

Checking and Adjusting of Feed Begin

Job No.

00-6

The exact adjustment of the feed begin is of decisive importance for the power output and the satisfactory operation of the engine. The specified adjustment data of the feed begin for vehicles of the different types and fields of application (see Job No. 00-0).

If the engine is equipped with an injection timing device, the feed begin is advanced in relation to the engine speed between 26 deg (basic adjustment) and 38 deg BTDC at 3500 rpm (also see Job No. 07-4, VI., Description of the Injection Timing Device).

A. OM 636

I. Checking the Markings for Top Dead Center (OT) and Feed Begin (FB)

Since the engines are equipped with different and differently marked flywheels or a flywheel could be mounted wrongly, the markings for top dead center and the feed begin must be checked before the checking and adjusting of the feed begin, to make absolutely sure, that the piston of the 1st cylinder is actually at top dead center and feed begin respectively.

Only the correct and exact adjustment of the feed begin guarantees the full power output and the smooth and satisfactory operation of the engine.

The engines of all types of the model OM 636 are therefore now furnished with a timing needle and with a TDC-marking and markings at 20 deg, 25 deg and 30 deg before top dead center on the belt pulley of the crankshaft for the easy checking and adjusting of the feed begin (see Figure 00-6/2).

With this arrangement a checking of the markings on engines of the recent production is always possible, even while installed.

On engines of the former production there are the following possibilities to check the markings:

- a) For installed or removed engines: through the marking on the belt pulley and the timing needle at the timing housing cover (see Figure 00-6/1).
- b) For installed or removed engines with attached clutch housing: through the marking on the flywheel and the inspection hole in the clutch housing (see Figure 00-6/4 and 00-6/5).
- c) Only for removed engine without clutch housing: through the marking at the flywheel (the markings are advanced 50 deg in relation to vertical) and the timing needle (see Figure 00-6/6).
- d) For removed engine without clutch housing: through the marking at the flywheel and the screwed-on hexagon screw (see Figure 00-6/7).
- e) If there is no marking or the accuracy of the marking is doubtful, make marking for feed begin (see Section IV).

Table of the Provided Markings at the Engines of the former Production, Model OM 636

	Marking a (Fig. 00-6/1)	Marking b (Fig. 00-6/4 and 00-6/5)	Marking c (Fig. 00-6/6 and 00-6/3 A and B)	Marking d (Fig. 00-6/7 and 00-6/3 C)
Belt Pulley-Part-No. and Timing Needle Part-No.	181 200 17 05 636 015 02 71 (see Figure 00-6/1)	—	—	—
Flywheel Part-No.	—	see marking and type identification of c and d and Figure 00-6/4 and Figure 00-6/5	636 030 02 05 (see Figure 00-6/6 and 00-6/3 A and B)	636 030 01 05 (see Figure 00-6/7 and 00-6/3 C)
Type identification of the engines	636. { 919 930 934	An inspection hole in clutch housing have the engines with the type identification 636. { 915 916 918 919 930 931 934	636. { 916 918 919 930 931 934 636.917- { 00 090 120 180 190 240 251 260 300 320 330 360 636.917/ { 2 4 10 13 19 20 24 25 26 27 30 also the engines of the type 917/0 version A, B, C, D, F, Q, U, V, W, X, Y and Z.	636. { 912 914 932 933 936 636.917- { 021 050 253 270 271 280 290 310 340 350 636.917/ { 3 6 9 11 14 15 16 17 18 21 22 32 also the engines of the type 917/0 version E, G, H, K, L, N, O, R, S and T.
For the engines of the type identification I, M and P the flywheel is sent by the customer to Daimler-Benz			636.917- { 040 and/or/5 272 636.917/12 636.917/0 of the versions	
The engines of the type identification will be supplied without flywheel by the Daimler-Benz Plant Untertuerkheim			636.917- { 022 and/or /28 023 and/or /33 221 and/or /23 222 and/or /29 223 - - 252 - - 370 - -	

Note: The engines of the type 636.917/5 and/or 917-040, 917/12, 917/31 and/or 917-252, 917-272 and the engines of the type 917/0 version J, M, and P are equipped with flywheels (for hydraulic clutches) produced outside our plants.

If the flywheels of these engines are without marking for feed begin determine the latter and mark flywheel or pulley accordingly.

2. Check this position at the pulley or at the flywheel through the inspection hole in the clutch housing.

The timing needle must point to the TDC-marking on the pulley (see Figure 00-6/1 and 00-6/2) or the marking OIT and/or |OT| on the flywheel depending on design of flywheel must be visible in the approximate center of the inspection hole in the clutch housing (see Figure 00-6/4 and 00-6/5).

