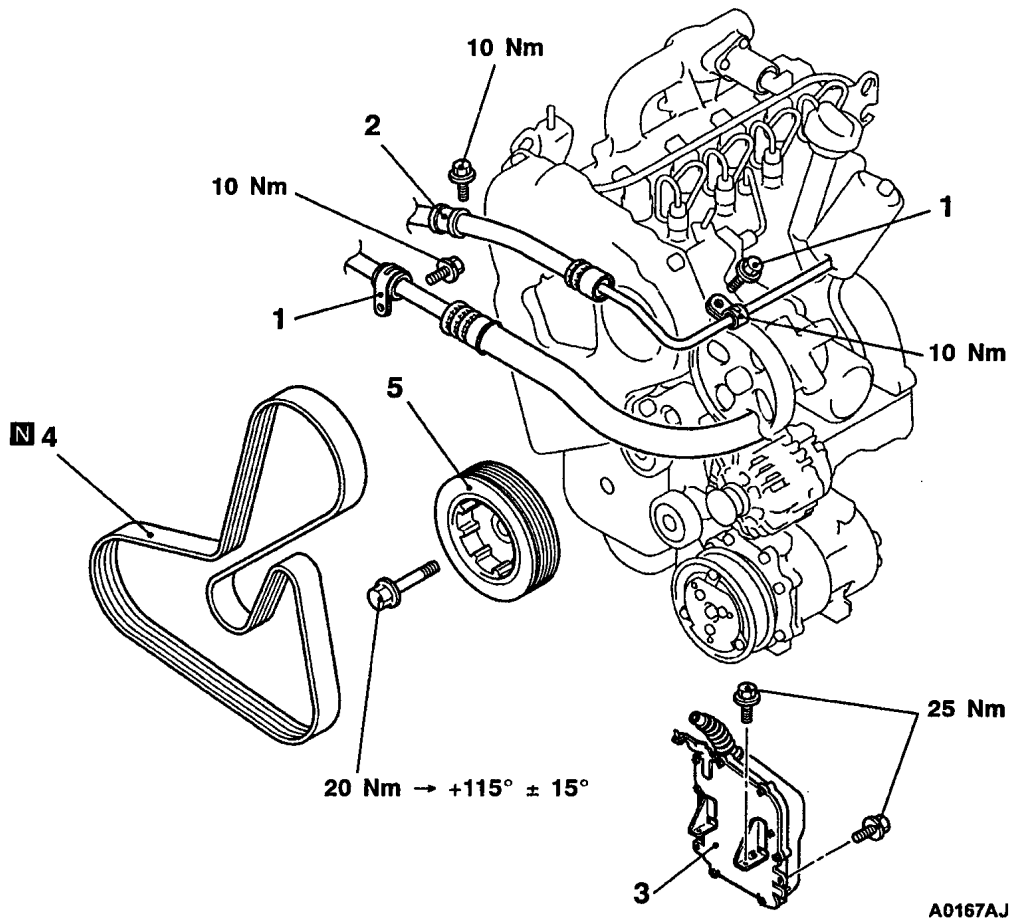


# CRANKSHAFT PULLEY

## REMOVAL AND INSTALLATION

**Pre-removal and Post-Installation Operation**

- Under Cover Removal and Installation



### Removal steps

1. A/C suction hose clamp
2. Power steering pressure hose clamp

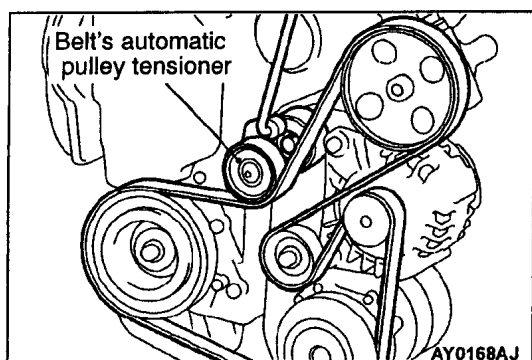


3. Engine-ECU assembly
4. Drive belt
5. Crankshaft pulley

### REMOVAL SERVICE POINTS

#### ◄A► ENGINE-ECU ASSEMBLY REMOVAL

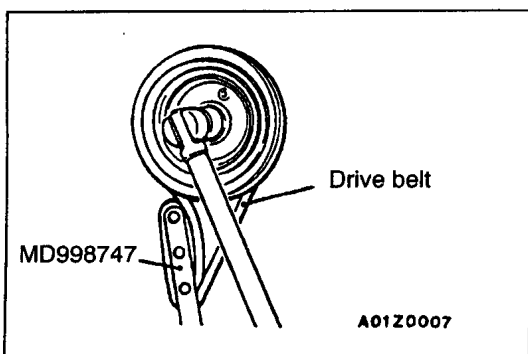
Remove the engine-ECU assembly with the harness attached to hold in the location where the removal of drive belt cannot be hindered.

**◀B▶ DRIVE BELT REMOVAL**

1. Loosen the belt's automatic pulley tensioner mounting bolt.
2. Hook 16 mm wrench to the protrusion of the belt's automatic pulley tensioner and turn the belt's automatic pulley tensioner clockwise to remove the drive belt.

**Caution**

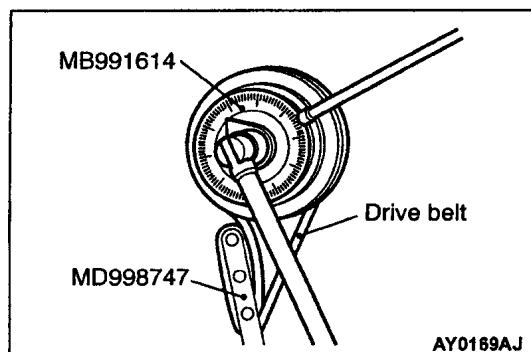
Do not use the removed drive belt again. Always make sure to replace the used drive belt with a new one.

**◀C▶ CRANKSHAFT PULLEY REMOVAL****Caution**

1. This drive belt will get damaged. Do not use the engine's drive belt.
2. Never use a damaged drive belt.

**INSTALLATION SERVICE POINT****▶A◀ CRANKSHAFT PULLEY INSTALLATION**

1. Use the special tool to hold the crankshaft pulley.
2. Tighten the crankshaft pulley mounting bolt to 20 Nm.
3. Place the special tool in a wrench to tighten the crankshaft pulley mounting bolt to  $115^\circ \pm 15^\circ$ .

