MECHANICAL

H6DO

1. General

The H6 engine is of a horizontally opposed, six-cylinder design. This four-stroke-cycle, water-cooled, DOHC engine uses a total of 24 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:

- A maintenance-free, chain-and-sprocket type camshaft drive mechanism is used which also contributes to reduction in the overall length of the engine.
- The cylinder block is an aluminum die-casting fitted with iron die-cast cylinder liners.
- Lightweight and compact design.

The cylinder bore pitch is 98.4 mm (3.874 in), which is much shorter than 113 mm (4.45 in) of the H4 engine.

The cylinder bore and piston stroke dimensions have been selected optimally for sufficient output and reduced size of the engine; they are 89.2 mm (3.512 in) and 80.0 mm (3.150 in) in contrast to 92.0 mm (3.622 in) and 75.0 mm (2.953 in) of the H4 engine.

The cylinder block is of a "siamese-triplet" design with the three cylinders of each bank cast without coolant passages between cylinders, while ensuring adequate cooling by employing an open-deck design.

The right bank camshafts and the left bank camshafts are driven by different timing chains, whereas the accessories are driven through their own pulleys by a single serpentine belt (two belts were used in the previous model's engine).

- Quiet operation

Unlike V6 engines, horizontally opposed six-cylinder engines do not generate secondary vibration (which is caused by primary operational vibration in a V6 engine and has a frequency twice as large as that of the primary vibration) although V6 engines have space saving merit. In addition to this inherent quietness provided by complete dynamic balance, the H6 engine incorporates the following quietly operating considerations:

The crankshaft is supported by seven bearings.

The chains driving the camshafts are provided with hydraulic tension adjusters and covered by a chain cover at the front of the engine.

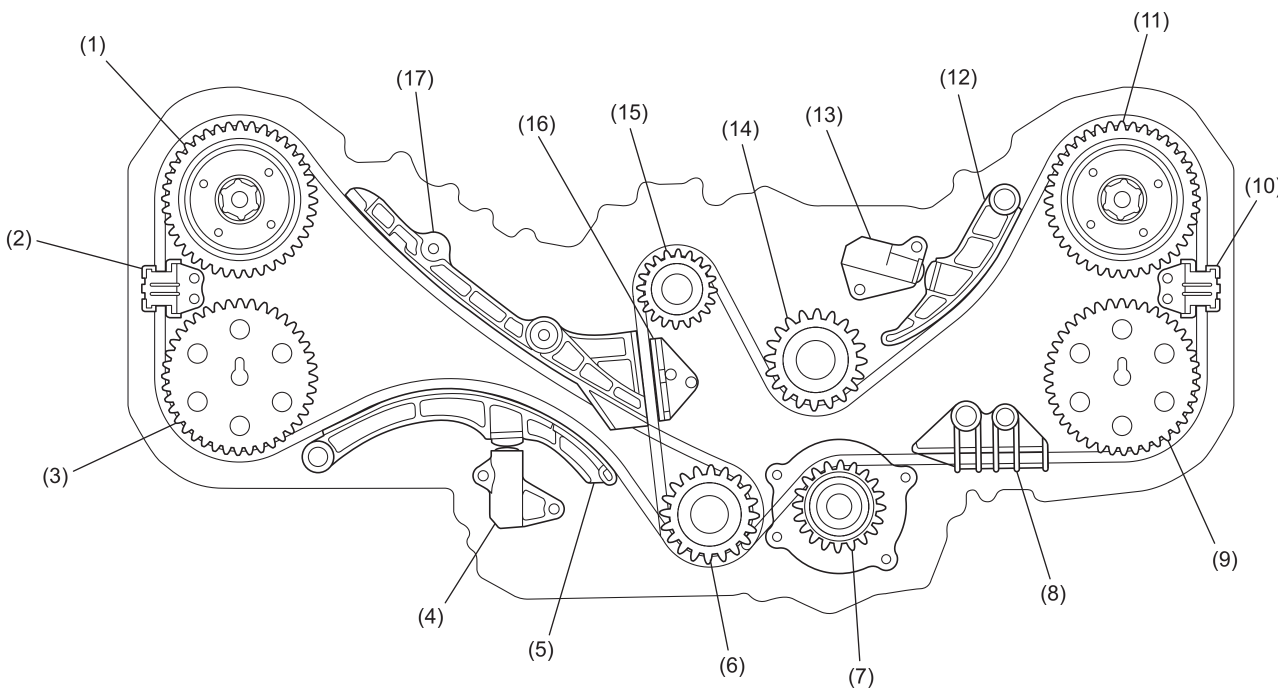
An aluminum die-cast oil pan upper reinforces the joint of the right and left cylinder block banks, while giving additional rigidity to the crankshaft bearing areas.

