Electrical System

E

Contents:

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Description of Electrical System

Generator

The six-volt electrical system is operated by a generator having a nominal output of 130 watts at 2600 r.p.m. The generator output is controlled by a regulator. A generator warning light is found on the speedometer dial at the left-hand bottom.

Starting Motor

The solenoid starting motor of the overrunning-clutch type produces 0.4 HP. It is operated by the ignition key.

Battery

The six-volt battery consists of three cells and has a capacity of 70 amp. hours at a twenty-hour discharge rate. The battery is located on the right-hand side of the frame under the rear seat and is securely held in position by a metal strap. The negative terminal of the battery is grounded.

Ignition

The battery supplies the low tension current which is converted to high tension current by the ignition coil. The distributor incorporates a centrifugal spark-advance mechanism. The ignition switch is located on the right-hand side of the instrument panel. A combined steering lock and ignition switch is available for service installation.

Lighting System

The built-in headlamps incorporate filaments for the high beam, low beam, and parking light. The reflectors are horizontally and vertically adjustable. The main lighting switch is of the push-pull type and has three positions. The selection of the high or low beam is done by means of a foot-controlled switch on the left-hand side of the clutch cable. A switched-on high beam is indicated by a blue light in the upper half of the speedometer dial.

The rear lighting is done by two tail lights on the fenders and a license plate light on the rear hood. The two stop lights are combined with the tail lights in bezels on the rear fender. On the De Luxe Model, the stop light is operated by a switch at the brake master cylinder. On the Standard Model, the stop light switch is situated behind the frame head cover and is operated by the foot brake push bar.

An oil pressure switch, in connection with a green warning light in the speedometer dial indicates a faulty oil circulation.

The interior light in the left-hand roof side member above the door pillar is controlled by a tumbler switch on the left-hand side below the instrument panel. On the De Luxe Model, the interior light is automatically switched on by the door contact switches when opening the doors. Additionally, a manual switch at the interior light allows the light to be switched off with the doors open. The speedometer light goes on when placing the interior light switch to the right.

The socket at the left-hand side of the front hood lock control knob is for connecting an inspection lamp.

Electrical Accessories

The horn is operated by a sliding contact at the steering column when pressing the button in the center of the steering wheel.

The built-in direction indicators at the door hinge pillars are operated by the switch below the steering wheel. The two arrows in the speedometer dial tell the driver that one of the indicators sticks out.

The windshield wiper motor, which operates two blades, is set into motion by a push-pull type switch on the instrument panel. The windshield wipers of the De Luxe Model are self-parking.

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The fuse box for the headlamps, windshield wipers, and horn is located underneath the front hood, on the left-hand side next to the fuel tank. Another fuse box, carrying fuses for tail and stop lights, direction indicator switch, interior light, and inspection lamp socket, is found on the back of the instrument panel.

Instruments

Speedometer and mileage recorder are driven by the left-hand front wheel through a cable.

Note:

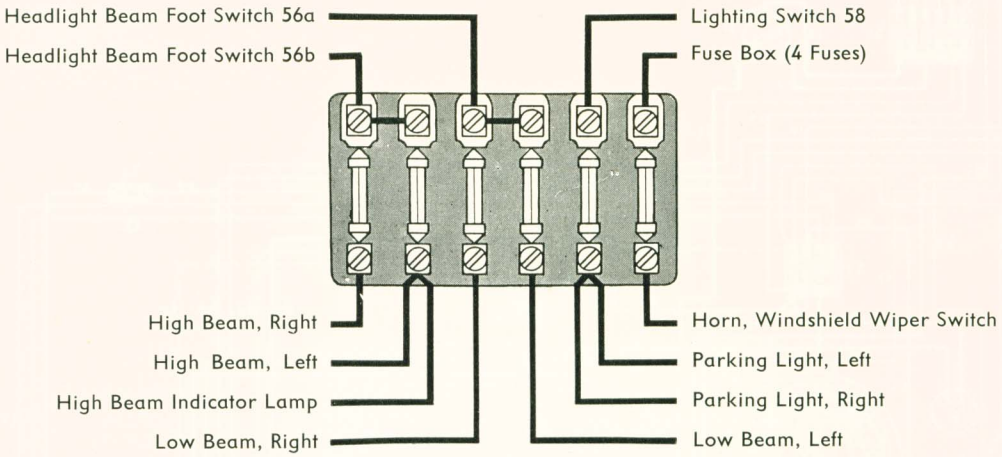
Repairs on the electrical system are generally limited to a removal of defective or worn components and a reconditioning of the wiring. To avoid excessive tension or a voltage drop, it is important to use cables of the same cross section when renewing (see key to wiring diagram).

Repairs on BOSCH parts should, if possible, be carried out by BOSCH Service Stations. The electrical system service is fully described on the following pages.

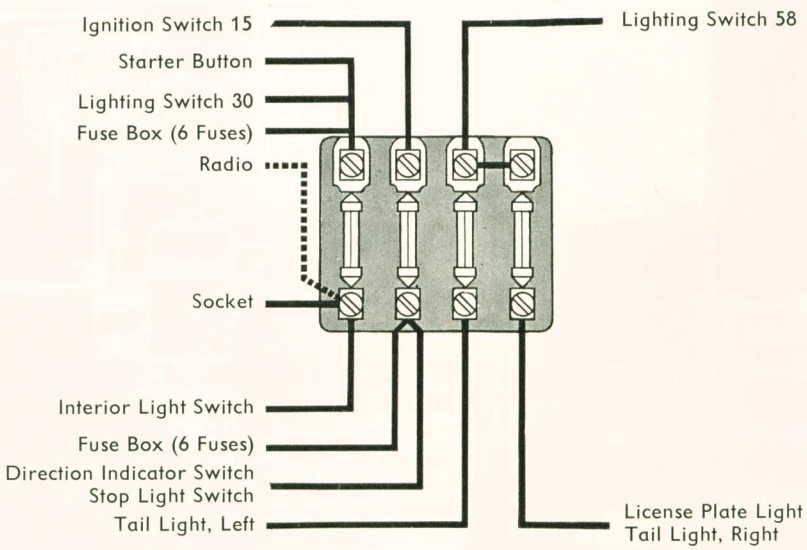
Important!

To avoid short circuits, the positive cable should be disconnected from the battery whenever an operation on the electrical system necessitates a detaching of cables.

Fuses



Fuse Box S 1 on the left side next to the fuel tank



Fuse Box S 2 on the back of the instrument panel

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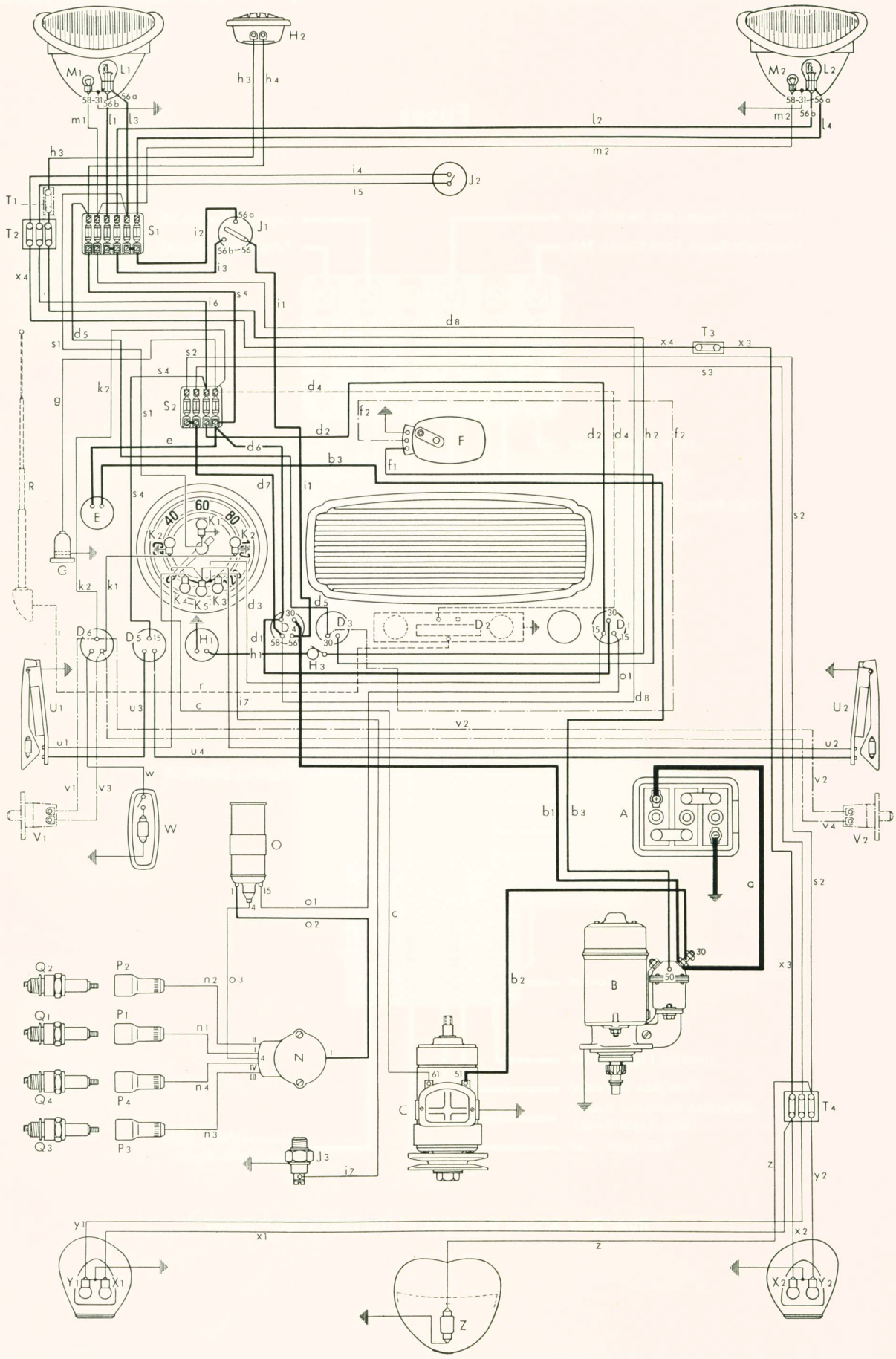
M1
L1
H2
M2
L2
58-31
56a
56b
T1
T2
S1
J1
J2
T3
S2
F
E
G
K1
K2
K3
K4
K5
H1
H3
D1
D2
D3
D4
D5
D6
U1
U2
V1
V2
W
A
B
C
N
O
P1
P2
P3
P4
Q1
Q2
Q3
Q4
J3
T4
X1
Y1
X2
Y2
Z

Key to Part Designations

A - Battery
B - Starting Motor
C - Generator
D_1 - Ignition Switch
D_2 - Radio ***
D_3 - Windshield Wiper Switch
D_4 - Lighting Switch
D_5 - Direction Indicator Switch
D_6 - Tumbler Switch (Instrument and interior lights)
E - Starter Button
F - Windshield Wiper Motor
G - Socket
H_1 - Horn Button
H_2 - Horn
H_3 - Horn Brush
J_1 - Headlight Dimmer Switch
J_2 - Stop Light Switch
J_3 - Oil Pressure Switch
K_1 - High Beam Indicator Lamp
K_2 - Instrument Light Bulbs
K_3 - Oil Pressure Warning Light
K_4 - Generator and Cooling Warning Light
K_5 - Direction Indicator Light (Two arrows)
L_1 - Two-Filament Bulb, Left
L_2 - Two-Filament Bulb, Right
M_1 - Parking Light, Left
M_2 - Parking Light, Right
N - Ignition Distributor
O - Ignition Coil
P_1 - Spark Plug Connector (Plug 1)
P_2 - Spark Plug Connector (Plug 2)
P_3 - Spark Plug Connector (Plug 3)
P_4 - Spark Plug Connector (Plug 4)
Q_1 - Spark Plug for Cylinder 1
Q_2 - Spark Plug for Cylinder 2
Q_3 - Spark Plug for Cylinder 3
Q_4 - Spark Plug for Cylinder 4
R - Radio Antenna ***
S_1 - Fuse Box (six fuses)
S_2 - Fuse Box (four fuses)
T_1 - Connector *
T_2 - Connector **
T_3 - Connector
T_4 - Connector
U_1 - Direction Indicator, Left
U_2 - Direction Indicator, Right
V_1 - Door Contact Switch, Left *
V_2 - Door Contact Switch, Right *
W - Interior Light
X_1 - Stop Light, Left
X_2 - Stop Light, Right
Y_1 - Tail Light, Left
Y_2 - Tail Light, Right
Z - License Plate Light

Key to Cable Colours

Designation	Colour	Cross Section sq. mm.	Designation	Colour	Cross Section sq. mm.	Designation	Colour	Cross Section sq. mm.
a	Black	25.0	i_2	White	2.5	s_1	Blue/White	0.5
b_1	Red	6.0	i_3	Yellow	2.5	s_2	Grey/Red	0.75
b_2	Red/Black	6.0	i_4	Black/Red	1.0	s_3	Grey/Black	0.75
b_3	Red	2.5	i_5	Black/Red	1.0	s_4	Black/White/Green	1.0
c	Blue	0.5	i_6	Black/Red	1.0	s_5	Black	1.5
d_1	Red	2.5	i_7	Blue/Green	0.5	u_1	Blue/Red	0.5
d_2	Black	1.5	k_1	Grey/Red	0.5	u_2	Blue/Red	0.5
d_3	Black	0.5	k_2	Black	0.5	u_3	Black/White	1.0
d_4	Service Installation		l_1	Yellow/Black	1.5	u_4	Black/Green	1.0
d_5	Black	1.0	l_2	Yellow	1.5	v_1	Grey/Green *	0.75
d_6	Black	1.5	l_3	White/Black	1.5	v_2	Grey/Green *	0.75
d_7	Grey/Black	2.5	l_4	White	1.5	v_3	Grey/Green *	0.75
d_8	Grey/Yellow	0.5	m_1	Grey/Black	0.5	v_4	Grey/Green *	0.75
e	Red	2.5	m_2	Grey	0.5	w	Grey/Green	0.5
f_1	Black/Lilac	1.0	n_1	Black	0.85	x_1	Black/Red	0.75
f_2	Black *	1.0	n_2	Black	0.85	x_2	Black/Red	0.75
g	Red	0.75	n_3	Black	0.85	x_3	Black/Red	1.0
h_1	Black	1.5	n_4	Black	0.85	x_4	Black/Red	1.0
h_2	Brown	1.0	o_1	Black	0.75	y_1	Grey/Black	0.75
h_3	Brown	1.0	o_2	Green	1.5	y_2	Grey	0.75
h_4	Black/Yellow	1.0	o_3	Black	0.85	z	Grey/Red	0.5
i_1	White/Black	2.5	r	Service Installation				

* = De Luxe only ** = Standard only *** = Service installation only

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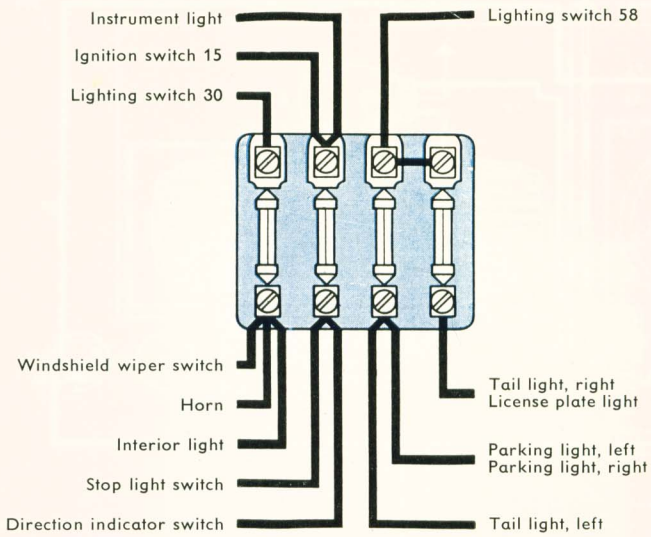
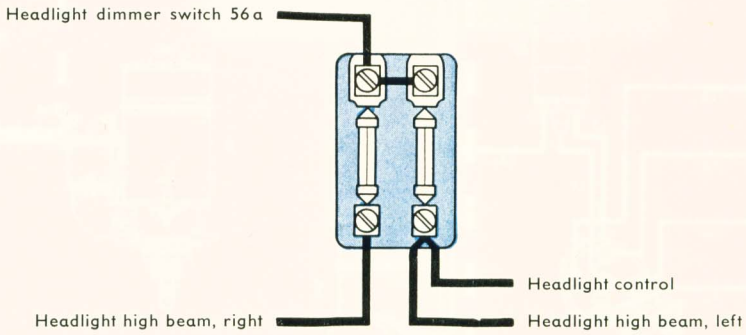
Fuses



Fuse box on the back of the instrument panel



Fuse box beside the fuel tank

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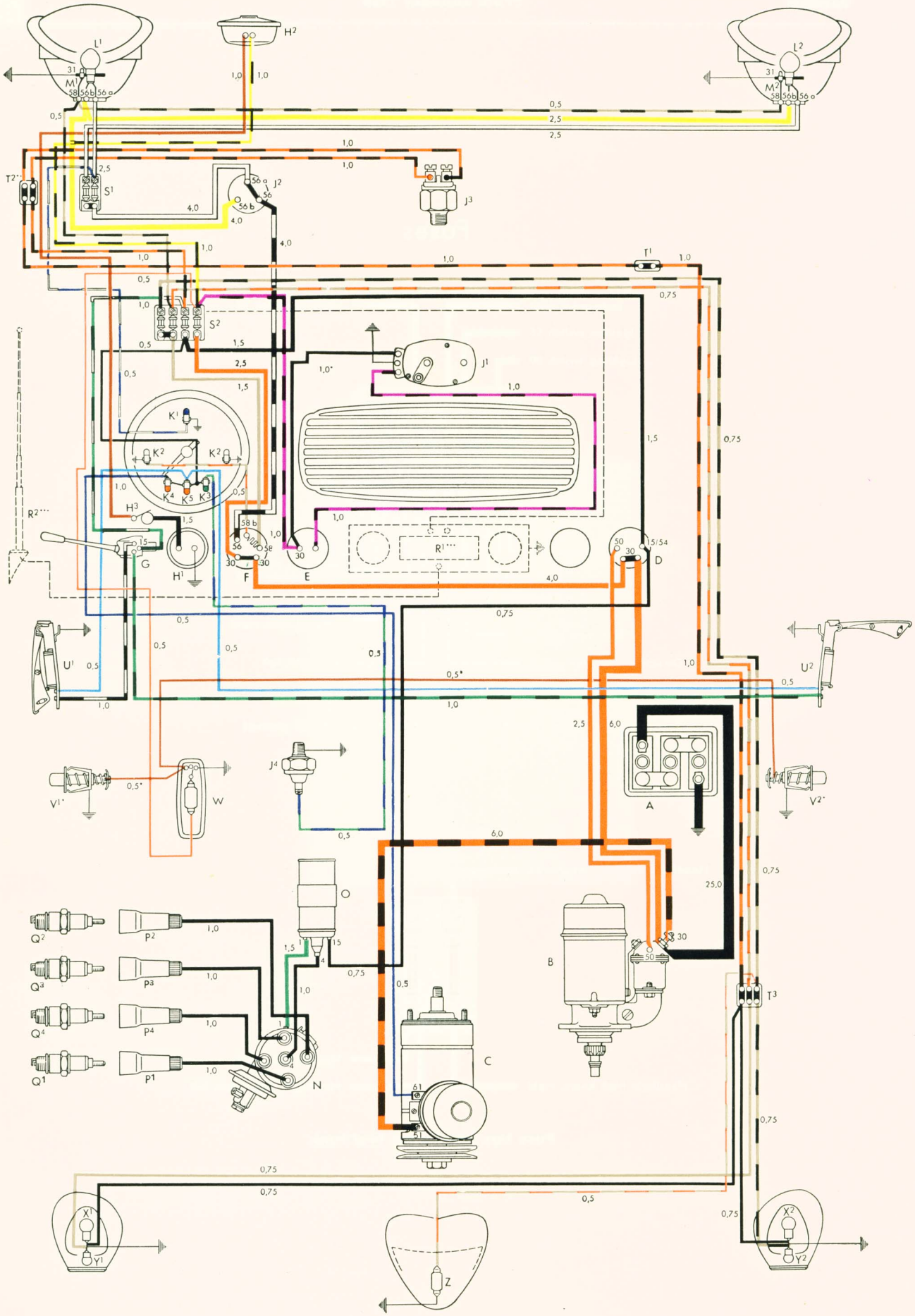
L1
L2
H2
M1
M2
S1
S2
J1
J2
J3
T1
T2
K1
K2
K3
K4
K5
H1
H3
R1
R2
G
F
E
D
U1
U2
V1
V2
W
J4
A
B
C
N
O
P1
P2
P3
P4
Q1
Q2
Q3
Q4
T3
X1
X2
Y1
Y2
Z

Key to Part Designations

A - Battery
B - Starting Motor
C - Generator
D - Ignition Switch
E - Windshield Wiper Switch
F - Lighting Switch
G - Direction Indicator Switch
H_1 - Horn Button
H_2 - Horn
H_3 - Horn Brush
I_1 - Windshield Wiper Motor
I_2 - Headlight Dimmer Switch
I_3 - Stop Light Switch
I_4 - Oil Pressure Switch
K_1 - High Beam Warning Light
K_2 - Instrument Light Bulbs
K_3 - Oil Pressure Warning Light
K_4 - Generator and Cooling Warning Light
K_5 - Direction Indicator Warning Light
L_1 - Two-Filament Bulb, left
L_2 - Two-Filament Bulb, right
M_1 - Parking Light, left
M_2 - Parking Light, right
N - Ignition Distributor
O - Ignition Coil
P_1 - Spark Plug Connector (Cylinder 1)
P_2 - Spark Plug Connector (Cylinder 2)
P_3 - Spark Plug Connector (Cylinder 3)
P_4 - Spark Plug Connector (Cylinder 4)
Q_1 - Spark Plug for Cylinder 1
Q_2 - Spark Plug for Cylinder 2
Q_3 - Spark Plug for Cylinder 3
Q_4 - Spark Plug for Cylinder 4
R_1 - Radio***)
R_2 - Radio Antenna***)
S_1 - Fuse Box beside the Fuel Tank
S_2 - Fuse Box on the Back of the Instrument Panel
T_1 - Connector
T_2 - Connector**)
T_3 - Connector
U_1 - Direction Indicator, left
U_2 - Direction Indicator, right
V_1 - Door Contact Switch, left*)
V_2 - Door Contact Switch, right*)
W - Interior Light
X_1 - Stop Light, left
X_2 - Stop Light, right
Y_1 - Tail Light, left
Y_2 - Tail Light, right
Z - License Plate Light

*) De Luxe only **) Standard only ***) Service Installation only

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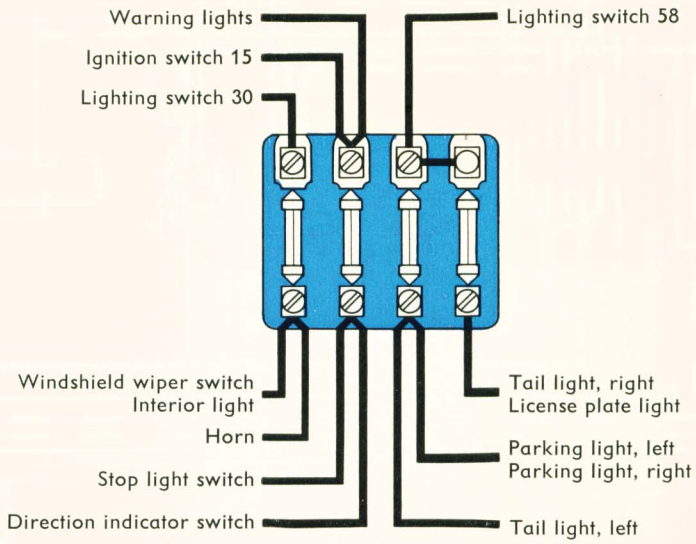
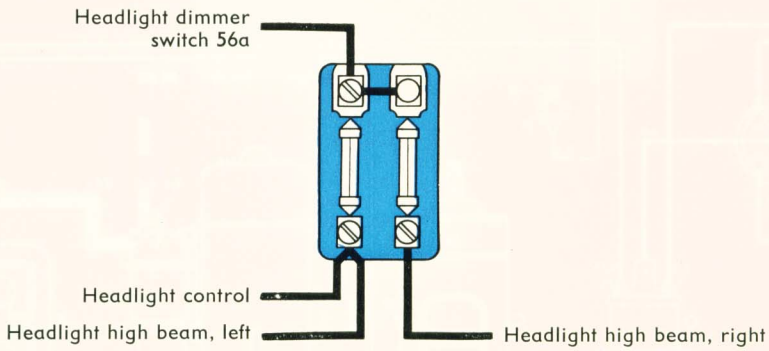
Fuses



Fuse box on the back of the instrument panel



Fuse box adjacent to the fuel tank

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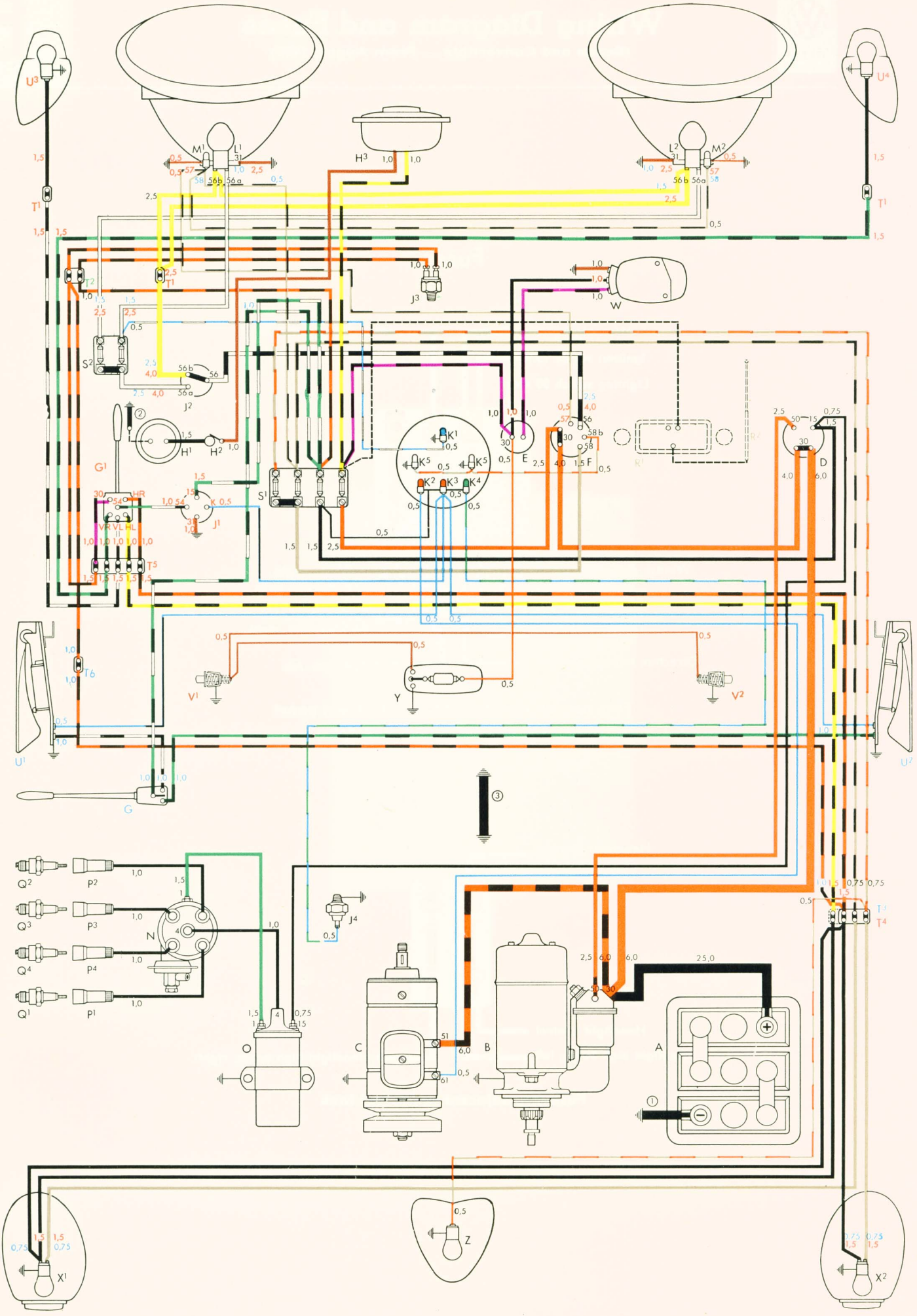
U3
U4
M1
L1
H3
L2
M2
T1
T2
J3
W
S2
J2
H1
H2
G1
S1
K1
K5
K2
K3
K4
E
F
D
J1
T5
T6
V1
Y
V2
U1
U2
G
Q2
P2
Q3
P3
Q4
P4
Q1
P1
N
J4
O
C
B
A
T3
T4
X1
Z
X2

Key to Colour Marking in Wiring Diagram Type 1

A - Battery
B - Starting Motor
C - Generator
D - Ignition/Starting Switch
E - Windshield Wiper Switch
F - Lighting Switch with Rheostat Control for Instrument Lighting
G - Direction Indicator Switch (semaphore)
G^1 - Direction Indicator Switch (flashing)
H^1 - Horn Button
H^2 - Horn Brush
H^3 - Horn
J^1 - Flasher Unit
J^2 - Headlight Dimmer Switch
J^3 - Stop Light Switch
J^4 - Oil Pressure Switch
K^1 - High Beam Warning Light
K^2 - Generator and Cooling Warning Light
K^3 - Direction Indicator Warning Light
K^4 - Oil Pressure Warning Light
K^5 - Instrument Light Bulbs
L^1 - Two-Filament Bulb, left
L^2 - Two-Filament Bulb, right
M^1 - Parking Light, left
M^2 - Parking Light, right
N - Ignition Distributor
O - Ignition Coil
P^1 - Spark Plug Connector (Cylinder 1)
P^2 - Spark Plug Connector (Cylinder 2)
P^3 - Spark Plug Connector (Cylinder 3)
P^4 - Spark Plug Connector (Cylinder 4)
Q^1 - Spark Plug for Cylinder 1
Q^2 - Spark Plug for Cylinder 2
Q^3 - Spark Plug for Cylinder 3
Q^4 - Spark Plug for Cylinder 4
R^1 - Radio
R^2 - Radio Antenna
S^1 - Fuse Box on the Back of the Instrument Panel
S^2 - Fuse Box adjacent to the Fuel Tank
T^1 - Connector
T^2 - Connector
T^3 - Connector
T^4 - Connector
T^5 - Connector
T^6 - Connector
U^1 - Direction Indicator (semaphore), left
U^2 - Direction Indicator (semaphore), right
U^3 - Direction Indicator (flashing), left
U^4 - Direction Indicator (flashing), right
V^1 - Door Contact Switch, left
V^2 - Door Contact Switch, right
W - Windshield Wiper Motor
X^1 - Stop and Tail Light, left
X^2 - Stop and Tail Light, right
Y - Interior Light
Z - License Plate Light

(1) - Battery Ground Strap
(2) - Steering Column Flange Ground Strap
(3) - Ground Strap between Transmission and Frame

Black = All Models
Blue = Standard and De Luxe
Green = Standard
Brown = De Luxe
Red = Special Equipment Required in Some Countries
Grey = Service Installation

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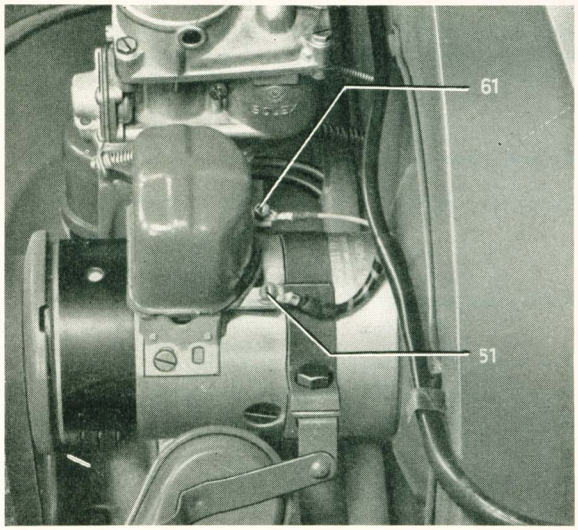
General Description

Make: BOSCH RED 130/6 2600 AL 16

The output of the generator is controlled by the regulator BOSCH RS/G 130/6/11. The output of 130 watts at 2600 r.p.m. corresponds to 1300 r.p.m. of the crankshaft (43 km/h. = 27 m.p.h.) in top gear. The generator is attached to its support by means of a strap. The armature is supported by a single-thrust ball bearing on either side. The armature shaft carries an adjustable pulley on the commutator side and the fan on the opposite side.

The generator regulator consists of two independent units encased in a sealed, moisture-proof and dirt-proof box mounted on the generator. The function of the cutout relay or circuit breaker is to close the circuit between the generator and the battery when the generator is producing current and to open this circuit so that the battery cannot discharge back through the generator when the generator slows or stops. The current limiting regulator and voltage regulator are designed to prevent the output and voltage of the generator from exceeding the predetermined safe maximum. It is important only to use a regulator which corresponds to the nominal output of the generator. A regulator designed to suit a higher output would lead to overcharging, while a regulator for a lower output would cause the generator to produce insufficient current for the electric circuit.

Connections:
Terminal 51 to terminal 30 at the starting motor.
Terminal 61 to generator warning lamp.

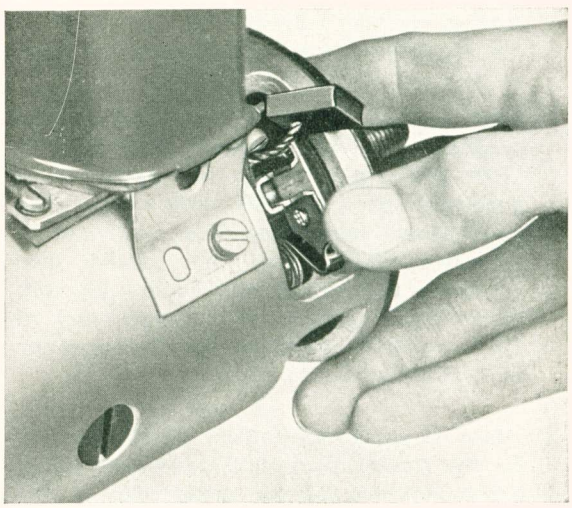


Note:

From Chassis No. 1 - 0 541 307 a new generator with an output of 160 watts at 2600 r.p.m. is being used. This generator may also be installed on earlier vehicles.

Inspections and Maintenance

The ball bearings of the generator are packed with BOSCH High Melting Point Grease and require no attention under normal conditions. Lubrication is, in general, only carried out when the engine is undergoing an overhaul. Never use ordinary grease! The brush gear should be inspected approx. every 10.000 km (6.000 miles). Worn brushes should be replaced (BOSCH DSK 2/38 z). The regulator requires no maintenance attention.



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Generator Warning Lamp

General Description

A red lamp is connected to a cable between terminals 51 and 61 of the regulator to provide an indication when the ignition is switched on. This lamp lights up when the engine is stationary or running slowly and goes out when the generator commences to charge.

The lamp also provides a control over the fan belt and the cooling fan. If the belt breaks, the generator and fan cease to revolve and the lamp lights up.

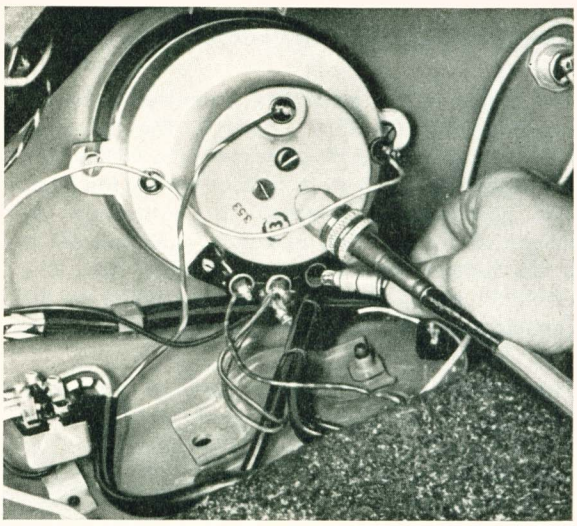
Lamp Type:

Indicator lamp J 6 V 1.2 W DIN 72 601

Bulb replacement

The lamp is accessible by opening the front hood and removing the instrument panel protection lining from the speedometer.

