

# **ISUZU COMMERCIAL TRUCK FORWARD TILTMASER**

## **SERVICE MANUAL 6HK1-TC ENGINE**

**1998-2001 FSR, FTR, FVR  
2000-2001 FRR  
2000-2001 WT5500**

## **FORWARD**

This service manual contains diagnosis, on-vehicle service, wiring diagrams, and component unit repair for 6HK1-TC engine. (1998 – 2001 FSR, FTR, FVR & 2000 – 2001 FRR (WT5500)/ENGINE).

Keep this manual in a handy place for ready reference. If properly used, it will enable the technician to serve the owners of these vehicles.

## **CAUTION:**

This service manual is intended for use by professional, qualified technicians.

Attempting repairs or service without the appropriate training, tools, and equipment could cause injury to you or others and damage to your vehicle that may cause it not to operate properly.

These vehicle contain parts dimensioned in the metric system as well as in the customary system. Some fasteners are metric and are very close in dimension to familiar customary fasteners in the inch system. It is important to note that, during any vehicle maintenance procedures, replacement fasteners must have the same measurements and strength as those removed, whether metric or customary. (Numbers on the heads of metric bolts and on surfaces of metric nuts indicate their strength. Customary bolts use radial lines for this purpose, while most customary nuts do not have strength markings.) Mismatched or incorrect fasteners can result in vehicle damage or malfunction, or possibly personal injury. Therefore, fasteners removed from the vehicle should be saved for re-use in the same location whenever possible. Where the fasteners are not satisfactory for re-use, care should be taken to select a replacement that matches the original. For information and assistance, see you Authorized dealer.

## CAUTION

To reduce the chance of personal injury and/or property damage, the following instructions must be carefully observed.

Proper service and repair are important to the safety of the service technician and the safe, reliable operation of all motor vehicles. If a part replacement is necessary, the part must be replaced with one of the same part number or with a part of the same quality. Do not use and incorrect or a replacement part of lesser quality.

The service procedures recommended and described in this service manual are effective methods of performing service and repair. Some of these procedures require the use of tools specially designed for the purpose.

Accordingly, anyone who intends to use a replacement part, service procedure or tool, which is not recommended by the vehicle manufacturer, must first determine that neither technician safety nor the safe operation of the vehicle will be jeopardized by the replacement part, service procedure or tool selected.

It is important to note that this manual contains various **Cautions** and **Notices** that must be carefully observed in order to reduce the risk of personal injury during service or repair, or the possibility that improper service or repair may damage the vehicle or render it unsafe. It is also important to understand that these 'Cautions' and 'Notices' are not exhaustive, because it is impossible to warn of all the possible hazardous consequences that might result from failure to follow these instructions.

# **SERVICE MANUAL**

## **6HK1-TC ENGINE FOR 1998-2001 FSR, FTR, FVR & 2000-2001 FRR 2000-2001 WT5500**

Any reference to brand names in this manual is intended merely as an example of types of lubricants, tools, materials, etc., recommended for use. In all cases, an equivalent may be used.

All information, illustrations, and specifications contained in this manual are based on the latest product information available at the time of publication approval. The right is reserved to make changes at any time without notice.

PUBLICATION NO. FSE01-ESM-C01  
ISUZU Motors Limited  
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# **SECTION 6**

# **ENGINE**

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**SECTION 6A6****DIESEL ENGINE ON-VEHICLE SERVICE**

*NOTICE: Always use the correct fastener in the correct location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.*

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**GENERAL DESCRIPTION**

The ISUZU model 6HK1-TC engine is used in the vehicle covered in this manual. The engine is an in-line six cylinder, four stroke, water cooled, direct fuel injection, turbocharged diesel. The charge air cooler is the air to air heat exchange system using a corrugated-fin heat exchanger installed in front of the radiator.

The forged crankshaft is supported by seven precision insert main bearings. The crankshaft thrust washer is located at the number seven crankshaft main bearing.

The connecting rods have precision insert type crankshaft (big end) bearings. The piston pins are retained by snap rings. The pistons have three compression rings and one oil

## 6A6 - 2 DIESEL ENGINE

control ring. The pistons are cooled by oil jets. Dry liners are used. The liners have been phosphated (P-Mn method), both inside and outside for long life.

The camshaft is supported by four plain bearings, and is gear driven. Motion is transferred to the overhead valves by shaft type roller valve rocker arms.

The cylinder head may be rebuilt with new valve guides and seats. Refer to "Engine Overhaul" in SECTION 6A6B.

For further information on engine overhaul of the 7.8L, refer to SECTION 6A6B.

For information about the turbocharger, refer to SECTION 6J.

## ENGINE IDENTIFICATION

The engine used in this vehicle is the 7.8L (475 CID).

The engine identification number is on the front right hand side (passenger) of the cylinder block. For further information, refer to SECTION 0A.

## ENGINE LUBRICATION

A gear type oil pump is used. The engine is equipped with both full flow and bypass filters. An oil cooler is provided to help control oil temperatures. Major moving parts are supplied with oil from a large oil gallery in the cylinder block.

## ON-VEHICLE SERVICE

### VALVE ROCKER ARM COVER

#### Remove or Disconnect (Figure 1)

1. Tilt the cab.
2. Negative battery cables. Refer to SECTION 6D1.
3. Air inlet pipes. Refer to SECTION 6J.
4. Valve rocker arm cover with gasket.

**NOTICE:** Do not pry on the valve rocker arm cover. Damage to the sealing surfaces may result.

#### Clean

- Oil and grease from the sealing surfaces on the cylinder head and the valve rocker arm cover.

#### Install or Connect (Figure 1)

1. Valve rocker arm cover and the gasket to the cylinder head.
2. Valve rocker arm bolts.

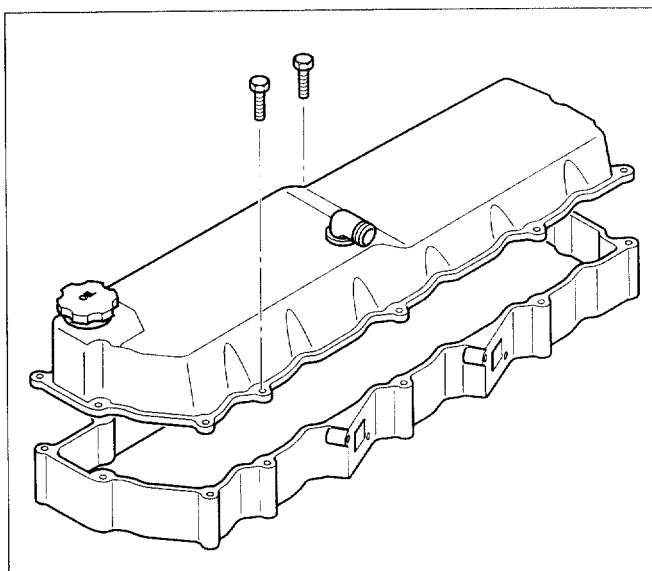


Figure 1 - Valve Rocker Arm Cover

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#### Tighten

- Valve rocker arm cover bolts to 13.N.m (113 lb. in.).
3. Air inlet pipes.
  4. Negative battery cables.
  5. Lower the cab.

### VALVE ROCKER ARM AND CAMSHAFT

#### Remove or Disconnect (Figure 2)

1. Tilt the cab. Refer to SECTION 0A.
2. Negative battery cables. Refer to SECTION 6D1.
3. Air inlet pipes. Refer to SECTION 6J.
4. Valve rocker arm cover. Refer to "Valve Rocker Arm Cover" in this section.
5. Connector both on the top of injectors and from engine harness.
6. Harness assembly.
7. Loosen all the valve adjusters, but do not remove.
8. Loosen the valve rocker arm shaft bracket bolts evenly, starting from the outer bolts moving to the inner bolts.

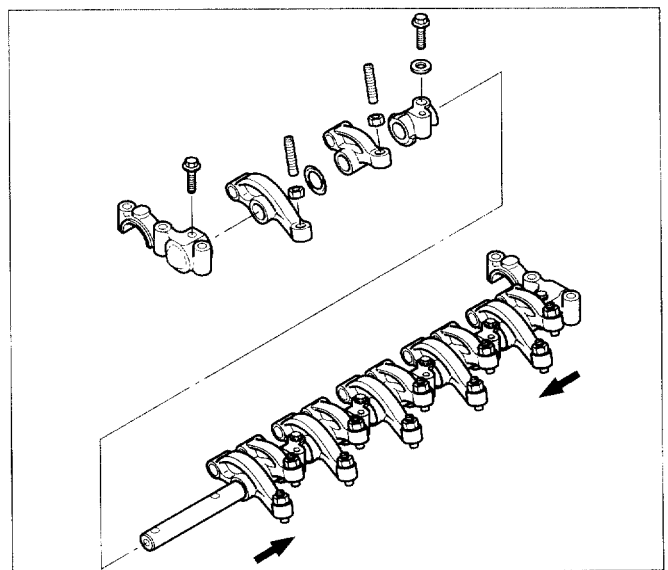


Figure 2 - Valve Train Components

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## ! Important

- Do not remove the rocker arm shaft bracket bolts from the valve rocker arm shaft assembly until the assembly is removed from the vehicle. Place on a work bench before disassembling.
- Valve rocker arm shaft assembly.
  - Loosen camshaft bearing cap nuts evenly, starting from the outer nut moving to the inner nut.
  - Camshaft assembly.

## ! Important

- Store used components in order so they can be reassembled in the same location.

## ⊕ Disassemble

- Rocker arm shaft bracket bolts, front camshaft bracket, valve rocker arm, valve rocker arm spring, valve rocker arm shaft bracket, and the rear camshaft bracket from the valve rocker arm shaft.

## 🧼 Clean

- Oil and dirt from the valve rocker arm assembly with approved cleaners.

## 👁 Inspect

- All the valve rocker arm components for excessive scoring and wear. Replace if necessary.

