

Document Title: Valves, adjusting	Function Group: 214	Information Type: Service Information	Date: 2014/7/8 0
Profile: ART, A40F (37535) [GB]			

Valves, adjusting

Op nbr 214-012

This service information describes adjustment of inlet and exhaust valves as well as setting and adjusting of the brake rocker arms.

Preloading unit injectors, see [237 Unit injector, adjusting pretension](#).

This operation also includes the tools and times needed for required parts of the following actions:

NOTE!

Markings 1–6 are for adjusting inlet valves and unit injectors. Markings V1–V6 are for adjusting exhaust valves and brake rocker arms.

○ [191 Service positions](#)

1. Place the machine in service position, see [191 Service positions](#).
2. Lower the front grill and open the engine hood.

Rotate the engine

3. Remove the belt guard.



Figure 1

4. Install an extension with a 32 mm socket on the crankshaft's belt pulley. The extension should be at least 25 cm (10 in) long.

NOTE!

Use an extension for the handle to achieve smoother rotation.

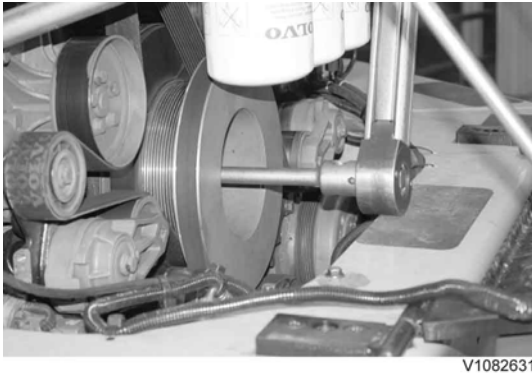


Figure 2

5. Remove the valve cover.
6. Loosen the bolts for the brake rocker arms' leaf springs. Leave the leaf springs in place.

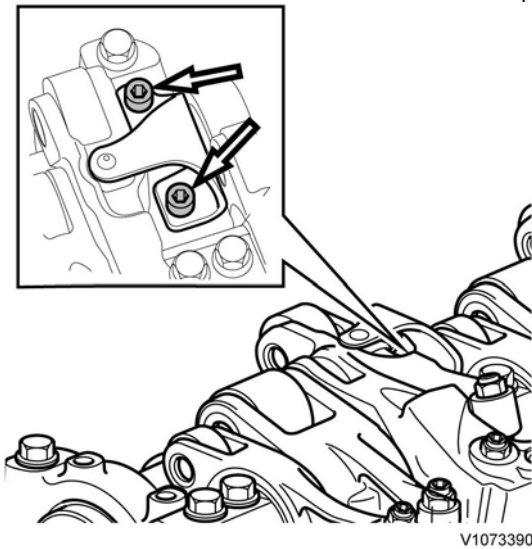


Figure 3

7. Rotate the engine in its rotational direction (clockwise) until the nearest line marking on the camshaft stands between the marks on the bearing cap.

NOTE!

Markings 1–6 are for adjusting inlet valves and unit injectors. Markings V1–V6 are for adjusting exhaust valves and brake rocker arms.

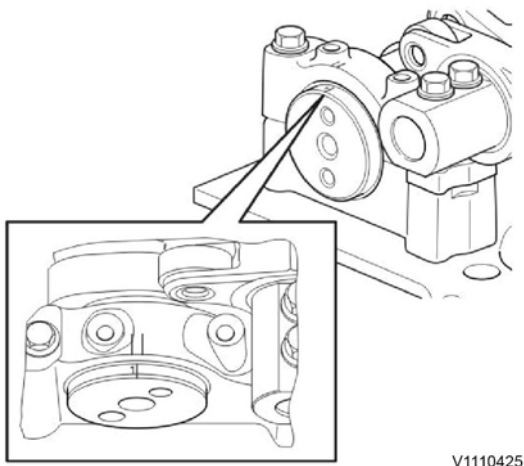


Figure 4

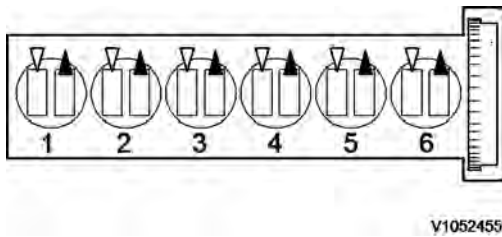


Figure 5

Cylinder number

Inlet valves, checking and adjusting

8. Check that the valve clearance between the yoke and rocker arm's thrust sleeve is according to [214 Valve system, specification](#). If needed, adjust as follows:

Adjust correct valve clearance for the inlet valves. Place a tool in adjusting screw B as counterhold and tighten lock nut A with a box-end wrench. See [214 Valve system, specification](#).

Recheck the valve clearance.

NOTE!

Using a marking pen, mark when adjusting is done to keep track of which valves, unit injectors, and brake rocker arms have been adjusted.

