2009 ENGINE

Mechanical - 3.0L - Tribute

ENGINE - 3.0L

The 3.0L is a V-6 engine that has the following features:

- Dual overhead camshafts
- Four valves per cylinder
- Sequential Multi-Port Fuel Injection (SFI)
- Composite lower intake manifold and composite upper intake manifold
- Aluminum cylinder heads
- 2-piece aluminum cylinder block
- Variable Camshaft Timing (VCT) system
- Electronic ignition with 6 ignition coils

IDENTIFICATION

For quick identification, refer to the safety certification decal:

- The decal is located on the LH front door lock face panel.
- An engine identification label is also attached to the engine.
- The symbol code on the identification tag identifies each engine for determining parts usage; for instance, engine displacement in liters or Cubic Inch Displacement (CID) and model year.

EXHAUST EMISSION CONTROL SYSTEM

For operation and required maintenance of the exhaust emission control devices used on this engine, see **ENGINE EMISSION CONTROL - 2.5L AND 3.0L** .

INDUCTION SYSTEM

The SFI provides the fuel/air mixture needed for the combustion in the cylinders. The 6 solenoid-operated fuel injectors:

- Are mounted between the fuel rail and the intake manifold.
- Meter fuel into the air intake stream in accordance with the engine demand.
- Are positioned so that their tips direct fuel just ahead of the engine intake valves.

VALVE TRAIN

The camshafts are mounted in the cylinder heads and act against a roller follower to open and close the valves. A hydraulic lash adjuster is located on one side of the roller follower and the valve tip on the opposite end. The

camshafts are driven off the front of each cylinder head by 2 chains (one each side). Both of the chains are driven by sprockets that are located on the crankshaft, just in front of the oil pump.

VARIABLE CAMSHAFT TIMING (VCT) SYSTEM

The VCT system changes intake camshaft timing dependent on engine speed, load and oil temperature. Oil pressure advances and retards camshaft timing to improve low-speed and high-speed engine performance, engine idle quality and exhaust emissions.

POSITIVE CRANKCASE VENTILATION SYSTEM

All engines are equipped with a closed-type positive crankcase ventilation system recycling the crankcase vapors to the upper intake manifold.

LUBRICATION SYSTEM

The engine lubrication system is of the force-feed type in which oil is supplied under full pressure to the crankshaft, connecting rod bearings and timing chain tensioners. The flow of oil to the valve tappets and valve train is controlled by a restricting orifice located in the head gasket.

OIL PUMP

The lubrication system is designed to provide optimum oil flow to critical components of the engine through its entire operating range.

The heart of the system is a positive displacement internal gear oil pump.

Generically this design is known as a gerotor pump, which operates as follows:

- The oil pump is mounted on the front face of the cylinder block.
- The inner rotor is piloted on the crankshaft post and is driven through flats on the crankshaft.
- System pressure is limited by an integral internally-vented relief valve which directs the bypassed oil back to the inlet side of the oil pump.
- Oil pump displacement has been selected to provide adequate volume to make sure of correct oil pressure both at hot idle and maximum speed.
- The relief valve calibration protects the system from excessive pressure during high viscosity conditions.
- The relief valve is designed to provide adequate connecting rod bearing lubrication under high-temperature and high-speed conditions.

COOLING SYSTEM

The engine cooling system includes the following:

- Radiator
- Dual electric fan assemblies
- Degas bottle (aids in maintaining the correct volume of engine coolant)

- Coolant thermostat
- Coolant hoses
- Coolant pump housing

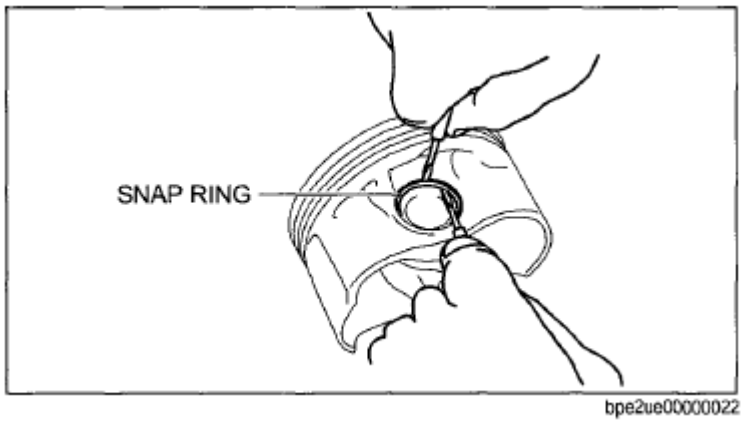


Fig. 1: Identifying Engine Cylinder Identification
Courtesy of MAZDA MOTORS CORP.

ACCESSORY DRIVE - 3.0L

ACCESSORY DRIVE

The accessory drive:

- has a single serpentine belt with 6 ribs.
- has an automatic drive belt tensioner.
- has a 3-ribbed water pump belt.

The accessory drive system provides power to operate components which power other systems. These could include components such as the generator, power steering pump and A/C compressor. Each of these components is equipped with a pulley which is driven by the accessory drive belt. The accessory drive belt is driven by the engine crankshaft pulley. One or more idler pulleys may be provided to facilitate belt routing and alignment. The automatic belt tensioner maintains correct belt tension and compensates for component wear and changes in system load. System load changes can be caused by the A/C compressor clutch engaging or disengaging, or demand changes on other systems powered by the accessory drive belt. To maintain correct operation of this system, it is critical that the correct length drive belt be installed. The pulleys must also be correctly aligned and kept clean.

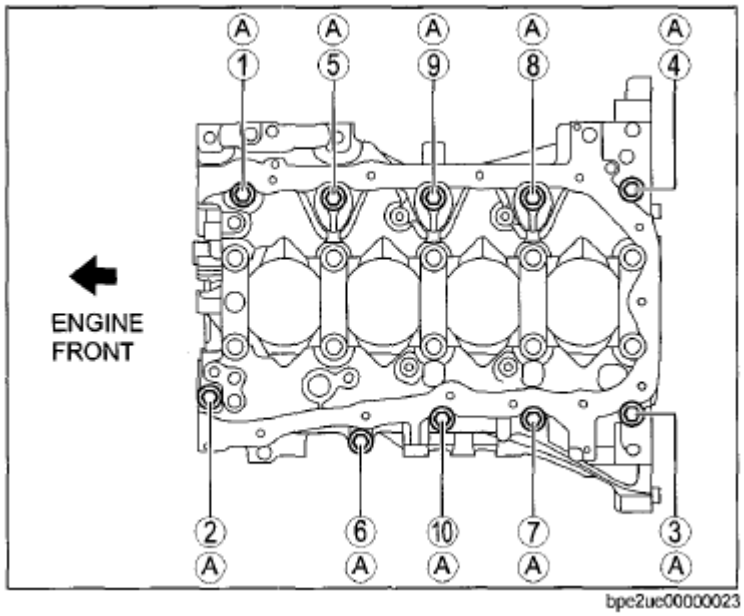


Fig. 2: Identifying Accessory Drive Belt Routing
Courtesy of MAZDA MOTORS CORP.

BELT TENSIONER

Automatic tensioners are calibrated to provide the correct amount of tension to the belt for a given accessory drive system. Unless a spring or damping band within the tensioner assembly breaks, or some other mechanical part fails, there is no need to check the tensioner for correct tension.

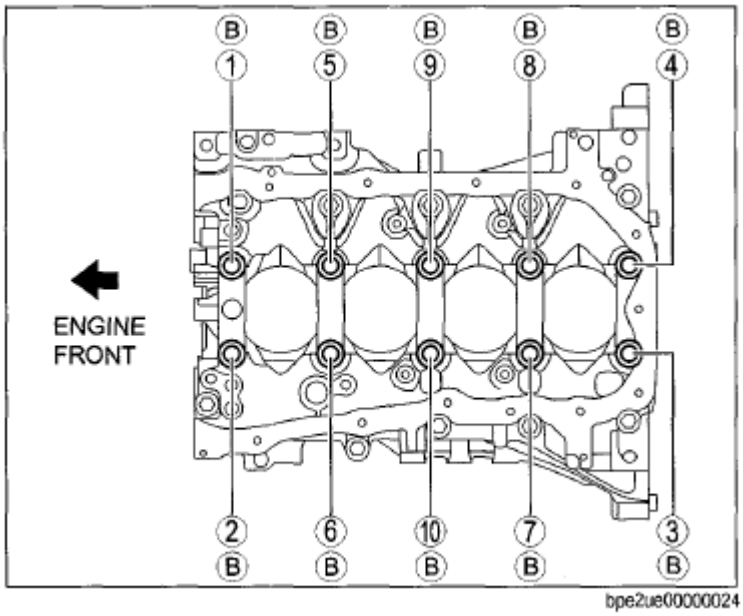


Fig. 3: Identifying Water Pump Drive Belt
Courtesy of MAZDA MOTORS CORP.

FRONT END ACCESSORY DRIVE (FEAD) EXPLODED VIEW - 3.0L

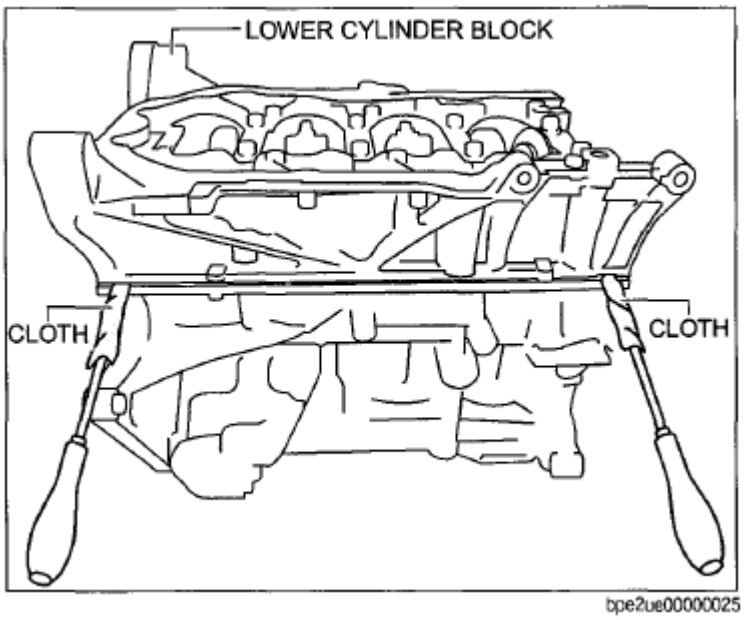


Fig. 4: Exploded View Of Front End Accessory Drive (FEAD)
Courtesy of MAZDA MOTORS CORP.

1. For additional information, see the procedures in this service information.

ACCESSORY DRIVE BELT REMOVAL/INSTALLATION - 3.0L

1. With the vehicle in NEUTRAL, position it on a hoist. See **LIFTING** .
2. Remove the pin-type retainer, 5 bolts and the RH lower splash shield.
   - To install, tighten to 9 N.m {0.9 kgf.m, 80 in.lbf}.
3. Rotate the accessory drive belt tensioner counterclockwise and remove the accessory drive belt.
4. To install, reverse the removal procedure.

NOTE:

- **Refer to the illustration for correct belt routing.**

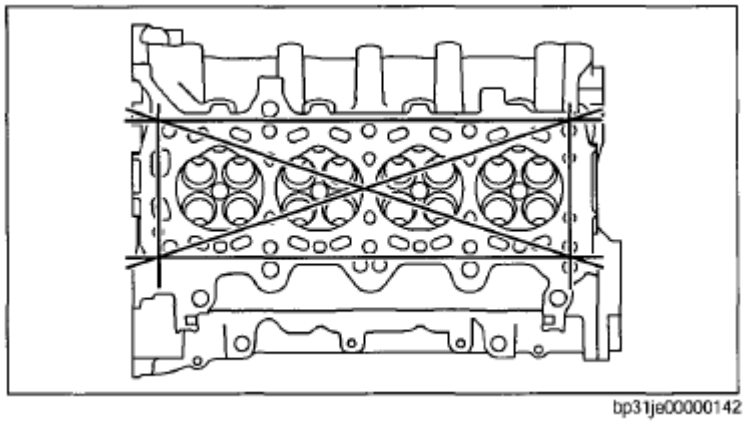


Fig. 5: Identifying Accessory Drive Belt And Tensioner
Courtesy of MAZDA MOTORS CORP.

ACCESSORY DRIVE BELT TENSIONER REMOVAL/INSTALLATION - 3.0L

1. With the vehicle in NEUTRAL, position it on a hoist. See **LIFTING** .
2. Remove the pin-type retainer, 5 bolts and the RH lower splash shield.
   - To install, tighten to 9 N.m {0.9 kgf.m, 80 in.lbf}.
3. Rotate the accessory drive belt tensioner counterclockwise and remove the accessory drive belt.
4. Remove the bolt and the accessory drive belt tensioner.
   - To install, tighten to 25 N.m {2.5 kgf.m, 18 ft.lbf}.
5. To install, reverse the removal procedure.

NOTE:

- **See the illustration for correct drive belt routing.**

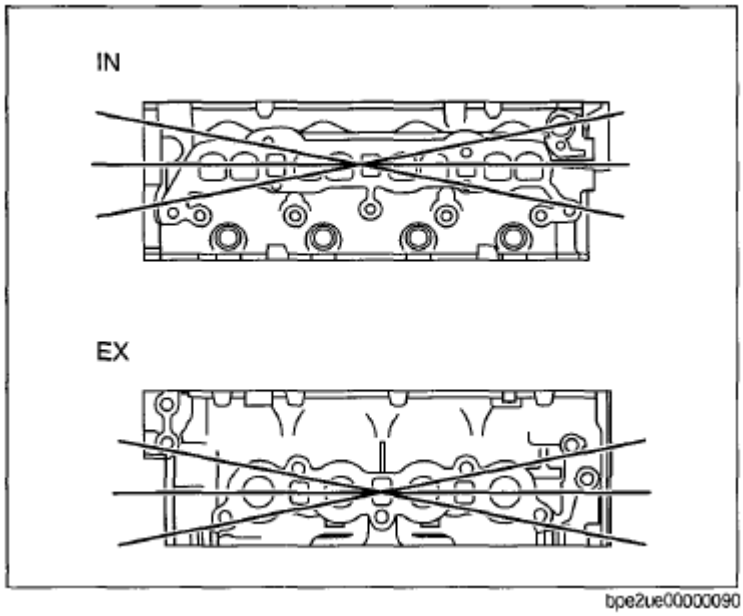


Fig. 6: Identifying Accessory Drive Belt And Tensioner
Courtesy of MAZDA MOTORS CORP.

WATER PUMP BELT REMOVAL/INSTALLATION - 3.0L

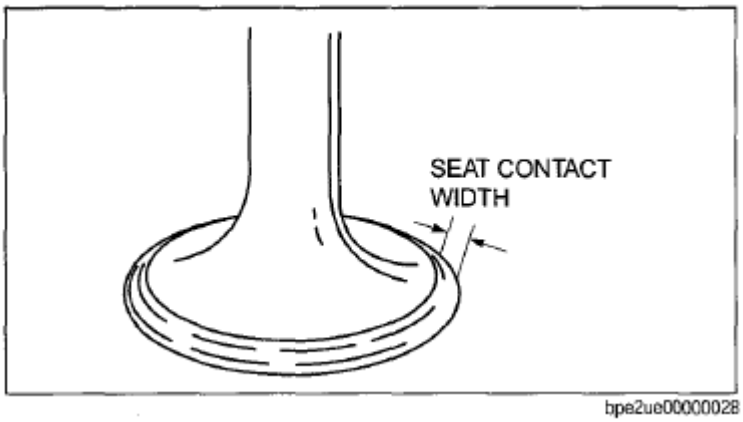


Fig. 7: Identifying Water Pump Belt And Components
Courtesy of MAZDA MOTORS CORP.

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. See **LIFTING** .
2. Remove the pin-type retainer, 5 bolts and the RH lower splash shield.
3. Position the Stretchy Belt Remover under the water pump belt as shown in the figure.

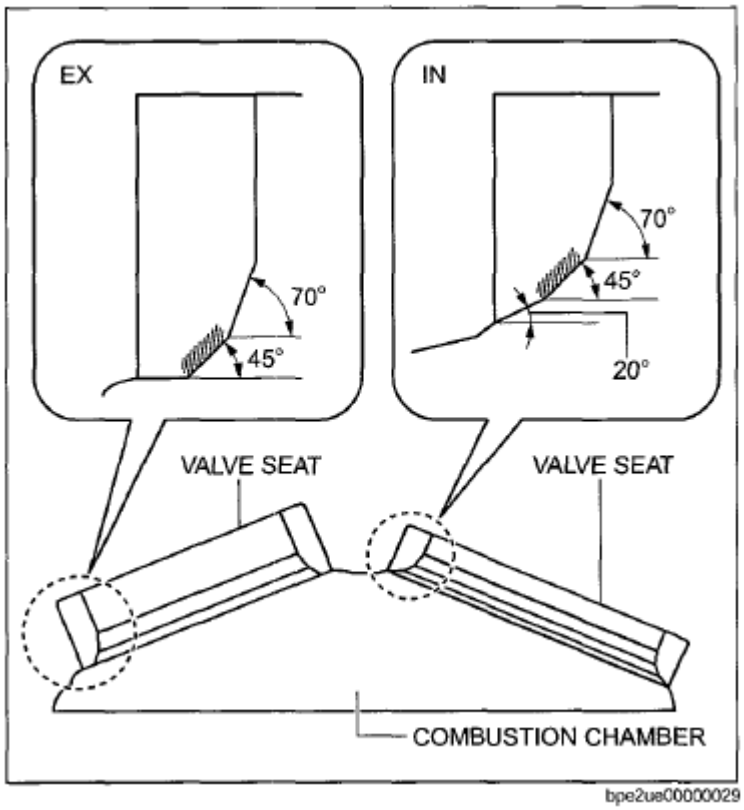


Fig. 8: Locating Water Pump Belt
Courtesy of MAZDA MOTORS CORP.

4. With the help of a assistant, turn the crankshaft clockwise and feed the Stretchy Belt Remover evenly on the camshaft water pump pulley as shown in the figure.

NOTE:

- **Feed the Stretchy Belt Remover onto the camshaft water pump pulley 152 mm (5.984 in).**

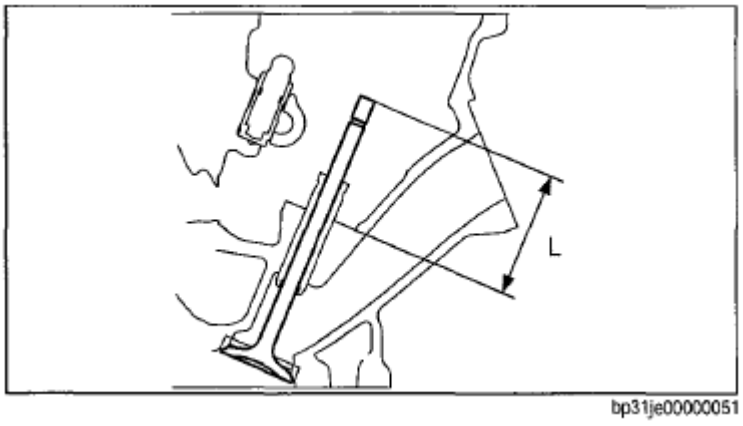


Fig. 9: Identifying Drive Belt Dimension
Courtesy of MAZDA MOTORS CORP.

5. Remove the water pump belt.
   - Fold the Stretchy Belt Remover over the top of the water pump belt.
   - In one quick motion, pull the Stretchy Belt Remover up and toward the RH front of the vehicle removing the water pump belt.

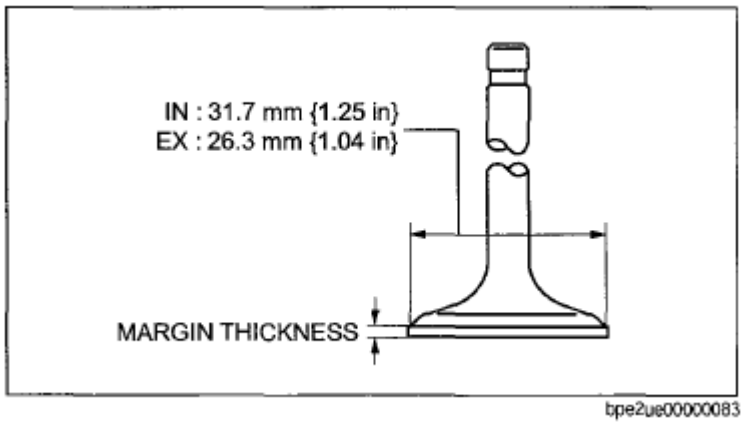


Fig. 10: Removing Water Pump Belt
Courtesy of MAZDA MOTORS CORP.

INSTALLATION

1. Install the water pump belt on the water pump pulley and position it on the camshaft pulley.

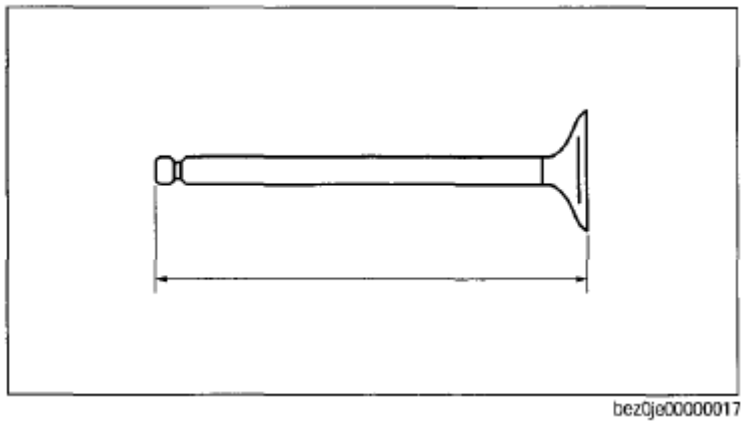


Fig. 11: Locating Water Pump Belt Marks
Courtesy of MAZDA MOTORS CORP.

2. Rotate the crankshaft clockwise to seat the water pump belt on the camshaft pulley.

CAUTION:
- **Do not use any screwdrivers, pliers or other metal objects that could cause damage to the belt or camshaft pulley while installing the belt.**

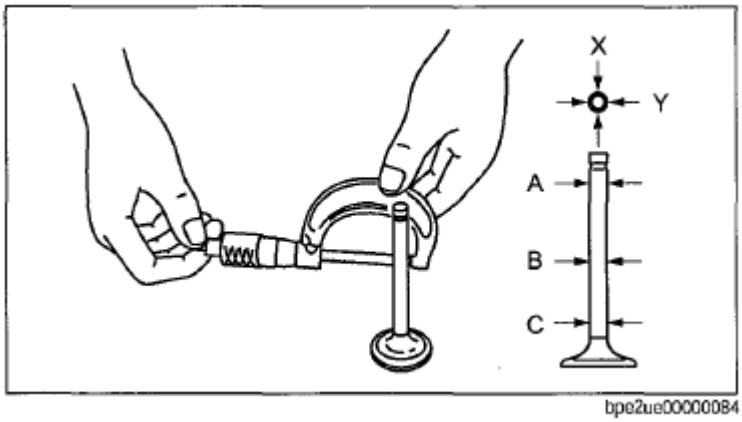


Fig. 12: Rotating Crankshaft Clockwise
Courtesy of MAZDA MOTORS CORP.

3. Install the RH lower splash shield, pin-type retainer and 5 bolts.
    - Tighten to 9 N.m {0.9 kgf.m, 80 in.lbf}.

VALVE COVER REMOVAL/INSTALLATION - LH, 3.0L

LH Valve Cover (View 1 of 3)

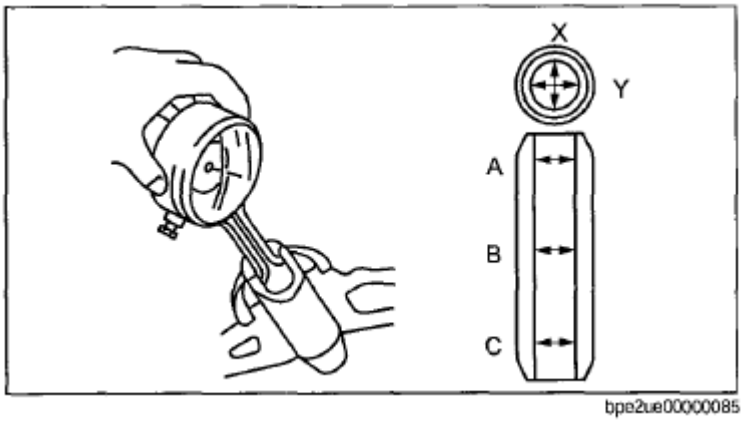


Fig. 13: Identifying LH Valve Cover Components (1 Of 3)
Courtesy of MAZDA MOTORS CORP.

LH Valve Cover (View 2 of 3)

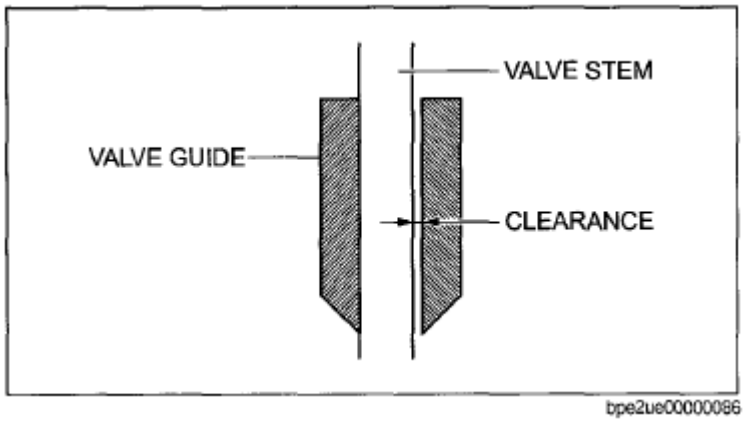


Fig. 14: Identifying LH Valve Cover Components (2 Of 3)
Courtesy of MAZDA MOTORS CORP.

LH Valve Cover (View 3 of 3)

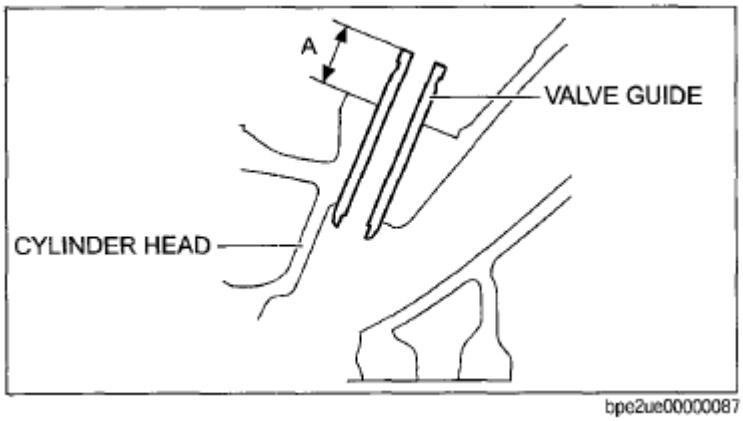


Fig. 15: Identifying LH Valve Cover Components (3 Of 3)
Courtesy of MAZDA MOTORS CORP.

REMOVAL

CAUTION:
- **During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.**

1. Remove the LH ignition coil-on-plugs. See **IGNITION COIL-ON-PLUG REMOVAL/INSTALLATION - 3.0L** .
2. Detach the upper radiator hose from the 2 retainers on the cooling fan shroud and position the hose aside.
3. Detach the 2 wiring retainers from the valve cover.
4. Detach the 2 wiring retainers from the valve cover stud bolts.

5. Disconnect the Variable Camshaft Timing (VCT) electrical connector.
6. Disconnect the Heated Oxygen Sensor (HO2S) electrical connector.
7. Remove the 8 bolts, 6 stud bolts and the valve cover.
   - Remove and discard the gasket.
8. Remove the 5 bolts, 8 stud bolts and the valve cover.
   - Remove and discard the gasket.

NOTE:

- **Inspect the crankcase ventilation tube and valve cover sealing area. If either a new valve cover or crank-case ventilation tube is required, both components must be installed new.**

INSTALLATION

1. Apply a bead of silicone gasket and sealant in 2 places where the engine front cover meets the cylinder head.

NOTE:

- **If the valve cover is not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with metal surface prep. Failure to follow this procedure can cause future oil leakage.**

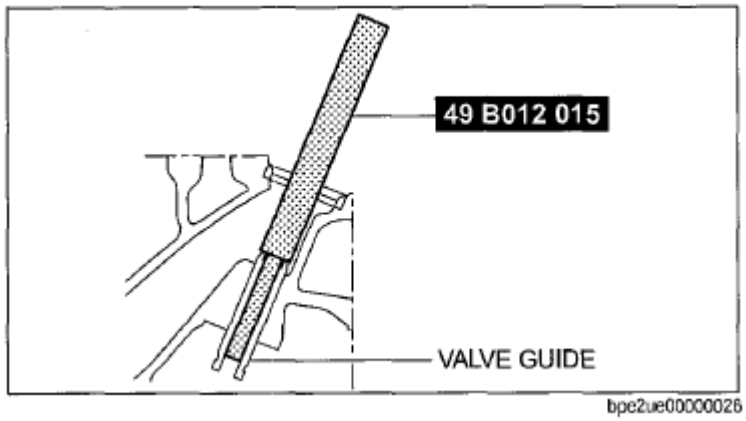


Fig. 16: Identifying Silicone Gasket Dimension
Courtesy of MAZDA MOTORS CORP.

2. Position the valve cover and install the bolts and stud bolts.
   - Tighten in the sequence shown in the figure to 10 N.m {1.0 kgf.m, 89 in.lbf}.

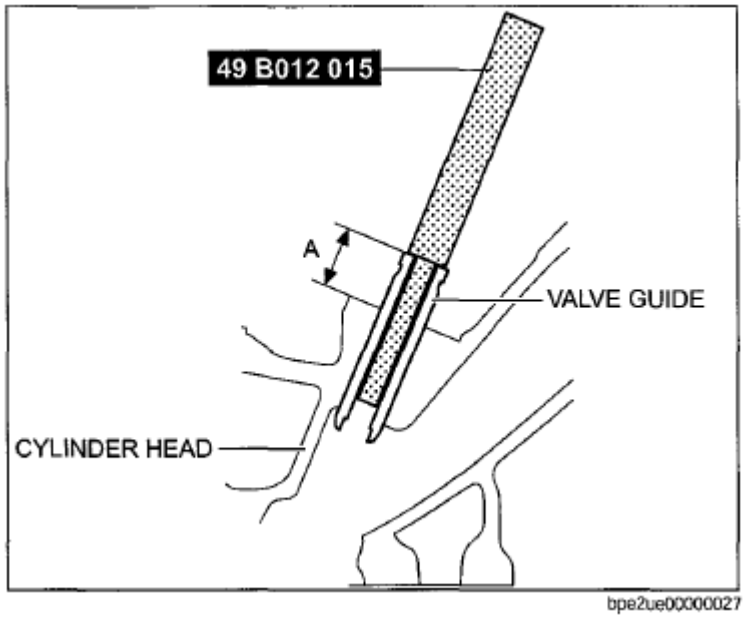


Fig. 17: Identifying Valve Cover Bolts And Stud Bolts In Sequence
Courtesy of MAZDA MOTORS CORP.

3. Connect the HO2S electrical connector.
4. Connect the VCT electrical connector.
5. Attach the 2 wiring retainers to the valve cover stud bolts.
6. Attach the 2 wiring retainers to the valve cover.
7. Attach the upper radiator hose to the 2 retainers on the cooling fan shroud.
8. Install the LH ignition coil-on-plugs. See **IGNITION COIL-ON-PLUG REMOVAL/INSTALLATION - 3.0L** .

VALVE COVER REMOVAL/INSTALLATION - RH, 3.0L

RH Valve Cover (View 1 of 2)

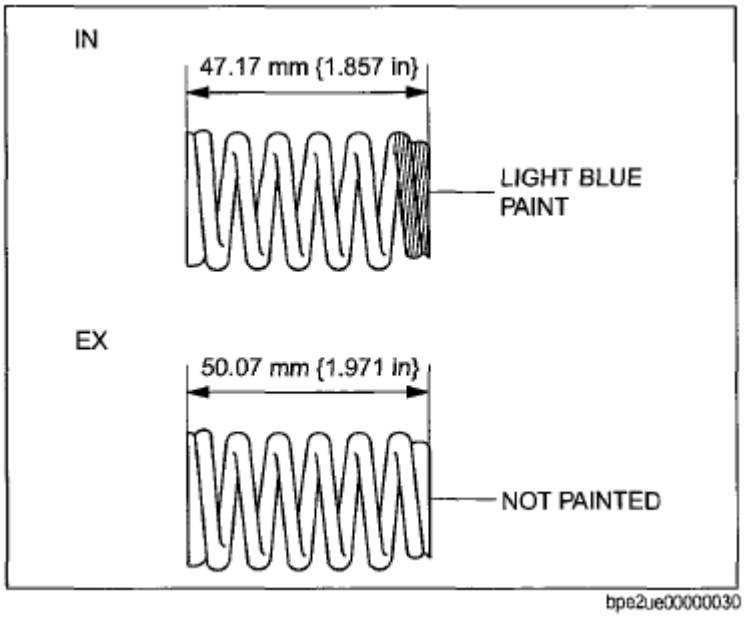


Fig. 18: Identifying RH Valve Cover Components (1 Of 2)
Courtesy of MAZDA MOTORS CORP.

RH Valve Cover (View 2 of 2)

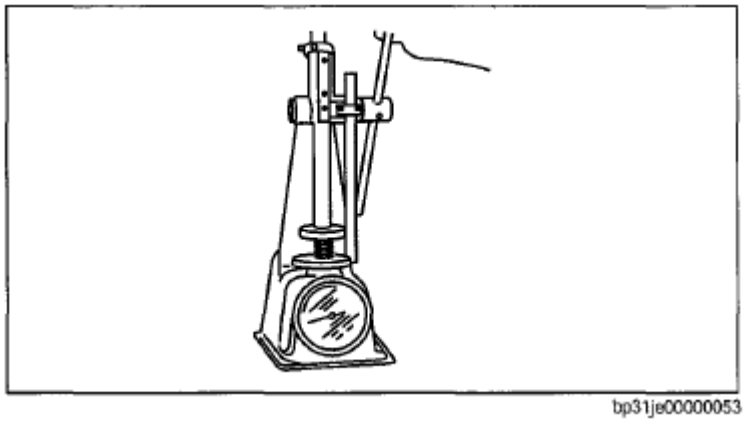


Fig. 19: Identifying RH Valve Cover Components (2 Of 2)
Courtesy of MAZDA MOTORS CORP.

REMOVAL

CAUTION:
- **During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, may cause engine failure.**

1. Remove the RH ignition coil-on-plugs. See **IGNITION COIL-ON-PLUG**

REMOVAL/INSTALLATION - 3.0L .

2. Detach the 4 main engine control wiring harness retainers from the valve cover stud bolts.
3. Detach the 3 main engine control wiring harness retainers from the valve cover.
4. Disconnect the Variable Camshaft Timing (VCT) electrical connector.
5. Detach the Crankshaft Position (CKP) wiring harness retainer from the stud.
6. Remove the 11 bolts, 3 stud bolts and the valve cover.
    - Remove and discard the gasket.

INSTALLATION

1. Apply a bead of silicone gasket and sealant in 2 places where the engine front cover meets the cylinder head.

NOTE:

- **If the valve cover is not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with metal surface prep. Failure to follow this procedure can cause future oil leakage.**

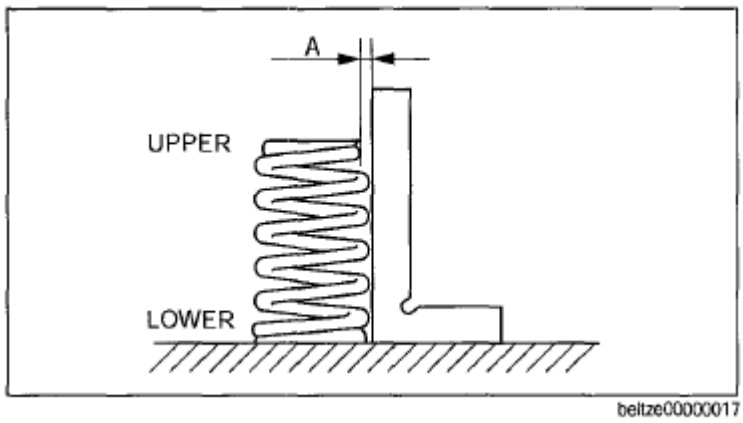


Fig. 20: Identifying Silicone Gasket Dimension
Courtesy of MAZDA MOTORS CORP.

2. Position the valve cover and install the 11 bolts and 3 stud bolts.
    - Tighten in the sequence shown in the figure to 10 N.m {1.0 kgf.m, 89 in.lbf}.

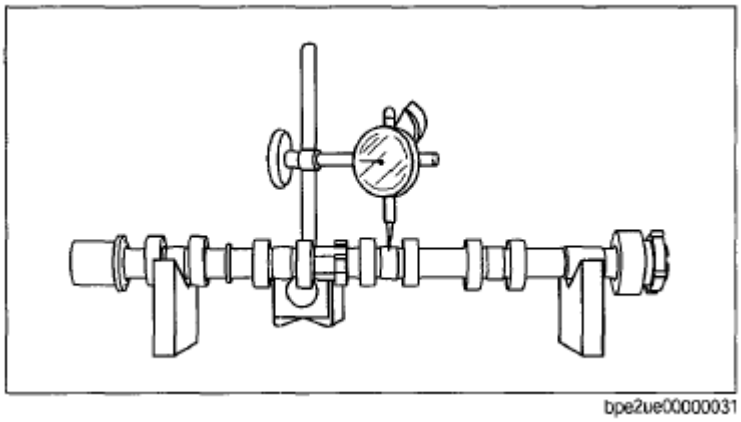


Fig. 21: Identifying Valve Cover Bolts And Stud Bolts In Sequence
Courtesy of MAZDA MOTORS CORP.

3. Attach the CKP wiring harness retainer on the stud.
4. Connect the VCT electrical connector.
5. Attach the 3 main engine control wiring harness retainers to the valve cover.
6. Attach the 4 main engine control wiring harness retainers to the valve cover stud bolts.
7. Install the RH ignition coil-on-plugs. See **IGNITION COIL-ON-PLUG REMOVAL/INSTALLATION - 3.0L** .

LOWER END COMPONENTS EXPLODED VIEW - 3.0L

CRANKSHAFT PULLEY AND FRONT SEAL

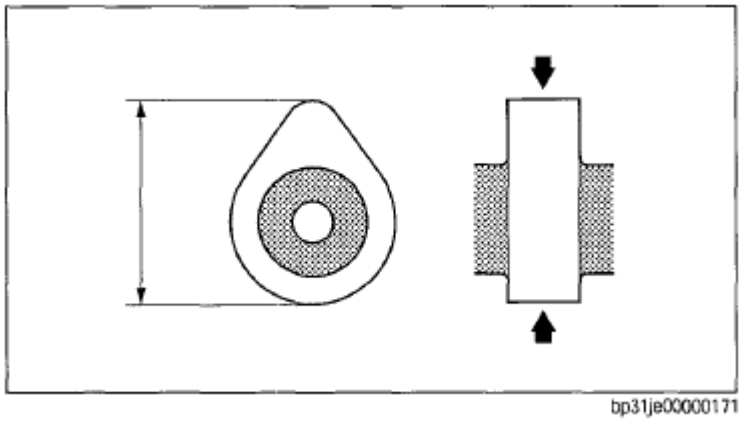


Fig. 22: Identifying Crankshaft Pulley And Front Seal Components
Courtesy of MAZDA MOTORS CORP.

FLEXPLATE AND REAR SEAL

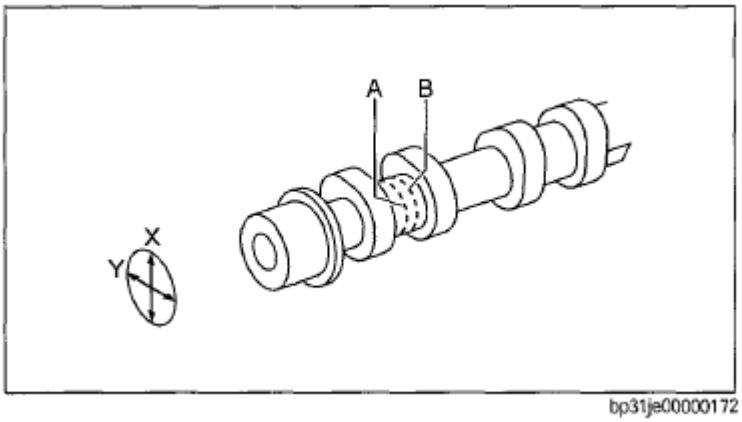


Fig. 23: Identifying Flexplate And Rear Seal Components
Courtesy of MAZDA MOTORS CORP.

1. For additional information, see the procedures in this service information.

CRANKSHAFT PULLEY REMOVAL/INSTALLATION - 3.0L

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. See **LIFTING** .
2. Remove the accessory drive belt. See **ACCESSORY DRIVE BELT REMOVAL/INSTALLATION - 3.0L** .
3. Remove the crankshaft pulley bolt and washer.
   - Discard the crankshaft pulley bolt.
4. Using the 3-Jaw Puller, remove the crankshaft pulley.

INSTALLATION

1. Lubricate the crankshaft front seal inner lip with clean engine oil.
2. Apply silicone gasket and sealant to the end of the keyway slot.

NOTE:
- **Clean the keyway and slot using metal surface prep before applying silicone gasket and sealer.**

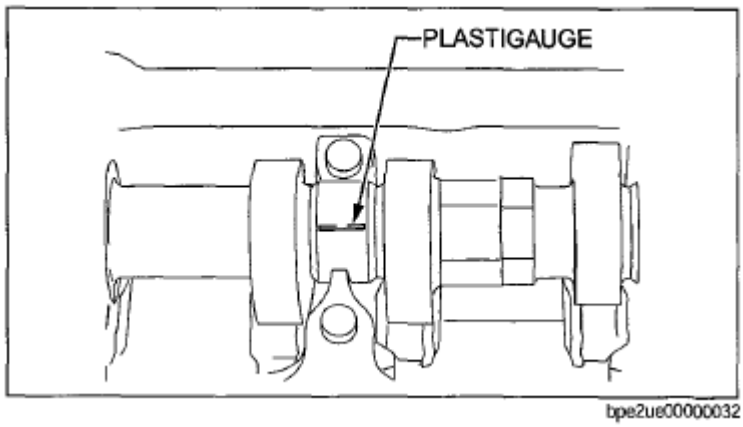


Fig. 24: Using 3-Jaw Puller To Remove Crankshaft Pulley
Courtesy of MAZDA MOTORS CORP.

NOTE:

- **The crankshaft pulley must be installed and the bolt tightened within 4 minutes of applying the silicone gasket and sealer.**

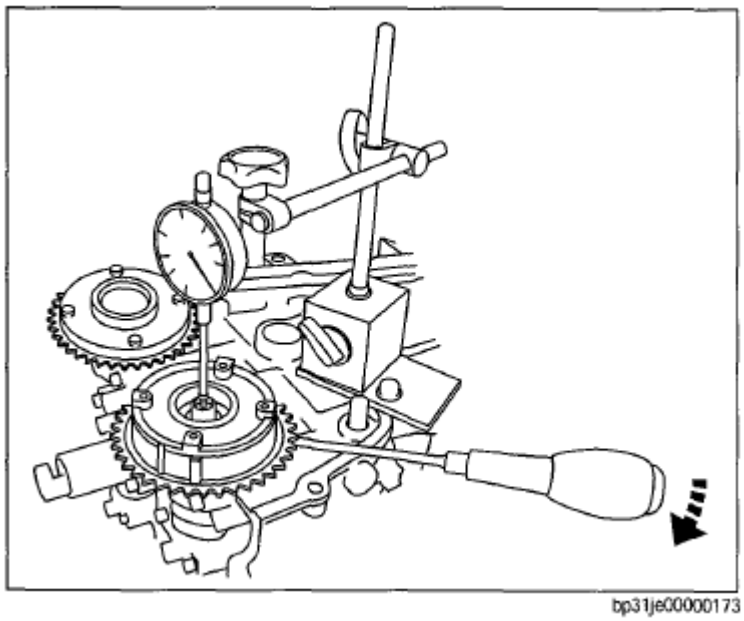


Fig. 25: Locating Silicone Gasket Location
Courtesy of MAZDA MOTORS CORP.

3. Using the Crankshaft Vibration Damper Installer, install the crankshaft pulley.

NOTE:

- **Lubricate the outside diameter sealing surface with clean engine oil.**

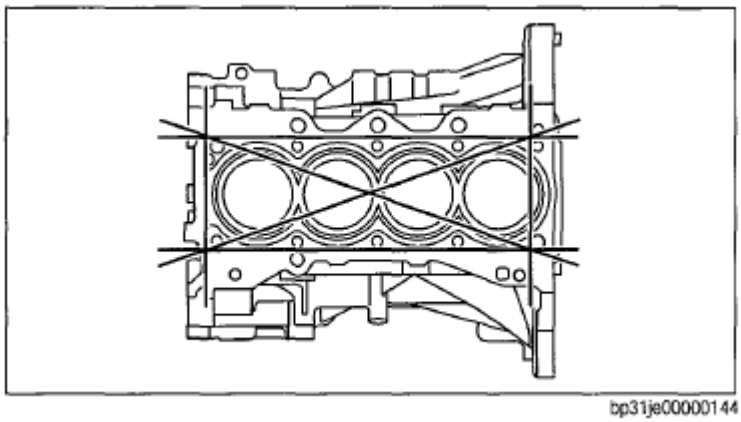


Fig. 26: Locating Crankshaft Vibration Damper Installer
Courtesy of MAZDA MOTORS CORP.

4. Install the bolt and washer. Using the special tool to hold the crankshaft pulley, tighten the bolt in 4 stages:
   - Stage 1: Tighten the bolt to 120 N.m {12.2 kgf.m, 89 ft.lbf}.
   - Stage 2: Loosen the bolt one full turn.
   - Stage 3: Tighten the bolt to 50 N.m {5.1 kgf.m, 37 ft.lbf}.
   - Stage 4: Tighten the bolt an additional 90 degrees.
5. Install the accessory drive belt. See **ACCESSORY DRIVE BELT REMOVAL/INSTALLATION - 3.0L** .

CRANKSHAFT FRONT SEAL REMOVAL/INSTALLATION - 3.0L

REMOVAL

1. With the vehicle in NEUTRAL, position it in a hoist. See **LIFTING** .
2. Remove the crankshaft pulley. See **CRANKSHAFT PULLEY REMOVAL/INSTALLATION - 3.0L** .
3. Using the Oil Seal Remover, remove and discard the crankshaft front seal.

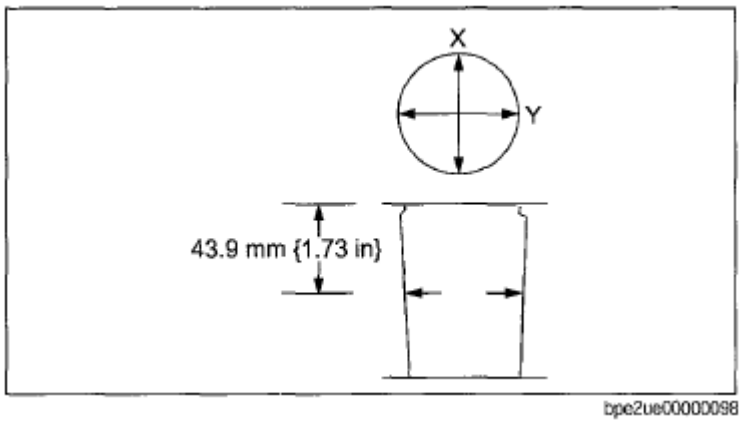


Fig. 27: Using Special Tool To Remove Crankshaft Front Seal
Courtesy of MAZDA MOTORS CORP.

INSTALLATION

1. Apply clean engine oil to the seal lip and seal bore before installing the seal.

NOTE:
- **Clean all sealing surfaces with metal surface prep.**

2. Using the Front Cover Oil Seal Installer and the Crankshaft Vibration Damper Installer, install a new crankshaft front seal.

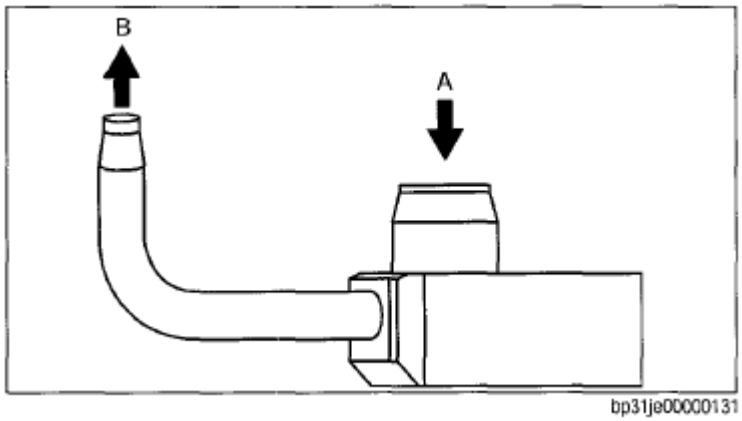


Fig. 28: Using Special Tool To Install Crankshaft Front Seal
Courtesy of MAZDA MOTORS CORP.

3. Install the crankshaft pulley. See **CRANKSHAFT PULLEY REMOVAL/INSTALLATION - 3.0L** .

FLEXPLATE REMOVAL/INSTALLATION - 3.0L

1. With the vehicle in NEUTRAL, position it on a hoist. See **LIFTING** .
2. Remove the transaxle. See **TRANSAXLE - 3.0L REMOVAL** or **TRANSAXLE - 3.0L INSTALLATION** .
3. Remove the bolts and the flexplate.
   - To install, tighten to 80 N.m {8.1 kgf.m, 59 ft.lbf}
4. To install, reverse the removal procedure.

CRANKSHAFT REAR SEAL REMOVAL/INSTALLATION - 3.0L

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. See **LIFTING** .
2. Remove the flexplate. See **FLEXPLATE REMOVAL/INSTALLATION - 3.0L** .

3. Using the Slide Hammer and the Crankshaft Rear Oil Seal Remover, remove and discard the crankshaft rear oil seal.

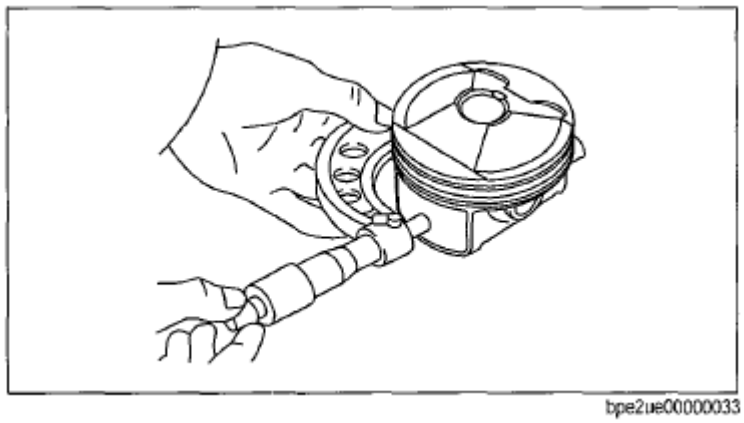


Fig. 29: Identifying Special Tool (307-005 And 303-519)
Courtesy of MAZDA MOTORS CORP.

INSTALLATION

1. Using the Crankshaft Rear Main Oil Seal Installer Bolts and the Crankshaft Rear Main Oil Seal Installer, install the crankshaft rear oil seal.

NOTE:
- **Clean all sealing surfaces with metal surface prep.**

NOTE:
- **Apply clean engine oil to the seal lip and seal bore before installing the seal.**

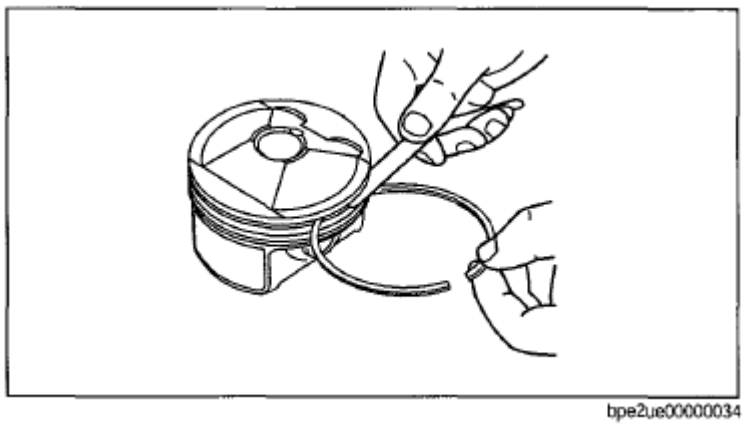


Fig. 30: Using Special Tool To Install Crankshaft Rear Oil Seal
Courtesy of MAZDA MOTORS CORP.

2. Install the flexplate. See **FLEXPLATE REMOVAL/INSTALLATION - 3.0L** .

ENGINE FRONT COVER REMOVAL/INSTALLATION - 3.0L

Engine Front Cover (View 1 of 3)

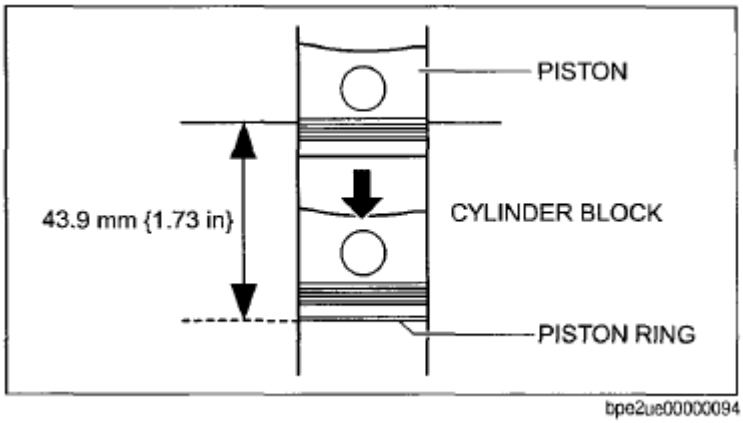


Fig. 31: Identifying Engine Front Cover Components (1 Of 3)
Courtesy of MAZDA MOTORS CORP.

Engine Front Cover (View 2 of 3)

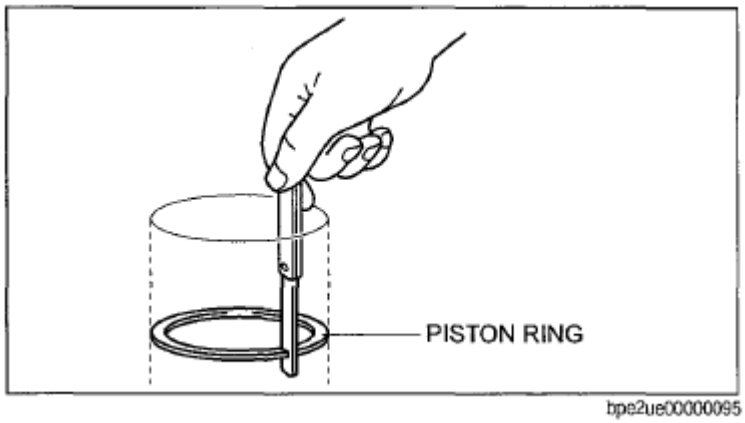


Fig. 32: Identifying Engine Front Cover Components (2 Of 3)
Courtesy of MAZDA MOTORS CORP.

Engine Front Cover (View 3 of 3)

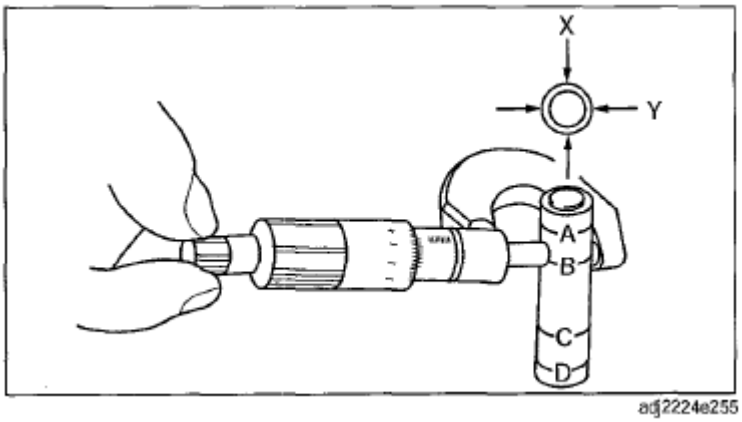


Fig. 33: Identifying Engine Front Cover Components (3 Of 3)
Courtesy of MAZDA MOTORS CORP.

REMOVAL

CAUTION:
- **During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.**

1. With the vehicle in NEUTRAL, position it on a hoist. See **LIFTING** .
2. Release the fuel system pressure. See **FUEL SYSTEM PRESSURE RELEASE** .
3. Disconnect the negative battery cable. See **BATTERY DISCONNECT** .
4. Remove the crankshaft front oil seal. See **CRANKSHAFT FRONT SEAL REMOVAL/INSTALLATION - 3.0L** .
5. Remove the generator bolt and the 2 nuts.

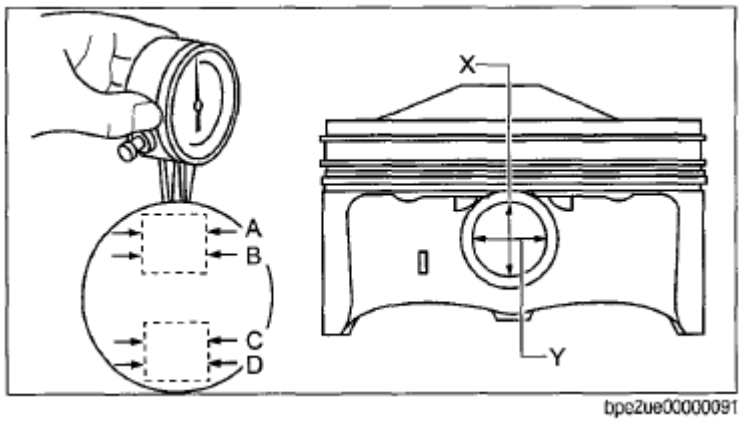


Fig. 34: Locating Generator Bolt And Nuts
Courtesy of MAZDA MOTORS CORP.

6. Remove the stud and position the generator away from the engine.

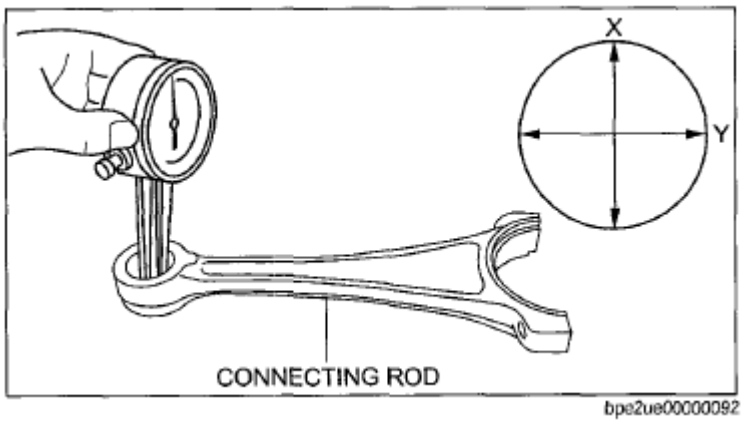


Fig. 35: Locating Stud And Generator
Courtesy of MAZDA MOTORS CORP.

7. Remove the bolt and the accessory drive belt tensioner.
8. Detach the wiring harness retainer from the engine front cover stud bolt.
9. Disconnect the Crankshaft Position (CKP) sensor electrical connector.
10. Disconnect the 2 Camshaft Position (CMP) sensor electrical connectors and detach the wiring harness retainer from the engine front cover stud bolt.
11. Remove the LH and RH Variable Camshaft Timing (VCT) oil control solenoids.
12. Remove the engine support insulator. See **ENGINE SUPPORT INSULATORS REMOVAL/INSTALLATION - 3.0L** .
13. Remove the 2 oil pan-to-front cover bolts.
14. Remove the 14 bolts, 2 stud bolts and the engine front cover.
    - Remove and discard the gaskets.

INSTALLATION

1. Use a plastic scraping tool to remove all traces of sealant.
    - Clean all sealing surfaces with metal surface prep and install new gaskets.

CAUTION:
- **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths.**

CAUTION:
- **Do not damage the oil pan gasket while cleaning the sealant from the lower cylinder block-to-oil pan joint.**

2. Apply a 6 mm (0.23 in) diameter dot of silicone gasket and sealer to the cylinder block, lower cylinder

block, cylinder head and oil pan mating surfaces.

NOTE:

- **The engine front cover must be installed and the bolts tightened within 4 minutes of applying sealant.**

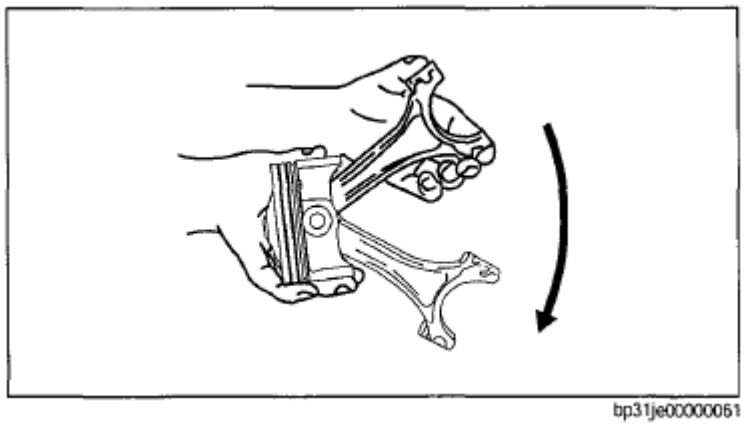


Fig. 36: Locating Silicone Gasket Location
Courtesy of MAZDA MOTORS CORP.

3. Position the engine front cover and install the bolts. Tighten in the sequence shown in the figure to 25 N.m {2.5 kgf.m, 18 ft.lbf}.

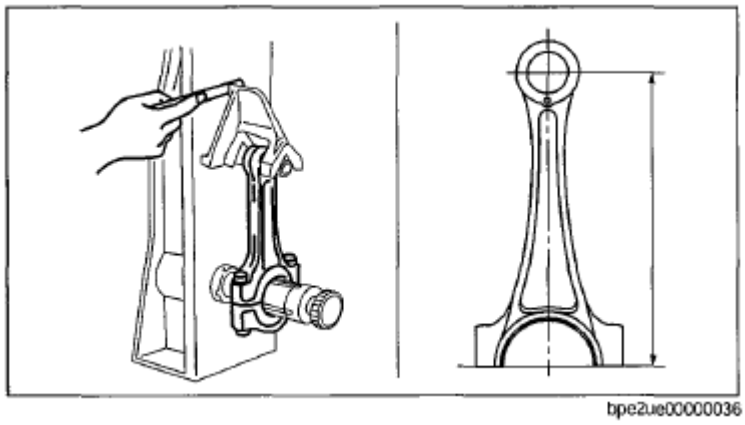


Fig. 37: Identifying Engine Front Cover Bolts In Sequence
Courtesy of MAZDA MOTORS CORP.

4. Install the 2 oil pan-to-front cover bolts.
   - Tighten to 10 N.m {1.0 kgf.m, 89 in.lbf}.
5. Remove the oil pan drain plug and drain the engine oil.
   - Install the plug and tighten to 26 N.m {2.6 kgf.m, 19 ft.lbf}.
6. Install the engine support insulator. See **ENGINE SUPPORT INSULATORS REMOVAL/INSTALLATION - 3.0L** .

7. Install the LH and RH Variable Camshaft Timing (VCT) oil control solenoids.
8. Connect the 2 Camshaft Position (CMP) sensor electrical connectors and detach the wiring harness retainer from the engine front cover stud bolt.
9. Connect the Crankshaft Position (CKP) sensor electrical connector.
10. Attach the wiring harness retainer to the engine front cover stud bolt.
11. Install the accessory drive belt tensioner and the 3 bolts.
    - Tighten to 25 N.m {2.5 kgf.m, 18 ft.lbf}.
12. Position the generator and install the stud.
    - Tighten to 8 N.m {0.8 kgf.m, 71 in.lbf}.
13. Install the generator bolt and 2 nuts.
    - Tighten to 47 N.m {4.7 kgf.m, 35 ft.lbf}.
14. Install the crankshaft front oil seal. See **CRANKSHAFT FRONT SEAL REMOVAL/INSTALLATION - 3.0L** .
15. Fill the engine with clean engine oil.
16. Connect the battery ground cable.

TIMING DRIVE COMPONENTS REMOVAL/INSTALLATION - 3.0L

REMOVAL

CAUTION:
- **Failure to verify correct timing drive component alignment will result in severe engine damage.**

CAUTION:
- **During engine repair procedures, cleanliness is extremely important. Any foreign material (including any material created while cleaning gasket surfaces) that enters the oil passages, coolant passages or the oil pan, may cause engine failure.**

1. Remove the engine front cover. See **ENGINE FRONT COVER REMOVAL/INSTALLATION - 3.0L** .
2. Remove the LH and RH spark plugs. See **SPARK PLUGS REMOVAL/INSTALLATION - 3.0L** .
3. Remove the ignition pulse wheel.

NOTE:
- **This pulse wheel is used in several different engines. Install the pulse wheel with the key-way in the slot stamped "30" or "30RFF" (orange in color).**

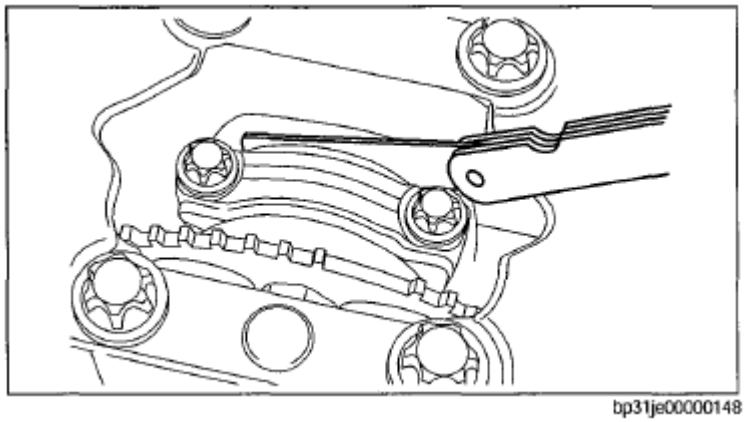


Fig. 38: Locating Ignition Pulse Wheel
Courtesy of MAZDA MOTORS CORP.

4. Install the crankshaft pulley bolt and washer.

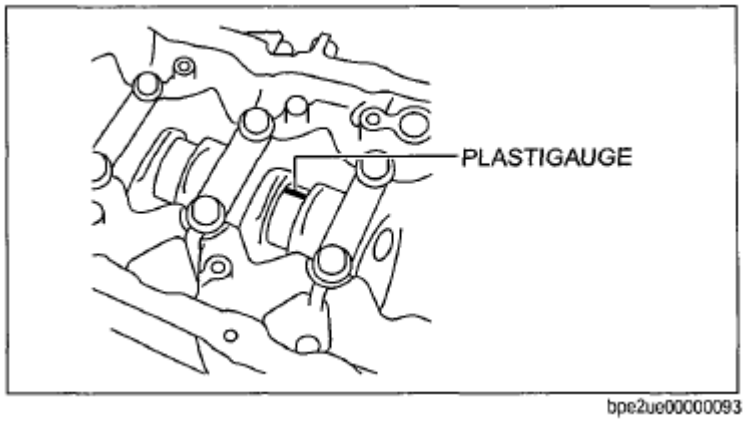


Fig. 39: Locating Crankshaft Pulley Bolt And Washer
Courtesy of MAZDA MOTORS CORP.

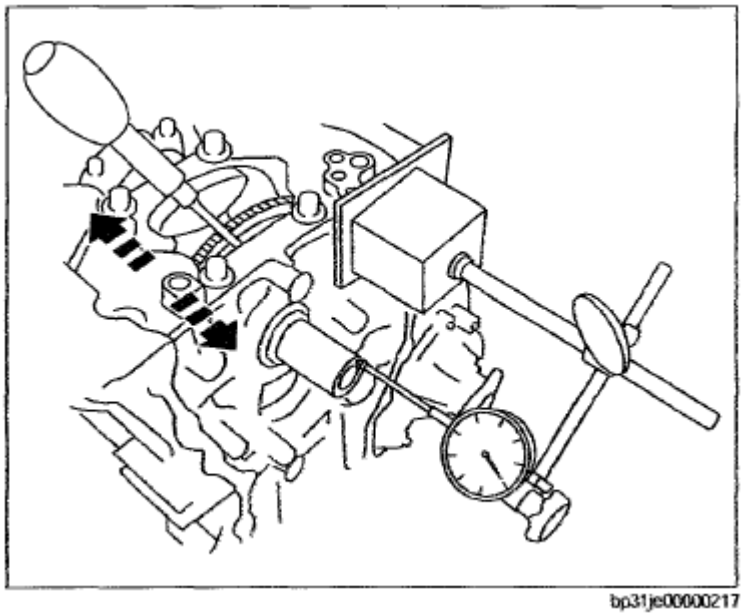


Fig. 40: Locating Chain Link Marks
Courtesy of MAZDA MOTORS CORP.

5. Rotate the crankshaft clockwise to position the crankshaft keyway in the 11 o'clock position and position the camshafts in the correct position. This will position the number one cylinder at top dead center (TDC).
    - Verify that the camshafts are correctly located. If not, rotate the crankshaft one additional turn and re-check.
6. Rotate the crankshaft clockwise 120 degrees to the 3 o'clock position to locate the RH camshafts in the neutral position.

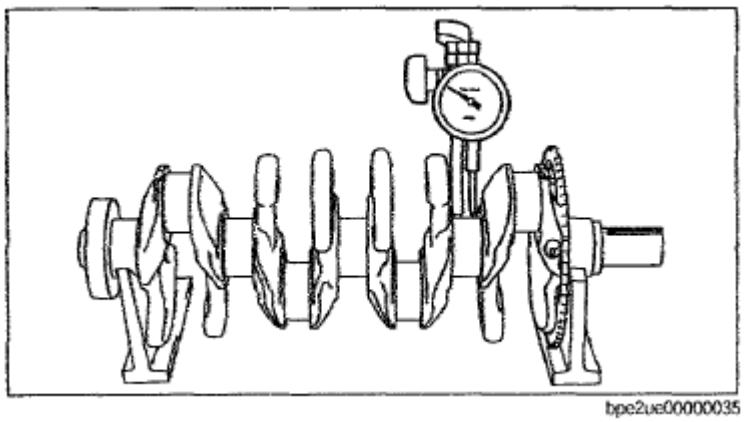


Fig. 41: Locating Crankshaft Keyway
Courtesy of MAZDA MOTORS CORP.

7. Verify that the RH camshafts are in the neutral position.

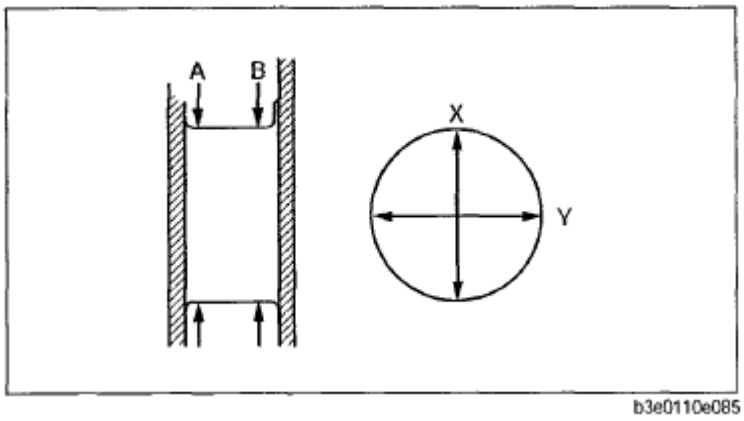


Fig. 42: Locating RH Camshafts Marks
Courtesy of MAZDA MOTORS CORP.

8. Remove the RH timing chain and tensioner arm.
    1. Remove the bolts.
    2. Remove the tensioner.
    3. Remove the tensioner arm.

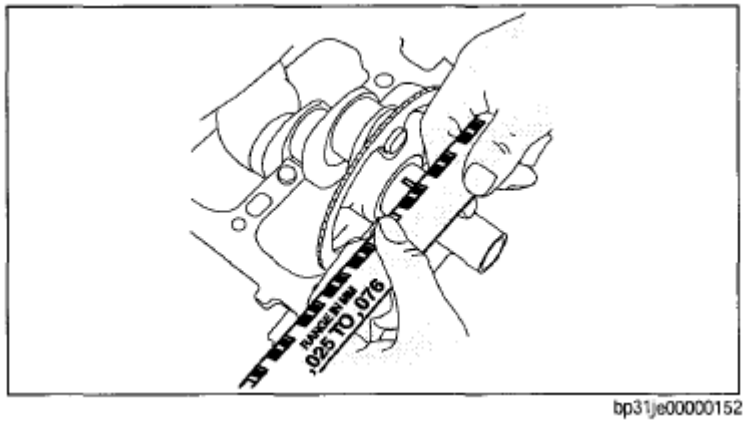


Fig. 43: Identifying Tensioner Arm, Tensioner And Bolts
Courtesy of MAZDA MOTORS CORP.

9. Remove the 2 bolts and the RH timing chain guide.
    - Remove the RH timing chain from the engine.

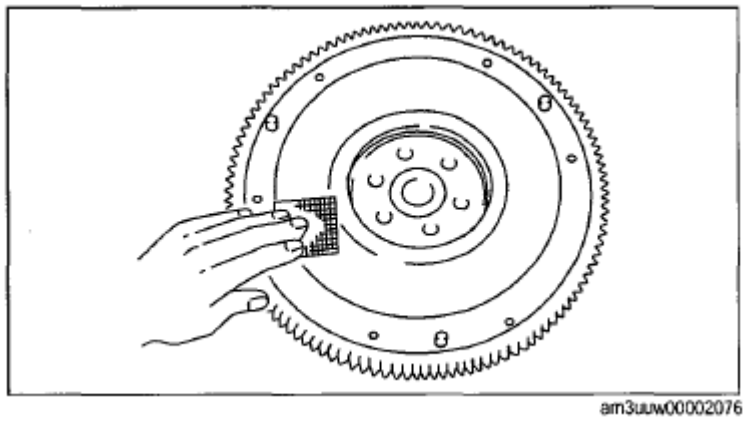


Fig. 44: Locating Bolts And RH Timing Chain Guide
Courtesy of MAZDA MOTORS CORP.

10. Rotate the crankshaft clockwise 600 degrees (1-2/3 times) to position the crankshaft keyway in the 11 o'clock position. This will position the LH camshafts in the neutral position.

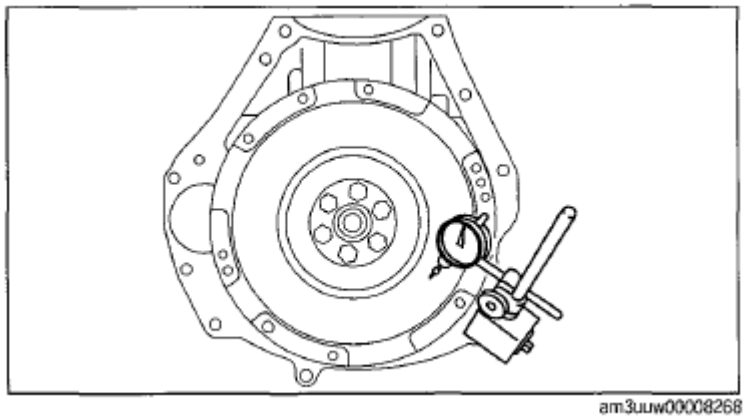


Fig. 45: Locating Crankshaft Keyway
Courtesy of MAZDA MOTORS CORP.

11. Verify that the LH camshafts are in the neutral position.

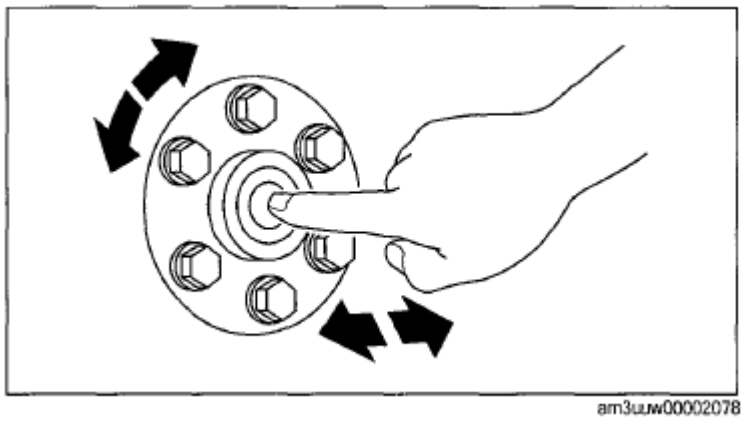


Fig. 46: Locating LH Camshafts Marks
Courtesy of MAZDA MOTORS CORP.

12. Remove the LH timing chain and tensioner arm.
    1. Remove the bolts.
    2. Remove the tensioner.
    3. Remove the tensioner arm.

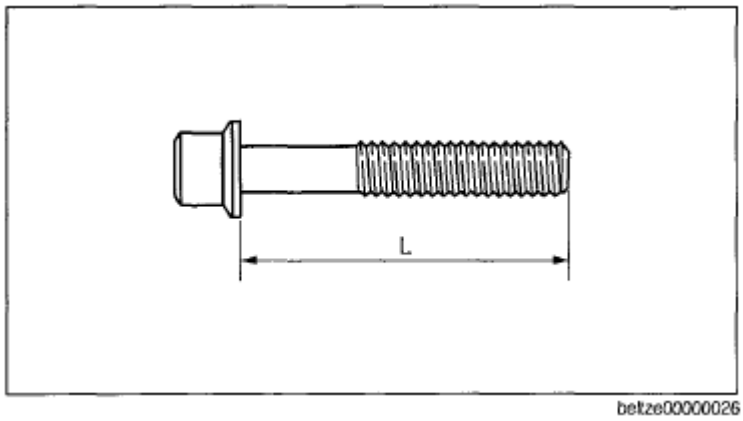
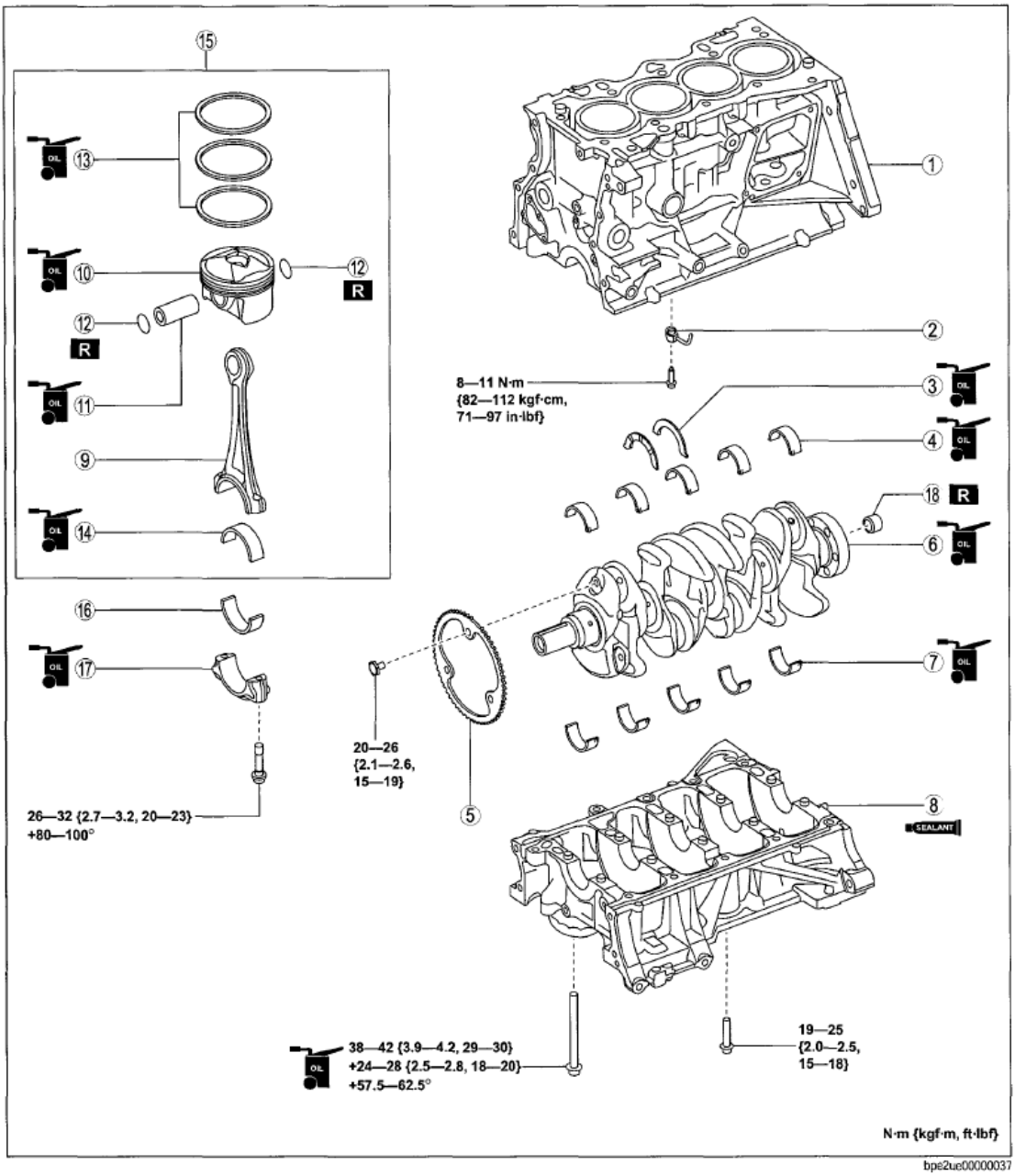


Fig. 47: Identifying Tensioner Arm, Tensioner And Bolt
Courtesy of MAZDA MOTORS CORP.

13. Remove the LH timing chain and timing chain guide.
    - Remove the LH timing chain from the engine.



bpe2ue00000037

1	Upper cylinder block
2	Oil jet valve
3	Thrust bearing (See Thrust Bearing And Main Bearing Assembly Note.)
7	Lower main bearing (See Thrust Bearing And Main Bearing Assembly Note.)
8	Lower cylinder block (See Lower Cylinder Block Assembly Note.)
9	Connecting rod
10	Piston
11	Piston pin (See Piston Pin Assembly Note.)
12	Snap ring (See Snap Ring Assembly Note.)

4	Upper main bearing (See Thrust Bearing And Main Bearing Assembly Note.)
5	Plate (See Plate Assembly Note.)
6	Crankshaft
14	Upper connecting rod bearing (See Connecting Rod Bearing Assembly Note.)
15	Piston, connecting rod (See Piston, Connecting Rod Assembly Note.)
16	Lower connecting rod bearing (See Connecting Rod Bearing Assembly Note.)
17	Connecting rod cap (See Connecting Rod Cap Assembly Note.)

Fig. 48: Locating LH Timing Chain And Timing Chain Guide
Courtesy of MAZDA MOTORS CORP.

14. Remove the crankshaft pulley bolt and the crankshaft sprockets.

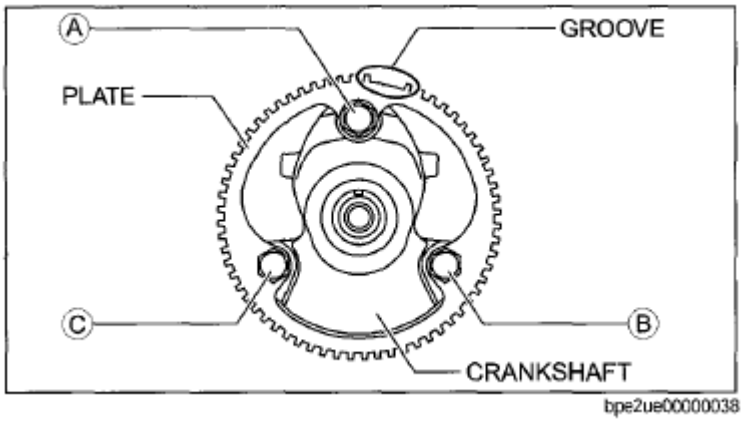


Fig. 49: Locating Crankshaft Pulley Bolt And Crankshaft Sprockets
Courtesy of MAZDA MOTORS CORP.

INSTALLATION

1. Install the crankshaft sprockets with the timing marks out.

CAUTION:
- **Failure to verify correct timing drive component alignment will result in severe engine damage.**

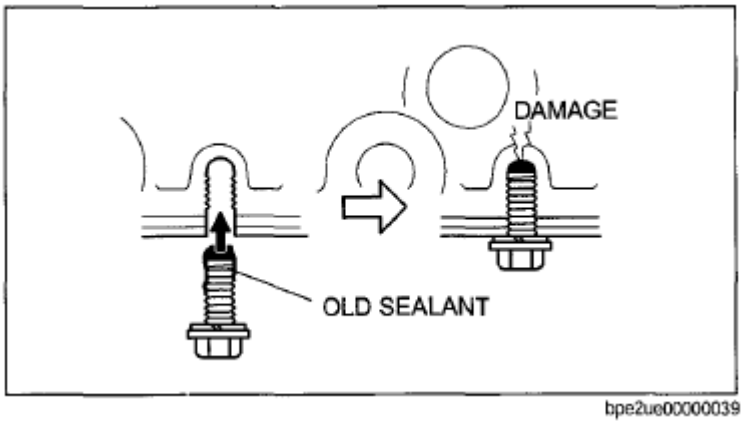


Fig. 50: Locating Crankshaft Sprockets
Courtesy of MAZDA MOTORS CORP.

2. Position the chain tensioner in a soft-jawed vise.

NOTE:
- **LH shown in the figure, RH side similar.**

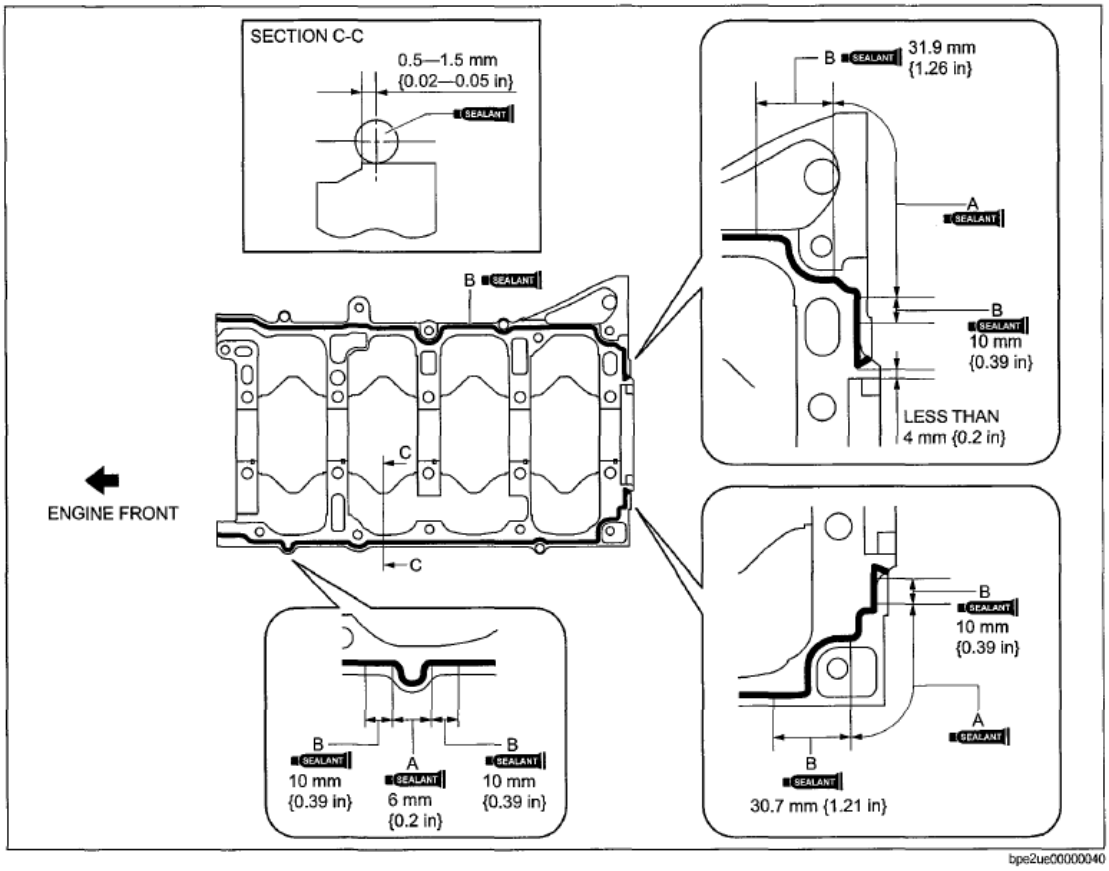


Fig. 51: Identifying Chain Tensioner
Courtesy of MAZDA MOTORS CORP.

3. Hold the chain tensioner ratchet lock mechanism away from the ratchet stem with a small pick.

NOTE:

- **LH shown in the figure, RH similar.**

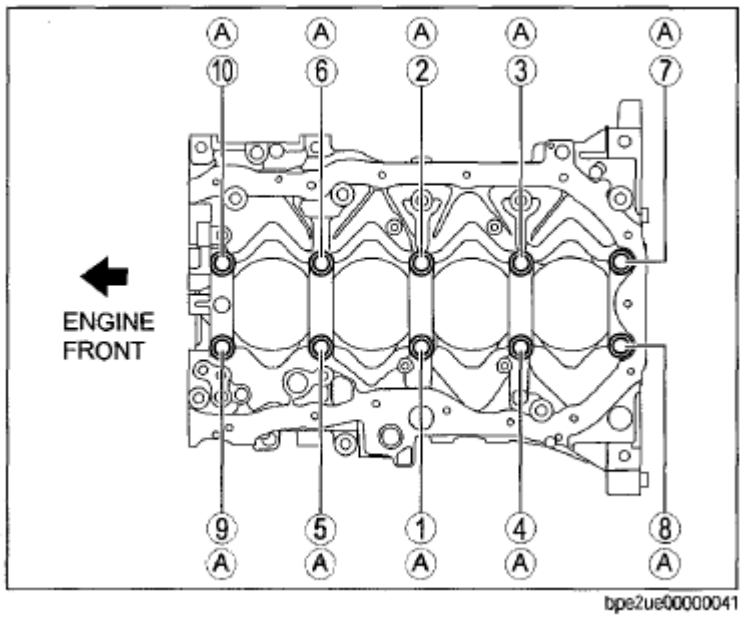


Fig. 52: Illustrating Holding Chain Tensioner Ratchet Lock Mechanism With Small Pick
Courtesy of MAZDA MOTORS CORP.

