

2009 ENGINE**Engine Mechanical (2TR-FE) - Tacoma****ENGINE****ON-VEHICLE INSPECTION**

1. **INSPECT ENGINE COOLANT** (See ON-VEHICLE INSPECTION)
2. **INSPECT ENGINE OIL**

(See LUBRICATION SYSTEM)

3. **INSPECT BATTERY** (See ON-VEHICLE INSPECTION)
4. **INSPECT AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY**

- a. Remove the air filter.
- b. Visually check that the air filter is not excessively damaged or oily. If necessary, replace the air filter.

5. **INSPECT SPARK PLUG**

(See ON-VEHICLE INSPECTION)

6. **INSPECT V-RIBBED BELT TENSIONER ASSEMBLY**

- a. Idle the engine and then stop the engine. Check that the drive belt is between the edges of the tensioner pulley.
- b. Remove the drive belt from the tensioner pulley.
- c. Turn the pulley, and check that the tensioner bearing moves smoothly and quietly.

If necessary, replace the tensioner.

7. **INSPECT VALVE LASH ADJUSTER NOISE**

- a. Rev up the engine several times. Check that the engine does not make any abnormal noises [*a]. If abnormal noises are heard, warm up the engine and idle it for more than 30 minutes. Then repeat step [*a].

HINT:

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

8. **INSPECT IGNITION TIMING**

- a. When using a Techstream:
 1. Warm up the engine.
 2. Turn the ignition switch OFF.

3. Connect the Techstream to the DLC3.
4. Turn the ignition switch ON (IG).
5. Turn the tester ON.
6. Enter the following menus:

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

Ignition timing:

3 to 7 BTDC (during idling)

NOTE: Turn all electrical systems OFF.

HINT:

Refer to the Techstream operator's manual for further information regarding the selection of Data List.

7. Check that the ignition timing advances immediately when engine speed is increased.
- b. When not using a Techstream:
1. Turn the ignition switch to ON.
 2. Start the engine and warm it up.
 3. Install the tester terminal of a timing light in the position shown in the illustration.

NOTE:

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

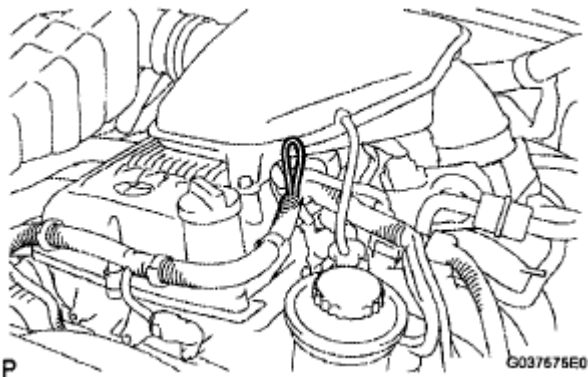


Fig. 1: Installing Tester Terminal Of Timing Light
Courtesy of ABLE BODY CORP.

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

SST 09843-18040

NOTE: Be careful not to connect the wrong terminals. It may damage the engine.

5. Check that the ignition timing is within the specification.

Ignition timing:

3 to 7° BTDC (during idling)

NOTE: Turn all electrical systems OFF.

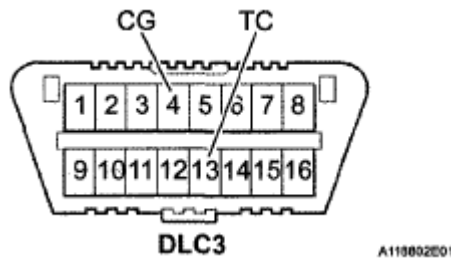


Fig. 2: Identifying Terminals (TC) And (CG) Of DLC3
Courtesy of ABLE BODY CORP.

9. INSPECT ENGINE IDLING SPEED

- a. When using a Techstream:
 1. Warm up the engine.
 2. Turn the ignition switch OFF.
 3. Connect the Techstream to the DLC3.
 4. Turn the ignition switch ON (IG).
 5. Turn the tester ON.
 6. Enter the following menus:

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

Idling speed:

600 to 700 rpm

NOTE:

- Turn all electrical system OFF.
- When checking the idling speed, the transmission is in the neutral position.

HINT:

Refer to the Techstream operator's manual for further information regarding the selection of Data List.

b. When not using a Techstream:

1. Turn the ignition switch ON.
2. Start the engine and warm it up.
3. Install SST onto terminal 9 (TAC) of the DLC3. Connect a tachometer, then measure the engine idling speed.

SST 09843-18030

Idling speed:

600 to 700 rpm

NOTE:

- Turn all electrical systems OFF.
- When checking the idling speed, the transmission should be in the neutral position.

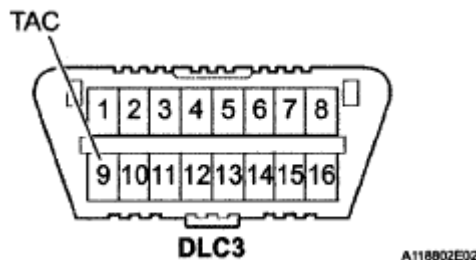


Fig. 3: Identifying Terminal (TAC) Of DLC3
Courtesy of ABLE BODY CORP.

10. INSPECT COMPRESSION

- a. Warm up the engine, then stop it.
- b. Remove the intake air connector.
- c. Remove the ignition coils.
- d. Remove the spark plugs.
- e. Disconnect the fuel injector connector.
- f. Inspect the compression.
 1. Insert a compression gauge into the plug hole.
 2. Crank the engine, then measure the compression pressure.

Compression pressure:

1230 kPa (12.5 kgf/cm² , 178 psi)

Minimum pressure:

880 kPa (9.0 kgf/cm² , 128 psi) or more

Difference between each cylinder:

68 kPa (0.7 kgf/cm² , 10 psi) or less

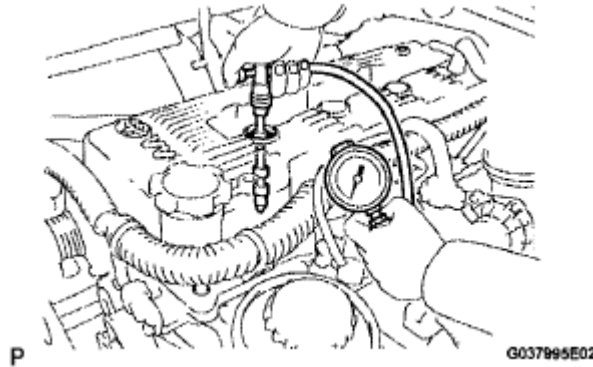


Fig. 4: Measuring Compression Pressure
Courtesy of ABLE BODY CORP.

NOTE:

- Use a fully-charged battery so the engine speed can be increased to 250 rpm or more.
- Inspect the other cylinders in the same way.
- Measure the compression pressure in as short a time as possible.

3. If the compression pressure is low, pour a small amount of engine oil into the cylinder block, then measure it again.

HINT:

- If the compression pressure increases after adding the engine oil, the piston rings may be worn.
- If the compression pressure does not charge after pouring engine oil, defects may be occurring around the valves.

11. INSPECT CO/HC

HINT:

This inspection is for checking whether the CO/HC concentration in the emission gas while idling complies with the regulations.

- a. Start the engine.

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

HINT:

When performing the 2 mode (2,500 rpm and idle) test, follow the applicable local regulations. If the CO/HC concentration does not comply with the regulations, troubleshoot in the order given below.

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

PROBLEMS CHART

CO	HC	Problems	Causes
Normal	High	Rough idling	1. Faulty ignition: ○ Incorrect timing ○ Fouled, shorted or improperly gapped plugs 2. Incorrect valve clearance 3. Leakage in intake and exhaust valves 4. Leakage in cylinders
Low	High	Rough idling (Fluctuation HC reading)	1. Vacuum leakage: ○ PCV hoses ○ Intake manifold ○ Throttle body ○ Brake booster line 2. Lean mixture causing misfire
High	High	Rough idling (Black smoke from exhaust)	1. Restricted air filter 2. Plugged PCV valve 3. Faulty SFI systems: ○ Faulty pressure regulator ○ Faulty engine coolant temperature sensor ○ Faulty mass air flow meter ○ Faulty ECM ○ Faulty injectors ○ Faulty throttle body

DRIVE BELT

ON-VEHICLE INSPECTION

1. INSPECT FAN AND GENERATOR V BELT

- a. Visually check the belt for excessive wear, frayed cords, etc.
 - If any defects are found, replace the V-ribbed belt.
 - Cracks on the rib side of the belt are considered acceptable. If the belt has chunks missing from the ribs, it should be replaced.

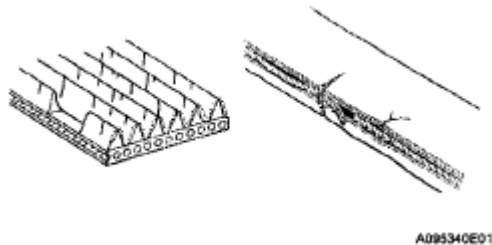


Fig. 5: Identifying Defect Belts
Courtesy of ABLE BODY CORP.

- b. Check that the tensioner indicator mark is within range A shown in the illustration. If the mark is not within range A, replace the V belt.

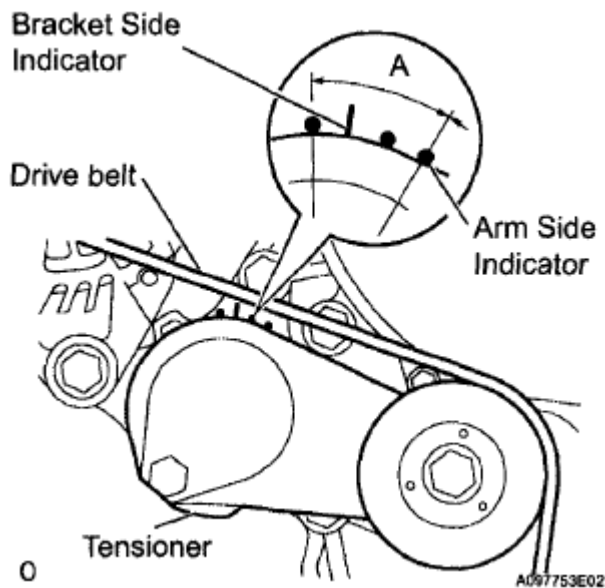


Fig. 6: Identifying Tensioner Indicator Mark
Courtesy of ABLE BODY CORP.

REMOVAL

1. REMOVE FAN AND GENERATOR V BELT

- a. Turning the hexagonal bolt on the V-ribbed belt tensioner clockwise, loosen and then remove the V belt.

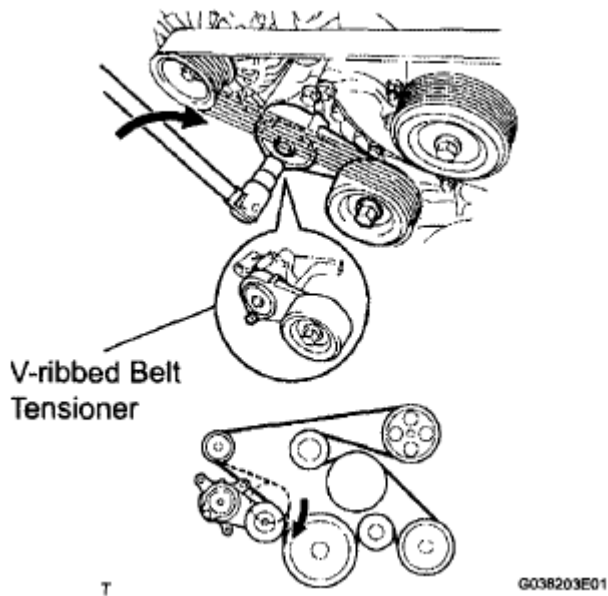


Fig. 7: Removing V Belt
Courtesy of ABLE BODY CORP.

INSTALLATION**1. INSTALL FAN AND GENERATOR V BELT**

- a. Provisionally install the V belt onto each pulley.

NOTE: Install the V belt onto each pulley and finally install the V belt onto the V-ribbed belt tensioner.

- b. Turn the hexagonal bolt on the V-ribbed belt tensioner clockwise and install the V belt onto the V-ribbed belt tensioner pulley.

2. INSPECT FAN AND GENERATOR V BELT (See ON-VEHICLE INSPECTION)

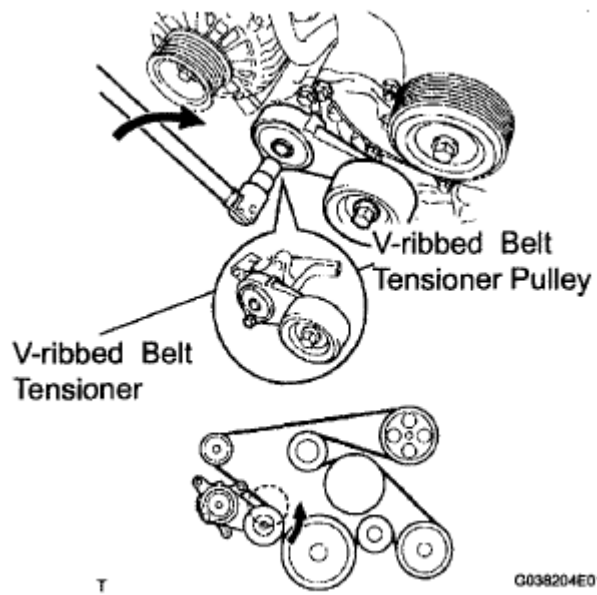


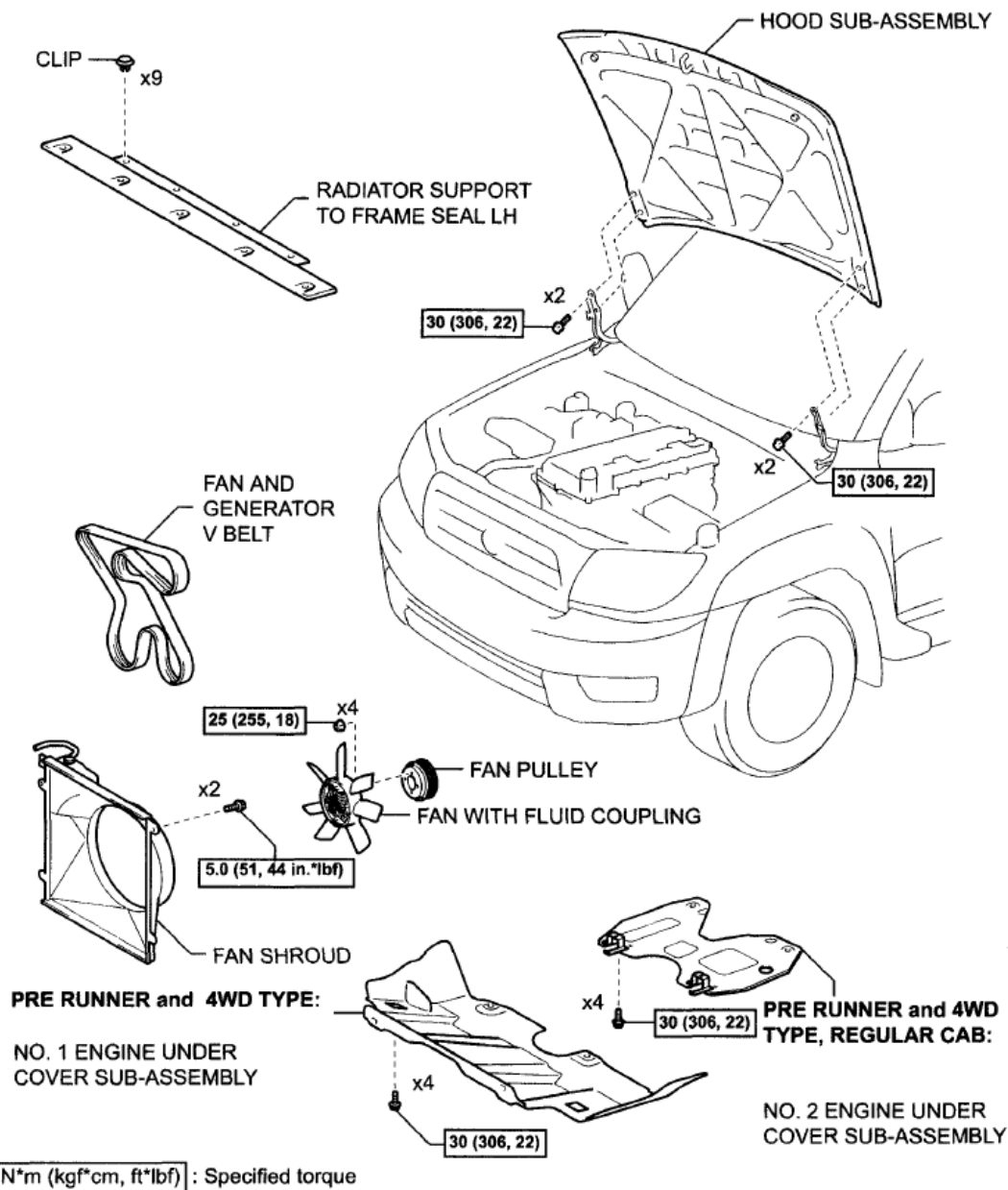
Fig. 8: Installing V Belt Onto Pulley
Courtesy of ABLE BODY CORP.

TIMING CHAIN

COMPONENTS

2009 Toyota Tacoma PreRunner

2009 ENGINE Engine Mechanical (2TR-FE) - Tacoma

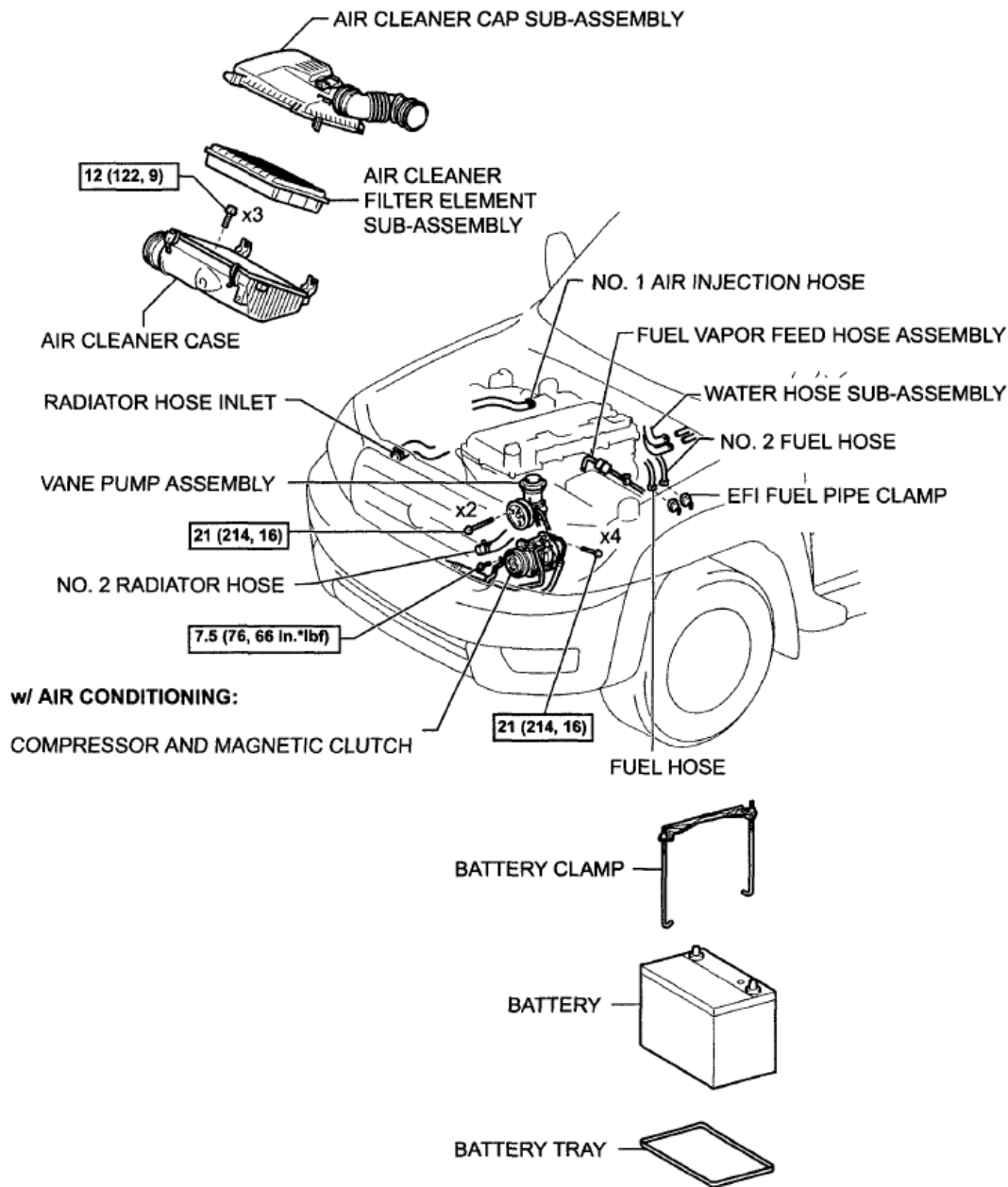


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Fig. 9: Exploded View Of Timing Chain Components & Torque Specification (1 Of 14)
Courtesy of ABLE BODY CORP.

2009 Toyota Tacoma PreRunner

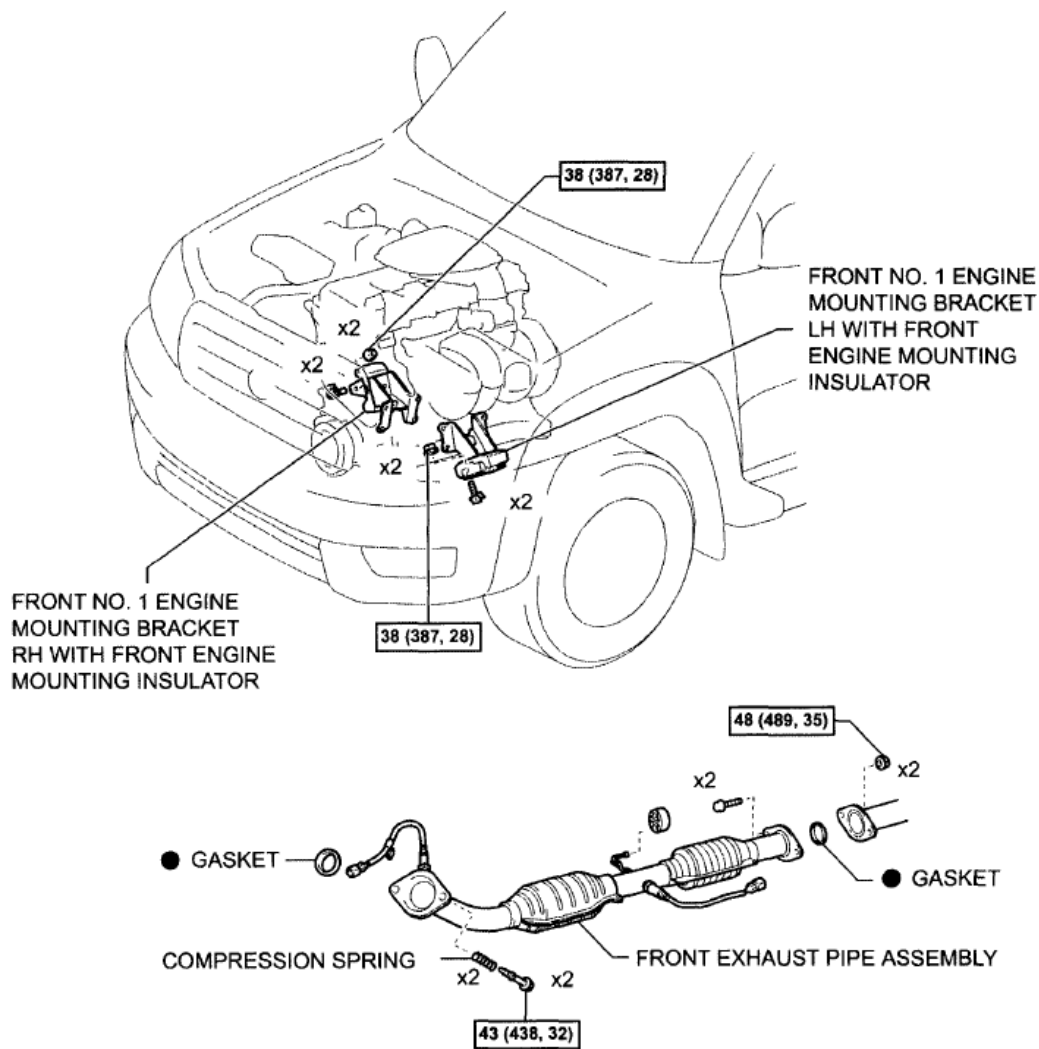
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N*m (kgf*cm, ft*lbf) : Specified torque

A113642E01

Fig. 10: Exploded View Of Timing Chain Components & Torque Specification (2 Of 14)
Courtesy of ABLE BODY CORP.



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

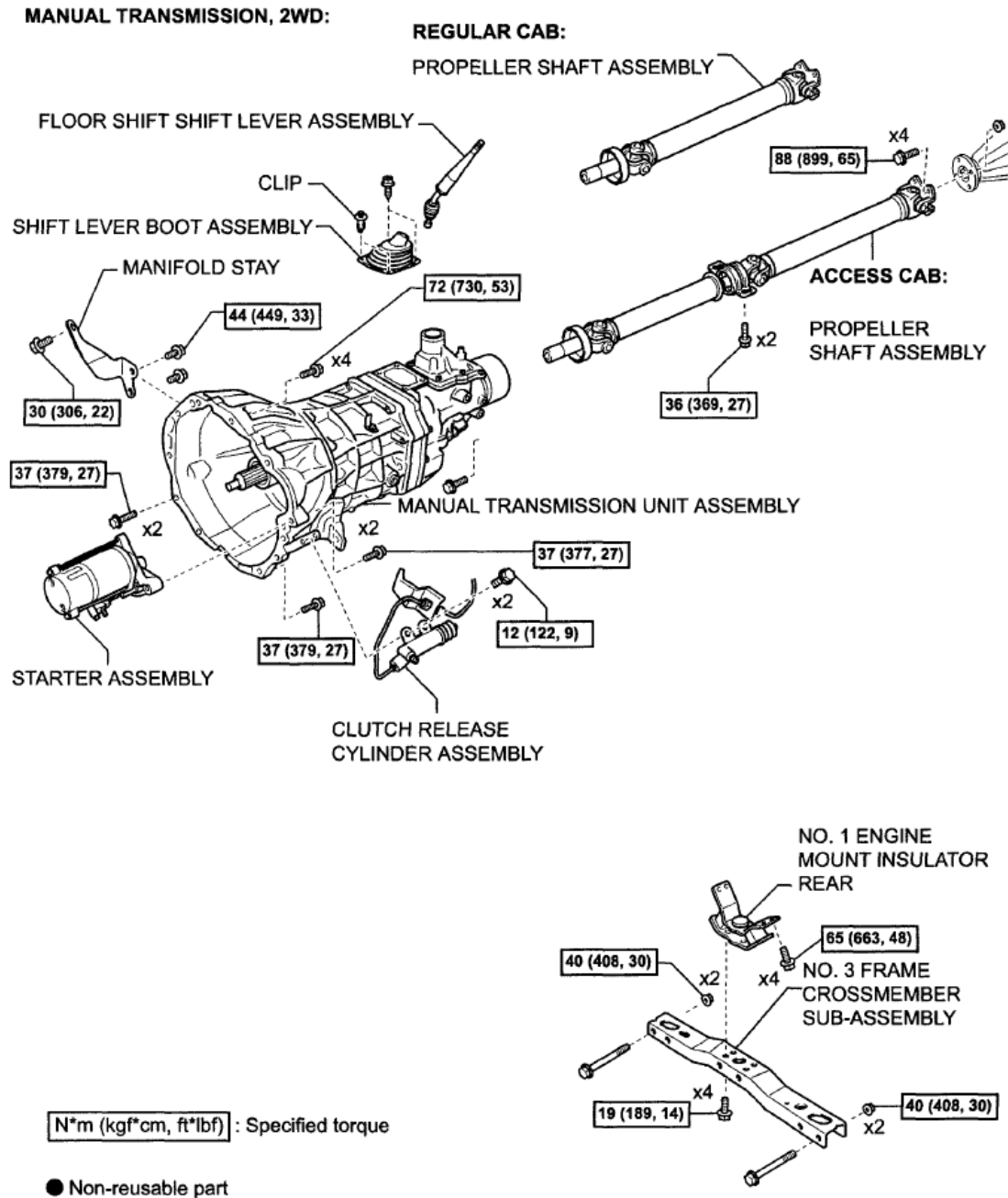
● Non-reusable part

A113643E01

Fig. 11: Exploded View Of Timing Chain Components & Torque Specification (3 Of 14)
Courtesy of ABLE BODY CORP.

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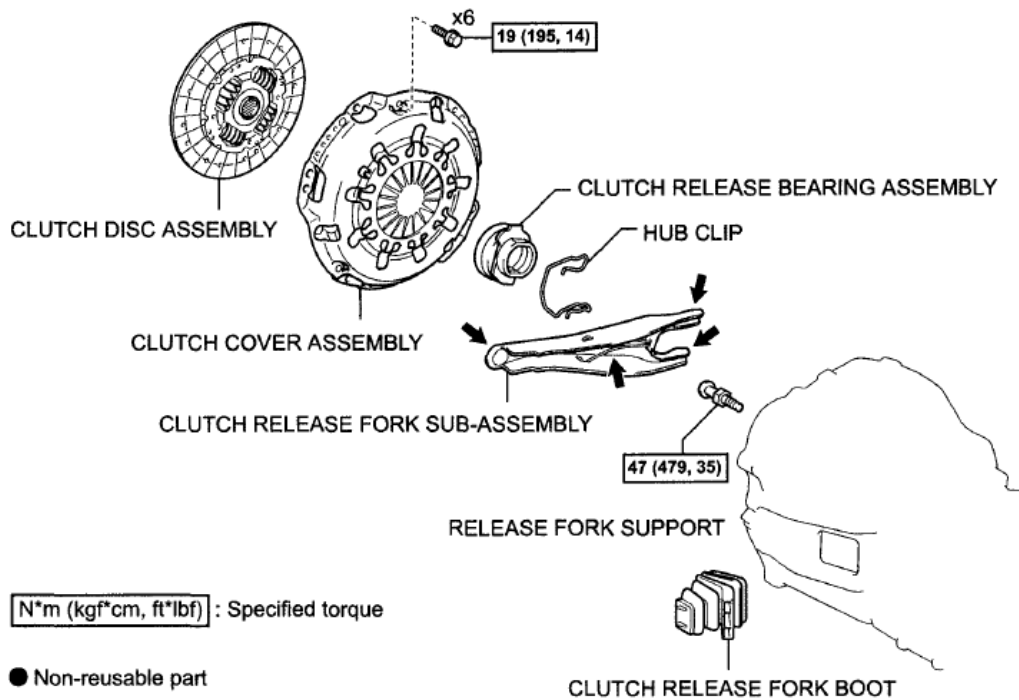


Y

A113649E01

Fig. 12: Exploded View Of Timing Chain Components & Torque Specification (4 Of 14)
Courtesy of ABLE BODY CORP.

MANUAL TRANSMISSION:



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Fig. 14: Exploded View Of Timing Chain Components & Torque Specification (6 Of 14)
 Courtesy of ABLE BODY CORP.

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AUTOMATIC TRANSMISSION:

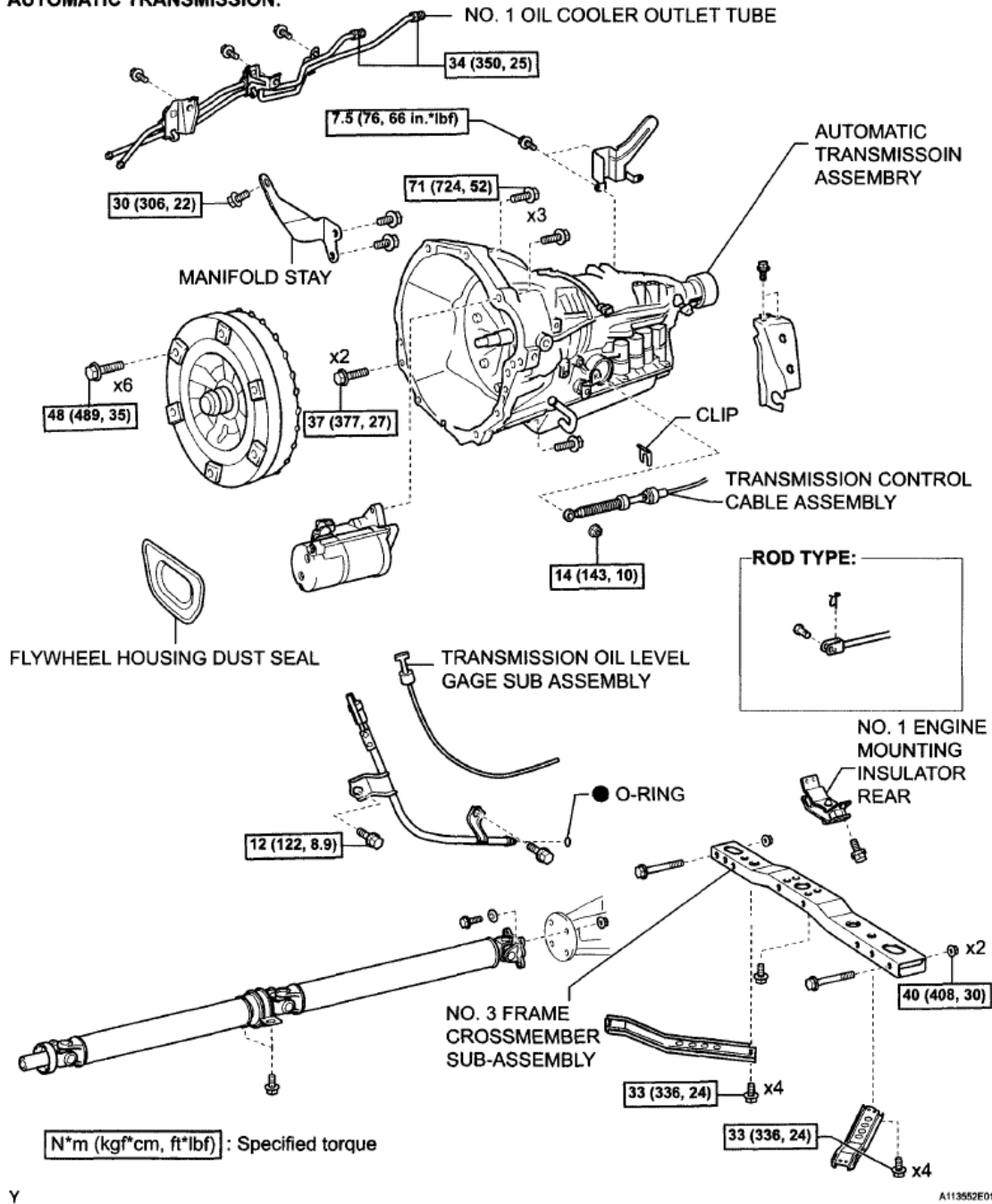
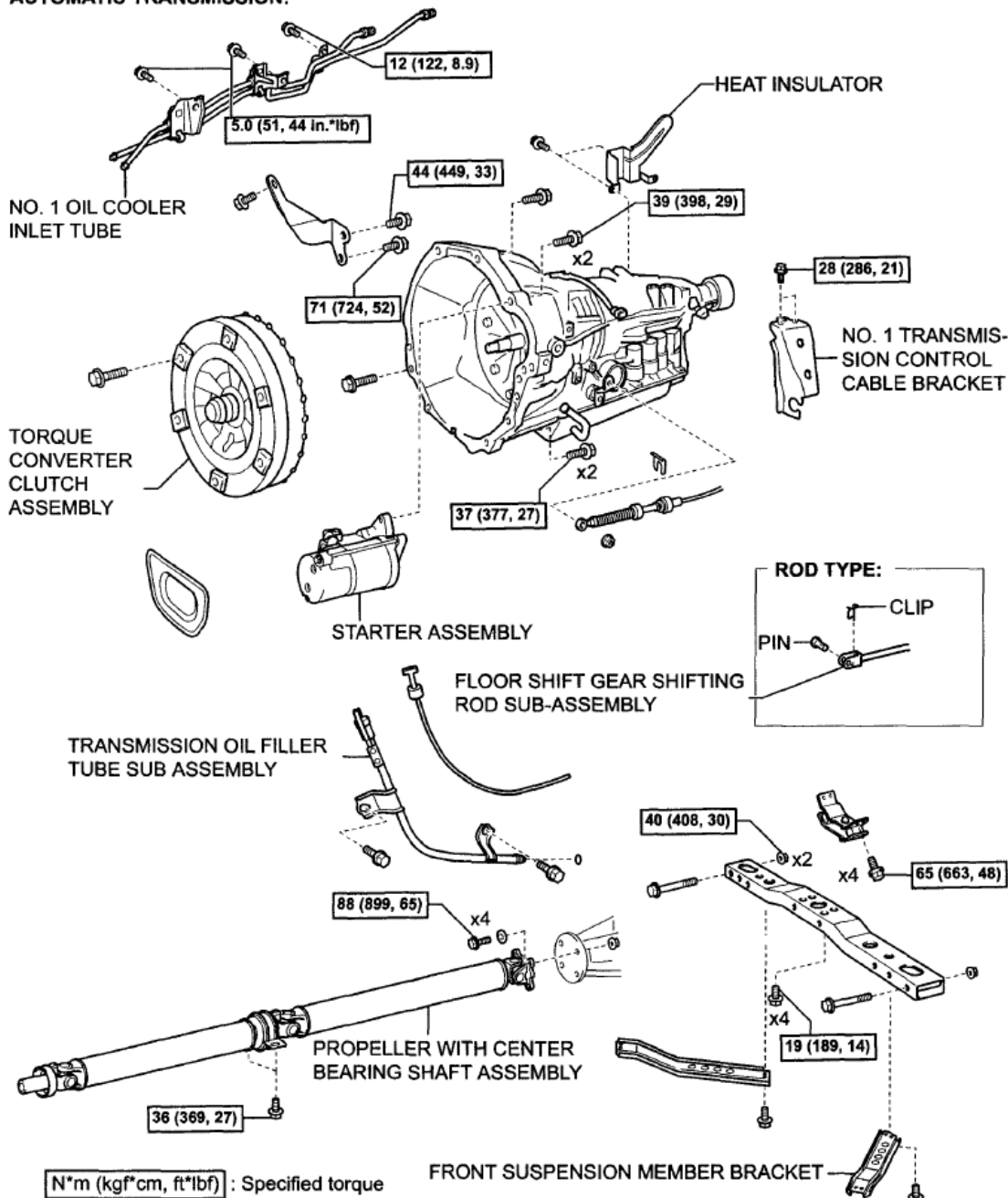


Fig. 15: Exploded View Of Timing Chain Components & Torque Specification (7 Of 14)
Courtesy of ABLE BODY CORP.

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2009 ENGINE Engine Mechanical (2TR-FE) - Tacoma

AUTOMATIC TRANSMISSION:



A113552E02

Fig. 16: Exploded View Of Timing Chain Components & Torque Specification (8 Of 14)
Courtesy of ABLE BODY CORP.

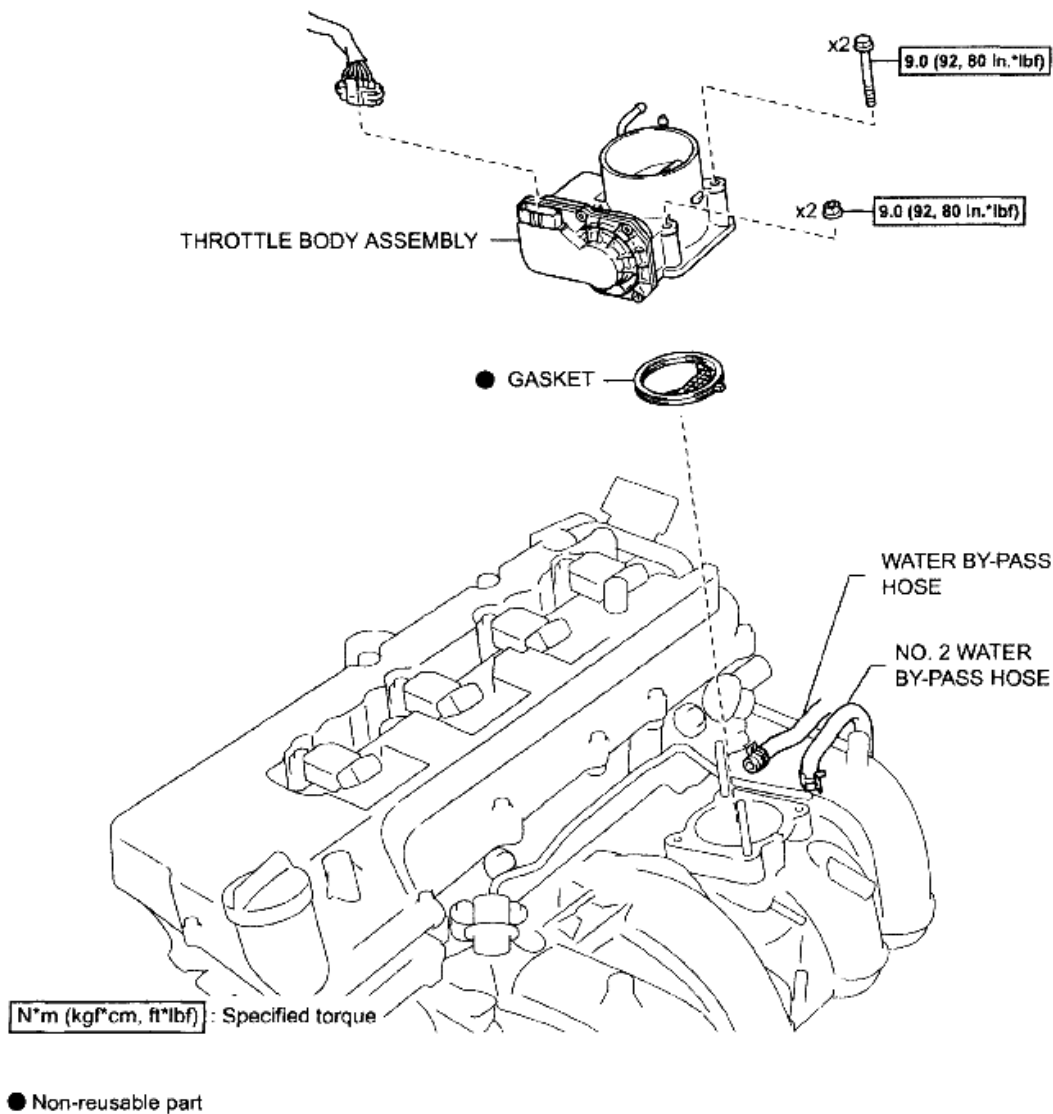
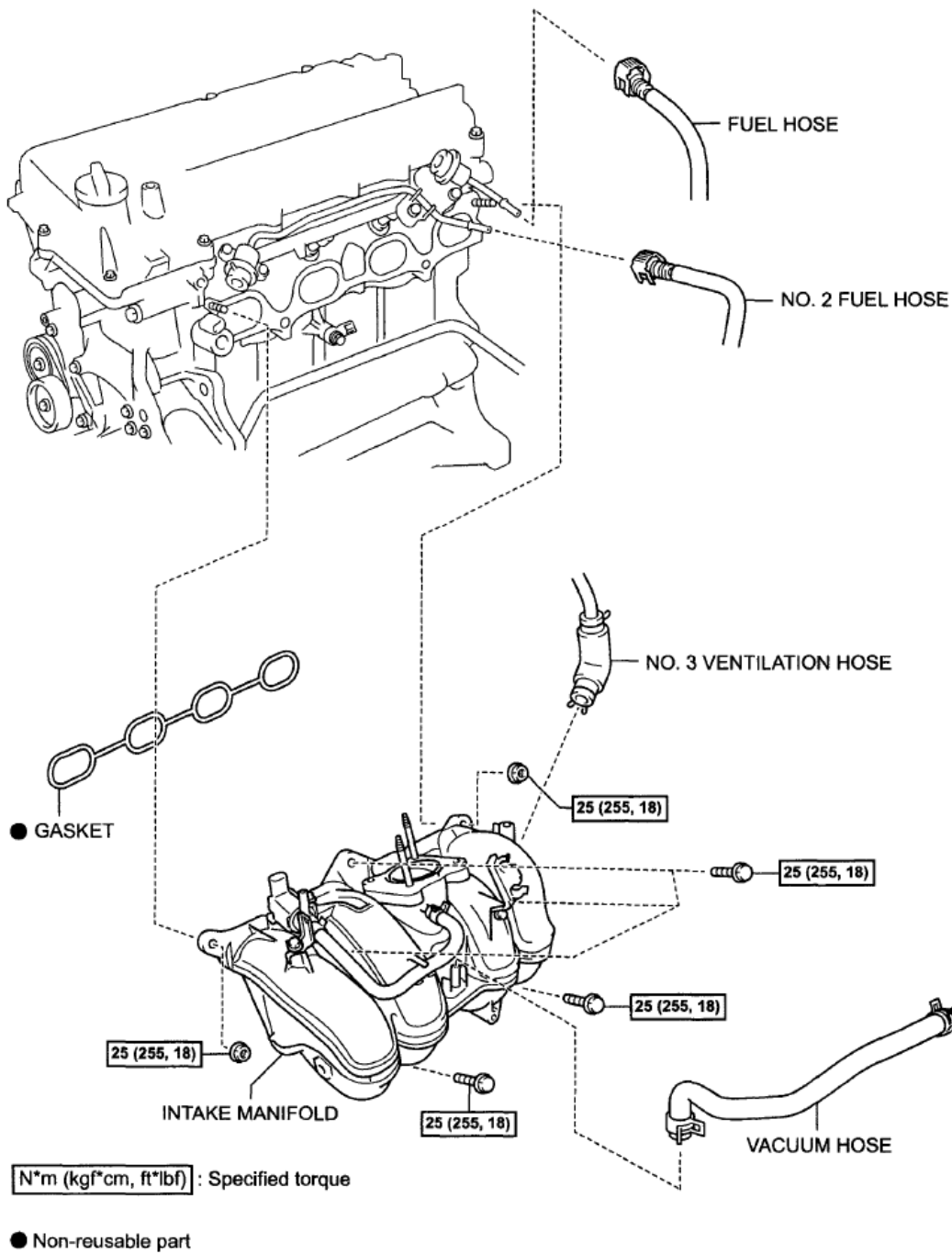
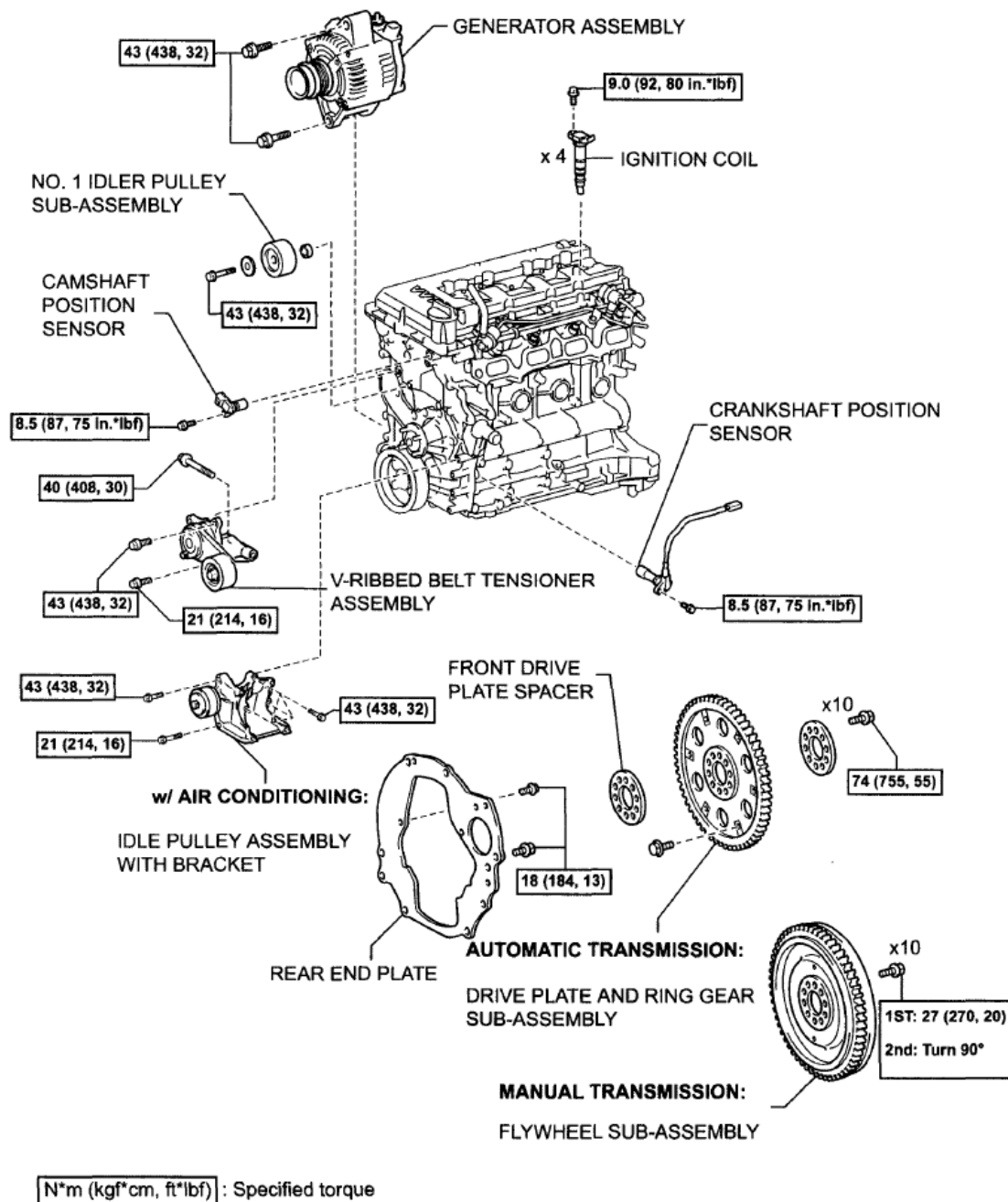


Fig. 17: Exploded View Of Timing Chain Components & Torque Specification (9 Of 14)
 Courtesy of ABLE BODY CORP.



A113644E01

Fig. 18: Exploded View Of Timing Chain Components & Torque Specification (10 Of 14)
Courtesy of ABLE BODY CORP.



A154175E01

Fig. 19: Exploded View Of Timing Chain Components & Torque Specification (11 Of 14)
 Courtesy of ABLE BODY CORP.

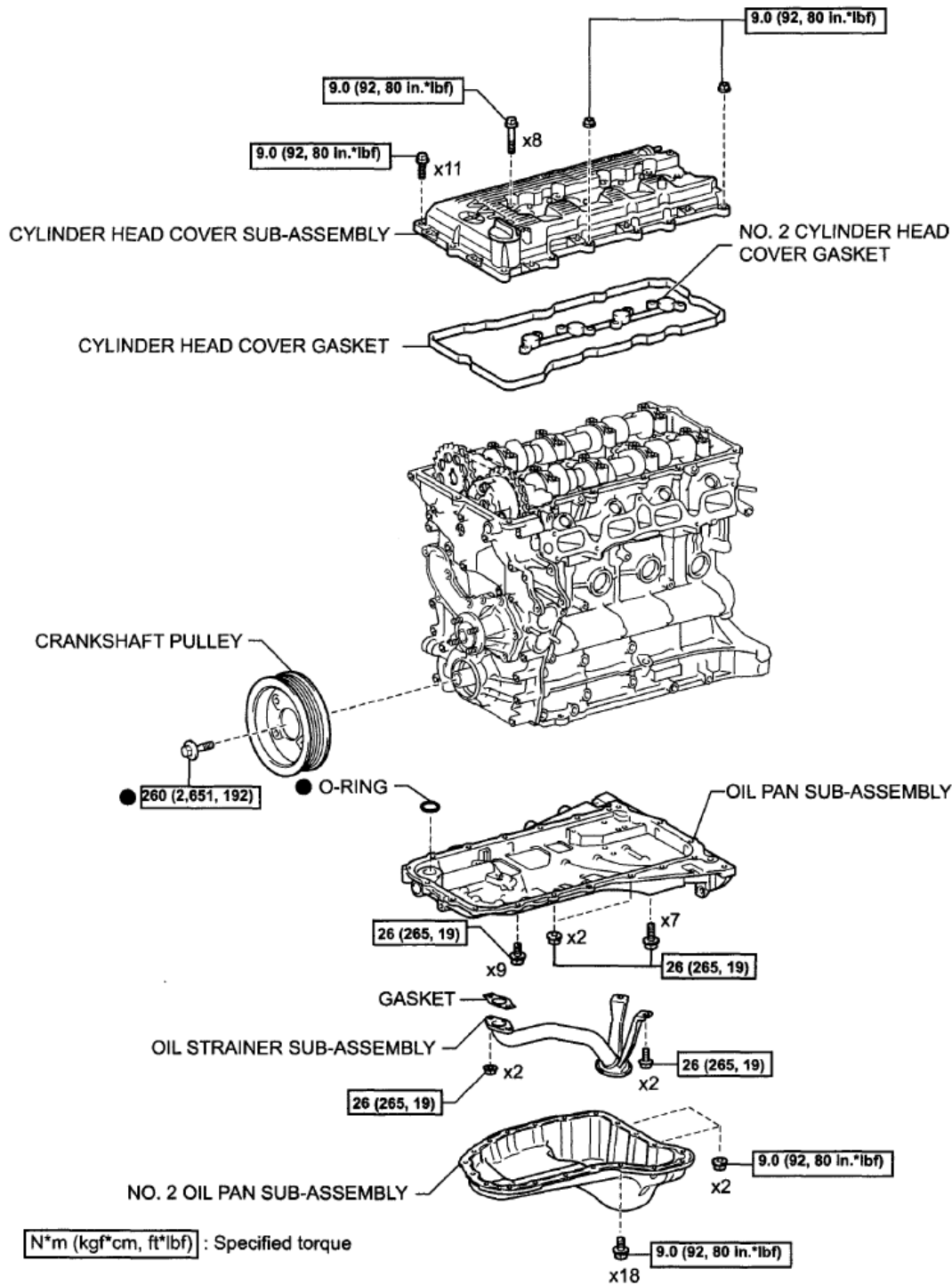
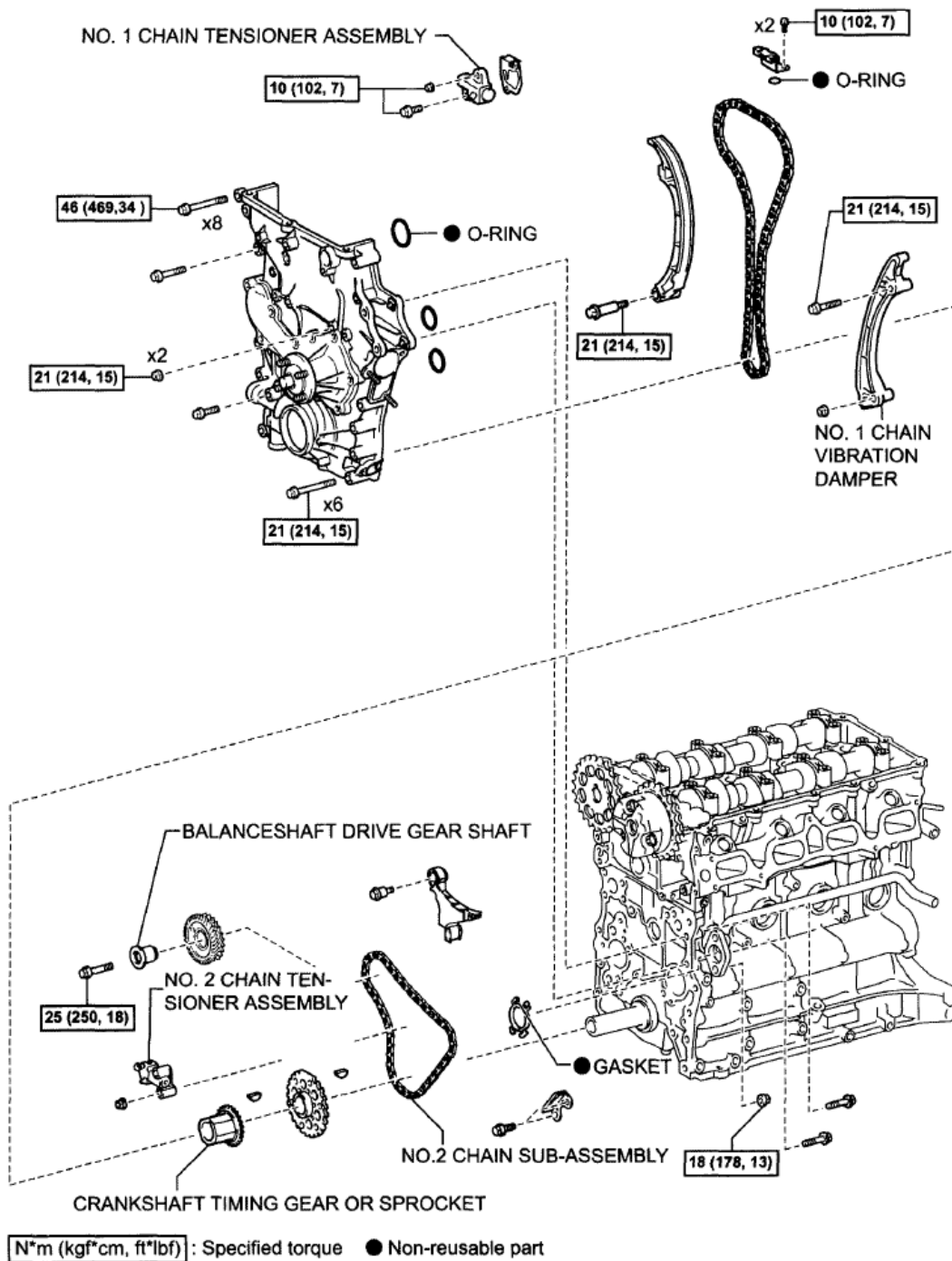


Fig. 20: Exploded View Of Timing Chain Components & Torque Specification (12 Of 14)
 Courtesy of ABLE BODY CORP.



A113634E01

Fig. 21: Exploded View Of Timing Chain Components & Torque Specification (13 Of 14)
Courtesy of ABLE BODY CORP.

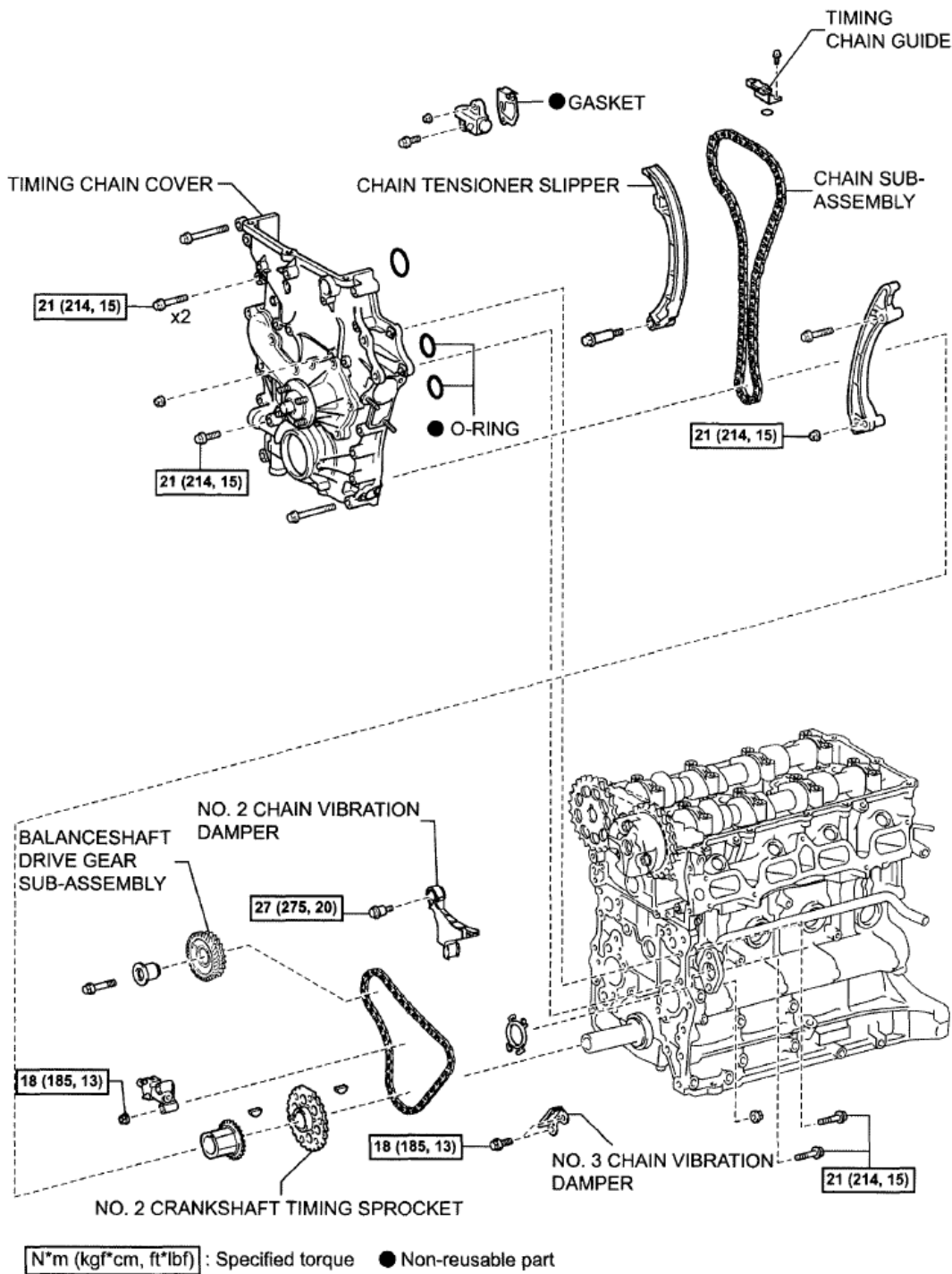


Fig. 22: Exploded View Of Timing Chain Components & Torque Specification (14 Of 14)
Courtesy of ABLE BODY CORP.

REMOVAL

1. REMOVE HOOD SUB-ASSEMBLY

2. DISCHARGE FUEL SYSTEM PRESSURE

(See **FUEL SYSTEM**)

3. **REMOVE NO. 1 ENGINE UNDER COVER SUB-ASSEMBLY (for 4WD and Pre-Runner)**
 - a. Remove the 4 bolts, then remove the No. 1 engine under cover.
4. **REMOVE NO. 2 ENGINE UNDER COVER SUB-ASSEMBLY (for 4WD and Pre-Runner, Regular Cab)**
 - a. Remove the 4 bolts, then remove the No. 2 engine under cover.
5. **DRAIN ENGINE OIL** (See **OIL FILTER**)
6. **DRAIN ENGINE COOLANT** (See **COOLANT**)
7. **REMOVE BATTERY**
8. **REMOVE BATTERY TRAY**
9. **REMOVE RADIATOR SUPPORT TO FRAME SEAL LH** (See **ON-VEHICLE CLEANING**)
10. **REMOVE FAN SHROUD** (See **REMOVAL**)
11. **REMOVE AIR CLEANER CAP SUB-ASSEMBLY** (See **AIR SWITCHING VALVE**)
12. **REMOVE AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY**
13. **REMOVE AIR CLEANER CASE**
 - a. Remove the 3 bolts, then remove the air cleaner case.
14. **SEPARATE VANE PUMP ASSEMBLY**
 - a. Disconnect the vane pump connector.
 - b. Remove the 2 bolts, then separate the vane pump.

HINT:

Do not disconnect the hose. Hang the vane pump with a rope.

15. REMOVE NO. 2 RADIATOR HOSE

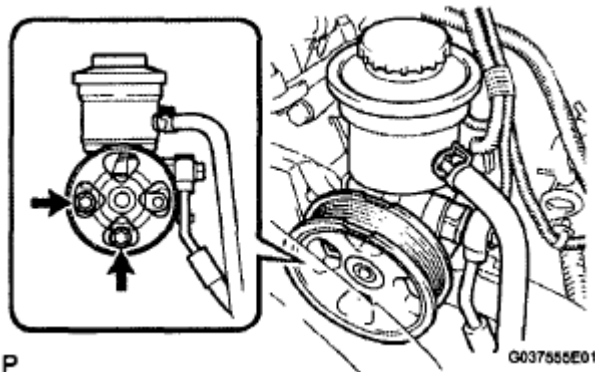


Fig. 23: Locating Vane Pump Bolts
Courtesy of ABLE BODY CORP.

16. SEPARATE COMPRESSOR AND MAGNETIC CLUTCH (w/Air Conditioning System)

- a. Remove the bolt shown in the illustration.

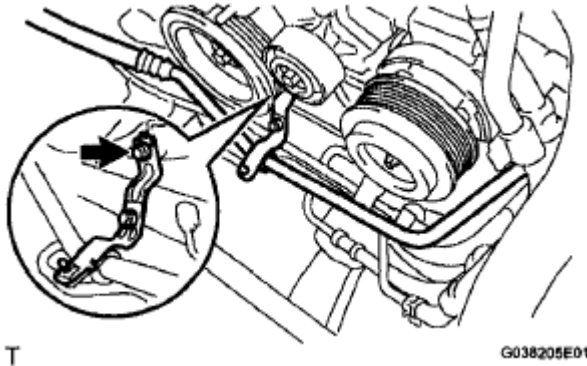


Fig. 24: Locating Bolt
Courtesy of ABLE BODY CORP.

- b. Disconnect the compressor and magnetic clutch connector.
- c. Remove the 4 bolts, then separate the compressor and magnetic clutch.

HINT:

Do not disconnect the hose. Hang the vane pump with a rope.

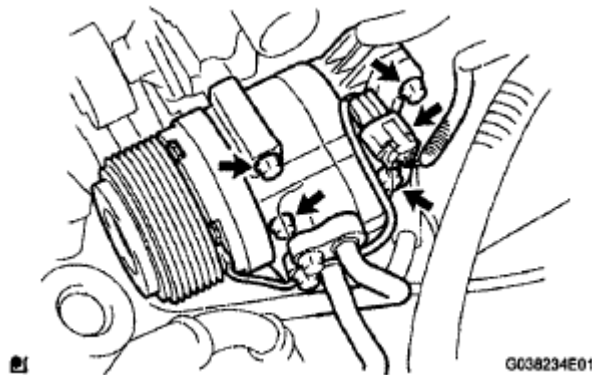
17. REMOVE RADIATOR HOSE INLET**18. SEPARATE WATER HOSE SUB-ASSEMBLY (See REMOVAL)**

Fig. 25: Locating Compressor And Magnetic Clutch With Bolts
Courtesy of ABLE BODY CORP.

19. **DISCONNECT FUEL HOSE** (See REMOVAL)
20. **DISCONNECT FUEL HOSE NO.2** (See REMOVAL)
21. **SEPARATE FUEL VAPOR FEED HOSE ASSEMBLY** (See REMOVAL)
22. **DISCONNECT NO. 1 AIR INJECTION HOSE** (See REMOVAL)

- 23. **DISCONNECT ENGINE WIRE** (See REMOVAL)
- 24. **REMOVE EXHAUST PIPE ASSEMBLY** (See REMOVAL)
- 25. **REMOVE FRONT EXHAUST PIPE ASSEMBLY** (See REMOVAL)
- 26. **REMOVE MANUAL TRANSMISSION UNIT ASSEMBLY**

MANUAL TRANSMISSION UNIT ASSEMBLY REFERENCE

Transmission	Refer to
R155	<u>REMOVAL</u>
R155F	<u>REMOVAL</u>

- 27. **REMOVE AUTOMATIC TRANSMISSION ASSEMBLY**

(See REMOVAL)

- 28. **REMOVE ENGINE ASSEMBLY** (See REMOVAL)
- 29. **REMOVE CLUTCH COVER ASSEMBLY** (for Manual Transmission)

CLUTCH COVER ASSEMBLY REFERENCE

Transmission	Refer to
R155	<u>CLUTCH UNIT (FOR R155)</u>
R155F	<u>CLUTCH UNIT (FOR R155F)</u>

- 30. **REMOVE CLUTCH DISC ASSEMBLY** (for Manual Transmission)

CLUTCH COVER ASSEMBLY REFERENCE

Transmission	Refer to
R155	<u>CLUTCH UNIT (FOR R155)</u>
R155F	<u>CLUTCH UNIT (FOR R155F)</u>

- 31. **REMOVE FLYWHEEL SUB-ASSEMBLY** (for Manual Transmission) (See REMOVAL)
- 32. **REMOVE DRIVE PLATE AND RING GEAR SUB-ASSEMBLY** (for Automatic Transmission)
(See REMOVAL)
- 33. **REMOVE REAR END PLATE**
 - a. Remove the 2 bolts, then remove the rear end plate.
- 34. **REMOVE INTAKE AIR CONNECTOR** (See ON-VEHICLE INSPECTION)
- 35. **REMOVE GENERATOR ASSEMBLY** (See REMOVAL)
- 36. **REMOVE V-RIBBED BELT TENSIONER ASSEMBLY** (See WATER PUMP)
- 37. **REMOVE NO. 1 IDLER PULLEY SUB-ASSEMBLY**
 - a. Remove the bolt and No. 1 idler pulley sub-assembly.
- 38. **REMOVE IDLE PULLEY ASSEMBLY WITH BRACKET** (w/Air Conditioning System) (See CRANKSHAFT POSITION SENSOR)
- 39. **REMOVE CRANKSHAFT POSITION SENSOR** (See CAMSHAFT POSITION SENSOR)

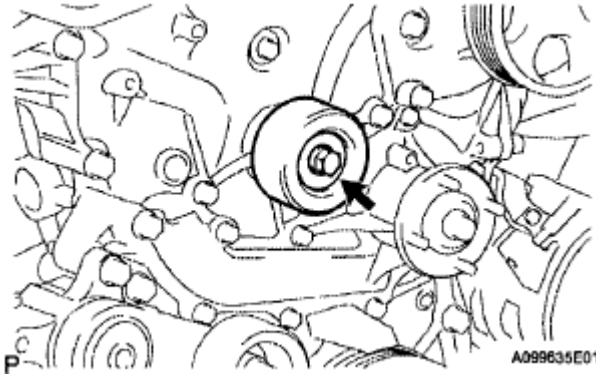
40. REMOVE CAMSHAFT POSITION SENSOR (See CAMSHAFT POSITION SENSOR)

Fig. 26: Locating No. 1 Idler Pulley Sub-Assembly With Bolt
Courtesy of ABLE BODY CORP.

41. REMOVE NO. 1 INTAKE MANIFOLD TO HEAD GASKET (See INSTALLATION)**42. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY (See REMOVAL)****43. REMOVE CRANKSHAFT PULLEY**

a. Set the No. 1 cylinder to the TDC/compression.

1. Turn the crankshaft pulley clockwise and align its timing mark notch with the timing mark "0".
2. Check that the timing marks of the camshaft timing gear are located as illustrated.

HINT:

If not, turn the crankshaft to align the marks.

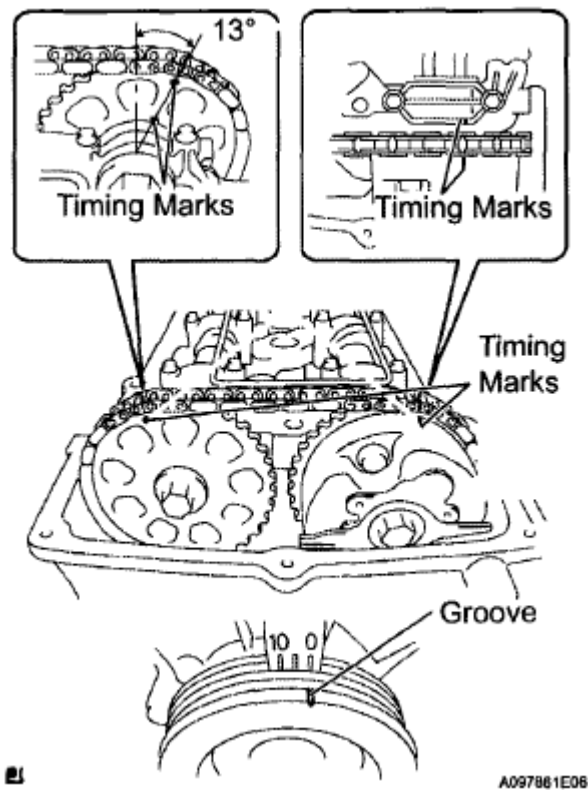


Fig. 27: Aligning Timing Marks Of Camshaft Timing Gear
Courtesy of ABLE BODY CORP.

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

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

HINT:

Loosen the crankshaft pulley bolt until only 2 or 3 threads are still installed in the crankshaft.

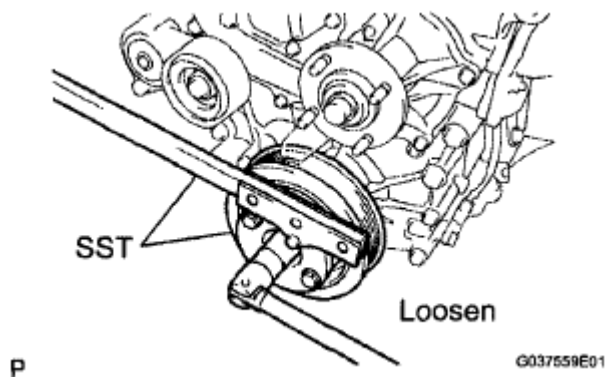


Fig. 28: Loosening Crankshaft Pulley Bolt
Courtesy of ABLE BODY CORP.

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

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

44. REMOVE OIL LEVEL GAGE SUB-ASSEMBLY

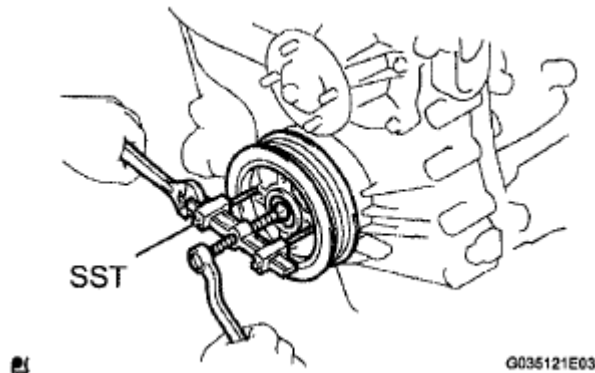


Fig. 29: Removing Crankshaft Pulley And Crankshaft Pulley Bolt
Courtesy of ABLE BODY CORP.

45. REMOVE NO. 2 OIL PAN SUB-ASSEMBLY

- a. Remove the 18 bolts and 2 nuts.

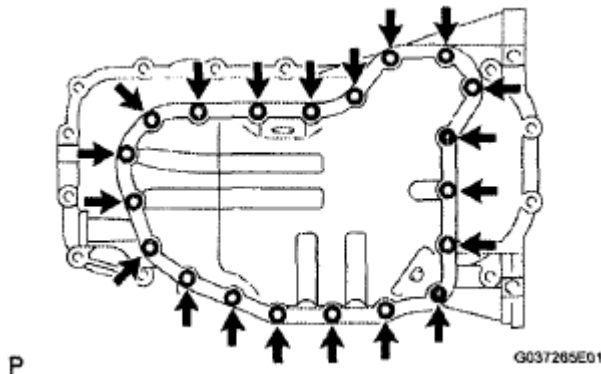


Fig. 30: Locating Oil Pan Bolts And Nuts
Courtesy of ABLE BODY CORP.

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

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

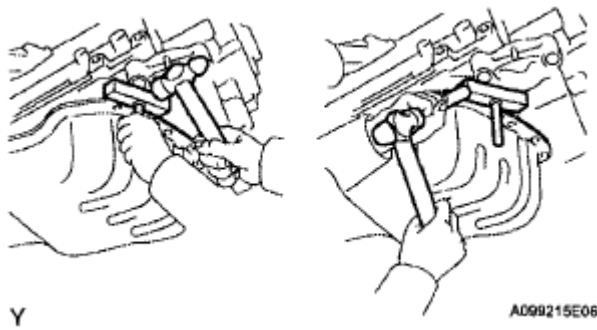


Fig. 31: Inserting Blade Of Oil Pan Seal Cutter Between Pans
Courtesy of ABLE BODY CORP.

46. REMOVE OIL STRAINER SUB-ASSEMBLY

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

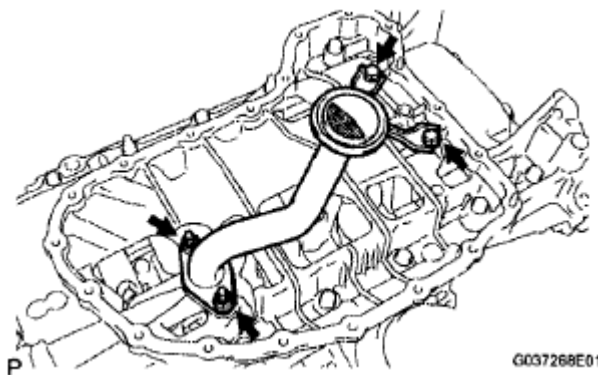


Fig. 32: Locating Oil Strainer With Bolts And Nuts
Courtesy of ABLE BODY CORP.

47. REMOVE OIL PAN SUB-ASSEMBLY

- a. Remove the 16 bolts and 2 nuts.

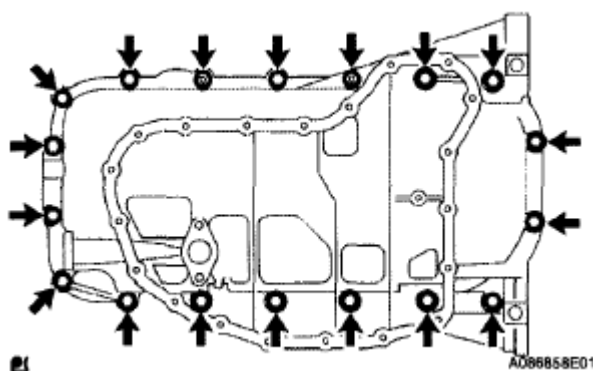


Fig. 33: Locating Oil Pan Bolts And Nuts
Courtesy of ABLE BODY CORP.

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

HINT:

Tape the screwdriver tip before use.

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

48. **REMOVE TIMING CHAIN COVER** (See **REMOVAL**)

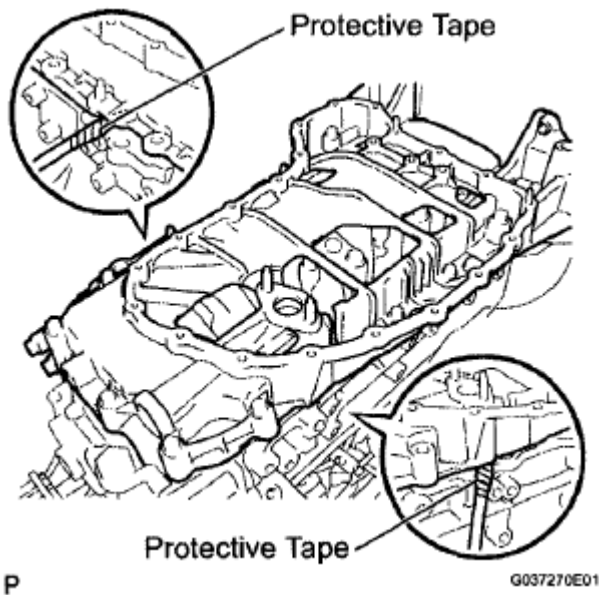


Fig. 34: Removing Oil Pan By Prying Between Oil Pan And Cylinder Block
Courtesy of ABLE BODY CORP.

49. **REMOVE TIMING CHAIN GUIDE**

- a. Make sure that each matchmark is in the position shown in the illustration.

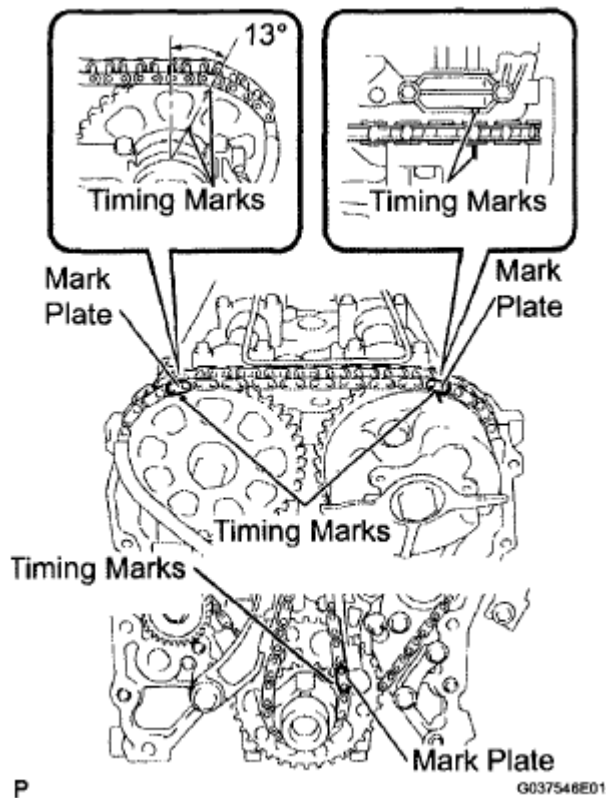


Fig. 35: Aligning Timing Mark
Courtesy of ABLE BODY CORP.

- b. Remove the 2 bolts, timing chain guide and O-ring.

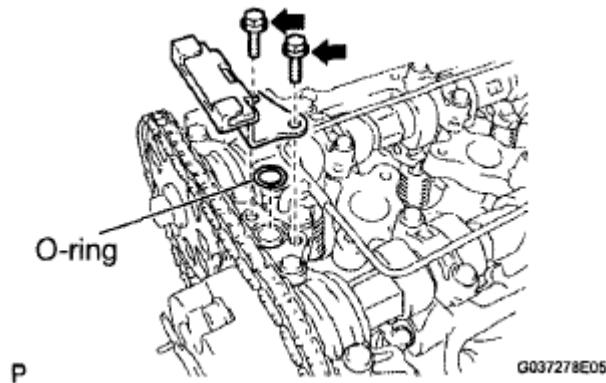


Fig. 36: Locating O-Ring And Chain Guide With Bolts
Courtesy of ABLE BODY CORP.

50. REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY

NOTE:

- When the chain tensioner is removed, do not rotate the crankshaft.
- When the chain is removed and the camshaft needs to be rotated,

rotate the crankshaft 90° to the right.

- 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 3.0 mm (0.118 in.) diameter bar into the stopper plate hole.

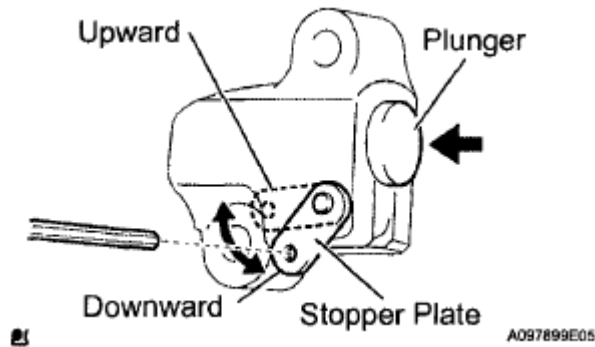


Fig. 37: Pushing Plunger Deep Into Tensioner
Courtesy of ABLE BODY CORP.

- c. Remove the bolt, nut, chain tensioner and gasket.

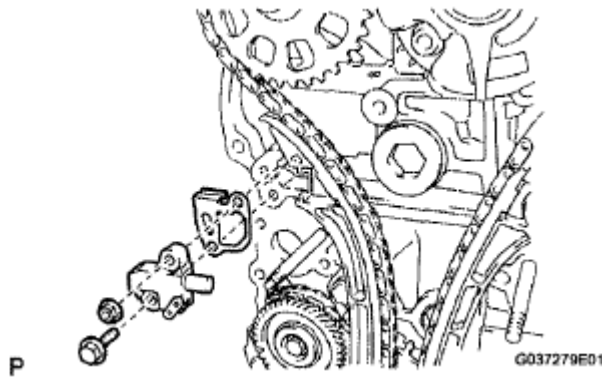


Fig. 38: Identifying Gasket And Chain Tensioner No.1
Courtesy of ABLE BODY CORP.

51. REMOVE CHAIN TENSIONER SLIPPER

- a. Remove the bolt and tensioner slipper.

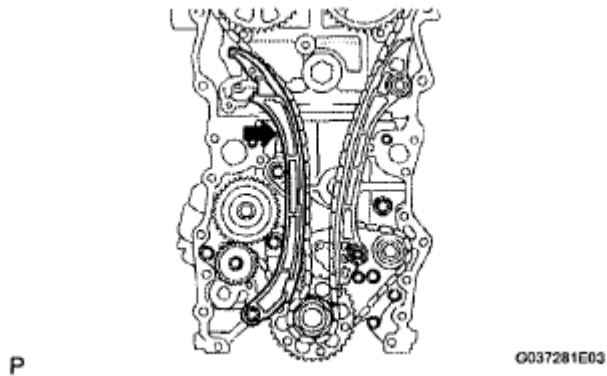


Fig. 39: Locating Tensioner Slipper With Bolt
Courtesy of ABLE BODY CORP.

52. REMOVE NO. 1 CHAIN VIBRATION DAMPER

- a. Remove the 2 bolts and vibration damper.

53. REMOVE CHAIN SUB-ASSEMBLY

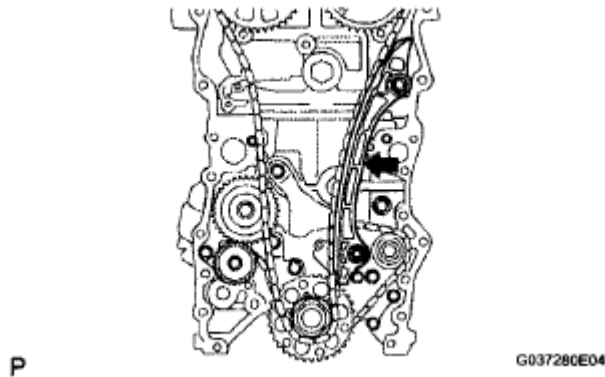


Fig. 40: Locating Vibration Damper With Bolt And Nut
Courtesy of ABLE BODY CORP.

54. REMOVE CRANKSHAFT TIMING GEAR OR SPROCKET

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

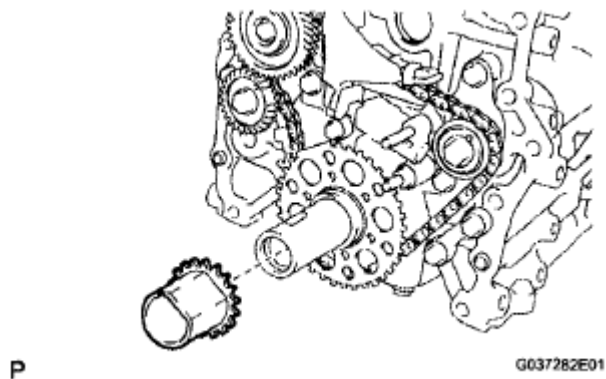


Fig. 41: Identifying Timing Sprocket
Courtesy of ABLE BODY CORP.

55. REMOVE NO. 2 CHAIN VIBRATION DAMPER

- a. Remove the bolt and No. 2 chain vibration damper.

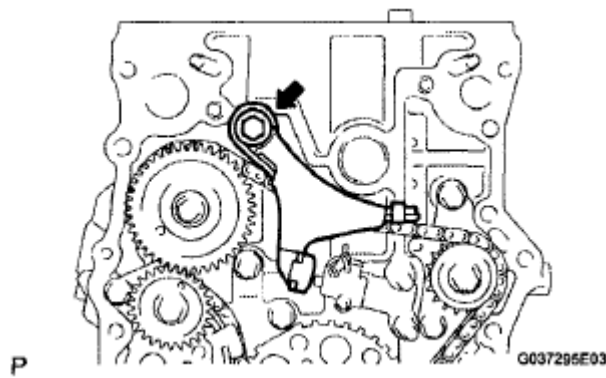


Fig. 42: Locating Bolt And No. 2 Chain Vibration Damper
Courtesy of ABLE BODY CORP.

56. REMOVE NO. 3 CHAIN VIBRATION DAMPER

- a. Remove the 2 bolts and No. 3 chain vibration damper.

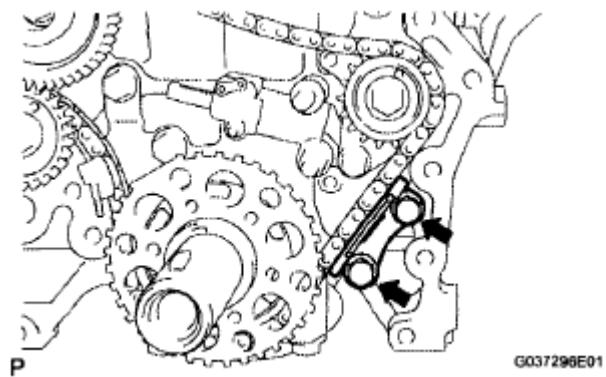


Fig. 43: Locating Chain Vibration Damper No.3 With Bolts

Courtesy of ABLE BODY CORP.