The engine is connected to the transmission more rigidity than with the H4 engine by using 11 bolts (eight bolts in the H4 engine).

2. Timing Chains

● Two timing chains are used to drive the camshafts, one each for driving the two camshafts on each bank. Every camshaft is fitted with a sprocket through which it is driven by the corresponding timing chain. The left bank timing chain transmits the power from the crankshaft sprocket directly to the left bank camshaft sprockets, whereas the right bank timing chain transmits the crankshaft power via the lower idler sprocket which is driven by the left bank timing chain. (The lower idler gear has two tooth rows; the left bank timing chain engages with the inner row teeth and the right bank chain engages with the outer row teeth.) By this way, the right and left bank camshafts rotate in synchronization with each other.
The left bank timing chain also drives the water pump.

● The hydro-mechanical automatic chain tension adjuster provided for each chain constantly maintains the specified chain tension necessary to properly drive the camshafts, as well as to provide this chain and sprocket camshaft drive mechanism with a “maintenance-free” feature.



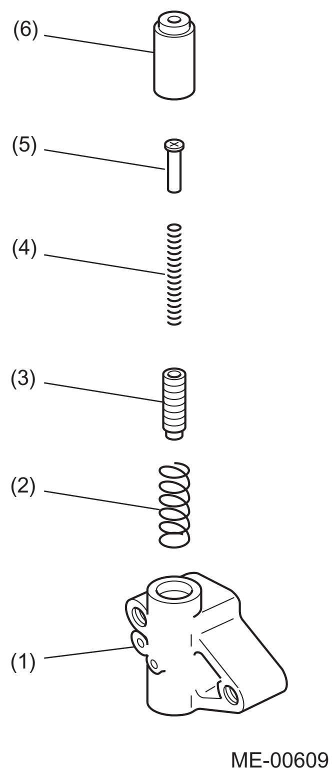
ME-02431

(1) Intake camshaft sprocket RH
(2) No. 1 chain guide RH
(3) Exhaust camshaft sprocket RH
(4) Chain tension adjuster RH
(5) Chain tension adjuster lever RH
(6) Lower idler sprocket
(7) Water pump sprocket
(8) No. 2 chain guide LH
(9) Exhaust camshaft sprocket LH
(10) No. 1 chain guide LH
(11) Intake camshaft sprocket LH
(12) Chain tension adjuster lever LH
(13) Chain tension adjuster LH
(14) Upper idler sprocket
(15) Crankshaft sprocket
(16) Center chain guide
(17) No. 2 chain guide RH

3. Automatic Chain Tension Adjuster

The right and left bank timing chains are provided with their own tensioners. The tensioners are of a hydro-mechanical type that utilizes the engine oil pressure and can automatically keep the tension of the chains at a proper level without need for manual adjustments.

The tensioner case has an oil port that aligns with the oil port in the cylinder block when it is installed in position. The inside of the tensioner case is a high-pressure hydraulic chamber with a check ball. The pressure of the oil in the chamber is adjusted by the relief valve. Featuring a plunger with external screw threads, the tensioner can keep the chain taut constantly even when the engine is stationary.



