Installation of Spark Plugs

Spark plugs should only be slackened and tightened by means of the Articulated Spark Plug Wrench 000581 00 67. Great care is necessary when this wrench is used to screw in the spark plugs, as a certain amount of experience is necessary to insert the spark plug correctly. In order to avoid damage to the plugs and to the thread in the cylinder head, Spark Plug Holder 198 580 00 65 should be used for screwing in the spark plugs (Fig. 01-3/4b).

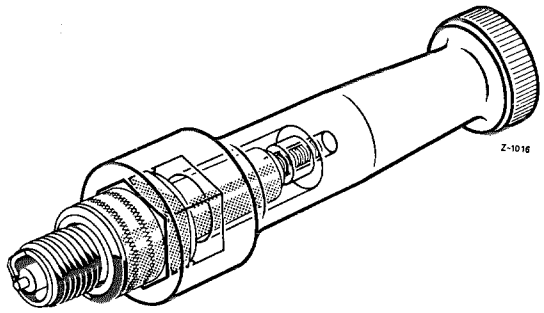

Fig. 01-3/4b

The Rubber Socket 000 581 00 86 pressed into the Articulated Spark Plug Wrench and the Socket 000 581 00 56 screwed into the Spark Plug Holder are replaceable.

D. Measurement and Adjustment of Distributor Contact Gaps and Angles of Closure

Measurement and adjustment on Models 180 a, 180 b, 190 SL, 220 a, 219, 220 S, and 220 SE are carried out in the same way as on Model 190. **We should like to point out again that whenever the angle of closure has been corrected, it is absolutely necessary to check whether the contact gap is still satisfactory.**

When the contact gaps have been adjusted, it is always necessary to check and if necessary to readjust the ignition setting.

Distributor Contact Gaps and Angles of Closure

Model	180 a, 180 b, 190, 190 b, 190 SL	220 a, 219, 220 S, 220 SE
Distributor contact gap (mm)	0.4—0.5	0.3—0.4
Angle of closure *)	50° ± 2°	36° ± 2°

*) When measuring the angle of closure please note that at higher engine speeds it may be lower by a maximum of 3°.

E. Ignition Setting

For the ignition setting in Models 180 a, 180 b, 190 SL, 220 a, 219, 220 S, and 220 SE see the details given in the Model 190 Workshop Manual.
Ignition adjustment should always be made by means of a flash stroboscope, and a timing light should only be used in exceptional circumstances.
The adjustment data are listed in the Table overleaf.

Ignition Setting

Model	Compression ratio ε	Distributor Bosch designation	Basic setting and stroboscope value at starter speed	Stroboscope values at engine speed (rpm)					
				800	800	1500	3000	4500	4500
				Automatic vacuum control					
				with	without	without	without	without	with
180 a [4] 190	6.8:1	VJU 4 BR 14 VJU 4 BR 22 VJUR 4 BR 27	8° ± 1° BTDC	15°—23° 12°—19°	26°—32° 12°—19°	27°—33°	32°—39°	41°—47°	49°—59°
180 b [4]	7.0:1	VJUR 4 BR 28	4° ± 1° BTDC	0°—10°	0°—10°	18°—25°	37°—43°	46°—52°	52°—62°
220 a 219	6.8:1 7.6:1	VJU 6 BR 24 VJUR 6 BR 24 VJUR 6 BR 38	5° ± 1° BTDC	10°—19°	10°—19°	23°—30°	28°—34°	34°—41°	42°—53° [1]
219	8.7:1	VJUR 6 BR 38	1° ± 1° ATDC	4°—13°	4°—13°	17°—24°	22°—28°	28°—35°	36°—47° [1]
220 S	6.8:1 7.6:1	VJUR 6 BR 24 VJUR 6 BR 38	8° ± 1° BTDC	13°—22°	13°—22°	26°—33°	31°—37°	37°—44°	45°—56° [1]
220 S	8.7:1	VJU 6 BR 38	2° ± 1° BTDC	7°—16°	7°—16°	20°—27°	25°—31°	31°—38°	39°—50° [1]
220 SE	8.7:1	VJUR 6 BR 32	2° ± 1° BTDC [2]	0°—6°	0°—6°	13°—19°	24°—28°	28° [3]	36°—40°
190 SL	8.5:1 8.8:1	VJUR 4 BR 11 VJ 4 BR 12	1° ± 1° BTDC	—	—	—	35°—41°	—	—
		VJ 4 BR 11 VJR 4 BR 24	9° ± 1° BTDC	—	—	—	35°—41°	—	—

