Testing Timing

Job No.
00–8

In general, there are no changes in the valve timing of the engine Model OM 636 or only slight ones due to the wear of the timing gears and cams, but this has no essential effect on the power output of the engine.

It might happen, however, that by installing the wrong or inexactly machined camshaft the timing no longer corresponds to the specified values. Furthermore, a shifting of the timing is caused by an incorrect setting of the camshaft. In other words, the timing is shifted by the same amount and in the same direction as the camshaft is incorrectly set.

In the case of the OM 621 the timing may vary after a longer period of operation owing to re-machining of the separating surfaces of the cylinder crankcase or of the cylinder head or owing to an elongation of the double roller chain. Generally, this slight variation will not seriously affect the power of the engine. If necessary, it can, however, be corrected by offsetting a key on the camshaft.

Because the feed begin is also varied thereby, it is imperative to check and correct it in all these cases (see Job No. 00–6).

Testing the timing with the specified valve clearance (operating valve clearance) is not sufficiently accurate. Therefore, the timing of the inlet and exhaust valves is listed for a valve clearance of 0.4 mm.

But this test valve clearance is not adjusted, only the test measurements are conducted at a valve lift of 0.4 mm, because this method is considerably more accurate.

By measuring at a valve lift of 0.4 mm the same timing is obtained as by basing the test on the valve clearance of 0.4 mm.

In general, it is sufficient to carry out the testing of the timing at the inlet and exhaust valve of the 1st cylinder only.

The test measurements cannot be carried out on all installed engine types due to lack of space.

The Testing is performed as follows:

1. Attach a suitable scale with a 360 deg graduation to the crankshaft and a timing needle to the timing housing cover (Figure 00–8/1).

Note: With the OM 621 the gradated disc part No. 180 589 07 23 (360 deg gradation) can be mounted on the camshaft in place of the crankshaft (see Figure No. 00–8/2).

Do not fail to observe here that the values read on the camshaft must be doubled!

2. Remove all glow plugs and remove the cylinder head cover.

3. Set the piston of the 1st cylinder to ignition dead center.

4. Now turn the scale (1) in such a way that the needle (2) points to the 0 deg mark. Secure scale in this position. (Figure 00–8/1.)

Note: Depending on the design of the pulley use a longer fixing screw and a corresponding spacer.

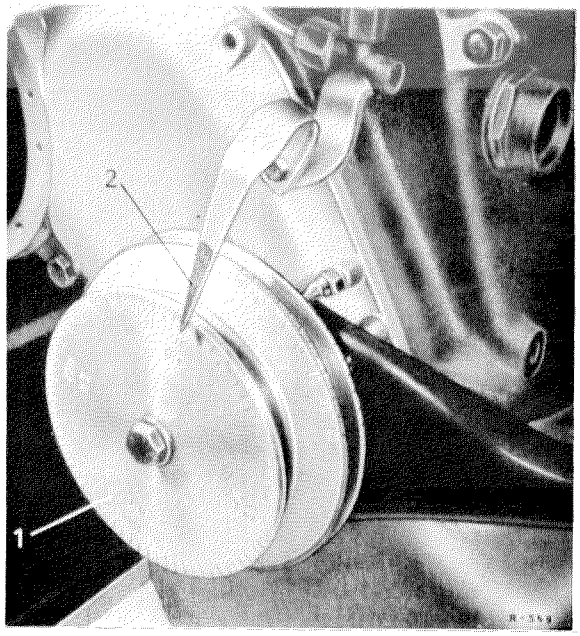

Figure 00–8/1

1 Scale
2 Timing Needle

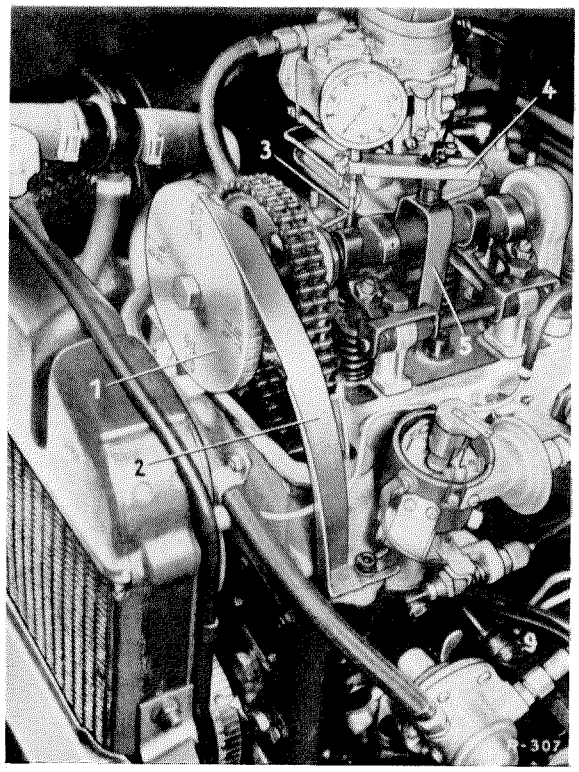

Figure 00–8/2

This figure shows the measurement taken at an installed gasoline engine, Model 190

1 gradated disc, part No. 180 589 07 23
2 pointer (manufacture yourself)
3 feeler pin
4 dial gauge holder part No. 198 589 01 21
5 bracket for cylinder head cover

5. In order to eliminate the given operating valve clearance insert a tolerance gauge between the valve stem end and the rocker in the case of the OM 636 and the rocker and the cap nut of the valve in the case of the OM 621 (see Figure 00–8/3).

   The tolerance gauge must be at least thick enough to safely eliminate the available operating valve clearance. It does not make any difference if the valve is slightly lifted in the progress.

