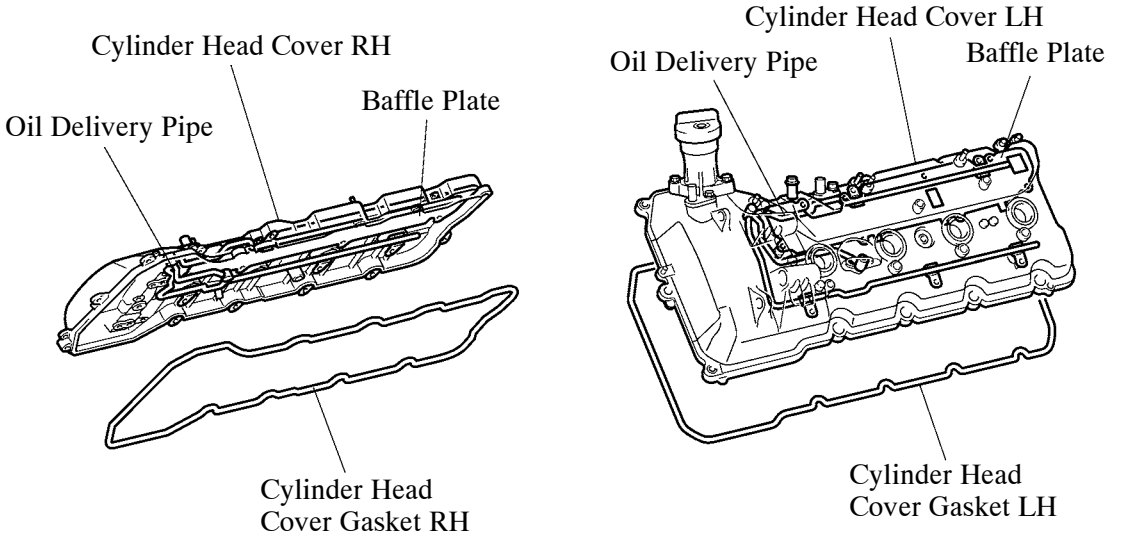
4. Engine Proper

Cylinder Head Cover

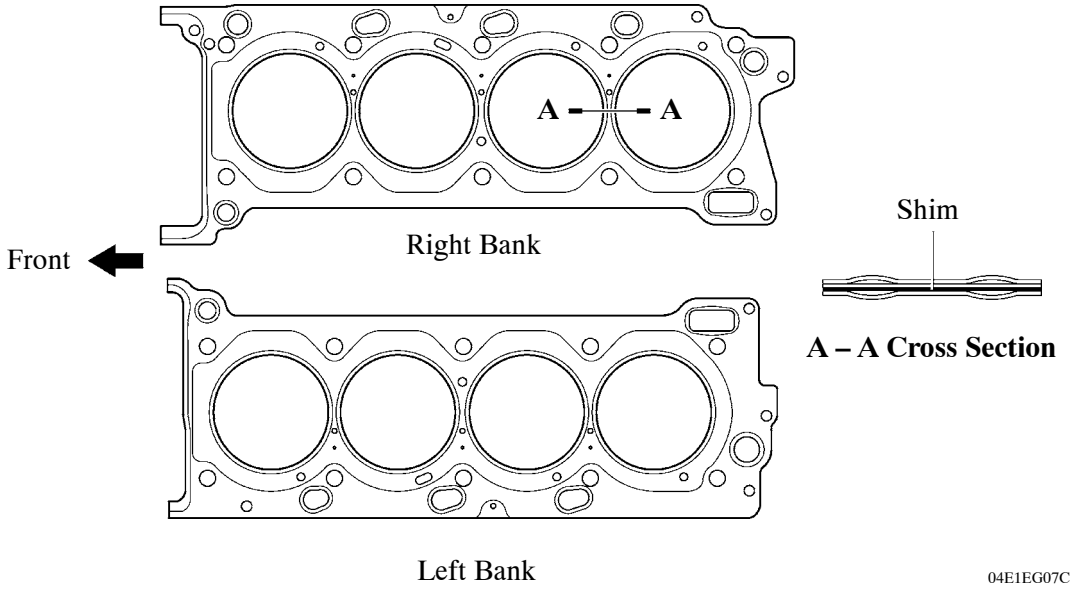
- Lightweight yet high-strength aluminum cylinder head covers are used.
- An oil delivery pipe is installed inside the cylinder head covers. This ensures lubrication to the sliding parts of the valve rocker arms, improving reliability.
- Large baffle plates are built into the cylinder head covers. As a result, the speed of blowby gas flow is reduced, and the oil mist is removed from the blowby gas. Due to this, the amount of oil lost is reduced.



