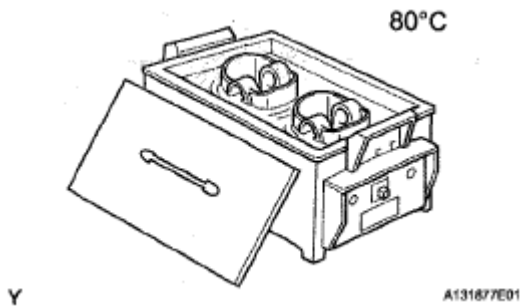


Fig. 330: Heating Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Coat the piston pin with engine oil.
- d. Align the front marks of the piston and connecting rod, and push in the piston pin with your thumb.

HINT:

The piston and pin are a matched set.

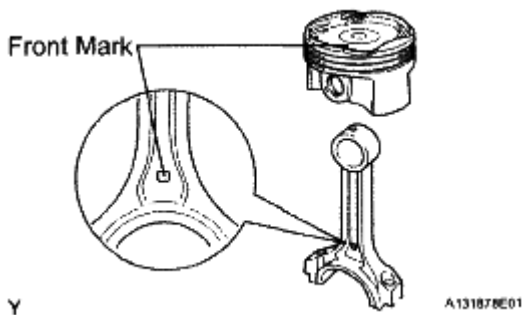


Fig. 331: Aligning Front Marks Of Piston And Connecting Rod
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Check the fitting condition between the piston and piston pin by trying to move the piston back and forth on the piston pin.

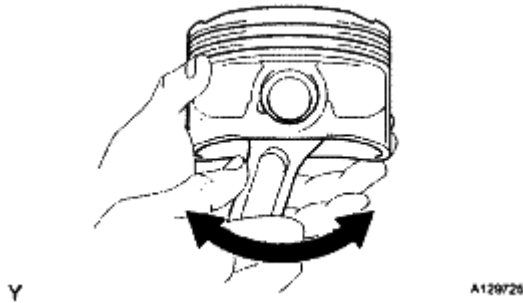


Fig. 332: Checking Fitting Condition Between Piston And Piston Pin
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Using a screwdriver, install a new snap ring at the other end of the piston pin hole.

HINT:

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

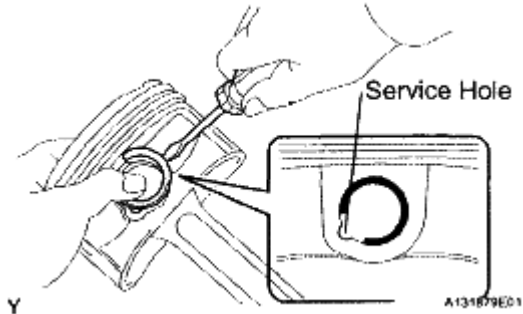


Fig. 333: Installing Snap Ring
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. INSTALL PISTON RING SET

- a. Install the oil ring expander and 2 side rails by hand.
- b. Using a piston ring expander, install the 2 compression rings so that the painted marks are positioned as shown in the illustration.

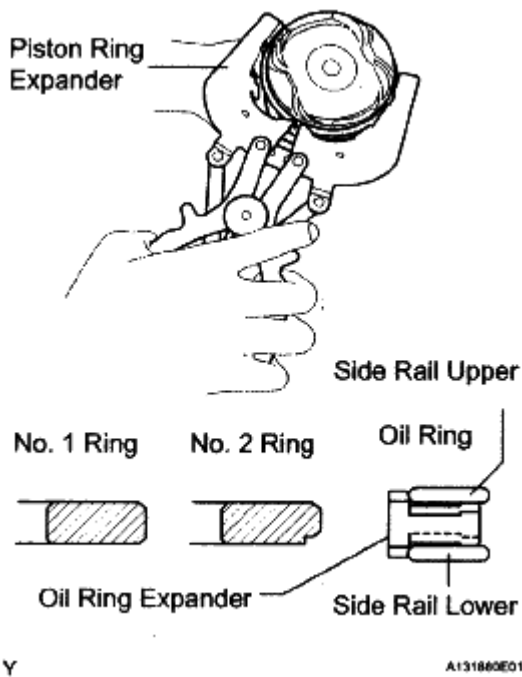


Fig. 334: Installing Oil Ring Expander And Side Rails
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Position the piston rings so that the ring ends are as shown in the illustration.

NOTE: Do not align the ring ends.

7. INSTALL CRANKSHAFT BEARING

NOTE: Main bearings come in widths between 18.0 mm (0.709 in.) and 21.0 mm (0.827 in.). Install the 21.0 mm (0.827 in.) bearings in the No. 1 and No. 4 cylinder block journal positions with the main bearing cap. Install the 18.0 mm (0.709 in.) bearings in the No. 2 and No. 3 positions.

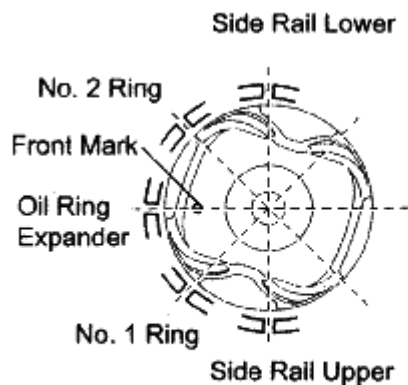
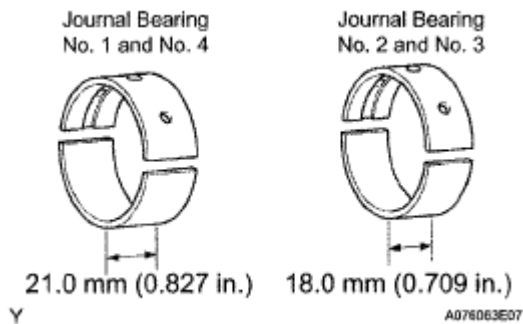


Fig. 335: Positioning Piston Rings

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

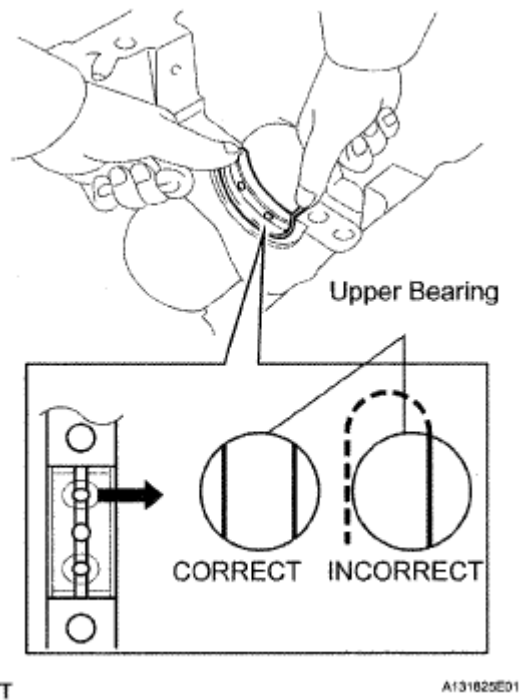
- a. Clean the main journal and the both surfaces of the bearing.

**Fig. 336: Identifying Main Journal Bearing Dimension**

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

- b. Install the upper bearing.
 1. Install the upper bearing to the cylinder block as shown in the illustration.

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

**Fig. 337: Installing Upper Bearing**

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

- c. Install the lower bearing.

1. Install the lower bearing to the bearing cap.
2. Using vernier calipers, measure the distance between the bearing cap's edge and the lower bearing's edge.

Dimension (A - B): 0.7 mm (0.0276 in.) or less.

NOTE: Do not apply engine oil to the bearing's contact area and underside.

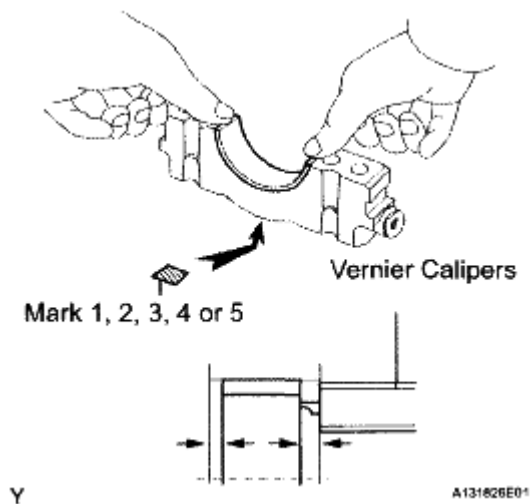


Fig. 338: Installing Lower Bearing To Bearing Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. INSTALL CRANKSHAFT

- a. Install the crankshaft thrust washer to the cylinder block.
 1. Install the 2 thrust washers under the No. 2 journal position of the cylinder block with the oil grooves facing outward.
- b. Apply engine oil to the upper bearing, then place the crankshaft on the cylinder block.

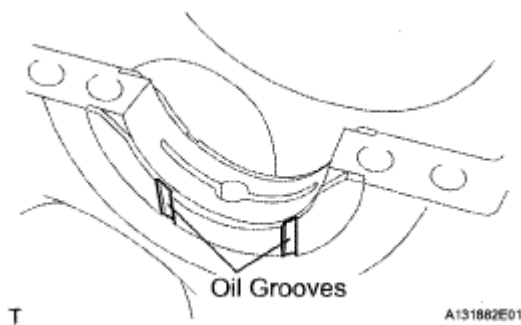


Fig. 339: Identifying Oil Grooves
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Confirm the front marks and numbers of the main bearing caps and install the bearing caps on the cylinder block.

HINT:

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

- d. Apply a light coat of engine oil to the threads and under the head of the bearing cap bolts.
- e. Temporarily install the 8 main bearing cap bolts to the inside positions.

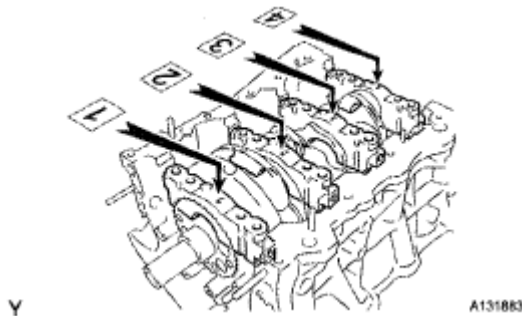


Fig. 340: Identifying Front Marks And Numbers Of Main Bearing Caps
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Insert the main bearing cap by hand until the clearance between the main bearing cap and the cylinder block is less than 6 mm (0.23 in.) by marking the 2 internal bearing cap bolts as a guide.

Bolt length: 100 to 102 mm (3.94 to 4.02 in.)

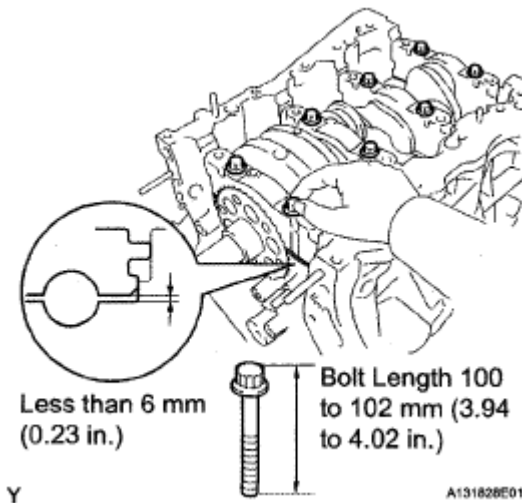


Fig. 341: Checking Clearance Between Main Bearing Cap And Cylinder Block
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Using a plastic hammer, lightly tap the bearing cap to ensure a proper fit.

- h. Apply a light coat of engine oil to the threads and under the heads of the 8 main bearing cap bolts.

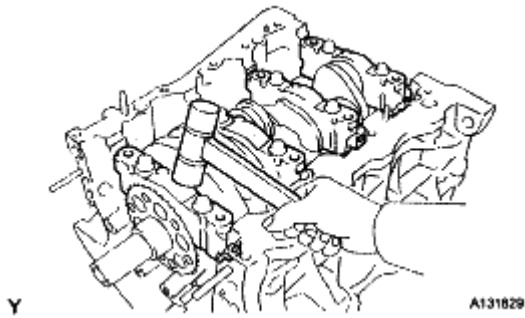


Fig. 342: Tapping Bearing Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- i. Install the 8 main bearing cap bolts to the outside positions.

Bolt length: 105.5 to 107.5 mm (4.15 to 4.23 in.)

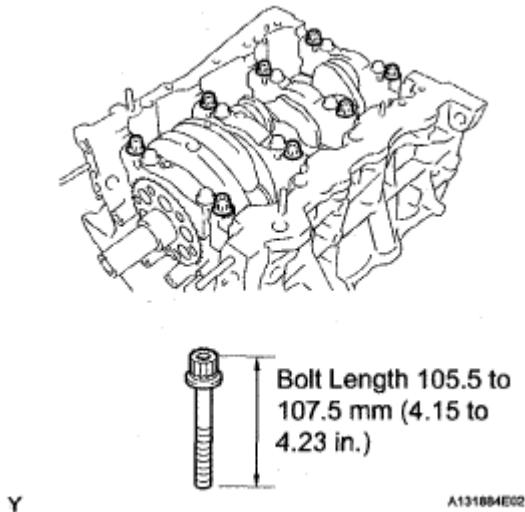


Fig. 343: Identifying Main Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- j. Install the crankshaft bearing cap bolts.

HINT:

The main bearing cap bolts are tightened in 2 progressive steps.

- k. Step 1

1. Install and uniformly tighten the 16 main bearing cap bolts in the sequence shown in the illustration.

Torque: 61 N*m (622 kgf*cm, 45 ft.*lbf)

If any of the main bearing cap bolts does not meet the torque specified, replace it.

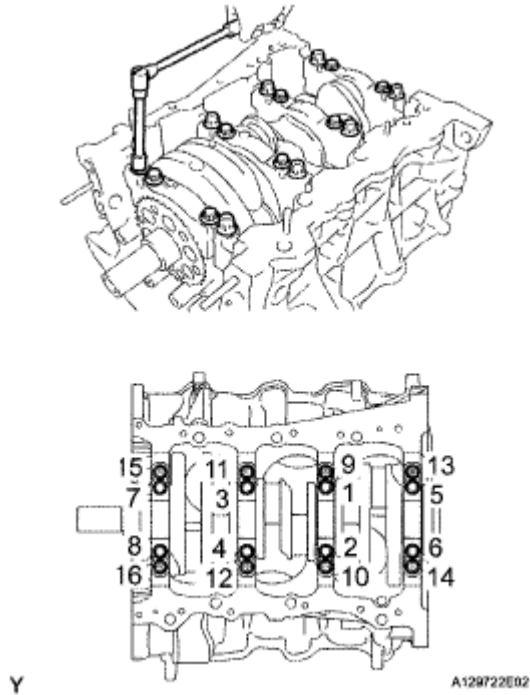


Fig. 344: Tightening Main Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. Step 2
 1. Mark the front of the bearing cap bolts with paint.
 2. Tighten the bearing cap bolts another 90° in the order above.
 3. Check that the painted mark is now at a 90° angle to the front.
- m. Check that the crankshaft turns smoothly.
- n. Check the crankshaft thrust clearance.

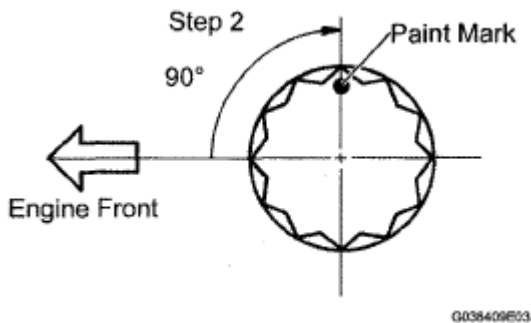


Fig. 345: Identifying Front Mark Of Bearing Cap Bolts With Paint
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- o. Install and uniformly tighten the 8 main bearing cap bolts in several steps and in the sequence shown in the illustration.

