

Engine Timing

Job No.

05-5

Change: Model 180 c and chain tensioner 3rd and 4th version added.

A. Testing and Grinding Valves

This procedure is for models 180 a, 180 b, 180 c, 190 b, 190 SL, 220 a, 219, 220 S and 220 SE the same as for model 190.

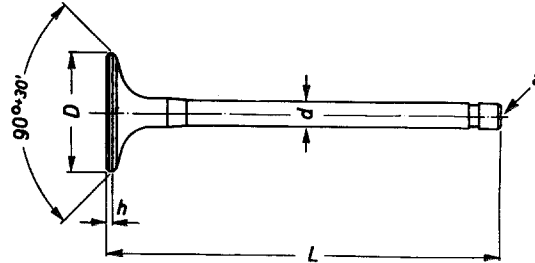


Fig. 05-5/1

Dimensions of Valves

Model	Valve head dia. D	Stem dia. d	Length L	Height "h" of valve head ¹⁾		Valve seat angle	Hardness at valve stem tip a
				when new	machining limit		
Inlet Valve							
180 a, 180 b, 180 c 190, 190 b 190 SL	$\frac{44.2}{44.1}$	$\frac{8.970}{8.948}$	128	1.5	1	90° + 30'	HRc 55
220 a, 219 220 S, 220 SE	$\frac{39.2}{39.1}$						
Exhaust Valve							
180 a, 180 b, 180 c ²⁾ 190, 190 b ²⁾	$\frac{37.2}{37.1}$	$\frac{9.950}{9.928}$	112.75	2.25	1.5	90° + 30'	HRc 55
190 SL ²⁾	$\frac{37.25}{36.95}$		112.70	2.35—2.55			HRc 50
220 a 219 (e = 7.6:1)	$\frac{35.2}{35.1}$		112.75	2.25			HRc 50
$\left. \begin{matrix} 219 \\ 220 S \\ 220 SE \end{matrix} \right\} \begin{matrix} a) \\ b) \end{matrix}$	$\frac{35.25}{34.95}$		112.70	2.35—2.55			HRc 50

¹⁾ Refer also to Fig. 05-5/2 and 05-5/3.

²⁾ Sodium-cooled.

³⁾ At a compression ratio $\epsilon = 8.7:1$.

Note: Permissible run-out between valve stem and valve cone max. 0.03 mm.

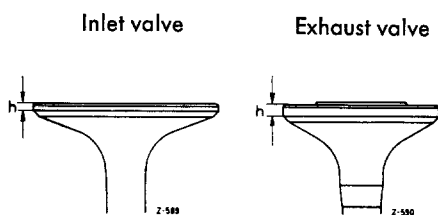


Fig. 05-5/2

Fig. 05-5/3

Sodium cooled exhaust valves (Fig. 05-5/3) have been installed as standard parts on model 190 SL as from engine end No. 6502311, on model 219 as from engine end No. 7504348, and on 220 S and 220 SE as from 1st engine.

Observe safety regulations when scrapping sodium-cooled valves (refer to Job No. 01-4, Section C).

B. Testing Valve Springs

The inner and outer valve springs of models 180 a, 180 b, 180 c, 190 b, 190 SL, 220 a, 219, 220 S and 220 SE are the same as for model 190.

The wear limit for the final load given in the table is -10%.

Testing Table for Valve Springs

Model 180 a, 180 b, 180 c, 190, 190 b, 190 SL, 220 a, 219, 220 S and 220 SE

	External Diameter mm	Wire gage mm	Free Length mm	Length load depressed		Length under final load	
				mm	kg	mm	kg
Inner spring	20.7	2.6	42	34.2	8.9	25.7	18.6 ⁺² ₋₁
Outer spring	30.6	4	47	38.4	23.1	29.9	45.9 ^{+4.5} _{-2.2}

C. Sealing Valve Stem

The valve stem sealing system for models 180 a, 180 b, 190 b, 190 SL, 220 a, 219 and 220 S is the same as for model 190.

While on model 220 SE the valve stem seal for the exhaust valves are also similar, the inlet valves are sealed with a silicone sealing ring (4), which is held against the valve guide by means of the sealing ring retainer (3) and the inner valve spring (4). (Fig. 05-5/4).

Hardened or cracked silicone sealing rings should be replaced. The same applies for sealings rings which have been compressed too hard. When new, the distance between the sealing ring retainer (3) and the washer (2) should be approx. 1 mm.

For models 180 c and 190 SL with further modified valve timing, refer to valve sealing Fig. 01-4/20 c and d.