4. Slowly compress the timing chain tensioner.

CAUTION:
- **During tensioner compression, do not release the ratchet stem until the tensioner piston is fully bottomed in its bore or damage to the ratchet stem will result.**

5. Retain the tensioner piston with a 1.5 mm (0.06 in) wire or paper clip.

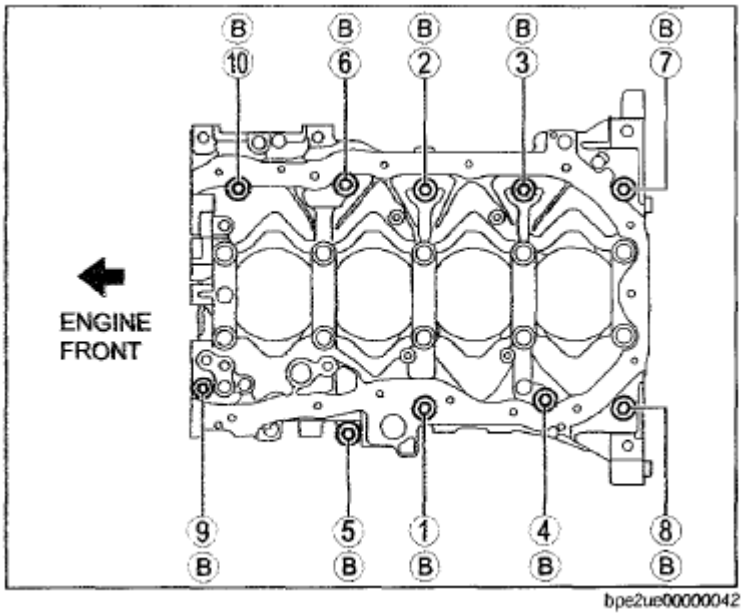


Fig. 53: Identifying Retain Tensioner Piston Wire Or Paper Clip
Courtesy of MAZDA MOTORS CORP.

6. If timing marks on the timing chains are not evident, use a permanent-type marker to mark the crankshaft and camshaft timing marks on the LH and RH timing chains.
    1. Mark any link to use as the crankshaft timing mark.
    2. Starting with the crankshaft timing mark, count 29 links and mark the link.
    3. Continue counting to 42 and mark the link.

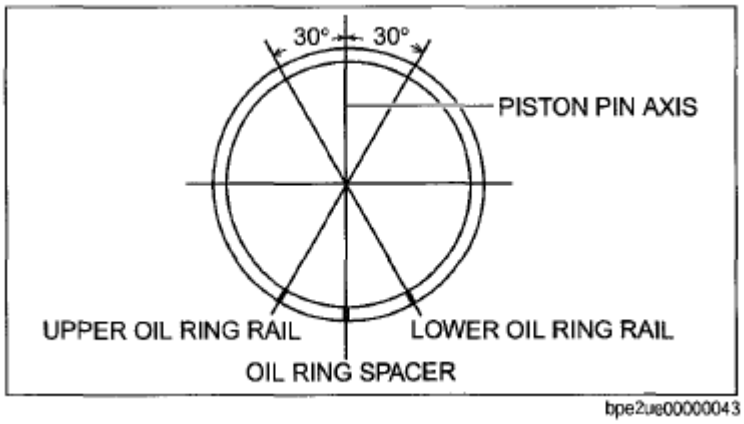


Fig. 54: Identifying Timing Marks On Timing Chains
Courtesy of MAZDA MOTORS CORP.

7. Position the LH timing chain and guide and install the bolts.
    - Tighten to 25 N.m {2.5 kgf.m, 18 ft.lbf}.
    - Align the marks on the timing chain with the marks on the camshaft and crankshaft sprockets.

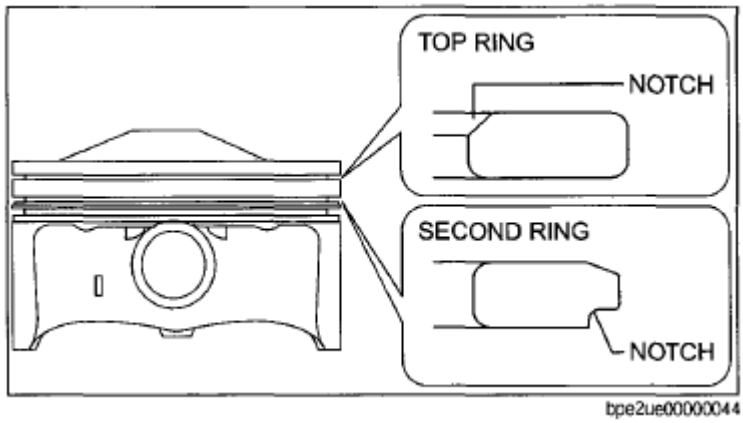


Fig. 55: Locating LH Timing Chain, Guide And Bolts
Courtesy of MAZDA MOTORS CORP.

8. Install the LH timing chain and tensioner arm and the LH timing chain tensioner.
    1. Install the tensioner arm.
    2. Position the tensioner.
    3. Install the bolt.
        1. Tighten to 25 N.m {2.5 kgf.m, 18 ft.lbf}.

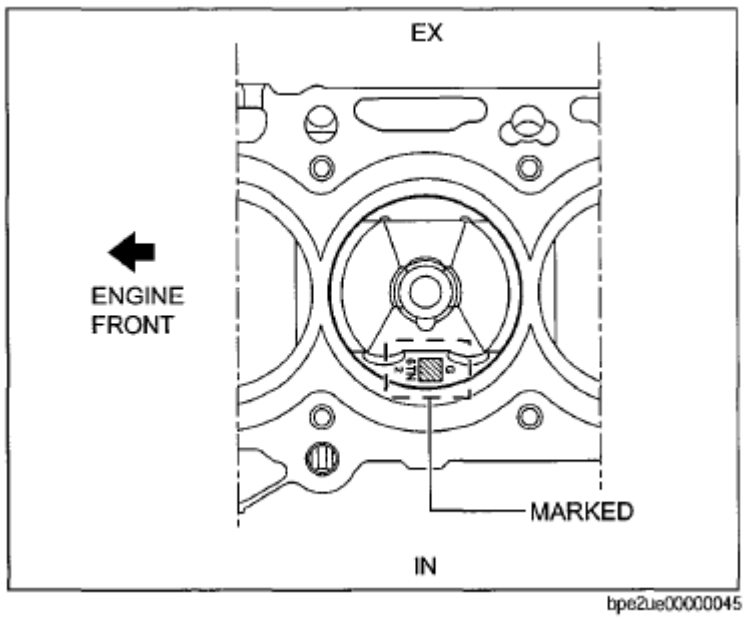


Fig. 56: Identifying Tensioner Arm, Tensioner And Bolt
Courtesy of MAZDA MOTORS CORP.

9. Install the crankshaft pulley bolt and rotate the crankshaft clockwise 120 degrees until the crankshaft keyway is in the 3 o'clock position.

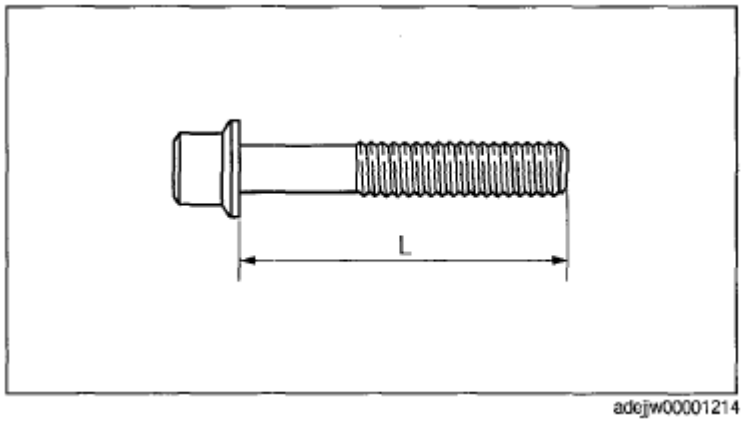


Fig. 57: Locating Crankshaft Keyway
Courtesy of MAZDA MOTORS CORP.

10. Verify that the RH camshafts are correctly positioned.

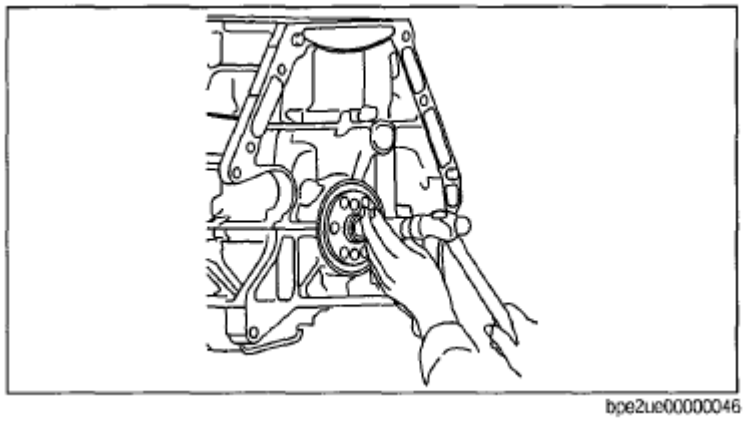


Fig. 58: Locating RH Camshafts Marks
Courtesy of MAZDA MOTORS CORP.

11. Position the RH timing chain and chain guide and install the bolts.
    - Tighten to 25 N.m {2.5 kgf.m, 18 ft.lbf}.
    - Align the marks on the timing chain with the marks on the camshaft and crankshaft sprockets.

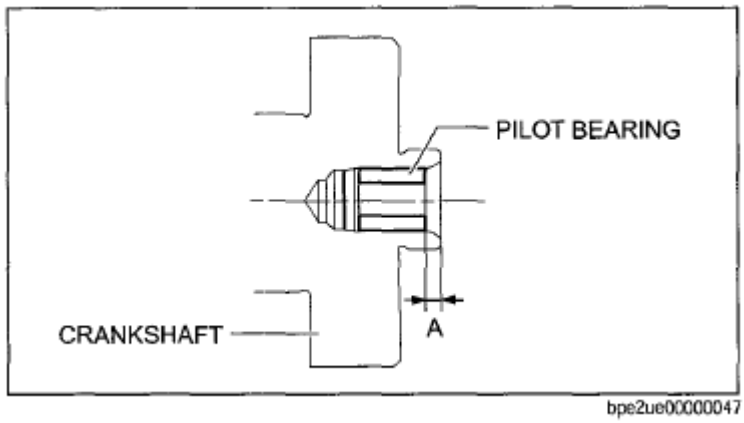
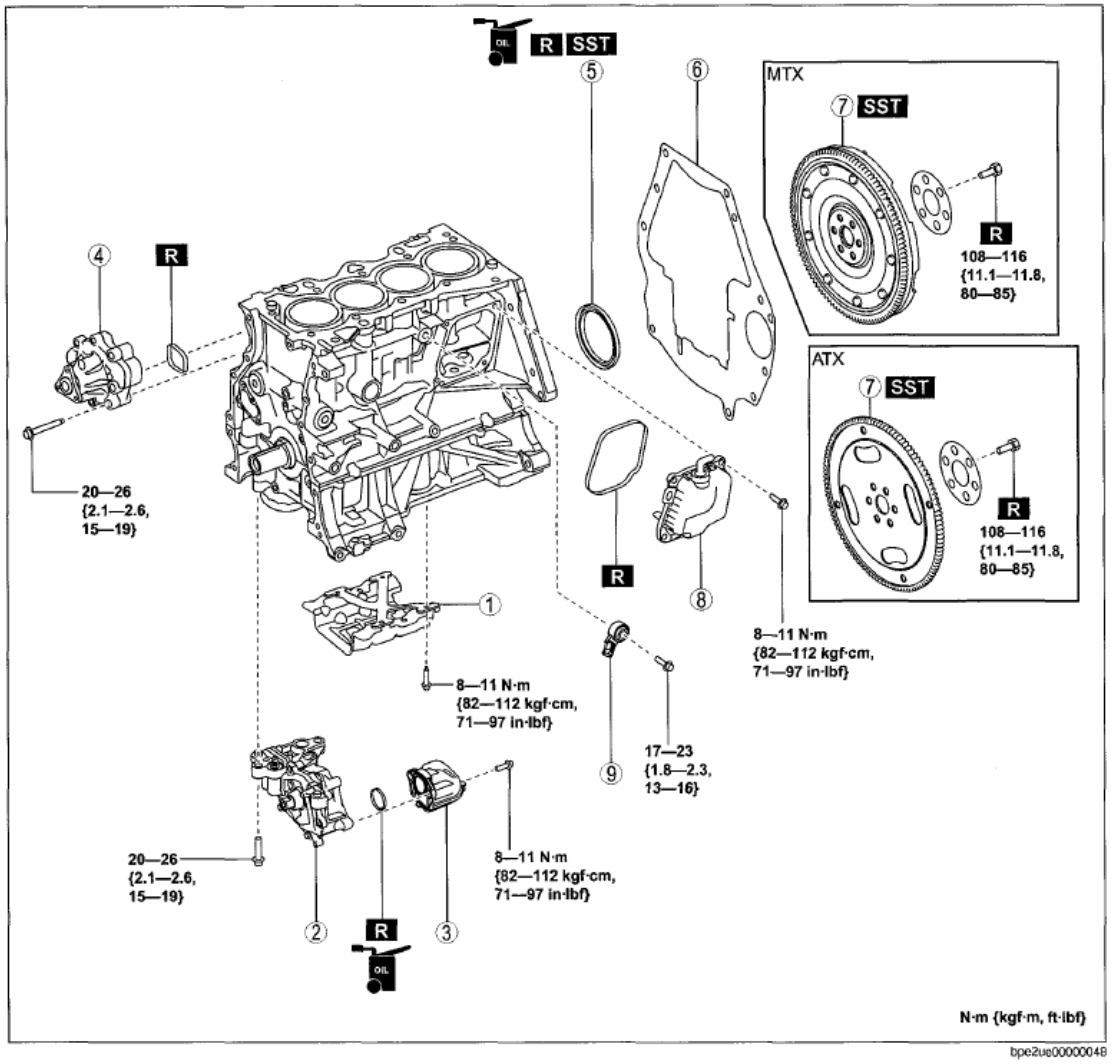


Fig. 59: Locating RH Timing Chain, Chain Guide And Bolts
Courtesy of MAZDA MOTORS CORP.

12. Install the RH timing chain tensioner and tensioner arm.
    1. Install the tensioner arm.
    2. Position the tensioner.
    3. Install the bolts.
        1. Tighten to 25 N.m {2.5 kgf.m, 18 ft.lbf}.



1	Oil baffle plate (See Oil Baffle Plate Assembly Note.)
2	Oil pump (See Oil Pump Assembly Note.)
3	Oil strainer
4	Water pump (See Water Pump Assembly Note.)
5	Rear oil seal (See Rear Oil Seal Assembly Note.)

6	End plate (See End Plate Assembly Note.)
7	Flywheel (MTX), drive plate (ATX) (See Flywheel (MTX), Drive Plate (ATX) Assembly Note.)
8	Oil separator
9	Knock sensor

Fig. 60: Identifying Tensioner Arm, Tensioner And Bolt
Courtesy of MAZDA MOTORS CORP.

13. Remove the LH and RH timing chain tensioner piston retaining wires.
14. Rotate the crankshaft counterclockwise 120 degrees to top dead center (TDC).

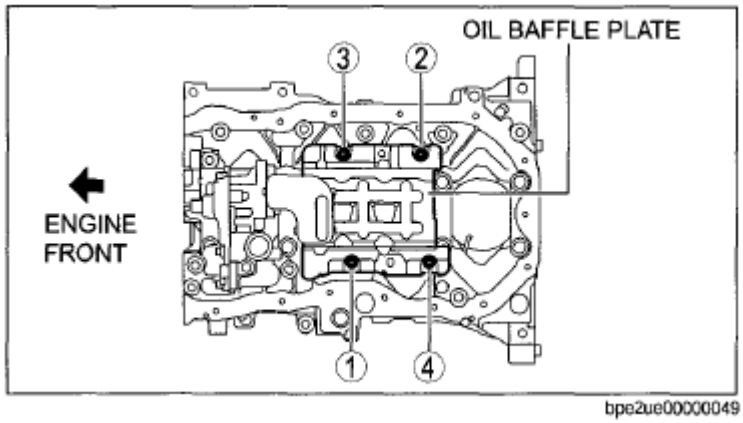


Fig. 61: Locating LH And RH Timing Chain Marks
Courtesy of MAZDA MOTORS CORP.

15. Verify the timing with the following steps.
    1. There should be 12 chain links between the camshaft timing marks.
    2. There should be 27 chain links between the camshaft and crankshaft timing marks.
    3. There should be 30 chain links between the camshaft and crankshaft timing marks.

CAUTION:
- **Failure to verify correct timing drive component alignment will result in severe engine damage.**

16. Remove the crankshaft pulley bolt and washer.

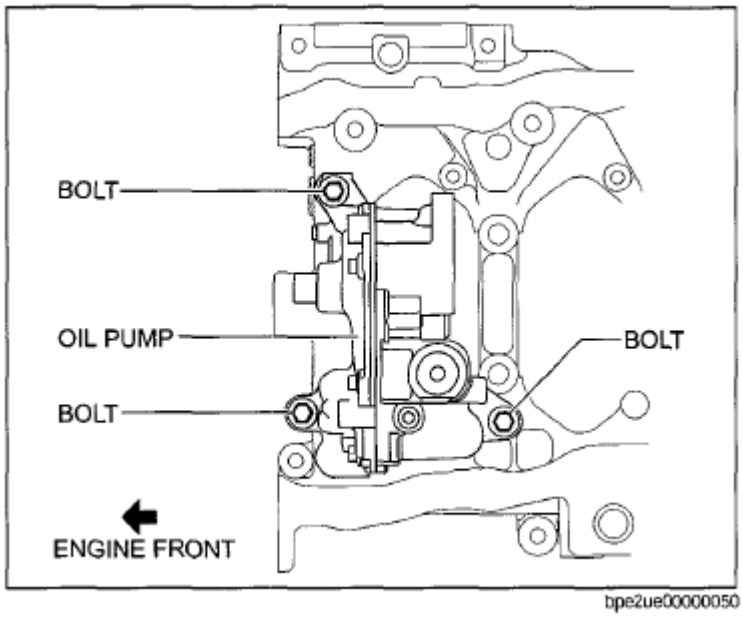


Fig. 62: Locating Crankshaft Pulley Bolt And Washer
Courtesy of MAZDA MOTORS CORP.

17. Install the ignition pulse wheel.

CAUTION:

- **This pulse wheel is used in several different engines. Install the pulse wheel with the keyway in the slot stamped "30" or "30RFF" (orange in color).**

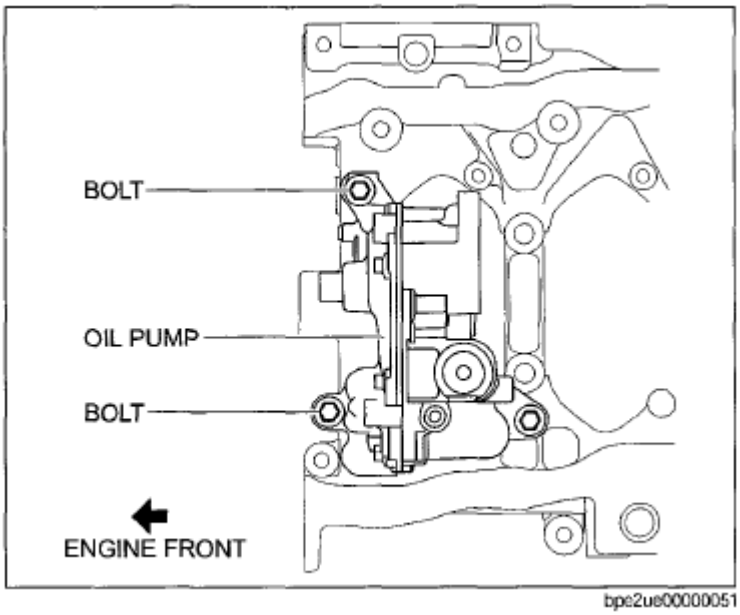


Fig. 63: Locating Ignition Pulse Wheel
Courtesy of MAZDA MOTORS CORP.

18. Install the LH and RH spark plugs. See **SPARK PLUGS REMOVAL/INSTALLATION - 3.0L** .
19. Install the engine front cover. See **ENGINE FRONT COVER REMOVAL/INSTALLATION - 3.0L** .

VALVE TRAIN COMPONENTS EXPLODED VIEW - 3.0L

LH SIDE ROLLER FOLLOWER, HYDRAULIC LASH ADJUSTER AND VALVE SPRING

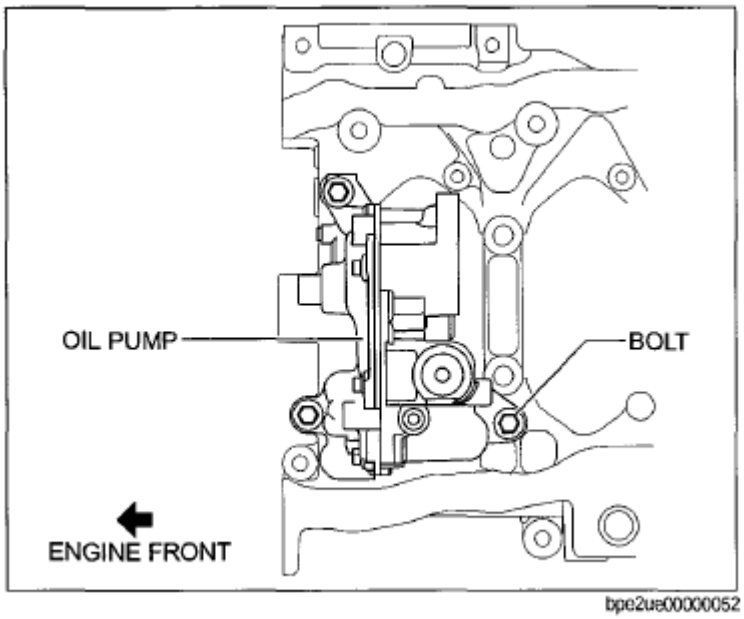


Fig. 64: Identifying LH Side Roller Follower, Hydraulic Lash Adjuster And Valve Spring Components
Courtesy of MAZDA MOTORS CORP.

LH SIDE INTAKE AND EXHAUST CAMSHAFTS

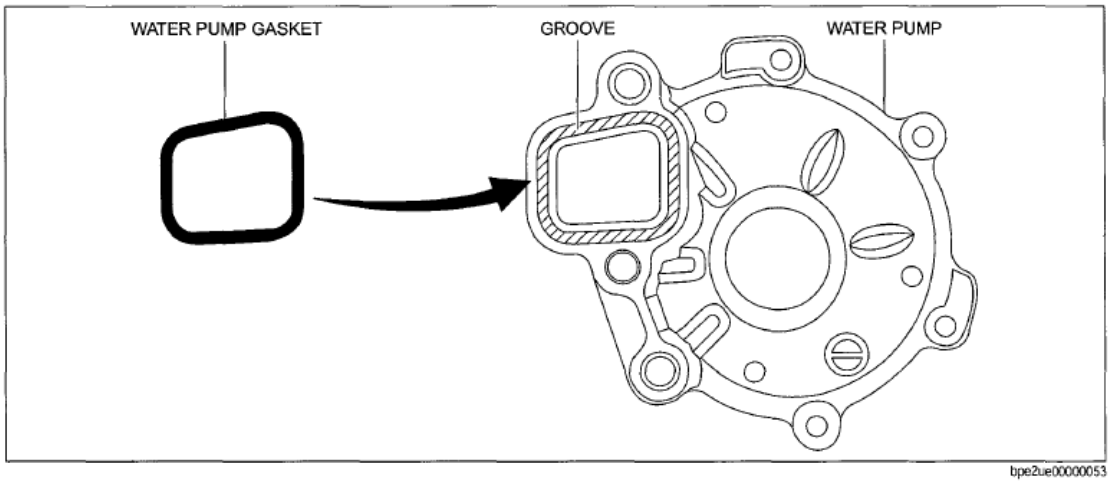


Fig. 65: Identifying LH Side Intake And Exhaust Camshafts Components
Courtesy of MAZDA MOTORS CORP.

COOLANT PUMP BELT AND PULLEY

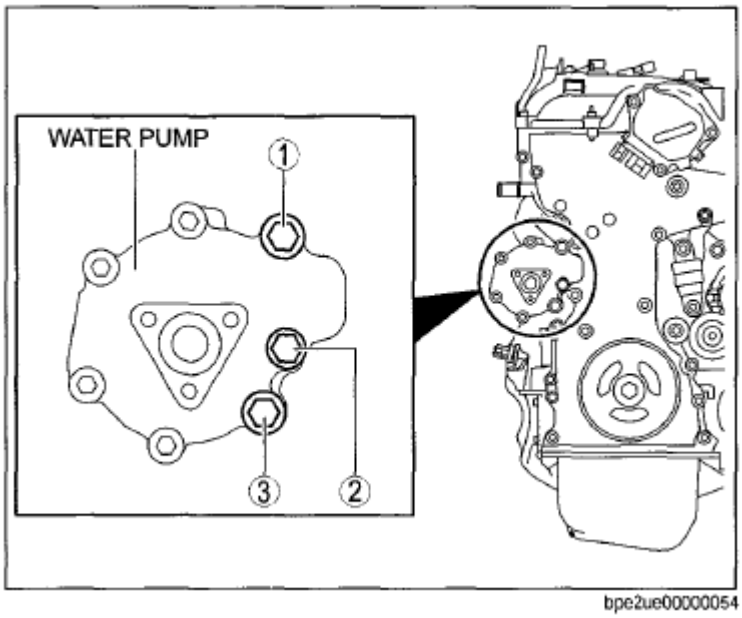


Fig. 66: Identifying Coolant Pump Belt And Pulley
Courtesy of MAZDA MOTORS CORP.

RH SIDE ROLLER FOLLOWER, HYDRAULIC LASH ADJUSTER AND VALVE SPRING

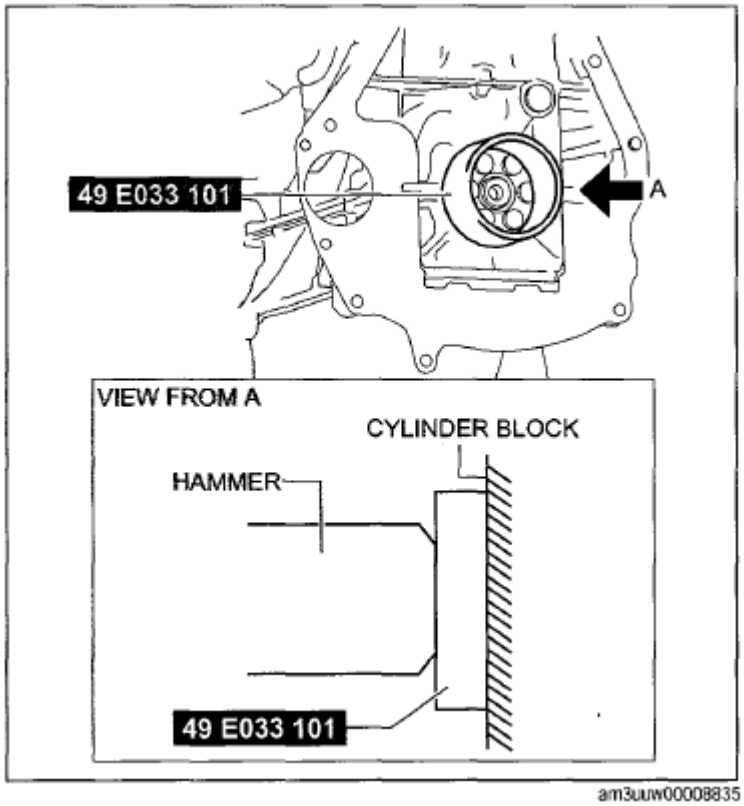


Fig. 67: Identifying RH Side Roller Follower, Hydraulic Lash Adjuster And Valve Spring Components

Courtesy of MAZDA MOTORS CORP.

RH SIDE INTAKE AND EXHAUST CAMSHAFT

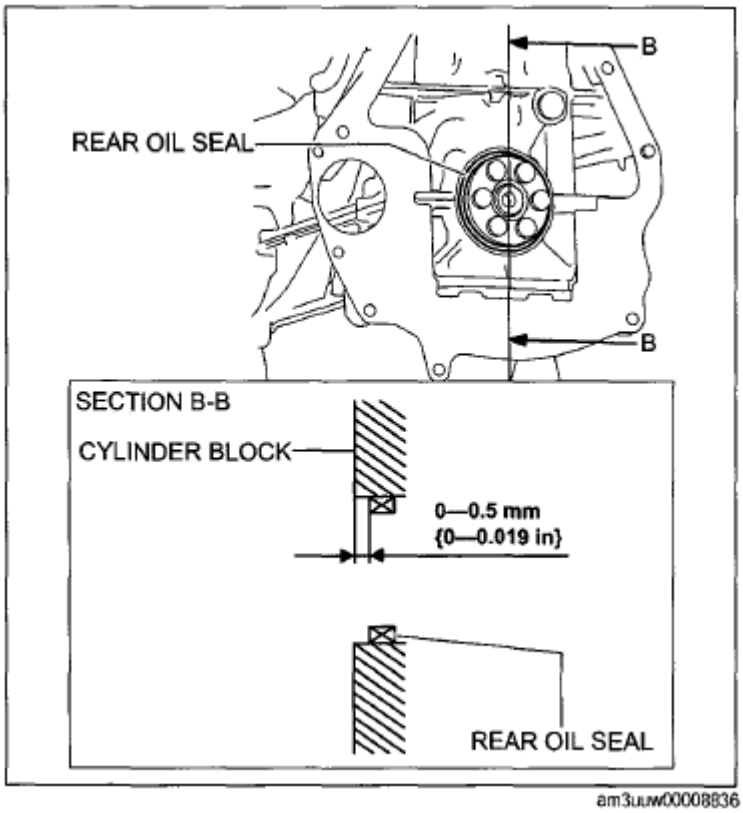


Fig. 68: Identifying RH Side Intake And Exhaust Camshaft Components
Courtesy of MAZDA MOTORS CORP.

1. For additional information, see the procedures in this service information.

CAMSHAFTS REMOVAL/INSTALLATION - LH, 3.0L

REMOVAL

1. Remove the water pump belt. See **WATER PUMP BELT REMOVAL/INSTALLATION - 3.0L** .
2. Remove the timing drive components. See **TIMING DRIVE COMPONENTS REMOVAL/INSTALLATION - 3.0L** .
3. Using the Water Pump Pulley Plate, Water Pump Shaft Protector and the Crankshaft Vibration Damper Remover, remove the coolant pump pulley.

NOTE:

- **Failure to use the correct special tools, assembled as shown in the illustration, will result in damage to the coolant pump pulley and/or special tools.**

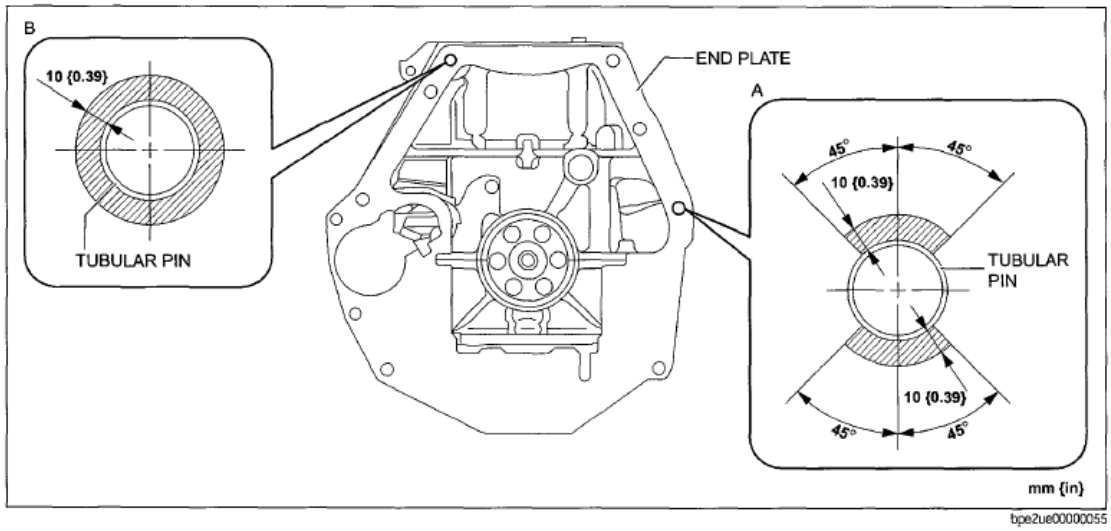


Fig. 69: Identifying Water Pump Pulley Plate, Water Pump Shaft Protector And Crankshaft Vibration Damper Remover
Courtesy of MAZDA MOTORS CORP.

4. Using the Oil Seal Remover, remove and discard the camshaft oil seal.

CAUTION:
- **Do not scratch the camshaft sealing surface while removing the camshaft oil seal. If scratched, camshaft oil seal leakage may occur.**

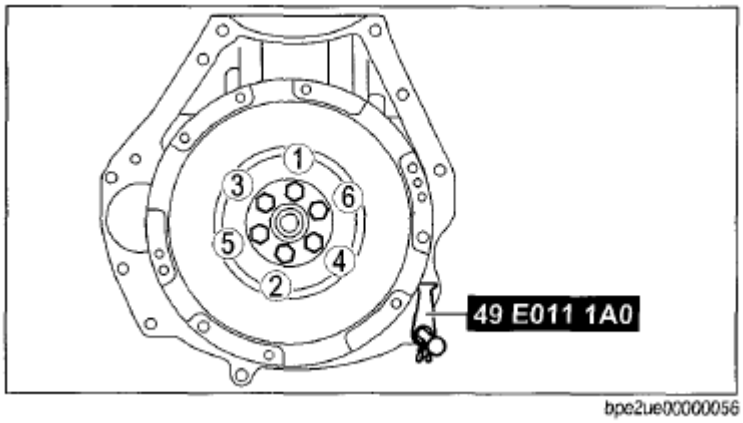
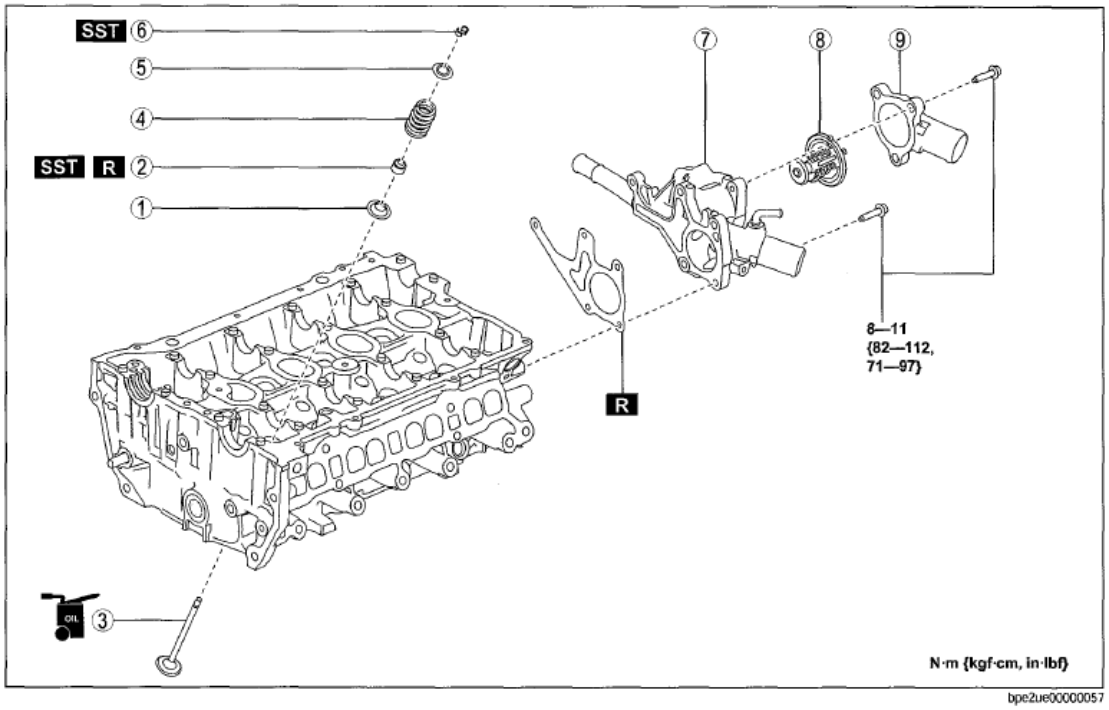


Fig. 70: Removing Camshaft Oil Seal Using Oil Seal Remover
Courtesy of MAZDA MOTORS CORP.

5. Remove the 2 bolts and the camshaft oil seal retainer.
   - Discard the press-in-place gasket.



1	Lower valve spring seat
2	Valve seal (See Valve Seal Assembly Note.)
3	Valve
4	Valve spring (See Valve Spring Assembly Note.)
5	Upper valve spring seat

6	Valve keeper (See Valve Keeper Assembly Note.)
7	Water outlet (See Water Outlet Assembly Note.)
8	Thermostat (See Thermostat Assembly Note.)
9	Thermostat cover

Fig. 71: Locating Bolts And Camshaft Oil Seal Retainer
Courtesy of MAZDA MOTORS CORP.

6. Verify the LH camshafts are in the neutral position.

CAUTION:
- **The camshafts must be in the neutral position before removing the bearing caps or damage to the engine may occur.**

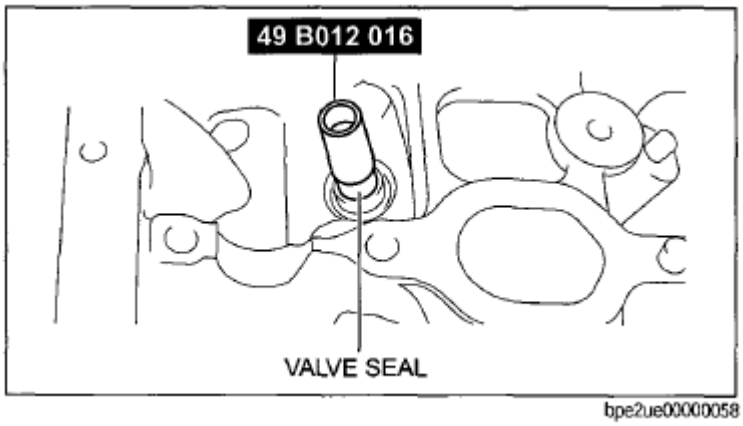


Fig. 72: Locating LH Camshafts
Courtesy of MAZDA MOTORS CORP.

7. Remove the 3 bolts and the LH camshaft phaser and sprocket.

NOTE:

- **Do not allow the camshaft to rotate from the neutral position while removing the camshaft phaser and sprocket or damage to the engine may occur.**

NOTE:

- **Install a 3/8-in ratchet and extension into the D-slot on the rear of the intake camshaft to hold the camshaft in place for removal of the camshaft phaser and sprocket bolts.**

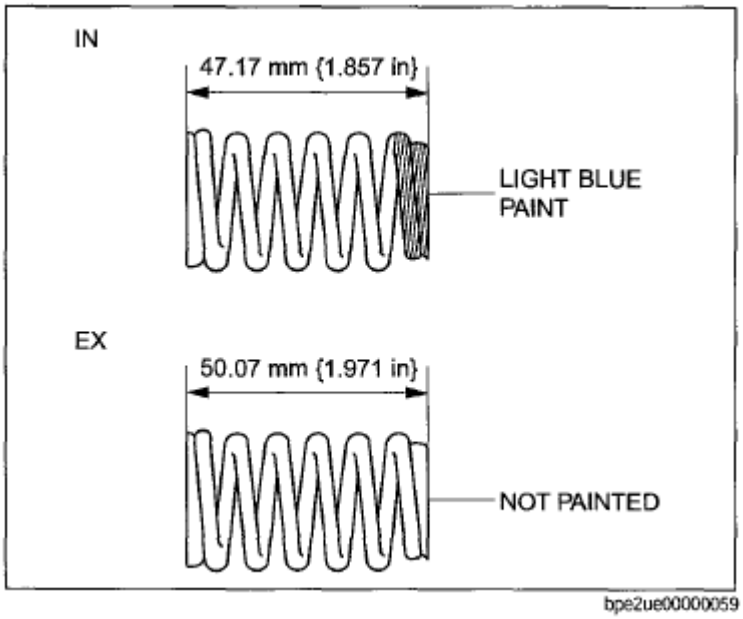


Fig. 73: Locating Bolts, LH Camshaft Phaser And Sprocket
Courtesy of MAZDA MOTORS CORP.

8. If necessary, mark the camshaft bearing cap position and orientation as shown in the illustration.

CAUTION:

- **Cylinder head camshaft bearing caps must be assembled in their original positions. Some engines have factory markings on the camshaft bearing caps (as shown in illustration). Engines that do not have the factory markings must be marked for correct position and orientation prior to removal. Failure to install the camshaft bearing caps in their original positions may result in severe engine damage.**

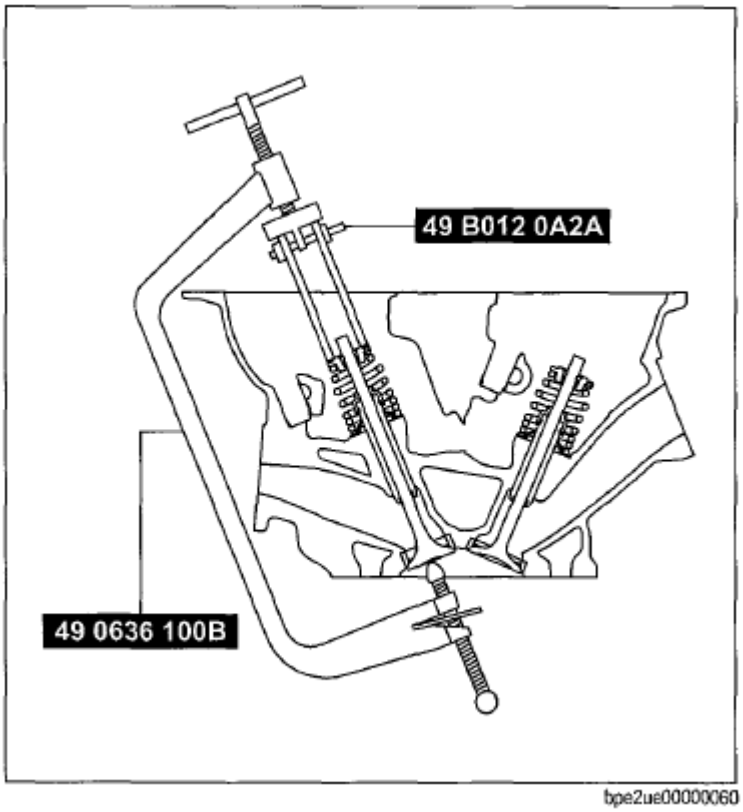


Fig. 74: Locating Camshaft Bearing Cap
Courtesy of MAZDA MOTORS CORP.

9. Loosen the bolts evenly in the sequence shown in the figure.
    1. Remove the camshaft bearing thrust caps (1L and 5L).
    2. Remove the remaining camshaft bearing caps.
    3. Remove the camshafts from the cylinder head.

CAUTION:
- **After loosening all of the camshaft bearing cap bolts, remove the camshaft bearing thrust caps (1L and 5L) first, or damage to the thrust caps may occur.**

NOTE:
- **Make sure the camshaft bearing caps are marked as instructed in the previous step.**

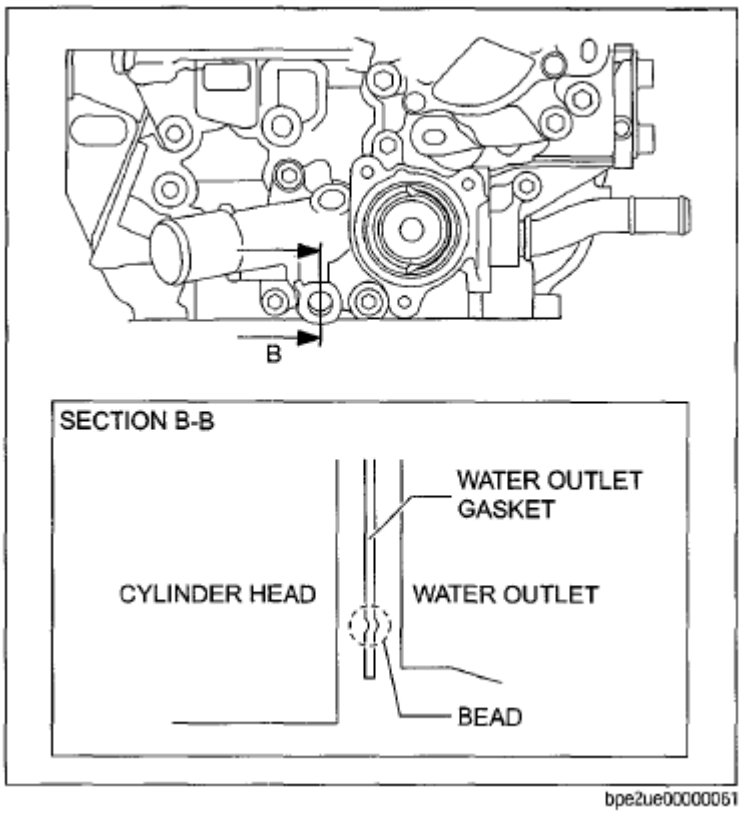


Fig. 75: Identifying Camshaft Bearing Cap Bolts In Sequence
Courtesy of MAZDA MOTORS CORP.

INSTALLATION

1. Position the camshaft phaser and sprocket onto the intake camshaft.
    - Install the 3 bolts finger-tight.

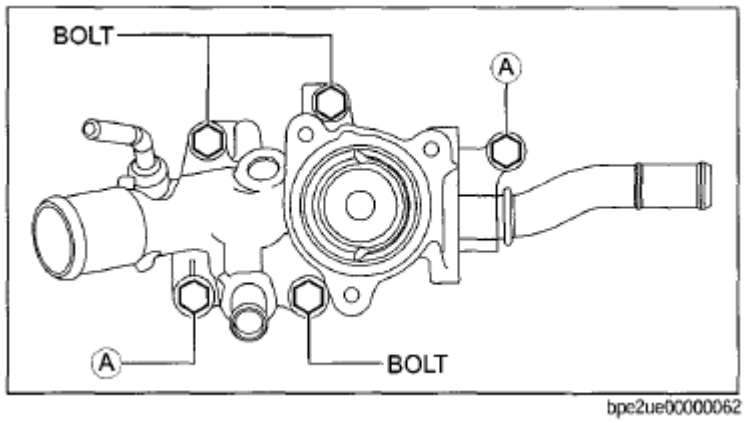


Fig. 76: Locating LH Camshafts
Courtesy of MAZDA MOTORS CORP.

2. Lubricate the LH camshafts with clean engine oil and carefully position the camshafts onto the cylinder head.
   - Align the LH camshafts as shown in the figure.
3. Lubricate the bearing surfaces of the camshaft bearing thrust caps with clean engine oil and install the bearing thrust caps.
   - Loosely install the bolts.

CAUTION:
- **Cylinder head camshaft journal caps and cylinder heads are numbered to verify that they are assembled in their original positions. If not reassembled in their original positions, severe engine damage may occur.**

CAUTION:
- **Do not install the camshaft journal thrust caps until all of the camshaft bearing caps have been installed or damage to the thrust caps can occur.**

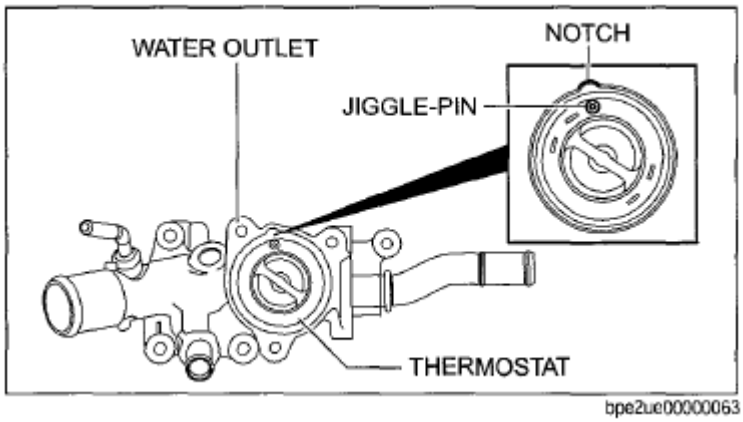


Fig. 77: Locating Cylinder Head Camshaft Journal Caps
Courtesy of MAZDA MOTORS CORP.

4. Lubricate the bearing surfaces of the LH camshaft bearing thrust caps with clean engine oil and install the bearing thrust caps.
   - Loosely install the bolts.

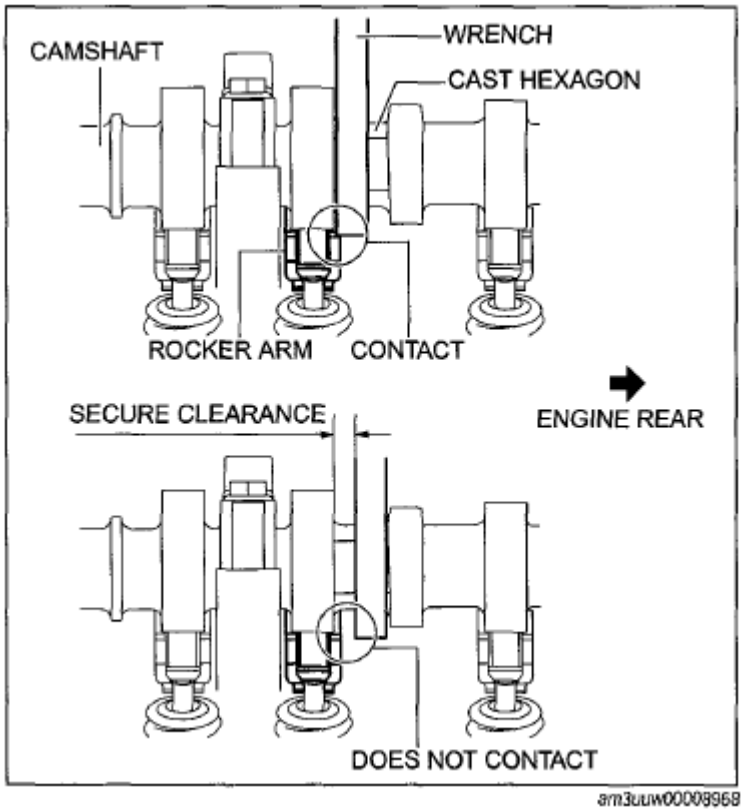


Fig. 78: Locating LH Camshaft Bearing Thrust Caps And Bolts
Courtesy of MAZDA MOTORS CORP.

5. Tighten the LH camshaft bearing cap bolts in the sequence shown in the figure in 2 stages.
   - Stage 1: Tighten to 10 N.m {1.0 kgf.m, 89 in.lbf}.
   - Stage 2: Tighten to 10 N.m {1.0 kgf.m, 89 in.lbf}.

NOTE:

- **Make sure to tighten the camshaft bearing cap bolts in sequence in 2 stages.**

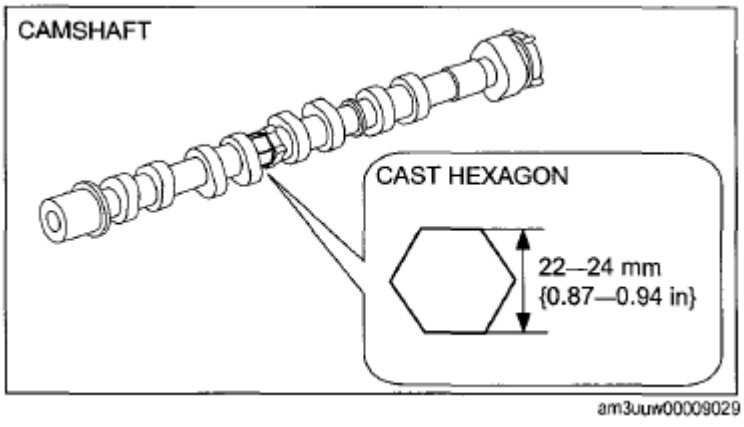
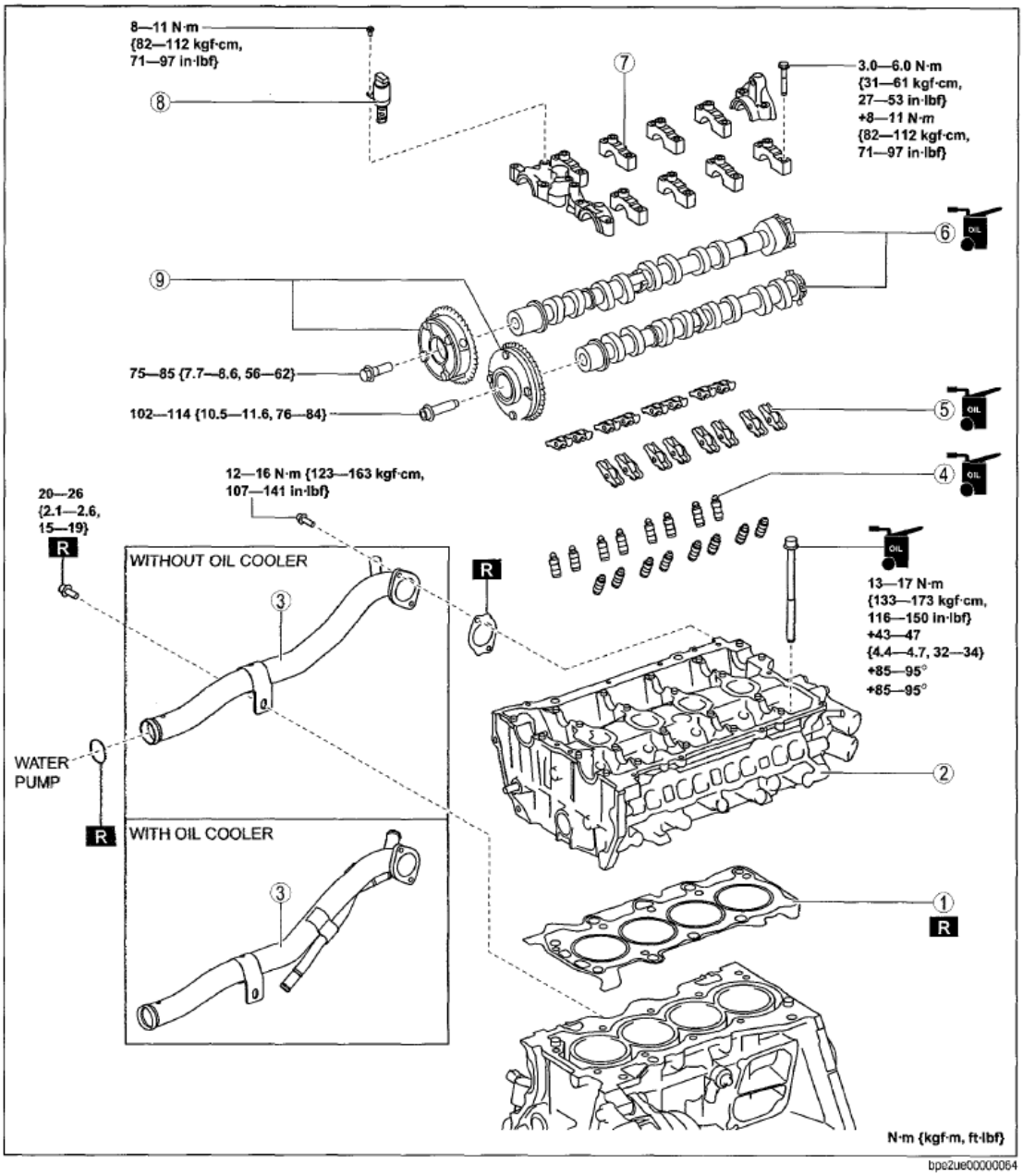


Fig. 79: Identifying LH Camshaft Bearing Caps Bolts In Sequence
Courtesy of MAZDA MOTORS CORP.

6. Tighten the 3 LH camshaft phaser and sprocket bolts to 18 N.m {1.8 kgf.m, 159 in.lbf}.

CAUTION:
- **Do not allow the camshaft to rotate from the neutral position while tightening the camshaft phaser and sprocket bolts or damage to the engine may occur.**

NOTE:
- **Install a 3/8-in ratchet and extension into the D-slot on the rear of the intake camshaft to hold the camshaft in place for tightening of the camshaft phaser and sprocket bolts.**



1	Cylinder head gasket
2	Cylinder head (See Cylinder Head Assembly Note.)
3	Water inlet pipe (See Water Inlet Pipe Assembly Note.)
4	HLA (See HLA Assembly Note.)
5	Rocker arm (See Rocker Arm Assembly Note.)

6	Camshaft (See Camshaft Assembly Note.)
7	Camshaft cap (See Camshaft Assembly Note.)
8	OCV
9	Electric variable valve timing actuator, hydraulic variable valve timing actuator (See Electric Variable Valve Timing Actuator, Hydraulic Variable Valve Timing Actuator Assembly Note.)

Fig. 80: Locating Bolts, LH Camshaft Phaser And Sprocket
Courtesy of MAZDA MOTORS CORP.

7. Install the special tool in the camshaft as shown in the illustration.

- Install the camshaft oil seal retainer and the 2 bolts.
- Tighten to 10 N.m {1.0 kgf.m, 89 in.lbf}.

NOTE:

- **Clean the sealing surfaces with metal surface prep before installing a new press-in-place gasket.**

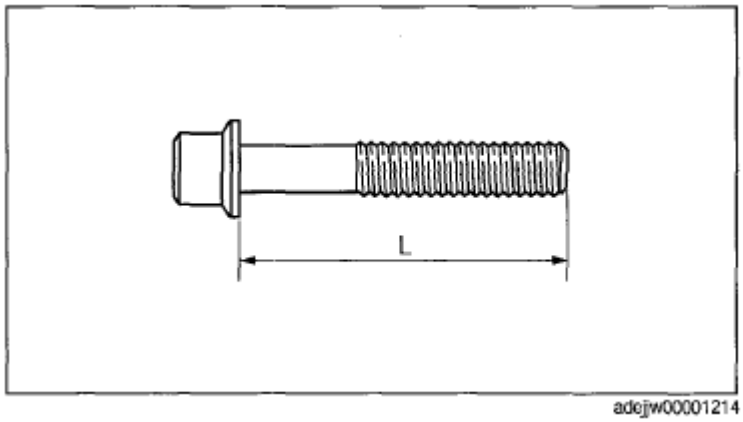


Fig. 81: Locating Bolts And Camshaft Oil Seal Retainer
Courtesy of MAZDA MOTORS CORP.

8. Using the Camshaft Oil Seal Installer, Camshaft Oil Seal Protector and the Power Steering Pump Pulley Installer, install the camshaft oil seal.

NOTE:

- **Lubricate the camshaft oil seal with clean engine oil.**

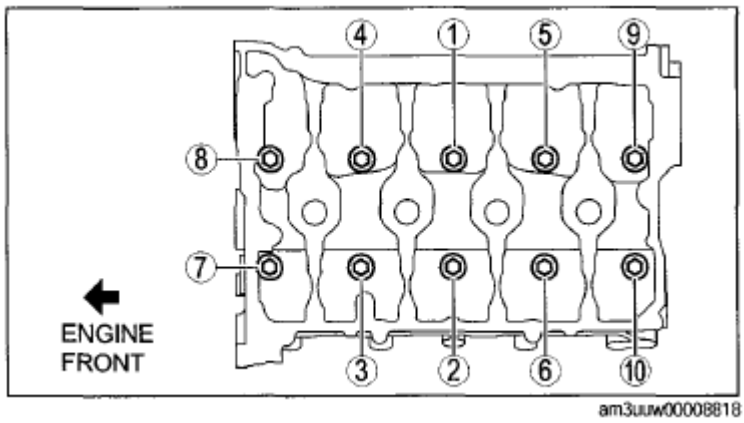


Fig. 82: Identifying Special Tools (303-464, 303-463 And 211-185)
Courtesy of MAZDA MOTORS CORP.

9. Install the Camshaft Pulley Installer in the camshaft as shown in the illustration.
   - Adjust the collar on the Camshaft Pulley Installer screw to get the best thread engagement in the rear of the camshaft.

CAUTION:
- **Failure to use the correct special tools, assembled as shown in the illustration, will result in damage to the coolant pump pulley and/or special tools.**

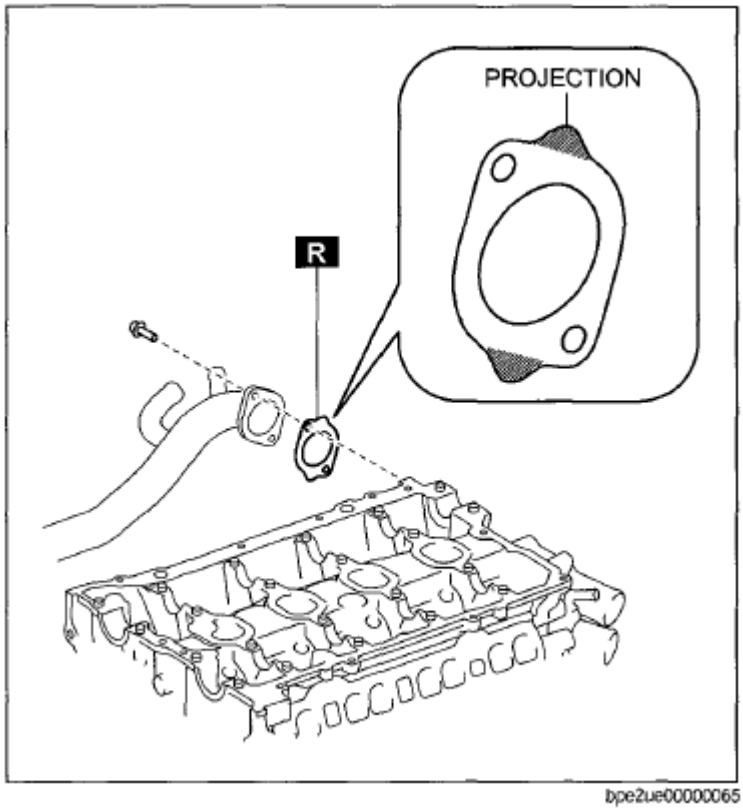


Fig. 83: Identifying Camshaft Pulley Installer In Camshaft
Courtesy of MAZDA MOTORS CORP.

10. Position the coolant pump pulley over the previously installed Camshaft Pulley Installer and on the end of the camshaft. Install the Camshaft Pulley Installer, Power Steering Pump Pulley Installer and the Water Pump Pulley Spacer as shown in the illustration.
    - Using the Camshaft Pulley Installer, Power Steering Pump Pulley Installer and the Water Pump Pulley Spacer, install a new service coolant pump pulley flush with the end of the camshaft.

CAUTION:
- **Failure to use the correct special tools, assembled as shown in the illustration, will result in damage to the coolant pump pulley and/or special tools.**

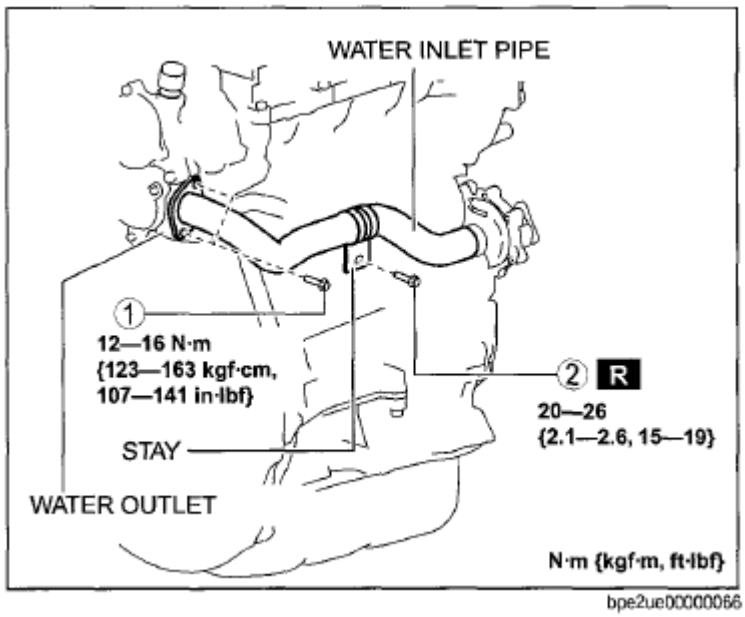


Fig. 84: Identifying Camshaft Pulley Installer
Courtesy of MAZDA MOTORS CORP.

NOTE:

- **Only the roller collared nut from the Power Steering Pump Pulley Installer (211-185) is used on Camshaft Pulley Installer (303-458).**

11. Install the timing drive components. See **TIMING DRIVE COMPONENTS REMOVAL/INSTALLATION - 3.0L** .
12. Install the water pump belt. See **WATER PUMP BELT REMOVAL/INSTALLATION - 3.0L** .

CAMSHAFTS REMOVAL/INSTALLATION - RH, 3.0L

REMOVAL

1. Remove the timing drive components. See **TIMING DRIVE COMPONENTS REMOVAL/INSTALLATION - 3.0L** .
2. Verify the RH camshafts are in the neutral position.

CAUTION:

- **The camshafts must be in the neutral position before removing the bearing caps or damage to the engine may occur.**

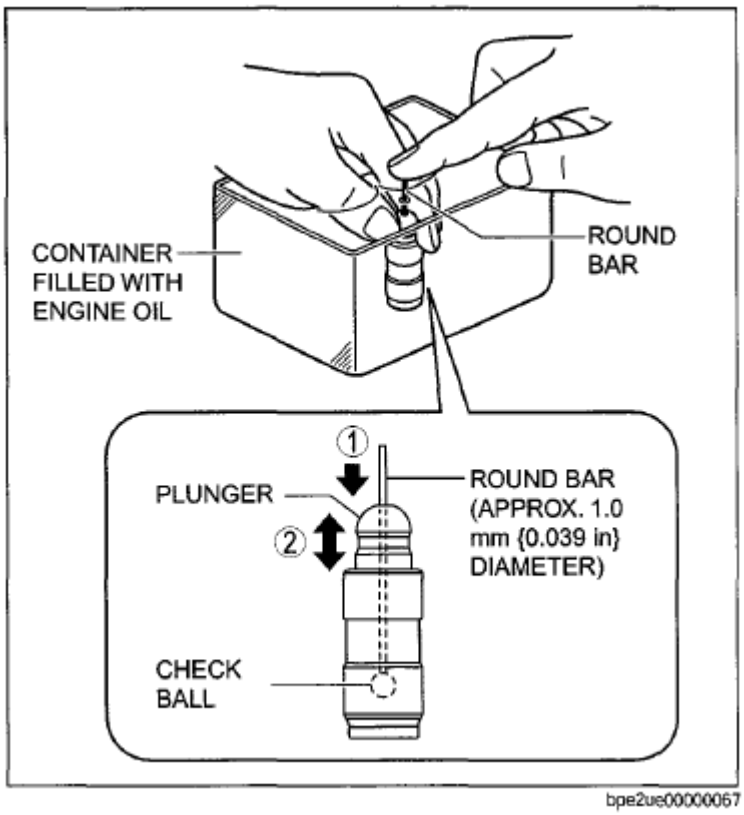


Fig. 85: Locating RH Camshafts Marks
Courtesy of MAZDA MOTORS CORP.

3. Remove the 3 bolts and the RH camshaft phaser and sprocket.

CAUTION:
- **Do not allow the camshaft to rotate from the neutral position while removing the camshaft phaser and sprocket or damage to the engine may occur.**

NOTE:
- **Install a 3/8-in ratchet and extension into the D-slot on the rear of the intake camshaft to hold the camshaft in place for removal of the camshaft phaser and sprocket bolts.**

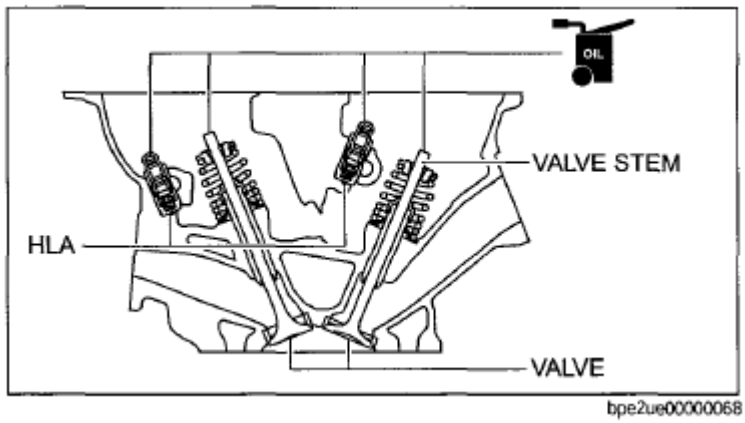


Fig. 86: Locating Bolts And RH Camshaft Phaser And Sprocket
Courtesy of MAZDA MOTORS CORP.

4. If necessary, mark the camshaft bearing cap position and orientation as shown in the illustration.

CAUTION:

- **Cylinder head camshaft bearing caps must be assembled in their positions. Some engines have factory markings on the camshaft caps (as shown in illustration). Engines that do not have the facto markings must be marked for correct position and orientation pri removal. Failure to install the camshaft bearing caps in their origi positions may result in severe engine damage.**

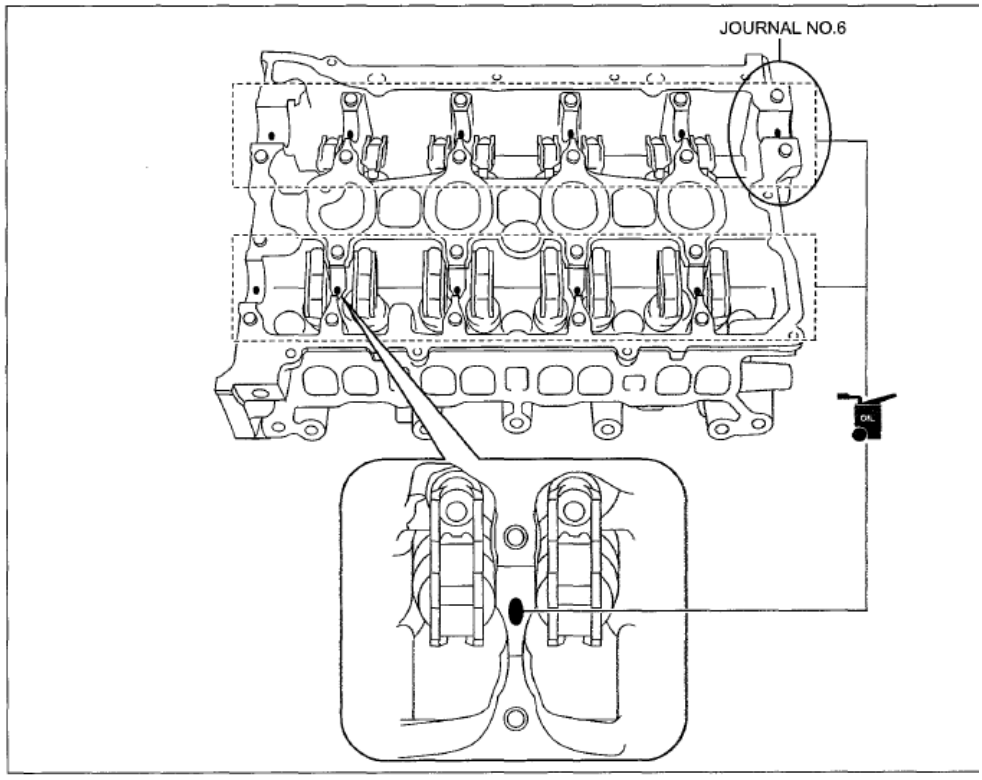


Fig. 87: Locating Camshaft Bearing Cap
Courtesy of MAZDA MOTORS CORP.

5. Loosen the bolts evenly in the sequence shown in the figure.
    1. Remove the camshaft bearing thrust caps (5R and 1R).
    2. Remove the remaining camshaft bearing caps.
    3. Remove the camshafts from the cylinder head.

CAUTION:

- **After loosening all of the camshaft bearing cap bolts, remove the camshaft bearing thrust caps (5R and 1R) first, or damage to the thrust caps may occur.**

NOTE:

- **Make sure the camshaft bearing caps are marked as instructed in the previous step.**

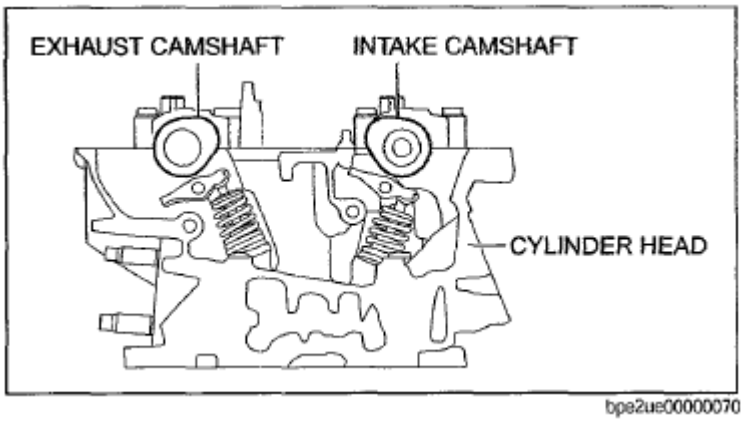


Fig. 88: Locating Camshaft Bearing Cap Bolts
Courtesy of MAZDA MOTORS CORP.

INSTALLATION

1. Position the RH camshaft phaser and sprocket onto the intake camshaft.
   - Install the 3 bolts finger-tight.

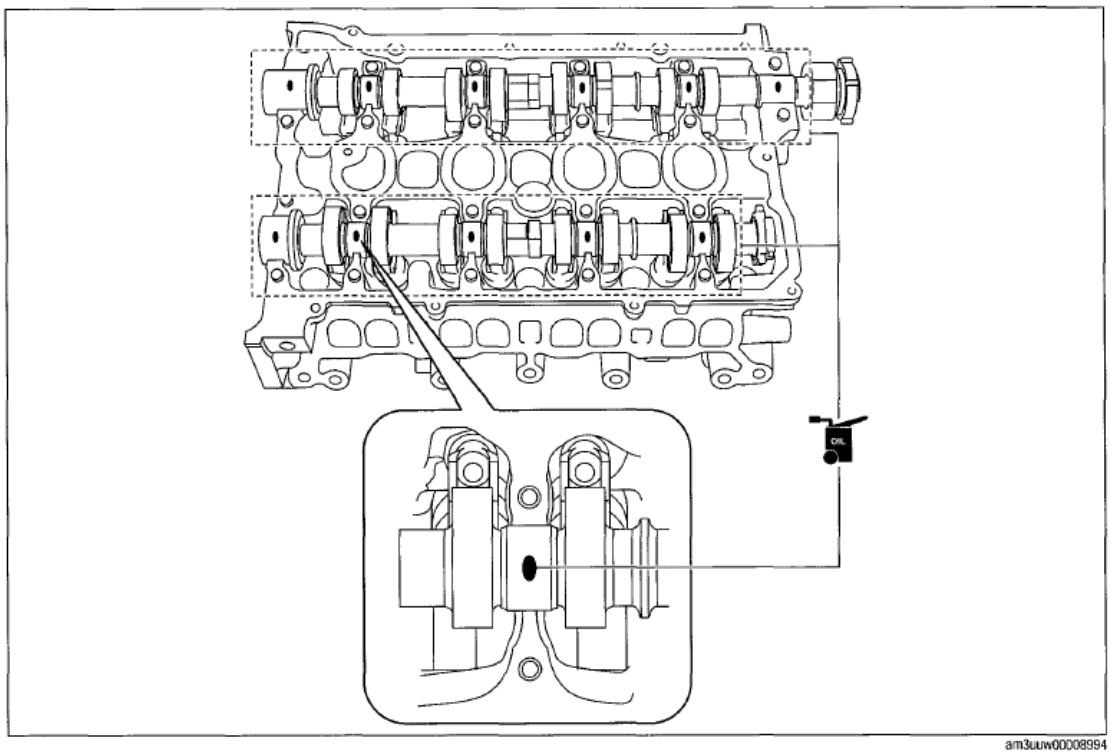


Fig. 89: Locating RH Camshafts Marks
Courtesy of MAZDA MOTORS CORP.

2. Lubricate the RH camshafts with clean engine oil and carefully position the camshafts onto the cylinder head.

- Align the RH camshafts as shown in the figure.

3. Install the camshaft bearing caps.
   - Loosely install the bolts.

CAUTION:
- **Cylinder head camshaft journal caps and cylinder heads are numbered to verify that they are assembled in their original positions. If not reassembled in their original positions, severe engine damage may occur.**

CAUTION:
- **Do not install the camshaft journal thrust caps until all of the camshaft bearing caps have been installed or damage to the thrust caps can occur.**

NOTE:
- **Lubricate the bearing surfaces of the RH camshaft bearing caps with clean engine oil.**

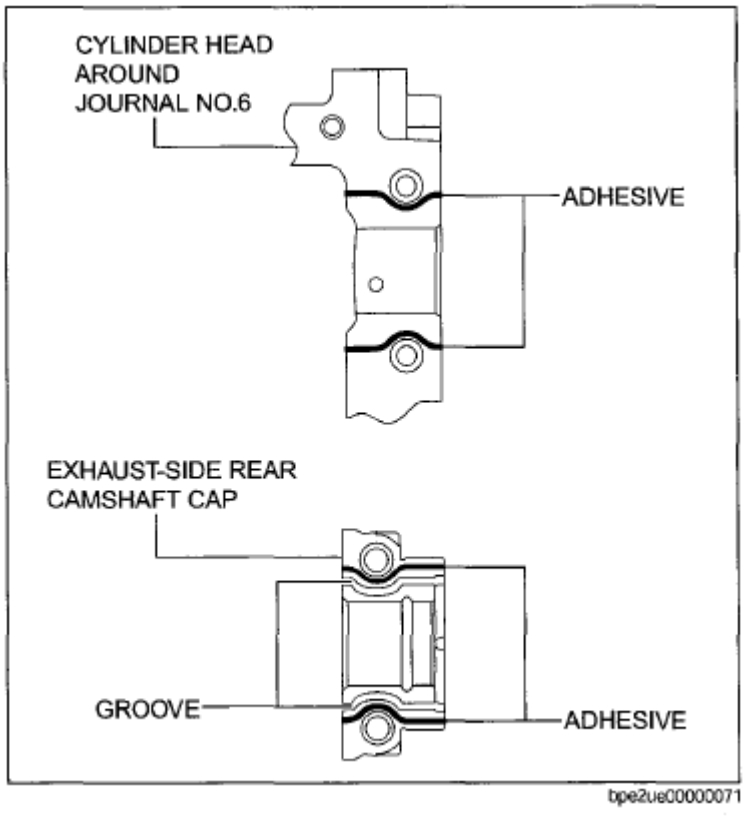


Fig. 90: Locating Camshaft Bearing Caps And Bolts
Courtesy of MAZDA MOTORS CORP.

4. Install the camshaft bearing thrust caps.
   - Loosely install the bolts.

NOTE:

- **Lubricate the bearing surfaces of the RH camshaft bearing thrust caps with clean engine oil.**

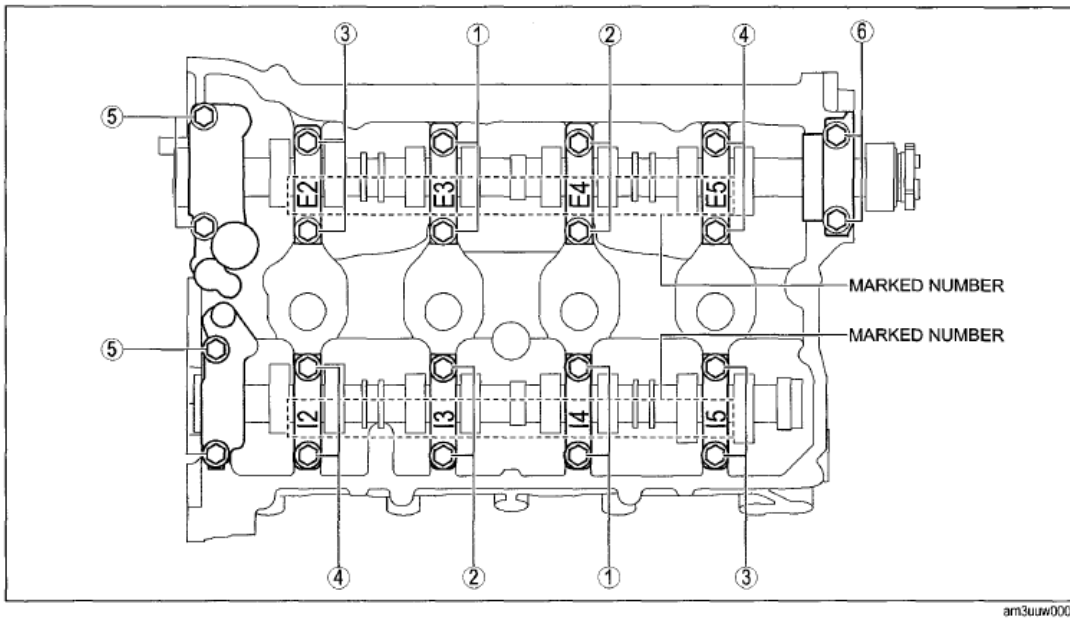


Fig. 91: Locating Camshaft Bearing Thrust Caps And Bolts
Courtesy of MAZDA MOTORS CORP.

5. Tighten the RH camshaft bearing cap bolts in the sequence shown in the figure in 2 stages.
   - Stage 1: Tighten to 10 N.m {1.0 kgf.m, 89 in.lbf}.
   - Stage 2: Individually loosen and then tighten each camshaft bearing cap to 10 N.m {1.0 kgf.m, 89 in.lbf}.

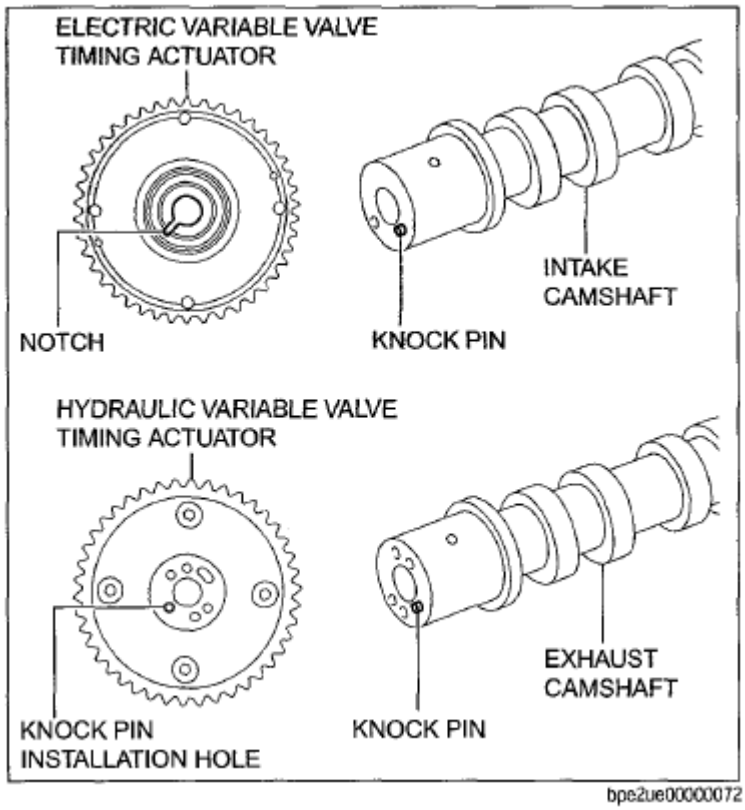


Fig. 92: Locating RH Camshaft Bearing Cap Bolts
Courtesy of MAZDA MOTORS CORP.

6. Tighten the 3 RH camshaft phaser and sprocket bolts to 18 N.m {1.8 kgf.m, 159 in.lbf}.

CAUTION:
- **Do not allow the camshaft to rotate from the neutral position while tightening the camshaft phaser and sprocket bolts or damage to the engine may occur.**

NOTE:
- **Install a 3/8-in ratchet and extension into the D-slot on the rear of the intake camshaft to hold the camshaft in place for tightening of the camshaft phaser and sprocket bolts.**

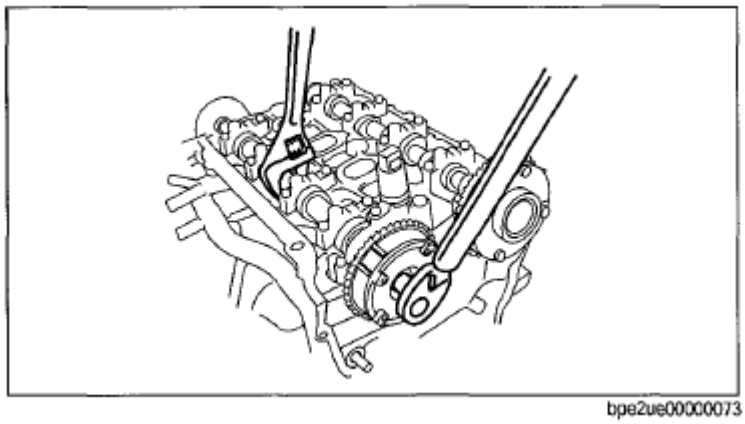


Fig. 93: Locating Bolts And RH Camshaft Phaser And Sprocket
Courtesy of MAZDA MOTORS CORP.

7. Install the timing drive components. See **TIMING DRIVE COMPONENTS REMOVAL/INSTALLATION - 3.0L** .

CAMSHAFT ROLLER FOLLOWERS REMOVAL/INSTALLATION - 3.0L

1. With the engine in NEUTRAL, position it on a hoist. See **FLEXPLATE REMOVAL/INSTALLATION - 3.0L** .
2. Remove the LH and RH valve covers. See **VALVE COVER REMOVAL/INSTALLATION - RH, 3.0L** and **VALVE COVER REMOVAL/INSTALLATION - LH, 3.0L** .

CAUTION:
- **Only use hand tools when removing or installing the spark plugs or damage may occur to the cylinder head or spark plug.**

3. Remove the 6 spark plugs.
   - To install, tighten to 15 N.m {1.5 kgf.m, 133 in.lbf}.
4. Remove the RH splash shield.
   - To install, tighten to 9 N.m {0.9 kgf.m, 80 in.lbf}.
5. Rotate the crankshaft until the camshaft lobe is pointing directly away from the follower.
6. Using the special tool, remove the followers.

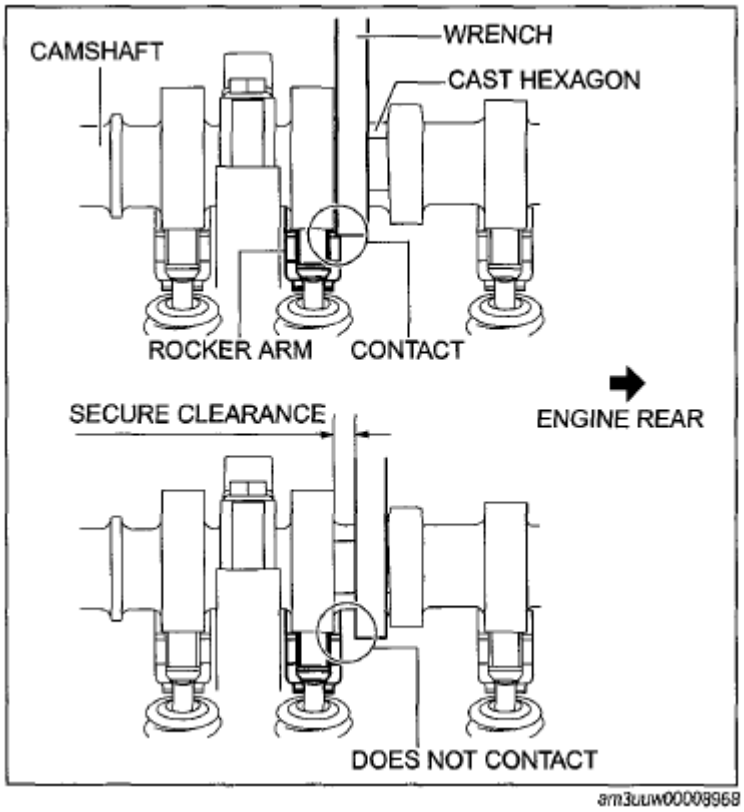


Fig. 94: Using Special Tool To Remove Followers
Courtesy of MAZDA MOTORS CORP.

7. To install, reverse the removal procedure.
   - Lubricate the camshaft followers with clean engine oil.

HYDRAULIC LASH ADJUSTERS REMOVAL/INSTALLATION - 3.0L

1. Remove the camshaft roller followers. See **CAMSHAFT ROLLER FOLLOWERS REMOVAL/INSTALLATION - 3.0L** .
2. Remove the hydraulic lash adjusters.

NOTE:
- **Mark the positions of the hydraulic lash adjusters to make sure they are assembled in their original position.**

3. To install, reverse the removal procedure.
   - Lubricate the hydraulic lash adjusters with clean engine oil.

NOTE:
- **Inspect the hydraulic lash adjusters for scoring marks and uneven wear in the bore. Install new lash adjusters if necessary.**

VALVE SPRING, RETAINER AND SEAL REMOVAL/INSTALLATION - 3.0L

REMOVAL

1. Remove the camshaft roller followers. See **CAMSHAFT ROLLER FOLLOWERS REMOVAL/INSTALLATION - 3.0L** .
2. Pressurize the cylinder using compressed air.

