

2008 Mazda CX-9 Grand Touring

2008 ENGINE Mechanical (MZI-3.7) - Mazda CX-9

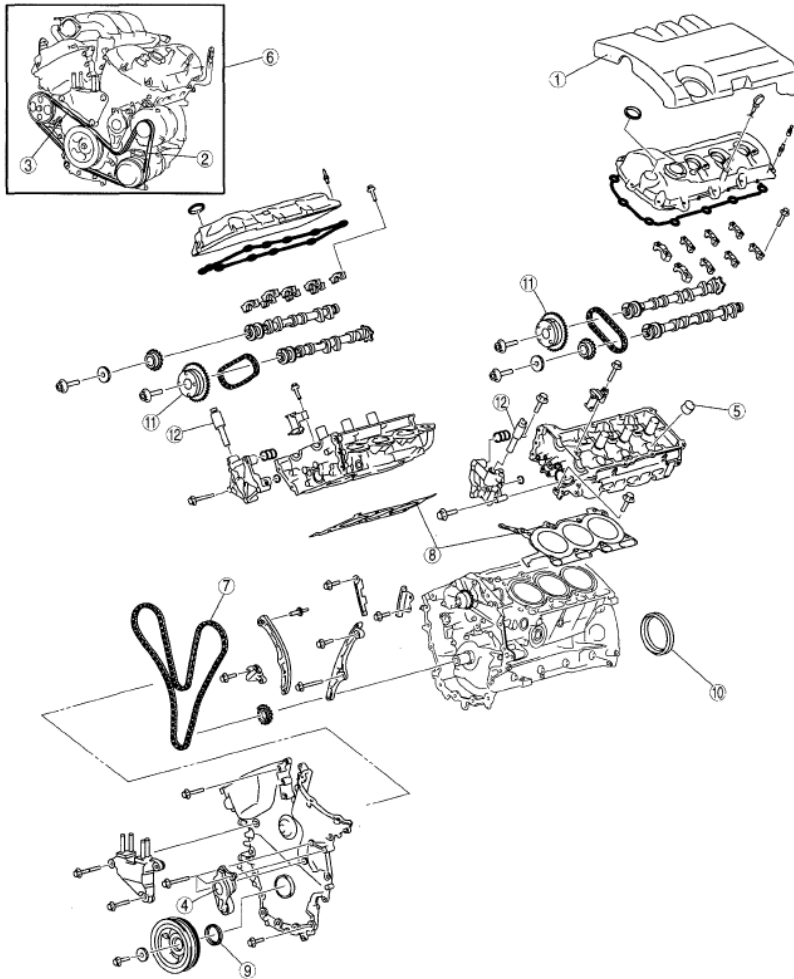
2008 ENGINE

Mechanical (MZI-3.7) - Mazda CX-9

ENGINE LOCATION INDEX [MZI-3.7]

2008 Mazda CX-9 Grand Touring

2008 ENGINE Mechanical (MZI-3.7) - Mazda CX-9



ac9auw00000193

1	Engine cover (See 01-10-8 ENGINE COVER REMOVAL/ INSTALLATION [MZI-3.7].)
2	Generator and A/C drive belt (See 01-10-4 DRIVE BELT INSPECTION [MZI-3.7].) (See 01-10-5 DRIVE BELT REMOVAL/ INSTALLATION [MZI-3.7].)
3	Power steering oil pump drive belt (See 01-10-4 DRIVE BELT INSPECTION [MZI-3.7].) (See 01-10-5 DRIVE BELT REMOVAL/ INSTALLATION [MZI-3.7].)
4	Drive belt auto tensioner (See 01-10-7 DRIVE BELT AUTO TENSIONER INSPECTION [MZI-3.7].)
5	Tappet (See 01-10-8 VALVE CLEARANCE INSPECTION/ ADJUSTMENT [MZI-3.7].)

6	Engine (See 01-10-18 COMPRESSION INSPECTION [MZI-3.7].) (See 01-10-50 ENGINE REMOVAL/INSTALLATION [MZI-3.7].) (See 01-10-56 ENGINE DISASSEMBLY/ ASSEMBLY [MZI-3.7].) (See 01-10-3 ENGINE TUNE-UP [MZI-3.7].)
7	Timing chain (See 01-10-19 TIMING CHAIN REMOVAL/ INSTALLATION [MZI-3.7].)
8	Cylinder head gasket (See 01-10-32 CYLINDER HEAD GASKET REPLACEMENT [MZI-3.7].)
9	Front oil seal (See 01-10-42 FRONT OIL SEAL REPLACEMENT [MZI-3.7].)
10	Rear oil seal (See 01-10-49 REAR OIL SEAL REPLACEMENT [MZI-3.7].)
11	Variable valve timing actuator (See 01-10-10 VARIABLE VALVE TIMING ACTUATOR REMOVAL/INSTALLATION [MZI-3.7].)
12	OCV (See 01-10-17 OIL CONTROL VALVE (OCV) REMOVAL/INSTALLATION [MZI-3.7].) (See 01-10-16 OIL CONTROL VALVE (OCV) INSPECTION [MZI-3.7].)

Fig. 1: Exploded View Of Engine Components
Courtesy of MAZDA MOTORS CORP.

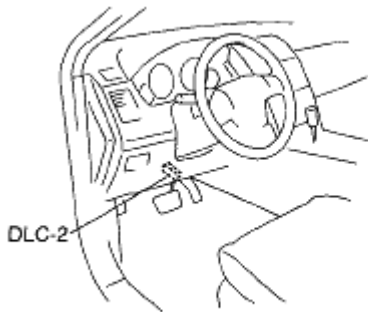
ENGINE TUNE-UP [MZI-3.7]

NOTE:

- If the accelerator pedal is depressed continuously for a specified time, the engine speed may decrease to the idle speed. This is due to the fuel cut control operation, which prevents overheating, and it does not indicate a malfunction.

ENGINE TUNE-UP PREPARATION

1. Verify that the selector lever is in the P position.
2. Connect the M-MDS to the DLC-2.
3. Turn off the electrical loads.
4. Verify that no DTCs are available.
5. Warm up the engine as follows.
 1. Start the engine.
 2. Perform no-load racing at **2,500-3,000 rpm** for **3 min.** (ECT is **approx. 80 °C {176 °F}** or more)
 3. Release the accelerator pedal.
 4. Wait until the cooling fans stop.



ac9uuw00000115

Fig. 2: Identifying DLC-2 Part Location
Courtesy of MAZDA MOTORS CORP.

IGNITION TIMING INSPECTION

1. Perform "Engine Tune-up Preparation". (See **ENGINE TUNE-UP PREPARATION.**)

NOTE:

- The ignition timing cannot be adjusted.
- The M-MDS is required to verify the ignition timing.

2. Verify that the ignition timing (M-MDS: SPARKADV) is within the specification using M-MDS function.

Ignition timing Approx. BTDC 13°

3. Verify that ignition timing advances when the engine speed increases gradually.

2008 Mazda CX-9 Grand Touring

2008 ENGINE Mechanical (MZI-3.7) - Mazda CX-9

- If it is not within the specification, refer to "ENGINE SYMPTOM TROUBLESHOOTING". (See **SYMPTOM DIAGNOSTIC INDEX [MZI-3.7]** .)

IDLE SPEED INSPECTION

1. Perform "Engine Tune-up Preparation". (See **ENGINE TUNE-UP PREPARATION.**)

NOTE:

- The idle speed cannot be adjusted.
- The M-MDS is required to verify the idle speed.

2. Verify that the idle speed (M-MDS: RPM) is within the specification using M-MDS.

Idle speed (P position)

No load: 570-670 rpm

Electrical load on: 630-730 rpm

Power steering oil pump operation: 600-700 rpm

A/C and heater operation: 570-850 rpm [-40-49 °C {-40-120 °F}]

IDLE MIXTURE INSPECTION

1. Perform "Engine Tune-up Preparation". (See **ENGINE TUNE-UP PREPARATION.**)
2. Verify that the idle speed and ignition timing are within the specification. (See **IGNITION TIMING INSPECTION.**) (See **IDLE SPEED INSPECTION.**)
3. Insert an exhaust gas analyzer into the tailpipe.
4. Verify that the CO and HC concentrations are within the specified regulation.
 - If not within the regulation, refer to "ENGINE SYMPTOM TROUBLESHOOTING". (See **SYMPTOM DIAGNOSTIC INDEX [MZI-3.7]** .)

Idle mixture

HC concentration: Within the regulation

CO concentration: Within the regulation

DRIVE BELT INSPECTION [MZI-3.7]

GENERATOR & A/C DRIVE BELT

NOTE:

- The generator and A/C drive belt deflection/tension inspection is not necessary because of the use of the drive belt auto tensioner.

1. Verify that the drive belt auto tensioner indicator mark does not exceed the maximum belt length.
 - If it exceeds the maximum belt length, replace the generator and A/C drive belt. (See **DRIVE BELT REMOVAL/INSTALLATION [MZI-3.7].**)
2. Visually inspect the generator and A/C drive belt for damage and cracks.
 - If there is generator and A/C drive belt damage and cracks, replace the generator and A/C drive belt. (See **DRIVE BELT REMOVAL/INSTALLATION [MZI-3.7].**)

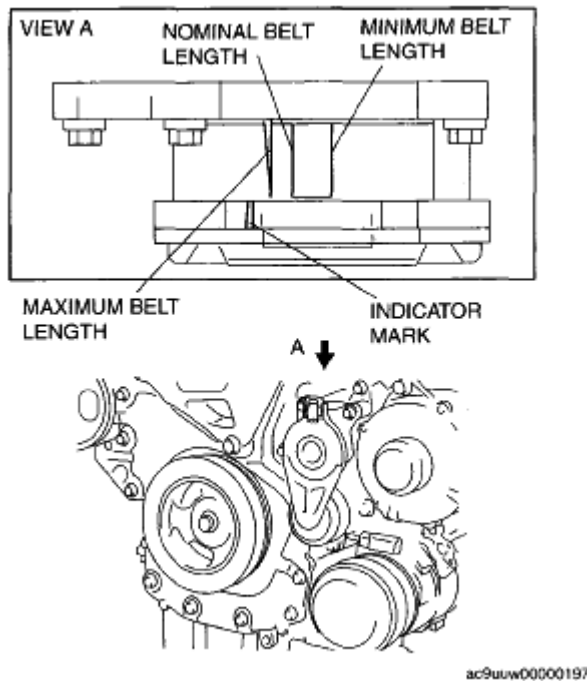


Fig. 3: Identifying Belt Length
Courtesy of MAZDA MOTORS CORP.

POWER STEERING OIL PUMP DRIVE BELT

1. Visually inspect the power steering oil pump drive belt for damage and cracks.
 - If there is power steering oil pump drive belt damage and cracks, replace the power steering oil pump drive belt. (See **DRIVE BELT REMOVAL/INSTALLATION [MZI-3.7].**)

DRIVE BELT REMOVAL/INSTALLATION [MZI-3.7]

GENERATOR & A/C DRIVE BELT

NOTE:

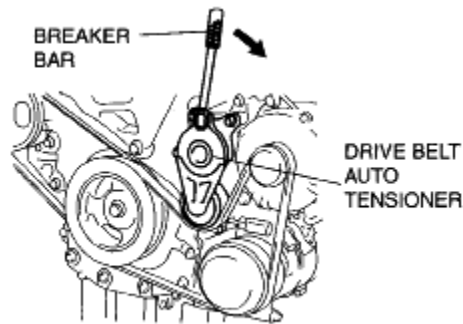
- When removing the generator and A/C drive belt, perform the procedure with two people, one releasing the belt tension and the other removing the belt.

1. Remove the engine cover. (See **ENGINE COVER REMOVAL/INSTALLATION [MZI-3.7].**)

2. Remove the front wheel and tire (RH). (See **GENERAL PROCEDURES (SUSPENSION)** .)
3. Remove the splash shield (RH).
4. Set a breaker bar on the center of the tensioner pulley as shown.
5. Using the breaker bar, turn the center of the tensioner pulley clockwise to release the tension on the generator and A/C drive belt.
6. Remove the generator and A/C drive belt.
7. Install the generator and A/C drive belt.

NOTE:

- **When the generator and A/C drive belt is replaced with a new one, the drive belt auto tensioner indicator mark is aligned with the nominal belt length mark.**



ac9uuw00000196

Fig. 4: Turning Center Of Tensioner Pulley
Courtesy of MAZDA MOTORS CORP.

8. Verify that the drive belt auto tensioner indicator mark is within the maximum and minimum belt length. (See **DRIVE BELT INSPECTION [MZI-3.7]**.)
 - If the drive belt auto tensioner indicator mark is not within the limit, replace the generator and A/C drive belt.
9. Install the splash shield (RH).
10. Install the front wheel and tire (RH). (See **GENERAL PROCEDURES (SUSPENSION)** .)
11. Install the engine cover. (See **ENGINE COVER REMOVAL/INSTALLATION [MZI-3.7]**.)

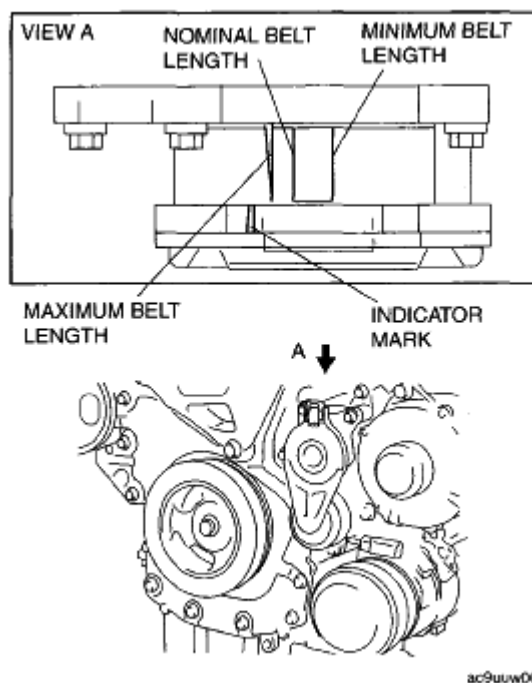


Fig. 5: Identifying Belt Length
 Courtesy of MAZDA MOTORS CORP.

POWER STEERING OIL PUMP DRIVE BELT

1. Remove the generator and A/C drive belt. (See GENERATOR AND A/C DRIVE BELT.)
2. Remove the power steering oil pump drive belt.
 1. Install the **SST** between the power steering oil pump drive belt and the power steering oil pump pulley.

NOTE:

- Hold the **SST** by hand until it is lodges between the power steering oil pump pulley and power steering oil pump drive belt.

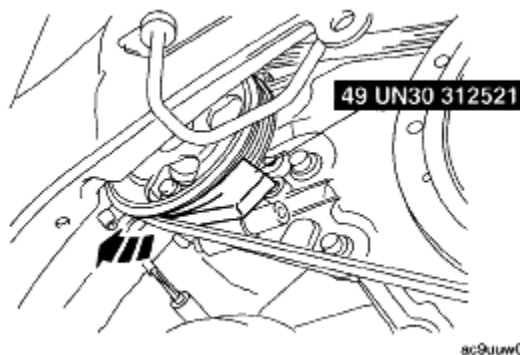


Fig. 6: View Of SST Between Power Steering Oil Pump Drive Belt & Power Steering Oil Pump Pulley

Courtesy of MAZDA MOTORS CORP.

2. Turn the crankshaft clockwise to remove the power steering oil pump drive belt.

NOTE:

- If there is power steering oil pump drive belt damage and cracks, replace the power steering oil pump drive belt.

3. Install the power steering oil pump drive belt.

1. Install the **SST** according to the following steps.

1. Loosen the clamp adapter nut of the **SST**.

NOTE:

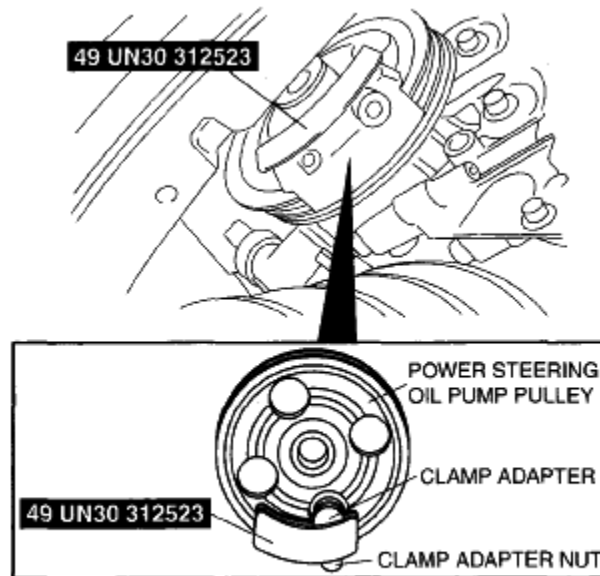
- There is no need to remove the clamp adapter nut completely when positioning the **SST** on the power steering oil pump pulley.

2. Position the **SST** on the power steering oil pump pulley with the clamp adapter in one of the holes of the pulley.

3. Tighten the clamp adapter nut by hand.

NOTE:

- Hand tightening of the clamp adapter nut is sufficient.



ac9Uuw0001875

Fig. 7: Positioning SST On Power Steering Oil Pump Pulley
Courtesy of MAZDA MOTORS CORP.

2. Position the power steering oil pump drive belt around the **SST** and the power steering oil pump

pulley.

NOTE:

- Hold the SST and power steering oil pump drive belt by hand until the power steering oil pump drive belt is properly seated.

3. Turn the crankshaft clockwise to install the power steering oil pump drive belt.

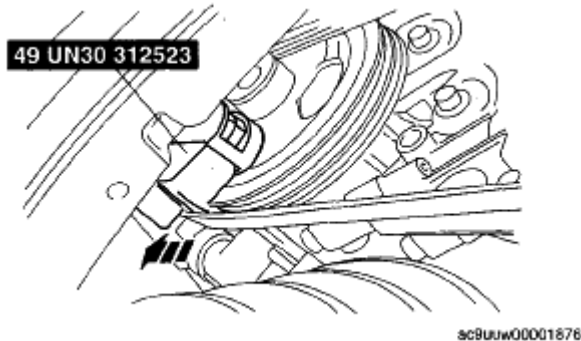


Fig. 8: Positioning Power Steering Oil Pump Drive Belt
Courtesy of MAZDA MOTORS CORP.

NOTE:

- Verify that the power steering oil pump drive belt is firmly attached to the pulleys.

4. Install the generator and A/C drive belt. (See **GENERATOR AND A/C DRIVE BELT**.)
5. Verify that the drive belt auto tensioner indicator mark does not exceed the maximum belt length. (See **DRIVE BELT INSPECTION [MZI-3.7]**.)
 - If it exceeds the maximum belt length, replace the generator and A/C drive belt.

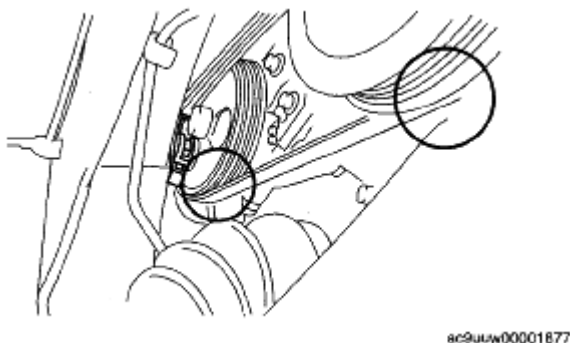


Fig. 9: Identifying Power Steering Oil Pump Drive Belt With Pulleys
Courtesy of MAZDA MOTORS CORP.

DRIVE BELT AUTO TENSIONER INSPECTION [MZI-3.7]

1. Remove the engine cover. (See **ENGINE COVER REMOVAL/INSTALLATION [MZI-3.7]**.)

2. Remove the front wheel and tire (RH). (See **GENERAL PROCEDURES (SUSPENSION)** .)
3. Remove the splash shield (RH).
4. Remove the generator and A/C drive belt. (See **DRIVE BELT REMOVAL/INSTALLATION [MZI-3.7]**.)
5. Verify that the drive belt auto tensioner moves smoothly in the operational direction.
 - Replace the drive belt auto tensioner if necessary.

Tightening torque: 8.9-12.1 N.m {91-123 kgf.cm, 79-107 in.lbf}

6. Turn the drive belt auto tensioner pulley by hand and verify that it rotates smoothly.
 - Replace the drive belt auto tensioner if necessary.

Tightening torque: 8.9-12.1 N.m {91-123 kgf.cm, 79-107 in.lbf}

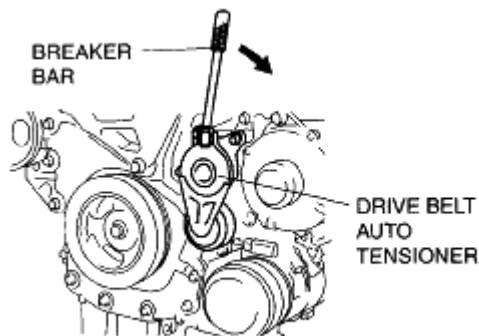


Fig. 10: Turning Drive Belt Auto Tensioner Pulley
Courtesy of MAZDA MOTORS CORP.

7. Install in the reverse order of removal.

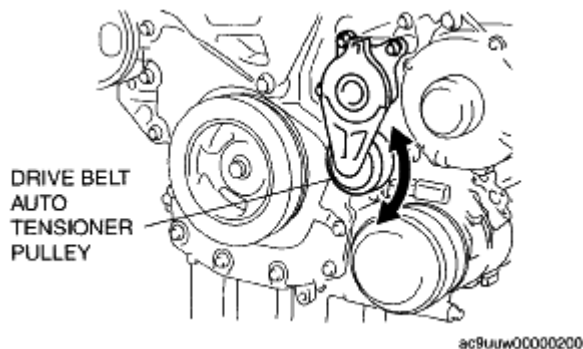


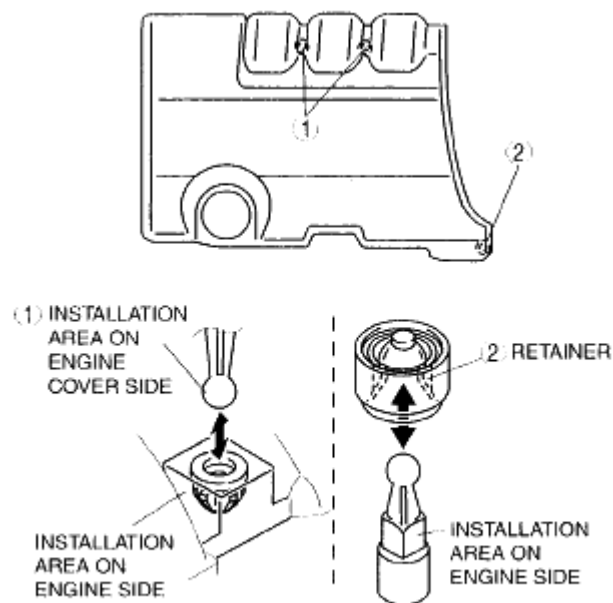
Fig. 11: Identifying Drive Belt Auto Tensioner Pulley
Courtesy of MAZDA MOTORS CORP.

1. Remove the engine cover in the order indicated in the figure.

NOTE:

- **Firmly pull the engine cover near the locations shown to disengage the retainers.**

2. Install in the reverse order of removal.



ac9kuw0000166

Fig. 12: View Of Engine Cover Side
 Courtesy of MAZDA MOTORS CORP.

VALVE CLEARANCE INSPECTION/ADJUSTMENT [MZI-3.7]

VALVE CLEARANCE INSPECTION

1. Disconnect the negative battery cable.
2. Remove the engine cover. (See ENGINE COVER REMOVAL/INSTALLATION [MZI-3.7].)
3. Remove the ventilation hose.
4. Remove the resonance chamber. (See INTAKE-AIR SYSTEM REMOVAL/INSTALLATION [MZI-3.7] .)
5. Remove the dynamic chamber and throttle body as a single unit. (See INTAKE-AIR SYSTEM REMOVAL/INSTALLATION [MZI-3.7] .)
6. Disconnect the wiring harness.
7. Remove the ignition coils. (See IGNITION COIL REMOVAL/INSTALLATION [MZI-3.7] .)
8. Remove the dipstick.
9. Remove the cylinder head cover. (See TIMING CHAIN REMOVAL/INSTALLATION [MZI-3.7].)

10. Remove the front wheel and tire (RH). (See **GENERAL PROCEDURES (SUSPENSION)** .)
11. Remove the splash shield (RH).
12. Measure the valve clearance.
 1. Rotate the crankshaft clockwise and verify that the timing mark of the intake side camshaft sprocket is in the position shown in the figure. In this position, the No.1 cylinder is at the TDC of the compression stroke.
 2. Measure the valve clearance of location A shown in the figure.
 - If it is not within the specification, replace the tappet and adjust the valve clearance to the median value of the standard.

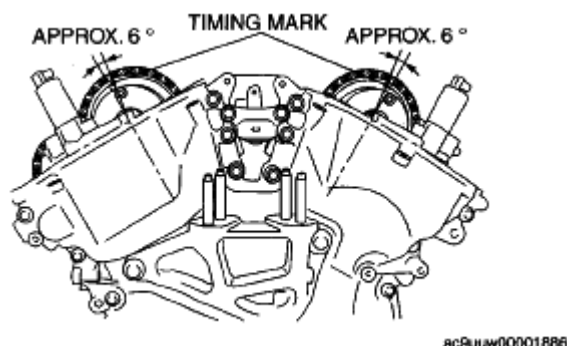


Fig. 13: Identifying Valve Clearance Gap
Courtesy of MAZDA MOTORS CORP.