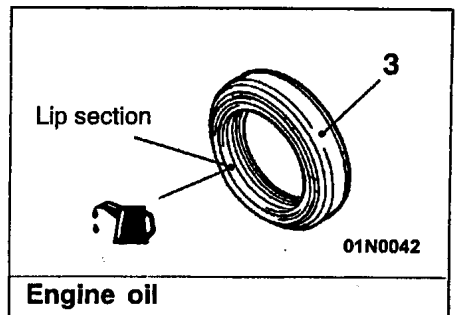
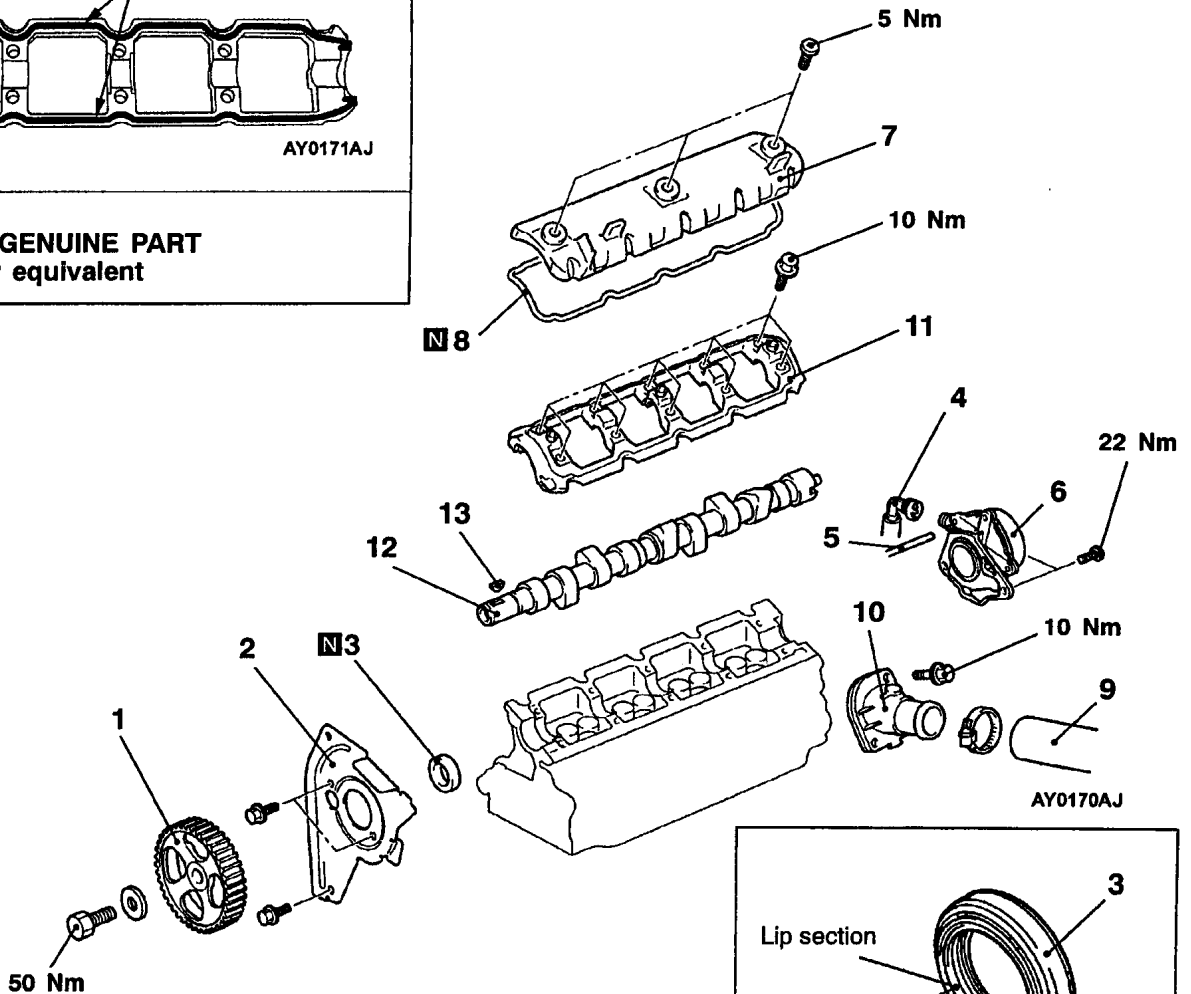
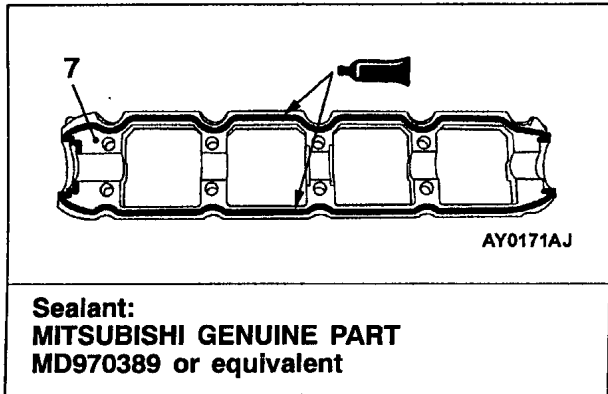


# CAMSHAFT AND CAMSHAFT OIL SEAL

## REMOVAL AND INSTALLATION

**Pre-removal and Post-installation Operation**

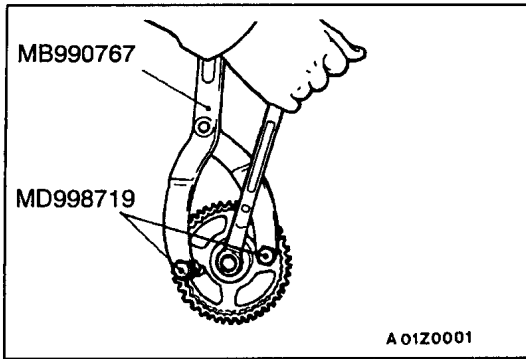
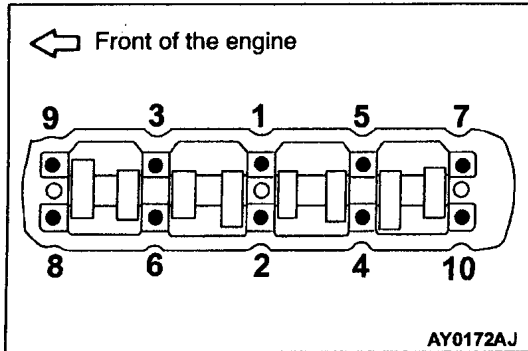
- Engine Coolant Draining and Supplying (Refer to GROUP 14 - On-vehicle Service.)
- Air Cleaner Removal and Installation (Refer to GROUP 15.)
- Timing Belt Removal and Installation (Refer to P.11C-18.)



**Removal steps**

- ◀A▶ ▶C▶ 1. Camshaft sprocket
- ▶B▶ 2. Timing belt under cover upper
- 3. Camshaft oil seal
- 4. Brake booster vacuum hose connection
- 5. Vacuum hose connection
- 6. Vacuum pump assembly

- ▶A▶ 7. Rocker cover
- 8. Rocker cover gasket
- 9. Radiator upper hose connection
- 10. Water inlet fitting
- ▶A▶ 11. Beam camshaft cap
- 12. Camshaft
- 13. Key

**REMOVAL SERVICE POINT****◀A▶ CAMSHAFT SPROCKET REMOVAL****INSTALLATION SERVICE POINTS****▶A◀ BEAM CAMSHAFT CAP INSTALLATION**

Tighten the beam camshaft cap mounting bolts to the specified torque in the order shown in the illustration.

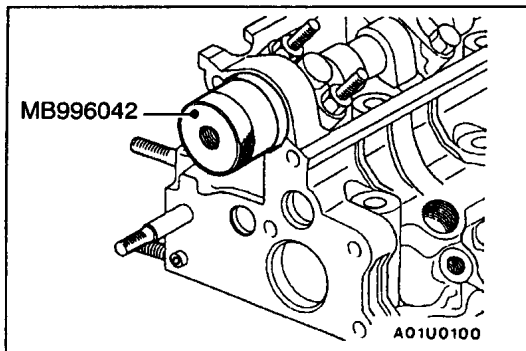
**Tightening torque: 10 Nm**

**▶B◀ CAMSHAFT OIL SEAL INSTALLATION**

1. Coat the lip of the oil seal with a thin layer of engine oil.
2. Tape off the camshaft.
3. Locate the oil seal over the camshaft.
4. Fit the oil seal with the special tool.

