

Motor-Elektrik

Engine-Electrical

Moteur-électricité

Motore-Impianto elettrico

Motor-equipio eléctrico

Motor – Elsystem

Motor-elektrisch

12 Engine – Electrical System

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Specifications

Engine – electrical system

Model	320/6 320/6 A	323 i 323 i A *)
12 11 . . . Distributor		
Manufacturer	Bosch	
Type	PFUD 6	PGFUD 6
Bosch No.	0 231 309 007	0 237 302 006 1)
BMW part number	12 11 1 360 659	12 11 1 266 723
Distributor rotor with speed governor		
Cutout speed (crankshaft)	1/min	6600 ± 150
Cutout speed (camshaft)	1/min	3300 ± 75
12 11 . . . Distributor rotor with speed governor		
Manufacturer	Bosch	
Bosch No.	1 234 332 196	
Suppressor resistor	k Ω	5

*) Version for Sweden

1) with inductive (contactless) transmitter. *Warning:* never work on the contactless transistorized coil ignition system unless the engine is stopped and the ignition switched off. Risk of fatal electric shock.

Specifications

Engine – electrical system

Model	320/6 320/6 A	323 i 323 i A*)
12 11 . . . Condenser		
Manufacturer	Bosch	–
Bosch No.	1 237 330 303	–
Capacitance	μF 0.18 . . . 0.22	–
Insulation resistance	$\text{k}\Omega$ min. 200	–
12 11 . . . Position indicator		
Manufacturer	Bosch	
Bosch No.	0 335 541 010	
Resistance measured between leads at temperature	Ω at $^{\circ}\text{C}$ ($^{\circ}\text{F}$) 80 \pm 10 25 (77)	
Air gap between position indicator and vibration damper	mm (in)	0.2 . . . 2.0 (0.008 . . . 0.8)

*) Version for Sweden

Engine – electrical system

Specifications

Model	320/6 320/6 A	323 i 323 i A *)
12 11 ... Ignition timing		
Distributor – Bosch No.	0 231 309 007	0 237 302 006
Dwell angle	35 ... 41	
	deg.	
	%	
at 4500/min	58 ... 68	52 ... 57
	deg.	
	%	86.7 ... 95.0
Breaker points gap	mm (in)	–
	$\leq 0.35 (0.014)$	
Spark plug electrode gap	mm (in)	see 12 12 ... Spark plugs
Firing order		1 – 5 – 3 – 6 – 2 – 4
Static ignition timing 1) with engine cold		10° before TDC
Dynamic ignition timing 2) with engine running at normal operating temperature (vacuum ignition control out of action, dwell angle tester switched off)		–
– at engine speed	°CS 1/min	22° before TDC 1500

*) Version for Sweden

1) Guide value only. Always time the ignition dynamically.

2) With BMW digital tester, using TDC position indicator installed on engine or if necessary marks or vibration damper (V-belt pulley) or ball mark on flywheel, illuminated with stroboscopic lamp. On automatic transmission cars, TDC = short pin, ignition timing mark = long pin

Specifications

Engine – electrical system

Model	320/6 320/6 A	323 i 323 i A *)
12 11 ... Ignition timing (continued)		
Centrifugal ignition advance (measured with vacuum ignition control out of action and engine at normal operating temperature, using BMW digital or dwell angle tester ¹⁾)	°CS before TDC	
1000 /min	10 ... 14°	11° ... 17°
1500 /min	22°	22°
2000 /min	23 ... 29°	
2400 /min		27 ... 33° (ends)
2500 /min	25 ... 31°	
3000 /min	27 ... 33°	
3500 /min	30 ... 36° (ends)	
Max. ignition advance (without vacuum advance)	°CS	30 ± 3

*) Version for Sweden

1) If necessary, illuminate TDC mark with strobe lamp

Specifications

Engine – electrical system

Model	320/6 320/6 A	323 i 323 i A *)
12 11 . . . Ignition timing (continued)		
Vacuum ignition control Bosch distributor number	0 231 309 007	
Vacuum control direction	advance	retard
Start:	150 . . . 190 (153 . . . 180) ¹⁾	140 . . . 280 (73 . . . 113) ¹⁾
Torr (mm Hg)	112 . . . 142 (115 . . . 135) ¹⁾	105 . . . 210 (55 . . . 85) ¹⁾
in Hg	4.41 . . . 5.59 (4.53 . . . 5.31) ¹⁾	4.13 . . . 8.27 (2.17 . . . 3.35) ¹⁾
End:	240 . . . 260 (233 . . . 247) ¹⁾	340 . . . 420 (120 . . . 247) ¹⁾
mm Hg	180 . . . 195 (175 . . . 185) ¹⁾	255 . . . 315 (90 . . . 105) ¹⁾
in Hg	7.09 . . . 7.68 (6.89 . . . 7.28) ²⁾	10.04 . . . 12.40 (3.54 . . . 4.13) ¹⁾
Range of control	°CS	°CS
	10	10
		14
		16

*) Version for Sweden

1) Previous values (until 8/77)

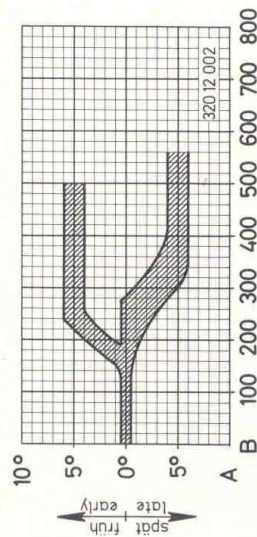
Specifications

Engine – electrical system

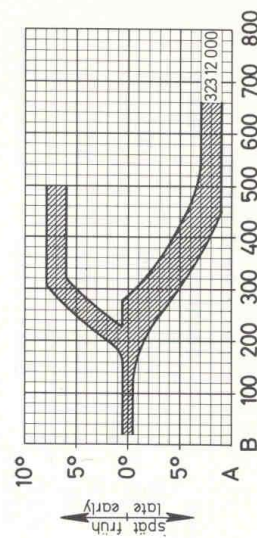
Model	320/6 320/6 A	323 i 323 i *
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Vacuum ignition control graphs

A = Distributor shaft movements in degrees
B = Vacuum in mbar



Bosch distributor number 0 231 309 007



Bosch distributor number 0 237 302 006

*) Version for Sweden

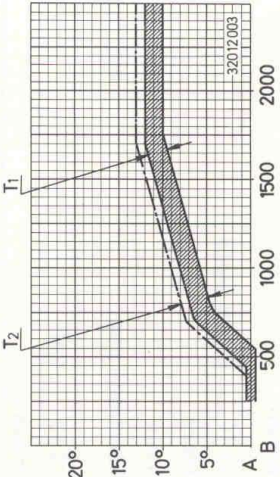
Specifications

Engine – electrical system

Model	320/6 320/6 A	323 i 323 i A *)
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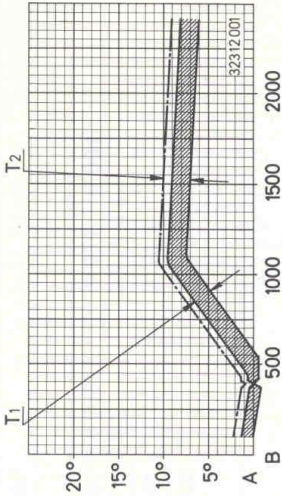
Centrifugal advance graphs – ignition control values for distributor test bench measurement

- A = Distributor shaft movement in degrees
- B = Distributor shaft speed in 1/min
- T₁ = Tolerance band with distributor in new condition
- T₂ = Tolerance band when distributor has been run



Bosch distributor number 0 231 309 007

*) Version for Sweden



Bosch distributor number 0 237 302 006

Specifications

Engine – electrical system

Model	320/6 320/6 A	323 i 323 i A *)
12 12 . . . Spark plugs		
Make	Beru	Bosch
Type	145/14/3 A	W 145 T 30
Electrode gap	mm (in)	N 10 Y
	0.6 + 0.1 (0.024 + 0.004)	0.65 + 0.05 (0.026 + 0.002)
12 13 . . . Coil		0.6 + 0.1 (0.024 + 0.004)
Make		Bosch
Bosch-Nr.	0 221 119 017 ¹⁾	0 221 122 010
Type	KW 12 V	KW 12 V
Primary winding resistance Ω	1.7 . . . 2.1	0.4
12 13 . . . Line resistor		
Make	¹⁾	Bosch
Bosch No.	¹⁾	0 227 900 101
Nominal resistance Ω	¹⁾	0.4 und 0.6

*) Version for Sweden

¹⁾ Coil 0 221 119 017 only in conjunction with line resistor rated $0.9 \pm 0.05 \Omega$. (Resistor lead in engine wiring harness).

Specifications

Engine – electrical system

Model	320/6 320/6 A	323 i 323 i A *)
1214 ... Control unit for transistorized coil ignition		
Make	–	Bosch
Bosch No.	–	0 227 100 025
Nominal voltage V	–	12
Operating voltage V	–	6 ... 15
1231 ... Alternator with attached regulator		
Make	Bosch	
Bosch No.	0 120 489 688	0 120 489 718
Nominal alternator output voltage V	14	14
Max. current A	65	65
Max. output W	910	910
Max. running speed 1/min	15 000	15 000
Charging commences at 1/min	1 060	1 060
2/3 of full current at 1/min	2 100	2 100
Max. current at 1/min	6 000	6 000

*) Version for Sweden

Specifications

Engine – electrical system

Model	320/6 320/6 A	323 i 323 i A *)
1231 . . . Alternator with attached regulator (continued)		
Min. slipping diameter	mm (in)	31.5 (1.24)
Min. projection	mm (in)	2.5 (0.10)
1231 . . . V-belt		
Narrow-section V-belt		9.5 × 950 LA
1232 . . . Regulator (attached to alternator)		
Make		Bosch
Bosch No.		0 192 052 006
Type		Bosch EE 14 V 3
Cut-in voltage	V	14.1 + 0.2
Controlled voltage range	V	13.7 . . . 14.5

*) Version for Sweden

Engine – electrical system

Specifications

Model	320/6 320/6 A	323 i 323 i A *)
12 14 . . . Control unit for transistorized coil ignition		
12 41 . . . Starter		
Make		Bosch
Bosch number		0 001 311 125
Type		GF → 12 V 1.1 kW
Direction of rotation		clockwise
Number of teeth on pinion		9
Armature axial play	mm (in)	0.05 . . . 0.3 (0.002 . . . 0.012)
Min. length of carbon brushes	mm (in)	11 (0.433)
Operating voltage	V	6 . . . 12
Test voltage	V	13 ± 0.26
Test temperature	°C (° F)	+ 20° (+ 68)
12 41 . . . Solenoid switch		
Current consumption (with nominal voltage at terminal 50)		
Engagement and hold-in windings A		40
Hold-in winding	A	7.5