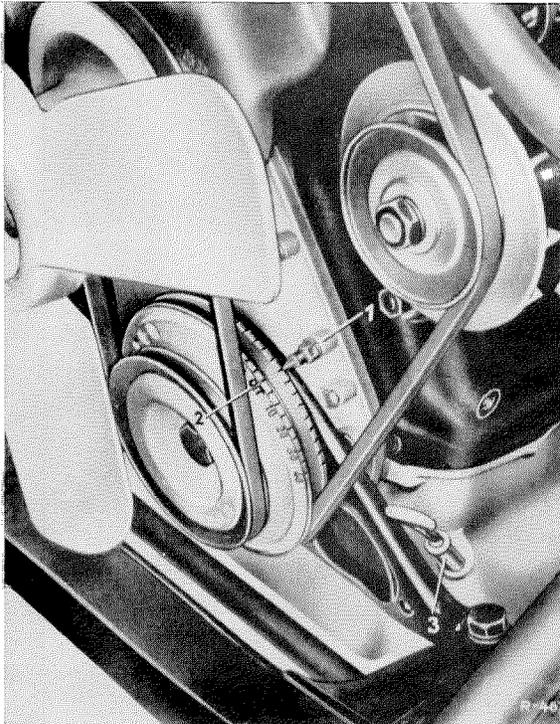


Figure 00-6/1

Belt pulley with TDC-marking (OT) and scale for the adjusting of the feed begin.

- 1 Fixing screw with timing needle
Part No. 636 015 02 71
- 2 TDC-marking (OT)
- 3 Oil dip stick

In the photograph the crankshaft is at top dead center

Checking on installed engines:

1. Bring the piston of the 1st cylinder to ignition dead center (see Job No. 00-3, Pos. 3).

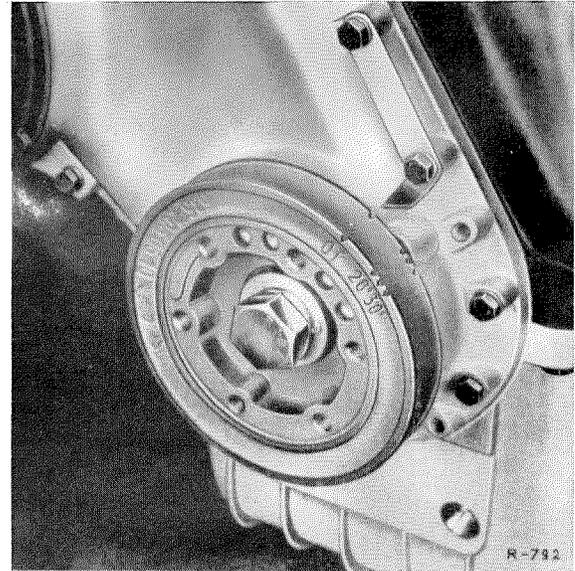


Figure 00-6/2

Belt pulley with TDC-marking (OT) and scale with Timing Needle Part No. 636 032 00 15

Note: On the flywheel Part No. 636 030 02 05 the markings for feed begin and top dead center were advanced 50 deg in relation to vertical, in order to be able to observe the markings through an inspection hole in the clutch housing while the engine is installed (see Figure 00-6/3 and 00-6/4).

On a part of the engines of the type 636.930, 919, and 934 the inspection hole is plugged with the screw Part No. 120 251 00 71 to keep out dirt. The screw also serves to ventilate the clutch housing (see Figure 00-6/4).

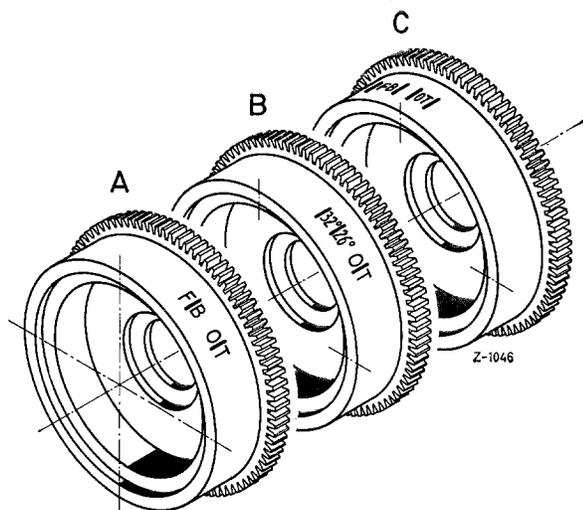


Figure 00-6/3

The Figure 00-6/3 shows the markings of the flywheel Part No. 636 030 02 05 and the flywheel Part No. 636 030 01 05.