Torque: 52 N*m (525 kgf*cm, 38 ft.*lbf)

HINT:

- Bolt (A) length: 45 mm (1.77 in.)
 - Except bolt (A) length: 30 mm (1.18 in.)
- p. Check that the crankshaft turns smoothly.
 - q. Check the crankshaft thrust clearance.

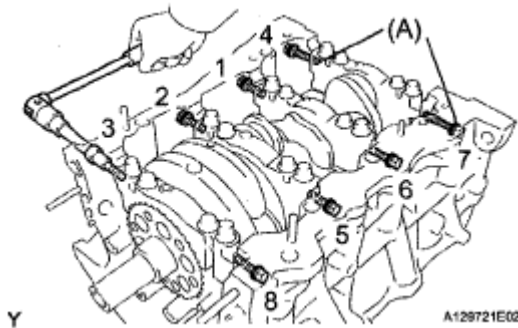


Fig. 346: Identifying Bearing Cap Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. INSTALL CONNECTING ROD BEARING

- a. Install the connecting rod bearing to the connecting rod and bearing cap.
- b. Using vernier calipers, measure the distance between the connecting rod's and bearing cap's edges, and each connecting rod bearing's edge.

Dimension (A-B): 0.7 mm (0.0276 in.) or less

NOTE: Do not apply engine oil to the bearing's contact area and underside.

10. INSTALL PISTON SUB-ASSEMBLY WITH CONNECTING ROD

- a. Apply engine oil to the cylinder walls, the pistons, and the surfaces of the connecting rod bearings.

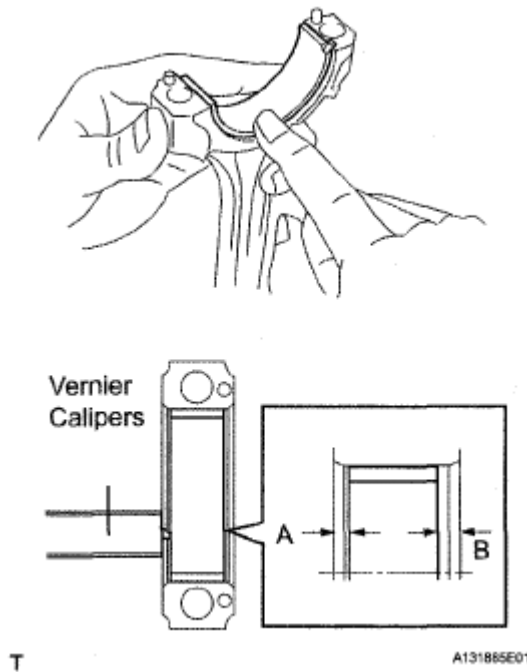


Fig. 347: Measuring Distance Between Connecting Rod's And Bearing Cap's Edges
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Position the piston rings so that the ring ends are as shown in the illustration.

NOTE: Do not align the ring ends.

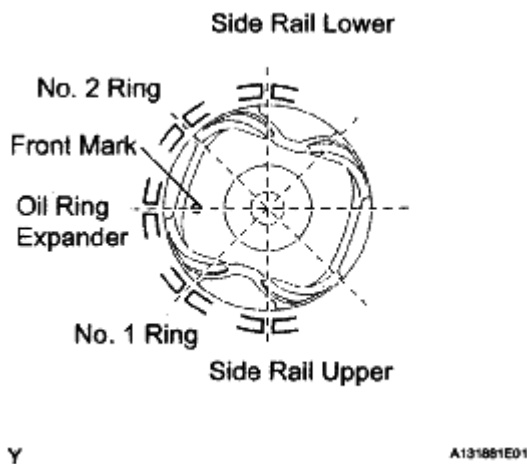


Fig. 348: Positioning Piston Rings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using a piston ring compressor, push the correctly numbered piston and connecting rod assembly into the cylinder with the front mark of the piston facing forward.
- d. Match the numbered connecting rod cap with the connecting rod.

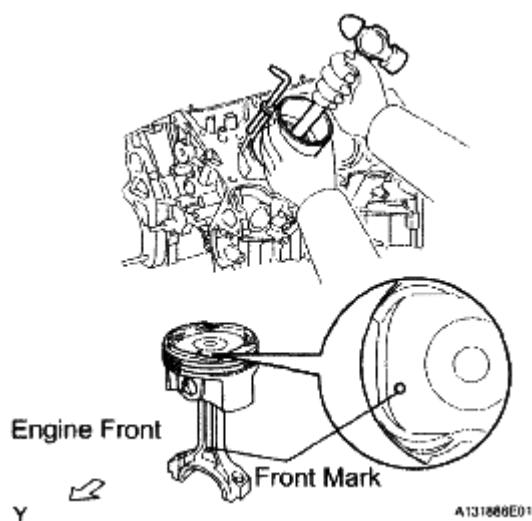


Fig. 349: Pushing Piston And Connecting Rod Assembly Into Cylinder
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Check that the front mark of the connecting rod cap is facing forward.
- f. Apply a light coat of engine oil to the threads and under the heads of the connecting rod cap bolts.
- g. Install the connecting cap bolts.

HINT:

The connecting cap bolts are tightened in 2 progressive steps.

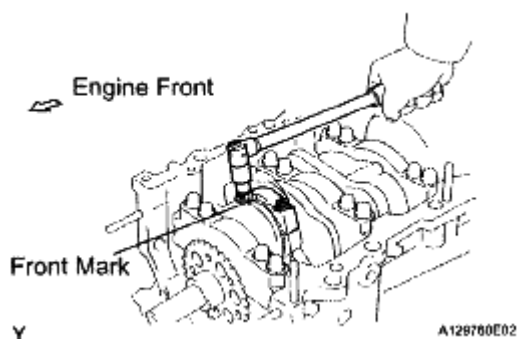


Fig. 350: Checking Front Mark Of Connecting Rod Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- h. Step 1
 1. Install and alternately tighten the bolts of the connecting rod cap in several steps.

Torque: 25 N*m (255 kgf*cm, 18 ft.*lbf)

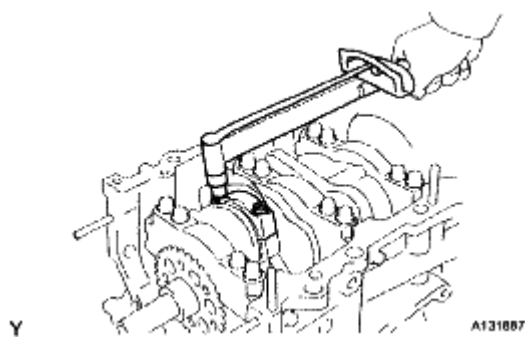


Fig. 351: Tightening Connecting Rod Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- i. Step 2
 - 1. Mark the front side of each connecting cap bolt with paint.
 - 2. Tighten the cap bolts another 90° as shown in the illustration.
 - 3. Check the painted mark is now at a 90° angle to the front.
- j. Check that the crankshaft turns smoothly.
- k. Check the connecting rod thrust clearance.

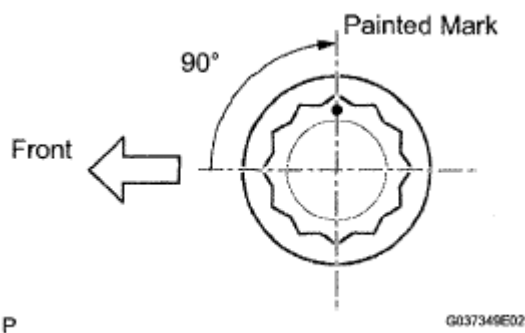


Fig. 352: Marking Front Side Of Connecting Cap Bolt With Paint
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. INSTALL RING PIN

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

Specified protrusion height: 2.5 to 3.5 mm (0.098 to 0.138 in.)

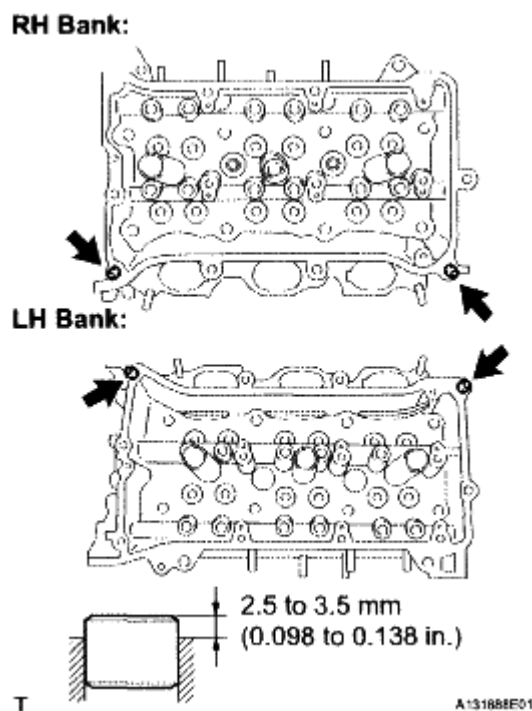


Fig. 353: Tapping Ring Pins

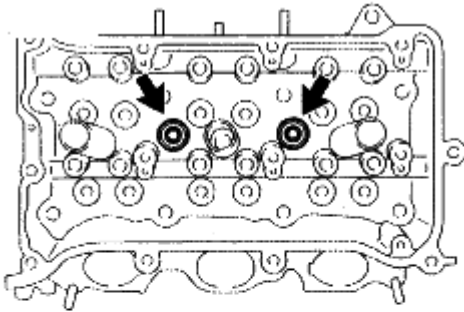
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. INSTALL WITH HEAD STRAIGHT SCREW PLUG NO. 1

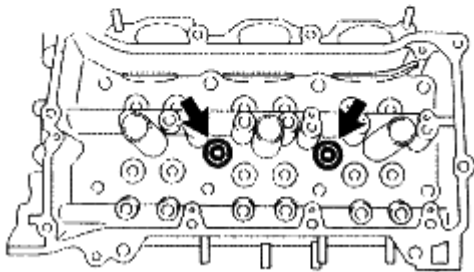
- a. Using a 10 mm hexagon wrench, install 4 new gaskets and the straight screw plugs.

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

RH Bank:



LH Bank:



T

A129718E01

Fig. 354: Removing Screw Plugs And Gaskets

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

13. INSTALL WITH HEAD STRAIGHT SCREW PLUG NO. 2

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

Torque: 80 N*m (816 kgf*cm, 59 ft.*lbf)

14. INSTALL STUD BOLT

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

- a. Using E6 and E8 "TORX" socket wrenches, install the stud bolts.

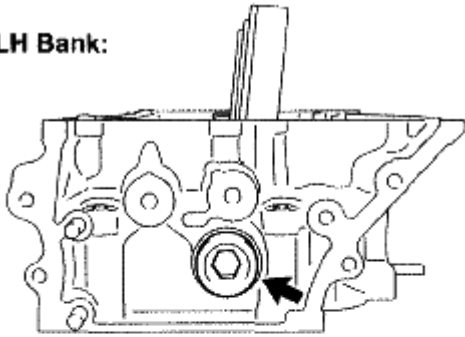
Torque: A and B bolts

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

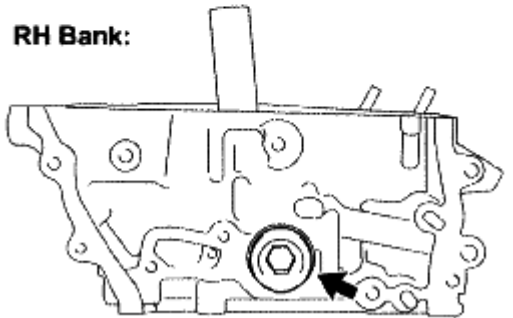
C bolt

4.0 N*m (41 kgf*cm, 35 in.*lbf)

LH Bank:



RH Bank:



T

A128719F01

Fig. 355: Locating Screw Plugs

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

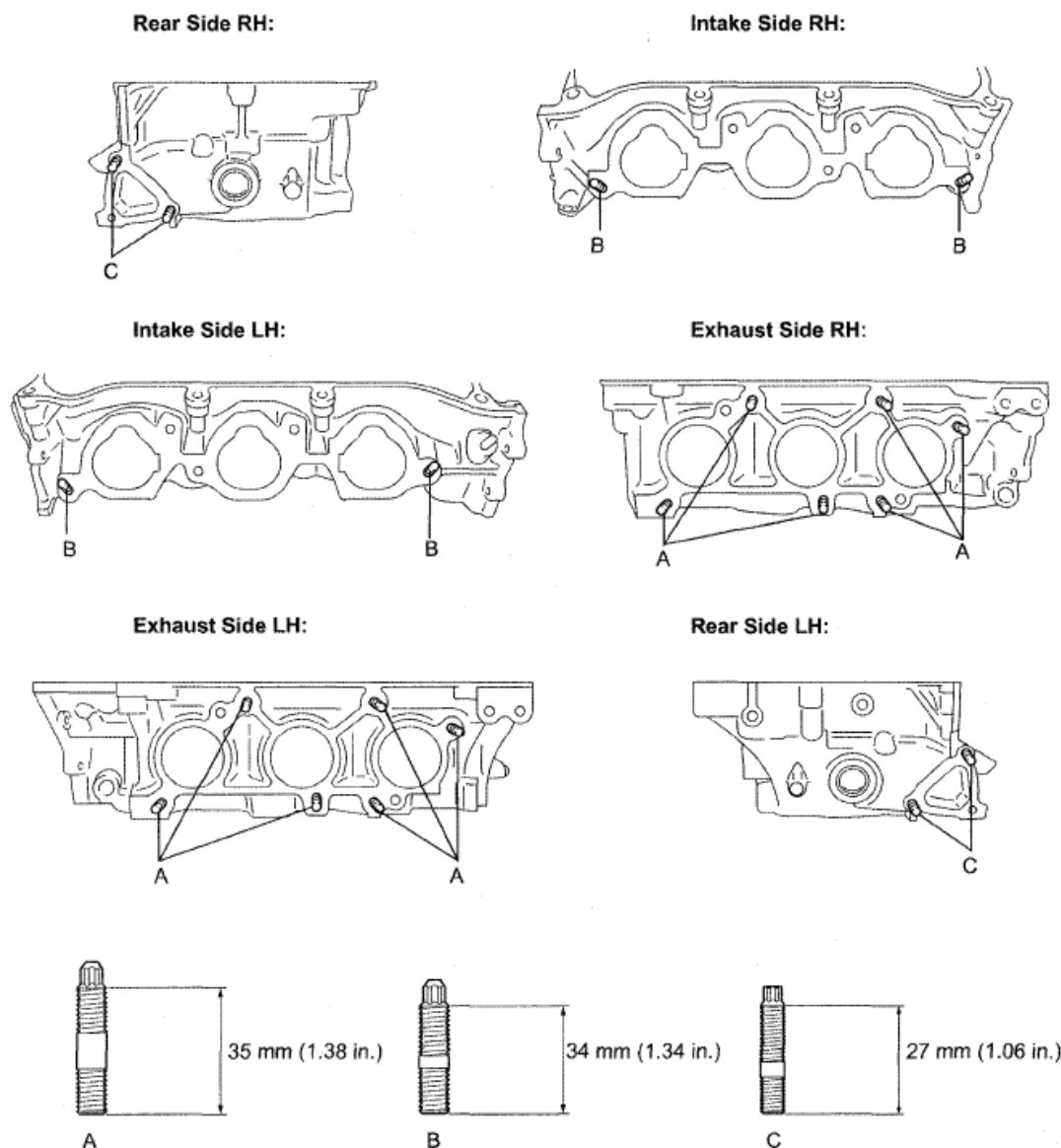


Fig. 356: Identifying Straight Pins Installing Location
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

15. INSTALL STRAIGHT PIN

- Using a plastic hammer, tap in 4 new straight pins as shown in the illustration.

Specified protrusion height: 17.5 to 19.5 mm (0.689 to 0.768 in.)