*) Version for Sweden

Engine – electrical system

Specifications

Model	320/6 320/6 A	323 i 323 i A *)
Tightening torques		
12 11 ... Distributor		
Distributor to crankcase (M 8)	Nm kpm lb.ft	19.6 ... 21.6 2.0 ... 2.2 14.5 ... 15.9
12 12 ... Spark plug		
Spark plug threads (M 14 × 1.25 mm)	Nm kpm lb.ft	24.0 ... 29 2.5 ... 3.0 18 ... 21
12 31 ... Alternator		
Belt pulley	Nm kpm lb.ft	34.4 ... 44.2 3.5 ... 4.5 25 ... 32
Alternator to pivot mount (M 8)	Nm kpm lb.ft	21.6 ... 23.5 2.2 ... 2.4 15.9 ... 17.3
Pivot mount to crankcase (M 8)	Nm kpm lb.ft	21.6 ... 23.5 2.2 ... 2.4 15.9 ... 17.3

*) Version for Sweden

Specifications

Engine – electrical system

Model	320/6 320/6 A	323 i 323 i A *)
12 31 . . . Alternator (continued)		
Tightening torques		
Alternator tensioning strap at protective cover (M 8)	Nm kpm lb.ft	21.6 . . . 23.5 2.2 . . . 2.4 15.9 . . . 17.3
Alternator to tensioning strap	Nm kpm lb.ft	21.6 . . . 23.5 2.2 . . . 2.4 15.9 . . . 17.3
12 41 . . . Starter		
Retaining bolts (M 10)	Nm kpm lb.ft	47.5 4.75 35.0

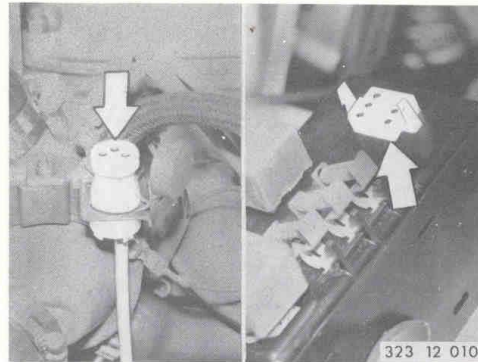
*) Version for Sweden

12 11 004 Timing ignition

– engine at normal operating temperature –

The following items must be correct before the ignition can be timed accurately:

- a) breaker points in good condition
 - b) dwell angle correct
 - c) TDC position indicator correctly located.
- Connect the BMW digital tester to the round-pin plug and the current distributor for the TDC position indicator.

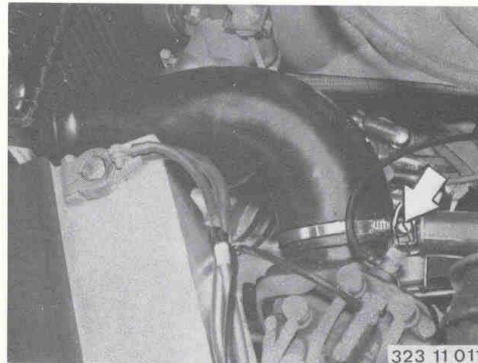


Version with contactless transistorized coil ignition:

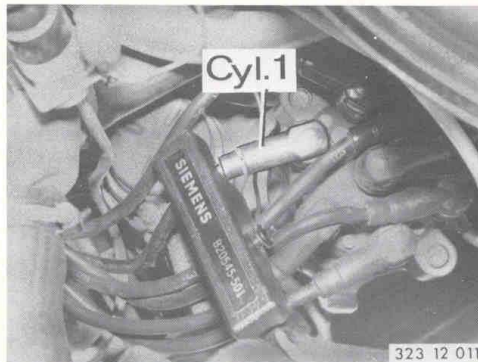
Warning: the dwell angle is a fixed feature and cannot be varied.

Dwell angle at 1500/min = $42^\circ \pm 10^\circ$
at 4500/min = $52^\circ \pm 5^\circ$

– check these settings.
Detach the tube.



Connect the detector clip to the ignition lead for cylinder 1, as close as possible to the distributor.

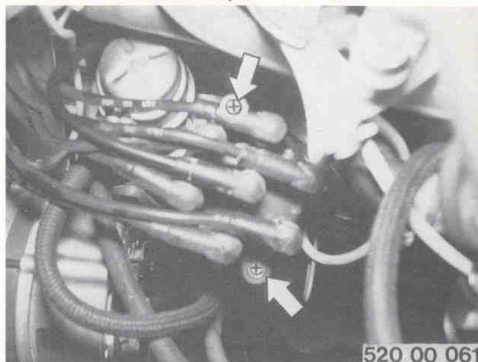


Version with breaker points:

Adjust dwell angle:

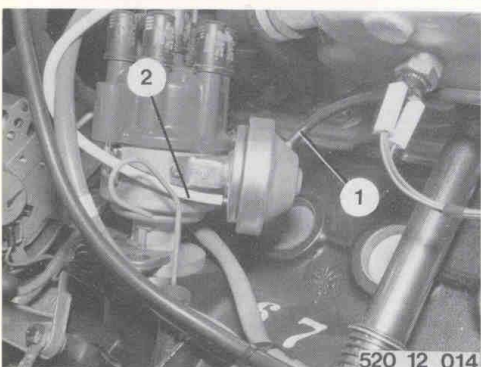
Overcome the spring-loading and turn the catch to the left to remove the distributor cap. Take out the distributor rotor and dust cover.

When installing: make sure that the dust cover and distributor cap are properly secured and the catches correctly seated.





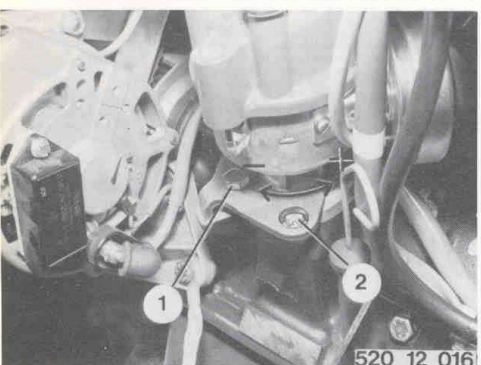
Turn the engine over with the starter.
Turn the breaker points carrier until the dwell angle is $35^{\circ} \dots 41^{\circ}$.
Aim for the lower value.



Detach the vacuum hoses for ignition advance (1) and retard (2).
Vacuum advance = black hose
Vacuum retard = white hose



Start the engine.
Program the BMW digital tester to 1500 ± 50 min at the speed control $\rightarrow \curvearrowleft$.
See also operating instructions for BMW digital tester.
Accelerate until engine speed is at least 1500/min.
Read off the ignition control angle ($22^{\circ} \pm 1^{\circ}$) at the digital tester.



To correct: loosen the distributor retaining bolt (1) and turn the distributor body at gear teeth (2) until ignition timing is correct.
+ = advance
- = retard

12 11 031 TDC position indicator – renewing

Pull the round-pin plug downwards out of the holder.

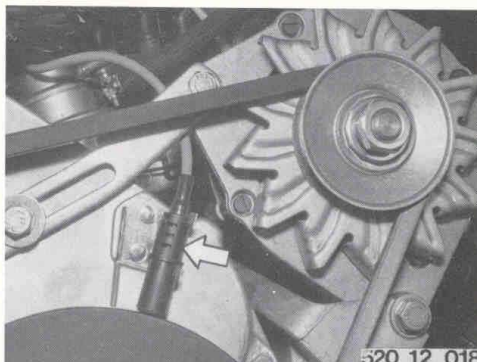
Detach the cap from the plug.



520 12 017

Lift the position indicator out of its clip.

When installing: make sure that the position indicator is correctly seated. The gap between the position indicator and the vibration damper should be 0.2 ... 2.0 mm (0.008 ... 0.08 in).



520 12 018

12 11 060 Distributor – removing and installing

Take off the distributor cap.

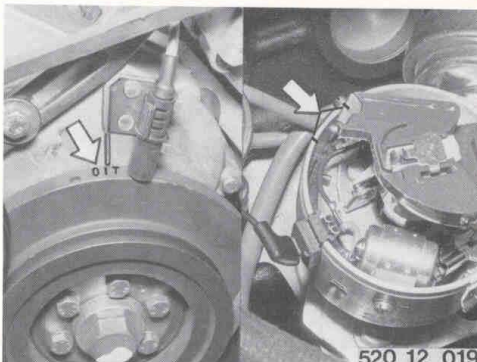
Detach lead from terminal 1 and pull off vacuum hoses.

Take out distributor rotor and dust cover.

Install the distributor rotor again.

Move the piston in cylinder 1 to TDC – the distributor rotor must be aligned with the notch in the distributor body.

When installing: black vacuum hose = ignition advance.



520 12 019

Remove bolt (1).

Take off retaining plate.

Pull out the distributor.



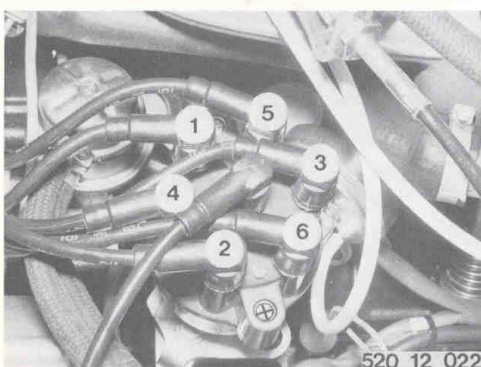
520 12 020



When installing: turn the distributor rotor approx. 25 mm (1 in) clockwise (A) away from the notch on the distributor body.

Carefully insert the distributor drive peg into the intermediate shaft.

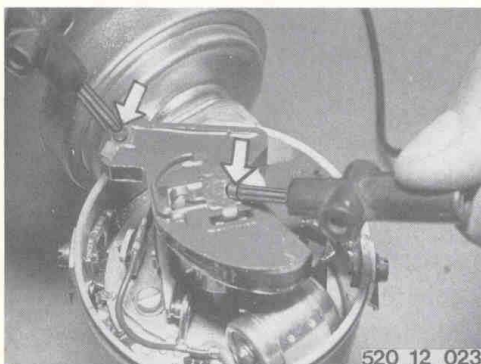
When installing: time the ignition – 12 11 004.



12 11 091 Distributor cap – renewing

Pull off the ignition leads. Take off the distributor cap and attach the new cap.