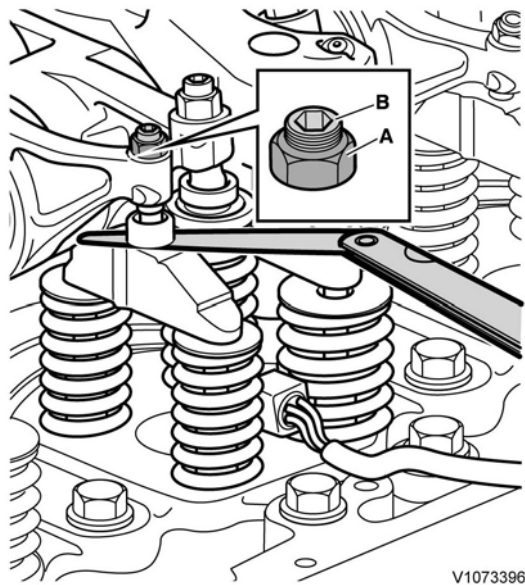


Figure 6

NOTE!

The unit injectors should only be adjusted if work has been done that involved removal of the rocker arm shaft.

The unit injectors are adjusted using the same camshaft marking as the inlet valves. See [237 Unit injector, adjusting pretension](#).

Valve yoke, balancing

NOTE!

When the adjusting screw is being screwed down, at the same time the yoke must be pressed down to contact with the valve stems. It is very important that the pressure is applied as close as possible to the middle of the yoke, see figure. Use a screwdriver or similar.

Unit injectors, adjusting

Exhaust valves, checking and adjusting

9. Adjust to zero clearance on the valve yoke by loosening the lock nut (A) and adjusting screw (B) so that it does not have contact with the valve stem. Press on the valve yoke and then screw down the adjusting screw so that the yoke has contact with the valve stem. Then tighten the adjusting screw another hex edge (60°). Then torque-tighten the lock nut (A) according to [214 Valve system, specification](#).



Figure 7

10. Check that the valve clearance between the yoke and rocker arm's thrust sleeve is according to [214 Valve system, specification](#).

Turn the sleeve so that it does not end up at an angle. Adjust the clearance and torque-tighten the lock bolt. Check the valve clearance **and leave the feeler gauge in place**.



Figure 8

Brake rocker arm, checking

11. The feeler gauge still in place should maximally eliminate the exhaust valve clearance. Check the brake rocker arm's clearance between the rocker arm and the camshaft with a shim or feeler gauge. Check that the clearance is correct, see [214 Valve system, specification](#).

NOTE!

If the check-measurement deviates from the value in Specifications, adjust as follows, otherwise proceed to Error

check.

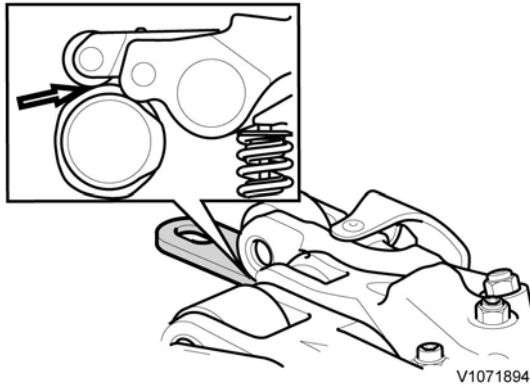


Figure 9

NOTE!

Leave the feeler gauge in place.

Brake rocker arm, adjusting

12. Loosen the brake rocker arm's lock nut A and turn adjusting screw B 0.5–1 turn counter-clockwise. Place a shim or feeler gauge between the camshaft and the brake rocker arm's roller. The shim's thickness should be according to [214 Valve system, specification](#). Tighten adjusting screw B to contact and then half a turn so that the valve yoke is pressed downward and the exhaust valves open slightly. Then the engine brake mechanism is heavily loaded and all parts are in correct position. Loosen adjusting screw B until the shim or feeler gauge can be slid in and out with some effort. Lock adjusting screw B in this position with lock nut A, with torque, see [214 Valve system, specification](#).

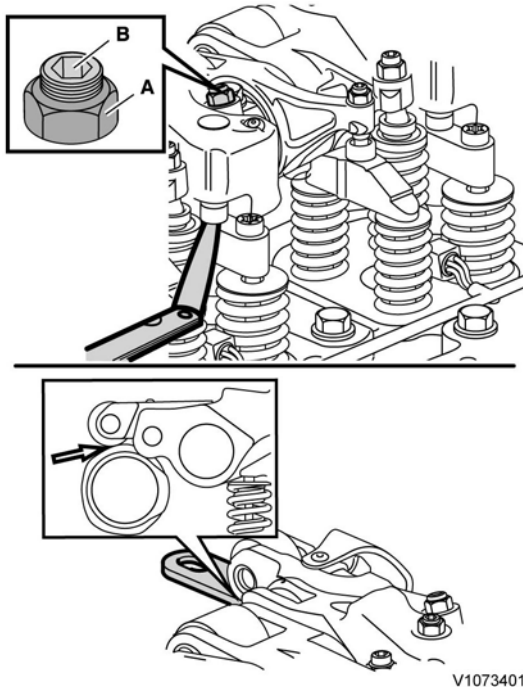


Figure 10

Error check

13. **Remove the feeler gauge and shim.** Check the clearance between the camshaft and the brake rocker arm's roller using a shim or feeler gauge with

thickness according to [214 Valve system, specification](#).