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Cylinder Head Gasket

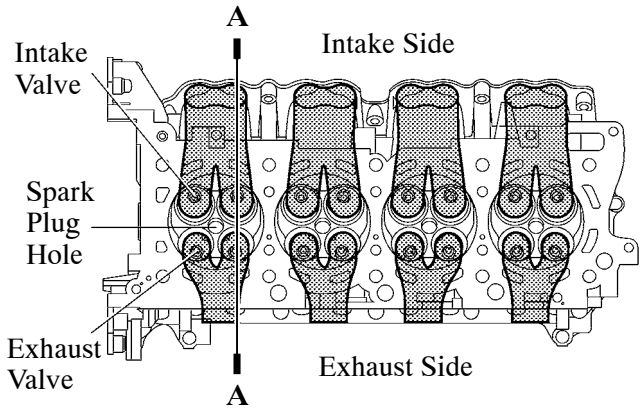
- 3-layer steel-laminate type cylinder head gaskets are used. A shim is used around the cylinder bore of each gasket to help enhance sealing performance and durability. This results in improved fuel economy, reduced consumption rate of engine oil and reduced emission of exhaust gases.
- The surface is coated with highly heat-resistant fluoro-rubber to support high power output.



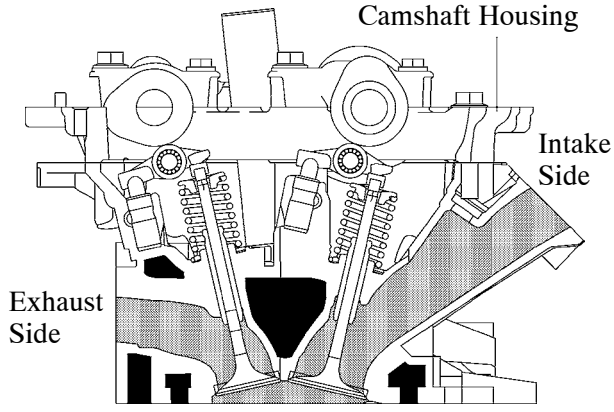
04E1EG07C

Cylinder Head

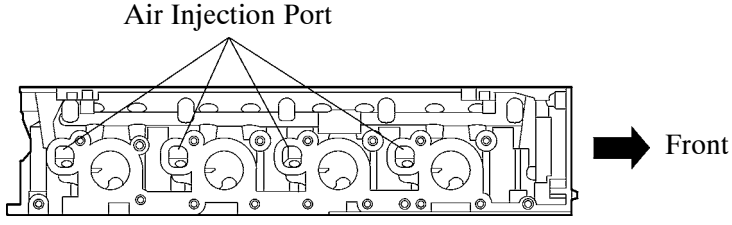
- The cylinder head structure has been simplified by separating the cam journal portion (camshaft housing) from the cylinder head.
- The cylinder head, which is made of aluminum, contains a pentroof type combustion chamber. The spark plug is located in the center of the combustion chamber in order to improve the engine's anti-knocking performance.
- The port configuration is an efficient cross-flow type in which the intake ports face the inside of the V bank and the exhaust ports face the outside.
- A siamese type intake port is used. The port diameter gradually decreases toward the combustion chamber to optimize the airflow speed and intake pulsation.
- An air injection port is provided for the air injection system.