1 - Remove socket and bulb from the speedometer.



2 - Slightly press bulb into its socket, turn it to the left and pull it out.

3 - Install new bulb in reverse order.

Testing Generator and Regulator

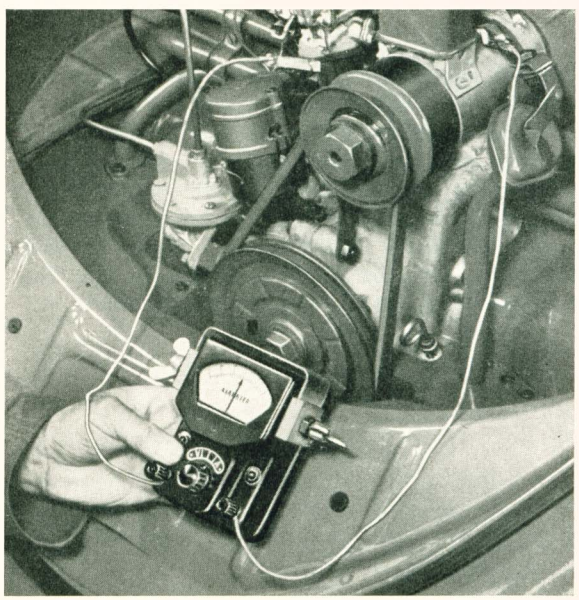
The fact that the generator warning lamp goes out after starting and when the engine picks up speed is not in itself a definite indication of a proper regulator setting and adequate charging of the battery. A test of the generator can first be carried out with the generator in the car. A good electric current and voltage testing instrument or a moving coil-type voltmeter (calibrated 0—30 volts) and a moving coil-type ammeter (calibrated 30—0—30 amperes) are required.

Testing Regulator Voltage

1 - Disconnect cable from terminal 51 at the regulator. Connect the positive lead of a moving coil-type voltmeter to terminal 51 at the regulator and ground the negative lead.

2 - Start engine. Increase the engine speed gradually from idle (approx. 500 r.p.m.) to 1750—2000 r.p.m., which corresponds to a generator speed of 3500—4000 r.p.m. The hand should jump from 0 to 6—7 volts at increased idling speed and should then constantly register between 7.3 and 8.6 volts (correct: 8.1 volts at room temperature of 20° C = 68° F), provided that the regulator is correctly set.

3 - When stopping the engine, watch carefully for the flicking back of the voltmeter hand, which indicates that the cutout relay is correctly operating.



Testing Charging Current

It may happen that the battery is not properly charged even when the regulator is correctly set. To check the charging current proceed as follows:

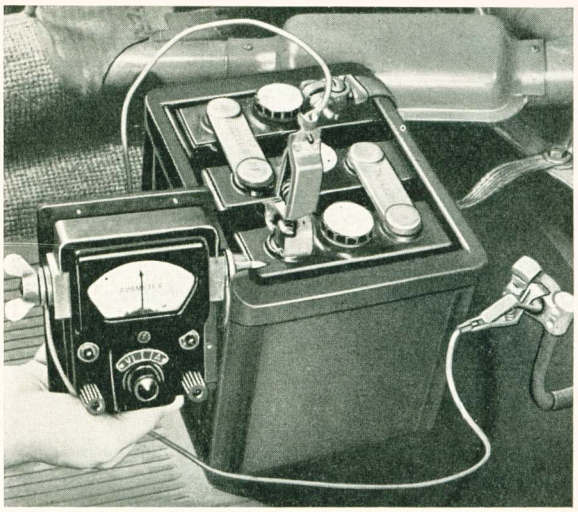
1 - Disconnect positive cable from battery and connect ammeter between cable and positive terminal at battery. If no electrical units are switched on, the ammeter hand must remain in zero position. The system is otherwise at fault.

2 - Switch on ignition or any light:

The hand must move to one side, indicating the supply of current in amperes.

3 - Start engine:

The hand must move to the opposite side as the speed increases. The charging circuit is otherwise not closed.



The indicated value of the charging current does not give evidence whether or not the regulator is correctly set, as the amount of the charging current depends on the state of charge of the battery.

Testing Current Regulator

To check the current regulator independently of the state of charge of the battery you require:

a - a moving coil-type voltmeter calibrated 0—30 volts,

b - a moving coil-type ammeter calibrated 30—0—30 amperes,

c - a fixed resistance of 0.276 ohms, suitable for a load of 25 amperes.

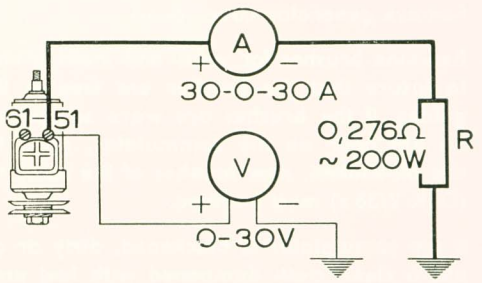
The check can be carried out with the generator in position on the vehicle or on the test bench.

1 - Disconnect cable from terminal 51 at the regulator.

2 - Connect the resistance in series with the ammeter between terminal 51 at the regulator and ground.

3 - Connect positive lead of voltmeter to terminal 51 at the regulator and ground the negative lead.

4 - Start engine. With the generator running at a speed of 3500—4000 r.p.m., the load should be approx. within 23—26.5 amperes at a voltage between 6.4—7.3 volts.



If the readings are not within these limits, the regulator should be replaced. Re-setting or repairing the regulator is in all cases up to a special workshop which is equipped with the testing appliances required. Any interference with the regulator system, as a cleaning or remachining of the contact points, may completely alter the electrical adjustments, causing great damage to the electrical system.

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Removing and Installing Regulator

Removal

1 - Disconnect cables from terminals 51 and 61 at the regulator.

2 - Remove the slotted screws that attach the regulator to the generator and take off regulator.

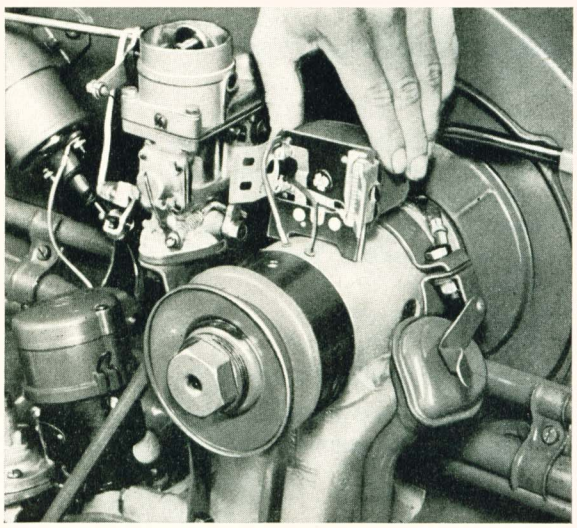
3 - Disconnect the two cables from the terminals marked "+" and "F" at the bottom of the regulator.

Installation

This is a reversal of the above procedure, but the following points should be heeded:

1 - The thicker cable comes from the positive brush and must be connected to the terminal "+" at the bottom of the regulator.

2 - The thinner cable comes from the field coils and must be connected to the terminal "F" at the bottom of the regulator.



If, after replacement of the regulator, the readings are still not within the limits mentioned under "Testing Current Regulator", the generator is faulty.

Checking Brushes and Commutator

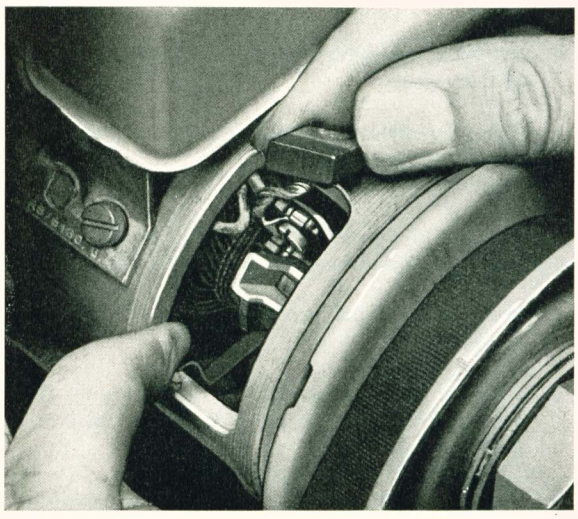
1 - Remove generator cover band.

2 - Examine brushes for wear and make a check to insure that the brushes are free in their guides. If the brushes are worn so that they do not bear on the commutator, or if they are oil-soaked, new brushes of the same type (DSK 2/38 z) must be fitted.

3 - If the commutator is blackened, dirty or oily, use a clean cloth dampened with fuel and a piece of wood. Make sure that no dirt enters the ball bearing.

4 - Check brush spring tension. Renew weak springs.

5 - If the commutator is worn, rough or burned, the generator should be disassembled for overhaul.



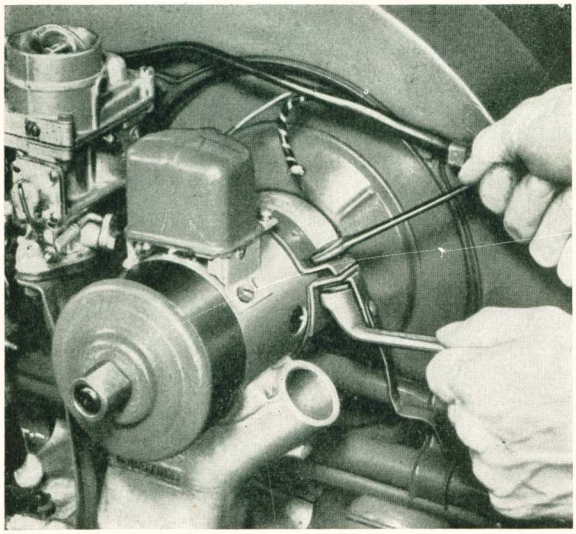
Removing and Installing Generator

Removal

1 - Disconnect cables from regulator.

2 - Take off fan belt.

3 - Release generator mounting strap.



4 - Remove throttle ring and the screws on both sides of the fan housing and slightly lift up the fan housing.

5 - Remove ignition cables and projecting tube.

6 - Remove four screws on fan cover and take off generator.

Installation

This is a reversal of the operations described above, but attention should be paid to the points below:

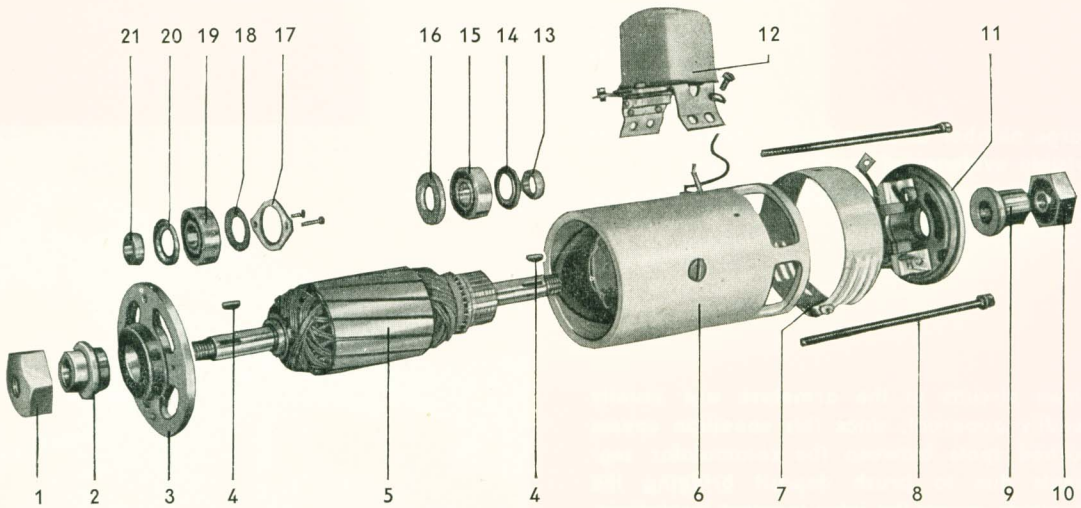
1 - Make sure that the paper gasket is on the generator support.

2 - Note concentric positions of throttle ring with air intake flange.

3 - Connect red cable to terminal 51 at the regulator.

4 - Connect blue cable to terminal 61 at the regulator.

Disassembly and Assembly of Generator



1 - Fan Nut
2 - Fan Hub
3 - End Plate
4 - Woodruff Key
5 - Armature
6 - Frame and Field Assembly
7 - Cover Band
8 - Through Bolt and Lockwasher
9 - Pulley Hub
10 - Pulley Nut
11 - Brush Holder End Plate
12 - Regulator
13 - Spacer
14 - Seal
15 - Ball Bearing
16 - Spacer Washer
17 - Bearing Retainer and Screws
18 - Washer
19 - Ball Bearing
20 - Seal
21 - Spacer

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Disassembly

1 - Remove regulator.

2 - Remove pulley and fan.

3 - Disconnect field coil terminal from brush holder of the positive brush.

4 - Remove both generator through bolts.

5 - Disassemble generator frame and withdraw armature.

6 - Pull off ball bearings.

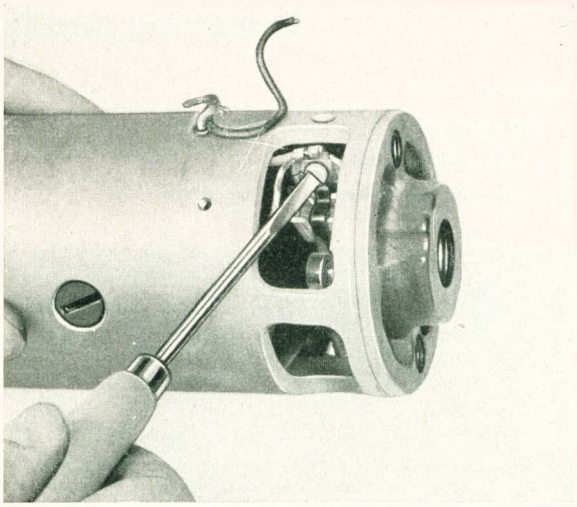
After disassembly, thoroughly wash the components in fuel and dry them with compressed air.

Assembly

This is a reversal of the preceding operations, but the following points should be observed:

1 - Inspect armature, field coils, cable connections and brushes.

2 - Examine ball bearings for wear and damage. Renew if necessary. Thoroughly rinse the bearings in fuel and fill them with BOSCH High Melting Point Grease.

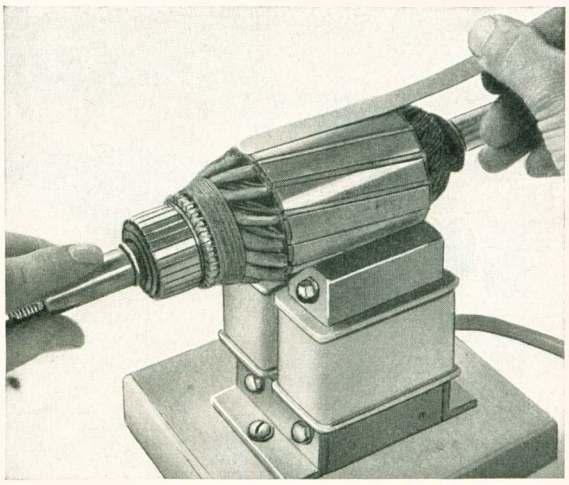


3 - Note ball bearing axial play: Too low a play may damage the bearings while too large a play may cause the armature to foul the field coils.

4 - See that cables are correctly connected to brush holder and regulator.

Testing Armature

In a large number of cases the armature does not give visible evidence of trouble. The armature is tested for open circuits, short circuits and ground.

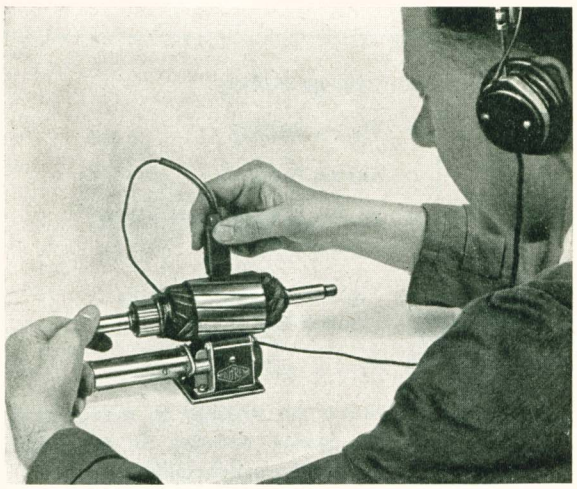


Test

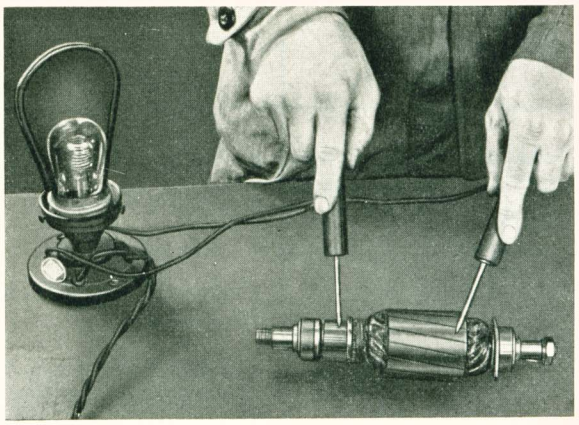
1 - Open circuits in the armature are usually readily apparent, since this condition causes burned spots between the commutator segments due to brush deposit bridging the segments across the inter-segment insulations. Open circuits can also be determined by a sensitive growler, which is, however scarcely available in workshops.

2 - A shorted winding can only be tested by means of a growler. Place the armature on the growler, turn the armature slowly and hold a thin steel strip or hacksaw blade over, is as shown in the illustration. Short circuits in the armature cause the steel strip or hacksaw blade to vibrate against the core when it is held above the slot containing the shorted winding.

With another type growler the armature is turned, while the mechanic moves a feeler along the armature core. A short circuit in the windings is indicated by a growling noise in the receivers due to alternating current generated in the coil of the feeler by induction.



3 - The armature is grounded when the armature core contacts the windings or when carbon dust has entered the windings.



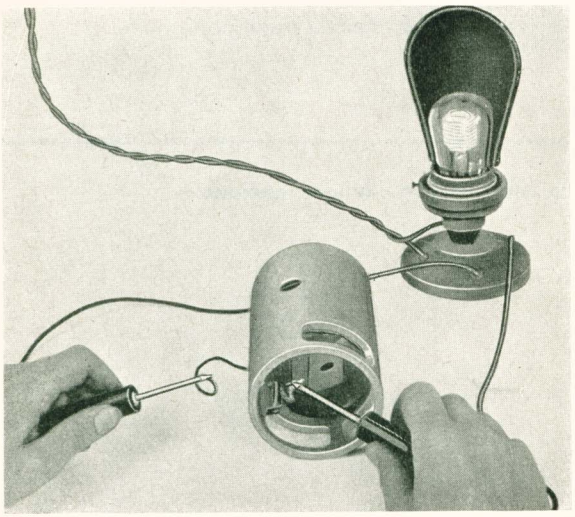
A test is carried out with a test lamp for a line voltage of 220 volts with test points held on commutator and armature core.

Testing Field Coils

The two field coils are tested for open circuits, short circuits and ground.

Test

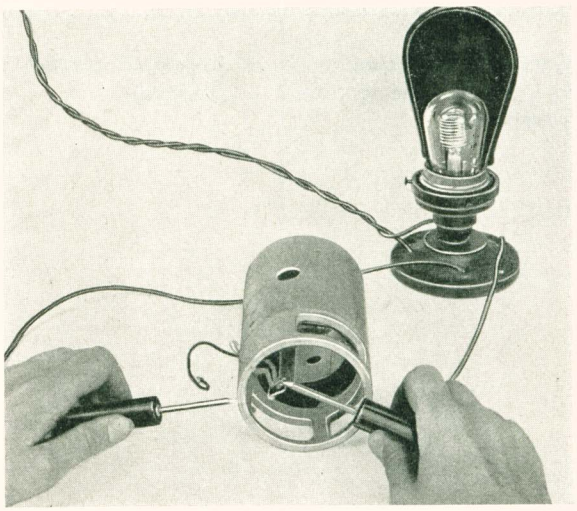
1 - Test each field coil individually for open circuits by connecting their ends with a 220-volt test lamp or a battery in series with a 6-volt test lamp.



2 - Short circuit in the field windings can be checked by connecting an ohmmeter to the ends of each coil and comparing the readings.

Should such an instrument not be available, connect a 6-volt battery in series with an ammeter to the coil ends and compare the current draw of the two coils. If the current draw of one coil is higher (difference more than 0.5 amperes), there is a short circuit in the windings.

3 - Test the field coils for ground by connecting a 220-volt test lamp with the end of one field coil and the frame.



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Generator Trouble Checking

The red generator lamp lights up when the ignition is switched on and should go out when the engine has been started and the speed increases.

Symptom	Cause	Remedy
Generator lamp does not light with ignition switched on	a - Battery discharged	a - Charge battery
	b - Battery defective	b - Renew battery
	c - Bulb burned out	c - Renew bulb
	d - Corroded or loose battery terminals	d - Clean or tighten terminals respectively
	e - Loose connections or broken cables	e - Tighten or repair cables respectively
	f - Ignition switch defective	f - Renew ignition switch
	g - Generator brushes do not make contact with commutator	g - Make the brushes to move freely or renew brushes. If necessary, renew the brush springs
Generator lamp does not go out or flares up when engine is accelerated	a - Drive belt loose or faulty	a - Adjust belt tension or renew belt
	b - Regulator faulty	b - Renew regulator
	c - Charging cables loose or disrupted	c - Check cables and connections
	d - Generator faulty	d - Check generator
Generator lamp goes out only at high speed	a - Generator faulty	a - Check generator
	b - Regulator faulty	b - Renew regulator
Generator lamp continues to light with the ignition switched off	a - Regulator contact points sticking (burned)	a - Renew regulator

General Description

Type: BOSCH EED 0.4/6 L/4

The Volkswagen engine is started by a solenoid starting motor of the overrunning-clutch type, producing 0.4 HP. The starting motor draws a heavy current to turn a stiff engine. The drive end of the armature shaft is supported in a bush which is recessed in the transmission case. The starting motor is operated by the ignition key, which causes the solenoid starter switch to shift the pinion (9 teeth) into mesh with the flywheel ring gear (109 teeth). When the solenoid switch closes by the magnetic field, a complete circuit is formed to crank the engine. As soon as the engine fires, the magnetic switch no longer draws current when releasing the ignition key, and the pinion is returned by spring tension. If the starting motor is not immediately switched out when the engine is tarted, the overrunning clutch prevents the armature from being turned and protects the parts against damage.

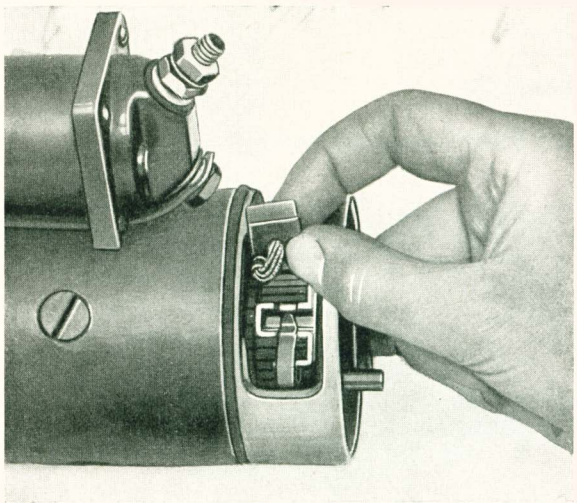
Note:

From Chassis No. 1 320 559 a new starting motor designated EED 0.5/6 L 4 is used in current production. The new starting motor is equipped with four brushes on the commutator instead of two and has 0.5 hp. The dimensions have remained unchanged. The new starting motor develops a higher cranking speed and is thus more efficient especially in severe frost.

Maintenance

The armature bearings must only be lubricated when overhauling the starting motor. When removing the enginge, the armature bush should be inspected for wear (VW Gauge 246) and renewed if badly worn. The bush is to be filled with Special Grease VW A 051 prior to re-fitting the starting motor.

Every 10.000 km (6.000 miles) take off starting motor end cap, inspect brushes for wear and make sure that they slide freely in their guides. Renew worn brushes and weak brush springs. The commutator must not be oily or gummed. If the commutator is rough and pitted, or shows burned spots, the starting motor must be overhauled. In some cases the commutator can be cleaned by means of a clean cloth dampened with fuel and wrapped around a piece of wood.



Removing and Installing Starting Motor

Removal

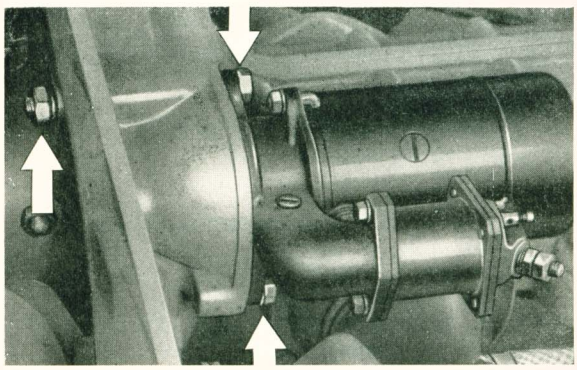
1 - Disconnect positive battery cable at battery.

2 - Disconnect battery switch at terminal 30 of the starting motor.

3 - Disconnect control cable (to starting button) at terminal 50 of the starting motor.

4 - Remove bolt and nuts that attach starting motor to transmission case.

5 - Withdraw starting motor.



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Installation

This is a reversal of the preceding operations, but the following points should be noted:

1 - Lubricate starter shaft bush with Special Grease VW - A 051.

2 - Apply VW Sealing Compound D 1 a between intermediate bracket and transmission case.

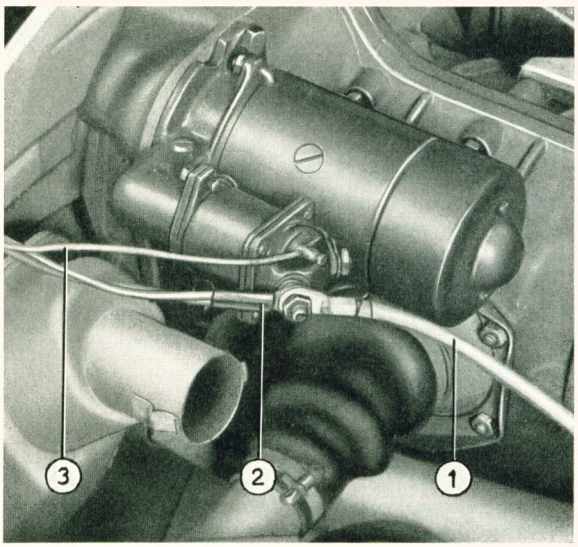
3 - Make sure that the terminals are clean and not loosely connected.

Connections:

1 - Battery (positive terminal).

2 - Terminal 51 at generator and terminal 30 at lighting switch.

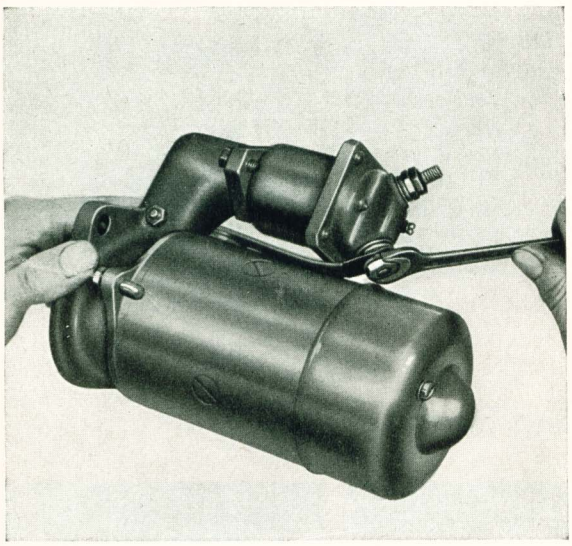
3 - Ignition switch.



Removing and Installing Solenoid Switch

Removal

1 - Release connector from solenoid switch.



2 - Remove screws that attach solenoid switch to intermediate bracket.

3 - Slightly withdraw pinion and remove solenoid switch.

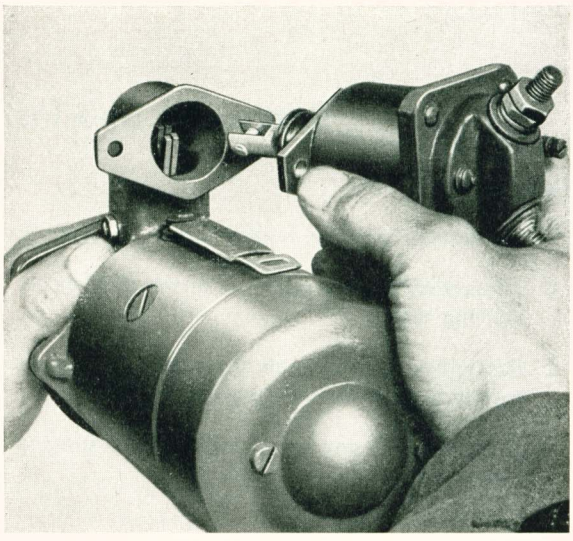
Defective solenoid switches must be replaced. Never alter the setting of the switch.

Installation

This is a reversal of the removal procedure, but attention should be paid to the following points:

1 - The contacts of the solenoid switch may have become twisted by using too much force when tightening nuts. This occasionally leads to damage of the insulation. Test them for ground with a 220-volt test lamp.

2 - To facilitate connecting solenoid switch with shift lever, slightly pull out starter drive pinion.



Inspecting Brushes and Commutator

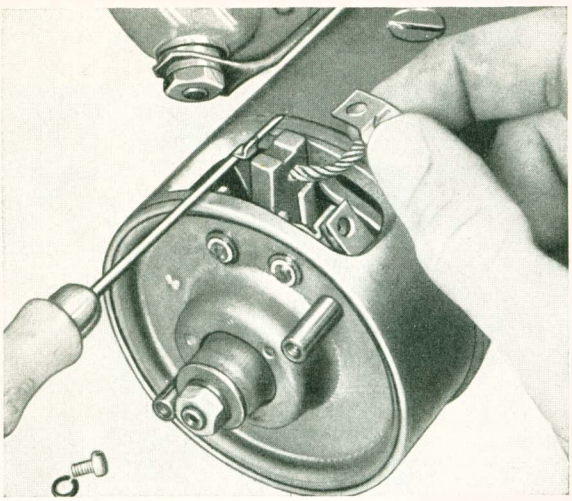
1 - Remove starting motor end cap.

2 - Inspect brushes for wear and make sure that they slide freely in the guide of the brush holders. If the brushes are worn so that they will not bear on the commutator, or if the flexible connector is exposed on the running face, they must be replaced by new ones of the same type. Also replace brushes which are oil-saturated or have loose flexible connectors. When replacing brushes, see that the flexible connector is free to avoid sticking of the brushes during operation.

3 - Test tension of brush springs. Fit a new spring if the tension is low.

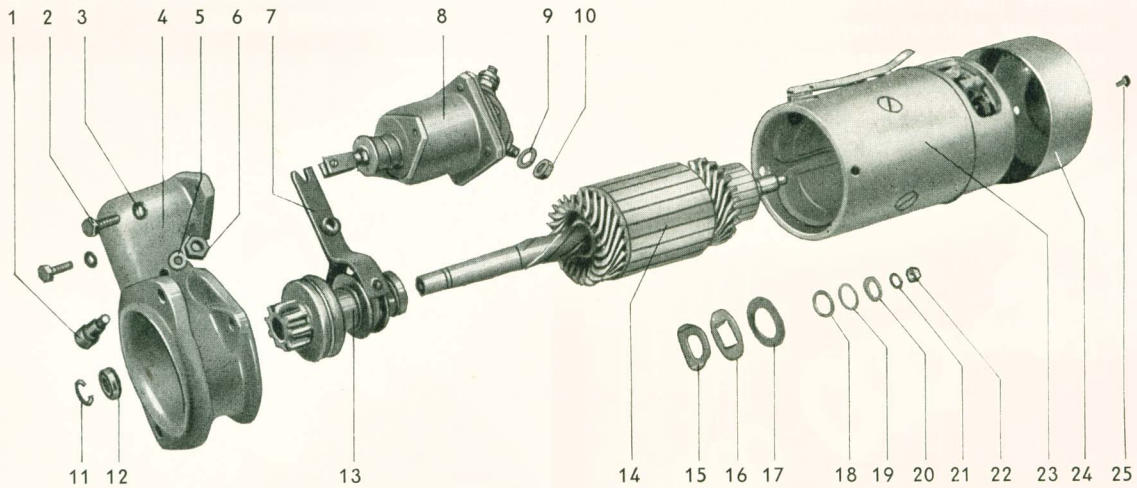
4 - If the commutator is oily or gummed, clean with a cloth dampened with fuel and wrapped around a piece of wood.

Take care that no dirt or fuel enters the bearing.



5 - If the commutator surface is rough and pitted, or shows burned spots, the starting motor should be overhauled.

Disassembling and Assembling Starting Motor



1 - Shift Lever Pivot Screw
2 - Bolt
3 - Washer
4 - Intermediate Bracket
5 - Washer
6 - Nut
7 - Shift Lever
8 - Solenoid Switch
9 - Lockwasher
10 - Nut
11 - Circlip
12 - Pinion Stop Ring
13 - Drive Pinion Assy
14 - Armature
15 - Lockwasher
16 - Retainer Plate
17 - Thrust Washer
18 - Fiber Washer
19 - End Play Washer
20 - Cone Washer
21 - Lockwasher
22 - Nut
23 - Frame and Field Assy
24 - End Cap
25 - Slotted Screw

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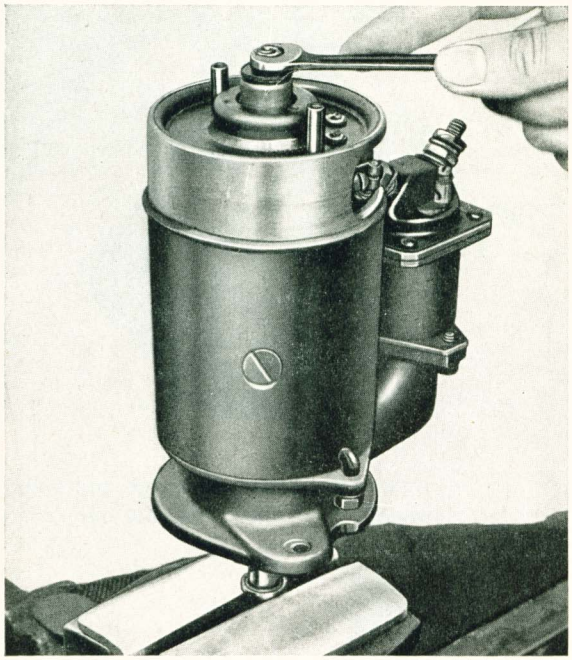
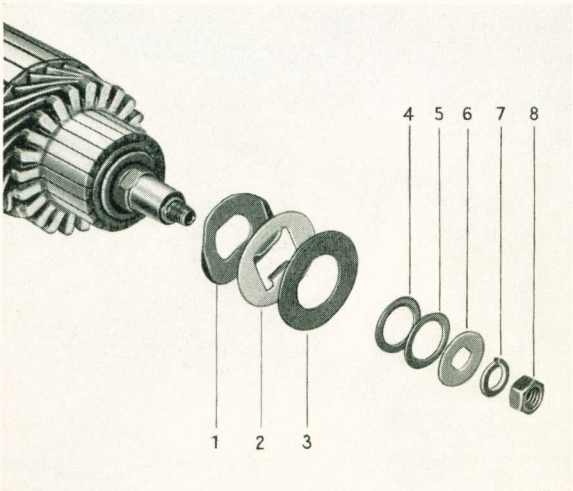
Disassembly

1 - Detach connector from solenoid switch. Remove end cap and lift up brushes.

2 - Clamp armature shaft at the drive pinion in a vise (use soft jaws) and remove nut at the commutator end of the starting motor.