It should be possible to slide the shim or feeler gauge into the clearance without resistance.

NOTE!

In case of insufficient clearance, start over from Exhaust valves, checking.

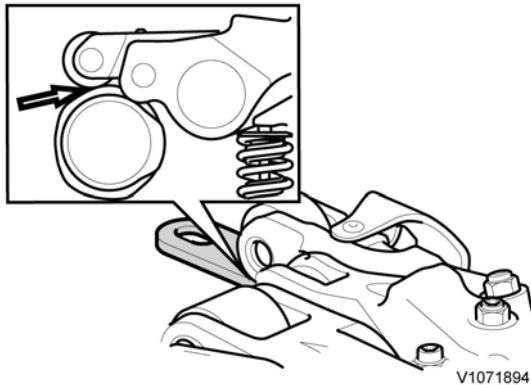


Figure 11

NOTE!

The error check may never be used for adjusting work.

14. Adjust the rest of the valves, brake rocker arms, and unit injectors in the same way.
15. Check that the guide pin is located directly opposite the bowl in the spring plate. Tighten the bolts for the brake rocker arms' leaf springs.

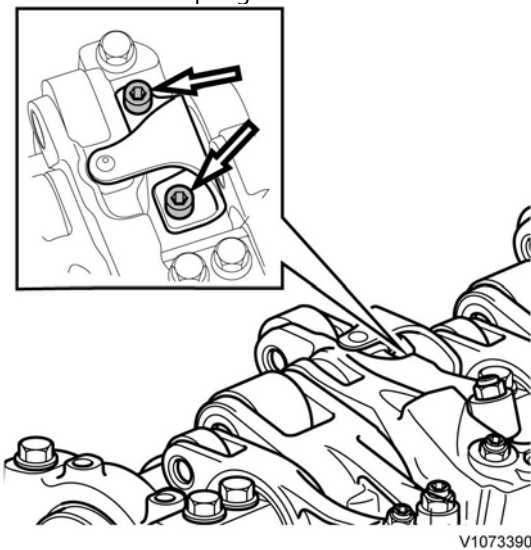


Figure 12

16. Install the valve cover.
17. Remove the rotation equipment and install the belt guard.
18. Close the engine hood and raise the front grill.
19. Restore the machine from service position.
20. Start the engine and check its function.

Document Title: Engine timing gear, description	Function Group: 215	Information Type: Service Information	Date: 2014/7/8 0
Profile: ART, A40F (37535) [GB]			

