

III. Checking and Adjusting of Injection Pump according to Test Data Sheets

a) Adjusting Data of Injection Pump according to Section A

1. General

If the measured values deviate from the nominal values, the pump plungers must be adjusted correctly.

Incorrectly adjusted and unequally discharging elements can cause engine trouble. If an element has shifted in the direction FULL, it can happen that the engine fails to stop when switched off. Shifting in the direction STOP can cause stalling of the corresponding cylinder.

2. Adjusting the Discharge Rate

Return the change-over tap of the test stand to output test and operate the pump for a short period, until the pump delivers evenly again. The governor is kept disengaged during output testing. The control rod is held in the required position by the clamping device.

To do this, only now mount the control rod travel adjusting device EFEP 304, part No. 000 589 84 21 for the 'M' pump (OM 621) (see Figure 07-5/8a).

The control rod travel adjusting device (5) is screwed on in place of the feed pump; thus the opening is closed at the same time. The guide pin is connected with an additional clamp to be mounted on the control rod; however, do not fail to observe that the clamping pieces (2) for adjusting the feed quantity allow for sufficient adjustment (see Figure 07-5/8a).

Use the adjusting lever to set the control rod to the extreme stopping position. In this position, mount the adjusting device in such a way that the guide pin engages into the \odot mark of the perforated plate. Then adjust the control rod to the framed value on the test sheet specified for 'uniform delivery'.

Before the adjusting of the discharge rate check the STOP position of the control rod. The perforated plate and the plug bolt of the control rod adjusting fixture must then be engaged at the zero mark.

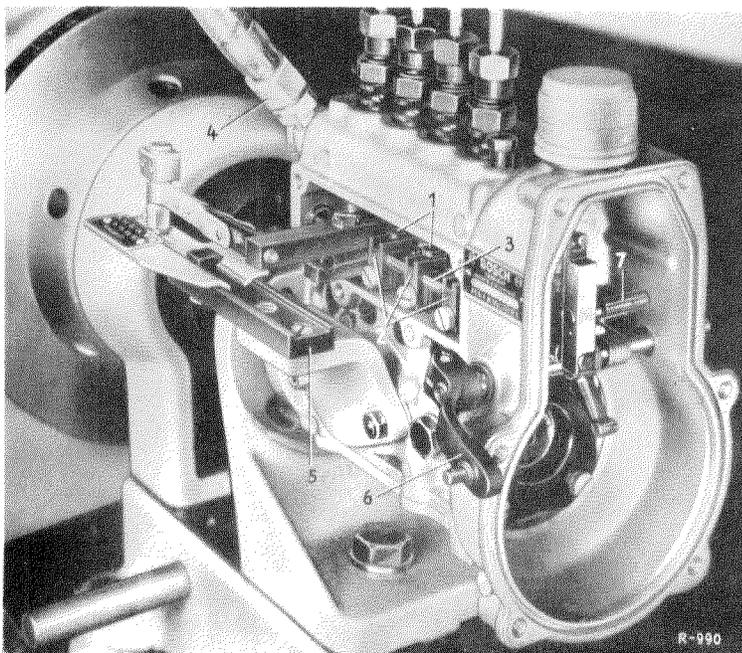


Figure 07-5/8a

- 1 Lever arm with pin and control sleeve
- 2 Clamping pieces with guide groove and screw
- 3 Control rod
- 4 Fuel feed line
- 5 Control rod travel adjusting device EFEP 304 part No. 000 589 84 21
- 6 Adjusting lever
- 7 Pin for hooking in governor

Then test the discharge rate of the individual elements according to the values specified in the test data sheets (Section A). For this purpose adjust the control rod with the adjusting fixture according to the data listed in the test data sheets. The **uniform delivery** must be measured first. This is considered as the base adjustment for the discharge rate of all pump elements. The test values are boxed-in and listed in Section A, Column 2 and 3 of the data sheet.

The difference in output between the individual elements should not exceed the value specified in Column 4.

The output of each element should possibly be the same for this point of measuring. The idling discharge rate of the individual pump elements must be very accurately adjusted, and there must be no greater difference between the individual elements than 1.5 cm³ per 1000 strokes.