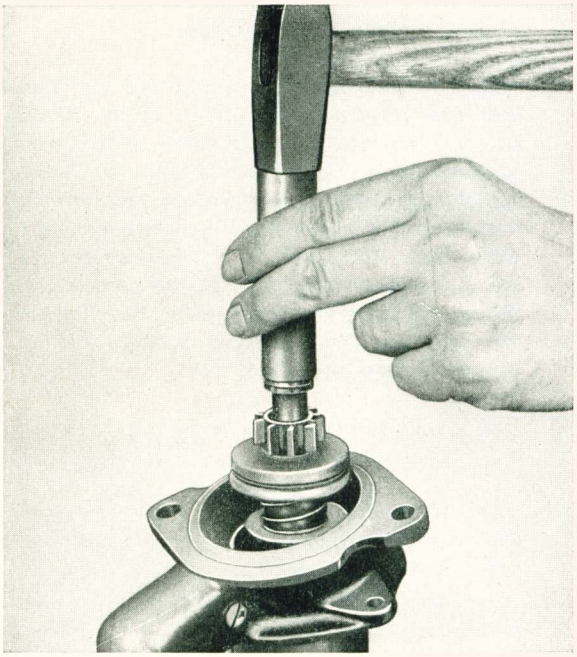
3 - Remove nuts of intermediate bracket hook studs and pull out intermediate bracket with armature. Note arrangement of washers for proper reassembly.



1 - Lockwasher
2 - Retainer Plate
3 - Thrust Washer
} Inside

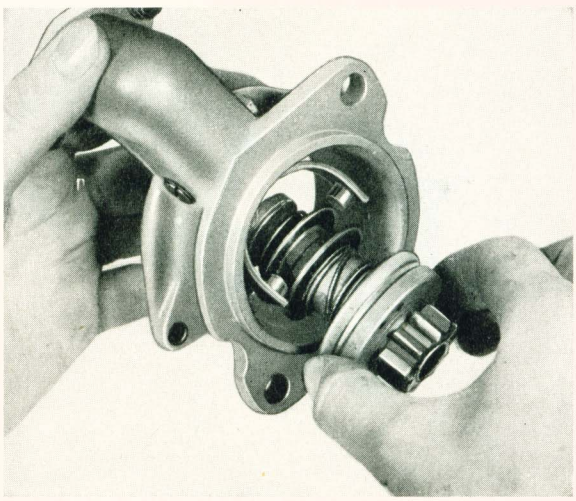
4 - Fiber Washer
5 - End Play Washer
6 - Cone Washer
7 - Lockwasher
8 - Nut
} Outside

4 - Place armature in a vise with the commutator end pointing downwards and drive back pinion stop ring by means of a hollow punch.



5 - Remove circlip and pull off stop ring. Remove burr which might have developed at circlip groove.

6 - Withdraw armature from intermediate bracket and remove drive pinion.



Assembly

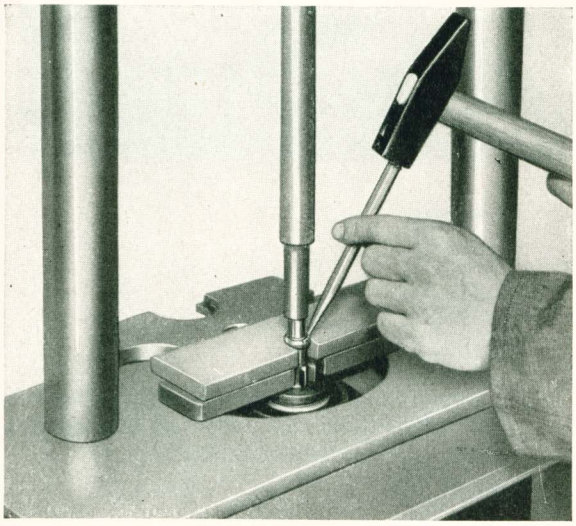
The components are washed in fuel and then dried with compressed air. The compo-bushing of the commutator bearing is only cleaned as far as it is accessible. The drive pinion must only be washed in fuel when it has become oily by leaks and when it is not easily engaging during cold weather. If necessary, renew crankshaft oil seal or main drive shaft oil seal.

When assembling, the following points should be noted:

1 - When replacing bush in commutator bearing, the new bush must be placed in a hot oil bath prior to assembly.

2 - Bearing points, armature brake, drive pinion seat, and shift lever should be greased with Universal Grease VW - A 052.

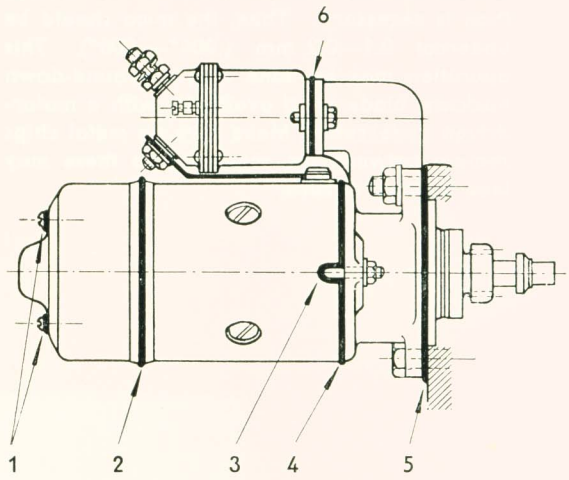
3 - The stop ring must be secured in position after installation of circlip by means of a narrow chisel.



4 - The armature shaft end play must be within 0.1—0.3 mm (.004"—.012") and can be adjusted by fitting washers.

5 - Do not forget to fit end cap rubber seal.

6 - To avoid starting trouble caused by water entering the starting motor, the following points should be sealed with VW Sealing Compound D 1a:



1 - Holes for slotted screws in end cap.

2 - Rubber seal between frame and end cap.

3 - Holes in frame for hook studs of intermediate bracket.

4 - Jointing faces of frame and intermediate bracket.

5 - Jointing faces of transmission case and intermediate bracket.

6 - Jointing faces between solenoid switch and intermediate bracket.

Testing Armature

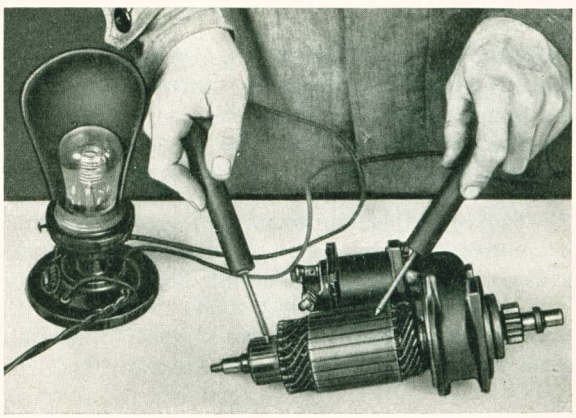
In a large number of cases the armature does not give visible evidence of trouble. The armature is tested for open circuits, short circuits and ground.

Test

1 - Open circuits in the armature are usually readily apparent, since this condition causes burned spots between the commutator segments due to brush deposits bridging the segments across the intersegment insulations. Check soldered commutator riser-bar connections.

2 - The armature is tested for short circuits on the growler. Place the armature on the growler and slowly revolve it while holding a thin steel strip or hacksaw blade above the armature core. Short circuits in the armature cause the steel strip or hacksaw blade to vibrate against the core when it is held above the slot containing shorted winding.

3 - The armature is grounded when the armature core comes into contact with the winding or when carbon dust has entered the windings (direct and indirect ground). The armature is tested electrically for ground while placing one test point of a lamp for a line voltage of 220 volts on the armature core and the other on the commutator.



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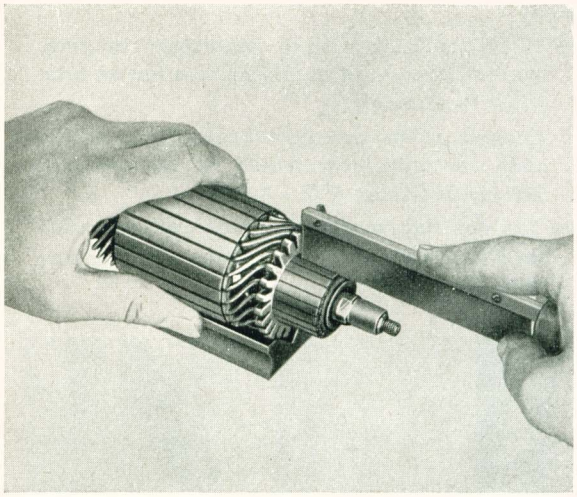
4 - The commutator consists of copper segments and mica. If the commutator is out of round and roughened by burned spots, or if it is grooved, it should be turned in a lathe to obtain a smooth surface. Do not remove more metal than is necessary. Then, the mica should be undercut 0.1—0.2 mm (.004"—.008"). This operation may be done with a ground-down hacksaw blade or, if available, with a motor-driven undercutter. Make sure no metal chips remain between the segments, as these may lead to short circuits.



Testing Field Coils

The two field coils are tested for open circuits, short circuits and ground.

Test

1 - The field coils can be tested for an open circuit by connecting a 6-volt battery in series with a test lamp and placing the points at the ends of each coil.

2 - If the outer insulation of the field coils is found to be in order, there is rarely a short circuit in the windings. To determine short circuits is generally beyond the scope of a workshop, as this requires special appliances.

3 - Test for a grounded field with points of a 220-volt test lamp on one coil end and frame.

4 - Also make sure that the electrical connections between the two field coils are in order.

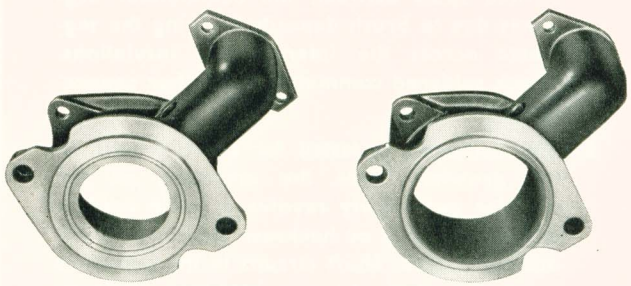
Starting Motor

(Sealed)

With effect from Chassis No. 1 517 414 a new starting motor with the designation EED 0.5/6 L 34/1, (Part. No. 111 911 021 B) is installed.

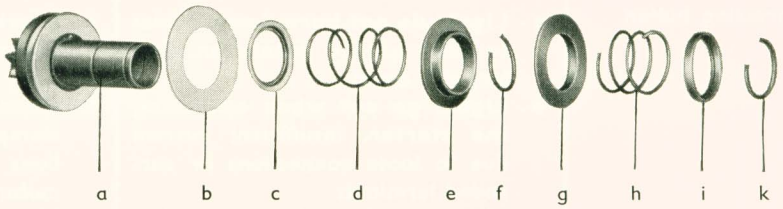
The starting motor drive pinion assy has additionally been provided with a thrust collar which, with the motor at rest, comes to rest on the altered intermediate bracket. The width of the rear guide ring has been decreased in this connection.

The stop ring on the armature shaft which provided a limitation for the pinion in starting motors of previous design has been omitted. The limitation is now provided by the thrust collar. Armatures of new design cannot be installed in earlier starting motors because of the absence of the stop ring.

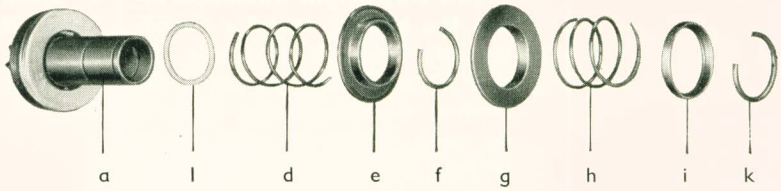


The purpose of this modification is to prevent ingress of moisture and dirt into the starting motor.

new type:



earlier type:



a - Pinion
b - Thrust Collar
c - Spring Seat
d - Helical Spring
e - Guide Ring
f - Snap Ring
g - Guide Ring
h - Helical Spring
i - Spacer
k - Snap Ring
l - Stop Ring

To convert earlier starting motors into sealed ones proceed as follows:

Parts required:

1 Cover Plate	Part No. 111 911 351
1 Spring Seat	Part No. 111 911 349
1 Guide Ring, rear	Part No. 111 911 343 A
1 Intermediate Bracket	Part No. 111 911 255 A
1 Armature	Part No. 111 911 311 A

1 - Remove starting motor.

2 - Remove solenoid switch.

3 - Remove intermediate bracket and take out pinion assy. Replace the intermediate bracket by one of new design.

4 - Remove armature and replace by a new one.

5 - Remove rear snap ring from pinion assy.

6 - Remove spacer and helical spring.

7 - Remove rear guide ring and replace by ring of new design.

8 - Remove snap ring.

9 - Remove front guide ring and helical spring.

10 - Remove stop ring.

Assembly:

Put thrust collar and spring seat on the protective cap of the overrunning clutch and assemble starting motor.

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Starting Motor Trouble Checking

Symptom	Cause	Remedy
Starter does not operate when pressing button	Switch on the lamps when testing:	
	a - **Lights do not burn.** Loose cables or poor ground connection. Battery run down	a - Check battery cables and connections. Test voltage of battery
	b - **Lights go out when operating the starter.** Insufficient current due to loose connections or corroded terminals	b - Clean battery terminals and cable clamps, clean and tighten connections between battery, starting motor and ground
	c - **Lights go dim when operating the starter.** Battery run down	c - Charge battery
	d - **Lights stay bright when operating the starter.** Make a jumper contact between terminals 30 and 50 at starting motor: If the starting motor operates, there is an open circuit in cable 50 to ignition switch, or in cable 30 to lighting switch, or the ignition switch is defective	d - Eliminate open circuits, replace defective parts
	e - **Lights stay bright and plunger in solenoid switch is pulled when operating the starter.** Disconnect battery cable from terminal 30 at starting motor and connect it to terminal stud of connector (contact blade). If the starting motor operates, the contacts of the solenoid switch are worn or dirty	e - Replace solenoid switch
Starting motor does not operate when battery cable is directly connected with terminal stud of connector (contact) blade	a - Brushes sticking	a - Clean brushes and guides of brush holders
	b - Brushes worn	b - Replace brushes
	c - Weak spring tension. Brushes do not make contact	c - Replace springs
	d - Commutator dirty	d - Clean commutator
	e - Commutator rough, pitted, or burned	e - Recondition starting motor
	f - Armature or field coils defective	f - Overhaul starting motor
Sluggish or slow action of the starting motor	a - Battery run down	a - Charge battery
	b - Insufficient current flow due to losse or corroded connections	b - Clean battery terminals and cable clamps, tighten connections
	c - Brushes sticking	c - Clean brushes and guides of brush holders
	d - Brushes worn	d - Replace brushes
	e - Commutator dirty	e - Clean commutator
	f - Commutator rough, pitted, or burned	f - Recondition starting motor
	g - Armature or field coils defective	g - Overhaul starting motor
Starting motor is heard to operate, but cranks engine erratically or not at all	a - Drive pinion defective	a - Replace drive pinion
	b - Flywheel gear ring defective	b - Replace flywheel or remachine gear ring
Drive pinion does not move out of mesh	a - Drive pinion or armature shaft dirty or damaged	a - Overhaul starting motor
	b - Solenoid switch defective	b - Replace solenoid switch

General Description

Type: 6 volts, 70 amp.-hours

The battery stores the energy produced by the generator and supplies current for operating starting motor, lights, and other electrical accessories. It consists of three cells, each of which has a positive lead peroxide plate group (PbO_2) and a negative sponge lead plate group (Pb). The electrolyte is made up of about 40 per cent sulphuric acid and about 60 per cent water ($H_2SO_4 + H_2O$) having a specific gravity of 1.285 = 32° Bé (Baumé).

The cells are united in the battery case and connected electrically by lead cell connectors. To avoid confusion, the positive battery terminal post is made thicker than the negative terminal post.

Cell voltage

The average voltage of each cell is 2 volts. It increases to about 2.5—2.7 volts with the battery being charged and decreases to between 2.1 and 2.0 volts soon after the charging current has been cut out. The battery is discharged when the cell voltage has dropped to 1.75—1.8 volts under no-load conditions.

Battery Rating

The discharging rate of the battery amounts to 70 ampere-hours. The 20-hour rate represents the amount of current a battery can deliver for 20 hours at a temperature of 20° C (70° F). Thus, a battery of 70 ampere-hours can deliver a current of 3.5 amperes for 20 hours at a temperature of 20° C (70° F).

Chemical Activities in Battery:

Discharging

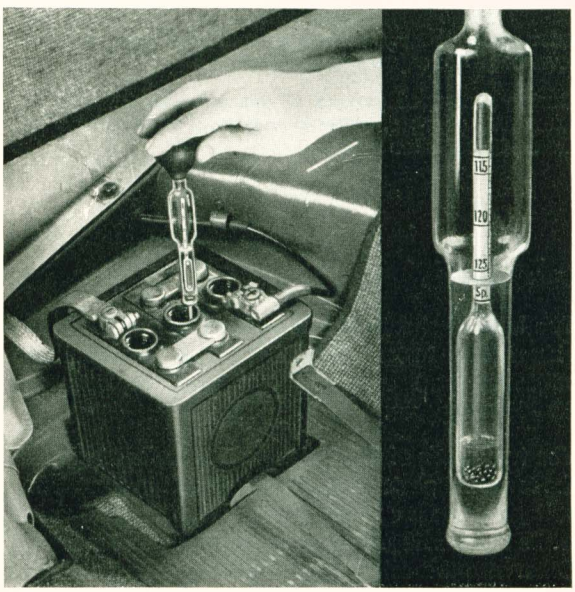
The sponge lead (negative plate) and lead peroxide (positive plate) change to lead sulphate ($PbSO_4$) during the discharge process. The sulphate comes from the sulphuric acid; the electrolyte loses acid and gains water, thus the specific gravity decreases.

Charging

The direct current from the generator causes the lead sulphate to change back to sponge lead in the negative plates and lead peroxide in the positive plates, and the sulphuric acid reappears in the electrolyte, increasing the specific gravity of the electrolyte. If the charging current is not cut off in time, hydrogen and oxygen gases are generated in the cell and the battery commences to "boil".

Battery Maintenance

Ready starting of the engine depends upon perfect condition of the battery. It should, therefore, be inspected at regular intervals.



Hydrometer Test

The state of charge of the battery may be checked by means of a battery hydrometer. The specific gravity of the battery liquid will increase with the charging of the battery. Tested with the hydrometer, the gravity can be read from the scale of a float.

Battery fully discharged	18° Bé =	spec. gravity 1.142
Battery semi-charged	27° Bé =	spec. gravity 1.230
Battery fully charged	32° Bé =	spec. gravity 1.285

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Electrolyte Level

During operation, the electrolyte level in the battery drops due to loss of water. Only distilled water should be added, as other water has chemical properties which are harmful to the electrolyte. The electrolyte level should be approximately 15 mm (.60″) above the plates. Never add acid, unless it is known that acid has been spilled from the battery. Check specific gravity afterwards and compensate if necessary.

Note:

The standard level of the battery acid has been lowered with effect from May 1958.

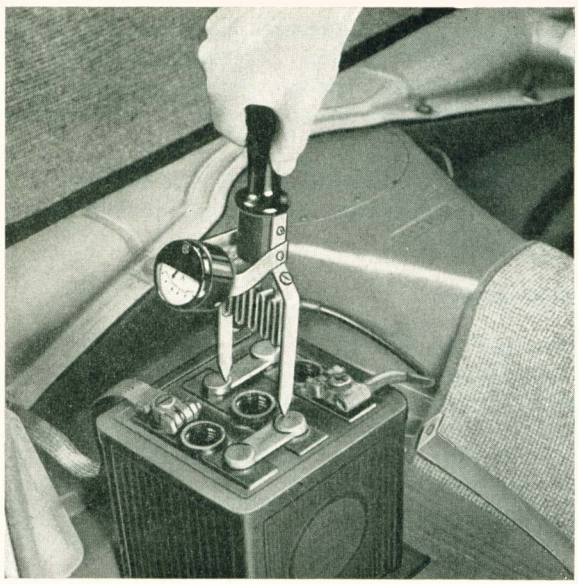
The acid should reach up to 5 mm = 13/64″ (formerly 10—15 mm = 25/64—19/32″) above the top edges of the battery plates (separators) or to about just above the splash plate, if any. If there is an acid level mark, the acid level has to be adjusted accordingly.

During prolonged periods of operation in day-time or when fully charged, batteries may tend to "boil over" if the acid level is too high.

Voltage Test

The high-discharge test is carried out by an individual cell tester consisting of a low-reading voltmeter and a heavy resistance of between 80—100 amperes.

The two prods of this instrument are placed across the terminal posts of each battery cell in turn. The voltage of each cell should not fall below 1.6 volts while the reading is being taken (10 to 15 seconds). Otherwise the cell is discharged or defective. The normal voltage is 2 volts. The difference between the cells should not be in excess of 0.2 volt.



How to Maintain Battery

Because of the high stress imposed on the battery when starting, the average service life of a battery amounts to two years. The battery is subjected to an especially heavy strain by continuously trying to start when the engine does not fire at once, since a current of up to 250 amperes is drawn from the battery when starting.

The battery must be held firmly in its mounting. Terminal posts and cable clamps should be kept free from corrosion to prevent excessive electrical resistance. They should be cleaned with a clean rag, or, in severe cases, with some battery pole cleaner. Then coat the posts and cable clamps with vaseline or petroleum jelly to prevent corrosion. Cable clamps which are difficult to remove from the terminal posts due to corrosion should be removed with a special tool designed for this purpose.

Since some spraying of battery electrolyte is natural as the battery is being charged, traces of electrolyte should be cleaned off by use of a wire brush and common baking soda solution to avoid damage to the fabric and metal parts.

Recharging Battery

It is good practice to remove the battery at intervals of three or four months and discharge it down to a cell voltage of 1.8 volts before recharging it. Batteries are subject to a selfdischarge of 1 per cent per day with the battery in good condition. If the car is left stationary for a longer period, the battery must be recharged at 7-week intervals.

The current input depends on the capacity of the battery and should, with a battery of 70 amp. hours, not exceed the rate of 7.0 amperes. Thus, the charging requires about 10 hours or more at a lower charging rate. The fully charged condition is reached when the cell voltage has increased to approx. 2.5—2.7 volts, the battery is gassing freely and there is no further rise in voltage for three hours. This should be checked at intervals of 1 hour.

Before charging, the vent plugs should be removed.

Charging New Batteries

New batteries are generally received in an uncharged condition. When charging, the manufacturer's instructions should be followed, however, some general hints are given below:

1 - Remove vent plugs and fill cells with chemically pure battery acid diluted with distilled water to a specific gravity of 1.285 at 20° C (70° F). The level should be approx. 15 mm (.60″) above the plates.

2 - Let the battery stand for 5 or 6 hours to allow the plates to be saturated with electrolyte. The electrolyte level drops slightly during this period.

3 - Add electrolyte to restore correct level.

4 - Charge battery at a rate of 5 amperes until the voltage of each cell is between 2.5 and 2.7 volts and all cells gas freely.

5 - The maximum permissible temperature of electrolyte during external charging is 40° C (105° F) and if this is reached, the charge should be suspended to allow the temperature to fall.

6 - After charging, check specific gravity (1.285 = 32° Baumé) and adjust it if necessary. Should an adding of acid or distilled water become necessary, the battery must be recharged for a short time to insure a good mixing of the fluid.

7 - The vent plugs must be replaced not earlier than two hours after the charging, if possible still later. Wash off spilled electrolyte and then dry battery.

Cold Operation

It is true that the conductivity and degree of viscosity of the electrolyte largely depends on temperature conditions. Extreme cold considerably reduces battery output. At an electrolyte temperature of —15° C (5° F), the output amounts to only 50 per cent of that at a temperature of +20° C (70° F).

The higher the gravity of the electrolyte, the lower its temperature must be before it will freeze. The battery must, therefore, be kept in a sufficiently charged condition to prevent its freezing. If the freezing has not ruined the battery, working conditions can be restored by thawing out and recharging the battery.

Spec. Gravity	Freezing Temperature
1.285	—65° C (—85° F)
1.18	—22.5° C (—8° F)
1.14	—13° C (9° F)

The increased stress imposed on the battery by the starting motor at low temperatures, which has to crank the stiff engine, necessitates a more frequent inspection of the battery. In winter, it is recommended to remove the battery at 4-week intervals for recharging and checking specific gravity and electrolyte level.

Caution! Keep any open flame away from the room where batteries are charged. It is advisable not to have precision tools and instruments in such rooms.

Note:

From Chassis No. 1 - 0 931 501 approx. a new battery of reduced height has been installed. The clamping strap has been altered accordingly. The capacity amounts to 66 amp. hours. The cold start performance of the battery has gone up by 50 per cent. on account of the increased number of plates.

The new battery can be used on earlier cars only in connection with the new lid and the shorter clamping strap.

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Karmann Ghia Models

Battery Ground Strap

With effect from Chassis No. 1 304 939 the length of the battery ground strap on the Karmann Ghia has been increased from 240 mm (9.45") to 360 mm (14.17"). The new strap (Part No. 141 971 235) runs from the battery direct to the engine where it is fastened with the fillister-head screw below the oil filler cap.

Hitherto the ground strap was fastened to the engine compartment floor. The modification is to reduce the voltage drop.

General Description

The ignition equipment consists of the battery, switch, ignition coil, ignition distributor with centrifugal advance mechanism, spark plugs and wiring. The low tension current, supplied by the battery, is converted to high tension current by the ignition coil.

Ignition Coil

General Description

Type: Bosch TK 6/3

The ignition coil consists of an iron core around which are a primary circuit made up of a winding of a few hundred turns of heavy wire and a secondary circuit made up of a winding of many thousands of turns of a fine wire. The process in the ignition coil is similar to that of a transformer. As the contact points separate in the distributor, the flow of current from the battery through the primary winding of the coil is interrupted and the magnetic field collapses. The collapsing magnetic field induces high-voltage surge that is conducted through the distributor rotor and cap to a spark plug. A condenser is connected in parallel with the contact breaker to prevent a heavy electric arc to take place across the separating contact points, because it momentarily provides a place for the current to flow as the points begin to move apart.

Maintenance

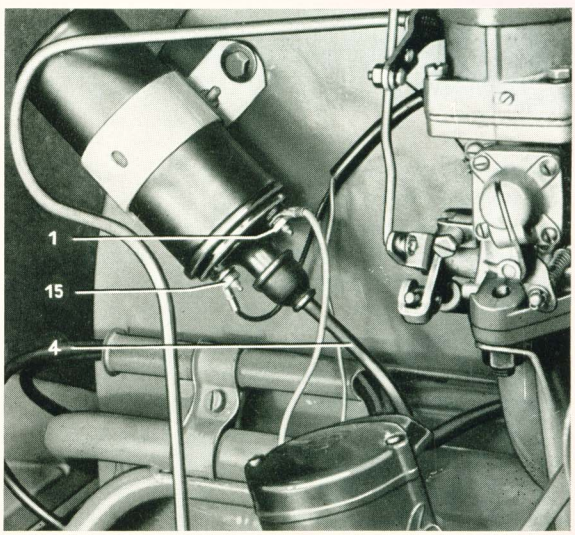
The coil insulating cap must be kept clean and dry to prevent high-tension leakage across the cap.

Inspection

To test the ignition coil for serviceability, the length of the spark produced by it should be measured. This can be done on a test bench or on the engine.

If, after an inspection, the supply of current and the distributor are considered in good order, disconnect lead 4 at distributor and hold it about 7 mm (.03″) from the crankcase.

If no spark occurs while cranking the engine, the ignition coil must be replaced.



Connections:

Terminal 1 to distributor (contact breaker)
Terminal 15 to ignition switch
Terminal 4 to distributor cap (high-tension lead)

Distributor

General Description

Type: BOSCH VE 4 BRS 383

The distributor serves the purpose of distributing the high voltage current to the spark plugs in proper time. Timing of the distributor point opening is controlled by manual setting and a centrifugal spark-advance mechanism.

Maintenance

Dirty or slightly burned breaker points should be cleaned up by the use of a point file, which is made especially for this purpose. Emery cloth should not be used. The contacting surfaces must be flat and even to insure a parallel contact. To obtain this, the moving point must be slightly pressed against the fixed point while moving the file between them.

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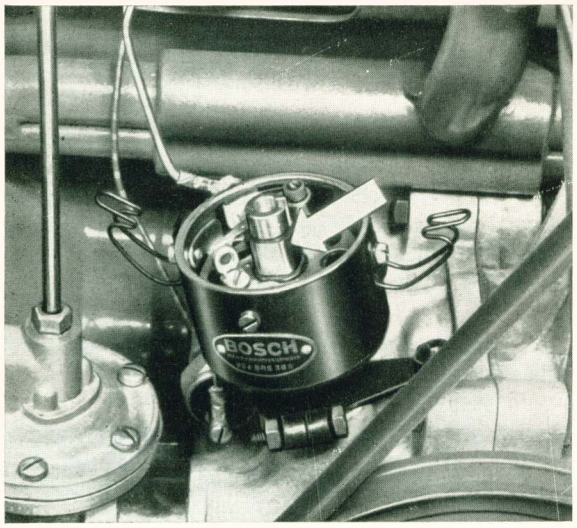
Clean the interior of the distributor with compressed air. The cam lobes should be slightly greased with Universal Grease VW - A 052 to reduce wear of the fiber block to a minimum.



It is recommended to add a few drops of engine oil down the shaft through the contact breaker plate when carrying out the first service inspection of the car, but care should be taken that no oil comes into contact with the breaker points.

The rotor finger and the four segments of the distributor cap are subjected to a certain amount of wear because of the sparks continuously occurring during operation. Troubles may occur, if the insulating material of the distributor cap or the rotor is cracked. The cap must be kept clean and dry inside and out to avoid high-tension leakages and short circuits. When mounting the cap, make sure that the spring-loaded brush for the rotor is fitted.

Adjusting Breaker Points

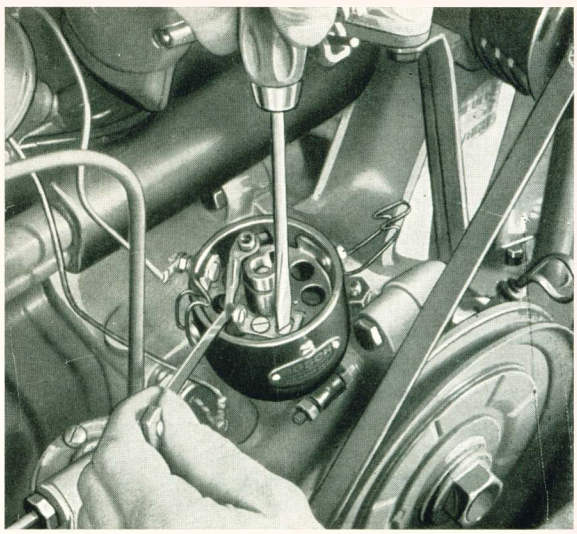
To adjust the breaker points proceed as follows:

1 - Remove distributor cap and rotor.

2 - Crank the engine until the fiber block on the breaker arm rests on the highest point of the cam lobe.

3 - Loosen the lock screw of the fixed breaker point.

4 - Turn the eccentric adjusting screw until the correct gap of 0.4 mm (0.016″) is obtained. Check with a feeler gauge.



5 - Tighten lock screw.

6 - Recheck the gap.

Important!
After the contact points have been adjusted it is absolutely necessary to readjust the ignition timing, as a change of 0.1 mm (0.004″) in the amount of gap changes the ignition timing by about 3° of the crankshaft angle.

A correct opening and closing of the breaker points is only insured, if there is no radial play in the distributor shaft and bearings.

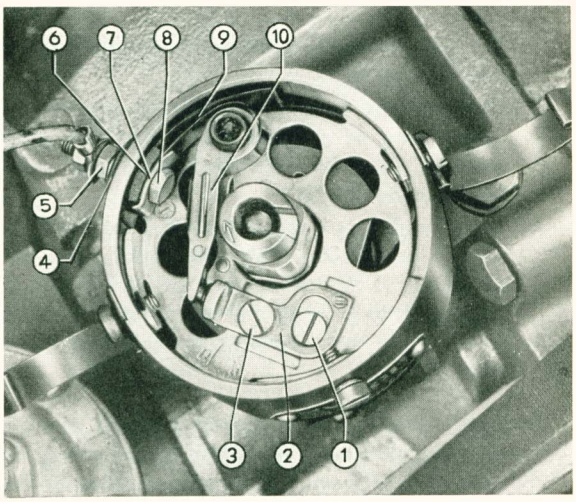
Replacing Breaker Points

The breaker points naturally wear during service by burning. If the point has been reached where an adjustment is no longer possible, or if the breaker points are badly burned, install a new set:

1 - Remove distributor cap.

2 - Disconnect low-tension cable from terminal 1 at distributor.

3 - Loosen nut of terminal screw and lift off breaker arm.



1 - Breaker point adjusting screw
2 - Breaker point
3 - Breaker point lock screw
4 - Insulating washer
5 - Primary lead connection
6 - Insulation piece
7 - Angle plate
8 - Terminal screw
9 - Insulation
10 - Breaker arm

When fitting the new breaker arm, note proper position of insulation to avoid short circuit at this point.

4 - Connect low-tension cable.

5 - Replace fixed breaker point after having removed the lock screw.

6 - Readjust breaker point gap. Refit rotor and distributor cap.

Ignition Timing

Before timing the ignition to 5° before top dead center, the breaker points must be checked.

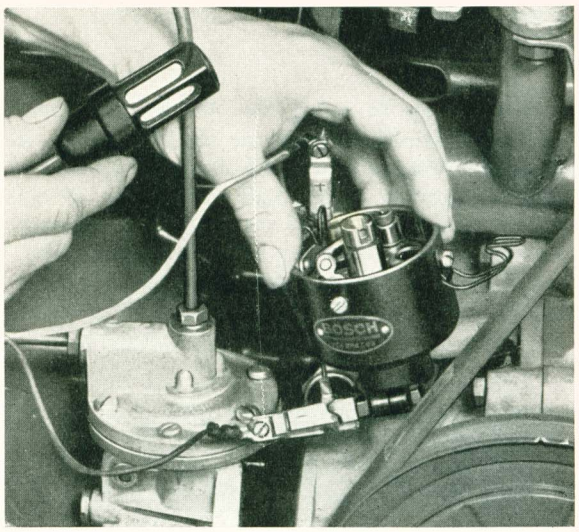
1 - Crank the engine until the mark of the crankshaft pulley lines up with the vertical crankcase jointing faces and the distributor rotor arm is in the position for firing on the No. 1 cylinder (see mark on rim of distributor base).

2 - Loosen clamp screw of distributor retainer.

3 - Connect one lead of 6-volt test lamp to terminal 1 at distributor and the other to ground.

4 - Switch on ignition.

5 - Rotate the distributor body clockwise until the contact points are closed and then slowly counter-clockwise until the breaker points just mark to open and the test lamp lights up.



6 - Tighten clamp screw of distributor retainer.

7 - Refit rotor and distributor cap.

The ignition is correctly timed for all four cylinders, if the lamp lights up when the mark on the pulley is exactly in its highest or lowest position (in line with the crankcase jointing faces) while slowly cranking the engine.

Centrifugal Advance Mechanism

The centrifugal mechanism consists of two weights that throw out against spring tension. This movement is transmitted through a toggle arrangement to the breaker cam, causing it to advance or move ahead with respect to the distributor drive shaft as engine speed increases (max. 30°).