## 📏 Measure

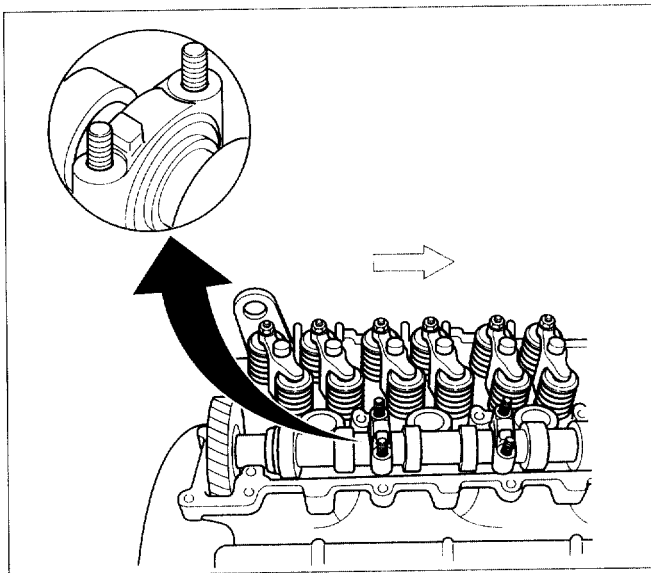
- Valve rocker arm. Refer to SECTION 6A6B for valve rocker arm specifications.

## ↔ Install or Connect (Figures 3 and 6)

- Camshaft to the cylinder head.
- Camshaft bearing caps to the cylinder head.

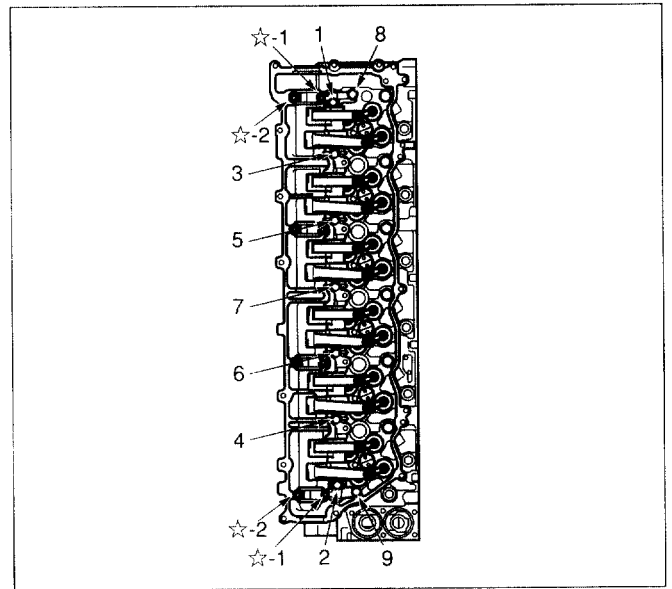
## ! Important

- Camshaft bearing caps must be installed in facing front mark to engine front.



**Figure 3 – Camshaft Bearing Caps Direction**

- Tighten camshaft bearing cap to 27 N·m (20 lb-ft).



**Figure 4 – Rocker Arm Shaft Bracket Tightening Sequence**

- Tighten the valve rocker arm bolts.

## ! Important

- Loosen the valve adjustment bolts completely.
- Tightening sequence must be strictly observed to avoid rocker arm shaft damage due to possible excessive bending.

## 🔧 Tighten (Figure 4)

- First of all tighten star mark 1 nut then tighten star mark 2 nut.
- After tighten star mark 1 and 2, tighten rocker arm shaft bracket bolts in sequence.
  - Star mark nut 1 and 2 to 27 N·m (20 lb-ft)
  - Bolts 1 through 7 to 56 N·m (41 lb-ft).
  - Bolts 8 and 9 to 27 N·m (20 lb-ft).

## 🔑 Adjust

- Refer to SECTION 6A6B for the "Valve Rocker Arm Adjustment" procedure.

- Apply the sealant to lower surface of lower case and put on the cylinder head.

## 🔧 Tighten

- Bolts 19 N·m (14 lb-ft)

- Harness assembly.

## 🔧 Tighten

- Bolt 21 N·m (16 lb-ft)

- Tighten connector nuts to injector

- Nut 1.4 N·m (12 lb-in)

- Connect harness connector.

- Valve rocker arm cover and the gasket to the cylinder head.

- Valve rocker arm cover bolts.

## 🔧 Tighten

- Valve rocker arm cover bolts to 13 N·m (113 lb-in).

- Air inlet pipes.

- Negative battery cables.

- Lower the cab.



## VALVE STEM SEAL AND VALVE SPRING

Tools Required:

J36022 Air Adapter

J43267 Valve Stem Seal Installer

J43263 Valve Spring Compressor

### Remove or Disconnect (Figures 5 through 7)

1. Tilt the cab. Refer to SECTION 0A.
2. Negative battery cables. Refer to SECTION 6D1.
3. Air inlet pipes. Refer to SECTION 6J.
4. Valve rocker arm cover. Refer to "Valve Rocker Arm Cover" in this section.
5. Valve rocker arm shaft assembly. Refer to "Valve Rocker Arm" in this section.
6. Valve bridge.
7. Glow plugs.
8. Valve keys.
  - A. Install J36022 adapter at the glow plug hole into the cylinder head.
  - B. Apply compressed air to hold the valves in place.
  - C. Install J43263 to the cylinder head and compress the valve spring.
  - D. Remove the valve keys.
  - E. Carefully release the valve spring tension.
9. Valve spring retainers.
10. Inner and outer valve springs.
11. Valve spring seats.
12. Valve stem seals.

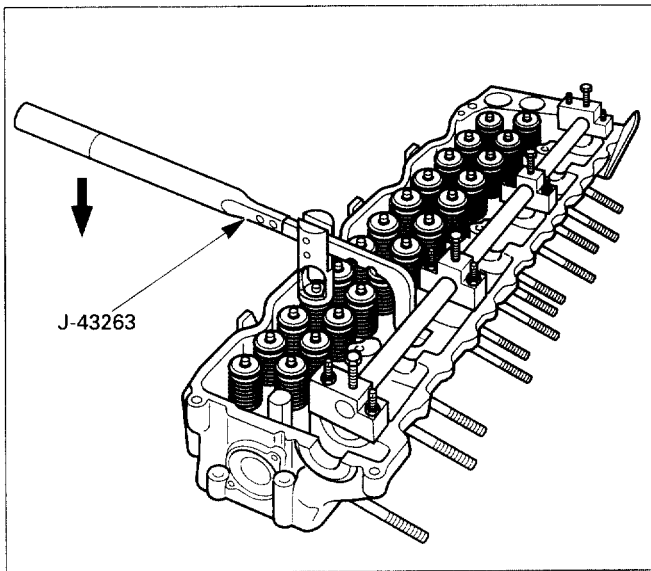


Figure 5 - Compressing the Valve Spring

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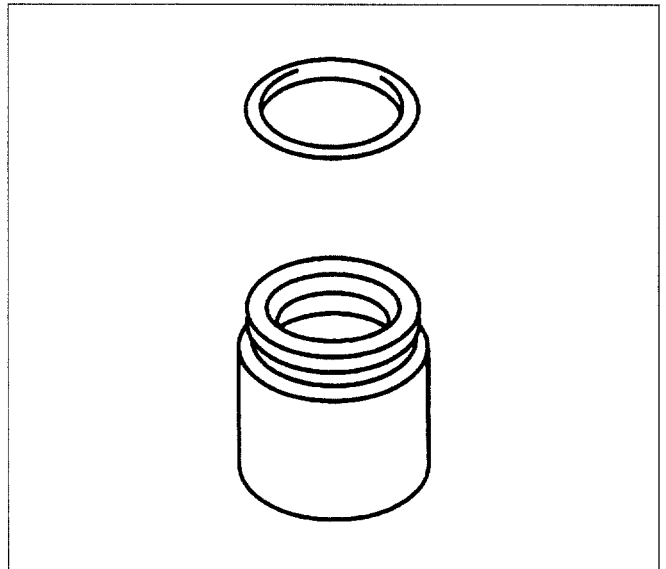


Figure 6 - Valve Seal

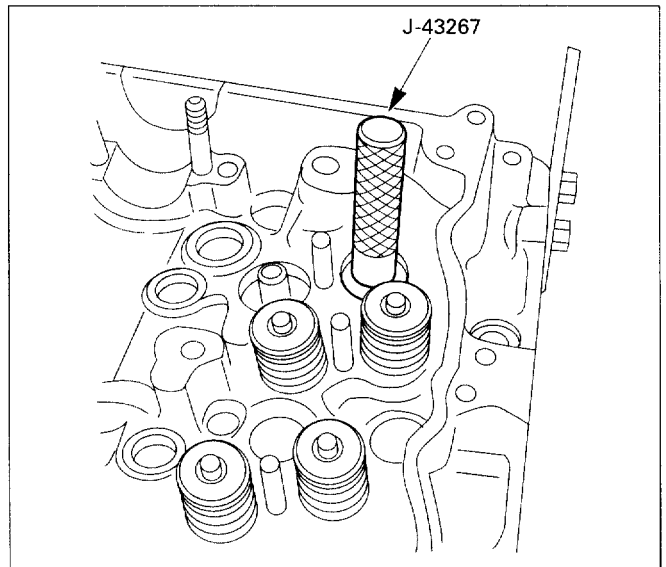


Figure 7 - Installing the Valve Seal

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### Install or Connect (Figures 5 through 7)

- Lubricate the new valve stem seals with clean engine oil.
  - Valve stem seals using J43267.
1. Valve stem seals.
  2. Valve spring seats.
  3. Inner and outer valve springs.
  4. Valve spring retainers.
    - A. With compressed air applied to the cylinder, compress the valve spring using J43263.
    - B. Install the valve keys.
    - C. Carefully release the valve spring tension. Make sure the valve keys stay in place.
    - D. Remove J43263.
    - E. Remove J36022.
  5. Valve bridge.
  6. Glow plugs.
  7. Valve rocker arm assembly. Refer to "Valve Rocker Arm" in this section.
  8. Valve rocker arm cover.

9. Air inlet pipes.
10. Negative battery cables.
11. Lower the cab.

## INTAKE MANIFOLD

### Remove or Disconnect (Figures 8 and 9)

1. Tilt the cab. Refer to SECTION 0A.
2. Negative battery cables. Refer to SECTION 6D1.
3. Air inlet pipes and brackets. Refer to SECTION 6J.
4. Coolant over flow hose bracket from the intake manifold. Refer to SECTION 6B.

