

# MECHANICAL

# *ME(H4DOTC)*

---

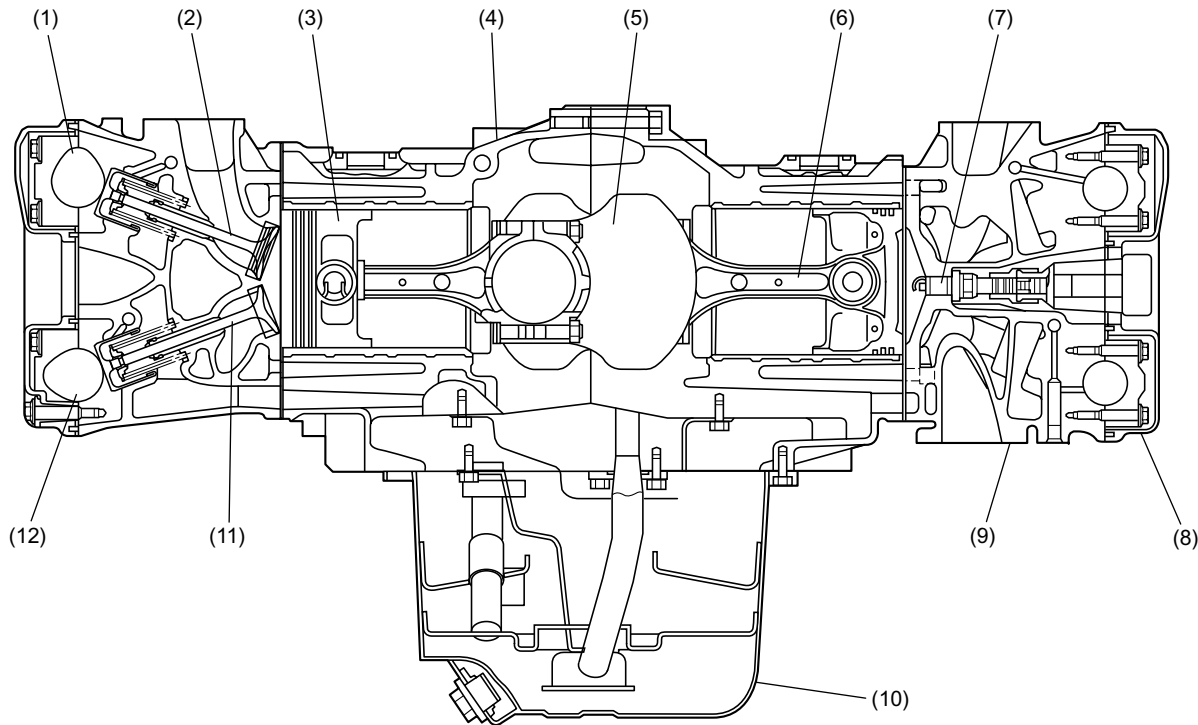
	Page
1. General .....	2
2. Timing Belt .....	3
3. Automatic Belt Tension Adjuster .....	4
4. Belt Cover .....	6
5. Camshaft .....	7
6. Cylinder Head .....	9
7. Cylinder Block .....	10
8. Crankshaft .....	11
9. Piston .....	12
10. Engine Mounting .....	13

### 1. General

The engine used in this vehicle is of a horizontally opposed, four-cylinder design. This four-stroke-cycle, water-cooled, DOHC turbocharged engine uses a total of 16 valves and its main components are made of aluminum alloy. It is fueled by a multiple fuel injection system.

The engine's major structural and functional features are as follows:

- The cylinder head forms pentroof combustion chambers, each having a spark plug located at its center and two each of intake and exhaust valves (four valves per cylinder). The intake and exhaust ports are located in a cross-flow arrangement.
- A single timing belt drives four camshafts on the left and right banks and the engine coolant pump on the left bank. Belt tension is automatically adjusted by a belt tension adjuster, eliminating need for a manual adjustment.
- The crankshaft is supported by five bearings with high rigidity and strength.
- The cylinder block is an aluminum die casting fitted with iron die-cast cylinder liners.