57. REMOVE NO. 2 CHAIN TENSIONER ASSEMBLY

- a. Remove the nut and No. 2 chain tensioner assembly.

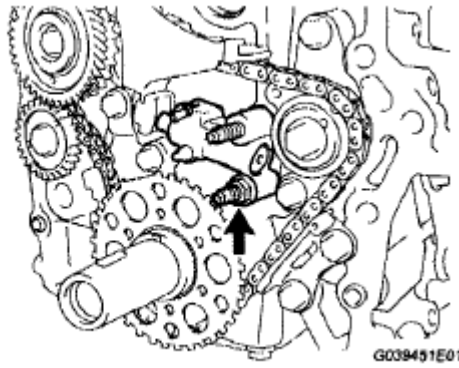


Fig. 44: Locating Nut And No. 2 Chain Tensioner Assembly
Courtesy of ABLE BODY CORP.

58. REMOVE NO.2 CHAIN SUB-ASSEMBLY

- a. Remove the bolt, balanceshaft drive gear shaft and balanceshaft drive gear.
- b. Remove the crankshaft timing sprocket No. 2 and chain.

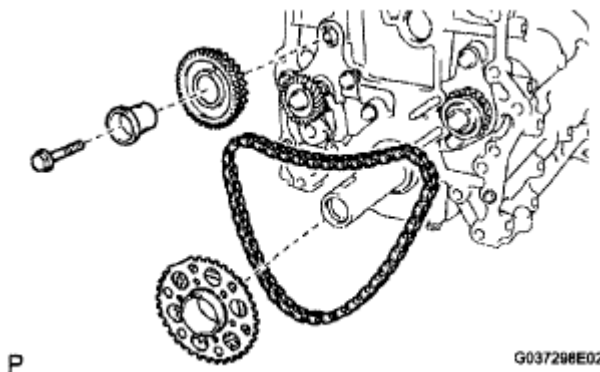
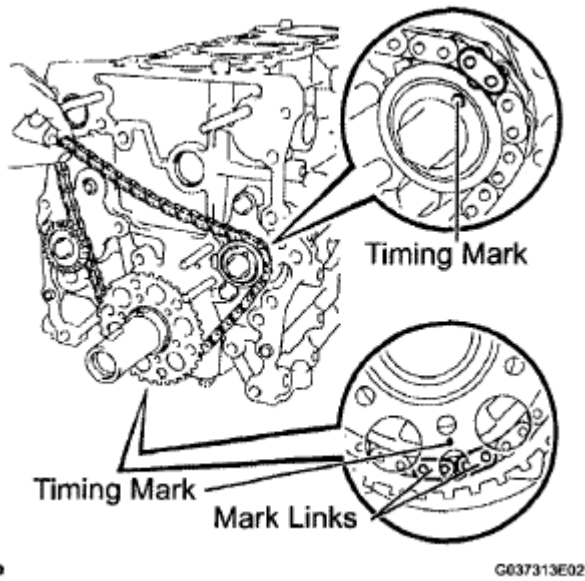


Fig. 45: Identifying Crankshaft Timing Sprocket No. 2 And Chain
Courtesy of ABLE BODY CORP.

INSTALLATION**1. INSTALL NO.2 CHAIN SUB-ASSEMBLY**

- a. Install the chain with its mark links aligned with the timing marks on the crankshaft timing sprocket and balanceshaft timing sprocket.



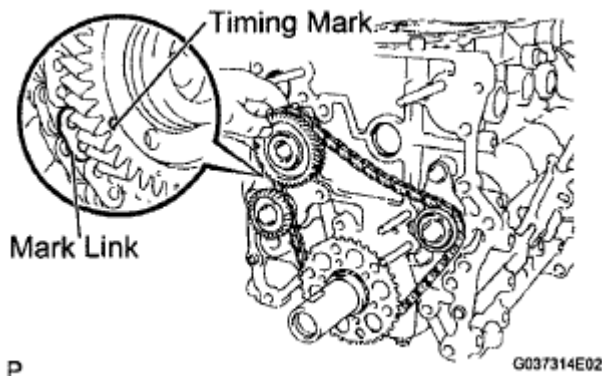
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Fig. 46: Aligning Timing Marks On Crankshaft Timing Sprocket And Balancer Timing Sprocket

Courtesy of ABLE BODY CORP.

- b. Bring the other mark link of the crankshaft timing sprocket behind the large timing mark of the balancer drive gear.
- c. Insert the balancer drive gear shaft through the balancer drive gear so that it fits into the thrust plate hole.



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Fig. 47: Inserting Balancer Drive Gear Shaft

Courtesy of ABLE BODY CORP.

- d. Align the small timing mark of the balancer drive gear with the timing mark of the balancer timing gear.
- e. Install the bolt onto the balancer drive gear and tighten it.

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

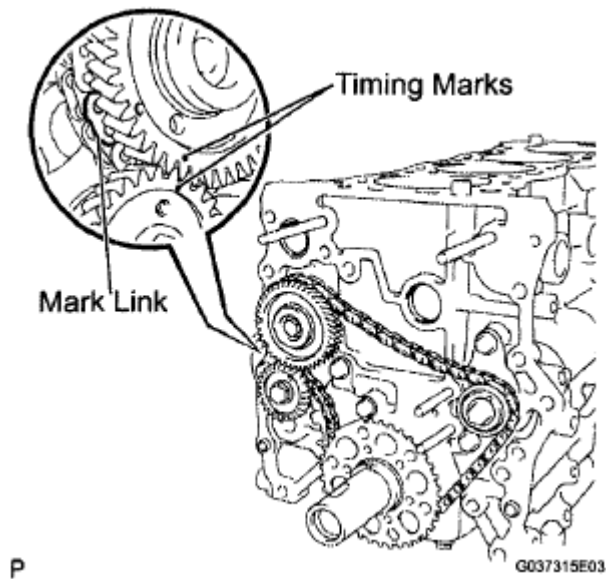


Fig. 48: Aligning Small Timing Mark Of Balancerhaft Drive Gear With Timing Mark Of Balancerhaft Timing Gear
 Courtesy of ABLE BODY CORP.

- f. Check that each timing mark is aligned with the corresponding mark link.

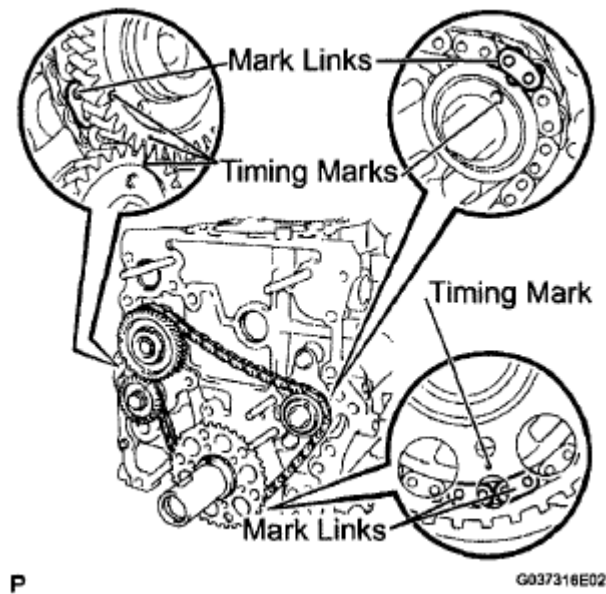


Fig. 49: Aligning Timing Mark With Corresponding Mark Link
 Courtesy of ABLE BODY CORP.

2. INSTALL NO. 2 CHAIN TENSIONER ASSEMBLY

- a. Install the chain tensioner with the nut.

Torque: 18 N*m (185 kgf*cm, 13 ft.*lbf)

NOTE: Assemble the chain tensioner with the 3.0 mm (0.118 in.) diameter bar installed, then remove the bar after assembly. When doing this, avoid pushing the vibration damper against the chain.

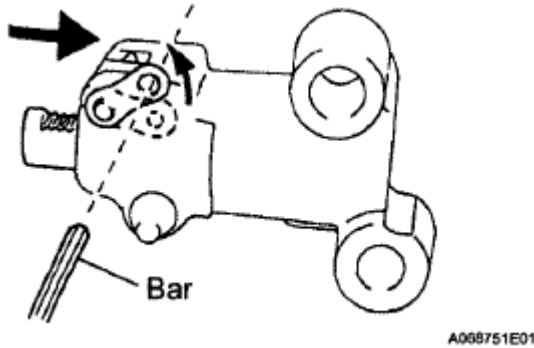


Fig. 50: Installing Chain Tensioner With Nut
Courtesy of ABLE BODY CORP.

3. INSTALL NO. 3 CHAIN VIBRATION DAMPER

- a. Install the No. 3 chain vibration damper with the 2 bolts.

Torque: 18 N*m (185 kgf*cm, 13 ft.*lbf)

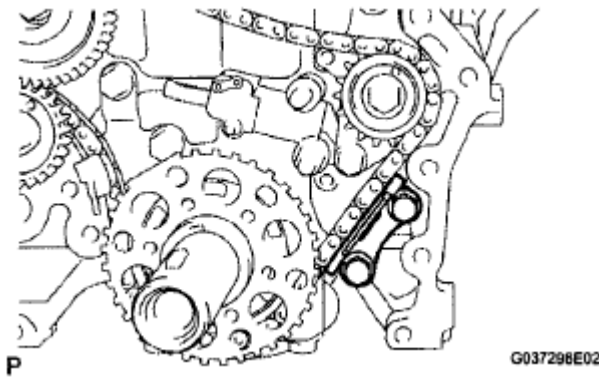


Fig. 51: Identifying Crankshaft Timing Sprocket No. 2 And Chain
Courtesy of ABLE BODY CORP.

4. INSTALL CHAIN VIBRATION DAMPER NO.2

- a. Install the chain vibration damper with the bolt.

Torque: 27 N*m (270 kgf*cm, 20 ft.*lbf)

- b. Remove the pin from the chain tensioner and release the plunger.

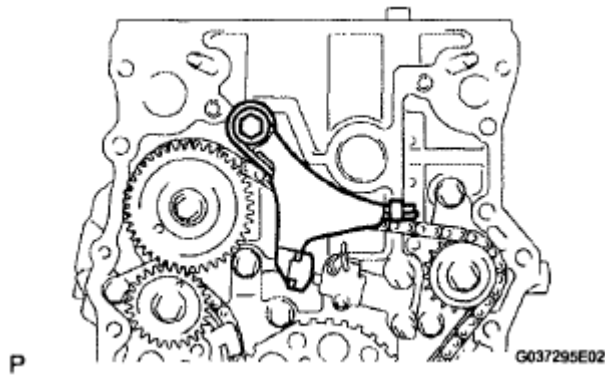


Fig. 52: Identifying Chain Vibration Damper With Bolt
Courtesy of ABLE BODY CORP.

5. INSTALL CRANKSHAFT TIMING GEAR OR SPROCKET

- a. Install the timing sprocket as shown in the illustration.

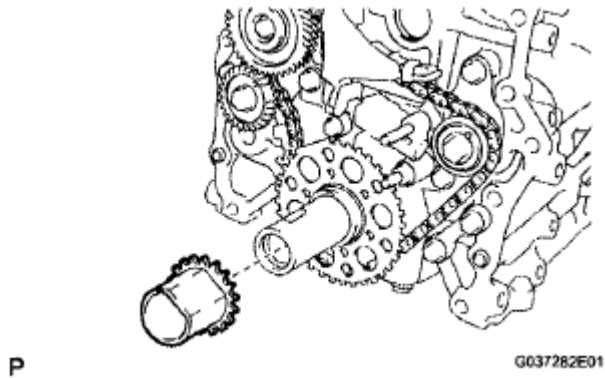


Fig. 53: Identifying Timing Sprocket
Courtesy of ABLE BODY CORP.

6. INSTALL NO. 1 CHAIN VIBRATION DAMPER

- a. Install the vibration damper with the bolt and nut.

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

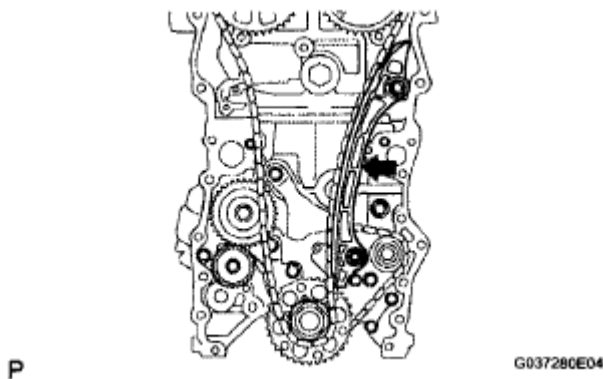


Fig. 54: Locating Vibration Damper With Bolt And Nut
Courtesy of ABLE BODY CORP.

7. INSTALL CHAIN SUB-ASSEMBLY

- As shown in the illustration, install the chain onto the sprocket and gear with the painted marks aligned with the timing marks on the sprocket and gear.

HINT:

- The camshaft mark plate is orange.
- The crankshaft mark plate is yellow.

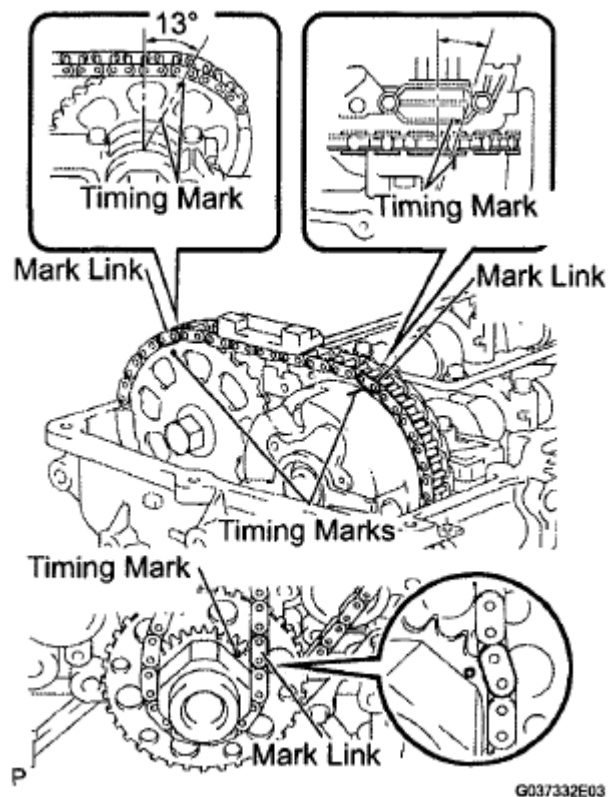


Fig. 55: Aligning Timing Marks On Sprocket And Gear
Courtesy of ABLE BODY CORP.

- b. Use a rope to tie the chain of the crankshaft timing sprocket. Tie the rope near the sprocket.

NOTE: After the chain tensioner has been installed, the rope must be removed.

HINT:

The rope is tied to prevent gear jumping.

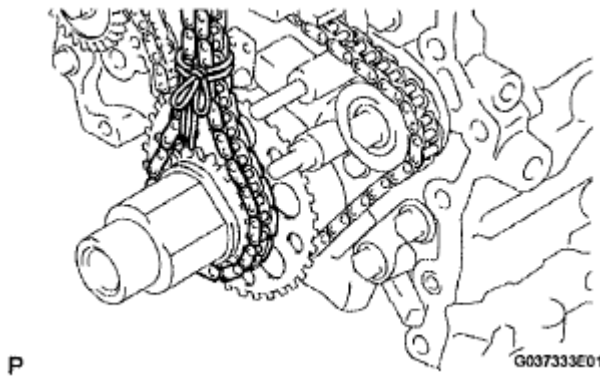


Fig. 56: Tying Rope Near Sprocket
Courtesy of ABLE BODY CORP.

8. INSTALL CHAIN TENSIONER SLIPPER

- a. Install the tensioner slipper with the bolt.

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

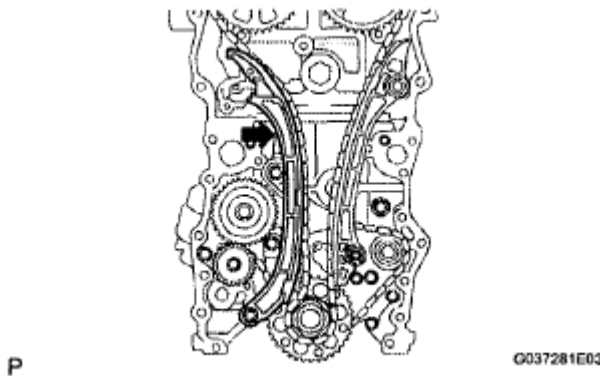


Fig. 57: Locating Tensioner Slipper With Bolt
Courtesy of ABLE BODY CORP.

9. INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY

- a. Install a new gasket and the chain tensioner with the bolt and nut.

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

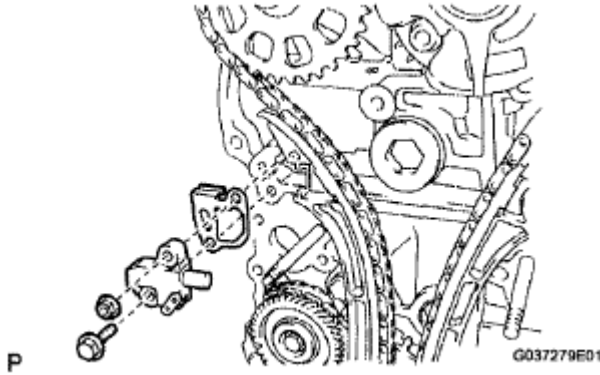


Fig. 58: Identifying Gasket And Chain Tensioner No.1
Courtesy of ABLE BODY CORP.

10. INSTALL TIMING CHAIN GUIDE

- a. Install a new O-ring and the chain guide with the 2 bolts.

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

11. INSTALL TIMING CHAIN COVER (See REASSEMBLY)

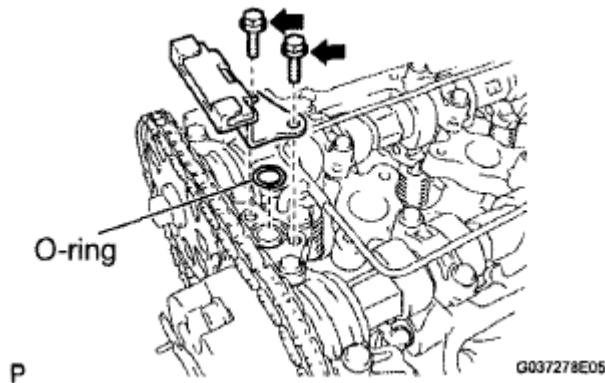


Fig. 59: Identifying O-Ring And Chain Guide With Bolts
Courtesy of ABLE BODY CORP.

12. INSTALL OIL PAN SUB-ASSEMBLY

- a. Apply continuous beads of seal packing to the places shown in the illustration.

Seal packing:

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

Seal width:

2 to 3 mm (0.079 to 0.118 in.)

NOTE:

- **Remove any oil from the contact surface.**
- **Install the crankcase within 3 minutes of applying the seal packing.**
- **Do not start the engine for at least 2 hours after installation.**

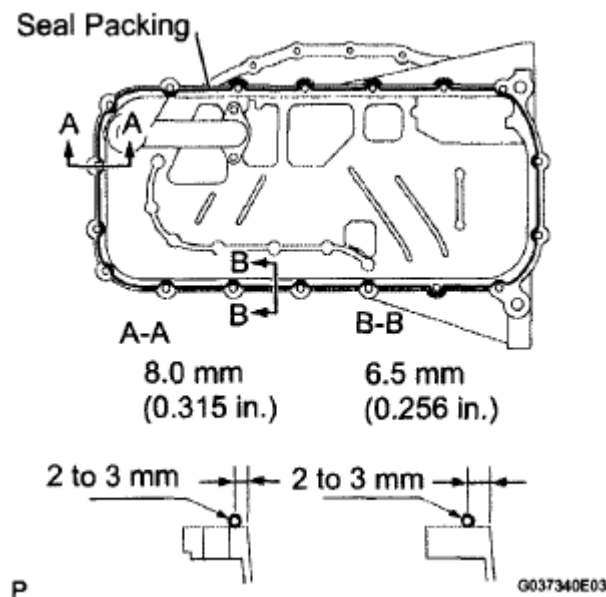


Fig. 60: Identifying Seal Packing Applying Area
Courtesy of ABLE BODY CORP.

- b. Loosely install the oil pan with the 16 bolts and 2 nuts.

HINT:

Bolt length:

20 mm (0.79 in.) for bolt A,

40 mm (1.57 in.) for bolt B

- c. Uniformly tighten the 16 bolts and 2 nuts in the sequence shown in the illustration.

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

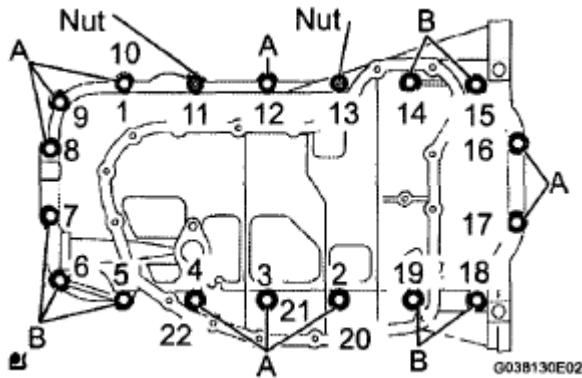


Fig. 61: Identifying Tightening Sequence Of Oil Pan Bolts And Nuts
Courtesy of ABLE BODY CORP.

13. INSTALL OIL STRAINER SUB-ASSEMBLY

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

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

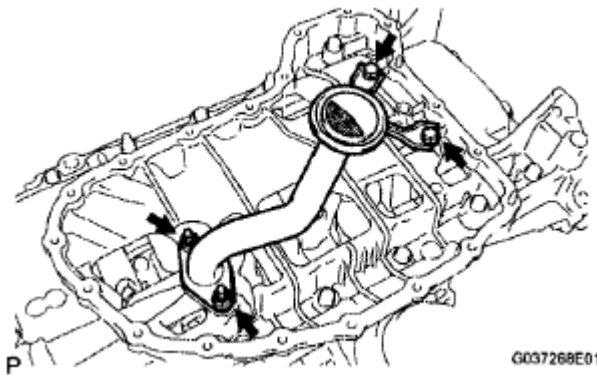


Fig. 62: Locating Gasket And Oil Strainer With Bolts And Nuts
Courtesy of ABLE BODY CORP.

14. INSTALL NO. 2 OIL PAN SUB-ASSEMBLY

- Apply continuous beads of seal packing to the places shown in the illustration.

Seal packing:

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

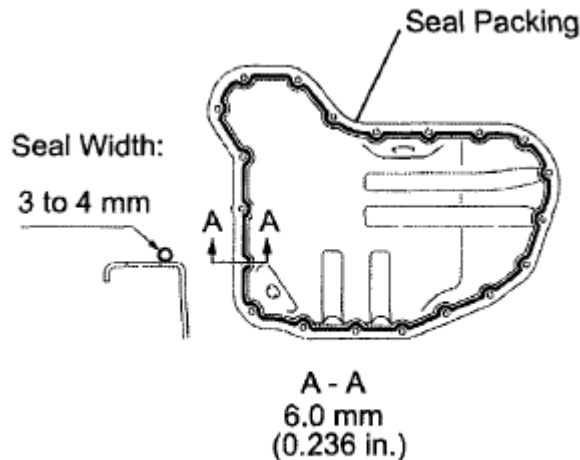
Seal width:

3 to 4 mm (0.118 to 0.157 in.)

NOTE:

- Remove any oil from the contact surface.

- Install the crankcase within 3 minutes of applying the seal packing.
- Do not start the engine for at least 2 hours after installation.



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Fig. 63: Identifying Seal Packing Applying Area
Courtesy of ABLE BODY CORP.

- Provisionally install the oil pan with the 18 bolts and 2 nuts.
- Uniformly tighten the 18 bolts and 2 nuts in the sequence shown in the illustration.

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

- Install a new gasket and the drain plug.

15. INSTALL OIL LEVEL GAGE SUB-ASSEMBLY

16. INSTALL CRANKSHAFT PULLEY (See INSTALLATION)

17. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY (See INSTALLATION)

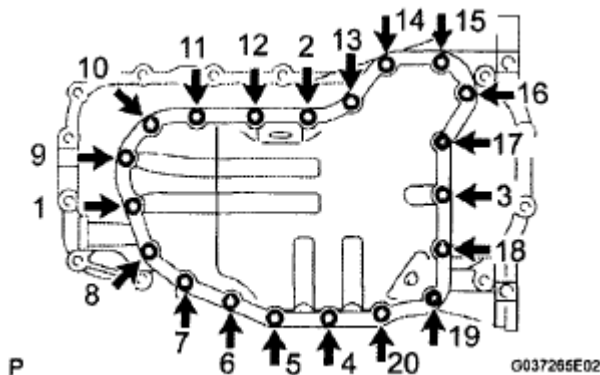


Fig. 64: Identifying Tightening Sequence Of Oil Pan Bolts And Nuts

Courtesy of ABLE BODY CORP.

18. **INSTALL NO. 1 INTAKE MANIFOLD TO HEAD GASKET** (See INSTALLATION)
19. **INSTALL CAMSHAFT POSITION SENSOR** (See CAMSHAFT POSITION SENSOR)
20. **INSTALL CRANKSHAFT POSITION SENSOR** (See CAMSHAFT POSITION SENSOR)
21. **INSTALL IDLE PULLEY ASSEMBLY WITH BRACKET (w/Air Conditioning System)** (See CAMSHAFT POSITION SENSOR)
22. **INSTALL NO. 1 IDLER PULLEY SUB-ASSEMBLY**
 - a. Install the No. 1 idler pulley sub-assembly with the bolt.

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

23. **INSTALL V-RIBBED BELT TENSIONER ASSEMBLY** (See INSTALLATION)
24. **INSTALL GENERATOR ASSEMBLY** (See INSTALLATION)
25. **INSTALL INTAKE AIR CONNECTOR** (See INSTALLATION)

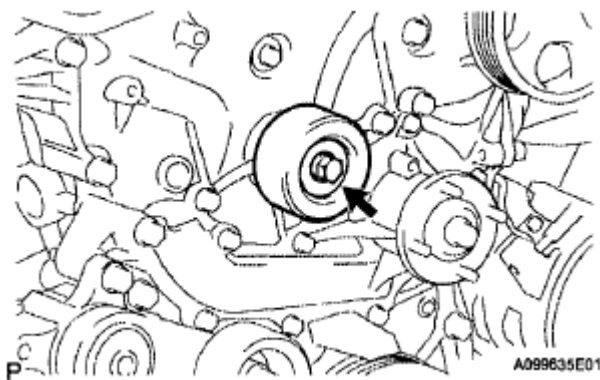


Fig. 65: Locating No. 1 Idler Pulley Sub-Assembly With Bolt
Courtesy of ABLE BODY CORP.

26. **INSTALL REAR END PLATE**
 - a. Install the rear end plate with the 2 bolts.
- Torque: 18 N*m (184 kgf*cm, 13 ft.*lbf)**
27. **INSTALL DRIVE PLATE AND RING GEAR SUB-ASSEMBLY (for Automatic Transmission)** (See INSTALLATION)
 28. **INSTALL FLYWHEEL SUB-ASSEMBLY (for Manual Transmission)** (See INSTALLATION)
 29. **INSTALL CLUTCH DISC ASSEMBLY (for Manual Transmission)**

CLUTCH DISC ASSEMBLY REFERENCE

Transmission	Refer to
R155	<u>INSTALLATION</u>
R155F	<u>INSTALLATION</u>

30. INSTALL CLUTCH COVER ASSEMBLY (for Manual Transmission)**CLUTCH COVER ASSEMBLY REFERENCE**

Transmission	Refer to
R155	<u>INSTALLATION</u>
R155F	<u>INSTALLATION</u>

31. INSTALL ENGINE ASSEMBLY (See INSTALLATION)**32. INSTALL AUTOMATIC TRANSMISSION ASSEMBLY**

(See INSTALLATION)

33. INSTALL MANUAL TRANSMISSION UNIT ASSEMBLY**MANUAL TRANSMISSION UNIT ASSEMBLY REFERENCE**

Transmission	Refer to
R155	<u>INSTALLATION</u>
R155F	<u>INSTALLATION</u>

34. INSTALL EXHAUST PIPE ASSEMBLY FRONT (See REMOVAL)**35. INSTALL EXHAUST PIPE ASSEMBLY TAIL (See REMOVAL)****36. CONNECT ENGINE WIRE****37. CONNECT NO. 1 AIR INJECTION HOSE (See INSTALLATION)****38. CONNECT FUEL VAPOR FEED HOSE ASSEMBLY (See INSTALLATION)****39. CONNECT NO. 2 FUEL HOSE (See INSTALLATION)****40. CONNECT FUEL HOSE (See INSTALLATION)****41. INSTALL WATER HOSE SUB-ASSEMBLY (See INSTALLATION)****42. INSTALL RADIATOR HOSE INLET****43. INSTALL COMPRESSOR AND MAGNETIC CLUTCH (w/Air Conditioning System)**

- a. Install the compressor and magnetic clutch with the 4 bolts.

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

- b. Connect the compressor and magnetic clutch connector.

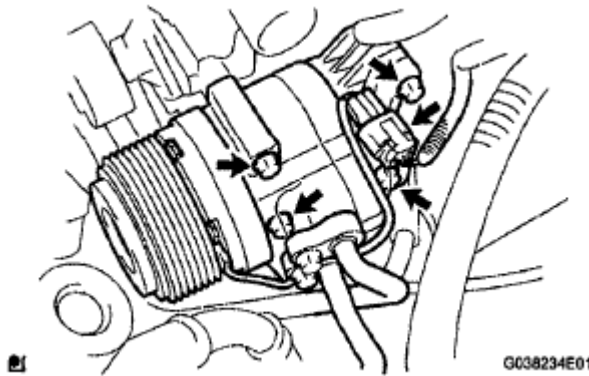


Fig. 66: Locating Compressor And Magnetic Clutch With Bolts
Courtesy of ABLE BODY CORP.

- c. Install the bolt shown in the illustration.

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

44. INSTALL NO. 2 RADIATOR HOSE

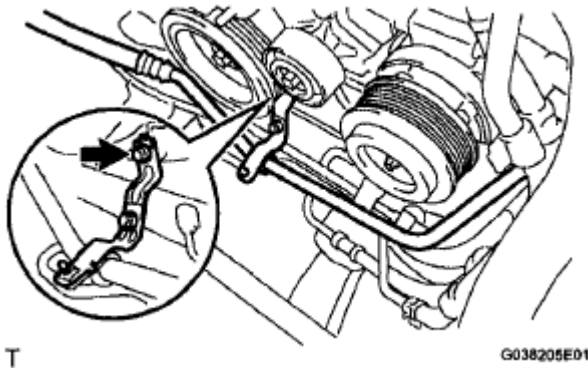


Fig. 67: Locating Bolt
Courtesy of ABLE BODY CORP.

45. INSTALL VANE PUMP ASSEMBLY

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

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

- b. Connect the vane pump connector.

46. INSTALL AIR CLEANER CASE

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

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

47. INSTALL AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY

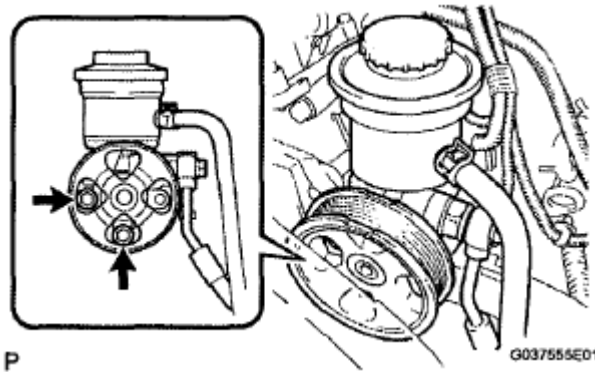


Fig. 68: Locating Air Cleaner Case With Bolts
Courtesy of ABLE BODY CORP.

48. **INSTALL AIR CLEANER CAP SUB-ASSEMBLY** (See INSTALLATION)
49. **INSTALL FAN SHROUD** (See INSTALLATION)
50. **INSTALL RADIATOR SUPPORT TO FRAME SEAL LH** (See INSTALLATION)
51. **INSTALL BATTERY TRAY**
52. **INSTALL BATTERY**
53. **ADD ENGINE OIL** (See INSTALLATION)
54. **ADD ENGINE COOLANT** (See COOLANT)
55. **CHECK FOR ENGINE OIL LEVEL**
56. **CHECK FOR FUEL LEAKAGE**
57. **CHECK FOR ENGINE COOLANT LEAKAGE** (See ON-VEHICLE INSPECTION)
58. **CHECK FOR OIL LEAKAGE**
59. **CHECK FOR EXHAUST GAS LEAKAGE**
60. **INSTALL NO. 1 ENGINE UNDER COVER SUB-ASSEMBLY** (for 4WD and Pre-Runner)
 - a. Install the No. 1 engine under cover with the 4 bolts.

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

61. **INSTALL NO. 2 ENGINE UNDER COVER SUB-ASSEMBLY** (for 4WD and Pre-Runner, Regular Cab)
 - a. Install the No. 2 engine under cover with the 4 bolts.

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

62. **INSTALL HOOD SUB-ASSEMBLY**

(See REASSEMBLY)

CAMSHAFT

COMPONENTS

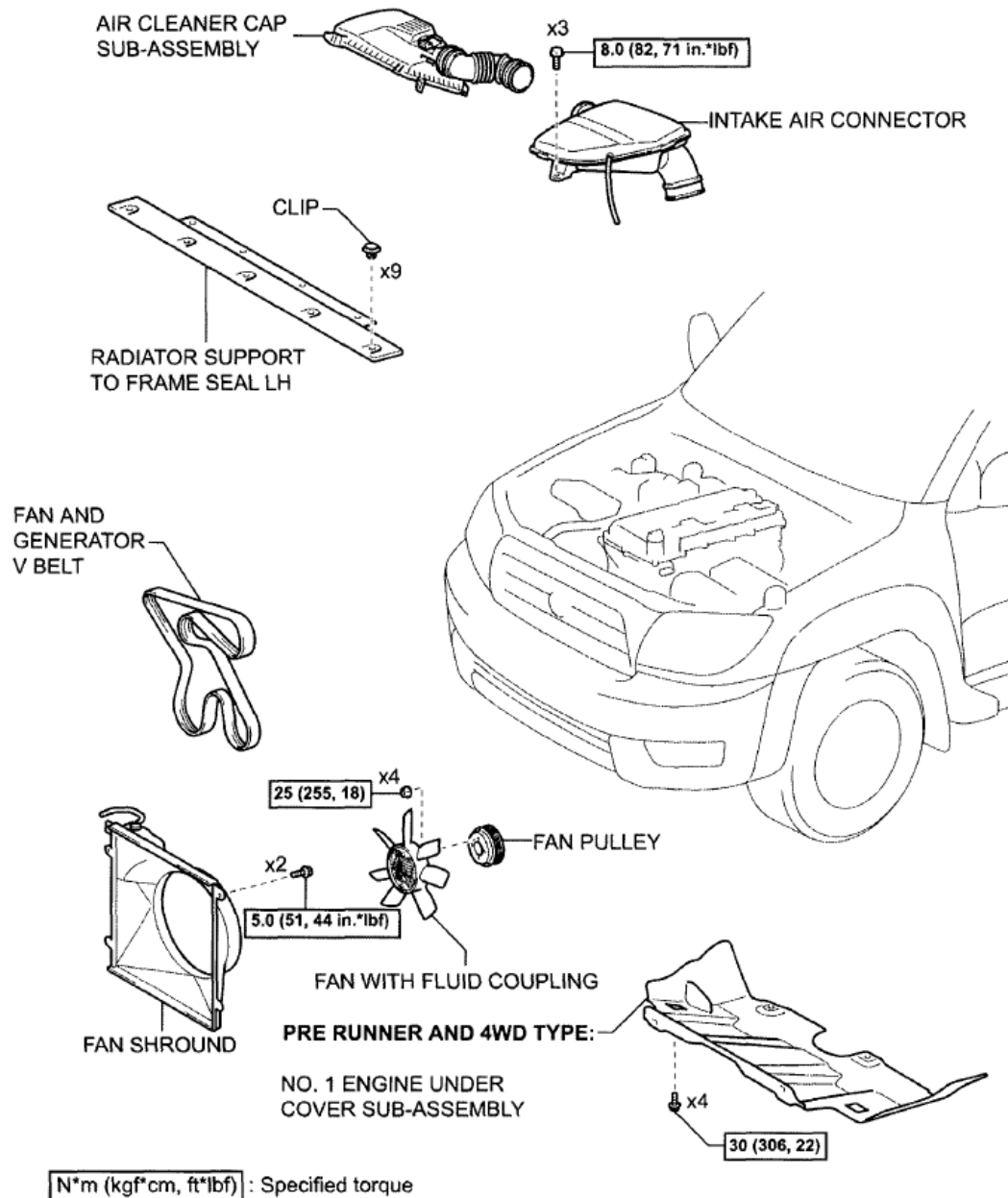
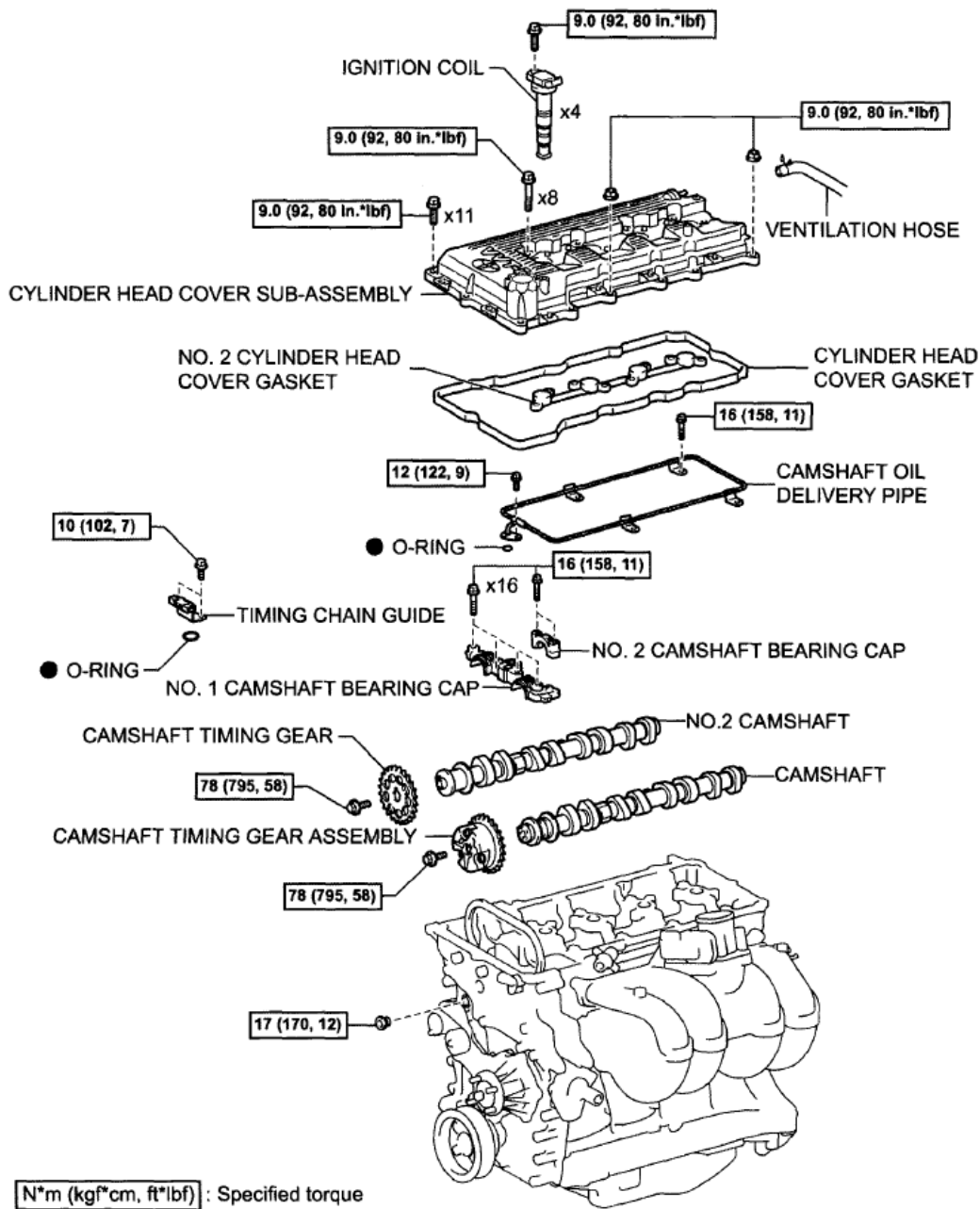


Fig. 69: Exploded View Of Camshaft Components & Torque Specification (1 Of 2)
Courtesy of ABLE BODY CORP.

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Fig. 70: Exploded View Of Camshaft Components & Torque Specification (2 Of 2)
Courtesy of ABLE BODY CORP.

REMOVAL

1. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**
2. **REMOVE NO. 1 ENGINE UNDER COVER SUB-ASSEMBLY (for 4WD)**
 - a. Remove the 4 bolts, then remove the No. 1 engine under cover.

3. **DRAIN ENGINE COOLANT** (See COOLANT)
4. **REMOVE RADIATOR SUPPORT TO FRAME SEAL LH** (See ON-VEHICLE CLEANING)
5. **REMOVE FAN SHROUD** (See REMOVAL)
6. **REMOVE AIR CLEANER CAP SUB-ASSEMBLY** (See AIR SWITCHING VALVE)
7. **REMOVE INTAKE AIR CONNECTOR** (See ON-VEHICLE INSPECTION)
8. **REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY**
 - a. Disconnect the ignition coil connectors.
 - b. Disconnect the throttle with motor body connector.
 - c. Disconnect the VSV connector.
 - d. Disconnect the camshaft position sensor connector.
 - e. Disconnect the engine wire harness clamps.

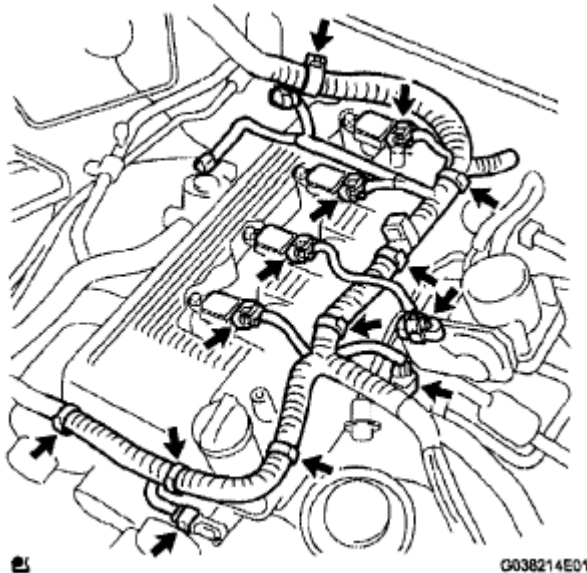


Fig. 71: Locating Camshaft Position Sensor Connector
Courtesy of ABLE BODY CORP.

- f. Remove the bolts, then remove the ignition coils.

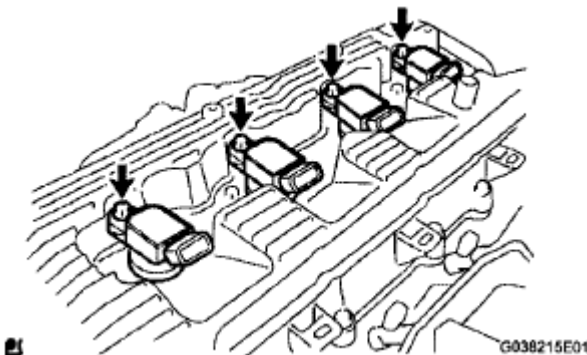


Fig. 72: Locating Ignition Coils With Bolts
Courtesy of ABLE BODY CORP.

- g. Disconnect the ventilation hose.

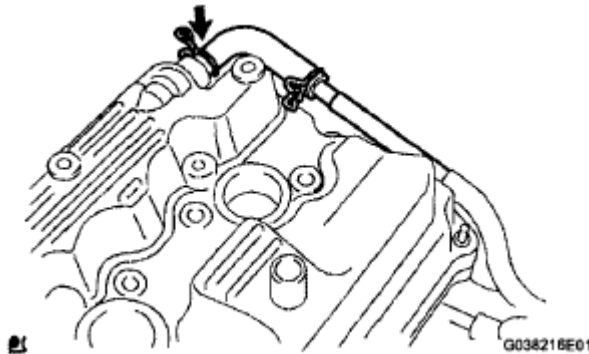


Fig. 73: Locating Ventilation Hose
Courtesy of ABLE BODY CORP.

- h. Remove the 19 bolts and 2 nuts, then remove the cylinder head cover.

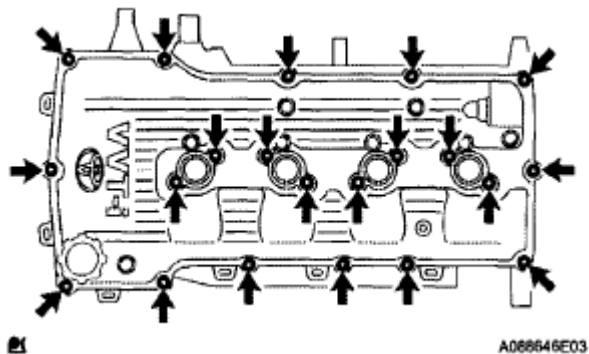


Fig. 74: Locating Bolts, Nuts And Cylinder Head Cover
Courtesy of ABLE BODY CORP.

9. REMOVE TIMING CHAIN GUIDE

- a. Remove the 2 bolts, then remove the timing chain guide.

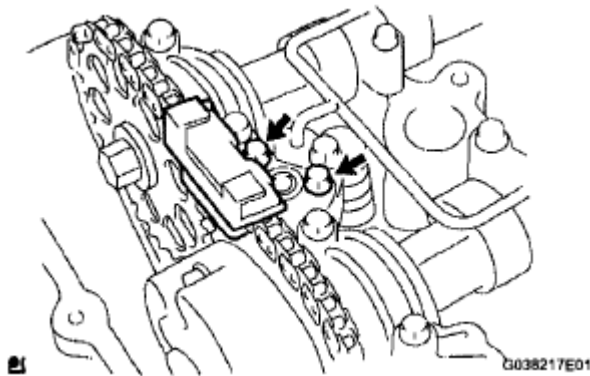


Fig. 75: Locating Timing Chain Guide With Bolts
Courtesy of ABLE BODY CORP.

- b. Remove the O-ring.

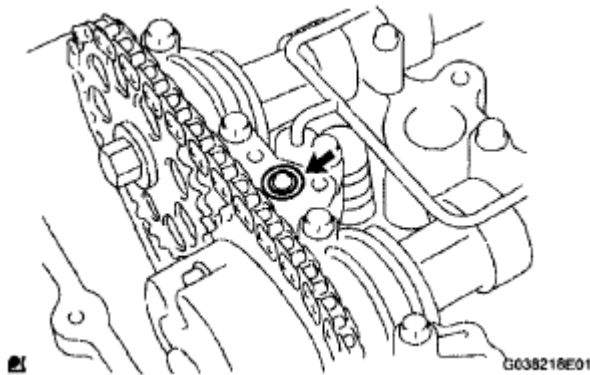


Fig. 76: Locating O-Ring Onto Camshaft Bearing Cap
Courtesy of ABLE BODY CORP.

10. REMOVE CAMSHAFT

- a. Set the No. 1 cylinder to the TDC/compression.
1. Turn the crankshaft pulley clockwise and align its timing mark notch with the timing mark "0".
 2. Check that the timing marks of the camshaft timing gear are located as illustrated.

HINT:

If not, turn the crankshaft to align the marks.

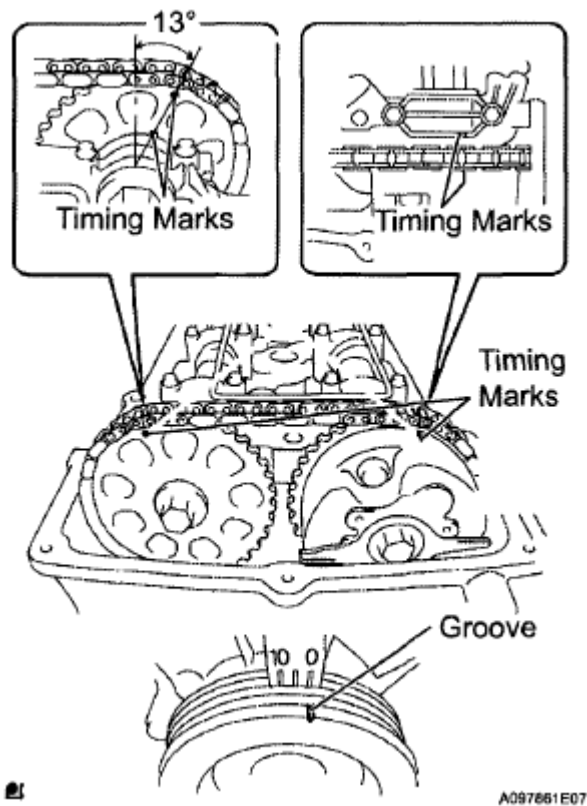


Fig. 77: Aligning Timing Marks Of Camshaft Timing Gear
Courtesy of ABLE BODY CORP.

- b. Place paint marks on the timing chain plates that align with timing marks of the camshaft timing gear.

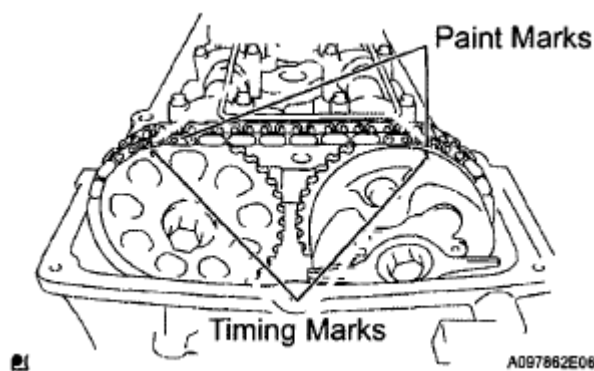


Fig. 78: Aligning Timing Marks Of Camshaft Timing Gear
Courtesy of ABLE BODY CORP.

- c. Hold the hexagonal lobe of the No. 2 camshaft with an adjustable wrench.

NOTE: Be careful not to damage the camshaft oil delivery pipe.

- d. Loosen the bolt.

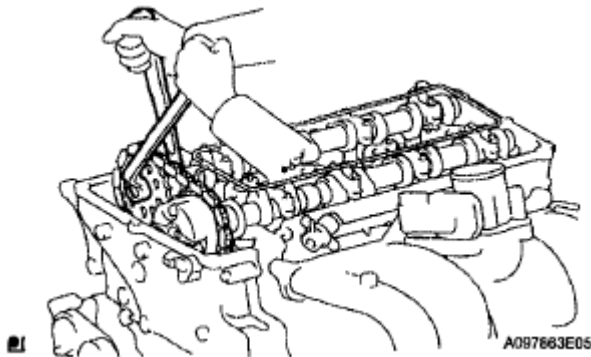


Fig. 79: Loosening Bolt
Courtesy of ABLE BODY CORP.

- e. Using 10 mm socket hexagon wrench, remove the head straight screw plug.

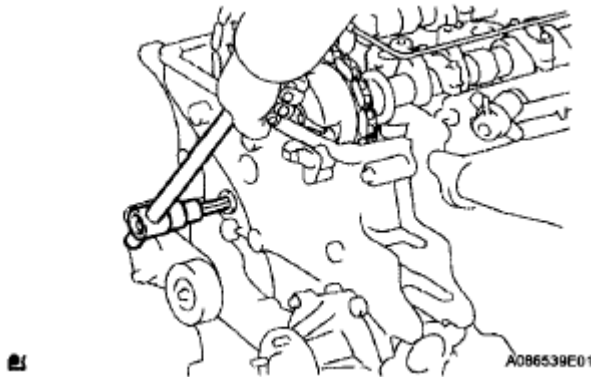


Fig. 80: Removing Head Straight Screw Plug
Courtesy of ABLE BODY CORP.

- f. Insert a screwdriver into the service hole of the chain tensioner to hold the stopper plate of the chain tensioner lifted up.

HINT:

Lifting up the stopper plate of the chain tensioner unlocks the plunger.

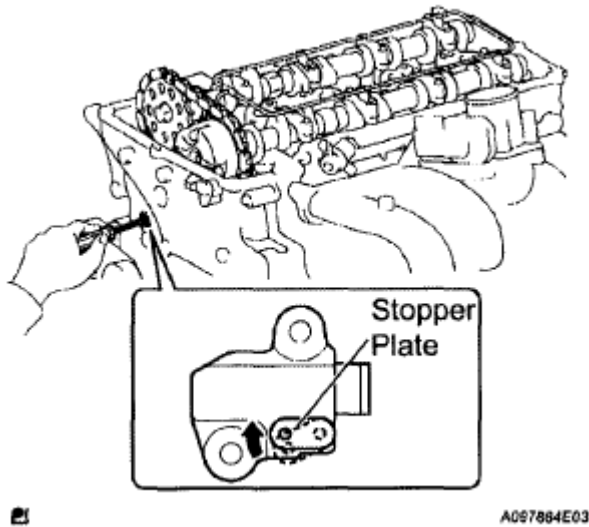


Fig. 81: Inserting Screwdriver Into Service Hole Of Chain Tensioner
Courtesy of ABLE BODY CORP.

- g. While keeping the stopper plate of the chain tensioner lifted up, slightly rotate the hexagonal lobe of the No. 2 camshaft clockwise with an adjustable wrench so the plunger of the chain tensioner is pushed.

HINT:

When the No. 2 camshaft is slightly rotated clockwise, the plunger is pushed.

NOTE: Be careful not to damage the camshaft oil delivery pipe.

- h. Keeping the adjustable wrench installed, remove the screwdriver with the plunger pushed in.

NOTE: Do not move the adjustable wrench.

HINT:

Removing the screwdriver lifts down the stopper plate and locks the plunger.

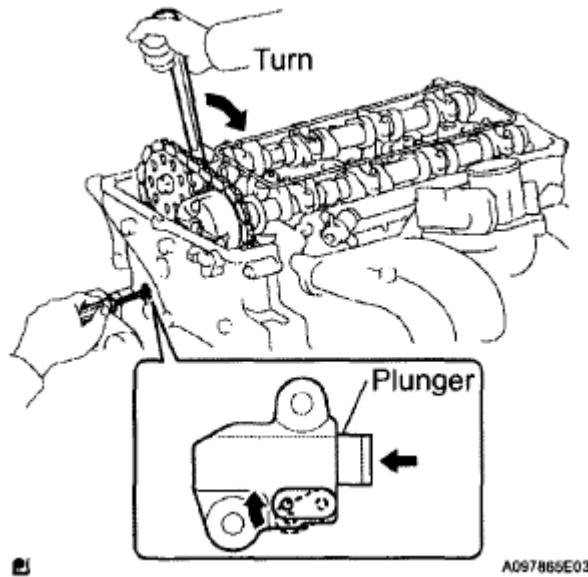


Fig. 82: Removing Screwdriver With Plunger
Courtesy of ABLE BODY CORP.

- i. Insert a 3.0 mm (0.118 in.) diameter bar into the hole of the stopper plate with the stopper plate of the chain tensioner lifted down and locked.

HINT:

If a 3.0 mm (0.118 in.) diameter bar cannot be inserted into the hole of the stopper plate, rotate the No. 2 camshaft slightly to the left and right. Then a 3.0 mm (0.118 in.) diameter bar can be inserted easily.

- j. Secure the 3.0 mm (0.118 in.) diameter bar with tape.

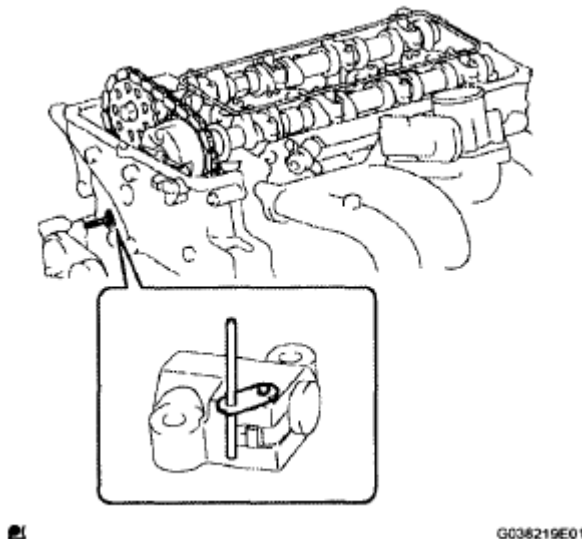


Fig. 83: Inserting Diameter Bar Into Hole Of Stopper Plate
Courtesy of ABLE BODY CORP.

- k. Remove the bolt, then remove the camshaft timing gear.

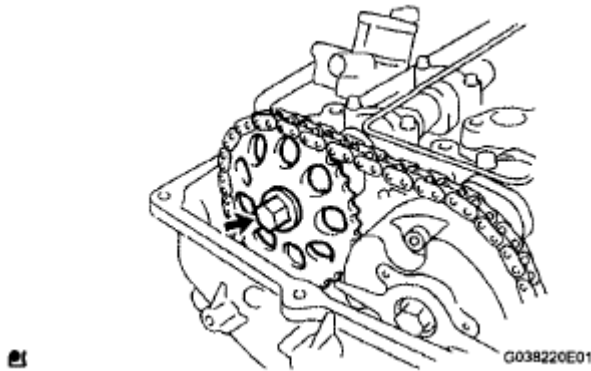


Fig. 84: Removing Bolt And Camshaft Timing Gear
Courtesy of ABLE BODY CORP.

- l. Using several steps, uniformly loosen and remove the 21 bearing cap bolts in the sequence shown in the illustration.

NOTE: Place the camshaft on a flat surface and loosen the bolts uniformly.

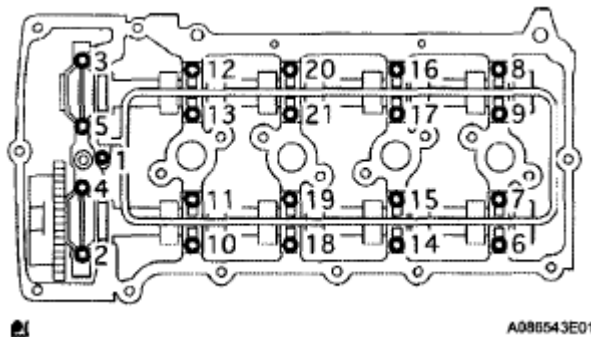


Fig. 85: Identifying Bearing Cap Bolts
Courtesy of ABLE BODY CORP.

- m. Remove the camshaft oil delivery pipe and O-ring.

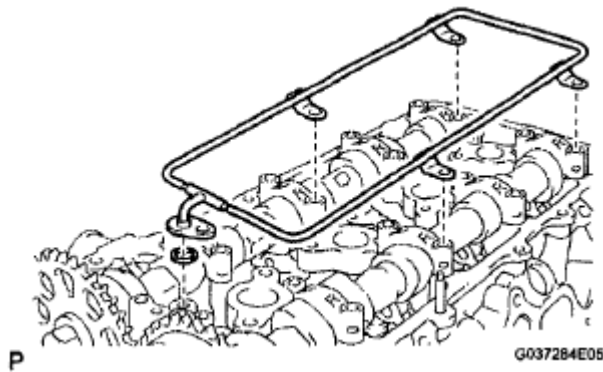


Fig. 86: Identifying Camshaft Oil Delivery Pipe
Courtesy of ABLE BODY CORP.

- n. Remove the camshaft bearing cap No. 1 and 8 camshaft bearing caps No. 2.

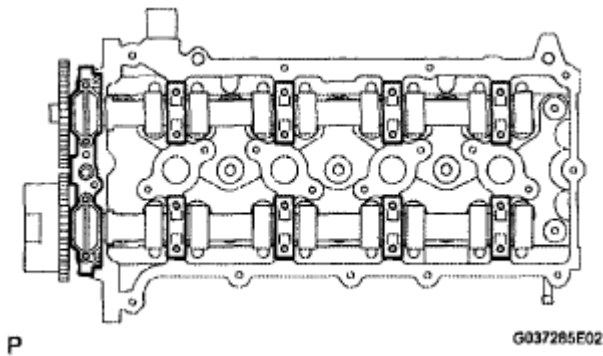


Fig. 87: Identifying Camshaft Bearing Caps
Courtesy of ABLE BODY CORP.

- o. Remove the camshaft and No. 2 camshaft.

NOTE:

- Do not pry the camshaft with a tool by applying excessive force to it.
- Do not damage the cylinder head when removing the camshafts.

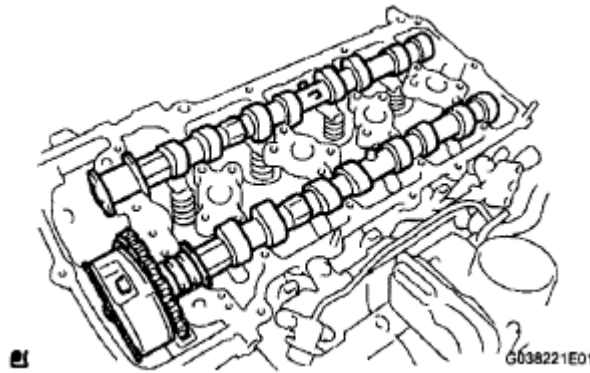


Fig. 88: Identifying Camshaft And No. 2 Camshaft
Courtesy of ABLE BODY CORP.

- p. Tie the chain with a piece of string or wire.

NOTE: Prevent foreign objects from getting into the engine compartment with a shop rag.

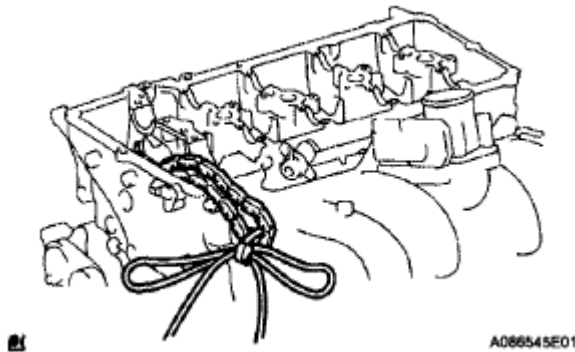


Fig. 89: Tying Chain With Piece Of String Or Wire
Courtesy of ABLE BODY CORP.

11. REMOVE CAMSHAFT TIMING GEAR ASSEMBLY

- a. Clamp the camshaft in a vise, then check that the camshaft timing gear does not rotate.

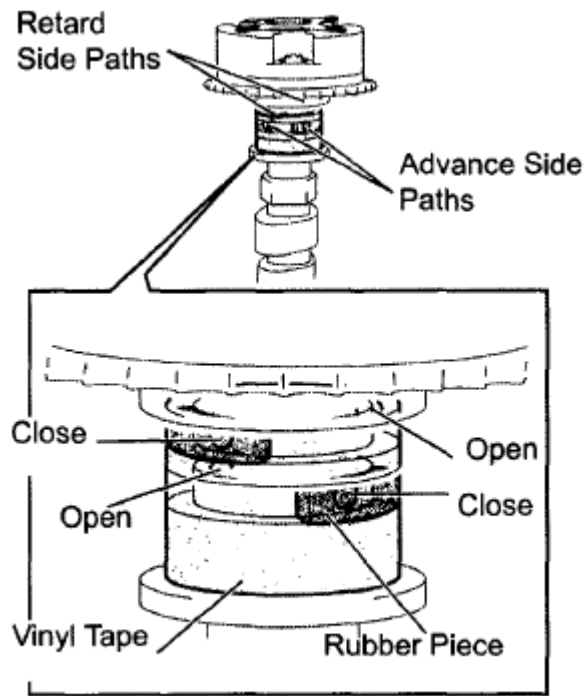
NOTE: Do not damage the camshaft by clamping it in a vise too tightly.

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

HINT:

One of the 2 grooves located on the cam journal is for retarding cam timing (upper) and the other is for advancing cam timing (lower). Each groove has 2 oil paths. Plug one of the 2 oil paths for each groove with a piece of rubber before wrapping the cam journal with the tape.

- c. Puncture the tape covering the advance side path and retard side path on the opposite side.

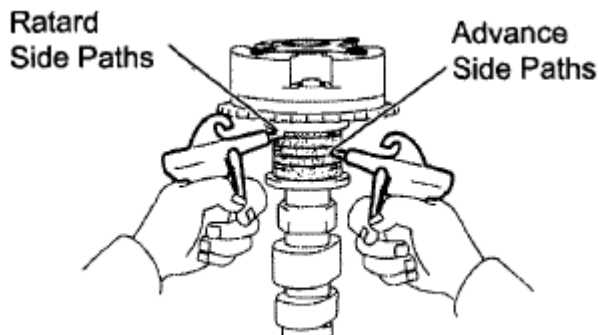


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Fig. 90: Identifying Advance Side Path And Retard Side Path On Opposite Side
Courtesy of ABLE BODY CORP.

- d. Apply air pressure at approximately 200 kPa (2.0 kgf/cm², 29 psi) into the 2 paths (the advance side path and retard side path) from the 2 punctures.

NOTE: When applying air pressure, cover the paths with a shop rag to prevent oil splashes.



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Fig. 91: Applying Air Pressure To Camshaft Timing Gear Both Path
Courtesy of ABLE BODY CORP.

- e. Confirm that the camshaft timing gear revolves in the advance direction when reducing the air pressure on the retard side path.

HINT:

The lock pin is released and the camshaft timing gear revolves in the advance direction.

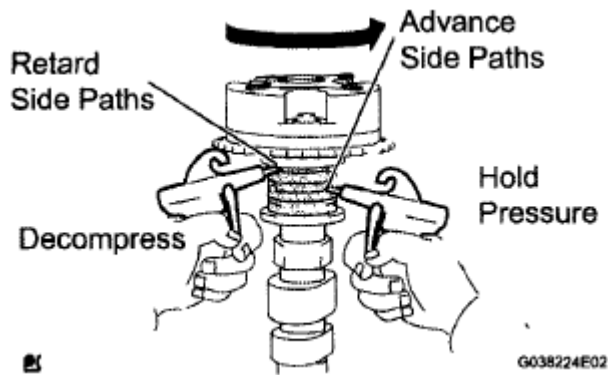


Fig. 92: Identifying Camshaft Timing Gear Turning Position
Courtesy of ABLE BODY CORP.

- f. When the camshaft timing gear reaches the most advanced position, release the air pressure on the retard side path, then release the air pressure on the advance side path.

NOTE: If the air pressure on the advance side path is released first, the camshaft timing gear assembly occasionally shifts in the retard direction abruptly. This may damage the lock pin. Be sure to release the air pressure on the retard side path first.

- g. Remove the fringe bolt of the camshaft timing gear.

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

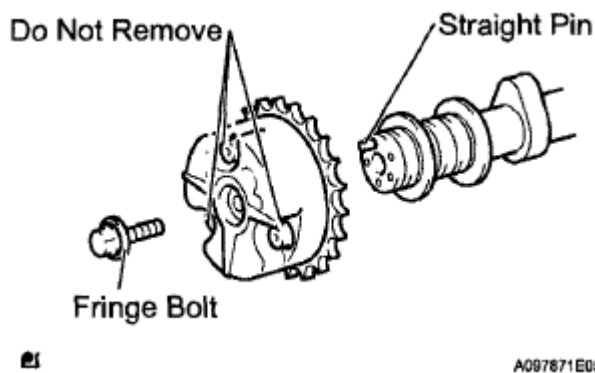


Fig. 93: Removing Fringe Bolt Of Camshaft Timing Gear
Courtesy of ABLE BODY CORP.

INSTALLATION

1. INSTALL CAMSHAFT TIMING GEAR ASSEMBLY

- a. Put the camshaft timing gear and camshaft together by aligning the key groove and straight pin.
- b. Gently press the gear against the camshaft, and turn the gear. Push further at the position where the pin fits into the groove.

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

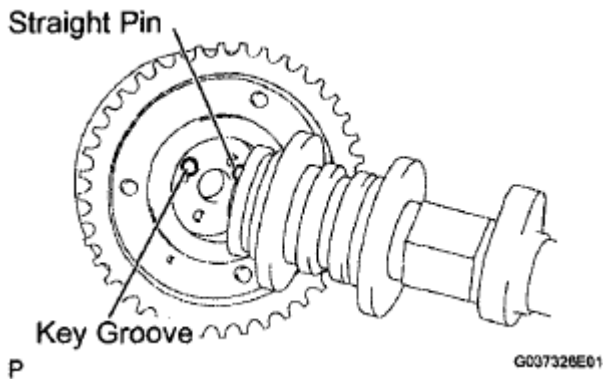


Fig. 94: Identifying Key Groove And Straight Pin
Courtesy of ABLE BODY CORP.

- c. Check that there is no clearance between the gear's fringe and the camshaft.
- d. Tighten the fringe bolt with the camshaft timing gear fixed.

Torque: 78 N*m (795 kgf*cm, 58 ft.*lbf)

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

2. INSTALL CAMSHAFT

NOTE: Check that the valve rocker arm is correctly set as shown in the illustration.

- a. Apply clean engine oil to the camshaft's cam portion and the cylinder head journals.
- b. Install the chain onto the camshaft timing gear, with the painted mark of the link aligned with the timing mark of the camshaft timing gear.

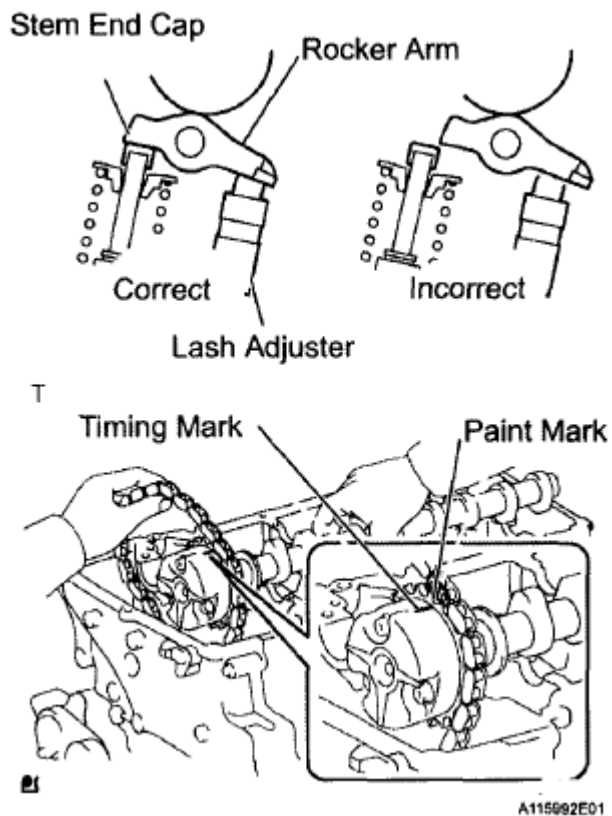


Fig. 95: Installing Chain Onto Camshaft Timing Gear
Courtesy of ABLE BODY CORP.

- c. Set the 2 camshafts as shown in the illustration.

NOTE: **Align the paint mark with the timing mark before setting the camshaft.**

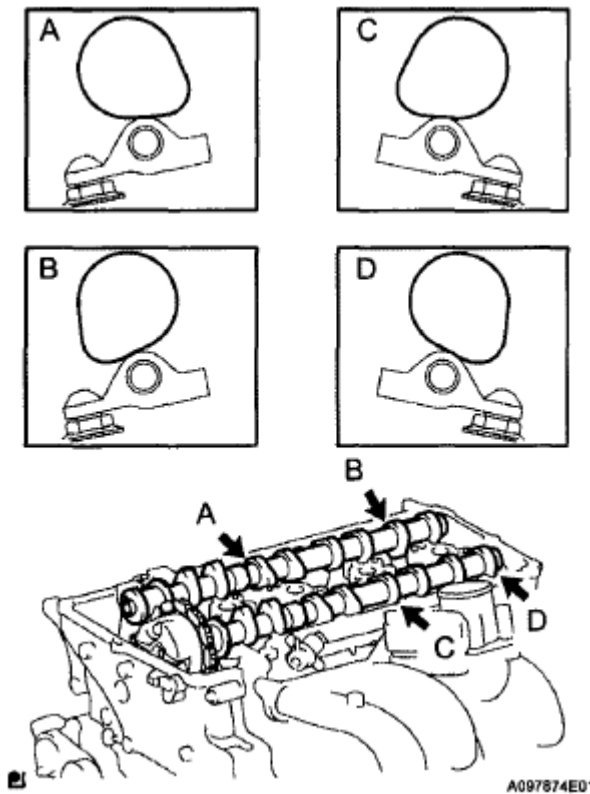


Fig. 96: Identifying Camshafts Position
Courtesy of ABLE BODY CORP.

- d. Provisionally install the No. 1 camshaft bearing cap.
- e. Check the proper location of each No. 2 camshaft bearing cap and install each one.

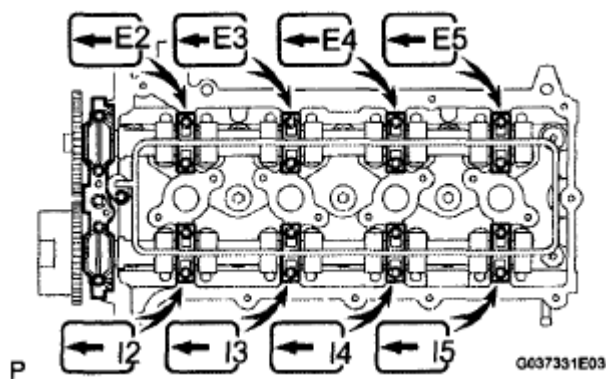


Fig. 97: Installing Camshaft Bearing Cap No.1
Courtesy of ABLE BODY CORP.

- f. Install a new O-ring onto the No. 1 camshaft bearing cap.
- g. Provisionally install the camshaft oil delivery pipe.

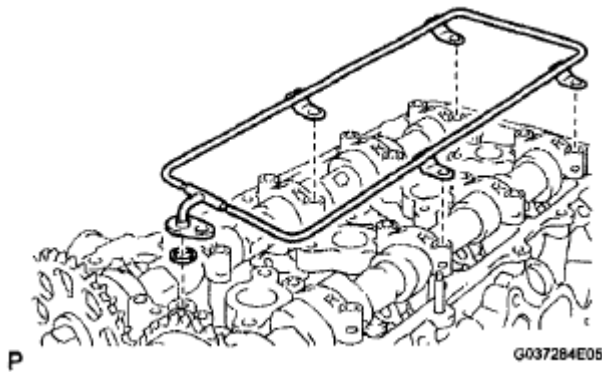


Fig. 98: Installing Camshaft Oil Delivery Pipe
Courtesy of ABLE BODY CORP.

- h. Tighten the bolts in the order shown in the illustration.

Torque: 12 N*m (122 kgf*cm, 9 ft.*lbf) for bolt A 16 N*m (158 kgf*cm, 11 ft.*lbf) for bolts except bolt A

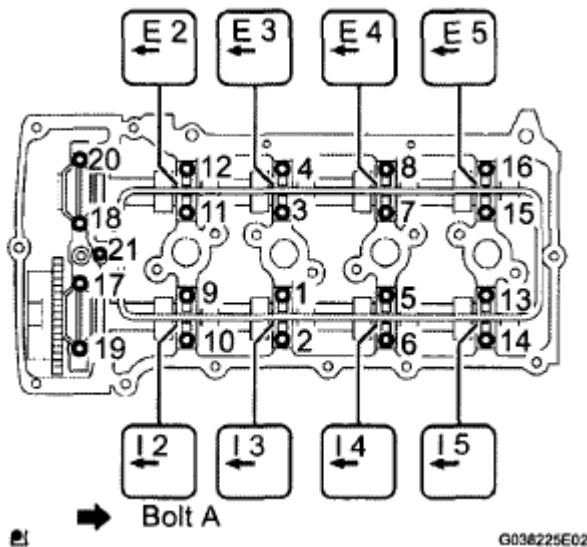


Fig. 99: Identifying Tightening Sequence Of Bolts
Courtesy of ABLE BODY CORP.

- i. Check that each timing mark is set in the position shown in the illustration.

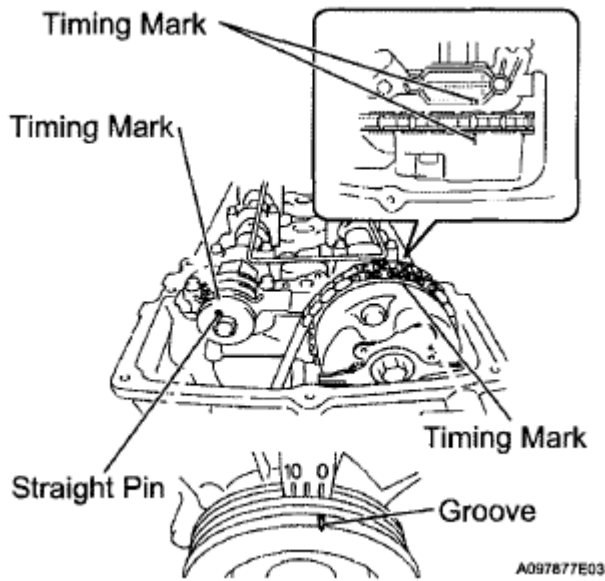


Fig. 100: Aligning Timing Mark
Courtesy of ABLE BODY CORP.

- j. Install the timing chain onto the camshaft timing gear, with the paint mark aligned with the timing mark on the camshaft timing gear.

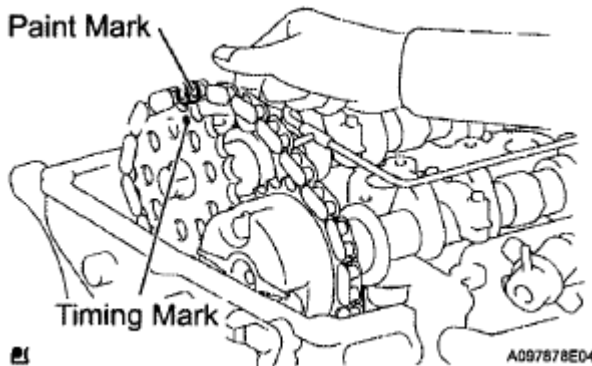


Fig. 101: Installing Timing Chain Onto Camshaft Timing Gear
Courtesy of ABLE BODY CORP.

- k. Align the No. 2 camshaft straight pin and camshaft timing gear straight pin hole. Then install the camshaft timing gear onto the No. 2 camshaft.

NOTE: If the straight pin and straight pin hole are difficult to align, slightly rotate the No. 2 camshaft to the left and right using the hexagonal lobe of the camshaft. Then attempt to align them again.

- l. Hold the hexagonal lobe of the No. 2 camshaft with the adjustable wrench.
- m. Tighten the bolt.

Torque: 78 N*m (795 kgf*cm, 58 ft.*lbf)

- n. Remove the 3.0 mm (0.118 in.) diameter bar from the chain tensioner.
- o. Apply adhesive to 2 or 3 threads of the timing gear case with head straight screw plug.

Adhesive:

Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

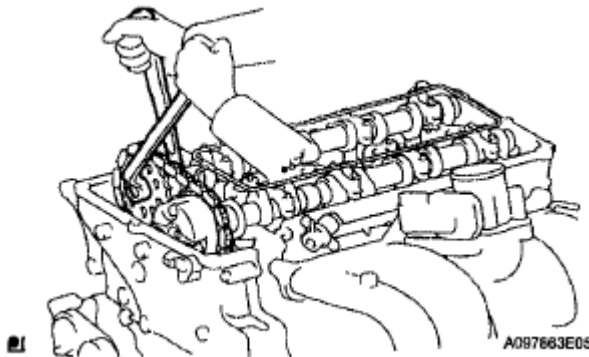


Fig. 102: Loosening Bolt
Courtesy of ABLE BODY CORP.

- p. Using a 10 mm socket hexagon wrench, install the timing gear case with head straight screw plug.

Torque: 17 N*m (170 kgf*cm, 12 ft.*lbf)

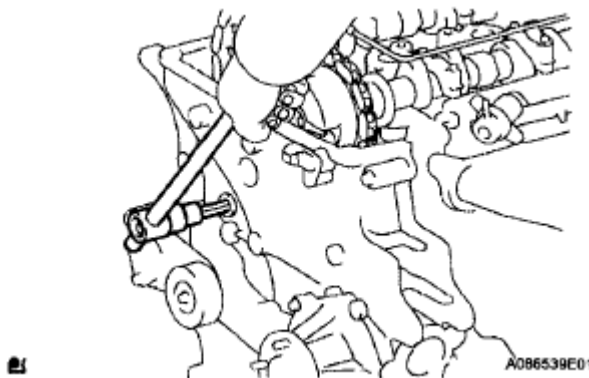


Fig. 103: Installing Timing Gear Case With Head Straight Screw Plug
Courtesy of ABLE BODY CORP.

3. INSTALL TIMING CHAIN GUIDE

- a. Install a new O-ring onto the camshaft bearing cap.

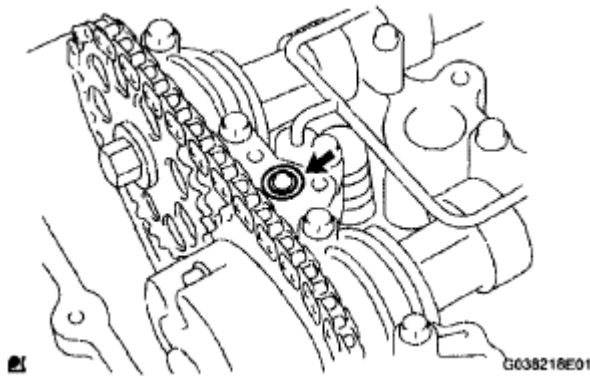


Fig. 104: Installing O-Ring Onto Camshaft Bearing Cap
Courtesy of ABLE BODY CORP.

- b. Install the timing chain guide with the 2 bolts.

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

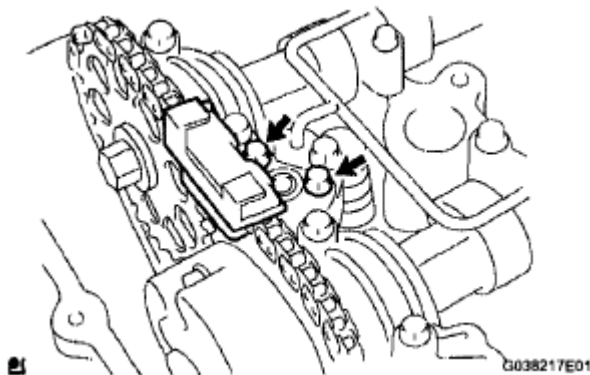


Fig. 105: Locating Timing Chain Guide With Bolts
Courtesy of ABLE BODY CORP.

4. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY

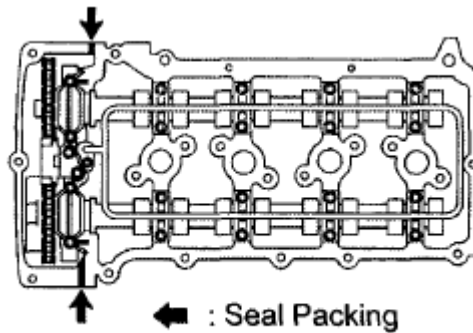
- a. Apply seal packing to the 2 locations shown in the illustration.

Seal packing:

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

NOTE:

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



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Fig. 106: Locating Seal Packing Applying Area
Courtesy of ABLE BODY CORP.

- b. Provisionally install the cylinder head cover with the 19 bolts and 2 nuts.
- c. Tighten bolts A shown in the illustration.

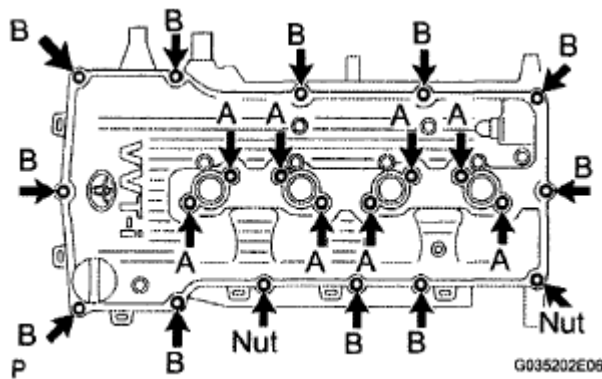
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)

- d. Tighten bolts B and nuts shown in the illustration.

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

- e. Tighten bolts A again.

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



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Fig. 107: Tightening Bolts
Courtesy of ABLE BODY CORP.

- f. Connect the ventilation hose.

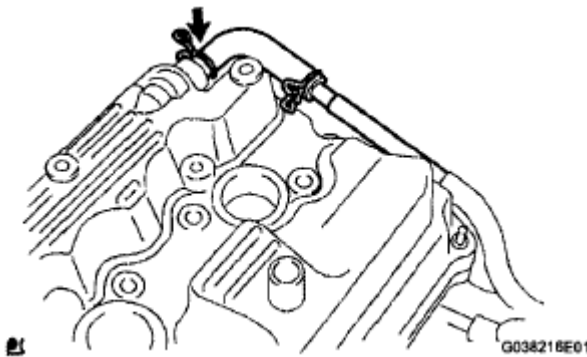


Fig. 108: Locating Ventilation Hose
Courtesy of ABLE BODY CORP.

- g. Install the ignition coils with the bolts.

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

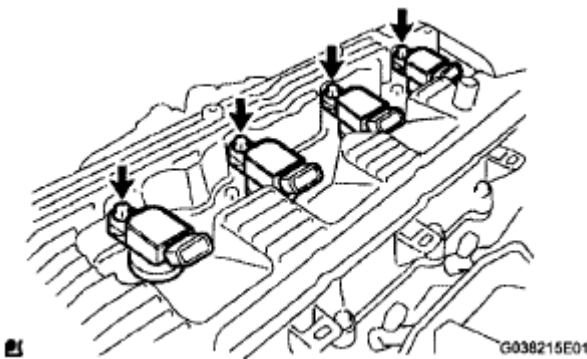


Fig. 109: Locating Ignition Coils With Bolts
Courtesy of ABLE BODY CORP.