View from Bottom Side 080EG31TE



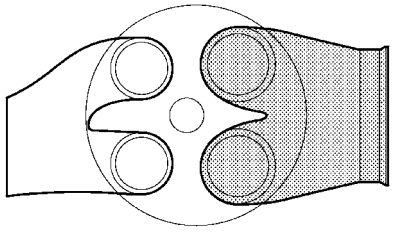
A – A Cross Section 04E1EG09C



View from Exhaust Side 04E1EG10C

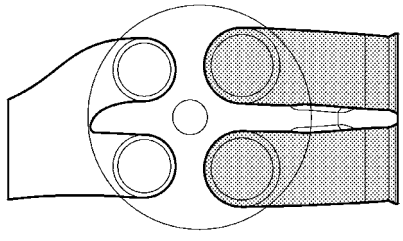
— REFERENCE —

Siamese Type



036EG28TE

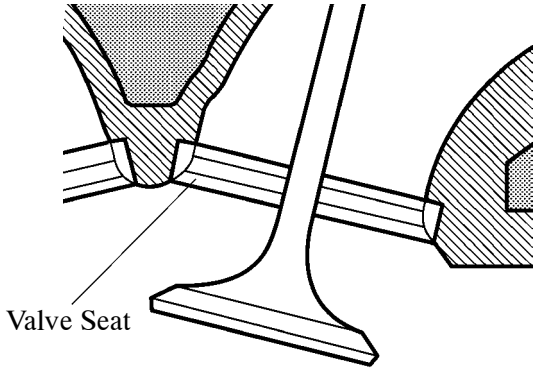
Independent Type



036EG29TE

— Change From 3UR-FE Engine —

The material of the exhaust valve seat has been changed. High-resistant sintered alloy is used for the valve seat to be compatible with alcohol fuel.