Testing Centrifugal Advance Mechanism

The effect of the advance mechanism can be checked by turning the mounted rotor clockwise

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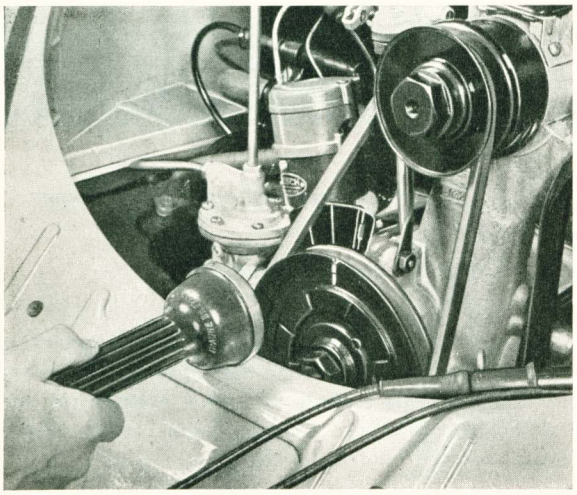
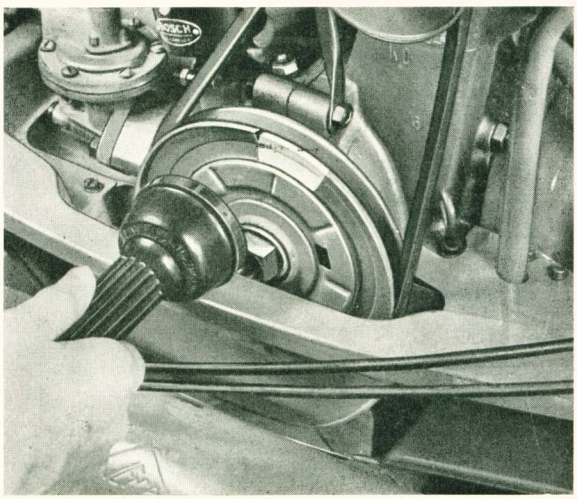
up to the stop. The rotor must move back to its original position, that is, to the opposite stop when it is released. Otherwise the advance mechanism is dirty or the spring tension is incorrect. A "pinking" noise in the engine, which seems to be inexplicable, is occasionally caused by a defective advance mechanism. The ignition timing indicator VW 342 enables the mechanic to carry out a precise checking of the advance mechanism in a simple way.

A control scale (drawing No. 373 for local production), specially designed for the VW engine, is attached to the crankcase and shows in connection with the ignition timing light the setting of the ignition and the action of the centrifugal advance mechanism. A faulty setting, or mechanical troubles, evidenced by a too advanced, retarded, or uneven ignition timing, can easily be detected.





Application:

1 - Attach control scale to distributor mounting stud so that the scale slot is in line with the vertical crankcase jointing faces.

2 - Draw a line 2—3 mm (0.08"—0.11") thick at the ignition timing mark on the fan pulley with chalk or paint.

3 - Connect one lead of the timing light to the spark plug of cylinder No. 1 and the other lead to the disconnected spark plug cable (series connection).

4 - Start engine. — Hold timing light close to pulley and scale. The distributor functions properly, if the white line on the pulley is steadily (not jerkily) moving within that field of the scale corresponding to the speed of the engine.

If the timing light is used without the scale, a white line 10 mm (2.5") thick should be drawn along the circumference of the pulley from the ignition timing mark 47 mm (1.85") in clockwise direction (see fig. below).

At idling speed, the left end of the line should approx. line up with the crankcase jointing faces and the right end should approx. line up with them at to speed.

White Line at:	Speed	Advanced Ignition
Scale Slot	Standstill	5°
1st Scale Line	Approx. 600 R. P. M.	Approx. 5°— 9°
2nd Scale Line	Approx. 1400 R. P. M.	Approx. 15°—20°
3rd Scale Line	Approx. 2800 R. P. M.	Approx. 32°—37°

Testing Condenser

The condenser is very important to obtain the required high voltage for the ignition. It also reduces the spark occurring between the points when they separate to prevent a premature burning of the points.

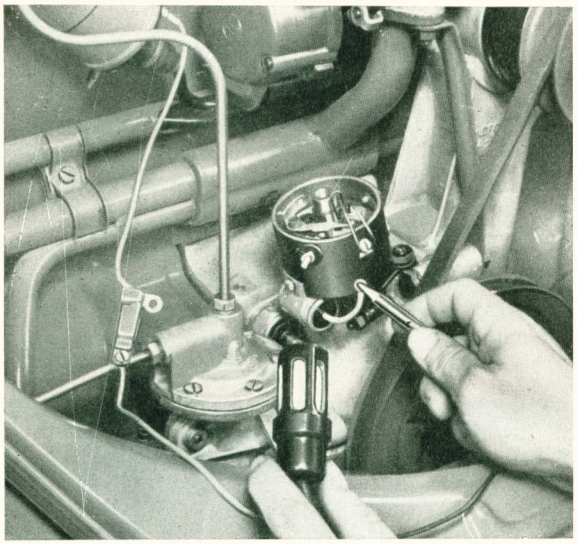
A defective condenser is indicated by burned breaker points and wek spark in connection with difficult starting, or failure of the engine to start.

Test

Modern testing equipment checks a condenser for high resistance, insulation leakage, and capacity. If condenser testing equipment is not available, proceed as follows:

1 - Disconnect cable 1 and condenser cable at terminal of breaker arm.

2 - Connect the one lead of a 6-volt test lamp to terminal 1 at ignition coil and the other to the condenser cable.



3 - Switch on ignition. If the test lamp lights up, the condenser is grounded and should be replaced.

4 - Connect cable 1 and condenser cable.

5 - Disconnect high tension lead 4 at distributor cap and hold it approx. 1/4 inch from the crankcase or other suitable ground.

6 - Crank engine with ignition switched on. If no spark occurs at the prescribed distance, the check should be repeated with a new condenser.

Only use condensers of the prescribed type: ZKO 29/6 2 Z, as condensers of incorrect capacities will seriously affect breaker point life.

Removing and Installing Distributor

1 - Disconnect cable from terminal 1 at distributor (loosen breaker point terminal screw).

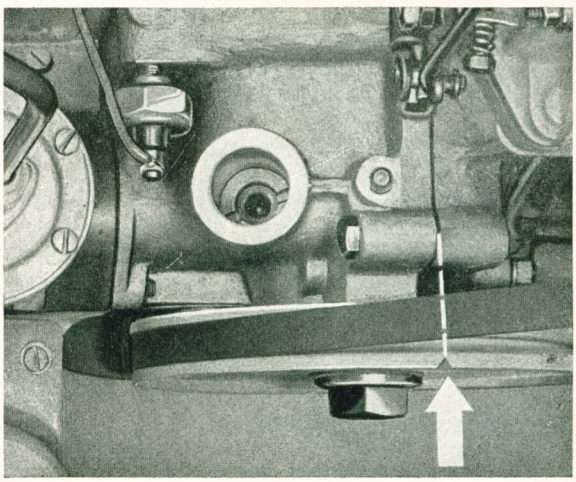
2 - Take off distributor cap.

3 - Loosen nut of distributor retainer.

4 - Lift off distributor.

Installing the distributor is done in the reverse order, but the following points should be noted:

1 - Crank the engine until it is in the position for firing on the No. 1 cylinder. The slot of the distributor drive pinion must then be offset towards the rear and nearly parallel to the fan pulley, while the fan pulley mark is in line with the crankcase jointing faces.



2 - Make sure the distance spring is properly seated in the distributor drive pinion head.

3 - When installing distributor, turn distributor shaft until the finger of the rotor points to the mark for cylinder No. 1 on the base rim and

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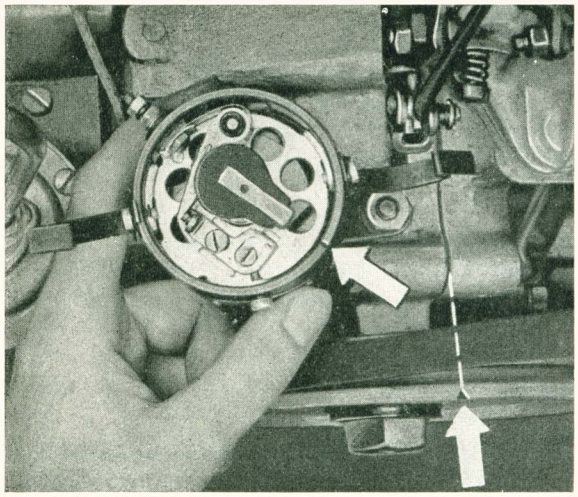
the shaft end enters the slot in the distributor drive pinion.

4 - Time the ignition.

Note:

All 1131 c. c. engines were equipped with the ignition distributor BOSCH VE 4 BRS 383 at the factory. This distributor is interchangeable with the distributor BOSCH VJ 4 BR 8; however, the basic advance adjustment must be altered as indicated below when using the latter distributor:

1131 c. c. Engine, 25 b. hp. with compression ratio of 5.6:1		
Ignition Distributor BOSCH	Ignition Timing	Timing Mark
VE 4 BRS 383	5° before T. D. C.	In line with crankcase jointing faces
VJ 4 BR 8	12.5° before T. D. C.	12 mm (.5″) to the left of crankcase jointing faces



Spark Plugs

Types	1131 c.c.	1192 c.c.
Bosch	W 175 T 1	W 225 T 1
Beru	K 175/14 U 2	225/14 U 2
Lodge	H 14	H 14 or HN
Champion	L 10 S	L 10 S
AC	45 L	43 L
Auto-Lite	—	AE 6 or AER 6
KLG	—	F 70

Spark plug thread = 14 mm (.551″)

The electric spark jumps the gap between the two electrodes to ignite the fuel-air mixture in the combustion chamber. Never use plugs of other types than mentioned above, as starting, idling, acceleration and max. performance greatly depend on the right choice of the spark plug. The heat range of the correct plug can be ascertained from the above table.

Maintenance and Inspection

Spark plugs should be cleaned and the gaps checked at 5000 km (3000 miles) intervals.

To an experienced and skilled mechanic, the appearance of the spark plug gives evidence of the adjustment and engine operation condition. The following rules are generally applicable:

Electrodes and insulator

fawn — good carburetor setting and correct performance of spark plug;

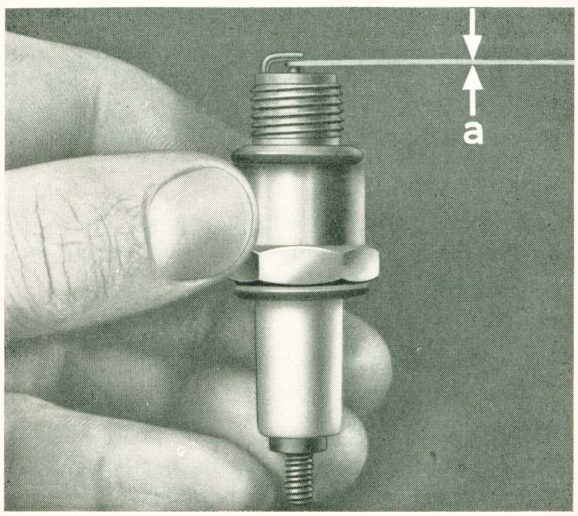
black — mixture too rich;

lightgrey — mixture too lean;

oiled up — failure of spark plug or worn out cylinder.

In the case of fuel containing lead-tetra-ethyl (anti-knock fuel), the insulator will show a grey colour, provided the engine is correctly adjusted.

During operation, the plug gap increases due to natural burning. If the gap has increased too much, the plug may fail to operate. The gap is checked by means of a gauge and adjusted by bending the ground (outer) electrode to the correct value (0.6—0.7 mm = .024″—.027″).



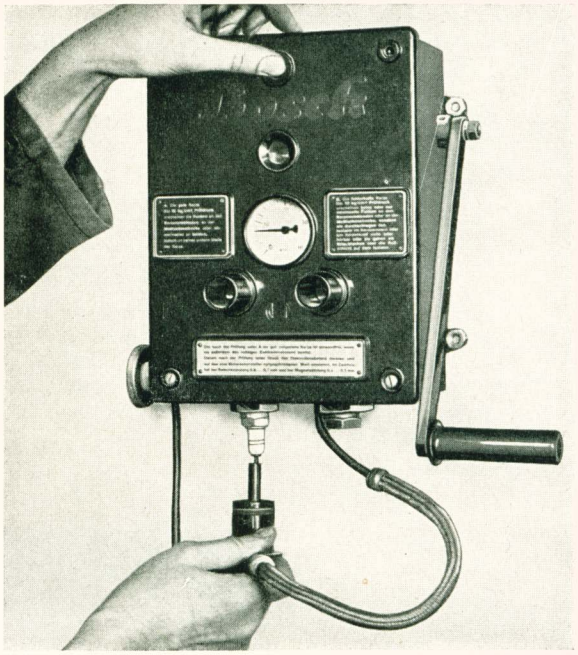
a = 0.6—0.7 mm (.024″—.027″)

A number of testing devices for spark plugs are in use, where the spark must occur under pressure (6—7 atm. = 85—100 lbs./sq. in.) and can be watched through an inspection hole.

When installing spark plugs, make sure the gaskets are not forgotten. For peak engine performance, it is recommended to replace spark plugs every 15.000 km (9.500 miles).

Dirty spark plugs are cleaned with a brush and a chip of wood. Oiled-up spark plugs are made serviceable by burning them dry. The insulator must be kept clean and dry to avoid short circuits and high-tension leakage. A sand-blast type cleaner should be used for cleaning spark plugs, if available.

If vehicles are mainly driven in city traffic and over short distances during the cold season, the spark plug gaps should be decreased from 0.6—0.7 mm (.024"—.027") to 0.4—0.5 mm (.016"—.020").



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General Description

The ignition equipment consists of the battery, ignition coil, and ignition distributor with centrifugal advance mechanism. The additional advance obtained by the vacuum mechanism is to improve operating smoothness and fuel economy under part-throttle conditions. The low tension current, supplied by the 6-volt battery, is converted to high tension current by the ignition coil.

Ignition Coil

General

Type: Bosch TE 6 A 3

The ignition coil consists of an iron core around which are a primary circuit made up of a winding of a few hundred turns of heavy wire and a secondary circuit made up of a winding of many thousands of turns of a fine wire. The process in the ignition coil is similar to that of a transformer. As the contact points separate in the distributor, the flow of current from the battery through the primary winding of the coil is interrupted and the magnetic field collapses. The collapsing magnetic field induces high-voltage surge that is conducted through the distributor rotor and cap to a spark plug. A condenser is connected in parallel with the contact breaker to prevent a heavy electric arc from taking place across the separating contact points, because it momentarily provides a place for the current to flow as the points begin to move apart.

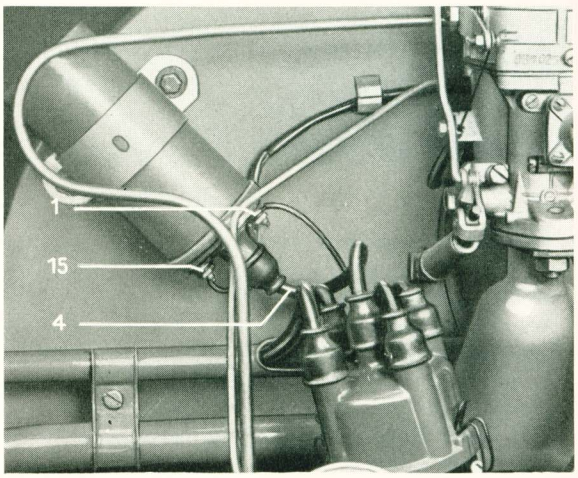
Maintenance

The coil insulating cap must be kept clean and dry to prevent high-tension leakage across the cap.

Inspection

To test the ignition coil for serviceability, the length of the spark produced by it should be measured. This can be done on a test bench or on the engine. If, after an inspection, the supply of current and the distributor are considered in good order, disconnect lead 4 at distributor and hold it about 7 mm (.3″) from the crankcase.

If no spark occurs while cranking the engine, the ignition coil must be replaced, provided that the condenser has been founded to be in perfect order.



Connections:

Terminal 1 to distributor (contakt breaker)
Terminal 15 to ignition switch
Terminal 4 to distributor cap (high-tension lead)

Note:

From Chassis No. 1 261 493 a new type ignition coil, designated TE 6 B 1, is used on all new production cars. This coil has a higher output, thus offering safer engine operation under extreme conditions of load.

The two types of ignition coil are interchangeable.

Distributor

General

Type: BOSCH V JU 4 BR 3 mk

The distributor serves the purposes of distributing the high voltage current to the spark plugs in proper time. Timing of the distributor point opening is controlled by manual setting and a centrifugal spark-advance mechanism. Under part-throttle conditions, an additional advance is accomplished by the vacuum advance mechanism.

Maintenance

Dirty or slightly burned breaker points should be cleaned up by the use of a point file, which is made especially for this purpose. Emery cloth should not be used. The contacting surfaces must be flat and even to insure a parallel contact. To obtain this, the moving point must be slightly pressed against the fixed point while moving the file between them.

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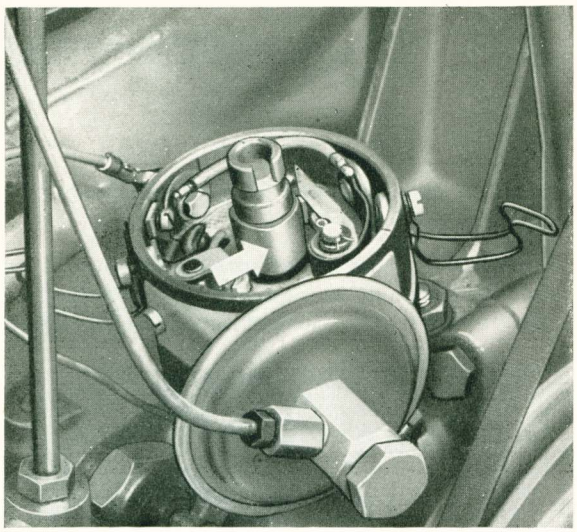
Clean the interior of the distributor with compressed air. The cam lobes should be slightly greased with Universal Grease VW - A 052 to reduce wear of the fiber block to a minimum.



It is recommended to add a few drops of engine oil down the shaft through the contact breaker plate when carrying out the first service inspection of the car, but care should be taken that no oil comes into contact with the breaker points.

The rotor finger and the four segments of the distributor cap are subjected to a certain amount of wear due to spark continuously occurring during operation. Troubles may occur if the insulating material of the distributor cap or the rotor is cracked. The cap must be kept clean and dry inside and out to avoid high-tension leakages and short circuits. When mounting the cap, make sure that the spring-loaded brush for the rotor is fitted.

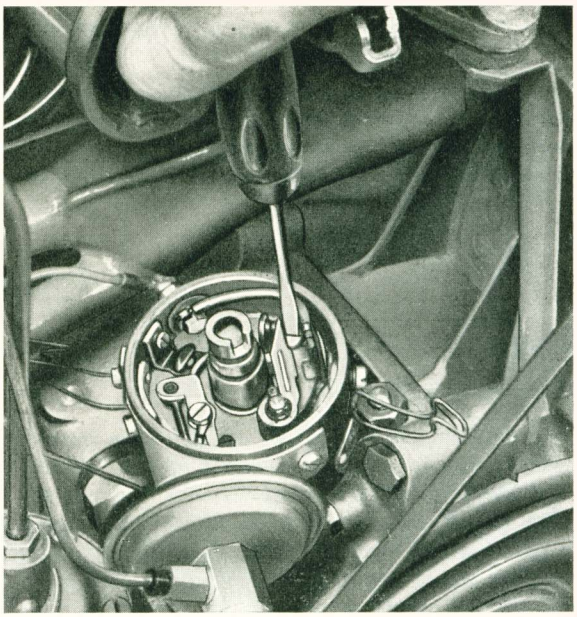
Adjusting Breaker Points

To adjust the breaker points proceed as follows:

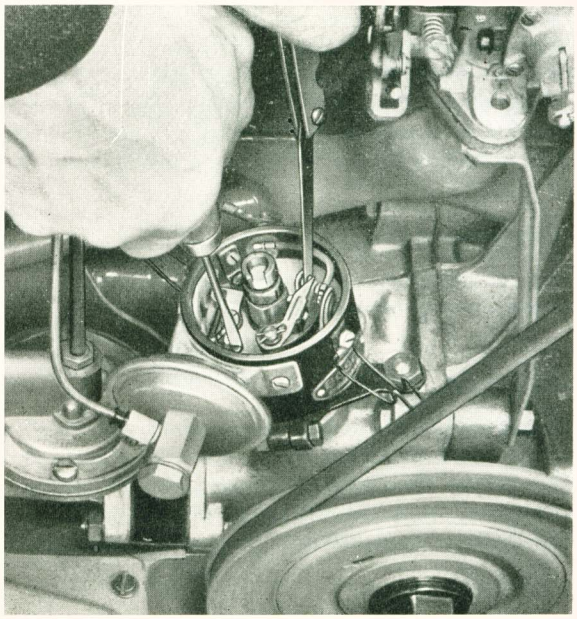
1 - Remove distributor cap and rotor.

2 - Crank the engine until the fiber block on the breaker arm rests on the highest point of the cam lobe.

3 - Loosen the lock screw of the fixed breaker point.



4 - Turn the eccentric adjusting screw until the correct gap of 0.4 mm (.016″) is obtained. Check with a feeler gauge.



5 - Tighten lock screw.

Important!
After the contact points have been adjusted, it is absolutely necessary to readjust the ignition timing, as a change of 0.1 mm (.004″) in the amount of gap changes the ignition timing by about 3° of the crankshaft angle.

A correct opening and closing of the breaker points is only ensured, if there is no radial play in the distributor shaft and bearings.

Replacing Breaker Points

The breaker points naturally wear during service by burning. If the point has been reached where an adjustment is no longer possible, or if the breaker points are badly burned, install a new set:

1 - Remove distributor cap and rotor.

2 - Disconnect low-tension cable from terminal 1 at distributor.

3 - Loosen nut of terminal screw and take off breaker arm cable.

4 - Remove spring clip and washer from breaker arm pin.

5 - Disconnect breaker arm spring and insulation from the terminal on the breaker plate and remove breaker arm.

6 - Remove breaker point lock screw.

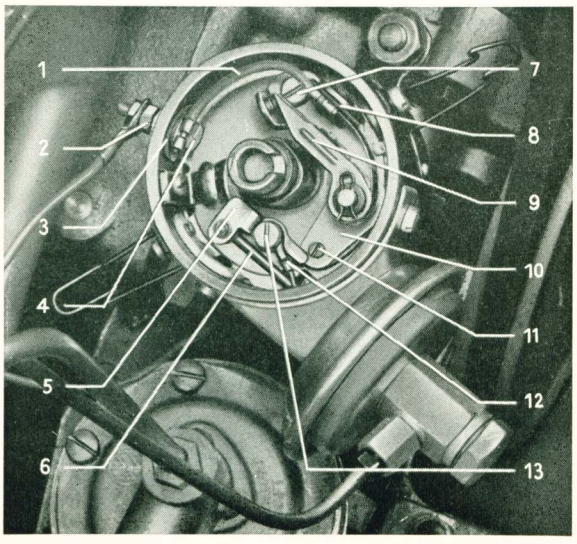
7 - Remove screw of vacuum pull rod bracket.

8 - Take off breaker point.
When fitting the new breaker arm, note proper position of insulation to avoid short circuits at this point.

9 - Tighten screw of vacuum pull rod bracket.

10 - Connect low-tension cable.

11 - Reset breaker point gap and ignition timing.



1 - Primary lead
2 - Primary lead connection
3 - Insulating washer
4 - Terminal screw
5 - Pull rod bracket
6 - Vacuum pull rod
7 - Lock screw
8 - Insulating washer
9 - Breaker arm
10 - Breaker point
11 - Adjusting screw
12 - Ground lead
13 - Bracket screw

Ignition Timing

The ignition timing should always be set with the engine cold.

Prior to timing the ignition to 7.5° before top dead center, the breaker point gap must be checked.

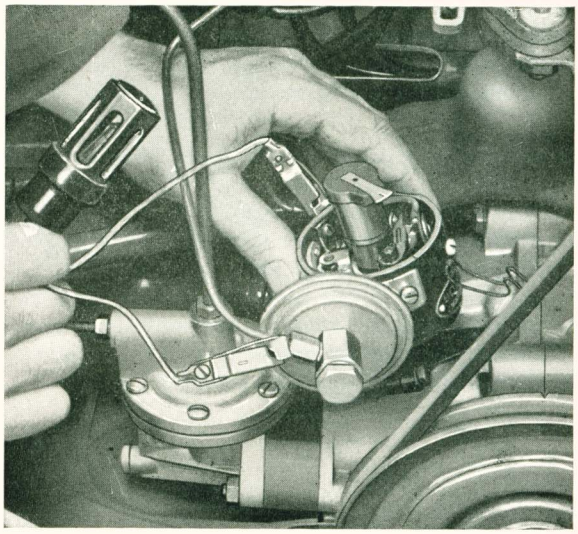
1 - Crank the engine until the mark of the crankshaft pulley lines up with the vertical crankcase jointing faces and the distributor rotor arm is in the position for firing on the No. 1 cylinder (see mark on rim of distributor base).

2 - Loosen clamp screw of distributor retainer.

3 - Connect one lead of 6-volt test lamp to terminal 1 at distributor and the other to ground.

4 - Switch on ignition.

5 - Rotate the distributor body clockwise until the contact points are closed and then slowly anti-clockwise until the breaker points are just about to open and the test lamp lights up.



6 - Tighten clamp screw of distributor retainer.

7 - Refit rotor and distributor cap.

The ignition is correctly timed for all four cylinders, if the lamp lights up when the mark on the pulley is exactly in its highest or lowest position (in line with the crankcase jointing faces) while slowly cranking the engine.

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Centrifugal Advance Mechanism

The centrifugal mechanism consists of two weigths that throw out against spring tension. This movement is transmitted through a toggle arrangement to the breaker cam, causing it to advance or move ahead with respect to the distributor drive shaft as engine speed increases (max. 26°).

Under part-load conditions, an additional spark advance is accomplished by the vacuum advance mechanism being connected to the carburetor. The vacuum taken from the carburetor actuates the diaphragm in the vacuum chamber. The movement of the diaphragm is transmitted to the breaker plate by means of a pull rod, causing the breaker plate with the points to move ahead with respect to the distributor drive shaft.

Testing Centrifugal Advance Mechanism

The effect of the advance mechanism can be checked by turning the mounted rotor clockwise up to the stop. The rotor must move back to its original position, that is, to the opposite stop when it is released. Otherwise the advance mechanism is dirty or the spring tension is incorrect. The ignition timing indicator VW 342 enables the mechanic to carry out a precise checking of the advance mechanism in a simple manner.

A control scale (drawing No. VW 654, formerly VW 373, for local manufacture and Workshop Bulletin E/28), specially designed for the VW engine, is attached to the crankcase and shows in connection with the ignition testing light the setting of the ignition and the action of the centrifugal advance mechanism. A faulty setting, or mechanical troubles, evidenced by a too advanced, retarded, or uneven ignition timing, can easily be detected.

Application:

1 - Disconnect vacuum line from ignition distributor and plug it up.

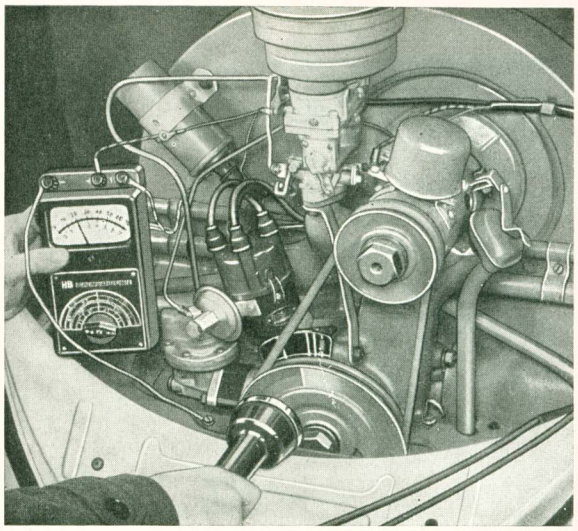
2 - Screw control scale on distributor mounting stud so that the scale slot is in line with the vertical crankcase jointing faces and the radius marked on the scale conforms with the outer diameter of the pulley.

3 - Draw a line 2—3 mm (.08"—.11") thick opposite to the ignition timing mark on the fan pulley with chalk or paint.

4 - Connect one lead of the testing light to the spark plug of cylinder No. 1 and the other lead to the disconnect spark plug cable (series connection).

5 - Connect tachometer.

6 - Start engine. — Hold testing light close to pulley and scale. The distributor functions properly if the white line on the pulley is steadily (not jerkily) moving within that field of the scale corresponding to the speed of the engine.



White Line at:	Speed	Advanced ignition by centrifugal mechanism
Scale Slot	Standstill	7.5°
1st Scale Line	Approx. 1200 R. P. M.	Approx. 8°—13°
2nd Scale Line	Approx. 2000 R. P. M.	Approx. 13.5—16.5°
3rd Scale Line	Approx. 3300 R. P. M.	Approx. 31.5—34.5°

Testing Vacuum Advance Mechanism

The vacuum advance is tested by comparing it with the centrifugal advance.

Procedure:

1 - Connect vacuum line.

2 - Let the engine run at approx. 2000 r.p.m. and point the light to the scale.

Should no tachometer be available, it is advisable to determine the position of the throttle (by turning the idling adjusting screw) which had been obtained at the second scale line (2000 r. p. m.) when checking the centrifugal advance mechanism.

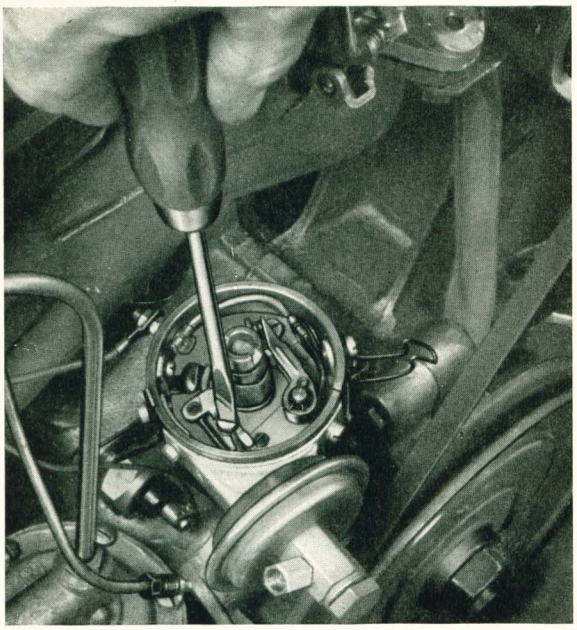
3 - The operation of the vacuum advance mechanism is correct if the advance is materially greater at 2000 r.p.m. than with the centrifugal mechanism only. If no increased advance is perceptible, check vacuum line and chamber for leaks. Renew damaged parts.

Removing and Installing Vacuum Advance Mechanism

1 - Detach vacuum line from vacuum chamber assembly.

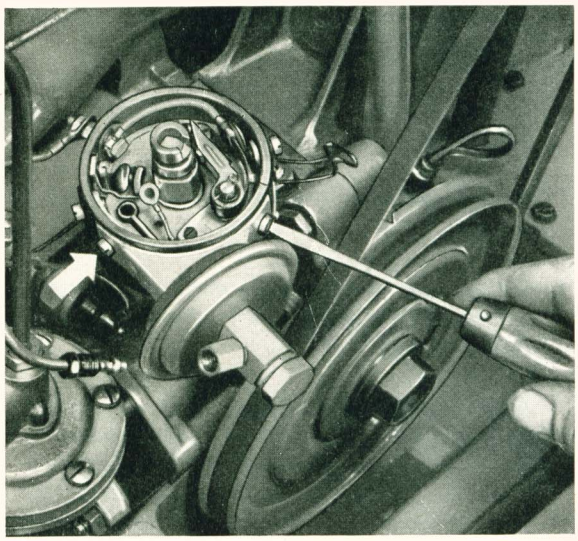
2 - Take off distributor cap and rotor.

3 - Take off pull rod bracket after having removed the screw.



4 - Remove the two vacuum chamber attaching screws.

5 - Remove vacuum chamber and pull rod.



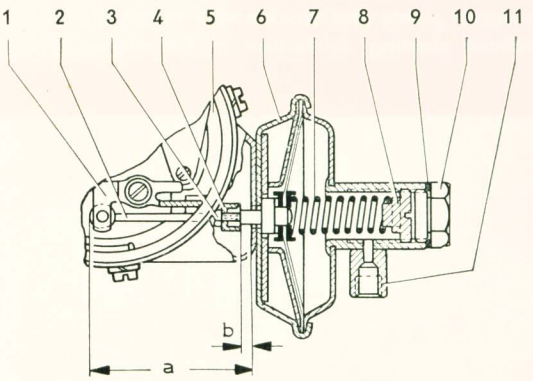
Installation is a reversal of the removal procedure, but the following points should be heeded:

1 - Reset breaker point gap and ignition timing.

2 - The spring in the vacuum chamber is set by the manufacturer by means of special tools and no attempt should be made to adjust it.

3 - Adjust pull rod (distance from vacuum chamber to pull rod end) to a = 43.4 ± 0.2 mm (1.709″ ± .008″).

4 - Adjust the adjusting nut on the pull rod (distance from nut face to vacuum chamber) to b = 3.5 ± 0.15 mm (.138″ ± .006″) and tighten counter nut.



1 - Pull rod bracket
2 - Pull rod
3 - Counter nut
4 - Adjusting nut
5 - Ignition distributor
6 - Vacuum chamber
7 - Vacuum chamber spring
8 - Spring seat
9 - Seal
10 - Plug
11 - Vacuum line connection

a = 43.4 < 0.2 mm (1.709″ < .008″)
b = 3.5 < 0.15 mm (.138″ < .006″)

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5 - Lightly grease pull rod with Universal Grease VW - A 052.

6 - Loosely attach vacuum chamber assy to the distributor.

7 - Tighten pull rod bracket screw and ground lead.

8 - Install rotor and bring the mark on the rotor in line with the mark on the edge of the distributor housing.

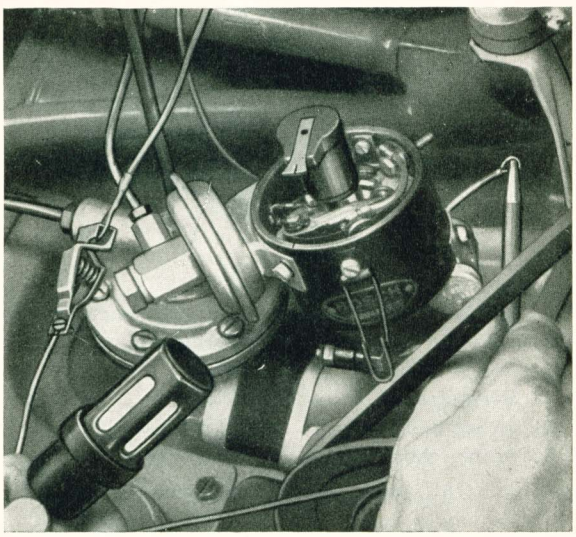
In this position, the breaker points should just have started to open (it is recommended to check by means of a 6-volt test lamp). Should it not be possible to obtain this condition by moving the vacuum chamber in the holes for the attaching screws, the dimension (a) of the pull rod should be altered and dimension (b) readjusted.

9 - Tighten vacuum chamber attaching screws.

Testing Condenser

The condenser is very important to obtain the required high voltage for the ignition. It also reduces the spark occurring between the points when they separate to prevent a premature burning of the points.

A defective condenser is indicated by burned breaker points and weak spark in connection with difficult starting, or failure of the engine to start.



Test

Modern testing equipment checks a condenser for high resistance, insulation leakage, and capacity.

If condenser testing equipment is not available, proceed as follows:

1 - Disconnect cable 1 and condenser cable at terminal of breaker arm.

2 - Connect the one lead of a 6-volt test lamp to terminal 1 at ignition coil and the other to the condenser cable.

3 - Switch on ignition. If the test lamp lights up, the condenser is grounded and should be replaced.

4 - Connect cable 1 and condenser cable.

5 - Disconnect high tension lead 4 at distributor cap and hold it approx. 1/4 inch from the crankcase or other suitable ground.

6 - Crank engine with ignition switched on. If no spark occurs at the prescribed distance, the check should be repeated with a new condenser.

Only use condenser of the prescribed type: ZKO 29/6 2 Z, as condensers of incorrect capacities will seriously affect breaker point life.

Removing and Installing Distributor

1 - Detach vacuum line from vacuum chamber.

2 - Disconnect cable from terminal 1 at distributor (loosen breaker point terminal screw).

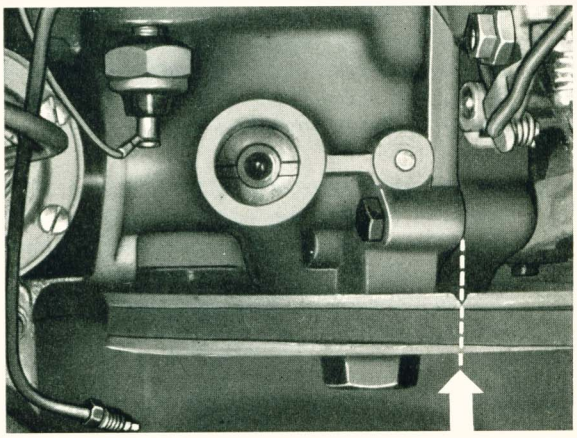
3 - Take off distributor cap.