- A = Markings of the flywheel
636 030 02 05 former version
OT = top dead center
FB = feed begin 32° BTDC
- B = Markings of the flywheel
636 030 02 05 present version
OT = top dead center
26° = feed begin 26° BTDC for engines
with injection timing device and
engines for fork lifts
32° = feed begin 32° BTDC for engines
without injection timing device
- C = Markings of the flywheel
636 030 01 05
OT = top dead center
FB = feed begin 30° BTDC
(see Figure 00-6/7)

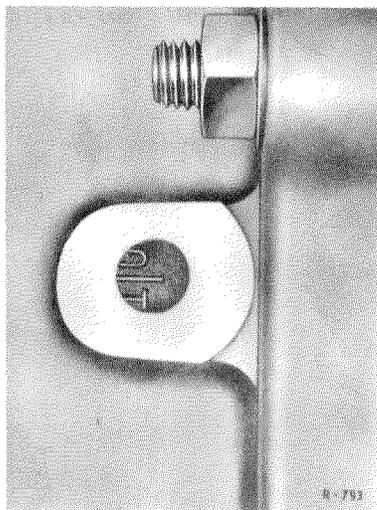


Figure 00-6/4

Figure 00-6/4 shows the TDC-marking (OT) as seen through the inspection hole of a clutch housing of our Vehicle Model 180 D (type 636.930).

00-6/4

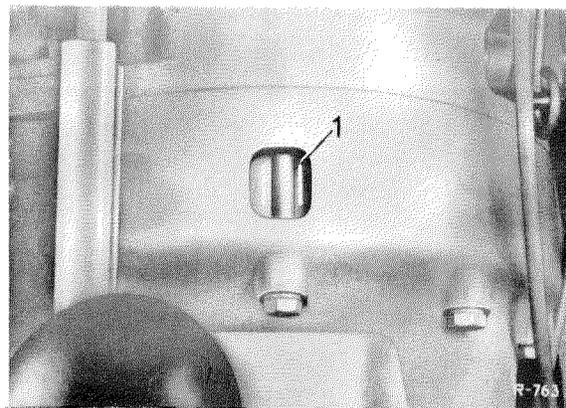


Figure 00-6/5

Figure 00-6/5 shows the marking OT (1) as seen through the inspection hole in the clutch housing of our "Unimog" vehicle (type 636.914).

Checking removed engines:

1. Bring the piston of the 1st cylinder to ignition dead center (see Job No. 00-3, Pos. 3).
2. Check this position at the pulley (see Figure 00-6/1 and 00-6/2) **or** at the flywheel after attaching the timing needle Part No. 636 589 00 23 to the dowel pin (see Figure 00-6/6) **or** at the flywheel after screwing on a hexagon screw (see Figure 00-6/7).

The timing needle must point to the OT-marking on the belt pulley (see Figure 00-6/1) **or** the Timing Needle Part No. 636 589 00 23 must point to the OT-marking on the flywheel (see Figure 00-6/6) **or** the hexagon screw must be located between the lines marked with [OT] (see Figure 00-6/7).

The Figure 00-6/6 shows the Timing Needle Part No. 636 589 00 23 which is fixed by the dowel pin; the marking FB = feed begin 32 deg before top dead center and the marking OT = top dead center.

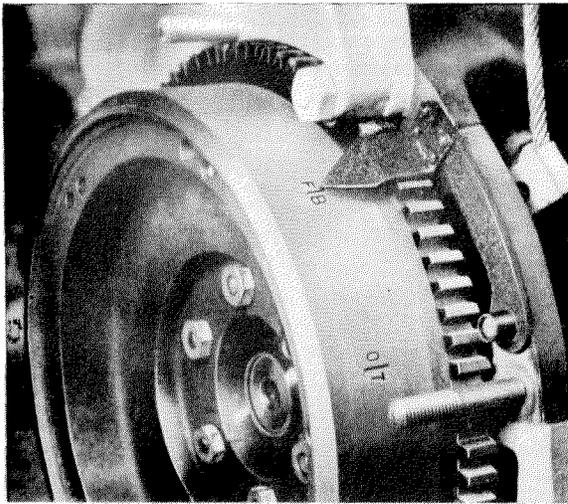


Figure 00-6/6

Flywheel Part No. 636 030 02 05

OT = top dead center
 FB = feed begin
 and/or at the first engines
 EB = begin of injection

The markings on this flywheel are advanced 50 deg in relation to the vertical.

