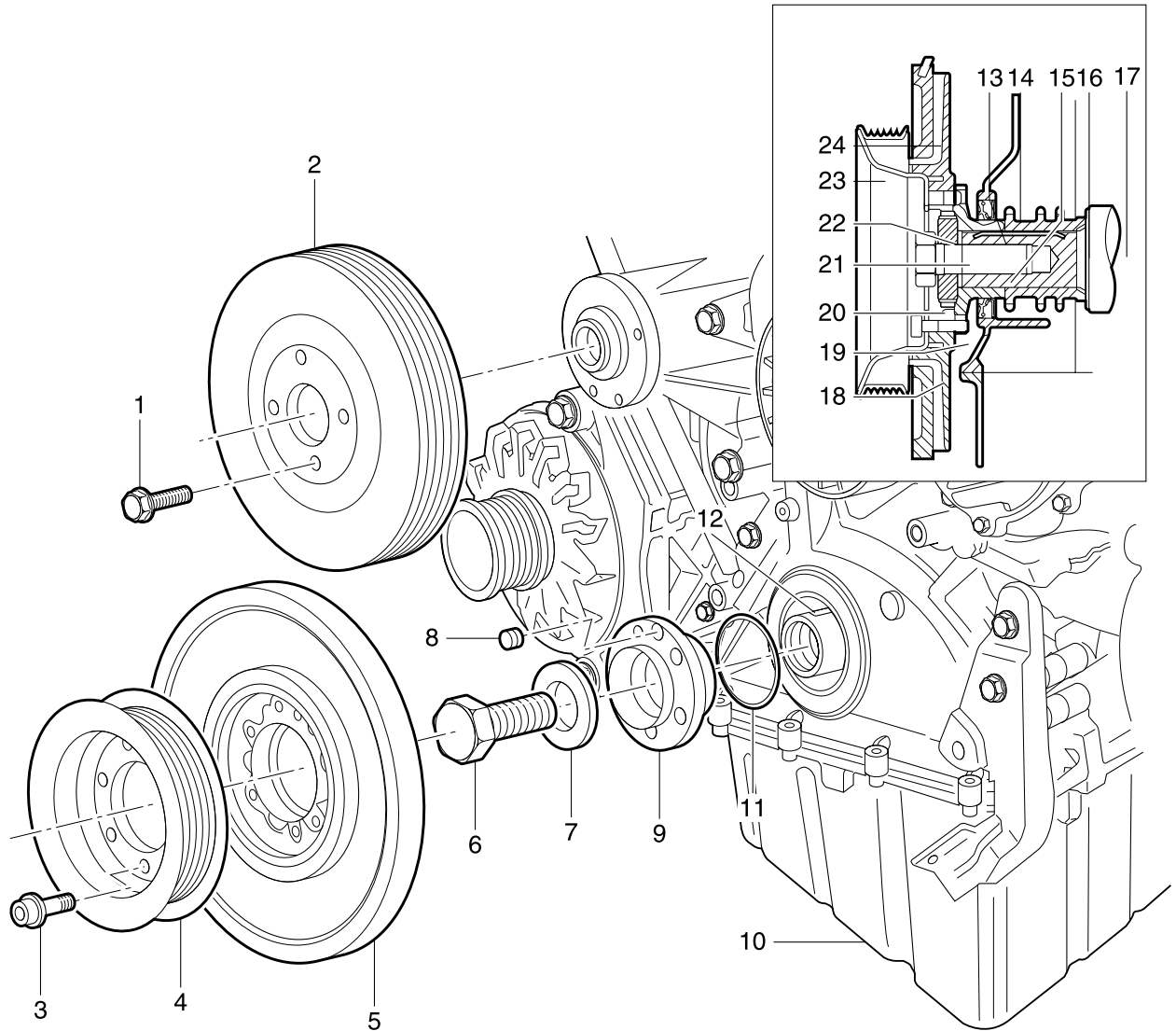


CRANKSHAFT ASSEMBLY

VIBRATION DAMPER AND HUB

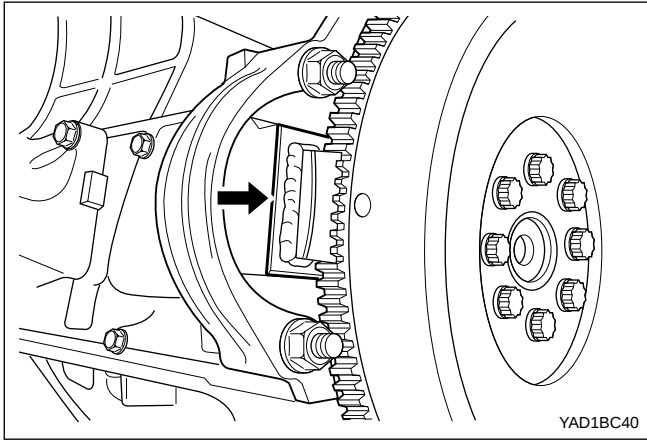
Preceding Work: Removal of the cooling fan
Removal of poly V-belt



YAD1BDQ0

1B3-58 DIESEL ENGINE MECHANICAL

1 Bolt	10 N•m (89 lb-in)	13 Radial Seal	
2 Cooling Fan Belt Pulley		14 Timing Gear Case Cover	
3 Socket Bolt	23 N•m (17 lb-ft)	15 Key	
4 Crankshaft Belt Pulley		16 Crankshaft Sprocket	
5 Vibration Damper		17 Crankshaft	
6 Bolt	200 N•m (148 lb-ft)+ 90°	18 Socket Bolt	23 N•m (17 lb-ft)
7 Washer		19 Washer	
8 Straight Pin		20 Bolt	20 N•m (148 lb-ft)+ 90°
9 Hub		21 Hub	
10 Oil Pan		22 Straight Pin	
11 Radial Seal		23 Crankshaft Velt Pulley	
12 Key		24 Vibration Damper	



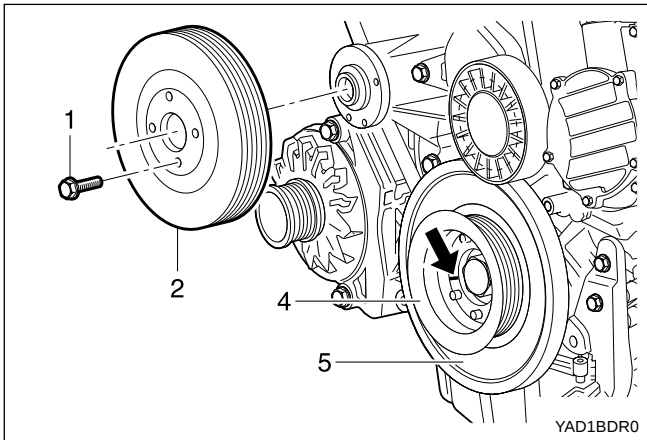
Tools Required

- 103 589 00 33 00 Puller
- 601 589 03 14 00 Sleeve
- 602 589 00 40 00 Engine Lock

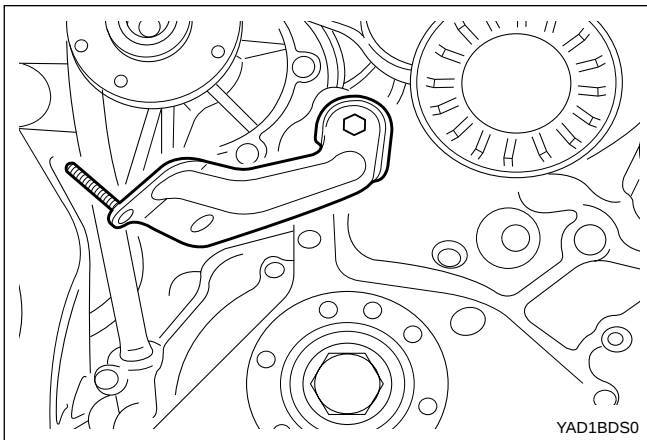
Removal Procedure

1. Remove the starter motor and install the engine lock 602 589 00 40 00 into the flywheel ring gear.
2. Remove the poly V-belt.
3. Remove the cooling fan.

Notice: Keep the fan in vertical position.

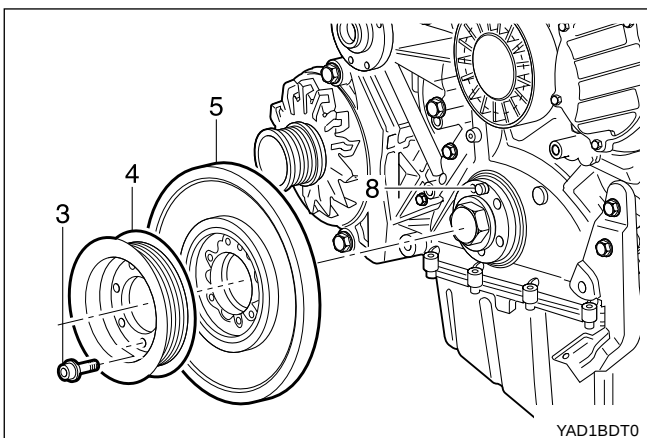


4. Remove the cooling fan belt pulley (2).
5. Place alignment marks (arrow) on the vibration damper (5) and crankshaft belt pulley (4).

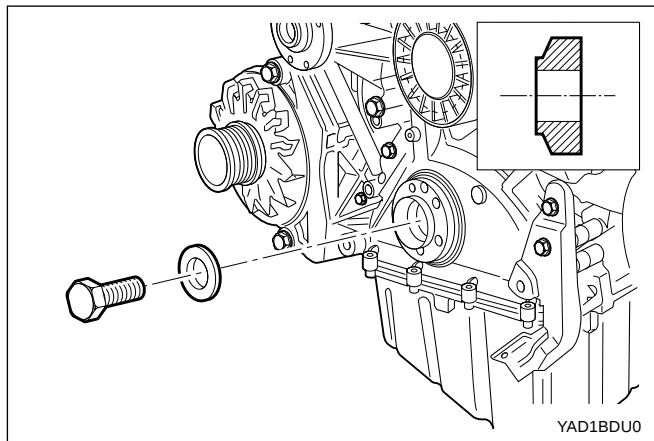


6. Remove the timing sensor bracket.

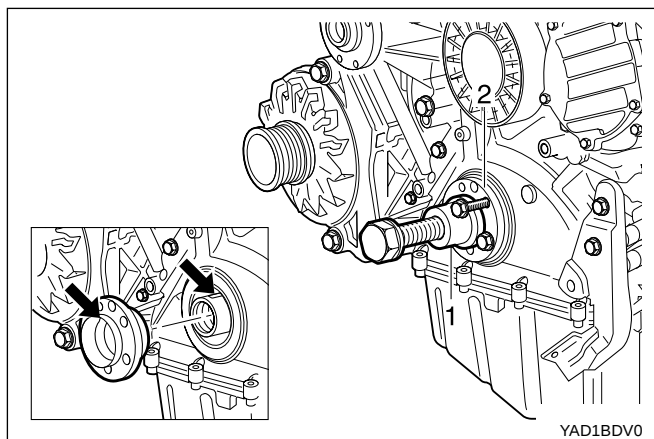
Notice: Remove if necessary.



