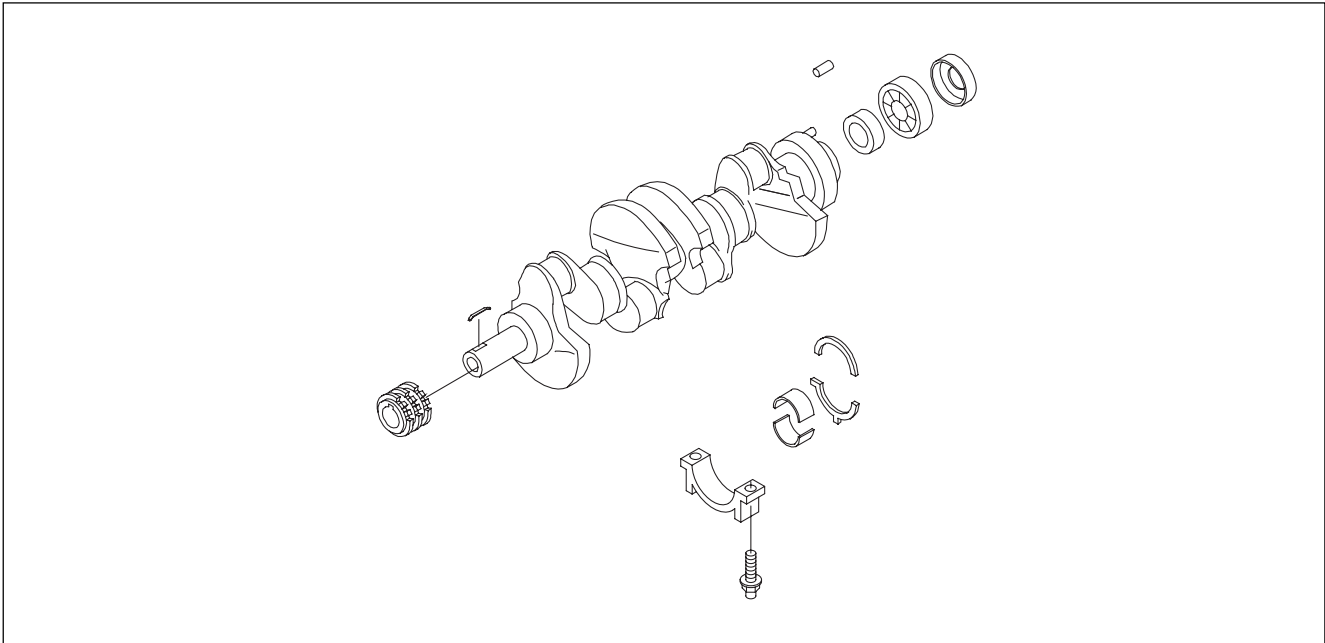


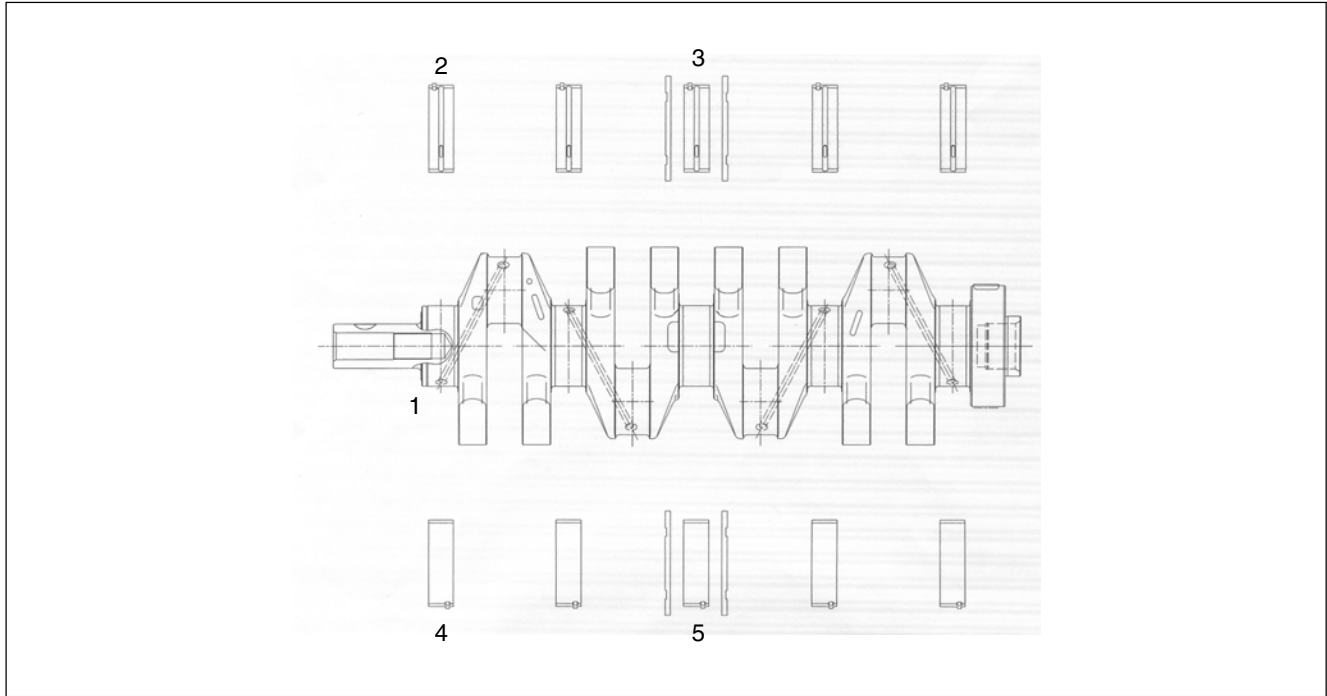
CRANKSHAFT

- ※ **Preceding Works:** Removal of end cover
 Removal of pistons
 Removal of crankshaft sprocket



- | | |
|--|--|
| 1. Crankshaft main bearing shells, upper | 5. Lower thrust bearing |
| 2. Upper thrust bearing | 6. Crankshaft main bearing cap |
| 3. Crankshaft | 7. Crankshaft thrust bearing cap |
| 4. Crankshaft main bearing shells, lower | 8. 12-sided stretch bolt..... 55 ± 5.0 Nm, 90° + 10° |

ARRANGEMENT OF THRUST WASHERS AND BEARINGS



- 1. Crankshaft
- 2. Crankshaft main bearing shells, upper
- 3. Upper thrust bearing
- 4. Crankshaft main bearing shells, lower
- 5. Lower thrust bearing

NOTICE

- The clearance between bearing shell and bore and between bearing shell and journal are various. Refer to the table on next page to select bearings when installing.

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► Dimensions of Crankshaft Main Bearing