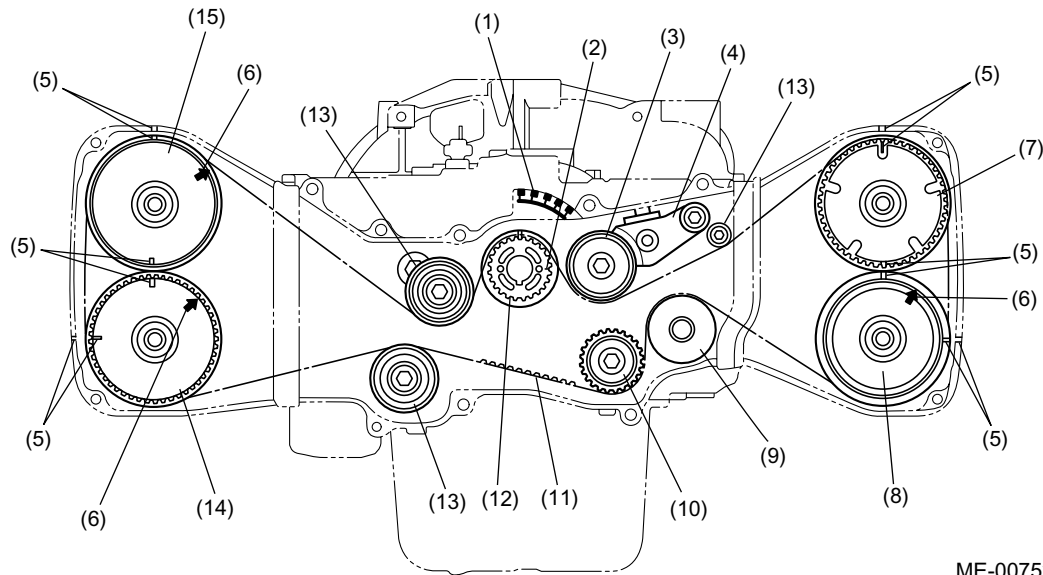


ME-00761

- |                     |                        |                       |
|---------------------|------------------------|-----------------------|
| (1) Intake camshaft | (5) Crankshaft         | (9) Cylinder Head     |
| (2) Intake valve    | (6) Connecting rod     | (10) Oil pan          |
| (3) Piston          | (7) Spark plug         | (11) Exhaust valve    |
| (4) Cylinder block  | (8) Valve rocker cover | (12) Exhaust camshaft |

## 2. Timing Belt

- A single timing belt drives four camshafts (intake and exhaust camshafts on each bank). The belt also drives the water pump by its non-toothed side.
- The timing belt teeth have a specially designed round profile which contributes to quiet operation. The timing belt is made of strong and inflexible core cords, wear-resistant canvas and heat-resistant rubber material.
- A hydraulic automatic belt tension adjuster always keeps the belt taut to the specified tension. Any manual belt tension adjustment is unnecessary.



ME-00752

- |   |                                   |
|---|-----------------------------------|
| (1) Timing indicator (for timing mark of crankshaft pulley) | (9) Water pump pulley             |
| (2) *Piston position mark                                   | (10) Idler No. 2                  |
| (3) Belt tension pulley                                     | (11) Timing belt                  |
| (4) Automatic belt tension adjuster assembly                | (12) Crankshaft sprocket          |
| (5) Alignment mark  | (13) Idler                        |
| (6) **Piston position mark                                  | (14) Exhaust camshaft sprocket RH |
| (7) Intake camshaft sprocket LH                             | (15) Intake camshaft sprocket RH  |
| (8) Exhaust camshaft sprocket LH                            |                                   |

### NOTE:

\*: The #1 piston is set at the top dead center (TDC) when the piston-position mark on the crankshaft sprocket is aligned with the mark on cylinder block.

\*\*: The #1 piston is set at TDC on the compression stroke when the piston-position mark on the camshaft sprocket is facing directly upward.