### Important

- Do not bend the fuel injector lines in any shape or form to ease the removal of the intake manifold.
5. Fuel lines from the fuel common rail to the fuel injector. Refer to SECTION 6C2.
  6. Fuel lines from supply pump to fuel common rail.

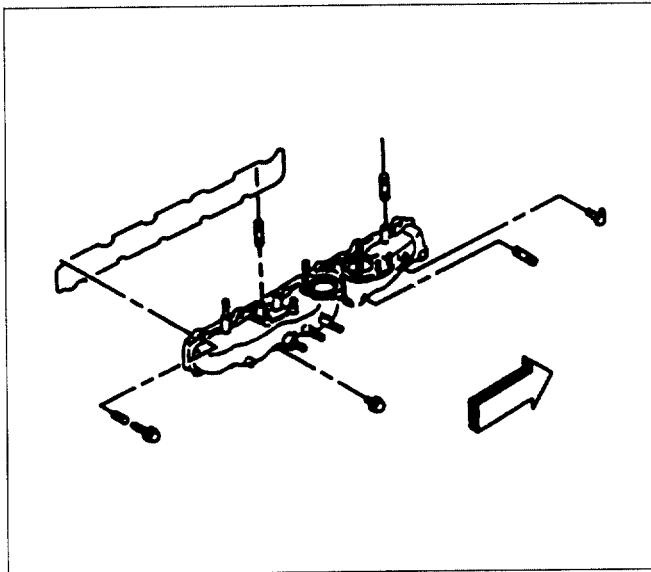


Figure 8 - Intake Manifold and Gasket

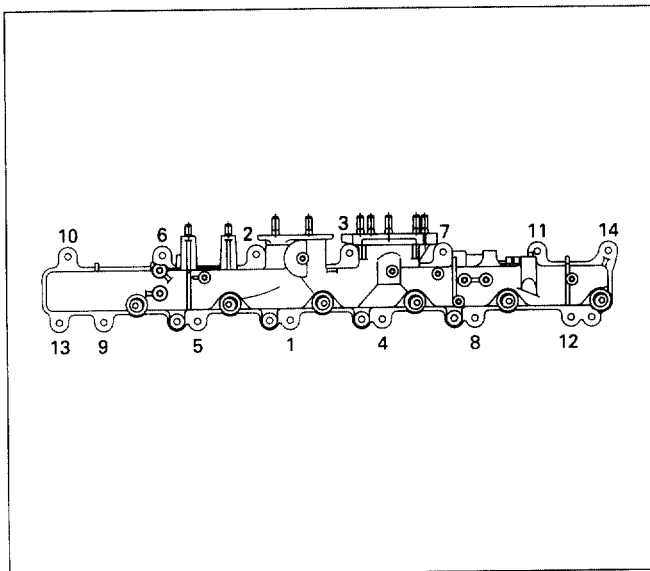


Figure 9 - Intake Manifold Tightening Sequence

7. Fuel injector return line from the fuel injector, fuel common rail and the fuel supply pump. Refer to SECTION 6C2.
8. Fuel filter and the bracket from the intake manifold. Refer to SECTION 6C2.
9. Intake manifold bolts.
10. Intake manifold and the gasket.

### Inspect

- Intake manifold for cracks or damage to the gasket mating surfaces.

### Install or Connect (Figures 8 and 9)

1. Intake manifold and gasket to the cylinder head.
2. Intake manifold bolts and nuts.
3. Fuel common rail.

### Tighten

- Intake manifold bolts to 15 N·m (130 lb. in.).
4. Fuel lines from the supply pump to the fuel common rail.
  5. Fuel lines from the common rail the fuel injector.
  6. Fuel injector return line from fuel injector, fuel common rail and the fuel supply pump.
  7. Fuel filter and the bracket to the intake manifold.
  8. Fuel lines to the fuel filter and to the fuel supply pump.
  9. Negative battery cables.
  10. Lower the cab.

## EXHAUST MANIFOLD

### Remove or Disconnect (Figure 10)

1. Tilt the cab. Refer to SECTION 0A.
2. Negative battery cables. Refer to SECTION 6D1.
3. Turbocharger assembly. Refer to SECTION 6J.
4. Exhaust heat shield.
5. Exhaust manifold nuts, bolts, washers, and the spacers.
6. Exhaust manifold and the gasket.

### Inspect

- Exhaust manifold for cracks or damage.

### Measure

- Use a straight edge to check the flatness of the exhaust manifold. If a gap of 0.4 mm (0.015 in.) or more exists, replace the exhaust manifold.

### Install or Connect (Figure)

1. Exhaust gasket and the exhaust manifold.
2. Exhaust manifold bolts, washers, spacers and the nuts.

### Tighten

- Exhaust manifold bolts and nuts to 34 N·m (25 lb. ft).
3. Exhaust manifold heat shield.
  4. Turbocharger assembly.
  5. Negative battery cables.
  6. Lower the cab.

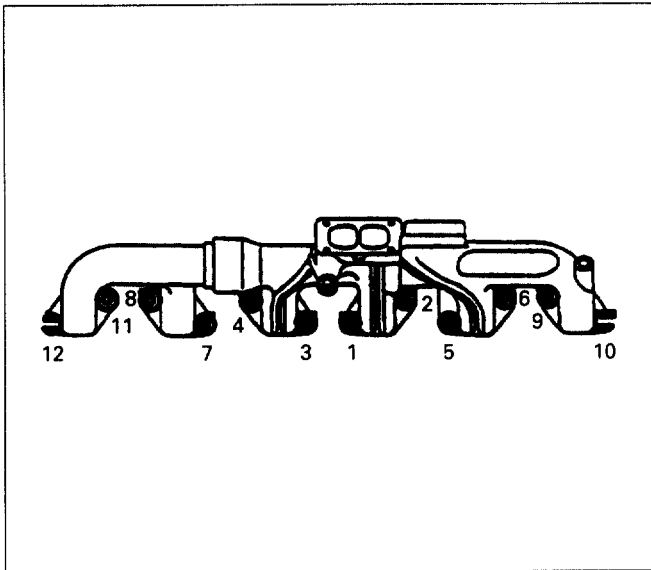


Figure 10 - Exhaust Manifold

## CYLINDER HEAD

### Remove or Disconnect (Figures 11 through 14)

1. Tilt the cab. Refer to SECTION 0A.
2. Negative battery cables. Refer to SECTION 6D1.
3. Drain the cooling system. Refer to SECTION 6B.
4. Air inlet pipes. Refer to SECTION 6J.
5. Turbocharger assembly. Refer to SECTION 6J.
6. Intake manifold assembly. Refer to "Intake Manifold" in this section.
7. Exhaust manifold assembly. Refer to "Exhaust Manifold" in this section.
8. Heat shield and bracket.
9. Valve rocker arm cover. Refer to "Valve Rocker Arm Cover" in this section.
10. Valve rocker arm and camshaft from the cylinder head. Refer to "Valve rocker arm and camshaft" in this section.
11. Fuel injector nozzles. Refer to SECTION 6C2.
12. Coolant line from the air compressor to the cylinder head.
13. Glow plugs. Refer to SECTION 6D6.
14. Air compressor line bracket from the rear of the cylinder head. Refer to SECTION 5J.
15. Cylinder head bolts from the cylinder head.
16. Cylinder head and the gasket from the engine.

### Clean

- Carbon deposits from the combustion chambers.
- All traces of the old cylinder head gasket from the cylinder head and the engine block.
- Cylinder head bolt threads using a wire brush
- Metal chips and dirt from the threads in the cylinder block.

### Inspect

- Cylinder head for cracks or damaged parts.
- Threaded parts for wear or damage.

### Measure

- Use a straight edge to check the flatness of the cylinder head. If the cylinder head has more than 0.2 mm (0.0078 in.) gap between the straight edge and the surface of the cylinder head, replace the cylinder head. Refer to SECTION 6A6B.

### Install or Connect (Figures 10 through 14)

1. Cylinder head and the gasket to the engine block.
  - Apply sealant to the rear corners of the cylinder block.
  - Install the cylinder head gasket with the part number facing up.
2. Cylinder head bolts to the cylinder head.

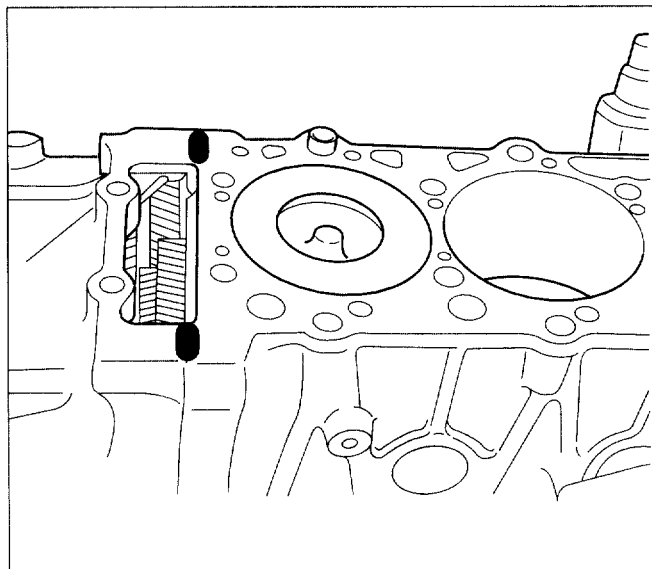


Figure 11 - Apply the Sealant

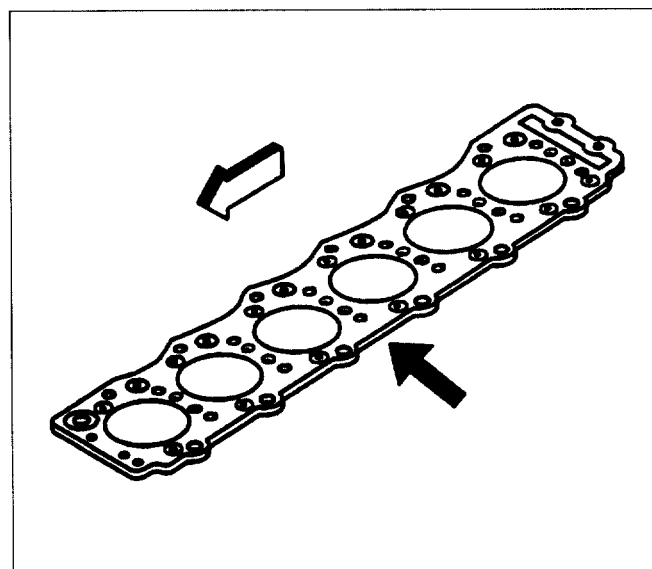


Figure 12 - Installing the Cylinder Head Gasket



## Tighten

- Cylinder head bolts in the following steps.