Standard valve clearance [Engine cold]

IN: 0.150-0.250 mm {0.00591-0.00984 in}

EX: 0.300-0.400 mm {0.0119-0.0157 in}

NOTE:

- **Make sure to note down the measured values for choosing the suitable replacement tappets.**

2008 Mazda CX-9 Grand Touring

2008 ENGINE Mechanical (MZI-3.7) - Mazda CX-9

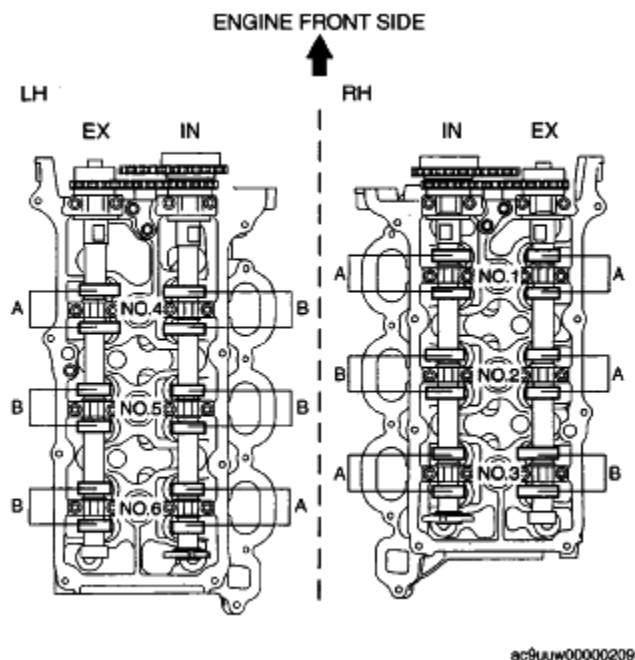


Fig. 14: Identifying Engine Front Side
Courtesy of MAZDA MOTORS CORP.

3. Mark the crank pulley and engine front cover as shown in the figure.
4. Rotate the crankshaft clockwise 360° so that the No.5 cylinder is at TDC of the compression stroke.
5. Measure the valve clearance of location B shown in the figure.
 - If it is not within the specification, replace the tappet and adjust the valve clearance to the median value of the standard.

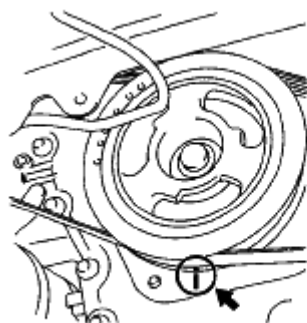


Fig. 15: Locating Crank Pulley Mark
Courtesy of MAZDA MOTORS CORP.

Standard valve clearance [Engine cold]

IN: 0.150-0.250 mm {0.00591-0.00984 in}

2008 Mazda CX-9 Grand Touring

2008 ENGINE Mechanical (MZI-3.7) - Mazda CX-9

EX: 0.300-0.400 mm {0.0119-0.0157 in}

NOTE:

- Make sure to note down the measured values for choosing the suitable replacement tappets.

13. Install in the reverse order of removal.

VALVE CLEARANCE ADJUSTMENT

1. Follow the cylinder head gasket replacement procedure and remove the camshafts and camshaft sprocket as a single unit. (See **CYLINDER HEAD GASKET REPLACEMENT [MZI-3.7].**)
2. Remove the tappet.
3. Install an appropriate tappet based on the results of the valve clearance inspection.

Selected tappet = Removed tappet thickness + Measured valve clearance - Standard valve clearance

Standard valve clearance [Engine cold]

IN: 0.150-0.250 mm {0.00591-0.00984 in}

EX: 0.300-0.400 mm {0.0119-0.0157 in}

4. Install in the reverse order of removal.

VARIABLE VALVE TIMING ACTUATOR REMOVAL/INSTALLATION [MZI-3.7]

WARNING:

- Fuel vapor is hazardous. It can very easily ignite, causing serious injury and damage. Always keep sparks and flames away from fuel.
- Fuel line spills and leakage are dangerous. Fuel can ignite and cause serious injuries or death and damage. Fuel can also irritate skin and eyes. To prevent this, always complete the "Fuel Line Safety Procedure". (See **BEFORE SERVICE PRECAUTION [MZI-3.7]** .)
- Continuous exposure to USED engine oil has caused skin cancer in laboratory mice. Protect your skin by washing with soap and water immediately after working with engine oil.

CAUTION:

- The variable valve timing actuator cannot be disassembled because it is a precision unit.

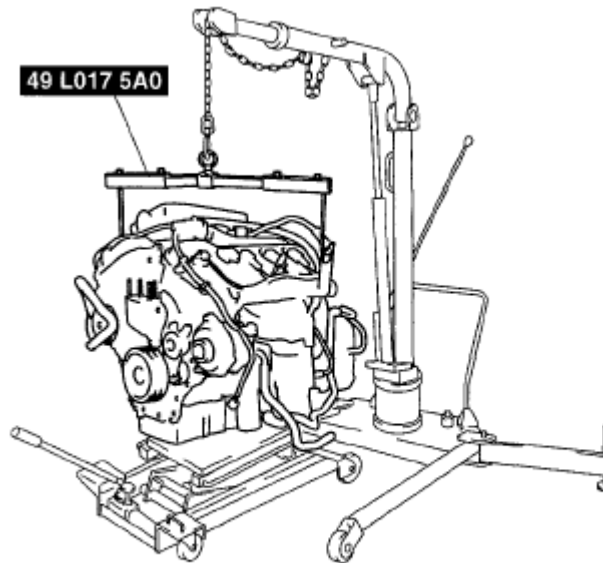
NOTE:

- The following procedure "VARIABLE VALVE TIMING ACTUATOR REMOVAL/INSTALLATION" is performed after the engine and transaxle component is removed from the vehicle. (See **ENGINE REMOVAL/INSTALLATION [MZI-3.7].**)

1. Drain the engine oil. (See **ENGINE OIL REPLACEMENT [MZI-3.7]** .)
2. Remove the engine and transaxle component. (See **ENGINE REMOVAL/INSTALLATION [MZI-3.7]**.)
3. Secure the engine and transaxle component using a hoist and the **SST**.
4. Remove the dynamic chamber and throttle body as a single unit. (See **INTAKE-AIR SYSTEM REMOVAL/INSTALLATION [MZI-3.7]** .)
5. Remove the ignition coils. (See **IGNITION COIL REMOVAL/INSTALLATION [MZI-3.7]** .)
6. Remove the dipstick.
7. Remove the power steering oil pump drive belt. (See **DRIVE BELT REMOVAL/INSTALLATION [MZI-3.7]**.)
8. Remove the power steering oil pump. (See **POWER STEERING OIL PUMP REMOVAL/INSTALLATION** .)

CAUTION:

- When removing the timing chain and marking the timing marks on the chain, mark the camshaft timing chain as well.



ac9uww00001883

Fig. 16: View Of Engine & Transaxle Component With SST
Courtesy of MAZDA MOTORS CORP.

9. Follow the "TIMING CHAIN REMOVAL/INSTALLATION" procedure and removal the timing chain. (See **TIMING CHAIN REMOVAL/INSTALLATION [MZI-3.7]**.)
10. Remove in the order indicated in the table.
11. Install in the reverse order of removal.
12. Start the engine and:
 1. Inspect the runout and contact on the pulley and belt.

2008 Mazda CX-9 Grand Touring

2008 ENGINE Mechanical (MZI-3.7) - Mazda CX-9

2. Inspect for engine oil, engine coolant, ATF, power steering fluid and fuel leakage.
 3. Verify the ignition timing, idle speed and idle mixture. (See **ENGINE TUNE-UP [MZI-3.7]**.)
 4. Engine accessories operation.
13. Perform a road test.

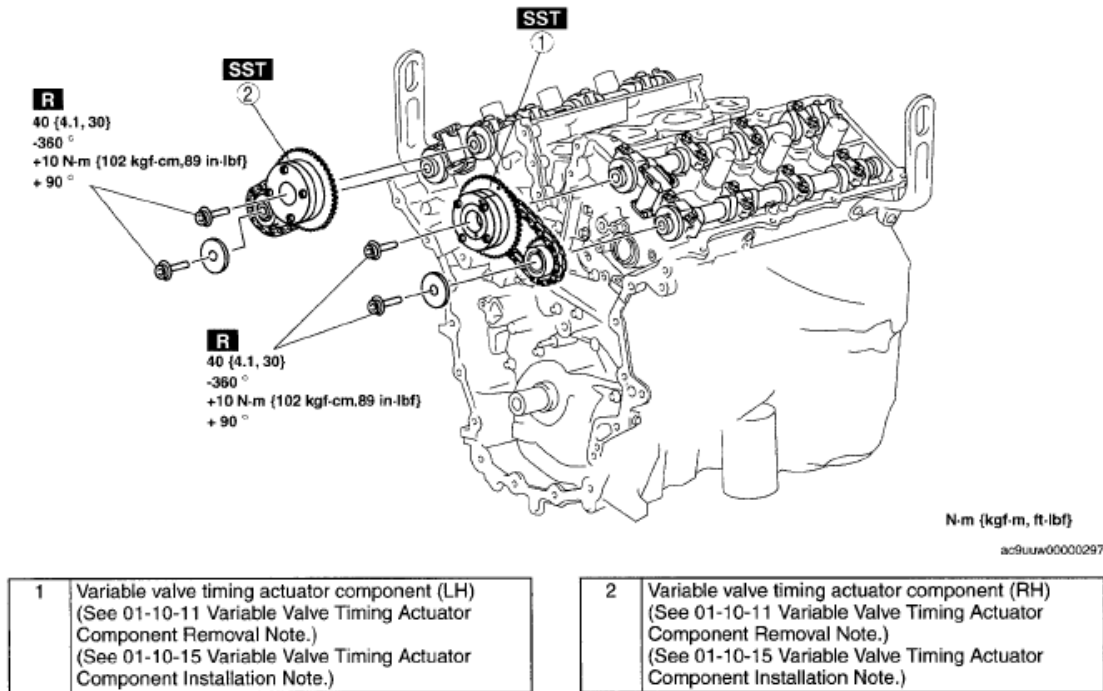


Fig. 17: Identifying Engine Components With SST & Torque Specifications
Courtesy of MAZDA MOTORS CORP.

VARIABLE VALVE TIMING ACTUATOR COMPONENT REMOVAL NOTE

CAUTION:

- Do not rotate the crankshaft counterclockwise. The timing chains may bind, causing engine damage.

1. Turn the crankshaft clockwise so that the crankshaft keyway is in the 11 o'clock position. (This will position the No.1 cylinder at TDC.)

NOTE:

- Verify that there are timing marks in three locations (Yellow 1, Black 2) on the timing chain. If any timing marks are missing, mark the timing chain.
- When marking the crankshaft sprocket side timing chain, change the mark color.
- If replacing with a new timing chain, place alignment marks in the same positions as those prior to the replacement.

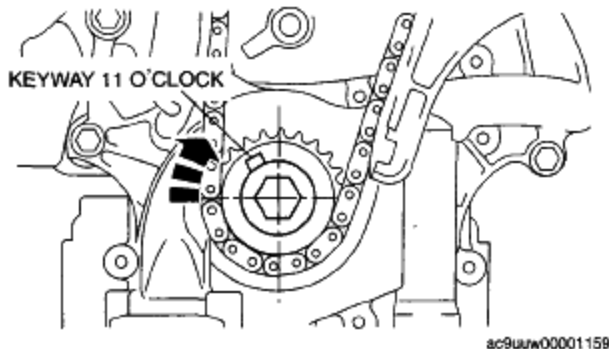


Fig. 18: Turning Crankshaft Clockwise
Courtesy of MAZDA MOTORS CORP.

2. Mark the timing chain at the position of each timing sprocket timing mark.

CAUTION:

- Verify that there are timing marks in two locations on the camshaft timing chain. If any timing marks are missing, mark the camshaft timing chain.
- If replacing with a new variable valve timing actuator, place alignment marks in the same positions as those prior to the replacement.

3. Mark the camshaft timing chain at the positions where it is aligned with each of the camshaft sprocket on both banks.

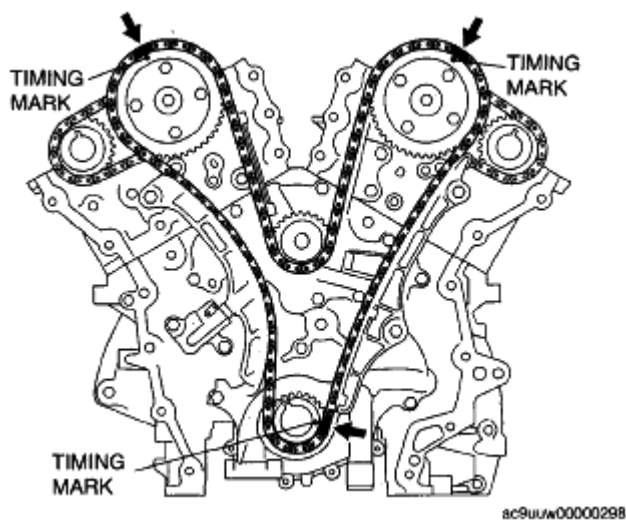


Fig. 19: Locating Camshaft Timing Chain Mark
Courtesy of MAZDA MOTORS CORP.

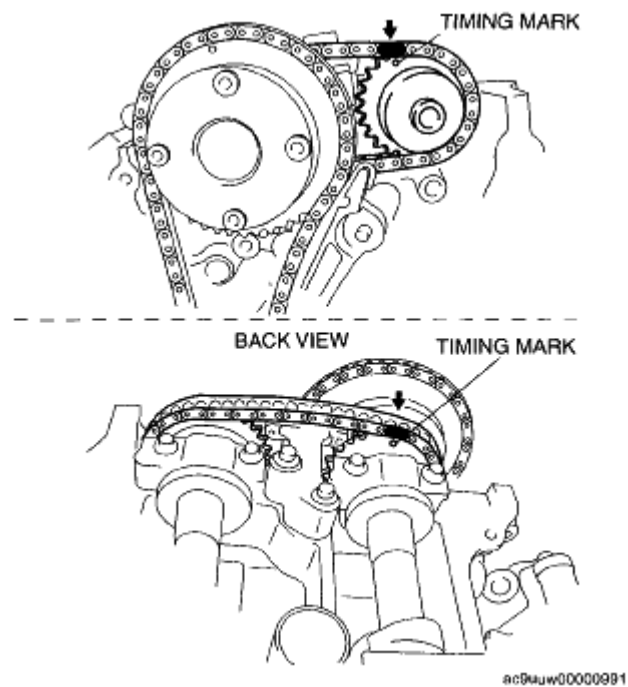


Fig. 20: Locating Camshaft Timing Chain Mark (LH)
Courtesy of MAZDA MOTORS CORP.

RH

4. Remove the timing chain in the following order.
 1. Chain tensioner
 2. Timing chain
 3. Tensioner arm
 4. Chain guide

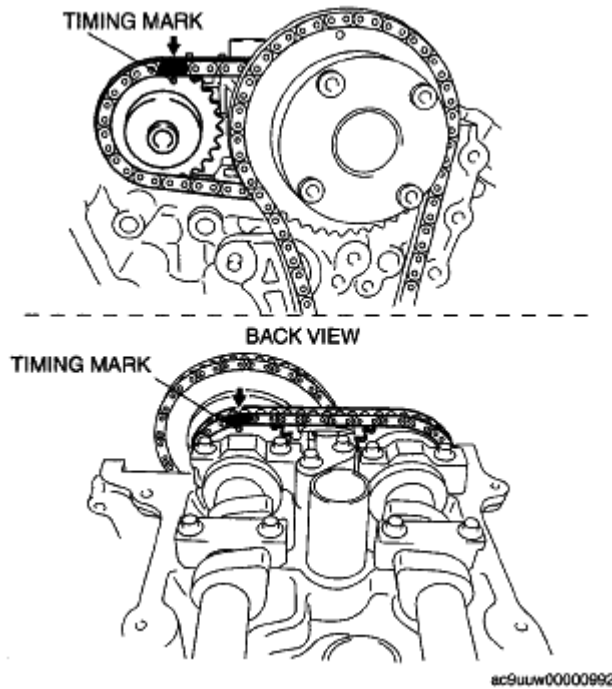


Fig. 21: Locating Timing Chain Mark Location
Courtesy of MAZDA MOTORS CORP.

5. Crankshaft sprocket

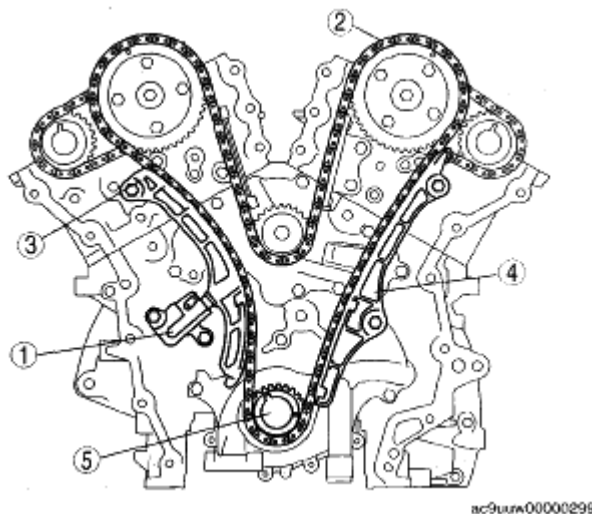


Fig. 22: Identifying Crankshaft Sprocket
Courtesy of MAZDA MOTORS CORP.

5. Rotate the crankshaft counterclockwise until the keyway is in the 9 o'clock position.
6. Slowly compress the camshaft timing chain tensioner (LH) piston by hand.

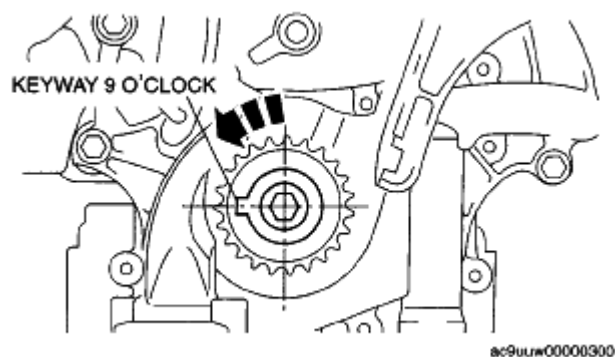


Fig. 23: Rotating Crankshaft Counterclockwise
Courtesy of MAZDA MOTORS CORP.

7. Insert an **approx. 1.0 mm {0.039 in}** thin wire or paper clip into the camshaft timing chain tensioner (LH) shown in the figure to hold the tensioner piston.

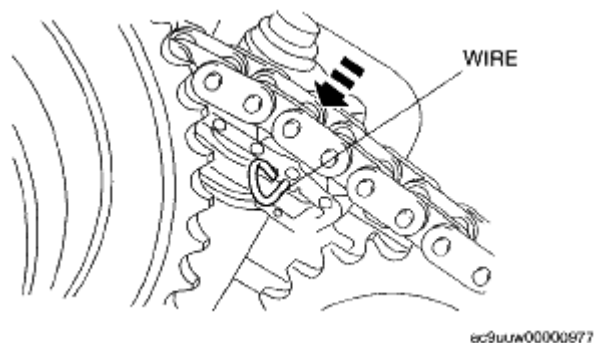


Fig. 24: Inserting Paper Clip Into Camshaft Timing Chain Tensioner (LH)
Courtesy of MAZDA MOTORS CORP.

8. Install the SST onto the camshafts (LH).

NOTE:

- The camshaft sprocket is integrated with the variable valve timing actuator and cannot be disassembled.

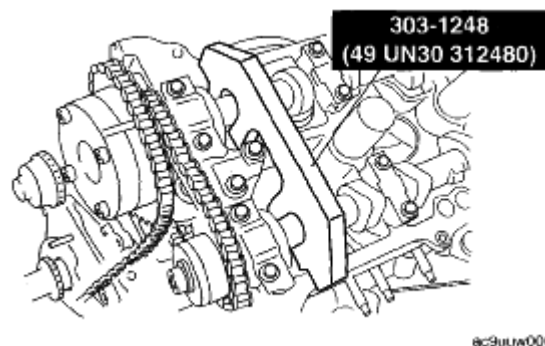


Fig. 25: Identifying SST Onto Camshafts (LH)

Courtesy of MAZDA MOTORS CORP.

9. Remove the variable valve timing actuator, camshaft timing chain and the exhaust camshaft sprocket of the LH bank as a single unit.
10. Slowly compress the camshaft timing chain tensioner (RH) piston by hand.
11. Insert an **approx. 1.0 mm {0.039 in}** thin wire or paper clip into the camshaft timing chain tensioner (RH) shown in the figure to hold the tensioner piston.

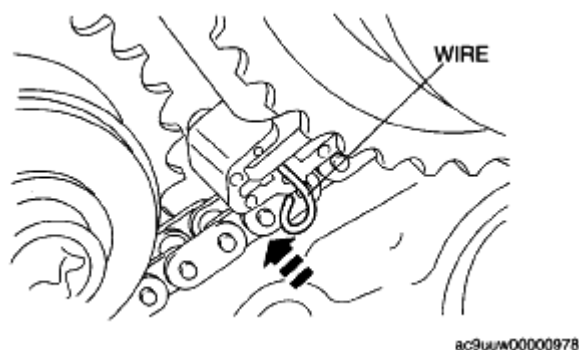


Fig. 26: Inserting Thin Wire Or Paper Clip Into Camshaft Timing Chain Tensioner (RH)
Courtesy of MAZDA MOTORS CORP.

12. Install the SST onto the camshafts (RH).

NOTE:

- **The camshaft sprocket is integrated with the variable valve timing actuator and cannot be disassembled.**

13. Remove the variable valve timing actuator, camshaft timing chain and the exhaust camshaft sprocket of the RH bank as a single unit.

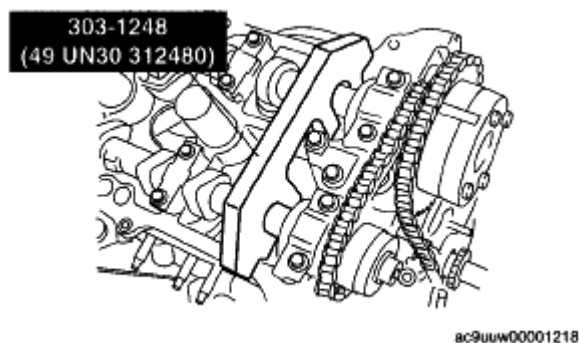


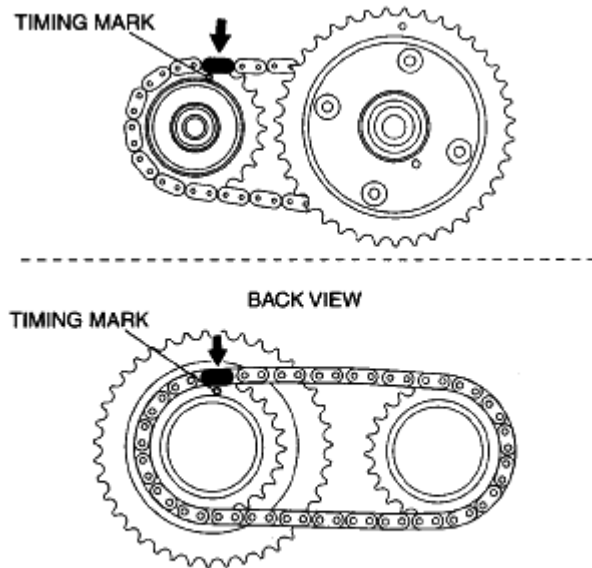
Fig. 27: Identifying SST Onto Camshafts (RH)
Courtesy of MAZDA MOTORS CORP.

VARIABLE VALVE TIMING ACTUATOR COMPONENT INSTALLATION NOTE

1. Align the alignment marks on the camshaft timing chain and both intake and exhaust side camshaft

sprockets of both banks.

RH



ac9uuw00002026

Fig. 28: Locating Alignment Marks On Camshaft Timing Chain (RH)
Courtesy of MAZDA MOTORS CORP.

LH

2. Install the variable valve timing actuator, camshaft timing chain and the exhaust camshaft sprocket of the RH bank as a single unit.

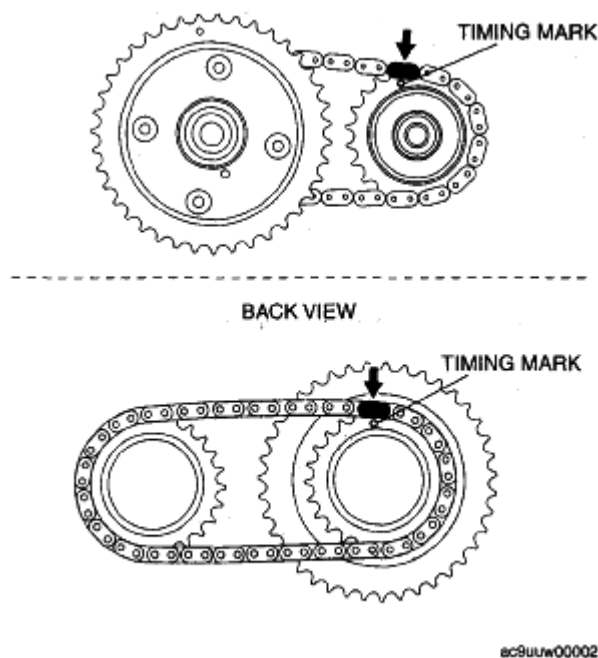


Fig. 29: Locating Alignment Marks On Camshaft Timing Chain (LH)
Courtesy of MAZDA MOTORS CORP.

3. Remove the retaining wire inserted into the camshaft timing chain tensioner (RH).
4. Tighten the new camshaft sprocket (RH) installation bolts using the following 4 steps.
 1. Tighten to **40 N.m {4.1 kgf.m, 30 ft.lbf}**.
 2. Loosen **360 °** (one full turn) in reverse order.
 3. Tighten to **10 N.m {102 kgf.cm, 89 in.lbf}**.
 4. Tighten to **90 °**
5. Install the variable valve timing actuator, camshaft timing chain and the exhaust camshaft sprocket of the LH bank as a single unit.

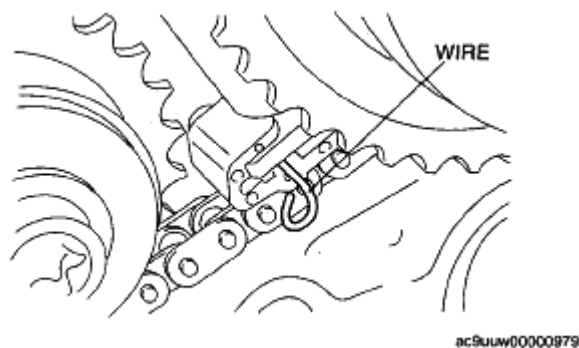


Fig. 30: Locating Retaining Wire Into Camshaft Timing Chain Tensioner
Courtesy of MAZDA MOTORS CORP.