# AUTOMATIC BELT TENSION ADJUSTER

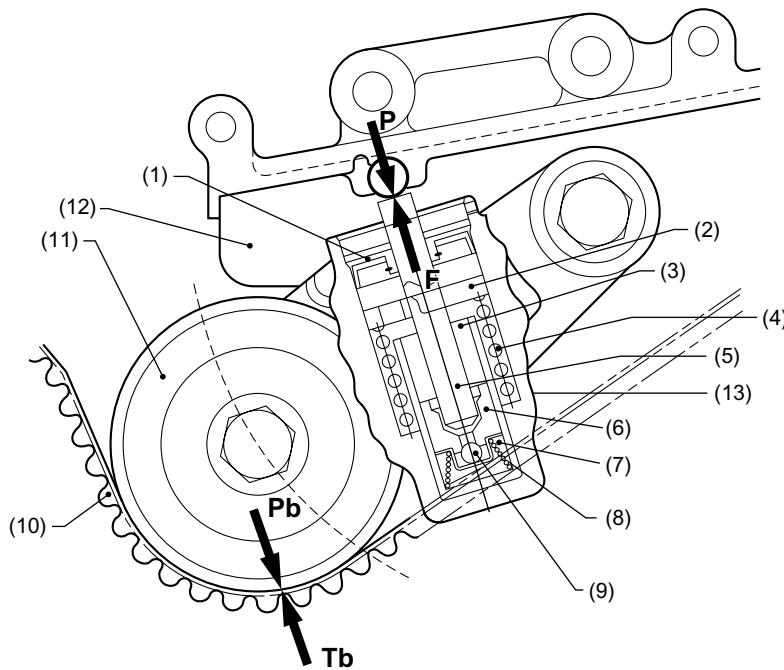
MECHANICAL

## 3. Automatic Belt Tension Adjuster

The automatic belt tension adjuster consists of a tensioner unit and a bracket. It maintains the timing belt tension automatically at a specified level to enable the belt to transmit power correctly, reduce operating noise and increase the life of the belt.

The cylinder of the tensioner unit incorporates an adjuster rod, wear ring, plunger spring, return spring, check ball and silicone oil.

The automatic belt tension adjuster gives tension to the belt by a levering action which is produced by the push force of the tensioner unit's adjuster rod. It operates in the process detailed below.



ME-00314

- |                           |                          |
|---------------------------|--------------------------|
| (1) Oil seal              | (8) Plunger spring       |
| (2) Wear ring             | (9) Check ball           |
| (3) Oil reservoir chamber | (10) Timing belt         |
| (4) Return spring         | (11) Belt tension pulley |
| (5) Adjuster rod          | (12) Tensioner bracket   |
| (6) Plunger               | (13) Cylinder            |
| (7) Oil pressure chamber  |                          |

- Timing belt tensioning action

When the belt becomes slack, the adjuster rod is pushed upward by the return spring. The oil in the reservoir chamber, which is pressurized by the plunger spring to a certain level, pushes open the check ball and flows into the oil pressure chamber to keep the pressure constant.

The thrust force  $F$  resulting from extension of the adjuster rod applies a counterclockwise torque to the tensioner bracket, which causes the belt tension pulley at its end to turn in the same direction. This applies tensioning pressure  $P_b$  to the timing belt.

- Timing belt tension balancing action

When the belt tension pulley is pushed against the timing belt with pressure  $P_b$ , reaction force  $T_b$  of the timing belt generates the reaction force  $P$  at the point on which the adjuster rod force is acting. This force  $P$  pushes the adjuster rod until it balances with the sum of the thrust force  $F$  and the pressure of the oil in the oil pressure chamber. Therefore, the timing belt tension is kept constant.

- Over-tension correction action

If the tension of the timing belt increases excessively, the force  $P$  becomes larger than the thrust force  $F$  and silicone oil is returned from the oil pressure chamber to the reservoir chamber little by little until the force  $P$  balances again with the thrust force  $F$ . Thus the timing belt tension is maintained at the specified level at all times.