### For M14 Bolts

- Apply molybdenum disulfide grease to thread and contact surface of washer.
- Tighten cylinder head bolt and follow the tightening order 1 to 26.
  - 98 N·m (72 lb·ft.).
  - 147 N·m (108 lb·ft.).
  - Turn all the cylinder head bolts an additional 45 degree.

### For M10 Bolts

- Apply engine oil to threads and follow the tightening order number 27 to 28.
  - 39 N·m (28 lb·ft.)

3. Camshaft and valve rocker arm to the cylinder head. Refer to "Valve rocker arm and Camshaft" in this section.
4. Valve rocker arm cover.
5. Coolant line from the air compressor to the cylinder head.
6. Air compressor lines and the bracket to the rear of the cylinder head.
7. Glow plugs.
8. Fuel injector nozzles.
9. Valve rocker arm cover.
10. Exhaust manifold. Refer to "Exhaust Manifold" in this section.
11. Intake manifold. Refer to "Intake Manifold" in this section.
12. Turbocharger assembly. Refer to SECTION 6J.
13. Air inlet pipes.
14. Negative battery cables.
15. Lower the cab.



## Important

- Check the cylinder head bolts faulty, and its using limit is six times. If a problem is found, replace as necessary.

## CYLINDER HEAD REPAIR

- Refer to SECTION 6A6B for cylinder head repair.

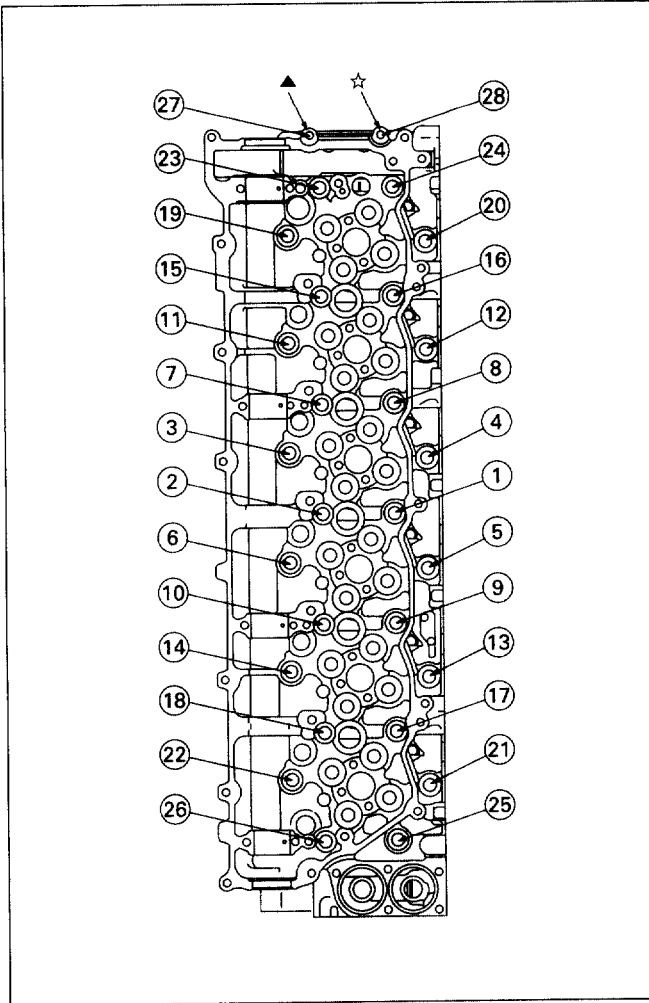


Figure 13 - Cylinder Head Torque Sequence

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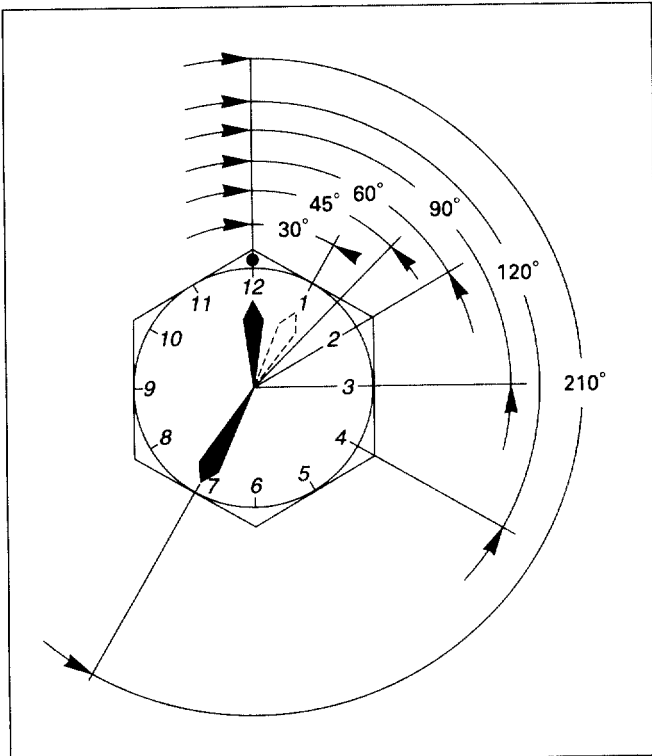


Figure 14 - Final Torque Step

## CRANKSHAFT BALANCER (EXTERNAL) FRONT COVER AND FRONT COVER OIL SEAL

### Tools Required:

- J.39046 Crankshaft Balancer (External) Remover and Installer
- J41220 Oil Slinger Remover
- J41221 Oil Seal Installer

### Remove or Disconnect (Figures 15 through 16)

1. Tilt the cab. Refer to SECTION 0A.
2. Negative battery cables. Refer to SECTION 6D1.
3. Drive belts. Refer to SECTION 6B.
4. Crankshaft balancer bolts and washers from the crankshaft balancer.
5. Crankshaft balancer bolt and the washer.
6. Crankshaft balancer from the crankshaft.
7. Front cover seal.
  - Carefully pry out the seal with a screw driver. Do not damage the front cover.
8. Front cover bolts.
9. Front cover.

### Important

- Oil slinger must be replaced if the front cover oil seal has been removed.
- Install J41220 and remove the oil slinger.

### Install or Connect (Figures 17 through 20)

1. Oil slinger.
  - Install J41221.
    - A. Apply clean engine oil to the oil slinger.
    - B. Insert the oil slinger into the adapter.
    - C. Install the oil slinger sleeve to the adapter, and tighten the center bolt until the sleeve comes in contact with the adapter and stops.
    - D. After pressing in the oil slinger, make sure that the distance between the crankshaft end surface and the oil slinger is,  $11.5 \pm 0.15$  mm ( $0.453 \pm 0.006$  in.).
      - Check the measurement at several different points.
2. Apply the sealant on the cylinder block then install the front cover.
3. Front cover bolts.

### Tighten

- Bolts to 19 N·m (14 lb·ft).
4. Front cover seal.
    - Install J41221.
      - A. Apply clean engine oil to the oil seal.
      - B. Insert the oil seal into the adapter.
      - C. Install the oil seal to the adapter, and tighten the center bolt until the sleeve comes in contact with the adapter and stops.
      - D. After pressing in the oil seal, make sure that the distance between the crankshaft end surface and the oil seal is  $8.5 \pm 0.15$  mm ( $0.335 \pm 0.005$  in.).
        - Check the measurement at several different points.