6. Remove the retaining wire inserted into the camshaft timing chain tensioner (LH).

7. Tighten the new camshaft sprocket (LH) installation bolts using the following 4 steps.
 1. Tighten to **40 N.m {4.1 kgf.m, 30 ft.lbf}**.
 2. Loosen **360 °** (one full turn) in reverse order.
 3. Tighten to **10 N.m {102 kgf.cm, 89 in.lbf}**.
 4. Tighten to **90 °**

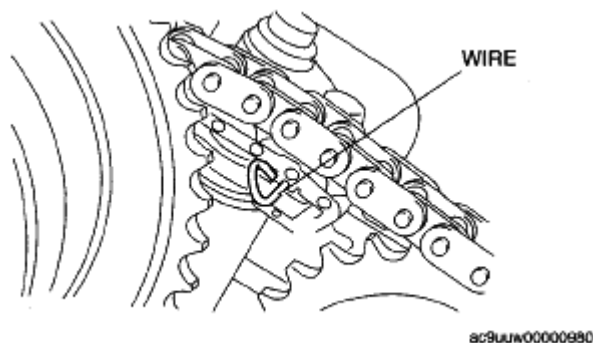


Fig. 31: Locating Retaining Wire Into Camshaft Timing Chain Tensioner
Courtesy of MAZDA MOTORS CORP.

8. Rotate the crankshaft clockwise until the keyway is in the 11 o'clock position. (This will position the No.1 cylinder at TDC.)
9. Follow the "TIMING CHAIN REMOVAL/INSTALLATION" procedure and install the timing chain. (See **TIMING CHAIN REMOVAL/INSTALLATION [MZI-3.7]**.)
10. Remove the **SSTs** installed to the camshaft components on both banks.

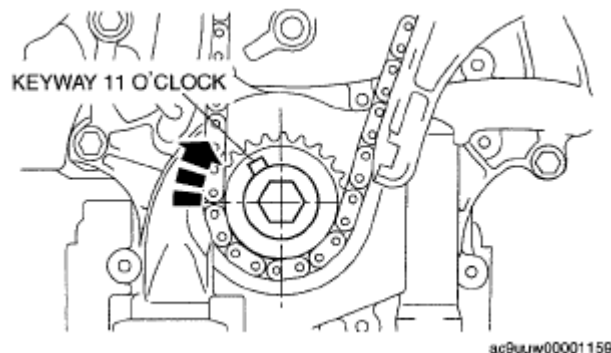


Fig. 32: Rotating Crankshaft Clockwise
Courtesy of MAZDA MOTORS CORP.

OIL CONTROL VALVE (OCV) INSPECTION [MZI-3.7]

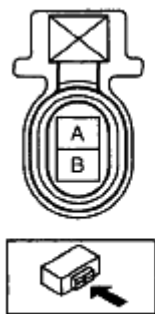
COIL RESISTANCE INSPECTION

1. Disconnect the negative battery cable.

2. Remove the engine cover. (See **ENGINE COVER REMOVAL/INSTALLATION [MZI-3.7].**)
3. Disconnect the OCV connector.
4. Measure the coil resistance between terminals A and B using a tester.
 - If it is not within the specification, replace the OCV.

Oil control valve resistance 5-14 ohms

5. Install in the reverse order of removal.

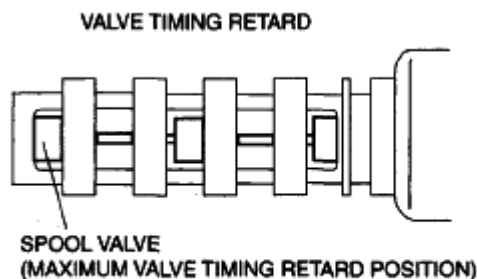


ac9uuw00000990

Fig. 33: Locating OCV Connector
Courtesy of MAZDA MOTORS CORP.

SPOOL VALVE OPERATION INSPECTION

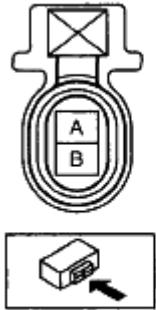
1. Disconnect the negative battery cable.
2. Remove the OCV. (See **OIL CONTROL VALVE (OCV) REMOVAL/INSTALLATION [MZI-3.7].**)
3. Verify that the spool valve in the OCV is in the maximum valve timing retard position as indicated in the figure.
 - If not as specified, replace the OCV.
4. Verify that the battery is fully charged.
 - If not as specified, recharge the battery.



ac9uuw00000990

Fig. 34: Identifying Maximum Valve Timing Retard Position (Spool Valve)
Courtesy of MAZDA MOTORS CORP.

5. Apply battery positive voltage between the OCV terminals and verify that the spool valve operates and moves to the maximum valve timing advance position.



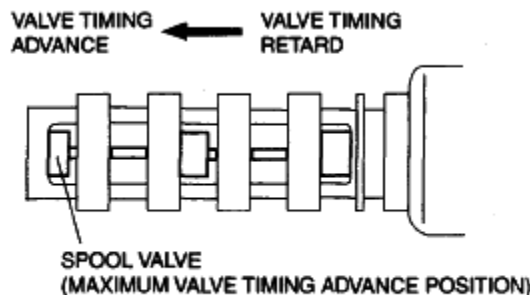
ac9uuw0000990

Fig. 35: Locating OCV Connector
Courtesy of MAZDA MOTORS CORP.

- If not as specified, replace the OCV.

NOTE:

- When applying battery positive voltage between the OCV terminals, the connection can be either of the following:
 - Positive battery cable to terminal A, Negative battery cable to terminal B
 - Positive battery cable to terminal B, Negative battery cable to terminal A



ac9uuw0000382

Fig. 36: Identifying Maximum Valve Timing Advance Position (Spool Valve)
Courtesy of MAZDA MOTORS CORP.

6. Stop applying battery positive voltage and verify that the spool valve returns to the maximum valve timing retard position.
 - If not as specified, replace the OCV. (See **OIL CONTROL VALVE (OCV) REMOVAL/INSTALLATION [MZI-3.7].**)
7. Install in the reverse order of removal.

OIL CONTROL VALVE (OCV) REMOVAL/INSTALLATION [MZI-3.7]

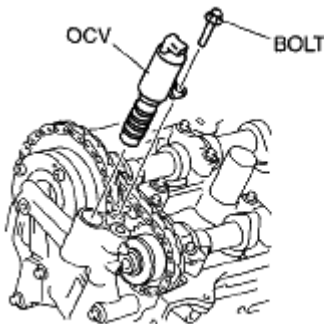
1. Disconnect the negative battery cable.
2. Remove the engine cover. (See ENGINE COVER REMOVAL/INSTALLATION [MZI-3.7].)
3. Remove the ventilation hose. (See QUICK RELEASE CONNECTOR (EMISSION SYSTEM) REMOVAL/INSTALLATION [MZI-3.7].)
4. Disconnect the vacuum hose. (See INTAKE-AIR SYSTEM REMOVAL/INSTALLATION [MZI-3.7].)
5. Remove the resonance chamber. (See INTAKE-AIR SYSTEM REMOVAL/INSTALLATION [MZI-3.7].)
6. Remove the dynamic chamber and throttle body as a single unit. (See INTAKE-AIR SYSTEM REMOVAL/INSTALLATION [MZI-3.7].)
7. Disconnect the wiring harness.
8. Remove the ignition coils. (See IGNITION COIL REMOVAL/INSTALLATION [MZI-3.7].)
9. Remove the dipstick.
10. Remove the cylinder head cover. (See TIMING CHAIN REMOVAL/INSTALLATION [MZI-3.7].)
11. Remove the OCV.

NOTE:

- The LH side is shown, however, the RH side is the same.

Tightening torque: 8.5-11.5 N.m {87-117 kgf.cm, 76-101 in.lbf}

12. Install in the reverse order of removal.



ac9uuw0000247

Fig. 37: Identifying OCV & Bolt
Courtesy of MAZDA MOTORS CORP.

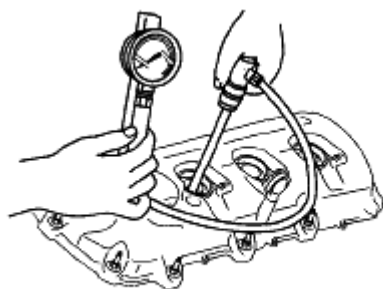
COMPRESSION INSPECTION [MZI-3.7]

WARNING:

- Hot engines and oil can cause severe burns. Turn off the engine and wait until they are cool.

- Fuel vapor is hazardous. It can very easily ignite, causing serious injury and damage. Always keep sparks and flames away from fuel.
- Fuel line spills and leakage are dangerous. Fuel can ignite and cause serious injuries or death and damage. Fuel can also irritate skin and eyes. To prevent this, always complete the "Fuel Line Safety Procedure". (See BEFORE SERVICE PRECAUTION [MZI-3.7] .)

1. Verify that the battery is fully charged.
 - Recharge it if necessary. (See BATTERY INSPECTION [MZI-3.7] .)
2. Warm up the engine to the normal operating temperature.
3. Perform "Fuel Line Safety Procedure". Leave the fuel pump relay removed. (See BEFORE SERVICE PRECAUTION [MZI-3.7] .)
4. Remove the engine cover. (See ENGINE COVER REMOVAL/INSTALLATION [MZI-3.7].)
5. Remove the dynamic chamber and throttle body as a single unit. (See INTAKE-AIR SYSTEM REMOVAL/INSTALLATION [MZI-3.7] .)
6. Remove the ignition coils. (See IGNITION COIL REMOVAL/INSTALLATION [MZI-3.7] .)
7. Remove the spark plugs.
8. Measure the compression pressure using the following procedure.
 1. Connect the compression gauge into the spark plug hole.
 2. Crank the engine a **minimum of five** compression strokes and record the highest reading.



ac9uuw00000138

Fig. 38: Measuring Compression Pressure
Courtesy of MAZDA MOTORS CORP.

NOTE:

- Note the approximate number of compression strokes required to obtain the highest reading.
3. Repeat the test on each cylinder, cranking the engine approximately the same number of compression strokes.
 4. The indicated compression pressures are considered within specification if the lowest reading cylinder is within **75%** of the highest reading. Refer to the COMPRESSION PRESSURE LIMIT CHART.

2008 Mazda CX-9 Grand Touring

2008 ENGINE Mechanical (MZI-3.7) - Mazda CX-9

1,048 {10.68, 152}	786 {8.02, 114}	1,255 {12.79, 182}	936 {9.54, 136}	1,462 {14.90,212}	1,089 {11.10, 158}	1,669 {17.01,242}	1,248 {12.73, 181}
1,062 {10.82, 154}	793 {8.09, 115}	1,269 {12.93, 184}	952 {9.70,138}	1,476 {15.04,214}	1,103 {11.25, 160}	1,682 {17.14,244}	1,262 {12.87, 183}
1,076 {10.96, 156}	807 {8.23, 117,}	1,282 {13.06,186}	965 {9.84, 140}	1,489 {15.17,216}	1,117 {11.39, 162}	1,696 {17.28,246}	1,269 {12.94, 184}
1,089 {11.10, 158}	814 {8.30, 118}	1,296 {13.21,188}	972 {9.91, 141}	1,503 {15.32,218}	1,124 {11.46, 163}	1,710 {17.43,248}	1,202 {12.26, 186}
1,103 {11.24, 160}	827 {8.43, 120}	1,310 {13.35, 190}	979 {9.98, 142}	1,517 {15.46,220}	1,138 {11.60, 165}	1,724 {17.57,250}	1,289 {13.14, 187}
1,110 {11.31, 161}	834 {8.50, 121}	1,324 {13.49, 192}	993 {10.2, 144}	1,631 {16.62,222}	1,145 {11.67, 166}	-	-

9. Remove the compression gauge.
10. Install the spark plugs. (See **SPARK PLUG REMOVAL/INSTALLATION [MZI-3.7]** .)
11. Install the ignition coils. (See **IGNITION COIL REMOVAL/INSTALLATION [MZI-3.7]** .)
12. Install the dynamic chamber and throttle body as a single unit. (See **INTAKE-AIR SYSTEM REMOVAL/INSTALLATION [MZI-3.7]** .)
13. Install the engine cover. (See **ENGINE COVER REMOVAL/INSTALLATION [MZI-3.7]**.)
14. Install the fuel pump relay.
15. Complete the "AFTER REPAIR PROCEDURE". (See **AFTER SERVICE PRECAUTION [MZI-3.7]** .)

TIMING CHAIN REMOVAL/INSTALLATION [MZI-3.7]

WARNING:

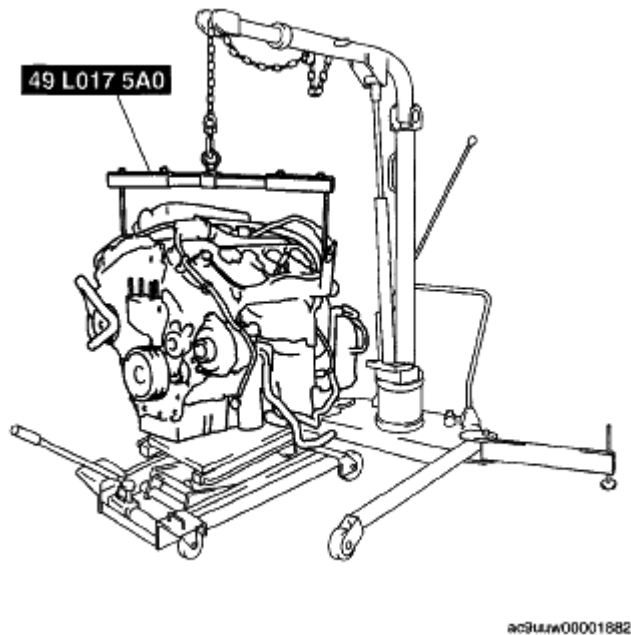
- Fuel vapor is hazardous. It can very easily ignite, causing serious injury and damage. Always keep sparks and flames away from fuel.
- Fuel line spills and leakage are dangerous. Fuel can ignite and cause serious injures or death and damage. Fuel can also irritate skin and eyes. To prevent this, always complete the "Fuel Line Safety Procedure". (See **BEFORE SERVICE PRECAUTION [MZI-3.7]** .)
- Continuous exposure to USED engine oil has caused skin cancer in laboratory mice. Protect your skin by washing with soap and water immediately after working with engine oil.

NOTE:

- The following procedure "TIMING CHAIN REMOVAL/INSTALLATION" is

performed after the engine and transaxle component is removed from the vehicle. (See ENGINE REMOVAL/INSTALLATION [MZI-3.7].)

1. Drain the engine oil. (See ENGINE OIL REPLACEMENT [MZI-3.7] .)
2. Remove the engine and transaxle component. (See ENGINE REMOVAL/INSTALLATION [MZI-3.7].)
3. Secure the engine and transaxle component using a hoist and the SST.



ac9uuw00001882

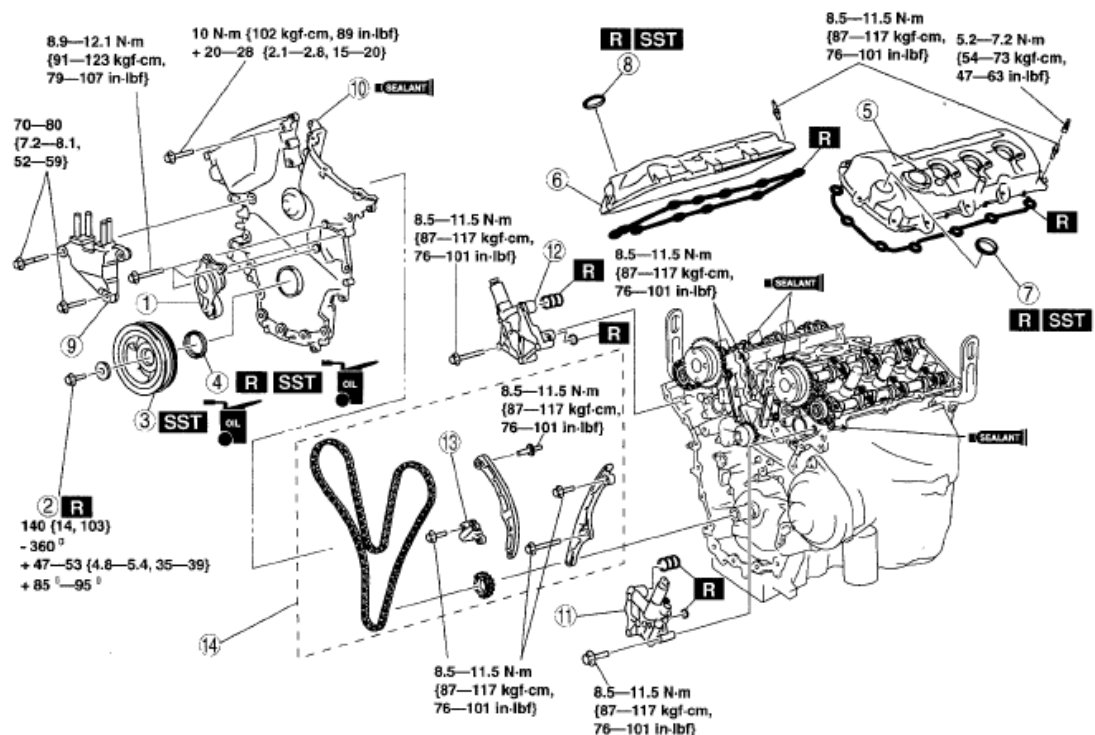
Fig. 39: Identifying Engine & Transaxle Component With SST
Courtesy of MAZDA MOTORS CORP.

4. Remove the dynamic chamber and throttle body as a single unit. (See INTAKE-AIR SYSTEM REMOVAL/INSTALLATION [MZI-3.7] .)
5. Remove the ignition coils. (See IGNITION COIL REMOVAL/INSTALLATION [MZI-3.7] .)
6. Remove the dipstick.
7. Remove the power steering oil pump drive belt. (See DRIVE BELT REMOVAL/INSTALLATION [MZI-3.7].)
8. Remove the power steering oil pump. (See POWER STEERING OIL PUMP REMOVAL/INSTALLATION .)
9. Remove in the order indicated in the table.
10. Install in the reverse order of removal.
11. Start the engine and:
 1. Inspect the runout and contact on the pulley and belt.
 2. Inspect for engine oil, engine coolant, ATF, power steering fluid and fuel leakage.
 3. Verify the ignition timing, idle speed and idle mixture. (See ENGINE TUNE-UP [MZI-3.7].)

2008 Mazda CX-9 Grand Touring

2008 ENGINE Mechanical (MZI-3.7) - Mazda CX-9

4. Engine accessories operation.
12. Perform a road test.



N-m (kgf-m, ft-lbf)

ac9uuw0002737

1	Drive belt auto tensioner
2	Crankshaft pulley lock bolt (See 01-10-21 Crankshaft Pulley Lock Bolt Removal Note.) (See 01-10-31 Crankshaft Pulley Lock Bolt Installation Note.)
3	Crankshaft pulley (See 01-10-21 Crankshaft Pulley Removal Note.) (See 01-10-31 Crankshaft Pulley Installation Note.)
4	Front oil seal (See 01-10-22 Front Oil Seal Removal Note.) (See 01-10-30 Front Oil Seal Installation Note.)
5	Cylinder head cover (LH) (See 01-10-22 Cylinder Head Cover Removal Note.) (See 01-10-29 Cylinder Head Cover Installation Note.)
6	Cylinder head cover (RH) (See 01-10-22 Cylinder Head Cover Removal Note.) (See 01-10-29 Cylinder Head Cover Installation Note.)
7	Cylinder head cover oil seal (LH) (See 01-10-23 Cylinder Head Cover Oil Seal Removal Note.) (See 01-10-29 Cylinder Head Cover Oil Seal Installation Note.)

8	Cylinder head cover oil seal (RH) (See 01-10-23 Cylinder Head Cover Oil Seal Removal Note.) (See 01-10-29 Cylinder Head Cover Oil Seal Installation Note.)
9	No.3 engine mount bracket (See 01-10-23 Engine Front Cover and No.3 Engine Mount Bracket Removal Note.) (See 01-10-28 Engine Front Cover and No.3 Engine Mount Bracket Installation Note.)
10	Engine front cover (See 01-10-23 Engine Front Cover and No.3 Engine Mount Bracket Removal Note.) (See 01-10-28 Engine Front Cover and No.3 Engine Mount Bracket Installation Note.)
11	OCV component (LH) (See 01-10-24 OCV Component Removal Note.) (See 01-10-25 OCV Component Installation Note.)
12	OCV component (RH) (See 01-10-24 OCV Component Removal Note.) (See 01-10-25 OCV Component Installation Note.)
13	Chain tensioner
14	Timing chain component (See 01-10-24 Timing Chain Component Removal Note.) (See 01-10-26 Timing Chain Component Installation Note.)

Fig. 40: Identifying Engine Components With Torque Specifications
 Courtesy of MAZDA MOTORS CORP.

CRANKSHAFT PULLEY LOCK BOLT REMOVAL NOTE

1. Remove the starter. (See STARTER REMOVAL/INSTALLATION [MZI-3.7] .)
2. Set a flathead screwdriver to the drive plate in the position indicated in the figure to lock the crankshaft rotation.
3. Remove the crankshaft pulley lock bolt and washer.

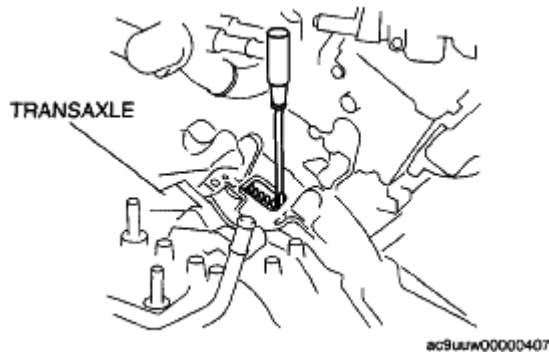


Fig. 41: Locking Crankshaft Rotation
 Courtesy of MAZDA MOTORS CORP.

CRANKSHAFT PULLEY REMOVAL NOTE

1. Remove the washer from the crankshaft pulley lock bolt, install a suitable spacer (thickness: **approx. 14 mm {0.55 in}** , diameter: **approx. 30 mm {1.18 in}**), (similar to front shock absorber lower nut) to the crankshaft pulley lock bolt, and install the crankshaft pulley lock bolt to the crankshaft.

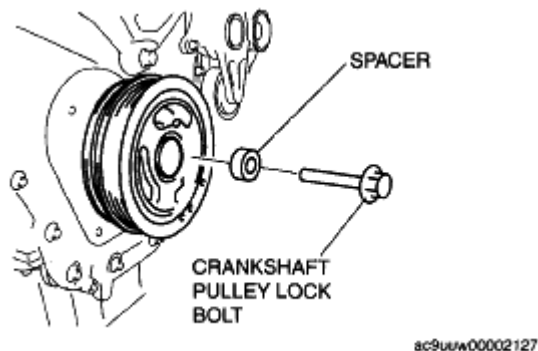
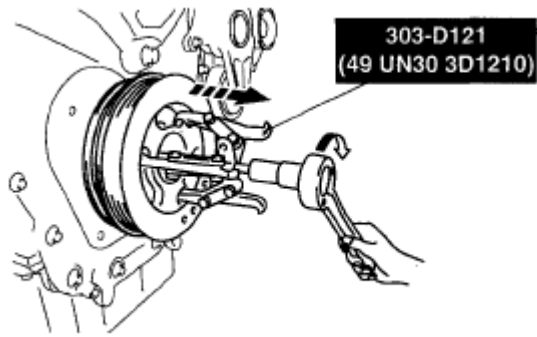


Fig. 42: Identifying Crankshaft Pulley Lock Bolt & Spacer
 Courtesy of MAZDA MOTORS CORP.

2. Remove the crankshaft pulley using the SST.
3. Remove the crankshaft pulley lock bolt and spacer.

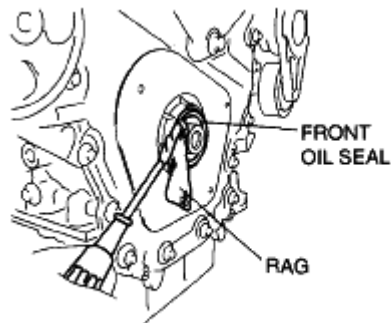


ac9uuw00000151

Fig. 43: Removing Crankshaft Pulley With SST
Courtesy of MAZDA MOTORS CORP.

FRONT OIL SEAL REMOVAL NOTE

1. Remove the front oil seal using a flathead screwdriver as shown.



ac9uuw00000258

Fig. 44: Removing Front Oil Seal
Courtesy of MAZDA MOTORS CORP.

CYLINDER HEAD COVER REMOVAL NOTE

1. Remove the cylinder head cover bolts in the order shown.

RH

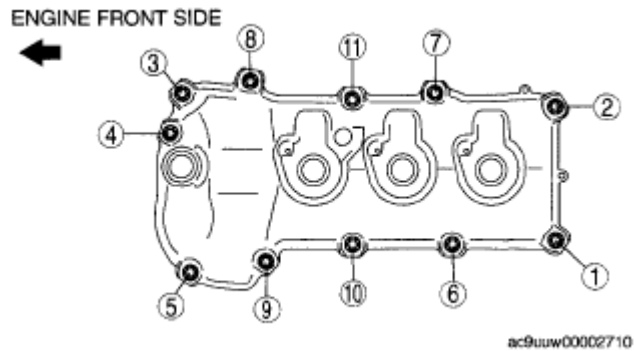


Fig. 45: Identifying Cylinder Head Cover Bolts (RH)
Courtesy of MAZDA MOTORS CORP.

LH

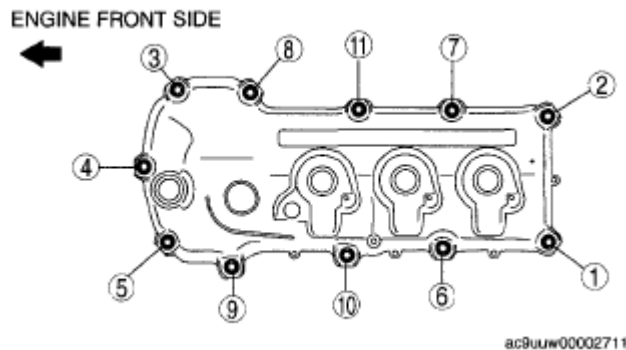


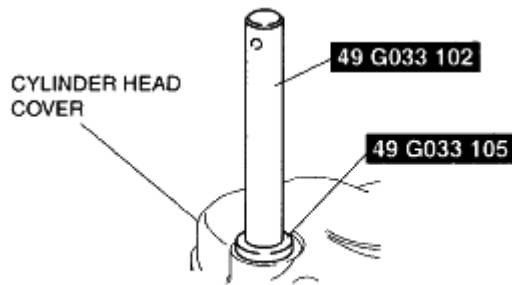
Fig. 46: Identifying Cylinder Head Cover Bolts (LH)
Courtesy of MAZDA MOTORS CORP.