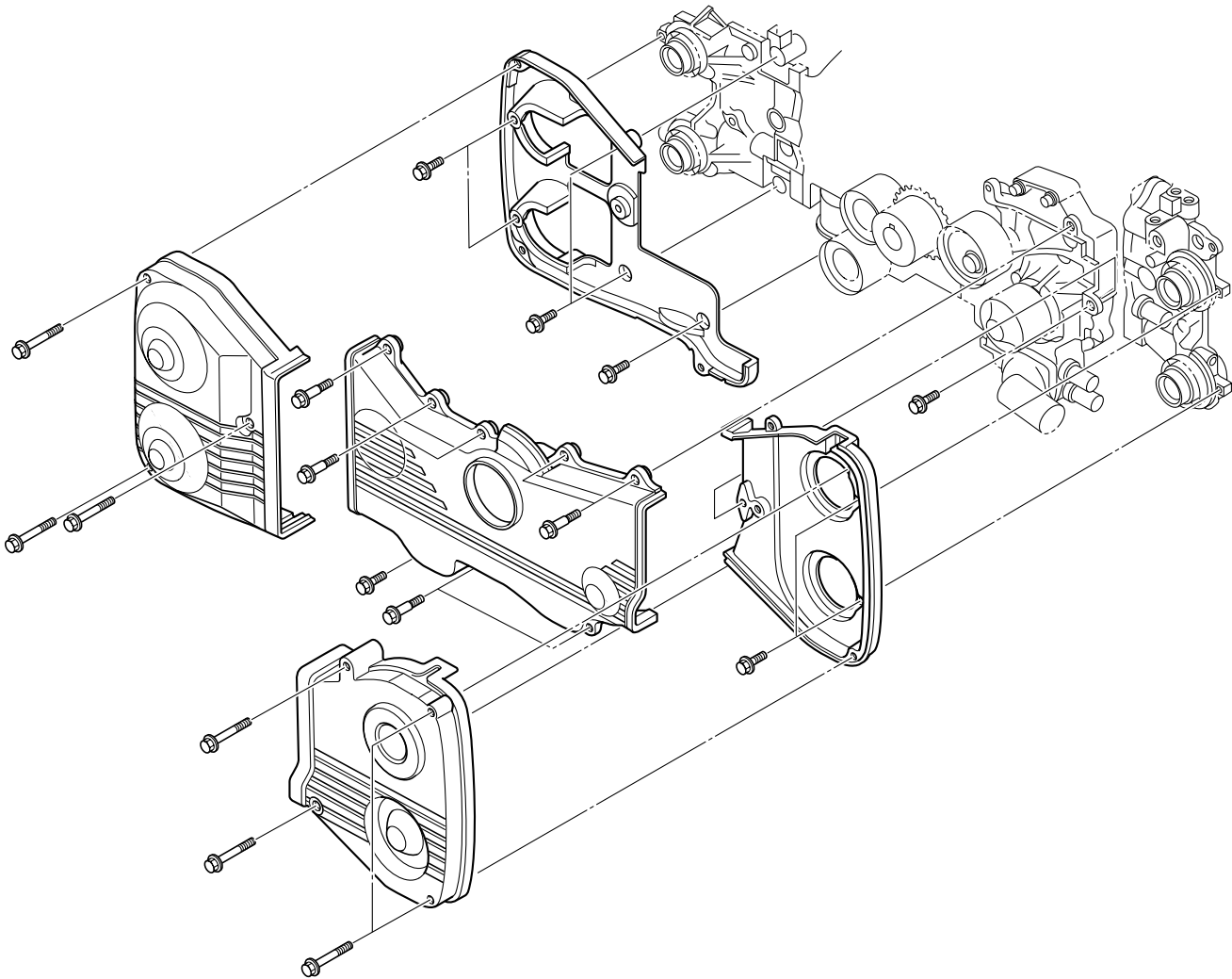
## BELT COVER

### MECHANICAL

---

#### 4. Belt Cover

- The belt cover is made of lightweight, heat resistant synthetic resin molding. It constitutes a totally enclosed housing with its cylinder block mating edges sealed with rubber gaskets. This effectively protects the inside components from dust and liquid.
- Rubber seals used between the cylinder block and the belt cover effectively reduces transmission of noise and vibration.
- The front belt cover has a line mark for ignition-timing checking.