**▶C◀ CAMSHAFT SPROCKET INSTALLATION**

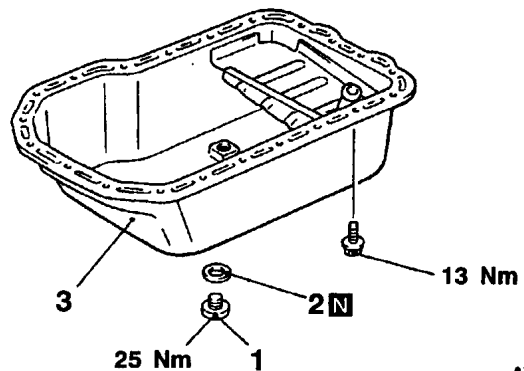
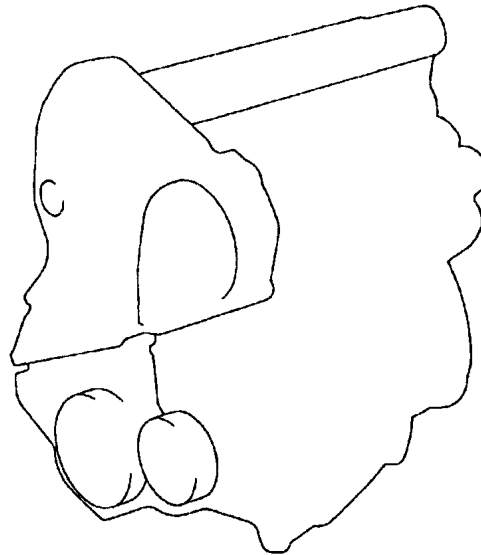
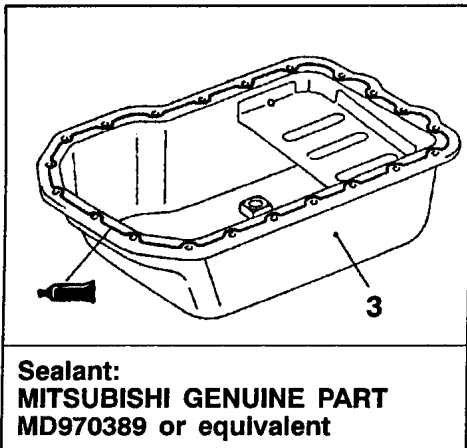
Use the special tool to secure the camshaft sprocket in the same way as during removal, and then tighten the bolt to the specified torque.



**OIL PAN**

**REMOVAL AND INSTALLATION**

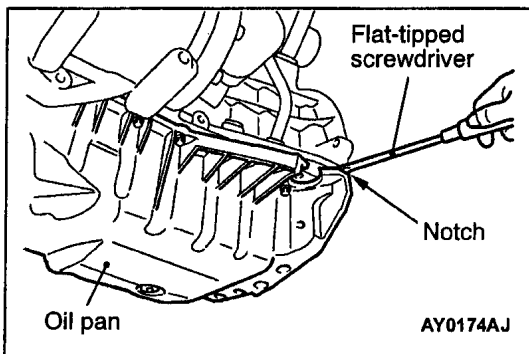
- Pre-removal and Post-installation Operation**
- Under Cover Removal and Installation
  - Engine Oil Draining and Supplying (Refer to GROUP 12 – On-vehicle Service.)
  - Oil Level Gauge Removal and Installation



AY0173AJ

**Removal steps**

1. Drain plug
2. Drain plug gasket
3. Oil pan



**REMOVAL SERVICE POINT**

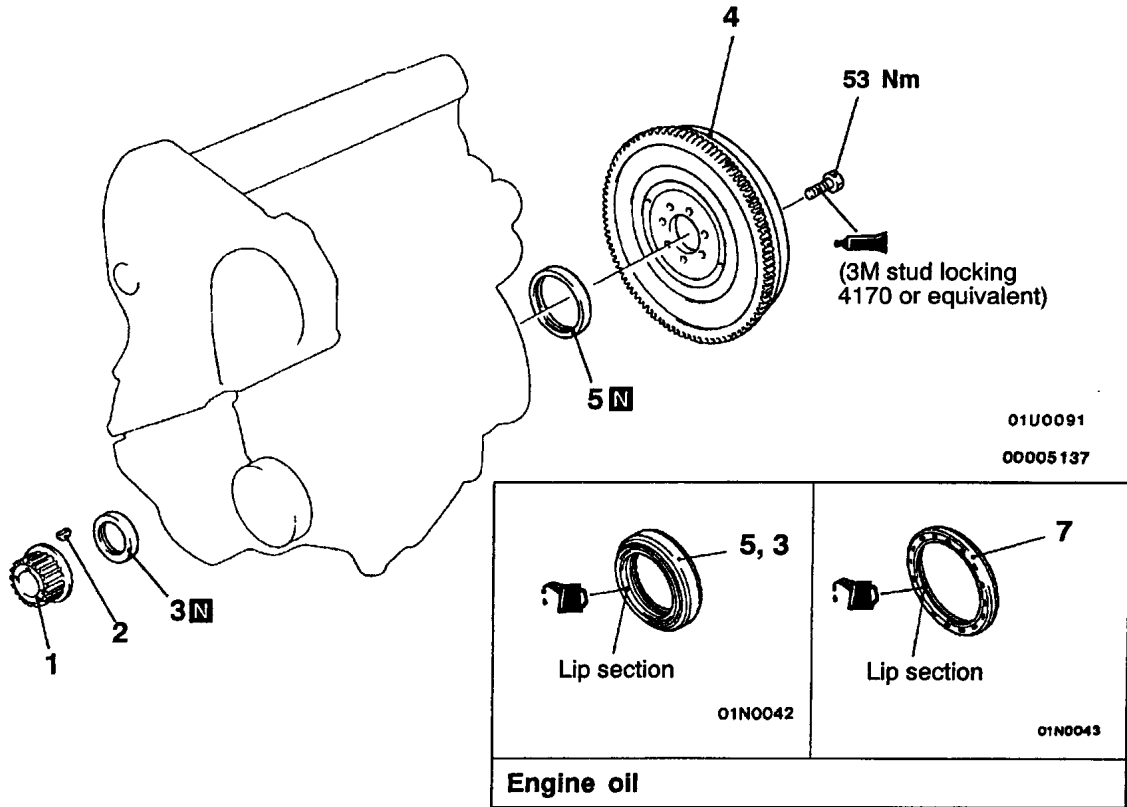
**◀A▶ OIL PAN REMOVAL**

Insert a flat-tipped screwdriver into the notch of the oil pan, and turn it to remove the oil pan.

**Caution**

Because the upper oil pan used is made from aluminium, the oil pan remover (MB998727) should not be used.

**CRANKSHAFT OIL SEAL  
REMOVAL AND INSTALLATION**



**Crankshaft front oil seal removal steps**

- Timing belt (Refer to P.11C-18.)
- 1. Crankshaft sprocket
- 2. Key
- 3. Crankshaft front oil seal



**Crankshaft rear oil seal removal steps**

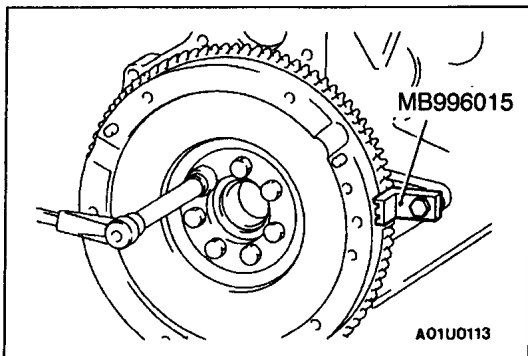
- Transmission assembly (Refer to GROUP 22.)
- Clutch cover and disc
- 4. Flywheel assembly
- 5. Crankshaft rear oil seal

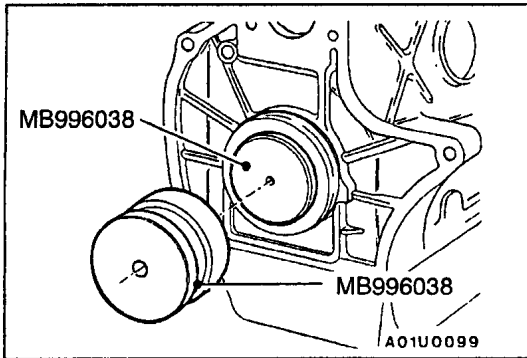


**REMOVAL SERVICE POINT**

**◀A▶ FLYWHEEL ASSEMBLY REMOVAL**

Use the special tool to secure the flywheel and remove the bolts.





## INSTALLATION SERVICE POINTS

### ►A◄ CRANKSHAFT REAR OIL SEAL INSTALLATION

1. Coat the lip of the oil seal with a thin layer of engine oil.
2. Locate the special tool (installer guide) over the crankshaft.
3. Locate the oil seal over the guide.
4. Fit the oil seal with special tool (installer).