Color	Crankshaft Journal	Upper Main Bearing	Lower Main Bearing
Blue	61.965 ~ 61.960	2.260 ~ 2.255	2.260 ~ 2.255
Yellow	61.960 ~ 61.955	2.265 ~ 2.260	2.265 ~ 2.260
Red	61.955 ~ 61.950	2.270 ~ 2.265	2.270 ~ 2.265
White	61.950 ~ 61.945	-	2.275 ~ 2.270
Violet	61.945 ~ 61.940	-	2.280 ~ 2.275

► Bearing Clearance

(mm)

Description		Crankshaft Bearing	Thrust Bearing
Radial clearance	When new	0.027 ~ 0.051	0.026 ~ 0.068
	Wear limit	Max. 0.070	Max. 0.080
Axial clearance	When new	0.100 ~ 0.254	-
	Wear limit	Max. 0.300	-

► Matching the Fit Bearing Journal Width to Thrust Washers

(mm)

Fit bearing Journal Width	Thrust Washer Thickness
26.300 ~ 26.333	2.15
26.400 ~ 26.433	2.20
26.500 ~ 26.533	2.25
26.700 ~ 26.733	2.35
26.800 ~ 26.833	2.40

NOTICE

- Measure the crankshaft axial clearance and correct if necessary with appropriate thrust washers.
- Thrust washers of the same thickness must be installed on both sides of the fit bearing.