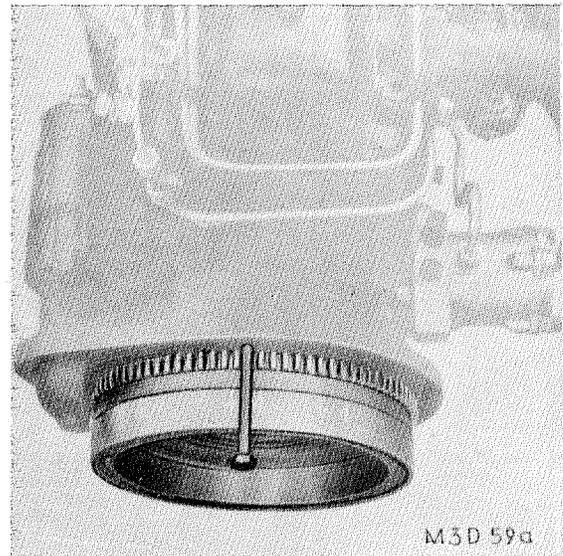


Figure 00-6/7

Flywheel Part No. 636 030 01 05

In the photograph the crankshaft is at feed begin 30 deg before top dead center
 OT = top dead center and
 FB = feed begin 30° BTDC
 each indicated by 2 lines

II. Checking Feed Begin with the Overflow Method on Removed or Installed Engines

1. Set the piston of the 1st cylinder to ignition dead center (see Job No. 00-3, Pos. 3) and check marking according to Job No. 00-6, Pos. 1.
2. Remove the glow plug of the 1st cylinder, turn the crankshaft approximately 50 deg in the opposite direction, so that the crankshaft is approx. 50 deg BTDC and approx. 20 deg before feed begin.

The gear backlash is eliminated or the chain is kept tensioned by the fact that the crankshaft is again turned in the correct sense of rotation between 50 deg BTDC and the feed begin. This is the reason why the crankshaft should by all means be turned back to approx. 50 deg BTDC and not only just to feed begin.

Note: On engines with injection timing device the crankshaft must always be turned in the correct sense of rotation, so that the centrifugal weights are not forced out of their idling stop position.

Therefore, turn the engine $1\frac{3}{4}$ revolutions in direction of rotation. Furthermore, before each checking of the feed begin the injection timing device has to be checked for its idling stop position.

To do this remove the lid of the timing housing cover. Then check with finger whether the centrifugal weights are in their idling stop position (see Figure 00-6/8).

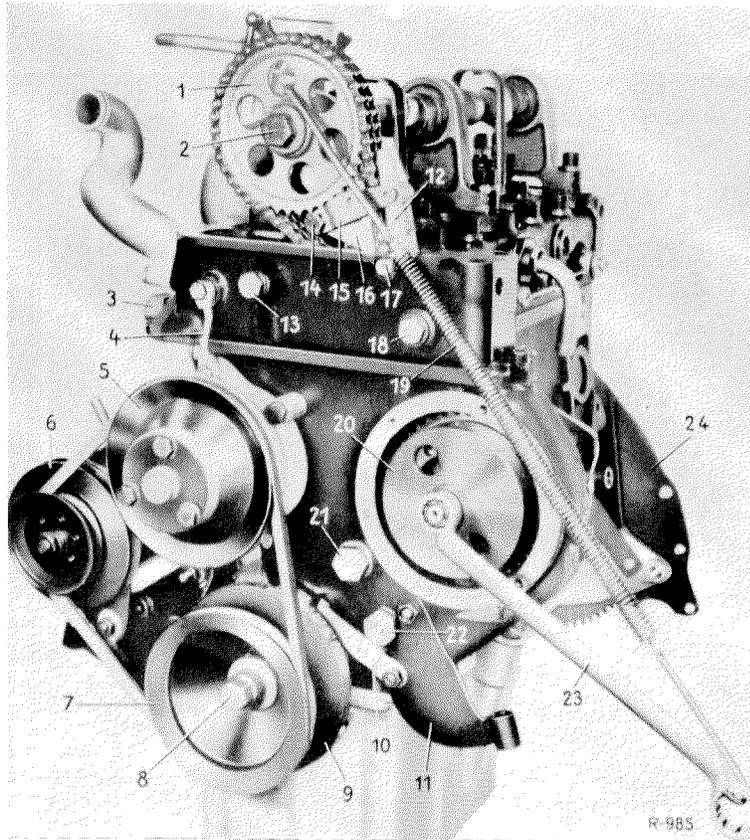


Figure 00-6/8a

Engine OM 621

- | | |
|---|---|
| 1 Camshaft gear | 14 Hex. hd.screw M 8×50 |
| 2 Hex. hd. screw M 14×1.5×40 | 15 Holder for guide rail, inner |
| 3 Chain tightener | 16 Guide rail, inner |
| 4 Venting line for water pump | 17 Pivot pin for guide rail on cylinder head |
| 5 Water pump | 18 Screw plug for guide sprocket bearing pin |
| 6 Generator | 19 Return spring |
| 7 Pulley on crankshaft | 20 Injection timing device |
| 8 Collar screw | 21 Screw plug for oil pressure relief valve |
| 9 Counterweight, graduated | 22 Screw plug with guide rail bearing pin, bottom in cylinder crankcase |
| 10 Adjusting pointer | 23 Box wrench |
| 11 Engine support, front, left | 24 Intermediate plate on cylinder crankcase for starter motor mounting |
| 12 Guide rail, outer with locking wire on cylinder head | |
| 13 Screw plug for idler sprocket bearing pin | |