### ►B◄ FLYWHEEL ASSEMBLY INSTALLATION

1. Clean off all sealant, oil and other substances which are adhering to the threaded bolts, crankshaft thread holes and the flywheel.
2. Apply sealant to the threaded mounting bolts.

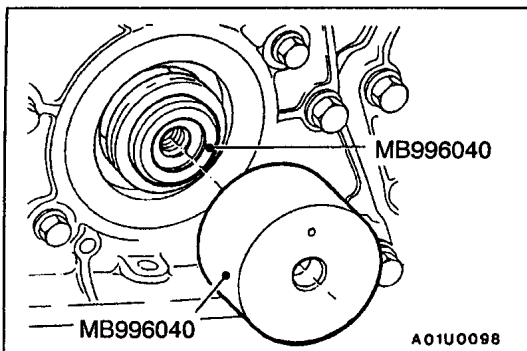
**Specified sealant: 3M Stud locking 4170 or equivalent**

3. Use the special tool to secure the flywheel, and then tighten the bolts to the specified torque.

**Tightening torque: 53 Nm**

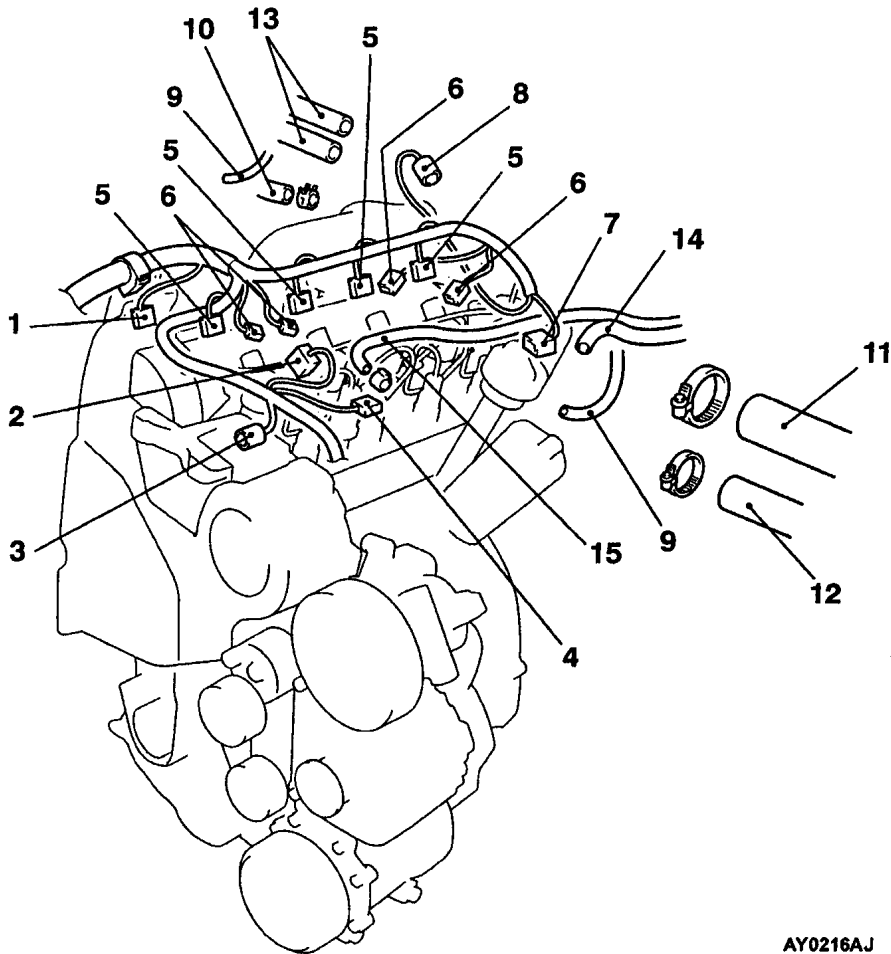
### ►C◄ CRANKSHAFT FRONT OIL SEAL INSTALLATION

1. Coat the lip of the oil seal with a thin layer of engine oil.
2. Locate the special tool (installer guide) over the crankshaft.
3. Locate the oil seal over the guide.
4. Fit the oil seal with special tool (installer).



**CYLINDER HEAD GASKET****REMOVAL AND INSTALLATION****Pre-removal and Post-installation Operation**

- Engine Coolant Draining and Supplying (Refer to GROUP 14 – On-vehicle Service.)
- Engine Oil Draining and Supplying (Refer to GROUP 12 – On-vehicle Service.)
- Timing Belt Removal and Installation (Refer to P.11C-18.)
- Air Cleaner and Air Intake Hose Removal and Installation (Refer to GROUP 15.)
- Catalytic Converter Removal and Installation (Refer to GROUP 15 – Exhaust Pipe and Main Muffler.)



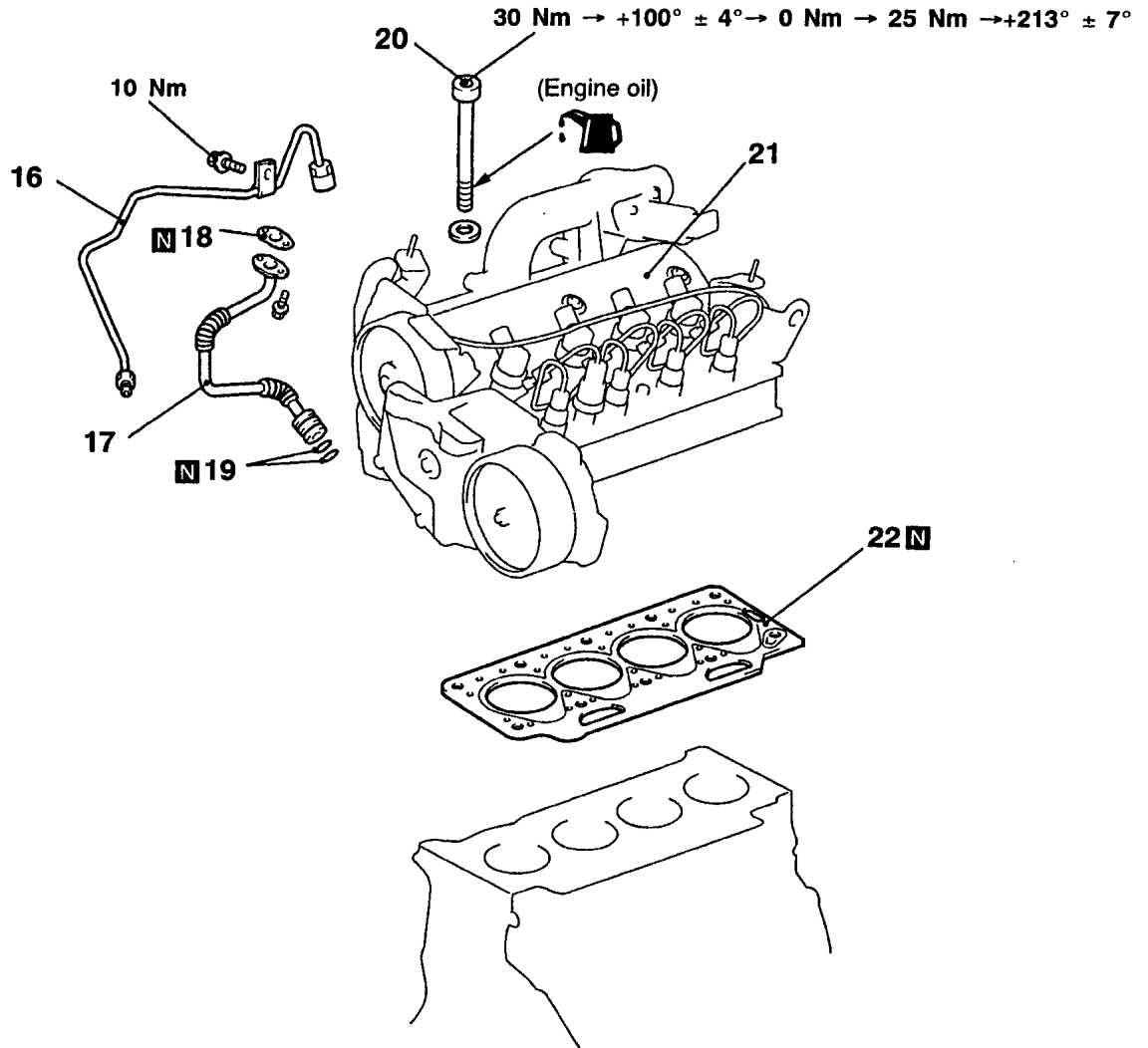
AY0216AJ

**Removal steps**

1. Camshaft position sensor connector
2. Fuel pressure sensor connector
3. Fuel high pressure pump connector
4. Fuel temperature sensor connector
5. Fuel injector connector
6. Glow plug connector
7. Water temperature sensor connector
8. EGR valve connector
9. Vacuum hose connection
10. Brake booster vacuum hose connection
11. Radiator upper hose connection
12. Water hose connection
13. Heater hose connection
14. Fuel return hose connection
15. Fuel supply hose connection