► Matching the Crankshaft Bearing Shells to Basic Bearing Bore in Crankcase

Marking of Basic Bearing Bore in Lower Mating Surface	Relevant Crankshaft Bearing Shell With Color Coding
1 punch mark or blue	blue or white - blue
2 punch marks or yellow	yellow or white - yellow
3 punch marks or red	red or white - red

► **Matching Crankshaft Bearing Shells to Basic Bearing Journal of Crankshaft**

Marking of Bearing Journals on Crank Webs	Relevant Crankshaft Bearing Shell With Color Coding
blue or white - blue	blue or white - blue
yellow or white - blue	yellow or white - yellow
red or white - blue	red or white - red

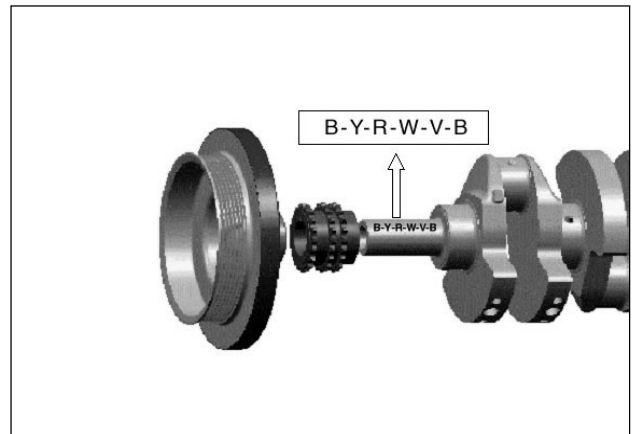
► **Selection of Upper Main Bearing Shell**

Punch Mark	Color
•	Blue
• •	Yellow
• • •	Red



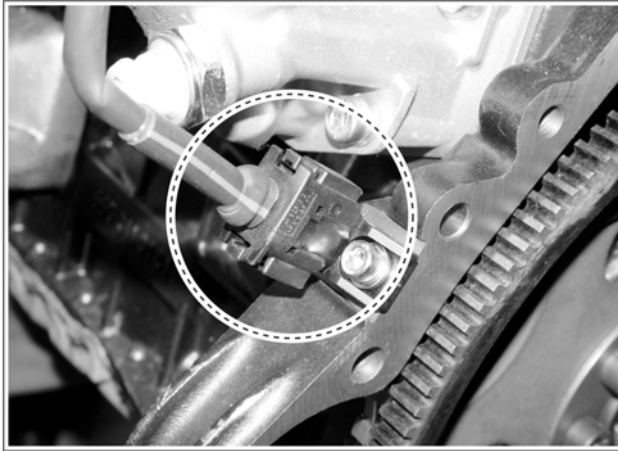
► **Selection of Lower Main Bearing Shell**

Mark	Color
B	Blue
Y	Yellow
R	Red
W	White
V	Violet

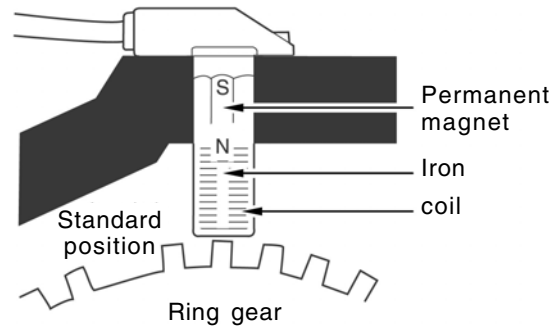


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► Crankshaft Position Sensor