NOTE:

- **If air pressure has forced the piston to the bottom of the cylinder, any loss of air pressure will allow the valve(s) to fall into the cylinder. A rubber band, tape or string wrapped around the end of the valve stem will prevent this from happening.**

3. Using the special tool, remove the key, retainer, and valve spring.

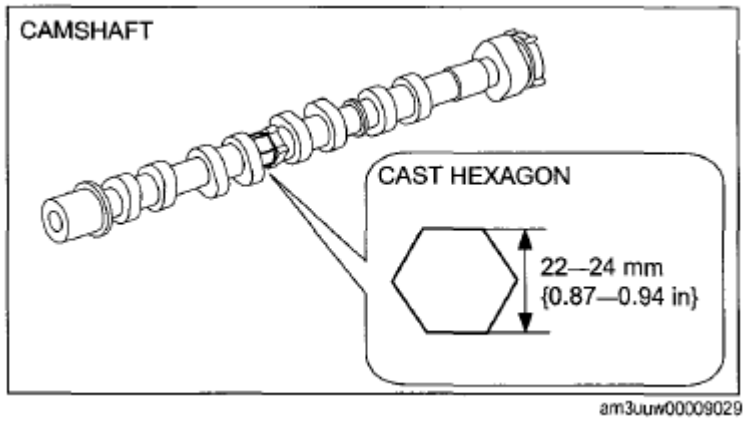
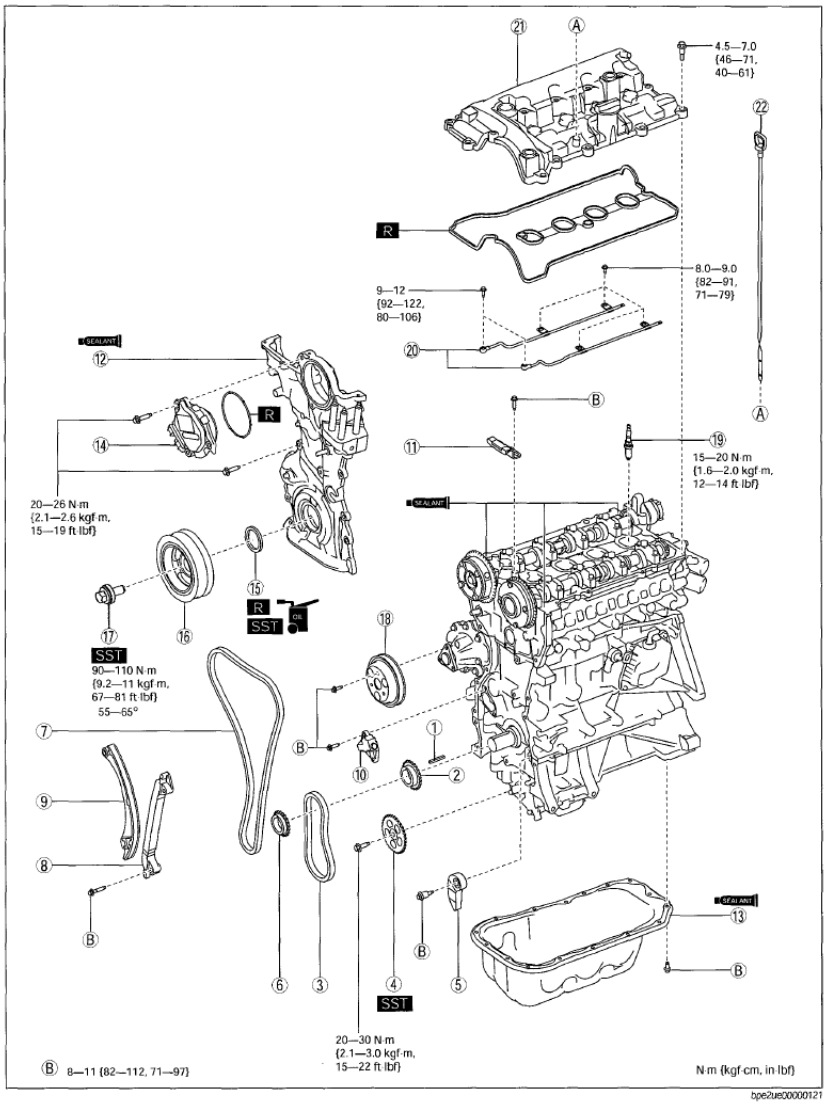


Fig. 95: Identifying Key, Retainer And Valve Spring
Courtesy of MAZDA MOTORS CORP.

4. Remove the valve seal.

NOTE:

- **Camshaft removed for clarity.**



1	Key
3	Oil pump chain
4	Oil pump driven sprocket (See Oil Pump Driven Sprocket Assembly Note.)
5	Oil pump chain tensioner
6	Crankshaft sprocket
7	Timing chain (See Timing Chain Assembly Note.)
8	Chain guide (No.2) (See Timing Chain Assembly Note.)
9	Tensioner arm (See Timing Chain Assembly Note.)
10	Chain tensioner (See Timing Chain Assembly Note.)
11	Chain guide (No.1) (See Timing Chain Assembly Note.)
12	Engine front cover (See Engine Front Cover Assembly Note.)
13	Oil pan (See Oil Pan Assembly Note.)

2	Oil pump drive sprocket
14	Electric variable valve timing motor/driver (See Electric Variable Valve Timing Motor/ Driver Assembly Note.)
15	Front oil seal (See Front Oil Seal Assembly Note.)
16	Crankshaft pulley
17	Crankshaft pulley lock bolt (See Crankshaft Pulley Lock Bolt Assembly Note.)
18	Water pump pulley (See Water Pump Pulley Assembly Note.)
19	Spark plug
20	Oil shower pipe (See Oil Shower Pipe Installation Note.)
21	Cylinder head cover (See Cylinder Head Cover Installation Note.)
22	Dipstick

Fig. 96: Locating Valve Seal
Courtesy of MAZDA MOTORS CORP.

INSTALLATION

1. Using the special tool, install the valve seal.

NOTE:

- **Lubricate the valve guide with clean engine oil.**

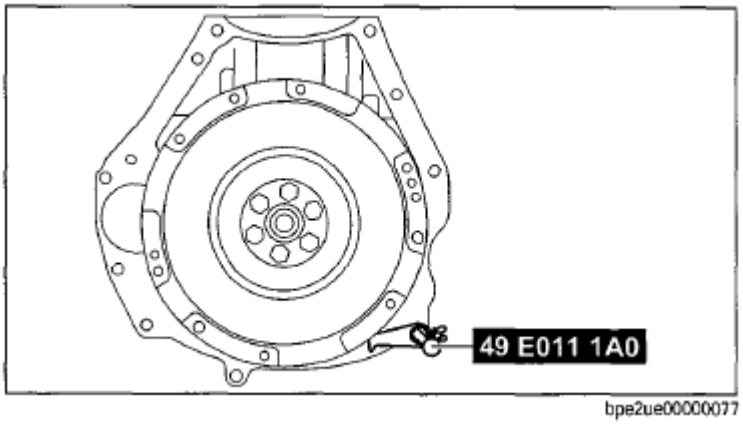


Fig. 97: Installing Valve Seal
Courtesy of MAZDA MOTORS CORP.

2. Using the special tool, install the valve spring, retainer and key.

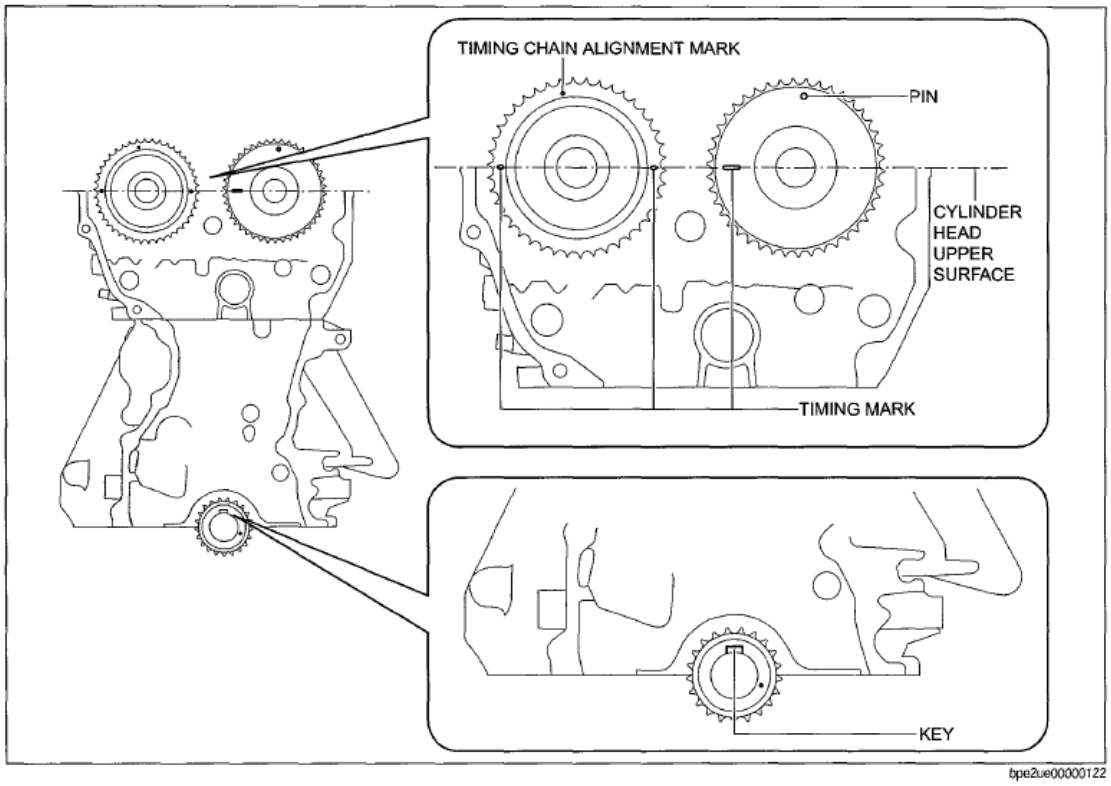


Fig. 98: Identifying Valve Spring, Retainer And Key
Courtesy of MAZDA MOTORS CORP.

3. Install the camshaft roller followers. See **CAMSHAFT ROLLER FOLLOWERS REMOVAL/INSTALLATION - 3.0L** .

CYLINDER HEAD REMOVAL/INSTALLATION - LH, 3.0L

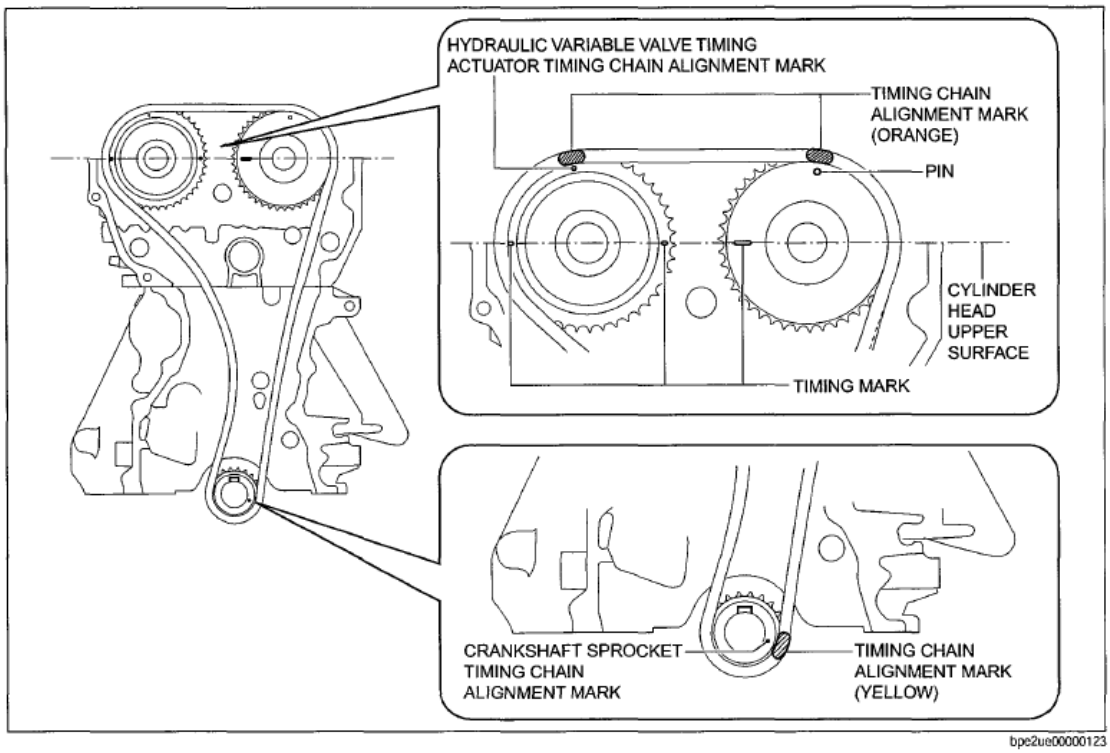


Fig. 99: Identifying Cylinder Head Components
Courtesy of MAZDA MOTORS CORP.

REMOVAL

CAUTION:

- **During engine repair procedures, cleanliness is extremely important. Any foreign material, (including any material created while cleaning gasket surfaces) that enters the oil passages, coolant passages or the oil pan, can cause engine failure.**

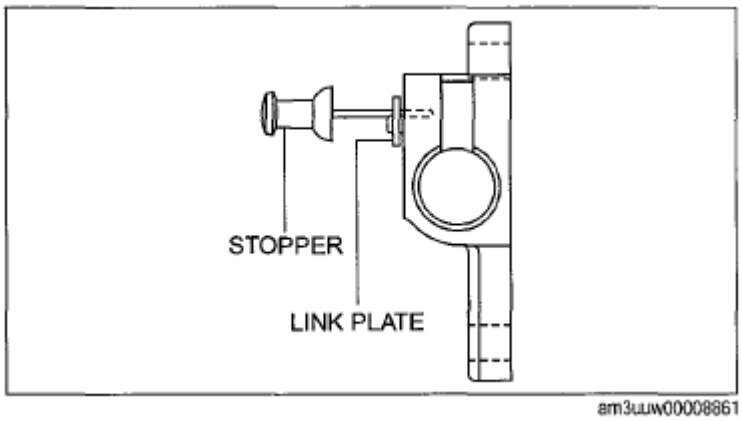


Fig. 100: Identifying Coolant Bypass Tube
Courtesy of MAZDA MOTORS CORP.

1. With the vehicle in NEUTRAL, position it on a hoist. See **LIFTING** .
2. Remove the lower intake manifold. See **LOWER INTAKE MANIFOLD REMOVAL/INSTALLATION - 3.0L** .
3. Remove the coolant bypass tube.
4. Remove the LH camshafts. See **CAMSHAFTS REMOVAL/INSTALLATION - LH, 3.0L** .
5. Remove the camshaft roller followers.

CAUTION:
- **The camshaft roller followers must be installed in their original positions. If not installed in their original positions, severe engine damage may occur.**

6. Remove the hydraulic lash adjusters.

CAUTION:
- **The hydraulic lash adjusters must be installed in their original positions. If not installed in their original positions, severe engine damage may occur.**

7. Remove the LH exhaust manifold. See **CATALYTIC CONVERTER REMOVAL/INSTALLATION - LH, 3.0L** .
8. Remove the 4 upper radiator support bracket bolts.
9. Remove the oil level indicator.
10. Remove the stud bolt and remove the oil level indicator tube.
    - Remove and discard the O-ring seal.
11. Remove the 3 bolts and position the water pump aside.

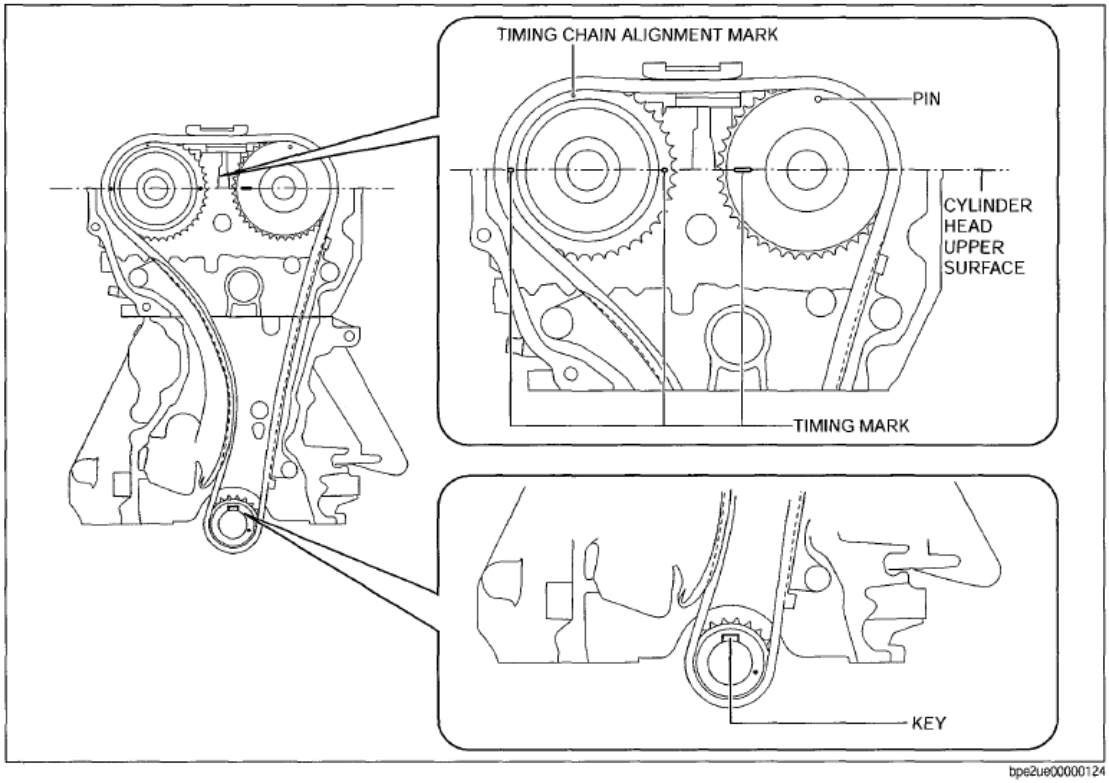


Fig. 101: Locating Bolts And Water Pump Aside
Courtesy of MAZDA MOTORS CORP.

12. Remove the bolts in the sequence shown in the figure.

NOTE:

- **New cylinder head bolts must be installed. They are torque-to-yield designed and cannot be reused.**

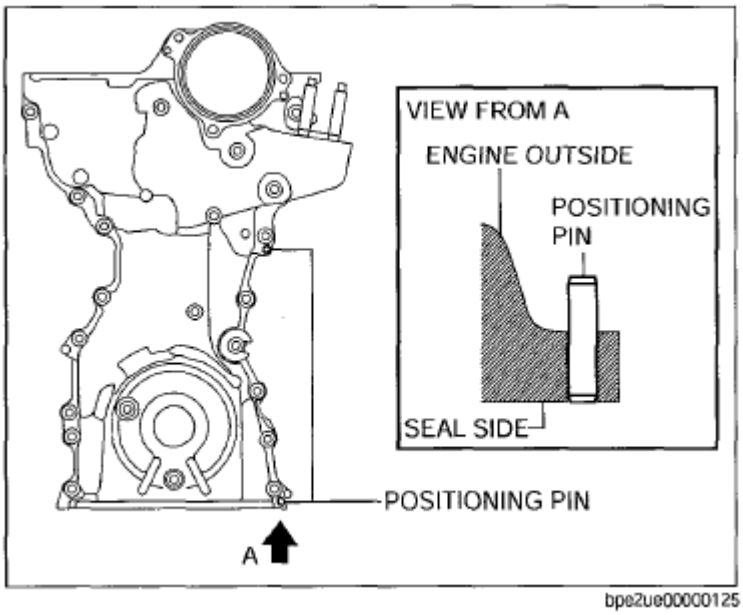


Fig. 102: Identifying Cylinder Head Bolts In Sequence
Courtesy of MAZDA MOTORS CORP.

13. Remove the cylinder head and support the cylinder head on a bench with the head gasket up.
    - Discard the gasket and bolts.
14. Inspect all areas of the deck face with a straightedge and feeler gauge. The cylinder head must not have depressions deeper than 0.0254 mm (0.001 in) across a 38.1 mm (1.5 in) square area, or scratches more than 0.0254 mm (0.001 in).

NOTE:
- **The straightedge used must be flat within 0.0051 mm (0.0002 in) per foot of tool length.**

INSTALLATION

1. Use a plastic scraping tool to remove all traces of the head gasket.
    - Clean all surfaces with metal surface prep.

CAUTION:
- **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths.**

2. Position a new gasket and the cylinder head.
3. Install the bolts and tighten in 6 stages in the sequence shown in the figure.
    - Stage 1: Tighten to 40 N.m {4.1 kgf.m, 30 ft.lbf}.
    - Stage 2: Tighten bolts 90 degrees.

- Stage 3: Loosen 1 full turn.
- Stage 4: Tighten to 40 N.m {4.1 kgf.m, 30 ft.lbf}.
- Stage 5: Tighten bolts 90 degrees.
- Stage 6: Tighten bolts 90 degrees.

NOTE:

- **New cylinder head bolts must be installed. They are torque-to-yield designed and cannot be reused.**

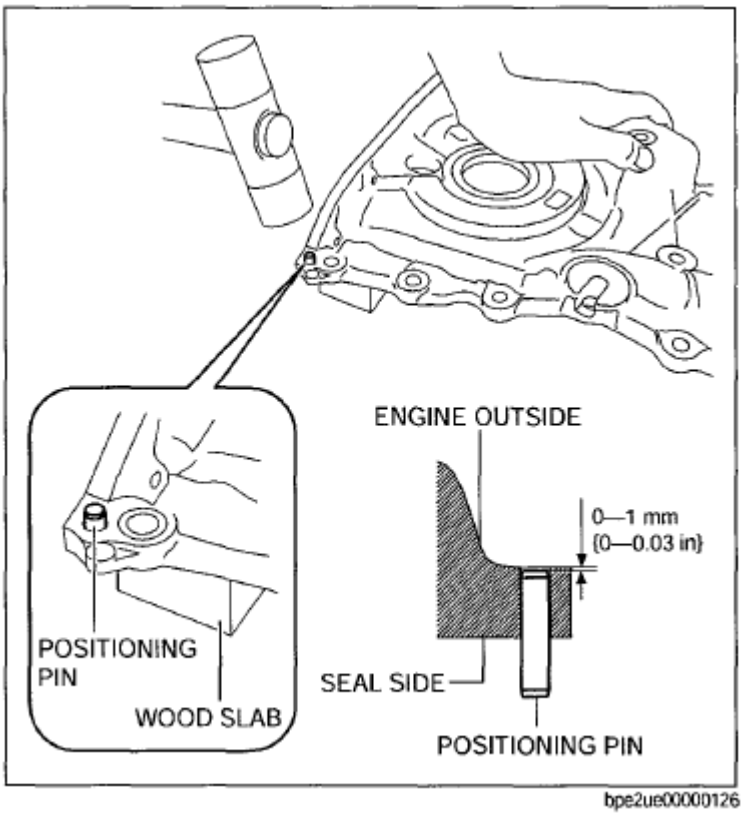


Fig. 103: Identifying Cylinder Head Bolts In Sequence
Courtesy of MAZDA MOTORS CORP.

4. Position the water pump and install the bolts.
   - Tighten to 10 N.m {1.0 kgf.m, 89 in.lbf}.
5. Install the oil level indicator tube and stud bolt.
   - Tighten to 10 N.m {1.0 kgf.m, 89 in.lbf}.

NOTE:

- **Install a new O-ring seal and lubricate with clean engine oil.**

6. Install the oil level indicator.
7. Install the 4 upper radiator support bracket bolts.

- Tighten to 10 N.m {1.0 kgf.m, 89 in.lbf}.

8. Install the LH exhaust manifold. See **CATALYTIC CONVERTER REMOVAL/INSTALLATION - LH, 3.0L** .
9. Install the hydraulic lash adjusters.
   - Lubricate the hydraulic lash adjusters with clean engine oil.

CAUTION:
- **The hydraulic lash adjusters must be installed in their original positions. If not installed in their original positions, severe engine damage may occur.**

10. Install the camshaft roller followers.
    - Lubricate the camshaft roller followers with clean engine oil.

CAUTION:
- **The camshaft roller followers must be installed in their original positions. If not installed in their original positions, severe engine damage may occur.**

11. Install the camshafts. See **CAMSHAFTS REMOVAL/INSTALLATION - LH, 3.0L** .
12. Install the coolant bypass tube.
13. Install the lower intake manifold. See **LOWER INTAKE MANIFOLD REMOVAL/INSTALLATION - 3.0L** .

CYLINDER HEAD REMOVAL/INSTALLATION - RH, 3.0L

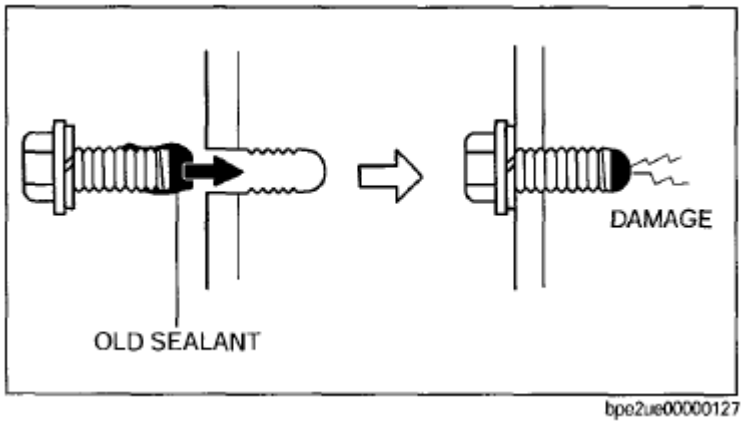


Fig. 104: Identifying Cylinder Head Components
Courtesy of MAZDA MOTORS CORP.

REMOVAL

CAUTION:
- **During engine repair procedures, cleanliness is extremely important. Any foreign material (including any material created while cleaning**

gasket surfaces) that enters the oil passages, coolant passages or the oil pan may cause engine failure.

1. With the vehicle in NEUTRAL, position it on a hoist. See **LIFTING** .
2. Remove the lower intake manifold. See **LOWER INTAKE MANIFOLD REMOVAL/INSTALLATION - 3.0L** .
3. Remove the coolant bypass tube.
4. Remove the RH camshafts. See **CAMSHAFTS REMOVAL/INSTALLATION - RH, 3.0L** .
5. Remove the camshaft roller followers.

CAUTION:
- **The camshaft roller followers must be installed in their original positions. If not reassembled in their original positions, severe engine damage may occur.**

6. Remove the hydraulic lash adjusters.

CAUTION:
- **The hydraulic lash adjusters must be installed in their original positions. If not reassembled in their original positions, severe engine damage may occur.**

7. Remove the RH exhaust manifold. See **CATALYTIC CONVERTER REMOVAL/INSTALLATION - RH, 3.0L** .
8. Remove the bolts in the sequence shown in the figure.

NOTE:
- **New cylinder head bolts must be installed. They are torque-to-yield designed and cannot be reused.**

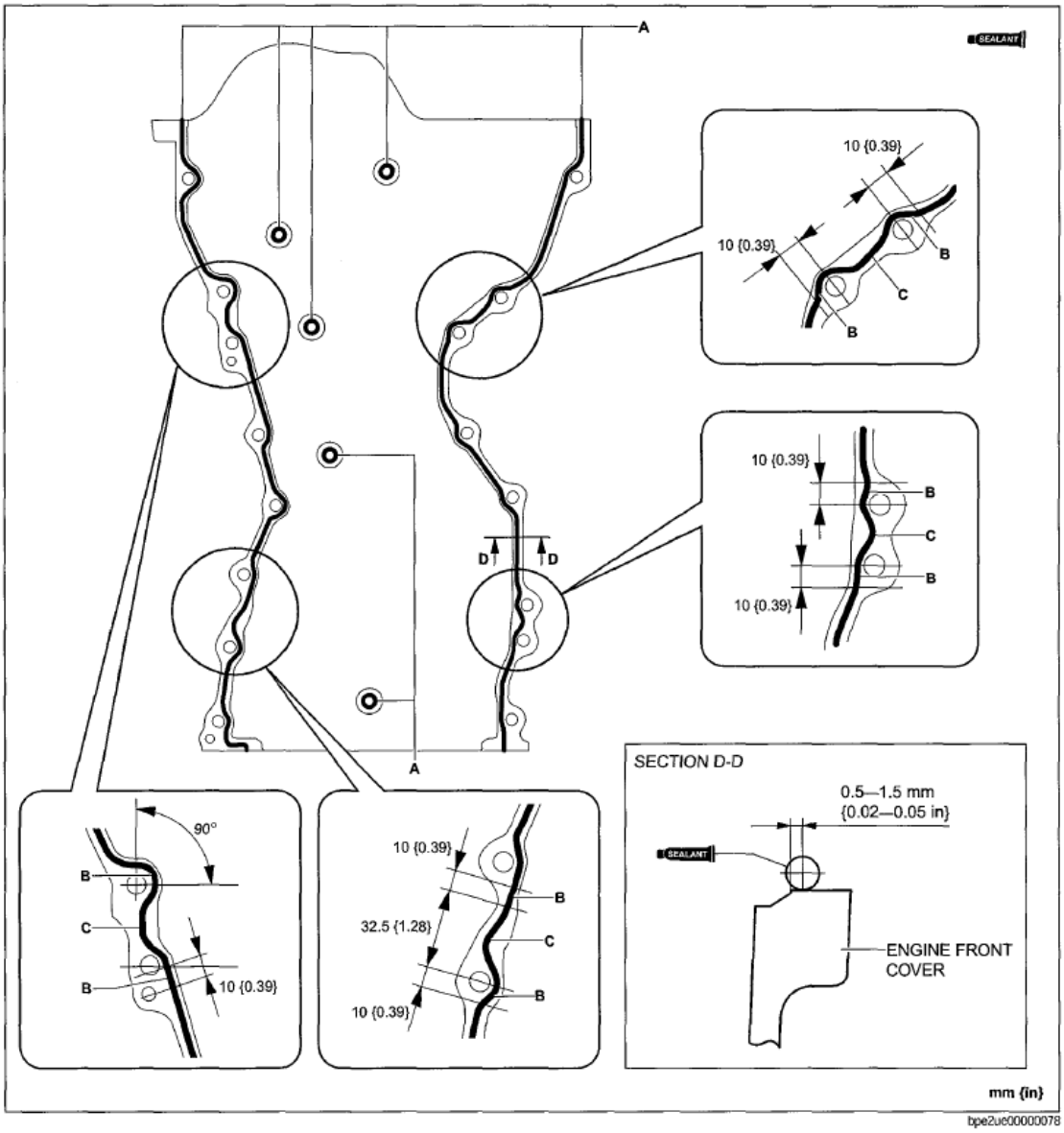


Fig. 105: Identifying Cylinder Head Bolts In Sequence
Courtesy of MAZDA MOTORS CORP.

9. Remove the cylinder head and support the cylinder head on a bench with the head gasket side up.
   - Discard the gasket and the bolts.
10. Inspect all areas of the deck face with a straightedge and feeler gauge. The cylinder head must not have depressions deeper than 0.0254 mm (0.001 in) across a 38.1 mm (1.5 in) square area, or scratches more than 0.0254 mm (0.001 in).

NOTE:

- **The straightedge must be flat within 0.0051 mm (0.0002 in) per foot of tool length.**

INSTALLATION

1. Use a plastic scraping tool to remove all traces of the head gasket.
   - Clean all surfaces with metal surface prep.

CAUTION:
- **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces, these tools cause scratches and gouges which make leak paths.**

2. Position a new gasket and the cylinder head.
3. Install the bolts and tighten in 6 stages in the sequence shown in the figure.
   - Stage 1: Tighten to 40 N.m {4.1 kgf.m, 30 ft.lbf}.
   - Stage 2: Tighten bolts 90 degrees.
   - Stage 3: Loosen one full turn.
   - Stage 4: Tighten to 40 N.m {4.1 kgf.m, 30 ft.lbf}.
   - Stage 5: Tighten 90 degrees.
   - Stage 6: Tighten 90 degrees.

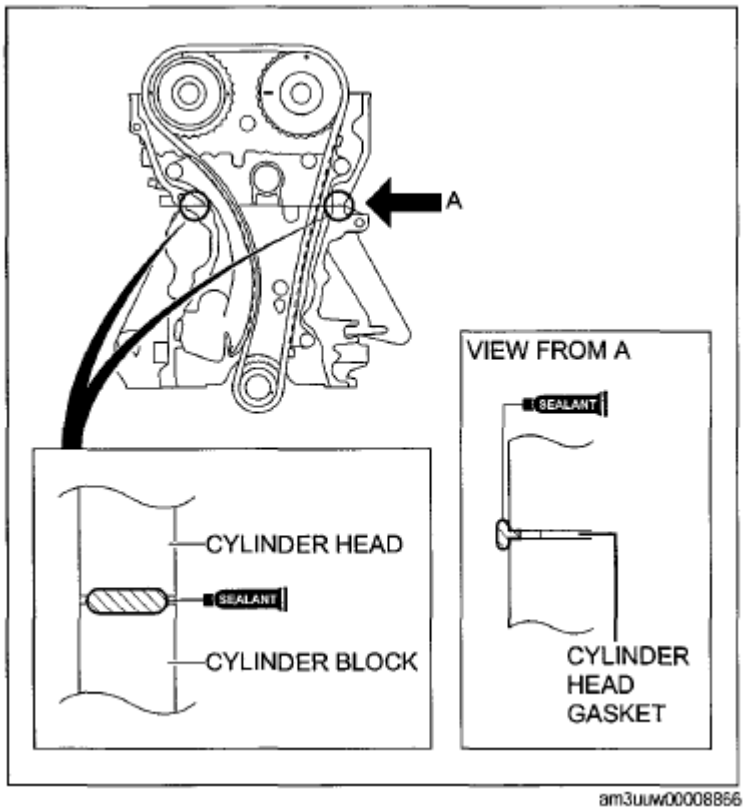


Fig. 106: Identifying Cylinder Head Bolts In Sequence
Courtesy of MAZDA MOTORS CORP.

4. Install RH exhaust manifold. See **CATALYTIC CONVERTER REMOVAL/INSTALLATION - RH,**

3.0L .

5. Install the hydraulic lash adjusters.
   - Lubricate the hydraulic lash adjusters with clean engine oil.

CAUTION:
- **The hydraulic lash adjusters must be installed in their original positions. If not reassembled in their original positions, severe engine damage may occur.**

6. Install the camshaft roller followers.
   - Lubricate the camshaft roller followers with clean engine oil.

CAUTION:
- **The camshaft roller followers must be installed in their original positions. If not reassembled in their original positions, severe engine damage may occur.**

7. Install the RH camshafts. See **CAMSHAFTS REMOVAL/INSTALLATION - RH, 3.0L** .
8. Install the coolant bypass tube.
9. Install the lower intake manifold. See **LOWER INTAKE MANIFOLD REMOVAL/INSTALLATION - 3.0L** .

ENGINE SUPPORT INSULATORS REMOVAL/INSTALLATION - 3.0L

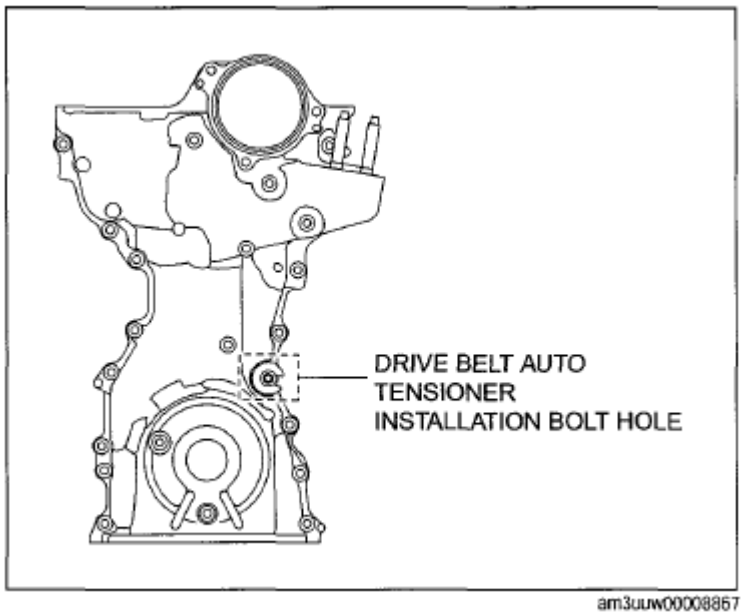


Fig. 107: Identifying Engine Support Insulators Components
Courtesy of MAZDA MOTORS CORP.

1. Remove the lower intake manifold. See **LOWER INTAKE MANIFOLD REMOVAL/INSTALLATION - 3.0L** .

2. Remove the engine support insulator bracket bolt.
    - To install, tighten to 90 N.m {9.2 kgf.m, 66 ft.lbf}.

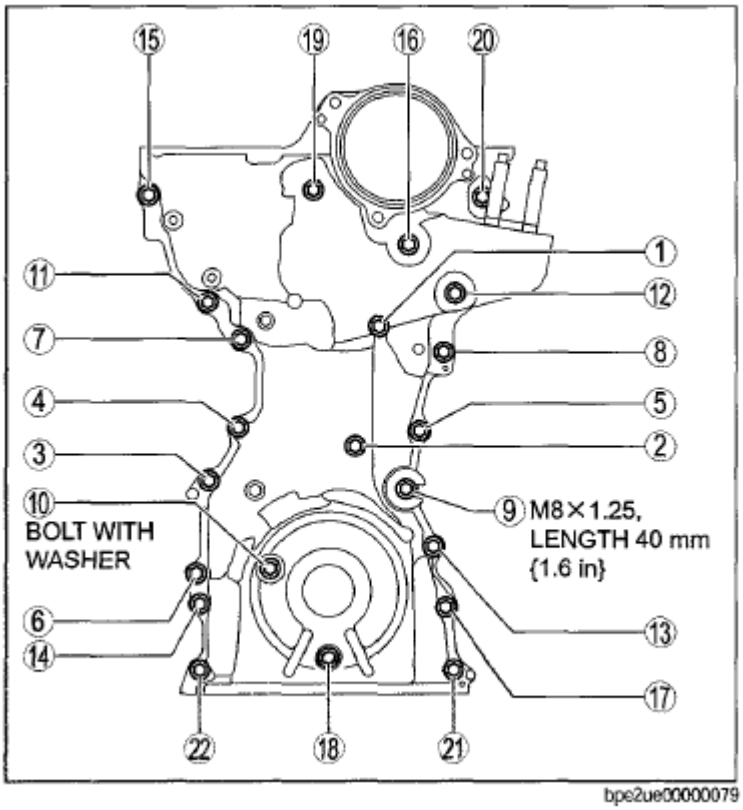


Fig. 108: Identifying Engine Support Insulator Bracket And Bolt
Courtesy of MAZDA MOTORS CORP.

3. Install the special tools.
    1. Position the 2 universal adapter brackets on the top of the cylinder block.
    2. Install the 2 M8 x 1.25 x 36 mm (1.41 in) bolts and tighten to 10 N.m {1.0 kgf.m, 89 in.lbf}.
    3. Use a suitable piece of chain.
    4. Fasten the chain to the 2 Universal Adapter Brackets with a suitable nut, washer and bolt.

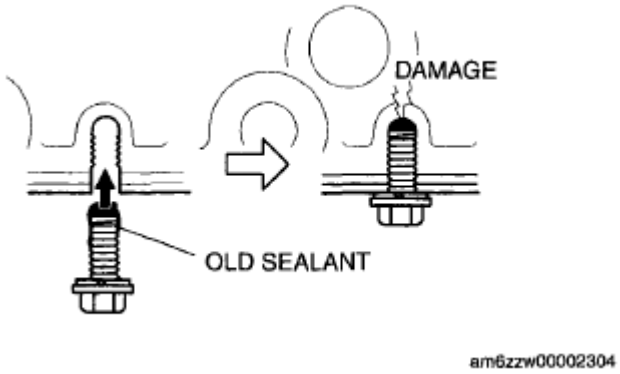


Fig. 109: Lifting Engine Using Special Tool
Courtesy of MAZDA MOTORS CORP.

4. Using the special tool, lift the engine 12 mm (0.47 in).
5. Remove the nut and ground wire eyelet from the engine support insulator bracket stud.
    - To install, tighten to 25 N.m {2.5 kgf.m, 18 ft.lbf}.
6. Remove the 3 nuts and the engine support insulator bracket.
    - To install, tighten to 55 N.m {5.6 kgf.m, 41 ft.lbf}.
7. Remove the 3 bolts and the engine support insulator.
    - To install, tighten to 48 N.m {4.9 kgf.m, 41 ft.lbf}.
8. To install, reverse the removal procedure.

ENGINE - 3.0L REMOVAL

REMOVAL

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. See **LIFTING** .
2. Release the fuel system pressure. See **FUEL SYSTEM PRESSURE RELEASE** .
3. Remove the battery tray. See **BATTERY TRAY REMOVAL/INSTALLATION** .
4. Remove the air cleaner outlet tube and air cleaner. See **AIR CLEANER OUTLET PIPE REMOVAL/INSTALLATION - 3.0L** .
5. Remove the front wheel and tires. See **WHEEL AND TIRE REMOVAL/INSTALLATION** .
6. Remove the lower splash shields.

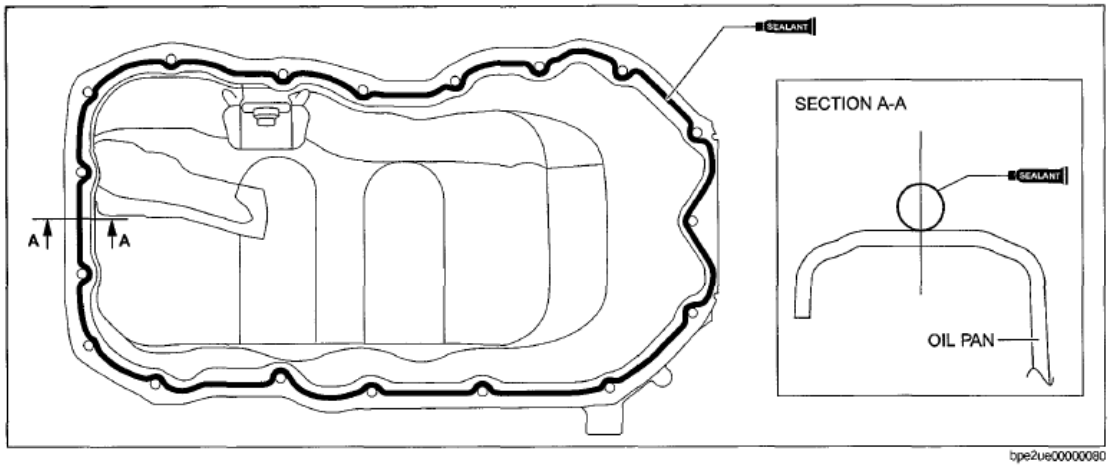


Fig. 110: Locating Lower Splash Shields
Courtesy of MAZDA MOTORS CORP.

7. Remove the 4 bolts and the lateral support crossmember.

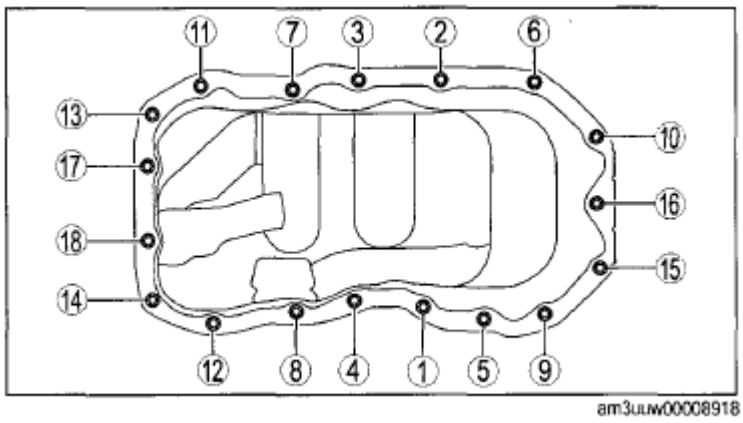


Fig. 111: Locating Bolts And Lateral Support Crossmember
Courtesy of MAZDA MOTORS CORP.

8. Disconnect the LH Catalyst Monitor Sensor (CMS) electrical connector.

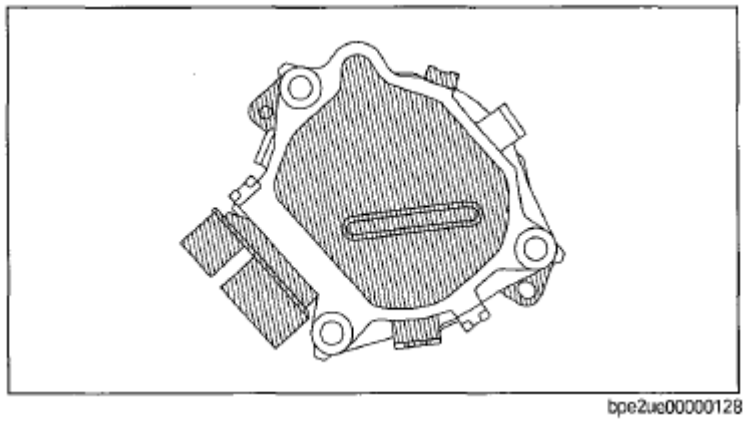


Fig. 112: Locating LH Catalyst Monitor Sensor (CMS) Electrical Connector
Courtesy of MAZDA MOTORS CORP.

9. Disconnect the RH CMS electrical connector.

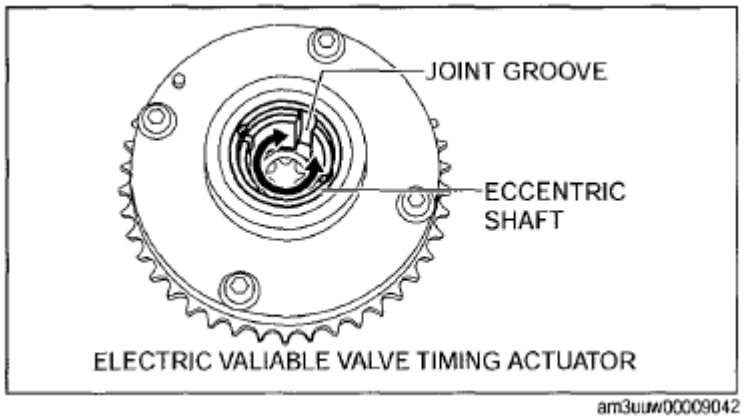


Fig. 113: Locating RH CMS Electrical Connector
Courtesy of MAZDA MOTORS CORP.

10. Remove the exhaust Y-pipe. See **EXHAUST CROSSOVER PIPE REMOVAL/INSTALLATION - 3.0L** .
11. Remove the RH and LH halfshafts. See **FRONT DRIVE HALFSHAFTS REMOVAL/INSTALLATION** .
12. Remove the 2 intermediate shaft bearing retainer nuts.

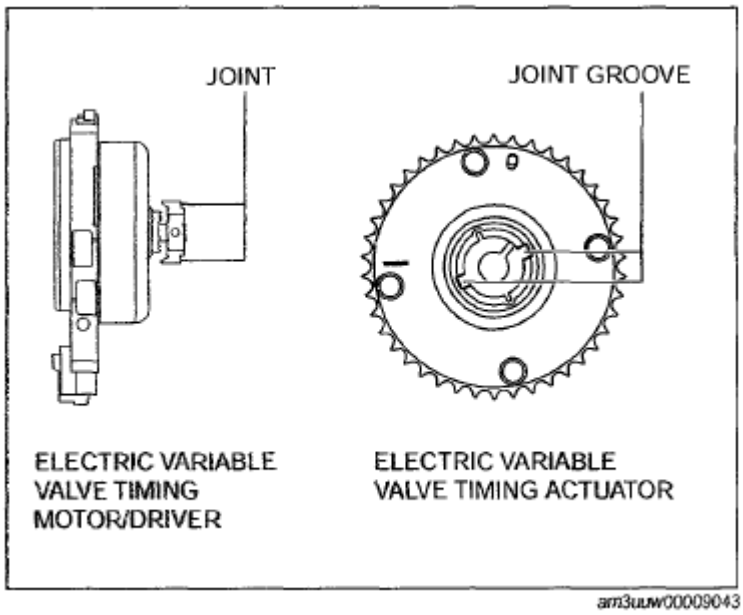


Fig. 114: Locating Intermediate Shaft Bearing Retainer Nuts
Courtesy of MAZDA MOTORS CORP.

13. Remove the intermediate shaft.

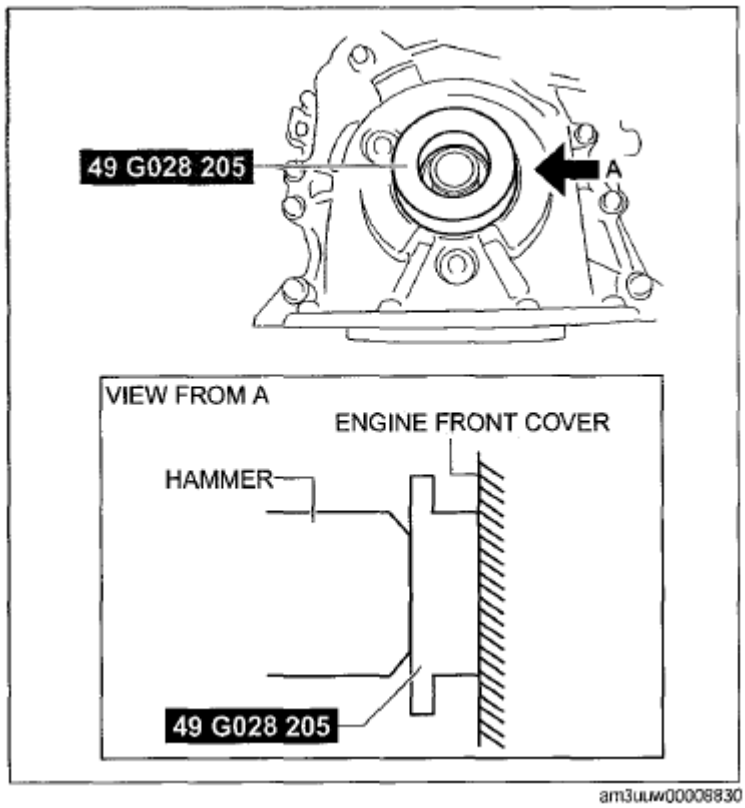


Fig. 115: Locating Intermediate Shaft

Courtesy of MAZDA MOTORS CORP.

NOTE:

- **On All-Wheel Drive (AWD) vehicles, the Power Transfer Unit (PTU) seal must be replaced every time the intermediate shaft is removed.**

All wheel drive (AWD) vehicles

14. Remove and discard the 6 front d rives haft-to-PTU bolts and washers.
    - Position the driveshaft aside and support with mechanic's wire.

CAUTION:

- **Do not reuse the driveshaft flange bolts and washers. Install new bolts and washers or damage to the vehicle may occur.**

NOTE:

- **Index-mark the drive shaft flange and Power Transfer Unit (PTU) flange for installation.**

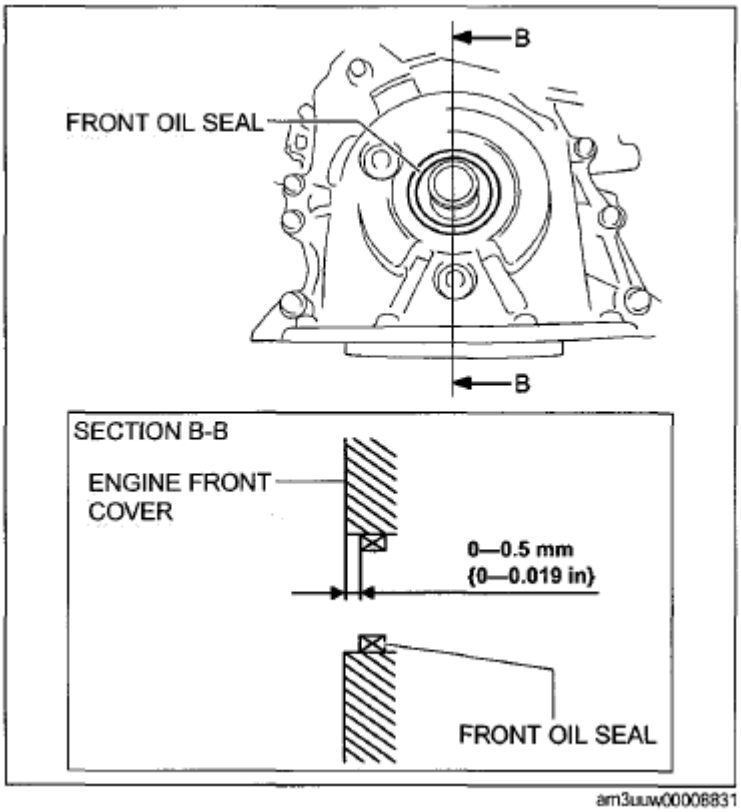


Fig. 116: Locating Front Drives Haft-To-PTU Bolts And Washers
Courtesy of MAZDA MOTORS CORP.

All vehicles

15. Rotate the accessory drive belt tensioner counterclockwise and remove the accessory drive belt.

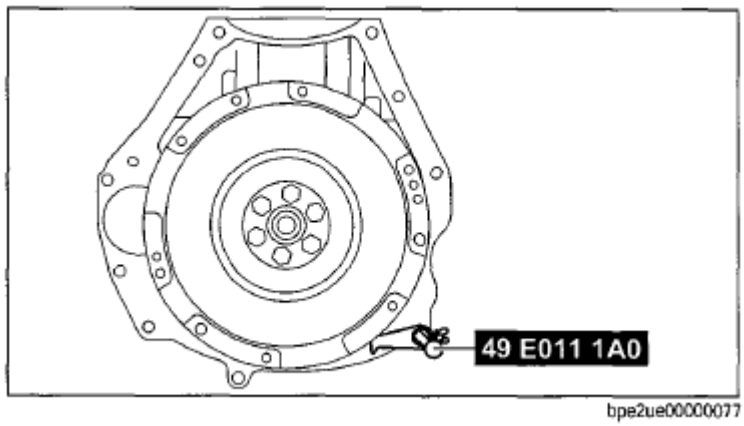


Fig. 117: Rotating Accessory Drive Belt Tensioner Counterclockwise
Courtesy of MAZDA MOTORS CORP.

16. Drain the engine coolant. See **COOLING SYSTEM DRAINING, FILLING AND BLEEDING - 3.0L** .
17. Drain the engine oil and install the drain plug.
    - Tighten to 26 N.m {2.6 kgf.m, 19 ft.lbf}.
18. Disconnect the A/C compressor electrical connector.

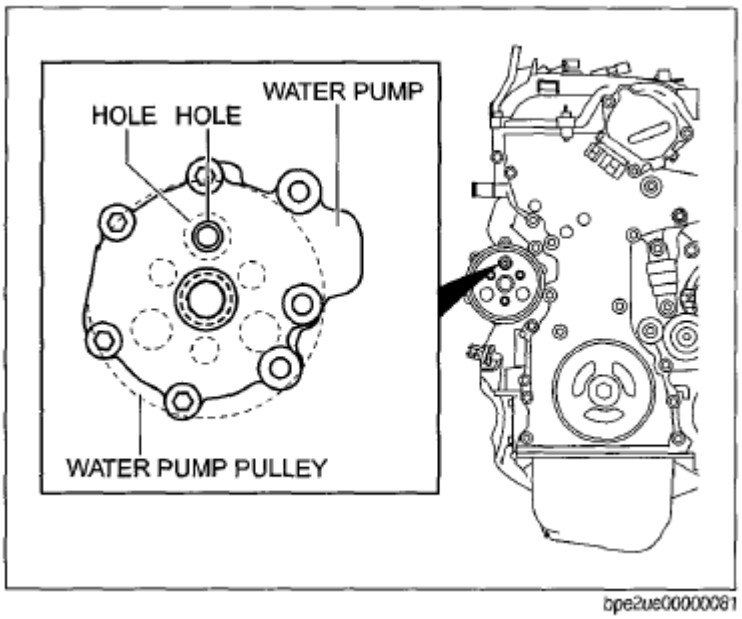


Fig. 118: Locating A/C Compressor Electrical Connector
Courtesy of MAZDA MOTORS CORP.

19. Remove the 3 bolts and position the A/C compressor aside.

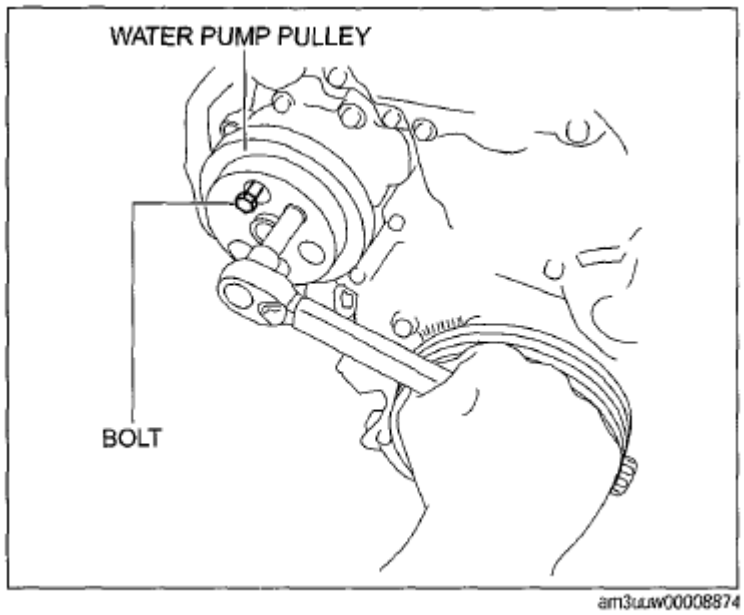


Fig. 119: Locating Bolts And A/C Compressor Aside
Courtesy of MAZDA MOTORS CORP.

20. Disconnect the generator electrical connector.

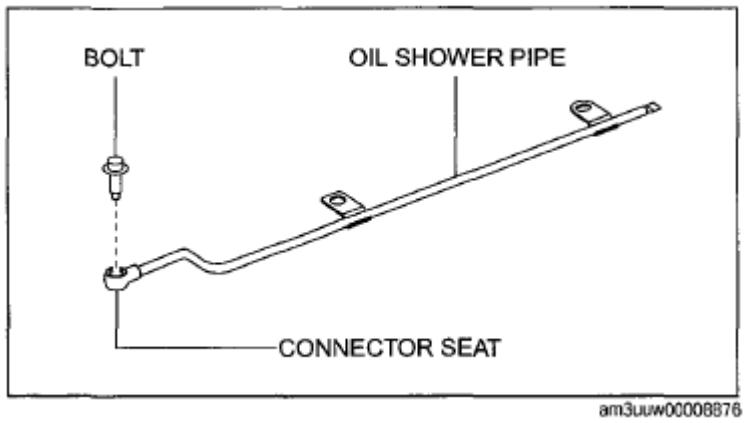


Fig. 120: Locating Generator Electrical Connector
Courtesy of MAZDA MOTORS CORP.

21. Remove the front roll restrictor bolt and the 2 bolts for the engine support cross brace.

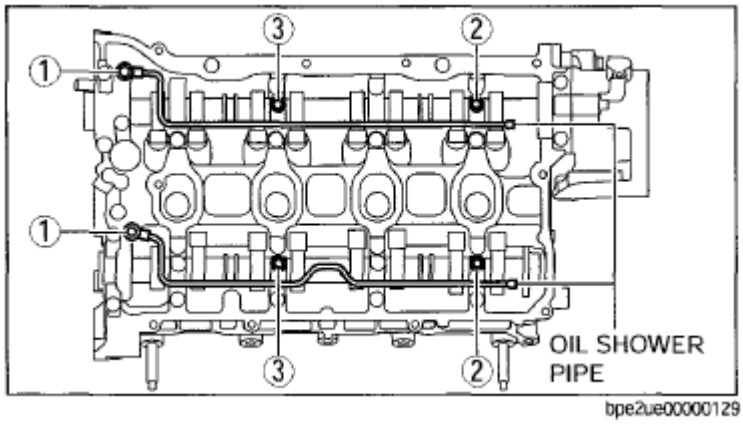


Fig. 121: Locating Front Roll Restrictor Bolt And Bolts
Courtesy of MAZDA MOTORS CORP.

22. Remove the rear nut and the engine support crossmember.
    - Discard the nut.

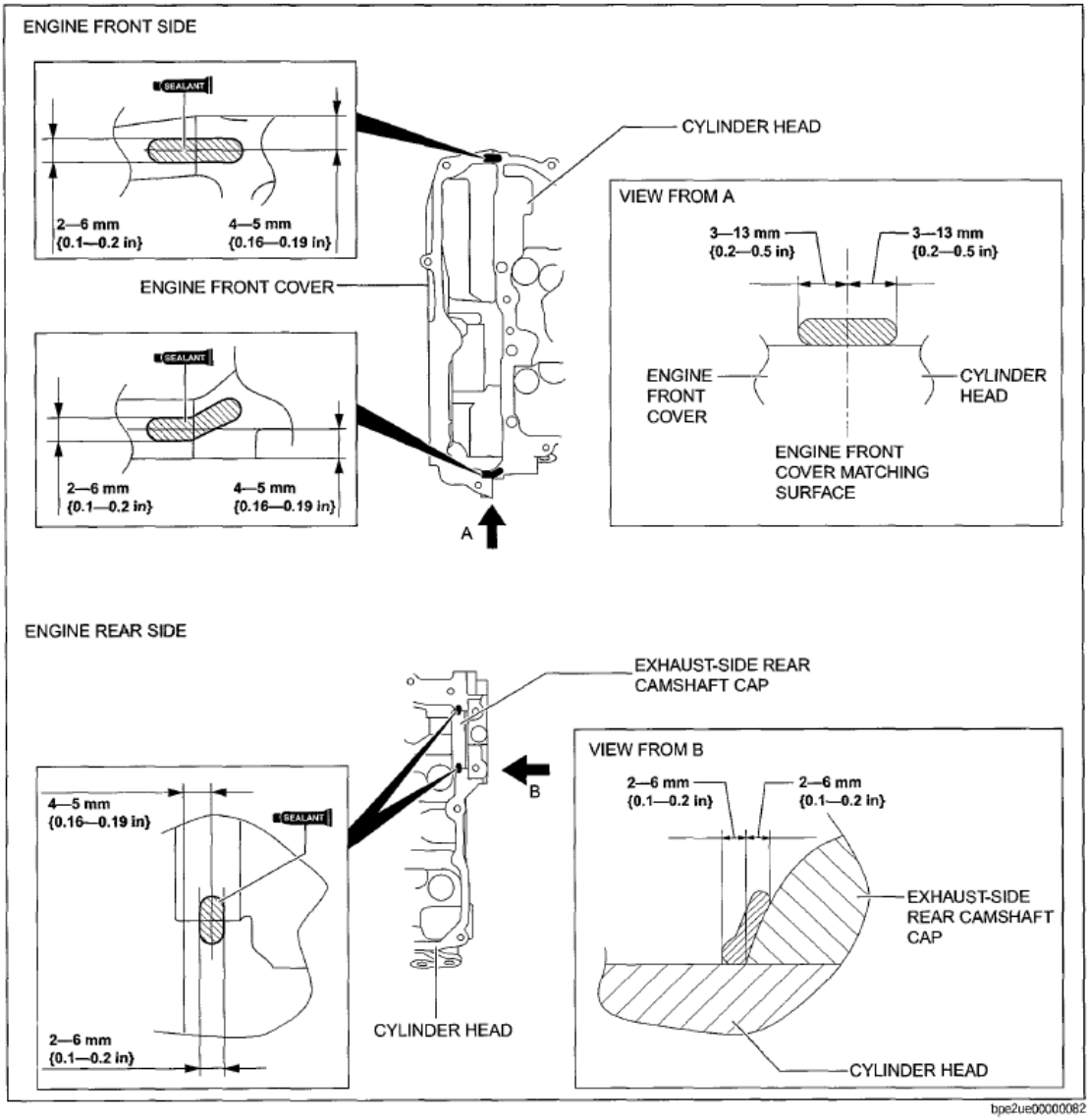


Fig. 122: Locating Nut And Engine Support Crossmember
Courtesy of MAZDA MOTORS CORP.

23. Remove the 2 secondary latches from the transaxle fluid cooler tubes.

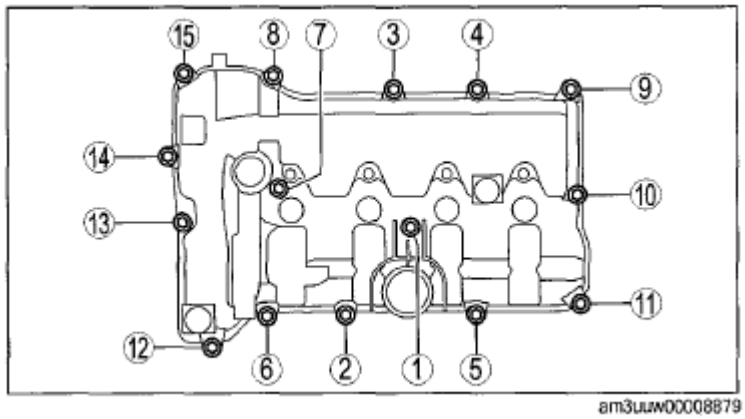


Fig. 123: Locating Secondary Latches And Transaxle Fluid Cooler Tubes
Courtesy of MAZDA MOTORS CORP.

24. Using the Transmission Cooler Line Disconnect Tool, disconnect the 2 transaxle fluid cooler tubes (1 shown in the figure).

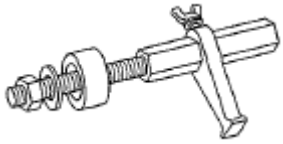


Fig. 124: Identifying Transmission Cooler Line Disconnect Tool
Courtesy of MAZDA MOTORS CORP.

25. Disconnect the 2 transmission electrical connectors and detach the wiring retainer from the stud bolt.

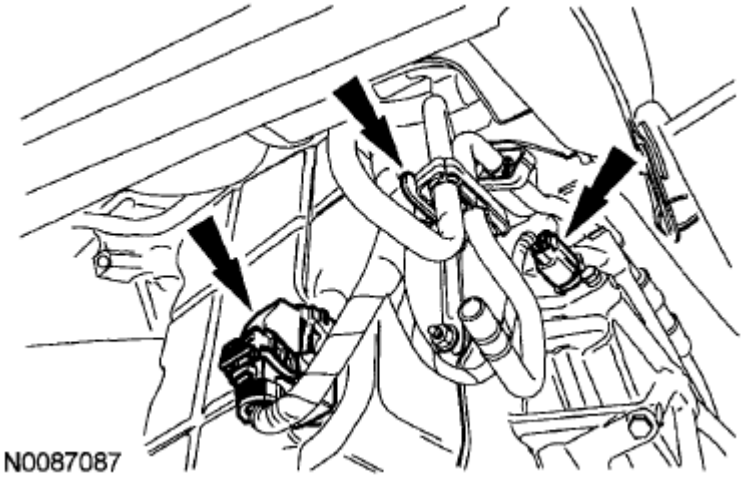


Fig. 125: Locating Transmission Electrical Connectors And Stud Bolt
Courtesy of MAZDA MOTORS CORP.

26. Disconnect the upper and lower radiator hoses.

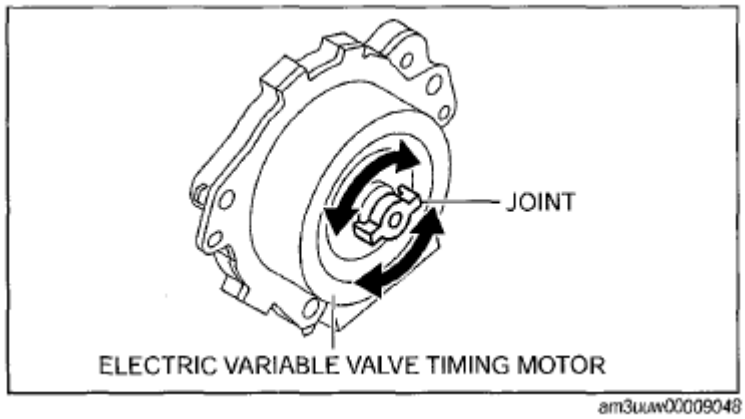


Fig. 126: Locating Upper And Lower Radiator Hoses
Courtesy of MAZDA MOTORS CORP.

27. Disconnect the 2 heater hoses.

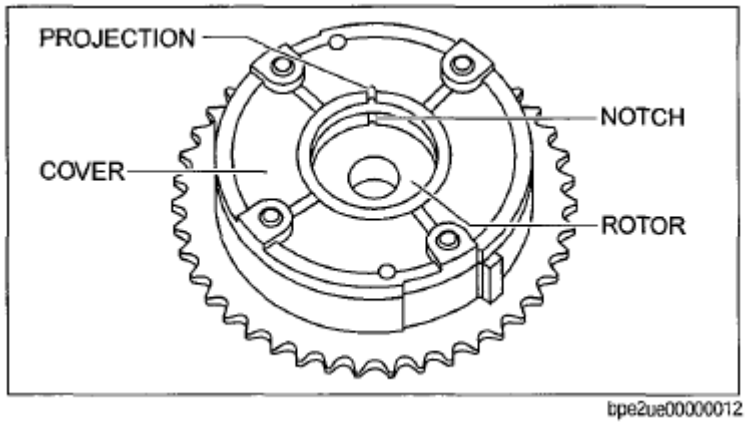


Fig. 127: Locating Heater Hoses
Courtesy of MAZDA MOTORS CORP.

28. Disconnect the fuel supply tube quick connect coupling from the fuel rail.

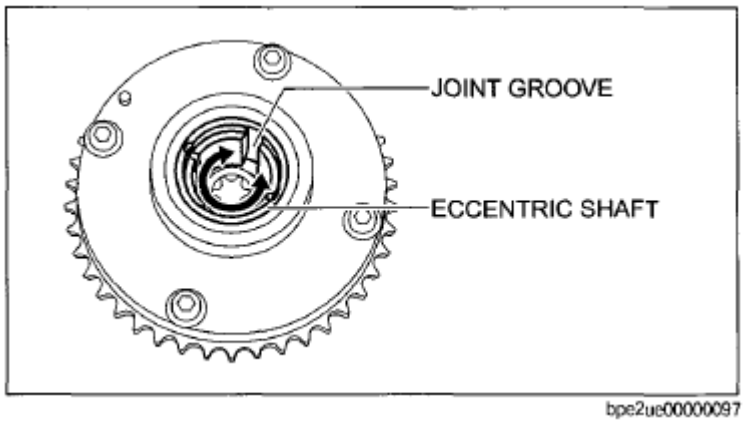


Fig. 128: Locating Fuel Supply Tube Quick Connect Coupling
Courtesy of MAZDA MOTORS CORP.

29. Disconnect the gearshift cable from the trans-axle.

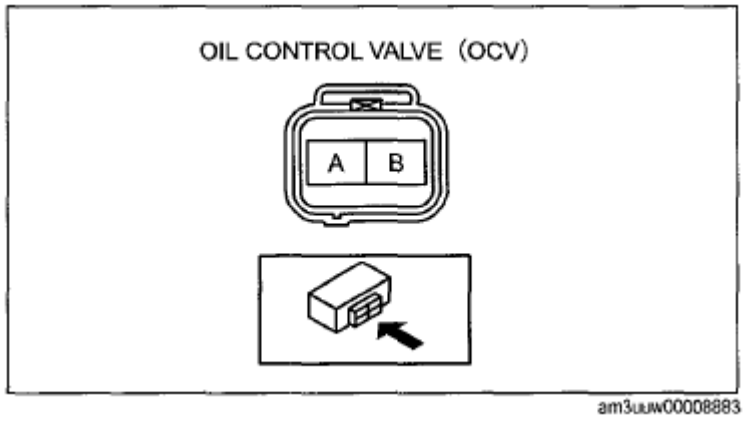


Fig. 129: Locating Gearshift Cable
Courtesy of MAZDA MOTORS CORP.

30. Remove the 2 shift cable bracket bolts, and position the cable and bracket aside.

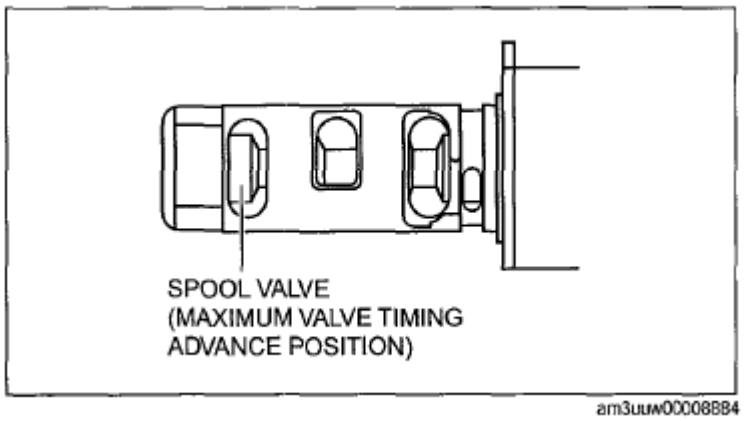


Fig. 130: Locating Shift Cable Bracket Bolts
Courtesy of MAZDA MOTORS CORP.

31. Detach the shift cable retainer from the bracket.

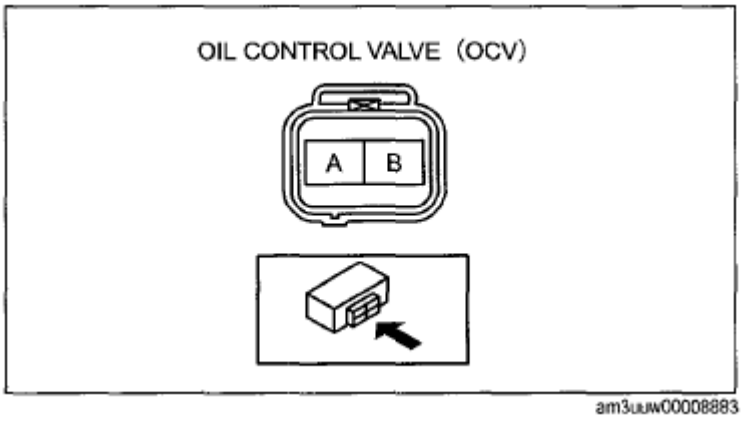


Fig. 131: Locating Shift Cable Retainer
Courtesy of MAZDA MOTORS CORP.

32. Disconnect the Evaporative Emission (EVAP) canister purge valve tube and disconnect the brake booster vacuum tube from the intake manifold.

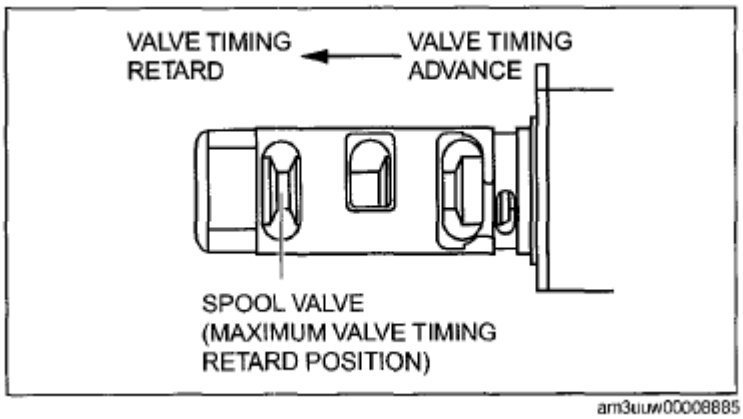


Fig. 132: Locating Evaporative Emission (EVAP) Canister Purge Valve Tube And Brake Booster Vacuum Tube
Courtesy of MAZDA MOTORS CORP.

33. Disconnect the middle PCM electrical connector and the engine wiring harness electrical connector.
    - Detach the 2 wiring harness retainers.

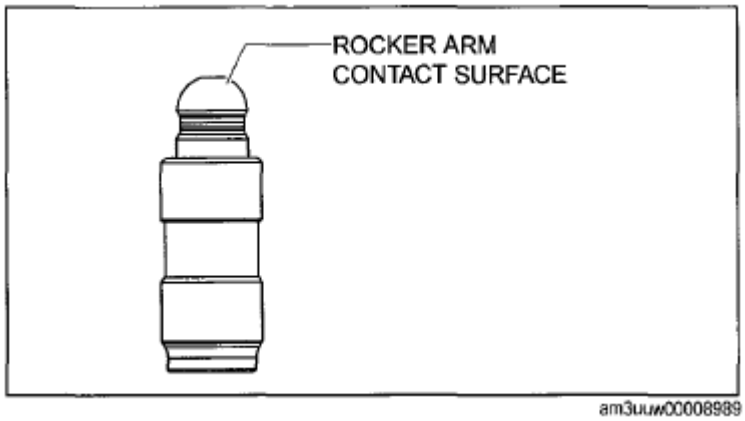


Fig. 133: Locating Wiring Harness Retainers
Courtesy of MAZDA MOTORS CORP.

34. Detach the wiring harness retainer from the battery tray bracket.

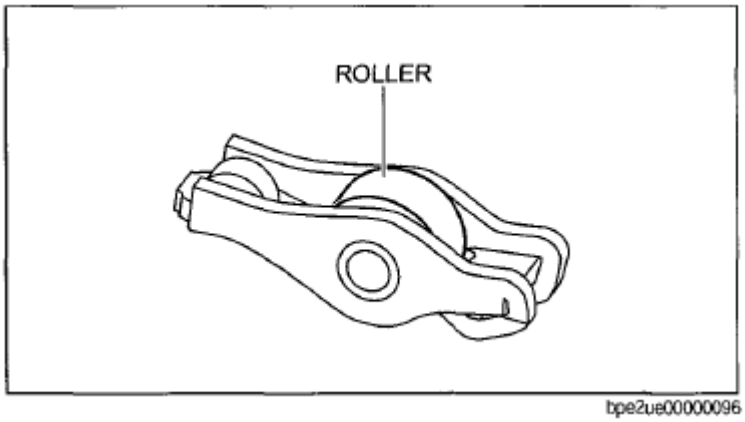


Fig. 134: Locating Wiring Harness Retainer
Courtesy of MAZDA MOTORS CORP.

35. Remove the bolt and detach the ground wire.

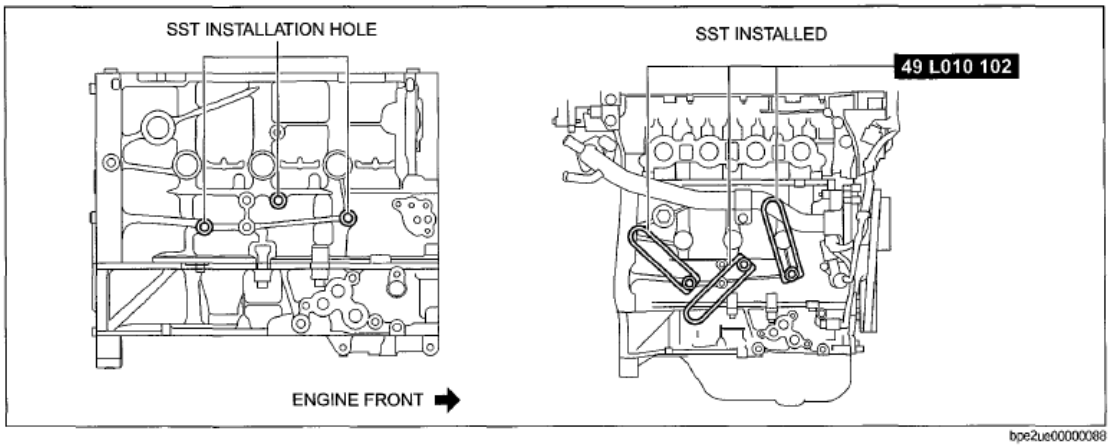


Fig. 135: Locating Bolt And Ground Wire
Courtesy of MAZDA MOTORS CORP.

36. Remove the nut and disconnect the cable from the Power Distribution Box (PDB).

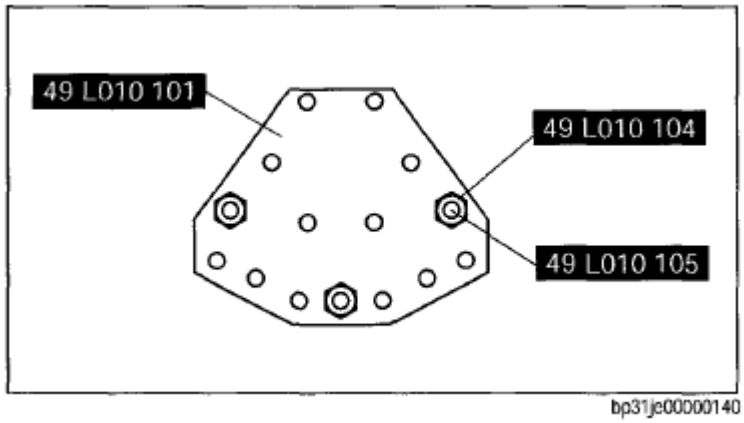


Fig. 136: Locating Nut And Cable
Courtesy of MAZDA MOTORS CORP.

37. Disconnect the electrical connector from the PDB.

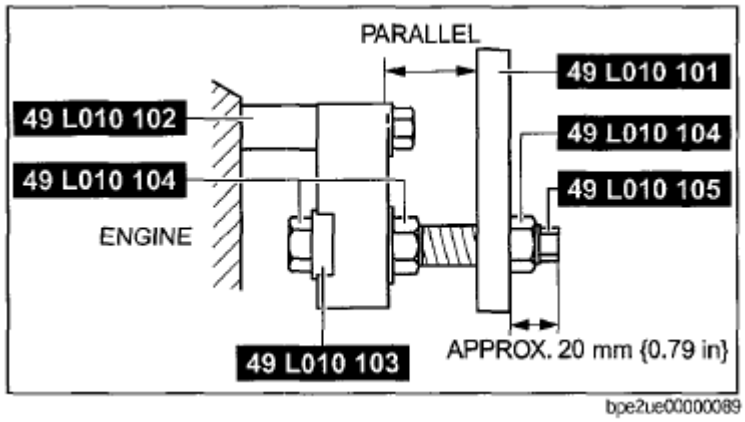


Fig. 137: Locating Electrical Connector
Courtesy of MAZDA MOTORS CORP.

38. Remove the nut and the ground wire eyelet from the engine mount stud.

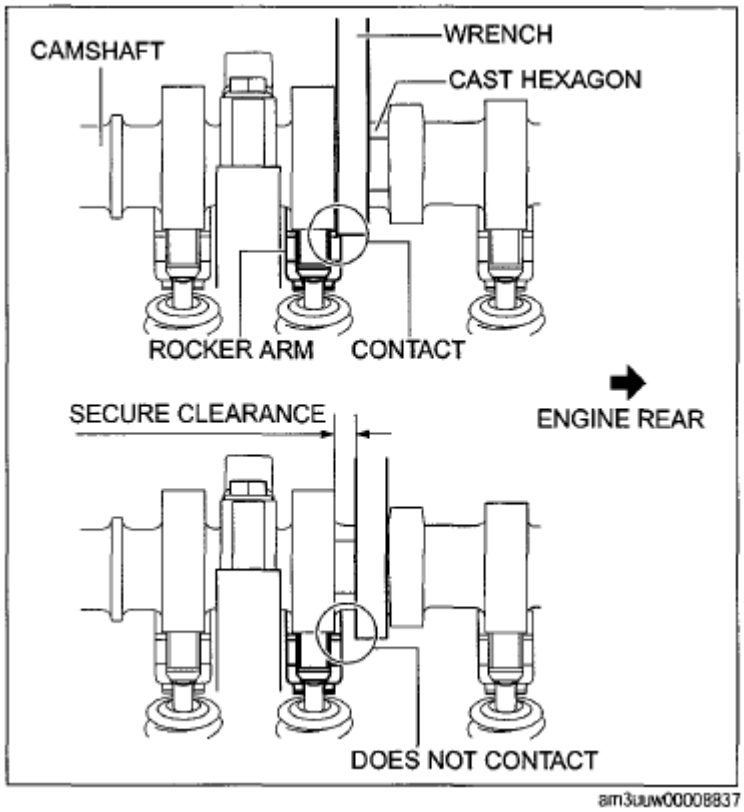


Fig. 138: Locating Nut And Ground Wire Eyelet
Courtesy of MAZDA MOTORS CORP.

39. If equipped, disconnect the engine block heater electrical connector.

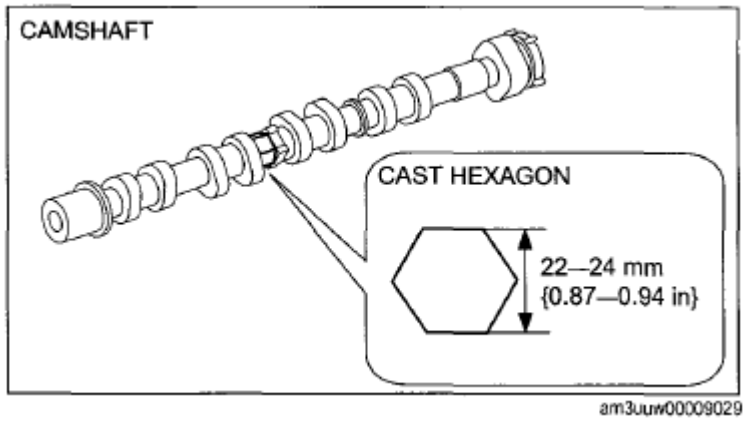
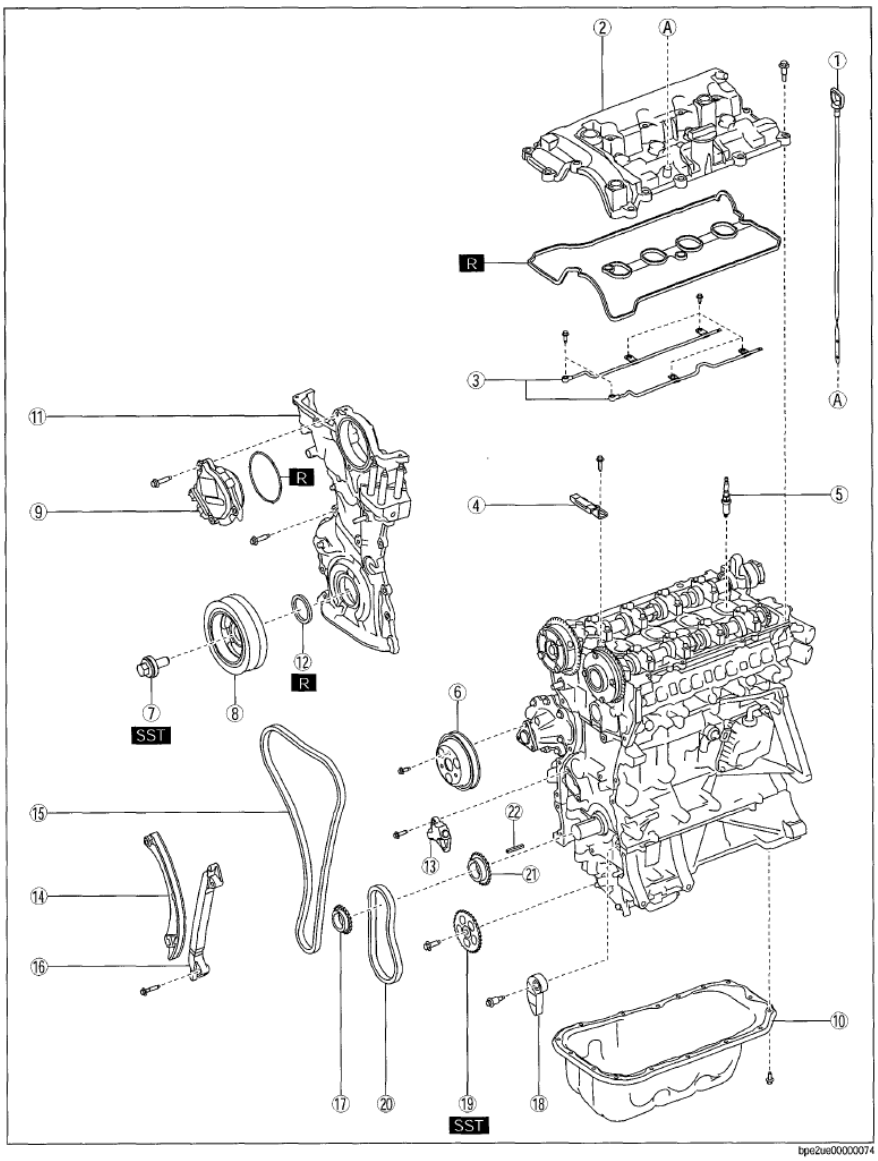


Fig. 139: Locating Engine Block Heater Electrical Connector
Courtesy of MAZDA MOTORS CORP.

40. Remove the access cover.



1	Dipstick
2	Cylinder head cover
5	Spark plug
6	Water pump pulley (See Water Pump Pulley Disassembly Note.)
7	Crankshaft pulley lock bolt (See Crankshaft Pulley Lock Bolt Disassembly Note.)
8	Crankshaft pulley
9	Electric variable valve timing motor/driver
10	Oil pan (See Oil Pan Disassembly Note.)
11	Engine front cover (See Engine Front Cover Disassembly Note.)
12	Front oil seal (See Front Oil Seal Disassembly Note.)

3	Oil shower pipe
4	Chain guide (No.1)
13	Chain tensioner (See Chain Tensioner Removal Note.)
14	Tensioner arm
15	Timing chain
16	Chain guide (No.2)
17	Crankshaft sprocket
18	Oil pump chain tensioner
19	Oil pump driven sprocket (See Oil Pump Driven Sprocket Disassembly Note.)
20	Oil pump chain
21	Oil pump drive sprocket
22	Key

Fig. 140: Locating Access Cover
Courtesy of MAZDA MOTORS CORP.

41. Remove the 4 torque converter nuts.

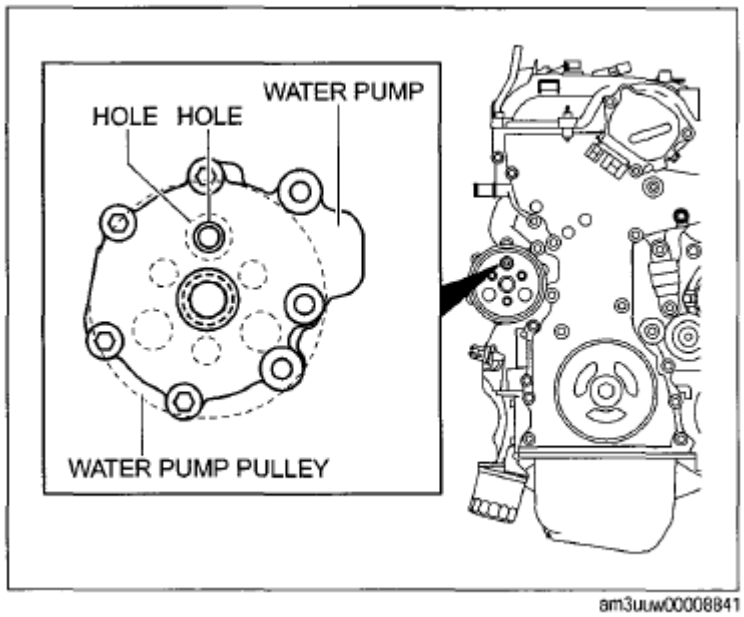


Fig. 141: Locating Torque Converter Nuts
Courtesy of MAZDA MOTORS CORP.