ME-00343

## 5. Camshaft

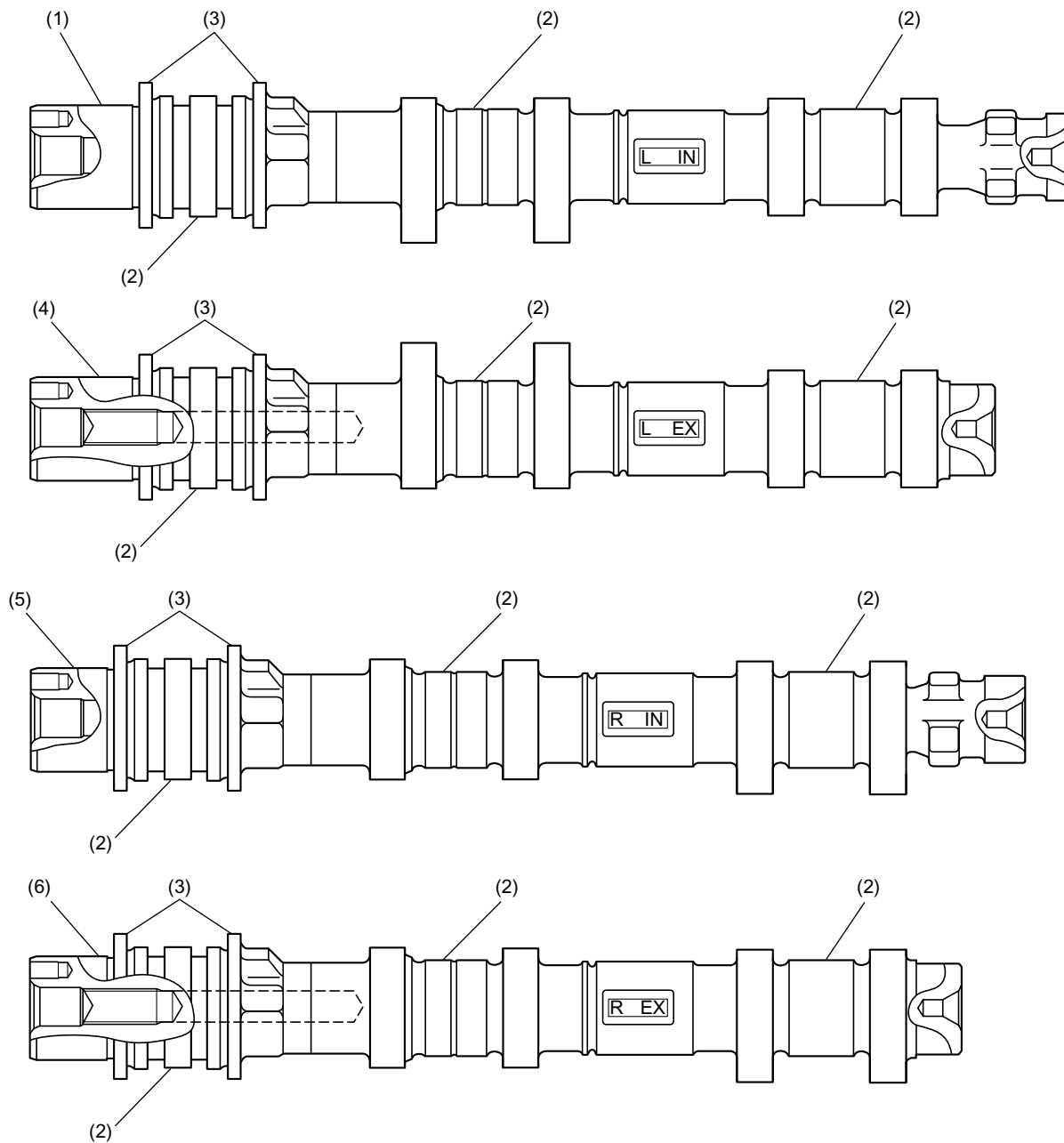
The DOHC engine uses four camshafts in all; intake and exhaust camshafts on each of the right and left banks.