- h. Install the engine wire harness clamps.
i. Connect the camshaft position sensor connector.
j. Connect the VSV connector.
k. Connect the throttle with motor body connector.
l. Connect the ignition coil connectors.
5. **INSTALL INTAKE AIR CONNECTOR** (See **INSTALLATION**)
6. **INSTALL AIR CLEANER CAP SUB-ASSEMBLY** (See **INSTALLATION**)
7. **INSTALL FAN SHROUD** (See **INSTALLATION**)
8. **INSTALL RADIATOR SUPPORT TO FRAME SEAL LH** (See **INSTALLATION**)
9. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**

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

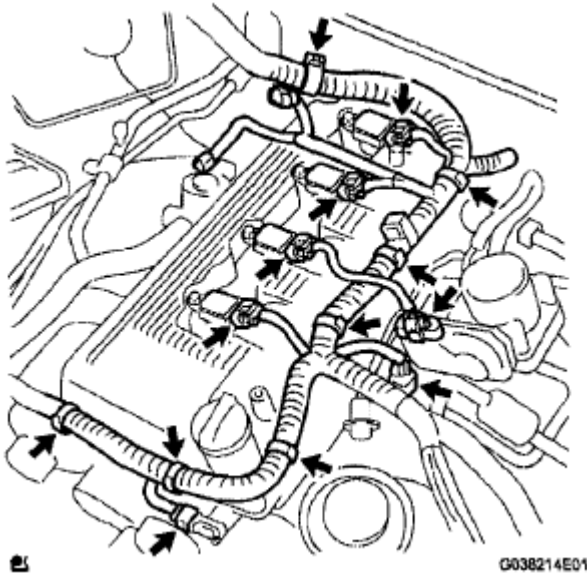


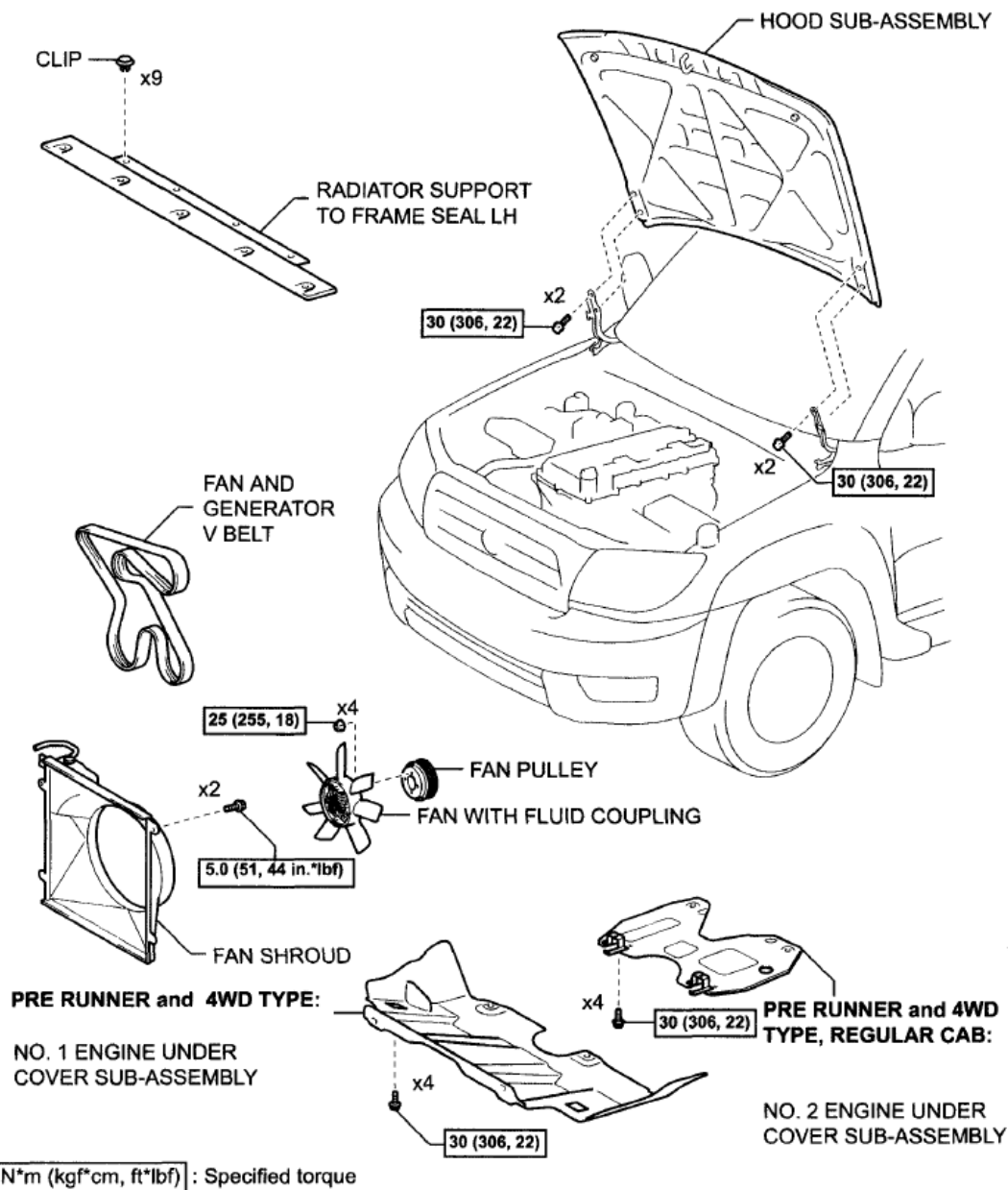
Fig. 110: Locating Camshaft Position Sensor Connector
Courtesy of ABLE BODY CORP.

10. **ADD ENGINE COOLANT** (See **COOLANT**)
11. **CHECK FOR ENGINE COOLANT LEAKAGE** (See **ON-VEHICLE INSPECTION**)
12. **CHECK FOR ENGINE OIL LEAKAGE**
13. **INSTALL NO. 1 ENGINE UNDER COVER SUB-ASSEMBLY** (for Pre Runner and 4WD Type)
 - a. Install the No. 1 engine under cover with the 4 bolts.

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

CYLINDER HEAD

COMPONENTS

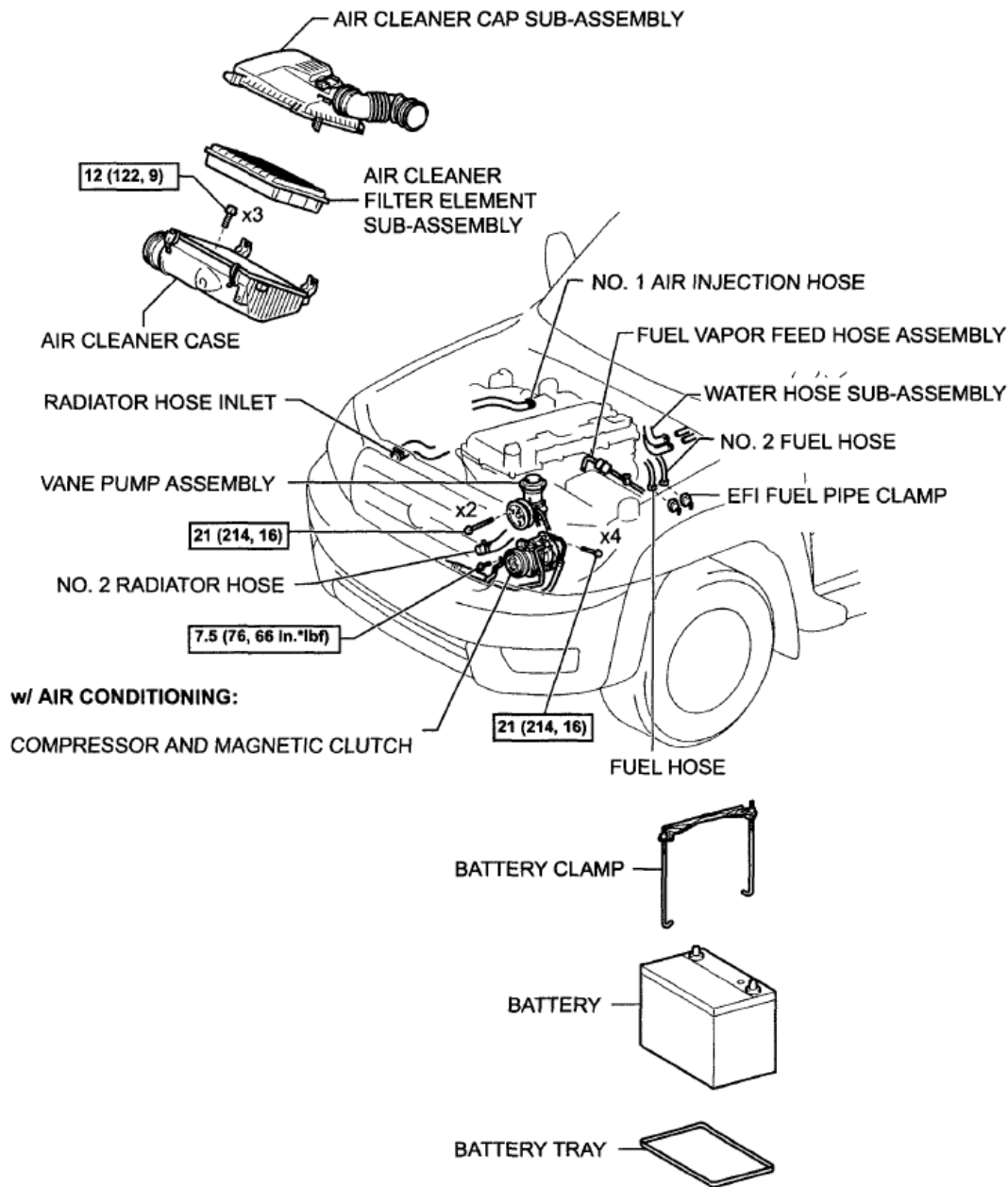


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Fig. 111: Exploded View Of Cylinder Head Components & Torque Specification (1 Of 15)
Courtesy of ABLE BODY CORP.

2009 Toyota Tacoma PreRunner

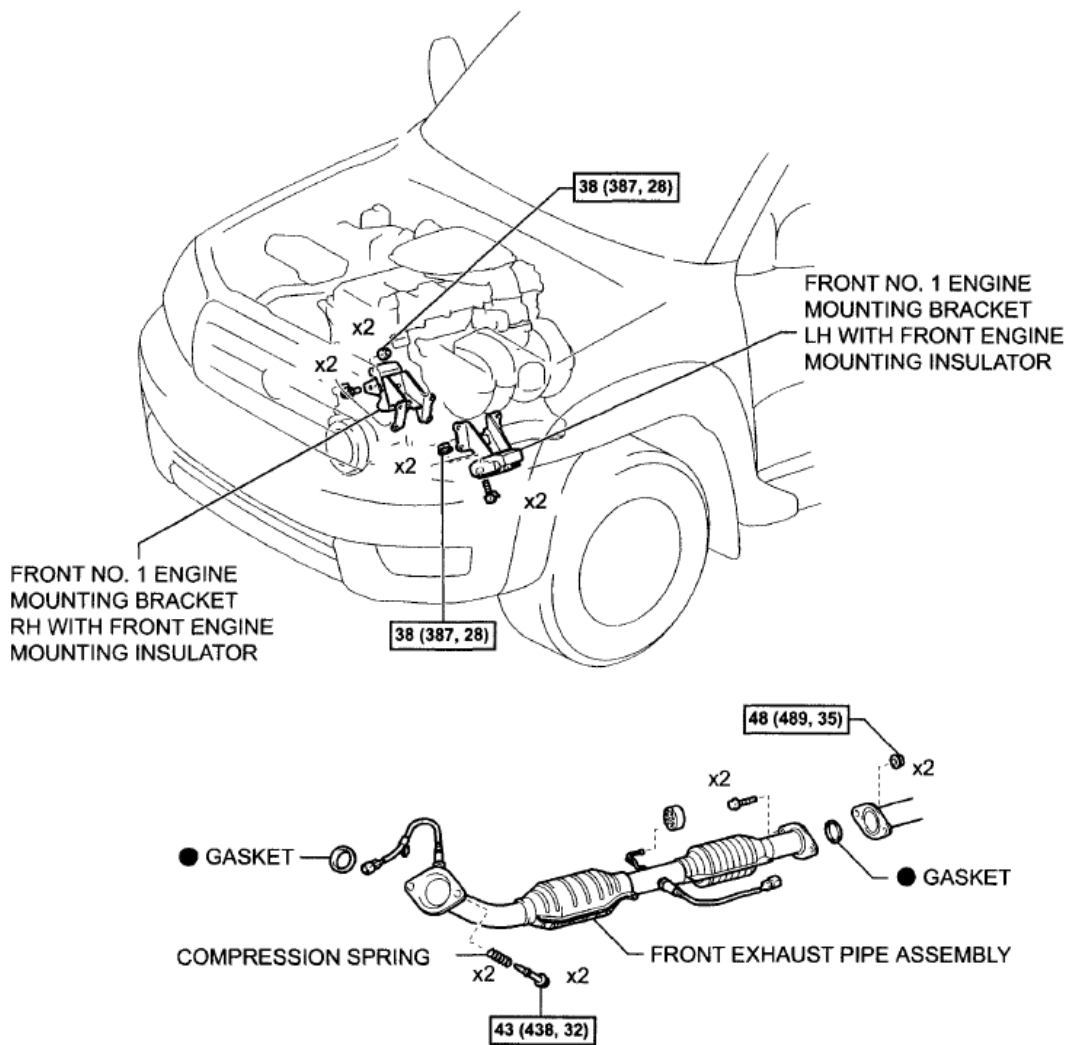
2009 ENGINE Engine Mechanical (2TR-FE) - Tacoma



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

A113642E01

Fig. 112: Exploded View Of Cylinder Head Components & Torque Specification (2 Of 15)
Courtesy of ABLE BODY CORP.

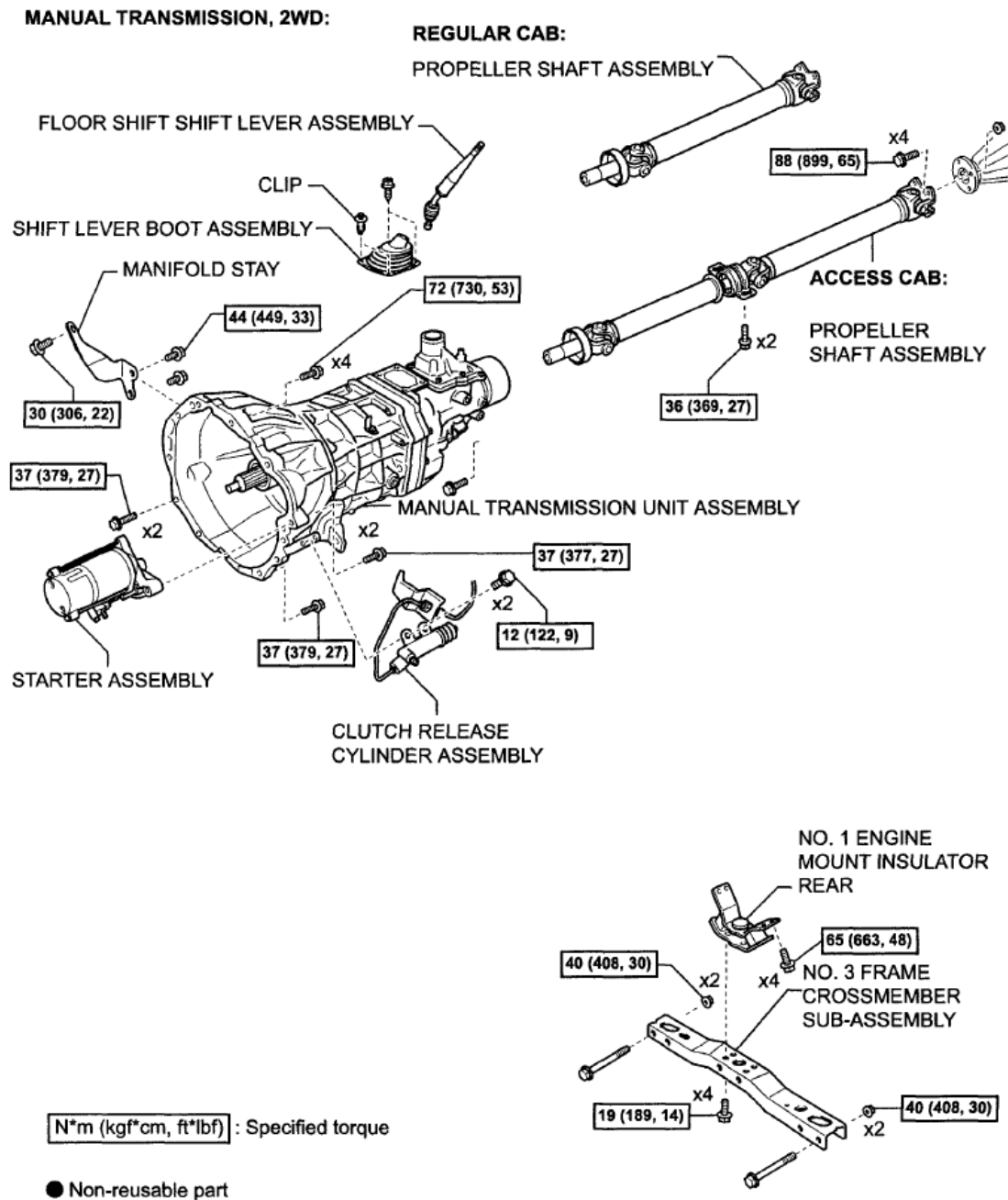


N*m (kgf*cm, ft*lb) : Specified torque

● Non-reusable part

A113643E04

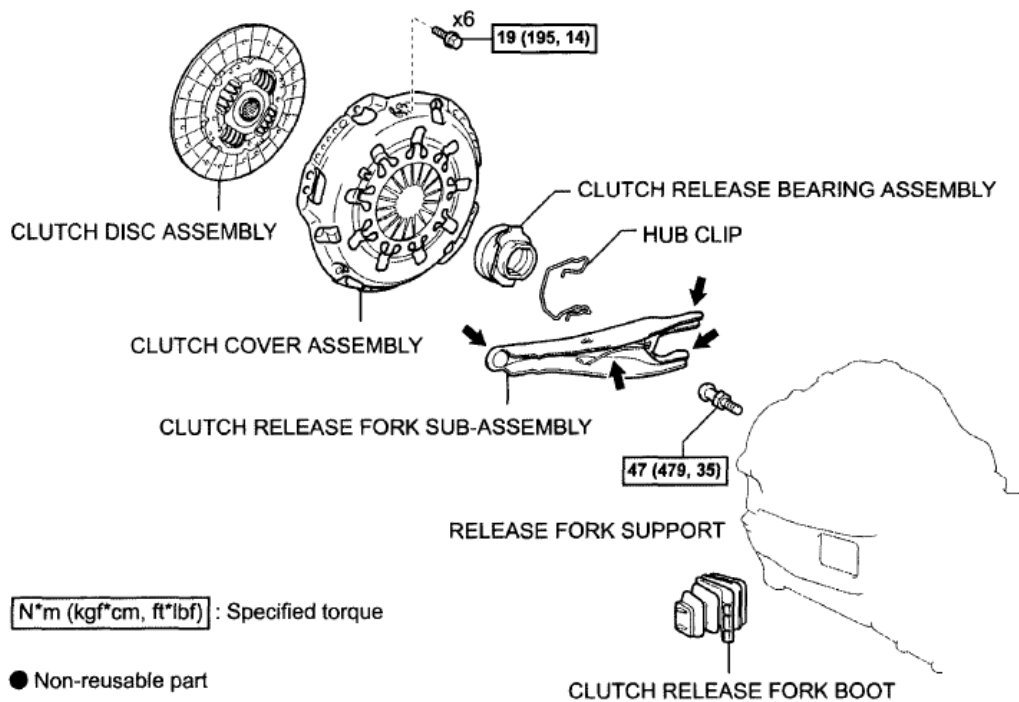
Fig. 113: Exploded View Of Cylinder Head Components & Torque Specification (3 Of 15)
 Courtesy of ABLE BODY CORP.



A113649E01

Fig. 114: Exploded View Of Cylinder Head Components & Torque Specification (4 Of 15)
 Courtesy of ABLE BODY CORP.

MANUAL TRANSMISSION:



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Fig. 116: Exploded View Of Cylinder Head Components & Torque Specification (6 Of 15)
 Courtesy of ABLE BODY CORP.

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AUTOMATIC TRANSMISSION:

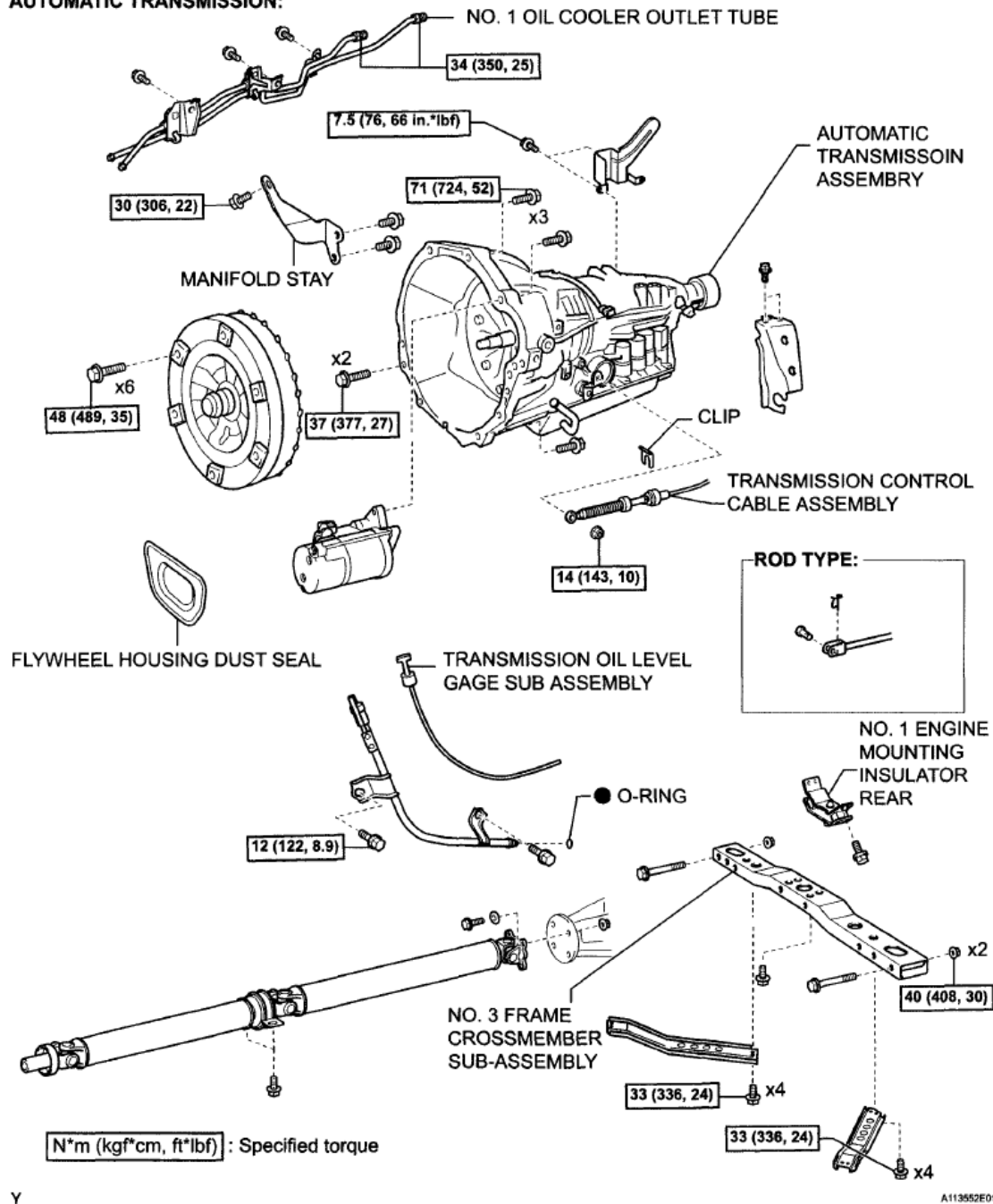
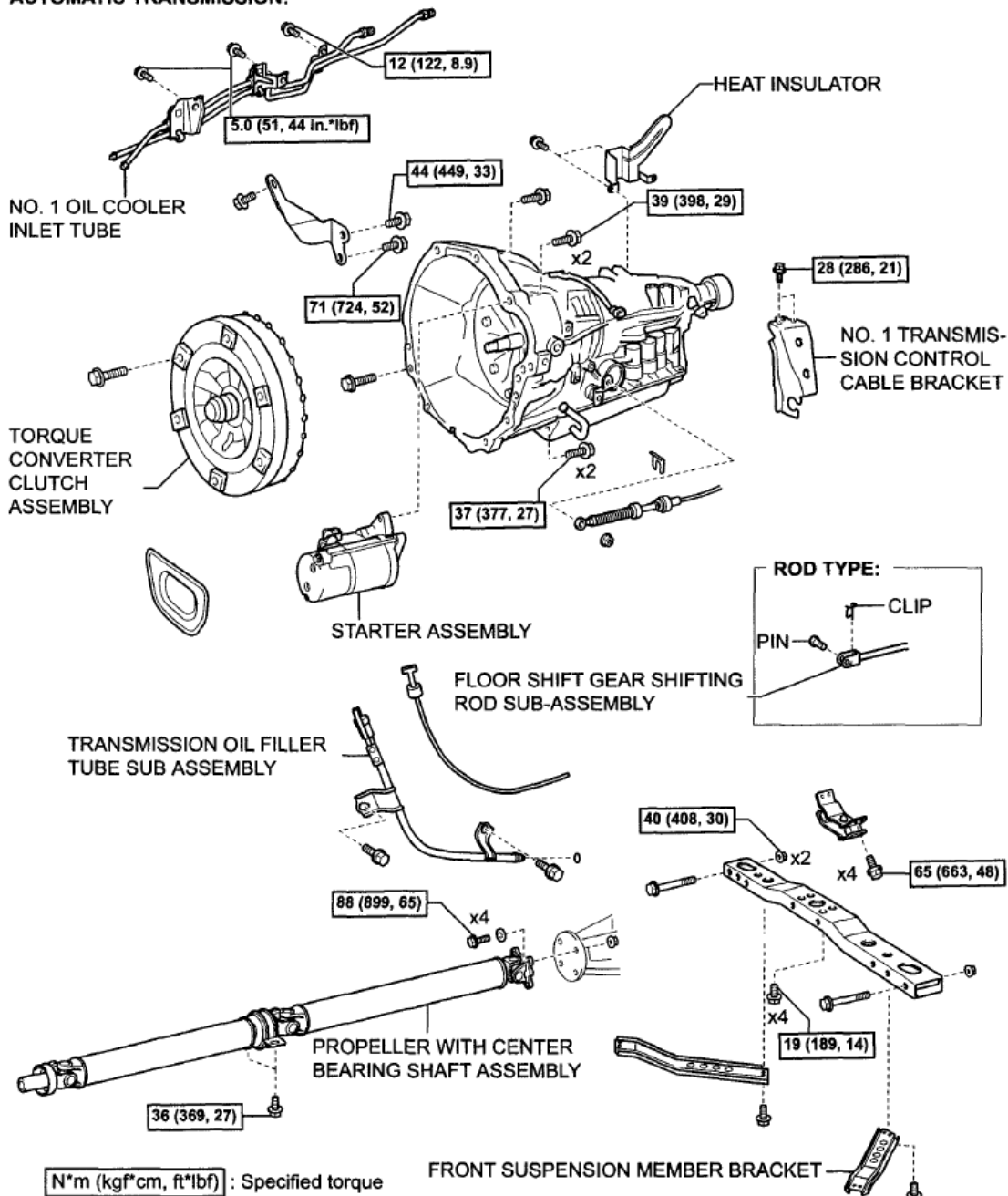


Fig. 117: Exploded View Of Cylinder Head Components & Torque Specification (7 Of 15)
Courtesy of ABLE BODY CORP.

2009 Toyota Tacoma PreRunner

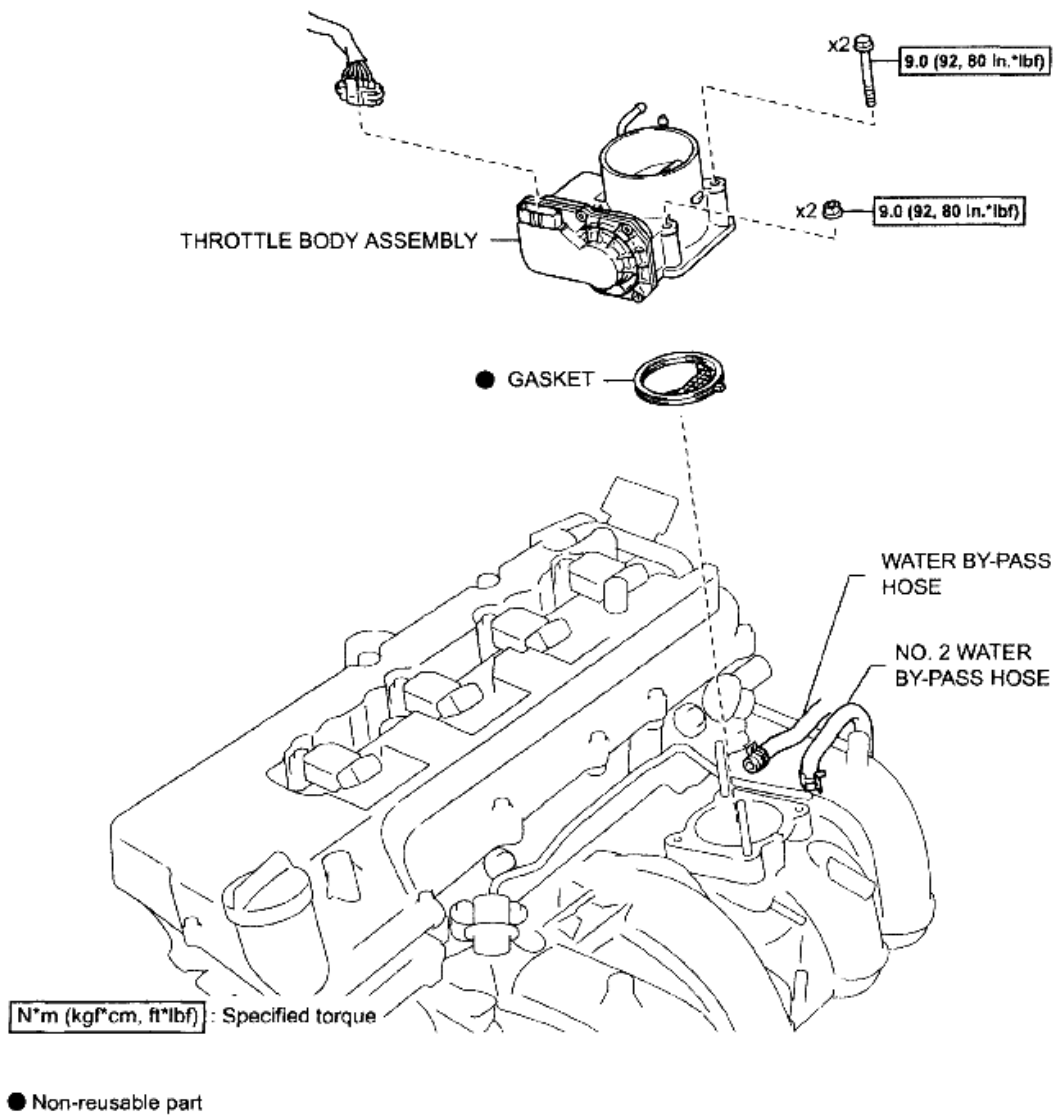
2009 ENGINE Engine Mechanical (2TR-FE) - Tacoma

AUTOMATIC TRANSMISSION:



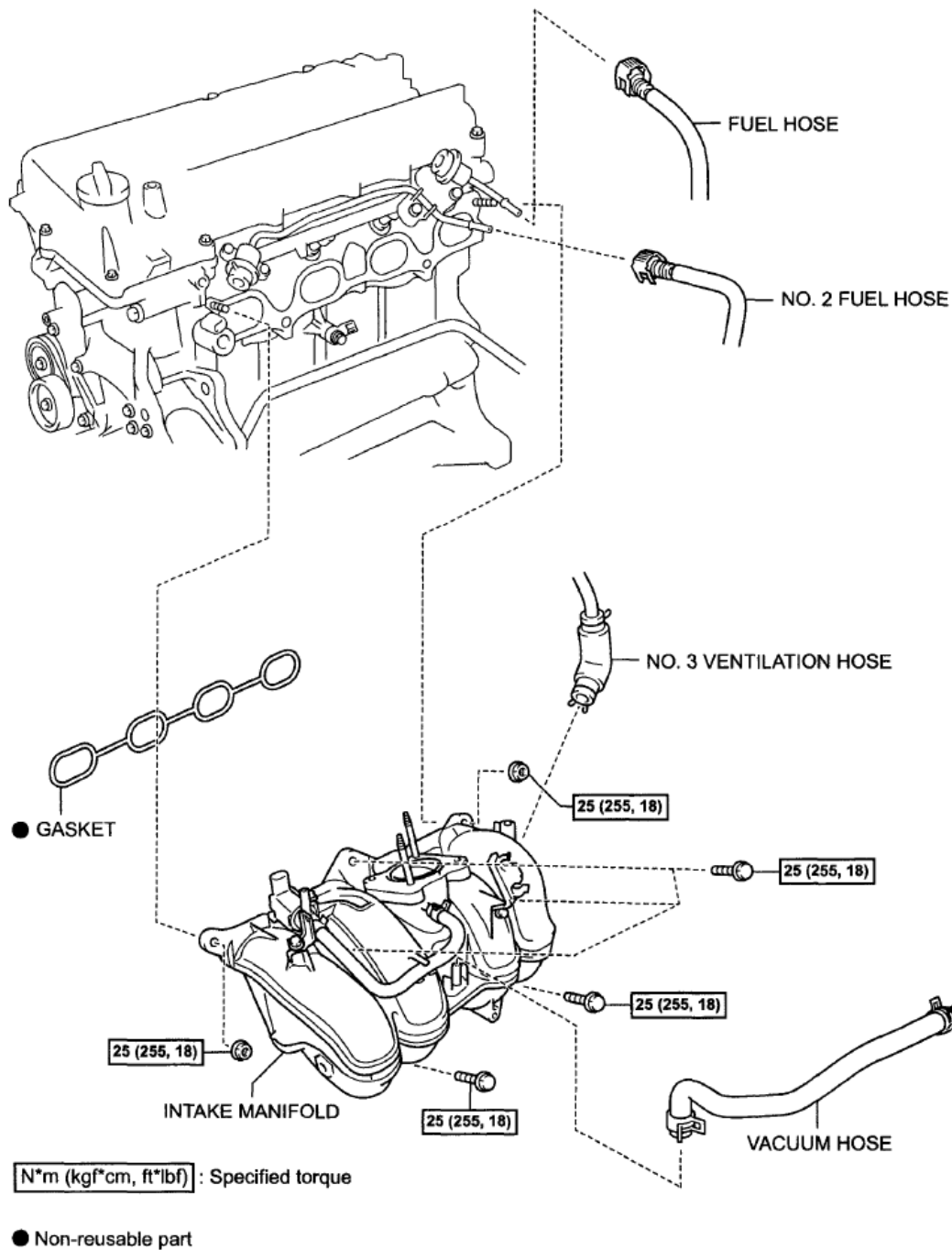
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Fig. 118: Exploded View Of Cylinder Head Components & Torque Specification (8 Of 15)
Courtesy of ABLE BODY CORP.



A/13824EO1

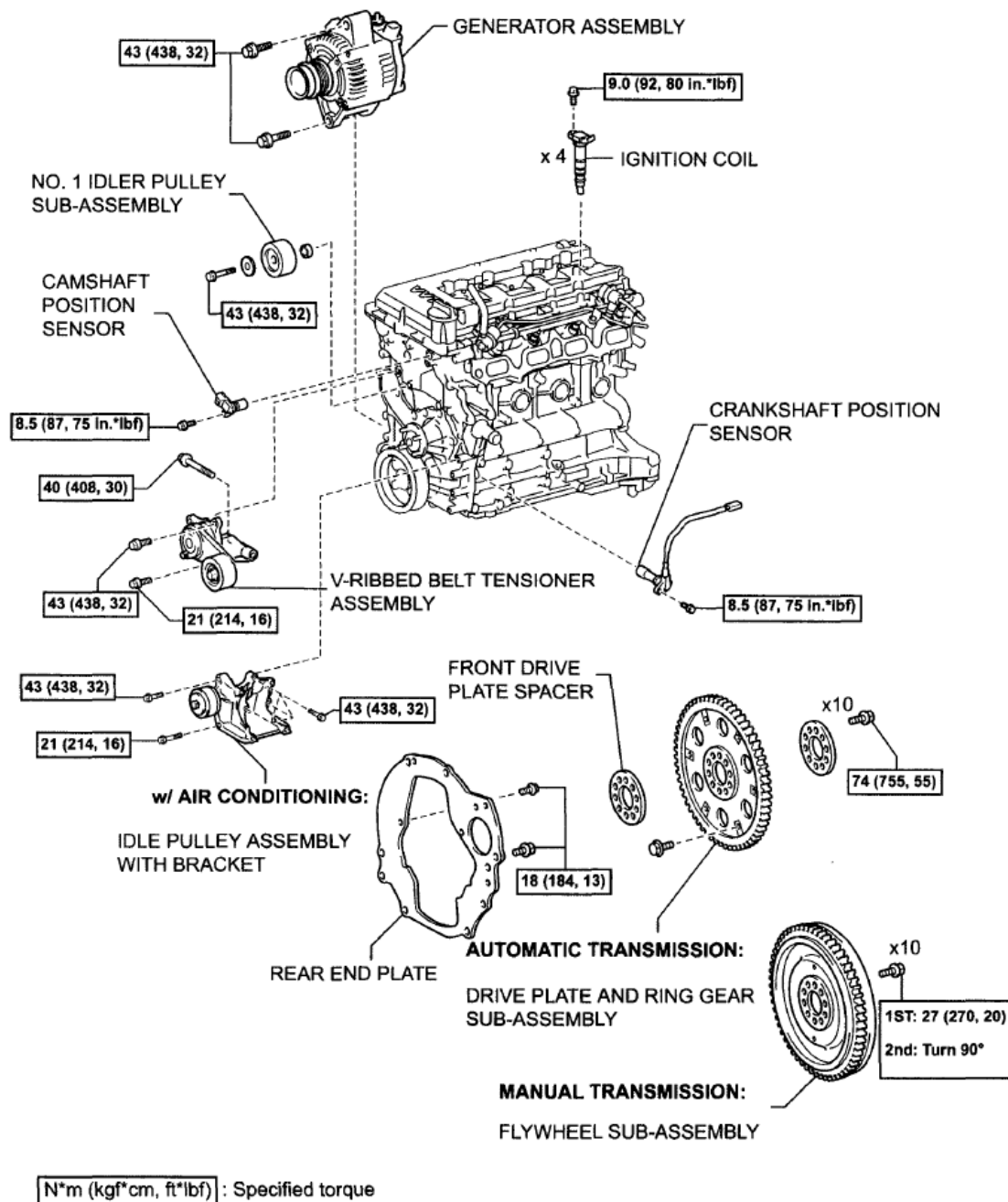
Fig. 119: Exploded View Of Cylinder Head Components & Torque Specification (9 Of 15)
 Courtesy of ABLE BODY CORP.



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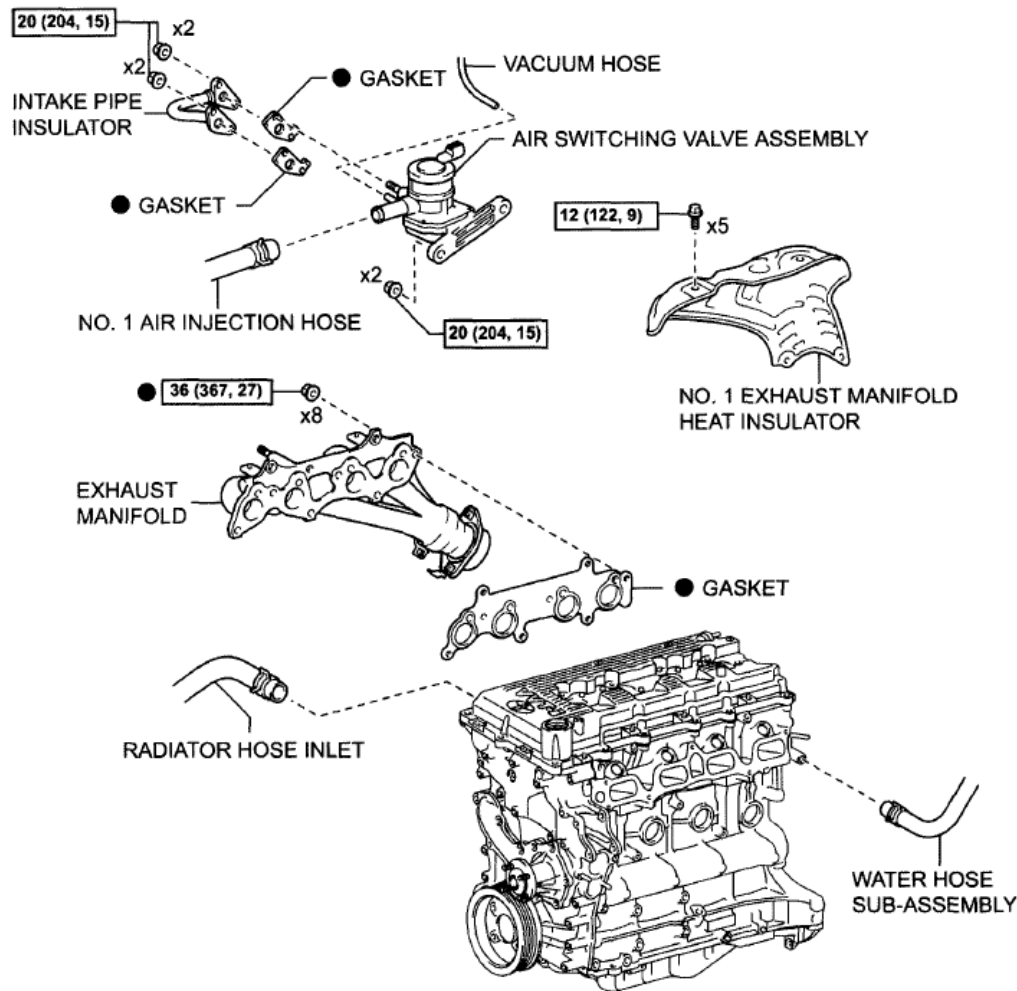
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Fig. 120: Exploded View Of Cylinder Head Components & Torque Specification (10 Of 15)
Courtesy of ABLE BODY CORP.



A154175E01

Fig. 121: Exploded View Of Cylinder Head Components & Torque Specification (11 Of 15)
Courtesy of ABLE BODY CORP.



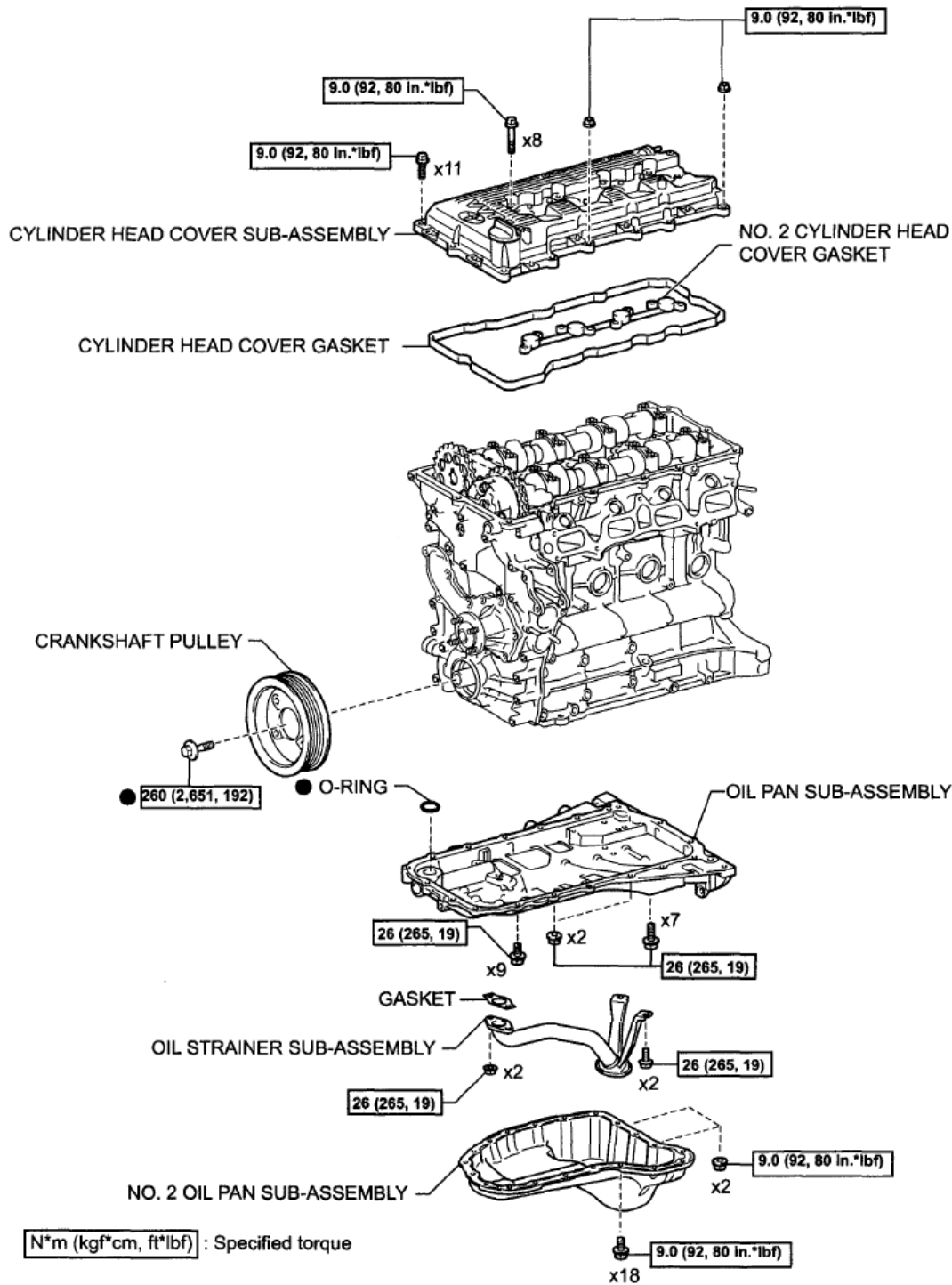
N*m (kgf*cm, ft*lb) : Specified torque

● Non-reusable part

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A113637E01

Fig. 122: Exploded View Of Cylinder Head Components & Torque Specification (12 Of 15)
Courtesy of ABLE BODY CORP.



A113620E01

Fig. 123: Exploded View Of Cylinder Head Components & Torque Specification (13 Of 15)
 Courtesy of ABLE BODY CORP.

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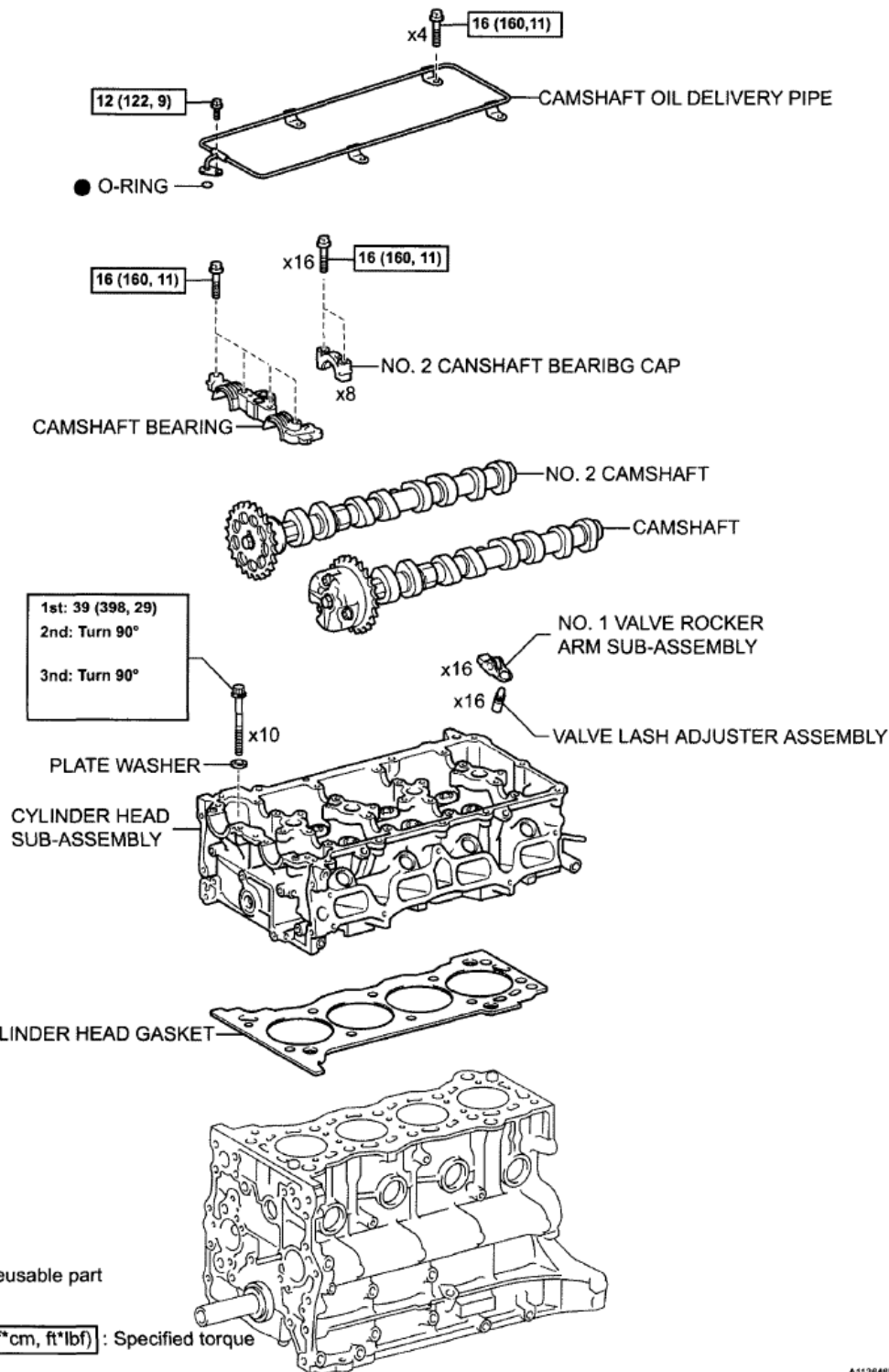


Fig. 125: Exploded View Of Cylinder Head Components & Torque Specification (15 Of 15)
Courtesy of ABLE BODY CORP.

REMOVAL

1. **REMOVE HOOD SUB-ASSEMBLY**
2. **DISCHARGE FUEL SYSTEM PRESSURE**

(See **FUEL SYSTEM**)

3. **REMOVE NO. 1 ENGINE UNDER COVER SUB-ASSEMBLY (for Pre Runner and 4WD Type)**
 - a. Remove the 4 bolts, then remove the No. 1 engine under cover.
4. **REMOVE NO. 2 ENGINE UNDER COVER SUB-ASSEMBLY (for Pre Runner and 4WD Type, Regular Cab)**
 - a. Remove the 4 bolts, then remove the No. 2 engine under cover.
5. **DRAIN ENGINE OIL (See OIL FILTER)**
6. **DRAIN ENGINE COOLANT (See COOLANT)**
7. **REMOVE BATTERY**
8. **REMOVE BATTERY TRAY**
9. **REMOVE RADIATOR SUPPORT TO FRAME SEAL LH (See ON-VEHICLE CLEANING)**
10. **REMOVE FAN SHROUD (See REMOVAL)**
11. **REMOVE AIR CLEANER CAP SUB-ASSEMBLY (See AIR SWITCHING VALVE)**
12. **REMOVE AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY**
13. **REMOVE AIR CLEANER CASE**
 - a. Remove the 3 bolts, then remove the air cleaner case.
14. **SEPARATE VANE PUMP ASSEMBLY (See REMOVAL)**
15. **REMOVE NO. 2 RADIATOR HOSE**
16. **SEPARATE COMPRESSOR AND MAGNETIC CLUTCH (w/Air Conditioning) (See REMOVAL)**
17. **REMOVE RADIATOR HOSE INLET**
18. **SEPARATE WATER HOSE SUB-ASSEMBLY (See REMOVAL)**
19. **DISCONNECT FUEL HOSE (See REMOVAL)**
20. **DISCONNECT NO. 2 FUEL HOSE (See REMOVAL)**
21. **SEPARATE FUEL VAPOR FEED HOSE ASSEMBLY (See REMOVAL)**
22. **DISCONNECT NO. 1 AIR INJECTION HOSE (See REMOVAL)**
23. **DISCONNECT ENGINE WIRE (See REMOVAL)**
24. **REMOVE EXHAUST PIPE ASSEMBLY TAIL (See REMOVAL)**
25. **REMOVE EXHAUST PIPE ASSEMBLY FRONT (See REMOVAL)**
26. **REMOVE MANUAL TRANSMISSION UNIT ASSEMBLY**

MANUAL TRANSMISSION UNIT ASSEMBLY REFERENCE

Transmission	Refer to
R155	<u>REMOVAL</u>
R155F	<u>REMOVAL</u>

27. REMOVE AUTOMATIC TRANSMISSION ASSEMBLY(See **INSTALLATION**)**28. REMOVE ENGINE ASSEMBLY (See INSTALLATION)****29. REMOVE CLUTCH COVER ASSEMBLY (for Manual Transmission)****CLUTCH COVER ASSEMBLY REFERENCE**

Transmission	Refer to
R155	<u>CLUTCH UNIT (FOR R155)</u>
R155F	<u>CLUTCH UNIT (FOR R155F)</u>

30. REMOVE CLUTCH DISC ASSEMBLY (for Manual Transmission)**CLUTCH DISC ASSEMBLY REFERENCE**

Transmission	Refer to
R155	<u>CLUTCH UNIT (FOR R155)</u>
R155F	<u>CLUTCH UNIT (FOR R155F)</u>

31. REMOVE FLYWHEEL SUB-ASSEMBLY (for Automatic Transmission) (See REMOVAL)**32. REMOVE DRIVE PLATE AND RING GEAR SUB-ASSEMBLY (for Manual Transmission) (See REMOVAL)****33. REMOVE REAR END PLATE**

- a. Remove the 2 bolts, then remove the rear end plate.

34. REMOVE INTAKE AIR CONNECTOR (See ON-VEHICLE INSPECTION)**35. REMOVE GENERATOR ASSEMBLY (See REMOVAL)****36. REMOVE NO. 1 EXHAUST MANIFOLD HEAT INSULATOR (See AIR SWITCHING VALVE)****37. REMOVE INTAKE PIPE INSULATOR (See AIR SWITCHING VALVE)****38. REMOVE AIR SWITCHING VALVE ASSEMBLY (See INSPECTION)****39. REMOVE EXHAUST MANIFOLD**

- a. Remove the 8 nuts, then remove the exhaust manifold.

40. REMOVE V-RIBBED BELT TENSIONER ASSEMBLY (See WATER PUMP)**41. REMOVE NO. 1 IDLER PULLEY SUB-ASSEMBLY (See REMOVAL)****42. REMOVE IDLE PULLEY ASSEMBLY WITH BRACKET (w/Air Conditioning System) (See CRANKSHAFT POSITION SENSOR)**

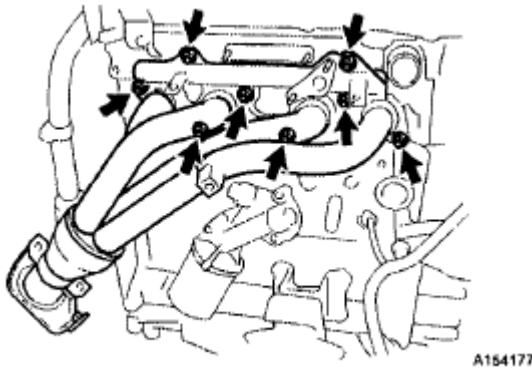


Fig. 126: Locating Exhaust Manifold Bolts
Courtesy of ABLE BODY CORP.

43. REMOVE CRANKSHAFT POSITION SENSOR (See CAMSHAFT POSITION SENSOR)
44. REMOVE CAMSHAFT POSITION SENSOR (See CAMSHAFT POSITION SENSOR)
45. REMOVE NO. 1 INTAKE MANIFOLD HEAD GASKET (See REMOVAL)
46. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY (See REMOVAL)
47. REMOVE CRANKSHAFT PULLEY (See REMOVAL)
48. REMOVE OIL LEVEL GAGE SUB-ASSEMBLY
49. REMOVE NO. 2 OIL PAN SUB-ASSEMBLY (See REMOVAL)
50. REMOVE OIL STRAINER SUB-ASSEMBLY (See REMOVAL)
51. REMOVE OIL PAN SUB-ASSEMBLY (See REMOVAL)
52. REMOVE TIMING CHAIN COVER (See REMOVAL)
53. REMOVE TIMING CHAIN GUIDE (See REMOVAL)
54. REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY (See REMOVAL)
55. REMOVE CHAIN TENSIONER SLIPPER (See REMOVAL)
56. REMOVE NO. 1 CHAIN VIBRATION DAMPER (See REMOVAL)
57. REMOVE CHAIN SUB-ASSEMBLY
58. REMOVE CAMSHAFT (See REMOVAL)
59. REMOVE NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY
 - a. Remove the 16 valve rocker arms.

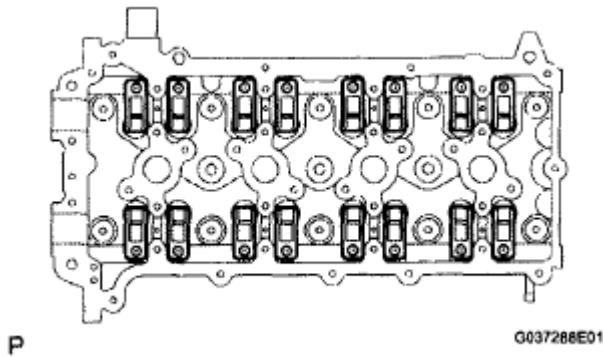


Fig. 127: Identifying Valve Rocker Arms
Courtesy of ABLE BODY CORP.

60. REMOVE VALVE LASH ADJUSTER ASSEMBLY

- a. Remove the valve lash adjuster.

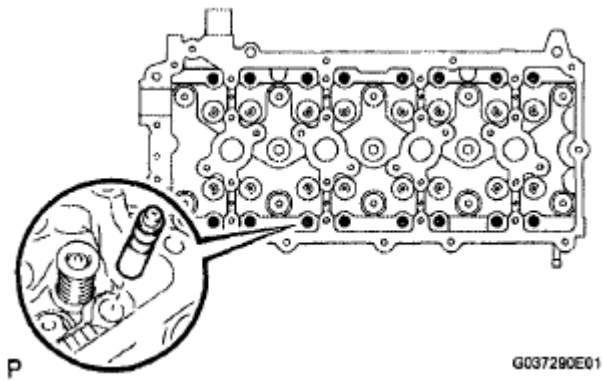


Fig. 128: Identifying Lash Adjusters
Courtesy of ABLE BODY CORP.

61. REMOVE CYLINDER HEAD SUB-ASSEMBLY

- a. Disconnect the water hose shown in the illustration.
- b. Disconnect the engine coolant temperature sensor connector.
- c. Remove the bolts, then separate the wire harnesses.
- d. Remove the bolt, then separate the wire harness bracket.

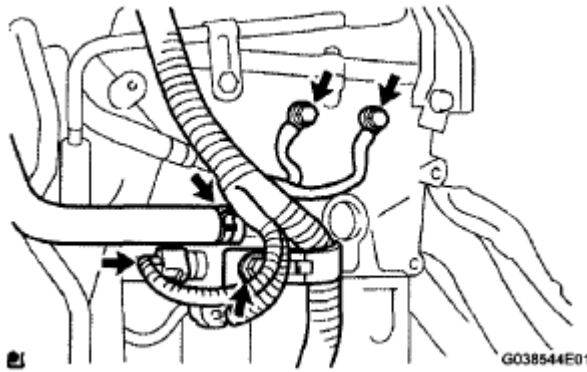


Fig. 129: Locating Wire Harnesses
Courtesy of ABLE BODY CORP.

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

NOTE:

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

62. REMOVE CYLINDER HEAD GASKET

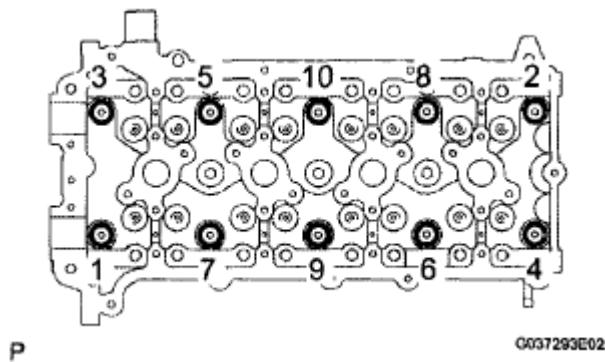


Fig. 130: Identifying Loosening Sequence Of Cylinder Head Bolts
Courtesy of ABLE BODY CORP.

INSPECTION

1. INSPECT CYLINDER HEAD SET BOLT

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

Standard outside diameter:

10.76 to 10.97 mm (0.4236 to 0.4319 in.)

Minimum outside diameter:

10.40 mm (0.4094 in.)

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 smallest diameter.

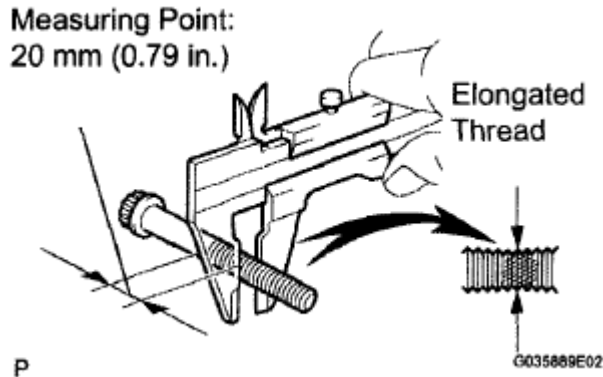


Fig. 131: Measuring Minimum Diameter Of Elongated Thread At Measuring Point
Courtesy of ABLE BODY CORP.

INSTALLATION

1. INSTALL CYLINDER HEAD GASKET

- Apply continuous beads of seal packing to the cylinder block upper side and cylinder head gasket upper side as shown in the illustration.

Seal packing:

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

4 to 7 mm (0.15 to 0.28 in.)

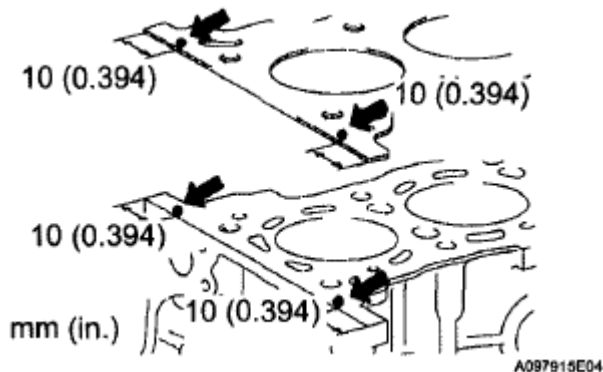


Fig. 132: Applying Continuous Beads Of Seal Packing To Cylinder Block Upper Side
Courtesy of ABLE BODY CORP.

NOTE:

- Remove any oil from the contact surface.
- Install the cylinder head gasket within 3 minutes of applying the seal packing.
- Install the cylinder head bolt within 15 minutes of applying the seal packing.
- Do not pour in engine oil for at least 4 hours after installation.

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

NOTE:

- Make sure that the cylinder head gasket is installed in the correct direction.
- Place the cylinder head gently in order to avoid damaging the gasket with the bottom part of the head.

2. INSTALL CYLINDER HEAD SUB-ASSEMBLY

HINT:

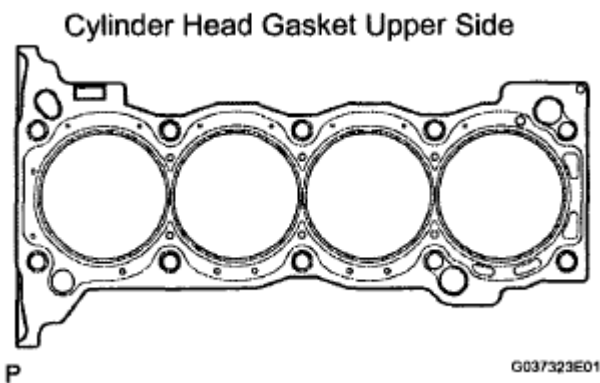


Fig. 133: Placing Cylinder Head Gasket On Cylinder Block Surface With Lot No. Stamp
Courtesy of ABLE BODY CORP.

The cylinder head bolts are tightened in 2 successive steps.

- Place the cylinder head on the cylinder block.
- Apply a light coat of engine oil to the threads and under the heads of the cylinder head bolts.
- Using several steps, uniformly install and tighten the 10 cylinder head bolts with plate washers with a 10 mm bi-hexagon wrench in the sequence shown in the illustration.

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

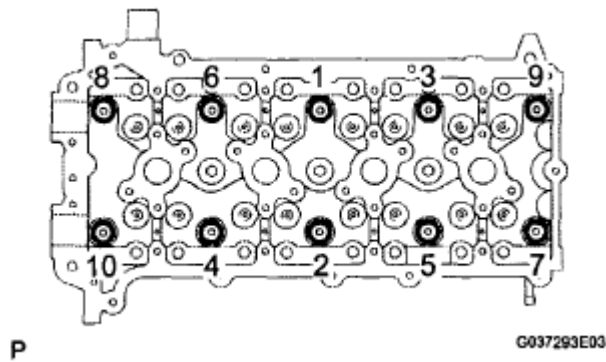


Fig. 134: Identifying Tightening Sequence Of Cylinder Head Bolts
Courtesy of ABLE BODY CORP.

- d. Mark the front of the cylinder head bolt head with paint.
- e. Retighten the cylinder head bolts by 90° in the same order as in step (c).
- f. Retighten the cylinder head bolts by an additional 90° .
- g. Check that the painted mark is at a 180° from the original position.

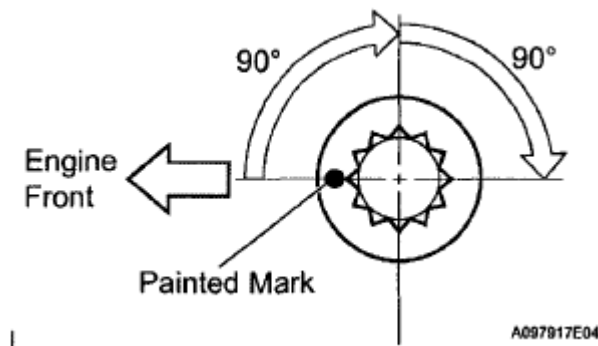


Fig. 135: Marking Front Of Cylinder Head Bolt Head With Paint
Courtesy of ABLE BODY CORP.

- h. Seal packing will seep out on the engine's front side. Thoroughly wipe clean any seal packing.
- i. Install the wire harness bracket with the bolt.
- j. Install the wire harness with the bolts.
- k. Connect the engine coolant temperature sensor connector.
- l. Install the water hose.

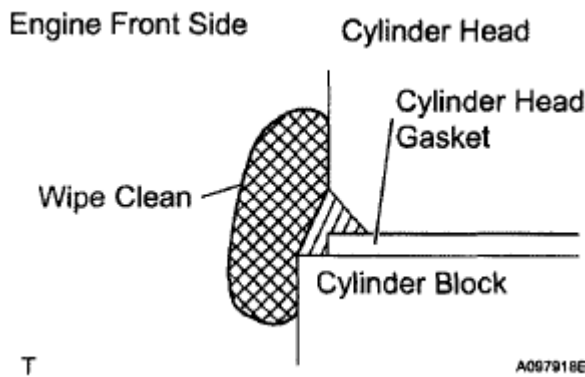


Fig. 136: Identifying Seal Packing On Engine's Front Side
 Courtesy of ABLE BODY CORP.

3. INSPECT 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 the tip of SST into the lash adjuster's plunger and press down the checkball inside the plunger.

SST 09276-75010

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

OK:

Plunger moves up and down.

NOTE:

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

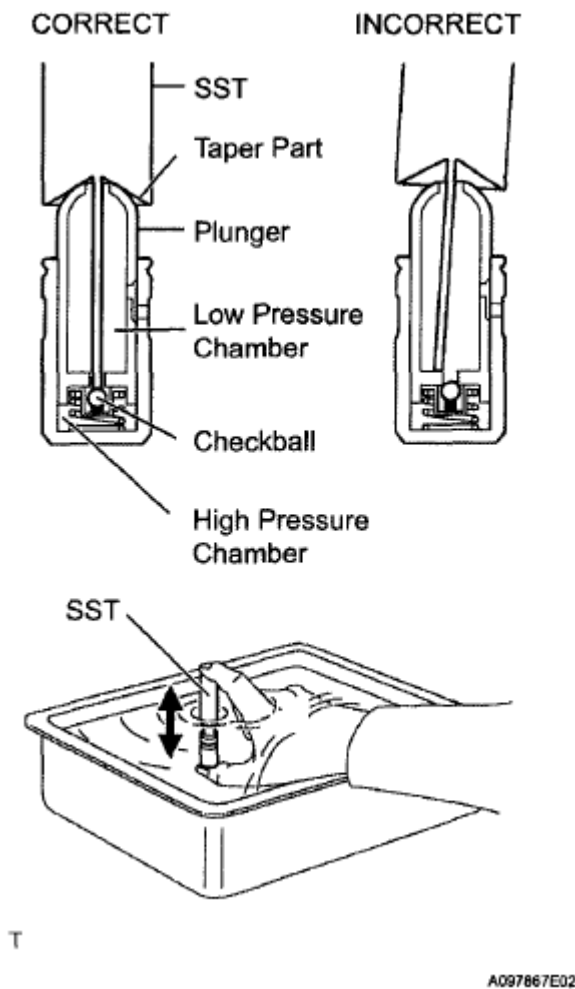


Fig. 137: Inserting Tip Of SST Into Lash Adjuster's Plunger
Courtesy of ABLE BODY CORP.

4. INSTALL VALVE LASH ADJUSTER ASSEMBLY

- a. Install the valve lash adjuster.

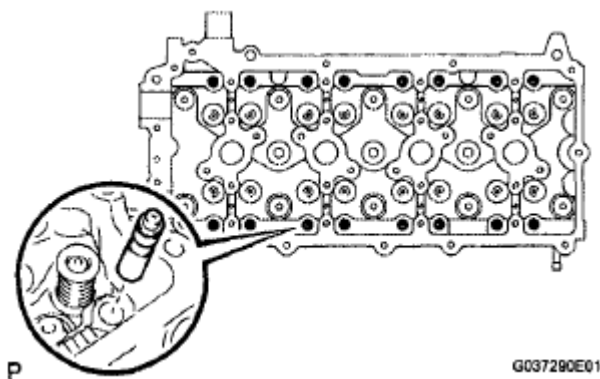


Fig. 138: Identifying Lash Adjusters

Courtesy of ABLE BODY CORP.

5. **INSTALL NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY**
 - a. Install the 16 valve rocker arms.
6. **INSTALL CAMSHAFT** (See INSTALLATION)
7. **INSTALL NO. 1 CHAIN VIBRATION DAMPER** (See INSTALLATION)
8. **INSTALL CHAIN SUB-ASSEMBLY** (See INSTALLATION)
9. **INSTALL CHAIN TENSIONER SLIPPER** (See INSTALLATION)

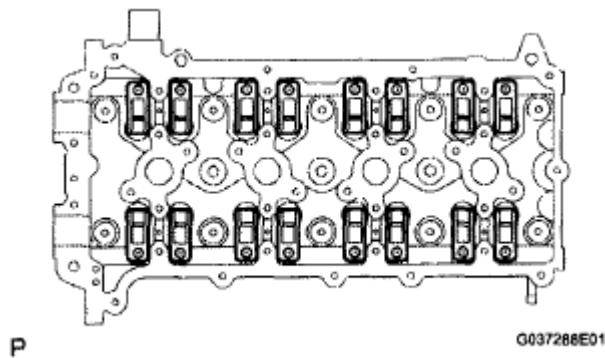


Fig. 139: Identifying Valve Rocker Arms
Courtesy of ABLE BODY CORP.

10. **INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY** (See INSTALLATION)
11. **INSTALL TIMING CHAIN GUIDE** (See INSTALLATION)
12. **INSTALL TIMING CHAIN COVER** (See REASSEMBLY)
13. **INSTALL OIL PAN SUB-ASSEMBLY** (See INSTALLATION)
14. **INSTALL OIL STRAINER SUB-ASSEMBLY** (See INSTALLATION)
15. **INSTALL NO. 2 OIL PAN SUB-ASSEMBLY** (See INSTALLATION)
16. **INSTALL OIL LEVEL GAGE SUB-ASSEMBLY**
17. **INSTALL CRANKSHAFT PULLEY** (See INSTALLATION)
18. **INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY** (See INSTALLATION)
19. **INSTALL NO. 1 INTAKE MANIFOLD TO HEAD GASKET** (See INSTALLATION)
20. **INSTALL CAMSHAFT POSITION SENSOR** (See CAMSHAFT POSITION SENSOR)
21. **INSTALL CRANKSHAFT POSITION SENSOR** (See CAMSHAFT POSITION SENSOR)
22. **INSTALL IDLE PULLEY ASSEMBLY WITH BRACKET (w/Air Conditioning System)** (See INSTALLATION)
23. **INSTALL NO. 1 IDLER PULLEY SUB-ASSEMBLY** (See INSTALLATION)
24. **INSTALL V-RIBBED BELT TENSIONER ASSEMBLY** (See INSTALLATION)
25. **INSTALL EXHAUST MANIFOLD**
 - a. Install a new gasket and the exhaust manifold with 8 new nuts.

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

26. **INSTALL AIR SWITCHING VALVE ASSEMBLY** (See INSTALLATION)
27. **INSTALL INTAKE PIPE INSULATOR** (See INSTALLATION)
28. **INSTALL NO. 1 EXHAUST MANIFOLD HEAT INSULATOR** (See INSTALLATION)

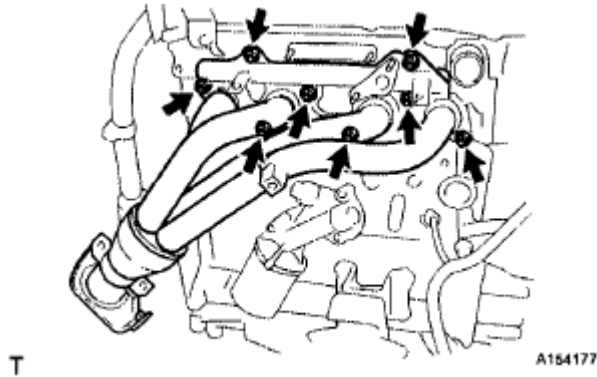


Fig. 140: Locating Exhaust Manifold Bolts
Courtesy of ABLE BODY CORP.

29. **INSTALL GENERATOR ASSEMBLY** (See INSTALLATION)
30. **INSTALL INTAKE AIR CONNECTOR** (See INSTALLATION)
31. **INSTALL REAR END PLATE**
 - a. Install the rear end plate with the 2 bolts.

Torque: 18 N*m (178 kgf*cm, 13 ft.*lbf)

32. **INSTALL DRIVE PLATE AND RING GEAR SUB-ASSEMBLY** (for Automatic Transmission) (See INSTALLATION)
33. **INSTALL FLYWHEEL SUB-ASSEMBLY** (for Manual Transmission) (See INSTALLATION)
34. **INSTALL CLUTCH DISC ASSEMBLY** (for Manual Transmission)

CLUTCH DISC ASSEMBLY REFERENCE

Transmission	Refer to
R155	<u>INSTALLATION</u>
R155F	<u>INSTALLATION</u>

35. **INSTALL CLUTCH COVER ASSEMBLY** (for Manual Transmission)

CLUTCH COVER ASSEMBLY REFERENCE

Transmission	Refer to
R155	<u>INSTALLATION</u>
R155F	<u>INSTALLATION</u>

- 36. **INSTALL ENGINE ASSEMBLY** (See INSTALLATION)
- 37. **INSTALL AUTOMATIC TRANSMISSION ASSEMBLY**

(See REASSEMBLY)

- 38. **INSTALL MANUAL TRANSMISSION UNIT ASSEMBLY**

MANUAL TRANSMISSION UNIT ASSEMBLY REFERENCE

Transmission	Refer to
R155	<u>INSTALLATION</u>
R155F	<u>INSTALLATION</u>

- 39. **INSTALL EXHAUST PIPE ASSEMBLY FRONT** (See INSTALLATION)
- 40. **INSTALL EXHAUST PIPE ASSEMBLY TAIL** (See REMOVAL)
- 41. **CONNECT ENGINE WIRE**
- 42. **CONNECT NO. 1 AIR INJECTION HOSE** (See INSTALLATION)
- 43. **CONNECT FUEL VAPOR FEED HOSE ASSEMBLY**
- 44. **CONNECT NO. 2 FUEL HOSE** (See INSTALLATION)
- 45. **CONNECT FUEL HOSE** (See INSTALLATION)
- 46. **INSTALL WATER HOSE SUB-ASSEMBLY** (See INSTALLATION)
- 47. **INSTALL RADIATOR HOSE INLET**
- 48. **INSTALL COMPRESSOR AND MAGNETIC CLUTCH (With Air Conditioning)** (See INSTALLATION)
- 49. **INSTALL NO. 2 RADIATOR HOSE**
- 50. **INSTALL VANE PUMP ASSEMBLY** (See INSTALLATION)
- 51. **INSTALL AIR CLEANER CASE**
 - a. Install the air cleaner case with the 3 bolts.

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

- 52. **INSTALL AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY**
- 53. **INSTALL AIR CLEANER CAP SUB-ASSEMBLY** (See INSTALLATION)
- 54. **INSTALL FAN SHROUD** (See INSTALLATION)
- 55. **INSTALL RADIATOR SUPPORT TO FRAME SEAL LH** (See INSTALLATION)
- 56. **INSTALL BATTERY TRAY**
- 57. **INSTALL BATTERY**
- 58. **ADD ENGINE OIL** (See INSTALLATION)
- 59. **ADD ENGINE COOLANT** (See COOLANT)
- 60. **CHECK ENGINE OIL LEVEL**
- 61. **CHECK FOR FUEL LEAKAGE**

62. **CHECK FOR ENGINE COOLANT LEAKAGE** (See ON-VEHICLE INSPECTION)
63. **CHECK FOR OIL LEAKAGE**
64. **CHECK FOR EXHAUST GAS LEAKAGE**
65. **INSTALL NO. 1 ENGINE UNDER COVER SUB-ASSEMBLY** (for Pre Runner and 4WD Type)
 - a. Install the No. 1 engine under cover with the 4 bolts.

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

66. **INSTALL NO. 2 ENGINE UNDER COVER SUB-ASSEMBLY** (for Pre Runner and 4WD Type, Regular Cab)
 - a. Install the No. 2 engine under cover with the 4 bolts.

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

67. **INSTALL HOOD SUB-ASSEMBLY**

(See REASSEMBLY)

ENGINE FRONT OIL SEAL

REMOVAL

1. **REMOVE ENGINE UNDER COVER SUB-ASSEMBLY NO.1** (for Pre Runner and 4WD Type)
 - a. Remove the 4 bolts, then remove the No. 1 engine under cover.
2. **DRAIN ENGINE COOLANT** (See COOLANT)
3. **REMOVE RADIATOR SUPPORT TO FRAME SEAL LH** (See ON-VEHICLE CLEANING)
4. **REMOVE FAN SHROUD** (See REMOVAL)
5. **REMOVE CRANKSHAFT PULLEY**
 - a. Remove the bolt, then separate the bracket, (w/AIR CONDITIONING)

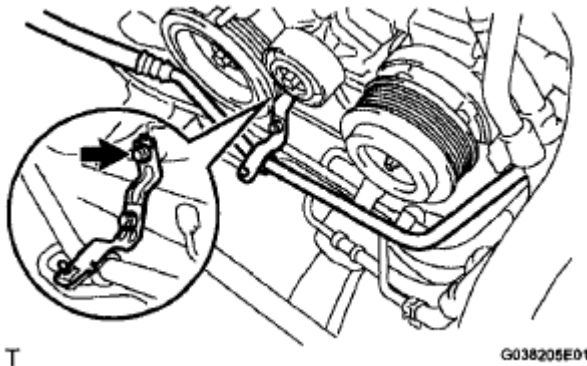


Fig. 141: Locating Bolt
Courtesy of ABLE BODY CORP.

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

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

HINT:

Loosen the crankshaft pulley bolt until only 2 or 3 threads are still installed in the crankshaft.

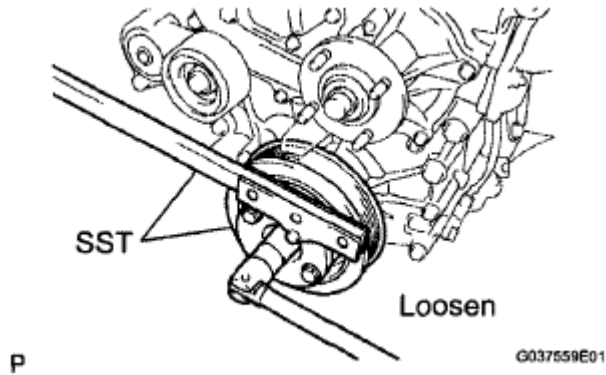


Fig. 142: Loosening Crankshaft Pulley Bolt
Courtesy of ABLE BODY CORP.

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

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

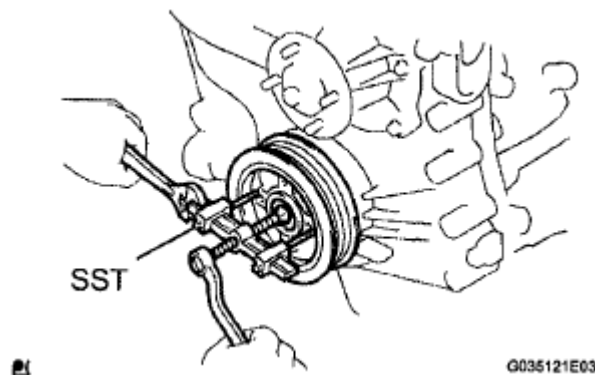


Fig. 143: Removing Crankshaft Pulley And Crankshaft Pulley Bolt
Courtesy of ABLE BODY CORP.

6. REMOVE TIMING GEAR CASE OR TIMING CHAIN CASE OIL SEAL

- Using a cutter knife, cut off the lip of the oil seal.
- Using a screwdriver with its tip wrapped in tape, pry out the oil seal and remove it.

NOTE: Check the crankshaft for damage after removing the oil seal. If

damaged, smooth the surface with 400-grit sandpaper.

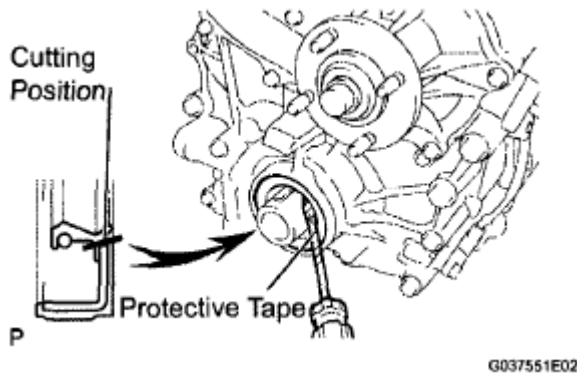


Fig. 144: Prying Out Oil Seal
Courtesy of ABLE BODY CORP.

INSTALLATION

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

- a. Apply a light coat of MP grease to the lip of a new oil seal.

NOTE: Keep the lip free of foreign objects.

- b. Using SST, uniformly tap a new oil seal in until its surface is flush with the timing chain cover edge.

SST 09223-50010

NOTE:

- Do not tap the oil seal in at an angle.
- Wipe any extra grease off the crankshaft.

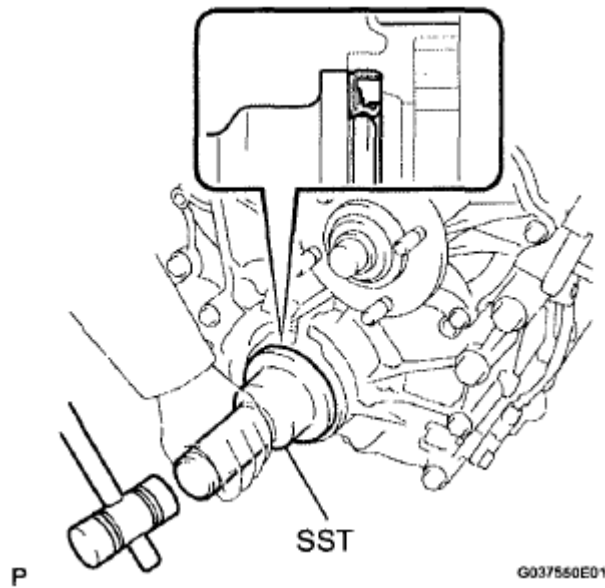


Fig. 145: Tapping Oil Seal
Courtesy of ABLE BODY CORP.

2. INSTALL CRANKSHAFT PULLEY

- Align the set key of the crankshaft with the key groove of the pulley, and slide on the pulley.
- Provisionally install a new crankshaft pulley bolt onto the crankshaft.
- Using SST, hold the crankshaft pulley and tighten the crankshaft pulley bolt.

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

Torque: 260 N*m (2,651 kgf*cm, 192 ft.*lbf)

NOTE: Do not reuse the pulley bolt.

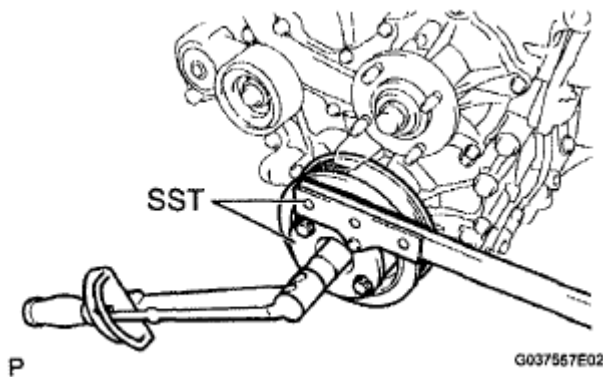


Fig. 146: Installing Crankshaft Pulley Bolt Onto Crankshaft
Courtesy of ABLE BODY CORP.

- d. Install the bracket with the bolt, (w/AIR CONDITIONING)

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

3. **INSTALL FAN SHROUD** (See INSTALLATION)
4. **INSTALL RADIATOR SUPPORT TO FRAME SEAL LH** (See INSTALLATION)
5. **ADD ENGINE COOLANT** (See COOLANT)
6. **CHECK FOR ENGINE COOLANT LEAKAGE** (See ON-VEHICLE INSPECTION)
7. **CHECK FOR ENGINE OIL LEAKAGE**

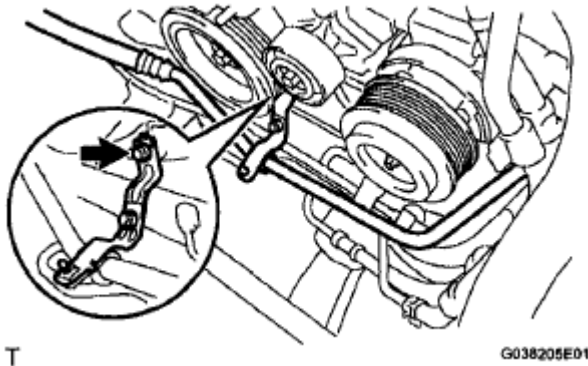


Fig. 147: Locating Bolt
Courtesy of ABLE BODY CORP.

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

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

ENGINE REAR OIL SEAL

REMOVAL

1. **REMOVE MANUAL TRANSMISSION UNIT ASSEMBLY**

MANUAL TRANSMISSION UNIT ASSEMBLY REFERENCE

Transmission	Refer to
R155	<u>REMOVAL</u>
R155F	<u>REMOVAL</u>

2. **REMOVE AUTOMATIC TRANSMISSION ASSEMBLY**

(See INSTALLATION)

3. **REMOVE CLUTCH COVER ASSEMBLY (for Manual Transmission)**

CLUTCH COVER ASSEMBLY REFERENCE

Transmission	Refer to
R155	<u>CLUTCH UNIT (FOR R155)</u>
R155F	<u>CLUTCH UNIT (FOR R155F)</u>

4. REMOVE CLUTCH DISC ASSEMBLY (for Manual Transmission)

CLUTCH DISC ASSEMBLY REFERENCE

Transmission	Refer to
R155	<u>CLUTCH UNIT (FOR R155)</u>
R155F	<u>CLUTCH UNIT (FOR R155F)</u>

5. REMOVE FLYWHEEL SUB-ASSEMBLY (for Manual Transmission)

- a. Using SST, hold the crankshaft pulley.

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

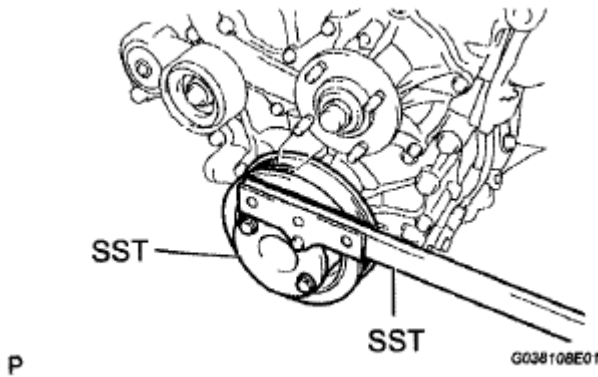


Fig. 148: Holding Crankshaft Pulley
Courtesy of ABLE BODY CORP.

- b. Remove the 10 bolts, then remove the flywheel.

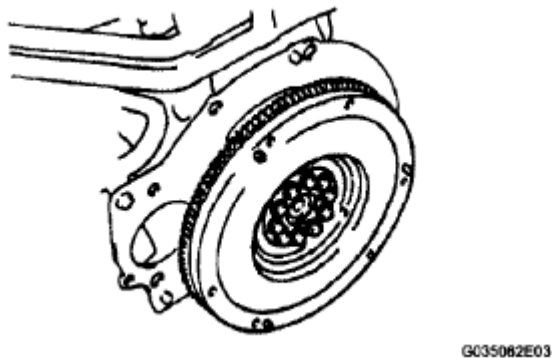


Fig. 149: Identifying Bolts And Flywheel
Courtesy of ABLE BODY CORP.

6. REMOVE DRIVE PLATE and RING GEAR SUB-ASSEMBLY (for Automatic Transmission)

- a. Using SST, hold the crankshaft pulley.

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

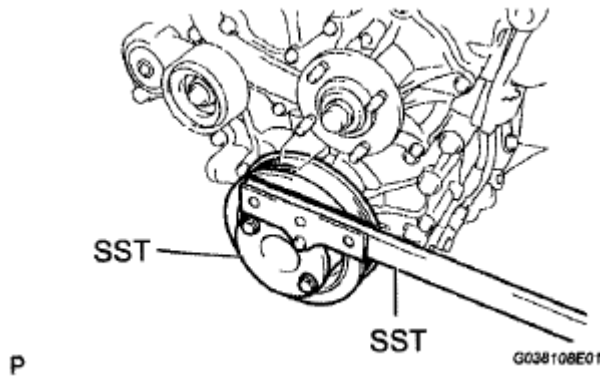


Fig. 150: Holding Crankshaft Pulley
Courtesy of ABLE BODY CORP.