Fig. 357: Tapping Straight Pins
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

16. INSTALL VALVE SPRING SEAT

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

17. INSTALL VALVE STEM OIL SEAL

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

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

HINT:

The intake valve oil seals are white and the exhaust valve oil seals are black.

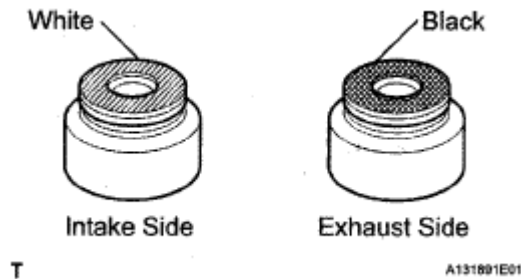


Fig. 358: Identifying Valve Oil Seals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

SST 09201-41020

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

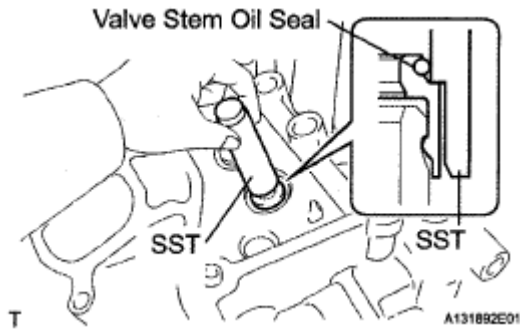


Fig. 359: Pushing Oil Seals

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

18. INSTALL INTAKE VALVE

- Apply a plenty of engine oil to the tip area of the intake valve shown in the illustration.
- 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.

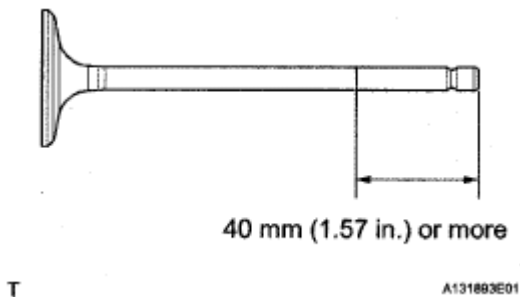


Fig. 360: Identifying Valve Stem Tip Area Dimension

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

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

SST 09202-70020 (09202-00010)

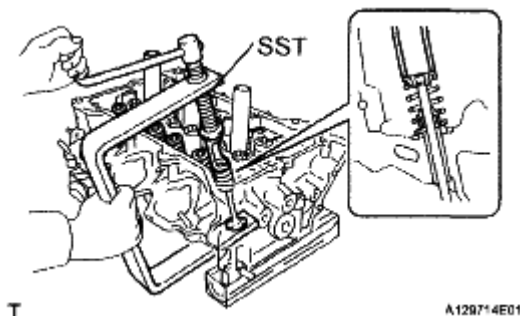


Fig. 361: Compressing Compression Spring

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

- d. Using a plastic hammer, lightly tap the valve stem tip to ensure a proper fit.

NOTE: Be careful not to damage the retainer.

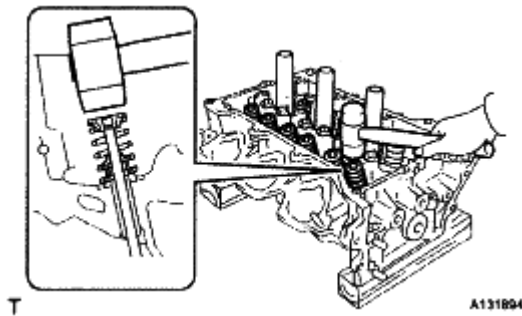


Fig. 362: Tapping Valve Stem Tip

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

19. INSTALL EXHAUST VALVE

- a. Apply a plenty 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.

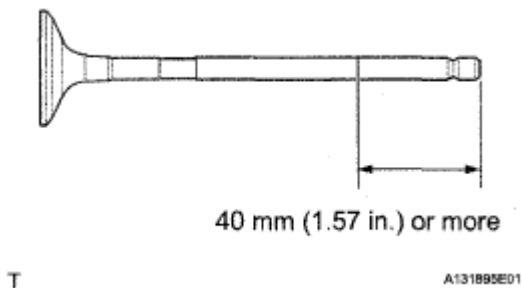


Fig. 363: Identifying Valve Stem Tip Area Dimension

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)

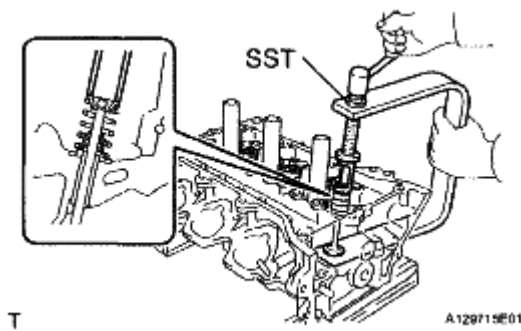


Fig. 364: Compressing Compression Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Using a plastic hammer, lightly tap the valve stem tip to ensure a proper fit.

NOTE: Be careful not to damage the retainer.

20. INSTALL VALVE STEM CAP

- a. Apply a light coat of engine oil to the valve stem caps.
- b. Install the valve stem caps to the cylinder head.

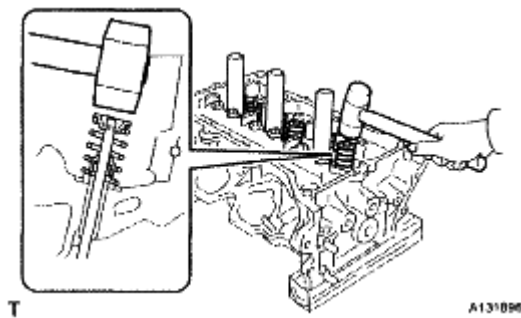


Fig. 365: Tapping Valve Stem Tip
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

21. INSTALL ENGINE REAR OIL SEAL RETAINER

- a. Apply seal packing in a continuous bead as shown in the illustration.

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

Seal diameter: 2.0 to 3.0 mm (0.079 to 0.118 in.)

NOTE:

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

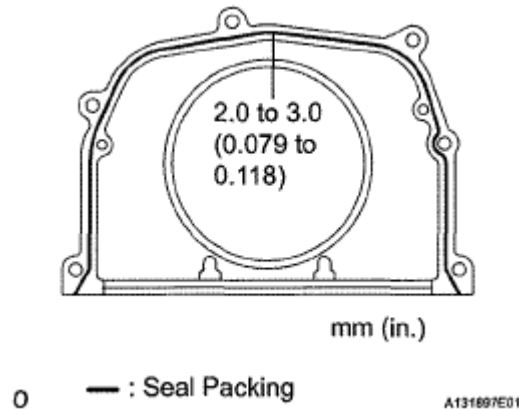


Fig. 366: Applying Seal Packing In Continuous Bead
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the oil seal retainer with the 6 bolts.

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

NOTE: Be sure to apply adhesive 1324 to the bolts in the places indicated by **A** before installing them.

Adhesive: Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

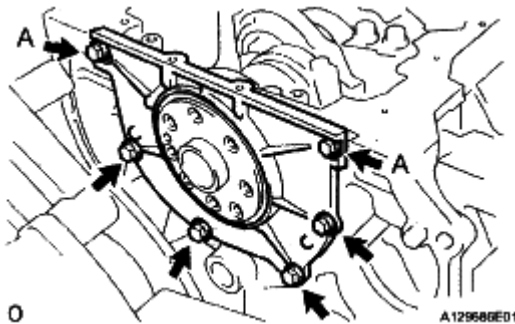


Fig. 367: Identifying Oil Seal Retainer With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

22. INSTALL WATER INLET PIPE

- a. Install the water inlet pipe with the 2 bolts.

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

- b. Install the water by-pass hose No. 1.

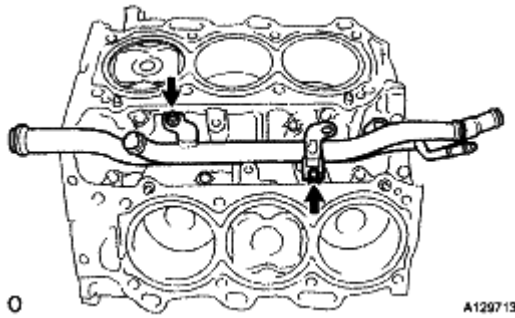


Fig. 368: Locating Water Outlet Pipe Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

23. INSTALL CYLINDER HEAD SUB-ASSEMBLY

- a. Place the cylinder head gasket on the cylinder block surface with the front face of the Lot No. stamp upward.

NOTE:

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

- b. Place the cylinder head on the cylinder block.

NOTE:

Ensure that no oil is on the mounting surface of the cylinder head.

HINT:

The cylinder head bolts are tightened in 3 progressive steps.

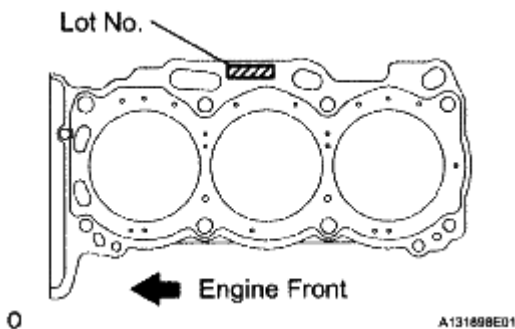


Fig. 369: Placing Cylinder Head Gasket On Cylinder Block Surface With Lot No. Stamp Upward
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Apply a light coat of engine oil to the threads and under the heads of the cylinder head bolts.
- d. Step 1
 1. Using a 10 mm bi-hexagon wrench, install and uniformly tighten the 8 cylinder head bolts

with the plate washers in several steps and in the sequence shown in the illustration.

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

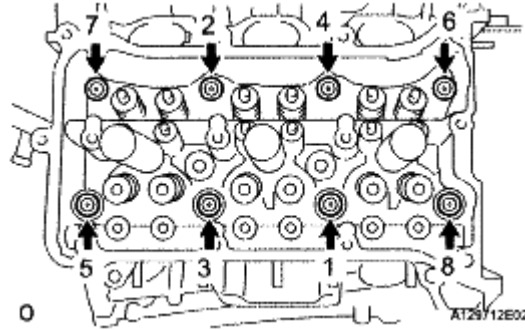


Fig. 370: Identifying Cylinder Head Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Step 2
 - 1. Mark the cylinder head bolt head with paint as shown in the illustration.
 - 2. Tighten the cylinder head bolts another 90°.
- f. Step 3
 - 1. Tighten the cylinder head bolts by an additional 90°.
 - 2. Check that the painted mark is now facing rearward.

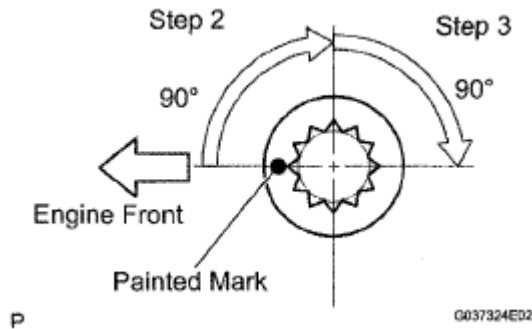


Fig. 371: Marking Cylinder Head Bolt Head With Paint
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Seal packing will seep out on the engine's front side. Thoroughly wipe clean any seal packing.

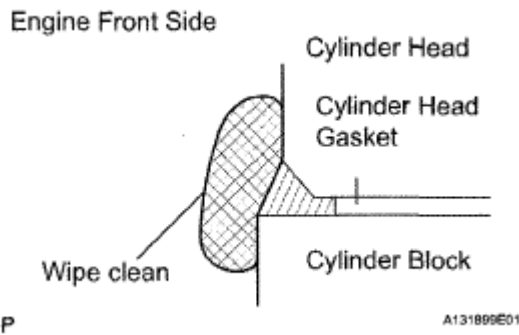


Fig. 372: Wiping Clean Seal Packing

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

24. INSTALL CYLINDER HEAD LH

- Place the cylinder head gasket on the cylinder block surface with the front face of the Lot No. stamp upward.

NOTE:

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

- Place the cylinder head on the cylinder block.

NOTE:

Ensure that no oil is on the mounting surface of the cylinder head.

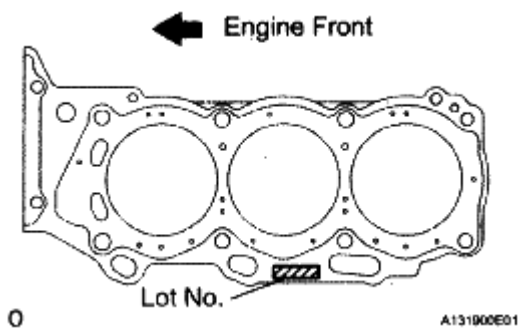


Fig. 373: Placing Cylinder Head Gasket On Cylinder Block Surface With Lot No. Stamp Upward

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

HINT:

The cylinder head bolts are tightened in 3 progressive steps.

- Apply a light coat of engine oil to the threads and under the heads of the cylinder head bolts.
- Step 1

1. Using a 10 mm bi-hexagon wrench, install and uniformly tighten the 8 cylinder head bolts with the plate washers in several steps and in the sequence shown in the illustration.

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

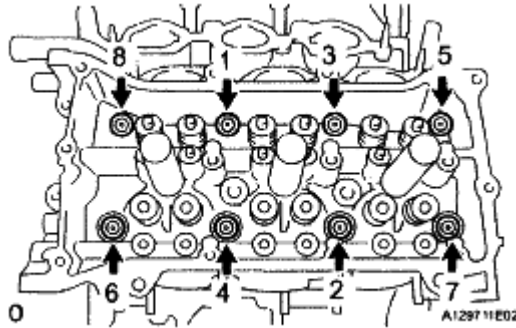


Fig. 374: Identifying Cylinder Head Bolts With Plate Washers Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Step 2
 1. Mark the cylinder head bolt head with paint as shown in the illustration.
 2. Tighten the cylinder head bolts another 90°.
- f. Step 3
 1. Tighten the cylinder head bolts by an additional 90°.
 2. Check that the painted mark is now facing rearward.

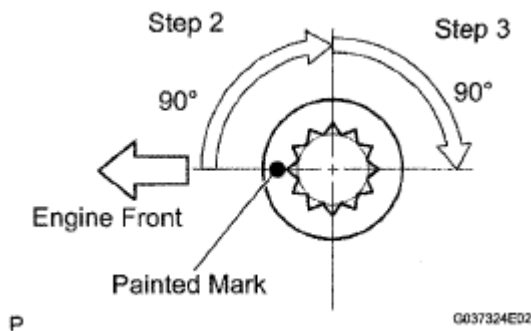


Fig. 375: Marking Cylinder Head Bolt Head With Paint
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Tighten the 2 bolts in the order shown in the illustration.

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

NOTE: Only use the specifications stated above when tightening the bolts 1 and 2 shown in the illustration.

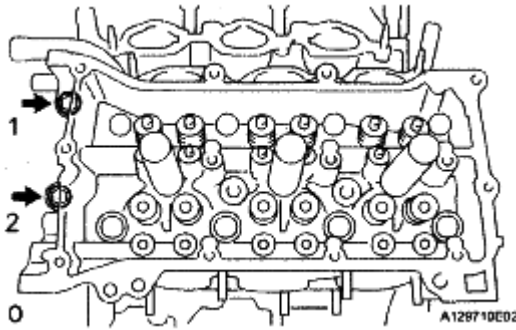


Fig. 376: Identifying Tightening Sequence Of Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- h. Seal packing will seep out on the engine's front side. Thoroughly wipe clean any seal packing.

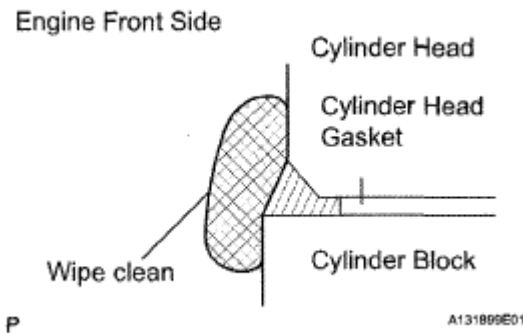


Fig. 377: Wiping Clean Seal Packing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

25. INSTALL VALVE LASH ADJUSTER ASSEMBLY

NOTE:

- Keep the lash adjuster free from dirt and foreign objects.
- Only use clean engine oil.

