Timing Periods (values with reference to 0.4 mm valve lift)

Type	Camshaft[1)]	Inlet valve opens BTDC	Inlet valve closes ABDC	Exhaust valve opens BBDC	Exhaust valve closes ATDC
M 116.980 M 116.981 M 116.982	46/47	22°	50°	45°	17°
M 117.982	48/49	22°	48°	47°	17°
M 116.980 M 116.981 M 117.981 M 117.984	52/53	27°	43°	61°	13°

1) Camshafts with identification number 46, 48 or 52 are for cylinders 5–8 left, with identification number 47, 49, or 53 for cylinders 1–4 right.

Tightening Torque in kpm

Hex. bolt for attaching cylinder head cover	0.5

Special Tools

Removal and installation tool for rocker arm	116 589 00 61 00
Dial gauge holder	121 589 00 21 00
Threaded pin M 6 (accessory for dial gauge holder)	121 589 00 21 12

Note

The determination of the timing periods is too inaccurate under the influence of the specified valve clearance. **Test measurements are therefore made with the valve clearance cancelled and with 0.4 mm valve lift.** For normal shop work, measuring the timing periods on inlet valve of cylinder 1 and 6 will be adequate.

Inspection

1 Remove cylinder head covers.

2 Unscrew spark plugs and unscrew ground connection cable on ignition coil.

3 Push out tensioning springs (Fig. 1) with a screw driver (05.1–230).

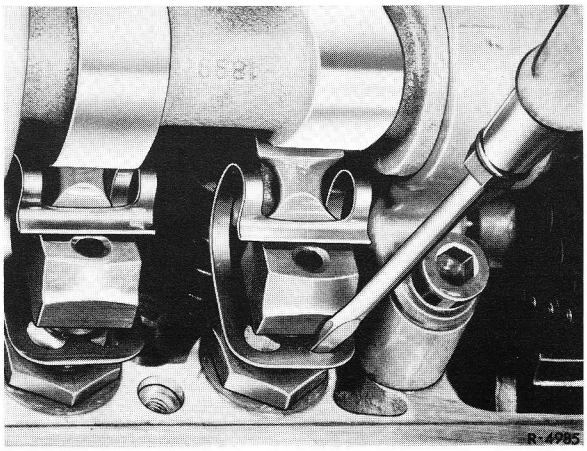

Fig. 1

4 Determine code number of camshafts. The code numbers are punched in on rear camshaft face end.

5 Push cover out of crankshaft pulley by means of a screw driver.

6 Position tool combination (Fig. 2) on hex. bolt for attaching hub to crankshaft and turn crankshaft in direction of rotation until the tip of the inlet cam to be measured points vertically away from the sliding surface of the rocker arm.

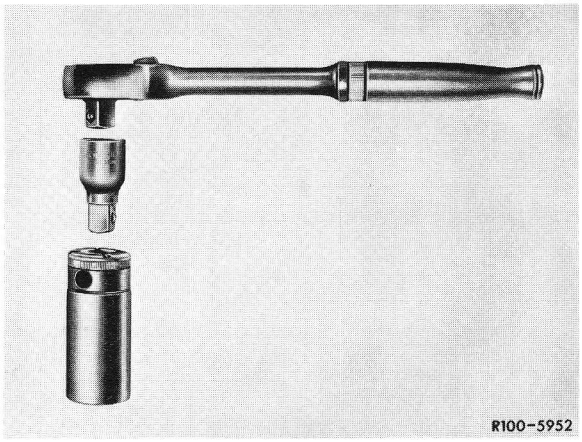

Fig. 2

Caution! Do not rotate engine on hex. bolts of camshaft gears.

Never rotate engine **in reverse direction** while measuring, since this will result in considerable measuring errors.

7 Push valve downwards with installing and removing tool for rocker arm and introduce a valve gauge in between the cam and the rocker arm.

The valve gauge must be thick enough to cancel the valve clearance completely.

8 Screw dial gauge holder with reduction piece to cylinder head (Fig. 3).

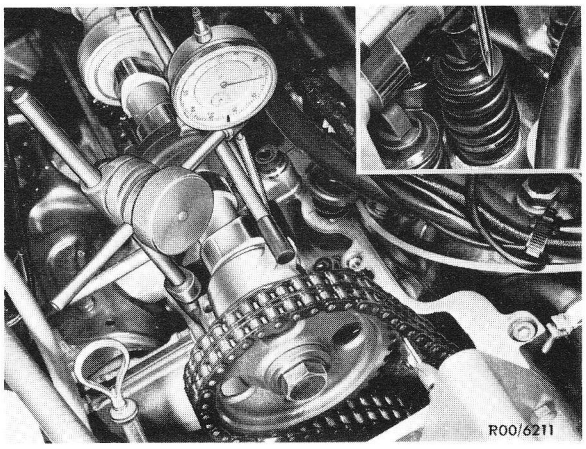

Fig. 3

9 Attach dial gauge in such a manner that the feeler rests on the valve retainer of the inlet valve under a preload of at least 2 mm. Set graduations of dial gauge to zero.

Caution! The feeler pin should rest accurately and vertically on valve retainer, since otherwise considerable measuring errors will result.

10 Keep turning engine in direction of rotation until the dial gauge shows 0.40 mm less, that is, the number 60. Then read the preload of the dial gauge on mm graduations (small indicator).

11 Read value on vibration damper in this position of engine. Value should be in agreement with value "inlet valve opens" in Table.

12 Keep turning engine until the valve is lifted only 0.40 mm when closing. The dial gauge should again indicate 60. The preload of the dial gauge should be the same as during begin of opening.

13 Read "end of closing" of valve on vibration damper.

14 To check after reading the end of closing keep turning up to basic cam circle. The dial gauge should again return to zero.

Correction

15 If the timing requires corrections, an offset woodruff key or a new roller chain must be installed. Woodruff keys are available with the following offsets:

Offset mm	Part No.	for a correction of approx.	
0.7	621 991 04 67	4°	CS
0.9	621 991 02 67	6 1/2°	CS
1.1	621 991 01 67	8°	CS
1.3	621 991 00 67	10°	CS

Note: When using an offset woodruff key, the following must be observed:

An offset of the woodruff key to the right (seen in driving direction) results in an earlier begin of inlet, an offset to the left in a later begin of offset. An offset by one tooth on camshaft gear provides approx. 18° on crankshaft.

Example: If the inlet valve of engine 116.982 does not open until 12.5 crankshaft degrees (rated value 19°), the difference between the camshaft and the crankshaft is 6 1/2° crankshaft degrees.

A shift of 6 1/2° CS can be corrected by the installation of a woodruff key offset by 0.9 mm.

An offset on the camshaft gear by one tooth, with an offset woodruff key turned around, provides a shift of the timing by approx. 11 1/2° CS.

16 Repeat jobs 10–14.

17 Remove dial gauge holder and valve gauge.

18 Attach tensioning springs (05.1–230).

19 Screw-in spark plugs and connect ground connection cable to ignition coil.

20 Mount cylinder head covers, watching out for perfect seat of gaskets.

21 Fit cover into crankshaft pulley.

22 Run engine and check cylinder head covers for leaks.

23 Check firing point upon installation of a new timing chain (07.5.1–515).