- b. Remove the 10 bolts, drive plate spacer rear, drive plate and ring gear and drive plate spacer front.

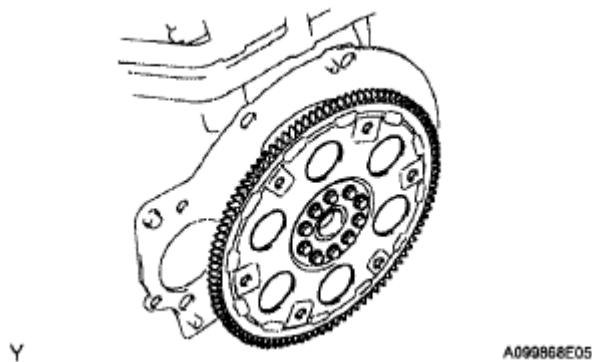


Fig. 151: Identifying Drive Plate And Ring Gear
Courtesy of ABLE BODY CORP.

7. REMOVE ENGINE REAR OIL SEAL

- a. Using a cutter knife, cut off the lip of the oil seal.
- b. Using a screwdriver with its tip wrapped in tape, pry out the oil seal and remove it.

NOTE: Check the crankshaft for damage after removing the oil seal. If damaged, smooth the surface with 400-grit sandpaper.

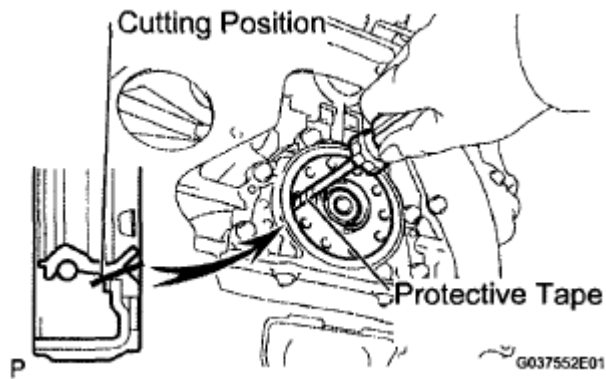


Fig. 152: Prying Out Oil Seal
Courtesy of ABLE BODY CORP.

INSTALLATION

1. INSTALL ENGINE REAR OIL SEAL

- Apply a light coat of MP grease to the lip of a new oil seal.

NOTE: Keep the lip free of foreign objects.

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

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

NOTE:

- Do not tap the oil seal in at an angle.
- Wipe any extra grease off the crankshaft.

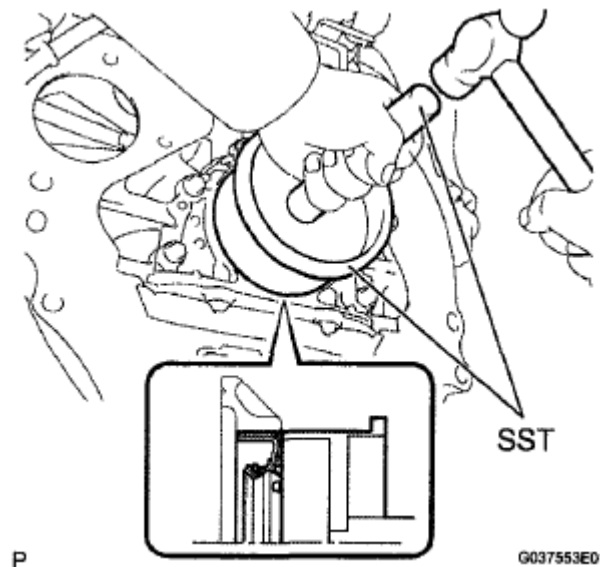


Fig. 153: Tapping Oil Seal
Courtesy of ABLE BODY CORP.

2. INSTALL FLYWHEEL SUB-ASSEMBLY (for Manual Transmission)

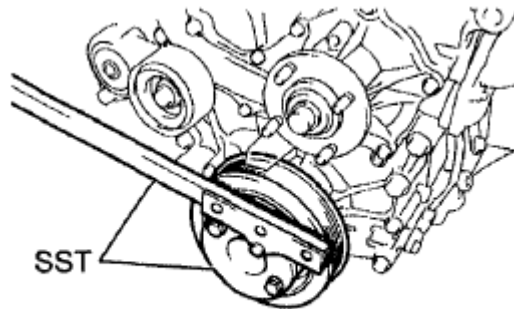
- a. Clean the 10 bolts and 10 bolt holes.
- b. Apply adhesive to 2 or 3 threads of the 10 bolts.

Adhesive:

Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

- c. Using SST, hold the crankshaft.

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



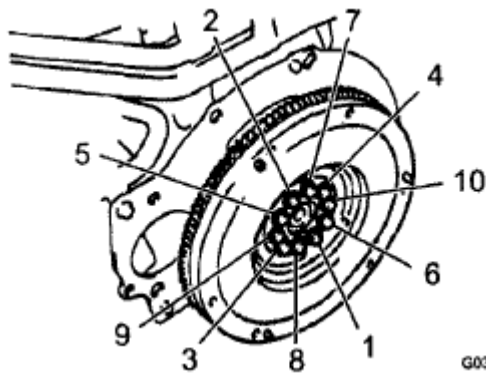
P

G038167E01

Fig. 154: Holding Crankshaft
Courtesy of ABLE BODY CORP.

- d. Using several steps, uniformly install and tighten the 10 bolts in the sequence shown in the illustration.

Torque: 27 N*m (270 kgf*cm, 20 ft.*lbf)



G035062E04

Fig. 155: Identifying Tightening Sequence Of Bolts

Courtesy of ABLE BODY CORP.

- e. Mark the bolts with paint as shown in the illustration.
- f. Retighten the bolts by 90° in the same sequence as in step (d).
- g. Check that the paint mark of each bolt is at a 90° from the original position.

NOTE: Do not start the engine for at least 1 hour after installation.

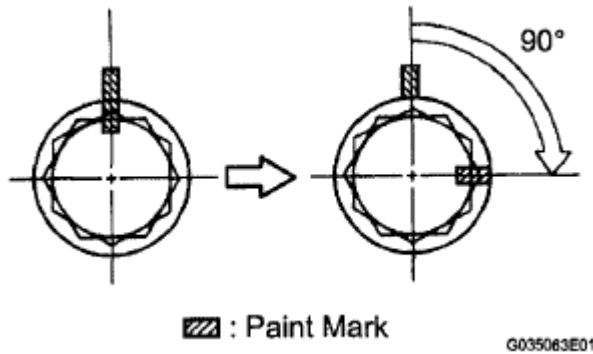


Fig. 156: Marking Bolts With Paint
Courtesy of ABLE BODY CORP.

3. INSTALL DRIVE PLATE and RING GEAR SUB-ASSEMBLY (for Automatic Transmission)

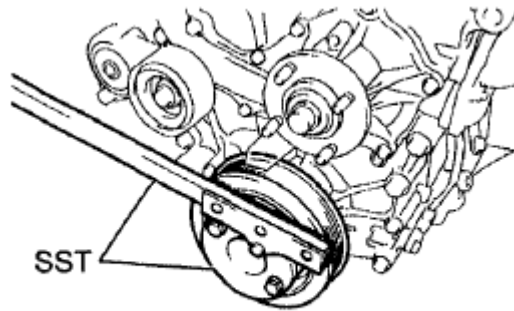
- a. Clean the 10 bolts and 10 bolt holes.
- b. Apply adhesive to 2 or 3 threads of the 10 bolts.

Adhesive:

Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

- c. Provisionally install the drive plate spacer front, drive plate and ring gear and drive plate rear with the 10 bolts.
- d. Using SST, hold the crankshaft.

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



P

G038167E01

Fig. 157: Holding Crankshaft
Courtesy of ABLE BODY CORP.

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

Torque: 74 N*m (755 kgf*cm, 55 ft.*lbf)

NOTE: Do not start the engine for at least 1 hour after installation.

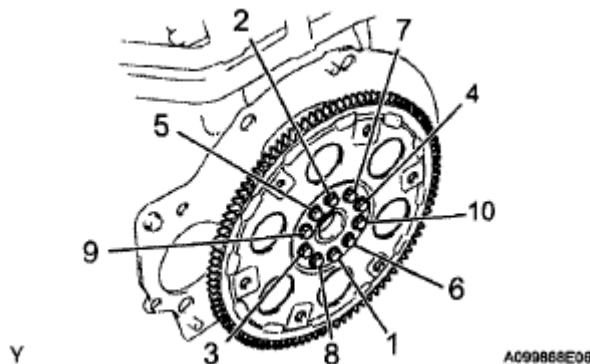


Fig. 158: Identifying Tightening Sequence Of Bolts
Courtesy of ABLE BODY CORP.

4. INSTALL CLUTCH DISC ASSEMBLY (for Manual Transmission)

CLUTCH DISC ASSEMBLY REFERENCE

Transmission	Refer to
R155	INSTALLATION
R155F	INSTALLATION

SST 09301-00210

5. INSTALL CLUTCH COVER ASSEMBLY (for Manual Transmission)

CLUTCH COVER ASSEMBLY REFERENCE

Transmission	Refer to
R155	<u>INSTALLATION</u>
R155F	<u>INSTALLATION</u>

6. INSTALL MANUAL TRANSMISSION UNIT ASSEMBLY**MANUAL TRANSMISSION UNIT ASSEMBLY REFERENCE**

Transmission	Refer to
R155	<u>INSTALLATION</u>
R155F	<u>INSTALLATION</u>

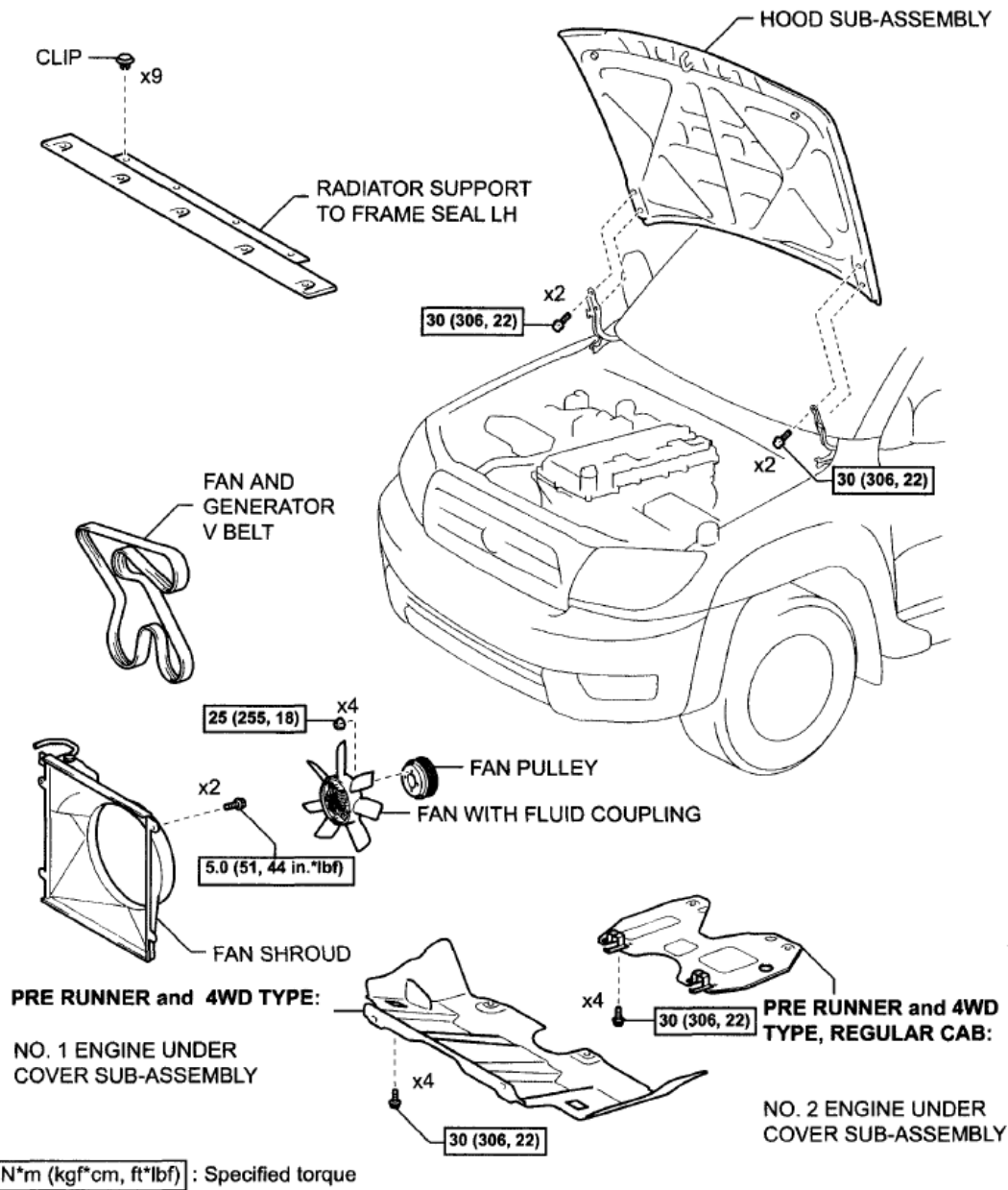
7. INSTALL AUTOMATIC TRANSMISSION ASSEMBLY

(See **REASSEMBLY**)

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

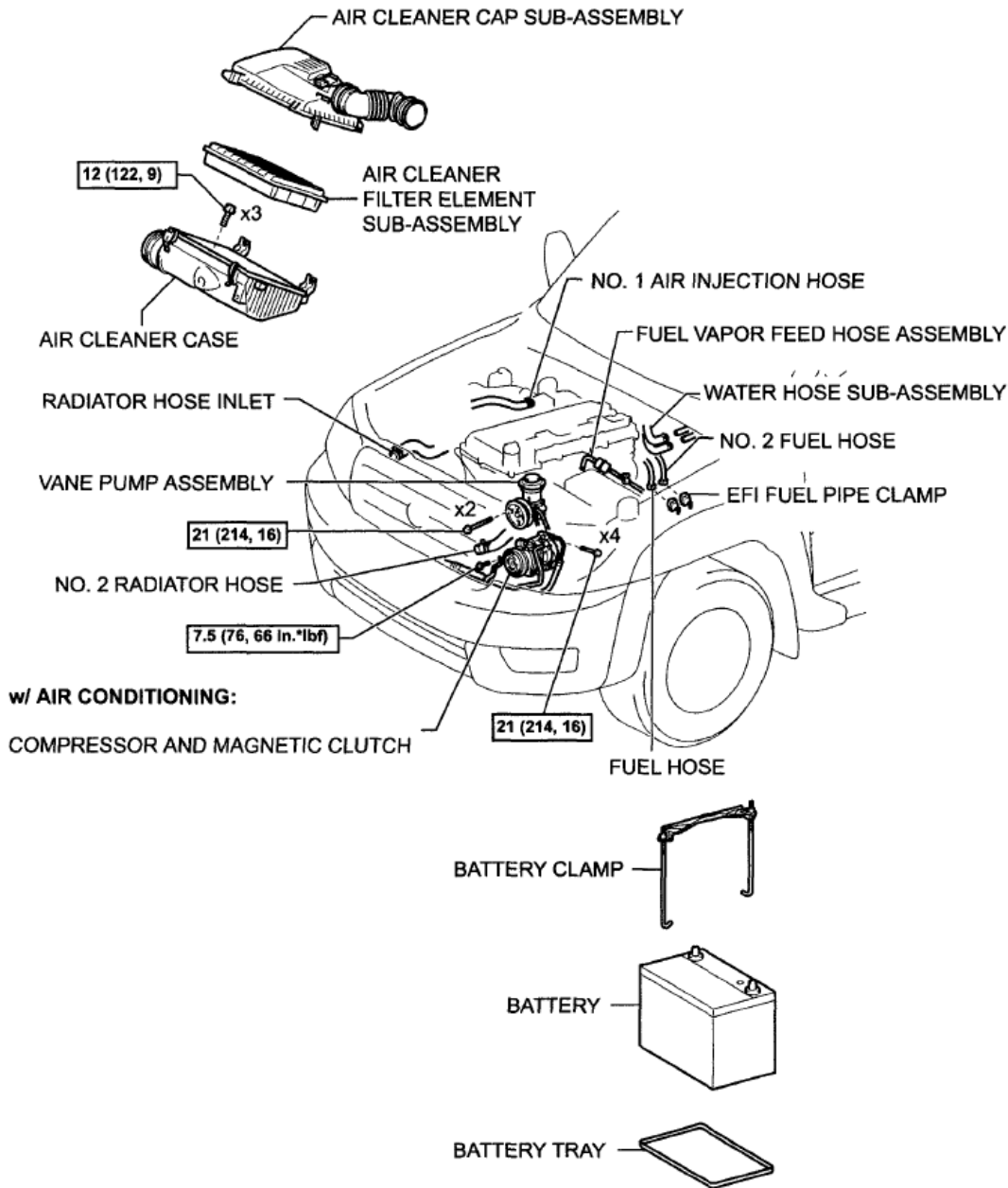
2009 Toyota Tacoma PreRunner

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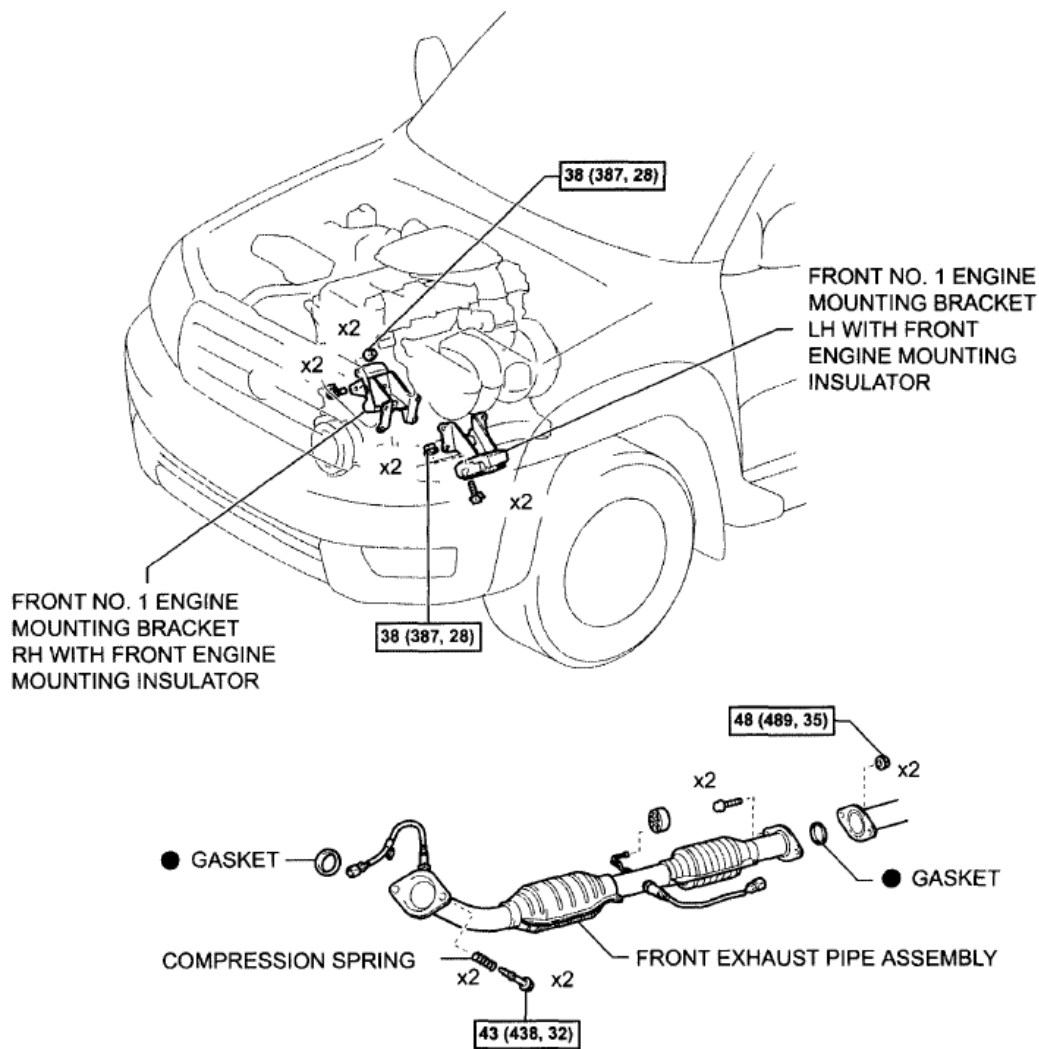
Fig. 159: Exploded View Of Engine Assembly Components & Torque Specification (1 Of 12)
Courtesy of ABLE BODY CORP.



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

A113642E01

Fig. 160: Exploded View Of Engine Assembly Components & Torque Specification (2 Of 12)
Courtesy of ABLE BODY CORP.

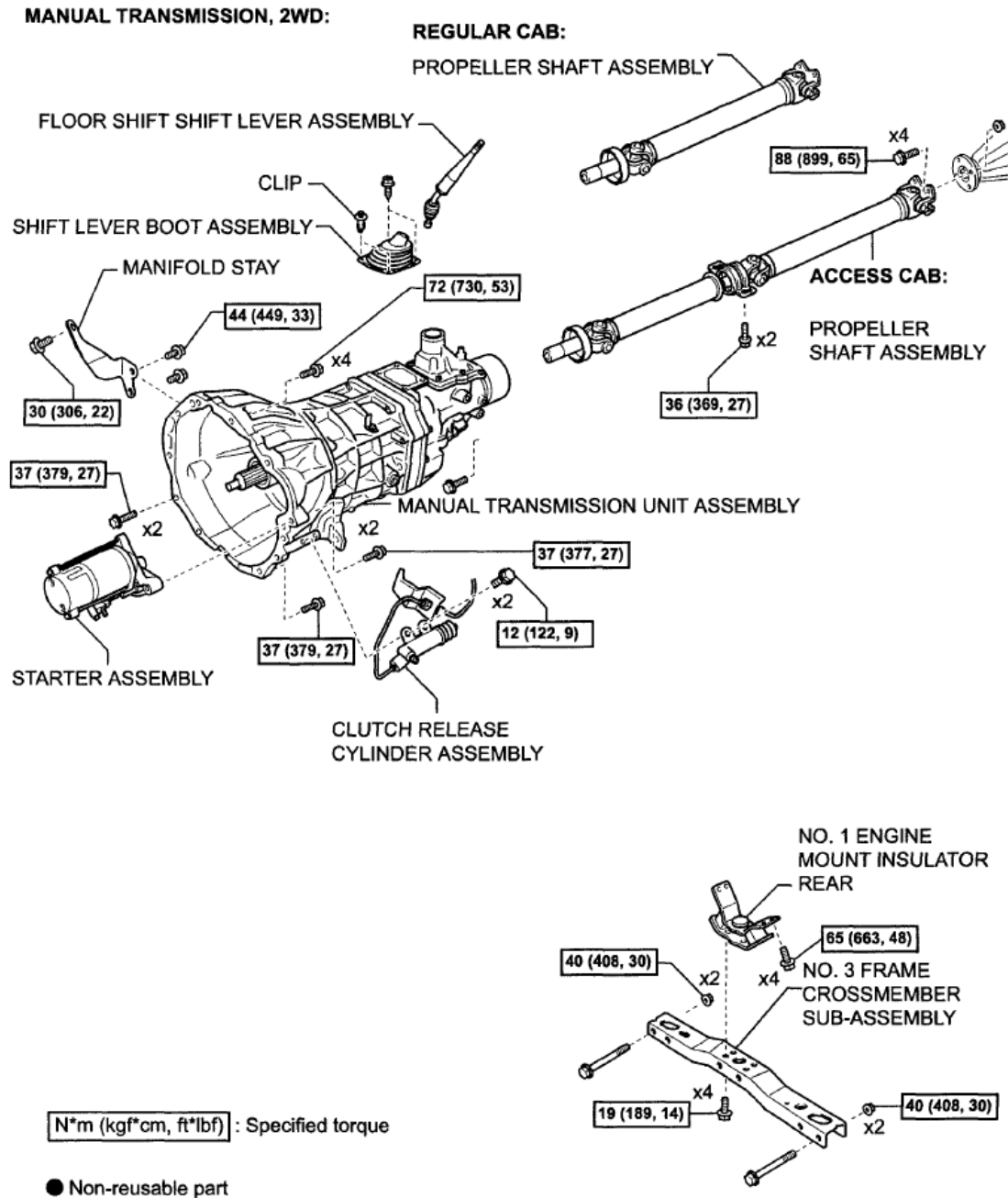


N*m (kgf*cm, ft*lb) : Specified torque

● Non-reusable part

A113643E01

Fig. 161: Exploded View Of Engine Assembly Components & Torque Specification (3 Of 12)
Courtesy of ABLE BODY CORP.



A113649E01

Fig. 162: Exploded View Of Engine Assembly Components & Torque Specification (4 Of 12)
Courtesy of ABLE BODY CORP.

2009 Toyota Tacoma PreRunner

2009 ENGINE Engine Mechanical (2TR-FE) - Tacoma

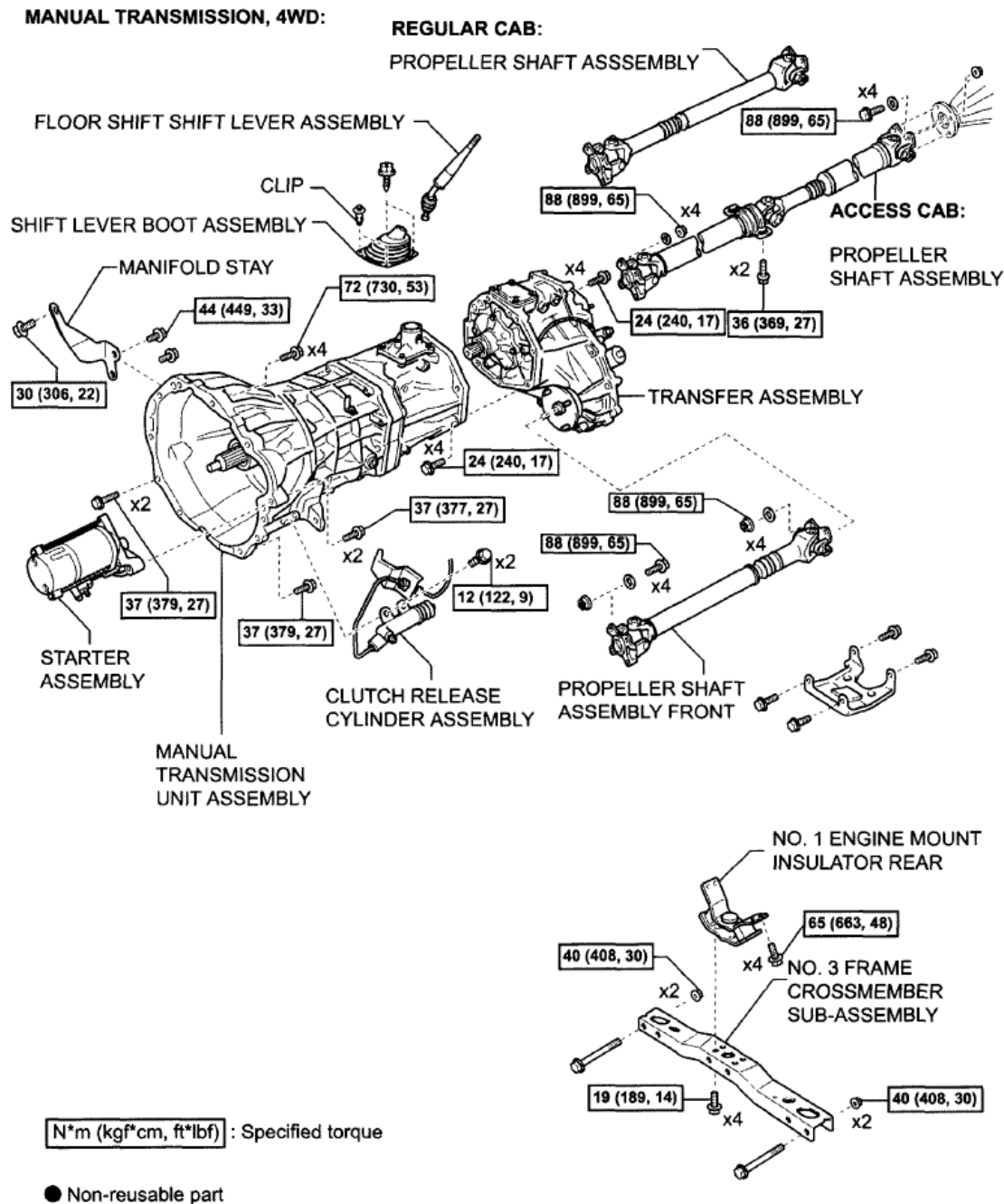
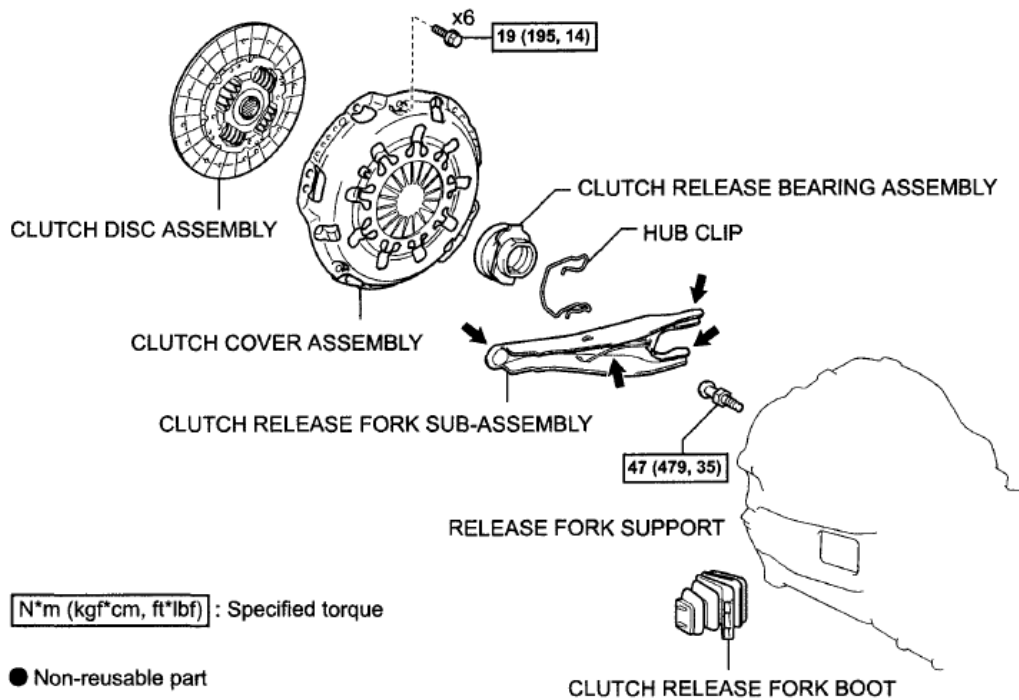


Fig. 163: Exploded View Of Engine Assembly Components & Torque Specification (5 Of 12)
Courtesy of ABLE BODY CORP.

MANUAL TRANSMISSION:



A113861E01

Fig. 164: Exploded View Of Engine Assembly Components & Torque Specification (6 Of 12)
 Courtesy of ABLE BODY CORP.

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AUTOMATIC TRANSMISSION:

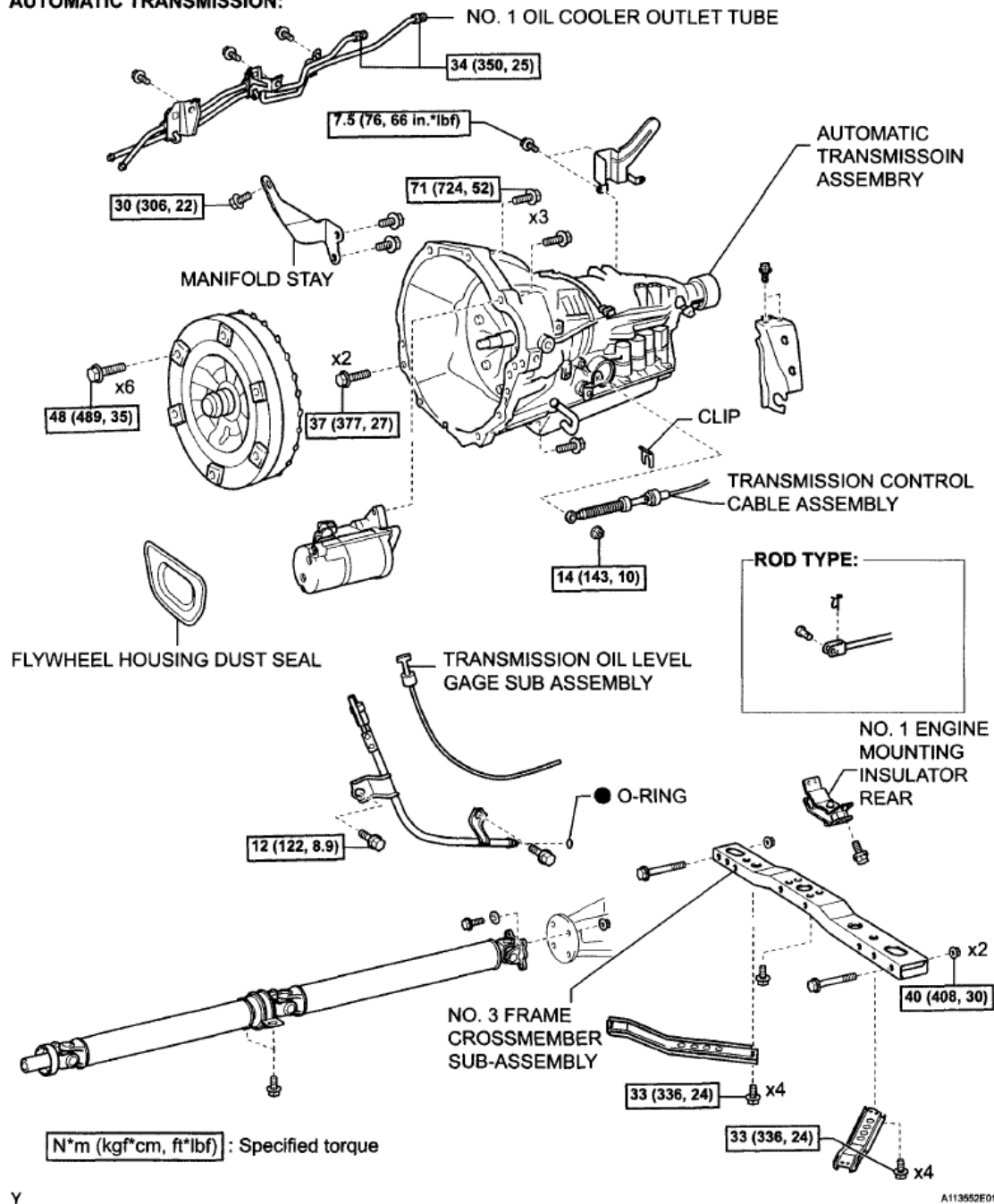
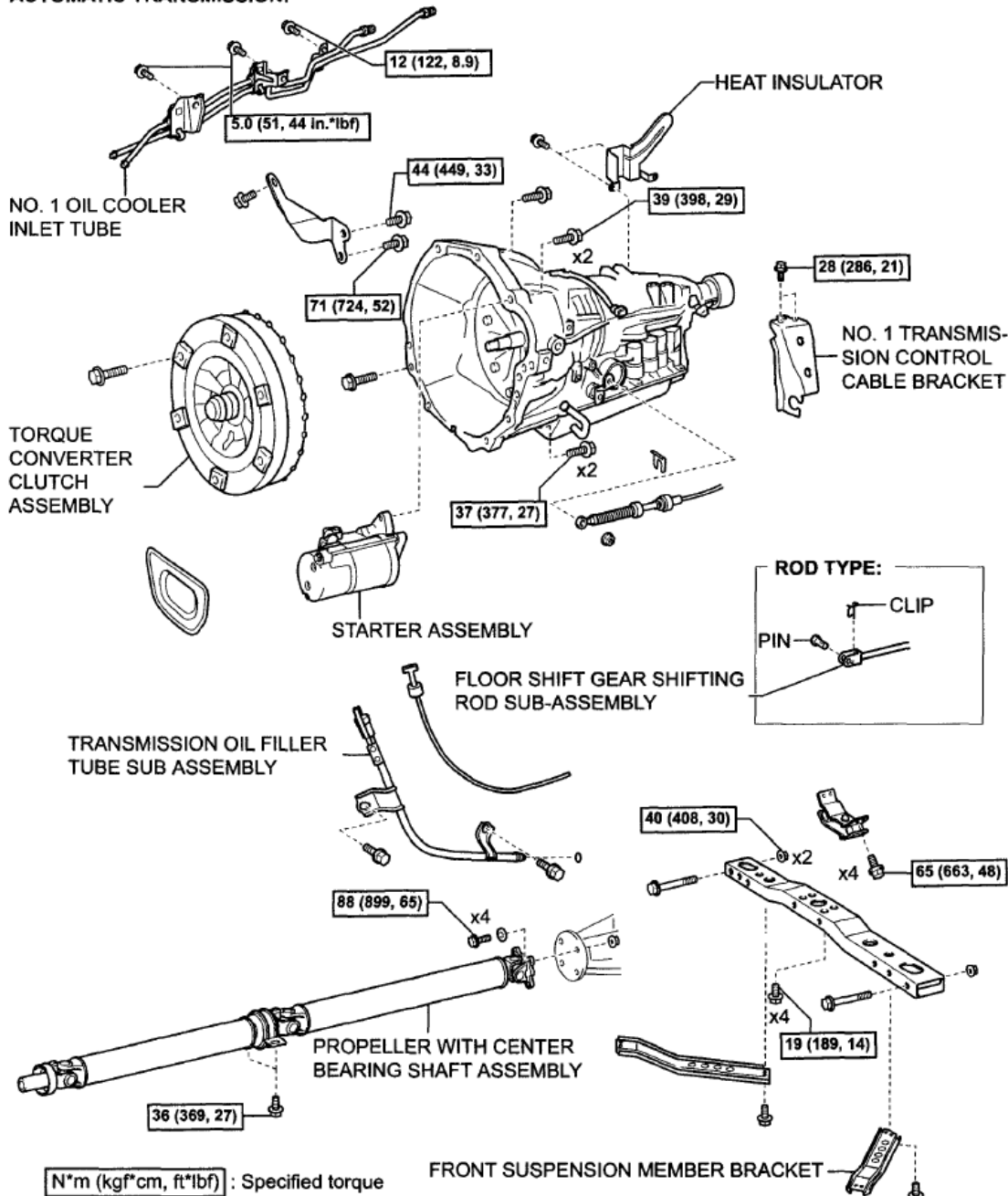


Fig. 165: Exploded View Of Engine Assembly Components & Torque Specification (7 Of 12)
Courtesy of ABLE BODY CORP.

2009 Toyota Tacoma PreRunner

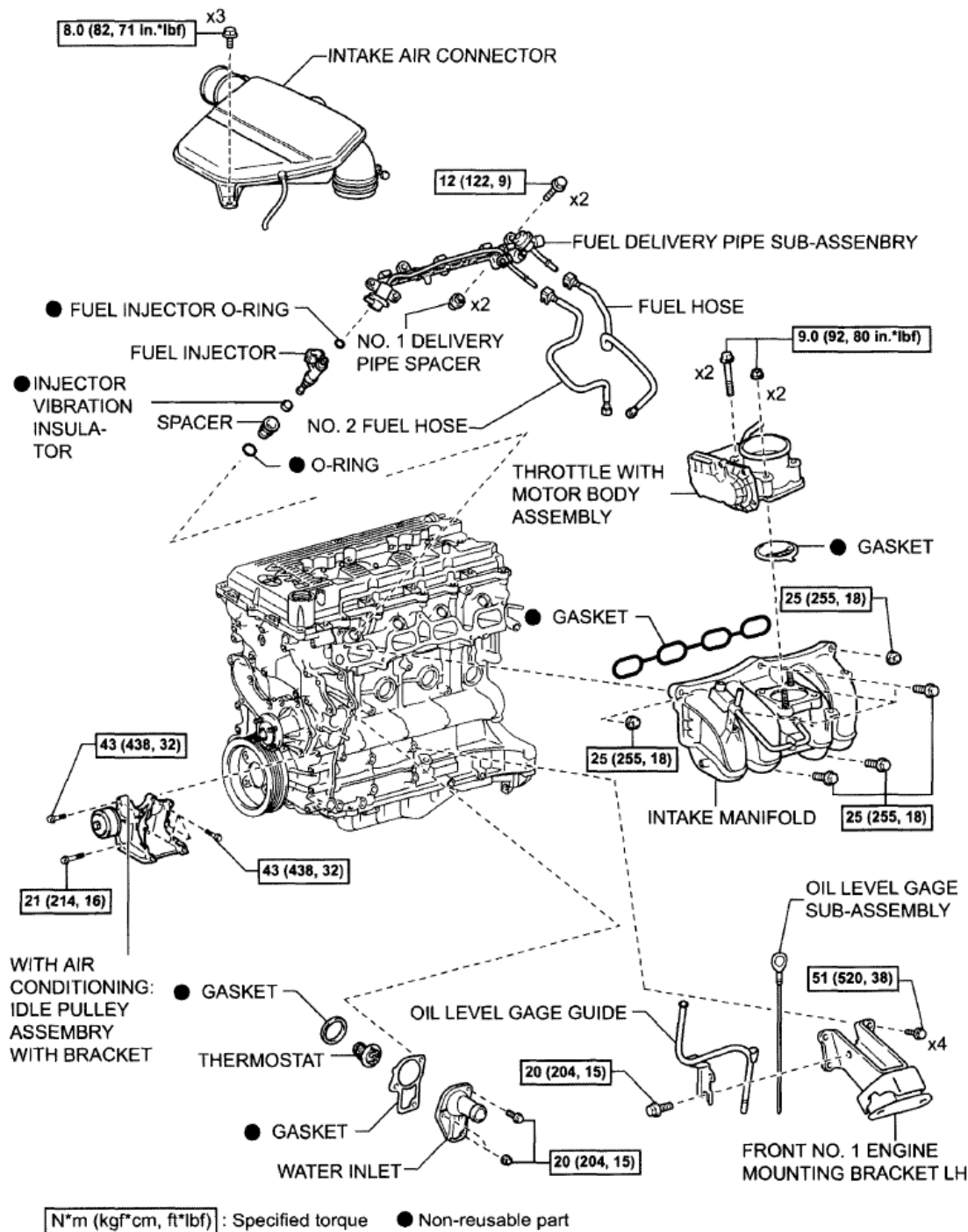
2009 ENGINE Engine Mechanical (2TR-FE) - Tacoma

AUTOMATIC TRANSMISSION:



A113552E02

Fig. 166: Exploded View Of Engine Assembly Components & Torque Specification (8 Of 12)
Courtesy of ABLE BODY CORP.



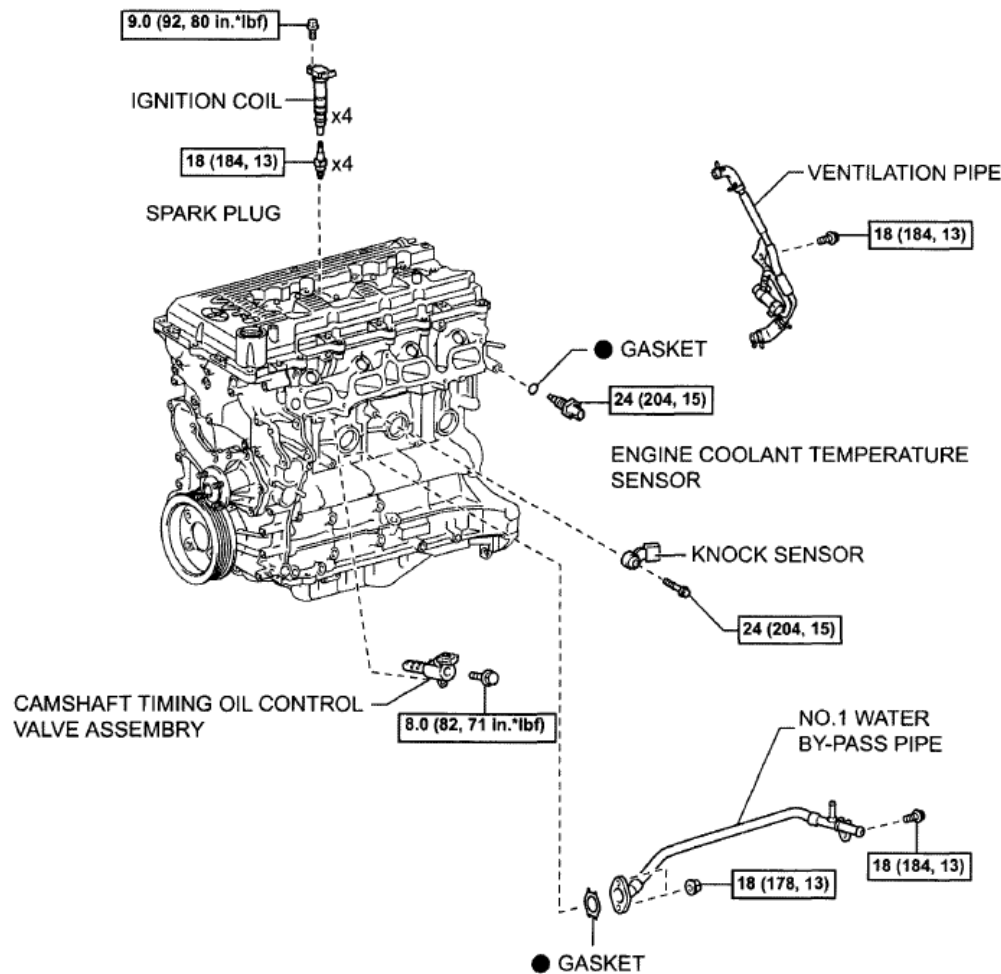
T

A113838E01

Fig. 167: Exploded View Of Engine Assembly Components & Torque Specification (9 Of 12)
 Courtesy of ABLE BODY CORP.

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2009 ENGINE Engine Mechanical (2TR-FE) - Tacoma



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

● Non-reusable part

T

A113639E01

Fig. 168: Exploded View Of Engine Assembly Components & Torque Specification (10 Of 12)
Courtesy of ABLE BODY CORP.

2009 Toyota Tacoma PreRunner

2009 ENGINE Engine Mechanical (2TR-FE) - Tacoma

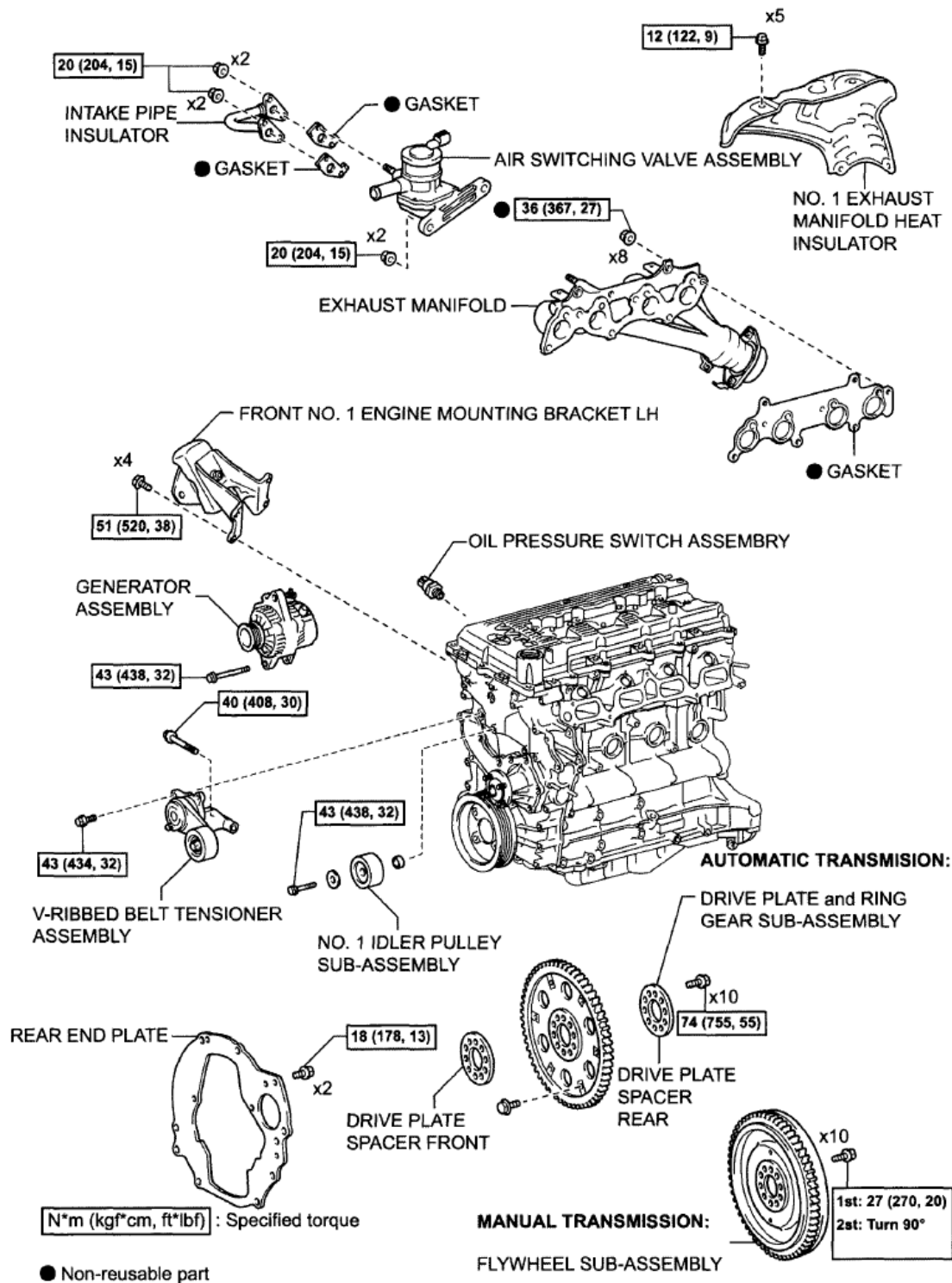


Fig. 169: Exploded View Of Engine Assembly Components & Torque Specification (11 Of 12)
Courtesy of ABLE BODY CORP.

2009 Toyota Tacoma PreRunner

2009 ENGINE Engine Mechanical (2TR-FE) - Tacoma

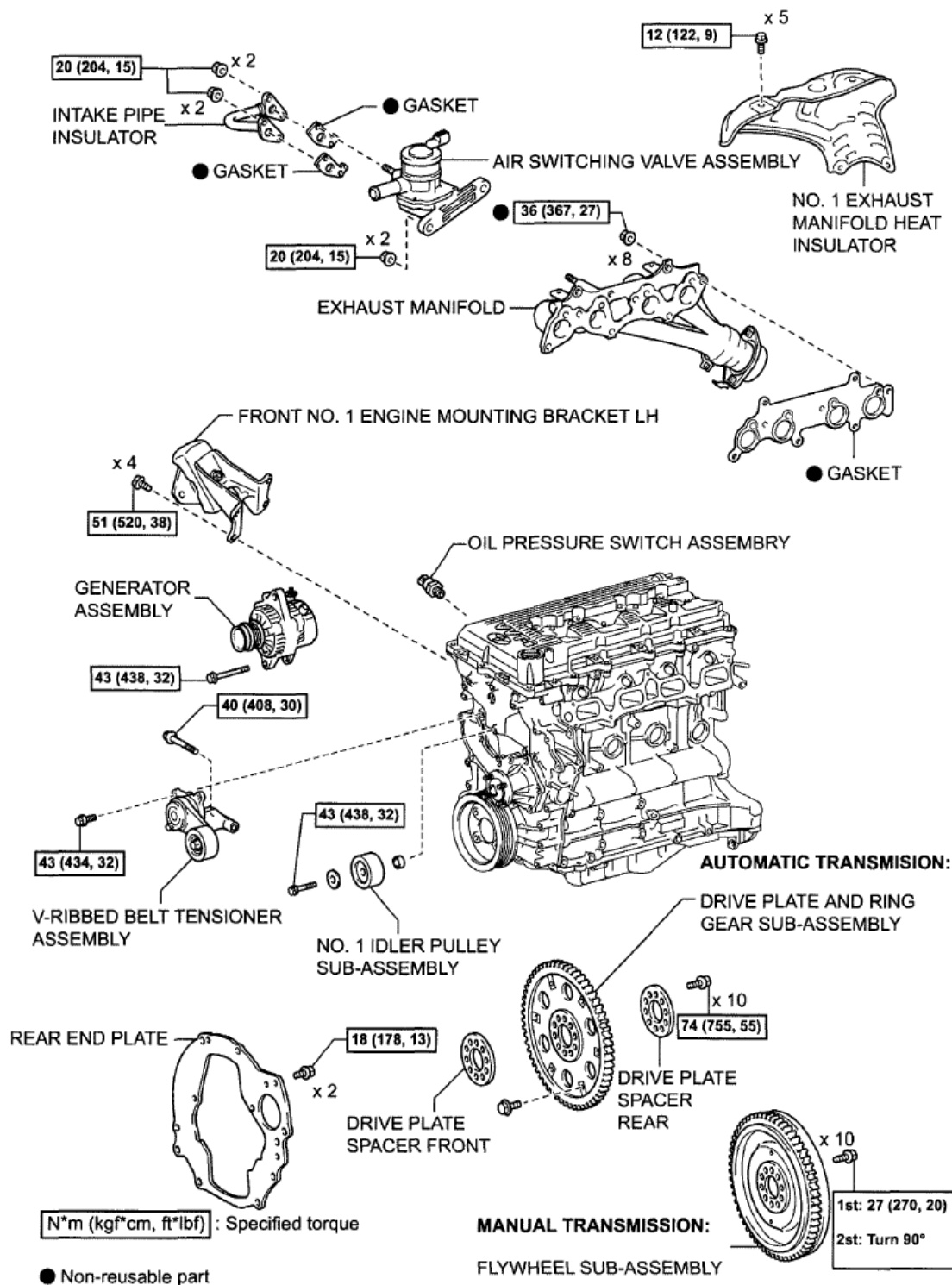


Fig. 170: Exploded View Of Engine Assembly Components & Torque Specification (12 Of 12)
Courtesy of ABLE BODY CORP.

REMOVAL

1. **REMOVE HOOD SUB-ASSEMBLY**
2. **DISCHARGE FUEL SYSTEM PRESSURE**

(See **FUEL SYSTEM**)

3. **REMOVE NO. 1 ENGINE UNDER COVER SUB-ASSEMBLY (for Pre Runner and 4WD Type)**
 - a. Remove the 4 bolts, then remove the engine under cover No. 1.
4. **REMOVE NO. 2 ENGINE UNDER COVER SUB-ASSEMBLY (for Pre Runner and 4WD Type, Regular Cab)**
 - a. Remove the 4 bolts, then remove engine cover No.2.
5. **DRAIN ENGINE COOLANT (See COOLANT)**
6. **REMOVE BATTERY**
7. **REMOVE BATTERY TRAY**
8. **REMOVE RADIATOR SUPPORT TO FRAME SEAL LH (See ON-VEHICLE CLEANING)**
9. **REMOVE FAN SHROUD (See REMOVAL)**
10. **REMOVE AIR CLEANER CAP SUB-ASSEMBLY (See AIR SWITCHING VALVE)**
11. **REMOVE AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY**
12. **REMOVE AIR CLEANER CASE**
 - a. Remove the 3 bolts, then remove the air cleaner case.
13. **SEPARATE VANE PUMP (See REMOVAL)**
14. **REMOVE NO. 2 RADIATOR HOSE**
15. **SEPARATE COMPRESSOR AND MAGNETIC CLUTCH (w/Air Conditioning System) (See REMOVAL)**
16. **REMOVE RADIATOR HOSE INLET**
17. **SEPARATE WATER HOSE SUB-ASSEMBLY**
 - a. Separate the water hoses.
18. **DISCONNECT FUEL HOSE (See REMOVAL)**
19. **DISCONNECT NO. 2 FUEL HOSE (See REMOVAL)**

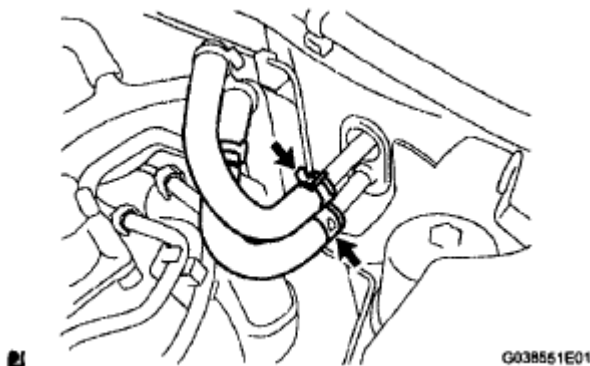


Fig. 171: Locating Water Hose
Courtesy of ABLE BODY CORP.

20. SEPARATE FUEL VAPOR FEED HOSE ASSEMBLY

- a. Disconnect the fuel vapor feed hose.

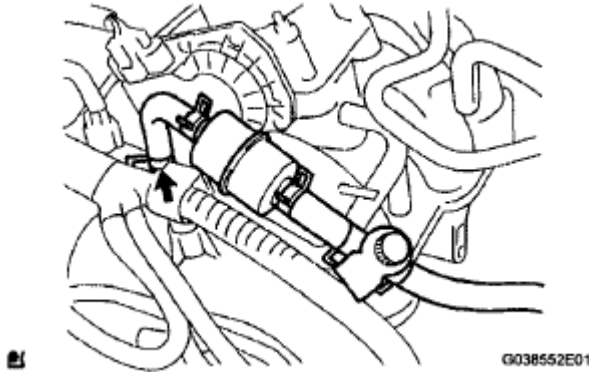


Fig. 172: Locating Fuel Feed Hose
Courtesy of ABLE BODY CORP.

21. DISCONNECT NO. 1 AIR INJECTION HOSE

- a. Disconnect the No.1 air injection hose.

22. DISCONNECT ENGINE WIRE

- a. Disconnect the connector from the ECM, then pull the engine wire harness to the compartment side.

NOTE: **Do not forcibly pull the wire harness to the engine compartment side.**

- b. Disconnect all wire harnesses and connectors in the engine room.



Fig. 173: Locating No.1 Air Injection Hose
Courtesy of ABLE BODY CORP.

23. REMOVE EXHAUST PIPE ASSEMBLY TAIL (See REMOVAL)**24. REMOVE EXHAUST PIPE ASSEMBLY FRONT (See REMOVAL)****25. REMOVE MANUAL TRANSMISSION UNIT ASSEMBLY**

MANUAL TRANSMISSION UNIT ASSEMBLY REFERENCE

Transmission	Refer to
R155	REMOVAL
R155F	REMOVAL

26. REMOVE AUTOMATIC TRANSMISSION ASSEMBLY

(See **INSTALLATION**)

27. REMOVE ENGINE ASSEMBLY

- a. Install the engine hanger with the bolt.

Torque: 42 N*m (420 kgf*cm, 30 ft.*lbf) Part No

TORQUE SPECIFICATION

Part Name	Part No.
Engine hanger	12281-75040
Bolt	91552-A1020

NOTE: Be sure to use the bolts when installing the engine hanger.

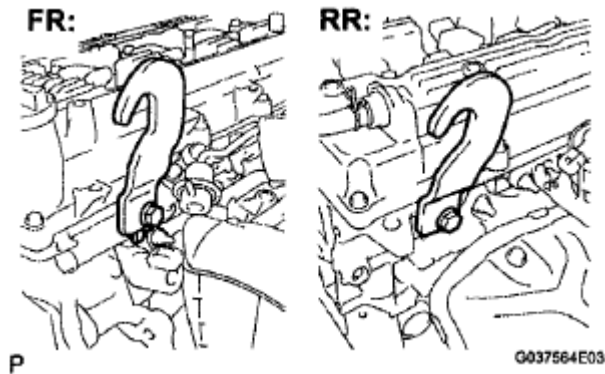


Fig. 174: Identifying Engine Hanger With Bolt
Courtesy of ABLE BODY CORP.

- b. Attach the engine sling device and chain block to the engine hangers.
- c. Remove the 4 bolts and 4 nuts.
- d. Lift the engine out of the vehicle slowly and carefully by operating the engine sling device and chain block.

NOTE: Make sure that no wires, hoses or cables are connected to the engine.

28. REMOVE CLUTCH COVER ASSEMBLY (for Manual Transmission)

CLUTCH COVER ASSEMBLY REFERENCE

Transmission	Refer to
R155	<u>CLUTCH UNIT (FOR R155)</u>
R155F	<u>CLUTCH UNIT (FOR R155F)</u>

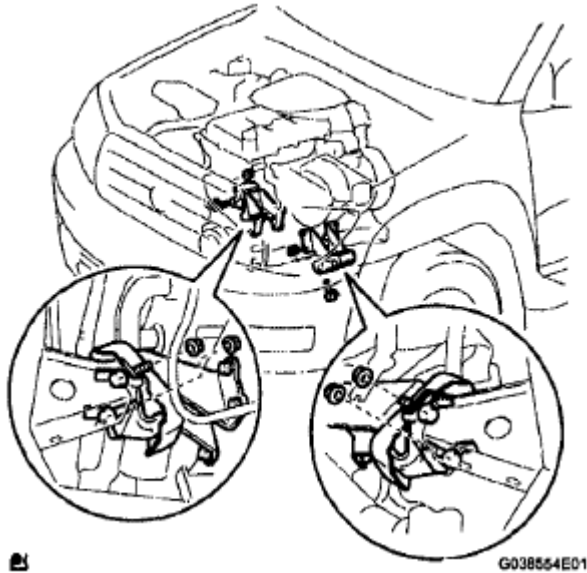


Fig. 175: Identifying Bolts And Engine Hangers
Courtesy of ABLE BODY CORP.

29. REMOVE CLUTCH DISC ASSEMBLY (for Manual Transmission)

CLUTCH DISC ASSEMBLY REFERENCE

Transmission	Refer to
R155	<u>CLUTCH UNIT (FOR R155)</u>
R155F	<u>CLUTCH UNIT (FOR R155F)</u>

30. REMOVE FLYWHEEL SUB-ASSEMBLY (for Manual Transmission) (See REMOVAL)
31. REMOVE DRIVE PLATE AND RING GEAR SUB-ASSEMBLY (for Automatic Transmission) (See REMOVAL)
32. REMOVE REAR END PLATE (See REMOVAL)
33. REMOVE INTAKE AIR CONNECTOR (See ON-VEHICLE INSPECTION)
34. REMOVE FUEL HOSE (See REMOVAL)
35. REMOVE NO. 2 FUEL HOSE (See REMOVAL)
36. REMOVE THROTTLE WITH MOTOR BODY ASSEMBLY (See REMOVAL)
37. REMOVE NO. 1 INTAKE MANIFOLD TO HEAD GASKET (See REMOVAL)
38. REMOVE IDLE PULLEY ASSEMBLY WITH BRACKET (w/Air Conditioning System) (See CRANKSHAFT POSITION SENSOR)
39. REMOVE ENGINE WIRE

40. REMOVE OIL LEVEL GAGE SUB-ASSEMBLY**41. REMOVE OIL LEVEL GAGE GUIDE**

- a. Remove the bolts, then remove the oil level gage guide.

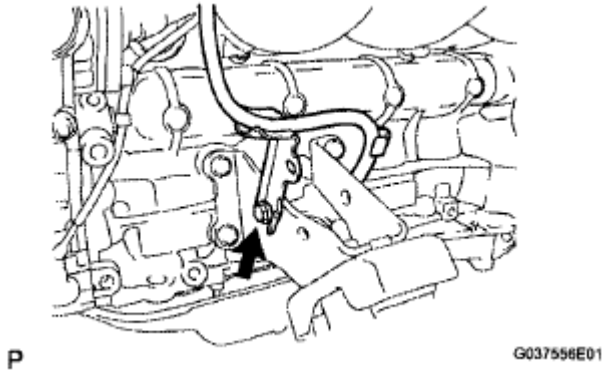


Fig. 176: Locating Oil Level Gage Guide With Bolt
Courtesy of ABLE BODY CORP.

42. REMOVE FRONT NO. 1 ENGINE MOUNTING BRACKET

- a. Remove the 4 bolts, then remove the engine mounting bracket front No. 1 LH with engine mounting insulator front.

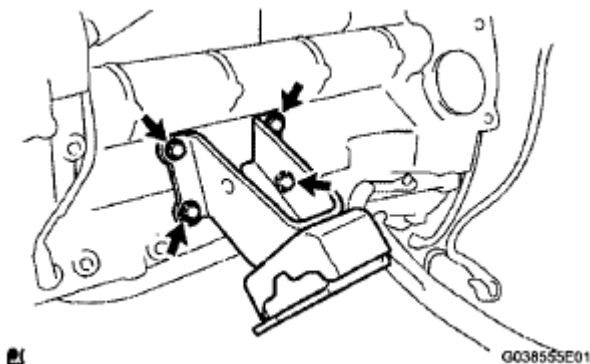
43. REMOVE THERMOSTAT (See THERMOSTAT)**44. REMOVE FUEL INJECTOR ASSEMBLY (See INSPECTION)****45. REMOVE KNOCK SENSOR (See INSPECTION)**

Fig. 177: Locating Engine Mounting Bracket Front No. 1 LH With Bolts
Courtesy of ABLE BODY CORP.

46. REMOVE ENGINE COOLANT TEMPERATURE SENSOR

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

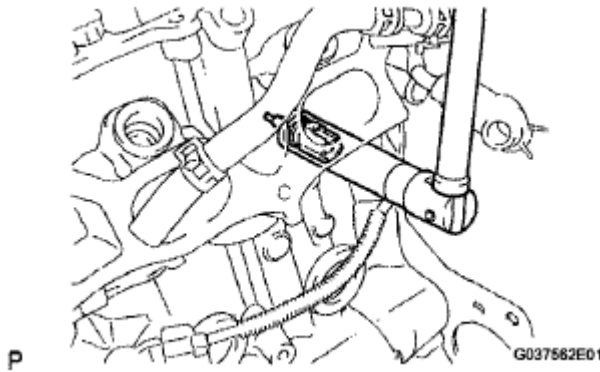


Fig. 178: Removing/Installing Engine Coolant Temperature Sensor
Courtesy of ABLE BODY CORP.

47. REMOVE NO. 1 WATER BY-PASS PIPE

- a. Remove the 2 nuts, then remove the water by-pass pipe No. 1.

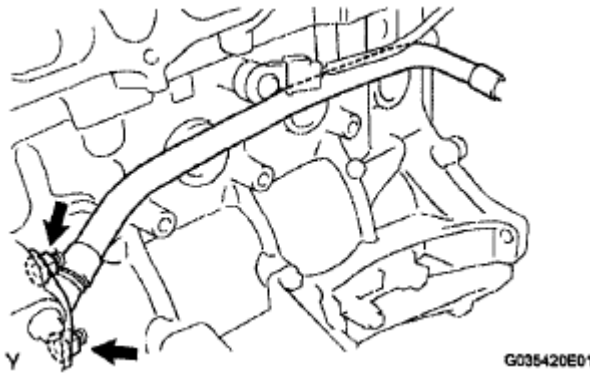


Fig. 179: Locating Water By-Pass Pipe No. 1
Courtesy of ABLE BODY CORP.

48. REMOVE VENTILATION PIPE

- a. Remove the bolts, then remove the ventilation pipe.

49. REMOVE IGNITION COIL ASSEMBLY

(See **REMOVAL**)

50. REMOVE SPARK PLUG

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

52. REMOVE NO. 1 IDLER PULLEY SUB-ASSEMBLY (See **REMOVAL)**

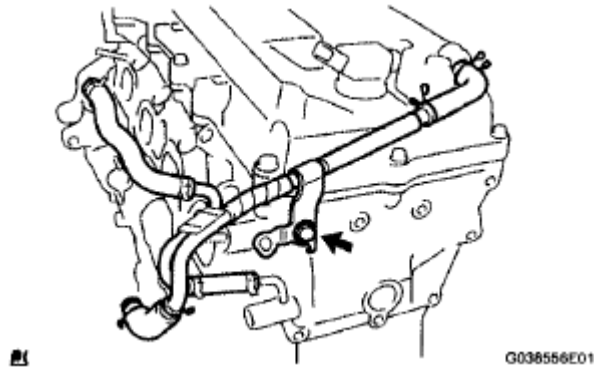


Fig. 180: Locating Ventilation Pipe With Bolt
Courtesy of ABLE BODY CORP.

53. REMOVE V-RIBBED BELT TENSIONER ASSEMBLY (See WATER PUMP)
54. REMOVE NO. 1 EXHAUST MANIFOLD HEAT INSULATOR (See AIR SWITCHING VALVE)
55. REMOVE AIR SWITCHING VALVE ASSEMBLY (See INSPECTION)
56. REMOVE EXHAUST MANIFOLD (See REMOVAL)
57. REMOVE FRONT NO. 1 ENGINE MOUNTING BRACKET RH
 - a. Remove the 4 bolts, then remove the engine mounting bracket front No. 1 together with the engine mounting insulator front.
58. REMOVE ENGINE OIL PRESSURE SWITCH ASSEMBLY
(See LUBRICATION SYSTEM)

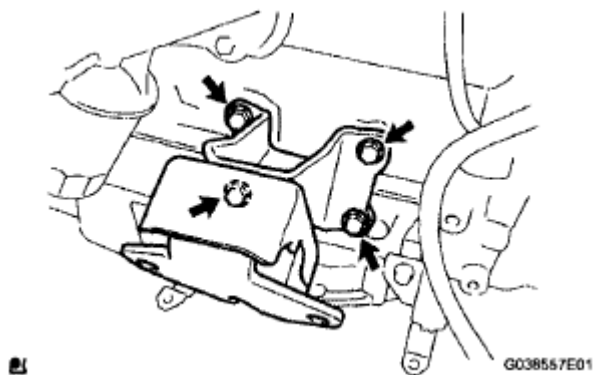


Fig. 181: Locating Engine Mounting Bracket Front No. 1 RH With Bolts
Courtesy of ABLE BODY CORP.

INSTALLATION

1. INSTALL ENGINE OIL PRESSURE SWITCH ASSEMBLY
(See LUBRICATION SYSTEM)

2. INSTALL FRONT NO. 1 ENGINE MOUNTING BRACKET RH

- a. Install the engine mounting bracket front No. 1 RH with the 4 bolts.

Torque: 51 N*m (520 kgf*cm, 38 ft.*lbf)

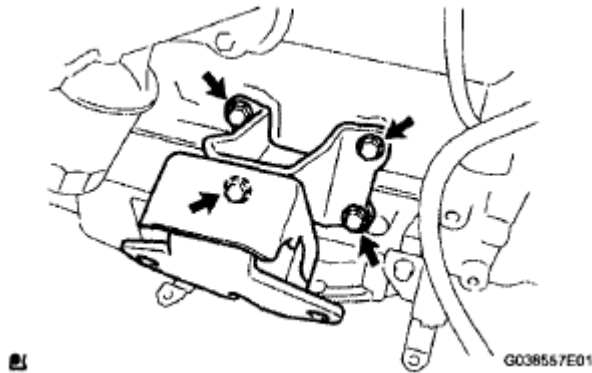
3. INSTALL EXHAUST MANIFOLD (See INSTALLATION)**4. INSTALL AIR SWITCHING VALVE ASSEMBLY (See INSTALLATION)****5. INSTALL NO. 1 EXHAUST MANIFOLD HEAT INSULATOR (See INSTALLATION)**

Fig. 182: Locating Engine Mounting Bracket Front No. 1 RH With Bolts
Courtesy of ABLE BODY CORP.

6. INSTALL V-RIBBED BELT TENSIONER ASSEMBLY (See INSTALLATION)**7. INSTALL NO. 1 IDLER PULLEY SUB-ASSEMBLY (See INSTALLATION)****8. INSTALL GENERATOR ASSEMBLY (See INSTALLATION)****9. INSTALL SPARK PLUG**

Torque: 18 N*m (184 kgf*cm, 13 ft.*lbf)

10. INSTALL IGNITION COIL ASSEMBLY

(See INSTALLATION)

11. INSTALL VENTILATION PIPE

- a. Install the ventilation pipe with the bolt.

Torque: 18 N*m (184 kgf*cm, 13 ft.*lbf)

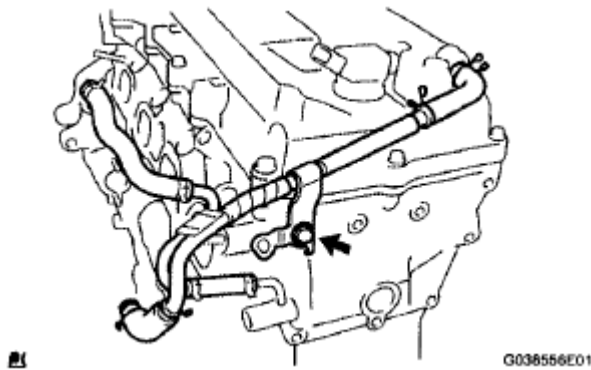


Fig. 183: Locating Ventilation Pipe With Bolt
Courtesy of ABLE BODY CORP.

12. INSTALL NO. 1 WATER BY-PASS PIPE

- a. Install a new gasket, then install the water by-pass pipe No. 1.

Torque: 18 N*m (178 kgf*cm, 13 ft.*lbf)

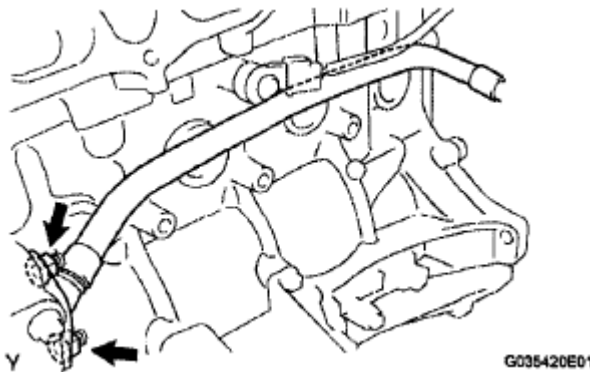


Fig. 184: Locating Water By-Pass Pipe No. 1
Courtesy of ABLE BODY CORP.

13. INSTALL ENGINE COOLANT TEMPERATURE SENSOR

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

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

14. INSTALL KNOCK SENSOR (See INSPECTION)

15. INSTALL FUEL INJECTOR ASSEMBLY (See INSTALLATION)

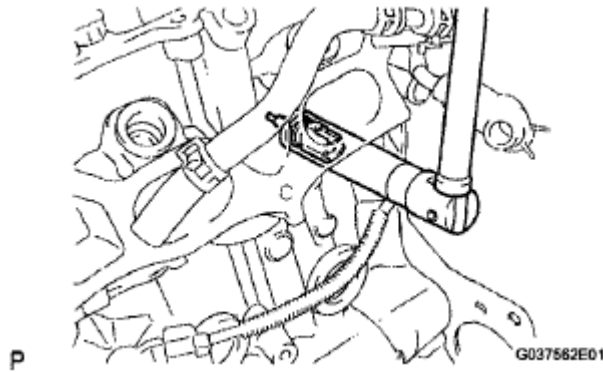


Fig. 185: Removing/Installing Engine Coolant Temperature Sensor
Courtesy of ABLE BODY CORP.

16. **INSTALL THERMOSTAT** (See **INSTALLATION**)
17. **INSTALL FRONT NO. 1 ENGINE MOUNTING BRACKET LH**
 - a. Install engine mounting bracket front No. 1 LH with the 4 bolts.

Torque: 51 N*m (520 kgf*cm, 38 ft.*lbf)

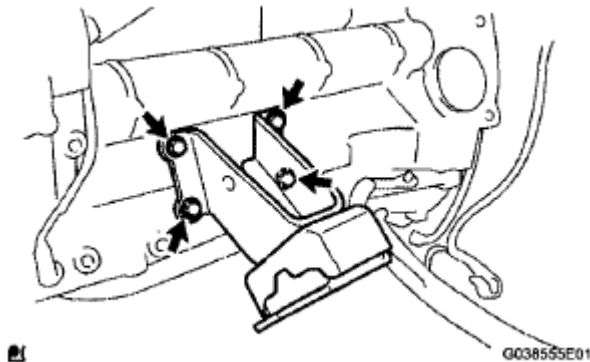


Fig. 186: Locating Engine Mounting Bracket Front No. 1 LH With Bolts
Courtesy of ABLE BODY CORP.

18. **INSTALL OIL LEVEL GAGE GUIDE**
 - a. Install the oil level gage guide with the bolt.
- Torque: 20 N*m (204 kgf*cm, 15 ft.*lbf)**
19. **INSTALL OIL LEVEL GAGE SUB-ASSEMBLY**
 20. **INSTALL ENGINE WIRE**
 21. **INSTALL IDLE PULLEY ASSEMBLY WITH BRACKET (w/Air Conditioning System)** (See **INSTALLATION**)
 22. **INSTALL NO. 1 INTAKE MANIFOLD TO HEAD GASKET** (See **INSTALLATION**)

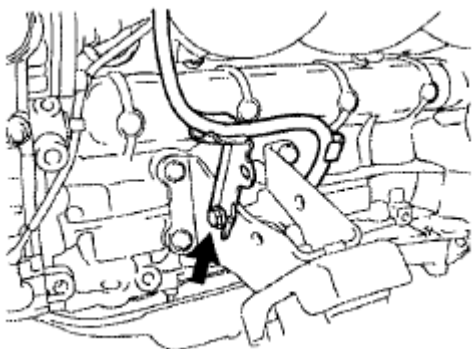


Fig. 187: Locating Oil Level Gage Guide With Bolt
Courtesy of ABLE BODY CORP.

23. INSTALL THROTTLE WITH MOTOR BODY ASSEMBLY (See INSPECTION)
24. INSTALL NO. 2 FUEL HOSE (See INSTALLATION)
25. INSTALL FUEL HOSE (See INSTALLATION)
26. INSTALL INTAKE AIR CONNECTOR (See INSTALLATION)
27. INSTALL REAR END PLATE (See INSTALLATION)
28. INSTALL DRIVE PLATE AND RING GEAR SUB-ASSEMBLY (for Automatic Transmission) (See INSTALLATION)
29. INSTALL FLYWHEEL SUB-ASSEMBLY (for Manual Transmission) (See INSTALLATION)
30. INSTALL CLUTCH DISC ASSEMBLY (for Manual Transmission)

CLUTCH DISC ASSEMBLY REFERENCE

Transmission	Refer to
R155	<u>INSTALLATION</u>
R155F	<u>INSTALLATION</u>

31. INSTALL CLUTCH COVER ASSEMBLY (for Manual Transmission)

CLUTCH COVER ASSEMBLY REFERENCE

Transmission	Refer to
R155	<u>INSTALLATION</u>
R155F	<u>INSTALLATION</u>

32. INSTALL ENGINE ASSEMBLY
 - a. Attach the engine sling device and chain block to the engine hangers.
 - b. Keep the engine level, and align the engine mounting bracket front No. 1 RH w/engine mounting insulator front and LH with the body mountings.
 - c. Attach the engine mounting bracket front No. 1 RH w/engine mounting insulator front and LH, and install the 4 bolts and nuts.

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

- d. Remove the bolts, then remove the engine hangers.

33. INSTALL AUTOMATIC TRANSMISSION ASSEMBLY

(See **REASSEMBLY**)

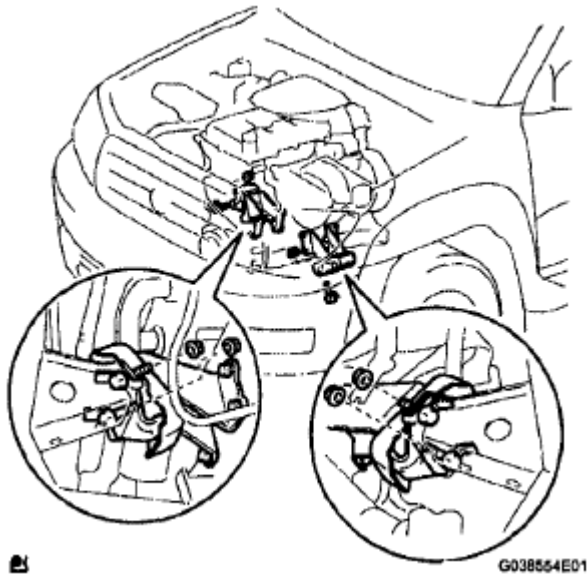


Fig. 188: Identifying Bolts And Engine Hangers
Courtesy of ABLE BODY CORP.

34. INSTALL MANUAL TRANSMISSION UNIT ASSEMBLY

MANUAL TRANSMISSION UNIT ASSEMBLY REFERENCE

Transmission	Refer to
R155	INSTALLATION
R155F	INSTALLATION

35. INSTALL FRONT EXHAUST PIPE ASSEMBLY (See **REMOVAL)**

36. INSTALL EXHAUST PIPE ASSEMBLY TAIL (See **REMOVAL)**

37. INSTALL ENGINE WIRE

38. CONNECT NO. 1 AIR INJECTION HOSE

- a. Connect the fuel vapor feed hose.



Fig. 189: Locating No.1 Air Injection Hose
Courtesy of ABLE BODY CORP.

39. **CONNECT FUEL VAPOR FEED HOSE ASSEMBLY**
 - a. Connect the fuel feed hose.
40. **CONNECT NO. 2 FUEL HOSE** (See **INSTALLATION**)
41. **CONNECT FUEL HOSE** (See **INSTALLATION**)

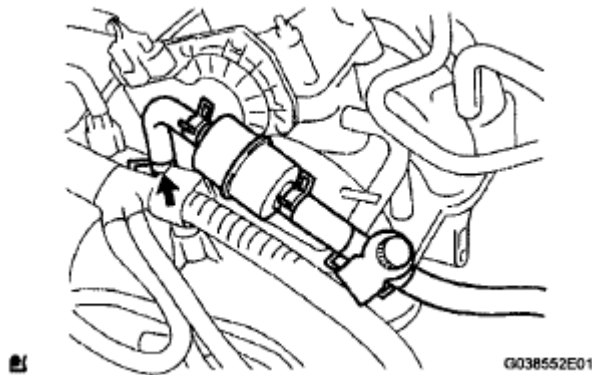


Fig. 190: Locating Fuel Feed Hose
Courtesy of ABLE BODY CORP.

42. **INSTALL WATER HOSE SUB-ASSEMBLY**
 - a. Install the water hose.
43. **INSTALL RADIATOR HOSE INLET**
44. **INSTALL COMPRESSOR AND MAGNETIC CLUTCH (w/Air Conditioning System)** (See **INSTALLATION**)
45. **INSTALL NO. 2 RADIATOR HOSE**
46. **INSTALL VANE PUMP ASSEMBLY** (See **INSTALLATION**)
47. **INSTALL AIR CLEANER CASE**
 - a. Install the air cleaner case with the 3 bolts.

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

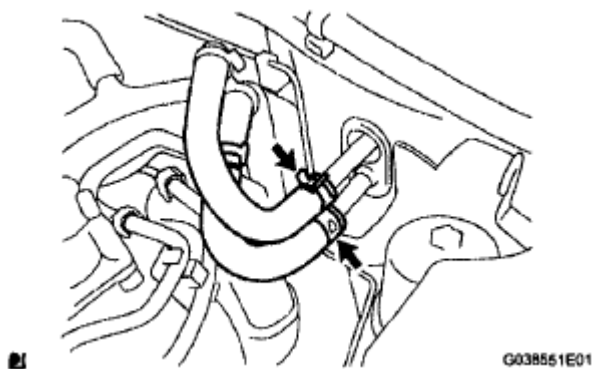


Fig. 191: Locating Water Hose
Courtesy of ABLE BODY CORP.

48. **INSTALL AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY**
49. **INSTALL AIR CLEANER CAP SUB-ASSEMBLY** (See INSTALLATION)
50. **INSTALL FAN SHROUD** (See INSTALLATION)
51. **INSTALL RADIATOR SUPPORT TO FRAME SEAL LH** (See INSTALLATION)
52. **INSTALL BATTERY TRAY**
53. **INSTALL BATTERY**
54. **ADD ENGINE COOLANT** (See COOLANT)
55. **ADD ENGINE OIL** (See INSTALLATION)
56. **CHECK FOR ENGINE OIL LEVEL**
57. **CHECK FOR FUEL LEAKAGE**
58. **CHECK FOR ENGINE COOLANT LEAKAGE** (See ON-VEHICLE INSPECTION)
59. **CHECK FOR OIL LEAKAGE**
60. **CHECK FOR EXHAUST GAS LEAKAGE**
61. **INSPECT IGNITION TIMING** (See ON-VEHICLE INSPECTION)
62. **INSPECT ENGINE IDLE SPEED** (See ON-VEHICLE INSPECTION)
63. **INSPECT CO/HC** (See ON-VEHICLE INSPECTION)
64. **INSTALL NO. 1 ENGINE UNDER COVER SUB-ASSEMBLY** (for Pre Runner and 4WD Type)
 - a. Install the engine under cover No. 1 with the 4 bolts.

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

65. **INSTALL NO. 2 ENGINE UNDER COVER SUB-ASSEMBLY** (for Pre Runner and 4WD Type, Regular Cab)
 - a. Install the engine under cover No. 2 with the 4 bolts.

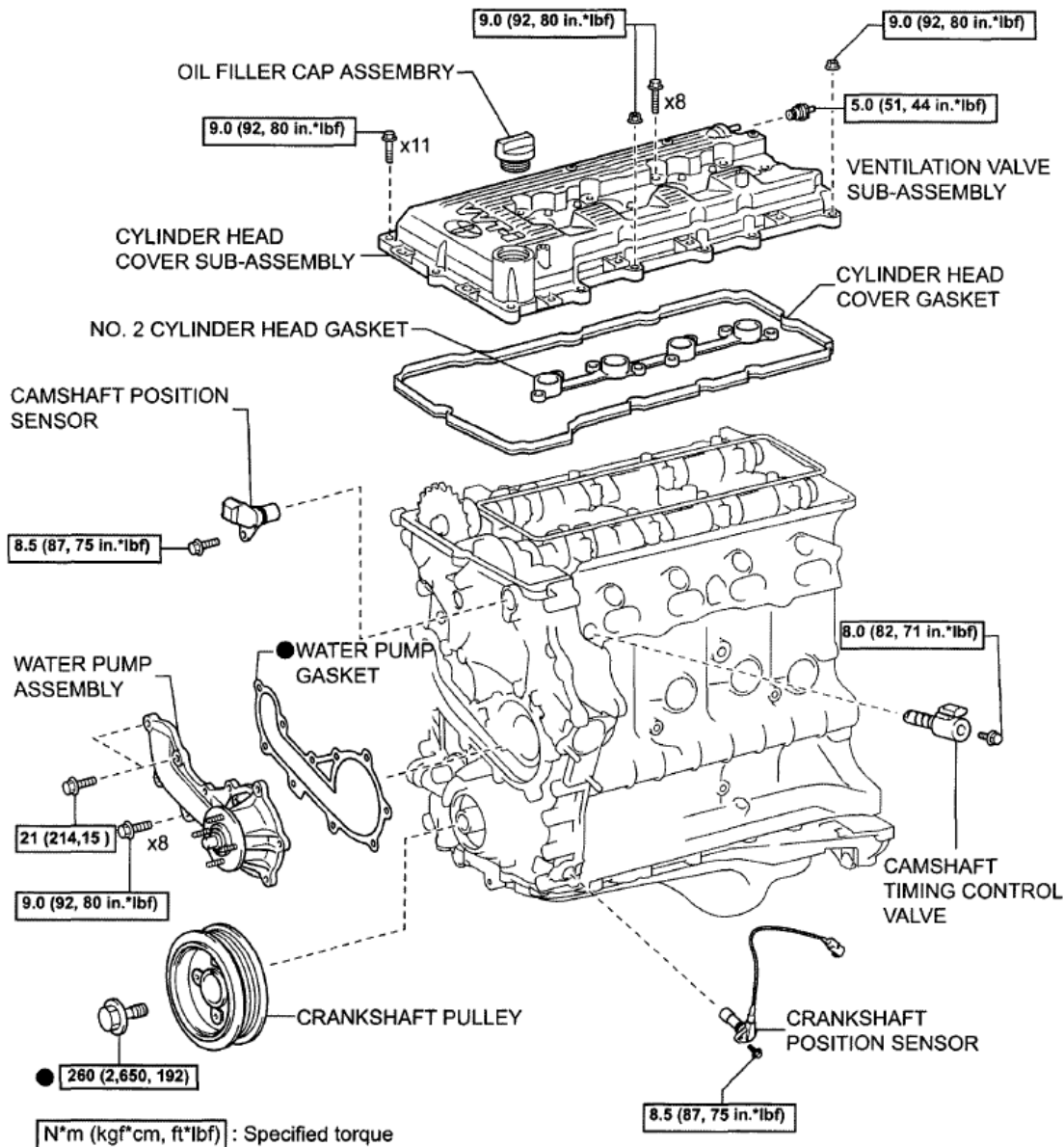
Torque: 30 N*m (306 kgf*cm, 22 ft.*lbf)

66. **INSTALL HOOD SUB-ASSEMBLY**

(See **REASSEMBLY**)

ENGINE UNIT

COMPONENTS



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Fig. 192: Identifying Engine Unit Components & Torque Specification (1 Of 7)
Courtesy of ABLE BODY CORP.