When installing: note correct order of ignition leads (firing order): 1-5-3-6-2-4.



12 11 111 Distributor rotor – renewing

Take off the distributor cap.

Pull out the distributor rotor.

Resistance of suppressed rotor¹⁾.

Important: the cutout speed¹⁾ of the distributor rotor is stamped underneath.



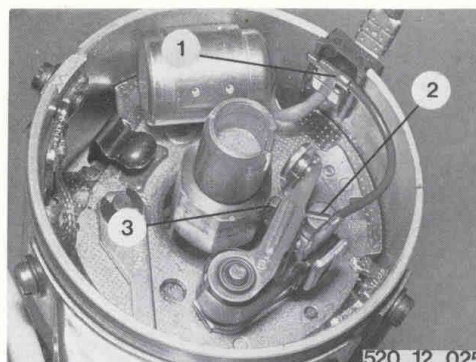
12 11 141 Breaker points – renewing

Take off the distributor cap.

Remove the distributor rotor and dust cap.

¹⁾ See specifications

Pull off flat pin plug (1).
 Remove screw (2).
 Pull out the breaker points assembly.
When installing: clean new points to remove grease.
 Apply Bosch Ft 1 v 4 grease to cam and lift section (3) of breaker arm.
 Adjust dwell angle and ignition timing – 12 11 004.



12 11 151 Pulse transmitter in distributor – checking/renewing

Important: no work is to be performed on the contactless transistorized coil ignition system unless the engine is stopped and the ignition switched off. Risk of fatal electric shock.
 The pulse transmitter delivers an AC signal varying between app. 0.3 and 100 V according to running speed. This is used as a control signal to interrupt the ignition spark.

a) Testing

Disconnect the transmitter lead at the plug between the distributor and the control unit.
 Connect the Program tester.

Test lead red to terminal 7, black to terminal 31d.

Set range switch to x0.1 V.

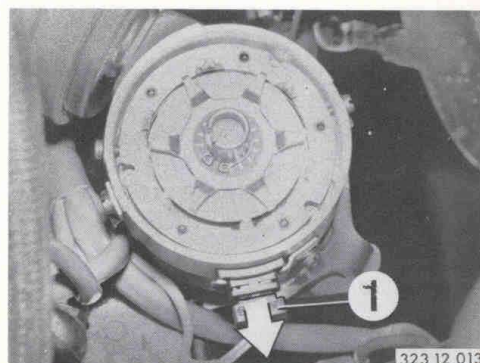
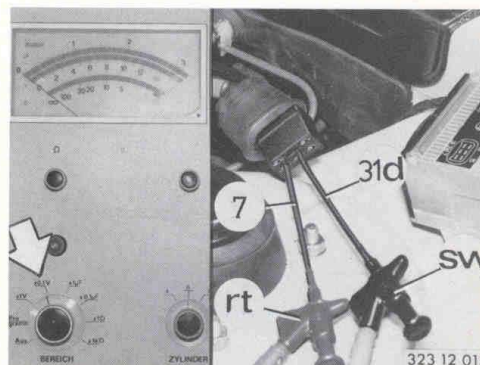
Operate the starter.

If a reading of at least 0.05 V is obtained, the pulse transmitter is in good working order.
 If not, the fault is in the control unit.

b) Renewing

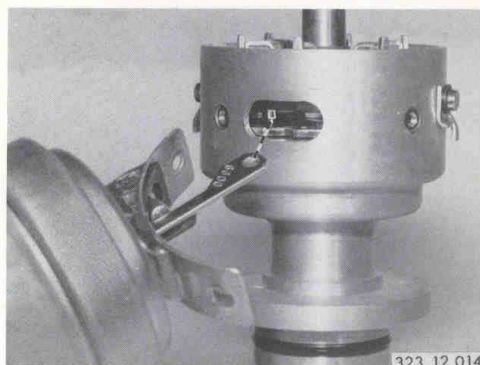
Pull out plug (1).

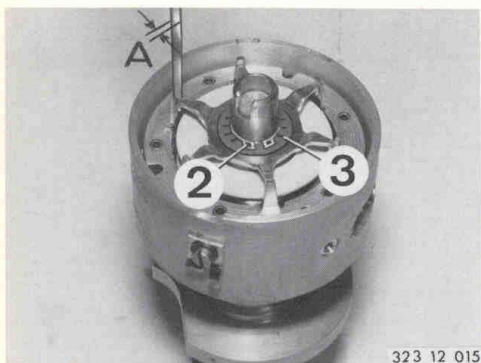
Remove the distributor – 12 11 060.



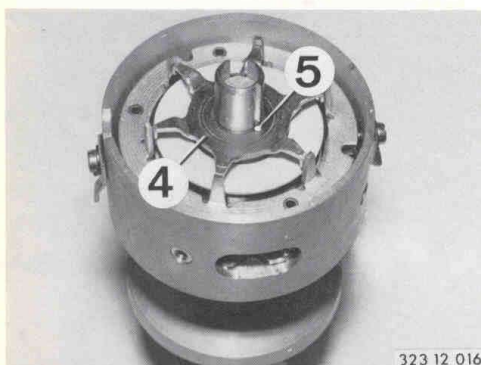
Loosen the retaining screws and disconnect the vacuum ignition control device (press the connecting link down).

When installing: attach the connecting link to its journal, and grease the linkage.

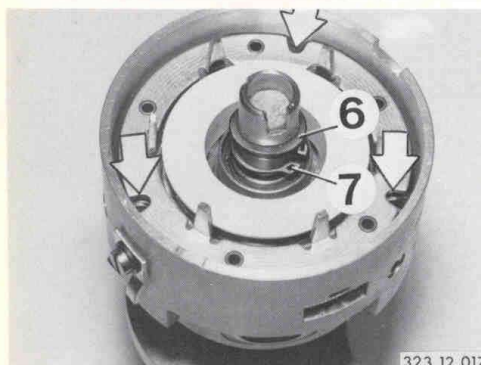




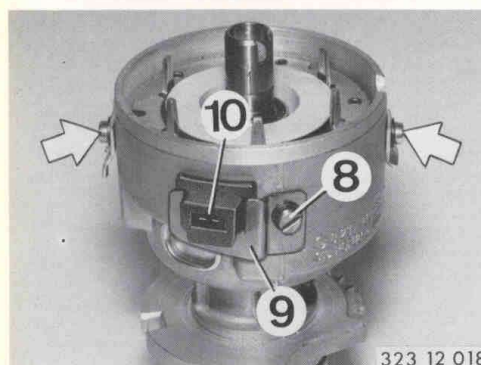
Lift out Seeger circlips (2).
Remove cup spring (3).
When installing: check gap between pulse transmitter wheel and pulse transmitter.
 $A = 0.35 \dots 0.70 \text{ mm} (0.014 \dots 0.028 \text{ in})$.



Carefully press up the pulse transmitter wheel (4) with two screwdriver blades on opposite sides.
Note: locating pin (5).
When installing: cutout in pulse transmitter wheel must engage in groove on distributor shaft.

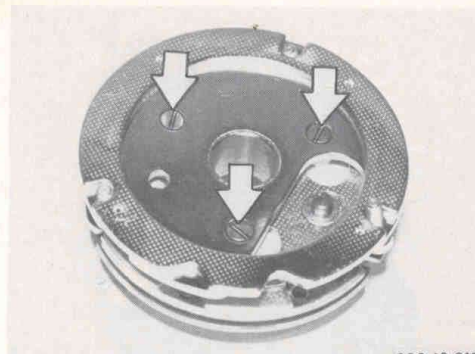


Take out thrust washer (6).
Remove the three retaining screws with a 3 mm Allen key.
Remove Seeger circlip (7).



Remove screw (8) and take off retaining plate (9).
Pull out plug (10).
Loosen screws for mounting and take off carrier plate.

Unscrew pulse transmitter from carrier plate.



323 12 019

When installing: lugs face cutout for plug-in section.



323 12 020

12 11 171 Condenser – renewing

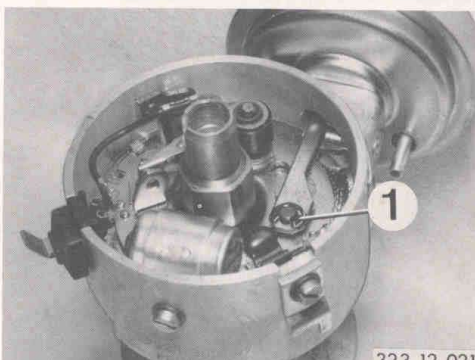
Take off the distributor cap.
Remove the distributor rotor and dust cap.
Detach cable 1 and the lead from the breaker points.
Lift cable connecting block out of distributor.
Remove screw holding condenser.
Remove the condenser.
When installing: use only condenser with part number 1 237 330 303.



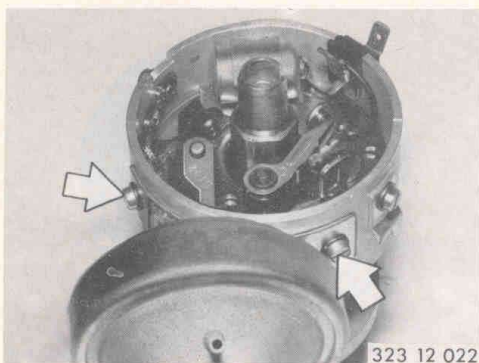
520 12 026

12 11 201 Vacuum control unit for distributor – renewing

Remove the distributor – 12 11 060.
Remove the distributor rotor and the dust cover.
Extract circlip (1).

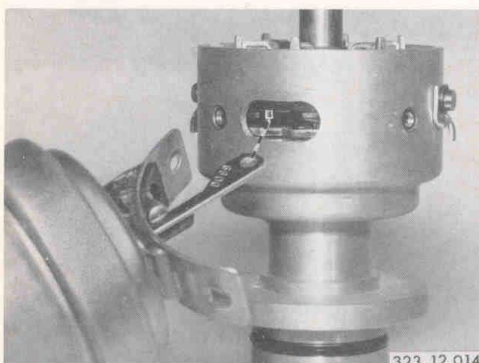


323 12 021



323 12 022

Remove the retaining screws and lift out the vacuum control unit.



323 12 014

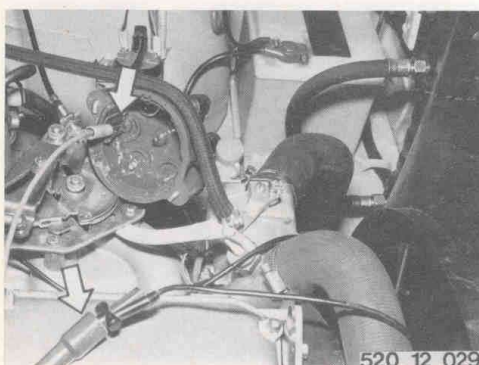
Version with contactless transistorized coil ignition:

Warning: never work on the contactless transistorized coil ignition system unless the engine is stopped and the ignition switched off. Danger of fatal electric shock.