CYLINDER HEAD COVER OIL SEAL REMOVAL NOTE

NOTE:

- Inspect the OCV attachment hole seals and spark plug tube attachment hole seals. Remove the any damaged seals.
- The OCV attachment hole seals removal is shown, the spark plug tube attachment hole seals removal procedure is the same.

1. Tap the OCV attachment hole seals and spark plug tube attachment hole seals using the SSTs and hammer.

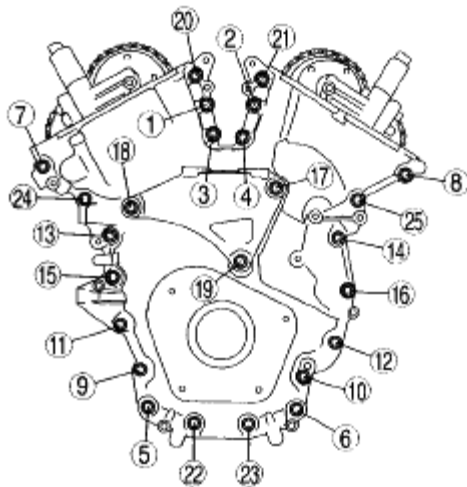


ac9uuw00000598

Fig. 47: View Of Cylinder Head Cover Oil Seal & SST
Courtesy of MAZDA MOTORS CORP.

ENGINE FRONT COVER AND NO.3 ENGINE MOUNT BRACKET REMOVAL NOTE

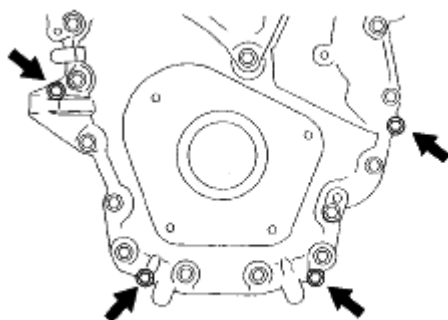
1. Loosen the engine front cover and No.3 engine mount bracket installation bolts in the order shown in the figure.
2. Install 4 of the engine front cover bolts (finger tightened) into the 4 threaded holes in the engine front cover.



ac9uuw00001105

Fig. 48: Identifying Engine Front Cover & No.3 Engine Mount Bracket
Courtesy of MAZDA MOTORS CORP.

1. Tighten the bolts one turn at a time in a crisscross pattern until the engine front cover-to-cylinder block seal is released.
2. Remove the engine front cover.



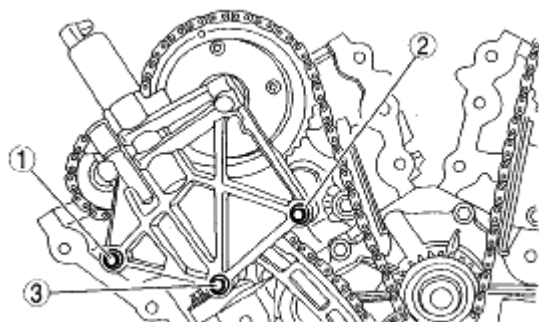
ac9uuw00001106

Fig. 49: Locating Engine Front Cover Bolts
Courtesy of MAZDA MOTORS CORP.

OCV COMPONENT REMOVAL NOTE

1. Loosen the OCV component installation bolts in the order shown in the figure.

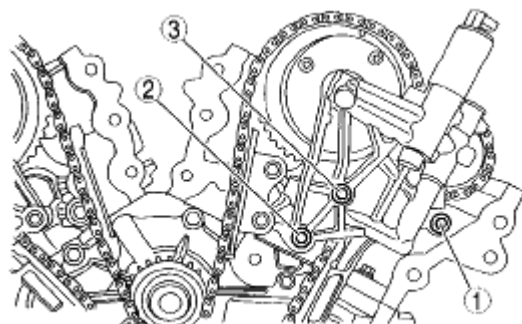
RH



ac9uuw00002419

Fig. 50: Identifying OCV Component Bolts (RH)
Courtesy of MAZDA MOTORS CORP.

LH



ac9uuw00002420

Fig. 51: Identifying OCV Component Bolts (LH)

Courtesy of MAZDA MOTORS CORP.

TIMING CHAIN COMPONENT REMOVAL NOTE

CAUTION:

- Do not rotate the crankshaft counterclockwise. The timing chains may bind, causing engine damage.

1. Turn the crankshaft clockwise so that the crankshaft keyway is in the 11 o'clock position. (This will position the No.1 cylinder at TDC.)

NOTE:

- Verify that there are timing marks in three locations (Yellow 1, Black 2) on the timing chain. If any timing marks are missing, mark the timing chain.
- When marking the crankshaft sprocket side timing chain, change the mark color.
- When the timing chain is replaced with a new one, mark the new timing chain at the same positions as the removed timing chain.

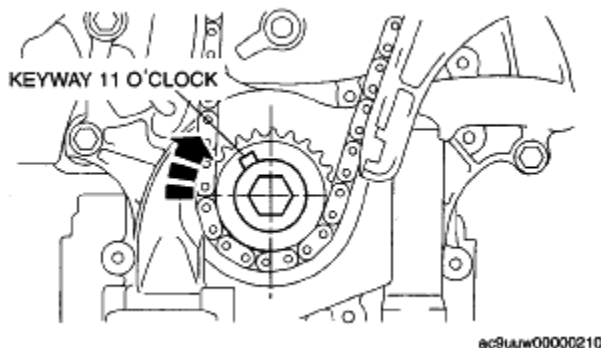


Fig. 52: Turning Crankshaft Clockwise
Courtesy of MAZDA MOTORS CORP.

2. Mark the timing chain at the position of each timing sprocket timing mark.
3. Remove the timing chain in the following order.
 1. Chain tensioner
 2. Timing chain
 3. Tensioner arm
 4. Chain guide

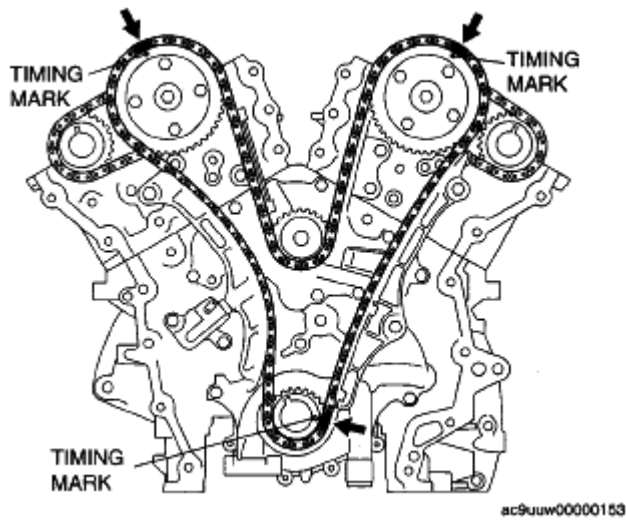


Fig. 53: Identifying Timing Sprocket Timing Mark
Courtesy of MAZDA MOTORS CORP.

5. Crankshaft sprocket

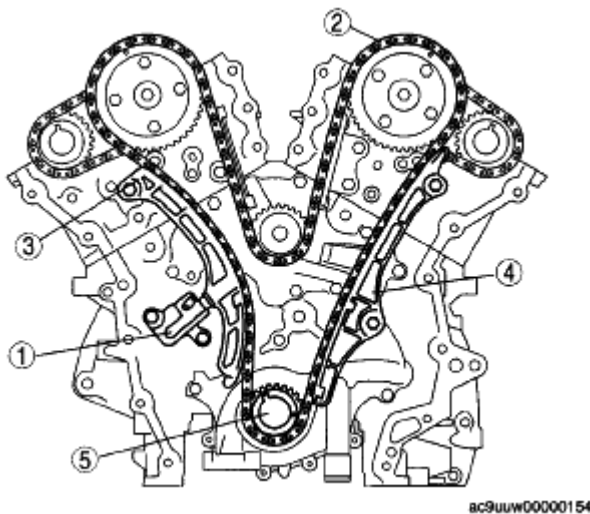


Fig. 54: Identifying Crankshaft Sprocket
Courtesy of MAZDA MOTORS CORP.

OCV COMPONENT INSTALLATION NOTE

1. Tighten the OCV component installation bolts in the order shown in the figure.

RH

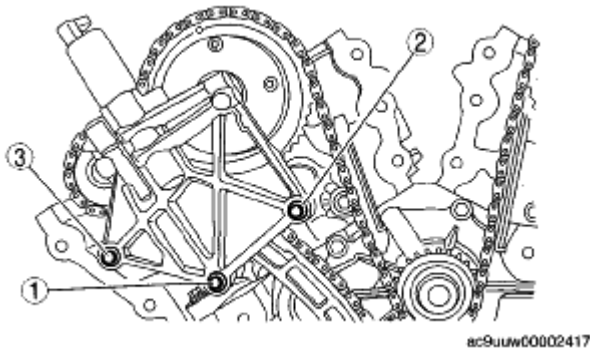


Fig. 55: Identifying OCV Component Bolts (RH)
Courtesy of MAZDA MOTORS CORP.

LH

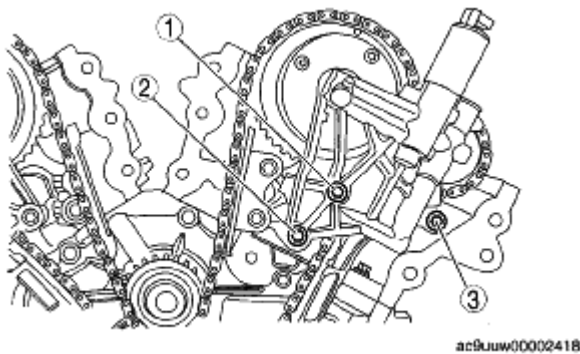


Fig. 56: Identifying OCV Component Bolts (LH)
Courtesy of MAZDA MOTORS CORP.

TIMING CHAIN COMPONENT INSTALLATION NOTE

1. Verify that the crankshaft keyway is at 11 o'clock position.

NOTE:

- Of the three marked locations on the timing chain, align the mark that has a different color to the crankshaft sprocket side timing mark.

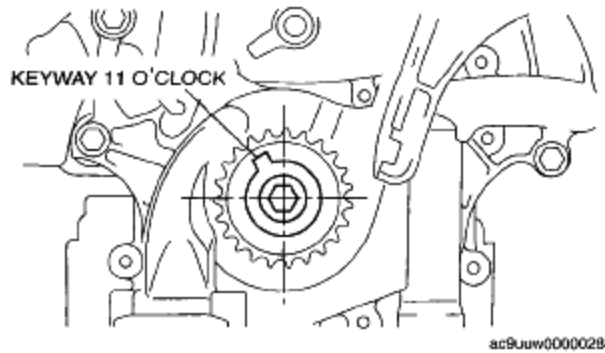


Fig. 57: Identifying Timing Chain Component
Courtesy of MAZDA MOTORS CORP.

2. Place alignment marks on the timing chain corresponding to each of the alignment marks on the timing sprocket.

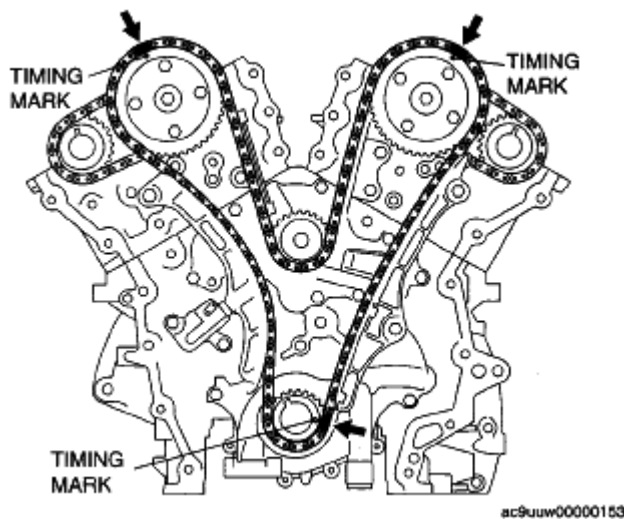


Fig. 58: View Of Alignment Marks On Timing Chain
Courtesy of MAZDA MOTORS CORP.

3. Push down the link plate of the timing chain tensioner and release the plunger lock.

NOTE:

- The plunger should retract with minimal force. If binding occurs, remove the chain tensioner from the vise and reset it in the vise.

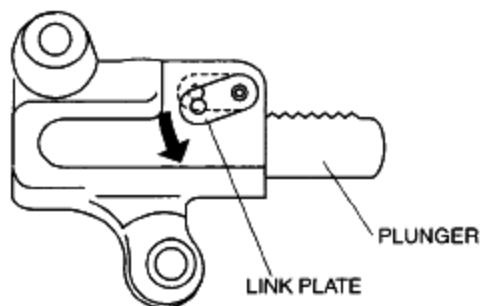


Fig. 59: Pushing Link Plate Of Timing Chain Tensioner
Courtesy of MAZDA MOTORS CORP.

4. Secure the chain tensioner using a vice attached with a soft base, and slowly press the plunger back shown in the figure while pressing down the link plate.
5. Release the pressure slightly from the plunger, and move the plunger back and forth **2-3 mm {0.08-0.11 in}**.

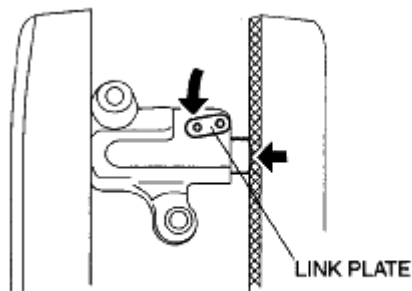
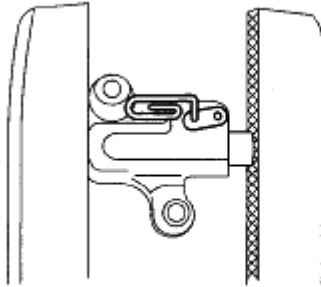


Fig. 60: Pressing Plunger
Courtesy of MAZDA MOTORS CORP.

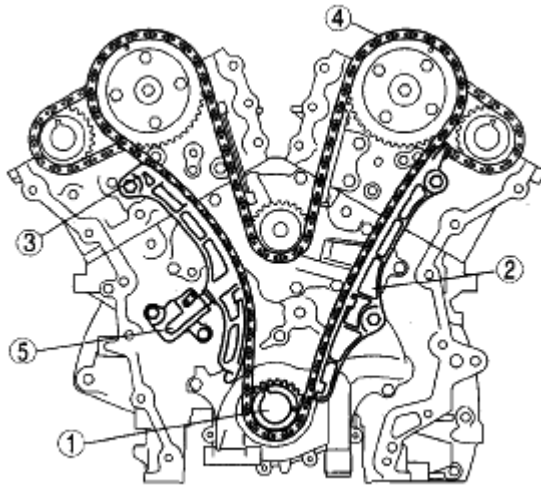
6. Insert an **approx. 1.5 mm {0.059 in}** thick wire or paper clip where the link plate hole and the tensioner body hole overlap to fix the link plate and lock the plunger.
7. Install the timing chain in the following order.
 1. Crankshaft sprocket
 2. Chain guide
 3. Tensioner arm
 4. Timing chain
 5. Chain tensioner



ac9uuw00000156

Fig. 61: Identifying Link Plate Hole & Tensioner Body Hole
Courtesy of MAZDA MOTORS CORP.

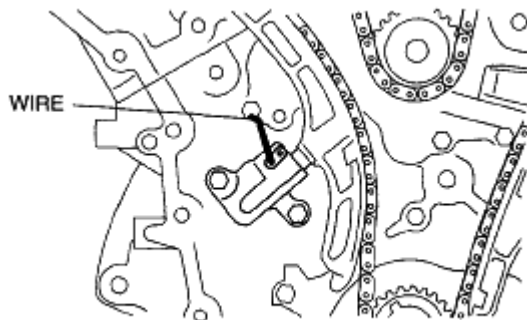
Tightening torque: 8.5-11.5 N.m {87-117 kgf.cm, 76-101 in.lbf}



ac9uuw00000155

Fig. 62: Identifying Crankshaft Sprocket, Tensioner Arm, Timing Chain & Chain Tensioner
Courtesy of MAZDA MOTORS CORP.

8. Remove the retaining wire.



ac9uuw00000158

Fig. 63: View Of Retaining Wire

Courtesy of MAZDA MOTORS CORP.

ENGINE FRONT COVER & NO.3 ENGINE MOUNT BRACKET INSTALLATION NOTE

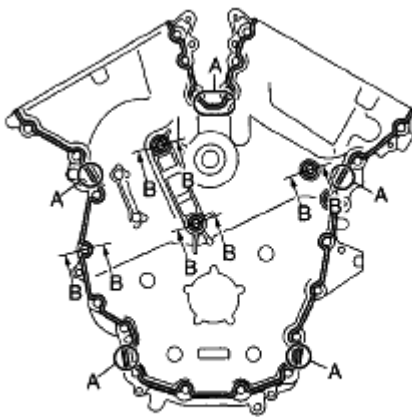
1. Apply the silicon sealant (Loctite 5900) to the engine front cover shown in the figure.

Silicon sealant thickness

A: 5.0-6.0 mm {0.197-0.236 in}

B: 2.5-3.5 mm {0.099-0.137 in}

2. Install the engine front cover and No.3 engine mount bracket.
 1. Tighten the engine front cover and No.3 engine mount bracket installation bolts in 4 steps in the order shown in the figure.



ac9uuw0000599

Fig. 64: Identifying Engine Front Cover Sealant Area
 Courtesy of MAZDA MOTORS CORP.

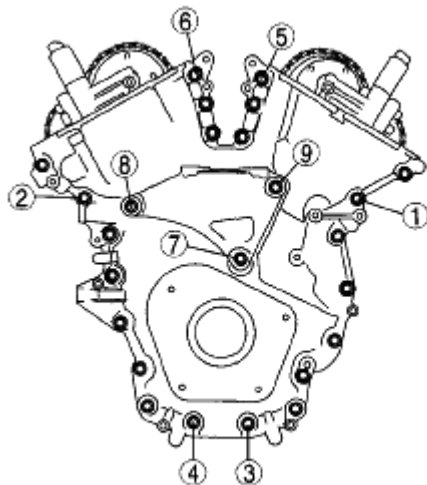
- CAUTION:**
- Install the engine front cover and No.3 engine mount bracket installation bolts within 10 min of applying the silicone sealant.

Tightening Torque

TIGHTENING TORQUE SPECIFICATION

Step	Installation position	Tightening torque
1	1-6	10 N.m {102 kgf.cm, 89 in.lbf}
2	7-9	15 N.m {1.5 kgf.m, 11 ft.lbf}
3	1-6	20-28 N.m {2.1-2.8 kgf.m, 15-20 ft.lbf}
4	7-9	70-80 N.m {7.2-8.1 kgf.m, 52-59 ft.lbf}

2. Tighten the engine front cover installation bolts in the order in 2 steps in the order shown in the figure.



ac9uuw00001107

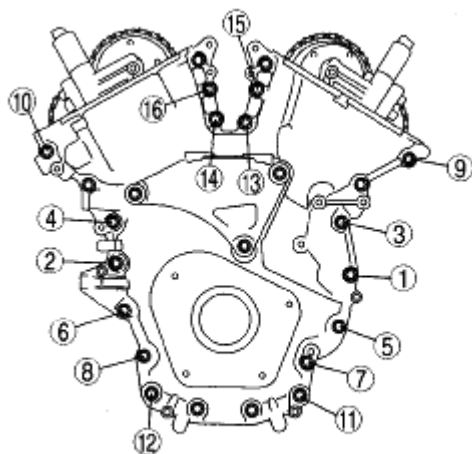
Fig. 65: Identifying Engine Front Cover Bolts Tightening Sequence
Courtesy of MAZDA MOTORS CORP.

CAUTION:

- Install the engine front cover installation bolts within 60 min of applying the silicone sealant.

Tightening torque

1. Tighten to 10 N.m {102 kgf.cm, 89 in.lbf}.
2. Tighten to 20-28 N.m {2.1-2.8 kgf.m, 15-20 ft.lbf}.



ac9uuw00001108

Fig. 66: Identifying Engine Front Cover Bolts Tightening Sequence
Courtesy of MAZDA MOTORS CORP.

CYLINDER HEAD COVER OIL SEAL NOTE

NOTE:

- Installation of new seals is only required if damaged seals were removed during disassembly of the engine.

1. Push the OCV attachment hole seals and spark plug tube attachment hole seals slightly in by hand.
2. Tap the OCV attachment hole seals and spark plug tube attachment hole seals using the **SST** and hammer.

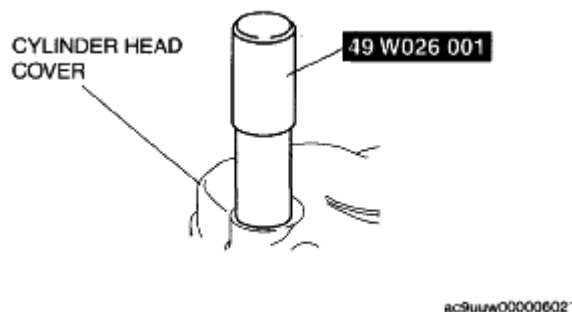


Fig. 67: Identifying Cylinder Head Cover With SST
Courtesy of MAZDA MOTORS CORP.

CYLINDER HEAD COVER INSTALLATION NOTE

1. Apply silicone sealant (Loctite 5900) to the mating faces as shown.

RH

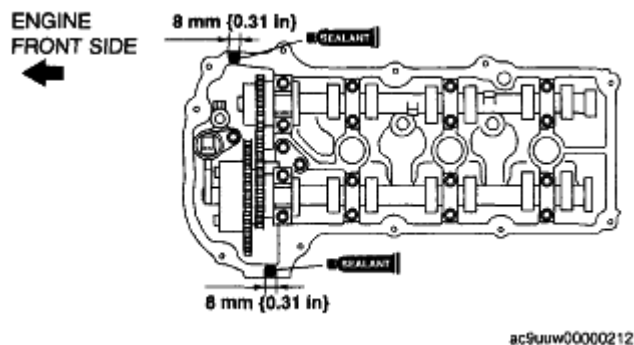


Fig. 68: Applying Silicone Sealant To Mating Faces (RH)
Courtesy of MAZDA MOTORS CORP.

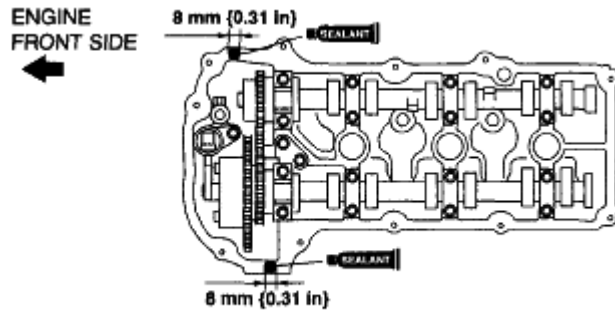
LH

2. Install the cylinder head cover with a new gasket.
3. Tighten the bolts in the order as shown.

2008 Mazda CX-9 Grand Touring

2008 ENGINE Mechanical (MZI-3.7) - Mazda CX-9

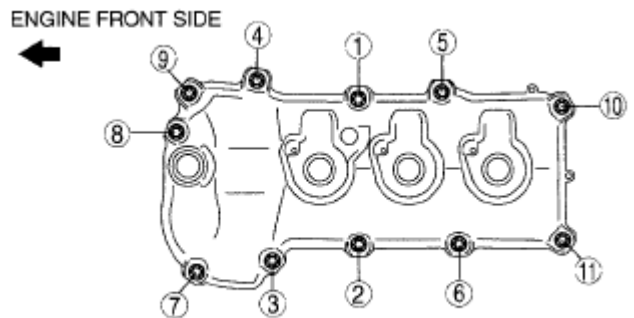
- CAUTION:**
- Install the cylinder head cover installation bolt and studs within 5 min of applying the silicone sealant.



ac9uuw0000212

Fig. 69: Applying Silicone Sealant To Mating Faces (LH)
Courtesy of MAZDA MOTORS CORP.

RH



ac9uuw00002712

Fig. 70: Identifying Cylinder Head Cover Bolts Tightening Sequence (RH)
Courtesy of MAZDA MOTORS CORP.

LH

Tightening torque

8.5-11.5 N.m {87-117 kgf.cm, 76-101 in.lbf}

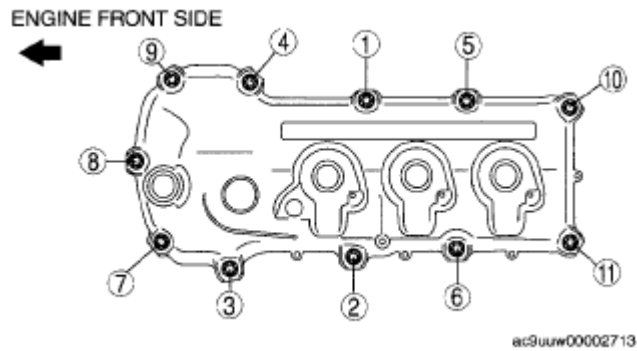


Fig. 71: Identifying Cylinder Head Cover Bolts Tightening Sequence (LH)
 Courtesy of MAZDA MOTORS CORP.

FRONT OIL SEAL INSTALLATION NOTE

NOTE:

- Apply clean engine oil to the front oil seal bore in the engine front cover.