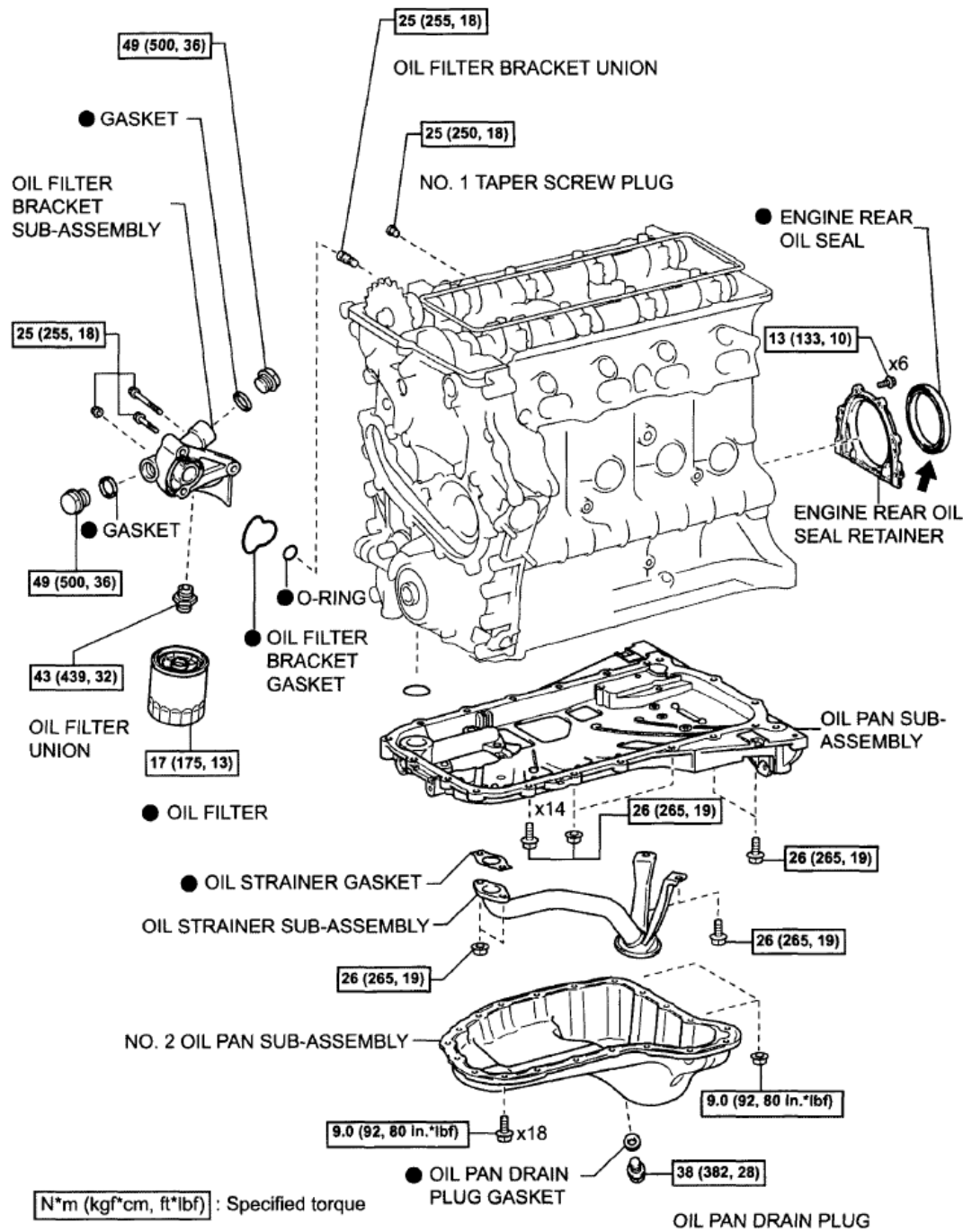


Fig. 193: Identifying Engine Unit Components & Torque Specification (2 Of 7)
Courtesy of ABLE BODY CORP.

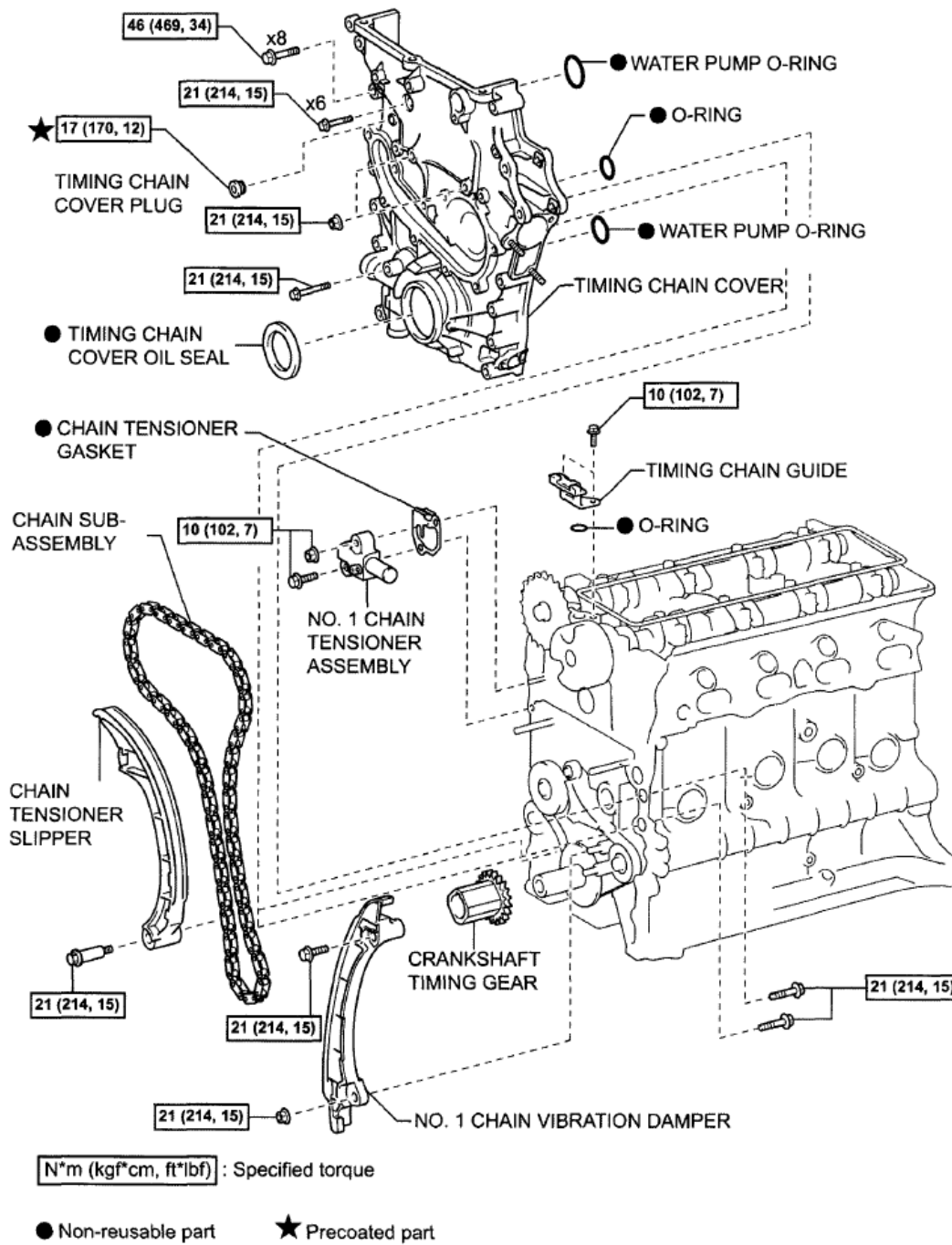


Fig. 194: Identifying Engine Unit Components & Torque Specification (3 Of 7)
Courtesy of ABLE BODY CORP.

2009 Toyota Tacoma PreRunner

2009 ENGINE Engine Mechanical (2TR-FE) - Tacoma

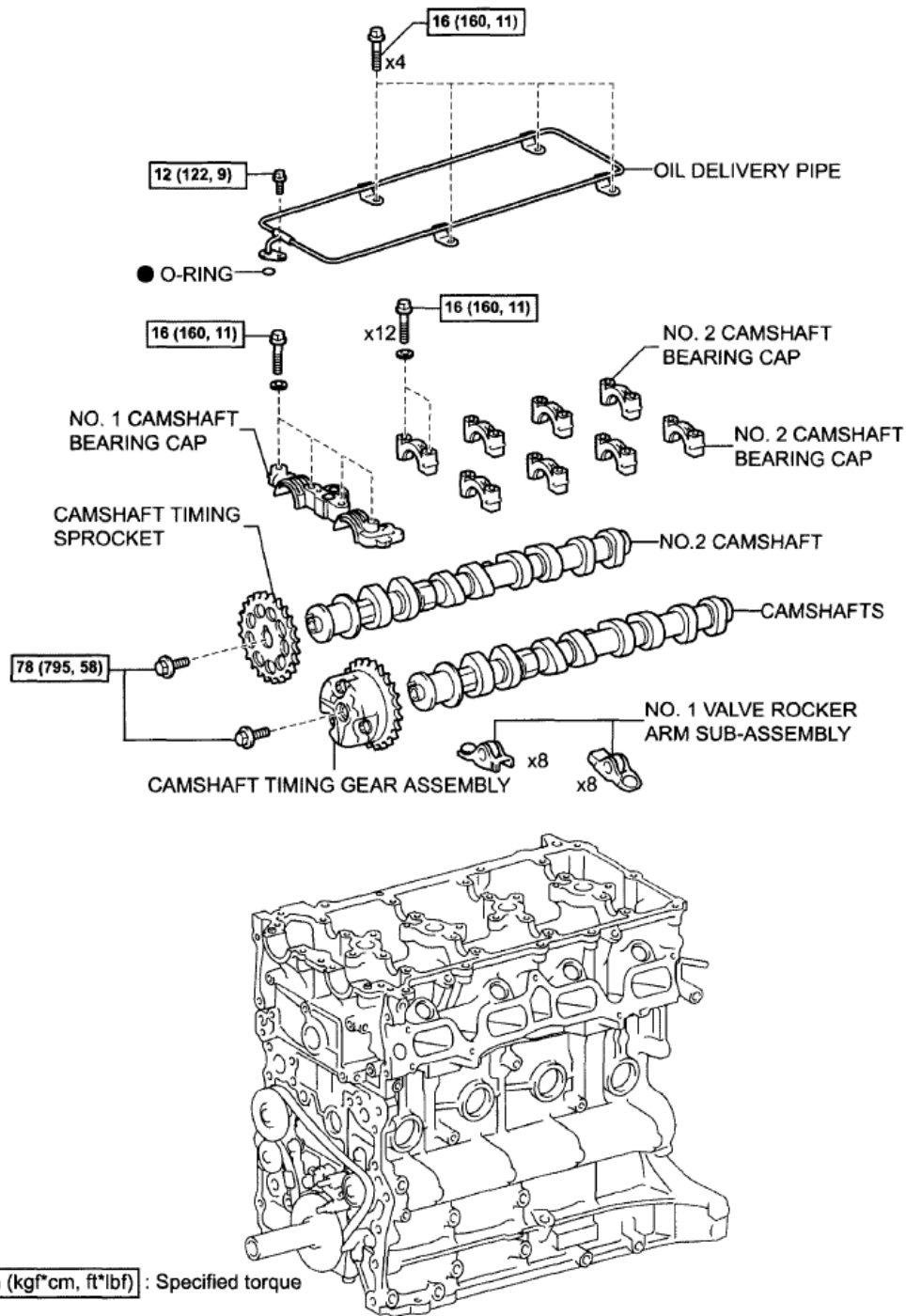
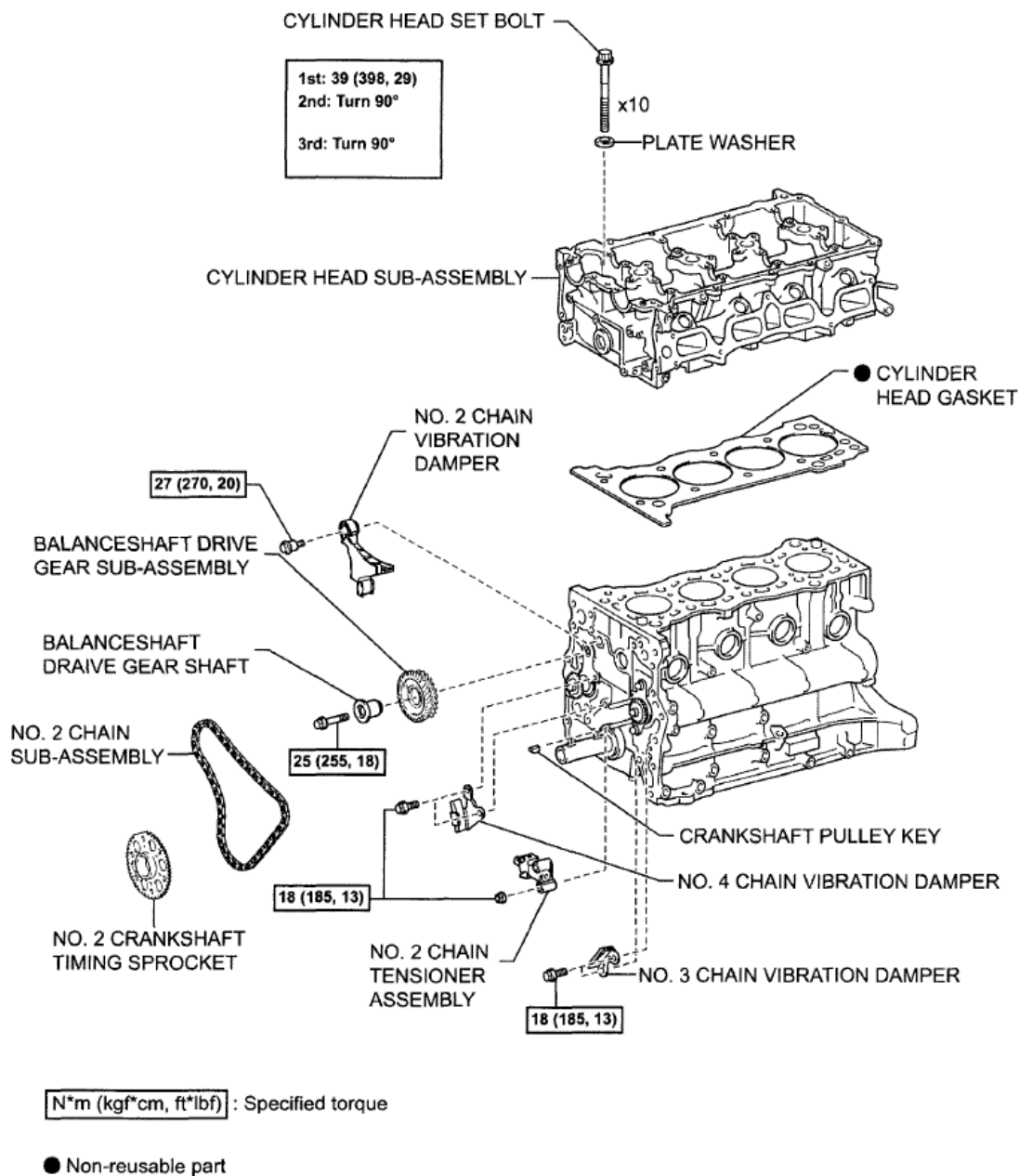


Fig. 195: Identifying Engine Unit Components & Torque Specification (4 Of 7)
Courtesy of ABLE BODY CORP.



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Fig. 196: Identifying Engine Unit Components & Torque Specification (5 Of 7)
 Courtesy of ABLE BODY CORP.

2009 ENGINE Engine Mechanical (2TR-FE) - Tacoma



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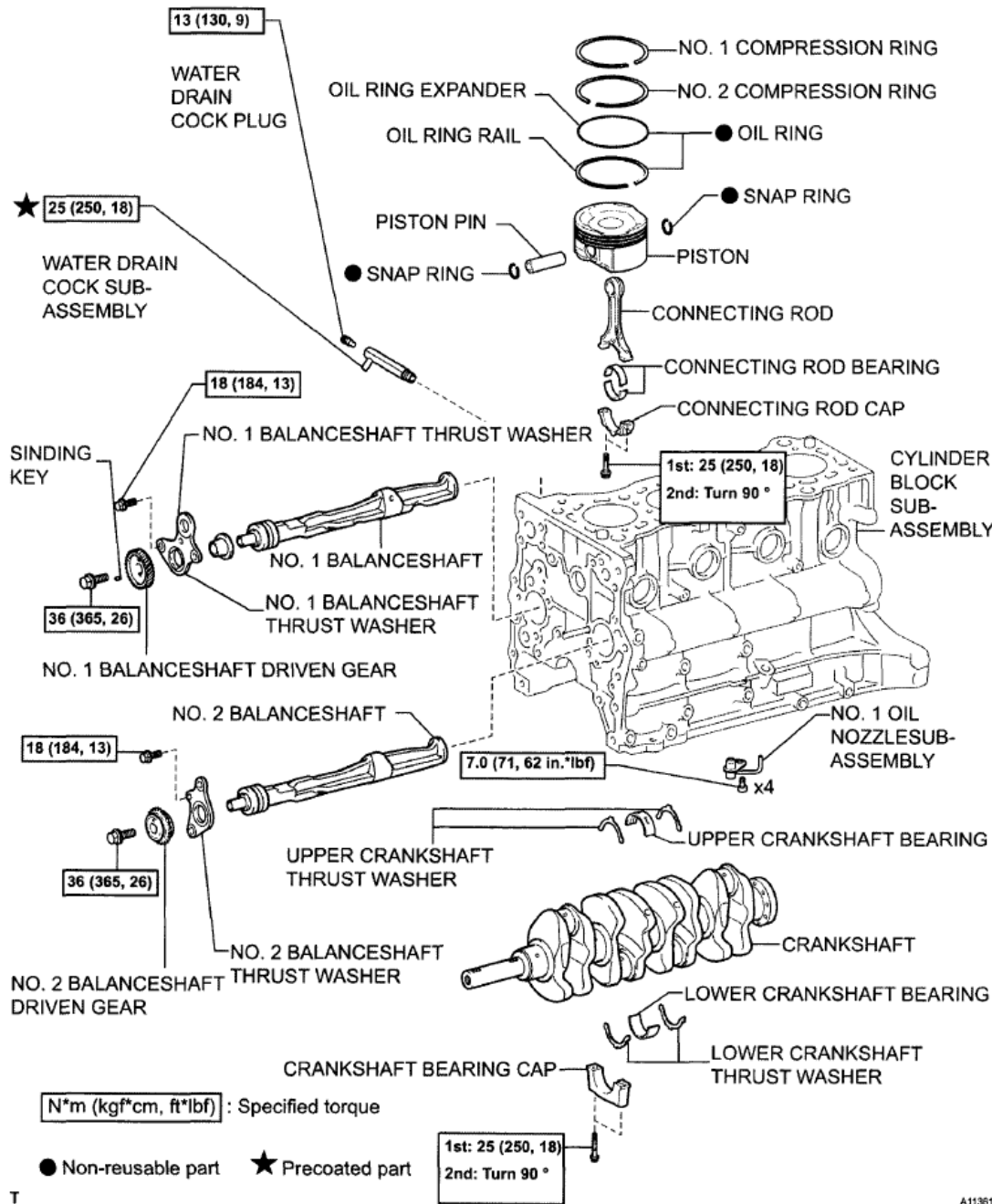


Fig. 198: Identifying Engine Unit Components & Torque Specification (7 Of 7)
Courtesy of ABLE BODY CORP.

DISASSEMBLY

1. REMOVE OIL FILLER CAP SUB-ASSEMBLY

- Remove the oil filler cap sub-assembly.

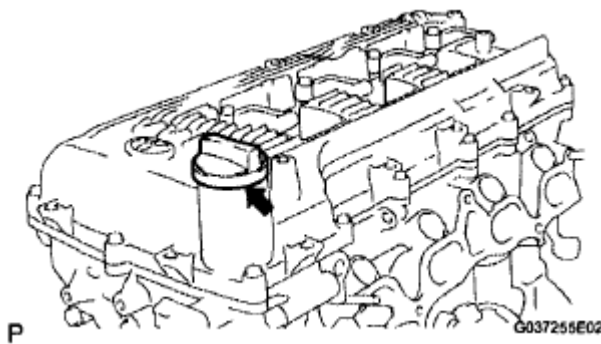


Fig. 199: Locating Oil Filler Cap Sub-Assembly
Courtesy of ABLE BODY CORP.

2. REMOVE VENTILATION VALVE SUB-ASSEMBLY

- a. Remove the ventilation valve sub-assembly.

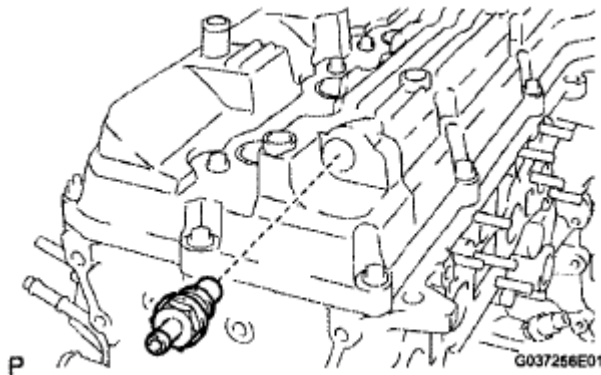


Fig. 200: Identifying Ventilation Valve Sub-Assembly
Courtesy of ABLE BODY CORP.

3. REMOVE CAMSHAFT POSITION SENSOR

- a. Remove the bolt and camshaft position sensor.

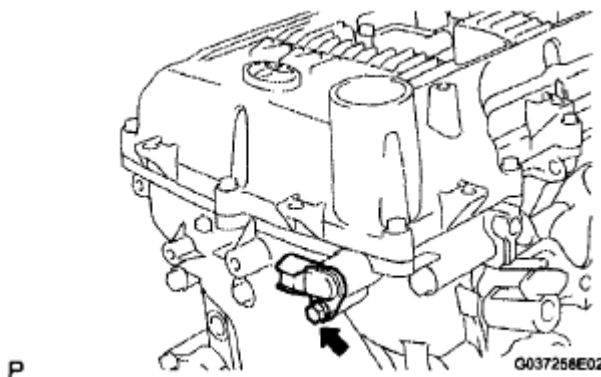


Fig. 201: Locating Bolt And Camshaft Position Sensor
Courtesy of ABLE BODY CORP.

4. REMOVE CRANKSHAFT POSITION SENSOR

- a. Remove the bolt and crankshaft position sensor.

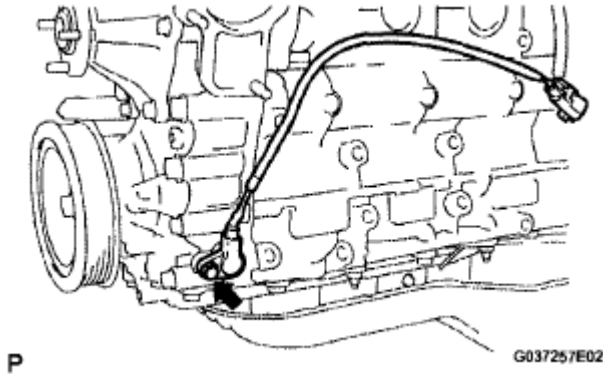


Fig. 202: Locating Bolt And Crankshaft Position Sensor
Courtesy of ABLE BODY CORP.

5. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

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

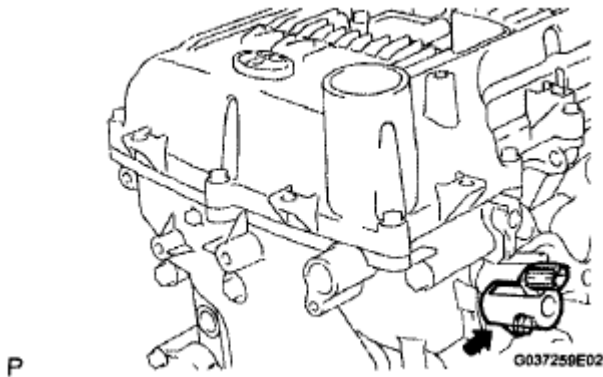


Fig. 203: Locating Camshaft Timing Oil Control Valve Assembly With Bolt
Courtesy of ABLE BODY CORP.

6. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY

- a. Remove the 19 bolts, 2 nuts, head cover and 2 gaskets.

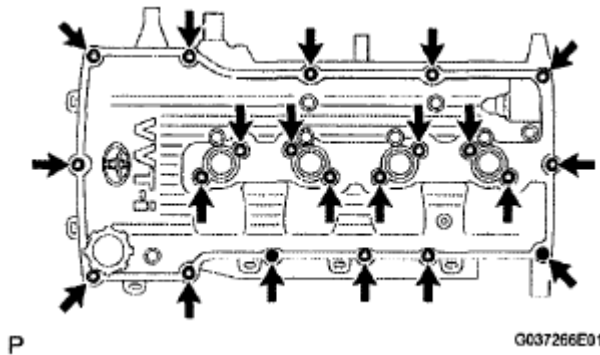


Fig. 204: Locating Cylinder Head Cover With Bolts And Nuts
Courtesy of ABLE BODY CORP.

7. REMOVE CRANKSHAFT PULLEY

- Turn the crankshaft pulley, and align its groove with timing mark 0 of the timing chain cover.
- Check that the timing marks of the camshaft timing gear and sprocket are aligned with the timing marks of the bearing cap No.1, as shown in the illustration.

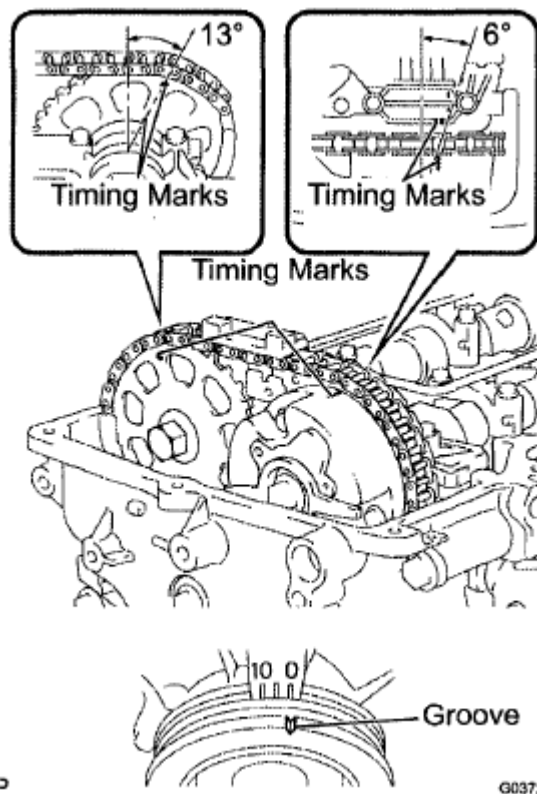


Fig. 205: Aligning Timing Marks Of Camshaft Timing Gear And Sprocket
Courtesy of ABLE BODY CORP.

- Using SST, loosen the crankshaft pulley bolt.

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

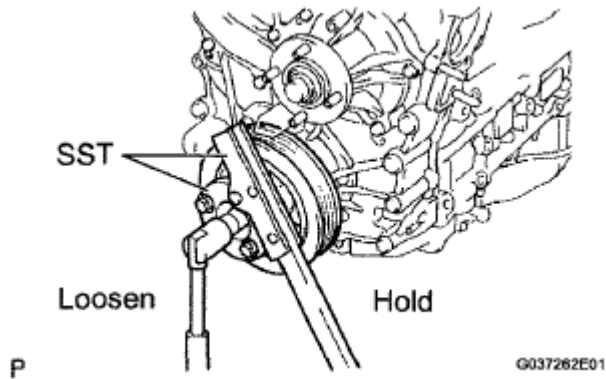


Fig. 206: Loosening Crankshaft Pulley Bolt
Courtesy of ABLE BODY CORP.

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

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

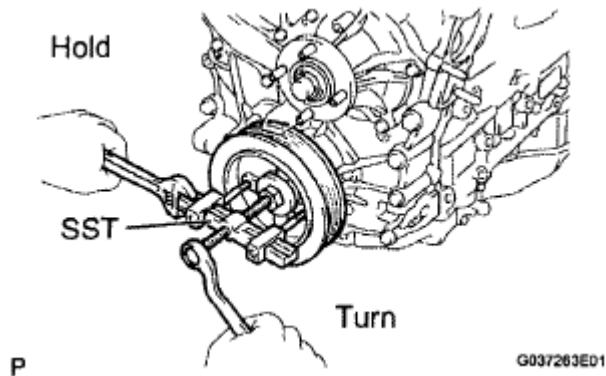


Fig. 207: Removing Crankshaft Pulley Bolt And Crankshaft Pulley
Courtesy of ABLE BODY CORP.

8. REMOVE NO. 2 OIL PAN SUB-ASSEMBLY

- a. Remove the drain plug and gasket.
- b. Remove the 18 bolts and 2 nuts.

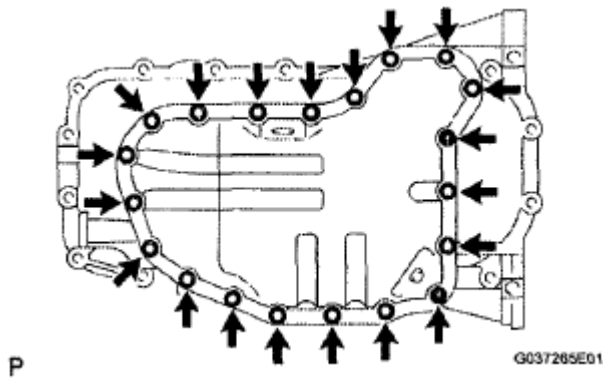


Fig. 208: Locating Oil Pan Bolts And Nuts
Courtesy of ABLE BODY CORP.

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

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

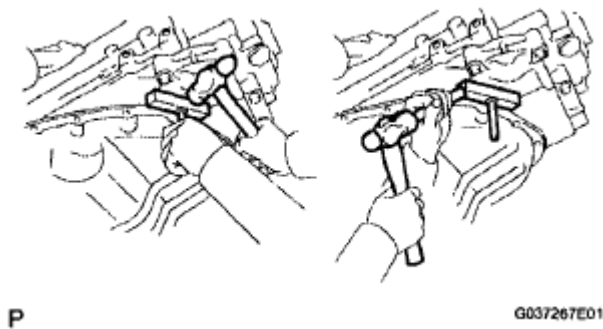


Fig. 209: Inserting Blade Of SST Between Oil Pans
Courtesy of ABLE BODY CORP.

9. REMOVE OIL STRAINER SUB-ASSEMBLY

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

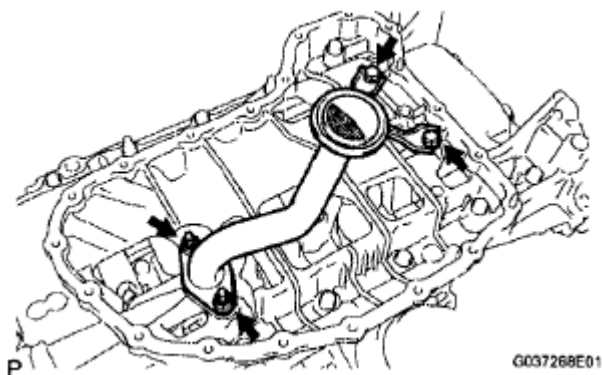


Fig. 210: Locating Gasket And Oil Strainer With Bolts And Nuts
Courtesy of ABLE BODY CORP.

10. REMOVE OIL PAN SUB-ASSEMBLY

- a. Remove the 16 bolts and 2 nuts.

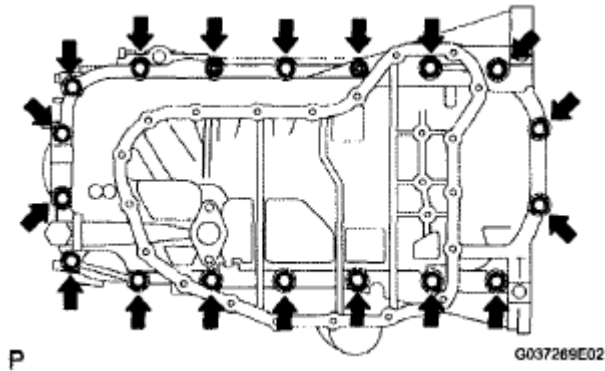


Fig. 211: Locating Oil Pan Bolts And Nuts
Courtesy of ABLE BODY CORP.

- 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.

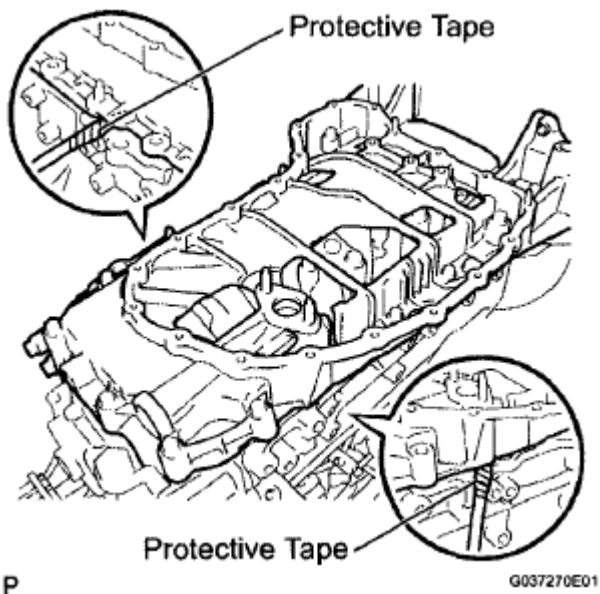


Fig. 212: Prying Between Oil Pan
Courtesy of ABLE BODY CORP.

- c. Remove the O-ring.

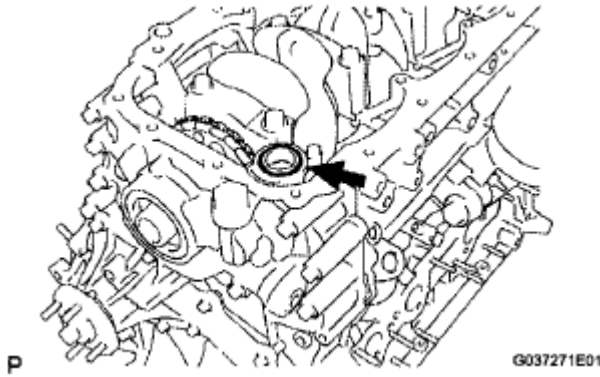


Fig. 213: Locating O-Ring
Courtesy of ABLE BODY CORP.

11. REMOVE TIMING CHAIN COVER

- a. Remove the 19 bolts and 2 nuts as shown in the illustration.

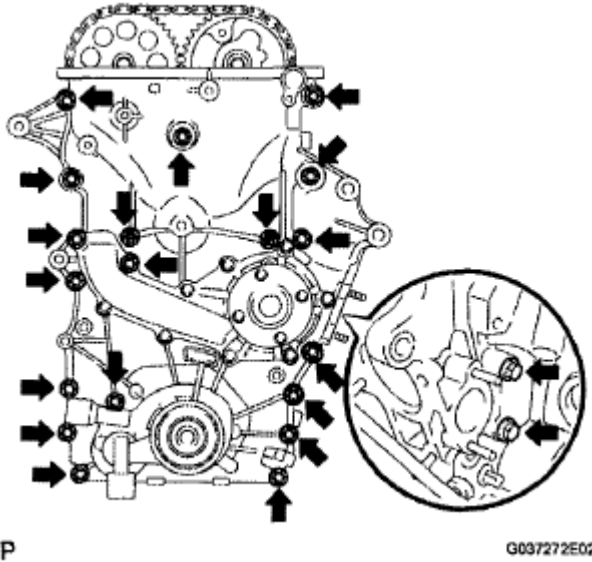


Fig. 214: Locating Timing Chain Cover Bolts And Nuts
Courtesy of ABLE BODY CORP.

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

HINT:

Tape the screwdriver tip before use.

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

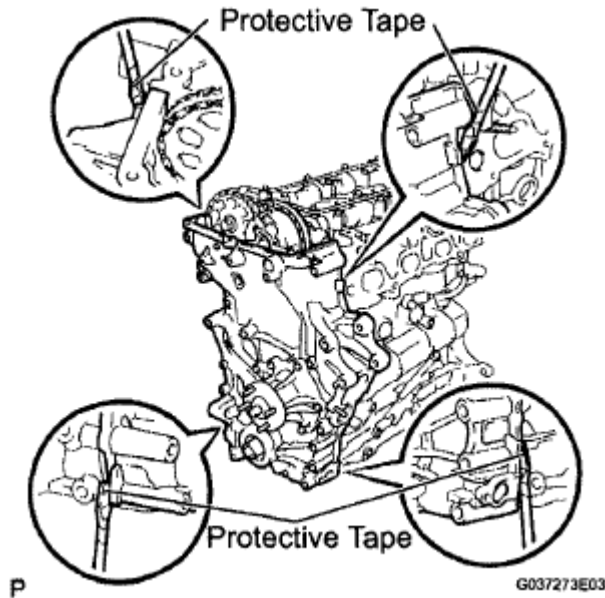


Fig. 215: Prying Between Timing Chain Cover And Cylinder Head
Courtesy of ABLE BODY CORP.

- c. Remove the 3 O-rings.

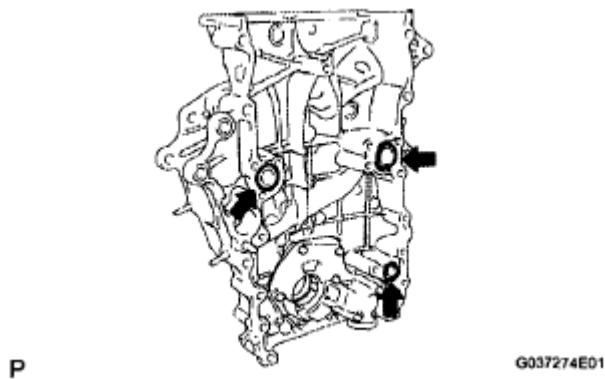


Fig. 216: Locating O-Rings
Courtesy of ABLE BODY CORP.

- d. Using a 10 mm socket hexagon wrench, remove the timing chain cover plug.

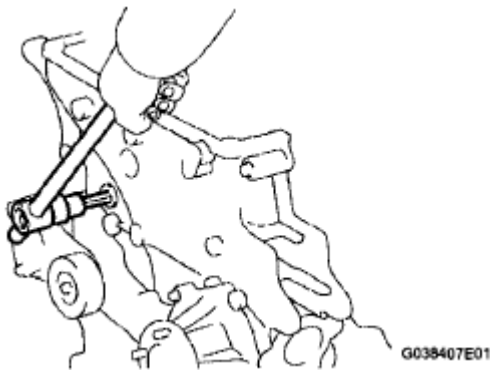


Fig. 217: Removing Timing Chain Cover Plug
Courtesy of ABLE BODY CORP.

12. REMOVE WATER PUMP ASSEMBLY

- a. Remove the 8 bolts, water pump and gasket.

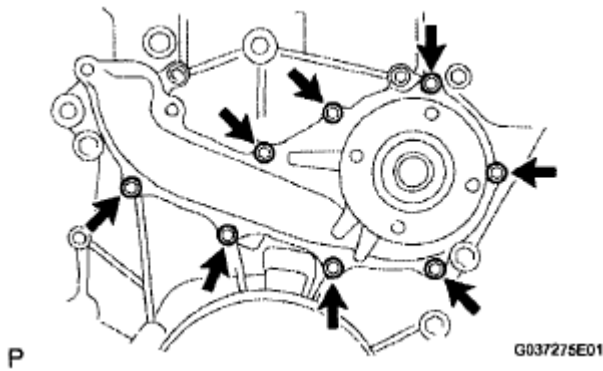


Fig. 218: Locating Gasket And Water Pump With Bolts
Courtesy of ABLE BODY CORP.

13. REMOVE TIMING CHAIN GUIDE

- a. Remove the 2 bolts, timing chain guide and O-ring.

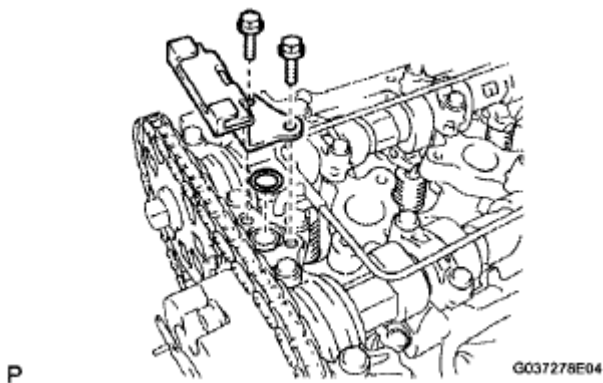


Fig. 219: Identifying O-Ring And Chain Guide With Bolts

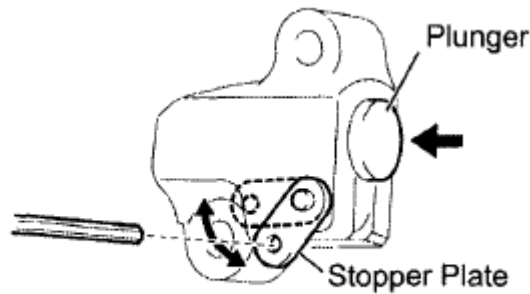
Courtesy of ABLE BODY CORP.

14. REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY

NOTE:

- When the chain tensioner is removed, do not rotate the crankshaft.
- When the chain is removed and the camshaft needs to be rotated, rotate the crankshaft 90 degrees to the right.

- 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 stopper plate's hole.



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Fig. 220: Moving Stopper Plate Upward To Release Lock
Courtesy of ABLE BODY CORP.

- c. Remove the bolt, nut, chain tensioner assembly No.1 and gasket.

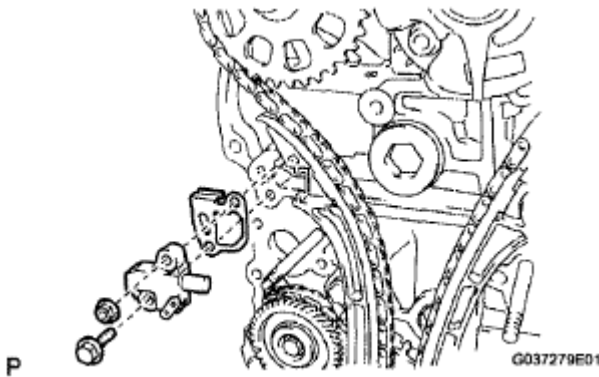


Fig. 221: Identifying Gasket And Chain Tensioner No.1
Courtesy of ABLE BODY CORP.

15. REMOVE CHAIN TENSIONER SLIPPER

- a. Remove the bolt and tensioner slipper.

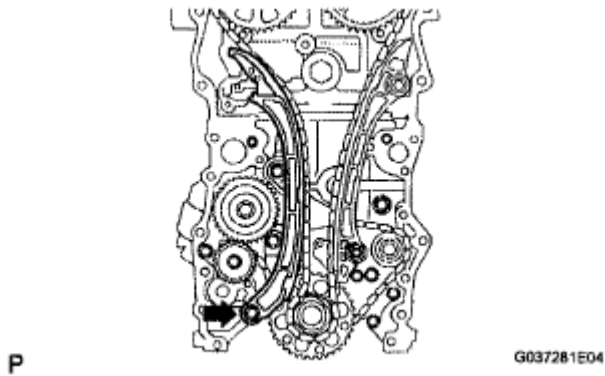


Fig. 222: Locating Tensioner Slipper With Bolt
Courtesy of ABLE BODY CORP.

16. REMOVE NO. 1 CHAIN VIBRATION DAMPER

- a. Remove the bolt, nut, and vibration damper.

17. REMOVE CHAIN SUB-ASSEMBLY

- a. Remove the chain.

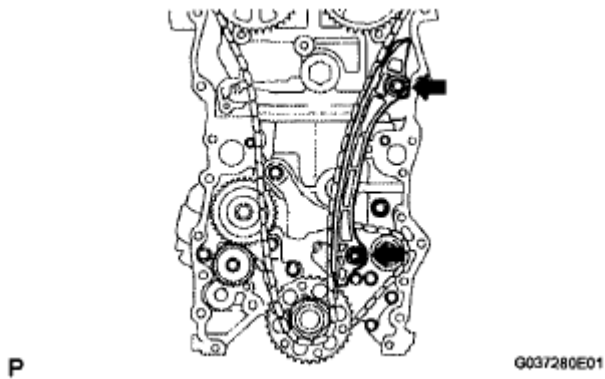
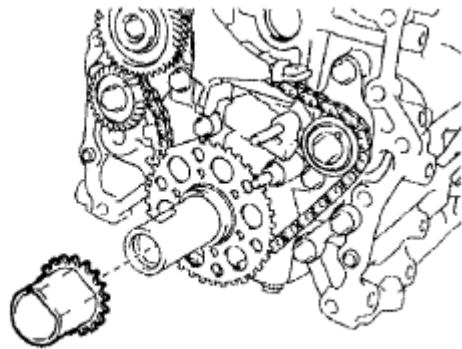


Fig. 223: Locating Vibration Damper With Bolt And Nut
Courtesy of ABLE BODY CORP.

18. REMOVE CRANKSHAFT TIMING GEAR OR SPROCKET

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



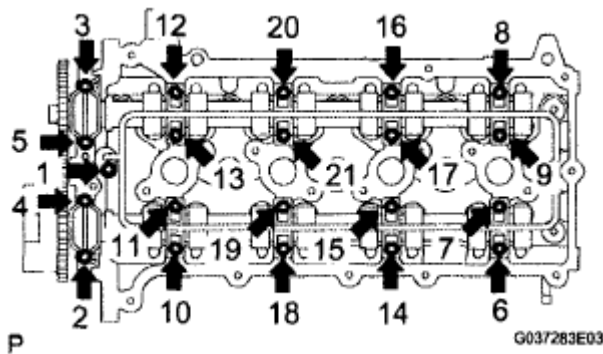
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Fig. 224: Identifying Timing Sprocket
Courtesy of ABLE BODY CORP.

19. REMOVE CAMSHAFT BEARING CAP

- a. Uniformly loosen and remove the 21 bearing cap bolts and 20 washers on the camshafts in the sequence shown in the illustration.

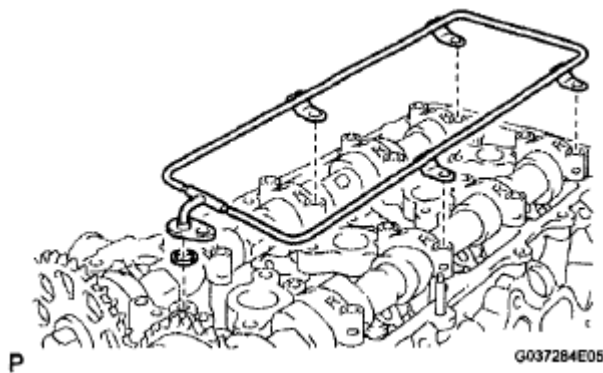


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Fig. 225: Locating Bearing Cap Bolts
Courtesy of ABLE BODY CORP.

- b. Remove the oil delivery pipe and O-ring from the bearing caps.



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Fig. 226: Identifying Camshaft Oil Delivery Pipe
Courtesy of ABLE BODY CORP.

- c. Remove the 9 bearing caps.

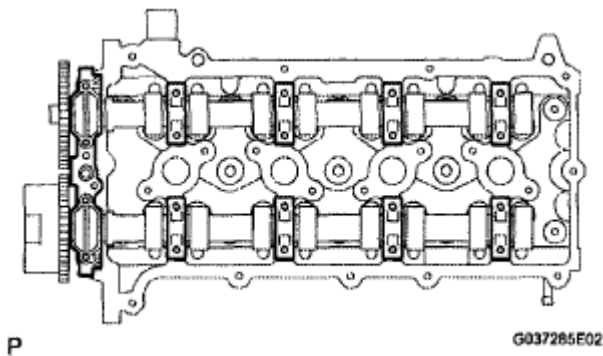


Fig. 227: Identifying Bearing Caps
Courtesy of ABLE BODY CORP.

20. REMOVE CAMSHAFT

- a. Remove the camshaft sub-assembly.

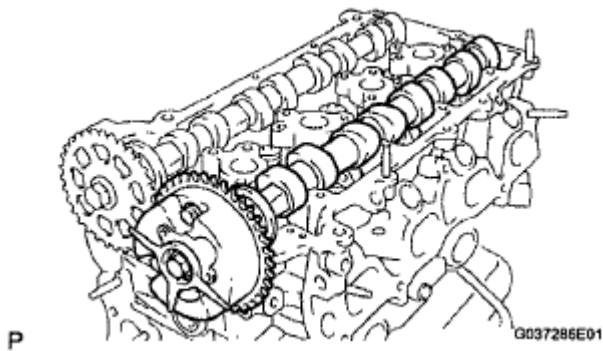


Fig. 228: Identifying Camshaft Sub-Assembly
Courtesy of ABLE BODY CORP.

21. REMOVE NO.2 CAMSHAFT

- a. Remove the No.2 camshaft sub-assembly.

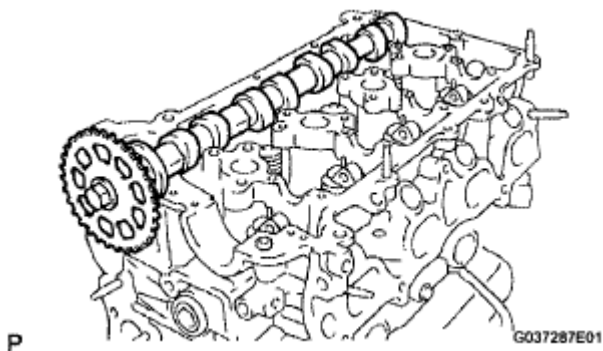


Fig. 229: Identifying No.2 Camshaft Sub-Assembly
Courtesy of ABLE BODY CORP.

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

- a. Remove the 16 valve rocker arm sub-assembly.

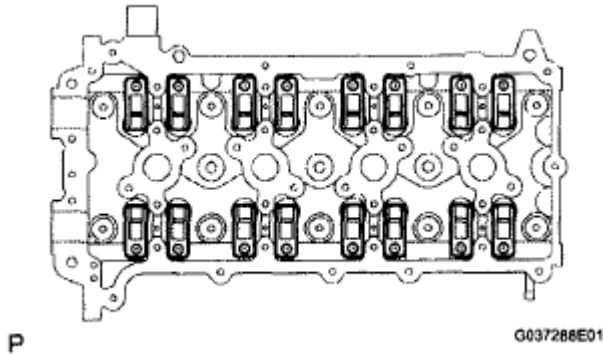


Fig. 230: Identifying Valve Rocker Arms
Courtesy of ABLE BODY CORP.

23. REMOVE CAMSHAFT TIMING SPROCKET

- a. Fix the camshaft with a vise and then remove the sprocket bolt and camshaft timing sprocket.

NOTE: Be careful not to damage the camshaft.

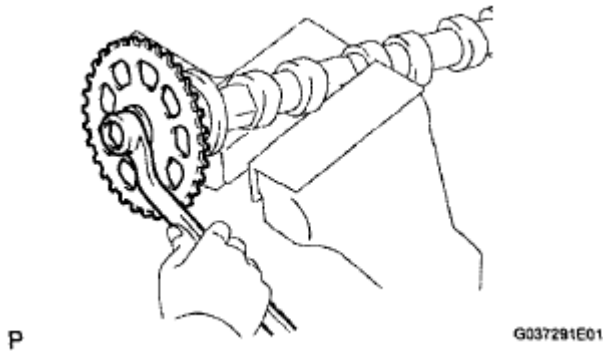


Fig. 231: Removing Sprocket Bolt And Camshaft Timing Sprocket
Courtesy of ABLE BODY CORP.

24. REMOVE CAMSHAFT TIMING GEAR ASSEMBLY

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

NOTE: Be careful not to damage the camshaft.

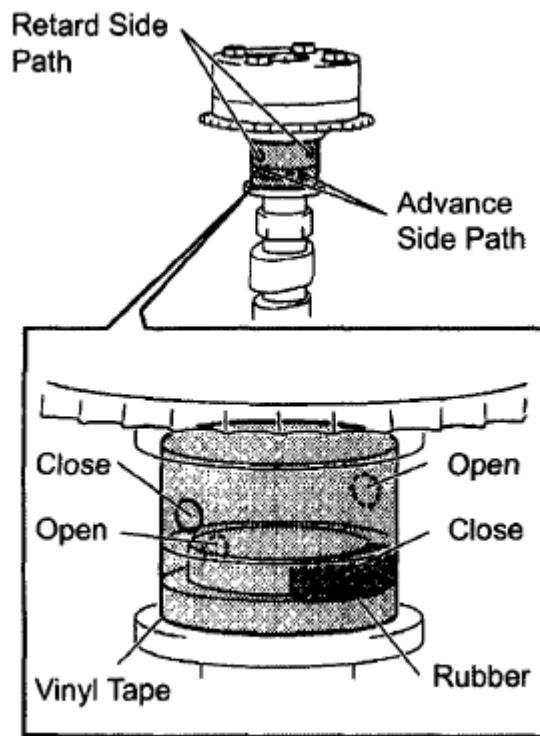
- b. Release the lock pin.

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.



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Fig. 232: Identifying Advance Side Path And Retard Side Path On Opposite Side
Courtesy of ABLE BODY CORP.

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

CAUTION: Some oil splashing will occur. Cover the paths with a shop rag.

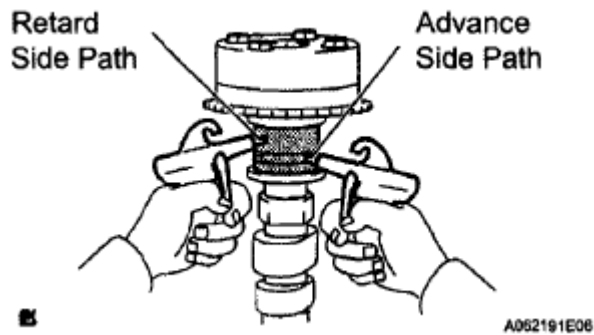


Fig. 233: Applying Air Pressure To Camshaft Timing Gear Both Path
Courtesy of ABLE BODY CORP.

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

OK:

Gear rotates in the advance direction.

HINT:

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

5. When the camshaft timing gear reaches the most advanced position, 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.

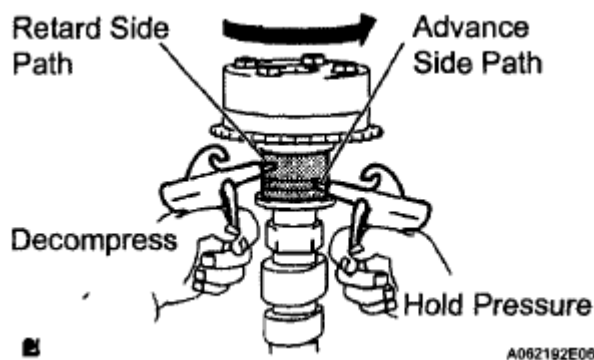


Fig. 234: Identifying Camshaft Timing Gear Turning Position
Courtesy of ABLE BODY CORP.

- c. Check for smooth rotation.

1. Rotate the camshaft timing gear within its movable range several times, but do not turn it to

the most retarded position. Check that the gear rotates smoothly.

OK:

Gear rotates in the advance direction.

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

d. Check the lock in the most retarded position.

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

25. REMOVE CAMSHAFT TIMING GEAR ASSEMBLY

a. 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.

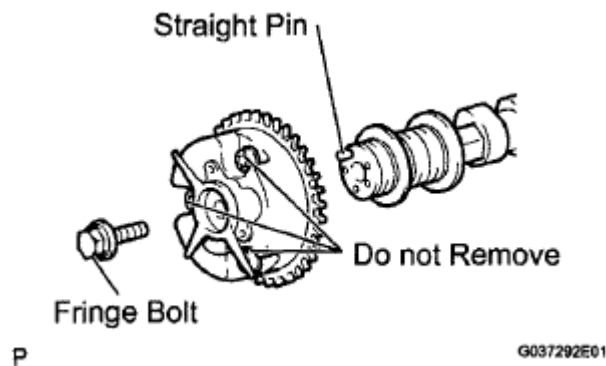


Fig. 235: Identifying Fringe Bolt And Camshaft Timing Gear
Courtesy of ABLE BODY CORP.

26. REMOVE CYLINDER HEAD SUB-ASSEMBLY

a. Uniformly loosen the 10 bolts in the sequence shown in the illustration. Remove the 10 cylinder head bolts and plate washers.

NOTE:

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

b. Remove the cylinder head.

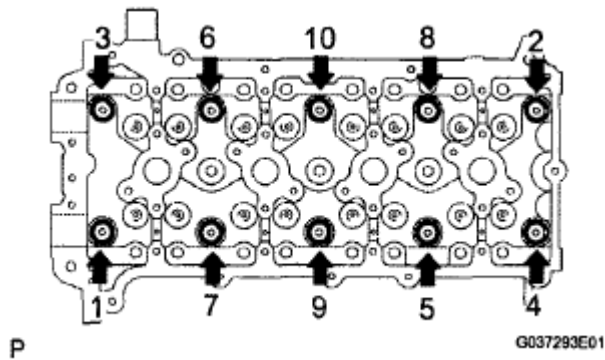


Fig. 236: Locating Cylinder Head Bolts
Courtesy of ABLE BODY CORP.

27. REMOVE CYLINDER HEAD GASKET

- a. Remove the cylinder head and gasket.

28. REMOVE NO. 2 CHAIN VIBRATION DAMPER

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

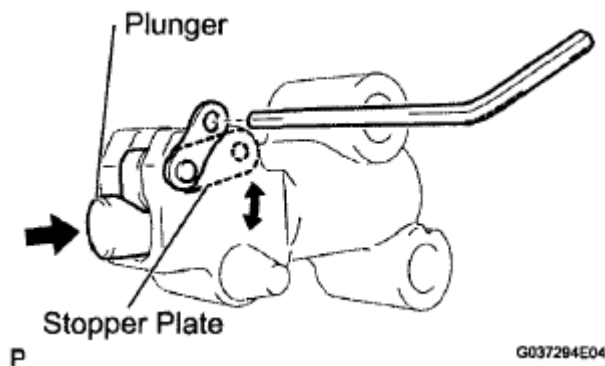


Fig. 237: Pushing Plunger Deep Into Tensioner
Courtesy of ABLE BODY CORP.

- c. Remove the bolt and chain vibration damper No.2.

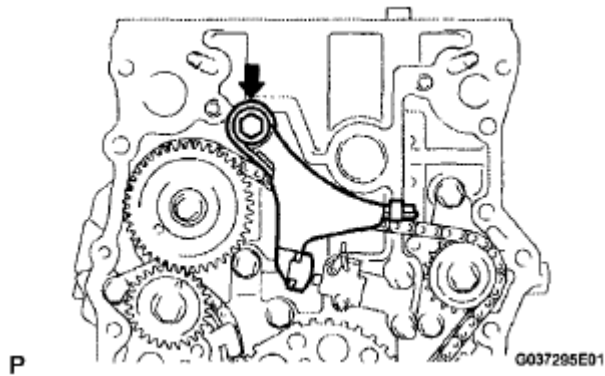


Fig. 238: Locating Chain Vibration Damper No.2 With Bolt
Courtesy of ABLE BODY CORP.

29. REMOVE NO. 3 CHAIN VIBRATION DAMPER

- a. Remove the 2 bolts and chain vibration damper No.3.

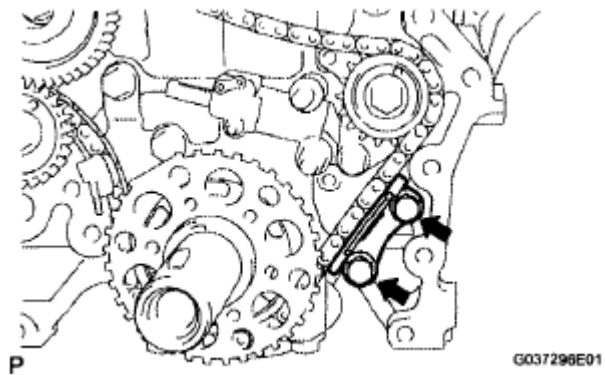


Fig. 239: Locating Chain Vibration Damper No.3 With Bolts
Courtesy of ABLE BODY CORP.

30. REMOVE NO. 2 CHAIN TENSIONER ASSEMBLY

- a. Remove the hexagon wrench from the tensioner assembly No.2.
- b. Remove the nut and chain tensioner assembly No.2.

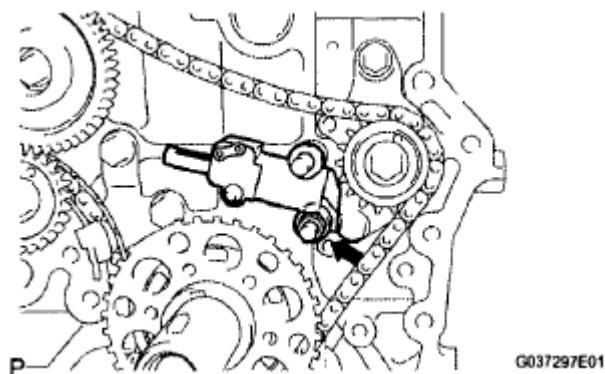


Fig. 240: Locating Chain Tensioner Assembly No.2 With Nut
Courtesy of ABLE BODY CORP.

31. REMOVE NO.2 CHAIN SUB-ASSEMBLY

- a. Remove the bolt, balanceshaft drive gear shaft and balanceshaft drive gear.
- b. Remove the crankshaft timing sprocket No.2 and chain.

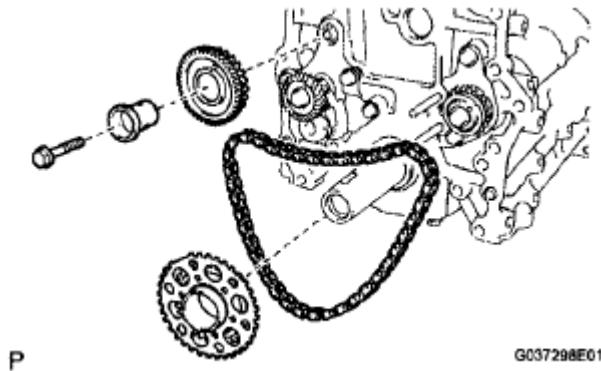


Fig. 241: Identifying Crankshaft Timing Sprocket No.2 And Chain
Courtesy of ABLE BODY CORP.

32. REMOVE NO. 4 CHAIN VIBRATION DAMPER

- a. Remove the 2 bolts and vibration damper No.4.

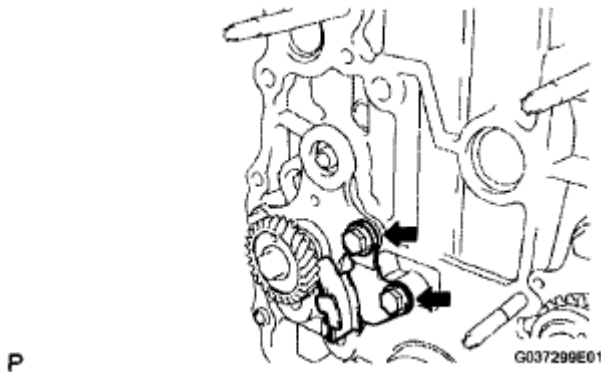


Fig. 242: Locating Vibration Damper No.4 With Bolts
Courtesy of ABLE BODY CORP.

33. REMOVE CRANKSHAFT PULLEY SET CRANKSHAFT KEY

- a. Remove the 2 pulley set keys from the crankshaft.

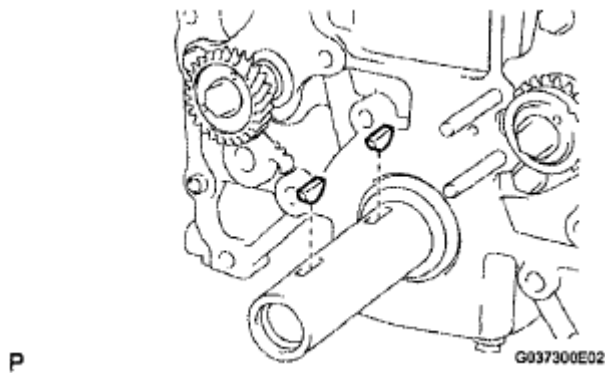


Fig. 243: Identifying Pulley Keys To Crankshaft
Courtesy of ABLE BODY CORP.

34. REMOVE OIL FILTER SUB-ASSEMBLY

- a. Using SST, remove the oil filter.

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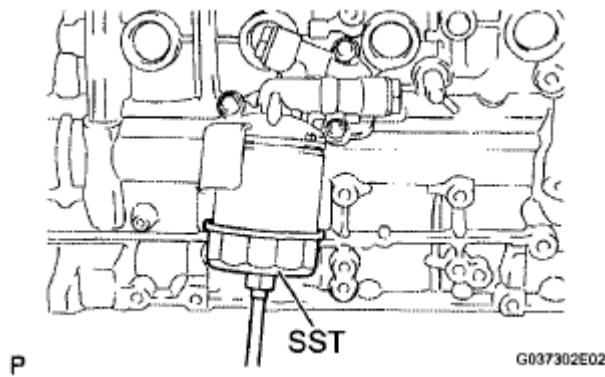


Fig. 244: Removing Oil Filter
Courtesy of ABLE BODY CORP.

- b. Using a 27 mm socket wrench, remove the oil filter union.

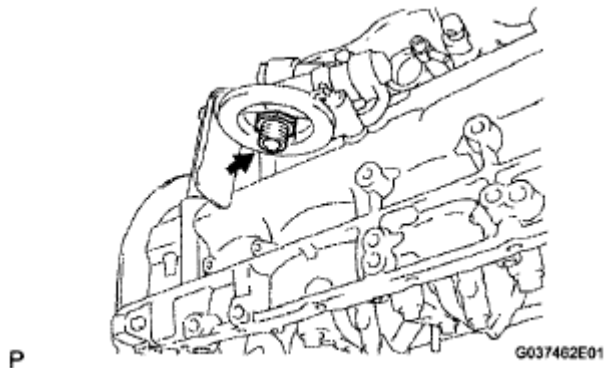


Fig. 245: Locating Oil Filter Union
Courtesy of ABLE BODY CORP.

35. REMOVE OIL FILTER BRACKET SUB-ASSEMBLY

- a. Remove the 2 bolts and nut from the oil filter bracket.
- b. Remove the 2 screw plugs and 2 gaskets from the oil filter bracket.

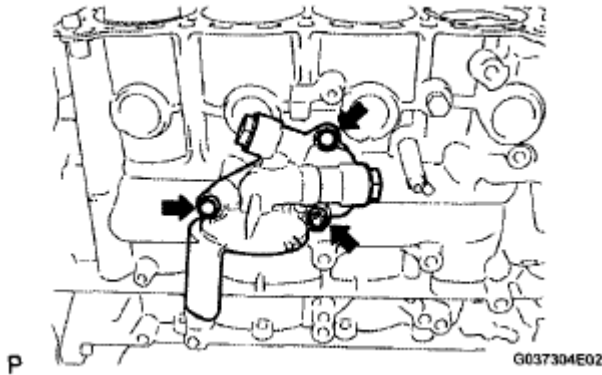


Fig. 246: Locating Oil Filter Bracket With Bolts And Nut
Courtesy of ABLE BODY CORP.

- c. Remove the oil filter bracket gasket and O-ring.

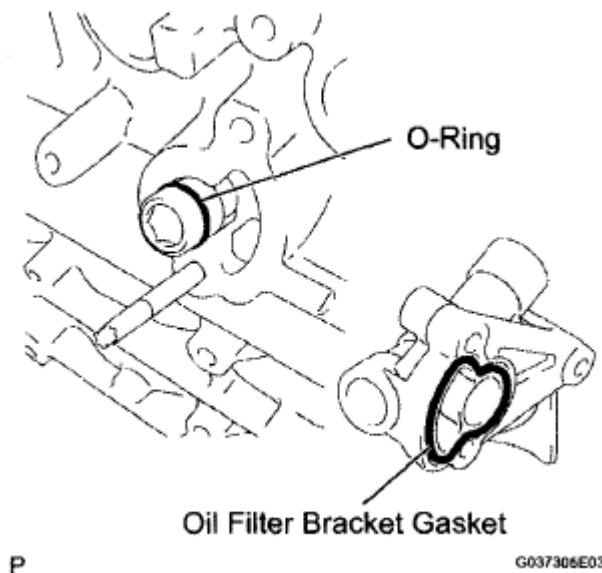


Fig. 247: Identifying O-Ring
Courtesy of ABLE BODY CORP.

- d. Using a hexagon wrench, remove the oil filter bracket union.

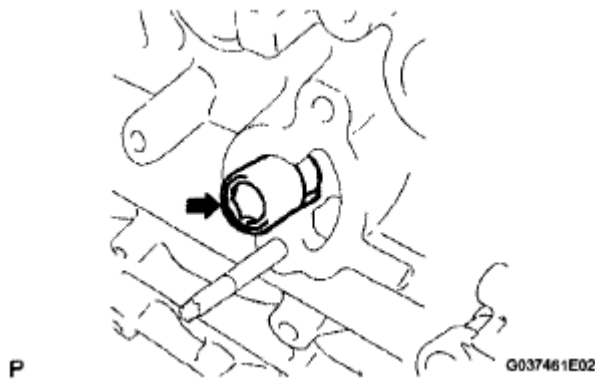


Fig. 248: Locating Oil Filter Bracket Union
Courtesy of ABLE BODY CORP.

36. REMOVE NO. 1 WITH HEAD TAPER SCREW PLUG

- a. Remove the taper screw plug from the cylinder block.

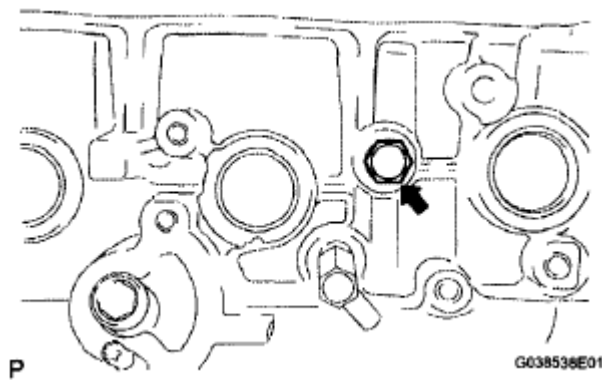


Fig. 249: Locating Taper Screw Plug
Courtesy of ABLE BODY CORP.

37. REMOVE ENGINE REAR OIL SEAL RETAINER

- a. Remove the 6 bolts.
- b. Using a screwdriver with its tip taped, pry out the oil seal retainer.

HINT:

Tape the screwdriver tip before use.

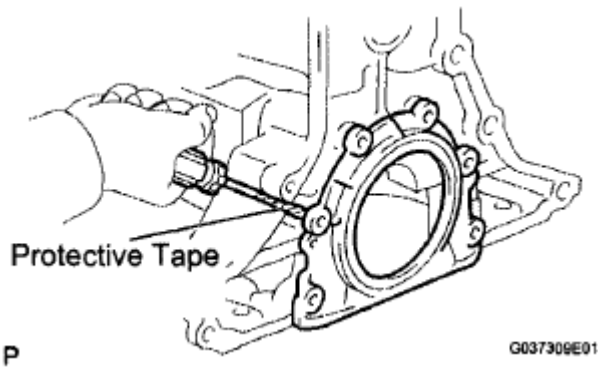


Fig. 250: Prying Out Oil Seal Retainer
Courtesy of ABLE BODY CORP.

38. REMOVE VALVE STEM CAP

- a. Remove the valve stem caps from the cylinder head.

HINT:

Arrange the removed parts in the correct order.

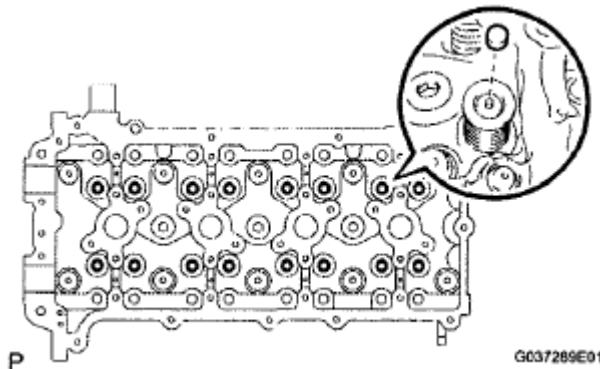


Fig. 251: Identifying Valve Stem Caps
Courtesy of ABLE BODY CORP.

39. REMOVE VALVE LASH ADJUSTER ASSEMBLY

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

HINT:

Arrange the removed parts in the correct order.

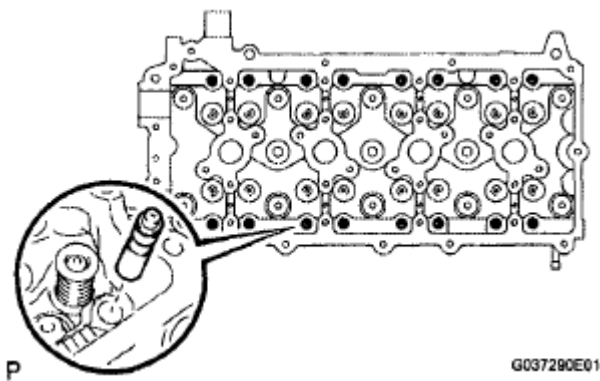


Fig. 252: Identifying Lash Adjusters
Courtesy of ABLE BODY CORP.

40. REMOVE INTAKE VALVE

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

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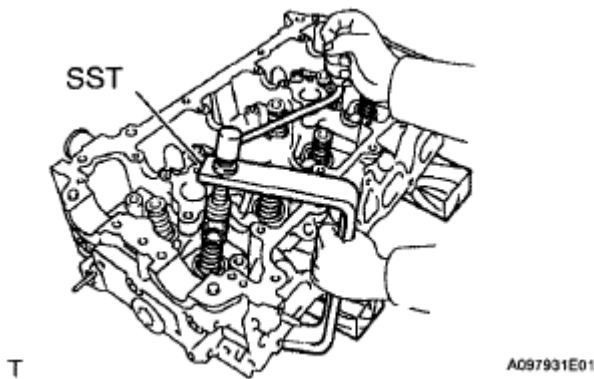


Fig. 253: Compressing Spring
Courtesy of ABLE BODY CORP.

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

HINT:

Arrange the removed parts in the correct order.

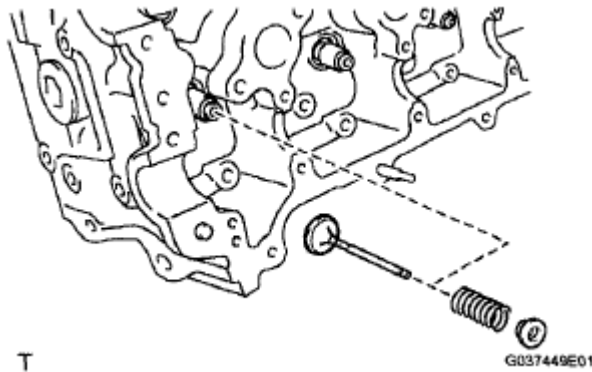


Fig. 254: Identifying Valve, Compression Spring And Spring Retainer To Cylinder Head
Courtesy of ABLE BODY CORP.

41. REMOVE EXHAUST VALVE

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

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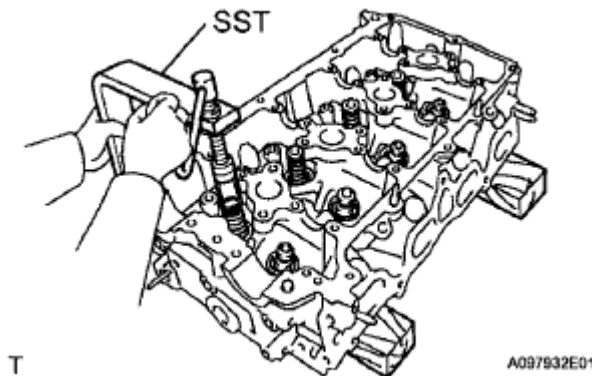


Fig. 255: Removing Valve Retainer Locks
Courtesy of ABLE BODY CORP.

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

HINT:

Arrange the removed parts in the correct order.

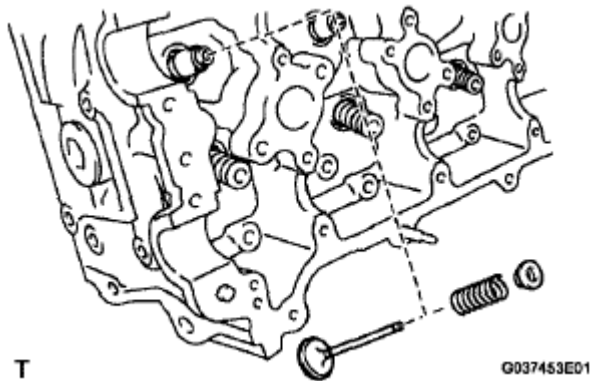


Fig. 256: Identifying Retainer, Compression Spring, And Valve
Courtesy of ABLE BODY CORP.

42. REMOVE VALVE STEM OIL SEAL

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

43. REMOVE VALVE SPRING SEAT

- a. Remove the valve spring seats from the cylinder head.



Fig. 257: Removing Oil Seals
Courtesy of ABLE BODY CORP.

44. REMOVE OIL CONTROL VALVE FILTER

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

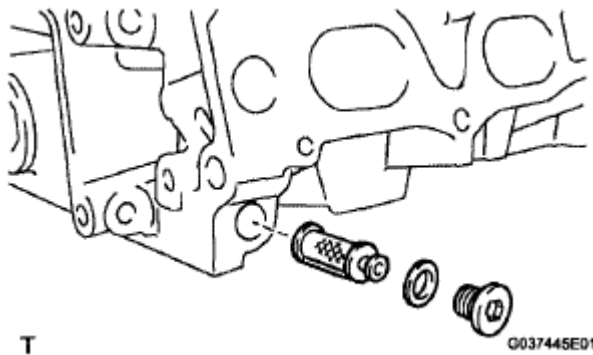


Fig. 258: Identifying Valve Spring Seats To Cylinder Head
Courtesy of ABLE BODY CORP.

45. REMOVE NO. 1 WITH HEAD STRAIGHT SCREW PLUG

- a. Using a 10 mm hexagon wrench, remove the 3 screw plugs and 3 gaskets.

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

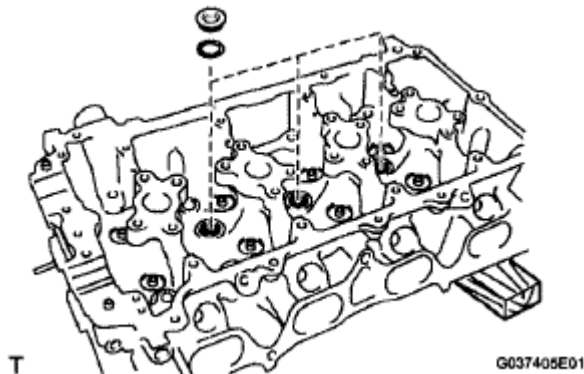


Fig. 259: Identifying Gaskets And Straight Screw Plugs
Courtesy of ABLE BODY CORP.

46. REMOVE NO. 2 WITH HEAD STRAIGHT SCREW PLUG

- a. Using a 19 mm hexagon wrench, remove the screw plug and gasket.

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

47. REMOVE CRANKSHAFT BEARING

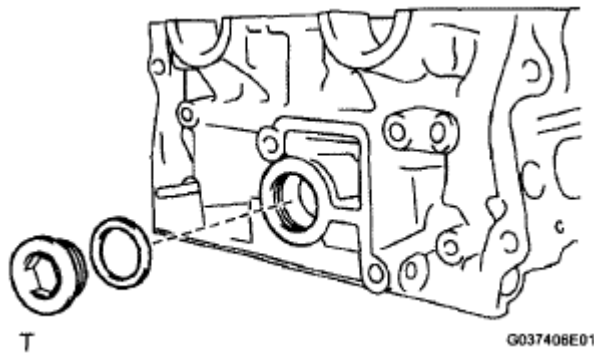


Fig. 260: Identifying Gasket And Straight Screw Plug
Courtesy of ABLE BODY CORP.

48. 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.

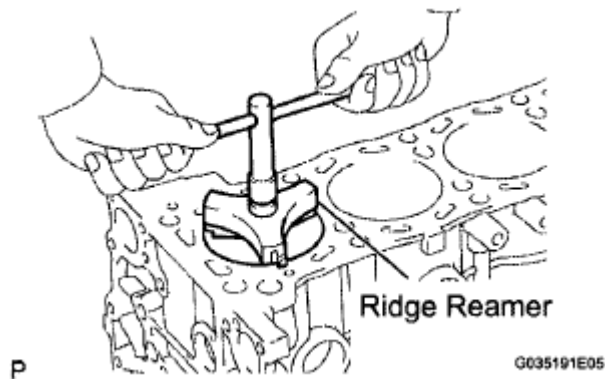


Fig. 261: Grinding Top Of Cylinder
Courtesy of ABLE BODY CORP.

49. REMOVE CONNECTING ROD BEARING

HINT:

Arrange the removed parts in the correct order.

50. REMOVE CRANKSHAFT

- Uniformly loosen the 10 bearing cap bolts, in several steps, in the sequence shown in the illustration.

HINT:

- Keep the lower bearings and crankshaft bearing caps together.
 - Arrange the thrust washers in the correct order.
- b. Lift out the crankshaft.

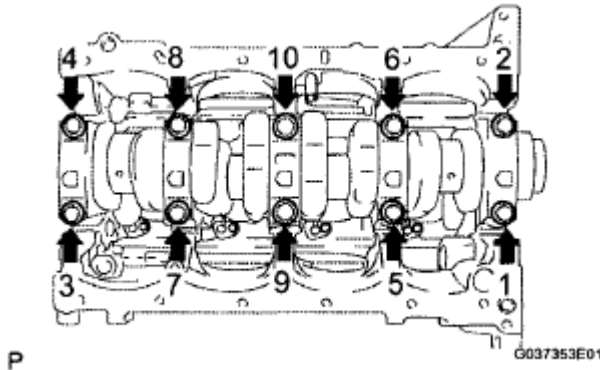


Fig. 262: Locating Bearing Cap Bolts
Courtesy of ABLE BODY CORP.

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

HINT:

Arrange the main bearing caps, bearings and thrust washers in the correct order.

51. REMOVE CRANKSHAFT BEARING

HINT:

Arrange the removed parts in the correct order.

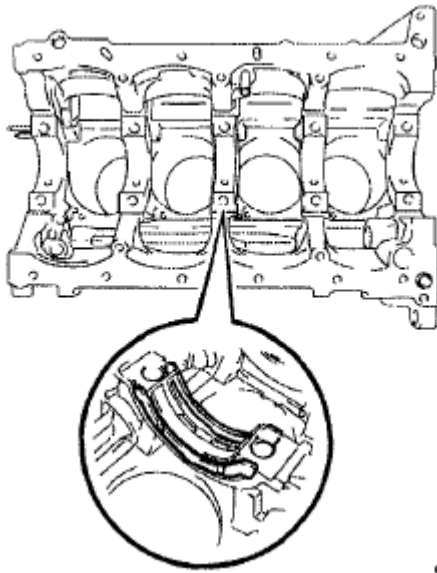


Fig. 263: Identifying Upper Bearings And Upper Thrust Washers
Courtesy of ABLE BODY CORP.

52. REMOVE PISTON RING SET

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

HINT:

Arrange the piston rings in the correct order.

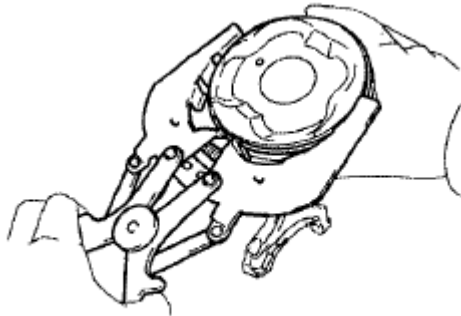


Fig. 264: Removing Oil Ring Rail
Courtesy of ABLE BODY CORP.

53. REMOVE CYLINDER BLOCK WATER DRAIN COCK SUB-ASSEMBLY

- a. Remove the water drain cock sub-assembly from the cylinder block.
- b. Remove the water drain cock plug from the water drain cock sub-assembly.

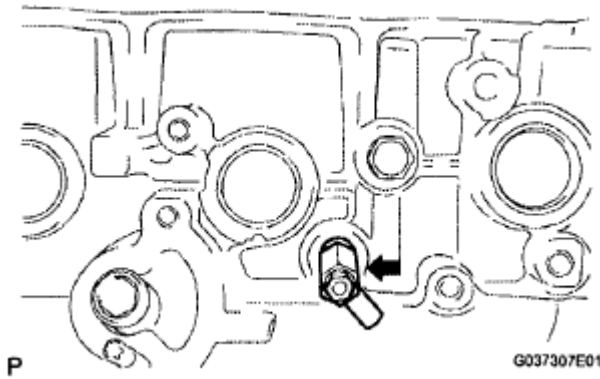


Fig. 265: Locating Water Drain Cock Plug
Courtesy of ABLE BODY CORP.

54. REMOVE WITH PIN PISTON SUB-ASSEMBLY

- 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.

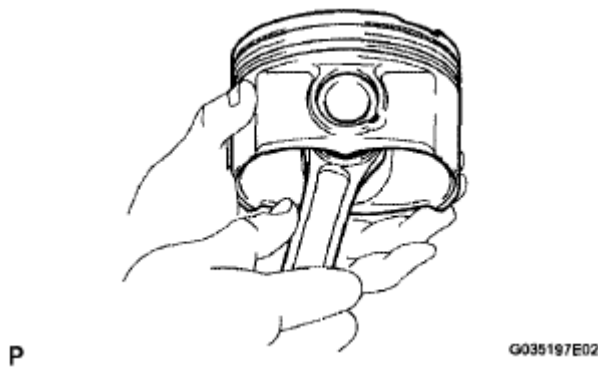


Fig. 266: Checking Fitting Condition Between Piston And Piston Pin
Courtesy of ABLE BODY CORP.

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

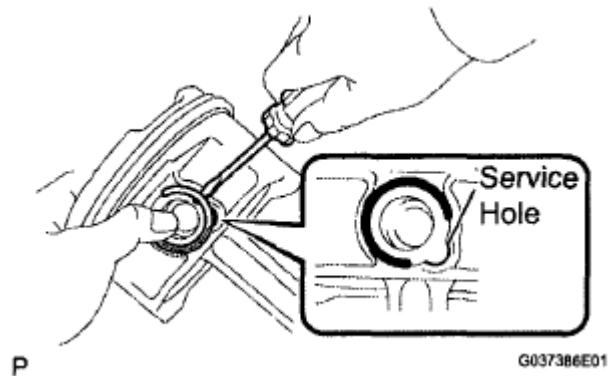


Fig. 267: Prying Off Snap Rings
Courtesy of ABLE BODY CORP.

2. Gradually heat the piston to approximately 80 to 90°C (176 to 194°F).

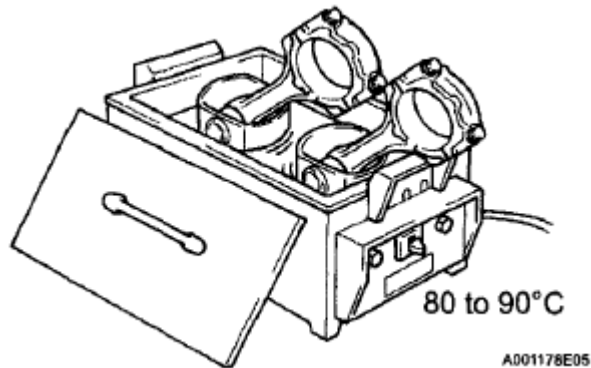


Fig. 268: Heating Piston
Courtesy of ABLE BODY CORP.

3. Using a brass bar and plastic-faced 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.

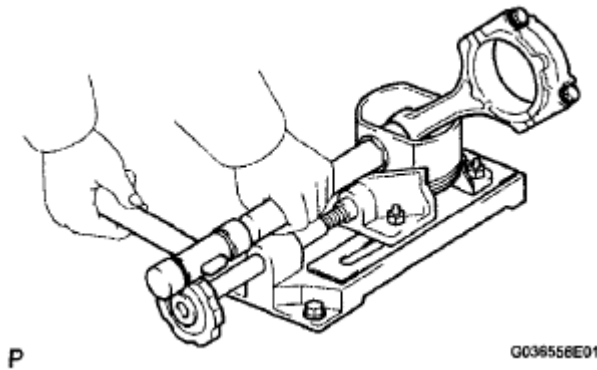


Fig. 269: Removing Connecting Rod
Courtesy of ABLE BODY CORP.