Remove the distributor – 12 11 060.

Take out the retaining screws and disconnect the vacuum control unit (press connecting link down).

When installing: grease the connecting link and connect to journal.



520 12 029

12 11 209 Distributor cap/ignition leads – checking

Detach the distributor cap and the ignition lead plugs.

Check condition of lead plugs.

Measure resistance¹⁾.

The better the insulation, the higher the resistance value which will be measured.

¹⁾ See specifications

Trouble shooting – distributor (with contact breaker)

Fault	Cause ¹⁾	Remedy
Engine will not start, or misfires and stops	Burned or dirty breaker points	Renew breaker points
Engine runs erratically and misfires	Stray currents across distributor cap	Clean distributor cap, renew if necessary
Engine misfires under part load	Defective suppressor resistor in distributor rotor	Renew distributor rotor
Engine power output drops	Dwell angle incorrect. Contact gap not identical at all lobes of cam – uneven cam wear	Adjust dwell angle. Renew distributor
Engine backfiring – noise developed	Contact breaker plate for vacuum ignition control is worn or loose	Renew distributor
Engine will not accelerate	No centrifugal ignition control – cam seized or rusted to shaft	Free distributor cam on shaft (oil): if necessary, renew distributor
Engine starts, but cuts out immediately	Open or short circuit at condenser	Renew condenser
Engine misfires – fuel consumption too high	Defective ignition lead Defective spark plug cap Defective suppressor resistors	Renew ignition lead Renew spark plug cap Renew suppressor resistors

¹⁾ Determine with BMW Program tester 1100 005

12 13 011 Coil – renewing

Warning: never work on the contactless transistorized coil ignition system unless the engine is stopped and the ignition switched off. Risk of fatal electric shock.

Check the coil – 11 00 009.

Detach the leads.

Detach the coil from its retaining plate.

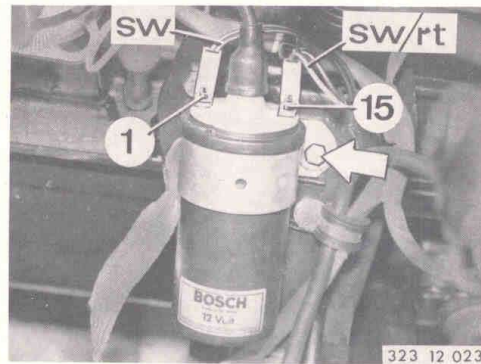
When installing: black/red lead to terminal 15
black lead to terminal 1

Warning: do not accidentally confuse the coil for the standard ignition system (with breaker points) and the coil for the TSZ transistorized contactless coil ignition system.

Bosch number 0 221 119 017 for coil with breaker points system

Bosch number 0 221 122 010 for contactless transistorized system

If these items are confused, there will be severe erosion at the breaker points even after only a short distance has been covered, and misfiring and poor cold starting will occur.



12 13 051 Line resistor for coil – renewing

Warning: never work on the contactless transistorized coil ignition system unless the engine is stopped and the ignition switched off. Risk of fatal electric shock.

Version without breaker points

Remove the battery.

Detach the leads.

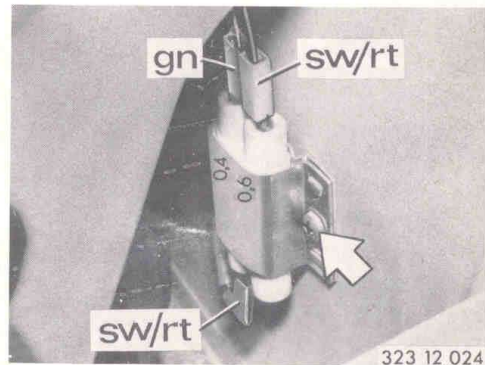
Detach the line resistor from the retaining plate.

When installing:

black/red lead to 0.6 Ohm resistor

green lead to 0.4 Ohm resistor

black/red lead to 0.4 Ohm resistor.



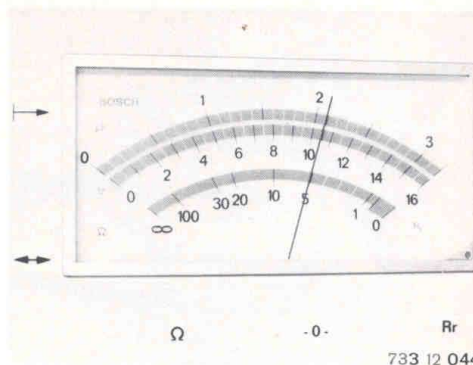
12 14 009 Control unit for transistorized ignition – checking

Warning: never work on the contactless transistorized coil ignition system unless the engine is stopped and the ignition switched off. Risk of fatal electric shock.

A) Connect the Program tester
Switch position U 1.



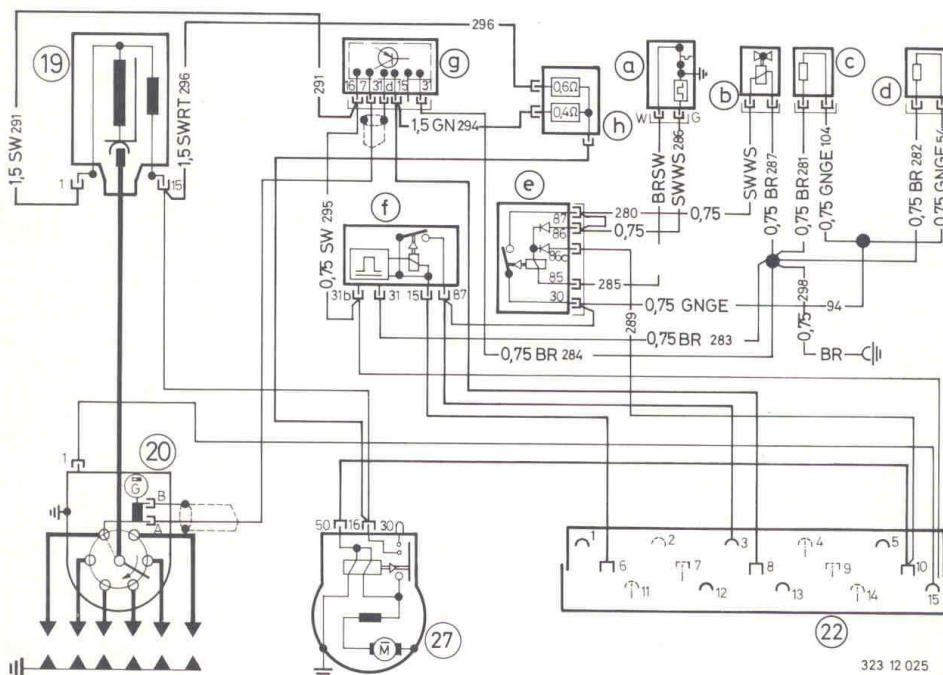
Switch position U (1)
Scale 1.6 V



With the ignition switched on, the reading must be below 2.0 V.

If more than 2.0 V are shown, the control unit has a fault.

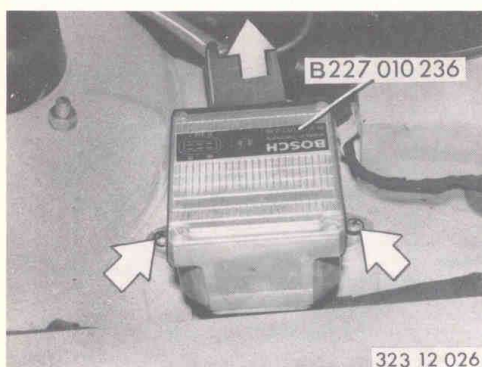
If no dwell angle reading is shown, test the pulse transmitter – 12 11 151.



Circuit diagram for transistorized ignition – K-Jetronic

- | | | | |
|----|--------------------|---|--------------------------------------------|
| 19 | Coil | c | Warming-up regulator |
| 20 | Distributor | d | Additional air slide |
| 22 | Engine plug | e | Diode relay |
| 27 | Starter | f | Fuel pump relay |
| a | Thermo-time switch | g | Transistorized ignition (TSZ) control unit |
| b | Starting valve | h | Resistors |

SW = black
RT = red
GN = green
BR = brown



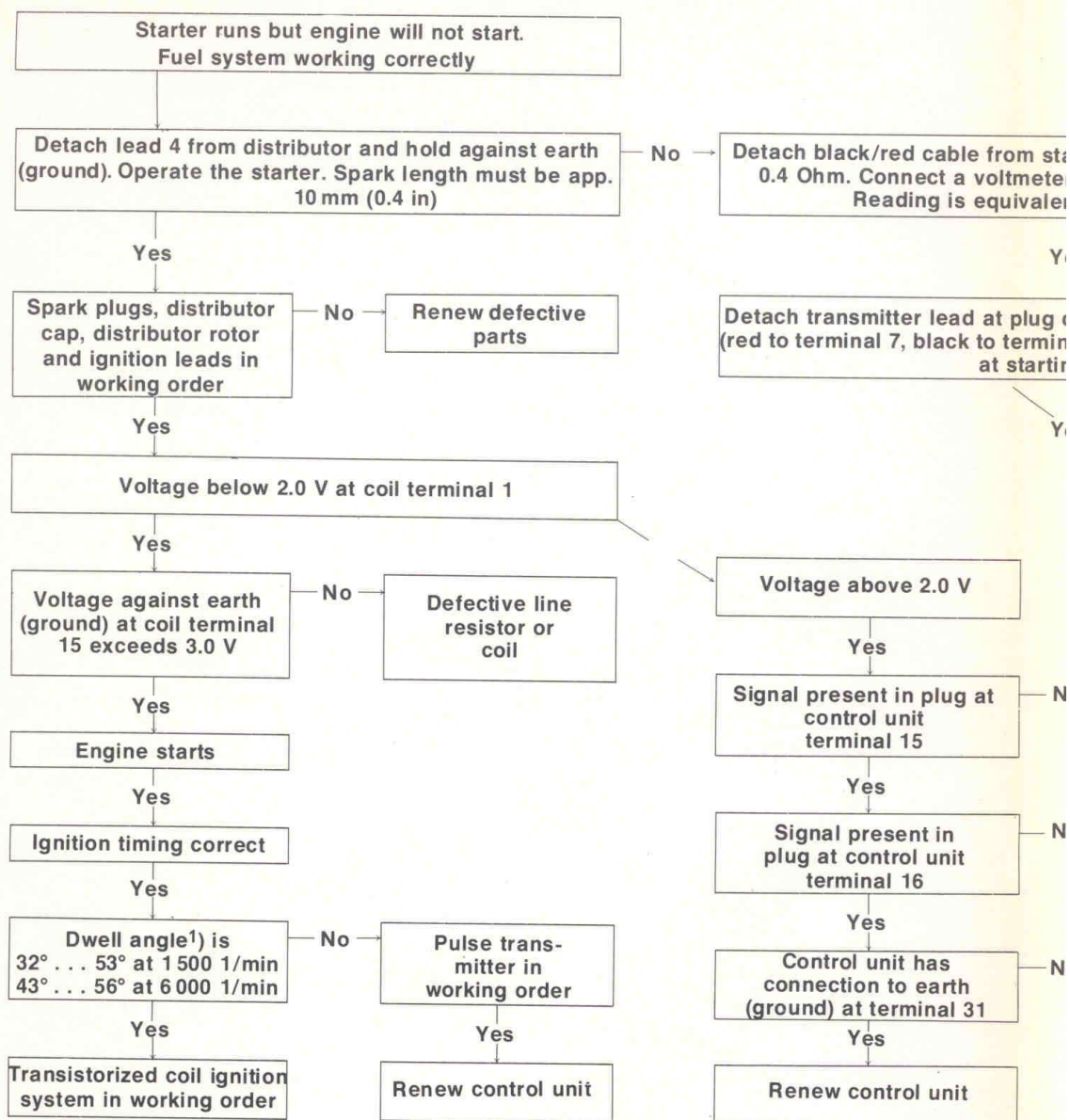
12 14 010 Control unit for transistorized ignition – renewing