Engine timing gear, description

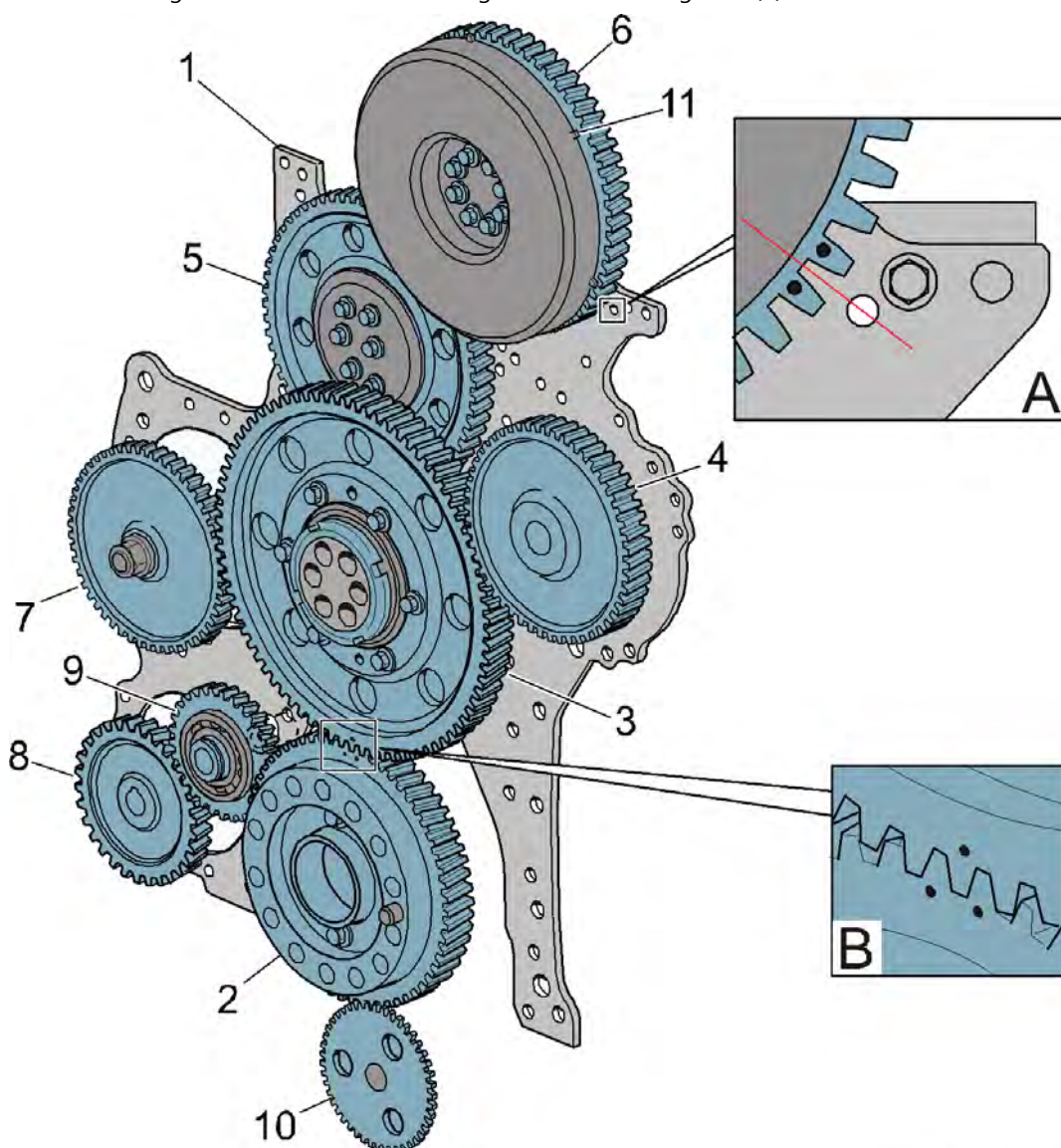
Engine timing gear

The engine has a rear-mounted timing gear on a 6 mm thick steel plate (1).

The timing gear plate is fastened to the cylinder block with a number of M8-bolts (as well as an M10-bolt) and is sealed against the cylinder block and cylinder head with sealant. The sealant is applied in a bead on the plate.

On the timing gear plate there is a drilled hole which, with the markings on the camshaft gear (A), are used together to enable correct installation of the camshaft gear.

The crankshaft gear and the double transfer gear are marked together (B) for correct installation.



V1083625

Figure 1

V1083625

1. Timing gear plate
 2. Gear, crankshaft
 3. Transfer gear, double
 4. Not used
 5. Transfer gear, adjustable
 6. Camshaft gear
 7. Drive gear, air compressor
 8. Drive gear, fuel feed pump
 9. Transfer gear
 10. Drive gear, lubrication oil pump
 11. Vibration damper with teeth for inductive camshaft sensor
- A. Hole for guide pin
B. Marking for crankshaft

Belt transmission, description

The belt transmission is located at the front end of the engine and has three multi-groove drive belts.

- The drive belt (3) drives the coolant pump (1), while the belt tensioner (7) keeps the belt tight.
- The drive belt (2) drives the alternator (and AC compressor if installed), while the belt tensioner (6) keeps the belt tight.