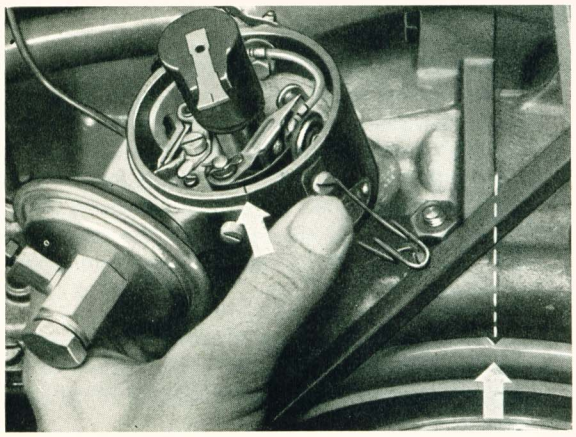
4 - Remove clamp screw of distributor retainer.

5 L Lift off distributor.

Installing the distributor is done in the reverse order, but the following points should be noted:

1 - Crank the engine until it is in the position for firing on the No. 1 cylinder. The slot of the distributor drive pinion must then be offset towards the rear and nearly parallel to the fan pulley while the fan pulley mark is in line with the crankcase jointing faces.





2 - Make sure the distance spring is properly seated in the distributor drive pinion head.

3 - When installing distributor, turn distributor shaft until the finger of the rotor points to the mark for cylinder No. 1 on the base rim and the shaft end enters the slot in the distributor drive pinion.

4 - Time the ignition.

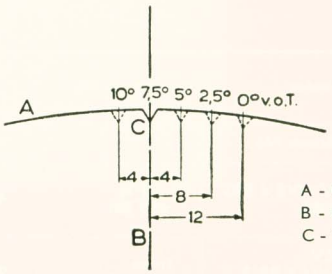
Note:

From Chassis No. 1 210 230 the vacuum line between the carburetor and the vacuum chamber at the distributor is bent to follow a different route than before.

On earlier cars, the vacuum line slightly roses from its connection at the carburetor and runs below the choke control cable along the fan housing to the vacuum chamber. The new line winds up from the carburetor by 10—15 mm (.39″—.59″) and runs below the accelerator cable to the vacuum chamber in the shortest possible way. This modification has been made to simplify the layout and to prevent fuel from entering the vacuum chamber.

Interchangeability of Ignition Distributors

The distributors BOSCH VJU 4 BR 2 and VJU 4 BR 3 used on 1192 c.c. engines up to Chassis No. 1-0702742 can be re-used when installing flat-head pistons; however the basic advance adjustment must be altered as indicated in the table below:



A - Outer dia. of fan pulley
B - Crankcase jointing faces
C - Timing mark

Ignition Distributor BOSCH	1192 c. c. Engine with compression ratio of 6.6:1				1192 c. c. Engine with compression ratio of 6.1:1			
	Fuel above 80 octane		Fuel below 80 octane		Fuel above 80 octane		Fuel below 80 octane	
	Ignition timing	Timing mark	Ignition timing	Timing mark	Ignition timing	Timing mark	Ignition timing	Timing mark
VJU 4 BR 2	2.5° before T. D. C.	8 mm (.3″) to the right of crankcase jointing faces	T. D. C.	12 mm (.47″) to the right of crankcase jointing faces	7.5° before T. D. C.	In line with crankcase jointing faces	7.5° before T. D. C.	In line with crankcase jointing faces
VJU 4 BR 3	5° before T. D. C.	4 mm (.16″) to the right of crankcase jointing faces	2.5° before T. D. C.	8 mm (.3″) to the right of crankcase jointing faces	7.5° before T. D. C.	In line with crankcase jointing faces	7.5° before T. D. C.	In line with crankcase jointing faces
VJU 4 BR 8	7.5° before T. D. C.	In line with crankcase jointing faces	7.5° before T. D. C.	In line with crankcase jointing faces	10° before T. D. C.	4 mm (.16″) to the left of crankcase jointing faces	10° before T. D. C.	4 mm (.16″) to the left of crankcase jointing faces

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Points to observe

1 - Important for a correct timing is the position of the timing mark on the fan pulley to the crankcase jointing faces. For example "8 mm (.3") to the right" in the column "Timing Mark" means that the timing mark must be 8 mm (.3") to the right as measured from the crankcase jointing faces to obtain the required 2.5° before T. D. C. of the corresponding distributor.

2 - The antiknock qualities of ordinary fuel are now in Germany from 80 to 84 octane, and super fuels are rated between 86 and 90 octane (Res. F. 1).

The octane rating of fuels in other countries will be given by the Service Department on request.

3 - With the Ignition Distributor VJU 4 BR 2 a loss of power of about 3 per cent is likely up to 1800 r.p.m. on account of the smaller amount of advance. At a speed of about 2200—2400 r.p.m. a slight gain in power can be expected, whereas the power will slightly drop again at higher speeds.

4 - The use of the Ignition Distributor VJU 4 BR 3 involves a slight loss of power and a somewhat higher fuel consumption, which is, however, practically immaterial.

Both distributors have a slight increase in the engine noise in common, this noise is particularly connected with the distributor VJU 4 BR 2. The noise must be put up with when not using distributor VJU 4 BR 8.

5 - The Ignition Distributor BOSCH VJU 4 BR 8 can also installed on engines equipped with earlier type pistons. The basic adjustment must then be altered to 10 degrees before T. D. C. (timing mark is 4 mm to the left of the crankcase jointing faces).

Note:

To be made dust-proof, the ignition distributor BOSCH VJU 4 BR 8 requires merely the installation of a cover plate (Part No. 919 135 a) when operating in dust-laden atmosphere. It is **not** necessary to replace the rotor.

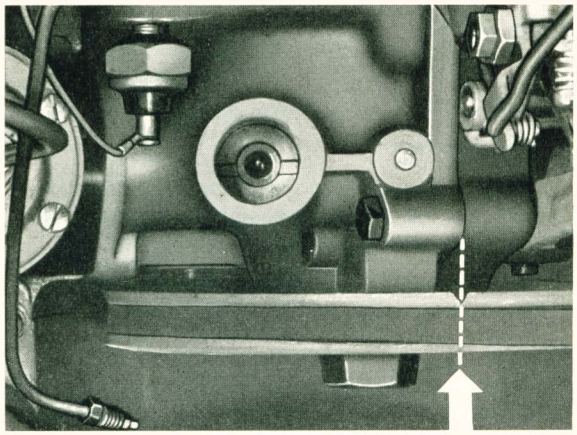
Up to Chassis No. 1 - 702 741 it is necessary to replace the rotor by that of the Part Number 919 141 a.

Ignition Distributor and Screened Rotor

When installing a car radio, it should be made sure that the required screened rotor is of the right type to suit the distributor.

BOSCH distributors and screened rotors should be matched in accordance with the chart given below.

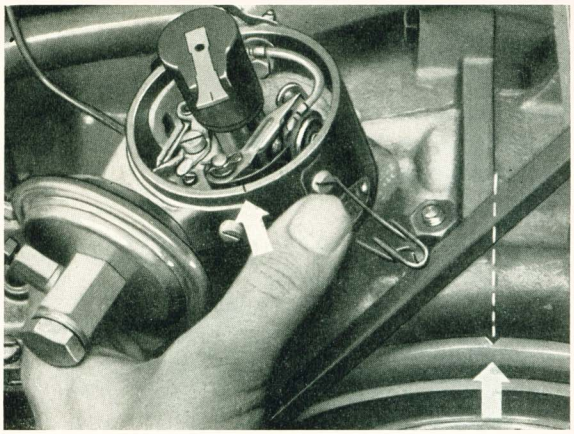
Ignition Distributor		Engine No.	Distributor Cap	Standard Rotor	Screened Rotor	Dust Cover
Part No.	Bosch No.		Part No.	Part No.	Part No.	Part No.
919 021 a	ZV/VE 4 BRS 383	1 to 695 281	919 105 a	919 141 b	919 141 d*)	919 135
11 919 021 a discontinued	ZV/ VJU 4 BR 3 (mk)	from 695 282	919 105 b	919 141 c	919 141 e	919 135 a
11 919 021 b	ZV/ VJU 4 BR 8 (mk)	from 849 905 also suitable from 695 282	919 105 b	919 141 c	919 141 e	919 135 a
			*) Requires distributor cap Part No. 919 105			



2 - Make sure the distance spring is properly seated in the distributor drive pinion head.

3 - When installing distributor, turn distributor shaft until the finger of the rotor points to the mark for cylinder No. 1 on the base rim and the shaft end enters the slot in the distributor drive pinion.

4 - Time the ignition.



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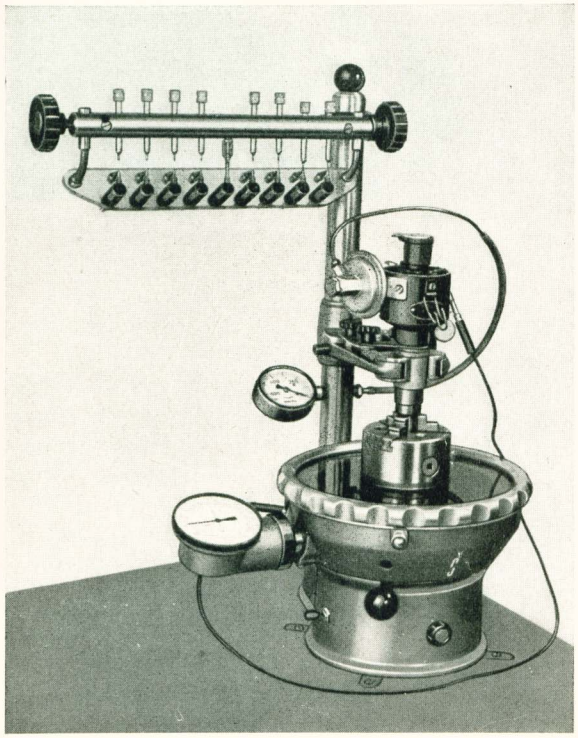
Spark Advance Tests

Ignition Distributor Types:

BOSCH VJU 4 BR 3 mk

BOSCH VJU 4 BR 8 mk

For an accurate checking of the centrifugal and vacuum advance, the distributor should be mounted in a suitable test stand.



The spark advance must comply with the specifications given on the reverse side.

To check the spark advance, the following procedure should be adopted:

1 - The centrifugal advance can be checked throughout the complete speed range, but it is generally sufficient to check at the crankshaft RPM printed in red.

If the spark advance is not up to the specifications, thoroughly check the centrifugal advance mechanism, including the springs. Clean, grease, or replace parts as found necessary.

Important!

When disassembling distributor, note the position of the two weights, which are of different shapes.

To maintain peak engine performance, it is necessary to check the dwell angle whenever having the distributor disassembled or the breaker points replaced.

Dwell angle of BOSCH Ignition Distributor

VJU 4 BR 3 mk = 50 to 55 degrees

VJU 4 BR 8 mk = 52 to 56 degrees

2 - If the centrifugal advance mechanism is found to operate perfectly, the vacuum advance should be checked at a constant RPM within a range where the centrifugal weights do not come into action (e.g., with the Bosch distributor VJU 4 BR 8 mk, this is between 1500 and 2000 crankshaft RPM). After the exact degree has been determined, the vacuum spark advance can be checked through the complete speed range by means of a vacuum pump.

The vacuum advance can be corrected by removing the vacuum chamber plug and adjusting the spring. If necessary, check vacuum chamber and vacuum line for leaks. Replace defective parts.

Note:

The instruction given in page E 5—13 under point 2 (Installation) does not apply, if suitable testing equipment is available.

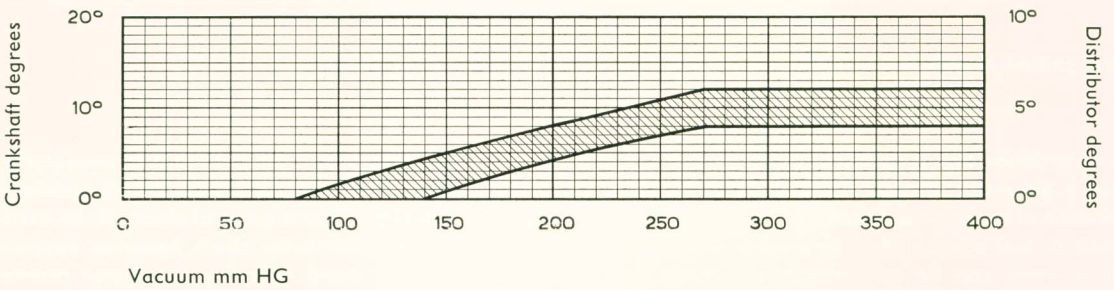
With the ignition distributor mounted on the engine, only the centrifugal spark advance should be checked with a timing light. The scale provided with a graduation from 0 to 35 degrees is attached to the crankcase and shows in connection with the ignition timing light the setting of the ignition and the action of the centrifugal advance mechanism.

Ignition Distributor Bosch VJU 4 BR 8 mk

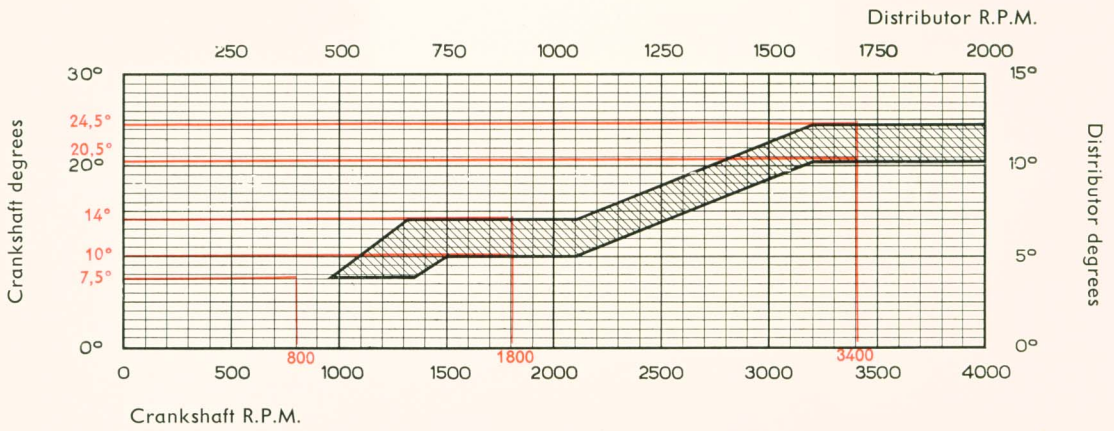
From Chassis No. 1 113 449

Beginning with the above chassis number, the centrifugal and vacuum spark advance curves of the ignition distributor BOSCH VJU 4 BR 8 mk have been slightly altered. The type number of the distributor remains unchanged. The figures and letters stamped on the distributor body above the fire protection screen indicate month and year of construction for easy identification. The modification in question is incorporated in all distributors of the aforementioned type from "3 M" onwards, the figure "3" standing for **March** and the letter "M" for **1956**. The months are indicated by the figures from 1 to 12, while the years are shown by letter in alphabetical order (e.g. M = 1956, N = 1957, etc.).

Vacuum Advance



Centrifugal Advance



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Ignition Timing

Special attention has to be paid to the checking and adjusting of ignition timing. Time and again it has been found that the ignition is advanced at will as compared to standard setting. Quite obviously, ignition advance is recurred to in order to increase engine output or to reduce fuel consumption. Actually, however, such an arbitrary advance will result in the permissible advance limits being exceeded in certain speed ranges. Engine output will then not be higher than with the specified ignition timing but operation will become abnormally noisy. Furthermore, working under load in the lower speed range, there will appear a certain tendency toward ignition knock while with the correct setting, and using normal gasoline (76 octane Res. F 1), the engine can be operated without any knock at all.

Consequently, it will be absolutely necessary to comply under all circumstances with the ignition timing specified for the engines of the various years of construction and for the requisite ignition distributors.

> Adjustment of the ignition timing by means of the notch on the belt pulley and of the crankcase should be carried out only with the engine cold.

If the ignition is adjusted with the engine hot, there will be too much advance.

The distributor has a centrifugal governor and, in the case of VW Passenger Cars of recent production, a vacuum governor. Proper functioning and setting of this governing device are essential for the satisfactory operation of the engine. Ignition testing lamp and control scale are sufficient for a general check. If, on account of output, fuel consumption or engine noise, a more thorough ignition distributor check becomes necessary, such a check can be carried out accurately only on a special testing stand with the distributor removed. Applying the trial and error method with other distributors of which the correct setting is not known will not serve any useful purpose.

Engines found to have an arbitrarily advanced ignition setting should be adjusted to the correct timing without delay. In any event, it will be advisable to inform the customer accordingly. Prolonged operation at advanced ignition may result in a premature increase of main bearing play.

Headlights

General Description

The built-in headlights combine high beam, low beam and parking light. The two-filament bulb for the high and low beam and a ball lamp for the parking light are attached to one common holder, which is secured in position by a tension spring or a clip.

The headlight beams can be aimed vertically and horizontally.

Lamp Types:

Two-filament bulb B 6 V 35/35 W DIN 72601

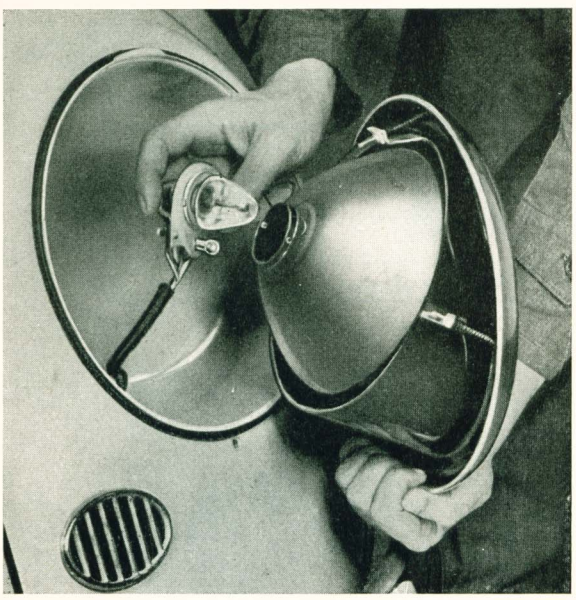
Parking light bulb H 6 V 1.5 W DIN 72601

Bulb Replacement

1 - Loosen the slotted screw at the bottom of the headlight rim.

2 - Pull out the lens and reflector unit.

3 - Turn down clip or unhook tension spring and remove lamp holder.



4 - Replace bulb.

When replacing a bulb, make sure the new bulb is clean and not loose in its socket. Only use bulbs recommended or supplied by the factory. Never use headlight bulbs which differ in colour or candlepower.

Lens Replacement

1 - Remove lens and reflector unit.

2 - Take off lamp holder.

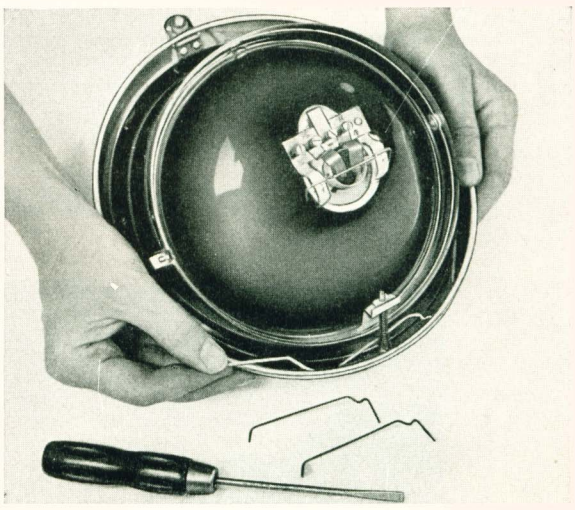
3 - Remove lens retaining spring clips from rim by means of a screwdriver (Bosch Headlights: 8 spring clips; Hella Headlights: 2 spring clips).

4 - Lift up retaining ring and reflector so that the lens and gasket can be removed.

5 - Place gasket on new lens and put the lens in the rim, taking care that the VW sign is upright.

6 - Place retaining ring and reflector in position and check if gasket is correctly seated between rim and retaining ring.

7 - Refit spring clips.



When replacing a lens, the reflector must not be touched, as the effect of the sensitive reflecting surface may otherwise be considerably reduced.

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Aiming Headlights

Headlight beams can easily and quickly be aimed by devices which consist of a series of prisms and reflectors that throw a miniature pattern of the illuminating pattern on a screen, only a foot or so from the lens.

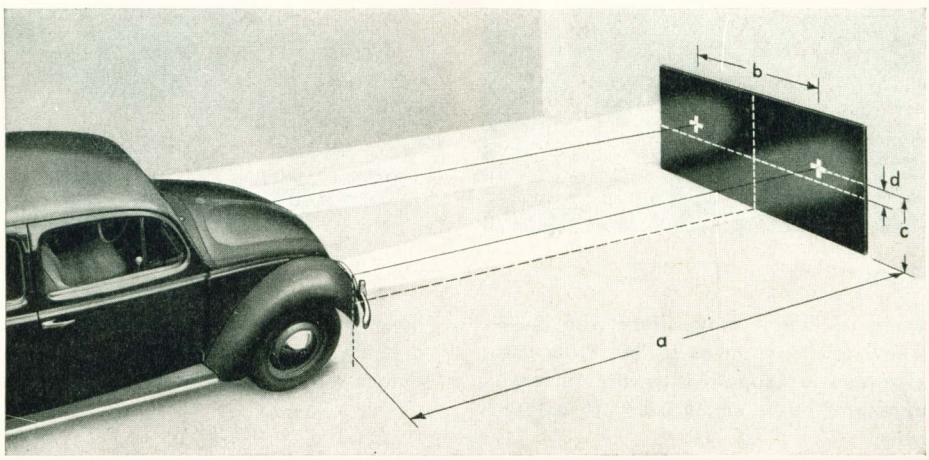
If such equipment is not available, the headlight can be aimed by means of a screen as instructed below:

Stop the car on a smooth, level floor with a dark-coloured vertical screen 5 m (16 feet 5 in.) ahead. The car should be normally laden and the tires properly inflated to assure correct adjustment. The center line of the car must hit the center of the screen exactly between the two cross marks. Switch on the high beams and check the illuminating patterns at the cross marks.

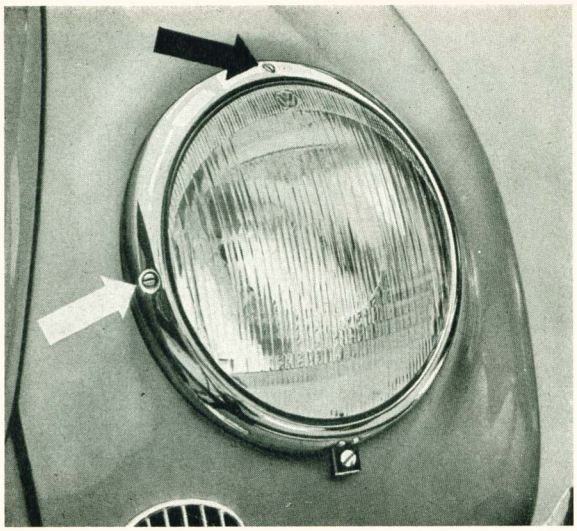
Independent adjustment of both horizontal and vertical aim is provided with the adjustment screws in the headlight rim.

After aiming has been completed, switch on low beams and check distance between the upper limit of the light spot and the center of the cross which should amount to 5 cm (2″).

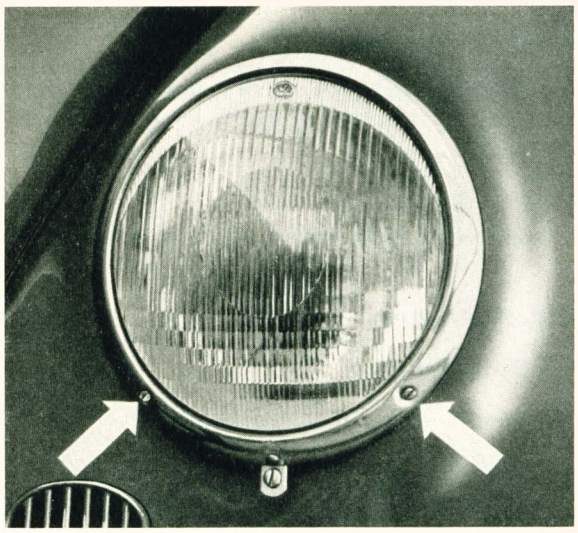
Dimensions for Screen		
a	Distance from lens to screen	5 m (16 ft. 5 in.)
b	Distance between crosses	1104 mm (3 ft. 7 in.)
c	Height of crosses	610 mm (2 ft.)
d	Distance between upper limit of low beam and center of cross	50 mm (2″)



BOSCH



HELLA



Adjustment	Bosch	Hella
Vertical	Turn upper screw to right — beam swings down to left — beam swings up	Turn left screw to right — beam swings up to left — beam swings down
Horizontal	Turn right screw to right — beams swings to left to left — beam swings to right	Turn right screw to right — beam swings to right to left — beam swings to left

("Right" and "Left" screw means in driving direction)

Headlight Indicator Lamp

General Description

When switching on the high beam, a blue control lamp in the instrument board lights up. The lamp is connected with the cable to terminal 56 a (high beam) of the right headlamp.

Lamp Type:

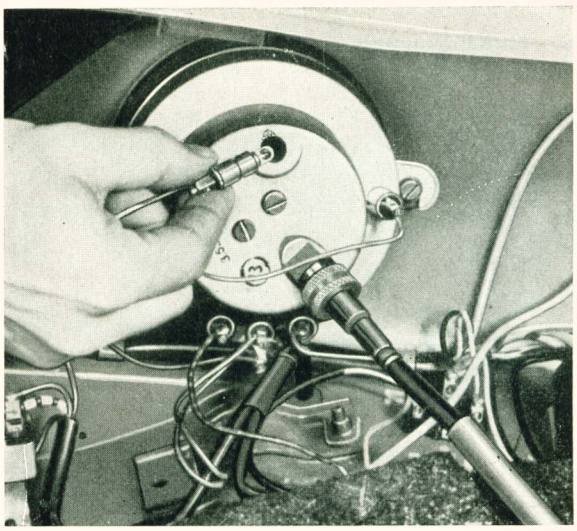
Indicator lamp J 6 V 1.2 W DIN 72601

Bulb Replacement

The bulb is accessible after the front hood has been opened and the lining in front of the instrument panel turned down.

1 - Pull out socket and bulb.

2 - Slightly press bulb into its socket, turn it slightly and pull it out.



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License Plate Light

General Description

The license plate light housing is fitted to the rear hood and is accessible by opening the rear hood.

Lamp Type:

License plate light bulb L 6 V 5 W DIN 72601

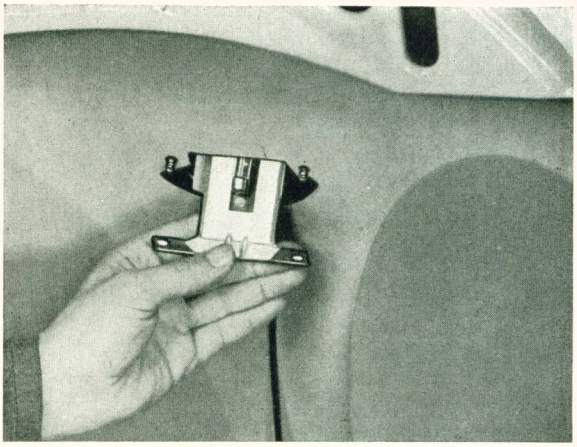
Bulb Replacement

1 - Open rear hood.

2 - Remove wing nuts and take off lamp holder.

3 - Replace bulb.

To make sure that the bulb is tightly seated and makes good contact, check the pre-tension of the contact springs and clean them if dirt is present. Check housing gasket and renew it if found necessary.



Note:

From August 1951 the number plate light on the rear hood is provided with a dome-shaped diffusing lens and is positioned higher for better illumination of the new number plate. The tubular-shaped bulb is replaced by a 10 Watt bulb G 6 V 10 W DIN T 2601.

Stop Light Switch

Mechanical Brake

The stop light switch of the mechanical brake is situated under the frame head cover and is operated by the foot brake push bar.

Adjustment:

1 - Remove frame head cover.

2 - Pull parking brake lever by two notches.

3 - Loosen counternut of adjusting screw.

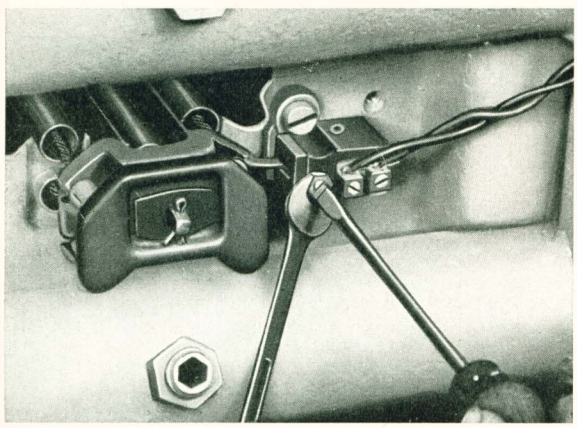
4 - Turn adjusting screw until stop lamp lights up; then turn it back until the lamp is just going out.

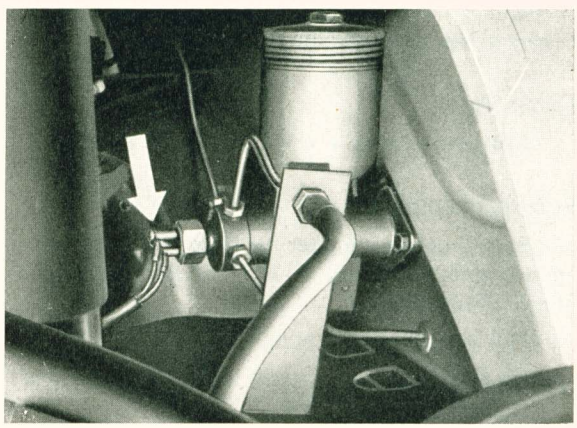
5 - Tighten counternut of adjusting screw.

6 - Replace frame head cover.

Hydraulic Brake:

The stop light switch of the hydraulic brake is situated at the brake master cylinder and is not adjustable.

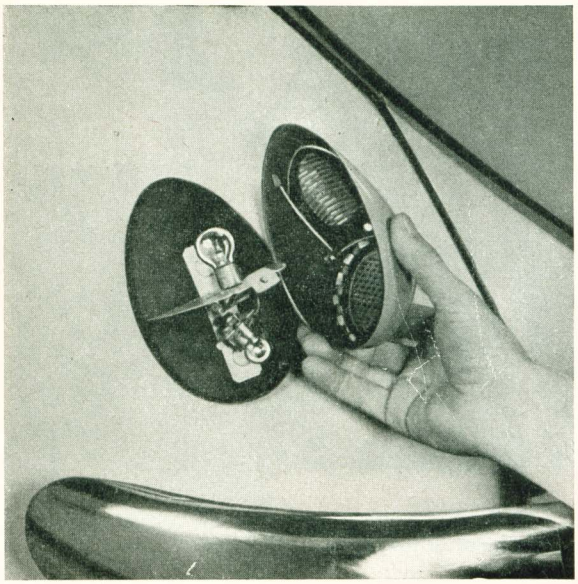




Stop and Tail Lights

General Description

The combined stop and tail lights, including reflectors, are located one on each rear fender.



Lamp Types:

Stop light bulb F 6 V 15 W DIN 72601

Tail light bulb G 6 V 5 W DIN 72601

Bulb Replacement

1 - Remove slotted screws and take off stop and tail light housing.

2 - Replace the bulbs, taking care that they are tightly seated and make good contact.

3 - Check condition of housing gasket and renew it if found necessary.

4 - The lamp holder can be taken off by disconnecting the cable and removing the nuts accessible from under the fender.

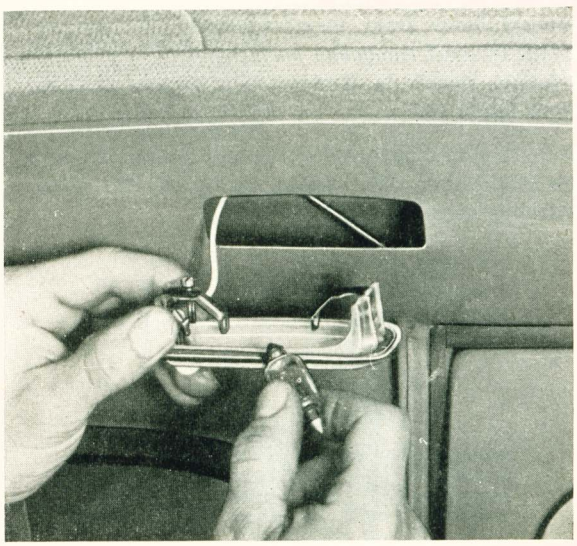
Note:

When replacing the tail lamp glass or the reflector glass, use Sealing Compound D 15 to obtain a perfect seal. Take about 10 grammes (.35 oz.) of the compound, knead it in the hand and roll a sort of strand of about 3 mm diam. (.12").

Interior Light

General Description

The interior light, operated by a tumbler switch below the instrument panel, is situated in the left-hand roof side member above the door pillar. The interior light incorporates a tumbler switch which permits the light to be switched off with the doors of the De Luxe or Convertible open.



Lamp Type:

Bulb L 6 V 5 W DIN 72601

Bulb Replacement

1 - Grip the interior light rim at both ends, and pull it off the roof side member.

2 - Replace the bulb, taking care that it is tightly seated and makes good contact.

Door Contact Switch

The Volkswagen De Luxe and Convertible are additionally fitted with a door contact switch on each side. They are parallel connected to the switch in the instrument board and operate the interior light when a door is opened.

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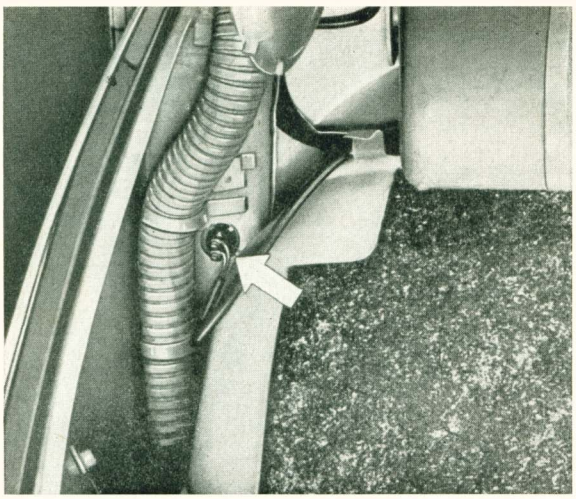
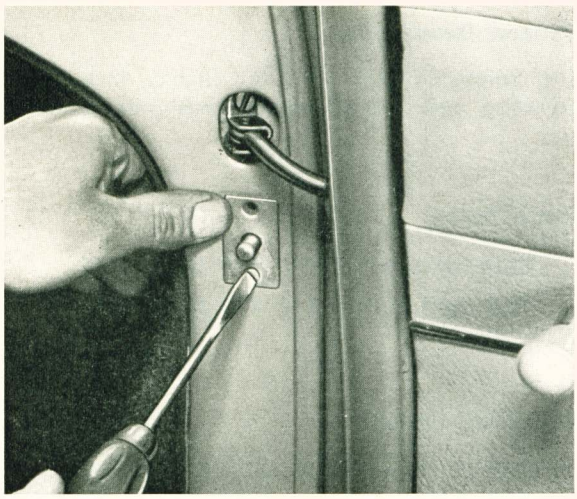
Removing and Installing Door Contact Switch



1 - Open front hood and turn down the lining in front of the instrument panel.

2 - Remove contact switch retaining screws.



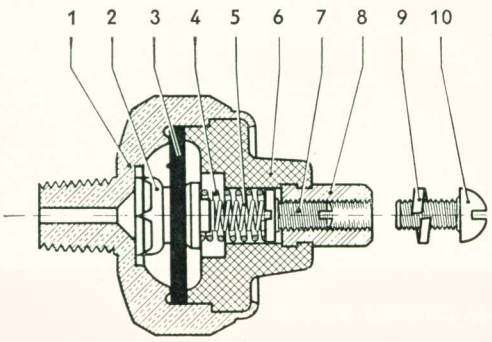
3 - Withdraw contact switch and disconnect cable. Installation is a reversal of the preceding operations.