42. Remove the 2 oil pan-to-transaxle bolts.

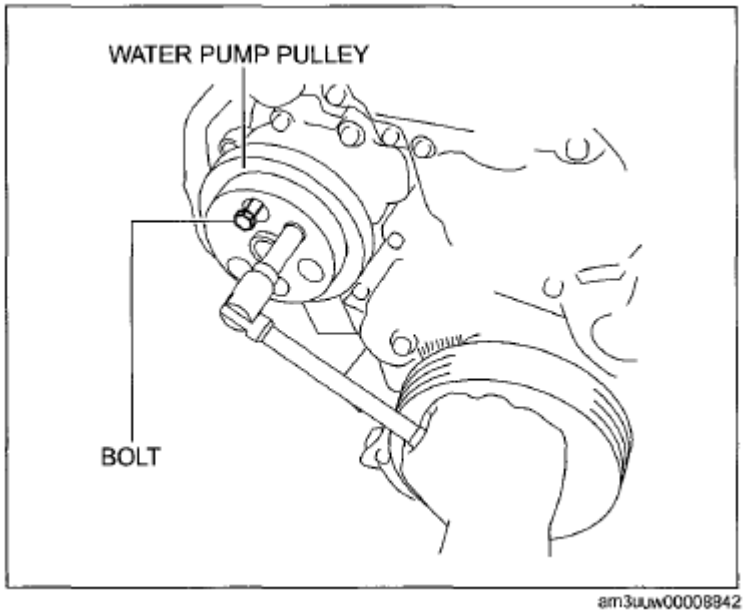


Fig. 142: Locating Oil Pan-To-Transaxle Bolts
Courtesy of MAZDA MOTORS CORP.

43. Remove the 2 nuts and the transaxle-to-engine stud.

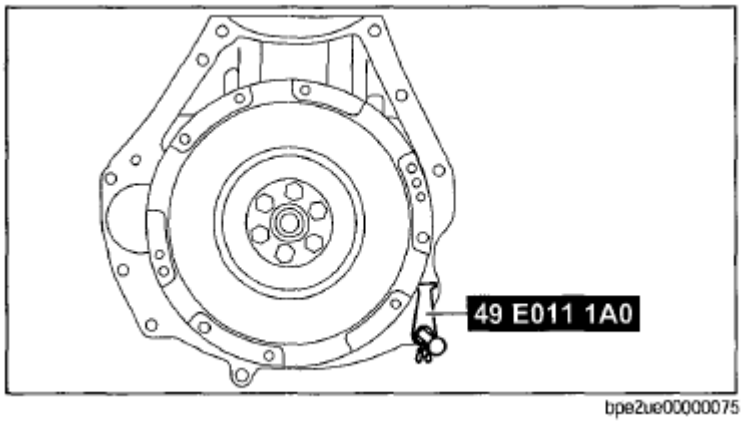


Fig. 143: Locating Nuts And Transaxle-To-Engine Stud
Courtesy of MAZDA MOTORS CORP.

44. Remove the 3 bolts and the halfshaft support bracket.

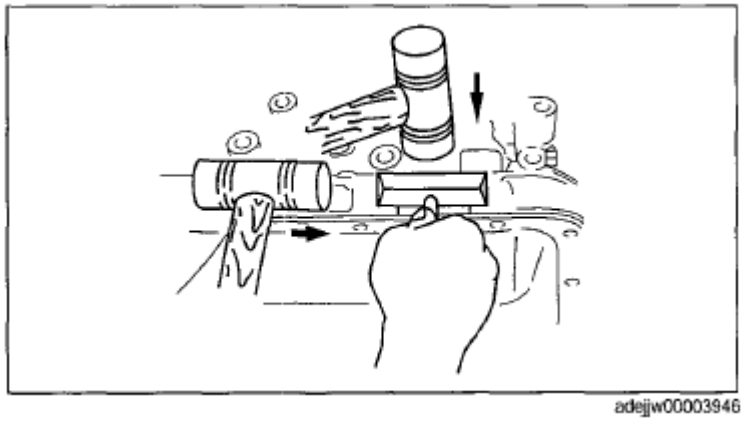


Fig. 144: Locating Bolts And Halfshaft Support Bracket
Courtesy of MAZDA MOTORS CORP.

45. Using the Universal Adapter Brackets, secure the engine and transaxle to the Powertrain Lift.

CAUTION:
- **Do not allow the engine oil pan to rest on the powertrain lift. Doing so may cause damage to the oil pan.**

NOTE:
- **The next 5 steps must be carried out with the vehicle raised and the Powertrain Lift in position.**

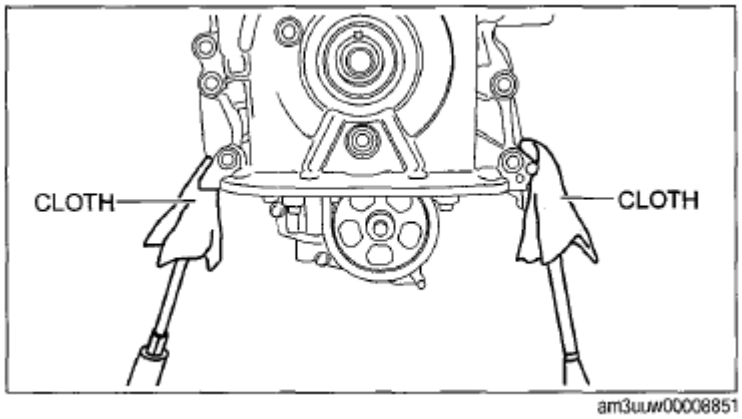


Fig. 145: Securing Engine And Transaxle To Powertrain Lift
Courtesy of MAZDA MOTORS CORP.

46. Remove the RH transaxle support insulator bolt.

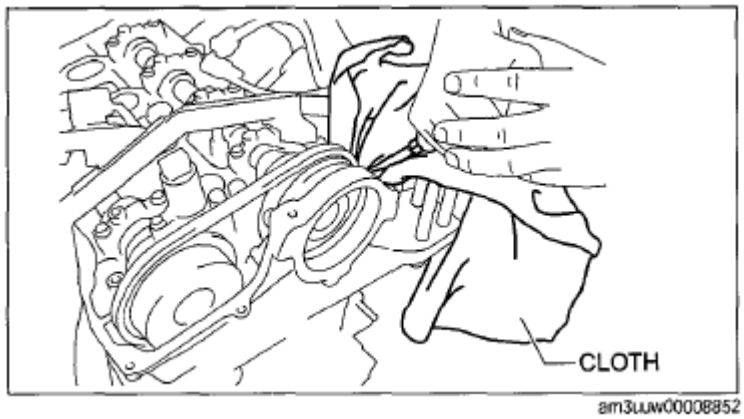


Fig. 146: Locating RH Transaxle Support Insulator Bolt
Courtesy of MAZDA MOTORS CORP.

47. Remove the bolt, nuts and the RH transaxle support insulator.

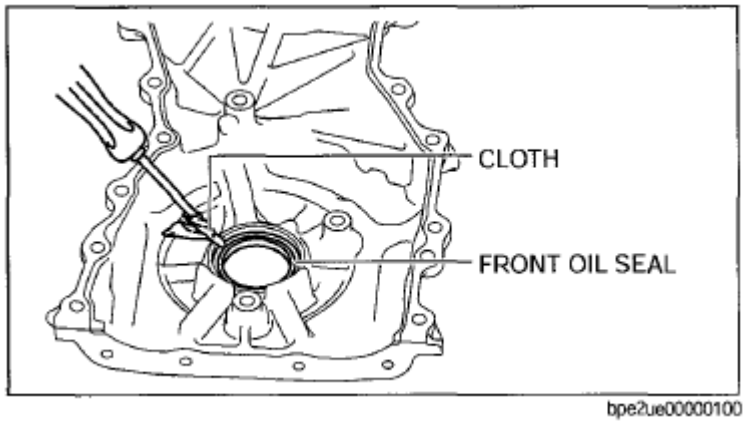


Fig. 147: Locating Bolt, Nuts And RH Transaxle Support Insulator
Courtesy of MAZDA MOTORS CORP.

48. Remove the rear transaxle support through bolt.

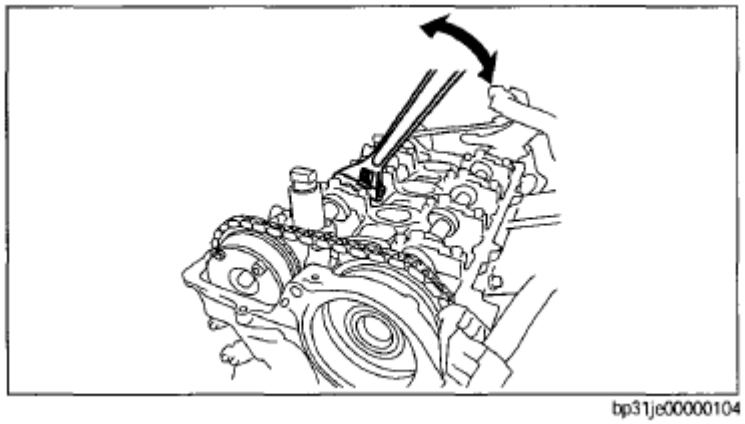


Fig. 148: Locating Rear Transaxle Support Through Bolt
Courtesy of MAZDA MOTORS CORP.

49. Remove the 3 engine support bracket nuts and the bolt.
    - Remove the engine support bracket.
50. Lower the powertrain from the vehicle.

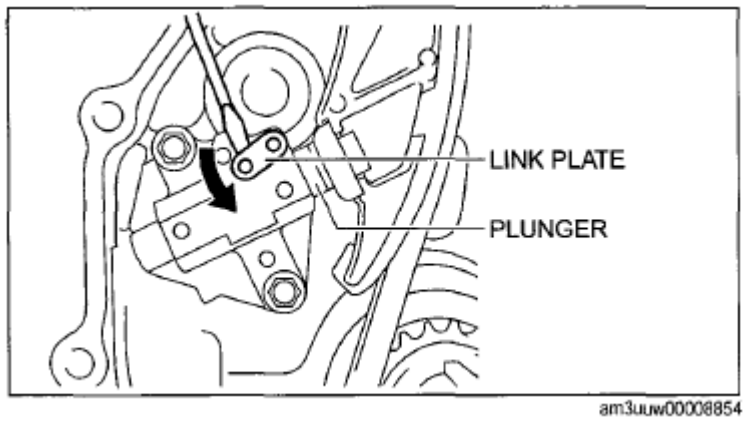


Fig. 149: Locating Engine Support Bracket Nuts And Bolt
Courtesy of MAZDA MOTORS CORP.

51. Remove the nut and the starter wiring ground.

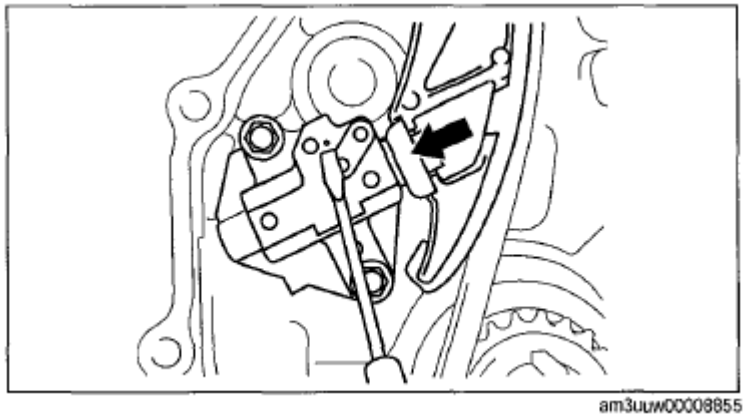


Fig. 150: Locating Nut And Starter Wiring Ground
Courtesy of MAZDA MOTORS CORP.

52. Remove the 2 nuts and the starter wiring.

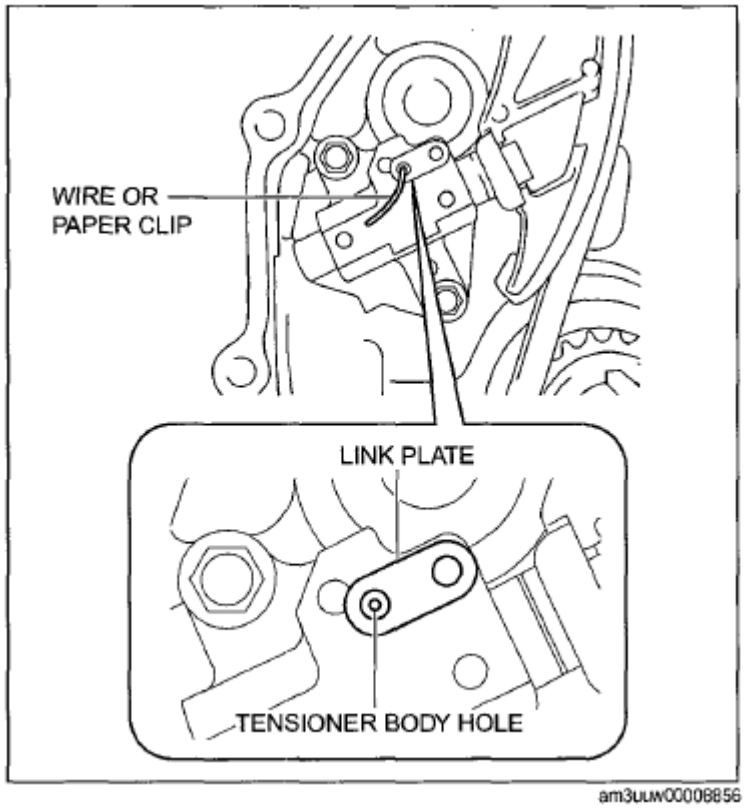


Fig. 151: Locating Nuts And Starter Wiring
Courtesy of MAZDA MOTORS CORP.

53. Remove the 2 stud bolts and the starter.

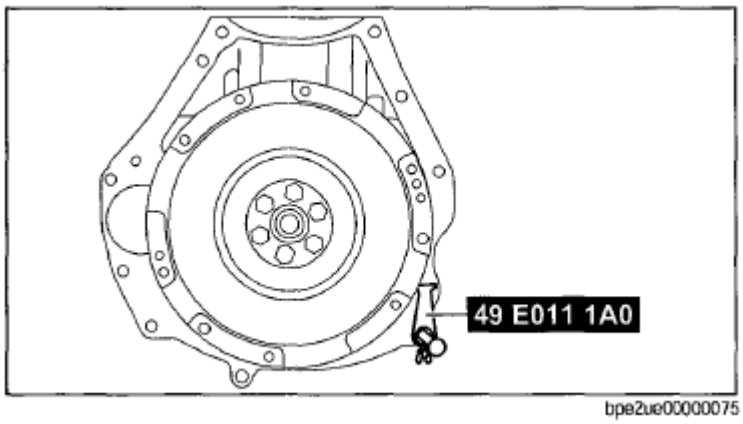


Fig. 152: Locating Stud Bolts And Starter
Courtesy of MAZDA MOTORS CORP.

AWD vehicles

54. Disconnect the RH Heated Oxygen Sensor (HO2S) electrical connector.

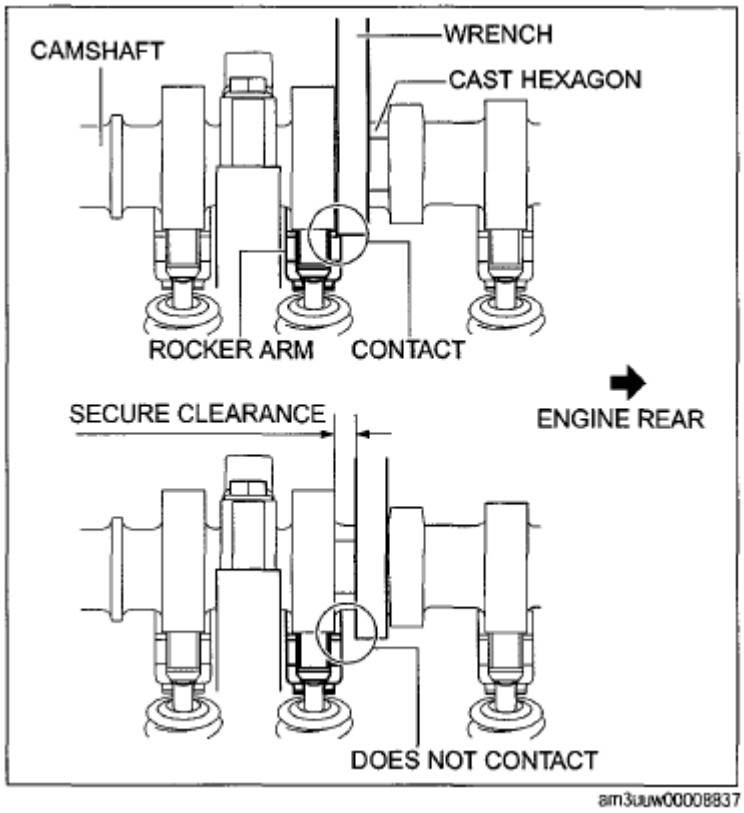


Fig. 153: Locating RH Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of MAZDA MOTORS CORP.

55. Remove the 3 bolts and the RH heat shield.

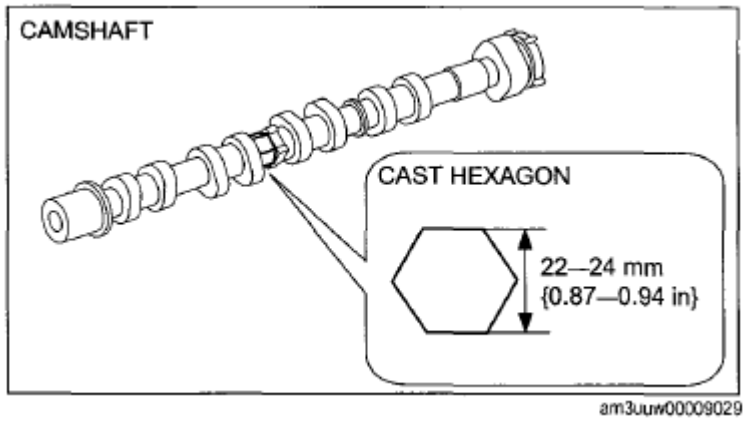
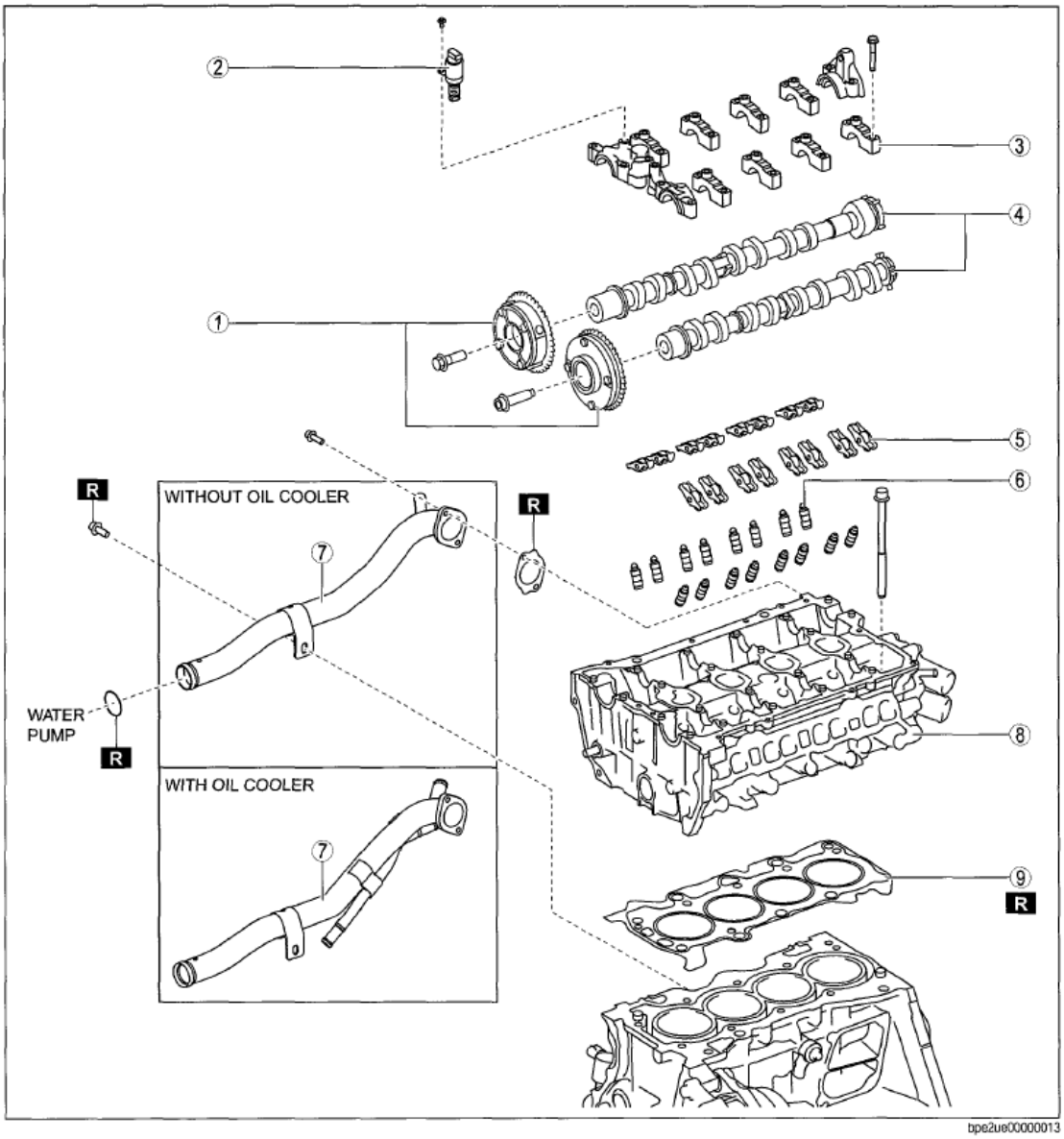


Fig. 154: Locating Bolts And RH Heat Shield
Courtesy of MAZDA MOTORS CORP.

56. Remove the EGR tube fitting from the EGR valve.



1	Electric variable valve timing actuator, hydraulic variable valve timing actuator (See Electric Variable Valve Timing Actuator, Hydraulic Variable Valve Timing Actuator Disassembly Note.)
2	OCV
3	Camshaft cap (See Camshaft Cap Disassembly Note.)
4	Camshaft

5	Rocker arm (See Rocker Arm Disassembly Note.)
6	HLA (See HLA Disassembly Note.)
7	Water inlet pipe
8	Cylinder head (See Cylinder Head Disassembly Note.)
9	Cylinder head gasket

Fig. 155: Locating EGR Tube Fitting
Courtesy of MAZDA MOTORS CORP.

57. Remove the 3 nuts and the RH catalytic converter.
    - Discard the nuts and gasket.

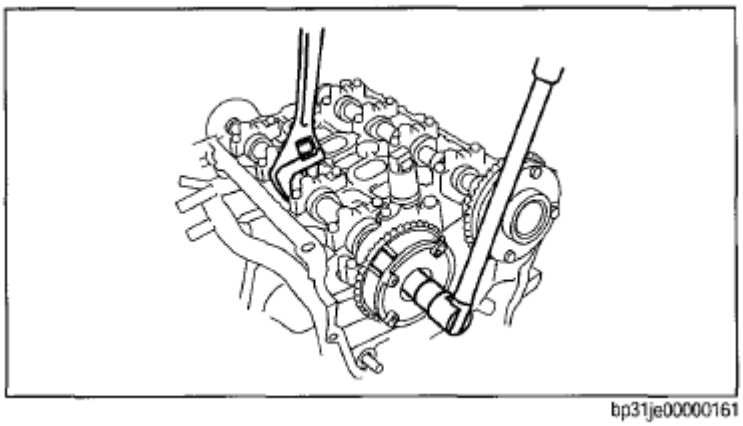


Fig. 156: Locating Nuts And RH Catalytic Converter
Courtesy of MAZDA MOTORS CORP.

58. Remove the bolts and the Power Transfer Unit (PTU) support bracket.

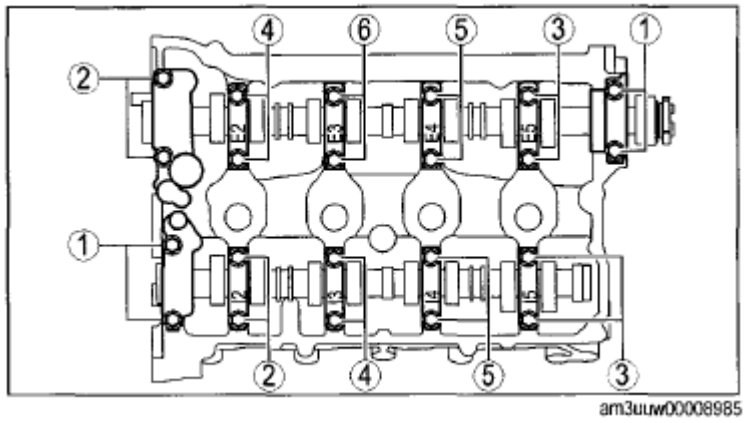


Fig. 157: Locating Bolts And Power Transfer Unit (PTU) Support Bracket
Courtesy of MAZDA MOTORS CORP.

59. Remove the 6 RH exhaust manifold nuts (3 shown in the figure) and the manifold.
    - Discard the nuts and gasket.

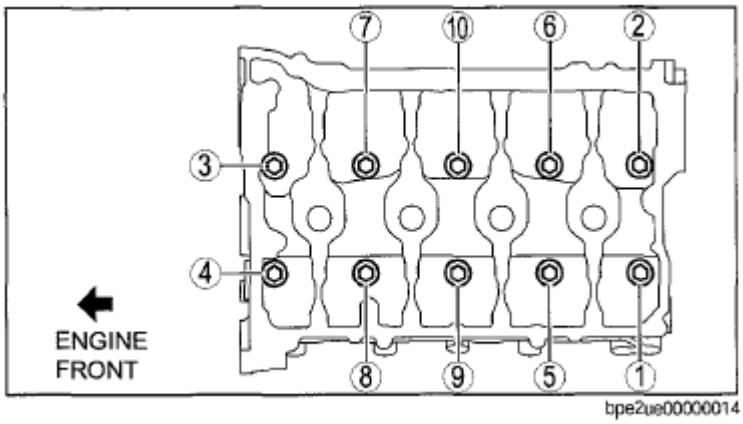
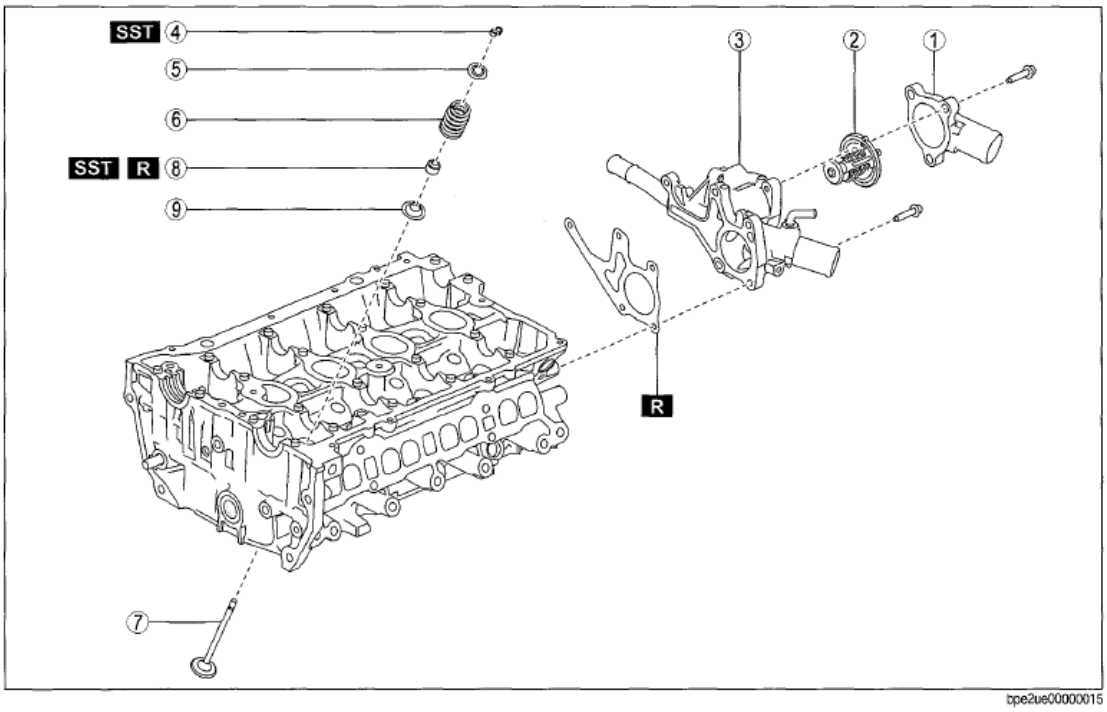


Fig. 158: Locating RH Exhaust Manifold Nuts And Manifold
Courtesy of MAZDA MOTORS CORP.

60. Remove and discard the 6 RH exhaust manifold studs.



1	Thermostat cover
2	Thermostat
3	Water outlet
4	Valve keeper (See Valve Keeper Disassembly Note.)
5	Upper valve spring seat

6	Valve spring
7	Valve
8	Valve seal (See Valve Seal Disassembly Note.)
9	Lower valve spring seat

Fig. 159: Locating RH Exhaust Manifold Studs
Courtesy of MAZDA MOTORS CORP.

61. Remove the 3 bolts and the PTU heat shield.

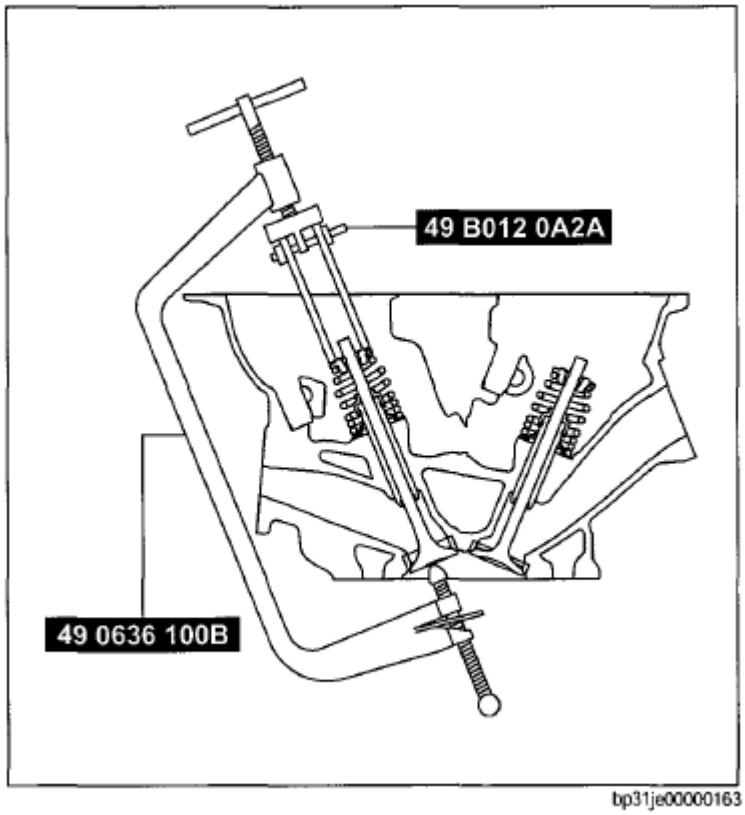


Fig. 160: Locating Bolts And PTU Heat Shield
Courtesy of MAZDA MOTORS CORP.

62. Using the Halfshaft Oil Seal Remover and Slide Hammer, remove the intermediate shaft seal.

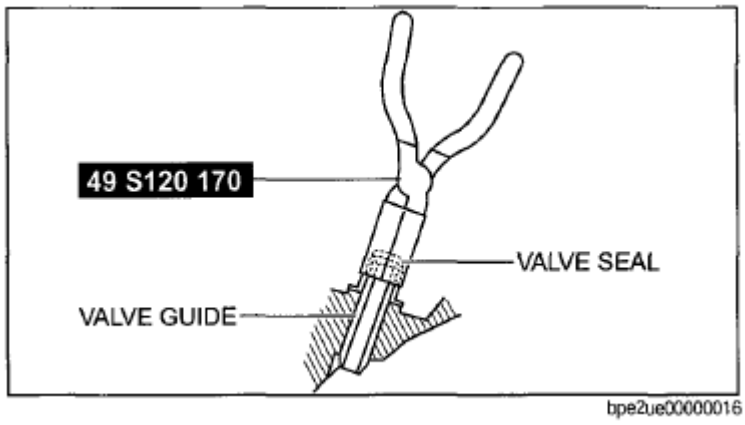


Fig. 161: Removing Intermediate Shaft Seal
Courtesy of MAZDA MOTORS CORP.

63. Remove the bolt, detach the pin-type retainer and position the Power Transfer Unit (PTU) vent tube aside.

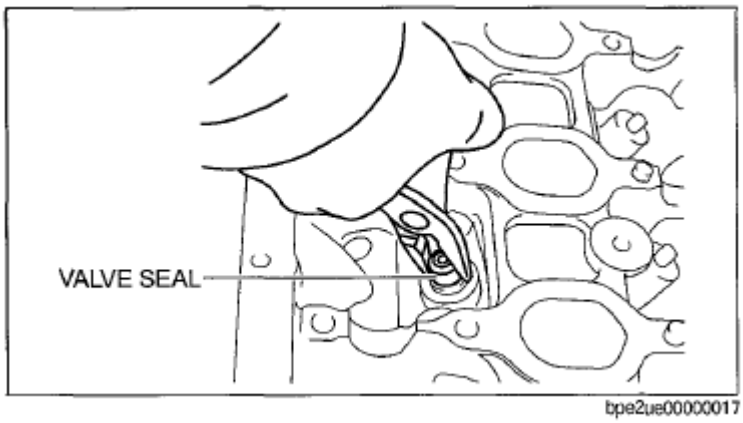
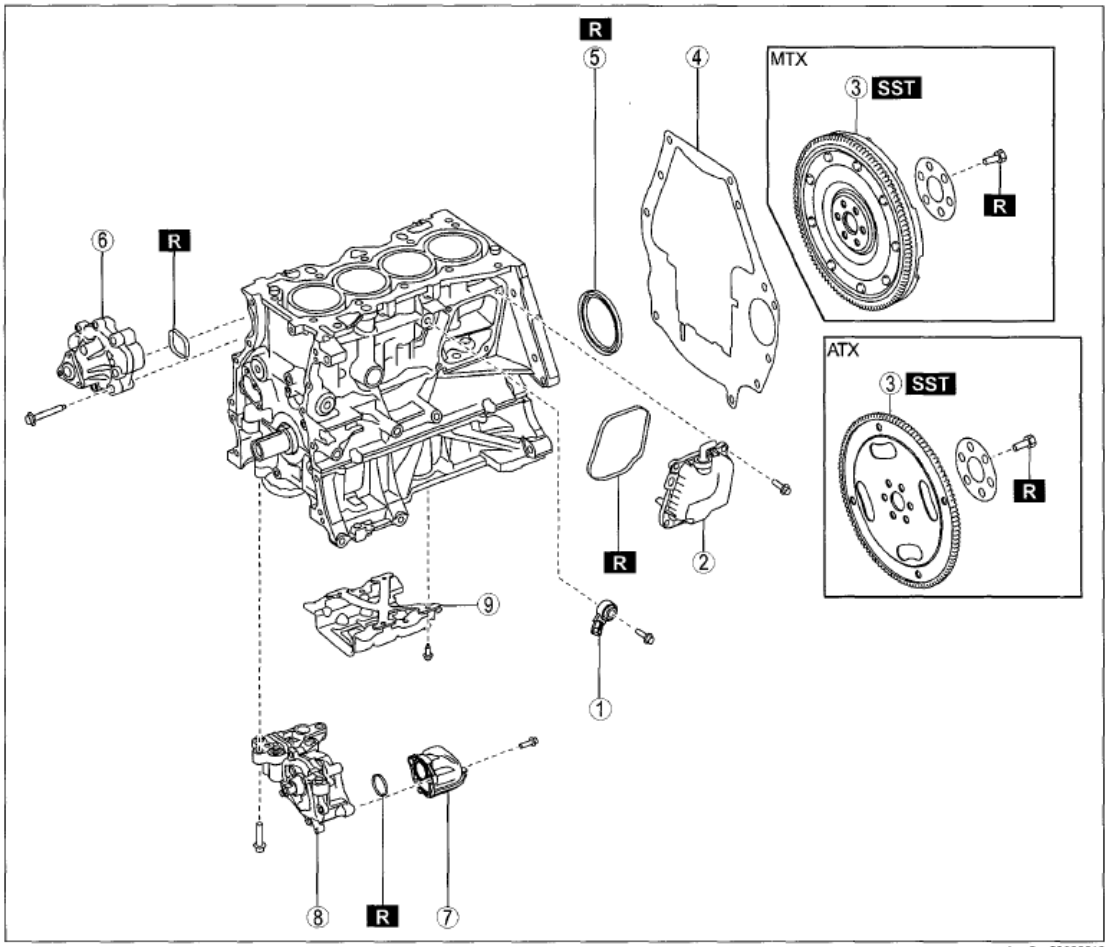


Fig. 162: Locating Bolt, Pin-Type Retainer And Power Transfer Unit (PTU) Vent Tube Aside
Courtesy of MAZDA MOTORS CORP.

64. Remove the 3 PTU bolts.



1	Knock sensor
2	Oil separator
3	Flywheel (MTX), Drive plate (ATX) (See Flywheel (MTX), Drive Plate (ATX) Disassembly Note.)
4	End plate

5	Rear oil seal (See Rear Oil Seal Removal Note.)
6	Water pump
7	Oil strainer
8	Oil pump
9	Oil baffle plate

Fig. 163: Locating PTU Bolts
Courtesy of MAZDA MOTORS CORP.

65. Remove the bolt and the PTU.

AWD vehicles

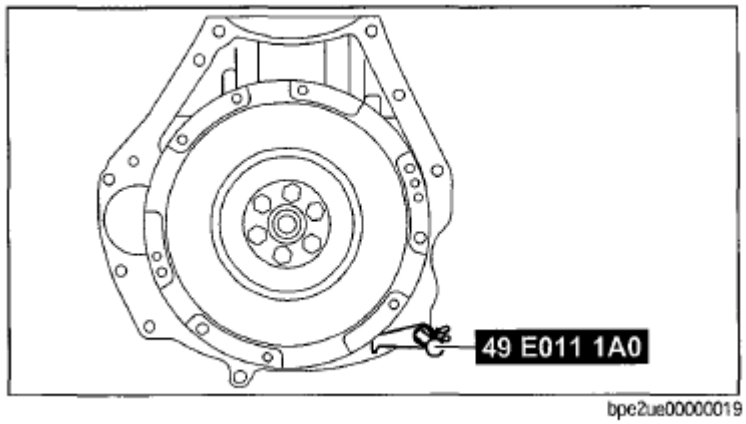


Fig. 164: Locating Bolt And PTU
Courtesy of MAZDA MOTORS CORP.

66. Install the lower half of the Engine Lifting Bracket Set.

NOTE:

- **When installing the lower half of the Engine Lifting Bracket Set, it will be easier to loosely install the upper bolt first then install the lower bolt.**

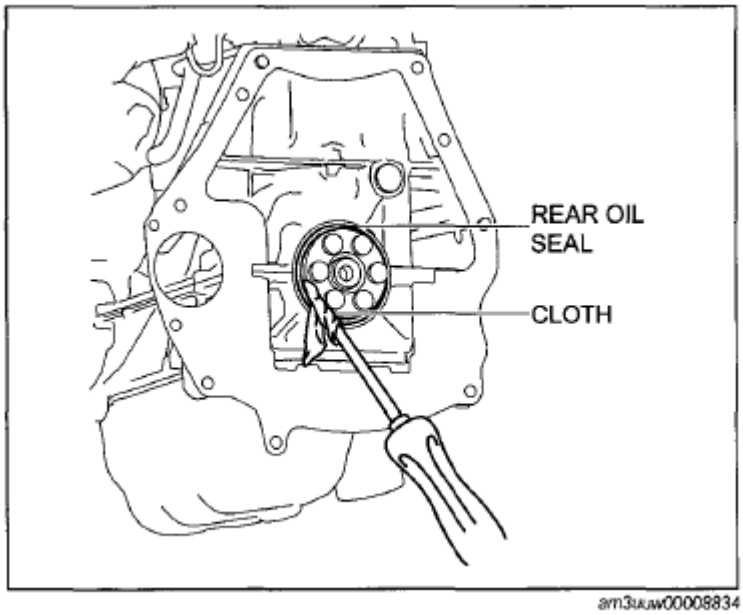
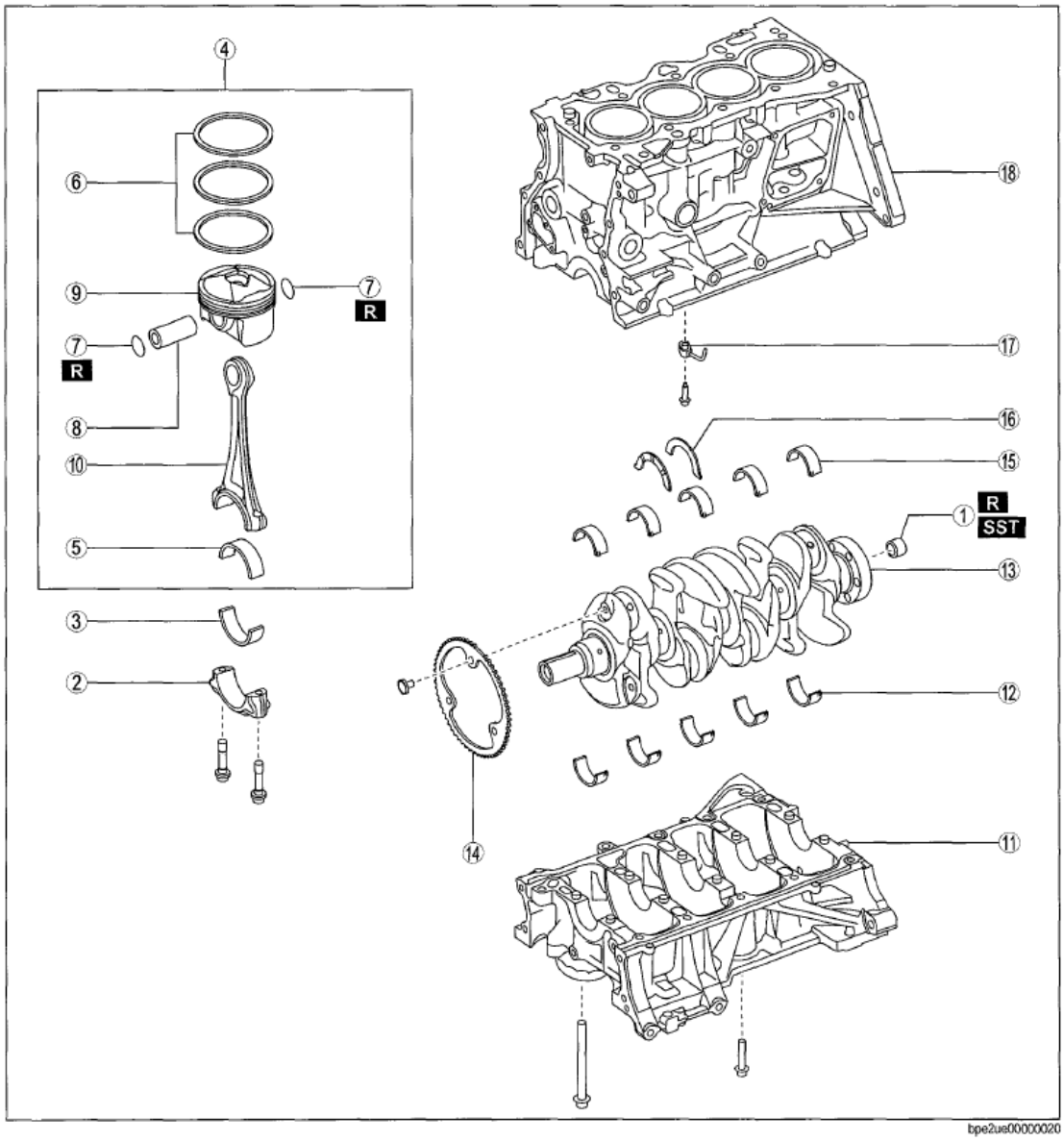


Fig. 165: Identifying Engine Lifting Bracket Set
Courtesy of MAZDA MOTORS CORP.

67. Install the upper half of the Engine Lifting Bracket Set.



1	Pilot bearing (MTX) (See Pilot Bearing Disassembly Note.)
2	Connecting rod cap (See Connecting Rod Cap Disassembly Note.)
3	Lower connecting rod bearing (See Connecting Rod Bearing Disassembly Note.)
4	Piston, connecting rod (See Piston, Connecting Rod Disassembly Note.)
11	Lower cylinder block (See Lower Cylinder Block Disassembly Note.)
12	Lower main bearing (See Thrust Bearing And Main Bearing Disassembly Note.)
13	Crankshaft (See Crankshaft Disassembly Note.)
14	Plate

5	Upper connecting rod bearing (See Connecting Rod Bearing Disassembly Note.)
6	Piston ring
7	Snap ring (See Snap Ring Disassembly Note.)
8	Piston pin
9	Piston
10	Connecting rod
15	Upper main bearing (See Thrust Bearing And Main Bearing Disassembly Note.)
16	Thrust bearing (See Thrust Bearing And Main Bearing Disassembly Note.)
17	Oil jet valve
18	Upper cylinder block

Fig. 166: Identifying Engine Lifting Bracket Set
Courtesy of MAZDA MOTORS CORP.

68. Install the Universal Adapter Brackets and the Engine Lifting Bracket to the front of the RH cylinder head.

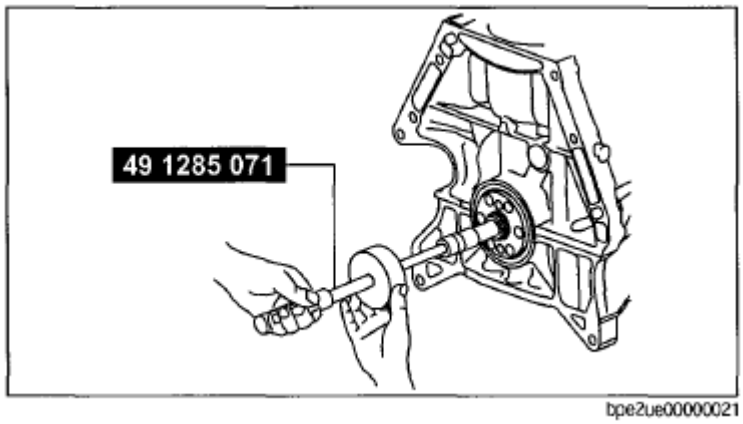


Fig. 167: Identifying Universal Adapter Brackets And Engine Lifting Bracket
Courtesy of MAZDA MOTORS CORP.

69. Install the Universal Adapter Brackets and the Engine Lifting Bracket to the rear of the LH cylinder head.

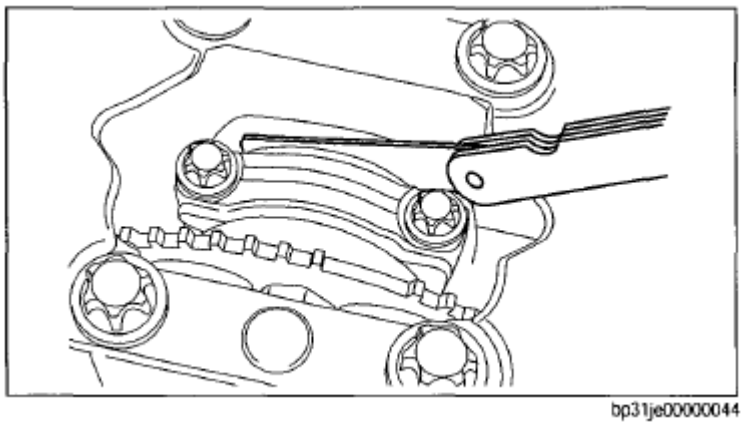


Fig. 168: Identifying Universal Adapter Brackets And Engine Lifting Bracket
Courtesy of MAZDA MOTORS CORP.

70. Using the Spreader Bar, Engine Lifting Brackets, Engine Lifting Bracket Set and a suitable engine crane, remove the engine and transaxle from the Powertrain Lift.

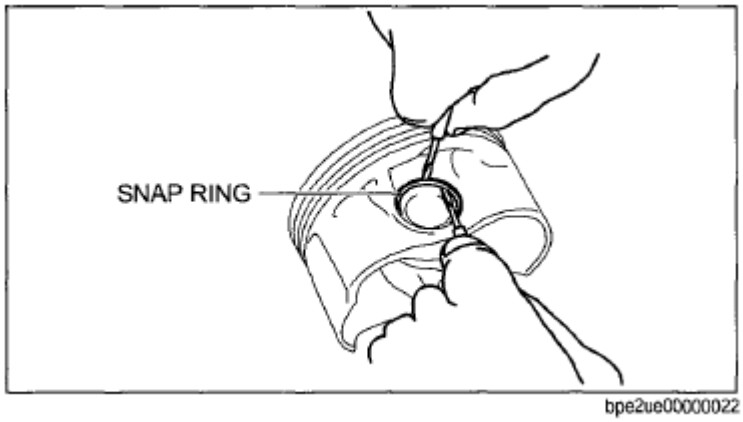


Fig. 169: Identifying Spreader Bar, Engine Lifting Brackets, Engine Lifting Bracket Set And Suitable Engine Crane
Courtesy of MAZDA MOTORS CORP.

71. Remove the 5 remaining transaxle-to-engine bolts (3 shown in the figure).

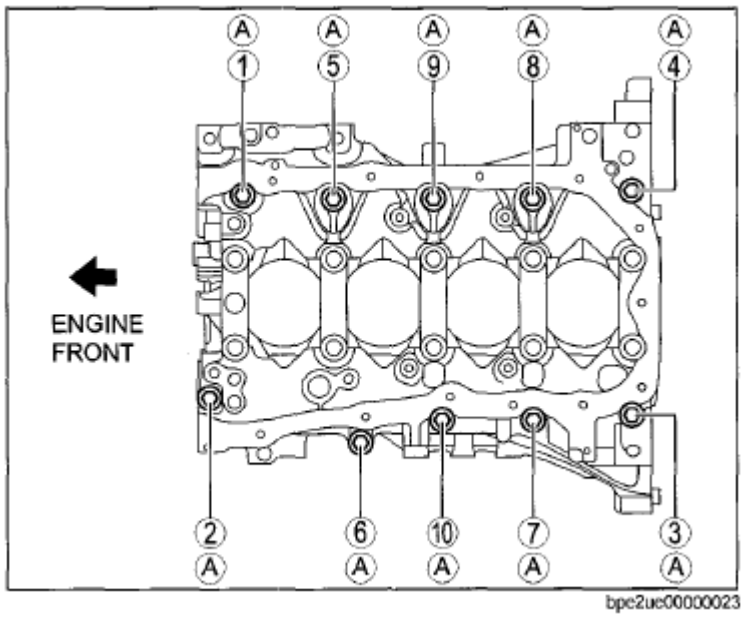


Fig. 170: Locating Transaxle-To-Engine Bolts
Courtesy of MAZDA MOTORS CORP.

72. Using the Spreader Bar, Engine Lifting Brackets, Engine Lifting Bracket Set and a suitable engine crane, separate the engine and trans-axle.

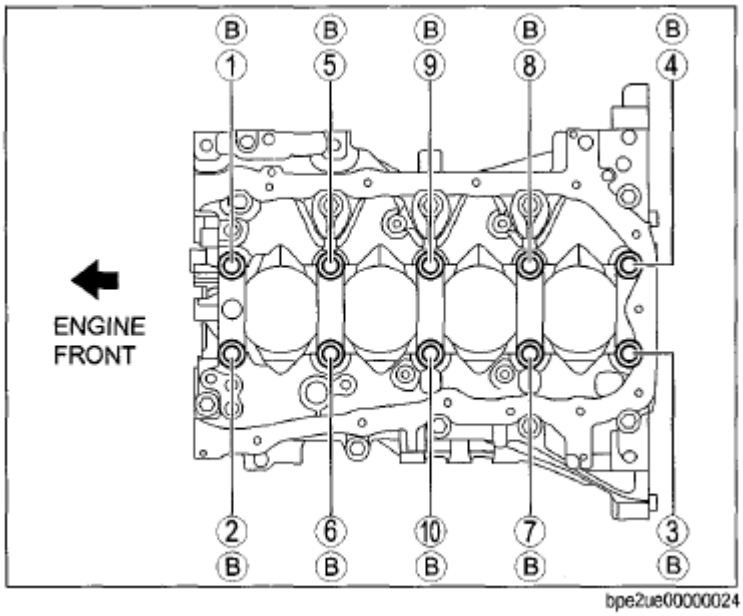


Fig. 171: Identifying Spreader Bar, Engine Lifting Brackets, Engine Lifting Bracket Set And Suitable Engine Crane
Courtesy of MAZDA MOTORS CORP.

ENGINE DISASSEMBLY - 3.0L

DISASSEMBLY

All vehicles

CAUTION:
- **During engine repair procedures, cleanliness is extremely important. Any foreign material (including any material created while cleaning gasket surfaces) that enters the oil passages, coolant passages or the oil pan may cause engine failure.**

1. Remove the bolts and the flexplate.

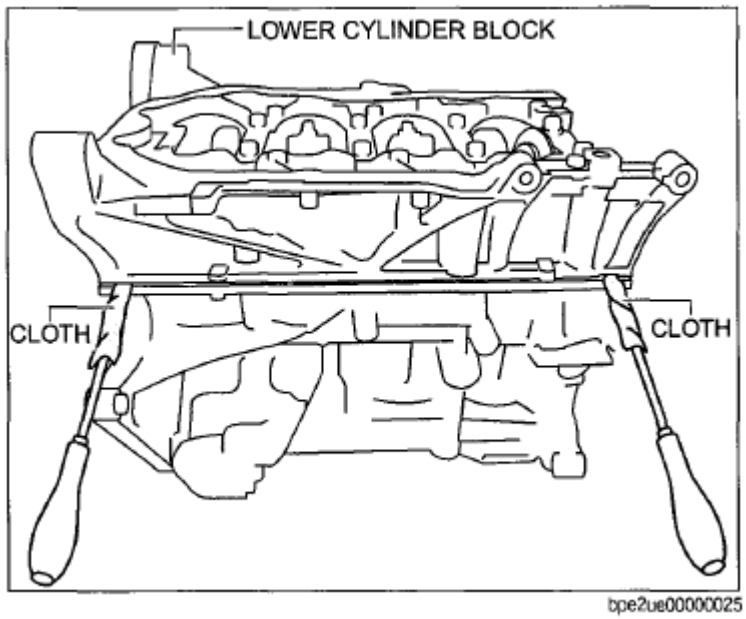


Fig. 172: Locating Bolts And Flexplate
Courtesy of MAZDA MOTORS CORP.

2. Remove the engine-to-transaxle separator plate.

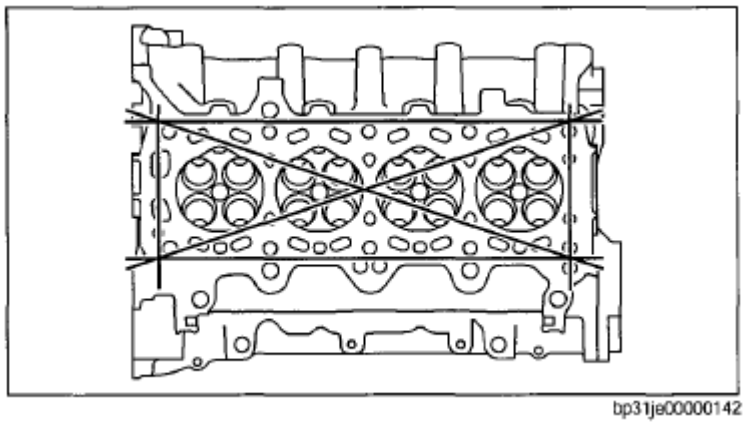


Fig. 173: Locating Engine-To-Transaxle Separator Plate
Courtesy of MAZDA MOTORS CORP.

3. Using the special tools, remove and discard the crankshaft rear oil seal.

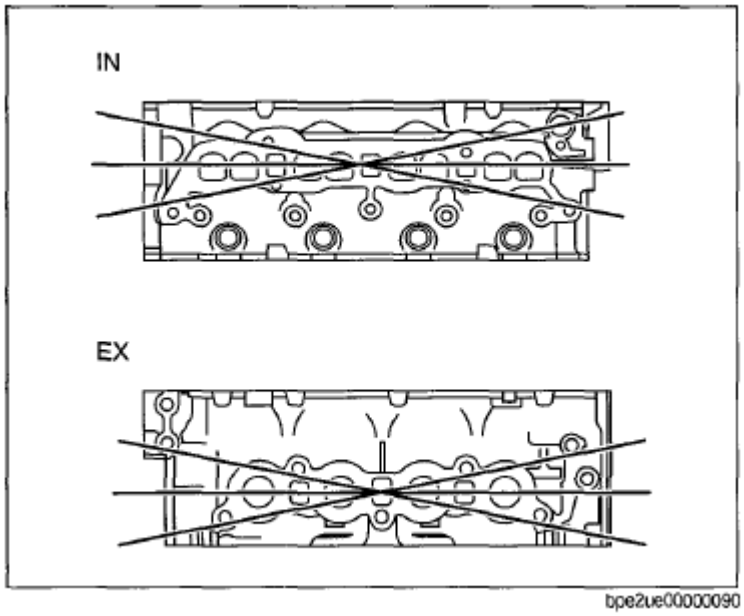


Fig. 174: Identifying Special Tool (307-005 And 303-519)
Courtesy of MAZDA MOTORS CORP.

4. Mount the engine on a suitable stand.
5. Disconnect the engine block Knock Sensor (KS) electrical connector and detach the wire harness retainer, disconnect the Cylinder Head Temperature (CHT) sensor electrical connector and the cylinder head KS electrical connector.

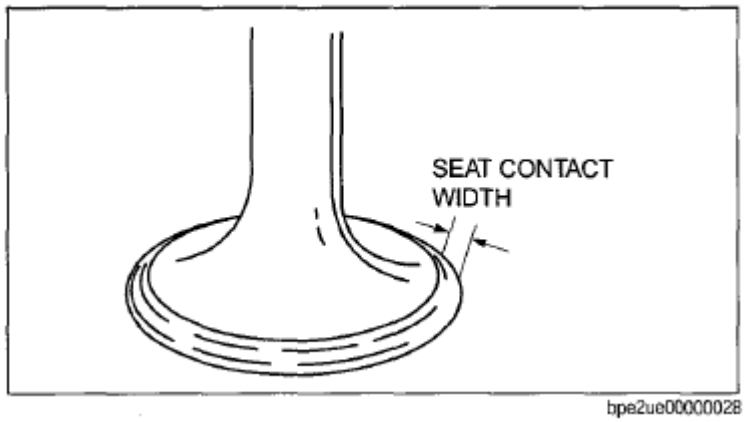


Fig. 175: Locating Engine Block Knock Sensor (KS) Electrical Connector And Wire Harness Retainer
Courtesy of MAZDA MOTORS CORP.

6. Disconnect the electronic throttle control electrical connector.

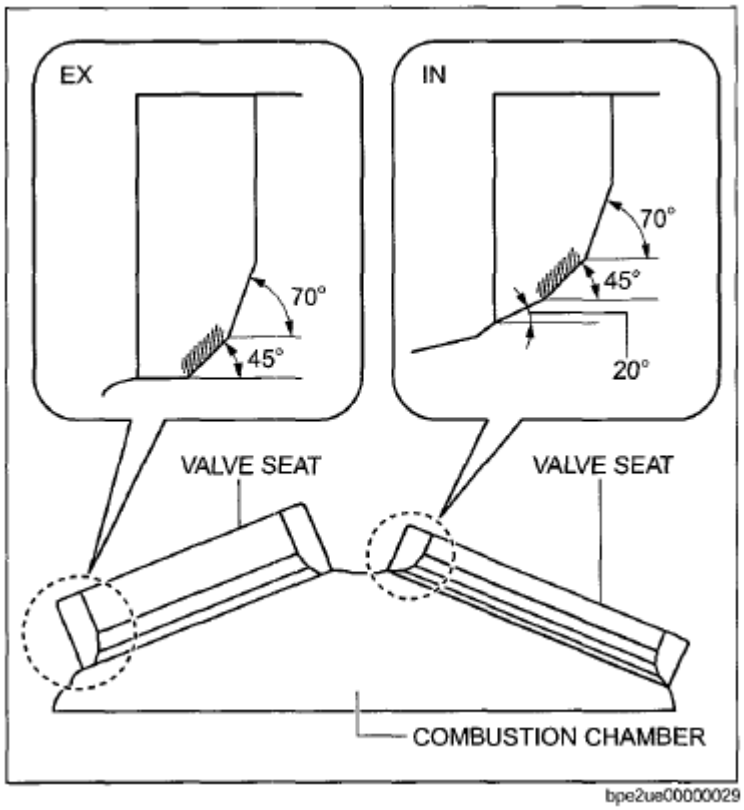


Fig. 176: Locating Electronic Throttle Control Electrical Connector
Courtesy of MAZDA MOTORS CORP.

7. Disconnect the Evaporative Emission (EVAP) canister purge valve electrical connector.

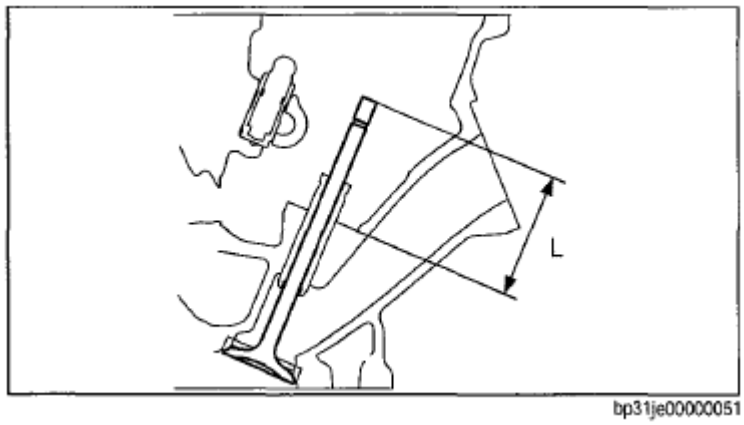


Fig. 177: Locating Evaporative Emission (EVAP) Canister Purge Valve Electrical Connector
Courtesy of MAZDA MOTORS CORP.

8. Disconnect the EGR regulator electrical connector and detach the wiring retainer.

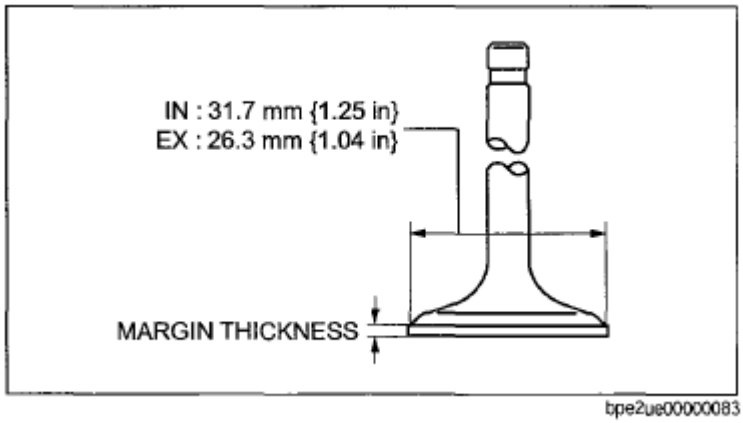


Fig. 178: Locating EGR Regulator Electrical Connector And Wiring Retainer
Courtesy of MAZDA MOTORS CORP.

9. Detach the wiring harness retainer from the upper intake manifold.

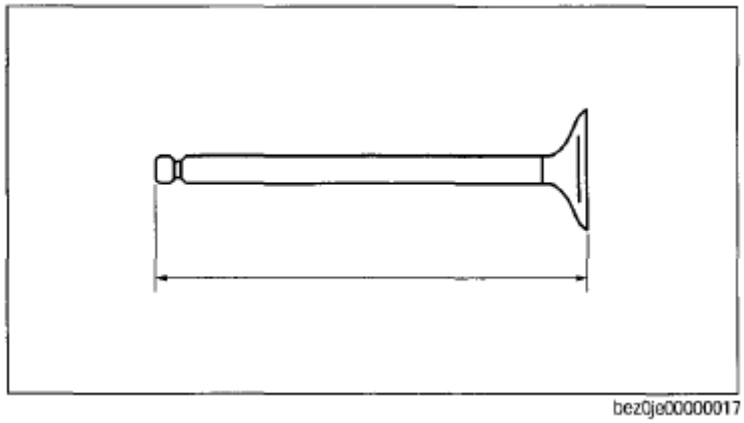


Fig. 179: Locating Wiring Harness Retainer
Courtesy of MAZDA MOTORS CORP.

10. Disconnect the Manifold Absolute Pressure (MAP) electrical connector and detach the wiring retainer.
11. Disconnect the RH coil-on-plug electrical connectors.
    - Detach the 2 wiring harness retainers.

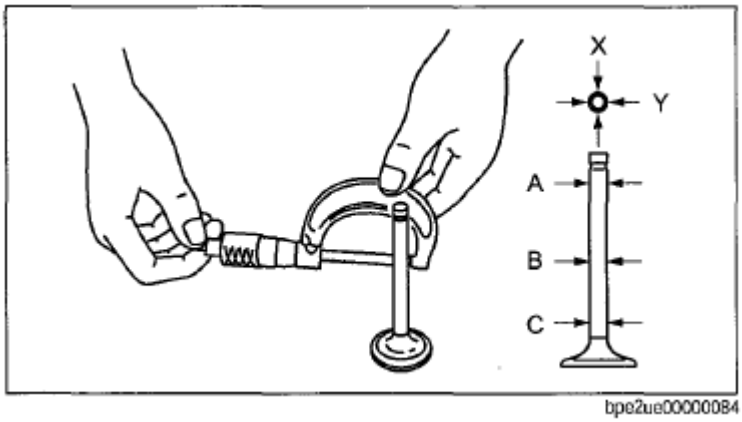


Fig. 180: Locating RH Coil-On-Plug Electrical Connectors
Courtesy of MAZDA MOTORS CORP.

Front wheel drive (FWD) vehicles

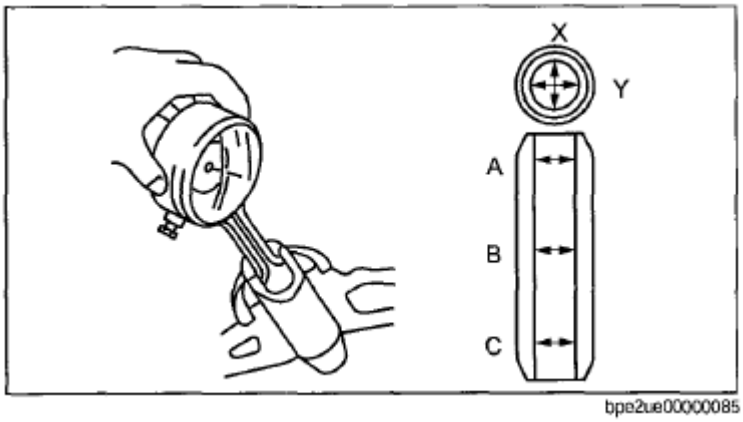


Fig. 181: Locating RH Coil-On-Plug Electrical Connectors - Front Wheel Drive (FWD) Vehicles
Courtesy of MAZDA MOTORS CORP.

12. Disconnect the RH heated oxygen sensor (HO2S) electrical connector.

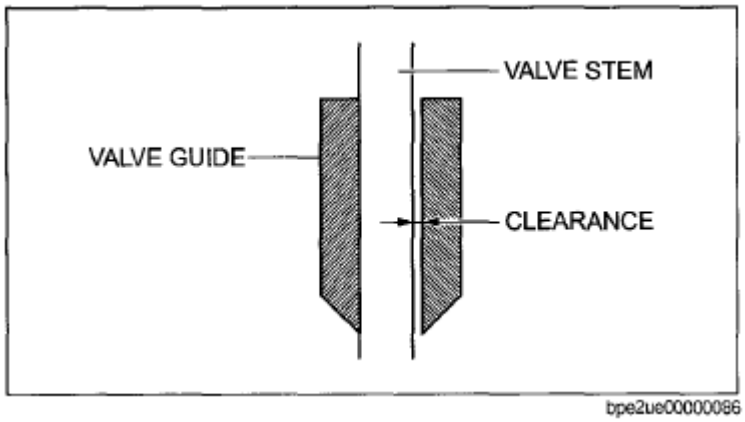


Fig. 182: Locating RH Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of MAZDA MOTORS CORP.

All vehicles

13. Disconnect the RH Variable Camshaft Timing (VCT) electrical connector.

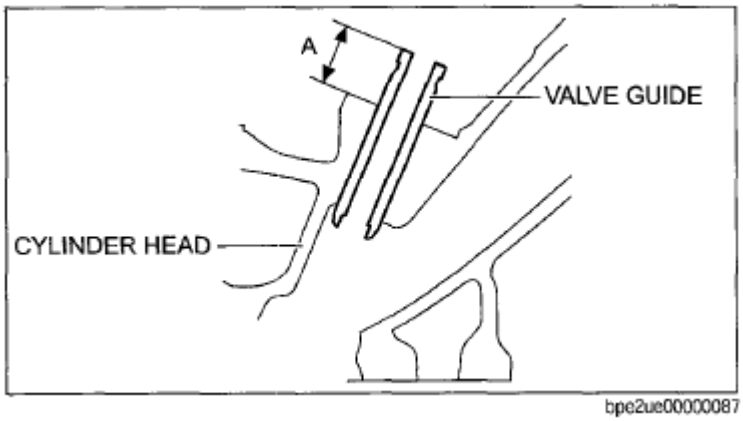


Fig. 183: Locating RH Variable Camshaft Timing (VCT) Electrical Connector
Courtesy of MAZDA MOTORS CORP.

14. Disconnect the Crankshaft Position (CKP) sensor electrical connector and detach the 2 wiring harness retainers.

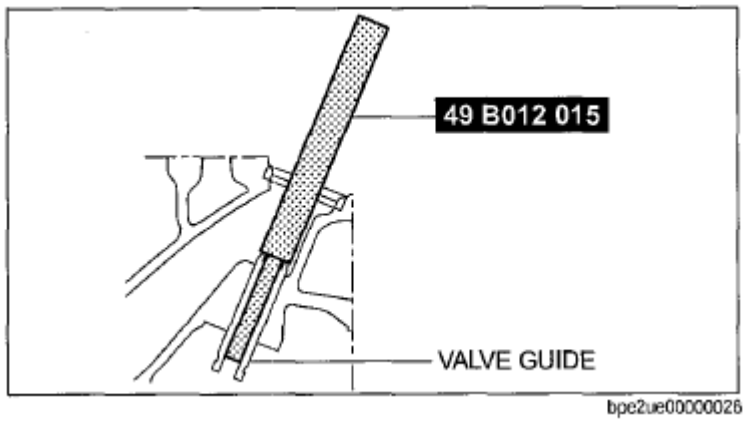


Fig. 184: Locating Crankshaft Position (CKP) Sensor Electrical Connector And Wiring Harness Retainers
Courtesy of MAZDA MOTORS CORP.

15. Disconnect the 2 Camshaft Position (CMP) sensor electrical connectors and detach the wiring harness retainer from the engine front cover stud bolt.

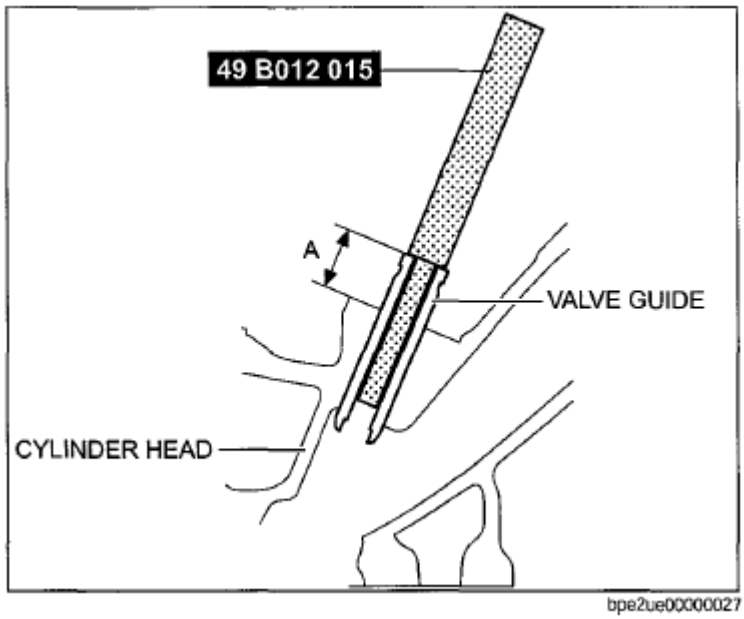


Fig. 185: Locating Camshaft Position (CMP) Sensor Electrical Connectors And Wiring Harness Retainer
Courtesy of MAZDA MOTORS CORP.

16. Disconnect the fuel injector wiring harness electrical connector.

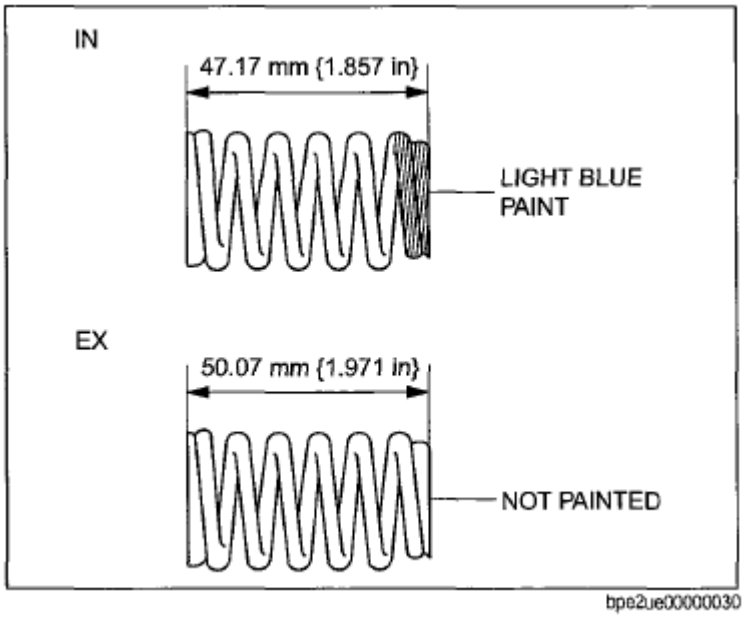


Fig. 186: Locating Fuel Injector Wiring Harness Electrical Connector
Courtesy of MAZDA MOTORS CORP.

17. Disconnect the LH VCT electrical connector.

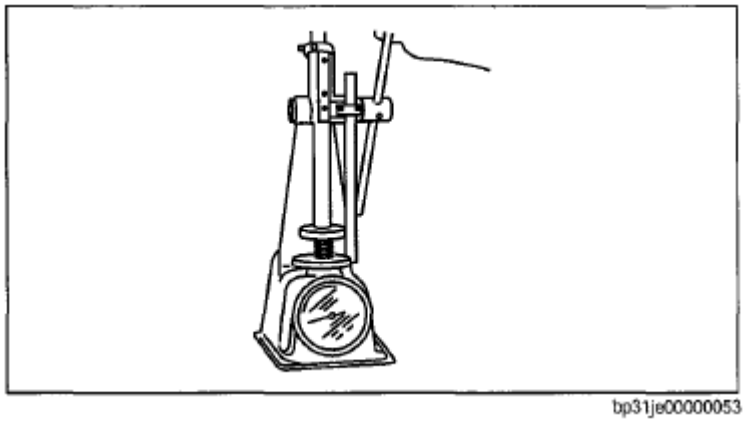


Fig. 187: Locating LH VCT Electrical Connector
Courtesy of MAZDA MOTORS CORP.

18. Disconnect the Engine Oil Pressure (EOP) switch electrical connector and detach the wiring retainer.

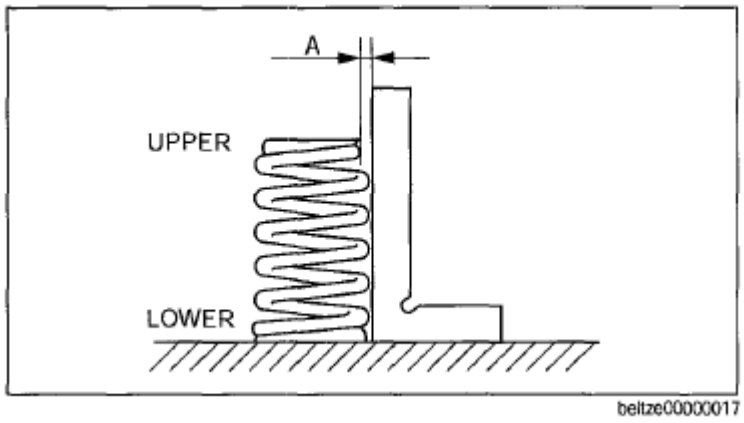


Fig. 188: Locating Engine Oil Pressure (EOP) Switch Electrical Connector And Wiring Retainer
Courtesy of MAZDA MOTORS CORP.

19. Disconnect the LH HO2S electrical connector.

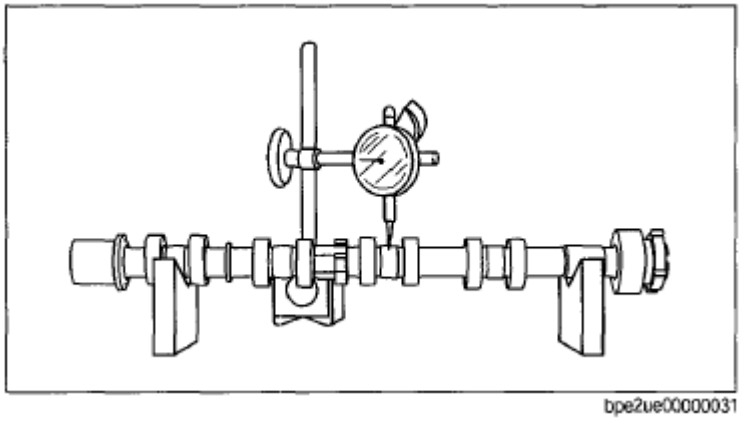


Fig. 189: Locating LH HO2S Electrical Connector
Courtesy of MAZDA MOTORS CORP.

20. Disconnect the 3 LH coil-on-plug electrical connectors.
    - Detach the 2 wiring harness retainers.

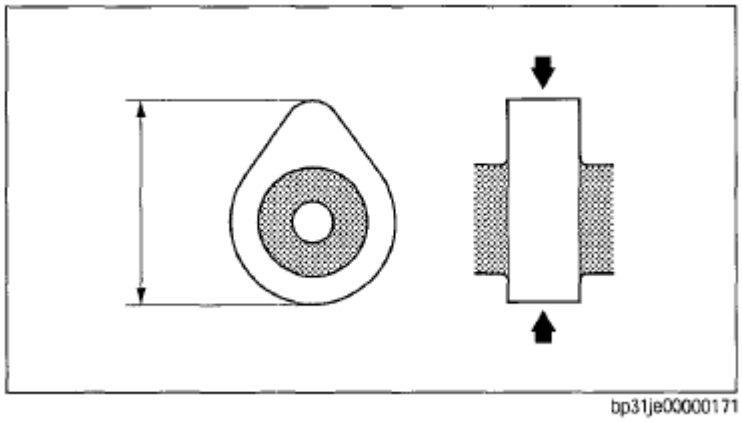


Fig. 190: Locating LH Coil-On-Plug Electrical Connectors
Courtesy of MAZDA MOTORS CORP.

21. Remove the nut and the B+ wire from the generator.

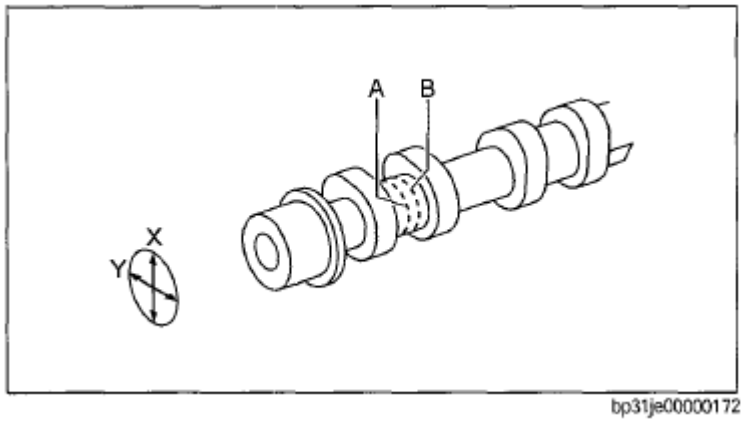


Fig. 191: Locating Nut And B+ Wire
Courtesy of MAZDA MOTORS CORP.

22. Detach the 2 wiring harness retainers.
    - Remove the B+ harness from the engine.

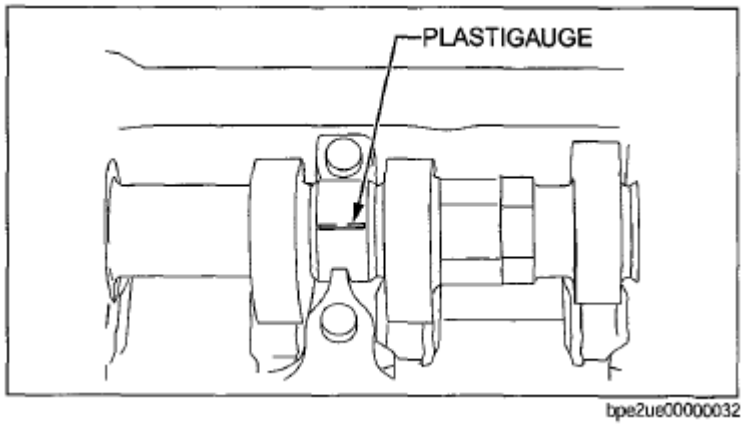


Fig. 192: Locating Wiring Harness Retainers
Courtesy of MAZDA MOTORS CORP.

Front wheel drive (FWD) vehicles

23. Remove the EGR tube fitting from the EGR valve.

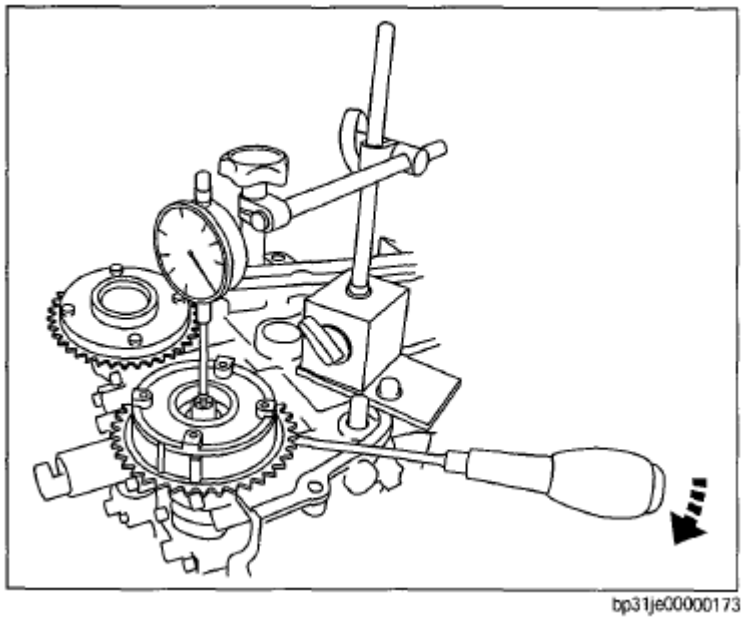


Fig. 193: Locating EGR Tube Fitting
Courtesy of MAZDA MOTORS CORP.

All vehicles

24. Remove the 2 upper intake manifold bracket bolts (1 shown in the figure).

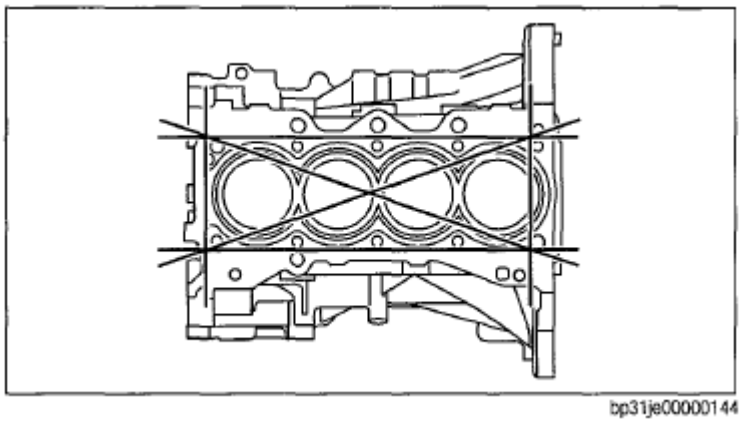


Fig. 194: Locating Upper Intake Manifold Bracket Bolt
Courtesy of MAZDA MOTORS CORP.

25. Remove the 7 bolts and the upper intake manifold.
    - Remove and discard the gaskets.

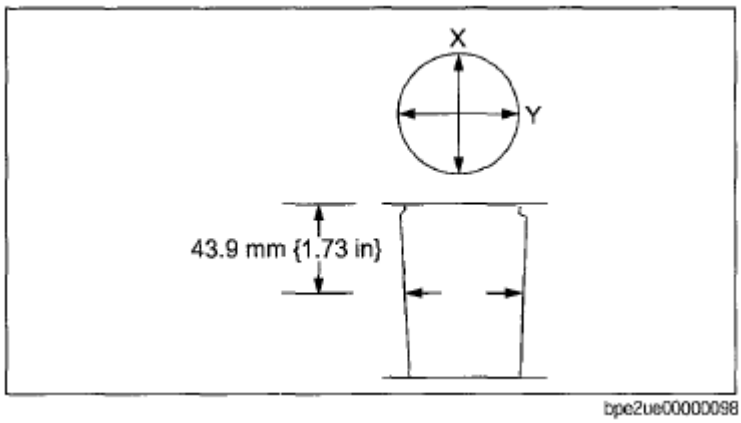


Fig. 195: Locating Bolts And Upper Intake Manifold
Courtesy of MAZDA MOTORS CORP.

26. Remove the 4 bolts and the fuel rail and injectors as an assembly.

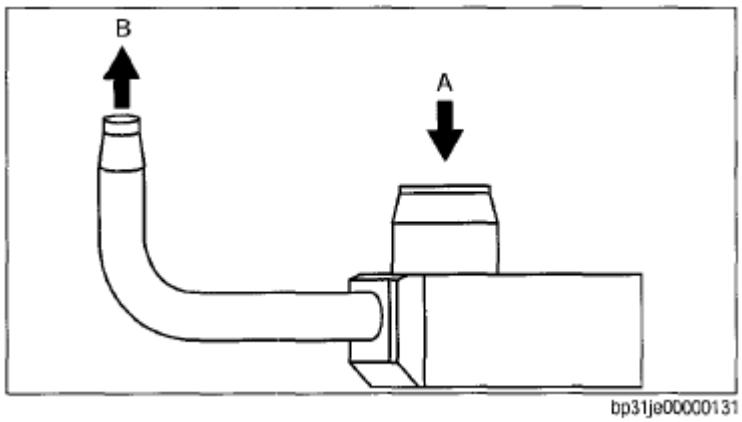


Fig. 196: Locating Bolts, Fuel Rail And Injectors
Courtesy of MAZDA MOTORS CORP.

27. Remove the 8 lower intake manifold bolts and the lower intake manifold.
    - Remove and discard the gaskets.

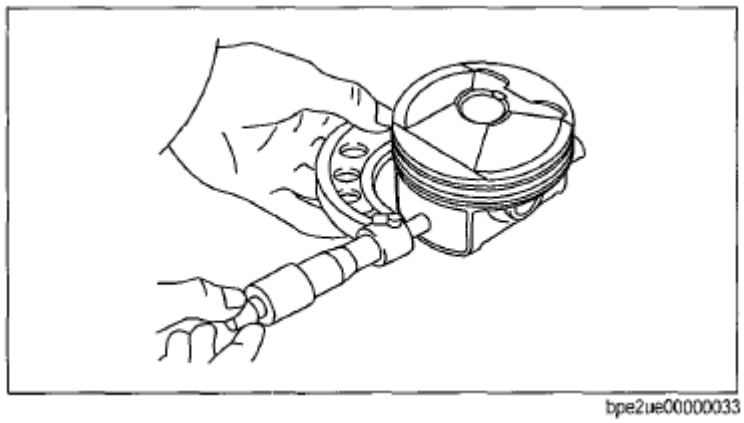


Fig. 197: Locating Lower Intake Manifold Bolts And Lower Intake Manifold
Courtesy of MAZDA MOTORS CORP.

28. Remove the 6 bolts and the 6 coil-on-plugs.

NOTE:
- **When removing the coil-on-plugs, a slight twisting motion will break the seal and ease removal.**

NOTE:
- **LH shown in the figure, RH similar.**

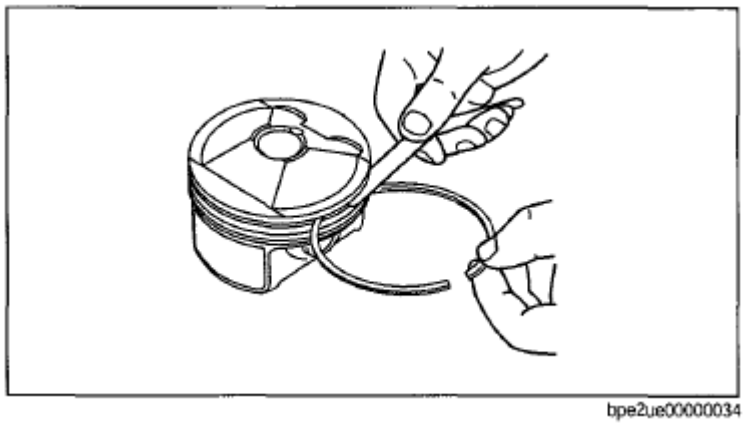


Fig. 198: Locating Bolts And Coil-On-Plugs
Courtesy of MAZDA MOTORS CORP.