- a. Place the lash adjuster into a container full of engine oil.
- b. Insert SST's tip into the lash adjuster's plunger and use the tip to press down on the checkball inside the plunger.

SST 09276-75010

- c. Squeeze SST and lash adjuster together to move the plunger up and down 5 to 6 times.
- d. Check the movement of the plunger and bleed the air.

OK: Plunger moves up and down.

NOTE: When bleeding high-pressure air from the compression chamber,

make sure that the tip of SST is actually pressing the checkball as shown in the illustration. If the checkball is not pressed, air will not bleed.

- e. After bleeding the air, remove SST. Then quickly and firmly press the plunger with a finger.

OK: Plunger is very difficult to move.

If the result is not as specified, replace the lash adjuster.

- f. Install the lash adjusters.

NOTE: Install the lash adjuster at the same place it was removed from.

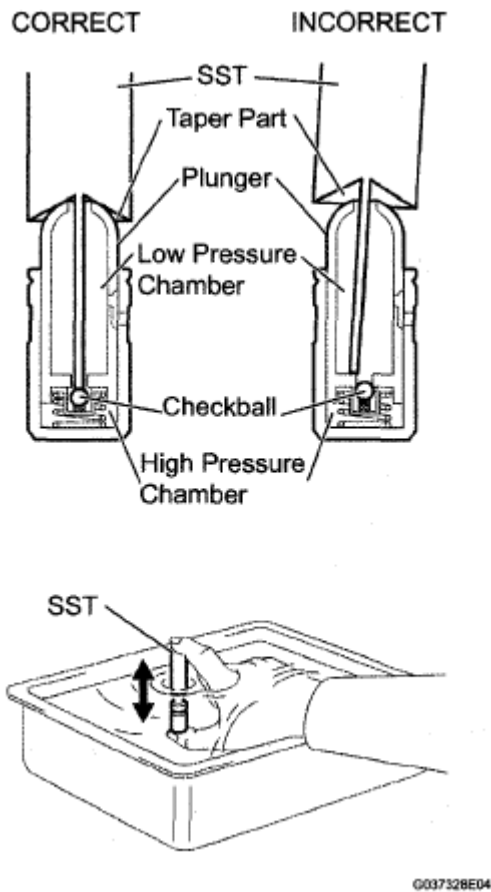


Fig. 378: Inserting SST's Tip Into Lash Adjuster's Plunger
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

26. INSTALL NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY

- a. Apply engine oil to the lash adjuster tips and valve stem cap ends.
- b. Make sure that the valve rocker arms are installed as shown in the illustration.

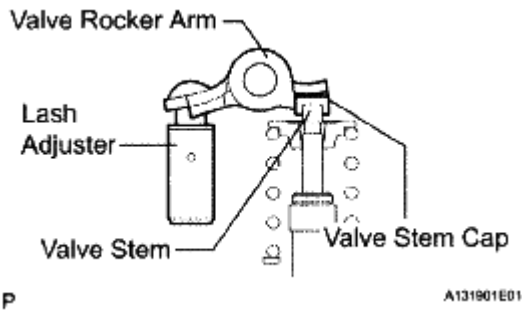


Fig. 379: Identifying Valve Rocker Arm Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

27. INSTALL CAMSHAFT BEARING CAP RH

- Apply engine oil to the camshaft journals, camshaft housings and bearing caps.
- Install the camshaft and camshaft No. 2 to the camshaft housing RH.
- Make sure of the marks and numbers on the camshaft bearing caps and place them in each proper position and direction.

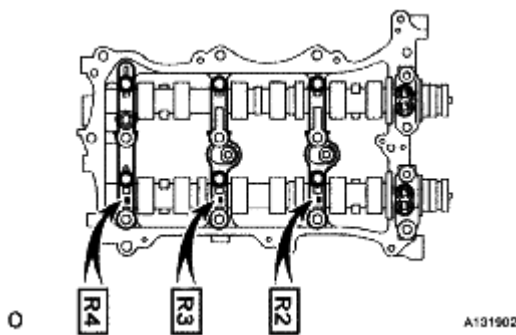


Fig. 380: Identifying Marks And Numbers On Camshaft Bearing Caps
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Temporarily tighten the 8 bolts in the order shown in the illustration.

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

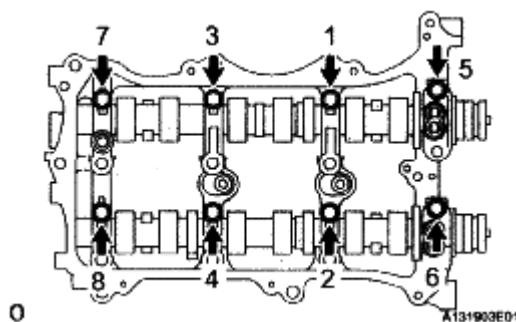


Fig. 381: Identifying Camshaft Bolts Tightening Sequence

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

28. INSTALL CAMSHAFT HOUSING SUB-ASSEMBLY RH

- a. Apply seal packing in a continuous bead as shown in the illustration.

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

Seal diameter: 3.5 to 4.5 mm (0.138 to 0.177 in.)

NOTE:

- Remove any oil from the contact surface.
- Install the camshaft housing sub-assembly RH within 3 minutes and tighten the bolts within 15 minutes after applying seal packing.
- Do not start the engine for at least 2 hours after installing.

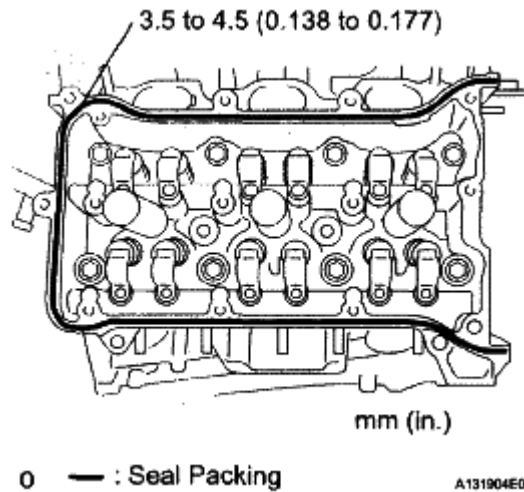


Fig. 382: Applying Seal Packing In Continuous Bead
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the camshaft housing RH, and tighten the 12 bolts in the order shown in the illustration.

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

NOTE:

Make sure that the knock pins of the camshafts are positioned as shown in the illustration before installing the camshaft housing RH.

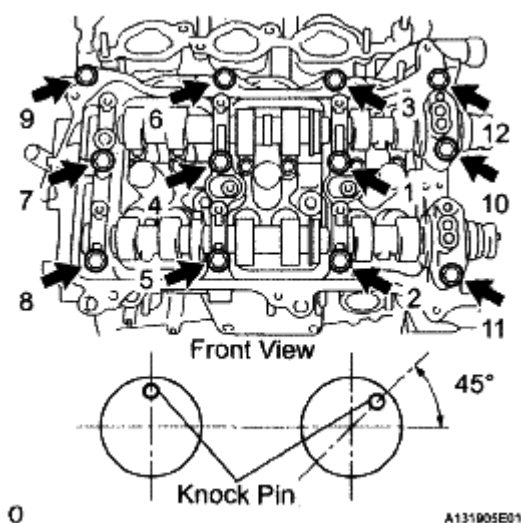


Fig. 383: Identifying Camshaft Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Tighten the 8 bolts in the order shown in the illustration.

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

NOTE: Thoroughly wipe clean any seal packing.

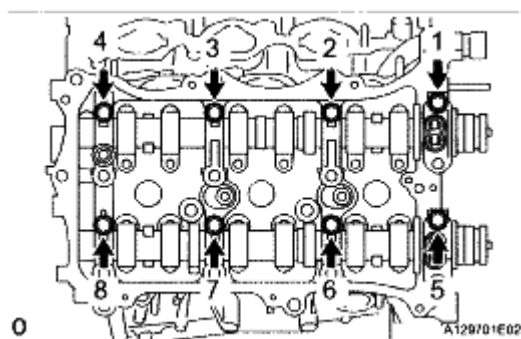


Fig. 384: Identifying Camshaft Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Install 3 new gaskets.

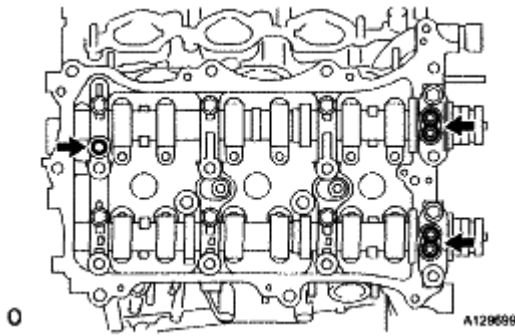


Fig. 385: Locating Camshaft Bearing Cap Gaskets
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

29. INSTALL CAMSHAFT BEARING CAP

- Apply engine oil to the camshaft journals, camshaft housings and bearing caps.
- Install the camshaft No. 3 and camshaft No. 4 to the camshaft housing LH.
- Make sure of the marks and numbers on the camshaft bearing caps and place them in each proper position and direction.

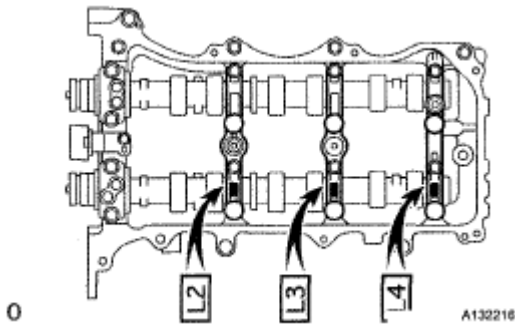


Fig. 386: Identifying Marks And Numbers On Camshaft Bearing Caps
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Temporarily tighten the 8 bolts in the order shown in the illustration.

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

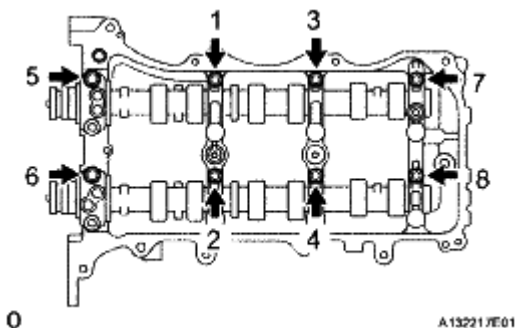


Fig. 387: Identifying Camshaft Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

30. INSTALL CAMSHAFT HOUSING SUB-ASSEMBLY LH

- a. Apply seal packing in a continuous bead as shown in the illustration.

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

Seal diameter: 3.5 to 4.5 mm (0.138 to 0.177 in.)

NOTE:

- Remove any oil from the contact surface.
- Install the camshaft housing sub-assembly LH within 3 minutes and tighten the bolts within 15 minutes after applying seal packing.
- Do not start the engine for at least 2 hours after installing.

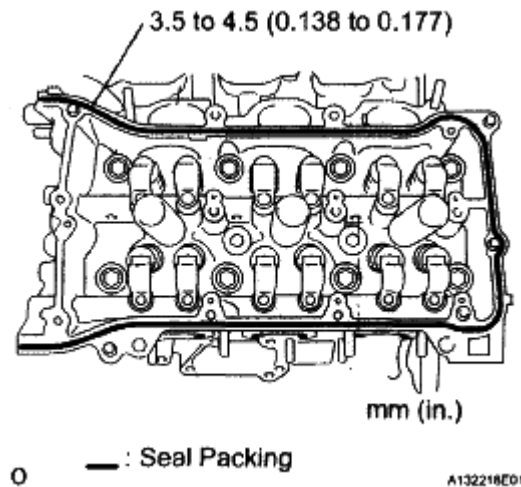


Fig. 388: Applying Seal Packing In Continuous Bead
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the camshaft housing LH, and tighten the 13 bolts in the order shown in the illustration.

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

NOTE:

Make sure that the knock pins of the camshafts are positioned as shown in the illustration before installing the camshaft housing LH.

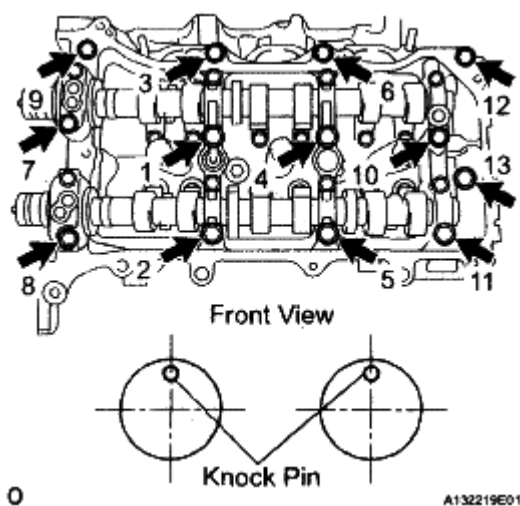


Fig. 389: Identifying Camshaft Housing Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Tighten the 8 bolts in the order shown in the illustration.

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

NOTE: Thoroughly wipe clean any seal packing.

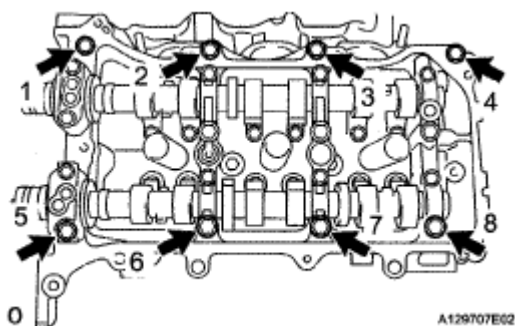


Fig. 390: Identifying Camshaft Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Install 3 new gaskets.

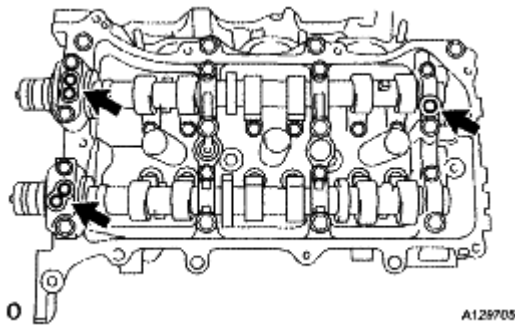


Fig. 391: Locating Camshaft Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

31. INSTALL NO. 2 CHAIN TENSIONER ASSEMBLY

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

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

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

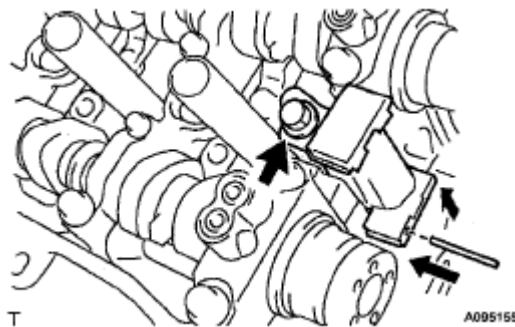


Fig. 392: Locating Chain Tensioner No. 2 With Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

32. INSTALL CAMSHAFT TIMING GEARS AND NO. 2 CHAIN (for RH BANK)

CAUTION: For additional information on timing chain/gear removal guidelines, installation and camshaft timing gear alignment, see 2GR-FE VALVE TIMING PROCEDURE .

- Align the mark plate (yellow) with the timing marks (1-dot mark) of the camshaft timing gears as shown in the illustration.
- Apply a small amount of engine oil to the bolt threads and bolt-seating surface.
- Align the knock pin of the camshaft with the pin hole of the camshaft timing gear. Install the camshaft timing gear and camshaft timing exhaust gear RH with the No. 2 chain installed.

