12 Electrical System – Engine

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Electrical system-engine

Model		1502	1602	1802	2002	2002 A	2002 TI	2002 tii
Starter: Bosch		EF 12 V 0.8 hp (0.58 kW)			GF (R) 12 V 1 hp (0.73 kW)			
Nominal voltage	V	12						
Operating voltage	V	6 ... 12						
Test voltage	V	13						
Test temperature	°C (°F)	20° (68°)						
Operating temperature	°C (°F)	–30° ... +90° (–22° ... +194°)						
Max. permissible temp.	°C (°F)	100° (212°)						
Max. output	kW (hp)	0.85 (1.15)			0.96 (1.30)			
at current	Amps	175			210			
at voltage	V	9.6						
Max. torque	Nm (lb.ft)	13.2 (9.5)			17.5 (12.7)			
at current	Amps	340			380			
at voltage	V	7.7						
Max. speed	rev/min	2400			1300			
Direction of rotation		to right (clockwise)						
Max. short-circuit current at battery	Amps	340			380			
	Amp/h	36, 1/2 full			56, 1/2 full			
Current consumption of solenoid switch-engagement and retaining coil	Amps	35						
-retaining coil	Amp/h	6						
Weight	kg (lb)	approx. 6.5 (14.3)			approx 7.5 (16.5)			
Number of teeth (pinion)		9						

Specifications

Electrical system — engine

Model		1502	1602	1802	2002	2002 A	2002 TI	2002 tii
Alternator: Bosch		K1 → 14V45A24		K1 → 14V45A24[2]				K1 → 14V45A22
Nominal voltage	V	12						
Alternator output voltage	V	14						
Max. current	Amps	45 (35)[3]						45
Max. output	W	650 (500)[3]						630
Max. speed	rev/min	14 000						
Operates within temperature range	°C (°F)	−40°...+90° (−40°...+194°)						
Max. permissible housing temperature	°C (°F)	90° (194°)						
Charging starts at	rev/min	1150 (1000)[3]						
2/3 of max. current reached at	rev/min	2200 (2000)[3]						
Max. current reached at	rev/min	6000						
V−belt	mm	9.5x875 LA or 9.1x870						9.5x975 LA[4][5]
Voltage regulator: Bosch		AD 1/14 V[1]						
Operating voltage (U)	V	14						
Regulator voltage	V	12						
Regulator voltage at 20°C (68°F)	V	13.5...14.2						
Effective voltage for alternator current	Amps	35						
at speed	rev/min	2700						
Max. field current	Amps	3						
Max. ambient temperature	°C (°F)	+70° (158°)						
Min. ambient temperature	°C (°F)	−30° (−22°)						

1) ADN 1 voltage regulator suppressed for radio
2) previously K1/14V/35A (special equipment)
3) Values in brackets applicable to previous alternator K1/14V/35A
4) previously 9.5x965 LA with plastic induction resonator pipe and cast generator support
5) or 9.5x965 serrated V−belt to prevent squeaking

Specifications

Electrical system – engine

Model		1502	1602	1802	2002	2002 A	2002 TI	2002 tii
Coil: Type (Bosch)		K12V[7]						
Mean wattage at 1000 rev/min	W	19[8]						
Max. spark rate with 6mm (0.236 in) spark		16000[9]						
Starting spark length at 3600 sparks/min and 6V	mm(in)	10 (0.394)[10]						
Operating spark length at 3600 sparks/min	mm(in)	15 (0.591)[11]						
Temperature stability	°C (°F)	–30...+90 (–22...+194)						
Max. permissible temperature	°C (°F)	+120 (248)[12]						
Weight approx.	kg (lb)	0.85 (1.87)[13]						
On–load ignition voltage	V	15000[14]						
Series resistance[1]	Ω	1.8±0.05[5][6]						
Spark plugs: Thread		M14 x 1.25						
Bosch		W145T30	W200T30[2]	W200T30	W200T30[4][15] W175T30[4][15]	WG200T30[3] W175T30[4][15]	W200T30	WG200T30[3] W175T30[4]
Electrode gap	mm (in)	0.6+0.1 (0.024±0.004)						
Beru		145/14/3A	200/14/3A[2]	200/14/3A	200/14/3A 175/14/3A	G200/14/3[3] 175/14/3A[4]	200/14/3A	G200/14/3[3] 175/14/3A[4]
Electrode gap	mm (in)	0.6+0.1 (0.024+0.004)						

1) Ignition coil for USA version and Automatic only in conjunction with series resistance
2) Previously for USA version: Beru G 200/14/3 or Bosch WG 200 T 30
3) Applicable until combustion chamber shape was changed
4) Applicable as from reduction of compression ratio to 9.5:1 and after change of combustion chamber. Engines with the new combustion chamber are marked on the outside by the letters "E12" cast in the cylinder head on the intake side.
5) At 20°C (68°F)
6) Previously 0.9 Ω
7) Previously TE 12V coil on BMW 1602, KW 12V coil on BMW 2002 A
8) 16 W on TE 12 V coil, 20 W on KW 12 V coil
9) 11000 on Te 12V coil, 18000 on KW 12V coil
10) 6.5mm (0.256 in) on TE 12 V coil
11) 13mm (0.512 in) on TE 12 V coil, 16mm (0.630 In) on KW 12 V coil
12) previously 90°C (194°F)
13) 1.1kg (2.43 lb) on KW 12 V coil
14) 13000 on TE 12 V coil
15) Bosch W 145T30 for USA version

Specifications

Electrical system – engine

Model		1502	1602	1802	2002	2002 A	2002 TI	2002 tii
Spark plugs continued Champion		N–12 Y	N–9 Y	N–8 Y	N–8 Y N–9 Y [1)9)]	N–9 Y [1)9)]	N–8 Y	N–9 Y [1)]
Electrode gap	mm (in)	0.6+0.1 (0.024+0.004)						
EYQUEM		–	750 LS		707 LS		–	707 LS
Electrode gap	mm (in)	0.6+0.1 (0.024+0.004)						
Distributor (Bosch)		JR4D4	JF UR 4			JFUD	JFR4	
Bosch Order No.		0 231 188 001	0 231 180 004 [2)]		0 231 180 005 [2)]	0 231 180 003 [3)] 0 231 180 008 [3)]	0 231 151 008 [4)]	0 231 151 009 [5)]
Distributor rotor with rev governor Crankshaft switch–off speed	rev/min	6600±150						
Camshaft switch–off speed	rev/min	3300± 75						
Contact breaker points gap	mm (in)	min. 0.35 (0.0138)						
Points spring pressure	p (oz)	500...630 (17.7...22.3)	450...500 (15.9...17.7)					
Dwell angle	∢ °	59...65			59...65 [7)]		59...61	59...65 [8)]
	%	66...72			66 ... 72 [7)]		66...69	66...72 [8)]
Firing order		1 – 3 – 4 – 2						
Capacity of condenser	µF	0.23...0.32 [6)]						

1) Applicable as from reduction of compression ratio to 9.5:1 and after change of combustion chamber. Engines with the new combustion chamber are marked on the outside by the letters "E12" cast in the cylinder head on the intake side.
2) 0 231 180 004 was previously 0 231 115 072 or ... 048, 0 231 180 005 was previously 0 231 115 071 or ... 045. (Adjustment data and dwell angles remain the same, but with centrifugal rev governor built in)
3) USA version only. 0 231 180 003 and ... 008 with centrifugal rev governor was previously 0 231 113 081 or ... 071. 0 231 180 003 applicable up to 1973 version and as spare part. 0 231 180 003 applicable up to 1973 version and as spare part. 0 231 180 008 applicable as from 1973 version
4) Previously 0 231 129 026 or ... 033.
5) 0 231 151 009 replaces 0 231 151 008 and 0 231 129 037 or 0 231 151 003. 0 231 151 008 for USA version
6) 0.2±10% condenser capacity for Bosch 0 231 180 008 distributor for BMW 2002/2002 A USA version; 0 231 188 001 for BMW 1502; 0 231 180 008 for BMW 2002 A
7) Dwell angle 58...64° or 64...71° on BMW 2002/2002 A USA version, 2002/2002 A California and 49–states version (74/75 models)
8) Dwell angle 59...61° or 66...69° on BMW 2002 tii USA version (74 models)
9) Applies also to USA version

Specifications

Electrical system – engine

Model		1502	1602	1802	2002	2002 A	2002 TI	2002 tii
Insulating resistance of condenser	Ω	200 000						
Series resistance of condenser	Ω	0.01						
Resistance of distributor rotor	KΩ	5						
Ignition point, static –with cold engine–	°CS	3° bTDC					TDC	
Ignition timing		Dynamic with engine running at normal operating temperature, mark on flywheel (vacuum hose removed, adjustment angle tester switched off)						
	°CS	25° bTDC at 1900± 50 rev/min	25° b TDC at 1400±50 rev/min[2]				25°bTDC at 2200 rev/min[12]	25°bTDC at 2400 rev/min[3][4][11]
Max. centrifugal advance	∢°	18.3°	18°		16°	21.6°	16°	
Max. vacuum advance	∢°	–	50±10[5]					
Ignition advance based on dynamic ignition timing	°CS	Measured with timing advance tester, engine at normal operating temperature, vacuum hose removed. Point strobe light at TDC mark.						
1000 rev/min.		5° ...10°	23° ...27°		14° ...19°	11° ...15°[6]	3° ...8° 18° ...22°[7] 10° ...13°[8]	2° ...7° 2° ...3°[10] 0° ...4°[9]
1500 rev/min.		16° ...20°	25° ...29°		25° ...29°	17° ...21°[6]	14° ...19° 23° ...27°[7] 17° ...21°[8]	12° ...17° 8° ...12°[10] 10° ...14°[9]
2000 rev/min.		26° ...30°	30° ...34°		31° ...36°	23° ...27°[6]	20° ...24° 28° ... 32°[7] 22° ...26°[8]	18° ...22° 14° ...18°[10] 15° ...20°[9]
2500 rev/min.		32° ...37°	34° ...38°		35° ...40°	30° ...33°[6]	25° ...29° 33° ...37°[7] 26° ...30°[8]	24° ...28° 20° ...24°[10] 21° ...26°[9]
2700 rev/min.		–	–		38° ...42° (end)	–	– 35° ...39°[7] (end)	– – 25°[9]

1) Guide value only. Always time ignition by dynamic method
2) BMW 2002/2002 A (74 models), USA version 25° bTDC at 1500 rev/min; BMW 2002 49-state version/75 models) 25° bTDC at 2400 rev/min; BMW 2002/2002 A California and 2002 A 49-state version (75 models) 25° bTDC at 2800 rev/min
3) USA version; 25° bTDC at 2700 rev/min
4) In countries (e. g. Germany) with 0.4 g/l lead content limit in fuel, correct ignition timing to 25° bTDC at 2900 rev/min.
5) 6±1° on BMW 2002 A (from 73 models on)
6) Ignition timing values with distributor No. 0 231 180 003
7) Ignition timing values with distributor No. 0 231 129 026 for 2002 TI
8) Ignition timing values with distributor No. 0 231 129 033 for 2002 TI
9) Ignition timing values for USA version
10) Ignition timing values changed, see also footnote 4)
11) Ignition timing altered from 2400 rev/min to 2800 rev/min to suit W. German fuel lead content laws from 1.1.1976 onwards.
Introduced on production vehicles from chassis No. 2 736 983 – 2002 tii
2 770 923 – 2002 tii RHD
12) BMW 2002 TI with distributor 0 231 129 026: 25° bTDC

Specifications

Electrical system – engine

Model	1502	1602	1802	2002	2002 A	2002 TI	2002 tii
Ignition timing (continued)	–	–		–	–	–	–
2900 rev/min						–	25^{o} 05)
						–	–
3000 rev/min	34^{o} ...38^{o}	38^{o} ...42^{o}		–	37^{o} ...41^{o} 01)	30^{o} ...34^{o}	28^{o} ...32^{o}
						–	24^{o} ...28^{o} 05)
						29^{o} ... 33^{o} 03)	25^{o} ...30^{o} 04)
3500 rev/min	37^{o} ...41^{o}	40^{o} ...44^{o}		–	41^{o} ...45^{o} 01)	32^{o} ...36^{o} (end)	30^{o} ...34^{o} (end)
						–	26^{o} ...30^{o} 05) (end)
						33^{o} ...37^{o} 03) (end)	27^{o} ...32^{o} 04) (end)
3800 rev/min	–	42^{o} ...46^{o} (end)		–	–	–	– – –
4000 rev/min	38^{o} ...45^{o} (end)	–		–	42^{o} ...46^{o} 01) (end)	–	– – –
Max. adjustment range measured at crankshaft	$42^{o}\pm3^{o}$	$44^{o}\pm2^{o}$		$40^{o}\pm2^{o}$	$44^{o}\pm2^{o}$ 01)	$34^{o}\pm2^{o}$	$32^{o}\pm2^{o}$
						$37^{o}\pm2^{o}$ 02)	$28^{o}\pm2^{o}$ 05)
						$35^{o}\pm2^{o}$ 03)	$29^{o}\pm2^{o}$ 04)
Vacuum advance Start: mm (in) Hg	–	120...150 (4.72...5.91) 6)				–	
End: mm (in) Hg	–	195...210 (7.68...8.27) 6)				–	
Adjustment range measured at crankshaft	–	8^{o}...12^{o} 06)				–	

