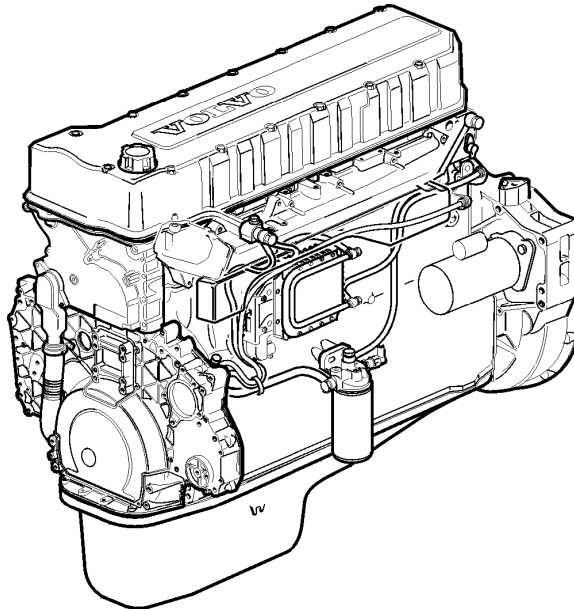


This TSI Service Bulletin replaces TSI Service Bulletin 216-001, "Crankshaft, D12, D12A, D12B, D12C" (11.2001), publication no. PV776-TSP160577

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## Crankshaft D12, D12A, D12B, D12C

### Crankshaft



W2003244

VOLVO D12C Engine

This information covers procedures for crankshaft repair on VOLVO D12, D12A, D12B, and D12C engines.

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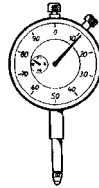
# Tools

## Special Tools

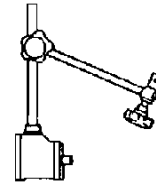
The following special tools are used to replace or repair components. The tools can be ordered from Volvo; please use the specified part number when ordering.



**9996956**  
Flywheel Turning Tool



**9989876**  
Dial Indicator



**9999696**  
Magnetic Stand



**9996950**  
Stop Tool for Flywheel

# Service Procedures

**2161-04-05-01**

## Crankshaft, Overhaul

(Crankshaft removed)

### Crankshaft Inspection

To avoid unnecessary overhauling, crankshaft inspection must be extremely thorough. To determine overhauling requirements, the following applies:

Clean the crankshaft thoroughly. Measure the bearing journals for out-of-roundness, wear and taper.

Tolerances are as follows:

- Maximum allowable out-of-round on main and connecting rod bearing journals — 0.08 mm (0.003 in.).

Check the bearing journals for surface damage. Regrind the shaft if surface damage is present.



#### **CAUTION**

Do not attempt to straighten a bent crankshaft. A bent crankshaft must be replaced.

Check for cracks before and after any grinding. To check for cracks, use any of the following methods:

- Magnetic particle method — The crankshaft is magnetized and then covered with fine magnetic powder or solution. Cracks form a small local magnet which causes the particles in the powder or solution to gather, marking the crack or flaw.
- Fluorescent magnetic particle method — This is similar to the magnetic particle method, but uses fluorescent magnetic particles that glow under a black light.
- Dye penetrant method — A fluorescent liquid penetrant is applied and the excess removed. The part is dried and then a developer is applied, which draws the penetrant out of the flaws and cracks by capillary action. Using a black light, the flaws or cracks can be readily identified.

## Crankshaft Grinding

**1**

Perform complete crankshaft inspections.

**2**

Grind to specifications. When grinding, it is important that the fillet radius and the transition from the radius to the respective journals lies within the stated specifications.

**3**

Use a grinding pin or emery cloth to remove any sharp edges that occur at the oil channel inlet holes during grinding.

**4**

Check that there are no grinding burns on the shaft.

**5**

Check that the shaft does not throw (see Crankshaft Inspection).

**6**

Check for cracks (see Crankshaft Inspection).

**7**

Check the surface finish requirements on the bearing journals and radius. See Service Information, Specifications, Group 20.

**8**

After grinding, clean grinding dust and other contaminants from the shaft and oil channels. In order to effectively clean all the oil channels, the crankshaft is equipped with threaded plugs. The plugs should be removed during the cleaning process.

## 2162-03-03-01 Main Bearings, Replacement (All)

(Oil Pan Removed)

Not Included:

- Oil Pan Guard Plate, Replacement

You must read and understand the precautions and guidelines in Service Information, Group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

*Special tools: 9996956*

### Removal

**1**

Remove the inspection cover from beneath the flywheel housing and install turning tool 9996956.

9996956

**2**

Remove the oil supply pipe from the engine block. Remove number 1 main bearing bolts and carefully remove oil pump and bearing assembly.

**Note:** Replace main bearings on number 1 after all other bearings have been replaced.

**3**

Remove one main bearing cap at a time.