FWD vehicles

29. Disconnect the RH Heated Oxygen Sensor (HO2S) electrical connector.

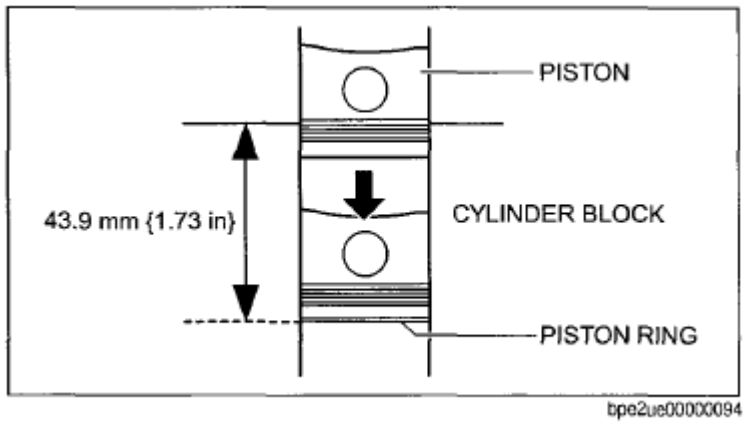


Fig. 199: Locating RH Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of MAZDA MOTORS CORP.

30. Remove the 3 bolts and the RH heat shield.

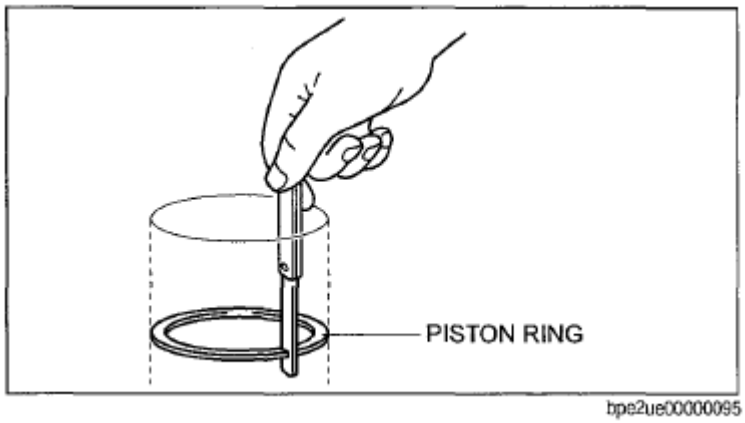


Fig. 200: Locating Bolts And RH Heat Shield
Courtesy of MAZDA MOTORS CORP.

31. Remove the 3 nuts and the RH catalytic converter.
    - Discard the nuts and gasket.

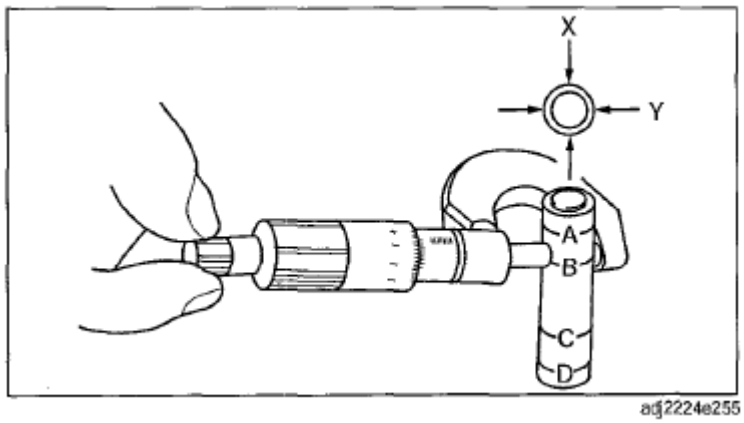


Fig. 201: Locating Nuts And RH Catalytic Converter
Courtesy of MAZDA MOTORS CORP.

32. Remove the 6 RH exhaust manifold nuts and the manifold.
    - Discard the nuts and gasket.

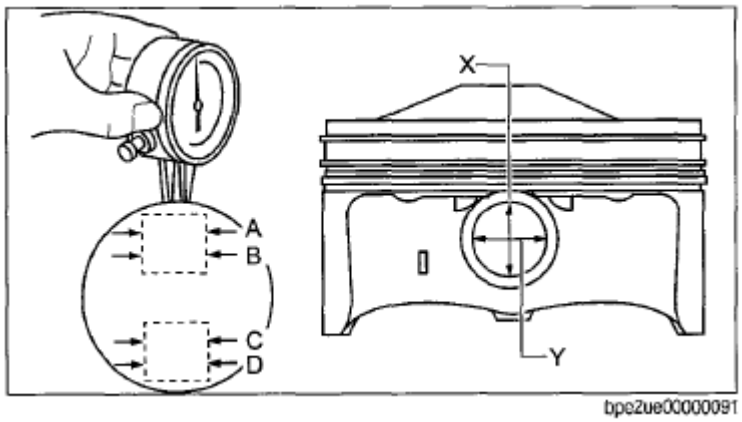


Fig. 202: Locating RH Exhaust Manifold Nuts And Manifold
Courtesy of MAZDA MOTORS CORP.

33. Remove and discard the 6 RH exhaust manifold studs.

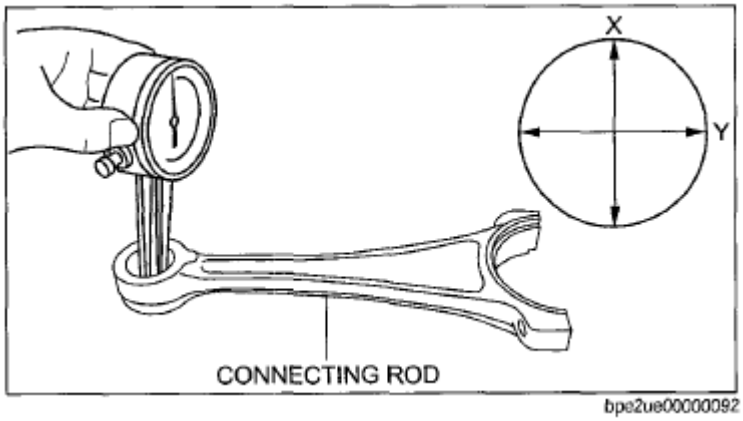


Fig. 203: Locating RH Exhaust Manifold Studs
Courtesy of MAZDA MOTORS CORP.

All vehicles

34. Remove the bolt, 2 nuts and the generator.

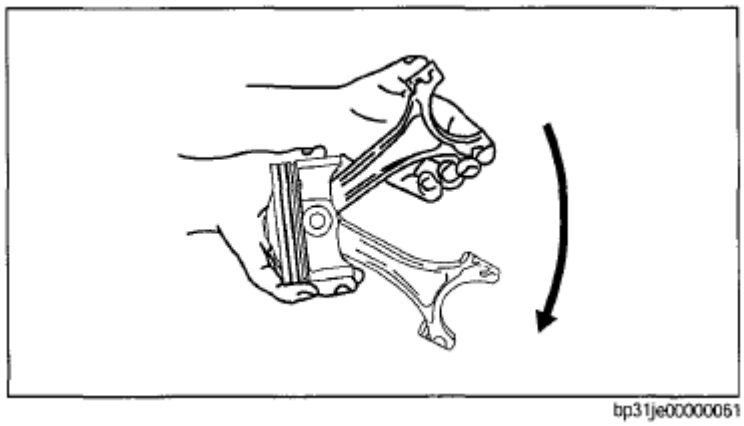


Fig. 204: Locating Bolt, Nuts And Generator
Courtesy of MAZDA MOTORS CORP.

35. Remove the 3 bolts and the A/C compressor bracket.

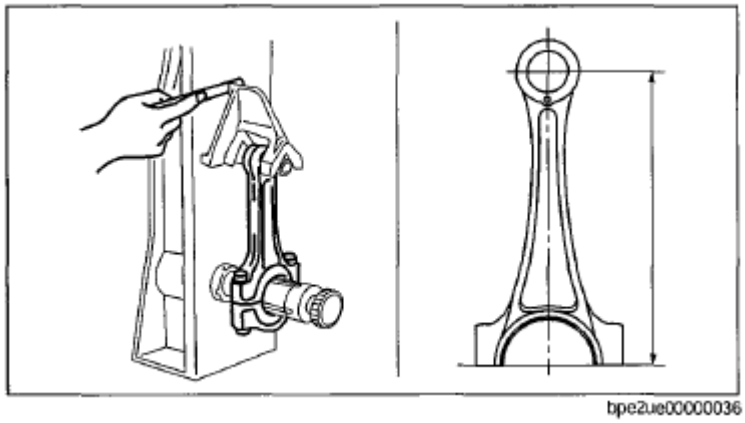


Fig. 205: Locating Bolts And A/C Compressor Bracket
Courtesy of MAZDA MOTORS CORP.

36. Remove the 3 bolts and the LH heat shield.

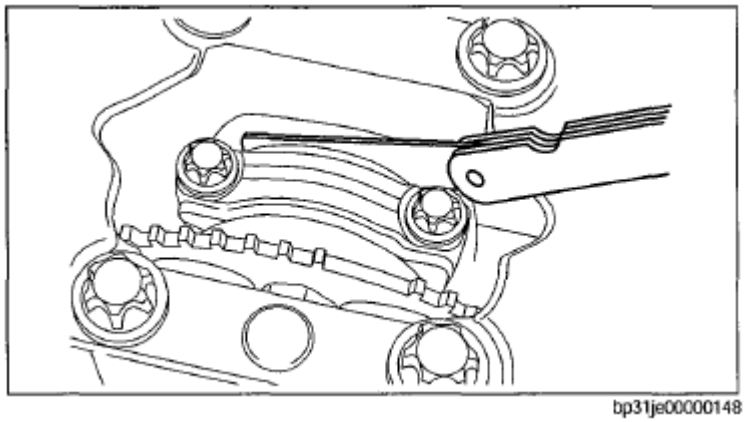


Fig. 206: Locating Bolts And LH Heat Shield
Courtesy of MAZDA MOTORS CORP.

37. Remove the stud bolt and the oil level indicator and tube.
    - Remove and discard the O-ring seal.

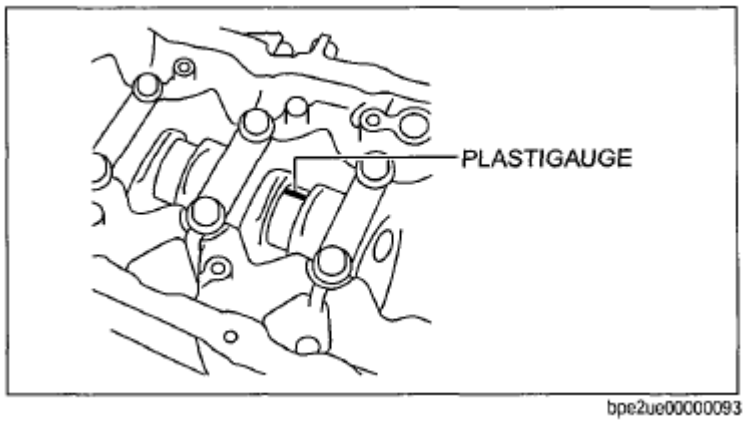


Fig. 207: Locating Stud Bolt And Oil Level Indicator And Tube
Courtesy of MAZDA MOTORS CORP.

38. Remove the 6 nuts, the LH catalytic converter and the gasket.
    - Discard the gasket and nuts.

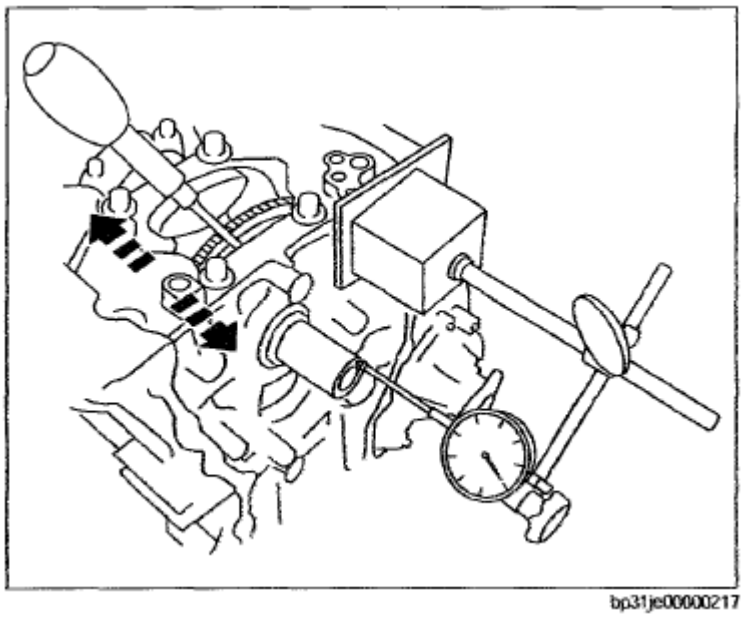


Fig. 208: Locating Gasket And Nuts
Courtesy of MAZDA MOTORS CORP.

39. Remove and discard the 6 LH exhaust manifold studs.

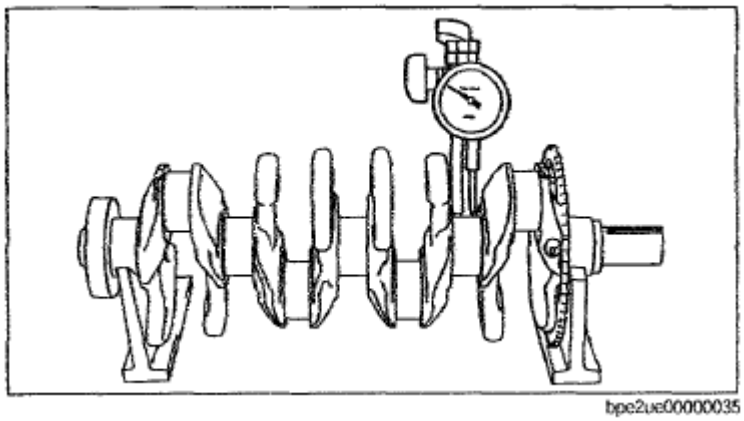


Fig. 209: Locating LH Exhaust Manifold Studs
Courtesy of MAZDA MOTORS CORP.

40. Remove the EOP switch and, if equipped, the block heater.

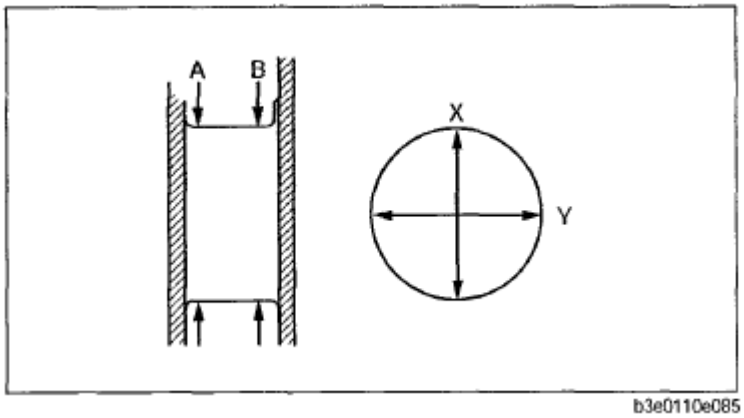


Fig. 210: Locating EOP Switch And Block Heater
Courtesy of MAZDA MOTORS CORP.

41. Remove and discard the oil filter.

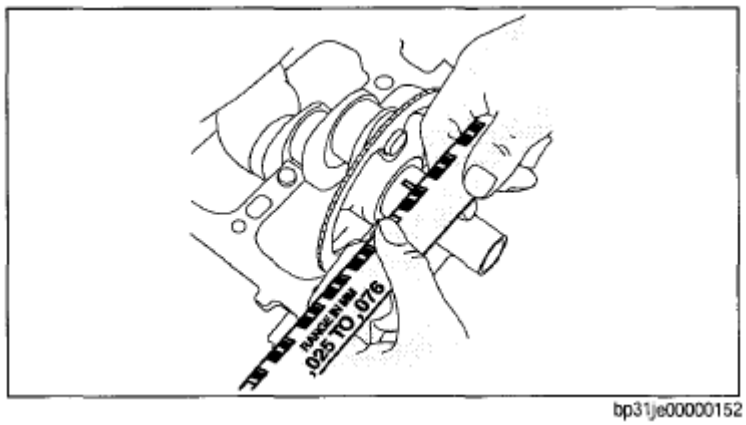


Fig. 211: Locating Oil Filter
Courtesy of MAZDA MOTORS CORP.

42. Position the Stretchy Belt Remover under the coolant pump belt as shown in the figure.

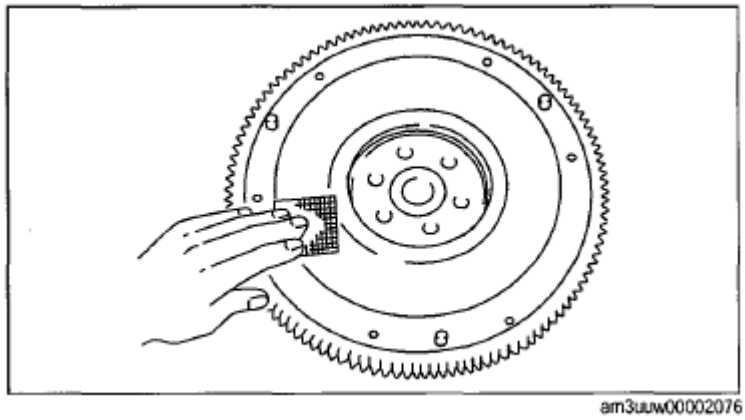


Fig. 212: Locating Stretchy Belt Remover Under Coolant Pump Belt
Courtesy of MAZDA MOTORS CORP.

43. With the help of a assistant, turn the crankshaft clockwise and feed the Stretchy Belt Remover evenly on the camshaft coolant pump pulley as shown in the figure.

NOTE:

- **Feed the Stretchy Belt Remover on to the camshaft coolant pump pulley 152 mm (5.984 in).**

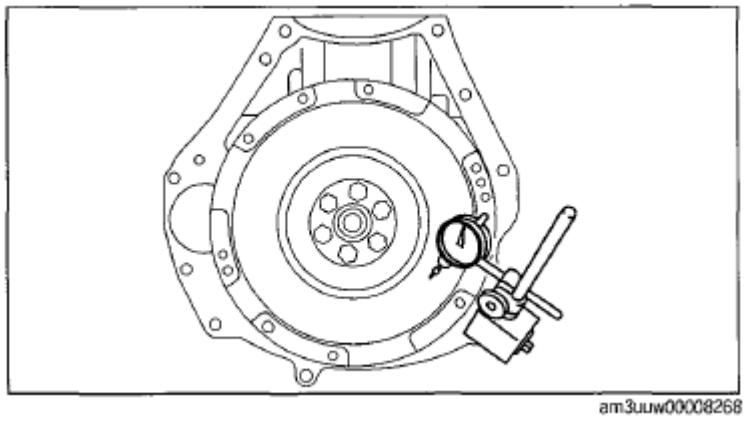


Fig. 213: Turning Crankshaft Clockwise
Courtesy of MAZDA MOTORS CORP.

44. Remove the coolant pump belt.
    - Fold the Stretchy Belt Remover over the top of the coolant pump belt.
    - In one quick motion, pull the Stretchy Belt Remover up and toward the RH front of the vehicle removing the coolant pump belt.

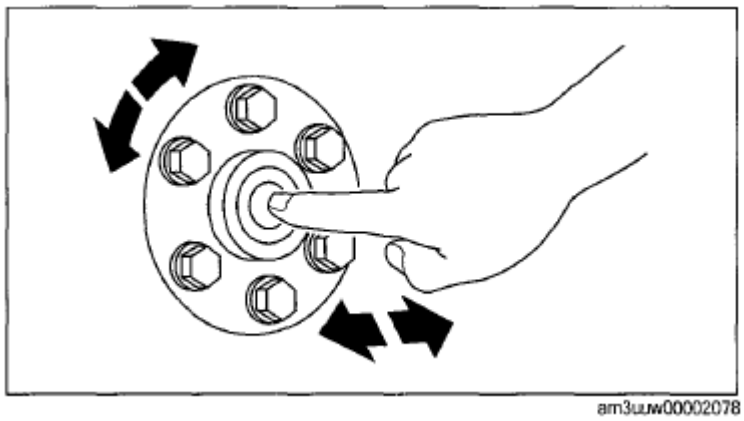


Fig. 214: Removing Coolant Pump Belt
Courtesy of MAZDA MOTORS CORP.

45. Using the Water Pump Pulley Plate, Water Pump Shaft Protector and the Crankshaft Vibration Damper Remover, remove the coolant pump pulley.

CAUTION:
- **Failure to use the correct special tools, assembled as shown in the illustration, will result in damage to the coolant pump pulley and/or special tools.**

46. Remove the 5 coolant pump housing bolts.

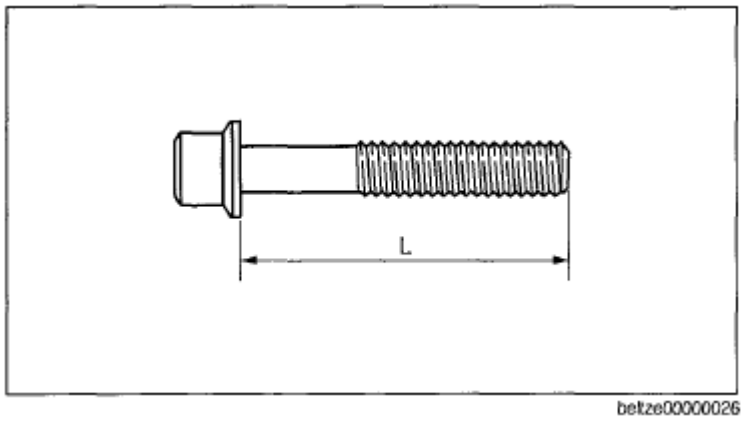
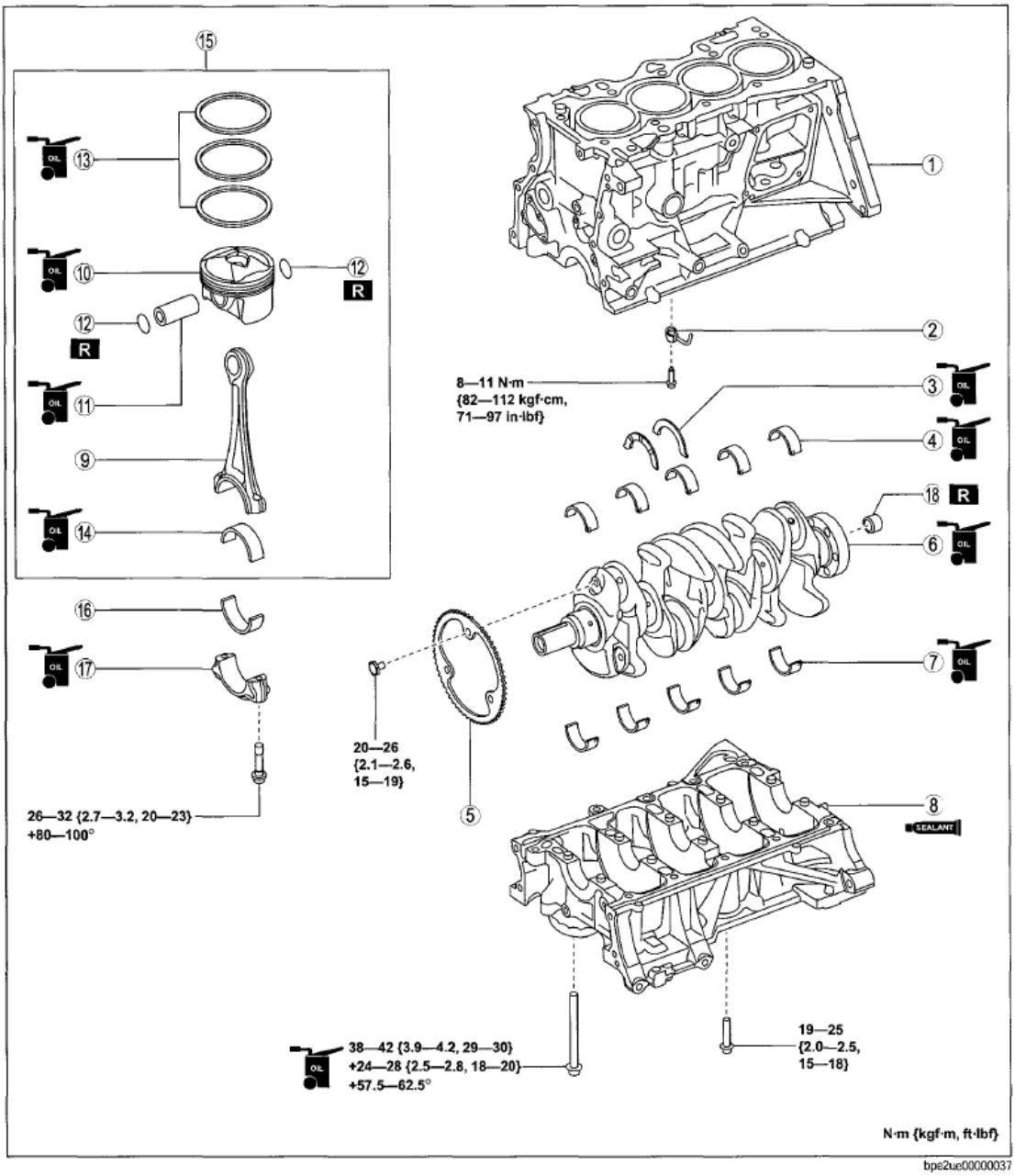


Fig. 215: Identifying Water Pump Pulley Plate, Water Pump Shaft Protector And Crankshaft Vibration Damper Remover
Courtesy of MAZDA MOTORS CORP.



bpe2ue00000037

1	Upper cylinder block
2	Oil jet valve
3	Thrust bearing (See Thrust Bearing And Main Bearing Assembly Note.)
7	Lower main bearing (See Thrust Bearing And Main Bearing Assembly Note.)
8	Lower cylinder block (See Lower Cylinder Block Assembly Note.)
9	Connecting rod
10	Piston
11	Piston pin (See Piston Pin Assembly Note.)
12	Snap ring (See Snap Ring Assembly Note.)

4	Upper main bearing (See Thrust Bearing And Main Bearing Assembly Note.)
5	Plate (See Plate Assembly Note.)
6	Crankshaft
14	Upper connecting rod bearing (See Connecting Rod Bearing Assembly Note.)
15	Piston, connecting rod (See Piston, Connecting Rod Assembly Note.)
16	Lower connecting rod bearing (See Connecting Rod Bearing Assembly Note.)
17	Connecting rod cap (See Connecting Rod Cap Assembly Note.)

Fig. 216: Locating Coolant Pump Housing Bolts
Courtesy of MAZDA MOTORS CORP.

47. Loosen the clamp and detach the coolant hose. Remove the coolant pump housing.

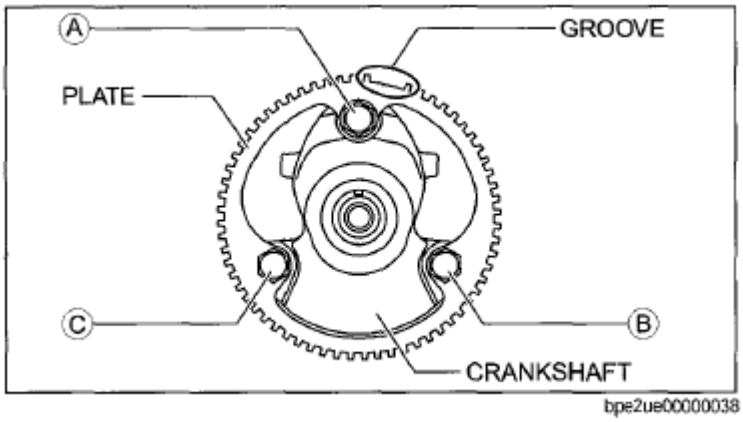


Fig. 217: Locating Clamp And Coolant Hose
Courtesy of MAZDA MOTORS CORP.

48. Remove the nut and the radio interference capacitor.

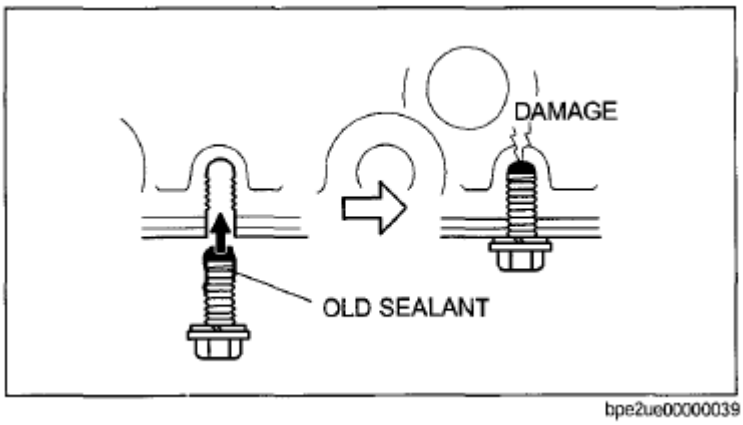


Fig. 218: Locating Nut And Radio Interference Capacitor
Courtesy of MAZDA MOTORS CORP.

49. Remove the bolts and the RH valve cover.
    - Discard the gasket.

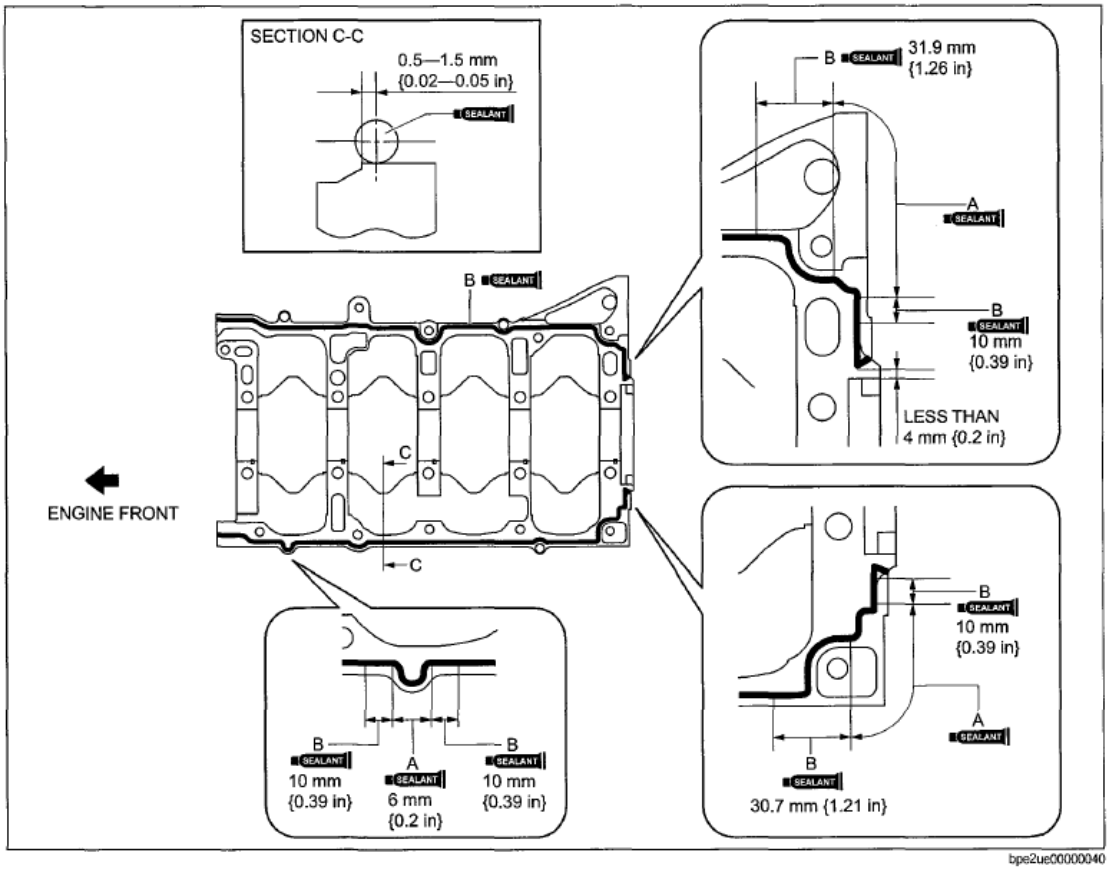


Fig. 219: Locating Bolts And RH Valve Cover
Courtesy of MAZDA MOTORS CORP.

50. Remove the bolts and the LH valve cover.
    - Discard the gasket.

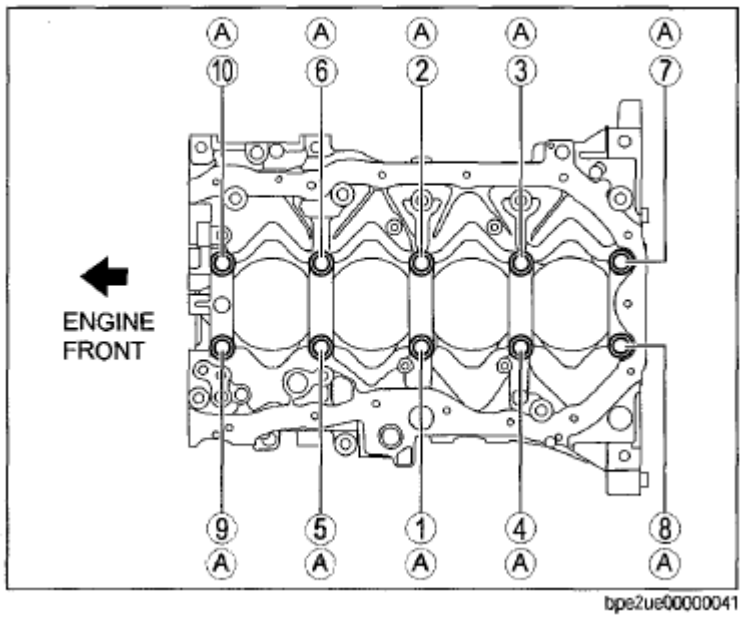


Fig. 220: Locating Bolts And LH Valve Cover
Courtesy of MAZDA MOTORS CORP.

51. Remove the 15 bolts and the oil pan.
    - Discard the gasket.

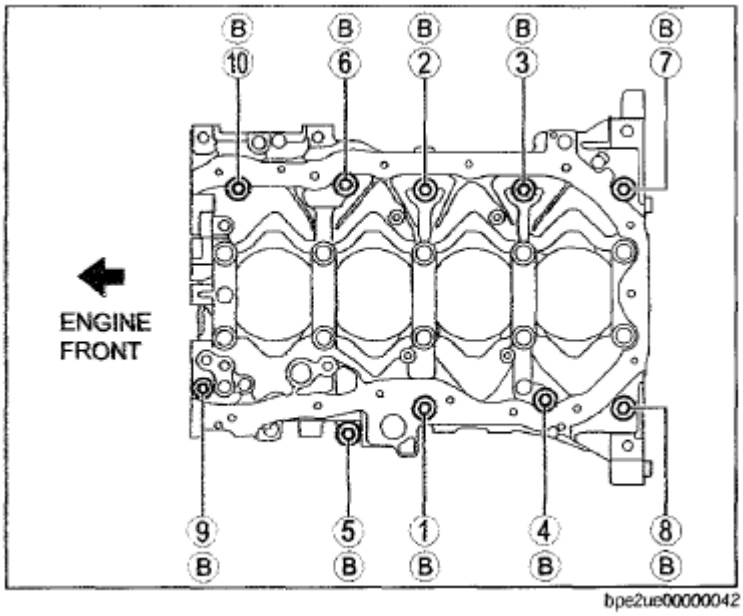


Fig. 221: Locating Bolts And Oil Pan
Courtesy of MAZDA MOTORS CORP.

52. Remove the 2 bolts and the oil pump screen and pickup tube.

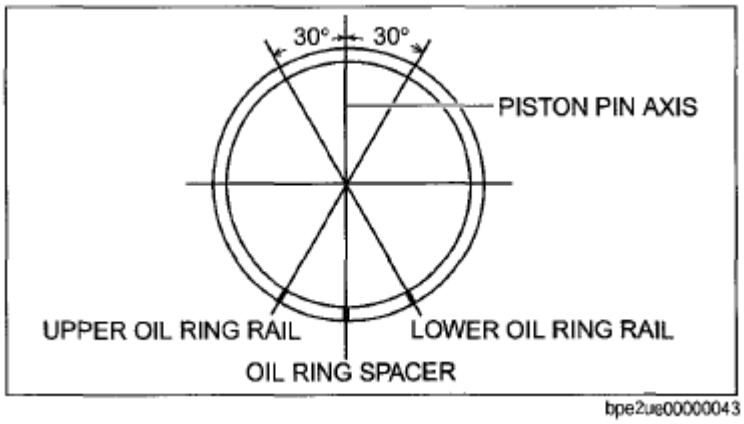


Fig. 222: Locating Bolts, Oil Pump Screen And Pickup Tube
Courtesy of MAZDA MOTORS CORP.

53. Remove and discard the O-ring seal.

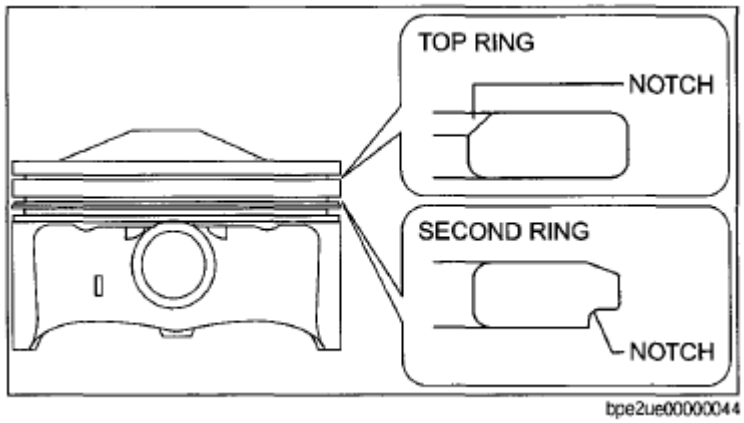


Fig. 223: Locating O-Ring Seal
Courtesy of MAZDA MOTORS CORP.

54. Remove the oil pan baffle.
    1. Remove the 4 M6 oil pan baffle nuts.
    2. Remove the 4 M8 oil pan baffle nuts.

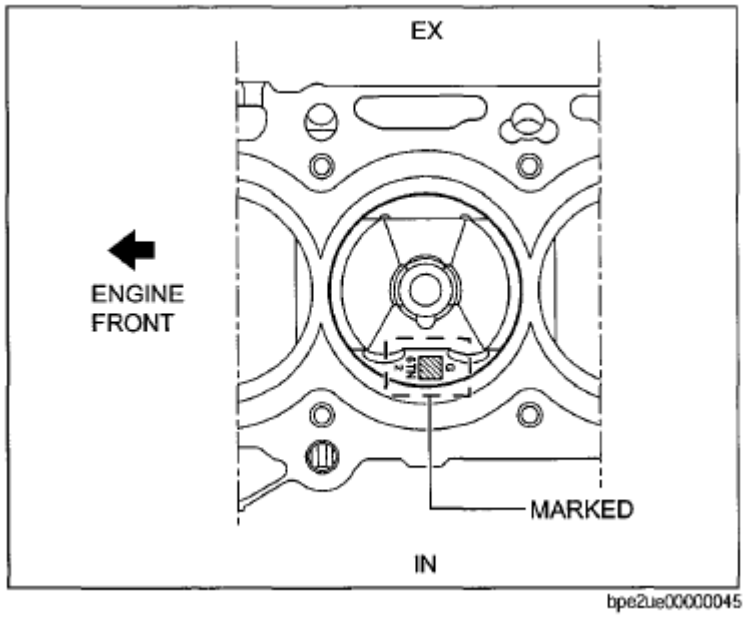


Fig. 224: Identifying Oil Pan Baffle Nuts
Courtesy of MAZDA MOTORS CORP.

55. Remove the 3 bolts and the accessory drive belt tensioner.

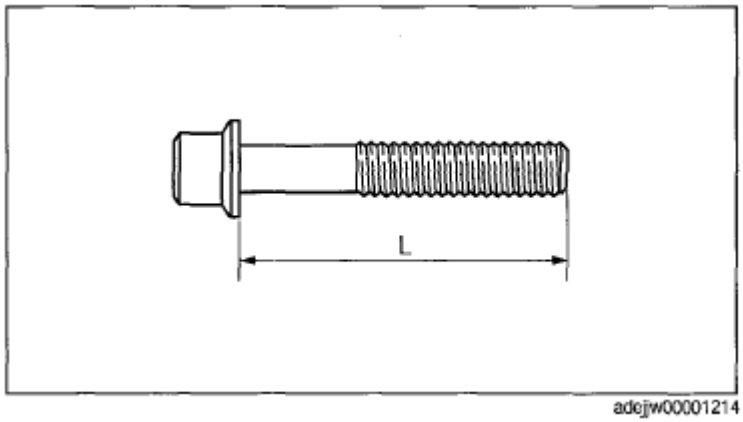


Fig. 225: Locating Bolts And Accessory Drive Belt Tensioner
Courtesy of MAZDA MOTORS CORP.

56. Remove the crankshaft pulley bolt and washer.
    - Discard the crankshaft pulley bolt.

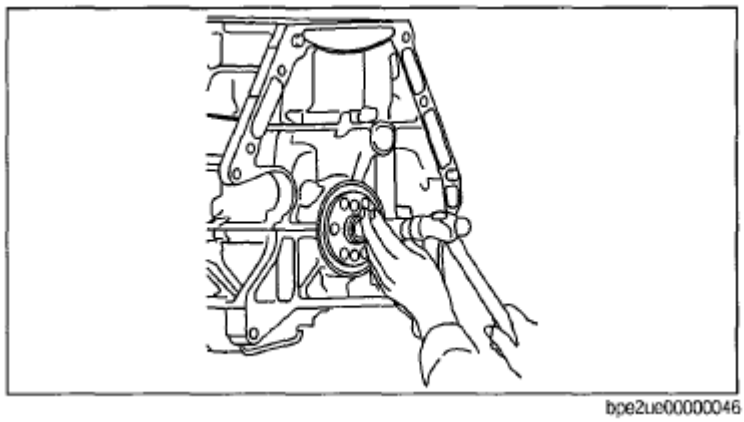


Fig. 226: Locating Crankshaft Pulley Bolt
Courtesy of MAZDA MOTORS CORP.

57. Using the 3-Jaw Puller, remove the crankshaft pulley.

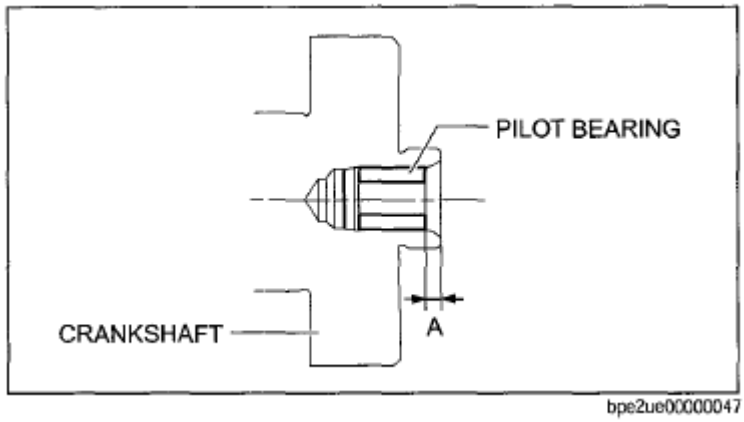
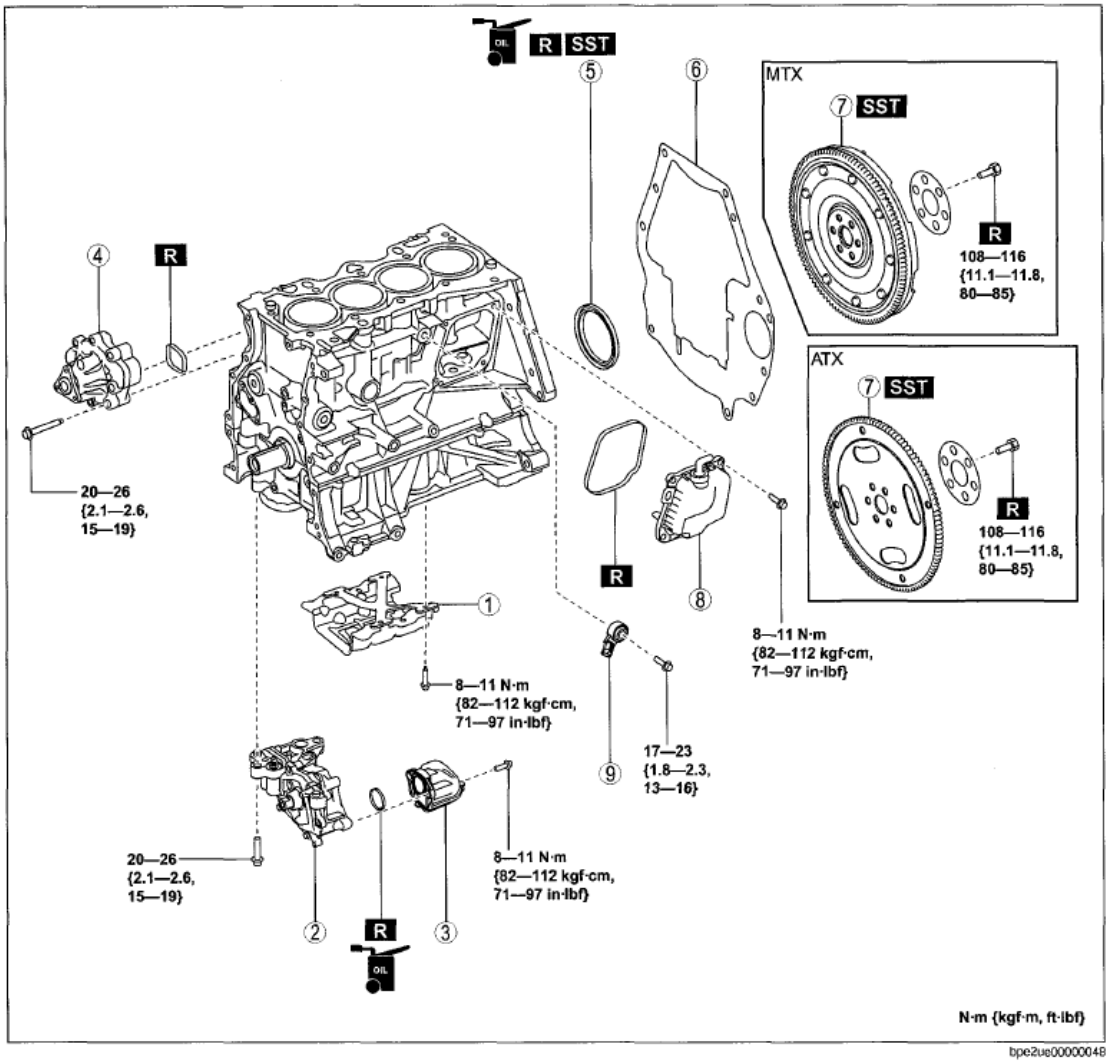


Fig. 227: Using 3-Jaw Puller To Remove Crankshaft Pulley
Courtesy of MAZDA MOTORS CORP.

58. Using the Oil Seal Remover, remove and discard the crankshaft front seal.



1	Oil baffle plate (See Oil Baffle Plate Assembly Note.)	6	End plate (See End Plate Assembly Note.)
2	Oil pump (See Oil Pump Assembly Note.)	7	Flywheel (MTX), drive plate (ATX) (See Flywheel (MTX), Drive Plate (ATX) Assembly Note.)
3	Oil strainer	8	Oil separator
4	Water pump (See Water Pump Assembly Note.)	9	Knock sensor
5	Rear oil seal (See Rear Oil Seal Assembly Note.)		

Fig. 228: Using Special Tool To Remove Crankshaft Front Seal
Courtesy of MAZDA MOTORS CORP.

59. Remove the 2 bolts and the LH VCT.

NOTE:

- **Note the position of the alignment dowel on the engine front cover.**

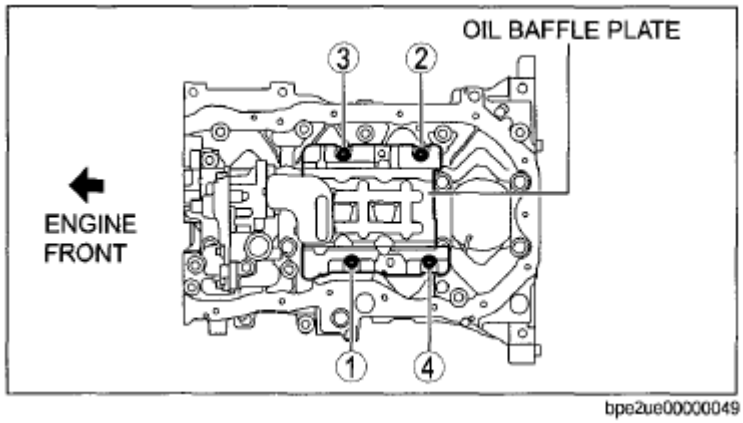


Fig. 229: Locating Bolts And LH VCT
Courtesy of MAZDA MOTORS CORP.

60. Remove the 2 bolts and the RH VCT.

NOTE:

- **Note the position of the alignment dowel on the engine front cover.**

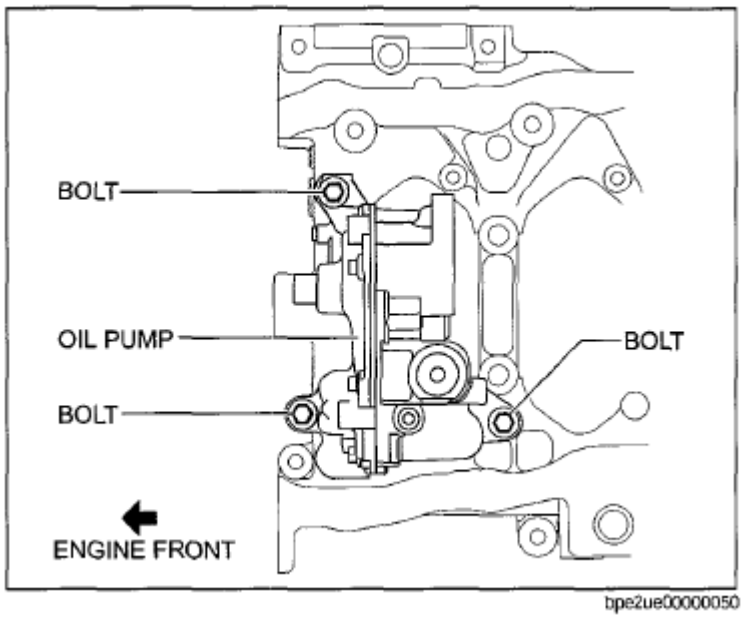


Fig. 230: Locating Bolts And RH VCT
Courtesy of MAZDA MOTORS CORP.

61. Remove the 14 bolts, 2 stud bolts and the engine front cover.
    - Discard the gaskets.

CAUTION:

- **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surface.**

These tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove all traces of sealant.

NOTE:

- **Note the location of all bolts and stud bolts for installation.**

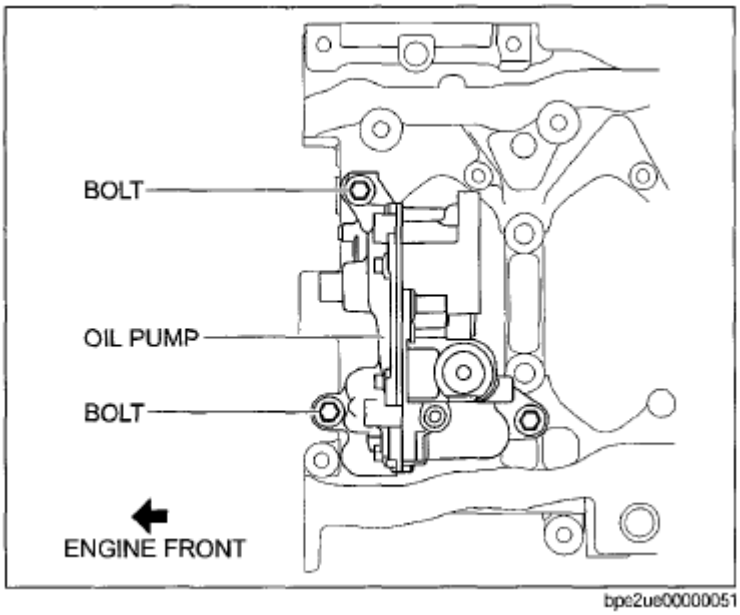


Fig. 231: Locating Bolts, Stud Bolts And Engine Front Cover
Courtesy of MAZDA MOTORS CORP.

62. Remove the LH and RH spark plugs.

CAUTION:

- **Only use hand tools when removing or installing the spark plugs or damage can occur to the cylinder head or spark plug.**

NOTE:

- **LH shown in the figure, RH similar.**

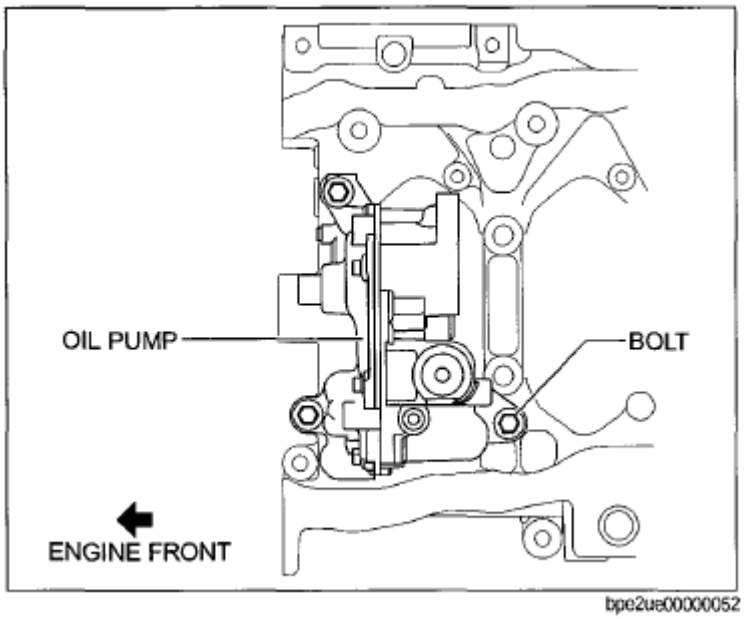


Fig. 232: Locating Spark Plugs
Courtesy of MAZDA MOTORS CORP.

63. Remove the ignition pulse wheel.

NOTE:

- **This pulse wheel is used in several different engines. Install the pulse wheel with the key-way in the slot stamped "30RFF" (orange in color).**

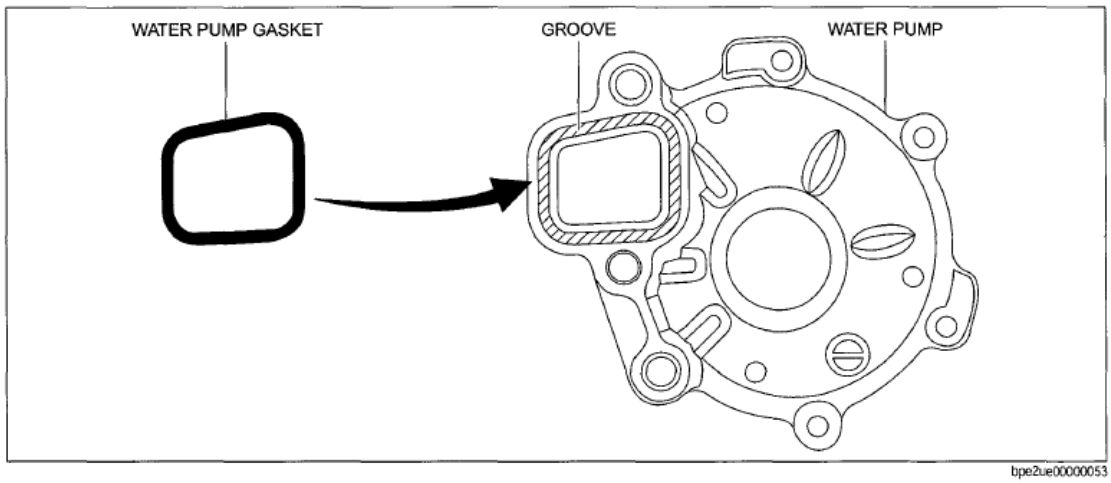


Fig. 233: Locating Ignition Pulse Wheel
Courtesy of MAZDA MOTORS CORP.

64. Install the crankshaft pulley bolt and washer.

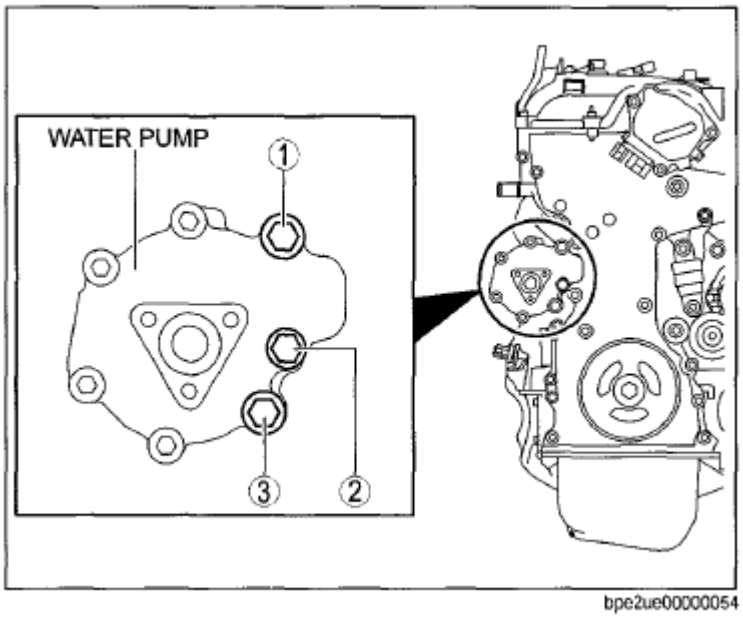


Fig. 234: Locating Crankshaft Pulley Bolt And Washer
Courtesy of MAZDA MOTORS CORP.

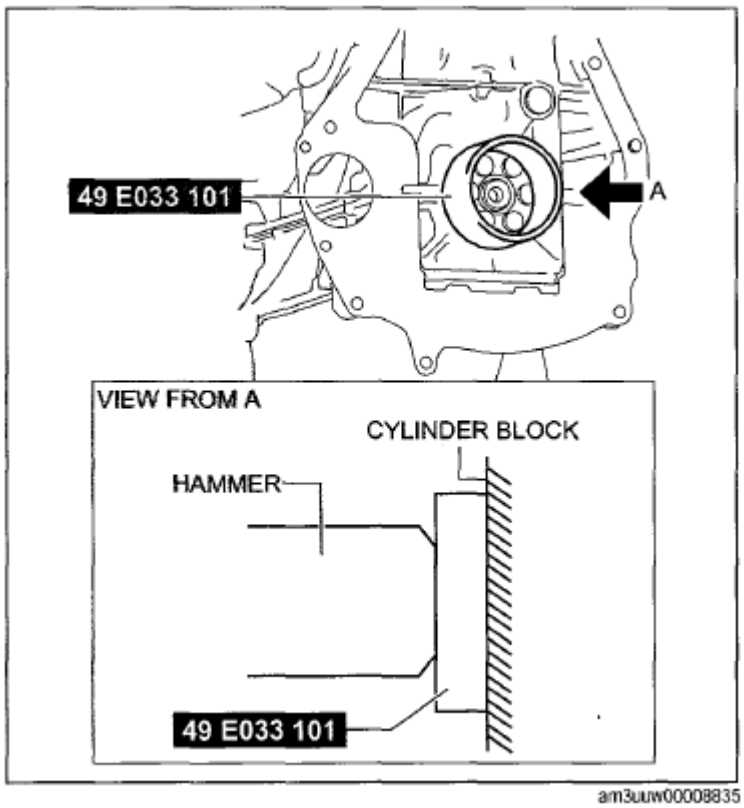


Fig. 235: Locating Chain Link Marks
Courtesy of MAZDA MOTORS CORP.

65. Rotate the crankshaft clockwise to position the crankshaft keyway in the 11 o'clock position and position the camshafts in the correct position. This will position the No. 1 cylinder at Top Dead Center (TDC).
    - Verify that the camshafts are correctly located. If not, rotate the crankshaft one additional turn and recheck.
66. Rotate the crankshaft clockwise 120 degrees to the 3 o'clock position to position the RH camshafts in the neutral position.

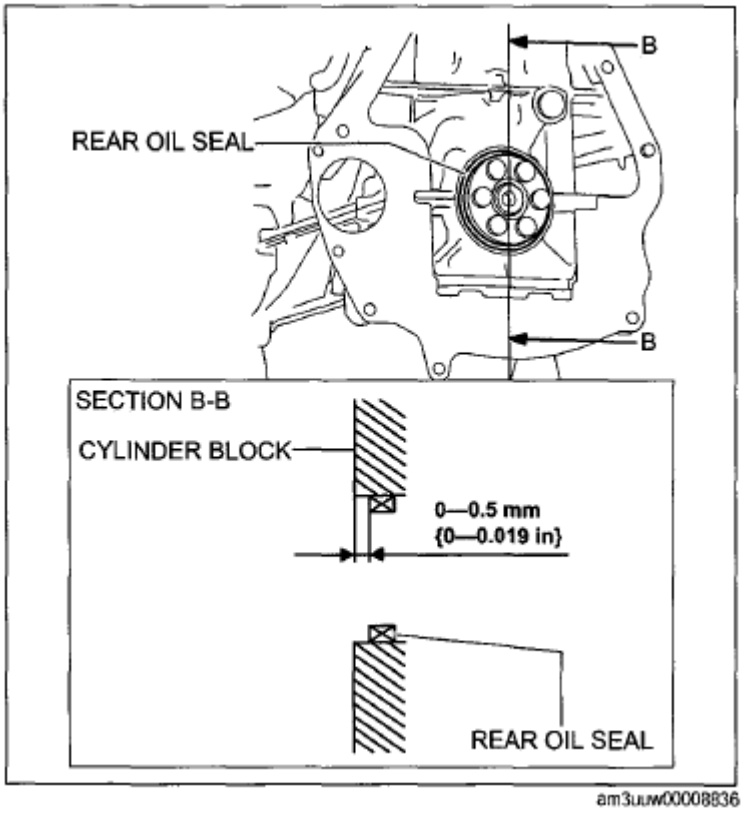


Fig. 236: Locating Crankshaft Keyway
Courtesy of MAZDA MOTORS CORP.

67. Verify that the RH camshafts are in the neutral position.

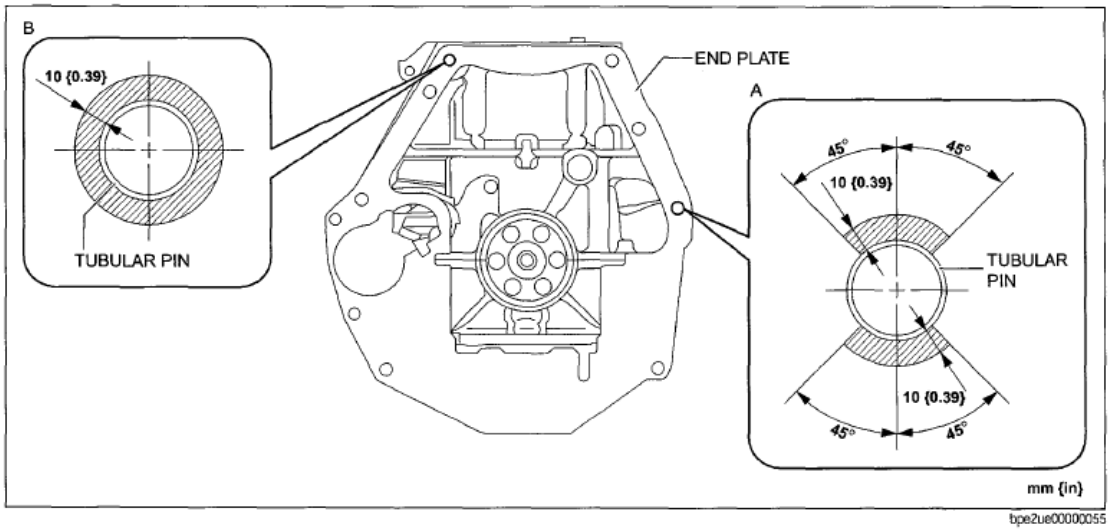


Fig. 237: Locating RH Camshafts Marks
Courtesy of MAZDA MOTORS CORP.

68. Remove the RH timing chain tensioner arm.
    1. Remove the 2 bolts.
    2. Remove the tensioner.
    3. Remove the tensioner arm.

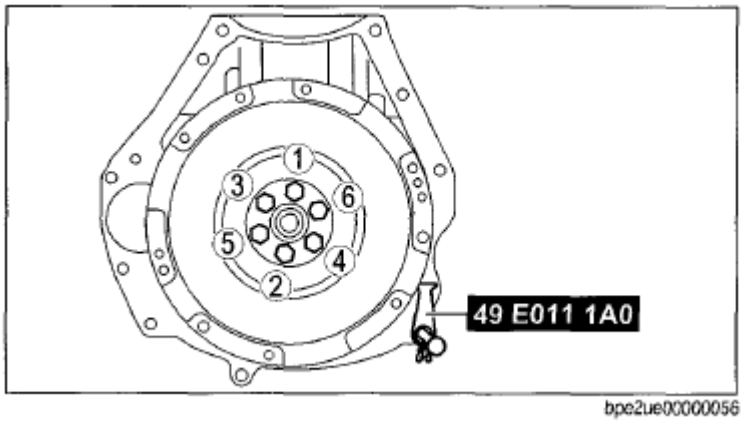
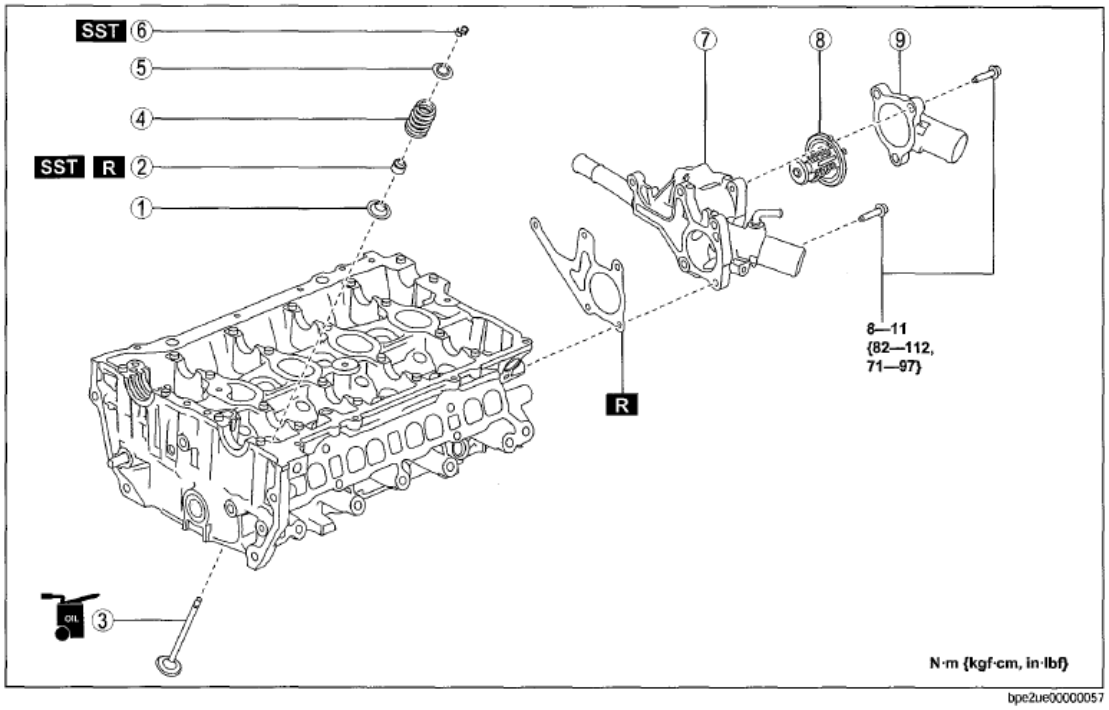


Fig. 238: Identifying Tensioner Arm, Tensioner And Bolts
Courtesy of MAZDA MOTORS CORP.

69. Remove the 2 bolts and the RH timing chain guide.
    - Remove the RH timing chain from the engine.



1	Lower valve spring seat	6	Valve keeper (See Valve Keeper Assembly Note.)
2	Valve seal (See Valve Seal Assembly Note.)	7	Water outlet (See Water Outlet Assembly Note.)
3	Valve	8	Thermostat (See Thermostat Assembly Note.)
4	Valve spring (See Valve Spring Assembly Note.)	9	Thermostat cover
5	Upper valve spring seat		

Fig. 239: Locating Bolts And RH Timing Chain Guide
Courtesy of MAZDA MOTORS CORP.

70. Rotate the crankcase clockwise 600 degrees (one and two-thirds turns) to position the crankcase keyway in the 11 o'clock position. This will position the LH camshafts in the neutral position.

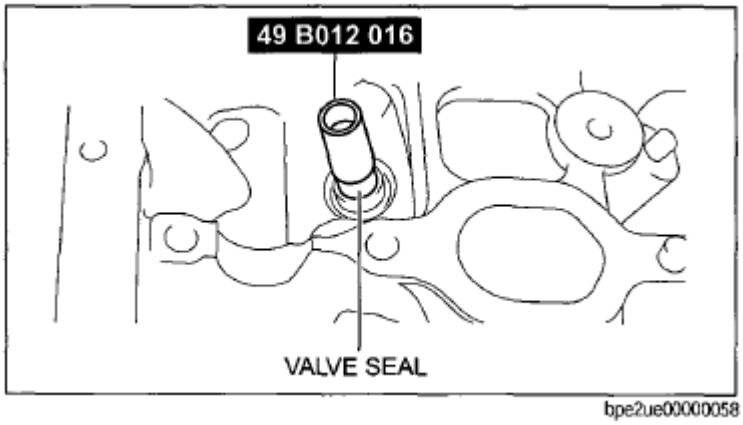


Fig. 240: Locating Crankshaft Keyway
Courtesy of MAZDA MOTORS CORP.

71. Verify the LH camshafts are in the neutral position.

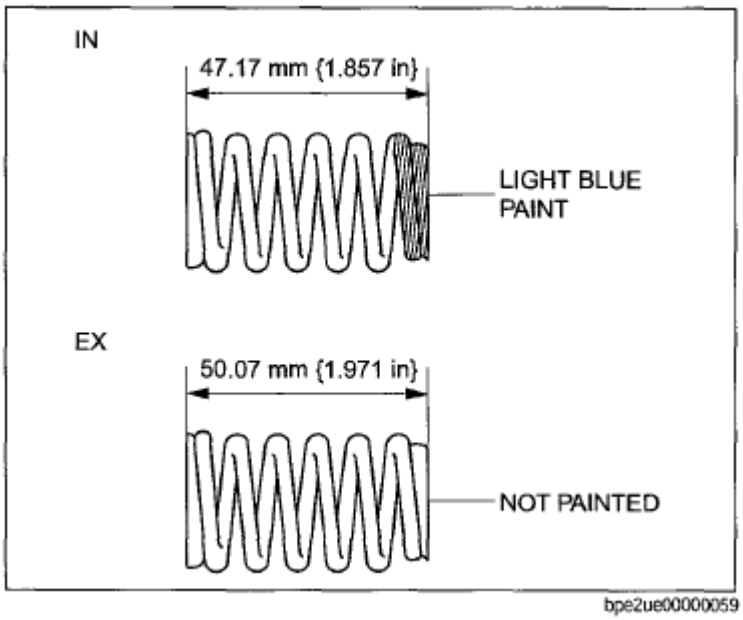


Fig. 241: Locating LH Camshafts Marks
Courtesy of MAZDA MOTORS CORP.

72. Remove the LH timing chain and tensioner arm.
    1. Remove the 2 bolts.
    2. Remove the tensioner.
    3. Remove the tensioner arm.

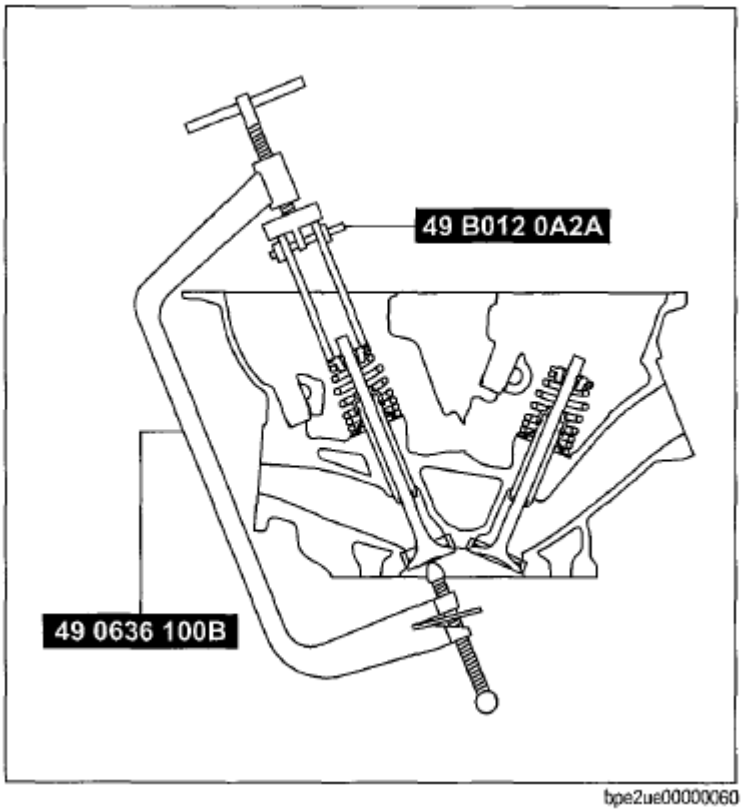


Fig. 242: Locating LH Timing Chain And Tensioner Arm
Courtesy of MAZDA MOTORS CORP.

73. Remove the 2 bolts and the LH timing chain guide.
    - Remove the LH timing chain from the engine.

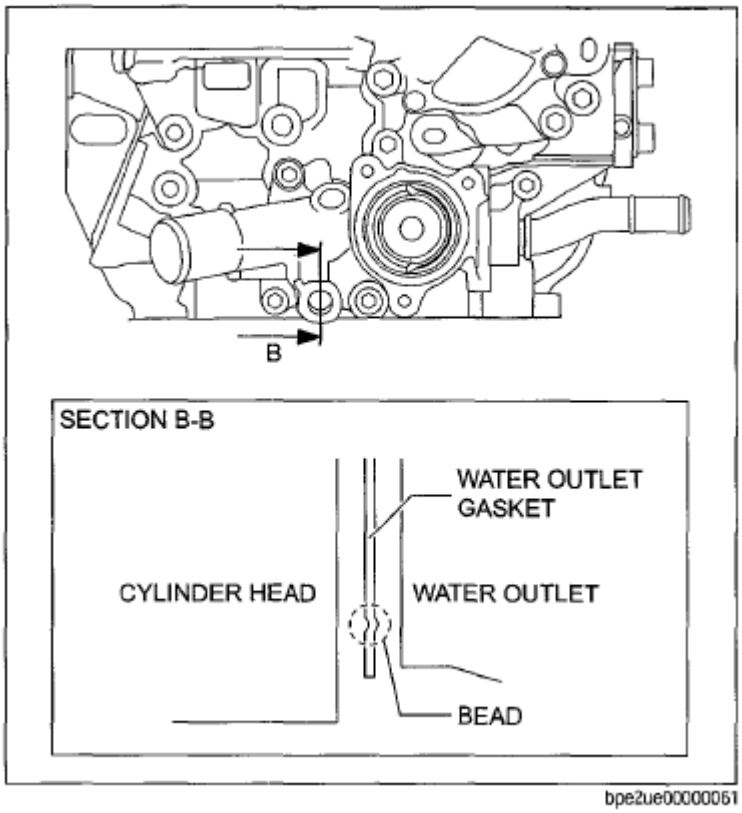


Fig. 243: Locating Bolts And LH Timing Chain Guide
Courtesy of MAZDA MOTORS CORP.

74. Remove the crankshaft pulley bolt and the crankshaft sprocket.

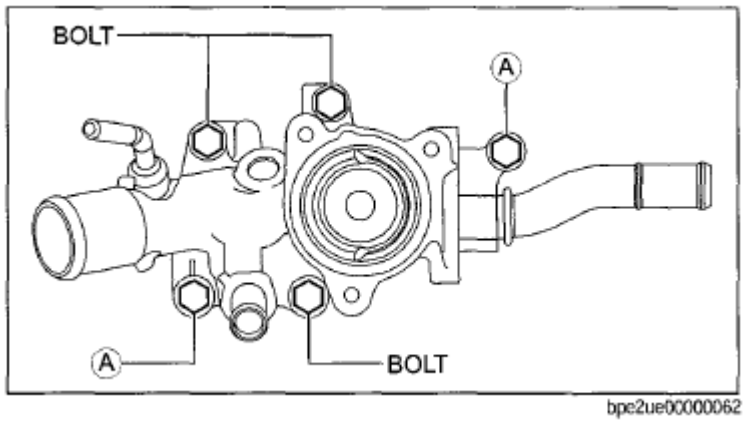


Fig. 244: Locating Crankshaft Pulley Bolt And Crankshaft Sprocket
Courtesy of MAZDA MOTORS CORP.

75. Remove the 4 bolts in the sequence shown in the figure.
    - Remove the oil pump.

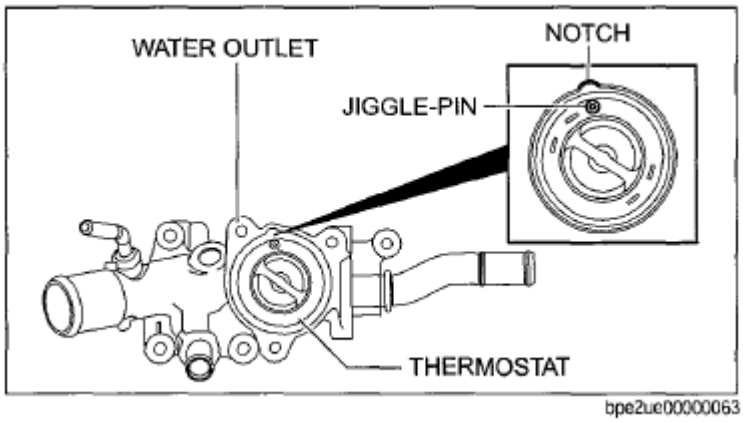


Fig. 245: Identifying Oil Pump Bolts In Sequence
Courtesy of MAZDA MOTORS CORP.

76. Using the Oil Seal Remover, remove the camshaft oil seal and discard.

CAUTION:
- **Do not scratch the camshaft sealing surface while removing the camshaft oil seal. If scratched, camshaft oil seal leakage may occur.**

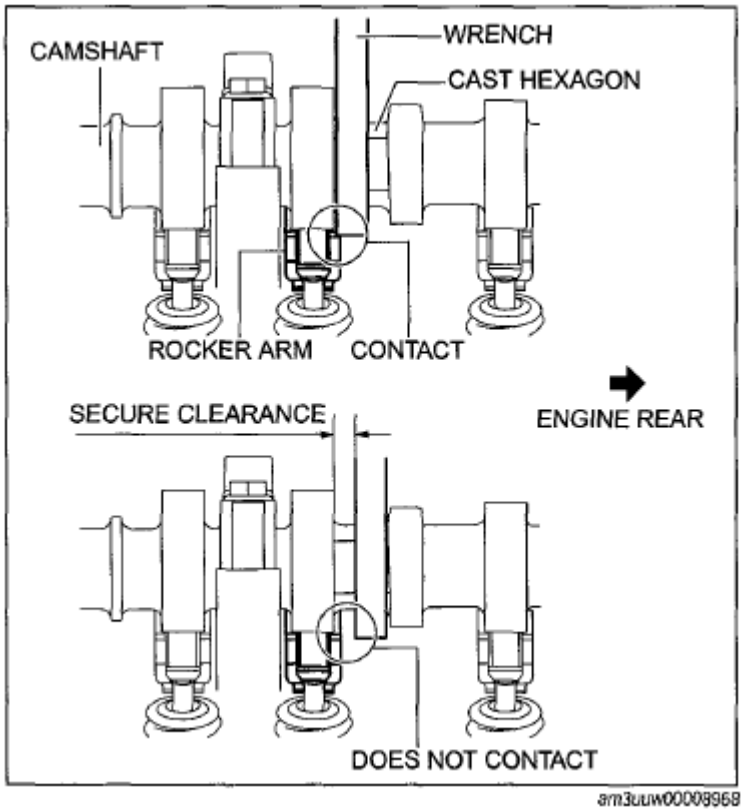


Fig. 246: Removing Camshaft Oil Seal
Courtesy of MAZDA MOTORS CORP.

77. Remove the 2 bolts and the camshaft oil seal retainer.
    - Discard the press-in-place gasket.

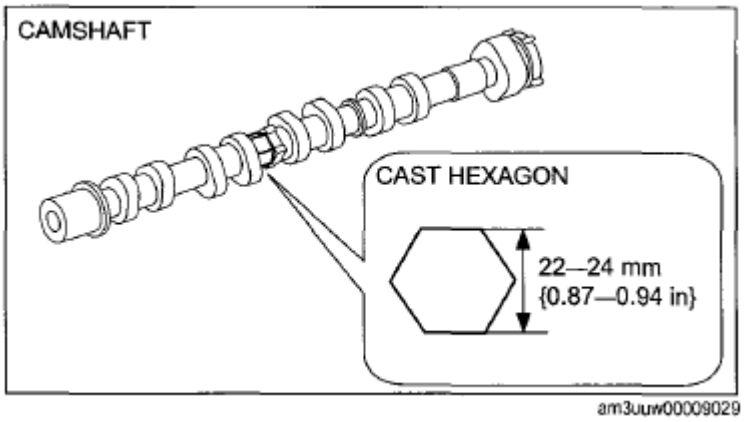
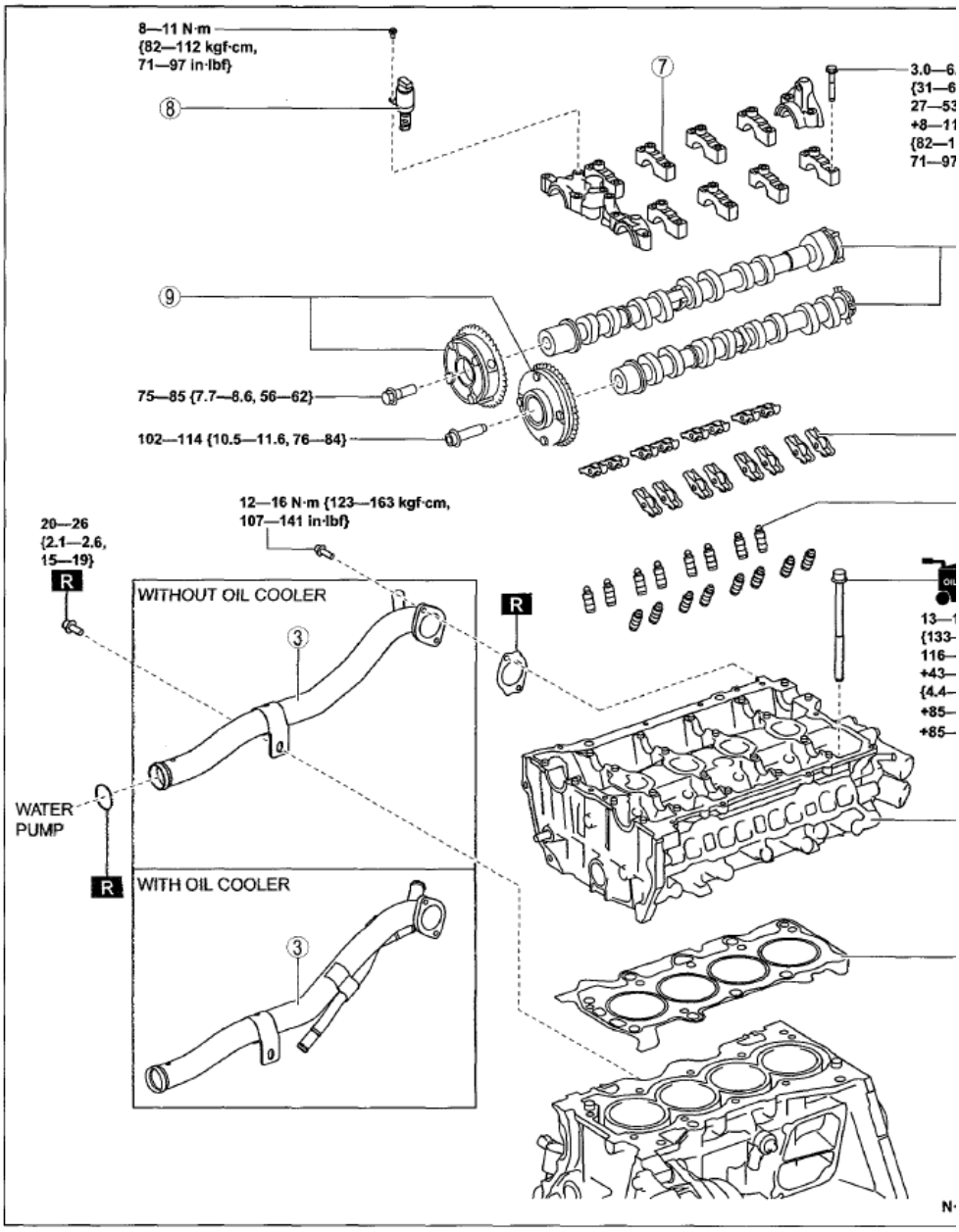


Fig. 247: Locating Bolts And Camshaft Oil Seal Retainer
Courtesy of MAZDA MOTORS CORP.

78. Verify the LH camshafts are in the neutral position.

CAUTION:
- **The camshafts must be in the neutral position before removing th bearing caps or damage to the engine may occur.**



1	Cylinder head gasket
2	Cylinder head (See Cylinder Head Assembly Note.)
3	Water inlet pipe (See Water Inlet Pipe Assembly Note.)
4	HLA (See HLA Assembly Note.)
5	Rocker arm (See Rocker Arm Assembly Note.)

6	Camshaft (See Camshaft Assembly No
7	Camshaft cap (See Camshaft Assembly No
8	OCV
9	Electric variable valve timing actuator, variable valve timing actuator (See Electric Variable Valve Actuator, Hydraulic Variable Valve Tim Assembly Note.)

Fig. 248: Locating LH Camshafts
Courtesy of MAZDA MOTORS CORP.

79. Remove the 3 bolts and the LH camshaft Phaser and sprocket.

CAUTION:
- **Do not allow the camshaft to rotate from the neutral position while removing the camshaft phaser and sprocket or damage to the engine may occur.**

NOTE:
- **Install a 3/8-in ratchet and extension into the D-slot on the rear of the intake camshaft to hold the camshaft in place for removal of the camshaft phaser and sprocket bolts.**

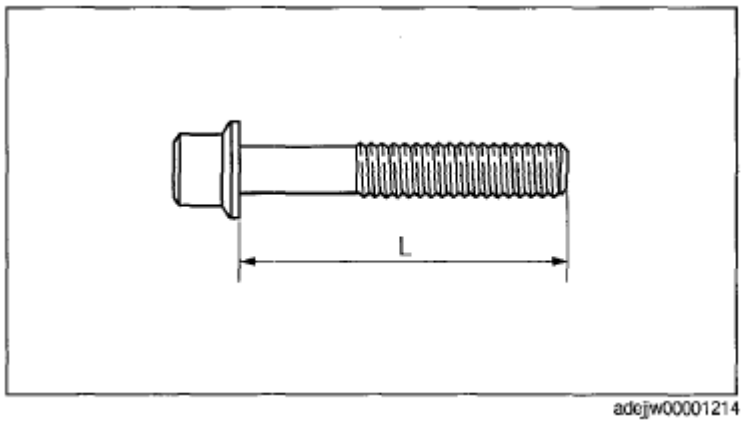


Fig. 249: Locating Bolts, LH Camshaft Phaser And Sprocket
Courtesy of MAZDA MOTORS CORP.

80. Remove and discard the VCT system oil filter screen from the LH camshaft.

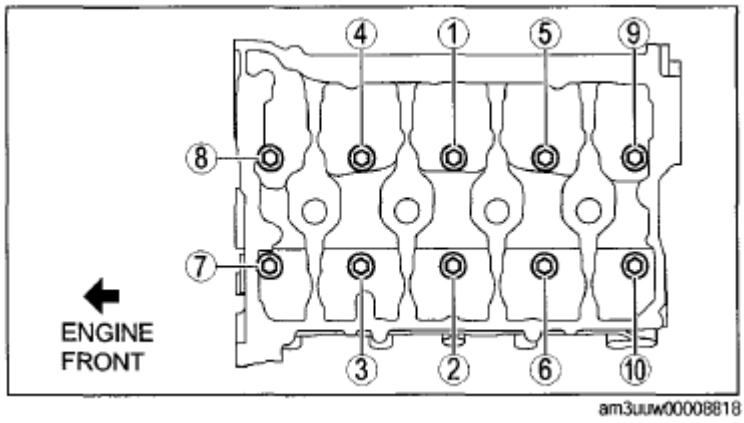


Fig. 250: Locating VCT System Oil Filter Screen
Courtesy of MAZDA MOTORS CORP.

81. If necessary, mark the camshaft bearing cap position and orientation as shown in the illustration.

CAUTION:
- **Cylinder head camshaft bearing caps must be assembled in their original positions. Some engines have factory markings on**

the camshaft bearing caps (as shown in illustration). Engines that do not have the factory markings must be marked for correct position and orientation prior to removal. Failure to install the camshaft bearing caps in their original positions may result in severe engine damage.