1. Push the front oil seal slightly in by hand.
2. Tap the front oil seal in evenly using the SST and a hammer.

Substitution SST

- **49G028 203**

Outer diameter: 58-70 mm {2.3-2.7 in}

Inner diameter: 56-58 mm {2.3-2.2 in}

Tube with board thickness 2 mm {0.079 in} or more

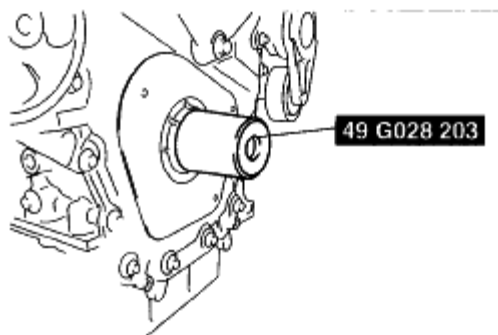


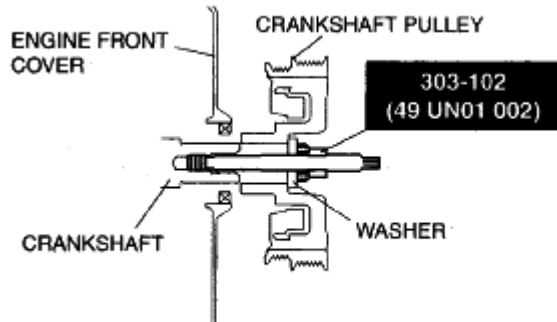
Fig. 72: Tapping Front Oil Seal With SST
 Courtesy of MAZDA MOTORS CORP.

CRANKSHAFT PULLEY INSTALLATION NOTE

NOTE:

- Lubricate the contact surface (exterior area of inner diameter) of the front oil seal with clean engine oil.

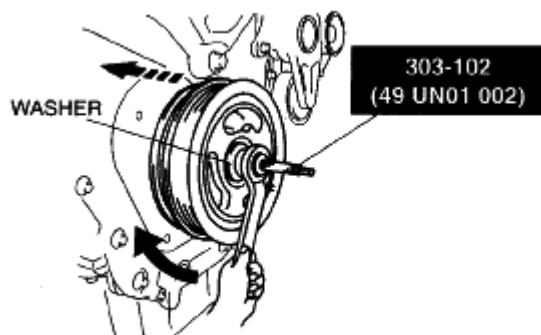
1. Install the crankshaft pulley, washer, and SST to the crankshaft.



ac9uuw00001884

Fig. 73: View Of Crankshaft Pulley & Washer
 Courtesy of MAZDA MOTORS CORP.

2. Tighten the SST nut and install the crankshaft pulley.



ac9uuw00002114

Fig. 74: Installing Crankshaft Pulley With SST
 Courtesy of MAZDA MOTORS CORP.

CRANKSHAFT PULLEY LOCK BOLT INSTALLATION NOTE

1. Set a flathead screwdriver to the drive plate in the position indicated in the figure to lock the crankshaft rotation.
2. Tighten the new crankshaft pulley lock bolt in four steps.
 1. Tighten to **140 N.m {14 kgf.m, 103 ft.lbf}**.
 2. Loosen **360 °** (one full turn) in reverse order.
 3. Tighten to **47-53 N.m {4.8-5.4 kgf.m, 35-39 ft.lbf}**.
 4. Tighten **85 °--95 °**.
3. Install the starter. (See **STARTER REMOVAL/INSTALLATION [MZI-3.7]** .)

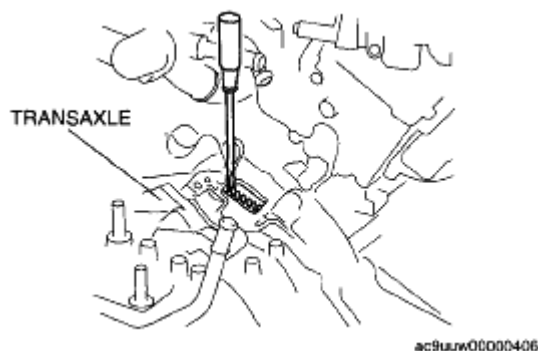


Fig. 75: Locking Crankshaft Rotation
 Courtesy of MAZDA MOTORS CORP.

CYLINDER HEAD GASKET REPLACEMENT [MZI-3.7]

WARNING:

- Fuel vapor is hazardous. It can very easily ignite, causing serious injury and damage. Always keep sparks and flames away from fuel.
- Fuel line spills and leakage are dangerous. Fuel can ignite and cause serious injuries or death and damage. Fuel can also irritate skin and eyes. To prevent this, always complete the "Fuel Line Safety Procedure". (See BEFORE SERVICE PRECAUTION [MZI-3.7] .)
- Continuous exposure to USED engine oil has caused skin cancer in laboratory mice. Protect your skin by washing with soap and water immediately after working with engine oil.

NOTE:

- The following procedure "CYLINDER HEAD GASKET REPLACEMENT" is performed after the engine and transaxle component is removed from the vehicle. (See ENGINE REMOVAL/INSTALLATION [MZI-3.7].)

1. Drain the engine oil. (See ENGINE OIL REPLACEMENT [MZI-3.7] .)
2. Remove the engine and transaxle component. (See ENGINE REMOVAL/INSTALLATION [MZI-3.7].)
3. Using a hoist, lower the engine and transaxle component on a level surface.

WARNING:

- Protect and stabilize the lowered engine and transaxle component with creosotes to prevent injury or damage due to roll over.

4. Remove the dynamic chamber and throttle body as a single unit. (See INTAKE-AIR SYSTEM REMOVAL/INSTALLATION [MZI-3.7] .)
5. Remove the fuel injector and fuel distributor together as a single unit. (See FUEL INJECTOR REMOVAL/INSTALLATION [MZI-3.7] .)
6. Remove the thermostat and thermostat housing together as a single unit. (See THERMOSTAT

REMOVAL/INSTALLATION [MZI-3.7] .)

7. Remove the Intake manifold. (See **INTAKE-AIR SYSTEM REMOVAL/INSTALLATION [MZI-3.7] .)**)
8. Remove both WU-TWCs together with both exhaust manifolds as a single unit. (See **EXHAUST SYSTEM REMOVAL/INSTALLATION [MZI-3.7] .)**)
9. Remove the ignition coils. (See **IGNITION COIL REMOVAL/INSTALLATION [MZI-3.7] .)**)
10. Remove the dipstick.
11. Remove the power steering oil pump drive belt. (See **DRIVE BELT REMOVAL/INSTALLATION [MZI-3.7].)**)
12. Remove the power steering oil pump. (See **POWER STEERING OIL PUMP REMOVAL/INSTALLATION .)**)
13. Remove the generator. (See **GENERATOR REMOVAL/INSTALLATION [MZI-3.7] .)**)

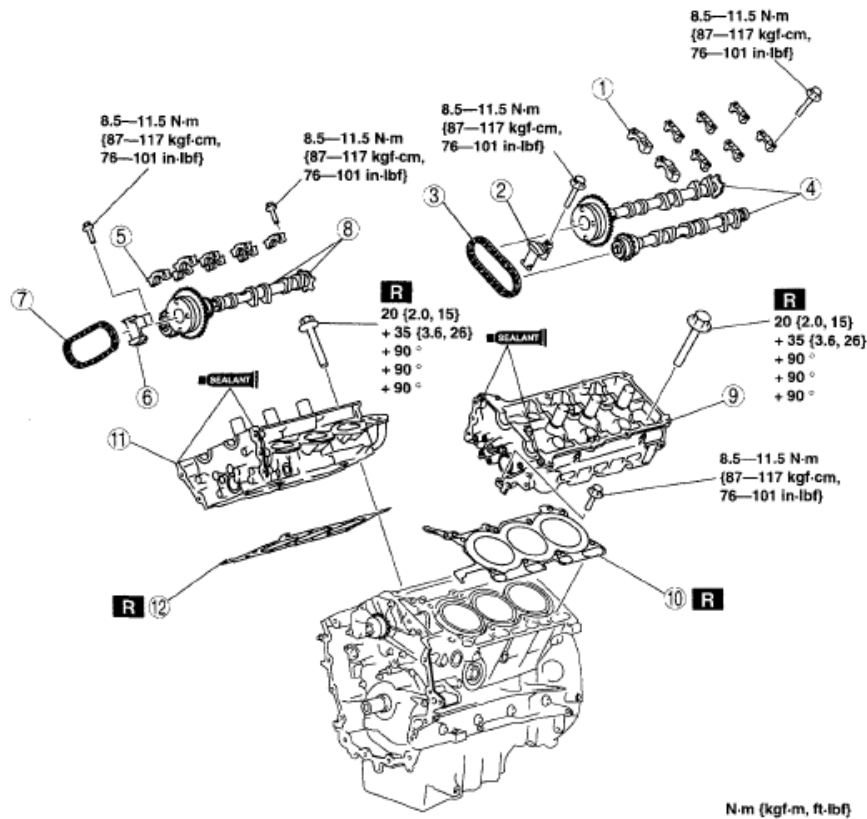
CAUTION:

- **When removing the timing chain and marking the timing marks on the chain, mark the camshaft timing chain as well.**

14. Follow the "TIMING CHAIN REMOVAL/INSTALLATION" procedure and removal the timing chain. (See **TIMING CHAIN REMOVAL/INSTALLATION [MZI-3.7].)**)
15. Remove in the order indicated in the table.
16. Install in the reverse order of removal.
17. Start the engine and:
 1. Inspect the runout and contact on the pulley and belt.
 2. Inspect for engine oil, engine coolant, ATF, power steering fluid and fuel leakage.
 3. Verify the ignition timing, idle speed and idle mixture. (See **ENGINE TUNE-UP [MZI-3.7].)**)
 4. Engine accessories operation
18. Perform a road test.

2008 Mazda CX-9 Grand Touring

2008 ENGINE Mechanical (MZI-3.7) - Mazda CX-9



ac9uuw0000214

1	Camshaft cap (LH)
2	Camshaft timing chain tensioner (LH)
3	Camshaft timing chain (LH)
4	Camshaft component (LH) (See 01-10-34 Camshaft Component Removal Note.) (See 01-10-39 Camshaft Component Installation Note.)
5	Camshaft cap (RH)
6	Camshaft timing chain tensioner (RH)
7	Camshaft timing chain (RH)

8	Camshaft component (RH) (See 01-10-34 Camshaft Component Removal Note.) (See 01-10-39 Camshaft Component Installation Note.)
9	Cylinder head (LH) (See 01-10-38 Cylinder Head Removal Note.) (See 01-10-38 Cylinder Head Installation Note.)
10	Cylinder head gasket (LH)
11	Cylinder head (RH) (See 01-10-38 Cylinder Head Removal Note.) (See 01-10-38 Cylinder Head Installation Note.)
12	Cylinder head gasket (RH)

Fig. 76: Identifying Engine Components & Torque Specifications
Courtesy of MAZDA MOTORS CORP.

CAMSHAFT COMPONENT REMOVAL NOTE

CAUTION:

- Do not rotate the crankshaft counterclockwise. The timing chains may bind, causing engine damage.

1. Turn the crankshaft clockwise so that the crankshaft keyway is in the 11 o'clock position. (This will position the No.1 cylinder at TDC.)

NOTE:

- Verify that there are timing marks in three locations (Yellow 1, Black

2) on the timing chain. If any timing marks are missing, mark the timing chain.

- When marking the crankshaft sprocket side timing chain, change the mark color.
- When the timing chain is replaced with a new one, mark the new timing chain at the same positions as the removed timing chain.

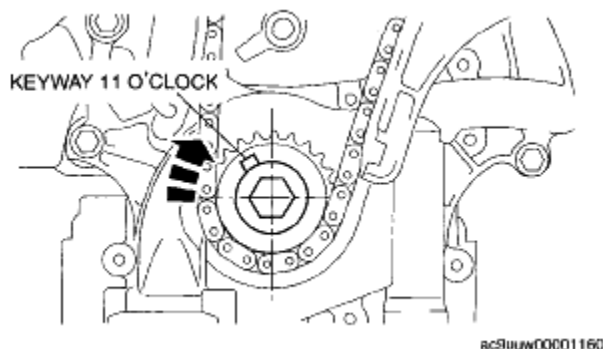


Fig. 77: Turning Crankshaft Clockwise
Courtesy of MAZDA MOTORS CORP.

2. Mark the timing chain at the position of each timing sprocket timing mark.

NOTE:

- Verify that there are timing marks in two locations on the camshaft timing chain. If any timing marks are missing, mark the camshaft timing chain.
- If replacing with a new camshaft timing chain, place alignment marks in the same positions as those prior to the replacement.

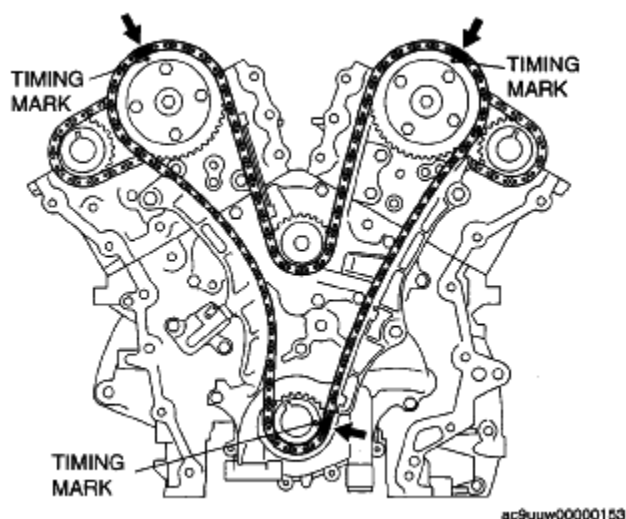


Fig. 78: Identifying Timing Chain Marks Location

Courtesy of MAZDA MOTORS CORP.

3. Mark the camshaft timing chain at the positions where it is aligned with each of the camshaft sprocket on both banks.

LH

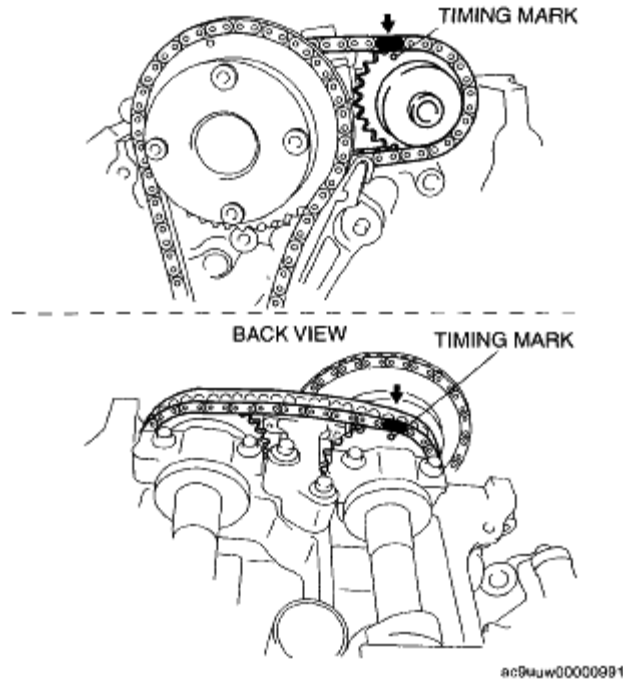


Fig. 79: Identifying Mark Of Camshaft Timing Chain
Courtesy of MAZDA MOTORS CORP.

RH

4. Remove the timing chain in the following order.
 1. Chain tensioner
 2. Timing chain
 3. Tensioner arm
 4. Chain guide

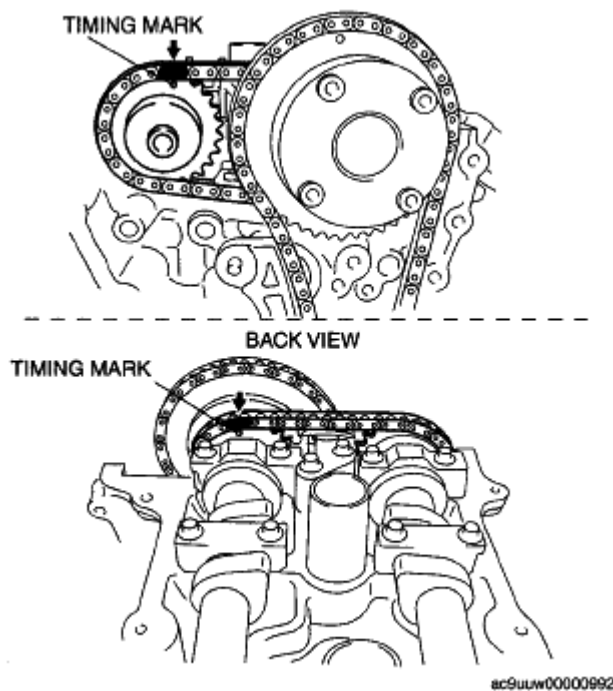


Fig. 80: Locating Timing Chain Mark
Courtesy of MAZDA MOTORS CORP.

5. Crankshaft sprocket

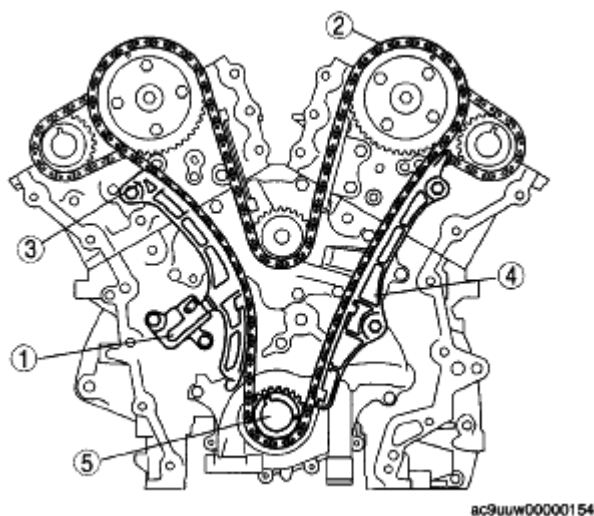


Fig. 81: Identifying Crankshaft Sprocket Bolts
Courtesy of MAZDA MOTORS CORP.

5. Rotate the crankshaft counterclockwise until the keyway is in the 9 o'clock position.
6. Slowly compress the camshaft timing chain tensioner (LH) piston by hand.

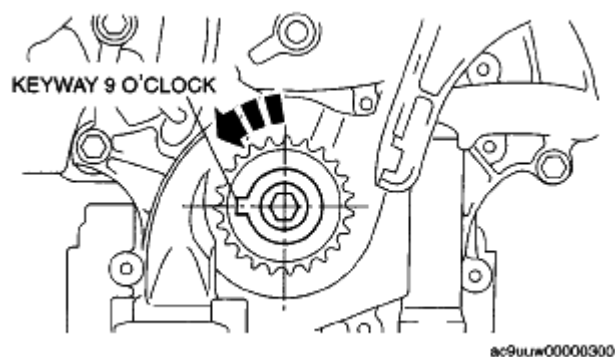


Fig. 82: Rotating Crankshaft Counterclockwise
Courtesy of MAZDA MOTORS CORP.

7. Insert an **approx. 1.0 mm {0.039 in}** thin wire or paper clip into the camshaft timing chain tensioner (LH) shown in the figure to hold the tensioner piston.

NOTE:

- When the timing chain removed, valve spring pressure will rotate the camshaft (LH) approx. 3 ° to a neutral position.

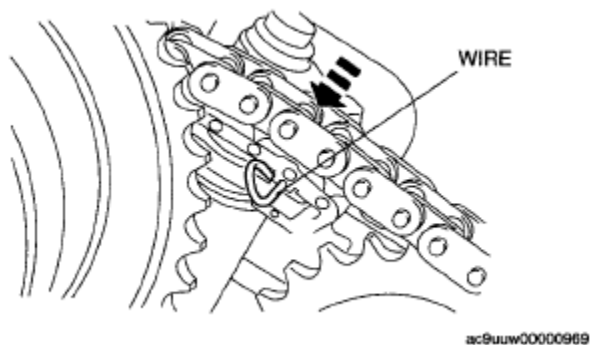


Fig. 83: Inserting Wire Or Paper Clip Into Camshaft Timing Chain Tensioner (LH)
Courtesy of MAZDA MOTORS CORP.

8. Verify that the camshafts (LH) are in the neutral position.

NOTE:

- The cylinder head and the camshaft bearing caps are numbered to make sure they are reassembled in their original position. When removed, keep the bearing caps with the cylinder head they were removed from. Do not mix the caps.

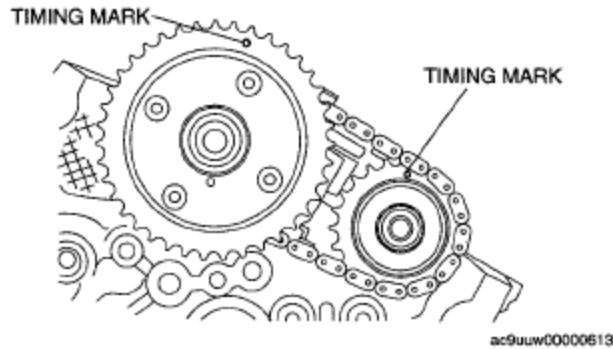


Fig. 84: Identifying Camshafts Timing Mark
 Courtesy of MAZDA MOTORS CORP.

9. Loosen the LH bank camshaft cap bolts in several passes in the order shown in the figure and remove the camshaft cap.
10. Remove the camshaft, camshaft sprocket, camshaft timing chain, and camshaft timing chain tensioner of the LH bank as a single unit.
11. Slowly compress the camshaft timing chain tensioner (RH) piston by hand.

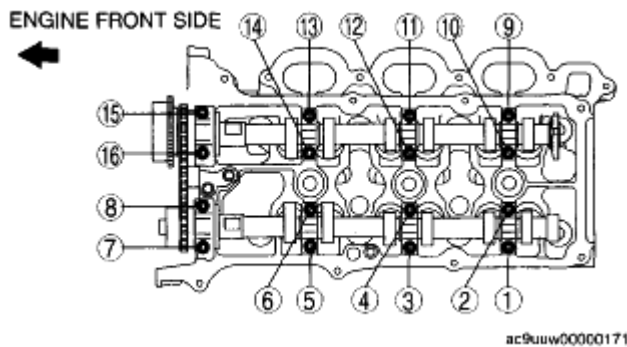


Fig. 85: Identifying Camshaft Cap Bolts Loosen Sequence
 Courtesy of MAZDA MOTORS CORP.

12. Insert an **approx. 1.0 mm {0.039 in}** thin wire or paper clip into the camshaft timing chain tensioner (RH) shown in the figure to hold the tensioner piston.

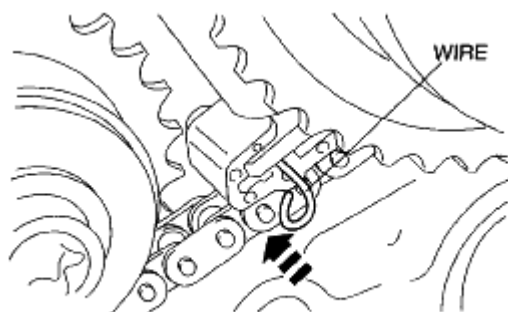


Fig. 86: Inserting Wire Or Paper Clip Into Camshaft Timing Chain Tensioner (RH)
Courtesy of MAZDA MOTORS CORP.

- Put a wrench to the position shown in the figure on the RH bank camshaft, rotate the RH bank camshaft counterclockwise, and set the camshaft to the neutral position.

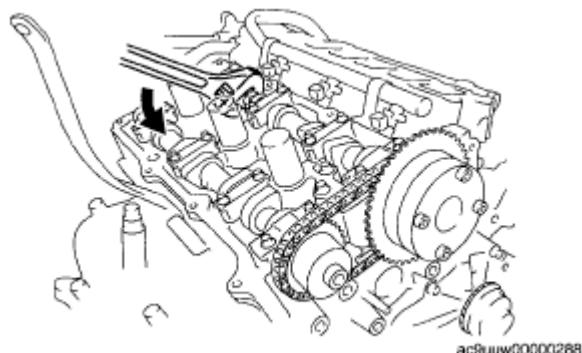


Fig. 87: Rotating RH Bank Camshaft Counterclockwise
Courtesy of MAZDA MOTORS CORP.

NOTE:

- The cylinder head and the camshaft bearing caps are numbered to make sure they are reassembled in their original position. When removed, keep the bearing caps with the cylinder head they were removed from. Do not mix the caps.

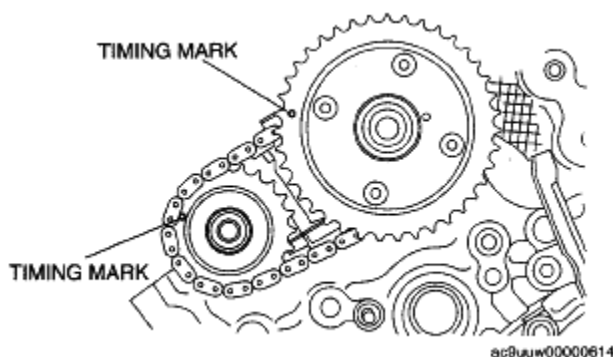


Fig. 88: Identifying Timing Mark Of Crankshaft
Courtesy of MAZDA MOTORS CORP.

- Loosen the RH bank camshaft cap bolts in several passes in the order shown in the figure and remove the camshaft cap.
- Remove the camshaft, camshaft sprocket, camshaft timing chain, and camshaft timing chain tensioner of the RH bank as a single unit.

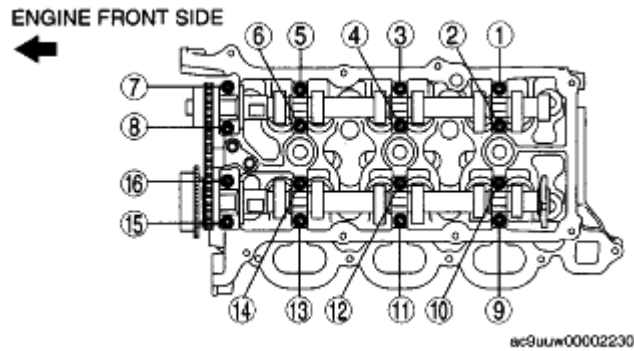


Fig. 89: Identifying RH Bank Camshaft Cap Bolts Loosening Sequence
 Courtesy of MAZDA MOTORS CORP.