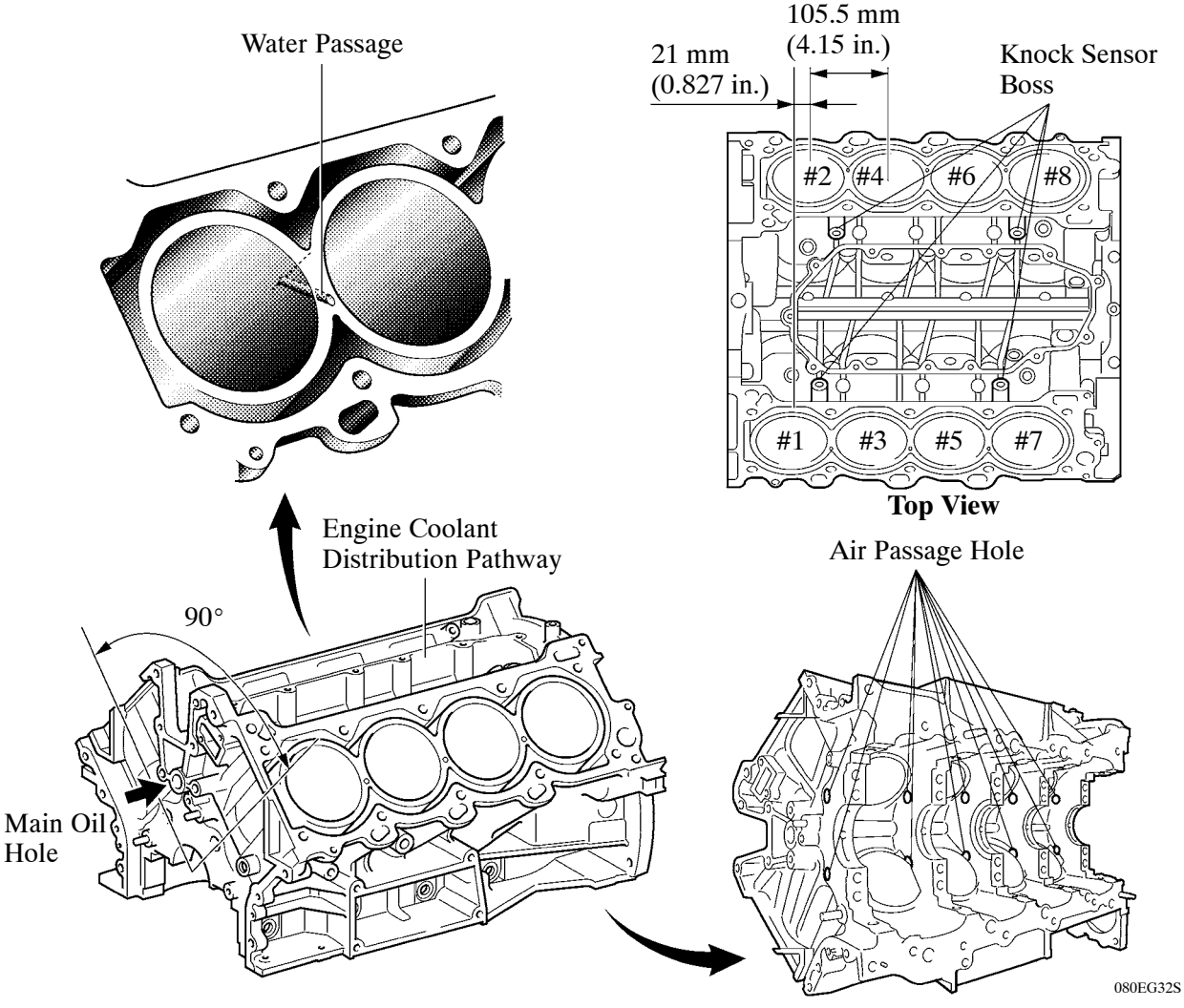


10ZEG01Y

Cylinder Block

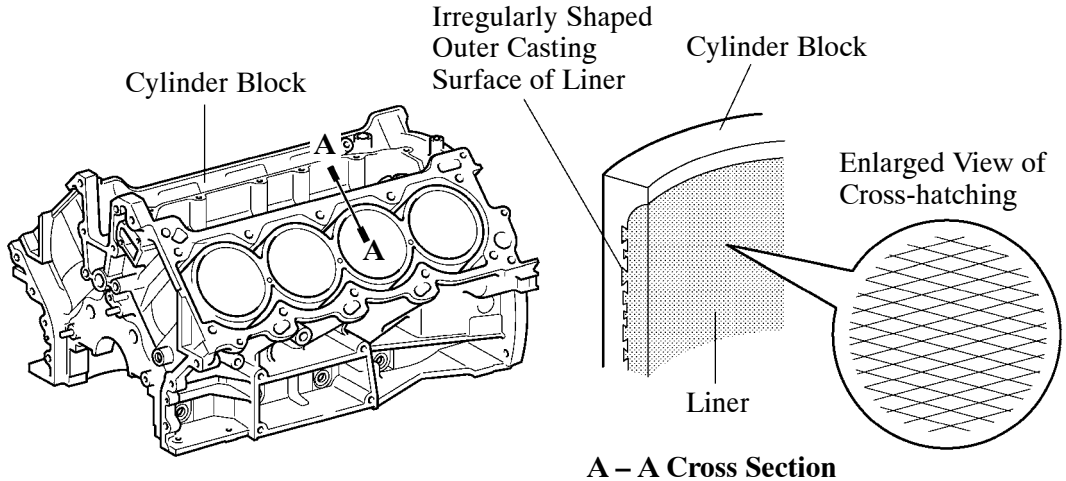
1) General

- The cylinder block is made of aluminum alloy.
- The cylinder block has a bank angle of 90°, a bank offset of 21 mm (0.827 in.) and a bore pitch of 105.5 mm (4.15 in.), resulting in a compact block in its length and width considering its displacement.
- Spiny-type liners are used.
- An engine coolant distribution pathway is provided between the left and right banks. The engine coolant sent by the water pump passes through the engine coolant distribution pathway and flows to the cylinder head and water jackets of both banks. The engine coolant distribution pathway also cools the engine oil in the main oil hole located directly below the pathway.
- A water passage is provided between the cylinder bores. By allowing the engine coolant to flow between the cylinder bores, this construction keeps the temperature of the cylinder walls uniform.
- Plastic cylinder block water jacket spacers are inserted in the water jacket. They control the flow of the engine coolant in order to attain a uniform temperature around the combustion chambers.
- Installation bosses of the 4 knock sensors are located on the inner side of left and right banks to enhance the accuracy of the knock sensors.
- Air passage holes are provided on bulkheads of the cylinder block. As a result, the air at the bottom of the cylinder flows smoother, and pumping loss (back pressure at the bottom of the piston generated by the piston's reciprocating movement) has been reduced to improve the engine's output.