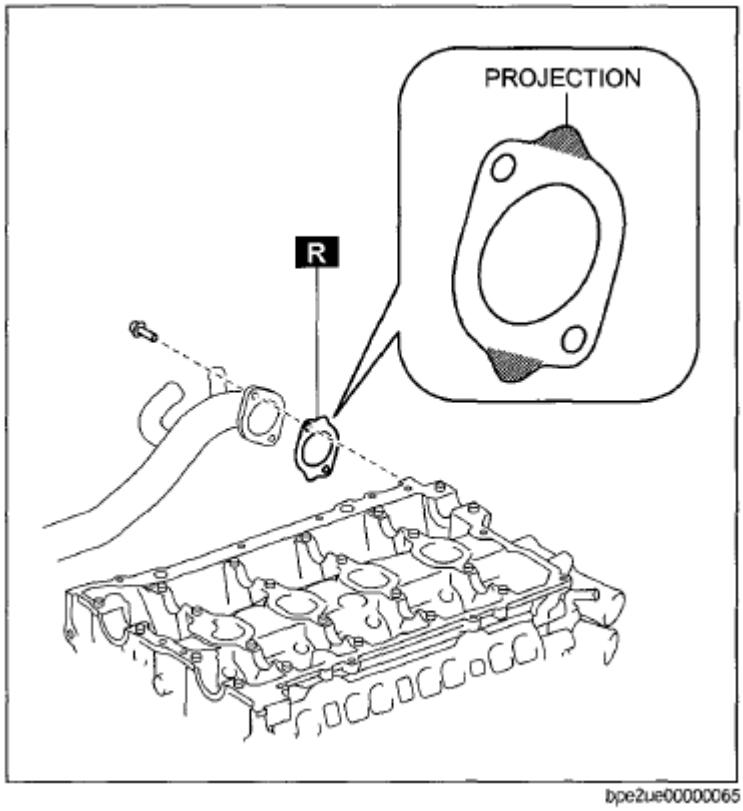


Fig. 251: Locating Camshaft Bearing Cap
Courtesy of MAZDA MOTORS CORP.

82. Loosen the bolts evenly in the sequence shown in the figure.
    1. Remove the camshaft bearing thrust caps (1L and 5L).
    2. Remove the remaining camshaft bearing caps.
    3. Remove the camshafts from the cylinder head.

CAUTION:

- **Cylinder head camshaft bearing caps must be assembled in their original positions. Some engines have factory markings on the camshaft bearing caps (as shown in illustration). Engines that do not have the factory markings must be marked for correct position and orientation prior to removal. Failure to install the camshaft bearing caps in their original positions may result in severe engine damage.**

NOTE:

- **Make sure the camshaft bearing caps are marked as instructed in the previous step.**

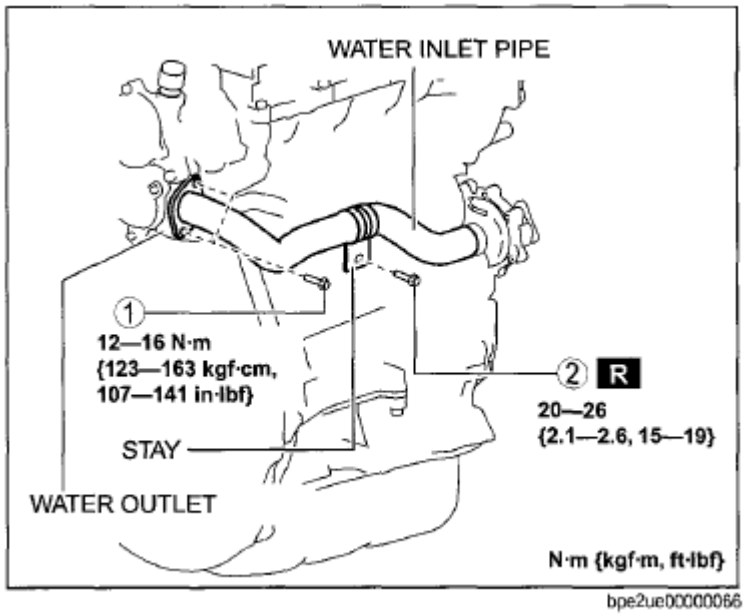


Fig. 252: Identifying Camshaft Bearing Cap Bolts In Sequence
Courtesy of MAZDA MOTORS CORP.

83. Verify the RH camshafts are in the neutral position.

CAUTION:

- **The camshafts must be in the neutral position before removing the bearing caps or damage to the engine may occur.**

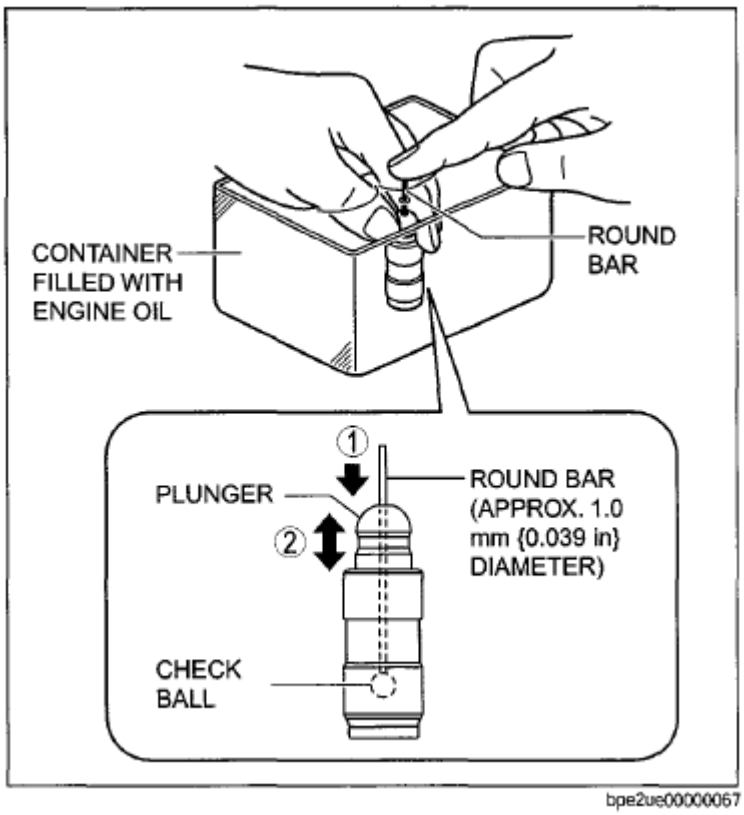


Fig. 253: Locating LH Timing Chain And Tensioner Arm
Courtesy of MAZDA MOTORS CORP.

84. Remove the 3 bolts and the RH camshaft phaser and sprocket.

CAUTION:
- **Do not allow the camshaft to rotate from the neutral position while removing the camshaft phaser and sprocket or damage to the engine may occur.**

NOTE:
- **Install a 3/8-in ratchet and extension into the D-slot on the rear of the intake camshaft to hold the camshaft in place for removal of the camshaft phaser and sprocket bolts.**

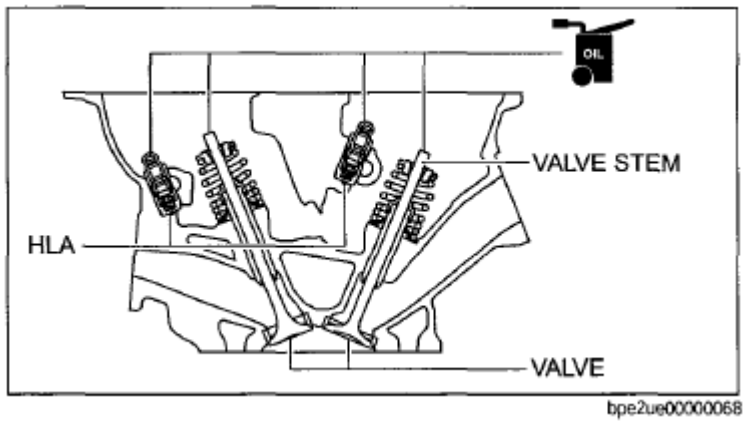


Fig. 254: Locating Bolts And RH Camshaft Phaser And Sprocket
Courtesy of MAZDA MOTORS CORP.

85. Remove and discard the VCT system oil filter screen from the RH camshaft.

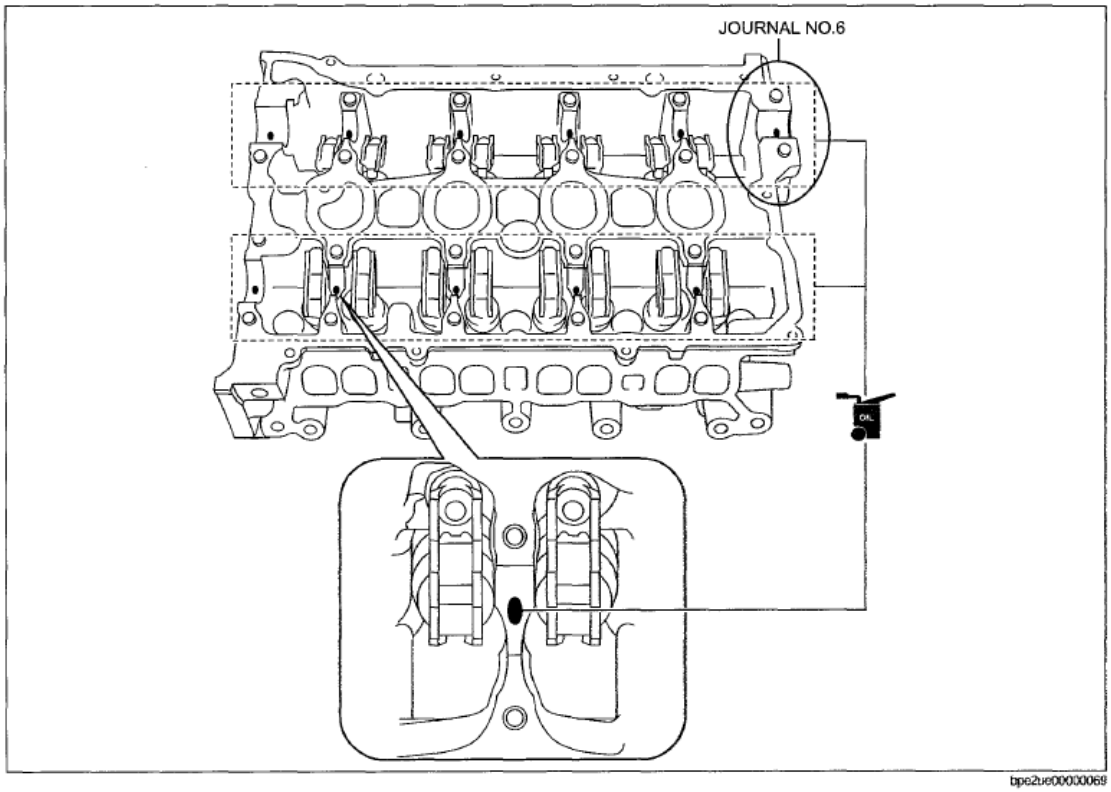


Fig. 255: Locating VCT System Oil Filter Screen
Courtesy of MAZDA MOTORS CORP.

86. If necessary, mark the camshaft bearing cap position and orientation as shown in the illustration.

CAUTION:
- **Cylinder head camshaft bearing caps must be assembled in**

their original positions. Some engines have factory markings on the camshaft bearing caps (as shown in illustration). Engines that do not have the factory markings must be marked for correct position and orientation prior to removal. Failure to install the camshaft bearing caps in their original positions may result in severe engine damage.

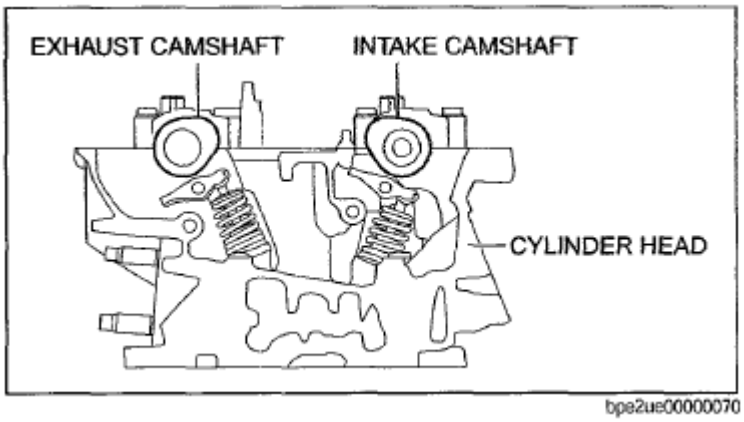


Fig. 256: Locating Camshaft Bearing Cap Bolts
Courtesy of MAZDA MOTORS CORP.

87. Loosen the bolts evenly in the sequence shown in the figure.
    1. Remove the camshaft bearing thrust caps (5R and 1R).
    2. Remove the remaining camshaft bearing caps.
    3. Remove the camshafts from the cylinder head.

CAUTION:
- **After loosening all of the camshaft bearing cap bolts, remove the camshaft bearing thrust caps (5R and 1R) first, or damage to the thrust caps may occur.**

NOTE:
- **Make sure the camshaft bearing caps are marked as instructed in the previous step.**

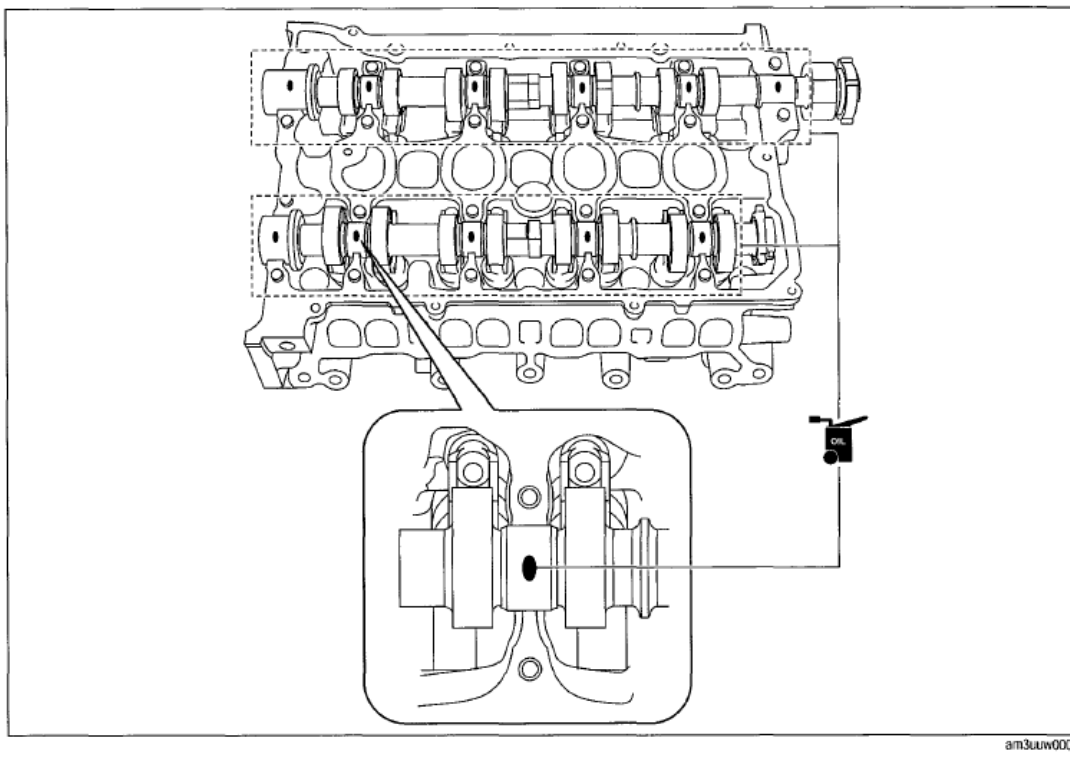


Fig. 257: Identifying Camshaft Bearing Cap Bolts In Sequence
Courtesy of MAZDA MOTORS CORP.

88. Remove the LH and RH camshaft roller followers.
    - Mark the location of the roller followers, using a permanent-type marker.

CAUTION:
- **The camshaft roller followers must be installed in their original positions. If not reassembled in their original positions, severe engine damage may occur.**

NOTE:
- **RH shown in the figure, LH similar.**

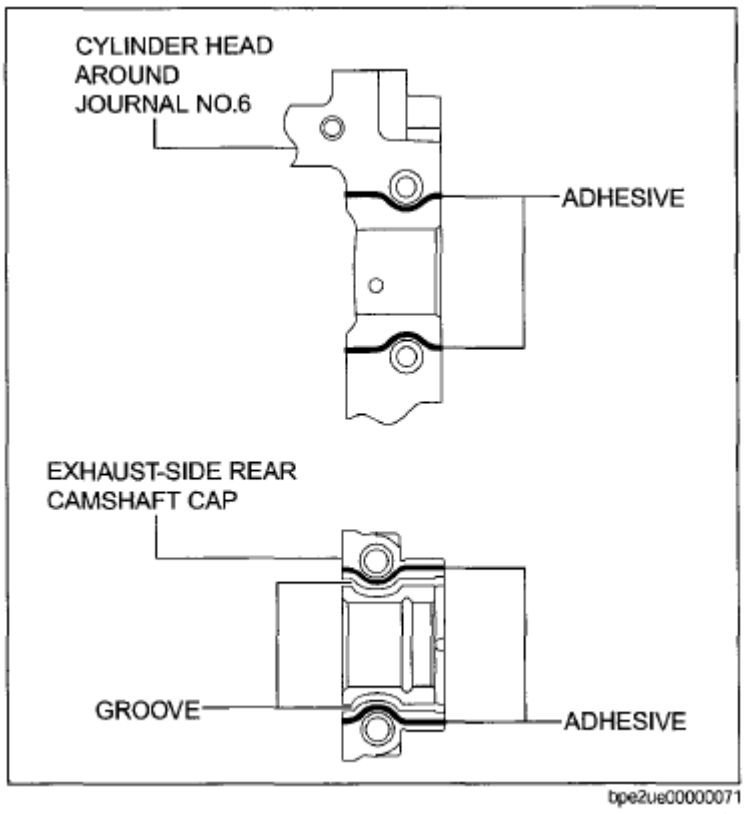


Fig. 258: Locating Camshaft Roller Followers
Courtesy of MAZDA MOTORS CORP.

89. Remove the hydraulic lash adjusters.

CAUTION:
- **The hydraulic lash adjusters must be installed in their original po**
  If not reassembled in their original positions, severe engine dama
  occur.

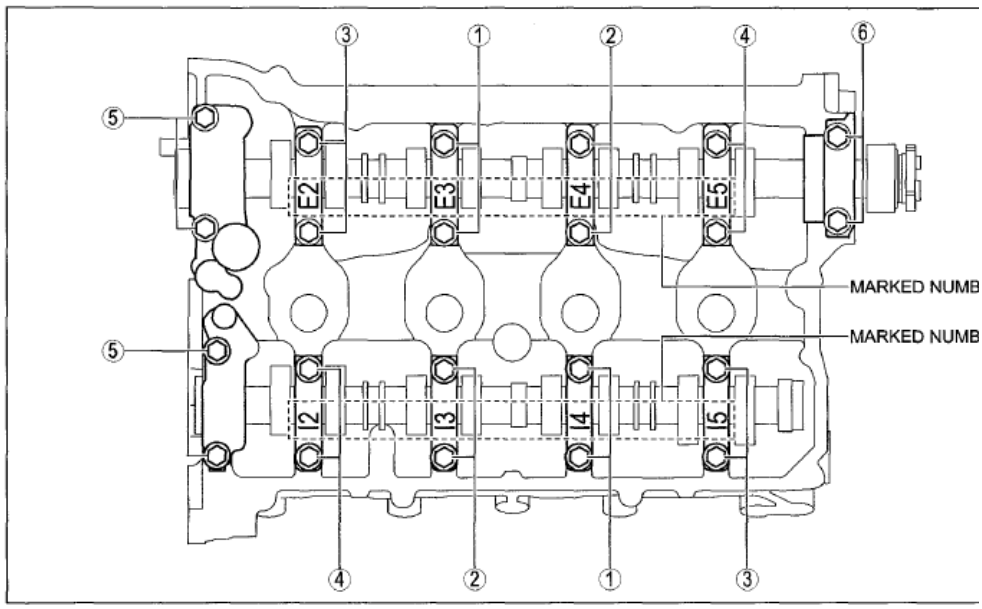


Fig. 259: Locating Hydraulic Lash Adjusters
Courtesy of MAZDA MOTORS CORP.

90. Loosen the bolts in the indicated sequence and remove the LH and RH cylinder heads.
    - Discard the bolts and the gaskets.

NOTE:
- **RH shown in the figure, LH similar.**

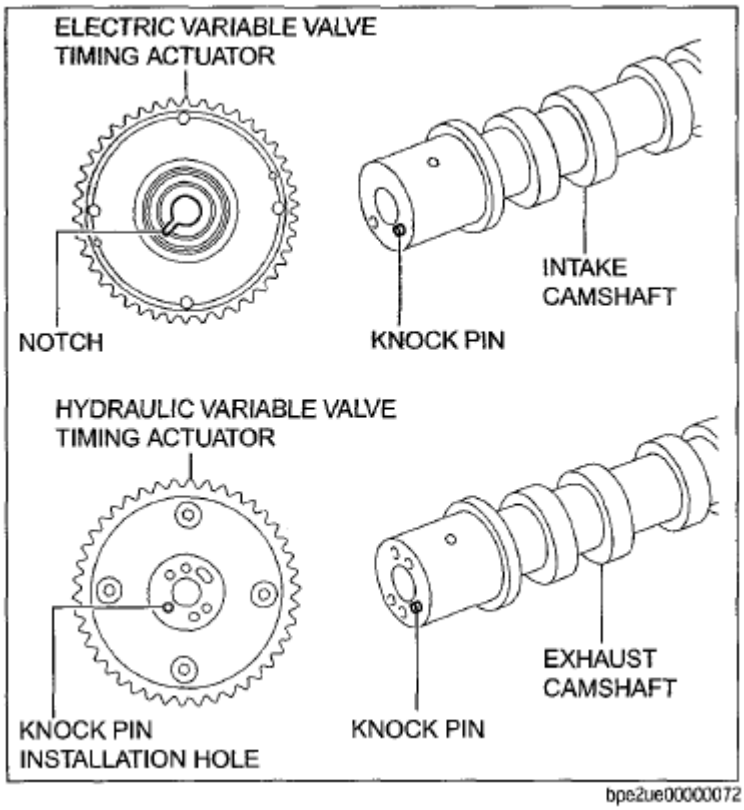


Fig. 260: Identifying Cylinder Heads Bolts In Sequence
Courtesy of MAZDA MOTORS CORP.

91. Support the cylinder heads on a bench with the head gasket side up. Check the cylinder head distortion and the cylinder block distortion.

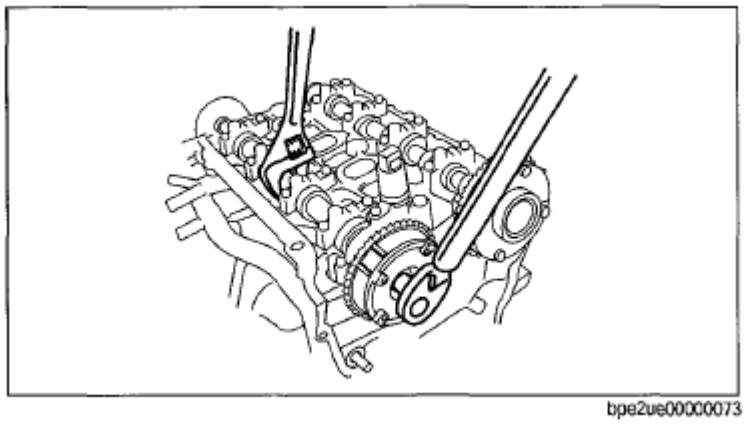


Fig. 261: Locating Hydraulic Lash Adjusters
Courtesy of MAZDA MOTORS CORP.

92. Remove the bolts and the oil separator cover.

- Discard the gasket.

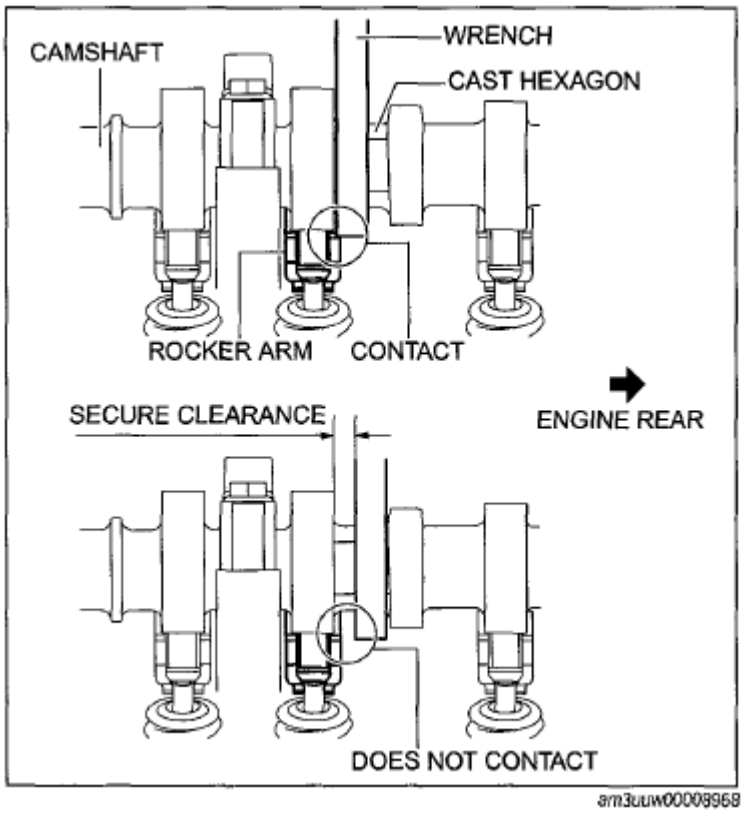


Fig. 262: Locating Bolts And Oil Separator Cover
Courtesy of MAZDA MOTORS CORP.

93. Remove the crankshaft key.

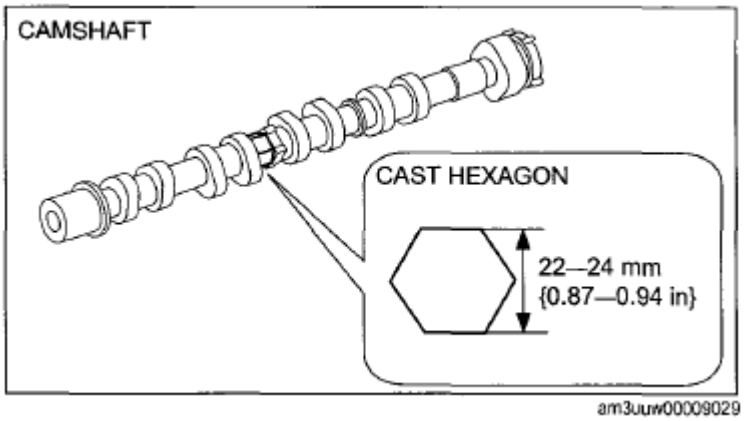
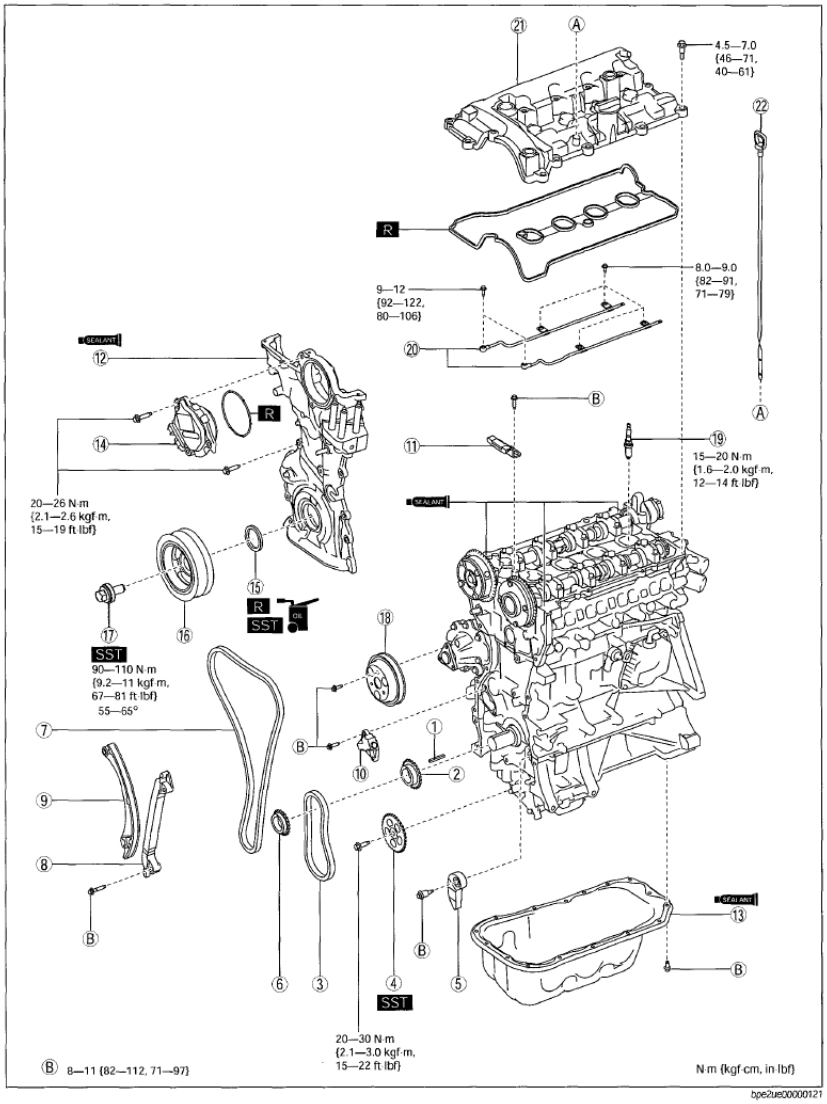


Fig. 263: Locating Crankshaft Key
Courtesy of MAZDA MOTORS CORP.

FRONT AND LOWER ENGINE BLOCK- 3.0L EXPLODED VIEW



1	Key
3	Oil pump chain
4	Oil pump driven sprocket (See Oil Pump Driven Sprocket Assembly Note.)
5	Oil pump chain tensioner
6	Crankshaft sprocket
7	Timing chain (See Timing Chain Assembly Note.)
8	Chain guide (No.2) (See Timing Chain Assembly Note.)
9	Tensioner arm (See Timing Chain Assembly Note.)
10	Chain tensioner (See Timing Chain Assembly Note.)
11	Chain guide (No.1) (See Timing Chain Assembly Note.)
12	Engine front cover (See Engine Front Cover Assembly Note.)
13	Oil pan (See Oil Pan Assembly Note.)

2	Oil pump drive sprocket
14	Electric variable valve timing motor/driver (See Electric Variable Valve Timing Motor/ Driver Assembly Note.)
15	Front oil seal (See Front Oil Seal Assembly Note.)
16	Crankshaft pulley
17	Crankshaft pulley lock bolt (See Crankshaft Pulley Lock Bolt Assembly Note.)
18	Water pump pulley (See Water Pump Pulley Assembly Note.)
19	Spark plug
20	Oil shower pipe (See Oil Shower Pipe Installation Note.)
21	Cylinder head cover (See Cylinder Head Cover Installation Note.)
22	Dipstick

Fig. 264: Exploded View Of Front And Lower Engine Block (1 Of 2)
Courtesy of MAZDA MOTORS CORP.

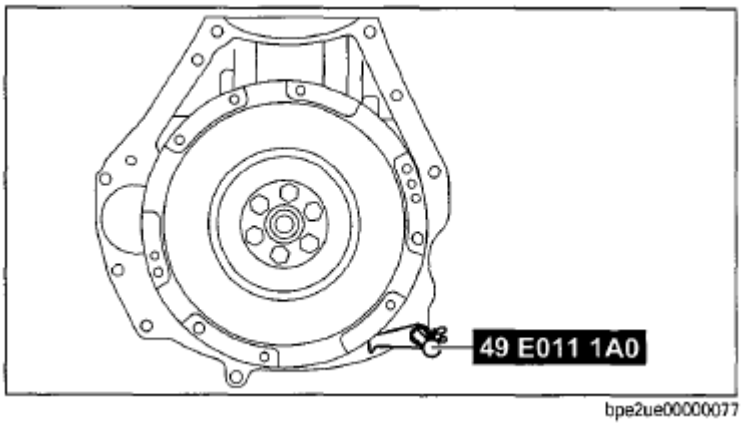


Fig. 265: Exploded View Of Front And Lower Engine Block (2 Of 2)
Courtesy of MAZDA MOTORS CORP.

1. For additional information, see the procedures in this service information.

CYLINDER HEAD DISASSEMBLY/ASSEMBLY - 3.0L

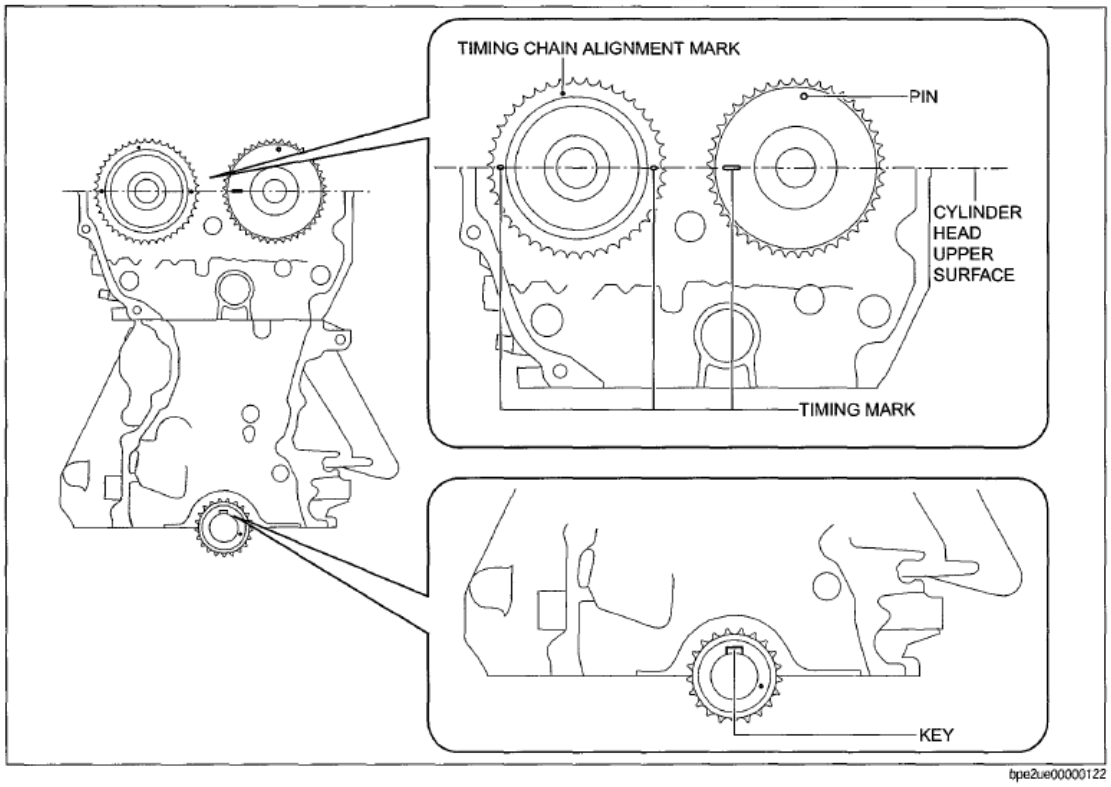


Fig. 266: Identifying Cylinder Head Components
Courtesy of MAZDA MOTORS CORP.

DISASSEMBLY

CAUTION:
- **If the components are to be reinstalled, they must be installed in the same position. Mark the components removed for locations. If not installed in their original positions, severe engine damage may occur.**

1. Using the special tools, remove the keys, retainer, and spring.

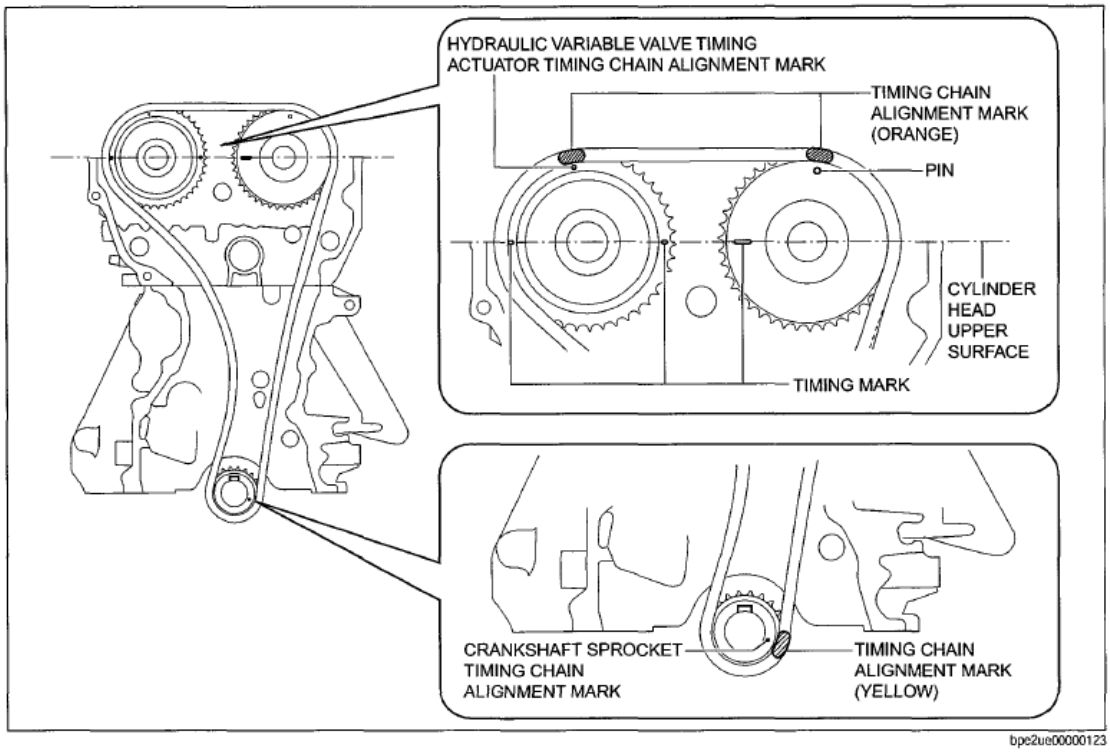


Fig. 267: Identifying Special Tools On Keys, Retainer And Spring
Courtesy of MAZDA MOTORS CORP.

2. Remove the valve from the cylinder head.
3. Remove the valve stem seal.

ASSEMBLY

1. Using the special tool, install the valve stem seal.

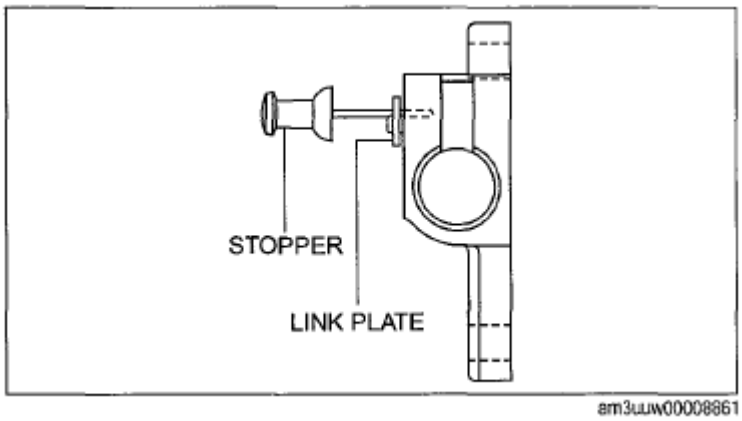


Fig. 268: Identifying Special Tool On Valve Stem Seal
Courtesy of MAZDA MOTORS CORP.

2. Install the valve.
3. Using the special tools, install the valve spring, retainer and key.

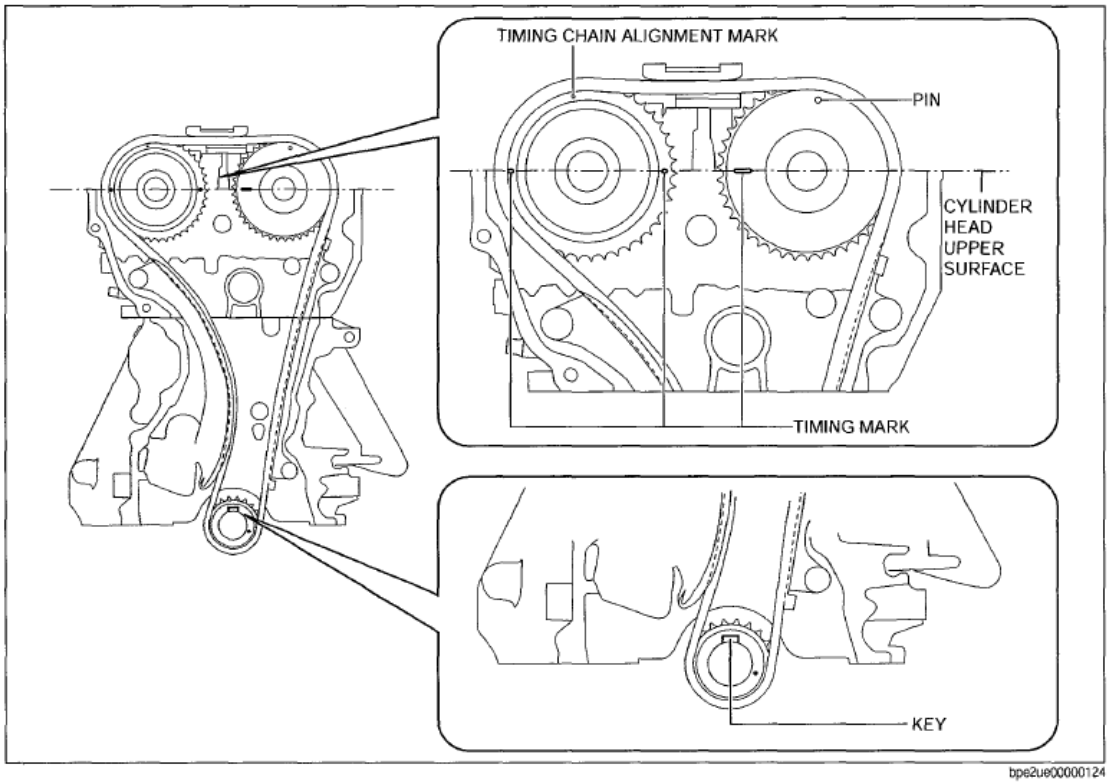


Fig. 269: Identifying Special Tools On Keys, Retainer And Spring
Courtesy of MAZDA MOTORS CORP.

ENGINE ASSEMBLY - 3.0L

ASSEMBLY

All vehicles

CAUTION:
- **During engine repair procedures, cleanliness is extremely important. Any foreign material (including any material created while cleaning gasket surfaces) that enters the oil passages, coolant passages or the oil pan, may cause engine failure.**

CAUTION:
- **If the oil pan during engine disassembly, it must be installed after the engine and transaxle are assembled and the transaxle-to-engine bolts are installed. Failure to follow this assembly sequence can result in oil leaks.**

1. If removed, install the crankshaft key into the keyway on the crankshaft.

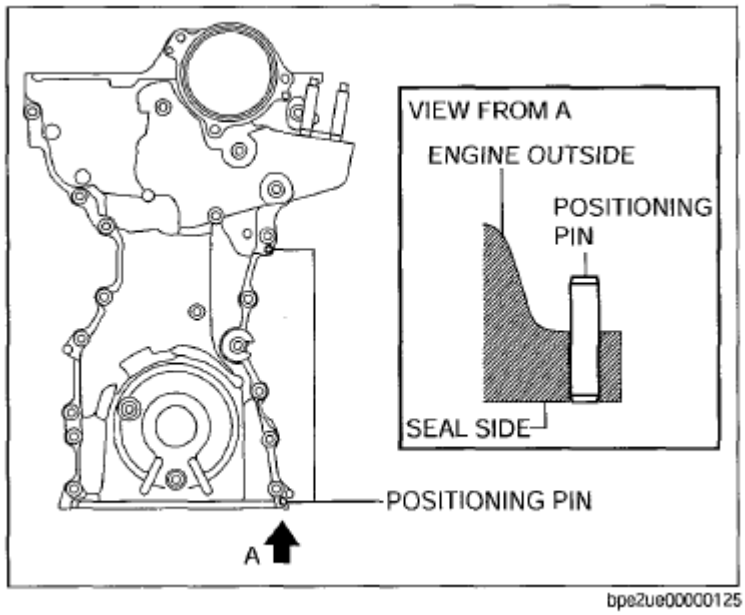


Fig. 270: Locating Crankshaft Key
Courtesy of MAZDA MOTORS CORP.

2. Install the crankcase cover, a new gasket and the bolts.
   - To install, tighten to 10 N.m {1.0 kgf.m, 89 in.lbf}.

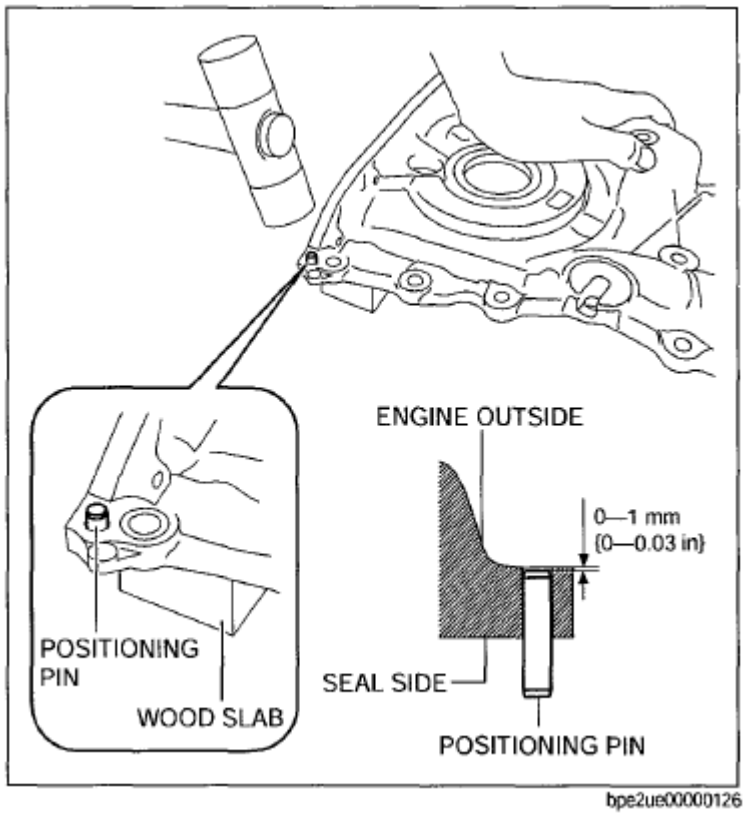


Fig. 271: Locating Bolts And Oil Separator Cover
Courtesy of MAZDA MOTORS CORP.

3. Position the new LH and RH cylinder heads and gaskets. Install new bolts and tighten in the sequence shown in the figure in 6 stages.
   - Stage 1: Tighten to 40 N.m {4.1 kgf.m, 30 ft.lbf}.
   - Stage 2: Tighten 90 N.m {9.2 kgf.m, 66 ft.lbf}.
   - Stage 3: Loosen one full turn.
   - Stage 4: Tighten to 40 N.m {4.1 kgf.m, 30 ft.lbf}.
   - Stage 5: Tighten 90 degrees.
   - Stage 6: Tighten 90 degrees.

NOTE:
- **LH shown in the figure, RH similar.**

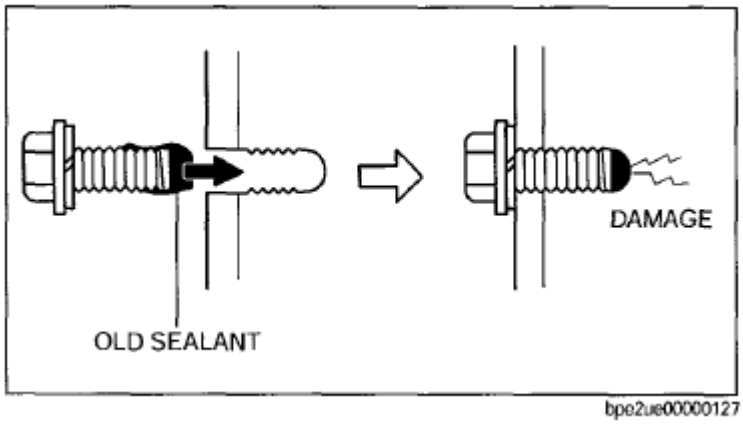


Fig. 272: Identifying Cylinder Heads Bolts In Sequence
Courtesy of MAZDA MOTORS CORP.

4. Install the crankshaft damper bolt and rotate the crankshaft keyway to the 11 o'clock position to locate top dead center (TDC).

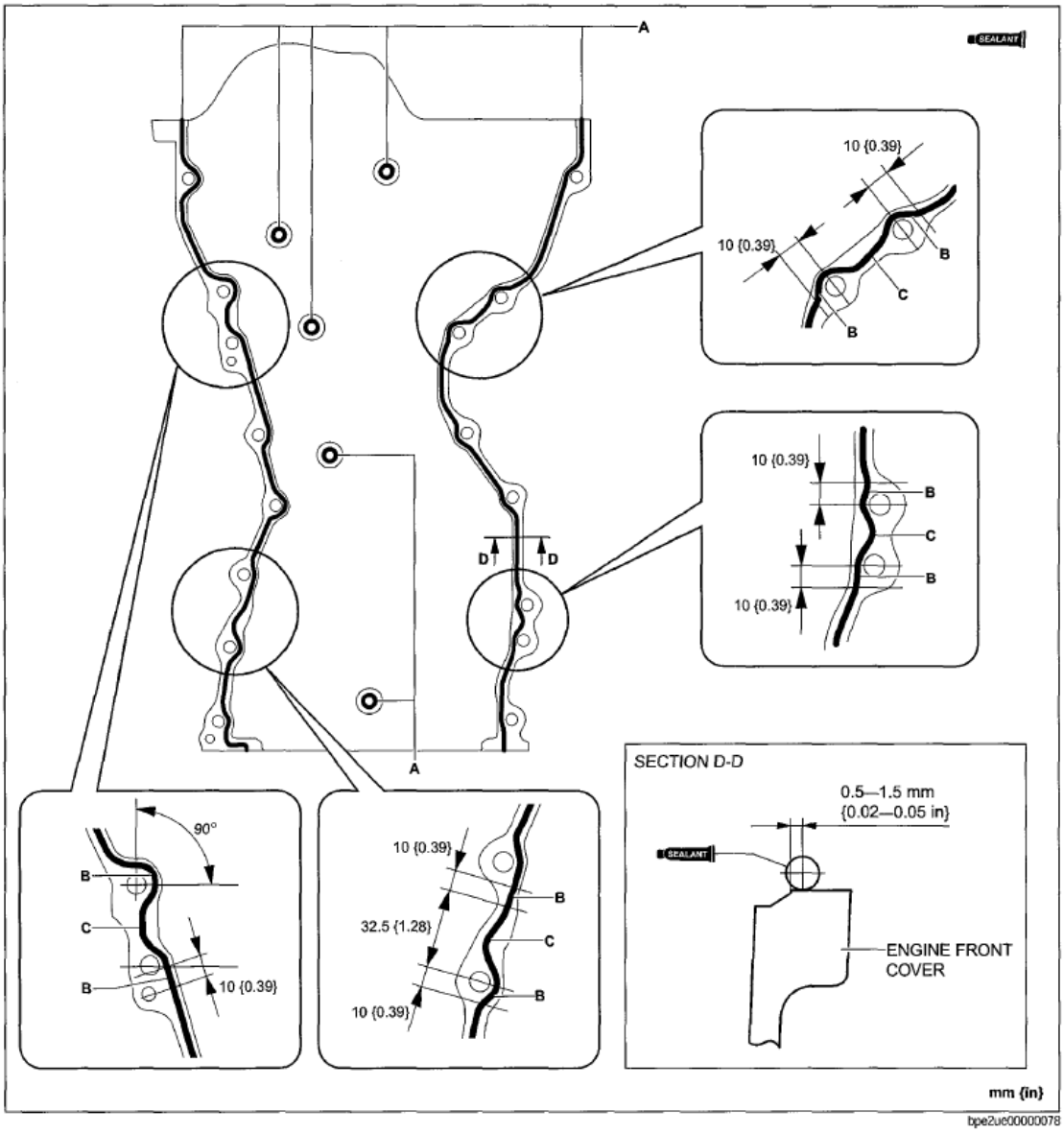


Fig. 273: Locating Crankshaft Damper Bolt
Courtesy of MAZDA MOTORS CORP.

5. Install the hydraulic lash adjusters.
   - Lubricate the hydraulic lash adjusters with clean engine oil.

CAUTION:
- **The hydraulic lash adjusters must be installed in their original positions. If not reassembled in their original positions, severe engine damage may occur.**

6. Apply clean engine oil to the LH and RH camshaft roller followers.
7. Install the LH and RH camshaft roller followers.

CAUTION:
- **The camshaft roller followers must be installed in their original positions. If not reassembled in their original positions, severe engine damage may occur.**

NOTE:
- **RH shown in the figure, LH similar.**

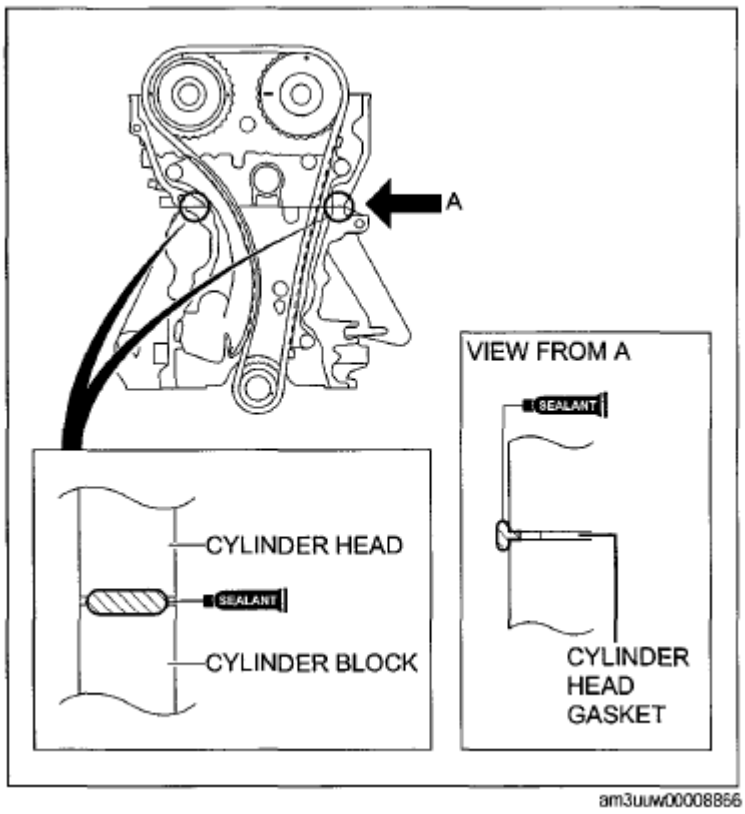


Fig. 274: Locating Camshaft Roller Followers
Courtesy of MAZDA MOTORS CORP.

8. Install the new LH and RH oil filter screens in the intake camshafts.

NOTE:
- **RH shown in the figure, LH similar.**

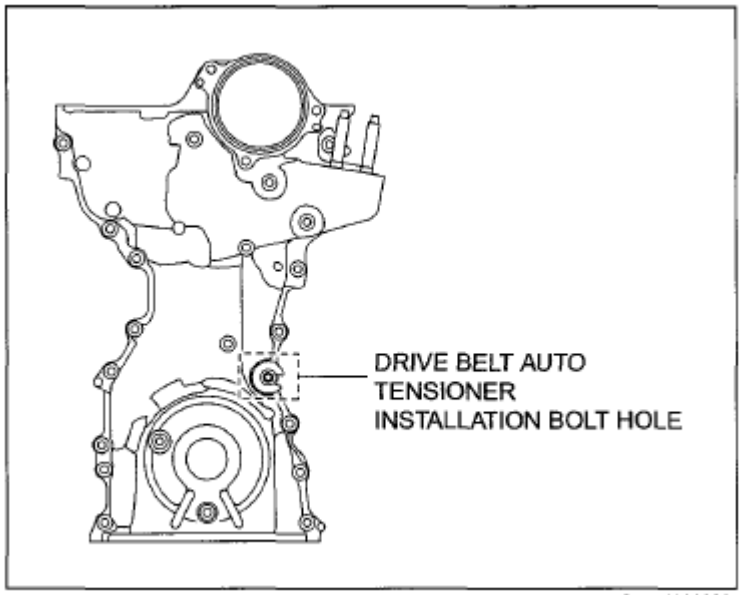


Fig. 275: Locating VCT System Oil Filter Screen
Courtesy of MAZDA MOTORS CORP.

9. Position the camshaft phaser and sprockets onto the intake camshafts.
    - Install the 3 bolts finger-tight.
10. Lubricate the LH camshafts with clean engine oil and carefully position the camshafts onto the cylinder head.
    - Align the LH camshafts as shown in the figure.

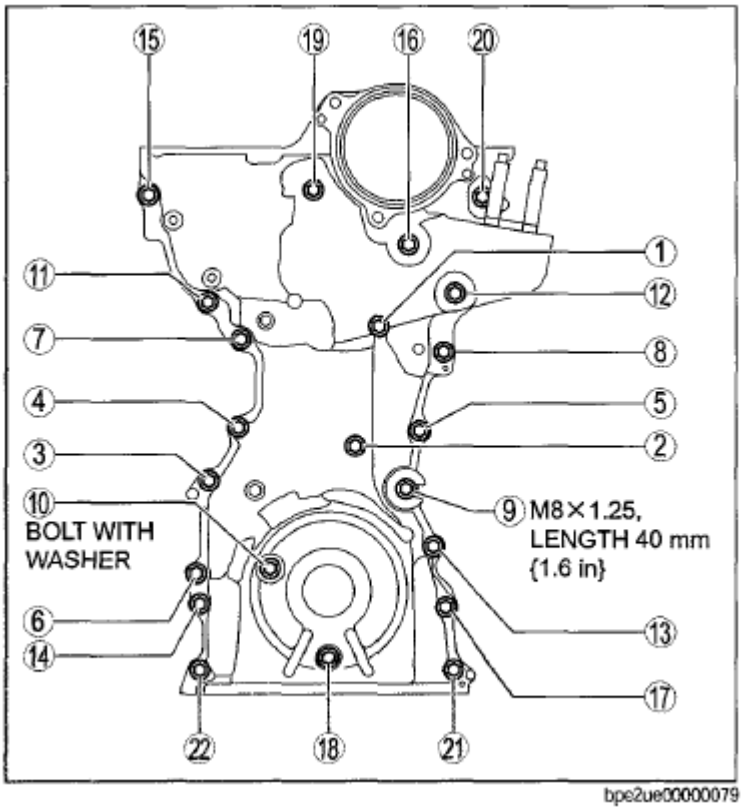


Fig. 276: Locating LH Camshafts
Courtesy of MAZDA MOTORS CORP.

11. Lubricate the bearing surfaces of the LH camshaft bearing caps with clean engine oil and install the bearing caps.
    - Loosely install the bolts.

CAUTION:
- **Cylinder head camshaft journal caps and cylinder heads are numbered to verify that they are assembled in their original positions. If not reassembled in their original positions, severe engine damage may occur.**

CAUTION:
- **Do not install the camshaft journal thrust caps until all of the camshaft bearing caps have been installed, or damage to the thrust caps can occur.**

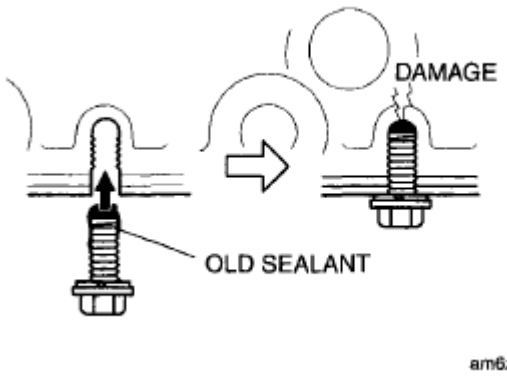


Fig. 277: Locating Cylinder Head Camshaft Journal Caps
Courtesy of MAZDA MOTORS CORP.

12. Lubricate the bearing surfaces of the LH camshaft bearing thrust caps with clean engine oil and install the bearing thrust caps.
    - Loosely install the bolts.

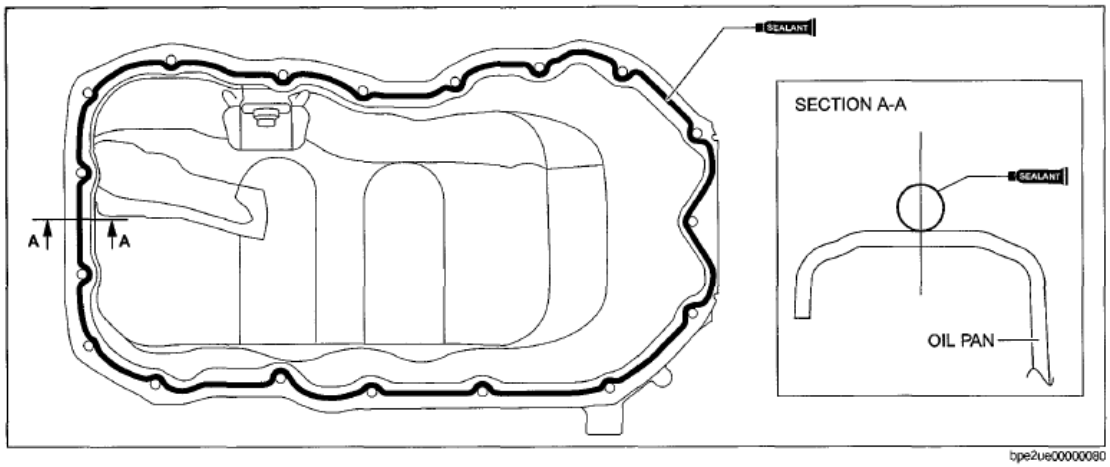


Fig. 278: Locating LH Camshaft Bearing Thrust Caps And Bolts
Courtesy of MAZDA MOTORS CORP.

13. Tighten the LH camshaft bearing cap bolts in the sequence shown in the figure in 2 stages.
    - Stage 1: Tighten to 10 N.m {1.0 kgf.m, 89 in.lbf}.
    - Stage 2: Individually loosen and then tighten each camshaft bearing cap to 10 N.m {1.0 kgf.m, 89 in.lbf}.

NOTE:

- **Make sure to tighten the camshaft bearing cap bolts in sequence in 2 stages.**

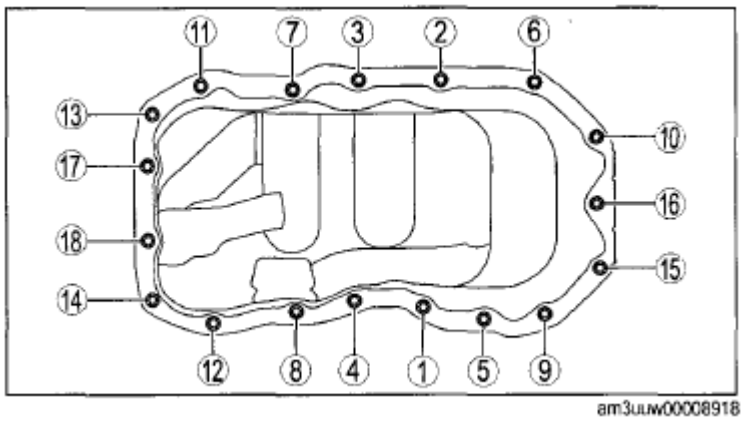


Fig. 279: Identifying LH Camshaft Bearing Caps Bolts In Sequence
Courtesy of MAZDA MOTORS CORP.

14. Lubricate the bearing surfaces of the RH camshaft thrust bearing caps with clean engine oil and install the bearing caps.
    - Tighten the 3 LH camshaft phaser and sprocket bolts to 18 N.m {1.8 kgf.m, 159 in.lbf}.

CAUTION:
- **Do not allow the camshaft to rotate from the neutral position while tightening the camshaft phaser and sprocket bolts or damage to the engine may occur.**

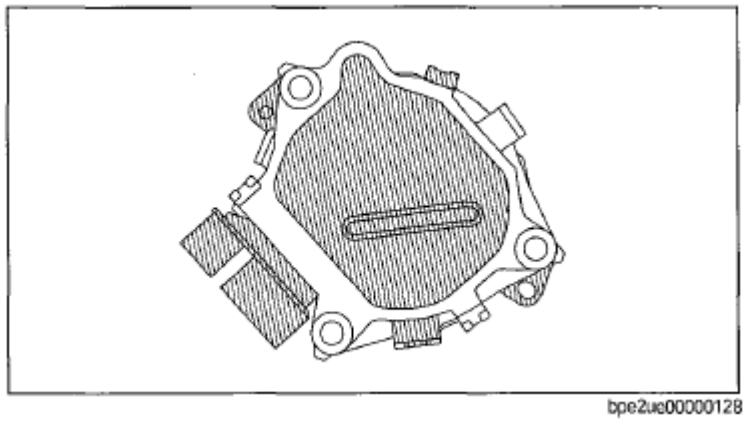


Fig. 280: Locating Bolts, LH Camshaft Phaser And Sprocket
Courtesy of MAZDA MOTORS CORP.

NOTE:
- **Install a 3/8-in ratchet and extension into the D-slot on the rear of the intake camshaft to hold the camshaft in place for tightening of the camshaft phaser and sprocket bolts.**

15. Install the camshaft oil seal retainer and the 2 bolts.
    - Tighten in the sequence shown in the figure to 10 N.m {1.0 kgf.m, 89 in.lbf}.

NOTE:

- **Clean the sealing surface with metal surface prep before installing a new press-in-place gasket.**

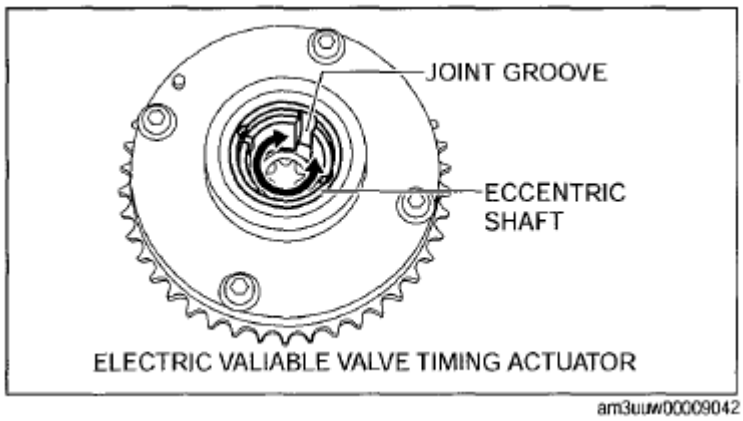


Fig. 281: Locating Bolts And Camshaft Oil Seal Retainer
Courtesy of MAZDA MOTORS CORP.

16. Using the Power Steering Pump Pulley Installer, Camshaft Oil Seal Installer and the Camshaft Oil Seal Protector, install a new camshaft oil seal.

NOTE:

- **Apply clean engine oil to the seal lip and seal bore before installing the seal.**

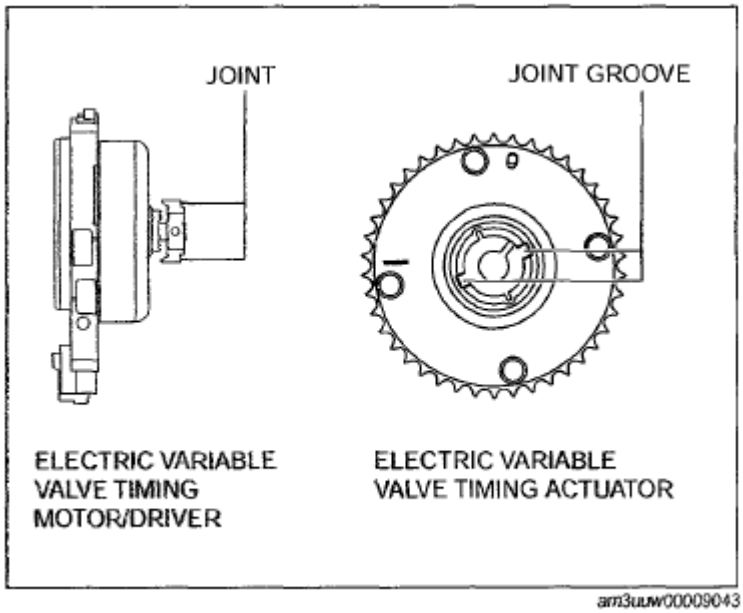


Fig. 282: Identifying Special Tools (303-464, 303-463 And 211-185)
Courtesy of MAZDA MOTORS CORP.

17. Lubricate the RH camshafts with clean engine oil and carefully position the camshafts onto the cylinder head.
    - Align the RH camshafts as shown in the figure.

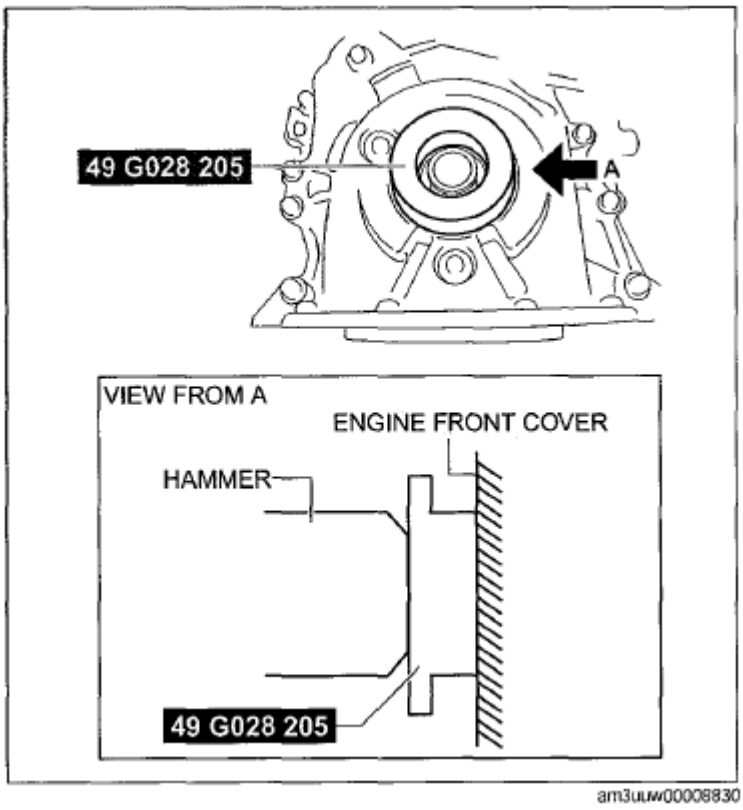


Fig. 283: Locating RH Camshafts Marks
Courtesy of MAZDA MOTORS CORP.

18. Install the camshaft bearing caps.
    - Loosely install the bolts.

CAUTION:
- **Cylinder head camshaft journal caps and cylinder heads are numbered to verify that they are assembled in their original positions. If not reassembled in their original positions, severe engine damage may occur.**

CAUTION:
- **Do not install the camshaft journal thrust caps until all of the camshaft bearing caps have been installed or damage to the thrust caps can occur.**

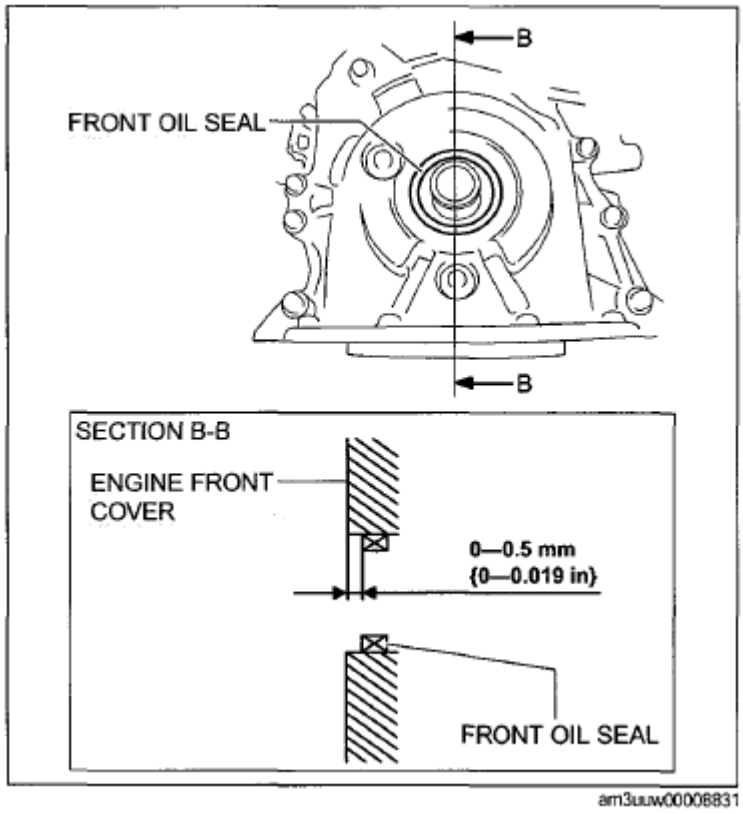


Fig. 284: [Locating Radiator]
Courtesy of MAZDA MOTORS CORP.

NOTE:
- **Lubricate the bearing surfaces of the RH camshaft bearing caps with clean engine oil.**

19. Install the camshaft bearing thrust caps.
    - Loosely install the bolts.

NOTE:
- **Lubricate the bearing surfaces of the RH camshaft bearing thrust caps with clean engine oil.**

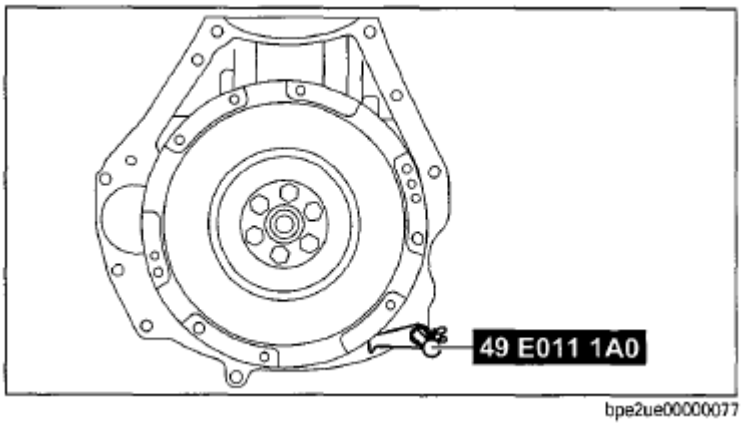


Fig. 285: Locating Camshaft Bearing Thrust Caps And Bolts
Courtesy of MAZDA MOTORS CORP.

20. Tighten the RH camshaft bearing cap bolts in the sequence shown in the figure in 2 stages.
    - Stage 1: Tighten to 10 N.m {1.0 kgf.m, 89 in.lbf}.
    - Stage 2: Individually loosen and then tighten each camshaft bearing cap to 10 N.m {1.0 kgf.m, 89 in.lbf}.

NOTE:

- **Make sure to tighten the camshaft bearing cap bolts in sequence in 2 stages.**

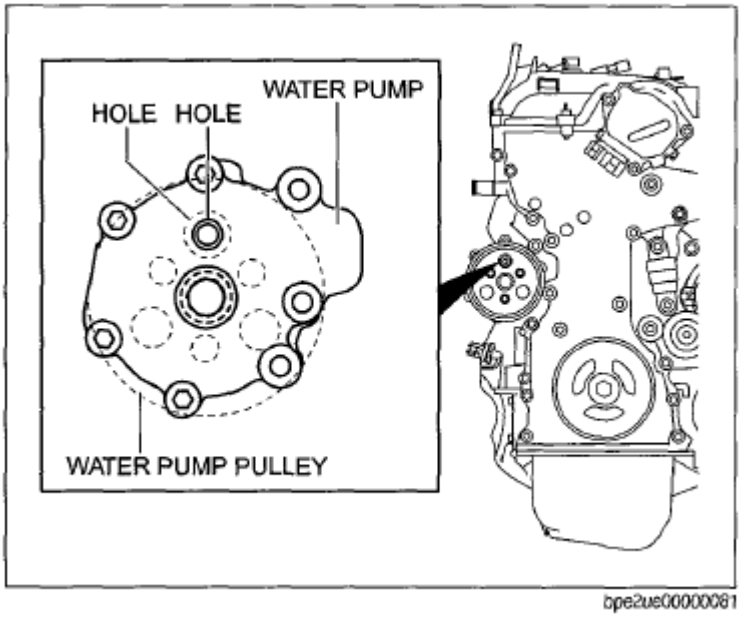


Fig. 286: Identifying RH Camshaft Bearing Cap Bolts In Sequence
Courtesy of MAZDA MOTORS CORP.

21. Tighten the 3 RH camshaft phaser and sprocket bolts to 18 N.m {1.8 kgf.m, 159 in.lbf}.

CAUTION:
- **Do not allow the camshaft to rotate from the neutral position while tightening the camshaft phaser and sprocket bolts or damage to the engine may occur.**

NOTE:
- **Install a 3/8-in ratchet and extension into the D-slot on the rear of the intake camshaft to hold the camshaft in place for tightening of the camshaft phaser and sprocket bolts.**

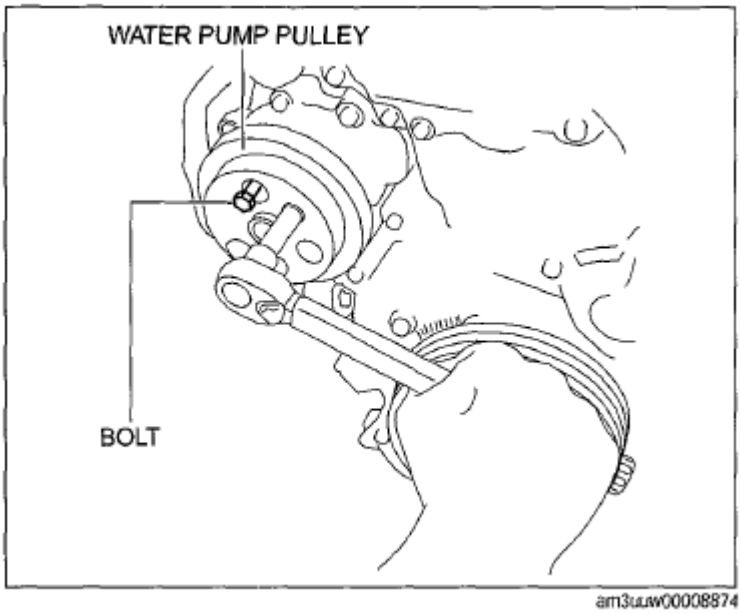


Fig. 287: Locating Bolts And RH Camshaft Phaser And Sprocket
Courtesy of MAZDA MOTORS CORP.

22. Position the oil pump and install the bolts.
    - Tighten in the sequence shown in the figure to 10 N.m {1.0 kgf.m, 89 in.lbf}.

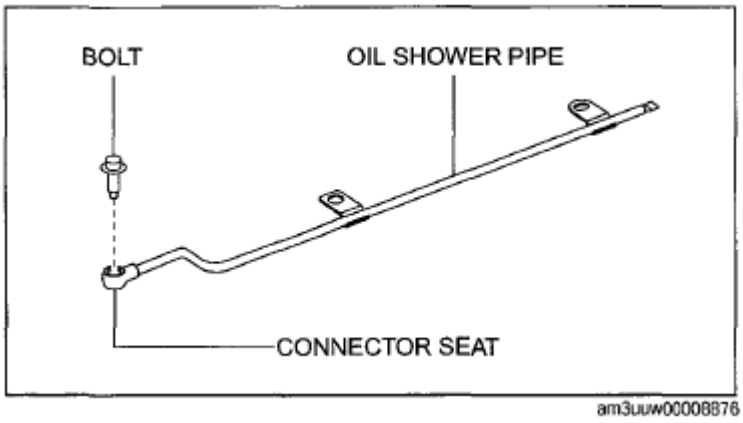


Fig. 288: Locating Oil Pump And Bolts
Courtesy of MAZDA MOTORS CORP.

23. Remove the crankshaft pulley bolt.

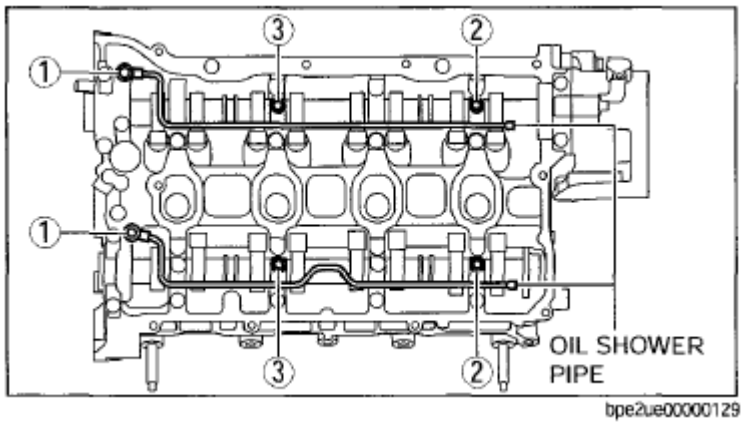


Fig. 289: Locating Crankshaft Pulley Bolt
Courtesy of MAZDA MOTORS CORP.

24. Install the crankshaft sprockets with the timing marks out.

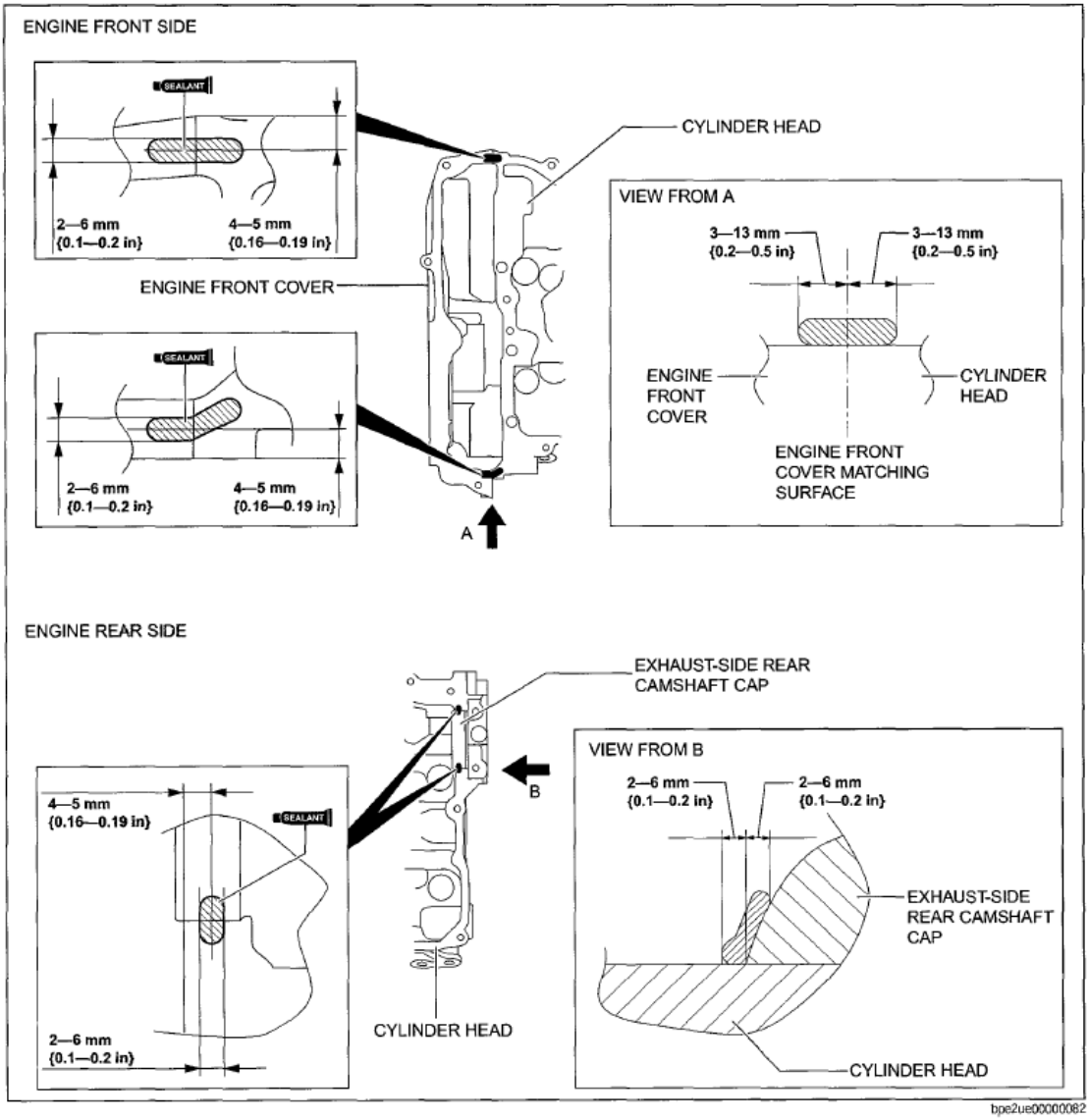


Fig. 290: Locating Crankshaft Sprockets
Courtesy of MAZDA MOTORS CORP.

25. Position the chain tensioner in a soft-jawed vise.

NOTE:

- **LH shown in the figure, RH similar.**

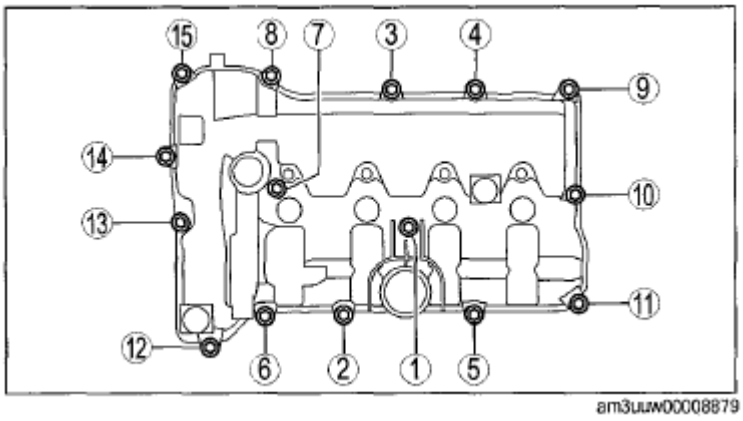


Fig. 291: Locating Chain Tensioner
Courtesy of MAZDA MOTORS CORP.

26. Hold the chain tensioner ratchet lock mechanism away from the ratchet stem with a small pick.

NOTE:
- **LH shown in the figure, RH similar.**

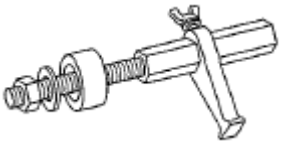


Fig. 292: Holding Chain Tensioner Ratchet Lock Mechanism With Small Pick
Courtesy of MAZDA MOTORS CORP.

27. Slowly compress the timing chain tensioner.

CAUTION:
- **During tensioner compression, do not release the ratchet stem until the tensioner piston is fully bottomed in its bore or damage to the ratchet stem will result.**

28. Retain the tensioner piston with a 1.5 mm (0.06 in) diameter wire or paper clip.

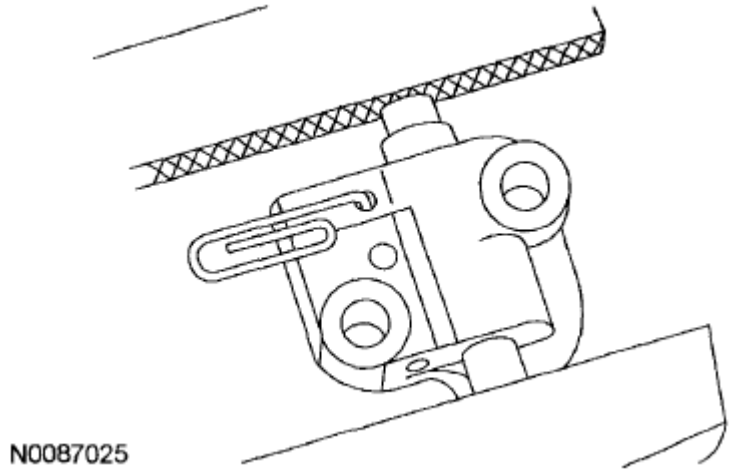


Fig. 293: Identifying Retain Tensioner Piston With Wire Or Paper Clip
Courtesy of MAZDA MOTORS CORP.

29. If timing marks in the timing chains are not evident, use a permanent-type marker to mark the crankshaft and camshaft timing marks on the LH and RH timing chains.
    1. Mark any link to use as the crankshaft timing mark.
    2. Starting with the crankshaft timing mark, count 29 links and mark the link.
    3. Continue counting to link 42 and mark the link.

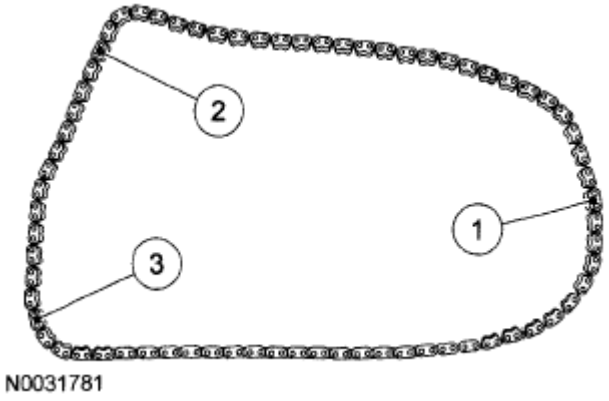


Fig. 294: Identifying Timing Marks In Timing Chains
Courtesy of MAZDA MOTORS CORP.

30. Install the RH timing chain tensioner arm and the RH timing chain tensioner.
    - Tighten to 25 N.m {2.5 kgf.m, 18 ft.lbf}.
    - Align the marks on the timing chain with the marks on the camshaft and crankshaft sprockets.

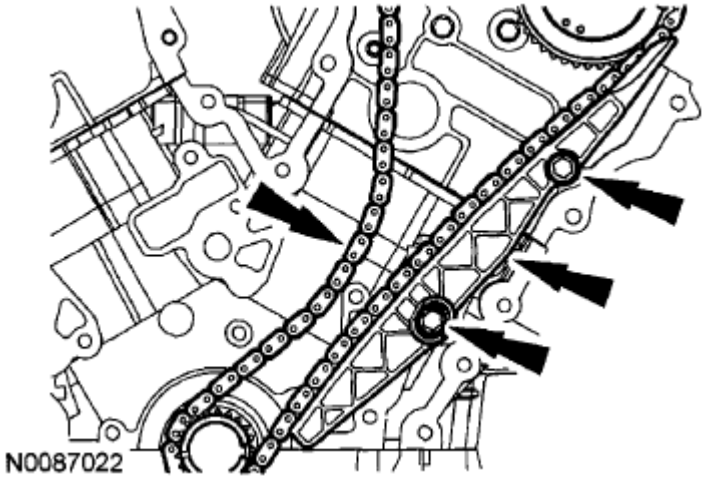


Fig. 295: Locating Bolts And LH Timing Chain Guide
Courtesy of MAZDA MOTORS CORP.