Belt transmission for engine without diesel particle filter

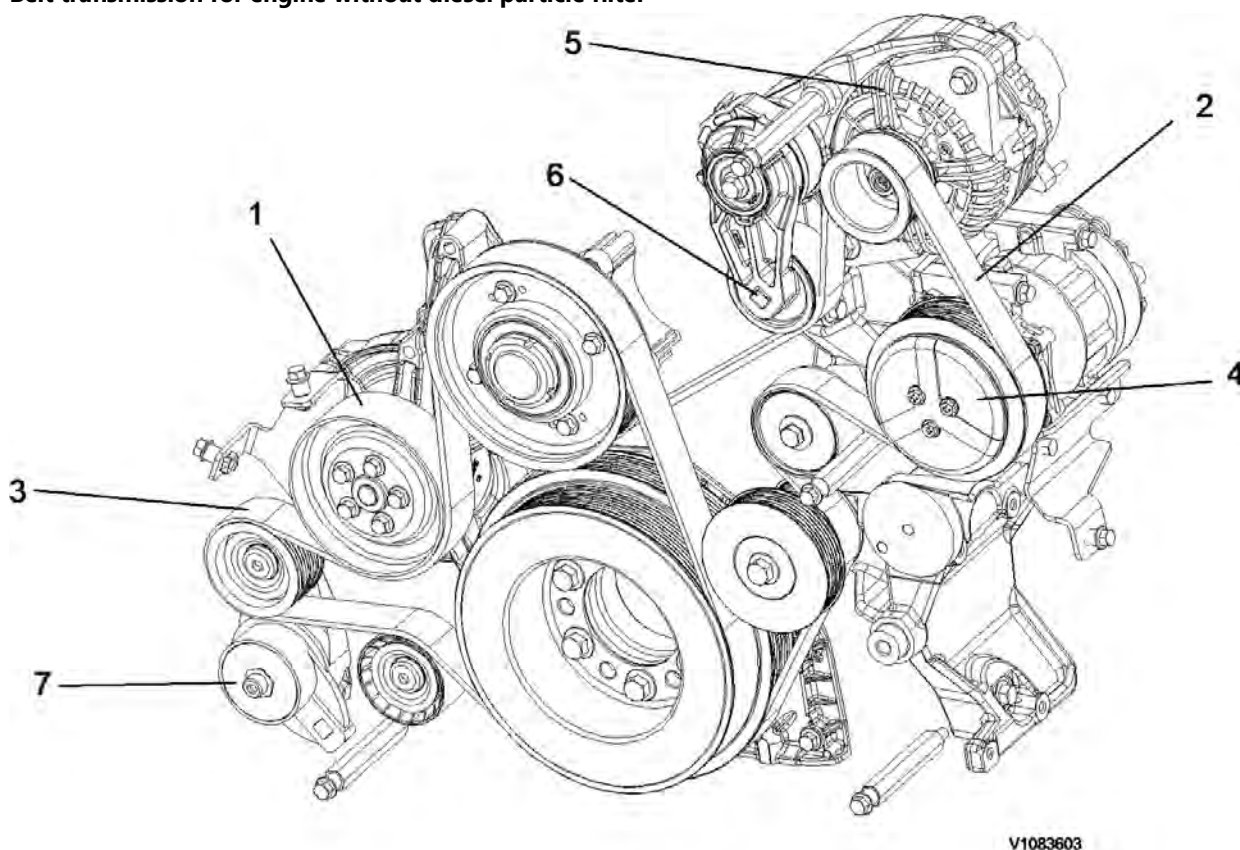


Figure 2

The figure shows engine D16F

1. Coolant pump
2. Drive belt
3. Drive belt
4. AC Compressor
5. Alternator

- 6. Belt tensioner
- 7. Belt tensioner

- The drive belt (3) drives the coolant pump (1), while the belt tensioner (8) keeps the belt tight.
- The drive belt (2) drives the alternator (and AC compressor if installed), while the belt tensioner (9) keeps the belt tight.
- The drive belt (7) drives the air pump (6), while the belt tensioner (10) keeps the belt tight.