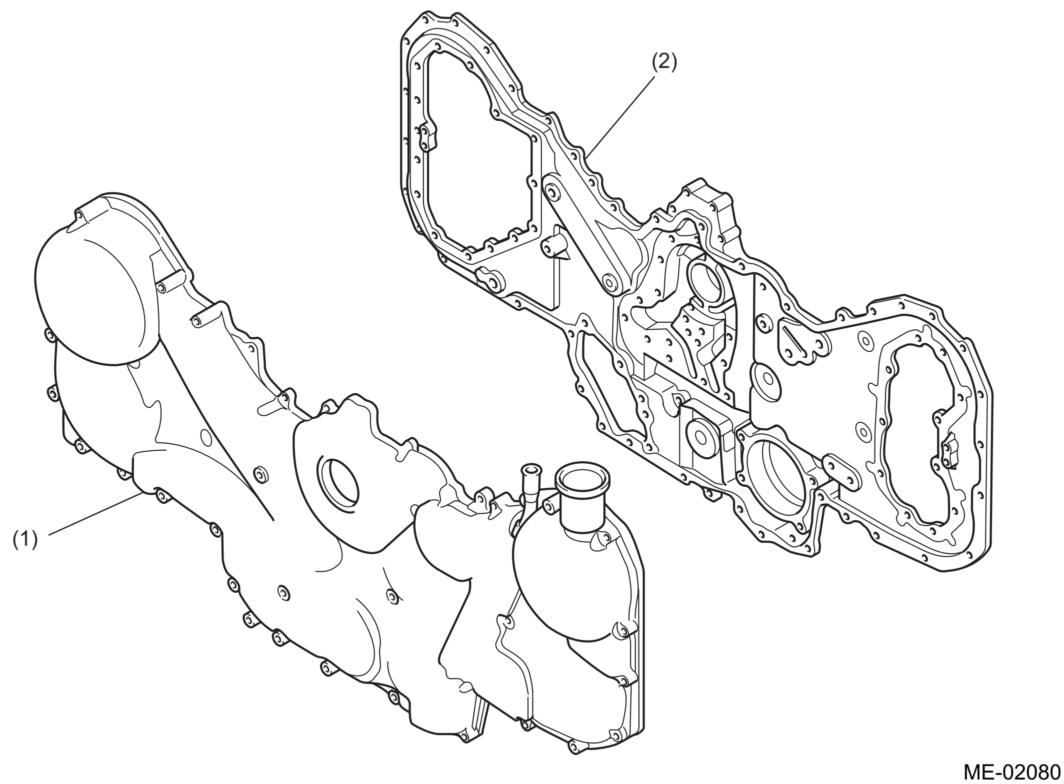
(1) Tensioner case
(2) Spring
(3) Plunger
(4) Spring
(5) Adjuster rod
(6) Plunger case

4. Timing Chain Case

● The timing chain case is formed by the front chain cover and rear chain cover, both made of aluminum die-casting. This two-piece chain case design helps reduce noise.

● Sealing materials used between the engine block and rear chain cover are an O-ring, metal gasket, and liquid gasket. Between the front and rear chain covers, liquid gasket is used to prevent oil from leaking out.