The cam lobe noses are finished by “chill” treatment to increase wear resistance and anti-scuffing properties.

Each camshaft is supported at its three journals and held in position by three camshaft caps. Each camshaft has a flange which fits in the corresponding groove in the cylinder head to receive thrust forces generated in the camshaft.

# CAMSHAFT

## MECHANICAL



ME-00743

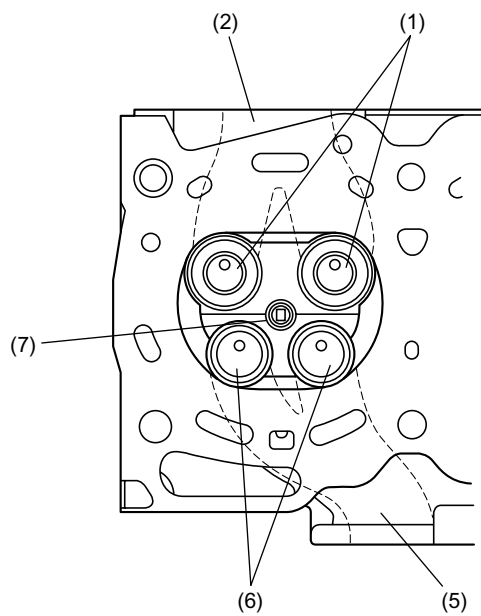
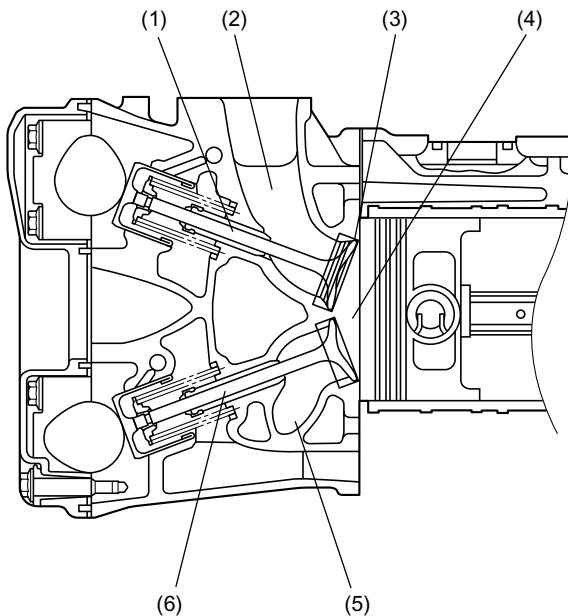
- (1) Intake camshaft LH
- (2) Journal
- (3) Flange

- (4) Exhaust camshaft LH
- (5) Intake camshaft RH
- (6) Exhaust camshaft RH

**ME(H4DOTC)-8**

## 6. Cylinder Head

- The cylinder head is made of aluminum die casting.
- Each combustion chamber in the cylinder head is a compact, pentroof design. The spark plug is located at the center of the combustion chamber, which contributes to creation of a wide “squish area” for increased combustion efficiency.
- The two intake and two exhaust valves are arranged on opposite sides for a cross-flow feature.
- The cylinder head gasket is a metallic gasket consisting of three layers of the stainless steel sheets. The gasket is highly resistant to heat and maintains high level of sealing performance for a long period.