Belt transmission for engine with diesel particle filter

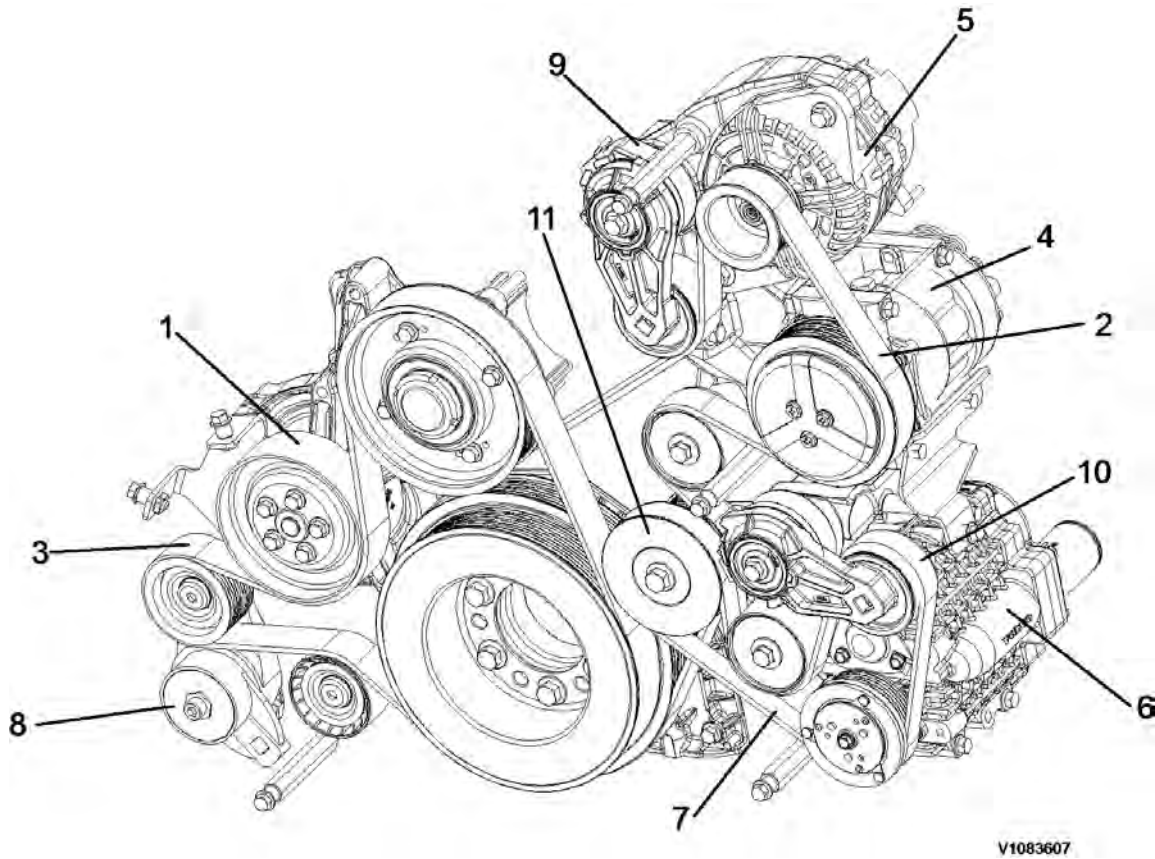
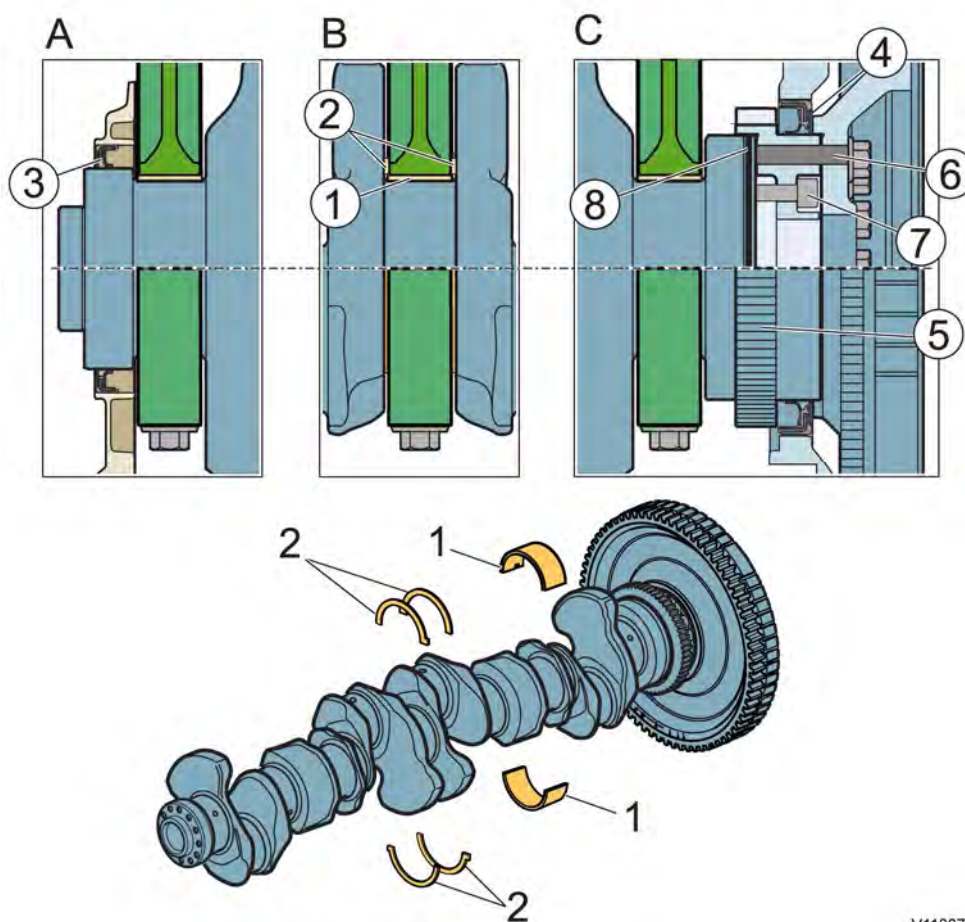


Figure 3
The figure shows engine D16H

- 1. Coolant pump
- 2. Drive belt
- 3. Drive belt
- 4. AC Compressor
- 5. Alternator
- 6. Air pump
- 7. Drive belt
- 8. Belt tensioner, coolant pump
- 9. Belt tensioner, AC compressor and alternator
- 10. Belt tensioner, air pump
- 11. Drive gear, air pump

Document Title: Crank mechanism, description	Function Group: 216	Information Type: Service Information	Date: 2014/7/8 0
Profile: ART, A40F (37535) [GB]			