[1] In the case of the 2nd version distributor VJUR 6 BR 38 the vacuum control is 10±2° on the crankshaft, as compared with 20±2° on distributors VJUR 6 BR 38, 1st version, VJUR 6 BR 24, and VJU 6 BR 24. The values given in the above Table apply to distributor VJUR 6 BR 38, 2nd version; the corresponding values for the 1st version and for the two distributors VJUR 6 BR 24 and VJU 6 BR 24 are 10° higher (e. g. 52°—63° instead of 42°—53°).

[2] The basic setting only applies to the assembly setting. For the final ignition setting see the values given for a speed of n = 4500 rpm without automatic vacuum control.

[3] In the case of distributor VJUR 6 BR 32 T, whose centrifugal governor advance curve is near the upper limit of the tolerance range, the centrifugal governor control already starts at a speed of n = 650 rpm. For this reason the ignition setting with a distributor VJUR 6 BR 32 T should also be checked at idling speed. At this speed the ignition setting must not be earlier than 4° BTDC. If the value is smaller, ignition can be retarded up to 26° BTDC at a speed of n = 4500 rpm.

If in exceptional cases a fuel with an octane rating lower than 96—99 ROZ (F—1) has to be used, ignition must be retarded in order to adapt it to the octane number of the fuel used. This setting should be carried out only within certain limits set out below.

Fuel with ROZ	Stroboscope value at n = 4500 rpm
93	26° BTDC
90	22° BTDC
88	20° BTDC

Ignition should be retarded at the distributor bearing by means of the hand lever. Adjustment by one graduation changes the ignition by 2° on the crankshaft. As soon as premium gasoline is being used, the hand lever should be moved back to its full advance position (28° BTDC at n = 4500 rpm).

If in engines which have run for a considerable time, the ignition is found to have moved in the "advance" direction, check the end play of the idling gear shaft, which should be 0.05—0.12 mm. If the end play exceeds 0.20 mm, the wear parts must be replaced.

[4] Ignition setting on Models 180 a and 180 b with a compression ratio ε = 7.5:1 for countries with altitudes above 2000 meters: 8° BTDC.

Note: The distributor named last with each model indicates the present standard design.
On model 190 SL the distributors VJ 4 BR 12, VJ 4 BR 11 and VJR 4 BR 24 have no vacuum control. Though the distributor VJUR 4 BR 11 is provided with a vacuum box, it is not connected. Compared with the two other distributors the VJ 4 BR 11 and VJR 4 BR 24 have a different movement curve. Therefore, care must be taken, that the various distributors are not mixed up when the ignition is adjusted.

Measurement of Ignition Vacuum Control

If the initial operation of the vacuum control and the amount of the vacuum should ever require an inspection, the following table shows the required values. However, the vacuum at the distributor should not be confused with the vacuum at the testing connection of the intake pipe. For this reason a Tee-piece should be inserted on the distributor when measuring the vacuum.

Initial Operation of Vacuum Control and Amount of Vacuum

Model	Distributor	Begins to operate at Engine Speed without Load rpm	Vacuum at Distributor mm Hg
180 a, 190	VJU 4 BR 14 VJU 4 BR 22 VJUR 4 BR 27	1000–1200	90–120
180 b, 180 c	VJUR 4 BR 28	1000–1200	90–130
200 a, 219	VJU 6 BR 24 VJUR 6 BR 24	1400–1600	90–120
219	VJUR 6 BR 38	1400–1600[1])	90–160
220 S	VJUR 6 BR 24	1800–2000	90–120
	VJUR 6 BR 38	1800–2000	90–160
220 SE	VJUR 6 BR 32	800–1000	90–140

[1]) For carburetors with by-pass bores (as from Nr. 3908566) vacuum control at engine speed n = 2500–3500 rpm

F. Checking Camshaft Adjustment

The camshaft adjustment for models 180 a, 180 b, 180 c, 190 SL, 220 a, 219, 220 S and 220 SE is tested in the same workshop way as described in the manual for model 190.

Contrary to the above and contrary to the more recent models the earlier 220a and the early 190 SL models have no marks at the front of the counterweight on the crankshaft. On these engines the graduation on the flywheel should be used, which is exposed at bottom of clutch housing after removing cover plate.