2) Spiny-type Liner

- The liners are the spiny-type which have been manufactured so that their casting exteriors form large irregular surfaces in order to enhance the adhesion between the liners and the aluminum cylinder block. The enhanced adhesion helps heat dissipation, resulting in an overall lower temperature and heat deformation of the cylinder bores.
- The shape of the cross-hatching of the liner surface has been optimized to improve oil retention performance, resulting in reduced friction.

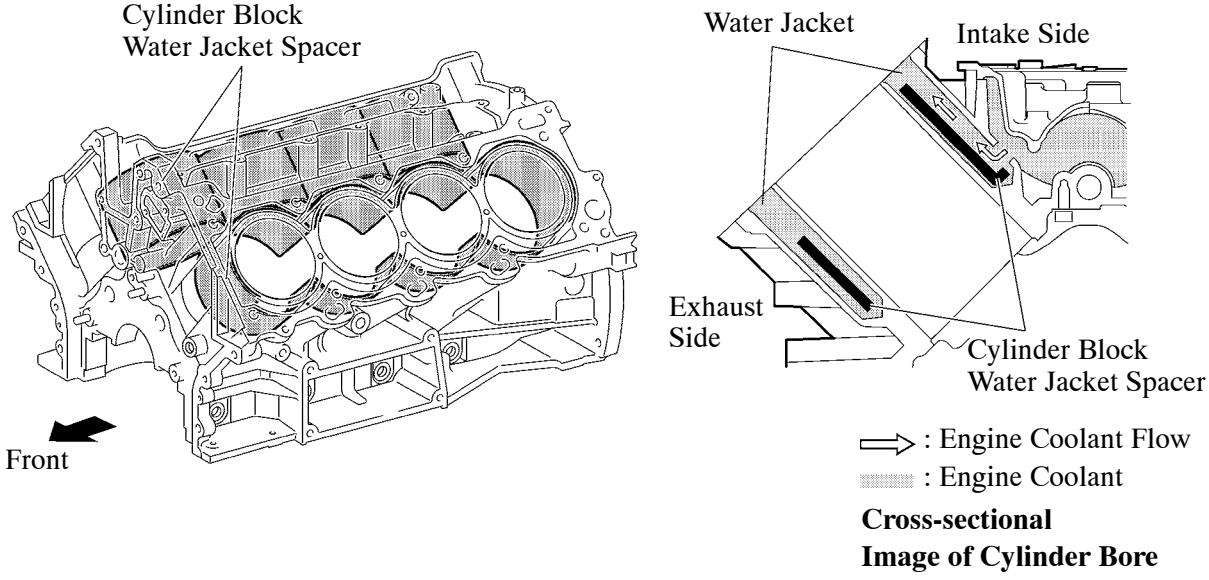


A – A Cross Section

080EG33S

3) Cylinder Block Water Jacket Spacer

The temperature of the intake side of the cylinder bore tends to be lower. For this reason, a wide cylinder block water jacket spacer covers the cylinder bores in order to suppress the flow of the engine coolant and prevent excessive cooling. On the other hand, the temperature of the exhaust side of the cylinder bore tends to be higher. A cylinder block water jacket spacer covers the lower area of the cylinder bores in order to direct the engine coolant to the upper area of the cylinder bores where the temperature is higher. This makes the temperature around the cylinder bores more uniform. As a result, the viscosity of the engine oil (which lubricates the area between the wall surface of the cylinder bore and the piston) decreases, thus reducing friction between the cylinder bore and the piston.