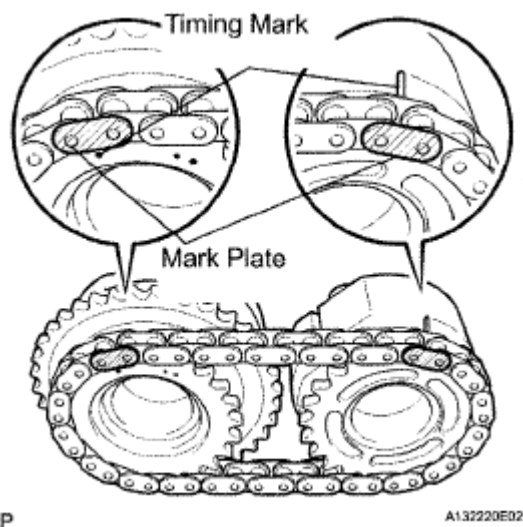


Fig. 393: Aligning Mark Plate With Timing Marks Of Camshaft Timing Gears
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

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

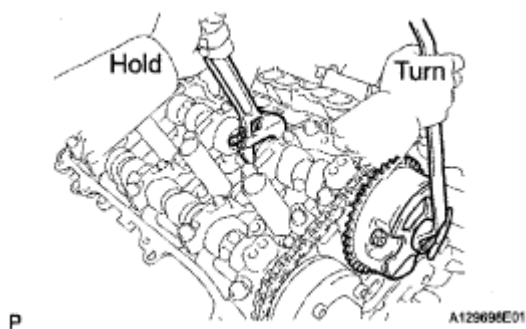


Fig. 394: Holding Hexagonal Portion Of Camshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

33. INSTALL NO. 3 CHAIN TENSIONER ASSEMBLY

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

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

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

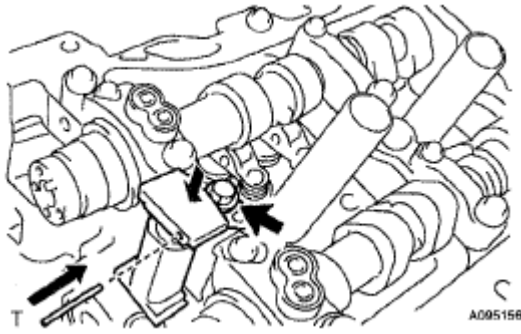


Fig. 395: Locating Chain Tensioner No. 3 With Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

34. INSTALL CAMSHAFT TIMING GEARS AND NO. 2 CHAIN (for LH BANK)

CAUTION: For additional information on timing chain/gear removal guidelines, installation and camshaft timing gear alignment, see 2GR-FE VALVE TIMING PROCEDURE .

- Align the mark plate (yellow) with the timing marks (2-dot mark) of the camshaft timing gears as shown in the illustration.
- Apply a small amount of engine oil to the bolt threads and bolt-seating surface.
- Align the knock pin of the camshaft with the pin hole of the camshaft timing gear. Install the camshaft timing gear and camshaft timing exhaust gear LH with the No. 2 chain installed.

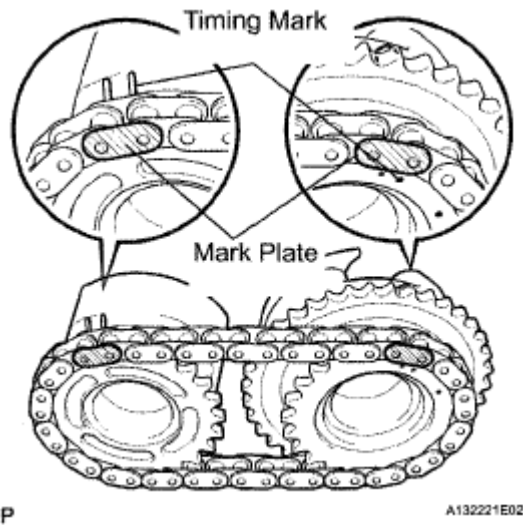


Fig. 396: Aligning Mark Plate With Timing Marks Of Camshaft Timing Gears
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

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

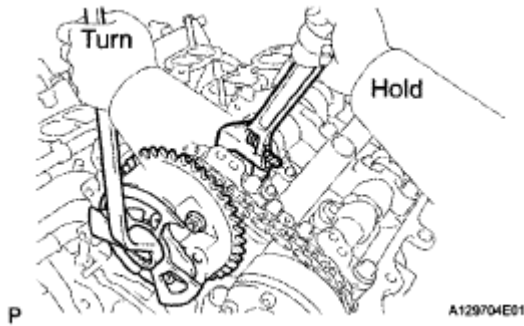


Fig. 397: Holding Hexagonal Portion Of Camshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

35. INSTALL NO. 1 CHAIN VIBRATION DAMPER

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

Torque: 23 N*m (230 kgf*cm, 17 ft.*lbf)

36. INSTALL NO. 2 CHAIN VIBRATION DAMPER

- a. Install the 2 chain vibration damper.

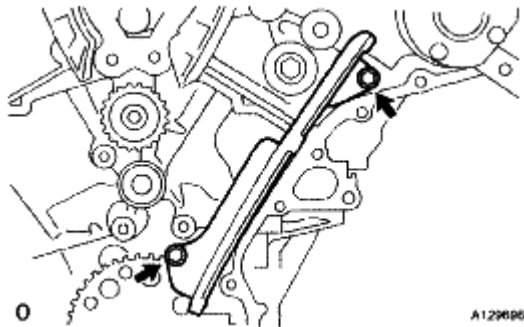


Fig. 398: Locating Chain Vibration Dampers
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

37. INSTALL CRANKSHAFT TIMING GEAR

- a. Install the timing gear set keys and timing gear as shown in the illustration.

38. INSTALL IDLE SPROCKET ASSEMBLY

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

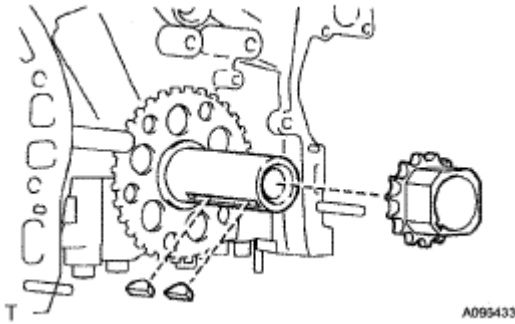


Fig. 399: Identifying Crankshaft Timing Gear

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

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

NOTE: Be careful of the idle gear direction.

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

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

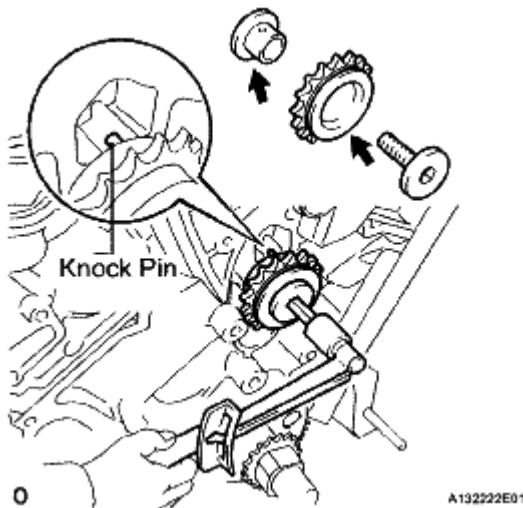


Fig. 400: Tightening Idle Gear Shaft No. 2

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

39. INSTALL CHAIN SUB-ASSEMBLY

- a. Align the mark plate and timing marks as shown in the illustration and install the chain.

HINT:

The camshaft mark plate is orange.

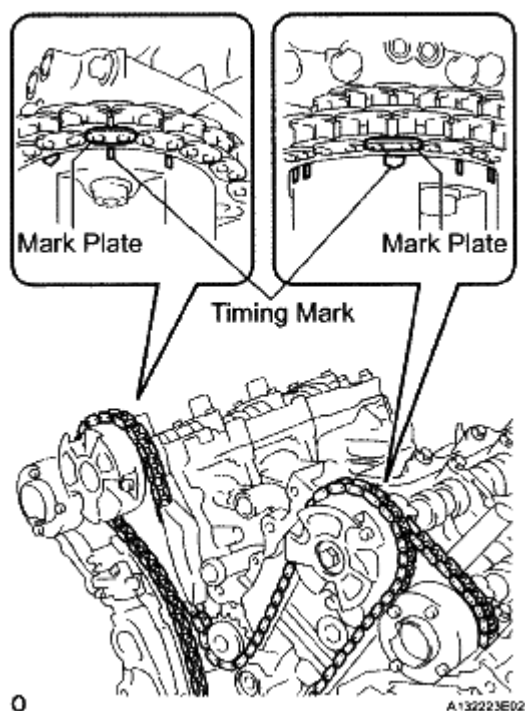


Fig. 401: Aligning Mark Plate And Timing Marks
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Do not pass the chain over the crankshaft, just put it on it.

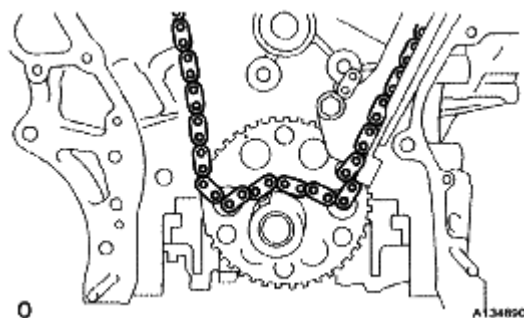
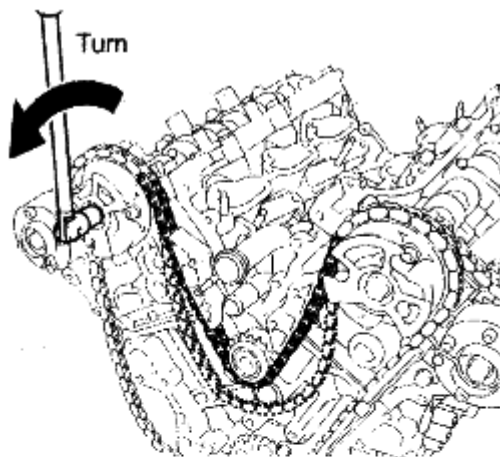


Fig. 402: Passing Chain Over Crankshaft
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Turn the camshaft timing gear assembly on the RH bank counterclockwise to tighten the chain between the banks.

NOTE: When the idle sprocket is reused, align the chain plates with the marks on the sprocket in order to tighten the chain between the banks.



When the Idle sprocket is reused:

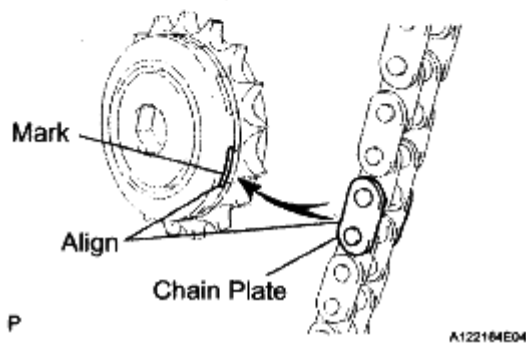


Fig. 403: Turning Camshaft Timing Gear Assembly On RH Bank Counterclockwise
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Align the mark plate and timing marks as shown in the illustration and install the chain onto the crankshaft timing sprocket.

HINT:

The crankshaft mark plate is yellow.

- e. Temporarily tighten the pulley set bolt.

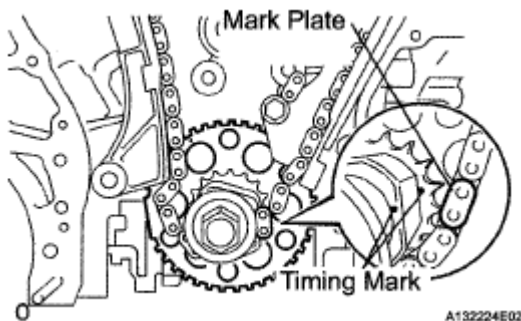


Fig. 404: Aligning Mark Plate And Timing Marks

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

- f. Turn the crankshaft clockwise to set it to the RH block bore center line (TDC / compression).

40. INSTALL CHAIN TENSIONER SLIPPER

- a. Install the chain tensioner slipper.

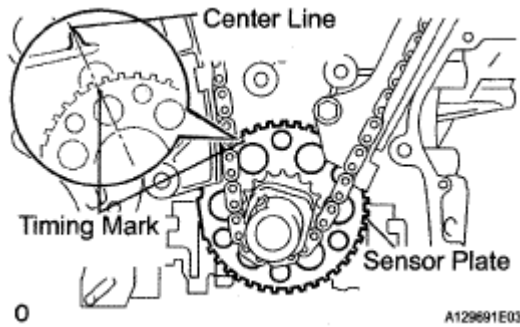


Fig. 405: Identifying Sensor Plate And Timing Mark

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

41. INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY

- a. Move the stopper plate upward to release the lock, and push the plunger deep into the tensioner.
- b. Move the stopper plate downward to set the lock, and insert a hexagon wrench into the hole of the stopper plate.

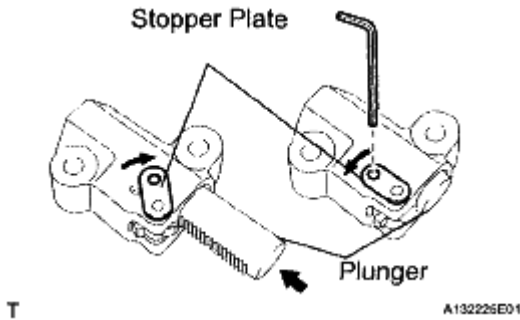


Fig. 406: Pushing Plunger Deep Into Tensioner

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

- c. Install the chain tensioner No. 1 with the 2 bolts.

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

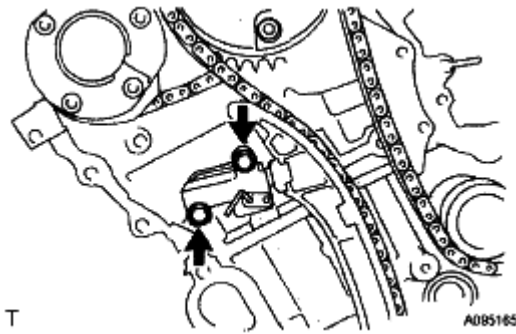


Fig. 407: Locating Chain Tensioner No. 1 With Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Remove the hexagon wrench of the chain tensioner.
- e. Remove the lock pin of the chain tensioner assembly No. 1. Check that each timing mark is aligned with the crankshaft at the TDC / compression.