1) Ignition control values with distributor 0 231 180 003
2) Ignition control values with distributor 0 231 129 026 on 2002 TI
3) Ignition control values with distributor 0 231 129 033 on 2002 TI
4) Ignition control values for USA version
5) Modified ignition control values; see also Footnote 4) on page 12-0/7
6) BMW 2002 A (from 73 model) – ignition
retard = Start 155...230 mm (6.10...9.06 in) Hg
End 312...345 mm (12.3...13.6 in) Hg
Adjustment range 12^{o}CS

Specifications

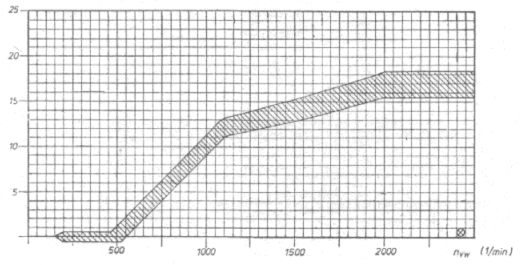
Electrical system — engine

Model	1502	1602	1802	2002	2002 A	2002 TI	2002 tii
Centrifugal advance curves	For measurements on distributor test bench measured at distributor shaft						

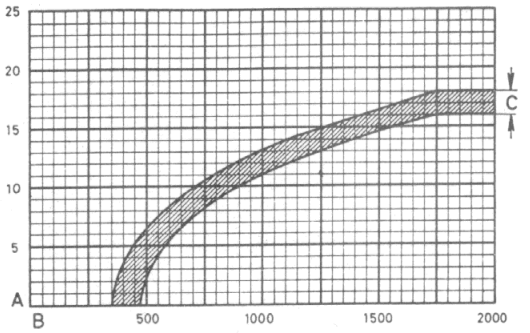
A Camshaft in degrees

B Camshaft

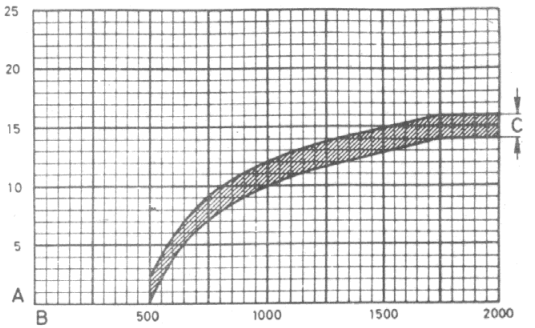
C Centrifugal adjustment



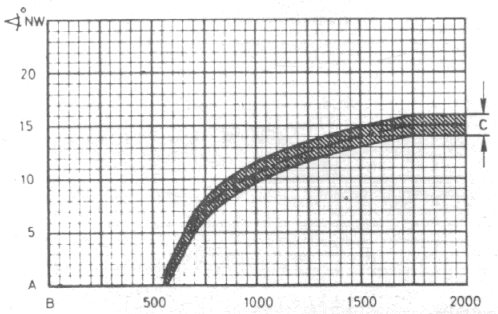
Bosch distributor 0 231 188 001
BMW 1502



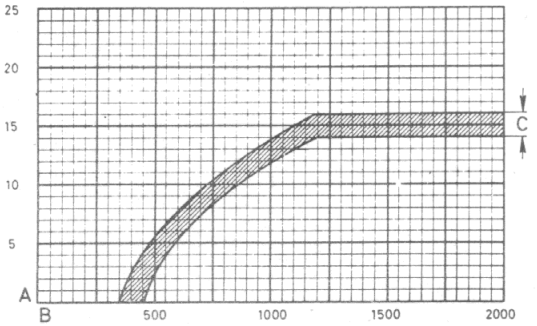
Bosch distributor 0 231 180 004
BMW 1602/1802



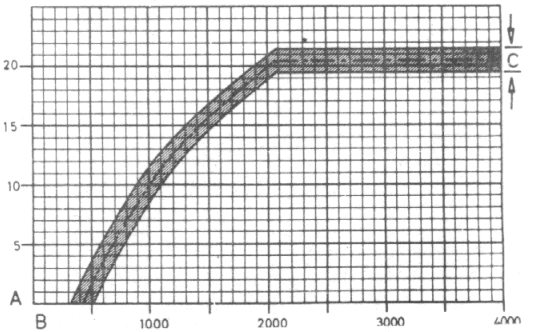
Bosch distributor 0 231 123 033
BMW 2002 TI



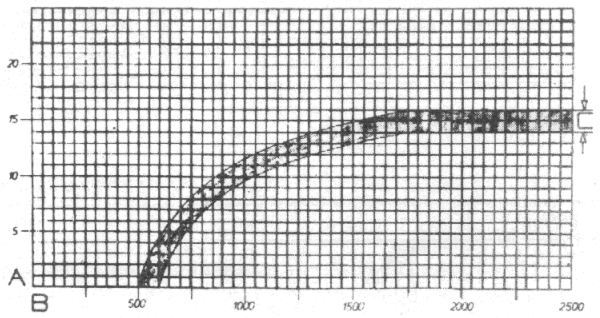
Bosch distributor 0 231 151 008
BMW 2002 TI/2002 tii/2002 tii USA version



Bosch distributor 0 231 180 005 and ... 008
BMW 2002/2002 A (and USA version as from 1973 model)



Bosch distributor 0 231 180 003
BMW 2002/2002 A/USA up to 1973 model



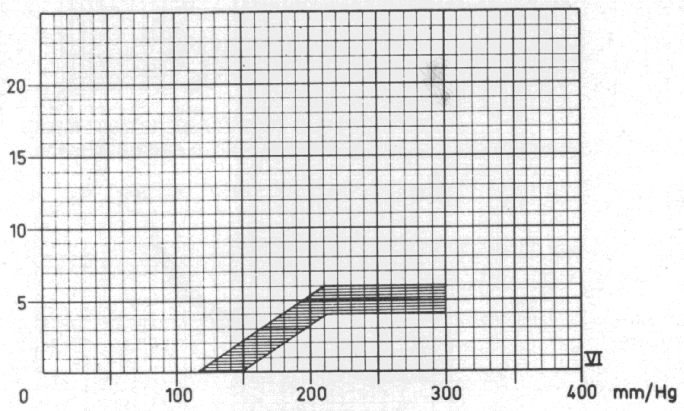
Bosch distributor 0 231 151 009
BMW 2002 tii

Specifications

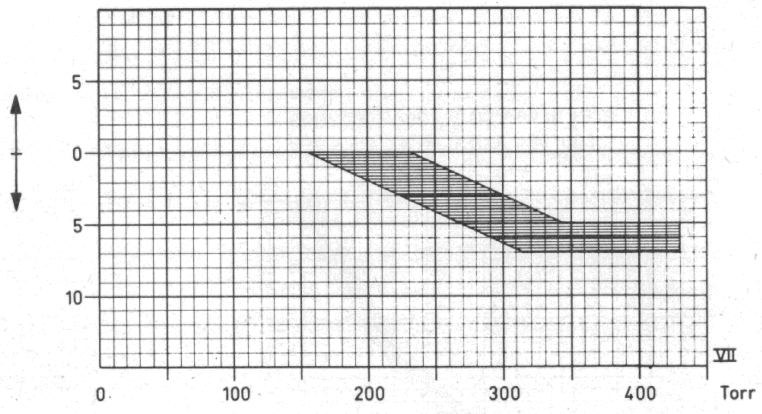
Electrical system — engine

Model	1502	1602	1802	2002	2002 A	2002 TI	2002 tii

Vacuum advance curves

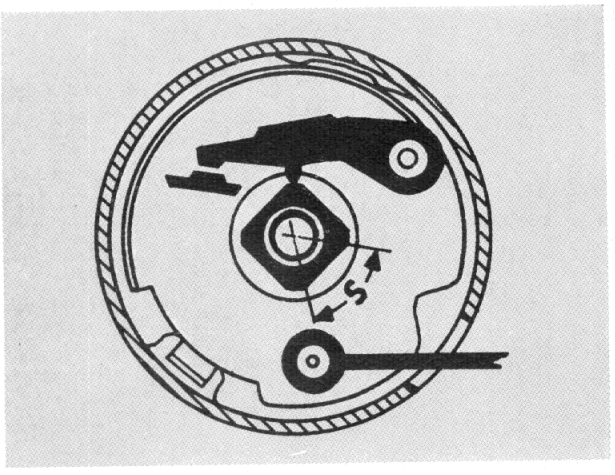


Bosch distributor 0 231 180 003
0 231 180 004
0 231 180 005
— BMW 1602/1802/2002/2002 A —



Bosch distributor 0 231 180 008
— BMW 2002 A (as from 1973 model) —

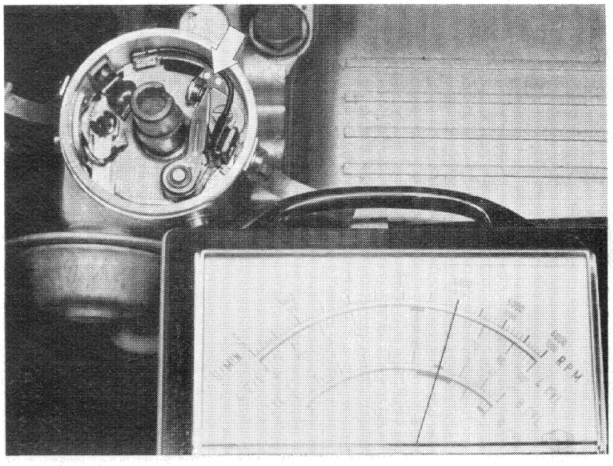
12 11 004 Setting ignition timing



A) Dwell angle

Before the ignition timing can be accurately set it is essential that the contact breaker points be in good condition and the dwell angle (S) correctly adjusted.

■



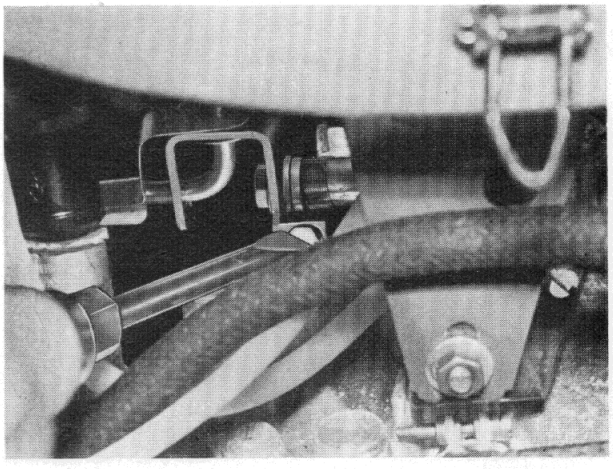
Remove distributor cap.

Connect dwell angle tester.

Turn engine with starter.

Set dwell angle[1]) to lowest value by turning the contact carrier.

■



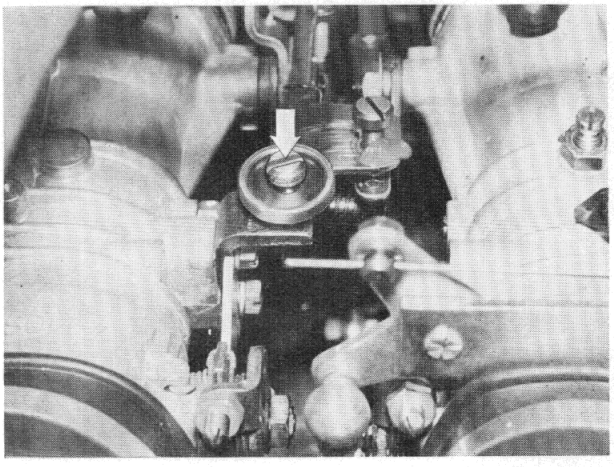
B) Ignition timing

Pull vacuum hose from vacuum unit.

Increase engine speed[1]) at operating temperature.

Note: When setting of ignition timing has been completed set idling speed 13 00 004.

■

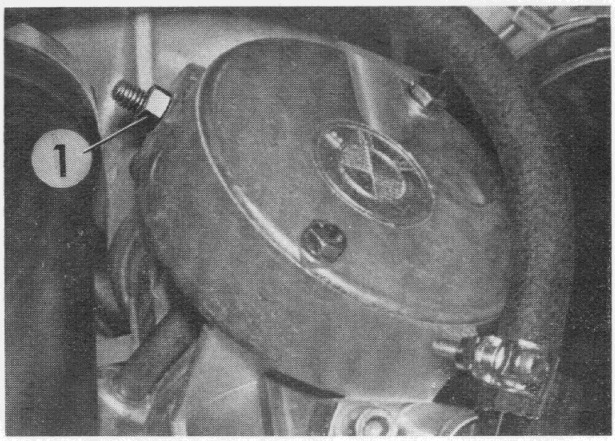


Increase engine speed[1]) on 2002 TI at operating temperature.