Y0218AJ

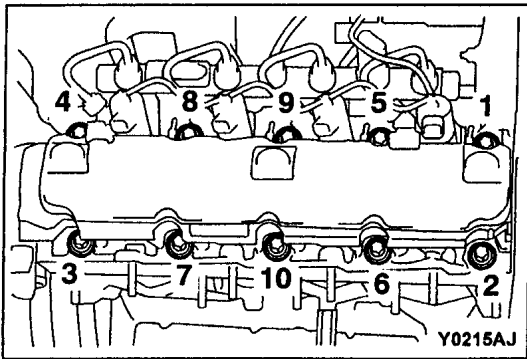
- 16. Oil pipe assembly
- 17. Oil return pipe assembly
- 18. Oil return pipe gasket
- 19. O-ring

- ◀B▶ ▶B◀ 20. Cylinder head bolt
- ▶A◀ 21. Cylinder head assembly
- ▶A◀ 22. Cylinder head gasket

**REMOVAL SERVICE POINTS**

**◀A▶ FUEL RETURN HOSE CONNECTION/FUEL SUPPLY HOSE CONNECTION REMOVAL**

After disconnecting the fuel return hose and the fuel supply hose, put the cover at the end of the fuel line to prevent foreign objects from entering.



### ◀B▶ CYLINDER HEAD BOLT REMOVAL

Loosen the cylinder head bolt in the order of the illustrated numbers in two or three stages for removal.

#### Caution

Do not use the removed cylinder head bolt again. Always replace the used cylinder head bolt with a new one.

## INSTALLATION SERVICE POINTS

### ▶A▶ CYLINDER HEAD GASKET INSTALLATION

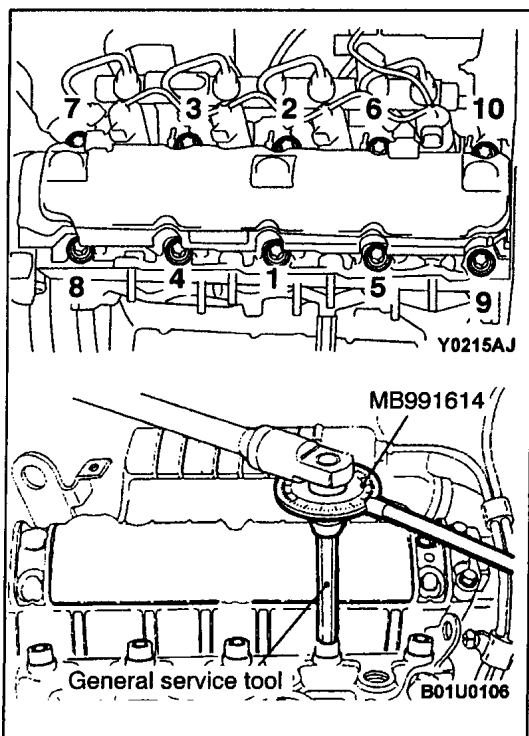
1. Wipe off all oil and grease from the gasket mounting surface.
2. Install so that the shapes of the cylinder head holes match the shapes of the respective cylinder head gasket holes.

### ▶B▶ CYLINDER HEAD BOLT INSTALLATION

1. Tighten the new cylinder head bolt in the order of the illustrated numbers to 30 Nm.
2. Place the special tool in a wrench to tighten the cylinder head bolt in the order of the illustrated numbers to  $100^\circ \pm 4^\circ$ .
3. Wait for approximately 3 minutes until the cylinder head gasket fits in the cylinder head and the cylinder block.
4. Loosen the illustrated number 1 and 2 bolts completely.
5. Tighten the illustrated number 1 and 2 bolts to 25 Nm.
6. Place the special tool in a wrench to tighten the illustrated number 1 and 2 bolts to  $213^\circ \pm 7^\circ$ .
7. Divide the rest of the bolts into pairs: Number 3 and 4 bolts, number 5 and 6 bolts, number 7 and 8 bolts, number 9 and 10 bolts. And tighten them as a pair according to the procedures 3, 4, and 5.

#### Caution

The cylinder head bolt will be extended if the cylinder head is tightened. If the cylinder head bolt is tightened too much, replace it with a new one instead of tightening it again.