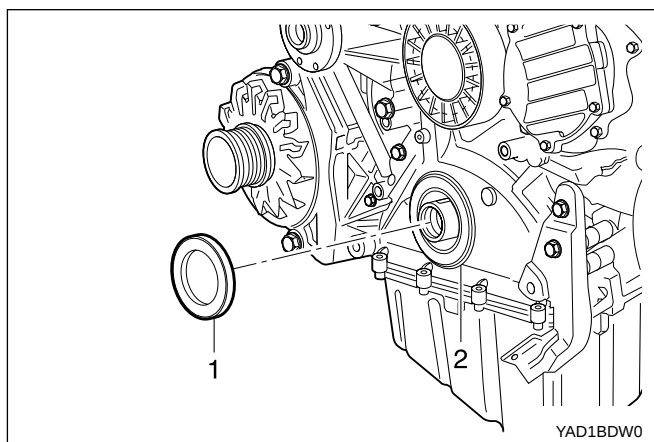
7. Remove the socket bolts (3) and then remove the belt pulley (4) and vibration damper (5).



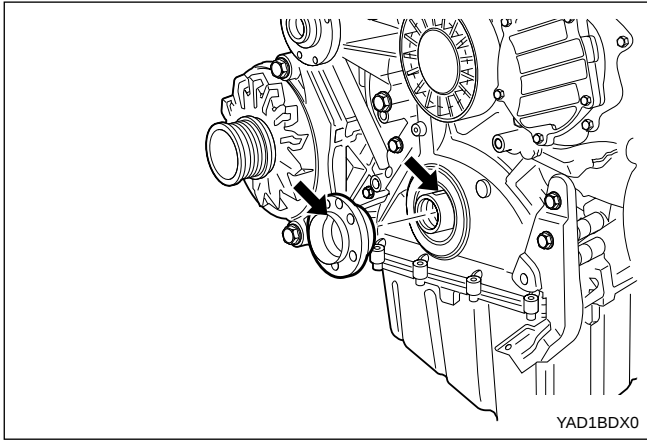
8. Remove the washer and bolt.



9. Remove the hub by using a puller 103 589 00 33 00.



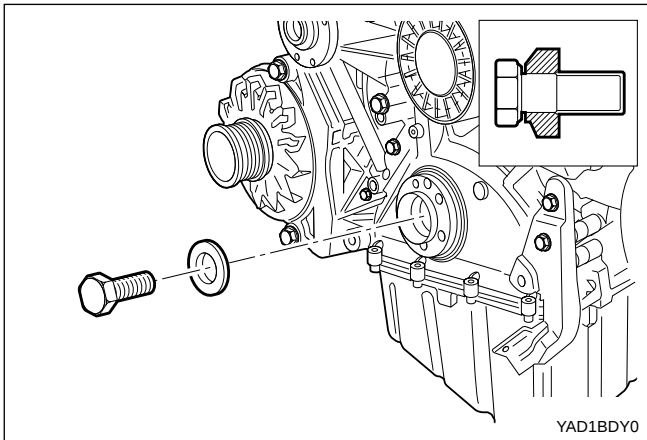
10. Pull out the radial seal (1) and be careful not to damage the sealing surface of timing case cover.



Installation Procedure

1. Install the hub.

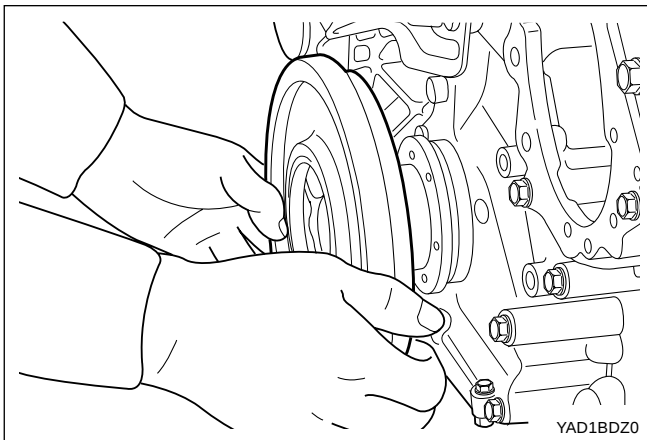
Notice: Exactly align the woodruff key and the groove of hub (arrow).



2. Install the washer and tighten the bolt.

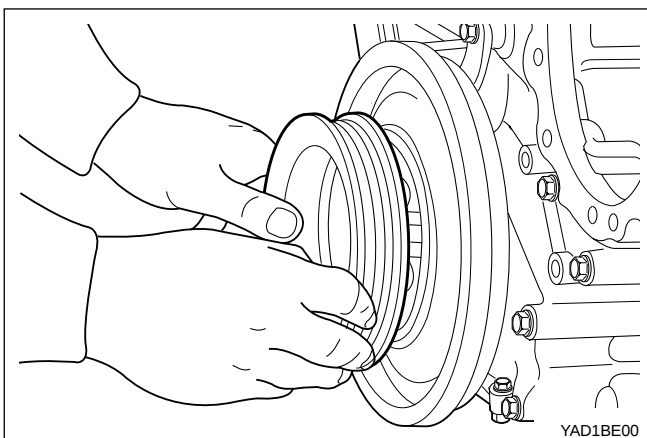
Installation Notice

Tightening Torque	200 N•m (148 lb-ft)+ 90°
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3. Install the vibration damper.

Notice: Exactly align and insert onto the straight pin.

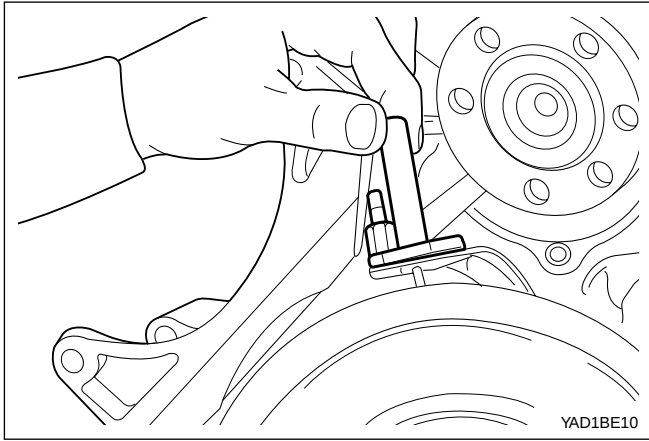


4. Install the crankshaft belt pulley.

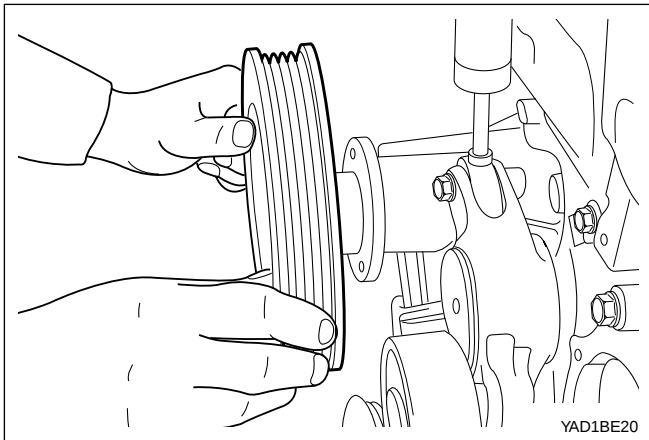
Installation Notice

Tightening Torque	23 N•m (17 lb-ft)
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Align the alignment marks.



5. Install the timing sensor bracket.
Refer to "TDC Setting" in this section.

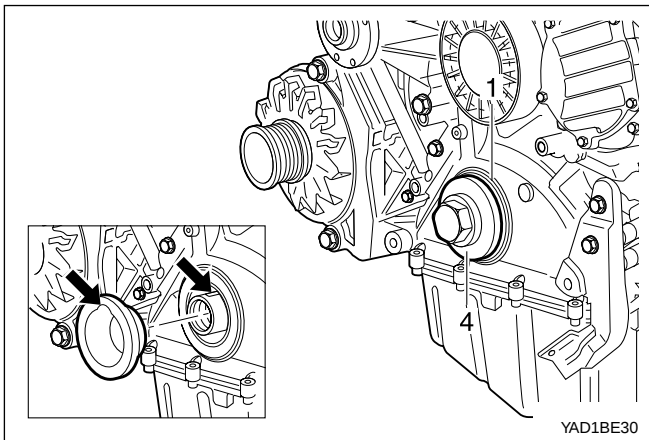


6. Install the cooling fan pulley.

Installation Notice

Tightening Torque	10 N•m (89 lb-in)
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7. Install the cooling fan.
8. Install the fan belt.
9. Remove the engine lock 602 589 00 40 00.

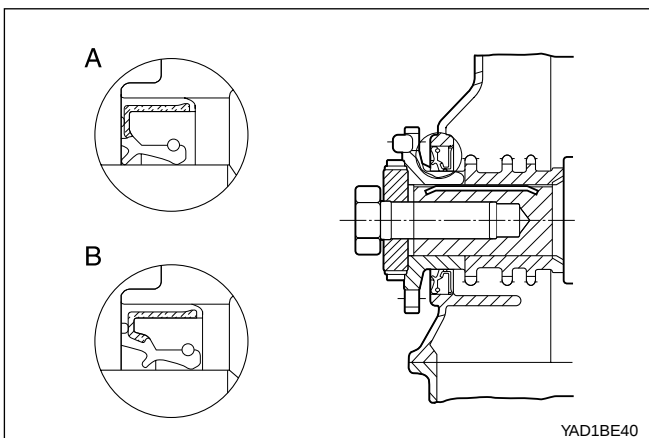


10. Thoroughly clean the mounting bore of the radial seal.
11. Coat a little oil on the sealing lip of new radial (1) and contact surface.

Notice: Don't use grease.

12. Install the radial seal (1) by using a sleeve 601 589 03 14 00 (4).

Notice: Align the groove of sleeve and woodruff key (arrow).