After timing ignition, retighten adjusting screw.

■

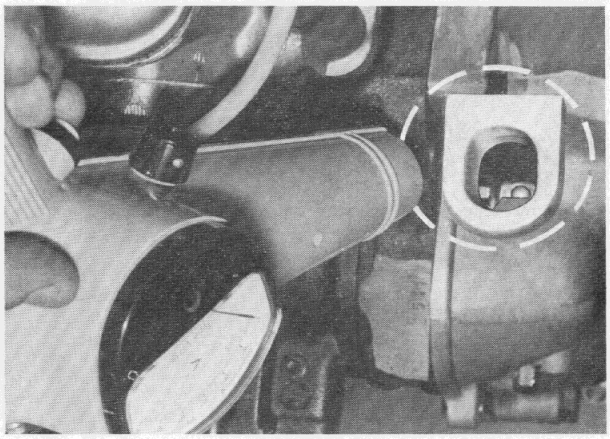
[1]) See Technical Data.



Increase engine speed[1]) on the 2002 tii by the adjustment screw (1). Engine must be at operating temperature.

When setting of ignition timing has been completed, set idling speed[1]).

■



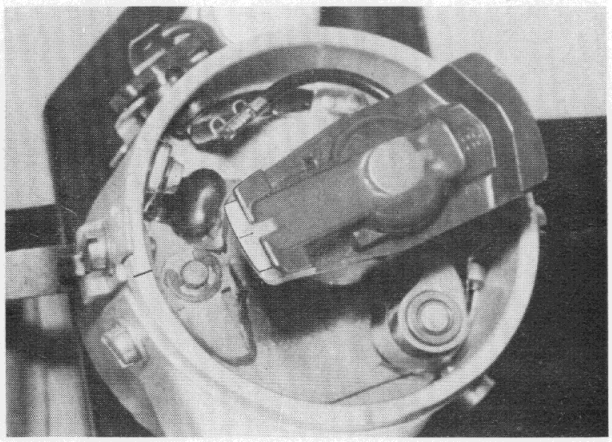
Dwell angle indicator must be switched off.

Illuminate ball mark on flywheel with ignition light pistol.

Slacken distributor and turn until centre of ball is visible at edge of inspection hole.

■

12 11 060 Removing and fitting distributor



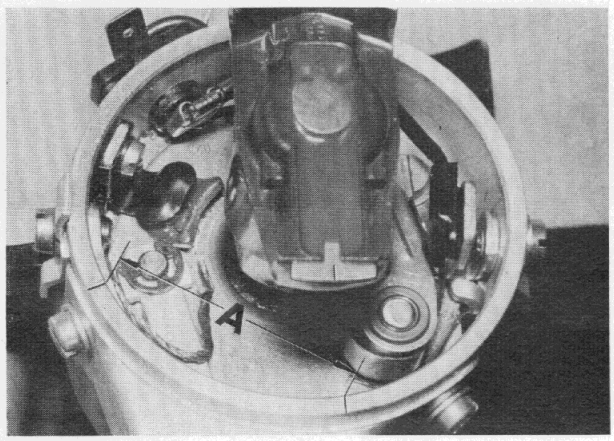
Remove distributor cap.

Pull lead off terminal 1.

Pull off vacuum pipe.

Set piston in No. 1 cylinder to TDC, i.e. notch on distributor rotor lines up with notch on distributor body. Unscrew clamp screw, pull out the distributor.

■



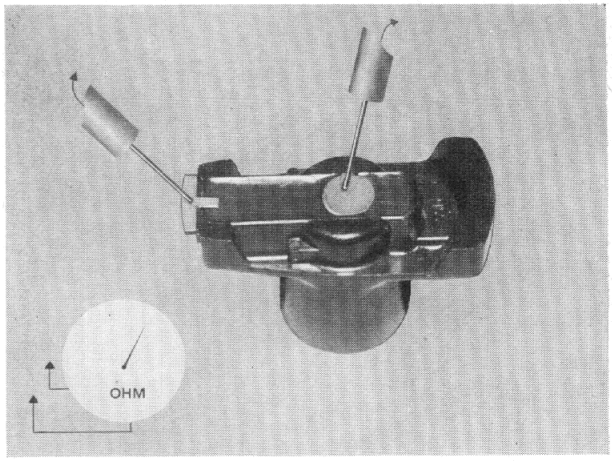
Fitting instruction: Turn distributor rotor approx. 3.5 cm (1.4") (A) anti-clockwise from the notch.

Insert distributor drive in camshaft drive.

■

[1]) See technical data

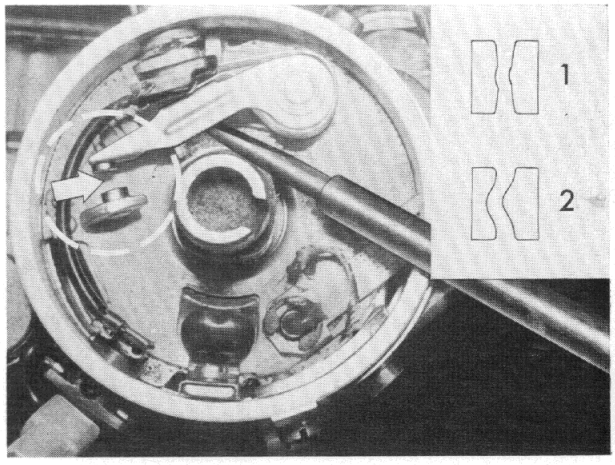
12 11 109 Checking distributor rotor



Check resistance of distributor rotor
Resistance of suppressed distributor rotor is approx. 5000 Ohm.

■

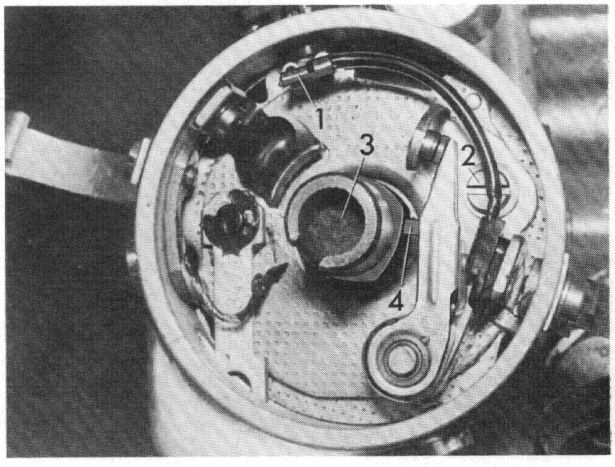
12 11 141 Replacing breaker contacts



Inspection of surface condition of contacts.

1 permissible,
2 not permissible, must be replaced.

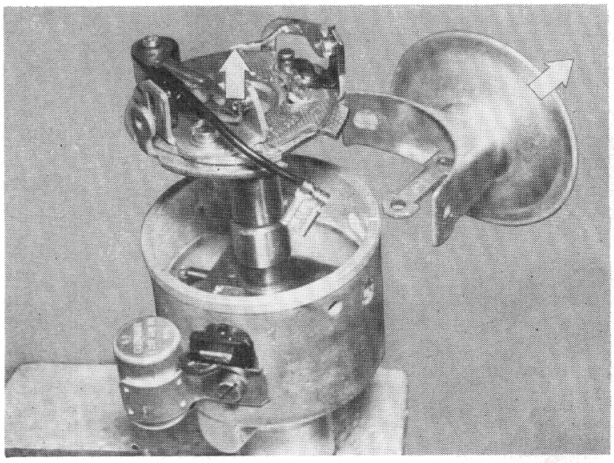
■



Remove flat plug (1).
Unscrew screw (2).
Lift out breaker contacts.
Fitting instruction: Clean grease from new contacts.
Saturate felt (3) with engine oil.
Lubricate cam and follower (4) on contact breaker arm with Bosch Ft 1 v 4 grease.
Set ignition timing 12 11 004.

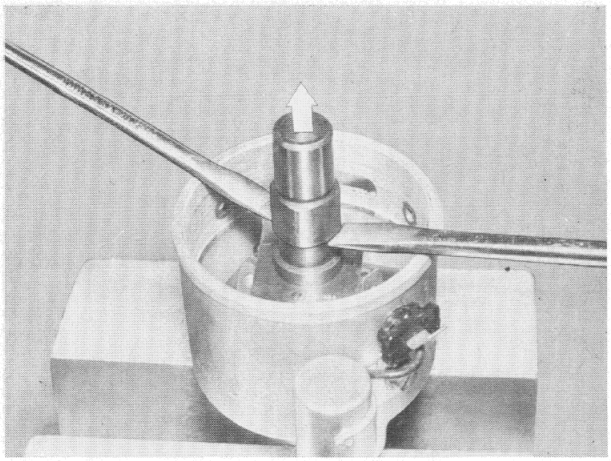
■

12 11 572 Overhauling distributor



Remove vacuum unit.
Remove contact breaker plate.

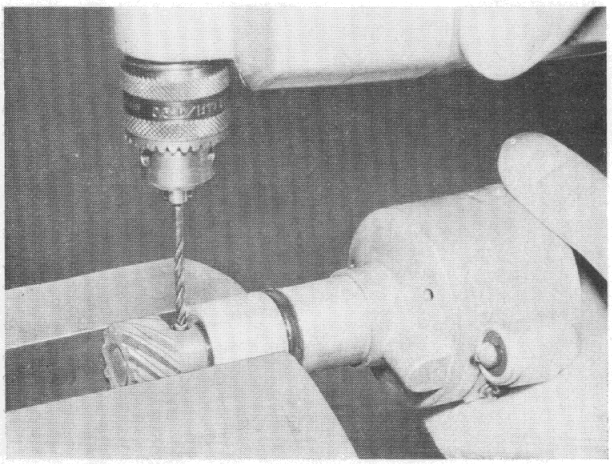
■



Force cam upwards with two screwdrivers until retaining ring springs out of groove.

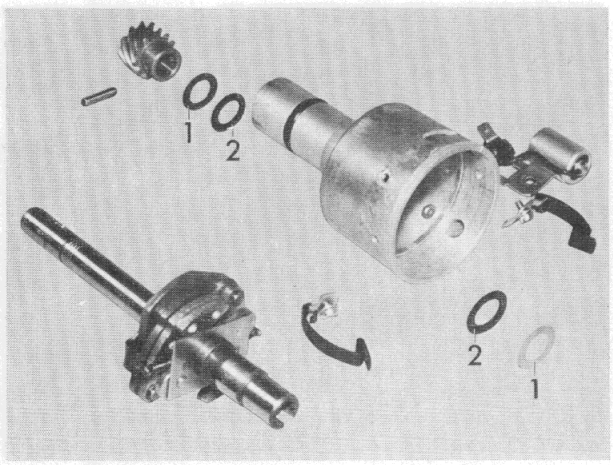
Note: Do not pull out the grease felt, or the retaining ring underneath will spring out.

■



Drill out grooved dowel pin. — 3 mm dia. drill (0.118")

■



Remove distributor shaft with centrifugal weights and cam.

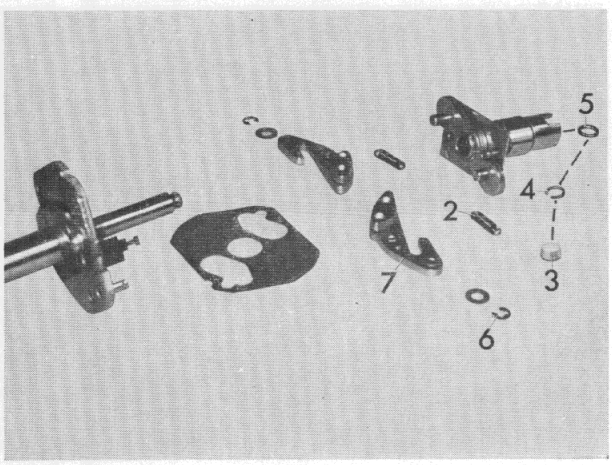
Fitting instruction:

1 Thrust washer

2 Insulating washer

Check bearing bushes and replace if necessary.

■



Detach springs (2), withdraw grease felt (3), retaining ring (4), washer (5) and cam.

Remove clips (6) and centrifugal weights (7).

Fitting instruction: Lubricate cam with engine oil and centrifugal weights with Bosch Ft 1v22 grease when fitting. If holder or springs have been replaced, check centrifugal advance curve on distributor test bench and adjust if necessary.