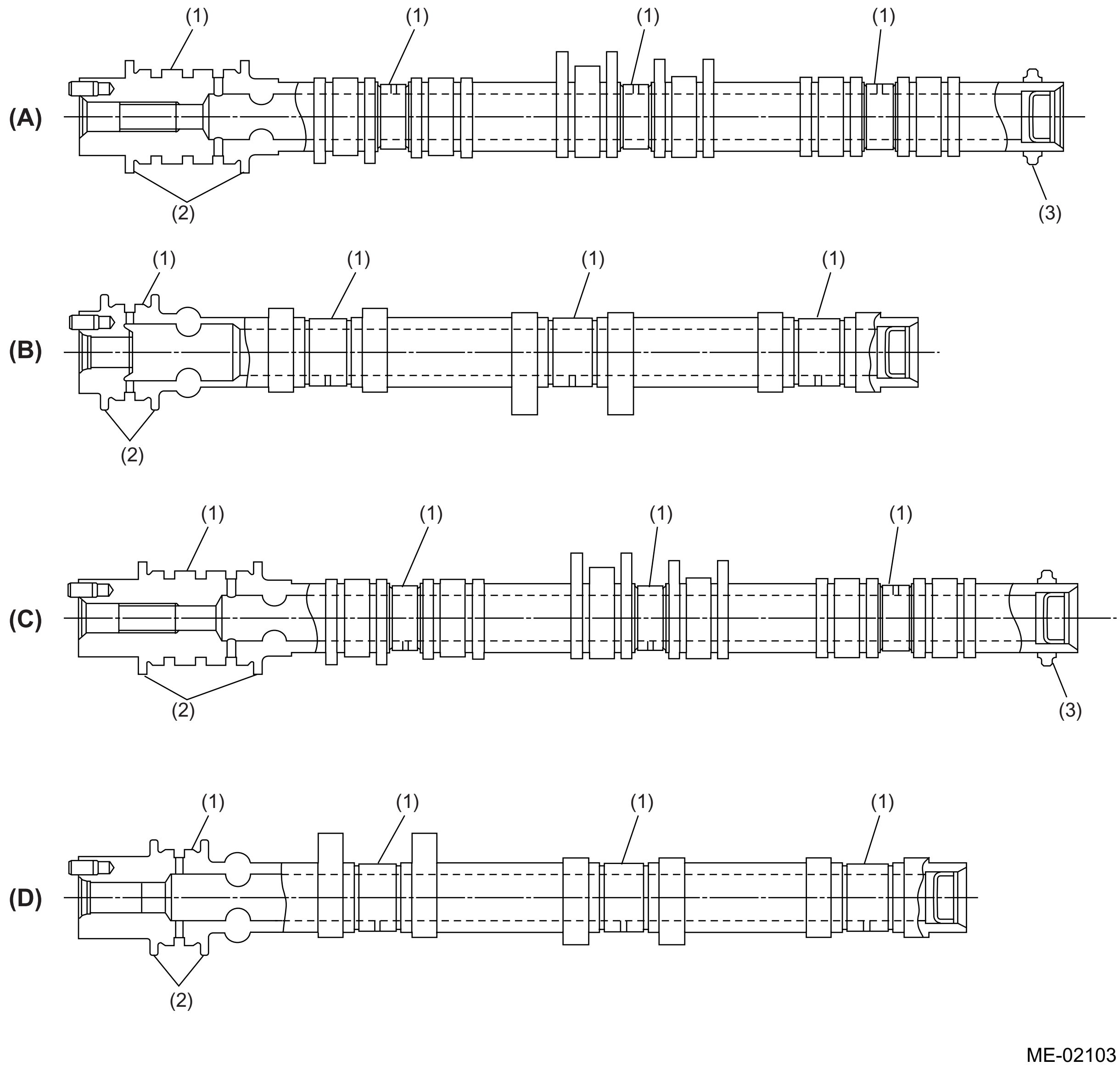
● A fluorocarbon resin oil seal is used at the crankshaft opening in the front chain cover.



(1) Front chain cover
(2) Rear chain cover

5. Camshaft

- The camshafts are of a composite material type using sintered steel for cam lobes and carbon steel for pipe part.
The sintered steel cams are very high in the resistance to wear, which enables the cam lift to be increased. In addition, use of the sintered steel cams contributes to reduction in weight.
- Each camshaft is supported at its four journals by the corresponding bearings. The front-most bearing has flanges on its both ends to receive thrust loads that are generated during movement of the camshaft.
- The bearings are lubricated by the oil that enters the passage in each camshaft from the port at the front-end journal and flows out through the hole in each journal.
- The intake camshaft has at its rear end a flange, which is used as an angle sensing wheel by the camshaft position sensor.
- As the engine is equipped with a variable valve lift system, each of the intake camshafts have high-lift cams and low-lift cams.