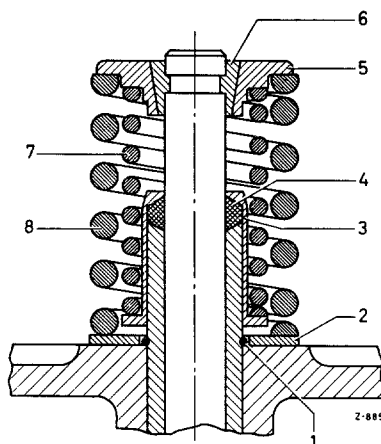


Fig. 05-5/4

Valve Stem Sealing at Inlet Valve Model 220 SE

- | | |
|---------------------------|-------------------------|
| 1 Snap ring | 5 Valve spring retainer |
| 2 Washer | 6 Valve cone half |
| 3 Sealing ring retainer | 7 Inner valve spring |
| 4 Sealing ring (silicone) | 8 Outer valve spring |

D. Grinding of Camshaft

For models 180 a, 180 b, 180 c, 190 b, 190 SL, 220 a, 219, 220 S and 220 SE regrinding of the camshaft is similar to model 190. Four-cylinder engines have a camshaft with three bearing surfaces, 6-cylinder engines have four.

When regrinding the 1st bearing journal only a max. of 0.1 mm may be ground off the end thrust surface of shoulder "b" (Fig. 05-5/5). The same amount as ground off at shoulder "b" should be ground off at surface "a", so that the dimension 34 H 8 (34.000 to 34.039 mm) is definitely maintained. Otherwise the end play of the camshaft and with it the deviation from the sprocket wheel alignment is too large. Lateral deflection at surface "a" should not exceed 0.01 mm.

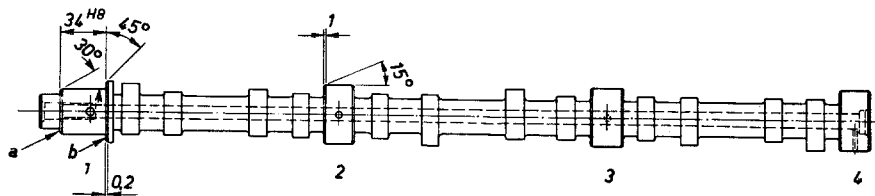


Fig. 05-5/5

Camshaft of a 6-cylinder engine

Prior to regrinding the camshaft of model 220 a, 219, 220 S and 220 SE the cover (2) which seals the oil passage, should be removed and the oil transfer tube (1) should be pulled out of the camshaft (Fig. 05-5/6).

Following the grinding of the camshaft the oil holes should be cleaned well and blown-out. Then, if previously removed, the oil transfer tube is returned into the oil passage and the aperture at the rear end of the camshaft is closed with a new sealing cover.

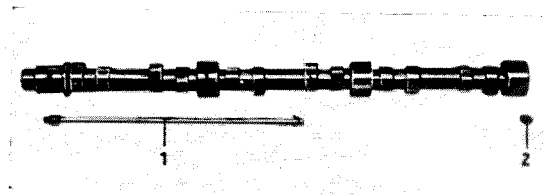


Fig. 05-5/6

1 Oil transfer tube 2 Sealing cover

Bearing Play of Camshaft

Models 180 a, 180 b, 180 c, 190, 190 b, 190 SL, 220 a, 219, 220 S and 220 SE

Radial play	End play
0.025–0.045	0.050–0.128

Grinding Dimensions of Camshaft and Camshaft Bearing Measurements

Model	Overhaul Stage	1 st Bearing		2 nd Bearing		3 rd Bearing	
		Shaft	Bearing	Shaft	Bearing	Shaft	Bearing
180 a 180 b 190 SL	Standard size	<u>34.975</u>	<u>35.000</u>	<u>44.975</u>	<u>45.000</u>	<u>45.975</u>	<u>46.000</u>
		34.959	35.016	44.959	45.016	45.959	46.016
	Intermediate Stage	<u>34.875</u>	<u>34.900</u>	<u>44.875</u>	<u>44.900</u>	<u>45.875</u>	<u>45.900</u>
		34.859	34.916	44.859	44.916	45.859	45.916
	1 st Overhaul Stage	<u>34.725</u>	<u>34.750</u>	<u>44.725</u>	<u>44.750</u>	<u>45.725</u>	<u>45.750</u>
		34.709	34.766	44.709	44.766	45.709	45.766
220 a 219 220 S 220 SE	Standard size	1 st Bearing		2 nd and 3 rd Bearing		4 th Bearing	
		<u>34.975</u>	<u>35.000</u>	<u>44.975</u>	<u>45.000</u>	<u>45.975</u>	<u>46.000</u>
	Intermediate Stage	34.959	35.016	44.959	45.016	45.959	46.016
		<u>34.875</u>	<u>34.900</u>	<u>44.875</u>	<u>44.900</u>	<u>45.875</u>	<u>45.900</u>
	1 st Overhaul Stage	34.859	34.916	44.859	44.916	45.859	45.916
		<u>34.725</u>	<u>34.750</u>	<u>44.725</u>	<u>44.750</u>	<u>45.725</u>	<u>45.750</u>
		34.709	34.766	44.709	44.766	45.709	45.766