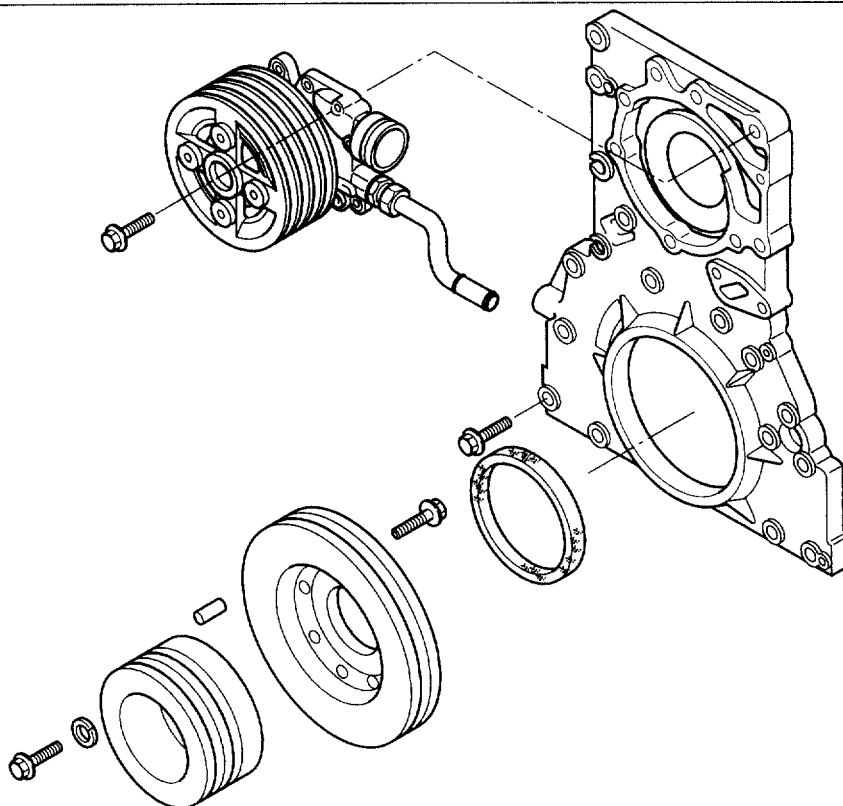


Figure 15 – Crankshaft Balancer and Front Cover Components

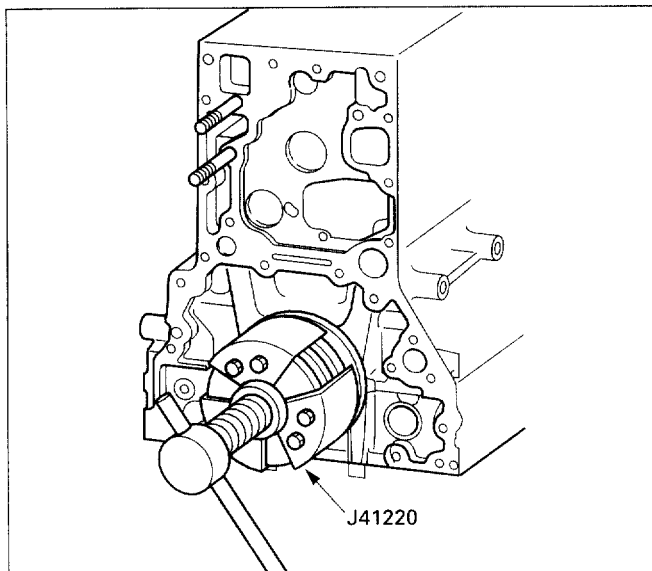


Figure 16 - Removing the Oil Slinger

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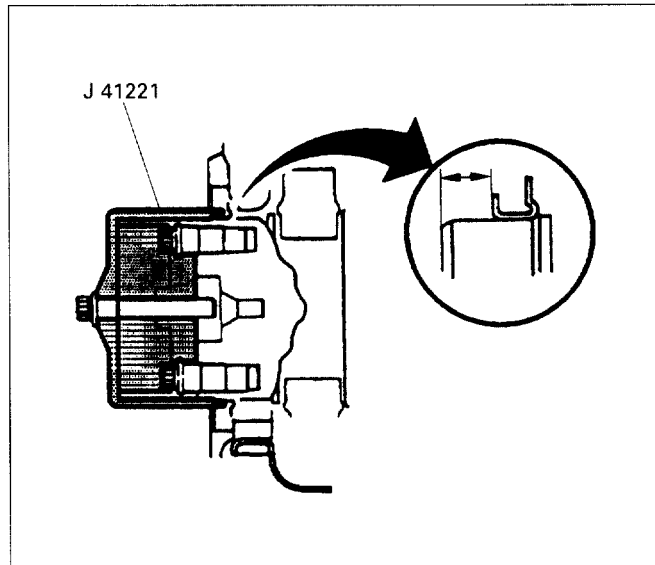


Figure 19 - Checking the Slinger Clearance

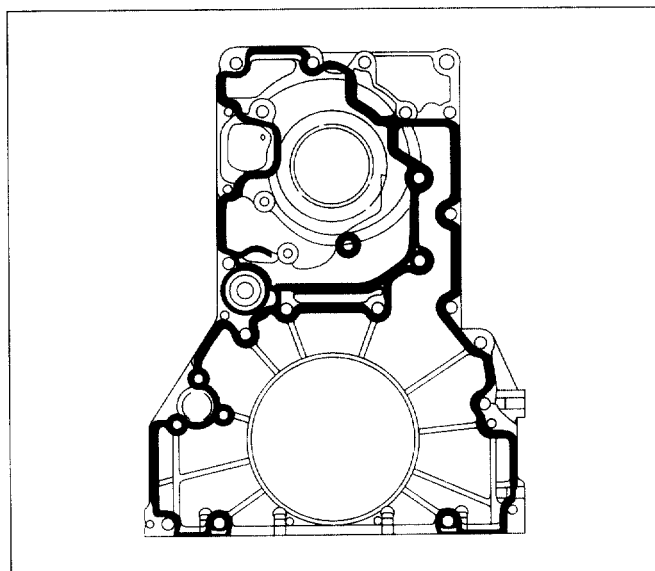


Figure 17 - Apply the Sealant

020MV002

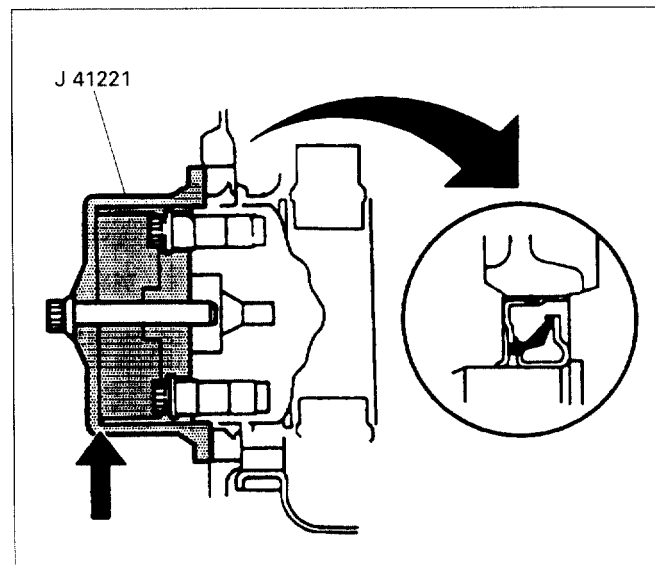


Figure 20 - Checking the Seal Clearance

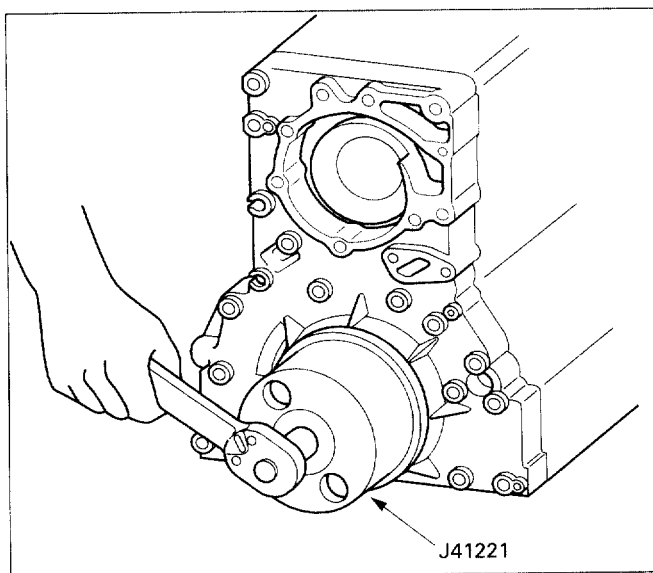


Figure 18 - Install Oil Seal and Slinger

015MV007



### Inspect

- Crankshaft balancer for excessive wear or damage.
- Crankshaft balancer for silicone leakage. If leakage appears, replace the crankshaft balancer.

5. Crankshaft balancer, bolts and washers.



### Tighten

- Crankshaft balancer bolts and nuts to 48 N·m (35 lb·ft).

6. Crankshaft balancer to the crankshaft.

7. Crankshaft balancer bolt and washer to the crankshaft.



### Tighten

- Crankshaft balancer bolt and washer to 200 N·m (148 lb·ft).

8. Drive belts.

9. Negative battery cables.

10. Lower the cab.

# 6A6 - 10 DIESEL ENGINE

## OIL PAN

### Remove or Disconnect

1. Tilt the cab. Refer to SECTION 0A.
2. Negative battery cables. Refer to SECTION 6D1.
  - Drain the crankcase.
3. Engine oil level indicator.
4. Bolts from the oil pan.
5. Oil pan.

### Clean

- Sealant from the oil pan and the engine block.
- Sludge and dirt from the inside of the oil pan.
- All mating surfaces must be free of oil and dirt.

### Install or Connect (Figures 21 through 23)

1. Apply sealant to the oil pan.
2. Apply sealant to the four corners of the cylinder block.
  - Apply a bead of silicone sealant approx. 2 mm (0.08 in.) thick and approx. 3 mm (0.12 in.) wide (Three Bond No. 1207C).
3. Bolts to the oil pan.

### Tighten

- Oil pan bolts to 24 N·m (17 lb-ft.)
4. Engine oil level indicator.
  5. Negative battery cables.
  6. Lower the cab.
    - Fill the crankcase with the proper grade and quantity of engine oil. Refer to SECTION 0B.

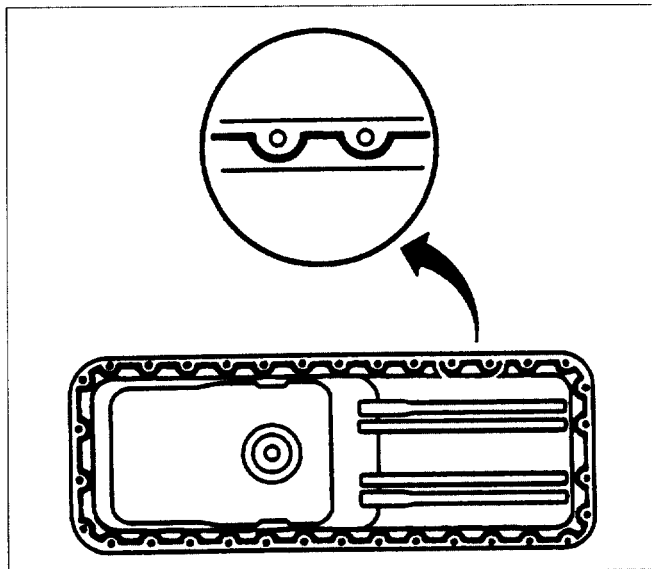
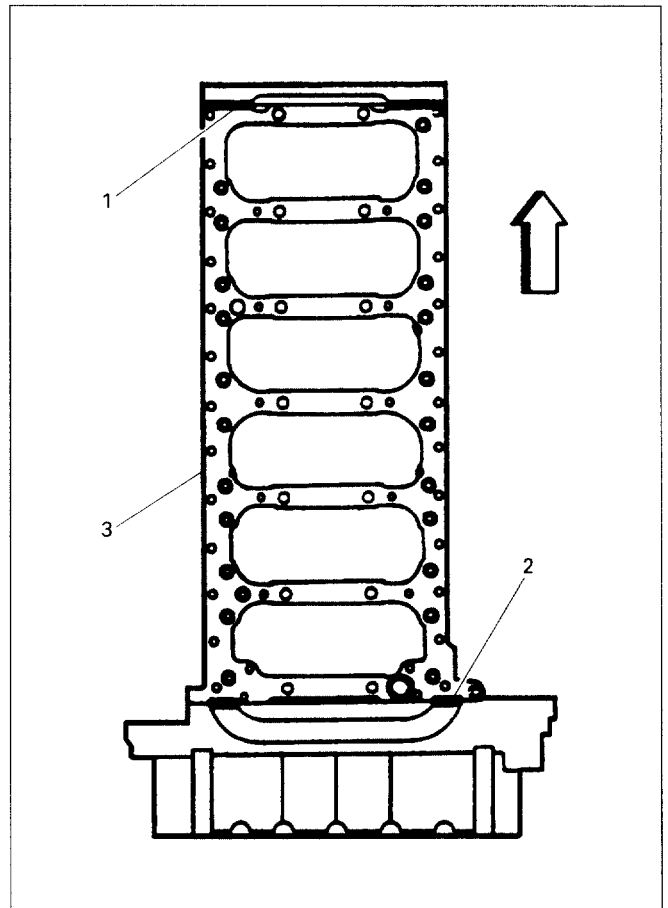