6. Screw the measuring pin (2) into the dial gauge and attach the dial gauge by means of the dial gauge holder to the fixing bolt of the rocker brackets, so that the measuring pin has a tension of 2.0 mm and stands vertically on the spring retainer of the inlet valve of the 1st cylinder (Figure 00–8/3).

Note: The measuring pin of the dial gauge must be exactly vertical to the surface of the spring retainer, otherwise considerable measuring mistakes will result.

In the case of the OM 621 it is imperative to also properly bleed the chain tightener.

7. Now set the scale of the dial gauge to zero.

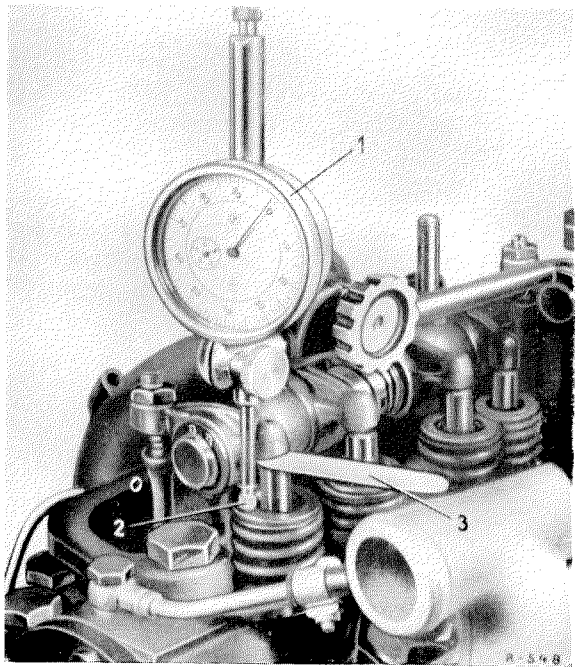

Figure 00–8/3

1 Dial Gauge
2 Measuring Pin
3 Tolerance Gauge

8. Turn the crankshaft in the direction of engine rotation, so that the dial gauge indicates 0.4 mm less, in other words, until the valve has been lifted 0.4 mm.

   Now read the value indicated at the graduation scale.

   This value indicates the beginning of valve opening.

   (As regards timing, refer to Job No. 00–0.)

   If the graduated disk on the OM 621 is mounted on the camshaft, double the indicated value.

9. Continue to turn the crankshaft in the direction of engine rotation until the valve is still lifted 0.4 mm during the closing procedure, meaning the dial gauge indicates the same value as at the beginning of opening. During this procedure make sure that the adjusted tension of the dial gauge of 2.0 mm is maintained.

   Read the value indicated at the graduation scale. **The indicated value stands for the end of closing of the inlet valve.**

Note: Never rotate engine in opposite direction during test procedures, because the result will be considerable measuring mistakes. To check the reading turn the engine until the needle (2) points to the 0-deg mark on the scale (1) (see Figure 00–8/1). At the same time the dial gauge must go back to zero.

10. **Check the timing of the exhaust valve in the same way.**

11. If an adjustment of the timing is necessary, install an offset key or a new camshaft. Offsetting the key toward the right (seen in driving direction) results in advanced feed begin. Offsetting the key toward the left results in retarded feed begin. A 0.20 mm offset of the key corresponds to approx. 1° 30′ crankshaft.

The following offset keys are available:

3° 20′ = 0.9 mm, Part No. 621 991 02 67 for an adjustment of approx. 6½° crankshaft
4° = 1.1 mm, Part No. 621 991 01 67 for an adjustment of approx. 8° crankshaft
5° = 1.3 mm, Part No. 621 991 00 67 for an adjustment of approx. 10° crankshaft

Offsetting the camshaft by one tooth will shift the feed begin on the OM 636 approx. 14° 30′ and on the OM 621 approx. 18° crankshaft.

Example: If the inlet valve on model OM 621 – type 621.912, 621.913 and 621.914 opens at 6° crankshaft only, there is a difference of 6½ crankshaft degrees on the camshaft as compared to the crankshaft.

Shifting of 6½ crankshaft degrees can be done by installing a key offset by 3° 20′.

Offsetting the chain by one tooth on camshaft gear toward the left when seen from front, results in shifting the camshaft or resetting the feed begin by approx. 11½ crankshaft degrees, respectively, when the key which is offset by 3° 20′ is inserted in reverse.

12. **Checking valve spacing:** Following testing and adjustment of timing, check space between inlet and exhaust valve disks and pistons on all cylinders.

The minimum space for overlapping dead center between		Model	
		OM 636	OM 621
inlet valve and piston at 5° **after** TDC should amount to	mm	1.1	1.5
exhaust valve and piston at 5° **before** TDC should amount to	mm	1.5	2.3

If the space is smaller, there is the risk that the valve will knock against the piston crown. When making measurements, the dial gauge and graduated disk are fitted in the same way as for measuring the timing. Then turn piston of cylinder to be measured – for example on model OM 621 – for determining spacing between **inlet** valve and piston on 5° **after** TDC (overlap dead center) and set dial gauge under preload from 3.00 mm to 0. The inlet valve is now pressed downwards so that it rests on piston. The dial gauge should now go back at least 1.5 mm, refer to table in our example.

Note: Overlapping dead center = TDC prior to suction stroke. If the space between the valves and the piston is smaller than stated in the table, lower valve seat correspondingly. (See Job No. 01–8.) In doing so, check first whether the small space is caused by oil carbon deposit on piston crown, or on valve disk, respectively.

13. **Check feed begin and adjust**
Setting of feed begin, see Job No. 00–6, Section III. A chain elongation of 5 mm corresponds to a retarded timing of feed begin of approx. 2° on crankshaft.