55. REMOVE NO. 1 OIL NOZZLE SUB-ASSEMBLY

- a. Using a 5 mm hexagon wrench, remove the oil nozzles.

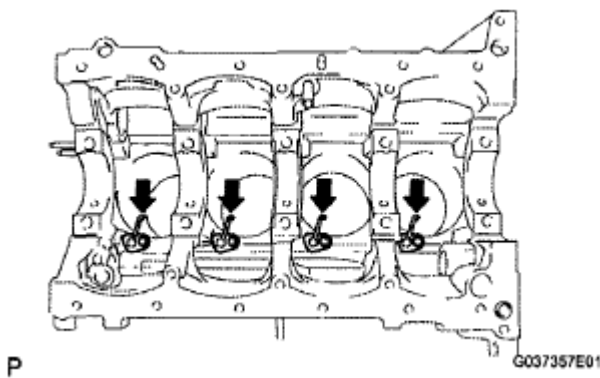


Fig. 270: Locating Oil Nozzles
Courtesy of ABLE BODY CORP.

56. REMOVE N0.1 BALANCESHAFT

- a. Remove the bolt.

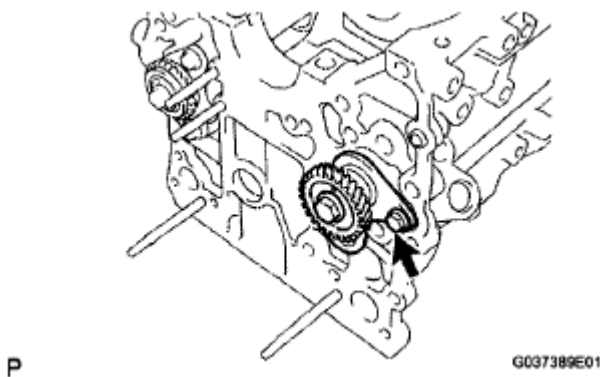


Fig. 271: Locating N0.1 Balanceshaft Bolts

Courtesy of ABLE BODY CORP.

- b. Remove the balancershaft from the cylinder block.

NOTE: When removing the balancershaft, make sure to support the balancershaft with both hands and avoid scratching the balancershaft bearing on the cylinder block side.

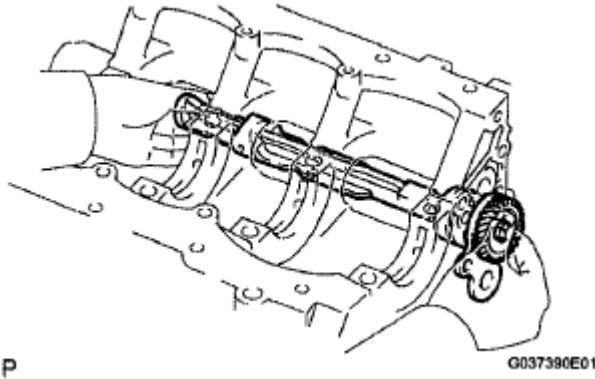


Fig. 272: Identifying No.1 Balancershaft To Cylinder Block
Courtesy of ABLE BODY CORP.

57. REMOVE NO. 1 BALANCERSHAFT DRIVEN GEAR

- a. Mount the head portion of the balancershaft in a vise.

NOTE: Be careful not to damage the balancershaft.

- b. Remove the bolt.
- c. Remove the balancershaft driven gear No.1 (*1), sliding key (*2), balancershaft thrust washer No.1 (*3) and balancershaft thrust spacer (*4).

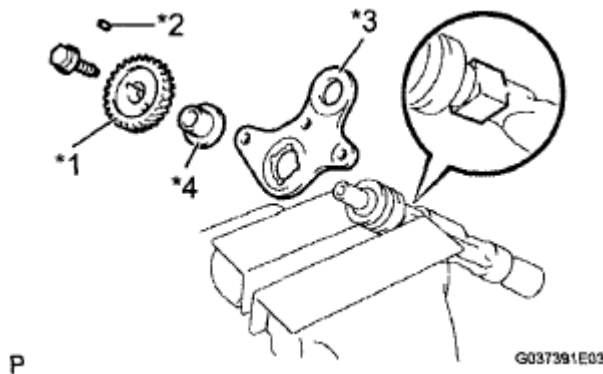


Fig. 273: Mounting Head Portion Of Balancershaft In Vise
Courtesy of ABLE BODY CORP.

58. REMOVE NO.2 BALANCESHAFT

- a. Remove the 2 bolts.

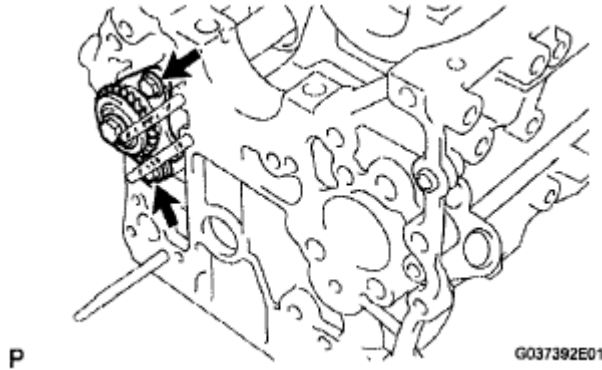


Fig. 274: Locating No.2 Balanceshaft Bolts
Courtesy of ABLE BODY CORP.

- b. Remove the balanceshaft from the cylinder block.

NOTE: When removing the balanceshaft, make sure to support the balanceshaft with both hands and avoid scratching the balanceshaft bearing on the cylinder block side.

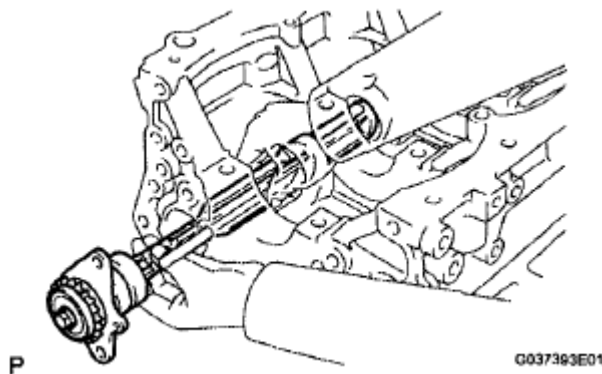


Fig. 275: Removing Balanceshaft To Cylinder Block
Courtesy of ABLE BODY CORP.

59. REMOVE NO. 2 BALANCESHAFT DRIVEN GEAR

- a. Mount the head portion of the balanceshaft in a vise.

NOTE: Be careful not to damage the balanceshaft.

- b. Remove the bolt.
- c. Remove the balanceshaft driven gear No.2 (*1) and balanceshaft thrust washer No.2 (*2).

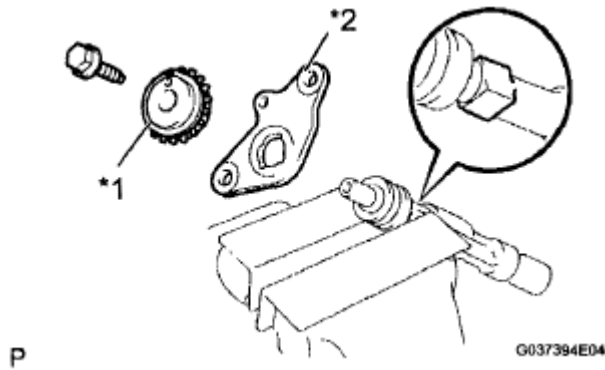


Fig. 276: Mounting Head Portion Of Balancer shaft In Vise
Courtesy of ABLE BODY CORP.

INSPECTION

1. 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 16 links.

Maximum chain elongation:

147.5 mm (5.807 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.

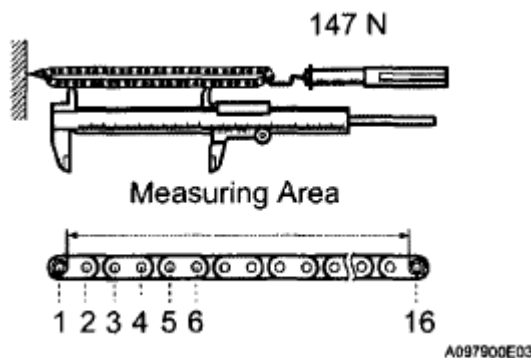


Fig. 277: Measuring Length Of Links
Courtesy of ABLE BODY CORP.

2. 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 16 links.

Maximum chain elongation:

123.6 mm (4.866 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.

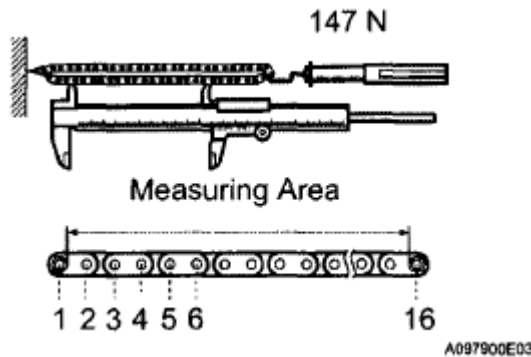


Fig. 278: Measuring Length Of Links
Courtesy of ABLE BODY CORP.

3. 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.

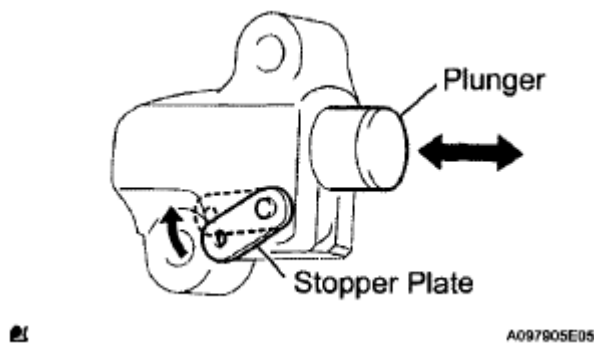


Fig. 279: Moving Stopper Plate
Courtesy of ABLE BODY CORP.

4. INSPECT NO. 2 CHAIN TENSIONER ASSEMBLY

- a. Move the stopper plate downward to release the lock. Push the plunger and check that it moves smoothly.

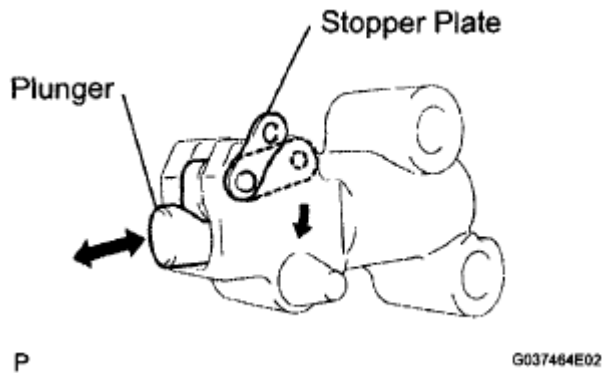


Fig. 280: Moving Stopper Plate
Courtesy of ABLE BODY CORP.

5. INSPECT CAMSHAFT TIMING GEAR OR SPROCKET

- a. Measure the distance between the most worn out sprocket tip and the beginning of the worn area below the tip.

Minimum distance:

1.0 mm (0.039 in.)

If the distance is less than the minimum, replace the sprocket.

HINT:

If the worn area is too small or difficult to distinguish from a normal area, perform steps (b) and (c) below.

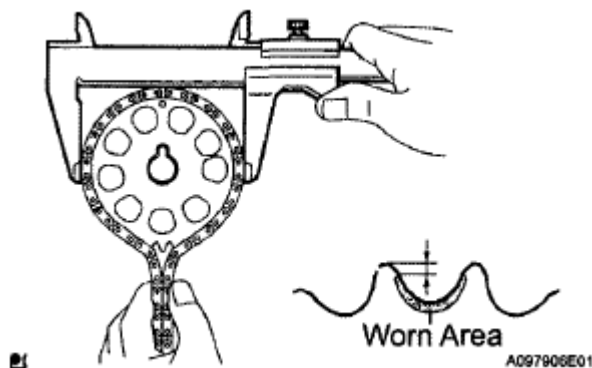


Fig. 281: Measuring Distance Between Most Worn Out Sprocket Tip And Beginning
Courtesy of ABLE BODY CORP.

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

Minimum sprocket diameter (with chain): 113.8 mm (4.480 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.

6. INSPECT CAMSHAFT TIMING GEAR ASSEMBLY

- Measure the distance between the most worn out timing gear tip and the beginning of the worn area below the tip.

Minimum distance:

1.0 mm (0.039 in.)

If the distance is less than the minimum, replace the timing gear.

HINT:

If the worn area is too small or difficult to distinguish from a normal area, perform steps (b) and (c) below.

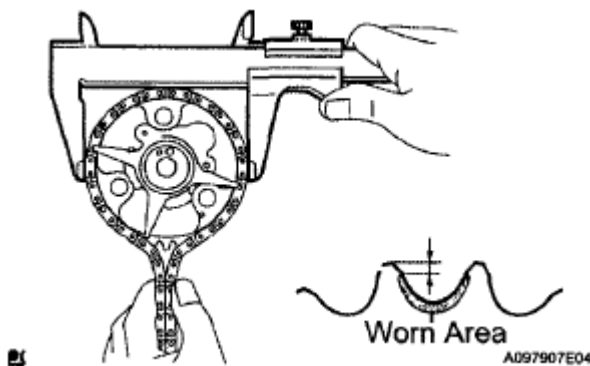


Fig. 282: Measuring Distance Between Most Worn Out Timing Gear Tip And Beginning
Courtesy of ABLE BODY CORP.

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

Minimum sprocket diameter (with chain):

113.8 mm (4.480 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 timing gear.

7. INSPECT CRANKSHAFT TIMING GEAR OR SPROCKET

- a. Measure the distance between the most worn out sprocket tip and the beginning of the worn area below the tip.

Minimum distance:

1.0 mm (0.039 in.)

If the distance is less than the minimum, replace the sprocket.

HINT:

If the worn area is too small or difficult to distinguish from a normal area, perform steps (b) and (c) below.

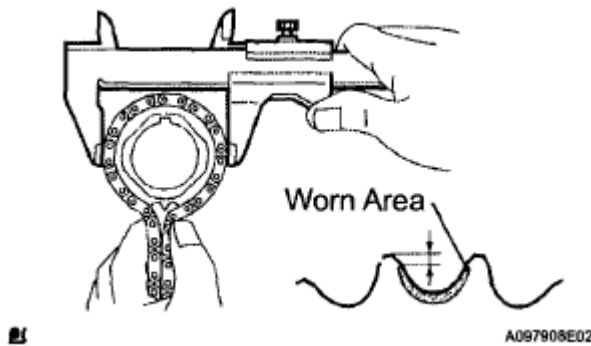


Fig. 283: Measuring Distance Between Most Worn Out Sprocket Tip And Beginning
Courtesy of ABLE BODY CORP.

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

Minimum sprocket diameter (with chain):

59.4 mm (2.338 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.

8. INSPECT CHAIN TENSIONER SLIPPER

- a. Using vernier calipers, measure the tensioner slipper wear.

Maximum wear:

2.0 mm (0.079 in.)

If the wear is greater than the maximum, replace the tensioner slipper.

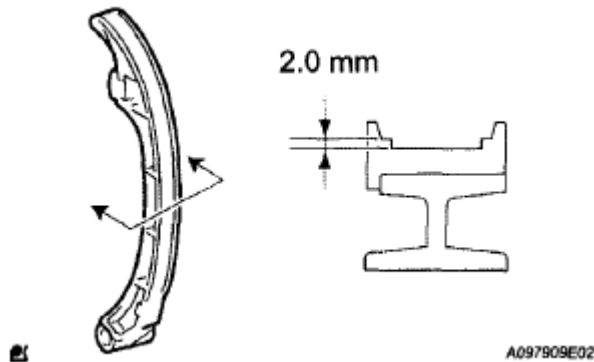


Fig. 284: Measuring Tensioner Slipper Wear
Courtesy of ABLE BODY CORP.

9. INSPECT NO. 1 CHAIN VIBRATION DAMPER

- a. Using vernier calipers, measure the vibration damper wear.

Maximum wear:

2.0 mm (0.079 in.)

If the wear is greater than the maximum, replace the vibration damper.

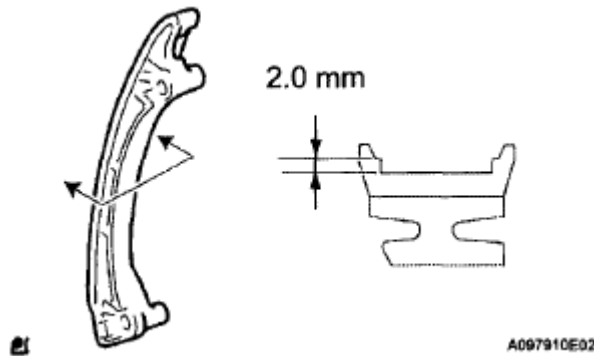


Fig. 285: Measuring Vibration Damper Wear
Courtesy of ABLE BODY CORP.

10. INSPECT TIMING CHAIN GUIDE

- a. Using vernier calipers, measure the chain guide wear.

Maximum wear:

0.5 mm (0.020 in.)

If the wear is greater than the maximum, replace the timing chain guide.

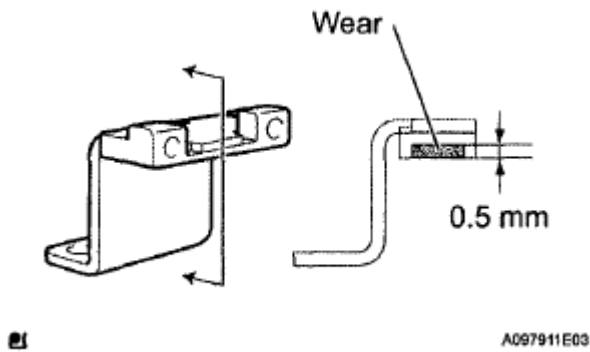


Fig. 286: Measuring Chain Guide Wear
Courtesy of ABLE BODY CORP.

11. INSPECT NO. 2 CRANKSHAFT TIMING SPROCKET

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

Minimum sprocket diameter (with chain):

96.7 mm (3.807 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.

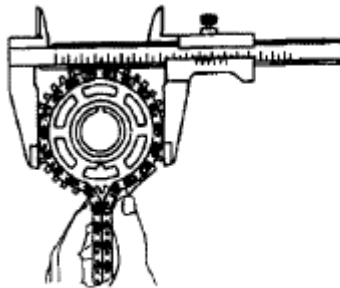


Fig. 287: Measuring Sprocket Diameter
Courtesy of ABLE BODY CORP.

12. INSPECT BALANCE SHAFT DRIVE GEAR SUB-ASSEMBLY

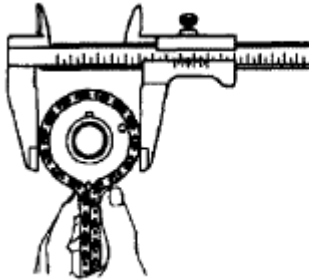
- Wrap the chain around the sprocket.
- Using vernier calipers, measure the sprocket diameter with the chain.

Minimum sprocket diameter (with chain):

75.9 mm (2.988 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.



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Fig. 288: Measuring Sprocket Diameter
Courtesy of ABLE BODY CORP.

13. INSPECT NO. 2 CHAIN VIBRATION DAMPER

- a. Using vernier calipers, measure the vibration damper No.2 wear.

Maximum wear:

1.0 mm (0.039 in.)

If the wear is greater than the maximum, replace the vibration damper.

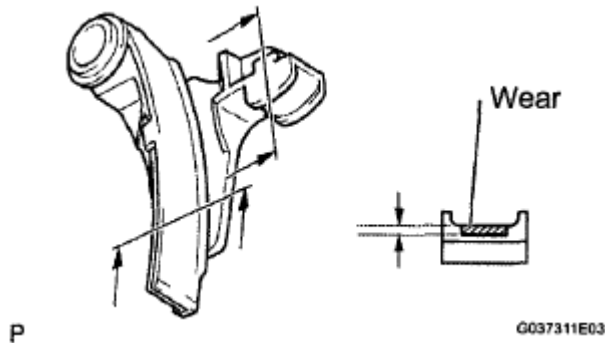


Fig. 289: Measuring Vibration Damper No.2 Wear
Courtesy of ABLE BODY CORP.

14. INSPECT NO. 3 CHAIN VIBRATION DAMPER

- a. Using vernier calipers, measure the vibration damper No.3 wear.

Maximum wear:

1.0 mm (0.039 in.)

If the wear is greater than the maximum, replace the vibration damper.

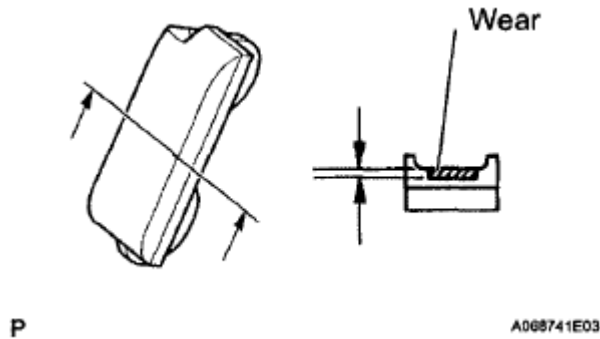


Fig. 290: Measuring Vibration Damper No.3 Wear
Courtesy of ABLE BODY CORP.

15. INSPECT NO. 4 CHAIN VIBRATION DAMPER

- a. Using vernier calipers, measure the vibration damper No.4 wear.

Maximum wear:

1.0 mm (0.039 in.)

If the wear is greater than the maximum, replace the vibration damper.

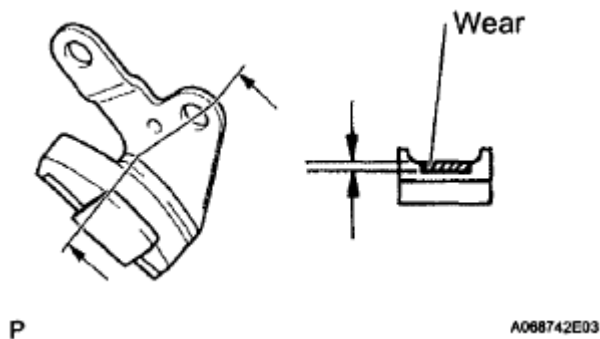


Fig. 291: Measure Vibration Damper No. 4 Wear
Courtesy of ABLE BODY CORP.

16. INSPECT CYLINDER HEAD SET BOLT

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

Standard outside diameter:

10.76 to 10.97 mm (0.4236 to 0.4319 in.)

Minimum outside diameter:

10.40 mm (0.4094 in.)

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.

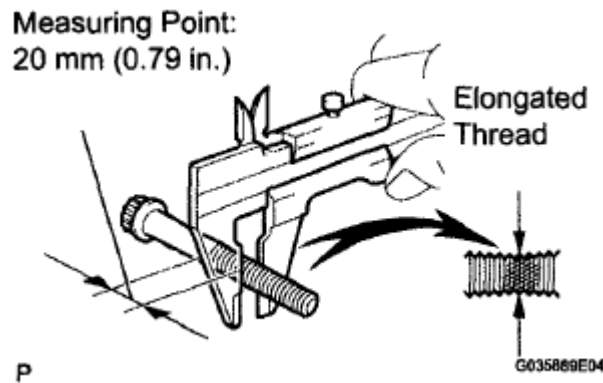


Fig. 292: Measuring Minimum Diameter Of Elongated Thread
Courtesy of ABLE BODY CORP.

17. INSTALL CRANKSHAFT PULLEY SET CRANKSHAFT KEY

- a. Install the 2 pulley keys to the crankshaft.

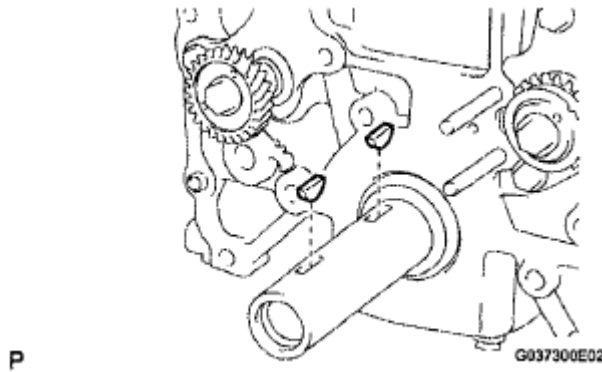


Fig. 293: Installing Pulley Keys To Crankshaft
Courtesy of ABLE BODY CORP.

18. INSTALL NO. 4 CHAIN VIBRATION DAMPER

- a. Install the vibration damper No.4 with the 2 bolts.

Torque: 18 N*m (185 kgf*cm, 13 ft.*lbf)

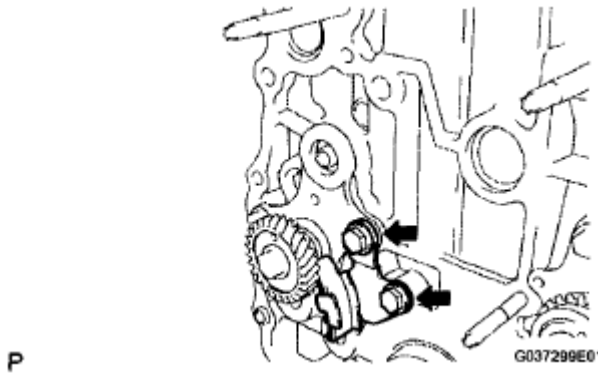


Fig. 294: Locating Vibration Damper No. With Bolts
Courtesy of ABLE BODY CORP.

19. INSPECT 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 the 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 the 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 the 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.

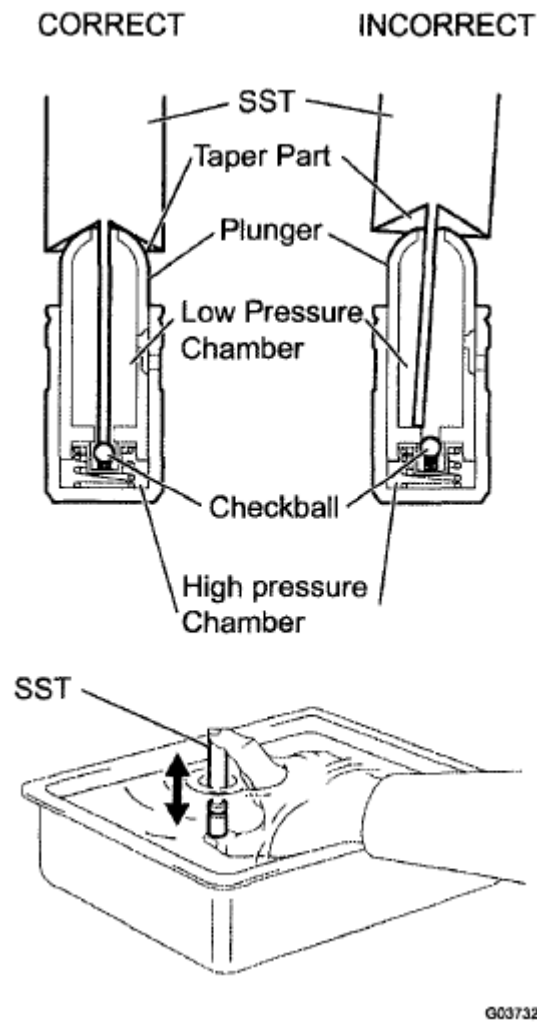


Fig. 295: Inserting SST's Tip Into Lash Adjuster's Plunger
Courtesy of ABLE BODY CORP.

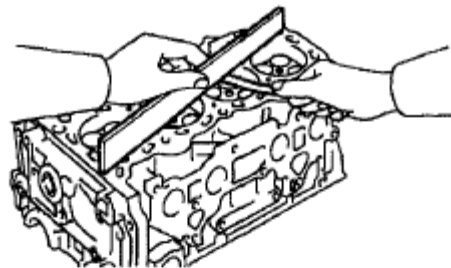
20. INSPECT CYLINDER HEAD FOR FLATNESS

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

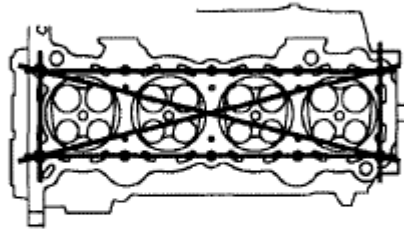
Maximum warpage:

0.05 mm (0.0020 in.)

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



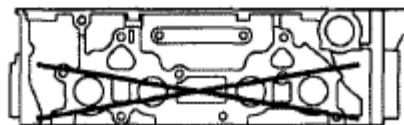
Cylinder Block Side



Intake Manifold Side



Exhaust Manifold Side



T

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Fig. 296: Measuring Warpage Of Contact Surface Of Contacting Cylinder Block And Manifolds

Courtesy of ABLE BODY CORP.

21. INSPECT CYLINDER HEAD FOR CRACKS

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

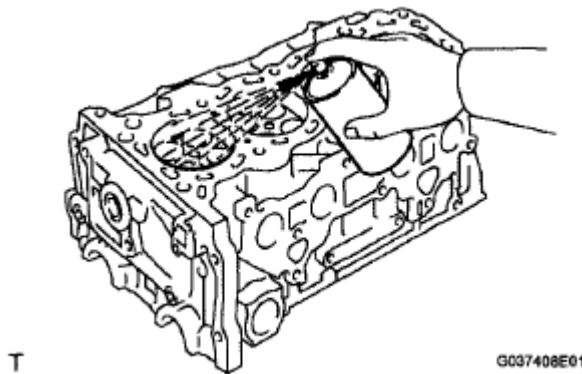


Fig. 297: Inspecting Cylinder Head For Cracks
Courtesy of ABLE BODY CORP.

22. INSPECT INTAKE VALVE SEAT

- Apply a light coat of prussian blue (or white lead) to the valve face.
- Lightly press the valve face against the valve seat.
- Check the valve face and valve seat by using the following procedure.
 - If prussian blue appears around the entire valve face, the valve face is concentric. If not, replace the valve.
 - If prussian blue appears around the entire valve seat, the guide and valve face are concentric. If not, resurface the valve seat.
 - Check that the valve seat contacts in the middle of the valve face with the width between 1.0 and 1.4 mm (0.039 and 0.055 in.).

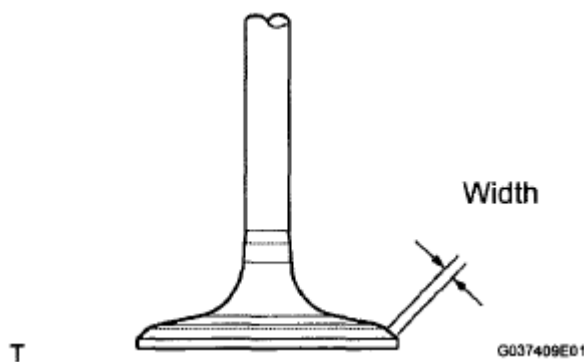


Fig. 298: Measuring Intake Valve Seat Width
Courtesy of ABLE BODY CORP.

23. INSPECT EXHAUST VALVE SEAT

- Apply a light coat of prussian blue (or white lead) to the valve face.
- Lightly press the valve face against the valve seat.
- Check the valve face and valve seat by using to the following procedure.
 - 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 1.0 and 1.4 mm (0.039 and 0.055 in.).

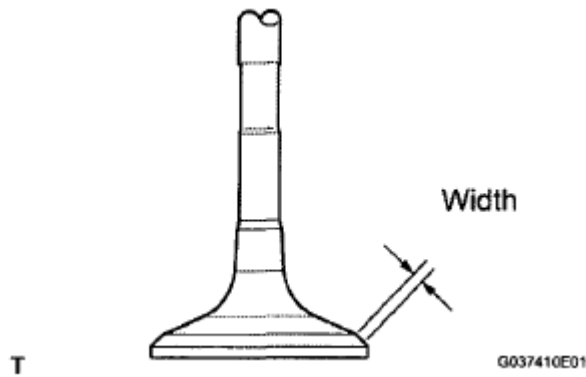


Fig. 299: Measuring Exhaust Valve Seat Width
Courtesy of ABLE BODY CORP.

24. INSPECT CAMSHAFT

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

Maximum circle runout:

0.03 mm (0.0012 in.)

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

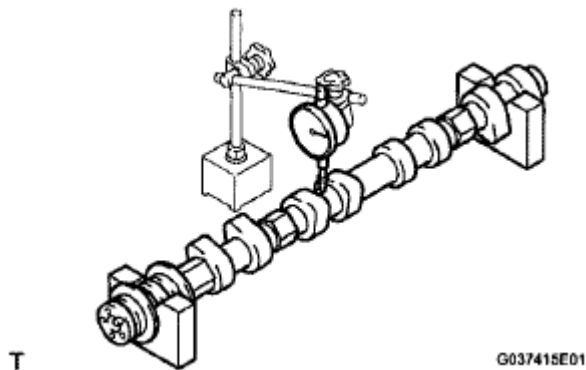


Fig. 300: Measuring Camshaft Runout
Courtesy of ABLE BODY CORP.

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

Standard cam lobe height:

42.855 to 42.955 mm (1.6872 to 1.6911 in.)

Minimum cam lobe height:

42.855 mm (1.6872 in.)

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

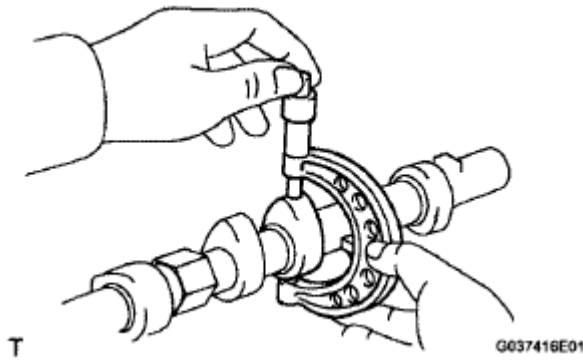


Fig. 301: Measuring Cam Lobe Height
Courtesy of ABLE BODY CORP.

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

Standard journal diameter

STANDARD JOURNAL DIAMETER SPECIFICATION

No.1 journal	35.949 to 35.965 mm (1.4153 to 1.4159 in.)
Other journal	26.959 to 26.975 mm (1.0614 to 1.0620 in.)

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

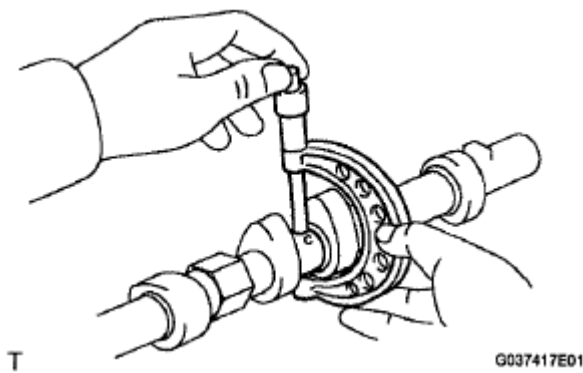


Fig. 302: Measuring Journal Diameter
Courtesy of ABLE BODY CORP.

25. INSPECT NO.2 CAMSHAFT

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

Maximum circle runout:

0.03 mm (0.0012 in.)

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

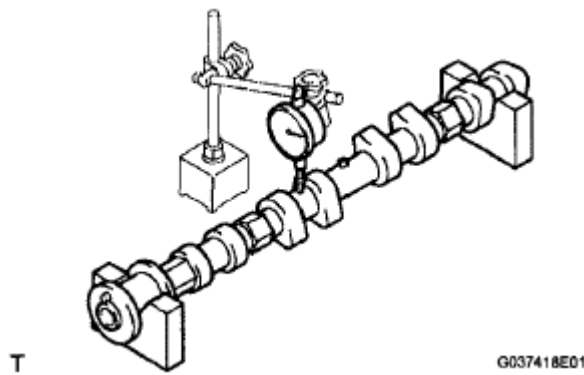


Fig. 303: Measuring No.2 Camshaft Runout
Courtesy of ABLE BODY CORP.

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

Standard cam lobe height:

42.854 to 42.954 mm (1.687 to 1.6911 in.)

Minimum cam lobe height:

42.854 mm (1.6872 in.)

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

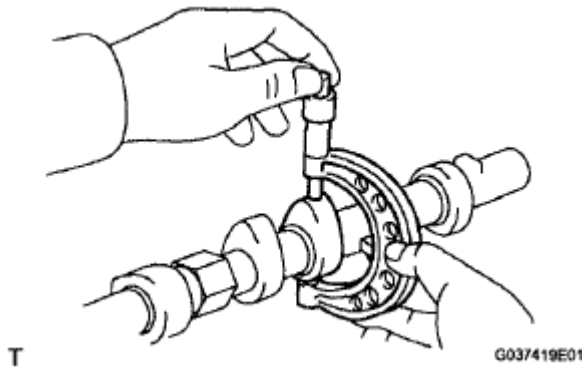


Fig. 304: Measuring Cam Lobe Height
Courtesy of ABLE BODY CORP.

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

Standard journal diameter

STANDARD JOURNAL DIAMETER SPECIFICATION

No.1 journal	35.949 to 35.965 mm (1.4153 to 1.4159 in.)
Other journal	26.959 to 26.975 mm (1.0614 to 1.0620 in.)

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

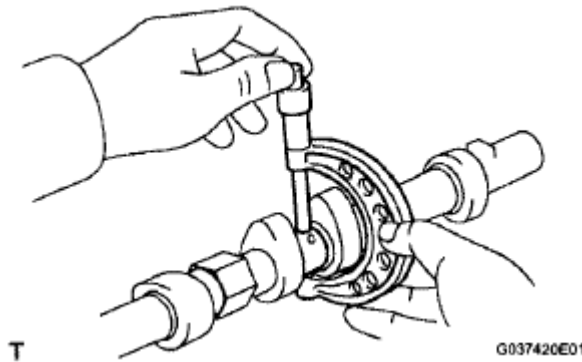


Fig. 305: Measuring Journal Diameter
Courtesy of ABLE BODY CORP.

26. INSPECT CAMSHAFT THRUST CLEARANCE

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

Standard thrust clearance:

0.10 to 0.24 mm (0.004 to 0.009 in.)

Maximum thrust clearance:

0.26 mm (0.010 in.)

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

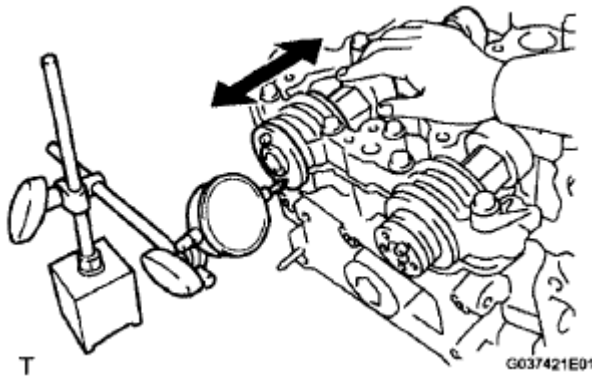


Fig. 306: Measuring Thrust Clearance
Courtesy of ABLE BODY CORP.

27. INSPECT CAMSHAFT OIL CLEARANCE

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

Torque: 16 N*m (160 kgf*cm, 11 ft.*lbf)

NOTE: Do not turn the camshaft.

- e. Remove the bearing caps.

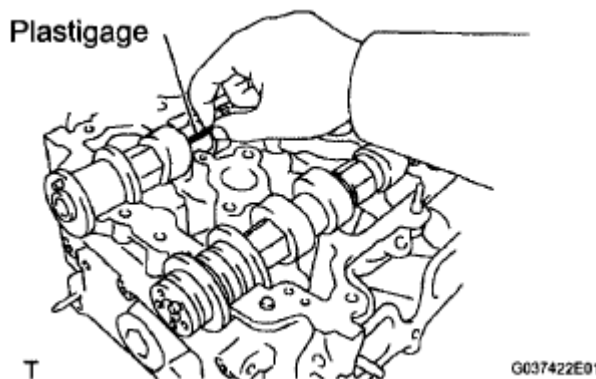


Fig. 307: Laying Strip Of Plastigage Across Of Camshaft Journals

Courtesy of ABLE BODY CORP.

- f. Measure the Plastigage at its widest point.

Standard oil clearance

OIL CLEARANCE SPECIFICATION

No.1 journal	0.035 to 0.072 mm (0.0014 to 0.0029 in.)
Other journal	0.025 to 0.062 mm (0.00098 to 0.0024 in.)

Maximum oil clearance:

0.08 mm (0.003 in.)

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

- g. Completely remove the Plastigage.

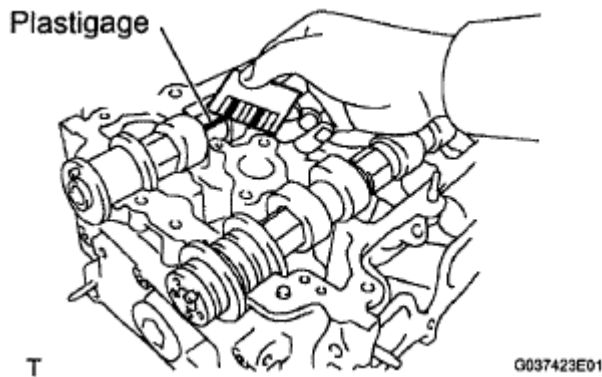


Fig. 308: Measuring Plastigage At Widest
Courtesy of ABLE BODY CORP.

28. INSPECT INNER COMPRESSION SPRING

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

Free length:

48.53 mm (1.9106 in.)

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

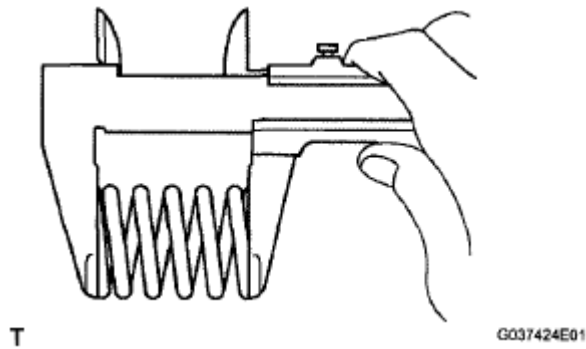


Fig. 309: Measuring Free Length Of Inner Compression Spring
Courtesy of ABLE BODY CORP.

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

Maximum deviation:

1.5 mm (0.059 in.)

Maximum angle (reference):

2°

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

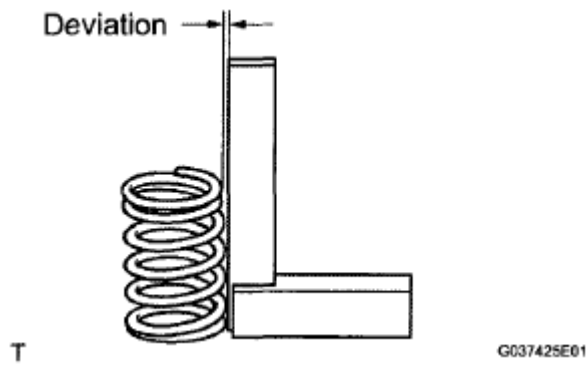


Fig. 310: Measuring Deviation Of Inner Compression Spring
Courtesy of ABLE BODY CORP.

29. INSPECT INTAKE VALVE

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

Standard overall length:

106.26 mm (4.1835 in.)

Minimum overall length:

105.96 mm (4.1716 in.)

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

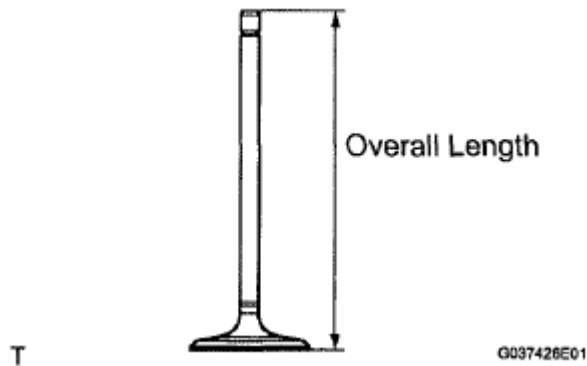


Fig. 311: Measuring Valve's Overall Length
Courtesy of ABLE BODY CORP.

- b. 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.)

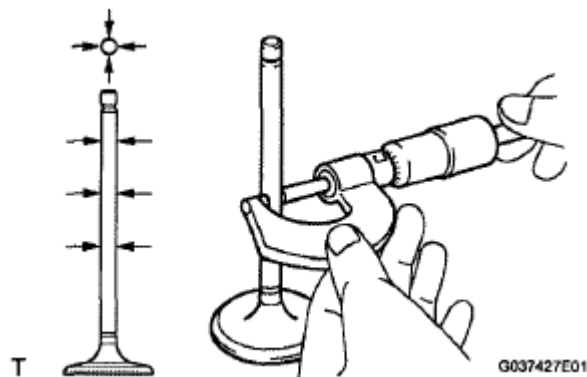


Fig. 312: Measuring Diameter Of Valve Stem
Courtesy of ABLE BODY CORP.

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

Standard margin thickness:

1.05 to 1.45 mm (0.0413 to 0.0571 in.)

Minimum margin thickness:

0.50 mm (0.0197 in.)

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

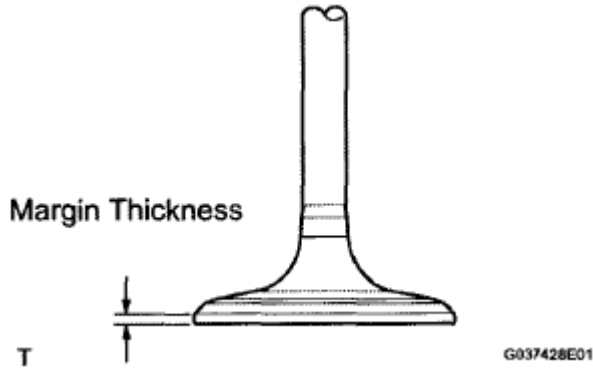


Fig. 313: Measuring Valve Head Margin Thickness
Courtesy of ABLE BODY CORP.

30. INSPECT EXHAUST VALVE

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

Standard overall length:

106.74 mm (4.2024 in.)

Minimum overall length:

106.44 mm (4.1905 in.)

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

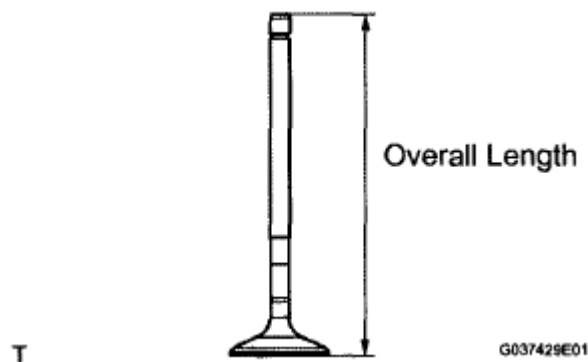


Fig. 314: Measuring Valve's Overall Length
Courtesy of ABLE BODY CORP.

- b. 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.)

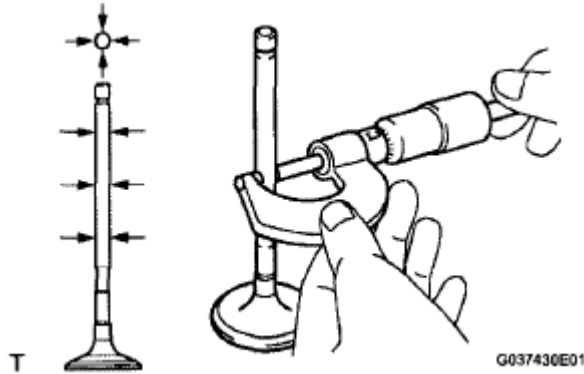


Fig. 315: Measuring Diameter Of Valve Stem
Courtesy of ABLE BODY CORP.

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

Standard margin thickness:

1.2 to 1.6 mm (0.0472 to 0.0630 in.)

Minimum margin thickness:

0.50 mm (0.0197 in.)

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

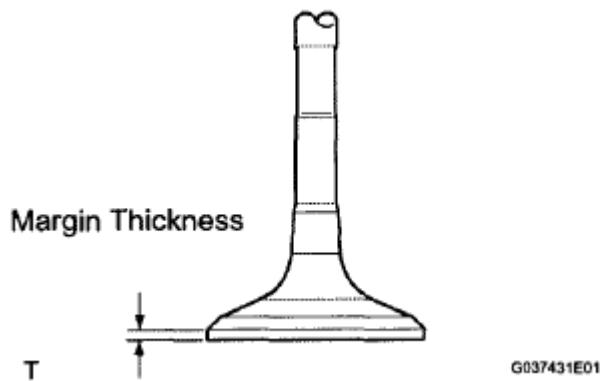


Fig. 316: Measuring Valve Head Margin Thickness
Courtesy of ABLE BODY CORP.

31. INSPECT VALVE GUIDE BUSHING

- a. 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.)**

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

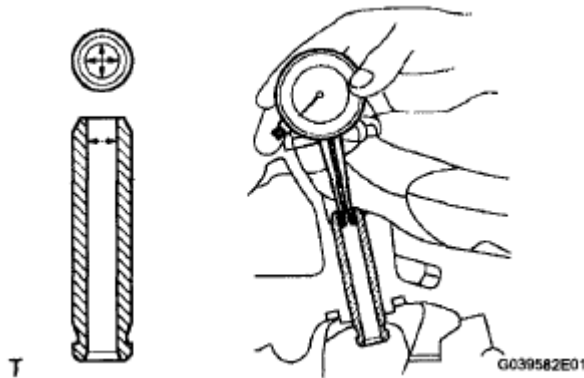
Standard oil clearance:**0.025 to 0.060 mm (0.0010 to 0.0024 in.) (Intake) 0.030 to 0.065 mm (0.0012 to 0.0026 in.) (Exhaust)**

Fig. 317: Measuring Inside Diameter Of Guide Bush
Courtesy of ABLE BODY CORP.

Maximum oil clearance:**0.08 mm (0.0032 in.) (Intake)****0.10 mm (0.0039 in.) (Exhaust)****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.

32. INSPECT CONNECTING ROD THRUST CLEARANCE

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

Standard thrust clearance:**0.150 to 0.350 mm (0.0059 to 0.0138 in.)****Maximum thrust clearance:**

0.40 mm (0.016 in.)

If the thrust clearance is greater than the maximum, replace the connecting rod assembly(s). If necessary, replace the crankshaft.

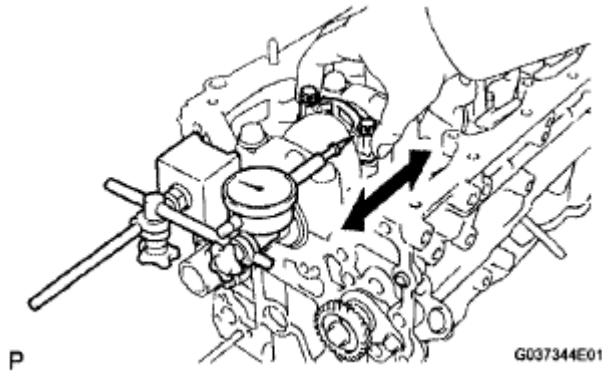


Fig. 318: Measuring Thrust Clearance
Courtesy of ABLE BODY CORP.

33. INSPECT CONNECTING ROD OIL CLEARANCE

- a. Check that the matchmarks on the connecting rod and cap are aligned to ensure the correct reassembly.

HINT:

The matchmarks on the connecting rods and caps are for ensuring the correct reassembly.

- b. Remove the 2 connecting rod cap bolts.
- c. Using the 2 removed connecting rod cap bolts, remove the connecting rod cap and lower bearing by wiggling the connecting rod cap right and left.

HINT:

Keep the lower bearing inserted to the connecting rod cap.

- d. Clean the crank pin and bearing.
- e. Check the crank pin and bearing for pitting and scratches.

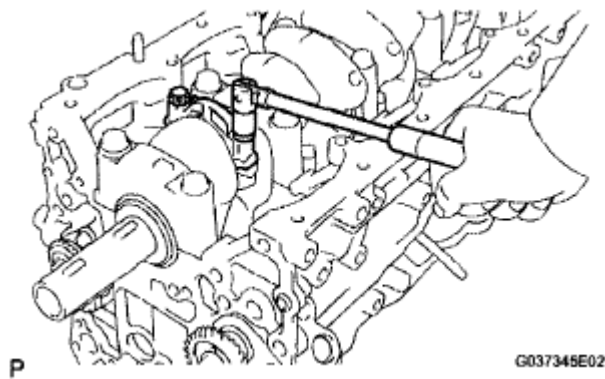


Fig. 319: Removing Connecting Rod Cap Bolts
Courtesy of ABLE BODY CORP.

- f. Lay a strip of Plastigage on the crank pin.

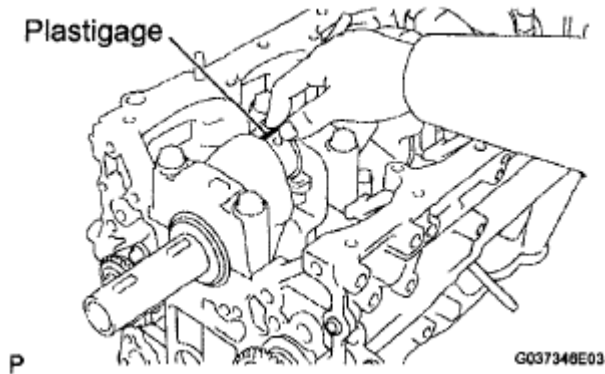


Fig. 320: Laying Strip Of Plastigage On Crank Pin
Courtesy of ABLE BODY CORP.

- g. Check that the front mark of the connecting rod cap is facing forward.

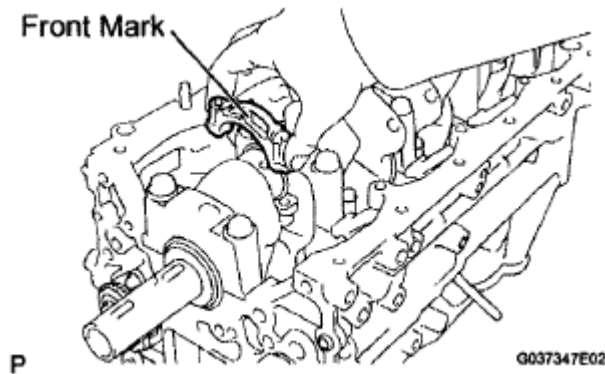


Fig. 321: Checking Front Mark Of Connecting Rod Cap
Courtesy of ABLE BODY CORP.

- h. Install the connecting rod cap.

NOTE: Do not turn the crankshaft.

- i. Remove the 2 bolts and connecting rod cap (see steps (b) and (c) above).

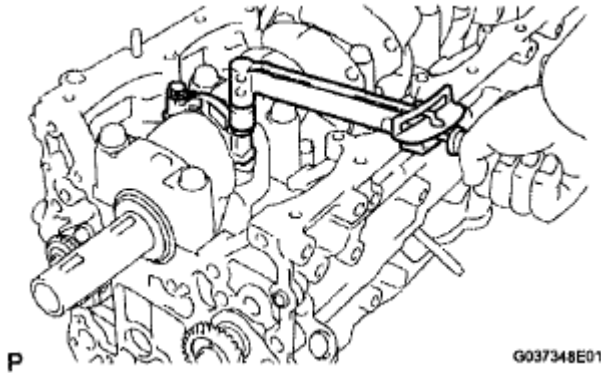


Fig. 322: Removing Bolts And Connecting Rod Cap
Courtesy of ABLE BODY CORP.

- j. Measure the Plastigage at its widest point.

Standard oil clearance:

0.024 to 0.049 mm (0.0009 to 0.0019 in.)

Maximum oil clearance:

0.066 mm (0.0026 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 a 1, 2 and 3 mark on its surface.

Reference

Crankshaft pin diameter

CRANKSHAFT PIN DIAMETER SPECIFICATION

Mark	Thickness
4	52.989 to 53.002 mm (2.0862 to 2.0867 in.)
5	52.989 to 53.002 mm (2.0862 to 2.0867 in.)

6 | 52.989 to 53.002 mm (2.0862 to 2.0867 in.)

Standard bearing center wall thickness

STANDARD BEARING CENTER WALL THICKNESS SPECIFICATION

Mark	Thickness
4	1.484 to 1.487 mm (0.0584 to 0.0585 in.)
5	1.488 to 1.490 mm (0.0586 to 0.0587 in.)
6	1.491 to 1.493 mm (0.0587 to 0.0588 in.)

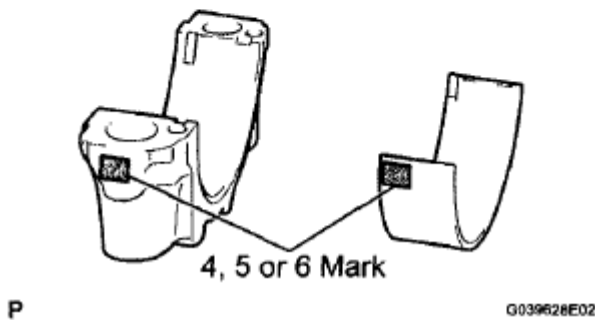
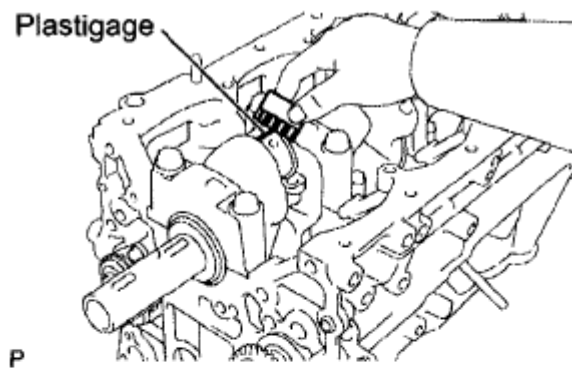


Fig. 323: Measuring Plastigage At Widest
Courtesy of ABLE BODY CORP.

- k. Completely remove the Plastigage.

34. 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:

0.020 to 0.220 mm (0.0008 to 0.0087 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:

2.440 to 2.490 mm (0.0961 to 0.0980 in.)

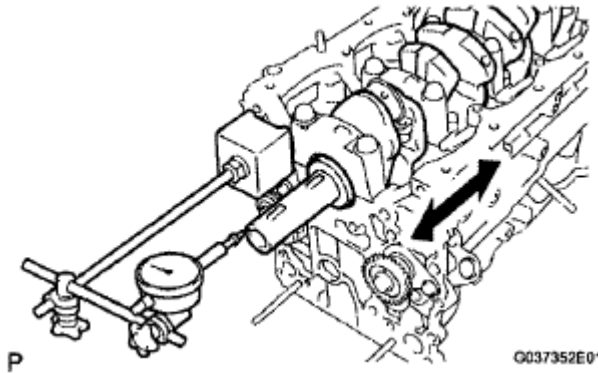


Fig. 324: Measuring Thrust Clearance
Courtesy of ABLE BODY CORP.

35. CLEAN WITH PIN PISTON SUB-ASSEMBLY

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

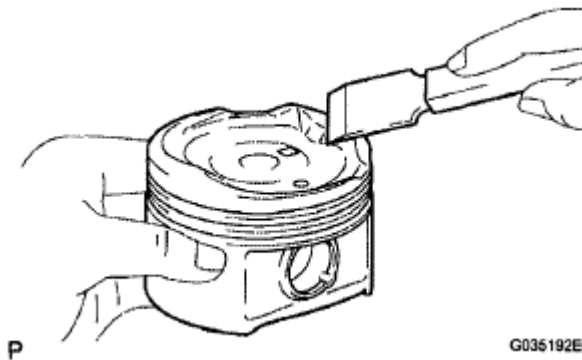


Fig. 325: Removing Carbon From Piston Top
Courtesy of ABLE BODY CORP.

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

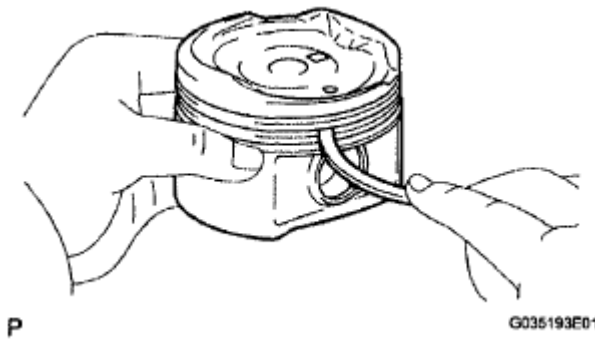


Fig. 326: Cleaning Piston Ring Grooves
Courtesy of ABLE BODY CORP.

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

NOTE: Do not use a wire brush.

36. INSPECT NO. 1 OIL NOZZLE SUB-ASSEMBLY

- a. Check the oil nozzles for damage or clogging. If necessary, replace the oil nozzle.

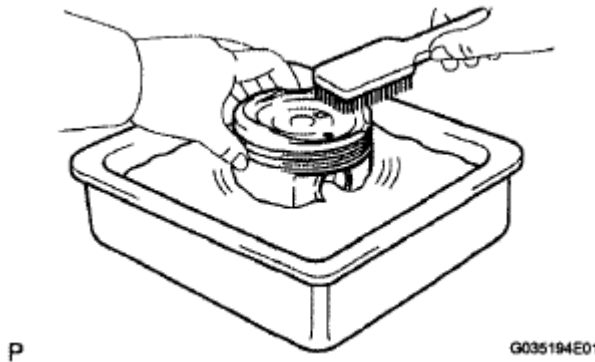


Fig. 327: Cleaning Piston Using Solvent And Brush
Courtesy of ABLE BODY CORP.

37. INSPECT BALANCE SHAFT THRUST CLEARANCE

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

Standard thrust clearance:

0.07 to 0.13 mm (0.0027 to 0.0051 in.)

Maximum thrust clearance:

0.20 mm (0.0079 in.)

If the thrust clearance is greater than the maximum, replace the balanceshaft thrust washer. If

necessary, replace the balanceshaft.

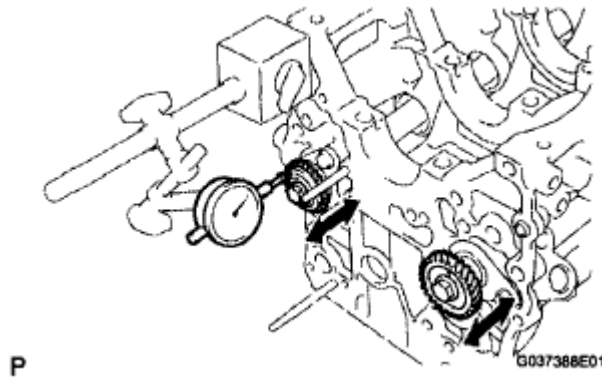


Fig. 328: Measuring Thrust Clearance
Courtesy of ABLE BODY CORP.

38. INSPECT CYLINDER BLOCK FOR FLATNESS

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

Maximum warpage:

0.05 mm (0.0020 in.)

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

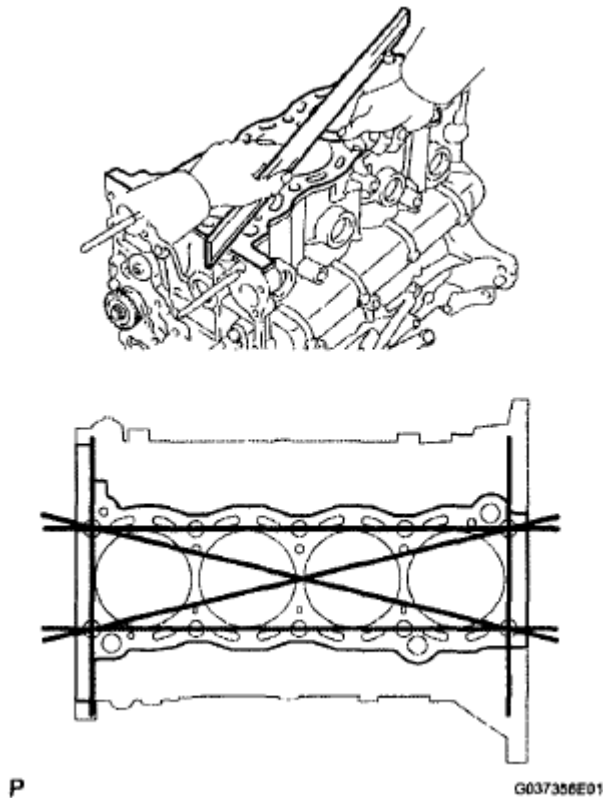


Fig. 329: Measuring Warpage Of Contact Surface Of Cylinder Head Gasket
Courtesy of ABLE BODY CORP.

- b. Visually check the cylinder for vertical scratches. If deep scratches are present, rebore all the 4 cylinders. If necessary, replace the cylinder block.

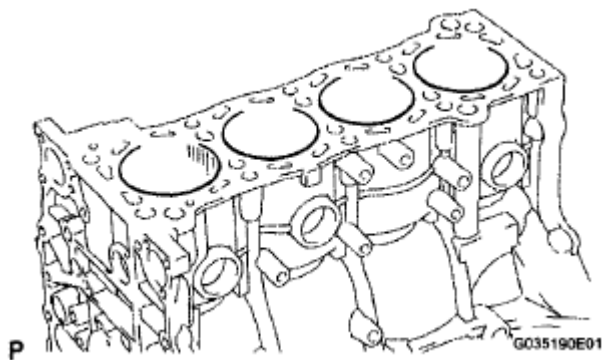


Fig. 330: Identifying Cylinder Block
Courtesy of ABLE BODY CORP.

39. INSPECT CYLINDER BORE

- a. Using a cylinder gauge, measure the cylinder bore diameter at positions A in the thrust and axial directions.

Standard diameter:

94.990 to 95.003 mm (3.7398 to 3.7403 in.)

Maximum difference diameter:

0.2 mm (0.008 in.)

If the diameter is greater than the maximum, rebore all the 4 cylinders. If necessary, replace the cylinder block.

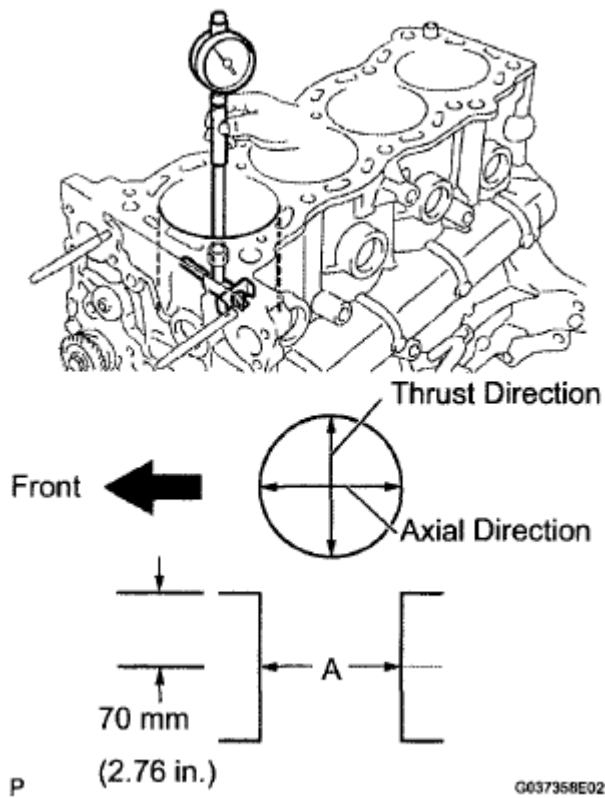


Fig. 331: Measuring Cylinder Bore Diameter
 Courtesy of ABLE BODY CORP.

- b. Inspect the cylinder ridge.

If the wear is less than 0.2 mm (0.008 in.), using a ridge reamer, grind the top of the cylinder.

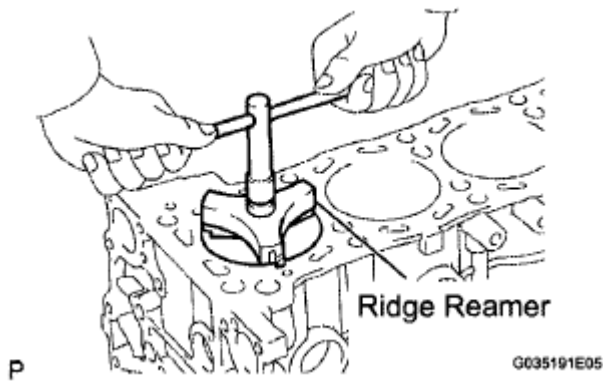


Fig. 332: Grinding Top Of Cylinder
Courtesy of ABLE BODY CORP.

40. CLEAN CYLINDER BLOCK

- Using a gasket scraper, remove all the gasket material from the top surface of the cylinder block.
- Using a soft brush and solvent, thoroughly clean the cylinder block.

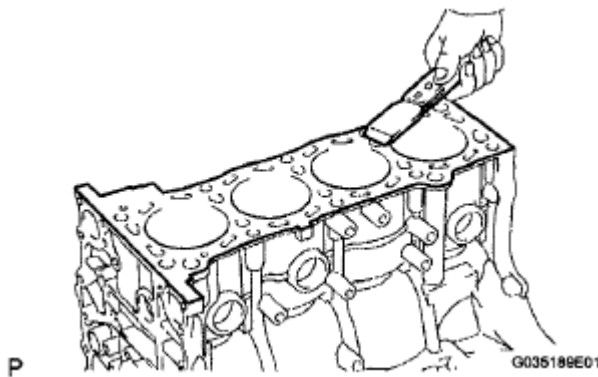


Fig. 333: Removing Gasket Material From Top Surface Of Cylinder Block
Courtesy of ABLE BODY CORP.

41. INSPECT PISTON DIAMETER

- Using a micrometer, measure the piston diameter at right angles to the piston center line, the indicated distance from the piston end.

Distance:

9.3 mm (0.366 in.)

Piston diameter:

94.941 to 94.971 mm (3.7378 to 3.7390 in.) (for standard)

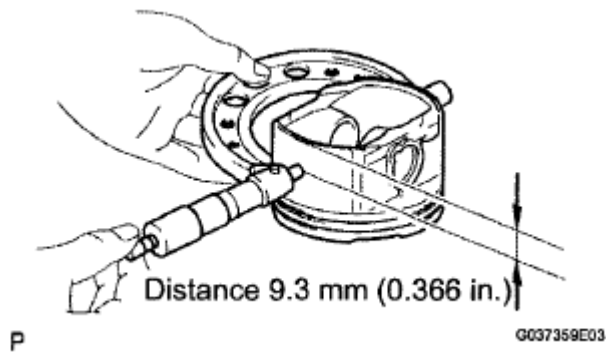


Fig. 334: Measuring Piston Diameter
Courtesy of ABLE BODY CORP.

42. INSPECT PISTON OIL CLEARANCE

- a. Measure the cylinder bore diameter in the thrust directions (see step 20).
- b. Subtract the piston diameter measurement from the cylinder bore diameter measurement.

Standard oil clearance:

0.019 to 0.052 mm (0.0007 to 0.0020 in.)

If the oil clearance is greater than the standard, replace all the pistons and rebore all the cylinders. If necessary, replace the cylinder block.

HINT:

- Bore all the cylinders for the O/S piston outside diameter.
 - Replace all the piston rings with ones to match the O/S pistons.
- c. If the oil clearance is greater than the standard.
 1. Prepare 4 new O/S pistons.

O/S 0.50 piston diameter:

95.441 to 95.451 mm (3.7575 to 3.7579 in.)

2. Using a micrometer, measure the piston diameter at right angles to the piston center line, the indicated distance from the piston end.

Distance:

9.3 mm (0.366 in.)

3. Calculate the amount each cylinder is to be rebored as follows:

Size to be rebored = P + C - H

PISTON DIAMETER SPECIFICATION

P	Piston diameter
C	Piston clearance: 0.019 to 0.052 mm (0.0007 to 0.0020 in.)
H	Allowance for honing: 0.02 mm (0.0008 in.) or less

4. Bore and hone the cylinders to calculated dimensions.

Maximum honing:

0.02 mm (0.0008 in.)

NOTE: Excess honing will destroy the finished roundness.

43. INSPECT RING GROOVE CLEARANCE

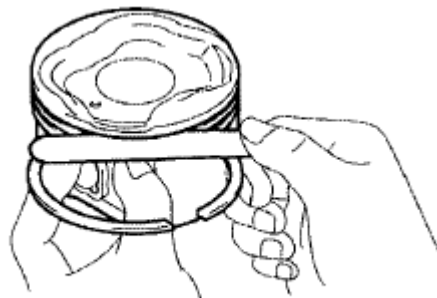
- a. Using a feeler gauge, measure the clearance between a new piston ring and the wall of the ring groove.

Ring groove clearance

RING GROOVE CLEARANCE SPECIFICATION

No.1	0.020 to 0.075 mm (0.0008 to 0.0030 in.)
No.2	0.020 to 0.065 mm (0.0008 to 0.0026 in.)
Oil	0.020 to 0.070 mm (0.0008 to 0.0028 in.)

If the clearance is not as specified, replace the piston.



P

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Fig. 335: Measuring Ring Groove Clearance
Courtesy of ABLE BODY CORP.

44. INSPECT PISTON RING END GAP

- a. Insert the piston ring into the cylinder bore.
- b. 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.

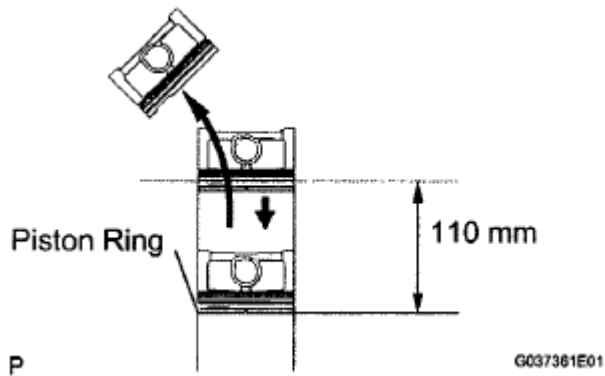


Fig. 336: Inserting Piston Ring Into Cylinder Bore
Courtesy of ABLE BODY CORP.

- c. Using a feeler gauge, measure the end gap.

Standard end gap

PISTON RING GAP SPECIFICATION

No.1	0.22 to 0.34 mm (0.0087 to 0.0134 in.)
No.2	0.45 to 0.57 mm (0.0177 to 0.0224 in.)
Oil	0.10 to 0.40 mm (0.0039 to 0.0157 in.)

Maximum end gap

PISTON RING GAP SPECIFICATION

No. 1	0.90 mm (0.0354 in.)
No.2	1.36 mm (0.0535 in.)
Oil	0.75 mm (0.0295 in.)

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, rebore all the 4 cylinders or replace the cylinder block.

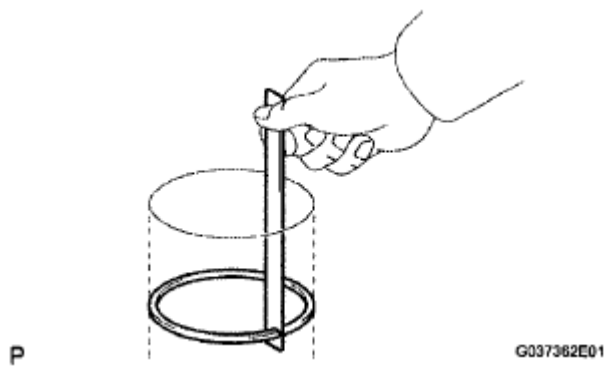


Fig. 337: Measuring End Gap
Courtesy of ABLE BODY CORP.

45. INSPECT PISTON PIN OIL CLEARANCE

- a. Using a caliper gauge, measure the inside diameter of the piston pin hole.

Piston pin hole inside diameter:

22.001 to 22.010 mm (0.8662 to 0.8665 in.)

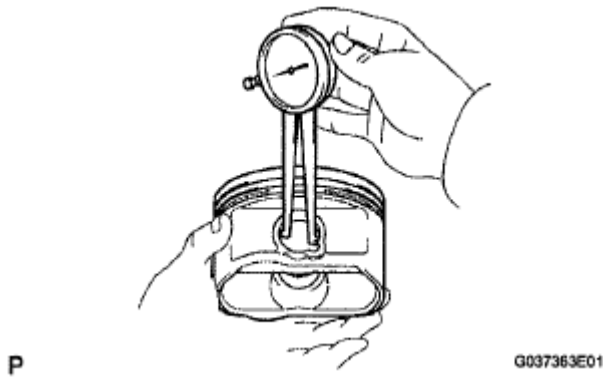


Fig. 338: Measuring Inside Diameter Of Piston Pin Hole
Courtesy of ABLE BODY CORP.

- b. Using a micrometer, measure the piston pin diameter.

Piston pin diameter:

21.997 to 22.006 mm (0.8660 to 0.8664 in.)

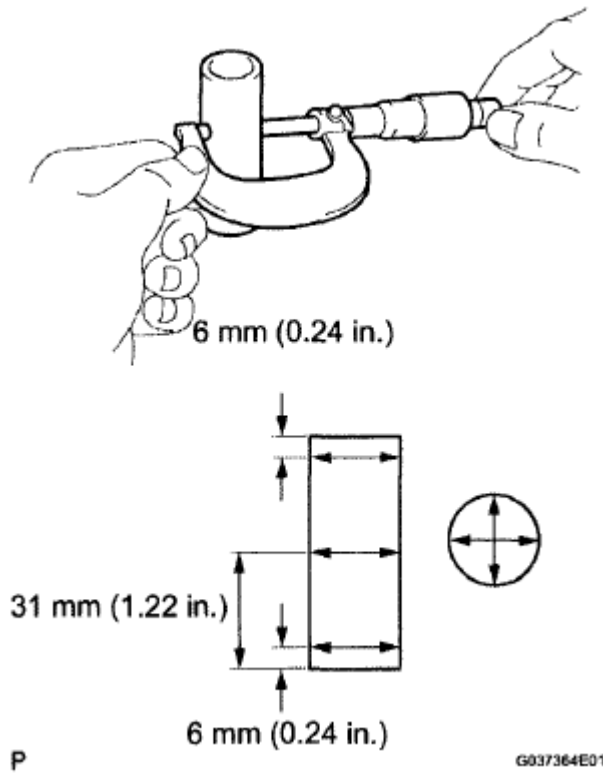


Fig. 339: Measuring Piston Pin Diameter
Courtesy of ABLE BODY CORP.

- c. Using a caliper gauge, measure the inside diameter of the connecting rod bushing.

Bushing inside diameter:

22.005 to 22.014 mm (0.8663 to 0.8667 in.)

- d. Subtract the piston pin diameter measurement from the piston pin hole diameter measurement.

Standard oil clearance:

0.001 to 0.007 mm (0.00004 to 0.00028 in.)

Maximum oil clearance:

0.010 mm (0.0004 in.)

HINT:

If the oil clearance is greater than the maximum, replace the piston and piston pin as a set.

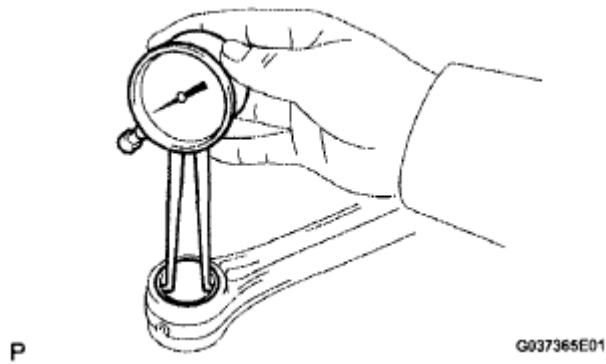


Fig. 340: Measuring Inside Diameter Of Connecting Rod Bushing
Courtesy of ABLE BODY CORP.

- e. Subtract the piston pin diameter measurement from the bushing inside diameter measurement.

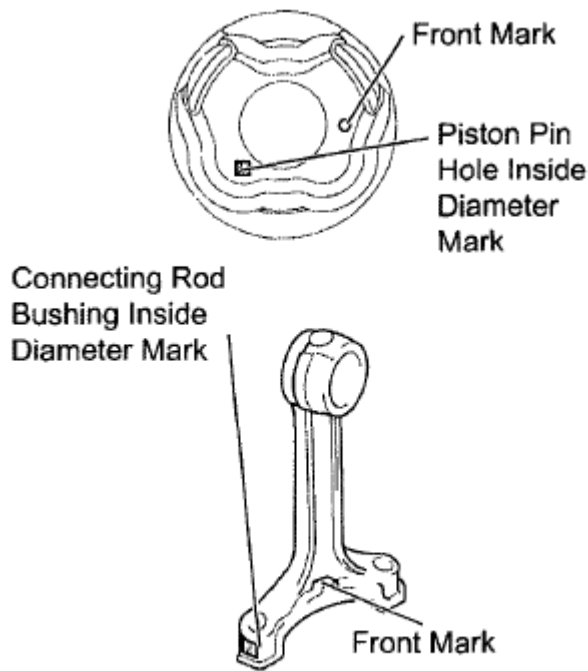
Standard oil clearance:

0.005 to 0.011 mm (0.0002 to 0.0004 in.)

Maximum oil clearance:

0.025 mm (0.0010 in.)

- f. If the oil clearance is greater than the maximum, replace the bushing. If necessary, replace the connecting rod and piston pin as a set.



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Fig. 341: Identifying Connecting Rod Bushing Inside Diameter Mark
Courtesy of ABLE BODY CORP.

46. INSPECT CONNECTING ROD

- a. Using a rod aligner and feeler gauge, check the connecting rod alignment.
 1. Check for bend.

Maximum bend:

0.03 mm (0.0012 in.) per 100 mm (3.94 in.)

If the bend is greater than the maximum, replace the connecting rod sub-assembly.

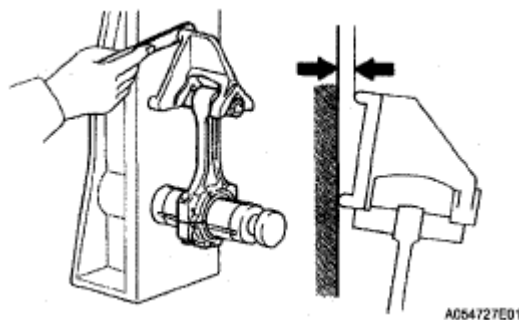


Fig. 342: Checking Connecting Rod Alignment
Courtesy of ABLE BODY CORP.

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 sub-assembly.

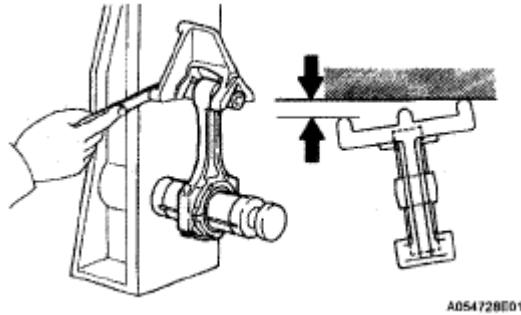


Fig. 343: Checking Connecting Rod Twist
Courtesy of ABLE BODY CORP.

47. INSPECT CONNECTING ROD BOLT

- a. Using vernier calipers, measure the tension portion diameter of the bolt.

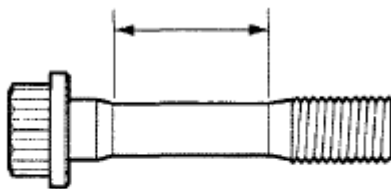
Standard diameter:

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. 344: Measuring Tension Portion Diameter Of Bolt
Courtesy of ABLE BODY CORP.

48. INSPECT CRANKSHAFT

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

Maximum circle runout:

0.03 mm (0.0012 in.)

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

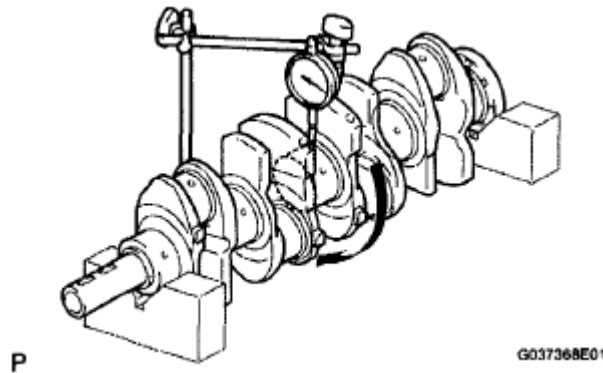


Fig. 345: Measuring Crankshaft Circle Runout
 Courtesy of ABLE BODY CORP.

- b. Inspect the main journals.
 1. Using a micrometer, measure the diameter of each main journal.

Standard journal diameter:

STANDARD JOURNAL DIAMETER SPECIFICATION

No.3 Journal	59.981 to 59.994 mm (2.3615 to 2.3620 in.)
Except No.3 journal	59.987 to 60.000 mm (2.3619 to 2.3622 in.)

If the diameter is not as specified, check the oil clearance (see step 30). 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:

0.005 mm (0.0002 in.)

If the taper and out-of-round is greater than the maximum, replace the crankshaft.

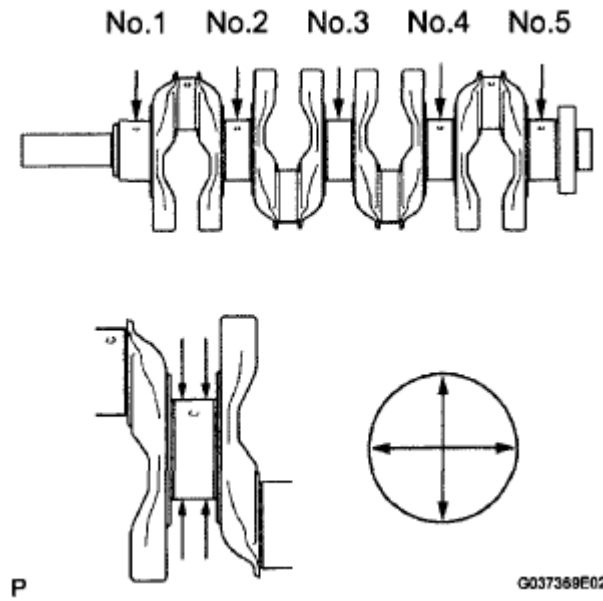


Fig. 346: Measuring Diameter Of Main Journal
Courtesy of ABLE BODY CORP.

- c. Inspect the crank pin.
 - 1. Using a micrometer, measure the diameter of each crank pin.

Diameter:

52.989 to 53.002 mm (2.0862 to 2.0867 in.)

If the diameter is not as specified, check the oil clearance (see step 2). 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:

0.003 mm (0.0001 in.)

If the taper and out-of-round is greater than the maximum, replace the crankshaft.

49. INSPECT CRANKSHAFT OIL CLEARANCE

HINT:

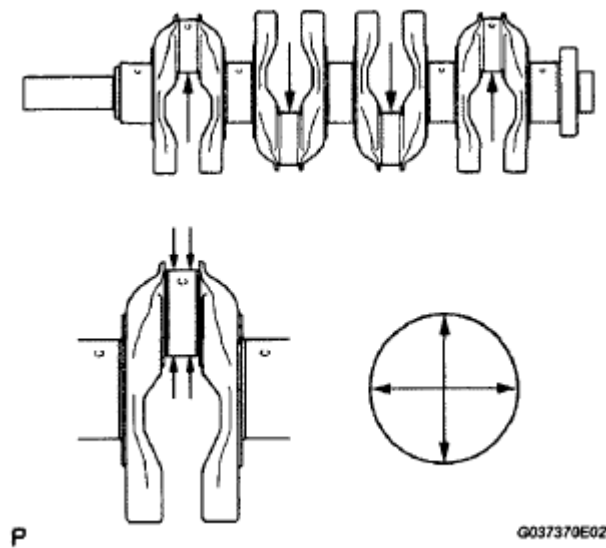


Fig. 347: Measuring Diameter Of Crank Pin
Courtesy of ABLE BODY CORP.

- Keep the lower bearings and crankshaft bearing caps together.
- Arrange the thrust washers in the correct order.
- Keep the upper crankshaft bearings and upper thrust washers together with the cylinder block.
- a. Clean each main journal and bearing.
- b. Check each main journal and bearing for pitting and scratches.

If the journal or bearing is damaged, replace the bearing.

- c. Place the crankshaft on the cylinder block.
- d. Lay a strip of Plastigage across each journal.

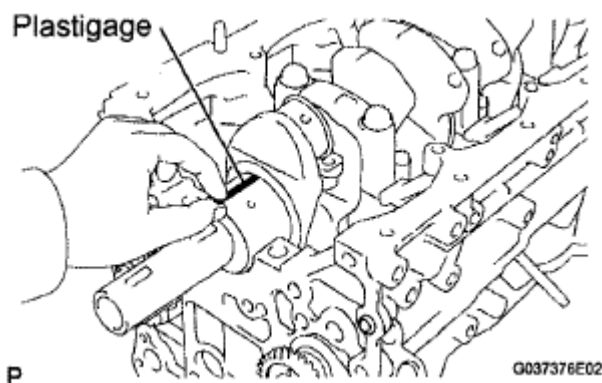


Fig. 348: Laying Strip Of Plastigage Across Journal
Courtesy of ABLE BODY CORP.

- e. Install the 5 crankshaft bearing caps in their proper locations.

- f. Install the 5 crankshaft bearing caps with the 10 bolts (see step 49).

NOTE: Do not turn the crankshaft.

- g. Remove the 10 bolts and 5 crankshaft bearing caps.