CYLINDER HEAD REMOVAL NOTE

1. Loosen the cylinder head bolts in several passes in the order shown.

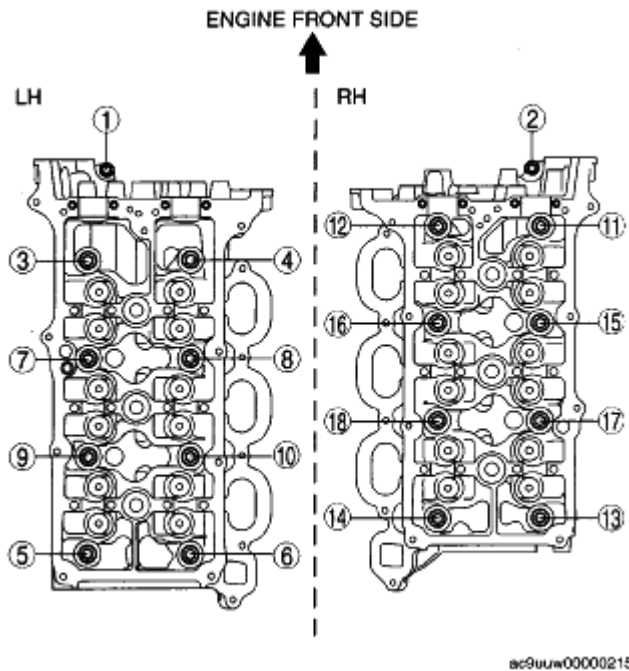


Fig. 90: Identifying Cylinder Head Bolts Loosening Sequence (Engine Front Side)
 Courtesy of MAZDA MOTORS CORP.

CYLINDER HEAD INSTALLATION NOTE

NOTE:

- The cylinder head bolts must be replaced with new bolts. The bolts are torque-to-yield designed and cannot be reused.

1. Tighten the cylinder head bolts in the order in 6 steps in the order shown in the figure.

2008 Mazda CX-9 Grand Touring

2008 ENGINE Mechanical (MZI-3.7) - Mazda CX-9

Tightening Torque

TIGHTENING TORQUE SPECIFICATION

Step	Installation position	Tightening torque
1	1-16	20 N.m {2.0 kgf.m, 15 ft.lbf}
2	1-16	35 N.m {3.6 kgf.m, 26 ft.lbf}
3	1-16	90°
4	1-16	90°
5	1-16	90°
6	17, 18	8.5-11.5 N.m {87-117 kgf.cm, 76-101 in.lbf}

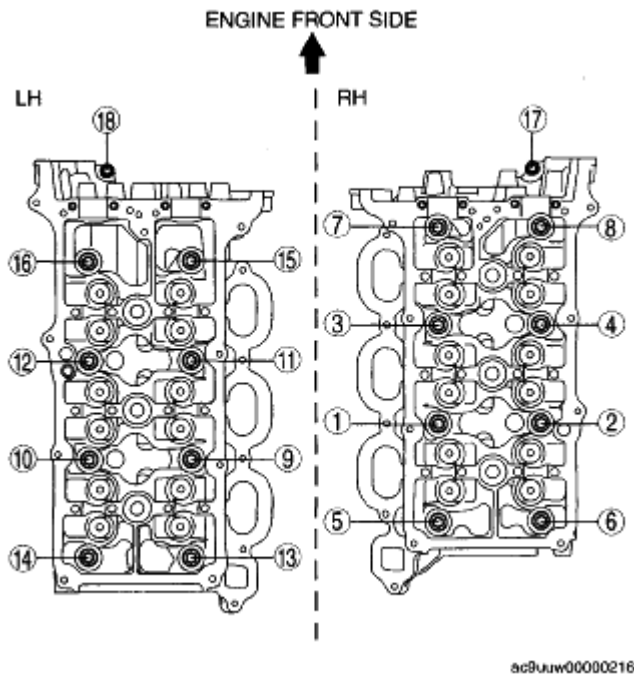


Fig. 91: Identifying Cylinder Head Bolts Tightening Sequence (Engine Front Side)
Courtesy of MAZDA MOTORS CORP.

CAMSHAFT COMPONENT INSTALLATION NOTE

1. Assemble the camshaft timing chain tensioners on both sides.

Tightening torque: 8.5-11.5 N.m {87-117 kgf.cm, 76-101 in.lbf}

NOTE:

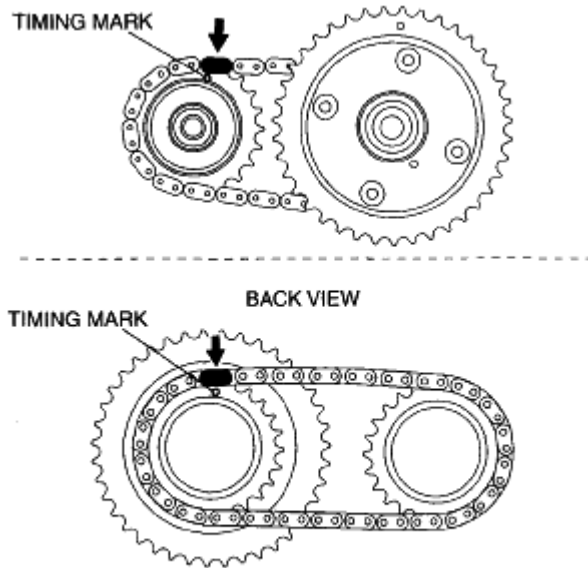
- Install the camshaft, camshaft sprocket and camshaft timing chain of the both bank as a single unit.

2. Install the camshaft component (RH).

1. Install the camshaft timing chain by aligning the colored links on the camshaft timing chain with

the marks on the camshaft sprockets (RH).

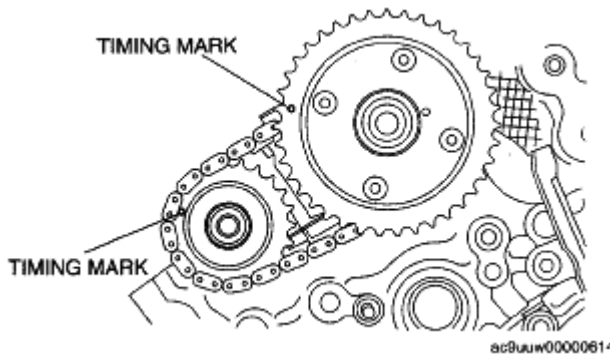
RH



ac9uuw00002024

Fig. 92: Locating Camshaft Timing Chain Mark
Courtesy of MAZDA MOTORS CORP.

2. Position the camshaft component onto the cylinder head (RH) in the neutral position as shown.



ac9uuw00000614

Fig. 93: Identifying Timing Mark Of Crankshaft
Courtesy of MAZDA MOTORS CORP.

3. Install the RH bank camshaft caps and temporarily tighten the camshaft cap bolts evenly in the order shown in several passes.

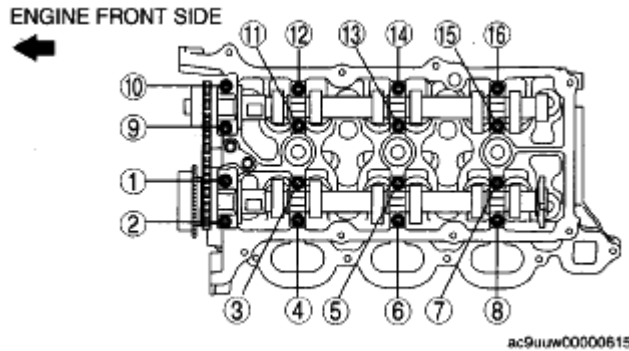


Fig. 94: Identifying Camshaft Cap Bolts Tightening Sequence
Courtesy of MAZDA MOTORS CORP.

Tightening torque: 8.5-11.5 N.m {87-117 kgf.cm, 76-101 in.lbf}

4. Remove the retaining wire inserted into the camshaft timing chain tensioner (RH).

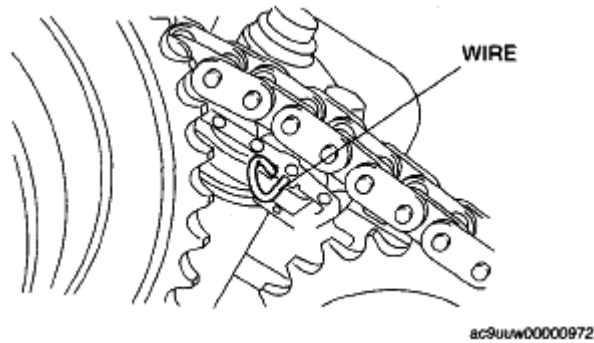


Fig. 95: Identifying Retaining Wire Into Camshaft Timing Chain Tensioner (RH)
Courtesy of MAZDA MOTORS CORP.

5. Using the RH bank camshaft sprocket installation bolt at the position shown in the figure, rotate the RH bank camshaft clockwise.

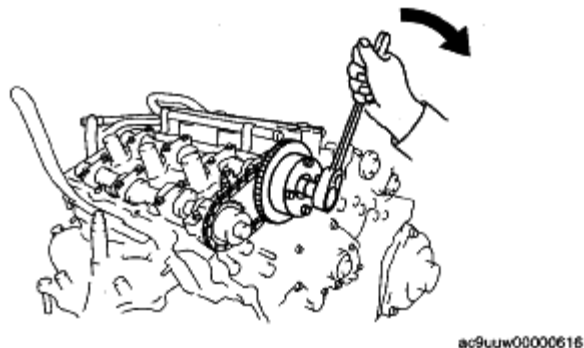


Fig. 96: Rotating RH Bank Camshaft Clockwise
Courtesy of MAZDA MOTORS CORP.

3. Install the camshaft component (LH).
 1. Install the camshaft timing chain by aligning the colored links on the camshaft timing chain with the marks on the camshaft sprockets (LH).

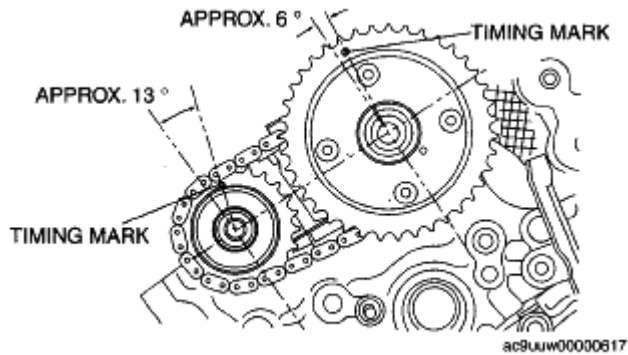


Fig. 97: Installing Camshaft Component (LH)
Courtesy of MAZDA MOTORS CORP.

LH

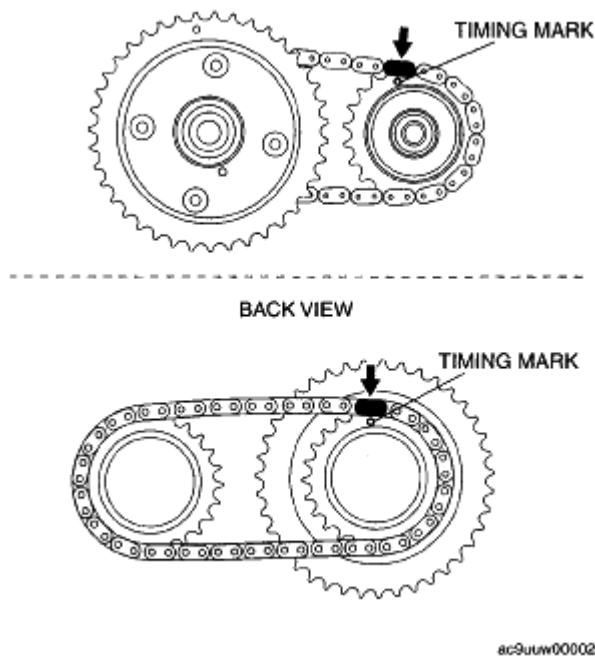


Fig. 98: Locating Camshaft Timing Chain Marks
Courtesy of MAZDA MOTORS CORP.

2. Position the camshafts onto the cylinder head (LH) in the neutral position as shown.

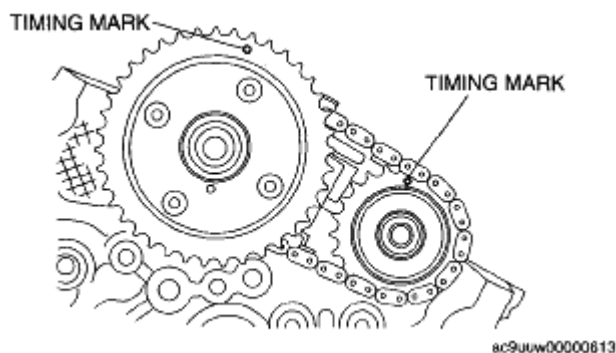


Fig. 99: Positioning Camshafts Onto Cylinder Head (LH)
Courtesy of MAZDA MOTORS CORP.

3. Install the LH bank camshaft caps and temporarily tighten the camshaft cap bolts evenly in the order shown in several passes.

Tightening torque: 8.5-11.5 N-m {87-117 kgf-cm 76-101 in-lbf}

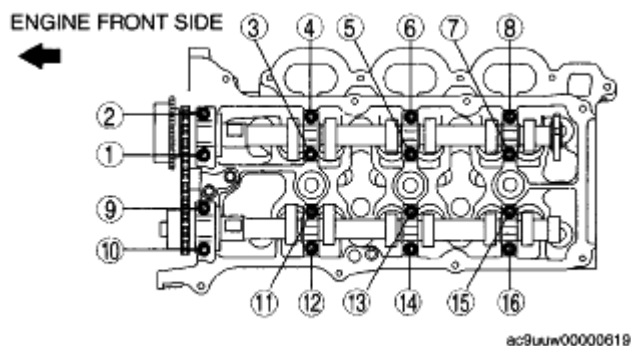


Fig. 100: Identifying Camshaft Cap Bolts Tightening Sequence
Courtesy of MAZDA MOTORS CORP.

4. Remove the retaining wire inserted into the camshaft timing chain tensioner (LH).

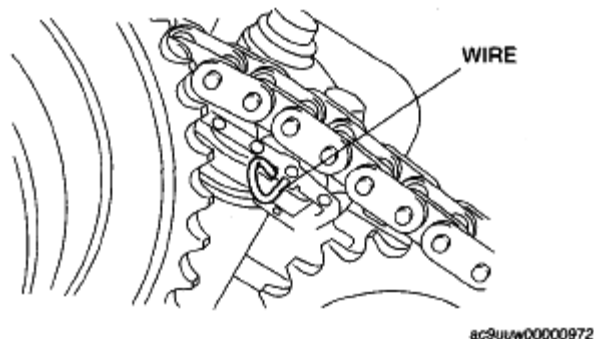


Fig. 101: Identifying Retaining Wire Into Camshaft Timing Chain Tensioner (LH)
Courtesy of MAZDA MOTORS CORP.

4. Turn the crankshaft clockwise so that the crankshaft keyway is in the 11 o'clock position. (This will position the No.1 cylinder at TDC.)
5. Follow the **TIMING CHAIN REMOVAL/INSTALLATION**" procedure and install the timing chain. (See **TIMING CHAIN REMOVAL/INSTALLATION [MZI-3.7]**.)

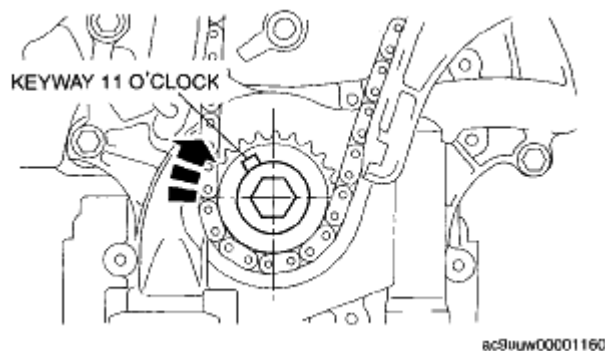


Fig. 102: Turning Crankshaft Clockwise
Courtesy of MAZDA MOTORS CORP.

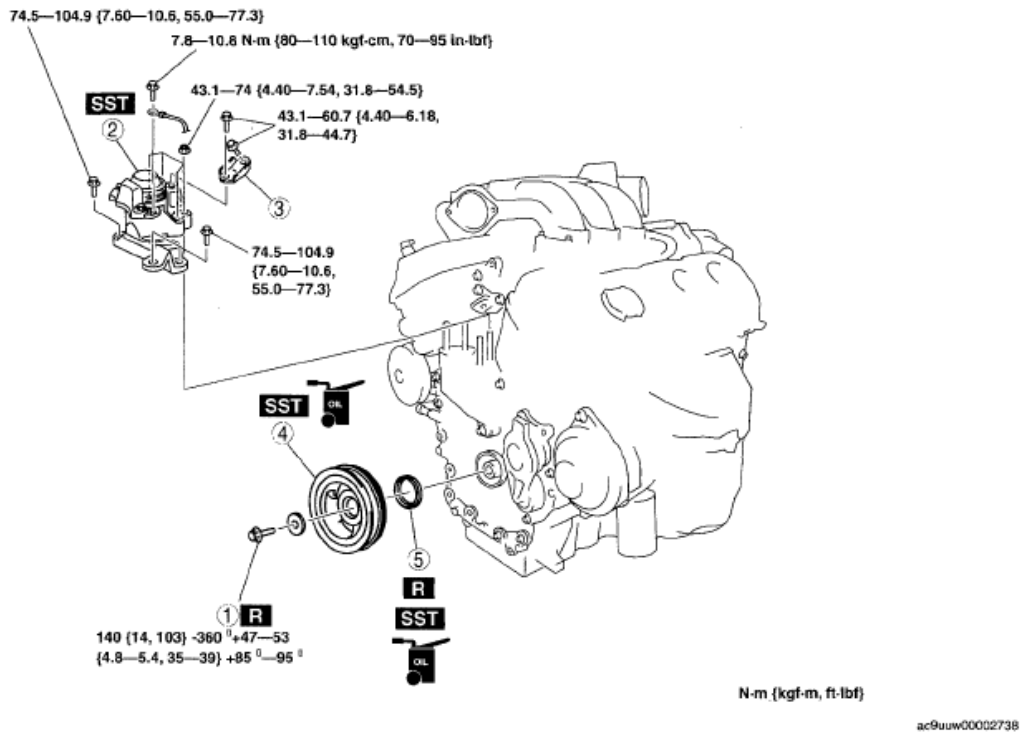
FRONT OIL SEAL REPLACEMENT [MZI-3.7]

1. Disconnect the negative battery cable.
2. Remove the engine cover. (See **ENGINE COVER REMOVAL/INSTALLATION [MZI-3.7]**.)
3. Position the power steering reserve tank out of the way. (See **POWER STEERING OIL PUMP REMOVAL/INSTALLATION** .)
4. Remove the both front wheels and tires. (See **GENERAL PROCEDURES (SUSPENSION)** .)
5. Remove the splash shield (RH).
6. Position the both ABS wheel-speed sensor out of the way. (See **FRONT ABS WHEEL-SPEED SENSOR REMOVAL/INSTALLATION** .)
7. Position the front stabilizer control link (lower side) (RH) out of the way. (See **FRONT STABILIZER REMOVAL/INSTALLATION** .)
8. Position the tie-rod end ball joint (RH) out of the way. (See **FRONT CROSSMEMBER REMOVAL/INSTALLATION** .)
9. Remove the front shock absorber (LH) lower side bolts, position and secure the wheel hub and steering knuckle component (LH) out of the way with a rope or wire. (See **FRONT SHOCK ABSORBER AND COIL SPRING REMOVAL/INSTALLATION** .)
10. Disconnect the front drive shaft (RH) from the joint shaft side. (See **FRONT DRIVE SHAFT REMOVAL/INSTALLATION** .)
11. Remove the front pipe and middle pipe as a single unit. (See **EXHAUST SYSTEM REMOVAL/INSTALLATION [MZI-3.7]** .)
12. Position the propeller shaft out of the way. (AWD) (See **PROPELLER SHAFT REMOVAL/INSTALLATION** .)
13. Remove the generator and A/C drive belt. (See **DRIVE BELT REMOVAL/INSTALLATION [MZI-3.7]** .)

2008 Mazda CX-9 Grand Touring

2008 ENGINE Mechanical (MZI-3.7) - Mazda CX-9

14. Remove the power steering oil pump drive belt. (See **DRIVE BELT REMOVAL/INSTALLATION [MZI-3.7]**.)
15. Remove in the order indicated in the table.
16. Install in the reverse order of removal.



1	Crankshaft pulley lock bolt (See 01-10-43 Crankshaft Pulley Lock Bolt Removal Note.) (See 01-10-48 Crankshaft Pulley Lock Bolt Installation Note.)
2	No.3 engine mount (See 01-10-43 No.3 Engine Mount Removal Note.) (See 01-10-47 No.3 Engine Mount Installation Note.)

3	No.3 engine mount stay (No.3 engine mount side)
4	Crankshaft pulley (See 01-10-46 Crankshaft Pulley Removal Note.) (See 01-10-47 Crankshaft Pulley Installation Note.)
5	Front oil seal (See 01-10-46 Front Oil Seal Removal Note) (See 01-10-46 Front Oil Seal Installation Note)

Fig. 103: Identifying Crankshaft Pulley Lock Bolt, Crankshaft Pulley, Oil Seal & Torque Specifications

Courtesy of MAZDA MOTORS CORP.

CRANKSHAFT PULLEY LOCK BOLT REMOVAL NOTE

1. Remove the cover as shown in the figure.

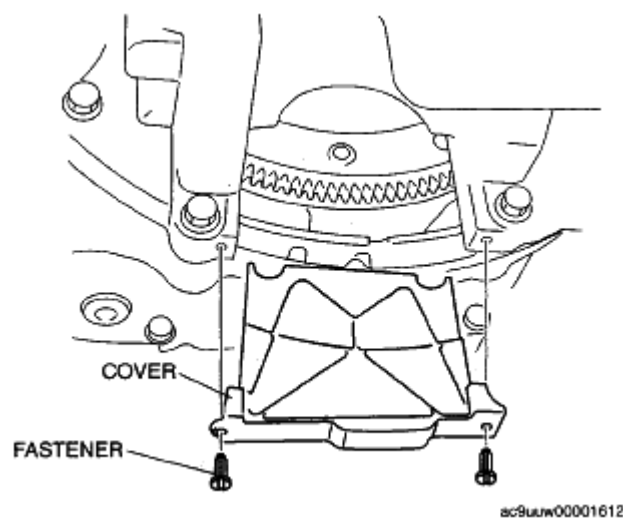


Fig. 104: Identifying Crankshaft Pulley Lock Bolt, Cover & Fastener
Courtesy of MAZDA MOTORS CORP.

2. Set a wrench to the drive plate bolt at the position shown in the figure to lock the crankshaft rotation.
3. Remove the crankshaft pulley lock bolt and washer.

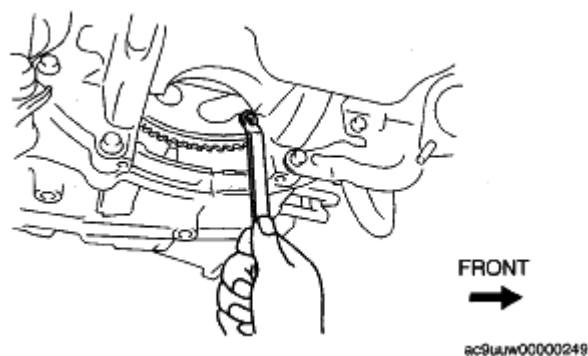


Fig. 105: Removing Crankshaft Pulley Lock Bolt
Courtesy of MAZDA MOTORS CORP.

NO.3 ENGINE MOUNT REMOVAL NOTE

1. Loosen the No.1 engine mount bolt C.

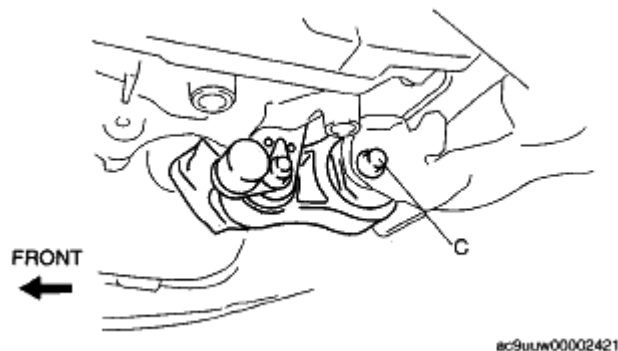


Fig. 106: View Of No.1 Engine Mount Bolt C
Courtesy of MAZDA MOTORS CORP.

2. Remove the No.1 engine mount bracket bolts A and B as shown.

NOTE:

- Do not remove the No.1 engine mount rubber from the front crossmember.

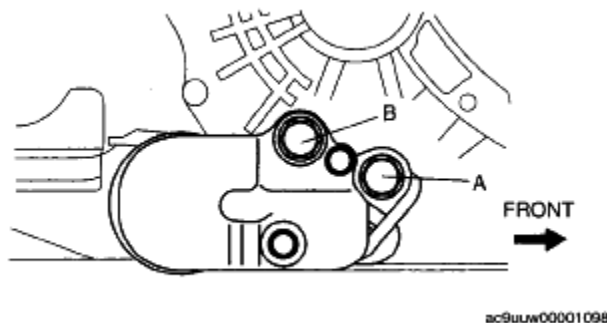
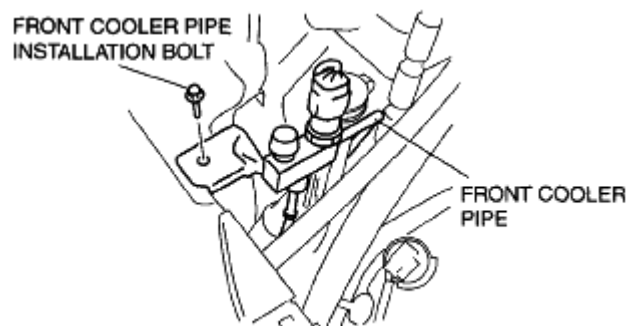


Fig. 107: Identifying No.1 Engine Mount Bracket Bolts
Courtesy of MAZDA MOTORS CORP.