ME-00762

- (1) Intake valve
- (2) Intake port
- (3) Squish area
- (4) Combustion chamber

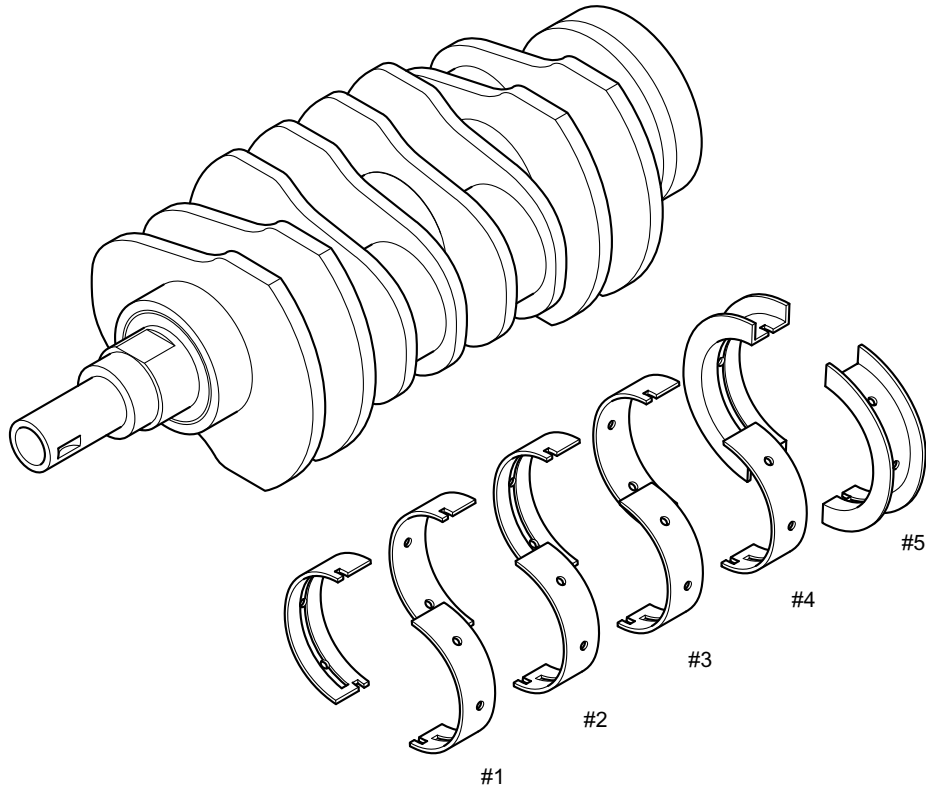
- (5) Exhaust port
- (6) Exhaust valve
- (7) Spark plug

## 7. Cylinder Block

- The cylinder block is made of aluminum die casting. Its open-deck design provides it with such advantageous features as relatively small weight, high rigidity and excellent cooling efficiency.
- The cylinder liners are made of cast iron. They are dry type which means their outer surfaces are entirely in contact with the cylinder block.
- The cylinder block supports the crankshaft at its five journals. The journal supporting portions are designed such that sufficient stiffness and quiet operation are ensured.
- The oil pump is located in the front center of the cylinder block and the engine coolant pump is located at the front of the left-cylinder bank. At the rear of the right-cylinder bank is an oil separator which removes oil mist contained in blow-by gas.

## 8. Crankshaft

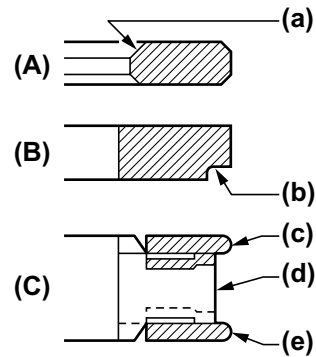
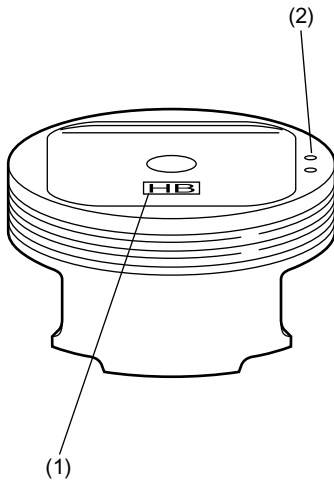
The crankshaft is supported in the cylinder block by five bearings. Each corner formed by a journal or pin and a web is finished by fillet-rolling method which increases strength of that area. The five crankshaft bearings are made of aluminum alloy and the No. 5 bearing is provided with a flanged metal to support thrust forces.