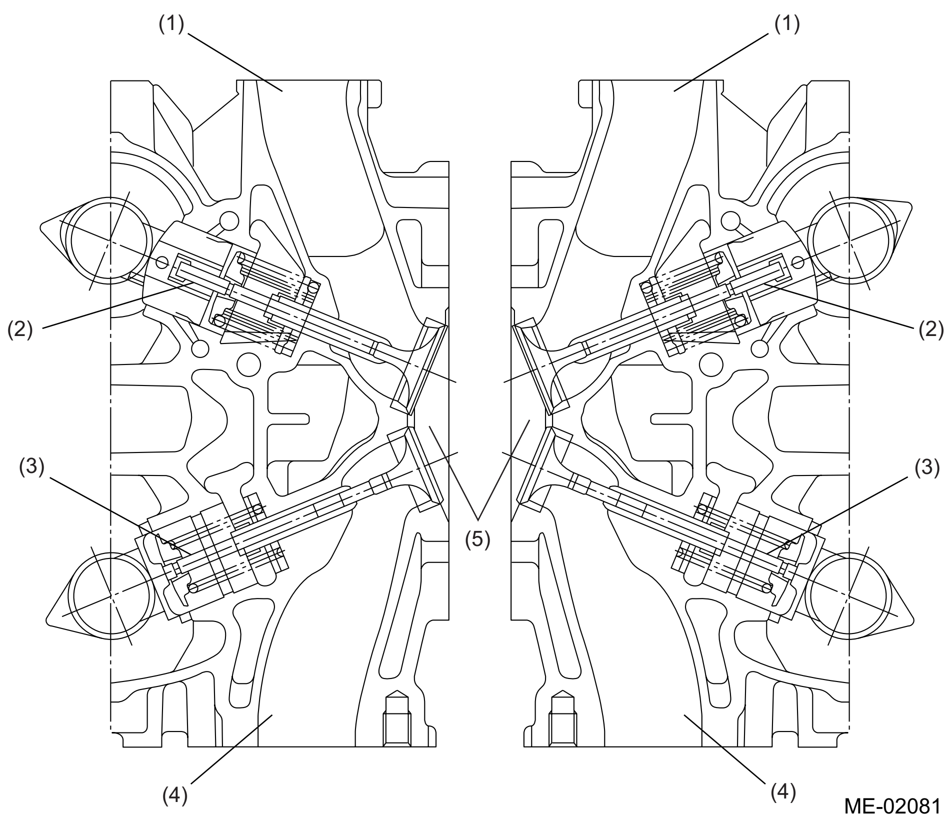


(1) Journal
(2) Shaft flange
(3) Camshaft position sensor flange

(A) Intake camshaft RH
(B) Exhaust camshaft RH
(C) Intake camshaft LH
(D) Exhaust camshaft LH

6. Cylinder Head

- The cylinder heads are made of aluminum alloy, which features light weight and high cooling efficiency.
- Each cylinder head incorporates a DOHC mechanism, which is adapted to the four valves per cylinder arrangement. A variable valve lift system is used at the intake port. The exhaust ports are formed in three independent ports. These design features contribute together to higher output.
- The combustion chamber is of a compact pent roof design with the spark plug located at its top center. The squish area formed between the piston top surface and combustion chamber helps improve mixing of air and fuel and thus combustion efficiency.
- Coolant flows from the rear to the front of the cylinder head of each bank. This serial-flow coolant line arrangement ensures highly efficient cooling of the engine.
- A metal gasket is used between the cylinder head and cylinder block. Tightening the cylinder head bolts by the angle-tightening method ensures invariable sealing performance of this gasket.



(1) Intake port
(2) Intake valve
(3) Exhaust valve
(4) Exhaust port
(5) Combustion chamber

7. Cylinder Block

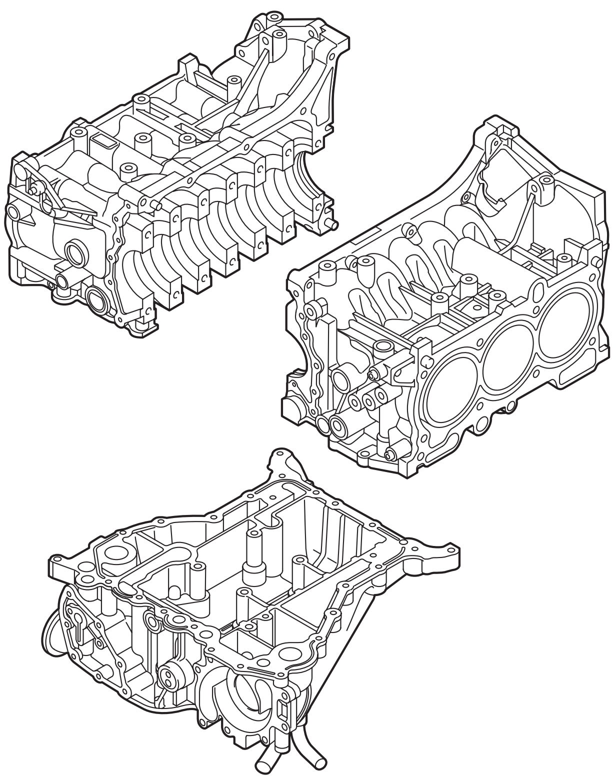
● The cylinder block of this horizontally-opposed-cylinder engine is made of aluminum die-casting. It is split into right and left halves at its center where the crankshaft is supported. The cylinder liners are made of cast iron and are embedded as integral part of the cylinder block body during the casting process.