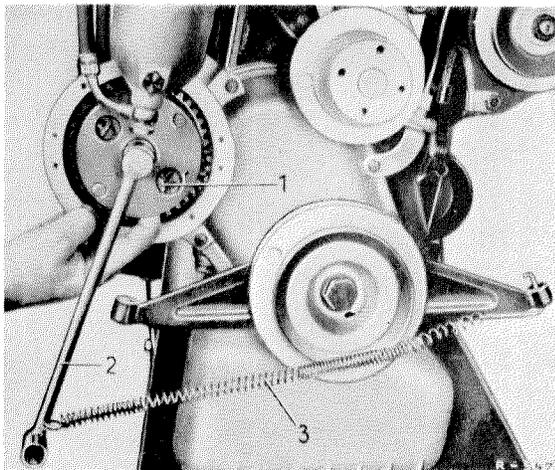


Figure 00-6/8

Engine OM 636

- 1 Check position of centrifugal weight rollers
- 2 Wrench to hold injection timing device
- 3 Return spring

Hold the injection timing device in the idling stop position by means of a double box wrench which is held in place by a long spring (see Figure 00-6/8 and 00-6/8 a), to make sure that the centrifugal weights remain in the idling stop position during the adjusting of the feed begin. This device prevents the centrifugal weights from moving during the cranking of the engine (even in reverse direction).

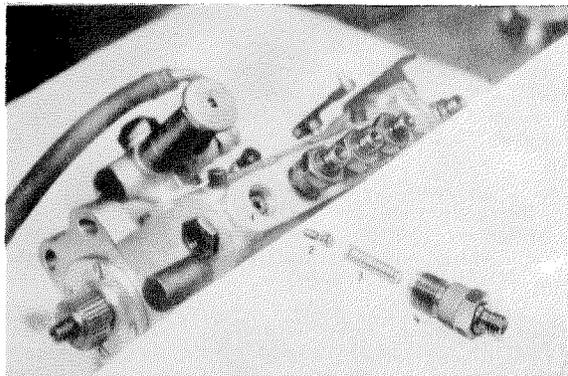


Fig. 00-6/9

A-Injection pump for OM 636 engines

- | | |
|------------------|-------------------------------------|
| 1 Pump cylinder | 3 Tension spring |
| 2 Pressure valve | 4 Connector (pressure valve holder) |

Pipe connection, pressure valve and seal ring of the M-Injection Pump for OM 621 engines (see Fig. 00-6/14).

3. Disconnect injection line at the pressure nipple of the 1st pump cylinder. Unscrew the pressure nipple, take out pressure valve and pressure spring (see Figure 00-6/9). Screw the pressure nipple in again and attach the overflow tube (4) Part No. 636 589 02 23 (see Figure 00-6/10).
4. Connect fuel tank (1) Part No. 0005890523 with injection pump, fill tank with clean fuel and open the stop cock (2) of the fuel tank (see Figure 00-6/10).

The fuel flows out of the overflow tube (see Figure 00-6/11).