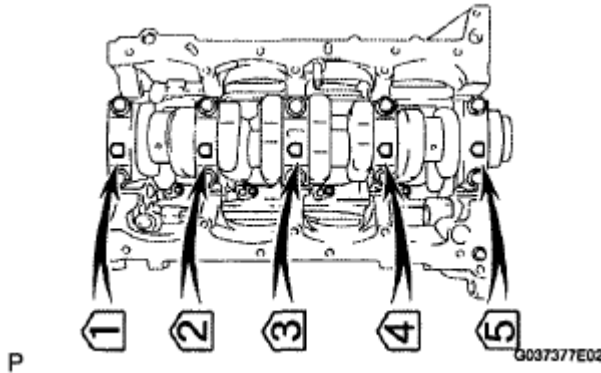


Fig. 349: Identifying Crankshaft Bearing Caps Proper Installation Position
Courtesy of ABLE BODY CORP.

- h. Measure the Plastigage at its widest point.

Standard oil clearance

OIL CLEARANCE SPECIFICATION

Bearing Cap	Standard
No.3	0.030 to 0.055 mm (0.0012 to 0.0022 in.)
Others	0.024 to 0.049 mm (0.0009 to 0.0019 in.)

Maximum oil clearance:

0.10 mm (0.0039 in.)

If the oil clearance is greater than the maximum, replace the crankshaft bearing.

HINT:

- If replacing the cylinder block, measure the bearing standard clearance.
- If replacing a bearing, first check the number on the cylinder block for the bearing's respective journal. Then replace the bearing with one that has the same number. Each bearing's standard thickness is indicated by a 1, 2 or 3 mark on its surface.

Reference

Cylinder block main journal bore diameter

CYLINDER BLOCK MAIN JOURNAL BORE DIAMETER SPECIFICATION

Mark	Diameter
1	64.004 to 64.010 mm (2.5198 to 2.5201 in.)
2	64.011 to 64.016 mm (2.5201 to 2.5203 in.)
3	64.017 to 64.022 mm (2.5203 to 2.5206 in.)

Standard bearing center wall thickness**STANDARD BEARING CENTER WALL THICKNESS SPECIFICATION**

Mark	Thickness
1	1.987 to 1.990 mm (0.0782 to 0.0783 in.)
2	1.991 to 1.993 mm (0.0784 to 0.0785 in.)
3	1.994 to 1.996 mm (0.0785 to 0.0786 in.)

- i. Completely remove the Plastigage.

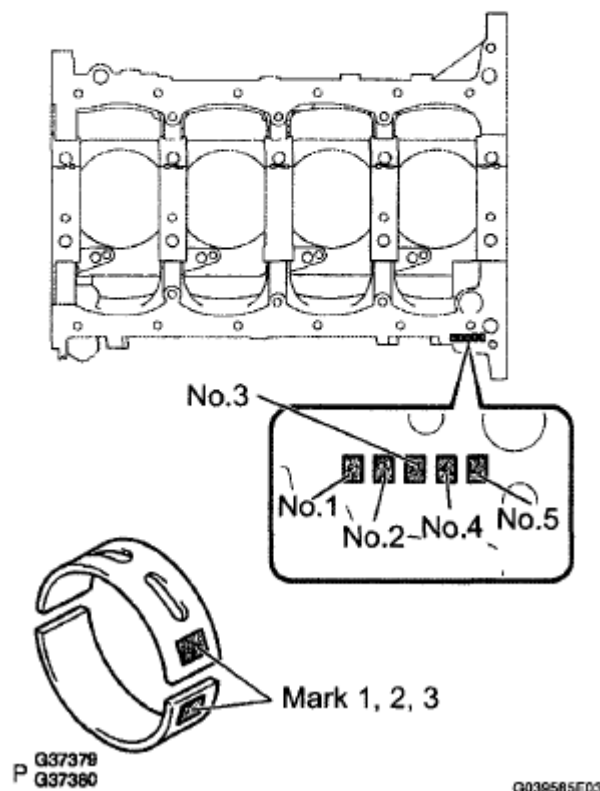
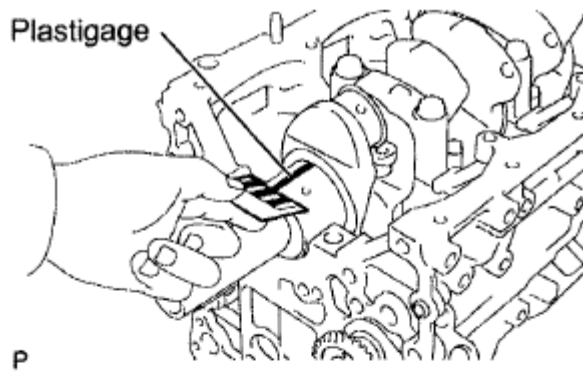


Fig. 350: Measuring Plastigage At Widest
Courtesy of ABLE BODY CORP.

50. INSPECT CRANKSHAFT BEARING CAP SET BOLT

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

Standard diameter:

10.76 to 10.97 mm (0.4236 to 0.4319 in.)

Minimum diameter:

10.66 mm (0.4197 in.)

If the diameter is less than the minimum, replace the bolt.

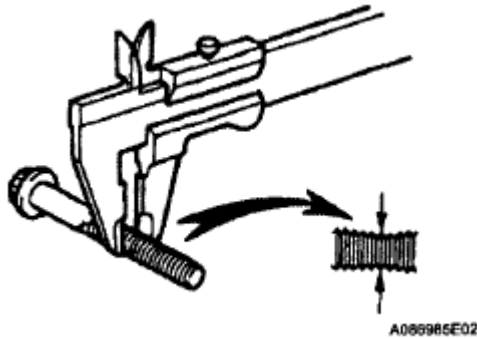


Fig. 351: Measuring Diameter Of Compressed Thread
Courtesy of ABLE BODY CORP.

51. INSPECT NO.1 BALANCESHAFT

- a. Inspect the diameter of the journal.
 1. Using a micrometer, measure the diameter of the balancshaft main journals.

Main journal diameter

MAIN JOURNAL DIAMETER SPECIFICATION

A	37.969 to 37.985 mm (1.4948 to 1.4955 in.)
B	37.449 to 37.465 mm (1.4744 to 1.4750 in.)

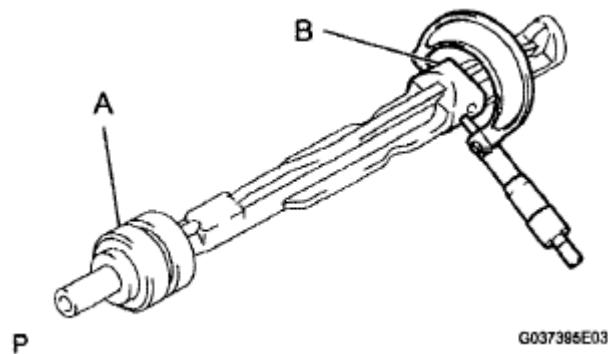


Fig. 352: Measuring Diameter Of Balancshaft Main Journals
Courtesy of ABLE BODY CORP.

- b. Inspect the diameter of bearing.
 1. Using a cylinder gauge, measure the inside diameter of the balancshaft bearing.

Bearing inside diameter

BEARING INSIDE DIAMETER SPECIFICATION

A	38.025 to 38.045 mm (1.4970 to 1.4978 in.)
B	37.525 to 37.545 mm (1.4774 to 1.4781 in.)

c. Inspect oil clearance.

1. Subtract the balancershaft main journal diameter measurement from the balancershaft bearing inside diameter measurement.

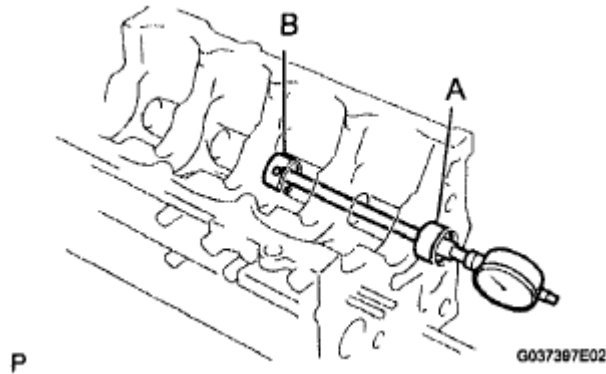


Fig. 353: Measuring Inside Diameter Of Balancershaft Bearing
 Courtesy of ABLE BODY CORP.

Standard oil clearance**OIL CLEARANCE SPECIFICATION**

A	0.040 to 0.076 mm (0.0016 to 0.0030 in.)
B	0.060 to 0.096 mm (0.0024 to 0.0038 in.)

Maximum oil clearance:

0.15 mm (0.0059 in.)

If the oil clearance is greater than the maximum, replace the cylinder block and balancershaft.

52. INSPECT NO.2 BALANCESHAFT

- a. Inspect the diameter of the journal.
 1. Using a micrometer, measure the diameter of the balancershaft main journals.

Main journal diameter**MAIN JOURNAL DIAMETER SPECIFICATION**

A	37.969 to 37.985 mm (1.4948 to 1.4955 in.)
B	37.449 to 37.465 mm (1.4744 to 1.4750 in.)

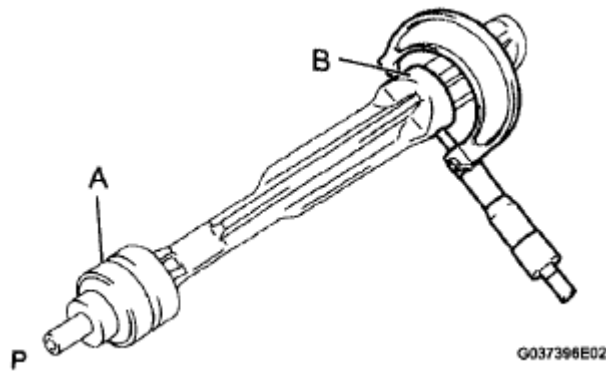


Fig. 354: Measuring Diameter Of Balancer shaft Main Journals
Courtesy of ABLE BODY CORP.

- b. Inspect the diameter of bearing.
 - 1. Using a cylinder gauge, measure the inside diameter of the balancer shaft bearing.

Bearing inside diameter

BEARING INSIDE DIAMETER SPECIFICATION

A	38.025 to 38.045 mm (1.4970 to 1.4978 in.)
B	37.525 to 37.545 mm (1.4774 to 1.4781 in.)

- c. Inspect oil clearance.

Standard oil clearance

OIL CLEARANCE SPECIFICATION

A	0.040 to 0.076 mm (0.0016 to 0.0030 in.)
B	0.060 to 0.096 mm (0.0024 to 0.0038 in.)

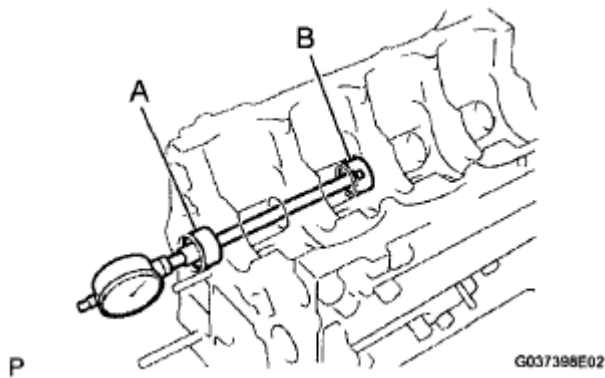


Fig. 355: Measuring Inside Diameter Of Balancer shaft Bearing
Courtesy of ABLE BODY CORP.

Maximum oil clearance: 0.15 mm (0.0059 in.)

If the oil clearance is greater than the maximum, replace the cylinder block and balanceshaft.

REPLACEMENT

1. REMOVE TIMING CHAIN COVER OIL SEAL

- a. Using a screwdriver with its tip taped, pry out the oil seal.

HINT:

Tape the screwdriver tip before use.

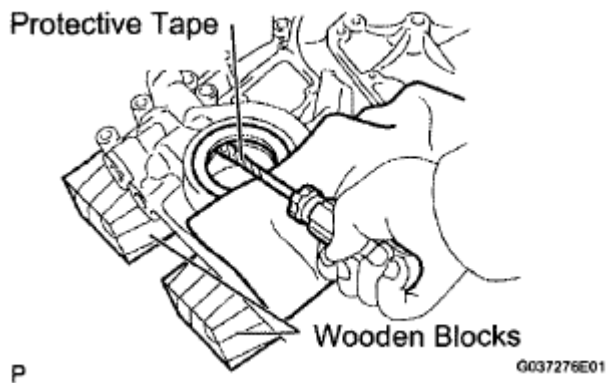


Fig. 356: Prying Out Oil Seal
Courtesy of ABLE BODY CORP.

2. INSTALL TIMING CHAIN COVER OIL SEAL

- a. Place the timing chain cover on wooden blocks.
- b. Using SST, tap in a new oil seal until its surface is flush with the timing gear case edge.

SST 09223-50010

NOTE:

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

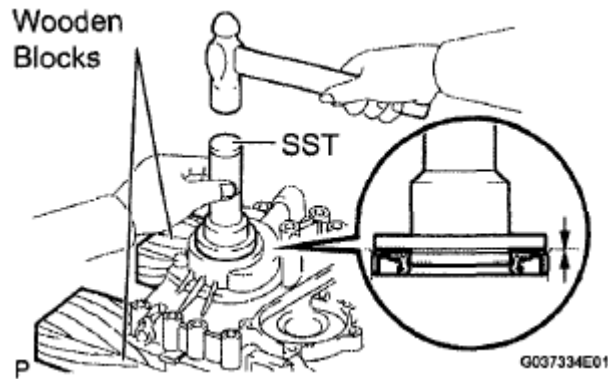


Fig. 357: Tapping Oil Seal
Courtesy of ABLE BODY CORP.

3. REMOVE ENGINE REAR OIL SEAL

- Place the oil seal retainer on wooden blocks.
- Using a screwdriver with its tip taped and a hammer, tap out the oil seal.

HINT:

Tape the screwdriver tip before use.

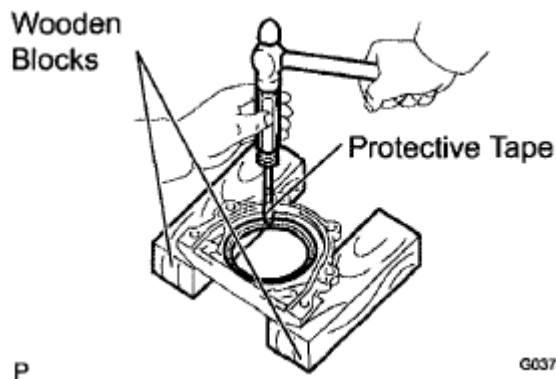


Fig. 358: Tapping Out Oil Seal
Courtesy of ABLE BODY CORP.

4. 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, 09950-70010 (09951 -07150)

NOTE:

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

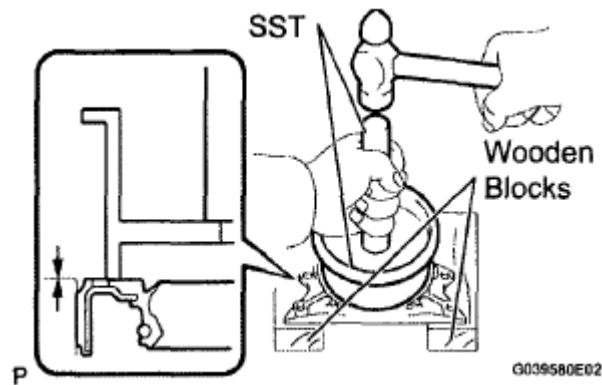


Fig. 359: Tapping In Oil Seal
Courtesy of ABLE BODY CORP.

5. REMOVE INTAKE VALVE GUIDE BUSH

- a. Heat the cylinder head to 80 to 100°C (176 to 212°F).

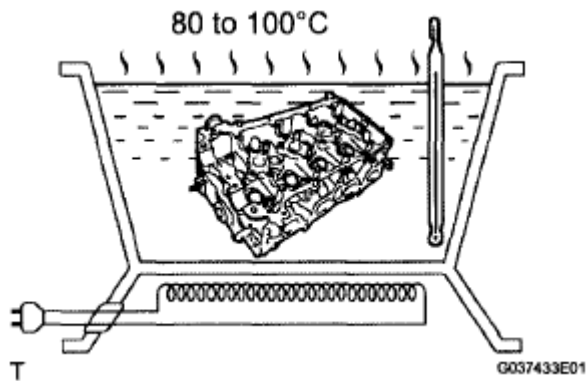


Fig. 360: Heating Cylinder Head
Courtesy of ABLE BODY CORP.

- b. Place the cylinder head on wooden blocks.
- c. Using SST and a hammer, tap out the guide bush.

SST 09201-01055, 09950-70010 (09951 -07100)

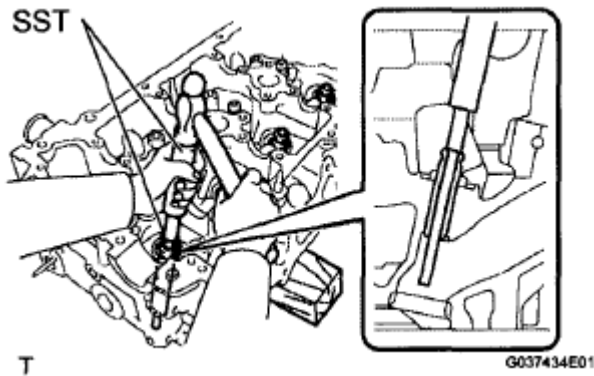


Fig. 361: Tapping Out Guide Bush
Courtesy of ABLE BODY CORP.

6. 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)

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

BUSH BORE DIAMETER SPECIFICATION

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

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.

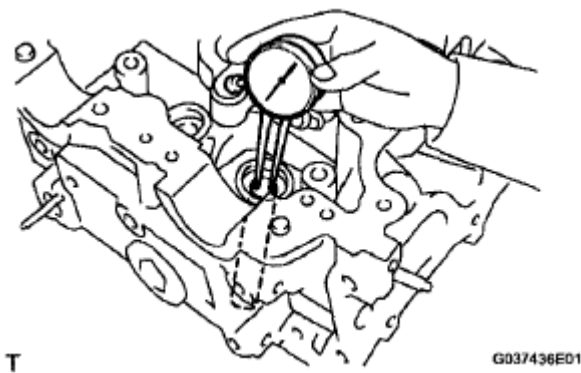


Fig. 362: Measuring Bush Bore Diameter Of Cylinder Head
Courtesy of ABLE BODY CORP.

- c. Heat the cylinder head to 80 to 100°C (176 to 212°F).

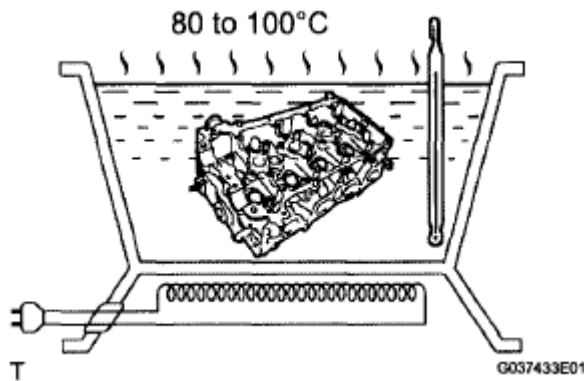


Fig. 363: Heating Cylinder Head
Courtesy of ABLE BODY CORP.

- 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 -01055, 09950-70010 (09951 -07100)

Protrusion height (A): 9.8 to 10.2 mm (0.3858 to 0.4016 in.)

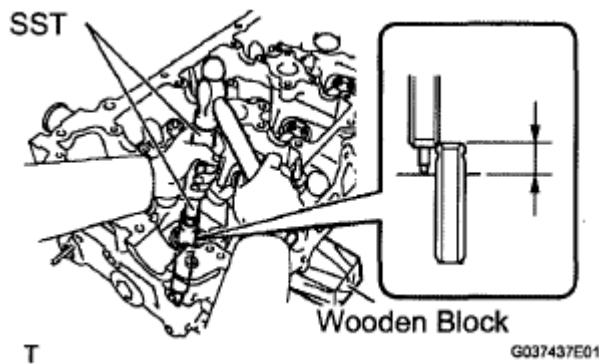


Fig. 364: Tapping In Valve Guide Bush
Courtesy of ABLE BODY CORP.

- 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.)

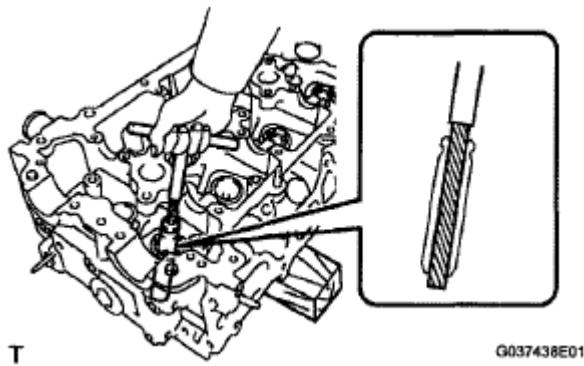


Fig. 365: Reaming Valve Guide Bush
Courtesy of ABLE BODY CORP.

7. 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 09201-01055, 09950-70010 (09951-07100)

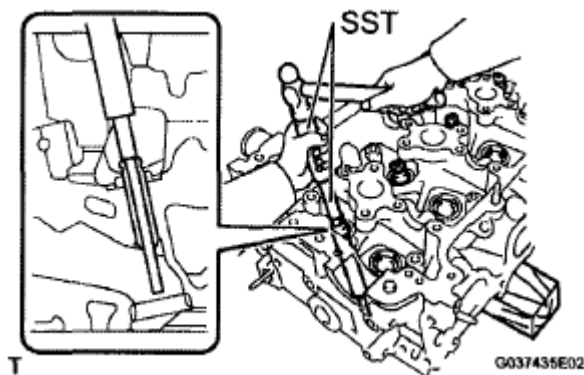


Fig. 366: Tapping Out Guide Bush
Courtesy of ABLE BODY CORP.

8. INSTALL EXHAUST VALVE GUIDE BUSH

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

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

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

BUSH BORE DIAMETER SPECIFICATION

Bush bore diameter	Bush size
10.285 to 10.306 mm (0.4049 to 0.4057 in.)	Use STD

10.335 to 10.356 mm (0.4069 to 0.4077 in.)|Use O/S 0.05|

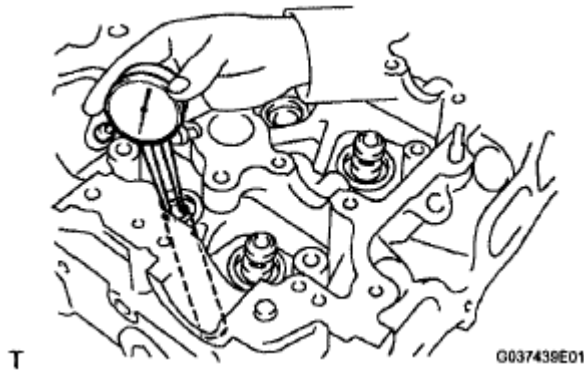


Fig. 367: Measuring Bush Bore Diameter Of Cylinder Head
Courtesy of ABLE BODY CORP.

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).

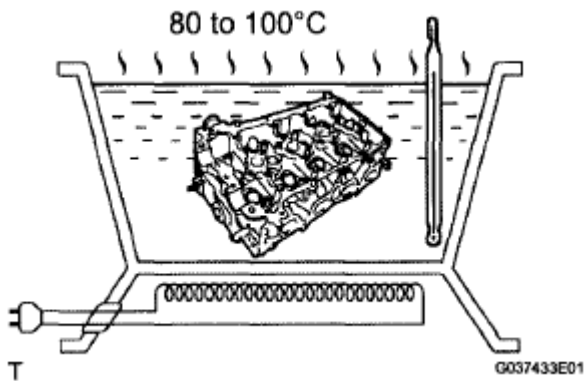


Fig. 368: Heating Cylinder Head
Courtesy of ABLE BODY CORP.

- 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 -01055, 09950-70010 (09951 -07100)

Protrusion height (A): 7.6 to 8.0 mm (0.2992 to 0.3150 in.)

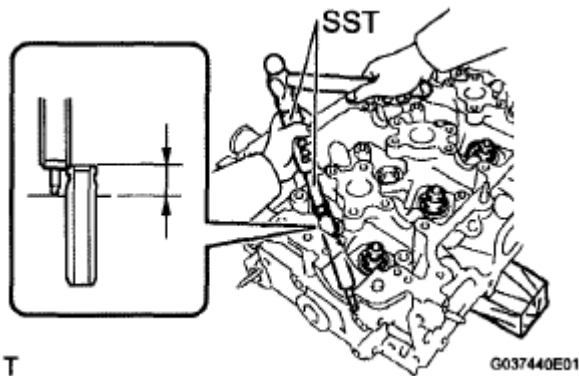


Fig. 369: Tapping In Valve Guide Bush
Courtesy of ABLE BODY CORP.

- 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.)

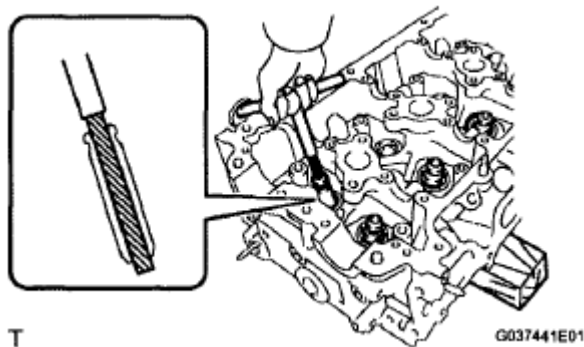


Fig. 370: Reaming Valve Guide Bushing
Courtesy of ABLE BODY CORP.

9. REMOVE CONNECTING ROD SMALL END BUSH

- a. Using SST and a press, press out the bush.

SST 09222-30010

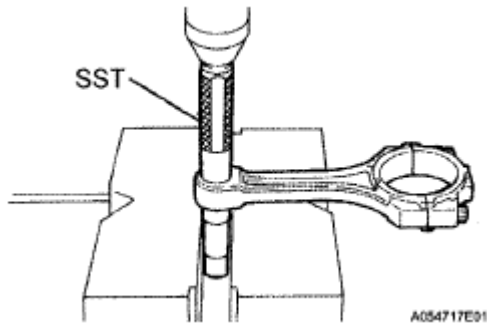


Fig. 371: Installing Connecting Rod Small End Bush Using SST And Press
Courtesy of ABLE BODY CORP.

10. INSTALL CONNECTING ROD SMALL END BUSH

- a. Align the oil holes of a new bush and the connecting rod.

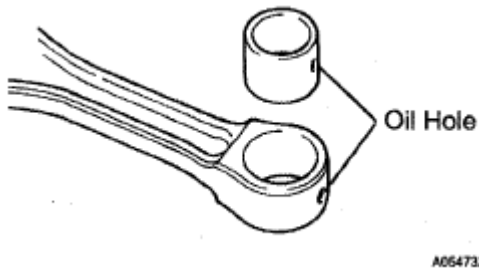


Fig. 372: Aligning Oil Holes Of A New Bush And Connecting Rod
Courtesy of ABLE BODY CORP.

- b. Using SST and a press, press in the bush.

SST 09222-30010

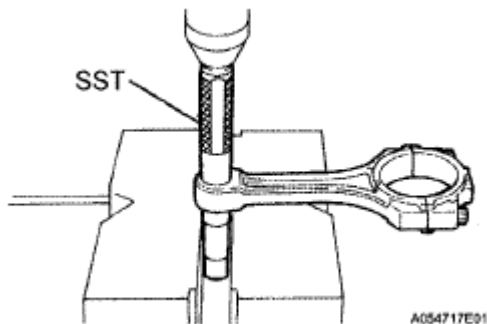


Fig. 373: Installing Connecting Rod Small End Bush Using SST And Press
Courtesy of ABLE BODY CORP.

- c. Using a pin hole grinder, hone the bush to obtain the standard specified clearance (see step 26.) between the bush and piston pin.

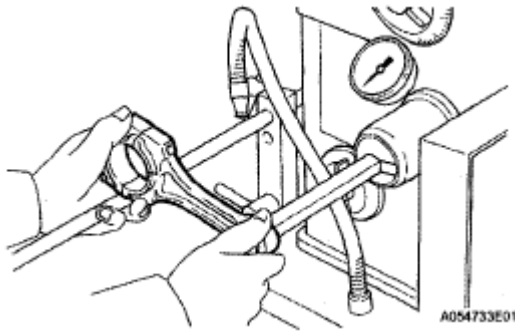


Fig. 374: Grinding Pin Hole
Courtesy of ABLE BODY CORP.

- 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.

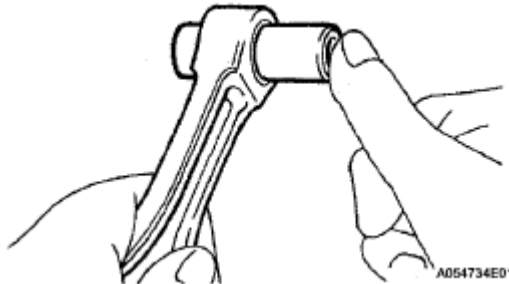


Fig. 375: Checking Piston Pin
Courtesy of ABLE BODY CORP.

REASSEMBLY

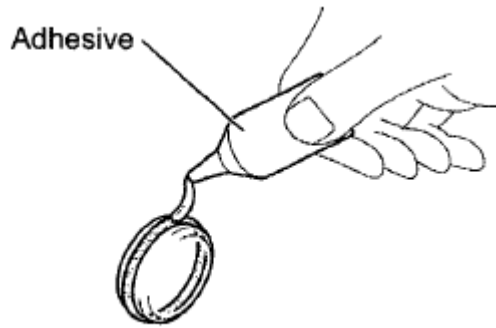
1. INSTALL TIGHT PLUG

NOTE: If water leaks from the tight plug or the plug corrodes, replace it.

- a. Apply adhesive around the tight plugs.

Adhesive:

Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent



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A058128E12

Fig. 376: Applying Adhesive Around Tight Plugs
Courtesy of ABLE BODY CORP.

- b. Using SST and a hammer, tap in new tight plugs as shown in the illustration.
- c. Using SST, tap in the 8 tight plugs A and C.

SST 09950-60010 (09951 -00350), 09950-70010 (09951-07100)

- d. Using SST, tap in the tight plug B.

SST 09950-60010 (09951 -00300), 09950-70010 (09951-07100)

- e. Using SST, tap in the 3 tight plugs D.

SST 09950-60010 (09951-00400), 09950-70010 (09951-07100)

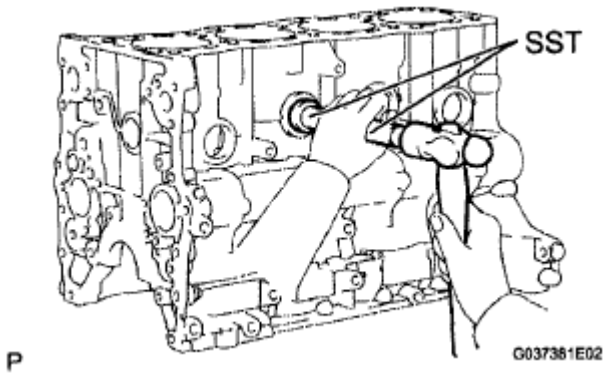
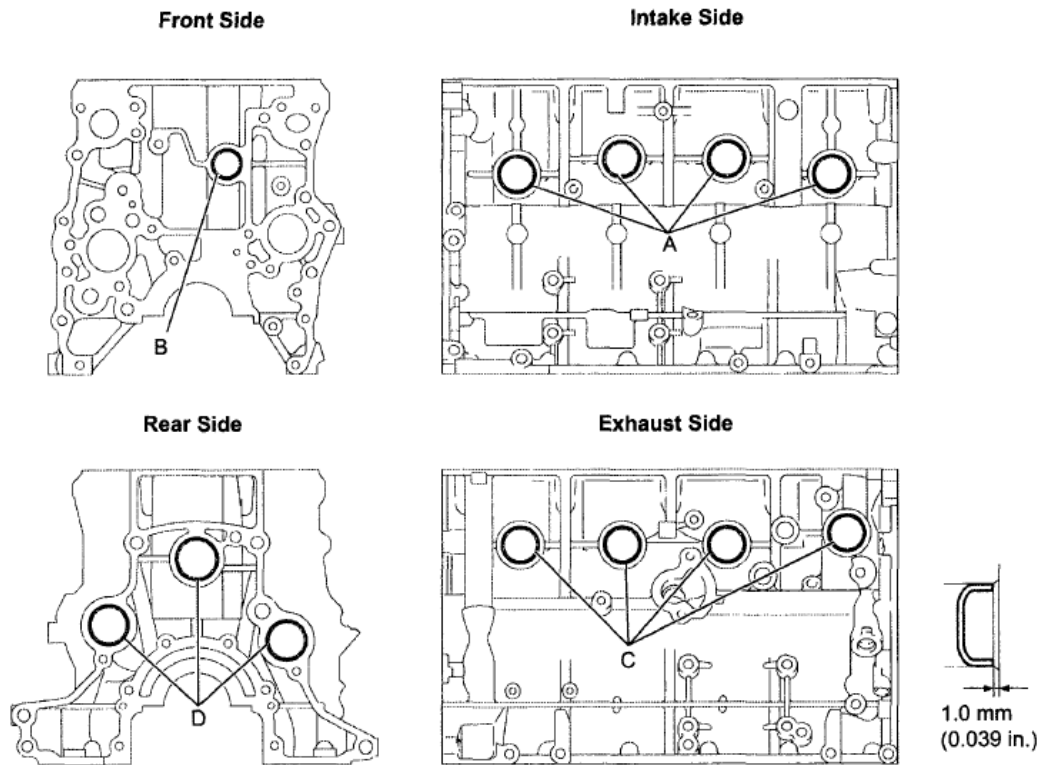


Fig. 377: Tapping Tight Plugs
Courtesy of ABLE BODY CORP.



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G037382E02

Fig. 378: Identifying Tight Plug Location
Courtesy of ABLE BODY CORP.

2. INSTALL STUD BOLT

- Using an E7 "torx" socket wrench, install the stud bolts B and D.

Torque: 7.5 N*m (77 kgf*cm, 66 in.*lbf) for stud bolts B and D

- Using an E8 "torx" socket wrench, install the stud bolts A.

Torque: 7.5 N*m (77 kgf*cm, 66 in.*lbf) for stud bolts A

- Apply adhesive to the hole for the stud bolt C on the cylinder block. Using an E7 "torx" socket wrench, install the stud bolts C.

Torque: 7.5 N*m (77 kgf*cm, 66 in.*lbf) for stud bolt C

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

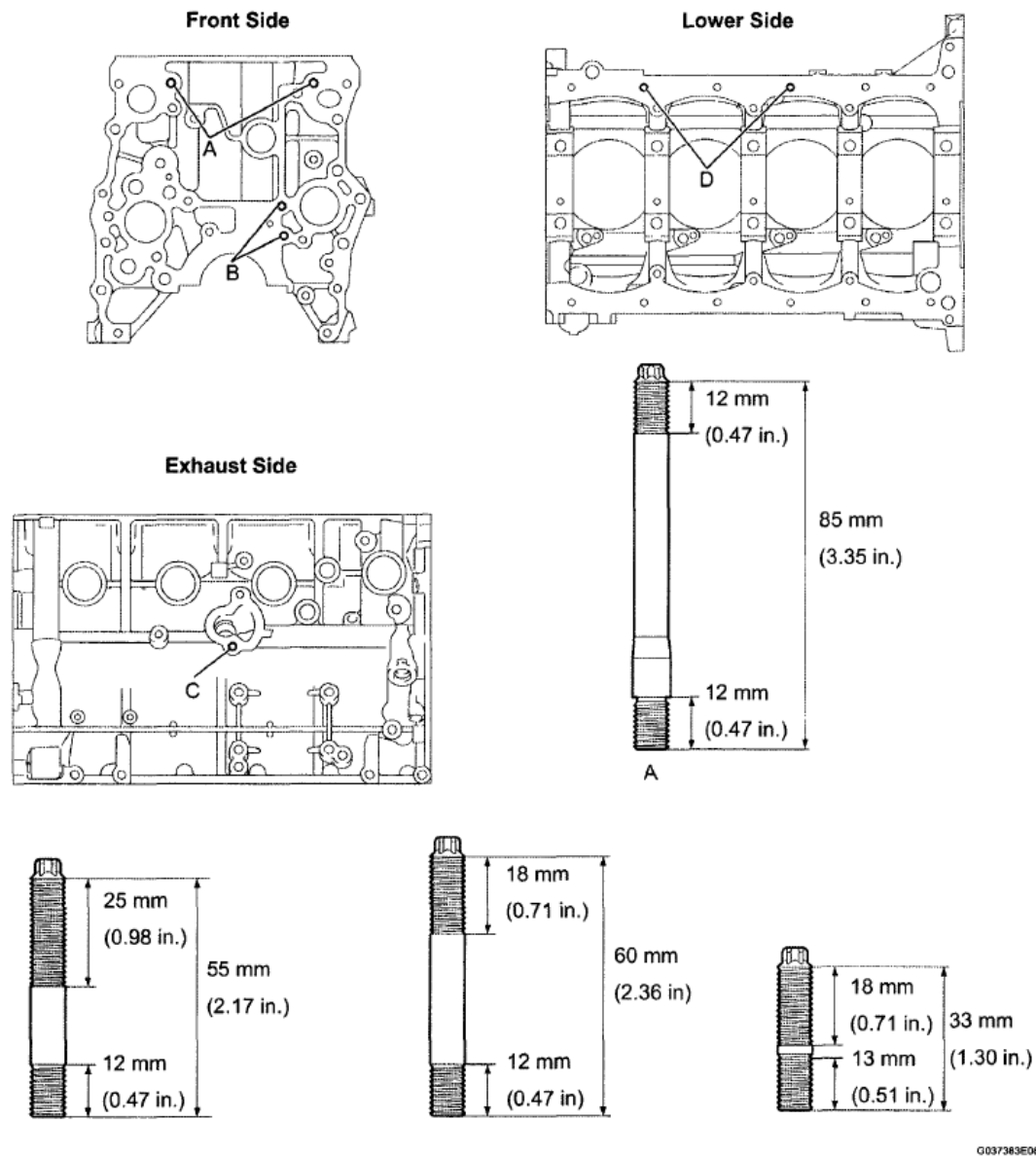


Fig. 379: Identifying Stud Bolt Installation Location And Dimension
Courtesy of ABLE BODY CORP.

3. INSTALL STRAIGHT PIN

- Using a plastic-faced hammer, tap in new straight pins to the cylinder block.

4. INSTALL RING PIN

- Using a plastic-faced hammer, tap in new ring pins to the cylinder block.

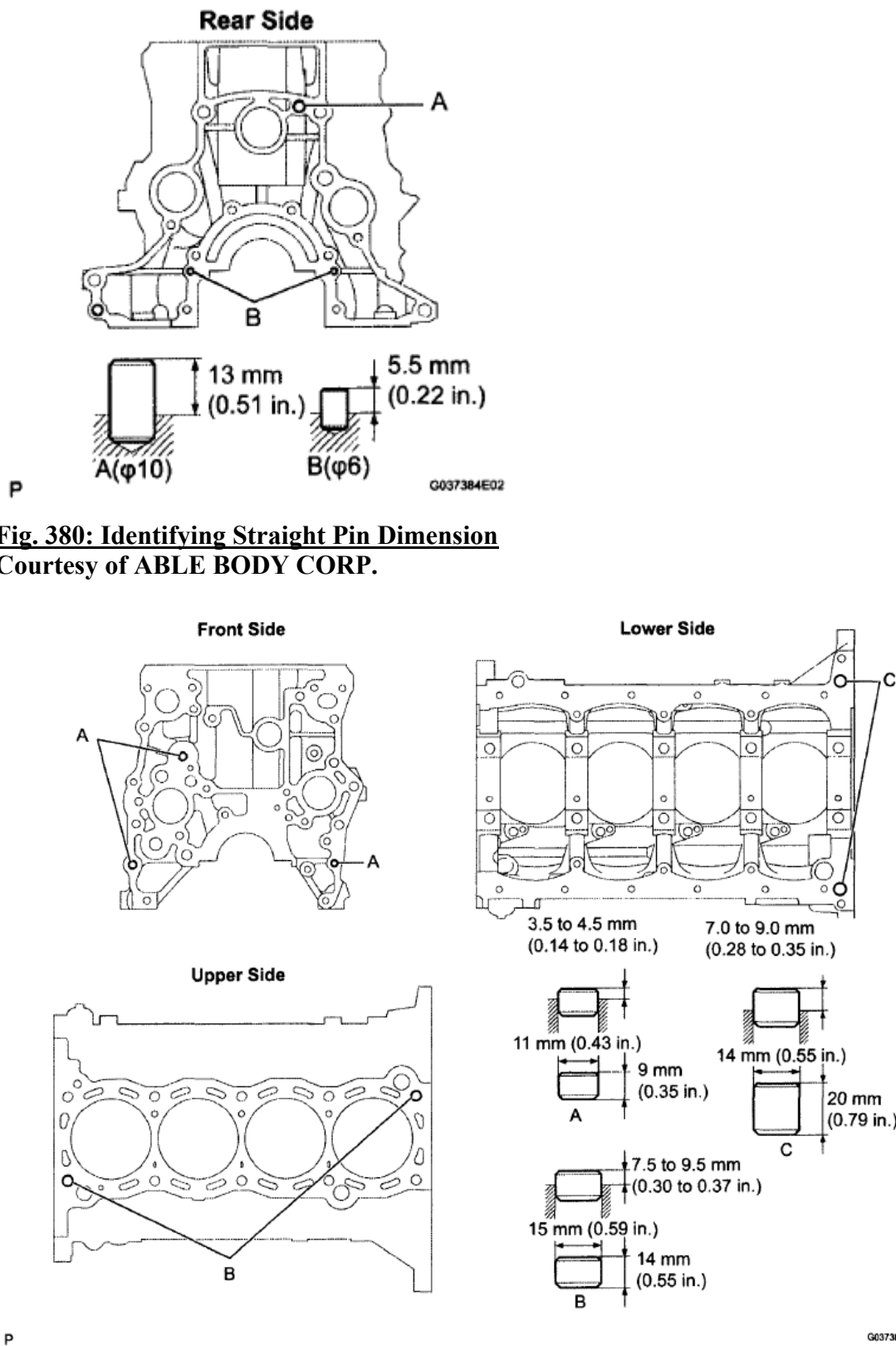


Fig. 380: Identifying Straight Pin Dimension
Courtesy of ABLE BODY CORP.

Fig. 381: Identifying Ring Pin Installation Location And Dimension
Courtesy of ABLE BODY CORP.

5. INSTALL NO. 2 BALANCESHAFT DRIVEN GEAR

- a. Mount the head portion of the balancer shaft in a vise.

NOTE: Be careful not to damage the balancer shaft.

- b. Install the balancer shaft thrust washer No.2 (* 1) and balancer shaft driven gear No.2 (* 2).
- c. Install and torque the bolt.

Torque: 36 N*m (365 kgf*cm, 26 ft.*lbf)

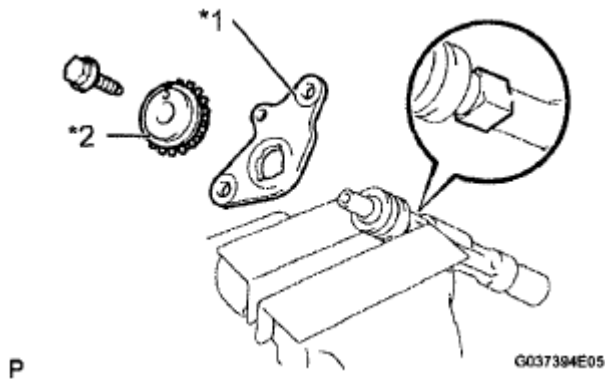


Fig. 382: Installing Balancer shaft Thrust Washer No.2
Courtesy of ABLE BODY CORP.

6. INSTALL NO.2 BALANCESHAFT

- a. Install the balancer shaft to the cylinder block.

NOTE: When installing the balancer shaft, make sure to support the balancer shaft with both hands and avoid scratching the balancer shaft bearing on the cylinder block side.

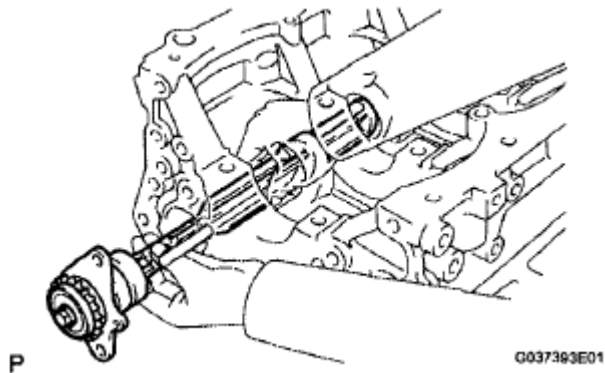


Fig. 383: Installing Balancer shaft To Cylinder Block
Courtesy of ABLE BODY CORP.

- b. Install and torque the 2 bolts.

Torque: 18 N*m (184 kgf*cm, 13 ft.*lbf)

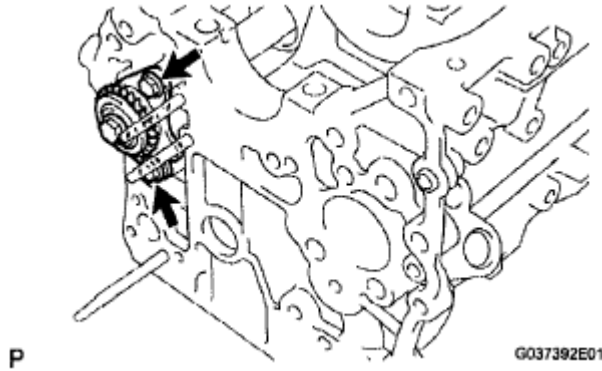


Fig. 384: Locating Bolts
Courtesy of ABLE BODY CORP.

7. INSTALL NO. 1 BALANCESHAFT DRIVEN GEAR

- a. Mount the head portion of the balancerhaft in a vise.

NOTE: Be careful not to damage the balancerhaft.

- b. Install the balancerhaft thrust spacer (* 1), balancerhaft thrust washer No.1 (* 2), sliding key (* 3) and balancerhaft driven gear No.1 (* 4).
- c. Install and torque the bolt.

Torque: 36 N*m (365 kgf*cm, 26 ft.*lbf)

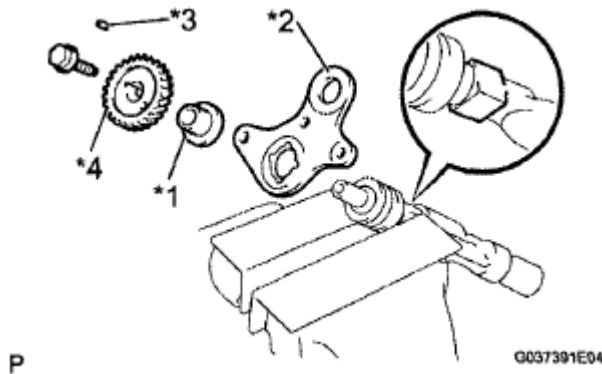


Fig. 385: Installing Balancerhaft Thrust Spacer, Balancerhaft Thrust Washer No.1
Courtesy of ABLE BODY CORP.

8. INSTALL NO.1 BALANCESHAFT

- a. Install the No.1 balancerhaft to the cylinder block.

NOTE: When installing the balancershaft, make sure to support the balancershaft with both hands and avoid scratching the balancershaft bearing on the cylinder block side.

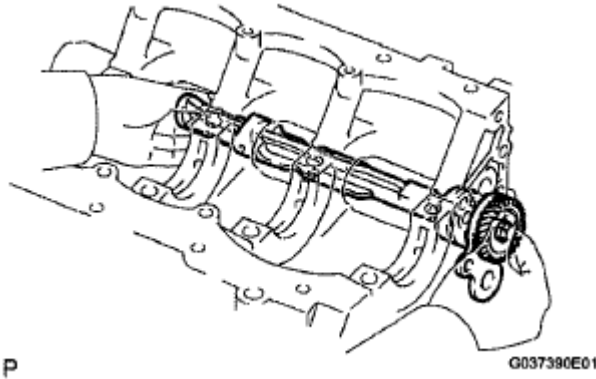


Fig. 386: Installing No.1 Balancershaft To Cylinder Block
Courtesy of ABLE BODY CORP.

- b. Install and torque the bolt.

Torque: 18 N*m (184 kgf*cm, 13 ft.*lbf)

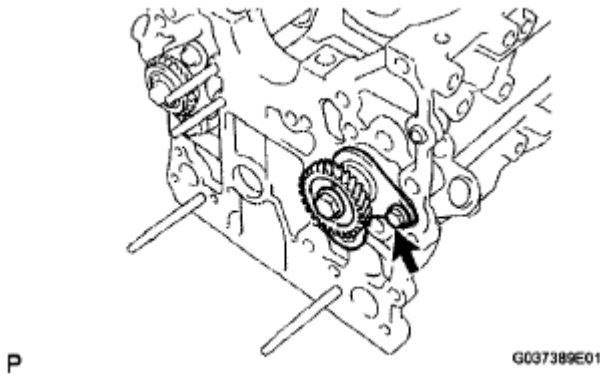


Fig. 387: Locating Bolt
Courtesy of ABLE BODY CORP.

9. INSTALL CYLINDER BLOCK WATER DRAIN COCK SUB-ASSEMBLY

- a. Apply adhesive around the drain cock.

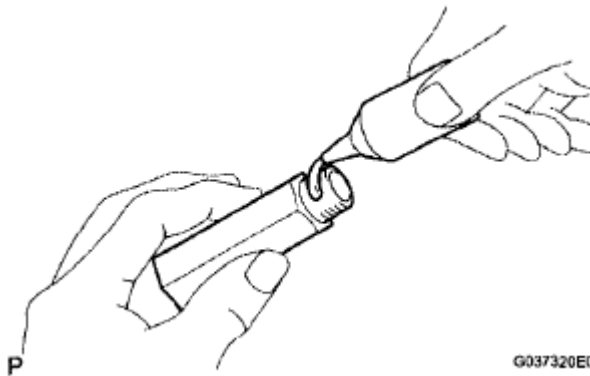


Fig. 388: Applying Adhesive Around Drain Cock
Courtesy of ABLE BODY CORP.

- b. Install the cylinder block water drain cock as shown in the illustration.

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

- c. Install the water drain cock plug to the water drain cock sub-assembly.

Torque: 13 N*m (130 kgf*cm, 9 in.*lbf)

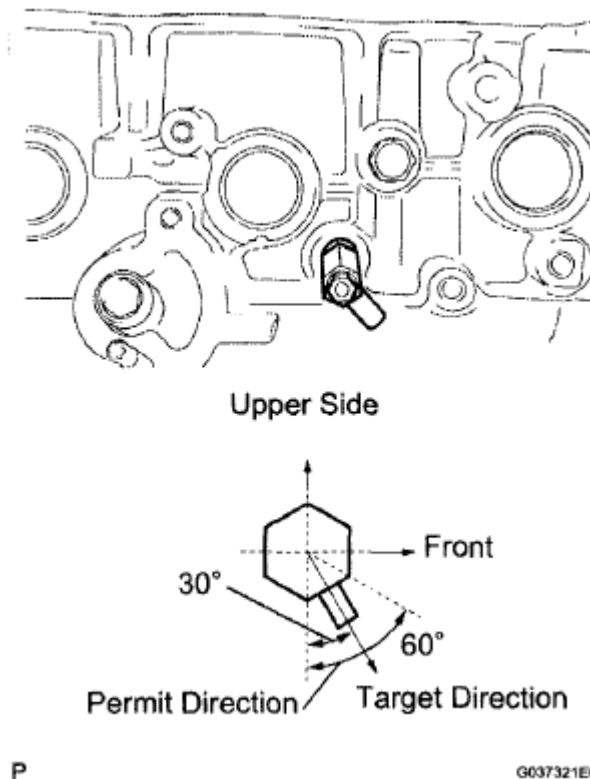


Fig. 389: Installing Cylinder Block Water Drain Cock
Courtesy of ABLE BODY CORP.

10. INSTALL NO. 1 OIL NOZZLE SUB-ASSEMBLY

- a. Using an E7 "torx" socket wrench, install the oil nozzles.

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

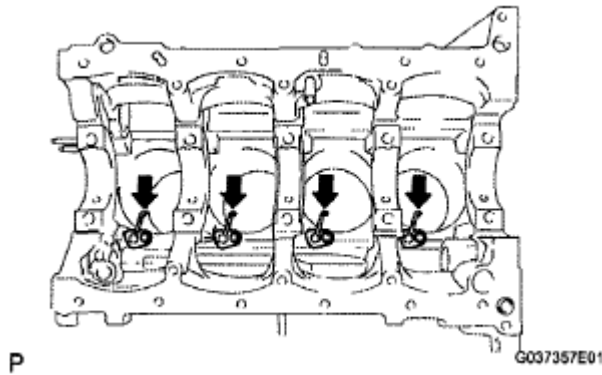


Fig. 390: Locating Oil Nozzles
Courtesy of ABLE BODY CORP.

11. INSTALL WITH PIN PISTON SUB-ASSEMBLY

- a. Assemble the piston and connecting rod.
 1. Using a screwdriver, install a new snap ring at one end of the piston pin hole.

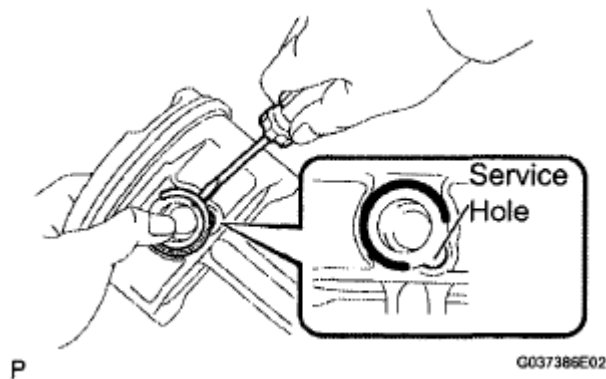


Fig. 391: Installing Snap Ring
Courtesy of ABLE BODY CORP.

2. Gradually heat the piston to approximately 80 to 90°C (176 to 194°F).

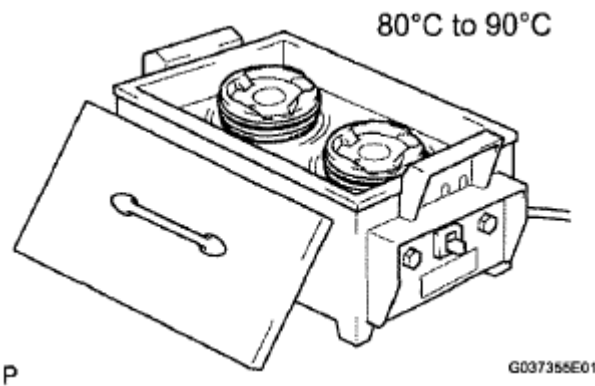


Fig. 392: Heating Piston
Courtesy of ABLE BODY CORP.

3. Coat the piston pin with engine oil.
4. 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.

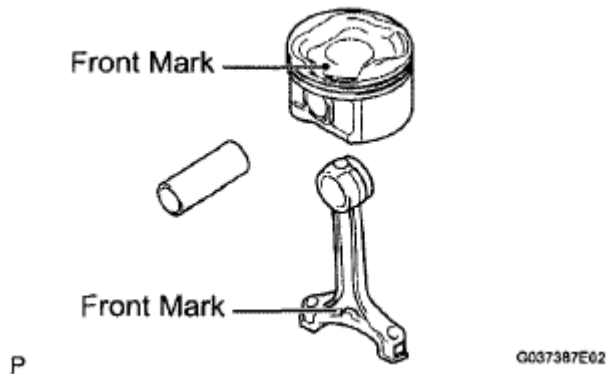


Fig. 393: Aligning Front Marks Of Piston And Connecting Rod, And Push In Piston Pin
Courtesy of ABLE BODY CORP.

5. Check the fitting condition between the piston and piston pin by trying to move the piston back and forth on the piston pin.

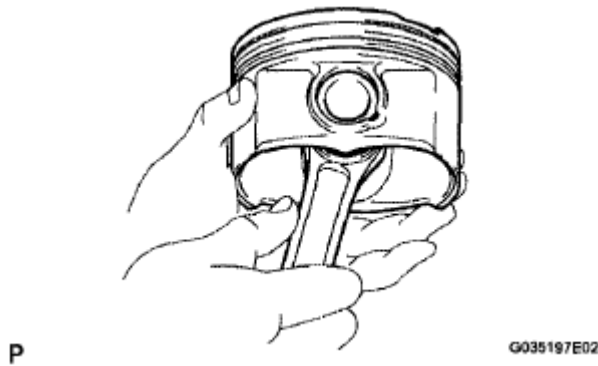


Fig. 394: Checking Fitting Condition Between Piston And Piston Pin
Courtesy of ABLE BODY CORP.

6. Using a screwdriver, install a new snap ring at the other end of the piston pin hole.

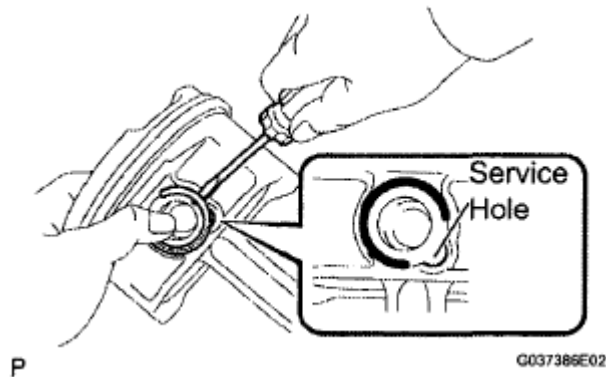


Fig. 395: Installing Snap Ring
Courtesy of ABLE BODY CORP.

12. INSTALL PISTON RING SET

- a. Install the oil ring expander by hand.
- b. Using a piston ring expander, install the oil ring rail.

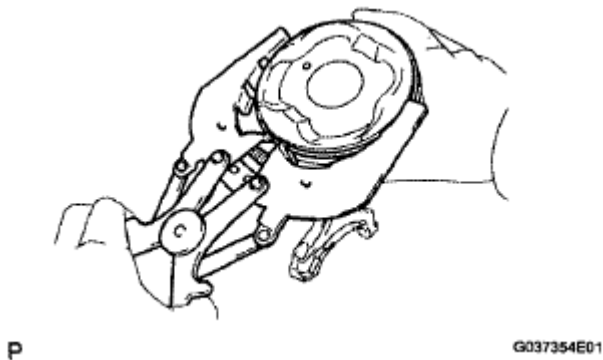


Fig. 396: Installing Oil Ring Rail

Courtesy of ABLE BODY CORP.

- c. Using a piston ring expander, install the 2 compression rings so that the painted marks are positioned as shown in the illustration.

HINT:

- Install the compression ring No.1 with the code mark (1N) facing upward.
- Install the compression ring No.2 with the code mark (2N) facing upward.

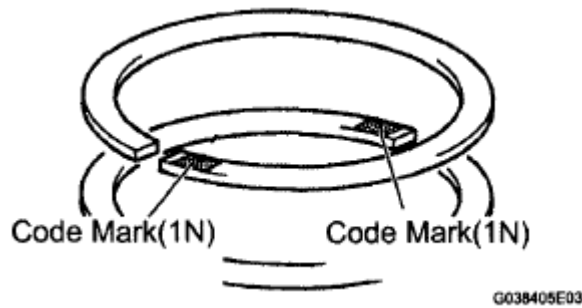


Fig. 397: Identifying Compression Rings Code Mark Installation Position
Courtesy of ABLE BODY CORP.

- d. Position the piston rings so that the ring ends are as shown in the illustration.

NOTE: **Do not align the ring ends.**

13. INSTALL CRANKSHAFT BEARING

- NOTE:**
- **Do not apply engine oil to the bearing's contact area and backside.**
 - **The crankshaft bearing cap bolt is tightened in 2 progressive steps.**

- a. Clean the main journal, and the both surfaces of the bearing.

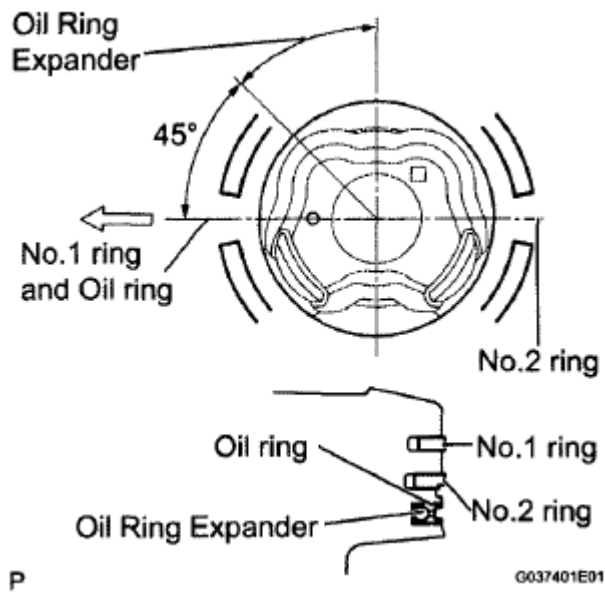
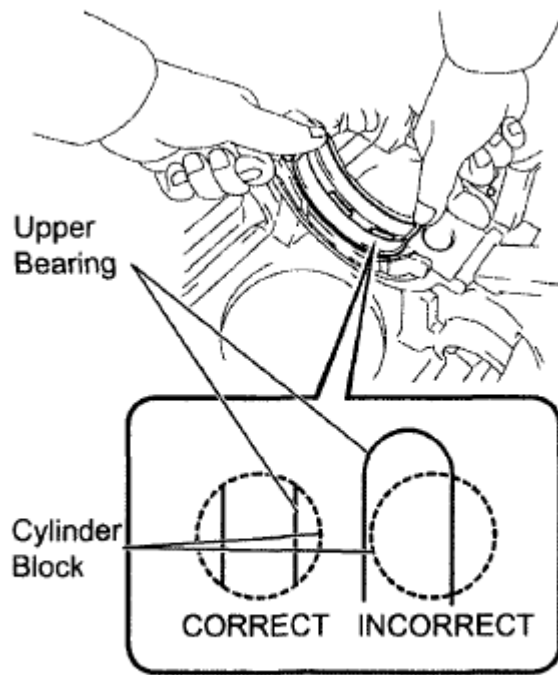


Fig. 398: Positioning Piston Rings
Courtesy of ABLE BODY CORP.

- 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's contact area and backside.



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Fig. 399: Installing Upper Bearing To Cylinder Block
Courtesy of ABLE BODY CORP.

- 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):

0.3 mm (0.0118 in.) or less

HINT:

LOWER BEARING JOURNAL DIMENSION REFERENCE

Journal	Dimension (A)
#1, 5	3.75 mm (0.1476 in.)
#3	1.75 mm (0.0689 in.)
#2, 4	2.75 mm (0.1083 in.)

NOTE: Do not apply engine oil to the bearing's contact area and backside.

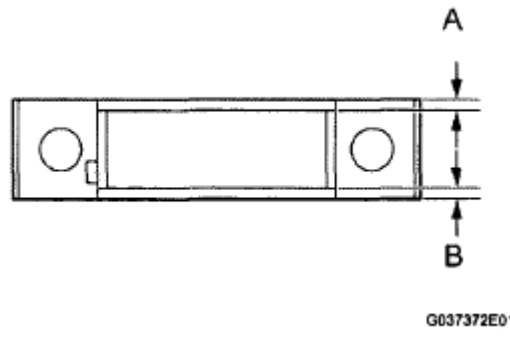


Fig. 400: Measuring Distance Between Bearing Cap's Edge And Lower Bearing's Edge
Courtesy of ABLE BODY CORP.

- d. With the upper bearing and lower bearing installed, use a plastic-faced hammer to install the bearing caps to the cylinder block.

NOTE: Make sure that the bearing caps are installed in the correct positions and direction.

- e. Using vernier calipers, measure the amount of misalignment between the upper bearing and lower bearing, as shown in the illustration.

Standard:

0.9 mm (0.035 in.) or less

- f. Remove the bearing cap.

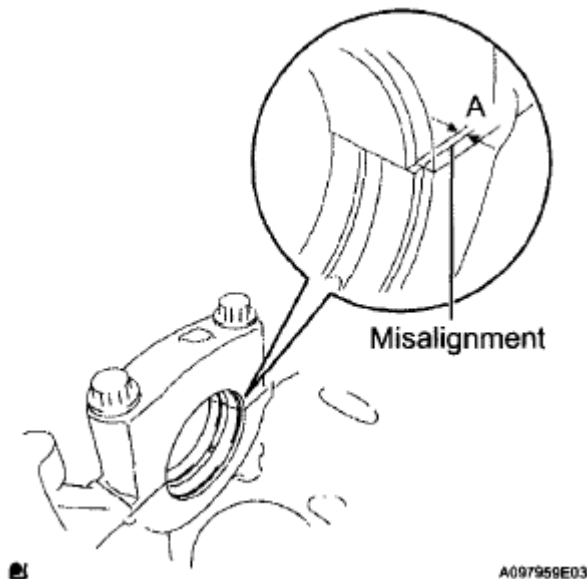


Fig. 401: Measuring Amount Of Misalignment Between Upper Bearing And Lower Bearing
Courtesy of ABLE BODY CORP.

g. Install the crankshaft thrust washer upper to the cylinder block.

1. Install the 2 thrust washers under the No.3 journal position of the cylinder block with the oil grooves facing outward.

NOTE: Be careful when installing the thrust bearing upper and lower as they are similar but cannot be interchanged.

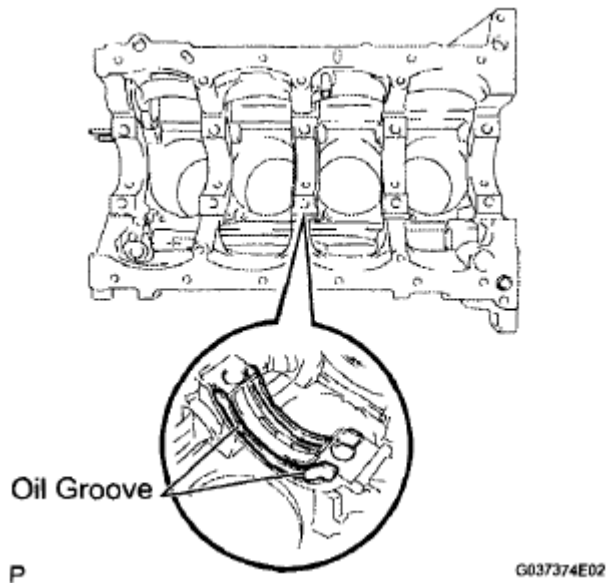


Fig. 402: Installing Crankshaft Thrust Washer Upper To Cylinder Block
Courtesy of ABLE BODY CORP.

2. Install the 2 thrust washers on the No.3 bearing cap with the grooves facing outward.

NOTE: Be careful when installing the thrust bearing upper and lower as they are similar but cannot be interchanged. The bearing lower has a claw as shown in the illustration.

3. Apply engine oil to the lower bearing.

h. **INSTALL CRANKSHAFT**

- a. Apply engine oil to the upper bearing, then place the crankshaft on the cylinder block.

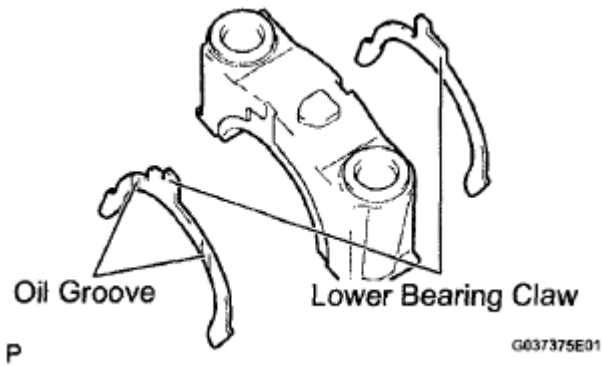


Fig. 403: Installing Thrust Washers On No.3 Bearing Cap
Courtesy of ABLE BODY CORP.

- b. Install the 5 crankshaft bearing caps in their proper locations.

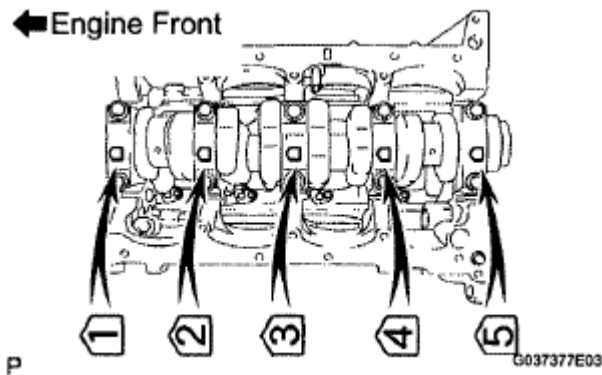


Fig. 404: Identifying Crankshaft Bearing Caps Proper Installation Position
Courtesy of ABLE BODY CORP.

- c. Install the crankshaft bearing cap bolts.

HINT:

The main bearing cap bolts are tightened in 2 progressive steps.

- d. Step 1
1. Install and uniformly tighten the 10 main bearing cap bolts in the sequence shown in the illustration.

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

If any of the main bearing cap bolts does not meet the torque specification, replace the main bearing cap bolt.

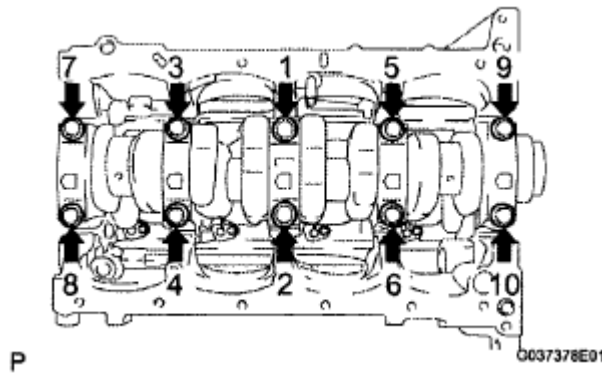


Fig. 405: Identifying Tightening Sequence Of Main Bearing Cap Bolts
Courtesy of ABLE BODY CORP.

- e. Step 2
 - 1. Mark the front of the bearing cap bolts with paint.
 - 2. Retighten the bearing cap bolts by 90° in the order above.
 - 3. Check that the painted mark is now at a 90° angle to the front.
- f. Check that the crankshaft turns smoothly.
- g. Check the crankshaft thrust clearance (see step 5).

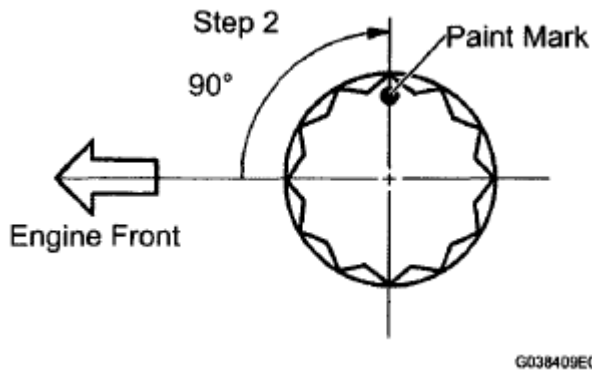


Fig. 406: Marking Front Of Bearing Cap Bolts With Paint
Courtesy of ABLE BODY CORP.

i. INSTALL CONNECTING ROD BEARING

- a. Align the bearing claw with the groove of the connecting rod or connecting cap.
- b. Install the bearings in the connecting rod and connecting rod cap.

NOTE: Clean the backside of the bearing and the bearing surface of the connecting rod.

j. INSTALL PISTON SUB-ASSEMBLY WITH CONNECTING ROD

- a. Apply engine oil to the cylinder walls, the pistons, and the surfaces of connecting rod bearings.

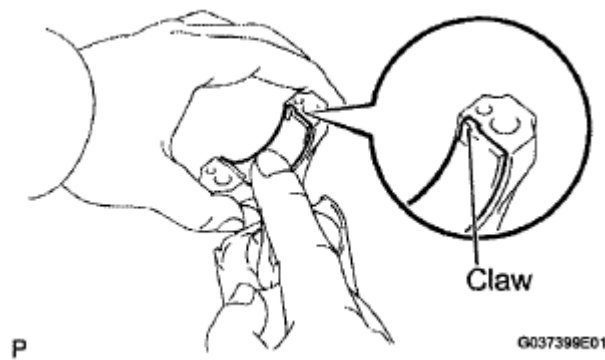


Fig. 407: Aligning Bearing Claw With Groove Of Connecting Rod Or Connecting Cap
Courtesy of ABLE BODY CORP.

- b. Position the piston rings so that the ring ends are as shown in the illustration.

CAUTION: Do not align the ring ends.

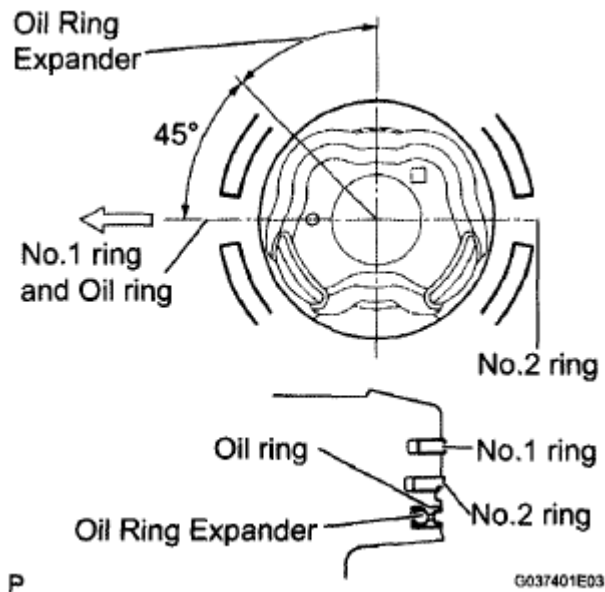


Fig. 408: Positioning Piston Rings
Courtesy of ABLE BODY CORP.

- 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.

NOTE:

- Match the numbered connecting rod cap with the connecting rod.

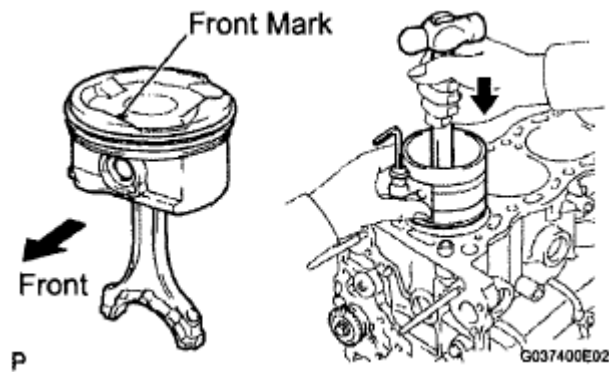


Fig. 409: Pushing Piston
Courtesy of ABLE BODY CORP.

- 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.

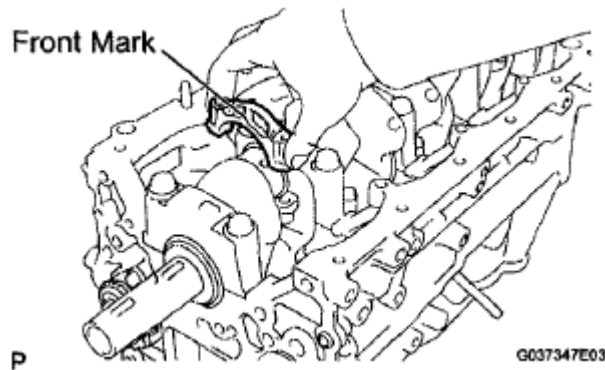


Fig. 410: Checking Front Mark Of Connecting Rod Cap
Courtesy of ABLE BODY CORP.

- g. Install and alternately tighten the bolts of the connecting rod cap in several steps.

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

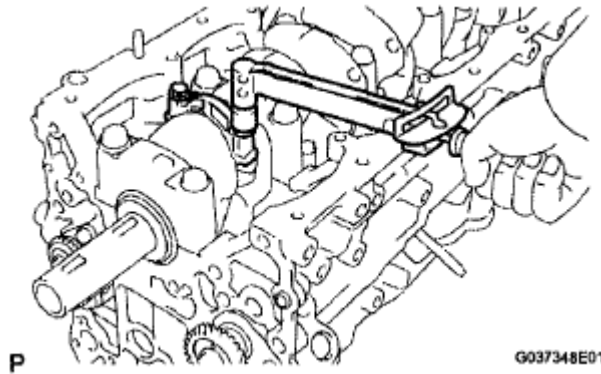


Fig. 411: Removing Bolts And Connecting Rod Cap
Courtesy of ABLE BODY CORP.

- h. Mark the front side of each connecting cap bolt with paint.
- i. Retighten the cap bolts by 90° as shown.
- j. Check that the painted mark is now at a 90° angle to the front.
- k. Check that the crankshaft turns smoothly.
- l. Check the connecting rod thrust clearance (see step 1).

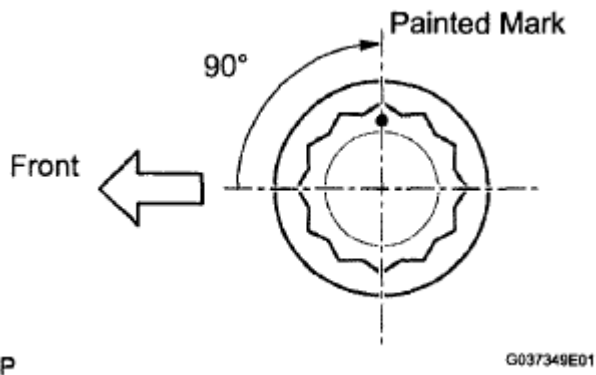


Fig. 412: Marking Front Side Of Each Connecting Cap Bolt With Paint
Courtesy of ABLE BODY CORP.

k. **INSTALL CAMSHAFT BEARING CAP SETTING RING PIN**

NOTE: It is not necessary to remove with head pin unless it is being replaced.

- a. Using a plastic-faced hammer, tap in a new ring pin until the pin stops.

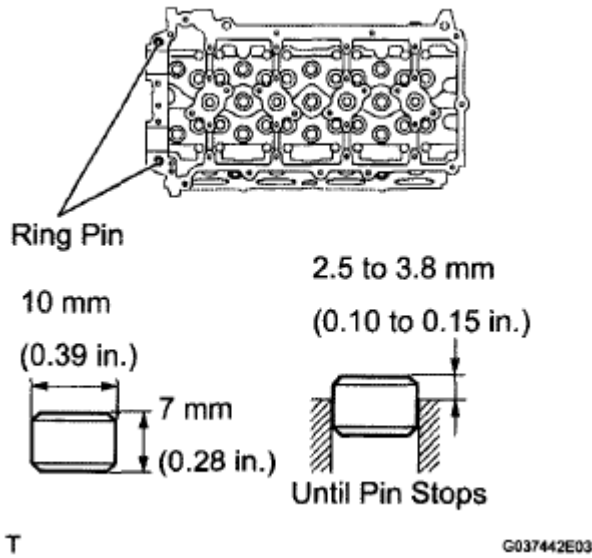


Fig. 413: Identifying Ring Pin Dimension
Courtesy of ABLE BODY CORP.

1. INSTALL NO. 1 TIGHT PLUG

NOTE: If water leaks from the tight plug or the plug corrodes, replace it.

- Apply adhesive to the tight plug hole of the cylinder head.

Adhesive:

Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

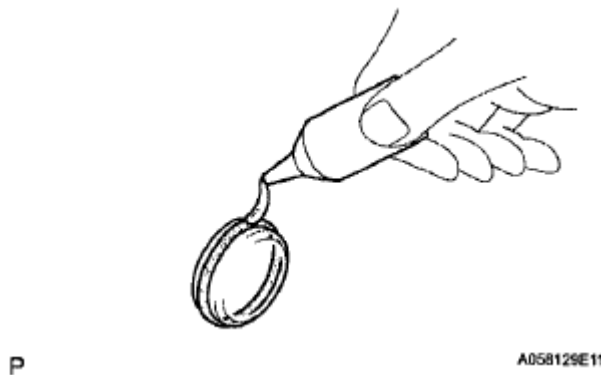


Fig. 414: Applying Adhesive To Tight Plug Hole Of Cylinder Head
Courtesy of ABLE BODY CORP.

- Using SST, tap in a new tight plug to the cylinder head as shown in the illustration.

SST 09950-60010 (09951-00250), 09950-70010 (09951-07100)

m. **INSTALL STUD BOLT**

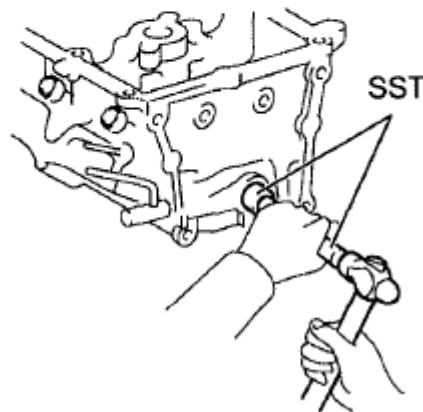
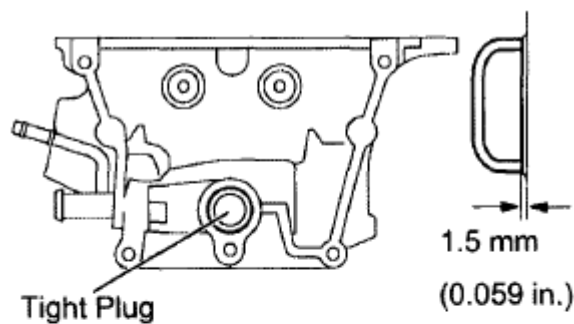
NOTE: If the stud bolt is deformed or the threads are damaged, replace it.

- a. Using E6 and E7 "torx" socket wrenchs, install the stud bolts.

Torque: 3.0 N*m (31 kgf*cm, 27 in.*lbf) for stud bolt A

7.5 N*m (76 kgf*cm, 66 in.*lbf) for stud bolt B

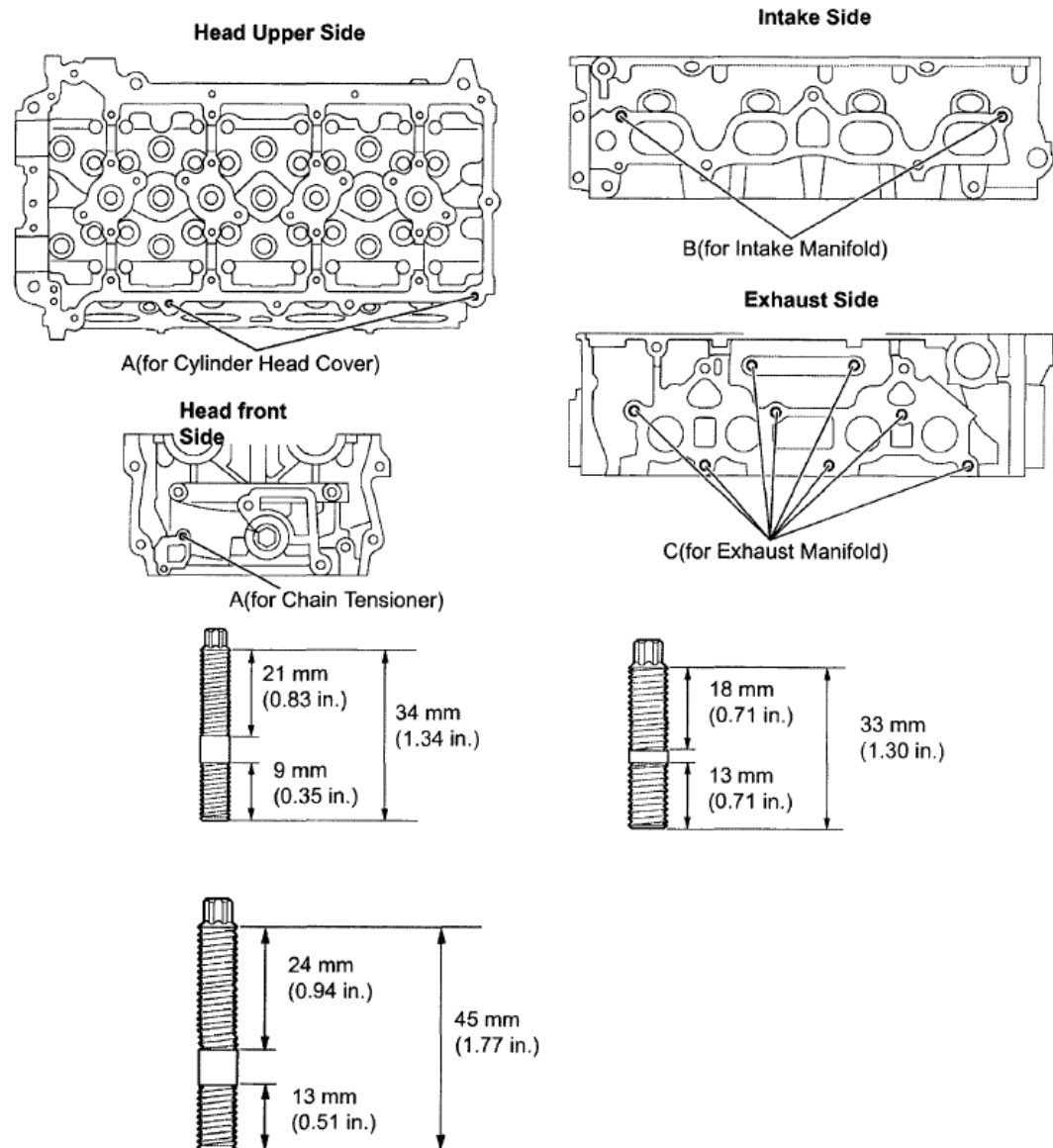
9.5 N*m (97 kgf*cm, 84 in.*lbf) for stud bolt C



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Fig. 415: Tapping Tight Plug To Cylinder Head
Courtesy of ABLE BODY CORP.



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Fig. 416: Identifying Stud Bolt Installation Location And Dimension
Courtesy of ABLE BODY CORP.

n. INSTALL NO. 1 WITH HEAD STRAIGHT SCREW PLUG

- a. Using a 10 mm hexagon wrench, install 3 new gaskets and the straight screw plugs.

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

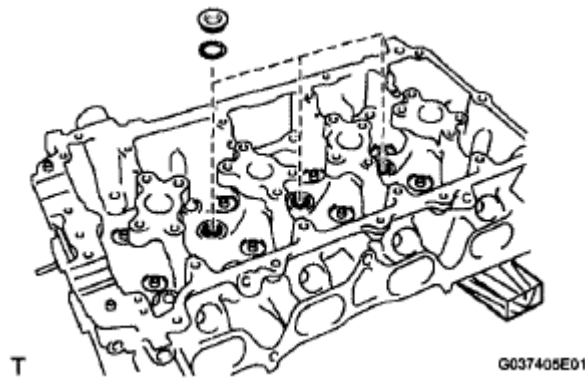


Fig. 417: Identifying Gaskets And Straight Screw Plugs
Courtesy of ABLE BODY CORP.

o. INSTALL NO. 2 WITH HEAD STRAIGHT SCREW PLUG

- a. Using a 19 mm hexagon wrench, install a new gasket and the straight screw plug.

Torque: 90 N*m (918 kgf*cm, 66 ft.*lbf)

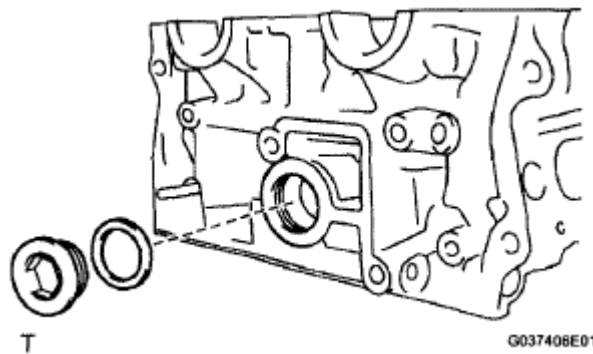


Fig. 418: Identifying Gasket And Straight Screw Plug
Courtesy of ABLE BODY CORP.

p. INSTALL OIL CONTROL VALVE FILTER

- a. Check that no foreign matter is on the mesh part of the filter.

If foreign objects are present, clean the part thoroughly.

- b. Using a 8 mm hexagon wrench, install a new gasket and the oil control valve filter with the screw plug.

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

q. INSTALL VALVE SPRING SEAT

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

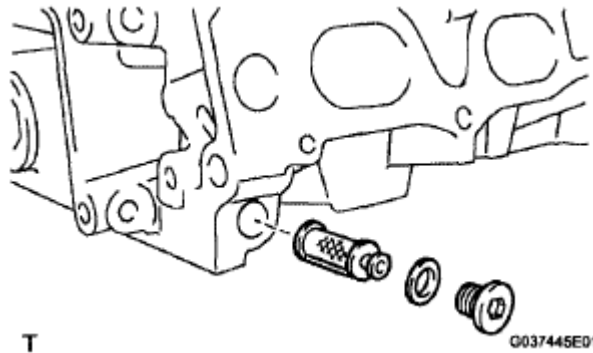


Fig. 419: Identifying Valve Spring Seats To Cylinder Head
Courtesy of ABLE BODY CORP.