● The coolant passages of the right and left banks are independent of each other (parallel-flow type). The water jackets around the cylinder liners are open at the cylinder head side end of each bank (open-deck design).

● The cylinder block supports the crankshafts journals through seven main bearings rigidly and quietly. The #7 bearing is a flanged thrust bearing which controls the crankshafts end play.

● Rigid engine-to-transmission connection is ensured by 11 bolts (three more bolts than with the H4 engine).

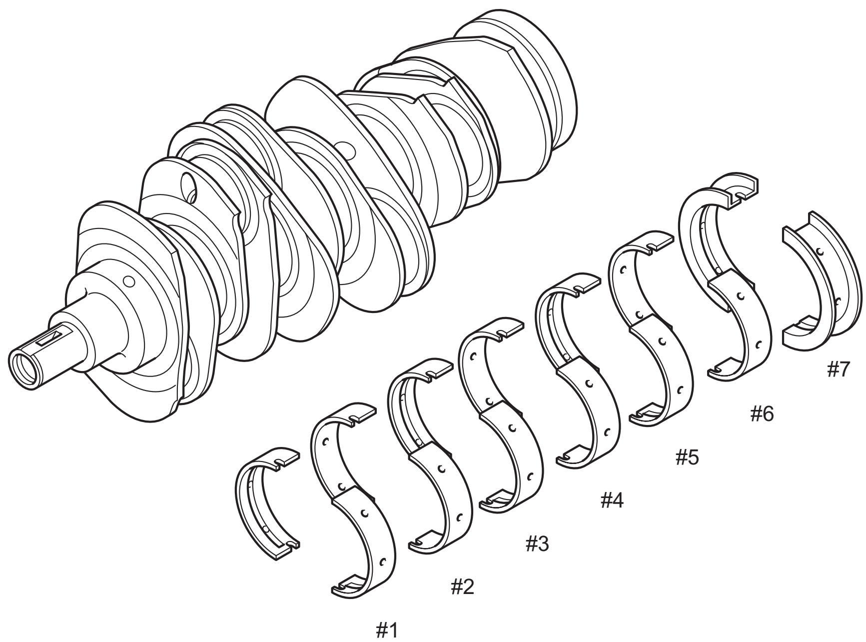
● The aluminum die-cast oil pan upper located below the cylinder block reinforces connection between the cylinder block banks and its special form provides a baffle effect to suppress large fluctuation of oil level. In addition, the oil pan upper constitutes part of the oil and cooling circuits as well as the water pump volute chamber and thermostat chamber.



ME-02082

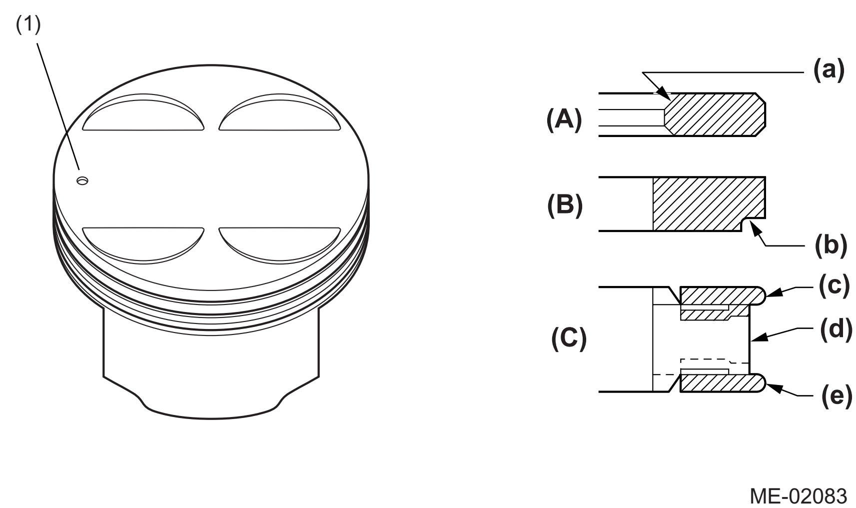
8. Crankshaft

The crankshaft is supported in the cylinder block by seven 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 seven crankshaft bearings are made of aluminum alloy and the No. 7 bearing is provided with a flanged metal to support thrust forces.