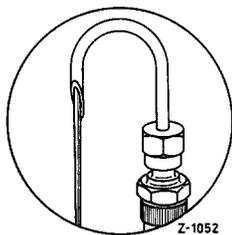


Fig. 00-6/11

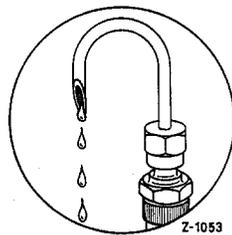


Fig. 00-6/12

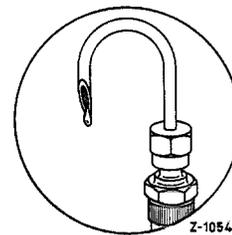


Fig. 00-6/13

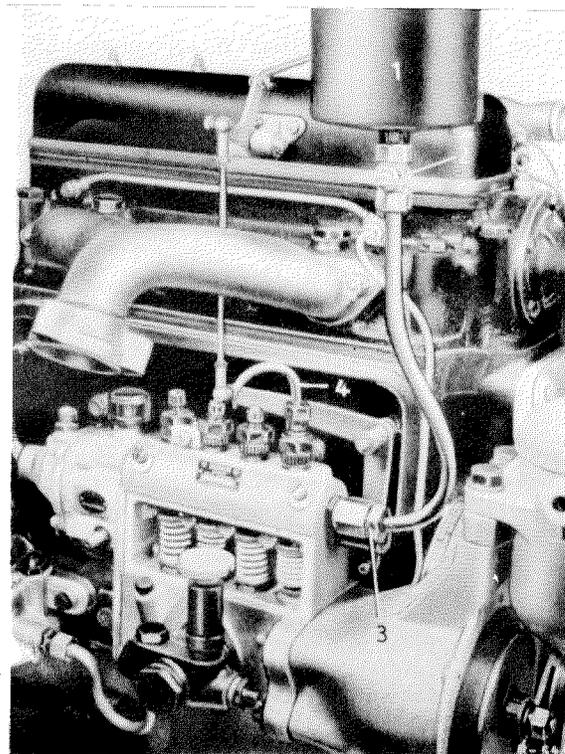


Fig. 00-6/10

- 1 Fuel tank Part No. 000 589 05 23 with tube 621 589 01 90 00
- 2 Stop cock
- 3 Connector at the injection pump
- 4 Overflow tube Part No. 636 589 02 23 screwed onto the pipe connector of the 1st pump cylinder

Note: For checking it is not imperative to connect the fuel tank. To do this, it is sufficient to unscrew the bleeder screw on the fuel main filter, as it is done during the bleeding procedure. The fuel stored will suffice to carry out one or two checks.

5. Then turn crankshaft slowly in direction of rotation until the fuel starts to drip (see Figure 00-6/12) and/or until the fuel is just about to stop dripping. Approx. 15 to 20 seconds later one additional drop may follow (see Figure 00-6/13).

In this position the pump plunger just closes the inlet oilway in the pump cylinder, that is, the plunger of the 1st cylinder of the injection pump is set to feed begin (see Figure 07-4/4). If the position of the timing needle also coincides with the feed beginning marking and/or with the respective number of degrees on the belt pulley or on the counterweight (see Figure 00-6/1 and 00-6/17 and/or the feed begin marking on the flywheel is also located in the center of the inspection hole of the clutch

housing (see Figure 00-6/4 and 00-6/5), then the feed beginning is correctly adjusted. If the adjustment is incorrect, then adjust feed begin (see Section III) again. In order to repeat the checking turn crankshaft for exactly two revolutions in the direction of engine rotation (see Section II, Note of item 2). Turn again slowly towards the end of the second revolution until the fuel just stops dripping at the overflow tube (see Figure 00-6/11, 00-6/12 and 00-6/13).

Note: The engines of type 190 Db as from engine No. 321.910-10-012326, as well as engines of type 180 Dc, L and O 319 and 190 Dc are equipped with an injection pump having two guiding edges, that is, the pistons of these injection pumps have a top as well as a bottom guiding edge. Due to the guiding edge at the top the feed begin will be retarded in the idling and partial load range of the engine with the result that the engine will run smoother.

Contrary to the former injection pump type with **only** a single, bottom guiding edge, the feed begin for these injection pumps is dependent on the position of the pistons of the elements, or control rod, respectively. **Therefore, it is absolutely necessary during testing of injection pumps with two guiding edges that the position of the control rod is set to full load, since in this position the feed begin is constant.** During checks, detach starter and stop pulls on injection pump adjusting lever to make sure that the adjusting lever is on full load.

During installation of starter and stop pulls make sure that in position "Fahrt" (Driving) of the glow starter and stop switch there is a play of approx. 2.0 mm (0.0787 in.) between the bolt of the injection pump adjusting lever and the rear portion of the oblong hole. In addition, check bowden controls on oblong hole for easy running.

Be sure that the injection pump feed begin is measured acc. to the overflow method, since this method is safer and provides better values than the capillary method.

III. Adjusting Feed Begin with the Overflow Method on Removed and Installed Engines

1. Conduct operations described in Section II.
2. Slowly turn crankshaft in direction of engine rotation until the timing needle corresponds to the feed begin marking and/or the respective degree marked on the pulley or on the counterweight (see Figure 00-6/1 and 00-6/17) or until the feed begin marking at the flywheel is located in the center of the inspection hole of the clutch housing (see Figure 00-6/4 and 00-6/5).

Note: All engine types of the model OM 636 are now furnished with a timing needle and with a TDC marking and markings at 20°, 25° and 30° BTDC on the belt pulley of the crankshaft (see Figure 00-6/2).

3. Loosen the injection pump at the supporting flange so that it can just be turned.
4. Then determine feed begin by turning the injection pump in the respective direction.

On the OM 636 turning the injection pump towards the engine causes a retarded feed begin, turning away from the engine causes the opposite.

On the OM 621 turning the injection pump towards the engine causes an advanced feed begin, turning away from the engine causes a retarded feed begin.

The injection pump is set to feed begin if the fuel has just stopped dripping at the overflow tube. After approx. 15 to 20 seconds one additional drop may follow (see Figure 00-6/13). Fix injection pump in this position by tightening 2 hex nuts and check adjustment again (see Section II).

Note: During the turning of the injection pump remove injection lines, if necessary.

5. If the adjustment is correct, tighten all hex nuts well for attachment of injection pump.
6. Unscrew the fuel tank (1) and the overflow tube (4) (see Figure 00-6/10).