<Location of Crankshaft Position Sensor>

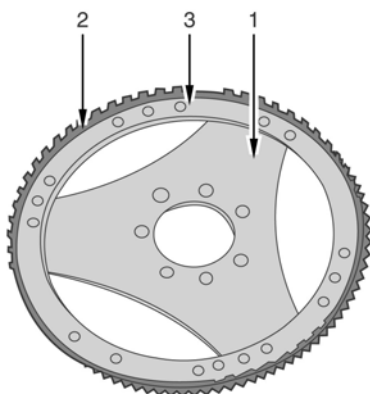


<Structure of Crankshaft Position Sensor>

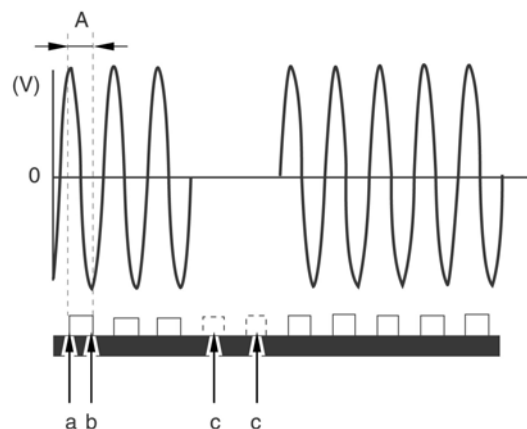
The crankshaft position sensor is located near to flywheel on the rear of cylinder block. It generates AC voltage between increment type driven plate that fixed on flywheel inside. The sensor consists of soft iron core that wined copper wire on permanent magnet and generates sign wave AC voltage when magnetism on the sensor wheel passes the sensor.

When the crankshaft rotates, '+' signal will be generated from near the front edge and '-' signal will be generated from near the rear edge among teeth on the driven plate near to crankshaft position. The AC voltage increases as the engine speed increases, however, no signal occurs from the 2-missing-tooth on the increment type driven plate. By using these teeth, ECU recognizes TDC of No. 1 and 5 cylinders.

ECU converts the alternative signals into digital signals to recognize crankshaft position, piston position and engine speed. The piston position that coupled with crankshaft is main factor in calculating injection timing. By analyzing the reference position and camshaft position sensor, can recognize No. 1 cylinder and calculate the crankshaft speed.



<Drive Plate>



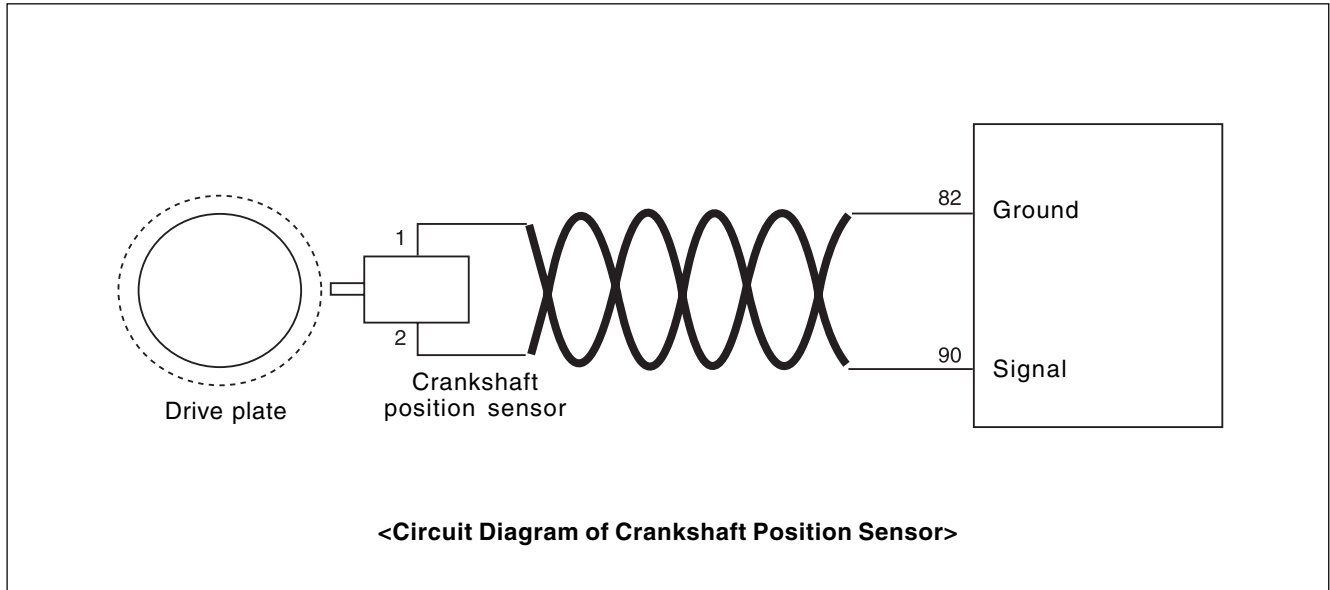
A. Distance between '+' max. voltage and '-' max. voltage