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, 3 and 5 pistons) or upward (Nos. 2, 4 and 6 pistons).
- Recesses are provided in the piston to maintain clearance between the piston and valve heads. All the right and left bank pistons are the same in shape. Each piston has a location mark (mark indicating the front of engine) on its top.
- 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 an interrupt (cut) on the bottom outside to reduce oil consumption.



(1)	Location mark (engine front side)	**(A)**	Top ring	**(a)**	Inner-bevel
		(B)	Second ring	**(b)**	Cut
		(C)	Oil ring	**(c)**	Upper rail
				(d)	Expander
				(e)	Lower rail

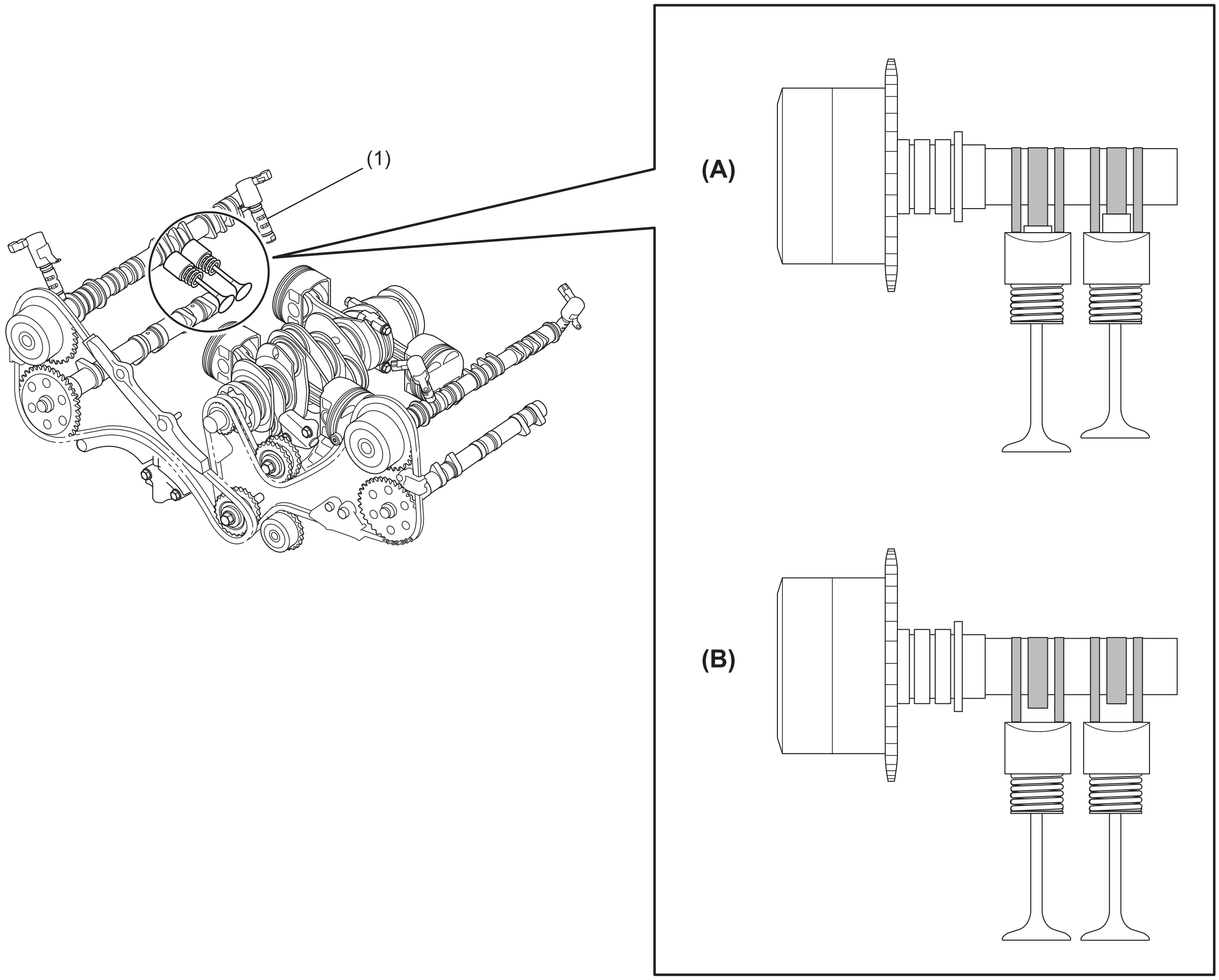
10.Variable Valve Timing System

Regarding the construction and operation of the variable valve timing system, refer to ME (H4DOTC) section, Variable Valve Timing System. <Ref. to ME(H4DOTC) section, Variable Valve Timing System.>

11.Variable Valve Lift System

The engine is provided with a variable valve lift system. The variable valve lift system optimizes the intake valve lift by switching to use low lift cams or high lift cams in accordance with engine speed.

- In response to the signals from the ECM, the oil switching solenoid valve operates to switch the valve lift.