Figure 21 - Apply the Sealant



### Legend

- (1) Applying the Sealant at the Front Corners
- (2) Applying the Sealant at the Rear Corners
- (3) Cylinder Block

Figure 22 - Applying the Sealant

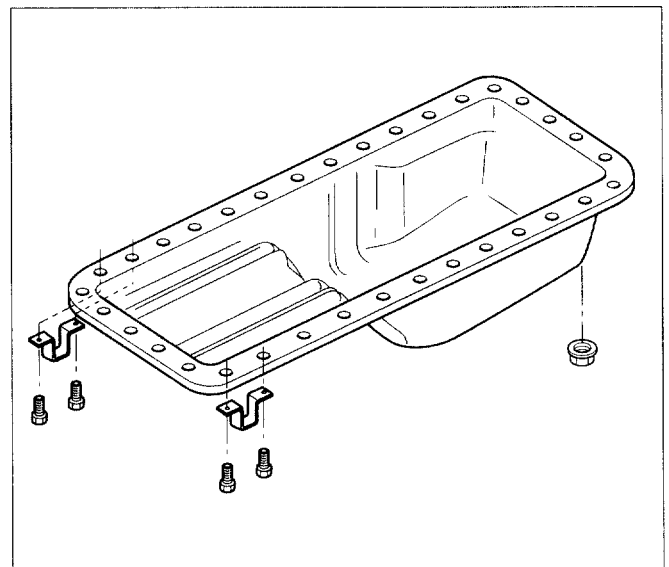


Figure 23 - Oil Pan

013MV001

## OIL PUMP

- For further information, refer to SECTION 6A6B.

### OIL PUMP REPAIR

- For further information, refer to SECTION 6A6B.

## CRANKSHAFT REAR OIL SEAL

Tools Required:

J41220 Oil Slinger Remover

J41221 Oil Seal Installer

### Remove or Disconnect (Figure 24)

1. Tilt the cab. Refer to SECTION 0A.
2. Negative battery cables. Refer to SECTION 6D1.
3. Raise the vehicle.
  - Support the engine with a suitable stand.
4. Transmission assembly. Refer to SECTION 7A6 for automatic transmission, or SECTION 7B for manual transmission.
5. Flywheel or clutch. Refer to SECTION 7C.
6. Oil slinger and the rear crankshaft oil seal.
  - Install J41220 and remove the oil slinger and oil seal.

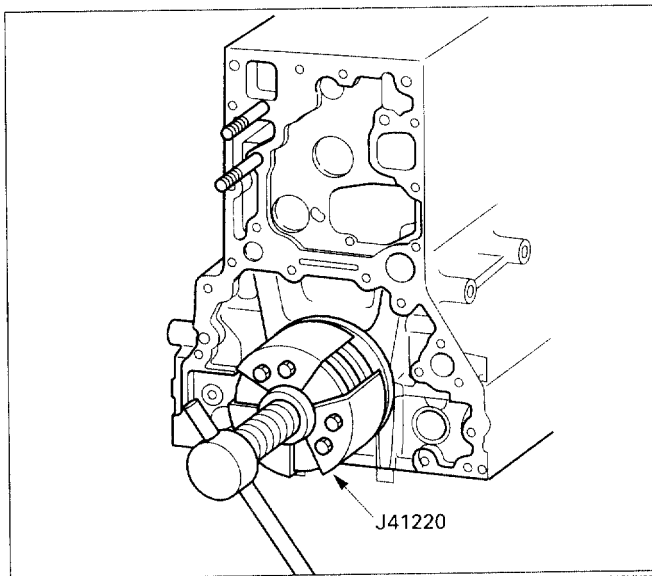


Figure 24 – Removing the Oil Slinger

### Important

- Crankshaft rear oil slinger is gray. Front cover oil slinger is black.

### Install or Connect (Figure 25 through 28)

1. Oil slinger.
  - Install J41221.
    - A. Do not apply engine oil to the oil slinger inside surface.
    - B. Insert the oil slinger into the adapter.
    - C. Install the oil slinger sleeve to the adapter, and tighten the center bolt until the sleeve comes in contact with the adapter and stops.

- D. After pressing in the oil slinger, make sure that the distance between the crankshaft end surface and the oil slinger is (1)  $10.5 \pm 0.15$  mm ( $0.413 \pm 0.006$  in.).
  - Check the measurement at several different points.

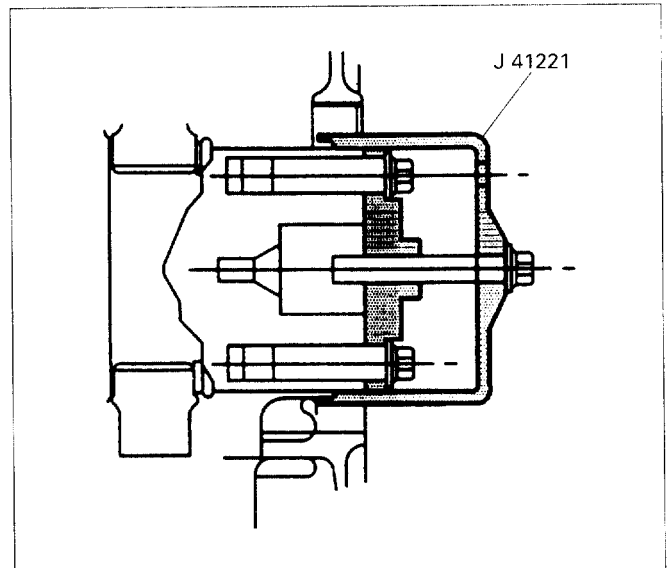
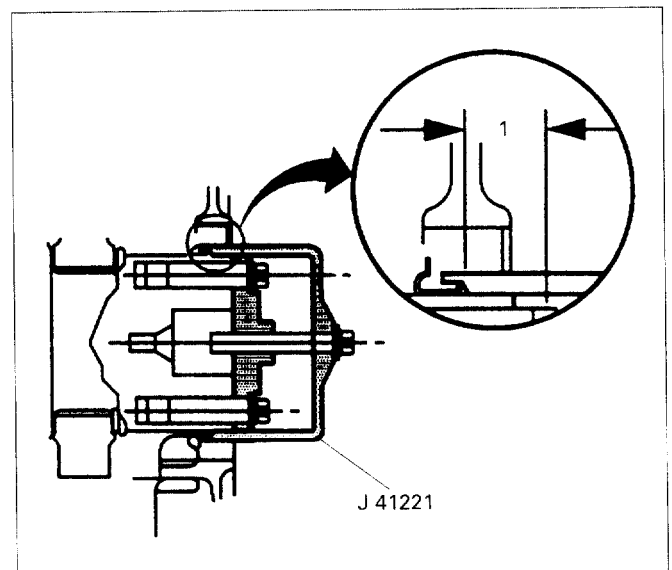


Figure 25 – Installing the Oil Slinger



### Legend

(1) Measuring the Depth

Figure 26 – Measuring the Installed Depth

2. Crankshaft rear seal.
  - Install J41221.
    - A. Apply clean engine oil to the oil seal lip. Do not apply engine oil to outside surface.
    - B. Insert the oil seal adapter.
    - C. Install the oil seal to the adapter, and tighten the center bolt until the sleeve comes in contact with the adapter and stops.