ME-00319

## 9. Piston

- The pistons are of a slipper skirt design for reduced weight and friction. The oil control ring groove utilizes a thermal design.
- The piston pin is offset either downward (Nos. 1 and 3 pistons) or upward (Nos. 2 and 4 pistons).
- The piston head has recesses to prevent interference with the intake and exhaust valves. It also has engraved marks to identify the piston size and the direction of installation. All the pistons are common in their design.
- Three piston rings are used for each piston — two compression rings and one oil control ring. The top piston ring has inner bevels and the second piston ring has a cut on the bottom outside to reduce oil consumption.



ME-00346

(1) Identification mark

(2) Location mark (engine front side)

(A) Top ring

(B) Second ring

(C) Oil ring

(a) Inner-bevel

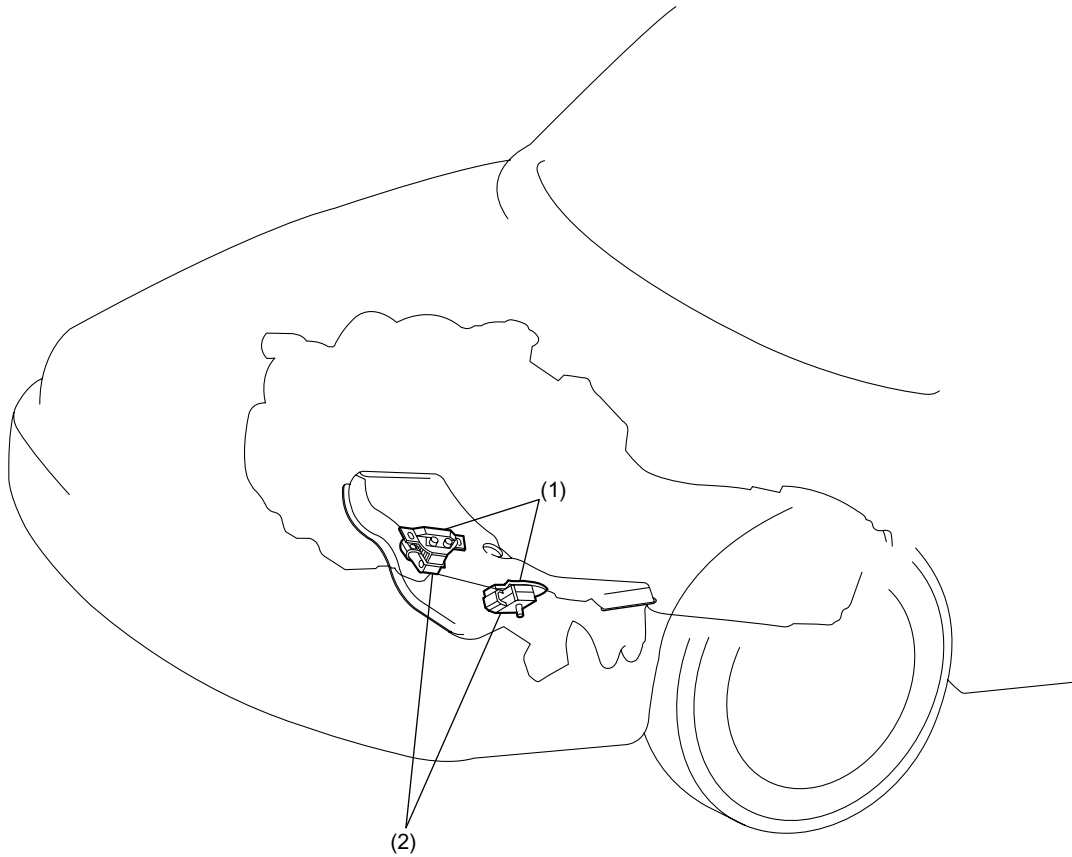
(b) Cut

(c) Upper rail

(d) Spacer

(e) Lower rail

## 10.Engine Mounting



ME-00321

- (1) Bracket
- (2) Cushion rubber

# ENGINE MOUNTING

MECHANICAL

---

**MEMO**