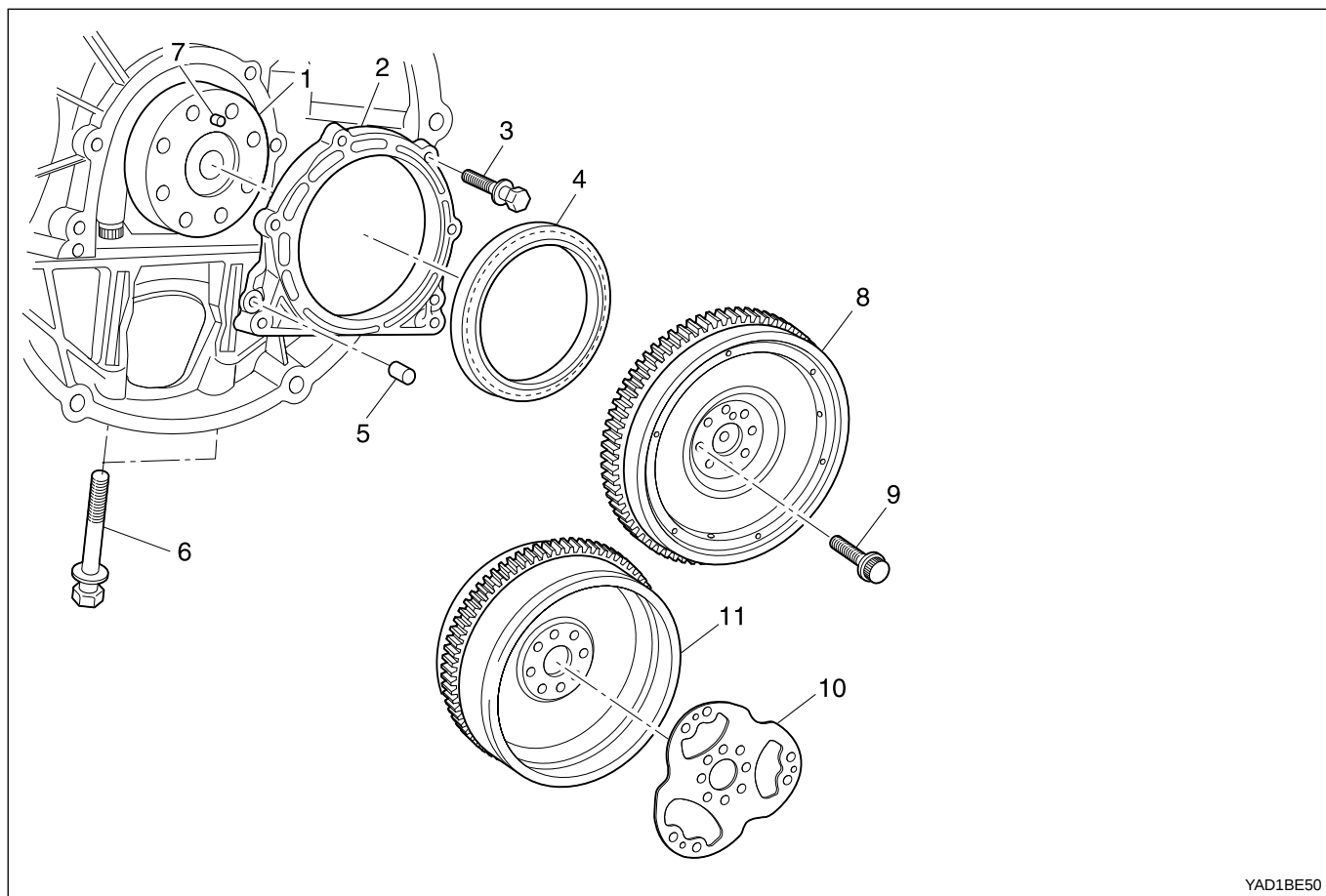


Notice: The sealing lip of the repair radial seal is offset to the inside by 2 mm to ensure that it does not run in any groove which the standard radial seal may have left on the crankshaft flange.

- A Standard Radial Seal
- B Repair Radial Seal

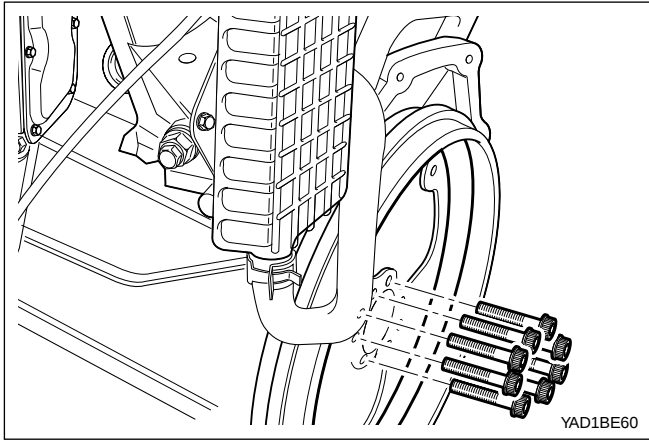
FLYWHEEL AND CRANKSHAFT END COVER

Preceding Work: Removal of the transmission
Removal of the clutch



YAD1BE50

- | | |
|---|---|
| 1 Crankshaft Flange | 7 Straight Pin |
| 2 End Cover Clean Loctite 573 | 8 Flywheel (Manual Transmission) |
| 3 Bolt..... 10 N•m (89 lb-in) Loctite 573 | 9 12-Sided Stretch Bolt |
| 4 Radial Seal..... Replace | Check, 45 N•m (33 lb-ft)+ 90° |
| 5 Dowel Sleeve | 10 Drive Plate (Automatic Transmission) |
| 6 Bolt..... 10 N•m (89 lb-in) Loctite 573 | 11 Flywheel (Automatic Transmission) |



Tools Required

601 589 03 43 00 Oil Seal Assembler

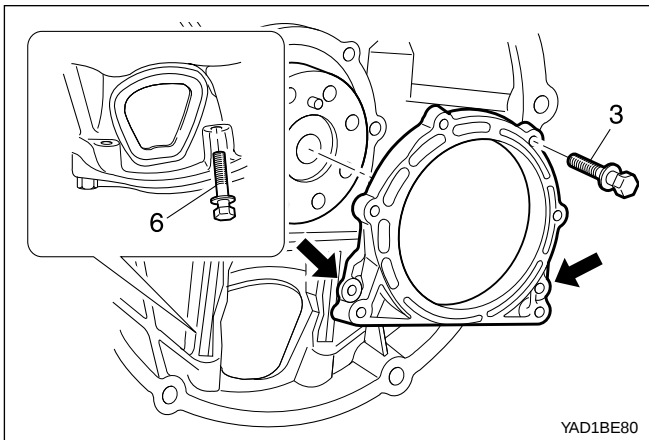
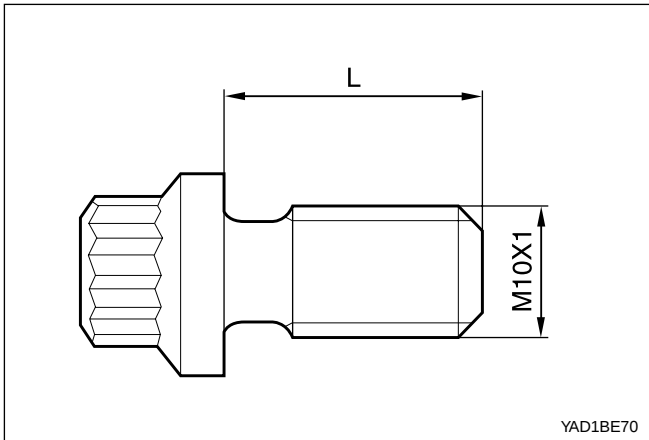
602 589 00 40 00 Engine Lock

Removal Procedure

1. Install the engine lock 602 589 00 40 00.
2. Remove the 12-sided stretch bolts.

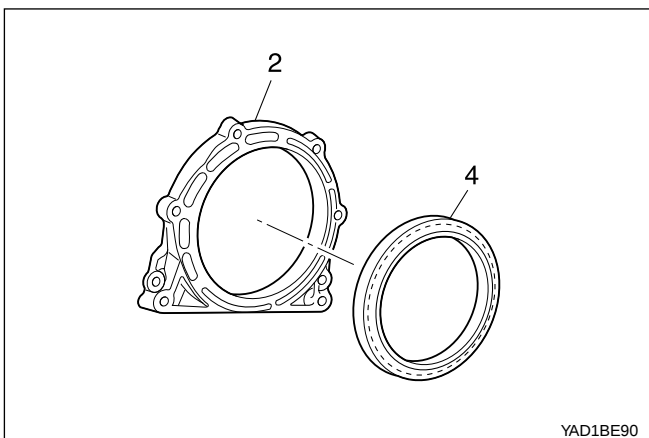
Notice: Remove the flywheel and drive plate, if equipped with automatic transmission.

Notice: If the length 'L' of bolts exceeds 22.5 mm, replace the bolts.

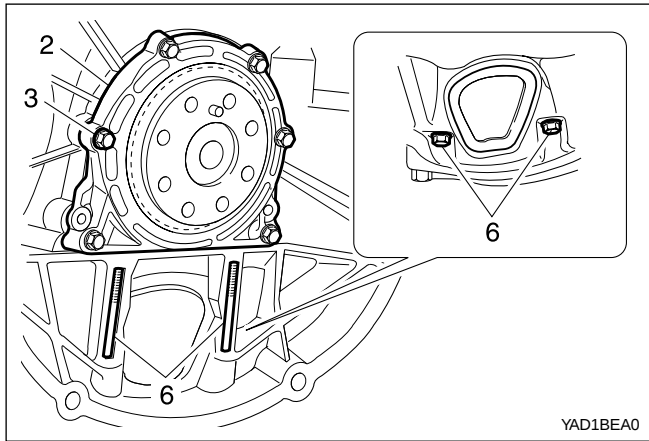


3. Remove the bolts (3. 6) from end cover, by pulling out the lug (arrow), remove the cover.

Notice: Be careful not to damage the oil pan gasket.



4. Remove the radial seal (4) with care not to damage the sealing surface.



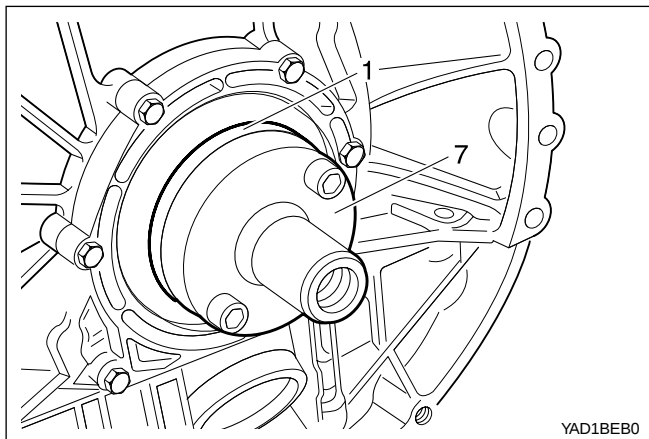
Installation Procedure

1. Thoroughly clean the sealing surface of end cover and apply Loctite 573.
2. Clean the groove of radial seal.
3. Apply Loctite 573 on the bolts and install the end cover.

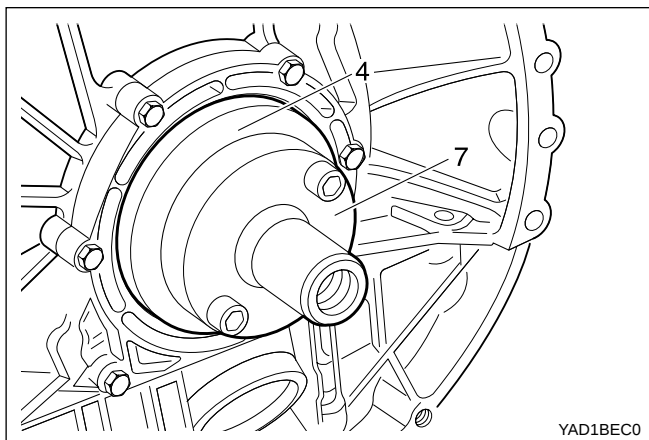
Installation Notice

Tightening Torque	10 N•m (89 lb-in)
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Be careful not to damage the oil pan gasket.



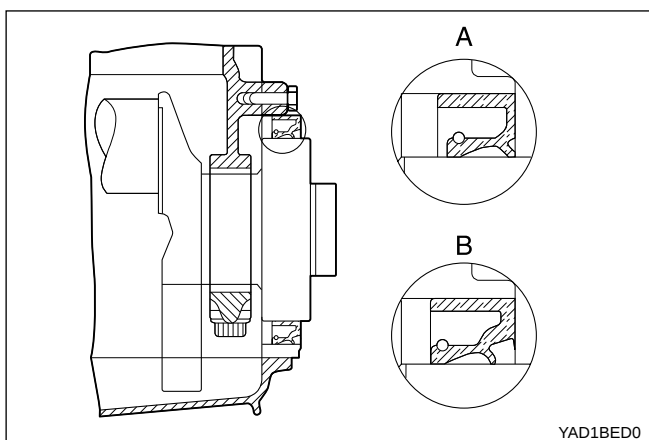
4. Install the inner oil seal assembler 601 589 03 43 00 to the crankshaft flange.