**4**



### WARNING

Use **ONLY** the correct engine barring techniques for manually rotating the crankshaft. **Do not** attempt to rotate the engine by pulling or prying on the fan. This practice can cause serious personal injury.

Remove the upper bearing shell. First insert a pin into the crankshaft oil hole. Then use tool 9996956 to roll the bearing shell out by turning the crankshaft against the direction of rotation.

**Note:** Verify that any pin used to remove the upper bearing shell will not damage the crank or the bearing seat in the block before using.

9996956

**5**

Clean and check the bearing seat, cap, crank journal and bearing shells. If the bearing has seized, determine the cause and extent of damage before installing new bearing shells.

**6**

The maximum tolerances for the main bearing journals on the crankshaft are:

- Maximum allowable out-of-round — 0.08 mm (0.003 in.).
- Maximum allowable taper — 0.05 mm (0.002 in.).

**Note:** Due to the possibility of encountering an engine with a reground crankshaft, when replacing crankshaft bearings, be sure to install the correct size-bearing shells.

0.08 mm (0.003 in.)

0.05 mm (0.002 in.)

### Installation

**7**

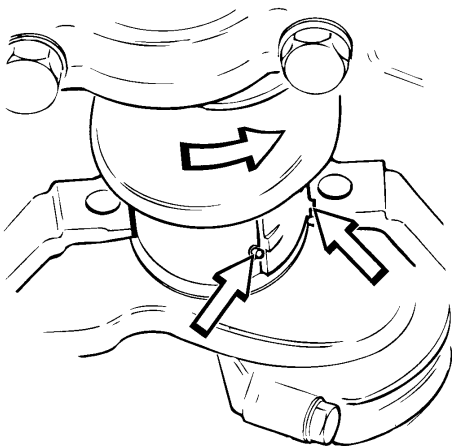
Lubricate the crank shaft journal and the new bearing shells with clean engine oil.

**8**

Install the upper bearing shell by turning the crankshaft in the direction of rotation with cranking tool 9996956 and the pin in the oil hole.

**Note:** Check that the locating tab on the bearing shell fits correctly into the recess in the bearing seat.

9996956



T2006735

Installing the main bearing

**9**

Install the main bearing cap together with the lower bearing shell. Use a two-step procedure to torque tighten the bolts:

Tighten the bolts to  $150 \pm 20$  Nm ( $110 \pm 14$  ft-lb).

Turn the bolts an additional  $120 \pm 5^\circ$ .

150  $\pm$  20 Nm  
(110  $\pm$  14 ft-lb), 120  $\pm$  5 $^\circ$

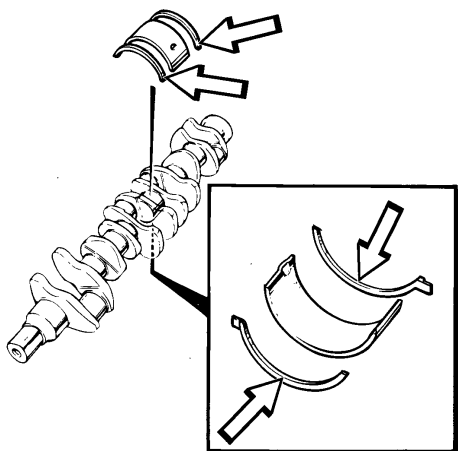
**10**

Replace the other main bearings, one at a time and in the same manner as the first one. After replacing each bearing, check that the crankshaft rotates freely by turning it around with cranking tool 9996956.

9996956

**11**

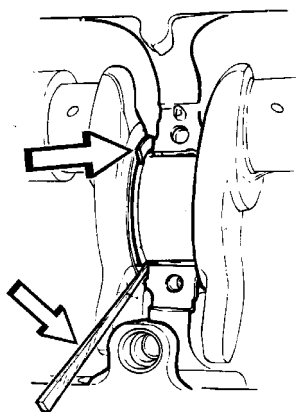
The crankshaft thrust bearing is mounted in the center main bearing seat. Thrust bearing washers are available in several oversize dimensions.



T2006736

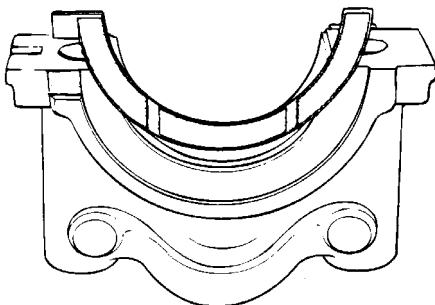
Thrust bearing

**12**



T2006737

Removing the crankshaft thrust bearing



T2006738

Thrust bearings

Use a narrow piece of plastic or wood to remove the thrust bearing in the cylinder block bearing seat. The thrust bearings in the main bearing cap are placed in the milled grooves.

**13**

Replace number 1 main bearings as described in previous steps. Install front cap and oil pump assembly, making sure the oil pump idler gear lines up properly with the crankshaft gear. Torque the main bearing bolts.