It must be further observed that this difference stays as small as possible during the other testing operations. Compensate the values if necessary.

In order to change the discharge rate of one pump plunger on the 'A' Pump of Model OM 636 the clamping screw on the pinion segment must be loosened and the control sleeve must then be turned together with the pump plunger by means of the Tool EF 8208 A (Figure 07-5/9).

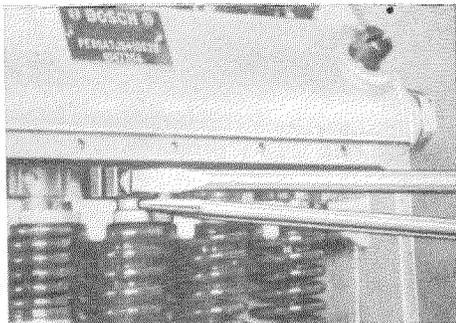


Figure 07-5/9

With the 'M' pump on the OM 621, for varying the feed quantity of a pump plunger, it is necessary to loosen the clamping screw (21) on the adjustable clamping piece (20) and then to move the clamping

piece (20) on the control rod (see Figure 07-4/25), thereby observe that each clamping piece lies within the respective marking lines (1) (see Figure 07-5/6).

Moving of the clamping pieces in direction '**VOLL**' (full) increases and moving in direction **STOP** decreases the quantity.

By moving the clamping pieces (20), the pump plunger (8) is turned by the pin (19), the control sleeve (11) with lever arm and plunger lug (13) (see Figure 07-4/25).

The loss of output listed in Section A, Column 5 of the test data sheets specifies how many cm³ the outputs of an element can vary at the same control position but different speeds.

For used elements the maximum permissible loss of output is calculated as follows:

Take from Column 3, Section A of the test data sheet for each **lowest control position specified**

the **largest** output value at **1000 rpm**,

the **smallest** output value at **200 rpm**

and subtract.

Example:

(see Test sheet DAI-1,7a
dtd. Mar. 10th 1958)

| rpm | CRT mm | cm ³ /100 str. |
|------------|--------|---------------------------|
| 1000 | 9 | 1.5 |
| 200 | 9 | 0.7 |
| Difference | | 0.8 |

This calculated value can then be increased by 10 to 15 %:

0.1

Hence: max. permissible loss of output:

0.9 cm³/100 str.

If an element is subjected to this permissible loss of output, the element must be adjusted to highest output at the higher speed.

After finishing the output adjusting and testing on the 'A'-Pump of Model OM 636 tighten the clamping screws of the pinion segments and mark the position of the control sleeve in relation to the (respective) pinion segment with a marking tool. Make sure that there is only one marking each. Old markings must therefore be removed (Figure 07-5/10).

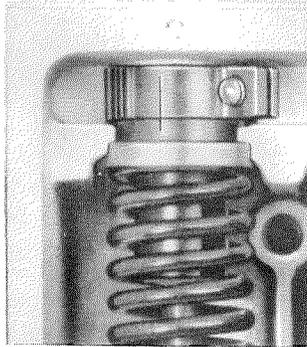


Figure 07-5/10

Line mark on the control sleeve and the pinion segment.

Regarding the 'M' pump, OM 621

After the adjustment and checking of the feed quantity, tighten the clamping screws of the clamping pieces and further check:

1. Whether the clamping pieces (2) lie within the respective marking lines (1) (see Figure 07-5/6).
2. Whether the control rod (18) moves easily and whether the control sleeves (11) have vertical clearance (see Figure 07-4/25).
3. Whether the clamping pieces (20) do not graze on the upper spring retainers or on the tappet springs (12) (see Figure 07-4/25).
4. Whether the pin (19) in the groove of the individual clamping piece (20), with the control rod in extreme STOP or 'VOLL' (full) position, is still engaged (see Figure 07-4/25).

b) Adjusting Data of Governor according to Section B of the Test Data Sheet

1. General

Mount the governor to the injection pump.

Reverse the slide with the vernier scale of the control rod travel measuring device so that the vernier scale slides on the measuring plate (see Figure 07-5/8a).