31. Install the LH timing chain tensioner arm and the LH timing chain tensioner.
    1. Install the tensioner arm.
    2. Position the tensioner.
        1. Install the bolts.
    - Tighten to 25 N.m {2.5 kgf.m, 18 ft.lbf}.

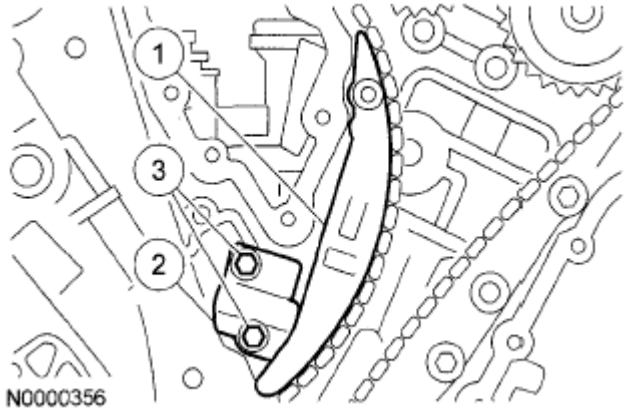


Fig. 296: Identifying Tensioner Arm, Tensioner And Bolt
Courtesy of MAZDA MOTORS CORP.

32. Install the crankshaft pulley bolt and rotate the crankshaft clockwise 120 degrees until the crankshaft keyway is in the 3 o'clock position.

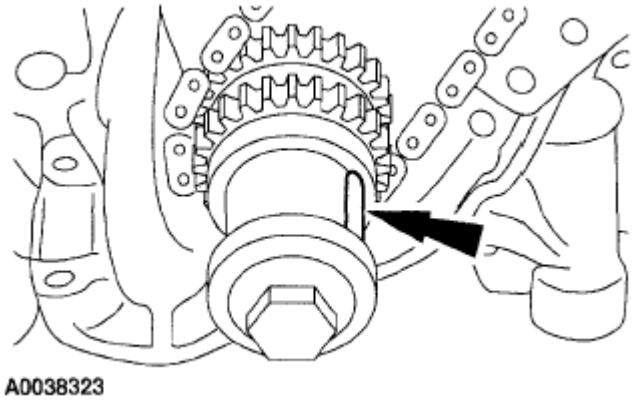


Fig. 297: Locating Crankshaft Keyway
Courtesy of MAZDA MOTORS CORP.

33. Verify that the RH camshafts are correctly positioned.

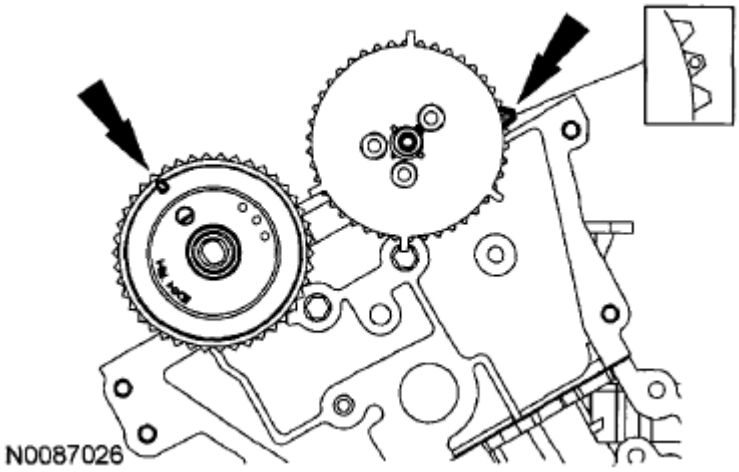


Fig. 298: Locating RH Camshafts Marks
Courtesy of MAZDA MOTORS CORP.

34. Install the RH timing chain and chain guide and install the bolts.
    - Tighten to 25 N.m {2.5 kgf.m, 18 ft.lbf}.
    - Align the marks on the timing chain with the marks on the camshaft and crankshaft sprockets.

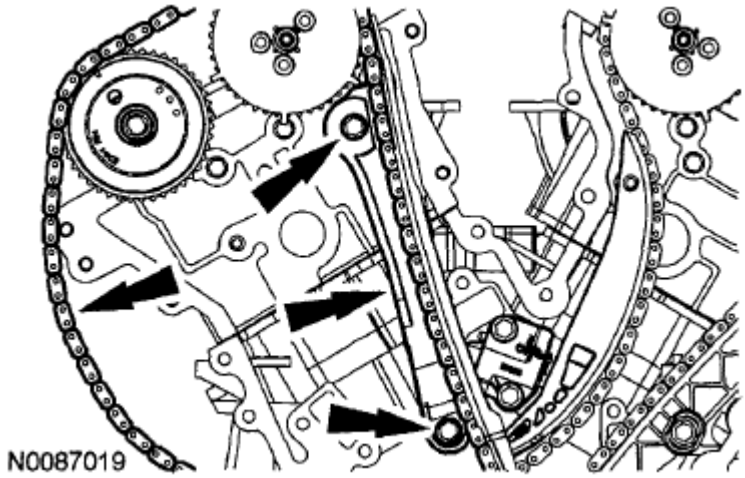


Fig. 299: Locating Bolts And RH Timing Chain Guide
Courtesy of MAZDA MOTORS CORP.

35. Install the RH timing chain tensioner and tensioner arm.
    1. Install the tensioner arm.
    2. Position the tensioner.
    3. Install the bolts.
        1. Tighten to 25 N.m {2.5 kgf.m, 18 ft.lbf}.

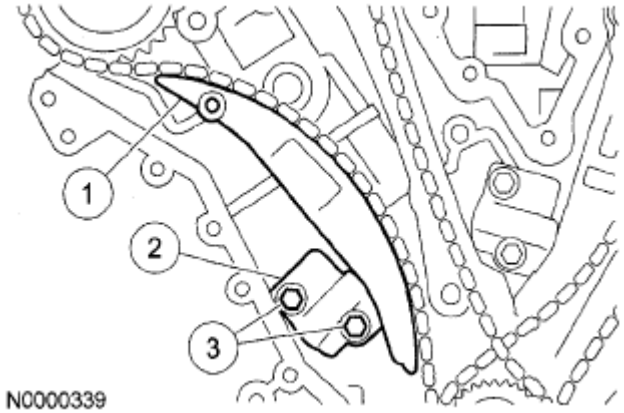


Fig. 300: Identifying Tensioner Arm, Tensioner And Bolt
Courtesy of MAZDA MOTORS CORP.

36. Remove the LH and RH timing chain tensioner piston retaining wires.
37. Rotate the crankshaft counterclockwise 120 degrees to TDC.
38. Verify the timing with the following steps.
    1. There should be 12 chain links between the camshaft timing marks.
    2. There should be 27 chain links between the camshaft and the crankshaft timing marks.
    3. There should be 30 chain links between the camshaft and the crankshaft timing marks.

CAUTION:

- **Failure to verify correct timing drive component alignment will result in severe engine damage.**

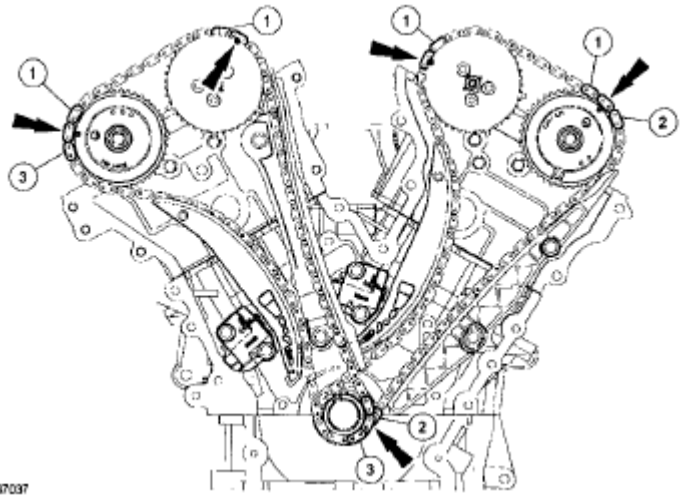


Fig. 301: Locating Chain Links Marks
Courtesy of MAZDA MOTORS CORP.

39. Remove the crankshaft pulley bolt and washer.

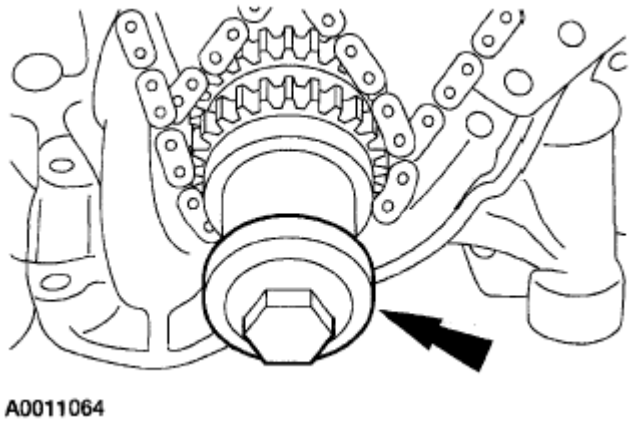


Fig. 302: Locating Crankshaft Pulley Bolt And Washer
Courtesy of MAZDA MOTORS CORP.

40. Install the ignition pulse wheel.

NOTE:

- **This pulse wheel is used in several different engines. Install the pulse wheel with the key-way in the slot stamped "30RFF" only (orange in color).**

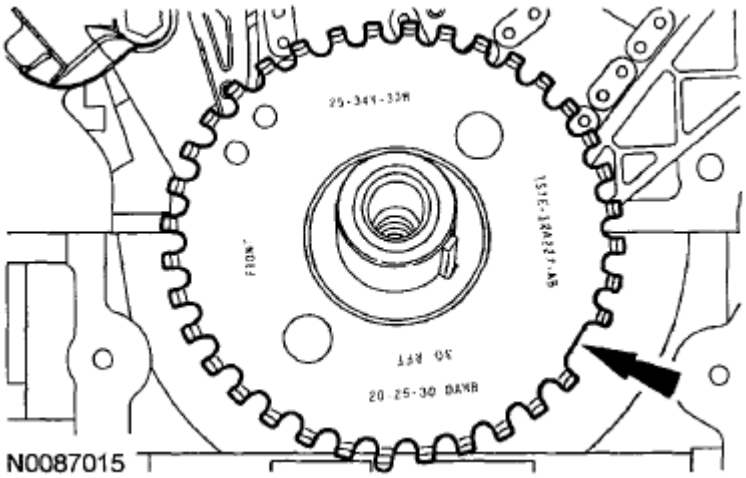


Fig. 303: Locating Ignition Pulse Wheel
Courtesy of MAZDA MOTORS CORP.

41. Install the LH and RH spark plugs.
    - Tighten to 15 N.m {1.5 kgf.m, 133 in.lbf}.

CAUTION:
- **Only use hand tools when removing or installing the spark plugs, damage can occur to the cylinder head or spark plug.**

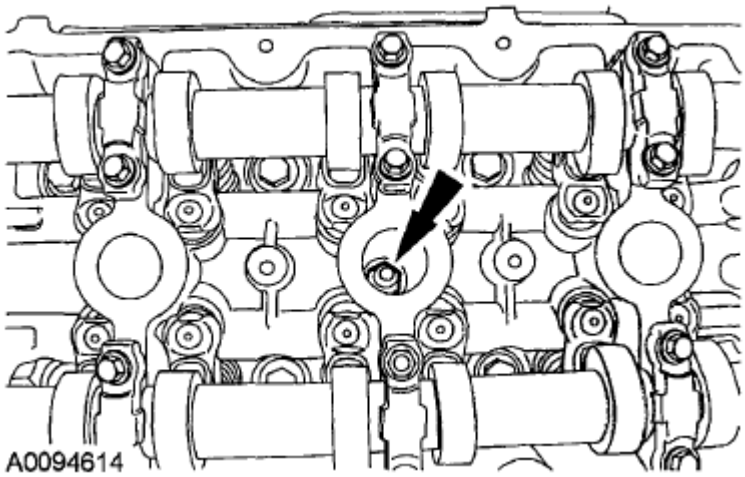


Fig. 304: Locating Spark Plugs
Courtesy of MAZDA MOTORS CORP.

42. Use a plastic scraping tool to remove all traces of sealant.
    - Clean all sealing surfaces with metal surface prep and install new gaskets.

CAUTION:
- **Do not use metal scrapers, wire brushes, power abrasive**

discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths.

CAUTION:
- **Do not damage the oil pan gasket while cleaning the sealant from the lower cylinder block-to-oil pan joint.**

43. Apply a 6 mm (0.24 in) dot of silicone gasket and sealant to the cylinder block to lower cylinder block and cylinder head mating surfaces.

NOTE:
- **Clean and degrease the sealing surfaces with metal surface prep before applying gasket and sealant.**

NOTE:
- **The front cover must be installed and the bolts tightened within 4 minutes of sealant application.**

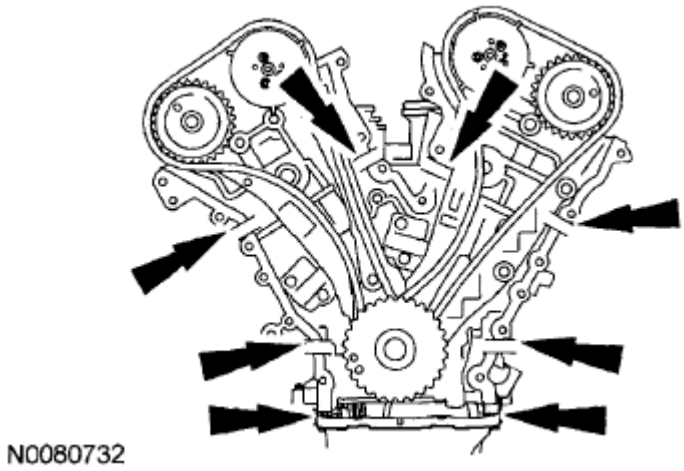
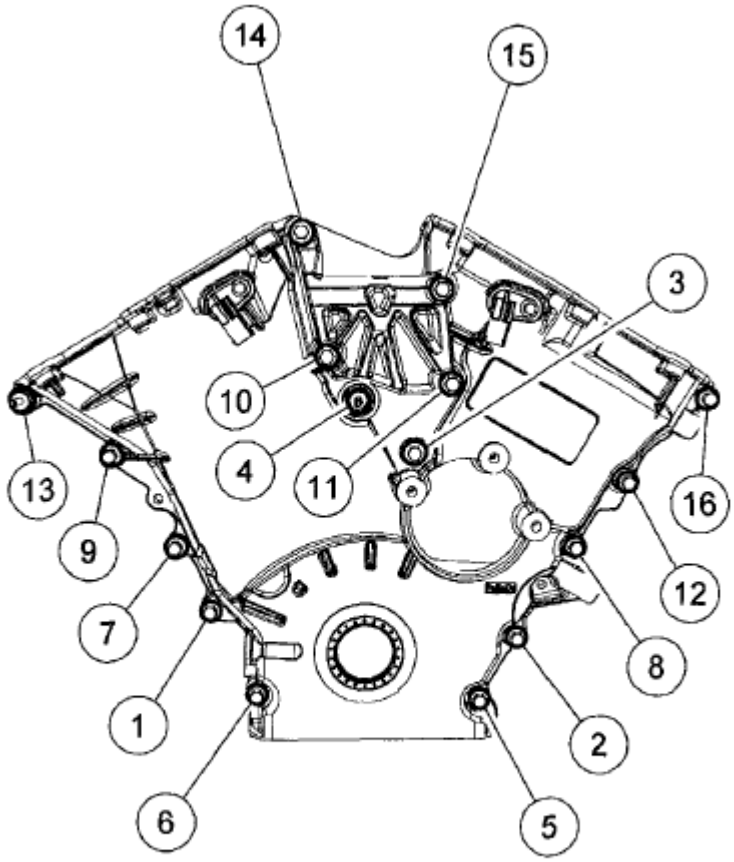


Fig. 305: Locating Silicone Gasket Location
Courtesy of MAZDA MOTORS CORP.

44. Position the front cover and install the bolts and stud bolts.
    - Tighten to 25 N.m {2.5 kgf.m, 18 ft.lbf}.

NOTE:
- **Fasteners 4 and 13 are stud bolts.**



N0089880

Fig. 306: Identifying Front Cover Bolts And Stud Bolts
Courtesy of MAZDA MOTORS CORP.

45. Install the 2 bolts and the LH Variable Camshaft Timing (VCT) solenoid.
    - Tighten to 10 N.m {1.0 kgf.m, 89 in.lbf}.

NOTE:
- **Note the position of the alignment dowel on the engine front cover.**

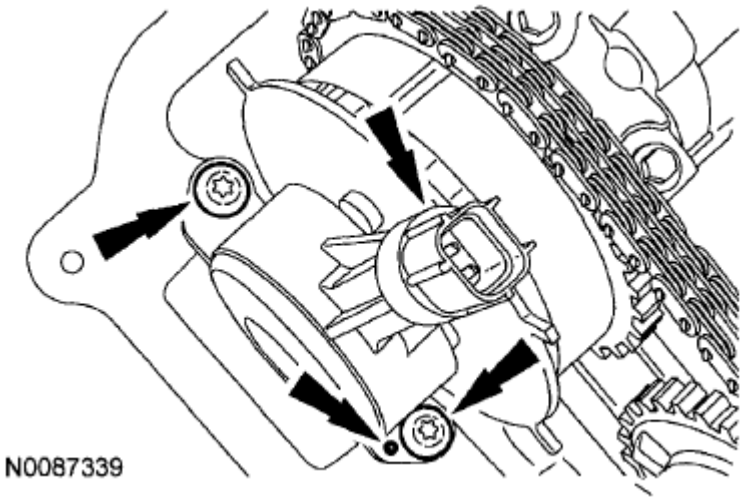


Fig. 307: Locating Bolts And LH Variable Camshaft Timing (VCT) Solenoid
Courtesy of MAZDA MOTORS CORP.

46. Install the 2 bolts and the RH VCT solenoid.
    - To install, tighten to 10 N.m {1.0 kgf.m, 89 in.lbf}.

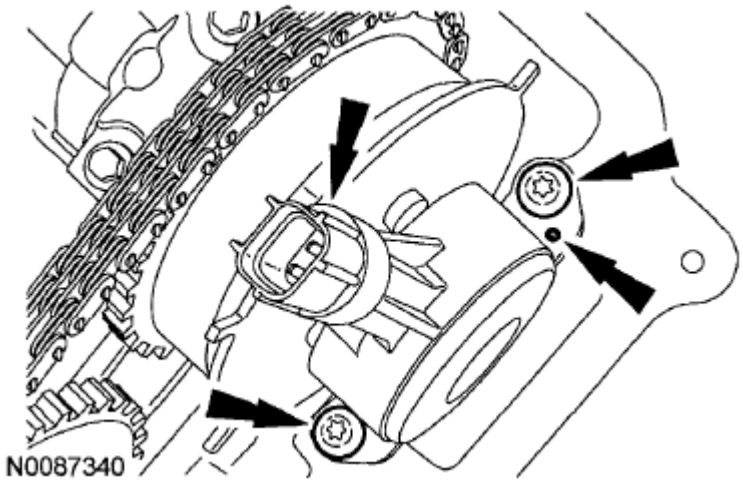


Fig. 308: Locating Bolts And RH VCT Solenoid
Courtesy of MAZDA MOTORS CORP.

47. Apply clean engine oil to the seal lip and seal bore before installing the seal.

NOTE:
- **Clean all sealing surfaces with metal surface prep.**

48. Using the Front Cover Oil Seal Installer and the Crankshaft Vibration Damper Installer, install a new crankshaft front seal.

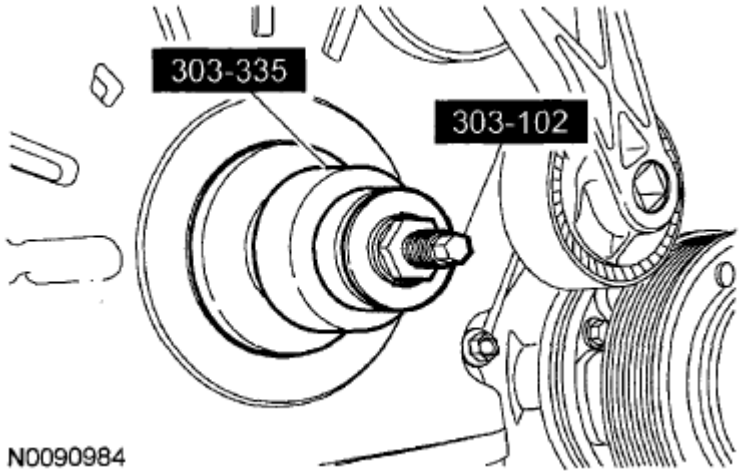


Fig. 309: Using Special Tool To Install Crankshaft Front Seal
Courtesy of MAZDA MOTORS CORP.

49. Apply silicone gasket and sealant to the end of the crankshaft pulley keyway slot.

NOTE:

- **Clean the keyway and slot using metal surface prep before applying silicone gasket and sealant.**

NOTE:

- **Sealing surfaces must be free of dirt and oil.**

NOTE:

- **The crankshaft pulley must be installed and the bolt tightened within 4 minutes of sealant application.**

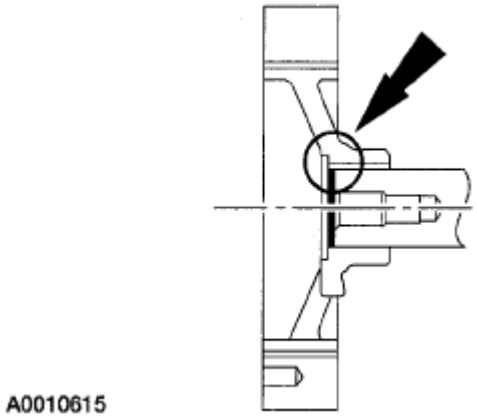


Fig. 310: Locating Silicone Gasket
Courtesy of MAZDA MOTORS CORP.

50. Using the Crankshaft Vibration Damper Installer, install the crankshaft pulley.

NOTE:

- **Lubricate the outside diameter sealing surface with clean engine oil.**

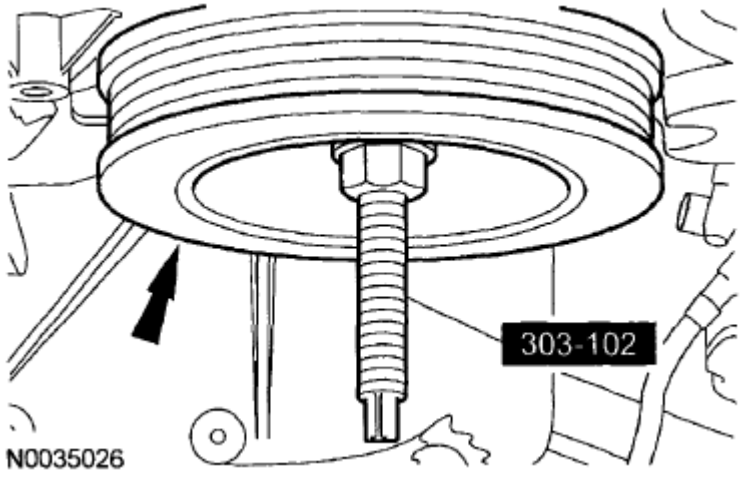


Fig. 311: Installing Crankshaft Pulley
Courtesy of MAZDA MOTORS CORP.

51. Install the bolt and washer. Tighten the bolt in 4 stages:
    - Stage 1: Tighten to 120 N.m {12.0 kgf.m, 89 ft.lbf}.
    - Stage 2: Loosen one full turn.
    - Stage 3: Tighten to 50 N.m {5.0 kgf.m, 37 ft.lbf}.
    - Stage 4: Tighten an additional 90 degrees.

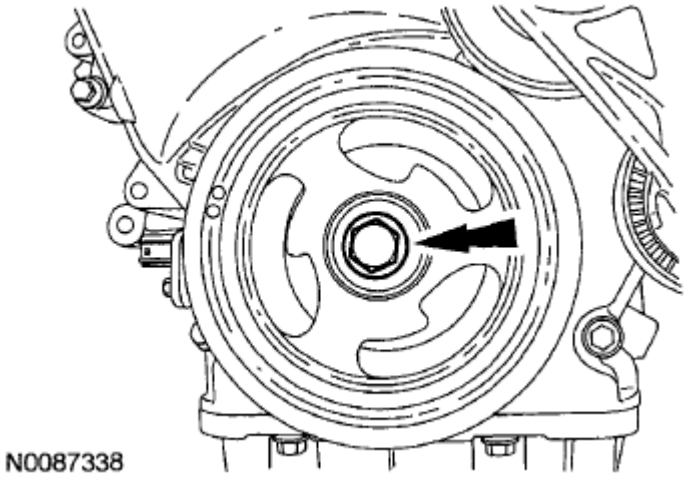


Fig. 312: Locating Bolt And Washer
Courtesy of MAZDA MOTORS CORP.

52. Install the belt tensioner and the 3 bolts.
    - Tighten to 25 N.m {2.5 kgf.m, 18 ft.lbf}.

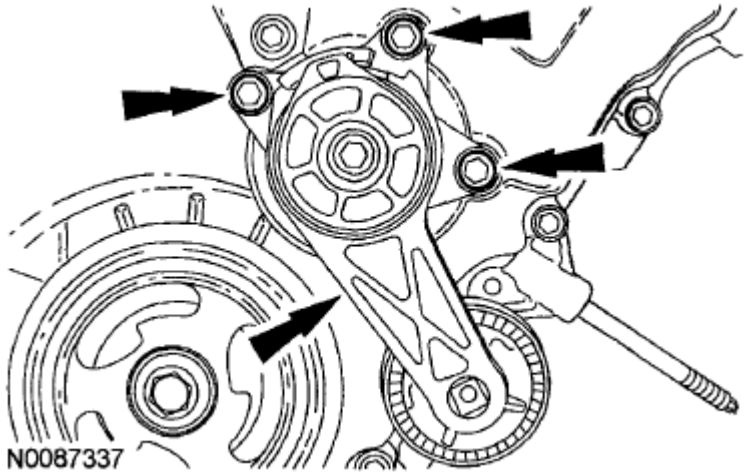


Fig. 313: Locating Belt Tensioner And Bolts
Courtesy of MAZDA MOTORS CORP.

53. Install the 8 nuts and the oil pan baffle.
    1. Tighten the 4 M6 oil pan baffle nuts in 2 stages.
        1. Stage 1: Tighten to 5 N.m {0.5 kgf.m, 44 in.lbf}.
        2. Stage 2: Tighten an additional 45 degrees.
    2. Then install and tighten the 4 M8 oil pan baffle nuts in 2 stages.
        1. Stage 1: Tighten to 15 N.m {1.5 kgf.m, 133 in.lbf}.
        2. Stage 2: Tighten an additional 45 degrees.

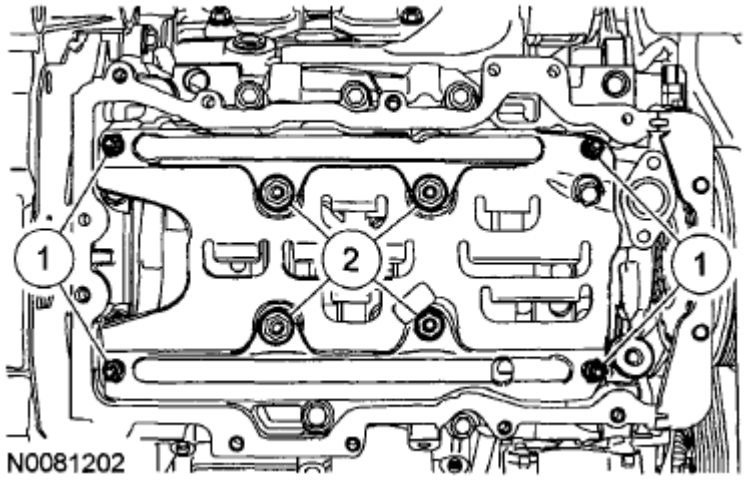
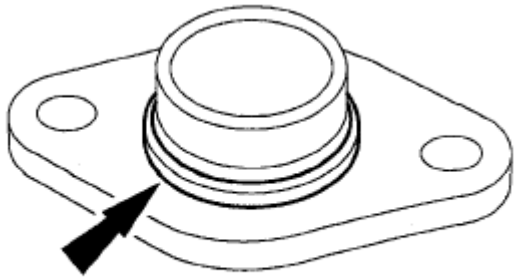


Fig. 314: Identifying Nuts And Oil Pan Baffle
Courtesy of MAZDA MOTORS CORP.

54. Install a new O-ring seal on the oil pump screen and pickup tube.
    - Lubricate the O-ring seal with clean engine oil.



A0011413

Fig. 315: Locating O-Ring Seal
Courtesy of MAZDA MOTORS CORP.

55. Install the oil pump screen and pickup tube.
    1. Position the oil pump screen and pickup tube.
    2. Install the 2 bolts and tighten to 10 N.m {1.0 kgf.m, 89 in.lbf}.

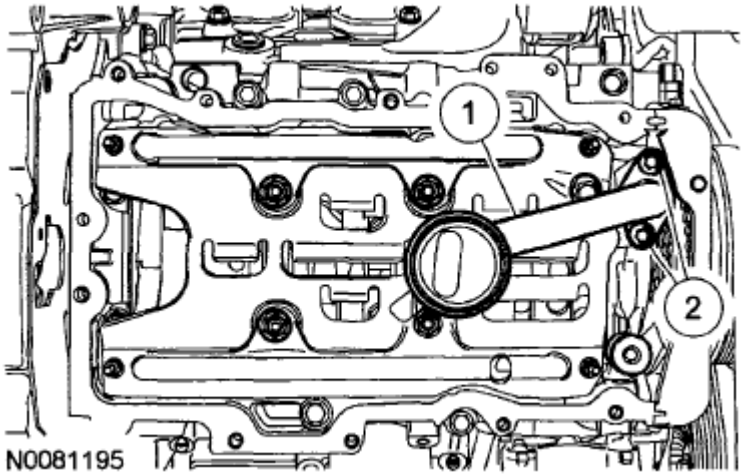


Fig. 316: Identifying Oil Pump Screen And Pickup Tube Bolts
Courtesy of MAZDA MOTORS CORP.

56. Apply an 8 mm (0.31 in) dot of silicone gasket and sealant at the cylinder block to front cover mating surface and the cam seal retainer-to-cylinder head joints.

NOTE:
- **The valve cover must be installed and the bolts and studs tightened within 4 minutes of sealant application.**

NOTE:
- **Clean cylinder head and front cover surface using metal surface prep before applying silicone gasket and sealant.**

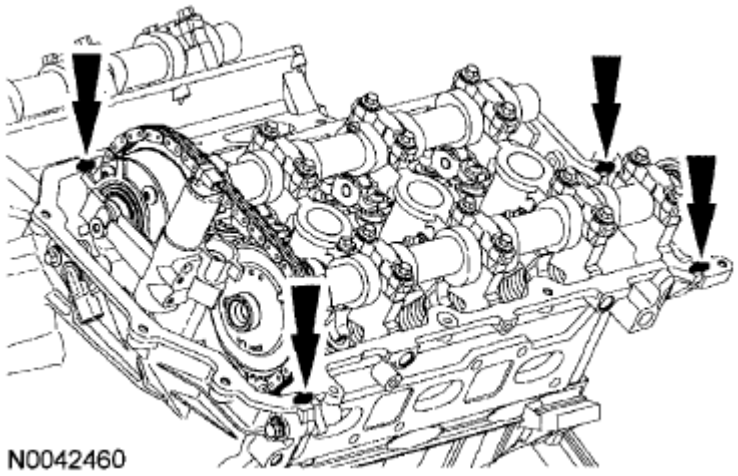


Fig. 317: Locating Silicone Gasket And Sealant
Courtesy of MAZDA MOTORS CORP.

57. Position the LH valve cover and install the bolts and stud bolts.
    - To install, tighten to 10 N.m {1.0 kgf.m, 89 in.lbf}.

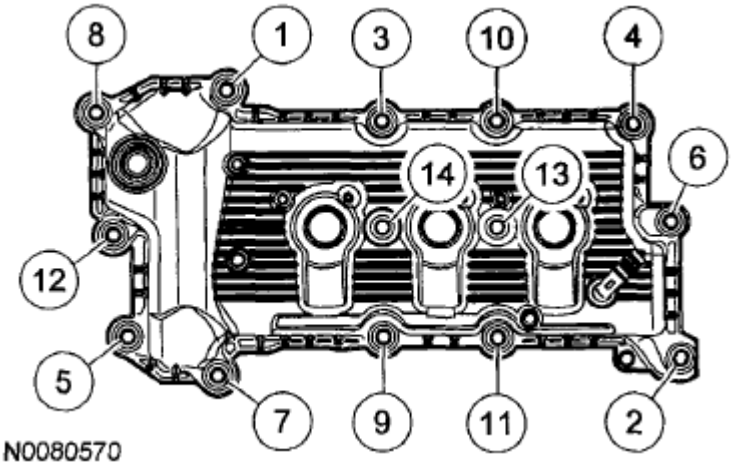


Fig. 318: Identifying LH Valve Cover, Bolts And Stud Bolts
Courtesy of MAZDA MOTORS CORP.

58. Apply an 8 mm (0.31 in) dot of silicone gasket sealant to the front cover-to-cylinder head joints.

NOTE:
- **The valve cover must be installed and the bolts and stud bolts tightened within 4 minutes of sealant application.**

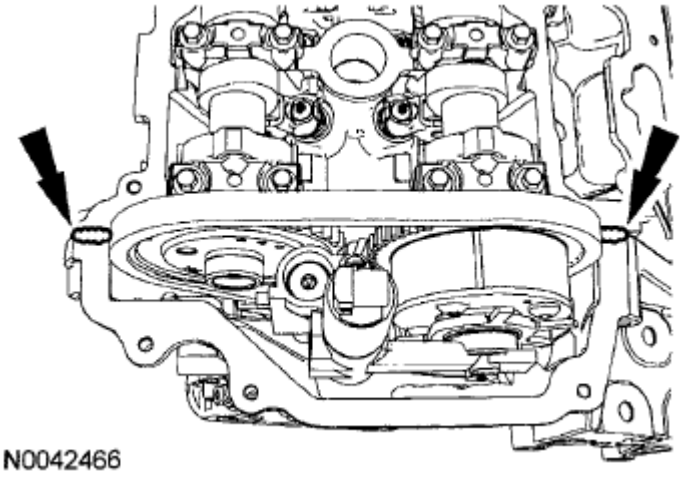


Fig. 319: Locating Silicone Gasket Sealant
Courtesy of MAZDA MOTORS CORP.

59. Position the RH valve cover and install the bolts and stud bolts.
    - To install, tighten to 10 N.m {1.0 kgf.m, 89 in.lbf}.

NOTE:
- **Install a new valve cover gasket.**

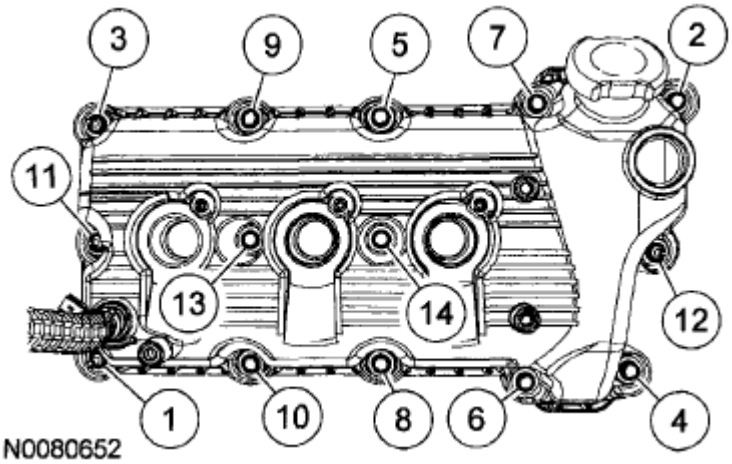


Fig. 320: Identifying RH Valve Cover, Bolts And Stud Bolts
Courtesy of MAZDA MOTORS CORP.

60. Install the radio interference capacitor and the nut.
    - To install, tighten to 6 N.m {0.6 kgf.m, 53 in.lbf}.

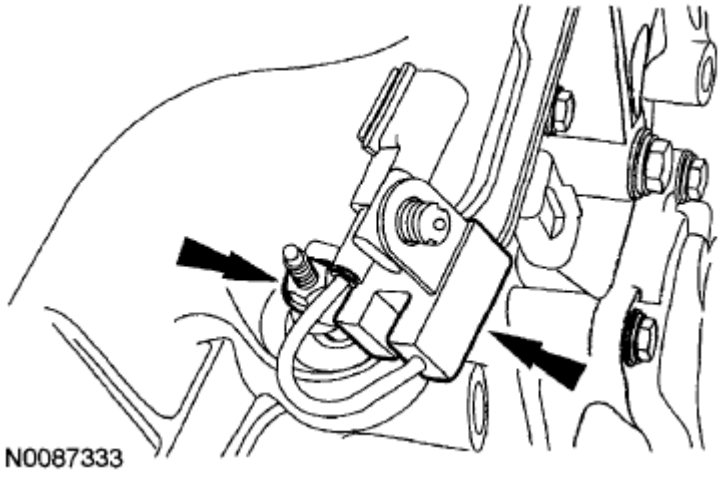


Fig. 321: Locating Radio Interference Capacitor And Nut
Courtesy of MAZDA MOTORS CORP.

61. Position the coolant pump housing and attach the coolant hose.
    - To install, tighten to 7 N.m {0.7 kgf.m, 62 in.lbf}.

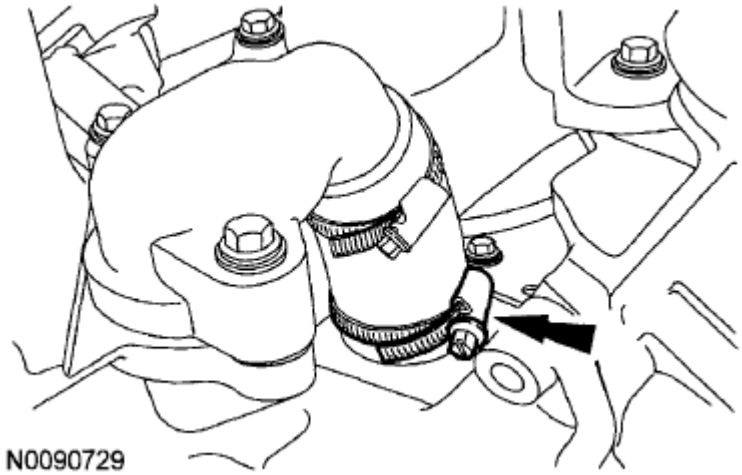


Fig. 322: Locating Coolant Hose Clamp
Courtesy of MAZDA MOTORS CORP.

62. Install the 5 coolant pump housing bolts.
    - To install, tighten to 10 N.m {1.0 kgf.m, 89 in.lbf}.

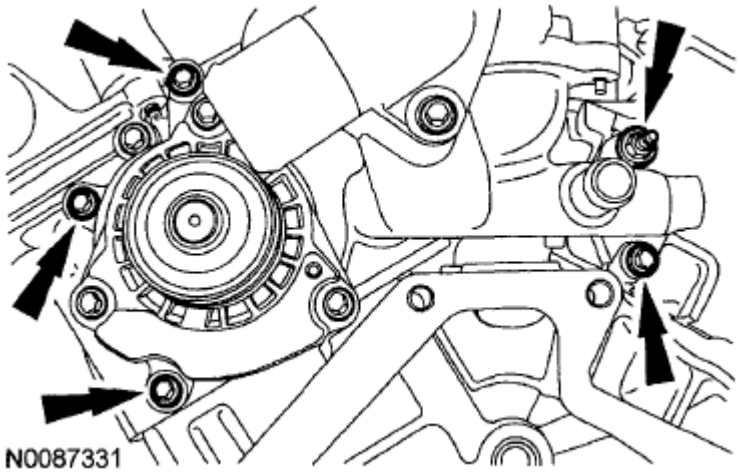


Fig. 323: Locating Coolant Pump Housing Bolts
Courtesy of MAZDA MOTORS CORP.

63. Install the Camshaft Pulley Installer in the camshaft as shown in the illustration.
    - Adjust the collar on the Camshaft Pulley Installer screw to get the best thread engagement in the rear of the camshaft.

CAUTION:
- **Failure to use the correct special tools, assembled as shown in the illustration, will result in damage to the coolant pump pulley and/or special tools.**

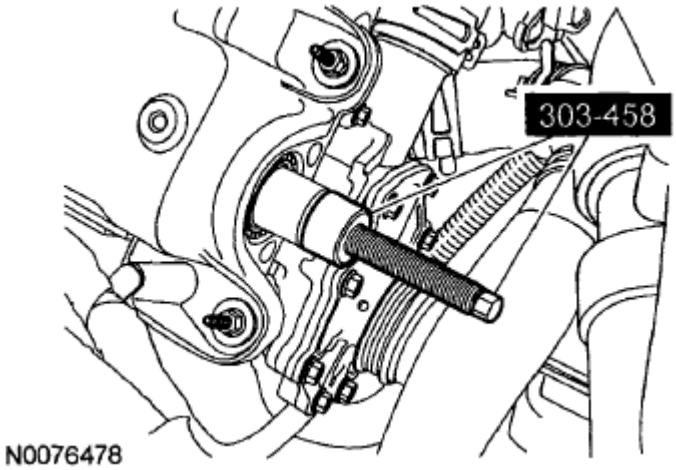


Fig. 324: Identifying Camshaft Pulley Installer
Courtesy of MAZDA MOTORS CORP.

64. Position the coolant pump pulley over the previously installed Camshaft Pulley Installer and on the end of the camshaft. Install the Camshaft Pulley Installer, Power Steering Pump Pulley Installer and the Water Pump Pulley Spacer as shown in the illustration.
    - Using the Camshaft Pulley Installer, Power Steering Pump Pulley Installer and the Water Pump

Pulley Spacer, install a new service coolant pump pulley flush with the end of the camshaft.

CAUTION:

- **Failure to use the correct special tools, assembled as shown in the illustration, will result in damage to the coolant pump pulley and/or special tools.**

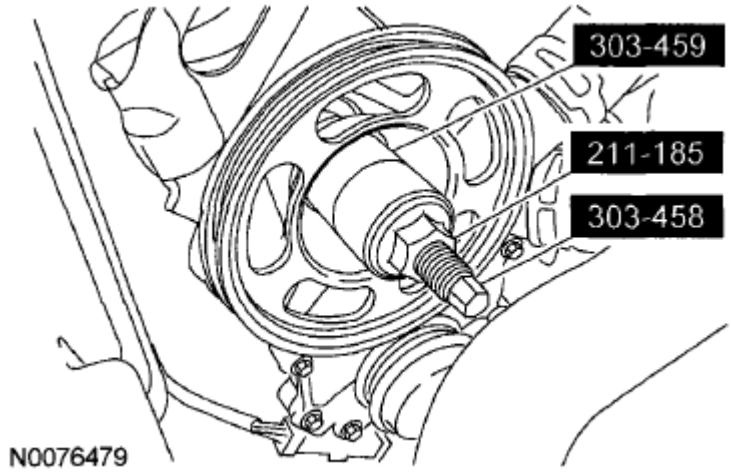


Fig. 325: Identifying Camshaft Pulley Installer
Courtesy of MAZDA MOTORS CORP.

NOTE:

- **Only the roller collared nut from the Power Steering Pump Pulley Installer (211-185) is used on Camshaft Pulley Installer (303-485).**

65. Install the coolant pump belt on the coolant pump pulley and position it on the camshaft pulley.

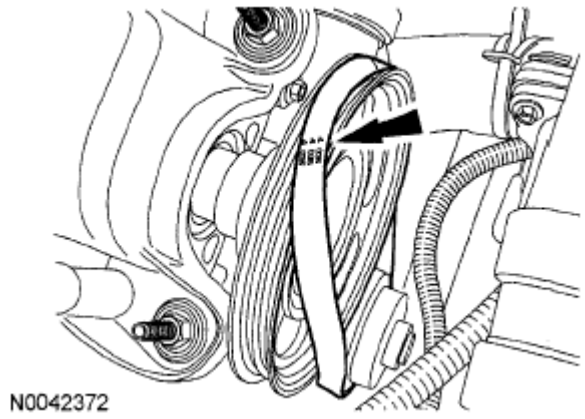


Fig. 326: Locating Water Pump Belt Marks
Courtesy of MAZDA MOTORS CORP.

66. Rotate the crankshaft clockwise to seat the water pump belt on the camshaft pulley.

CAUTION:
- **Do not use any screwdrivers, pliers or other metal objects that could cause damage to the belt or camshaft pulley while installing the belt.**

67. Lubricate the O-ring seal with clean engine oil and install the oil filter.
    - Tighten to 5 N.m {0.5 kgf.m, 44 in.lbf} and then rotate an additional 180 degrees.

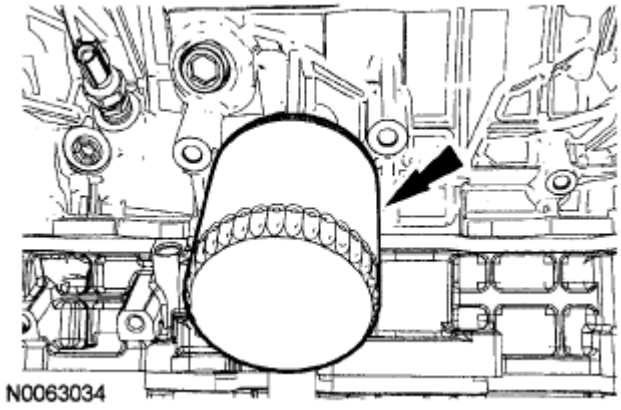


Fig. 327: Locating Oil Filter
Courtesy of MAZDA MOTORS CORP.

68. Install the Engine Oil Pressure (EOP) switch and, if equipped, the block heater.
    - Tighten the EOP switch to 14 N.m {1.4 kgf.m, 124 in.lbf}
    - Tighten the block heater to 21 N.m {2.1 kgf.m, 15 ft.lbf}.

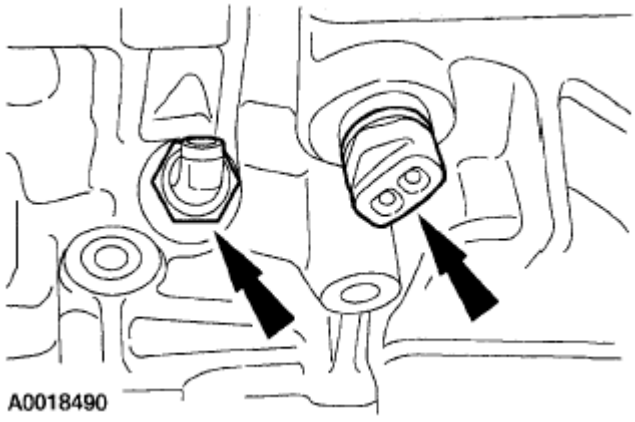


Fig. 328: Locating EOP Switch And Block Heater
Courtesy of MAZDA MOTORS CORP.

69. Install 6 new LH catalytic converter studs.
    - To install, tighten to 12 N.m {1.2 kgf.m, 106 in.lbf}.

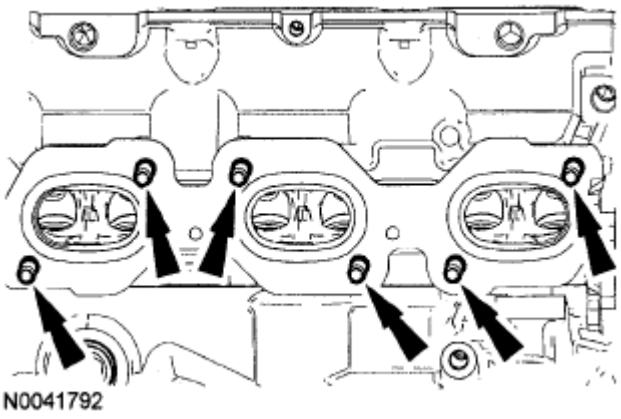


Fig. 329: Locating LH Catalytic Converter Studs
Courtesy of MAZDA MOTORS CORP.

70. Install a new gasket and the LH catalytic converter and 6 new nuts.
    - Tighten in the sequence shown in the figure to 20 N.m {2.0 kgf.m, 177 in.lbf}.

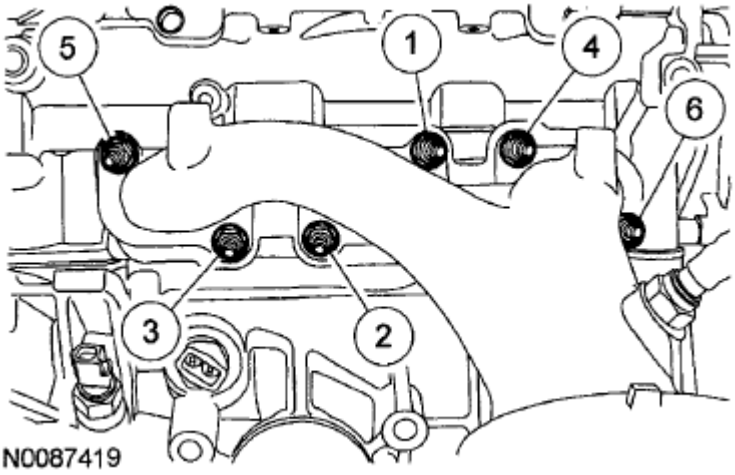


Fig. 330: Identifying Gasket, LH Catalytic Converter And Nuts
Courtesy of MAZDA MOTORS CORP.

71. Install a new O-ring on the oil level indicator tube. Apply clean engine oil to the O-ring.

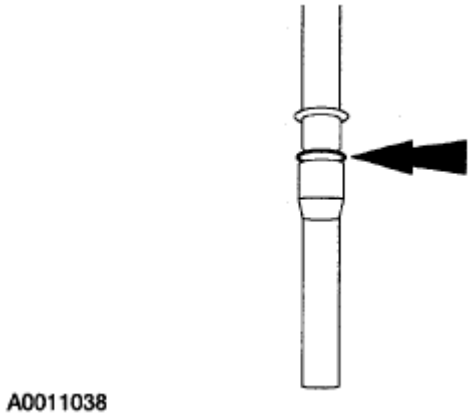


Fig. 331: Locating O-Ring On Oil Level Indicator Tube
Courtesy of MAZDA MOTORS CORP.

72. Position the oil level indicator and tube and install the stud bolt.
    - Tighten to 10 N.m {1.0 kgf.m, 89 in.lbf}.

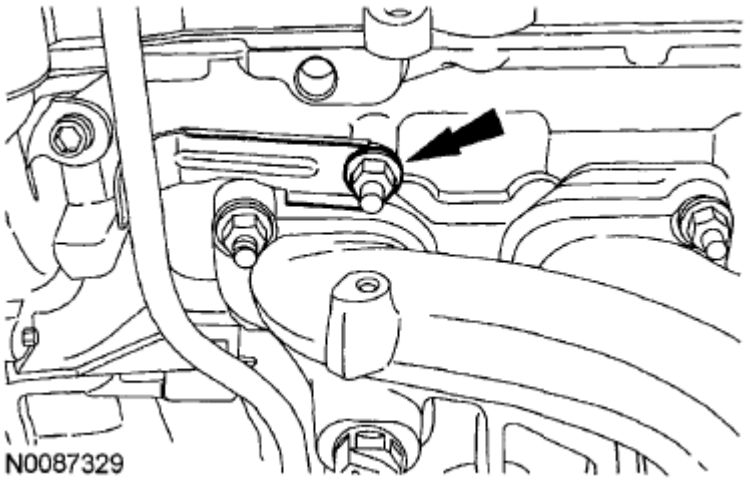


Fig. 332: Locating Oil Level Indicator And Stud Bolt
Courtesy of MAZDA MOTORS CORP.

73. Install the 3 bolts and the LH heat shield.
    - Tighten to 10 N.m {1.0 kgf.m, 89 in.lbf}.

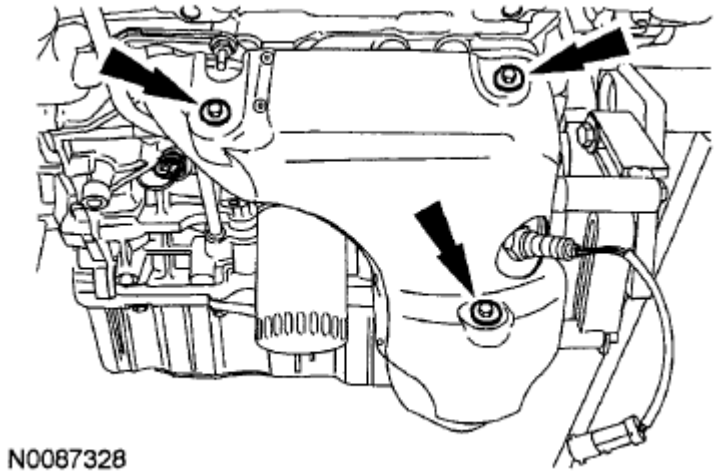


Fig. 333: Locating Bolts And LH Heat Shield
Courtesy of MAZDA MOTORS CORP.

74. Install the 3 bolts and the A/C compressor bracket.
    - Tighten to 25 N.m {2.5 kgf.m, 18 ft.lbf}.

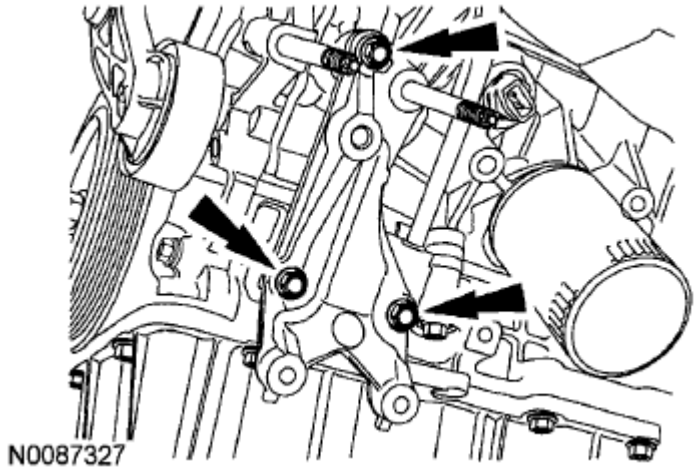


Fig. 334: Locating Bolts And A/C Compressor Bracket
Courtesy of MAZDA MOTORS CORP.

75. Position the generator and install the bolt and 2 nuts.
    - Tighten to 10 N.m {1.0 kgf.m, 89 in.lbf}.

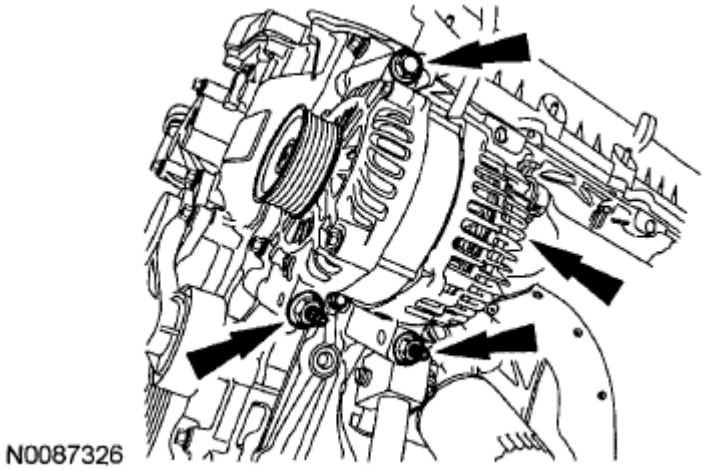


Fig. 335: Locating Bolt, Nuts And Generator
Courtesy of MAZDA MOTORS CORP.

FWD vehicles

76. Install 6 new RH exhaust manifold studs.
    - Tighten to 12 N.m {1.2 kgf.m, 106 ft.lbf}.

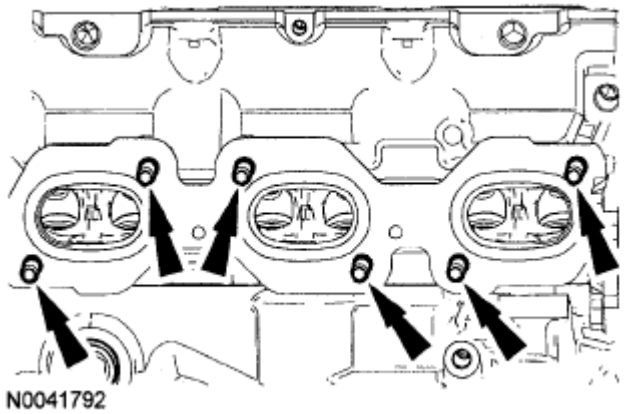


Fig. 336: Locating RH Exhaust Manifold Studs
Courtesy of MAZDA MOTORS CORP.

77. Install a new gasket and the RH exhaust manifold and new nuts.
    - Stage 1: Tighten to 20 N.m {2.0 kgf.m, 177 in.lbf}.
    - Stage 2: Tighten to 20 N.m {2.0 kgf.m, 177 in.lbf}.

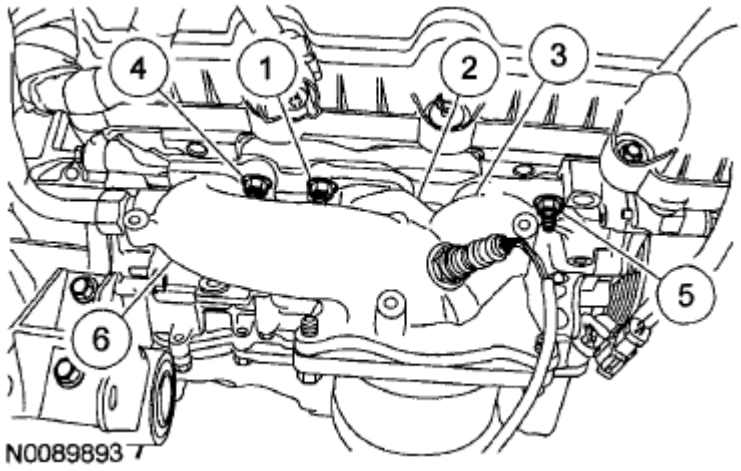


Fig. 337: Identifying Gasket, RH Exhaust Manifold And Nuts
Courtesy of MAZDA MOTORS CORP.

78. Install a new gasket and the RH catalytic converter and the 3 new nuts.
    - Tighten to 40 N.m {4.0 kgf.m, 30 ft.lbf}.

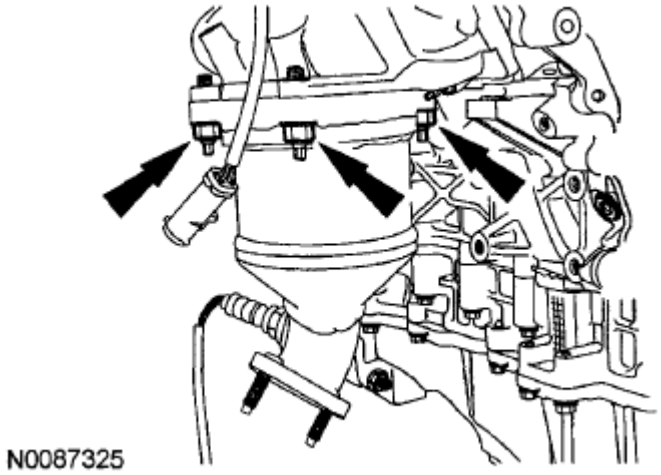


Fig. 338: Locating Gasket, Catalytic Converter And Nuts
Courtesy of MAZDA MOTORS CORP.

79. Install the 3 bolts and the RH heat shield.
    - Tighten to 10 N.m {1.0 kgf.m, 89 in.lbf}.

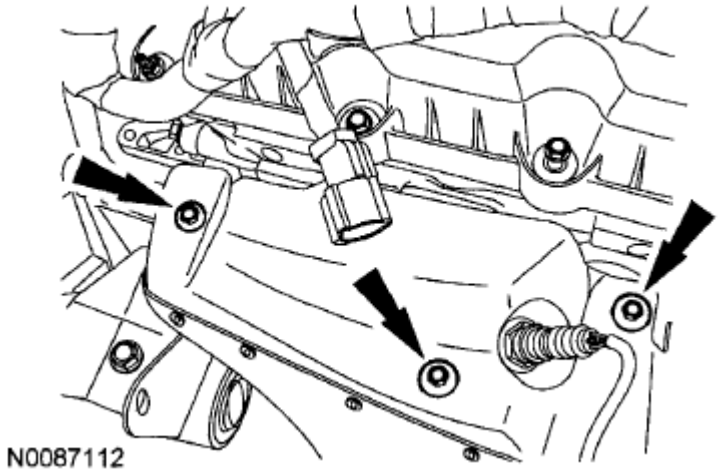


Fig. 339: Locating Bolts And RH Heat Shield
Courtesy of MAZDA MOTORS CORP.

80. Connect the RH Heated Oxygen Sensor (HO2S) electrical connector.

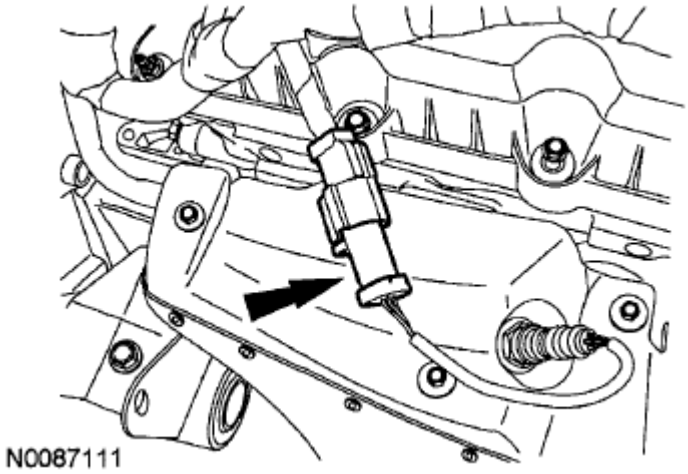


Fig. 340: Locating RH Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of MAZDA MOTORS CORP.

All vehicles

81. Install the 6 coil-on-plugs and the bolts.
    - To install, tighten to 6 N.m {0.6 kgf.m, 53 in.lbf}.

NOTE:
- **LH shown in the figure, RH similar.**

NOTE:
- **Apply a light film of silicone brake caliper grease and dielectric compound to the interior of the spark plug boot prior to installation.**

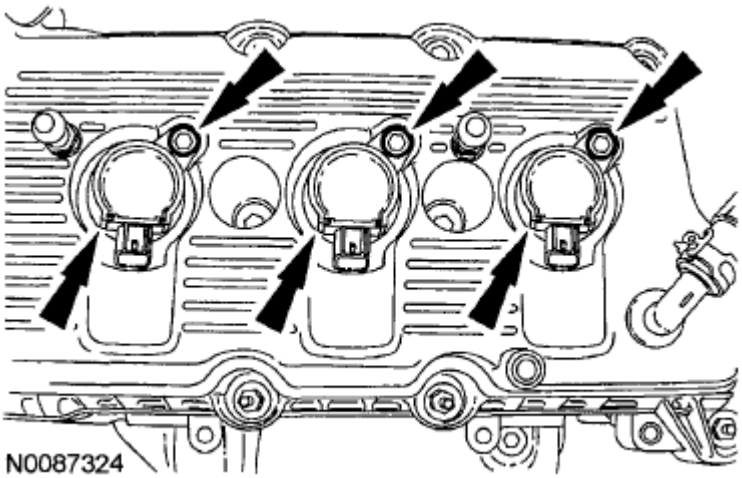


Fig. 341: Locating Bolts And Coil-On-Plugs
Courtesy of MAZDA MOTORS CORP.

82. Position the lower intake manifold and install the 8 bolts.
    - Tighten in the sequence shown in the figure to 10 N.m {1.0 kgf.m, 89 in.lbf}.

NOTE:
- **Clean and inspect all sealing surfaces. Install new gaskets.**

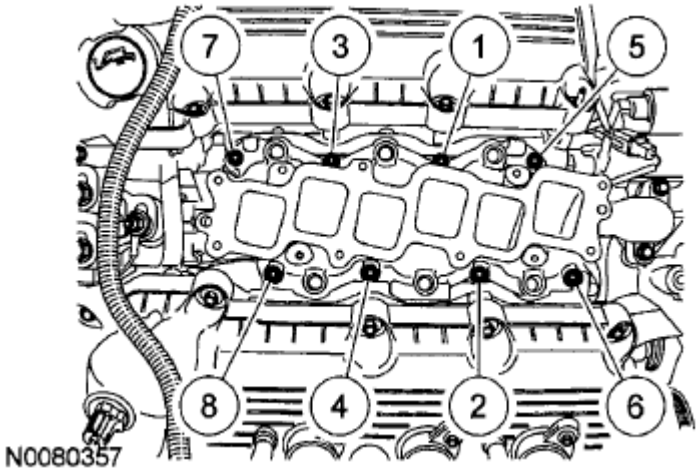


Fig. 342: Identifying Lower Intake Manifold Bolts In Sequence
Courtesy of MAZDA MOTORS CORP.

83. Install new fuel injector O-rings.
    - Separate the fuel injectors from the fuel rail.
    - Remove and discard the fuel injector O-rings.
    - Install new O-rings and lubricate with clean engine oil.
    - Install the fuel injectors onto the fuel rail.

CAUTION:
- **Use O-ring seals that are made of special fuel-resistant material. Use of ordinary O-rings can cause the fuel system to leak. Do not reuse the O-ring seals.**

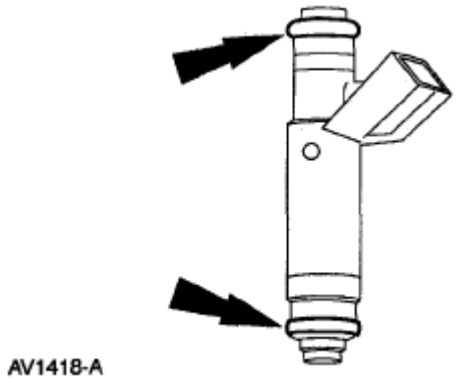


Fig. 343: Locating O-Ring Seals
Courtesy of MAZDA MOTORS CORP.

84. Install the 4 bolts and the fuel rail and injectors assembly.
    - Tighten in the sequence shown in the figure to 10 N.m {1.0 kgf.m, 89 in.lbf}.

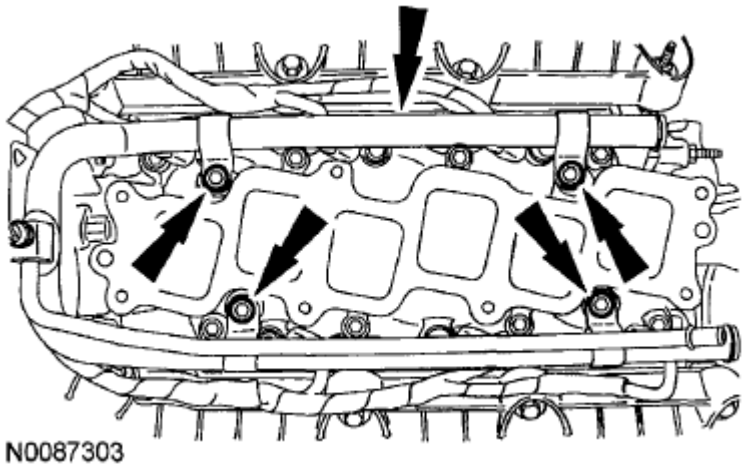


Fig. 344: Locating Bolts, Fuel Rail And Injectors
Courtesy of MAZDA MOTORS CORP.

85. Position the upper intake manifold and install the 7 bolts.
    - Tighten the bolts in 2 stages in the sequence shown in the figure.
        - Stage 1: Tighten to 10 N.m {1.0 kgf.m, 89 in.lbf}.
        - Stage 2: Tighten an additional 45 degrees.

NOTE:
- **Clean and inspect all sealing surfaces. Install new gaskets.**

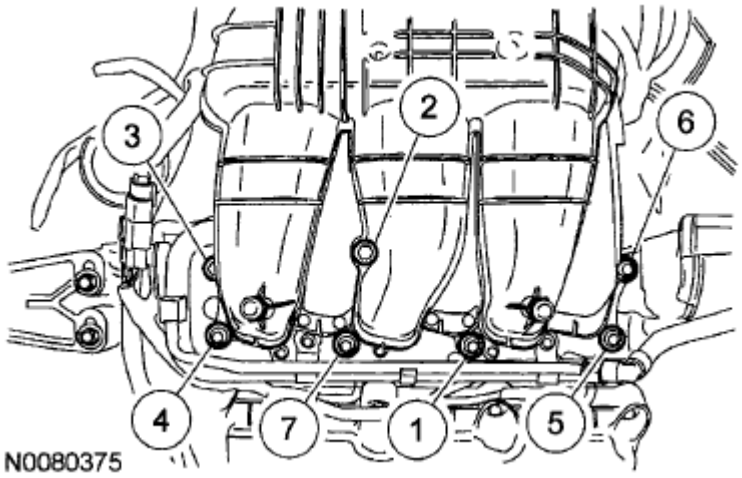


Fig. 345: Identifying Upper Intake Manifold Bolts In Sequence
Courtesy of MAZDA MOTORS CORP.

86. Loosen the upper intake manifold bracket lower bolt. Install the upper bolts (1 shown in the figure), then tighten all the bolts.
    - Tighten to 10 N.m {1.0 kgf.m, 89 in.lbf}.

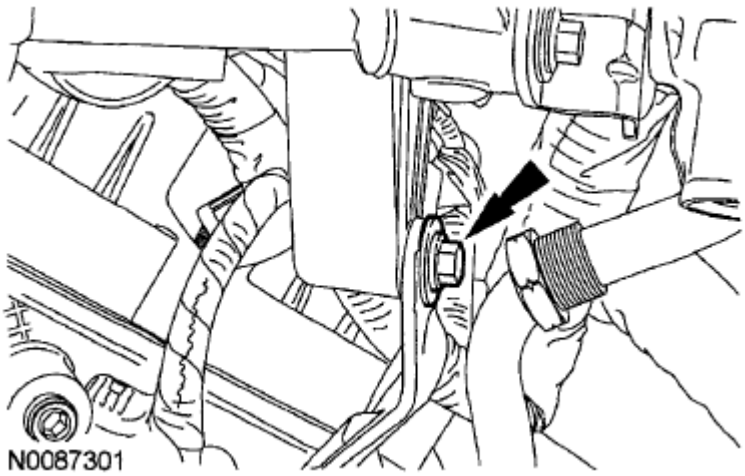


Fig. 346: Locating Upper Intake Manifold Bracket Lower Bolt
Courtesy of MAZDA MOTORS CORP.

FWD vehicles

87. Install the EGR tube fitting in the EGR valve.
    - Tighten to 40 N.m {4.0 kgf.m, 30 ft.lbf}.

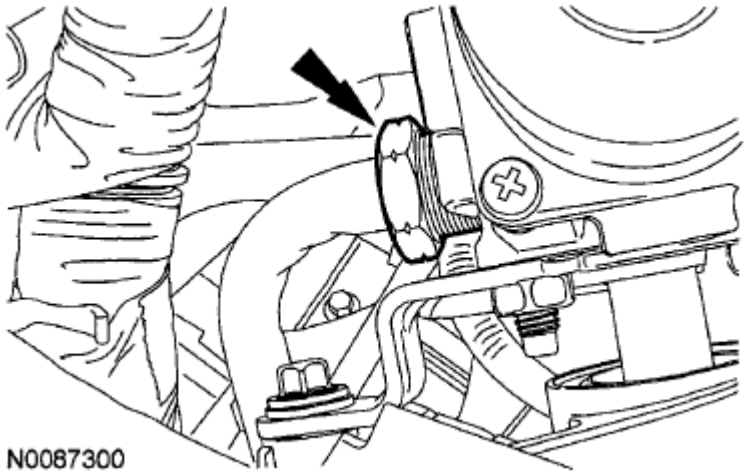


Fig. 347: Locating EGR Tube Fitting
Courtesy of MAZDA MOTORS CORP.

All vehicles

88. Position and attach the 3 B+ wiring harness retainers.

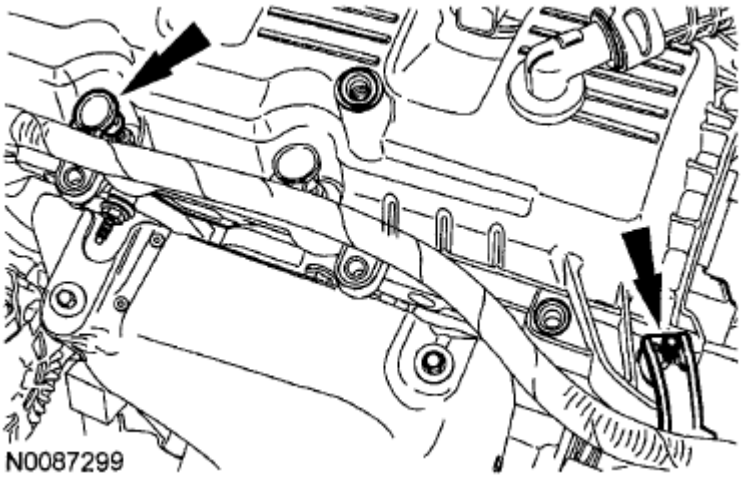


Fig. 348: Locating Hydraulic Lash Adjusters
Courtesy of MAZDA MOTORS CORP.

89. Install the B+ wire and nut on the generator.
    - Tighten to 8 N.m {8.0 kgf.m, 71 in.lbf}.

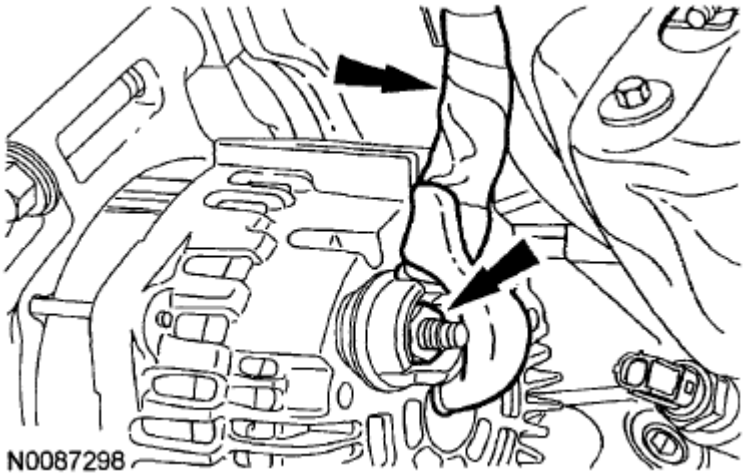


Fig. 349: Locating Nut And B+ Wire
Courtesy of MAZDA MOTORS CORP.

90. Connect the 3 LH coil-on-plug electrical connectors.
    - Attach the 2 wiring harness retainers.

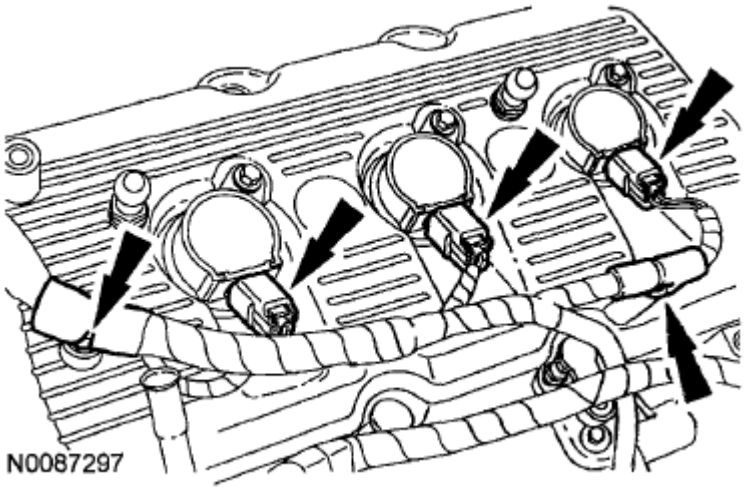


Fig. 350: Locating LH Coil-On-Plug Electrical Connectors
Courtesy of MAZDA MOTORS CORP.

91. Connect the LH Heated Oxygen Sensor (HO2S) electrical connector.

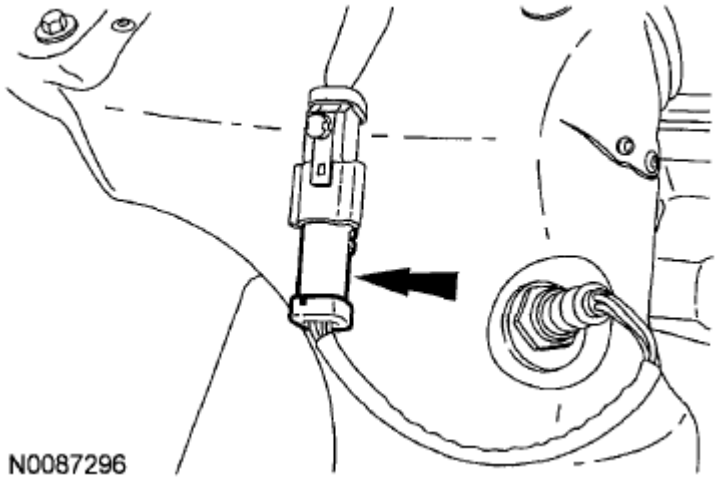


Fig. 351: Locating LH HO2S Electrical Connector
Courtesy of MAZDA MOTORS CORP.

92. Connect the Engine Oil Pressure (EOP) switch electrical connector and attach the wiring retainer.

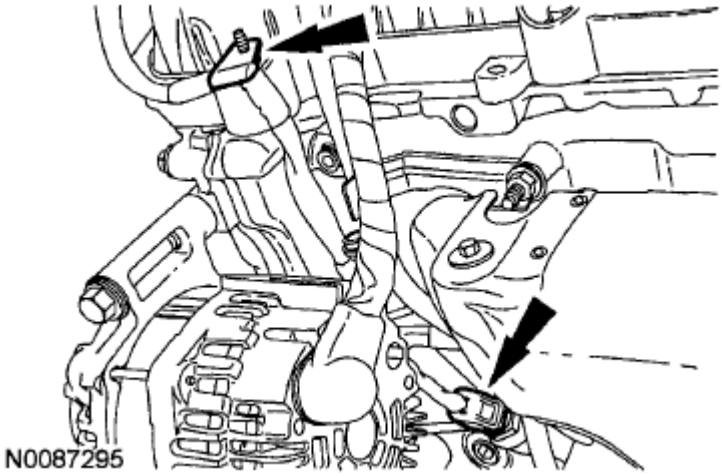


Fig. 352: Locating Engine Oil Pressure (EOP) Switch Electrical Connector And Wiring Retainer
Courtesy of MAZDA MOTORS CORP.

93. Connect the LH VCT electrical connector.

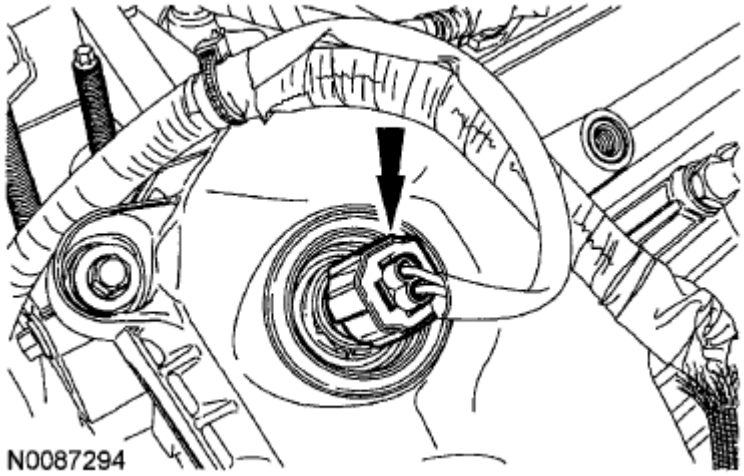


Fig. 353: Locating LH VCT Electrical Connector
Courtesy of MAZDA MOTORS CORP.

94. Connect the fuel injector wiring harness electrical connector.

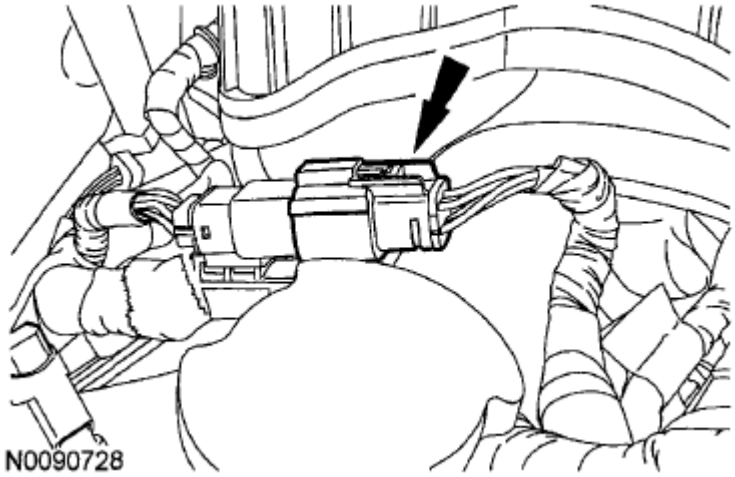


Fig. 354: Locating Fuel Injector Wiring Harness Electrical Connector
Courtesy of MAZDA MOTORS CORP.

95. Connect the 2 Camshaft Position (CMP) sensor electrical connectors and attach the wiring harness retainer from the engine front cover stud bolt.

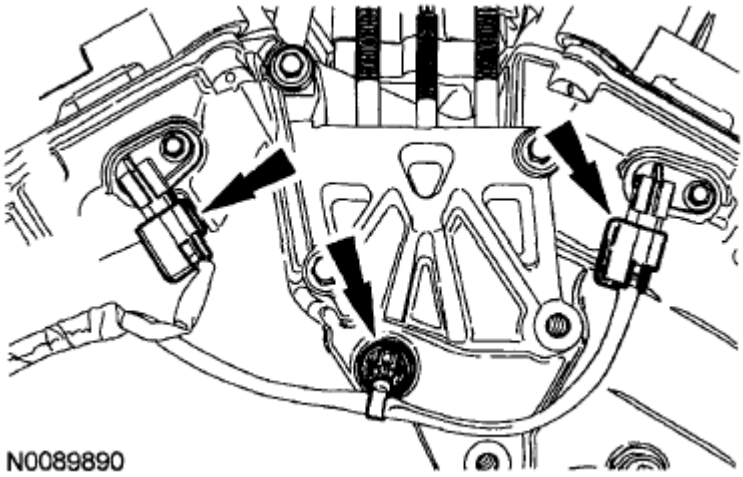


Fig. 355: Locating Camshaft Position (CMP) Sensor Electrical Connectors And Wiring Harness Retainer
Courtesy of MAZDA MOTORS CORP.

96. Connect the Crankshaft Position (CKP) sensor electrical connector and attach the 2 wiring harness retainers.

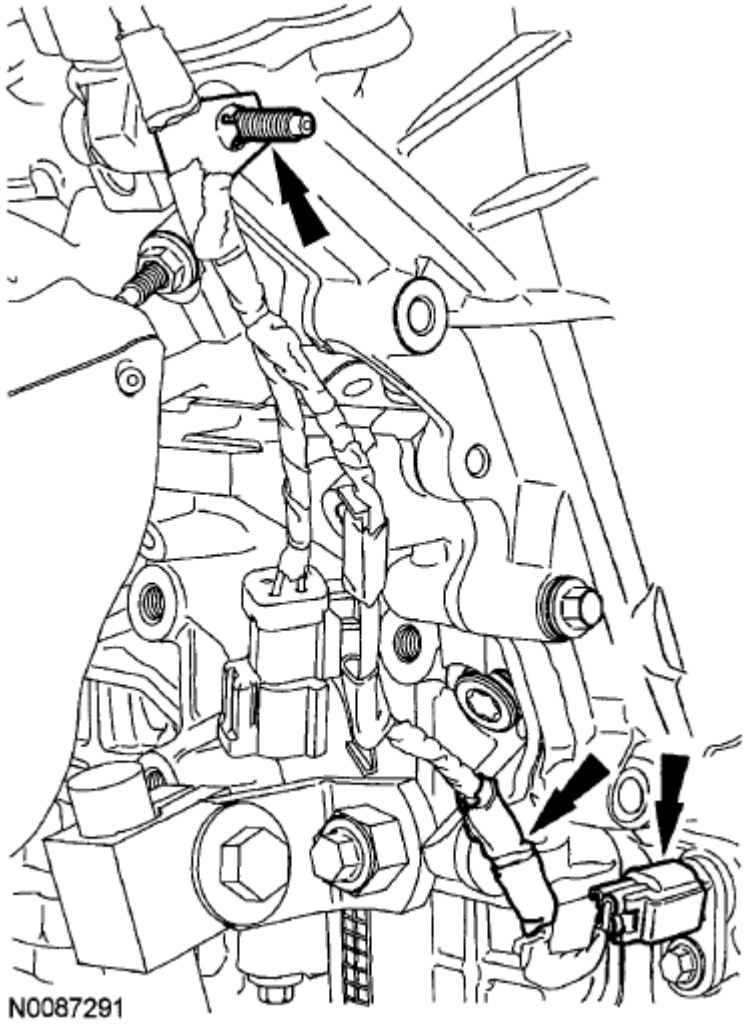


Fig. 356: Locating Crankshaft Position (CKP) Sensor Electrical Connector And Wiring Harness Retainers
Courtesy of MAZDA MOTORS CORP.

97. Connect the RH VCT electrical connector.

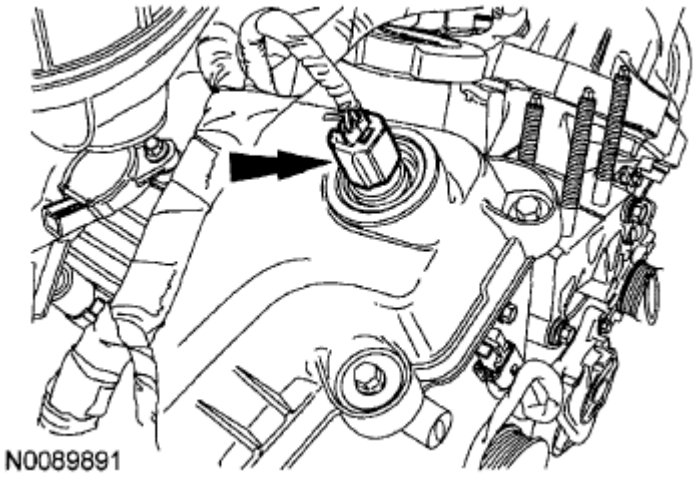


Fig. 357: Locating RH VCT Electrical Connector
Courtesy of MAZDA MOTORS CORP.

98. Connect the RH coil-on-plug electrical connectors.
    - Attach the 2 wiring harness retainers.

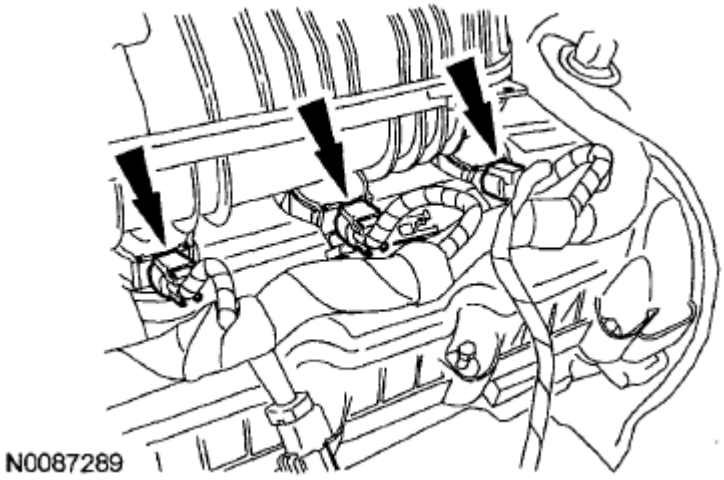


Fig. 358: Locating RH Coil-On-Plug Electrical Connectors
Courtesy of MAZDA MOTORS CORP.

FWD vehicles

99. Connect the RH HO2S electrical connector.

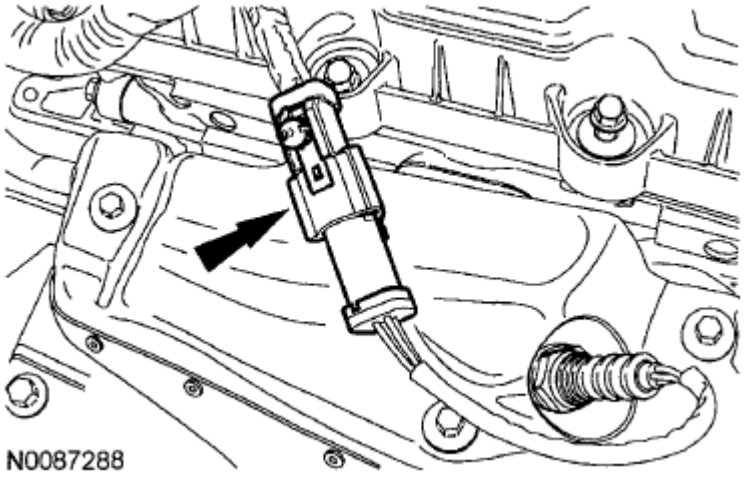


Fig. 359: Locating RH HO2S Electrical Connector
Courtesy of MAZDA MOTORS CORP.

All vehicles

100. Connect the Manifold Absolute Pressure (MAP) electrical connector and attach the wiring retainer.

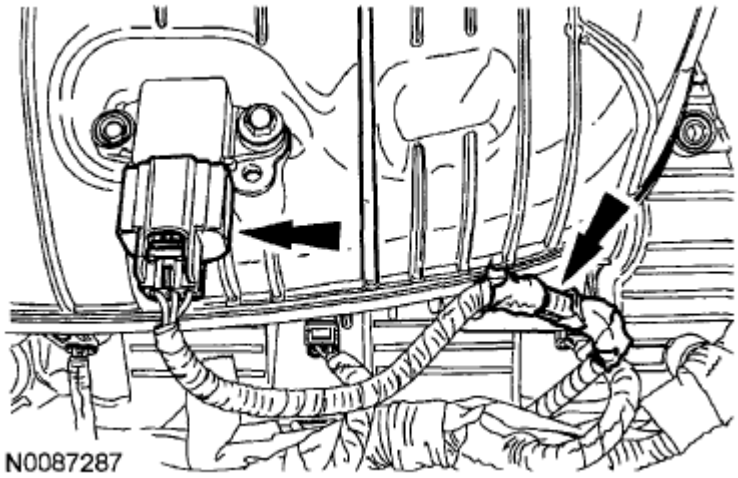


Fig. 360: Locating Manifold Absolute Pressure (MAP) Electrical Connector And Wiring Retainer
Courtesy of MAZDA MOTORS CORP.