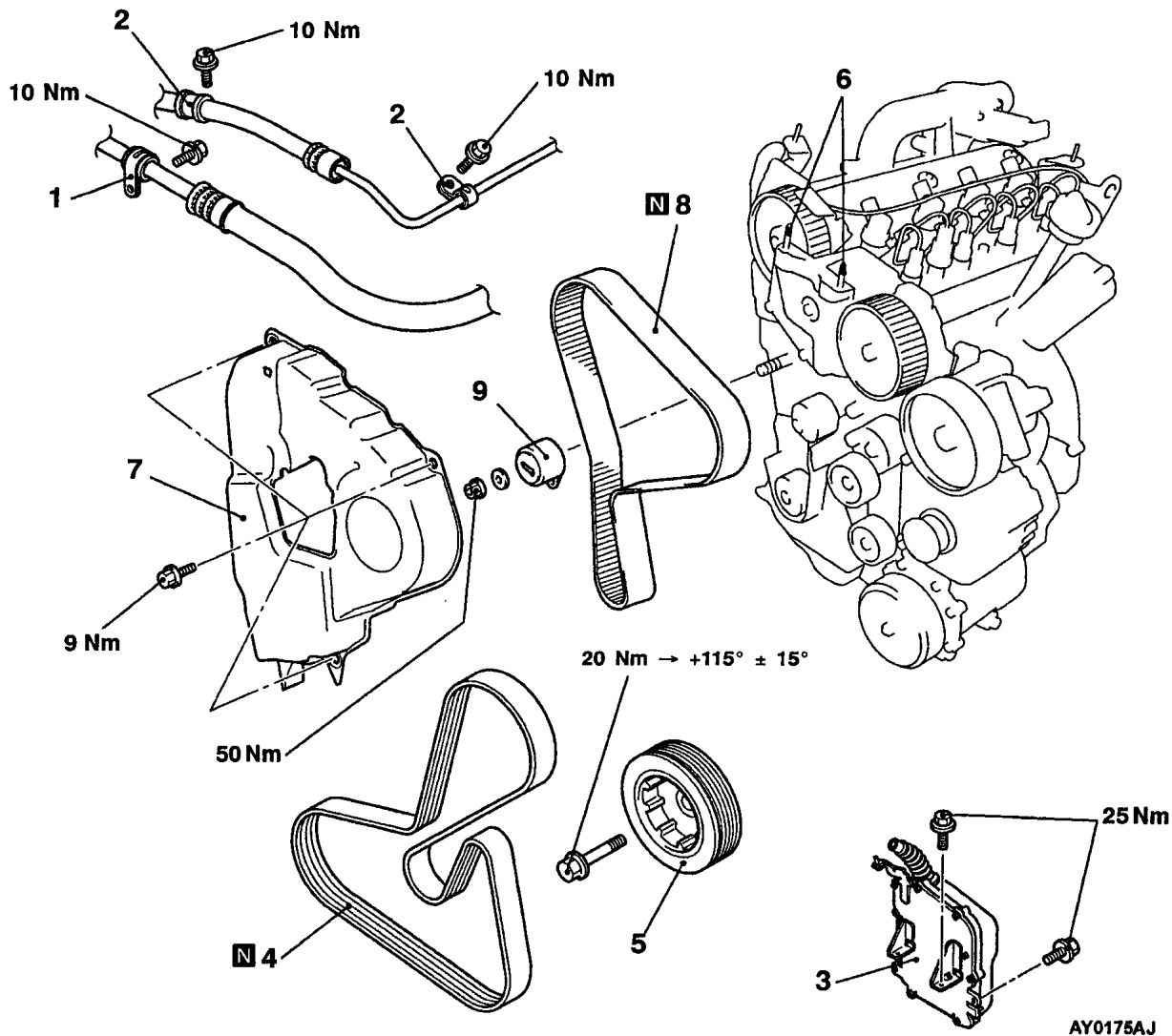


# TIMING BELT

## REMOVAL AND INSTALLATION

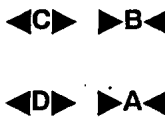
**Pre-removal and Post-Installation Operation**

- Under Cover Removal and Installation
- Engine Mount Bracket Removal and Installation (Refer to GROUP 32.)



**Removal steps**

1. A/C suction hose clamp
2. Power steering pressure hose clamp
3. Engine-ECU assembly
4. Drive belt

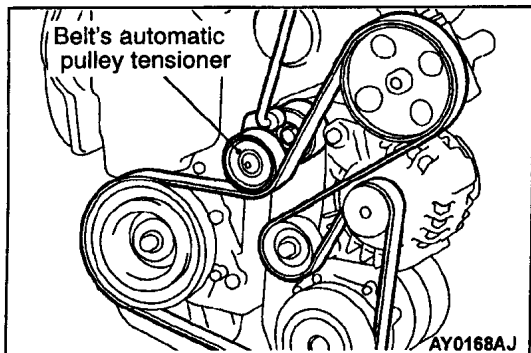


5. Crankshaft pulley
6. Stud bolt
7. Timing belt cover
8. Timing belt
9. Timing belt tensioner pulley



**REMOVAL SERVICE POINTS****◀A▶ ENGINE-ECU ASSEMBLY REMOVAL**

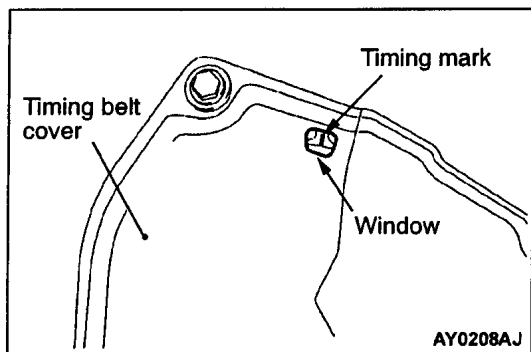
Remove the engine-ECU assembly with the harness attached and hold it in the location where the removal of drive belt cannot be hindered.

**◀B▶ DRIVE BELT REMOVAL**

1. Loosen the belt's automatic pulley tensioner mounting bolt.
2. Hook 16 mm wrench to the protrusion of the belt's automatic pulley tensioner and turn the belt's automatic pulley tensioner clockwise to remove the drive belt.

**Caution**

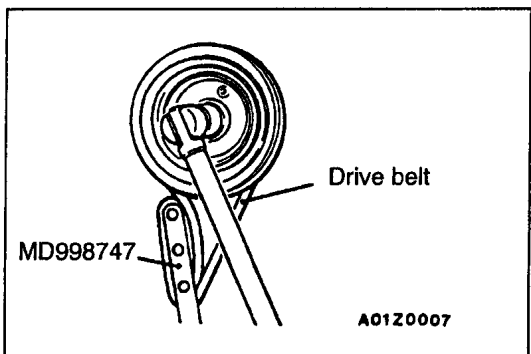
**Do not use the removed drive belt again. Always make sure to replace the used drive belt with a new one.**

**◀C▶ CRANKSHAFT PULLEY REMOVAL**

1. Turn the crankshaft clockwise to align the timing mark of the camshaft sprocket with the centre of the window of the timing belt cover.

**Caution**

**The crankshaft must always be turned clockwise.**



2. Use the special tool to hold the crankshaft pulley, loosen the crankshaft pulley mounting bolt, and remove the crankshaft pulley.

**Caution**

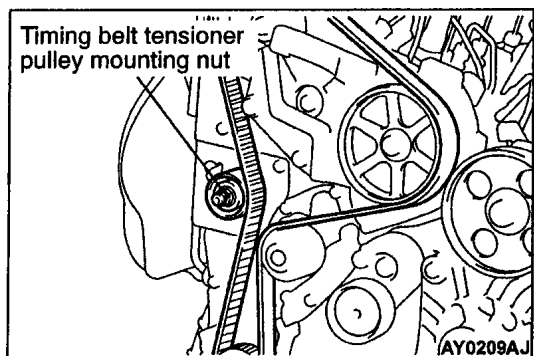
1. **This drive belt will get damaged. Do not use the engine's drive belt.**
2. **Never use a damaged drive belt.**
3. **When the crankshaft pulley mounting bolt is loosened, be careful not to miss the timing mark while turning the crankshaft pulley.**

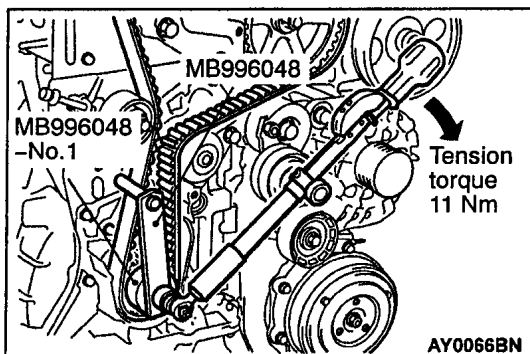
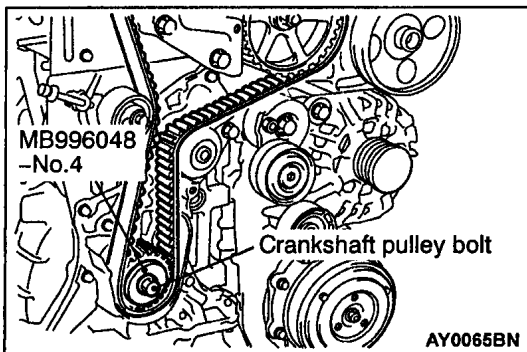
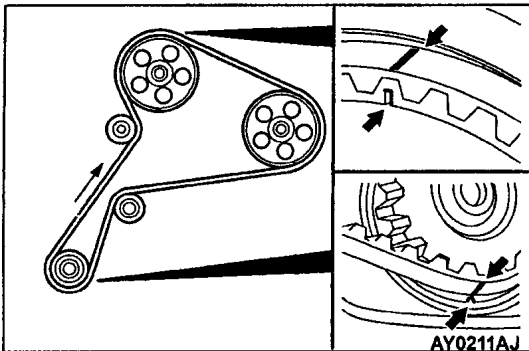
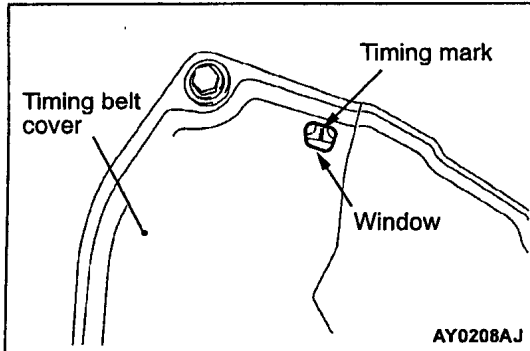
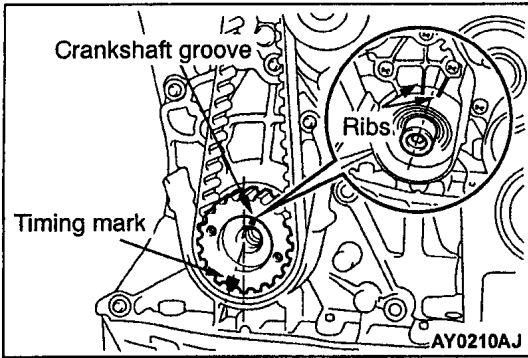
**◀D▶ TIMING BELT REMOVAL**

Loosen the timing belt tensioner pulley mounting nut to remove the timing belt.