# 6A6 - 12 DIESEL ENGINE

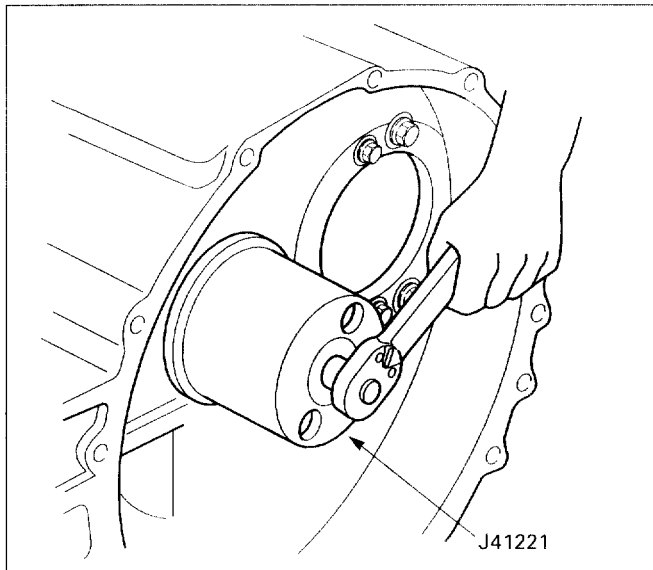


Figure 27 – Installing the Oil Seal

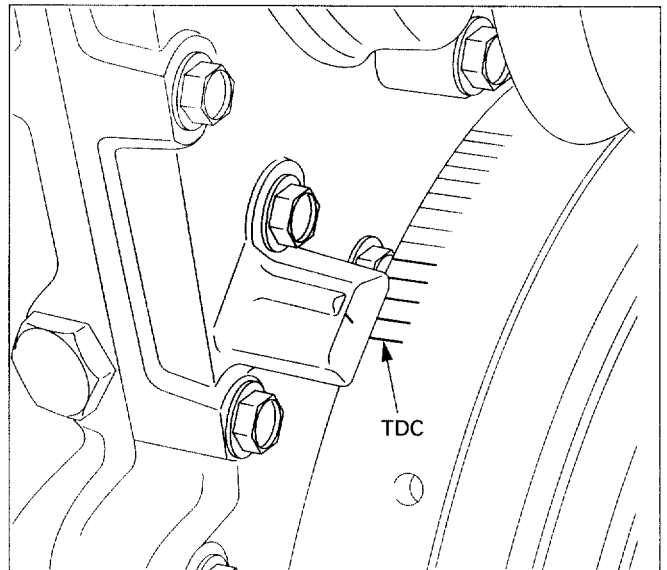
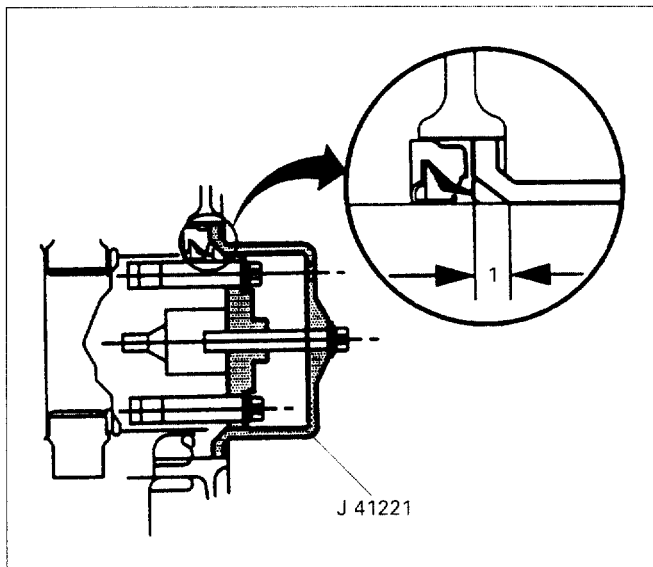


Figure 29 – Timing Marks



## Legend

(1) Measuring the Depth

Figure 28 – Measuring the Installed Depth

D. After pressing in the oil seal, make sure that the distance between the crankshaft end surface and the oil seal is (1)  $7.5 \pm 0.15$  mm ( $0.295 \pm 0.006$  in.).

- Check the measurement at several different points.

3. Flywheel or clutch. Refer to SECTION 7C.
4. Transmission assembly.
  - Remove engine support.
5. Lower the vehicle.
6. Negative battery cables.
7. Lower the cab.

## CAMSHAFT

Tools Required:

J 22888-D Crankshaft Sprocket Puller

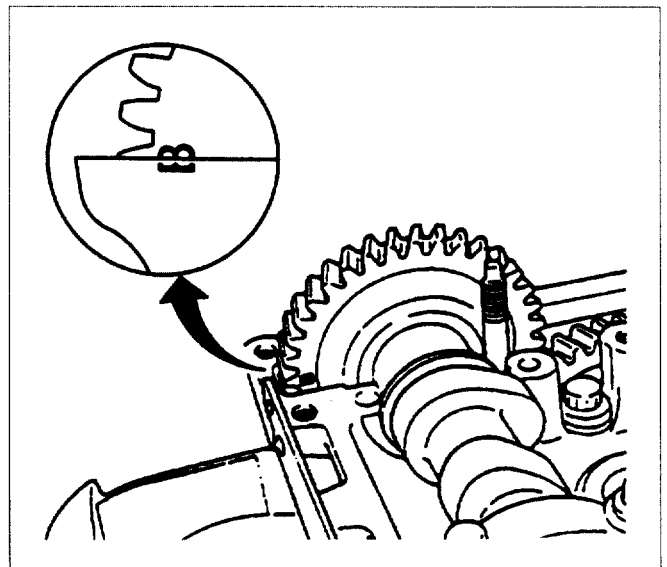


Figure 30 – Camshaft Timing Marks

## Remove or Disconnect (Figures 29 through 34)

1. Tilt the cab. Refer to SECTION 0A.
2. Negative battery cables. Refer to SECTION 6D1.
3. Glow plugs. Refer to SECTION 6D6.
4. Valve rocker arm cover. Refer to "Valve Rocker Arm Cover" in this section.
5. Rotate the engine to top dead center and align the timing marks on the camshaft (B).
6. Both connector on the injector and from engine harness.
7. Harness assembly.
8. Loosen the valve rocker arm adjusters, but do not remove them.
9. Loosen the valve rocker arm shaft bracket bolts evenly, starting from the outside bolts moving to the inner bolts.
10. Valve rocker arm assembly.
11. Loosen camshaft bearing cap nuts evenly starting from the outer nut moving to the inner nut.
12. Camshaft assembly with gear.

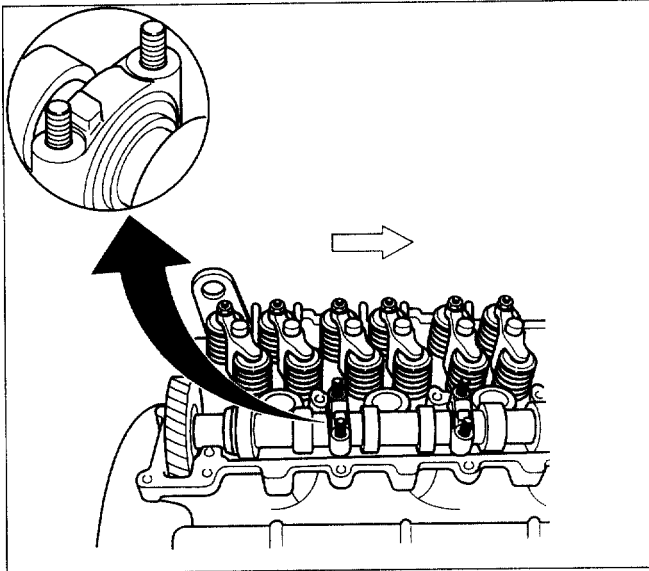


Figure 31 – Camshaft Bearing Caps Direction

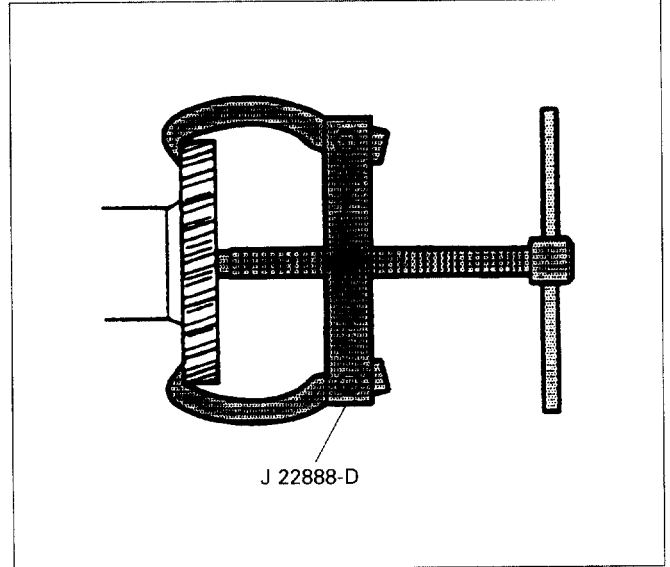


Figure 33 – Removing the Camshaft Gear

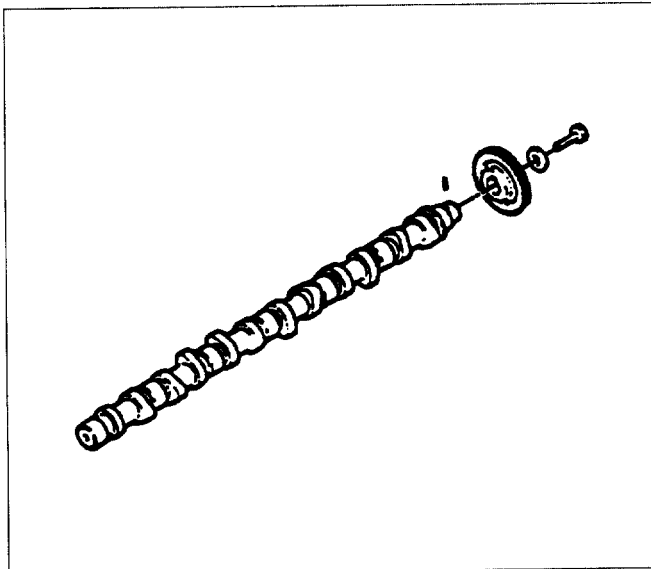


Figure 32 – Camshaft and Components

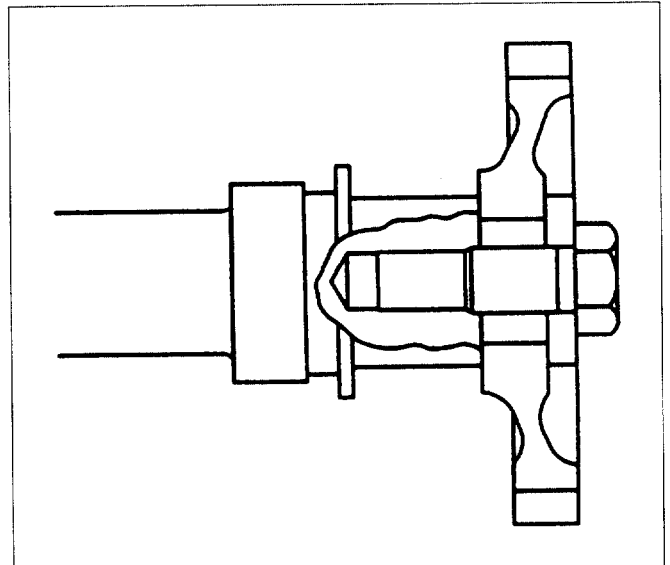


Figure 34 – Installing the Camshaft Gear



### Important

- Do not remove the rocker arm shaft bracket bolts from the valve rocker arm shaft assembly.
13. Gear from the camshaft.

- Install J22888-D on gear.
- Remove the gear.



### Clean

- Camshaft gear bore and keyway.



### Inspect

- Camshaft for excessive wear on the lobes and the bearing surfaces.
- Camshaft gear for chips or broken teeth.



### Measure

- Camshaft
- Refer to SECTION 6A6B in this manual for the camshaft specifications.