The **pneumatic governor** attached to the injection pump is tested on the pump test stand in connection with the vacuum aggregate EFEP 14. During the adjusting of the different vacuum values adhere to the consecutive order as listed in the test data sheet. The vacuum is increased by clockwise turning of the hand wheel (10) of the vacuum aggregate (see Figure 07-5/3).

If not particularly specified, the pump is driven with $n = 500$ rpm during the testing of the control rod travel.

2. Testing Control Rod Travel

(The suction line of the vacuum aggregate is not yet connected, because the instrument would otherwise be endangered.)

While the pump is not in operation check whether the control rod is running easily and does not stick.

Hold the control rod in the stop position by means of the adjusting lever and push strongly at the free control rod end. If the control rod gives more than 2 mm, the double lever is installed the wrong way and must be set right.

Set the control travel measuring device to zero while the adjusting lever is in stop position (see Figure 07-5/5 and 07-5/8a).

Remove the full load stop screw and release the adjusting lever. The control rod must travel approx. 21 mm.

3. Testing for Leaks

Connect vacuum line and test for leaks according to data of test data sheet, Section B, Column 2 and 3.

The specified pressure data indicate the vacuum which must be adjusted at the beginning of the specified test period and the still permissible pressure at the end of the test period.

4. Limiting Control Rod Travel

Adjust the control rod travel at the full load stop screw located below the governor cover according to the values specified in the test data sheet, Section B, Column 4 and 5. Alternately adjust the vacuum and the stop screw, until the specified value is reached in each case.

5. Testing Control Rod Travel and (on EP/MZ governors) Adjusting the Additional Spring.

Test the governor according to the values listed in Section B, Column 8 and 9 of the test data sheet. If these values cannot be reached, replace the control spring and/or adjust the additional spring and secure with lock nut.

6. Testing the Adapting Action

Disconnect the vacuum in order to check the adapting travel. The control rod will automatically go to FULL then.

Check the adapting travel by lightly pressing the control rod in direction STOP and subsequent releasing. If necessary, adjust the adapting travel as specified in Column 1, Section B, of the test data sheet by installing spacer, which must be level and without burrs (see Figure 07-5/11).

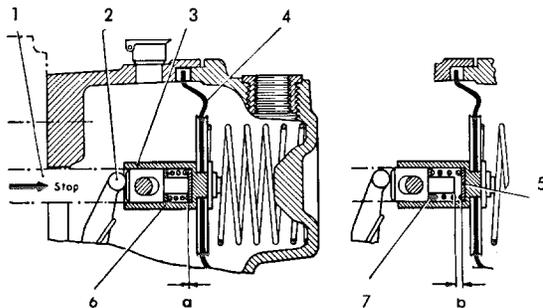


Figure 07-5/11

- a Adapting travel = 0
- b Max. adapting travel, see test data sheet, Column 1
- 1 Control rod
- 2 Full load stop
- 3 Diaphragm bolt
- 4 Diaphragm
- 5 Spacer (without hole)
- 6 Adapting spring
- 7 Adapting washer (with hole)

Check the controlling travel of the adapter according to the data in section B columns 8 to 11 of the test data sheet and, if necessary, adjust by installing compensating washers (7) (with hole) as described below:

If the governing begins too early, reduce the spring pressure.

If the governing begins too late, increase the spring pressure.

A change in initial tension of 0.1 mm corresponds to approx. 5 mm water column.

The control spring and diaphragm with adapting spring are adjusted together and will be delivered as only one spare part. The parts must be installed carefully.

7. Control rod travel check for governors with engaging cam (EP/MN . . .) OM 621

As for the EP/MZ governors, the value 'adjusting point' (section B, column 4 and 5 of the test sheet), is also to be taken as a starting point for these governors. **If no values are specified there, use the full load quantity (section C, columns 1-3), which in this case have to be adjusted according to items 5 and 6, before testing the governor.**

At definite measuring points, which are specially marked if necessary, the additional spring (18) or the Stupser housing (19) has to be brought into contact with the engaging cam (15) by turning the lever (16) for mechanical additional control and pressing the additional spring (18); to do this, set the engaging cam to idling position (15b full stroke) (see Figure 07-4/26).

c) Adjusting Data of Injection Pump with Governor according to Section C of the Test Data Sheet

1. General

Each engine has an individual max. speed and max. output based on the design of the engine. If the engine is stressed beyond these points, it will be overloaded. Speed and output of an engine depend on the amount of fuel delivered by the injection

pump, which in turn depends on the control rod travel. To prevent the danger of engine overloading, the control rod travel must be limited in the direction FULL. This is achieved by the adjustable full load stop screw on the governor.