- Unscrew pipe connection nipple (4), install pressure valve (2) and tension spring (3) (see Figure 00-6/9). Screw in pipe connection nipple again and **tighten with a torque of 4.5 + 0.5 mkg (32.5 + 3.6 ft. lb.)**. To guarantee perfect seat of sealing ring, **loosen pipe connection again and tighten with 4.5 + 0.5 mkg for the second time, loosen for the third time and tighten again with 4.5 + 0.5 mkg**. Attach clamping jaw lock between pipe connections; in doing so, tighten attaching bolts with a torque of 0.9 mkg (6.5 ft. lb.) (too much torque on the low or high pressure elements may cause leaks or distortions of the injection pump casing).

Connect injection line.

Applying too high or too low a torque when tightening the connection nipple may cause irregularities and trouble on the pump and on the engine.

In the case of the OM 621 also observe the following: before screwing in the pipe connection (1), insert a new seal ring (4) each time (part. No. 001 997 34 40 for injection pump PES 4 M ... R 3, RS 3, R 4 and PES 4 M ... RS 14, or part No. 001 997 17 40 for injection pump PES 4 M ... RT,

R 1/2 and R 1/24, respectively. Check rubber seal ring (2) for damage (see Figure 00-6/14).

Additionally, it should be mentioned that the pressure valve holder (5) with pressure valve, seal ring (4) and pipe connections (1) of the reinforced injection pumps PES 4 M ... R 3, RS 3, R 4 and RS 14 are not interchangeable with those of injection pumps PES 4 M R 1, R 1/2 and R 1/24 (see Figure 00-6/14).

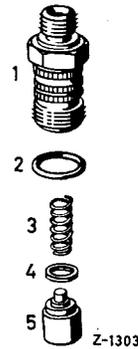


Fig. 00-6/14

- 1 Pipe connection nipple
- 2 Seal ring (rubber)
- 3 Spring
- 4 Seal ring (bronze)
- 5 Pressure valve holder with pressure valve

Note: When installing the pressure valve make sure that the parts are clean, because dirty valves can cause engine trouble.

- Bleed the fuel system (see Job No. 00-10).
- Operate installed engine and check connections for leaks.

IV. Making Markings at Installed or Removed Engines OM 636 without Markings

- Set piston of 1st cylinder to ignition dead center (see Job No. 00-3, item 3).
- Remove glow plug of 1st cylinder, turn crankshaft approx. 50 deg opposite to direction of rotation, so that the crankshaft is approx. 50 deg BTDC.

Note: On engines with injection timing device the crankshaft must be turned $1\frac{3}{4}$ revolutions in the direction of engine rotation. The injection timing device must also be checked on its idling stop position (see Section II, Note of Pos. 2).

- Disconnect ground cable at negative pole of battery for reasons of safety.
- Use valve lifter to press inlet valve downwards and insert a feeler gauge of a given thickness (a) between valve stem and rocker arm (see Figure 00-6/15).

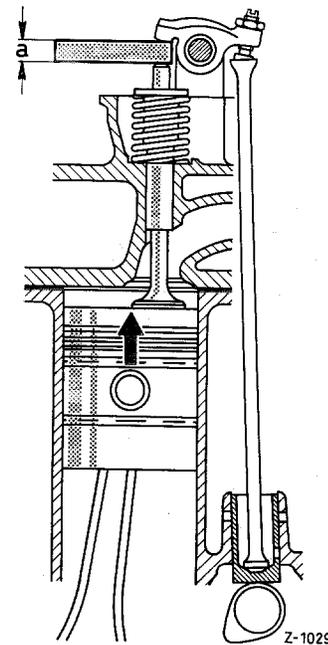


Fig. 00-6/15

a = Thickness of feeler gauge

- For the feed begin at
- 32° BTDC = a feeler gauge
12 mm thick
 - 30° BTDC = a feeler gauge
10.50 mm thick
 - 26° BTDC = a feeler gauge
8.75 mm thick

A tolerance of 0.375 mm corresponds to 1/2 deg at the crankshaft.

Note: The operations according to Paragraphs 4, 5, 6 and 7 should only be performed by a conscientious and good specialist.

5. Carefully **turn crankshaft manually** until the piston crown touches the valve disc (see Figure 00-6/15). Turn crankshaft at fixing screw (8), which serves to secure the pulley to the crankshaft, with box spanner 27 mm wide and ratchet or with a double box wrench with offset head or turn at fan (see Figure 00-3/1).

Do not crank engine with the starter.

6. If the crankshaft is set to the correct feed begin attach the timing needle to the timing housing cover and make a marking on the belt pulley. The marking and the timing needle must correspond. With the help of the timing needle and the marking on the pulley the feed begin can be correctly checked and adjusted any time afterwards.
7. Turn crankshaft approx. 30 deg **opposite** to engine rotation. Press inlet valve downwards by using valve lifter to remove the feeler gauge inserted between the valve stem and the rocker (see Figure 00-6/15).
8. Connect ground cable to negative pole of battery.
9. Check feed begin and adjust (see Section II and III).