For Model 180 c, 190 c and 190 SL with further modified valve timing the 2nd and 3rd camshaft bearing have the same diameter (refer to following table). The 1st bearing has the same dia. as above.

180 c, 190 c 190 SL		Standard Size	Intermediate Stage	1 st Overhaul Stage
Diameter	of shaft	<u>48.975</u>	<u>48.875</u>	<u>48.725</u>
		48.959	48.859	48.709
	of bearing	<u>49.000</u>	<u>48.900</u>	<u>48.750</u>
		49.016	48.916	48.766

The Brinell hardness HB or scleroscope hardness of bearing journals, cam base circle, cam nose and lifting flank are for models 180 a, 180 b, 180 c, 190 b, 190 SL, 220 a, 219, 220 S and 220 SE the same as for models 190.

	Brinell hardness HB in kg/mm ²	Scleroscope hardness
Bearing journal and cam base circle	217–248	36–40
Cam nose and lifting flank	minimum 500	minimum 64

E. Re-Bedding of Camshaft

New camshaft bearing should be installed only with cylinder head in position, screwed-down with the prescribed tightening torque. The work can also be done easily with the engine mounted in vehicle. Procedure for models 180 a, 180 b, 180 c, 190 b, 190 SL, 220 a, 219, 220 S and 220 SE is the same as for model 190.

F. Testing of Chain Tensioner

Testing of the chain tensioner for models 180 a, 180 b, 180 c, 190 b, 190 SL, 220 a, 219, 220 S and 220 SE is the same as for model 190. Figs. 05-5/7 to 05-5/8 show the 1st, 2nd, 3rd und 4th version; the table below shows which version was installed for the individual models.

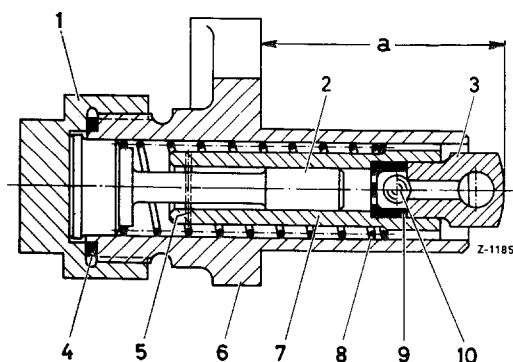


Fig. 05-5/7

1st Version

- | | | |
|----------------|---------------------------|-----------------|
| 1 Cover cap | 5 Dowel pin | 9 Ball retainer |
| 2 Pressure pin | 6 Chain tensioner housing | 10 Steel ball |
| 3 Head | 7 Pressure sleeve | |
| 4 Sealing ring | 8 Pressure spring | |

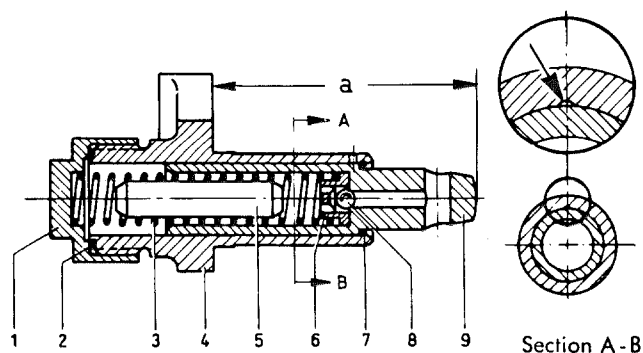


Fig. 05-5/8

2nd Version

- | | | |
|-------------------|-----------|----------------|
| 1 Cap nut | 4 Housing | 7 Snap ring |
| 2 Sealing ring | 5 Pin | 8 Ball |
| 3 Pressure spring | 6 Ball | 9 Pressure pin |

Chain Tensioner 1st Version

Model	Part No.	Dimension "a" with disassembled chain tensioner
180 a 190 190 SL	121 050 03 11	58
220 a 219 220 S	180 050 03 11	52

Chain Tensioner 2nd Version

Model	Part No.	Dimension "a" with disassembled chain tensioner
180 a, 180 b 190, 190 b 190 SL	621 050 00 11	58
219 220 S 220 SE	180 050 05 11	52

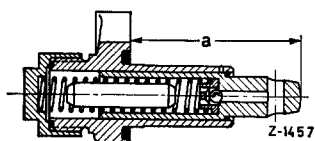


Fig. 05-5/8

3rd Version

1) The chain tensioner 3rd version is functionally similar to the 2nd version, however, the chain tensioner housing is provided with an annular groove and the seal between the chain tensioner and the cylinder crankcase is a rubber ring, which eliminates the former sealing shim (flange seal).