5. Coat a little oil on the sealing lip of new radial seal and contacting surface.

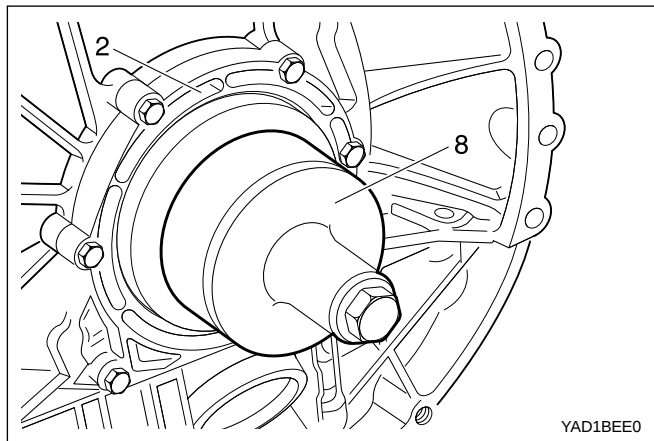
Notice: Don't use grease.

6. Insert the new radial seal (4) on to the oil seal assembler 601 589 03 43 00 (7).



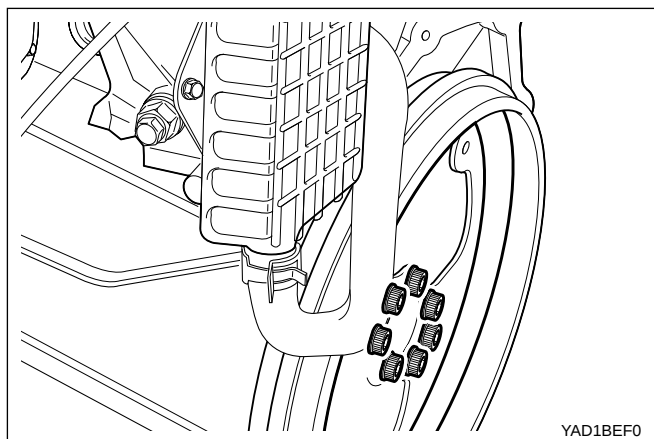
Notice: The sealing lip of the repair radial seal is offset to the inside by 3 mm to ensure that it does not run in any groove which the standard radial seal may have left on the crankshaft flange.

- A Standard Radial Seal
B Repair Radial Seal



7. Install the outer oil seal assembler 601 589 03 43 00 on the seal and by tightening the bolts, press the radial seal into the end cover as far as the stop.

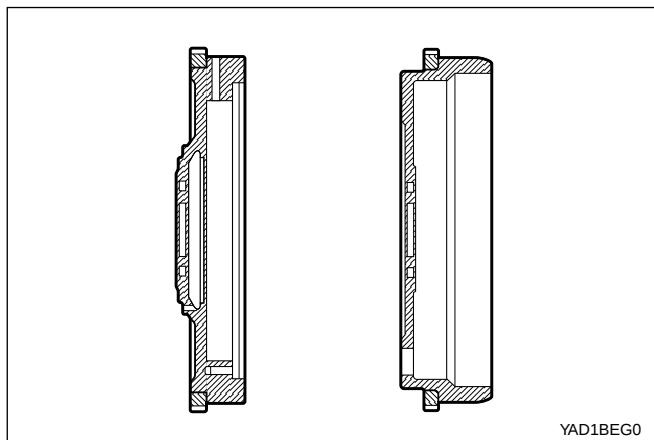
Notice: The seal must be positioned exactly at right angles in the end cover to ensure that it provide a proper seal.



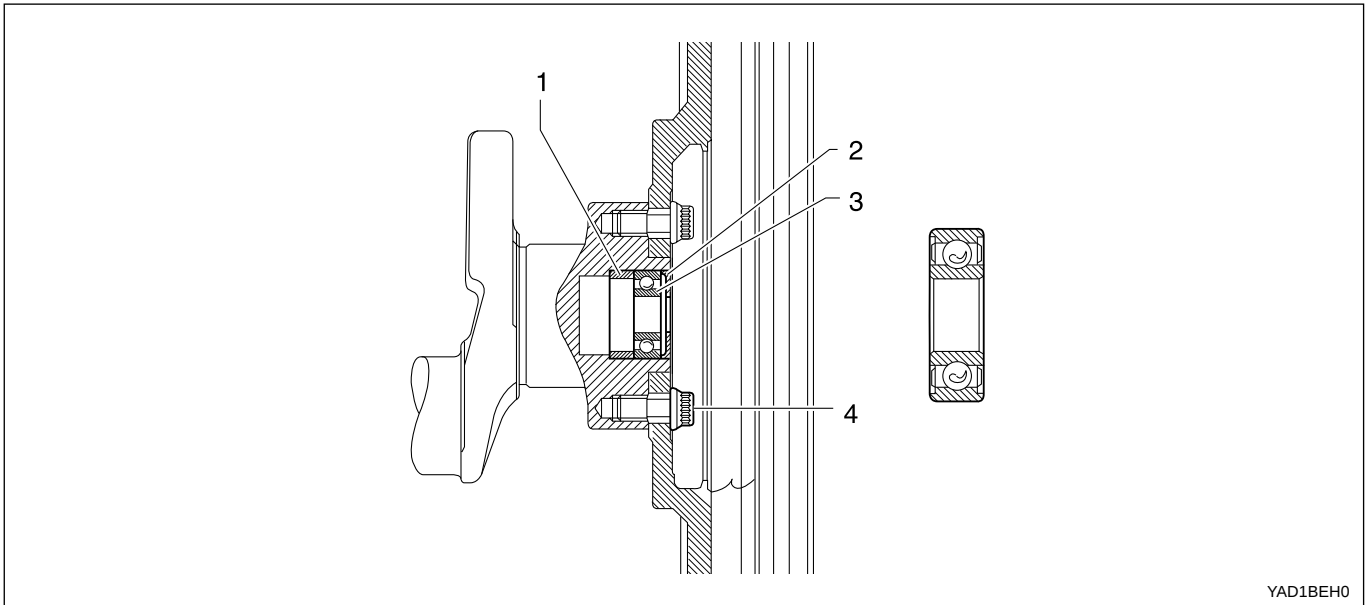
8. Install the flywheel.

Installation Notice

Tightening Torque	45 N•m (33 lb-ft)+ 90°
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CRANKSHAFT BALL BEARING



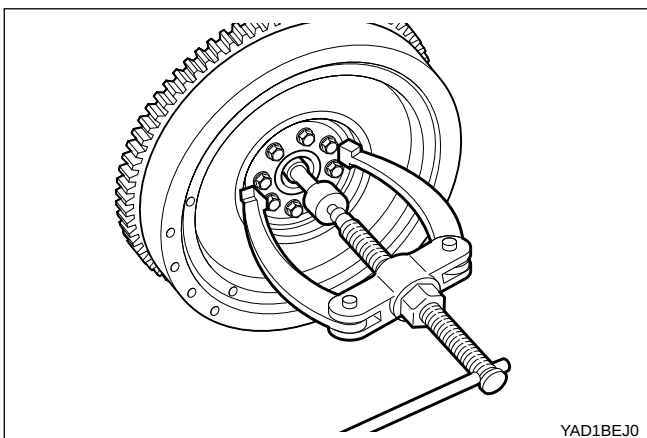
YAD1BEH0

- | | | | |
|---------------|---------|----------------|------------------------|
| 1 Spacer | | 3 Ball Bearing | |
| 2 Cover | Replace | 4 Bolt | 45 N•m (33 lb-ft)+ 90° |

Notice: Manual transmission only.

Tools Required

- 000 589 25 33 00 Internal Extractor
000 589 33 33 00 Counter Support



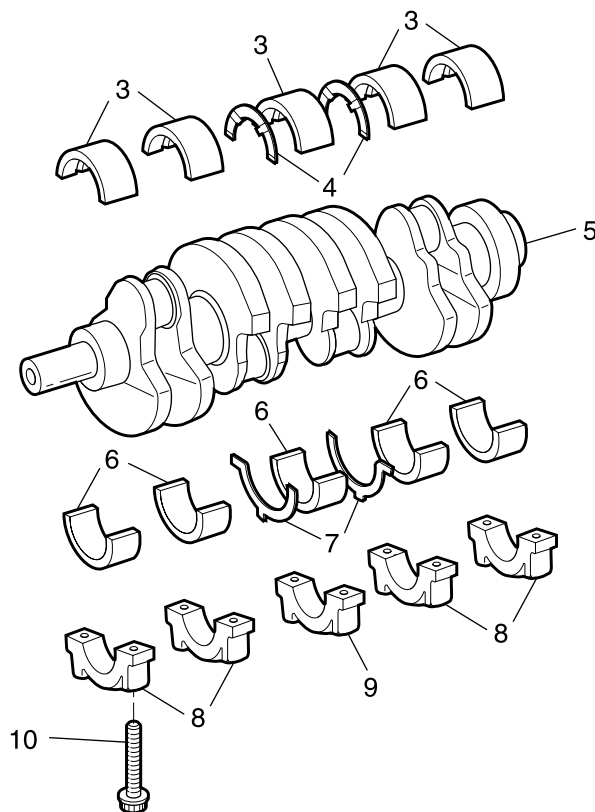
YAD1BEJ0

Removal & Installation Procedure

1. Remove the manual transmission.
2. Using a internal extractor 000 589 25 33 00 and counter support 000 589 33 33 00, pull out the locking ring and ball bearing together.
3. Apply Loctite 241 on the new ball bearing and then insert the ball bearing to be stopped at the spacer ring by using a proper mandrel.

CRANKSHAFT

Preceding Work: Removal of the end cover
Removal of the piston
Removal of the crankshaft sprocket