a. Front edge

b. Rear edge

c. 2-missing-tooth

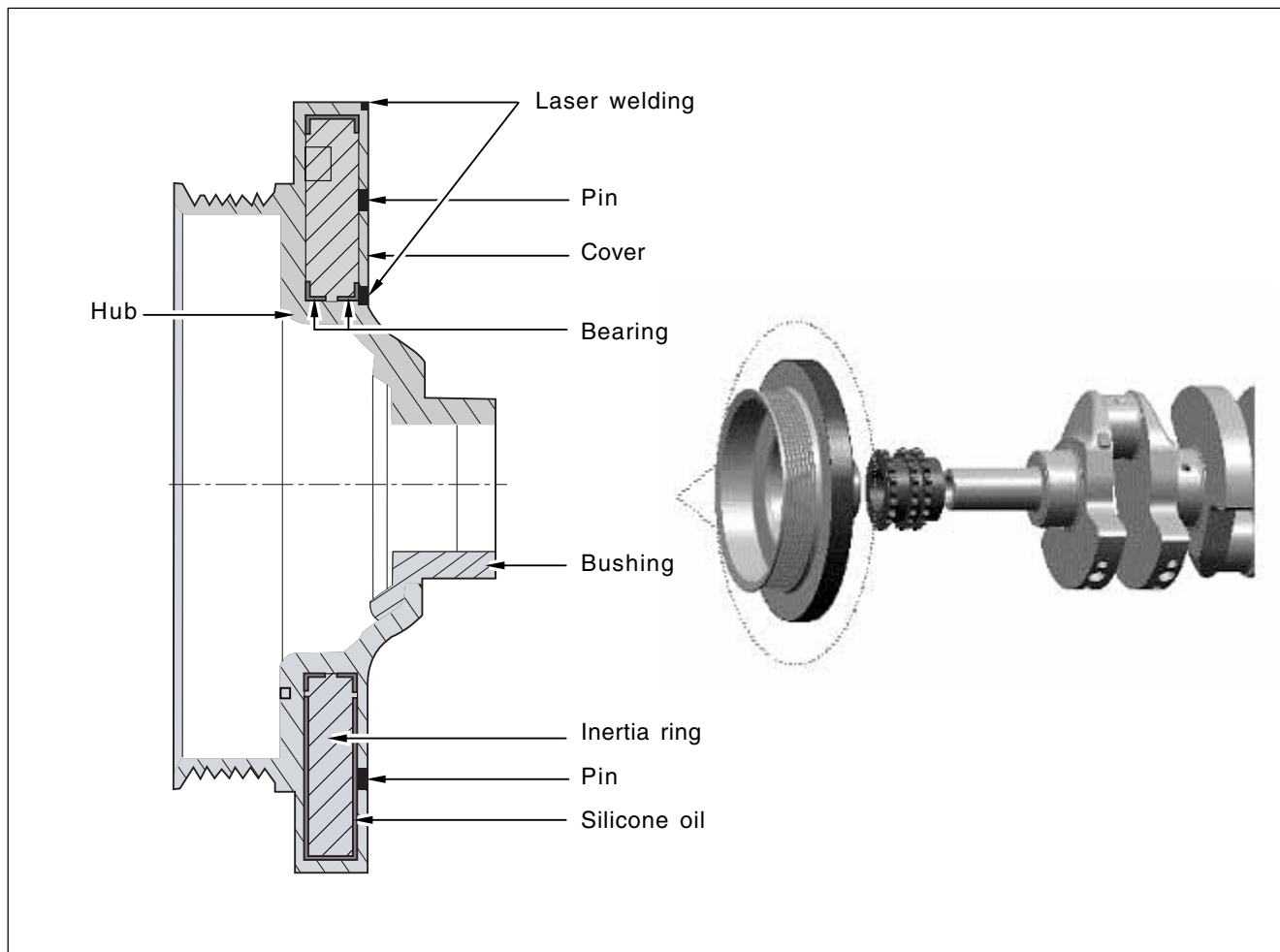
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Output voltage (1 ~ 150 V)	Min. voltage: 1.0 V (40 rpm, air gap: 1.3 mm)
	Max voltage: 150 V (7000 rpm, air gap: 0.3 mm)
Sensor unit coil resistance (Ω)	1,090 ± 15 %
Sensor air gap	0.7 ~ 1.5 mm
Operating temperature	- 40 ~ 150°C
Tightening torque	6 ~ 8 Nm