Crank mechanism, description



V1100763

Figure 1

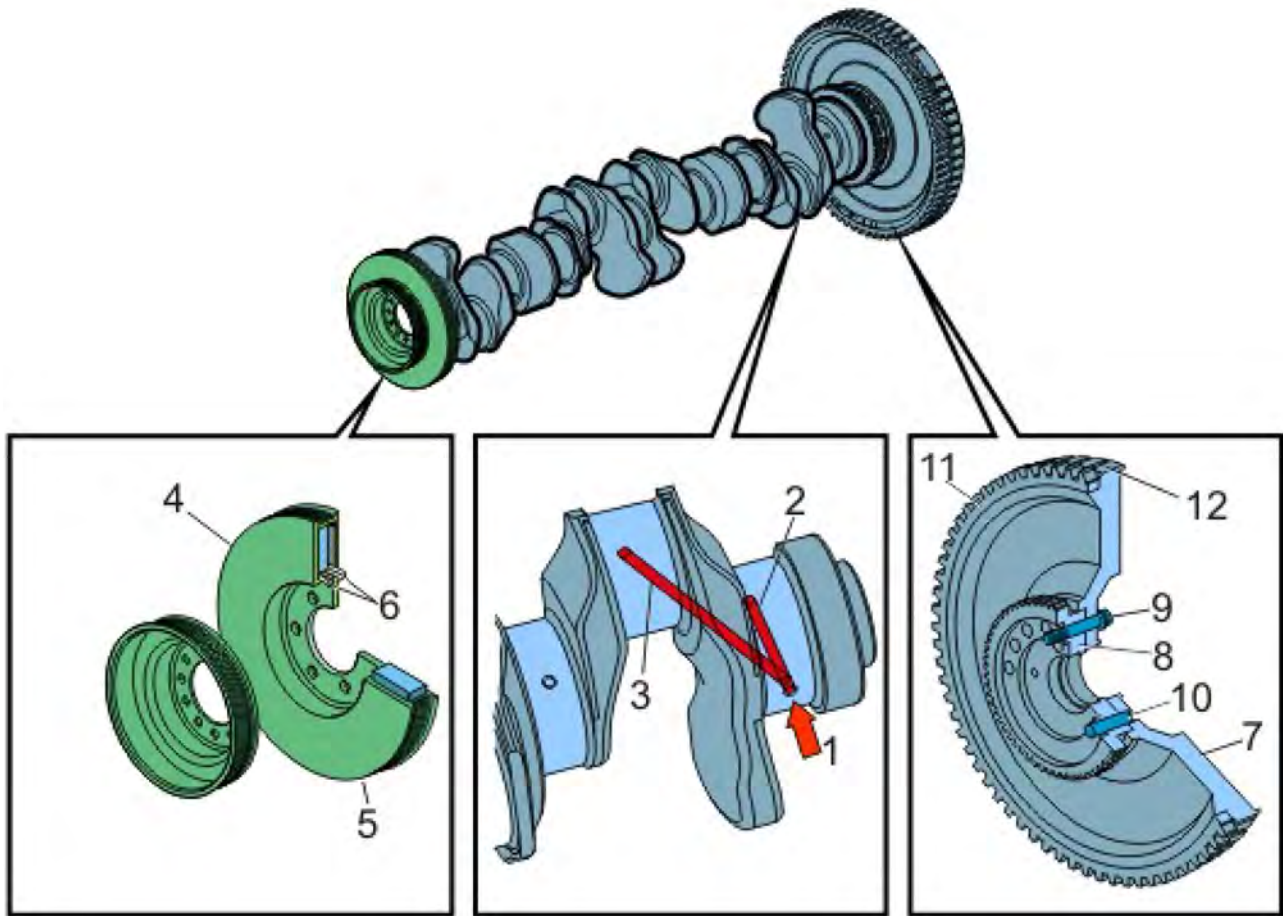
- A. Leading edge
- B. Middle centre bearing
- C. Trailing edge — engine timing gear

- 1. Bearing shells
- 2. Thrust bearing
- 3. Front teflon seal
- 4. Rear teflon seal
- 5. Gear
- 6. Bolt, flywheel
- 7. Bolt, crankshaft gear
- 8. O-ring

The crankshaft is drop-forged and has induction-hardened bearing surfaces. The crankshaft is carried in seven main bearings with replaceable bearing shells. In the middle main bearing there is also the thrust bearing which is made up of four washers

shaped like half-moons.

At the leading edge the seal is made up of a teflon seal against the front crankshaft flange. At the trailing edge there is also a teflon seal that seals against a machined surface on crankshaft gear. The gear is fixed to the crankshaft with a guide pin and two bolts. In the rear crankshaft flange there is a groove for the O-ring that seals between the flange and the gear.



V1100764

Figure 2

1. Main bearing journal
2. Lubrication channel, main bearing pin
3. Lubrication channel, big-end bearing pin
4. Damper housing
5. Cast iron ring
6. Bushes
7. Flywheel
8. Gear
9. M16 bolts
10. Guide pin
11. Starter ring gear
12. Groove for speed sensor

Lubrication of the crankshaft takes place via separate channels in the cylinder block to each main bearing. The main bearing pins have drilled lubrication channels and from each main bearing pin, except the middle one, there is a drilled channel to the nearest big-end bearing pin.