The specified full load discharge rate is measured for 1000 strokes.

For this purpose determine the discharge rates of the individual cylinders.

Diesel engines react very strongly to small differences in the discharge rate. The pump must therefore be scrupulously adjusted on the test stand and must not be changed again. If there is an unpermissible smoking after attaching the pump to the engine, the pump can again be put on the test stand and can be adjusted close to the lowest limit of the specified full load discharge rate.

2. Adjusting the Full Load Discharge Rate and/or the Full Load Stop Screw

The adjusting must be done in accordance to the data listed in the test data sheet, Section C, Column 1, 2, and 3.

Firmly tighten the lock nut of the stop screw after each adjustment.

Note: Since the vacuums of the engines are always somewhat subjected to deviations, it must be taken into consideration that the throttle butterfly in the throttle duct needs minor adjusting after the installation of the injection pump.

3. **Check the overall discharge rate** (for the adapting travel). The test must be conducted according to the data listed in Section C, Column 4, 5, and 6 of the test data sheet.

4. **Check Idling Stop** (position of additional spring).

On the 'A' pump of the **OM 636**, the adjustment has to be carried out according

to the data of the test sheet, section C., columns 7, 8 and 9.

For this purpose switch off the test stand and remove the vacuum line. Then lightly pull the control rod in the direction FULL (max. position for full load) and determine position of control rod at the control travel measuring device.

After that carefully press control rod in direction STOP until a harder resistance can be felt. Determine control travel again. If the harder resistance cannot be felt properly, remove the control spring and repeat the test. Then reinstall the control spring. The difference between the two control rod travels must correspond to the value listed in Section C, Column 9, if not, the idling stop screw (additional spring) must be readjusted with the help of the pegged box wrench EFEP 95, and the lock nut must again be well tightened (Figure 07-5/12).

The adjustment of the adjusting screw with additional spring (6) must be very accurate, so that the diaphragm (3) oscillating during idling knocks against the stop bolt (Stupser) in the direction STOP (see Figure 07-8/3).

Note: If the pump elements are replaced during repair work on the injection pump PES 4 A 50 B 410 RS 204, elements with single control edge are installed instead of the former ones with double control edge. After this modification the former pump designation should be changed to PES 4 A 50 B 410 RS 144. The replacement of the elements must only be done by the firm Bosch.

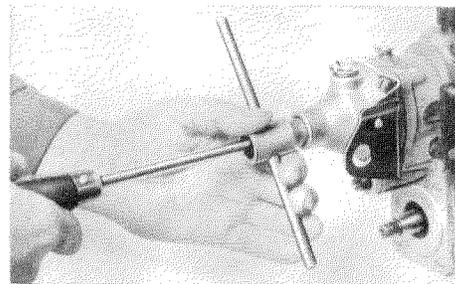


Figure 07-5/12

The adjustment or checking of the idling stop of the 'M' pump for the OM 621 is also done in accordance with the data of the test sheet, section C, columns 7, 8 and 9 and/or refer to the back side of the test sheet.

5. After checking and adjustment, screw on the leak oil overflow outlet and for the 'M' pump also screw on the overflow valve.
6. Check the oil level of the injection pump. On the 'A' pump for the OM 636 the check is done by the oil dip stick; fill in through the flap oiler. On the 'M' pump, unscrew

the oil level check screw. Fill in lube oil through the bore for the air filter (41) until it starts to flow out at the bore for the oil level check screw at the front side of the housing, this refers to pumps with pneumatic governor. Then screw in the oil level check screw. Do not forget the seal ring. Screw in the air filter (41) by hand; an installed engaging spring prevents the air filter from loosening by itself (see Figure 07-4/25).

On pumps with centrifugal governors, check the oil level on the level stick of the governor.