- At low engine speeds, the lift is reduced to increase intake air speed and to obtain effective combustion and higher torque output. The lift of the two valves are different from each other. By differentiating the intake air volume in this way, a swirl occurs in the combustion chamber and combustion is improved.
- At high engine speeds, the lift is increased to reduce intake resistance and to obtain higher power.
- To protect the engine, the system does not allow racing up the engine to high speeds in P or N range.



ME-02104

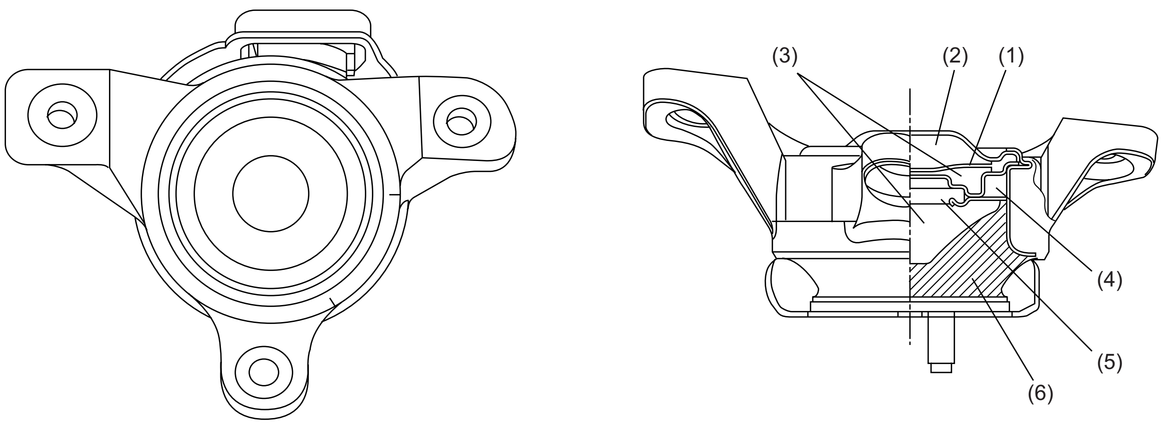
(1) Oil switching solenoid valve

(A) During low speed operation

(B) During high speed operation

12.Engine Mounting

The front cushion rubber for H6 engines hold the engine at three points to increase rigidity. The cushion has an upper and lower liquid chambers inside, and an orifice connects the upper and lower liquid chambers while a diaphragm separates the upper liquid chamber and air chamber. A rubber membrane is also added, and vibration and noise are reduced by optimally tuning its spring constant.



ME-02105

(1) Diaphragm
(2) Air chamber
(3) Liquid chamber
(4) Orifice
(5) Membrane (rubber)
(6) Rubber

MEMO