■

Trouble shooting on distributor

Fault	Cause 1)	Remedy
Engine does not start or cuts out.	Breaker contacts burnt or dirty.	Renew breaker contacts
Engine runs unevenly and cuts out.	Tracking in distributor cap.	Clean distributor cap, renew if necessary.
Engine cuts out at part throttle.	Defective resistor suppressor in distributor rotor.	Renew distributor rotor.
Engine performance decreases.	Dwell angle incorrect. Contact clearance is not the same on all cams. Uneven wear of cam.	Adjust dwell angle. Renew distributor cam.
Engine cuts out – generation of noise.	Contact breaker plate on distributors with vacuum control displaced.	Renew contact breaker plate or distributor if necessary
Engine does not accelerate.	No centrifugal advance – cam sized up on shaft or rusted.	Free distributor cam on shaft, renew if necessary.
Engine starts and cuts out.	Break or short-circuit in condenser	Renew condenser.
Engine cuts out – high fuel consumption.	Defective HT lead. Defective spark plug connector. Defective resistor suppressors.	Renew HT lead. Renew spark plug connector Renew resistor suppressors

1) Determine with BMW Program Engine Test 11 00 009

12 12 011 Replacement of spark plugs

Pull off spark plug leads.

Screw out spark plugs.

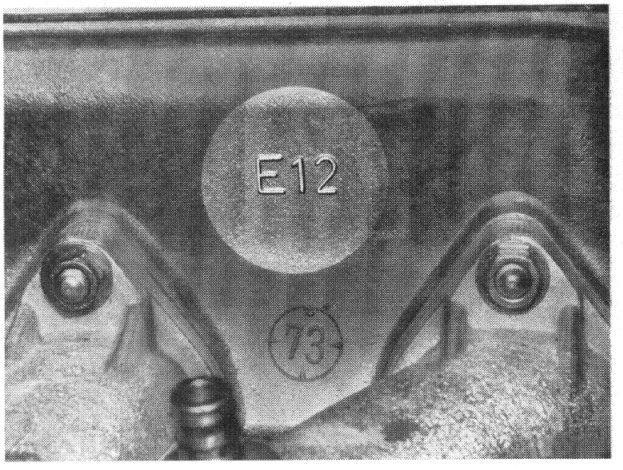
Note when fitting: Coat thread with graphite grease or similar substance.

Note firing order.

Important: Note modification of combustion chamber of two-litre engines. Modification is marked on cylinder E 12.

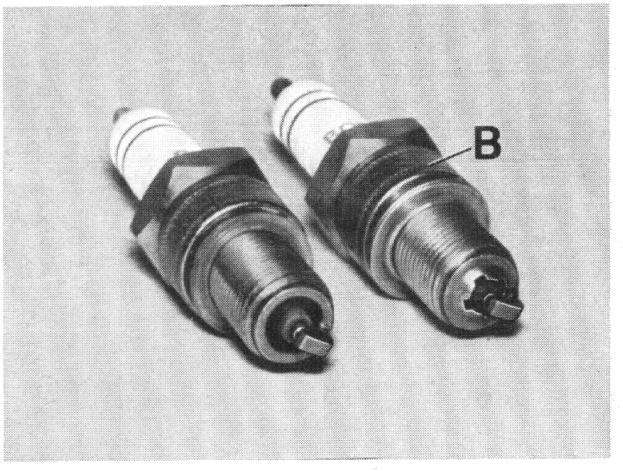
Due to this modification, the thermal values[1]) of the spark plugs have also been changed.

■



Always use air surface gap spark plugs for injecton engines (B).

■



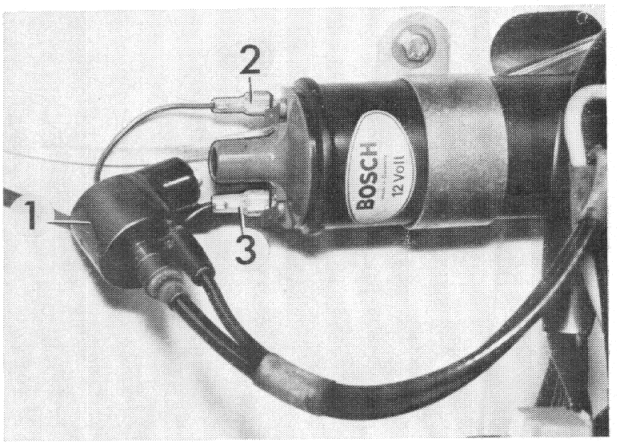
[1]) see Specifications

12 13 011 Replacement of coil

Detect coil error; Program Test cf. 11 00 009.
Pull ignition cable (1) and cables (2) and (3) off coil.
Note when fitting: Terminal 15 — green cable
1 — black cable

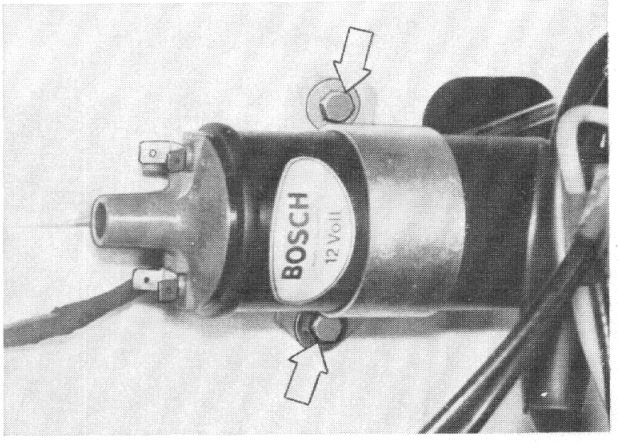
With rev counter connected:
1 — black cable

■



Remove coil from wheel arch.

■



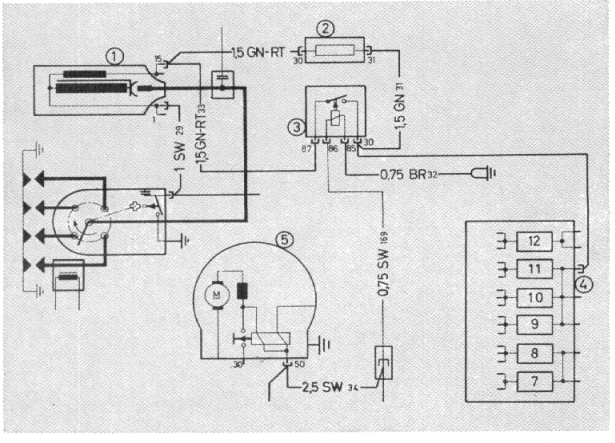
Note when fitting: Note mark on coil[1]).

■

If the engine does not start properly, a high-performance coil with primary resistor can be fitted subsequently.

1 = high-perforance coil
2 = primary resistor
3 = relay
4 = fuse No. 11
5 = starter

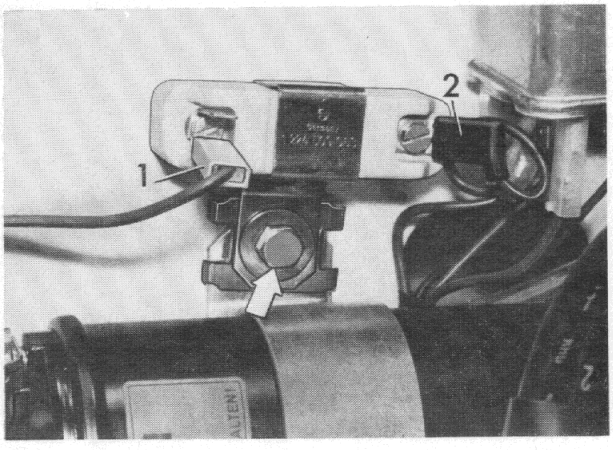
■



[1]) see Specifications

10.73 Addition

12 13 051 Replacement of coil primary resistor

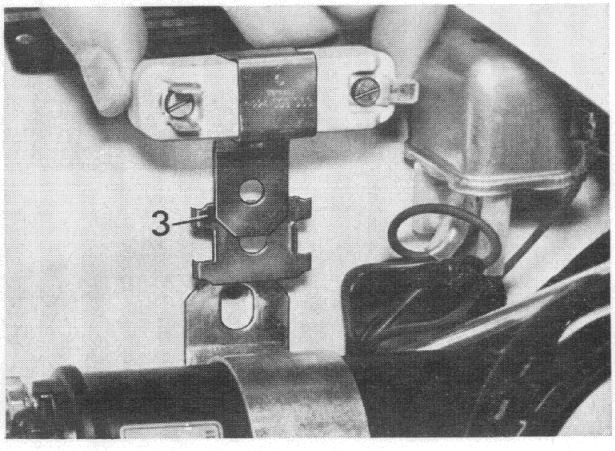


Pull cables (1) and (2) off primary resistor.

Note when fitting:

cable (1), green, comes from relay terminal 30
cable (2), green and red, leads to coil terminal 15
Remove primary resistor.

■



Important: Push safety catch (3) between support bracket and fasten with bolt.

■

12 31 019 Quick check of alternator and regulator

Carry out this check only if the telltale remains on permanently while the engine is running.

Stop engine and pull multiple plug off regulator.

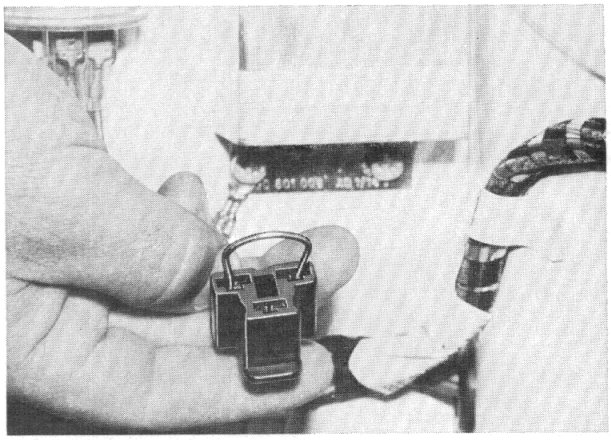
Using a piece of wire as a bridge, connect flat plug of blue cable (D +/61) to flat plug of black cable (DF).

Start engine and run at a speed of approx. 1000 rpm.

If the battery charge telltale goes off immediately, the alternator is defective.

If the battery charge telltale glows slightly or remains on without fading, overhaul alternator.

■



12 31 020 Removal and fitting of alternator

General:

Important: Disconnect wires and cables between battery, alternator and regulator only when engine is not running.

If the battery is charged while in the car, always disconnect the plus and minus cables from the battery.

When using electric arc welding equipment, connect the earth treminal of the welder directly to the part of the car being welded.

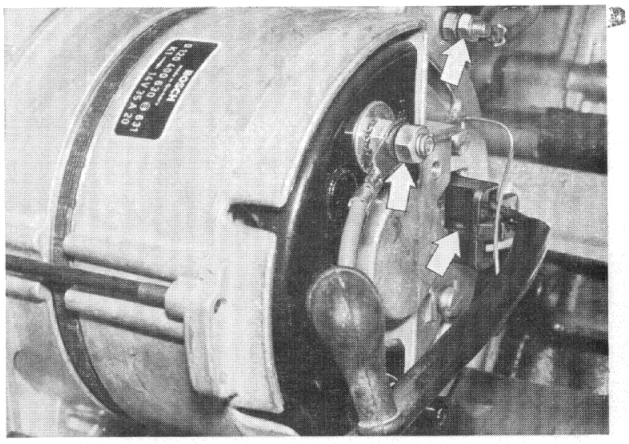
Disconnect minus cable from battery.

Pull off multiple plug.

Disconnect cable from alternator.

Brown: earth
Red: B+
On tii, remove battery and stabilizer bar as well cf. 31 35 000.

■

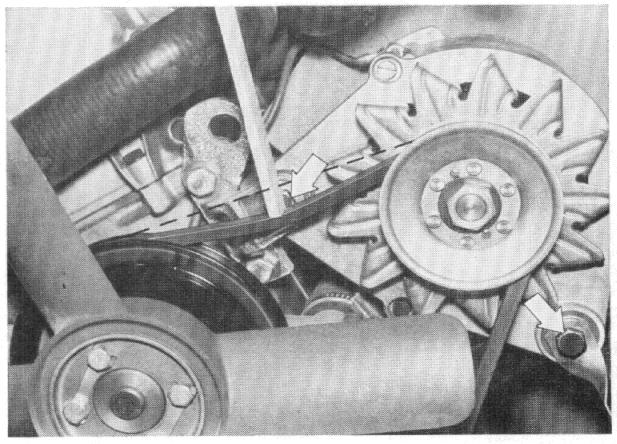


Unscrew fastening bolts on tightening belt and suspension.

Take out alternator.

Note when fitting: The V-belt must be tensioned in such a way that it can be pressed in by 5 ÷ 10 mm (approx. 0.2 ÷ 0.4").