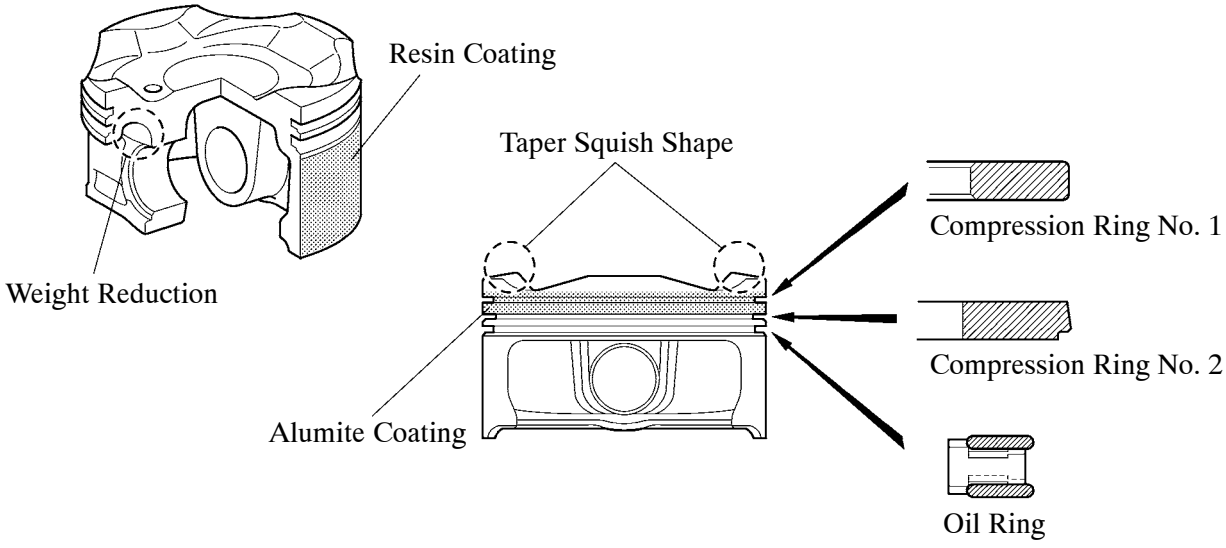


**Cross-sectional
Image of Cylinder Bore**

04E1EG13C

Piston

- The pistons are made of aluminum alloy.
- A compact combustion chamber is provided on top of the piston to achieve stable combustion. Together with the pentroof type combustion chamber of the cylinder head, this achieves a high compression ratio, resulting in both high performance and excellent fuel economy.
- A taper squish combustion chamber is used to improve anti-knocking performance and intake efficiency. In addition, engine performance and fuel economy are improved.
- In order to reduce weight, cast holes are provided on the bottom of the piston head near the pin bosses as shown in the illustration below.
- The piston skirt is coated with resin to reduce friction losses.
- The groove of the top ring is coated with alumite (anodic oxide coating) to ensure abrasion resistance.
- By increasing the machining precision of the cylinder bore diameter in the block, only one size of piston is required.