Oil Pressure Switch

General Description

The oil pressure switch is installed in the oil pressure line between oil pump and oil cooler. With the engine not operating, the spring-loaded contact, which is connected with a diaphragm, is closed. After the ignition had been switched on, battery current flows from terminal 15 of the ignition switch through the green warning lamp and the oil pressure switch to ground. The green warning lamp lights up.

With the engine operating, the oil pressure actuates the diaphragm. The contact opens and the green warning lamp goes out.

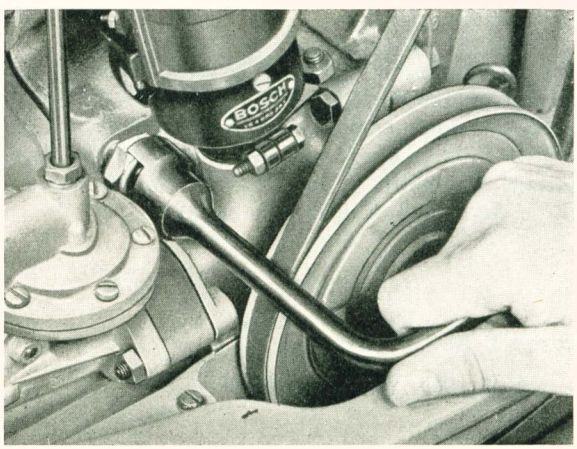


1 - Switch body
2 - Contact
3 - Diaphragm
4 - Pressure spring, outer
5 - Pressure spring, inner
6 - Insulation
7 - Adjusting screw
8 - Terminal
9 - Lockring
10 - End Screw

Removal

1 - Disconnect cable at oil pressure switch.

2 - Remove oil pressure switch with wrench VW 159.



Installation

Sealing is effected by the tapered thread. Do not use undue force to tighten the switch to avoid damaging the thread.

After installation, the switch should be checked in connection with the green warning light in the speedometer dial.

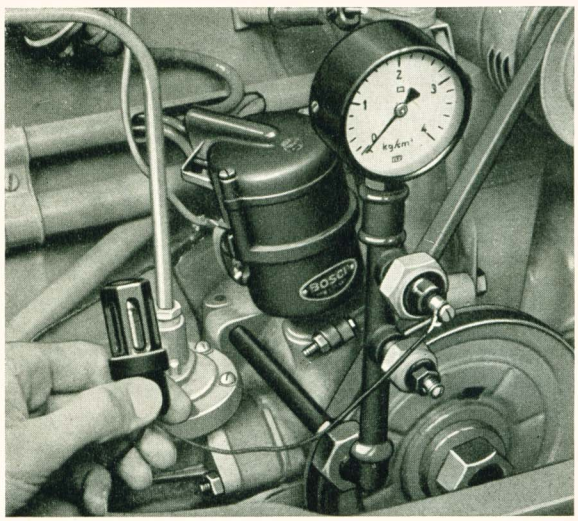
Adjusting Oil Pressure Switch

The oil pressure switch can be adjusted by means of special testing equipment or, on the engine, by a simple testing device with a manometer (drawing VW 963 for local manufacture) and a test lamp, after the engine has attained operating temperature.

1 - Screw oil pressure switch into the testing device.

2 - Screw testing device into seat for oil pressure switch and connect one lead of the test lamp to the oil pressure switch and the other lead to terminal 15 at ignition coil. The test lamp should then light up. Otherwise, turn the adjusting screw clockwise by a narrow screwdriver. If the lamp does not light up, the switch is defective and must be replaced.

3 - Start engine. The lamp must go out when the manometer indicates pressure above 0.4—0.6 atm. (5.7—8.5 lbs./sq. in.) At a lower pressure, the contact should be closed and the lamp light up. With the engine cold, the lamp should go out at normal idling speed, and with the engine warm, it should go out as the speed increases.



If the lamp goes out too late, the adjusting screw must be turned anti-clockwise.

4 - Stop engine. The test lamp is likely to go out later, as the oil pressure decreases slowly.

Beside an adjustment of the pressure switch, no other maintenance operations are required.

Oil Pressure Warning Lamp

General Description

The green oil pressure warning lamp is between terminal 15 at ignition switch and oil pressure switch terminal. The warning lamp lights up when switching on the ignition and at low oil pressure.

Lamp Type:

Warning Lamp J 6 V 1.2 W DIN 72601

Replacing Bulb

The lamp is accessible after the front hood has been opened and the lining in front of the instrument panel removed.

1 - Pull out socket and bulb from speedometer.

2 - Slightly press down the bulb into its socket, turn it slightly and pull it out.

Note:

If the lamp lights up continuously during the ride, the chances are that the oil circulation has been interrupted, which means that the lubrication of the engine has ceased.

An occasional lighting up of the lamp with the engine warm and at low speed does not indicate trouble, if it goes out again as the speed increases. At low outside temperatures the lamp lights up in general only at idling speed, but at high outside temperatures the lamp may also light up at low speed in the various gears, or when changing gears, if the engine oil has a very low viscosity.

The engine oils now in use are of a comparatively low viscosity. This is advantageous with a view to an easy starting of a cold engine (low frictional loss) and favourable lubricating and cooling conditions of all moving parts, as there is a high velocity of the oil circulation at comparatively low pressure. If the oil pressure control lamp goes out not earlier than at high speeds, check adjustment of oil pressure switch before suspecting any other part.

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Stop and Tail Lights

(From August 1955)

Description

Each rear fender carries a combined stop and tail lamp with reflex reflector and a two-filament bulb.

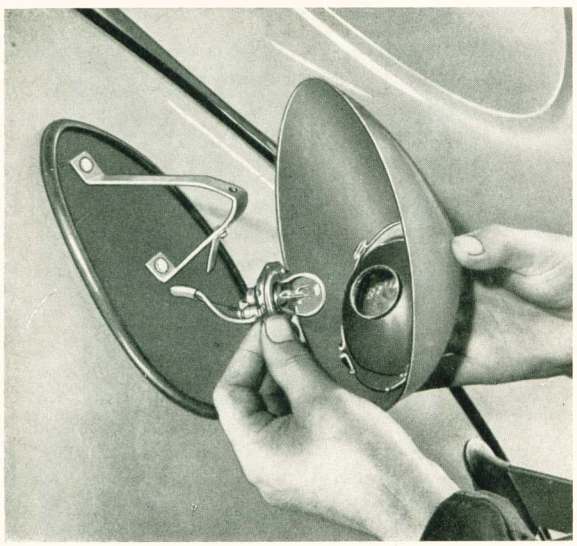
Lamp Type

Two filament bulb 6 V 5/20 W DIN 72601

Bulb Replacement

1 - Take off the bezel after having removed the Phillips screw.

2 - Withdraw the bulb holder from the reflector.



3 - Replace bulb. Make sure the bulb is tight and is making perfect contact.

4 - Be sure the rubber strip between bezel and fender is in perfect condition, replace if necessary.

5 - When placing the bezel in position, care should be taken to insure that the rubber strip lip embraces the bezel.

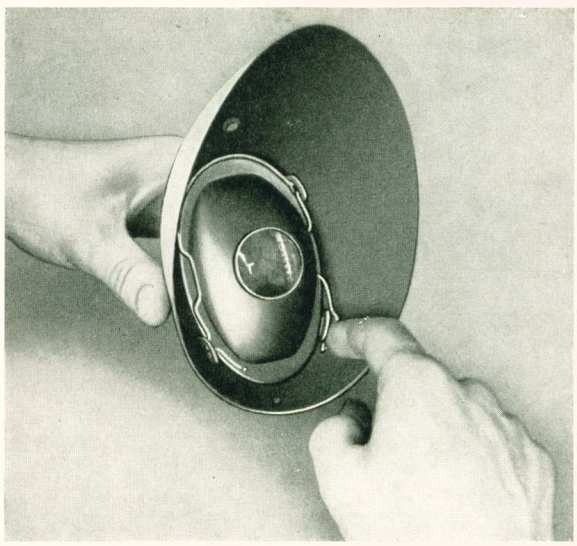
6 - The bezel mounting bracket can be taken off after removing the two nuts from below the fender.

Reflex Reflector Replacement

1 - Take off the bezel after having removed the Phillips screw.

2 - Withdraw the bulb holder from the reflector.

3 - Remove reflector spring clip by pressing it out of the retaining noses. Take off reflector and reflex reflector (glass).



4 - Install new reflex reflector.

5 - When placing the bezel in position, be sure the rubber strip lip embraces the bezel.

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Headlamps

General Description

The flush fitting headlamps in the front fenders combine high beams, low beams, and parking lights (side lights). The two filament bulb for the high and low beams and the parking light bulb are attached to one common holder held in position by a tension spring.

Provision is made for the headlight beams to be aimed vertically and horizontally.

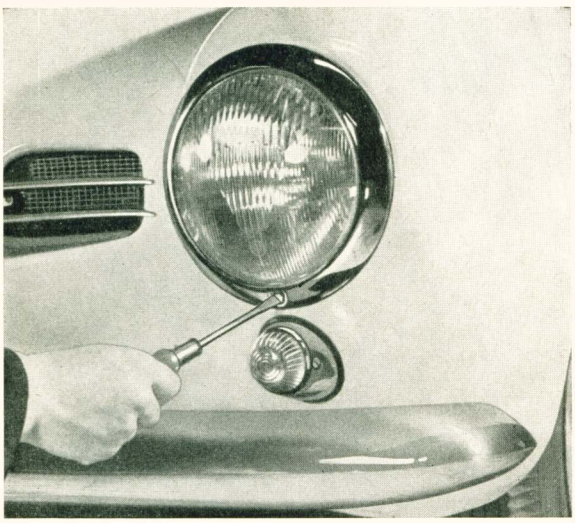
Lamp Types:

Two filament bulb B 6 V 35/35 W DIN 72601

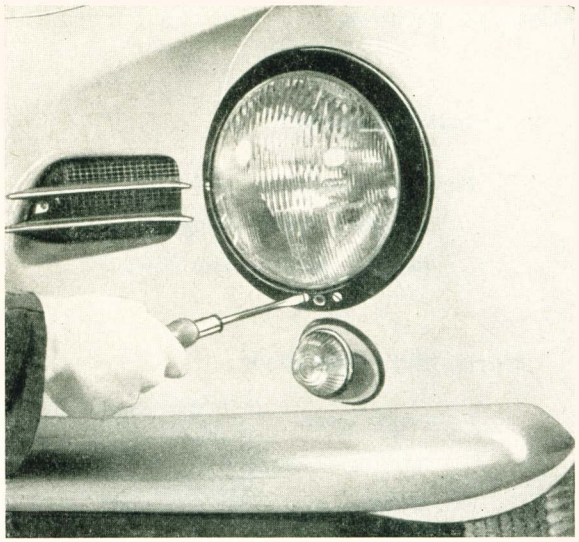
Parking light bulb H 6 V 2 W DIN 72601

Bulb Replacement

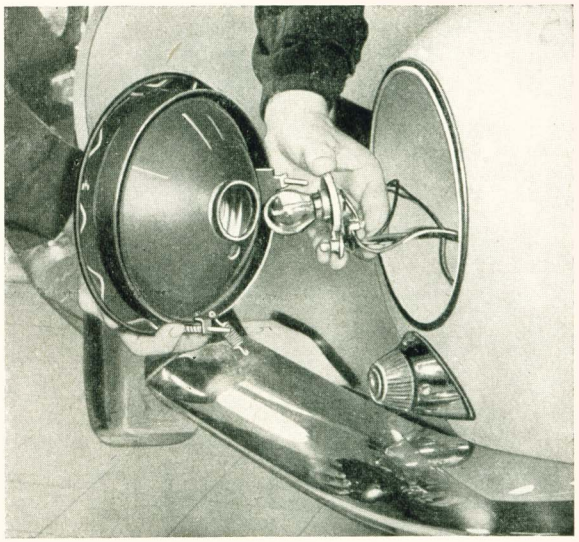
1 - Remove the slotted screw at the bottom of the front rim, and unhook the rim from the top engagement for removal.



2 - Loosen the fixing screw at the bottom of the light unit rim and pull out the light unit.



3 - Unhook the tension spring, and pull out the lamp holder.



4 - Replace the bulb.

When replacing a bulb, make sure the new bulb is clean and not loose in its socket. Only use bulbs recommended or supplied by the factory. Never use headlight bulbs which differ in colour or candle-power.

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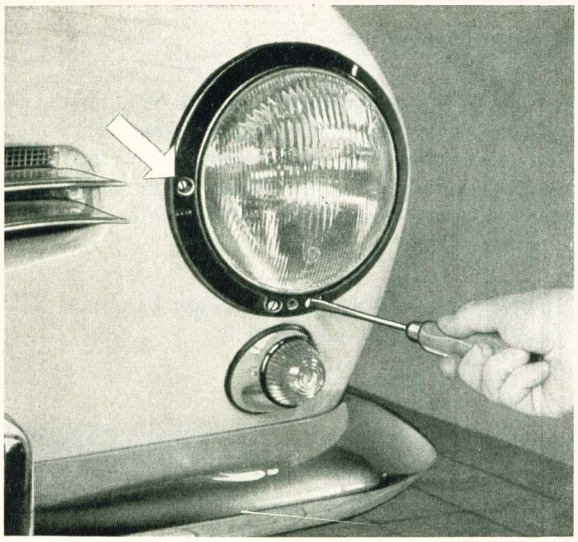
Aiming Headlights

Access to the adjusting screws is obtained by removing the front rim.



Vertical Adjustment

Turn lower screw

to right — beam swings up

to left — beam swings down

Horizontal Adjustment

Turn right screw

to right — beam swings to left

to left — beam swings to right

Stop and Tail Lights

General Description

The combined stop/tail lights with reflex reflectors are flush fitting in the rear fenders. One bulb on each side serves for both direction indicator light and stop light. When applying the brake with the direction indicator turned on, one of the two stop lights flashes.

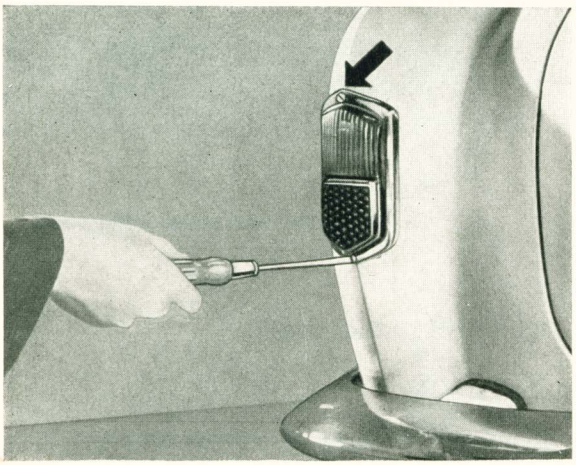
Lamp Types:

Stop light bulb 6 V 15 W

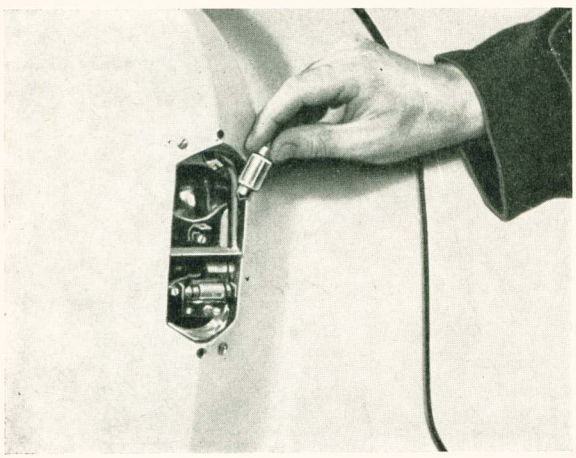
Tail light bulb L 6 V 5 W
DIN 72601

Bulb Replacement

1 - Remove the two slotted screws and take off rim and lens.



2 - Replace bulbs. Be sure the bulbs make perfect contact in their sockets.



3 - In assembling, care should be taken to insure that the rim is properly seated and there is a perfect seal between fender and lens. If found necessary, take about 20 grammes (.7 oz.) of Sealing Compound D 15 and roll a sort of strand of about 3 mm (.12") dia.

Stop/Tail Light Housing Replacement

1 - Remove the two slotted screws and take off rim and lens.

2 - Disconnect the cables.

3 - Open the rear hood and turn back the trim panel to gain access to the housing.

4 - Remove the two housing attaching screws, while holding the corresponding threaded plates from inside the engine compartment.

5 - Take off the housing from inside the engine compartment.

6 - Check condition of gasket between housing and fender, replace if found necessary.

7 - When installing the housing, make sure the gasket is properly seated.

8 - Be sure the holes for the lens rim fixing screws register with the corresponding holes of the threaded plates.

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License Plate Light

The two bulbs of the license plate light are accessible by opening the rear hood.

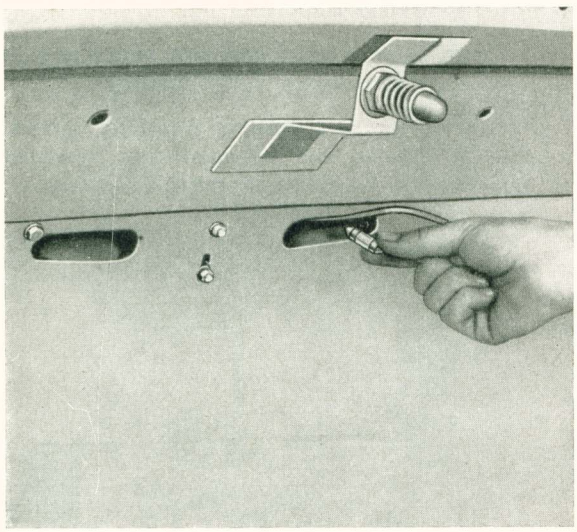
Lamp Type:

License plate light bulb L 6 V 5 W DIN 72601

Bulb Replacement

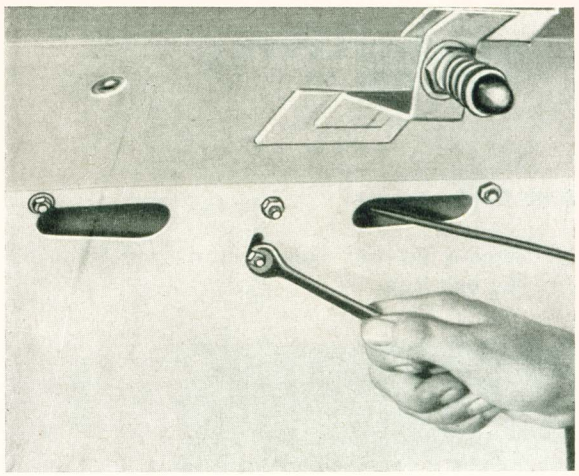
1 - Open rear hood.

2 - Remove bulbs through the openings and replace them.



License Plate Light Housing Removal and Installation

1 - Remove the four nuts.



2 - Disconnect the cables and remove the bulbs.

3 - Take off rubber gasket.

To install, reverse the above procedure and make sure the rubber gasket is properly positioned.

Interior Light

The interior lamp is automatically operated by opening or closing either of the doors. A manual three-position switch incorporated in the lamp fitting allows the light to be turned off with the doors open.

Positions of switch:

Upper	— on
Intermediate	— off
Lower	— door contacts

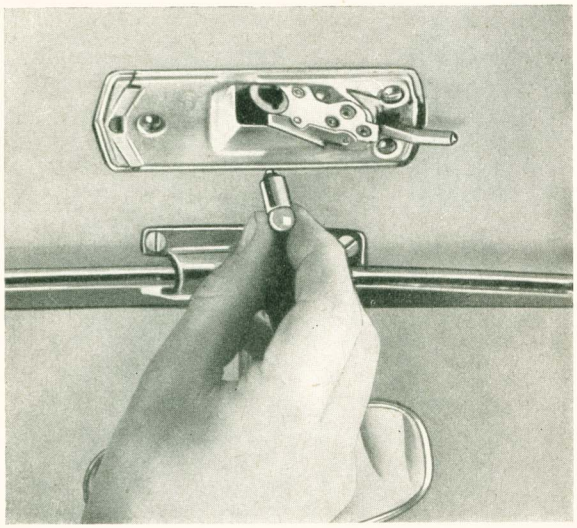
Lamp Type:

Bulb 6 V 5 W DIN 72601

Bulb Replacement

1 - Pull off glass and rim with both hands.

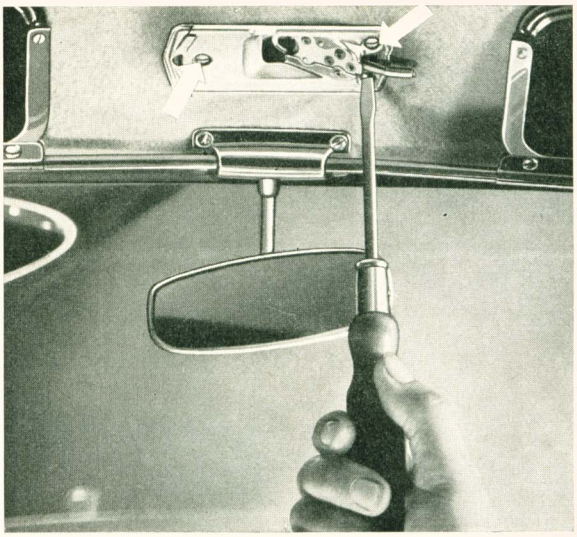
2 - Replace the bulb.



Lamp Fitting Removal

1 - Pull off glass and rim.

2 - Remove the three fixing screws and take off the fitting.



3 - Disconnect the two cables.

To install, reverse the preceding operations and make sure the cables are properly connected.

Door Contact Switch

Each door is provided with a contact switch, by means of which the interior light is automatically turned on with the lamp tumbler switch in the lower position.

Door Contact Switch Replacement

1 - Pull door contact switch out of the door hinge pillar.

2 - Disconnect the cable.

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Windshield Wiper

General Description

The windshield wiper motor and linkage for both wiper blades are attached to one common bracket, which is accessible after the front hood has been opened. The windshield wiper switch is to the right of the steering column.

Maintenance

All moving joints of the windshield wiper gearing and linkage should be oiled at regular intervals. Check if the wiper blades bear evenly on the windshield and make sure that the sweep, or stroke, adjustment is correct, so that the sweep is not farther to one side than to the other.

Removing and Installing Windshield Wiper

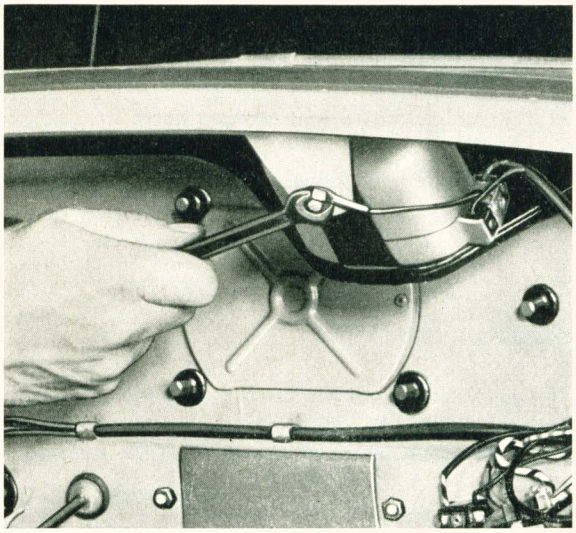
1 - Release fixing screw that holds wiper arms to the clamping brackets and take off wiper arms.

2 - Remove hex. nut with bonnet washer and outer rubber bush at both wiper arm bearings.

3 - Disconnect cable at windshield wiper motor.

4 - Remove bolt and nut that attach windshield wiper mounting bracket to body.

5 - Withdraw bracket complete with motor and linkage.



Installation is a reversal of the above, but the following points should be observed.

1 - Adjust mounting bracket by moving it in its clearance hole until the wiper bearing shaft is square to the windshield.

2 - Note correct arrangement of bonnet washers and rubber bushes.

3 - Connect ground cable.

Electrical Horn

General Descriptions

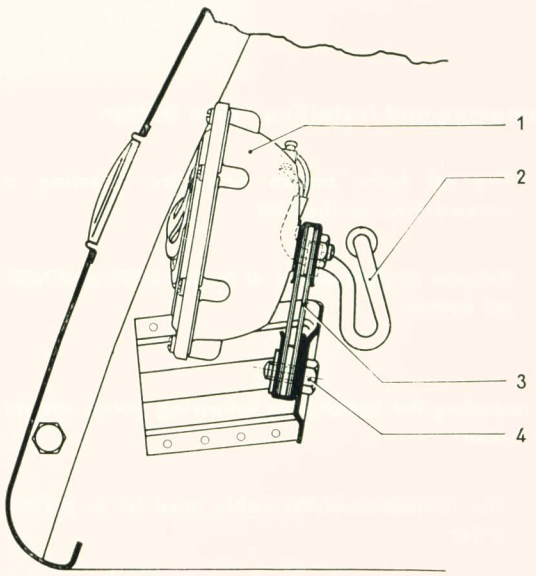
An electro-magnet in the horn produces vibration in connection with a breaker mechanism. The vibration is transmitted to the diaphragm, which produces the sound. A condenser or short circuit ring reduces the tension of the spark occurring between the points of the breaker mechanism to avoid damage by burning. The horn is operated by a push button switch on the steering wheel hub, which closes the circuit with ground (negative terminal of battery). Current is drawn through a brush in the steering column tube and a sliding contact ring on the steering column.

Note:

From Chassis No. 1 - 0 950 000 the body of the electric horn — made by Hella — is covered with a perforated plate to prevent ingress of small stones. Additionally, the water drain slots are made wider to allow splash water that may have entered to drain off quickly.

Maintenance

Care should be taken that the horn bracket is not damaged and the horn does not touch the body, as the vibration will otherwise be affected. Damage may result from worn or dirty breaker points, ingress of water, and defective condenser.



1 - Horn
2 - Cable
3 - Bracket
4 - Bolt

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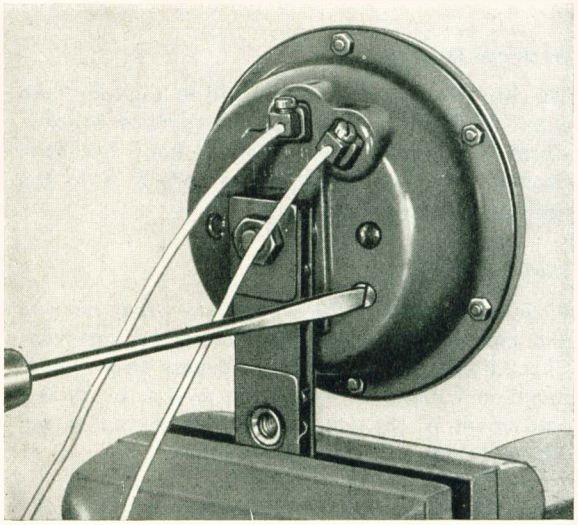
Removing and Installing Electric Horn

1 - Remove bolt at horn bracket under left-hand front fender.

2 - Disconnect cable and remove horn.

When installing the horn, make sure that it does not contact the body.



Adjusting Electric Horn

The performance of the horn is affected by worn breaker points. An adjustment is made by means of the adjusting screw on the back of the housing.

1 - Remove horn.

2 - Clamp horn in a vise as shown by the illustration.

3 - Connect horn to a 6-volt battery, if possible in series with a contact button.

4 - Adjust horn by slowly turning the adjusting screw clockwise or anti-clockwise until the point is reached at which the horn is giving its best performance and the pitch of the tone is normal.

If, after having adjusted the breaker points, the horn is still uncertain in its action, giving only a choking sound, or does not vibrate, it should be replaced.

Important!

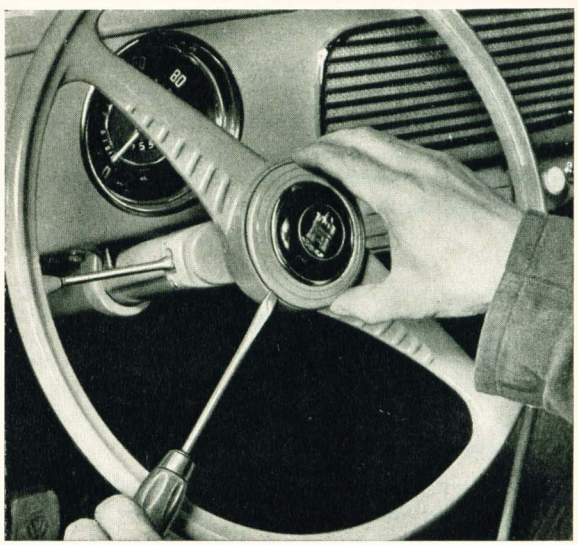
It may be appropriate to mention in this connection that the adjustment screw should be sealed with paint whenever the tone is readjusted. If neglecting this point, the horn will be rendered unserviceable by ingress of water.

Electric Horn Feed Circuit

Removing and Installing Horn Button

1 - Pry off horn button assy. by inserting a screwdriver in the slot.

2 - Release contact screw at horn button and take off button.



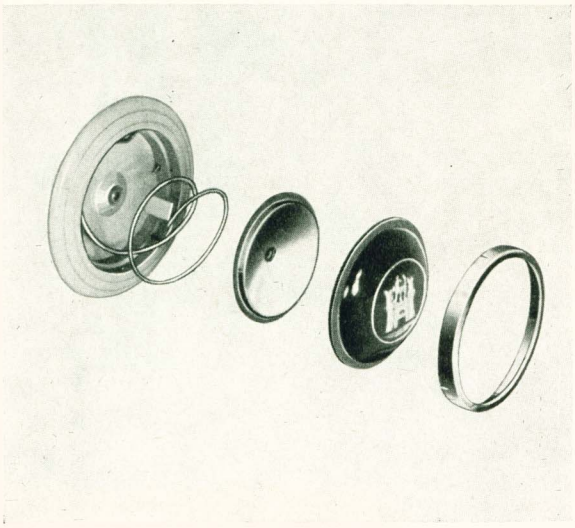
In installing the button, the following points should be noted:

1 - The insulation of the cable must be in perfect order.

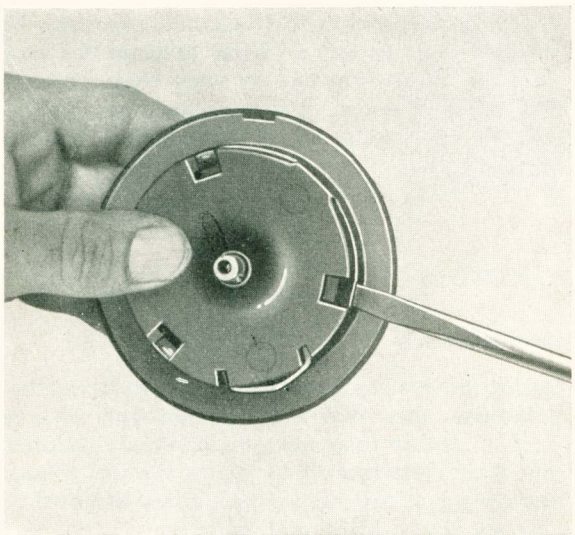
2 - Make sure that the horn button assy. is tightly seated. Bend the spring, as necessary.

Disassembly and Assembly of Horn Button

To insure a good contact, the contact surfaces must be free from dirt and corrosion.



If a replacement of parts or a cleaning is considered necessary, turn up the retaining ring lugs and take off retaining ring, button, and contact plate.



Sliding Contact at Steering Column

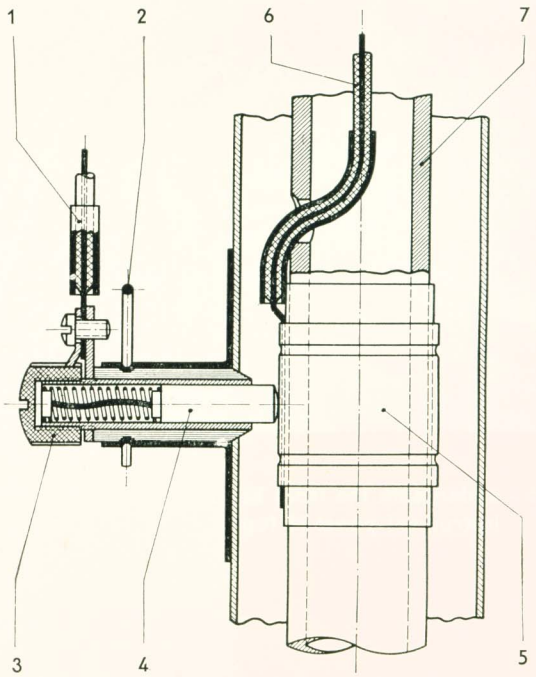
The sliding contact between horn and horn button at the steering wheel hub is to take up the turns of the steering column. The horn may fail to operate if the contact is worn or dirty, or if the insulation is defective.

Replacing Brush

1 - Remove spring clip.

2 - Pull out brush holder with brush.

3 - Replace brush and spring.



1 - Cable to horn
2 - Spring clip
3 - Tapped cap
4 - Brush and spring
5 - Contact ring
6 - Cable to horn button
7 - Steering column

Cleaning Contact Ring

1 - Remove brush holder with brush.

2 - Clean contact ring with a wooden stick and fine emery cloth by turning the steering column several times in both directions.

Make also sure that there is a good ground connection at the steering column coupling.

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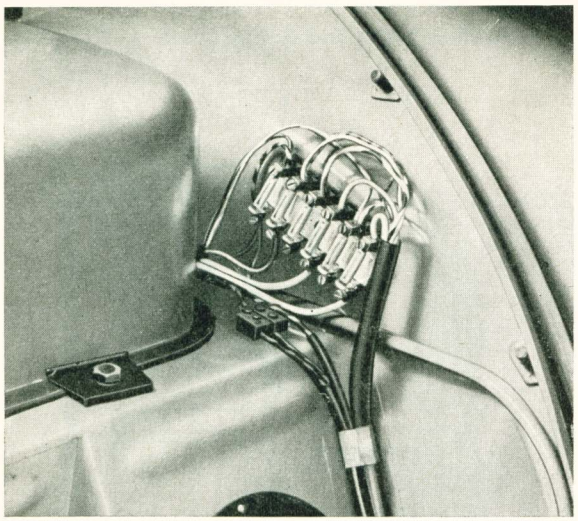
Fuse Boxes

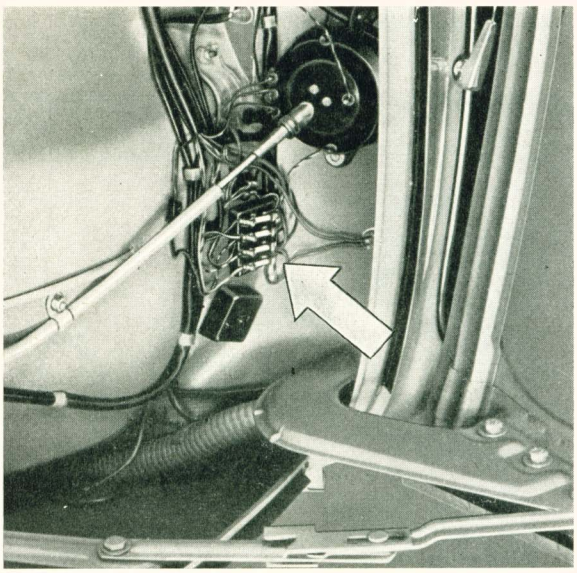
General Note

Fuse boxes are located as follows:

a - underneath the front hood, on the left side next to the fuel tank (6 fuses),



b - underneath the front hood on the back of the instrument panel (4 fuses).



Exchanging Fuses

A blown fuse can be removed by pressing down the retaining clip.

When a fuse has blown out, it is not sufficient to merely replace it by a new one. Inspect the electrical system for evidence of short circuits or other faults that may have caused the fuse to blow out.

Under no circumstances should any fuse be mended with tin-foil or wire, because this may result in severe damage to some other parts of the electrical system. It is important that replacement fuses should be of the correct capacity (8/15 amp.).

Direction Indicators

General Description

The built-in direction indicators are connected to the indicator lamp in speedometer. They are operated by the switch on the steering column. When one indicator is in the horizontal position, the control circuit is closed by a special contact in the direction indicator and the lamp lights up.

Each of the two direction indicators is illuminated by a bulb.