**14**

Connect oil supply pipe to block and torque tighten to specifications. Refer to Service Information, Group 20.

**15**

When all the main bearing caps have been torqued according to the specifications, use a dial indicator to measure axial play.

- Maximum allowable axial play — 0.40 mm (0.016 in.).

**16**

Remove cranking tool 9996956 from the flywheel housing.

9996956

## 2165-03-03-01 Connecting Rod Bearings, Replacement (All)

(Oil Pan Removed)

Not Included:

- Oil Pan Guard Plate, Replacement

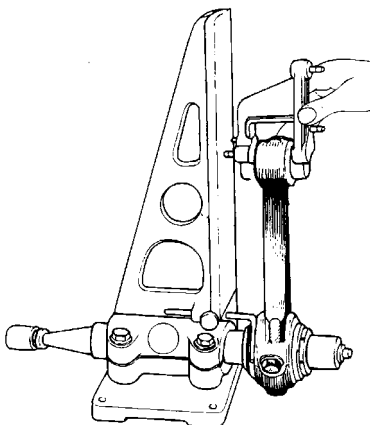
**Note:** Before replacing the connecting rod bearing, check the connecting rod for cracks, straightness and twist. If any of these conditions exist, replace connecting rod. Ream connecting rod bushings when replacing on connecting rods which have trapeze-shaped piston pin ends. This allows an oiled piston pin to slide through the bushing.

*Special tools: 9996956*

### Check for distortion

**1**

Use a new piston pin and measure the connecting rod in an alignment fixture or similar tool to determine distortion.



T2007060

Checking the connecting rod for distortion





T2007062

Examples of distortion

## 2

Tolerances:

- Straightness — a maximum deviation of 0.06 mm (0.0024 in.) is allowed on a length of 100 mm (4 in.).
- Torsional twist — a maximum deviation of 0.15 mm (0.0059 in.) is allowed on a length of 100 mm (4 in.).

0.06 mm (0.0024 in.)

0.15 mm (0.0059 in.)

## Removal

### 3

Install cranking tool 9996956 and rotate the flywheel until the bearing caps on number 1 and number 6 connecting rods move into position for removing the bolts.

9996956

### 4

Remove the caps on number 1 and number 6 connecting rods. Remove the bearing shells and clean the bearing seating in the cap and connecting rod.

**Note:** Due to the possibility of encountering an engine with a reground crankshaft, when replacing crank bearings, make sure to install the correct size bearing shells.

### 5

Check the bearing shells and bearing journals. If any bearing has seized, determine the reason and extent of damage before installing new shells.

### 6

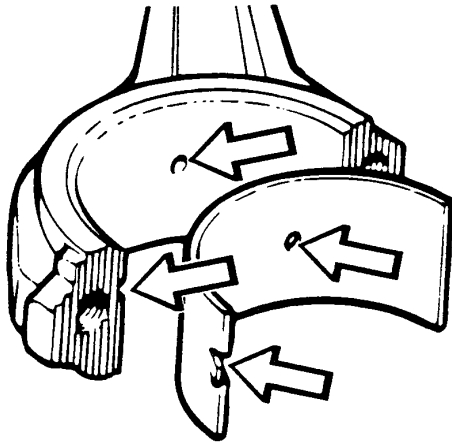
The maximum tolerances for the connecting rod bearing journals on the crankshaft are:

- Maximum allowable out-of-round — 0.08 mm (0.003 in.).
- Maximum allowable taper — 0.05 mm (0.002 in.).

**Note:** If uncertain, measure the bearing journal to see if the crankshaft is standard size or undersize.

0.08 mm (0.003 in.)

0.05 mm (0.002 in.)



Connecting rod bearing

T2007122

## Installation

**7**

Install the new bearing shells and make sure that the correct size bearings are installed. Also make sure that the bearing shell locating tab correctly enters the recess in the connecting rod and that the oil holes in the connecting rod and bearing shell line up.

**8**

Lubricate the bearing shells and crankshaft bearing journals with clean engine oil. Install the caps in position on their respective connecting rod. Torque-tighten the connecting rod bearing cap bolts to:

**D12, D12A, D12B, D12C**      $275 \pm 15 \text{ Nm}$  ( $205 \pm 10 \text{ ft-lb}$ )

**9**

Use a feeler gauge to measure the connecting rod axial clearance. The connecting rod must move freely from side to side.

$<0.25 \text{ mm}$  ( $<0.0059 \text{ in.}$ )

**10**

Rotate the flywheel until connecting rods 2 and 5 are in position and repeat steps 2 through 4 (Removal) and steps 1 through 2 (Installation).

**11**

Rotate the flywheel until connecting rods 3 and 4 are in position. Repeat steps 2 through 4 (Removal) and steps 1 through 2 (Installation).

**12**

Check that none of the bearings are seizing. Check for proper clearance (for more information, refer to Specifications, Group 20)

**13**

Remove flywheel turning tool 9996956 from the flywheel housing.

9996956