**Caution**

**Do not use the removed timing belt again. Always replace the used timing belt with a new one.**

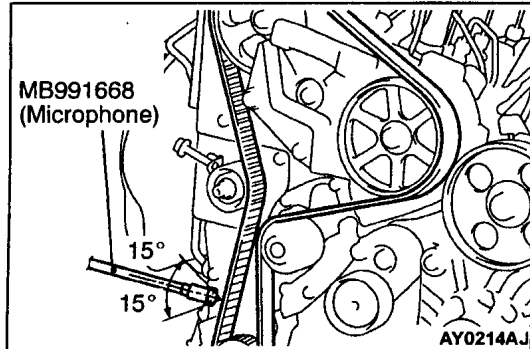
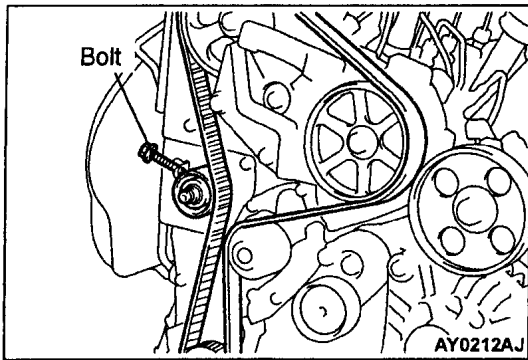




## INSTALLATION SERVICE POINTS

### ▶A◀TIMING BELT INSTALLATION

1. Turn the crankshaft clockwise to align the crankshaft groove with the centre of the two ribs of the crankshaft closure cover. Furthermore, confirm that the timing mark of the crankshaft sprocket is a tooth off to the left of the perpendicular shaft in the engine.
2. Confirm that the timing mark of the camshaft sprocket aligns with the centre of the window of the timing belt cover.
3. Fit the timing belt so that the lines on the belt are aligned with the marks on the crankshaft and camshaft sprockets.
4. Install No.4 washer of special tool MB996048 and the crankshaft pulley bolt to the crankshaft.
5. Install No.1 cover of special tool MB996048 to the crankshaft pulley bolt, and use a torque wrench to tension the timing belt to 11 Nm.
6. Remove special tool MB996048 and No.1 cover.

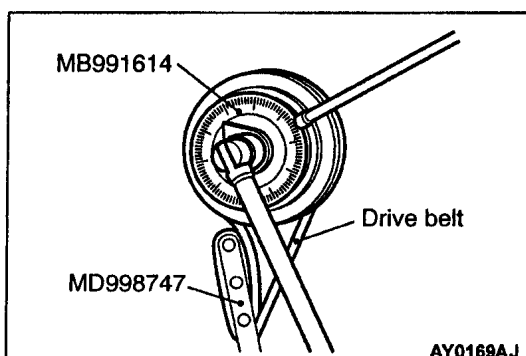


7. Place the bolt in the timing belt tensioner pulley to tighten the bolt so that the timing belt tension becomes the standard value.  
Use the MUT-II to measure the timing belt tension.

**Standard value: 90 ± 15 Hz**

#### The Measurement Method of Timing Belt Tension

- (1) Connect the special tool (MB991668) to the MUT-II.
  - (2) Connect the MUT-II to the diagnosis connector.
  - (3) Turn the ignition switch to the on position to select "Belt tension measurement" in the menu.
  - (4) Place the microphone 10 to 20 mm behind the belt located in the centre between the camshaft sprocket and the crankshaft sprocket and hold it perpendicular to the belt (approximate inclination of ± 15° or less).
  - (5) Pluck the centre position of the belt between the camshaft sprocket and the crankshaft sprocket to measure the vibration frequency of the belt.
8. After adjusting the vibration frequency, tighten the tensioner pulley bolt to 10 Nm.
  9. Rotate the crankshaft clockwise, and align the timing marks.
  10. Tension the timing belt to 11 Nm in the same manner as step 5.
  11. Measure the vibration frequency of the the timing belt in the same manner as step 7, and check that it is within the standard value. If not within the standard value, adjust the timing belt again.
- Standard value: 90 ± 15 Hz**
12. Tighten the tensioner pulley bolt to 50 Nm, and remove No.4 washer of special tool MB996048 and the crankshaft pulley bolt.



#### ►B◀ CRANKSHAFT PULLEY INSTALLATION

1. Use the special tool to hold the crankshaft pulley as shown in the removal procedures.
2. Tighten the crankshaft pulley mounting bolt to 20 Nm.
3. Place the special tool in a wrench to tighten the crankshaft pulley mounting bolt to 115° ± 15°.

## ENGINE ASSEMBLY

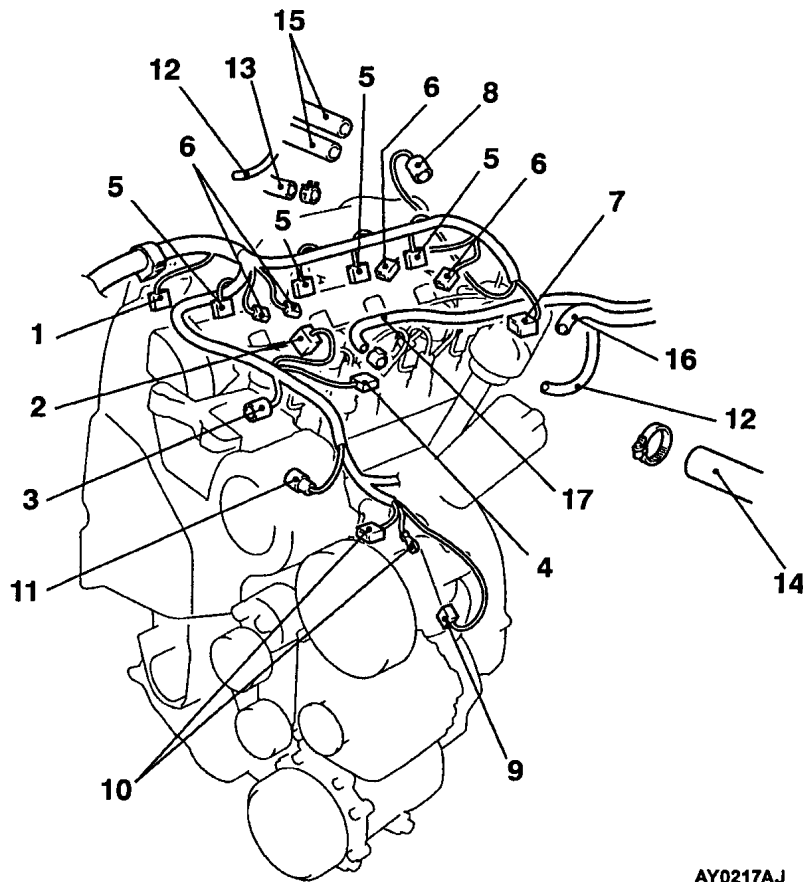
## REMOVAL AND INSTALLATION

## Caution

Mounting locations marked by \* should be provisionally tightened, and then fully tightened when the body is supporting the full weight of the engine.

## Pre-removal and Post-installation Operation

- Hood Removal and Installation
- Under Cover Removal and Installation
- Engine Coolant Draining and Supplying (Refer to GROUP 14 – On-vehicle Service.)
- Air Cleaner Removal and Installation (Refer to GROUP 15.)
- Inter Cooler and Inter Cooler Hose Removal and Installation (Refer to GROUP 15.)
- Front Exhaust Pipe Removal and Installation (Refer to GROUP 15.)
- Drive Belt Removal and Installation (Refer to P.11C-8.)