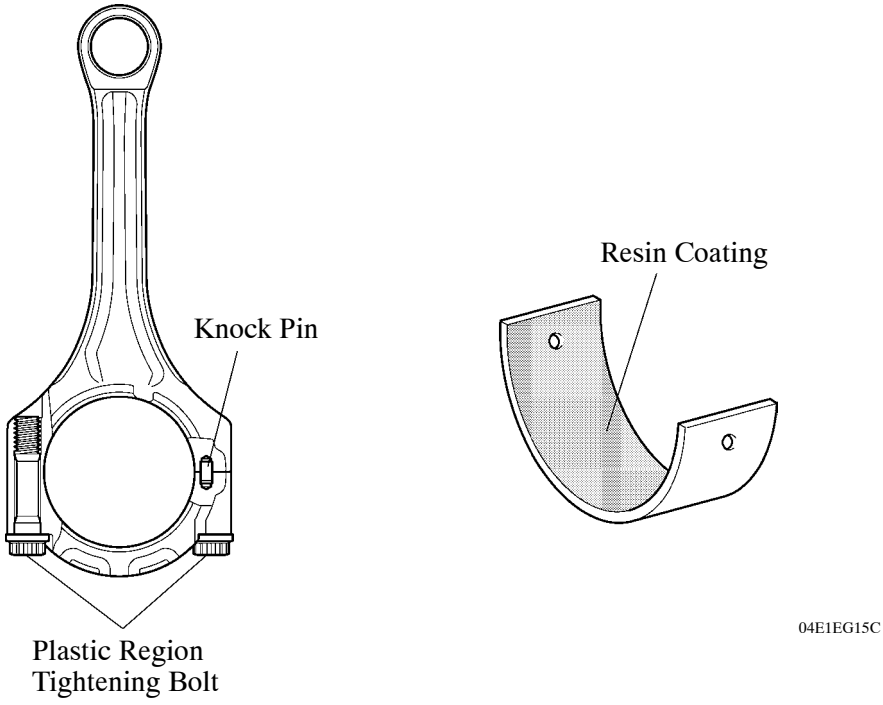
080EG01TE

Service Tip

The same pistons are used for both right and left banks. When installing a piston, the front mark should face the front of the engine.

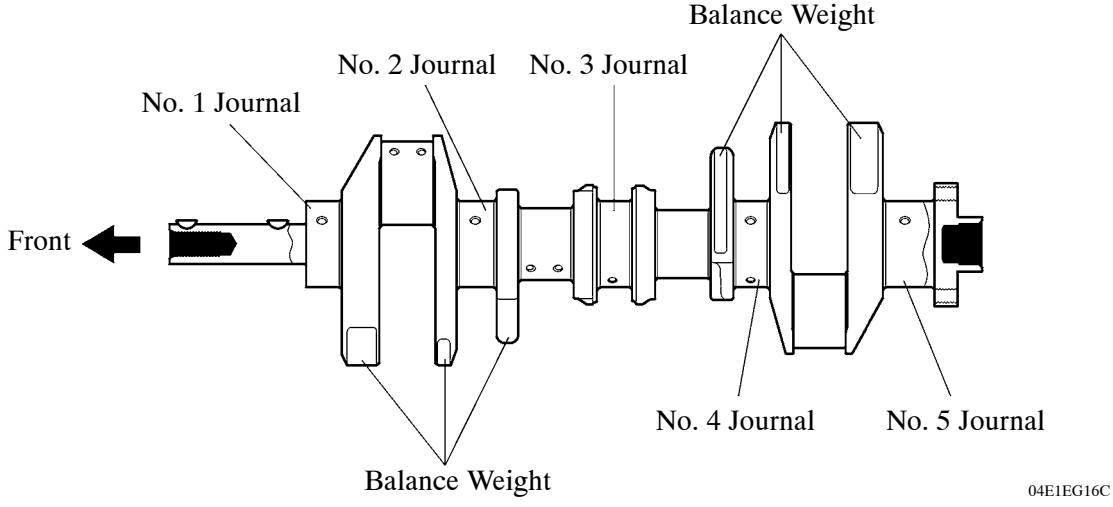
Connecting Rod and Connecting Rod Bearing

- Connecting rods that have been forged for high strength are used for weight reduction.
- Knock pins are used at the mating surfaces of the bearing caps of the connecting rod to minimize the shifting of the bearing caps during assembly.
- Nutless type plastic region tightening bolts are used on the connecting rods for lightweight design.
- Resin-coated aluminum bearings are used for the connecting rod bearings. The connecting rod bearings are reduced in width to reduce friction.