■



12 31 303 Replacement of V-belt

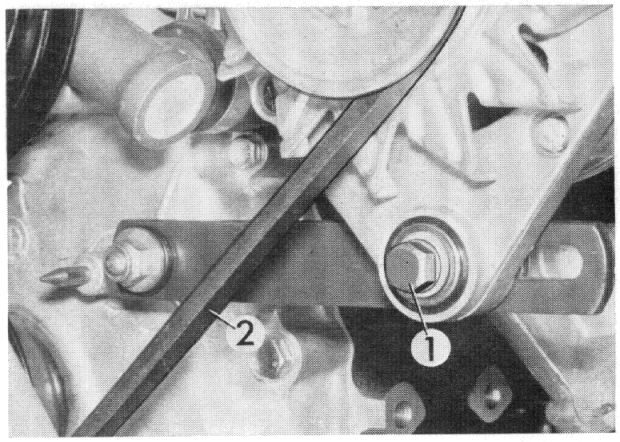
Unscrew bolt (1) and remove V-belt (2).

Note when fitting: Tighten V-belt.

The V-belt must be tensioned in such a way that it can be pressed in by 5 ÷ 10 mm (approx. 0.2 ÷ 0.4").

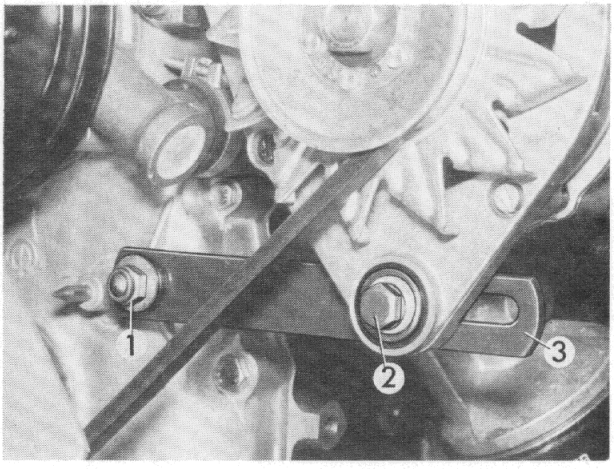
Note lenght of V-belt[1]).

■



[1]) see Specifications

10.73 Alteration



12 31 361 Replacement of joint bush in tightening belt

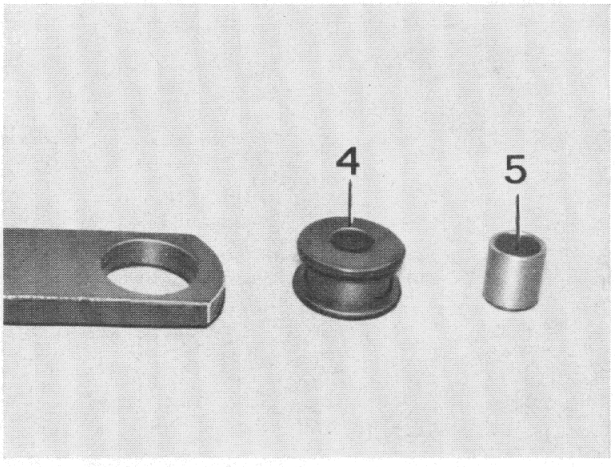
Unscrew nut (1) and bolt (2).

Remove tightening belt (3).

Important: In the region of the gearbox cover, the tightening belt is curved slightly to the back.

Note when fitting: Tension V-belt.

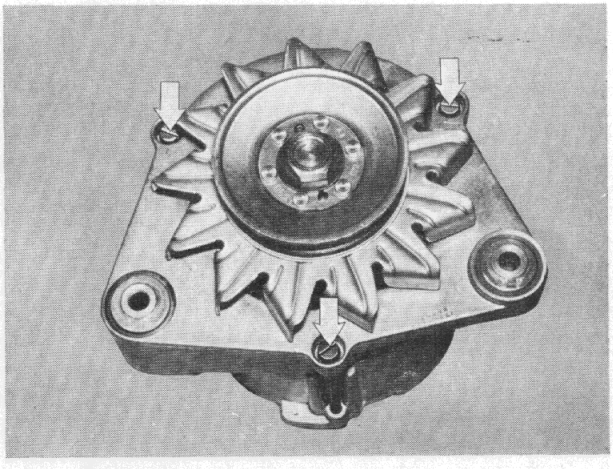
■



Fit in joint bush (4) and spacer sleeve (5).

To make fitting easier, coat joint bush with glycerin.

■

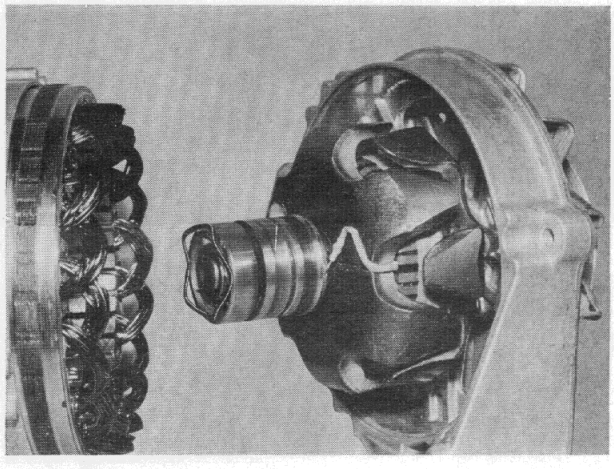


12 31 602 Overhaul of alternator

(A) Replace carbon brushes.

Unscrew bolts.

■



Remove rotor.

Note when fitting: The diode carrier is located in the upper half.

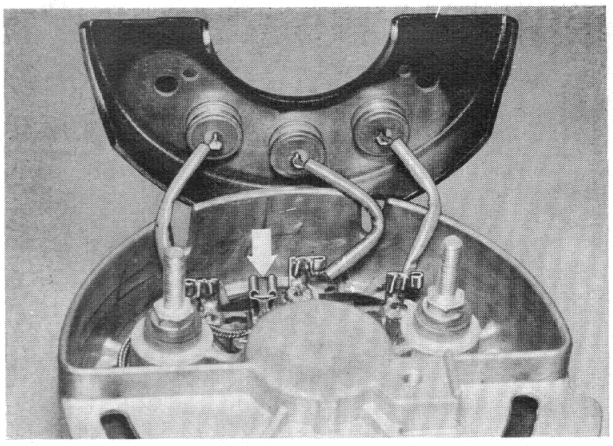
Fit corrugated disc in front of grooved ball bearing.

Check collector rings.

■

Remove diode carrier.
Pull of connection cable plug.
Unscrew fastening bolts for carbon brush support.

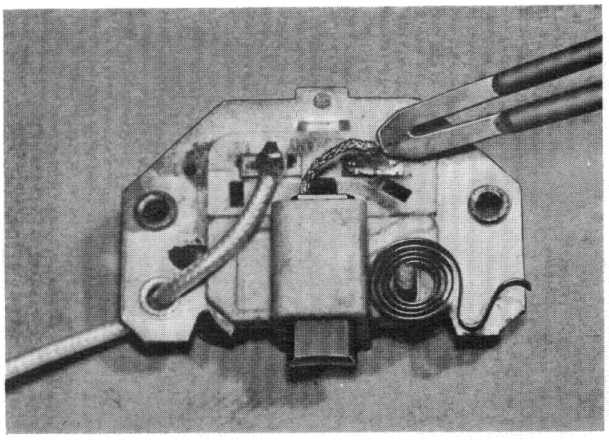
■



Remove carbon brushes by soldering and solder on again after completion of work.

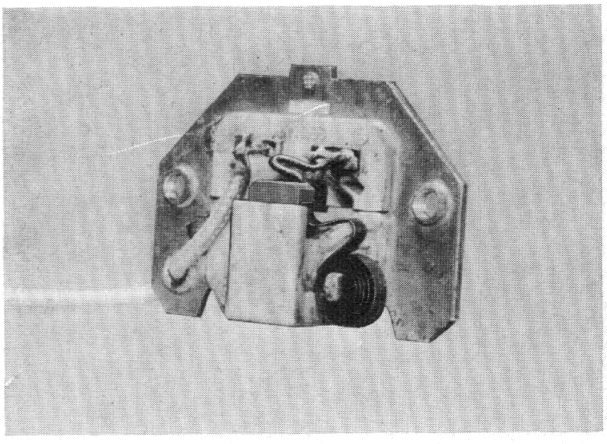
Note when fitting: Do not allow rosin-core solder to flow onto copper-standed wire.

■



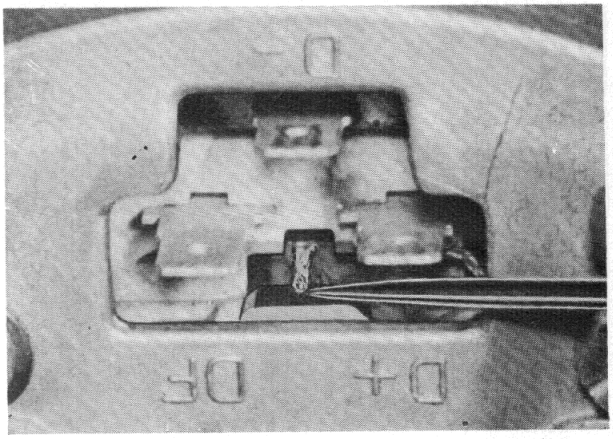
Push up carbon brushes and secure.

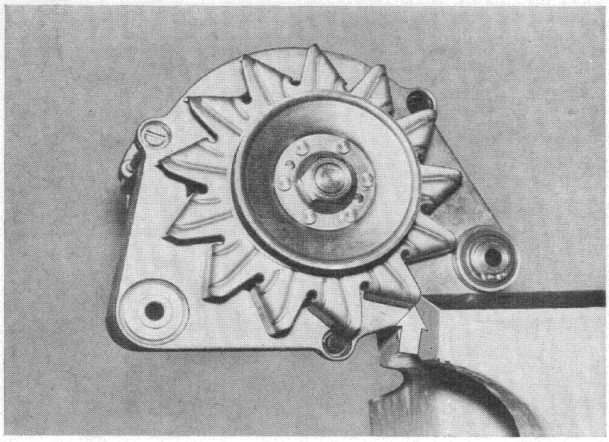
■



Assemble alternator.
Press carbon brushes onto collector rings.

■



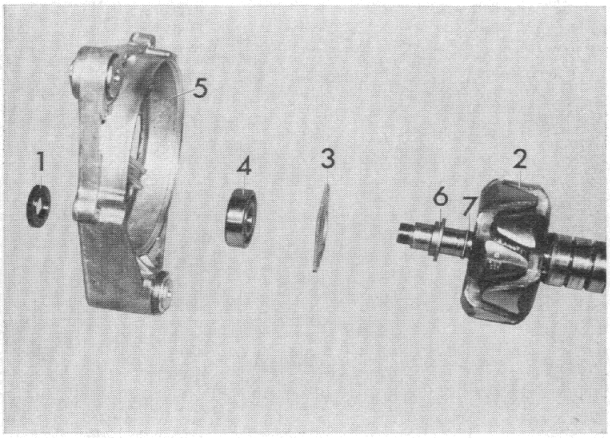


(B) Replacement of grooved bearing

Block cooling fan disc so that it cannot rotate and remove.

Take out disc spring.

■



Remove spacer ring (1).

Force out rotor (2).

Unscrew support plate (3).

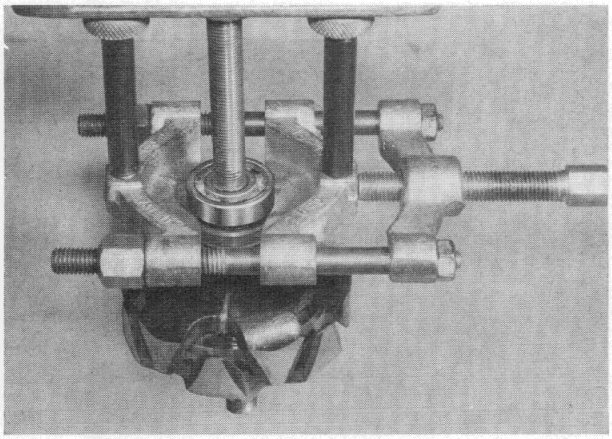
Press grooved bearing (4) out of bearing support (5).

Note when fitting: Coat grooved bearing with Ft 1 v 34 grease.

The open end of the bearing must face towards the rotor.

Push runner (6) over wire catch (7).

■



Pull grooved bearing off rotor.

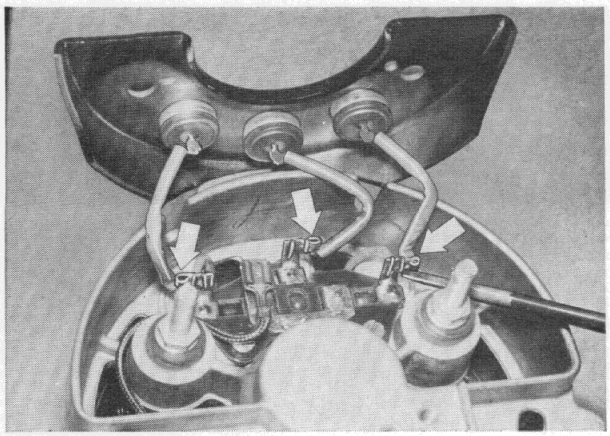
Note when fitting: Use only C 3 bearing.