Warning: Never work on the contactless transistorized ignition system unless the engine is stopped and the ignition switched off. Risk of fatal electric shock.

Pull out plug.

Detach control unit from wheel arch.

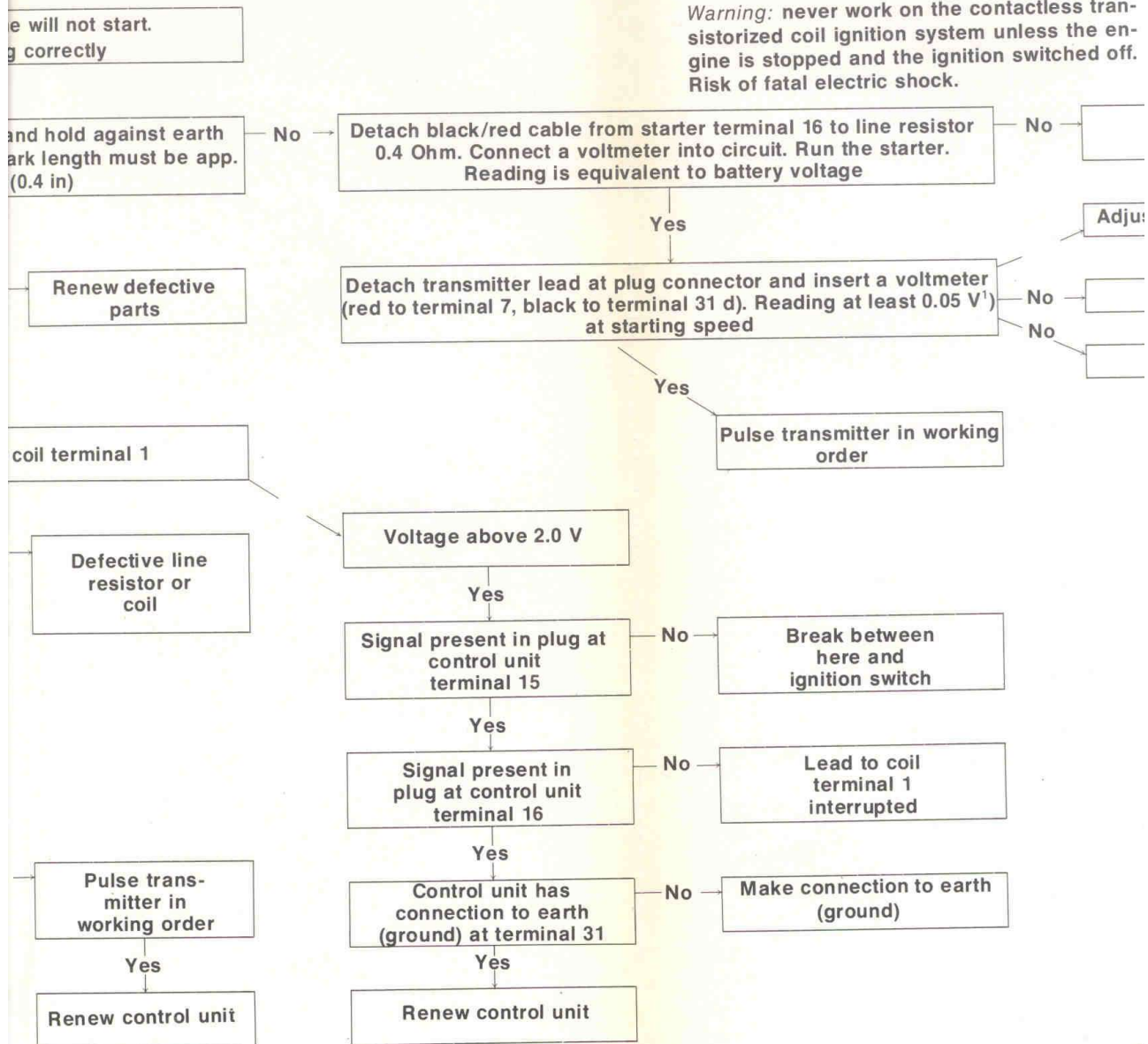
Install only control unit with Bosch number B 227 010 236.



¹⁾ measured with BMW Program tester

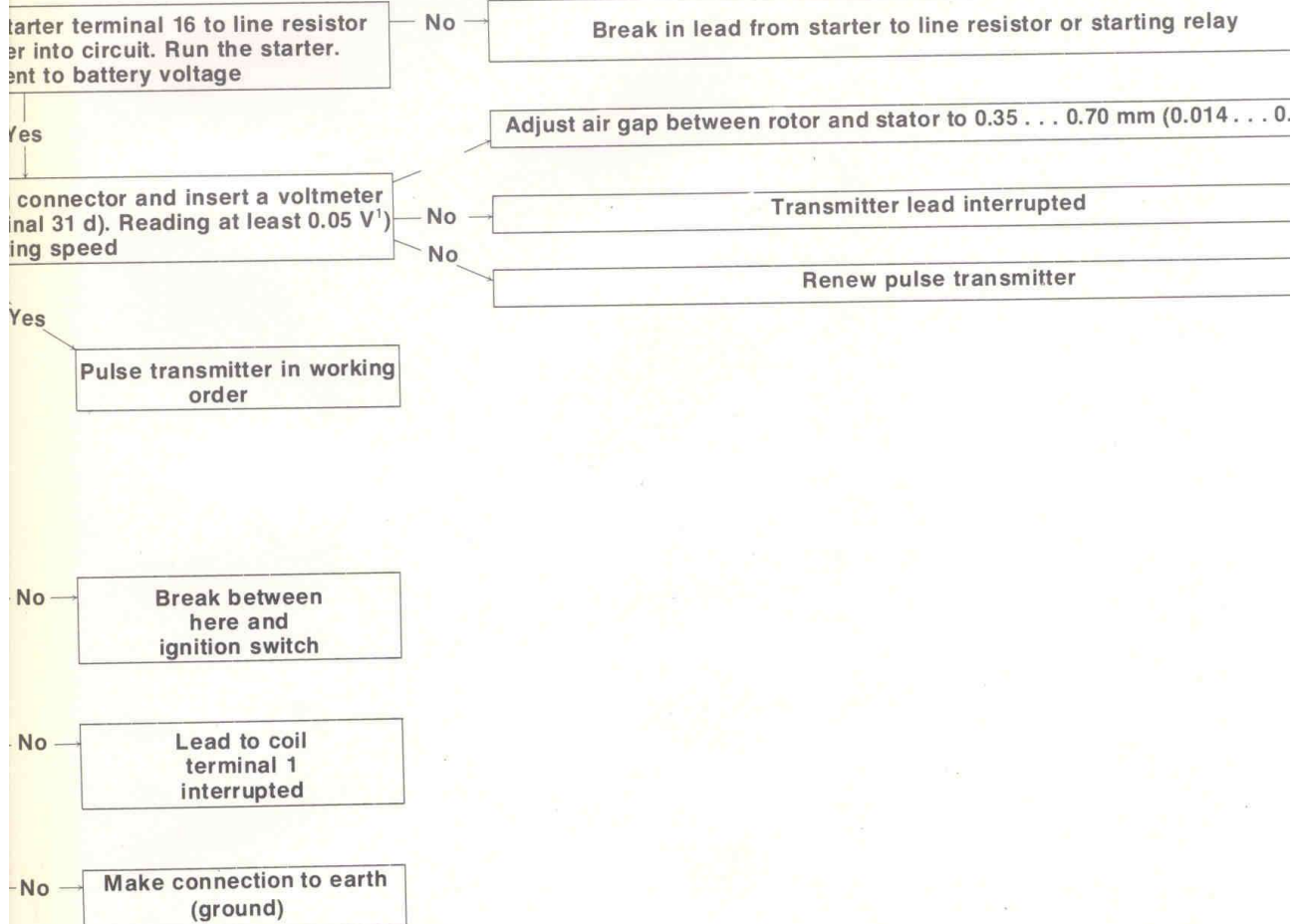
Trouble shooting – contactless transistorized coil ignition system

Warning: never work on the contactless transistorized coil ignition system unless the engine is stopped and the ignition switched off. Risk of fatal electric shock.



ble shooting – contactless transistorized ignition

Warning: never work on the contactless transistorized coil ignition system unless the engine is stopped and the ignition switched off.
Risk of fatal electric shock.



transistorized ignition

actless tran-
less the en-
switched off.

No

Break in lead from starter to line resistor or starting relay

Adjust air gap between rotor and stator to 0.35 . . . 0.70 mm (0.014 . . . 0.028 in)

No

Transmitter lead interrupted

No

Renew pulse transmitter

12 31 009 Alternator and regulator – checking

For test procedure, see Program Test 11 00 005.

12 31 020 Alternator – removing and installing

Warning: Do not disconnect the leads between the battery and the alternator unless the engine is stopped.