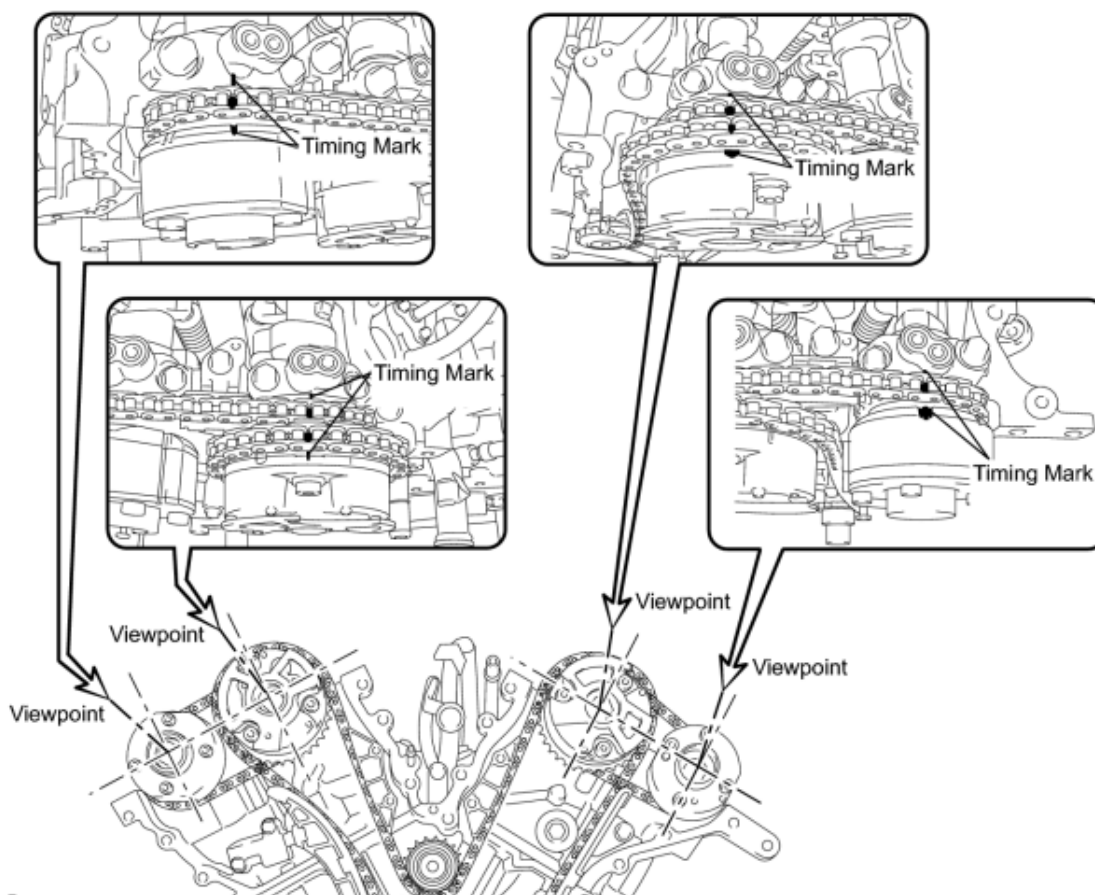
42. INSPECT VALVE TIMING

- a. Check the camshaft timing marks.

NOTE:

- Check each timing mark from a viewpoint directly in line with the center of the camshaft and the timing mark on each camshaft timing gear.
- If the timing marks are checked from any other viewpoint, the valve timing may appear misaligned.

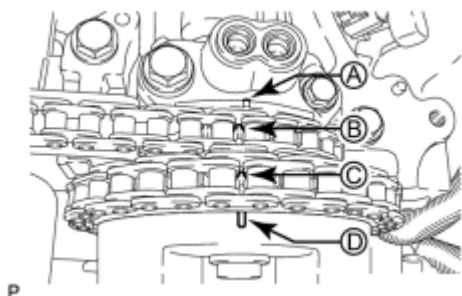
- b. Check that each camshaft timing mark is positioned as shown in the illustration.



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Fig. 408: Checking Timing Marks Alignment

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



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Fig. 409: Checking Timing Marks Alignment

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

HINT:

For the intake camshaft:

Be sure to check mark A at the point when marks B, C, and D are positioned in line. If the marks are checked from any other viewpoint, they cannot be checked correctly.

- c. If the valve timing is misaligned, reinstall the timing chain.
- d. Remove the pulley set bolt.

43. INSTALL WATER PUMP ASSEMBLY

- a. Install a new gasket and the water pump with the 8 bolts.

Torque: 9.1 N*m (93 kgf*cm, 81 in.*lbf)

NOTE: Be sure to replace the bolts indicated by B with new ones or reuse them after applying adhesive 1344.

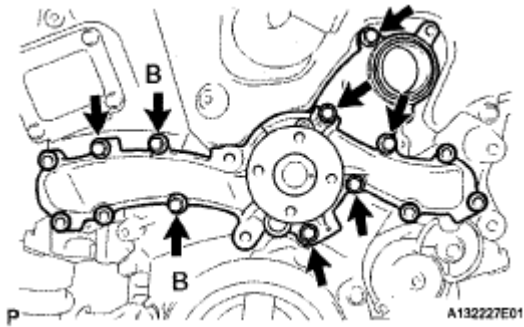


Fig. 410: Locating Water Pump Bolts

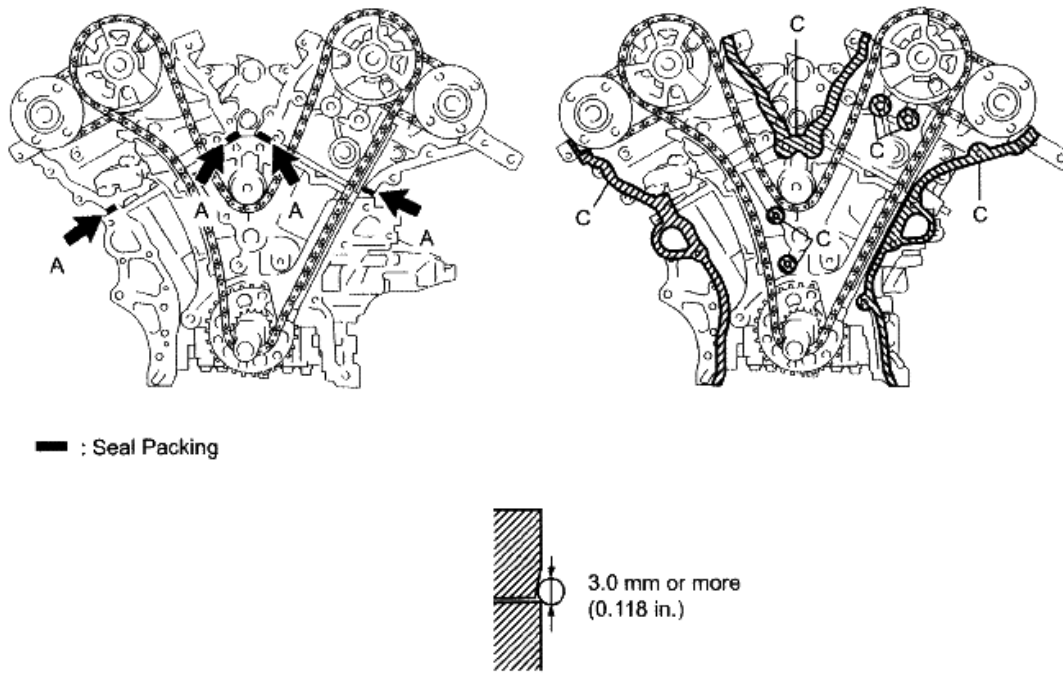
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

44. INSTALL TIMING CHAIN COVER SUB-ASSEMBLY

- a. Install a new gasket and the chain cover plate with the 4 bolts.

Torque: 9.1 N*m (93 kgf*cm, 81 in.*lbf)

- b. Apply seal packing in a continuous bead to the engine unit as shown in the following illustration.



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Fig. 411: Applying Seal Packing In Continuous Bead To Engine Unit
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Seal width: 3.0 mm or more (0.118 in.)

NOTE:

- Be sure to clean and degrease the contact surfaces, especially the areas indicated by C in the illustration.
 - When the contact surfaces are wet, degrease with cleaning agent and wipe off with an oil-free cloth before applying seal packing.
 - Install the crankcase within 3 minutes and tighten the bolts within 15 minutes after applying seal packing.
 - Do not start the engine for at least 2 hours after installation.
- c. Apply seal packing in a continuous bead to the timing chain cover as shown in the following illustration.

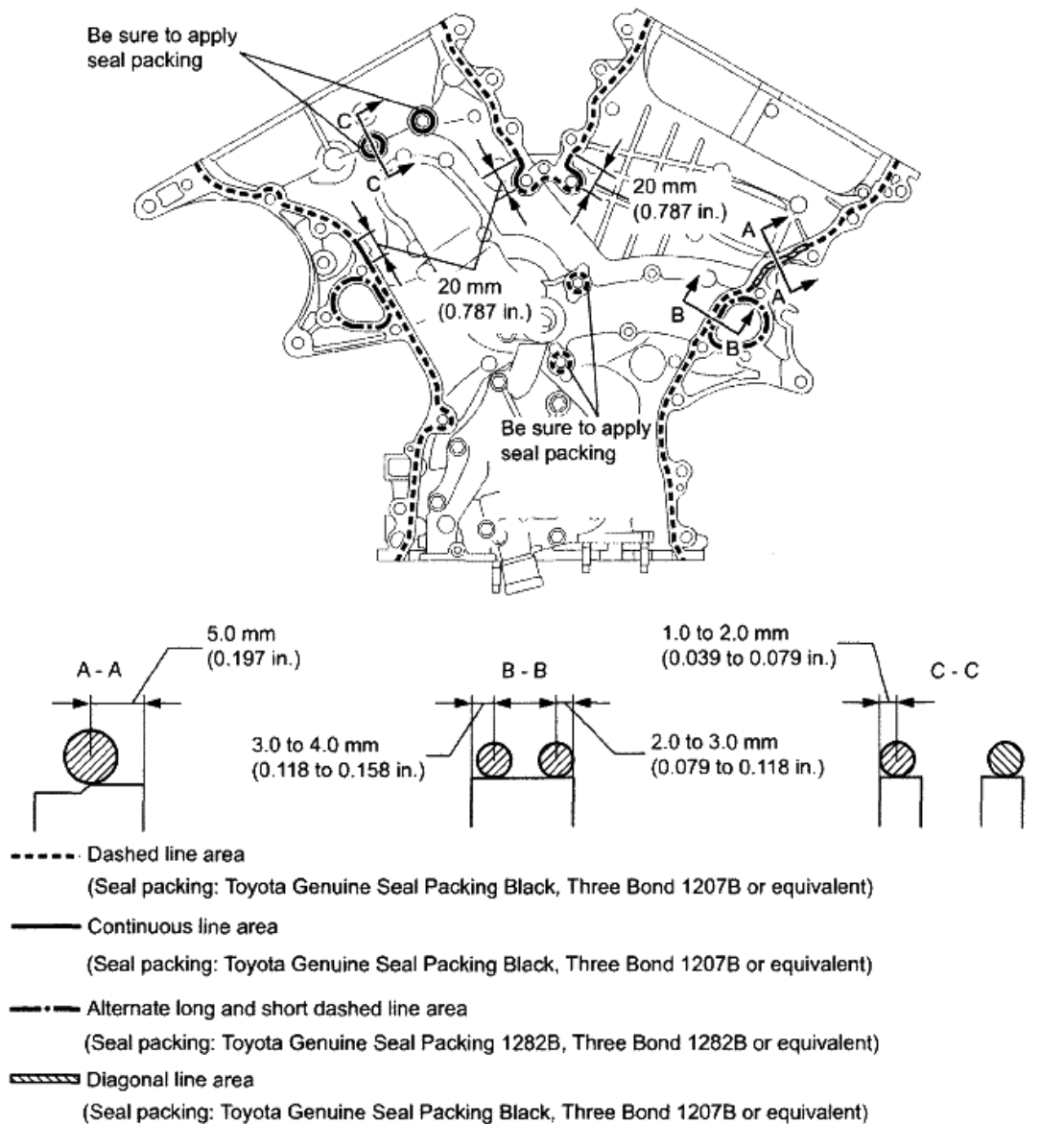


Fig. 412: Applying Seal Packing In Continuous Bead To Timing Chain Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Toyota Genuine Seal Packing Black 1282B, Three Bond 1282B or equivalent

NOTE:

- When the contact surfaces are wet, degrease with cleaning agent and wipe off with an oil-free cloth before applying seal packing.
- Install the crankcase within 3 minutes and tighten the bolts within 15 minutes after applying seal packing.
- Do not start the engine for at least 2 hours after installation.

HINT:

Apply seal packing referring to the table and illustration below.

SEAL PACKING DIAMETER SPECIFICATION

Area	Seal Packing Diameter	Application Position from Inside Seal Line
Dashed line area	3.5 mm or more (0.138 in.)	3.0 to 4.0 mm (0.118 to 0.158 in.)
Continuous line area	4.5 mm or more (0.177 in.)	3.0 to 4.0 mm (0.118 to 0.158 in.)
Alternate long and short dashed line area	3.5 mm or more (0.138 in.)	2.0 to 3.0 mm (0.079 to 0.118 in.)
Diagonal line area	6.0 mm or more (0.236 in.)	5.0 mm (0.197 in.)

- d. Install a new gasket.

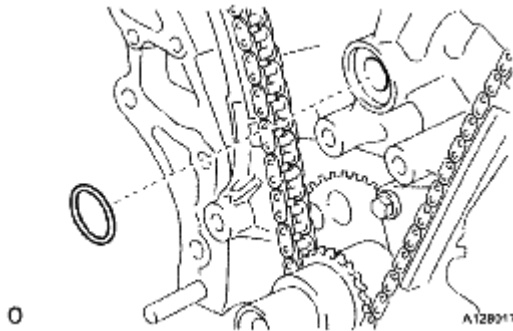


Fig. 413: Identifying Gasket

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

- e. Align the oil pump's drive rotor spline and the crankshaft as shown in the illustration. Install the spline and chain cover to the crankshaft.

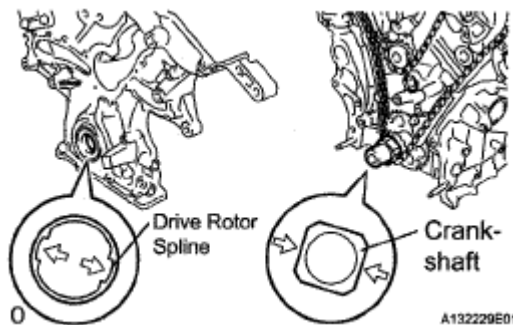


Fig. 414: Aligning Oil Pump's Drive Rotor Spline And Crankshaft

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

- f. Loosely install the timing chain cover with the 23 bolts and 2 nuts, but do not tighten the bolts and 2 nuts yet.

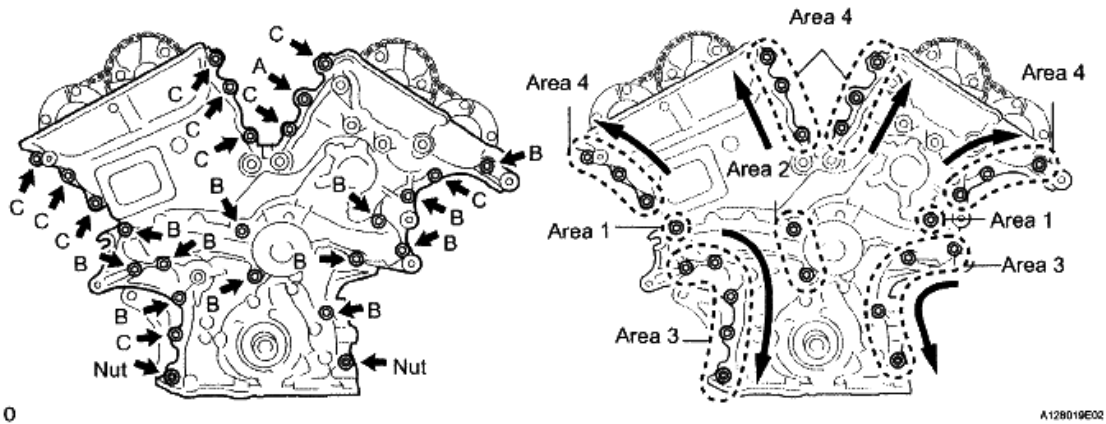


Fig. 415: Locating Timing Chain Cover With Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE: Make sure that there is no oil on the bolt threads.

HINT:

Bolt length

BOLT LENGTH SPECIFICATION

Item	Length
Bolt A	40 mm (1.57 in.)
Bolt B	55 mm (2.17 in.)
Bolt C	25 mm (0.98 in.)

- g. Fully tighten the bolts in this order: Area 1 and Area 2.

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

- h. Fully tighten the bolts and nuts in this order: Area 3.

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

- i. Fully tighten the bolts in this order: Area 4.

Torque: Bolt A

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

Bolts except A

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

45. INSTALL WATER INLET HOUSING

- a. Install 2 new O-rings.
- b. Apply soapy water to the O-ring.