Coat grooved bearing with Ft 1 v 34 grease.

The open end of the bearing must face towards the housing.

Insert corrugated disc into housing before fitting grooved bearing.

■



(C) Plus diodes

Unfasten diode carrier.

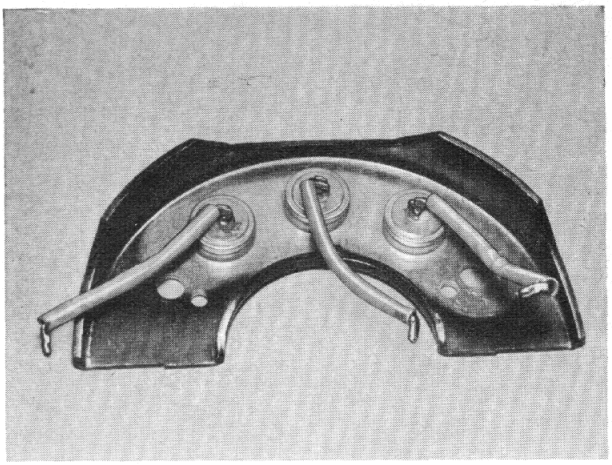
Disconnect cables (solder).

■

(a) Check diodes with a maximum of 24 volts.
(b) When + contacts housing, the inspection lamp must not flash on.

Always replace all three diodes with diode carrier.

■



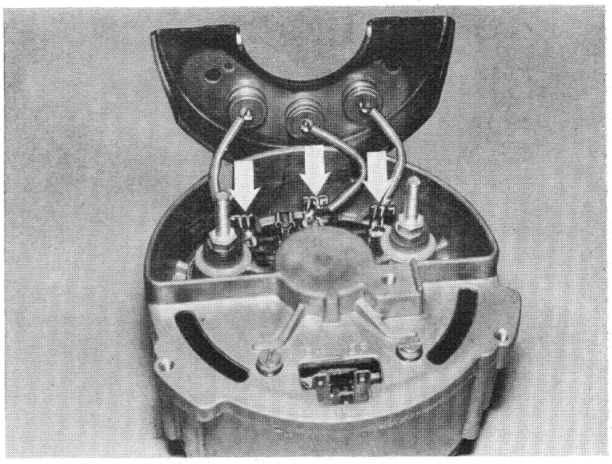
(D) Exciter diodes

Remove rotor.

Disconnect plus diodes, minus diodes and support cable (solder).

Unfasten diode carrier.

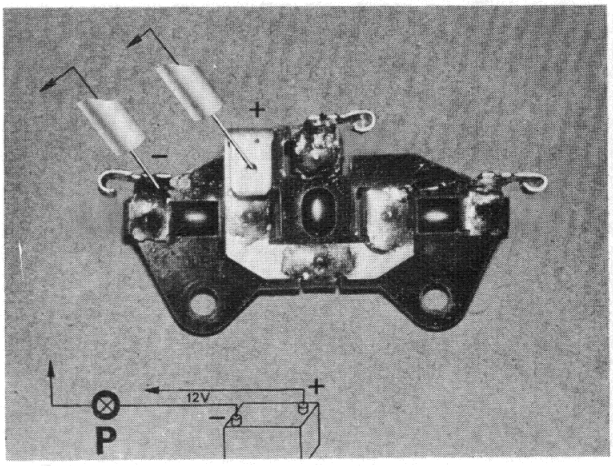
■



(a) Check diodes with a maximum of 24 volts.
(b) When + is brought into contact with the plug connection, inspection lamp (P) must not flash on.

Note when fitting: Always replace all three diodes with diode carrier.

■



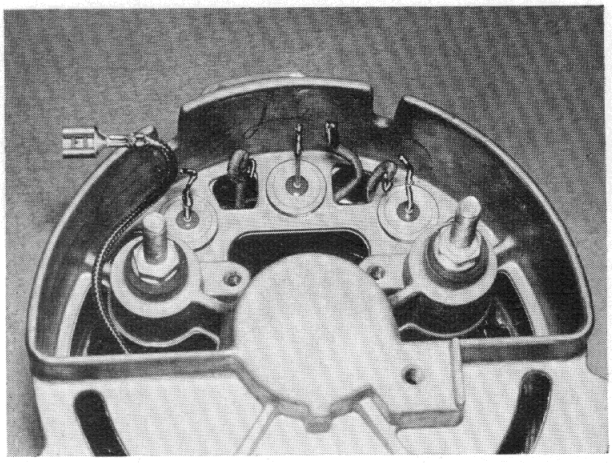
(E) Minus diodes

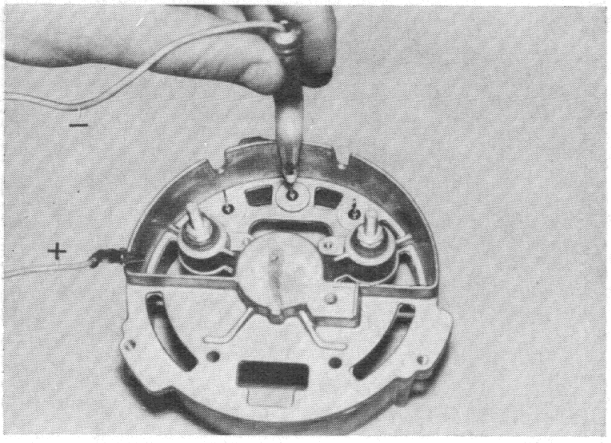
Disconnect support cable and minus diodes (solder).

Pull off flat plug.

Disconnect diode carrier.

■



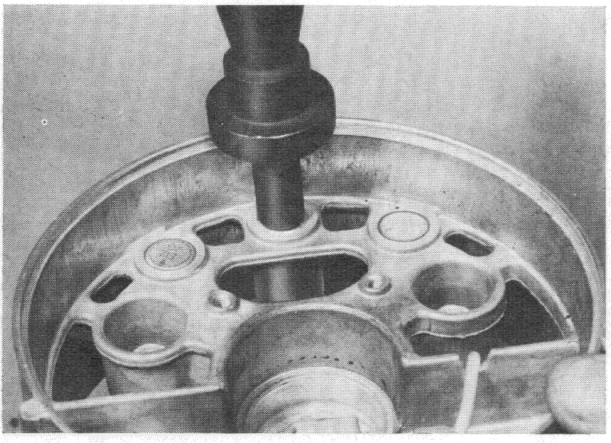


Take out support.

(a) Check diodes with a maximum of 24 volts.

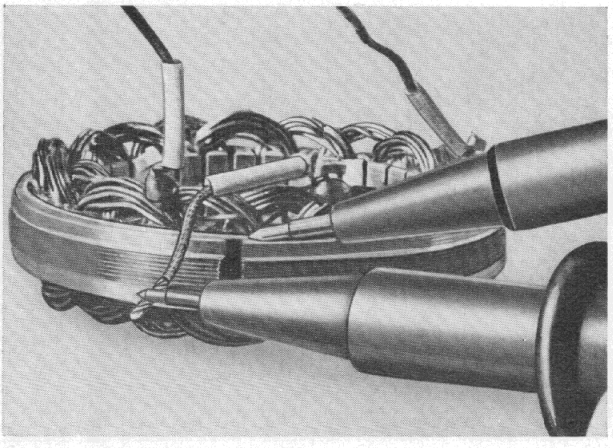
(b) When + is brought into contact with the housing, the inspection lamp must flash on.

■



(c) Coat diodes with silicon oil 63 v 2 and press into a sleeve with an internal diameter of 17 mm (0.6693") by using tool No. EFLJ 57/0.

■



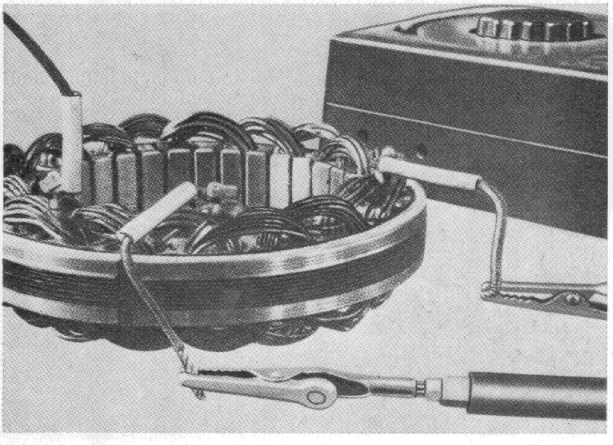
(F) Remove support winding and check

Remove rotor.

Solder support cable off diode carrier.

Take out support.

(a) By appling 40 volts alternating current, check support winding for earth contact.

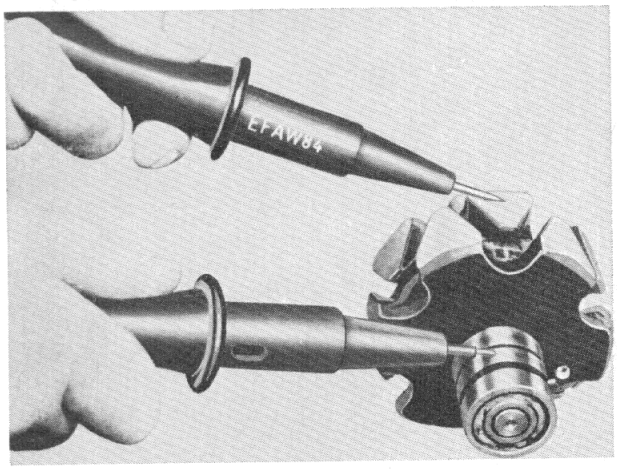


(b) Check resistance between phase exits. Should be 0.26 Ohm + 10%.

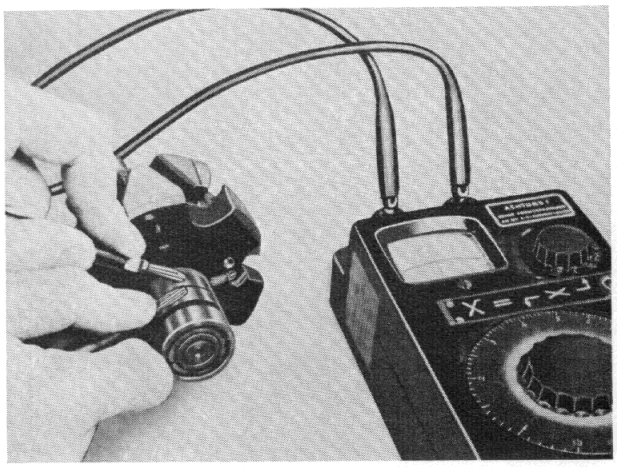
■

(G) Check jaw-type pole rotor

By applying 40 volts alternating current, check jaw-type pole rotor removed from car whether it has earth contact. (EFAW 84 testers).

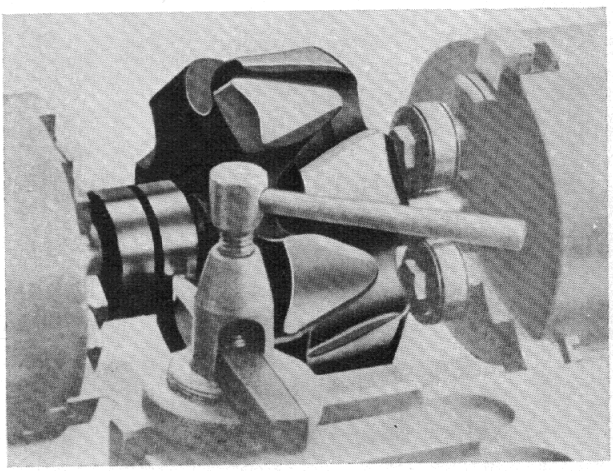


Check exiter winding (Ohmmeter).
14 V alternator = 4.0 Ohm + 10%.

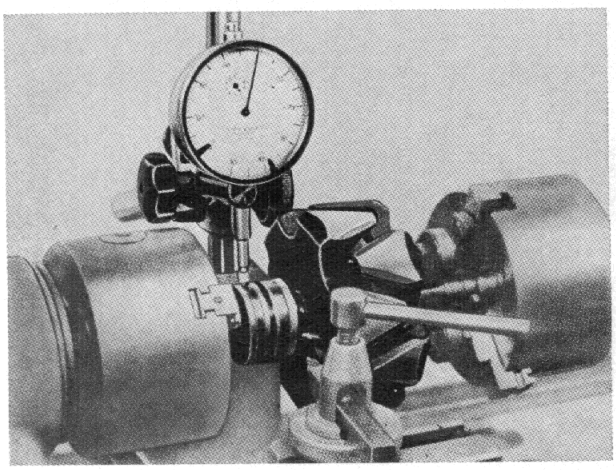


For fitting collector rings in position, use EFAW 75 or GDF 85 R 3 tailstock backrest.

Important: Minimum diameter of collector rings: 31.5 mm (1.2402").