If the battery is recharged without removing it from the vehicle, the positive and negative battery leads must be disconnected.

When arc welding on the vehicle, the ground (earth) terminals of the welding equipment should be attached directly to the vehicle component being welded.

Disconnect the negative lead at the battery. Detach the leads at the alternator.

B + Red

D + Blue

Remove the bolt holding the alternator at the tensioning strap.

Loosen the upper mounting and lift out the alternator.

When installing: It should be possible to press in the V-belt by 5–10 mm (0.2–0.4 in).

12 31 101 Belt pulley/cooling fan – renewing

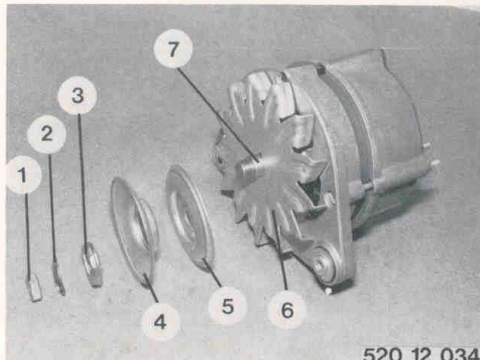
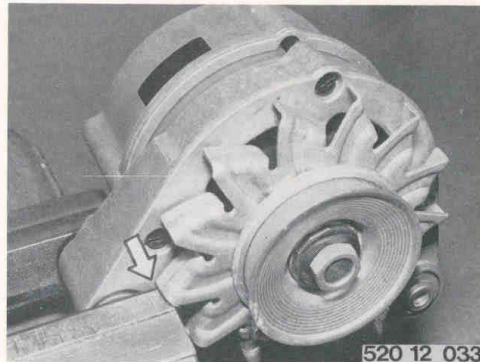
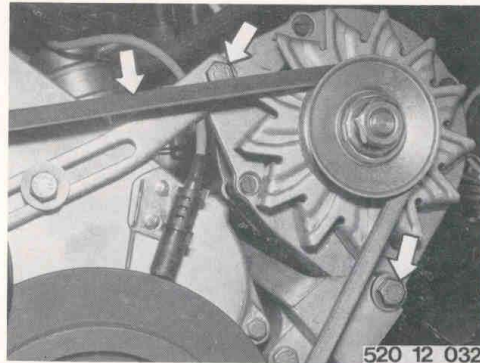
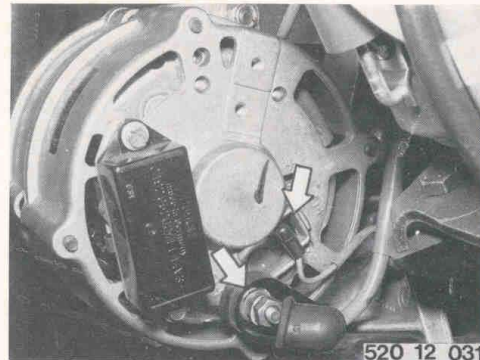
Remove the alternator – 12 31 020.

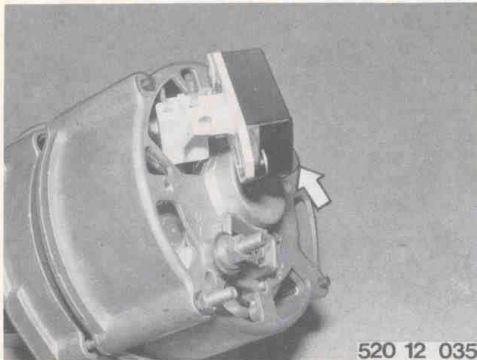
Prevent the cooling fan from turning, and detach it.

When installing: note correct tightening torque¹⁾.

Installation order: nut (1), corrugated washer (2), washer (3), belt pulley (4 + 5), cooling fan (6), key (7).

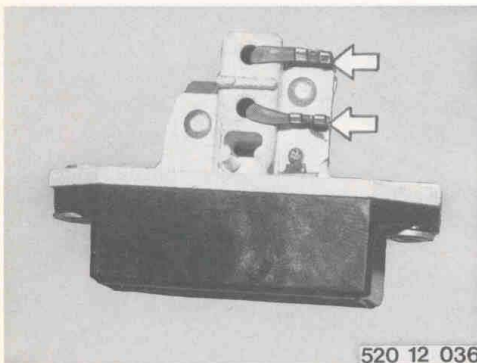
¹⁾ See specifications



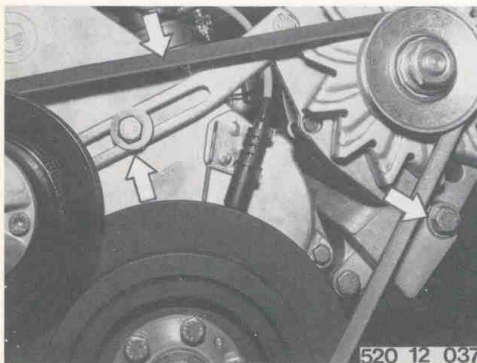


12 31 201 Carbon brushes – renewing

Take off the regulator and remove complete with carbon brush holder.

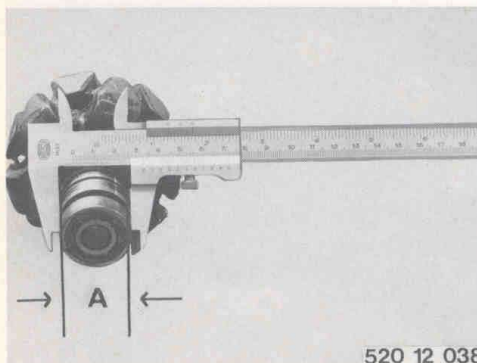


Unsolder the carbon brushes and solder in the new brushes.



12 31 301 V-belt – renewing

Loosen the alternator at the tensioning strap and the upper mounting. Take off the V-belt¹⁾. When installing: It should be possible to press in the V-belt by 5 ... 10 mm (0.2 ... 0.4 in).



12 31 569 Sliprings – skimming – alternator stripped –

To skim the sliprings, tailstock spindle EFAW 75 or GDF 85 R 3 must be used.

Remove only enough material to smooth out the scored areas.

Warning: Minimum slipring diameter 31.5 mm (1.24 in).

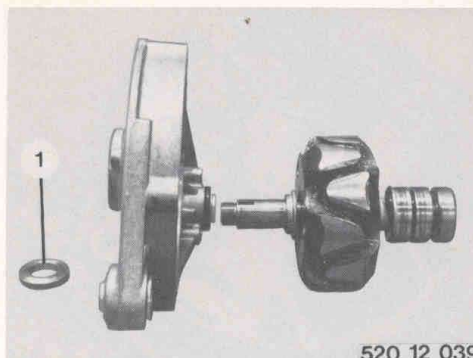
After skimming, check that sliprings still run true. Max. permissible runout 0.03 mm (0.0012 in).

¹⁾ See specifications.

**12 31 571 Rotor – renewing
– alternator stripped –**

Press the rotor out of the bearing plate.

When installing: The collar on disc (1) faces the ball bearing.

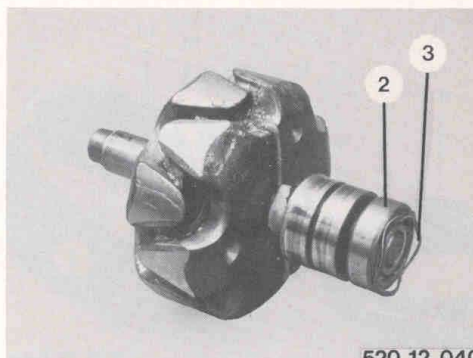


520 12 039

Pull the ball bearing (2) away from the rotor.
When installing: Grease the bearing with Ft 1 v 34 grease.

The open side of the bearing faces the housing.

Place the corrugated washer (3) into the housing before installing the ball bearing.



520 12 040

**12 31 581 Both ball bearings – renewing
– alternator stripped –**

Take off the retaining plate (2).

Press the ball bearing (3) out of the bearing plate.

When installing: The open side of the bearing faces the rotor.

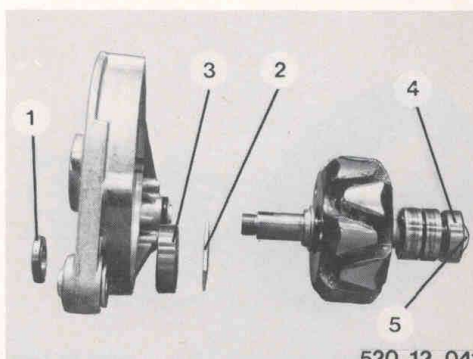
The shoulder on disc (1) faces the ball bearing.

Pull the ball bearing (4) away from the rotor.

Use only C 3 bearings.

The open side of the bearing faces the rotor.

Insert corrugated washer (5) into the housing before installing the ball bearing.



520 12 041

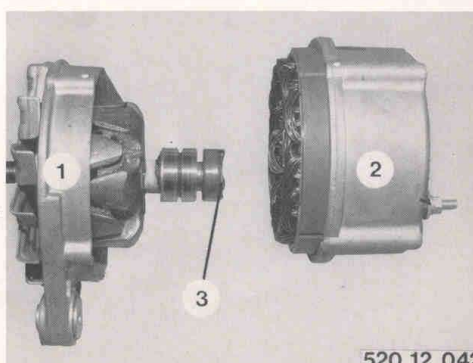
12 31 691 Diode board – renewing

Detach the regulator.

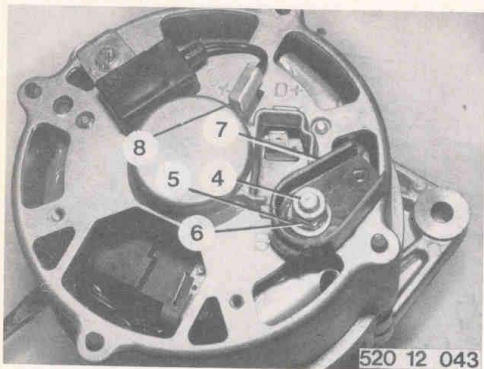
Mark the correct installed position of the housing (1) in relation to the slipring bearing (2).

Detach the housing (1) from the slipring bearing (2).