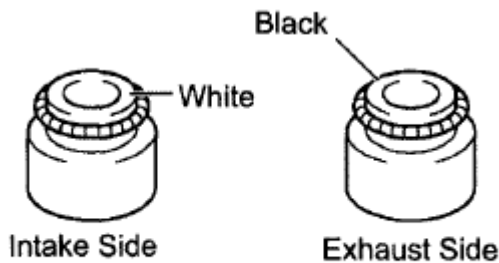
r. INSTALL VALVE STEM OIL SEAL

- 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.



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Fig. 420: Identifying Oil Seal
Courtesy of ABLE BODY CORP.

- 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.

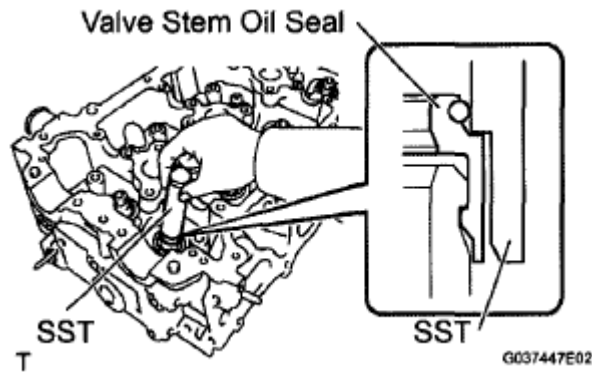


Fig. 421: Pushing Oil Seals
Courtesy of ABLE BODY CORP.

s. **INSTALL INTAKE VALVE**

- a. Apply plenty of engine oil to the tip area of the intake valve shown in the illustration.

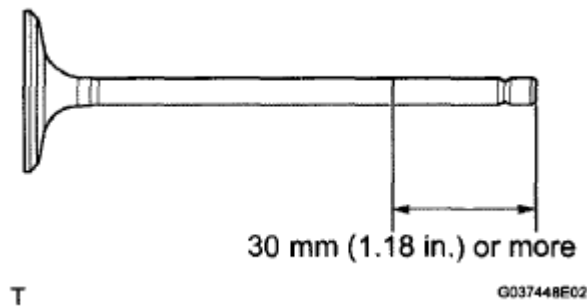


Fig. 422: Identifying Tip Area Of Intake Valve
Courtesy of ABLE BODY CORP.

- 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.

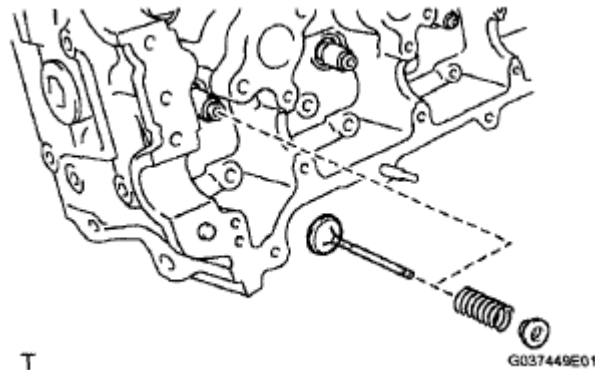


Fig. 423: Identifying Valve, Compression Spring And Spring Retainer To Cylinder

Head

Courtesy of ABLE BODY CORP.

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

SST 09202-70020 (09202-00010)

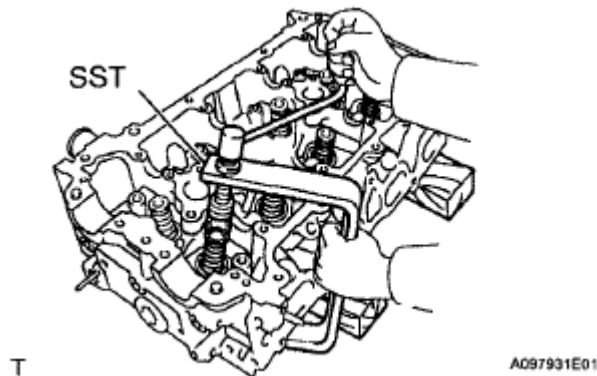


Fig. 424: Compressing Spring
Courtesy of ABLE BODY CORP.

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

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

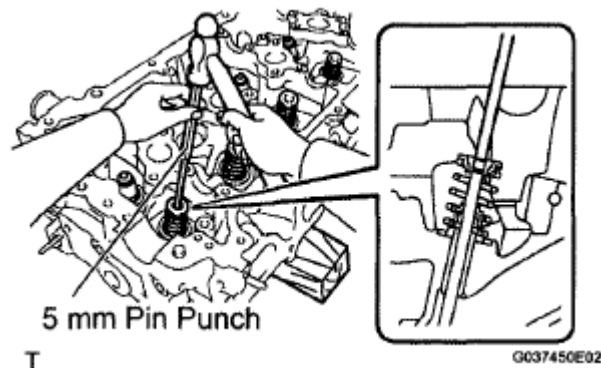


Fig. 425: Tapping Valve Stem Tip
Courtesy of ABLE BODY CORP.

t. INSTALL EXHAUST VALVE

- a. Apply plenty of engine oil to the tip area of the intake valve shown in the illustration.

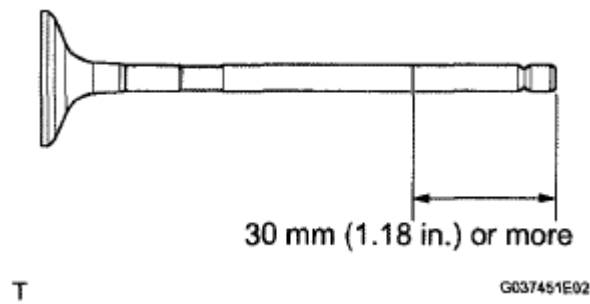


Fig. 426: Identifying Tip Area Of Exhaust Valve
Courtesy of ABLE BODY CORP.

- 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.

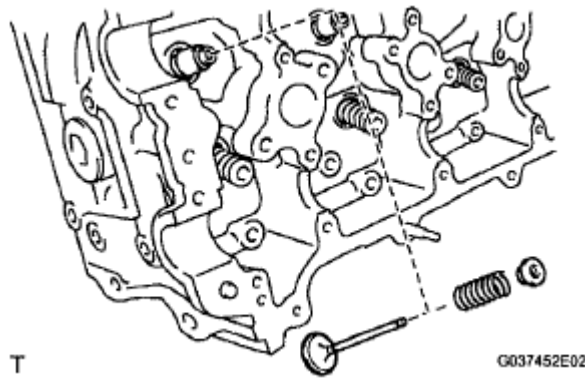


Fig. 427: Identifying Valve, Compression Spring And Spring Retainer To Cylinder Head
Courtesy of ABLE BODY CORP.

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

SST 09202-70020 (09202-00010)

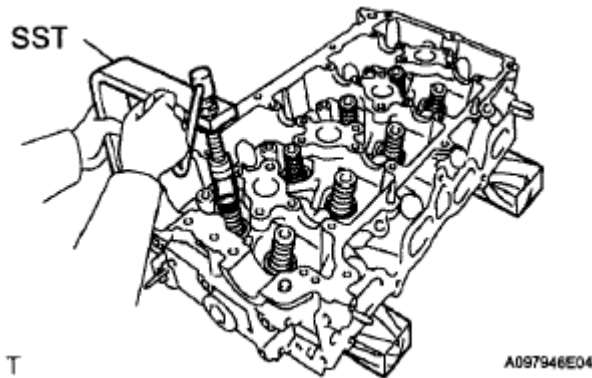


Fig. 428: Compressing Spring
Courtesy of ABLE BODY CORP.

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

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

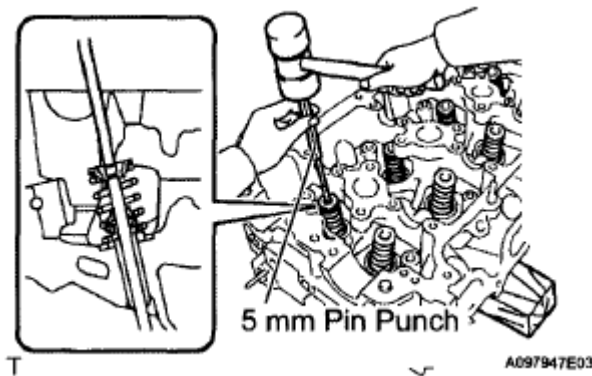


Fig. 429: Tapping Valve Stem Tip
Courtesy of ABLE BODY CORP.

u. **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 the 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.

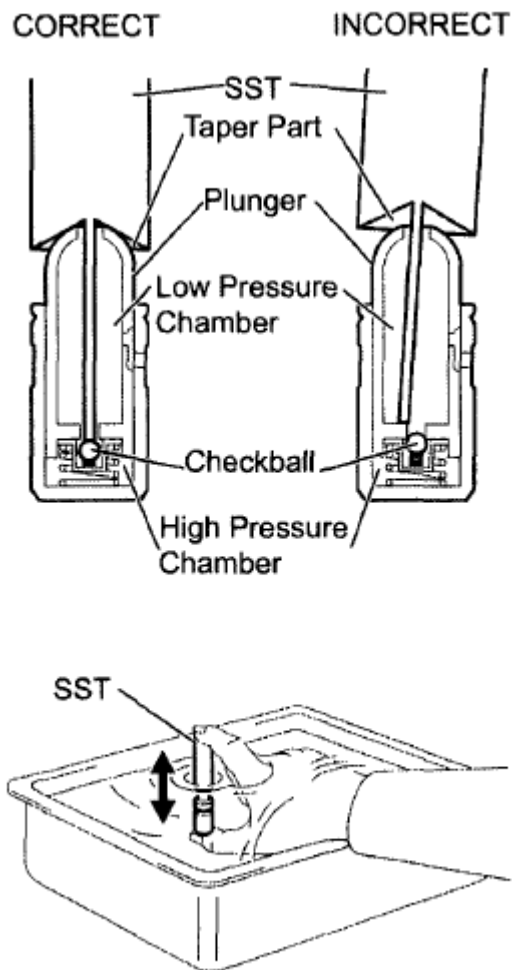
NOTE: When bleeding high-pressure air from the compression chamber, make sure that the tip of the SST is actually pressing the checkball as shown in the illustration. If the checkball is not pressed, air will not bleed.

- e. After bleeding the air, remove the 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.



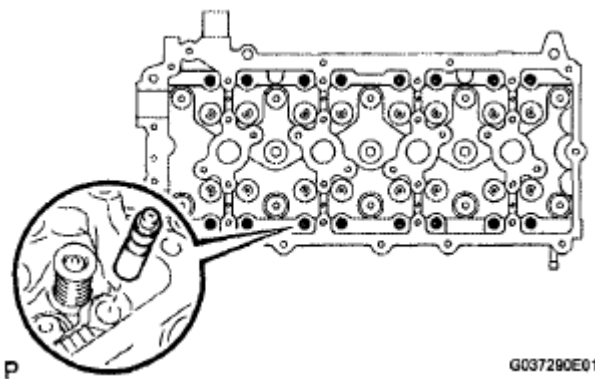
P

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Fig. 430: Inserting SST's Tip Into Lash Adjuster's Plunger
Courtesy of ABLE BODY CORP.

- f. Install the lash adjusters.

NOTE: Install the lash adjuster to the original position.



P

G037290E01

Fig. 431: Identifying Lash Adjusters
Courtesy of ABLE BODY CORP.

v. 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.

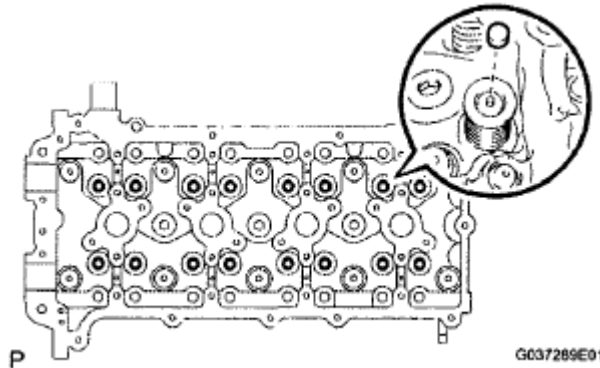


Fig. 432: Identifying Valve Stem Caps To Cylinder Head
Courtesy of ABLE BODY CORP.

w. INSTALL CRANKSHAFT PULLEY SET CRANKSHAFT KEY

- a. Install the 2 pulley keys to the crankshaft.

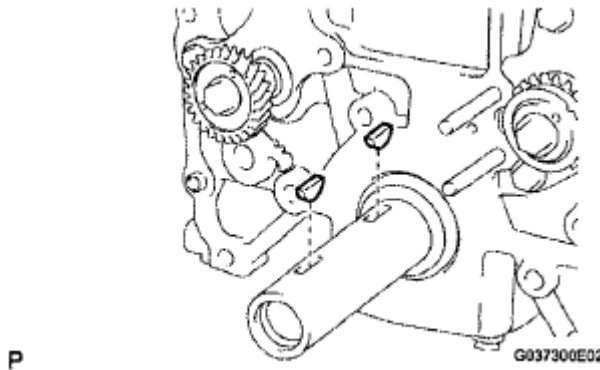


Fig. 433: Installing Pulley Keys To Crankshaft
Courtesy of ABLE BODY CORP.

x. INSTALL NO. 4 CHAIN VIBRATION DAMPER

- a. Install the vibration damper No.4 with the 2 bolts.

Torque: 18 N*m (185 kgf*cm, 13 ft.*lbf)

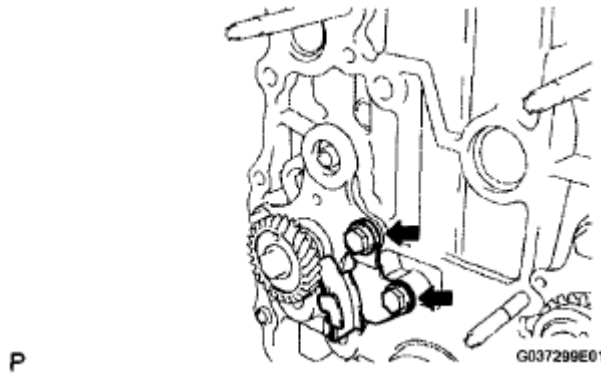


Fig. 434: Locating Vibration Damper No. With Bolts
Courtesy of ABLE BODY CORP.

y. **INSTALL NO.2 CHAIN SUB-ASSEMBLY**

- a. Install the timing sprocket No.2 as shown in the illustration.

NOTE: Check that the No.1 cylinder is at TDC and that the weights of the No.1 and No.2 balancershafts are at the bottom side.

HINT:

Install the sensor plate with the front mark facing forward.

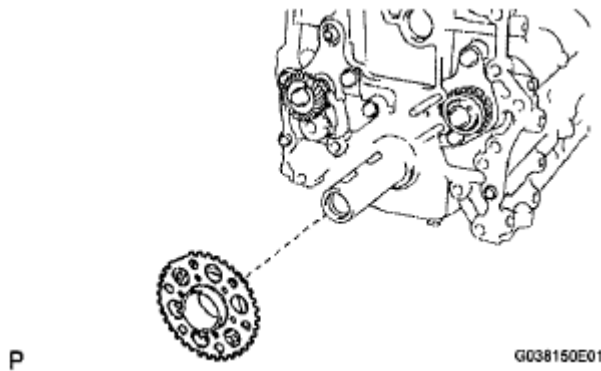


Fig. 435: Identifying Timing Sprocket No.2
Courtesy of ABLE BODY CORP.

- b. As shown in the illustration, install the chain on the sprocket and gear with the painted marks aligned with the timing marks on the sprocket and gear.

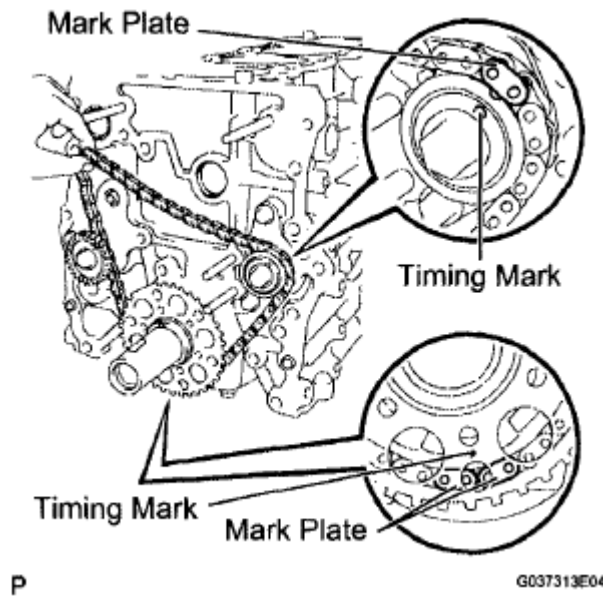


Fig. 436: Installing Chain On Sprocket And Gear
Courtesy of ABLE BODY CORP.

- c. Fit the other mark link of the crankshaft timing sprocket behind the large timing mark of the balancer shaft drive gear.
- d. Insert the balancer shaft drive gear shaft through the balancer shaft drive gear so that it fits into the thrust plate hole.

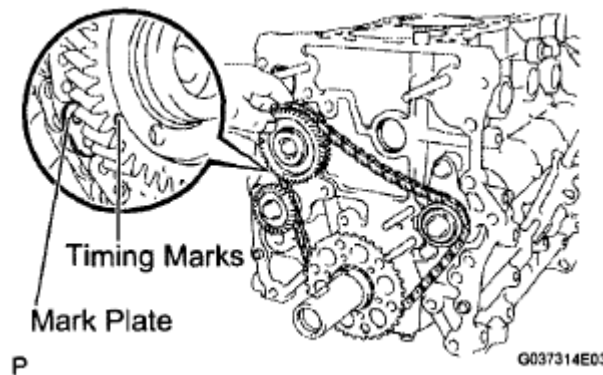


Fig. 437: Fitting Other Mark Link Of Crankshaft Timing Sprocket
Courtesy of ABLE BODY CORP.

- e. Align the small timing mark of the balancer shaft drive gear with the timing mark of the balancer shaft timing gear.
- f. Install the bolt to the balancer shaft drive gear and tighten it.

Torque: 25 N*m (255 kgf*cm, 18 ft.*lbf)

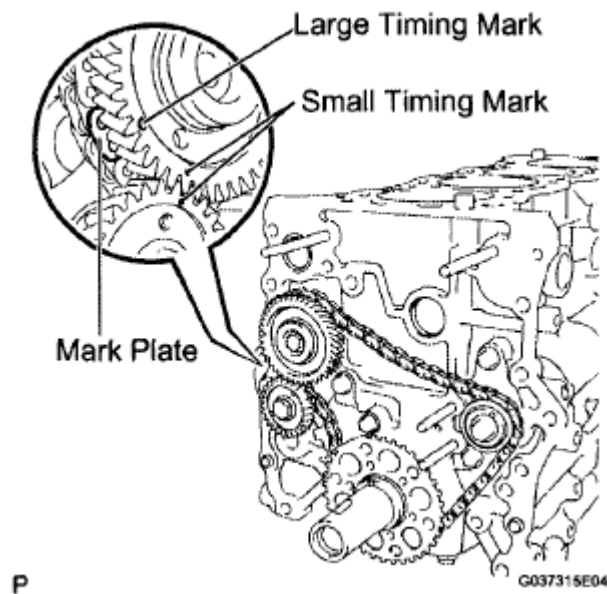


Fig. 438: Aligning Small Timing Mark Of Balanceshaft Drive Gear With Timing Mark Of Balanceshaft Timing Gear
 Courtesy of ABLE BODY CORP.

- g. Check that each timing mark is matched with the corresponding mark link.

NOTE: Check that the No.1 cylinder is at TDC and that the weights of the No.1 and No.2 balancershafts are at the bottom side.

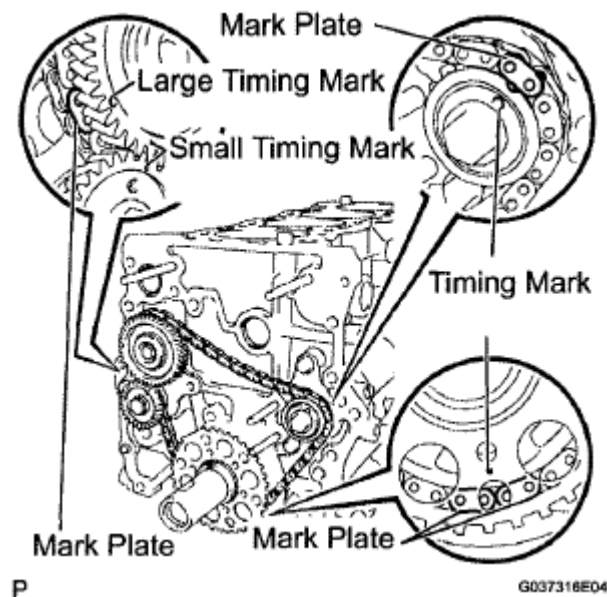


Fig. 439: Checking Timing Mark Is Matched With Corresponding Mark Link
 Courtesy of ABLE BODY CORP.

- z. **INSTALL NO. 2 CHAIN TENSIONER ASSEMBLY** (a) Install the chain tensioner assembly No.2 with the nut.

Torque: 18 N*m (185 kgf*cm, 13 ft.*lbf)

NOTE: Assemble the chain tensioner with the pin installed, then remove the pin after assembly. When doing this, avoid pushing the vibration damper against the chain.

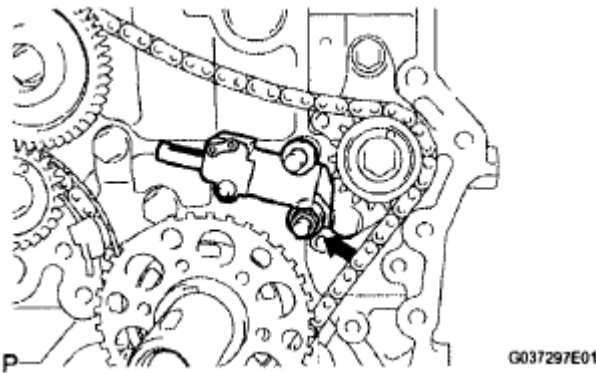


Fig. 440: Locating Chain Tensioner Assembly No.2 With Nut
Courtesy of ABLE BODY CORP.

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

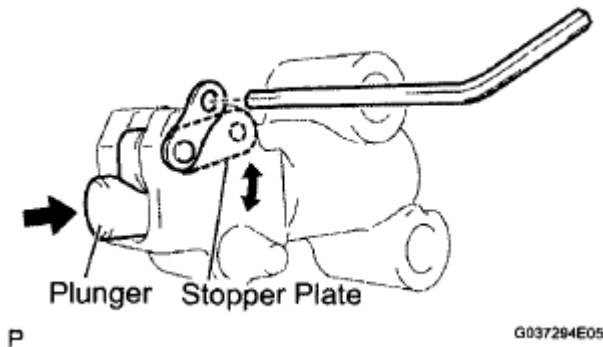


Fig. 441: Moving Stopper Plate
Courtesy of ABLE BODY CORP.

14. **INSTALL NO. 3 CHAIN VIBRATION DAMPER**

- a. Install the chain vibration damper No.3 with the 2 bolts.

Torque: 18 N*m (185 kgf*cm, 13 ft.*lbf)

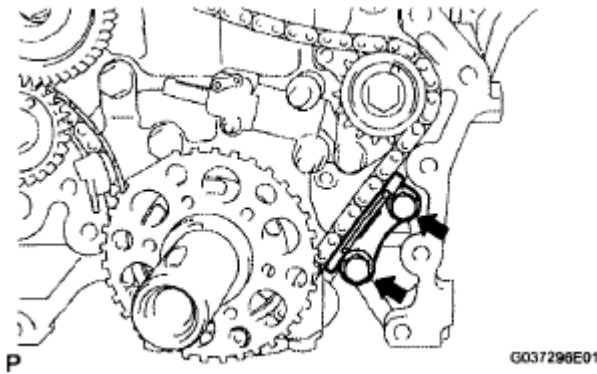


Fig. 442: Locating Chain Vibration Damper No.3 With Bolts
Courtesy of ABLE BODY CORP.

15. INSTALL NO. 2 CHAIN VIBRATION DAMPER

- a. Install the chain vibration damper No.2 with the bolt.

Torque: 27 N*m (270 kgf*cm, 20 ft.*lbf)

- b. Remove a pin from the chain tensioner assy No.2 and release the plunger.

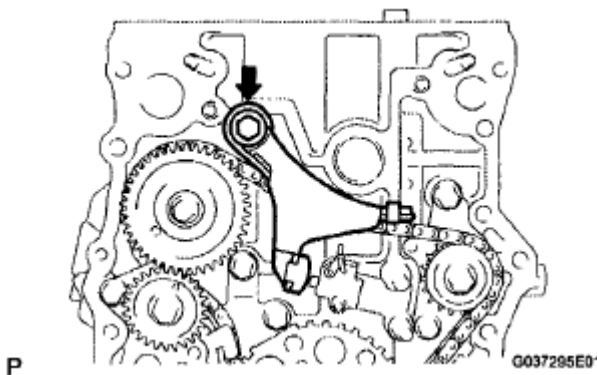


Fig. 443: Locating Chain Vibration Damper No.2 With Bolt
Courtesy of ABLE BODY CORP.

16. INSTALL NO. 1 WITH HEAD TAPER SCREW PLUG

- a. Install the screw plug No. 1 to the cylinder block.

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

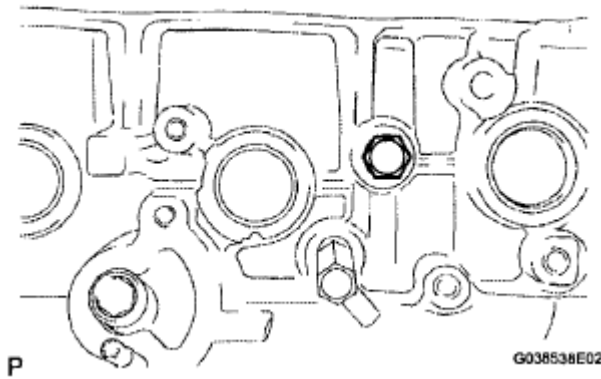


Fig. 444: Locating Screw Plug No.1 To Cylinder Block
Courtesy of ABLE BODY CORP.

17. INSTALL OIL FILTER BRACKET SUB-ASSEMBLY

- a. Using a hexagon wrench, install the oil filter bracket union.

Torque: 25 N*m (255 kgf*cm, 18 ft.*lbf)

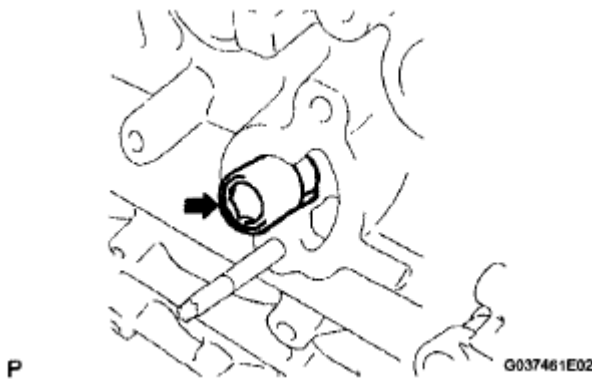


Fig. 445: Locating Oil Filter Bracket Union
Courtesy of ABLE BODY CORP.

- b. Install a new oil filter bracket gasket to the oil filter bracket.
- c. Install a new O-ring to the oil filter bracket union.

NOTE: Apply a light coat of engine oil to the new O-ring and oil filter bracket.

- d. Install 2 new gaskets and the 2 screw plugs to the oil filter bracket.

Torque: 49 N*m (500 kgf*cm, 36 ft.*lbf)

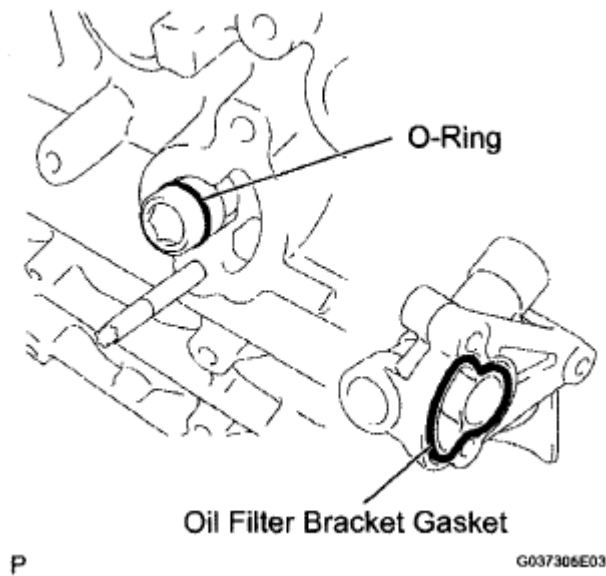


Fig. 446: Locating O-Ring To Oil Filter Bracket Union
Courtesy of ABLE BODY CORP.

- e. Install the oil filter bracket with the 2 bolts and nut.

Torque: 25 N*m (255 kgf*cm, 18 ft.*lbf)

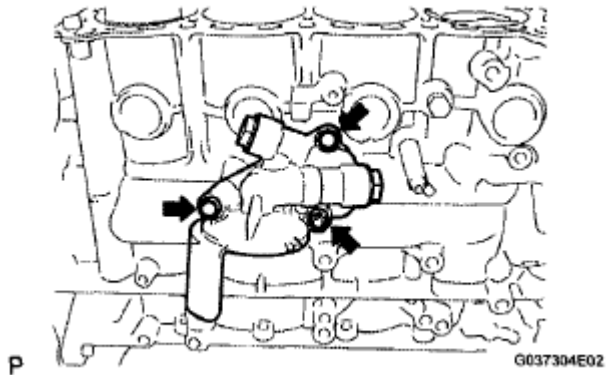


Fig. 447: Locating Oil Filter Bracket With Bolts And Nut
Courtesy of ABLE BODY CORP.

- f. Using a 27 mm socket wrench, install the oil filter union.

Torque: 43 N*m (439 kgf*cm, 32 ft.*lbf)

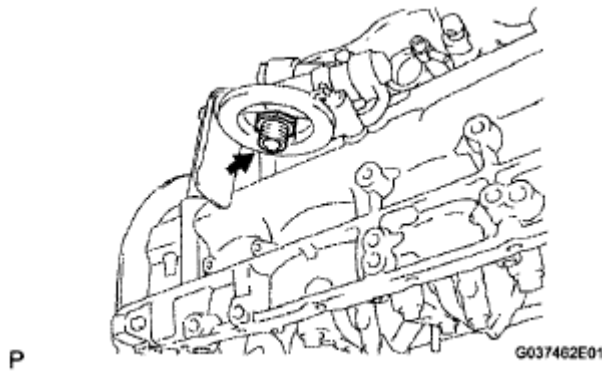


Fig. 448: Locating Oil Filter Union
Courtesy of ABLE BODY CORP.

18. INSTALL OIL FILTER SUB-ASSEMBLY

- a. Check and clean the oil filter installation surface.
- b. Apply clean engine oil to the gasket of a new oil filter.
- c. Lightly screw the oil filter into place, and tighten it until the gasket contacts the seat.
- d. Using SST, tighten the oil filter.

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1. When using a torque wrench: Using a torque wrench, tighten the oil filter.

Torque: 17 N*m (175 kgf*cm, 13 ft.*lbf)

2. When not using a torque wrench: Tighten it an additional 3/4 turn.

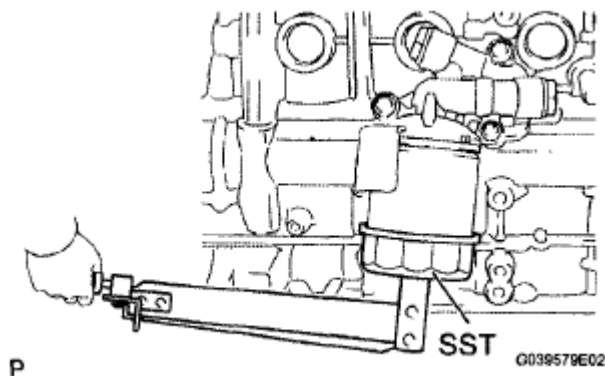


Fig. 449: Tightening Oil Filter
Courtesy of ABLE BODY CORP.

19. 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 width:

2 to 3 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 4 hours after installing.**

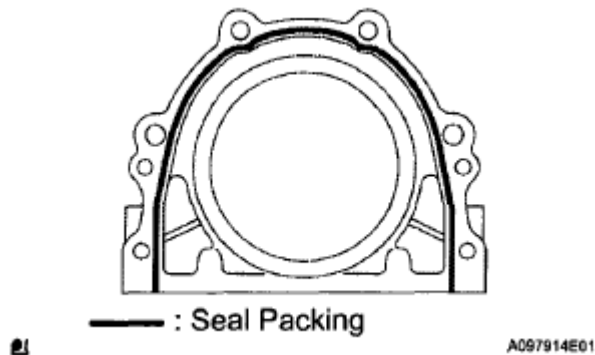


Fig. 450: Identifying Seal Packing Applying Area
Courtesy of ABLE BODY CORP.

- b. Install the oil seal retainer with the 6 bolts.

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

20. INSTALL CYLINDER HEAD GASKET

- a. Apply a continuous bead (seal width: 4 to 7 mm (0.15 to 0.28 in.)) of seal packing to the cylinder block upper side and cylinder head gasket upper side as shown in the illustration.

Seal packing:

Toyota Genuine Seal Packing 1282B, Three Bond 1282B or equivalent

Seal width:

4 to 7 mm (0.15 to 0.28 in.)

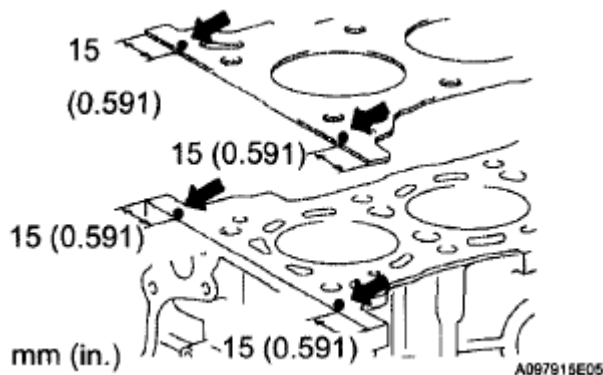


Fig. 451: Applying Continuous Bead Of Seal Packing To Cylinder Block Upper Side
Courtesy of ABLE BODY CORP.

NOTE:

- Remove any oil from the contact surface.
- Install the cylinder head gasket within 3 minutes after applying the seal packing.
- Install the cylinder head bolt within 15 minutes after applying the seal packing.
- Do not put into engine oil within 4 hours of installation.

- b. Install a new cylinder head gasket on the cylinder block surface with the Lot No. stamp upper side facing upward.

NOTE:

- Make sure that the installation direction is correct.
- Place the cylinder head gently to avoid damaging the gasket with the bottom part of the head.

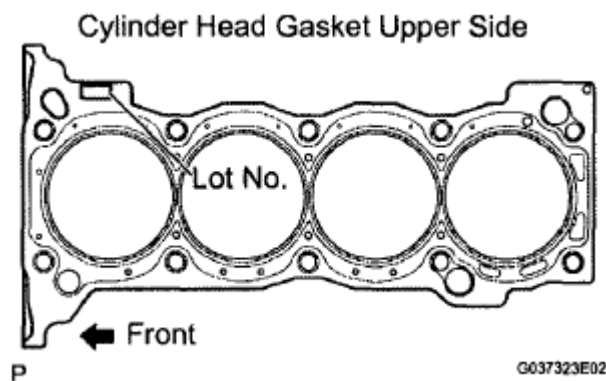


Fig. 452: Identifying Cylinder Head Gasket Upper Side
Courtesy of ABLE BODY CORP.

21. INSTALL CYLINDER HEAD SUB-ASSEMBLY

HINT:

The cylinder head bolts are tightened in 3 progressive steps.

- a. Place the cylinder head on the cylinder block.
- b. Apply a light coat of engine oil to the threads and under the heads of the cylinder head bolts.
- c. Step 1
 1. Install and uniformly tighten the 10 cylinder head bolts with the plate washers, in several steps, in the sequence shown.

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

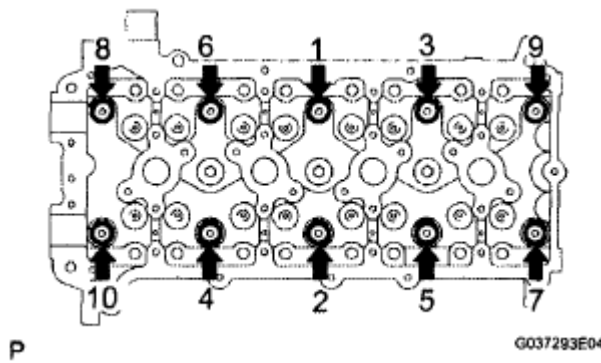


Fig. 453: Identifying Tightening Sequence Of Cylinder Head Bolts
Courtesy of ABLE BODY CORP.

- d. Step 2
 1. Mark the cylinder head bolt head with paint as shown in the illustration.
 2. Retighten the cylinder head bolts by 90°.
- e. Step 3
 1. Retighten the cylinder head bolts by an additional 90°.
 2. Check that the painted mark is now facing rearward.

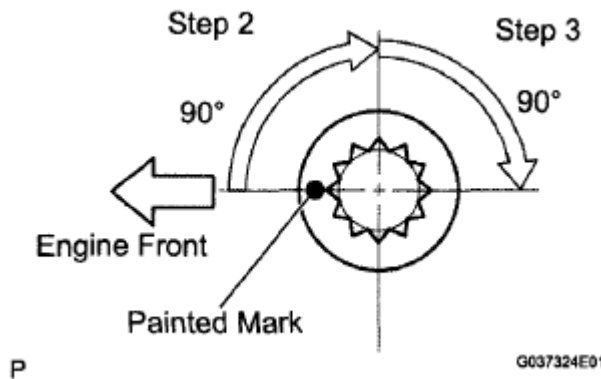


Fig. 454: Marking Cylinder Head Bolt Head With Paint

Courtesy of ABLE BODY CORP.

- f. Seal packing will seep out on the engine's front side. Thoroughly wipe clean any seal packing.

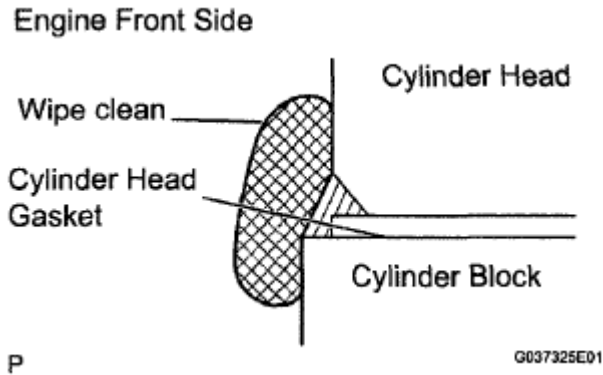


Fig. 455: Identifying Seal Packing Of Engine's Front Side
Courtesy of ABLE BODY CORP.

22. INSTALL CAMSHAFT TIMING SPROCKET

- a. Clamp the camshaft in a vise and then install the camshaft timing sprocket to the camshaft with the sprocket bolt.

Torque: 78 N*m (795 kgf*cm, 58 ft.*lbf)

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

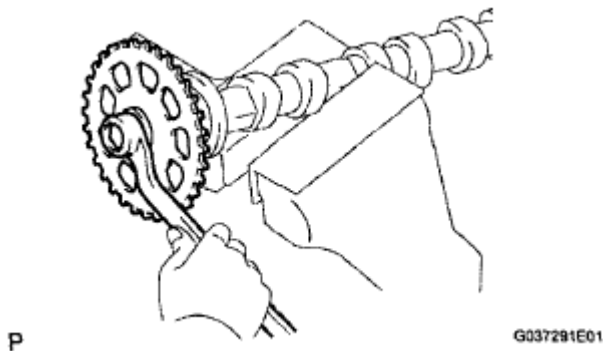


Fig. 456: Removing Sprocket Bolt And Camshaft Timing Sprocket
Courtesy of ABLE BODY CORP.

23. INSTALL CAMSHAFT TIMING GEAR ASSEMBLY

- a. Put the camshaft timing gear and camshaft together by aligning the key groove and straight pin.
- b. 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).

- c. Check that there is no clearance between the gear's fringe and the camshaft.
- d. Tighten the fringe bolt with the camshaft timing gear fixed.

Torque: 78 N*m (795 kgf*cm, 58 ft.*lbf)

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

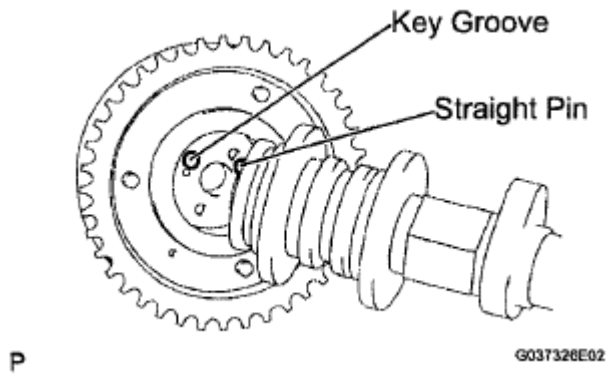


Fig. 457: Putting Camshaft Timing Gear And Camshaft
Courtesy of ABLE BODY CORP.

24. INSTALL NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY

- a. Set the 16 rocker arms to the lash adjusters.

NOTE: Before and after setting the camshaft and No.2 camshaft, firmly set the rocker arm to the lash adjuster.

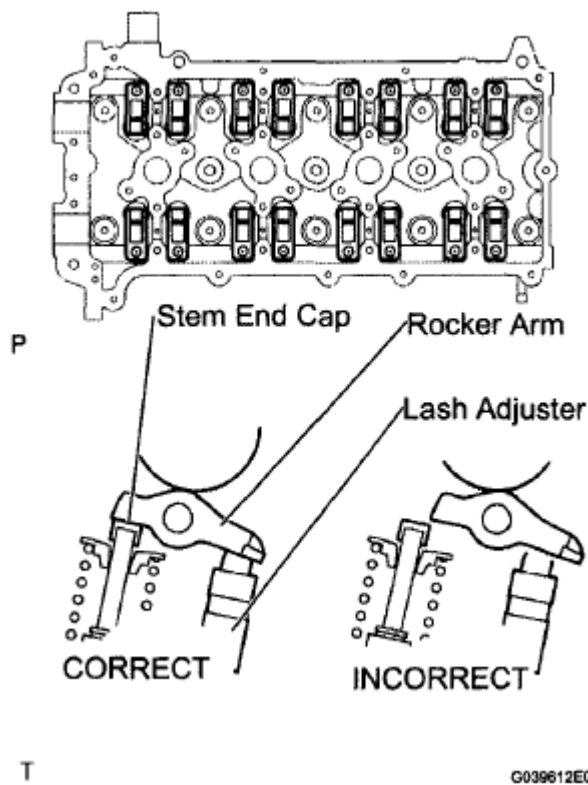


Fig. 458: Setting Rocker Arms To Lash Adjusters
Courtesy of ABLE BODY CORP.

25. INSTALL CAMSHAFTS

- Apply clean engine oil to the camshaft's cam portion and the cylinder head journals.
- Set the camshaft and No.2 camshaft as shown in the illustration.

NOTE: Before and after setting the camshaft and No.2 camshaft, firmly set the rocker arm to the lash adjuster.

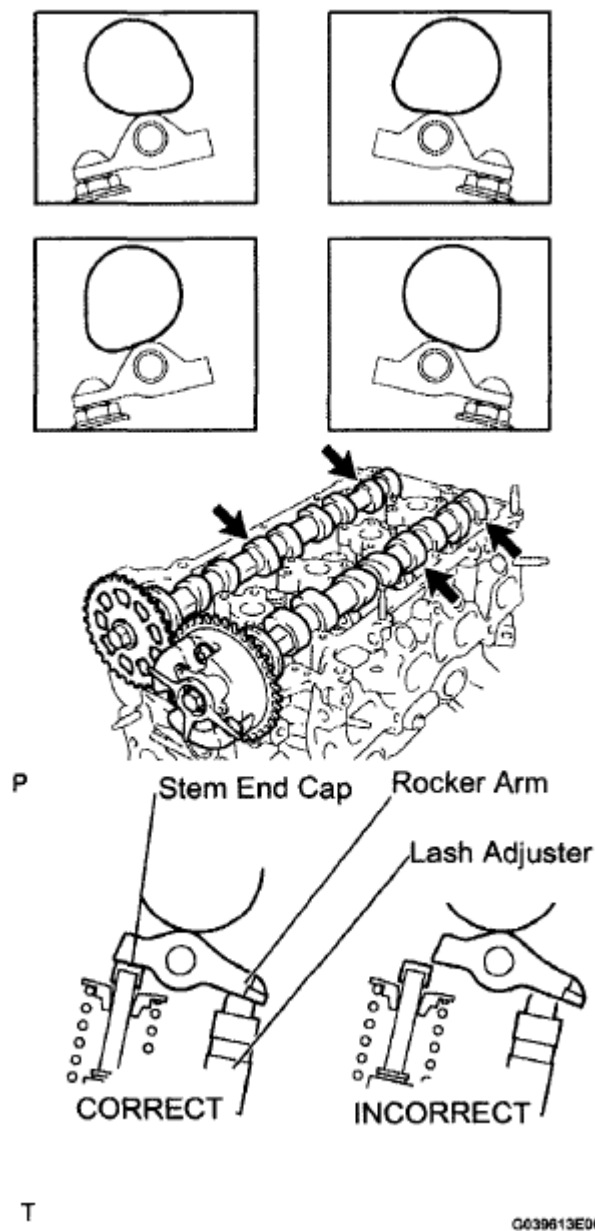


Fig. 459: Locating Camshafts Lobe Position
Courtesy of ABLE BODY CORP.

26. INSTALL CAMSHAFT BEARING CAP

- Temporarily install the camshaft bearing cap No.1.
- Check the proper location of each camshaft bearing cap No.2 and install them.

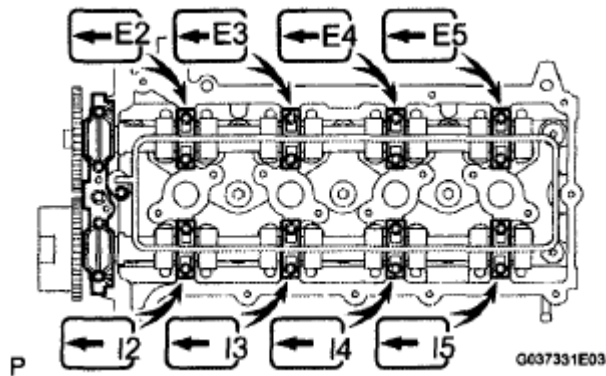


Fig. 460: Installing Camshaft Bearing Cap No.1
Courtesy of ABLE BODY CORP.

- c. Install a new O-ring to the camshaft bearing cap No.1.
- d. Temporarily install the oil delivery pipe.

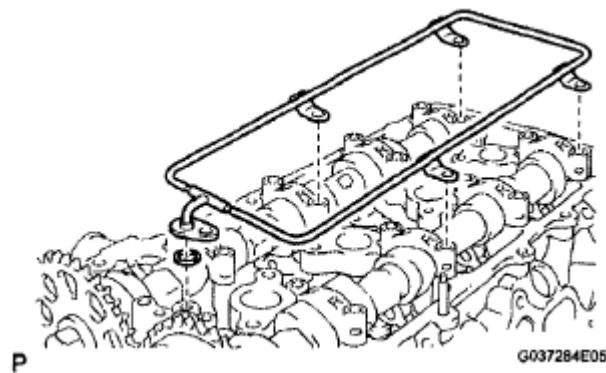


Fig. 461: Identifying Camshaft Oil Delivery Pipe
Courtesy of ABLE BODY CORP.

- e. Tighten the 21 bolts and 20 washers in the order shown in the illustration.

Torque: 12 N*m (122 kgf*cm, 9 ft.*lbf) for bolt A 16 N*m (160 kgf*cm, 11 ft.*lbf) for except bolt A

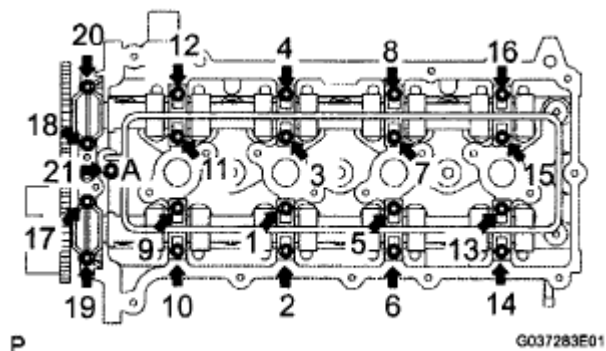


Fig. 462: Identifying Tightening Sequence Of Bolts
Courtesy of ABLE BODY CORP.

27. INSTALL CRANKSHAFT TIMING SPROCKET

- a. Install the timing sprocket as shown in the illustration.

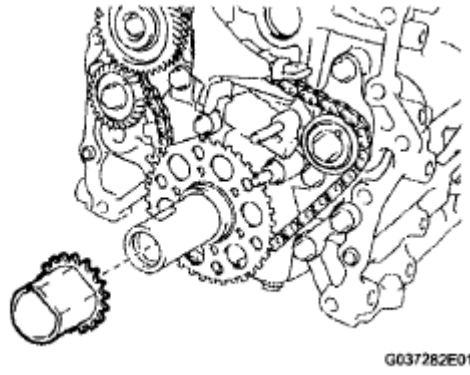


Fig. 463: Installing Timing Sprocket
Courtesy of ABLE BODY CORP.

28. INSTALL NO. 1 CHAIN VIBRATION DAMPER

- a. Install the vibration damper with the bolt and nut.

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

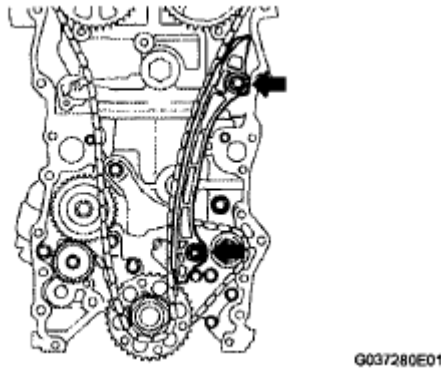


Fig. 464: Locating Vibration Damper With Bolt And Nut
Courtesy of ABLE BODY CORP.

29. INSTALL CHAIN SUB-ASSEMBLY

- a. As shown in the illustration, install the chain on the sprocket and gear with the painted marks aligned with the timing marks on the sprocket and gear.

HINT:

- The camshaft mark plate is yellow.

- The crankshaft mark plate is orange.

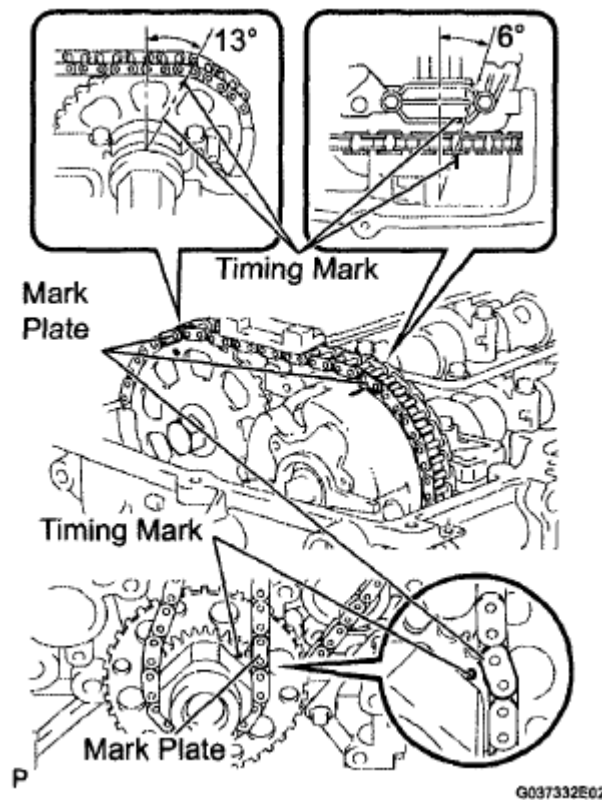


Fig. 465: Aligning Timing Marks On Sprocket And Gear
 Courtesy of ABLE BODY CORP.

- Use a rope to tie the chain of the crankshaft timing sprocket. Tie the rope near the sprocket.

NOTE: After the chain tensioner has been installed, the rope must be removed.

HINT:

The rope is tied so that the chain will not jump a tooth.

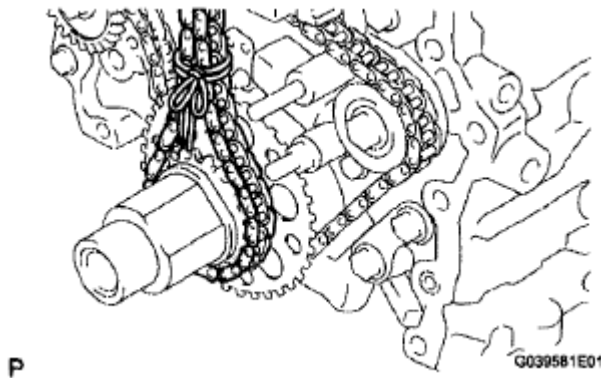


Fig. 466: Tying Chain Of Crankshaft Timing Sprocket
Courtesy of ABLE BODY CORP.

30. INSTALL CHAIN TENSIONER SLIPPER

- a. Install the tensioner slipper with the bolt.

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

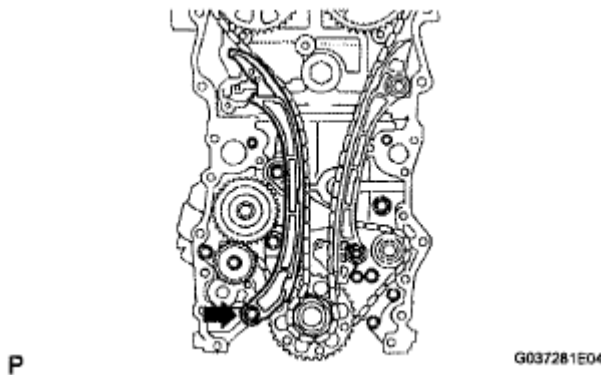


Fig. 467: Locating Tensioner Slipper With Bolt
Courtesy of ABLE BODY CORP.

31. INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY

- a. Install a new gasket and the chain tensioner No.1 with the bolt and nut.

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

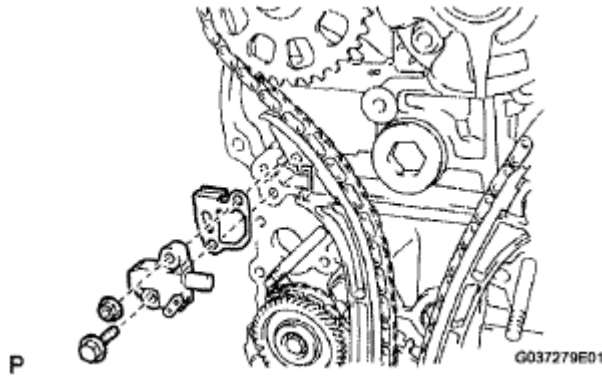


Fig. 468: Installing Gasket And Chain Tensioner No.1
Courtesy of ABLE BODY CORP.

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

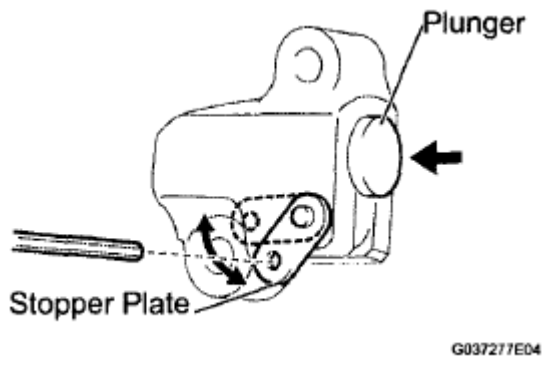


Fig. 469: Moving Stopper Plate
Courtesy of ABLE BODY CORP.

32. INSTALL TIMING CHAIN GUIDE

- a. Install a new O-ring and the chain guide with the 2 bolts.

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

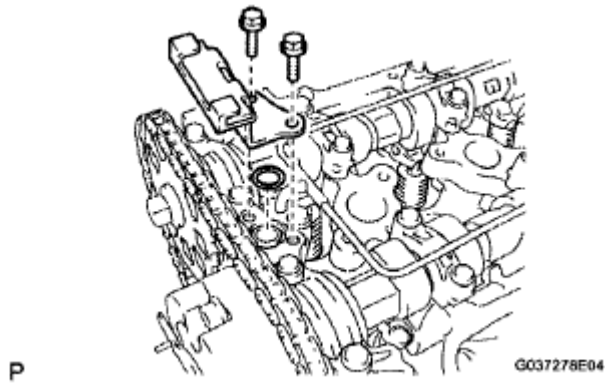


Fig. 470: Identifying O-Ring And Chain Guide With Bolts
Courtesy of ABLE BODY CORP.

33. INSTALL WATER PUMP ASSEMBLY

- a. Install a new gasket and the water pump with the 8 bolts.

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

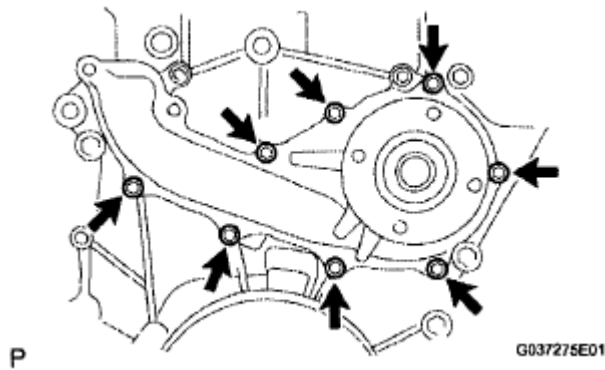


Fig. 471: Locating Gasket And Water Pump With Bolts
Courtesy of ABLE BODY CORP.

34. INSTALL TIMING CHAIN COVER

- a. Install 3 new O-rings to the timing chain cover as shown in the illustration.

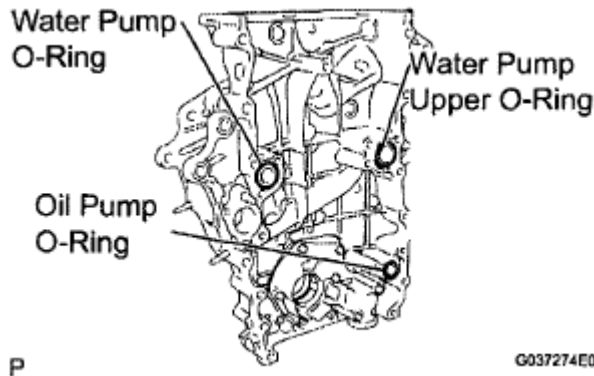


Fig. 472: Identifying O-Rings And Timing Chain Cover
Courtesy of ABLE BODY CORP.

- b. Apply adhesive to the timing gear case plug.

Adhesive:

Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

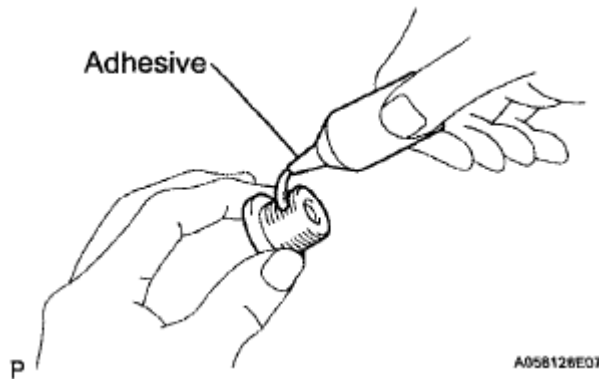


Fig. 473: Applying Adhesive To Timing Gear Case Plug
Courtesy of ABLE BODY CORP.

- c. Using a 10 mm socket hexagon wrench, install the timing chain cover plug.

Torque: 17 N*m (170 kgf*cm, 12 ft.*lbf)

- d. Apply seal packing in a continuous bead to the timing chain cover as shown in the following illustration.

Seal packing:

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

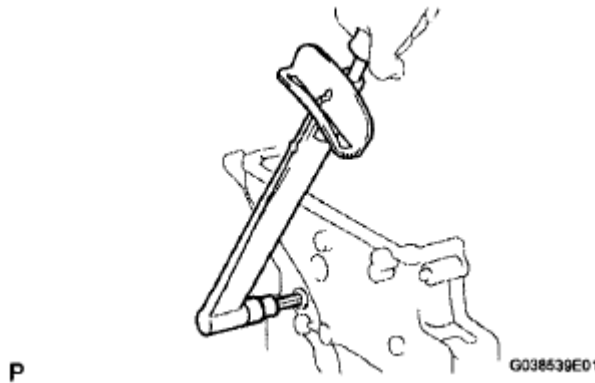


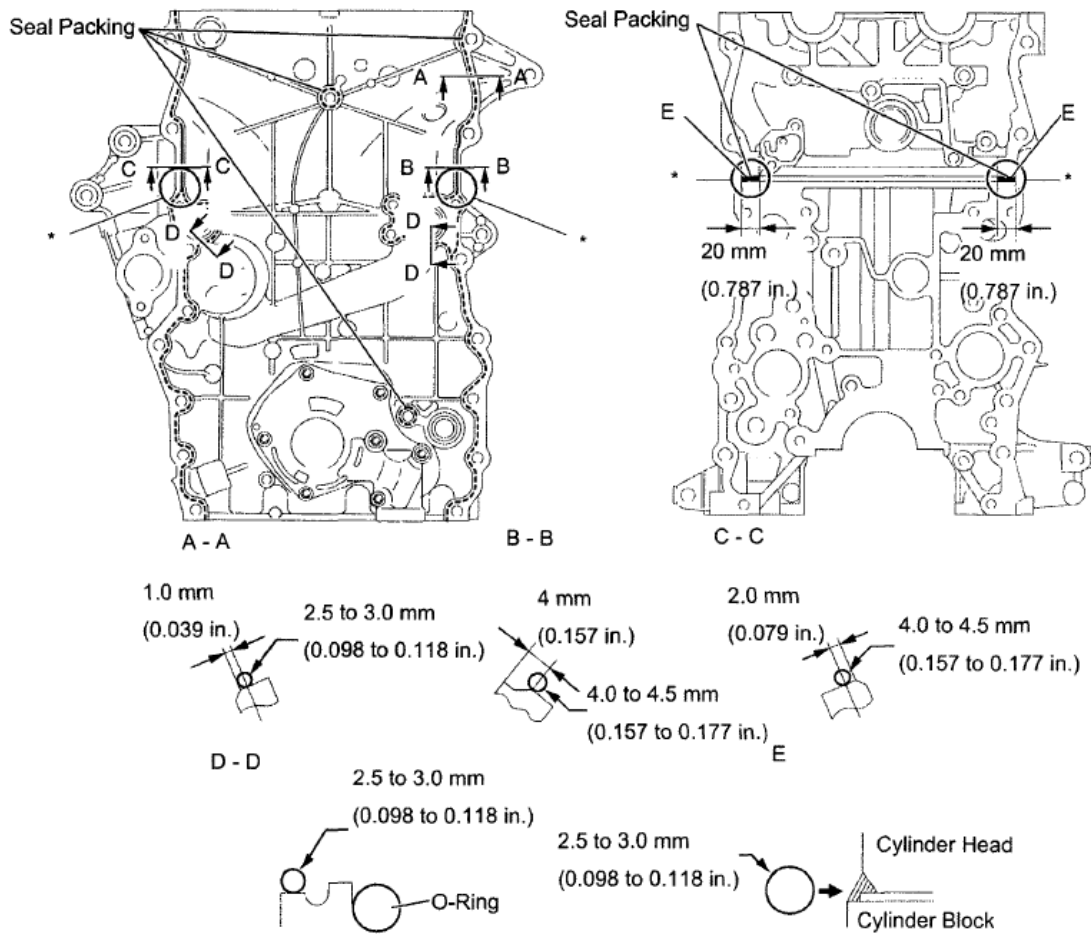
Fig. 474: Installing Timing Chain Cover Plug
Courtesy of ABLE BODY CORP.

SPECIFIED CONDITION

Position	Specified Condition
A - A,	2.5 to 3.0 mm (0.098 to 0.118 in.)
B - B, C - C	4.0 to 4.5 mm (0.157 to 0.177 in.)
D - D	2.5 to 3.0 mm (0.098 to 0.118 in.)
E	2.5 to 3.5 mm (0.098 to 0.138 in.)

NOTE:

- Be sure to clean and degrease the contact surfaces, especially 4 areas indicated by * in the illustration.
- When the contact surfaces are wet, 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 4 hours after installing.



P

0039490E05

Fig. 475: Identifying Seal Packing Applying Area
Courtesy of ABLE BODY CORP.

- 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.
- Temporarily install the the timing chain cover with the 19 bolts and 2 nuts, but do not tighten the bolts and nuts yet.
- Excluding bolts A, fully tighten the bolts and nuts in this order: Area 1, Area 2 and Area 3.

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

HINT:

Bolt length:

75 mm (2.95 in.) for bolt A (M10)

75 mm (2.95 in.) for bolt B (M8)

87 mm (3.43 in.) for bolt C

95 mm (3.74 in.) for bolt D

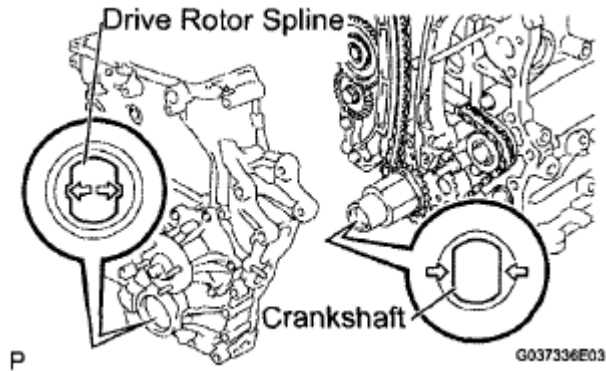


Fig. 476: Aligning Oil Pump's Drive Rotor Spline And Crankshaft
Courtesy of ABLE BODY CORP.

- h. Fully tighten the bolts labeled A in this order: Area 2 and Area 3.

Torque: 46 N*m (469 kgf*cm, 34 ft.*lbf)

- i. Fully tighten the bolts labeled E in Area 4.

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

HINT:

Bolt length: 35 mm (1.37 in.) for bolt E

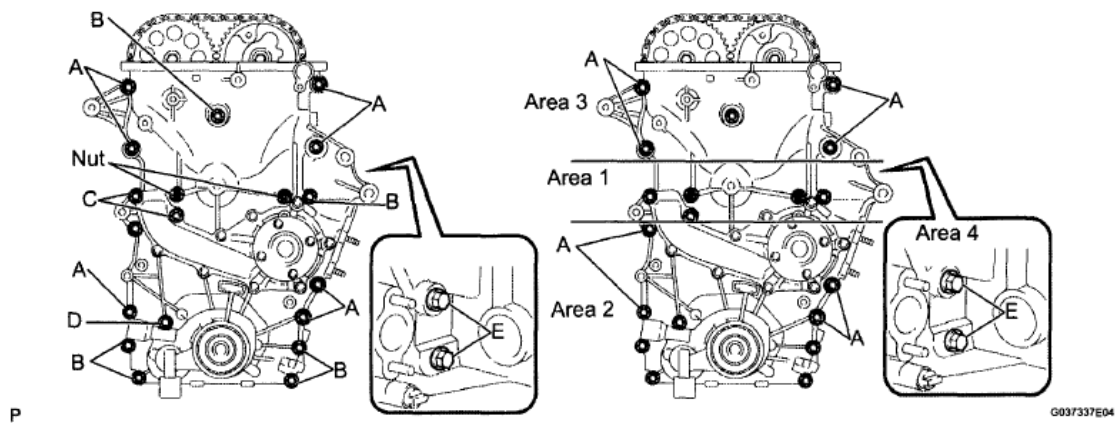


Fig. 477: Identifying Bolts Location And Sequence
Courtesy of ABLE BODY CORP.

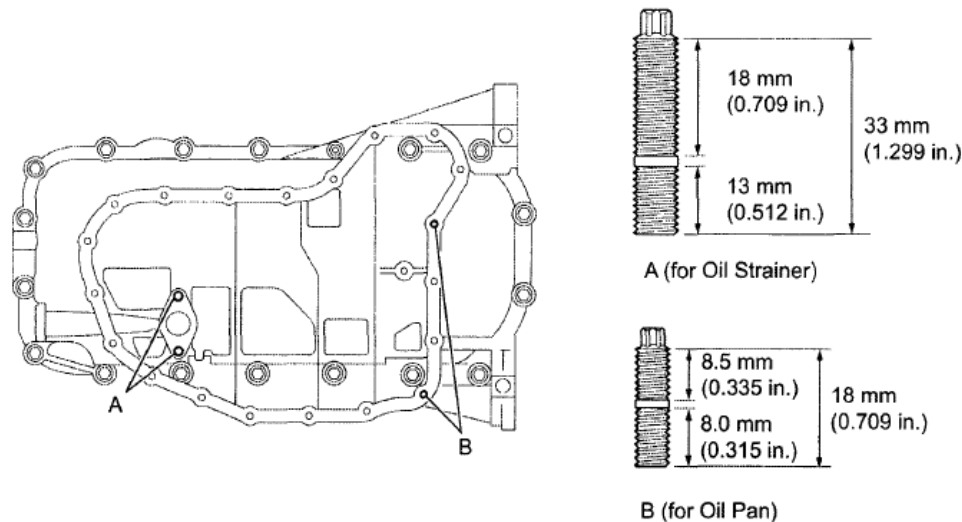
35. INSTALL OIL PAN SUB-ASSEMBLY

a. Install the stud bolt.

1. Using an E5 "torx" socket wrench, install the stud bolts labeled A for the oil pan as shown in the illustration.
2. Using an E7 "torx" socket wrench, install the stud bolts labeled B for the oil strainer as shown in the illustration.

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

3.0 N*m (31 kgf*cm, 27 in.*lbf) for stud bolt B



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G037338E04

Fig. 478: Identifying Stud Bolt Location And Dimension
Courtesy of ABLE BODY CORP.

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 width:

2 to 3 mm (0.08 to 0.12 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 4 hours after installing.

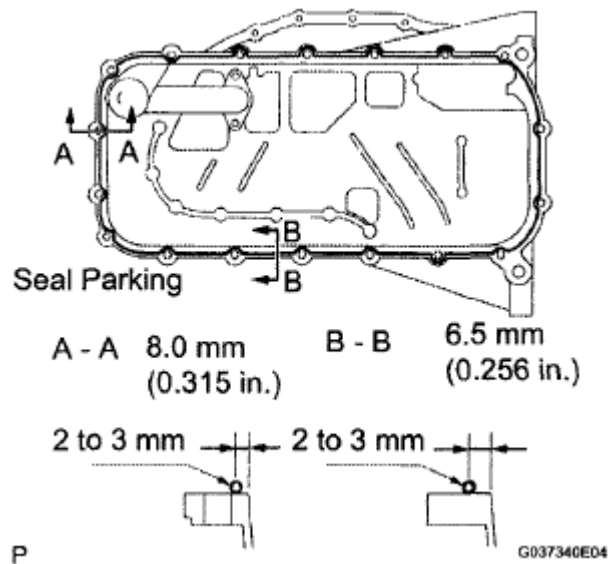


Fig. 479: Identifying Seal Packing Applying Area
Courtesy of ABLE BODY CORP.

- c. Install a new O-ring.

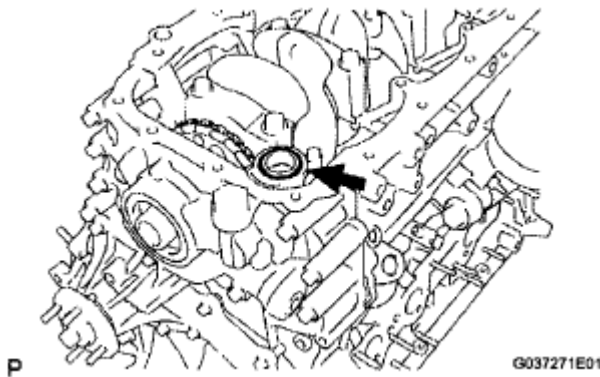


Fig. 480: Locating O-Ring
Courtesy of ABLE BODY CORP.

- d. Temporarily install the oil pan with the 16 bolts and 2 nuts.

HINT:

Bolt length:

20 mm (0.79 in.) for bolt A

40 mm (1.57 in.) for bolt B

- e. Uniformly tighten the 16 bolts and 2 nuts in the sequence shown in the illustration.

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

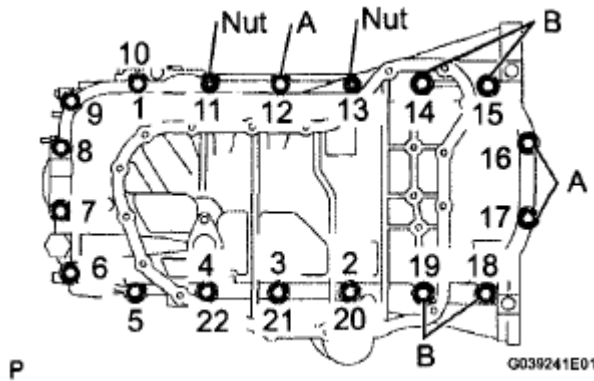


Fig. 481: Identifying Tightening Sequence Of Bolts And Nuts
Courtesy of ABLE BODY CORP.

36. INSTALL OIL STRAINER SUB-ASSEMBLY

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

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

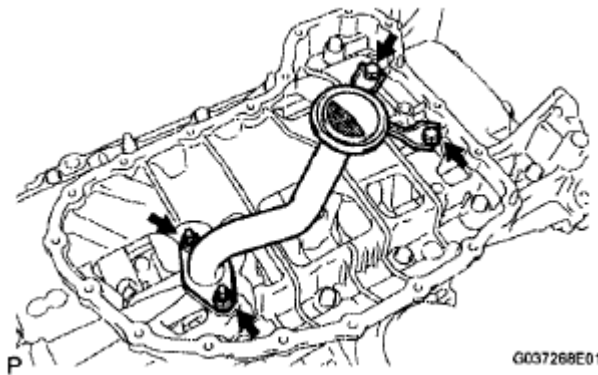


Fig. 482: Locating Gasket And Oil Strainer With Bolts And Nuts
Courtesy of ABLE BODY CORP.

37. INSTALL NO. 2 OIL PAN SUB-ASSEMBLY

- 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 width:

2.5 to 3.5 mm (0.098 to 0.138 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 4 hours after installing.

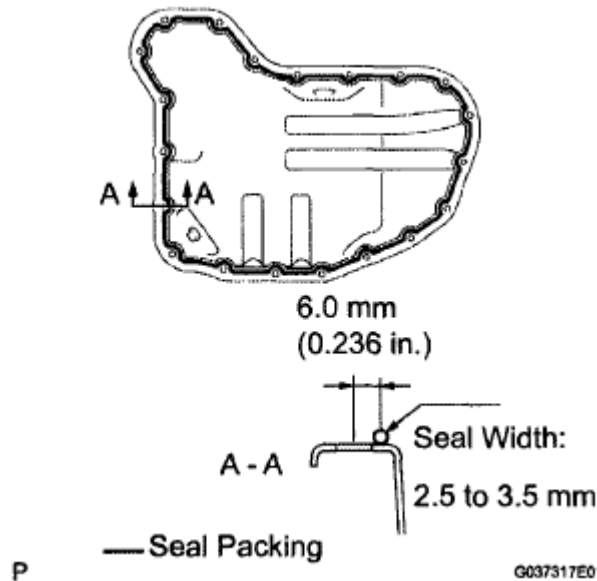


Fig. 483: Identifying Seal Packing Applying Area
Courtesy of ABLE BODY CORP.

- Temporarily install the oil pan with the 18 bolts and 2 nuts.
- Uniformly tighten the 18 bolts and 2 nuts in the sequence shown in the illustration.

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

- Install a new gasket and the drain plug.

Torque: 38 N*m (382 kgf*cm, 28 ft.*lbf)

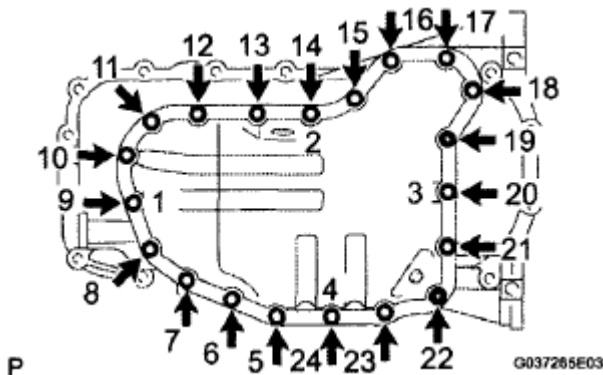


Fig. 484: Identifying Tightening Sequence Of Oil Pan Bolts And Nuts
Courtesy of ABLE BODY CORP.

38. INSTALL CRANKSHAFT PULLEY

- a. Align the pulley set key with the key groove of the pulley, and slide on the pulley.
- b. Using SST, install the new pulley bolt.

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

Torque: 260 N*m (2,650 kgf*cm, 192 ft.*lbf)

NOTE: Do not reuse the pulley bolt.

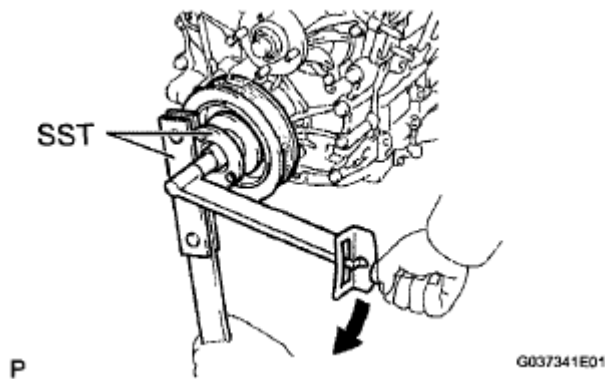


Fig. 485: Tightening Pulley Bolt
Courtesy of ABLE BODY CORP.

39. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY

- a. Apply seal packing as shown in the illustration.
- b. Install the 2 gaskets to the head cover.

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 4 hours after installing.

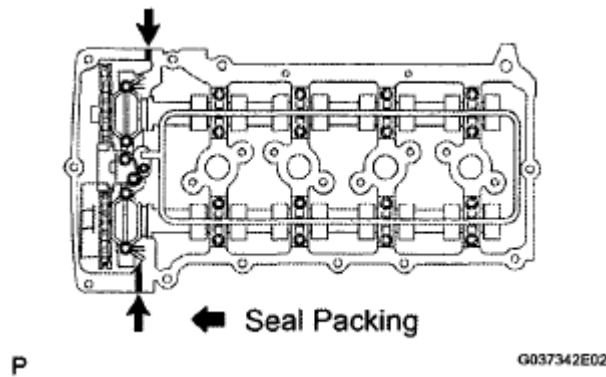


Fig. 486: Identifying Seal Packing Applying Area
Courtesy of ABLE BODY CORP.

- c. Temporarily install the cover with the 19 bolts and 2 nuts.

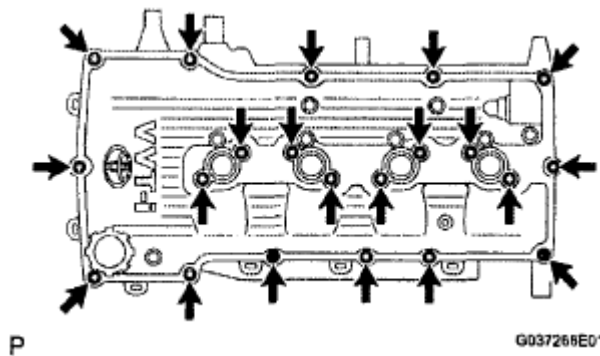


Fig. 487: Locating Gasket And Oil Strainer With Bolts And Nuts
Courtesy of ABLE BODY CORP.

- d. Fully tighten the bolts (A) shown in the illustration.

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

- e. Fully tighten the bolts (B) shown in the illustration.

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

HINT:

Make sure the tightening torque of bolts (A).

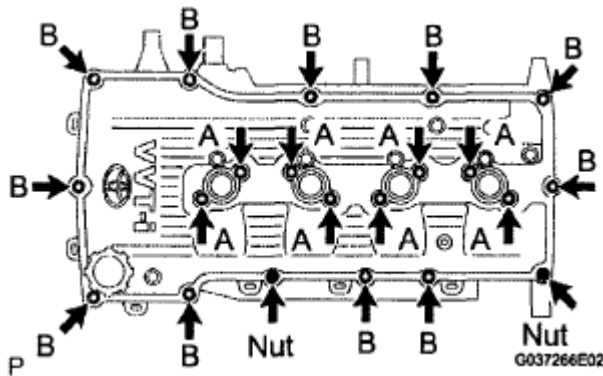


Fig. 488: Identifying Tightening Sequence Of Bolts
Courtesy of ABLE BODY CORP.

40. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

- a. Install the camshaft timing oil control valve assembly with the bolt.

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

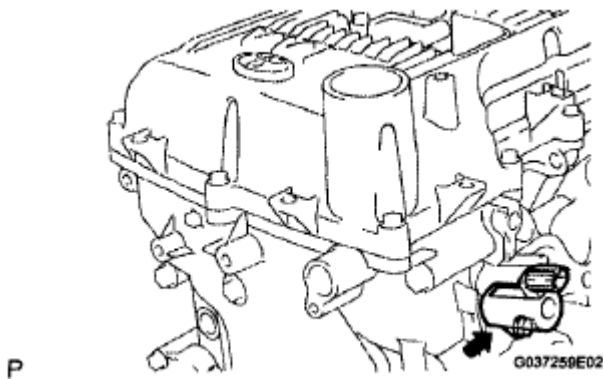


Fig. 489: Locating Camshaft Timing Oil Control Valve Assembly With Bolt
Courtesy of ABLE BODY CORP.

41. INSTALL CRANKSHAFT POSITION SENSOR

- a. Apply engine oil to the O-ring.
- b. Install the crankshaft position sensor with the bolt.

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

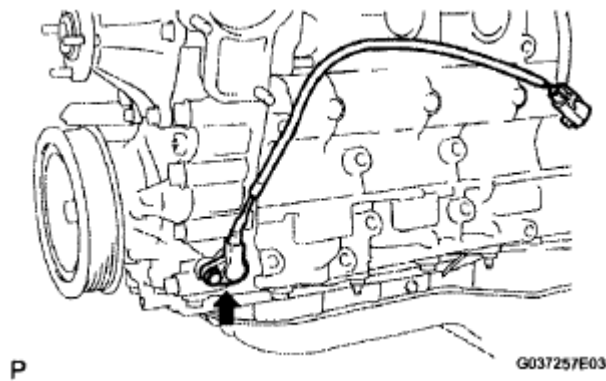


Fig. 490: Locating Crankshaft Position Sensor With Bolt
Courtesy of ABLE BODY CORP.

42. INSTALL CAMSHAFT POSITION SENSOR

- a. Apply engine oil to the O-ring.
- b. Install the camshaft position sensor with the bolt.

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

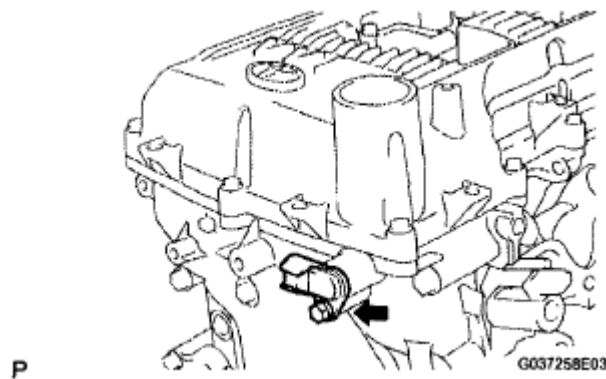


Fig. 491: Locating Camshaft Position Sensor With Bolt
Courtesy of ABLE BODY CORP.

43. INSTALL VENTILATION VALVE SUB-ASSEMBLY

- a. Install the ventilation valve sub-assembly.

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

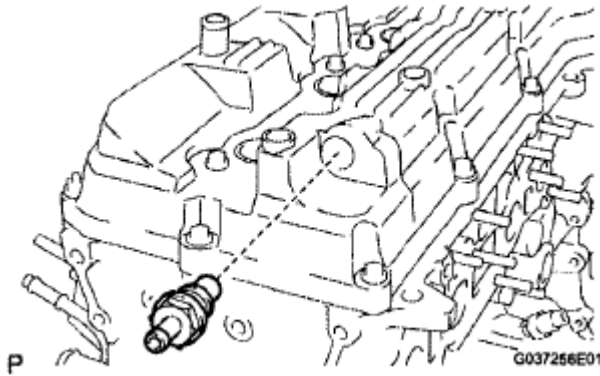


Fig. 492: Identifying Ventilation Valve Sub-Assembly
Courtesy of ABLE BODY CORP.

44. INSTALL OIL FILLER CAP SUB-ASSEMBLY

- a. Install the oil filler cap assembly.

REPAIR

1. REPAIR INTAKE VALVE SEAT

NOTE: Keep the lip free from foreign matter.

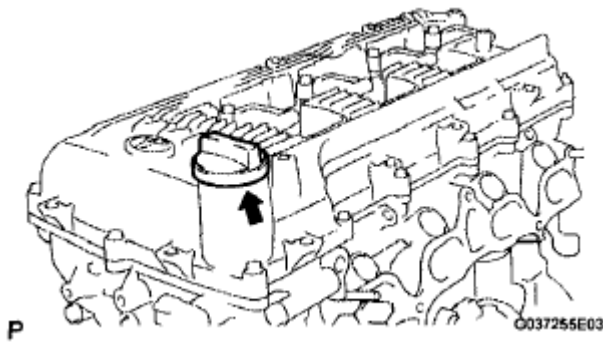


Fig. 493: Locating Oil Filler Cap Assembly
Courtesy of ABLE BODY CORP.

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

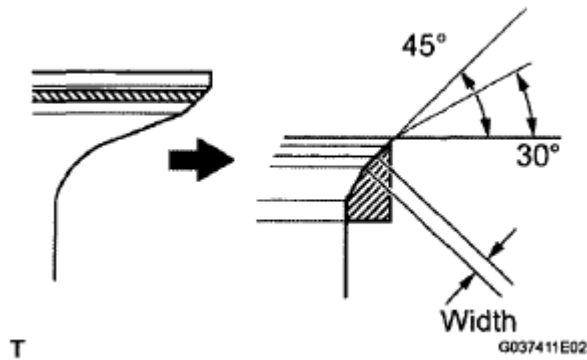


Fig. 494: Identifying Intake Valve Seat Angle
Courtesy of ABLE BODY CORP.

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

2. REPAIR EXHAUST VALVE SEAT

NOTE: Keep the lip free from foreign matter.

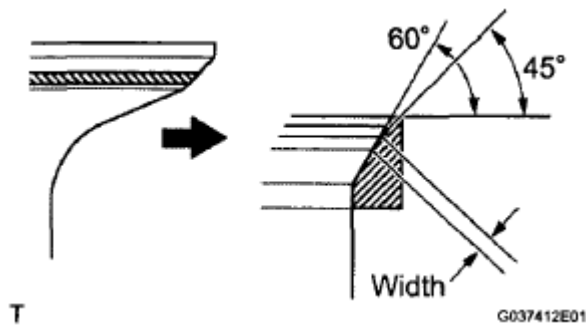


Fig. 495: Identifying Intake Valve Seat Angle
Courtesy of ABLE BODY CORP.

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

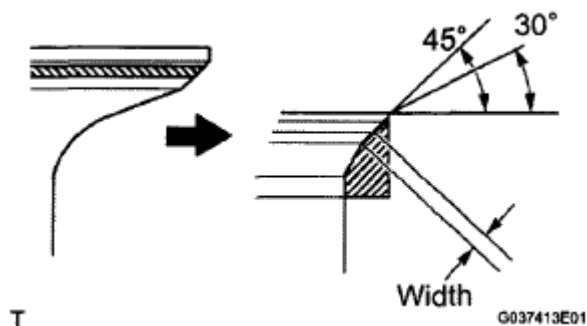


Fig. 496: Identifying Intake Exhaust Seat Angle
Courtesy of ABLE BODY CORP.

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

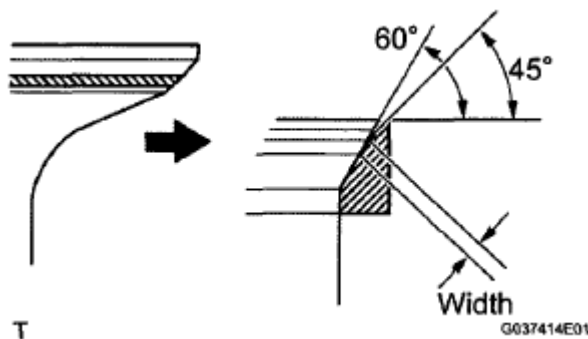


Fig. 497: Identifying Intake Exhaust Seat Angle
Courtesy of ABLE BODY CORP.