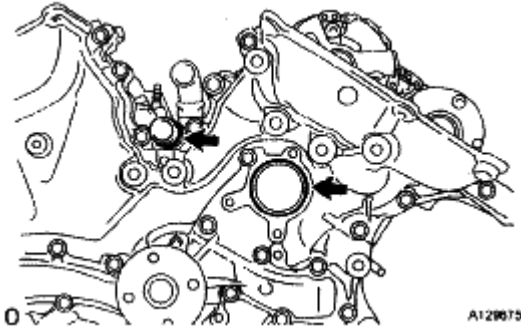


Fig. 416: Locating O-Rings

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

- c. Install the water inlet with the 2 bolts and nut.

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

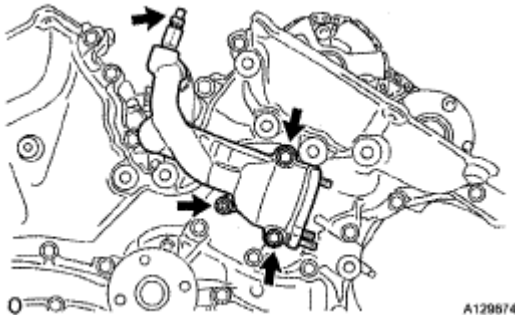


Fig. 417: Locating Water Inlet Housing Bolts And Nuts

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

- d. Apply adhesive around the drain cock.

Adhesive: Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

- e. Install the water drain cock to the water inlet housing.

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

- f. Install the water drain cock plug to the water drain cock.

Torque: 13 N*m (130 kgf*cm, 9 ft.*lbf)

- g. Install a new gasket to the thermostat.

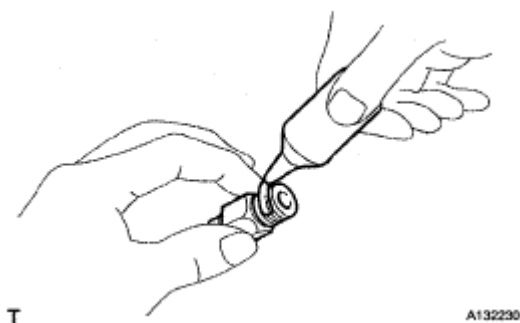


Fig. 418: Applying Adhesive Around Drain Cock
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- h. Align the thermostat jiggle valve with the upper stud bolt, and insert the thermostat in the water inlet housing.

HINT:

The jiggle valve may be set within 10° of either side of the prescribed position.

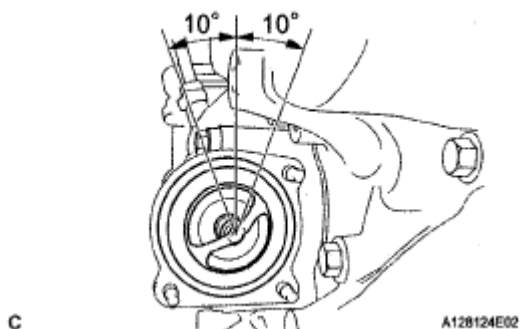


Fig. 419: Aligning Thermostat Jiggle Valve With Upper Stud Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- i. Install the water inlet with the 2 nuts.

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

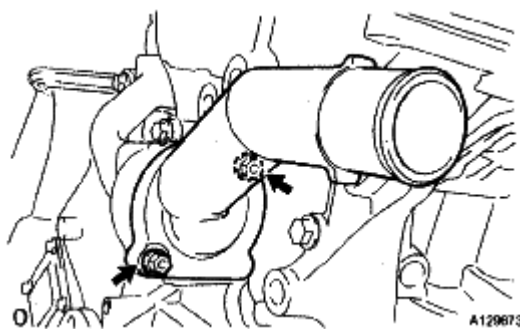


Fig. 420: Locating Water Inlet Housing Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

46. INSTALL ENGINE MOUNTING BRACKET FRONT NO. 1 LH

- a. Install the engine mounting bracket front No. 1 LH with the 6 bolts.

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

NOTE:

- Install the water inlet and mounting bracket within 15 minutes after installing the chain cover.

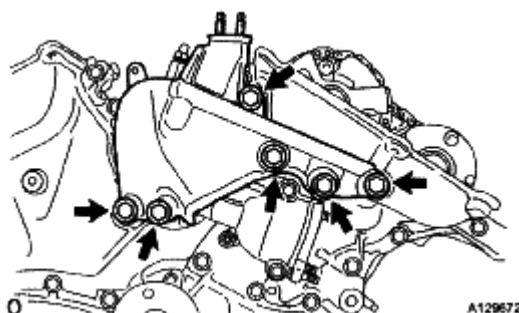


Fig. 421: Locating Engine Mounting Bracket Front No. 1 Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Do not start the engine for at least 2 hours after installation.

47. INSTALL OIL PAN BAFFLE PLATE NO.1

- a. Install the oil pan baffle plate with the 7 bolts.

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

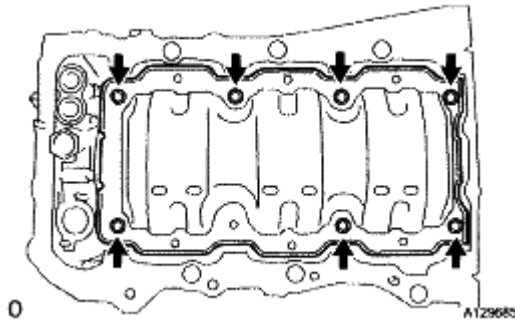


Fig. 422: Locating Oil Pan Baffle Plate Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

48. INSTALL OIL PAN SUB-ASSEMBLY

a. Install the stud bolt.

1. Using an E8 "TORX" socket wrench, install the stud bolts as shown in the illustration.

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

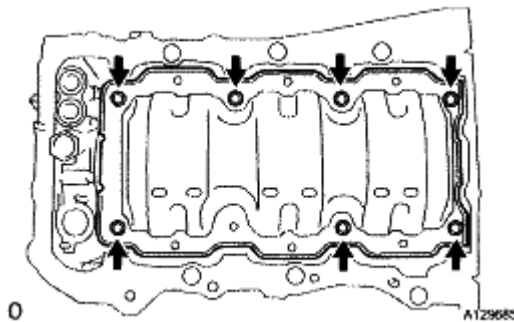


Fig. 423: Locating Oil Pan Baffle Plate Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

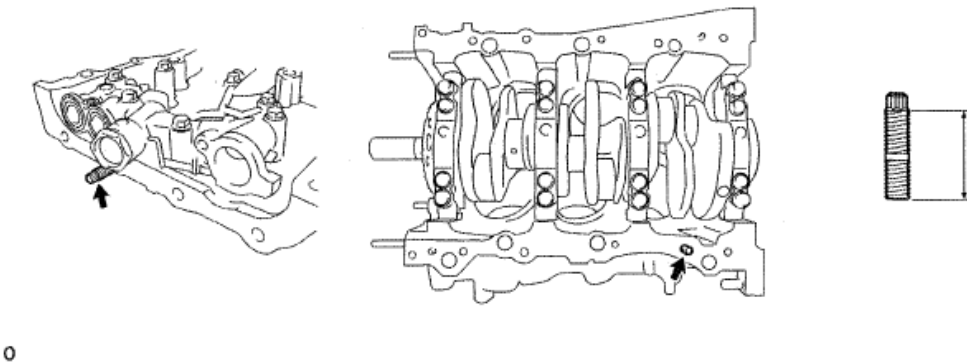


Fig. 424: Locating Stud Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Apply seal packing in a continuous bead as shown in the illustration.

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

Seal diameter: 3.0 to 4.0 mm (0.118 to 0.156 in.)

NOTE:

- **Remove any oil from the contact surface.**
- **Install the crankcase within 3 minutes after applying seal packing.**
- **Do not start the engine for at least 2 hours after installation.**

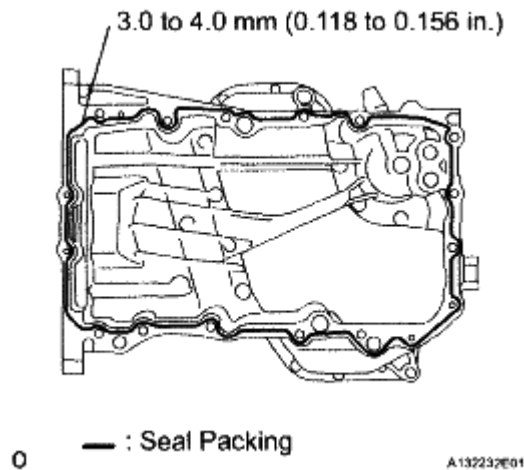


Fig. 425: Applying Seal Packing In Continuous Bead
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install 2 new O-rings.

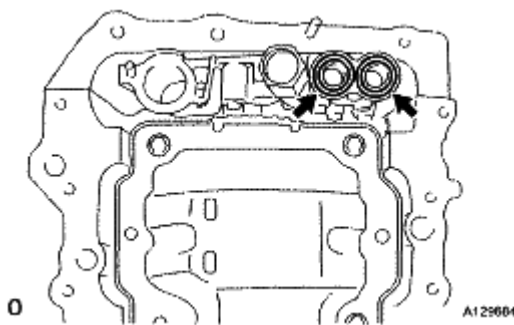


Fig. 426: Locating O-Rings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Install the oil pan with the 16 bolts and 2 nuts.

Torque: Bolt A

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

Bolts except A

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

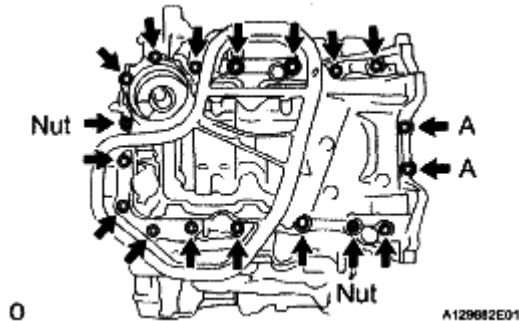


Fig. 427: Locating Oil Pan With Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

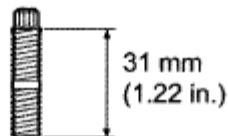
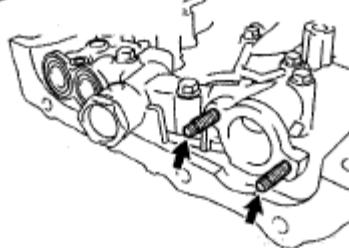
49. INSTALL OIL STRAINER SUB-ASSEMBLY

a. Install the stud bolt.

1. Using an E6 "TORX" socket wrench, install the stud bolts as shown in the illustration.

Torque: 4.0 N*m (41 kgf*cm, 35 in.*lbf)

Timing Chain Cover:



0

A132233E01

Fig. 428: Locating Stud Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

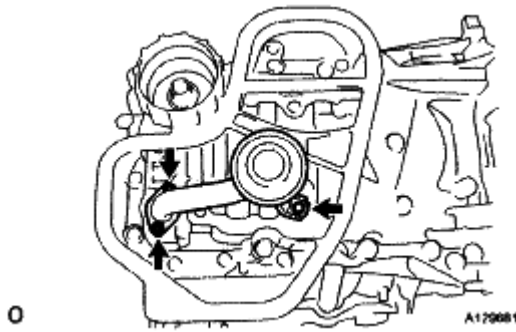


Fig. 429: Locating Oil Strainer Sub-Assembly Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

50. INSTALL OIL PAN SUB-ASSEMBLY NO. 2

- a. Apply seal packing in a continuous bead as shown in the illustration.

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

Seal diameter: 3.0 to 4.0 mm (0.118 to 0.156 in.)

NOTE:

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



Fig. 430: Applying Seal Packing In Continuous Bead
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the stud bolt.
 1. Using an E6 "TORX" socket wrench, install the stud bolts as shown in the illustration.

Torque: 4.0 N*m (41 kgf*cm, 35 in.*lbf)

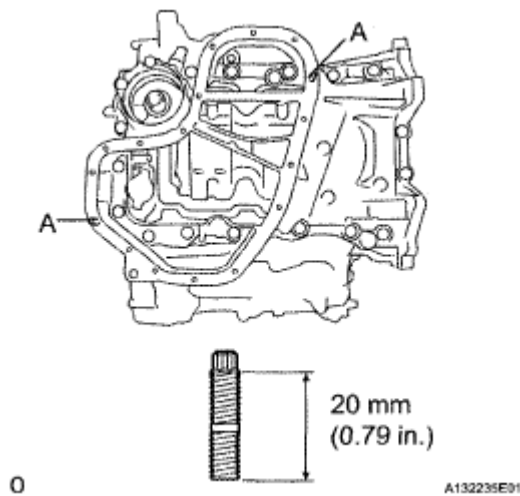


Fig. 431: Identifying Stud Bolt Dimension
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the oil pan No. 2 with the 16 bolts and 2 nuts.

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

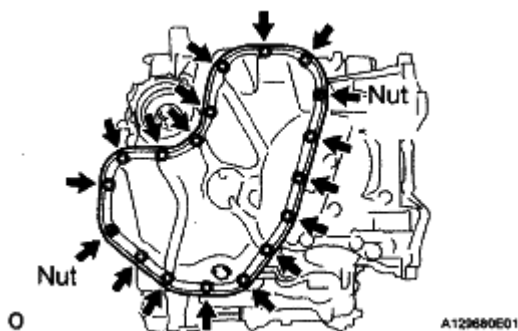


Fig. 432: Locating Oil Pan No. 2 With Bolts And Nuts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

51. INSTALL OIL PAN DRAIN PLUG

- a. Install a new gasket and the drain plug.

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

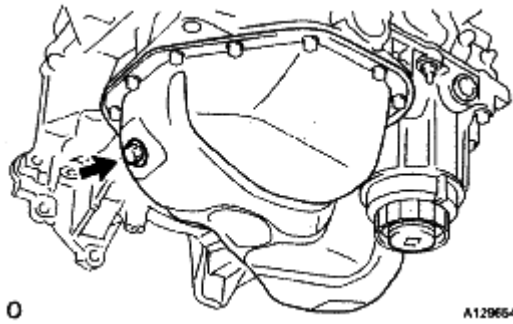


Fig. 433: Locating Drain Plug And Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

52. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY

- a. Apply seal packing as shown in the illustration.

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

NOTE:

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

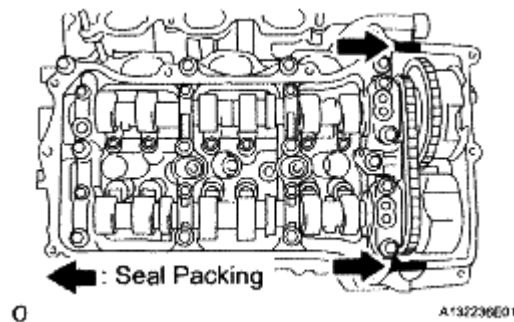


Fig. 434: Locating Gasket To Head Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the gasket to the head cover.
- c. Install the head cover with the 12 bolts.

Torque: Bolt A

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

Bolts except A

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

HINT:

Make sure the tightening torque of bolt 1.

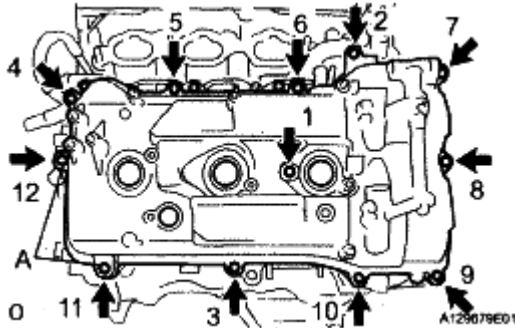


Fig. 435: Identifying Head Cover Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

53. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY LH

- a. Apply seal packing as shown in the illustration.

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

NOTE:

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

- b. Install the gasket to the head cover.