V. Checking and Adjusting Feed Begin with Stroke Advance Tester

The feed begin can also be adjusted with the Stroke Advance Tester Part No. 000 589 68 21 for the OM 636 and with the tester Part No. 000 58985 21 for the OM 621 on removed engines. On installed engines the use of the stroke advance tester is not possible on all types due to the limited space. In this case determine the feed begin by measuring the stroke advance of the plunger.

The Feed Begin for all Injection Pumps of the Engines Model OM 636 and OM 621 correspond to a Stroke Advance of the Pump Plunger of 1.7 + 0.1 mm, starting at Bottom Dead Center.

a) Checking Feed Begin

1. Remove the protecting cover of the injection pump tappet housing.
2. Rotate engine in operational direction until the push rod for the piston of the 1st pump cylinder is at bottom dead center.
3. Put stroke advance tester (1) to the pump in such a way that the measuring pin (2) comes to rest on the push rod of the first pump cylinder (see Figure 00-6/16). The dial gauge must be pre-loaded approx. 0.5 mm at the same time. Then turn the scale of the dial gauge so that the needle points to zero.
4. Turn engine slowly in direction of rotation until the dial gauge indicates a movement of 1.7 + 0.1 mm.

Note: In order to eliminate faults in measuring during the cranking of the engine, press stroke advance tester well against the support at the injection pump.

5. In this position of the injection pump the feed begin marking and/or the corresponding degree on the pulley (see Figure 00-6/1) or on the flywheel must coincide with the timing needle (see Figure 00-6/6) or the hexagon screw must be situated between the two lines marked with "FB" on the flywheel (see 00-6/7).

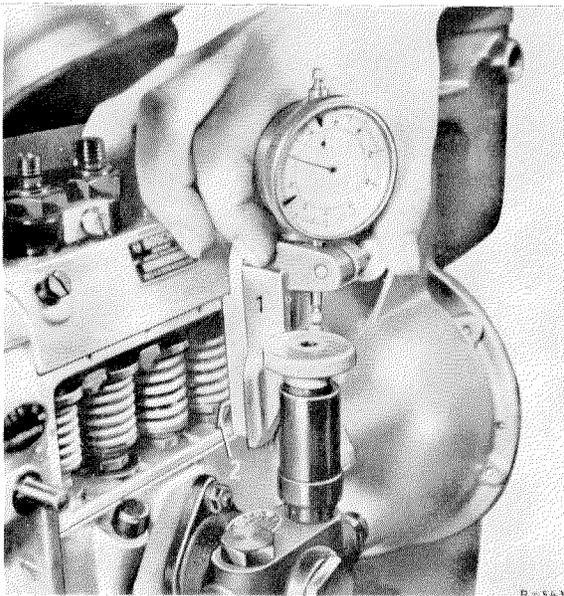


Figure 00-6/16

- 1 Stroke Advance Tester 000 589 68 21
- 2 Measuring pin of stroke advance tester

b) Adjusting the Feed Begin

1. Execute operations according to Point a Paragraph 1 to 3.
2. Set engine to feed begin. The feed begin marking or the respective degree value on the pulley and/or the flywheel must coincide with timing needle.

B. OM 621

I. Checking and adjusting of the feed begin according to the overflow method (spill method) with the engine installed or removed

1. Set the piston of the 1st cylinder to the ignition dead center (see Job No. 00-3, item 3).
2. Check this position on the counterweight at the front of the crankshaft. The adjusting pointer (2) must point approximately to the TDC mark on the counterweight (1) (see Figure 00-6/17).

Note: For checking and adjusting of the feed

3. Loosen injection pump at supporting flange so that it can just be turned.
4. Press stroke advance tester well against the support at the injection pump and turn the injection pump in such a way that the dial gauge indicates a movement of 1.7 ± 0.1 mm.

On the OM 636 turning the injection pump towards the engine causes a retarded feed begin, turning the other way causes advancing.

The injection pump is now also set to feed begin. Secure injection pump in this position.

Note: During the turning of the injection pump disconnect injection lines if necessary.

5. Test adjustment of feed beginning (see Section a) and correct again if necessary (also see Job No. 07-5, Section II, Point c, adjusting stroke advance and checking feed begin).

begin and the TDC, the OM 621 engines are provided with an adjusting pointer on the cylinder crankcase and a gradation on the counterweight of the crankshaft (see Figure 00-6/17).

3. Carry out operations as under A, Model OM 636, Section II, items 2-5.
4. Carry out operations as under A, Model OM 636, Section III, items 1-9.