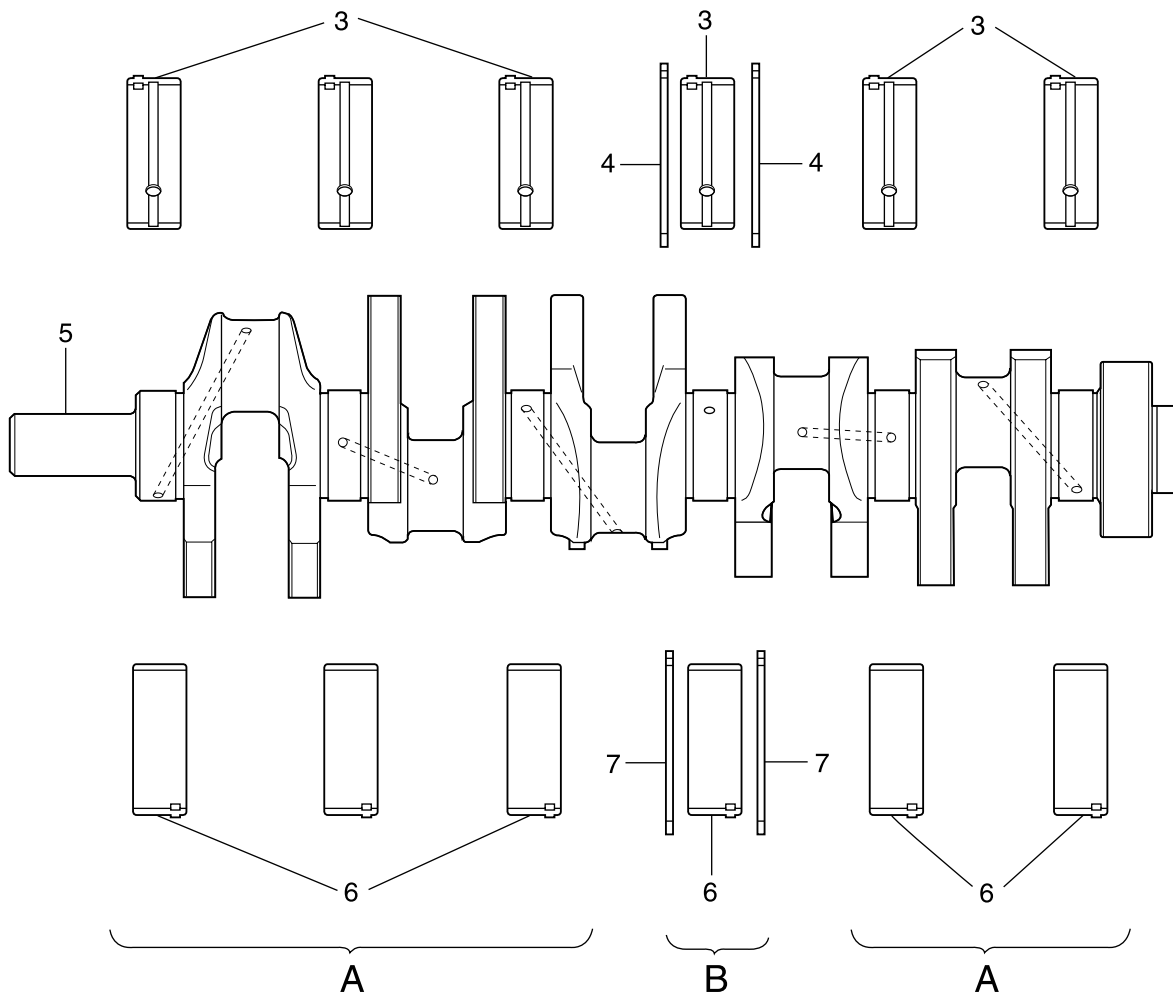


YAD1BEK0

- 3 Crankshaft Main Bearing Shells (Upper)
- 4 Thrust Bearings (Upper)
- 5 Crankshaft
- 6 Crankshaft Main Bearing Shells (Lower)

- 7 Thrust Bearings (Lower)
- 8 Crankshaft Bearing Cap
- 9 Crankshaft Bearing Cap (Fit Bearing)
- 10 12-sided Stretch Bolts.... 55 N•m (41 lb-ft)+ 90°

Thrust Washer and Bearing Arrangement



YAD1BEL0

- 3 Crankshaft Main Bearing Shells (Upper)
- 4 Thrust Bearings (Upper)
- 5 Crankshaft
- 6 Crankshaft Main Bearing Shells (Lower)
- 7 Thrust Bearings (Lower)

- A Radial Bearings
- B Radial and Axial Bearings (Thrust Bearing)

Notice: The gaps between the bearing shell and bore and between the bearing shell and journal are different each other. Refer to service data.

Crankshaft Standard and Repair Sizes

	Crankshaft bearing journal diameter	Thrust bearing journal width	Thrust bearing journal diameter
Standard size	50.950 - 57.965	24.500 - 24.533	47.950 - 47.965
		24.600 - 24.633	
Repair size 1	57.500 - 57.715	24.700 - 24.733	47.700 - 47.715
Repair size 2	57.450 - 57.465	24.900 - 24.933	47.450 - 47.650
Repair size 3	57.200 - 57.215	25.000 - 25.033	47.200 - 47.215
Repair size 4	56.950 - 56.965	-	46.950 - 46.965

Bearing Clearances

		Crankshaft bearing	Thrust bearing
Radial clearances	New	0.027 - 0.051 mm	0.026 - 0.068 mm
	Limit	Max. 0.070 mm	Max. 0.080 mm
Axial clearances	New	0.100 - 0.254 mm	-
	Limit	Max. 0.300 mm	-

Matching Fit Bearing Journal Width to Thrust Bearings

Fit bearing journal width	Thrust bearings thickness
24.500 - 24.533 mm	2.15 mm
24.600 - 24.633 mm	2.20 mm
24.700 - 24.733 mm	2.25 mm
24.900 - 24.933 mm	2.35 mm
25.000 - 25.033 mm	2.40 mm

Notice:

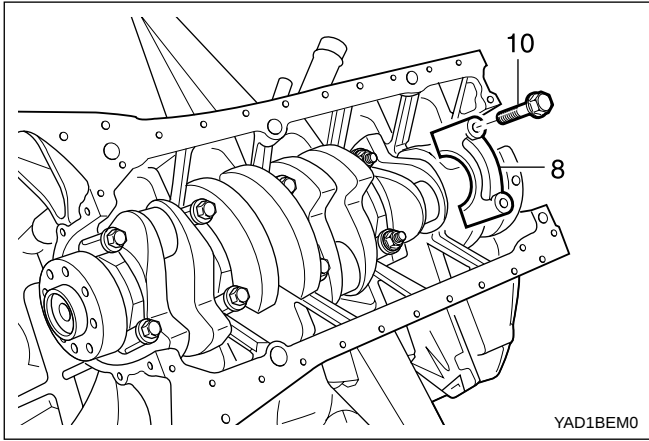
- Measure crankshaft axial clearance and adjust with proper thrust Bearing.
- The same thickness of washer must be installed on both sides of the fit bearing.

Matching Crankshaft Bearing Shells to Basic Bearing Bore in Crankshaft

Marking of basic bearing bore in lower parting surface	Color code of relevant crankshaft bearing shell
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	Color code of relevant crankshaft bearing shell
Blue or white-blue	Blue or white-blue
Yellow or white-blue	Yellow or white-yellow
Red or white-blue	Red or white-red



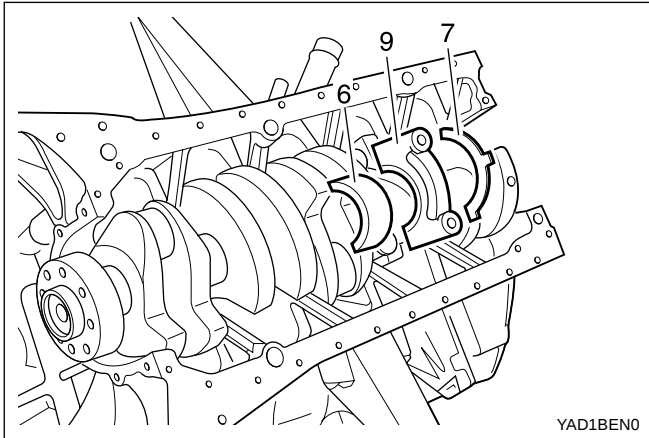
Tools required

- 001 589 53 21 00 Dial Gauge
- 363 589 02 21 00 Dial Gauge Holder
- 366 589 00 21 05 Extension

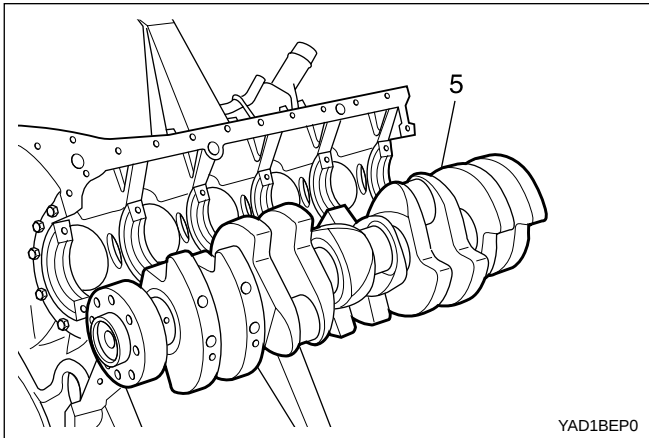
Removal & Installation Procedure

1. Remove the bearing cap bolt.
2. Remove the bearing caps (8).

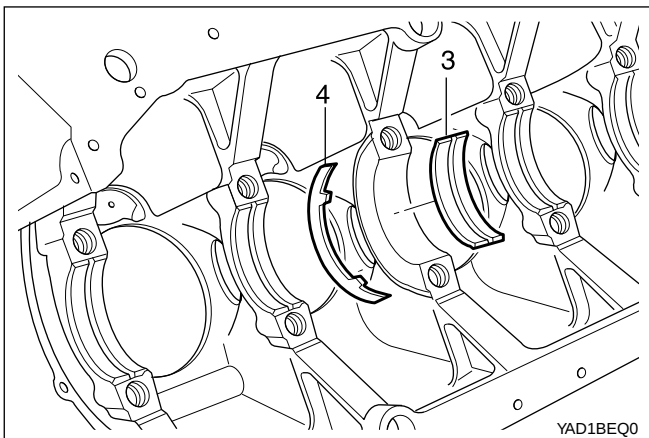
Notice: The crankshaft bearing caps are marked with stamped numbers. Remove the bearing cap from the vibration damper side.



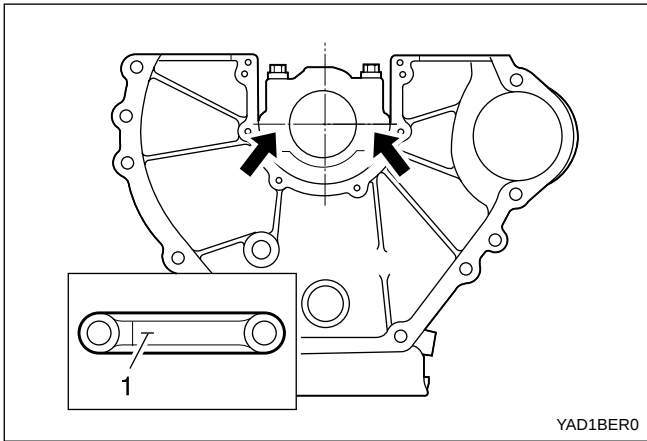
3. Remove the crankshaft bearing caps (9) and lower thrust bearings (7).
4. Remove the lower bearing shell (6) from the bearing cap (9).



5. Remove the crankshaft (5).



6. Remove the upper thrust bearings (4).
7. Remove the upper bearing shells (3) from crankcase.



8. Thoroughly clean the oil gallery.
9. Select a proper new bearing shells with reference to table.
10. Coat the new bearing shells with oil and insert into the crankcase and into the crankshaft bearing caps.

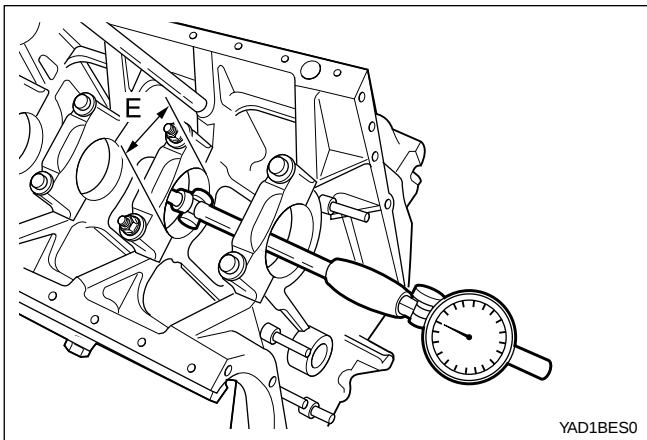
Notice: Do not mix up upper and lower crankshaft bearing shells.