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TORSIONAL VIBRATION DAMPER



► System Description

1. Components: Hub, inertia ring, cover, bearing, bushing, silicone oil
2. Functions: The crankshaft pulley optimizes the drive system by reducing the amount of torsional vibration in crankshaft. Conventional rubber damper is limited in changing materials (rubbers) to absorb vibration, but this crankshaft pulley (viscous damper), using silicone oil, takes advantage of less changing viscosity according to the temperature.

DISASSEMBLY AND REASSEMBLY

1. Unscrew the bolts and remove the connecting rod journal bearing and bearing caps.

NOTICE

- Position the #1 piston at TDC and remove the piston connecting rod journal bearing caps.

2. Remove the bearing cap bolts.
3. Remove the bearing caps.

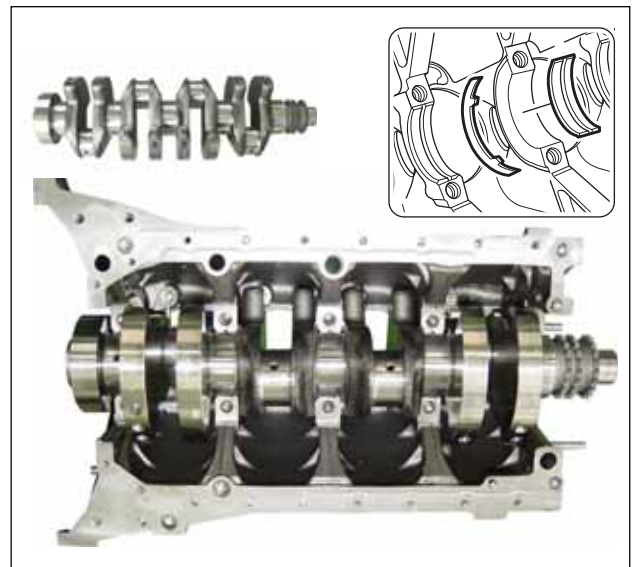
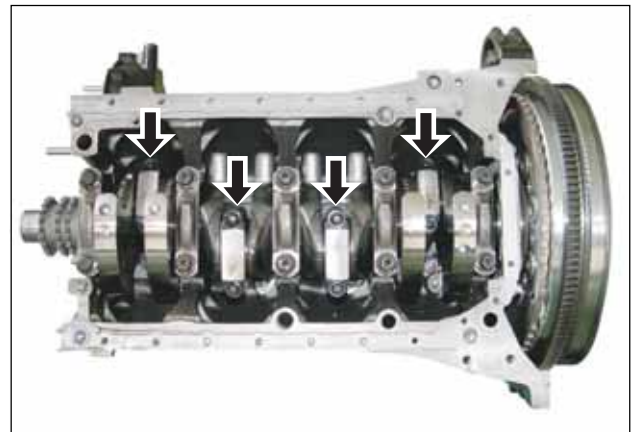
NOTICE

- The crankshaft bearing caps are marked with stamped numbers. Start to remove from the crankshaft pulley side.
- Do not mix up the bearing shells.