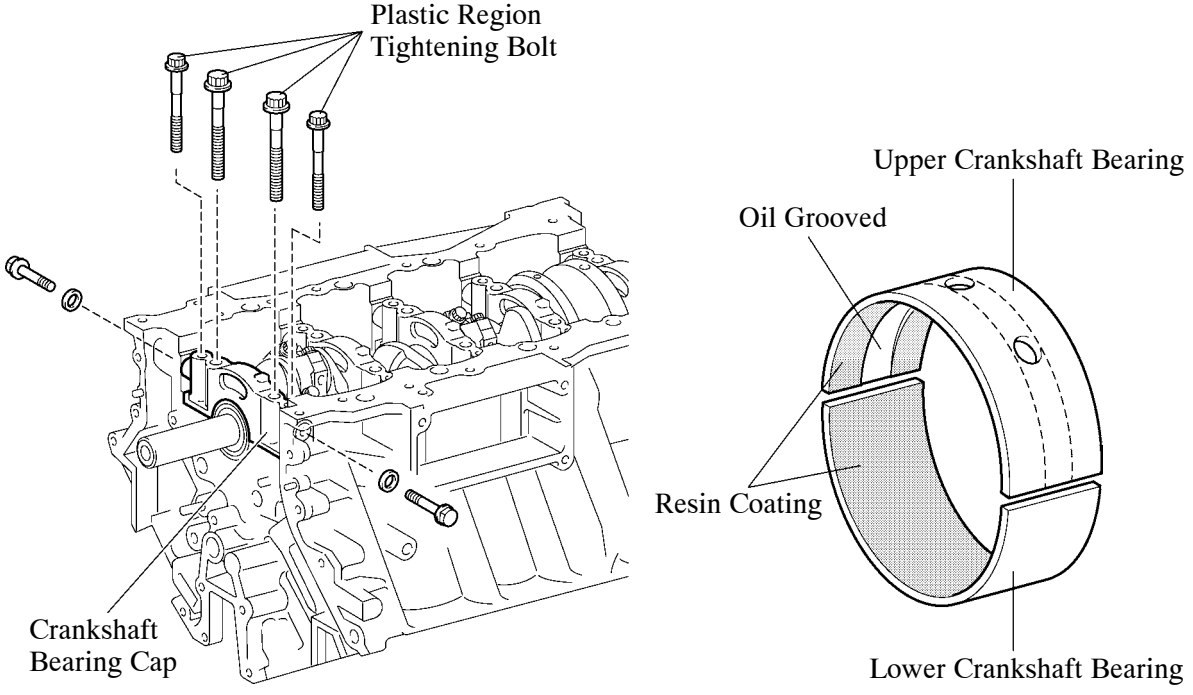
Crankshaft

- A crankshaft made of forged steel, which excels in rigidity and wear resistance, is used.
- The crankshaft has 5 main bearing journals and 6 balance weights.



Crankshaft Bearing and Crankshaft Bearing Cap

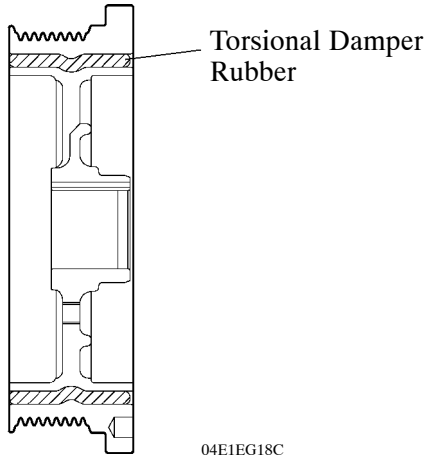
- The crankshaft bearings are made of aluminum alloy.
- The crankshaft bearings are reduced in width to reduce friction. The bearing lining surface is coated with resin to improve wear and seizure resistance.
- The upper crankshaft bearing has an oil groove around its inside circumference.
- The crankshaft bearing caps use 4 plastic region tightening bolts of different sizes in the inner and outer sides to secure the journals. This makes the crankshaft bearing caps more compact and lightweight. In addition, each cap has been tightened laterally to improve its reliability.



04E1EG17C

Crankshaft Pulley

The crankshaft pulley uses a torsional damper rubber and has been optimized to reduce noise and vibration.



04E1EG18C

Oil Pan

- The No. 1 oil pan is made of aluminum alloy.
- The No. 1 oil pan is secured to the cylinder block and the transmission housing to increase rigidity.
- The shape of the oil pan baffle plate has been optimized to ensure the proper space between the crankshaft and the engine oil surface. This enhances the separation of oil flow and ventilation gases, thereby reducing friction and improving lubrication performance.