2) The chain tensioner 4th version (for 4-cyl. engines with further modified valve timing) differs from the 3rd version only by its stronger pressure spring. This chain tensioner is identified by a red dot on the cap nut.

Chain Tensioner 3rd Version

Model	Installed as from Engine End No.	Part No.	Dimension "a" with disassembled chain tensioner (refer to illustration)
180 b	017 323	121 050 04 11	58
190 b	015 336		
190 SL	018 423		
220 SE CA and CpA	001 059 000 240	180 050 06 11	52

Chain Tensioner 4th Version

180 c	000 013	121 050 05 11	58
190 c	000 341		
190 SL	000 007		

Pressure Spring for Chain Tensioner

Model	Pressure spring Part No.	External Diameter	Wire gage	Free Length	Length under load			
					depressed mm	kg	under final load mm	kg
180 a ¹⁾ , 190 ²⁾ , 190 SL ³⁾	121 993 02 01	15.6	1.1	118	44	1.85	38	1.9-2.05
180 a ⁴⁾ , 190 ⁵⁾ , 190 SL ⁶⁾ 180 b, 190 b, 219 ⁷⁾ 220 S ⁸⁾ , 220 b, 220 Sb 220 SE, 220 SEb	621 993 00 01	11.5	1.0	124	50	1.85	44	1.9-2.05
180 c, 190 c, 190 SL ¹¹⁾	621 993 02 01	11.3	1.3	91	50	4.2	44	4.5-5.3
219 ⁹⁾ , 220 S ¹⁰⁾	180 993 09 01	15.4	1.0	200	45	1.55	39	1.65-1.7

1) Installed on 180a up to engine end No. 85 02 800.

2) Installed on 190 up to engine end No. 85 03 700.

3) Installed on 190 SL up to engine end No. 85 00 900.

4) Installed on 180a as from engine end No. 85 02 801.

5) Installed on 190 as from engine end No. 85 03 701.

6) Installed on 190 SL as from engine end No. 85 00 901.

7) Installed on 219 as from engine end No. 85 01 851.

8) Installed on 220 S as from engine end No. 85 03 500.

9) Installed on 219 up to engine end No. 85 01 851.

10) Installed on 220 S up to engine end No. 85 03 500.

11) with further modified valve timing.

1st Version

Disassembly and reassembly of chain tensioner is the same as for the 1st version of model 190 (refer to Workshop Manual Model 190).

2nd, 3rd and 4th Version

Disassembly:

1. Unscrew cap nut (1) (Fig. 05-5/8).
2. Remove pressure spring (3), pin (5) ball retainer (6), ball (8) and pressure pin (9) from housing (4).
3. Clean all parts thoroughly and check for wear, replace if required. The radial play of the pressure pin (9) in housing (4) is 0.05–0.06 mm.

Reassembly:

4. Place pressure pin (9) into housing (4). Insert ball (8), ball retainer (6) as well as spring (3) with pin (5) into pressure pin (9). Screw-on cap nut (1) with sealing ring (2) and tighten, making sure that pressure spring presses on cap nut.
5. Fill chain tensioner with oil, bleed and test.

G. Repair of Tension Sprocket and Tension Bearing

This procedure for models 180 a, 180 b, 180 c, 190 b, 190 SL, 220 a, 219, 220 S and 220 SE is the same as for model 190. Dimensions and tolerances of the individual parts are also the same.

Model 220 SE has an additional guide sprocket (7) which is supported in cylinder head (Fig. 05-0/9).