After fitting, checking collector rings for any out-of-roundness. Max. permissible out-of-roundness: 0.03 mm (0.001181").

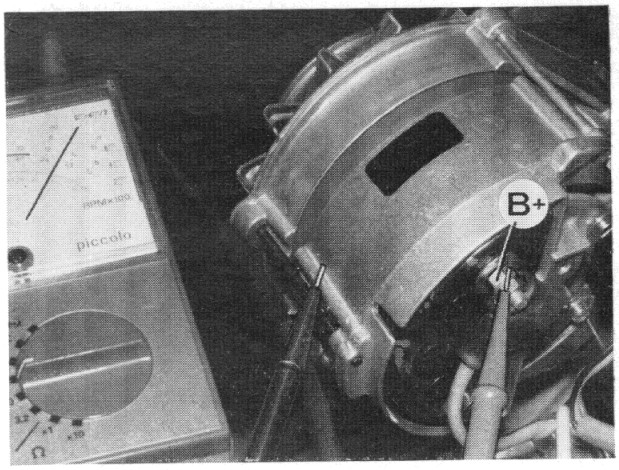


12 32 000 Removing and fitting voltage regulator

For Program Test, see page 11-00/6.
If no program tester is available:
Battery voltage must be up to specification.

A) Connect voltmeter between B + and earth (ground).
At 2000 rev/min, reading should be 13.5 ... 14.6 V.
Regulator is faulty if reading is over 14.6 V.
If voltmeter shows no reading with engine stopped or running, the carbon brushes may be too short or there may be an open circuit in the regulator.

■

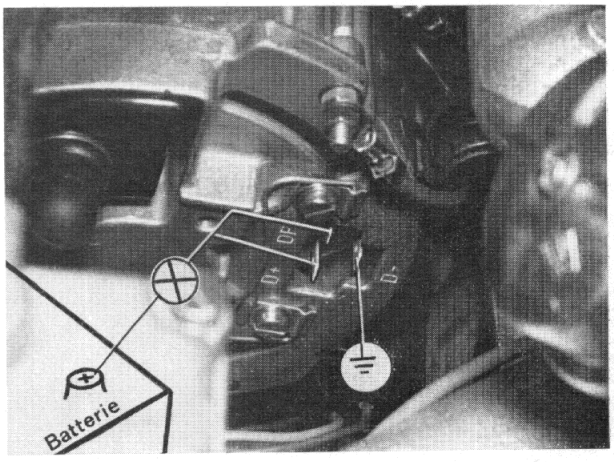


B) Connect D + and DF
Connect test lamp to battery + and to lead between D + and DF.

1. Alternator is in good working order if test lamp burns brightly with engine stopped and goes out when the engine is running.

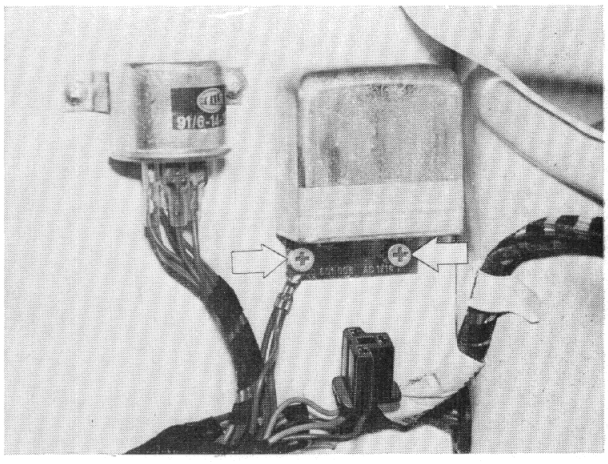
B) 2. If the bulb still glows, the stator winding or diodes are faulty.

■



Pull off multi-pin plug.
Remove screws.

■



A Voltage regulator[1]) not suppressed, yellow adhesive tape.
B Voltage regulator[1]) suppressed, white adhesive tape.

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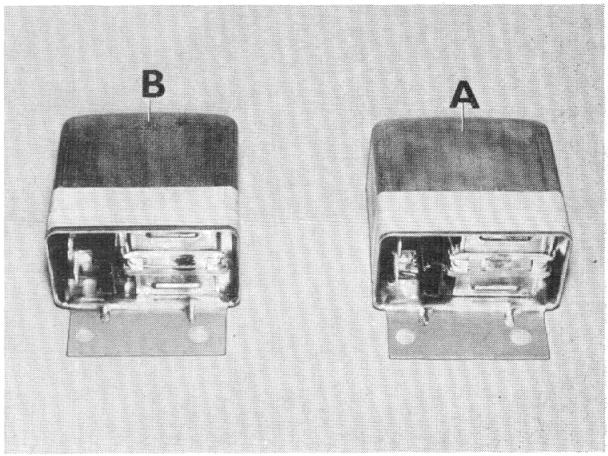

[1]) See specifications

Trouble shooting – alternator

Fault	Cause	Remedy
Alternator noisy	Defective ball bearing V-belt defective Belt pulley loose	Renew ball bearing Renew V-belt Tighten fixing nut
With engine running the telltale lamp burns with half normal intensity	V-belt loose Poor contact at cable connector Regulator defective Carbon brushes defective Rectifier diode is defective or has short to earth Stator has short to earth Armature has partial short to earth	Tension V-belt Check cable connections and cable connector Renew regulator Renew carbon brushes Renew rectifier diode Renew stator Renew armature
Heavy gas formation in battery	Poor contact between regulator and alternator Regulator defective	Check cable connections on regulator and alternator Renew regulator
With engine running the telltale lamp burns with half or full intensity	V-belt loose Regulator defective Break or short-circuit in supply lines Carbon brushes defective Armature winding defective Exciter circuit broken Diodes or diode carrier defective Lead D+/61 has short to earth	Tension V-belt Renew regulator Check cable connections and cables Renew carbon brushes Renew armature winding Check cable connections Check diodes or diode carrier renew if necessary Rectify short or renew lead
Telltale lamp does not light up when engine is running	Telltale lamp bulb blown Lead 61 broken	Install a new 4 Watt bulb Repair break
Telltale lamp does not light up with engine stopped and ignition switched on.	Telltale lamp bulb blown Battery flat Battery faulty Loose or damaged lead Faulty regulator Short-circuited positive diode in alternator Carbon brushes worn Corrosion on sliprings, open circuit in rotor winding	Install a new 4 Watt bulb Recharge battery Renew battery Renew lead or reconnect to terminal Renew regulator Detach charging lead at once to avoid discharge when at a standstill; have alternator reconditioned Renew carbon brushes Have alternator reconditioned

12 41 009 Checking starter motor in vehicle — with motor tester —

Can only be carried out on starter test bench in the case of automatic transmission.

To carry out check, engage 4th gear and depress. foot brake.

Operate starter for 2 ÷ 3 seconds, starting voltage must not drop below 8 Volt under load and must be the same with Voltmeter circuits 1 and 2, otherwise there is a poor earth connection on the motor or battery.

Read off curren consumption[1]) on ammeter at the same time.

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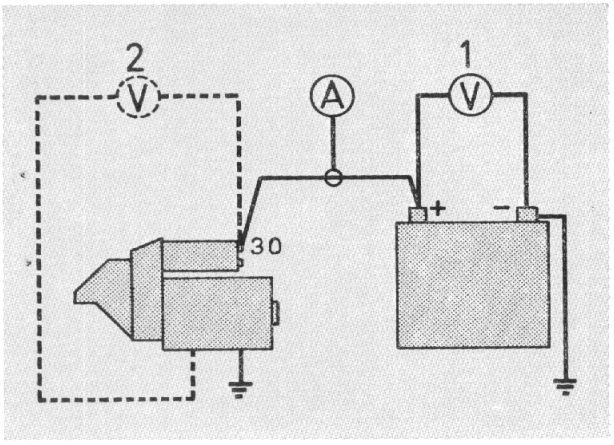
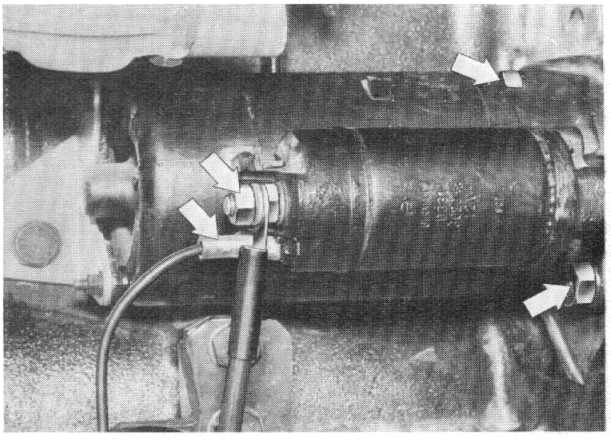


12 41 020 Removing and fitting starter motor

Disconnect negative terminal from battery and plug connections and supply cables from starter.

Remove starter motor from flange.

■



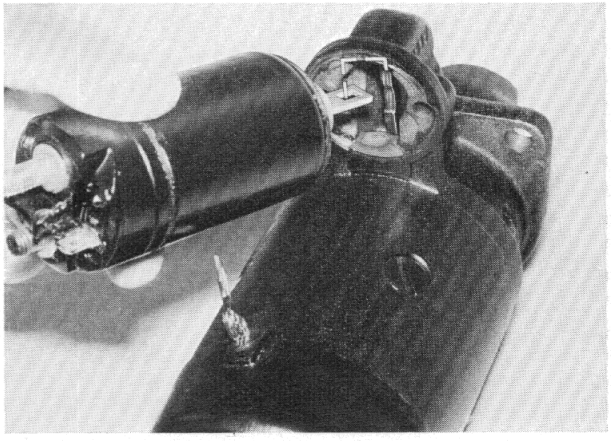
12 41 513 Stripping and assembling starter motor

Unscrew cables to exciter winding.

Remove solenoid switch.

Detach engaging lever.

■



Remove dust cap (1).

Remove lock washer (2), shims (3) and gasket (4).

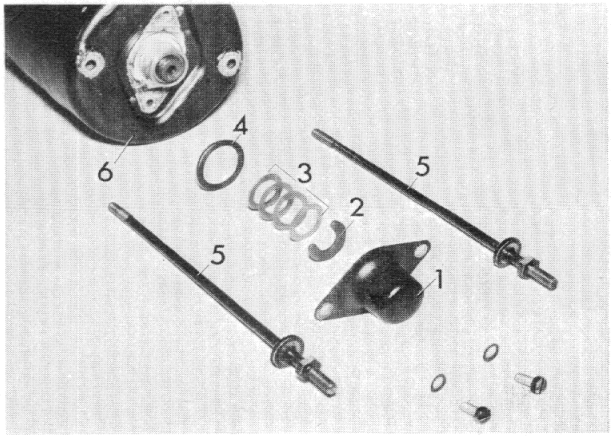
Unscrew pole casing bolts (5).

Pull off cap (6).

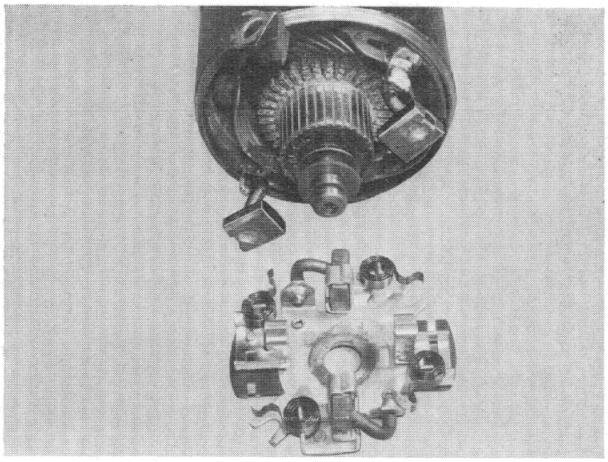
Fitting instruction: Set axial play of armature to 0.1 ÷ 0.15 mm (0.0039 ÷ 0.0059").

Check commutator bearing.

■

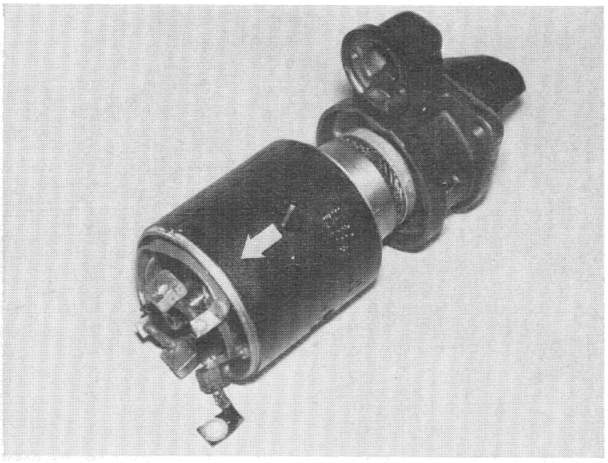


[1]) See Technical data.



Lift out positive brushes and remove brush support plate.