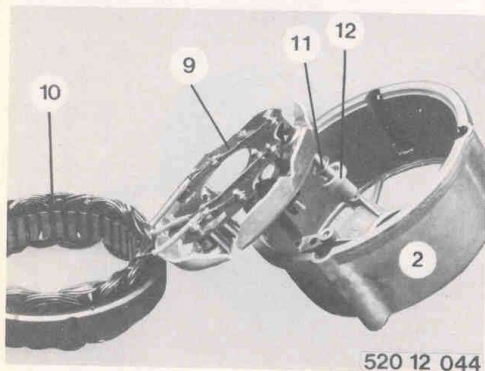
When installing: Attach corrugated washer (3) with Ft 1 v 34 grease before installing the ball bearing.



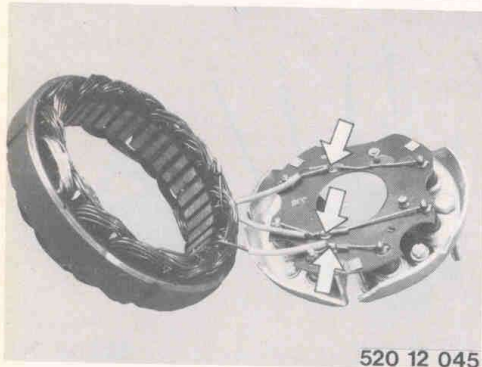
520 12 042



Remove nut (4) and spring washer (5), washer (6) and insulating washer (7). Pull off the plug (8) for the suppressor.



Detach diode board (9) and stator (10) from slipping mount (2). Note correct installed position of washer (11) and insulating bushing (12).



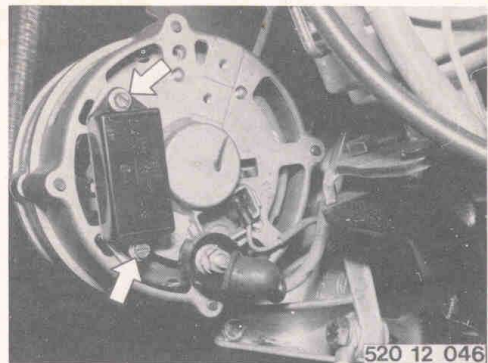
Unsolder the diode board from the stator winding.

12 32 001 Regulator – renewing

The regulator can only be renewed together with the carbon brush holder.

Remove and install the regulator.

When installing: use only Bosch regulator 0 192 052 004.

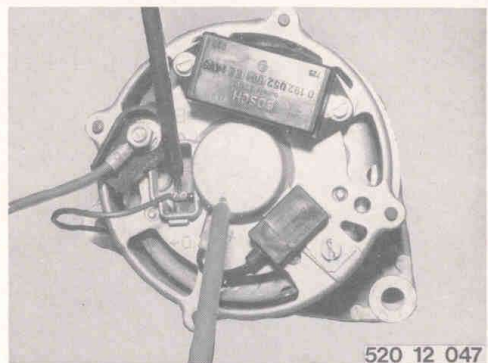


If Program tester is not available:

A. Full battery voltage must be available¹⁾. Connect a voltmeter between D+ and ground (earth).

At 2000 min⁻¹, a reading of 13.5–14.6 V must be obtained.

The regulator is defective if the reading exceeds 14.6 V.



¹⁾ See test values

2.73

¹⁾ See test values

12-32/1

12-32/1

Trouble-shooting – alternator

Fault	Cause	Remedy
Noise from alternator	Defective ball bearing Defective V-belt Belt pulley loose	Renew ball bearing Renew V-belt Tighten belt pulley nuts
Telltale lamp burns at half intensity when engine is running	V-belt slack Poor contact at cable connectors Regulator defective Defective carbon brushes Rectifier diode defective or has short to ground (earth) Short to ground (earth) at stator Partial short to ground (earth) at rotor	Correct V-belt tension Check cable connectors and cables Renew regulator Renew carbon brushes Renew rectifier diode Renew stator Renew rotor
Severe gas formation at battery	Poor contact between regulator and alternator Regulator defective	Check cable connections at regulator and alternator Renew regulator
Telltale lamp burns at half or full intensity when engine is running	Slack V-belt Defective regulator Open or short circuit in supply leads Defective carbon brushes Defective rotor winding Exciter current circuit broken Diodes or diode board defective	Retension V-belt Renew regulator Check cable connections and leads Renew carbon brushes Renew rotor Check cable connections Check diodes or diode board and renew if necessary Rectify short circuit or renew lead
Telltale lamp does not come on at all when engine is started	Telltale lamp bulb blown Lead 61 open circuit	Install a 4 Watt bulb Repair lead
Telltale lamp does not come on when ignition is switched on before engine is started	Telltale lamp bulb blown Battery run down Battery flat Lead detached or defective Defective regulator Positive diode short circuited in alternator	Install a new 4 Watt bulb Recharge battery Renew battery Renew lead or tighten connections Renew regulator Detach charge lead immediately to prevent battery discharge when engine is stopped; have alternator repaired Renew carbon brushes Have alternator repaired
Telltale lamp remains on when ignition is turned off	Defective diodes	Renew diode board

12 41 009 Starter – checking without removal from vehicle

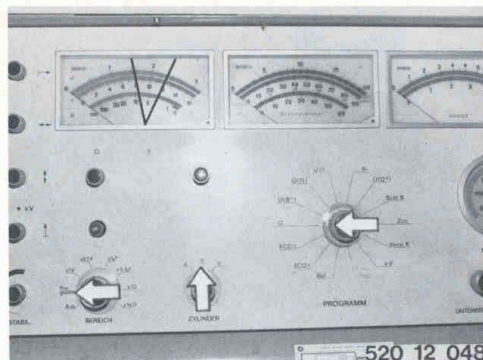
The battery must be fully charged¹⁾ before this test is made.

On cars with automatic transmission, the starter must be removed and checked on a starter test bench.

Engage a gear and hold the car with the foot brake.

Run the starter for 2–3 seconds.

Starting voltage must not drop below 8 V¹⁾.



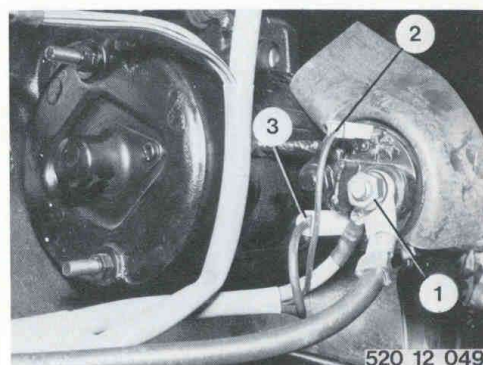
12 41 020 Starter – removing and installing

Disconnect the negative lead from the battery. Detach and attach the air cleaner – 13 71 000. Detach leads from starter.

(1) 30 to battery and alternator

(2) 50 black/yellow

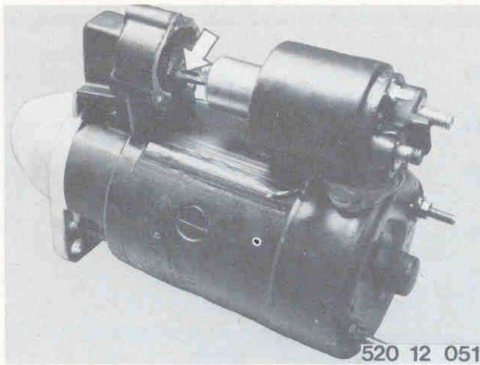
(3) 16 black/red



Remove the bolts retaining the starter and take out the starter.



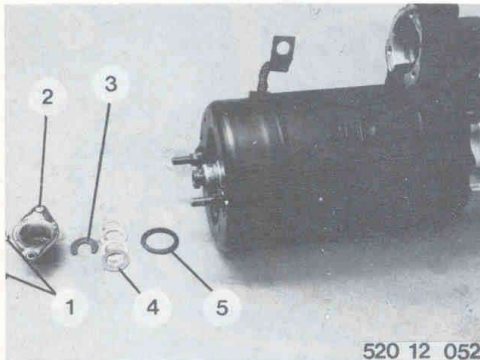
¹⁾ See test values



520 12 051

12 41 511 Solenoid switch – renewing – starter removed –

Unscrew the lead from the exciter winding.
Remove the bolts holding the solenoid switch.
Disconnect the engagement lever.

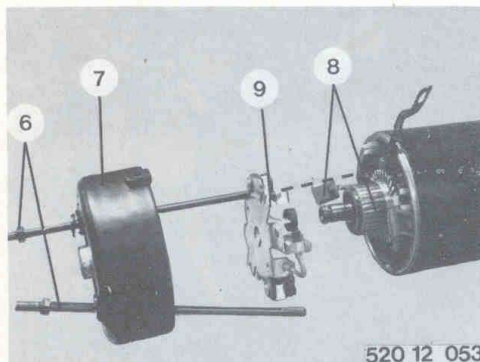


520 12 052

12 41 513 Starter – stripping and assembling

Remove the solenoid switch – 12 41 511.
Take out the retaining screws (1).
Take off the dust cap (2).
Remove the lock washer (3), shims (4) and seal (5).

When installing: use shims to adjust armature endplay to 0.10 ... 0.15 mm (0.004 ... 0.006 in) (4).

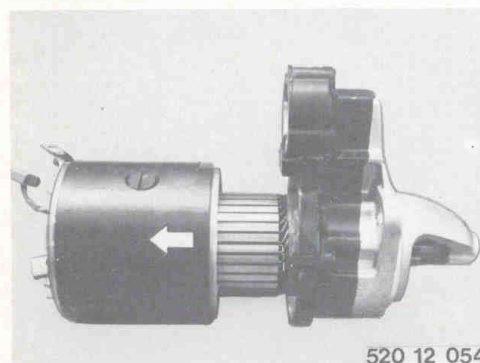


520 12 053

Remove the pole housing screws (6) and pull off cap (7).

Lift out the positive brushes (8) and detach the brush holder board (9).

When installing: note correct installed position of brush holder board (9). Pole housing screws (6) must be inserted through the locating slots in the brush holder board (9). Pass the exciter winding lead through the rubber seal. Check condition of commutator bearings.



520 12 054

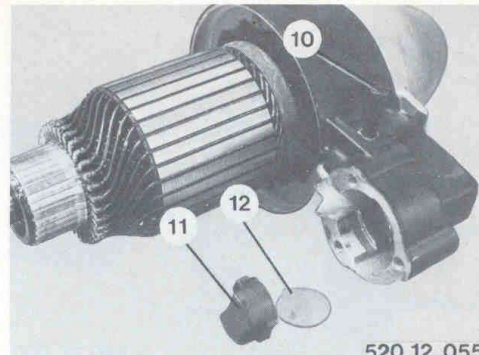
Separate the pole housing from the input side bearing.

When installing: note correct installed position of pole housing. The slot in the pole housing faces the rubber projection.

Remove pivot screw (10) for engagement lever.