The vibration damper is of hydraulic type and is bolted directly on the crankshaft's front flange. In the damper housing there is an oscillating mass in the form of a cast iron ring that can rotate freely on the bushings. The space between the damper housing and oscillating mass is filled with silicone oil of high viscosity. When the crankshaft rotates, torsional stresses are generated in the crankshaft by the pistons' power strokes. The viscous silicone oil evens out the movement between the

crankshaft's pulsating rotation and the oscillating mass' smooth rotation, thus reducing the vibrations.

The flywheel and the gear located in-between are bolted on the crankshaft's rear flange with 14 M16-bolts. The flywheel is fitted to the crankshaft with a guide pin in the same position as the gear. On the outside there are machined grooves for the engine's speed sensor, speed sensor, flywheel, SE2701. The starter ring gear is shrink-fit on the flywheel and can be replaced.

Supplementary information

See also:

- [482 PTO \(Power Take Off\). description](#)

Diagnostics

Detailed information about relevant warnings and the error codes below are found under the diagnostics section.

Component	Control unit	Message ID
SE2701	MID128	SID22

Document Title: Crankshaft, replacing front oil seal	Function Group: 216	Information Type: Service Information	Date: 2014/7/8 0
Profile: ART, A40F (37535) [GB]			

Crankshaft, replacing front oil seal

Op nbr 216-014

[88800021 Installation tool](#)

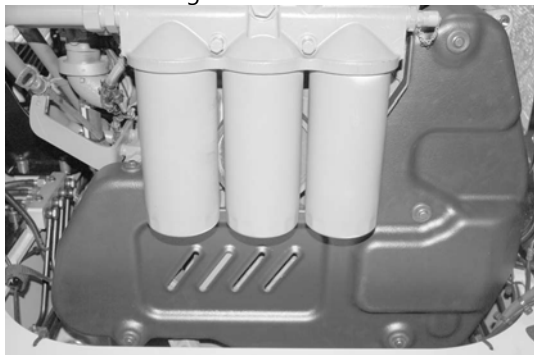
[9992000 Handle](#)

This operation also includes required tools and times for applicable parts of the following operations:

- [191 Service positions](#)

Removing

1. Place the machine in service position.
See [191 Service positions](#)
2. Lower the front grill and pump up the engine hood.
3. Remove the belt guard.



V1090991

Figure 1
The figure shows engine D16

4. For EGR-engine: Remove the belt for the air pump. Remove the middle belt for the coolant pump and the inner belt for the AC and alternator.
Use a 1/2" ratchet handle to hold down the belt tensioner.

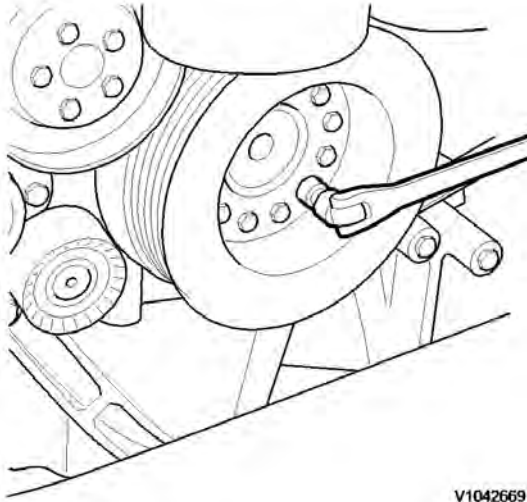


V1086656

Figure 2

The figure shows an engine with EGR.

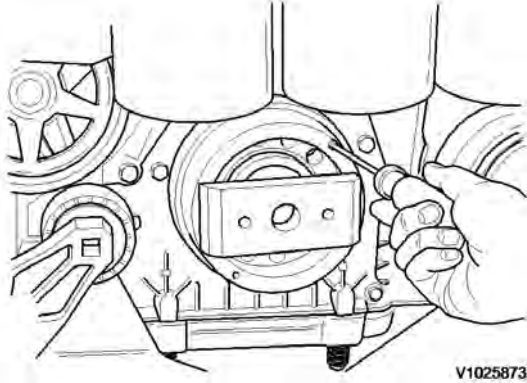
5. Belt pulley and vibration damper are balanced. Make a marking showing how they are located. Loosen and remove the rotation tool with the bolts for the for the crankshaft's belt pulleys and vibration damper. Remove the belt pulley/vibration damper.



V1042669

Figure 3

6. Clean the crankshaft end.
Install 88800021 Installation tool.
Drill, using the guide holes in the tool, two holes, $\varnothing=3.5\text{ mm}$ (**0.14 in hole**) in the seal.
7. Screw in two self-tapping screws $\varnothing\text{ 5 mm}$ (**0.20 in**) in the seal.



V1025873

Figure 4

8. Screw in two fully threaded bolts **M10x60 mm** in the tool.
Pull out the seal.
Remove the screws and seal from the tool.



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