3. Position the coolant reserve tank out of the way. (See COOLANT RESERVE TANK REMOVAL/INSTALLATION [MZI-3.7] .)
4. Remove the following parts to install the SST.
 1. The windshield wiper arm and blade. (See WINDSHIELD WIPER ARM AND BLADE REMOVAL/INSTALLATION .)
 2. The cowl grille. (See COWL GRILLE REMOVAL/INSTALLATION .)
 3. The cowl panel. (See COWL PANEL REMOVAL/INSTALLATION .)
 4. The air cleaner. (See INTAKE-AIR SYSTEM REMOVAL/INSTALLATION [MZI-3.7] .)
 5. The front cooler pipe installation bolt (position the front cooler pipe out of the way.).
5. Install the **SST** using the following procedure.



ac8uuw00002422

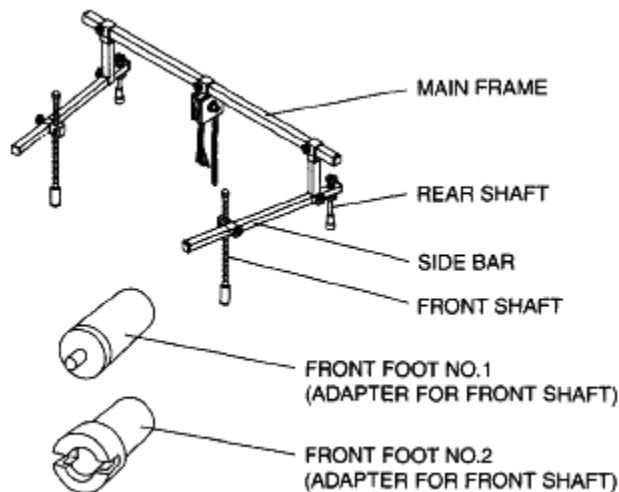
Fig. 108: Identifying Front Cooler Pipe & Bolt
Courtesy of MAZDA MOTORS CORP.

CAUTION:

- Refer to the SST instruction manual for the basic handing procedure.

NOTE:

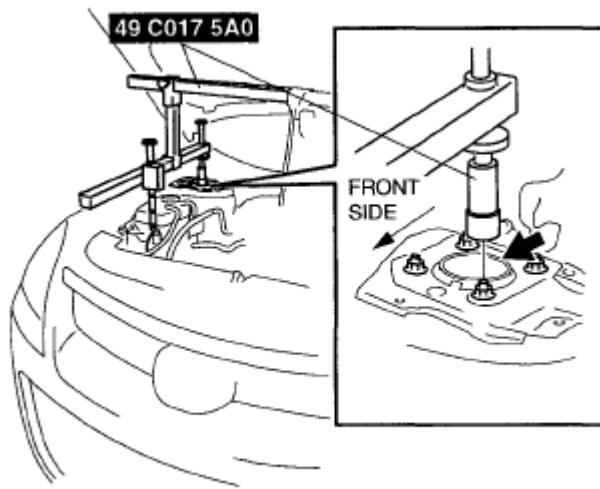
- When installing the SST, adjust the position of each shaft so that they do not interfere with the vehicle body.



ac8uuw00000021

Fig. 109: Identifying Main Frame, Rear Shaft, Side Bar & Front Shaft
Courtesy of MAZDA MOTORS CORP.

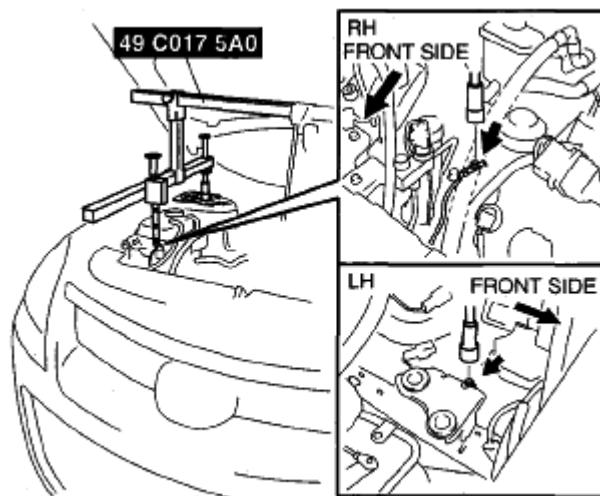
1. Install the right rear shaft of the SST to the bolt of the right shock absorber shown in the figure.
2. Install the left rear shaft of the SST to the bolt of the left shock absorber (Identical position to the right side).



ac9uuw00000186

Fig. 110: View Of Right Rear Shaft Of SST
Courtesy of MAZDA MOTORS CORP.

3. Install the left/right front shaft of the SST with front foot No.2 to the bolt shown in the figure.
4. Adjust the positions of the SST side bars so that they are the same height (left and right) and horizontal.
5. Make sure each joint is securely tightened.



ac9uuw00000186

Fig. 111: View Of Left/Right Front Shaft Of SST
Courtesy of MAZDA MOTORS CORP.

6. Support the engine using the SSTs.
7. Remove the No.3 engine mount.

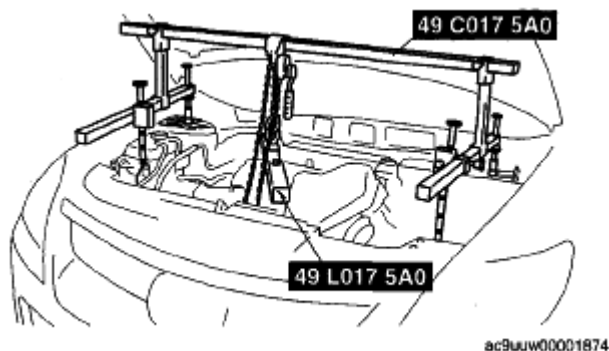


Fig. 112: Identifying No.3 Engine Mount
Courtesy of MAZDA MOTORS CORP.

CRANKSHAFT PULLEY REMOVAL NOTE

1. Slightly loosen the SST (49 C017 5A0) support and tilt the engine to the lower side slightly.
2. Remove the washer from the crankshaft pulley lock bolt, install a suitable spacer (thickness: **approx. 14 mm {0.55 in}** , diameter: **approx. 30 mm {1.18 in}**) , (similar to front shock absorber lower nut) to the crankshaft pulley lock bolt, and install the crankshaft pulley lock bolt to the crankshaft.

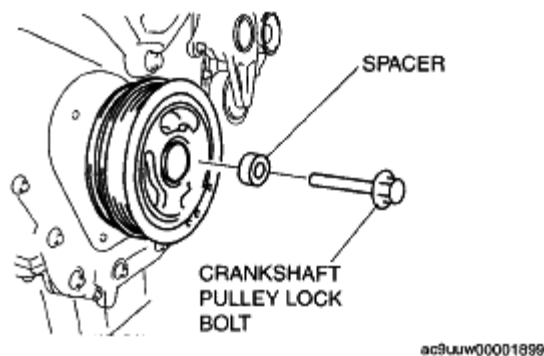
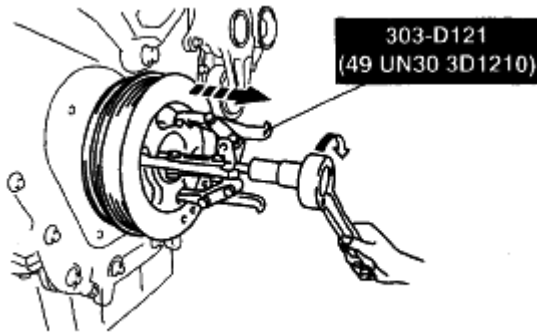


Fig. 113: Identifying Crankshaft Pulley Lock Bolt & Spacer
Courtesy of MAZDA MOTORS CORP.

3. Remove the crankshaft pulley using the SST.
4. Remove the crankshaft pulley lock bolt and spacer.

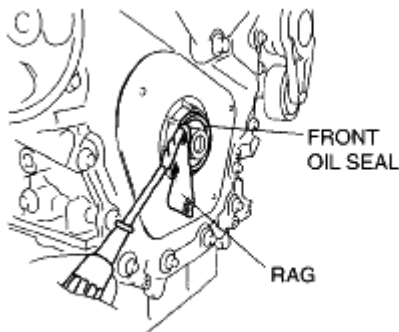


ac9uuw00000151

Fig. 114: Removing Crankshaft Pulley With SST
Courtesy of MAZDA MOTORS CORP.

FRONT OIL SEAL REMOVAL NOTE

1. Remove the front oil seal using a flathead screwdriver as shown.



ac9uuw00000255

Fig. 115: Identifying Front Oil Seal & RAG
Courtesy of MAZDA MOTORS CORP.

FRONT OIL SEAL INSTALLATION NOTE

NOTE:

- Apply clean engine oil to the front oil seal bore in the engine front cover.

1. Push the front oil seal slightly in by hand.
2. Tap the front oil seal in evenly using the SST and a hammer.

Substitution SST

- 49G028 203

Outer diameter: 58-70 mm {2.3-2.7 in}

Inner diameter: 56-58 mm {2.3-2.2 in}

Tube with board thickness 2 mm {0.079 in} or more

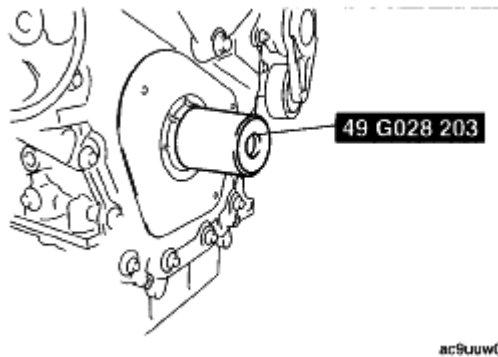


Fig. 116: Identifying Front Oil Seal With SST
Courtesy of MAZDA MOTORS CORP.

CRANKSHAFT PULLEY INSTALLATION NOTE

NOTE:

- Lubricate the contact surface (exterior area of inner diameter) of the front oil seal with clean engine oil.

1. Install the crankshaft pulley, washer, and SST to the crankshaft.

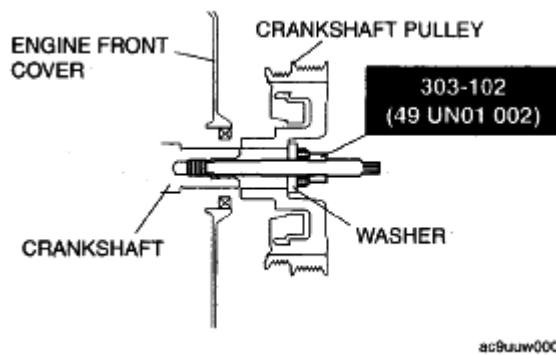
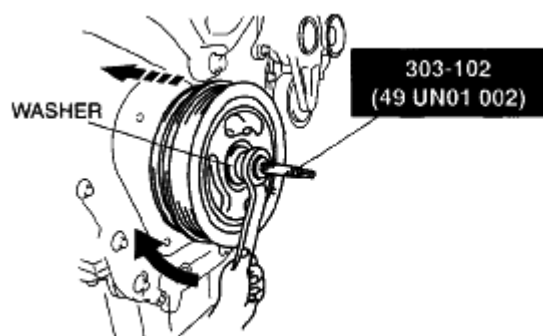


Fig. 117: Identifying Crankshaft Pulley, Washer & SST
Courtesy of MAZDA MOTORS CORP.

2. Tighten the SST nut and install the crankshaft pulley.

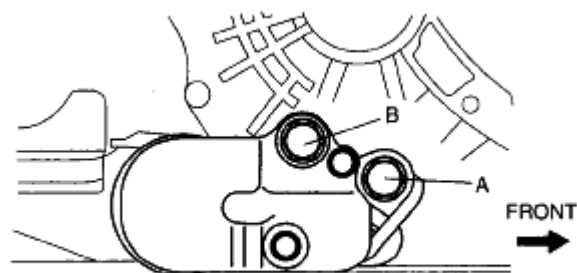


ac9uuw00001900

Fig. 118: Installing Crankshaft Pulley
 Courtesy of MAZDA MOTORS CORP.

NO.3 ENGINE MOUNT INSTALLATION NOTE

1. Using the SST (49 C017 5A0) , tilt up the engine until it is vertical.
2. Tighten the bolts on the No.1 engine mount bracket in the order of A, B.

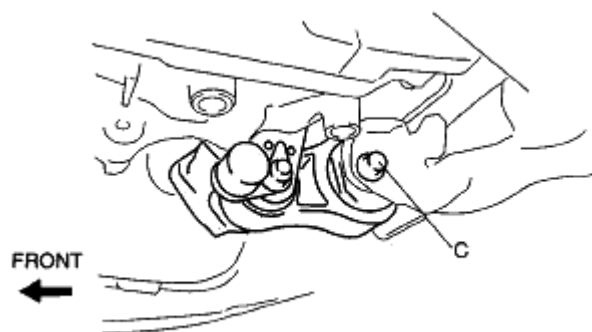


ac9uuw00001098

Fig. 119: Identifying No.1 Engine Mount Bracket
 Courtesy of MAZDA MOTORS CORP.

3. Tighten the No.1 engine mount bolt C at the specified torque.

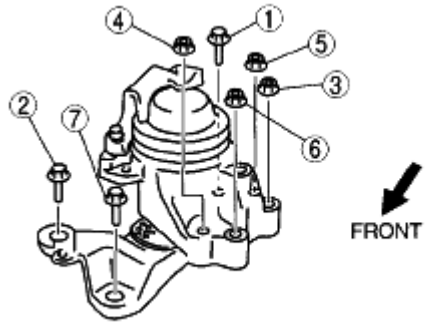
No.1 engine mount through-bolt tightening torque 93.1-116.6 N.m {9.50-11.8 kgf.m, 68.7-85.9 ft.lbf}



ac9uuw00002421

Fig. 120: Identifying No.1 Engine Mount Bolt
 Courtesy of MAZDA MOTORS CORP.

4. Temporarily tighten the No.3 engine mount bolt and nuts in the order shown in the figure.



ac9uuw00000222

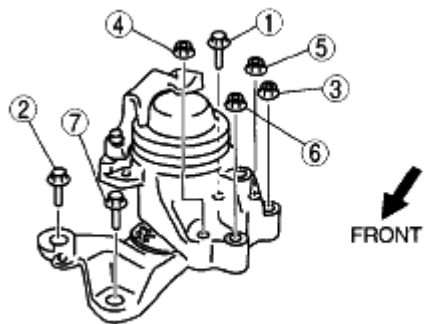
Fig. 121: Identifying No.3 Engine Mount Bolt & Nuts Tightening Sequence
 Courtesy of MAZDA MOTORS CORP.

5. Tighten the No.3 engine mount in the order shown in the figure.

Tightening Torque

TIGHTENING TORQUE SPECIFICATION

Installation Position	Tightening Torque
1, 2, 7	74.5-104.9 N.m {7.60-10.6 kgf.m, 55.0-77.3 ft.lbf}
3, 4, 5, 6	43.1-74 N.m {4.40-7.54 kgf.m, 31.8-54.5 ft.lbf}

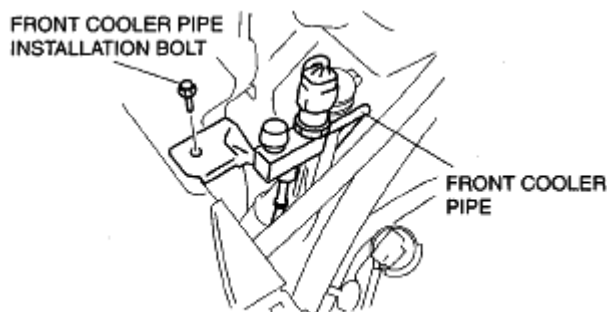


ac9uuw00000222

Fig. 122: Identifying No.3 Engine Mount Bolt & Nuts Tightening Sequence
 Courtesy of MAZDA MOTORS CORP.

6. Remove the SST (49 C017 5A0).
7. Install the following parts.
 1. Install the front cooler pipe installation bolt.

Tightening torque: 8-12 N.m {82-122 kgf.cm, 71-106 in.lbf}



ac9uuw00000146

Fig. 123: Identifying Front Cooler Pipe Installation Bolt & Front Cooler Pipe
Courtesy of MAZDA MOTORS CORP.

2. The air cleaner. (See INTAKE-AIR SYSTEM REMOVAL/INSTALLATION [MZI-3.7] .)
3. The cowl panel. (See COWL PANEL REMOVAL/INSTALLATION .)
4. The cowl grille. (See COWL GRILLE REMOVAL/INSTALLATION .)
5. The windshield wiper arm and blade. (See WINDSHIELD WIPER ARM AND BLADE REMOVAL/INSTALLATION .)
8. Install the coolant reserve tank. (See COOLANT RESERVE TANK REMOVAL/INSTALLATION [MZI-3.7] .)

CRANKSHAFT PULLEY LOCK BOLT INSTALLATION NOTE

1. Rotate the crankshaft clockwise, and set a wrench to the drive plate bolt at the position shown in the figure to lock the crankshaft rotation.
2. Tighten the new crankshaft pulley lock bolt in 4 steps.
 1. Tighten to **140 N.m {14 kgf.m, 103 ft.lbf}**.
 2. Loosen **360 °** (one full turn) in reverse order.
 3. Tighten to **47-53 N.m {4.8-5.4 kgf.m, 35-39 ft.lbf}**.
 4. Tighten **85 °--95 °**.
3. Verify the tightening torque for the drive plate installation bolt to which the wrench has been set. (See COOLANT RESERVE TANK REMOVAL/INSTALLATION [MZI-3.7] .)

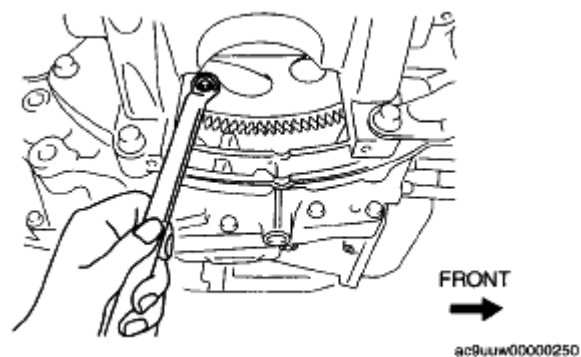


Fig. 124: Setting Drive Plate Bolt
Courtesy of MAZDA MOTORS CORP.

4. Install the cover as shown in the figure.

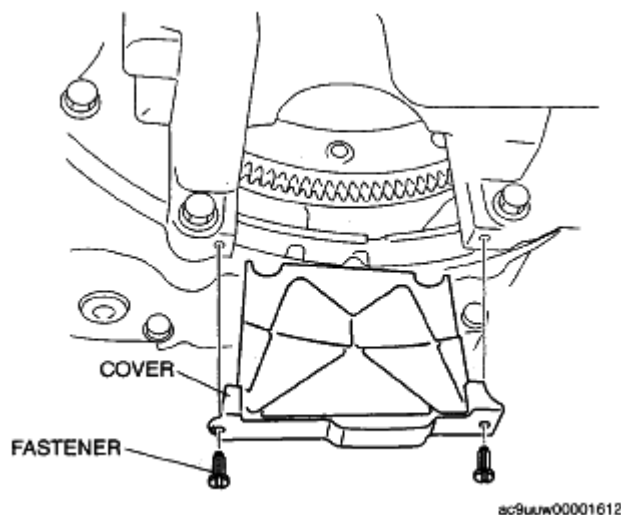


Fig. 125: Identifying Crankshaft Pulley Lock Bolt, Cover & Fastener
Courtesy of MAZDA MOTORS CORP.

REAR OIL SEAL REPLACEMENT [MZI-3.7]

1. Remove the automatic transaxle. (See [AUTOMATIC TRANSAXLE REMOVAL/INSTALLATION \[AW6A-EL, AW6AX-EL\]](#) .)
2. Remove the drive plate. (See [DRIVE PLATE REMOVAL/INSTALLATION \[AW6A-EL, AW6AX-EL\]](#) .)
3. Remove in the order indicated in the table.
4. Install in the reverse order of removal.

2008 Mazda CX-9 Grand Touring

2008 ENGINE Mechanical (MZI-3.7) - Mazda CX-9

1	CKP sensor pulse wheel
2	Rear oil seal (See 01-10-49 Rear Oil Seal Removal Note.) (See 01-10-50 Rear Oil Seal Installation Note.)

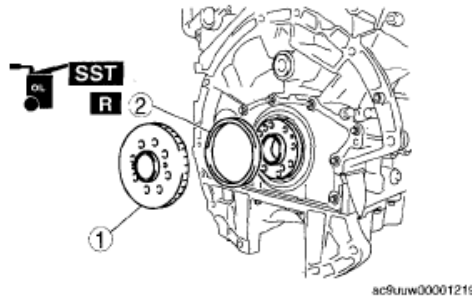


Fig. 126: Identifying CKP Sensor Pulse Wheel & Rear Oil Seal
Courtesy of MAZDA MOTORS CORP.

REAR OIL SEAL REMOVAL NOTE

1. Using a flathead screwdriver, remove the rear oil seal.

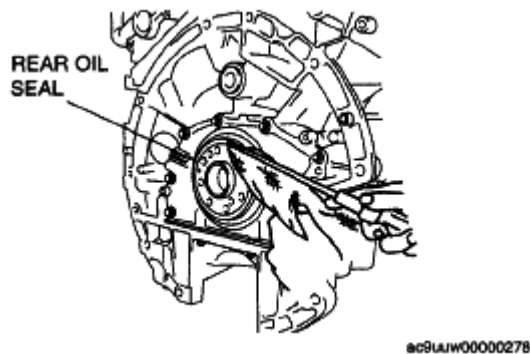


Fig. 127: Removing Rear Oil Seal
Courtesy of MAZDA MOTORS CORP.

REAR OIL SEAL INSTALLATION NOTE

NOTE:

- Lubricate the rear oil seal lips and bore with clean engine oil.

1. Push the rear oil seal slightly in by hand.
2. Tap the rear oil seal in evenly using the **SST** and a hammer.

Substitution SST

- **49W011 101**

Outer diameter: 105 mm {4.13 in} or more Inner diameter: 93-105 mm {3.7-4.1 in} Tube with board thickness 2 mm {0.079 in} or more

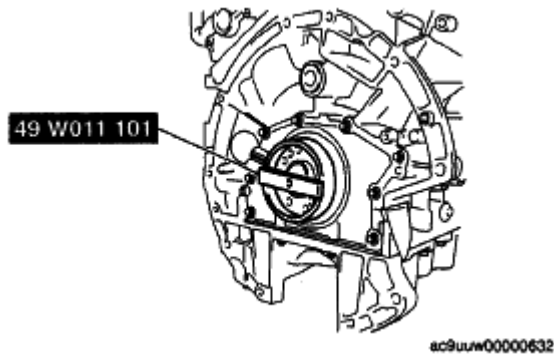


Fig. 128: Identifying Rear Oil Seal
Courtesy of MAZDA MOTORS CORP.

ENGINE REMOVAL/INSTALLATION [MZI-3.7]

WARNING:

- Fuel vapor is hazardous. It can very easily ignite, causing serious injury and damage. Always keep sparks and flames away from fuel.
- Fuel line spills and leakage are dangerous. Fuel can ignite and cause serious injuries or death and damage. Fuel can also irritate skin and eyes. To prevent this, always complete the "Fuel Line Safety Procedure". (See BEFORE SERVICE PRECAUTION [MZI-3.7] .)

1. Perform "Fuel Line Safety Procedures". Leave the fuel pump relay removed. (See BEFORE SERVICE PRECAUTION [MZI-3.7] .)
2. Disconnect both battery cables.
3. Remove the battery and battery tray. (See BATTERY REMOVAL/INSTALLATION [MZI-3.7] .)
4. Drain the power steering fluid. (See POWER STEERING FLUID INSPECTION .)
5. Drain the engine coolant. (See ENGINE COOLANT REPLACEMENT [MZI-3.7] .)
6. Remove the engine cover. (See ENGINE COVER REMOVAL/INSTALLATION [MZI-3.7] .)
7. Remove the ventilation hose. (See QUICK RELEASE CONNECTOR (EMISSION SYSTEM) REMOVAL/INSTALLATION [MZI-3.7] .)
8. Disconnect the vacuum hose. (See INTAKE-AIR SYSTEM REMOVAL/INSTALLATION [MZI-3.7] .)
9. Remove the air cleaner. (See INTAKE-AIR SYSTEM REMOVAL/INSTALLATION [MZI-3.7] .)
10. Remove the resonance chamber. (See INTAKE-AIR SYSTEM REMOVAL/INSTALLATION [MZI-3.7] .)
11. Remove the both front wheels and tires. (See GENERAL PROCEDURES (SUSPENSION) .)
12. Remove the splash shield (RH).
13. Remove the generator and A/C drive belt. (See DRIVE BELT REMOVAL/INSTALLATION [MZI-3.7] .)
14. Disconnect the front drive shaft (RH) from the joint shaft side. (See FRONT DRIVE SHAFT REMOVAL/INSTALLATION .)

2008 Mazda CX-9 Grand Touring

2008 ENGINE Mechanical (MZI-3.7) - Mazda CX-9

15. Disconnect the front drive shaft (LH) from the transaxle side. (See **FRONT DRIVE SHAFT REMOVAL/INSTALLATION** .)
16. Remove the front pipe and middle pipe as a single unit. (See **EXHAUST SYSTEM REMOVAL/INSTALLATION [MZI-3.7]** .)
17. Position the propeller shaft out of the way. (AWD) (See **PROPELLER SHAFT REMOVAL/INSTALLATION** .)
18. Disconnect the selector cable from the transaxle side. (See **AUTOMATIC TRANSAXLE REMOVAL/INSTALLATION [AW6A-EL, AW6AX-EL]** .)
19. Disconnect the heater hose. (See **HEATER PIPE AND HOSE COMPONENT REMOVAL/INSTALLATION** .)
20. Disconnect the power steering return hose. (See **POWER STEERING OIL PUMP REMOVAL/INSTALLATION** .)
21. Disconnect the radiator hose. (See **RADIATOR REMOVAL/INSTALLATION [MZI-3.7]** .)
22. Disconnect the water hose. (See **OIL COOLER REMOVAL/INSTALLATION [MZI-3.7]** .)
23. Disconnect the ATF oil cooler hose.
24. Disconnect the plastic fuel hose. (See **BEFORE SERVICE PRECAUTION [MZI-3.7]** .) (See **QUICK RELEASE CONNECTOR (EMISSION SYSTEM) REMOVAL/INSTALLATION [MZI-3.7]** .)
25. Disconnect the wiring harness.

NOTE:

- Do not disconnect the engine side of this wiring harness.