### Install or Connect (Figures 31 and 34)

1. Gear to the camshaft.
2. Bolt to the camshaft.



### Tighten

- Camshaft gear bolt to 142 N·m (105 lb-ft).

3. Camshaft and bearing cap to the cylinder head. Refer to "Valve Rocker Arm and Camshaft" in this section.
4. Valve rocker arm assembly to the cylinder head. Refer to "Valve Rocker Arm and Camshaft" in this section.



### Adjust

- Valve Rocker Arms.
  - Refer to SECTION 6A6B, for the valve rocker arm adjustment procedure.
5. Valve rocker arm cover and gasket to the cylinder head.
  6. Valve rocker arm cover bolts.

# 6A6 – 14 DIESEL ENGINE

## Tighten

- Valve rocker arm cover bolts to 13 N·m (113 lb-in).
7. Glow plugs.
  8. Negative battery cables.
  9. Lower the cab.

## CONNECTING ROD AND PISTON

1. Remove the engine assembly. Refer to "Engine" in this section.
2. Refer to "Engine Overhaul" in SECTION 6A6B.

## CRANKSHAFT MAIN BEARING

1. Remove the engine. Refer to "Engine" in this section.
2. Refer to "Engine Overhaul" in SECTION 6A6B.

## CRANKSHAFT

1. Remove the engine. Refer to "Engine" in this section.
2. Refer to "Engine Overhaul" in SECTION 6A6B.

## FLYWHEEL

### Remove or Disconnect (Figure 35)

1. Negative battery cables. Refer to SECTION 6D1.
2. Raise the vehicle.
3. Transmission assembly. Refer to SECTION 7A6 for automatic transmission, or SECTION 7B for manual transmission.
4. Clutch assembly, (if equipped). Refer to SECTION 7C.
5. Bolts and spacer.
6. Flywheel assembly. Refer to SECTION 7A.

## Inspect

- Flywheel for burning, scoring, warping or excessive wear.
- Flywheel ring gear for worn or broken teeth.

## FLYWHEEL RING GEAR

### Remove or Disconnect (Figure 35)

1. Use a torch to heat the flywheel ring gear evenly.

**NOTICE:** *Never heat the flywheel ring gear to red hot. This will change its metal structure and could cause damage to the ring gear or flywheel*

2. Drive the flywheel ring gear off with a hammer and a drift.
3. Heat the flywheel ring gear evenly to allow the ring gear fit on the flywheel. Do not allow the temperature exceed 120 deg C (250 deg F).
4. Ring gear to the flywheel, as soon as it is heated (Figure 36).

### Install or Connect (Figure 35)

1. Flywheel to the crankshaft.
2. Bolts and spacer to the flywheel, (apply a small amount of molybdenum to the bolts). Refer to SECTION 7A, for the proper bolt tightening sequence.
3. Clutch to the flywheel.
4. Transmission assembly to the engine.
5. Lower the vehicle.
6. Negative battery cables.

## ENGINE MOUNTS

Cushion-type mountings are used at both the front and the rear of the engine.

## INSPECTING ENGINE MOUNTS

**NOTICE:** *Broken or deteriorated mounts can cause misalignment and eventually destroy certain drive train components. Also, when a single mount breaks, the remaining mountings are subjected to abnormally high stresses, which may lead to early wear and breakage.*

Engine mounts should be inspected periodically and replaced if any damaged or deteriorated mounts are found.

Check the engine mounting brackets for cracks or elongated bolt holes. Replace the brackets if necessary. Check the mounting fasteners for the correct torque. Refer to "Specifications" at the end of this section. Inspect the rubber parts for deterioration and replace if needed.

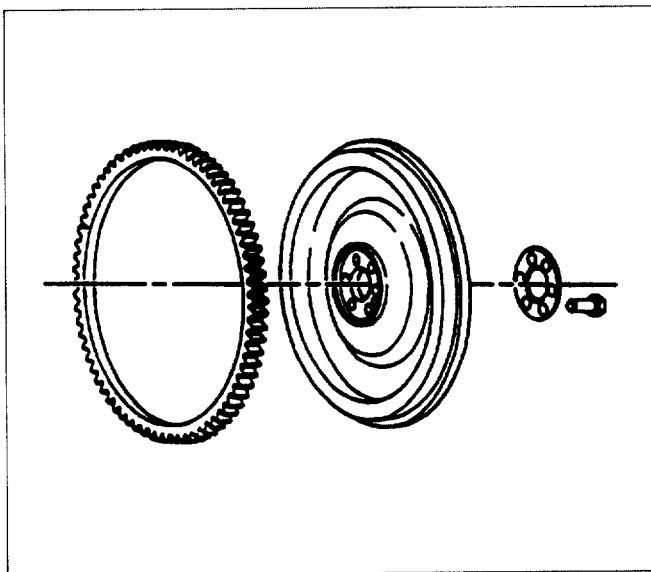


Figure 35 – Flywheel and components

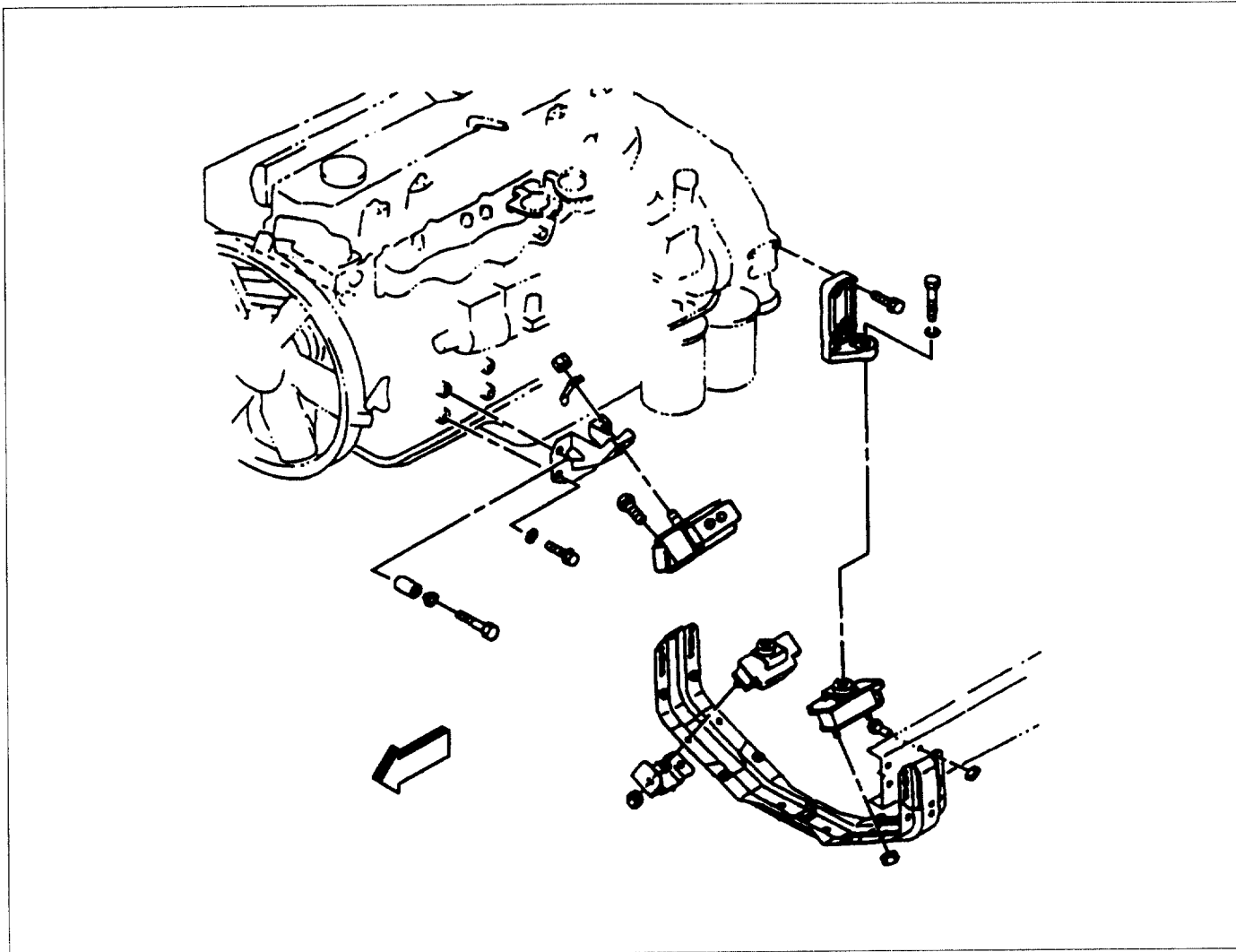


Figure 36 – Engine Mounts

**FRONT ENGINE MOUNT**

**↔** Remove or Disconnect (Figure 36)

**NOTICE:** When the raising or supporting the engine, do not use a jack under the oil pan, any sheet metal, or crankshaft pulley. Jacking against these parts may cause damage.

1. Tilt the cab. Refer to SECTION 0A.
2. Negative battery cables. Refer to SECTION 6D1.
3. Engine mounting nuts and washers from the mounting bracket to the front mount.

**NOTICE:** When supporting the engine to replace a mount, raise the engine only to the height required to provide clearance for the mount removal. It may be necessary to drain the cooling system and disconnect hoses to avoid damage when the engine is raised. Be careful that control linkage and wiring are not damaged from raising the engine. When replacing a single front mount, both mounts should be detached before attempting to raise the engine. Failure to do this will place excessive stress on the attached mounts when the engine is raised.

4. Bolts and nuts from the frame to the front mounts.
5. Raise the front of the engine.
  - Provide lifting equipment to safely support and raise the front of engine as required.
  - Raise the engine enough to permit removal of the mounting cushions.
6. Remove the front mounting cushion, spacers, washers as required.
7. Mounting bracket bolts and washers (if used).
8. Mount the front bracket to the engine, (if necessary).

**!** Important

- Any vehicle components held in place by the engine mounting fasteners must be supported before the fasteners are removed.

**↔** Install or Connect

1. Mounting bracket to the engine, (if necessary).

**Tighten**

- Mount bracket bolt to 78.5 N·m (58 lb·ft).

2. Mounting bracket bolts and washers.

**Tighten**

- Mounting bolts and nuts to 64 N·m (47 lb·ft).