■



Separate pole casing from drive bearing.

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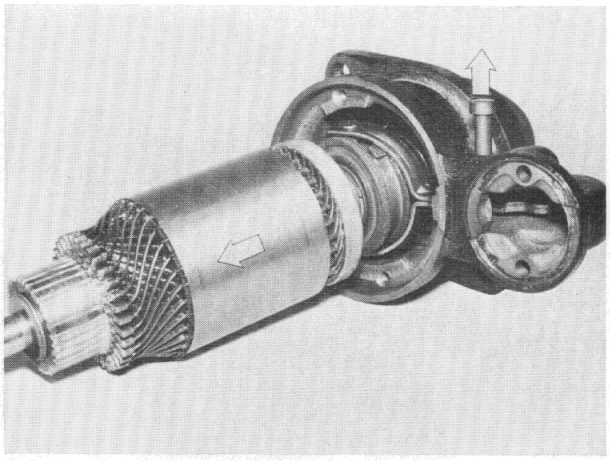

Unscrew bearing bolt for engaging lever.

Pull out armature with engaging lever.

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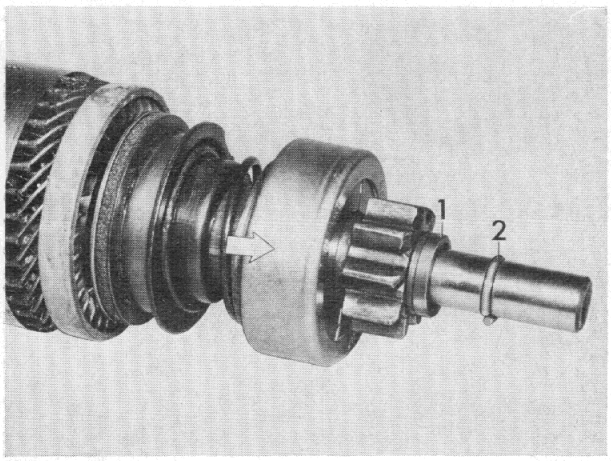


Push thrust ring (1) backwards.

Lift out retaining ring (2).

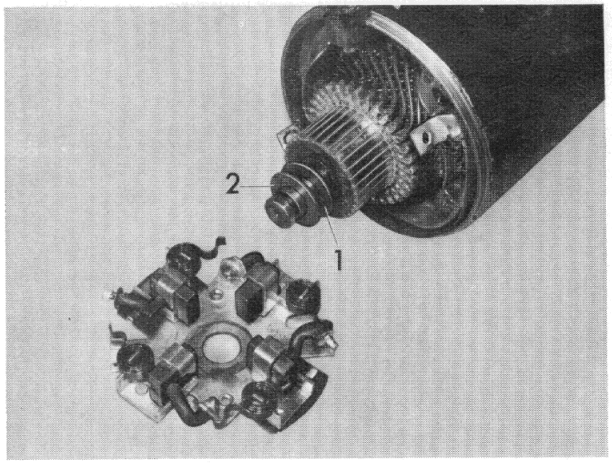
Pull off starter gear.

Fitting instruction: Coat coarse thread and starting ring with Bosch Ft 2 v 3 silicon lubricant.

Pull thrust ring over the retaining ring.

■

12 41 551 Renewing carbon brushes

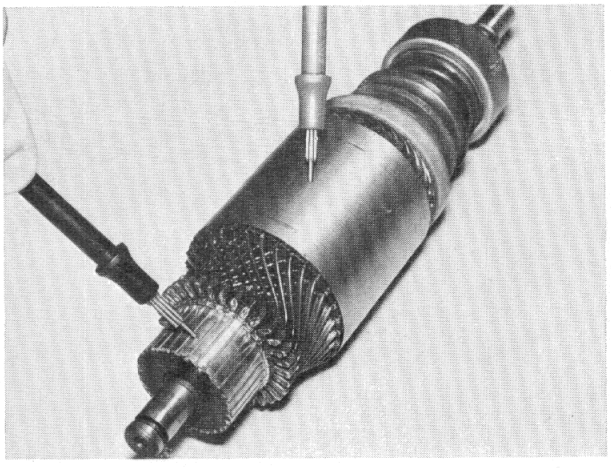


Unsolder and solder carbon brushes on the the exciter winding and on brush support plate.

Fitting instruction: Washer (1) on armature, insulating washer (2).

■

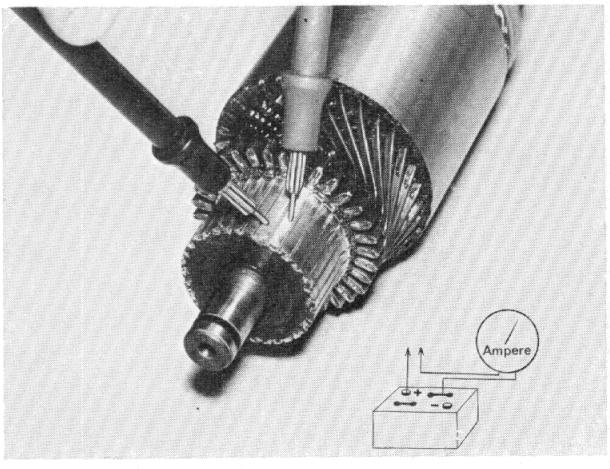
12 41 602 Overhauling starter motor



Check armature and field coil — test lamp 220 Volt — Scan commutator and armature stampings with testing points.

The lamp lights up in the case of an earth short-circuit — renew armature.

■



Wire ammeter (60 Amp range) into circuit and scan commutator briefly from bar to bar.

Test voltage 2 ÷ 4.

The deflection on the instrument should be the same between the individual bars.

Large variations indicate a break.

Renew armature if it has a break.

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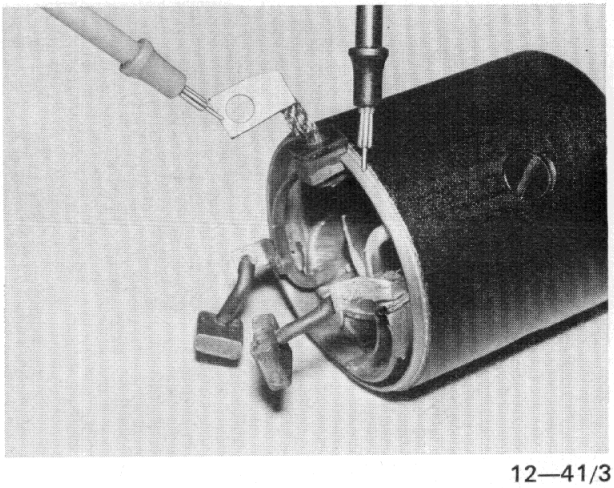

Check exciter winding for earth contact.

Visual inspection.

Renew burnt or charred windings.

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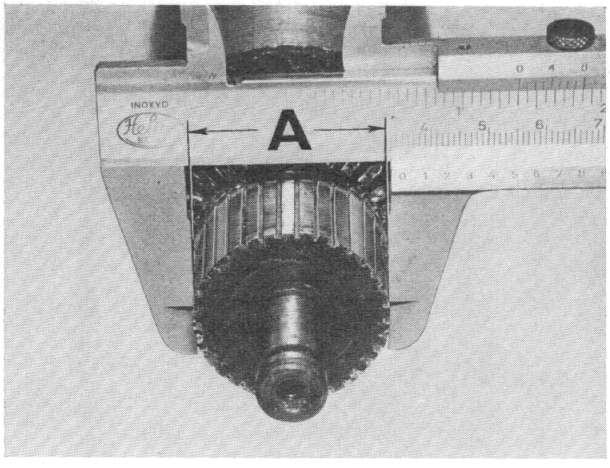

Finely skim commutator.

Diameter of commutator (A) must not be less than 33 mm (1.30 in.).

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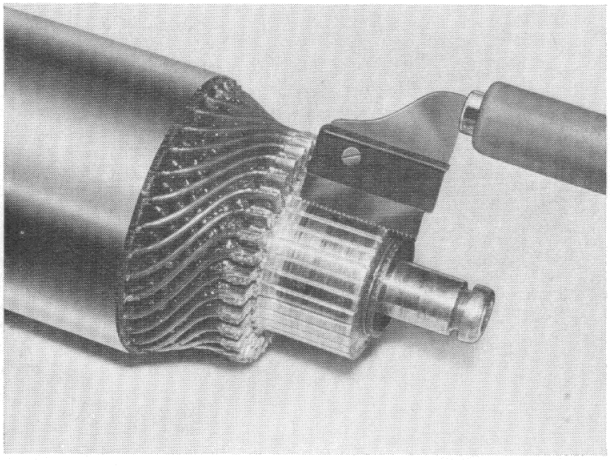

Undercut commutator bars.

Insulation should be 0.5 mm (0.02") deeper than the bars.

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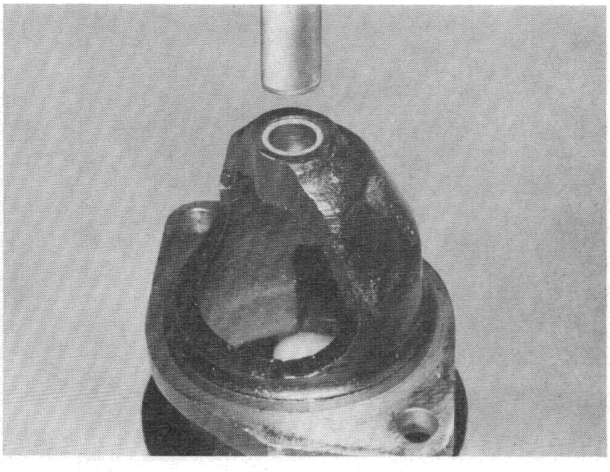
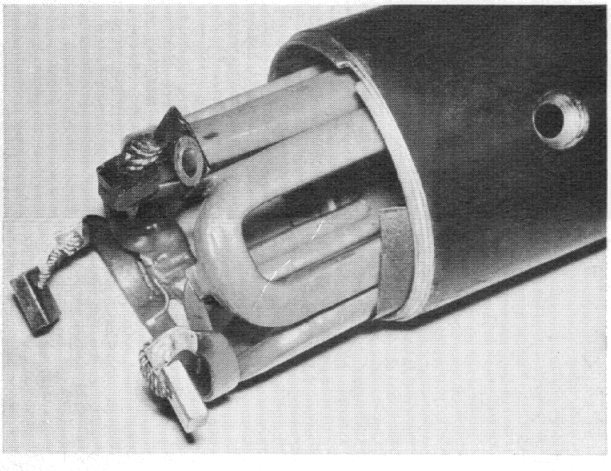


Press out worn bush.

Fitting instruction: Before fitting, soak new bush in engine oil for at least 1/2 hour and press in flush.

■



12 41 701 Renewing exciter winding — Starter stripped —

Mark pole shoes so that the same position can be achieved when assembling. Unscrew four pole screws.

Take pole shoes and exciter winding out of pole casing.

Fitting instruction: Before finally tightening pole screws, align pole shoes exactly parallel to the longitudinal axis.

Position paper insulating strip between exciter winding and pole casing.

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Trouble shooting – starter motor

Fault	Cause	Remedy
Starter motor does not turn when ignition/starter is switched on	Switch on lights: a) Lights do not go on Battery flat, battery circuit broken b) Lights go on, become slowly dimmer when starter is operated Battery flat c) Lights go on, but go out again immediately starter is operated Battery terminals or earth connection on body oxidized d) Lights normal. Bridge terminals 50 and 30 on starter. Starter motor turns. Ignition switch defective or break in the lines e) Lights normal. Solenoid functions, starter motor does not turn. Make bridge with appropriate cable from battery positive terminal to terminal 30 on starter. Starter motor turns. Solenoid contacts dirty or charred	a) Measure battery voltage Charge battery Check cable connections b) Charge battery c) Clean battery terminals on earth connection on body d) Renew ignition switch, rectify break e) Renew solenoid switch
Starter motor does not turn when cable is run direct from battery positive terminal to terminal 30	a) Carbon brushes too short b) Carbon brushes jammed c) Too little pressure on carbon brushes	a) Renew carbon brushes b) Free carbon brushes c) Renew compression springs
Starter motor turns too slowly, does not turn engine	a) Commutator dirty b) Armature or exciter winding defective	a) Clean commutator b) Repair starter motor
Starter motor turns at half speed, engine remains stationary or only turns in jerks	a) Drive pinion defective b) Ring gear defective c) Drive pinion does not disengage Coarse thread dirty or damaged	a) Renew drive pinion b) Renew flywheel c) Repair starter motor
Starter pinion not engaging. Starter motor spins at high speed	a) Pinion extremely dirty b) Faulty coil spring in solenoid switch c) Flywheel gear ring severely damaged	a) Clean pinion bearing b) Renew solenoid switch c) Renew gear ring
Starter pinion engages, but starter motor still does not turn engine over	a) Roller freewheel in drive pinion is slipping	a) Renew drive pinion