Extract rubber seal (11) and washer (12).

When installing: lug on washer (12) and rubber seal (11) face towards armature.

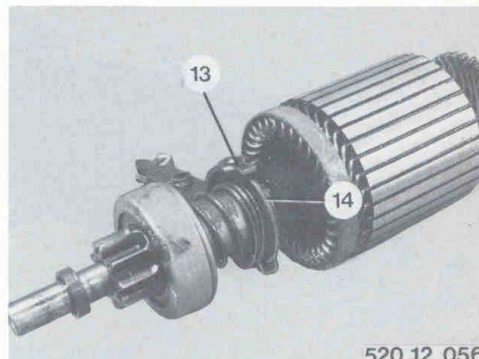


520 12 055

Pull the armature out of the input side bearing. Remove the engagement lever (13).

When installing: insert the engagement lever (13) so that the engagement ring (14) rests between the projections on the engagement lever.

Grease the engagement lever with Bosch Ft 2 v 3 silicone grease.



520 12 056

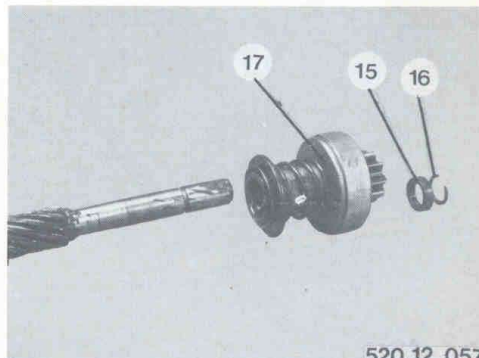
Press the thrust ring (15) back.

Lift out the circlip (16).

Pull off the starter gear (17).

When installing: apply Bosch Ft 2 v 3 silicone grease to spiral thread, engagement ring and intermediate bearing.

Pull thrust ring (15) over circlip (16).



520 12 057

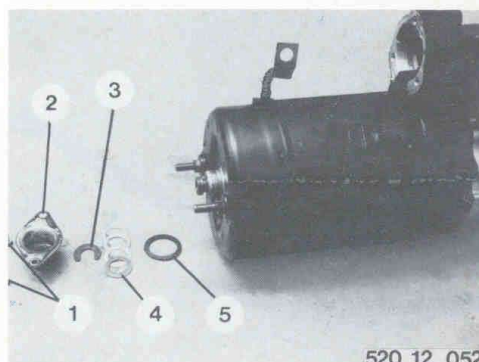
12 41 551 Carbon brushes – renewing – starter removed –

Take out the retaining screws (1).

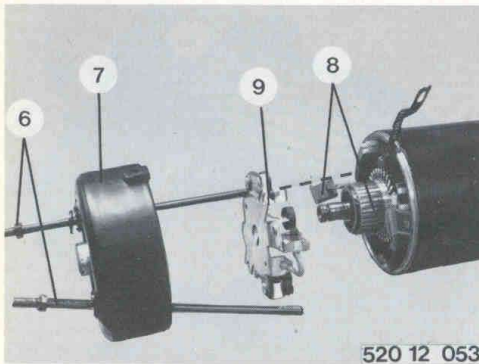
Take off the dust cap (2).

Remove the lock washer (3), shims (4) and seal (5).

When installing: adjust armature endplay with shims (4) to 0.10 ... 0.15 mm (0.004 ... 0.006 in).



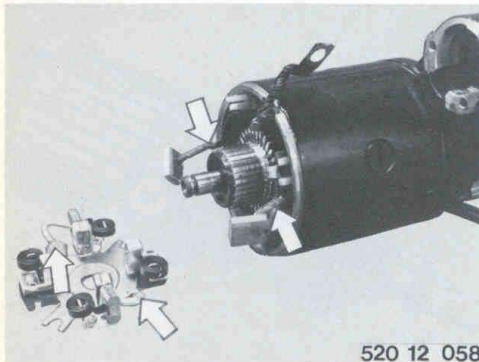
520 12 052



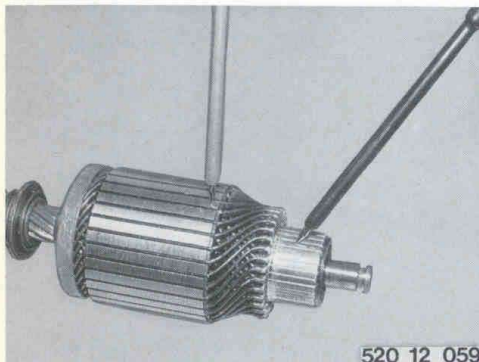
Remove the pole housing screws (6) and pull off the cap (7).

Lift out the positive brushes (8) and take off the brush holder plate (9).

When installing: note correct position of brush holder board (9). The pole housing screws (6) must be placed through the retaining slots in the brush holder board (9). Insert the exciter winding lead into the rubber seal. Check the commutator bearing.



Unsolder and resolder the carbon brushes to the exciter winding and the brush holder board.

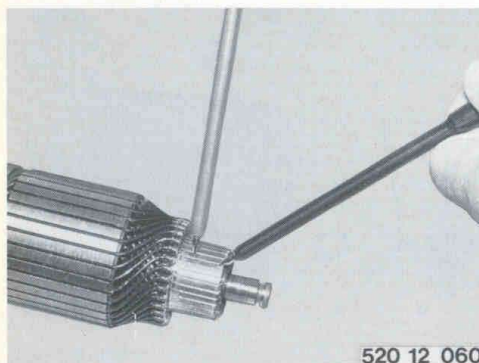


12 41 602 Starter – reconditioning – starter stripped down –

Check armature and field windings with 220 V test lamp.

Check the commutator and laminations with probes.

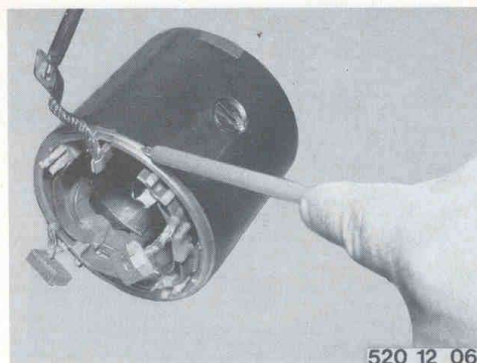
If there is a short to earth (ground), the lamp will light up. In this case, renew the armature.



Introduce an ammeter with 60 A measuring range into the current circuit, and test each lamination of the commutator in turn by touching briefly with the test probe. Test voltage 2 ... 4 V. The needle deflection on the meter should be the same between all laminations.

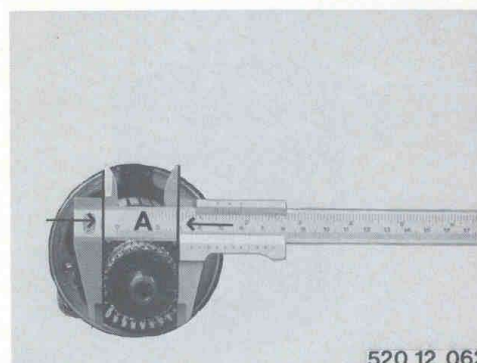
Severe fluctuations indicate an open circuit. Renew armature if an open circuit is found.

Check the exciter winding for short to earth (ground).
Carry out a visual inspection.
Renew burned or otherwise overheated windings.



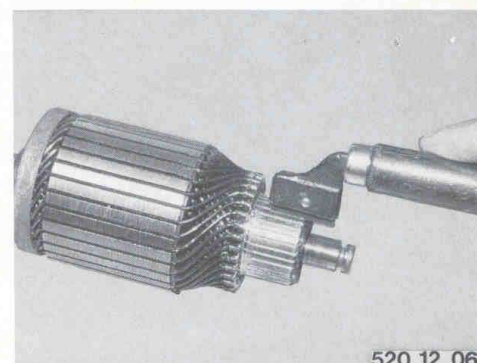
520 12 061

Skim the commutator surface to a fine finish. However, do not skim below the minimum commutator diameter (A) of 33 mm (1.3 in).



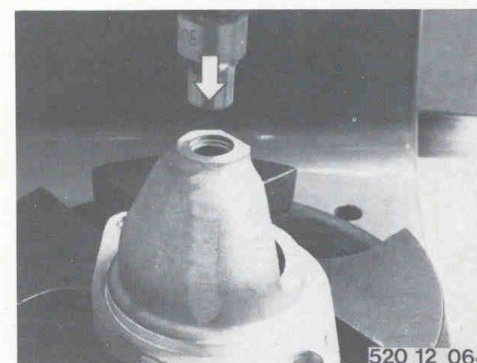
520 12 062

Cut back the insulation between the commutator plates.
The insulation should be 0.5 mm (0.02 in) below the surface of the plates.

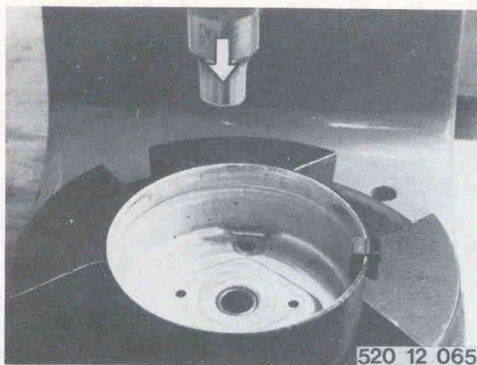


520 12 063

Press out bushing if worn.
When installing: before inserting new bushing, soak it for at least half an hour in engine oil, then press in until flush.



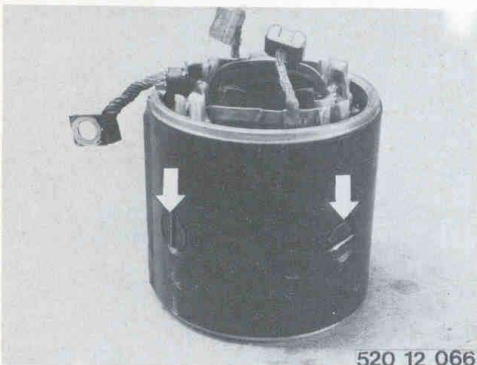
520 12 064



520 12 065

Press the bushing out of the intermediate bearing cap if worn.

When installing: soak the new bushing for at least half an hour in engine oil, then press in until flush.



520 12 066

12 41 701 Exciter winding – renewing – starter stripped down –

Mark the positions of the pole shoes so that they can be installed again in the same positions as before. Take out the four pole shoe screws and remove the pole shoes and the exciter winding from the pole housing.

When installing: before finally tightening the pole shoe screws after insertion, align the pole shoes exactly parallel with the longitudinal axis.