11. Install the bearing caps according to marking and tighten the 12-sided stretch bolts.

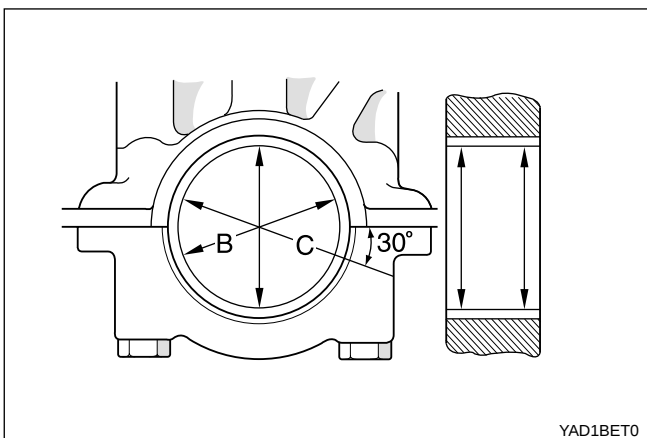
Installation Notice

Tightening Torque	55 N•m (41 lb-ft)+ 90°
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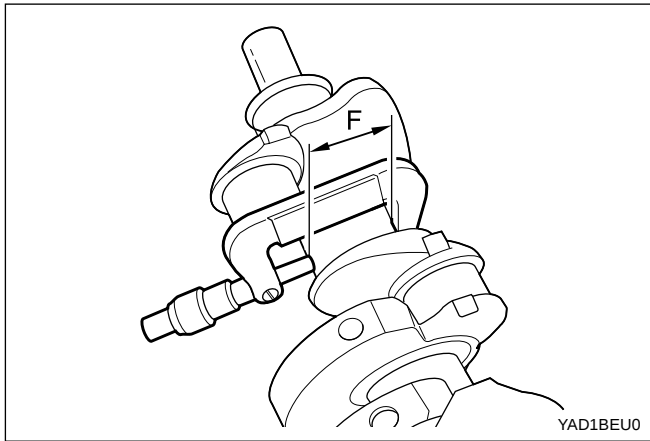
No. 1 is vibration damper side.



12. Measure crankshaft bearing diameters (E) using the dial gauge 001 589 53 21 00 and extension 366 589 00 21 05.

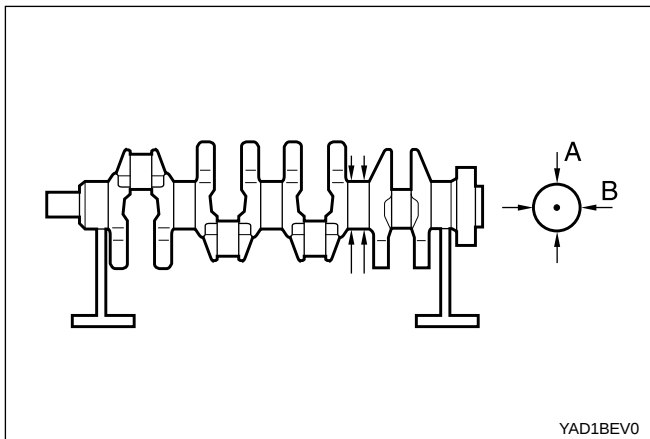


13. Measure at 3 points (A, B and C) and if the average value of B and C is less than A's value, the average value of B and C is the mean value and if more than A's value, A's value is the mean value.



14. Measure crankshaft bearing journal diameter (F).

Notice: When measured in A and B, the runout should not exceed 0.010 mm.

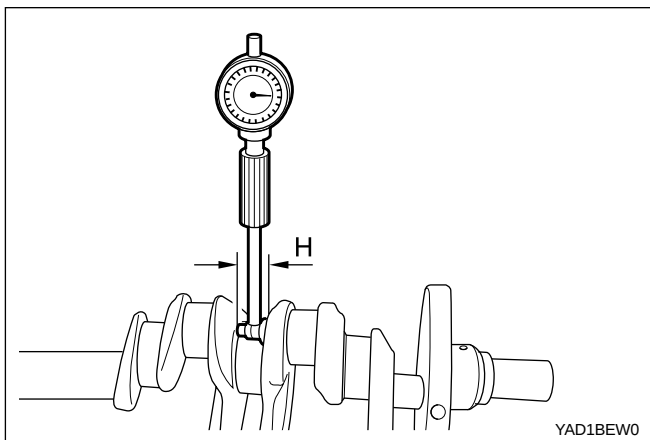


15. Measure radial clearance of crankshaft bearing (G).

Clearance 'G'	0.027 - 0.051 mm
---------------	------------------

Notice: If 'G' is out of standard, replace the bearing shells and adjust the radial clearance of crankshaft bearing.

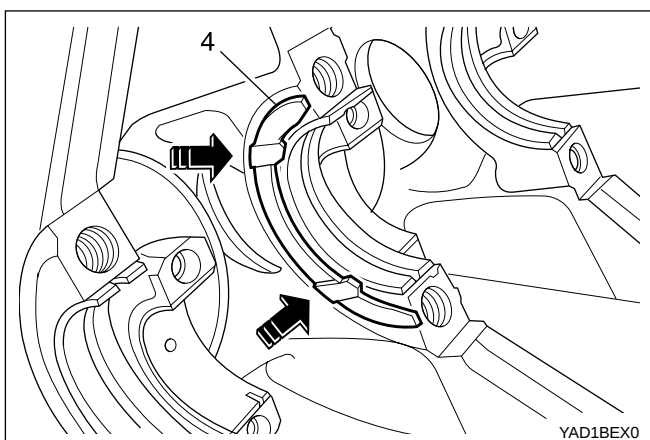
Example) Measured value 'E' = 57.700 mm
 Measured value 'F' = 57.659 mm
 Clearance 'G' = 0.041 mm



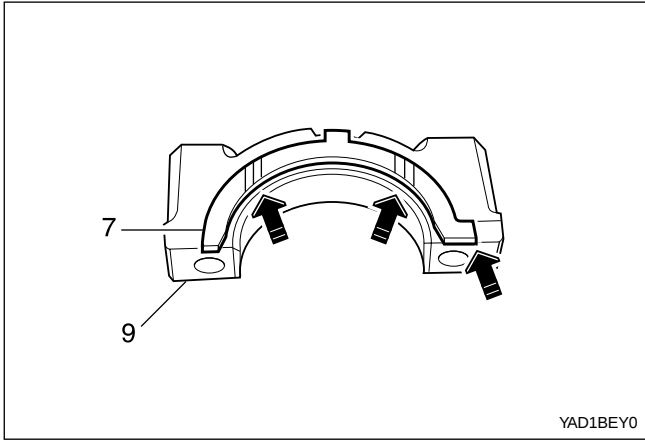
16. Remove the crankshaft bearing cap.

17. Measure width of thrust bearing journal (H) and adjust with proper thrust bearings (see table).

Notice: The same thickness of thrust washers should be installed on both sides of the thrust bearing.

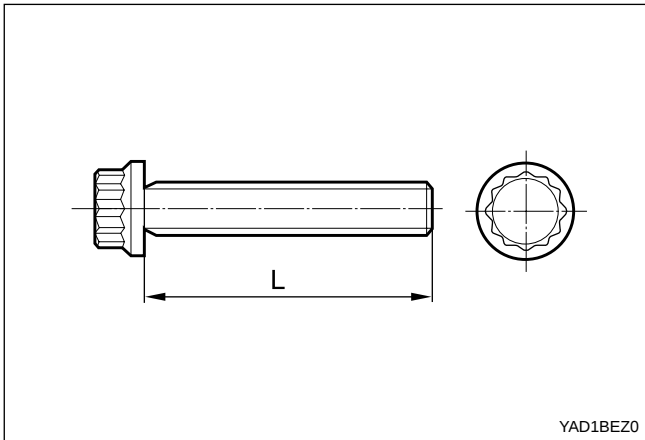


18. Coat the upper thrust bearing (4) with oil and insert into the crankcase so that the oil grooves are facing the crank webs (arrow).

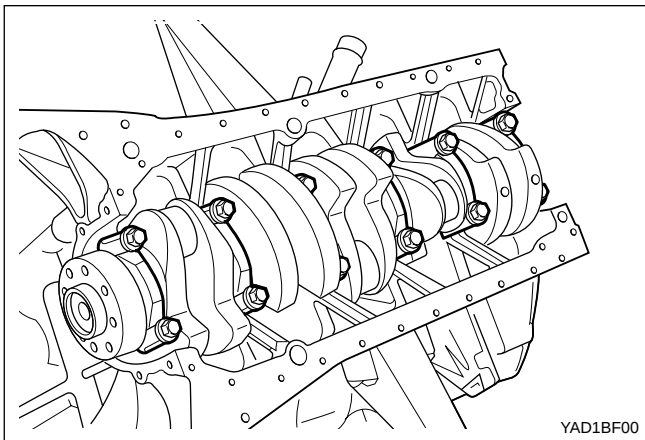


19. Coat the lower thrust bearing (7) with oil and insert into the crankshaft bearing cap so that the oil grooves are facing the crank webs (arrow).

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



Notice: If the max. length of bolts (L) exceed 63.8 mm, replace them.

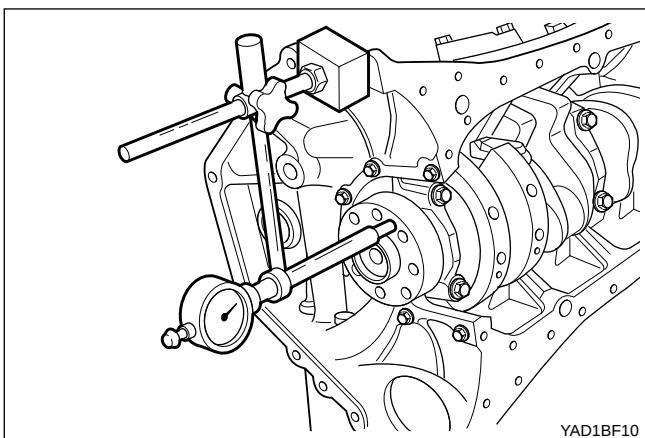


20. Coat the new crankshaft with engine oil and place it on the crankcase.
21. Install the crankshaft bearing caps according to marking and tighten the bolts.

Installation Notice

Tightening Torque	55 N•m (41 lb-ft)+ 90°
-------------------	------------------------

Install from No. 1 cap.

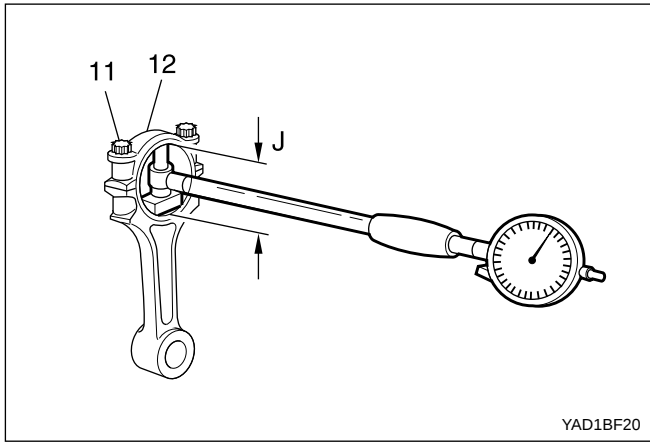


22. Rotate the crankshaft with hand and check whether it rotates smoothly.
23. Measure crankshaft bearing axial clearance using dial gauge 001 589 53 21 00 and dial gauge holder 363 589 02 21 00.