101. Attach the wiring harness retainer to the upper intake manifold.

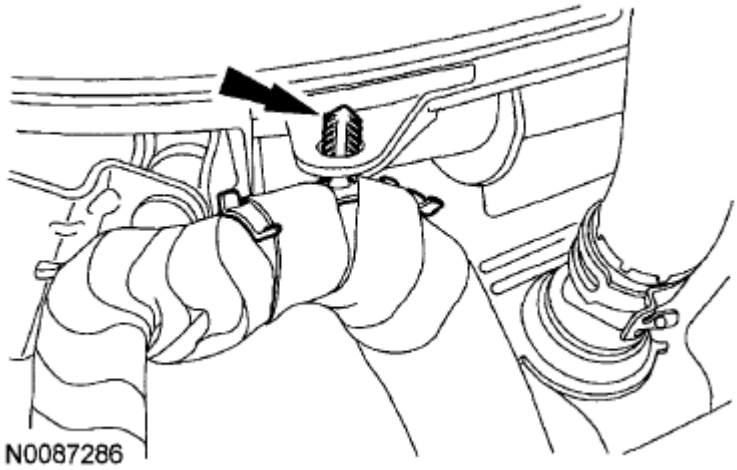


Fig. 361: Locating Wiring Harness Retainer
Courtesy of MAZDA MOTORS CORP.

102. Connect the EGR regulator electrical connector and attach the wiring retainer.

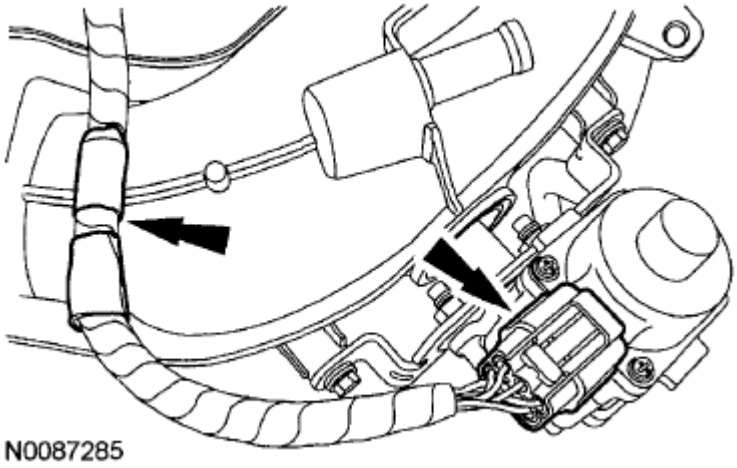


Fig. 362: Locating EGR Regulator Electrical Connector
Courtesy of MAZDA MOTORS CORP.

103. Connect the Evaporative Emission (EVAP) canister purge valve electrical connector.

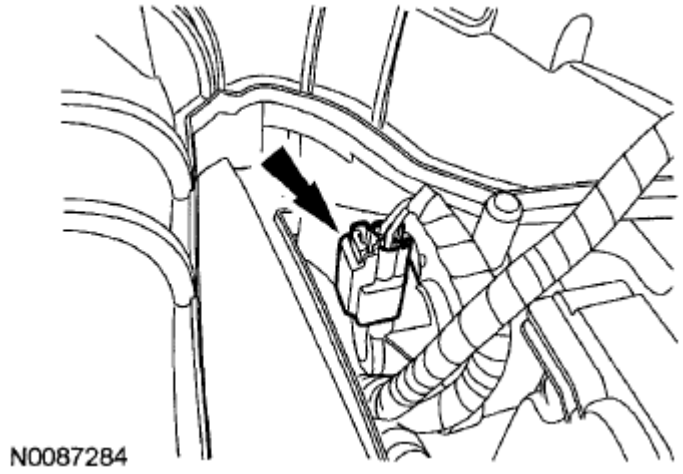


Fig. 363: Locating Evaporative Emission (EVAP) Canister Purge Valve Electrical Connector
Courtesy of MAZDA MOTORS CORP.

104. Connect the electronic throttle control electrical connector.

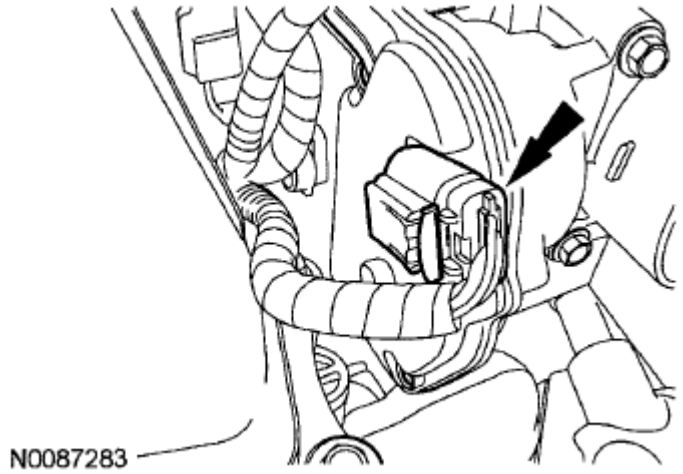


Fig. 364: Locating Electronic Throttle Control Electrical Connector
Courtesy of MAZDA MOTORS CORP.

105. Connect the engine block Knock Sensor (KS) electrical connector and attach the wire harness retainer, connect the Cylinder Head Temperature (CHT) sensor electrical connector and the cylinder head KS electrical connector.

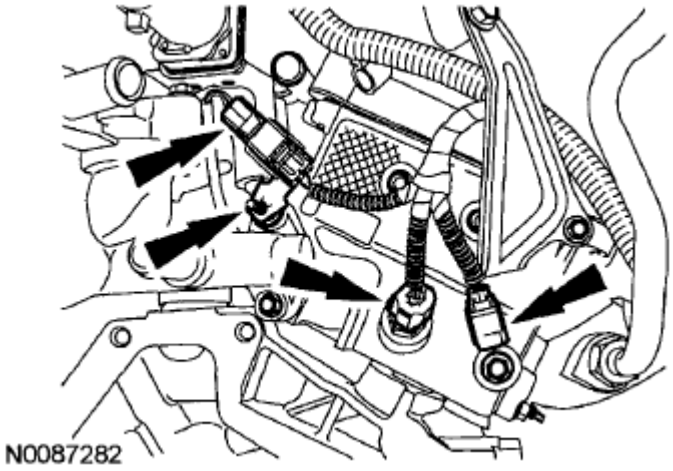


Fig. 365: Locating Engine Block Knock Sensor (KS) Electrical Connector And Wire Harness Retainer
Courtesy of MAZDA MOTORS CORP.

106. Using the Spreader Bar and the Engine Lifting Brackets, remove the engine from the engine stand.

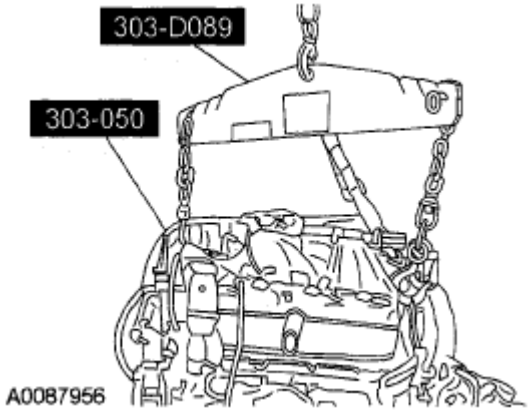


Fig. 366: Identifying Spreader Bar And Engine Lifting Brackets
Courtesy of MAZDA MOTORS CORP.

107. Using the Crankshaft Rear Main Oil Seal Installer and the Crankshaft Rear Main Oil Seal Installer Bolts, install the crankshaft rear oil seal.

NOTE:

- **Lubricate the seal lips and seal bore with clean engine oil before installing.**

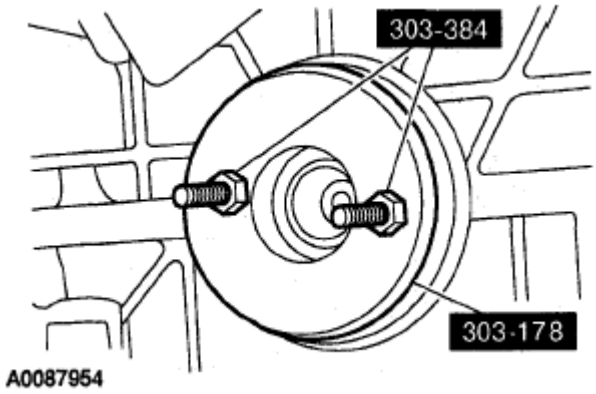


Fig. 367: Using Special Tool To Install Crankshaft Rear Oil Seal
Courtesy of MAZDA MOTORS CORP.

108. Install the engine-to-transaxle separator plate.

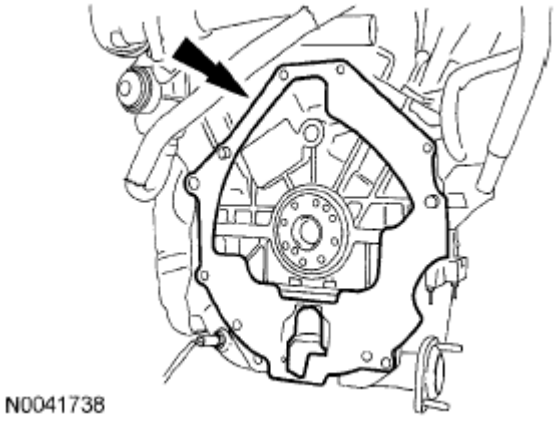


Fig. 368: Locating Engine-To-Transaxle Separator Plate
Courtesy of MAZDA MOTORS CORP.

109. Position the flexplate and install the bolts.
    - To install, tighten to 80 N.m {8.2 kgf.m, 59 ft.lbf}.

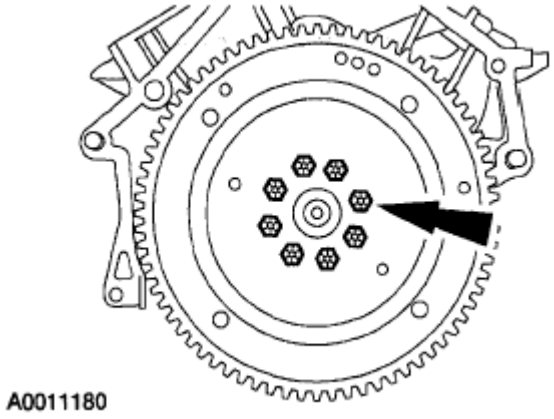


Fig. 369: Locating Bolts And Flexplate
Courtesy of MAZDA MOTORS CORP.

ENGINE - 3.0L INSTALLATION

INSTALLATION

CAUTION:
- **If the oil pan was removed during engine disassembly, it must be installed after the engine and transaxle are assembled and the transaxle-to-engine bolts are installed. Failure to follow this assembly sequence can result in engine oil leaks.**

All vehicles

1. Using the special tools, align the engine with the transaxle.

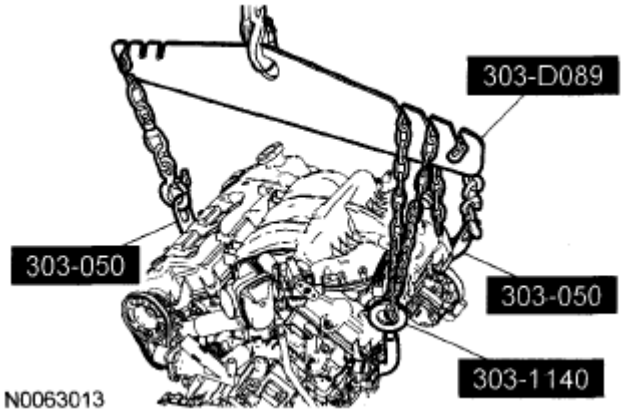


Fig. 370: Identifying Spreader Bar, Engine Lifting Brackets, Engine Lifting Bracket Set And Suitable Engine Crane
Courtesy of MAZDA MOTORS CORP.

2. Install the 5 transaxle-to-engine bolts (3 shown in the figure).

- Tighten to 48 N.m {4.9 kgf.m, 35 ft.lbf}.

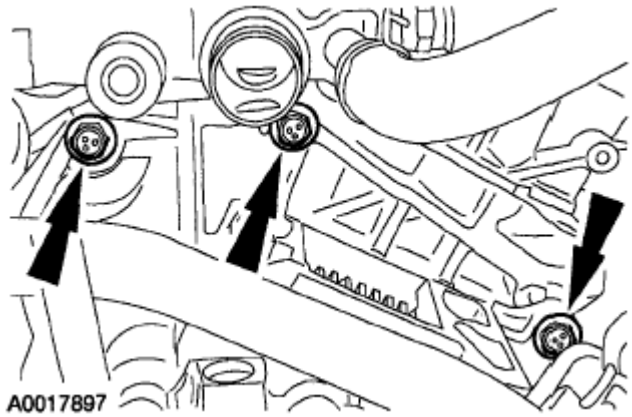
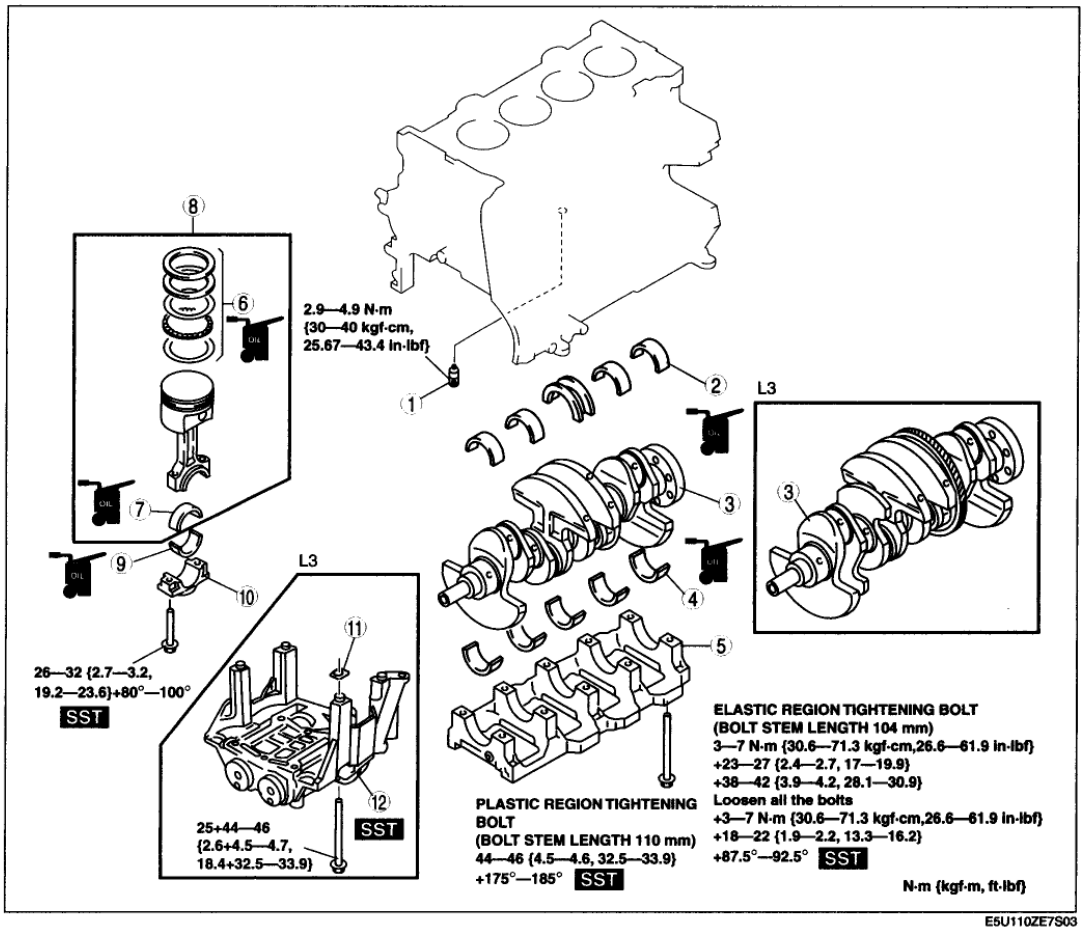


Fig. 371: Locating Transaxle-To-Engine Bolts
Courtesy of MAZDA MOTORS CORP.

3. Using the special tools, secure the engine and transaxle to the powertrain lift.



1	Oil jet valve
2	Upper main bearing, thrust bearing
3	Crankshaft
4	Lower main bearing, thrust bearing
5	Main bearing cap (See Main Bearing Cap Assembly Note)
6	Piston ring (See Piston Ring Assembly Note)
7	Upper connecting rod bearing (See Connecting Rod Bearing Assembly Note)

8	Connecting rod, piston assembly (See Piston Assembly Note)
9	Lower connecting rod bearing (See Connecting Rod Bearing Assembly Note)
10	Connecting rod cap (See Connecting Rod Cap Assembly Note)
11	Adjustment shim
12	Balancer unit (See Balancer Unit Assembly Note)

Fig. 372: Securing Engine And Transaxle To Powertrain Lift
Courtesy of MAZDA MOTORS CORP.

All wheel drive (AWD) vehicles

4. Using the Handle and PTO Driven Gear Oil Seal Installer, install the intermediate shaft seal.

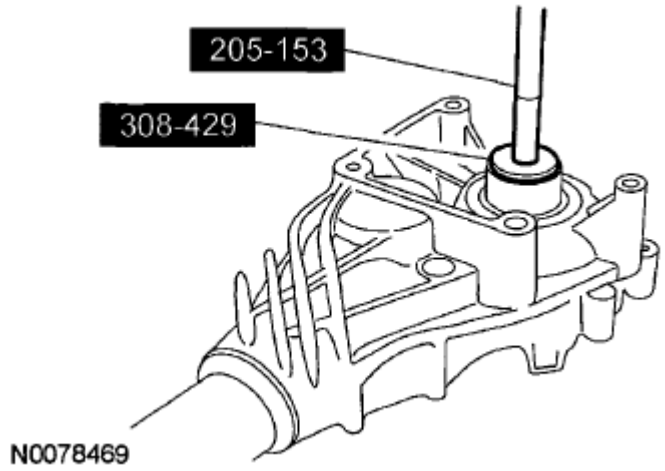


Fig. 373: Installing Intermediate Shaft Seal
Courtesy of MAZDA MOTORS CORP.

5. Install the Power Transfer Unit (PTU) heat shield and the 3 bolts.
    - Tighten to 11 N.m {1.1 kgf.m, 97 in.lbf}.

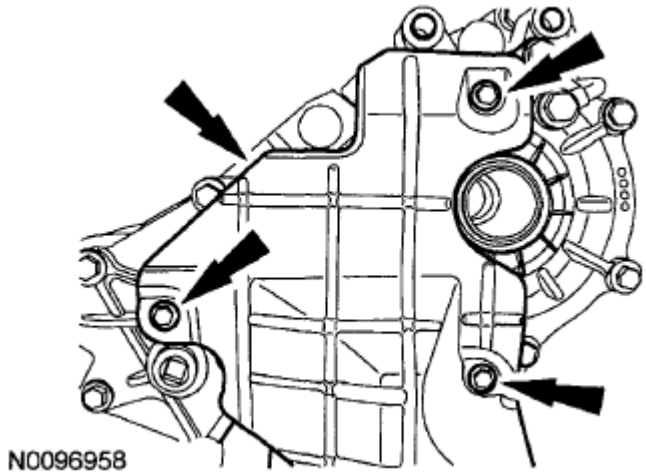


Fig. 374: Locating Power Transfer Unit (PTU) Heat Shield And Bolts
Courtesy of MAZDA MOTORS CORP.

6. Position the power transfer unit (PTU) and install the bolt.
    - Tighten to 45 N.m {4.6 kgf.m, 33 ft.lbf}.

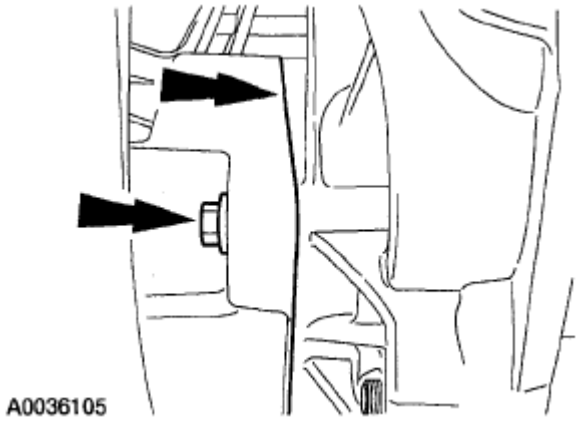


Fig. 375: Locating Power Transfer Unit (PTU) And Bolt
Courtesy of MAZDA MOTORS CORP.

7. Install the 3 PTU bolts.
    - Tighten to 45 N.m {4.6 kgf.m, 33 ft.lbf}.

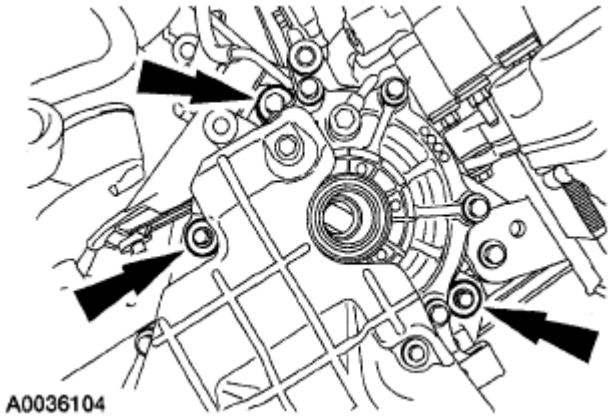


Fig. 376: Locating PTU Bolts
Courtesy of MAZDA MOTORS CORP.

8. Install the PTU vent tube, the pin-type retainer and the bolt.
    - Tighten to 14 N.m {1.4 kgf.m, 123 in.lbf}.

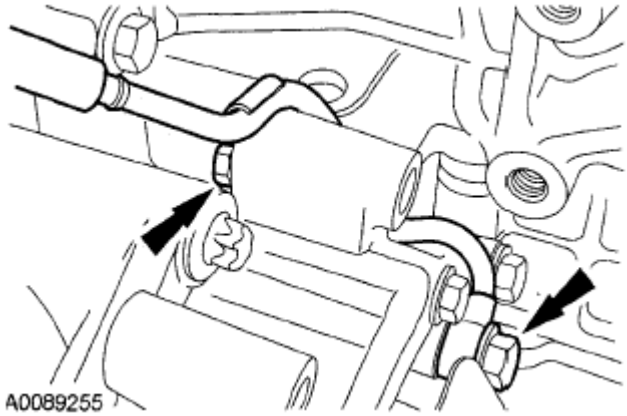


Fig. 377: Locating PTU Vent Tube, Pin-Type Retainer And Bolt
Courtesy of MAZDA MOTORS CORP.

9. Install the PTU support bracket and bolts.
    - Tighten to 55 N.m {5.5 kgf.m, 41 ft.lbf}.

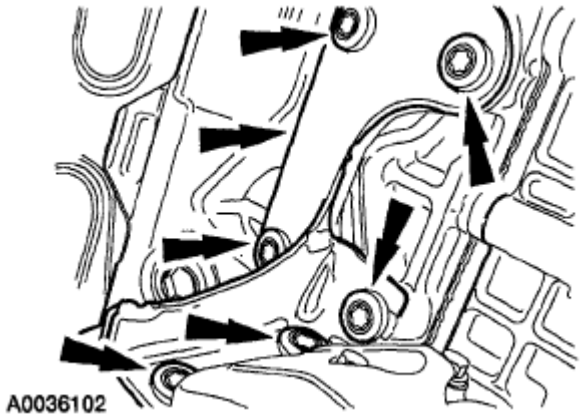


Fig. 378: Locating PTU Support Bracket And Bolts
Courtesy of MAZDA MOTORS CORP.

10. Install a new gasket and the RH catalytic converter and the 3 new nuts.
    - Tighten to 40 N.m {4.0 kgf.m, 30 ft.lbf}.

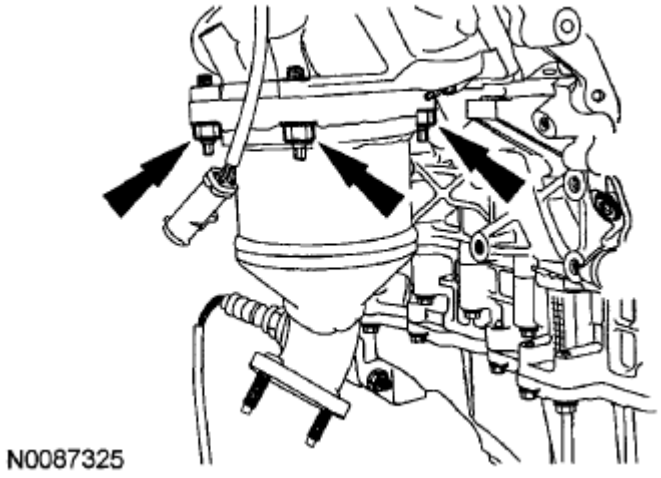


Fig. 379: Locating Gasket, Catalytic Converter And Nuts
Courtesy of MAZDA MOTORS CORP.

11. Using a new gasket, install the RH exhaust manifold and the 6 new nuts.
    - Stage 1: Tighten to 20 N.m {2.0 kgf.m, 177 in.lbf}.
    - Stage 2: Tighten to 20 N.m {2.0 kgf.m, 177 in.lbf}.

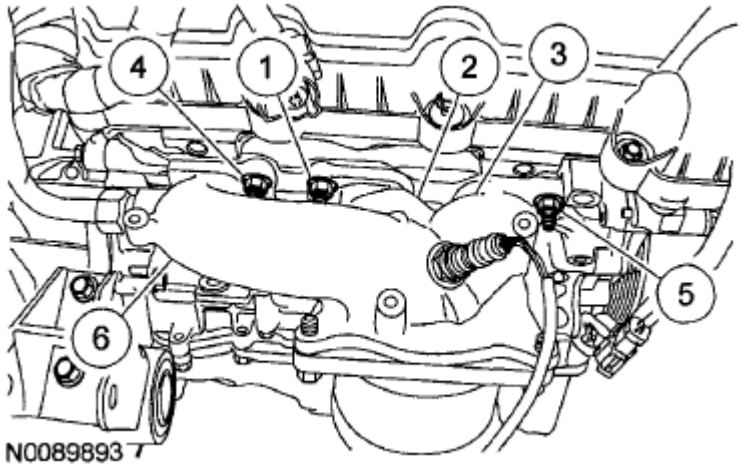


Fig. 380: Identifying RH Exhaust Manifold And Nuts
Courtesy of MAZDA MOTORS CORP.

12. Install the EGR tube fitting in the EGR valve.
    - Tighten to 40 N.m {4.0 kgf.m, 30 ft.lbf}.

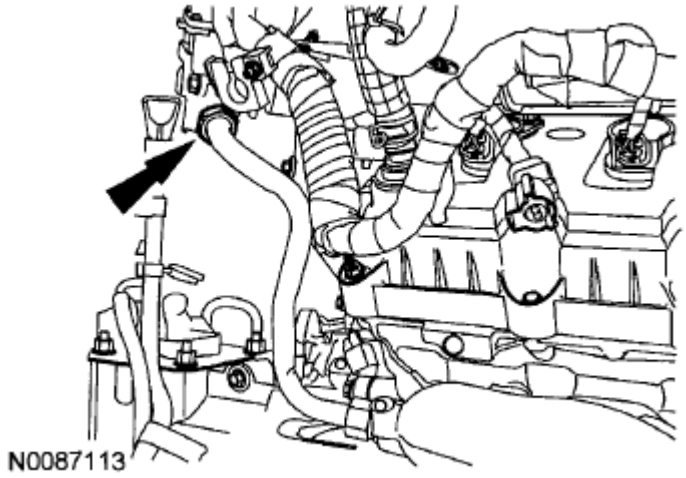


Fig. 381: Locating EGR Tube Fitting
Courtesy of MAZDA MOTORS CORP.

13. Install the 3 bolts and the RH heat shield.
    - Tighten to 10 N.m {1.0 kgf.m, 89 in.lbf}.

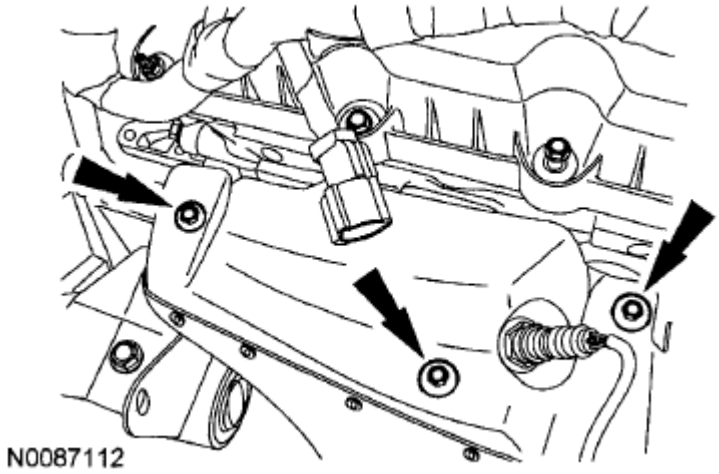


Fig. 382: Locating Bolts And RH Heat Shield
Courtesy of MAZDA MOTORS CORP.

14. Connect the RH Heated Oxygen Sensor (HO2S) electrical connector.

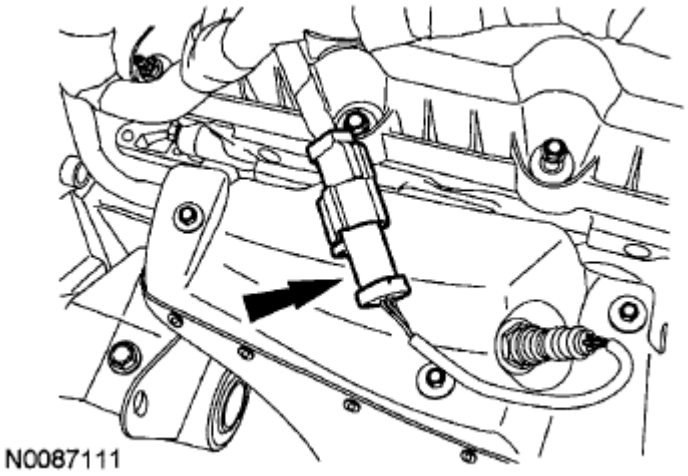


Fig. 383: Locating RH Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of MAZDA MOTORS CORP.

All vehicles

15. Install the 2 stud bolts and the starter.
    - Tighten to 27 N.m {2.7 kgf.m, 20 ft.lbf}.

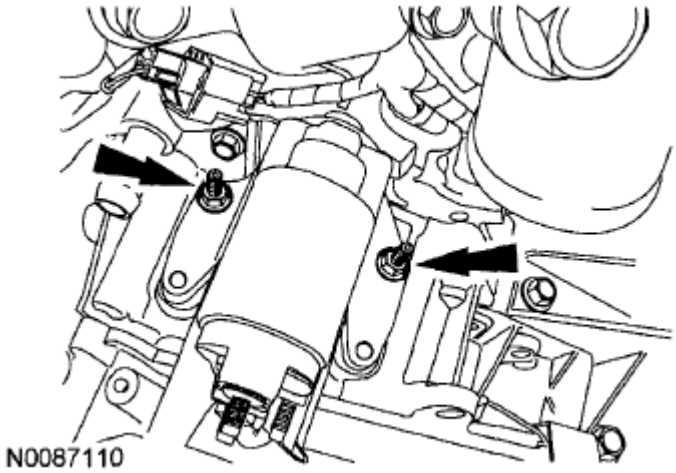


Fig. 384: Locating Stud Bolts And Starter
Courtesy of MAZDA MOTORS CORP.

16. Install the 2 nuts and the starter wiring.
    - Tighten the small starter motor solenoid wire nut to 5 N.m {0.5 kgf.m, 44 in.lbf}.
    - Tighten the large starter motor solenoid battery cable nut to 12 N.m {1.2 kgf.m, 106 in.lbf}.

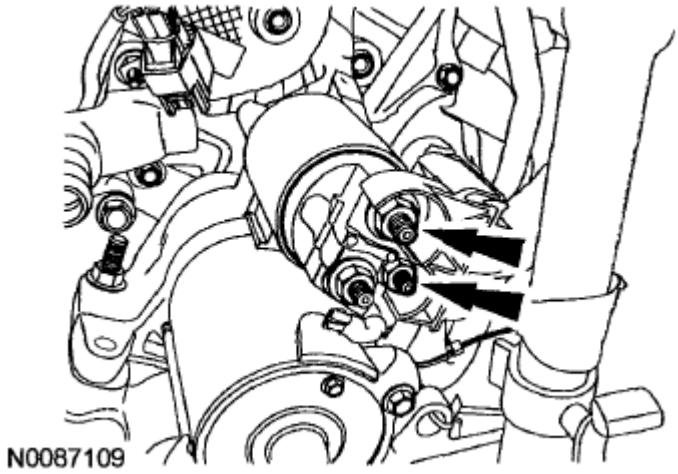


Fig. 385: Locating Nuts And Starter Wiring
Courtesy of MAZDA MOTORS CORP.

17. Install the nut and the starter wiring ground.
    - Tighten to 18 N.m {1.8 kgf.m, 159 in.lbf}.
18. Position the powertrain into the vehicle.

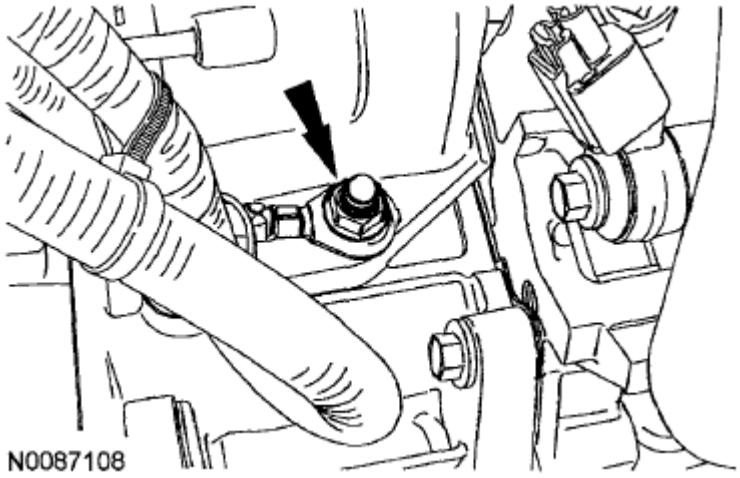


Fig. 386: Locating Nut And Starter Wiring Ground
Courtesy of MAZDA MOTORS CORP.

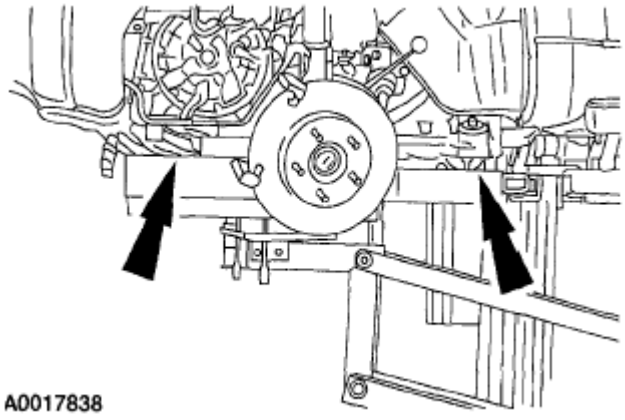


Fig. 387: Locating Powertrain Into Vehicle
Courtesy of MAZDA MOTORS CORP.

19. Install the engine support bracket, the bolt and the 3 nuts.
    - Tighten the nuts 55 N.m {5.5 kgf.m, 41 ft.lbf}.
    - Tighten the bolt 90 N.m {9.0 kgf.m, 66 ft.lbf}.
20. Install the rear transaxle support through bolt.
    - Tighten the bolt 103 N.m {10.3 kgf.m, 76 ft.lbf}.
21. Position the RH transaxle support insulator and install the bolt and nuts.
    - Tighten to 80 N.m {8.0 kgf.m, 59 ft.lbf} and the bolt to 90 N.m {9.2 kgf.m, 66 ft.lbf}.

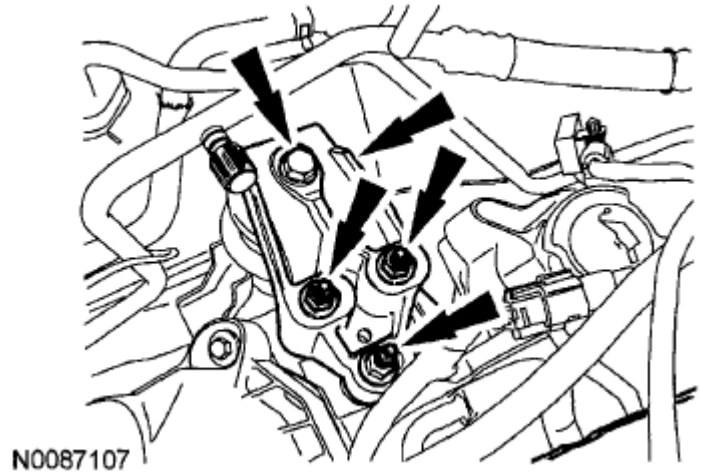


Fig. 388: Locating Engine Support Bracket Nuts And Bolt
Courtesy of MAZDA MOTORS CORP.

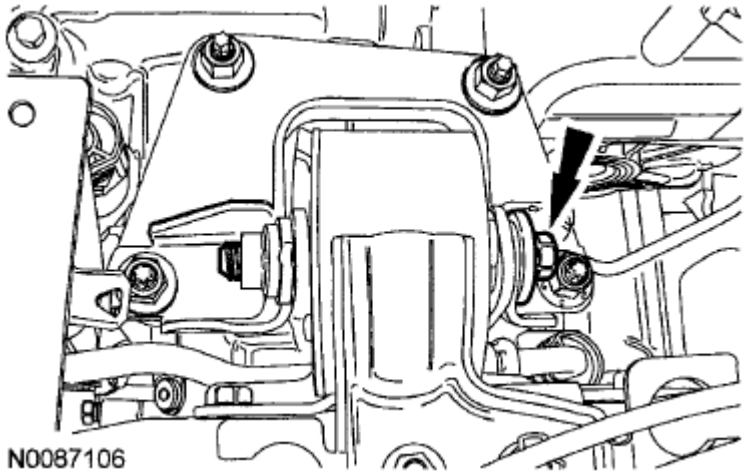


Fig. 389: Locating Rear Transaxle Support Through Bolt
Courtesy of MAZDA MOTORS CORP.

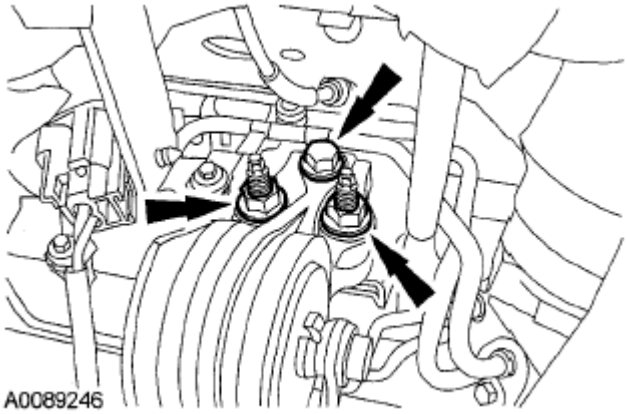


Fig. 390: Locating Bolt, Nuts And RH Transaxle Support Insulator
Courtesy of MAZDA MOTORS CORP.

22. Install the RH transaxle support insulator through bolt.
    - Tighten to 115 N.m {11.5 kgf.m, 85 ft.lbf}

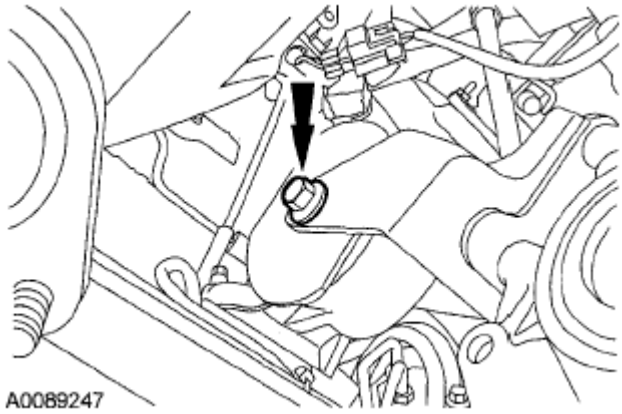


Fig. 391: Locating RH Transaxle Support Insulator Through Bolt
Courtesy of MAZDA MOTORS CORP.

23. Install the 3 bolts and the halfshaft support bracket.
    - Tighten to 48 N.m {4.8 kgf.m, 35 ft.lbf}

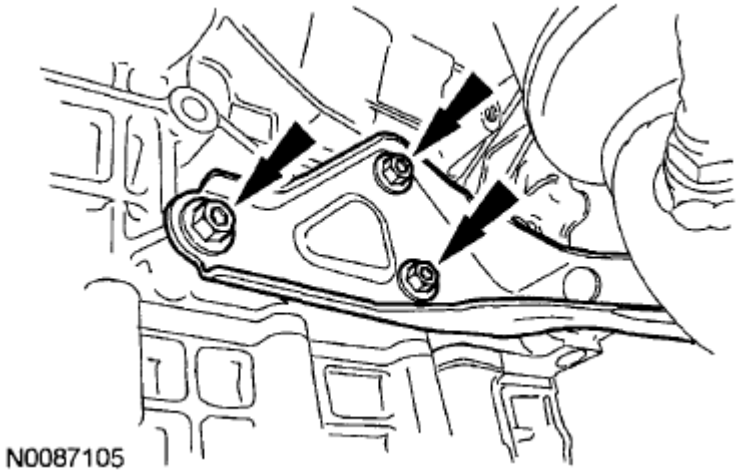


Fig. 392: Locating Bolts And Halfshaft Support Bracket
Courtesy of MAZDA MOTORS CORP.

24. Install the transaxle-to-engine stud and 2 nuts.
    - Tighten to 48 N.m {4.8 kgf.m, 35 ft.lbf}

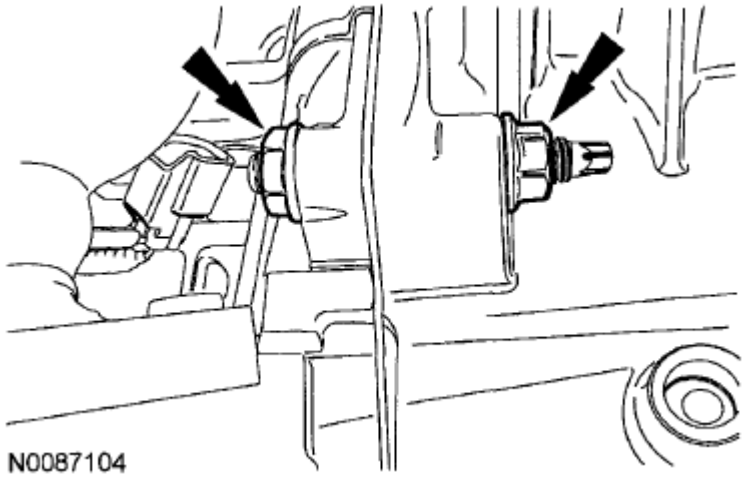


Fig. 393: Locating Transaxle-To-Engine Stud And Nuts
Courtesy of MAZDA MOTORS CORP.

25. Apply a 10 mm (0.39 in) dot of silicone gasket and sealant to the front cover-to-cylinder block sealing surface.

NOTE:
- **Clean and degrease all sealing surfaces with metal surface prep.**

NOTE:
- **The oil pan must be installed and the bolts tightened within 4 minutes of the sealant application.**

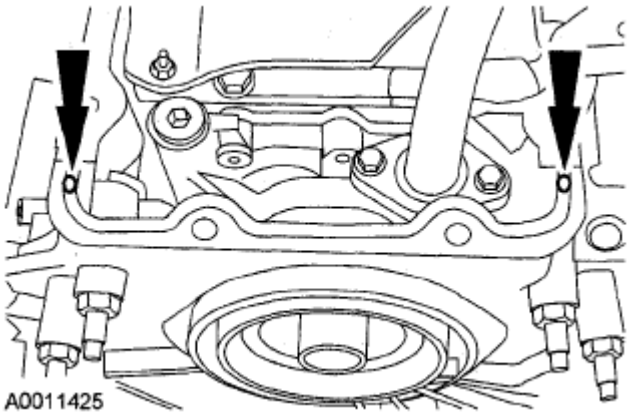


Fig. 394: Locating Dot Of Silicone Gasket
Courtesy of MAZDA MOTORS CORP.

26. Position the oil pan and gasket and loosely install the bolts and stud bolts.

NOTE:
- **Install a new oil pan gasket.**

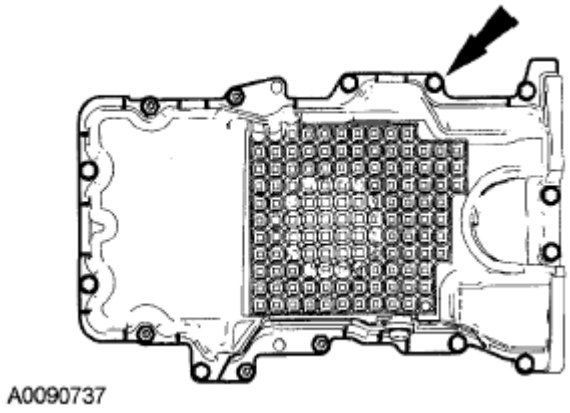


Fig. 395: Locating Oil Pan Bolts And Stud Bolts
Courtesy of MAZDA MOTORS CORP.

27. Install the 2 oil pan-to-transaxle bolts.
    - Tighten to 40 N.m {4.1 kgf.m, 30 ft.lbf}.

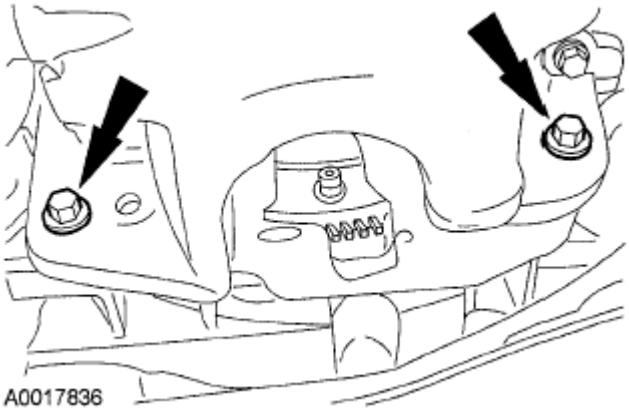


Fig. 396: Locating Oil Pan-To-Transaxle Bolts
Courtesy of MAZDA MOTORS CORP.

28. Tighten the oil pan bolts in the sequence shown in the figure to 25 N.m {2.5 kgf.m, 18 ft.lbf}.

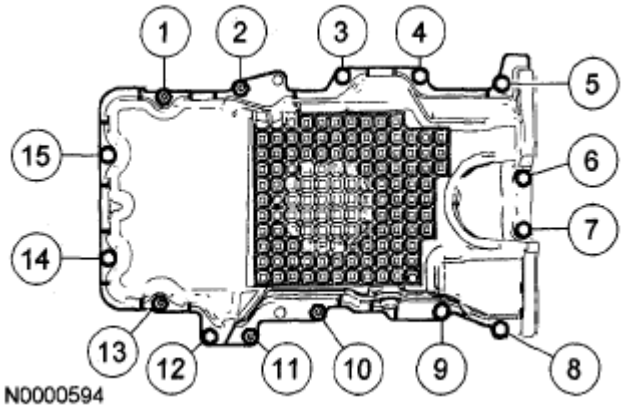


Fig. 397: Identifying Oil Pan Bolts In Sequence
Courtesy of MAZDA MOTORS CORP.

29. Install the 4 torque converter nuts.
    - Tighten to 40 N.m {4.1 kgf.m, 30 ft.lbf}.

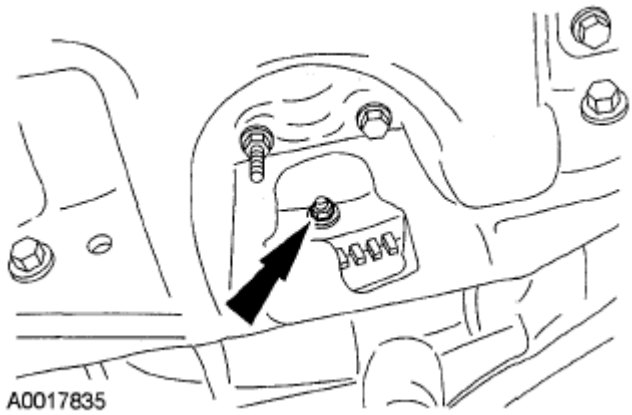


Fig. 398: Locating Torque Converter Nuts
Courtesy of MAZDA MOTORS CORP.

30. Install the torque converter inspection cover.

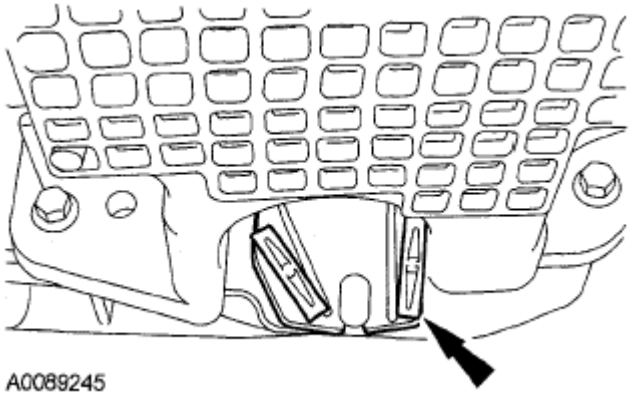


Fig. 399: Locating Torque Converter Inspection Cover
Courtesy of MAZDA MOTORS CORP.

31. If equipped, connect the engine block heater electrical connector.

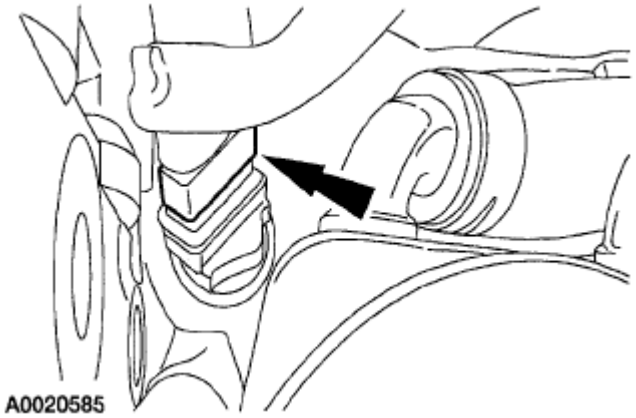


Fig. 400: Locating Engine Block Heater Electrical Connector
Courtesy of MAZDA MOTORS CORP.

32. Install the ground wire eyelet and nut to the engine mount stud.
    - Tighten to 25 N.m {2.5 kgf.m, 18 ft.lbf}.

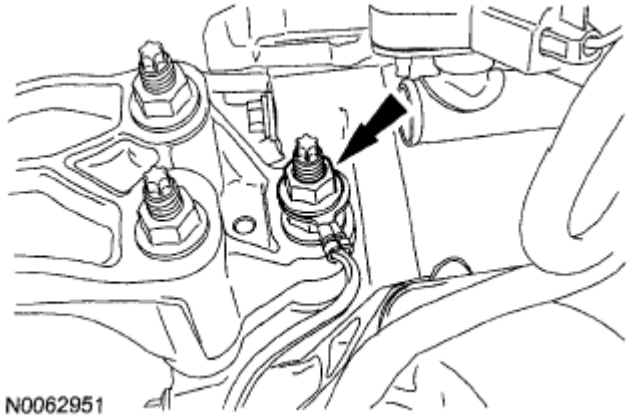


Fig. 401: Locating Ground Wire Eyelet And Nut
Courtesy of MAZDA MOTORS CORP.

33. Connect the electrical connector to the Power Distribution Box (PDB).

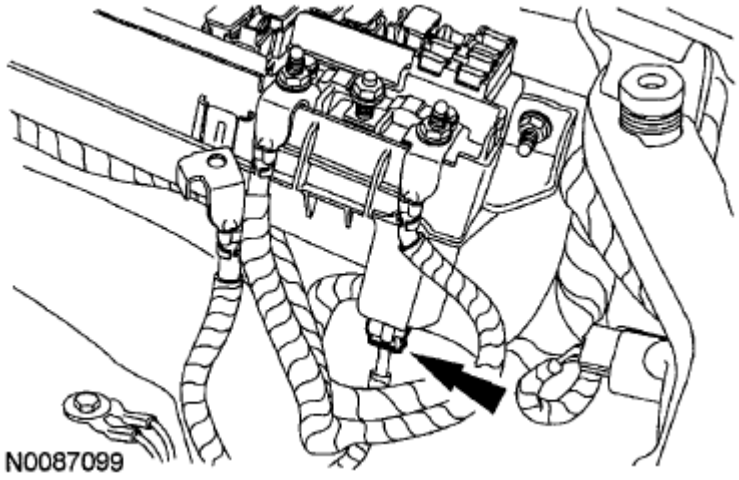


Fig. 402: Locating Power Distribution Box (PDB)
Courtesy of MAZDA MOTORS CORP.

34. Install the cable and the nut to the PDB.
    - Tighten to 12 N.m {1.2 kgf.m, 106 in.lbf}.

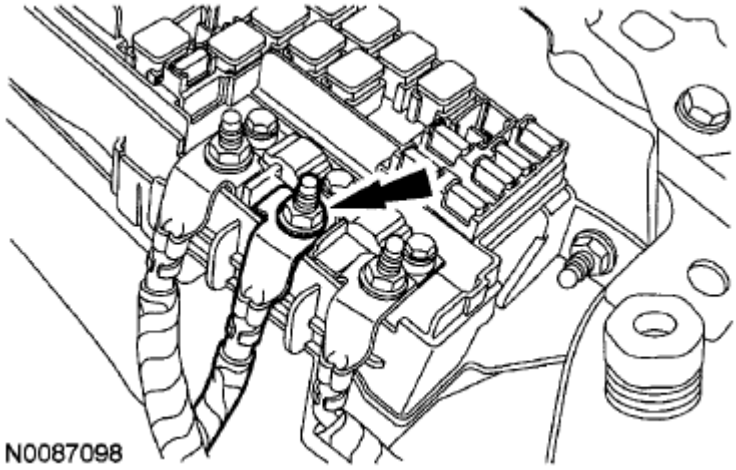


Fig. 403: Locating Cable And Nut
Courtesy of MAZDA MOTORS CORP.

35. Attach the ground wire and install the bolt.
    - Tighten to 10 N.m {1.0 kgf.m, 89 in.lbf}.

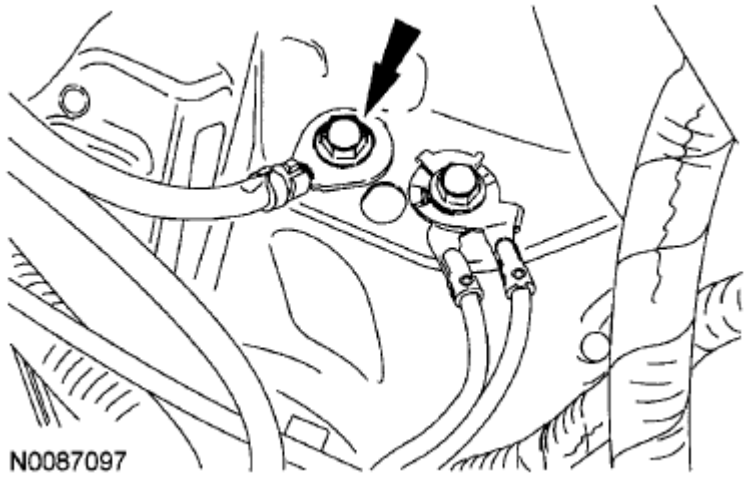


Fig. 404: Locating Ground Wire And Bolt
Courtesy of MAZDA MOTORS CORP.

36. Attach the wiring harness retainer to the battery tray bracket.

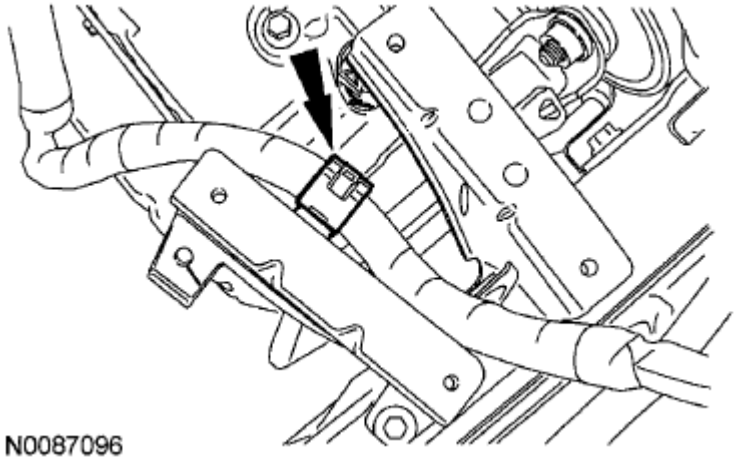


Fig. 405: Locating Wiring Harness Retainer
Courtesy of MAZDA MOTORS CORP.

37. Connect the middle PCM electrical connector and the engine wiring harness electrical connector.
    - Attach the 2 wiring harness retainers.

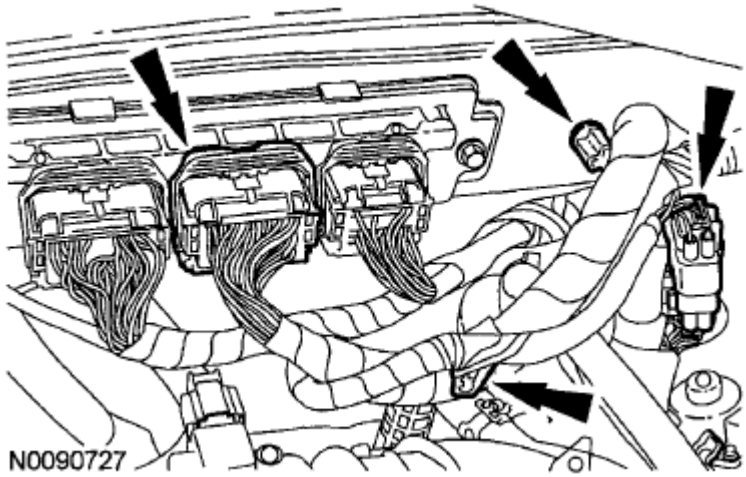


Fig. 406: Locating Wiring Harness Retainers
Courtesy of MAZDA MOTORS CORP.

38. Connect the Evaporative Emission (EVAP) canister purge valve tube and the brake booster vacuum tube to the intake manifold.

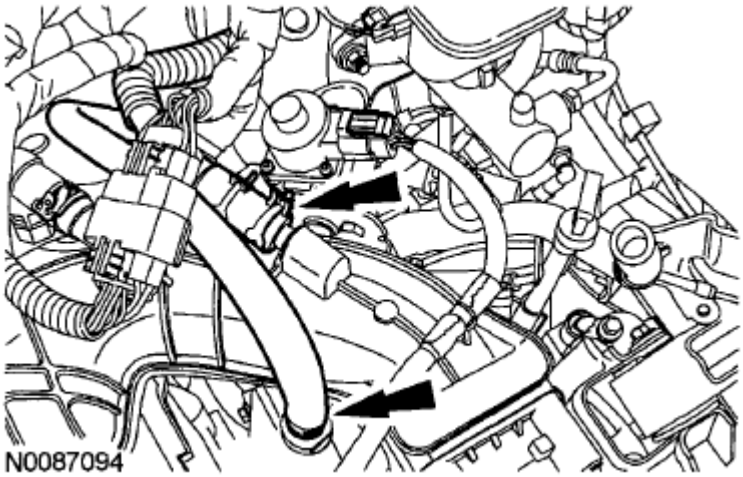


Fig. 407: Locating Evaporative Emission (EVAP) Canister Purge Valve Tube And Brake Booster Vacuum Tube
Courtesy of MAZDA MOTORS CORP.

39. Attach the shift cable retainer to the bracket.

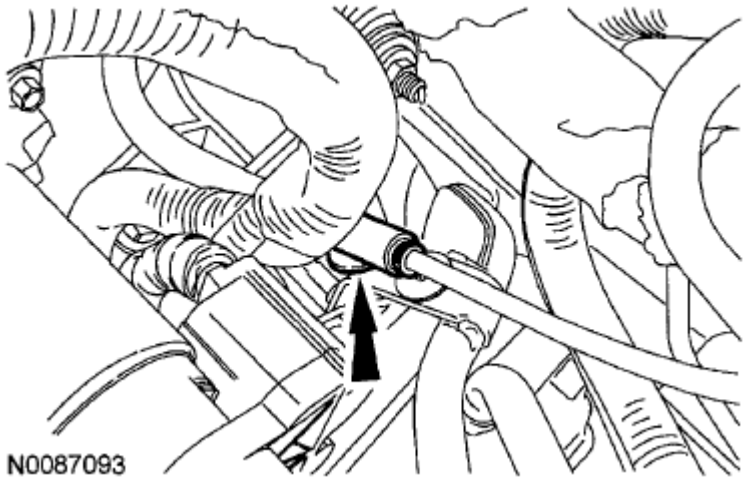


Fig. 408: Locating Shift Cable Retainer
Courtesy of MAZDA MOTORS CORP.

40. Position the shift cable and bracket in place, install the bolts.
    - Tighten to 23 N.m {2.3 kgf.m, 17 ft.lbf}.

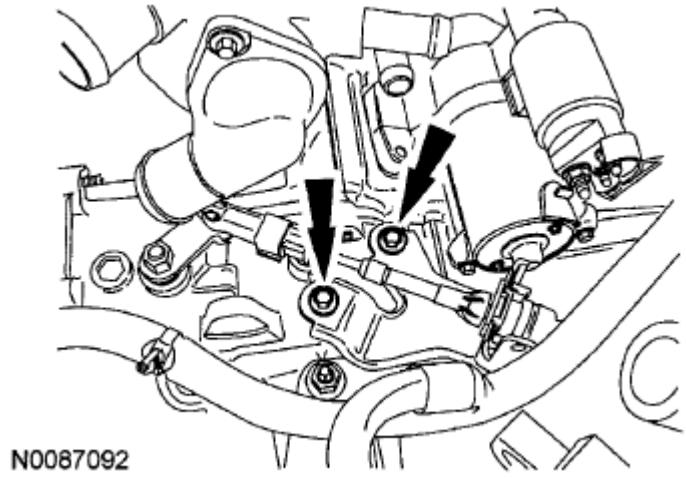


Fig. 409: Locating Shift Cable Bracket Bolts
Courtesy of MAZDA MOTORS CORP.

41. Connect the gearshift cable to the transaxle.

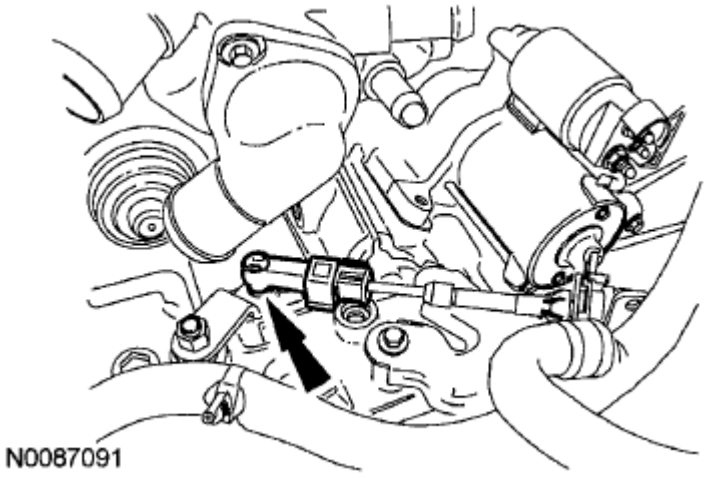


Fig. 410: Locating Gearshift Cable
Courtesy of MAZDA MOTORS CORP.

42. Connect the fuel supply tube quick connect coupling to the fuel rail. See **QUICK RELEASE COUPLING - DOUBLE LOCKING** .

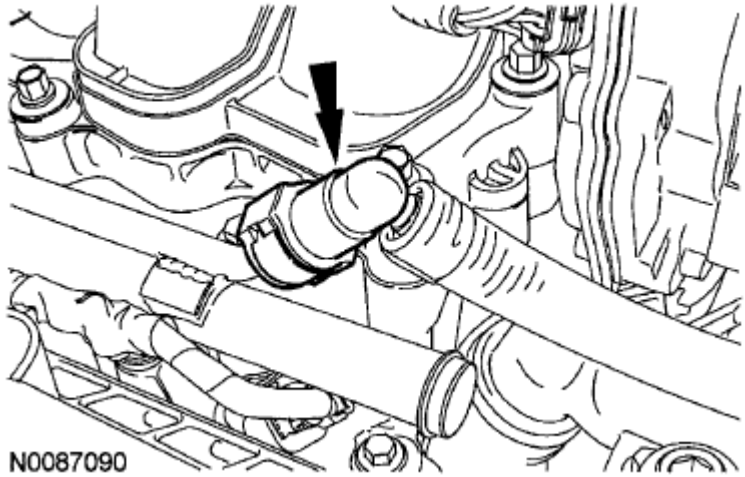


Fig. 411: Locating Fuel Supply Tube Quick Connect Coupling
Courtesy of MAZDA MOTORS CORP.

43. Connect the 2 heater hoses.

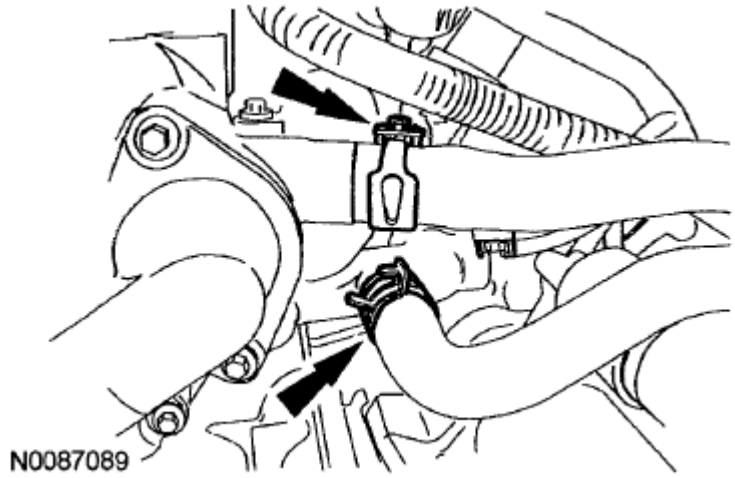


Fig. 412: Locating Heater Hoses
Courtesy of MAZDA MOTORS CORP.

44. Connect the upper and lower radiator hoses.

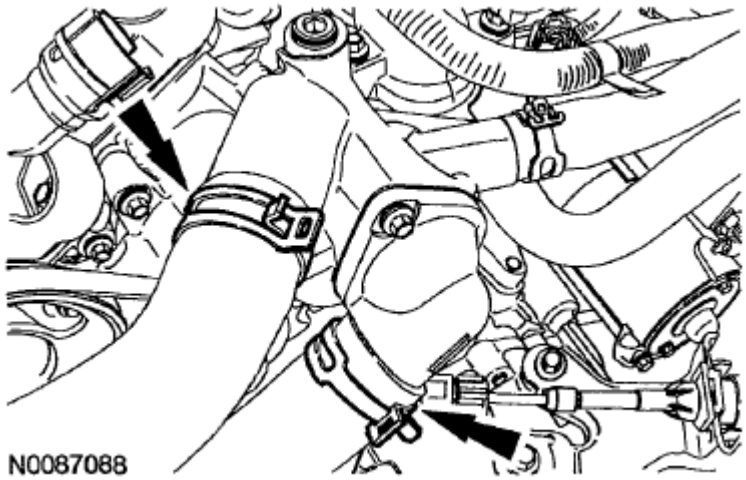


Fig. 413: Locating Upper And Lower Radiator Hoses
Courtesy of MAZDA MOTORS CORP.

45. Connect the 2 transmission electrical connectors and attach the wiring retainer to the stud bolt.

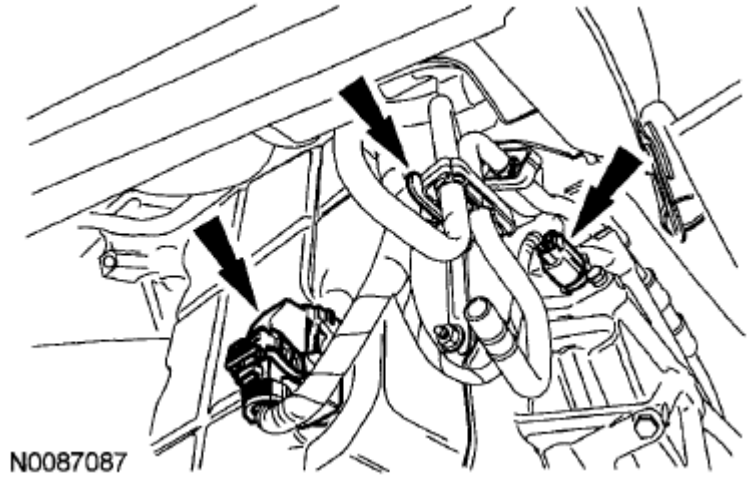


Fig. 414: Locating Transmission Electrical Connectors And Stud Bolt
Courtesy of MAZDA MOTORS CORP.

46. Connect the 2 transmission cooler tubes.

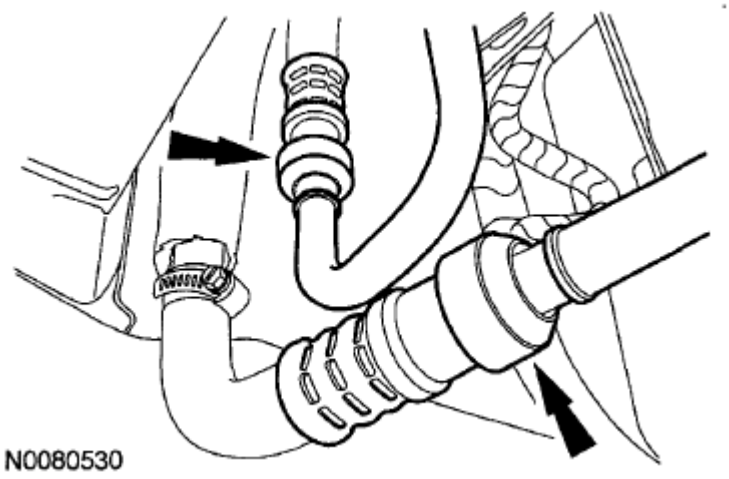


Fig. 415: Locating Transmission Cooler Tubes
Courtesy of MAZDA MOTORS CORP.

47. Install the 2 secondary latches to the transaxle fluid cooler tubes.

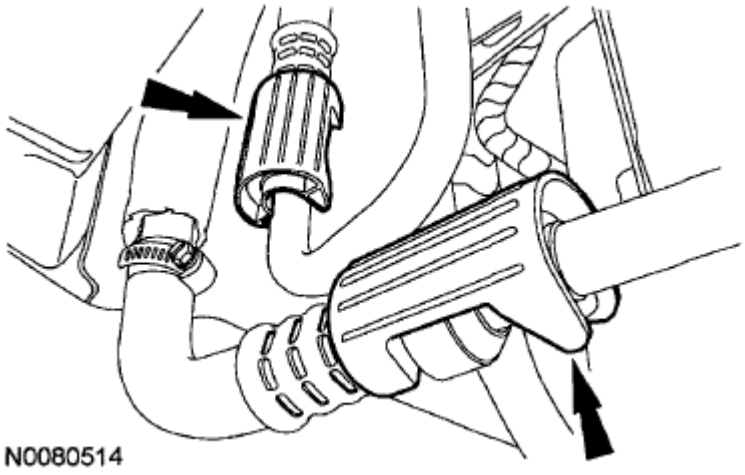


Fig. 416: Locating Secondary Latches
Courtesy of MAZDA MOTORS CORP.

48. Install the cross brace and the new nut finger-tight.

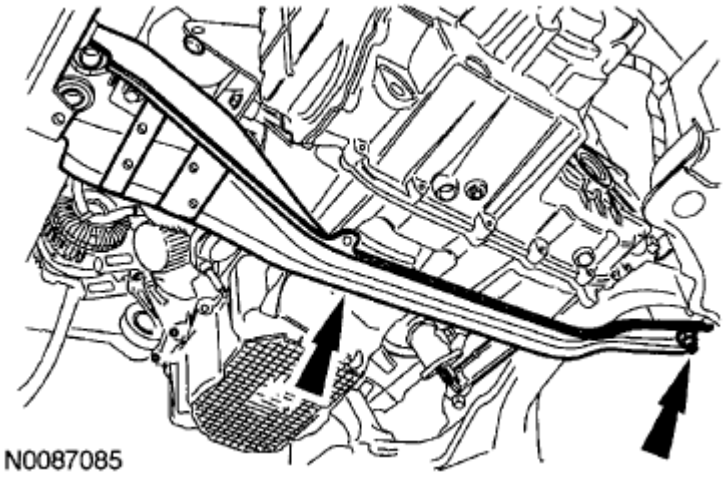


Fig. 417: Locating Cross Brace And Nut
Courtesy of MAZDA MOTORS CORP.

49. Install the 2 bolts for the cross brace and the bolt for the front roll restrictor.
    - Tighten the 2 cross brace bolts to 90 N.m {9.0 kgf.m, 66 ft.lbf}.
    - Tighten the front roll restrictor bolt to 115 N.m {11.5 kgf.m, 85 ft.lbf}.

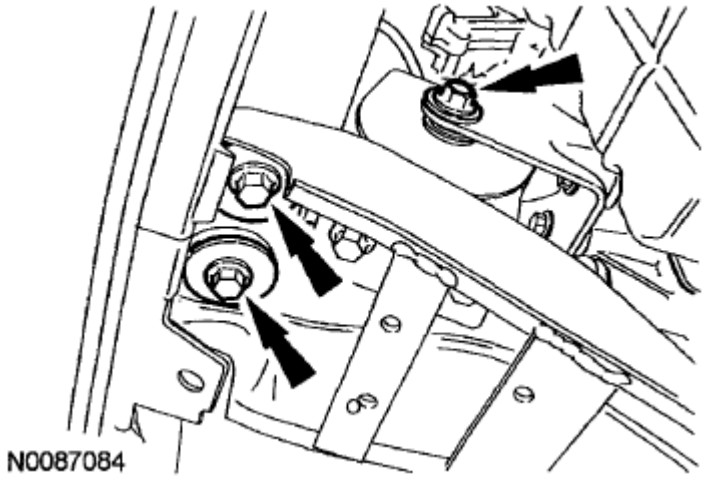


Fig. 418: Locating Front Roll Restrictor Bolt And Bolts
Courtesy of MAZDA MOTORS CORP.

50. Tighten the cross brace nut to 175 N.m {17.5 kgf.m, 129 ft.lbf}.

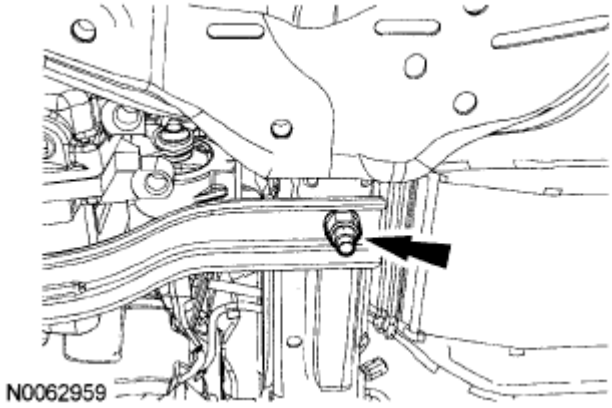


Fig. 419: Locating Cross Brace Nut
Courtesy of MAZDA MOTORS CORP.

51. Connect the generator electrical connector.

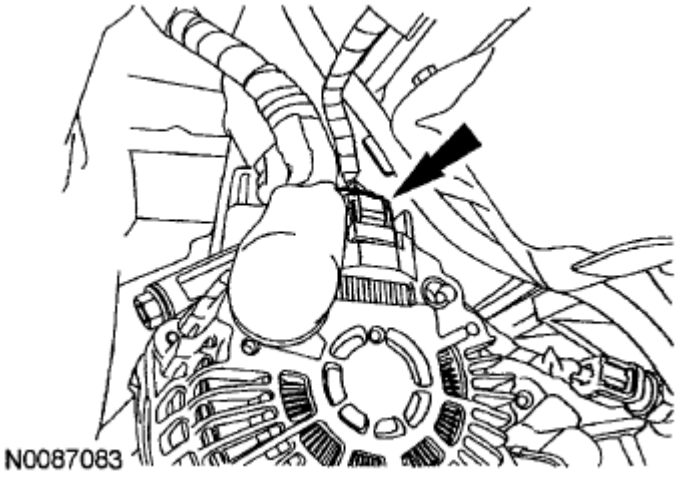


Fig. 420: Locating Generator Electrical Connector
Courtesy of MAZDA MOTORS CORP.

52. Position the A/C compressor and install the 3 bolts.
    - Tighten to 25 N.m {2.5 kgf.m, 18 ft.lbf}.

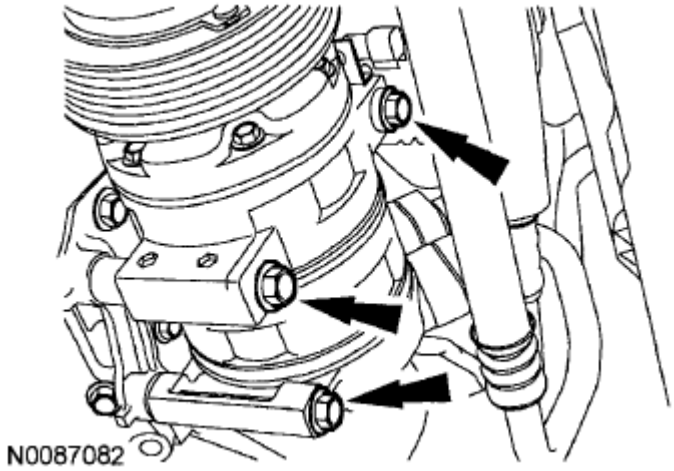


Fig. 421: Locating A/C Compressor And Bolts
Courtesy of MAZDA MOTORS CORP.

53. Connect the A/C compressor electrical connector.

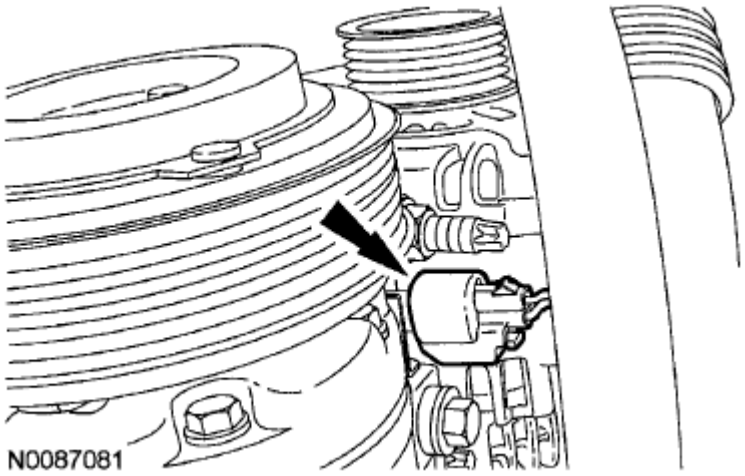


Fig. 422: Locating A/C Compressor Electrical Connector
Courtesy of MAZDA MOTORS CORP.

54. Rotate the accessory drive belt tensioner counterclockwise and install the accessory drive belt.

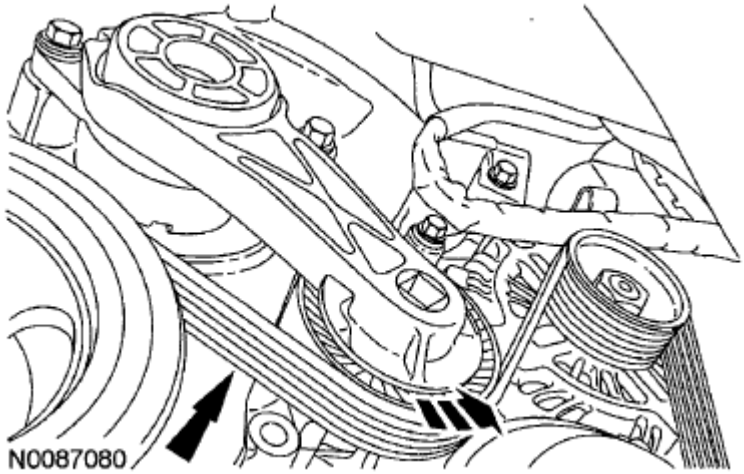


Fig. 423: Rotating Accessory Drive Belt Tensioner Counterclockwise
Courtesy of MAZDA MOTORS CORP.

AWD vehicles

55. Align the index-marks made during removal and install 6 new driveshaft-to-PTU bolts and washers.
    - Tighten to 37 N.m {3.5 kgf.m, 27 ft.lbf}.

CAUTION:
- **Do not reuse the driveshaft flange bolts and washers. Install new bolts and washers or damage to the vehicle may occur.**

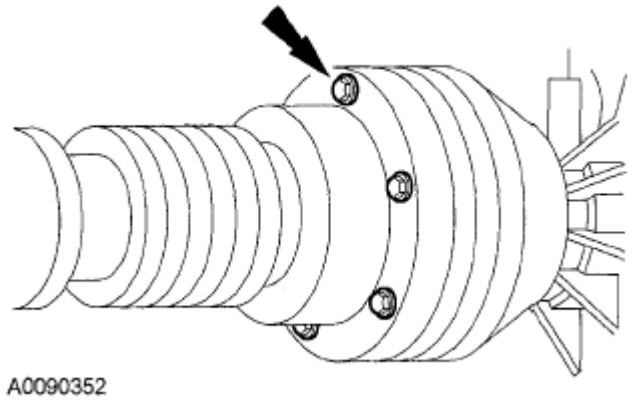


Fig. 424: Locating Front Drives Haft-To-PTU Bolts And Washers
Courtesy of MAZDA MOTORS CORP.

All vehicles

56. Install the intermediate shaft. See **FRONT DRIVE HALFSHAFTS REMOVAL/INSTALLATION** .
57. Install the 2 intermediate shaft bearing retainer nuts.
    - Tighten to 27 N.m {2.7 kgf.m, 20 ft.lbf}.
58. Install the exhaust crossover pipe. See **EXHAUST CROSSOVER PIPE REMOVAL/INSTALLATION - 3.0L** .

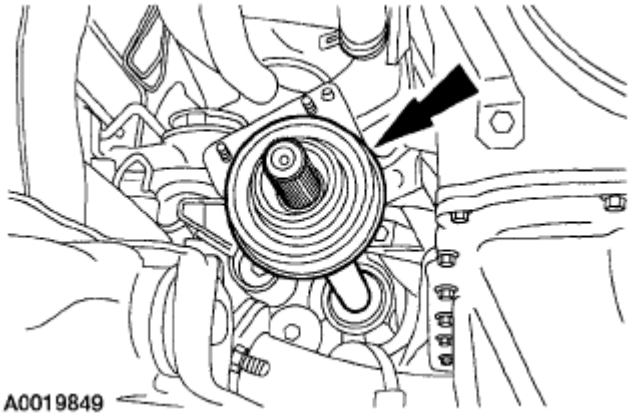


Fig. 425: Locating Intermediate Shaft
Courtesy of MAZDA MOTORS CORP.

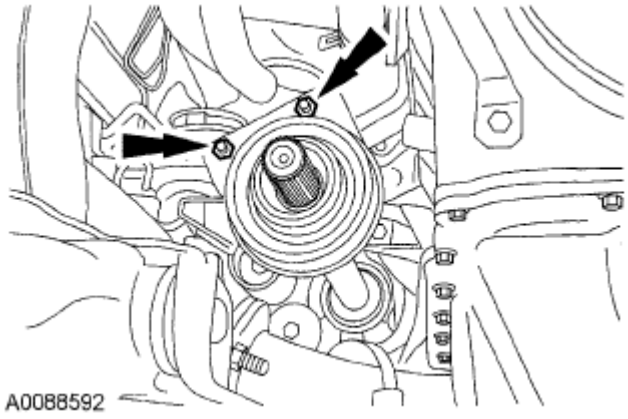


Fig. 426: Locating Intermediate Shaft Bearing Retainer Nuts
Courtesy of MAZDA MOTORS CORP.

59. Connect the RH Catalyst Monitor Sensor (CMS) electrical connector.

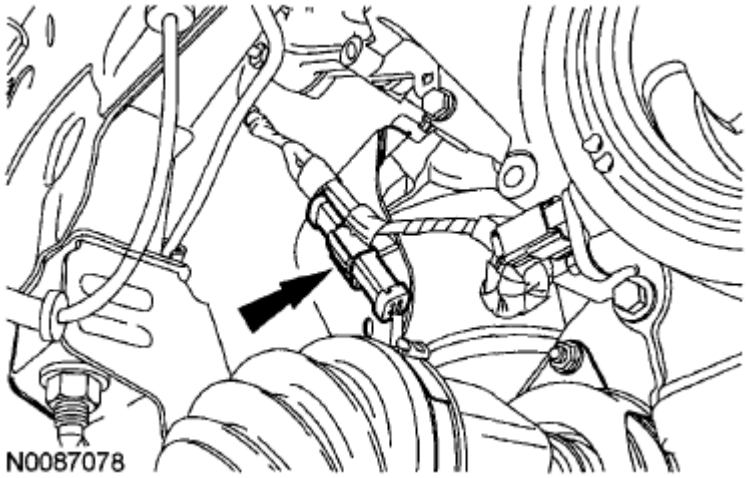


Fig. 427: Locating RH Catalyst Monitor Sensor (CMS) Electrical Connector
Courtesy of MAZDA MOTORS CORP.

60. Connect the LH CMS electrical connector.

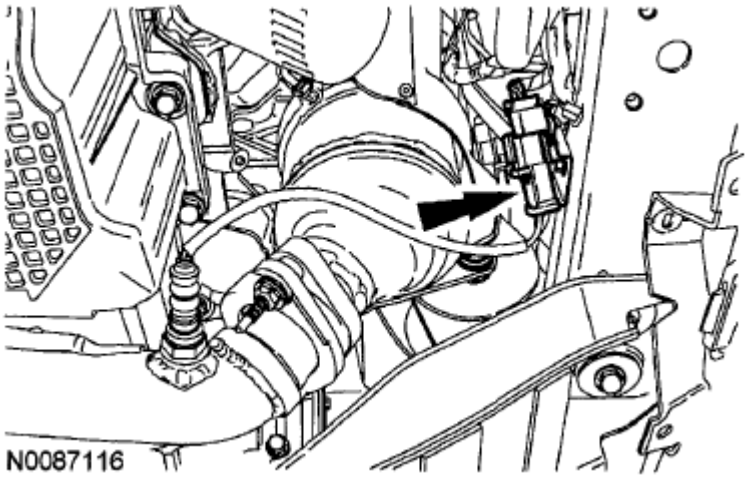


Fig. 428: Locating LH CMS Electrical Connector
Courtesy of MAZDA MOTORS CORP.

61. Install the lateral support crossmember and the 4 bolts.
    - Tighten to 115 N.m {11.5 kgf.m, 85 ft.lbf}.

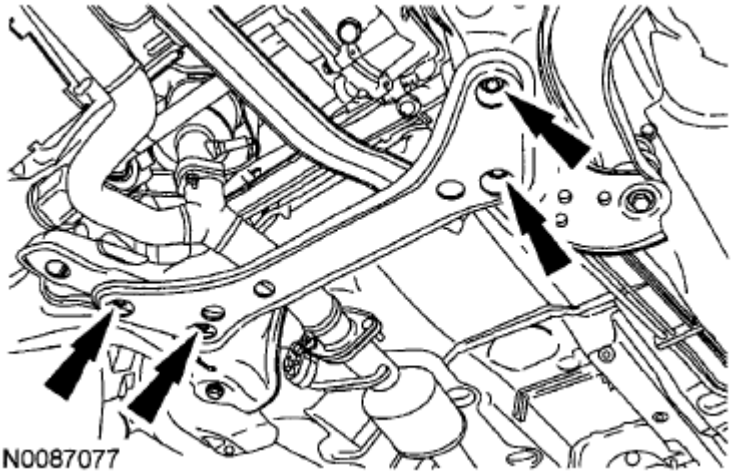


Fig. 429: Locating Lateral Support Crossmember And Bolts
Courtesy of MAZDA MOTORS CORP.

62. Install the lower splash shields and bolts.
    - Tighten to 9 N.m {0.9 kgf.m, 80 in.lbf}.

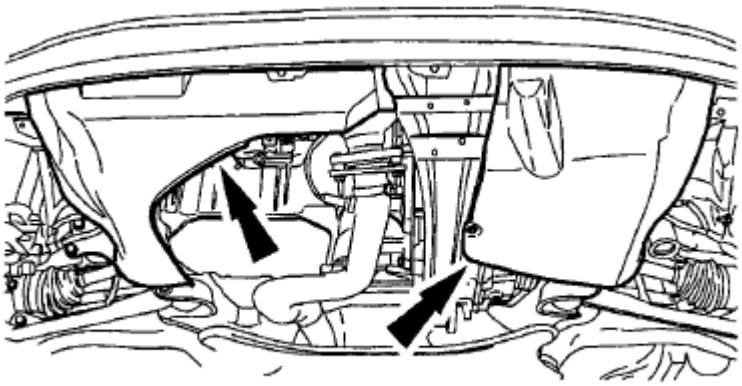


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Fig. 430: Locating Lower Splash Shields And Bolts
Courtesy of MAZDA MOTORS CORP.

63. Install the front wheels and tires. See **WHEEL AND TIRE REMOVAL/INSTALLATION** .
64. Install the air cleaner outlet tube pipe and air cleaner. See **AIR CLEANER OUTLET PIPE REMOVAL/INSTALLATION - 3.0L** .
65. Install the battery tray. See **BATTERY TRAY REMOVAL/INSTALLATION** .
66. Fill the engine with clean oil.
67. Fill and bleed the cooling system. See **COOLING SYSTEM DRAINING, FILLING AND BLEEDING - 3.0L** .