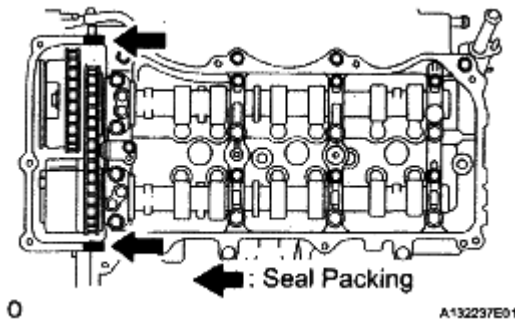


Fig. 436: Locating Gasket To Head Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the head cover with the 14 bolts.

Torque: Bolt A

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

Bolts except A

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

HINT:

Make sure the tightening torque of bolts 1 and 10.

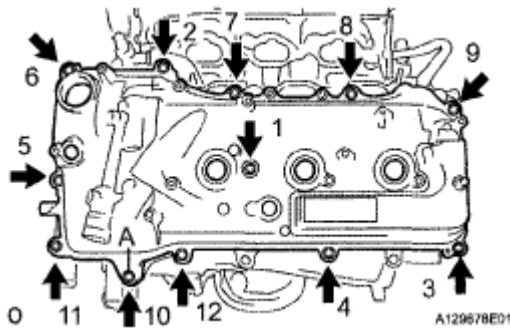


Fig. 437: Locating Head Cover With Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

54. INSTALL WATER OUTLET

- Install 2 new gaskets and a new O-ring.
- Apply soapy water to the O-ring.

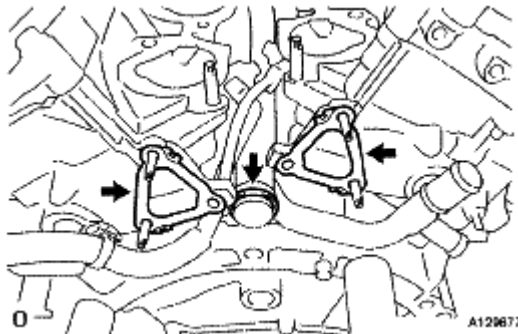


Fig. 438: Locating Gaskets And O-Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Install the water outlet with the 2 bolts and 4 nuts.

Torque: Bolts

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

Nuts

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

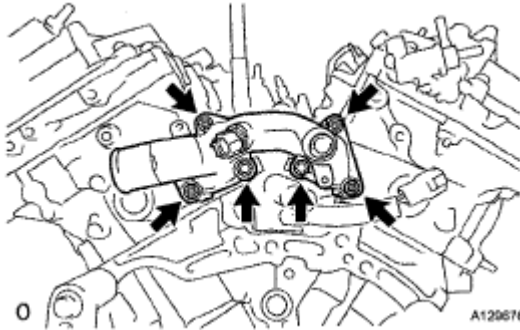


Fig. 439: Locating Water Outlet Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

55. INSTALL CRANKSHAFT PULLEY

- Align the pulley set key with the key groove of the pulley, and slide on the pulley.
- Using SST, install the pulley bolt.

SST 09213-70011 (09213-70020), 09330-00021

Torque: 250 N*m (2,550 kgf*cm, 184 ft.*lbf)

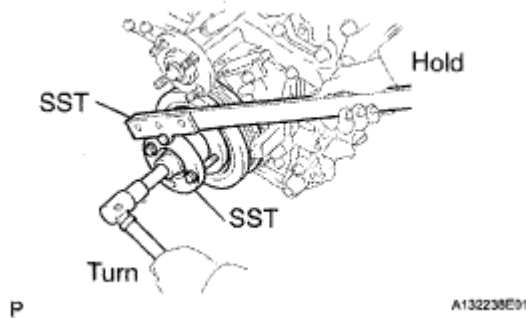


Fig. 440: Installing Pulley Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

56. INSTALL OIL FILTER ELEMENT

- Clean the inside of the oil filter cap, the threads and O-ring groove.
- Apply a small amount of engine oil to a new O-ring and install it to the oil filter cap.
- Set a new oil filter element to the oil filter cap.
- Remove dirt or foreign matter from the installation surface and inside of the engine.

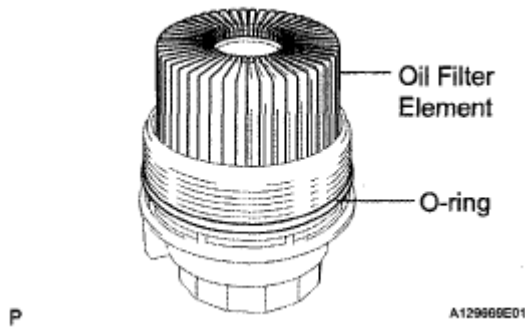


Fig. 441: Identifying Oil Filter Element And O-Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Apply a small amount of engine oil to the O-ring again and install the oil filter cap.

NOTE:

- Be careful that the O-ring does not get caught between the parts.
- The O-ring must not be twisted on the groove.

- f. Using SST, install the oil filter cap.

SST 09228-06501

Torque: 25 N*m (255 kgf*cm, 18 ft.*lbf)

NOTE:

Make sure that the oil filter is installed securely as shown in the illustration.

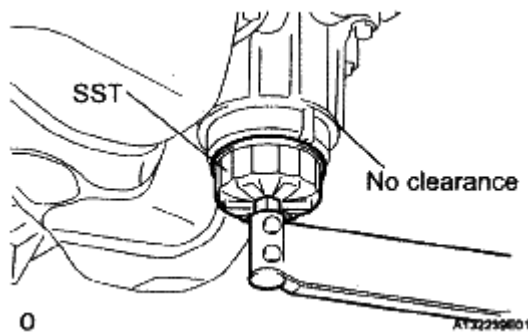


Fig. 442: Installing Oil Filter Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Apply a light coat of engine oil to a new O-ring and install it to the oil filter cap.

NOTE:

Remove all dirt and foreign matter from the installation surface.

- h. Install the oil filter drain plug to the oil filter cap.

Torque: 13 N*m (130 kgf*cm, 9 ft.*lbf)

NOTE: Make sure that the O-ring does not get caught between the parts.

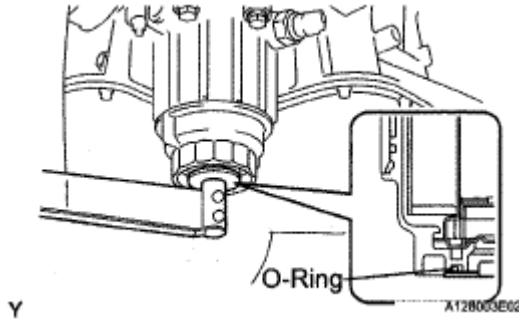


Fig. 443: Installing Oil Filter Drain Plug To Oil Filter Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

57. INSTALL CYLINDER BLOCK WATER DRAIN COCK SUB-ASSEMBLY

- a. Apply adhesive around the drain cocks.

Adhesive: Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

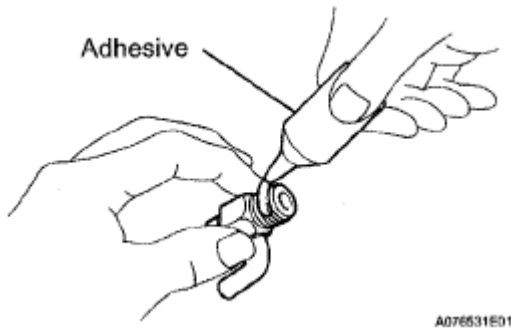


Fig. 444: Applying Adhesive Around Drain Cocks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the cylinder block water drain cocks as shown in the illustration.

Torque: 25 N*m (255 kgf*cm, 18 ft.*lbf)

NOTE:

- Do not rotate the drain cocks more than 1 revolution (360°) after tightening the drain cocks with the specified torque.
- Do not loosen the drain cocks after setting correctly.

- c. Install the water drain cock plug to the water drain cocks.

Torque: 13 N*m (130 kgf*cm, 9 ft.*lbf)

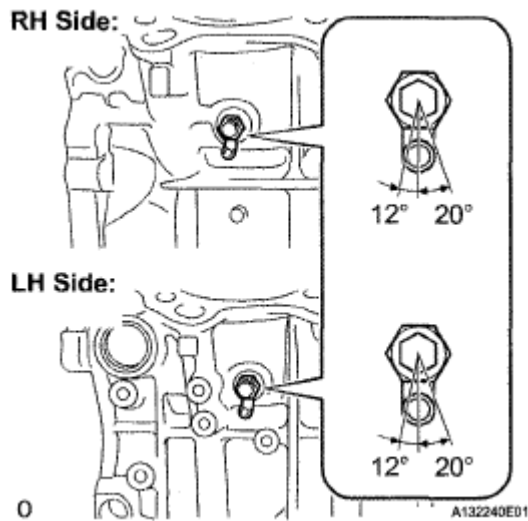


Fig. 445: Identifying Drain Cocks Rotating Angle
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

58. INSTALL OIL PIPE NO. 1

- Make sure that there is no foreign matter on the mesh of the oil control valve filter LH.
- Install the oil control valve filter LH to the oil pipe union. Install 2 new gaskets and temporarily install oil pipe No. 1 (on the head cover side) with the oil pipe union.
- Install a new gasket and temporarily install oil pipe No. 1 (on the cylinder head side) with the oil pipe union.

NOTE: Remove any oil from the contract surface.

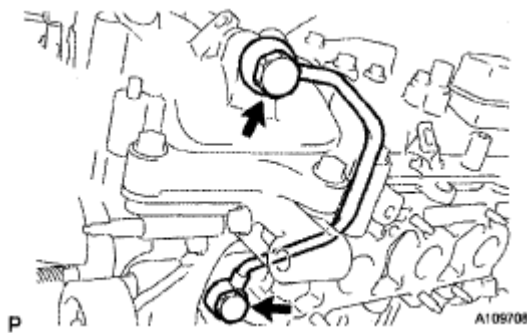


Fig. 446: Locating Oil Pipe Unions And Oil Pipe No. 1
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Tighten the oil pipe union (on the head cover side).

Torque: 65 N*m (662 kgf*cm, 48 ft.*lbf)

- Tighten the oil check valve bolt (on the cylinder head side).

Torque: 65 N*m (662 kgf*cm, 48 ft.*lbf)

59. INSTALL OIL PIPE

- a. Make sure that there is no foreign matter on the mesh of the oil control valve filter RH.
- b. Install the oil control valve filter RH to the oil pipe union. Install 2 new gaskets and temporarily install the oil pipe (on the head cover side) with the oil pipe union.

NOTE: Remove any oil from the contact surface.

- c. Install a new gasket and temporarily install the oil pipe (on the cylinder head side) with the oil pipe union.

NOTE: Remove any oil from the contact surface.

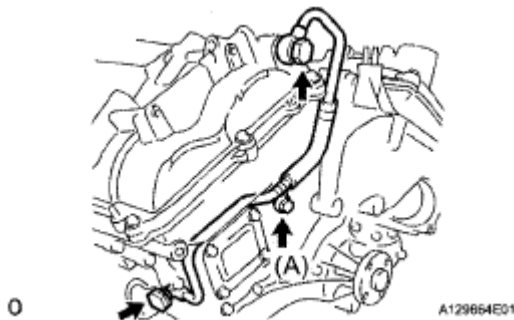


Fig. 447: Identifying Oil Pipe

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

- d. Install the bolt (A) to the cylinder head.

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

- e. Tighten the oil pipe union (on the head cover side).

Torque: 65 N*m (662 kgf*cm, 48 ft.*lbf)

- f. Tighten the oil pipe union (on the cylinder head side).

Torque: 65 N*m (662 kgf*cm, 48 ft.*lbf)

60. INSTALL CRANK POSITION SENSOR

- a. Install the crankshaft position sensor with the bolt.

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

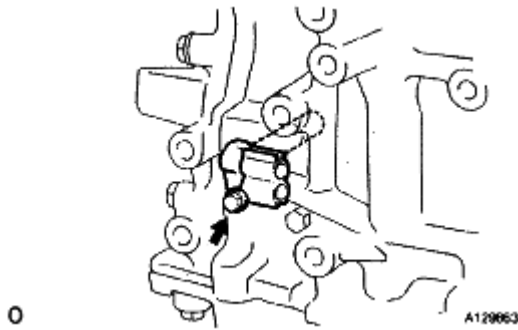


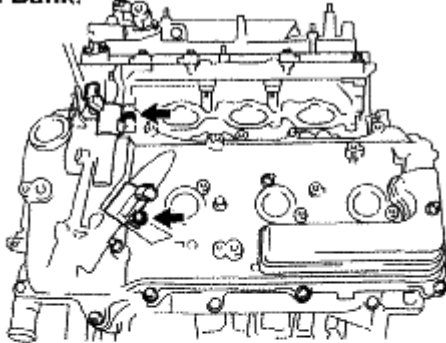
Fig. 448: Locating Crankshaft Position Sensor With Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

61. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

- a. Install the 4 camshaft timing oil control valves with the 4 bolts.

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

LH Bank:



RH Bank:

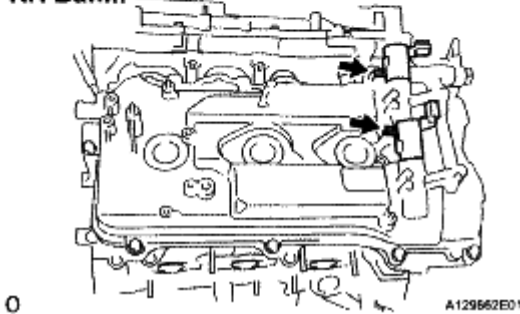


Fig. 449: Locating Camshaft Timing Oil Control Valves Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

62. INSTALL CAMSHAFT POSITION SENSOR

- a. Install the 4 camshaft position sensors with the 4 bolts.

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

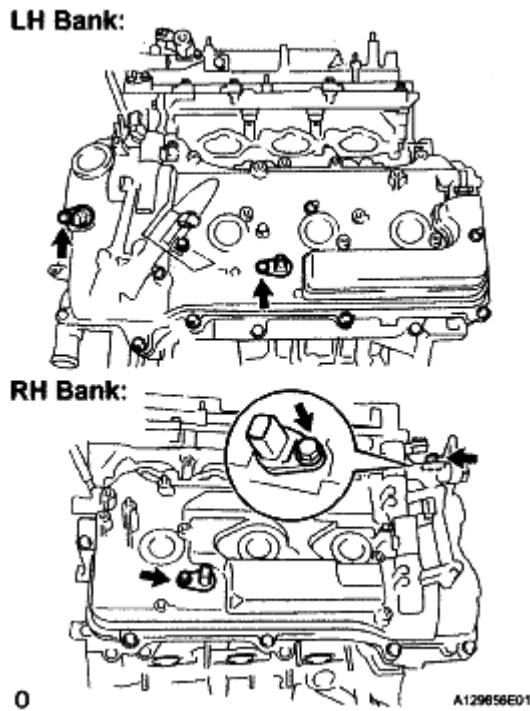


Fig. 450: Locating Camshaft Position Sensors Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

63. INSTALL VENTILATION VALVE SUB-ASSEMBLY

- a. Apply adhesive around the ventilation valve.

Adhesive: Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

- b. Install the ventilation valve sub-assembly.

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

64. INSTALL SPARK PLUG

- a. Install the 6 spark plugs.

Torque: 18 N*m (184 kgf*cm, 13 ft.*lbf)

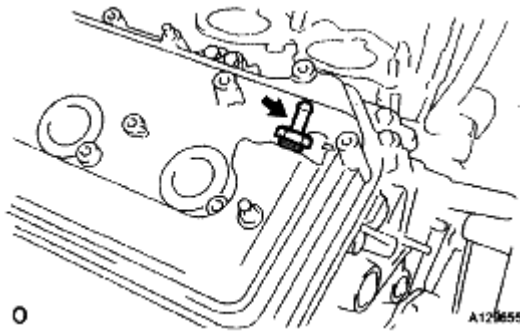


Fig. 451: Locating Ventilation Valve Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

65. INSTALL OIL FILLER CAP SUB-ASSEMBLY

- a. Install the oil filter cap sub-assembly.