Clearance	0.100 - 0.245 mm
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Notice: If the clearance is out of standard, adjust the axial clearance of crankshaft bearing by replacing the thrust washers.

Notice: The same thickness of thrust washers should be installed on both sides of the thrust bearing.

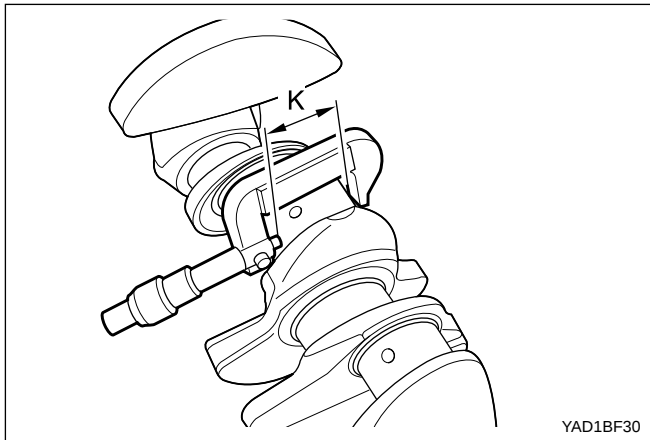


24. Insert the new connecting rod bearing shells into the connecting rod and connecting rod bearing cap and tighten the 12-sided stretch bolts (11).

Installation Notice

Tightening Torque	35 N•m (26 lb-ft)+ 90°
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25. Measure inner diameter of connecting rod bearing.



26. Measure connecting rod bearing journal diameter (K).

Notice: Refer to measurement of the crankshaft bearing journal diameter.

27. Measure the radial clearance (L) of the connecting rod bearing.

Example) Measured value 'J' = 47.700 mm
 Measured value 'K' = 47.653 mm
 Clearance 'L' = 0.047 mm

Radial Clearance 'L'	0.026 - 0.068 mm
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Notice: If the clearance is out of standard, adjust the radial clearance of connecting rod bearing by replacing the connecting rod bearing shells.

28. Remove the connecting rod bearing cap.
 29. Install the piston.
 30. Rotate the crankshaft by hand and check whether it rotates smoothly.
 31. If the bearings are damaged,
 - replace the oil presser relief valve.
 - clean the oil pump and oil filter housing carefully and replace the hose if necessary.

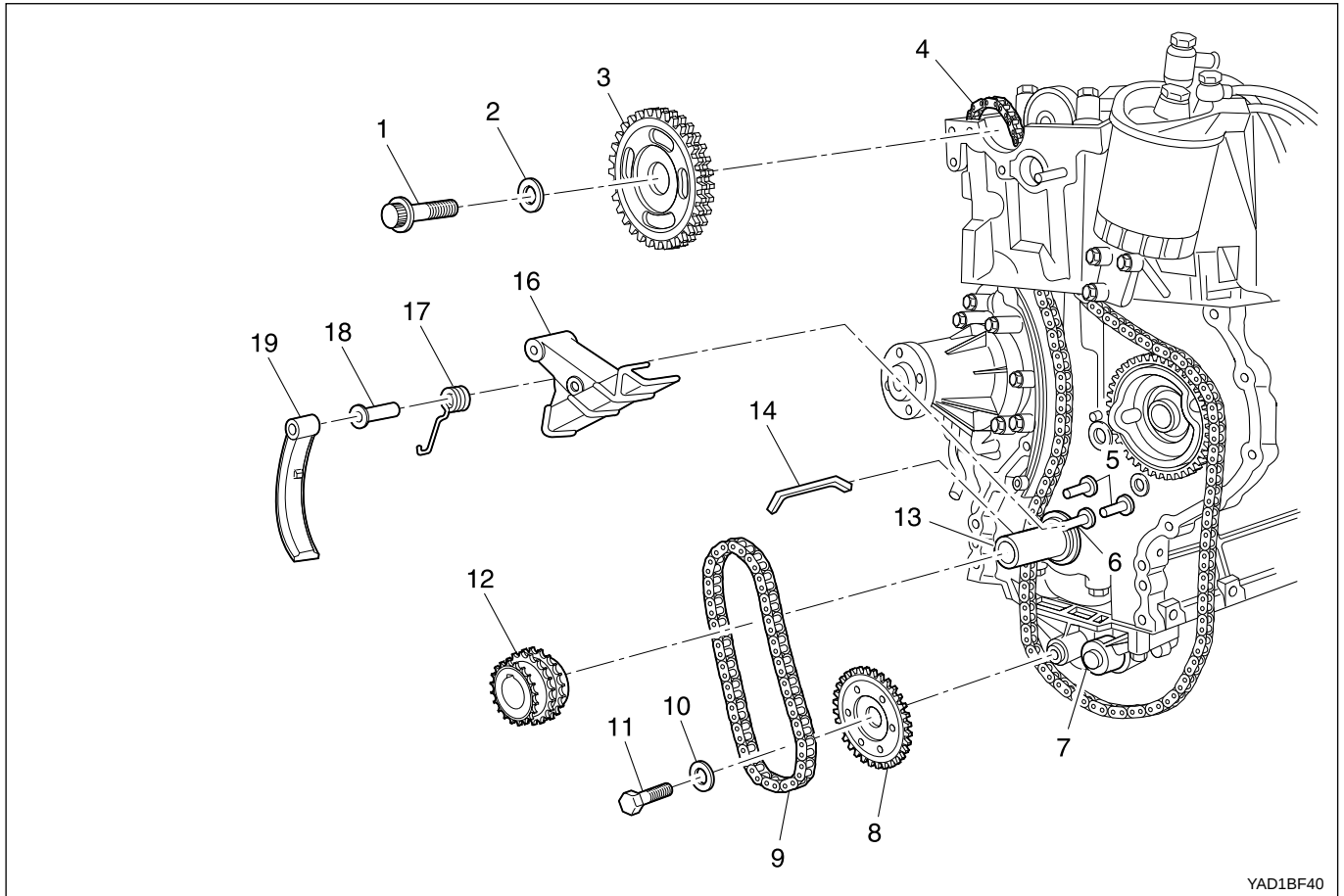
Notice: After assembling the engine, check the camshaft timing, adjust the start of fuel injection and check the TDC sensor bracket setting.

32. Fill oil and run the engine and then check the oil pressure and oil level.

Notice: Install the original oil filter element and then change the engine oil and oil filter element after 1,000 - 1,500 km.

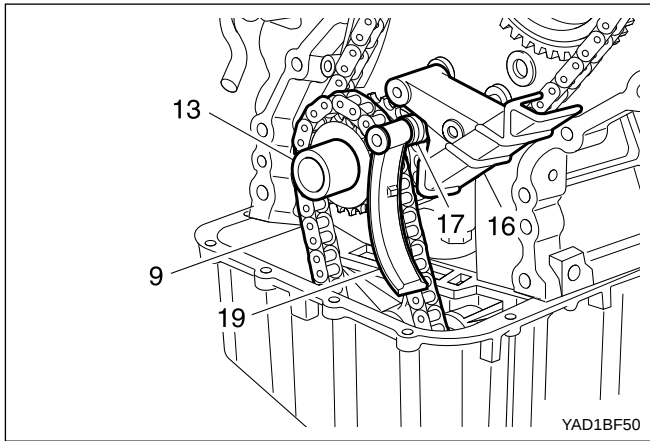
CRANKSHAFT SPROCKET

Preceding Work: Removal of oil pan
Removal of timing case cover



YAD1BF40

- | | |
|-------------------------------------|--------------------------------|
| 1 12-Sided Stretch Bolt (M11) | 10 Washer |
| Check, 25 N•m (18 lb-ft)+ 90° | 11 Bolt..... 25 N•m (18 lb-ft) |
| 2 Washer | 12 Crankshaft Sprocket |
| 3 Camshaft Sprocket | 13 Crankshaft |
| 4 Timing Chain | 14 Key |
| 5 Bearing Pin | 16 Guide Rail |
| 6 Bearing Pin | 17 Spring |
| 7 Oil Pump | 18 Bushing |
| 8 Oil Pump Sprocket | 19 Tensioning Lever |
| 9 Oil Pump Chain | |



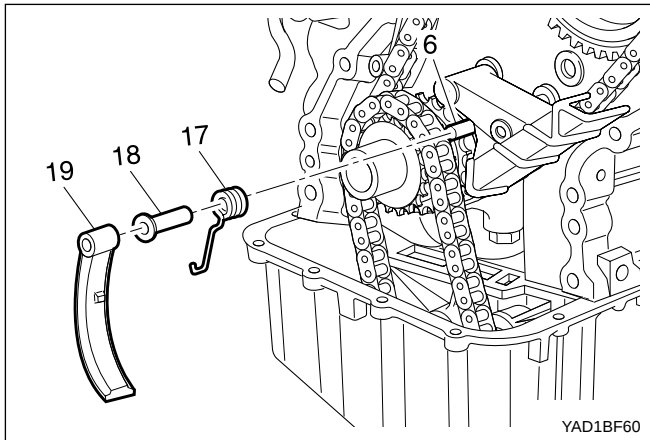
Special Tools

102 589 05 33 00 Puller

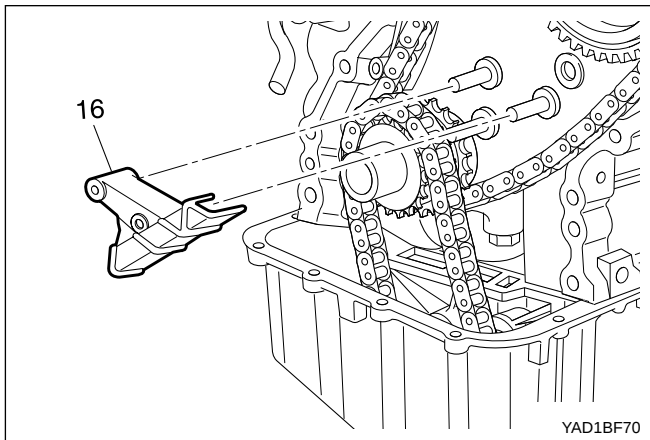
116 589 07 15 00 Drift

Removal Procedure

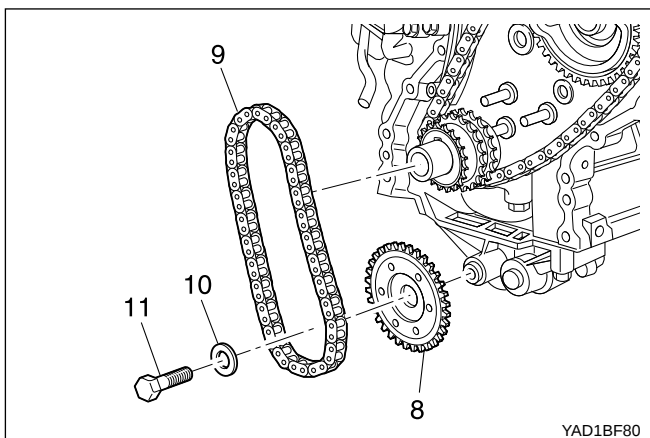
1. Pull out the tensioning lever (19) together with the spring (17) and guide rail (16) far enough until the tensioning lever has passed the oil pump chain (9) and is resting against the crankshaft (13).