Maintenance

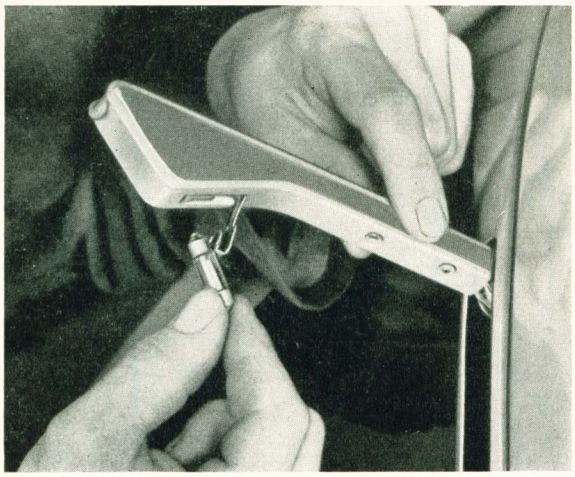
As the direction indicators are exposed to weather influences, they should be cleaned from time to time. If, due do some fault, the arm does not come out, it can be prised out by means of a tool without the danger of causing damage. Al parts should be cleaned with a brush and fuel.

Bearings and sliding surface may be lubricated with a few drops of corrosion-fighting chassis oil of low viscosity. Engine oil or grease must not be used.

After cleaning, the contact for the warning lamp and the connections should be checked.

Replacing Bulb

Direction indicators of several makes are being installed which slightly differ from one another, but the various procedures of replacing the bulbs can easily be found out.



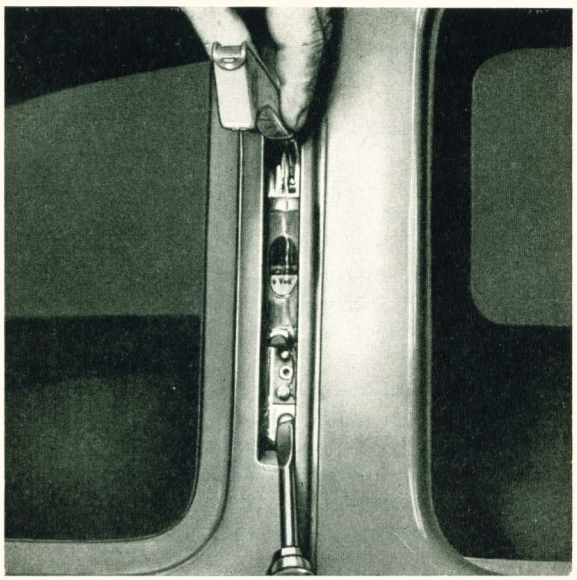
The arms may in all cases be pulled out and held in the horizontal position for replacing bulb, checking connections, and removal, without taking any precautions.

Bulb Type:

Direction Indicator Bulb
M 6 V 3 W DIN 72601

Removing and Installing Direction Indicator

1 - Raise indicator arm in horizontal position.



2 - Release fixing screw in door pillar.

3 - Remove indicator arm from door pillar.

4 - Disconnect cables.

Installation is a reversal of the preceding operations, but the following points should be observed:

1 - Connect cables.

Upper terminal: blue-red cable.

Lower terminal: black-white, or black-green cable.

2 - To refit the indicator arm, slide the retaining bracket on the back of the arm in an upward direction into the slot of the door pillar as far as it will go. Hold the arm in this position while tightening the fixing screw.

3 - The indicator arm must not slide against the sides of its recess. Rectify a sticking arm by carefully bending it until it moves freely.

Direction Indicator Warning Lamp

The red direction indicator warning lamp is between terminal 15 at ignition lock and the two cables to the control contacts of the indicators.

Lamp Type:

Warning Lamp
1 6 V 1.2 W DIN 72601

Replacing Bulb

Access to the bulb is gained by opening the front hood and turning down the lining in front of the instrument panel.

1 - Pull out socket and bulb from speedometer.

2 - Slightly press down the bulb into its socket, turn it and pull it out.

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Windshield Wiper Motor

With effect from Chassis No. 1 438 742 VW de Luxe models are being provided with SWF wiper motors equipped with a permanent magnetic brake and a special push-pull type switch with 3 cable connections.

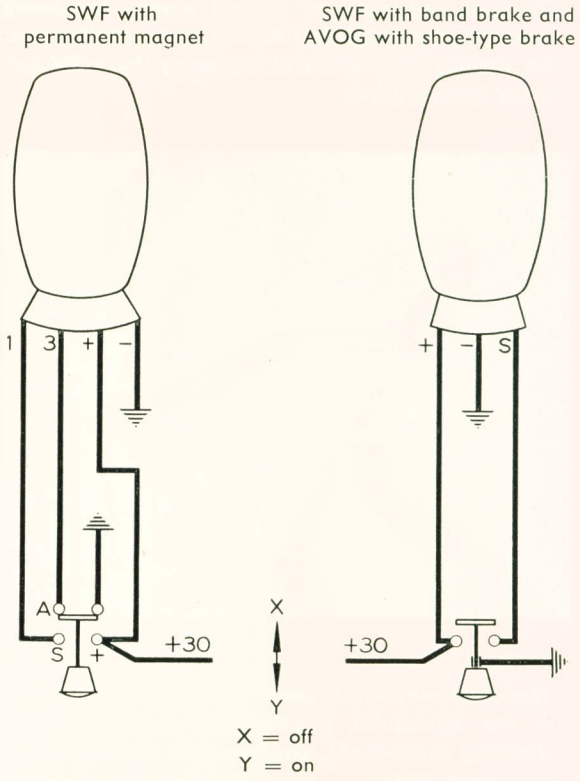
SWF wiper motor with magnetic brake
(4 terminals)
Part No. 113 955 111 A

1 push-pull type switch
(3 terminals)
Part No. 113 955 511 A

The different wirings are illustrated on the drawing. The new push-pull type switch with 3 terminals (previously 2 terminals) can be used with SWF motors with band brake (previous design) and AVOG motors with shoe-type brake. Both can be recognized by the 3 terminals.

The new SWF wiper motor is set for a higher number of wiper strokes, i.e., 44 strokes per minute as compared with 30 strokes per minute of the previous motor.

VW Passenger Cars



Windshield Wipers

By decreasing the distance between the wiper arms and by installing longer wiper blades to match the new larger windshield, the wiping area has been considerably enlarged from Chassis No. 1 600 440. In the parked position the right hand wiper blade comes to rest nearer to the lower edge of the windshield.

The exchange of old windshield wiper assemblies (wiper motor, frame with linkage, wiper arm and blades) for those of new design is not possible. Parts of previous design will still be available.

Windshield Wiper Motor

We have noticed repeatedly that windshield wiper motors are being exchanged even though they are not at all defective. In most cases the reasons for unsatisfactory operation were as follows:

1 - The switch operating knob has not been pulled out sufficiently. As a result, the contact strip may get stuck at a worn-off section of the material.

2 - Inadequate ground connection at the switch support bracket.

3 - Inadequate cable connections at the switch.

4 - Inadequate cable connections at the wiper motor and at the feed lines.

5 - Inadequate contact yoke pressure at the switch (can be remedied by rebending the yoke).

6 - Dirty contact surfaces.

7 - The switch operating knob has been screwed in too much so that it becomes impossible to switch the wiper motor off. This may happen when the inside thread of the knob is seated too far back or when the knob is screwed in so tightly that the small locking plate is bent backward.
In the event of any trouble with the windshield wiper, the switch should by all means be checked carefully to avoid subsequent complaints. This check can be carried out by testing with a switch that is in good working condition. A makeshift connection will be entirely sufficient for the purpose.

Windshield Wiper Motor Trouble Checking

(VW De Luxe)

E

Symptoms	Cause	Remedy
Windhield wiper motor operates too slowly, cuts out or comes to a standstill	a - Brushes (1) worn	a - Replace brushes
	b - Brush tension spring (2) too weak	b - Replace tension spring
	c - Brush levers (3) not free on their pivots	c - Free the brush levers by working them backwards or forwards by hand and by applying a trace of thin machine oil
	d - Commutator (4) dirty	d - Clean the commutator
	e - Moving joints of windshield wiper linkage devoid of grease	e - Thouroughly lubricate all moving joints with Universal Grease
Windshield wiper motor continues to run after manual switch is turned off	a - Brake band (5) effect not sufficient	a - Increase servo effect of brake band by lightly greasing the brake band contact surface of the armature
	b - Brake band broken	b - Replace brake band. Gap of ground contact points (a): 0.8 mm (.031")
Windshield wiper motor does not return the blades to parking position but stops at whatever point the manual switch is turned off	a - Excessive gap of ground contact points (6 and 7)	a - Check and adjust gap (a) to 0.8 mm (.031")
	b - Cam (9) incorrectly reinstalled	b - Correctly install the cam
	c - Windshield wiper motor for right-hand drive car installed in left-hand drive car	c - Install correct windshield wiper motor
Gabbling noise when switching on the motor and in some cases delayed operation of motor	Gap of ground contact points (6 and 7) too small	Increase gap by bending ground contact to approx. 0.8 mm (.031")
Squeaking noise of windshield wiper motor and in some cases connected with slow operation or burnt armature	a - Moving joints of windshield wiper linkages devoid of grease	a - Throughly grease all moving joints with Universal Grease
	b - Armature (10) fouls pole shoe (11)	b - Check armature for free movement. If necessary, loosen the four shoe (b) into proper positinn

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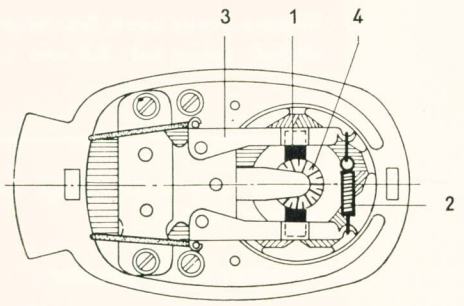
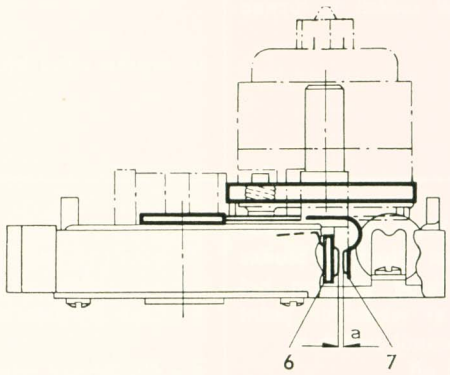
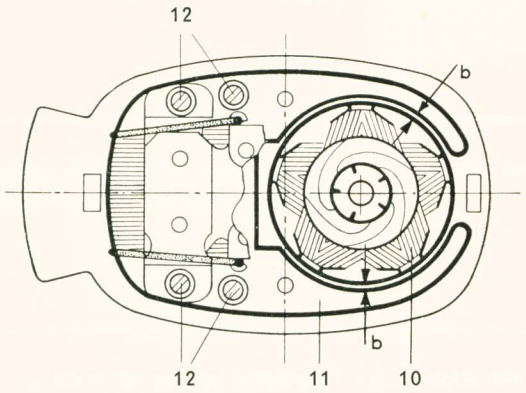
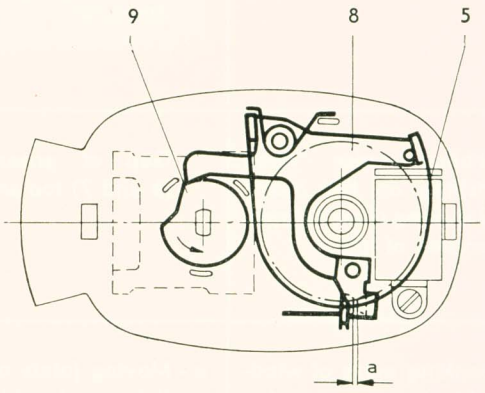
Symptoms	Cause	Remedy
Windshield wiper motor inoperative	a - Pole shoe (11) disarranged by blow on motor cap so that it makes contact with the armature (10)	a - Check armature for free movement (b). If necessary, loosen the four fixing screws (12) and bend pole shoe into proper position
	b - Armature burnt by short circuits, caused by disarranged pole shoe or overload due to the brake band not clearing the armature	b - Replace the motor
	c - Nose of cam lever (8) of earlier type windshield wiper motors too deeply pressed into the lowest point of the cam (9) by deranging the wiper linkage in cleaning the windshield	c - Bring the linkages to the normal rest position or replace the cam









1 - Brush
2 - Spring
3 - Brush lever
4 - Commutator
5 - Brake band
6 - Contact plate
7 - Contact spring
8 - Cam lever
9 - Cam
10 - Armature
11 - Pole shoe
12 - Four fixing screws

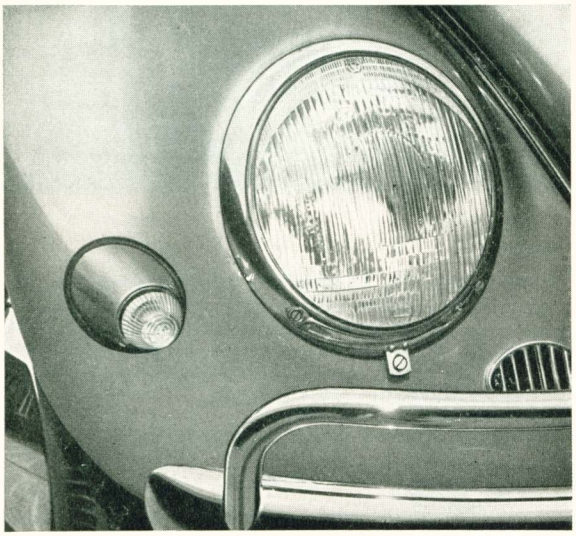
a = 0.8 mm (.031")
b = Free movement

Flashing Direction Indicators

(Used in some countries only)

Description

The front direction indicator lamps flank the headlamps. At the rear, the tail light, stop light, and



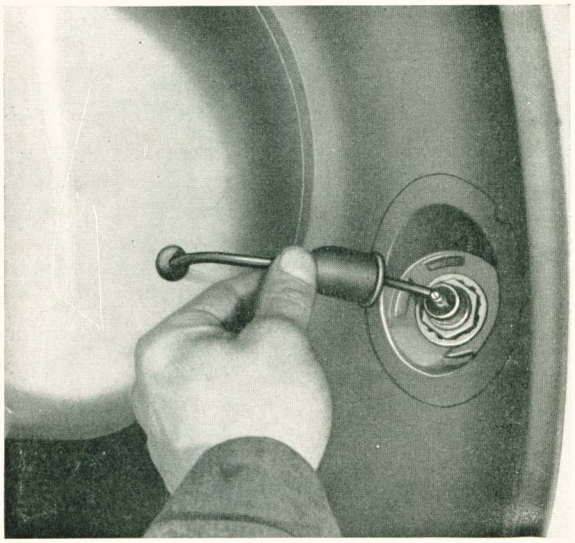
direction indicator light are combined into one unit, one of the two filaments serving for both stop light and direction indicator light. The direction indicator switch returns automatically to the neutral position when turn is completed. The switch is connected to the flasher unit which opens and closes the circuits to the front and rear direction indicator lights and to the pilot light in the instrument panel.

Lamp Type

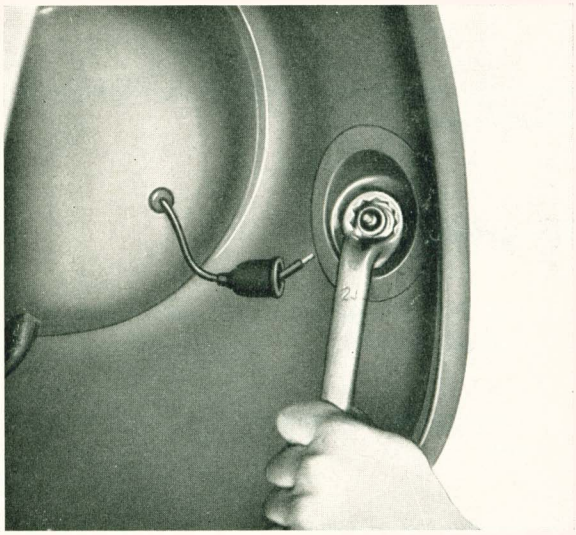
Front bulb: R 6 V 20 W DIN 72601
Rear bulb: 6 V 5/20 W DIN 72601

Front Bulb Replacement

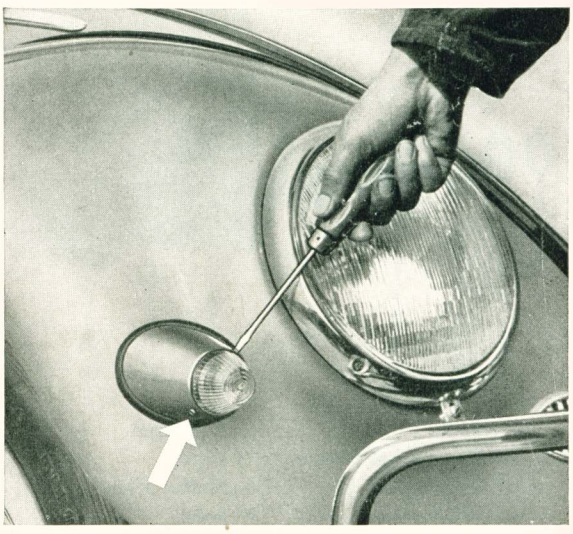
1 - Pull rubber boot from bulb holder and disconnect the cable.



2 - Loosen the hex. nut with a box wrench.



3 - Take off bezel and lens after removing the two slotted screws.



4 - Replace bulb.

5 - Be sure the rubber seal between bezel and fender is in perfect condition, replace if necessary.

6 - When tightening the nut, make sure the bezel is properly seated in the channel provided in the rubber seal.

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Rear Bulb Replacement

To replace the direction indicator rear bulb, follow the instructions given under "Stop and Tail Lights" (from August 1955).

Front Direction Indicator Lamp Assembly and Disassembly

Disassembly

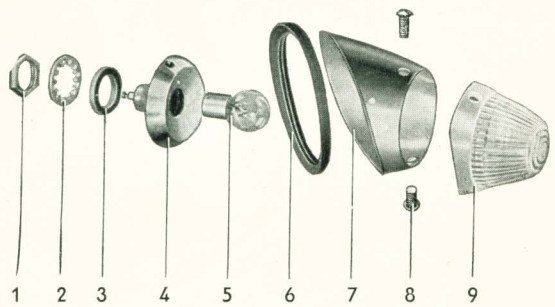
1 - Pull rubber boot from bulb holder and disconnect the cable.

2 - Take off the lamp unit after loosening the hex. nut.

3 - Remove the two slotted screws from the bezel.

4 - Remove bulb holder and bulb from bezel.

5 - Push out the lens toward the rear of the bezel.

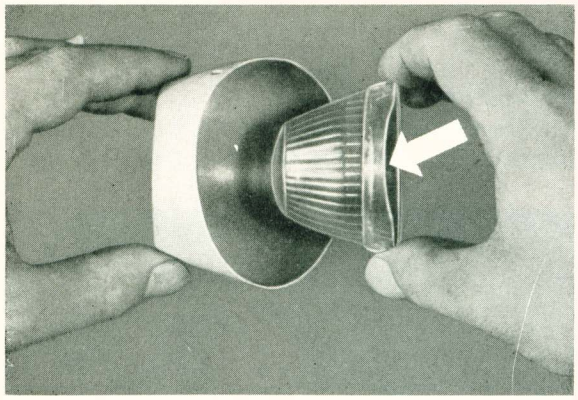


1 - Nut
2 - Shake-proof washer
3 - Rubber seal
4 - Bulb holder
5 - Bulb
6 - Bezel seal
7 - Bezel
8 - Slotted screw
9 - Lens

Assembly

To assemble the lamp, proceed in reverse order observing the following points:

1 - Put lens into bezel as shown in the picture.



Note:

From Chassis No. 1 168 937 the direction lamps are provided with a sealing compound D 15 between bezel (7) and lens (9) in current production (see white arrow). the opening (10) has been increased to 4 mm (.16″). Sealing compound should be additionally applied to the following points (see black arrows):

a - Between lens (9) and bulb holder (4)

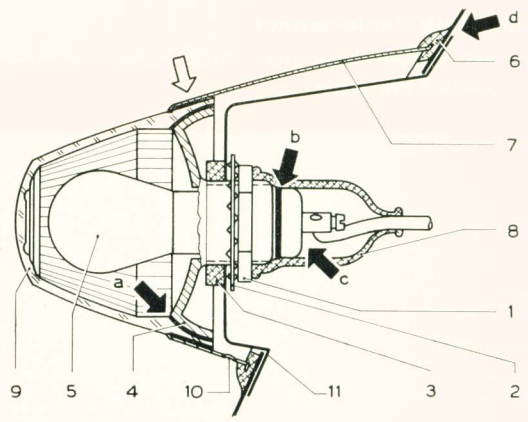
b - At the soldered bulb socket

c - At the slot between flange and fiber base of bulb holder

d - Around the edge of the bezel support, especially between the spot welds.

Apply the sealing compound D 15 in the form of strands rolled to a diameter of about 4 mm (.16″) dia.

It is important to make sure that the rubber seals (3 and 6) and the boot (8) are properly seated and the drain hole (10) is free from obstructions. It is recommended to increase the diameter of the hole to 4 mm (.16″).



1 - Hex. nut
2 - Shake-proof washer
3 - Rubber seal
4 - Bulb holder
5 - Bulb
6 - Bezel seal
7 - Bezel
8 - Protective cover
9 - Lens
10 - Drain hole
11 - Bezel support

2 - When installing the direction indicator lamp the notches on the inside of the bulb holder must fit into the slots of the bezel support.

3 - It is important to make sure that the rubber seal between bezel and front fender is properly seated.

Direction Indicator Pilot Light

The direction indicator pilot light (red) is connected between terminal 15 and terminal K of the flasher unit.

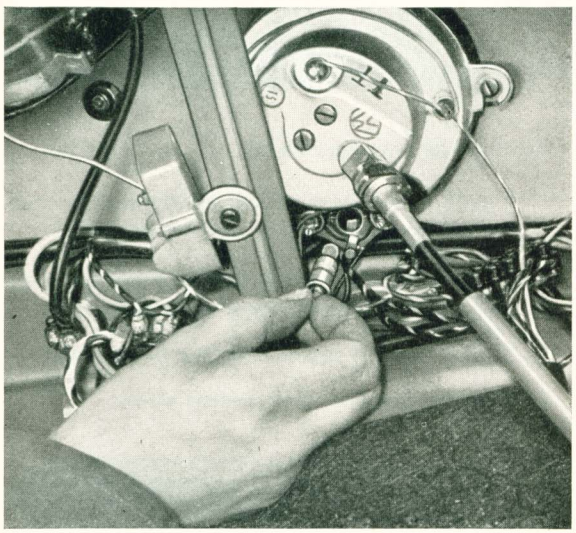
Lamp Type

Indicator bulb J 6 V 1.2 W DIN 72601

Bulb Replacement

1 - Pull bulb and socket from back side of speedometer.

2 - Slightly press bulb into its socket and turn it until it can be pulled out.



Direction Indicator Switch Replacement

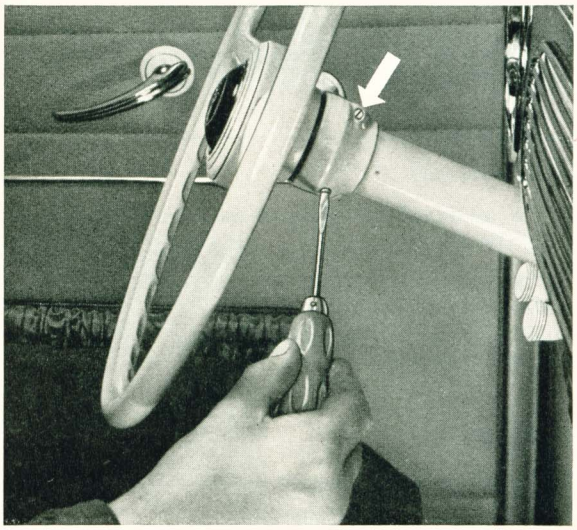
The direction indicator switch is mounted on the steering column below the steering wheel. This allows the driver to operate the switch lever without taking his hand off the wheel. The lever returns automatically to the neutral position when turn is completed.

To avoid short circuits, disconnect the positive cable from battery before carrying out the following operations:

Removal

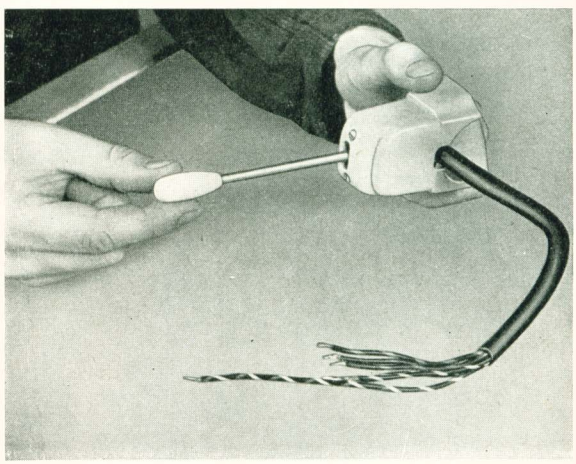
1 - Disconnect direction indicator switch cables in front luggage compartment.

2 - Remove the two direction indicator switch mounting screws.



3 - Take the cables out of the protection strip along the steering column and lift off the switch.

4 - Screw off the switch lever knob.



5 - Remove the switch cover attaching screws and take off the cover.

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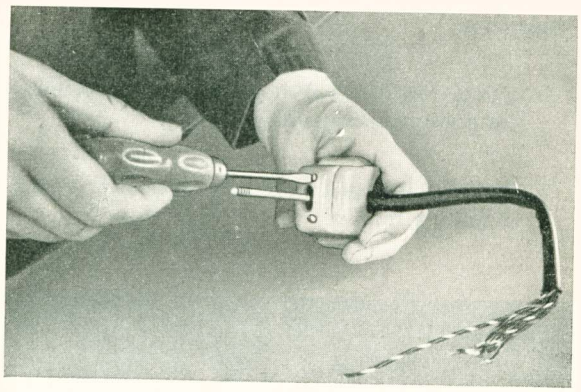


Important!

Do not detach the soldered cable connections in the switch.

Note:

Direction indicator switches are delivered with the cable connections soldered.

Assembly

To install the switch, reverse the removal procedure and observe the following points:

1 - Make sure the cables are properly connected.

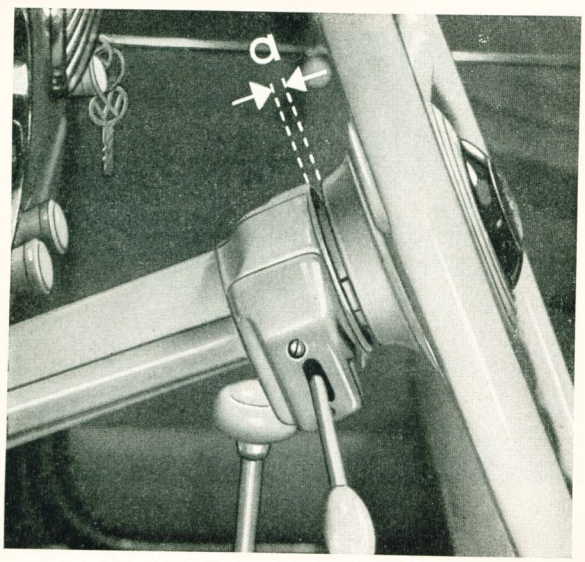
2 - Note proper position of cables and protection strip along steering column.

3 - Check direction indicator for proper functioning and automatic cancelling.

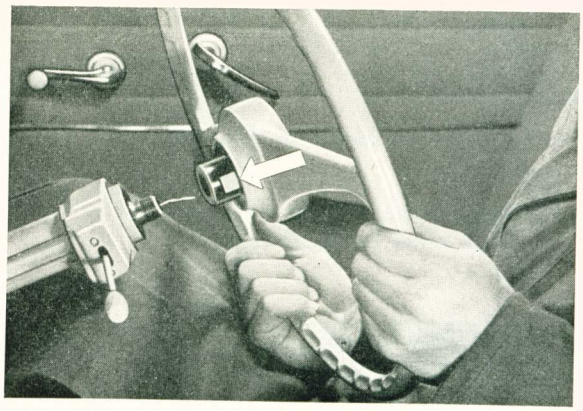
4 - The distance between the upper edge of the direction indicator switch and the lower edge of the steering column hub must be 2 mm (.08″), the automatic cancelling mechanism may otherwise fail to operate.

5 - If the lever does not return to the neutral position when turn is completed, correct the position of the switch by turning it either clockwise or anticlockwise on the steering column.

6 - Whenever installing the steering wheel, the contact nose in the steering wheel hub must be in line with the switch lever after the wheels are set in straight-ahead position.



a = 2 mm (.08″)



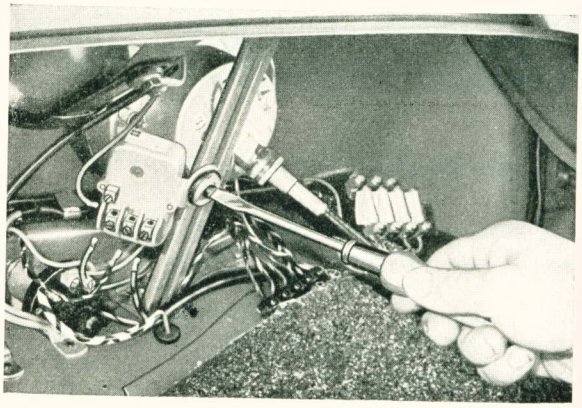
Flasher Unit Replacement

In order to avoid short circuits disconnect the positive battery terminal before starting to work.

Access to the flasher unit is obtained by removing the cover from the back of the instrument panel.

1 - Disconnect the cables from the flasher unit.

2 - Remove flasher unit mounting screw.



3 - Install new flasher unit.

4 - Make sure the flasher unit is properly wired.

Horn

General Description

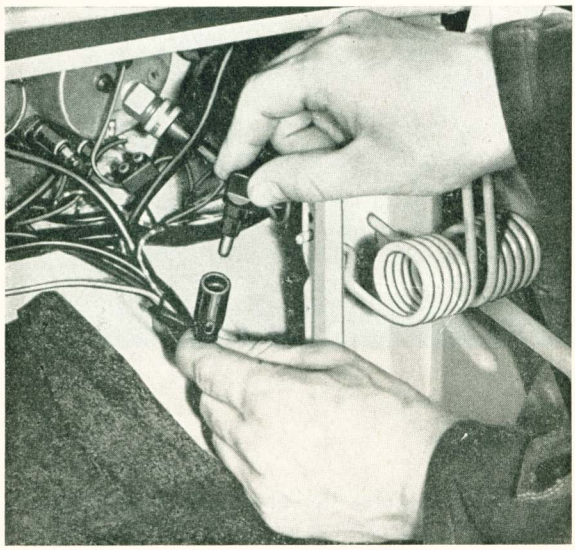
A matched pair of horns is located in the spare wheel compartment behind and opening that inclines downward. A rubber boot, screwed to the body by means of a retaining ring, encloses the horns and provides a perfect seal. The horns are operated by a button in the steering wheel hub via a relay. A connector provided with a fuse is in the cable between ignition switch and horn relay.

Maintenance

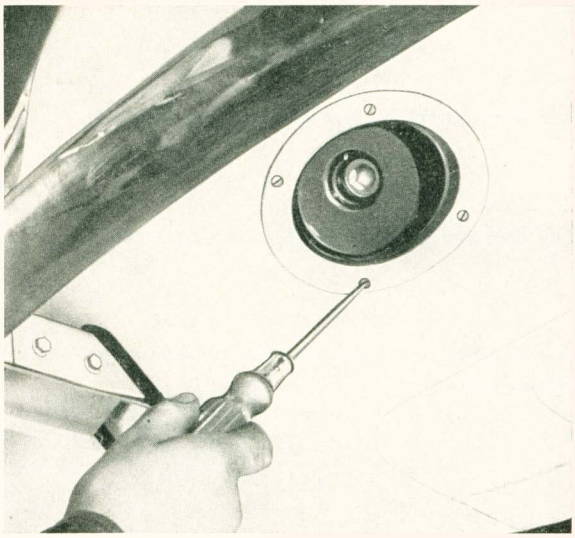
It is important to see that the flexible mounting parts and the rubber boot of the horns are free from damage.

Horn Removal and Installation

1 - Remove the fuse from the connector.

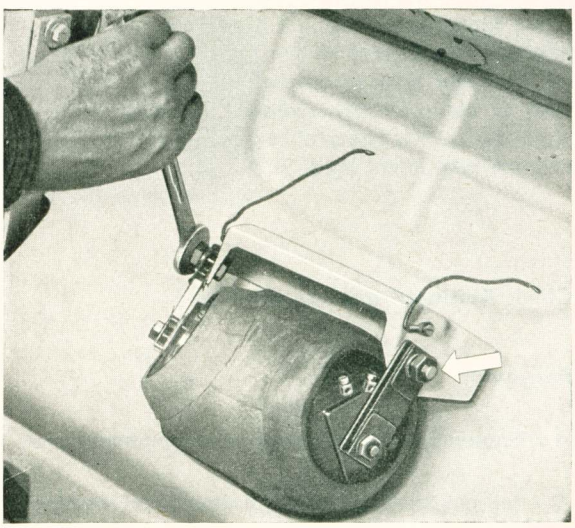


2 - Remove the screws from rubber boot retaining ring.



3 - Remove the spare wheel and disconnect the horn cables.

4 - Remove horn mounting bolts and nuts, and lift out the horns and rubber boot.



5 - Remove horns from rubber boot.

When installing, make sure there is a perfect ground connection and the rubber boot is properly positioned. The horns must not contact the body.

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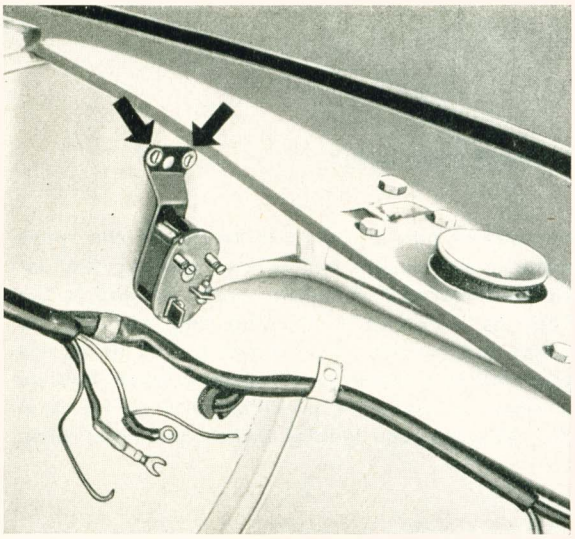
Replacing Horn Relay



1 - Remove the fure from the connector.

2 - Disconnect the four cables from the relay.

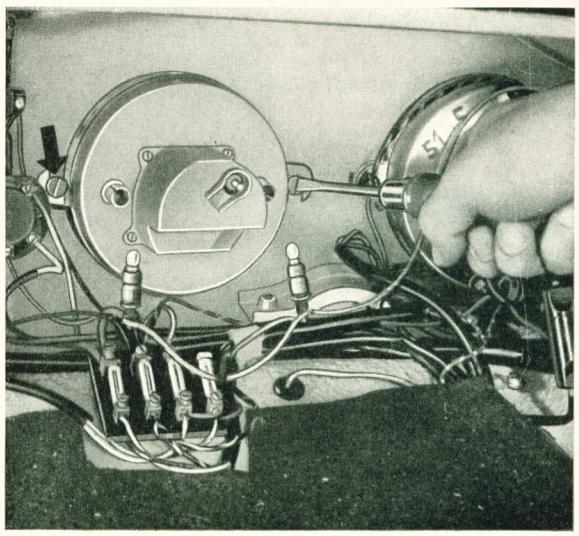
3 - Remove the two relay attaching screws.

When installing, make sure the cables are properly connected.

Clock

General Description

The electrically driven clock is situated to the right of the speedometer. Should it become necessary to reset the clock, push in the knob in the center of the dial and turn to correct the time. The clock light is automatically switched on with the exterior lights. It is rheostat-controlled in conjunction with the instrument light.



Clock Removal and Installation

Removal

1 - Remove front luggage compartment trim panel.

2 - Pull out the two bulbs and disconnect the clock supply cable.

3 - Remove the two clock attaching screws.

4 - Pull the clock off the instrument panel.

Installation

To install, reverse the preceding operations and make sure the clock is properly positioned before tightening the attaching screws.