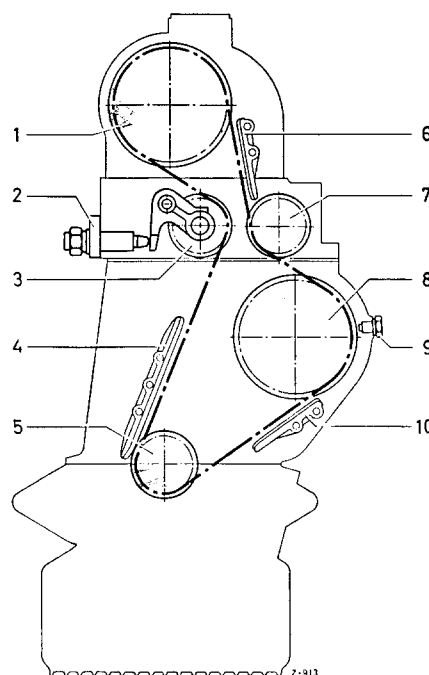


Fig. 05-5/9

Chain Drive for Model 220 SE

- 1 Camshaft timing gear
- 2 Chain tensioner
- 3 Tension sprocket
- 4 Long chain guide
- 5 Crankshaft timing gear
- 6 Short chain guide
- 7 Guide sprocket
- 8 Intermediate wheel
- 9 Lock screw
- 10 Short chain guide

To remove the pivot pin for the guide sprocket screw an M 8 screw into the threaded bore. If two spacer rings (4) are fitted, make sure when pulling the pivot pin out **that the spacer rings do not fall into the crankcase.**

Note: The spacer rings (4) are installed as standard parts only in the engines of Type 127.982 (Model 220 SEb) and Type 127.983 (Model 220 SE Convertible and Coupé with 120 HP).

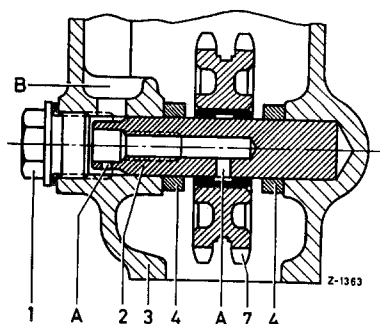


Fig. 05-5/10

- | | |
|-----------------|--|
| 1 Screw plug | 7 Guide sprocket |
| 2 Pivot pin | A Bore for lubrication of guide sprocket |
| 3 Cylinder head | B Oil case with oil bore |
| 4 Spacer ring | |

The following table contains the measurements

necessary for checking the pivot pin and the bore in the guide sprocket.

Guide Sprocket

Model 220 SE

Diameter of pivot pin	Bore in guide sprocket	Radial play
15.984 15.973	16.000 16.018	0.016—0.045

If the bushing in the guide sprocket is worn, it should be pressed out and a new bushing with a rough-turned bore pressed in.

Before pressing in a new bushing, set up the guide sprocket in the bore and lightly re-finish the teeth at their circumference (permissible eccentricity 0.02 mm). After re-finishing the teeth, press in the new bushing and then again set up the guide sprocket, this time with a chuck adapter gripping the circumference of the teeth and finish-turn the bore of the bushing (16.000 to 16.018 mm).

Maximum run-out of guide sprocket when set up on mandrel, measured at the circumference 0.02 mm.

Maximum eccentricity of guide sprocket, measured at the circumference 0.02 mm.

If the pivot pin shows signs of wear, it must be replaced.

H. Testing of Rocker Arm and Rocker Arm Mounting

For Models 180 a, 180 b, 190 SL, 220 a, 219, 220 S, and 220 SE this procedure as well as the dimensions and tolerances of the individual parts are the same as described for Model 190.

On earlier models the rocker arms were secured by sheet-metal spring clamps, whereas on recent models only spring steel wire clamps were fitted. When repairs are carried out, use only spring steel wire clamps Part No. 180 055 00 93. If the old rocker arm blocks are not being replaced, they must be provided with a notch to secure the spring clamp as shown in Fig. 05-5/11. The notch must correspond exactly to the dimensions given overleaf in order to ensure that the clamp is tensioned sufficiently and engages properly.

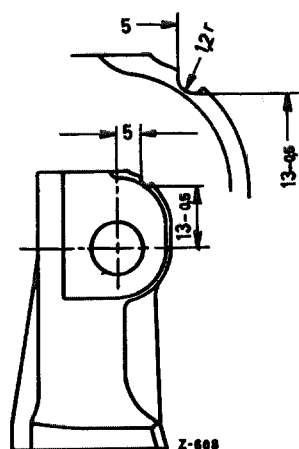


Fig. 05-5/11

Note: On Models 220 S and 220 SE the length of the rocker arm shafts is 153 mm for the 1st version and 159 mm for the 2nd version. The projecting ends of the 2nd version shafts prevent the spring clamps from jumping off the rocker arm shafts at high en-

gine speeds. If complaints are received, the 1st version can be replaced without any modification by the 2nd version (Part No. 180 055 08 05) on Models 219, 220 S, and 220 SE.