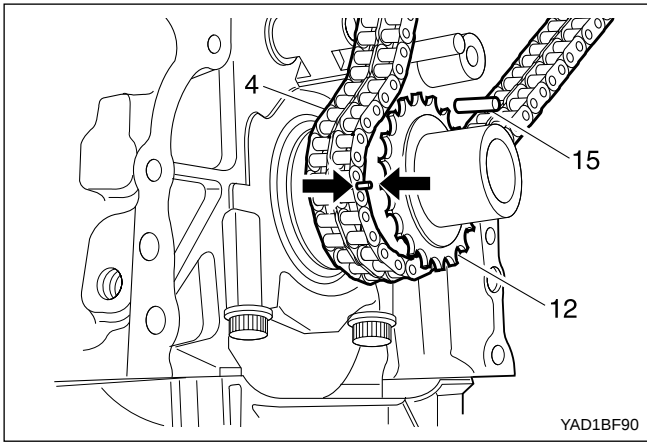
2. Pull out tensioning lever (19), spring (17) and bushing (18) from the bearing pin (6).



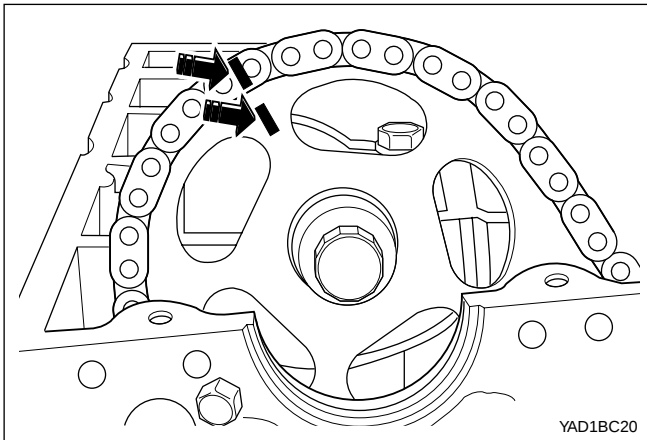
3. Pull out the guide rail (16).



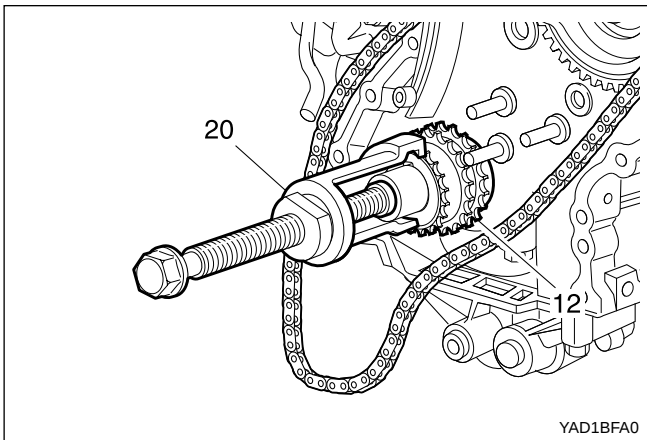
4. Remove the bolt (11) and then remove the washer (10), oil pump chain (9) and sprocket (8).



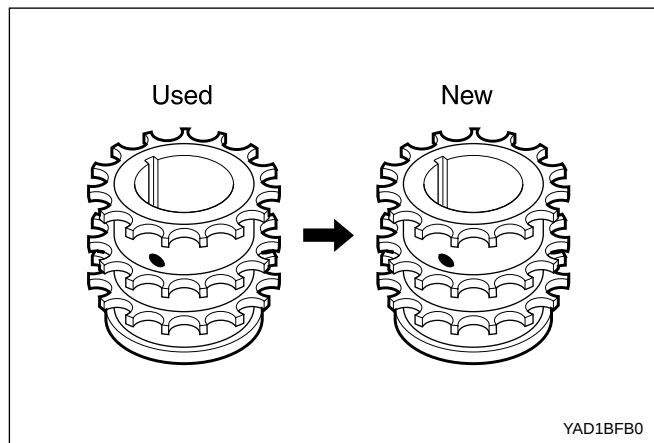
5. Place alignment marks (arrow) on the timing chain (4) and crankshaft sprocket (12).
6. Remove the woodruff key (15).



7. Place alignment marks (arrow) on the timing chain (4) and camshaft sprocket (3).
8. Remove the chain tensioner.
9. Remove the bolt (1) and then remove the washer (2) and camshaft sprocket (3).



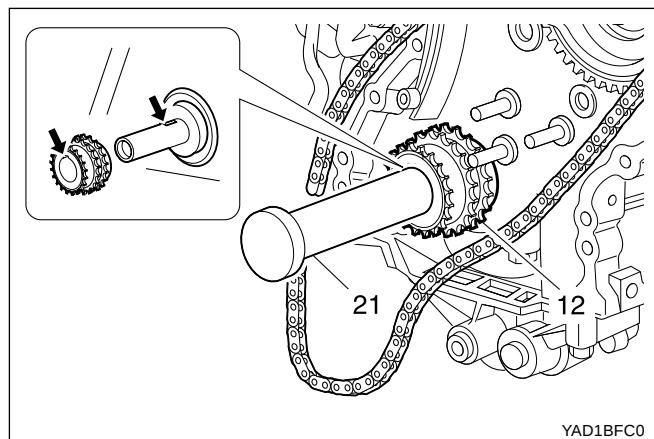
10. Remove the crankshaft sprocket (12) by using a puller 102 589 05 33 00 (20).



Installation Procedure

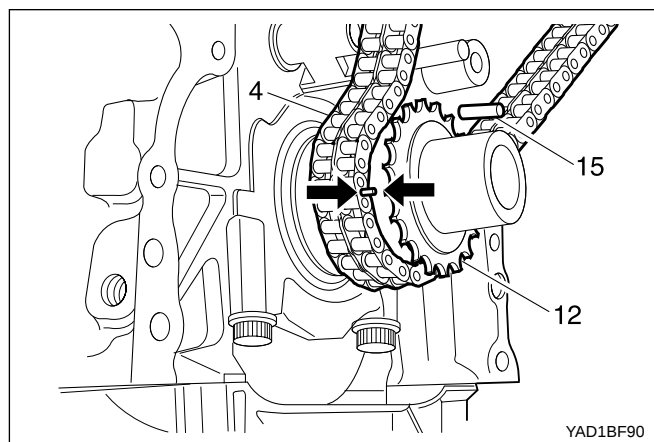
1. Put the same alignment mark on the new crankshaft sprocket as in the old sprocket.

Notice: Check the timing chain, camshaft sprocket, injection pump timing sprocket, oil pump chain and oil pump sprocket for wear and replace if necessary.



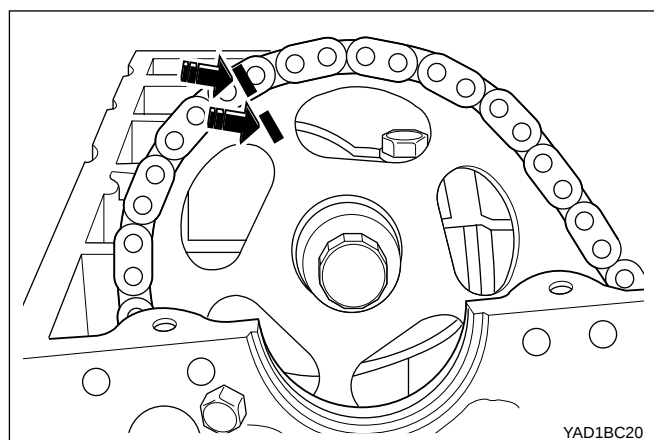
2. Install the new crankshaft sprocket (12) by using a drift 116 589 07 15 00 (21).

Notice: Align the groove of sprocket and woodruff key (arrow) exactly.



3. Fit the timing chain (4) on the crankshaft sprocket (12).

Notice: Align the alignment marks (arrow) on the chain and sprocket.

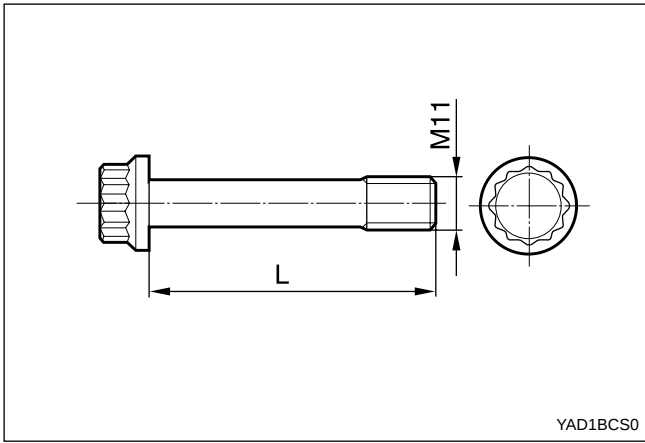


4. Install the camshaft sprocket (3).

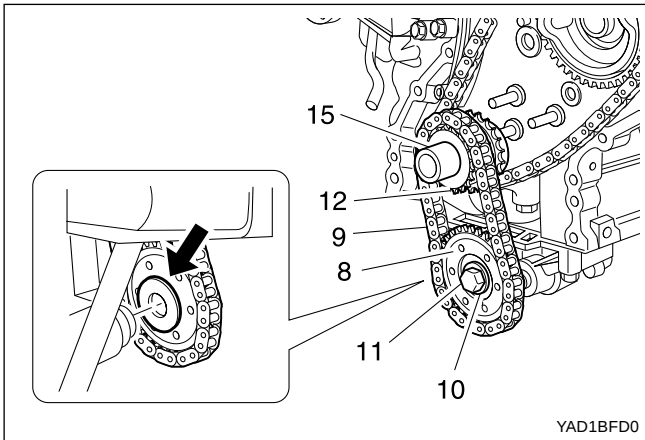
Installation Notice

Tightening Torque	25 N•m (18 lb-ft)+ 90°
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Pay attention on the alignment marks and dowel pin (arrow).



Notice: If the max. length 'L' of the stretch bolt exceeds 53.6 mm, replace it.



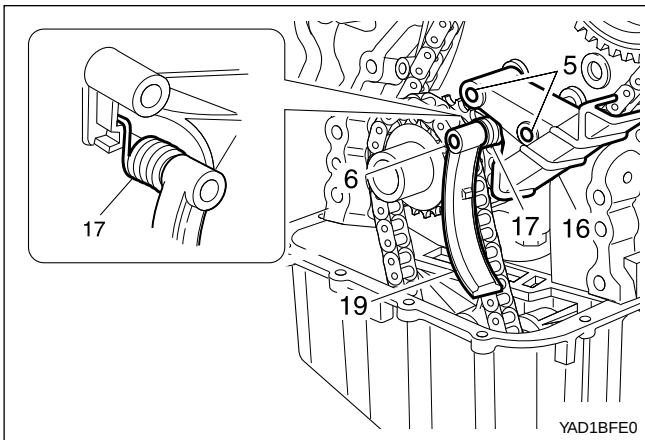
5. Fit the oil pump chain (9) on the crankshaft sprocket (12) and insert the oil pump sprocket (8) into the oil pump chain and then install it on the oil pump.

Installation Notice

Tightening Torque	25 N•m (18 lb-ft)
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The curved side of the oil pump sprocket should face the oil pump.

6. Insert the woodruff key (15).



7. Install the guide rail (16). Attach the spring (17) to guide rail and to tensioning lever together onto the bearing pins (5, 6).

Notice: Ensure that the spring is correctly located in the guide rail (arrow).