Flasher Units

On a number of Karmann Ghia Models, flasher units were installed which differ from those delivered as spare parts (Part No. 11 953 185) by having three terminals instead of four. When replacing old type flasher units (three terminals), the following points should be observed:

1 - Remove ground lead between direction indicator pilot light and left-hand speedometer fixing screw.

2 - Reconnect this ground lead to terminal 31 (negative) and to the mounting screw of the flasher unit.

3 - Connect an additional lead to the positive terminal of the generator and oil pressure warning lights and to the direction indicator pilot light.

Windshield Wiper Motor

With effect from Chassis No. 1 331 899 Karmann Ghia Models are being provided with SWF wiper motors which are equipped with a permanent magnetic brake and a special push-pull type switch with 3 cable connections.

New design:

SWF wiper motor with magnetic brake
(4 terminals)
Part No. 141 955 111 A
1 push-pull type switch
(3 terminals)
Part No. 141 955 511 A

Previous design:

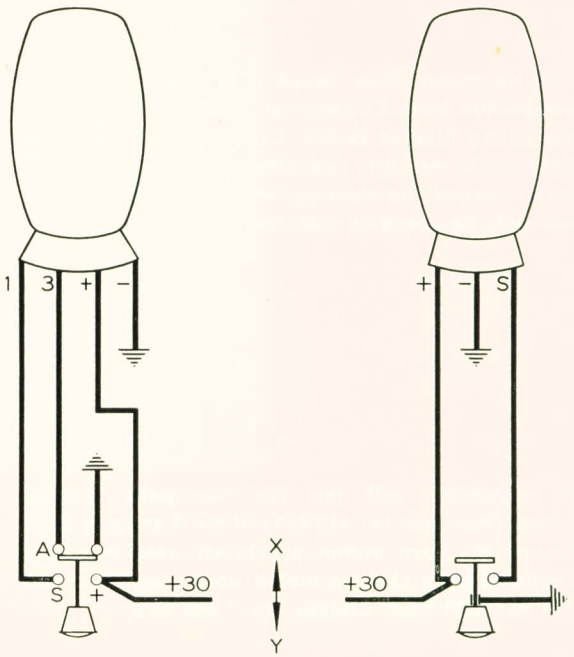
SWF wiper motor with band brake
(3 terminals)
Part No. 141 955 111
1 push-pull type switch
(2 terminals)
Part No. 141 955 511

The different wirings are illustrated on the drawing. The new push-pull type switch with 3 terminals can also be installed in connection with SWF motors with band brake (previous design), to be recognized by the 3 terminals.

The new SWF wiper motor is set for a higher number of wiper strokes, i.e., 44 strokes per minute as compared with 30 strokes per minute of the previous motor.

SWF with permanent magnet

SWF with band brake and AVOG with shoe-type brake



X = off
Y = on

Flasher Units

September 1957

Date introduced from Chassis No.:

VW Sedan	1 621 657
VW Convertible	1 532 758
Karmann Ghia Coupé	1 532 758

As of the above specified date all vehicles equipped with flashing type direction indicators will be fitted with a new, shockproof flasher unit, Spare Part No. 141 953 185 B.

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The new arrangement is as follows:

1 - The flasher unit is of cylindrical shape (formerly box-shaped).

2 - The ground cable to the flasher unit is no longer required. Instead, the unit is grounded by means of a metal strip held between the flasher unit housing and the holder and connected to the negative (—) terminal.

3 - Contrary to the former design, the new flasher unit does not require any warming-up period after being switched on.

The new unit may be exchanged for one of the former design. In this case it will, however, be necessary to lay a ground cable from the negative (—) terminal of the unit to the steering gear mounting bracket (in the case of the Karmann Ghia Coupé to the left-hand cover hinge stay).

Attention!

When installing a flasher unit of the new design in a vehicle of older type, the rubber pad between the flasher unit holder and the steering gear bracket (and in the case of the Karmann Ghia Coupé between the flasher unit holder and the left-hand cover hinge stay) is no longer fitted.

Remember that adequate ground connection is of the utmost importance.

Blinker Switch

The Karmann Ghia Coupé is provided in current production from Chassis No. 1 649 253 with a self-cancelling blinker switch. Combined with this is a light signal which is operated by lifting the blinker lever toward the steering wheel. The light signal can only be operated with the ignition switched on.

The relay for the light signal is mounted on the back of the instrument panel.
Service installation of the new blinker switch with light signal in vehicles of older version in conjunction with the steering wheel used previously is not possible.

Semicircle Horn Ring

In connection with the new two-spoke steering wheel (Part No. 141 415 651) of the Karmann Ghia Coupé the horn button previously used has been replaced by a chrome-plated horn ring (Part No. 141 951 551) from Chassis No. 1 649 253.

Service installation of the horn ring is only possible in conjunction with the new steering wheel and the shortened steering column (Part No. 141 415 505). Owing to the shorter steering column, the steering column tube should be pushed downward correspondingly.

Speedometer and Drive Cable

General Description

Speedometer and mileage recorder are driven by a cable from the left-hand front wheel. The speedometer is of the eddy-current type operating on the electro-magnetic principles. A ringshaped magnet is turned round by the speedometer drive shaft. An armature is located within an aluminium cup, which, without touching the magnet, is free to rotate.

The magnetic eddy-currents produced by induction when the armature revolves, cause the cup to rotate together with the speedometer hand shaft which is firmly attached to it. A fine spring is fitted to the upper end of this shaft as a brake, which counteracts the rotations of the cup and shaft, permitting only a predetermined movement of the speedometer hand. Under the braking effect of the spring, the deflection of the hand becomes greater as the speed of the magnet increases with the speed of the car.

The speedometer unit incorparates a mileage recorder which is driven trough a triple worm transmission. Five numeral rolls show the mileage covered by the vehicle.

The speedometer cable consists of several strands of wire and is protected by a flexible metal housing. Should a speedometer cable become defective, a new cable may be inserted in the old metal housing, if the housing has no sharp bends or fractures. This operations should be refered to a VDO Service Station.

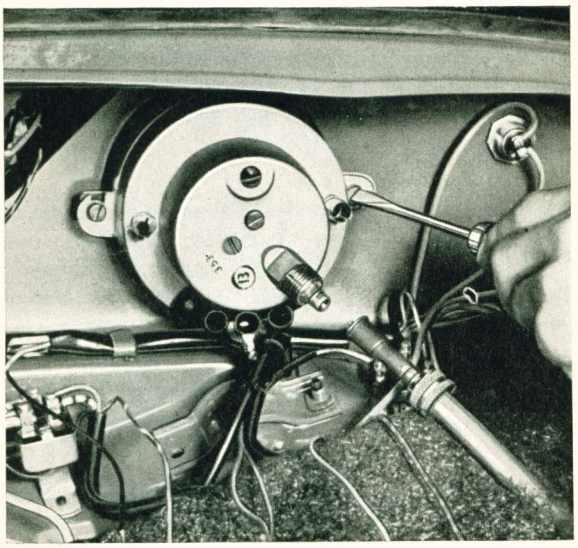
Removing and Installing Speedometer

Removal

1 - Remove indicator bulbs and instrument light bulb from the speedometer.

2 - Pull out cable at the speedometer by releasing the knurled nut.

3 - Remove the two slotted screws that attach the speedometer to the instrument board.



4 - Remove speedometer from instrument board.

Installation

Install the speedometer in the reverse oder. Before tightening the sloted screws, make sure that the speedometer is correctly seated so that the figures on the face stand upright.

Important!

No attempt should be made to alter the mileage indicated or interfere with the mechanism. When replacing or repairing the speedometer, the mileage figure must be the same as that indicated by the speedometer on its removal.

When a replacement must be carried out, the supplier should therefore be given the mileage which was indicated by the old speedometer.

Note:

Repairs on the guarantee basis are only carried out by VDO Service Stations.

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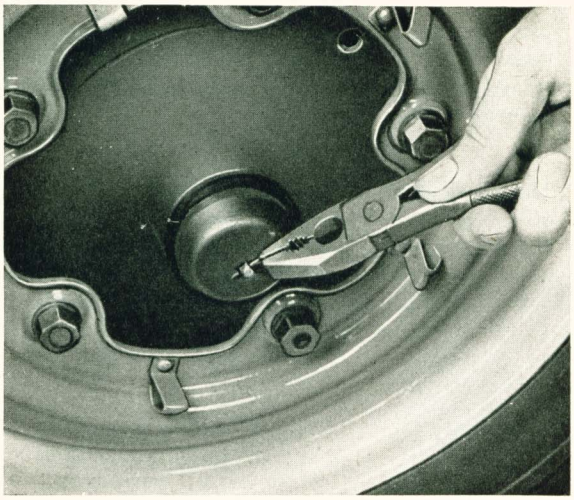
Removing and Installing Speedometer Cable

Removal

1 - Loosen knurled nut at speedometer.

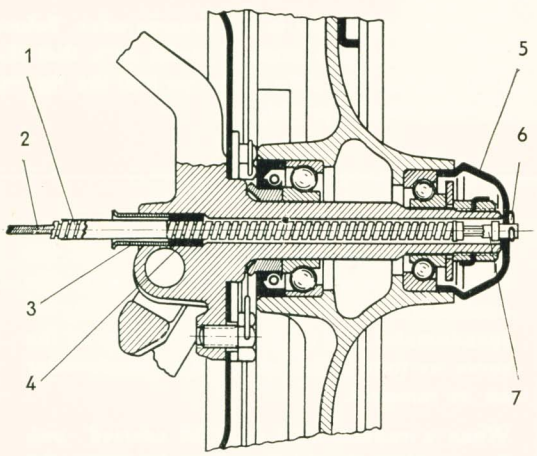
2 - Remove outer hub cap from left-hand front wheel.



3 - Remove cotter pin in square end of speedometer cable at hub cap.

4 - Pull cable out of the stub axle.

5 - Pull cable out of its flexible metal housing.



1 - Flexible metal housing
2 - Speedometer cable
3 - Guide sleeve
4 - Rubber sleeve
5 - Cap with square hole
6 - Cotter pin
7 - Cable drive end

Installation

This is a reversal of the preceding operations, but the following points should be noted:

1 - Lubricate cable with Universal Grease VW — A 052.

2 - Do not sharply bend or tear the cable.

3 - The upper end of the fixed conduit tube should be in line with the connecting piece projecting from the speedometer housing.

4 - The upper square end must correctly fit into the square hole in the connecting piece.

5 - Install new rubber sleeve in stub axle.

6 - Use new cotter pin for securing square end to hub cap.

Important

Special care should be taken when laying the speedometer cable.

During operation, the cable must not be noisy. The bends of the cable should not be below a radius of 150 mm (6″). With the front wheels in the straight-ahead position, the speedometer cable must run centrically through the fixed conduit tube at the body. There must be not sharp bending or tearing of the cable when turning the wheels from one steering lock to the other. Pressure on the flexible metal housing results in a run-out of the cable which is indicated by an unsteady speedometer hand. If there is a sharp bend, the free movement of the cable is restricted and the cable will break at this point after a short time of operation.

Make sure the rubber sleeve is properly seated in the stub axle. The function of this sleeve is to seal the stub axle unit against splash water, which may lead to bearing trouble and, in frost, to a freezing of the speedometer cable.

Only anti-freeze and water repellent grease should be used as lubricant. Oil is not suitable.

It is recommended to have speedometer cables repaired by VDO Service Stations.

Fuel Gauge

(Karmann Ghia Models)

With effect from Chassis No. 1 649 253 the Karmann Ghia Coupé is provided with a fuel gauge in current production. The device consists of a panel unit mounted between speedometer dial and clock, and a tank unit.

For service installation the following parts are needed:

Qty.	Designation	Part No.
1	Fuel gauge (panel unit)	141 919 031 A
1	Tank unit	111 919 051 A
1	Tank unit mounting ring	111 201 141
1	Gasket for tank unit	271 919 125
5	Hex. screws M 5 × 12 DIN 933, galvanized	N 10 207 1
5	Gaskets A 5 × 9 7603 DIN	N 13 802 1
3 m (3.28 yds.)	Cable 1 mm² (.039″) cross section	N 17 520 1

For service installation details see Technical Bulletin K 8.

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General

The installation of a car radio in the VW Sedan or VW Convertible does not involve any difficulties, as the instrument panel has been designed to allow a service installation of a special car radio. Although the installation of the radio system is greatly facilitated by the manufacturers delivering complete sets and relevant instructions, it is considered advisable to mention the most important points to assure a faultless reproduction at all times. It is recommended to adopt the following procedure for a car radio installation.

1 - Install antenna
2 - Install speaker
3 - Install receiver
4 - Install power unit
5 - Connection of receiver unit
6 - Antenna balance adjustment
7 - Suppression equipment

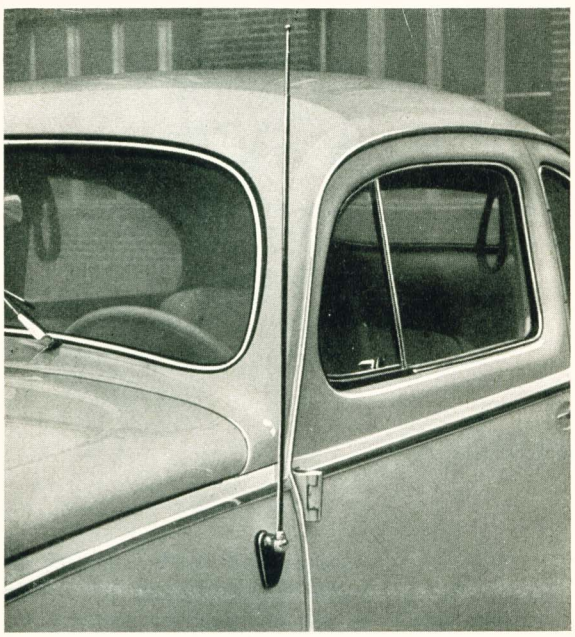
How to Install Antenna

General

To obtain a perfect radio reception, the antenna should be as near as possible to the receiver and should occupy a vertical position at a point where the electrical system interference is lowest. The following locations for the antenna are recommended:

Side Antenna, Left

The side antenna allows an unobstructed vision through the windshield. Another advantage is the ease of pulling out and pushing in the antenna by the driver while the car is in motion (left-hand drive). Additionally, the antenna of a parked car is on this side not exposed to children playing on the side-walk (right-hand traffic). The static produced by the left-hand front wheel, is without much disturbance, picked up by the speedometer cable.



Side Antenna, Right

The distance to the receiver is shorter than on the left-hand side. The wheel static may be stronger, since the electricity is not picked up by the speedometer cable as at the left-hand wheel.

Center Antenna

The center antenna insures a most favourable radio reception, as it is nearest to the receiver. The relatively long distance to the front wheels reduces the adverse effect of wheel static, and fluctuations of the magnetic field when driving on superhighways are less perceptible.

Disadvantageous is the obstruction of vision by the antenna bar in the center of the windshield. As the antenna is difficult to reach from the side of the car, it is often omitted to push it in. The antenna is likely to break when passing through low doorways.

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Other Antennae

Antennae located underneath the car and those fitted over the roof by using several insulated brackets, or those which are sewn in the top of Convertibles, are susceptible to static interference and are generally responsible for a weak reception.

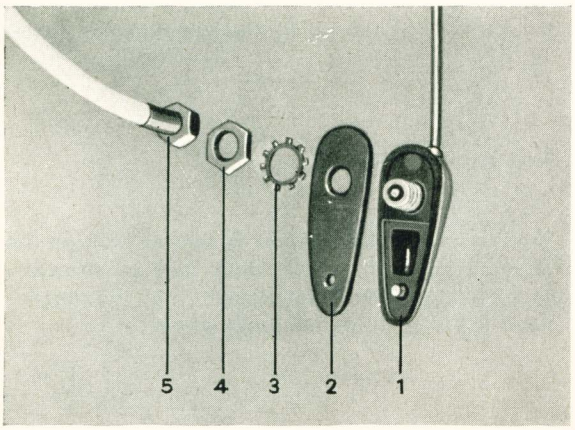
Installation

Note:
It is recommended to remove the spare wheel and the front luggage compartment lining prior to installing the antenna.

1 - Drill the holes for the antenna mounting, using a drill jig if possible.

2 - Scrape off the paint from the inside around the large hole to assure that the antenna lead screen is perfectly grounded.

3 - Place rubber gasket on the antenna foot and insert the threaded terminal and the locating pin, if present, in the holes.



1 - Antenna foot and antenna
2 - Rubber gasket
3 - Shake-proof washer
4 - Nut
5 - Union nut

4 - Place shake-proof washer on the threaded terminal projecting into the luggage compartment and tighten the nut.

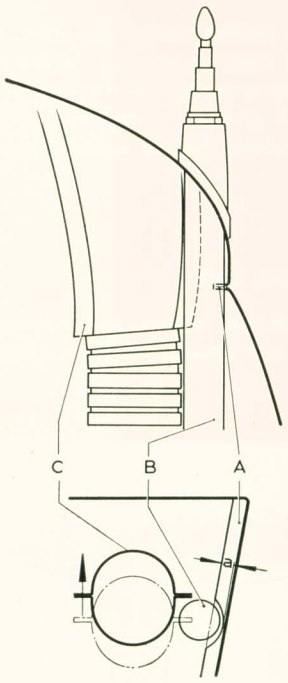
5 - Insert the antenna lead connector into the antenna foot terminal and tighten union nut.

Note:

The installation of telescope antennae in Passenger Cars from Chassis No. 1 - 0 931 501 can only be carried out in connection with the following two modifications:

1 - File a radius (A) a = 5 mm (19") into the front side panel flange in the left-hand rear corner of the luggage compartment for the antenna (B).

2 - Bend the left-hand windshield defroster duct (c) rearward by a few millimeters to allow the antenna (B) to pass through.



a = 5 mm

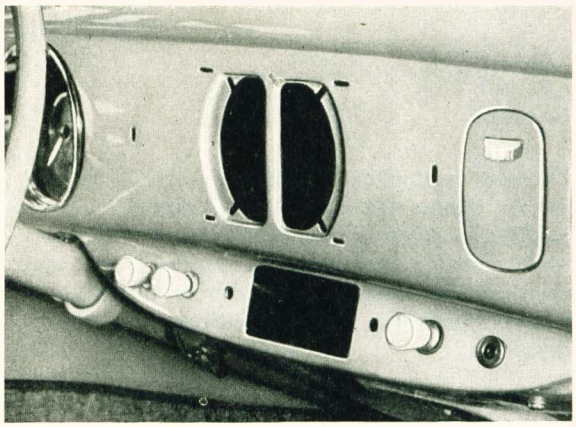
Speaker Installation

Installation

1 - Remove the rubber boots from the back of the instrument panel, turn up the retaining tongues of the ornamental speaker grille and take off speaker grille and gauze. Remove the screws that attach the speaker opening cover plate.

2 - Attach speaker and packing ring to the opening, using four cylindrical screws M 3. Make sure the two sockets, if present, for an extension speaker are easily accessible. The screw heads must be concealed behind the speaker grille.

3 - Attach the grille and gauze to the instrument panel by twisting the retaining tongues. Cement the six rubber boots in place.



Receiver Installation

1 - Take off "dial" opening cover plate after having removed the two nuts accessible from the luggage compartment.

2 - Insert one escutcheon plate each in the two holes for the control knobs.

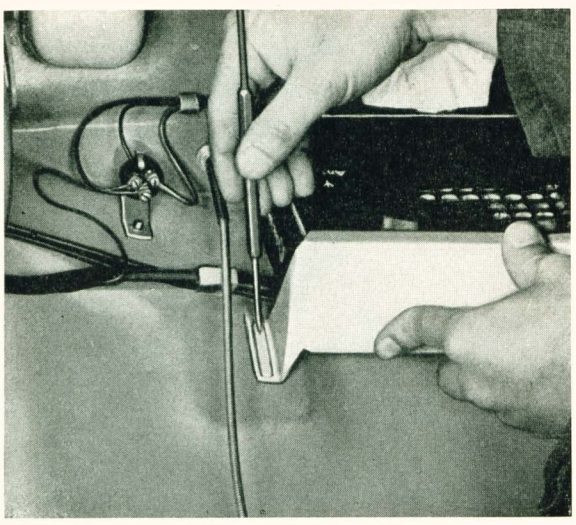
3 - Remove the two control knobs from the receiver.

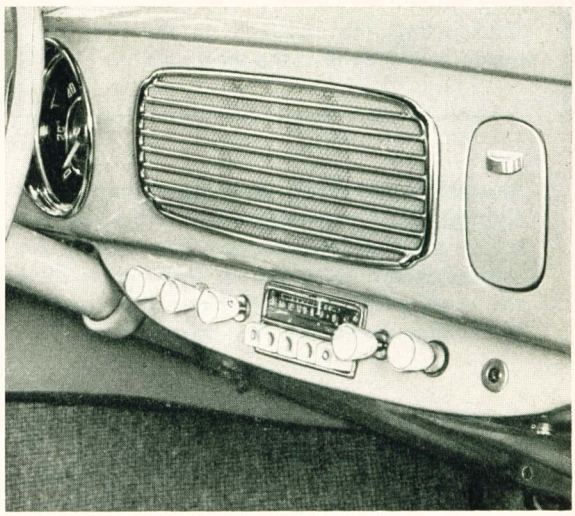
4 - Insert receiver in the opening in the instrument panel. Place retainer against the back face of the receiver and mark the holes for the mounting screws on the luggage compartment panel.

5 - Remove receiver, mark the holes with a center punch and drill by means of a 6.5 mm diam. (.26″) drill.

6 - Place the rubber gasket around the radio "dial" rim and reinstall the receiver. Place retainer against receiver back face and screw it in position. If necessary, interpose felt strips between retainer and receiver. Use shims to bring the receiver into line with the opening in the instrument panel.

7 - Screw the control knobs in position.





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Vibrator Installation

General

The best location for the vibrator unit is on the level surface behind the spare wheel. Should it not be possible to accommodate the vibrator in the spare wheel compartment, it is recommended to install it in the front luggage compartment. It is of paramount importance that the vibrator is perfectly grounded.

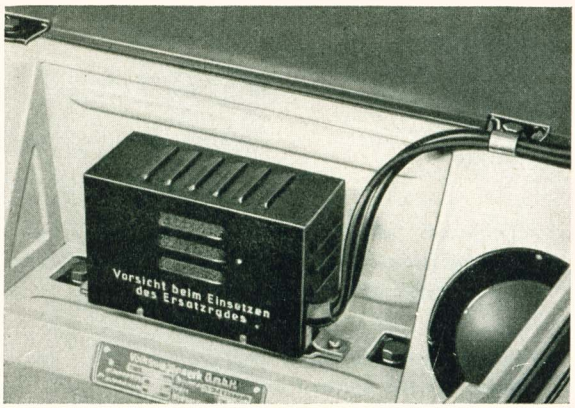
Installation (Spare Wheel Compartment)

1 - Place vibrator unit and retainer on the level surface of the spare wheel compartment so that the front edge of the unit is flush with the front edge of the level surface. The model detail plate must not be concealed in any way. It is considered expedient to attach the model plate to the inclined surface below the vibrator unit.

2 - Mark the holes for the mounting screws and drill 8.55 mm diam. (.33″) holes into the level plate.

3 - Scrape off the paint from the area where the retainer makes contact with the level panel to assure that the vibrator is perfectly grounded.

4 - Attach retainer by means of the two bolts and nuts M 8 to the body. Attach vibrator to the retainer by means of the screws.



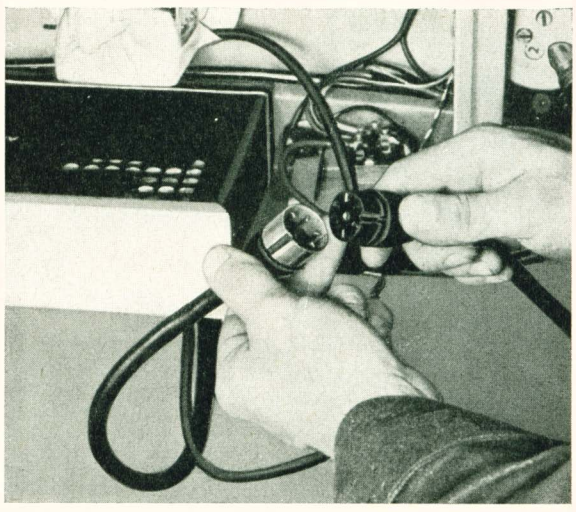
Connecting Receiver Unit

Attention!

Switch off the radio before connecting or disconnecting the speaker as there is a tension of 250 volts at the terminals.

1 - Remove rubber sleeve from the connector and connect the three-strand cable of the speaker to the cable of the receiver. The ends of the screen strands must oppose each other. After the cable ends have been connected, replace the rubber sleeve over the connector.

2 - Connect the vibrator cable with receiver cable by means of the plug and socket shown in the illustration. Take care that the projection engages with the corresponding groove. A short-circuit will occur when trying to connect the cables in another manner.



3 - Connect the battery cable of the receiver to the fuse terminal for the interior light (Fuse box for four fuses situated in front luggage compartment).

4 - Insert antenna lead plug in the antenna socket at the receiver.

Antenna Balance Adjustment

General

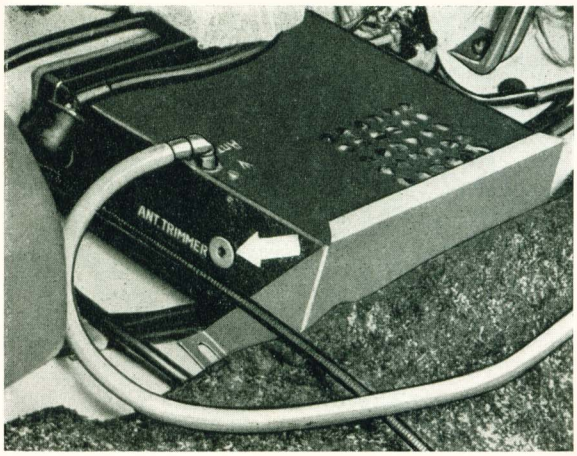
After the radio installation is completed, the antenna circuit of the radio should be balanced with the receiver installed on the vehicle.

Balance Adjustment

1 - Drive the vehicle under a viaduct or a suitable partially shielded location where reception will be diminished sufficiently to make the test.

2 - Tune in on a station on or near the 600 Kilocycle frequency.

3 - Adjust the speaker to peak volume at the antenna adjustment screw in the receiver (arrow).



Suppression Equipment

The car radio has to meet special requirements. It is to give faultless reproduction with a relatively short antenna. The car radio is therefore necessarily sensitive and may consequently pick up electrical system interference of the vehicle. The use of condensers and suppressors will generally provide the necessary shielding for suppression of electrical disturbances so that the quality and volume of reception will be normal and satisfactory, provided there is no irregularity in the receiver or antenna circuits. Disturbances may also be caused by poor ground, loose connections, or wheel static. When inspecting the radio installation, special attention should be paid to the ground connections. To suppress the electrical system, the following parts are required:

4 Spark plug connectors 10 K Ω

1 Suppressor sleeve 10 K Ω

2 Screening condensers 2.5 μ F

After the electrical system disturbances have been suppressed, turn the radio on for reception with engine running. Should any interference still be present, recheck the electrical system shielding and make sure the wires are making good connection. If the trouble cannot be located by the above procedure, the radio should be removed from the car and turned over to a radio serviceman.

Suppressing Ignition System

a - Spark Plugs

Replace the spark plug connectors by the four shielded connectors. Make sure the connectors make perfect contact with the cable cores.

b - Ignition Cable

Install suppressor sleeve in the cable between ignition coil and distributor, taking care that the sleeve is nearer to the distributor than to the coil.

c - Ignition Coil

1 - Connect screening condenser 2.5 u μ to terminal 15 of the ignition coil.

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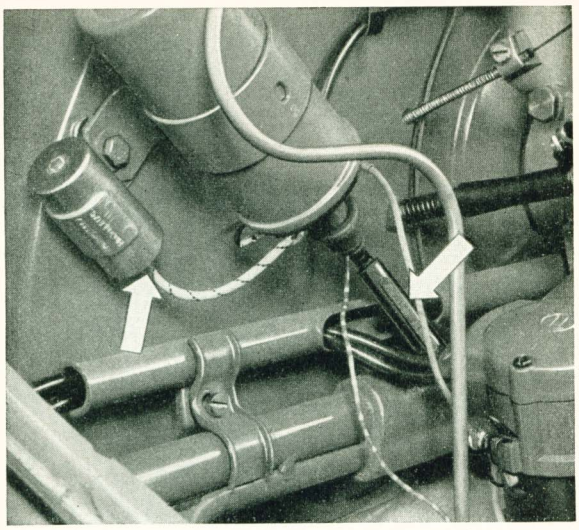
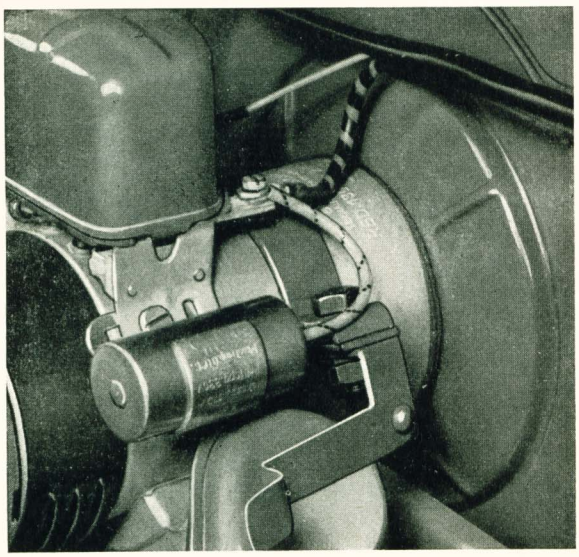
2 - Attach condenser retainer to the fan housing by means of the ignition coil mounting screw. Make sure there is a good ground connection.



Suppressing Generator

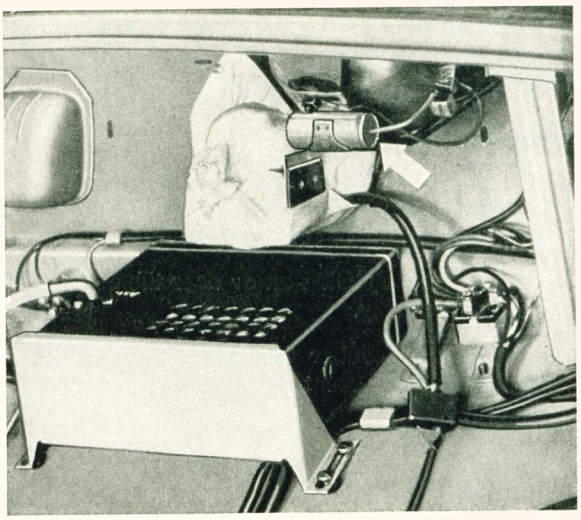
1 - Connect cable of screening condenser 2.5 μ F to terminal 51 of the regulator.



2 - Attach condenser retainer to the generator by means of the regulator mounting screw. Make sure there is a good ground connection.

Suppressing Windshield Wiper Motor

1 - Connect cable of screening condenser 2.5 μ F to positive terminal (30) of the windshield wiper motor.



2 - Attach the condenser retainer by means of the wiper motor mounting screw. Make sure there is a good ground connection.

Note:

For details on the supression of the electrical system when installing a car radio with ultra short wave length, reference should be made to the instructions furnished by the manufacturers with each radio set.

If there is still an occasional noise in the radio when the car is in motion, it is probably due to wheel static caused by the front wheel bearings. Wheel static collectors are available for installation on the wheels to ground the wheel components to the car frame.

Resistor Type Spark Plug Connectors

In most cases, occasional ignition failure in screened engines is caused by resistor type spark plug connectors.

May we, therefore, point out that the following types only are suited for installation in VW Passenger Cars and Transporters:

BOSCH EM/W 10/24 (Spare Part No. 113 035 255 A)

BERU BE 4/10

Furthermore, the suppressor sleeves formerly fitted between ignition distributor and ignition coil of BOSCH or BERU make may no longer be used. Instead, the following distributor rotors with built-in resistor are to be used exclusively:

BOSCH ZVVT 5 Z 5 Z (Spare Part No. 111 905 225 C)

BERU EVL 4/6

Minimizing the voltage drop

Ground strap connections at chassis and body

To minimize the voltage drop at the ground strap connections on VW Passenger Cars, the following modifications have been introduced from Chassis No. 1 109 359:

1 - Battery ground strap fixing screw galvanized.

2 - Lockwasher for battery ground strap fixing screw galvanized.

3 - Washer for battery ground strap fixing screw galvanized.

4 - The anchor nut in the frame is retapped prior to installation of battery ground strap to remove any traces of paint.

5 - No sealing compound is applied to the body sealing strip at the point where the ground strap is connected.

6 - The reinforcement angle at the hole for the battery ground strap fixing screws is galvanized where it makes contact with the strap. This contact surface should be scraped blank whenever a repainting job has been carried out.

7 - The two nuts for the studs attaching the transmission front rubber cushion to the frame are galvanized.

8 - The two lockwashers for the above nuts are galvanized.

9 - The frame studs are also galvanized. The threads are cleaned of all traces of paint.

Should an excessive voltage drop or difficult starting occur, check the aforementioned ground strap connections and, if found necessary, thoroughly clean the contact surfaces. The galvanized nuts, screws, and washers can be subsequently installed on all cars of earlier production.

Main Harness

From Chassis No. 1 278 049 the cross section of cable 15 from ignition starting switch to ignition coil has been increased from 0.75 sq. mm (.001 sq. inch.) to 1.5 sq. mm (.002 sq. inch.) in connection with the introduction of the new ignition coil TE 6 B 1.

The part number of the main harness remains unchanged.

A service installation of the thicker cable (1.5 sq. mm (.002 sq. inch.) is possible after having removed the headlining, as the headlining support wires make this job difficult to carry out. Cut off the disconnected ends of the old cable (0.75 sq. mm) (.001 sq. inch.) in the main harness.

Battery Ground Strap

From Chassis No. 1 329 174 the battery ground strap is no longer attached to one of the body mounting bolts, but is clamped to the frame cross member with a separate bolt. The cross member is provided with a hole and a welded-on nut. The new ground strap is attached by means of a bolt, a washer and a lock washer. The point of contact at the cross member is cleaned to the bare metal.

Starter Cable

(Karmann Ghia Models)

At routine servicing and whenever disconnecting and connecting the starter cable, it should be made a point to check the rubber grommet in the hole where the cable is routed through the luggage compartment panel.

As the grommet is a tight fit on the cable, it is possible that the grommet becomes dislodged from its seat in the panel by an improper installation of the cable or a heavy pull, leading to leaks and damage to the cable.

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Main Harness

In connection with the new instrument panel the length of the main harness cables has been altered on VW Passenger Cars from Chassis No. 1 600 440. The main harness is no longer housed in the RH roof member but in that on the left. This makes it necessary to install a separate harness from the generator to the starting motor.

The new main harness (Part No. 111 971 011 F, for RH drive 112 971 011 D, for sealed-beam headlamps 111 971 013 B) and the new harness between generator and starting motor (Part No. 111 971 127) can only be installed in Passenger Cars from August 1957 onwards.

Harnesses for cars of previous design will still be available.

1 - VW Special Service Tools

VW 159	Oil Pressure Switch Wrench
VW 246	Not-go Plug Gage

2 - VW Workshop Equipment for Local Manufacture

VW 654	Scale for Timing Light
VW 662	Oil Pressure Switch Tester

3 - Normal Hand Tools

Electrician's Screwdriver, 3 mm
Screwdriver, 6 mm
Combination pliers
Cutting pliers
Prick Punch (center punch)
Mechanic's hammer, 300 grams
Triangular scraper
Flat file, 180 mm in length
Round file, 180 mm in length
Half-round file, 180 mm in length
Phillips screwdriver, 3 mm
Open-end wrench, 6 mm
Open-end wrench, 9 mm
Open-end wrench, 10 mm
Open-end wrench, 17 mm
Box wrench, 17 mm
Wire brush
Oil-can
Can for derusting fluid
Grease container
Scratch awl
Test lamp, 6 volts
Contact file
Feeler gauge, 0.1—0.5 mm
Caliper square, 300 mm in length, measuring 1/50 mm
Tap M 6
Tap wrench, size 1, adjustable
Die M 6
Die stock, size 1
Drill, 5.0 mm
Drill, 7.0 mm
Inspection lamp with cable and plug
Electric drill

4 - Other Workshop Equipment

Hydrometer
Voltmeter
Spark plug cleaner and tester
Distributor test stand
Headlight aiming and testing device
Amperemeter and voltmeter

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