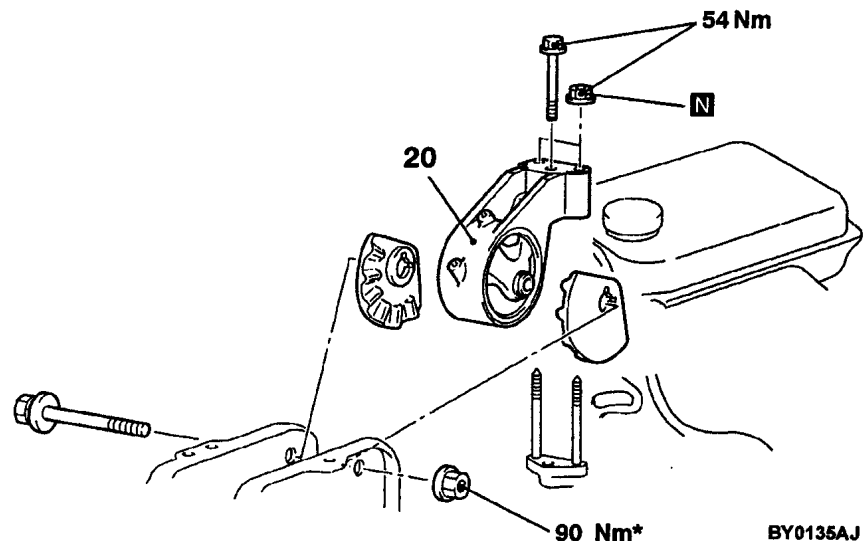
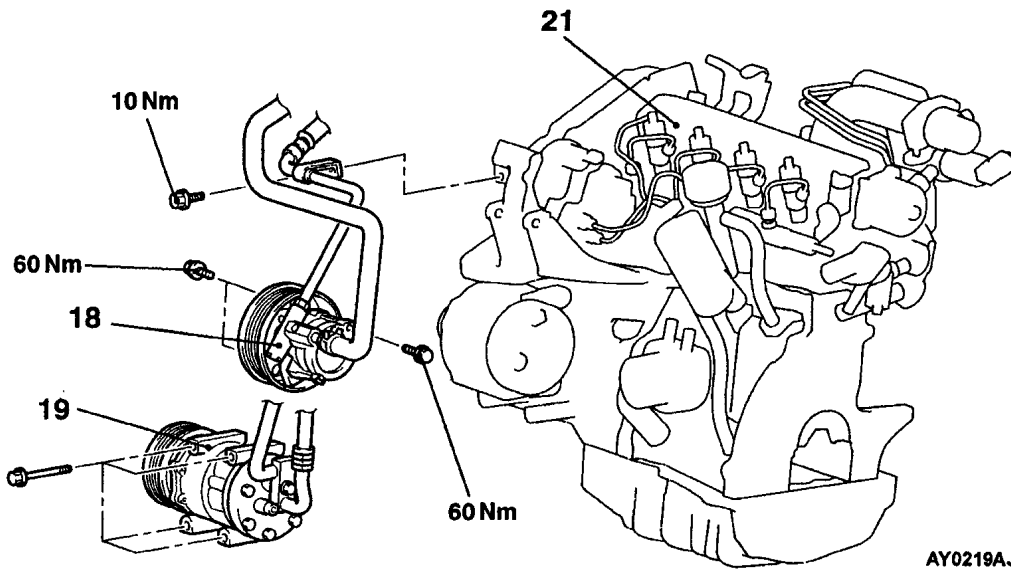


AY0217AJ

## Removal steps

- |   |  |
|---|--|
| <ol style="list-style-type: none"> <li>1. Camshaft position sensor connector</li> <li>2. Fuel pressure sensor connector</li> <li>3. Fuel high pressure pump connector</li> <li>4. Fuel temperature sensor connector</li> <li>5. Fuel injector connector</li> <li>6. Glow plug connector</li> <li>7. Engine coolant temperature sensor connector</li> <li>8. EGR valve connector</li> <li>9. A/C compressor connector</li> </ol> | <ol style="list-style-type: none"> <li>10. Alternator connector</li> <li>11. Oil pressure switch connector</li> <li>12. Vacuum hose connection</li> <li>13. Brake booster vacuum hose connection</li> <li>14. Water hose connection</li> <li>15. Heater hose connection</li> <li>16. Fuel return hose connection</li> <li>17. Fuel supply hose connection</li> </ol> |
|---|--|





- 18. Power steering oil pump
- 19. A/C compressor
  - Transmission assembly (Refer to GROUP 22.)



- 20. Engine mount bracket
- 21. Engine assembly

**REMOVAL SERVICE POINTS**

**◀A▶ FUEL RETURN HOSE CONNECTION/FUEL SUPPLY HOSE CONNECTION REMOVAL**

After disconnecting the fuel return hose and the fuel supply hose, put the cover at the end of the fuel line to prevent the foreign objects from entering.

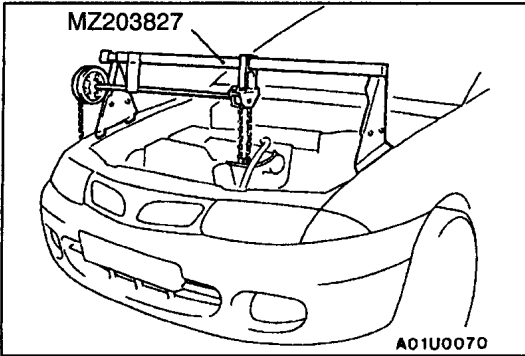
**◀B▶ POWER STEERING OIL PUMP REMOVAL**

Remove the power steering oil pump from the engine with the hose attached.

**NOTE**

Place the removed power steering oil pump where it will not be a hindrance when removing and installing the engine assembly, and tie it with a cord.





### ◀C▶ A/C COMPRESSOR REMOVAL

Disconnect the A/C compressor connector and remove the compressor from the compressor bracket with the hose still attached.

#### NOTE

Place the removed A/C compressor where it will not be a hindrance when removing and installing the engine assembly, and tie it with a cord.

### ◀D▶ ENGINE MOUNT BRACKET REMOVAL

1. Support the engine with a garage jack.
2. Remove the special tool which was attached when the transmission assembly was removed.
3. Hold the engine assembly with a chain block or similar tool.
4. Place a garage jack against the engine oil pan with a piece of wood in between, jack up the engine so that the weight of the engine is no longer being applied to the engine mount bracket, and then remove the engine mount bracket.

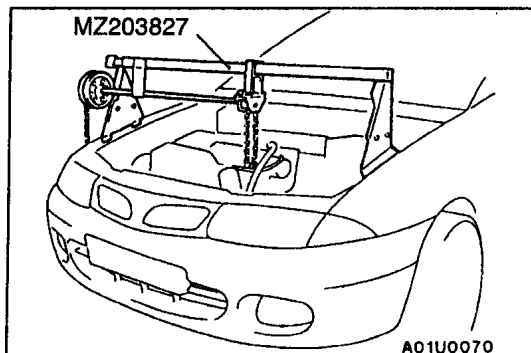
### ◀E▶ ENGINE ASSEMBLY REMOVAL

After checking that all cables, hoses and harness connectors, etc., are disconnected from the engine, lift the chain block slowly to remove the engine assembly upward from the engine compartment.

## INSTALLATION SERVICE POINTS

### ▶A▶ ENGINE ASSEMBLY INSTALLATION

Install the engine assembly, checking that the cables, hoses, and harness connectors are not clamped.



### ▶B▶ ENGINE MOUNT BRACKET INSTALLATION

1. Place a garage jack against the engine oil pan with a piece of wood in between, and install the engine mount bracket while adjusting the position of the engine.
2. Support the engine with the garage jack.
3. Remove the chain block and support the engine assembly with the special tool.