4. Remove the bearing caps and lower thrust bearing.
5. Separate the lower bearing shells from the bearing caps.
6. Remove the crankshaft.
7. Remove the upper thrust washers.
8. Remove the upper bearing shells from the crankcase.

NOTICE

- Do not mix up the bearing shells.



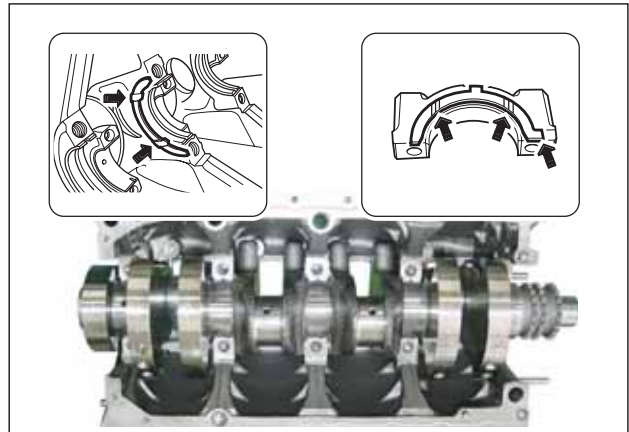
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Crankshaft - Reassembly

1. Thoroughly clean the oil galleries and check the journal section and bearings. Replace if necessary.



2. Coat the upper thrust washers with oil and insert into the crankcase so that the oil grooves are facing the crank webs (arrow).
3. Coat the lower thrust washers with oil and insert into the crankcase so that the oil grooves are facing the crank webs (arrow).

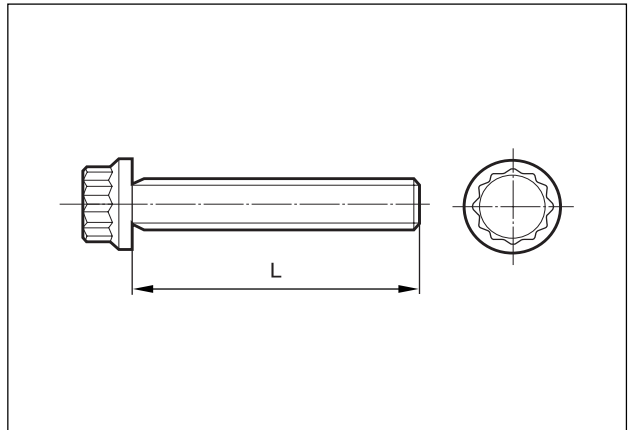


NOTICE

- The retaining lugs should be positioned in the grooves (arrow).

NOTICE

- If the maximum permissible length of $L = 63.8$ mm is exceeded, the 12-sided stretch bolts should be replaced.



4. Coat the new crankshaft with engine oil and place it on the crankcase.
5. Install the crankshaft bearing caps according to the markings and tighten the bolts.

Installation Notice

Tightening torque	55 ± 5 Nm + 90° + 10°
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- **Install from #1 cap.**



6. Position the #1 piston at TDC and install the crankshaft.
7. Install the piston connecting rod journal to the crankshaft journal and tighten the bolts.
8. Measure the crankshaft bearing axial clearance.
 - 1) When new: 0.100 ~ 0.266 mm
 - 2) When used: 0.300 mm
9. Rotate the crankshaft by hand and check whether it rotates smoothly.



GENERAL

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EXHAUST

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COOLING

FUEL

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SENSOR

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