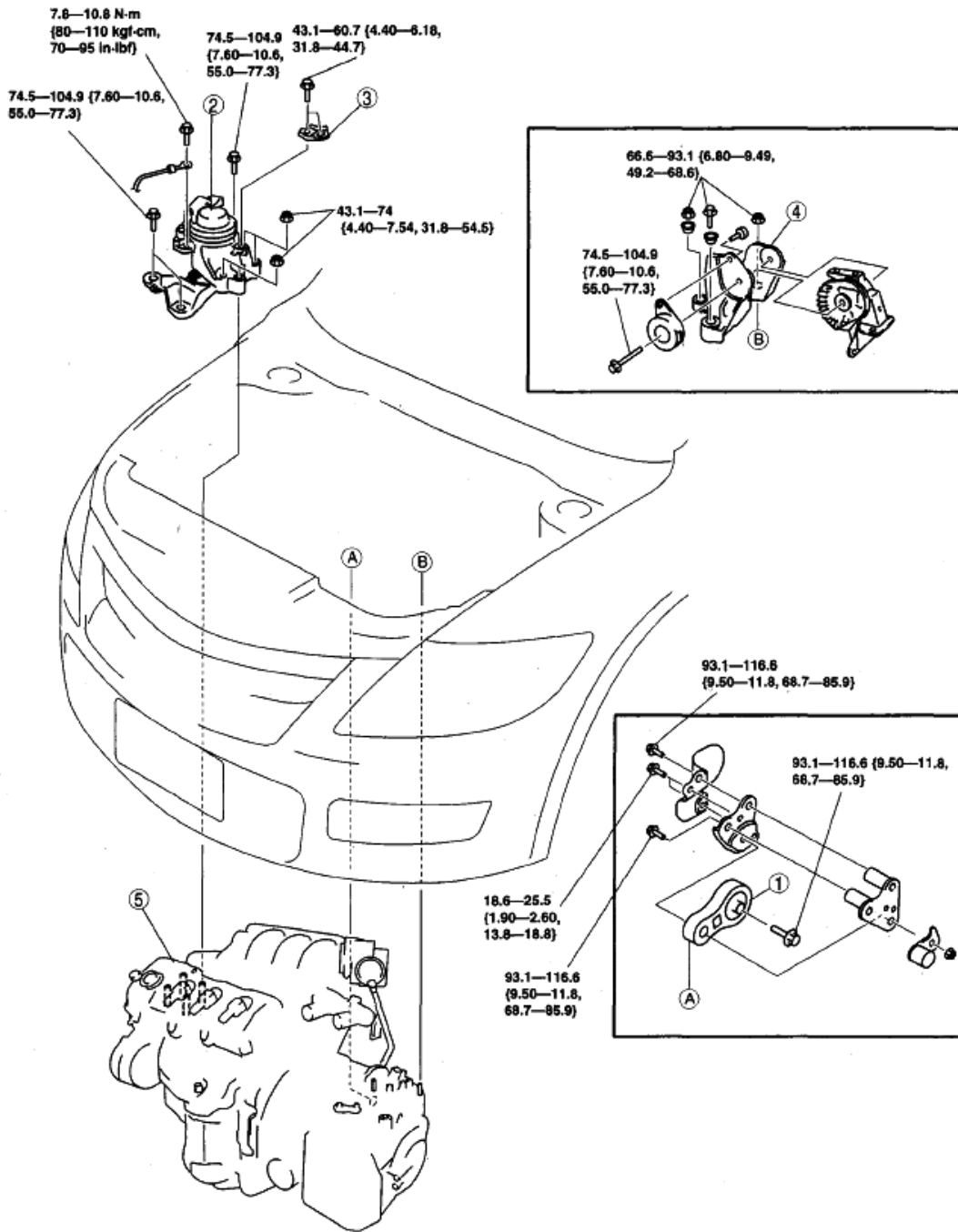
26. Remove the A/C compressor with the pipes connected and secure the A/C compressor using wire or rope so that it is out of the way. (See **A/C COMPRESSOR REMOVAL/INSTALLATION** .)
27. Remove the engine and transaxle component using an engine jack in the order indicated in the figure.
28. Install in the reverse order of removal.
29. Start the engine and:
 1. Inspect the runout and contact on the pulley and belt.
 2. Inspect for engine oil, engine coolant, ATF, power steering fluid and fuel leakage.
 3. Verify the ignition timing, idle speed and idle mixture. (See **ENGINE TUNE-UP [MZI-3.7]** .)
 4. Engine accessories operation
30. Perform a road test.

NOTE:

- If the engine is overhauled and installed to the vehicle, perform the road test and verify that there is no malfunction.

2008 Mazda CX-9 Grand Touring

2008 ENGINE Mechanical (MZI-3.7) - Mazda CX-9



ac9uuw0002135

1	No.1 engine mount (See No.1 Engine Mount Removal Note.)
2	No.3 engine mount rubber (See No.3 Engine Mount Rubber and No.4 Engine Mount Bracket Removal Note) (See Engine Mount Installation Note.)

3	No.3 engine mount stay (No.3 engine mount side)
4	No.4 engine mount bracket (See No.3 Engine Mount Rubber and No.4 Engine Mount Bracket Removal Note) (See Engine Mount Installation Note.)
5	Engine and transaxle (See Engine and Transaxle Removal Note.)

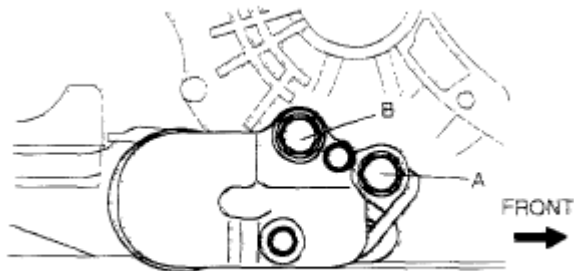
Fig. 129: Identifying Engine, Transaxle, Engine Mount Bracket, Engine Mount Rubber & Torque

Specifications

Courtesy of MAZDA MOTORS CORP.

NO.1 ENGINE MOUNT REMOVAL NOTE

1. Remove the front under cover A and front under cover B. (See **FRONT UNDER COVER REMOVAL/INSTALLATION** .)
2. Remove the transverse member. (See **TRANSVERSE MEMBER REMOVAL/INSTALLATION** .)
3. Remove the intermediate shaft installation bolt, and disconnect the steering shaft. (See **STEERING WHEEL AND COLUMN REMOVAL/INSTALLATION** .)
4. Remove the No.1 engine mount bracket bolts A and B as shown.

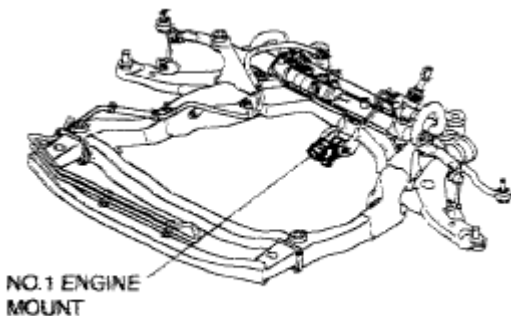


ac9uuv00002885

Fig. 130: Identifying No.1 Engine Mount Bracket Bolts

Courtesy of MAZDA MOTORS CORP.

5. Remove the No.1 engine mount No.1 engine mount bracket and the front crossmember as a single unit (See **FRONT CROSSMEMBER REMOVAL/INSTALLATION** .)



ac9uuv00002885

Fig. 131: Identifying No.1 Engine Mount

Courtesy of MAZDA MOTORS CORP.

NO.3 ENGINE MOUNT RUBBER AND NO.4 ENGINE MOUNT BRACKET REMOVAL NOTE

1. Secure the engine and transaxle using an engine jack and attachment.

- CAUTION:**
- Remove the engine and transaxle carefully, holding it steady. If the transaxle falls it could be damaged or cause injury.

2. Secure the engine, transaxle, and crossmember component using a hoist.

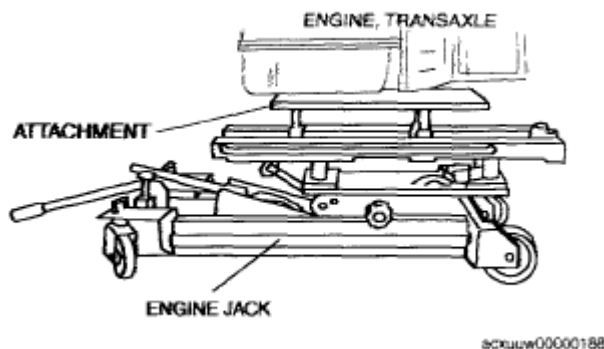


Fig. 132: Lifting Engine & Transaxle With Engine Jack
Courtesy of MAZDA MOTORS CORP.

ENGINE & TRANSAXLE REMOVAL NOTE

- NOTE:**
- When lowering the engine, slightly move it to the left side of the vehicle to set the A/C compressor out of the way.

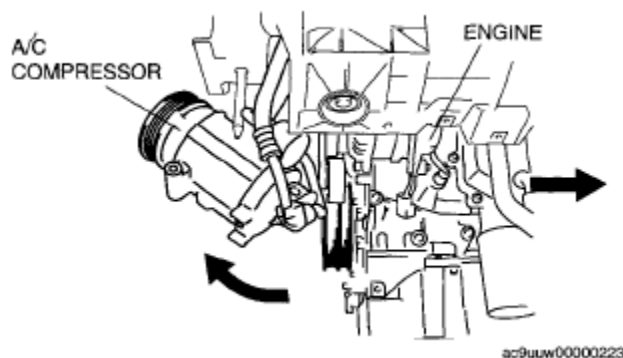


Fig. 133: Setting A/C Compressor
Courtesy of MAZDA MOTORS CORP.

ENGINE MOUNT INSTALLATION NOTE

1. Tighten the No.3 engine mount stud bolts.

Tightening torque: 15.7-23.5 N.m {1.61-2.39 kgf.m, 11.6-17.3 ft.lbf}

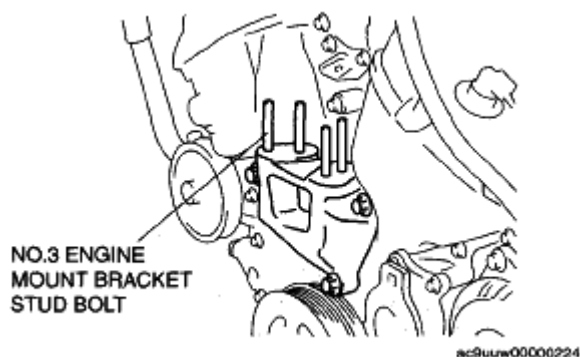


Fig. 134: Identifying No.3 Engine Mount Stud Bolts
Courtesy of MAZDA MOTORS CORP.

2. Secure the engine and the transaxle using an engine jack and attachment as shown.

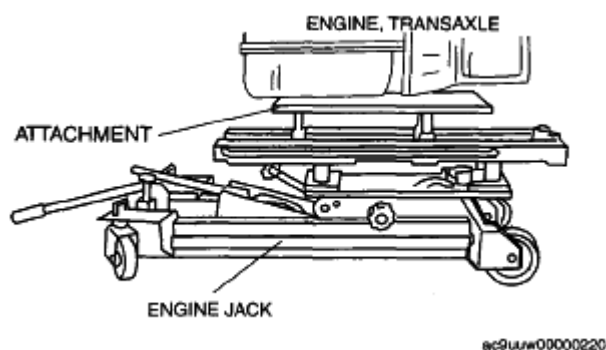


Fig. 135: Lifting Engine & Transaxle With Engine Jack
Courtesy of MAZDA MOTORS CORP.

3. Temporarily tighten the No.3 engine mount bolts and nuts in the order shown in the figure.
4. Temporarily tighten the No. 4 engine mount bracket in two passes.

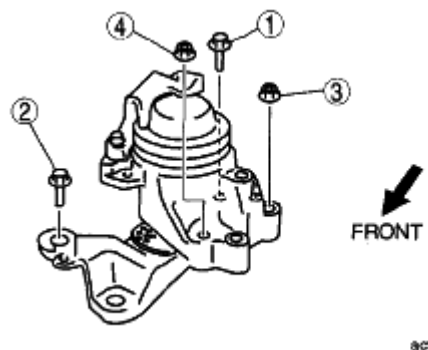


Fig. 136: Identifying No.3 Engine Mount Bolts & Nuts
Courtesy of MAZDA MOTORS CORP.

1. Temporarily tighten the No.4 engine mount bracket in the order shown in the figure until the flange

surface does not adhere.

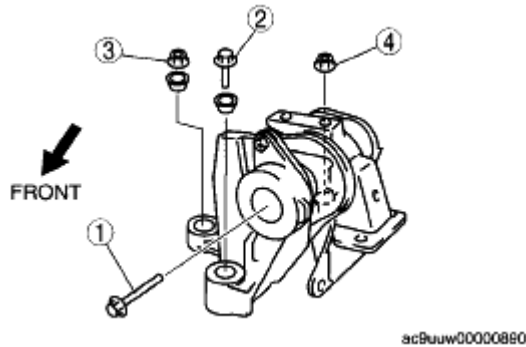


Fig. 137: Identifying No.4 Engine Mount Bracket
Courtesy of MAZDA MOTORS CORP.

- Temporarily tighten the No.4 engine mount bracket in the order shown in the figure until the flange surface firmly adheres.

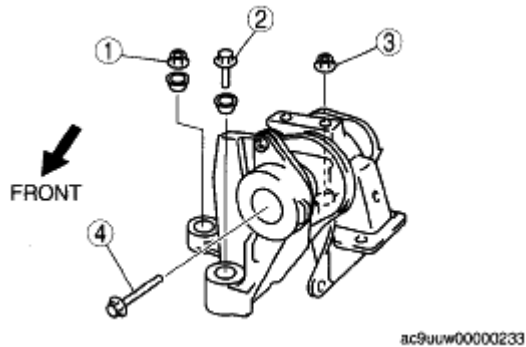


Fig. 138: Identifying No.4 Engine Mount Bracket
Courtesy of MAZDA MOTORS CORP.

- Install the No.1 engine mount, No.1 engine mount bracket and the front crossmember as a single unit. (See **FRONT CROSSMEMBER REMOVAL/INSTALLATION** .)

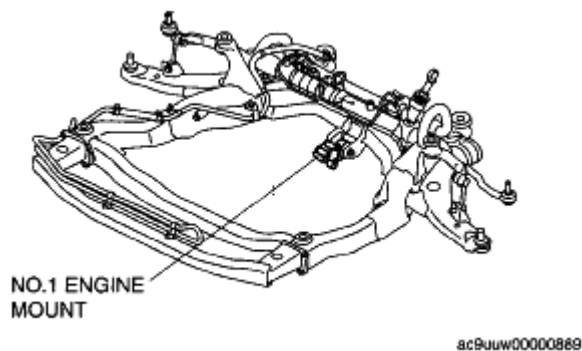
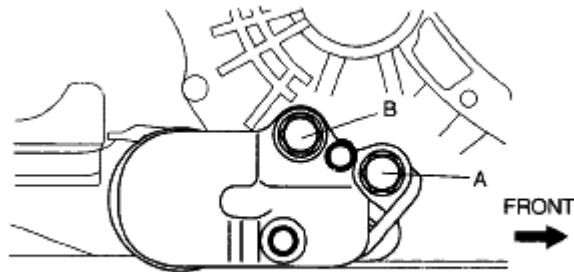


Fig. 139: Identifying No.1 Engine Mount

Courtesy of MAZDA MOTORS CORP.

6. Tighten the bolts on the No.1 engine mounting bracket in the order of A, B.

Tightening torque: 93.1-116.6 N.m {9.50-11.8 kgf.m, 68.7-85.9 ft.lbf}



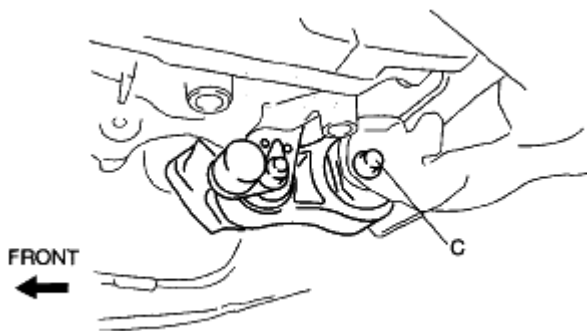
ac9uuw0000966

Fig. 140: Identifying Bolts On No.1 Engine Mounting Bracket
Courtesy of MAZDA MOTORS CORP.

7. Tighten the No.1 engine mount bolt C at the specified torque.

Tightening torque: 93.1-116.6 N.m {9.50-11.8 kgf.m, 68.7-85.9 ft.lbf}

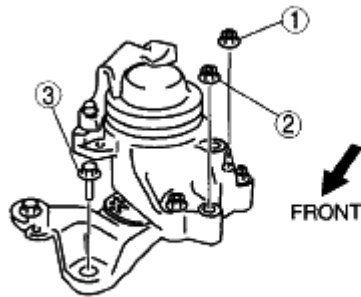
8. Install the intermediate shaft installation bolt, and disconnect the steering shaft. (See **STEERING WHEEL AND COLUMN REMOVAL/INSTALLATION** .)



ac9uuw0000967

Fig. 141: Identifying No.1 Engine Mount Bolt
Courtesy of MAZDA MOTORS CORP.

9. Install the transverse member. (See **TRANSVERSE MEMBER REMOVAL/INSTALLATION** .)
10. Install the front under cover A and front under cover B. (See **FRONT UNDER COVER REMOVAL/INSTALLATION** .)
11. Temporarily tighten the No.3 engine mount bolt and nuts in the order shown in the figure.



ac9uuw00000230

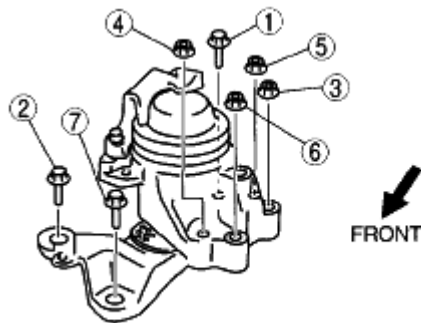
Fig. 142: Identifying No.3 Engine Mount Bolt & Nuts
 Courtesy of MAZDA MOTORS CORP.

12. Tighten the No.3 engine mount in the order shown in the figure.

Tightening Torque

TIGHTENING TORQUE SPECIFICATION

Installation Position	Tightening Torque
1, 2, 7	74.5-104.9 N.m {7.60-10.6 kgf.m, 55.0-77.3 ft.lbf}
3, 4, 5, 6	43.1-74 N.m {4.40-7.54 kgf.m, 31.8-54.5 ft.lbf}



ac9uuw00000222

Fig. 143: Identifying No.3 Engine Mount Bolt & Nuts
 Courtesy of MAZDA MOTORS CORP.

13. Tighten the No.4 engine mount in the order shown in the figure.

Tightening Torque

TIGHTENING TORQUE SPECIFICATION

Installation Position	Tightening Torque
1, 2, 3	66.6-93.1 N.m {6.80-9.49 kgf.m, 49.2-68.6 ft.lbf}
4	74.5-104.9 N.m {7.60-10.6 kgf.m, 55.0-77.3 ft.lbf}

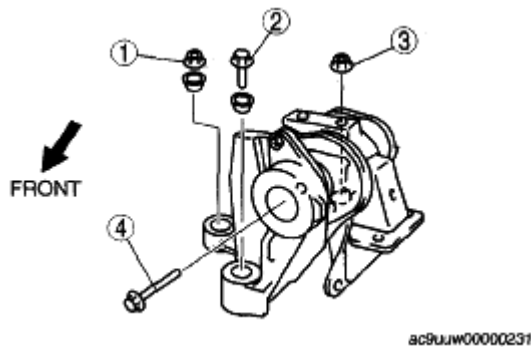


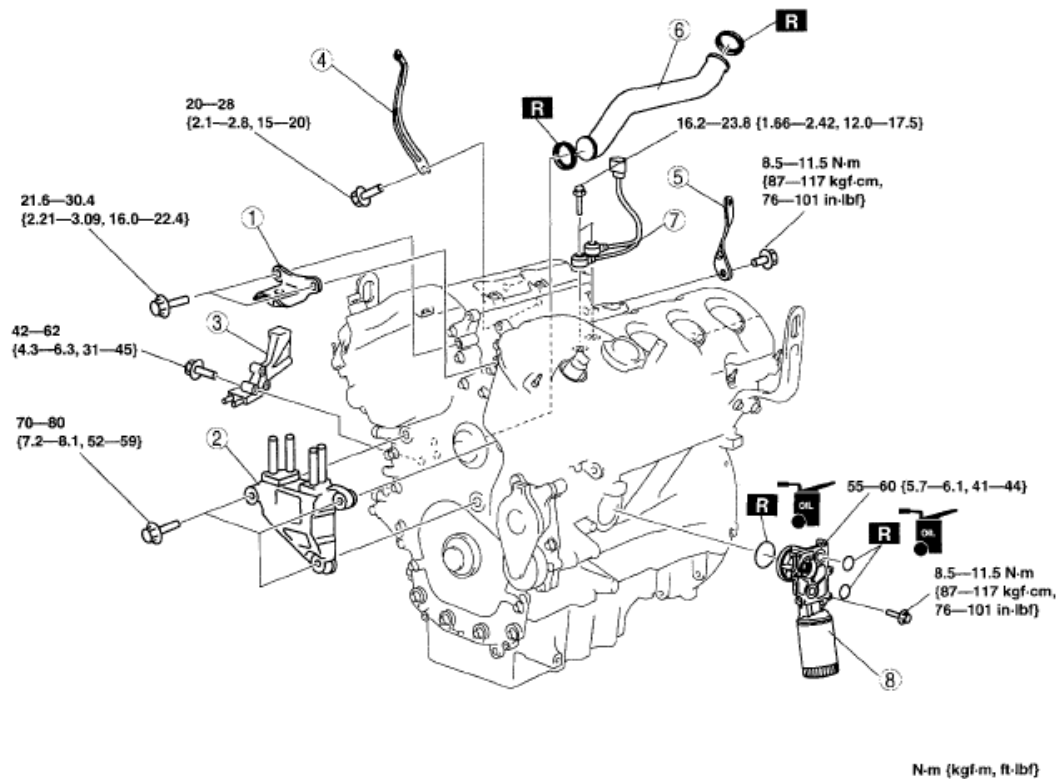
Fig. 144: Identifying No.4 Engine Mount Bolt & Nuts
 Courtesy of MAZDA MOTORS CORP.

ENGINE DISASSEMBLY/ASSEMBLY [MZI-3.7]

1. Remove the transaxle from the engine. (See [AUTOMATIC TRANSAXLE REMOVAL/INSTALLATION \[AW6A-EL, AW6AX-EL\]](#) .)
2. Remove the drive plate. (See [DRIVE PLATE REMOVAL/INSTALLATION \[AW6A-EL, AW6AX-EL\]](#) .)
3. Remove the ignition coils. (See [IGNITION COIL REMOVAL/INSTALLATION \[MZI-3.7\]](#) .)
4. Remove the CMP sensor. (See [CAMSHAFT POSITION \(CMP\) SENSOR REMOVAL/INSTALLATION \[MZI-3.7\]](#) .)
5. Remove the power steering oil pump. (See [POWER STEERING OIL PUMP REMOVAL/INSTALLATION](#) .)
6. Remove the generator. (See [GENERATOR REMOVAL/INSTALLATION \[MZI-3.7\]](#) .)
7. Remove the fuel injector and fuel distributor. (See [FUEL INJECTOR REMOVAL/INSTALLATION \[MZI-3.7\]](#) .)
8. Remove the intake-air system. (See [INTAKE-AIR SYSTEM REMOVAL/INSTALLATION \[MZI-3.7\]](#) .)
9. Remove the exhaust system. (See [EXHAUST SYSTEM REMOVAL/INSTALLATION \[MZI-3.7\]](#) .)
10. Remove the thermostat case and water hose component. (See [THERMOSTAT REMOVAL/INSTALLATION \[MZI-3.7\]](#) .)
11. Remove the CHT sensor. (See [CYLINDER HEAD TEMPERATURE \(CHT\) SENSOR REMOVAL/INSTALLATION \[MZI-3.7\]](#) .)
12. Remove the CKP sensor. (See [CRANKSHAFT POSITION \(CKP\) SENSOR REMOVAL/INSTALLATION \[MZI-3.7\]](#) .)
13. Remove the oil pressure switch. (See [OIL PRESSURE INSPECTION \[MZI-3.7\]](#) .)
14. Remove the oil cooler. (See [OIL COOLER REMOVAL/INSTALLATION \[MZI-3.7\]](#) .)
15. Disassemble in the order indicated in the table.
16. Assemble in the reverse order of disassembly.

2008 Mazda CX-9 Grand Touring

2008 ENGINE Mechanical (MZI-3.7) - Mazda CX-9



ac9uuw00002715

1	No.3 engine mount stay (engine front cover side) (See 01-10-57 No.3 Engine Mount Stay (Engine Front Cover Side) Installation Note.)
2	No.3 engine mount bracket
3	Transfer bracket (AWD)
4	Dynamic chamber bracket (engine right side)

5	Dynamic chamber bracket (engine back side)
6	Water inlet pipe (See 01-10-57 Water Inlet Pipe Installation Note.)
7	KS (See 01-40-30 KNOCK SENSOR (KS) REMOVAL/INSTALLATION [MZI-3.7].)
8	Oil filter adapter and oil filter

Fig. 145: Identifying Engine Bolts With Torque Specifications
Courtesy of MAZDA MOTORS CORP.

NO.3 ENGINE MOUNT STAY (ENGINE FRONT COVER SIDE) INSTALLATION NOTE

1. Tighten the No.3 engine mount stay (engine front cover side) in the order shown in the figure.

Tightening torque: 21.6-30.4 N.m {2.21-3.09 kgf.m, 16.0-22.4 ft.lbf}

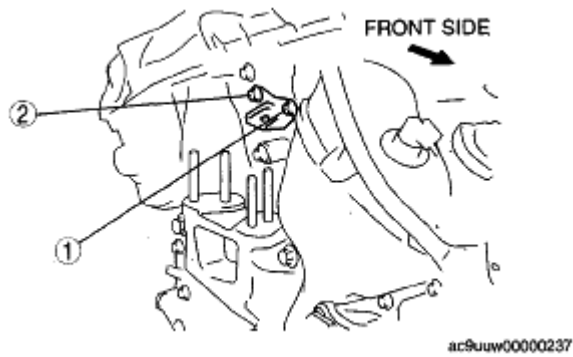


Fig. 146: Identifying No.3 Engine Mount Stay
Courtesy of MAZDA MOTORS CORP.

WATER INLET PIPE INSTALLATION NOTE

1. Apply clean engine coolant to the O-ring.